Metropolitan Planning Council

LOWER DES PLAINES RIVER WATERSHED- BASED PLAN

OCTOBER 2018

A WATER QUALITY FOCUSED SUPPLEMENT

TO MWRD'S DETAILED WATERSHED PLAN

Christopher B. Burke Engineering, Ltd.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

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MPC and CBBEL would also like to acknowledge contributions, ideas, and information drawn from watershed planning work led by the Chicago Metropolitan Agency for Planning (CMAP). CMAP has managed watershed planning projects for numerous areas in Northeastern Illinois, and is currently working on a plan for the Salt Creek watershed. CMAP maintains a webpage with information about watershed plans and watershed planning work in the region. The plans developed by CMAP and partner organizations and engineering firms were valuable resources from which ideas and content were drawn for this watershed planning document. Sections of the Resource Inventory in this plan mirror material from CMAP-led plans where the information is relevant across the region. This was an important efficiency for plan development and provides for some consistency in plans across the region. We would particularly like to thank Holly Hudson, Kelsey Pudlock, Nora Beck, and Jason Navota for being valuable collaborating partners in watershed planning and stormwater work.

Two other important resources for this watershed plan were the Higgins Creek TMDL report, prepared by Illinois EPA, and the draft Upper Des Plaines watershed plan developed by the Lake County Stormwater Management Commission. Additional references of great benefit in the watershed planning work were the "Guidance for Developing Watershed Action Plans in Illinois," developed by CMAP and Illinois EPA, and US EPA's "Handbook for Developing Watershed Plans to Restore and Protect Our Waters."

This watershed planning document is a supplement to the Lower Des Plaines Detailed Watershed Plan (DWP) prepared by the Metropolitan Water Reclamation District of Greater Chicago (MWRD) in 2011. The DWP addresses flooding issues in the watershed. This complementary document focuses on water quality. MWRD has provided numerous datasets, mapping tools and information to support the 2018 watershed planning work.

Finally, MPC and CBBEL would like to thank the members of the Peer Review Committee who lent experience and expertise to the WBP development process:

- Matt Bardol: Principal Water Resources Engineer, Geosyntec Consultants
- Noel Basquin: Chief Engineer, Transportation & Highways, Cook County
- Michael "Mick" Cosme: Senior Civil Engineer, MWRD
- Deanna Doohaluk: Watershed Project Manager, The Conservation Foundation
- K.C. Doyle: Energy & Sustainability Manager, Cook County, Department of Environmental Control
- Holly Hudson: Senior Aquatic Biologist, Chicago Metropolitan Agency for Planning
- Adam James: Drainage and Utilities Manager, Cook County Department of Transportation and Highways
- Eric Otto: Civil Engineer, Forest Preserves of Cook County
- John Quail: Director of Watershed Planning, Friends of the Chicago River
- Cindy Skrukrud: Clean Water Program Director, IL Chapter, Sierra Club
- Nancy Williamson: Ecosystem Administrator, Illinois Department of Natural Resources

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AISWCD	Association of Illinois Soil and Water Conservation Districts
AMSL	Above Mean Sea Level
AUID	Assessment Unit Identification
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CAWS	Chicago Area Waterway System
CBBEL	Christopher B. Burke Engineering, Ltd.
CMAP	Chicago Metropolitan Agency for Planning
COD	Chemical Oxygen Demand
COMM	Commercial
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DO	Dissolved Oxygen
DWP	Detailed Watershed Plan
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Authority
FIRM	Flood Insurance Rate Maps
FPCC	Forest Preserves of Cook County
HSG	Hydrologic Soil Groups
HUC	Hydrologic Unit Codes
IDNR	Illinois Department of Natural Resources
LTA	Local Technical Assistance
MPC	Metropolitan Planning Council
MS4	Municipal Separate Storm Sewer System
MWRD	Metropolitan Water Reclamation District of Greater Chicago
NAWQA	National Water Quality Assessment Program
NCDC	National Climatic Data Center
NFIP	National Flood Insurance Program
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
ROW	Right-of-Way
SRF	State Revolving Fund
SSMP	Small Streams Maintenance Program
SSURGO	Soil Survey Geographic Database

STEPL	Spreadsheet Tool for Estimating Pollutant Loads
T	Tolerable Soil Rate
TARP	Tunnel and Reservoir Project
TDML	Total Maximum Daily Load
TRANS	Transportation
TSS	Total Suspended Solids
US EPA	United States Environmental Protection Agency
USACE	U.S. Army Corp of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WMO	Watershed Management Ordinance
WPC	Watershed Planning Council

CHAPTER 1 INTRODUCTION

1.1 WATERSHED-BASED PLAN SCOPE AND PURPOSE

This watershed-based plan for the Lower Des Plaines River Planning Area in Cook County is a comprehensive overview of the water quality conditions in the watershed and measures that need to be implemented to restore and protect water quality. This document assesses current conditions, predicts future conditions, and makes recommendations to improve future conditions by taking appropriate actions. The appropriate actions come in a wide variety of forms but include education and outreach to people and communities within the watershed, and strategies for applying Best Management Practices (BMPs) to control sources of water pollution. The negative consequences of actions or inactions over the years have caused degradation in areas, and the reality is the watershed cannot be restored overnight. However, with proper planning and funding, and determined efforts by civic leaders, businesses, and residents, appropriate steps can be taken to markedly improve water quality. This plan identifies nonpoint source control measures to improve water quality.

The geographic scope of this watershed-based plan covers the section of the Des Plaines River from the Cook County/Lake County border at the upstream to the Cook County/Will County Border downstream. The location of the Lower Des Plaines River Planning Area is shown in Figure 1.1-1 as it relates to northeastern Illinois.

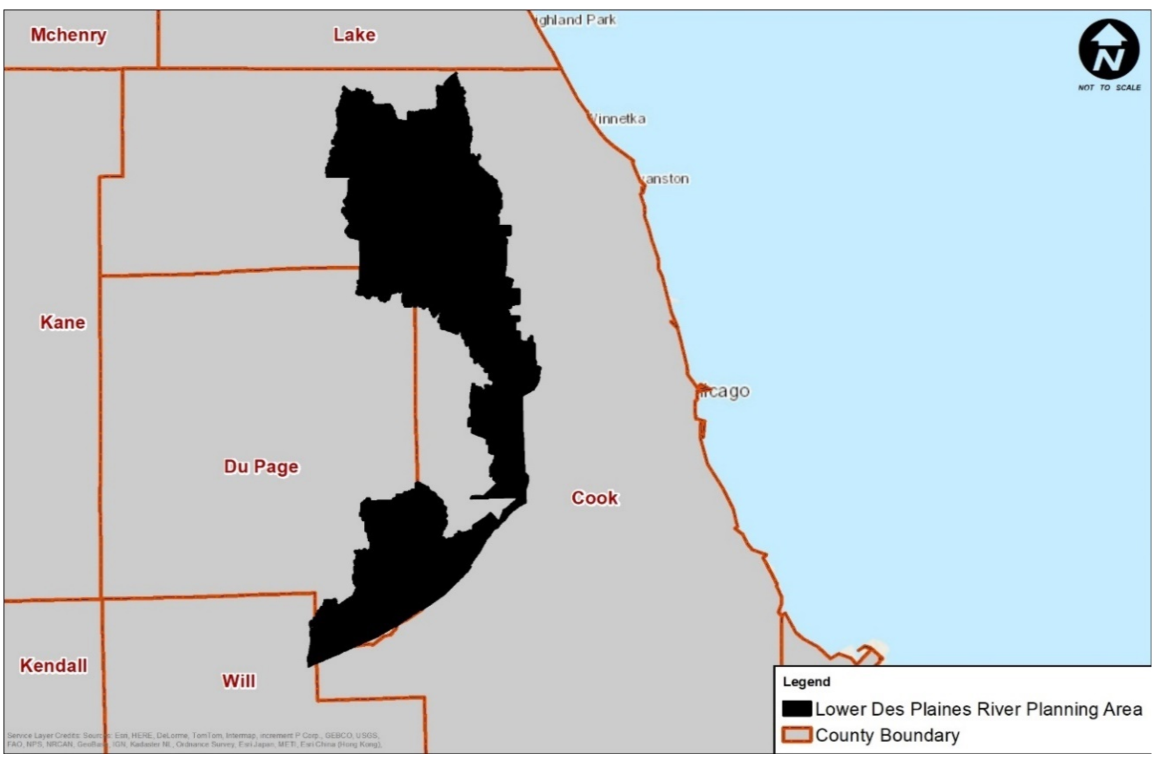


Figure 1.1-1 Lower Des Plaines River Planning Area in Northeastern Illinois

The Lake County Stormwater Commission has developed a watershed-based plan for the Des Plaines River watershed in Lake County, upstream of the area covered in this plan.

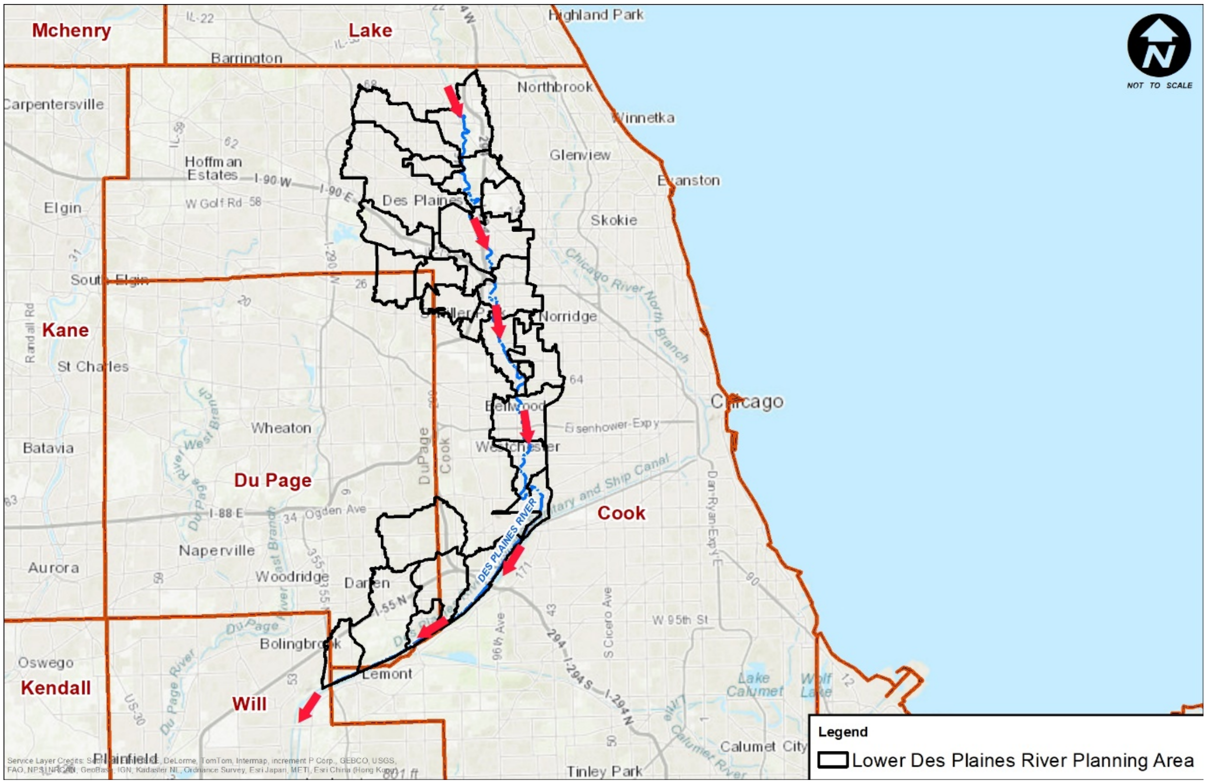


Figure 1.1-2 Lower Des Plaines River Planning Area in Cook County (flow direction in red)

The Des Plaines River originates in portions of Racine and Kenosha Counties in Wisconsin. The river flows southward for approximately 133 miles through Lake, Cook, DuPage, and Will Counties in Illinois, eventually meeting the Kankakee River west of Channahon to form the Illinois River. Of the approximate 680 square miles of watershed area tributary to the Des Plaines River, 170 square miles of drainage area are addressed in this plan. The watershed area covered in this planning document and the mainstem are highlighted in Figure 1.1-2. [1]

Of the 17 named major watercourses tributary to the Lower Des Plaines River mainstem in Cook County, 10 of these watercourses are included in this plan. The Addison Creek, East Avenue Ditch, Chicago Sanitary and Ship Canal, Buffalo Creek, Silver Creek, and Salt Creek watersheds have been excluded from this plan as these watercourses are covered in other plans. The Lower Des Plaines

[1] The scope of this planning document is the Lower Des Plaines River watershed (IL_G-03) including the following USGS 12-digit hydrologic unit codes (HUCs):

- 071200040504
- 071200040503 south of and excluding the confluence of Buffalo Creek
- 071200040505
- 071200040506 except for the Silver Creek Subwatershed
- 071200040706
- 071200040701
- 071200040706 east of Will County

mainstem and the major tributaries are shown in Figure 1.1-3. The tributary watercourses north of the mainstem Lower Des Plaines River generally flow south and the watercourses east and west of the Des Plaines River generally flow west and east, respectively, and drain to the mainstem.

Details regarding the various tributaries and the approximately 170 square mile drainage area addressed in this plan are provided in Sections 3.1and 3.13. Physical Stream Conditions are described in Section 3.14. The Water Quality Assessment is discussed in Section 3.17. Point sources of water pollution are covered in Section 3.18. This plan identifies the pollutant loadings and causes of impairment in Chapter 4. Watershed protection measures are discussed in Chapter 5 and Plan Implementation and Evaluation are covered in Chapters 6 and 7, respectively.

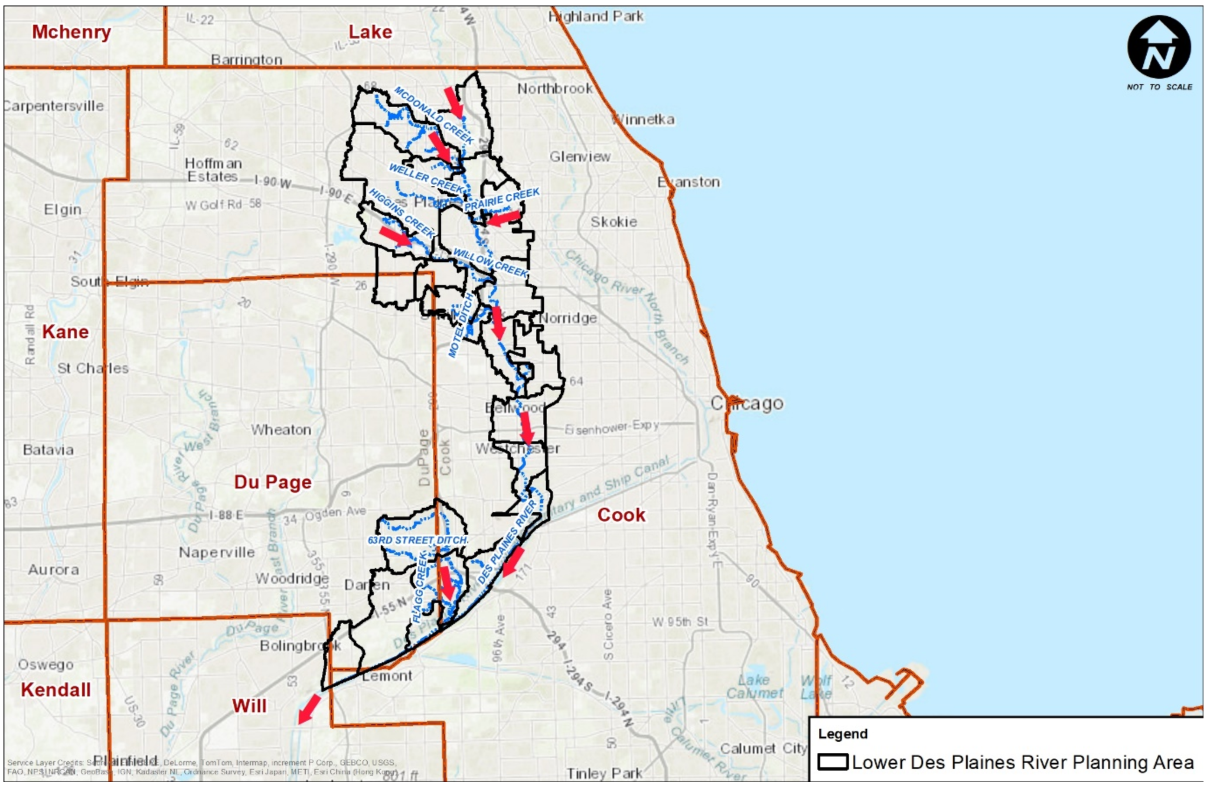
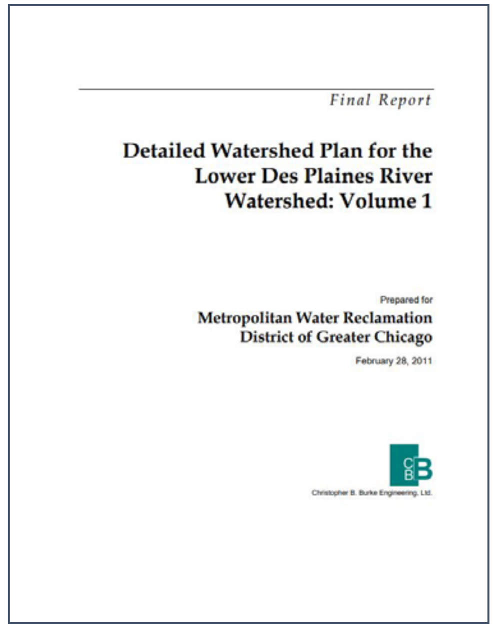


Figure 1.1-3 Lower Des Plaines River Planning Area and Major Tributaries (flow direction in red)

1.2 ADDENDUM TO DETAILED WATERSHED PLAN

This plan addresses water quality as a supplement to the Metropolitan Water Reclamation District of Greater Chicago (MWRD) Detailed Watershed Plan (DWP) for the Lower Des Plaines River Watershed. The DWP addresses flooding concerns in the watershed. This watershed-based plan examines water quality conditions and needs in the drainage areas of the Lower Des Plaines River in Cook County, and recommends measures to reduce pollutant loadings and improve water quality.



Final Report

Detailed Watershed Plan for the Lower Des Plaines River Watershed: Volume 1

Prepared for

Metropolitan Water Reclamation District of Greater Chicago

February 28, 2011

Christopher B. Burke Engineering, Ltd.

Figure 1.2-1 The DWP for Lower Des Plaines River

The Best Management Practices (BMPs) recommended for the watershed as a result of this plan are consistent with the intent of the MWRD Watershed Management Ordinance (WMO) and the Technical Guidance Manual. Nothing in this plan sets new ordinance requirements with respect to the WMO or water quality. The BMPs identified within the plan should work in concert with the WMO to better manage stormwater and restore and protect water quality.

The WMO is a living document that will periodically be updated/amended to address current conditions and stormwater management needs. This plan is intended to be complementary with the WMO including management strategies for detention and volume control.

1.3 THE NINE MINIMUM ELEMENTS OF A WATERSHED-BASED PLAN

The United States Environmental Protection Agency (US EPA) has identified nine key elements that are critical for achieving improvements in water quality. The Illinois Environmental Protection Agency (Illinois EPA) requires these nine elements be addressed in watershed plans funded with Clean Water Act Section 319 funds. Following are the nine key elements:

1. An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan).

2. An estimate of the load reductions expected for the management measures described in the plan (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time).

3. A description of the nonpoint source (NPS) management measures that will need to be implemented to achieve the load reductions estimated under paragraph 2. above (as well as to achieve other watershed goals identified in this watershed-based plan), and an identification of the critical areas in where those measures will be needed to implement this plan.

4. 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. Possible sources of funding, include Section 319 project grants and the State Clean Water Revolving Loan Fund.

5. 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 NPS management measures that will be implemented.

6. A schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious.

7. A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

8. 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, if not, the criteria for determining whether this watershed-based plan needs to be revised.

9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (8) above.

This watershed-based plan addresses the nine elements.

1.4 WHO SHOULD USE THIS PLAN AND HOW SHOULD IT BE USED

This watershed-based plan should be used by municipalities, watershed stakeholders, county and state agencies, and other entities that are charged with or have an interest in restoring and protecting water quality in the watershed. Often local interest groups comprised of citizens that are active in the watershed can have the biggest impact of improving the water quality because of their influence on elected officials. They are the people who see and deal with the water quality daily. The Forest Preserves of Cook County (FPCC), homeowner associations, local watershed groups and private conservation organizations will also have important roles. Support through funding from county, state and federal agencies can assist local agencies and private organizations to complete important projects.

This plan discusses in detail BMPs to reduce loadings of certain water quality constituents. The plan can be used by an individual or groups identified above to help envision and implement water quality projects. Similarly, it can be used by government agencies to establish additional water quality parameters for the watershed or to target improvements to water quality as new development occurs, whether it is a new or improved roadway corridor in the watershed or a new residential or commercial development.

1.5 IMPACTS OF DEVELOPMENT WITHIN THE WATERSHED

The water quality of the Lower Des Plaines River and its tributaries is greatly influenced by the various land uses in the watershed. While urban/suburban development dominates much of the watershed, there are large areas of open space, many of which are owned and managed by the FPCC. Understanding the impacts of urban development on water quality and the use of BMPs to offset those impacts is critical to address the sources of pollutant loadings in this watershed.

Chapter 5 discusses ways to counteract the impacts of urban development with various BMP implementation types. Chapter 6 discusses in more detail ways to attain water quality goals.

1.6 FUNDING FOR THE WATERSHED PLAN

Funding for this Watershed Plan was provided through Illinois EPA's Section 319 Nonpoint Source Pollution Control Grant Program. Section 319 grants are available to local units of government and other organizations to help restore and protect water quality in Illinois. A request was made by the Metropolitan Planning Council (MPC) to the Illinois EPA for the Section 319 grant. The Lower Des Plaines River Watershed is one of 4 watersheds being studied through the grant funding from Illinois EPA. MPC provided additional funds and resources to complete the watershed plans.

CHAPTER 2 WATERSHED PLANNING AREA, VISION, GOALS AND OBJECTIVES

2.1 WATERSHED ISSUES BASED ON STAKEHOLDER INPUT

The scope of this project is the development of a comprehensive watershed plan for the Lower Des Plaines River watershed in Cook County that identifies actions to improve water quality, and protect and enhance natural resources. A key purpose is to help stakeholders better understand the watershed and spur implementation of watershed improvement projects and programs that will accomplish the water quality goals for this watershed. Another key purpose of the project is to identify projects and project types that can be carried out by watershed stakeholders that will fit into a larger picture and contribute to the restoration and protection of water quality. Nonpoint source control projects identified in a State-approved watershed plan are potentially eligible for Section 319 funding to support project implementation. Having a watershed-based plan will allow Lower Des Plaines River partners to access Section 319 grant funding for restoration projects recommended in this plan.

Water quality issues/challenges and goals for restoration and protection have been established considering stakeholder input. MPC and CBBEL have met with the Lower Des Plaines Watershed Planning Council to discuss the watershed planning work. Dialogue with these groups and West Central Municipal Conference and North Central Council of Mayors will continue as plan implementation is undertaken.

2.2 VISION

Surface water bodies (i.e., lakes, rivers, and streams) must meet water quality standards set out to achieve designated uses. As discussed further in the body of this plan, use impairments have been identified by Illinois EPA in the Lower Des Plaines River watershed, and additional monitoring and assessment work has shown sub-optimal water quality conditions and poor aquatic habitat. Many of the problems identified in the watershed are associated with land use and land cover. The wide expanses of impervious surfaces in most of the subwatersheds produce large quantities of stormwater containing a myriad of pollutants. Best management practices, including on-the-ground practices as well as new or improved policy initiatives, need to be implemented by municipalities, landowners and other watershed stakeholders to restore and protect water quality.

The water quality vision for the Lower Des Plaines River watershed is to implement strategically planned and located best management practices that will meaningfully reduce pollutant loadings, which will then be reflected in improved ambient water quality that supports aquatic life and recreational uses. The types of BMPs that are appropriate in the watershed and a targeted implementation level are described in ensuing sections of this plan.

2.3 GOALS AND OBJECTIVES

The goal for implementation actions in the Lower Des Plaines River watershed is to improve water quality so that designated uses can be supported. To improve water quality, we need to reduce pollutant loads. In-depth analysis of the sources of water pollution and pollutant loadings revealed that stormwater runoff is the most significant source of pollutant loadings in the watershed. Stormwater

BMPs need to be implemented to reduce stormwater discharges and pollutant loadings from runoff to restore and protect water quality. The plan identifies a target level of BMP implementation which will result in the following load reductions:

Nitrogen Reduction	Phosphorus Reduction	BOD Reduction	Sediment Reduction
(lbs/yr)	(lbs/yr)	(lbs/yr)	(tons/yr)
4%	6%	2%	16%

These loading reductions will noticeably contribute to water quality improvement. Along with the pollutant load reductions, many of the stormwater BMPs that will be implemented will help reduce stormwater runoff *volumes*. For example, practices such as permeable pavement and bioretention will result in water being absorbed into the ground, vs. running off and draining into storm sewers. Reducing stormwater volumes will provide significant water quality benefits. The stormwater volumes and energy cause stream channel/ streambank erosion, which results in increased loadings of sediment and other pollutants. The stormwater BMPs will reduce this effect.

The combination of these factors and the measures set out in this plan are expected to result in significant progress toward attainment of designated uses.

Objectives related to this implementation goal are summarized below.

2.4 WATER QUALITY

A primary objective for this plan and for implementation actions is to improve water quality in the Lower Des Plaines River mainstem and major tributaries such that aquatic habitat and recreational uses are supported. There are significant opportunities for residents who live near the Des Plaines River to enjoy fishing, swimming, and boating/canoeing activities on the channel and some of the larger tributaries. However, presently many people perceive the water quality as being polluted and shy away from these recreational activities. With reduced pollutant loadings to the water bodies, water quality will be enhanced. Education and outreach efforts can highlight the efforts being made to improve water quality and communicate in an understandable way about water quality conditions and any risks. The result should be more confidence in using and enjoying these water resources.

2.5 NATURAL RESOURCES

There are valuable natural resources in the watershed, including forest preserve areas, wetlands, and open space/greenspace. However, some of the open space is in deteriorated condition. For example, vacant lots may be strewn with rubble and may not provide significant open space benefits. An objective for this plan is to restore and protect forested areas and open space to increase habitat and recreational value. Implementing green infrastructure practices on vacant parcels will help improve stormwater management and reduce pollutant loadings, and also provide habitat for some species. Efforts to protect and restore open space will help reduce fragmentation and enhance connectivity.

Priority areas for creation and restoration of greenspace will be riparian areas. Improvements in these areas will produce direct water quality benefits, in addition other natural resource-related benefits.

2.6 STORMWATER MANAGEMENT

As discussed throughout this document, stormwater is a significant source of pollutant loadings in the watershed, and the volumes of stormwater released to water bodies during and after storms produces erosion and other physical impacts to riverine environments. A major objective of this plan is to improve stormwater management in the watershed. This may include use of manufactured devices or other point-source type controls in some areas, but the majority of stormwater management improvements needed are nonpoint source controls – capturing rainwater near where it falls. Nonpoint source control practices can trap pollutants, reducing the amounts of pollutants delivered to water bodies, can slow down the surge of stormwater that occurs during peak runoff periods, and can help reduce the overall stormwater discharge volumes. Nonpoint source control practices can also reduce the severity and frequencies of the stormwater runoff events that would occur. Best management practices relating to stormwater management are described in Chapter 5 of this plan.

2.7 GREEN INFRASTRUCTURE

It is envisioned that many or most of the stormwater management measures implemented to reduce stormwater impacts and improve water quality will be green infrastructure practices. At the landscape scale, green infrastructure practices help restore and expand greenspace. At the site or neighborhood scale, green infrastructure practices remove pollutants and reduce the volume of stormwater discharges through infiltration, evapotranspiration, or harvesting and reusing stormwater. Examples of green infrastructure practices include rain gardens and bioswales, green roofs, permeable pavements, and cisterns. Where green infrastructure is well-designed and properly-maintained, the practices can provide significant co-benefits. For example, green infrastructure may provide habitat for pollinators or other species, and/or may be a park-like amenity for a community area.

2.8 RESPONSIBLE DEVELOPMENT

Population projections for the watershed predict noticeable population growth over the next 25 years. Population growth is accompanied by commercial development. Much of the expected residential and commercial development will actually be redevelopment — land developed previously which is vacant or underutilized will be redeveloped to increase density and accommodate the expected growth. As the redevelopment occurs, there will be significant opportunities to provide environmental safeguards and implement water quality-related controls. For example, communities can use zoning and comprehensive plans to steer development projects away from sensitive areas and promote infill and transit-oriented development. In addition, stormwater controls will be built in as sites are redeveloped. The Metropolitan Water Reclamation District WMO and local ordinances will require stormwater detention and volume control (green infrastructure) at development sites. Responsible development and redevelopment will be key aspects of improving quality of life in the watershed and helping to restore and protect water quality.

2.9 EDUCATION

Education and outreach will be crucial to support plan implementation and promote regional, local, and individual decision-making that helps improve water quality. Outreach to community leaders about the goals of the watershed plan, types of projects that would be valuable, as well as partnerships and funding opportunities, will substantively advance plan implementation. Integrating consideration of stormwater and water quality into local comprehensive plans, zoning decisions, and budgets will be important to achieving progress toward water quality goals. Additionally, outreach and education to civic groups, neighborhood organizations, businesses, and households will promote implementation of beneficial practices, such as rain gardens and sensible fertilizing techniques, and will build support for policy decisions and budgets that advance water quality improvement. An objective of the plan is to communicate out to these audiences the contents of the plan and catalyze implementation of the plan, but also to receive feedback on the plan and implementation measures, so that adaptive management concepts can be applied and plan components and implementation can improve over time. A related objective is to capitalize on local partnerships and expertise to enhance intergovernmental coordination for achieving progress toward water quality goals. Education and outreach activities are discussed further in Chapter 6 of this plan.

CHAPTER 3 LOWER DES PLAINES RIVER WATERSHED RESOURCE INVENTORY

3.1 THE WATERSHED

The headwaters of the Des Plaines River originate south of Union Grove in Racine County, Wisconsin. The river flows southward through Kenosha County before entering Lake County, Illinois east of Interstate 94. The Des Plaines River then flows south through Cook County, Illinois where it turns to the southwest near Lyons to flow parallel to the Chicago Sanitary and Ship Canal until its confluence with the Kankakee River. The Des Plaines River mainstem is approximately 150 miles in total length and flows through Lake and Cook County Forest Preserve corridors through much of Lake County and northern Cook County.

The Des Plaines River watershed area includes portions of Racine and Kenosha Counties in Wisconsin and Lake, Cook, DuPage, and Will Counties in Illinois. The majority of the watershed is urban/suburban developed area within the Chicago Metropolitan area with some agricultural lands in Lake and Will Counties. Of the approximately 680 square miles of watershed area tributary to the Des Plaines River, there are 170 square miles located in Cook County that are addressed in this plan. The largest tributary to the Lower Des Plaines River Watershed is Salt Creek. The Chicago Metropolitan Agency for Planning (CMAP), working with the Conservation Foundation and DuPage County Stormwater Management, is in the final stages of developing a watershed-based plan for the Salt Creek watershed. The Lake County Stormwater Commission in 2018 is creating a comprehensive watershed plan for the Des Plaines River segments in Lake County.

Previous studies covering the Lower Des Plaines River include a watershed plan developed by the Lower Des Plaines Ecosystem Partnership in 2004. This plan was prepared by the Partnership with funding from the Conservation 2000 Program of the Illinois Department of Natural Resources. The document provides valuable information about watershed conditions, habitat, and biological communities, and was an input to this plan.

Another very important planning document completed for the Lower Des Plaines River watershed is MWRD's Detailed Watershed Plan (DWP) for the Lower Des Plaines River, dated 2011. The scope of the Lower Des Plaines River DWP included the development of stormwater improvement projects to address regional problem areas along open waterways, with a focus on flooding. As part of the DWP, drainage divides for the Lower Des Plaines River watershed were established based upon consideration of the direction of steepest descent from local elevation maxima, and refined in some instances to reflect modifications to topographic drainage patterns caused by stormwater management infrastructure (TARP, storm sewer systems, culverts, etc.). Significant portions of the Lower Des Plaines River and tributary watersheds are drained by combined sewer systems. As part of the DWP, these areas were included in the hydrologic model with diversions created to simulate the approximate capacity of the interceptor sewers and the District's TARP system being constructed to address combined sewer overflows. Runoff diverted to TARP within the DWP watershed models was discounted from the overall flows tributary to the individual waterways.

3.1.1 Plan Scope

The USGS 12-digit hydrologic unit codes (HUCs) covered in this plan are shown in Figure 3.1-1. (Note Figure 3.1-1 and other maps of the watershed in this plan are rotated so that north is to the right. This allows for better annotations of subwatersheds and features on the map.)

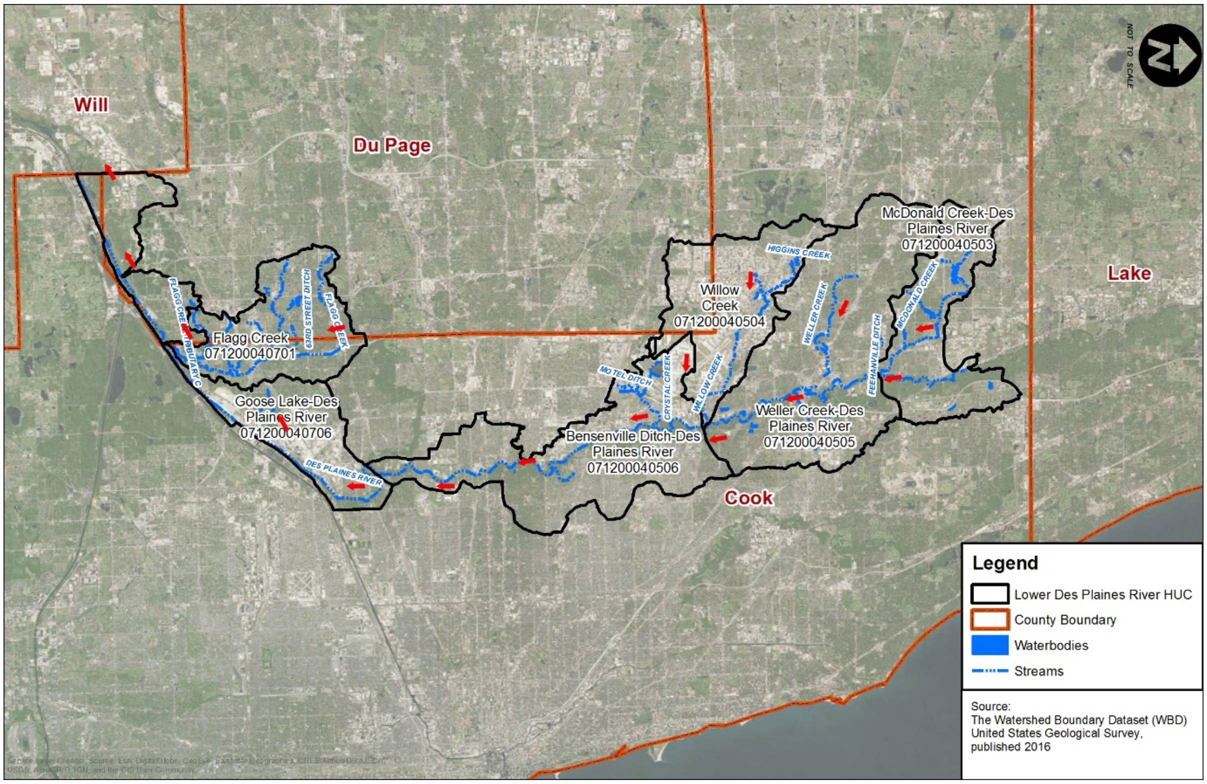


Figure 3.1-1 Lower Des Plaines River Planning Area by HUCs (flow direction in red)

The planning scope for this document defined by the Illinois EPA excludes some areas in Cook County that are covered by other plans as previously discussed (e.g., Silver Creek, Salt Creek). In addition, several tributary areas delineated and included in the MWRD DWP for the Lower Des Plaines River are not included in this current watershed-based plan as they do not drain into the Lower Des Plaines River mainstem. Drainage systems have been modified so that these areas drain to the TARP system, Summit Conduit or the Chicago Sanitary and Ship Canal. These areas are not included in calculations of pollutant loads or load reductions since the pollutants do not drain to the Des Plaines River. However, these areas are adjacent to areas covered in this plan and have similar land uses, so the BMPs recommended in this plan make sense for these areas as well.

The subwatershed areas excluded from this watershed-based plan are shown in Figure 3.1-2 (yellow-shaded boxes).

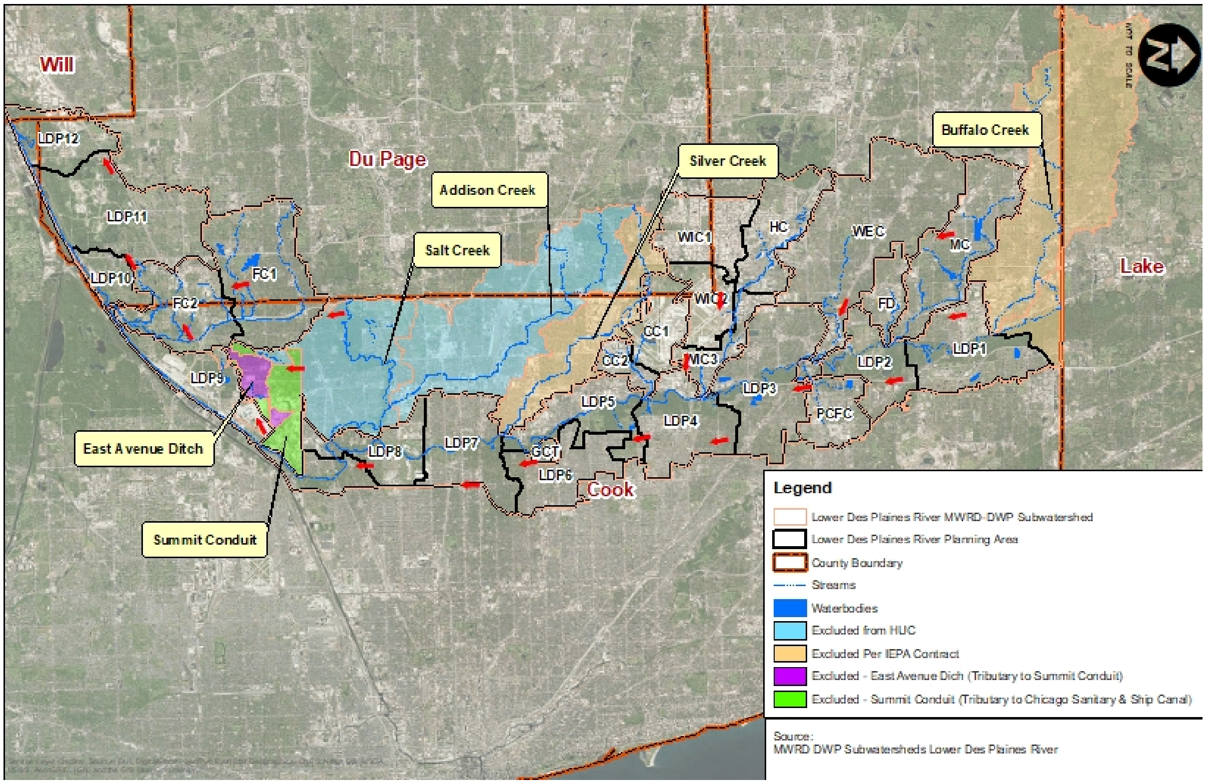


Figure 3.1-2 Lower Des Plaines River Planning Area (Excluded Subwatersheds)

3.1.2 Watershed Planning Units

The DWP subbasins and subwatersheds were overlaid with the USGS delineations for the HUCs to identify the watershed planning units to be used in this plan. The DWP subbasin and subwatershed delineations matched closely with only minor discrepancies with the USGS HUCs. For cases where reconciliation was necessary, the subbasins and subwatersheds created for the DWP have been used in this plan as the MWRD subbasin divides were created using the best available topographic data.

For this watershed-based plan, the HUCs have been subdivided into 25 *watershed planning units* based on sewersheds, stream confluences, similar land uses as well as overall watercourse topography. The boundaries of the watershed planning units reflect delineated subbasin boundaries in the DWP. DWP subbasins have been consolidated where the land use and potential pollutant sources were found to be similar. The term *watershed planning unit* is used in this plan to distinguish from *subwatershed* as that term is used in the DWP and the WMO.

The watershed planning units with the IDs used in this plan are shown in Figure 3.1-2 and Figure 3.1-3. Data on the watershed planning units is shown in Table 3.1-1.

	ID	Area (acres)	Area (square miles)	Watercourse
1	CC1	2,785	4.4	Crystal Creek
2	CC2	1,174	1.8	
3	FC1	7,619	11.9	Flagg Creek
4	FC2	5,504	7.9	
5	FD	1,732	2.7	Feehanville Ditch
6	GCT	356	0.6	Golf Course Tributary
7	HC	4,216	6.6	Higgins Creek
8	LDP1	5,452	8.5	Lower Des Plaines River
9	LDP2	3,525	5.5	
10	LDP3	7,144	11.2	
11	LDP4	4,650	7.3	
12	LDP5	4,067	6.4	
13	LDP6	3,748	5.9	
14	LDP7	4,943	7.7	
15	LDP8	3,359	5.2	
16	LDP9	5,733	9.0	
17	LDP10	1,729	2.7	
18	LDP11	8,137	12.7	
19	LDP12	3,213	5.0	
20	MC	6,464	10.1	McDonald Creek
21	PCFC	2,835	4.4	Prairie Creek – Farmer's Creek
22	WEC	12,009	18.8	Weller Creek
23	WIC1	3,897	6.1	Willow Creek
24	WIC2	2,534	4.0	
25	WIC3	1,968	3.1	
	Total	**108,329**	**169.5**	

Table 3.1-1 Lower Des Plaines River Planning Unit IDs, Areas, and Watercourses

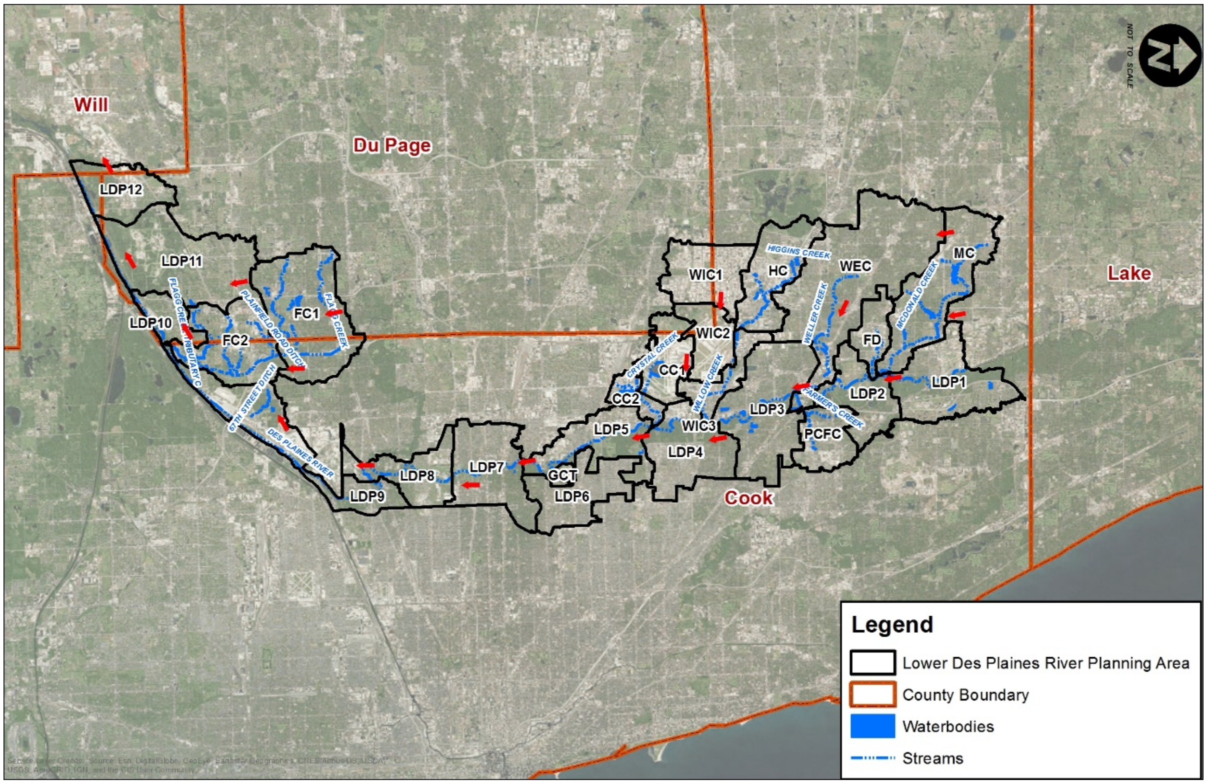


Figure 3.1-3 Lower Des Plaines River Watershed Planning Unit Identification

3.1.3 Topography

Flow in the mainstem Des Plaines River is from north to south southwest with approximately 60 feet of elevation change between the Des Plaines River at the Lake County boundary to the north and the border of Cook, DuPage, and Will Counties in the southwest (Figure 3.1-4).

Major tributaries flowing either west or east to the Des Plaines River mainstem. Topographically, the elevation difference between the headwaters of major tributaries (flowing laterally toward the mainstem) and the mainstem ranges approximately 60 to 140 feet in elevation.

Further discussion of each tributary of the Lower Des Plaines River watercourse is provided in the watershed drainage portion of this Chapter.

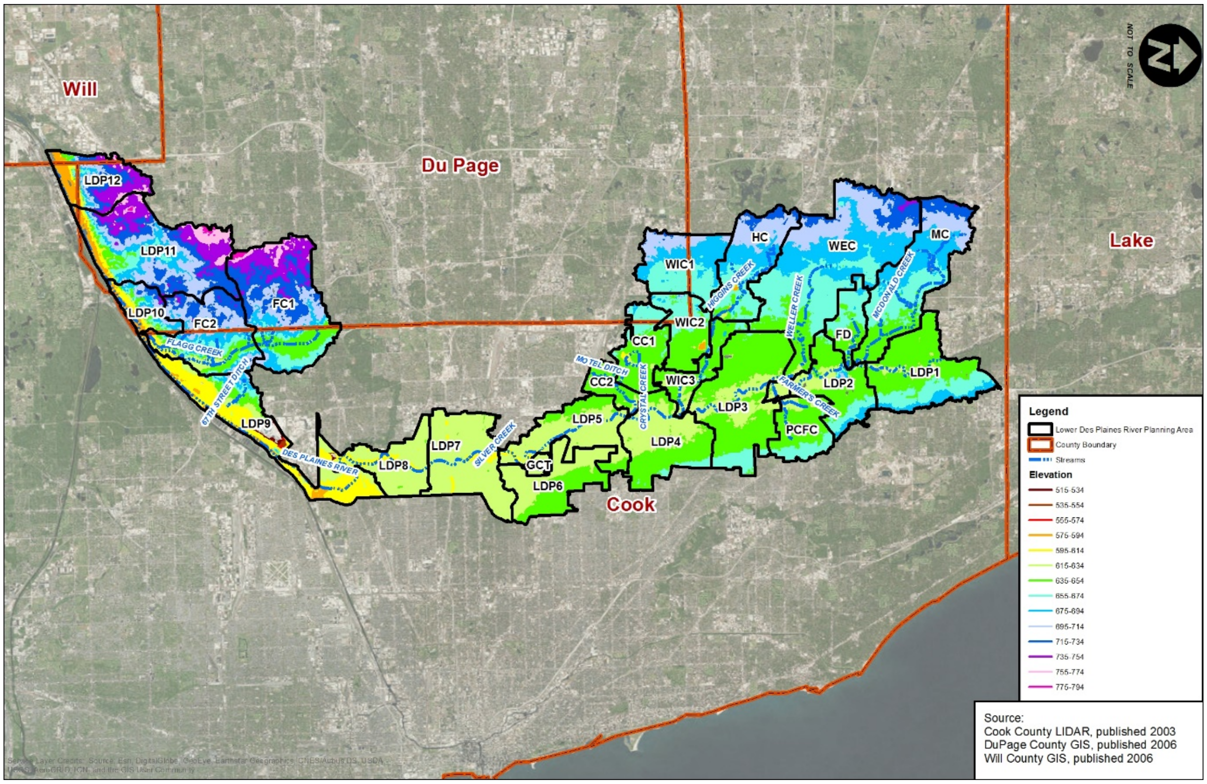


Figure 3.1-4 Lower Des Plaines River Planning Area Topography.

3.2 POPULATION AND DEMOGRAPHICS

Based on the 2010 decennial census, the population (2010) in the planning area is estimated to be 760,087. The Chicago Metropolitan Agency for Planning's (CMAP) GO TO 2040 comprehensive regional plan (updated version, October 2014) forecasts a 2040 population of 875,202 or 15 percent growth. The difference in population over the intervening 30 years translates into a (linear) growth rate of approximately 5 percent per decade. This rate of estimated population growth is slightly lower than the 17 percent growth forecast for Cook County overall and a 22 percent growth forecast for DuPage County. The following statistics were collected from City Data for the watershed planning area:

- Average Home Value = $294,603
- Average Household Income = $75,972
- Average Age = 37

Employment forecasts are similarly relevant in that growth will impact land use change, water use, water quality, and other factors. The revised GO TO 2040 forecast totals for the region estimate employment growth to be 18 percent for the planning area, 18 percent in Cook County, 26.2 percent in DuPage County, and 31.2 percent for the region. The 2010 employment was 410,463 and the projected 2040 employment is 484,357.

3.3 JURISDICTIONS, LOCAL GOVERNMENTS AND DISTRICTS

In northeastern Illinois, over 1,200 units of government collect revenues and provide services to the seven-county region's residents, businesses, and visitors. Portions of 57 municipalities and 21 townships, are included in the Lower Des Plaines River Planning Area (Figure 3.3-1 and Table 3.3-1). Municipal jurisdictions cover approximately 84% (90,473 acres) of the planning area and townships cover approximately 16% (17,856 acres) of the planning area. Among the larger municipalities in the watershed are Arlington Heights, Chicago, Des Plaines, and Mount Prospect, each with over 6% of the land area. The largest townships in the watershed are Wheeling and Maine Township containing nearly 14% and 13% of the area of the watershed, respectively.

Jurisdiction for stormwater management and water quality in the watershed primarily lies with MWRD and the municipalities. In Cook County, the MWRD oversees the implementation of the Watershed Management Ordinance that encompasses stormwater management and wetland and floodplain protection. MWRD is also responsible for treating most of the wastewater in Cook County.

The WMO forms the baseline for stormwater requirements in the watershed; development and redevelopment projects must at a minimum meet the requirements of the WMO for detention and volume control (green infrastructure). However, and municipalities can work with MWRD on the enforcement of the ordinances, and municipalities can enact more stringent rules. Townships generally do not have the same ordinance authorities as municipalities and the WMO requirements govern activities in the Townships.

The State and the Soil and Waters Conservation Districts help residents conserve, develop, manage, and wisely use land, water, and related resources.

Watershed planning in the watershed is typically done through the MWRD and six Watershed Planning Councils. Municipalities participate in the Watershed Planning Councils.

The MWRD WMO became effective in January 2014. Stormwater detention and volume control requirements apply to developments and redevelopments throughout the County, excluding the City of Chicago. The volume control requirements are intended to capture runoff from first flush storm events or runoff from the directly connected impervious areas of a development from the first inch of rainfall. Volume control practices are intended to provide treatment of the volume control storage amount through practices including infiltration trenches, infiltration basins and other retention practices. The required practices reduce the volume of stormwater being discharged, and also reduce pollutant loadings. The volume control itself greatly reduces loadings, and volumes not retained generally have lower pollutant concentrations because of the green infrastructure measures. The WMO also addresses soil erosion and sediment control during and after construction of all developments within Cook County. The enforcement of these provisions greatly reduces loadings of sediment and other pollutants.

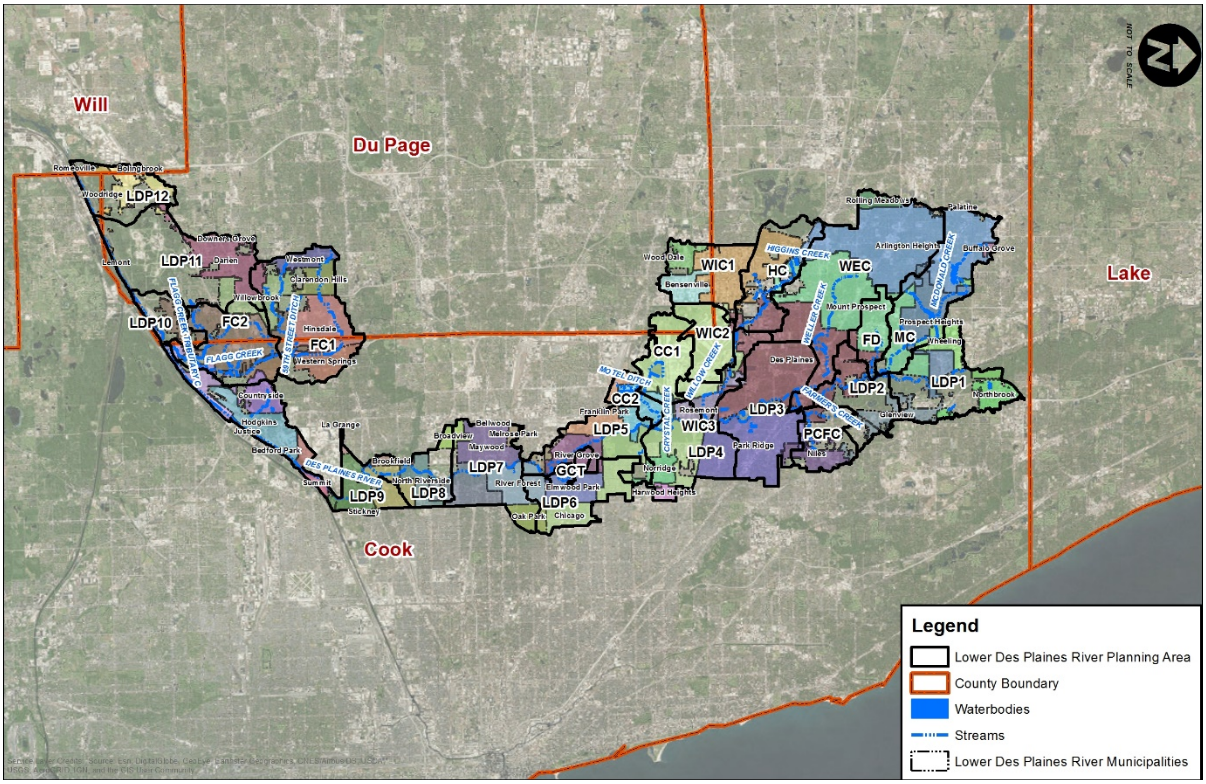


Figure 3.3-1 Municipalities within the Lower Des Plaines River Planning Area

As noted above, municipalities can work with MWRD on the enforcement of the County-wide ordinance. This may include reviews of plans for new developments and redevelopments, and/or the inspection of sites during construction.

MWRD is responsible for planning for, constructing, operating, and maintaining the larger or regional components of the sewer systems. The larger-scale projects described in the DWP will typically be carried out by MWRD. As discussed further below, with some design modifications many of the flood-oriented projects can also provide significant water quality benefits. MWRD can also provide assistance to municipalities, either financial assistance or technical assistance, on local stormwater projects.

Municipalities and townships typically are responsible for local stormwater systems. This includes not only planning for, constructing, operating, and maintaining local sewers and municipal detention facilities, but also non-structural BMPs such as street sweeping. Maintenance activities such as cleaning out catch basins and non-structural BMPs are very important for reducing nonpoint source pollutant loadings from urban runoff. Municipalities that are regulated Municipal Separate Storm Sewer System (MS4) communities must implement six minimum measures aimed at reducing pollutant loadings in stormwater discharges.

Many stormwater BMP projects identified in this watershed-based plan will likely be planned and carried out by municipalities (in some cases with MWRD technical or financial assistance). BMP projects may also be implemented by a township, a school district, or a non-governmental organization.

In addition to municipalities and townships, the Lower Des Plaines River Watershed governmental bodies include:

- Forest Preserves of Cook County
- Illinois State Representative Districts (3rd District, 7th District, 8th District, 15th District, 17th District, 19th District, 20th District, 21st District, 23rd District, 24th District, 31st District, 36th District, 46th District, 47th District, 53rd District, 54th District, 55th District, 57th District, 58th District, 59th District, 77th District, 78th District, 82nd District, 85th District)
- Illinois State Senatorial Districts (2nd District, 4th District, 8th District, 9th District, 10th District, 11th District, 12th District, 16th District, 18th District, 23rd District, 24th District, 27th District, 28th District, 29th District, 30th District, 39th District, 41st District, 43rd District)
- US Congressional Districts (3rd District, 4th District, 5th District, 6th District, 7th District, 8th District, 9th District, 10th District, 11th District, 13th District)
- Park Districts located within Cook County (Arlington Heights, Broadview, Buffalo Grove, Burr Ridge, Chicago, Countryside, Des Plaines, Elk Grove Village, Elmwood Park, Forest Park, Franklin Park, Glenview, Harwood Heights, Hinsdale, Hodgkins, Indian Head Park, Leyden Township, Lyons, Maine Township, Maywood, Melrose Park, Mount Prospect, Niles, North Riverside, Northbrook, Oak Park, Park Ridge, Prospect Heights, River Forest, River Grove, Riverside, Rosemont, Schiller Park, Western Springs, Wheeling, Willow Springs)

The governmental units in the watershed are shown in Table 3.3-1.

Jurisdictional Body	Acres	% of Watershed	Acres of Cook County	% of Cook County	Acres of DuPage County	% of DuPage County	Acres of Will County	% of Will County
Cook County	85,008	78.5	85,008	100.0	0	0.0	0	0.0
DuPage County	22,825	21.1	0	0.0	22,825	100.0	0	0.0
Will County	496	0.5	0	0.0	0	0.0	496	100.0
Total	108,329	100.0	85,008	100.0	22,825	100.0	496	100.0
Municipalities								
Arlington Heights	8,775	8.1	8,775	10.3	0	0.0	0	0.0
Bedford Park	98	0.1	98	0.1	0	0.0	0	0.0
Bellwood	11	0.0	11	0.0	0	0.0	0	0.0
Bensenville	1,008	0.9	0	0.0	1,008	4.4	0	0.0
Berwyn	26	0.0	26	0.0	0	0.0	0	0.0
Bolingbrook	40	0.0	0	0.0	0	0.0	40	8.1
Broadview	444	0.4	444	0.5	0	0.0	0	0.0
Brookfield	296	0.3	296	0.3	0	0.0	0	0.0
Buffalo Grove	103	0.1	103	0.1	0	0.0	0	0.0
Burr Ridge	4,613	4.3	1,667	2.0	2,946	12.9	0	0.0
Chicago	10,300	9.5	9,081	10.7	1,219	5.3	0	0.0
Clarendon Hills	793	0.7	0	0.0	793	3.5	0	0.0
Countryside	1019	0.9	1019	1.2	0	0.0	0	0.0
Darien	2,427	2.2	0	0.0	2,427	10.6	0	0.0
Des Plaines	9,260	8.5	9,260	10.9	0	0.0	0	0.0

Jurisdictional Body	Acres	% of Watershed	Acres of Cook County	% of Cook County	Acres of DuPage County	% of DuPage County	Acres of Will County	% of Will County
Downers Grove	38	0.0	0	0.0	38	0.2	0	0.0
Elk Grove Village	3,614	3.3	3,152	3.7	462	2.0	0	0.0
Elmwood Park	1,221	1.1	1,221	1.4	0	0.0	0	0.0
Forest Park	1,534	1.4	1,534	1.8	0	0.0	0	0.0
Forest View	2	0.0	2	0.0	0	0.0	0	0.0
Franklin Park	1,138	1.1	1,138	1.3	0	0.0	0	0.0
Glenview	1,463	1.4	1,463	1.7	0	0.0	0	0.0
Harwood Heights	276	0.3	276	0.3	0	0.0	0	0.0
Hinsdale	2,324	2.1	617	0.7	1,707	7.5	0	0.0
Hodgkins	1,584	1.5	1,584	1.9	0	0.0	0	0.0
Indian Head Park	573	0.5	573	0.7	0	0.0	0	0.0
Justice	29	0.0	29	0.0	0	0.0	0	0.0
La Grange	2	0.0	2	0.0	0	0.0	0	0.0
Lemont	273	0.3	100	0.1	137	0.6	36	7.3
Lyons	1,238	1.1	1,238	1.5	0	0.0	0	0.0
Maywood	1,685	1.6	1,685	2.0	0	0.0	0	0.0
Mc Cook	315	0.3	315	0.4	0	0.0	0	0.0
Melrose Park	376	0.3	376	0.4	0	0.0	0	0.0
Mount Prospect	6,694	6.2	6,694	7.9	0	0.0	0	0.0
Niles	991	0.9	991	1.2	0	0.0	0	0.0
Norridge	786	0.7	786	0.9	0	0.0	0	0.0
North Riverside	876	0.8	876	1.0	0	0.0	0	0.0
Northbrook	923	0.9	923	1.1	0	0.0	0	0.0
Oak Park	725	0.7	725	0.9	0	0.0	0	0.0
Palatine	26	0.0	26	0.0	0	0.0	0	0.0
Park Ridge	4,550	4.2	4,550	5.4	0	0.0	0	0.0
Prospect Heights	2,534	2.3	2,534	3.0	0	0.0	0	0.0
River Forest	1,586	1.5	1,586	1.9	0	0.0	0	0.0
River Grove	1,537	1.4	1,537	1.8	0	0.0	0	0.0
Riverside	1,291	1.2	1,291	1.5	0	0.0	0	0.0
Rolling Meadows	442	0.4	442	0.5	0	0.0	0	0.0
Romeoville	31	0.0	0	0.0	0	0.0	31	6.3
Rosemont	1,158	1.1	1,158	1.4	0	0.0	0	0.0
Schiller Park	1,768	1.6	1,768	2.1	0	0.0	0	0.0
Stickney	59	0.1	59	0.1	0	0.0	0	0.0
Summit	214	0.2	214	0.3	0	0.0	0	0.0
Western Springs	1,149	1.1	1,149	1.4	0	0.0	0	0.0
Westmont	732	0.7	0	0.0	732	3.2	0	0.0
Wheeling	1,264	1.2	1,264	1.5	0	0.0	0	0.0

Jurisdictional Body	Acres	% of Watershed	Acres of Cook County	% of Cook County	Acres of DuPage County	% of DuPage County	Acres of Will County	% of Will County
Willow Springs	1,338	1.2	1,338	1.6	0	0.0	0	0.0
Willowbrook	1,687	1.6	0	0.0	1,687	7.4	0	0.0
Wood Dale	557	0.5	0	0.0	557	2.4	0	0.0
Woodridge	1,208	1.1	0	0.0	1,025	4.5	183	36.9
Unincorporated Cook County	9,012	8.3	9,012	10.6	0	0.0	0	0.0
Unincorporated DuPage County	8,087	7.5	0	0.0	8,087	35.4	0	0.0
Unincorporated Will County	206	0.2	0	0.0	0	0.0	206	41.5
Total	108,329	100.0	85,008	100.0	22,825	100.0	496	100.0
Townships								
Addison	3,417	3.2	0	0.0	3,417	15.0	0	0.0
Berwyn	26	0.0	26	0.0	0	0.0	0	0.0
Downers Grove North	11022	10.2	0	0.0	11,022	48.3	0	0.0
Downers Grove South	8,378	7.7	0	0.0	8,386	36.7	0	0.0
DuPage	505	0.5	0	0.0	0	0.0	496	100.0
Elk Grove	10,822	10.0	10,822	12.7	0	0.0	0	0.0
Jefferson	9,131	8.4	9,131	10.7	0	0.0	0	0.0
Lemont	729	0.7	729	0.9	0	0.0	0	0.0
Leyden	7,185	6.6	7,185	8.5	0	0.0	0	0.0
Lyons	10,614	9.8	10,614	12.5	0	0.0	0	0.0
Maine	14,479	13.4	14,479	17.0	0	0.0	0	0.0
Northfield	4,952	4.6	4,952	5.8	0	0.0	0	0.0
Norwood Park	1,639	1.5	1,639	1.9	0	0.0	0	0.0
Oak Park	725	0.7	725	0.9	0	0.0	0	0.0
Palatine	484	0.4	484	0.6	0	0.0	0	0.0
Palos	27	0.0	27	0.0	0	0.0	0	0.0
Proviso	4,807	4.4	4,807	5.7	0	0.0	0	0.0
River Forest	1,587	1.5	1,587	1.9	0	0.0	0	0.0
Riverside	2,273	2.1	2,273	2.7	0	0.0	0	0.0
Stickney	61	0.1	61	0.1	0	0.0	0	0.0
Wheeling	15,468	14.3	15,468	18.2	0	0.0	0	0.0
Total	108,329	100.0	85,008	100.0	22,825	100.0	496	100.0
U.S. Congressional Districts								
3rd Congressional District	8,819	8.1	8,819	10.4	0	0.0	0	0.0
4th Congressional District	3,701	3.4	3,701	4.4	0	0.0	0	0.0
5th Congressional District	16,855	15.6	16,855	19.8	0	0.0	0	0.0
6th Congressional District	3,917	3.6	477	0.6	3,440	15.1	0	0.0
7th Congressional District	6,668	3.2	6,668	7.8	0	0.0	0	0.0
8th Congressional District	8,236	6.2	8,236	9.7	0	0.0	0	0.0
9th Congressional District	23,555	21.7	23,555	27.7	0	0.0	0	0.0

Jurisdictional Body	Acres	% of Watershed	Acres of Cook County	% of Cook County	Acres of DuPage County	% of DuPage County	Acres of Will County	% of Will County
10th Congressional District	14,804	13.7	14,804	17.4	0	0.0	0	0.0
11th Congressional District	2,389	2.2	1,894	2.2	0	0.0	496	100.0
13th Congressional District	19,384	17.9	0	0.0	19,384	84.9	0	0.0
Total	108,329	100.0	85,008	100.0	22,825	100.0	496	100.0
State Representative Districts								
State Representative District – 3rd	513	0.5	513	0.6	0	0.0	0	0.0
State Representative District – 7th	4,782	4.4	4,782	5.6	0	0.0	0	0.0
State Representative District – 8th	2,096	1.9	2,096	2.5	0	0.0	0	0.0
State Representative District – 15th	2,008	1.9	2,008	2.4	0	0.0	0	0.0
State Representative District - 17th	1,144	1.1	1,144	1.3	0	0.0	0	0.0
State Representative District - 19th	1,339	1.2	1,339	1.6	0	0.0	0	0.0
State Representative District - 20th	9,563	8.8	9,563	11.2	0	0.0	0	0.0
State Representative District – 21st	2,070	1.9	2,070	2.4	0	0.0	0	0.0
State Representative District – 23rd	1,734	1.6	1,734	2.0	0	0.0	0	0.0
State Representative District – 24th	267	0.2	267	0.3	0	0.0	0	0.0
State Representative District – 31st	3,231	3.0	3,231	3.8	0	0.0	0	0.0
State Representative District – 36th	426	0.4	426	0.5	0	0.0	0	0.0
State Representative District – 46th	1,117	1.0	0	0.0	1,117	4.9	0	0.0
State Representative District – 47th	4,370	4.0	657	0.8	3,713	16.3	0	0.0
State Representative District – 53rd	13,980	12.9	13,980	16.4	0	0.0	0	0.0
State Representative District – 54th	1,853	1.7	1,853	2.2	0	0.0	0	0.0
State Representative District – 55th	15,906	14.7	15,906	18.7	0	0.0	0	0.0
State Representative District – 57th	8,323	7.7	8,323	9.8	0	0.0	0	0.0
State Representative District – 58th	237	0.2	237	0.3	0	0.0	0	0.0
State Representative District – 59th	237	0.2	237	0.3	0	0.0	0	0.0
State Representative District – 77th	8,253	7.7	5,920	7.0	2,333	10.2	0	0.0
State Representative District – 78th	4,180	3.9	4,180	4.9	0	0.0	0	0.0
State Representative District – 82nd	20,204	18.7	4,542	5.3	15,662	68.6	0	0.0
State Representative District – 85th	505	0.5	0	0	0	0.0	496	100.0
Total	108,329	100.0	85,008	100.0	22,825	100.0	496	100.0
State Senate Districts								
State Senate District – 2nd	513	0.5	513	0.6	0	0.0	0	0.0
State Senate District – 4th	6,877	6.3	6,877	8.1	0	0.0	0	0.0
State Senate District – 8th	2,008	1.9	2,008	2.4	0	0.0	0	0.0
State Senate District - 9th	1,144	1.1	1,144	1.3	0	0.0	0	0.0
State Senate District - 10th	10,902	10.1	10,902	12.8	0	0.0	0	0.0
State Senate District - 11th	2,070	1.9	2,070	2.4	0	0.0	0	0.0
State Senate District - 12th	2,000	1.8	2,000	2.4	0	0.0	0	0.0
State Senate District - 16th	3,231	3.0	3,231	3.8	0	0.0	0	0.0

Jurisdictional Body	Acres	% of Watershed	Acres of Cook County	% of Cook County	Acres of DuPage County	% of DuPage County	Acres of Will County	% of Will County
State Senate District - 18th	426	0.4	426	0.5	0	0.0	0	0.0
State Senate District – 23rd	1,117	1.0	0	0.0	1,117	4.9	0	0.0
State Senate District - 24th	4,370	4.0	657	0.8	3,713	16.3	0	0.0
State Senate District - 27th	15,833	14.6	15,833	18.6	0	0.0	0	0.0
State Senate District - 28th	15,906	14.7	15,906	18.7	0	0.0	0	0.0
State Senate District - 29th	8,560	7.9	8,560	10.1	0	0.0	0	0.0
State Senate District - 30th	237	0.2	237	0.3	0	0.0	0	0.0
State Senate District - 39th	12,433	11.5	10,100	11.9	2,333	10.2	0	0.0
State Senate District – 41st	20,206	18.7	4,544	5.3	15,662	68.6	0	0.0
State Senate District – 43rd	496	0.5	0	0.0	0	0.0	496	100.0
Total	108,329	100.0	85,008	100.0	22,825	100.0	496	100.0
Park Districts								
Arlington Heights	399	0.4	399	0.5	0	0.0	0	0.0
Broadview	7	0.0	7	0.0	0	0.0	0	0.0
Buffalo Grove	7	0.0	7	0.0	0	0.0	0	0.0
Burr Ridge	57	0.1	57	0.1	0	0.0	0	0.0
Chicago	37	0.0	37	0.0	0	0.0	0	0.0
Countryside	7	0.0	7	0.0	0	0.0	0	0.0
Des Plaines	271	0.3	271	0.3	0	0.0	0	0.0
Elk Grove Village	21	0.0	21	0.0	0	0.0	0	0.0
Elmwood Park	3	0.0	3	0.0	0	0.0	0	0.0
Forest Park	21	0.0	21	0.0	0	0.0	0	0.0
Franklin Park	17	0.0	17	0.0	0	0.0	0	0.0
Glenview	174	0.2	174	0.2	0	0.0	0	0.0
Harwood Heights	20	0.0	20	0.0	0	0.0	0	0.0
Hinsdale	82	0.1	82	0.1	0	0.0	0	0.0
Hodgkins	14	0.0	14	0.0	0	0.0	0	0.0
Indian Head Park	7	0.0	7	0.0	0	0.0	0	0.0
Leyden Township	0	0.0	0	0.0	0	0.0	0	0.0
Lyons	17	0.0	17	0.0	0	0.0	0	0.0
Maine Township	13	0.0	13	0.0	0	0.0	0	0.0
Maywood	26	0.0	26	0.0	0	0.0	0	0.0
Melrose Park	2	0.0	2	0.0	0	0.0	0	0.0
Mount Prospect	307	0.3	307	0.4	0	0.0	0	0.0
Niles	14	0.0	14	0.0	0	0.0	0	0.0
North Riverside	27	0.0	27	0.0	0	0.0	0	0.0
Northbrook	52	0.0	52	0.1	0	0.0	0	0.0
Oak Park	22	0.0	22	0.0	0	0.0	0	0.0
Park Ridge	135	0.1	135	0.2	0	0.0	0	0.0

Jurisdictional Body	Acres	% of Watershed	Acres of Cook County	% of Cook County	Acres of DuPage County	% of DuPage County	Acres of Will County	% of Will County
Prospect Heights	144	0.1	144	0.2	0	0.0	0	0.0
River Forest	28	0.0	28	0.0	0	0.0	0	0.0
River Grove	82	0.1	82	0.1	0	0.0	0	0.0
Riverside	90	0.1	90	0.1	0	0.0	0	0.0
Rosemont	13	0.0	13	0.0	0	0.0	0	0.0
Schiller Park	33	0.0	33	0.0	0	0.0	0	0.0
Western Springs	66	0.1	66	0.1	0	0.0	0	0.0
Wheeling	26	0.0	26	0.0	0	0.0	0	0.0
Willow Springs	11	0.0	11	0.0	0	0.0	0	0.0
Total	2,252	2.1	2,252	2.7	0	0.0	0	0.0

Table 3.3-1 Lower Des Plaines River Planning Area Jurisdictions

The Lower Des Plaines River watershed is fortunate in that through MWRD efforts there is an active Watershed Planning Council. Quarterly meetings are convened during which the municipalities and townships and other watershed stakeholders are invited to discuss stormwater issues. MPC and CBBEL have presented information to and solicited information from the Lower Des Plaines River Watershed Council as part of the watershed planning process.

