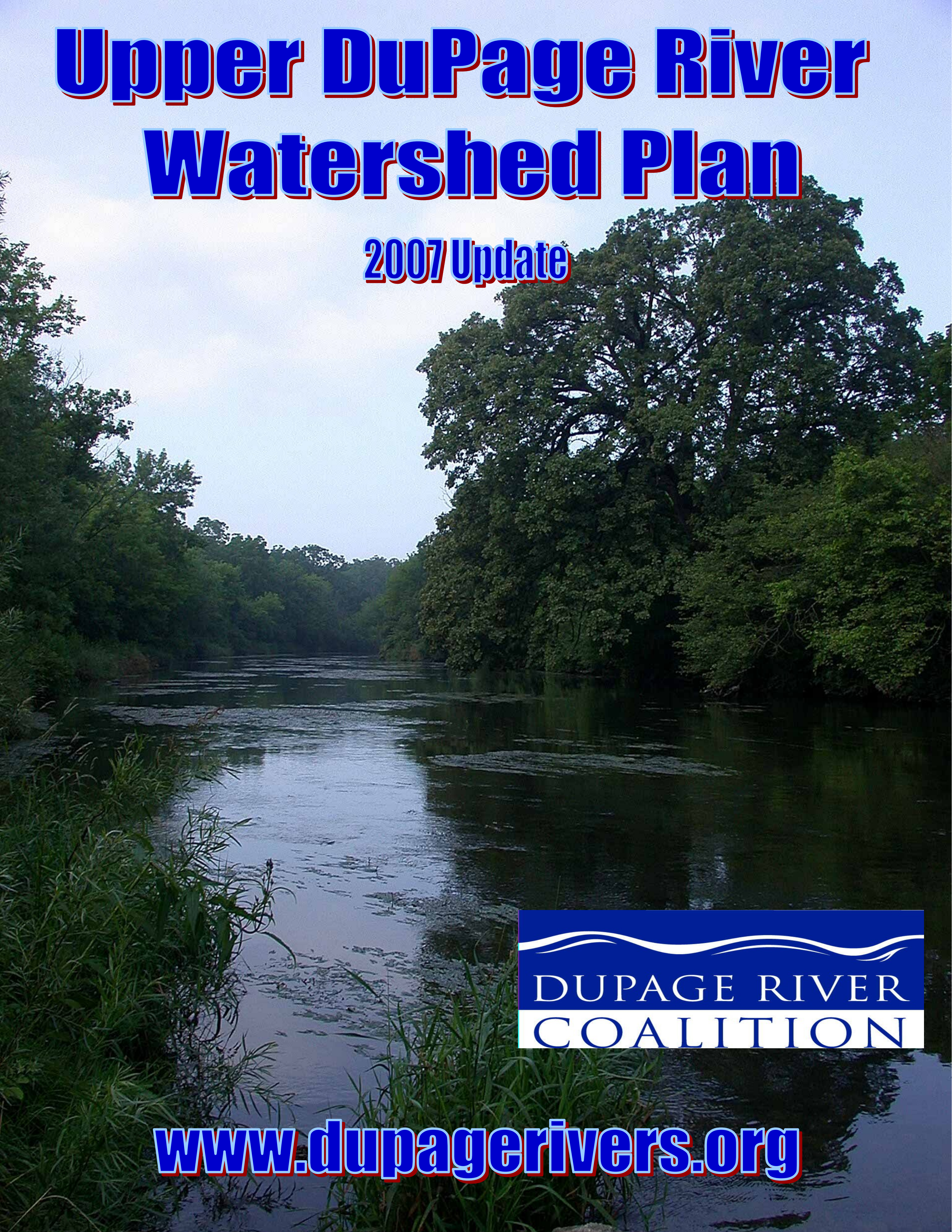
Upper DuPage River Watershed Plan

2007 Update



DUPAGE RIVER COALITION

www.dupagerivers.org

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2007 Update

VISION STATEMENT

"A clean stream which exceeds water quality standards, is enhanced by sensitive development, embraced by the public, protected to preserve biodiversity, and used for its recreational values."

DUPAGE RIVER COALITION

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1. Introduction

The upper DuPage River Watershed is the backdrop for 17 communities. Flowing from just north of the Cook/DuPage County boundary in Hanover Park to just south of the DuPage/Will County boundary in Naperville where the East and West Branches join to form the Main Stem DuPage River. The combined watersheds of the East and West Branches of the DuPage River drain approximately 200 square miles serving a population of over 600,000 people. The DuPage River Coalition has been active in the watershed since 1989 promoting the clean-up, restoration and protection. In 1998 the Coalition, with the help of nearly 100 stakeholders, completed the original watershed plan outlining goals and implementation tasks to improve the health of the watershed. The original plan was endorsed through resolution by every community in the watershed.

This update to the watershed plan is an effort to create a more a more detailed level of analysis utilizing the WinSLAMM runoff model to identify and prioritize sources of particular pollutants of concern and provide a useful tool for communities to compare best management practices (BMPs). The new update is also supported by comprehensive Bioassessment plan and dissolved oxygen monitoring program that will set a clear benchmark of current conditions, provide watershed resource management information and track future progress as projects are implemented. This new update also has a very different format. The plan will be presented as a website, www.dupagerivers.org this will provide the ability to keep watershed stakeholders up to date as new data and reports become available. It will also provide a way to showcase projects being completed by watershed partners.

1.1 Watershed Overview

The East and West Branches of the DuPage River Watershed are further divided into the sub-watersheds for the tributaries of the main stem. Table 1 provides the names and areas of each sub-watershed as well as a legend for the tributary codes for Map 1.

The East and West Branch watersheds span three counties, a small portion of Cook in the north, transversing DuPage from north to south with the confluence of the two branches just south of the DuPage/Will county line. The East Branch drains all or part of Bloomingdale, Glendale Heights, Lombard, Addison, Glen Ellyn, Downers Grove, Lisle, Westmont, Woodridge, Naperville, Bolingbrook and portions of unincorporated DuPage County. The West Branch drains all or part of Hanover Park, Roselle, Carol Stream, Bloomingdale, Glendale Heights, Glen Ellyn, West Chicago, Winfield, Wheaton, Warrenville, Lisle and Naperville and portions of unincorporated DuPage County. Acreages for the administrative units making up the East and West Branch of the DuPage River are given in Appendixes 1. A map showing the tributary sub-watersheds and the municipality or other administrative unit they lie in is given in Appendix 1.1 .Appendix 1.2 gives a map and description of major point sources.

Table 1 Upper DuPage River Watershed Tributaries (Source DuPage County Stormwater GIS data base 2006 data)

TRIBUTARY CODE	EAST BRANCH TRIBUTARIES	ACRES
EBAR	ARMITAGE CREEK	1,360
EBAT	ARMY TRAIL	283
EBCR	CRABTREE CREEK	983
EBE1	TRIB 1	431
EBE2	TRIB 2	785
EBE3	TRIB 3	312
EBE6	TRIB 6	1,183
EBE7	TRIB 7	553
EBGL	GLENCREST CREEK	1,739
EBGP	GLEN PARK	455
EBLA	LACEY CREEK	2,955
EBPR	PRENTISS CREEK	4,507
EBRC	ROTT CREEK	3,832
EBSJ	ST JOSEPH CREEK	7,204
EBSM	SWIFT MEADOWS	560
EBTS	22ND STREET TRIBUTARY	494
EBWI	WILLOWAY BROOK	2,879
EBEB	MAINSTEM	21,512
	TOTAL EAST BRANCH ACRES	**52,026**

TRIBUTARY CODE	WEST BRANCH TRIBUTARIES	ACRES
WBCC	CRESS CREEK	2,695
WBFE	FERRY CREEK	7,924
WBFX	S. OF FOXCROFT	586
WBKC	KLEIN CREEK	8,094
WBKR	KRESS CREEK	12,117
WBSP	SPRING BROOK 1	4,921
WBSR	STEEPLE RUN	1,754
WBW1	TRIB 1	1,725
WBW2	TRIB 2	3,005
WBW3	TRIB 3	1,081*[1]
WBW4	TRIB 4	1,890
WBW5	TRIB 5	1,071
WBW6	TRIB 6	771
WBW7	TRIB 7	375
WBW8	S. OF 87TH	494
WBWF	WINDING CREEK	732
WBWG	WINFIELD CREEK	5,419
WBWB	MAINSTEM	27,040
	TOTALWEST BRANCH ACRES	**81,692**

1.2 Watershed-Based Planning

The DuPage River Coalition got involved with watershed planning in 1996, working with Illinois EPA and the Natural Resource Conservation Service to develop one of the first watershed plans in the region in 1998. The idea at that time was that the document would be revisited and revised on a regular basis. This has been a constantly growing and evolving field, we have learned so much over the last 10 years and we are using that knowledge to move forward and create a forum that can help address the multi-faceted issues of a complex watershed.

We have not been the only ones assimilating these ideas. USEPA has incorporated the watershed-based approach into many of its major programs, in particular are regulations regarding eligibility for certain types of Clean Water Act, Section 319 funding. The Section 319 program represents the USEPA's primary nonpoint-source water pollution control program and has been an important funding source for water quality improvement projects throughout the DuPage River Watershed. The USEPA requires nine components of a watershed-based plan.

The Chicago Metropolitan Agency for Planning has published the Guide for Developing Watershed Action Plans in Illinois with funding from a Section 319 grant administered through the Illinois EPA. The "Illinois Guide" describes the USEPA's nine components and how they relate to the Illinois Model Watershed Planning Stages. The document is a great resource for

[1] The data for this table was created from the DuPage County Stormwater GIS database. In the section on the WinSLAMM modeling sub-watershed

watershed groups large and small to help with the planning process so that when you are ready for implementation, funding support can be found under the Section 319 program. Below is a table from the Illinois Guide that illustrates how each of the nine components of the section 319 program are addressed through the planning process.

Table 2. Watershed Planning Stages and Section 319 Components

Illinois Model Watershed Planning Stages	Section 319 Components
1. Identify Stakeholders	a. Identification of causes and sources that will need to be controlled to achieve load reductions estimated within the plan
2. Develop Goals and Objectives	
3. Inventory Watershed Resources and Conditions	
4. Assess Waterbody/Watershed Problems	
5. Recommend Management Practices	b. Estimate of the load reductions expected for the management measures described in component 3
	c. Description of the nonpoint-source management measures that need to be implemented in order to achieve the load reductions estimated in component 3; and identification of critical areas
	d. Information and public education component; and early and continued encouragement of public involvement in the design and implementation of the plan
6. Develop Action Plan	e. Estimate of the amounts of technical and financial assistance needed; costs; and the sources and authorities (e.g., ordinances) that will be relied upon to implement the plan
	f. Implementation schedule
7. Monitor Your Success	g. Description of interim, measurable milestones for determining whether NPS measures or other actions are being implemented
	h. Criteria to measure success and reevaluate the plan
	i. Monitoring component to evaluate effectiveness of implementation efforts over time

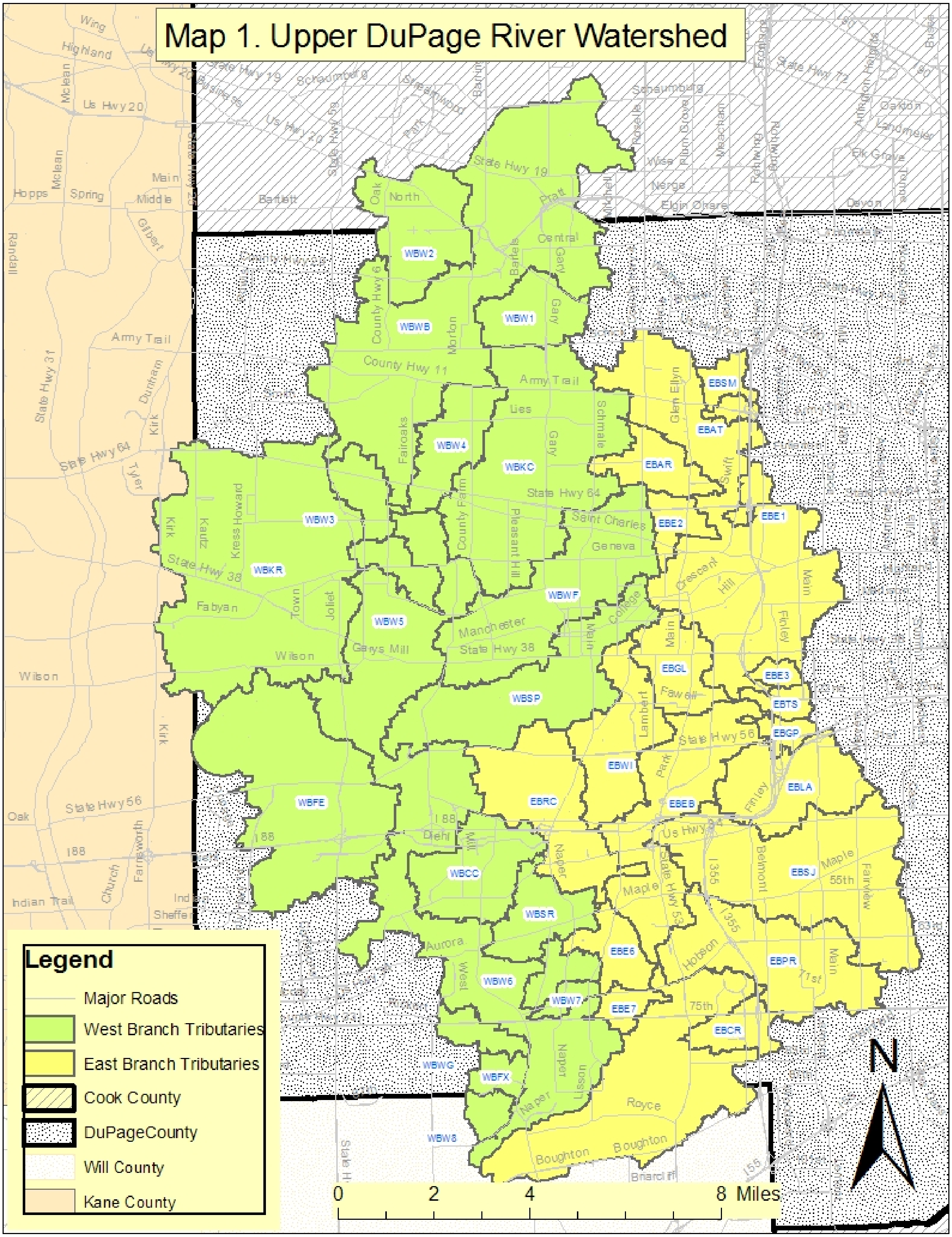


Figure 1. Upper DuPage Watershed and Tributary Sub- watersheds

1.3 Watershed Plan Goals

In 1998 the first watershed plan was developed with the help of nearly one hundred stakeholders. In early discussions, five major topic areas rose to the top of the list as priorities. These topic areas were prioritized and a goal was developed for each. The 2007 plan update made some minor changes to the goals to update them to current activities and to fill some gaps that were overlooked. The tables below outline the major goals and an overview of objectives and actions needed to meet the goals. More information about the action items is provided in more detail in later parts of this document or on the website at www.dupagerivers.org

Table 3. Education and Outreach Goal

To preserve and protect the natural resources within the DuPage River Watershed, all citizens need to learn what a watershed is, why a healthy watershed is important and how our actions affect the health of the watershed.		
Key Messages: ~ Rain is a valuable resource, keep rain where it falls. ~ Keep it clean! Don't Muddy the Waters ~ Leave no Child Inside - Connect kids (and their parents) with nature.		
Objectives & Actions	**Cost**	**Who?**
1. Coordinate Education and Outreach activities between parnter organizatoins to consistantly communitcate key messages across education and outreach programs.		
A watershed plan outreach "standard" will be developed and distribute along with available logos and graphics to all communities, park districts and others that provide watershed programming.		The Conservation Foundation
2. Develop Education and Outreach programs that focus on both increasing awareness and result in behavior change.		
Promote and utilize the "Four Steps of Community Based Social Marketing" to assist in the development of E/O programs.		All watershed programming providers
3. Promote the Conservation@Home program across the watershed.		
a. Work with Park Districts and Communities to provide Conservation @ Home programs in each community	$35,000/year part-time staff and materials	The Conservation Foundation
b. Install Conservation @ Home Kiosks at key locations to increase visiblity of program	$800/Kiosk x 15 Kiosk	The Conservation Foundation
4. Promote watershed based youth programming, both formal and non-formal, that makes a local connection to the DuPage River Watershed.		

a. Promote Chicago Wilderness' "Leave No Child Inside" initiitive to partner organizations as a framework to connect kids with nature		All watershed programming providers
i. Work with local park districts to develop family based nature programming		The Conservation Foundation, Park Districts
b. Provide watershed based teacher training for educators to increase understanding of watershed topics.		Forest Preserve District, The Conservation Foundation, SCARCE
c. Continue to support and expand existing watershed education programs including, but not limited to:		All watershed programming providers
i. Mighty Acorns		
ii. Envirothon		
iii. Bass in the Class		
iiii. Watershed Blues Teacher Training		
v. Discover the DuPage River		

Table 4. Water Quality Goal

To preserve and protect water quality within the DuPage River Watershed, nonpoint and point sources of pollution need to be reduced or eliminated and natural hydrology restored.				
Objectives & Actions	**Cost**	**Funding**	**Who?**	**Priority**
1. Implement TMDL plans to meet state water quality standards.				
a. Work through the adaptive management approach to further define and document impairments and implement viable projects as identified by the DuPage River Salt Creek Workgroup			DRSCW	
i. Support continued implementation of long-term bioassessment plan to track water quality improvements	$140,000/year	Current and future Section 319 grants, DRSCW membership	DRSCW	High
ii. Support continued implementation of Continuous Dissolved Oxygen Monitoring Program	$15,000/year + in-kind service from participating agencies	Current and future Section 319 grants, DRSCW membership	DRSCW	High
iii. Implement Dissolved Oxygen improvement projects as identified by DRSCW report due out in Fall 2007.	$2-8Million for East Branch DuPage River Project	Current and future Section 319 grants, DRSCW membership	DRSCW	High

iv. Implement Chloride Reduction Program Phase II		Current and future Section 319 grants, DRSCW membership	DRSCW	High
v. Develop wet weather program to define and address wet weather impacts	$100,000	Current and future Section 319 grants, DRSCW membership	DRSCW	High
2. Promote and encourage the use of Stormwater Best Management Practices (both pre and post construction) to increase infiltration and capture pollutants of concern.				
a. Implement recommendations for BMPs prioritized in the WinSLAMM model		Potential Section 319, DuPage County Stormwater Utility (pending), local community funds		
b. Hold workshops to promote and encourage the use of Stormwater BMPs such as those detailed in the WinSLAMM model or described in the DuPage County Stormwater Manual	$2000/workshop	DuPage County NPDES Phase II E&O funds	DuPage County, TCF	
c. Encourage and support changes to DuPage County Stormwater and Floodplain Ordinance to:			Coalition Partners	
i. Further define and enforce appropriate sediment and erosion control practices during construction				
ii. Mandate the use of permanent Stormwater BMPs				
iii. Require a CPESC signature for Erosion Control Plans				
d. Encourage and support changes to local ordinances to improve the acceptance of Stormwater BMPs and native landscaping			DRC/ TCF	
i. Survey communities ordinances to identify road blocks to BMP acceptance			DRC/ TCF	
ii. After review, provide examples for ordinance change/model ordinances			DRC/ TCF	
e. Develop and implement a stormwater retrofit program			DuPage County	High
i. Use Center for Watershed Protection's Urban Stormwater Retrofit Practices guide to develop a local stormwater retrofit program			DuPage County	
ii. Identify and prioritize retrofit opportunities by subwatershed			DuPage County	

iii. Require implementation of identified projects through redevelopment program			Communities DuPage County	
f. Support the development of a comprehensive DuPage County Stormwater Utility that will support BMP implementation and water quality monitoring.			Coalition Partners	High
g. Support the continued implementation of the NPDES Phase II Stormwater Permit thru further development and refinement of programs outlined in permit			NPDES Phase II Permitees	
3. Educate the public and private sector about their impact on water quality				
a. Promote the Conservation @ Home program across the watershed to increase knowledge and implementation of BMPs at the individual landowner scale			TCF	
b. Provide Certified Professional in Erosion and Sediment Control Review and Exam session at least annually	$2,500/ workshop		TCF	High
c. Provide technical workshops on the planning, design and implementation of BMPs	$2,500/workshop		DuPage County, TCF	
4. Conduct subwatershed surveys to further identify pollutant sources				
a. Conduct a streambank survey for each subwatershed to document the extent of streambank erosion and potential sediment loading and help prioritize restoration efforts.			Communities DuPage County	
5. Monitor the implementation of the thorium clean-up and restoration activities on the West Branch and provide information and assistance to private landowners as needed.				
a. Attend project progress meetings			TCF	Medium
b. Provide information through mailings or workshops through the Conservation @ Home program to assist private landowners in making decisions on appropriate landscape choices	~$500/mailing		TCF	

Table 5. Sustainable Development Goal

To inform landowners (both public and private) and policy makers about the impacts of land uses, land management practices and land development on the entire watershed and promote best management practices that reduce negative impacts.		
Objectives & Actions	**Cost**	**Who?**

1. Strengthen county-wide stormwater & floodplain ordinances and community ordinances to incorporate conservation design principles to take advantage of redevelopment opportunities as they occur.		
a. Provide training opportunities and workshops to increase awareness about how conservation design can be incorporated into suburban redevelopment		DuPage County, The Conservation Foundation
b. Identify and promote ways that local communities are implementing conservation design principles and best management practices that protect and improve water quality		DRC, The Conservation Foundation
c. Advocate that landowners develop property in an ecologically sustainable manner which protects water quality, natural areas and open space.		DRC, The Conservation Foundation
2. Protect critical areas of the watershed through acquisition or conservation easements.		
a. Utilize existing land acquisition plans from the Forest Preserve Districts and Park Districts to identify and prioritize protection efforts.		Land Managers
b. Update information collected through the DuPage West Branch Conservation Easement Program in 2002 and expand into appropriate areas in the East Branch Watershed.	$30,000	The Conservation Foundation

Table 6. Ecosystem and Biodiversity Goal

To promote the biological diversity of the DuPage River Watershed, natural areas throughout the watershed need to be protected, restored and linked into natural corridors.		
Objectives & Actions	**Cost**	**Who?**
1. Support Forest Preserve Districts and Park Districts land acquisition plans		
2. Promote the Chicago Wilderness Biodiversity Recovery Plan and restoration guidelines		
a. Promote Biodiversity Plan and restoration guidelines on DRC website		DRC
b. Work with private and public landowners to restore and manage natural areas with long-term plans		The Conservation Foundation, Forest Preserve District
Priority Habitats		
i. Stream Corridor Restoration along mainstems and tributaries		
ii. Wetland Restoration		

iii. Upland Restoration - Woodland, Savannah & Prairie		
3. Identify, preserve and restore key habitats across the watershed		
a. Work with local Forest Preserve Districts and Park Districts to identify restoration and management needs		
4. Reduce invasive species across the watershed		
a. Work with private and public landowners to remove invasive species and replace them with native species through the Conservation @ Home program		
b. Work with transportation managers to identify and manage for invasive species along roadways		

Table 7. River Access Goal

To encourage the public to appreciate the DuPage River as a valuable resource, the river corridor should be accessible for recreational use, where appropriate.		
Action	**Cost**	**Who?**
1. Promote awareness about the recreational opportunities along the DuPage River		
a. Promote & support the implementation of Openlands Project's Water Trails Plan.		Coalition Partners
b. Provide opportunities for residents to experience the stream from a different perspective		Coalition Partners

1.4 About the DuPage River Coalition

The DuPage River Coalition (DRC) was founded in 1988 by a group of concerned citizens that wanted to “clean up” the West Branch of the DuPage River. The group met with The Conservation Foundation to gain support for their work and so the West Branch Project was born. Although the group did discuss developing a watershed plan, many of them were not interested in *talking* about doing things, they just wanted to do them. These volunteers helped in the development of the first citizen stream monitoring program in the state, they also coordinated the first River Sweep in DuPage County and began the Storm Drain Stenciling Program.

Over time interest in river protection expanded and the East Branch DuPage River was included at which time the group took on the name of the DuPage River Coalition. In the mid 1990’s The Conservation Foundation hired an education staff person that helped coordinate the volunteer effort and in 1996 the DRC returned full circle and started work on the first watershed plan for the Upper DuPage River. The Plan was completed in 1998 with the help of nearly 100 stakeholders and grants from the DuPage Community Foundation, the Illinois Department of Natural Resources (DNR) and the Illinois Environmental Protection Agency (EPA). The original plan outlined goals and objectives as well as action items and recommendations to achieve our goals. All of the communities in the two watersheds signed resolutions of support for the watershed plan.

In 1998 the DRC also became an Ecosystem Partnership, a technical assistance and grant program through the Illinois DNR. This status made the watershed eligible for Conservation 2000 grants which fund habitat acquisition and restoration projects as well as environmental education and research projects. To date the Conservation 2000 program has funded 16 projects with over $813,600. The C2000 funds were further leveraged with over $2.2 million in matching funds for a grand total of more than $3 million. To maintain the Ecosystem Partnership status the DRC adopted Rules of Operation and elected officers in 2003. This process has helped the DRC gain local leadership but still remain associated with The Conservation Foundation which serves as the fiscal and administrative agent for the DRC.