One of the challenges with stormwater management is that a project or change in one location can affect another location in a separate municipality, especially a downstream jurisdiction. The watershed Planning council meetings allow participants to learn about proposed changes in stormwater requirements, proposed stormwater and water quality projects, and discuss problems or suggestions regardless if it is local or multijurisdictional problem. The resources of many municipalities and agencies can benefit the watershed when working together.

3.4 CLIMATE AND PRECIPITATION

Illinois is situated midway between the western Continental Divide and the Atlantic Ocean, and is often under the polar jet-stream, which creates low pressure systems that bring clouds, wind, and precipitation to the area. There are other environmental factors that affect the climate of Illinois, including solar energy, the proximity of Lake Michigan, and urban areas.

The planning area has a continental climate with hot, wet summers and cold, snowy winters. The seasons' average temperatures are 22˚F in the winter and 70˚F in the summer. Annual rainfall averages 36 inches and snowfall of 37 inches. Consistent with a continental climate, there is no pronounced wet or dry season (according to City Data). The winter season features the four driest months (December 2.57 in., January 1.92 in., and February 1.80 in., and March 2.38 in.) while summer features the wettest rainfall months (July 4.37 in., and August 4.23 in.). Spring (April through June) and fall (September through November) are similar for their average seasonal precipitation totals, 10.11 in. (3.37 in./mo.) and 9.2 in. (3.07 in./mo.), respectively.

The climate in the watershed planning area is notable for at least two reasons: 1) the threat of rain storms and resultant nonpoint source pollution is a year-round phenomenon, and 2) the lengthy winter season in combination with an extensive road network results in large amounts of applied road salts whose fate has a negative impact on both local surface waters and shallow groundwater.

3.5 CLIMATE CHANGE

While we have discussed the averages for the Illinois climate in the previous section, and the corresponding rainfall amounts, we are aware that the Cook County has experienced significant departures from the "average" rainfall storms many times over the past 20-plus years. Where we would often see rainfall of modest intensity over many hours or days, the Cook County area has been experiencing much more intense rainfall events that have led to significant flooding and degradation of water quality. The rainfall data used in the County and local ordinances typically references Bulletin 70 rainfall data prepared by Angel and Huff for a period 1901 to 1980. Another common source for rainfall data for the watershed is NOAA Atlas 14. Christopher B. Burke Engineering, Ltd. performed a detailed statistical analysis of the Cook County Precipitation Network rainfall dataset. This dataset is a quality controlled and hourly rainfall data for 25 stations throughout Cook County for the period of 1989-2013. The analysis utilized an L-moments approach which ensured that the dataset was homogeneous and used several different regressions to estimate the best fit for the dataset. The results of the analysis were then compared to previous rainfall studies in the region using older rainfall data including Bulletin 70 and NOAA Atlas 14.

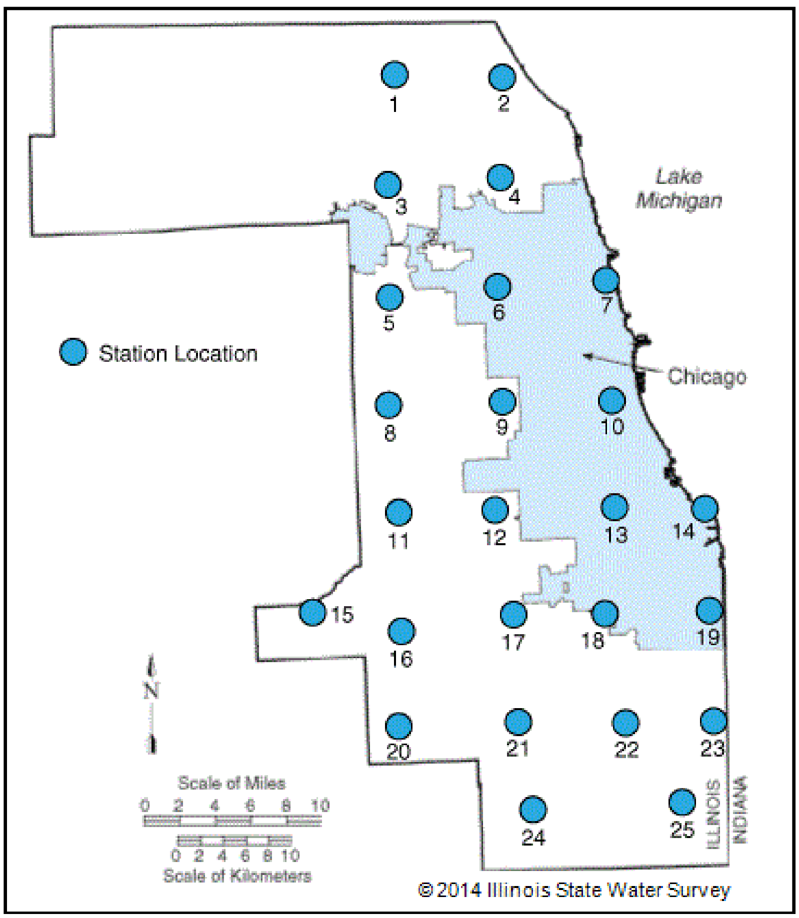


Figure 3.5-1 Cook County Precipitation Network Rain Gauge Location Map

As shown in Figure 3.5-1, the Cook County Precipitation Network contains 25 rain gauge locations throughout the County. Stations 1, 3, 4, 5, 6, 8, 9, 11, 12, 15, and 16 are located near or within the Lower Des Plaines River Planning Area. The results derived in the rainfall study were compared to historical rainfall estimates obtained from Bulletin 70 and NOAA Atlas 14. The estimated intensity which resulted from this study was found to be higher than Bulletin 70 at longer rainfall durations (greater than 3-hour) while in shorter durations (less than 3-hour) the estimated intensities are less than the ones in Bulletin 70. Furthermore, the rainfall estimates from this study was found to be higher than NOAA Atlas 14 study in all durations except for 1-hour duration where lower rainfall depths were estimated. These discrepancies can be explained by differences in the data and methodology used and the studied region. For Bulletin 70, Cook County has been considered as part of a larger section, identified as Northeast Illinois. The NOAA Atlas 14, volume 2, studied the Midwest region including Illinois with 11 stations in Cook County. The results presented herein were derived from actual rainfall data for all durations while in Bulletin 70, the estimates for durations shorter than 24 hours was obtained by applying duration-specific conversions to the 24-hour estimates.

NOAA publishes "Climate Normals" for various climate data, including precipitation over 30 year periods for stations throughout the country. The most recent data was for 1981-2010. Specifically, for precipitation data, the mean number of days per year with various amounts of precipitation is reported. Using the data for our study, the mean number of days annually with the daily precipitation of larger than 0.01-inches, 0.1-inches, 0.5-inches and 1-inch was calculated for all 25 stations in Cook County and the results for stations within the Lower Des Plaines River Planning Area are presented in Table 3.5-1.

Station #	Mean Number of Days Annually			
	Daily Precipitation			
	>=0.01	>=0.10	>=0.50	>=1.00
1	107.5	66.2	20.6	6.8
3	106.6	66.5	21.6	7.2
4	109.0	67.1	22.8	7.6
5	106.0	66.5	23.1	8.5
6	109.8	69.3	24.1	8.5
8	105.2	66.8	23.0	8.1
9	109.9	70.1	23.9	8.4
11	109.4	67.6	23.6	8.4
12	110.8	66.8	22.7	7.9
15	107.0	68.1	24.2	9.4
16	112.3	70.8	24.6	9.0

Table 3.5-1 Mean Number of Days Annually in Which Variable Precipitation Occurred

The results for station #5, a station within the Lower Des Plaines River Watershed, were compared to the results obtained from NOAA's studies on the O'Hare International Airport station (Table 3.5-2). Data presented in Table 3.5-2, show a higher mean number of days were obtained from this study versus NOAA's study for the more intense rainfalls (greater than 0.5-inch and greater than 1-inch) while for the less intense rainfalls (greater than 0.01-inch and greater than 0.1-inch) a lower number of days were noted from this study versus the NOAA's studies within 1971-2000 and 1981-2010.

Source	Mean Number of Days Annually with Daily Precipitation Greater Than			
	0.01”	0.10”	0.50”	1.00”
NOAA NCDC Chicago O’Hare Intl Airport, IL COOP ID 111549, 1971-2000	127.0	69.9	22.5	8.1
NOAA NCDC Chicago O’Hare Intl Airport, IL COOP ID 111549, 1981-2010	124.1	69.1	22.7	8.3
CBBEL Study, Station #5 (station within the Lower Des Plaines River Watershed), 1989-2013	106.0	66.5	23.1	8.5

Table 3.5-2 Study Results versus NOAA Published Study

Urban runoff and stormwater discharges are the most significant source of pollutant loadings in the Lower Des Plaines River Watershed. Changing rainfall patterns are expected to increase runoff volumes and pollutant loadings. Also, erosion within receiving watercourses can be exacerbated by intense storm events which cause sudden increases in water surface elevations and harshly fluctuating water levels (i.e., flashiness) in streams and lakes. The precipitation analyses discussed here suggests properly-sized BMPs to capture rainfall runoff will be increasingly important for the control of nonpoint source pollution.

3.6 SOILS

For purposes of this watershed resource inventory hydrologic soils groups, hydric soils, soil drainage class, and highly erodible soils will be discussed. A combination of physical, biological and chemical variables, such as topography, drainage patterns, climate, erosion and vegetation, have interacted over centuries to form the variety of soils found in the watershed. It is important to consider these soil classifications as they relate to land use/change and water quality. Soils determine the water-holding capacity and include both the erosion potential and infiltration capabilities. Soil characteristics indicate the manner in which soils in a particular area will interact with water in the environment, and therefore are useful in watershed planning. These can help to guide where restoration and best management practices are likely to be successful and where there may be constraints to project implementation. The soils data are obtained from the Soil Survey Geographic (SSURGO) Database produced by the U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS).[2]

3.6.1 Hydrologic Soil Groups

Hydrologic soil groups (HSGs) are categories of soils which feature similar physical and runoff characteristics. Along with land use, management practices, and hydrologic conditions, HSGs determine a soil’s associated runoff curve number which is used in turn to estimate direct runoff from rainfall. This information is particularly useful to planners, builders, and engineers to determine the suitability of sites for projects and their design. Projects might include, for example, stormwater management systems and septic tank/field location or more broadly, new neighborhood design.

[2] The NRCS Soil Survey of Cook County is posted on-line here: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/illinois/cookIL2012/Cook_IL.pdf

The four hydrologic soil groups are described as A – soils with low runoff potential when wet / water is transmitted freely through the soil, B – moderately low runoff potential when wet / water transmission through the soil is unimpeded, C – moderately high runoff potential when wet / water transmission is somewhat restricted, and D – high runoff potential when wet / water movement through the soil is restricted or very restricted. If certain wet soils can be drained, they are assigned to dual HSGs (e.g., A/D, B/D) based on their saturated hydraulic conductivity and the water table depth when drained. The first letter refers to the drained condition and the second to an undrained condition (Table 3.6-1).

Hydrologic Soil Group	*Definition/Characteristics*	*Area (acres)*	*Percent of Planning Area*
A	Soils have a low runoff potential when thoroughly wet. Water is transmitted freely through the soil	147.1	0.1%
A/D	The first letter applied to the drained condition and the second to the undrained condition	150.3	0.1%
B	Soils have a moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded.	2,093.9	1.9%
B/D	The first letter applied to the drained condition and the second to the undrained condition	8,034.7	7.4%
C	Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted.	15,652.9	14.4%
C/D	The first letter applied to the drained condition and the second to the undrained condition	21,161.8	19.5%
D	Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted.	32,122.7	29.7%
Unclassified	n/a	28,965.6	26.7%
	Totals	***108,329.0***	***100.0%***

Table 3.6-1 Characteristics and extent of hydrologic soil groups in the Lower Des Plaines River Planning Area

A large portion of the Lower Des Plaines River Planning Area features Group D soils (nearly 30 percent) (Figure 3.6-1). Unclassified soils are the second most common group, which consist of underlying waterbodies and gravel pits or highly urbanized areas where the ground has been previously disturbed and current, accurate data is not available. The dual group C/D and Group C soils are the next most common at 19.5 and 14.4 percent, respectively. Figure 3.6-1 illustrates a general pattern of HSG distribution, revealing that A/D and B/D soils are found primarily along stream and river corridors where under saturated condition, infiltration is limited and runoff potential is high.

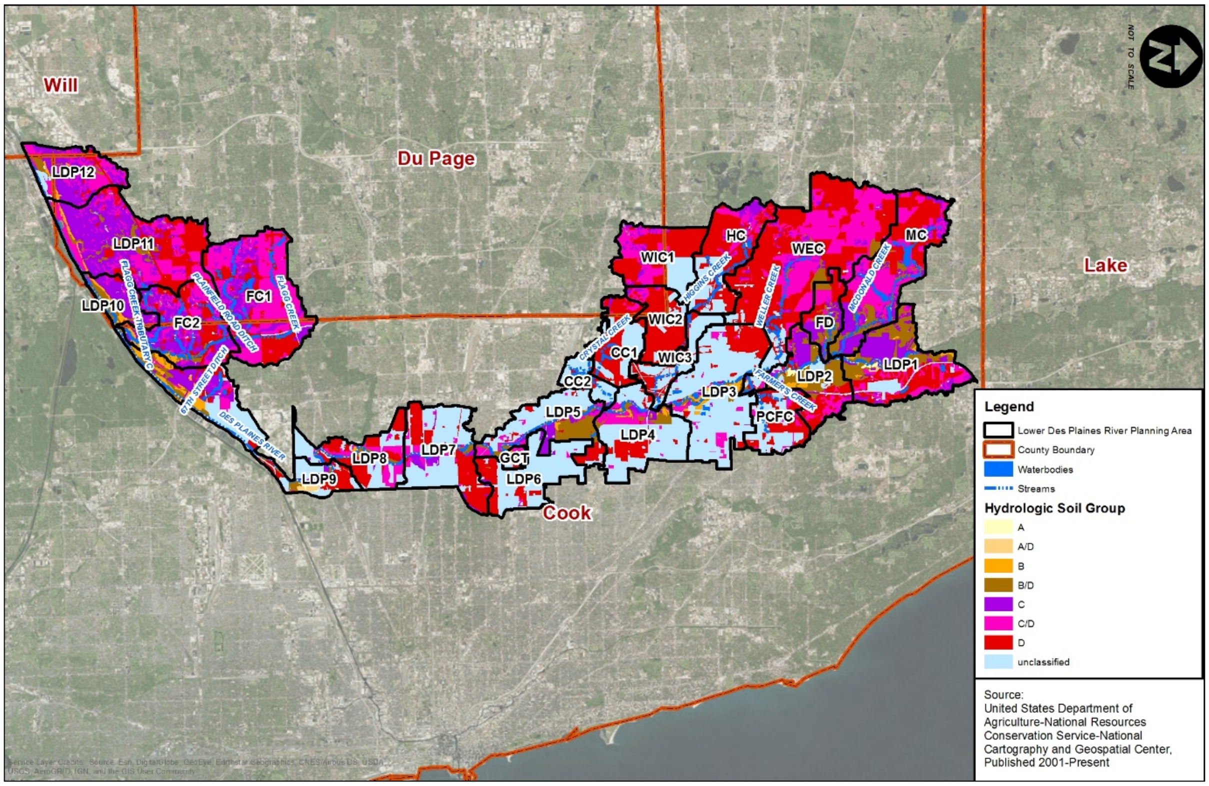


Figure 3.6-1 Hydrologic Soil Groups in the Lower Des Plaines River Planning Area

3.6.2 Hydric Soils

Hydric soils are those soils that developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation and are sufficiently wet in the upper part of the soil profile to develop anaerobic conditions during the growing season. The presence of hydric soils is used as one of three key criteria for identifying the historic existence of wetlands. Knowledge about hydric soils has both agricultural and nonagricultural applications including land-use planning, conservation-area planning, and potential wildlife habitat. Much like an understanding of hydrologic soils groups, knowledge of the location and pattern of hydric soils can inform planners, builders, and engineers and influence their project design and location decisions. For example, areas with hydric soils and drained hydric soils that do not presently contain wetlands may be candidates for wetland restoration.

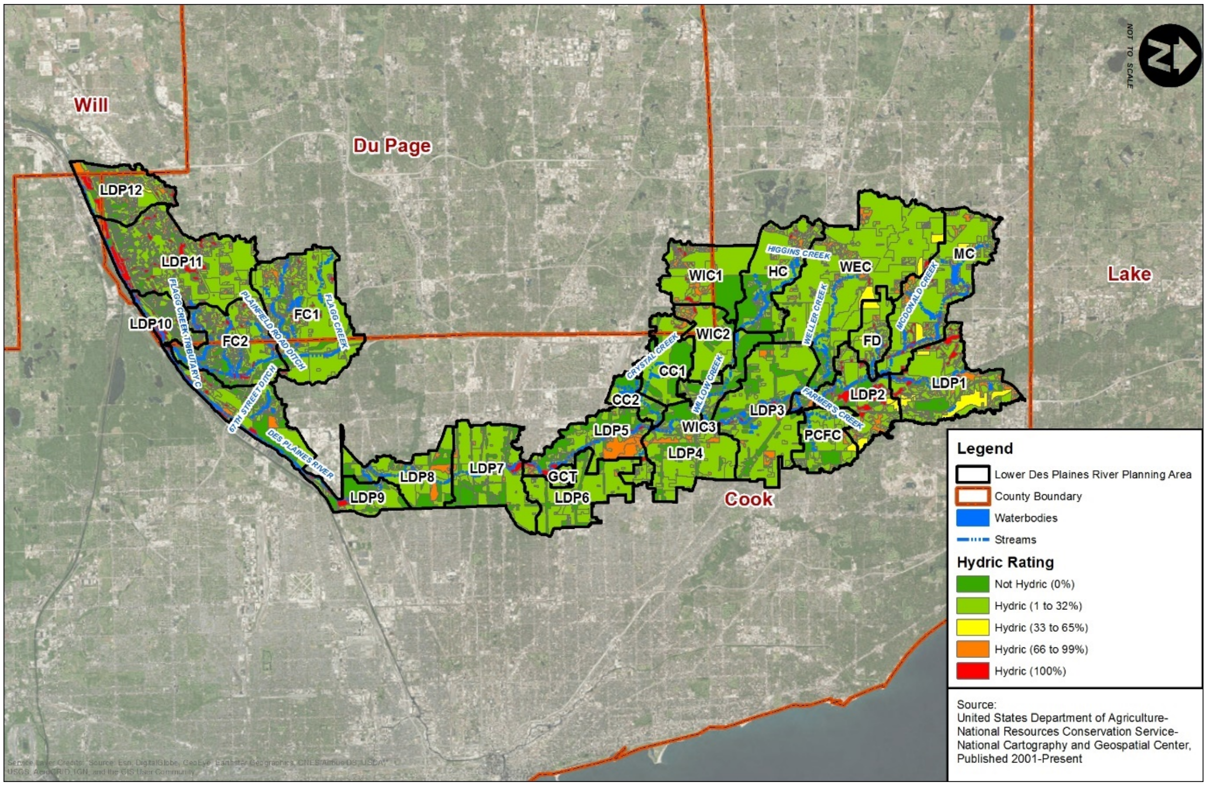


Figure 3.6-2 Hydric Soils in the Lower Des Plaines River Planning Area

The extent of hydric soils within the Lower Des Plaines River Planning Area is shown in Figure 3.6-2 and summarized in Table 3.6-2. Approximately 88% of the Lower Des Plaines River Planning Area features "not hydric" soils (rows 1 and 2 in the Table). "All hydric" soils are distributed throughout the planning area, most commonly along stream and river corridors, and represent about 12 percent of the planning area. Muck soils are a category of hydric soils.

Hydric Soil Class	*Area (acres)*	*Percent of Planning Area*
Not Hydric (0%)	23,117.0	21.3%
Hydric (1 to 32%)	72,267.3	66.7%
Hydric (33 to 65%)	1,552.6	1.4%
Hydric (66 to 99%)	6,299.3	5.8%
Hydric (100%)	5,092.8	4.7%
Totals	***108,329.0***	***100.0%***

Table 3.6-2 Hydric Soils in the Lower Des Plaines River Planning Area

3.6.3 Soil Drainage Class

Soils are categorized in drainage classes based on their natural drainage condition in reference to the frequency and duration of wet periods. The classes are Excessively Drained, Somewhat Excessively Drained, Well Drained, Moderately Well Drained, Somewhat Poorly Drained, Poorly Drained, and Very Poorly Drained. The extent of soils in these drainage classes within the Lower Des Plaines River Planning Area is shown in Figure 3.6-3 and enumerated in Table 3.6-3.

Knowledge of soil drainage class has both agricultural and nonagricultural applications. For example, Well Drained drainage classes (which cover approximately 5% of the planning area) indicate areas where stormwater infiltration BMPs may best be utilized. On the other hand, the Excessively Drained soils (about 0.2% of the planning area) may not be good locations for siting infiltration.

The Poorly Drained drainage classes indicate soils which limit or exclude crop growth unless artificially drained. Soils in the Somewhat Poorly Drained, Poorly Drained, or Very Poorly Drained drainage class occur on 21.2% of the planning area. These areas that are farmed can be taken as an approximation of the likely extent of artificial drainage given that crop growth on these lands would be severely impacted or even impossible without artificial drainage. BMPs such as rain gardens may need to be constructed with under-drains in areas with these soils.

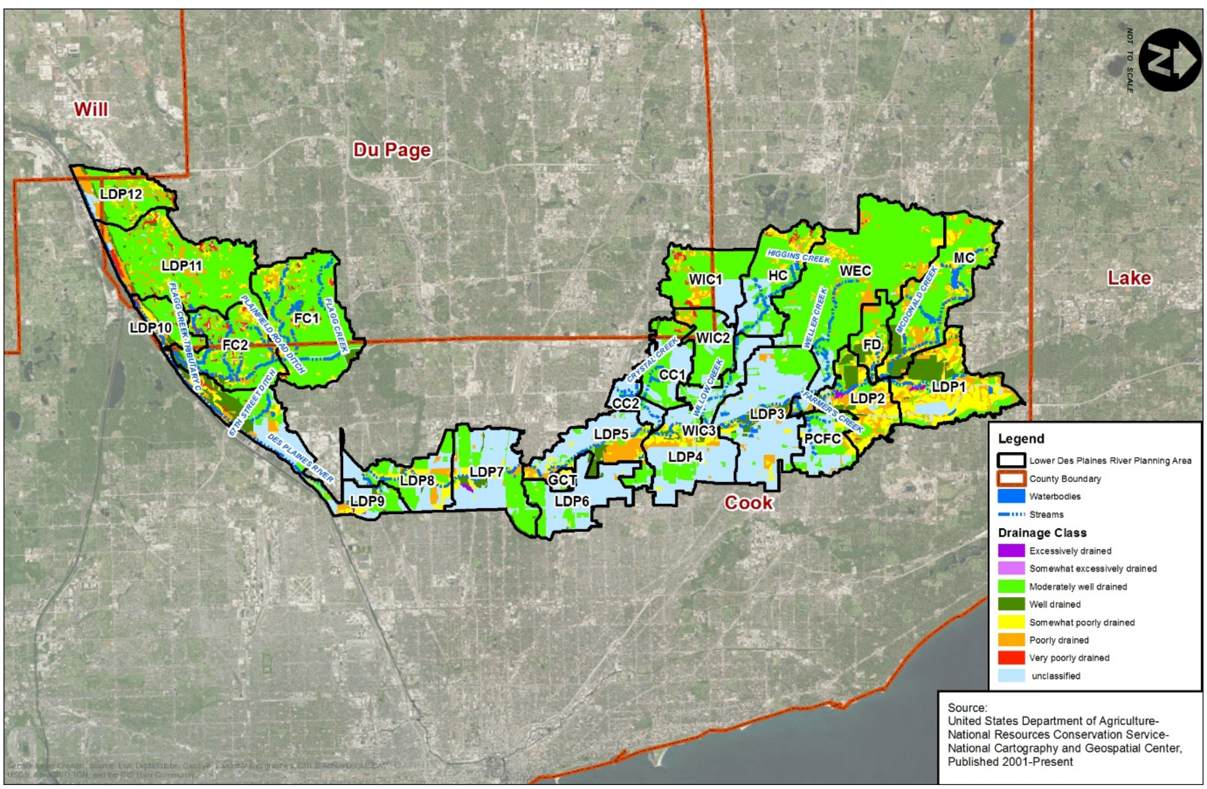


Figure 3.6-3 Soil Drainage Classes in the Lower Des Plaines River Planning Area

Soil Drainage Class	*Area (acres)*	*Percent of Planning Area*
Excessively Drained	184.5	0.2%
Somewhat Excessively Drained	0.0	0.0%
Moderately Well Drained	50,934.9	47.0%
Well Drained	5,465.3	5.0%
Somewhat Poorly Drained	10,870.3	10.0%
Poorly Drained	10,784.6	10.0%
Very Poorly Drained	1,282.9	1.2%
unclassified	28,806.5	26.6%
Totals	***108,329.0***	***100.0%***

Table 3.6-3 Extent of Soil Drainage Classes in the Lower Des Plaines River Planning Area

3.6.4 Highly Erodible Soils

Soil erodibility can be defined by the tendency of soil particles to become detached and mobilized by water and the ground slope. Erodible soils are susceptible to erosion from runoff during storm events due to a combination of slope, particle size, and cohesion. The USDA – NRCS defines a highly erodible soil or soil map unit as one that has a maximum potential for erosion that equals or exceeds eight times the tolerable soil erosion rate (T). The NRCS uses the Universal Soil Loss Equation (USLE) to determine a soil's erosion rate by analyzing rainfall effects, characteristics of the soil, slope length and steepness, and cropping and management practices. The "T factor" is the soil loss tolerance (in tons per acre) that can be used for conservation planning. It is defined as the maximum amount of erosion at which the quality of a soil as a medium for plant growth can be maintained. The T factors are integer values of from 1 through 5 tons per acre per year. The factor of 1 ton per acre per year is for shallow or otherwise fragile soils (shown as red in Figure 3.6-4) and 5 tons per acre per year is for deep soils that are least subject to damage by erosion (shown as green in Figure 3.6-4).

While the T factor is typically used for conservation planning on farms, it is appropriate to use soil tolerance for the objective of identifying the degree of soil loss potential. Highly erodible soils are considered in the watershed plan because erosion from these soils can potentially end up in surface waters, contributing to high amounts of total suspended solids and sediment accumulation in streams and lakes. This results in degradation of water quality due to silt and sediment deposition within the water body. Erodible soils along lakeshores and stream channels, and on disturbed land surfaces (e.g. active croplands and construction sites) are most susceptible to erosion. Therefore, stabilization practices near shorelines and stream channels could reduce erosion. All soils can severely erode when excavated and stockpiled; erosion control practices should be planned for any human disturbance of an area. Land developers are required to follow the National Pollutant Discharge Elimination System (NPDES) regulations and WMO requirements regarding soil erosion and sediment control measures during construction.

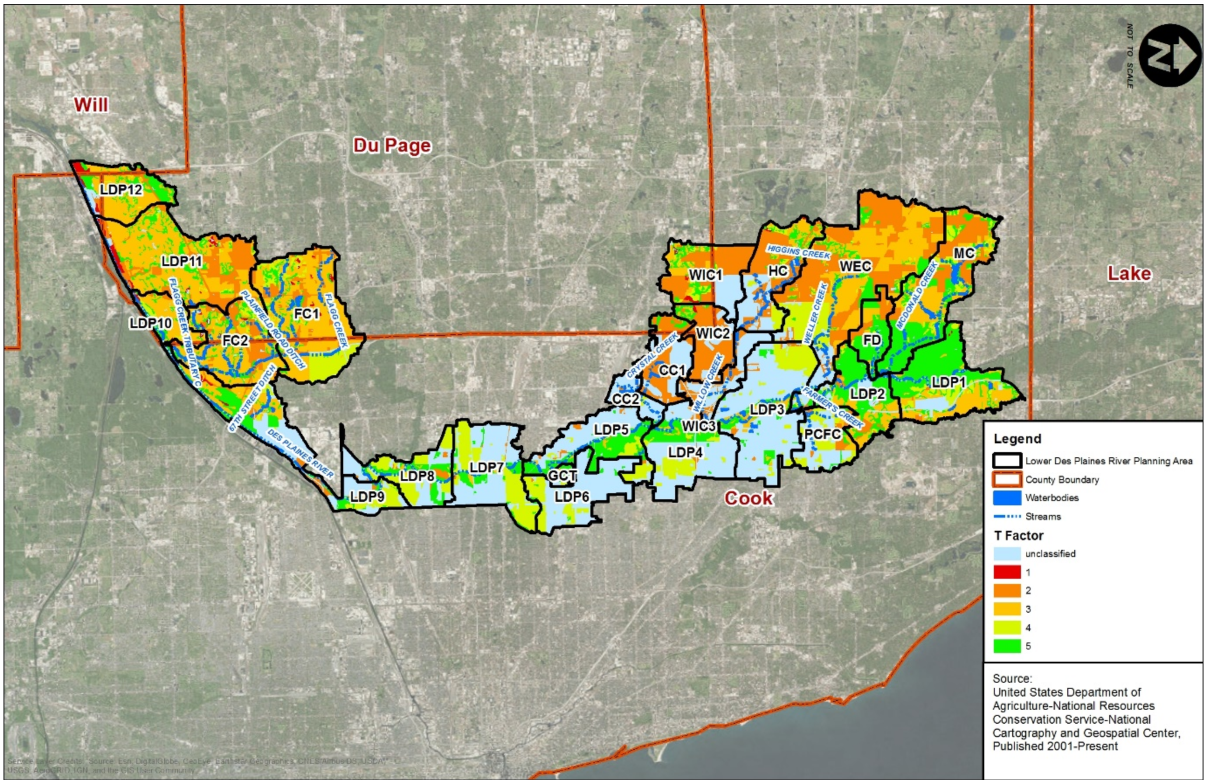


Figure 3.6-4 Highly Erodible Soils in the Lower Des Plaines River Planning Area

T Factor (tons/acre/year)	*Area (acres)*	*Percent of Planning Area*
0/unclassified	28,955.1	26.7%
1	672.4	0.6%
2	21,182.5	19.6%
3	25,715.7	23.7%
4	12,115.1	11.2%
5	19688.2	18.2%
Totals	***108,329.0***	***100.0%***

Table 3.6-4 Extent of Erodibility in the Lower Des Plaines River Planning Area

3.6.5 Groundwater

Prior to glaciation in Illinois, the predominately carbonate bedrock exposed at the land surface in northeastern Illinois was subjected to weathering and dissolution. This resulted in the development of significant secondary porosity, particularly within the upper 125 feet of bedrock, creating a productive aquifer. This aquifer is referred to as the shallow bedrock carbonate aquifer. This aquifer was and in some cases is an important source of groundwater for municipalities, industry, and private homeowners in northeastern Illinois.

The geologic units that comprise this aquifer consist of Silurian-age carbonates (mostly dolomite), the Maquoketa Formation (mostly shales), and the Galena-Platteville Groups (mostly limestone and dolomite). Strata dip towards Lake Michigan. Most of the bedrock in northeastern Illinois is now buried by glacial material, but exposures can be found along creeks and rivers throughout the area or can be seen in quarries.

Figure 3.6-5 below shows the estimated groundwater elevation (head) in feet above mean sea level (AMSL) for the shallow bedrock carbonate aquifer in northeastern Illinois. Groundwater flow generally mimics the land surface topography. Groundwater flow is divided into several flow systems based on topography, connections between the aquifer and streams, and variations in permeability. The highest heads occur in northern McHenry County and extend southward to northwestern Kane County. Another groundwater divide follows the Valparaiso moraine though western Lake County, far northwestern Cook, and western DuPage County, dividing a short westward flow path towards the Fox River and a long flow path towards the Des Plaines River. Groundwater flow systems become more localized farther south in Cook County due to the Des Plaines, DuPage, and Fox Rivers, which cut through glacial deposits to the bedrock in many areas.

In central Cook County a wide and shallow cone of depression has formed where groundwater elevations have dropped below the level of the canals and Lake Michigan. Although there are no major pumping wells in the region, other activities that could lower water levels include the dolomite quarries, the deep tunnels that are part of MWRD's Tunnel and Reservoir Project, and the many cross-connected wells with the underlying Cambrian-Ordovician Sandstones. With a low permeability and a low recharge rate through the thick covering of clay tills on the Chicago Lake Plain, the amount of water flowing through the aquifer is likely very little. (Illinois State Water Survey, Prairie Research Institute)

Comprehensive groundwater studies have not been conducted for the Lower Des Plaines River Watershed within the last 30 years. This research gap is due largely to the transition to use of Lake Michigan water as the source of drinking water. Many of the suburban communities in the watershed originally used groundwater as a source of drinking water. However, as the groundwater resources were becoming depleted and as the network of water pipes conveying Lake Michigan water expanded, most communities in the watershed have now converted to having surface water from the Lake as their source of drinking water. This transition enabled the region to continue growing, despite the groundwater issues, but also reduced the amount of resources dedicated to monitoring groundwater quality and quantity.

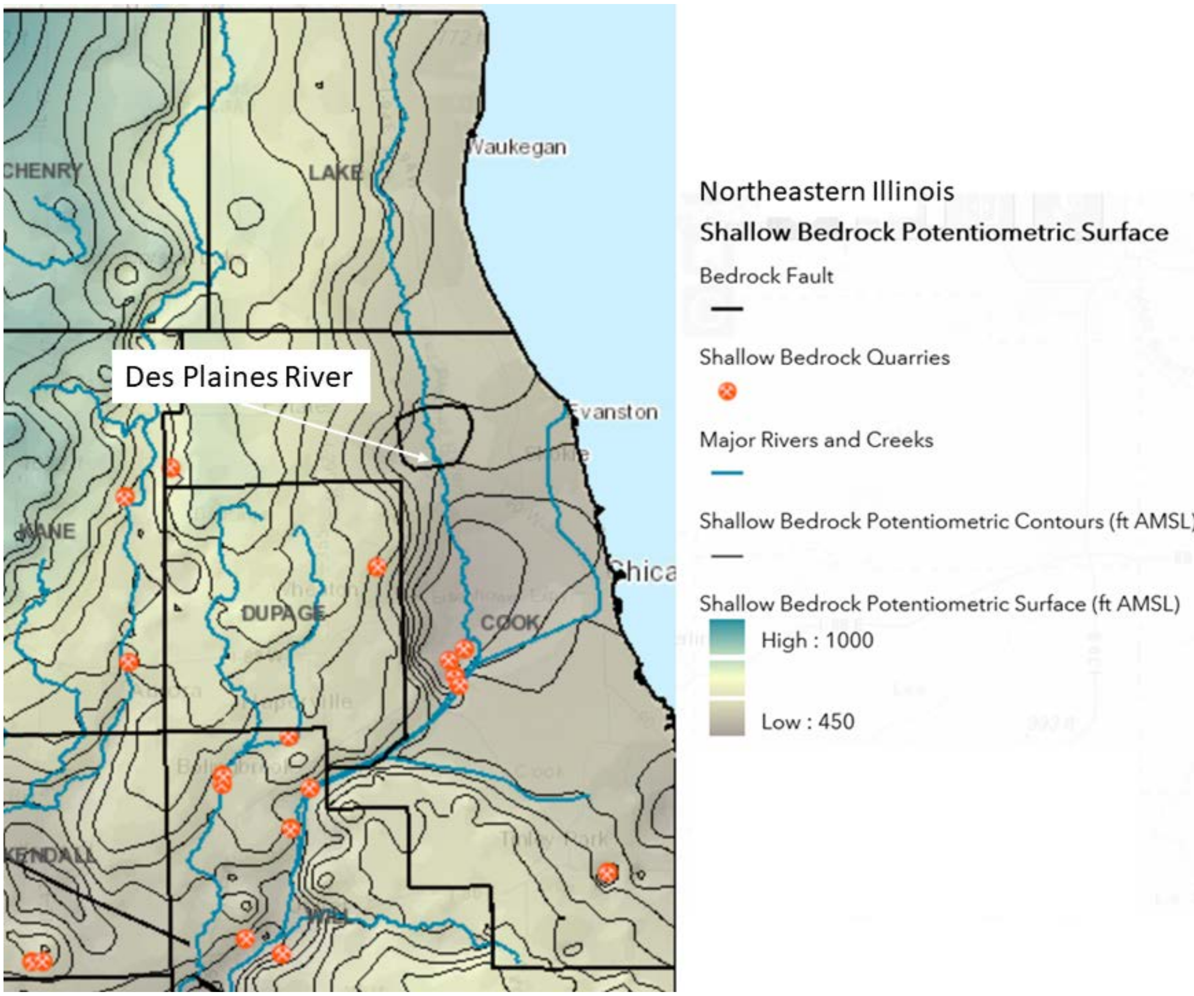


Figure 3.6-5 Shallow Bedrock Potentiometric Surface in Northeastern Illinois
Source: Illinois State Water Survey, Prairie Research Institute

3.7 FLOODPLAINS

A floodplain is defined as any land area susceptible to being inundated by floodwaters. The 100-year floodplain or base flood encompasses an area of land that has a 1% chance of being flooded or exceeded within any given year; the 500-year floodplain has a 0.2% chance of being flooded or exceeded within any given year. Floodways are defined by the National Flood Insurance Program (NFIP) as the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height (0.1 foot in Illinois). Floodways are a subset of the 100-year floodplain and carry the deeper, faster moving water during a flood event.

When a natural floodplain is developed for other uses, such uses become susceptible to flooding which can result in property and crop damage as well as degraded water quality. Development in the floodplain can even affect areas that are not directly adjacent to a waterbody, such that those areas can become flooded in heavy storms. Thus, it is important that floodplains and their relationship to land use be considered in watershed plans as well as any other type of land use planning.

According to floodplain data derived from the Federal Emergency Management Authority (FEMA) Flood Insurance Rate Maps (FIRMs), about 9.1 percent (9,856 acres) lies within the 100-year floodplain limits. The 9,856 acres includes studied and unstudied (Zone A) floodplains. About 4.3 percent (4,643 acres) of the planning area lies between the studied 100-year and 500-year floodplain (Table 3.7-1 and Figure 3.7-1). The total area of the 500-year floodplain is all the Zone A, 100-year and 500-year floodplain which is roughly 14,498.8 acres or 13.4% of the planning area. Encroachments in the floodplain should be monitored by communities since they can lead to increased upstream and downstream flood elevation.

Floodplain	*Cook County Area (acres)*	*DuPage County Area (acres)*	*Will County Area (acres)*	*Percent of Planning Area*
Zone A (unstudied)	709.5	236.7	486.4	1.3%
Only 100-year Floodplain	6,913.4	1,406.7	103.2	7.8%
Only 500-year Floodplain	3,913.6	727.4	2.0	4.3%
Totals	***11,536.5***	***2,370.8***	***591.6***	***13.4%***

Table 3.7-1 Floodplain in the Lower Des Plaines River Planning Area

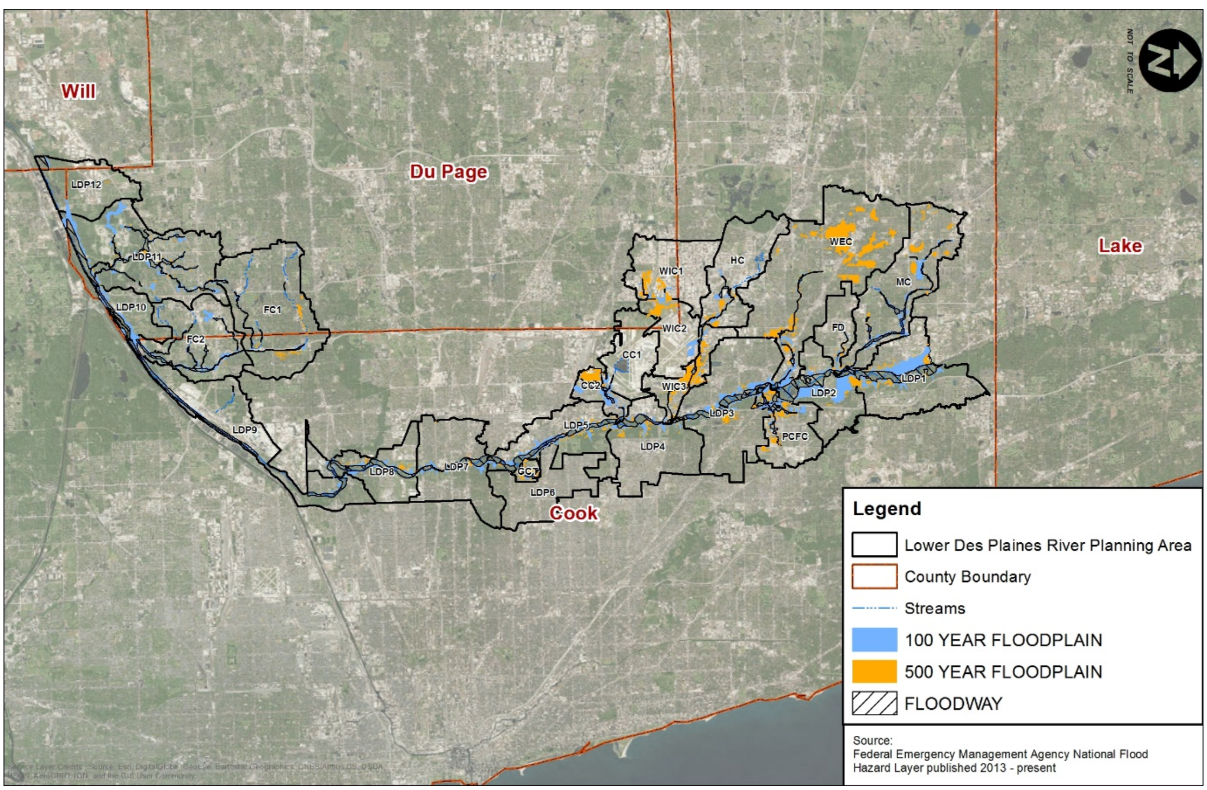


Figure 3.7-1 Floodplain in the Lower Des Plaines River Planning Area

3.8 WETLANDS

Wetlands provide a variety of functions including social, economic, and ecological benefits by providing valuable habitat, protecting natural hydrology and recharging groundwater. They also filter sediments and nutrients in runoff, provide wildlife habitat, reduce flooding, and help maintain water levels in streams. These functions improve water quality and the biological health of waterbodies, making wetlands an integral part of the watershed.

Figure 3.8-1 Wetlands located at point FC2 B

As the area was being developed, settlers altered presettlement wetlands by draining wet areas, channelizing streams, and clearing forests to farm the rich Midwestern soil. There are many wetland functions that generate ecosystem services that are valued by society. Wetlands are an integral part of the movement to conserve green infrastructure and thereby employ nature to help manage hydrology in the built environment. Despite this, the extent of America's wetlands continues to decline.

Based on the National Wetlands Inventory (NWI), there are an estimated 6,427 acres of wetlands, about 6% percent of the land area, within the Lower Des Plaines River Planning Area. Each wetland is categorized by its type (identification code), size and location. The specific function and quality is unknown on a regional scale because a county specific function inventory (e.g. quality, water-quality, habitat, flood reduction) is unavailable. The watershed does have a high concentration of wetlands along the Lower Des Plaines River mainstem.

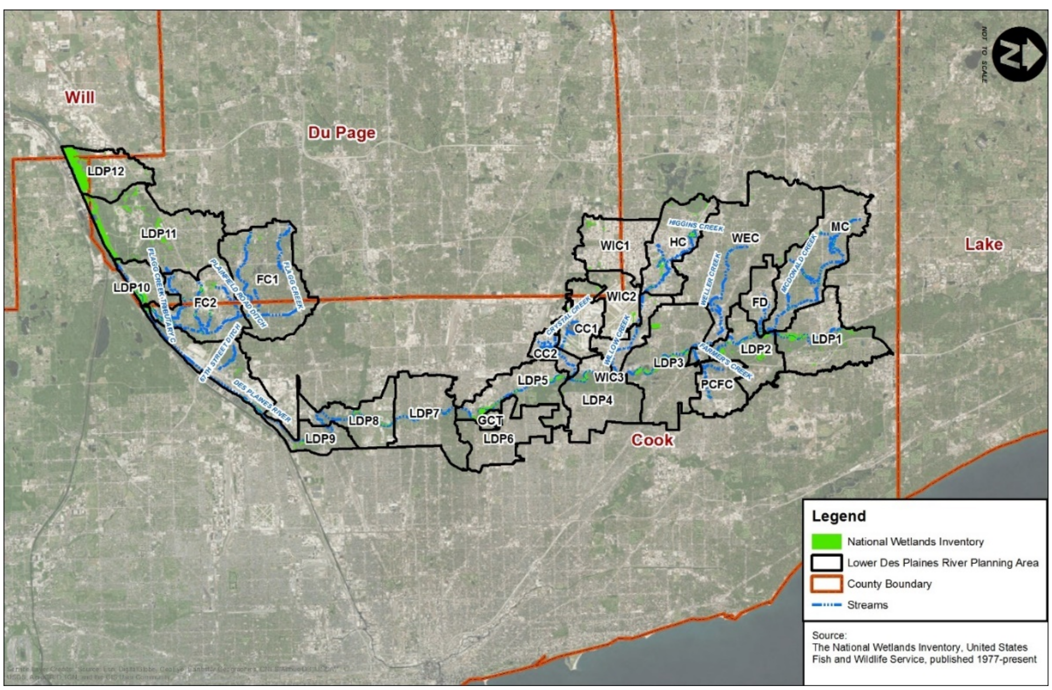


Figure 3.8-2 Wetlands in the Lower Des Plaines River Planning Area

3.9 LAND USE AND LAND COVER

Land use has a significant effect on basin hydrology, affecting the volume and characteristics of runoff produced by a given area. Land use is classified using CMAP's 2013 Land Use Inventory Classification Scheme and data inventory. The land-use scheme employs a new methodology and results in 57 categories of land use that are aggregated under five general categories: Urbanized, Agriculture, Open Space, Vacant or Under Construction, and Water. CMAP's land-use data is parcel-based.

For purposes of this watershed inventory, land use within the planning area is organized among ten categories (Figure 3.9-1 and Table 3.9-1). Open space (14.4%), Right-of-way (16.5%) and Residential (35.9%) are the most predominant land uses within the planning area. Much of the open space in the watershed is FPCC land. There is a large forest preserve complex along most of the Lower Des Plaines River portion of the planning area. The residential component reflects the many municipalities and developed communities in the planning area. The large percentage of right-of-way is important to note since these areas may present opportunities for publicly owned and maintained BMPs. Also, roads and local streets contribute to loadings of a variety of pollutants, including chlorides. Vacant land is the second least common of the area (0.6%). Agricultural land is the least common type of land use (0.1%). Overall the watershed planning area is highly developed throughout the Lower Des Plaines River planning area with little remaining open space. When development occurs it is often redevelopment on a parcel that previously had another use.

Land use within each of the watershed planning units is shown in Figure 3.9-1 and is tabulated by the 10 major categories in Table 3.9-1. It is extremely important to consider land use in the watershed planning process as land use relates to the types and amounts of pollutant runoff that will occur and what best management practices (BMPs) might be suitable.

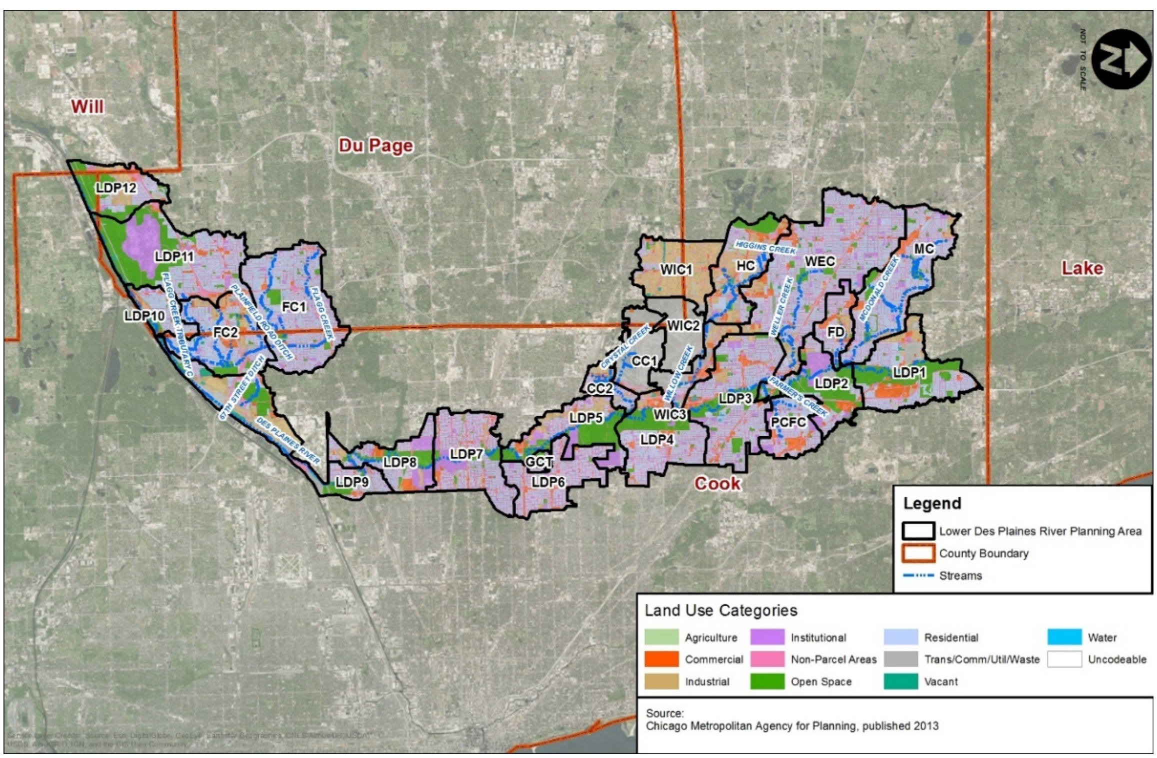


Figure 3.9-1 Land Use in the Lower Des Plaines River Planning Area

Land-Use Category	*Area (acres)*	*Percent of Planning Area*
Agriculture	142.6	0.1%
Residential	38,918.5	35.9%
Commercial	6,642.1	6.1%
Institutional	7,688.9	7.1%
Industrial	8,959.5	8.3%
T/C/U/W	10,960.7	10.1%
Open Space	15,629.9	14.4%
Right of Way	17,827.9	16.5%
Vacant/Under Construction	679.1	0.6%
Water	847.5	0.8%
Total	***108,329.0***	***100.0%***

Table 3.9-1 Land-Use Categories and extent within Lower Des Plaines River Planning Area

Notes: T/C/U/W = transportation, communications, utilities, and wastewater

3.9.1 Future Land Use Projections

The watershed planning area outside of the forest preserves (open space) is currently highly developed and densely populated. Approximately 14% of the watershed planning area consists of open space which is mainly forest preserve associated with the Des Plaines River mainstem corridor. The remaining 86% of the watershed planning area is densely developed with various land uses and extensive impervious areas. The residential and ROW land uses make up 53% of the watershed planning area. There are some vacant land parcels where businesses have closed or people have moved away, but these areas were previously developed and exhibit compacted soils, sporadic impervious cover and generally function like impervious surfaces from a hydrological point of view. The growth that is expected will primarily occur in one of two ways: (1) Parcels currently vacant or underutilized will be redeveloped for residential, commercial, or industrial uses; or (2) Areas currently developed will become more densely developed. For example, townhouses and multi-unit development projects will be planned at infill sites, as will associated commercial areas. The expected result is there will be greater population and greater business activity but minimal increase in impervious area (i.e., the land areas outside of protected open space will continue to be densely developed as it is today).

The watershed planning units that are currently priority areas for BMP implementation are discussed in ensuing sections of this plan. It is expected that the areas that are currently priority areas for implementing BMPs to control stormwater will continue to be priority areas in the future. Measures can be planned and implemented with confidence that they will help improve and protect water quality now and in the future. Likewise, goals for nonpoint source water quality improvements will remain unchanged based on future land use projections.

One additional factor that will be important looking to the future: The stormwater detention and volume control requirements in the Cook County Watershed Management Ordinance (WMO) apply to new developments and redevelopment projects. What that means is as areas in the watershed undergo redevelopment to accommodate population growth and new businesses, controls to reduce pollutant loadings from urban runoff will be integrated into these areas. In this way the expected growth in the watershed will be beneficial for water quality.

3.10 IMPERVIOUS SURFACE

Impervious surface is a land cover use that is paved or otherwise overlain with nonporous material (e.g., concrete, asphalt, roofs, etc.) that prevents infiltration of rain and snowmelt and is responsible for generating runoff and nonpoint source pollution. Impervious areas produce significant amounts of runoff, which is often delivered to receiving system rapidly through storm sewer networks. Impervious surface changes local hydrology which often leads to downcutting and widening of stream channels. The resultant erosion of the streambanks and streambeds further aggravates water quality and can negatively impact land resources and infrastructure. Impervious surfaces and the resultant runoff may also contribute to erosion of lakeshore areas. In addition, runoff from impervious areas often picks up pollutants, for example as water runs across a road or parking lot, and these pollutants are delivered to nearby surface waters. Given the impacts of impervious surface on local hydrology, water quality, and other resources, this man-made feature of the landscape warrants special attention in any effort to protect or restore water quality.

The National Land Cover Database 2011 (NLCD 2011) for the watershed planning area is shown in Figure 3.10-2. The NLCD 2011 is the most recent Landsat-based, 30-meter resolution land cover database for the Nation and corresponds well with the CMAP land use database. Each data point or pixel represents a 30-meter square remotely-sensed image of the Earth's surface with a value of imperviousness assigned that ranges from 0 to 100%.

The impervious surface area in the watershed is closely related to pollutant loadings and water quality. Rainwater runs across the impervious surfaces, picking up pollutant such as sediment, oil and grease, and bacteria, and then these pollutants are delivered to nearby water bodies. Additionally, wide expanses of impervious surfaces without adequate stormwater controls result in high volumes of runoff, which in turn causes stream sections to be flashy, which in turn degrades channels and produces erosion and sediment releases. For purposes of this plan, the extent of impervious surface is best understood in the context of its impact on water quality as shown in Figure 3.10-1. As the percentage of land cover imperviousness increases, general watercourse health degrades. This water quality can be understood as a function of impervious area coverage within the tributary area.

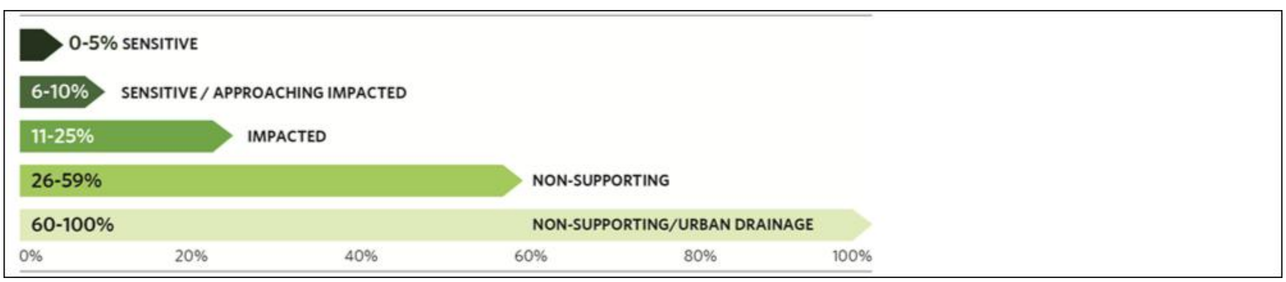


Figure 3.10-1 Stream Health Categories Relative to Extent of Impervious Surface

Figure 3.10-2 displays the pattern and extent of impervious surface within the Lower Des Plaines River Planning Area. Most of the planning area is at least 50% impervious, with a large portion of the watershed close to 90% impervious in the vicinity of O'Hare International Airport and the areas associated with major transportation corridors. The largest extent of pervious area is associated with the small narrow portion of the watershed near the Lower Des Plaines River mainstem, with much of this land owned and maintained by FPCC. The relationship between impervious surface and water quality is best examined at smaller units of geography. More localized land areas have direct impacts on the water quality of nearby lakes and streams. It will be appropriate to plan BMPs at priority locations to manage runoff from impervious areas.

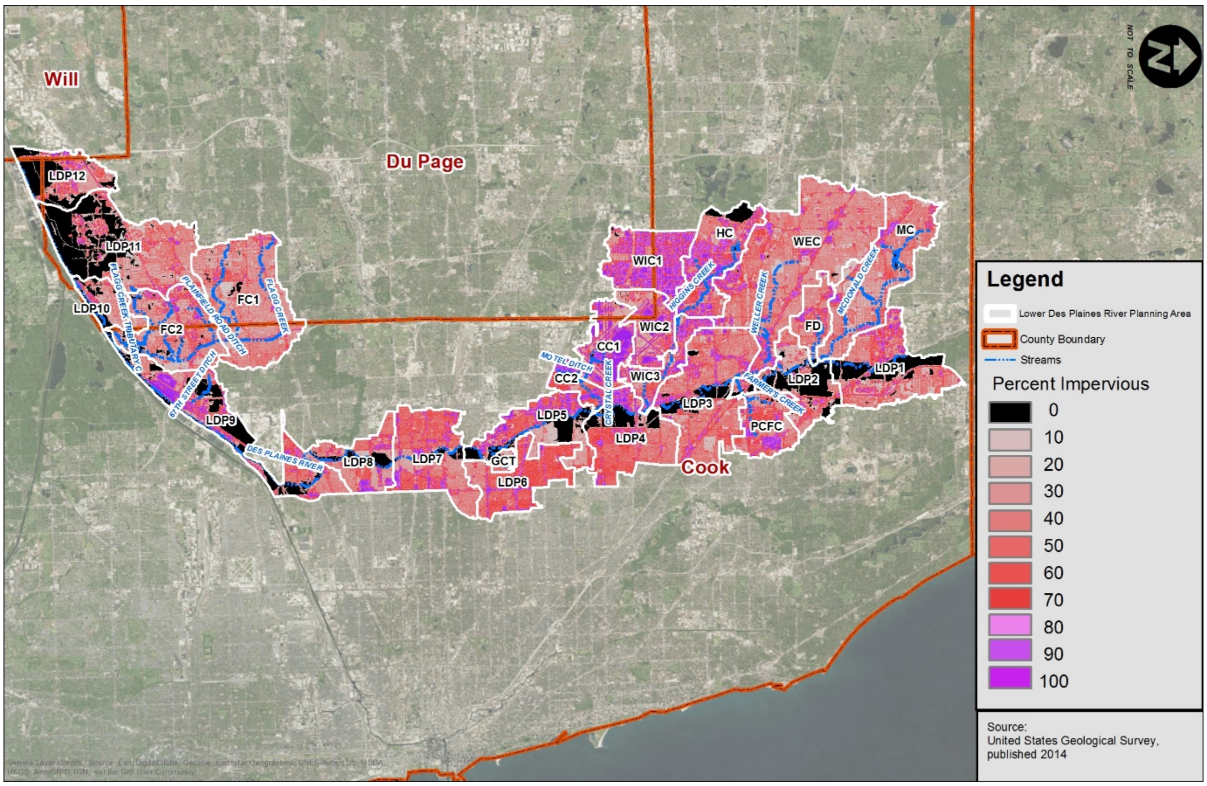


Figure 3.10-2 Impervious Surface (0-100%) in the Lower Des Plaines River Planning Area

Green infrastructure and volume control measures should be incorporated into projects as re-development proceeds in the watershed to restore and protect water quality for both this planning area and the downstream watersheds. Areas in and near the riparian corridor warrant special attention. Land should be protected as vegetated open space where feasible. For the existing highly impervious areas, low impact development and site-level green infrastructure should be retrofitted into these areas at the highest levels possible to not worsen the water quality. Population and employment growth forecasts for the planning area and County as discussed above suggest that without ordinances and subdivision codes that seek to protect water quality, the possibility of water resource degradation is great.

3.10.1 Coal Tar-Based Sealants

Impervious surfaces including roads and parking lots are of concern from a water quality perspective because water runs off these surfaces, drains into sewers, and is released in large quantities to receiving waters. There are physical effects from the stormwater discharges, in particular erosion from the volumes and energy in the discharges, but there are also chemical effects. The water picks up pollutants as it runs across surfaces and these substances are carried to the water bodies in the watershed. Pollution prevention practices can be employed to help reduce the amount of pollutants in the stormwater.

One practice that has specific and important water quality and public health implications is the sealing of pavements. Pavement sealants are applied to the asphalt pavement of many parking lots, driveways, and even playgrounds in the U.S. When first applied, the sealants cover the pavement with a glossy black and to a degree make the pavement look like new. Sealant products used commercially in the central, eastern, and northern U.S. often are coal-tar-based (whereas those used in the western U.S. typically are asphalt-based). Although the products look similar, they are chemically different. Coal-tar-based pavement sealants typically are 25-35 percent (by weight) coal tar or coal-tar pitch. Coal tar is a thick black liquid that's a byproduct of coke production. Coal tar contains high concentrations of a family of chemicals known as polycyclic aromatic hydrocarbons or PAHs. Sixteen PAHs have been classified by the U.S. Environmental Protection Agency as "Priority Pollutants." Six are classified as probable human carcinogens, and one (benzo[*a*]pyrene) is classified as a known human carcinogen. These are chemical substances we want to keep out of our air and water.

Coal tar-based pavement sealant products contain, on average, about 70,000 mg/kg of PAHs, on the order of 1,000 times higher than asphalt-based sealant products.[1] The fact that there is sealant on a driveway or parking lot or playground is not a water quality concern in and of itself. However, what happens is the sealant wears off the pavement over time, due to weather and vehicle traffic and snow plowing. The sealant is worn a fine powdery texture that is picked up by stormwater and transported to streams or lakes. PAHs can also accumulate in stormwater detention ponds. Having PAHs out in the environment is detrimental to the health of water bodies and the health of people. Consequently, PAHs are a pollutant of concern in the Lower Des Plaines watershed. The Lower Des Plaines Watershed Workgroup will be doing monitoring in 2018 and 2019 which will help characterize the presence of PAHs in the River.

A good pollution prevention practice to limit the release of PAHs in a watershed is to use a sealant product other than a coal tar-based sealant. Another option is to not seal pavement at all. In particular, converting a parking lot or driveway or playground to permeable pavement will allow water to soak into the ground and reduce stormwater discharge volumes and pollutant releases.

3.11 OPEN SPACE RESERVE

Open space reserve is an area of land and/or water that is protected or conserved such that development will not occur on this land at any time in the future. Land that is owned by the FPCC is a core component of the open space reserve within the planning area. Public parks are included along with private land on which a conservation easement is placed (Figure 3.11-1). Also shown on the figure are golf courses and other land that is privately held and could be sold and converted to a type of land use that is neither protected nor considered to be in a conservation status; thus, these lands are not necessarily a permanent part of the open space reserve.

[1] USGS https://tx.usgs.gov/sealcoat.html

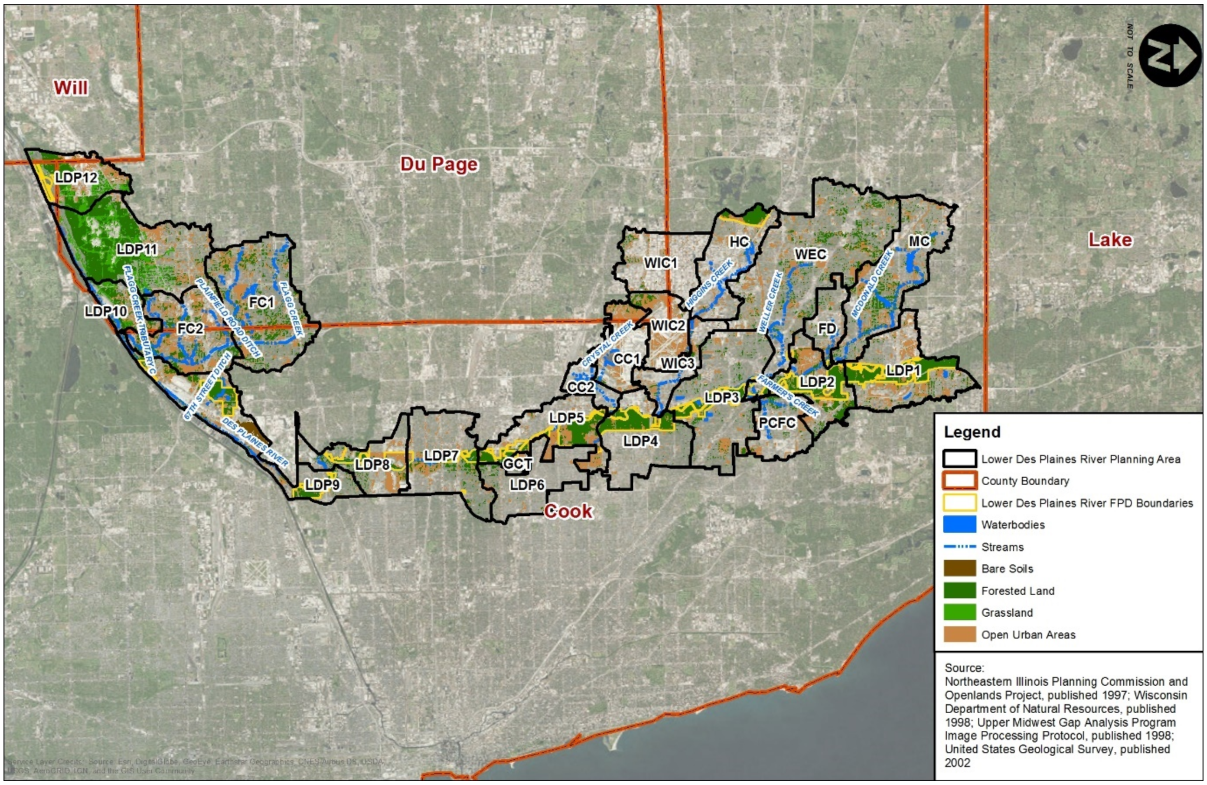


Figure 3.11-1 Greenways and Open Urban Areas in the Lower Des Plaines River Planning Area

Vegetation Type	*Area (acres)*	*Percent of Planning Area*
Bare Soils	393.0	0.4%
Forested Land	15,594.1	14.4%
Grassland	2,096.0	1.9%
Open Urban Areas	16,302.1	15.0%
Totals	***34,385.2***	***31.7%***

Table 3.11-1 Greenways and Open Urban Areas in the Lower Des Plaines River Planning Area

3.12 PRESETTLEMENT LAND COVER

For a qualitative sense of historical land use change, Figure 3.12-1 shows the presettlement land cover (primarily vegetation) in and around the Lower Des Plaines River Planning Area as surveyed in the early stages of Euro-American settlement in the early 1800s. At that time, the land cover was comprised primarily of forest and prairie along with wetlands (categorized as bottomland, slough, swamp, or other wetland types) and open water. Following European settlement, most of this land was converted to agricultural practices, followed by residential and commercial land uses. This historic land cover can be informative for current land use planning and future ecological restoration projects.

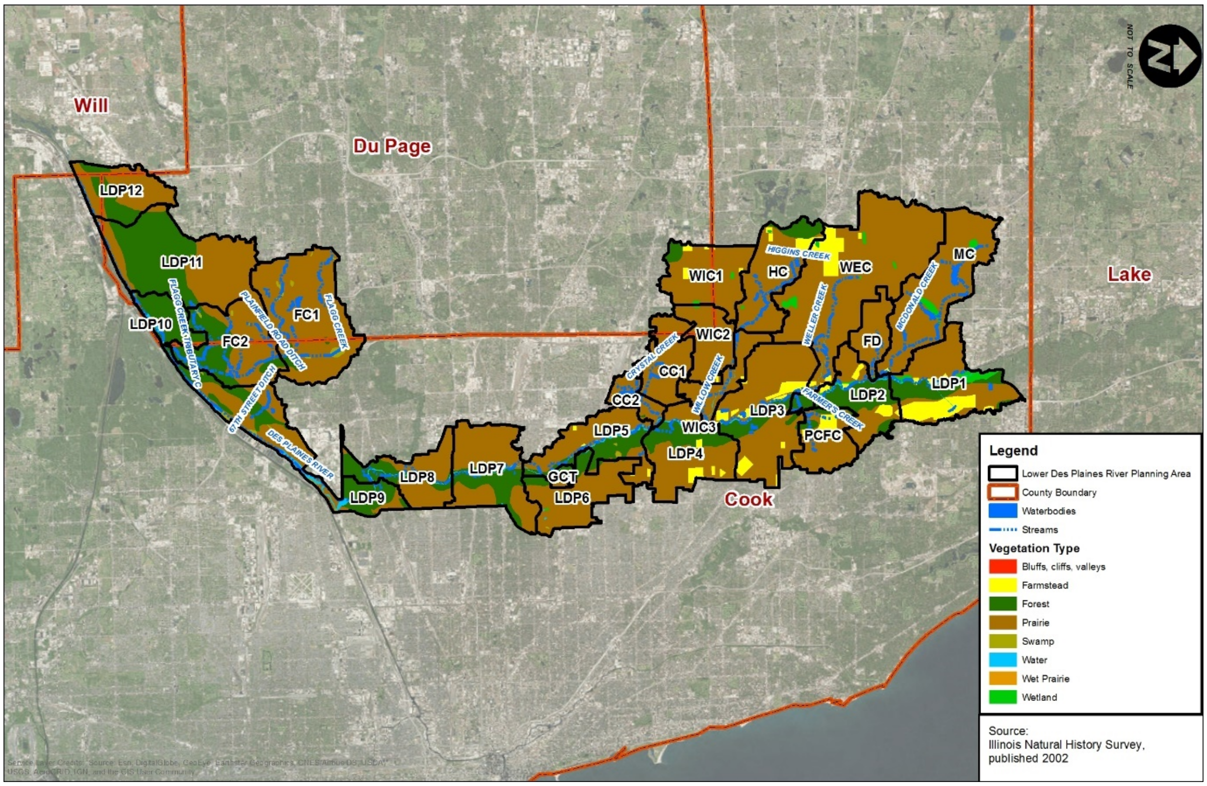


Figure 3.12-1 Presettlement Land Cover in the Lower Des Plaines River Planning Area

Vegetation Type	*Area (acres)*	*Percent of Planning Area*
Bluffs, cliffs, valleys	0.0	0.0%
Farmstead	3,945.2	3.6%
Forest	21,335.6	19.7%
Prairie	80,190.9	74.0%

Vegetation Type	Area (acres)	Percent of Planning Area
Swamp	479.2	0.4%
Water	1,300.6	1.2%
Wet Prairie	0.0	0.0%
Wetland	1,077.2	1.0%
Totals	***108,329***	***100.0%***

Table 3.12-1 Presettlement Land Cover in the Lower Des Plaines River Planning Area.

3.13 WATERSHED DRAINAGE SYSTEM

Water in the approximately 680 square mile Des Plaines River watershed generally flows north to south. There are several smaller watercourses in the watershed planning area that flow into the mainstem from the east or west as the mainstem flows south toward the Will County border. The Lower Des Plaines drainage system consists of the mainstem and the main tributaries, as described below and shown in Figure 3.13-1.

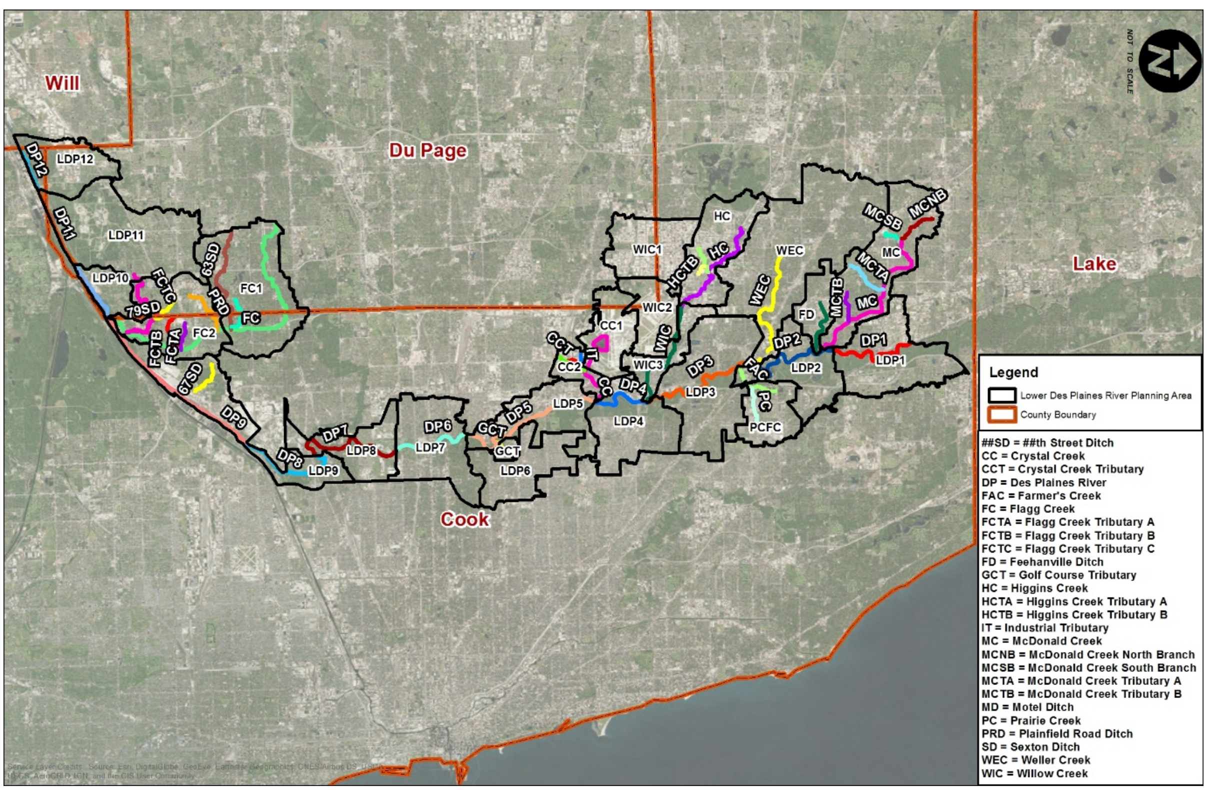


Figure 3.13-1 Watershed Drainage in the Lower Des Plaines River Planning Area

3.13.1 Mainstem Lower Des Plaines River

Figure 3.13-2 Lower Des Plaines River (LDP5 A)

The Des Plaines River watershed in Cook County includes numerous watercourses including the mainstem of the Des Plaines River and major tributaries including McDonald Creek, Weller Creek, Higgins Creek, Farmers-Prairie Creek, Feehanville Ditch, Willow Creek, Crystal Creek and Flagg Creek (Figure 3.13-1). The headwaters of the Des Plaines River begin in Racine County, Wisconsin and flow south through Kenosha County before entering Lake County, Illinois, just east of Interstate 94 at the Wisconsin/ Illinois state line. The Des Plaines River continues to flow south through Lake County and into Cook County before flowing southwest parallel to the Chicago Sanitary and Ship Canal and entering Will County. There is roughly 680 square miles of tributary area, with an approximate total length of 45 miles, from Illinois and Wisconsin to the Des Plaines River. The Des Plaines River contains moderate degrees of erosion and channelization, with a good condition of riparian areas. As noted above, the geographic scope of this plan is the Des Plaines River corridor in Cook County, north of the Chicago Sanitary and Ship Canal and south of the Cook County/Lake County border, excluding the East Avenue Ditch, Buffalo Creek, Lower Salt Creek, Addison Creek and Silver Creek drainage areas (Figure 3.1-2).

The Des Plaines River drains areas within numerous municipalities in Cook County. There is one flood control reservoir within the planning area, and multiple flood control projects have been implemented along the Lower Des Plaines River, including Levee 37, Levee 50, the McCook Levee and the Groveland Avenue Levee.

There are FPCC lands adjacent to the Des Plaines River along stretches of the River in Cook County. These Forest Preserve lands buffer and help protect the river. As discussed further below, the River channel has been significantly affected by stormwater volumes and the associated "flashiness" effects. The volumes of the water flowing through the system during and after storms have eroded many sections of riverbanks. The eroded riverbanks degrade terrestrial habitat and contribute sediment loadings to the River.

3.13.2 67th Street Ditch

The 67th Street Ditch watershed planning unit drains approximately 0.26 square miles, with an estimated length of 1.5 miles, and is roughly bounded by Joliet Road to the north, Willow Springs Road to the west, Brainard Avenue to the east, and Hillsdale Road to the south within the City of Countryside. The headwaters of the 67th Street Ditch originate west of Sunset Avenue then flow east through a residential subdivision in a 585-footlong culvert that outlets into the Arie Crown Forest Preserve. The 67th Street Ditch then flows through an industrial park prior to outletting into the Lower Des Plaines River at 71st Street.

3.13.3 Crystal Creek

Figure 3.13-3 Crystal Creek (CC2 A)

The Crystal Creek watershed planning unit includes the southeast portion of the O'Hare International Airport, portions of the City of Chicago, the Village of Franklin Park and the Village of Schiller Park within Cook County. Four major tributaries discharge into Crystal Creek, making up a 6.19 square mile area and an approximate length of 2.3 miles. These tributaries include Crystal Creek, Industrial Tributary, Motel Tributary and Sexton Ditch. The watershed planning unit contains 1 flood control reservoir: The South Detention Basin located within O'Hare International Airport, on airport property. The tributaries described above discharge into Crystal Creek downstream of O'Hare International Airport. Crystal Creek, in general, has a poor condition of riparian areas, a high degree of channelization, and a low degree of erosion.

A portion of the Crystal Creek watershed planning unit drains to the South Detention Basin on O'Hare International Airport property. Because runoff within the airport can be contaminated with deicing chemicals, the South Detention Basin is dewatered by a pump station. The pump station force main extends eastward to a MWRD TARP drop shaft located along the Des Plaines River. The tunnel conveys the flow southward to the Mainstream pumping station which pumps it to the District's Stickney Water Reclamation Plant for treatment. The remaining watershed area tributary to Crystal Creek discharges to the Lower Des Plaines River southwest of the intersection of Lawrence Avenue and River Road.

3.13.4 Des Plaines River Tributary A

The Des Plaines River Tributary A watershed planning unit measures approximately 0.40 square miles and is located north of Joliet Road, east of Wolf Road, west of Brainard Ave and south of 47th Street within the Village of LaGrange Park and the City of Countryside. The watershed contains no flood control reservoirs. The tributary originates downstream of Plainfield Road and flows north through the LaGrange Country Club where it enters a 48-inch reinforced concrete pipe (RCP) and empties into the local sewer system located within the Salt Creek Watershed.

3.13.5 Farmers Prairie Creek

The Farmers Prairie Creek watershed planning unit drains 4.5 square miles, and is comprised of Farmers Creek, Prairie Creek, Golf Road Storm Sewer, and Dempster Street Storm Sewer. Farmers Prairie Creek has an approximate total length of around 2 miles. There are no major flood control reservoirs in the Subwatershed; however, the Rand Park Flood Control & Multi-Use Trail Project (Levee 50) is located at the downstream end of the subwatershed. There are small reservoirs and diversions along Farmers and Prairie Creeks. The Farmers Prairie Creek subwatershed, which is located entirely within Cook County, drains areas within the City of Des Plaines, the Village of Glenview, the Village of Morton Grove, the Village of Niles, the City of Park Ridge and unincorporated areas.

The mainstem of Farmers Creek portion of the watershed is 1.26 square miles and begins just south of Golf Road, 0.25 miles east of the Interstate 294, with the headwaters consisting of Lake Mary Ann, Golf Road storm sewer overflows, and Dude Ranch Pond inflows. From this location, Farmers Creek flows south for 1.87 miles, passing through the Good Avenue Pond, Levee 50 area, and finally joins the Des Plaines River at River Mile 65.23.

The mainstem of Prairie Creek begins just to the north of a shopping strip mall located on the northwest corner of Greenwood Avenue and Ballard Road in the Village of Niles. The headwaters of Prairie Creek are from the Greenwood Avenue Storm Sewer area. Prairie Creek flows in a westerly direction for approximately 1.5 miles until its confluence with Farmer Creek at river mile 1.00. The Prairie Creek watershed contains the Ballard Road Reservoir and the Lutheran General Hospital East and West ponds, which are flow-through reservoirs. Farmers Prairie Creek consists of a fair condition of riparian areas, a low degree of erosion, and a high degree of channelization.

3.13.6 Feehanville Ditch

The Feehanville Ditch watershed planning unit drains approximately 2.7 square miles, with a length of approximately 2.3 miles, and is located north and adjacent to the Weller Creek watershed planning unit (north of O'Hare International Airport). Feehanville Ditch is an open channel beginning in an industrial/commercial park and flows east past Wolf Road. The open channel enters a long culvert just upstream of a railroad crossing which daylights and converges with an overland flow channel at the upstream face of Des Plaines River Road. The watershed planning unit consists mainly of residential and commercial land use and also contains an area of forest preserve (Camp Pine Woods Forest Preserve) east of Des Plaines River Road. Feehanville Ditch shows a fair condition of riparian areas, a high degree of channelization, and a low degree of erosion.

3.13.7 Flagg Creek

Figure 3.13-4 Flagg Creek (FC2 A)

The Flagg Creek watershed planning unit drains approximately 19.8 square miles, with a length of around 11.9 miles, and is located within Cook and DuPage Counties. The DuPage County portion of the watershed planning unit accounts for approximately 61% of the total drainage area. The Cook County portion of the Flagg Creek watershed planning unit is 7.7 square miles. Flagg Creek Mainstem flows in a general south-southeast direction until its confluence with the Des Plaines River in Willow Springs near the Cook-DuPage County line. Flagg Creek has a fair condition of riparian areas, a high degree of channelization, and a moderate degree of erosion.

The Flagg Creek watershed planning units drain areas within the Village of Burr Ridge, the City of Countryside, the Village of Hinsdale, the Village of Indian Head Park, the Village of Western Springs, and the Village of Willow Springs. The headwaters of Flagg Creek watercourse is in the Village of Westmont, which is located 3.25 miles west of County Line Road within DuPage County. Flagg Creek enters Cook County with a drainage area of 2.9 square miles, one block north of the BNSF Railroad Tracks. From this location Flagg Creek flows generally in a southern path for 7.6 miles until it crosses into DuPage County once again, approximately 0.25 miles south of the intersection of 91st Street and County Line Road in Willow Springs. From this location, Flagg Creek flows an additional 0.25 miles and joins the Des Plaines River at River Mile 32.2. The mainstem drainage area is 9.13 square miles with 5.54 square miles in Cook County.

Within the Flagg Creek watershed planning unit, there are seven minor tributaries to Flagg Creek that have been assessed in this plan. This is consistent with the watercourses assessed in the DWP for the Lower Des Plaines for Flagg Creek. These watercourses include: 59th St. Ditch, 63rd St. Ditch, Plainfield Road Ditch, Flagg Creek Tributary A, Flagg Creek Tributary B, 79th Street Ditch, and Flagg Creek Tributary C (in order from north to south).

- The 59th Street Ditch extends from 55th Street and Madison Street in Hinsdale and drains 1.31 square miles until its confluence with the 63rd Street Ditch in Western Springs. The length of this ditch is approximately 1.4 miles. The Cook County portion of the 59th Street ditch tributary area is 0.33 square miles.

- The 63rd Street Ditch drains 4.1 square miles with its headwaters at 59th Street and Cass Avenue in DuPage County. The length of this ditch is approximately 4.6 miles. The Cook County drainage area of the 63rd Street Ditch is 0.22 square miles.

- The Plainfield Road Ditch originates near Illinois Route 83 and Plainfield Road and drains 1.7 square miles at its confluence with Flagg Creek at river mile 4.82 in Indian Head Park. The total length of this ditch is approximately 2 miles. The Cook County drainage area of the Plainfield Road ditch is 0.32 square miles.

- Flagg Creek Tributary A has its headwaters at the Burr Ridge Village Center and drains 0.57 square miles with 0.21 square miles within Cook County. Its length is around 1-mile total.

- Flagg Creek Tributary B also originates in the Burr Ridge Village Center and flows west until its confluence with Flagg Creek in Lyons Township. The creek's total length is around 1.6 miles. Tributary B has a drainage area of 0.61 square miles with 0.35 square miles in Cook County.

Figure 3.13-5 Flagg Creek Tributary A (FC2 E)

- The 79th Street Ditch has its headwaters near Interstate 55 and Madison Street in Burr Ridge and flows to Tributary C. The length of this ditch is around 1.8 miles. The 79th Street Ditch drainage area is 0.64 square miles with 0.05 square miles in Cook County.

- Flagg Creek Tributary C originates near Interstate 55 and Illinois Route 83 in Willowbrook in DuPage County and drains 1.76 square miles until its confluence with Flagg Creek in Willow Springs. This tributary has a total length of around 4.6 miles. The Cook County portion of Tributary C is 0.64 square miles.

3.13.8 Golf Course Tributary

Golf Course Tributary Subwatershed measures approximately 0.55 square miles, with a total length of 1.1 miles, and is located south of West Grand Avenue, mainly within the Villages of Elmwood Park and River Grove in the southern part of the Des Plaines River Watershed. Golf Course Tributary depicts a good condition of riparian areas, a high degree of channelization, and a low degree of erosion.

3.13.9 McDonald Creek

Figure 3.13-6 McDonald Creek (MC B)

The McDonald Creek watershed planning unit is located in northwestern Cook County and encompasses an area of approximately 10.1 square miles, with a total Creek length of approximately 6.4 miles. The watershed planning unit includes portions of the municipalities of Arlington Heights, Prospect Heights, Mount Prospect, Wheeling, Buffalo Grove, Des Plaines, Palatine, and areas of Unincorporated Cook County. The McDonald Creek watershed planning unit is comprised of the McDonald Creek North Branch, McDonald Creek South Branch, McDonald Creek Tributary A, McDonald Creek Tributary B, and the mainstem of McDonald Creek. The subwatershed also includes Lake Arlington, an on-line flood control reservoir with a capacity of approximately 550 acre-feet. The headwaters of McDonald Creek are located just east of Route 53 in the Village of Arlington Heights, and the creek generally flows southeast until its confluence with the Des Plaines River in the Village of Mount Prospect. McDonald Creek presents a poor condition of riparian areas, a high degree of channelization, and a low degree of erosion.

The McDonald Creek North and South Branch combine at Lake Arlington, the outlet of which forms the headwaters of the mainstem stem of McDonald Creek. The length of the north branch is around 1.7 miles, while the length of the south branch is around 0.7 miles. There are three outlet control structures that comprise the outlet for Lake Arlington. Starting at the outlet of Lake Arlington, the mainstem of McDonald Creek generally flows southeast until its confluence with the Des Plaines River.

McDonald Creek Tributary A is an approximately 6,500-foot-long creek with a drainage area of approximately 0.9 square miles. The headwaters of McDonald Creek Tributary A begin at the Old Orchard County Club, located at the southwest corner of the intersection of Camp McDonald Road and Elmhurst Road (Route 83) in the Village of Mount Prospect. The creek generally flows northeast until its confluence with the mainstem stem of McDonald Creek near the intersection of Wheeling Road and Palatine Road in the City of Prospect Heights.

Figure 3.13-7 McDonald Creek (MC A)

McDonald Creek Tributary B is an approximately 5,200-foot-long creek with a drainage area of approximately 1.0 square mile. McDonald

Creek Tributary B parallels Euclid Avenue, flowing east from Wheeling Road until its confluence with the mainstem of McDonald Creek.

3.13.10 Weller Creek

Figure 3.13-8 Weller Creek (WEC A)

The Weller Creek watershed planning unit drains approximately 19 square miles, with a total length of 5.9 miles, and is located north of O'Hare International Airport primarily within the Villages of Mount Prospect and Arlington Heights. The watershed contains 4 flood control reservoirs: Clearwater Park, Crumley, Wilke-Kirchoff (Basins I and II) and the Mount Prospect Flood Control Reservoir. Weller Creek originates downstream of Central Road and flows south to the Mount Prospect Golf Course where it turns east toward Elmhurst Road and continues east to Mount Prospect Road. The creek then flows east under a railroad crossing where it enters a long culvert and continues south of a residential subdivision. An old overflow channel with a significantly higher invert than the existing main channel begins just downstream of the railroad and flows northeast and then south to join the main channel west of Northwest Highway. The main channel continues east and splits at a triple box culvert crossing west of Rand Road. The main channel flows southeast to its confluence with the Des Plaines River while the diversion channel is conveyed in a long culvert to the northeast to its outlet with the Des Plaines River. Weller Creek has a poor condition of riparian areas, a high degree of channelization, and a moderate degree of erosion.

3.13.11 Willow Creek

The Willow Creek watershed planning unit drains approximately 20 square miles, with a total length of around 5.7 miles, and is comprised of Willow Creek, Higgins Creek, Higgins Creek Tributary A and Higgins Creek Tributary B. The watershed planning unit contains the north portion of O'Hare International Airport. The watershed contains two flood control reservoirs: the Willow Creek Flood Control Reservoir interconnected with the North Detention Basin within O'Hare International Airport, and the Touhy Avenue Flood Control Reservoir Cells 1 and 2. Willow Creek, in total, shows a poor condition of riparian areas, a high degree of channelization, and a moderate degree of erosion.

Figure 3.13-9 Willow Creek (WIC3 B)

Willow Creek enters Cook County at York Road west of O'Hare International Airport and is conveyed northeast to its confluence with Higgins Creek within O'Hare International Airport downstream of Mount Prospect Road. The headwaters of Higgins Creek originate in the Ned Brown Forest Preserve located west of Arlington Heights Road. Higgins Creek flows southeast on the north side of Interstate 90 to its confluence with Higgins Creek Tributary A west of Elmhurst Road. Higgins Creek continues flowing southeast and under Interstate 90 where it is conveyed through the Touhy Avenue Flood Control Reservoir corridor before its confluence within Willow Creek within O'Hare International Airport. Downstream of the confluence of Willow and Higgins Creeks, the creek is known as Willow Creek and is conveyed through the relocated reach for the Phase 1 O'Hare International Airport Modernization Program, which includes the Willow Creek Flood Control Reservoir corridor. Willow Creek then continues to the southeast, through the Village of Rosemont, where several channel improvement projects have been implemented, then to the Des Plaines River. Areas directly tributary to Willow Creek in general are heavily drained by storm sewers.

3.13.12 Summit Conduit

The Summit Conduit is an inverted siphon that conveys flow from west of the Des Plaines River under the Des Plaines River to discharge in the Chicago Sanitary and Ship Canal. The area tributary to the Summit Conduit is roughly bounded by Willow Springs Road to the west, Joliet Road to the south and east and 47th Street to the north. The northeast portion of the drainage area extends southeast past Joliet Road to the McCook Levee to the northeast and the Des Plaines River south of the McCook Levee to approximately 55th Street. In addition to direct tributary area from the mainstem being tributary to the Summit Conduit, the entire East Avenue Ditch Subwatershed and the area tributary to the Plainfield Road storm sewer are tributary to the Summit Conduit. The Plainfield Road storm sewer conveys flow from the area south of Plainfield Road away from the Des Plaines River Tributary A subwatershed to the Summit Conduit. Loadings from this watershed planning unit have been excluded from this plan as the area drains to the Chicago Sanitary and Ship Canal (Figure 3.1-2).

3.14 PHYSICAL STREAM CONDITIONS

3.14.1 Watercourse Assessment Methodology

A desktop analysis was combined with field investigations to create an inventory of streams and tributaries with respect to streambed, bank, and riparian area conditions. The assessment focused on erosion, degree of channelization, condition of riparian areas and areas of debris blockages. The desktop analysis is based on review of high resolution aerial photography from 2013 through 2017. Aerial photography was used to identify large-scale issues including stream alterations, land uses that could contribute to nonpoint source pollution impairments, presence or absence of stream buffers, evidence of streambank erosion, in-channel impoundments, or other features of interest.

The review of aerial photography was conducted in conjunction with drainage class and soil erodibility mapping ("T" factor) previously created for each watershed planning unit. As previously discussed, T factors are integer values of from 1 through 5 tons per acre per year. The factor of 1 ton per acre per year is for shallow or otherwise fragile soils (shown as red in Figure 3.14-2) and 5 tons per acre per year is for deep soils that are least subject to damage by erosion (shown as green in Figure 3.14-2). While the T factor is typically used for conservation planning on farms, it is appropriate to use soil tolerance for the objective of identifying the degree of soil loss potential and in this case quantification of erosion. For the case of the Lower Des Plaines River Planning Area, the T factor is used in conjunction with aerial photography review to identify areas of low, moderate or high erosion.

Channels with high erodibility factors were identified as a channel susceptible to erosion. The combination of aerial reviews, identification of soil erodibility factors, and field assessments allowed for the assessment of overall erosion conditions, including streambed erosion. The field assessments included observations at bridges or other structures crossing a watercourse to both bolster and verify assessments made during the desktop analysis. The field assessments focused on the collection of data including bank heights, degree of bank erosion, degree of streambed erosion, streambed material, streambed sediment depth, streambed width, overall streambed description and water column description.

Google earth and street views were assessed as these street views provided detail in areas where watercourses have been highly channelized and hard armored as in the case through portions of Willow Creek watershed planning unit in the Village of Rosemont (**Error! Reference source not found.**). Data collected included a visual assessment of stream condition, adjacent land use, and environmental factors that could be attributed to altered flows and nonpoint source pollution.

The findings of the desktop analysis, field notes, and photographs of conditions at each location visited were compiled as a part of the evaluation. This comprehensive analysis was used to identify vulnerable locations within the streams and streambeds where bank and streambed erosion control measures can be implemented.

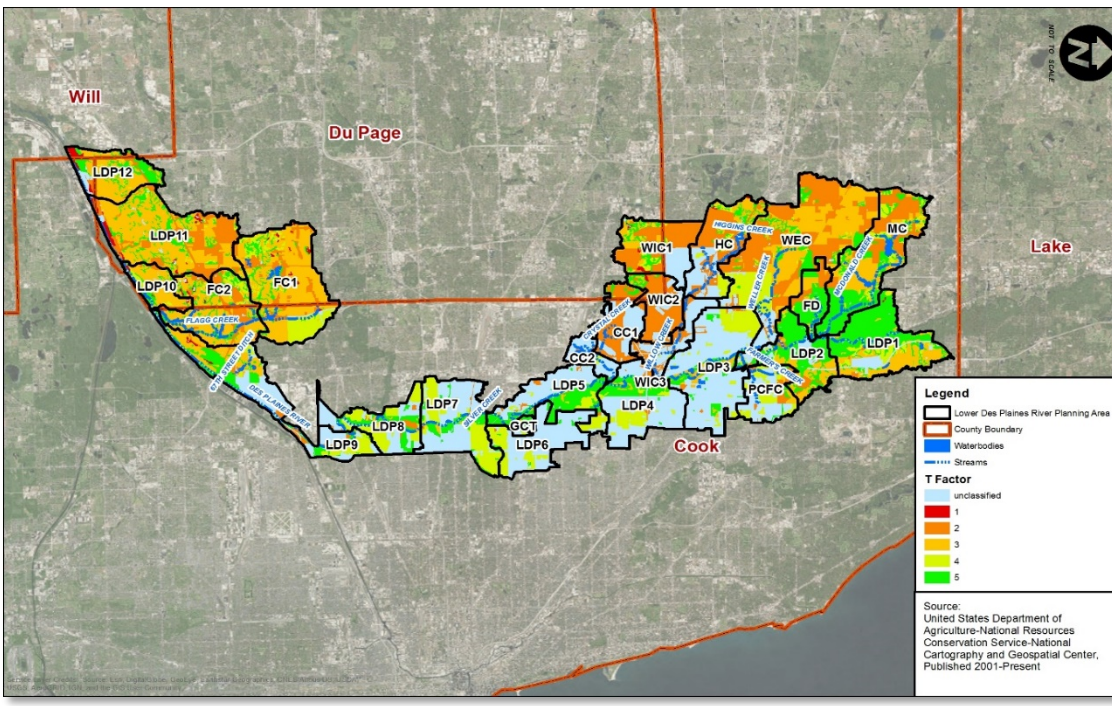


Figure 3.14-1 Highly Erodible Soils in the Lower Des Plaines River Planning Area

3.14.2 Channel Assessment Methodology

Channelization refers to the straightening of natural, meandering stream channels or the construction of channels for drainage (Figure 3.14-2). In natural meandering streams, channelization has the effect of reducing the overall length of the stream and increasing the gradient of the channel and therefore velocity. Channelization destroys in-stream and riparian habitat while disconnecting the stream from its floodplain. Channelization can also cause channel instability by reducing sinuosity while increasing streambank erosion (Figure 3.14-3). To restore and protect habitat and water quality, opportunities for re-meandering and reconnecting the stream with its floodplain should be pursued wherever possible.

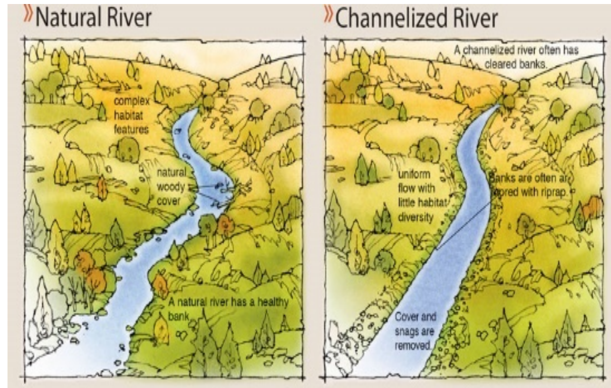


Figure 3.14-2 Channelization (Natural vs Channelized)

Figure 3.14-3 Example of channelization -location WIC 3

Figure 3.14-4 shows the degree of channelization in the Lower Des Plaines River planning area. Channelization is categorized as low, moderate or high degree. The condition of stream reaches in terms of stream channel erosion is shown in Figure 3.14-5.

The locations of the channel field assessments conducted in summer 2018 are shown in Figure 3.14-6. A summary of the data collected is shown below in Table 3.14-1.

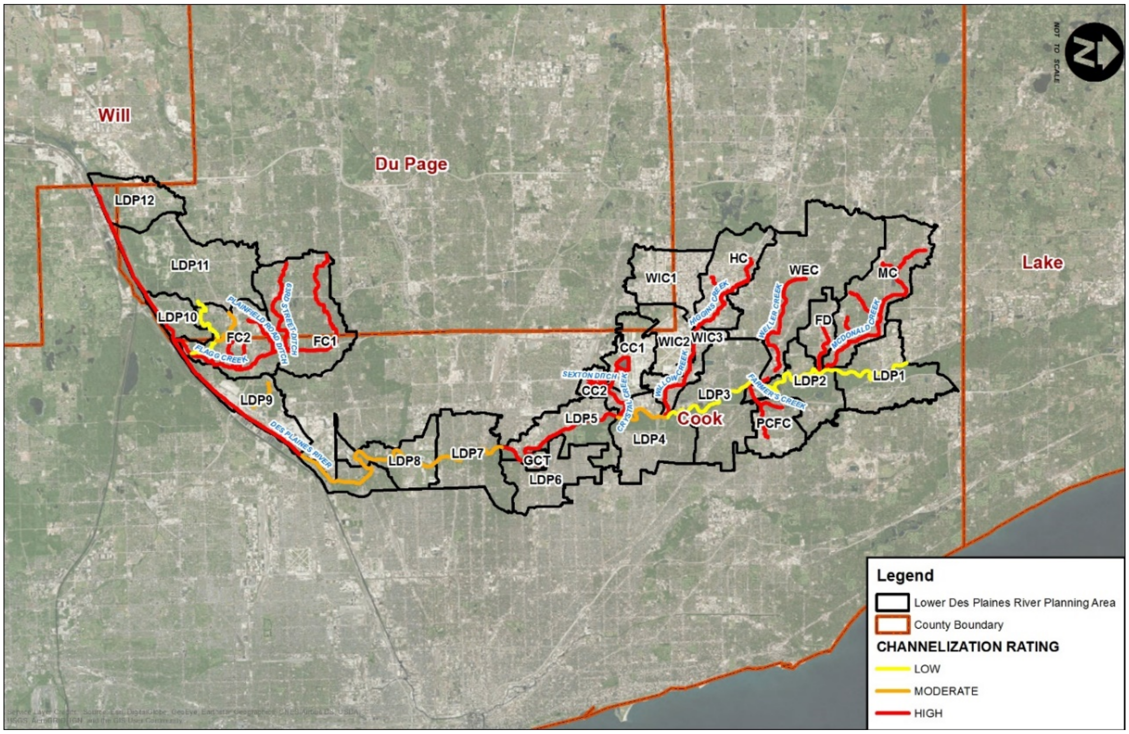


Figure 3.14-4 Summary of Channelization in the Lower Des Plaines River Planning Area

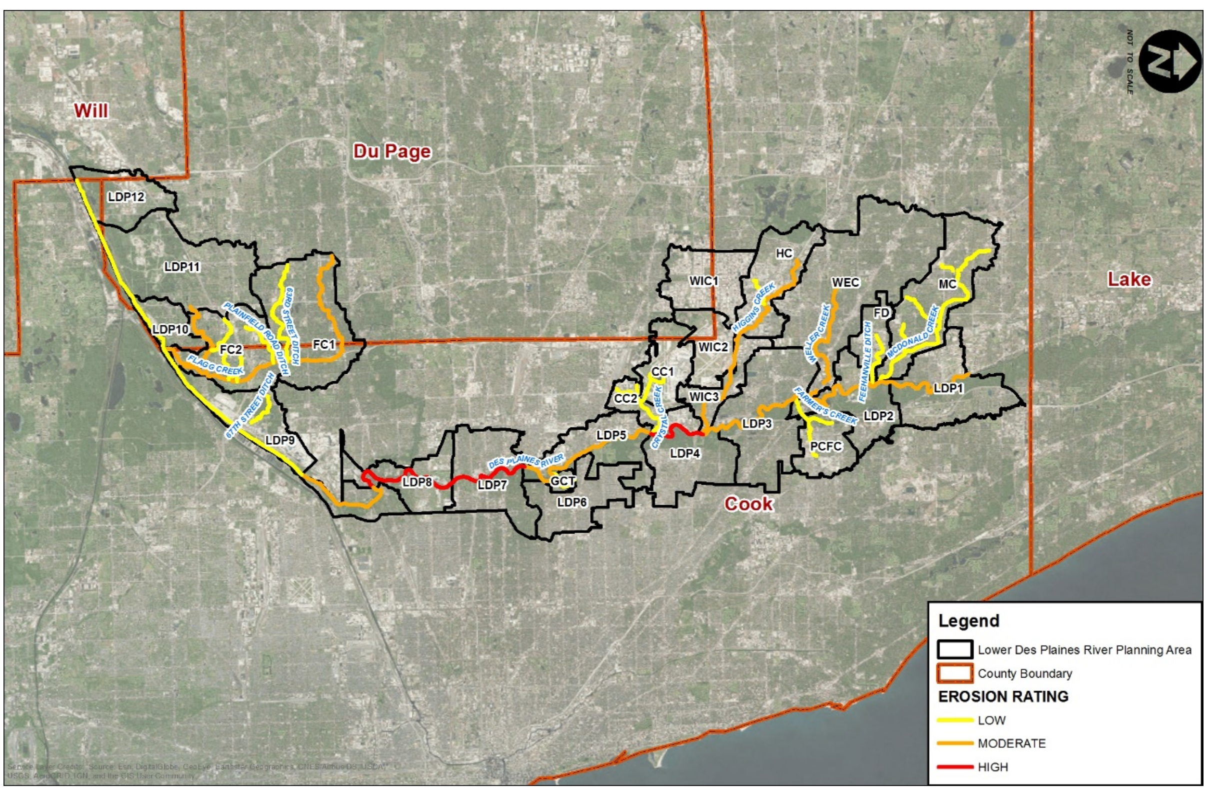


Figure 3.14-5 Summary of Stream Channel Erosion in the Lower Des Plaines River Planning Area

Segment	Bank Height		Sediment Depth		Channel Width		Channel Description	Streambed Description	Water Column Description
	Min	Max	Min	Max	(top of bank)	(normal water level)			
	(ft)	(ft)	(ft)	(ft)	ft	ft			
CC2 A	2	4	N/A	N/A	14.6	10.9	Medium channelization	Human and tree debris, rocky, trees surrounding	Sediment laden water
FC1 B	1	3	N/A	N/A	10	8	High channelization	Muddy bottom, little debris, little bank erosion	Sediment laden water
FC2 A	1.25	3.65	0.5	0.65	18	15	Low channelization	Rocky bottom, heavy erosion, little debris	Sediment laden water, yet transparent
FC2 B	0.65	2.65	0.15	0.25	30	26.6	Medium channelization	Rocky bottom, bank erosion, beaver dam and debris	Transparent water
FC2 D	1.25	3.15	0.3	0.3	37	33	High channelization	Rocky bottom, debris, medium erosion	Sediment laden water, dark algae
FC2 E	1.15	2.65	0.2	0.2	8	4	Medium channelization	Heavy erosion, debris by woods, skinny channel	Sediment laden water
HC A	1.5	5	N/A	N/A	7.69	7.69	High channelization	Rocky bottom, debris, heavy erosion with tree roots showing	Dark algae
HC B	1	7	N/A	N/A	15.4	7.14	High channelization	Rocky bottom, tree debris, little erosion, pipes present	Sediment laden water, dark algae
LDP1 A	0.8	6	N/A	N/A	71.4	66.7	High channelization	Rocky bottom, heavy erosion, falling trees	Transparent water
LDP2 A	0.05	0.05	N/A	N/A	80.7	68.5	Medium channelization	Muddy bottom, wide channel	Sediment laden water
LDP2 B	0.65	5.65	0.2	0.5	115	84.2	High channelization	Muddy bottom, heavy erosion with tree roots showing, tree debris	Sediment laden water
LDP4 A	1.2	3.5	N/A	N/A	125	97.1	Medium channelization	Muddy bottom, heavy erosion, falling trees and debris	Sediment laden water, yet transparent
LDP4 B	6	12	N/A	N/A	65.6	51.2	High channelization	Muddy bottom, erosion, tree debris, broken pipes	Sediment laden water
LDP5 A	1.95	3.65	3	3	121	99	High channelization	Muddy bottom, large sediment depth, heavy erosion, tree debris	Sediment laden water
LDP5 B	1	9	N/A	N/A	91.7	69.7	Medium channelization	Muddy and rocky bottom tree debris, pipe present	Sediment laden water, yet transparent
LDP7 A	0.5	3	N/A	N/A	112	93.6	High channelization	Muddy bottom, heavy erosion, tree debris present	Sediment laden water
LDP8 A	1.65	4.15	0.4	0.4	92.9	73.8	High channelization	Heavy erosion with tree roots showing, tree debris, flood marks	Sediment laden water
LDP8 B	0.15	0.65	N/A	N/A	141	112	High channelization	Rocky bottom, low erosion, fast flowing water	Transparent water
LDP8 C	2.05	4.65	0.2	0.3	84.8	64.3	High channelization	Muddy bottom, heavy erosion, tree debris	Sediment laden water
LDP9 A	2.35	3.37	0.5	0.55	130	115	High channelization	Muddy bottom, tree debris, erosion	Sediment laden water
LDP9 B	2.15	3.15	0.9	0.9	151	139	High channelization	Muddy bottom, heavy erosion, heavy tree debris	Sediment laden water, yet transparent
LDP11 A	1.15	3.05	0.3	0.3	219	198	High channelization	Tree debris, rocky bottom, low erosion	Transparent water
MC A	0.85	1.65	0.2	0.2	9.5	7.8	High channelization	Rocky bottom, little debris, high erosion	Sediment laden water
MC B	1.65	2.35	0.2	0.2	28	22.6	High channelization	Rocky and muddy bottom, heavy erosion	Sediment laden water
WEC A	0.65	2.05	0.05	0.1	23	17	High channelization	Rocky and grassy bank	Sediment laden water, dark algae
WIC3 A	0.8	3.5	N/A	N/A	60.5	44.4	Medium channelization	Heavy erosion, muddy bottom	Sediment laden water
WIC3 B	0.5	2	N/A	N/A	52.6	48.4	High channelization	Muddy and rocky bottom, erosion	Sediment laden water, yet transparent

Table 3.14-1 Summary of Stream Channel Field Data

The number of locations with sediment laden water highlight that erosion is occurring contributing to sediment loads, and that there are also sediment loadings from urban and suburban runoff. The locations with dark algae show the effects of excessive nutrient concentrations on the watercourses.

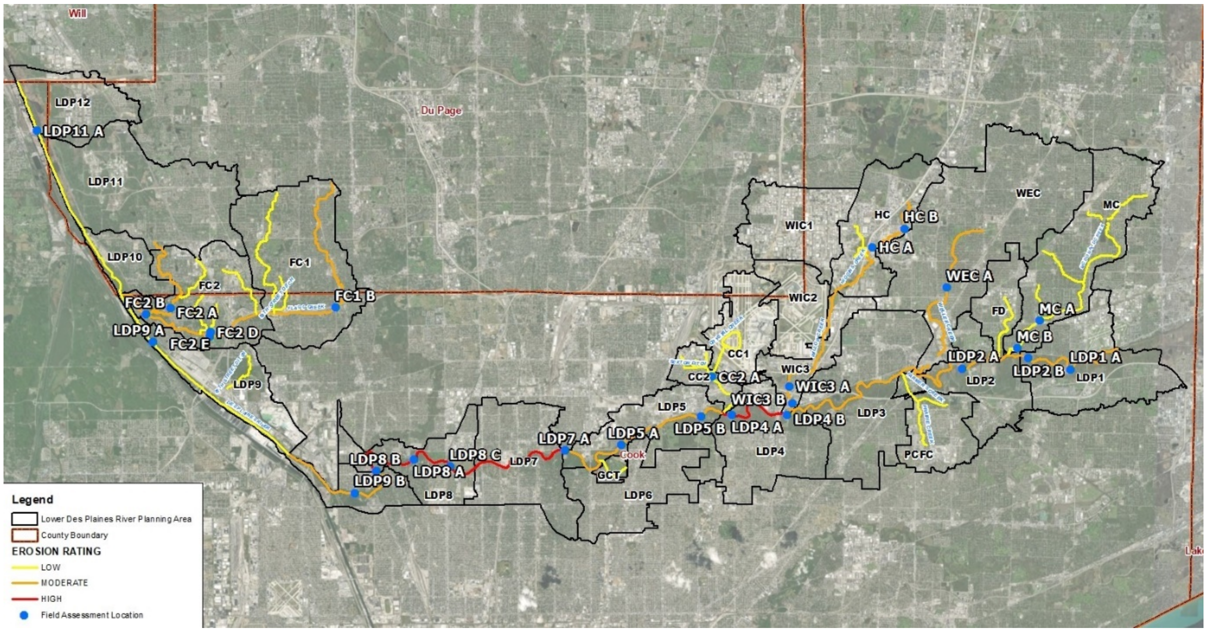


Figure 3.14-6 Stream Section Field Data Collection Locations

3.14.3 Riparian Area Assessment Methodology

A riparian zone or riparian area is the interface between land and a river or stream. A riparian area is comprised of vegetation, habitats, or ecosystems that are associated with bodies of water (streams or lakes) or are dependent on the existence of perennial, intermittent, or ephemeral surface or subsurface water drainage. An overall exhibit of the riparian area in the watershed planning area is shown in Figure 3.14-8. High resolution aerial imagery was used to assess riparian buffer conditions within 50-100 feet to each side of the watercourses throughout the watershed planning area. “Good” riparian condition was typically characterized by woodland, prairie, and/or wetland vegetation dominant on both sides of the stream. A “poor” condition was defined by turf grass and developed areas. A “fair” condition was noted as having at least some vegetative buffer along the stream to filter runoff from upland developed areas. Reaches with a “good” riparian condition were assessed based solely on aerial interpretation.

It should be noted that these areas may be dominated by invasive species, such as buckthorn, honeysuckle, reed canary grass, and phragmites, among others, and compromised in their pollutant filtering and settling capacities. The morphological changes produced in the alluvial terraces, including the channel reduction due to channelization and armoring activities lower the assessment. The elimination of meanders and construction of large closed conduit conveyance systems is also considered. Several figures and summary tables follow in the discussion below. Figure 3.14-8 shows the riparian areas within the watershed planning area and Figure 3.14-9 shows the condition of the riparian areas. Table 3.14-2 quantifies the stream lengths associated with the characterized riparian areas. Protecting and enhancing riparian areas will be helpful for protecting water quality in the Lower Des Plaines River and its tributaries.

Figure 3.14-7 Images Taken from Southern Area of Lower Des Plaines Watershed- Flagg Creek, Flagg Creek Tributary A, and Des Plaines River (FC2 B, FC2 E, LDP8 B, LDP9 B, LDP8 C, FC2 D)

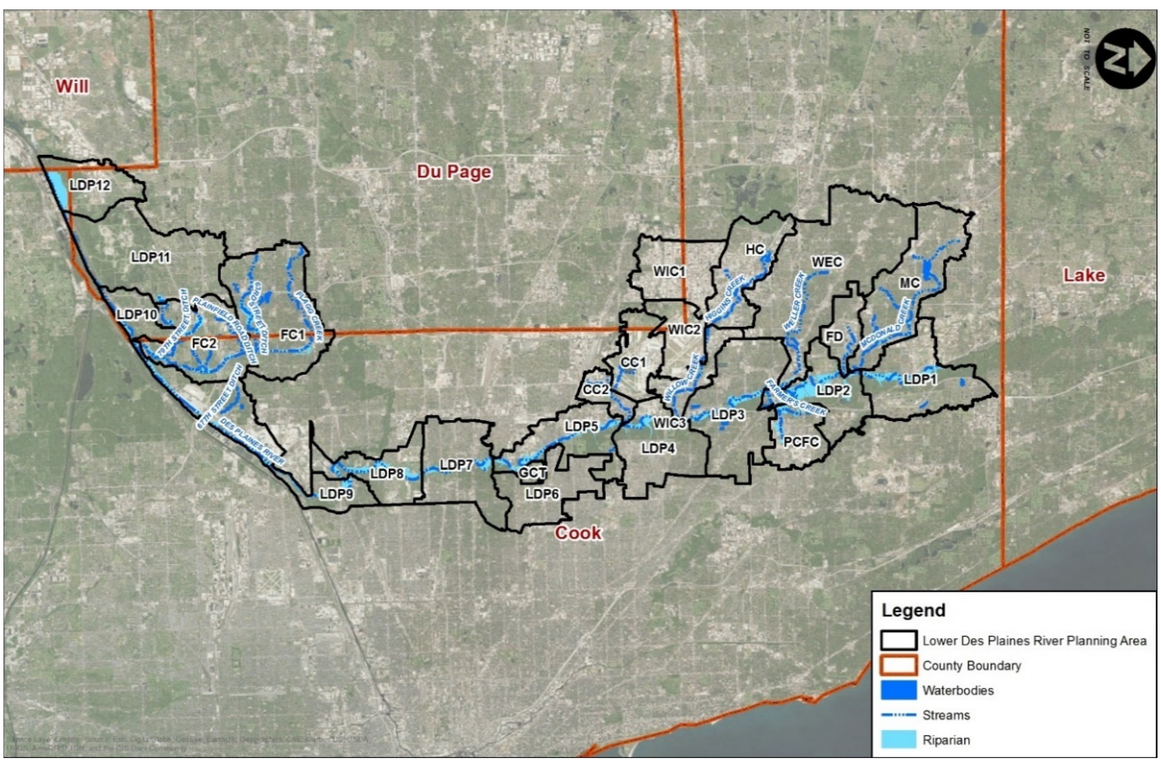


Figure 3.14-8 Riparian Corridors in the Lower Des Plaines River Planning Area

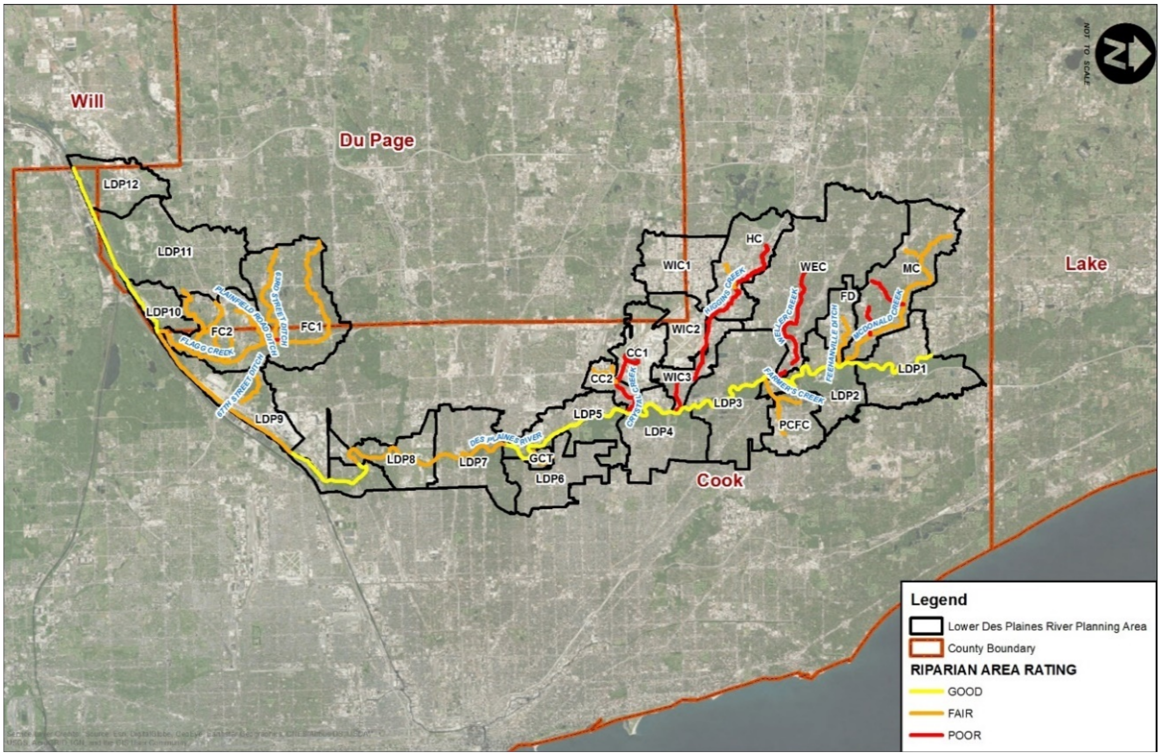


Figure 3.14-9 Summary of Riparian Area Conditions in the Lower Des Plaines River Planning Area

It can be seen from these figures that there is good or in some cases fair riparian condition near the Des Plaines River mainstem. This is largely a reflection of the FPCC lands adjacent to the River. However, the riparian condition of many of the tributaries is fair or poor. There is developed area almost right up to the floodway in many of these areas. In fact, nearly all of the tributary watercourses assessed west and east of the of the Lower Des Plaines River except for Higgins Creek Tributary B, 67th Street Ditch, 79th Street Ditch, and Flagg Creek Tributary C (listed north to south) flow through densely developed areas and are channelized. Erosion through these watercourses is low overall and moderate in some locations as the watercourses have been armored using various methods. The riparian area associated with these watercourses is that of an urban setting and does not promote a riparian habitat due to land constraints.

The majority of the mainstem of the Lower Des Plaines River lies within forest preserve areas where the riparian zone is protected. Generally, minimal to moderate channelization is present along the northern portion of the mainstem, from Wheeling to Bedford Park. Erosion is moderate to high as the river corridor narrows and velocity begins to increase through lower portion of the mainstem upstream of Bedford Park. High channelization, with low erosion due to constructed channelization and armoring, occurs south of Bedford Park once the Lower Des Plaines River reaches and begins to travel parallel to the Chicago Sanitary and Ship Canal.

Watercourse Name	Reach Code	Stream Length Assessed (feet)	Total Length (feet)	% of Total	Degree of Channelization	Riparian Area Condition	Degree of Erosion
59TH STREET DITCH	59SD	7,177	7,177	100%	HIGH	POOR	LOW
63RD STREET DITCH	63SD	24,235	24,235	100%	HIGH	FAIR	LOW
67TH STREET DITCH	67SD	8,154	8,154	100%	MODERATE	FAIR	LOW
79TH STREET DITCH	79SD	9,525	9,525	100%	MODERATE	FAIR	LOW
CRYSTAL CREEK	CC	12,144	12,144	100%	HIGH	POOR	LOW
CRYSTAL CREEK TRIBUTARY	CCT	8,448	8,448	100%	HIGH	FAIR	LOW
DES PLAINES RIVER	DP1	20,644	257,664	8%	LOW	GOOD	MODERATE
	DP2	25,044		10%	LOW	GOOD	MODERATE
	DP3	27,665		11%	LOW	GOOD	MODERATE
	DP4	13,246		5%	MODERATE	GOOD	HIGH
	DP5	31,908		12%	HIGH	GOOD	MODERATE
	DP6	17,334		7%	MODERATE	FAIR	HIGH
	DP7	24,944		10%	MODERATE	FAIR	HIGH
	DP8	21,726		8%	MODERATE	GOOD	MODERATE
	DP9	36,891		14%	HIGH	FAIR	LOW
	DP10	12,733		5%	HIGH	GOOD	LOW
	DP11	16,558		6%	HIGH	GOOD	LOW
	DP12	8,970		3%	HIGH	GOOD	LOW
FARMER’S CREEK	FAC	10,560	10,560	100%	HIGH	FAIR	LOW
FEEHANVILLE DITCH	FD	12,144	12,144	100%	HIGH	FAIR	LOW
FLAGG CREEK	FC	62,770	62,770	100%	HIGH	FAIR	MODERATE
FLAGG CREEK TRIBUTARY A	FCTA	5,520	5,520	100%	HIGH	FAIR	LOW
FLAGG CREEK TRIBUTARY B	FCTB	8,224	8,224	100%	HIGH	FAIR	LOW
FLAGG CREEK TRIBUTARY C	FCTC	24,464	24,464	100%	LOW	FAIR	MODERATE
GOLF COURSE TRIBUTARY	GCT	5,808	5,808	100%	HIGH	FAIR	LOW
HIGGINS CREEK	HC	24,486	24,486	100%	HIGH	POOR	MODERATE
HIGGINS CREEK TRIBUTARY A	HCTA	5,851	5,851	100%	HIGH	FAIR	LOW
HIGGINS CREEK TRIBUTARY B	HCTB	2,110	2,110	100%	MODERATE	FAIR	LOW
INDUSTRIAL TRIBUTARY	IT	3,070	3,070	100%	HIGH	FAIR	LOW
MCDONALD CREEK	MC	33,812	33,812	100%	HIGH	FAIR	LOW
MCDONALD CREEK NORTH BRANCH	MCNB	8,976	8,976	100%	HIGH	FAIR	LOW
MCDONALD CREEK SOUTH BRANCH	MCSB	3,696	3,696	100%	HIGH	FAIR	LOW
MCDONALD CREEK TRIBUTARY A	MCTA	6,336	6,336	100%	HIGH	POOR	LOW

Watercourse Name	Reach Code	Stream Length Assessed (feet)	Total Length (feet)	% of Total	Degree of Channelization	Riparian Area Condition	Degree of Erosion
MCDONALD CREEK TRIBUTARY B	MCTB	5,596	5,596	100%	HIGH	POOR	LOW
MOTEL DITCH	MD	1,584	1,584	100%	HIGH	FAIR	LOW
PLAINFIELD ROAD DITCH	PRD	10,344	10,344	100%	HIGH	FAIR	LOW
PRAIRIE CREEK	PC	7,877	7,877	100%	HIGH	FAIR	LOW
SEXTON DITCH	SD	1,873	1,873	100%	HIGH	FAIR	LOW
WELLER CREEK	WEC	31,152	31,152	100%	HIGH	POOR	MODERATE
WILLOW CREEK	WIC	30,096	30,096	100%	HIGH	POOR	MODERATE

Table 3.14-2 Summary of Channelization, Riparian Corridor and Erosion in the Lower Des Plaines River Planning Area

The results of the watercourse assessment indicate that channelization is generally high with riparian areas generally in moderate to poor condition along most of the tributaries to the mainstem. These areas of high channelization and poor riparian buffers are associated with densely urbanized areas. Many of the watercourses have some type of hard armoring to prevent future erosion. The combination of channelization and hard armoring has assisted with conveyance through the watercourse, however the loss of the riparian corridor and natural meandering negates the natural removal process of constituents found in stormwater runoff. Riparian areas are better along much of the mainstem, but streambanks are affected by River flashiness. These conditions highlight the need for BMPs to better manage stormwater and to measures to restore and protect any remaining open space and conversion of problematic land uses to open space within the riparian corridors. BMPs selected to restore the natural process may also include strategically planned and implemented streambank stabilization/restoration projects. The results of this watercourse assessment also correspond well with the erodible soils map; northern and central areas of the Lower Des Plaines River mainstem are more susceptible to erosion and exhibit moderate to high erosion (mainly due to lack of armoring) and areas elsewhere throughout the planning area are less erodible and exhibit low erosion (mainly due to a presence of some channelization measure, i.e., armoring). This also suggests the need for BMPs in areas noted with moderate erosion.

Figure 3.14-10: Images Taken from Northern Area of Lower Des Plaines Watershed- Des Plaines River, McDonald Creek, Higgins Creek, Weller Creek, Willow Creek (MC B, HC B, WEC A, WIC3 B, LDP5 A, LDP2 A)

3.15 DETENTION BASIN INVENTORY

Figure 3.15-1 LDP 189

Detention basins are man-made features that are used to temporarily store stormwater runoff during and after a storm. Detention basins can either be dry (during dry weather periods) or contain a permanent pool of water. The primary role of a detention basin is to store stormwater to reduce the risk of flooding, and basins can (but frequently do not) include design features to help protect local waterways. Detention basins are constructed to capture stormwater from storm events and snow melt, and then slowly release this water to a receiving watercourse. Problems such as streambank erosion and water pollution are just a few of the consequences of poorly managed stormwater. Degraded watercourses can be restored by employing BMPs, including retrofitting detention basins to incorporate features to restore and protect water quality.

Initial identification of detention basins within the Lower Des Plaines River planning area was accomplished using Google Earth. Additional information from the MWRD permitting database was analyzed and inventory information was expanded to include all applicable MWRD detention basins receiving a permit after 2012. Table 3.15-1 below is an inventory of detention basins in the Lower Des Plaines River Planning Area. The condition of the basin is identified, pointing to opportunities for basin retrofits. Inventory data is shown by municipality, watershed planning unit, tributary land use and type (dry or wet bottom). Detention basins often show signs of erosion where the fluctuation of water surface elevations from incoming stormwater can cause a ring of bare soil susceptible to erosion around shorelines. BMPs can be employed to retrofit eroding or unstable detention basins e.g., to flatten and naturalize the shorelines. Figure 3.15-3 displays the locations of detention basins.