In 2005 The Conservation Foundation received a Section 319 grant that was administered thru the Chicago Metropolitan Agency for Planning (CMAP) to update the watershed plan to meet new criteria developed by the U.S. Environmental Protection Agency. The updated watershed plan is being presented in a new and innovative way. This website is the watershed plan and much, much more. By using this format we will be able to continually update information on new technologies, projects and monitoring results without wasting time and resources on printed materials. Meeting these new criteria will keep the entire watershed eligible for Section 319 grant funds for Nonpoint Source Pollution Control projects administered by the Illinois EPA. This grant program has funded over 20 projects with more than $6 million in the watershed since 1998.

The mission of the DRC is to: ***Increase awareness of the DuPage River Watershed in those who live in it and improve the river's water quality through the active involvement of the community.***

The DuPage River Coalition is supported through membership dues as well as public and private grants. Please consider joining the DuPage River Coalition today to support local stream and watershed protection and restoration. The DRC holds quarterly meetings two of which coincide with the DuPage River Salt Creek Workgroup meetings. Meeting dates will be listed at www.dupagerivers.org.

1.5 Funding sources

The DuPage River Coalition is funded through membership and support from private and public grants. Implementation of the watershed plan will be sought from multiple sources including, but not limited to, Section 319 funds administered by the Illinois EPA, Conservation 2000 funds through the Illinois DNR Ecosystem Partnership program, Section 206 funds through the Army Corps of Engineers, special appropriation funds, private foundation and local partners. The implementation section of the plan identifies potential funding and potential implementers where appropriate.

1.6 Partners / Contributors

The DuPage River Coalition is working very closely with the DuPage River Salt Creek Workgroup to accomplish the goals of the watershed plan. Members of these two organizations include representatives from municipalities, NPDES permit holders, park districts, counties, consultants and other environmental organizations working together to complete studies, monitoring and implementing projects.

2. Watershed Summary

2.1 Natural Resources

The Upper DuPage River Watershed supports a range of habitats from river to oak woodland and wetland to dry prairie. Many of these natural areas are in public ownership, either Forest Preserve or Park District, although there are still pockets of high quality habitat in private ownership. In 2001 the Illinois DNR published "The DuPage River Basin – An Inventory of the Region's Resources" which included a full-color summary document and four supporting reports – Volume 1 Geology, Volume 2 Water Resources, Volume 3 Living Resources, and Volume 4 Socio-Economic Profile, Environmental Quality, Archaeological Resources. These documents provide a detailed summary of natural resources in the DuPage River Watershed and are available free of charge from the DuPage River Coalition.

A comprehensive study of water resources was completed in 2006-2007 by the DuPage River Salt Creek Workgroup with a final report due in June of 2008. Fish, macroinvertebrates, habitat, water and sediment chemistry were collected at 83 sites across the watershed. *Table 2 below summarizes the fish species found in the Upper DuPage River watershed. Full results of the bioassessment with recommendations for resource management and restoration will be available at www.dupagerivers.org in June 2008.

Upper DuPage River Fish Species	
Gizzard Shad	Black Bullhead
Central Mudminnow	Brown Bullhead
Shorthead Redhorse	Yellow Bullhead
White Sucker	Tadple Madtom
Common Carp	Blackstripe Top Minnow
Goldfish	Western Mosquitofish
Hornyhead Chup	Yellow Bass
Silver Chub	White Crappie
Creek Chub	Black Crappie
Striped Shiner	Rock Bass
Common Shiner	Smallmouth Bass
Spotfin Shiner	Largemouth Bass
Sand Shiner	Warmouth Sunfish
Golden Shiner	Green Sunfish
Bullhead Minnow	Bluegill Sunfish
Fathead Minnow	Orange Spotted Sunfish
Bluntnose Minnow	Longear Sunfish
Central Stoneroller	Pumpkin Seed Sunfish
Largescale Stoneroller	Johnny Darter
Channel Catfish	

Table 8. ***Upper DuPage Fish Species. Source DRSCW Bioassessment Plan Baseline Survey 2006-7***

Low Dissolved Oxygen is one of the major causes of impairment in the watershed. To further study the extent of this problem the DRSCW has implemented a continuous Dissolved Oxygen monitoring program at 2 sites on the West Branch and 5 sites on the East Branch, in addition, the Wheaton Sanitary District also maintains a monitoring site on the West Branch. This information is being analyzed with a low-flow model, QUAL-2K, to assess potential projects to improve dissolved oxygen. The data from this monitoring program is available from DRSCW (www.DRSCW.org). More information about this program can be found in Section 3.2.1

2.2 Water Quality

The Illinois Environmental Protection Agency is responsible for assessing stream health in Illinois. These assessments are published on a two year cycle in a newly titled report: Illinois Integrated Water Quality Report and Section 303(d) List – 2006. This report describes the designated uses for each water body and how well those uses are being supported. The report also lists the possible causes and sources of water quality impairments. This information is used to develop the Section 303(d) otherwise known as the List of Impaired Waters or simply the TMDL list. Table 9 below lists the potential causes for why our streams are not fully supporting the General Use and/or Aquatic Life Use.

Table 9 Causes and Sources of Impairment for the East and West Branches of the DuPage River. Based on the 2006 Integrated Water Quality Report and Section 303(d) List

Potential Causes of Impairment	Potential Sources of Impairment	In-stream Affect
Sedimentation/Siltation	Site Clearance (Land Development or Redevelopment), Urban Runoff/Storm Sewers, Highways, Road, Bridges, Infrastructure (New Construction), impacts from Hydro-structure Flow Regulations/Modifications	Covering of stream bottom habitat with silt, cloudy water, difficult for fish to see prey, depletion of Oxygen needed by fish and macroinvertebrates which can result in fewer species of fish and macroinvertebrates
Total Suspended Solids	Contaminated Sediments, Municipal Point Source Discharges	Covering of stream bottom habitat with silt, cloudy water, difficult for fish to see prey
Dissolved Oxygen	Channelization, Impacts from Hydro-structure Flow Regulations/Modifications, Urban Runoff/Storm Sewers, Municipal Point Source Discharges	Depletion of Oxygen needed by fish and macroinvertebrates which can result in fewer species of fish and macroinvertebrates
Total Phosphorus	Municipal Point Source Discharges, Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland, Waterfowl, Specialty Crop Production,	Increased Algal Growth, Depletion of Oxygen needed by fish and macroinvertebrates which can result in fewer species of fish and macroinvertebrates
Total Nitrogen	Site Clearance (Land Development or Redevelopment), Urban Runoff/Storm Sewers, Road, Bridges, Infrastructure (New Construction), Streambank Modifications /destabilization, Loss of Riparian Habitat	Increased algal growth, Depletion of Oxygen needed by fish and macroinvertebrates which can result in fewer species of fish and macroinvertebrates
Chlorides	Urban Runoff/Storm Sewers, Municipal Point Source Discharges	Increased salinity
Fecal Coliform	Urban Runoff/Storm Sewers, Source Unknown	Bacteria, Public Health/Primary Contact with water
Hexachlorobenzene	Contaminated Sediments	Toxic Substance - Automotive

Mercury	Contaminated Sediments	Toxic Substance - Heavy Metal
DDT	Contaminated Sediments	Toxic Substance - Pesticide
Oil & Grease	Source Unknown	
Aldrin	Contaminated Sediments	Toxic Substance - Pesticide
Silver	Contaminated Sediments	Toxic Substance - Metals
pH	Impacts from Hydro-structure Flow Regulations /Modifications	
Zinc	Urban Runoff/Storm Sewers, Municipal Point Source Discharges	Toxic Substance - Metals
Copper	Municipal Point Source Discharges	Toxic Substance - Metals

The watershed plan update assesses methods for dealing with four of these impairments; suspended solids, total phosphorus, dissolved oxygen (DO) and chlorides. Total Maximum Daily Loads have been developed for two of these impairments (DO and chlorides) and both are the subject of a comprehensive evaluation by the DuPage River Salt Creek Workgroup whose work is summarized in this document. The watershed plan update extends the analysis to look at total phosphorus (TP) and (TS) and total solids loading in stormwater runoff in the two watersheds. Point source loading is not considered in this particular analysis.

TS was esteemed to be, as well as a parameter of concern itself a proxy for other pollutants of concern namely metals. TP has been correlated with algae growth and low DO conditions. The approaches to dealing with all four potential causes of impairment are summarized below.

Sediment / Total Suspended Solids- TMDL (No)

- Utilize WinSLAMM model to calculate subwatershed loading, source areas and guide implementation of BMPs that reduce sediment loadings
- Encourage and support changes to DuPage County Stormwater and Floodplain Ordinance to:
    - Further define and enforce appropriate sediment and erosion control practices during construction
    - Mandate the use of permanent Stormwater BMPs
    - Require a CPESC signature for Erosion Control Plans
- Encourage and support changes to local ordinances to improve the acceptance of Stormwater BMPs
- Support the development of a comprehensive DuPage County Stormwater Utility that will support BMP implementation
- Support the implementation of the NPDES Phase II Stormwater Permit
- Conduct streambank erosion surveys in each subwatershed to assess needs
- Promote and expand the Conservation@Home program to work with landowners to reduce stormwater runoff
- Sponsoring Certified Professional in Erosion and Sediment Control Certification Workshops
- Support the Chicago Wilderness Biodiversity Recovery Plan and Management Guidelines. Priorities include:
    - Stream Corridor Restoration along mainstems and tributaries
    - Wetland Restoration

- Upland Restoration – Woodland, Savannah & Prairie
- Eradication of Invasive Species

Nutrients/Phosphorous TMDL (No)

- Utilize WinSLAMM model to calculate subwatershed loading, source areas and guide implementation of BMPs that reduce nutrient loadings
- Utilize WinSLAMM model data to guide implementation of BMPs that reduce nutrient loadings
- The development of a wet weather program to assist with identifying and tracking water quality impacts from wet weather events
- Promote and expand the Conservation@Home program to work with landowners to reduce stormwater runoff
- Support the Chicago Wilderness Biodiversity Recovery Plan and Management Guidelines. Priorities include:
    - Stream Corridor Restoration along mainstems and tributaries
    - Wetland Restoration
    - Upland Restoration – Woodland, Savannah & Prairie
    - Eradication of Invasive Species

Low Dissolved Oxygen - TMDL (Yes)

- Completion of the Dissolved Oxygen Improvement Feasibility Study
- Implementation of recommendations
- Data collected through the Continuous Dissolved Oxygen Monitoring Program is used to make management decisions
- The development of a wet weather program to assist with identifying and tracking water quality impacts from wet weather events

Chlorides / Total Dissolved Solids - (Yes)

- Implement a monitoring program using conductivity and a calibrated conversion model
- Carry out a citizen and public official education campaign on the use of chlorides, their impacts and on water quality
- Training on handling and storage of chlorides. Upgrade of storage facilities
- Agency staff training on alternative methods (pre-wetting, anti- icing and alternative products)

The Illinois Environmental Protection Agency (IEPA) is mandated with designating uses for waterways and assessing the quality of surface water.

Designated uses for the East and West Branch of the DuPage River are:

- Aquatic Life
- Fish Consumption
- Primary Contact
- Secondary Contact
- Aesthetic Quality

Both the East Branch and the West Branch are listed on the State 303(d) list, which lists waterways that are not achieving all or some of their designated uses. In response to the listing the IEPA developed a number of Total maximum Daily Loads (TMDLs) for the rivers. Total Maximum Daily Loads are developed for specific pollutants and look at probable sources of the pollution and make recommendations of how to remediate the situation.

The 1998 Illinois Section 303(d) List identified the East Branch of the DuPage River and its tributaries as impaired for nutrients, siltation, salinity/TDS/chlorides, suspended solids, low dissolved oxygen, habitat alterations and noxious aquatic plants. In 2000 the 305(b) Report listed the potential causes of these impairment to be nutrients, siltation, salinity/TDS/chlorides, suspended solids, habitat alterations, flow alterations, excessive algal growth/chlorophyll-a and low dissolved oxygen. In 2004 TMDLs were published for selected pollutants and a second round of TMDL development is scheduled for 2008. Tables 10 and 11 summarize the 303 (d) listing and the current status of TMDLs for the rivers.

Table 10. Existing listings and TMDLs for the East and West Branches of the DuPage River

River Name	2004 303(d) Impairments	Parameters TMDL prepared for	Date of Listing
East. Branch DuPage River	Cyanide, siltation, flow regime alteration, nitrates, Dissolved Oxygen (DO), Total Dissolved Solids (TDS), habitat alteration, Total Suspended Solids (TSS), phosphorus	DO, TDS, TSS, algae, phosphorus	2004
West Branch DuPage River	pH, siltation, DO, chlorides, flow regime alteration, habitat alteration, flow alteration, pathogen, TSS, TDS, phosphorus	TDS, copper	2004

Table 11. Parameters for which TMDLs are under development for the East and West Branches of the DuPage River.

303 (d) listing and TMDL Development for the East and West Branch DuPage River				
	Segment ID	**Water Name**	**Designated Use**	**Impairment**
4	IL_GBK-05	W. Br. DuPage R.	Aquatic Life	pH, Dissolved Oxygen
			Primary Contact Recreation	Fecal Coliform
5	IL_GBK-09	W. Br. DuPage R.	Aquatic Life	Oxygen, Dissolved
			Primary Contact Recreation	Fecal Coliform
6	IL_GBK-11	W. Br. DuPage R.	Aquatic Life	Zinc
			Primary Contact Recreation	Fecal Coliform
7	IL_GBK-12	W. Br. DuPage R.	Aquatic Life	Oxygen, Dissolved
8	IL_GBKA	Spring Brook	Aquatic Life	Oxygen, Dissolved
9	IL_GBKA-01	Spring Brook	Aquatic Life	Copper, TDS
10	IL_GBL-10	E. Br. DuPage R.	Primary Contact Recreation	Fecal Coliform
11	IL_RGG	CHURCHILL LAGOON	Aesthetic Quality, Aquatic Life	Phosphorus (Total)

Table adapted from IEPA request for proposals to develop TMDLs for North Eastern Illinois 2007. Source IEPA, The segment ID refers to an IEPA water quality coding system for sampling locations. A full map of these locations is given in appendix 2.

The TMDLs for both the East Branch of the DuPage River and the West Branch can be found at www. DRSCW.org/reports. Table 9 listed Causes and Sources of Impairment for the East and West Branches of the DuPage River Based on the 2006 Integrated Water Quality Report and Section 303(d) List along with some possible causes of the impairment. The remainder of this chapter is dedicated to examining the key pollutants that are currently covered by a TMDL in more detail.

2.2.1 Dissolved Oxygen (DO)

Illinois Water Quality Standards state that the DO shall not be less than 6.0 mg/L during at least 16 hours of any 24-hour period, and not less than 5.0 mg/L at any time

Source Illinois State Water Quality Standards

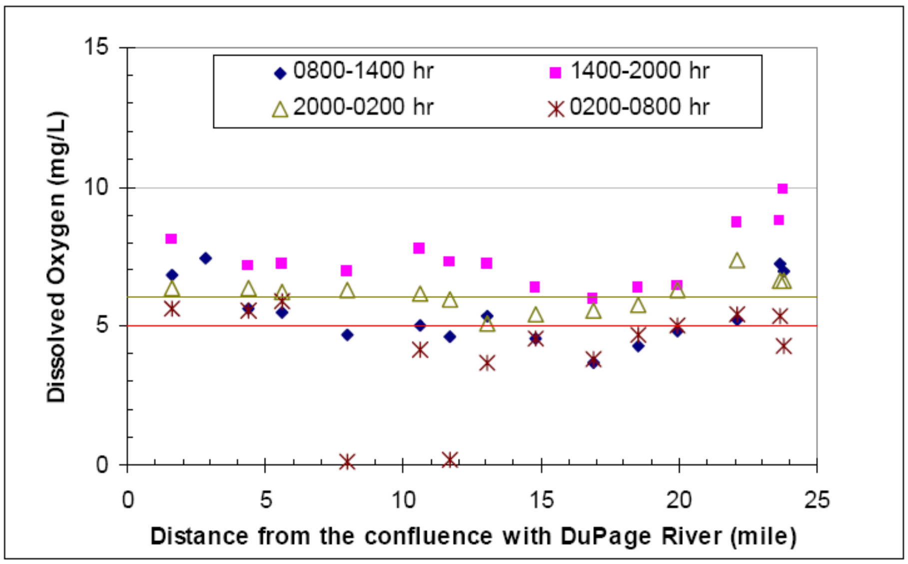
2.2.1.a East Branch DuPage River

The segments GBL 05, GBL 10, and GBL 08 of East Branch were listed for DO impairment. Based on data from a IEPA monitoring station in the Village of Lisle (station 05540210) and intensive diel sampling data from the summer of 1997 at a number of sites along the along the main-stem

The data only found a small number of excursions from State Standards (both of the 5mg/l standard and one of the 16hr 6 mg/l standards). The data suggested that the DO problem was associated with summer low-flow condition. These were the conditions used for the East Branch TMDL development.

Figure 2. ***DO on the East Branch DuPage River June 1997 (figure 4-7 in TMDL report)***

FIGURE 4-7
Diel Data Collected at Many East Branch of the DuPage River Sites on June 24–25, 1997, and the Water Quality Standards for DO



Source. TMDL for the East Branch of the DuPage River. Published 2004. The absolute 5 mg/l standard and the 16 hour 6 mg/l standard are clearly marked on the graph.

Table 12. Segments of the East Branch listed for DO impairment in the 2004 TMDL.

Water Body Segment	Source
GBL 05	Municipal point sources – Downers Grove SD WTC Urban runoff/Storm Sewer
GBL 08	Municipal point sources – Bloomingdale Reeves WRF and Glendale Heights STP Upstream impoundments – Churchill Woods Forest Preserve lake Urban runoff/storm sewer
GBL 10	Municipal point sources- Glenbard WW Authority, Glenbard STP Urban runoff/storm sewers

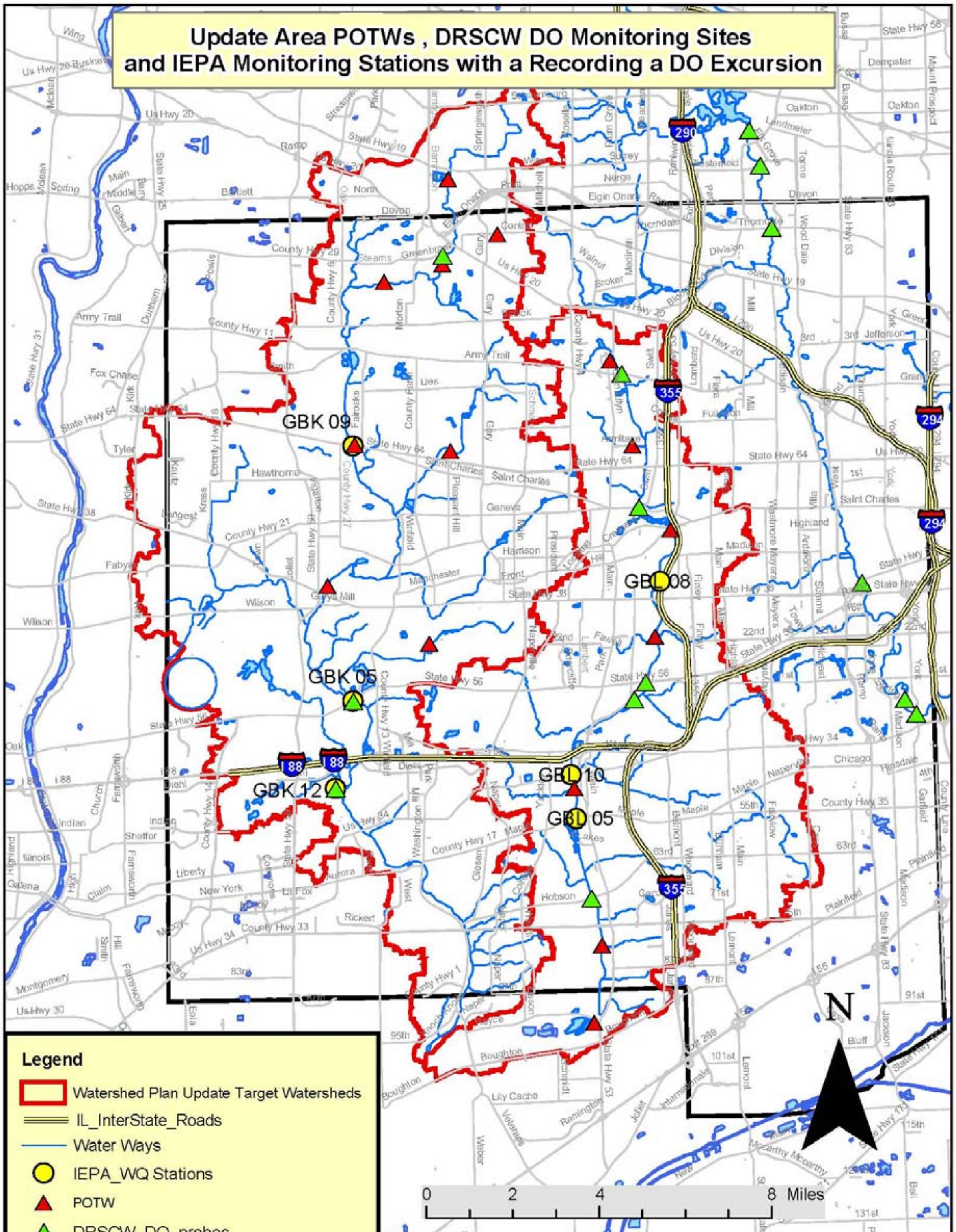
Source. TMDL for the East Branch of the DuPage River. Published 2004. .

Diel data collected on June 24 and 25, 1997, from all East Branch sites are presented in Figure 2. Caused identified by the TMDL for East Branch are listed in Table1 2 (from TMDL)
A map showing the locations of excursions flagged by the IEPA can be seen adjacent in Figure 3. Following the publishing of the TMDL document it became clear that the data was insufficient to identify the nature and source of the problem. The DRSCW with 319 funding from the IEPA launched a basin wide program in 2006, The location of the sites for the East and West Branch is shown on the adjacent map (map also shows the DRSCW DO sites and the MWRDGC sites on Salt Creek). In total five sites have had long term monitoring data collected on the East Branch and the program is detailed in chapter 3. The observed data from the sondes and the QUAL2k model results for East Branch, run as part of the program suggest three types of excursion occur:

A) Warm weather low flow conditions
B) Diurnal oscillations with excursions occurring in the early morning or during overcast periods
C) DO sags following heavy storm events

The QUAL 2K model results, run to simulate warm weather low flow conditions suggested that on the East Branch excursions classified under type A occurred at the Churchill Woods Impoundment. The reasons for this were primarily the high benthic oxygen demand caused by the sediment beds upstream of the low head dam at the site and the warm temperatures encountered in the shallow impoundment (NOTE: This site is not marked as a monitoring sites on adjacent map). Temperature is an important determinate of the level of sediment oxygen demand with the relationship showing increased activity at higher temperatures.

Figure 3 shows DO monitoring locations for the DRSCW and partner organizations on the East and West Branches of the DuPage River and Salt Creek. The program is detailed in Chapter 3. Also shown are those IEPA monitoring sites that are listed as being DO impaired as of November 2007.


Update Area POTWs , DRSCW DO Monitoring Sites
and IEPA Monitoring Stations with a Recording a DO Excursion
GBK 09
GBK 05
GBK 12
GBL 08
GBL 10
GBL 05
Legend
Watershed Plan Update Target Watersheds
IL_InterState_Roads
Water Ways
IEPA_WQ Stations
POTW
DRSCW_DO_probes
0 2 4 8 Miles
N

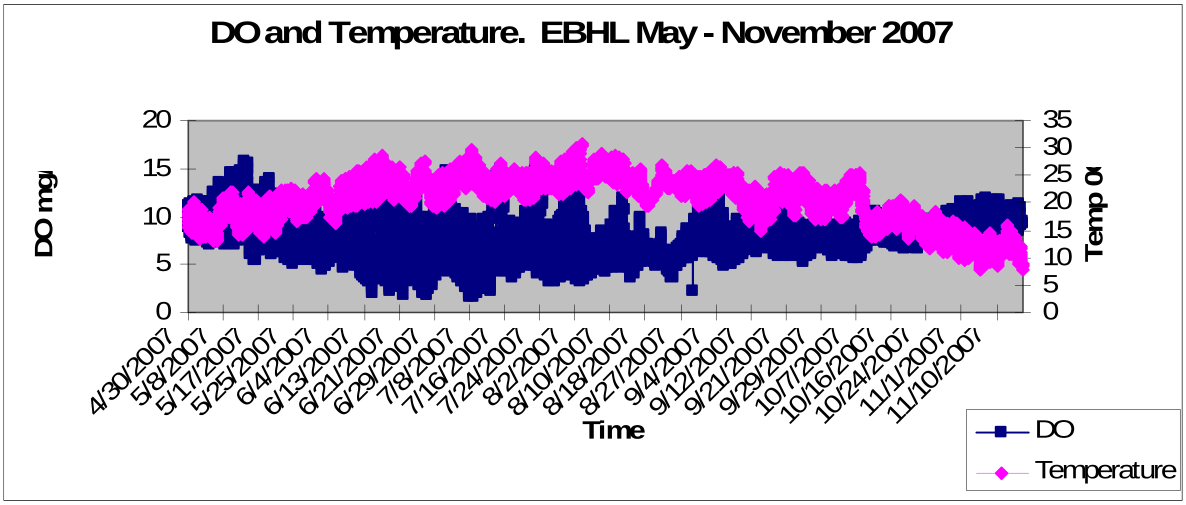
The DO data in the original TMDL was limited both spatially and temporally. The DRSCW program greatly expanded the coverage and depth of DO data available for both streams. The data has also been used to model low flow DO levels in the East Branch (please see chapter 3). Table 13 summarizes the locations and nature of the breaches of the DO standard that the DO monitoring program has recorded.