Figure 3.15-2 LDP 236

Detention Basin ID	*Municipality*	*Watershed Planning Unit*	*Tributary Land Use*	*Type*	*Stable/Needs Improvement*
LDP-1	Arlington Heights	MC	MF	Wet	Stable
LDP-2	Arlington Heights	MC	MF	Wet	Needs Improvement
LDP-3	Arlington Heights	MC	MF	Wet	Needs Improvement
LDP-4	Arlington Heights	MC	MF	Wet	Needs Improvement
LDP-5	Arlington Heights	MC	MF	Wet	Needs Improvement
LDP-6	Arlington Heights	MC	C	Wet	Stable
LDP-7	Arlington Heights	MC	SF/C	Wet	Stable
LDP-8	Arlington Heights	MC	C	Wet	Needs Improvement
LDP-9	Arlington Heights	MC	C	Wet	Needs Improvement
LDP-10	Arlington Heights	MC	C	Wet	Stable
LDP-11	Arlington Heights	MC	SF	Wet	Stable
LDP-12	Arlington Heights	MC	SF	Wet	Needs Improvement
LDP-13	Arlington Heights	MC	SF	Wet	Stable
LDP-14	Arlington Heights	MC	SF	Wet	Stable
LDP-15	Arlington Heights	MC	SF	Wet	Stable
LDP-16	Wheeling	MC	MF	Wet	Stable
LDP-17	Wheeling	MC	MF	Wet	Needs Improvement
LDP-18	Wheeling	MC	MF	Wet	Needs Improvement
LDP-19	Wheeling	LDP1	IND/TCU	Wet	Needs Improvement
LDP-20	Wheeling	LDP1	IND	Wet	Stable
LDP-21	Wheeling	LDP1	INST	Wet	Needs Improvement
LDP-22	Prospect Heights	LDP1	MF	Wet	Needs Improvement
LDP-23	Northbrook	LDP1	SF	Wet	Stable
LDP-24	Northbrook	LDP1	MF	Wet	Needs Improvement
LDP-25	Northbrook	LDP1	C	Wet	Stable
LDP-26	Elk Grove Township	LDP1	MF/REC	Wet	Needs Improvement
LDP-27	Elk Grove Township	LDP1	SF/REC	Wet	Needs Improvement
LDP-28	Northbrook	LDP1	MF	Wet	Needs Improvement
LDP-29	Prospect Heights	LDP1	MF	Wet	Needs Improvement
LDP-30	Prospect Heights	LDP1	MF	Wet	Needs Improvement
LDP-31	Prospect Heights	MC	INST	Dry	Needs Improvement
LDP-32	Arlington Heights	WEC	MF	Wet	Stable
LDP-33	Elk Grove Township	LDP1	C	Wet	Stable
LDP-34	Elk Grove Township	LDP1	C	Wet	Stable

LDP-35	Elk Grove Township	LDP1	C/SF	Wet	Stable
LDP-36	Prospect Heights	MC	SF/REC	Wet	Needs Improvement
LDP-37	Mount Prospect	MC	MF	Wet	Needs Improvement
LDP-38	Mount Prospect	MC	REC	Wet	Stable
LDP-39	Mount Prospect	MC	REC	Wet	Stable
LDP-40	Mount Prospect	MC	REC	Wet	Stable
LDP-41	Elk Grove Township	LDP1	MF	Wet	Needs Improvement
LDP-42	Arlington Heights	MC	REC	Wet	Stable
LDP-43	Glenview	LDP2	TCU/REC	Wet	Stable
LDP-44	Glenview	LDP2	C	Wet	Stable
LDP-45	Glenview	LDP2	C	Wet	Needs Improvement
LDP-46	Glenview	LDP2	C	Wet	Stable
LDP-47	Glenview	LDP2	C	Wet	Needs Improvement
LDP-48	Mount Prospect	FD	C	Wet	Stable
LDP-49	Mount Prospect	FD	C	Wet	Needs Improvement
LDP-50	Mount Prospect	FD	C	Wet	Needs Improvement
LDP-51	Mount Prospect	FD	IND	Wet	Needs Improvement
LDP-52	Mount Prospect	FD	IND	Wet	Needs Improvement
LDP-53	Mount Prospect	FD	IND	Wet	Stable
LDP-54	Mount Prospect	FD	C	Wet	Needs Improvement
LDP-55	Mount Prospect	FD	MF	Wet	Stable
LDP-56	Glenview	LDP2	REC	Wet	Needs Improvement
LDP-57	Glenview	LDP2	REC	Wet	Needs Improvement
LDP-58	Glenview	LDP2	REC	Wet	Needs Improvement
LDP-59	Glenview	LDP2	REC	Wet	Needs Improvement
LDP-60	Glenview	LDP2	REC	Wet	Needs Improvement
LDP-61	Elk Grove Township	LDP2	SF	Wet	Needs Improvement
LDP-62	Elk Grove Township	LDP2	MF	Wet	Stable
LDP-63	Des Plaines	LDP2	INST	Wet	Stable
LDP-64	Arlington Heights	WEC	MF	Wet	Stable
LDP-65	Arlington Heights	WEC	MF	Wet	Stable
LDP-66	Arlington Heights	WEC	INST	Wet	Stable
LDP-67	Des Plaines	LDP2	REC	Wet	Stable
LDP-68	Des Plaines	LDP2	REC	Wet	Stable
LDP-69	Niles	PCFC	MF	Wet	Stable
LDP-70	Niles	PCFC	MF	Wet	Stable

LDP-71	Mount Prospect	WEC	REC	Wet	Stable
LDP-72	Mount Prospect	WEC	REC	Wet	Needs Improvement
LDP-73	Mount Prospect	WEC	REC	Wet	Needs Improvement
LDP-74	Arlington Heights	WEC	C	Wet	Needs Improvement
LDP-75	Arlington Heights	HC	C	Wet	Needs Improvement
LDP-76	Des Plaines	WEC	TCU	Wet	Stable
LDP-77	Niles	PCFC	C	Dry	Stable
LDP-78	Des Plaines	WEC	MF	Dry	Stable
LDP-79	Arlington Heights	WEC	MF	Wet	Stable
LDP-80	Arlington Heights	WEC	MF	Wet	Stable
LDP-81	Arlington Heights	HC	SF	Wet	Needs Improvement
LDP-82	Arlington Heights	HC	IND	Wet	Stable
LDP-83	Arlington Heights	HC	IND	Wet	Stable
LDP-84	Arlington Heights	HC	C	Wet	Needs Improvement
LDP-85	Arlington Heights	HC	IND	Dry	Stable
LDP-86	Arlington Heights	HC	IND	Wet	Stable
LDP-87	Elk Grove Village	HC	C	Wet	Stable
LDP-88	Elk Grove Village	HC	C	Wet	Stable
LDP-89	Arlington Heights	HC	SF	Wet	Needs Improvement
LDP-90	Arlington Heights	HC	SF	Wet	Needs Improvement
LDP-91	Mount Prospect	HC	MF	Wet	Stable
LDP-92	Mount Prospect	HC	MF	Wet	Stable
LDP-93	Mount Prospect	WEC	IND	Wet	Needs Improvement
LDP-94	Mount Prospect	WEC	C	Wet	Needs Improvement
LDP-95	Des Plaines	LDP3	REC	Wet	Stable
LDP-96	Des Plaines	LDP3	REC	Wet	Stable
LDP-97	Des Plaines	LDP3	IND	Wet	Stable
LDP-98	Park Ridge	LDP3	C	Wet	Stable
LDP-99	Elk Grove Village	HC	IND	Wet	Stable
LDP-100	Des Plaines	HC	IND	Wet	Needs Improvement
LDP-101	Des Plaines	HC	IND	Wet	Needs Improvement
LDP-102	Park Ridge	LDP3	REC/SF	Wet	Stable
LDP-103	Elk Grove Township	HC	TCU	Wet	Needs Improvement
LDP-104	Des Plaines	WIC3	IND	Wet	Needs Improvement
LDP-105	Bensenville	WIC1	IND	Dry	Stable
LDP-106	Rosemont	LDP4	C	Wet	Needs Improvement

LDP-107	Chicago	CC1	IND	Dry	Needs Improvement
LDP-108	Schiller Park	CC2	TCU	Wet	Stable
LDP-109	Schiller Park	CC2	TCU	Wet	Stable
LDP-110	Schiller Park	CC1	TCU	Wet	Stable
LDP-111	Franklin Park	LDP5	IND	Wet	Needs Improvement
LDP-112	Chicago	LDP5	REC	Wet	Needs Improvement
LDP-113	Chicago	LDP5	REC	Wet	Stable
LDP-114	Franklin Park	LDP5	IND	Dry	Stable
LDP-115	Franklin Park	LDP5	C	Dry	Needs Improvement
LDP-116	Franklin Park	LDP5	IND	Wet	Stable
LDP-117	Franklin Park	LDP5	IND	Wet	Stable
LDP-118	Melrose Park	LDP5	IND	Wet	Stable
LDP-119	Melrose Park	LDP5	C	Wet	Needs Improvement
LDP-120	Melrose Park	LDP5	C	Wet	Stable
LDP-121	North Riverside	LDP8	INST	Wet	Stable
LDP-123	Western Springs	FC1	MF	Wet	Stable
LDP-124	Western Springs	FC1	C	Dry	Stable
LDP-125	Burr Ridge	FC1	SF	Wet	Stable
LDP-126	Burr Ridge	FC1	SF	Wet	Stable
LDP-127	Burr Ridge	FC1	SF	Wet	Stable
LDP-128	Indian Head Park	FC1	MF	Wet	Stable
LDP-129	Indian Head Park	FC1	MF	Wet	Stable
LDP-130	Indian Head Park	FC1	MF	Wet	Stable
LDP-131	Hodgkin’s	LDP9	C	Dry	Stable
LDP-132	Hodgkins	LDP9	MF	Wet	Needs Improvement
LDP-133	Countryside	LDP9	REC	Wet	Stable
LDP-134	Countryside	FC2	REC	Wet	Stable
LDP-135	Countryside	FC2	REC	Wet	Stable
LDP-136	Countryside	FC2	REC	Wet	Stable
LDP-137	Indian Head Park	FC2	MF	Wet	Stable
LDP-138	Indian Head Park	FC2	MF	Wet	Needs Improvement
LDP-139	Burr Ridge	FC2	SF	Wet	Stable
LDP-140	Burr Ridge	FC2	SF	Wet	Stable
LDP-141	Burr Ridge	FC2	SF	Wet	Stable
LDP-142	Burr Ridge	FC2	SF	Wet	Stable
LDP-143	Burr Ridge	FC2	SF	Wet	Stable

LDP-144	Burr Ridge	FC2	SF	Wet	Stable
LDP-145	Burr Ridge	FC2	MF	Wet	Needs Improvement
LDP-146	Burr Ridge	FC2	SF	Wet	Stable
LDP-147	Burr Ridge	FC2	SF	Wet	Stable
LDP-148	Burr Ridge	FC2	C	Wet	Needs Improvement
LDP-149	Hodgkins	LDP9	IND	Wet	Needs Improvement
LDP-150	Burr Ridge	FC2	SF	Wet	Needs Improvement
LDP-151	Burr Ridge	FC2	SF	Wet	Needs Improvement
LDP-152	Burr Ridge	FC2	SF	Wet	Needs Improvement
LDP-153	Willow Springs	FC2	SF	Wet	Needs Improvement
LDP-154	Burr Ridge	FC2	SF	Wet	Needs Improvement
LDP-155	Burr Ridge	LDP10	SF	Wet	Needs Improvement
LDP-156	Burr Ridge	LDP10	SF	Wet	Needs Improvement
LDP-157	Burr Ridge	LDP10	SF	Wet	Needs Improvement
LDP-158	Willow Springs	FC2	MF	Wet	Needs Improvement
LDP-159	Downers Grove Township	LDP11	INST	Wet	Stable
LDP-160	Woodridge	LDP12	IND	Wet	Stable
LDP-161	Woodridge	LDP12	IND	Wet	Stable
LDP-162	Arlington Heights	HC	SF/IND	Wet	Needs Improvement
LDP-163	Park Ridge	LDP3	MF	Wet	Stable
LDP-164	Burr Ridge	FC2	SF	Wet	Stable
LDP-165	Arlington Heights	MC	MF	Wet	Needs Improvement
LDP-166	Arlington Heights	MC	MF	Wet	Needs Improvement
LDP-167	Arlington Heights	MC	MF	Wet	Stable
LDP-168	Arlington Heights	WEC	IND	Dry	Stable
LDP-169	Arlington Heights	MC	C	Wet	Needs Improvement
LDP-170	Arlington Heights	MC	C	Wet	Needs Improvement
LDP-171	Arlington Heights	MC	C	Wet	Needs Improvement
LDP-172	Arlington Heights	WEC	MF	Dry	Needs Improvement
LDP-173	Wood Dale	WIC1	IND	Dry	Needs Improvement
LDP-174	Wood Dale	WIC1	IND	Dry	Stable
LDP-175	Elk Grove Village	WIC1	IND	Dry	Stable
LDP-176	Elk Grove Village	HC	IND	Dry	Stable
LDP-177	Mount Prospect	WEC	MF	Wet	Needs Improvement
LDP-178	Arlington Heights	MC	SF	Dry	Stable
LDP-179	Mount Prospect	WEC	REC	Dry	Stable

LDP-180	Mount Prospect	WEC	IND	Wet	Needs Improvement
LDP-181	Mount Prospect	WEC	SF	Wet	Stable
LDP-182	Prospect Heights	MC	INST	Dry	Stable
LDP-183	Arlington Heights	MC	SF	Wet	Stable
LDP-184	Arlington Heights	MC	SF	Wet	Stable
LDP-185	Des Plaines	HC	C	Dry	Stable
LDP-186	Elk Grove Village	WIC1	IND	Wet	Stable
LDP-187	Chicago	WIC1	IND	Wet	Needs Improvement
LDP-188	Des Plaines	WIC3	IND	Dry	Stable
LDP-189	Des Plaines	LDP3	INST	Wet	Stable
LDP-190	Des Plaines	LDP3	INST	Wet	Stable
LDP-191	Wheeling	LDP1	IND	Wet	Needs Improvement
LDP-192	Prospect Heights	LDP1	MF	Dry	Needs Improvement
LDP-193	Mount Prospect	MC	MF	Wet	Needs Improvement
LDP-194	Des Plaines	WEC	IND	Dry	Stable
LDP-195	Chicago	WIC3	TCU	Dry	Stable
LDP-196	Prospect Heights	LDP1	C	Wet	Stable
LDP-197	Rosemont	WIC3	MF	Wet	Needs Improvement
LDP-198	Franklin Park	LDP5	C	Dry	Stable
LDP-199	Franklin Park	LDP5	IND	Dry	Needs Improvement
LDP-200	Schiller Park	LDP4	C	Wet	Needs Improvement
LDP-201	Elk Grove Township	LDP2	MF	Wet	Needs Improvement
LDP-202	Elk Grove Township	LDP2	MF	Wet	Needs Improvement
LDP-203	Glenview	LDP2	MF	Wet	Stable
LDP-204	Glenview	LDP2	MF	Dry	Needs Improvement
LDP-205	Glenview	LDP2	REC	Wet	Stable
LDP-206	Glenview	LDP2	SF	Wet	Needs Improvement
LDP-207	Niles	PCFC	MF	Dry	Stable
LDP-208	Niles	PCFC	MF	Dry	Stable
LDP-209	Northbrook	LDP1	SF	Wet	Stable
LDP-210	Forest Park	LDP7	C	Wet	Needs Improvement
LDP-211	Forest Park	LDP7	C	Dry	Needs Improvement
LDP-212	Elk Grove Township	LDP8	REC	Wet	Stable
LDP-213	Elk Grove Township	LDP8	INST	Wet	Stable
LDP-214	North Riverside	LDP8	REC	Wet	Needs Improvement
LDP-216	Hinsdale	FC1	MF	Wet	Stable

LDP-217	Hinsdale	FC1	INST	Dry	Stable
LDP-218	Westmont	FC1	SF	Dry	Needs Improvement
LDP-220	Westmont	FC1	C	Dry	Needs Improvement
LDP-221	Burr Ridge	FC2	SF	Wet	Stable
LDP-222	Burr Ridge	FC2	SF	Wet	Stable
LDP-225	Hodgkins	LDP9	IND	Wet	Needs Improvement
LDP-226	Willowbrook	FC1	SF	Wet	Stable
LDP-227	Willowbrook	FC1	SF	Wet	Stable
LDP-228	Willowbrook	FC1	SF	Wet	Stable
LDP-229	Darien	LDP11	C	Dry	Stable
LDP-230	Darien	LDP11	C	Dry	Stable
LDP-231	Darien	LDP11	INST	Dry	Stable
LDP-232	Darien	LDP11	INST	Dry	Stable
LDP-233	Darien	LDP11	MF	Wet	Needs Improvement
LDP-234	Darien	LDP11	INST	Wet	Needs Improvement
LDP-235	Burr Ridge	LDP10	C	Wet	Stable
LDP-236	Downers Grove Township	LDP11	INST	Wet	Needs Improvement
LDP-12071	Mount Prospect	FD	INST	Underground	Not Applicable
LDP-12086	Mount Prospect	HC	C	Underground	Not Applicable
LDP-12150	Hodgkins	LDP9	REC	Underground	Not Applicable
LDP-12168	Elk Grove Village	WIC1	IND	Wet	Needs Improvement
LDP-12181	Arlington Heights	HC	C	Dry	Stable
LDP-12182	Arlington Heights	MC	C	Underground	Not Applicable
LDP-12241	Des Plaines	HC	C	Dry	Needs Improvement
LDP-12274	North Riverside	LDP8	IND	Dry	Stable
LDP-12282	Mount Prospect	WEC	C	Dry	Stable
LDP-13027	Elk Grove Village	WIC1	IND	Underground	Not Applicable
LDP-13029	Mount Prospect	FD	C	Underground	Not Applicable
LDP-13035	Prospect Heights	LDP1	C	Underground	Not Applicable
LDP-13039	Mount Prospect	MC	C	Dry	Stable
LDP-13046	Arlington Heights	WEC	INST	Underground	Not Applicable
LDP-13057	Elk Grove Village	WIC1	IND	Underground	Not Applicable
LDP-13077	Arlington Heights	MC	REC	Surface	Not Applicable
LDP-13079	North Riverside	LDP8	C	Underground	Not Applicable
LDP-13080	Des Plaines	WEC	MF	Wet	Stable
LDP-13096	Elk Grove Village	WIC1	IND	Dry	Needs Improvement

LDP-13111	Rosemont	LDP3	C	Underground	Not Applicable
LDP-13154	Niles	PCFC	INST	Dry	Stable
LDP-13156	Rosemont	LDP4	C	Underground	Not Applicable
LDP-13174	Glenview	LDP1	C	Underground/Wet	Not Applicable
LDP-13176	Schiller Park	CC2	C	Dry	Needs Improvement
LDP-13206	Des Plaines	WEC	IND	Underground	Not Applicable
LDP-13219	Western Springs	FC1	SF	Dry	Needs Improvement
LDP-13229	Arlington Heights	MC	REC	Underground	Not Applicable
LDP-13278	Park Ridge	PCFC	INST	Underground	Not Applicable
LDP-13284	Glenview	LDP1	C	Underground/Wet	Not Applicable
LDP-13301	Mount Prospect	FD	C	Dry	Needs Improvement
LDP-14010	Elk Grove Village	WIC1	IND	Dry	Needs Improvement
LDP-14013	River Grove	LDP5	INST	Underground	Not Applicable
LDP-14102	North Riverside	LDP8	IND	Dry	Stable
LDP-14140	North Riverside	LDP8	IND	Dry	Stable
LDP-14218	Des Plaines	WEC	IND	Dry	Stable
LDP-14239	Rosemont	WIC3	C	Underground	Not Applicable
LDP-14259	Rosemont	WIC3	IND	Underground	Not Applicable
LDP-14290	Glenview	LDP2	C	Underground	Not Applicable
LDP-14312	Elk Grove Village	WIC1	IND	Dry	Stable
LDP-14329	Unincorporated	FC2	REC	Dry	Needs Improvement
LDP-14344	Park Ridge	LDP3	C	Underground	Not Applicable
LDP-15009	Mount Prospect	WEC	INST	Underground	Not Applicable
LDP-15025	Wheeling	MC	MF	Wet	Stable
LDP-15028	Elk Grove Village	WIC1	IND	Underground	Not Applicable
LDP-15031	River Grove	LDP5	INST	Underground	Not Applicable
LDP-15035	Riverside	LDP8	C	Underground	Not Applicable
LDP-15059	Palatine	WEC	SF	Pipe	Not Applicable
LDP-15064	Lyons	LDP8	MF	Underground	Not Applicable
LDP-15115	Park Ridge	LDP3	C	Underground	Not Applicable
LDP-15120	Des Plaines	WEC	MF	Wet	Stable
LDP-15124	Des Plaines	LDP3	C	Underground	Not Applicable
LDP-15134	Franklin Park	CC2	IND	Underground	Not Applicable
LDP-15135	Franklin Park	CC2	IND	Wet	Needs Improvement
LDP-15155	River Forest	LDP7	INST	Underground	Not Applicable

LDP-15176	Unincorporated-Glenview	LDP2	INST	Wet	Needs Improvement
LDP-15184	Des Plaines	LDP3	INST	Underground	Not Applicable
LDP-15186	Lyons	LDP8	REC	Dry	Stable
LDP-15194	Mount Prospect	WEC	INST	Underground	Not Applicable
LDP-15214	Des Plaines	PCFC	C	Underground	Not Applicable
LDP-15234	Arlington Heights	MC	INST	Dry	Needs Improvement
LDP-15236	Mount Prospect	FD	INST	Dry	Needs Improvement
LDP-15245	Rosemont	WIC3	REC	Wet	Needs Improvement
LDP-15247	Rosemont	WIC3	C	Underground	Needs Improvement
LDP-15261	Hodgkins	LDP9	IND/INST	Wet	Needs Improvement
LDP-15263	Arlington Heights	MC	C	Wet	Needs Improvement
LDP-15264	Hodgkins	LDP9	IND	Wet	Needs Improvement
LDP-15273	Prospect Heights	WEC	C	Wet	Needs Improvement
LDP-15276	Arlington Heights	WEC	SF	Wet	Needs Improvement
LDP-15287	Prospect Heights	LDP1	C	Underground	Not Applicable
LDP-15289	Des Plaines	LDP3	SF	Underground	Not Applicable
LDP-15290	Prospect Heights	MC	SF	Wet	Needs Improvement
LDP-15306	North Riverside	LDP8	C	Underground	Not Applicable
LDP-15307	Elk Grove Village	HC	C	Wet	Needs Improvement
LDP-15322	Des Plaines	HC	IND	Underground	Not Applicable
LDP-15342	Arlington Heights	WEC	INST	Dry	Needs Improvement
LDP-15344	Arlington Heights	MC	INST	Dry	Needs Improvement
LDP-15357	Des Plaines	PCFC	INST	Underground	Not Applicable
LDP-15369	Hodgkins	LDP9	C	Underground	Not Applicable
LDP-15380	Schiller Park	CC2	IND	Dry	Needs Improvement
LDP-15383	Harwood Heights	LDP4	INST	Underground	Not Applicable
LDP-15392	Arlington Heights	WEC	INST	Wet	Stable
LDP-15393	Prospect Heights	MC	INST	Underground	Not Applicable
LDP-15395	Unincorporated	HC	C	Underground	Not Applicable
LDP-16006	Arlington Heights	WEC	REC	Underground	Not Applicable
LDP-16022	Willow Springs	FC2	SF	Not Applicable	Not Applicable
LDP-16023	Des Plaines	WEC	C	Underground	Not Applicable
LDP-16025	Unincorporated	LDP1	MF	Wet	Needs Improvement
LDP-16026	Arlington Heights	WEC	INST	Wet	Needs Improvement
LDP-16032	Franklin Park	LDP5	IND	Dry	Needs Improvement
LDP-16037	Elk Grove Village	WIC1	IND	Wet	Needs Improvement

LDP-16042	Des Plaines	WEC	C	Dry	Needs Improvement
LDP-16046	River Forest	LDP7	C	Underground?	Not Applicable
LDP-16051	Willow Springs	LDP9	SF	Not Applicable	Not Applicable
LDP-16052	Schiller Park	CC2	INST	Underground	Not Applicable
LDP-16062	Rosemont	LDP4	IND	Underground?	Not Applicable
LDP-16074	Des Plaines	WEC	IND	Wet	Needs Improvement
LDP-16084	Des Plaines	LDP3	C	Underground	Not Applicable
LDP-16089	Glenview	LDP1	C	Underground/Wet	Not Applicable
LDP-16097	North Riverside	LDP8	IND	Dry	Stable
LDP-16113	Glenview	LDP1	C	Underground/Wet	Not Applicable
LDP-16100	Wheeling	LDP1	C	Wet	Needs Improvement
LDP-16105	Wheeling	LDP1	C	Underground	Not Applicable
LDP-16115	Park Ridge	LDP3	C	Underground	Not Applicable
LDP-16134	Forest Park	LDP7	IND	Not Applicable	Not Applicable
LDP-16144	Des Plaines	FD	C	Wet	Needs Improvement
LDP-16148	Park Ridge	LDP3	INST	Dry	Needs Improvement
LDP-16151	River Forest	LDP7	INST	Dry/Underground	Needs Improvement
LDP-16165	Arlington Heights	WEC	MF	Dry/Underground	Stable
LDP-16174	Arlington Heights	MC	C	Wet	Needs Improvement
LDP-16178	Des Plaines	LDP3	INST	Underground	Not Applicable
LDP-16191	Rosemont	LDP3	INST	Underground	Not Applicable
LDP-16192	Arlington Heights	WEC	SF	Wet	Needs Improvement
LDP-16205	River Grove	LDP5	INST	Underground	Not Applicable
LDP-16213	River Forest	LDP7	C	Underground	Not Applicable
LDP-16215	Harwood Heights	LDP4	C	Underground	Not Applicable
LDP-16217	Des Plaines	LDP3	C	Underground	Not Applicable
LDP-16233	Schiller Park	LDP5	IND	Wet	Needs Improvement
LDP-16235	Elk Grove Village	WIC1	IND	Underground	Not Applicable
LDP-16236	Elk Grove Village	WIC1	IND	Wet	Needs Improvement
LDP-16244	Rosemont	LDP4	C	Underground	Not Applicable
LDP-16272	Park Ridge	LDP3	SF	Underground	Not Applicable
LDP-16280	Western Springs	FC1	IND	Underground	Not Applicable
LDP-16311	River Grove	LDP6	INST/SF	Underground	Not Applicable

Table 3.15-1 Inventory of Detention Basins in the Lower Des Plaines River Planning Area

Notes to Table:
CC – Crystal Creek; FC – Flagg Creek; FD – Feehanville Ditch; GCT – Golf Course Tributary; HC – Higgins Creek;
LDP – Lower Des Plaines River; MC – McDonald Creek; PCFC – Prairie Creek-Farmers Creek; WEC – Weller Creek; WIC – Willow Creek.

SF – Single Family Residential, MF – Multifamily, C – Commercial, IND – Industrial, INST – Institutional, REC – Recreation/Open Space, TCU – Transportation/Communications/Utilities

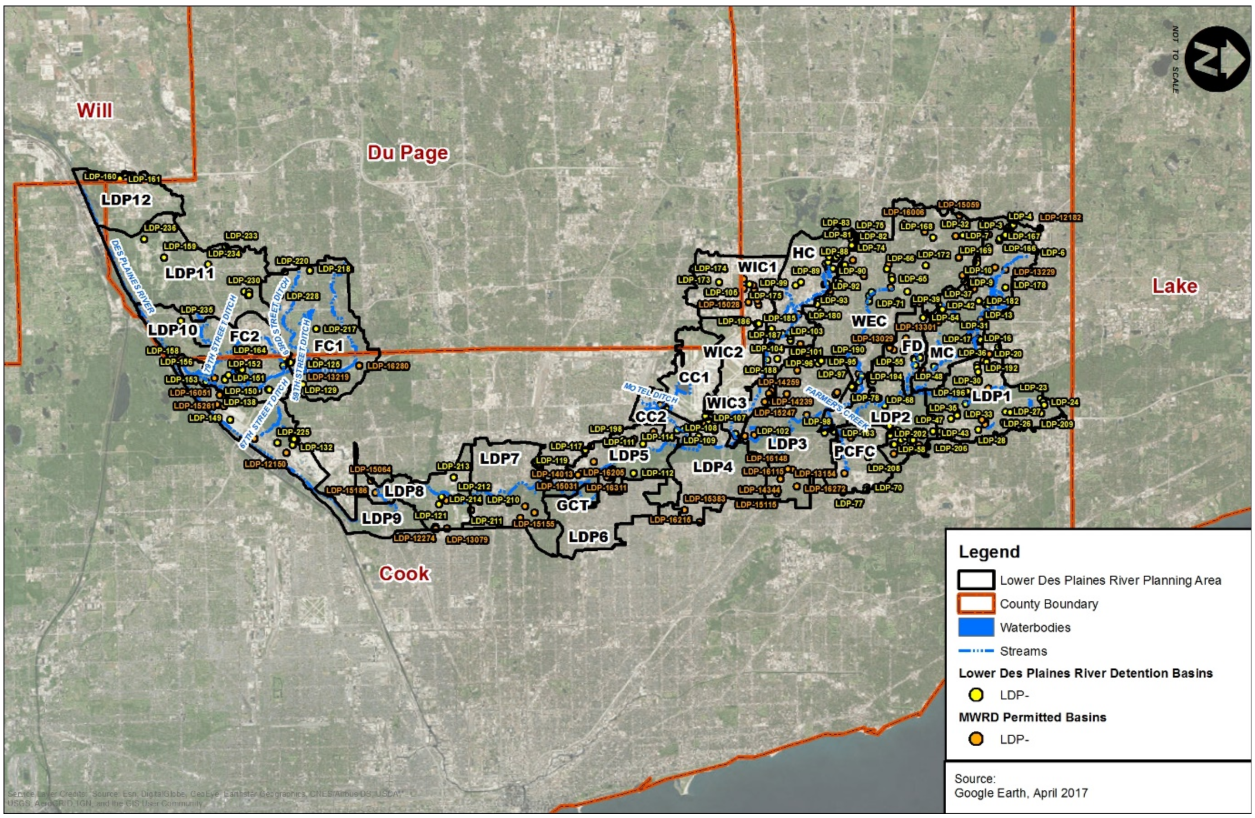


Figure 3.15-3 Lower Des Plaines River Planning Area Detention Basin Inventory

3.16 COOK COUNTY FOREST PRESERVE AND LOWER DES PLAINES RIVER PLANNING AREA LAKES

Much of the Lower Des Plaines River Planning Area is densely developed with relatively very few open bodies of water (Figure 3.16-1). Notable lakes within the watershed planning area include Lake Arlington, the lakes within Izaak Walton Park and Walnut Woods, Lake Shermerville, Citation Lake, Dude Ranch Lake, Murphy Lake, Park Lake, Peterson Lake, Golfview Lake (aka Johnson Slough), Ruth Lake, Lake Hinsdale, and Schustek Pond. These lakes are located on private property or within the jurisdiction of a property association or park district, etc. Notable lakes that are in the portion of the planning area that is under the jurisdiction of the FPCC include Axehead Lake (Figure 3.16-5), Beck Lake, Big Bend Lake, Belleau Lake, Lake Ida, Schiller Pond, and Thatcher Glen Pond. The following sections provide descriptions of each of the lakes and overall drainage.

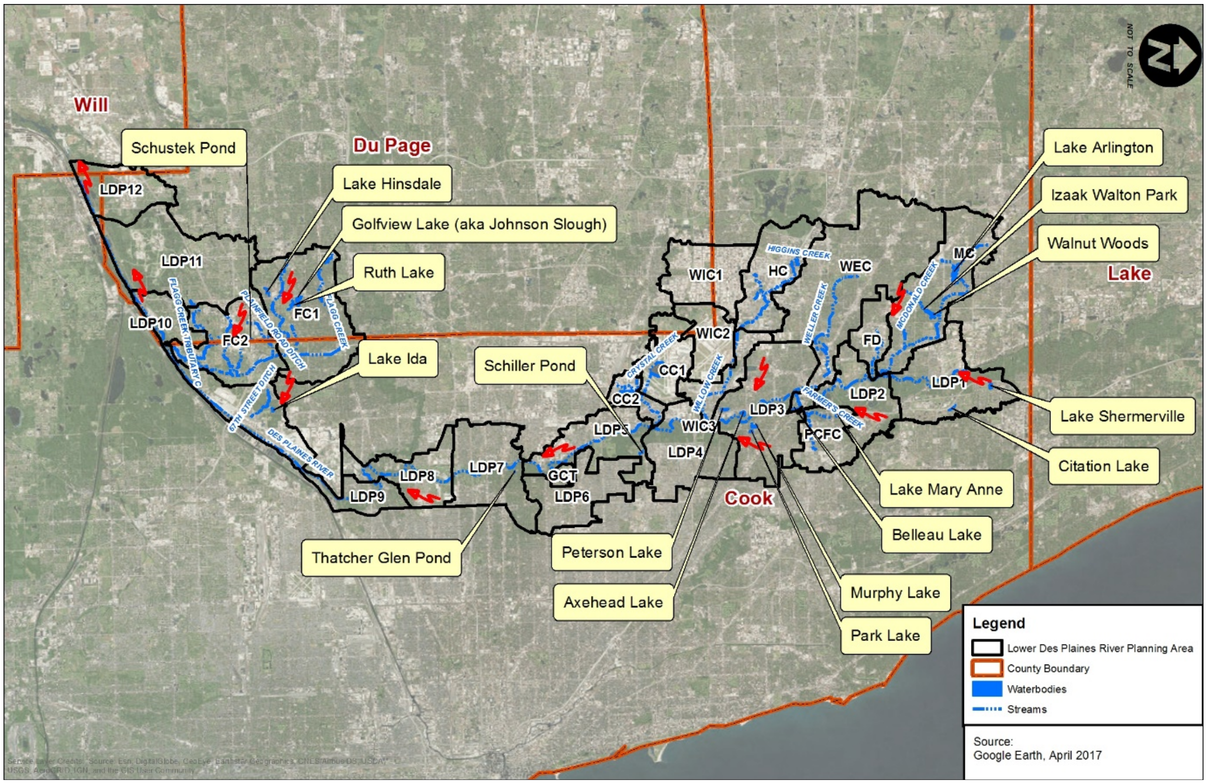


Figure 3.16-1 Lakes in the Lower Des Plaines River Planning Area

- Lake Arlington

The largest open water body in the watershed is Lake Arlington consisting of approximately 50 acres of open water with approximately 1.8 miles of shoreline in the Village of Arlington Heights and the McDonald Creek watershed planning unit. Erosion around the lake is low and the riparian area consists primarily of managed turf grass for recreation with some wetland buffer on the north side of the lake. Lake Arlington is located in the Village of Arlington Heights and is situated east of N. Windsor Drive, west of N. Schoenbeck Road, north of E. Palatine Road, and south of Wildwood Park. The lake is an on-line flood control reservoir of McDonald Creek with the McDonald Creek North and South Branches combining at the northwest and southwest corners of the lake, respectively. The outlet, at the southeast corner of the lake, forms the headwaters of the mainstem of McDonald Creek. There are three outlet control structures that comprise the outlet for Lake Arlington.

Figure 3.16-2 Lake Arlington

- Golfview Lake (aka Johnson Slough)

The second largest open water body in the watershed planning area is Golfview Lake (aka Johnson Slough) consisting of approximately 31 acres of open water with approximately 1.2 miles of shoreline located in the Township of Downers Grove and within the Flagg Creek 1 watershed planning unit. It is situated north of W. 58th Street, south of 55th Street, west of S. Monroe Street, and east of Kingery Highway. The slough outlets southeast into Ruth Lake via a minor open channel. The Golfview Lake and Ruth Lake system drains southeast to the 63rd Street Ditch ultimately outletting to Flagg Creek just north of Plainfield Road east of I-294.

Figure 3.16-3 Golfview Lake (aka Johnson Slough)

- Ruth Lake

Ruth Lake is located within the Flagg Creek 1 watershed planning unit and consists of approximately 12 acres of open water with approximately 3,300 feet of shoreline. Ruth Lake is located in Downers Grove Township and is situated north of 63rd Street, south of E. 58th Street, west of S. Madison Street, and east of S. Kingery Highway. Ruth Lake is located just downstream of Golfview Lake and is ultimately tributary to 63rd Street Ditch. The lake has a surface area of 20.4 acres and a shoreline length of 6,524 feet. Erosion around the lake is low however approximately 80% of the perimeter riparian area consists of managed turf grass for golf course recreation and lake accessibility associated with the Ruth Lake Country Club. The Ruth lake system drains southeast ultimately outletting to Flagg Creek and continuing south to the Lower Des Plaines River.

Figure 3.16-4 Ruth Lake

Figure 3.16-5 Axehead Lake

- Axehead Lake

Axehead Lake is located within the FPDCC in Unincorporated Cook County within Maine Township and is situated northeast of S. River Road, south of Touhy Avenue, and just west of the Des Plaines River. The lake is adjacent to the west bank of the Lower Des River. Based on Cook County 1-foot aerial topography the lake overtops to the southeast via overland flow and outlets to the Des Plaines River. The lake has a surface area of 17.2 acres and a shoreline length of 3,512 feet.

- Beck Lake

Beck Lake was constructed in 1958 and has a surface area of 38 acres with a maximum depth of 23 feet and a one mile shoreline. Beck Lake is a kidney shaped borrow pit that was formed was the Tri-State Tollway (I-294) was constructed. Beck Lake is located on the west side of the Tri-State Tollway approximately 0.5 miles north of Central Road. Beck Lake is currently owned and maintained by FPCC. Boating and fishing are significant recreational activities on Beck Lake. Fish species that inhabit the lake include largemouth bass, bluegill, perch, walleye, channel catfish, crappie, and bullheads.

Figure 3.16-6 Beck Lake

Figure 3.16-7 Belleau Lake

- Belleau Lake

Belleau Lake is located within the FPDCC in the City of Des Plaines and is situated west of I-294, south of N. Northwest Highway, and northeast of Busse Highway. The lake acts as an off-line storage facility along Farmer Creek just upstream of mainstem Des Plaines River. The lake outlets north to Farmer's Creek. The lake has a surface area of 12.0 acres and a shoreline length of 3,662 feet.

- Big Bend Lake

Similar to Beck Lake, Big Bend Lake was also constructed in 1958. Big Bend Lake is a crescent shaped water bodies owned and maintained by FPCC. The surface area is approximately (22 acres. Big Bend Lake is slightly deeper lake than Beck Lake (maximum depth is 25 feet) and has a longer shoreline (approximately 1.1 miles). Big Bend Lake is connected to the Des Plaines River by a short, shallow but wide channel. At this lake also boating and fishing are significant recreational activities. The fish species found in Big Bend Lake are similar to those found in Beck Lake.

Figure 3.16-8 Big Bend Lake

- Citation Lake

Citation Lake is located in the City of Northbrook and is situated north of Cornflower Trail, south and west of Whirlaway Drive and east of I-294. Based on Cook County 1-foot aerial topography the lake outlets to the southwest and passes beneath I-294 via a culvert before outletting to the mainstem Des Plaines River. The lake has a surface area of approximately 10.4 acres and a shoreline length of 4,249 feet.

- Izaak Walton Park

The lake within Izaak Walton Park is located in the City of Prospect Heights and is situated east of N. Elmhurst Road, northwest of Hillsdale Avenue, and south of Willow Road. It is an on-line storage reservoir of McDonald Creek Tributary A, which flows from south to north and outlets north toward Walnut Woods Lake. The lake has a surface area of 6.9 acres and a shoreline length of approximately 3,680 feet.

- Lake Hinsdale

Lake Hinsdale is located in the Village of Willowbrook and is situated north of 67th Street, south of 63rd Street, west of Clarendon Hills Road, and west of Kingery Highway. The lake outlets east, under Kingery Highway (Rte 83) via an underground culvert, and continues northeast through an open channel before tying into the 63rd Street Ditch and continuing east to Flagg Creek.

- Lake Ida

Lake Ida is located within the FPDCC in the City of Countryside and is situated north of 67th Street, south of Joliet Road, east of S. Brainard Avenue, and west of S. La Grange Road. Based on Cook County 1-foot aerial topography the Lake outlets southwest into a minor open channel outletting to the 67th Street and continuing east to the mainstem Des Plaines River. The lake has a surface area of 9.2 acres and a shoreline length of 2,398 feet.

- Lake Mary Ann

Lake Mary Ann is located in the City of Des Plaines and is situated south of Reding Circle, north of Golf Road, west of N. Oak Lane, and east of I-294. According to 1-foot aerial topography, the lake drains west toward the Des Plaines River. It has a surface area of 16.9 acres and a shoreline length of 4,775 feet.

- Lake Shermerville

Lake Shermerville is a manmade lake located in the City of Northbrook and is situated south of Rutgers Lane, north of Wood Oaks Green Park, west of Sanders Road, east of I-294. West of I-294 is the FPDCC and during large storm event, the lake overtops south along the east side of I-294 before traveling southwest through a culvert beneath I-294 and continuing west to the mainstem Des Plaines River via overland flow through the forest preserve. The lake covers an area of approximately 15.5 acres with roughly 4,104 feet of shoreline.

- Murphy Lake

Murphy Lake is located in the City of Park Ridge and is situated north of Murphy Lake Road, south of W. Sibley Street, west of N. Talcott Road, and east of N. Dee Road. Based on Cook County 1-foot aerial topography the lake passes beneath Talcott Road via a culvert and outlets west toward mainstem Des Plaines River. The lake has a surface area of 14.8 acres and a shoreline length of 4,720 feet.

- Park Lake

Park Lake is located in the City of Park Ridge and is situated north of W. Touhy Avenue, south of Elm Street, west of Shoreline Drive, and east of N. Dee Road. Based on Cook County 1-foot aerial topography the lake passes beneath Talcott Road via a culvert and outlets west to Murphy Lake (described above). The lake has a surface area of 6.6 acres and a shoreline length of 2,292 feet.

- Peterson Lake

Peterson Lake is located in the City of Des Plaines and is situated north of W. Devon Avenue, south of Pratt Street, east of Pattron Drive, and west of I-294. Based on Cook County 1-foot aerial topography the lake outlets east beneath I-294, and then S. River Road, via a storm sewer before discharging in the mainstem Des Plaines River. The lake has a surface area of 14.1 acres and a shoreline length of 3,950 feet.

- Schiller Pond

Schiller Pond is located within the FPDCC in the City of Chicago and is situated north of W. Irving Park Road, south of N. East River Road, west of N. Cumberland Avenue, and east of the Des Plaines River. Based on Cook County 1-foot aerial topography the lake overtops to the southeast and outlets to Schiller Brook via overland flow. Schiller Brook (a small open channel located on FPDCC property just west of the mainstem Des Plaines River) flows southwest and drains into the Des Plaines River. The lake has a surface area of 5.8 acres and a shoreline length of 3,043 feet.

- Schustek Pond

Schustek Pond is located in the City of Burr Ridge and is situated north of I-55, south of Veterans Boulevard, east of Harvester Drive, and west of County Line Road. According to Cook County 1-foot aerial topography, the pond drains southeast beneath I-55 via a storm-sewer before outletting to the headwaters of Flagg Creek Tributary A. The pond has a surface area of 8.1 acres and a shoreline length of 3,737 feet.

- Thatcher Glen Pond

Thatcher Glen Pond is located within the FPDCC in the Village of River Forest and is situated north of Edgewood Place, south of Chicago Avenue, west of Thatcher Avenue, and east of the Des Plaines River. Based on Cook County 1-foot aerial topography the lake outlets southwest draining directly to the Des Plaines River via a small open channel. The lake has a surface area of 1.2 acres and a shoreline length of 1,253 feet.

- Walnut Woods Lake

The lake in Walnut Woods is located in the City of Prospect Heights and is situated north of Willow Road, south and east of Hillcrest Drive, and west of Owen Street. The lake is on-line with McDonald Creek Tributary A. Flow enters the lake at the southwest corner from the upstream system in Izaak Walton Park and outlets at the north end of the lake via a culvert under Hillcrest Drive and continues north. The culvert extends north approximately 350 feet before outletting to the mainstem of McDonald Creek.

As with the watercourse assessment, a desktop analysis was combined with field investigations to create an inventory of the lakes and ponds described above with respect to bank conditions and riparian areas surrounding each of the lakes. The assessment focused on erosion and riparian or upland buffers. The desktop analysis is based on review of high resolution aerial photography from 2013 through 2017. Aerial photography was used to identify large scale issues including tributary land use area uses that could contribute to nonpoint source pollution impairments, presence or absence of lake buffers, evidence of erosion and any other features of interest. The field assessments were conducted to enhance the desktop assessment completed for the lakes above. Table 3.16-1 and Table 3.16-2 show the condition of shoreline buffer and degree of erosion for the lakes assessed for both the desktop and field assessments.

Lake Name	Reach Code	Shoreline Length Assessed (ft)	Good Condition (ft/%)		Fair Condition (ft/%)		Poor Condition (ft/%)	
Axehead Lake	AL	3,394	0	0%	0	0%	3,394	100%
Beck Lake	BKL	5,678	2,271	40%	1,420	25%	1,987	35%
Belleau Lake	BL	3,608	0	0%	1,804	50%	1,804	50%
Big Bend Lake	BBL	6,092	1,828	30%	609	10%	3,655	60%
Citation Lake	CL	4,188	0	0%	419	10%	3,769	90%
Golfview Lake (aka Johnson Slough)	GL	6,442	0	0%	322	5%	6,120	95%
Izaak Walton Park	IWP	3,500	0	0%	1,225	35%	2,275	65%
Lake Arlington	LA	9,623	0	0%	0	0%	9,623	100%
Lake Hinsdale	LH	6,443	0	0%	644	10%	5,799	90%
Lake Ida	LI	2,369	0	0%	0	0%	2,369	100%
Lake Mary Ann	LMA	4,642	232	5%	0	0%	4,410	95%
Lake Shermerville	LS	4,080	0	0%	408	10%	3,672	90%
Murphy Lake	ML	4,697	0	0%	0	0%	4,697	100%
Park Lake	PAL	2,328	0	0%	0	0%	2,328	100%
Peterson Lake	PEL	3,903	0	0%	0	0%	3,903	100%
Ruth Lake	RL	6,343	634	10%	0	0%	5,709	90%
Schiller Pond	SIP	2,927	0	0%	878	30%	2,049	70%
Schustek Pond	SUP	3,728	1,864	50%	1,118	30%	746	20%
Walnut Woods	WW	3,152	630	20%	0	0%	2,521	80%
Total		**87,137**	**7,459**	**8.6 %**	**8,847**	**10.2%**	**70,831**	**81.3%**

Table 3.16-1 Shoreline Buffer Condition for Lakes in the Lower Des Plaines Planning Area

Lake Name	Reach Code	Shoreline Length Assessed (ft)	None or Low Erosion (ft/%)		Moderate Erosion (ft/%)		High Erosion (ft/%)	
Axehead Lake	AL	3,394	3,394	100%	0	0%	0	0%
Beck Lake	BKL	5,678	4,826	85%	852	15%	0	0%
Belleau Lake	BL	3,608	3,067	85%	541	15%	0	0%
Big Bend Lake	BBL	6,092	0	0%	6,092	100%	0	0%
Citation Lake	CL	4,188	3,141	75%	1,047	25%	0	0%
Golfview Lake (aka Johnson Slough)	GL	6,442	5,476	85%	966	15%	0	0%
Izaak Walton Park	IWP	3,500	875	25%	2,625	75%	0	0%
Lake Arlington	LA	9,623	8,180	85%	1,443	15%	0	0%
Lake Hinsdale	LH	6,443	6,443	100%	0	0%	0	0%
Lake Ida	LI	2,369	2,369	100%	0	0%	0	0%
Lake Mary Ann	LMA	4,642	4,642	100%	0	0%	0	0%
Lake Shermerville	LS	4,080	3,060	75%	1,020	25%	0	0%
Murphy Lake	ML	4,697	3,992	85%	705	15%	0	0%
Park Lake	PAL	2,328	2,328	100%	0	0%	0	0%
Peterson Lake	PEL	3,903	3,903	100%	0	0%	0	0%
Ruth Lake	RL	6,343	6,343	100%	0	0%	0	0%
Schiller Pond	SIP	2,927	1,464	50%	1,464	50%	0	0%
Schustek Pond	SUP	3,728	3,728	100%	0	0%	0	0%
Walnut Woods	WW	3,152	2,679	85%	473	15%	0	0%
Total		**87,137**	69,910	80.2%	17,228	19.8%	0	0%

Table 3.16-2 Shoreline Erosion for Lakes in the Lower Des Plaines River Planning Area

3.17 WATER QUALITY ASSESSMENT

3.17.1 Surface Water Quality Assessment (Illinois EPA) - Watercourses

Twenty-nine watercourses were evaluated by Illinois EPA in the Lower Des Plaines River Planning Area with respect to designated uses and water quality standards. Seven of the twenty-nine watercourses within the Lower Des Plaines River Planning Area were included in the Illinois EPA Integrated Water Quality Report and Section 303(d) List (2016). Four of the watercourses failed to meet at least one of their designated uses and were considered impaired (i.e., included on the 303(d) List): the Lower Des Plaines River, Flagg Creek, Higgins Creek, and Willow Creek. The causes and sources for the impairments are included in Table 3.17-1. Most the designated uses for the other water bodies were not assessed.

Stream Name	*Illinois EPA AUID*	*Impairment*	*Use Attainment*			*Source*
			Not Supporting	*Fully Supporting*	*Not Assessed*	
Crystal Creek (CC)	IL_GN-01	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary Contact Recreation, Secondary Contact	No source identified
Des Plaines River (LDPR 1-12)	IL_G-03	Alteration in Stream-Side or Littoral Vegetative Covers, Aquatic Algae, Chloride, Fecal Coliform, Mercury, Other Flow Regime Alterations, pH, Phosphorous (Total), Polychlorinated biphenyls (PCBs)	Aquatic Life, Fish Consumption, Primary Contact Recreation	---	Aesthetic Quality, Secondary Contact	Atmospheric Deposition - Toxics, Channelization, Combined Sewer Overflows, Impacts from Hydrostructure Flow Regulation / Modification, Municipal Point Source Discharges, Source Unknown, Urban Runoff / Storm Sewers
	IL_G-15	Chloride, Dissolved Oxygen, Fecal Coliform, Loss of Instream Cover, Mercury, Phosphorous (Total), Polychlorinated biphenyls (PCBs), Sedimentation / Siltation	Aquatic Life, Fish Consumption, Primary Contact Recreation	Aesthetic Quality	Secondary Contact	Atmospheric Deposition – Toxics, Combined Sewer Overflows, Highway / Road / Bridge Runoff (Non-Construction Related), Municipal Point Source Discharges, Source Unknown, Urban Runoff / Storm Sewers
Des Plaines River (LDPR 1-12)	IL_G-22	Arsenic, Chloride, Fecal Coliform, Flow Alterations, Habitat Alterations, Methoxychlor, Mercury, Phosphorous (Total), Polychlorinated biphenyls (PCBs), Total Suspended Solids (TSS)	Aquatic Life, Fish Consumption, Primary Contact Recreation	---	Aesthetic Quality, Secondary Contact	Atmospheric Deposition – Toxics, Contaminated Sediments, Dam or Impoundment, Impacts from Hydrostructure Flow Regulation / Modification, Source Unknown, Upstream Impoundments (e.g., PI-566 Nrcs Structures), Urban

Stream Name	Illinois EPA AUID	Impairment	Use Attainment: Not Supporting	Fully Supporting	Not Assessed	Source
						Runoff / Storm Sewers
	IL_G-28	Alteration in Stream-Side or Littoral Vegetative Covers, Chloride, Dissolved Oxygen, Fecal Coliform, Mercury, Other Flow Regime Alterations, Phosphorous (Total), Polychlorinated biphenyls (PCBs)	Aquatic Life, Fish Consumption, Primary Contact Recreation	---	Aesthetic Quality, Secondary Quality	Atmospheric Deposition – Toxics, Combined Sewer Overflows, Impacts from Hydrostructure Flow Regulation / Modification, Municipal Point Source Discharges, Source Unknown, Streambank Modifications / Destabilization, Urban Runoff / Storm Sewers
	IL_G-30	Chloride, Dissolved Oxygen, Fecal Coliform, Mercury, Phosphorous (Total), Polychlorinated biphenyls (PCBs), Total Suspended Solids (TSS)	Aquatic Life, Fish Consumption, Primary Contact Recreation	---	Aesthetic Quality, Secondary Contact	Atmospheric Deposition - Toxics, Combined Sewer Overflows, Highway / Road / Bridge Runoff (Non-Construction Related), Municipal Point Source Discharges, Source Unknown, Urban Runoff/Storm Sewers

Stream Name	Illinois EPA AUID	Impairment	*Use Attainment* Not Supporting	Fully Supporting	Not Assessed	Source
Des Plaines River (LDPR 1-12)	IL_G-32	Chloride, Fecal Coliform, Mercury. Phosphorous (Total), Polychlorinated biphenyls (PCBs)	Aquatic Life, Fish Consumption, Primary Contact Recreation	---	Aesthetic Quality, Secondary Contact	Atmospheric Deposition - Toxics, Combined Sewer Overflows, Highway / Road / Bridge Runoff (Non-Construction Related), Municipal Point Source Discharges, Source Unknown, Urban Runoff/Storm Sewers
	IL_G-36	Aquatic Algae, Fecal Coliform, Mercury, Other Flow Regime Alterations, Phosphorous (Total), Polychlorinated biphenyls (PCBs)	Aquatic Life, Fish Consumption, Primary Contact Recreation	---	Aesthetic Quality, Secondary Contact	Atmospheric Deposition - Toxics, Dam or Impoundment, Impacts from Hydrostructure Flow Regulation / Modification, Municipal Point Source Discharges, Source Unknown, Urban Runoff / Storm Sewers
	IL_G-39	Aldrin, Arsenic, Chloride, Dissolved Oxygen, Fecal Coliform, Lindane, Methoxychlor, Mercury, Other Flow Regime Alterations, pH, Phosphorous (Total), Polychlorinated biphenyls (PCBs)	Aquatic Life, Fish Consumption, Primary Contact Recreation	---	Aesthetic Quality, Secondary Contact	Atmospheric Deposition – Toxics, Combined Sewer Overflows, Contaminated Sediments, Dam or Impoundment, Impacts from Hydrostructure Flow Regulation / Modification, Municipal Point Source Discharges, Source Unknown, Urban Runoff / Storm Sewers
Flagg Creek (FC)	IL_GK-03	Alteration in Stream-Side or Littoral Vegetative Covers, Arsenic, DDT, Hexachlorobenzene, Methoxychlor, Phosphorous (Total)	Aquatic Life	Aesthetic Quality	Fish Consumption, Primary Contact Recreation, Secondary Contact	Contaminated Sediments, Municipal Point Source Discharges, Site Clearance (Land Development or Redevelopment), Streambank Modifications / Destabilization

Stream Name	Illinois EPA AUID	Impairment	Use Attainment			Source
			Not Supporting	*Fully Supporting*	*Not Assessed*	
Higgins Creek (HC)	IL_GOA-01	Chloride, Fecal Coliform, Fluoride, Phosphorous (Total), Zinc	Aquatic Life, Primary Contact Recreation	---	Aesthetic Quality, Fish Consumption, Secondary Contact	Municipal Point Source Discharges, Urban Runoff / Storm Sewers
	IL_GOA-02	Cause Unknown, Chloride, Dissolved Oxygen, Fecal Coliform	Aquatic Life, Primary Contact Recreation	---	Aesthetic Quality, Fish Consumption, Secondary Contact	Urban Runoff / Storm Sewers
McDonald Creek (MC)	IL_GR-01	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary Contact Recreation, Secondary Contact	No source identified
Weller Creek (WEC)	No Assessment Available	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary Contact Recreation, Secondary Contact	No source identified
Willow Creek (WIC)	IL_GO-01	Alteration in Stream-Side or Littoral Vegetative Covers, Loss of Instream Cover, Phosphorous (Total)	Aquatic Life	---	Aesthetic Quality, Fish Consumption, Primary Contact Recreation, Secondary Contact	Channelization, Loss of Riparian Habitat, Municipal (Urbanized High Density Area), Municipal Point Source Discharges

Table 3.17-1 Summary of Impaired Watercourses in the Lower Des Plaines River Planning Area

Notes:

(1) Only stream segments with Assessment Unit Identification (AUID) numbers from the Illinois EPA 2016 Integrated Water Quality Report and Section 303(d) List are included in the table above.

Source: Resource Management Mapping Service (2017); Illinois Integrated Water Quality Report and Section 303(d) List (2016).

(2) As discussed further below, Illinois EPA has completed a TMDL for the Higgins Creek stream reaches.

The Table shows that aquatic life uses were not met in the Lower Des Plaines River, Flagg Creek, Higgins Creek, and Willow Creek. Both aquatic life and primary contact for recreation uses were assessed and found to be not supporting use. Recreational uses are affected by bacteria in the water body, which can make the water unsafe for wading or swimming or kayaking (see discussion below on water quality standards). Additionally, Table 3.17-1 indicates the majority of the sources of pollutant loadings as combined sewer overflows, highway/road or bridge runoff, municipal point source discharges, and urban runoff from storm sewer discharges. It should be noted that impairments from storm sewer related discharges are directly related to the creation of impervious area as storm sewers are required to drain these areas. The 303(d) data highlights that urban and suburban runoff is a primary source of loadings causing water quality impairments.

Historical monitoring in the Lower Des Plaines River Planning Area at times showed elevated levels of bacteria. MWRD has made significant strides to address Des Plaines area water quality through better stormwater management and wastewater treatment. A significant portion of the Lower Des Plaines River planning area, primarily tributary to the mainstem of the Lower Des Plaines River, benefits from MWRD's Tunnel and Reservoir Project (TARP). One of TARP's main goals is to improve the water quality of Chicagoland area rivers and streams. More specifically, Phase I of TARP was specifically designed to capture and enable the treatment of approximately 85% of combined sewer overflow (CSO) water from TARP's service area, (shown in Figure 3.17-1). CSOs release large amounts of bacteria and polluted water when these events occur. Evidence of this is provided in Table 3.17-1 as the cause of impairments for many of the watercourses listed includes CSOs

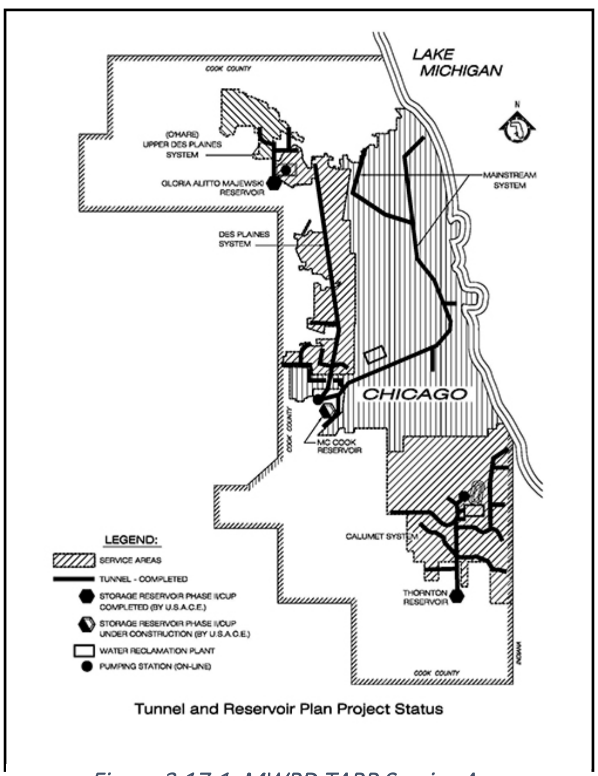


Figure 3.17-1 MWRD TARP Service Area

TARP Phase I includes 109.4 miles of deep, large diameter, rock tunnels. Construction of TARP Phase I was completed in 2006 and the entire system is now in operation. TARP Phase II, which is currently in progress, consists of three reservoirs intended primarily for flood control for the Chicagoland combined sewer area, but will also considerably enhance water quality. The three reservoirs under TARP Phase II are the Gloria Alitto Majewski Reservoir, the Thornton Reservoir, and the McCook Reservoir.

The U.S. Army Corps of Engineers (USACE) designed and constructed the Gloria Alitto Majewski Reservoir, which was completed in 1998. The Thornton Reservoir was constructed in two stages. The first stage, a temporary flood control reservoir called the Thornton Transitional Reservoir, was completed in March 2003 in the West Lobe of the Thornton Quarry. The second stage is a permanent combined reservoir, called the Thornton Composite Reservoir, constructed in the North Lobe of the Thornton Quarry and completed in 2013, and operational at the end of 2015. The Thornton Reservoir provides overbank flood relief for 9 communities, and has captured 37 billion gallons of flood water during 58 fill events since January 1st, 2018. In December 2017, Stage I of the McCook Reservoir was completed and put into service. McCook Reservoir Stage I provides approximately 3.5 billion gallons of storage capacity used for flood water. This will further reduce polluted CSO water and bacteria loadings from entering the Lower Des Plaines River planning area. It is expected that future monitoring data will show that watercourses throughout the Lower Des Plaines Planning Area are achieving recreation-based designated uses. Stormwater BMPs, structural and non-structural, can also help reduce bacteria pollutant loadings. These BMPs are discussed in ensuing sections of this watershed plan.

3.17.2 Surface Water Quality Assessments (Illinois DNR)

The Illinois Department of Natural Resources (IDNR) has biological stream ratings for Illinois streams. These ratings can be used to identify aquatic resource quality, including biologically diverse streams and those with a high degree of biological integrity. The diversity and integrity scores fall within one of five ratings ranging from A to E, with A representing the highest biological integrity or diversity of evaluated stream segments. A portion of Willow Creek was rated by IDNR (2008) as D (diversity). A portion of the Lower Des Plaines mainstem (the stretch from the confluence with Salt Creek south, to the Will County border) was rated as B (diversity) and C (integrity). The other streams did not have IDNR (2008) stream ratings for diversity or integrity within the study area. No streams in the planning area were identified as Biologically Significant Streams.

3.17.3 Water Quality Standards

Water pollution control programs are designed to protect the beneficial uses of the water resources of the state. Each State has the responsibility to set water quality standards that protect these beneficial uses, also called "designated uses." Illinois waters are designated for various uses including aquatic life, wildlife, agricultural use, primary contact (e.g., swimming, water skiing), secondary contact (e.g., boating, fishing), industrial use, public and food-processing water supply, and aesthetic quality. Illinois' water quality standards and water quality criteria provide the basis for assessing whether the beneficial uses of the state's waters are being attained. The Illinois Pollution Control Board is responsible for setting water quality standards to protect designated uses. The Illinois EPA is responsible for developing scientifically-based water quality standards and proposing them to the Illinois Pollution Control Board for adoption into state rules and regulations. The federal Clean Water Act requires States to review and update water quality standards every three years. Illinois EPA, in conjunction with USEPA, identifies and prioritizes those standards to be developed or revised during this three-year period.

The Illinois Pollution Control Board has established four primary sets (or categories) of narrative and numeric water quality standards for surface waters:

- General Use Standards, which are intended to protect aquatic life, wildlife, agricultural, primary contact, secondary contact, and most industrial uses;
- Public and Food Processing Water Supply Standards for waters associated with human consumption;
- Secondary Contact and Indigenous Aquatic Life Standards are intended to protect limited uses of those waters not suited for general use activities but are nonetheless suited for secondary contact uses and capable of supporting indigenous aquatic life limited only by the physical configuration of the body of water, characteristics, and origin of the water and the presence of contaminants in amounts that do not exceed these water quality standards. Secondary Contact and Indigenous Aquatic Life standards apply only to waters in which the General Use standards and the Public and Food Processing Water Supply standards do not apply; and
- Lake Michigan Basin Water Quality Standards.

The General Use Standards apply to the main watercourses in the planning area.

3.17.4 Higgins Creek TMDL

Illinois EPA completed a Total Maximum Daily Load (TMDL) analysis for the Higgins Creek sub-basin in 2013. The TMDL report includes a characterization of the sub-basin, a water quality assessment, pollutant load reduction targets, and an implementation plan. This watershed-based plan is aligned with the TMDL in terms of assessment of water quality characteristics and implementation actions.

A TMDL identifies the source of impairment and provides reduction estimates to meet water quality standards. The applicable water quality standards are based on the use classification applicable to waterbodies within the Higgins Creek sub-basin, which is General Use. As noted above, the General Use classification includes designated uses such as aquatic life, aesthetic quality, and primary contact recreation uses of the water bodies.

The TMDL development work included compilation and analysis of data to understand water quality conditions, specifically recognize impairments, and begin to identify sources of pollutant loadings. The identified impairments include dissolved oxygen (DO), fecal coliform, chloride, and total phosphorus.

The geographic scope of the Higgins Creek TMDL included some drainage areas not within the geographic scope of this plan. The entire Higgins Creek sub-basin includes land areas in Cook, Lake, and DuPage Counties in Illinois, and some drainage areas in Wisconsin. Many of these areas are covered in other watershed-based plans. The impaired waters covered in the Higgins Creek TMDL that are within the geographic scope of this Plan are:

- ✓ Beck Lake
- ✓ Big Bend Lake
- ✓ Two reaches of Higgins Creek

The impaired waterbodies are highlighted in red in Figure 3.17-2.

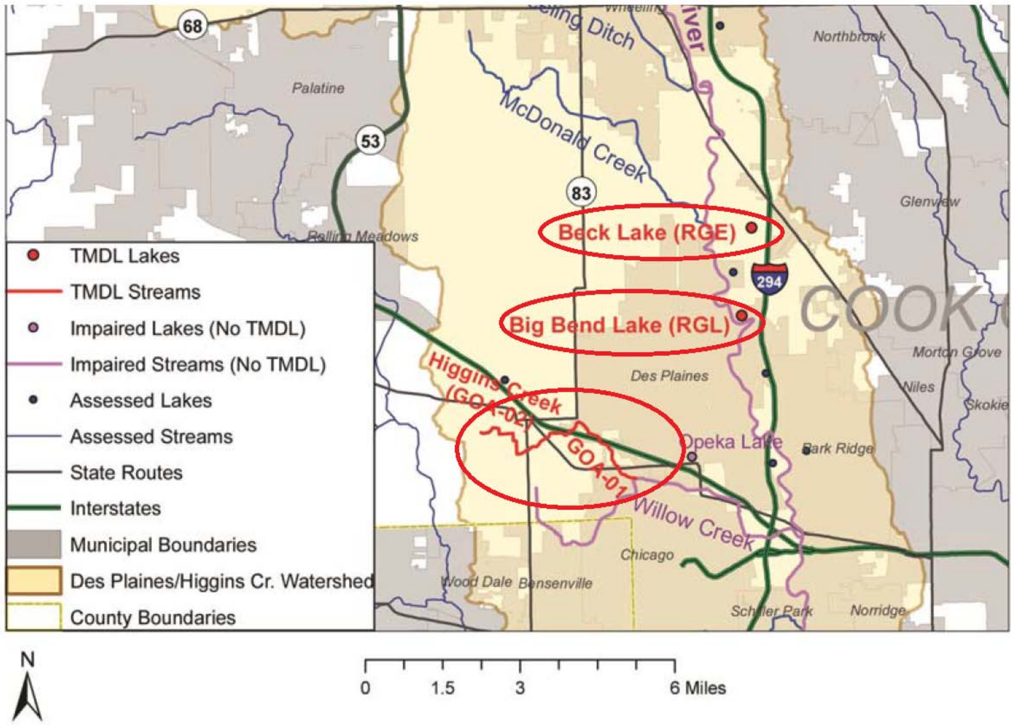


Figure 3.17-2- Impaired Waters in the Higgins Creek Subbasin

Source: Illinois EPA, Higgins Creek TMDL

Beck Lake and Big Bend Lake were identified as being impaired due to phosphorus concentrations (see also Section 3.17.5 below). Phosphorus in lake waters can foster growth of algae and impair beneficial uses. The TMDL pollutants for the two reaches of Higgins Creek (GOA-02 and GOA-01) were fecal coliform bacteria and chlorides. It is not surprising that these two reaches of Higgins Creek have elevated levels of chlorides, due to the extensive street and road networks in these drainage areas. The chloride pollutant loadings primarily come from salts applied to de-ice these streets and roads. Chloride loadings in the Des Plaines River watershed are discussed in more detail in Section 3.17.6 below.

Information on the lakes in the Des Plaines River watershed in Cook County, including Beck Lake and Big Bend Lake, is provided in Section 3.16 above. Various models were used in TMDL development to establish the water bodies' capacity to accept pollutants and to establish loading reduction targets. Appropriate models were selected based on the complexity of the system and the availability of data. The Lake Loading Response Model was used to model total phosphorus impairments in the lakes. The target maximum concentration for in-lake phosphorus Beck Lake and Big Bend Lake is 0.05 mg/L. For the impaired reaches of Higgins Creek, load duration curves were developed for the fecal coliform and chloride analyses in Higgins Creek. The calibrated models were used to calculate load capacity for each impairment parameter.

Causes of impairments, load reduction targets, and watershed restoration and protection measures are discussed below in Chapters 4 and 5 of this watershed-based plan.

3.17.5 Surface Water Quality Assessment (Illinois EPA) - Lakes

Inland Lakes have a total pond acreage of 318,477 in the State. More than 91,400 inland lakes and ponds exist in Illinois, 3,256 of which have a surface area of six acres or more (IDNR 1999). The term inland lake is used for any Illinois lake other than Lake Michigan and its bays/harbors. About three-fourths of Illinois' inland lakes are man-made, including dammed stream and side-channel impoundments, strip-mine lakes, borrow pits, and other excavated lakes. Natural lakes include glacial lakes in the northeastern counties, sinkhole ponds in the southwest, and oxbow and backwater lakes along major rivers. As with streams, lakes are assessed as Fully Supporting (good), Not Supporting (fair), or Not Supporting (poor), for each applicable designated use. Five of the seventeen reported lakes (in this plan) have been assessed and are located within the planning area: Axehead Lake, Beck Lake, Big Bend Lake, Des Plaines Lake (aka Lake Opeka), and Schiller Pond, shown in Table 3.17-2.

			Use Attainment			
Lake Name	*Illinois EPA AUID*	*Impairment*	*Not Supporting*	*Fully Supporting*	*Not Assessed*	*Source*
Axehead Lake	IL_RGZQ	---	---	Aesthetic Quality, Aquatic Life	Fish Consumption, Primary Contact Recreation, Secondary Contact	No source identified
Belleau Lake	IL_RGZR	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary, Secondary Contact Recreation	No source identified
Beck Lake (see also Higgins Creek TMDL report)	IL_RGE	Aquatic Plans (Macrophytes), Phosphorous (Total)	Aesthetic Quality	Aquatic Life	Fish Consumption, Primary, Secondary Contact Recreation	Runoff from Forest / Grassland / Parkland, Urban Runoff / Storm Sewers, Waterfowl
Big Bend Lake (see also Higgins Creek TMDL report)	IL_RGL	Aquatic Algae, Phosphorous (Total)	Aesthetic Quality	Aquatic Life	Fish Consumption, Primary, Secondary Contact Recreation	Internal Nutrient Recycling, Littoral / Shore Area Modifications (Non-Riverine), Runoff from Forest / Grassland / Parkland, Urban Runoff / Storm Sewers, Waterfowl

Lake Name	Illinois EPA AUID	Impairment	*Use Attainment* Not Supporting	Fully Supporting	Not Assessed	Source
Des Plaines Lake (aka Lake Opeka)	IL_RGF	Cause Unknown	Aesthetic Quality	Fish Consumption, Primary Contact Recreation, Secondary Contact	Aquatic Life	Source Unknown
Golfview Lake (aka Johnson Slough)	IL_RGZW	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary, Secondary Contact Recreation	No source identified
Lake Ida	IL_WGZO	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary, Secondary Contact Recreation	No source identified
Lake Mary Ann	No Assessment Available	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary, Secondary Contact Recreation	No source identified
Lake Shermerville	IL_WGZT	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary, Secondary Contact Recreation	No source identified
Park Lake	IL_WGH	---	---	---	Aesthetic Quality, Aquatic Life, Fish Consumption, Primary Contact Recreation, Secondary Contact	No source identified

Lake Name	Illinois EPA AUID	Impairment	*Use Attainment* Not Supporting	Fully Supporting	Not Assessed	Source
Schiller Pond	IL_SGF	Mercury, Polychlorinated Biphenyls (PCBs)	Aquatic Life Harvesting	---	Aesthetic Quality, Aquatic Life, Primary Contact Recreation, Secondary Contact	Atmospheric Deposition – Toxics, Source Unknown

Table 3.17-2 Summary of Impaired Lakes in the Lower Des Plaines River Planning Area

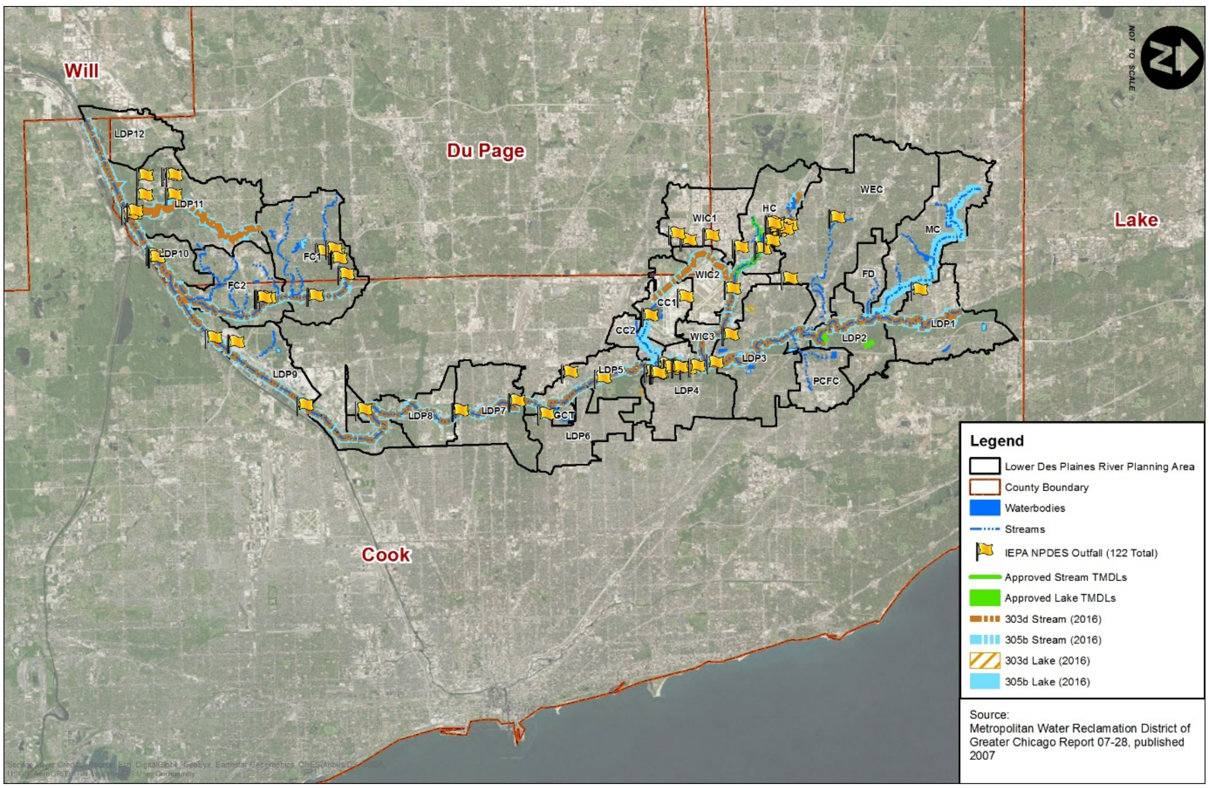


Figure 3.17-3 -Summary of Illinois EPA Impaired Watercourses in the Lower Des Plaines River Planning Area

3.17.6 MWRD Water Quality Sampling

MWRD has been monitoring water quality constituents as part of its Ambient Water Quality Monitoring program in the Lower Des Plaines River Planning Area since 2001. The list of constituents for which data is available is limited and data is somewhat sporadic as sampling programs may have been stopped or started for various reasons. Thus is must be understood that the data is not sufficiently systematic or robust such that conclusions can be drawn regarding if water quality standards are being met. Nevertheless it is illuminative to review the MWRD water quality information.

Comparison criteria for evaluating water quality data are shown in Table 3.17-3. The comparison criteria include enacted water quality standards for some parameters and other practical comparison values for other substances.

Water Quality Parameter	Reference	Comparison Criterion
Chloride	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; *Part 302 Water Quality Standards Section 302.304*	500 mg/L
Phosphorus	Wisconsin State Legislature, Administrative Code, Department of Natural Resources; Chapter NR 102.06 (3.a): Water quality Standards for Wisconsin Surface Waters *WQS for P adopted by Wisconsin*	0.1 mg/L
Total Suspended Solids	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; *Part 304 Effluent Standards* *Note these are Effluent Standards not WQS*	15.0 – 30.0 mg/L
Dissolved Oxygen	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; *Part 302 Water Quality Standards Section 302.206*	Summer: Minimum 5.0 mg/L Winter: Minimum 3.5 mg/L

Table 3.17-3 Water Quality Comparison Criteria

The MWRD sampling locations in the watershed planning area are shown on Figure 3.17-4.

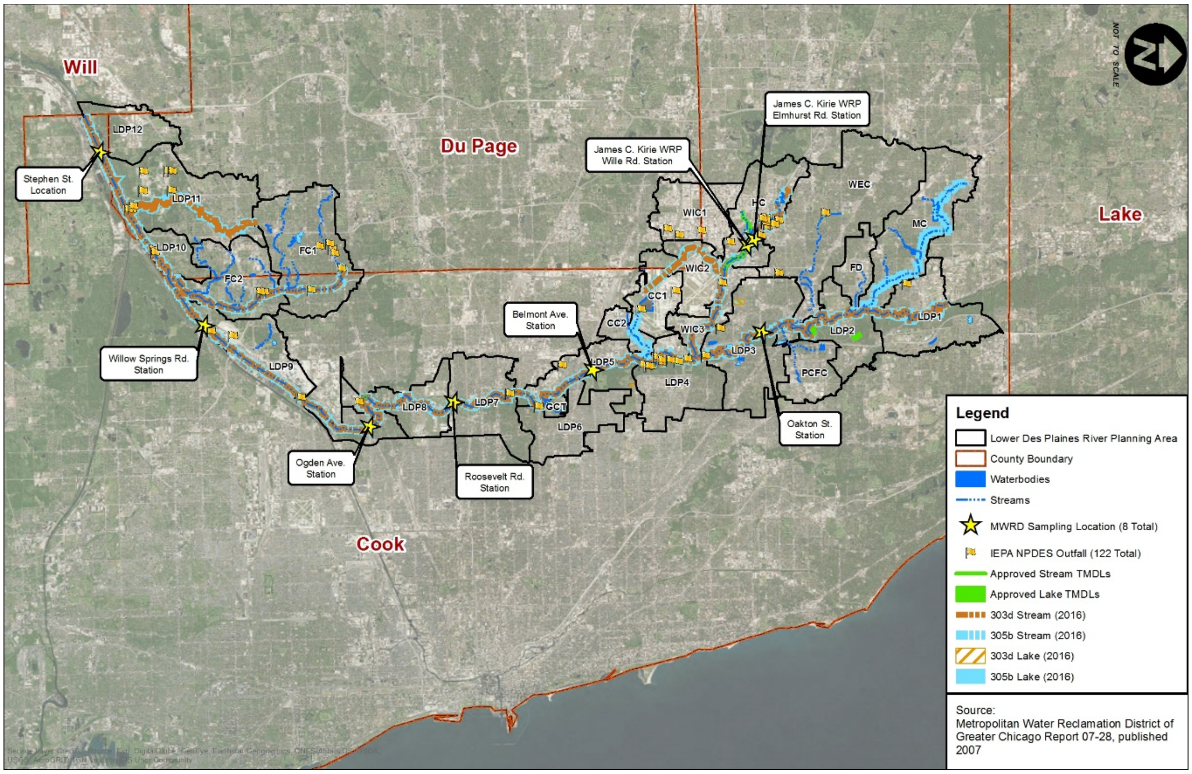


Figure 3.17-4 -MWRD Sampling Locations – Lower Des Plaines Planning Area

Average concentrations of DO, total phosphorus, total kjeldahl nitrogen and BOD based on MWRD data are shown in the following figures for the monitoring locations within the watershed planning area. In some cases, comparison criteria values are shown on the charts.

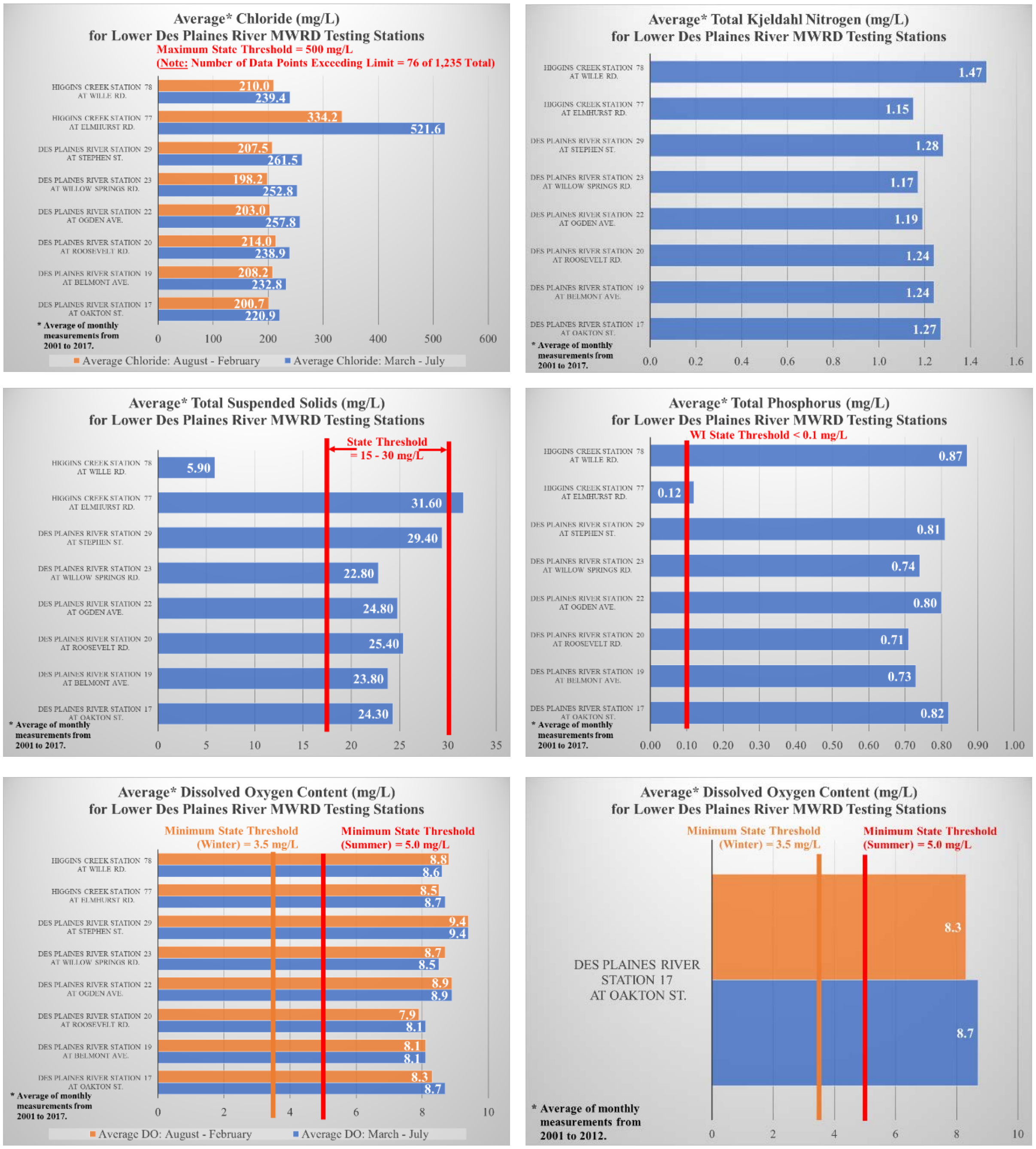


Figure 3.17-5 - Lower Des Plaines River Planning Area Water Quality Sampling Data – MWRD Sampling Program

The summaries of the MWRD data shown in Figure 3.17-5 depict averages from sampling once a month from 2001 to 2017 with the exception of DO, which is reported as an average of daily measurements. Chloride is reported as a monthly average for winter and summer months and includes the number of times the water quality criterion was exceeded. It should be noted that the data displayed in Figure 3.17-5 is a summary of the sampling data. For most of the parameters the data represent a "snap shot" of constituent level for one day in a single month. For some parameters, e.g., BOD, the monitoring data is only available for a relatively short time period (2001-2005). Thus, the data presented above should not be interpreted as a strong indicator as to if water quality goals are being met. Nevertheless, the data are useful for confirming priority pollutants and pointing toward priority pollutant sources. For example, the MWRD sampling indicates chloride concentrations are elevated and that the March – July concentrations are higher than August – February, showing chlorides remain in the river system for several months after the de-icing season. The measured phosphorus concentrations seem to confirm that nutrients are parameters of concern in the watershed. Continued and possibly more focused monitoring will be needed to more definitively assess the extent to which water quality criteria are being met.

3.17.7 Nonpoint Sources Pollutant Load Modeling

Based on water quality monitoring and the characteristics of the watershed, there are a number of pollutants that are of concern and will be focused on in this plan. These include sediment, nutrients (nitrogen and phosphorus), bacteria, and chlorides. The presence of these pollutants in the watershed and BMPs to address these pollutants are discussed in subsequent sections of this plan.

A nonpoint source of pollution can be defined as a source of pollution that releases from widely distributed or pervasive elements. Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Nonpoint source (NPS) pollution comes from many diffuse sources, and is distinguished from point sources, where pollutants are released to a water body via a constructed ditch or pipe. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers wetlands and ground waters. To provide recommendations within the watershed plan supplement, it is critical to identify pollutants of concern and sources within the watershed planning area. The relative magnitude of pollutant loads from each land use can then be quantified on a watershed based scale.

The analysis completed for the Lower Des Plaines River watershed quantified NPS loadings of total nitrogen, total phosphorus, and total suspended solids (sediment) as pollutant loads based on land use type. The analysis also included biological oxygen demand (BOD) as a function of land use for each watershed planning unit. An analysis of chloride is provided in the ensuing section.

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL), created by the U.S. EPA, was used to quantify pollutant loadings through the watershed planning area. The tool uses simple algorithms to calculate nutrient and sediment loads from various land uses. The tool can then calculate load reductions that would result from implementing various BMPs. For each watershed planning unit, the annual nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water as influenced by factors such as land use distribution and land management practices. Annual sediment load (sheet and rill erosion only) is calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio.

Pollutant load estimates were developed using the previously delineated watershed boundaries and the 25 watershed planning units. Calculations for total nitrogen, total phosphorus, total suspended solids and BOD were performed using STEPL. STEPL is a simple planning tool with certain limitations, it is not an in-stream response model and is an un-calibrated tool which estimates only watershed pollutant loading based on coarse data, such as event mean concentrations. Specific limitations and considerations of the spreadsheet model include:

- annual nutrient loading is based on runoff volume

- runoff pollutant concentrations are based on land use
- a single event mean concentration represents pollutant concentration for all storm events
- pollutant loads are estimated only for storm events based on average rainfall amount
- stream channel erosion is not accounted for as a pollutant source
- drain tiles and constructions sites are not included as a pollutant source.

Inputs for this loadings analysis included land use data from CMAP's 2013 Land Use Inventory for Northeast Illinois and an annual rainfall of 35.01 inches per year (weather station: IL CHICAGO MIDWAY AP 3). The CMAP land use data consists of a geodatabase and supporting documentation depicting land use in northeast Illinois divided into 60 categories. For STEPL, land use category input includes: urban, cropland, pastureland, forest, user defined, and feedlots. Within STEPL, the urban category was further broken down by commercial, industrial, institutional, transportation, multi-family, single-family, urban-cultivated, vacant (developed), and open space. Forest preserves and forested area were separated from the open space category and entered into STEPL as Forest to specifically capture the notable forest preserves in the watershed planning area. CMAP previously characterized open space into 5 categories including residential recreation areas and forested areas. Therefore, we quantified the open space subset 'forest' to capture forested areas and forest preserves.

Table 3.17-4 shows the total nitrogen, total phosphorous, total suspended solids, and BOD loadings for each watershed planning unit. These results indicate that based on existing watershed conditions, the WIC2 watershed planning unit is the largest nonpoint source contributor of total nitrogen (7.1%) and BOD (6.7%) while the FC2 watershed planning unit is the largest nonpoint contributor of total phosphorous (6.4%) and sediment load (11.0%). BMPs will need to be strategically planned and implemented in the developed areas to protect and restore water quality in the Lower Des Plaines River Planning Area.

Watershed Planning Unit	Total Nitrogen Load Estimate (lb/ac/yr)	Total Phosphorous Load Estimate (lb/ac/yr)	Sediment Load Estimate (t/ac/yr)	BOD Load Estimate (lb/ac/yr)
CC1	15.9	2.7	0.5	49.4
CC2	9.4	1.7	0.6	31.8
FC1	9.1	2.1	1.7	29.5
FC2	11.4	2.9	3.0	34.4
FD	9.1	1.8	1.1	31.2
GCT	4.5	0.7	0.2	15.1
HC	8.7	1.5	0.6	29.7
LDP1	7.2	1.5	0.9	23.9
LDP2	8.1	2.0	2.0	24.6
LDP3	8.4	1.8	1.4	27.4
LDP4	8.8	2.0	1.6	27.8
LDP5	9.0	2.3	2.5	26.4
LDP6	7.8	1.3	0.2	28.2
LDP7	10.5	2.4	2.1	32.8

Watershed Planning Unit	Total Nitrogen Load Estimate (lb/ac/yr)	Total Phosphorous Load Estimate (lb/ac/yr)	Sediment Load Estimate (t/ac/yr)	BOD Load Estimate (lb/ac/yr)
LDP8	9.8	2.5	2.6	29.6
LDP9	9.1	1.9	1.4	28.3
LDP10	6.7	1.3	0.6	23.8
LDP11	5.1	0.9	0.1	19.1
LDP12	6.2	1.1	0.2	21.0
MC	7.7	1.5	0.9	26.5
PCFC	6.9	1.1	0.2	26.1
WEC	8.8	1.8	1.2	29.5
WIC1	8.7	1.4	0.2	30.1
WIC2	16.0	2.7	0.4	49.6
WIC3	13.3	2.3	0.7	42.8
Total	226.0	45.1	27.2	738.5

Table 3.17-4 Summary of Pollutant Loading per Watershed Planning Unit in the Lower Des Plaines River Planning Area

Pollutant loadings per land use categories relevant to annual pollutant loadings from nonpoint sources have been analyzed using the STEPL spreadsheets and are summarized in Table 3.17-5.

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	773,742	126,600	2,761,625	18,359
Cropland	833	193	1,724	85
Forest & Grassland	3,035	1,479	7,422	103
Streambank	118,208	45,510	236,415	73,880
Total	895,817	173,783	3,007,186	92,427

Table 3.17-5 Summary of Pollutant Loadings per Land Use in the Lower Des Plaines River Area

Table 3.17-5 shows total nitrogen, total phosphorous, total suspended solids, and BOD loadings for each land use type. These results indicate that based on existing watershed conditions, urban land is the largest nonpoint source contributor of total nitrogen (86.4%), total phosphorous (72.8%), and BOD (91.8%).

Cropland in the land use table includes all agricultural land use. The land use dataset provided by CMAP is the best available land use dataset and does not break cropland into row crops and pasturelands. Per the CMAP classification of land use database; agricultural land classed by the county assessor as agricultural, is noted as parcel dominated by: row crops, field crops & fallow field farms & pasture, horse, dairy, livestock, and mixed, including dairy and other livestock agricultural processing. As noted above, the Lower Des Plaines River Planning Area is 99% developed outside of the open space reserve, there is minimal agricultural land use associated with the planning area.

This section of the resource inventory is intended to characterize and identify the existing watershed pollutant loads in each watershed planning unit. A detailed discussion and identification of annual pollutant load reduction *targets* for the Lower Des Plaines River watershed are provided in ensuing sections of this plan. The targets are based on the information characterized in this chapter and the loading reductions that are expected to occur with a planned level of BMP implementation.

3.17.8 Quantification of Chloride Loadings

Within the primarily urbanized Lower Des Plaines Planning Area, the primary source of chloride loading is from roadway, parking lot and sidewalk deicing activities. Chloride loads have been estimated for each municipality in the watershed planning area, as municipalities are responsible for purchasing and applying on public streets and parking areas the majority of chloride deicers. It is necessary to estimate the loadings based on an established methodology because currently there is no data readily available for the rates of use of chloride deicing materials being used throughout the watershed planning area.

Chloride loads were analyzed using methodology drawn from the 2014 Thorn Creek Watershed Based Plan Addendum, prepared by Geosyntec Consultants, Inc. and CMAP. This method was used in large part to be consistent with other communities in the region. The Thorn Creek Watershed Based Plan estimated the application of chloride-based deicers using de-icing survey information collected by the DuPage River Salt Creek Workgroup for several local municipalities.

According to the Thorn Creek Watershed Based Plan, usable survey responses were received from several Northeastern Illinois units of local government. The respondents represent a typical jurisdiction within the Lower Des Plaines River planning area. For the winter for 2011-2012, jurisdictions reported using between 230 and 1,071 pounds of salt per lane-mile per salt application event. The reported mean, standard deviation and median were 490, 313, and 327 pounds of salt per lane-mile per salt application event, respectively. With this data, the Thorn Creek methodology developed chloride loading estimates assuming applications of 300, 400, 500, and 800 pounds per lane-mile per salt application event.

To be consistent with the application rates used in the Thorn Creek Plan, it was determined that the chloride deicing methods were applied approximately 18 times per year between 2011 and 2012. The estimated chloride loadings per jurisdiction and per watershed planning unit are shown in Table 3.17-6 and Table 3.17-7 respectively.

Jurisdiction	Lane Miles	300 lb per lane-mile (tons/year)	400 lb per lane-mile (tons/year)	500 lb per lane-mile (tons/year)	800 lb per lane-mile (tons/year)
Unincorporated Cook County	249	679	905	1,131	1,809
Unincorporated DuPage	151	412	549	687	1,099
Unincorporated Will County	2	5	6	8	12
Arlington Heights	583	1,592	2,123	2,654	4,246
Bedford Park	11	29	39	49	78
Bellwood	12	32	43	54	86
Bensenville	54	147	196	245	393

Jurisdiction	Lane Miles	300 lb per lane-mile (tons/year)	400 lb per lane-mile (tons/year)	500 lb per lane-mile (tons/year)	800 lb per lane-mile (tons/year)
Berwyn	9	25	33	41	66
Bolingbrook	7	18	24	30	48
Broadview	68	185	247	309	494
Brookfield	39	107	142	178	284
Buffalo Grove	6	17	23	29	47
Burr Ridge	217	591	789	986	1,577
Chicago	437	1,194	1,592	1,990	3,184
Clarendon Hills	72	197	262	328	524
Countryside	60	165	219	274	439
Darien	200	546	728	910	1,457
Des Plaines	592	1,617	2,157	2,696	4,313
Downers Grove	3	10	13	16	25
Elk Grove Village	197	537	716	895	1,433
Elmwood Park	128	349	466	582	931
Forest Park	85	233	311	388	621
Forest View	1	2	3	4	6
Franklin Park	78	214	285	356	570
Glenview	121	330	440	550	880
Harwood Heights	31	83	111	139	222
Hinsdale	196	535	714	892	1,427
Hodgkins	46	125	167	208	333
Indian Head Park	48	132	176	220	353
Justice	-	-	-	-	-
La Grange	2	5	7	9	14
Lemont	25	70	93	116	185
Lyons	89	244	325	406	650
Maywood	158	432	576	720	1,152
McCook	1	2	3	3	5
Melrose Park	53	144	192	240	384
Mount Prospect	478	1,304	1,739	2,174	3,478
Niles	80	218	290	363	580
Norridge	87	238	317	396	633
North Riverside	48	132	176	220	352
Northbrook	59	162	216	270	432
Oak Park	80	219	292	365	583
Palatine	6	15	21	26	41
Park Ridge	366	998	1,331	1,664	2,662
Prospect Heights	145	396	528	660	1,056

Jurisdiction	Lane Miles	300 lb per lane-mile (tons/year)	400 lb per lane-mile (tons/year)	500 lb per lane-mile (tons/year)	800 lb per lane-mile (tons/year)
River Forest	122	334	446	557	891
River Grove	88	241	321	401	642
Riverside	83	227	303	379	606
Rolling Meadows	44	120	160	199	319
Romeoville	1	2	3	3	5
Rosemont	107	293	390	488	780
Schiller Park	149	406	541	677	1,083
Stickney	9	26	34	43	69
Summit	19	51	67	84	135
Western Springs	78	213	284	356	569
Westmont	70	192	257	321	513
Wheeling	54	149	198	248	397
Willow Springs	45	123	164	205	328
Willowbrook	119	325	433	542	867
Wood Dale	33	91	121	151	241
Woodridge	74	202	270	337	539
TOTAL	**6,477**	**17,682**	**23,576**	**29,469**	**47,151**

Table 3.17-6 Summary of Chloride Loadings per Jurisdiction in the Lower Des Plaines River Planning Area

Subwatershed	Lane Miles	300 lb per lane-mile (tons/year)	400 lb per lane-mile (tons/year)	500 lb per lane-mile (tons/year)	800 lb per lane-mile (tons/year)
CC1	82	223	297	371	594
CC2	96	262	349	436	698
FC1	548	1,496	1,995	2,493	3,989
FC2	264	721	961	1,201	1,922
FD	137	373	498	622	995
GCT	25	68	91	114	182
HC	226	618	824	1,029	1,647
LDP1	281	766	1,021	1,276	2,042
LDP2	137	373	498	622	996
LDP3	487	1,330	1,774	2,217	3,547
LDP4	378	1,032	1,376	1,720	2,752
LDP5	211	577	770	962	1,539

Subwatershed	Lane Miles	300 lb per lane-mile (tons/year)	400 lb per lane-mile (tons/year)	500 lb per lane-mile (tons/year)	800 lb per lane-mile (tons/year)
LDP6	382	1,044	1,392	1,740	2,783
LDP7	460	1,256	1,675	2,094	3,350
LDP8	206	563	751	938	1,502
LDP9	279	760	1,014	1,267	2,028
LDP10	62	170	227	284	454
LDP11	307	839	1,119	1,398	2,238
LDP12	138	378	504	630	1,007
MC	401	1,096	1,461	1,826	2,922
PCFC	174	474	632	790	1,264
WEC	837	2,284	3,046	3,807	6,091
WIC1	173	473	631	789	1,262
WIC2	17	45	60	75	120
WIC3	168	459	612	765	1,225
TOTAL	**6,477**	**17,682**	**23,576**	**29,469**	**47,151**

Table 3.17-7 Summary of Chloride Loadings per Watershed Planning Unit in the Lower Des Plaines River Planning Area

It should be noted these estimates are based on the use of deicers by municipalities mostly for deicing roads and public parking lots. Private contractors also apply deicers to privately-owned parking lots. Thus, actual loadings to water bodies in the Lower Des Plaines River planning area are higher than these estimated values. To protect designated uses, BMPs to reduce chloride loadings will need to be implemented.

3.18 POINT SOURCES

3.18.1 National Pollutant Discharge Elimination System (NPDES)

There are many "point source" discharges of pollutants in the Lower Des Plaines River watershed. Point source pollution originates from any discrete conveyance which would include discharges from industrial, concentrated animal feeding, or municipal. Conversely, nonpoint source pollution originates from diffuse sources and is generally carried to the waterbody by overland runoff. The Clean Water Act prohibits the discharge of "pollutants" through a "point source" into a "water of the United States" unless the discharge is covered by a National Pollutant Discharge Elimination System (NPDES) permit. Illinois EPA is the permitting authority for point source dischargers in Illinois. NPDES permits will contain effluent limitations, monitoring and reporting requirements, and other provisions to ensure that the discharge does not harm water quality or public health.

Figure 3.18-1 shows the location of the 122 Illinois EPA NPDES permitted outfalls located within the Lower Des Plaines Planning Area. The discharge from these outfalls range from Stormwater and Groundwater Runoff to Swimming Pool Drainage. Argonne National Laboratory has 42 outfalls listed, equating to approximately 34% of the total reported outfalls; the descriptions for these outfalls include stormwater runoff, combined sewer overflow, wastewater treatment effluent, sampling and reporting, cooling water, drain tiles, treated groundwater, and laboratory wastewater. The description and number of occurrences for each outfall type within the Lower Des Plaines watershed is listed as follows:

• Stormwater (& Groundwater) Runoff	45
• Combined Sewer Overflows	23
• Hydrostatic Test Water	10
• Effluent from Sewage Treatment Plants	8
• (Semi)-Annual Sampling & Reporting	7
• Cooling Water	6
• Drain Tiles	6
• O'Hare International Airport Excess Flow	4
• Water Reclamation Plant Emergency High Level Bypass	4
• Pump Priming Water	2
• Treated Contaminated Groundwater	2
• Argonne National Labs Laboratory Wastewater	1
• Groundwater Seepage	1
• No Description	1
• Stormwater (& Groundwater) Runoff	1
• Swimming Pool Drainage	1

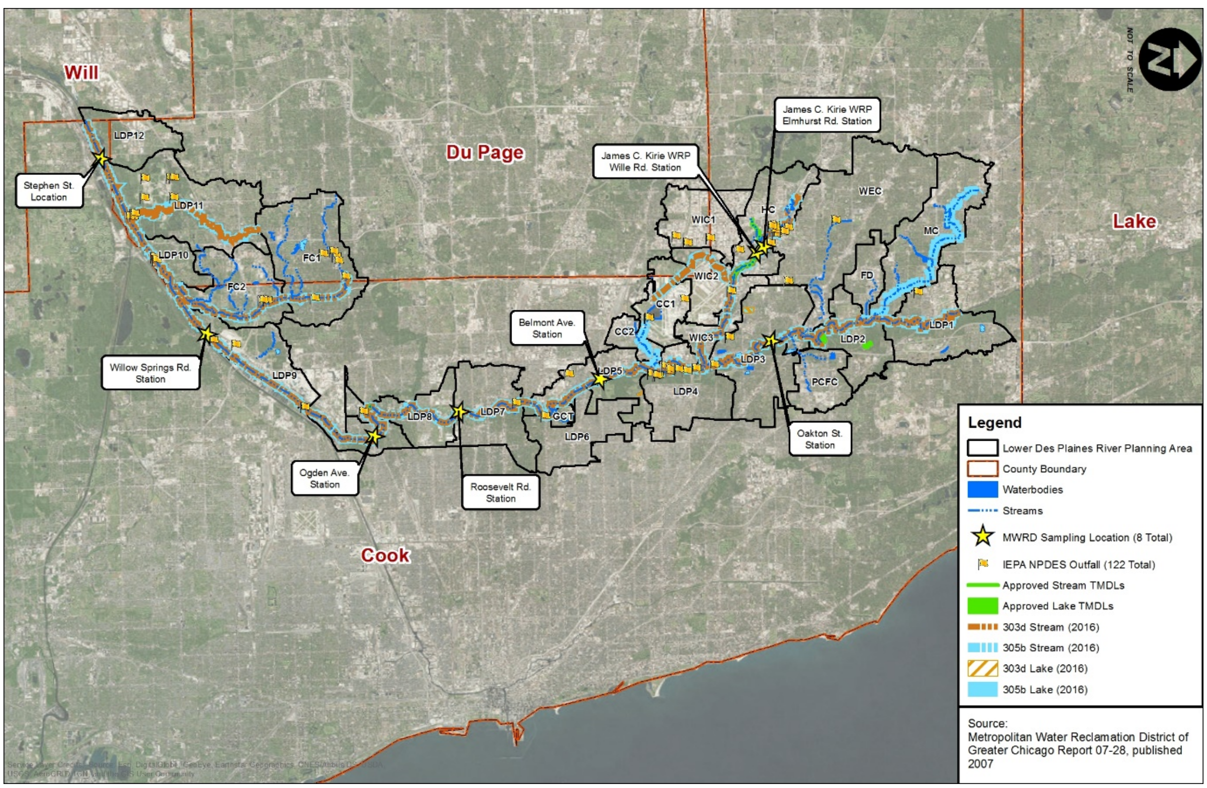


Figure 3.18-1 Lower Des Plaines River IEPA NPDES Outfall Locations

While there are a large number of continuous point source discharges, the pollutant loadings from these sources are largely less significant vs. other sources, including stormwater. NPDES permits are governing discharges from these point sources.

Municipalities discharging stormwater to the watercourses in the Lower Des Plaines River watershed planning area are regulated under the Illinois EPA NPDES Stormwater Permit Program. This program was created to improve the water quality of stormwater runoff from urban and suburban areas, and requires that municipalities obtain permit coverage for discharges of stormwater. Most units of government within the planning area are operators of small municipal separate storm sewer systems (MS4s). MS4s are intended to collect urban stormwater runoff, an important contributor to nonpoint source pollution, and, consequently, are regulated under the program.

In Illinois, discharges from small MS4s are regulated under Illinois EPA's General NPDES Permit No. ILR40. This permit requires that MS4 operators develop, implement, and enforce a stormwater management program to reduce the discharge of pollutants. A permittee's stormwater management program must include at least the following six minimum control measures:

1. Public education and outreach on storm water impacts
2. Public involvement and participation
3. Illicit discharge detection and elimination
4. Construction site storm water runoff control
5. Post construction storm water management in new development and redevelopment
6. Pollution prevention / good housekeeping for municipal operations

Because urban/suburban stormwater is a significant source of pollutant loadings, MS4 programs are an important element of efforts to restore and protect water quality in the watershed.

CHAPTER 4 WATERSHED PROBLEM ASSESSMENT

Nonpoint source pollution not captured under the NPDES Stormwater Phases I and II Rules are typically managed by the adoption and implementation of nonpoint source management programs. These programs are largely voluntary and promote practices on a watershed scale. Section 319 of the CWA allows grants to be awarded for assessments and projects to manage nonpoint source pollution. Runoff from impervious area and land use change in the highly-urbanized Lower Des Plaines River planning area is a major cause for degraded water quality in the waterbodies. Past stormwater management practices in the planning area have primarily focused on conventional stormwater management designed to convey and drain stormwater runoff from developed areas as efficiently as possible to prevent localized flooding. While development in large portions of the planning area occurred prior to the adoption of conventional stormwater management, detention basins and flow reduction strategies have been implemented on developments since the early 1970s. However, insufficient focus has been given to water quality and current stormwater management practices lack water quality components.

A watershed assessment is one of the most important aspects of watershed management as the assessment attempts to transform scientific data into policy-relevant information that can support decision-making and action. The following chapter of this plan focuses on the problems and watershed stressors identified in the watershed resource inventory for the Lower Des Plaines River Planning Area (Chapter 3).

The Lower Des Plaines Planning Area is a high density, urbanized watershed within the Chicagoland area where water quality suffers from watershed stressors stemming from land use conditions and the impact of land use change on aquatic and natural resources. This includes the creation of extensive areas of impervious surfaces, elimination of naturalized and/or riparian areas, and changes to overall stream corridors. The problems identified throughout this chapter include several current and potential future water quality-related problems.

4.1 LAND USE CHANGE

Land use change has widely been noted as the cause for water quality and watershed degradation. As part of the National Water Quality Assessment (NAWQA) Program, the USGS conducted a study of Effects of Urbanization on Stream Ecosystems (EUSE). The study was performed for nine metropolitan areas from 2003 through 2012 where biological, physical (hydrology and habitat) and chemical components were measured along reaches. The USGS study looks at a watercourses biological community, hydrology, habitat and chemistry and how these elements change as related to urban development across the country. The results of the USGS efforts indicate that the cause of degradation and sources of pollutant loadings are multi-faceted and interrelated. No single environmental factor was identified that can be used to explain why the health of streams decline as levels of urban development increase. The study showed that urban development can alter hydrology, habitat and stream chemistry (from pollutant loadings) which in turn cause multiple stressors that can degrade aquatic ecosystems. In addition, urban development leads to increased storm flow variability, often creating a "flash" of stormwater in receiving systems because of engineered drainage. This in turn leads to temperature fluctuation, erosion, increased velocities and channelization (Beaulieu et al., 2012). The USGS study is consistent with findings regarding conditions in the Lower Des Plaines watershed and helps inform plans to reduce nonpoint pollution sources.

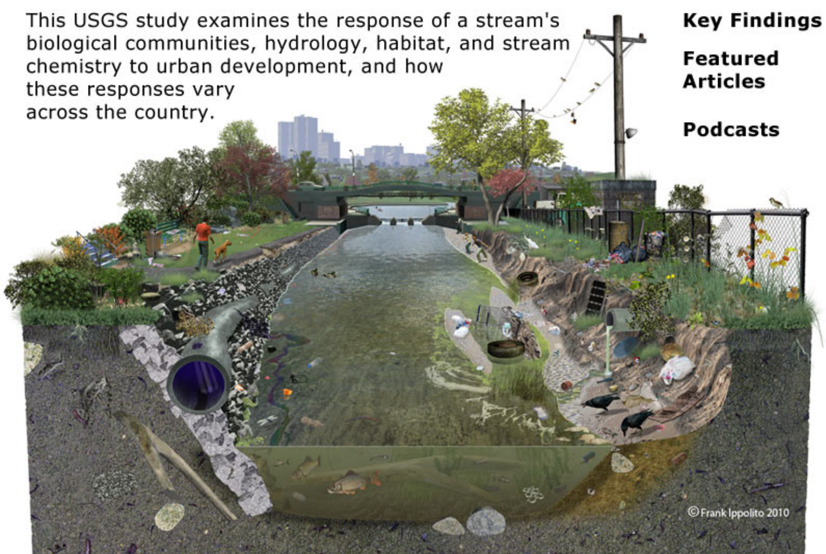


Figure 4.1-1 Effects of Urbanization on Stream Ecosystems (USGS, 2012)

The main takeaway from the USGS study is that in developed areas there are inter-related water quality stressors and that no one specific component alone leads to overall ecosystem degradation. A combination of factors, including physical effects and pollutant loadings, impact water quality and biological communities. Streams in different regions of the country respond differently to urban development. In this region and specific to the Lower Des Plaines River Planning Area, the resource inventory for which data is available and complied, indicates a dense, highly developed watershed. The physical changes to all watercourses throughout Lower Des Plaines River planning area are most notable as the resource inventory indicates that majority of the watercourses assessed have little to no riparian area (except in FPCC areas) and are highly channelized. Highly channelized areas typically have low to moderate erosion, but may provide lower quality habitat. The habitat destruction and habitat fragmentation has led to the complete elimination of riparian areas through the urbanized portions of the planning area.

The conversion of a historically wet prairie (as seen in the presettlement vegetation cover) to urban/ suburban areas has significantly degraded water quality and the aquatic ecosystem in the planning area. The removal of these ecosystems, the creation of impervious surfaces, and the alteration of stream networks have altered the hydraulic process of interception and infiltration while increasing stormwater quantities and the mobility of potential harmful constituents.

Much of the Lower Des Plaines River planning area was developed prior to the adoption of modern stormwater management practices. The changes to land use combined with lack of appropriate stormwater management measures implemented as development progressed has contributed to the degradation of water quality. This can be seen throughout much of the planning area along the Lower Des Plaines River where municipality incorporation dates as far back as the 1900's. Development in these municipalities occurred sporadically. The period with the most notable increases in population occurred during the 1940's through the 1970's. For example, the population of the City of Des Plaines grew from approximately 9,000 in the 1930s to 60,000 in the 1970's (Encyclopedia of Chicago). The timing of new development in the watershed is important with respect to stormwater management. Many stormwater systems did not include detention basins or other controls in the 1950's and 60's.

The MWRD did not begin to regulate stormwater until 1972 with the adoption of the Sewer Permit Ordinance. The Sewer Permit Ordinance focused on combined sewers. It was not until recently (May 2014) the MWRD adopted the Watershed Management Ordinance which directly addresses stormwater and water quality. Likewise, the EPA's National Pollution Discharge Elimination System (NPDES) was created in 1972, following much of the development of the planning area. Thus, without a focus on water quality and large development of the watershed over the last several decades, these areas release large volumes of stormwater which surge into the waterways delivering pollutants and contributing to erosion.

The overall land use change and impervious surface creation combined with minimal stormwater management controls has led to increased runoff volumes, creating altered hydrologic conditions for receiving streams. This is notable in the channelization and erosion characterization shown in Chapter 3.

4.2 LAND USE CHANGE AND STORMWATER QUALITY – CAUSES OF IMPAIRMENTS

A strong correlation exists between impervious area cover and degradation of aquatic ecosystems in receiving waters. This correlation has been validated in many scientific studies across the country. As stormwater runoff increases in volume and velocity, there is increased potential for erosion and the types and concentration of pollutants entering receiving waters increases. The lack of infiltration resulting from land use change eliminates the natural breakdown and filtering processes of the soil profile that normally cleanses and filters water as part of the natural water cycle (Miller, 2002). Many studies have shown a strong link between increased impervious area coverage and increased pollutant/constituent levels in receiving waters (Brabec et al., 2002).

The land use changes that have occurred in the Lower Des Plaines Planning Area have altered stormwater runoff and water quality. According to the existing condition land use data, the areas of the watershed not dedicated to forest preserve areas are densely developed with over 62% of the watershed dedicated to residential and transportation land use.

Stormwater runoff from urbanized areas is known to contain a wide range of pollutants coming from various point and nonpoint sources. Urban nonpoint source pollution is a significant contributor to water quality degradation (Brezonik and Stadelmann, 2002). MWRD has been monitoring water quality constituents as part of its Ambient Water Quality Monitoring in the Lower Des Plaines River since 2001. The list of constituents for which samples are analyzed is extensive, but they are only taken from four sampling locations along the mainstem. These locations are near point sources or inflow location from smaller tributaries. To quantify nonpoint source constituents from within the watershed, a characterization of typical constituents found in stormwater runoff was performed as seen in Chapter 3. As previously discussed, the nonpoint source pollutant loadings were quantified using the EPAs developed and widely accepted STEPL spreadsheet tool.

The nonpoint source constituents or watershed stressors characterized in Lower Des Plaines planning area are typical water quality stressors in urbanized areas and include:

- Sediment (Total Suspended Solids)
- Nutrients (Nitrogen and Phosphorus)
- Biochemical Oxygen Demand (BOD) – Indication of oxygen demanding substances
- Chlorides

Following the pollutant loading characterization, an analysis was conducted combining the pollutant loading results, field and desk-top assessments of watercourses, channelization, riparian areas and overall erodibility assessments to identify priority areas within the planning area. The characterization results for each constituent or stress factor were ranked using 4 quartiles (1 = low; 4= high) and sorted based on rank and land use to determine watershed priority areas.

Overall, impervious area dominates the watershed planning area. The exceptions are the areas of forest preserve, which constitute approximately 11% of the Lower Des Plaines planning area. The planning area is a highly developed with extensive impervious area suggesting that the watershed is susceptible to elevated pollutant levels associated with stormwater runoff from impervious area. Following is a discussion of the impairments and summary of the priority areas analysis completed for Lower Des Plaines planning area.

4.2.1 Sediment (Total Suspended Solids)

US EPA identifies sediment as the most common pollutant in rivers, stream and lakes. Sediment in stream beds disrupts the natural food chain by destroying the habitat where the smallest stream organisms live and causing massive declines in fish populations. Sediment also acts as a vehicle for other stormwater pollutants providing a mechanism to transport nutrients, hydrocarbons, metals and pesticides.

Elevated total suspended solids (TSS) in water bodies can result from several natural and anthropogenic sources. Natural sources include erosion of stream banks and bed materials and resuspension of sediment and organic material, as well as particulates carried into streams from the surrounding landscape by runoff. Anthropogenic sources of TSS include erosion from human activities that result in vegetation and soil disturbance such as site development or redevelopment, perturbation of the stream channel such as dredging, and rill, gully, and stream channel erosion resulting from concentrated or increased runoff caused by land use and land cover changes. Stormwater runoff is a major source of sediment loadings in urbanized areas.

The change in watershed hydrology associated with urban and suburban development in the Lower Des Plaines River planning area has caused channel erosion, widening and scouring which has compounded poor urban stream ecology. Visible impacts to watercourses throughout the Lower Des Plaines River Planning Area include eroded and exposed stream banks, fallen trees, sedimentation, and recognizably turbid conditions. The physical impacts have led to the degradation of water quality and habitat due to sediment loadings and is seen throughout the planning area. The increases in sediment throughout the planning area has reduced the penetration of light at depths within the water column and limits the growth of aquatic plants. Sediment loadings to stream beds have destroyed stream bed habitat where the smallest stream organisms live causing a disrupted food chain condition. This has led to the overall decline in biodiversity at all levels.

Stormwater runoff is a major source of sediment loadings in urbanized areas. The stormwater BMPs recommended in the plan typically do a very good job of reducing amounts of sediment/total suspended solids.

The indication of higher levels of sediment loading due to increased impervious area suggests increased levels of hydrocarbons, organic and inorganic compounds and heavy metals as sediment particles act as vehicles for these constituents (Hwang and Foster 2006,). Hydrocarbon pollutant loads resulting from stormwater runoff to a receiving stream are associated with high concentrations of suspended sediments. This is explained by the sorption properties of street dust, suspended solids and streambeds (Herrmann 1981). Water quality sampling conducted by MWRD at 4 sampling locations along the Lower Des Plaines River Mainstem generally confirms these findings from the literature; the monitoring conducted indicates the presence of many constitutes, including the following:

Dissolved Oxygen	Boron	Alkalinity	Manganese
pH	Cadmium	Chloride	Mercury
Ammonium	Calcium	Fluoride	Selenium
Total Nitrate	Chromium	Total Concentrated Solids	Silver
Total Phosphorus	Copper	Phenols	Zinc
Sulfate	Iron	Cyanide	Benzene
Total Dissolved Solids	Lead	Cyanide Weak Acid Disposable	Ethylbenzene
Turbidity	Magnesium	Fecal Coliform	Xylenes
Arsenic	Barium	E-coli	Nickel

The presence of these constituents has been identified at the four MWRD sampling locations during single monthly measurements from 2001 – 2016. The list includes metals, hydrocarbons and synthetic organic compounds. The sampling data confirms these pollutants exist in the watershed and can be found in runoff from the highly impervious urbanized areas. As noted above, hydrocarbon pollutant loads are associated with loadings of suspended sediments, which primarily are associated in this watershed with stormwater runoff. Consequently, this plan places a strong focus on BMPs and other measures to reduce sediment loads. Loading of metals and hydrocarbons can be reduced through the control of sediment loadings.

4.2.2 Sediment Loading

The characterization results as determined from STEPL for total suspended solids were ranked by watershed planning unit using 4 quartiles (Table 4.2-1). A spatial reference of the sediment loading ranking results is shown in Figure 4.2-1. The pollutant priority area ranking shows sediment loadings are greatest from the residential and transportation-related corridors when the ranking dataset is sorted by the transportation land use category. The watershed planning areas with a quartile ranking of 4 (shown in red) are priority areas for implementing BMPs and other measures to reduce sediment loadings. Areas where the riparian condition is identified as *Poor* are priority areas for buffers and restoration of riparian areas. Watershed planning units with upstream features that contribute to high erosion are beneficial areas for streambank restoration projects. The sub watershed ID areas that are in critical condition from sediment loading are WIC2, LDP9, LDP7, LDP4, FC2, LDP8, LDP2, and LDP5.

SUB	COM	IND	INS	TRA	RES	VAC	OPEN	WAT	FOR	AGR	t/yr	t/ac	Rank	Channel	Riparian	Erosion
WIC2	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	1013	0.40	2	N/A	N/A	N/A
CC1	2%	1%	0%	97%	0%	0%	0%	0%	0%	0%	1324	0.48	2	HIGH	POOR	LOW
WIC3	13%	13%	0%	65%	7%	1%	1%	0%	0%	0%	1028	0.52	2	HIGH	POOR	MOD
CC2	8%	18%	5%	33%	31%	1%	2%	0%	3%	0%	731	0.62	3	HIGH	POOR	LOW
LDP06	6%	1%	5%	31%	55%	0%	1%	0%	0%	0%	696	0.19	1	MOD	FAIR	HIGH
LDP09	4%	18%	2%	28%	20%	4%	1%	6%	17%	0%	7220	1.26	4	HIGH	GOOD	LOW
LDP07	6%	3%	14%	27%	42%	0%	2%	0%	6%	0%	8655	1.75	4	MOD	GOOD	MOD
HC	12%	28%	2%	27%	17%	1%	2%	0%	10%	2%	2395	0.57	3	LOW	GOOD	MOD
WEC	6%	5%	6%	25%	53%	0%	5%	0%	0%	0%	5095	0.42	2	HIGH	POOR	MOD
LDP04	8%	2%	3%	24%	39%	1%	1%	0%	21%	0%	6671	1.43	4	HIGH	GOOD	MOD
LDP12	1%	15%	2%	24%	21%	0%	1%	2%	33%	1%	717	0.22	1	HIGH	GOOD	LOW
FC1	3%	0%	5%	23%	64%	0%	5%	0%	0%	0%	5254	0.69	3	HIGH	FAIR	MOD
FD	17%	9%	8%	23%	40%	0%	3%	0%	1%	0%	547	0.3157	2	HIGH	FAIR	LOW
LDP03	7%	3%	6%	22%	44%	0%	5%	1%	11%	0%	8546	1.20	3	MOD	GOOD	HIGH
MC	6%	2%	5%	21%	55%	0%	10%	0%	0%	0%	2701	0.42	2	HIGH	FAIR	LOW
FC2	8%	9%	2%	21%	51%	1%	7%	0%	0%	0%	8207	1.63	4	HIGH	FAIR	MOD
LDP01	10%	7%	1%	21%	30%	0%	5%	0%	26%	0%	4493	0.82	3	LOW	GOOD	MOD
PCFC	13%	0%	15%	21%	45%	0%	2%	0%	4%	0%	652	0.23	1	HIGH	FAIR	LOW
WIC1	2%	68%	1%	19%	7%	2%	0%	0%	0%	0%	819	0.21	1	N/A	N/A	N/A
LDP10	8%	2%	2%	18%	54%	2%	4%	2%	7%	0%	1110	0.64	3	HIGH	GOOD	LOW
LDP08	8%	5%	18%	16%	28%	0%	6%	2%	16%	0%	7931	2.36	4	HIGH	FAIR	LOW
LDP02	6%	1%	21%	16%	18%	0%	6%	1%	32%	0%	6419	1.82	4	LOW	GOOD	MOD
LDP11	4%	1%	21%	15%	29%	1%	2%	1%	27%	0%	1174	0.14	1	HIGH	GOOD	LOW
LDP05	5%	13%	16%	14%	14%	0%	5%	1%	31%	0%	8968	2.21	4	MOD	FAIR	HIGH
GCT	0%	0%	7%	12%	27%	0%	45%	0%	9%	0%	63	0.18	1	HIGH	FAIR	LOW

Table 4.2-1 Summary of STEPL results for Sediment Loading by Watershed Planning Unit, Ranked and Sorted by Transportation Land Use

Notes: COM – Commercial; IND – Industrial; INS – Institutional (hospitals, schools, churches, cemeteries); TRA – Transportation (ROW, Rail, Roadways); RES – Residential; VAC – Vacant, OPEN – Open Space (e.g., Golf Courses); WAT – Water; FOR – Forest Preserve; AGR – Agriculture.

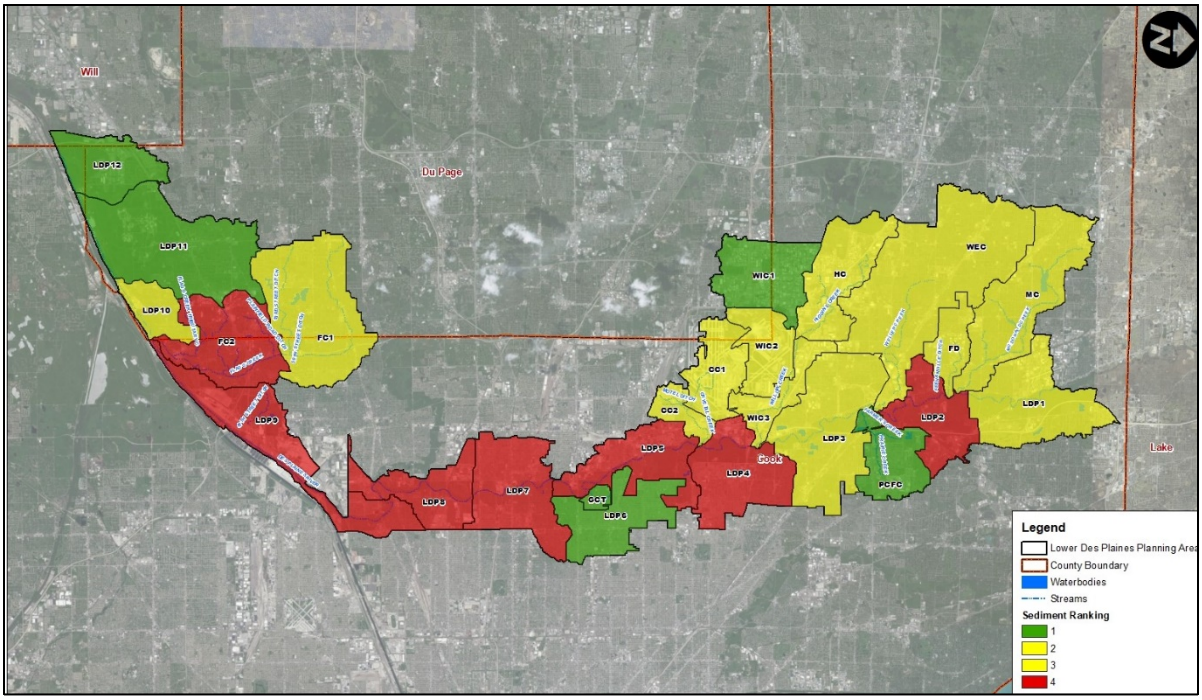


Figure 4.2-1 Sediment Load Ranking by Watershed Planning Unit

Figure 4.2-1 correlates with Table 4.2-1, and depicts the ranking of the sediment loadings found within each watershed planning unit. The priority area rankings show that sediment loadings are greatest for watershed planning units with the most intensive transportation land use. Watershed planning areas with rows highlighted in red are priority areas for BMPs and other measures to reduce sediment loadings. Also, as noted above, BMPs which reduce sediment loads associated with transportation land uses will simultaneously reduce loadings of other urban runoff pollutants that ride along with the sediment. While the table shows watershed planning units with high erosion have areas that are good candidates from streambank restoration projects, it is important to note that restoration projects should not be limited to the zone of high erosion only. The zone of high erosion could be used to target additional BMPs to be implemented upstream to prevent the causes for the zone of erosion.

4.2.3 Nutrients (Nitrogen and Phosphorus)

Nutrient pollution is one of America's most widespread, costly and challenging environmental problems. Nutrient pollution is the process where too many nutrients (nitrogen and phosphorus) are introduced into receiving streams and act like fertilizer in the water, leading to massive overgrowth of algae. Algae creates nuisance conditions limiting recreational uses, and certain types of algae emit toxins creating serious health risks.

With respect to water quality and aquatic habitat, excessive amounts of nutrients can lead to low levels of dissolved oxygen. Severe algae growth blocks light in the water column that is needed for plants to grow. In addition, when algae die and decay, this process uses the oxygen in the water leading to low levels of dissolved oxygen in the water. The lack of growth and use of remaining oxygen in the water greatly reduces water quality for aquatic ecosystems. The Higgins Creek TMDL identified Beck Lake and Big Bend Lake as being impaired due to phosphorus concentrations. Reducing nutrient loadings will be especially valuable in the drainage areas for these two lakes, and other lakes in the watershed.

The primary sources of nutrient pollution are from human activities and include runoff of fertilizers, animal manure, sewage treatment plant discharges, stormwater runoff, car and power plant emissions, and failing septic tanks. While nutrients are a necessary part of the natural ecosystem, too much can be harmful to water quality. Both phosphorus and nitrogen levels are elevated in the Lower Des Plaines planning area as seen by the MWRD water quality sampling data. Increased nutrient levels were identified throughout the Lower Des Plaines planning area during the watershed field work conducted in summer 2018.

To quantify nutrient loading from nonpoint sources or land use types, the water quality characterization results as determined from STEPL for nitrogen and phosphorus, were ranked per watershed planning unit using 4 quartiles (Table 4.2-2).

SUB	COM	IND	INS	TRA	RES	VAC	OPEN	WAT	FOR	AGR	Nitrogen			Phosphorus		
											lb/yr	lb/ac	Rank	lb/yr	lb/ac	Rank
WIC2	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	40,509	16.0	4	6,752	2.7	4
CC1	2%	1%	0%	97%	0%	0%	0%	0%	0%	0%	44,267	15.9	4	7,434	2.7	4
WIC3	13%	13%	0%	65%	7%	1%	1%	0%	0%	0%	25,533	13.0	4	4,263	2.2	4
CC2	8%	18%	5%	33%	31%	1%	2%	0%	3%	0%	10,991	9.4	4	1,965	1.7	3
LDP6	6%	1%	5%	31%	55%	0%	1%	0%	0%	0%	29,231	7.8	2	4,870	1.3	2
LDP9	4%	18%	2%	28%	20%	4%	1%	6%	17%	0%	51,090	8.9	3	10,607	1.9	3
LDP7	6%	3%	14%	27%	42%	0%	2%	0%	6%	0%	48,548	9.8	4	10,798	2.2	4
HC	12%	28%	2%	27%	17%	1%	2%	0%	10%	2%	36,885	8.7	3	6,457	1.5	3
WEC	6%	5%	6%	25%	53%	0%	5%	0%	0%	0%	90,612	7.5	2	16,059	1.3	2
LDP4	8%	2%	3%	24%	39%	1%	1%	0%	21%	0%	39,154	8.4	3	8,588	1.8	3
LDP12	1%	15%	2%	24%	21%	0%	1%	2%	33%	1%	19,954	6.2	1	3,491	1.1	1
FC1	3%	0%	5%	23%	64%	0%	5%	0%	0%	0%	56,987	7.5	2	11,015	1.4	2
FD	17%	9%	8%	23%	40%	0%	3%	0%	1%	0%	13,410	7.7	2	2,205	1.3	1
LDP3	7%	3%	6%	22%	44%	0%	5%	1%	11%	0%	57,356	8.0	3	12,104	1.7	3
MC	6%	2%	5%	21%	55%	0%	10%	0%	0%	0%	45,075	7.0	1	8,014	1.2	1
FC2	8%	9%	2%	21%	51%	1%	7%	0%	0%	0%	46,507	9.2	4	10,188	2.0	4
LDP1	10%	7%	1%	21%	30%	0%	5%	0%	26%	0%	38,381	7.0	2	7,592	1.4	2
PCFC	13%	0%	15%	21%	45%	0%	2%	0%	4%	0%	19,577	6.9	1	3,228	1.1	1
WIC1	2%	68%	1%	19%	7%	2%	0%	0%	0%	0%	33,843	8.7	3	5,459	1.4	2
LDP10	8%	2%	2%	18%	54%	2%	4%	2%	7%	0%	11,604	6.7	1	2,214	1.3	2
LDP8	8%	5%	18%	16%	28%	0%	6%	2%	16%	0%	31,306	9.3	4	7,754	2.3	4
LDP2	6%	1%	21%	16%	18%	0%	6%	1%	32%	0%	27,241	7.7	2	6,637	1.9	3
LDP11	4%	1%	21%	15%	29%	1%	2%	1%	27%	0%	41,538	5.1	1	7,110	0.9	1
LDP5	5%	13%	16%	14%	14%	0%	5%	1%	31%	0%	34,632	8.5	3	8,722	2.1	4
GCT	0%	0%	7%	12%	27%	0%	45%	0%	9%	0%	1,585	4.5	1	257	0.7	1

Table 4.2-2 Summary of STEPL results for Phosphorus and Nitrogen Loading by Watershed Planning Unit, Ranked and Sorted by Transportation Land Use

Notes: COM – Commercial; IND – Industrial; INS – Institutional (hospitals, schools, churches, cemeteries); TRA – Transportation (ROW, Rail, Roadways); RES – Residential; VAC – Vacant, OPEN – Open Space (e.g., Golf Courses); WAT – Water; FOR – Forest Preserve; AGR – Agriculture.

Table 4.2-2 shows that greater amounts of phosphorus and nitrogen loadings, as quantified using STEPL, are determined to be higher with transportation land uses. The number of pounds per year of phosphorus and nitrogen found within these watershed planning units correlate with the percentage of their transportation use areas. According to Table 4.2-2, phosphorus and nitrogen loads are relatively not as critical to reduce within the watershed areas of a quartile ranking of 1 (shown in green), while they are more critical to reduce within areas presenting a quartile ranking of 4 (shown in red). Subwatershed ID areas such as, WIC2, CC1, WIC3, CC2, LDP7, FC2, and LDP8, were found to have higher amounts of nitrogen loading compared to the other areas listed above. WIC2, CC1, WIC3, LDP07, FC2, LDP05, and LDP08 are the watershed planning units with higher amounts of phosphorus loading than the other areas listed above.

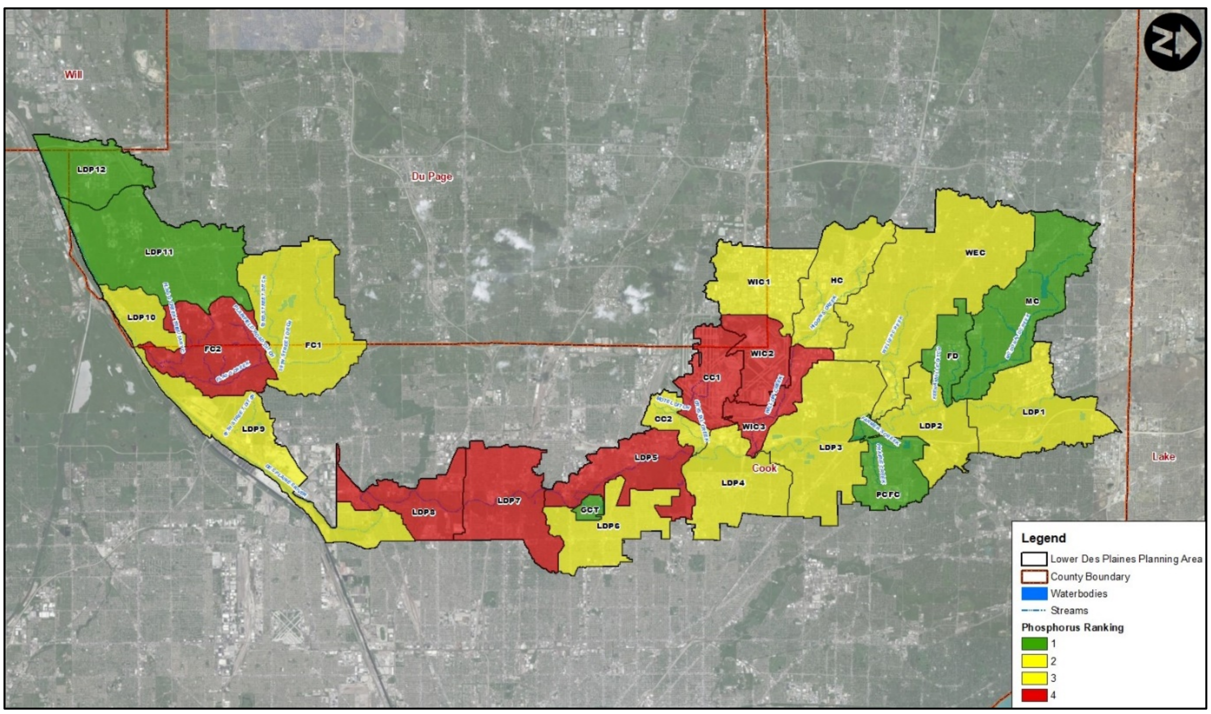


Figure 4.2-2 Phosphorus Load Ranking by Watershed Planning Unit

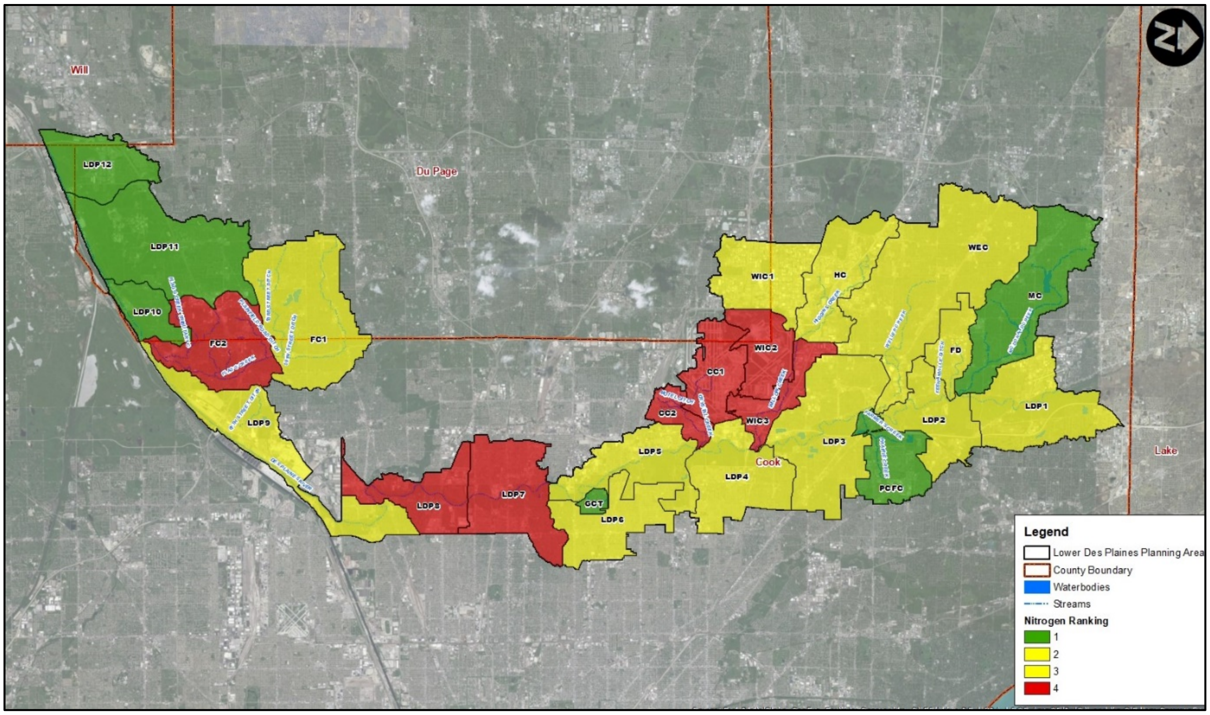


Figure 4.2-3 Nitrogen Load Ranking by Watershed Planning Unit

A spatial reference of the phosphorus and nitrogen load is shown above in Figure 4.2-2 and Figure 4.2-3, respectively. The priority area rankings show phosphorus and nitrogen loadings are greatest for watershed planning units with the most intensive transportation land use, as seen when the ranking dataset is sorted by the Transportation land use category. As noted above, primary sources of nutrient pollution can include runoff of fertilizers, stormwater runoff, car and power plant emissions through the combustion of fossil fuel (Lee et. al., 2003). The relatively higher loadings of nutrients where there is intensive transportation land use reflect the conspicuous amounts of impervious surfaces and vehicle emissions. Figures 4.2-2 and 4.2-3 show the Watershed Planning Units have very similar phosphorus and nitrogen loading rankings. Watershed planning areas with rows highlighted in red are priority areas for BMPs and other measures to reduce nutrient loadings. Practices to reduce sediment loads and nutrient loads are discussed in ensuing sections of this plan.