Table 13. Summary of DO violations of the 5mg/l standard for the East Branch of the DuPage River. Source DRSCW Permanent DO monitoring Program. observed and modeled DO for 2006 and 2007 .

Site	Type of Excursion	Note	Suspected Source
Churchill Woods	Diurnal oscillations bottoming out under 5 mg/l and as low as 1.5 mg/l, Modeled to have DO at 1mg/l under low flow warm conditions (33^0C)	QUAL 2k model results considered robust for East Branch, suggest site is the prone to low DO during dry warm weather Site also listed for phosphorous 2007	Nutrient loading
Army Trail Road	Diurnal oscillations bottoming out under 5 mg/l	June- July period	Nutrient loading
Butterfield Road	Diurnal oscillations bottoming out under 5 mg/l	June- July period	Nutrient loading
Hidden Lake Forest Preserve	Diurnal oscillations bottoming out under 5 mg/l DO sags following wet weather	June- July period	Nutrient loading and storm water loading with DO demanding material
Hobson Road	Diurnal oscillations bottoming out under 5 mg/l DO sags following wet weather	June- July period	Nutrient loading and storm water loading with DO demanding material

The most frequent kind of violation is driven by the diurnal cycle and occurs in the early morning (05.00-0.7.00 o'clock). Wide spreads in diurnal oscillations are commonly associated with high concentrations of algae blooms. Hourly pH data for these sites confirm that the DO swings are influenced heavily by aquatic vegetation as pH daily movements track those of DO (plants absorb carbon during the day and expel it at night so influencing water pH). Algae density is largely a function of phosphorous levels. Figure 4 for Hidden Lake on the East Branch clearly shows the influence the diurnal the cycle on DO levels.

Figure 4. DRSCW DO Data for 2007. East Branch DuPage River at the Hidden Lake Forest Preserve

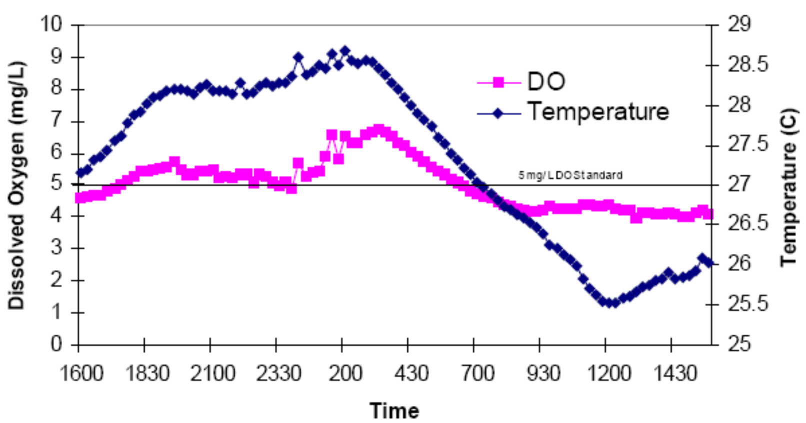


2.2.1.b West Branch.

The West Branch was not listed on the 2004 303 (d) list for dissolved oxygen but a TMDL is under development for three segments (see figure 3). Stations GBK 5 and 12 are both associated with low head dams (Warrenville Dam and McDowell Grove Dam respectively) and the excursion is based on data collected by the Conservation Foundation in 2003 (Assessment of Dams on the DuPage River 2003, The Conservation Foundation).

Figure 5. DO in Warrenville Dam Impoundment 2003.

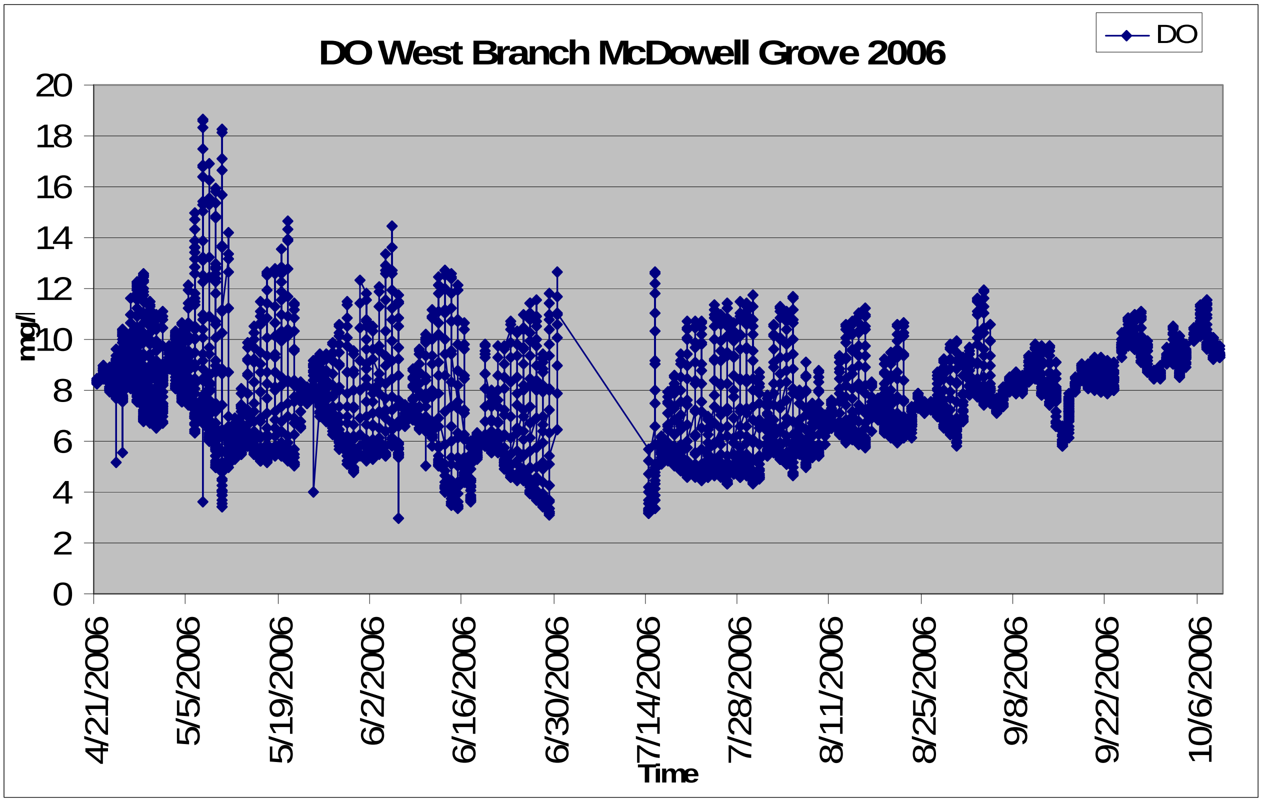
Figure 2.8 shows the diurnal fluctuation in dissolved oxygen (DO) and temperature in the Warrenville Grove Dam Impoundment over a 24-hour sampling period with a deployed Hydrolab. The DO does drop just below the 5 mg/L standard for at least ten hours over the 24-hour sampling period.



In 2006 the DRSCW deployed two sondes to the West Branch supplementing a DO sonde run independently on the West Branch by Wheaton Sanitary District since 2005. The location of all three sondes is shown on in Figure 3. The DRSCW DO monitoring program also recorded low

DO in the McDowell Forest Preserve impoundment. A summary The programs results are given in table 13.

Figure 6. DO fluctuation in the McDowell Forest Preserve Dam Impoundment Summer 2006.



The DO swings are most pronounced around the 10th of May varying from 5 mg/l to >18 mg/l in a single 24 hour period. Source: DRSCW Permanent DO monitoring program, 2006 data

Table 14. Summary of DRSCW DO WQ excursions data for 2006 and 2007 for West Branch observed

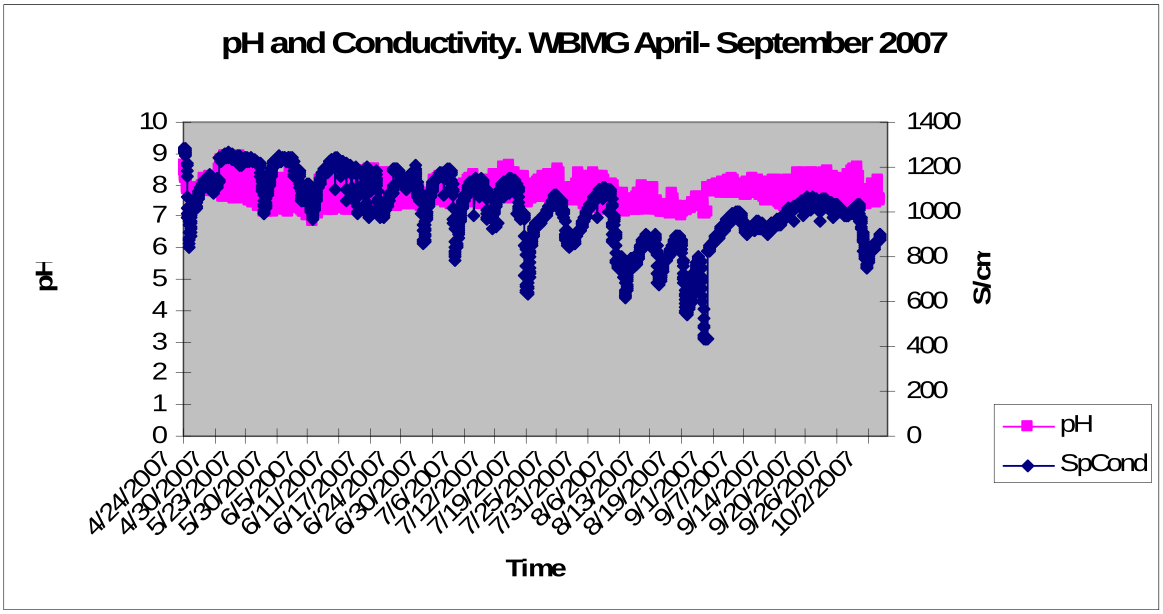
Site	Type of Excursion	Note	Suspected Source
Arlington Drive	NA		
McDowell Grove	Diurnal oscillations bottoming out under 5 mg/l	June- August period	Algea/Nutrient loading

Source: DRSCW Permanent DO monitoring program, 2006 and 2007 data

2.1.3. DO Analysis

The most frequent violation is due to diurnal activity. During periods of low UV radiation (evening, night or heavily overcast periods) plants stop photosynthesizing and start to respire CO2 and absorb O2 (the reverse process that occurs during active photosynthesis). In aquatic conditions with large amounts of vegetation this can quickly lead to very low DO conditions (as well as supersaturated conditions). In the both rivers the probable culprit is algae, both attached filamentous and planktonic. In fresh water such algae dominated conditions are linked to phosphorous loading from non-point and point sources.   The large daily DO (>9 mg/l in a 24 hour period) variation encountered at McDowell Grove and Churchill Woods is strongly suggestive that algae is the primary DO driver at the sites. Also suggestive of this process are the pH fluctuations recorded at the sites. pH for McDowell Grove Dam impoundment in 2007 is shown it Table 16

Table 15. pH and water conductivity. McDowell Grove Dam Impoundment 2007



The pH can be seen to vary between 7 and 9 on a daily basis. The variation is due to the removal and replacement of carbon as plants move through their photosynthetic cycle. The pH variation supports the analysis of high concentrations if algae in the water column at this and other sites in the project area.

The low flow DO sag at Churchill Woods (and possible at the McDowell Grove and Warrenville dams) is potentially more biologically damaging as they it is more protracted in time. The low flow DO conditions are largely due to Sediment Oxygen Demand from benthic deposits accumulating behind the low head dams. Such sediments can have a high BOD by containing animal waste with high nutrient concentrations as well as other organic deposits such as leaf litter or lawn fertilizers. Sources of sediment may be non-point runoff from the landscape, POTWs and stream bank erosion.

The wet weather sags may be due to the occurrence of small storms generating low DO concentrations by transporting oxygen-demanding materials and low-DO water washing of the landscape as well as re-suspending existing bed load increasing the water column sediment interface and so increasing DO demand. Phosphorous may also be a significant oart of wet weather washoff, leading to higher consternation of algae blooms.

POTW discharges can account for or contribute to the observed pollution but as the East Branch TMDL notes;

"WWTP effluents can deplete DO through BOD and ammonia loads. However, according to the DMR data and the IEPA monitoring data from 1997, WWTPs in the East Branch watershed generally discharged CBOD concentrations well below their permit limits. Also, ammonia concentrations from Bloomingdale STP and Glendale Heights STP were significantly lower than the permit limits"

Similar statements could be made about the West Branch. Lowering of phosphorous from POTW effluent may prove to be a necessary course of action but beyond the scope of this Watershed Plan update. The suggested remediation actions here concentrate on controlling phosphorous and BOD materials in stormwater and the removal of low head dams on the main stems so eliminating the sediment water interface encountered upstream of the dam.

2.2 Chlorides/TDS/Conductance[2]

Chloride, total dissolved solids (TDS) and conductance (or salinity) are three related parameters in water quality. TDS can be directly correlated to chloride and the specific conductivity of water has a well documented relationship with TDS. It is probable that resolving the the chloride impairments in the West and East Branches of the DuPage River the TDS and salinity problems will also be resolved.

The 2004 TMDLs for the two branches states that:

"According to the Illinois GU WQS, TDS concentrations (STORET parameter code 70300) shall not exceed 1,000 mg/L. Conductance is directly proportional to the TDS concentration. Although there is no GU WQS for conductance, a conductance value of 1,667 μmho/cm corresponds to 1,000 mg/L of TDS (305[b] guideline). Therefore, an exceedance of 1,667 μmho/cm of conductance is considered indicative of potential exceedance of the 1,000 mg/L of the TDS standard."

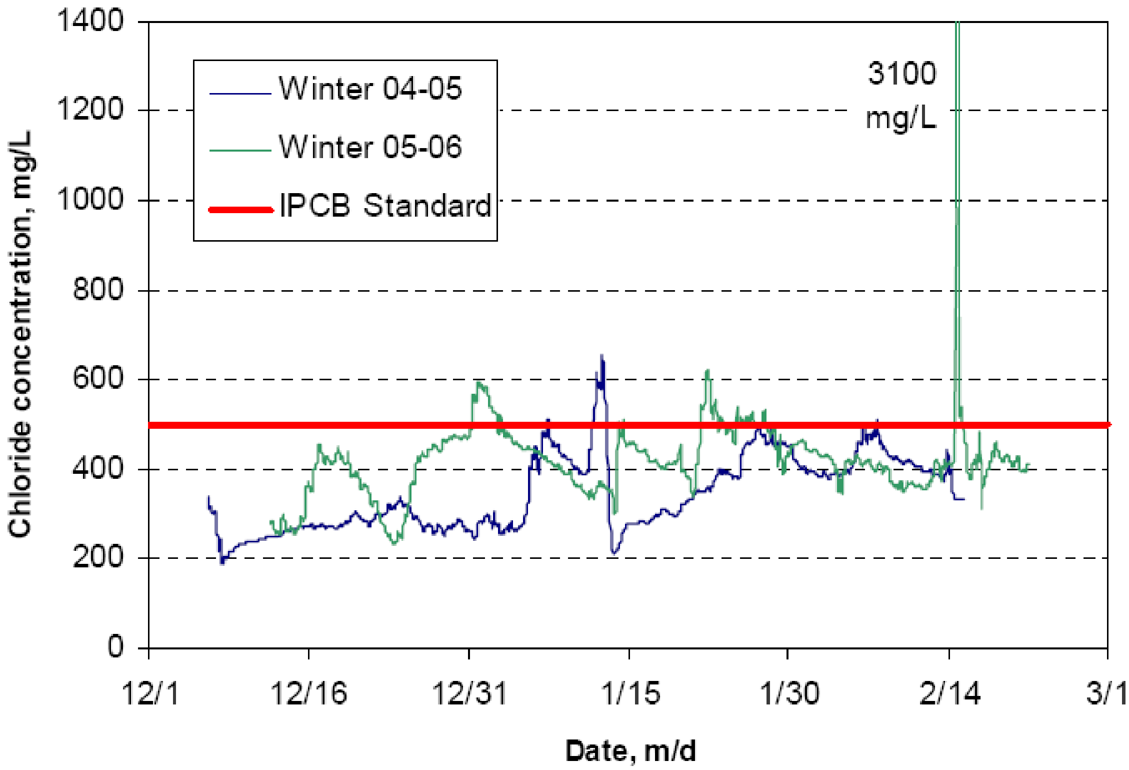
In 1972 the Illinois Pollution Control Board (IPCB) adopted the general use chloride water quality standard (WQS) of 500 mg/L. This standard lies between the acute and chronic chloride limits established by USEPA. Salt Creek and the East and West Branches of DuPage River are designated for general use; therefore, the 500 mg/L standard applies. (DRSCW Chloride Reduction Study Recommendations 2006)

By studying the seasonal nature of the impairment (more likely to occur during December – April Than May –November) and that the changes conductivity were mainly due to changes in chloride levels the TMDLs concluded that "high TDS/conductance is caused by road salt application in the winter months"

The WB stream segments listed as impaired for salinity, TDS, and chlorides are GBK 07, GBK 09, GBK 05, and GBK 12. The East Branch segments are GBL 05 and GBL 10. Segments are highlighted in the map in appendix 2.1.

[2] Chapter adapted from *DRSCW Chloride Reduction Report Final Recommendations 2007. Consultant CDM*

Figure 7. ***Chloride concentration at the Wheaton Sanitary District conductivity probe at Butterfield Road, west Branch, for the winters of 2004-05 and 2005-06.***



TDS data generated from conductivity data for the West Branch of the DuPage River at Butterfield Road. TDS data generated automatically by the conductivity probe based on a nationally established relationship. Data courtesy of Wheaton Sanitary District

Figure 8 shows sites listed in the East and West Branch chloride TMDLs as having exceeded the Sate Water Quality standard for chlorides.

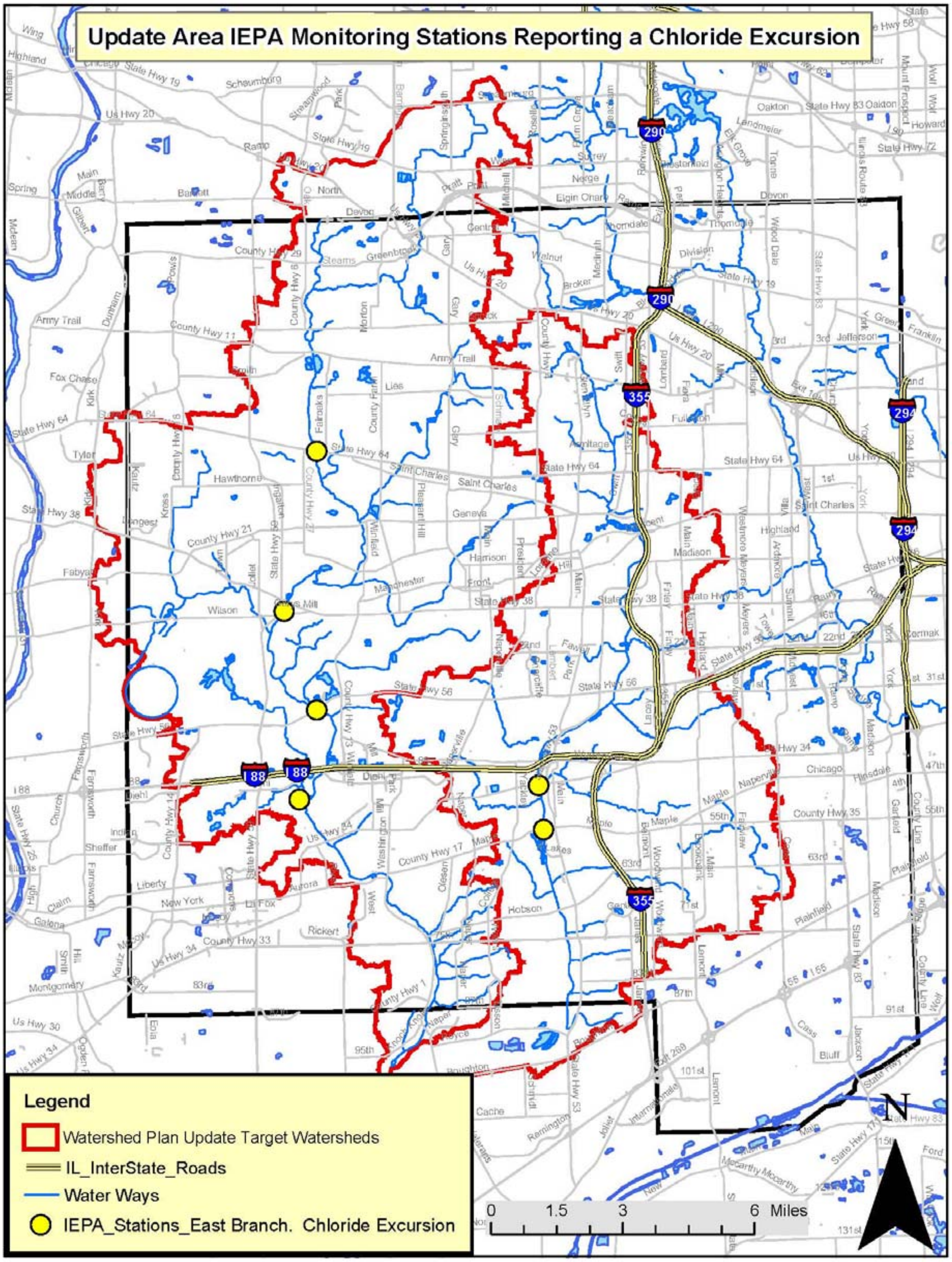

Update Area IEPA Monitoring Stations Reporting a Chloride Excursion
Legend
Watershed Plan Update Target Watersheds
IL_InterState_Roads
Water Ways
IEPA_Stations_East Branch. Chloride Excursion
0 1.5 3 6 Miles
N

Table 16. TMDL Chloride Allocations for Point and Non-Point Sources

	Salt Creek	*East Branch*	*West Branch*	*Total*
Point sources, tons of Cl^-/yr	28,700	34,100	19,300	82,100
Non-point sources, tons of Cl^-/yr	13,300	5,200	13,700	32,200

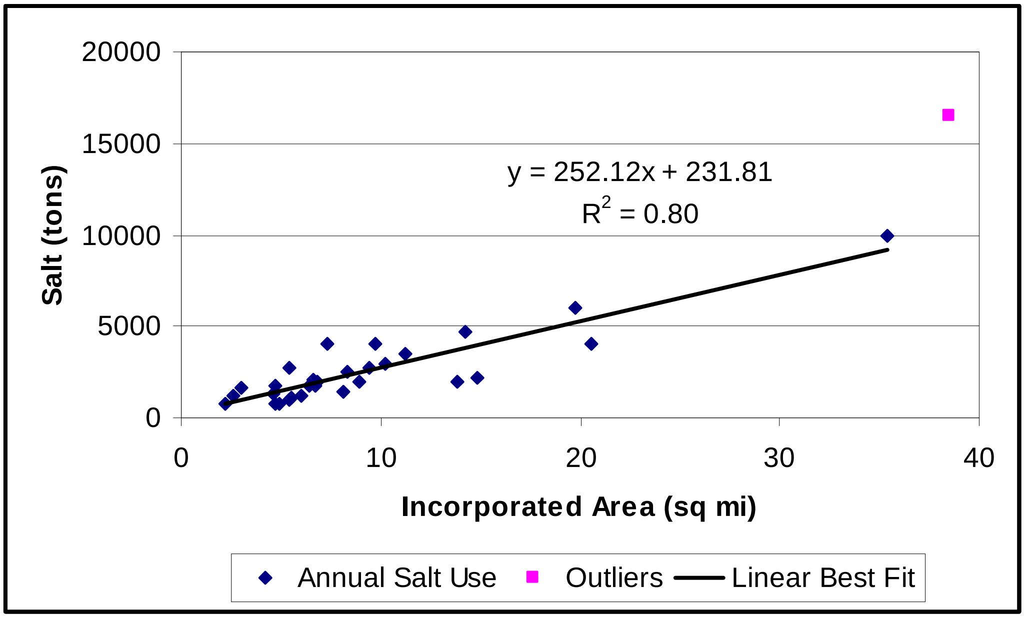
Source: IEPA, 2004, Salt Creek, East Branch and West Branch TMDL

In 2006 the DRSCW launched a more complete analysis of chloride use in the watersheds. In order to establish the amount of chlorides applied annually to the watersheds for deicing agencies who were responsible for de-icing practices were identified and contacted with a questionnaire. Since some of the municipalities and agencies who responded lie partly outside the watersheds, a geographical analysis of the data was conducted using Geographic Information Systems (GIS) tools.