4.2.4 Biological Oxygen Demand (BOD)

Dissolved oxygen (DO) in waterbodies is essential for aquatic life. The amount of DO in waterbodies is dependent on water temperature, the amount of oxygen taken out of the system by respiring and decaying organisms, and the amount of oxygen put back into the system by photosynthesizing plants, stream flow, and aeration. The temperature of a waterbody affects the amount of dissolved oxygen present because less oxygen dissolves in warm water than cold water.

Urban runoff can act as a food source for water-borne bacteria as discussed in the previous nutrient section. Bacteria in the waterbody uses DO to decompose organic matter thereby reducing DO present for aquatic ecosystems. The degradation of organic matter often occurs to the point where DO is reduced enough that aquatic life is impaired. Biochemical oxygen demand (BOD) is the measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions (presence of oxygen). High BOD loadings will result in low DO levels. Reduced DO concentrations in waterbodies in urbanized areas often occurs just after storm events because of oxygen demanding substances in receiving waters due to stormwater runoff (Erickson et. al., 2013).

BOD loadings can also come from wastewater treatment plants. The primary wastewater treatment plants located within the Lower Des Plaines watershed are the MWRD Stickney Water Reclamation Plant (WRP), located in Stickney and the James C. Kirie WRP, located in the City of Des Plaines. These plants remove both solids and organic material within the wastewater reducing the BOD loads within the watershed. Loadings are limited by the applicable NPDES permits for these facilities. Therefore, it can be concluded that stormwater runoff is the primary source of BOD loadings within the Lower Des Plaines watershed.

DO concentrations can also be a surrogate for overall water quality as a low concentration of DO suggest the presence of oxygen demanding pollutants. These pollutants may include nutrients, metals, hydrocarbons, synthetic organic and inorganic compounds as discussed above.

The sampling of BOD conducted by the MWRD at four sampling locations along the mainstem provides a snapshot of Lower Des Plaines River water quality conditions. To quantify BOD loadings from nonpoint sources or land use types, the water quality characterization results as determined from STEPL for BOD loadings were ranked per watershed planning unit using 4 quartiles (Table 4.2-3). A spatial reference of the BOD load is shown in Figure 4.2-4. The priority area ranking shows BOD loadings are greatest for watershed planning units with the most transportation land use. Watershed planning areas with a quartile ranking of 4 (highlighted in red) are priority areas for BMPs and other measures to reduce BOD loads.

SUB	COM	IND	INS	TRA	RES	VAC	OPEN	WAT	FOR	AGR	lb/yr	lb/ac	Rank
WIC2	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	125,578	49.6	4
CC1	2%	1%	0%	97%	0%	0%	0%	0%	0%	0%	137,472	49.4	4
WIC3	13%	13%	0%	65%	7%	1%	1%	0%	0%	0%	83,017	42.2	4
CC2	8%	18%	5%	33%	31%	1%	2%	0%	3%	0%	37,292	31.8	4
LDP6	6%	1%	5%	31%	55%	0%	1%	0%	0%	0%	105,575	28.2	3
LDP9	4%	18%	2%	28%	20%	4%	1%	6%	17%	0%	160,162	27.9	3
LDP7	6%	3%	14%	27%	42%	0%	2%	0%	6%	0%	156,014	31.6	4
HC	12%	28%	2%	27%	17%	1%	2%	0%	10%	2%	125,380	29.7	3
WEC	6%	5%	6%	25%	53%	0%	5%	0%	0%	0%	324,449	27.0	2
LDP4	8%	2%	3%	24%	39%	1%	1%	0%	21%	0%	125,897	27.1	3
LDP12	1%	15%	2%	24%	21%	0%	1%	2%	33%	1%	67,286	20.9	1
FC1	3%	0%	5%	23%	64%	0%	5%	0%	0%	0%	199,754	26.2	2
FD	17%	9%	8%	23%	40%	0%	3%	0%	1%	0%	49,517	28.6	3
LDP3	7%	3%	6%	22%	44%	0%	5%	1%	11%	0%	190,370	26.6	2
MC	6%	2%	5%	21%	55%	0%	10%	0%	0%	0%	162,094	25.1	2
FC2	8%	9%	2%	21%	51%	1%	7%	0%	0%	0%	151,303	30.0	4
LDP1	10%	7%	1%	21%	30%	0%	5%	0%	26%	0%	128,402	23.6	1
PCFC	13%	0%	15%	21%	45%	0%	2%	0%	4%	0%	74,007	26.1	2
WIC1	2%	68%	1%	19%	7%	2%	0%	0%	0%	0%	117,183	30.1	4
LDP10	8%	2%	2%	18%	54%	2%	4%	2%	7%	0%	41,178	23.8	1
LDP8	8%	5%	18%	16%	28%	0%	6%	2%	16%	0%	96,571	28.7	3
LDP2	6%	1%	21%	16%	18%	0%	6%	1%	32%	0%	84,201	23.9	1
LDP11	4%	1%	21%	15%	29%	1%	2%	1%	27%	0%	155,412	19.1	1
LDP5	5%	13%	16%	14%	14%	0%	5%	1%	31%	0%	103,683	25.5	2
GCT	0%	0%	7%	12%	27%	0%	45%	0%	9%	0%	5,387	15.1	1

Table 4.2-3 Summary of STEPL results for BOD Loading by Watershed Planning Unit, Ranked and Sorted by Transportation

Notes: COM – Commercial; IND – Industrial; INS – Institutional (hospitals, schools, churches, cemeteries); TRA – Transportation (ROW, Rail, Roadways); RES – Residential; VAC – Vacant, OPEN – Open Space (e.g., Golf Courses); WAT – Water; FOR – Forest Preserve; AGR – Agriculture.

In Table 4.2-3, greater amounts of BOD loading from nonpoint sources are determined to be found in areas with transportation and residential land uses. The main watershed planning units that have a higher BOD loading are found within O'Hare International Airport. O'Hare is an area with heavy transportation and heavy air pollution, which limits vegetation and increases BOD. It is found that this area also has substantial nutrients present (as seen in Table 4.2-2), which correlates with an increase in BOD loading. According to Table 4.2-3, BOD loads are relatively not as critical to reduce within the watershed areas of a quartile ranking of 1 (shown in green), while they are more critical to reduce within areas presenting a quartile ranking of 4 (shown in red). Sub watershed ID areas such as, WIC2, CC1, WIC3, CC2, LDP07, FC2, and WIC1, were found to have higher amounts of BOD loading compared to the other areas listed above.

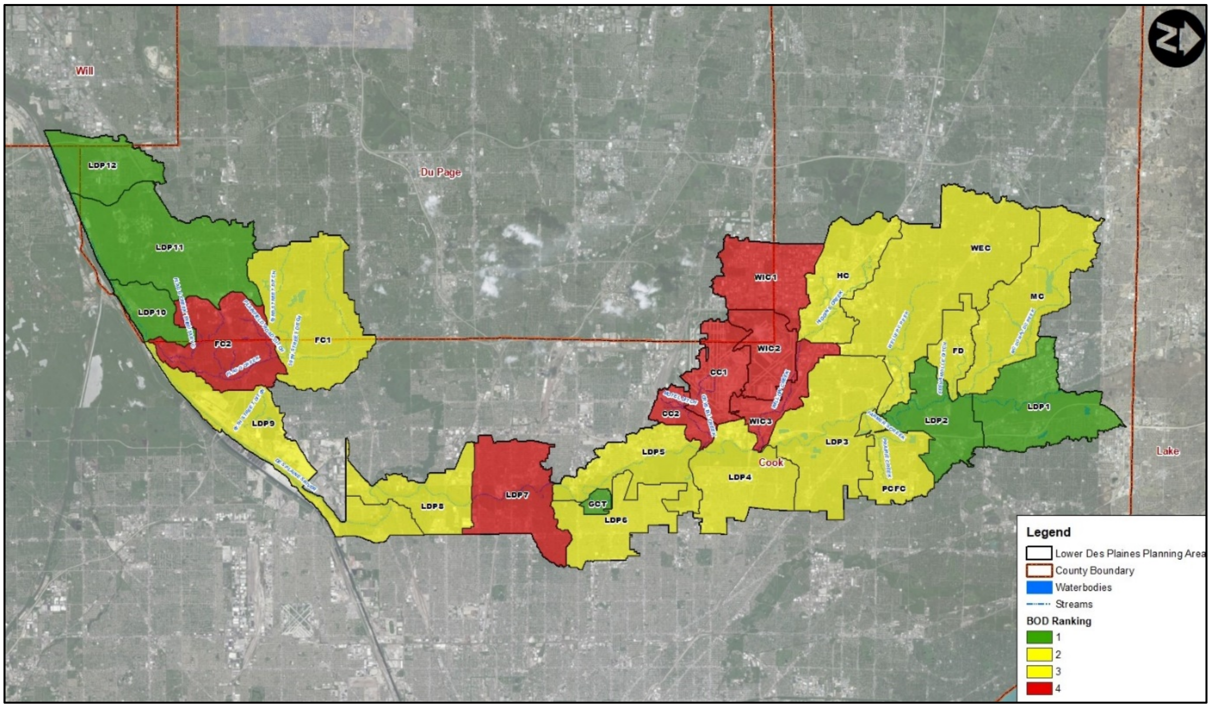


Figure 4.2-4 BOD Load Ranking by Watershed Planning Unit

Figure 4.2-4 shows the Watershed Planning Units with high BOD rankings are similar but not the same as the watershed planning units with high rankings for phosphorus and nitrogen. Also shown in Figure 4.2-4 are higher BOD loadings in areas dominated by development and high percentages of impervious area. Figure 4.2-4 corresponds well with Figure 3.10-2 (with respect to impervious areas). BOD in urban runoff is directly correlated with the percentage of the watershed developed or the percentage impervious (Erickson et. al., 2013). Any foreign oxidizing organic material found in stormwater can deplete dissolved oxygen from a receiving watercourse. This includes oils and greases (often higher concentration associated with transportation corridors) as well as grass clippings, mulch, compost, surfactants and pet waste (often associated with urban land uses). Figure 4.2-4 illustrates the link between impervious areas and BOD loading with respect urban land use and transportation corridors. This highlights the need to protect and restore habitat and other pervious area.

4.2.5 Chlorides

Chlorides are an emerging pollutant of concern. Chlorides can impair uses and in high concentrations are toxic to aquatic ecosystems. The Higgins Creek TMDL identified chlorides as the cause of impairments in two reaches of the Creek. In Lake County, data from all monitored sites indicate that chloride concentrations have increased over time, particularly from 2010-2015.

The primary source of chloride loadings within the Lower Des Plaines River planning area is deicing activities. Following application to a roadway surface, chloride (road salt) will run off into receiving waterbodies where the concentration in the waterbody will increase, particularly throughout the winter months when chloride concentrations spike. Chloride levels in soils and waterbodies can also continue to be elevated several months after winter has ended. In a study conducted by the USGS, chloride concentrations have increased substantially over time with average concentrations approximately doubling from 1990 to 2011.

The highly-urbanized Lower Des Plaines River planning area includes significant roadway and ROW land uses. Loading estimates developed as part of the watershed planning work indicate very high amounts of chloride are being released into the watershed each year. Best practices associated with optimizing the use of salt for deicing will be needed to reduce chloride loadings. Chapter 5 of this watershed based plan identifies generally accepted best practices for reducing chloride loadings.

The USGS study suggests that the rapid rate of chloride concentration increase is likely due to a combination of increased road salt application rates, increased baseline concentrations, and greater snowfall in the Midwestern U.S. during the study period (Corsi, et. al., 2014).

A highly intense transportation area in the Lower Des Plaines River includes O'Hare International Airport (O'Hare) where records show a negligible amount of chloride loading. The small load of chloride can be explained by the use of propylene glycol as a deicer around the airport. Propylene glycol is a clear, colorless, hygroscopic liquid and highly soluble in water. The biodegradation process requires oxygen, therefore, DO concentration in receiving water may be negatively affected. Use of propylene glycol as a deicer obligates the airport to collect all the contaminated runoff from the area and treat it as wastewater.

Watershed planning unit WIC2 and CC1 are unique within the Lower Des Plaines Watershed because they contain the airfield of O'Hare and its stormwater management infrastructure. Significant stormwater management infrastructure has been constructed over the years at O'Hare to contain and collect its stormwater runoff. This is due the widespread application of aircraft and pavement deicing and anti-icing chemicals within the airport. While various deicing/anti-icing agents have been used, the primary chemical used is glycol. The drainage systems at O'Hare have been designed to collect runoff from all areas where glycol is applied, or can potentially be thrown as part of snow removal operations. Therefore, all areas within 200' of a paved surface that is subject to aircraft movements are designed in a way that any runoff drains to a collection system internal to the airport. These surfaces are generically called "airside" surfaces. Other areas within the airport where aircraft do not travel and are beyond the 200' snow throw distance are conveyed through various storm sewer systems and discharged directly to one of the waterways on the airport (Willow-Higgins Creek, Crystal Creek, Bensenville Ditch).

Watershed planning unit CC1 is generally referred to as the South Airfield. Within the South Airfield, there are several drainage systems which collect runoff and convey it to either the Central Detention Basin or South Detention Basin, which are hydraulically connected and essentially function as one storage facility. The combination of these two basins provides approximately 1,900 ac-ft of storage volume. Discharge out of the basin is through a pump station and forcemain system that drains into the MWRD Tunnel and Reservoir Plan tunnel, and ultimately is conveyed to the MWRD's Stickney Plant for treatment. This system is currently the only means of dewatering the South Detention Basin, which means that all airside runoff within the South Airfield is treated at MWRD facilities and does not reach the surface waterways unless there was an overflow event. In that event, the South Basin overflows through twin 42" culverts that are the headwaters of Crystal Creek.

Watershed planning Unit WIC2 is generally referred to as the North Airfield. Within the North Airfield, there are several major storm sewer systems which collect runoff and convey it to a major storage basin known as the North Detention Basin. The North Detention Basin system is more complicated than the South because it is interconnected with the Willow-Higgins Creek Flood Control Facility and provides storage in two different operational scenarios. One is during winter, or deicing season, when the North Basin is used to collect and store runoff from the North Airfield that is contaminated with deicing agents. In this scenario, a gate system can close the connection between the North Detention Basin and the flood control reservoir so that it operates as an independent storage basin with a capacity of approximately 760 ac-ft. The basin is dewatered by pumping to an MWRD Interceptor Sewer, which ultimately drains to the Stickney treatment plant. Under the winter operational scenario, virtually all runoff is pumped to MWRD facilities for treatment. The only possible exception would be an overflow event, when the gate to the flood control facility can be opened to access the storage volume there. Water in the reservoir facility can be recirculated to the North Detention Basin so that it can be pumped to MWRD facilities.

During summer, or the non-deicing operational scenario, water stored in the North Detention Basin can be discharged into Willow-Higgins Creek if it meets the effluent limits of the airport's NPDES permit. The operational procedures at the airport are such that water in the North Detention Basin is tested daily for these effluent parameters to determine whether the discharge must be sent to MWRD facilities, or whether discharge can be to Willow-Higgins Creek. Typically, discharge from North Detention Basin is to Willow-Higgins Creek from May to November, and to the MWRD for the rest of the year.

To quantify chloride loading from nonpoint sources or land use types, the water quality characterization results as determined for chloride using application rates and lane miles within a watershed planning unit were ranked using 4 quartiles. The priority area ranking shows chloride loadings are greatest for watershed planning units with the highest residential land use as seen when ranking the dataset according to residential land use. This is due to the street networks in the residential areas and current deicing practices implemented on streets, driveways, and parking lots. As stated above, although watershed planning units CC1 and WIC2 are primarily transportation, areas within the airport that are considered "airside" are captured and treated; however, all landside areas are included in the chloride calculations. Measures to reduce chloride loads are important in all areas, but are especially critical in watershed planning areas with a quartile ranking of 4 (shown in red).

SUB	COM	IND	INS	TRA	RES	VAC	OPEN	WAT	FOR	AGR	ln mi	500 lb/ ln mi	Rank
FC1	3%	0%	5%	23%	64%	0%	5%	0%	0%	0%	548.00	2493.39	4
LDP06	6%	1%	5%	31%	55%	0%	1%	0%	0%	0%	382.33	1739.60	4
MC	6%	2%	5%	21%	55%	0%	10%	0%	0%	0%	401.38	1826.28	3
LDP10	8%	2%	2%	18%	54%	2%	4%	2%	7%	0%	62.43	284.05	1
WEC	6%	5%	6%	25%	53%	0%	5%	0%	0%	0%	836.71	3807.03	3
FC2	8%	9%	2%	21%	51%	1%	7%	0%	0%	0%	263.95	1200.95	2
PCFC	13%	0%	15%	21%	45%	0%	2%	0%	4%	0%	173.69	790.30	3
LDP03	7%	3%	6%	22%	44%	0%	5%	1%	11%	0%	487.27	2217.07	3
LDP07	6%	3%	14%	27%	42%	0%	2%	0%	6%	0%	460.21	2093.96	4
FD	17%	9%	8%	23%	40%	0%	3%	0%	1%	0%	136.70	621.97	4
LDP04	8%	2%	3%	24%	39%	1%	1%	0%	21%	0%	378.01	1719.94	4
CC2	8%	18%	5%	33%	31%	1%	2%	0%	3%	0%	95.88	436.26	4
LDP01	10%	7%	1%	21%	30%	0%	5%	0%	26%	0%	280.52	1276.38	2
LDP11	4%	1%	21%	15%	29%	1%	2%	1%	27%	0%	307.36	1398.47	1

SUB	COM	IND	INS	TRA	RES	VAC	OPEN	WAT	FOR	AGR	ln mi	500 lb/ ln mi	Rank
LDP08	8%	5%	18%	16%	28%	0%	6%	2%	16%	0%	206.26	938.50	3
GCT	0%	0%	7%	12%	27%	0%	45%	0%	9%	0%	25.05	114.00	3
LDP12	1%	15%	2%	24%	21%	0%	1%	2%	33%	1%	138.35	629.51	1
LDP09	4%	18%	2%	28%	20%	4%	1%	6%	17%	0%	278.51	1267.21	2
LDP02	6%	1%	21%	16%	18%	0%	6%	1%	32%	0%	136.81	622.48	1
HC	12%	28%	2%	27%	17%	1%	2%	0%	10%	2%	226.25	1029.42	2
LDP05	5%	13%	16%	14%	14%	0%	5%	1%	31%	0%	211.46	962.13	2
WIC1	2%	68%	1%	19%	7%	2%	0%	0%	0%	0%	173.36	788.78	2
WIC3	13%	13%	0%	65%	7%	1%	1%	0%	0%	0%	168.23	765.47	4
CC1	2%	1%	0%	97%	0%	0%	0%	0%	0%	0%	81.56	371.08	1
WIC2	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	16.54	75.25	1

Table 4.2-4 Summary of Chloride Loading by Watershed Planning Unit, Ranked and Sorted by Residential

Notes: COM – Commercial; IND – Industrial; INS – Institutional (hospitals, schools, churches, cemeteries); TRA – Transportation (ROW, Rail, Roadways); RES – Residential; VAC – Vacant, OPEN – Open Space (e.g., Golf Courses); WAT – Water; FOR – Forest Preserve; AGR – Agriculture.

In Table 4.2-4, greater amounts of chloride loading from nonpoint sources are determined to be found with higher percentages of residential areas. The amount of lane miles of chloride found within these watershed planning units correlate with the percentage of their residential areas. According to Table 4.2-4, chloride loads relatively more critical to reduce within areas presenting a quartile ranking of 4 (shown in red). Watershed planning units such as, FC1, LDP6, MC, WEC, LDP3, LDP7, and LDP4, were found to have higher amounts of chloride loading compared to the other areas listed above.

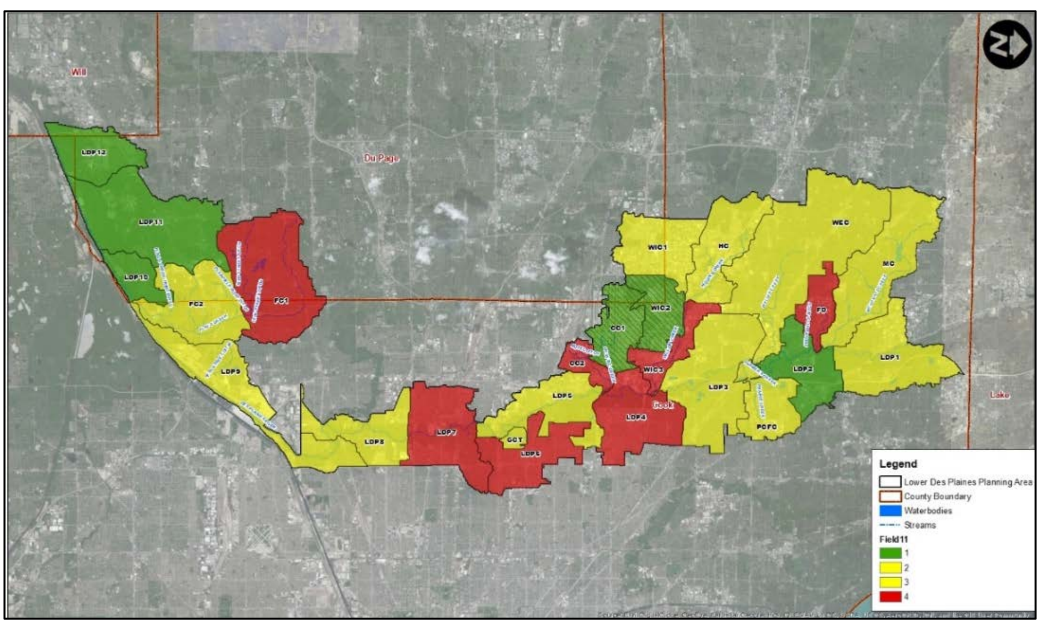


Figure 4.2-5 Chloride Load Ranking by Watershed Planning Unit

Note: The hatched Watershed Planning Units include O'Hare Airport

The figure above, Figure 4.2-5, correlates with Table 4.2-4, which presents the amount of chloride loadings found within each watershed planning unit. Chloride loads are relatively greater within areas presenting a quartile ranking of 4 (shown in red).

4.2.6 Stream, Shoreline, and Riparian Impairments

Most watercourses in the Lower Des Plaines River planning area have been channelized to some extent except for those reaches through forest preserve property. Most of the tributary watercourses assessed flow through developed areas and are highly channelized, including McDonald Creek, Weller Creek, Farmer's Creek, Higgins Creek, Willow Creek, Crystal Creek, Sexton Creek and Flagg Creek. Some reaches along these watercourses flow through large diameter pipes for significant distances before daylighting or discharging into the Des Plaines River. Erosion through these watercourses is moderate to minimal as the watercourses have been channelized using various methods to promote conveyance. There is little to no riparian area associated with these watercourses and the dense land use does not readily allow for a riparian habitat due to land constraints. Land use change has increased runoff rates, sediment loads, debris and eliminated natural riparian habitat as seen throughout the planning area. In areas where the waterbody is not piped or channelized, streambank erosion is often a concern and contributes to sediment loads and degraded habitat. In areas that are piped or armored, natural characteristics that would help reduce that loadings of sediment and other pollutants are lacking. The deposition of excess sediment and organic matter has greatly degraded streambed habitat. Excessive sediment loadings from runoff has led to areas of deep silt creating anaerobic conditions, non-supporting of fish habitat and low DO levels (Chapter 3).

The northern part of the Des Plaines River and Flagg Creek Tributary C both flow through forest preserve property. The upper sections of these watercourses exhibit minor channelization, while the lower sections within these residential areas are highly channelized, with very limited riparian areas. The Des Plaines River shows relatively greater loadings when these areas receive runoff from residential and roadway ROW land uses. The loss of habitat and riparian areas due to land use change and sediment loading has degraded water quality and reduced aquatic biodiversity.

4.3 OVERALL WATERSHED ASSESSMENT

When compared to other recently approved watershed based plans of similar land use (i.e., Cal-Sag Channel), nonpoint source loadings are on average greater in the Lower Des Plaines River Planning Area for all constituents. One reason for this is that the Lower Des Plaines River Planning Area is between 86% developed excluding open space and forest preserve areas while the Cal-Sag watershed is 73% developed. The data summarized in Chapter 3 and sections above indicate water quality is generally impaired, and is largely caused by urbanization which creates expanses of impervious area which greatly increases runoff volumes and pollutant loadings.

The Illinois EPA Integrated Water Quality Report indicates that the mainstem of the Lower Des Plaines River is impaired (Table 3.17-1). The Illinois EPA lists the Des Plaines River as impaired for mercury, polychlorinated biphenyls (PCBs) DO (low), total suspended solids (TSS), alteration stream-side or littoral vegetative cover, aquatic algae, chloride, fecal coliform, flow regime and habitat alteration, PH, polychlorinated, Sediment /siltation, Arsenic, methoxychlor, Aldrin, Lindane and total phosphorus. The use attainment for which the Lower Des Plaines River does not support is fish consumption, primary contact recreation and aquatic life. This is confirmed in the 303d list where the Illinois EPA identified the causes for these impairments as: Atmospheric deposition - toxics, channelization, contaminated sediments, urban runoff, storm sewer discharges, combined sewer overflows, impacts from hydrostructure flow regulation, municipal point source discharge, streambank modification/ destabilization, highway/road/bridge runoff (non-construction related), and dam or impoundment.

Per the Illinois EPA 303d list, Flagg Creek has also been assessed and is impaired due to alteration in stream-side or littoral vegetative cover, Arsenic, DDT, hexachlorobenzene, methoxychlor and Phosphorous. The cause of this impairment is identified as contaminated sediments, municipal point source discharge, streambank modification/ destabilization and site clearance (land development or redevelopment).

The other tributary watercourse assessed by the Illinois EPA in the Lower Des Plaines River Planning Area is Higgins Creek. Per the Illinois EPA 303d list, Higgins Creek is impaired due to chloride, fecal coliform, fluoride, phosphorous, zinc, PH, and DO. The cause of this impairment is identified as municipal point source discharges and urban runoff/ storm sewer. Illinois EPA has completed a TMDL for some but not all of the pollutants in the Higgins Creek subbasin.

The Illinois EPA also assessed Willow Creek as impaired for alteration in stream-side or littoral vegetative cover, loss of instream cover, and phosphorous. The cause of this impairment is identified as channelization, loss of riparian habitat, urbanized high-density areas and municipal point source discharges. These pollutants associated with the use impairments are typical constituents found in stormwater runoff and the impairments are largely a result of upstream water quality influences and stormwater discharges. The correlation between stressors included on the Illinois EPA 303d list and the stressors identified in the watershed assessment has been established linking increased impervious area with increased runoff and increased pollutant loadings, resulting in diminished water quality. The 303d list and the watershed assessment both point to stormwater runoff as the primary source of pollutant loadings.

As noted in Table 3.17-1, recreational uses are affected by bacteria in a water body, which can make the water unsafe for wading or swimming or kayaking. Sources of bacteria loadings can include point source discharges as well as urban runoff. The applicable water quality standard for fecal coliform bacteria is a 200 cfu/100ml geometric mean based on a minimum of five samples taken over any 30-day period or a 400 cfu/100ml maximum not to be exceeded in more than 10% of samples taken during any 30-day period. The Higgins Creek TMDL identified that two reaches of the Creek have uses impaired due to fecal coliform bacteria. In an urbanized watershed such as the Lower Des Plaines, stormwater can be a significant source of bacteria loadings.

Water quality in the Lower Des Plaines River in Cook County can be attributed to conditions of the water flowing into the watershed from Lake County and the conditions of and runoff from the watershed areas draining to the Lower Des Plaines River. As such, water quality in the Lower Des Plaines River reflects the surrounding watershed and upland land use practices and changes. As land use has changed and impervious areas increased, stormwater discharge volumes and pollutant loadings have increased, and overall water quality in the Lower Des Plaines River became more degraded. The data compiled and analyzed here suggest that urbanization and increases in impervious area and the associated stormwater discharges are the primary sources of pollutant loadings in the Lower Des Plaines River planning area, particularly as point sources are controlled via NPDES permits.

4.4 ASSESSMENT OF PREDICTED FUTURE LAND USE CHANGE AND STORMWATER QUALITY

Understanding future development patterns and impacts, and building in appropriate controls as development occurs, is an important proactive strategy to address water quality issues as growth occurs within the planning area. The population forecast presented in Chapter 3 indicates that the population density is expected to increase from 7.0 people per acre to 8.1 people per acre. Understanding that the Lower Des Plaines River Planning Area outside of the forest preserve areas is 86% developed, land use changes in the future will consist mainly of modifications to already impervious areas to accommodate a moderate population increase. It is expected that most of the population increase will be accommodated in more dense (multi-unit development) residential and associated commercial areas. There will be a slight increase in impervious area, but much of the growth will be fit into areas that are already largely impervious. Overall it is expected that the future projected priority areas identified in the previous section will remain unchanged because of population increase.

A factor that will help improve water quality conditions as redevelopment occurs is the MWRD WMO. The WMO establishes requirements for stormwater detention and volume control (green infrastructure) for many redevelopment projects. Many municipalities have similar stormwater ordinances. Thus, as redevelopment occurs, measures which will help reduce loadings will be built into the watershed, helping to reduce loadings even as growth occurs.

A primary conclusion from this plan is that existing priority areas for implementing BMPs to control stormwater will continue to be priority areas in the future. Measures can be planned and implemented in the priority areas with confidence that they will help improve and protect water quality now and in the future. Likewise, the goals established for nonpoint source water quality improvements will remain useful and valid based on future land use projections.

CHAPTER 5 WATERSHED PROTECTION MEASURES

As shown in the previous chapters, the Lower Des Plaines Planning Area is 86% developed. Runoff from impervious area and land use change in the highly-urbanized Lower Des Plaines Planning Area is a major cause for degraded water quality in the waterbodies. Past stormwater management practices in the planning area have primarily focused on conventional stormwater management designed to convey and drain stormwater runoff from developed areas as efficiently as possible to prevent localized flooding. While development in large portions of the planning area occurred prior to the adoption of conventional stormwater management, detention basins and flow reduction strategies have been implemented on developments since the early 1970's. However, insufficient focus has been given to water quality and current stormwater management practices typically lack water quality components.

Green infrastructure is a stormwater management tool that can be used to reduce pollutant loads in runoff resulting from urbanization and land use change. Green infrastructure practices also reduce the volume of stormwater discharged to waterbodies by infiltrating into the ground or evaporating into the air.

According to the EPA, green infrastructure, or nature-based solutions, is a term that describes a number of best management practices designed to reduce and treat stormwater runoff at its source while delivering environmental, social and economic benefits. Green infrastructure is an approach to stormwater management that mimics the natural hydrologic cycle by allowing and promoting infiltration and creating habitat. Using engineered systems and methodology, green infrastructure can provide a beneficial connection between natural environmental processes and gray stormwater management (conventional piped drainage) practices.

The purpose of this chapter is to identify and describe nonpoint source best management practices that will be valuable in the Lower Des Plaines planning area. The target or goal of these implemented practices is to reduce pollutant loads. While achieving water quality goals is affected by many factors, the following measures including both policy and on-the-ground improvements, have been identified as the most significant for making progress toward watershed goals.

5.1 GREEN INFRASTRUCTURE AND NONPOINT SOURCE MANAGENMENT MEASURES

BMPs can be implemented to reduce or prevent pollution from entering waterbodies. These practices can be non-structural such as a watershed program and policy change; or can be structural practices - individual practices or combinations of structures used to physically detain, treat and/or prevent pollution from reaching the waterbody. Generally, a combination of practices is the most effective stormwater management program.

Structural BMPs are effective for the treatment of runoff from smaller storm events and for the initial volumes of runoff from large storm events. The initial stormwater runoff at the beginning of a rain event will be more polluted than the stormwater runoff later in the event. This is because the initial runoff washes off pavements and "cleanses" the catchment. The stormwater containing this high initial pollutant load is called the "first flush". To be effective and efficient, consideration to the proper placement of a BMP should be factored into planning such that the design involves the capture of the first flush from frequent, small storm events. Intercepting the first 40% of runoff volume can remove 55% of TSS load, 53% of COD load, 58% of total nitrogen load, and 61% of total phosphorus load

(Dongya et. al., 2015). Treating the first flush is most effective on small catchments or individual properties, particularly if a high proportion of the catchment is impervious (as is the case of many catchments in the Lower Des Plaines River planning area). On an individual property or in a neighborhood, the first flush collection system can form an integral part of the stormwater pollution control system.

The following sections describe potential BMPs to reduce loadings from stormwater throughout the planning area. The Illinois Urban Manual is a resource for BMP planning. Table 2.1 in the Manual (AISWCD, 2009) provides a tool for applicable structural BMP selection. Also, BMP efficiency (performance) studies on BMPs can be found at the International Stormwater BMP Database[3].

5.1.1 Urban Stormwater Infrastructure Retrofits

Older developments (generally pre-1970) in an urban/suburban setting were constructed prior to stormwater management requirements and before modern design criteria had been established. While current stormwater management regulations intend to limit increases in pollution associated with new development, they do not specifically address the hydrologic modification associated with runoff from existing development (Bitting, et. al., 2008). **Retrofits** include new installations or upgrades to existing BMPs in developed areas where there is a lack of adequate stormwater treatment. Stormwater retrofit goals may include the correction of prior design or performance deficiencies, flood mitigation, disconnecting impervious areas, improving recharge and infiltration performance, addressing pollutants of concern, demonstrating new technologies, and supporting stream restoration activities (EPA, 2011). Examples of a stormwater retrofit are to install rain gardens or bioswales to take runoff from streets or parking lots, or to convert driveway or parking areas to permeable pavements. In some situations, improvements can be made to catch-basins. Communities and land owners can also install filtration BMPs downstream of government maintenance, industrial and commercial facilities; new infrastructure and improvement projects; transportation runoff collection points; and other land uses potentially generating a heavy load of pollutants. Filtration BMPs may also be appropriate upstream of sensitive areas affected by stormwater releases. Retrofitting BMPs or other measures into areas with existing development can significantly reduce pollutant loadings from stormwater discharges.

5.1.2 Detention Basin Retrofits

Potential **detention basin retrofits** include repurposing an existing basin to act as extended detention, wet pond, or constructed wetlands. These types of retrofits will provide for improved removal of pollutants while still allowing detention basins to provide flood control benefits. In many situations detention basins can be modified to provide greater water quality benefits at a low cost. Extended detention utilizes an under-sized restrictor, which causes water to back up and be stored temporarily within the pond or wetland allowing particulate pollutants to settle out. Extended detention is often utilized with other treatment options such as wet ponds and constructed wetlands to improve performance and aesthetics. **Dry extended detention ponds** have efficiencies of 70% TSS removal, 20% total phosphorous removal, and 25% total nitrogen removal. Wet ponds promote pollutant removal through settling in a permanent pool of standing water, with a residence time that can range from days to several weeks. Wet ponds are an ideal retrofit based on their consistent and high pollutant removal.

[3] www.bmpdatabase.org.

Wet ponds have removal efficiencies of 80% TSS, 50% total phosphorous, and 30% total nitrogen. **Constructed wetlands** are shallow depressions (typically less than one foot deep except at forebays and micropools) with long residence times that promote gravitational settling, biological uptake, and microbial activity. Constructed wetlands replicate a natural wetland ecosystem that enables consistent pollutant removal. Constructed wetlands have removal efficiencies of 70% TSS removal, 50% total phosphorous removal, and 25% total nitrogen removal (Center for Watershed Protection, 2007).

5.1.3 Building Rooftop Retrofits

Rooftop retrofits to a building consisting of either a green or blue roof, which detain stormwater runoff and reduce the peak rate of discharge, resulting in less runoff compared to a conventional rooftop. A **green roof** is comprised of a layer of vegetation and soil on top of a rooftop that stores and treats rooftop runoff. Green roofs can be either extensive or intensive systems, by being either a thin layer of soil and cover of grass or moss, or a thick layer of soil which contains vegetation such as trees, shrubs, or plants, respectively (Center for Watershed Protection, 2007). Green roofs provide runoff reduction but typically don't provide active removal of suspended solids, and may increase loading of total phosphorous and total nitrogen (Massachusetts Stormwater Handbook, 2008).

5.1.4 Rainwater Cisterns

A **rainwater cistern** is a container for temporarily holding water. They are usually used for catching and storing rainwater that has run off a building roof. Different models of rainwater cisterns offer an assortment of different features. Some are equipped with pumps and filters. Others are completely open while some are only partially covered from the elements. Each of these variations serve a specific purpose in harvesting rainwater. Rainwater cisterns provide a unique way to capture runoff from the first flush from a storm event and allow particulates to settle.

5.1.5 Bioretention Basins and Swales

Bioretention basins and swales consist of landscaping features adapted to increase infiltration and provide on-site removal of pollutants from stormwater runoff. Surface runoff is directed into shallow, landscape depressions, which are designed to incorporate many of the pollutant removal mechanisms that operate in forested or other natural (prairies, wetlands, etc.) ecosystems. Bioretention elements include rain gardens, sidewalk planters, curb extensions and other plant or soil systems designed to infiltrate and/or evapotranspirate stormwater (EPA, 2010). The removal efficiency for a bioretention basin is approximately 75% TSS removal and 16% total nitrogen removal. The total phosphorous removal efficiency is typically less significant (International Stormwater BMP Database, 2017). The reason for this is bioretention practices can commonly capture particulate phosphorus by settling or filtration, but leave dissolved phosphorus (typically phosphates) untreated. This untreated phosphorus accounts on average for 45%of total phosphorus in stormwater runoff and can be up to 95%of the total phosphorus, depending on the storm event (Erickson et al., 2012). Dissolved phosphorus is bioavailable and represents a significant concern for surface water quality.

Soil components and amendments that have been shown to be effective in increasing chemical sorption of dissolved phosphorus. Media that can be used to enhance the removal of dissolved phosphorus by green infrastructure practices include iron filings (Erickson et al., 2012) and steel wool (Erickson et al., 2007).

It should be noted that bioretention practices will infiltrate more rainwater more quickly in areas with A or B soils, as compared to C or D soils. If a bioretention practice will not hold/infiltrate all the water that will flow into it during a rain event, the practice can be designed with an underdrain. The underdrain will release excess water to the storm sewer system and thus prevent the practice from overtopping. Bioretention practices provide volume control and pollutant reduction benefits even if there is an underdrain, as some water is held in the soil, some is released back in the air through evapotranspiration, and some pollutants are filtered out as the rainfall runoff drains through the soil.

5.1.6 Vegetated Swales

A v**egetated swale** consists of an earthen channel vegetated with either native plants or conventional turf grasses. The vegetation slows down the movement of the water, which promotes the filtering of pollutants and sediments. Stormwater volumes are reduced through the process of infiltration during the conveyance of runoff. Native plantings provide the potential for greater pollutant removal vs. turf grasses as they are taller and provide more retardance, thus slowing down the runoff through the channel and trapping more pollutants. Side slopes no greater than 3:1 are recommended, with side slopes of 4:1 or less being ideal. The removal efficiency for a vegetated swale is approximately 83% TSS removal, 29% total phosphorous removal, and 25% total nitrogen removal (DuPage County, 2008).

5.1.7 Vegetated Filter Strips

A **vegetated filter strip** is a vegetated section flat land or low slope that accepts runoff from impervious areas as sheet flow across the strip. Pollutants are reduced through vegetative filtering while encouraging runoff to infiltrate the underlying soil. Filter strips used as a BMP can act as a landscaping feature or buffer between buildings and other developments. The removal efficiency for a vegetated filter strip is depended on length and removal rates increase as length is increased. The removal efficiency for vegetated filter strip 20 feet long is approximately 50% TSS removal, 25% total phosphorous removal, and 25% total nitrogen removal (DuPage County, 2008).

5.1.8 Permeable Pavement

Permeable pavement consists of permeable pavement material or pavement block designs which allow distributed infiltration of rainfall runoff into the underlying soil. There may typically be an underlying stone reservoir that temporarily stores the surface runoff before it infiltrates into the underlying soil. Examples include; porous asphalt, permeable concrete, permeable block pavers (EPA, 2010). Permeable pavements have removal efficiencies of approximately 72% TSS removal, and 42% total phosphorous removal. Limited data is available on expected total nitrogen removal (International Stormwater BMP Database, 2017). Besides filtering pollutants, permeable pavements can significantly reduce the volume of runoff discharged to waterbodies. This helps reduce the erosive effects of stormwater. Permeable pavements can be an important component of measures to restore and protect water quality as land areas can be used as they were before -- driveways, parking lots, etc. The paved surfaces are still used, they are just converted from impervious to pervious. Some studies have shown permeable pavements require somewhat less de-icing in winter as compared to conventional pavements, and thus this practice may provide benefits related to reducing chloride loadings.

5.1.9 Manufactured BMP Structures

Many **manufactured BMPs** and control devices exist on the market ranging from oil and grit (debris) separators to sand or biomass filters. They are capable of trapping debris, oil, grease, sediment, and other floatables that would otherwise be discharged to water resources (DuPage County, 2008). Manufactured BMPs are typically installed at outfall locations or at key junctures within a storm sewer network. Sizing and flow-through requirements are site-specific and typically dictated by the manufacturer specifications. Likewise, removal rates are specified by the manufacturer depending on site-specific applications. Typically, removal rates are 80% for TSS, 80% for free floatable hydrocarbons (DuPage County, 2008). Maintenance of manufactured devices is critical to ensure continued effective performance.

Manufactured control devices may be considered as point source controls, particularly if they are installed at outfall locations, and thus may not be eligible for Section 319 grant funding. However, installation of such devices by a municipality may be eligible for low interest loan financing from the State Revolving Fund (SRF).

5.1.10 Stream or Channel Restoration

Stream or channel restoration consists of returning a degraded corridor and aquatic ecosystem to a stable and healthy condition. This BMP involves both channel restoration and bank stabilization. Channel restoration involves constructed structures to address channel erosion and fish migration depending on the stream flow characteristics. Examples include rock vanes, w-weirs, current deflectors, mid-channel deflectors, channel constrictors, cross-channel logs and revetments. It should be noted that before any channel modifications to address erosion or deposition are implemented, upland watershed problems and processes (e.g., land use change sub-division development) must first be assessed. Correcting upstream problems should be the priority before channel modifications are implemented; otherwise the benefits of the restoration will be short-lived (NOAA Restoration Center). **Stream bank stabilization** involves using native deep-rooted vegetation, tree stumps and logs; synthetic geo-fabrics/textiles such as coir fiber logs and mats; stone and other materials to minimize erosion potential on regraded banks. A wide variety of geo-fabrics and textiles can be used by providing a temporary organic material cover material until a natural vegetation cover is established (NOAA Restoration Center).

In a few limited situations in the Lower Des Plaines River Watershed, where land is available and the project area is suitable, it may be possible to convert armored streambanks to naturalized streambanks with flatter slopes and vegetation. This would help slow down flows, thus reducing erosion potential, and help trap pollutants. Stream daylighting can similarly be beneficial where tributary sections are currently piped. However, the dense development patterns in much of the watershed will preclude these types of stream restoration projects.

Stream or channel restoration projects employ the Natural Channel Design Methodology as well as other methodologies that result in the creation of a stable dimension, pattern, and profile for a stream type and channel morphology appropriate to its landform and valley. The channel is designed such that over time, is self-maintaining, meaning its ability to transport the flow and sediment of its watershed without aggrading or degrading. These design methods promote the use of instream structures, bio-engineering, functional riparian corridors and floodplain connectivity (U.S. Fish & Wildlife Service, 2013)

5.1.11 Riparian Corridor and Riparian Buffer Strip Restoration

Riparian corridor restoration can often be the most cost-effective means for restoring water quality in streams impacted by nonpoint source pollution (U.S. EPA, 1996), and should always be considered when evaluating restoration options. A critical step for any riparian restoration is the establishment of a riparian reserve or buffer strip (Kauffman et al. 1997).

A **riparian buffer strip** is a linear band of permanent vegetation adjacent to an aquatic ecosystem intended to maintain or improve water quality by trapping and removing various nonpoint source pollutants (e.g., contaminants from herbicides and pesticides; nutrients from fertilizers; and sediment from upland soils) from both overland and shallow subsurface flow. **Buffer strips** occur in a variety of forms, including herbaceous or grassy buffers, grassed waterways, or forested riparian buffer strips (Fischer and Fischenich, 2000). A **riparian corridor** is a strip of vegetation that connects two or more larger patches of vegetation or habitat through which an organism will likely move over time. These landscape features are often referred to as conservation corridors, wildlife corridors, and dispersal corridors. Some scientists have suggested that corridors are a critical tool for reconnecting fragmented habitat (Fischer and Fischenich, 2000). Methods for restoring fragmented riparian corridors may include buy-outs of properties adjacent to watercourses where land use is unproductive. These buy-outs may also include properties that are inundated by flooding during frequent smaller storm events.

When used in concert with bank stabilization projects, the **riparian buffer strip and corridor restoration** will consist of re-grading streambanks to a stable slope, placing topsoil and other materials needed for sustaining plant growth, and selecting, installing and establishing appropriate vegetative species.

5.1.12 Re-connecting to Floodplains / Two-Stage Ditches

To restore and protect habitat and water quality, opportunities for re-meandering and reconnecting the stream with its floodplain should be pursued wherever possible. Riverine floodplains are dynamic systems that play an important role in the function and ecology of rivers. Floodplains are inundated periodically where the intermittent interaction between base flow in a rivers channel combines with the riparian or terrestrial overbank areas where some of the most fertile and bio-diverse conditions exist. Floodplains also disperse high flow energy while mitigating erosive potential and allow sediment deposition.

In the Lower Des Plaines watershed, many floodplains and riparian corridors have been developed and compromised to accommodate urbanized land use. In these cases, land use and site constraints prohibit the reconnection of floodplains due to challenges that largely include land ownership. A viable option in some such situations may be a two-stage channel. Two-stage ditches mimic natural floodplains and offer a unique solution to floodplain and riparian corridor reconnection by creating a channel and floodplain/riparian interaction within a smaller footprint. A two-stage ditch design incorporates benches on either side of the main channel by removing the ditch banks roughly 2-3 feet above the channel invert for a width of about 10 feet on each side. The laid-back banks at an elevation 2-3 feet above the channel invert allows the water to expand while decreasing velocity (energy). The benched areas become vital habitat allowing sedimentation and nutrient load reduction from the mainstem channel while improving ditch stability and reducing erosion.

5.1.13 Forebay Retrofits - Treatment at Existing Storm Sewer Outfalls and Hydraulic Structure Retrofits

A **forebay** is a pool or settling basin constructed at the incoming point of a BMP. The purpose of a forebay is to provide retention for a portion of the first flush stormwater runoff and allow sediment to settle out from the incoming stormwater before it reaches the larger BMP. The forebay traps pollutants and litter, and protects the practice from being clogged. Forebays facilitate maintenance as they are easier and less expensive to clean out as compared to repairing or replacing the full BMP.

While typically used as a component of a larger BMP (for example, wetland bottom and wet bottom detention basins), forebay retrofits at existing storm sewer outfalls allow treatment of the first flush from existing storm sewer networks outletting to a watercourse. Storm sewer outfalls are typically constructed to discharge at a watercourse often bypassing the infiltration benefits of a riparian corridor or buffer strip. The introduction of a forebay with the existing outfall "set back" from the watercourse mainstem will promote infiltration and allow some materials/litter to be removed before being released to the water body. Storm sewer outfalls at receiving waters are often in easements; further enhancing the forebay potential at an existing outfall.

5.1.14 Floating Wetlands

Floating wetlands are man-made islands that float in the water and are planted with wetland vegetation. The vegetation roots grow into the water and are used to filter the water by providing water-cleansing microorganisms. The islands typically take several years to establish. As the plant roots grow beneath the island, they absorb excess nutrients from fertilizer runoff, animal waste and other sources. Thus an important benefit of the floating wetlands is that they reduce nitrogen, phosphorus, TSS, pathogens and heavy metals. They also improve dissolved oxygen by reducing biological oxygen demand from organic muck build up. Floating wetlands may also provide habitat benefits for certain species.

The islands are typically located at the inlet of a pond so that runoff entering a basin passes by the floating wetlands. To keep them at a desired location, they are usually anchored with weights that allow the island to rise and fall with the change in elevation. Floating wetlands are not limited to a specific shape or area.

5.1.15 Forestation and Reforestation

Reforestation contributes to watershed protection. Tree canopies intercept rainwater and reduce the amount of runoff that needs to be managed. The root systems of trees also help absorb rainwater and trees provide other benefits such as helping to reduce urban heat island effects, soil productivity, better wildlife habitat, and recreation opportunities. Reforestation can occur on forested lands that have been disturbed, damaged, or destroyed, planned or unplanned. Reforestation is beneficial through a faster development of forest structure and series composition. Watersheds benefit from reforestation through their consumption of stormwater and nutrient removal. Plants can remove nutrients and contaminants from the soil and water, which can then be used for growth in reforestation.

Dependent on the situation, reforestation is done through either relying on natural regeneration or tree planting. When a seed source is lost, tree planting is needed to restore trees to the site. When reforestation is due to planned timber harvest activities, reforestation is typically paid for by receipts from timber sale purchases and reforestation partners funding the needs.

Forestation may also be an option on lands that in recent times were not forested, for example at a municipal park or on vacant parcels. Trees can also provide significant value in parkways or street right-of-ways.

5.1.16 Debris Jams

Most streams transport some amount of debris such as tree limbs, brush, and leaves. Because debris transport is a naturally occurring stream process, some debris can provide habitat and contribute to a diverse instream environment. However, too much debris can be problematic and may result in large debris jams, causing backwater flooding and sediment deposition. Debris jams can also cause erosion of the stream banks that can lead to damage of riparian lands and property.

MWRD operates a Small Streams Maintenance Program (SSMP) to allow for fish passage and other water quality-related benefits, and to help prevent costly flood damage. The program is implemented throughout Cook County. Dedicated crews provide a valuable service by removing debris from creeks, streams, and waterways. Project sites are determined based on reports from local municipalities and residents or from MWRD routine inspections. Besides removing existing blockages, MWRD crews and engineers also work to identify and fix potential problems before they become serious. Dead and dying trees, which can eventually fall into streams and cause blockages, are removed from the banks. Harmful invasive plant species are also removed. Buckthorn is particularly harmful and thrives in our climate; it chokes out native plants and has weak root systems, leaving the ground vulnerable to erosion. The success of the SSMP de-pends on cooperation and coordination among all communities to efficiently and respectfully manage the waterways, and on reports from local stakeholders on debris jams[4].

5.1.17 Chloride Reduction Strategies

Studies show that chlorides in urban streams have increased substantially over the last 50 years, especially in northern metropolitan areas like Chicago. While some structural BMPs can reduce chloride loadings to receiving waters (e.g. permeable pavement), significant chloride reduction needs to come from chloride reduction (pollution prevention) measures. This can be achieved through the adoption of standards and improved practices for winter salt use to help reduce the increasing trend in background salt levels.

In 2015, the Illinois Pollution Control Board adopted a new water quality standard for chloride in the Chicago Area Waterway System (CAWS) which includes the Lower Des Plaines River and its tributaries. Nonpoint source and point source controls will be needed to reduce chloride levels in the CAWS and ensure that the new standards are met. MWRD has convened and is coordinating a stakeholder group to address chloride concerns. The CAWS Chloride Initiative Workgroup is developing a technical report, which will address best management practices to reduce salt usage and also the social, environmental, and economic impacts of salt use reduction. The CAWS Chloride Initiative Workgroup is assessing current water conditions, documenting current road deicing activities, identifying opportunities to reduce road salt runoff while maintaining public safety, and developing pollutant minimization

[4] Stakeholders can notify MWRD of debris jams at this website: https://gispub.mwrd.org/ssmp/main.html

strategies. The report will be released in 2018. It is expected that the report will recommend best practices which can be implemented by municipalities and other stakeholders.

This watershed-based plan recommends a low-salt diet when it comes to de-icing pavements in the winter. Following are generally accepted best practices for reducing chloride loadings:

- Plow, shovel, and blow accumulated snow. Do not use salt or other de-icing chemicals to “burn-off” snow.
- Calibrate de-icing equipment. Knowing equipment is calibrated and the application rate is accurate will save chemical costs and will reduce environmental impacts. Calibrate annually and keep a record in the vehicle for spreader settings.
- Choose the right material and apply the correct amount. Know the limits of deicing chemicals. For example, rock salt is not effective at temperatures below 15°F no matter how much is applied. Check application rates given the current weather conditions.
- Use ground speed controls on spreaders. Application rates should correspond with vehicles speed.
- Pre-wet the salt. Adding brine to salt before it is applied will jump start the melting process and help keep the salt in place by reducing bounce and scatter. Pre-wetting salt can reduce application rates by 20 percent.
- Use anti-icing. Be proactive by applying de-icing chemical prior to snow and ice accumulation. It can reduce the amount of chemical needed by 30 percent.
- Don’t mix salt and sand. Salt is for melting and sand is for traction on top of the ice, they work against each other.
- Consider possible alternative to salt. For example beet juice is a de-icer.
- Be familiar with sensitive areas (such as wetlands or a small lake) to which stormwater may drain. Consider designating reduced salt areas or identifying safe alternatives to road salt in these areas.
- Proper storage and handling of road salt limits loss of salt to the environment and provides cost savings. The Salt Institute has published a Salt Storage Handbook (Salt Institute, 2006) with recommended practices and design criteria for storage facilities. The Illinois Department of Transportation already has standard designs which can be adopted by municipalities. Existing facilities should be evaluated for improvement and bulk handling practices reviewed.
- Department of Public Works supervisors and staff should attend training workshops and stay up to date with new technologies and practices.
- Educating the public is often a first step in any water quality improvement campaign. Increased awareness about the application of road salt and the effects of excessive loading to waterbodies can increase community support for chloride use reduction. Information about what homeowners and businesses can do to limit chloride salt application in addition to municipal leadership should be included.

Further information and ideas related to staff training and education and outreach are included in the Higgins Creek TMDL report, which described actions that can be taken to address the identified chloride impairments. Another valuable source of information is the Chloride Usage Education and Reduction Program Study prepared by the DuPage River Salt Creek Workgroup.[5]

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[5] posted at http://www.drscw.org

This watershed-based plan recommends these generally accepted practices, and other good ideas that may be recommended in the CAWS Chloride Initiative Workgroup report. The ultimate goal is to improve deicing practices so that less salt is used (and that the salt which is applied is used most effectively) with the result that chloride loadings to the watershed are reduced.

5.1.18 Tree Boxes

Tree boxes can be constructed at the base of trees in or adjacent to sidewalks, streets, or parking lots. Tree boxes mimic miniature bioretention areas installed beneath trees and can be very effective at treating runoff. Runoff is directed to the tree box, where vegetation and soil media have an opportunity to filter the runoff before it can enter a catch basin. The runoff collected by the tree box helps irrigate the tree while slowing and filtering runoff. Tree box filters are based on bioretention processes with improvements that enhance constituent removal, increased performance, ease of construction and improved aesthetics (http://lowimpactdevelopment.org/).

As noted above, planning for tree planting along roadways, along sidewalks, and in plazas can provide significant stormwater benefits. Tree canopies intercept rainwater and reduce the amount of runoff that needs to be managed. The root systems of trees also help absorb rainwater. Tree boxes can help enhance the survivability of street trees, which often struggle to have enough water and oxygen due to constraints on the growth of root systems.

5.1.19 MS4 Compliance

As previously discussed in Section 3.18.1, most units of government within the Lower Des Plaines River planning area are operators of small municipal separate storm sewer systems (MS4s). MS4s collect urban stormwater runoff, and discharge stormwater to local water bodies and, consequently are regulated under the State MS4 permitting program.

In Illinois, discharges from small MS4s are covered under Illinois EPA's General NPDES Permit No. ILR40. This permit requires that MS4 operators develop, implement, and enforce a stormwater management program to reduce the discharge of pollutants through the municipality's sewer system. The permittee's stormwater management program must include six minimum control measures:

1. Public education and outreach on storm water impacts
2. Public involvement and participation
3. Illicit discharge detection and elimination
4. Construction site storm water runoff control
5. Post construction storm water management in new development and redevelopment
6. Pollution prevention / good housekeeping for municipal operations

Effective local MS4 programs are an important component of the overall strategy for improving water quality in the Lower Des Plaines River watershed. For example, the non-structural BMPs that will be carried out by MS4 communities, such as street sweeping and good housekeeping for municipal operations, will reduce loadings of pollutants and complement the structural BMPs described above, such as rain gardens and bioswales and permeable pavement.

Many of the structural BMPs reduce pollutant loadings through methods such as sediment trapping and runoff reduction. Generally speaking, these BMPs do not target bacteria reduction. As noted in Chapter 3, bacteria is included on the 303d list as a stressor. Point sources with bacteria in the discharge have effluent limitations for bacteria. Stormwater can be a source of bacteria loadings. Two examples how bacteria can get into stormwater are: (1) Pet waste is not picked up, and fecal matter is washed off urban surfaces by stormwater; and (2) There can be cross-connections between sanitary and storm sewers, allowing sewage to be mixed the stormwater.

Effective implementation of the MS4 six minimum measures is a primary way of reducing bacteria loadings from stormwater. For example, minimum measure 3. is intended to find and eliminate inappropriate connections to the storm sewer system, including cross connections with the sanitary sewers. This program element can also help address other stressors, including visible oil. Street sweeping helps reduce loadings of bacteria as well as sediment and other pollutants as well as removing organic material (which is used by bacteria as food). Public education programs can highlight the need for residents to pick up pet wastes as a way to help protect the watershed. Compliance with municipalities' MS4 permit requirements is a critical aspect of efforts to reduce and prevent loadings of bacteria and other pollutants affecting the Lower Des Plaines River watershed.

5.1.20 Street Sweeping

Street sweeping is typically an important component of a community's MS4 program. Street sweeping has been a common practice for many years for aesthetic purposes and has been shown to be effective at removing large items like litter, leaves and twigs, and road debris. Sweeper technology has advanced from mechanical broom cleaners to regenerative air vacuum sweepers to high efficiency vacuum-assisted dry sweepers. This most recent technology has the capability of picking up a very high percentage of the finest sediment particles (where most water quality pollutants are attached) in dry, wet, or even frozen conditions. A well-designed street sweeping program using high efficiency street sweepers is a cost-effective method to reduce water quality pollutants from urban runoff. Communities should schedule sweeping considering the timing/frequency appropriate to specific areas. Sweep frequency can be adjusted by municipal area (central business district, arterials, commercial/industrial, etc.) and if possible, timing should be prior to storm events. On-street parking requirements should be set up to facilitate effective use of sweepers and in turn provide for increased pollutant removal.

High efficiency sweepers have been found to be extremely effective in removing fine sediments and preventing escape to the air with efficiencies ranging from 70% for particles less than 63 µm to 96% for particles larger than 6,370 µm (Sutherland and Jelen, 1997; RWMWD, 2005). Street sweeping is a cost-effective practice because the long-term removal costs per pound of materials when compared to other methods is low. It can also reduce pollutant loadings to other structural BMPs which will reduce maintenance costs and improve effectiveness to those structures.

5.1.21 Ordinance Authorities

Municipalities have authority under State law to adopt and enforce ordinances to meet community goals and needs. MS4 communities can use their authorities to adopt ordinances aimed at reducing key sources of pollutant loadings. Examples are to adopt ordinance provisions:

- Restricting the use of phosphorus based fertilizers for turf areas.

- Restricting the use of coal tar-based sealants on parking lots and driveways.
- Establishing tree preservation standards to preserve tree quantity and quality
- Allowing for turf grass areas and open space to be planted with native vegetation (some landscaping ordinances directly or indirectly restrict the use of native plants).

A useful source of information on model development requirements and a sample code and ordinance review worksheet can be found in Better Site Design: A Handbook for Changing Development Rules in Your Community (Center for Watershed Protection, 1998). US EPA has also developed a "Water Quality Scorecard" that can be used to evaluate local codes and ordinance to identify requirements that can improve stormwater management.

5.1.22 The Lower Des Plaines Watershed Group

The Lower Des Plaines Watershed Group was formed to bring together a diverse coalition of stakeholders to work together to preserve and enhance water quality and stream resource quality in the Lower Des Plaines River and its tributaries. The geographic scope of this group includes watershed areas in Cook County and Will County, and thus is somewhat larger than the geographic scope of this planning document. The primary goal is to provide local coordination to develop and implement a long-term, comprehensive monitoring program to assess current stream conditions in the watershed and identify the biggest stressors to aquatic life. The data will be used to develop and then implement a dynamic plan that seeks to achieve attainment of water quality standards and designated uses, including in particular aquatic life uses. It is expected that the monitoring will reveal key factors affecting aquatic habitat, and recommend projects or actions to improve habitat and in this way enrich and protect biological communities. Examples of recommended projects may include, removing dams or adding in-stream pool and riffle structures. Based on similar work done by the DuPage River/Salt Creek Workgroup, it is expected that significant, useful data will be generated and evaluated, and valuable projects will be specifically identified.

Monitoring will be carried out by the Watershed Group in 2018 in sub-watershed areas in both Will and DuPage Counties, and will be conducted in some areas in Cook County in 2019. This watershed planning document recommends that stakeholders implement targeted projects and programs based on Watershed Group data and planning to restore and protect biological communities.

5.1.23 Selecting and Implementing BMPs

This section of the watershed-based plan identifies recommended BMPs to address the different land covers and sources of pollution from runoff within the watershed. It should be noted that the plan identifies *types* of BMPs that would effectively address the sources of loadings. For example, bioretention basins and swales can be located and designed to capture runoff from parking lots and other impervious surfaces to reduce stormwater discharge volumes and pollutant loads. However, this plan does not list or *prescribe* specific BMPs to be implemented in specific places. The sizes and designs of BMPs and the optimal places for BMPs will need to be determined by communities and other stakeholders taking into account where benefits will be the greatest as well as numerous other factors including land ownership, budgets, community buy-in, and how maintenance will be assured. Also, new concepts or designs for BMPs may be developed during the plan implementation period. The plan intends there be flexibility to incorporate new BMP concepts if they cost-effectively reduce pollutant loadings from urban runoff and stormwater discharges.

CHAPTER 6 PLAN IMPLEMENTATION

Various water quality projects and BMP scenarios were reviewed and plan elements are identified per watershed planning unit, based on a review of the information collected in the watershed assessment as well as the potential pool of BMPs. BMP selection was based largely on site-specific land use, soil infiltration capacity, constructability and available space or site constraints. The following sections outline how the potential BMPs will be applied as a function of land use, where BMPs should be implemented, cost of implementation and overall reductions that will be achieved as a result of implementation.

6.1 BMP SYNTHETIC SCENARIO SELECTION

The Lower Des Plaines Planning Area includes 25 watershed planning units which consist largely of residential and roadway right-of-way areas. These two land uses make-up approximately 53% of the overall watershed. While open space is the third largest land use in the overall watershed, most of this area only is present within 8 watershed planning units and is typically forest preserve area that is not likely to be developed.

The following is an example of how BMP choices can be applied to the Lower Des Plaines Planning Area. The STEPL tool can be used to quantify the loading reductions that would be achieved by these combinations of BMPs. These BMP scenarios were developed based on: 1) land use; 2) BMP effectiveness; 3) infiltration capacities; and 4) quantifying load reductions using STEPL. A sensitivity analysis was completed to determine how a particular BMP selected from STEPL's suite of BMP choices performs and to determine which BMP is appropriate for a particular land use type. It should be noted that these BMP scenarios have not been optimized and could vary based on site constraints. The quantification of load reductions should not be limited to the scenario presented in this plan if a variation on these combinations is shown as such to meet reduction goals.

6.1.1 Residential Land Use (BMP Scenario)

1. Rain gardens or *bioretention* area at a rate of 0.06 acre/acre (50 feet x 50 feet per acre) of residential area.
2. Detention pond retrofits:
    a. Conversion of dry bottom ponds to a naturalized bottom for area of pond to create *extended wet detention*.
        i. Addition of forebays or *settling basins* at a rate of 0.03 acre / acre of pond (25 feet x 50 feet per acre of pond) x 2.
    b. Enhancement of wet bottom ponds for area of pond to create *extended wet detention*.
        i. Addition of forebays or *settling basins* at a rate of 0.03 acre / acre of pond (25 feet x 50 feet per acre of pond) x 2.
    c. Enhancement of wetland ponds to create *wetland detention* for the area of pond. Invasion species maintenance and management, increase bio-diversity.

6.1.2 Industrial / Commercial / Institutional Land Use (BMP Scenario)

1. Planter boxes or *bioretention* as landscaped median and parking islands 5 feet wide x 3 feet long; 1 per 200 feet of 3 sides of site perimeter. Assumed to be applied to 50% of total area.

2. *Infiltration trench* as 5 feet wide along 3 sides of perimeter of site to be applied downstream of planter boxes.
3. *Oil and grit separators* or mechanical BMPs to be applied 1 per 10 acre.
4. Detention pond retrofits:
    a. Conversion of dry bottom ponds to a naturalized bottom for area of pond to create *extended wet detention*.
        i. Addition of forebays or *settling basins* at a rate of 0.03 acre / acre of pond (25 feet x 50 feet per acre of pond) x 2.
    b. Enhancement of wet bottom ponds for area of pond to create *extended wet detention*.
        i. Addition of forebays or *settling basins* at a rate of 0.03 acre / acre of pond (25 feet x 50 feet per acre of pond) x 2.
    c. Enhancement of wetland ponds to create *wetland detention* for the area of pond.
5. *Bioretention* as green roofs assuming 15% of rooftop for all buildings.
6. *Rain harvesting* as cistern to collect the first inch of rainfall across the rooftops of all buildings.
7. *Porous pavement* to be applied to 10% of impervious areas.

6.1.3 Roadway ROWs and Transportation Hubs (BMP Scenario)

1. *Porous pavement* to be applied to 10% of impervious areas.
2. *Bioretention* as bioswales to be applied assuming the bioswale is 5 feet wide and the length of the roadways applied at a rate of 50% of the total area.
3. *Weekly street sweeping* total area of roadways only.
4. *Water quality inlets* = 1 per 500 feet of roadway based on perimeter of roadway.

6.1.4 Open spaces and Forest Areas (BMP Scenario)

1. *Vegetated filter strips* around perimeter of property at 5 feet wide.
2. *Water quality inlets* = 1 per 500 feet of roadway based on perimeter of roadway.
3. *Porous Pavement to be applied to parking lots associated with forest preserves (10% of impervious areas).*

6.1.5 Urban Cultivated and Vacant Land Use (BMP Scenario)

1. *Agricultural filter strips* around perimeter of property at 5 feet wide.

6.1.6 Various Land Use – applied throughout where opportunities exist (BMP Scenario)

1. Rain gardens or *bioretention* area at a rate of 0.06 acre/acre (50 feet x 50 feet per acre) of residential area.
2. Detention pond retrofits:
    a. Conversion of dry bottom ponds to a naturalized bottom for area of pond to create *extended wet detention*.
        i. Addition of forebays or *settling basins* at a rate of 0.03 acre / acre of pond (25 feet x 50 feet per acre of pond) x 2.
    b. Enhancement of wet bottom ponds for area of pond to create *extended wet detention*.
        i. Addition of forebays or *settling basins* at a rate of 0.03 acre / acre of pond (25 feet x 50 feet per acre of pond) x 2.

c. Enhancement of wetland ponds to create *wetland detention* for the area of pond. Invasion species maintenance and management.

6.1.7 Streambank and Riparian Corridor Restoration (BMP Scenario)

1. Watercourse specific *streambank restoration/stabilization* and enhancements including but not limited to channel regrading/re-meandering (pools, riffles, vanes), sediment removal, 2-stage ditches, bank regrading, slope stabilization (naturalized armoring, root wads, vegetated mechanically stabilized earth bank) and bio-engineering.
    a. Applications based on watercourse assessment and should not be limited to only areas identified in this plan as there are areas in the planning area that are unassessed.
2. Riparian area restoration and stream corridor or habitat restoration. Replacement of rip-rap, concrete and turf grass banks and adjacent areas with deep-rooted native vegetation.
    a. Applications based on watercourse assessment and should not be limited to only areas identified in this plan as there are areas in the planning area that are unassessed.

It should be noted that the BMP scenarios or templates presented above are among the many combinations that could be implemented. However, the scenarios presented are well-suited for the land cover in the Lower Des Plaines River watershed, and represent an ambitious but practicable level of implementation. These BMP combinations would be suitable and effective for reducing loadings associated with the various land covers within a watershed planning unit. STEPL can and has been used to quantify the loading reductions that would be achieved with these particular combinations of BMPs. The italicized and underlined BMPs in the sections above represent the corresponding identifier in STEPL.

It is anticipated there will be variations to the BMP combinations presented above in the watershed planning units. As summarized above, this watershed-based plan does not list or *prescribe* specific BMPs to be implemented in specific places. The sizes and designs of BMPs and the optimal places for BMPs will need to be determined by communities and other stakeholders considering where benefits will be the greatest as well as other factors including land ownership, budgets, community buy-in, and how maintenance will be assured. In some watershed planning units, certain BMP types may prove to be relatively more (or less) implementable, considering these factors. Thus, actual BMP combinations within a watershed planning unit can and likely will vary from these templates. The pollutant load reduction goals for the watershed planning units can remain steady, while there can be flexibility in selecting and siting the BMPs to meet the reduction goals.

Other BMP combinations are readily quantifiable using STEPL. However, the template scenarios presented above are representative of a typical and appropriate combination of BMPs within a watershed planning unit and are used within this plan to develop cost-estimates and quantify loading reductions that can be achieved.

6.2 BMP COST ESTIMATING

The following cost estimates for BMPs to be applied in the Lower Des Plaines Planning Area have been generated from a combination of project specific experience from both design and construction phases as well as a succinct review of previous watershed based plans. The cost estimates presented reflect an expected economy of scale for potential BMP projects and should be validated for site-specific projects based on actual site constraints as cost estimates may range significantly. Where costs are shown on a per acre basis, the costs reflect implementing a number of de-centralized practices that cumulatively amount to one acre green infrastructure area. This amount of retrofitting would have the capacity to manage runoff from a significantly larger acreage. Cost estimates have not been provided for policy change or education and outreach programs as these practices, while important, are not readily quantifiable.

Best Management Practice	Unit	Unit Cost
Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft^2$	Ac	$177,700
Bioretention as Green Roof (assuming structurally sound) @ ~ $30/ft^2$	Ac	$1,346,200
Bioretention as Bioswale @ ~ $15/ft^2$	Ac	$653,400
Extended Wet Detention (Detention Basin Retrofit - native planting in dry bottom pond)	Ac	$12,900
Extended Wet Detention (Detention Basin Retrofit - wet bottom pond restoration and bank enhancement)	Ac	$8,200
Cistern (Assuming a 10,000 gal Tank per 0.37 acers of tributary area)	Ac	$12,800
Settling Basins (To be included in all detention basin retrofits 4 ft deep) @ ~445 CY / AC @ $30 / CY)	Ac	$13,900
Porous Pavement @ ~ $8/ft^2$	Ac	$359,000
Vegetated Filter Strips @ ~ $3/ft^2$	Ac	$134,900
Infiltration Trench @ ~ $6/ft^2$	Ac	$269,300
Mechanical BMPs (assuming 1 per 10 acres of tributary area)	Ea	$10,300
Weekly Street Sweeping	Ac	$1,000
Water Quality Inlets (does not include maintenance)	Ea	$400
Wetland Restoration	Ac	$15,500
Streambank Stabilization	LF	$134
BMPs not assessed using STEPL		
Streambank Enhancement – Replacement of hardscape with native	LF	$103
Riparian Corridor Enhancement – Habitat Enhancement and Creation	Ac	$9,300
Hydraulic Outfall Structure Retrofits with Forebay Retrofits	Ea	$77,300
Floating Wetlands (quantified as unit(s) per acre of open water)	Ac	$10,300

6.3 LOWER DES PLAINES WATERSHED PRIORITY IMPLEMENTATION AREAS

A ranking system was used to determine which watershed planning units are the most severely impaired and are critical for BMP implementation to provide watershed planning unit and overall watershed benefits. Each pollutant load, as described in Chapter 4, was given a score from 1-4, with 1 being the least polluted to 4 being severely polluted, within each watershed planning unit. In addition, the riparian area of each watershed planning unit was given a score of 0 to 3, with 0 being not applicable (i.e., creek is enclosed in a pipe) to 3 with the riparian being in poor condition. The pollutant and riparian scores were then added to determine an overall score. The prioritization of each watershed planning unit was determined based on the overall score, with the most severely impaired watershed planning units having the highest score. Table 6.3-1 is a summary of the ranking system for each watershed planning unit. Priority was given to the watershed planning units in the top 20% of the overall scoring (i.e., most significant in terms of water quality).

Sub	N Load (lb/ac)		P Load (lb/ac)		BOD Load (lb/ac)		Sed Load (t/ac)		Chloride Load (t/ac)		Channel	Riparian	Erosion	Rip Score	Sub	Priority Score
LDP7	9.8	4	2.2	4	31.6	4	1.8	4	0.42	4	MOD	GOOD	MOD	1	LDP7	21
WIC3	13.0	4	2.2	4	42.2	4	0.5	2	0.39	4	HIGH	POOR	MOD	3	WIC3	21
CC2	9.4	4	1.7	3	31.8	4	0.6	3	0.37	4	HIGH	POOR	LOW	3	CC2	21
FC2	9.2	4	2.0	4	30.0	4	1.6	4	0.2	2	HIGH	FAIR	MOD	2	FC2	20
LDP8	9.3	4	2.3	4	28.7	3	2.4	4	0.28	3	HIGH	FAIR	LOW	2	LDP8	20
LDP4	8.4	3	1.8	3	27.1	3	1.4	4	0.37	4	HIGH	GOOD	MOD	1	LDP4	18
CC1	15.9	4	2.7	4	49.4	4	0.5	2	0.13	1	HIGH	POOR	LOW	3	CC1	18
LDP5	8.5	3	2.1	4	25.5	2	2.2	4	0.24	2	MOD	FAIR	HIGH	2	LDP5	17
LDP9	8.9	3	1.9	3	27.9	3	1.3	4	0.22	2	HIGH	GOOD	LOW	1	LDP9	16
FC1	7.5	2	1.4	2	26.2	2	0.7	3	0.33	4	HIGH	FAIR	MOD	2	FC1	15
WIC2	16.0	4	2.7	4	49.6	4	0.4	2	0.03	1	N/A	N/A	N/A	0	WIC2	15
LDP3	8.0	3	1.7	3	26.6	2	1.2	3	0.31	3	MOD	GOOD	HIGH	1	LDP3	15
HC	8.7	3	1.5	3	29.7	3	0.6	3	0.24	2	LOW	GOOD	MOD	1	HC	15
LDP6	7.8	2	1.3	2	28.2	3	0.2	1	0.46	4	MOD	FAIR	HIGH	2	LDP6	14
FD	7.7	2	1.3	1	28.6	3	0.3	2	0.36	4	HIGH	FAIR	LOW	2	FD	14
WEC	7.5	2	1.3	2	27.0	2	0.4	2	0.32	3	HIGH	POOR	MOD	3	WEC	14
WIC1	8.7	3	1.4	2	30.1	4	0.2	1	0.20	2	N/A	N/A	N/A	0	WIC1	12
LDP2	7.7	2	1.9	3	23.9	1	1.8	4	0.18	1	LOW	GOOD	MOD	1	LDP2	12
MC	7.0	1	1.2	1	25.1	2	0.4	2	0.28	3	HIGH	FAIR	LOW	2	MC	11
LDP1	7.0	2	1.4	2	23.6	1	0.8	3	0.23	2	LOW	GOOD	MOD	1	LDP1	11
PCFC	6.9	1	1.1	1	26.1	2	0.2	1	0.28	3	HIGH	FAIR	LOW	2	PCFC	10
LDP10	6.7	1	1.3	2	23.8	1	0.6	3	0.16	1	HIGH	GOOD	LOW	1	LDP10	9
GCT	4.5	1	0.7	1	15.1	1	0.2	1	0.32	3	HIGH	FAIR	LOW	2	GCT	9
LDP11	5.1	1	0.9	1	19.1	1	0.1	1	0.17	1	HIGH	GOOD	LOW	1	LDP11	6
LDP12	6.2	1	1.1	1	20.9	1	0.2	1	0.20	1	HIGH	GOOD	LOW	1	LDP12	6

Table 6.3-1 Lower Des Plaines Planning Area Pollutant Priority Ranking by Watershed Planning Unit

The watershed planning units that are the highest priority based on loadings are dominated by impervious area. Watershed planning units with the lowest overall pollutant loadings are generally in the portion of the watershed which is dominated by forest preserve and open spaces. It should be noted that although some of the watershed planning units have a low prioritization score, BMPs can nevertheless be implemented in these areas to help improve the quality of the Lower Des Plaines River and its tributaries.

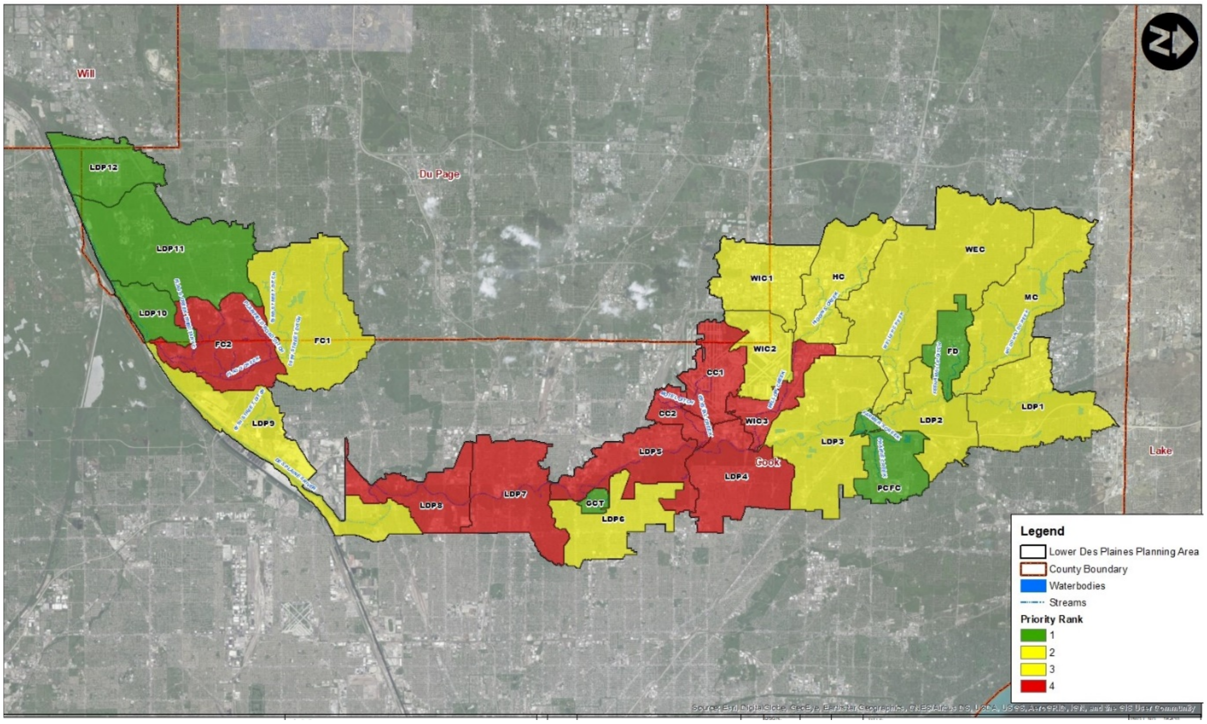

Figure 6.3-1 Lower Des Plaines Watershed Priority Area Ranking by Watershed Planning Unit

6.4 BMP IMPLEMENTATION, LOAD REDUCTIONS AND COST

Following the priority area analysis, special care was considered in how to apply BMPs pragmatically to land use types as described in Section 6.1 which is largely controlled by site constraints. Using both design and construction experience, various BMPs were selected for each watershed planning unit to generate the highest pollutant load removal and BMP efficiency per land use.

Overall reductions for a system of BMPs for each land use, in each watershed planning unit, were determined using the BMP Calculator in the STEPL suite combined with removal efficiencies per BMP as described in Section 5.1. An average BMP reduction value was derived from BMPs for urban areas, commercial and roadway / transportation areas. Following implementation, cost estimates of the implemented BMPs by watershed planning unit were determined using the information collected in Section 6.2. Cost estimates are valued in current 2017 pricing, and do not have a multiplier to reflect inflation over time. This decision was made so that the costs provided by this plan can be interpreted accurately in the future without having to calculate from inaccurate inflation rate projections.

Based on short- and long-term goals, stakeholder engagement, and funding considerations, the loading reductions and costs were determined for a target level of BMP implementation was developed for load reductions and cost. The following sections describe the methodology used to determine the load reductions (using STEPL) and cost estimates associated with the target implementation level.

In addition to the developed areas, there are existing lakes, wetlands and detention basins that can be enhanced. These improvement opportunities have been identified and incorporated into the BMP scenarios selected for each land use type. The MWRD detention basin database includes 38 detention basins within the watershed that received a Sewerage Permit for development. An additional 99 open water areas were identified within the watershed. These open water areas and detention basin retrofits have been incorporated into the following analyses.

As discussed in Section 4.4, the predicted population increase in the Lower Des Plaines Planning Area is from 6.4 people per acre to 7.2 people per acre. Understanding that the Lower Des Plaines River Planning Area outside of the forest preserve areas is 86% developed, as discussed above it is anticipated that existing and future priority area rankings are essentially the same due to little predicted land use change. Therefore, although the following analyses has been prepared for existing land uses and they also reflect projected future land use.

6.4.1 20% Implementation

The target level of BMP implementation is 20%. What this means is that runoff from 20% of the various land use areas within the watershed planning units will have runoff/stormwater controls as outlined above in Section 6.1. For example, if a watershed planning unit has residential areas, 20% of the residential land would have rain gardens or bioretention areas installed and would have detention pond retrofits. The target or objective of implementing BMPs to capture/treat runoff from 20% of the source areas is based on practicability and feasibility. It will be most feasible to implement BMPs in public areas, such as municipal parking lots, public parks, and road right-of-ways. BMPs can also be implemented on private property, but this presents certain challenges such as ensuring the practices will be preserved and maintained over time. The majority of the land in the watershed is privately owned. Our analysis concluded that the goal of implementing BMPs to manage/treat runoff from 20% of the source areas is the maximum amount of implementation that is practicable and realistic.

Through education and outreach watershed stakeholders can encourage implementation of BMPs on private property. This would result in a higher percentage of areas being treated, and further reductions to pollutant loadings. However, the quantification of effects presented in this watershed-based plan focuses on implementation of BMPs that can be designed to meet appropriate technical standards and will be reliably maintained, which corresponds to runoff from 20% of the land areas is treated with a BMP(s).

The numbers/scale of BMPs applied within each watershed planning unit (reflecting the Section 6.1 scenarios) are shown in Appendix 1. Appendix 1 displays BMP projects per watershed planning unit based on a detailed assessment of land cover/land use within the watershed planning unit. Information from this table was an input into the BMP Calculator in STEPL.

The table below shows the compiled pollutant loading reductions and costs per watershed planning unit, reflecting the land cover in that planning area and the Section 6.1 scenarios. The loading reductions were calculated from the BMP Calculator in the STEPL Suite to determine the "Combined BMP efficiency" as if numerous BMPs are applied in the watershed planning unit. Based on land use and the total BMPs applied, the Table shows the estimated loading reductions as computed from STEPL's Combined BMP selection within the Urban BMP Tool. Load reductions are shown for a suite of BMPs applied to a particular watershed planning unit as the overall BMP efficiency to depict a realistic application rate of multiple BMPs throughout a watershed planning unit.

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
CC1 (2785 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	0.78	Ac	$ 177,700					$ 139,197
	Infiltration Trench	52.22	Ac	$ 269,300					$ 14,063,300
	Oil/Grit Separators	1.29	Ac	$ 10,000					$ 12,864
	Bioretention (Green Roof) @ ~ $30/ft²	0.96	Ac	$ 1,346,200					$ 1,298,814
	Bioretention as Bioswale @ ~ $15/ft²	0.00	Ac	$ 653,400					$ -
	Cistern (10,000 Gal Tank/ 0.37 Ac)	17.38	Ea	$ 12,800					$ 222,512
	Porous Pavement @ ~ $8/ft²	0.04	Ac	$ 359,000					$ 14,647
	Weekly Street Sweeping	0.41	Ac	$ 1,000					$ 408
	Water Quality Inlets (does not include maintenance)	0.41	Ea	$ 400					$ 163
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.00	*Ac*	$ 13,900					$ -
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	0.00	Ac	$ 15,500					$ -
	Streambank Stabilization	1101.20	LF	$ 134					$ 147,561
Planning Unit Total					272	53	141	49	$ 15,899,466
CC2 (1174 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	8.44	Ac	$ 177,700					$ 1,500,589
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	4.15	Ac	$ 653,400					$ 2,710,400
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	2.87	Ac	$ 359,000					$ 1,029,325

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Weekly Street Sweeping	28.67	Ac	$ 1,000					$ 28,672
	Water Quality Inlets (does not include maintenance)	28.67	Ea	$ 400					$ 11,469
	Detention Basin Retrofit - native planting in dry bottom pond	0.32	Ac	$ 13,000					$ 4,177
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.02	*Ac*	$ 13,900					$ 268
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	1.91	Ac	$ 15,500					$ 29,544
	Streambank Stabilization	8004.80	LF	$ 134					$ 1,072,643
Planning Unit Total					274	78	488	97	$ 6,387,087
FC1 (7619 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	88.43	Ac	$ 177,700					$ 15,713,851
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	30.24	Ac	$ 653,400					$ 19,759,300
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	28.41	Ac	$ 359,000					$ 10,200,698
	Weekly Street Sweeping	284.14	Ac	$ 1,000					$ 284,142
	Water Quality Inlets (does not include maintenance)	284.14	Ea	$ 400					$ 113,657
	Detention Basin Retrofit - native planting in dry bottom pond	0.75	Ac	$ 13,000					$ 9,739
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.04	*Ac*	$ 13,900					$ 625
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	31.57	Ac	$ 15,500					$ 489,411

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Streambank Stabilization	8550.80	LF	$ 134					$ 1,145,807
Planning Unit Total					2,262	654	4,205	802	$ 47,717,229
FC2 (5040 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	45.37	Ac	$ 177,700					$ 8,063,109
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	14.57	Ac	$ 653,400					$ 9,520,038
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	11.33	Ac	$ 359,000					$ 4,067,338
	Weekly Street Sweeping	113.30	Ac	$ 1,000					$ 113,296
	Water Quality Inlets (does not include maintenance)	113.30	Ea	$ 400					$ 45,319
	Detention Basin Retrofit - native planting in dry bottom pond	0.13	Ac	$ 13,000					$ 1,734
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.11	Ac	$ 8,200					$ 9,139
	Settling Basins	0.07	*Ac*	$ 13,900					$ 1,041
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	50.53	Ac	$ 15,500					$ 783,173
	Streambank Stabilization	21906.00	LF	$ 134					$ 2,935,404
Planning Unit Total					2,779	970	5,892	1,423	$ 25,539,591
FD (1733 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	14.38	Ac	$ 177,700					$ 2,554,741
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Bioretention as Bioswale @ ~ $15/ft²	6.16	Ac	$ 653,400					$ 4,025,065
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	4.19	Ac	$ 359,000					$ 1,504,709
	Weekly Street Sweeping	41.91	Ac	$ 1,000					$ 41,914
	Water Quality Inlets (does not include maintenance)	41.91	Ea	$ 400					$ 16,766
	Detention Basin Retrofit - native planting in dry bottom pond	0.16	Ac	$ 13,000					$ 2,058
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.06	Ac	$ 8,200					$ 8,693
	Settling Basins	0.07	*Ac*	$ 13,900					$ 1,016
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	7.60	Ac	$ 15,500					$ 117,744
	Streambank Stabilization	4566.40	LF	$ 134					$ 611,898
Planning Unit Total					267	63	514	53	$ 8,884,603
GCT (356 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	1.96	Ac	$ 177,700					$ 347,865
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	0.78	Ac	$ 653,400					$ 511,951
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	0.61	Ac	$ 359,000					$ 218,726
	Weekly Street Sweeping	6.09	Ac	$ 1,000					$ 6,093
	Water Quality Inlets (does not include maintenance)	6.09	Ea	$ 400					$ 2,437
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Settling Basins	0.00	*Ac*	$ 13,900					$ -
	Vegetated Filter Strips @ ~ $3/ft²	65.67	*Ac*	$ 134,900					$ 8,858,448
	Wetland Restoration	1.29	Ac	$ 15,500					$ 20,008
	Streambank Stabilization	2213.20	LF	$ 134					$ 296,569
Planning Unit Total					87	13	237	8	$ 10,262,096
HC (4216 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	14.47	Ac	$ 177,700					$ 2,571,650
	Infiltration Trench	163.77	Ac	$ 269,300					$ 44,102,202
	Oil/Grit Separators	23.84	Ac	$ 10,000					$ 238,394
	Bioretention (Green Roof) @ ~ $30/ft2	17.88	Ac	$ 1,346,200					$ 24,069,450
	Bioretention as Bioswale @ ~ $15/ft²	12.02	Ac	$ 653,400					$ 7,850,843
	Cistern (10,000 Gal Tank/ 0.37 Ac)	322.15	Ea	$ 12,800					$ 4,123,572
	Porous Pavement @ ~ $8/ft²	7.14	Ac	$ 359,000					$ 2,562,230
	Weekly Street Sweeping	71.37	Ac	$ 1,000					$ 71,371
	Water Quality Inlets (does not include maintenance)	71.37	Ea	$ 400					$ 28,549
	Detention Basin Retrofit - native planting in dry bottom pond	0.08	Ac	$ 13,000					$ 1,073
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.13	Ac	$ 8,200					$ 9,296
	Settling Basins	0.07	*Ac*	$ 13,900					$ 1,014
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	30.08	Ac	$ 15,500					$ 466,300
	Streambank Stabilization	12433.60	LF	$ 134					$ 1,666,102
Planning Unit Total					1,659	390	2,010	333	$ 87,762,046
LDP1 (5452 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	32.61	Ac	$ 177,700					$ 5,794,895

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	12.87	Ac	$ 653,400					$ 8,412,283
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	7.79	Ac	$ 359,000					$ 2,795,381
	Weekly Street Sweeping	77.87	Ac	$ 1,000					$ 77,866
	Water Quality Inlets (does not include maintenance)	77.87	Ea	$ 400					$ 31,146
	Detention Basin Retrofit - native planting in dry bottom pond	0.05	Ac	$ 13,000					$ 705
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	2.04	Ac	$ 8,200					$ 16,725
	Settling Basins	0.13	*Ac*	$ 13,900					$ 1,746
	Vegetated Filter Strips @ ~ $3/ft²	3.35	*Ac*	$ 134,900					$ 451,565
	Wetland Restoration	65.61	Ac	$ 15,500					$ 1,016,998
	Streambank Stabilization	7749.20	LF	$ 134					$ 1,038,393
Planning Unit Total					1,414	491	2,769	713	$ 19,637,702
LDP2 (3525 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	7.11	Ac	$ 177,700					$ 1,264,089
	Infiltration Trench	128.36	Ac	$ 269,300					$ 34,568,539
	Oil/Grit Separators	14.65	Ac	$ 10,000					$ 146,466
	Bioretention (Green Roof) @ ~ $30/ft2	10.98	Ac	$ 1,346,200					$ 14,787,940
	Bioretention as Bioswale @ ~ $15/ft²	5.19	Ac	$ 653,400					$ 3,389,936
	Cistern (10,000 Gal Tank/ 0.37 Ac)	197.93	Ea	$ 12,800					$ 2,533,466
	Porous Pavement @ ~ $8/ft²	2.97	Ac	$ 359,000					$ 1,066,121

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Weekly Street Sweeping	29.70	Ac	$ 1,000					$ 29,697
	Water Quality Inlets (does not include maintenance)	29.70	Ea	$ 400					$ 11,879
	Detention Basin Retrofit - native planting in dry bottom pond	0.04	Ac	$ 13,000					$ 558
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.14	Ac	$ 8,200					$ 9,347
	Settling Basins	0.07	*Ac*	$ 13,900					$ 986
	Vegetated Filter Strips @ ~ $3/ft²	1.66	*Ac*	$ 134,900					$ 223,962
	Wetland Restoration	39.80	Ac	$ 15,500					$ 616,879
	Streambank Stabilization	9400.80	LF	$ 134					$ 1,259,707
Planning Unit Total					2,362	804	4,002	1,157	$ 59,909,573
LDP3 (7144 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	63.89	Ac	$ 177,700					$ 11,353,614
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	25.76	Ac	$ 653,400					$ 16,830,011
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	18.36	Ac	$ 359,000					$ 6,591,244
	Weekly Street Sweeping	183.60	Ac	$ 1,000					$ 183,600
	Water Quality Inlets (does not include maintenance)	183.60	Ea	$ 400					$ 73,440
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.00	*Ac*	$ 13,900					$ -
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Wetland Restoration	63.23	Ac	$ 15,500					$ 980,140
	Streambank Stabilization	10384.40	LF	$ 134					$ 1,391,510
Planning Unit Total					3,057	1,010	5,735	1,444	$ 37,403,559
LDP4 (4650 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	40.22	Ac	$ 177,700					$ 7,146,896
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	18.50	Ac	$ 653,400					$ 12,088,505
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	12.59	Ac	$ 359,000					$ 4,519,103
	Weekly Street Sweeping	125.88	Ac	$ 1,000					$ 125,880
	Water Quality Inlets (does not include maintenance)	125.88	Ea	$ 400					$ 50,352
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.18	Ac	$ 8,200					$ 1,480
	Settling Basins	0.01	*Ac*	$ 13,900					$ 150
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	16.18	Ac	$ 15,500					$ 250,821
	Streambank Stabilization	4972.00	LF	$ 134					$ 666,248
Planning Unit Total					2,365	791	4,400	1,150	$ 24,849,436
LDP5 (4067 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	10.37	Ac	$ 177,700					$ 1,842,759
	Infiltration Trench	122.53	Ac	$ 269,300					$ 32,998,537
	Oil/Grit Separators	13.35	Ac	$ 10,000					$ 133,464

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Bioretention (Green Roof) @ ~ $30/ft2	27.05	Ac	$ 1,346,200					$ 36,419,440
	Bioretention as Bioswale @ ~ $15/ft²	8.53	Ac	$ 653,400					$ 5,574,833
	Cistern (10,000 Gal Tank/ 0.37 Ac)	66.73	Ea	$ 12,800					$ 854,170
	Porous Pavement @ ~ $8/ft²	4.33	Ac	$ 359,000					$ 1,554,779
	Weekly Street Sweeping	43.31	Ac	$ 1,000					$ 43,309
	Water Quality Inlets (does not include maintenance)	43.31	Ea	$ 400					$ 17,323
	Detention Basin Retrofit - native planting in dry bottom pond	0.47	Ac	$ 13,000					$ 6,059
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.46	Ac	$ 8,200					$ 3,810
	Settling Basins	0.06	*Ac*	$ 13,900					$ 776
	Vegetated Filter Strips @ ~ $3/ft²	2.64	*Ac*	$ 134,900					$ 356,801
	Wetland Restoration	49.61	Ac	$ 15,500					$ 768,948
	Streambank Stabilization	12372.00	LF	$ 134					$ 1,657,848
Planning Unit Total					3,142	1,097	5,478	1,624	$ 82,232,856
LDP6 (3748 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	44.93	Ac	$ 177,700					$ 7,983,910
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	20.15	Ac	$ 653,400					$ 13,164,437
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	18.71	Ac	$ 359,000					$ 6,717,997
	Weekly Street Sweeping	187.13	Ac	$ 1,000					$ 187,131
	Water Quality Inlets (does not include maintenance)	187.13	Ea	$ 400					$ 74,852

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.01	*Ac*	$ 13,900					$ 150
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	0.04	Ac	$ 15,500					$ 675
	Streambank Stabilization	0.00	LF	$ 134					$ -
Planning Unit Total					693	112	1,014	23	$ 28,129,154
LDP 7 (4942 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	46.89	Ac	$ 177,700					$ 8,331,754
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	21.68	Ac	$ 653,400					$ 14,167,769
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	16.16	Ac	$ 359,000					$ 5,800,823
	Weekly Street Sweeping	161.58	Ac	$ 1,000					$ 161,583
	Water Quality Inlets (does not include maintenance)	161.58	Ea	$ 400					$ 64,633
	Detention Basin Retrofit - native planting in dry bottom pond	0.07	Ac	$ 13,000					$ 942
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.01	Ac	$ 8,200					$ 78
	Settling Basins	0.00	*Ac*	$ 13,900					$ 68
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	17.00	Ac	$ 15,500					$ 263,546
	Streambank Stabilization	6506.40	LF	$ 134					$ 871,858

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
Planning Unit Total					3,056	1,027	5,761	1,505	$ 29,663,053
LDP8 (3359 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	21.57	Ac	$ 177,700					$ 3,832,285
	Infiltration Trench	118.01	Ac	$ 269,300					$ 31,779,853
	Oil/Grit Separators	12.38	Ac	$ 10,000					$ 123,788
	Bioretention (Green Roof) @ ~ $30/ft2	9.28	Ac	$ 1,346,200					$ 12,498,255
	Bioretention as Bioswale @ ~ $15/ft²	8.49	Ac	$ 653,400					$ 5,546,882
	Cistern (10,000 Gal Tank/ 0.37 Ac)	167.28	Ea	$ 12,800					$ 2,141,198
	Porous Pavement @ ~ $8/ft²	4.22	Ac	$ 359,000					$ 1,514,070
	Weekly Street Sweeping	42.17	Ac	$ 1,000					$ 42,175
	Water Quality Inlets (does not include maintenance)	42.17	Ea	$ 400					$ 16,870
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.15	Ac	$ 8,200					$ 1,226
	Settling Basins	0.01	*Ac*	$ 13,900					$ 125
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	24.15	Ac	$ 15,500					$ 374,268
	Streambank Stabilization	9363.20	LF	$ 134					$ 1,254,669
Planning Unit Total					2,832	980	4,791	1,435	$ 59,125,663
LDP9 (5733 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	26.96	Ac	$ 177,700					$ 4,790,359
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	13.21	Ac	$ 653,400					$ 8,630,083

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	6.85	Ac	$ 359,000					$ 2,458,076
	Weekly Street Sweeping	68.47	Ac	$ 1,000					$ 68,470
	Water Quality Inlets (does not include maintenance)	68.47	Ea	$ 400					$ 27,388
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.23	Ac	$ 8,200					$ 10,055
	Settling Basins	0.07	*Ac*	$ 13,900					$ 1,023
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	76.10	Ac	$ 15,500					$ 1,179,593
	Streambank Stabilization	25264.40	LF	$ 134					$ 3,385,430
Planning Unit Total					2,304	802	4,595	1,197	$ 20,550,476
LDP10 (1729 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	14.56	Ac	$ 177,700					$ 2,587,752
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	3.29	Ac	$ 653,400					$ 2,151,985
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	2.56	Ac	$ 359,000					$ 919,413
	Weekly Street Sweeping	25.61	Ac	$ 1,000					$ 25,610
	Water Quality Inlets (does not include maintenance)	25.61	Ea	$ 400					$ 10,244
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.20	Ac	$ 8,200					$ 1,623

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Settling Basins	0.01	*Ac*	$ 13,900					$ 165
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	51.03	Ac	$ 15,500					$ 791,027
	Streambank Stabilization	4779.60	LF	$ 134					$ 640,466
Planning Unit Total					467	153	1,640	177	$ 7,128,286
LDP11 (8137 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	48.05	Ac	$ 177,700					$ 8,537,663
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	20.08	Ac	$ 653,400					$ 13,118,215
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	12.14	Ac	$ 359,000					$ 4,359,150
	Weekly Street Sweeping	121.42	Ac	$ 1,000					$ 121,425
	Water Quality Inlets (does not include maintenance)	121.42	Ea	$ 400					$ 48,570
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.80	Ac	$ 8,200					$ 6,532
	Settling Basins	0.05	*Ac*	$ 13,900					$ 664
	Vegetated Filter Strips @ ~ $3/ft²	5.42	*Ac*	$ 134,900					$ 731,259
	Wetland Restoration	176.52	Ac	$ 15,500					$ 2,736,030
	Streambank Stabilization	6215.20	LF	$ 134					$ 832,837
Planning Unit Total					543	136	1,748	58	$ 30,492,345
LDP12 (3213 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	10.08	Ac	$ 177,700					$ 1,790,854

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	10.08	Ac	$ 653,400					$ 6,584,941
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	6.20	Ac	$ 359,000					$ 2,227,234
	Weekly Street Sweeping	62.04	Ac	$ 1,000					$ 62,040
	Water Quality Inlets (does not include maintenance)	62.04	Ea	$ 400					$ 24,816
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.00	*Ac*	$ 13,900					$ -
	Vegetated Filter Strips @ ~ $3/ft²	3.33	*Ac*	$ 134,900					$ 448,641
	Wetland Restoration	135.54	Ac	$ 15,500					$ 2,100,793
	Streambank Stabilization	3367.20	LF	$ 134					$ 451,205
Planning Unit Total					407	104	1,481	61	$ 13,690,523
	Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2	64.86	Ac	$ 177,700					$ 11,524,820
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
MC (6465 acres)	*Bioretention (Green Roof) @ ~ $30/ft2*	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	22.14	Ac	$ 653,400					$ 14,468,817
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	18.18	Ac	$ 359,000					$ 6,525,078

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Weekly Street Sweeping	181.76	Ac	$ 1,000					$ 181,757
	Water Quality Inlets (does not include maintenance)	181.76	Ea	$ 400					$ 72,703
	Detention Basin Retrofit - native planting in dry bottom pond	0.41	Ac	$ 13,000					$ 5,269
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.98	Ac	$ 8,200					$ 16,273
	Settling Basins	0.14	*Ac*	$ 13,900					$ 1,993
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	30.94	Ac	$ 15,500					$ 479,524
	Streambank Stabilization	23572.80	LF	$ 134					$ 3,158,755
Planning Unit Total					1,337	363	3,560	353	$ 36,434,989
PCFC (2835 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	23.38	Ac	$ 177,700					$ 4,153,997
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	7.99	Ac	$ 653,400					$ 5,223,449
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	0.00	Ac	$ 359,000					$ -
	Weekly Street Sweeping	56.98	Ac	$ 1,000					$ 56,983
	Water Quality Inlets (does not include maintenance)	56.98	Ea	$ 400					$ 22,793
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.00	*Ac*	$ 13,900					$ -
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Wetland Restoration	13.88	Ac	$ 15,500					$ 215,066
	Streambank Stabilization	7081.60	LF	$ 134					$ 948,934
Planning Unit Total					317	71	576	48	$ 10,621,222
WEC (12010 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	124.50	Ac	$ 177,700					$ 22,123,192
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	47.75	Ac	$ 653,400					$ 31,198,035
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	38.16	Ac	$ 359,000					$ 13,699,289
	Weekly Street Sweeping	381.60	Ac	$ 1,000					$ 381,596
	Water Quality Inlets (does not include maintenance)	381.60	Ea	$ 400					$ 152,638
	Detention Basin Retrofit - native planting in dry bottom pond	1.04	Ac	$ 13,000					$ 13,458
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.13	Ac	$ 8,200					$ 9,281
	Settling Basins	0.13	*Ac*	$ 13,900					$ 1,807
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	19.05	Ac	$ 15,500					$ 295,318
	Streambank Stabilization	11817.60	LF	$ 134					$ 1,583,558
Planning Unit Total					2,396	613	4,024	627	$ 69,458,173
WIC1 (3897 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	12.96	Ac	$ 177,700					$ 2,303,127
	Infiltration Trench	244.17	Ac	$ 269,300					$ 65,756,062
	Oil/Grit Separators	53.00	Ac	$ 10,000					$ 529,964

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Bioretention (Green Roof) @ ~ $30/ft2	39.75	Ac	$ 1,346,200					$ 53,507,815
	Bioretention as Bioswale @ ~ $15/ft²	9.30	Ac	$ 653,400					$ 6,075,410
	Cistern (10,000 Gal Tank/ 0.37 Ac)	716.17	Ea	$ 12,800					$ 9,166,945
	Porous Pavement @ ~ $8/ft²	8.74	Ac	$ 359,000					$ 3,136,418
	Weekly Street Sweeping	87.37	Ac	$ 1,000					$ 87,365
	Water Quality Inlets (does not include maintenance)	87.37	Ea	$ 400					$ 34,946
	Detention Basin Retrofit - native planting in dry bottom pond	1.19	Ac	$ 13,000					$ 15,428
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.35	Ac	$ 8,200					$ 2,901
	Settling Basins	0.09	*Ac*	$ 13,900					$ 1,285
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	21.90	Ac	$ 15,500					$ 339,390
	Streambank Stabilization	0.00	LF	$ 134					$ -
Planning Unit Total					1,580	279	912	50	$ 140,957,056
WIC2 (2534 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	0.00	Ac	$ 177,700					$ -
	Infiltration Trench	0.00	Ac	$ 269,300					$ -
	Oil/Grit Separators	0.00	Ac	$ 10,000					$ -
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	$ 1,346,200					$ -
	Bioretention as Bioswale @ ~ $15/ft²	0.00	Ac	$ 653,400					$ -
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	$ 12,800					$ -
	Porous Pavement @ ~ $8/ft²	0.00	Ac	$ 359,000					$ -
	Weekly Street Sweeping	0.00	Ac	$ 1,000					$ -
	Water Quality Inlets (does not include maintenance)	0.00	Ea	$ 400					$ -

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	$ 8,200					$ -
	Settling Basins	0.00	*Ac*	$ 13,900					$ -
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	0.00	Ac	$ 15,500					$ -
	Streambank Stabilization	0.00	LF	$ 134					$ -
Planning Unit Total					0	0	0	0	$ -
WIC3 (1968 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	6.69	Ac	$ 177,700					$ 1,188,195
	Infiltration Trench	76.63	Ac	$ 269,300					$ 20,637,062
	Oil/Grit Separators	5.22	Ac	$ 10,000					$ 52,200
	Bioretention (Green Roof) @ ~ $30/ft2	3.92	Ac	$ 1,346,200					$ 5,270,373
	Bioretention as Bioswale @ ~ $15/ft²	5.54	Ac	$ 653,400					$ 3,617,900
	Cistern (10,000 Gal Tank/ 0.37 Ac)	70.54	Ea	$ 12,800					$ 902,919
	Porous Pavement @ ~ $8/ft²	4.66	Ac	$ 359,000					$ 1,674,520
	Weekly Street Sweeping	46.64	Ac	$ 1,000					$ 46,644
	Water Quality Inlets (does not include maintenance)	46.64	Ea	$ 400					$ 18,658
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	$ 13,000					$ -
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.40	Ac	$ 8,200					$ 3,242
	Settling Basins	0.02	*Ac*	$ 13,900					$ 330
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	$ 134,900					$ -
	Wetland Restoration	5.12	Ac	$ 15,500					$ 79,375
	Streambank Stabilization	8732.80	LF	$ 134					$ 1,170,195

Planning Unit ID	BMP	Amount	Unit	Cost	Nitrogen Reduced (lbs/yr)	Phosphorus Reduced (lbs/yr)	BOD Reduced (lbs/yr)	Sediment Reduced (tons/yr)	Costs to Implement BMP
Planning Unit Total					732	127	794	100	$ 34,661,612
Watershed Total					**36,606**	**11,181**	**66,764**	**14,487**	**$ 907,397,797**

Table 6.4-1 20% BMP Implementation, Load Reductions and Costs –Lower Des Plaines Planning Area

Notes: BMP Implementation is not considered for the airport property (Watershed Planning Unit WIC2) due to FAA regulation and season specific constraints. (see Section 4.2.5 for more information).

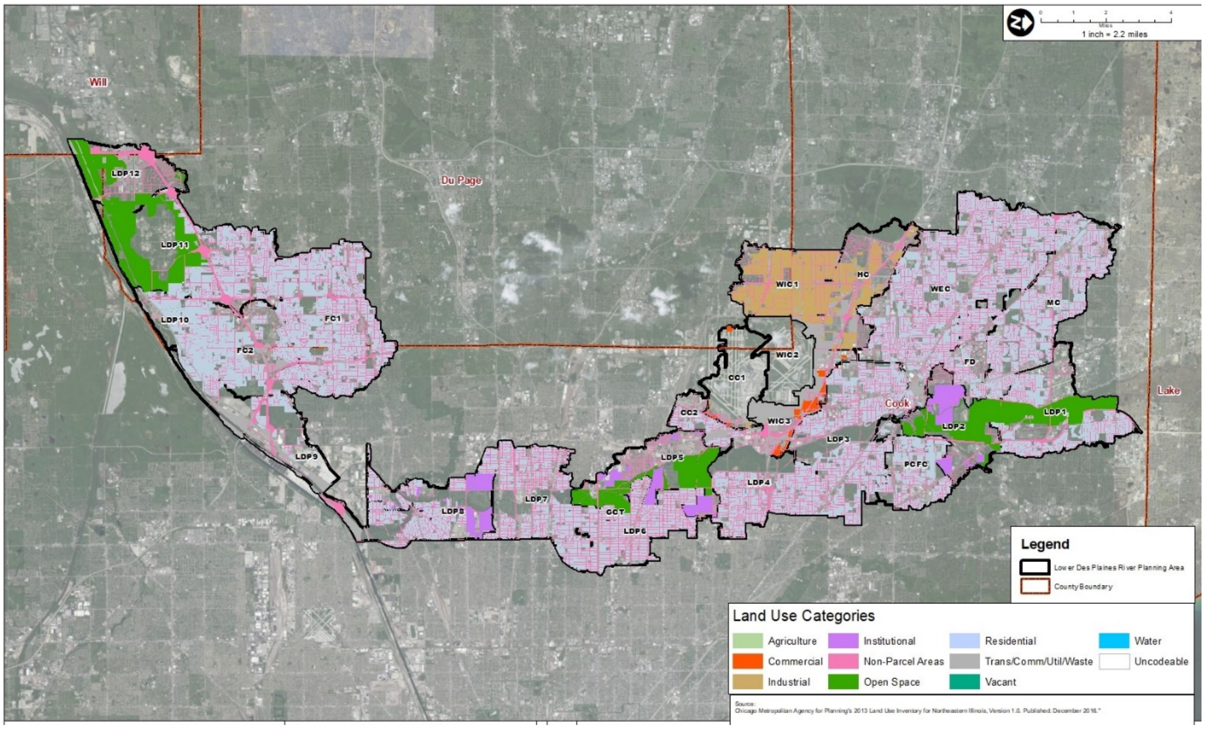

Figure 6.4-1 BMP Applications Per Land Use –Lower Des Plaines Planning Area

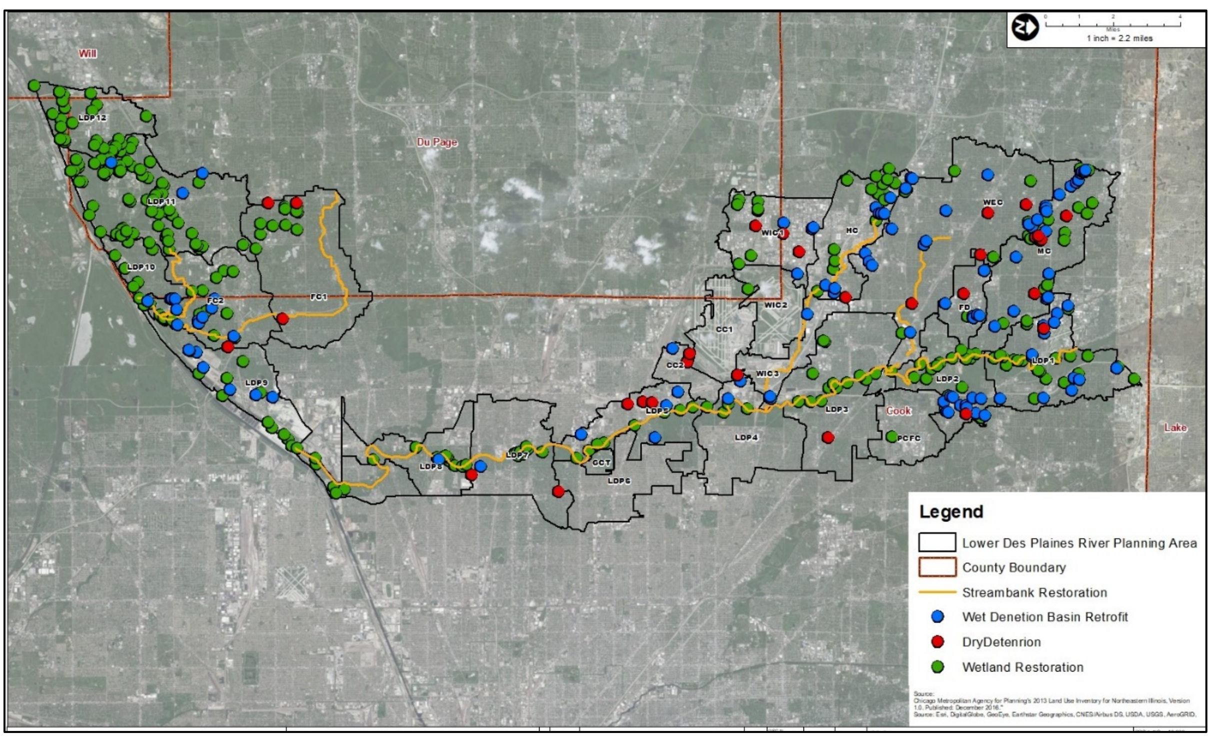

Figure 6.4-2 Detention Basin Retrofits and Restoration –Lower Des Plaines Planning Area

Targeting an implementation rate of 20% watershed-wide results in a substantial reduction in sediment loading – 16% -- with an overall cost of $907.4 million. The sediment load reduction is significant for water quality improvement, and also, as discussed above, reductions in sediment loading suggests reductions in other pollutants through reduction in transport of phosphorus, heavy metals and hydrocarbons. In addition, the existing high sediment accumulation in the watercourses (as assessed in Chapters 3 and 4) is one of the main stressors for habitat degradation leading to the creation of anaerobic conditions in streambeds and causing aquatic life impacts.

Nitrogen, phosphorus and BOD reductions vary on a percentage basis as compared to sediment. The relatively low percentage reductions of nutrients and BOD loadings reflect that some of the loadings are from point sources, vs. nonpoint. Media can be designed in to some practices to enhance the removal of dissolved phosphorus where nutrients are a particular concern, e.g., upstream of lakes. Also, policy change effects (nonstructural BMPs) are not reflected in the STEPL results. For example, a community can implement ordinance provisions to require non-phosphorus fertilizers, which would have the effect of reducing nutrient loadings in stormwater. Overall, the predicted effects and the assessment of the watershed conditions and needs highlight the need for sediment load reductions to improve water quality and support uses.

As indicated in previous sections, chloride reductions will need to be addressed through policy recommendations and non-structural BMPs (such as enhanced de-icing practices) due to the high solubility and residence time of chloride. Costs and effects associated with policy recommendations and changes are not included in Table 6.4-1.

This target level of BMP implementation will significantly reduce loadings and contribute to water quality improvement. It is difficult to precisely quantify and characterize the water quality rebound that will result from implementation of watershed wide nonpoint source pollution control measures. A key to understanding BMP implementation response within the watercourses is lag time. Even when management changes are well-designed and fully implemented, water quality monitoring efforts may not show definitive results if the monitoring period, program design, and sampling frequency are not sufficient to address the lag between treatment and response. The main components of lag time include the time required for an installed practice to produce an effect, the time required for the effect to be delivered to the water resource, the time required for the water body to respond to the effect, and the effectiveness of the monitoring program to measure the response (Meals, et al. 2009). Water quality characteristics are also affected by a variety of other factors, for example climate effects and activities in upstream watersheds.

Recognizing the difficulty in quantifying and characterizing the water quality rebound that will result and the timing of effects, this watershed plan is nevertheless establishing a target BMP implementation level. When considering a practical and reasonable implementation rate, the target for this plan is the 20% implementation rate. This will be an average across the watersheds, with priority areas targeted for a higher percentage of land area being addressed. While this target implementation level will involve very significant expenditures, implementation can occur over a 25-year period, spreading out the costs and allowing vehicles for funding, implementation, outreach and response to take effect.

As discussed further below, this plan envisions that watershed monitoring will continue and the effects of plan implementation can be assessed. The plan will be reviewed and updated at 10-year increments. In between plan updates adaptive management techniques can be used to fine-tune BMP implementation plans, for example placing greater focus on BMPs shown to be practicable and effective.

6.4.2 Plan Implementation Responsibility

Jurisdiction for stormwater management and water quality lies primarily with the MWRD and the municipalities within the watershed planning area.

As discussed above, it is anticipated MWRD will play a lead role on regional-scale stormwater projects, such as retrofitting possible flood control projects to provide water quality benefits (see Section 6.6). MWRD will also continue to implement, and periodically update, the WMO.

It is anticipated municipalities will play major roles in planning and implementing on-the-ground BMPs, such as implementing bioretention or permeable pavement in road right-of-ways or city parking lots. In most cases municipalities will also be responsible for maintenance of BMPs. MWRD may provide technical or financial assistance to municipalities for certain projects. MS4 communities will continue to implement their MS4 programs, including the six minimum measures.

Some BMP projects may also be implemented by other watershed stakeholders, such as school districts, not-for-profit organizations, or churches.

MWRD hosts quarterly Watershed Planning Council (WPC) meetings during which municipal stakeholders within the Lower Des Plaines planning area are informed of information including on-going capital improvement projects, completed projects, maintenance practices, chloride reduction strategies, and upcoming funding opportunities.

The local stakeholders who regularly attend the Lower Des Plaines WPC meetings are from the communities in the watershed. Many of the civic leaders are members of the West Central Municipal Conference and North Central Council of Mayors and the DuPage River Salt Creek Workgroup. The WPC meetings provide an opportunity for mayors and managers within the planning area to discuss capital improvement projects as well as water quality. Local officials can describe their needs and proposed projects, and look for opportunities to collaborate with neighboring communities. As discussed further below, the quarterly WPC meetings will be an important component of tracking plan implementation progress.

6.5 ADDITIONAL BMP IMPLEMENTATION

There are 10 lakes located within the Lower Des Plaines River Watershed that are included in the Illinois EPA's 303(d) list, of which 4 have been identified as being impaired. There are numerous other lakes within the watershed that are currently unassessed by the Illinois EPA, which are included in Chapter 3 of this plan. Lake water quality in the watershed is predominantly affected by pollutant loads coming into the lakes from upstream areas. Water quality improvements in the lakes will occur as BMPs are implemented in the upstream developed and undeveloped areas whose runoff contributes to the degradation of the waterbody. Implementation of BMPs in upstream areas that reduce nutrient loads will have significant beneficial effects on the lakes. Aquatic habitat in lakes and recreational activities on the lakes are significantly affected by algae growth which, as explained above, is dramatically affected by nutrient loadings. Implementation of BMPs as described above is expected to help restore and protect the lakes in the watershed. Additional improvements for lakes may include site-specific improvements. These improvements could be carried out in conjunction with the BMP plan implementation within the watershed planning unit and upstream.

Overall the focus of this plan is on capture and treatment of stormwater runoff and the impact that impervious surfaces have on water quality. The BMPs presented in this plan are identified with the goal of re-establishing or mimicking the watershed's historical drainage characteristics while reducing pollutant loadings in runoff as a function of volume reduction. The plan identifies recommended BMPs to address the different land covers and sources of pollution from runoff within the watershed. It should be noted that the plan identifies *types* of BMPs that would address the sources of loadings, but does not list or prescribe specific BMPs in specific places. The sizes and designs of BMPs and the optimal places for BMPs will need to be determined by communities and other stakeholders taking into account where benefits will be the greatest but also numerous factors including land ownership, budgets, community buy-in, and how maintenance will be assured. Also, new concepts or designs for BMPs may be developed during the plan implementation period. The plan intends there be flexibility to incorporate new BMP concepts if they cost-effectively reduce pollutant loadings from urban runoff and stormwater discharges.

6.6 MWRD DETAILED WATERSHED PLAN AND PROJECT RETROFITS

This plan addresses water quality as a supplement to the MWRD Detailed Watershed Plan for the Lower Des Plaines River. A promising and cost-effective approach for implementing pollutant reduction projects is to integrate pollutant control features into projects being designed for flood control. As such, many projects already identified in the DWP to address flooding concerns can be slightly modified or enhanced to provide a water quality component (Figure 6.6-1).

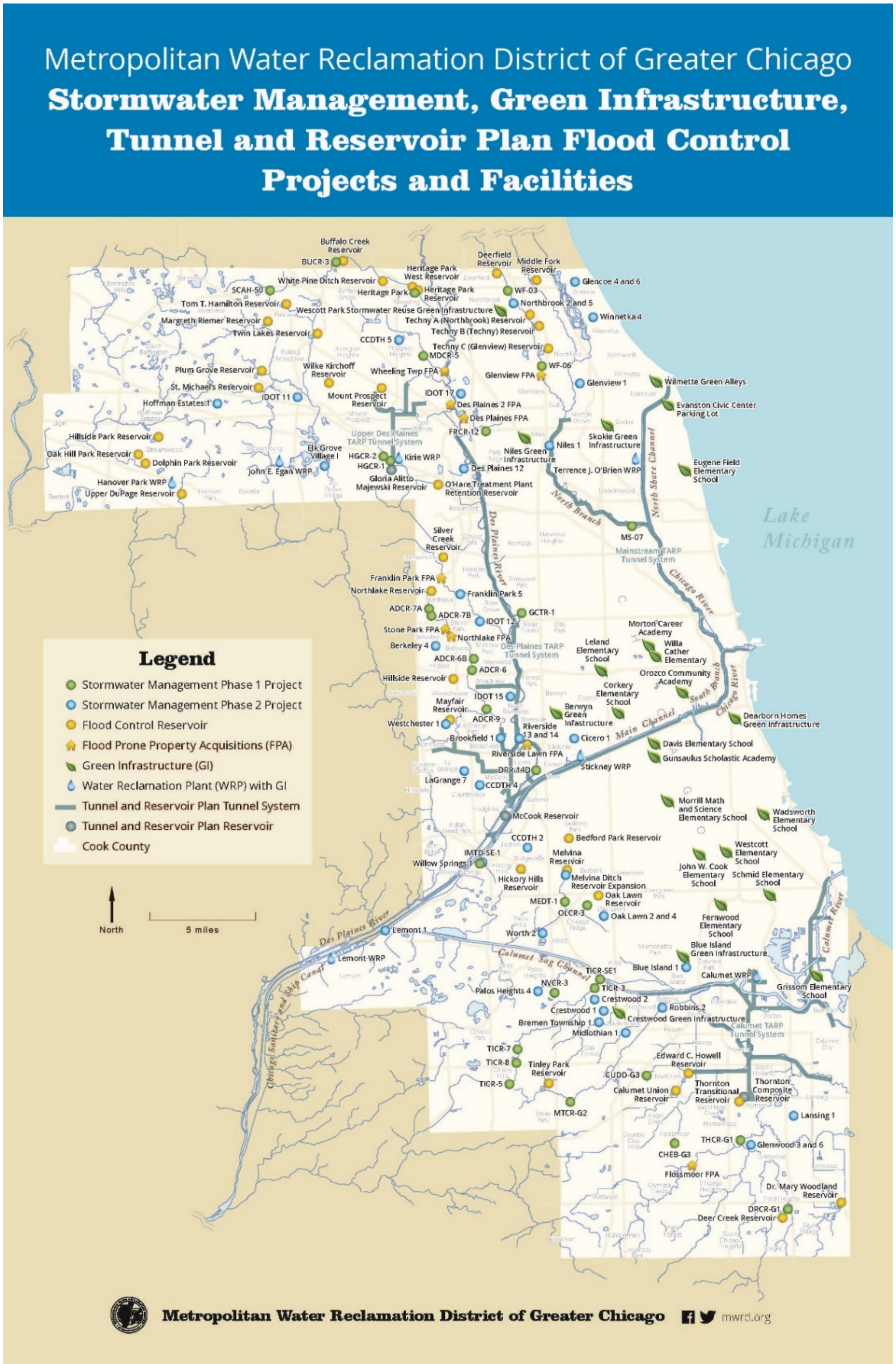

Figure 6.6-1 MWRD Facilities and Projects

As part of the MWRD DWP for the Lower Des Plaines River, a total of 44 projects were analyzed, with the main goal of reducing overbank flooding within the watershed. Of these 44 projects, which range in cost from $90,000 to $600 million dollars (2011 dollars), 18 projects were recommended as part of the DWP. For this plan, all projects, whether recommended or not, were reviewed to determine if water quality projects could be implemented/incorporated into the potential projects at these same locations. Eighteen (18) of the projects in the DWP could potentially have a water quality benefit, 8 of which were ultimately recommended in the DWP. To meet the goal of improvements in water quality, the project alternative identified in the DWP was reassessed to determine if a viable water quality component could be added to the water quality project. A list of the site-specific projects identified in the DWP for the purposes of water quality improvements to be implemented as part of this plan is shown in Table 6.6-1.

Subwatershed Plan ID	MWRD Subbasin ID	Cost	BC Ratio	Project Description	Plan Reco	DWP Reco
CC	CYCR-1	$7,425,208	0.01	Storage along Crystal Creek	Y	N
CCT	CYCR-4	$42,671,156	0.03	Flow Diversion of Crystal Creek Tributary	Y	Y
DP	DPR-14C	$260,991,361	0.03	47th Street Levee Enhancement	Y	Y
DP	DPR-22	$251,163,010	<0.01	Lyons Quarry Storage	Y	N
DP	DPR-23	$600,000,000	<0.01	USACE Concept Reservoirs	Y	N
FAC	FRCR-1	$3,077,059	0.7	Lake Mary Ann pump outlet and expansion of Dude Ranch Storage	Y	N
FAC	FRCR-4	$6,635,011	1.2	Expand Lutheran General Hospital West Pond	Y	N
FAC	FRCR-5	$4,679,253	0.6	New Maine Township East High School reservoir	Y	N
FAC	FRCR-7	$6,650,095	1.3	Dempster Street Division	Y	N
FAC	FRCR-8	$2,389,090	5.2	Lower Prairie Creek conveyance improvements	Y	N
FAC	FRCR-9	$8,123,019	1.1	Upper Prairie Creek conveyance improvements	Y	N
FC	FGCR-1	$6,229,554	0.05	Add 40-acre feet of storage to Spring Rock Park	Y	Y
FC	FGCR-4	$668,351	0.7	Replacement of two private bridges and channel improvements	Y	Y
FC	59DT-1	$969,361	0.1	Berm at Legge Park	Y	Y
FC	FGTB-1	$8,157,163	2.2	New channel and road crossing at Wolf Road	Y	Y
MC	MDCR-4	$89,757	0	Sediment Removal	Y	N
MC	MDCR-5	$797,625	0.3	Erosion Stabilization	Y	Y
WIC	HGCR-1	$762,604	0.3	Weir Rehabilitation and bank stabilization	Y	Y

Table 6.6-1 Potential MWRD Projects Identified in the Lower Des Plaines River DWP Recommended for Water Quality Enhancements in this WBP

The projects listed in Table 6.6-1 have been either identified or recommended in the DWP for water flood control. They are identified in this Plan as projects that have a potential to contain a viable water quality component. The projects envisioned in the DWP will require modification to include a water quality component as they do not as currently recommend in the DWP. The cost to modify the projects identified in the DWP with water quality components has not been included in this Plan. The cost in Table 6.6-1 reflects the cost estimate from the DWP only. It is expected that the incremental cost change to incorporate a water quality component(s) would be relatively low as compared to the overall project costs. The projects highlighted in Table 6.6-1 have been included in the total reach lengths to be restored as described in the synthetic BMP application and have been assessed in the pollutant load reduction discussion for implementation. These reach lengths are part of the overall stream length that is assessed in the STEPL calculations.

6.7 TECHNICAL AND FINANCIAL ASSISTANCE

Implementation of the plan will require substantial resources and partnerships with local, state, and federal organizations to fund planning, design, and implementation. There are many sources of funding program available. Below is a list of various programs available. Most of the programs require a local match of funds or in-kind services.

Illinois EPA Section 319

- Under Section 319, states, territories, and Indian tribes can receive grant money to support a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of projects that have been implemented. Grant provides up to 60% cost-share for eligible projects/activities that reduce nonpoint source pollution.

MWRD Green Infrastructure Assistance Program

- MWRD is committed to providing administrative and technical assistance to communities to facilitate the implementation of green infrastructure projects. MWRD funds projects based on the likelihood of flooding and/or basement backup reduction, number of structures benefitting, project cost, project location with respect to maintenance and outreach opportunities and socio-economic considerations.

MWRD Phase II Stormwater Projects

- In addition to supporting green infrastructure projects, MWRD also supports other stormwater projects through its Phase II stormwater assistance program. Government entities, including municipalities, townships, and county agencies, can apply for funding, engineering, or other MWRD assistance to address local flooding through the MWRD's Phase II Stormwater Management Program. Many of these projects can also provide water quality benefits. The project types under Phase II include the installation or improvement of "gray" infrastructure, localized detention, upsizing critical storm sewers and culverts, pump stations and establishing drainage ways.

EPA Clean Water State Revolving Fund (CWSRF)

- The CWSRF program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality projects. The program funds water quality protection projects for stormwater management, nonpoint source pollution control and estuary management.

National Fish and Wildlife Foundation – Chi-Cal Rivers Fund

- The Chi-Cal Rivers Fund is a public-private partnership working to restore the health, vitality and accessibility of the waterways in the Chicago and Calumet region by supporting green stormwater infrastructure, habitat enhancement, and public-use improvements.

National Fish and Wildlife Foundation – Five Star and Urban Waters Restoration Program

- The Five Star and Urban Waters Restoration Program seeks to develop nationwide community stewardship of local natural resources, preserving these resources for future generations and enhancing habitat for local wildlife. Projects seek to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff, and degraded shorelines caused by development.

Local Program Initiatives

- Communities will have a leadership role in implementing many BMP projects under this plan. Communities can and will seek out grant opportunities to help fund project implementation. In most cases the costs for maintaining BMPs will need to be covered by the project owner/sponsor. And certain high priority projects will need to be implemented even if grant funding cannot be obtained. To have a reliable, steady source of revenue for stormwater projects and maintenance, it is recommended that the communities in the watershed consider establishment of a stormwater utility and fee system. MPC's Steady Streams report provides information on establishment of a stormwater fee system.

6.8 SCHEDULE FOR IMPLEMENTATION

The following schedule is based on an implementation plan executed over the course of the next 25 years to make progress toward the established BMP implementation goals and the associated pollutant loading reduction targets:

2018 - 2019

- Outreach to municipalities and stakeholder groups regarding the components of the plan and Section 319 funding.
- Municipalities and stakeholder groups prepare project plans for beneficial projects, particularly in priority areas, and develop Section 319 grant applications for submittal to Illinois EPA.
- Municipalities and stakeholder groups prepare project plans for beneficial projects, particularly in priority areas, and develop SRF loan application materials for NPS or capital projects that will significantly contribute to watershed improvement.
- Outreach to teachers and schools.
- Work with MWRD to build water quality components into plans/designs for identified flood control projects.
- Track/inventory watershed projects.
- Continue watershed monitoring efforts and expand to the extent funding is available.

2019 - 2027

- Municipalities and stakeholder groups implement project plans where funding has been provided or local governments have appropriated funds.
- On-going outreach to municipalities and stakeholder groups regarding the components of the plan and Section 319 funding.
- Municipalities and stakeholder groups prepare project plans for beneficial projects, particularly in priority areas, and develop Section 319 grant applications for submittal to Illinois EPA.
- Municipalities and stakeholder groups prepare project plans for beneficial projects, particularly in priority areas, and develop SRF loan application materials for NPS or capital projects that will significantly contribute to watershed improvement.
- On-going outreach to teachers and schools. Develop and carry out events for in-service learning.

- MWRD, working with local partners, implements flood control projects which include water quality components.
- Track/inventory watershed projects.
- Continue watershed monitoring efforts.

2028

- Continue activities as above.
- Evaluate Plan implementation. What has worked well? What barriers have been encountered? How have pollutant sources changed? How have water quality conditions changed?
- Update Watershed Plan and submit to Illinois EPA for approval.

2029 - 2037

- Continue implementation activities as laid out in the updated Watershed Plan.
- Track/inventory watershed projects.
- Continue watershed monitoring efforts.

2038

- Continue implementation activities.
- Evaluate Plan implementation. What has worked well? What barriers have been encountered? How have pollutant sources changed? How have water quality conditions changed?
- Update Watershed Plan and submit to Illinois EPA for approval.

2039 - 2042

- Continue implementation activities as laid out in the updated Watershed Plan.
- Track/inventory watershed projects.
- Continue watershed monitoring efforts.

2043

- Evaluate Plan implementation. Have the 25-year goals for BMP implementation efforts and estimated loading reductions been achieved? How have water quality conditions changed?
- Plan next steps.

6.9 EDUCATION AND OUTREACH

The education and outreach component of the plan will be implemented to enhance public understanding and encourage positive behaviors and beneficial budgetary and policy decisions. Community engagement, education, and outreach are essential components of any watershed protection efforts. Such activities are crucial to the implementation of a watershed plan since they:

- Raise awareness of local water resource issues and foster support for solutions;
- Provide tools to help motivate changes in behavior among stakeholders and other targeted audiences;
- Provide engaged stakeholders with the necessary tools to become watershed stewards and help implement the watershed plan;
- Leverage partnerships among stakeholders and other public and private entities to implement watershed recommendations.