Municipalities, townships and other agencies were treated separately. The annual salt use of each municipality that returned a questionnaire was plotted against its incorporated area (see **Figure 9** below). There is a strong correlation between annual salt use and incorporated area ($R^2 = 0.80$). The best fit line through those data was used to estimate the annual salt use for each municipality not represented by a questionnaire. For example, one city which did not return a survey has an incorporated area of approximately 13 square miles, so its estimated salt use is approximately 3,500 tons annually. (One outlier was omitted from the statistical analysis, as illustrated in figure 9)

For each municipality, the annual salt use was multiplied by the fraction of incorporated area lying within the watersheds, to estimate the amount of salt applied within the watersheds. For example, 39.6% of Bartlett's area lies within the watersheds. Bartlett reported an annual salt use of 2,200 tons of salt; therefore, 872 tons (39.6%) was assumed to be used within the watersheds.

Figure 9. Annual salt use by municipalities that responded to the questionnaire.



Salt use in other communities was estimated from the best fit line Source DRSCW Chloride Reduction Study 2007.

Six townships returned questionnaires indicating their typical annual salt use. The average amount of deicing salt applied annually is 1,025 tons. The annual salt use of townships that did not return questionnaires was therefore estimated as the average, 1,025 tons.

It was assumed that townships only apply deicing salt in unincorporated areas. For townships whose unincorporated areas were partly outside the watersheds, the annual salt use figures were reduced using the same method employed with the municipalities. For example, Winfield Township has 20.64 square miles of unincorporated area, of which 88.7% is within the watersheds. Winfield Township reported an annual salt use of 600 tons of salt; therefore, 532 tons (88.7%) was assumed to fall within the watersheds.

Based on the responses the study suggested that the assumptions about application rates used by the TMDLs underestimated actual rates. For East Branch, the salting rate assumed was 800 lb per lane-mile per storm, a value based on literature from other major cities. For the West Branch, local data from four communities yielded an average rate of 1,300 lb per lane-mile per storm.

Using a watershed model, the TMDLs calculated the required reductions in chloride for each watershed. The TMDL baseline chloride loadings (TMDL Baseline) and recomeneded road salt allocations by watershed are shown for reference in Table 18. Loadings for the East Branch increase significantly while those for West Branch remain the same. The more detailed DRSCW study of 2006 suggests that much greater reductions will be needed in order to meet the loading goal than originally estimated in the TMDLs.

Table 17 Chloride load calculations (tons/yr) from road salt application

	Salt Creek	*East Branch*	*West Branch*	*Total*
DRSCW Baseline,3	32,600	16,900	21,200	70,700
TMDL Baseline,4	15,500	7,800	21,100	44,400
TMDL Target,5	13,300	5,200	13,700	32,200

2.2.1 Information Review

An information review was performed to obtain as much information as possible related to applicable regulations and guidelines, and road salting practices and their chloride contributions. The search for information was accomplished via a literature review, a questionnaire, and telephone surveys. This section summarizes the studies, articles, and brochures that relate to road salting regulations and practices in the DuPage River and Salt Creek watersheds, and available alternatives to existing practices that could result in reduced chloride loadings. The questionnaire was distributed to municipalities and agencies in the watersheds to obtain information related to their deicing practices. This information, as well as information gathered by other telephone surveys, is presented below, following a summary of the applicable regulations and guidelines.

2.2.2 Applicable Regulations and Guidelines

Chloride is an ionic form of the element chlorine, is found in many common salts, and is readily soluble. In its dissolved form, it does not degrade chemically or organically over time. Chloride should not be confused with chlorine, a soluble substance often used as a disinfectant. Reverse osmosis and distillation are potential methods of removing chloride from water.

Chloride has not always been viewed as a pollutant or contaminant of water. It is an essential part of the diet of humans and other animals, and the oceans have a normal, healthy, chloride concentration of about 21,000 mg/L. However, elevated concentrations of chloride in fresh water can threaten aquatic life as well as introducing a salty taste to sources of drinking water. The US Public Health Service and Health Canada both set the secondary drinking water chloride standard at 250 mg/L, and the US Public Health Service further recommends an ideal limit of 25 mg/L (Mangold, 2000).

The impact of chloride on aquatic life varies from species to species. In 1988 the USEPA conducted a broad literature search and established water quality criteria for chloride to protect aquatic life (USEPA, 1988). Data of sufficient quality were available to evaluate response (impacts) for three species: cladoceran (daphnia pulex), rainbow trout and fathead minnow. The published conclusion was that the four-day average and one-hour average chloride concentrations should not exceed 230 and 860 mg/L, respectively, if fresh water aquatic organisms and their uses are to be protected.

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[3] Loads calculated from municipal-survey questionnaires administered by the DRSCW
[4] TMDL chloride-load calculations
[5] TMDL target-load calculations

The TMDLs for these watersheds were specifically derived to achieve compliance with the 500 mg/L standard. In the West Branch watershed, a reduction of 35% is specified for chloride applied in deicing operations, and in the East Branch watershed the reduction is 33% (IEPA, 2004, East and West Branch TMDLs). The Salt Creek TMDL subdivided the watershed between Addison Creek and Salt Creek, which were targeted for 41% and 8% reductions, respectively (IEPA, 2004, Salt Creek TMDL). Throughout this report, the watersheds of Addison Creek and Salt Creek are collectively called "Salt Creek"; the overall Salt Creek reduction is 14%. Additional information on these reductions is provided in the TMDL documents.

2.2.3 Significant Sources of Chloride

The obvious first step in addressing the chloride levels in Salt Creek and DuPage River is to identify and prioritize the sources of chloride in the watersheds. With this objective, the Illinois Environmental Protection Agency (IEPA) spent considerable effort collecting and reviewing data, and modeling the watersheds.

Water samples were taken from the watersheds over the period from 1995 to 1999. During this time, there were five observed exceedances of the chloride WQS in Salt Creek. In the same period, one exceedance was observed in each of the East and West Branches of the DuPage River. All seven of these exceedances occurred in January, February or March. Furthermore, plots of observed chloride concentrations by month showed clear seasonal variation. In each watershed, the highest chloride concentrations occurred in winter months, while the lowest occurred in summer.

Modeling performed for establishment of the TMDLs included three sources of chloride: the background groundwater concentration, point source discharges and road salting.

- Groundwater provides base flow to the streams. The average groundwater chloride concentrations were 51 and 106 mg/L in the Salt Creek and East Branch watersheds, respectively. (Groundwater is not mentioned in the West Branch TMDL.)

- The range of observed chloride concentrations in point source discharges was 90 to 555 mg/L. These data were collected as part of The Conservation Foundation data collection program (IEPA, 2004, Salt Creek, East Branch and West Branch TMDLs). For modeling, the point source discharges were assigned a constant concentration for each watershed: 300 mg/L in the Salt Creek watershed and 400 mg/L in the East and West Branch watersheds.

- Chloride loading from road salting was based on 14 snowfall events, accounting for the length of road surface in each watershed and assuming a standard salt application rate. For Salt Creek and the East Branch, the rate assumed was 800 lb per lane-mile per storm, a value based on literature from other major cities. For the West Branch, local data from four communities yielded an average rate of 1,300 lb per lane-mile per storm.

The conclusion of the TMDL reports was that "[the] primary contributor to the [chloride WQS] exceedances is application of road salt for snow and ice control purposes. However, due to the sporadic nature of deicing activities, on a yearly basis, the chloride mass contributed to the West Branch DuPage River watershed is larger from point sources than nonpoint sources." (IEPA, 2004, West Branch TMDL) The conclusions regarding Salt Creek and the East Branch are the same.

Road salt is almost entirely sodium chloride, which is composed of 39.3% sodium and 60.7% chloride, by mass. (An anti-caking agent containing cyanide is usually added to road salt; the cyanide may pose a water quality concern, but is outside the scope of this study.)

In the TMDL reports, the contribution of chloride from non-point sources was calculated directly from "salt applied for deicing purposes, since that is the most direct measurement of chloride applied to the watershed." (IEPA, 2004, East Branch TMDL)

3 Existing Water Quality Programs

3.1 DuPage County

3.1.1 Stormwater Utility (Link to presentation on utility)

3.1.2 Illicit Discharge Detection and Elimination (Link to IDDE education material and presentation))

3.1.3 DuPage County BMP Manual (Link to Manuel)

3.2 DuPage River Salt Creek Work Group (DRSCW)

3.2.1 Permanent DO Monitoring Project

The DRSCW launched the continuous dissolved oxygen (DO) monitoring network in 2006. Prior to that DO had been monitored continuously at only one site on the West Branch, at Wheaton under the authority of Wheaton Sanitary District. Salt Creek had four permanent stations under the authority of Metropolitan Waster Water Authority of Greater Chicago (MWRDGC). Appendix 3 shows the location for DRSCW and partner DO sites.

Figure 10. HydroLab DS 5X *Built by HACH. The platform used by the DRSCW is equipped to collect data on DO, conductivity, pH and water temperature.*

The current distribution of permanent DO stations in the West and East basins of the DuPage River and of Salt Creek is three on the West Branch, five on the East Branch and seven on Salt Creek. Sites were selected based on the TMDLs reports of 2004, field reconnaissance by the DRSCW and the presence of spanning structure to allow the placement of a protective housing.

The ten sites maintained by the DRSCW use a HydroLab DS 5X (see figure 10) equipped to collect data on DO, pH, conductivity and water temperature. Stations have a sample interval of one hour and run from April through to October (a period recognized as
The project functions under a quality assurance plan agreed on with the Illinois Environmental Protection Agency. Details on the sites are given in table 19.

Table 18. DRSCW Permanent DO Monitoring Locations

IDENT	IDENT(All)	LAT	LONG	Y_PROJ	X_PROJ	CITY	SITUATION
WBMG	West Branch McDowell Grove	41.79592837	-88.18726339	4627799.98273665	401359.33330610	UNINC	In Dam impoundment
WBAD	West Branch Arlington Drive					Hanover Park	Housing on bridge River channel
EBHL	East Branch Hidden Lake	41.82570038	-88.05316435	4630960.29039640	412541.26333384	Downers Grove/UNINC	Riffle at downstream end of pond area
EBBR	East Branch Butterfield Road	41.83145318	-88.04790680	4631593.67120799	412985.66718110	UNINC/Downers Grove	Housing on bridge River channel
EBSC	East Branch Saint Charles	41.89029724	-88.05068966	4638129.84588364	412834.54564367	UNINC/Glen Ellyn	Housing on bridge River channel
EBHR	East Branch Hobson Road	41.75900159	-88.07245872	4623574.74373084	410846.57832272	UNINC/Woodridge	Housing on bridge Stream channel downstream of tributary
EBAT	East Branch Army Trail Road	41.93517074	-88.05843021	4643120.00939678	412253.86843183	UNINC/Bloomingdale	River channel

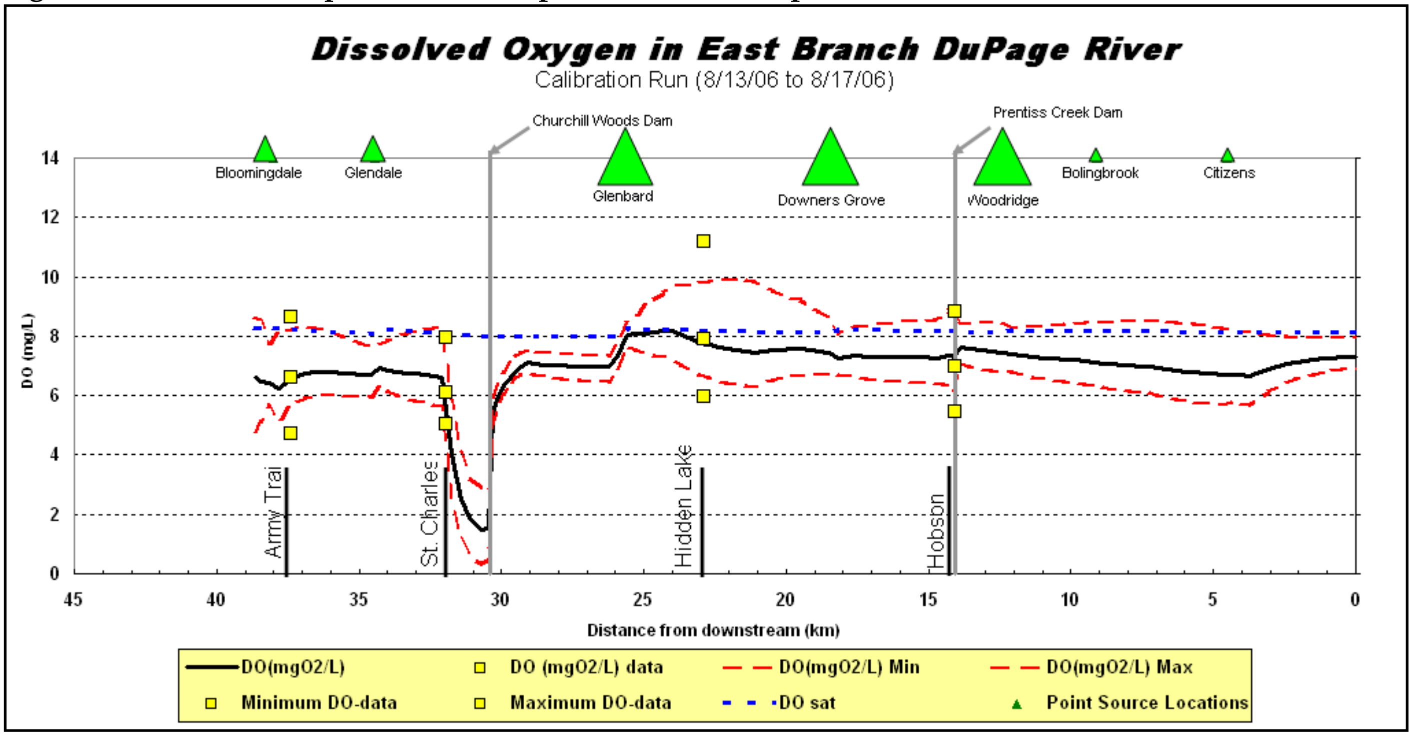
3.2.2 Stream Dissolved Oxygen Improvement Feasibility Study

The goal of this Stream Dissolved Oxygen Improvement Feasibility Study is to determine the feasibility and benefits of the removal or modification of dams, and of the onstruction and operation of in-stream aeration projects on Salt Creek and the East Branch of the DuPage River. This study will identify a specific project or projects that will help meet the TMDL goals for dissolved oxygen (DO) within the project area. DRSCW is most interested in projects that will address the biological impairment in a holistic manner considering all benefits to the ecosystem and surrounding community. The project is focused on developing a series of projects to reduce and eliminate DO impairments occurring during low flow periods in the rivers.

The studies objectives are:

- Identify appropriate projects for specific dam sites, considering dam removal, partial dam removal, or other modifications.
- Identify potential sites for stream aeration and select the best stream aeration technology that would consistently meet the dissolved oxygen standards.
- Develop the full scope of projects to be implemented, including regulatory issues, and project costs.

Figure 11. QUAL 2K output for selected period of 2006 compared to observed DO data



A DO profile for the East Branch of the DuPage River. Source DRSCW QUAL 2K model for East Branch 2006. The dams are marked as vertical grey lines. Churchill Woods shows a large fall in DO north of the dam. The yellow squares represents observed DO values for the time period being modeled. The model shows that Green Triangles represent POTWs discharging into the basin, the triangles relative size is representative of the plants design average flows. Vertical black lines represents major roads

- Select projects with secondary benefits to stream habitat, the surrounding natural environment, and neighboring properties.
- Conduct an effective and interactive public involvement program for stakeholders.

In order to analysis the streams under low flow conditions the project has developed a model of both the East Branch and Salt Creek. The main purpose of water quality modeling is to identify locations where low DO is expected or observed and quantitatively evaluate the effects of alternatives to potentially improve DO, that is, by removal and/or bridging of dams and stream aeration (mechanical, diffused air, side stream elevated pool, and pure oxygen). The model employed by the project is the QUAL 2K model. The model was set up using data collected from the watersheds, including rainfall, discharges from treatment works, stream geometry and sediment oxygen demand data (gathered in 2006 for East Branch). The output for two selected periods (following dry weather) was then compared to observed DO values gathered during 2006 by the continuous DO monitoring program. Figure 11 shows some of the model output for the East Branch.

The QUAL2K model was then utilized to simulate summer 2005 existing conditions, representing critical conditions for low dissolved oxygen. Certain model parameters were adjusted from the values used in the QUAL2E model scenarios to values that are more representative of the current physical and biochemical characteristics of Salt Creek and East Branch as determined from field investigations conducted as part of this study. Analysis using the model suggests that the largest low flow DO sag on the East Branch is the impoundment at Churchill Woods. The project is currently investigating scenarios for removing the dam at the site and restoring habitat in the area of the present impoundment.

3.2.3. DuPage River Bioassessment Program

The DuPage River Salt Creek Workgroup (DRSCW) coordinates a watershed wide monitoring program that includes approximately 75 sampling sites across the East and West Branches of the DuPage River watershed and its tributaries. A map of the locations can be found in appendix 3. Fish, macro-invertebrates, information about habitat and water samples are collected at each site. The West Branch DuPage River watershed was sampled during the summer of 2006 and the East Branch DuPage will be sampled during the summer of 2007. This first round of sampling will help to provide a benchmark of current conditions. The sites will be visited every three years to track improvements as various restoration projects and best management practices are implemented. As assessment information becomes available it will be posted on the website, the final report is due in June 2008.

The DRSCW contracted with Midwest Biodiversity Institute to develop the Bioassessment program plan. This plan describes the methodology for choosing sites and sampling techniques. The full Bioassessment Plan can be downloaded www.DRSCW.org . The data collected through this program will be used locally to help guide resource management activities to improve water quality. The data will also be used by the Illinois Environmental Protection Agency for water quality assessment purposes. The program is run under a quality assurance plan agreed upon by with the IEPA.

4. In the water- Habitat Restoration Projects on the Upper DuPage Watershed

Please find Chapter on restoration projects on website www.dupagerivers.org

5. Predicting Stormwater Pollution Loadings and Sources

In order to analyze the source and nature of stormwater pollution in the watersheds the update employed a model called WinSLAMM. The model was originally developed to better understand the relationships between sources of urban runoff pollutants and runoff quality when results gained from existing drainage based models did not match actual field measurements.

Advantages of WinSLAMM:

- *An emphasis on small storm hydrology and particulate wash off rather than very large and rare rains (a feature of drainage models). This was vital because empirical evidence has shown that storm water quality problems are mostly associated with frequent and relatively small rains.*
- *Strongly based on actual field observations*
- *Allows for a wide variety of source area and outfall control practices (BMPS)*
- *Has the ability to consider many storm water controls (affecting source areas, drainage systems, and outfalls) together, for a long series of rains*
- ***Applies stochastic analysis procedures to more accurately represent actual uncertainty in model input parameters in order to better predict the actual range of outfall conditions (especially pollutant concentrations).***
- ***It has a history of use on North America where it has been shown to accurately predict storm water flows and pollutant characteristics for a broad range of rains and control practices.***

Follow this link to visit WinSLAMM developers homepage http://www.winslamm.com/

While WinSLAMM offered a number of real advantages to the Watershed Update (see adjacent text box) it also demanded quite extensive data inputs. These inputs included rainfall, soil types, development data (land cover and land use). Rainfall data was readily available from DuPage County Stormwater and detailed soil maps in digital format were available from USDA, but detailed land cover maps in digital format were not available. Some excellent land cover maps such as the IDNR 1999-2000 Raster did not supply the level of detail necessary for this study. The Update team resolved to select a representative area, map it in detail and extrapolate the findings to the project area. Two sub- watersheds were selected one from the East Branch and one from the West Branch. The sub-watersheds were selected for their size (due to limited mapping resources), being broadly representative of the project area and having a mix of land use types; as it was seen that the pollutant loadings from different land uses may be significant and that may influence the prioritization of different land use areas for abatement practices. Together these sub watersheds had a total area of 1368 acres. The sub-watersheds are shown in Plate *.

The detailed sub basin mapping was done using a high resolution ortho- image from 2004. Mapping included identification and delimitation of both land use and source areas. In WinSLAMM land use is defined as a use category such as residential, open space, institutional, commercial and industrial uses. Source areas refer to actual land cover such as roads, sidewalks and buildings. Certain other characteristics were also mapped such as the pitch of roofs, connection of a surface to storm drains and the condition of the road

Figure 12. Example of Source Area Mapping, West Branch Study Area

Part of the West Branch land use and source area map over laid on a 2004 ortho- image. Land use categories presented here by using green space as shown in the legend, residential, commercial, industrial, freeway, large landscaped and undeveloped space. In fact all source areas (buildings, roads, sidewalks, driveways and parking) are similarly categorized. Numeric and alphabetic codes on buildings signify pitched (1) or non-pitched (2), on driveways connected (c) and unconnected (u) and on roads a scale of smoothness - smooth, i-intermediate and r – rough).

Picture of single residential lot from the West Branch Subwatershed Study Area: Building, sidewalk, driveway and green space were all mapped. Roof was coded as pitched, residential and connected (down spouts to storm sewer). Drive way and road is coded as residential, connected (curb and gutter) and smooth texture. Green space is coded as residential.

Soil classification was gathered from USDA soil maps

surfaces. Such details were collected during field visits to the target watersheds. An example of the land use/source area mapping is given in figure 12. The complete maps for each sub watershed are supplied in the appendixes 5 and 5.1. The pollution loads from source areas (roads, sidewalks, driveways, turf areas) were generated using recommended parameter files obtained from Wisconsin USGS (United States Geological Survey) rather than the default loadings contained in the model. WinSLAMM then modifies these parameters based on local conditions (soils types, drainage system and roughness of road surfaces). The WinSLAMM parameter files are available at the Wisconsin USGS page http://wi.water.usgs.gov/slamm/slamm_web_doc_07.htm. The results of the land use and source area calculations and the loading for selected pollutants are given in tables 20-24.

5.1 Pollutants Modeled using WinSLAMM

Two pollutants, total suspended solids (TSS) and total phosphorous (TP), were examined in the washoff model. TSS was analyzed for several reasons including the fact that in the quiescent areas of the waterway TSS can become deposited as sediments, besides being in suspension. Both rivers are listed for TSS. Many other pollutants of concern, such as metals, attach themselves to suspended fine-grained sediment. In the case of metals it is because of the ionic attraction (fine-grained clay particles are negatively charged, metals are positively charged), the metal mercury, for example, is associated with these fine solids. Various studies note that DDT and hexachlorobenzene, two other listed causes of impairment on neighboring Salt Creek, are found in sediments. The fine grained sediments found in the waterway can be washed in along with stormwater or can be re-suspended after being deposited and becoming part of the stream's bed load.

Phosphorous was analyzed as it represented a nutrient. In these watersheds excessive algae growth, indicative of high nutrient input, has been a concern. Both phosphorous and total nitrogen as N are listed as causes of impairments. Additionally the literature has indicated a relationship between phosphorous and dissolved oxygen, especially in impoundments, which are frequent in these basins in the form of backwater areas behind dams and restrictive on line structures and in detention basins. Many of the same BMP's that will reduce phosphorous inputs into the system will also reduce nitrogen inputs.

5.2 DuPage River Watershed Plan Update: Non Point Source Existing Conditions Analysis

In the following land use tables (Tables 20 and 21) the other urban/open space category includes parks and preserves. TS is total solids, TP is total phosphorous. The models suggests that while residential areas (56% and 67% of total area) produce the majority of the two pollutants studied they are not significantly more polluting per acre than commercial or industrial areas, which together form approximately 9% and 24% of the total area of the two watersheds respectively.
If we solve for the total phosphorous loadings for the two watersheds by area, the computed values are approximately 1.0 lbs/yr/acre for residential, 1.0 lbs/yr/acre for commercial and 1.4 lbs/yr/acre for industrial. Similarly, for total solids the computed loadings per acre are approximately 370 lbs/yr/acre for residential, 580 lbs/yr/acre for commercial and 1120 lbs/yr/acre for industrial. The source area mapping also suggests that open space (green space) is less polluting than impervious areas. Approximately 31% of the total area of the two watersheds is impervious, accounting for approximately 76% of predicted TS annual loading and approximately 54% of predicted TP annual loading. (Note in source area tables open space, green space, is all green areas from lawns, roadway easements to prairie to open water).
In summary, the data suggests that residential areas contribute the most pollution (TS and TP) in the two watershed, but are similarly and less polluting per acre than commercial (for phosphorous and total solids), and less polluting per acre than industrial areas.
Please note that due to rounding issues, the values presented in the total columns in the tables may not sum exactly. Unless otherwise stated all figures refer to annual production or reduction.

Table 19. Tributary 3 - West Branch Pollutant Loadings by Land Use

Land Usage	Residential	Institutional/Educational	Commercial	Industrial	Other Urban/ Open Space	Total
Total Acreage	493	70	33	41	247	884
Percentage of Total Area	56%	8%	4%	5%	28%	100%
Existing TS Load (lbs/yr)	144624	11861	21167	33018	24447	235118
% TS Load	62%	5%	9%	14%	10%	100%
Existing TP Load (lbs/yr)	438.5	31.9	31.4	41.8	93.9	637.4
% TP Load	69%	5%	5%	7%	15%	100%

*

Table 20. Tributary 3 - West Branch Pollutants Loadings by Source Area

% Pollutant Load From Selected Source Area (s)	Roofs	Parking Lots, Driveways and Sidewalks	Open Space	Streets	Total
Total Solids	5%	21%	35%	39%	100%
Total Phosphorous	3%	11%	58%	28%	100%
Source Areas as % Of Total Watershed Acreage	6%	7%	80%	7%	100%
Source Area in Acres	**49**	**69**	**705**	**62**	**884**

Table 21. 22nd St. Tributary - East Branch Pollutant Loadings by Land Use

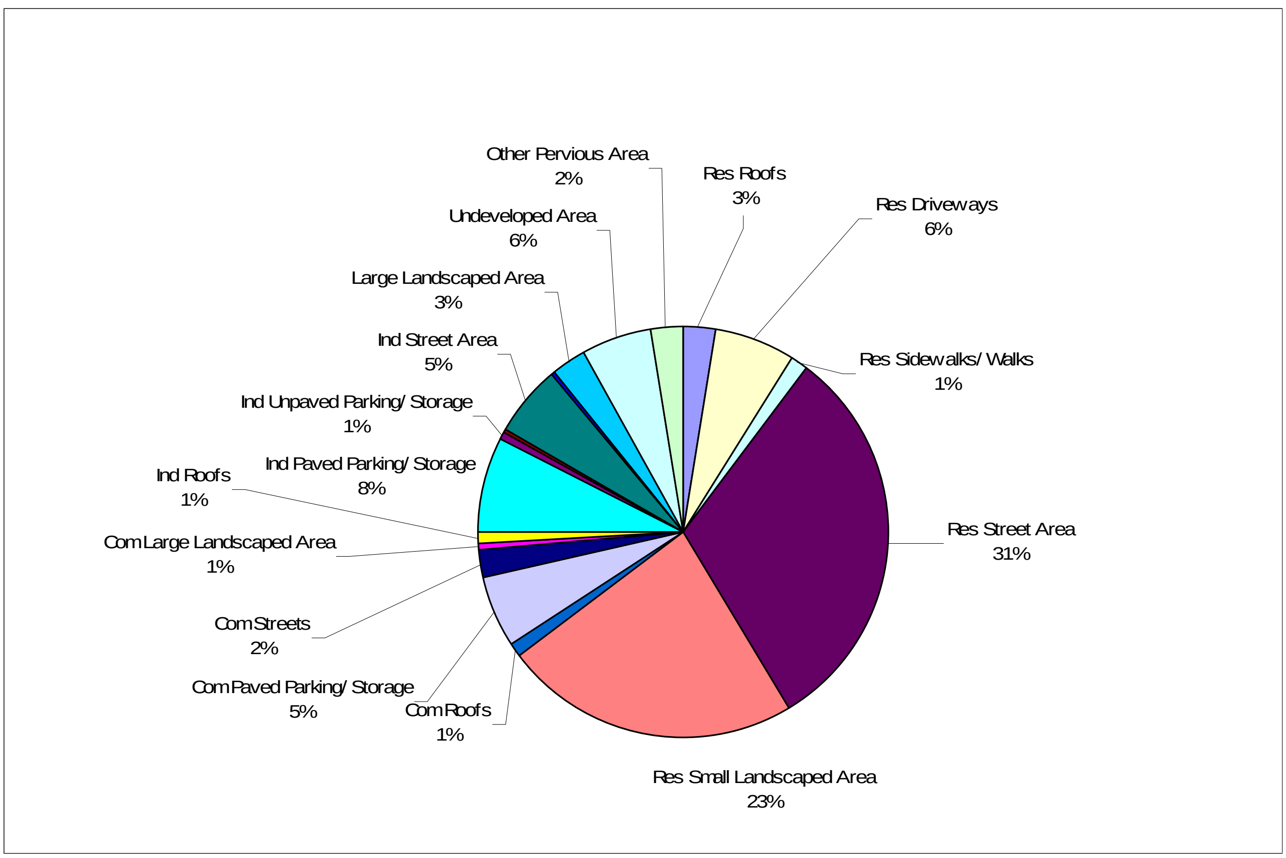
Land Usage	Residential	Institutional/Educational	Commercial	Industrial	Other Urban/ Open Space	Freeway	Total
Total Acreage	330	14	74	42	23	11	494
Percentage of Total Area	67%	3%	15%	9%	5%	2%	100%
Existing TS Load (lbs/yr)	157518	1132	41167	59749	3146	10610	273320
Percent TS Load	58%	0%	15%	22%	1%	4%	100%
Existing TP Load (lbs/yr)	371.9	2.8	73	72.8	13.1	18.6	552.2
Percent TP Load	67%	1%	13%	13%	2%	3%	100%

Table 22. 22nd St. Tributary - East Branch Pollutants Loadings by Source Area

% Pollutant Load From Selected Source Area (s)	Roofs	Parking Lots, Driveways and Sidewalks	Open Space	Streets	Total
Total Solids	10%	37%	14%	39%	100%
Total Phosphorous	8%	26%	32%	34%	100%
Source Area as % Of Total Watershed Acreage	16%	21%	51%	12%	100%
Source Area in Acres	**78**	**105**	**249**	**61**	**494**

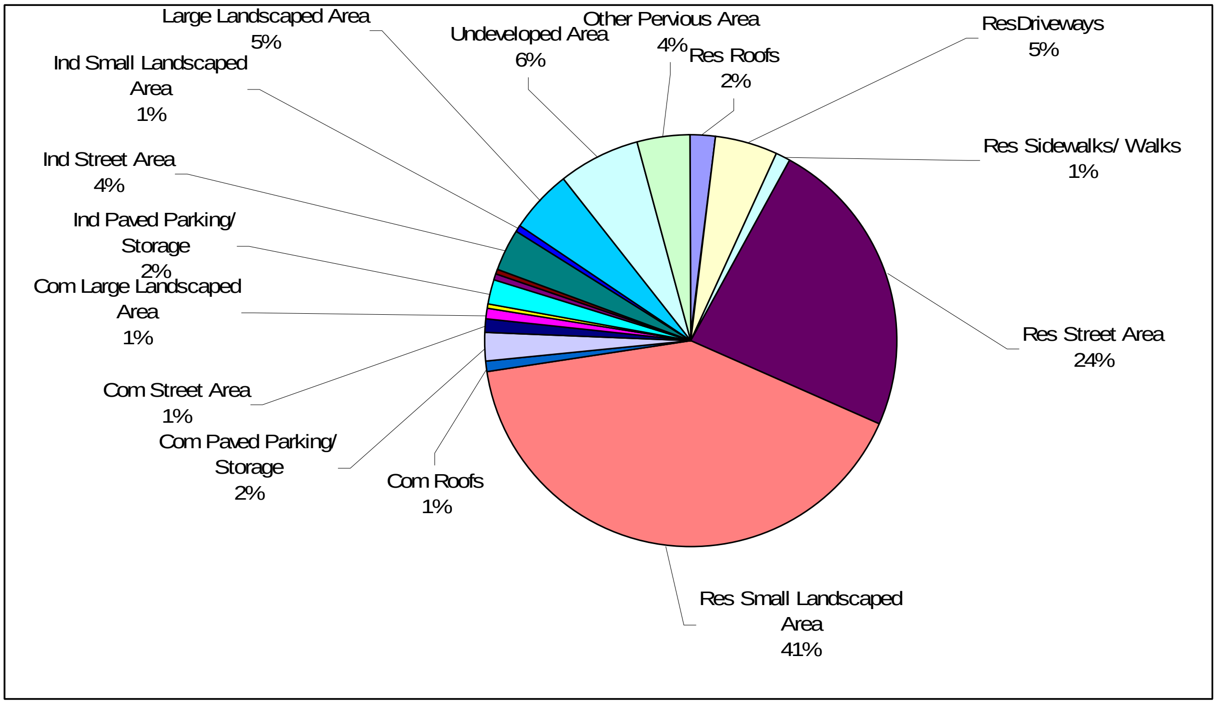
Given the detailed mapping and parameter files it is possible to look at the WinSLAMM source area land use output in more detail. Figures 13 through 16 present the watershed loadings from source areas under different land uses as a percentage of the total watershed loading.

Figure 13. West Branch Study Area Percentage Annual Total Solids Loadings by Source Areas under Different Land Uses



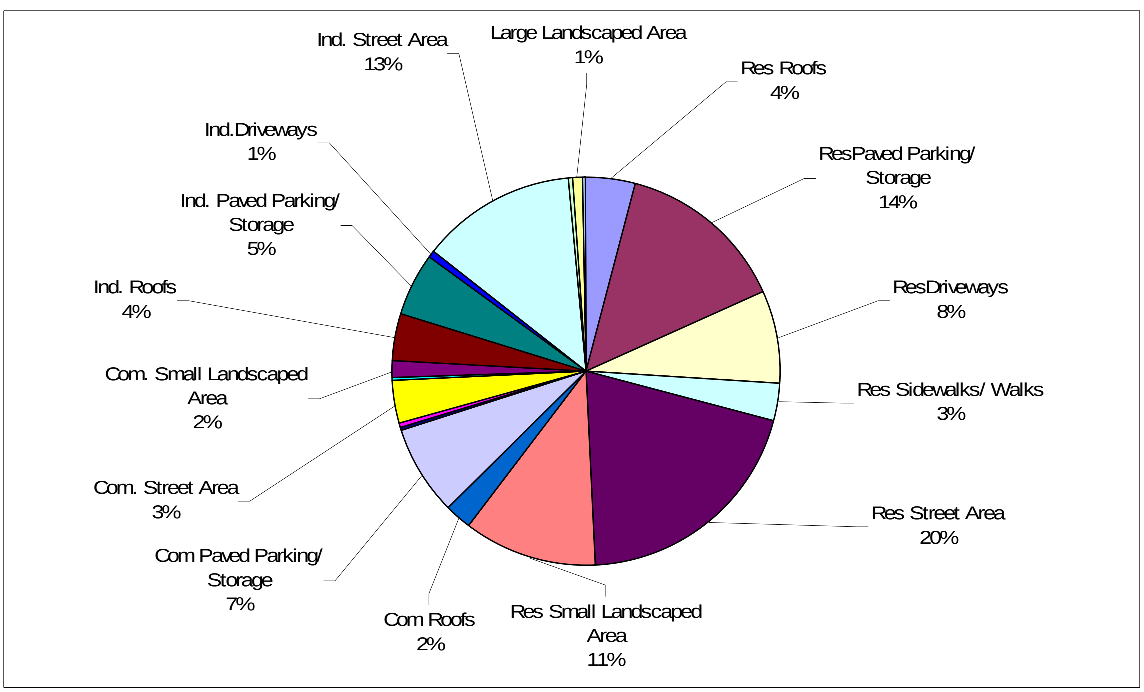
Percentage of annual totals solid contained in stormwater runoff from various source areas the in West Branch sample watershed (WBW3). WinSLAMM projected a total of 235118 lbs of TS would be produced per annum from the 884acre area. Areas producing less than 1% are not shown.

Figure 14. West Branch Study Area Percentage Annual Phosphorous Loadings by Source Areas under different Land uses



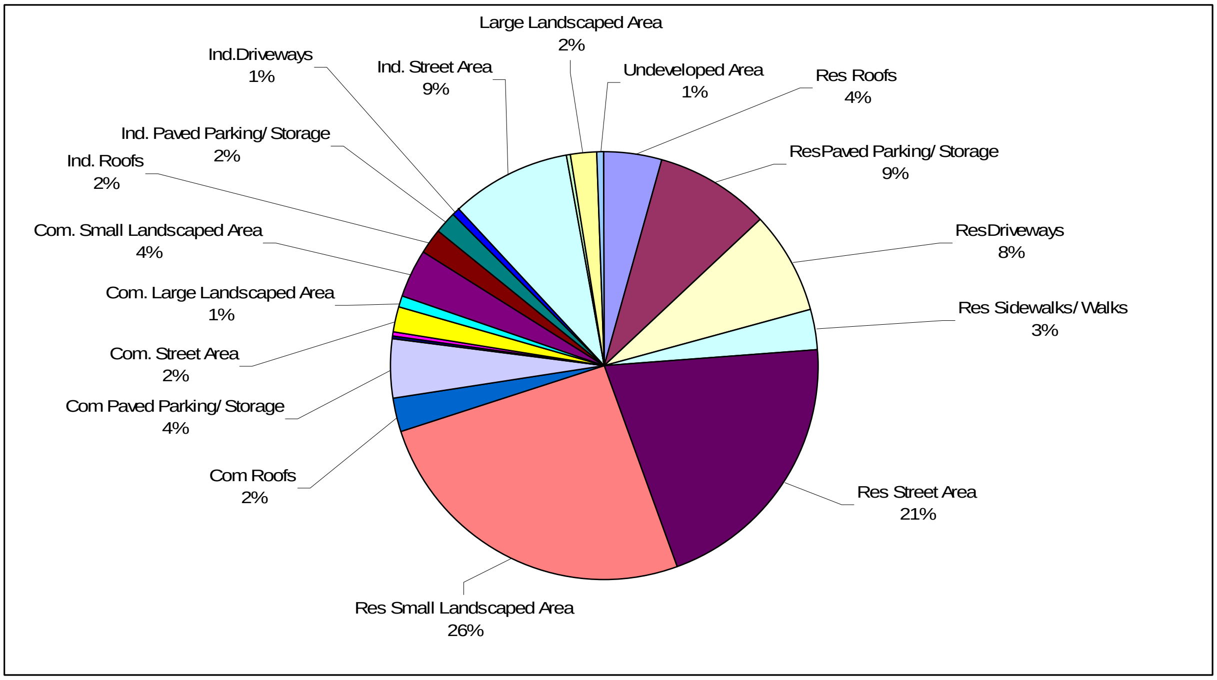
*Percentage of annual total phosphorous contained in stormwater runoff from various source areas in the West Branch sample watershed. WinSLAMM projected a total of 634.7 lbs of TP would **be** produced per annum from the 884 acre area. Areas producing less than 1% are not shown*

Figure 15. East Branch Study Area Annual Percentage Total Solids Loadings by Source Areas under Different Land Uses



Percentage of annual totals solid contained in stormwater runoff from various source areas in the East Branch sample watershed. WinSLAMM projected a total of 273320 lbs of TS would be produced annually from the 494 acre area. Areas producing less than 1% not shown

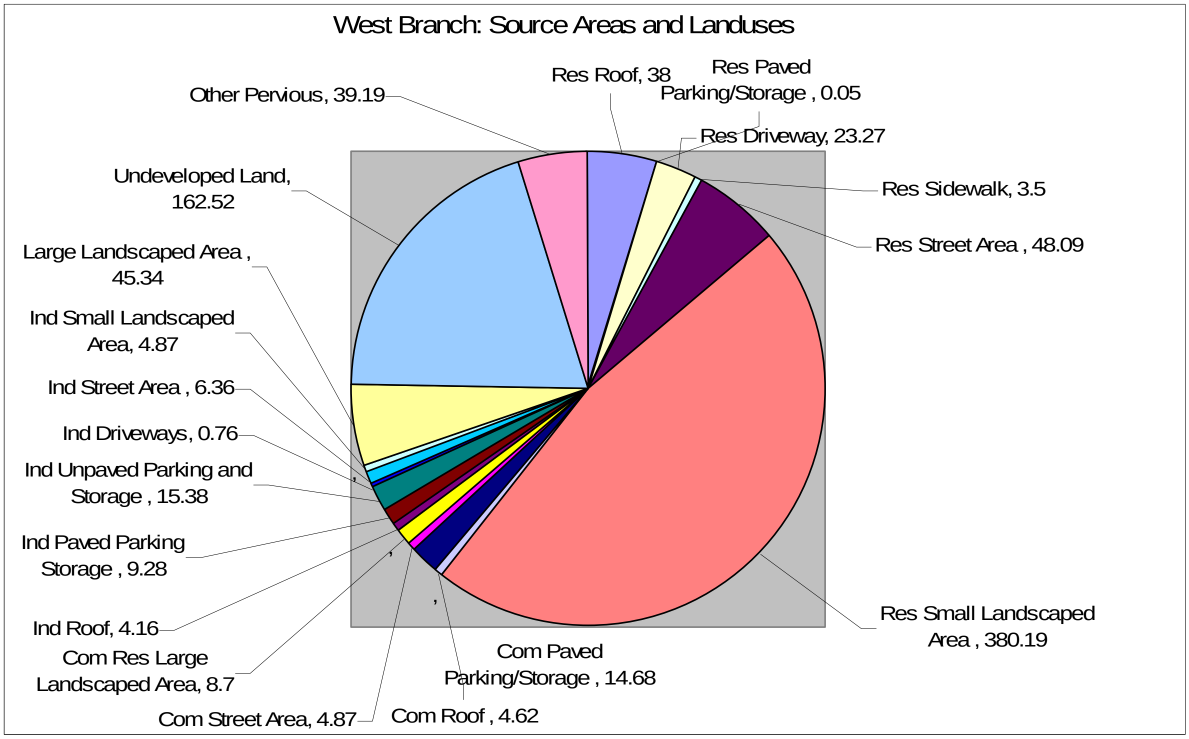
Figure 16. *East Branch Annual Percentage Phosphorous Loadings by Source Areas under different Land Uses*



Percentage of annual total phosphorous contained in stormwater runoff from various source areas the East Branch sample watershed. WinSLAMM projected a total of 552.2 lbs of TP be produced per annum from the 884 acre area. Areas producing less than 1% are not shown

In all four charts the biggest contributors are residential small landscaped areas and residential streets. However in the case of the West Branch Study Area residential landscaped areas are the single biggest source area by land use, and residential streets are the third (figure 17)

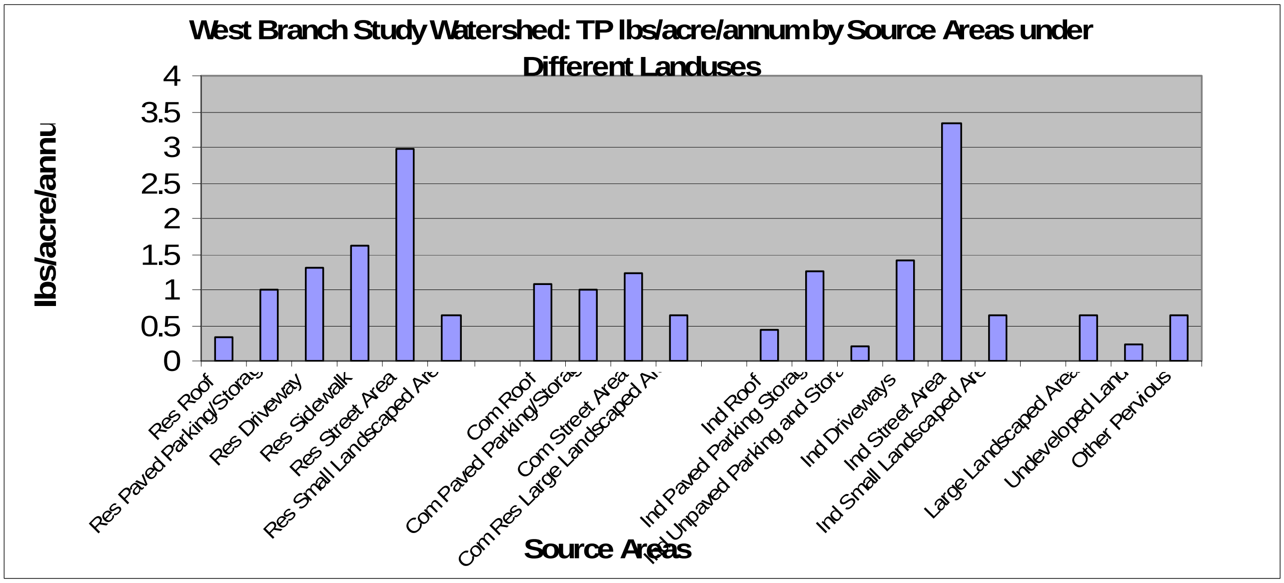
Figure 17. West Branch Study Area. Acreages for Source areas by Lands use



Acreages for mapped source areas for West Branch Study area under residential, commercial, industrial and open space land uses . Other uses accounted for less than 60 acres and are not included

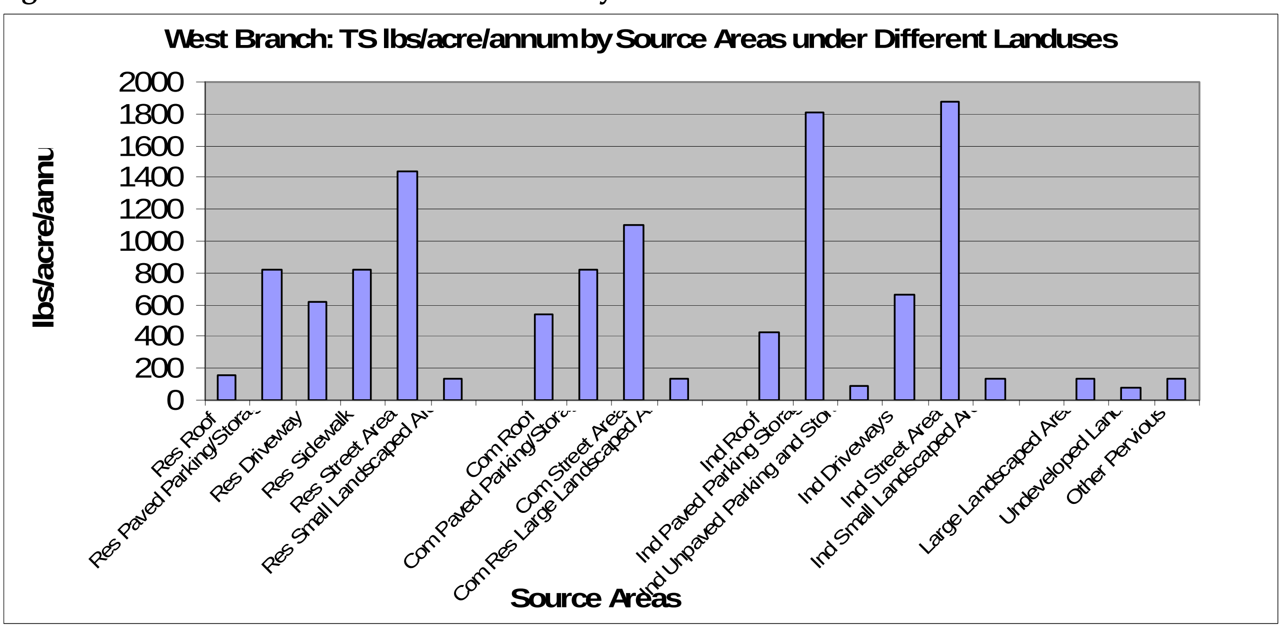
The East Branch Study Area when source areas under institutional land uses were dropped out residential green space accounted for 38 % of source are by land use, the largest area, and residential streets accounted for 8% just behind residential roofs and parking. Even the relatively industrialized East Branch sub-watershed was dominated spatially by commercial land use. When we solve the loadings by acreage to see what the most polluting area is on a per acre basis the results look somewhat different. The results are graphed in figures 18 to 21.

Figure 18 Total Phosphorous by acre of source area under different land uses



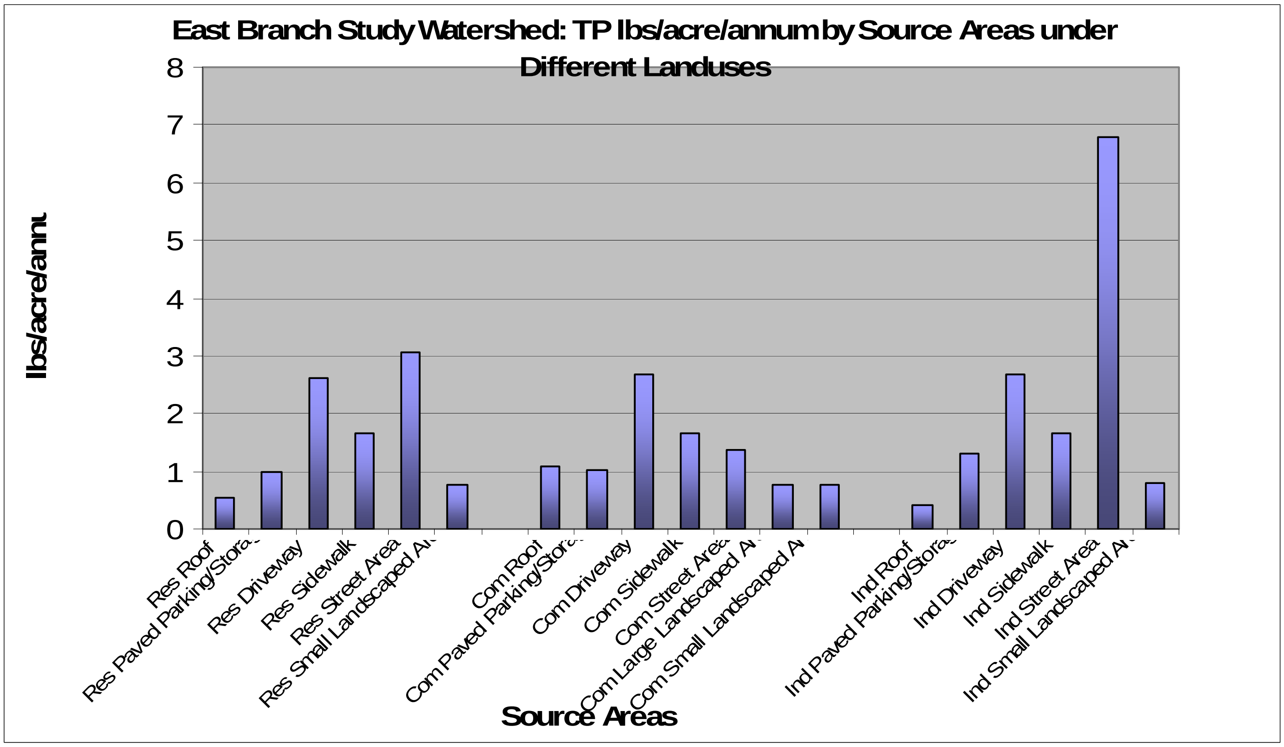
West Branch Study sub-watershed results for phosphorous loading per acre of source area. Results show that loadings per acre of impervious areas are higher than those from pervious areas. The results suggested loadings from street areas (industrial, residential) led followed by parking areas and sidewalks. Its is notable that the results suggest that in terms of phosphorous residential streets are more polluting per acre than residential green space. Only areas under residential, commercial, industrial and open space are considered in this graph.