Effective education and outreach is crucial to a watershed plan's success since many watershed problems result from human actions and solutions. Also, when constituents understand watershed issues and sources of pollutant loadings there this will lead to increased support for policy changes and investments needed to improve water quality. The education and outreach strategy will encourage continued public participation in selecting, designing, implementing and maintaining the nonpoint source pollution management measures which will be implemented.

Issues within watersheds are often the outcome of many small actions which to an individual or small group may not be understood as a source of degradation to local waterways. Remedies to watershed scale issues are often voluntary and need effective public support and willing participation to yield results. For this to be successful, stakeholders must become engaged in watershed stewardship activities and alter behaviors which adversely affect the watershed. Having a basic understanding of current issues and how both individual and collective actions can contribute toward improving and protecting natural resources helps in both motivating and providing a basis for changing behaviors and addressing watershed issues. Pollutant reduction campaigns across the watershed can be developed by working with watershed groups, community groups, or individuals, and appropriate methods of education and outreach will vary based audience.

6.9.1 Education and Outreach Goals and Objectives

The USEPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (Handbook) was used in the development of the Lower Des Plaines Watershed education and outreach strategy. The Handbook outlines a 6-step approach for developing and implementing an education and outreach program:

1. Define the driving forces, goals and objectives;
2. Identify and analyze the target audience;
3. Create the message;
4. Package the message;
5. Distribute the message; and
6. Evaluate the outreach campaign.

Implementing these 6 steps will allow the watershed stakeholders achieve their education and outreach goals and objectives, and contribute toward watershed restoration and protection goals. The *Handbook* informed and provided a template for the education and outreach components of this plan.

6.9.2 Target Audiences

There are specific audiences to target and partner with for education and outreach activities. These audiences include but are not limited to residents, municipalities, businesses and organizations located or that work within the watershed. Levels of understanding of watershed issues varies across these audiences, so education needs to be tailored accordingly. Likewise, education and outreach should not be a one-time effort, but rather an ongoing occurrence that is mutually beneficial and allows for 2-way communication -- feedback and ideas should be collected from target audiences. The goal is to be receptive to current partners and to attract future partners who have not yet engaged in watershed improvement activities.

Education and outreach partners are expected to include the following entities:

- Local Government Officials and Agencies
  - Continued support from local governments and public landowners will be required to engage in projects on public lands and communicate with residents to encourage participation in watershed improvement. Communities in the watershed will be asked to adopt the watershed plan and participate as part of this education and outreach process.
- Residents
  - It is necessary to inform, educate, and motivate residents and partner with municipal programs across the watershed to achieve its goals.
- Schools and Youth Groups
  - Education programs specifically created for schools and youth groups are necessary to accomplish watershed improvements in the future. School and youth group participation in outdoor activities, such as river cleanups or invasive species control, are excellent ways to engage youth in learning about watershed conditions.
- Developers, Contractors and Consultants
  - This group has the potential to negatively or positively affect the watershed through design and development processes.
  - Already regulated by local ordinances, compliance with a variety of best development standards, regulations, codes and ordinances to protect the watershed will demonstrate a culture for concern of the health for waterways, which will eventually benefit their clients and their product.
  - Consultants and contractors will play a key role in bringing education and outreach messages to their clients through influence for BMPs and watershed improvements.
- Landscapers/Lawn Care and Snow Removal Contractors
  - Contractors tasked with landscape and lawn care, as well as winter snow and ice removal have the potential to make a large impact on improving water quality within the watershed by implementing best management practices. By implementing best practices these enterprises can contribute toward significant reductions in nutrient and chloride loadings to the watershed and positive water quality changes.
  - Communities in the watershed can support education by maintaining registries for landscape, lawn care and winter maintenance providers with pollution reduction programs.
- Non-governmental Organizations
  - Our region has a wealth of non-governmental organizations committed to improved stormwater management, water quality and reduced flooding. Partnering with these agencies will help align goals, projects, resources and overall beneficial impacts for improved watershed conditions.

6.9.3 Partner Organizations

Several education and outreach programs are currently being implemented by other organizations in the Lower Des Plaines River Planning Area that stakeholders can take advantage of. These organizations include the following:

- MWRD
  - With this watershed-based plan being supplemental to the Lower Des Plaines Watershed DWP, MWRD has been a partner with the development of this watershed plan from the

start. The MWRD has provided numerous data sets, mapping tools and information throughout the watershed. In addition, MWRD is responsible for spearheading many improvement projects in the watershed as well as performing on-going stream maintenance and restoration projects while hosting community events. MWRD will continue to convene quarterly WPC meetings to discuss water quality-related topics.

- Lower Des Plaines River Watershed Planning Peer Review Committee
  - This group formed as a function of creating this plan, consists of private consultants, nonprofit groups and governmental organizations to provide technical guidance and input on the watershed plan. Members of the review committee include:
    - Christopher B. Burke Engineering, Ltd.
    - Metropolitan Planning Council
    - Geosyntec Consultants
    - The Sierra Club
    - The Conservation Foundation
    - Forest Preserves of Cook County
    - Cook County Planning and Development
    - Illinois Department of Natural Resources

The varied backgrounds and experience of these members brings valuable insight to the watershed planning process.

- Lower Des Plaines Watershed Group
  - This Group was formed in 2017 to provide local coordination to develop and implement a long-term, comprehensive monitoring program to assess current stream conditions in the watershed and identify the biggest stressors to aquatic life. The Group's assessments will focus on biological indicators of stream health and causes and sources of impairments. Actions to restore habitat and enhance biological communities will be recommended based on the monitoring data. This data-driven approach will enable the Group to make informed management decisions and identify the most cost-effective ways to improve local waterways and meet permit requirements.

- Illinois Environmental Protection Agency (Illinois EPA)
  - As a sponsor, Illinois EPA has provided valuable support in the form of grant funds for watershed planning and detailed review for the Lower Des Plaines watershed resource inventory and watershed-based plan.

- Chicago Metropolitan Agency for Planning (CMAP)
  - CMAP is the land use planning organization for northeastern Illinois. CMAP has provided detailed reviews of watershed documents, providing data, maps, exhibits, and statistics about the watershed. CMAP will play a valuable role improving stormwater management in the coming years through its release of the On-to-2050 regional plan and its Local Technical Assistance (LTA) program.

- Will – South Cook and the North Cook Soil and Water Conservation Districts (Districts)

- In conjunction with Natural Resources Conservation Service (NRCS), the Districts regulate and provide information for compliance with soil erosion and sediment control measures related natural resources.

6.9.4 General Message Guidance

Regional and local decision-makers today are bombarded with information and messages. As a result audiences are selective about what information they take in and even more selective about what information is acted upon. For this reason the education and outreach program needs to be strategic about how messages are formulated and communicated, so that they achieve positive results.

Target audiences will need specifically tailored messages through a variety of delivery methods for the education and outreach program to be effective. To encourage audiences to understand and act upon a key point, single issue messages are often simple and effective and simple. However, water quality improvement has many dimensions and many effects, so messages may sometimes be created to address multiple issues such as linking hydrology and stream health. General guidelines for education and outreach efforts in the Lower Des Plaines watershed include the following:

- Use terms which the public can readily understand and which speak to their values and priorities.
- Keep messages simple and straightforward with only a few key take-home messages. Use graphics and photos to illustrate the message.
- Repeat messages frequently and consistently, sometimes using different media to communicate the message.
- Use community events as an opportunity to communicate messages.
- Highlight connections between messages such as: storms, streams, land management, flooding and the urban landscape and streets.
- When with a target group, focus specifically on the elements of a project which are most applicable to their town, neighborhood, or property.
- Create several messages for topic areas, such as a broad message for the general public and additional targeted messages for specific audiences within the watershed such as landowners, business owners, and municipalities.
- Organize materials and education strategies with partner organizations to combine efforts, share costs, access new networks and create a consistent message.
- Materials and messages should all promote local watershed groups with contact information as well as a brief note on how to get involved.
- Provide background information on watersheds when needed. Certain audiences may benefit from a briefing on biology, the water cycle, and basics of watersheds.
- Share information on websites and in popular public and private locations such as parks, forest preserves, libraries, cafes, grocery shops and municipal administration buildings.

6.9.5 Media and Marketing Campaign

The Lower Des Plaines Planning Area stakeholders do not have funding sources at present to deploy a professional media and/or marketing campaign. However, such a campaign would be an appropriate strategy for several of the listed target audiences. In addition, the following methods have been utilized by other watershed groups and could be considered and used when applicable:

- o Package together a media kit and identify potential media outlets (radio, TV, newspaper, websites, etc.). Seek to take advantage of public service announcements on local TV or radio.
- o Install road signs at stream crossings and at watershed boundaries clearly stating that one is entering the watershed and urging citizens to protect the watershed and/or stream.
- o Implement a public relations and marketing campaign to include advertisements and outreach through newspapers, village newsletters, homeowner association circulars, and community meetings.
- o Post and distribute watershed maps, posters and brochures which include pollution control strategies, current projects, future projects, and fun facts about the watershed.

6.9.6 Public Involvement, Stewardship and Community Event Strategies

The following strategies have been used by other groups to increase the influence of education and outreach messages. Different groups within the watershed may choose to engage in one of more of these activities.

- o Seek to form a “Friends of the Des Plaines River” group similar to Friends of the Chicago River.
- o Look for event opportunities such as river clean-ups, watershed tours, stream walks, rain garden tours, restoration projects, and other participatory learning events.
- o Create an “Adopt-a-River” program with an individual or group accepting responsibility for managing a specific reach.
- o Create and publish a self-led tour of the watershed which notes scenic spots, natural areas, wetlands, trails, and areas of concern such as streambank erosion sites, stormwater outfalls, and urban runoff sites.
- o Publish a directory of outstanding watershed management projects and hold an annual award ceremony for exemplary projects.
- o Establish a form of recognition for watershed improvement efforts of industry, business, schools, citizens, elected officials, and environmental groups which implement watershed improvement projects.
- o Start a storm drain stenciling or button campaign, noting when storm drains lead directly to local water bodies. Distribute door hangers to educate residents on storm drain stenciling efforts.
- o Arrange tours to visit BMP sites and install interpretive signs at BMP installation sites.

Efforts should be made to reach out to local officials and partner organizations to plan events and initiatives and to advertise and communicate about watershed events. Information should also be shared widely through partner organizations about projects underway or completed and other watershed success stories.

6.9.7 Primary and Secondary Education

Stewardship activities targeted for schools and youth programs may include education and outreach activities such as the following:

- o Build a hands-on watershed curriculum which includes watershed ecology and nonpoint source pollution training for teachers, home-based educators, field trips, chemical test kits, nets, sampling equipment, and wildlife identification books. There are potential partnership opportunities with the Soil and Water Conservation Districts for sponsorship.

- Facilitate seminars and workshops for teachers, home-based educators, and/or an annual student congress.
- Maintain a group of trained student and teacher volunteers and create annual service learning opportunities such as clean ups and monitoring for students.

Outreach to school officials and teachers can be planned to prompt these types of initiatives.

6.9.8 Demonstration Projects with Educational Signage

Other watershed groups have installed demonstration projects (bioswales, rain gardens, etc.) coupled with interpretive signage to promote education and outreach. These types of on-the-ground projects can provide watershed improvements as well as provide public outreach and education. Events like ribbon-cutting ceremonies can be used to highlight the beneficial practices. Volunteers can sometimes be enlisted to carry out projects, such as to build a rain garden at a school or park.

6.9.9 Evaluating the Outreach Plan

Measured improvements in water quality in the watershed is the ultimate indicator of the effects of education and outreach and other plan implementation activities. While connecting improvements in water quality to specific programs or activities is quantitatively difficult, it is expected that increased public understanding of improved water quality will support beneficial policy actions and motivate future involvement watershed improvement efforts. For events and activities planned measures of participation and effect will be used to the extent possible, for example tracking numbers of participants at events, volunteer clean-ups, etc. Follow-up surveys can be used selectively to try to ascertain if messages received or events participated in resulted in beneficial watershed actions.

6.9.10 Watershed Information and Education Resources

In addition to this plan, there are numerous resources which provide targeted outreach messages, effective delivery methods, watershed management planning, media relations, and strategies to help in developing a successful outreach campaign. These resources include:

- USEPA Watershed Academy
- USEPA NPS Outreach Toolbox
- The Center for Watershed Protection
- The Illinois River Watershed Partnership

These organizations and resources can be downloaded and customized for the Lower Des Plaines Watershed. Some of the education and outreach methods discussed in this section can be incorporated into established work, projects, and education programs in the watershed, within existing budgets. Some activities (workshops, demonstration projects, and other large-scale actions) may require financial cost-share from public, private, or grant funding sources to support implementation.

6.9.11 Education and Outreach Initiatives

The watershed plan for the Upper Des Plaines River Watershed (Lake County) has suggested a number of education and outreach initiatives that may also be suitable and valuable in Cook County, including:

- Provide Information and training to riparian landowners on best practices for stream and lake shoreline restoration and maintenance that will reduce erosion and increase water quality.
- Continue to educate local municipalities, landowners, and public works staff on road salt alternatives and application BMPs to minimize the use of road salt by public and private snow removal providers.
- Inform homeowners and municipalities about water quality problems associated with sump pump, septic systems, and illicit storm drain hookups.
- Provide information on mosquito prevention measures for individual homeowners, including removing stagnant water in tires, buckets, clogged gutters, etc.
- Inform municipalities, businesses, and homeowner associations about detention basin and stormwater inlet maintenance practices that improve water quality and reduce flooding.
- Provide watershed residents with a report card that illustrates the ecological health of the watershed and reports progress towards watershed goals.
- Support and promote the Conservation at Home program to reduce stormwater runoff.
- Facilitate public training and engage students, teachers, riparian landowners, lake associations, and homeowner associations to volunteer for lake, stream, and natural area stewardship and monitoring of water resources.
- Non-profit organizations choose a school to work with to naturalize open space and implement green infrastructure in schoolyards and parking areas.
- Promote the removal of invasive plants by providing trainings aimed at species identification/control (species such as: phragmities, teasel, garlic mustard, buckthorn).
- Outreach campaign, demonstration site, and workshop promoting the establishment of native plants and proper plant selection.
- Inform homeowner's associations about the importance of funding and maintaining open space in developments and detention basins.
- Include stream name signs at all stream crossings.
- Incorporate watershed signage and information at public properties such as forest preserves, public parks, and public lakes.

CHAPTER 7 PLAN EVALUATION

Monitored water quality within the Lower Des Plaines River watershed is the fundamental indicator of success in implementing measures to restore and protect water quality -- the effects of measures implemented throughout the watershed will ultimately be reflected in changes to water quality. However, the changes will occur slowly over time, and water quality data will be affected by a number of other factors, including water quality in waters flowing into Cook County from upstream areas, weather, and infrastructure projects. Thus, to gauge plan implementation over shorter time horizons and identify plan implementation successes, indicators can be used to track progress. Indicators can include the number and scale of BMP projects planned and implemented, as well as the estimated pollutant loading reductions achieved. Recommended measures and milestones are presented in this section, along with recommendations regarding tracking and monitoring systems.

7.1 MEASUREABLE MILESTONES

The watershed assessment for the Lower Des Plaines River watershed has indicated that the most significant source of pollutant loadings is urban runoff and stormwater. The plan has identified BMP types and target levels of BMP implementation to reduce stormwater volumes and pollutant loadings. The measurable milestones being established to gauge plan implementation reflect the plan's emphasis on BMP implementation.

The table, Table 7.1-1, below sets out measurable milestones by BMP type for each watershed planning unit. The 5-, 10-, and 25-year implementation targets are cumulative numbers. The associated estimated sediment reductions associated with the 25-year goals are also shown for each watershed planning unit.

In addition to establishing milestones for BMP implementation, sediment loading reduction is used here as the metric for plan implementation tracking purposes. This is valid, as sediment/TSS levels in the water bodies are elevated, which contributes to use impairment. In addition, reductions in sediment loadings suggest reductions of loadings of other pollutants present in urban stormwater. As previously noted, sediment loadings also bring with them increased levels of hydrocarbons, organic and inorganic compounds and heavy metals, as sediment particles act as vehicles for these constituents. Reducing sediment loads results in reductions of loadings of other key pollutants. It should also be noted the methodology used to estimate sediment load reductions can also be used to estimate loading reductions for total phosphorus, nitrogen and BOD. This table focuses on sediment as the most useful surrogate or indicator pollutant.

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
CC1 (2785 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	0.78	Ac	0.0	0.1	0.3	0.8	
	Infiltration Trench	52.22	Ac	2.1	8.4	20.9	52.2	
	Oil/Grit Separators	1.29	Ac	0.1	0.2	0.5	1.3	
	Bioretention (Green Roof) @ ~ $	0.96	Ac	0.0	0.2	0.4	1.0	
	Bioretention as Bioswale @ ~ $15/ft²	0.00	Ac	0.0	0.0	0.0	0.0	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	17.38	Ea	0.7	2.8	7.0	17.4	
	Porous Pavement @ ~ $8/ft²	0.04	Ac	0.0	0.0	0.0	0.0	
	Weekly Street Sweeping	0.41	Ac	0.0	0.1	0.2	0.4	
	Water Quality Inlets (does not include maintenance)	0.41	Ea	0.0	0.1	0.2	0.4	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	0.00	Ac	0.0	0.0	0.0	0.0	
	Streambank Stabilization	1101.20	LF	44.0	176.2	440.5	1,101.2	
Subwatershed Total								49
CC2 (1174 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	8.44	Ac	0.3	1.4	3.4	8.4	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	4.15	Ac	0.2	0.7	1.7	4.1	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	2.87	Ac	0.1	0.5	1.1	2.9	
	Weekly Street Sweeping	28.67	Ac	1.1	4.6	11.5	28.7	
	Water Quality Inlets (does not include maintenance)	28.67	Ea	1.1	4.6	11.5	28.7	
	Detention Basin Retrofit - native planting in dry bottom pond	0.32	Ac	0.0	0.1	0.1	0.3	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.02	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	1.91	Ac	0.1	0.3	0.8	1.9	
	Streambank Stabilization	8004.80	LF	320.2	1,280.8	3,201.9	8,004.8	
Subwatershed Total								97
FC1 (7619 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	88.43	Ac	3.5	14.1	35.4	88.4	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Bioretention as Bioswale @ ~ $15/ft²	30.24	Ac	1.2	4.8	12.1	30.2	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	28.41	Ac	1.1	4.5	11.4	28.4	
	Weekly Street Sweeping	284.14	Ac	11.4	45.5	113.7	284.1	
	Water Quality Inlets (does not include maintenance)	284.14	Ea	11.4	45.5	113.7	284.1	
	Detention Basin Retrofit - native planting in dry bottom pond	0.75	Ac	0.0	0.1	0.3	0.7	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.04	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	31.57	Ac	1.3	5.1	12.6	31.6	
	Streambank Stabilization	8550.80	LF	342.0	1,368.1	3,420.3	8,550.8	
Subwatershed Total								802
FC2 (5040 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	45.37	Ac	1.8	7.3	18.1	45.4	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	14.57	Ac	0.6	2.3	5.8	14.6	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	11.33	Ac	0.5	1.8	4.5	11.3	
	Weekly Street Sweeping	113.30	Ac	4.5	18.1	45.3	113.3	
	Water Quality Inlets (does not include maintenance)	113.30	Ea	4.5	18.1	45.3	113.3	
	Detention Basin Retrofit - native planting in dry bottom pond	0.13	Ac	0.0	0.0	0.1	0.1	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.11	Ac	0.0	0.2	0.4	1.1	
	Settling Basins	0.07	*Ac*	0.0	0.0	0.0	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	50.53	Ac	2.0	8.1	20.2	50.5	
	Streambank Stabilization	21906.00	LF	876.2	3,505.0	8,762.4	21,906.0	
Subwatershed Total								1,423
FD (1733 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	14.38	Ac	0.6	2.3	5.8	14.4	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft²	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	6.16	Ac	0.2	1.0	2.5	6.2	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	4.19	Ac	0.2	0.7	1.7	4.2	
	Weekly Street Sweeping	41.91	Ac	1.7	6.7	16.8	41.9	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Water Quality Inlets (does not include maintenance)	41.91	Ea	1.7	6.7	16.8	41.9	
	Detention Basin Retrofit - native planting in dry bottom pond	0.16	Ac	0.0	0.0	0.1	0.2	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.06	Ac	0.0	0.2	0.4	1.1	
	Settling Basins	0.07	*Ac*	0.0	0.0	0.0	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	7.60	Ac	0.3	1.2	3.0	7.6	
	Streambank Stabilization	4566.40	LF	182.7	730.6	1,826.6	4,566.4	
Subwatershed Total								53
GCT (356 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	1.96	Ac	0.1	0.3	0.8	2.0	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	0.78	Ac	0.0	0.1	0.3	0.8	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	0.61	Ac	0.0	0.1	0.2	0.6	
	Weekly Street Sweeping	6.09	Ac	0.2	1.0	2.4	6.1	
	Water Quality Inlets (does not include maintenance)	6.09	Ea	0.2	1.0	2.4	6.1	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	65.67	*Ac*	2.6	10.5	26.3	65.7	
	Wetland Restoration	1.29	Ac	0.1	0.2	0.5	1.3	
	Streambank Stabilization	2213.20	LF	88.5	354.1	885.3	2,213.2	
Subwatershed Total								8
HC (4216 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	14.47	Ac	0.6	2.3	5.8	14.5	
	Infiltration Trench	163.77	Ac	6.6	26.2	65.5	163.8	
	Oil/Grit Separators	23.84	Ac	1.0	3.8	9.5	23.8	
	Bioretention (Green Roof) @ ~ $30/ft2	17.88	Ac	0.7	2.9	7.2	17.9	
	Bioretention as Bioswale @ ~ $15/ft²	12.02	Ac	0.5	1.9	4.8	12.0	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	322.15	Ea	12.9	51.5	128.9	322.2	
	Porous Pavement @ ~ $8/ft²	7.14	Ac	0.3	1.1	2.9	7.1	
	Weekly Street Sweeping	71.37	Ac	2.9	11.4	28.5	71.4	
	Water Quality Inlets (does not include maintenance)	71.37	Ea	2.9	11.4	28.5	71.4	
	Detention Basin Retrofit - native planting in dry bottom pond	0.08	Ac	0.0	0.0	0.0	0.1	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.13	Ac	0.0	0.2	0.5	1.1	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Settling Basins	0.07	*Ac*	0.0	0.0	0.0	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	30.08	Ac	1.2	4.8	12.0	30.1	
	Streambank Stabilization	12433.60	LF	497.3	1,989.4	4,973.4	12,433.6	
Subwatershed Total								332
LDP1 (5452 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	32.61	Ac	1.3	5.2	13.0	32.6	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	12.87	Ac	0.5	2.1	5.1	12.9	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	7.79	Ac	0.3	1.2	3.1	7.8	
	Weekly Street Sweeping	77.87	Ac	3.1	12.5	31.1	77.9	
	Water Quality Inlets (does not include maintenance)	77.87	Ea	3.1	12.5	31.1	77.9	
	Detention Basin Retrofit - native planting in dry bottom pond	0.05	Ac	0.0	0.0	0.0	0.1	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	2.04	Ac	0.1	0.3	0.8	2.0	
	Settling Basins	0.13	*Ac*	0.0	0.0	0.1	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	3.35	*Ac*	0.1	0.5	1.3	3.3	
	Wetland Restoration	65.61	Ac	2.6	10.5	26.2	65.6	
	Streambank Stabilization	7749.20	LF	310.0	1,239.9	3,099.7	7,749.2	
Subwatershed Total								713
LDP2 (3525 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	7.11	Ac	0.3	1.1	2.8	7.1	
	Infiltration Trench	128.36	Ac	5.1	20.5	51.3	128.4	
	Oil/Grit Separators	14.65	Ac	0.6	2.3	5.9	14.6	
	Bioretention (Green Roof) @ ~ $30/ft2	10.98	Ac	0.4	1.8	4.4	11.0	
	Bioretention as Bioswale @ ~ $15/ft²	5.19	Ac	0.2	0.8	2.1	5.2	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	197.93	Ea	7.9	31.7	79.2	197.9	
	Porous Pavement @ ~ $8/ft²	2.97	Ac	0.1	0.5	1.2	3.0	
	Weekly Street Sweeping	29.70	Ac	1.2	4.8	11.9	29.7	
	Water Quality Inlets (does not include maintenance)	29.70	Ea	1.2	4.8	11.9	29.7	
	Detention Basin Retrofit - native planting in dry bottom pond	0.04	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.14	Ac	0.0	0.2	0.5	1.1	
	Settling Basins	0.07	*Ac*	0.0	0.0	0.0	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	1.66	*Ac*	0.1	0.3	0.7	1.7	
	Wetland Restoration	39.80	Ac	1.6	6.4	15.9	39.8	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Streambank Stabilization	9400.80	LF	376.0	1,504.1	3,760.3	9,400.8	
Subwatershed Total								1,157
LDP3 (7144 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	63.89	Ac	2.6	10.2	25.6	63.9	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	25.76	Ac	1.0	4.1	10.3	25.8	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	18.36	Ac	0.7	2.9	7.3	18.4	
	Weekly Street Sweeping	183.60	Ac	7.3	29.4	73.4	183.6	
	Water Quality Inlets (does not include maintenance)	183.60	Ea	7.3	29.4	73.4	183.6	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	63.23	Ac	2.5	10.1	25.3	63.2	
	Streambank Stabilization	10384.40	LF	415.4	1,661.5	4,153.8	10,384.4	
Subwatershed Total								1,444
LDP4 (4650 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	40.22	Ac	1.6	6.4	16.1	40.2	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	18.50	Ac	0.7	3.0	7.4	18.5	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	12.59	Ac	0.5	2.0	5.0	12.6	
	Weekly Street Sweeping	125.88	Ac	5.0	20.1	50.4	125.9	
	Water Quality Inlets (does not include maintenance)	125.88	Ea	5.0	20.1	50.4	125.9	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.18	Ac	0.0	0.0	0.1	0.2	
	Settling Basins	0.01	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	16.18	Ac	0.6	2.6	6.5	16.2	
	Streambank Stabilization	4972.00	LF	198.9	795.5	1,988.8	4,972.0	
Subwatershed Total								1,150

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
LDP5 (4067 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	10.37	Ac	0.4	1.7	4.1	10.4	
	Infiltration Trench	122.53	Ac	4.9	19.6	49.0	122.5	
	Oil/Grit Separators	13.35	Ac	0.5	2.1	5.3	13.3	
	Bioretention (Green Roof) @ ~ $30/ft2	27.05	Ac	1.1	4.3	10.8	27.1	
	Bioretention as Bioswale @ ~ $15/ft²	8.53	Ac	0.3	1.4	3.4	8.5	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	66.73	Ea	2.7	10.7	26.7	66.7	
	Porous Pavement @ ~ $8/ft²	4.33	Ac	0.2	0.7	1.7	4.3	
	Weekly Street Sweeping	43.31	Ac	1.7	6.9	17.3	43.3	
	Water Quality Inlets (does not include maintenance)	43.31	Ea	1.7	6.9	17.3	43.3	
	Detention Basin Retrofit - native planting in dry bottom pond	0.47	Ac	0.0	0.1	0.2	0.5	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.46	Ac	0.0	0.1	0.2	0.5	
	Settling Basins	0.06	*Ac*	0.0	0.0	0.0	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	2.64	*Ac*	0.1	0.4	1.1	2.6	
	Wetland Restoration	49.61	Ac	2.0	7.9	19.8	49.6	
	Streambank Stabilization	12372.00	LF	494.9	1,979.5	4,948.8	12,372.0	
Subwatershed Total								1,624
LDP6 (3748 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	44.93	Ac	1.8	7.2	18.0	44.9	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	20.15	Ac	0.8	3.2	8.1	20.1	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	18.71	Ac	0.7	3.0	7.5	18.7	
	Weekly Street Sweeping	187.13	Ac	7.5	29.9	74.9	187.1	
	Water Quality Inlets (does not include maintenance)	187.13	Ea	7.5	29.9	74.9	187.1	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.01	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	0.04	Ac	0.0	0.0	0.0	0.0	
	Streambank Stabilization	0.00	LF	0.0	0.0	0.0	0.0	
Subwatershed Total								23
LDP 7 (4942 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	46.89	Ac	1.9	7.5	18.8	46.9	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	21.68	Ac	0.9	3.5	8.7	21.7	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	16.16	Ac	0.6	2.6	6.5	16.2	
	Weekly Street Sweeping	161.58	Ac	6.5	25.9	64.6	161.6	
	Water Quality Inlets (does not include maintenance)	161.58	Ea	6.5	25.9	64.6	161.6	
	Detention Basin Retrofit - native planting in dry bottom pond	0.07	Ac	0.0	0.0	0.0	0.1	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.01	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	17.00	Ac	0.7	2.7	6.8	17.0	
	Streambank Stabilization	6506.40	LF	260.3	1,041.0	2,602.6	6,506.4	
Subwatershed Total								1,505
LDP8 (3359 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	21.57	Ac	0.9	3.5	8.6	21.6	
	Infiltration Trench	118.01	Ac	4.7	18.9	47.2	118.0	
	Oil/Grit Separators	12.38	Ac	0.5	2.0	5.0	12.4	
	Bioretention (Green Roof) @ ~ $30/ft2	9.28	Ac	0.4	1.5	3.7	9.3	
	Bioretention as Bioswale @ ~ $15/ft²	8.49	Ac	0.3	1.4	3.4	8.5	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	167.28	Ea	6.7	26.8	66.9	167.3	
	Porous Pavement @ ~ $8/ft²	4.22	Ac	0.2	0.7	1.7	4.2	
	Weekly Street Sweeping	42.17	Ac	1.7	6.7	16.9	42.2	
	Water Quality Inlets (does not include maintenance)	42.17	Ea	1.7	6.7	16.9	42.2	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.15	Ac	0.0	0.0	0.1	0.1	
	Settling Basins	0.01	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	24.15	Ac	1.0	3.9	9.7	24.1	
	Streambank Stabilization	9363.20	LF	374.5	1,498.1	3,745.3	9,363.2	
Subwatershed Total					2,751	963	4,791	1,435
LDP9 (5733 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	26.96	Ac	1.1	4.3	10.8	27.0	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	13.21	Ac	0.5	2.1	5.3	13.2	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	6.85	Ac	0.3	1.1	2.7	6.8	
	Weekly Street Sweeping	68.47	Ac	2.7	11.0	27.4	68.5	
	Water Quality Inlets (does not include maintenance)	68.47	Ea	2.7	11.0	27.4	68.5	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.23	Ac	0.0	0.2	0.5	1.2	
	Settling Basins	0.07	*Ac*	0.0	0.0	0.0	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	76.10	Ac	3.0	12.2	30.4	76.1	
	Streambank Stabilization	25264.40	LF	1,010.6	4,042.3	10,105.8	25,264.4	
Subwatershed Total								1,197
LDP10 (1729 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	14.56	Ac	0.6	2.3	5.8	14.6	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	3.29	Ac	0.1	0.5	1.3	3.3	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	2.56	Ac	0.1	0.4	1.0	2.6	
	Weekly Street Sweeping	25.61	Ac	1.0	4.1	10.2	25.6	
	Water Quality Inlets (does not include maintenance)	25.61	Ea	1.0	4.1	10.2	25.6	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.20	Ac	0.0	0.0	0.1	0.2	
	Settling Basins	0.01	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	51.03	Ac	2.0	8.2	20.4	51.0	
	Streambank Stabilization	4779.60	LF	191.2	764.7	1,911.8	4,779.6	
Subwatershed Total								177
LDP11 (8137 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	48.05	Ac	1.9	7.7	19.2	48.0	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	20.08	Ac	0.8	3.2	8.0	20.1	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	12.14	Ac	0.5	1.9	4.9	12.1	
	Weekly Street Sweeping	121.42	Ac	4.9	19.4	48.6	121.4	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Water Quality Inlets (does not include maintenance)	121.42	Ea	4.9	19.4	48.6	121.4	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.80	Ac	0.0	0.1	0.3	0.8	
	Settling Basins	0.05	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	5.42	*Ac*	0.2	0.9	2.2	5.4	
	Wetland Restoration	176.52	Ac	7.1	28.2	70.6	176.5	
	Streambank Stabilization	6215.20	LF	248.6	994.4	2,486.1	6,215.2	
Subwatershed Total								58
LDP12 (3213 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	10.08	Ac	0.4	1.6	4.0	10.1	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	10.08	Ac	0.4	1.6	4.0	10.1	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	6.20	Ac	0.2	1.0	2.5	6.2	
	Weekly Street Sweeping	62.04	Ac	2.5	9.9	24.8	62.0	
	Water Quality Inlets (does not include maintenance)	62.04	Ea	2.5	9.9	24.8	62.0	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	3.33	*Ac*	0.1	0.5	1.3	3.3	
	Wetland Restoration	135.54	Ac	5.4	21.7	54.2	135.5	
	Streambank Stabilization	3367.20	LF	134.7	538.8	1,346.9	3,367.2	
Subwatershed Total								61
MC (6465 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	64.86	Ac	2.6	10.4	25.9	64.9	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	22.14	Ac	0.9	3.5	8.9	22.1	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	18.18	Ac	0.7	2.9	7.3	18.2	
	Weekly Street Sweeping	181.76	Ac	7.3	29.1	72.7	181.8	
	Water Quality Inlets (does not include maintenance)	181.76	Ea	7.3	29.1	72.7	181.8	
	Detention Basin Retrofit - native planting in dry bottom pond	0.41	Ac	0.0	0.1	0.2	0.4	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.98	Ac	0.1	0.3	0.8	2.0	
	Settling Basins	0.14	*Ac*	0.0	0.0	0.1	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	30.94	Ac	1.2	4.9	12.4	30.9	
	Streambank Stabilization	23572.80	LF	942.9	3,771.6	9,429.1	23,572.8	
Subwatershed Total								353
PCFC (2835 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	23.38	Ac	0.9	3.7	9.4	23.4	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	7.99	Ac	0.3	1.3	3.2	8.0	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	0.00	Ac	0.0	0.0	0.0	0.0	
	Weekly Street Sweeping	56.98	Ac	2.3	9.1	22.8	57.0	
	Water Quality Inlets (does not include maintenance)	56.98	Ea	2.3	9.1	22.8	57.0	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	13.88	Ac	0.6	2.2	5.6	13.9	
	Streambank Stabilization	7081.60	LF	283.3	1,133.1	2,832.6	7,081.6	
Subwatershed Total								48
WEC (12010 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	124.50	Ac	5.0	19.9	49.8	124.5	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	47.75	Ac	1.9	7.6	19.1	47.7	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	38.16	Ac	1.5	6.1	15.3	38.2	
	Weekly Street Sweeping	381.60	Ac	15.3	61.1	152.6	381.6	
	Water Quality Inlets (does not include maintenance)	381.60	Ea	15.3	61.1	152.6	381.6	
	Detention Basin Retrofit - native planting in dry bottom pond	1.04	Ac	0.0	0.2	0.4	1.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	1.13	Ac	0.0	0.2	0.5	1.1	
	Settling Basins	0.13	*Ac*	0.0	0.0	0.1	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
	Wetland Restoration	19.05	Ac	0.8	3.0	7.6	19.1	
	Streambank Stabilization	11817.60	LF	472.7	1,890.8	4,727.0	11,817.6	
Subwatershed Total								627
WIC1 (3897 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	12.96	Ac	0.5	2.1	5.2	13.0	
	Infiltration Trench	244.17	Ac	9.8	39.1	97.7	244.2	
	Oil/Grit Separators	53.00	Ac	2.1	8.5	21.2	53.0	
	Bioretention (Green Roof) @ ~ $30/ft2	39.75	Ac	1.6	6.4	15.9	39.7	
	Bioretention as Bioswale @ ~ $15/ft²	9.30	Ac	0.4	1.5	3.7	9.3	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	716.17	Ea	28.6	114.6	286.5	716.2	
	Porous Pavement @ ~ $8/ft²	8.74	Ac	0.3	1.4	3.5	8.7	
	Weekly Street Sweeping	87.37	Ac	3.5	14.0	34.9	87.4	
	Water Quality Inlets (does not include maintenance)	87.37	Ea	3.5	14.0	34.9	87.4	
	Detention Basin Retrofit - native planting in dry bottom pond	1.19	Ac	0.0	0.2	0.5	1.2	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.35	Ac	0.0	0.1	0.1	0.4	
	Settling Basins	0.09	*Ac*	0.0	0.0	0.0	0.1	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	21.90	Ac	0.9	3.5	8.8	21.9	
	Streambank Stabilization	0.00	LF	0.0	0.0	0.0	0.0	
Subwatershed Total								50
WIC2 (2534 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	0.00	Ac	0.0	0.0	0.0	0.0	
	Infiltration Trench	0.00	Ac	0.0	0.0	0.0	0.0	
	Oil/Grit Separators	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention (Green Roof) @ ~ $30/ft2	0.00	Ac	0.0	0.0	0.0	0.0	
	Bioretention as Bioswale @ ~ $15/ft²	0.00	Ac	0.0	0.0	0.0	0.0	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	0.00	Ea	0.0	0.0	0.0	0.0	
	Porous Pavement @ ~ $8/ft²	0.00	Ac	0.0	0.0	0.0	0.0	
	Weekly Street Sweeping	0.00	Ac	0.0	0.0	0.0	0.0	
	Water Quality Inlets (does not include maintenance)	0.00	Ea	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.00	Ac	0.0	0.0	0.0	0.0	
	Settling Basins	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	0.00	Ac	0.0	0.0	0.0	0.0	
	Streambank Stabilization	0.00	LF	0.0	0.0	0.0	0.0	

Planning Unit ID	BMP	Amount	Unit	2-Year Goal	5-Year Goal	10-Year Goal	25-Year Goal	Sediment Reduction Acheievd (tons/yr) by Year 25
Subwatershed Total								0
WIC3 (1968 acres)	*Bioretention (Rain Gardens / Planter Boxes / Landscaped Medians) @ ~ $4/ft2*	6.69	Ac	0.3	1.1	2.7	6.7	
	Infiltration Trench	76.63	Ac	3.1	12.3	30.7	76.6	
	Oil/Grit Separators	5.22	Ac	0.2	0.8	2.1	5.2	
	Bioretention (Green Roof) @ ~ $30/ft2	3.92	Ac	0.2	0.6	1.6	3.9	
	Bioretention as Bioswale @ ~ $15/ft²	5.54	Ac	0.2	0.9	2.2	5.5	
	Cistern (10,000 Gal Tank/ 0.37 Ac)	70.54	Ea	2.8	11.3	28.2	70.5	
	Porous Pavement @ ~ $8/ft²	4.66	Ac	0.2	0.7	1.9	4.7	
	Weekly Street Sweeping	46.64	Ac	1.9	7.5	18.7	46.6	
	Water Quality Inlets (does not include maintenance)	46.64	Ea	1.9	7.5	18.7	46.6	
	Detention Basin Retrofit - native planting in dry bottom pond	0.00	Ac	0.0	0.0	0.0	0.0	
	Detention Basin Retrofit - wet bottom pond restoration and bank enhancement	0.40	Ac	0.0	0.1	0.2	0.4	
	Settling Basins	0.02	*Ac*	0.0	0.0	0.0	0.0	
	Vegetated Filter Strips @ ~ $3/ft²	0.00	*Ac*	0.0	0.0	0.0	0.0	
	Wetland Restoration	5.12	Ac	0.2	0.8	2.0	5.1	
	Streambank Stabilization	8732.80	LF	349.3	1,397.2	3,493.1	8,732.8	
Subwatershed Total								100

Table 7.1-1 Measurable Milestones for 2-, 5-, 10-, and 25-year Goals –Lower Des Plaines Planning Area

7.2 MEASURING PROGRESS AND MONITORING EFFECTIVNESS

7.2.1 Tracking Plan Implementation

Reflecting discussions with MWRD and other watershed stakeholders, this plan identifies two primary mechanisms to track plan implementation over time:

(1) Many of the capital/BMP projects envisioned in this plan will need to be permitted under the MWRD WMO. MWRD has a database of permit actions. The database includes information such as BMP type and size and location as a function of the WMO requirements with respect to volume control and detention for new and redevelopment. A principal means of tracking plan implementation will be to periodically pull reports for permitted projects in the Lower Des Plaines River watershed. This will capture the majority of stormwater BMP projects and allow for a check to see to what extent the milestones in table 7.1-1 are being met. In this way MWRD can be aware of all the projects in the watershed.

(2) MWRD will include an agenda item in each quarterly Watershed Planning Council meeting to discuss project ideas and capture projects in process or completed. Watershed communities and other stakeholders can report on their projects, some of which may be small or otherwise

be of a nature that a WMO permit was not required. This will allow for projects to be tracked even if the project is not in the WMO permit database.

The cumulative expanse of projects completed can be compared to the table of milestones to determine if implementation is proceeding generally on schedule.

Communities that are MS4 communities and are subject to the State-wide MS4 general permit will also be tracking implementation of stormwater-related projects. This will include structural/on-the-ground projects as well as non-structural practices such as street sweeping. This is also a requirement of the State-wide MS4 general permit where an annual report outlining milestones for BMP implementation is required.

Participation in watershed protection events, trainings, workshops, and other outreach activities can be measured by event organizers. The effects of outreach activities will be selectively evaluated through surveys or other means. This includes encouragement of municipalities to allocate funding toward improving water quality.

7.3 CURRENT WATER QUALITY MONITORING EFFORTS AND FUTURE EFFORTS

The ultimate indicator of the effects of plan implementation will be changes in water quality. Recognizing that changes will occur slowly over time, and water quality data will be affected by a number of other factors, monitoring is nevertheless critical to understand conditions and identify changes. State-conducted monitoring has been very important to characterizing water quality in the Lower Des Plaines River watershed, including monitoring that has been carried out in the development of the 303(d) list of impaired waters. It will be valuable for the State to carry out monitoring in the watershed on a periodic basis, to the extent resources allow, to keep 303(d) listings up-to-date. If a segment(s) can be de-listed that will be a direct indicator that water quality has improved.

Biological monitoring would be a valuable complement to monitoring of chemical water quality. The Illinois DNR conducts monitoring at strategic locations to check for the presence of invasive species. It may be possible to draw out information about biological abundance and diversity from this sampling, if full biological surveys or the mainstem or tributaries are not practicable.

It is expected that the Lower Des Plaines Watershed Group will be conducting monitoring in sub-watershed areas in Will and DuPage Counties in 2018, and in some areas in Cook County in 2019. This monitoring will include testing for pollutant concentrations, assessments of physical conditions/ habitat, and assessment of biological communities. This monitoring will be extremely valuable for further assessing water quality conditions and planning restoration projects, especially as related to improving habitat.

As noted in Chapter 3, MWRD has been monitoring water quality constituents as part of its Ambient Water Quality Monitoring in the planning area since 2001. It will be valuable for the District to continue these monitoring efforts at as many stations as is feasible. The data on TSS, nutrients, DO, bacteria, and chlorides will be indicative of overall water quality and may reveal material results from BMP implementation.

There is a good amount data generated nationally on the effectiveness of BMPs. However, few studies have been done in the Lower Des Plaines River watershed. Studies of the performance of typical individual BMPs will be useful to determine locally the extent to which BMPs are performing as expected. Monitoring and observation of BMPs will also be valuable to assess if maintenance is occurring and if BMP performance is continuing over time.

CHAPTER 8 CONCLUSION

This watershed-based plan for the Lower Des Plaines River planning area is a comprehensive overview of the water quality conditions in the watershed and measures that need to be implemented to restore and protect water quality.

The analysis of water quality conditions and pollutant loadings reveals that stormwater discharges are the primary source of loadings of key pollutants. This is not surprising -- the planning area is approximately 86% developed excluding the forest preserves and open space areas. As would be expected in an urbanized watershed, much of the land area is covered with impervious surfaces. Much of the development in the watershed occurred prior to 1970's and stormwater control measures were not integrated into the areas. The overall land use characteristics and impervious surfaces and the fairly minimal stormwater controls result in high volumes of stormwater runoff and significant pollutant loadings.

Reflecting the identified sources of pollutant loadings, the plan recommends BMPs to better manage urban runoff and stormwater. Many of the recommended BMPs will have the function of intercepting and treating runoff, including green infrastructure practices. Green infrastructure practices including rain gardens, bioswales, permeable pavements and green roofs, capture and treat runoff, resulting in reduced stormwater volumes and reduced pollutant loads. The plan also notes the importance of non-structural controls, including but not limited to measures that communities will carry out in conformance with MS4 permit provisions. Enhanced de-icing practices will be critically important for reducing chloride loadings.

An aggressive level of BMP implementation will be needed to achieve substantial pollutant load reductions. The plan proposes a target degree of BMP implementation. Specifically the plan recommends that 20% of the land areas with the different land uses/land covers in the watershed will have BMPs applied. This is the degree of implementation expected to be practicable, given public vs. private land ownership, budgets, community-buy-in, and other factors. The watershed planning units contributing the greatest loadings are identified in the plan; these should be areas of focus for BMP implementation.

The plan identifies recommended BMPs to address the different land covers and sources of pollution from runoff within the watershed. It should be noted that the plan identifies *types* of BMPs that would address the sources of loadings, but does not list or *prescribe* specific BMPs in specific places. The sizes and designs of BMPs and the optimal places for BMPs will need to be determined by communities and other stakeholders taking into account where benefits will be the greatest but also numerous factors including land ownership, budgets, community buy-in, and how maintenance will be assured. Also, new concepts or designs for BMPs may be developed during the plan implementation period. The plan intends there be flexibility to incorporate new BMP concepts if they cost-effectively reduce pollutant loadings from urban runoff and stormwater discharges.

The plan models and quantifies the effects (i.e., the loading reductions) that would be achieved with a typical and suitable mix of BMPs within the watershed planning units, and the associated costs. Because of the size of the watershed and the amount of developed area, the 20% target implementation level represents a fairly immense scale of BMP implementation. The costs will be significant. This can be considered a *stretch goal*, that is an ambitious goal that will need to be pursued incrementally.

However, with creative thinking and strong resolve on the part of watershed decision-makers, businesses, and residents, significant progress can be made toward a healthy watershed that can be appreciated and enjoyed by all.

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APPENDIX 1 BMPS APPLIED WITHIN EACH WATERSHED PLANNING UNIT

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Subarea CC1 (O'Hare)																	
Commercial 2%	47.17	9.43			0.49	32.58	0.94	0.71	4.72	0.03	0.27	0.27					
Industrial 1%	17.15	3.43			0.29	19.64	0.34	0.26	1.72	0.01	0.14	0.14					
ROW	68.00	13.60		0													
Subarea CC2																	
Residential 31%	358.03	71.61	4.30							1.39	13.89	13.89					
Trans/Comm/Util/Waste 33%	387.83	77.57								1.48	14.78	14.78					
ROW	224.00	44.80		4													
Wetland - Residential	0.99	0.20															0.20
Wetland - Commercial	0.05	0.01															0.01
Wetland - Institutional	0.02	0.00															0.00
Wetland - Industrial	0.27	0.05															0.05
Wetland - Trans/Comm/Util/Waste	1.26	0.25															0.25
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	5.99	1.20															1.20
Wetland - Vacant	0.10	0.02															0.02
Wetland - Water	0.06	0.01															0.01
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	0.79	0.16															0.16
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	1.61	0.32											0.32		0.02		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	40024.00	8004.80															
Subarea FC1																	
Residential 64%	4849.03	969.81	58.19							20.90	209.02	209.02					
Trans/Comm/Util/Waste 23%	1752.70	350.54								7.51	75.12	75.12					
ROW	1633.00	326.60		30													
Wetland - Residential	105.44	21.09															21.09
Wetland - Commercial	1.18	0.24															0.24
Wetland - Institutional	1.17	0.23															0.23
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	8.39	1.68															1.68
Wetland - Cropland	0.11	0.02															0.02
Wetland - Open Space	32.50	6.50															6.50
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	1.91	0.38															0.38
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	7.17	1.43															1.43
Dry Detention - Residential	3.16	0.63											0.63		0.04		
Dry Detention - Commercial	0.59	0.12											0.12		0.01		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	42754.00	8550.80															

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Subarea FC2																	
Residential 51%	2567.07	513.41	30.80							8.03	80.25	80.25					
Trans/Comm/Util/Waste 21%	1074.88	214.98								3.30	33.04	33.04					
ROW	786.78	157.36		15													
Wetland - Residential	120.00	24.00															24.00
Wetland - Commercial	22.75	4.55															4.55
Wetland - Institutional	0.90	0.18															0.18
Wetland - Industrial	17.08	3.42															3.42
Wetland - Trans/Comm/Util/Waste	54.88	10.98															10.98
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	24.93	4.99															4.99
Wetland - Vacant	3.18	0.64															0.64
Wetland - Water	2.96	0.59															0.59
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	5.97	1.19															1.19
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.67	0.13											0.13		0.01		
Wet Detention - Residential	4.86	0.97												0.97	0.06		
Wet Detention - Commercial	0.71	0.14												0.14	0.01		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	109530.00	21906.00															
Subarea FD																	
Residential 40%	684.71	136.94	8.22							2.66	26.61	26.61					
Trans/Comm/Util/Waste 23%	397.35	79.47								1.53	15.30	15.30					
ROW	332.65	66.53		6													
Wetland - Residential	7.93	1.59															1.59
Wetland - Commercial	8.80	1.76															1.76
Wetland - Institutional	2.58	0.52															0.52
Wetland - Industrial	3.97	0.79															0.79
Wetland - Trans/Comm/Util/Waste	4.07	0.81															0.81
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	10.10	2.02															2.02
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	0.00	0.00															0.00
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	0.53	0.11															0.11
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.17	0.03											0.03		0.00		
Dry Detention - Institutional	0.62	0.12											0.12		0.01		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	1.98	0.40												0.40	0.02		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.98	0.20												0.20	0.01		
Wet Detention - Trans/Comm/Util/Waste	2.34	0.47												0.47	0.03		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	22832.00	4566.40															
Subarea GCT																	
Residential 27%	97.84	19.57	1.17							0.23	2.28	2.28					
Open Space 45%	191.65	38.33								0.38	3.81	3.81				65.67	

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
ROW	42.31	8.46		1													
Wetland - Residential	0.16	0.03															0.03
Wetland - Commercial	0.00	0.00															0.00
Wetland - Institutional	0.00	0.00															0.00
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	0.00	0.00															0.00
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	6.11	1.22															1.22
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	0.00	0.00															0.00
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	0.18	0.04															0.04
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	11066.00	2213.20															
Subarea HC																	
Industrial 28%	1191.97	238.39			2.46	163.77	23.84	17.88	119.20	3.63	36.33	36.33					
Trans/Comm/Util/Waste 27%	1121.09	224.22								3.50	35.04	35.04					
ROW	648.83	129.77		12													
Wetland - Residential	23.70	4.74															4.74
Wetland - Commercial	22.98	4.60															4.60
Wetland - Institutional	4.02	0.80															0.80
Wetland - Industrial	13.22	2.64															2.64
Wetland - Trans/Comm/Util/Waste	54.62	10.92															10.92
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	22.55	4.51															4.51
Wetland - Vacant	5.36	1.07															1.07
Wetland - Water	0.63	0.13															0.13
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	3.34	0.67															0.67
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.41	0.08											0.08		0.0050		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	1.54	0.31												0.31	0.02		
Wet Detention - Commercial	0.35	0.07												0.07	0.004		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	1.44	0.29												0.29	0.02		
Wet Detention - Trans/Comm/Util/Waste	2.34	0.47												0.47	0.03		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	62168.00	12433.60															
Subarea LDP1																	
Residential 30%	1644.66	328.93	19.74							4.17	41.71	41.71					
Forest 26%	1432.61	286.52								3.62	36.15	36.15				3.35	
ROW	695.23	139.05		13													
Wetland - Residential	36.98	7.40															7.40
Wetland - Commercial	15.75	3.15															3.15
Wetland - Institutional	0.00	0.00															0.00

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Wetland - Industrial	3.64	0.73															0.73
Wetland - Trans/Comm/Util/Waste	7.89	1.58															1.58
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	260.67	52.13															52.13
Wetland - Vacant	0.61	0.12															0.12
Wetland - Water	0.00	0.00															0.00
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	2.52	0.50															0.50
Dry Detention - Residential	0.27	0.05											0.05		0.003		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	6.86	1.37												1.37	0.08		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.53	0.11												0.11	0.01		
Wet Detention - Industrial	2.45	0.49												0.49	0.03		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.35	0.07												0.07	0.004		
Streambank Length	38746.00	7749.20															
Subarea LDP2																	
Institutional 21%	732.33	146.47			1.93	128.36	14.65	10.98	73.23	1.18	11.77	11.77					
Forest 32%	1133.74	226.75								1.79	17.93	17.93				1.66	
ROW	280.16	56.03		5													
Wetland - Residential	2.65	0.53															0.53
Wetland - Commercial	2.32	0.46															0.46
Wetland - Institutional	27.17	5.43															5.43
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	7.89	1.58															1.58
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	134.80	26.96															26.96
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	22.75	4.55															4.55
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	1.41	0.28															0.28
Dry Detention - Residential	0.21	0.04											0.04		0.003		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.68	0.14												0.14	0.008		
Wet Detention - Commercial	2.45	0.49												0.49	0.03		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	2.57	0.51												0.51	0.03		
Streambank Length	47004.00	9400.80															
Subarea LDP3																	
Residential 44%	3177.87	635.57	38.13							12.24	122.40	122.40					
Trans/Comm/Util/Waste 22%	1558.60	311.72								6.12	61.20	61.20					
ROW	1390.91	278.18		26													
Wetland - Residential	10.03	2.01															2.01
Wetland - Commercial	0.30	0.06															0.06
Wetland - Institutional	1.42	0.28															0.28
Wetland - Industrial	0.18	0.04															0.04
Wetland - Trans/Comm/Util/Waste	1.91	0.38															0.38
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	217.60	43.52															43.52

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Wetland - Vacant	0.07	0.01															0.01
Wetland - Water	81.89	16.38															16.38
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	2.77	0.55															0.55
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	51922.00	10384.40															
Subarea LDP4																	
Residential 39%	1809.83	361.97	21.72							7.79	77.93	77.93					
Trans/Comm/Util/Waste 24%	1132.61	226.52								4.80	47.95	47.95					
ROW	999.05	199.81		19													
Wetland - Residential	0.40	0.08															0.08
Wetland - Commercial	0.37	0.07															0.07
Wetland - Institutional	0.00	0.00															0.00
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	0.65	0.13															0.13
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	68.13	13.63															13.63
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	10.26	2.05															2.05
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	1.10	0.22															0.22
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.90	0.18												0.18	0.01		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	24860.00	4972.00															
Subarea LDP5																	
Institutional 16%	667.32	133.46			1.84	122.53	13.35	10.01	66.73	1.47	14.74	14.74					
Forest 31%	1266.50	253.30								2.86	28.57	28.57				2.64	
ROW	460.73	92.15		9													
Wetland - Residential	0.00	0.00															0.00
Wetland - Commercial	0.07	0.01															0.01
Wetland - Institutional	2.53	0.51															0.51
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	0.94	0.19															0.19
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	192.32	38.46															38.46
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	46.32	9.26															9.26
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	5.86	1.17															1.17

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	1.05	0.21											0.21		0.01		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	1.29	0.26											0.26		0.02		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.07	0.01												0.01	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.79	0.16												0.16	0.01		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	1.46	0.29												0.29	0.02		
Streambank Length	61860.00	12372.00															
Subarea LDP6																	
Residential 55%	2065.13	413.03	24.78							11.97	119.68	119.68					
Trans/Comm/Util/Waste 31%	1153.95	230.79								6.75	67.45	67.45					
Row	1087.97	217.59		20													
Wetland - Residential	0.00	0.00															0.00
Wetland - Commercial	0.00	0.00															0.00
Wetland - Institutional	0.00	0.00															0.00
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	0.00	0.00															0.00
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	0.18	0.04															0.04
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	0.02	0.00															0.00
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	0.02	0.00															0.00
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	0.00	0.00															
Subarea LDP7																	
Residential 42%	2100.29	420.06	25.20							9.84	98.35	98.35					
Trans/Comm/Util/Waste 27%	1325.47	265.09								6.32	63.23	63.23					
ROW	1170.89	234.18		22													
Wetland - Residential	0.34	0.07															0.07
Wetland - Commercial	0.78	0.16															0.16
Wetland - Institutional	12.18	2.44															2.44
Wetland - Industrial	0.13	0.03															0.03
Wetland - Trans/Comm/Util/Waste	0.85	0.17															0.17
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	62.67	12.53															12.53
Wetland - Vacant	0.11	0.02															0.02
Wetland - Water	6.47	1.29															1.29
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	1.49	0.30															0.30
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.36	0.07											0.07		0.004		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.05	0.01												0.01	0.001		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	32532.00	6506.40															
Subarea LDP8																	
Residential 28%	942.22	188.44	11.31							2.57	25.67	25.67					
Institutional 18%	618.94	123.79			1.77	118.01	12.38	9.28	61.89	1.65	16.50	16.50					
ROW	458.42	91.68		8													
Wetland - Residential	0.29	0.06															0.06
Wetland - Commercial	3.46	0.69															0.69
Wetland - Institutional	1.80	0.36															0.36
Wetland - Industrial	0.89	0.18															0.18
Wetland - Trans/Comm/Util/Waste	0.72	0.14															0.14
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	61.25	12.25															12.25
Wetland - Vacant	0.35	0.07															0.07
Wetland - Water	51.00	10.20															10.20
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	0.96	0.19															0.19
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.75	0.15												0.15	0.01		
Streambank Length	46816.00	9363.20															
Subarea LDP9																	
Residential 20%	1145.80	229.16	13.75							2.85	28.53	28.53					
Trans/Comm/Util/Waste 28%	1592.67	318.53								3.99	39.94	39.94					
ROW	713.23	142.65		13													
Wetland - Residential	2.27	0.45															0.45
Wetland - Commercial	0.50	0.10															0.10
Wetland - Institutional	14.48	2.90															2.90
Wetland - Industrial	18.23	3.65															3.65
Wetland - Trans/Comm/Util/Waste	11.09	2.22															2.22
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	69.46	13.89															13.89
Wetland - Vacant	26.95	5.39															5.39
Wetland - Water	229.57	45.91															45.91
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	7.96	1.59															1.59
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.23	0.05												0.05	0.003		

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	5.90	1.18												1.18	0.07		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	126322.00	25264.40															
Subarea LDP10																	
Residential 54%	939.08	187.82	11.27							1.92	19.21	19.21					
Trans/Comm/Util/Waste 18%	308.62	61.72								0.64	6.40	6.40					
ROW	177.85	35.57		3													
Wetland - Residential	29.75	5.95															5.95
Wetland - Commercial	29.45	5.89															5.89
Wetland - Institutional	2.03	0.41															0.41
Wetland - Industrial	0.98	0.20															0.20
Wetland - Trans/Comm/Util/Waste	18.43	3.69															3.69
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	103.29	20.66															20.66
Wetland - Vacant	35.55	7.11															7.11
Wetland - Water	33.75	6.75															6.75
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	1.95	0.39															0.39
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.99	0.20												0.20	0.01		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	23898.00	4779.60															
Subarea LDP11																	
Residential 29%	2330.71	466.14	27.97							6.29	62.88	62.88					
Forest 27%	2199.99	440.00								5.85	58.54	58.54				5.42	
ROW	1084.15	216.83		20													
Wetland - Residential	69.02	13.80															13.80
Wetland - Commercial	23.85	4.77															4.77
Wetland - Institutional	90.87	18.17															18.17
Wetland - Industrial	0.11	0.02															0.02
Wetland - Trans/Comm/Util/Waste	47.23	9.45															9.45
Wetland - Cropland	3.54	0.71															0.71
Wetland - Open Space	518.16	103.63															103.63
Wetland - Vacant	57.88	11.58															11.58
Wetland - Water	57.47	11.49															11.49
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	14.45	2.89															2.89
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.05	0.01												0.01	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	3.93	0.79												0.79	0.05		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	31076.00	6215.20															
Subarea LDP12																	
Trans/Comm/Util/Waste 24%	225.42	45.08								2.61	26.12	26.12					
Forest 33%	1070.42	214.08								3.59	35.92	35.92				3.33	
ROW	544.21	108.84		10													
Wetland - Residential	26.03	5.21															5.21
Wetland - Commercial	0.00	0.00															0.00
Wetland - Institutional	0.85	0.17															0.17
Wetland - Industrial	5.13	1.03															1.03
Wetland - Trans/Comm/Util/Waste	100.86	20.17															20.17
Wetland - Cropland	0.17	0.03															0.03
Wetland - Open Space	476.97	95.39															95.39
Wetland - Vacant	6.96	1.39															1.39
Wetland - Water	37.11	7.42															7.42
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	23.58	4.72															4.72
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	16836.00	3367.20															
Subarea MC																	
Residential 55%	3559.30	711.86	42.71							13.15	131.53	131.53					
Trans/Comm/Util/Waste 21%	1382.65	276.53								5.02	50.22	50.22					
ROW	1195.77	239.15		22													
Wetland - Residential	45.29	9.06															9.06
Wetland - Commercial	14.51	2.90															2.90
Wetland - Institutional	1.40	0.28															0.28
Wetland - Industrial	0.23	0.05															0.05
Wetland - Trans/Comm/Util/Waste	3.06	0.61															0.61
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	62.53	12.51															12.51
Wetland - Vacant	0.16	0.03															0.03
Wetland - Water	20.07	4.01															4.01
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	7.43	1.49															1.49
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	2.03	0.41											0.41		0.02		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	7.08	1.42												1.42	0.08		
Wet Detention - Commercial	2.84	0.57												0.57	0.03		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	117864.00	23572.80															

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Subarea PCFC																	
Residential 45%	1281.85	256.37	15.38							3.89	38.85	38.85					
Trans/Comm/Util/Waste 21%	581.72	116.34								1.81	18.13	18.13					
ROW	431.69	86.34		8													
Wetland - Residential	30.54	6.11															6.11
Wetland - Commercial	1.82	0.36															0.36
Wetland - Institutional	6.29	1.26															1.26
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	6.84	1.37															1.37
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	16.85	3.37															3.37
Wetland - Vacant	1.20	0.24															0.24
Wetland - Water	3.77	0.75															0.75
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	2.06	0.41															0.41
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	35408.00	7081.60															
Subarea WEC																	
Residential 53%	6395.85	1279.17	76.75							27.33	273.31	273.31					
Trans/Comm/Util/Waste 25%	2944.65	588.93								10.83	108.29	108.29					
ROW	2578.35	515.67		48													
Wetland - Residential	20.43	4.09															4.09
Wetland - Commercial	9.05	1.81															1.81
Wetland - Institutional	13.52	2.70															2.70
Wetland - Industrial	5.69	1.14															1.14
Wetland - Trans/Comm/Util/Waste	4.80	0.96															0.96
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	27.12	5.42															5.42
Wetland - Vacant	0.28	0.06															0.06
Wetland - Water	8.71	1.74															1.74
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	5.67	1.13															1.13
Dry Detention - Residential	0.62	0.12											0.12		0.01		
Dry Detention - Commercial	2.06	0.41											0.41		0.02		
Dry Detention - Institutional	2.50	0.50											0.50		0.03		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.27	0.05												0.05	0.0033		
Wet Detention - Commercial	0.58	0.12												0.12	0.01		
Wet Detention - Institutional	1.87	0.37												0.37	0.02		
Wet Detention - Industrial	1.27	0.25												0.25	0.02		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	1.67	0.33												0.33	0.02		
Streambank Length	59088.00	11817.60															
Subarea WIC1																	
Industrial 68%	2649.82	529.96			3.66	244.17	53.00	39.75	264.98	6.83	68.29	68.29					
Trans/Comm/Util/Waste 19%	741.09	148.22								1.91	19.08	19.08					
ROW	502.10	100.42		9													

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Wetland - Residential	4.96	0.99															0.99
Wetland - Commercial	0.51	0.10															0.10
Wetland - Institutional	0.16	0.03															0.03
Wetland - Industrial	44.39	8.88															8.88
Wetland - Trans/Comm/Util/Waste	16.58	3.32															3.32
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	16.32	3.26															3.26
Wetland - Vacant	16.85	3.37															3.37
Wetland - Water	1.22	0.24															0.24
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	8.48	1.70															1.70
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	5.93	1.19											1.19		0.07		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	1.77	0.35												0.35	0.02		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	0.00	0.00															
Subarea WIC2 (O'Hare)																	
Trans/Comm/Util/Waste 100%	2534.28	506.86															
ROW	21.99	4.40															
Wetland - Residential	0.00	0.00															0.00
Wetland - Commercial	0.00	0.00															0.00
Wetland - Institutional	0.00	0.00															0.00
Wetland - Industrial	0.00	0.00															0.00
Wetland - Trans/Comm/Util/Waste	42.87	8.57															8.57
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	0.00	0.00															0.00
Wetland - Vacant	0.00	0.00															0.00
Wetland - Water	0.00	0.00															0.00
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	0.03	0.01															0.01
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.00	0.00												0.00	0.00		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	0.00	0.00												0.00	0.00		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.00	0.00												0.00	0.00		
Streambank Length	0.00	0.00															
Subarea WIC3																	
Commercial 13%	261.00	52.20			1.15	76.63	5.22	3.92	26.10	0.78	7.77	7.77					
Trans/Comm/Util/Waste 65%	1278.42	255.68								3.89	38.87	38.87					
ROW	299.00	59.80		6													
Wetland - Residential	0.85	0.17															0.17
Wetland - Commercial	2.63	0.53															0.53
Wetland - Institutional	0.13	0.03															0.03
Wetland - Industrial	7.98	1.60															1.60
Wetland - Trans/Comm/Util/Waste	9.80	1.96															1.96

	Planning Unit Area	Implementation Area (20% of PU Area Area)	Rain Gardens 0.06 acres per acre (*Bioretention*)	Bioswale (5' wide per linear foot of roadway - *Bioretention*)	Planter Boxes (*Bioretention*)	*Infiltration Trench* (d/s of planter boxes)	*Oil/Grit Separators* (1 per 10 acres)	Green Roof (15% of all buildings - *Bioretention*)	*Cistern* (10,000 Gal Tank/ 0.37 Ac)	*Porous Pavement* (10% of Roadway Max)	*Weekly Street Sweeping* (Total Area of Roadway)	*WQ Inlets* (Contributing Area = Total Roadway Area)	Native Planting in Bottom of Dry Pond (*Ext. Wet Detention*)	Wet Bottom Pond Restoration (*Ext. Wet Detention*)	*Settling Basin* (2 per pond)	*Vegetated Filter Strips* (5' around perimeter - 50% of Area)	Wetland Restoration (*Wetland Detention*)
Wetland - Cropland	0.00	0.00															0.00
Wetland - Open Space	0.46	0.09															0.09
Wetland - Vacant	1.04	0.21															0.21
Wetland - Water	0.80	0.16															0.16
Wetland - Forest	0.00	0.00															0.00
Wetland - Non-Parcel Areas	1.91	0.38															0.38
Dry Detention - Residential	0.00	0.00											0.00		0.00		
Dry Detention - Commercial	0.00	0.00											0.00		0.00		
Dry Detention - Institutional	0.00	0.00											0.00		0.00		
Dry Detention - Industrial	0.00	0.00											0.00		0.00		
Dry Detention - Trans/Comm/Util/Waste	0.00	0.00											0.00		0.00		
Dry Detention - Cropland	0.00	0.00											0.00		0.00		
Dry Detention - Open Space	0.00	0.00											0.00		0.00		
Wet Detention - Residential	0.91	0.18												0.18	0.01		
Wet Detention - Commercial	0.00	0.00												0.00	0.00		
Wet Detention - Institutional	0.00	0.00												0.00	0.00		
Wet Detention - Industrial	1.00	0.20												0.20	0.01		
Wet Detention - Trans/Comm/Util/Waste	0.00	0.00												0.00	0.00		
Wet Detention - Cropland	0.00	0.00												0.00	0.00		
Wet Detention - Open Space	0.07	0.01												0.01	0.00		
Streambank Length	43664.00	8732.80															