Figure 19. West Branch Trib 3. Total Solids by acre of source area under different land uses



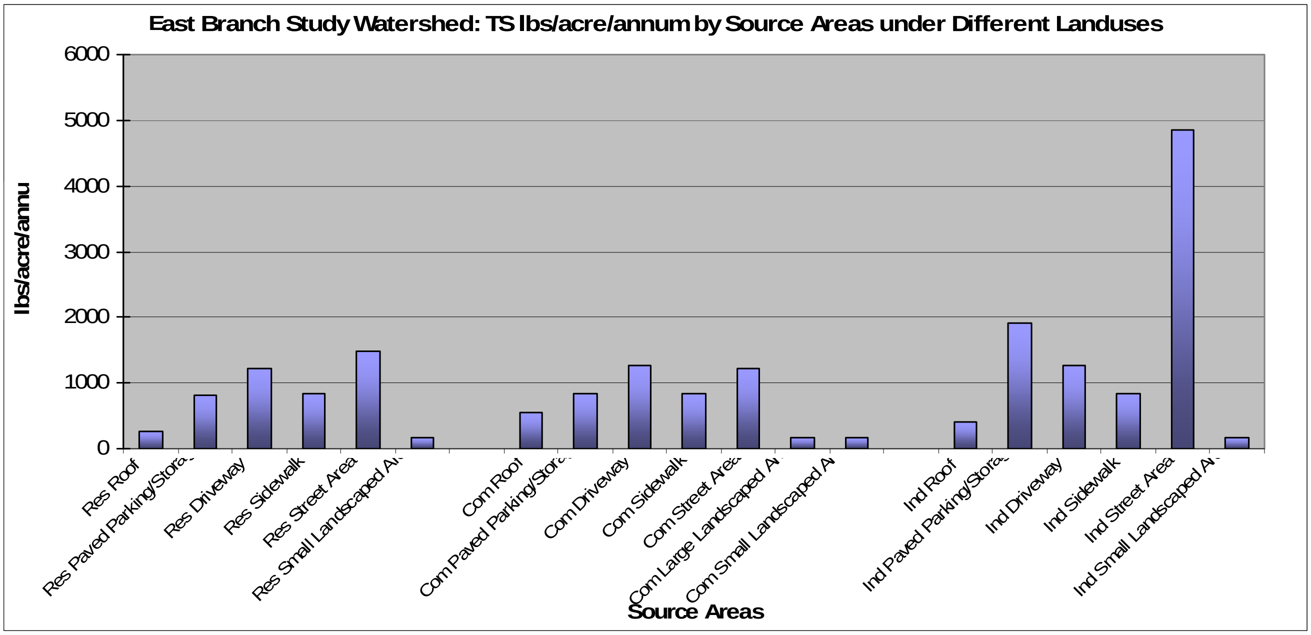
West Branch Study sub-watershed results for total solids loading per acre of source area. Road and parking areas under industrial use dominate followed by residential and commercial street and parking areas.

Figure 20. East Brach Study Area Total Phosphorous by acre of source area under different land uses



East Branch Study sub-watershed results for phosphorous loading per acre of source area Confirming the results of the West Branch loading per acre analysis, impervious areas contribute mote phosphorus to the watershed per acre than do pervious surfaces. Again the largest output per acre is from industrial street areas followed by residential street areas. Industrial, residential and commercial parking facilities also figure prominently.

Figure 21. East Brach Study Area ,Total Solids by acre of source area under different land uses



East Branch Study sub-watershed results for total solids loading per acre of source area Industrial impervious areas are the largest contributes per acre with streets being the largest single contributor. Again loadings per acre from residential and commercial streets were similar.

5.2.1 Extrapolation to the Rest of the Watershed.

The methodology of using the detailed data to calculate the existing non-point source loads was based on the identification of the land use makeup of the sub watershed where the source area was not mapped in detail was done using DuPage County's land use parcel data. Areas of commercial, residential, industrial and institutional land were aggregated for each sub watershed in the East and West Branch watersheds. DuPage County Right of Way (ROW) data was then allocated to the land use totals field according to its status and proximity to the identified parcels. Areas with out land use files (Cook County portions of the watersheds) were portioned to reflect the land use percentages of the basins as a whole.

In order to calculate areas for the various source areas an analysis of the two mapped areas was carried out and a relationship between parcels under different land uses and their land cover (green space, sidewalk drive ways buildings) developed. Two levels of residential parcels were developed based on lot sizes. ROW data was also looked at for a relationship between impervious area and ROW area. The portions of the various land use lots were then portioned out on based on the equivalent lot calculations.

Areas of open water were dropped out of the calculation and ownership data supplied by the Forest Preserve District of DuPage County and the Forest Preserve of Cook County were used to assist in calculating undeveloped land areas. The results are shown in annexes 7 and 8

5.3. Interventions To Reduce Non-point Source Pollution in the Upper DuPage Watershed

Working with DuPage Counties Municipal Engineers a number of potential (Best Management Practices) BMPs were evaluated and screened. The screening process looked at a number of criteria, most notably the probability of being widely adopted across the watershed. The absence of a certain BMP from the list does not infer that that BMP would not prove useful in the landscape examined. Rather the exercise aimed to bring a number of BMPs to the surface that could be widely adopted across the watershed so they could be tested for impacts on non-point pollution.

Some BMPs that seemed promising because of their high treatment values and because they targeted source areas that were proportionately more polluting were rejected during this process. For example bio-swales on road sides were screened out as the Municipal Engineers felt that road easements were already overcrowded with utilities. The list of BMPs selected for testing were:

- Rain Barrels
- Dry Wells
- Porous Pavement
- Rain Gardens
- Grassed Swales
- Street Sweeping
- Centrifugal Separators

5.3.1 Model assumptions for selected BMPs

A description of each of the selected BMPs is given in the appendices. Below is a summary of each of the assumptions used in modeling the individual BMPs

Assumptions for Rain Barrels

- Rain barrels were applied only to residential land use roofs.
- The barrels were sized at 3 square feet in cross-sectional area and 2.23 feet in height to equal the 50 gallon rain barrels sold by The Conservation Foundation.
- Assumed that households with rain barrels used an average of 10 gallons/day from the barrel during the months of March-October. In the other months, no water from the rain barrels was used.
- One rain barrel was used for one residential roof. The total number of residential roofs in the East Branch is 627 and in the West Branch is 833.
- Model runs were made with the assumption that 10%, 25%, 50%, and 100% of the residential roofs had rain barrels.

Assumptions for Dry Wells

- Dry wells were applied only to residential land use roofs.
- The dry wells were sized at 9 square feet in cross-sectional area and 3 feet in height.

- It was assumed that infiltration only occurs through the bottom of the dry well. The native infiltration rate for the West Branch was set at 0.3 inches/hour (silty loam soil) and the East Branch was set to be 0.1 inches/hour (clay loam).
- Overflow from the dry well occurs through a 1 foot high by 12 foot wide weir. The weir is located 3 feet above the bottom of the dry well.
- One dry well was used for one roof. The total number of residential roofs in the East Branch is 627 and in the West Branch is 833.
- Model runs were made with the assumption that 10%, 25%, 50%, and 100% of the residential roofs had dry wells.

Assumptions for Rain Gardens

- Rain garden target areas were roofs and parking lots in all land uses as well as landscaped areas in the residential land use category.
- Rain gardens consist of 2.5 feet of amended soil with 0.2 void ratio located above 1 foot of rock aggregate with 0.40 void ratio. The gardens are underdrained by a 4-inch diameter pipe set a 1/2 foot above the base of the bottom of the rain garden (bottom of the rock aggregate).
- Flow from the rain gardens occurs through a 0.5 foot high 10 foot wide weir for residential areas and a 0.5 foot high 200 foot wide weir for non-residential areas. The weir is located 3.5 feet above the bottom of the garden (bottom of the rock aggregate).
- The native infiltration rate for the West Branch was set at 0.3 inches/hour (silty loam soil) and the East Branch was set to be 0.1 inches/hour (clay loam).
- It was assumed that the total area of rain gardens was 5% of the areas to be treated. The total rain garden area was then divided by a unit rain garden size to determine the number of rain gardens needed.
- Rain gardens in the residential land use category were assumed to be 100 square feet (10x10). In other land use categories, the unit gardens were assumed to be 200 square feet (10x20).
- Model runs were run using 10%, 25%, 50%, and 100% of target areas treated.

Assumptions for Porous Pavement

- Porous pavement target areas were driveways and parking lots in all land uses.
- The parking lots were set to consist of 4 inch paver layer with 0.25 void ratio, 2 inch sand settling bed with 0.3 void ratio, and an 8 inch rock aggregate layer with 0.4 void ratio.
- The initial infiltration rate of the pavement was set to be 2 inches/hour. The native infiltration rate for the West Branch was set at 0.3 inches/hour (silty loam soil) and the East Branch was set to be 0.1 in/hour (clay loam).
- Model runs were performed assuming that 10%, 50%, and 100% of the target land uses were converted to porous pavement.

Assumptions for Grassed Swales

- Grassed swales applied an overall reduction to runoff pollutants from all land use categories.
- They were sized at 10 foot bottom width with 2:1 side slopes and a 1% longitudinal slope and a Manning's n of 0.05.
- A medium density residential area value from WinSLAMM (350 ft of swale/acre) of swales/acre was utilized.
- Infiltration rate for swales was set at .15 in/hour.
- The percentage of existing curb and gutter areas versus the percentage of swaled areas was set to be 18% curb and gutter and 82% swales in the West Branch Sub-Watershed. The East Branch Sub-Watershed was said to have a 50% curb and gutter to 50% swales ratio. These ratios were based off of percent impervious versus percent pervious in the respective watersheds.
- Models were run with the assumption that 10%, 25%, and 50% of the curb and gutter were converted to swales.

Assumptions for Street Sweeping

- Street sweeping was applied to streets in all land use categories.
- Street sweeping was set to run throughout the year.
- Street sweeping productivity coefficients defined by WinSLAMM based on street texture, parking density and parking controls.
- Medium parking densities with no parking controls were used.
- Street sweeping models were run for weekly (one pass per week) and monthly (one pass every four weeks) frequencies comparing vacuum and mechanical sweeping.

Centrifugal Separators

- Centrifugal separator target areas were streets in all land uses.
- It was assumed that the centrifugal separators would reduce pollutant loadings by 50%.
- Model runs were performed for 10%, 25%, 50%, and 100% of the streets being treated with centrifugal separators.

5.3.1. Reduction Rates Under Various Levels of Adoption of Selected BMPs in the Sample Watersheds

The projected reduction rates in the two selected pollutants are summarized in tables 24 and 25. Reductions in pollutants in these tables are expressed as a percentage reduction of total pollutant loading for the TS and TP in each sub-watershed. A number of trends are discernable. The treatment levels shown are clearly linked to the type and nature of the source area treated. The lowest reductions calculated were for rain barrels and dry wells, both treating residential roofs, a relatively small area of each sub watershed and with a low pollution loading rate per acre.

TABLE

Table 23. Tributary 3 West Branch Sample Sub Watershed. Reduction Loads for TS and TP under increasing levels of implementation of selected BMPs on target source areas.

TABLE

Table 24. 22nd Street Tributary - East Branch Sample Sub Watershed. Reduction Loads for TS and TP under increasing levels of implementation of selected BMPs on target source areas.

Indeed, mechanical street sweeping which, in each case only, treated a few percentage points more of watershed area showed reduction rates that were higher at the lowest level treatment (once per month, approximately present conditions) than either rain barrel or dry wells did when placed to treat every residential roof.

Mechanical street sweeping proved less effective at reducing loadings than vacuum street sweeping. It is also interesting to note the abatement curve for sweeping looks different than the curves for other treatments (separators, rain gardens) in that it is the least steep. This is probably due to the nature of street sweeping in that we treat the same area with increasing frequency rather than increase the area treated so the marginal impact will decrease with increased sweeping while other interventions may look linear.

Table 25. West Branch Study Area. Reduction rates for Annual TS Loadings from Source Areas Under Selected BMPS

Land Use	Rain Garden	Porous Pavement	Rain Barrel	Centrifugal Separator	Mechanical Sweeping	Vaccum Sweeping
Roofs	30%	0%	52%	0%	0%	0%
Driveways	0%	66%	0%	0%	0%	0%
Roads	0%	0%	0%	35%	8%	15%
Parking	46%	80%	0%	0%	0%	0%
Small Landscaped area	75%	0%	0%	0%	0%	0%
Undeveloped	0%	0%	0%	0%	0%	0%
Other greenspace	0%	0%	0%	0%	0%	0%

Projected reductions under 100% adoption of selected BMPs in the West Branch Study sub-watershed study area. Reduction rates are percentages of Source Area loading totals under a mix of land uses

Table 26. East Branch Study Area. Reduction rates for Annual TS Loadings by Source Area Under Selected BMPS

Land Use	Rain Garden	Porous Pavement	Rain Barrel	Centrifugal Separator	Mechanical Sweeping	Vaccum Sweeping
Roofs	16%	0%	35%	0%	0%	0%
Driveways	0%	60%	0%	0%	0%	0%
Roads	0%	0%	0%	34%	8%	14%
Parking	20%	71%	0%	0%	0%	0%
Small Landscaped area	54%	0%	0%	0%	0%	0%
Undeveloped	0%	0%	0%	0%	0%	0%
Other greenspace	0%	0%	0%	0%	0%	0%

**Projected reductions under 100% adoption of selected BMPs in the East Branch Study sub-watershed study area. Reduction rates are percentages of Source Area loading totals under a mix of land uses*

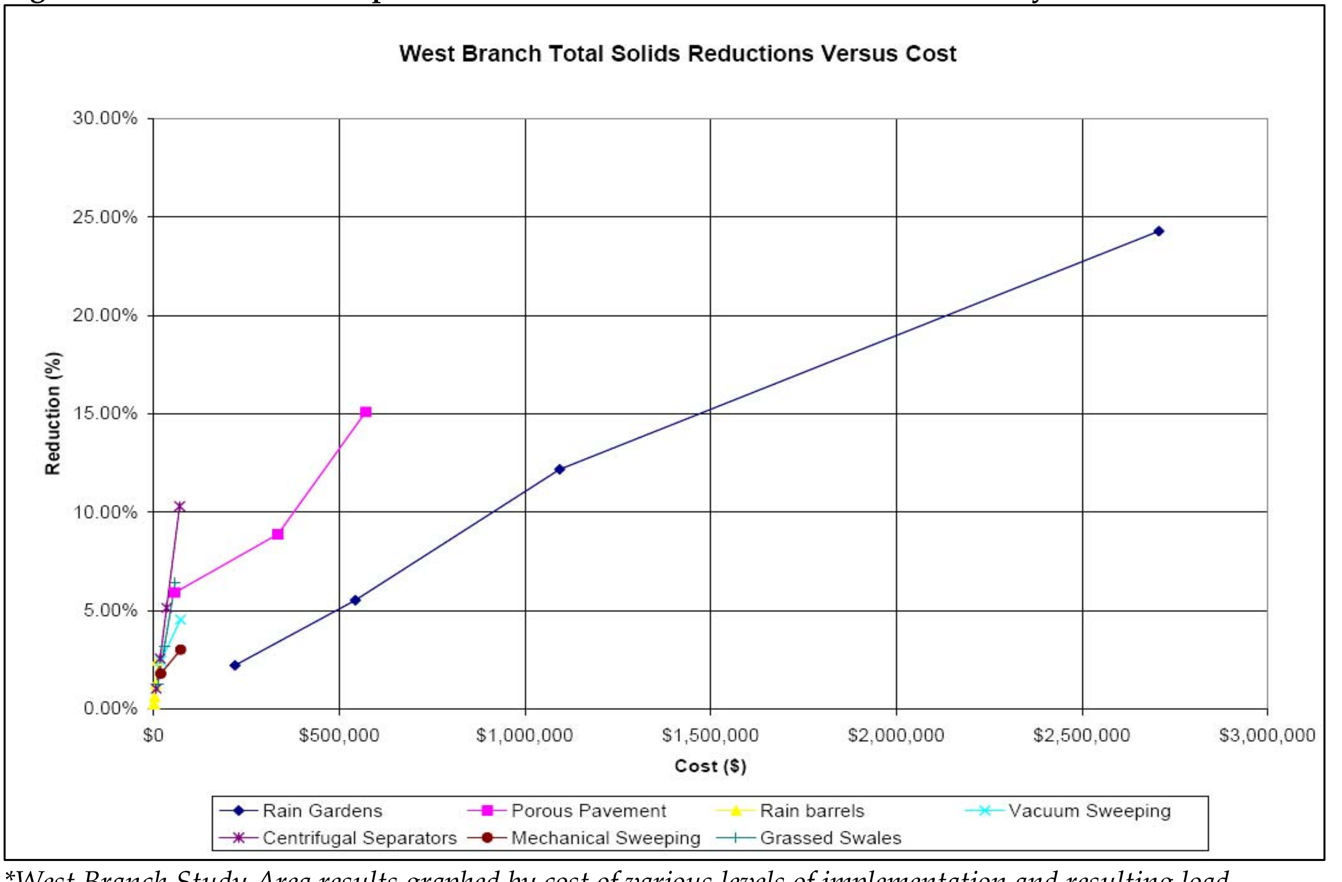
The largest source area reductions were calculated to occur under a rain garden/bio-infiltration scenario in the West Branch and under permeable paving on the East Branch. However, as shown in the cost benefit graphics *, rain gardens are also the most expensive option to execute. In each cost treatment graphic the steeper the curve the more efficient the BMP in terms of pollutant abatement projected for expenditure. The differences in the abatement curves between the two study areas reflect the different conditions of the sub-watersheds roads surface, soil types and land use makeup. The relative predominance of industrial and commercial surfaces and road surfaces in the East Branch mean that the centrifugal separators, permeable pavers, grassy swales and street sweeping can affect a larger influence than in the West Branch study area where residential land use with its low density streets and parking areas dominate.

Here rain gardens show the greatest potential for reducing total watershed pollution but are still less cost effective than the other options[6].

Under the conditions represented in the model centrifugal separators, vacuum street sweeping, conversion to grassy swales and porous pavement were calculated to be cost effective in that order. The results suggest that municipalities looking at situating BMPS optimally should consider the ratios of land used in their municipalities.

The BMP combinations were then applied to each sub watershed based on the land use, soil types and source areas contained by the sub watershed. The resulting reduction estimates and their estimated costs are given in appendixes 5.2 and 5.3.

Figure 22. Cost Benefit Graphic for Selected BMPS for the West Branch Study Area



**West Branch Study Area results graphed by cost of various levels of implementation and resulting load reductions. Cost is given on the x axis and reduction rates, expressed as a percentage reduction of total sub-watershed loading is given on the y axis. The steeper the line, the more cost effective the treatment. In this graphic source areas treated are not sorted by land use and the reductions are applied at the same rate across all source areas targeted by the BMP.*

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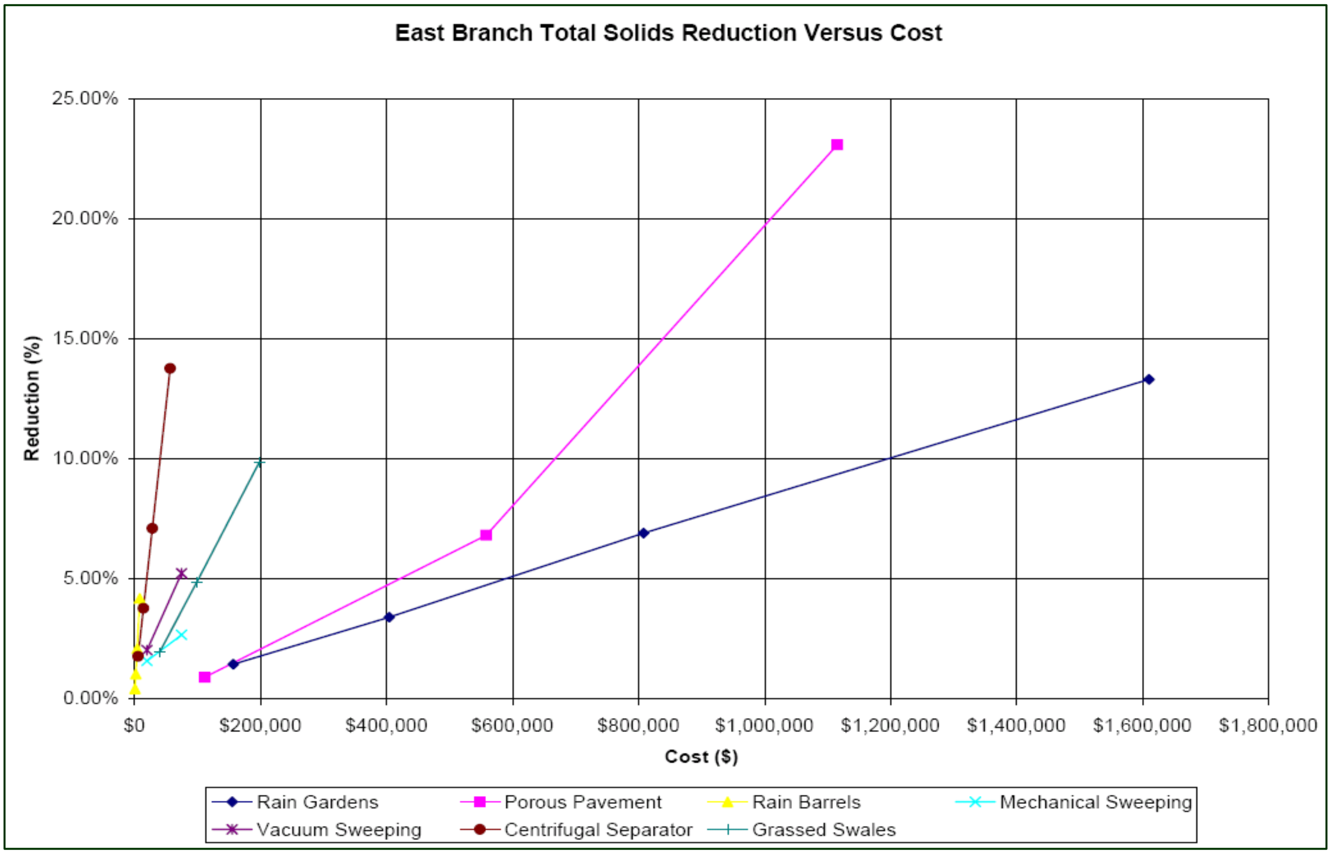
[6] It should be noted that in treating source areas in the model at this level all source areas are treated at the same percentage rate. That is at 10% of parking lots under treatment all parking lots will have 10% of their surface area treated. As a result abatement results will be averaged between parking areas under different land uses. This is important to remember when looking at how to us the results to optimize the situating BMPS.

Figure 23. Cost Benefit Graphic for Selected BMPS for the East Branch Study Area



East Branch Study Area results graphed by cost of various levels of implementation and resulting load reductions. Cost is given on the x axis and reduction rates, expressed as a percentage reduction of total sub-watershed loading is given on the y axis. The steeper the line, the more cost effective the treatment. In this graphic source areas treated are not sorted by land use and the reductions are applied at the same rate across all source areas targeted by the BMP.

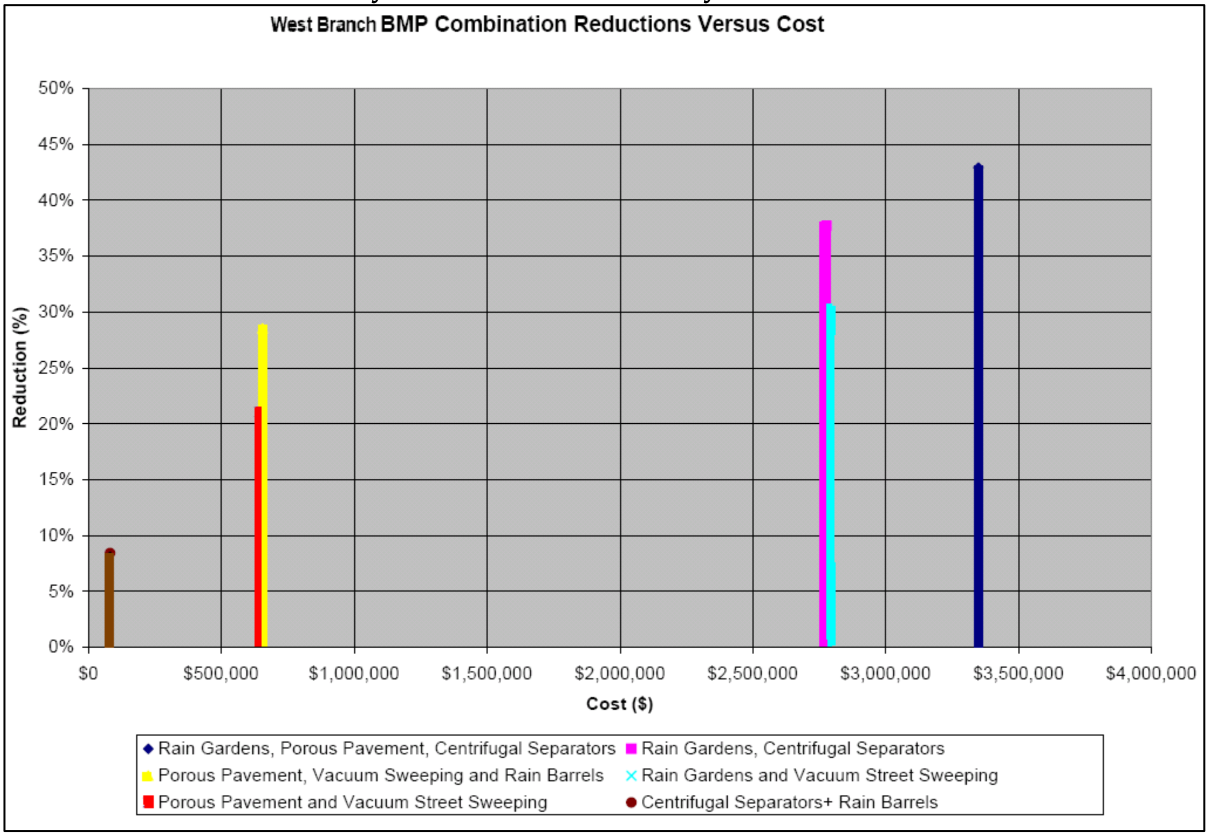
5.3.2. BMP Combinations and Associated reductions for Sub-watersheds

Table 27. West Branch BMP combinations and Associated Annual Sub-watershed Loading Reductions

BMP Combinations	TS Reduction
Rain Gardens, Porous Pavement (Driveways only), Centrifugal Separators	43%
Rain Gardens, Centrifugal Separators	38%
Porous Pavement, Vacuum Sweeping and Rain Barrels	21%
Rain Gardens and Vacuum Street Sweeping	30%
Porous Pavement and Vacuum Street Sweeping	21%
Centrifugal Separators+ Rain Barrels	14%

Tributary 3 - West Branch study Area BMP combinations and associated TS reductions: Used 100% BMP implementations for all combinations, for vacuum street sweeping that included the once per week frequency BMP. NOTE:. Results Do Not Include Drainage Swales which give an additional reduction up to 6% possible.

Table 28. West Branch Study Area Cost Benefit Analysis for Tested BMP Combinations



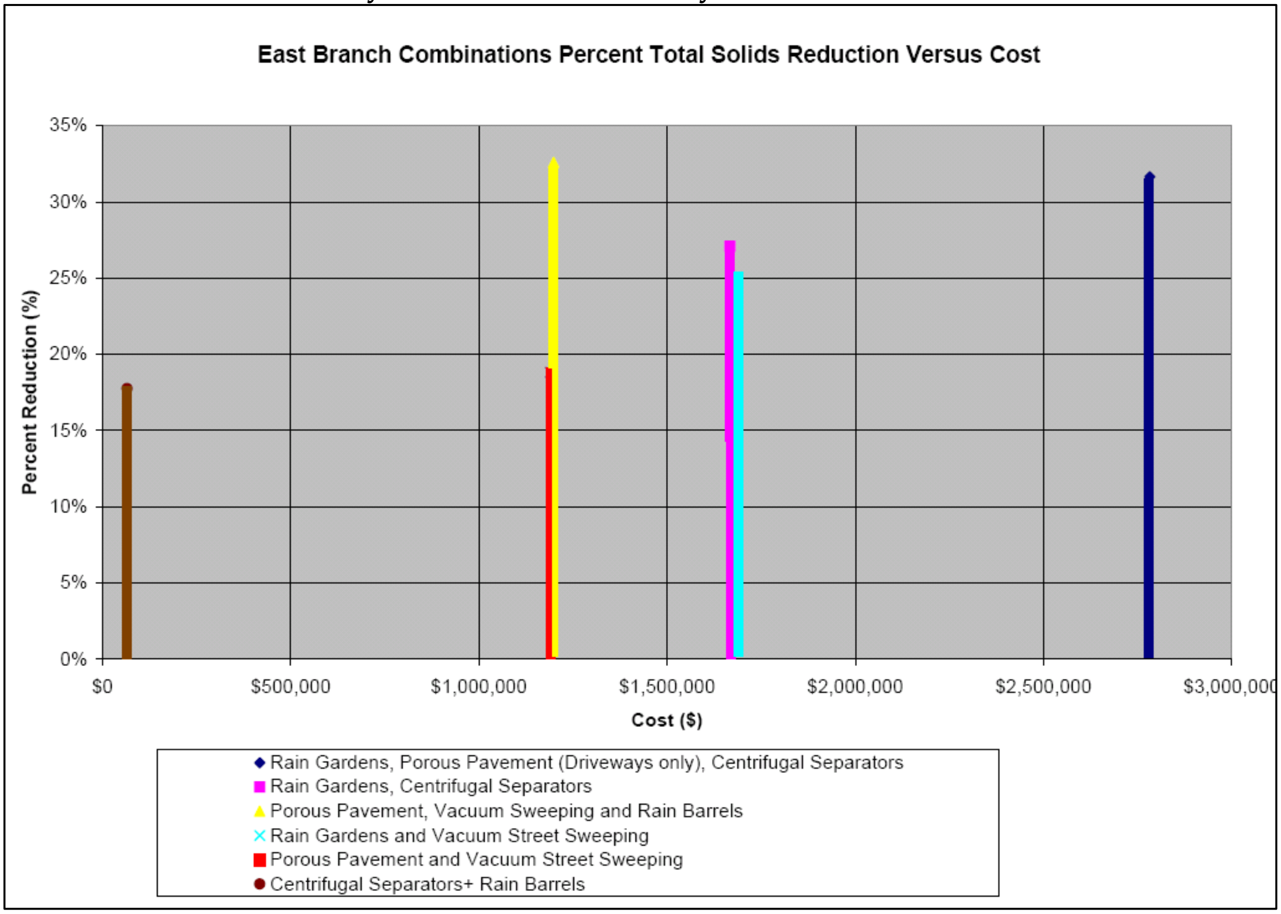
Cost Benefit Analysis for TS using combinations of BMPS at 100% adoption of the BMP across the sub-watershed. Cost is given on the x axis and reduction totals on the y axis.

Table 29. East Branch Study Areas BMP combinations and Associated Annual Sub-watershed Loading Reductions

BMP Combinations	TS Reduction
Rain Gardens, Porous Pavement (Driveways only), Centrifugal Separators	37%
Rain Gardens, Centrifugal Separators	31%
Porous Pavement, Vacuum Sweeping and Rain Barrels	29%
Rain Gardens and Vacuum Street Sweeping	23%
Porous Pavement and Vacuum Street Sweeping	29%
Centrifugal Separators+ Rain Barrels	14%

22nd StreetTributary - East Branch study Area BMP combinations and associated TS reductions: Used 100% BMP implementations for all combinations, for vacuum street sweeping that included the once per week frequency BMP. NOTE:. Results Do Not Include Drainage Swales which give an additional reduction up to 6% possible.

Table 30. East Branch Study Area Cost Benefit Analysis for Tested BMP Combinations



Cost Benefit Analysis for TS using combinations of BMPS at 100% adoption of the BMP across the sub-watershed. Cost is given on the x axis and reduction totals on the y axis.

The reductions rates were then extrapolated to the other sub-watersheds. The results are given in the following tables. Tables also show the pre-development conditions calculated by WinSLAMM. All loading and reductions are annual and for TS loadings.

Table 31. West Branch Sub-watersheds. Application of BMP combinations to source areas in the watersheds other than the Study Area.

Table 32. West Branch Sub-watersheds. Application of BMP combinations to source areas in the watersheds other than the Study Area (continued)

Table 33. East Branch Sub-watersheds. Application of BMP combinations to source areas in the watersheds other than the Study Area.

Table 34. East Branch Sub-watersheds. Application of BMP combinations to source areas in the watersheds other than the Study Area (continued)

5.4 Non-point Source Pollution Reduction Recommendations

Based on the results no recommendations were developed for either rain barrels or dry wells (for treating residential roofs). The watershed area they treated was too small and not a major source of pollution either on an absolute or per acre basis for them too show any discernable impact. However in stating this, the following should be remembered:

- This analysis looked at water quality only, both BMPs offer storm water quantity benefits that most of the other BMPs do not.
- Rain barrels were the cheapest BMP per unit considered. It is therefore the most accessible to watershed citizenry. Its value may lie in watershed education and allowing citizens to participate in storm water management who would not otherwise cat at all.
- Dry wells would have shown a bigger treatment value if they had treated drive ways instead of roofs. If single family residences are going to install BMPs this may be a consideration worth examining.

5.4.1 Centrifugal Separators

The results suggest that amongst the BMPs studied centrifugal separators are potentially the most cost effective means to lowering non-point pollution from landscape washoff in the East and West Branch (see figures 22 and 23). In the WinSLAMM model they were used to treat roads (placed on the storm sewer inlets of those connected to a storm drain) the single most polluting source area on a loading per unit area basis, Centrifugal separators generally do not take up significant right of way space especially when compared to other BMPs. However, larger sizing criteria could increase their size and thus compete for right of way space. They do need to be placed where they will not conflict with other utilities, including being at least 10' away from water mains.

Table 35 **Tributary 3-West Branch Centrifugal Separators Annual Sub-Watershed Load Reductions**

Treatment Percentage	Source Area(s)	Total Solids	Total Phosphorous
10%	Streets	1.3%	1.0%
25%		3.4%	2.6%
50%		6.7%	5.1%
100%		13.4%	10.3%

Levels of adoption of the BMP Centrifugal Separators on the sub-watershed streets under all land use categories and resulting pollution reduction.

The model assumed that all streets had storm drains attached and were therefore capable of being retrofitted in this manner. This is not a realistic assumption; many streets do not have storm sewers connecting them to the sewer or local detention. In this regard the model will overestimate the amount of area treated.

Recommendations

1. Retrofit storm sewers inlets on roads servicing the following land use areas in order of priority
2. The separators should be set according to local conditions but generally should be aimed at collecting particles in the >65 micron category

Table 36. Recommendations for placing centrifugal separators in the stormsewers of roads under various land use categories

Land use	Priority	Notes
Industrial	1	If not possible due to lack of storm sewers replace with high vacuum sweeping
High Density Residential	2	If not possible due to lack of storm sewers replace with high vacuum sweeping.
Medium-Low Density Residential	3	If not possible due to lack of storm sewers replace with high vacuum sweeping.
Commercial	3	If not possible due to lack of storm sewers replace with high vacuum sweeping.
Institutional	4	
Open Space	5	

5.4.3 Permeable Pavers

Permeable Pavers were applied to all drive way and parking areas across all land use categories. Reduction rates for TS loading from loadings from parking areas under all land use categories are of the order of 80% (WB study area) and 71 % (EB study area) were calculated, the difference being a reflection of the lower infiltration rates allocated for the East Branch with its higher percentage of clay soils.

Permeable Pavers were applied to all drive way and parking areas across all land use categories. Reduction rates for TS loading from parking areas of 80% (WB study area) and 71 % (EB study area) were calculated, the difference being a reflection of the lower infiltration rates allocated for the East Branch with its higher percentage of clay soils.

Parking lots, driveways and sidewalks accounted for 11% of the total phosphorous and 21% of the total solids for the WB study area while accounting for 7% of the total area. On the East Branch parking lots, driveways and sidewalks accounted for 26% of the total phosphorous and 37% of the total solids while accounting for 21% of the total area. The application of permeable pavers to the relevant source areas in the EB study area suggested a reduction of 15% for phosphorous and 23% for TS despite the lower treatment rate.

The per acre analysis suggested that industrial driveways and parking were the most polluting area on a per acre basis in both study areas except streets (residential sidewalks are excluded as their surface area accounts for a small fraction of the total watershed area).

While the results suggest that industrial driveways and paved parking areas should be prioritized the inputs from residential driveways was significant for both TS and TP in both study areas (5% of TP and 6% of TS annual loads from the West Branches sub-watersheds is generated by residential driveways which form approximately 2% of the total area)

Recommendations
The following recommendations are made by the plan update:

- Ordinances modified to allow for permeable type paving systems or to allow the Village Engineer to exercise judgment.

- Encourage the transition of parking and drive ways in areas zoned industrial to permeable pavers. EXCEPT in areas given to the transfer and storage of hazardous materials

- Encourage the transition of parking and drive ways in areas zoned commercial to permeable pavers. EXCEPT in areas given to the transfer and storage of hazardous materials

- Examine the cost effectiveness of permeable pavers versus drywells for residential driveways. If favorable investigate and develop mechanisms for encouraging the adoption of permeable pavers for single family residences (possible credits under the proposed utility).

Figure 24 Permeable Driveway and Parking in Residential Area,

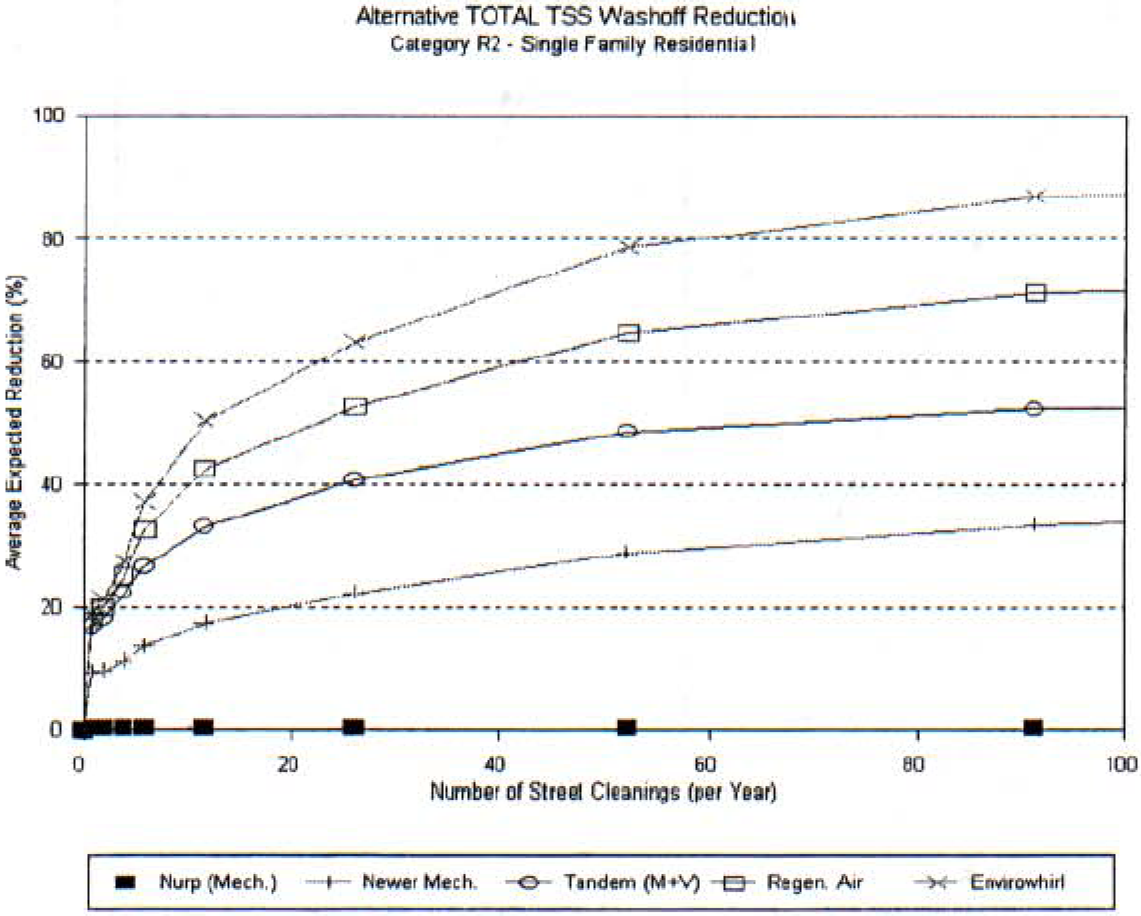
Courtesy of Kabbes Engineering

5.4.4 Street Sweeping

Street sweeping was considered because unlike structural BMPs is does not take up space in already crowded rights of way and public works departments are already familiar with it. The study examined two types of street sweeping, vacuum sweepers and mechanical sweepers. Technology, even amongst purely mechanical sweepers has vastly improved the TSS reduction potential of street sweeping operations since the USEPA first published the Nationwide Urban Runoff Program (NURP) in 1983. NURP, a major three year study at 28 locations nationwide concluded that street sweeping was largely ineffective as a means for reducing event mean concentrations (including TSS) in storm runoff.

As noted earlier, pollutants tend to be associated with finer (<65 microns) particles, the same particles that sweepers of the NURP study were least able to pickup. Rates of TS removal in the WinSLAMM model (based on figures from the West Branch) show a 15% reduction in loading of washoff from the source area under a weekly sweeping regime (assuming moderate traffic density and low level parking controls). These levels may be conservative; published results suggest much higher levels are possible as in Plate 1

Figure 25. Contrary to Conventional wisdom, Street Sweeping can be an effective BMP.



Newer Mech and Enviowhirl are equivalent to mechanical and vacuum trucks respectively. Sutherland & Jelen 1997[7]

As the graph shows treatment reduced TSS wash off reduction on residential streets were observed to be as high as 75% for vacuum sweeping and 28% for mechanical sweeping of residential streets. This compares with the rates reported by Minton, G. R., et al in 1998[8] that high-efficiency street sweepers and operations (i.e. vacuum sweepers) may increase the percent removal to 70+%.

WinSLAMM predicted 15% and 8 % reduction for TS from streets under all categories of land use using weekly sweepings by vacuum and mechanical sweeping respectively (based on West

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[7] Sutherland, R.C. & Jelen, S. L. (1997). Contrary to conventional wisdom, street sweeping can be an effective BMP. In: *Advances in modeling the management of stormwater impacts*. James, W(Ed.), Vol. 5. Lewis Publishers.

[8] Minton, G.R., Lief, B. & Sutherland, R. (November 1998). High efficiency sweeping or clean a street, save a Salmon! *Stormwater Treatment Northwest*, Vol. 4, No. 4.

Branch sub watershed street data). The differences may be because of land use variations, deviations in the types of solids under consideration and assumptions about parking controls. The 1997 study did find lower rates of percentage reduction on major arteries as compared to residential streets. However deviations between the uptake rate of the sweepers in the model and that observed in the study are also likely. The default rate in the model will need to be reviewed. However the model out puts while showing lower treatment levels than the studies did agree with the relative efficiencies of both practices with vacuum sweeping appearing approximately twice as effective at removing TSS in washoff

Questionnaires sent to a number of public works in the East and West Branch watersheds on sweeping practices elicited 7 responses. These are set out in table 38:

Table 37. Municipalities Response to Street Sweeper Questioner from

Agency	**Equipment**	**Frequency of sweeping**
Bloomingdale	Mechanical	April-November - All curbed streets 9 times per year
Carols Stream	High Efficiency Vacuum	Street sweep the entire Village at least six times per year. Some areas receive more sweepings where warranted.
Lombard	Mechanical	Streets swept every three weeks for seven months spring through Fall
Warren Ville	Mechanical	April through October and sometimes into early November. Generally once a month unless additional sweeping is necessary in the Fall due to leaves.
Hanover Park	Mechanical	Streets are swept eight months out of the year, April to September, the streets are swept once a month, and then weekly during leaf season.
Glendale Heights	Mechanical	Village-wide approximately 9 times per year, April to November - about once per month.
Bolingbrook	Mechanical	12 months out of the year. Individual streets are swept about once a month.

Street Sweeping Data collected from Public Works departments operating in the East and West Branch of the DuPage Watershed.

Responses were consistent with 5 of the seven sweeping once a month, one (Lombard) swept more frequently (every three weeks) and one, Carols Stream less. Only one vacuumed throughout the entire year (Bolingbrook). Only Carols Stream used high efficiency vacuum trucks

The model suggests that the effectiveness of using a vacuum truck once a month to once a week is relatively large. What is the optimal sweeping interval?

Type of operation	TS % reduction in washoff with weekly sweeping	TS % reduction in washoff with sweeping every four weeks
Vacuum West Branch	15.4	5.9
Vacuum East Branch	14.1	5.6
Mechanical West Branch	7.7	4.6
Mechanical East Branch	7.9	4.6

Table 38 Reductions predicted by WinSLAMM for source area (roads) all land uses following different frequencies of street sweeping using mechanical and vacuum sweepers for selected sub watersheds. Assumes medium parking density and traffic controls.

Table 38 would suggest that sweeping weekly to every two weeks as a improvement over every four weeks with removal rates nearly tripling with vacuum truck. A similar increase is not seen with mechanical sweepers however. Wisconsin has found a sweeping program involving about 30 passes per year (a reasonable expectation for Wisconsin), the estimated reduction in washoff of total suspended solids was approximately 60%[9]. However frequency of sweeping is only one consideration and the model suggested that reduction rates for loading were sensitive to parking densities. The WinSLAMM land use analysis showed that while streets accounted for 39 % of TS washoff in the target sub-watersheds, TS loadings differed for according to land use. In the West Branch Commercial and industrial landscapes produced annually 641 and 805 lbs of TS respectively, next highest was residential with 293 lbs. East Branch shows the same ranking (Commercial 556 lbs, Industrial 1423 lbs,) but here residential ran a close third at 477 lbs per acre annually. This is due to a combination of denser development (more impervious surface) and a higher predominance of clay soils. The analysis does suggest however that increased sweeping effort should be concentrated on industrial and commercial areas in order to maximize results.

Looking at the loading from source areas within the land use categories suggests that this initial analysis may be somewhat misleading. Per acre loadings for residential streets were slightly higher than those for commercial streets for both TS and TP. The apparent contradiction can be explained by the fact that commercial areas mainly consist of parking and roadway, both high TS loading source areas leading to a larger per acre out put from commercial areas as a whole.

Vacuum road sweeping also impacted phosphorous loadings with similar percentage reductions to those of TS being recorded.

Given the efficiencies of treatment why are more municipalities not using vacuum trucks, there are a number of possibilities they have a much larger capital cost, they will not pick up larger debris and have problems picking up wet vegetation (such as wet grass clippings) and the live cycles of existing equipment and. It is also probable that most departments view street

[9] Bannerman, R. (2002). Effectiveness of Enviro Whirl Technology. *SchwarzeTechnologies* Web site, Schwarze.com 1/28/02.

sweeping as a public service to keep streets clean rather than as a water quality issue and mechanical sweepers are sufficient to deal with most visible debris. Appendix 5.6 looks at the cost and of mechanical sweepers versus vacuum sweepers for a sample municipality.

As can be seen, the initial purchase price of the of the vacuum sweeper are more than offset by its longer life span and its lower maintenance and operation costs.

Recommendations
The following recommendations are made by the plan update:

- Encourage and support the acquisition and use of high-efficiency street sweepers (vacuum or newer technology) by local governments within the program area .

- Investigate the possibilities for setting up a program area fund to look at assisting communities to purchase high efficiency sweepers and look at cost sharing arrangements for between larger communities and smaller communities to allow vacuum sweeping of commercial and industrial areas in communities with low lane miles

- Recommend local governments within the District revise existing street sweeping programs and move towards the frequencies set out in Table 39. Variations due to observed traffic flows or seasonal peaks of activity may also help optimize effort

Table 39. Recommended Frequency for Street Sweeping in Different Land use Categories

Land use	**Frequency per year***	**Notes**
Industrial	18	May need increased parking controls
High Density Residential	12	May need increased parking controls
Commercial (with parking lot sweeping)	12	May need increased parking controls
Medium-Low Density Residential	9	May need increased parking controls
Commercial (without parking lot sweeping)	9	May need increased parking controls
Institutional	6-1	May be reduced if effort needed in other areas
Open Space	4-1	Fall sweeping. May be reduced if effort needed in other areas

Based on sweeping April – November or nine months of activity

- Review local contacts for landscape maintenance on mediums and road right of ways in order to avoid introducing unnecessary green waste onto road surface
- Increase requirements for tandem sweeping (both vacuum and mechanical) during construction projects in the plan area.
- Create training for highways department staff to emphasize the link between street sweeping operations and water quality (should investigate protocols for sweeping looking at speed of sweeping and parking controls)
- Investigate the possibilities for extending sweeping to industrial and commercial parking areas and driveways.

See appendix 5.4 and 5.5 for maps and tables of sites for increased sweeping (industrial and commercial areas)

5.4.5 Rain Gardens

Rain gardens did show impressive reductions in both TP and TS when placed to treat runoff from residential green space and roofs and parking lots under all land use categories. However they are a relatively expensive abatement method, in the East Branch study area both centrifugal separators and pervious pavers showed greater reductions for considerably less cost. In the West Branch they were calculated to deliver the largest reduction of any of the BMPs. This is due the higher infiltration rates attached to the rain gardens in the WB study areas, the relatively greater importance of residential areas[10] and the denser development pattern of the East Branch study area.

Rains gardens can be retrofitted in parking lots during their lifespan rather than waiting for the lifecycle of the lot to be finished. Treatment rates for both TS and TP, even with the limited retention ability used in the model, are both promising.

Table 40. WB study Area. Rain Garden (Treats Roofs and Parking Lots and Residential Landscaping)

Treatment Level	Total Acreage Treated	Percentage of Watershed Treated	Total Solids Reduction	Total Phosphorus Reduction
10%	45.3	5.1%	2.4%	3.2%
25%	113.3	12.8%	6.1%	8.1%
50%	226.4	25.6%	12.2%	16.3%
100%	452.7	51.2%	24.3%	32.6%

Table 41. EB study Area. Rain Garden (Treats Roofs and Parking Lots and Residential

Treatment Level	Total Acreage treated	Percentage of Watershed Treated	Total Solids Reduction	Total Phosphorus Reduction
10%	33.5	6.8%	1.8%	1.8%
25%	83.8	17.0%	4.4%	4.4%
50%	167.8	34.0%	8.8%	8.9%
100%	335.5	67.9%	17.6%	17.9%

Landscaping

The following recommendations are made based on the results

[10] Residential areas for the East Branch actually account for 67% of total area, while only 56% in the West Branch. However if we drop open space out of the West Branch that portion would grow to 72% ot the total

Table 42 Priority for source to be retrofitted with Rain Gardens

Land use	Priority	Notes
Industrial Parking	1	Review local soils
Commercial Parking	2	Review local soils
Residential Green Space	3	Review local soils

6. Winter Storm NPS Pollution: Chloride Reduction[11]

6.1. Chloride Sources Project Area Current Practices Summary

In November 2006 and April 2007, the DRSCW distributed a questionnaire to 80 municipalities and public works agencies. The purpose of the questionnaire was to obtain baseline information about the current deicing practices throughout the DuPage River and Salt Creek watersheds. The questionnaire asked for information about deicing practices and strategies under the following categories:

- Snow removal policy
- Anti-icing and deicing methods
- Deicing and snow removal equipment
- Salt storage
- Equipment maintenance
- Management and record-keeping
- Training

Figure 26. Winter storm on 75th Street, East Branch watershed 2007,

As of June 7, 2007, 39 responses had been received. The following sections summarize the responses in each of the above categories.

Figure 27. Anti-icing of a Forest Preserve Parking lot (courtesy of FPDDPC)

6.1.2. Snow Removal Policy

The questionnaire asked for the agency's snow removal policy and the length of roadway served. All 39 agencies provided policies. Most snow removal policies are based on achieving bare pavement within a certain amount of time following the end of the storm; the time allowances vary from 4 to 24 hours. In some cases, primary roadways are prioritized. The length of roadway served varies between 55 and 1,400 lane-miles, and the total of all the responses is approximately 10,000 lane-miles.

[11] Summary of DRSCW report "Chloride Reduction Recommendations" 2006 produced by CDM. Study for upper DuPage River and Salt Creek.

6.1.3. Anti-Icing and Deicing Methods

The second section of the questionnaire asked whether agencies used anti-icing, and what substances or products they employed for anti-icing and deicing (see chapter on alternative programs). Out of the 39 respondents, 14 mentioned anti-icing practices; in most cases the anti-icing program is limited to occasional pre-salting or liquid spreading in priority locations. For deicing agents, 38 agencies use solid rock salt and 34 use liquid calcium chloride. Five agencies use salt brine (NaCl). Calcium magnesium acetate (CMA) is used by four agencies. Abrasives, liquid magnesium chloride and liquid potassium acetate are each used by two agencies. One agency uses an agricultural deicing product.

Pre-wetting is practiced by approximately 29 agencies. This figure was inferred from whether the agencies either use pre-wetted materials or own equipment for spreading pre-wetted solids.

The third section asked what equipment was used for deicing and snow removal efforts. Snow plows were reported in use by 34 agencies, and the remaining agencies are also assumed to use snow plows. Mechanically-controlled and computer-controlled spreaders for deicing agents are both widely used: 32 agencies have mechanically-controlled equipment and 23 have computer-controlled. Equipment for spreading liquids is used by 15 agencies. End loaders and bobcats were frequently mentioned on the "Other" line.

6.1.4. Storage

The next section asked for some basic information about how salt was stored. Out of the 38 agencies using salt:

33 store salt on an impervious pad;
37 keep the salt in a "storage structure";
25 said their salt is not exposed at all to the elements;
15 said drainage from their storage area(s) is controlled or collected; and
7 said their loading area(s) are covered or contained.

The number of storage areas owned and maintained by each agency ranges from 1 to 3, with the majority having just one. Seventeen of the agencies store salt within 1,000 ft of the nearest water body, and two agencies store it within 100 ft.

6.1.5. Equipment Maintenance

The next section asked how the snowfighting equipment was washed. For 36 agencies the equipment is washed at an indoor station draining to the sanitary sewer. Three agencies wash equipment outside where the water can drain to a sanitary sewer, and five mentioned outdoor washing in areas not drained to a sanitary sewer.

6.1.6. Training

The sixth section asked for information about the management of the deicing programs. Operators are trained annually (or more often) in 32 agencies. Four of the remaining agencies train at the start of employment, and the other three did not specify a training schedule.

The rate of salt application is established by the director or supervisor in 33 agencies, and by the operators in five agencies. The spreading rate is controlled by the operator in 24 agencies, controlled automatically in 14 agencies and set at a fixed rate in 7 agencies.

Twenty-two agencies keep records of salt usage per truck, twenty-eight keep records for each storm, and twenty-three keep records for each winter. Each agency provided an estimate of the average amount of salt they used per winter; the total of their estimates is 126,000 tons per winter.

6.1.7. Participation in a Potential Pilot Study

The final question asked whether the agency would consider participating in future pilot studies or demonstration projects for alternative deicing equipment or practices. Twenty-three indicated a willingness to participate.

6.1.8 Private Snowplowing Business Practices

On March 29, 2007, nine municipalities in the study area were contacted to ask about license requirements for private snow plowing businesses. The municipalities were Addison, Bartlett, Bloomingdale, Carol Stream, Downers Grove, Elmhurst, Lisle, Naperville and Palatine. Snow plowing businesses are not required to hold a license anywhere except in Addison and Palatine. Licenses in those municipalities are for the office location only, and do not regulate how deicing practices are conducted.

Between March 30th and April 4th, 2007, eight private snow removal contractors in the study area were contacted. Private contractors tend to serve commercial, industrial and residential customers, clearing parking lots and private drives rather than roads. Based on surveying those contractors, their salt use ranges from 7.5 to 500 tons per winter, and averages approximately one ton per acre of parking lot per winter. Private contractors are not usually required to hold a business license in the area they serve unless they have an office location in the served area. Many of their customers require them to hold insurance. Based on a business search, there are approximately 130 private snow removal services in the study area.

6.2 Chloride Reduction Strategies

6.2.1 Review of Alternative Methods

The 2007 study by the DRSCW (contractor CDM) evaluated a number of measures including mechanical measures (ploughing and the use of abrasives), alternative products and methods to optimize the effects of applied chlorides.

A widely used practice is spreading abrasives, such as sand, on the roadway. Although abrasives supply some traction for traffic, contain no chlorides, they have a number of drawbacks including damage to vehicles, clogging of drains, decreasing road traction once the ice is gone and inferior performance during storms.

The most promising application methods reviewed were variations on the current practice of road salting, **anti-icing and pre-wetting**. Here are the definitions used by Environment Canada (2003):

- "Anti-icing is the application of a deicer to the roadway before a frost or snowfall to prevent melted snow and ice from forming a bond with the road surface."

- "Pre-wetting is the addition of a liquid to solid deicers or abrasives before application to quicken melting and improve material adherence to the road surface."

Anti-icing is a preventative measure, as deicing agents are applied to roads before snow or ice appears. Clearly, the timing of the application is critical, and anti-icing strategies depend on information systems and forecasting of road conditions. A simple anti-icing program is the application of salt brine to the roads when a storm is forecasted. The brine may or may not dry before the storm comes, but as soon as snow falls or frost begins to form the brine will activate and prevent a bond forming between the ice and the pavement.

Figure 28. City of Naperville snow fighting staff in action. West Branch DuPage River watershed

The MN/DOT Field Handbook reports that anti-icing uses about 25% of the material at a tenth of the cost of conventional deicing this is supported by the experience of the McHenry County Division of Transportation.

Cost savings of 52% or greater have been reported with a reduction of chlorides in range of 32%. One objection to anti-icing is that it necessitates a change in operational strategy by having trucks on the roads before a storm rather than during or after. The City of Chicago, for example, found the change in operations difficult during an anti-icing trial (Keating, 2001). The U. S. Department of Transportation (USDOT, 1996) has published a manual to help managers implement anti-icing programs. Anti-icing agents are most commonly liquids, but can also be pre-wetted solids. A variety of anti-icing and deicing agents is presented in Table 43.

Pre-wetting is a variation on the usual practice of spreading solid salt and/or abrasives during a storm event, and does not require a significant change in snowfighting strategy. The Wisconsin Transportation Information Center (WTIC, 2005) and others (Mangold, 2000; MN/DOT, 2005) report that a conventional application of dry salt wastes about 30% of the material due to wind- and traffic-induced scatter. This waste can be reduced to only 4% by pre-wetting the material before spreading it (WTIC, 2005; TAC, 2005). Materials savings due to pre-wetting have been found as high as 53% (O'Keefe and Shi, 2005). Pre-wetted salt also acts more quickly than dry salt because there is no delay waiting for a brine to form.

A drawback of pre-wetting is the cost of equipment modification for onboard pre-wetting capability. However, MN/DOT (2005) points out that pre-treatment can be used instead of pre-wetting. Pre-treatment involves mixing a liquid deicer with the salt stockpile before it is loaded into spreader trucks. This precludes the need for equipment modifications.

Table 43. Summarizes various chemical products available as anti-icing and deicing agents.

Product	*Estimated Cost1*	*Cl- by mass*	*Eutectic Temperature2*	*Other Characteristics*
Rock salt (NaCl)	\$20-40 / ton or \$0.03-0.10 / gal	61%	-6°F	Very corrosive; harmful to vegetation; can attract wildlife
Calcium chloride (CaCl2)	\$200-340 / ton	64%	-60°F	Extremely corrosive; exothermic melting; dissolves in atmospheric moisture; harmful to vegetation
Magnesium chloride (MgCl2)	\$260-780 / ton	75%	-27°F	Corrosive; can attack concrete
Potassium Chloride (KCl)	\$240 / ton	48%	12°F	Corrosive
Calcium magnesium acetate (CMA)	\$650-2000 / ton	0%	-18°F	Low toxicity; non-corrosive; can cause O2 depletion

Product	*Estimated Cost1*	*Cl- by mass*	*Eutectic Temperature2*	*Other Characteristics*
Potassium acetate (CF7®)	$2.60-3.90 / gal or $600 / ton	0%	-76°F	Non-corrosive; can cause O2 depletion
Urea	$280 / ton	0%	+10°F	Endothermic; degrades to ammonia, then nitrate; working temperature same as CMA
Ice Slicer®	$58-64 / ton	Some	-6°F	Granular and reddish, with naturally occurring complex chlorides (Mg, Ca, Na and K chlorides); 20-70% less corrosive than rock salt; harmful to vegetation
CG-90® Surface Saver®	$185-250 / ton	63%	-5°F	Handles like road salt; 76% NaCl, 22% MgCl2 plus corrosion-inhibitor
Caliber® M1000	$0.55-1.50 / gal	23%	-86°F	Corn derivative liquid deicer plus 30% MgCl2; corrosion inhibitor; can cause O2 depletion
GEOMELT® 55	$1.25-1.90 / gal	0%	-44°F	Organic anti-icer/ deicer; 4x less corrosive than water; can be mixed with brines or solid salts
M50 (Ice Ban®, Magic Minus Zero®)	$0.70-0.85 / gal	11%	-78°F	Organic deicer plus MgCl2 solution (15% MgCl2 by weight); less corrosive than water; oxygen demand equivalent to CMA; pH < 4.0
MagicSalt®	1.4 times rock salt	61%		Rock salt treated with M50; effective down to -35°F; use 30 to 50% less than plain rock salt

1 The estimated material costs were based on the references cited above as well as a web search of product sales. The costs may vary regionally and with time.

2 The eutectic temperature is the lowest temperature at which the deicing agent can remain in liquid form. The minimum working temperature is loosely defined and tends to be higher; for example, rock salt's eutectic temperature is -6°F, but its minimum working temperature is approximately 16 to 20°F.

Some of the deicing products listed in Table 43 contain little or no chloride, but introduce concerns with biochemical oxygen demand (BOD) in receiving waters. These include the acetate products as well as the organic process derivatives.
Responses to the questionnaire indicated that most agencies in the watersheds are using rock salt pre-wetted with calcium chloride. Two agencies use sand, three use magnesium chloride, four use CMA, two use potassium acetate, and one uses GEOMELT® 55.

Instrumentation and Data Collection can work with other snowfighting practices by informing agencies' decisions on winter maintenance and improving the effectiveness of deicing practices. They include the following:

- Load scales at storage facilities and in spreader trucks
- Benchmarking of salt usage on municipal routes
- Maintaining records of salt use by route, by storm and by winter
- Ground speed sensors and digital spreaders on salt trucks
- Real-time salt application monitoring with Automated Vehicle Location systems
- Pavement temperature sensors on trucks and in-ground installations
- Regional and local weather forecasts
- Road condition monitoring and forecasting, including networks of monitoring stations called Road Weather Information Systems (RWIS)

Illinois has a state-wide network of 51 RWIS stations, which save the state millions of dollars each year in snow removal costs (Dameron, 2004).

6.2.2 Potential Strategies to Reduce Chloride

There are a variety of potential strategies to reduce the chloride applied as road salt within the East and West Branch of DuPage River watersheds and the Salt Creek watershed. Since the effectiveness of a given strategy is dependent on the specifics of implementation and on the current local practices, the potential reductions in chloride can only be approximately estimated. The report states that if the recommended measures are aggressively implemented, the overall expected reduction in chloride loading could be 40% or potentially more. Considering that some agencies may not participate and that some measures may not be as effective as in other studies, a conservative expectation may be a 10-20% overall reduction.

Table 44. Summary of recommendations and projected chloride reductions for the East and West Branch DuPage River and Salt Creek. DRSCW Chloride Reduction Report 2007.

Strategy	Potential Chloride Reduction [12]	Constraints
Improved Storage and handling	10%	Staff time for training and cost of upgrading facilities
Alternative products	Potentially 100% depending on ratios employed	More expensive than chlorides
Pre-wetting	8%	Cost of equipment modification for onboard pre-wetting
Anti-icing	24%	Change of practice (staff active before rather than during storm)

6.2.3. Recommended Measures

The recommended measures are given below in order of priority:

- Chloride concentration monitoring in streams
- Storage and bulk handling improvements
- Staff training and public outreach
- Further implementation of alternative application methods (pre-wetting and anti-icing)
- Follow up chloride concentration monitoring in streams to demonstrate effectiveness

1) Monitoring to Demonstrate Program Effectiveness

Chloride concentrations in local streams should be monitored both before and after implementing the preceding recommendations so that the effectiveness of any chloride reducing measures can be demonstrated.

2) Salt Storage and Handling

Proper salt storage and bulk handling practices can limit the amount salt entering the environment before it is applied to road surfaces. The BMPs developed in other states and in Canada provide excellent guidance. Any new storage facilities built should

[12] Pre-wetting rteductions based on a 30% reduction and the practice being adopted by the 26% of agencies not currently practicing the techniques, anti-icing reduction based on chloride savings of 38% achieved by Michigan Department of Transportation and the practice being adopted by the 64% of the agencies not currently using it

adhere to these BMPs. Standard designs used by local agencies (for example, Illinois Department of Transportation) may be appropriate for adoption by municipal public works departments.

Existing storage facilities should be considered for improvements, particularly if the salt is partially exposed to the elements, drainage is uncontrolled, or salt is not stored on an impervious pad.

Current bulk handling practices should be reviewed and compared to the most up-to-date published BMPs. Annual staff training should include reviews of proper handling practices and the reasons for them. In particular:

- Salt should be handled as little as possible to avoid particle breakdown and loss.
- Care should be taken to minimize spillage and clean up spilled salt.
- Records should be kept of the salt used on each route, during each storm, by each vehicle and by each applicator. The records should be examined regularly to confirm that the target salt application rates are being met

The combined measures of education, training and improved storage and handling practices may lead to a chloride reduction of up to 10%.

3) Public Education and Staff Training

A public education campaign can increase the community's awareness of water quality issues, and increase community support for chloride-saving initiatives. The campaign can provide information about what homeowners and businesses can do to reduce chloride use, as well as describe the practices and objectives adopted by their municipal leadership. Elements of a public education program could include:

- Flyers or fact sheets for public distribution. The mailing lists used by environmental groups may be useful for targeted outreach. Mailings could be prepared in a general form that is adaptable to individual community programs.

- Presentations or fact sheets targeted to municipal government officials. A mayors' caucus may be an appropriate forum.

- Public access television spots.

- Newspaper articles or advertisements.

- Declaration of "Limited Salt Use Areas" to highlight water quality protection.

Staff training has been shown to reduce the quantity of salt used. This training may be implemented as part of the municipality's NPDES Phase II permitting requirements. Elements of a staff training program could include:

- Annual refresher training for municipal applicators, covering the impacts of their work on water quality, the harmful effects of salt on environment and infrastructure, proper spreading techniques and equipment, proper storage and handling of salt, record-keeping policies, and clear guidance regarding the appropriate amount of salt to be used in each situation.

- Initial training for new employees. Properly trained veteran employees can give additional on-the-job training. Training programs are also offered by the American Public Works Association and Northeastern Illinois Public Safety Training Academy.
- Similar training could be required for private snow removal contractors. This training could be enforced by making it a requirement for a business or operating license or by general permit, where such businesses are currently licensed or permitted.

Alternative Application Methods
Pre-wetting
Approximately 74% of agencies in the DuPage River and Salt Creek watersheds pre-wet their deicing salt. Pre-wetting results in cost and material savings, and should be implemented by every deicing agency. A further savings of 5,400 tons (8% across the study area) may be achieved by full implementation of pre-wetting.

Anti-icing
Anti-icing is widely promoted as a cost-effective and environmentally conscious practice (MN/DOT, 2005). If anti-icing were implemented throughout the watershed, potentially 17,200 tons of chloride (24%) could be saved annually.
All deicing agencies should strongly consider implementing an anti-icing program. Anti-icing requires staff training and equipment modification or purchase. Many resources are available on the internet and from Federal and State departments to assist managers in starting an anti-icing program.

Accurate weather forecasts are critical for implementing anti-icing practices. Deicing agencies may wish to take advantage of the Illinois state-wide RWIS network, develop their own information systems or use "just-in-time" anti-icing.

Alternative Products

Using non-chloride deicing products could be effective at reducing short term winter month chloride water quality exceedances. Long term pilot testing of an alternative non-chloride deicing product in a select drainage shed would be necessary to determine effectiveness.

Acetate deicers completely eliminate chloride from deicing operations. However, they are relatively expensive, and may be economically prohibitive on a watershed scale. Organic deicers provide another non-chloride alternative. These proprietary products are comparatively expensive, but can be used in small quantities as pre-wetting agents or in combination with other deicing liquids. Carol Stream is using a beet-based deicer and reports a reduction in accidents (Scaramella, 2006). The McHenry County Division of Transportation also uses a beet-based additive, which they combine with liquid chloride salts for anti-icing and pre-wetting (Devries, 2007).
The acetate deicers and the organic process derivative deicers are both biodegradable, and therefore may impose an oxygen demand on receiving waters.

7. Education and Outreach

There are many DuPage River Coalition partners that provide educational programming in both formal and non-formal settings for both adults and children. Efforts are being made to coordinate key messages across programming about watersheds. The sections below provide some details about programs currently being implemented and expanded across the watershed. More information about these and other education and outreach programs are available on the website at www.dupagerivers.org

7.1 Residents

The DuPage River Coalition (DRC) has long been partnered with The Conservation Foundation to clean up, protect and restore the DuPage River Watershed. The DRC has adopted the Foundation's Conservation@Home program as the chief watershed education and outreach tool for residents. The program is designed to work with any size landowner from a small condo patio to the common space of a subdivision to a multi-acre lot along the DuPage River. The program empowers landowners with meaningful conservation practices that can make a positive impact on the health of the DuPage River Watershed and the local environment. The program provides a certification process for residents that have natural areas on their property or that have incorporated natural landscaping and water conservation practices. Residents receive a sign that they can proudly display in their yard and a quarterly newsletter providing information about local restoration and conservation information.

Conservation@Home also provides programming through presentations for Homeowners Associations, Garden or other Civic Clubs and Church groups. Presentations can range from a general overview of the program to a series of presentation on different types of habitats like rain gardens or butterfly gardens. Hands-on workshops are also being offered on building rain gardens and rain barrels. Partnerships are being developed with Park Districts to expand these offerings to a wider audience. These programs are designed to encourage residents to change their behaviors to benefit the local environment and improve their quality of life. Conservation@Home. Behavior change is being tracked through the number of certifications completed, revisits to certified properties to evaluate improvements, number of rain barrels sold and surveys from workshop participants.

The program also encompasses components of Chicago Wilderness' Leave No Child Inside program by encouraging families to create and explore natural habitats in their yards together.

7.2 School Age Programming

The DuPage River Coalition partners are working to continue and expand environmental education through both formal and non-formal settings including teacher training like Watershed Blues Teacher Training, hands on activities like Mighty Acorns, Bass in the Class and Envirothon. One of the most exciting, new programs in our region is Chicago Wilderness' Leave No Child Inside. The DuPage River Coalition is working with The Conservation Foundation to develop and offer more family oriented programming to get kids in-touch with nature.

7.3 Technical Community - Municipal & County Staff, Developers, Consultants

The DuPage River Coalition, working with The Conservation Foundation and DuPage County Stormwater Management Division is providing several workshops throughout the year focusing on Best Management Practices. Topics for these workshops have included Certified Professional in Erosion and Sediment Control (CPESC) review course and exam, streambank stabilization, stormwater BMPs and Good Housekeeping. The topics are reviewed annually and planned according to need.

8. Implementation Milestones & Evaluation

8.1 Milestones

Writing an implementation schedule for a 200 square-mile watershed is a daunting task. There are a number of on-going studies in the watershed that will result in exciting projects which may drive our priorities. With more than forty communities, park districts and other interested organizations participating or supporting various watershed projects it is hard to keep everyone heading in the same direction.

One of our first tasks is promoting the new website. The website is meant to be a clearinghouse of watershed information, a place for others to share what they are doing to support the plan as well as a place to look for help. The first phase of the website, providing the basic information about the watershed plan and water quality programs is complete. The second phase will further expand in other program areas as well as provide specific information for each subwatershed. This work should be completed over the winter 2007-2008.

Other milestones for projects that are in-progress include:

- Bioassessment Monitoring Program which will provide a base-line assessment of water quality conditions. Field work will be completed in the fall of 2007 and the final report will be available by June 2008. Second round of sampling program will begin in 2009 in the West Branch watershed.
- Dissolved Oxygen Improvement Feasibility Study which is focusing on dissolved oxygen problems on the East Branch DuPage River will be completed by the end of 2007 with specific recommendations for projects in the East Branch watershed. Design and engineering work for at least one recommended project will begin in early 2008 with project implementation in 2009 as funding allows.
- Continuous Dissolved Oxygen monitoring data will be available at the end of each calendar year.
- Chloride Reduction Study Phase I with an implementation plan will be completed in the fall of 2007. Recommendations will be implemented as funding allows over 2008 and 2009
- Wet Weather Program will be developed by spring of 2008 with recommendations for implementation.
- DuPage County will make final decision on Stormwater Utility program in winter 2007-2008. New program could be in place as early as 2009.
- A minimum of 5 BMP presentation/workshops will be offered by the end of 2009.
- A survey of community ordinances will be completed in 2008 with recommendations for ordinance changes to facilitate BMPs prioritized in the WinSLAMM model.
- Certified Professional in Erosion and Sediment Control Review Course and Exam will be held November 5 & 6, 2007 and in fall of 2008.
- A minimum of 15 Conservation @ Home presentations will be held each year.
- Goal of 25 new Conservation @ Home yard certifications in 2008 & 2009
- 5 new Conservation @ Home Kiosks to be installed in 2008 & 2009
- Watershed Plan Outreach “Standard” will be completed and distributed winter/spring 2007-2008.

8.2 Evaluation

Evaluation is an on-going process in every facet of implementation. Many times it is very informal, a discussion with co-workers about how well a presentation went or comment from a workshop participant. To demonstrate the success of a program and justify the expenditure of funds a more formal evaluation process needs to take place.

Although our big picture goal is to improve water quality, it is sometimes difficult to link the implementation of a particular BMP or an education program to water quality improvement. So, different types of indicators are used to evaluate programs over the short-term and long term. Programmatic Indicators are generally administrative, how many: workshops presented, brochures printed, people participated, or grants were secured. Social Indicators measure peoples attitudes, level of involvement, or behavior changes. Environmental Indicators measure endpoints in the environment like pollutant levels, fish species, in-stream habitat, or amount of streambank erosion.

Programmatic indicators are relatively easy to keep track of and generally reported through the NPDES Phase II program. The DRC will be working with partner organizations to use social indicators to track behavior change resulting from education and outreach programs. The DuPage River Salt Creek Workgroup is monitoring for a whole host of environmental indicators including fish, macroinvertebrates, in-stream habitat, water and sediment chemistry constituents, and dissolved oxygen. This information will give us a good baseline data set as well as an ongoing data collection program to track trends and improvements.

One of the benefits of using a website as the platform for our watershed plan is that it allows for continual updates as new information becomes available or as priorities may change. Working together the DRC and the DuPage River Salt Creek Workgroup will review the Implementation Plan on an annual basis to keep action items up to date and to chart implementation success.

Evaluation and the programs and actors responsible are set out in appendix 8