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Executive Summary

2007 Plan Amendment

The Plan amendments incorporate the resource management plans developed by the Lower St. Croix Watershed Management Organization (LSCWMO) for Karst features, O'Conner's Stream and Lake and Kelle's Coulee. The amendment also updated the Plan standards with the specific standards developed for the LSCWMO Rules. Additionally, the amendment incorporates information to ease municipal adoption of the LSCWMO Plan by reference by incorporating appropriate Metropolitan Council requirements for Local Water Management Plans.

Introduction and Plan Requirements

The Lower St. Croix Watershed Management Organization (LSCWMO) was organized on June 21, 1985 to fulfill the watershed planning and management responsibilities of what is now MN Statutes Chapter 103B. The LSCWMO is organized under a Joint Powers Agreement between Denmark Township and the Cities of Afton, Cottage Grove, and Hastings. The first generation Watershed Management Plan (Plan) was written and adopted in 1991.

The Washington County Water Governance Study (Washington County, 1999) has recommended the enlargement of the Valley Branch Watershed District to include the LSCWMO, but the timing of this enlargement is dependent on the LSCWMO's ability and willingness to take on an active water management role. This Plan outlines the steps the LSCWMO is taking to achieve the goals of the County Governance Study while maintaining the status of a Watershed Management Organization (WMO).

Watershed Issues and Issue Statements

Numerous issues were identified during the issue identification process which included input from a cross section of the community, agency representatives, and environmental interest groups. The issues were grouped into the following four watershed management areas:

- Protection of Surface Water Resources;
- Mitigation of Stormwater Impacts;
- Groundwater Quality and Quantity; and
- Protection of Key Natural Resources.

The watershed management areas with corresponding goals and watershed relevance are presented below.

Protection of Surface Water Resources

The LSCWMO contains numerous high quality surface water resources. Protection of these resources is critical to maintaining the ecological integrity of the watershed, providing diversity of fish and wildlife habitats, maintaining unique natural communities, and contributing to the protection of key recreational areas including the St. Croix and Mississippi Rivers. As identified in Section III. Land and Water Resource Inventory, the key surface water features of the Watershed include:

- Kelle's Coulee
- Trout Brook
- O'Conners Creek and Lake
- St. Croix River
- Mississippi River and Conley Lake

Mitigation of Stormwater Impacts

Land use alterations and development can result in increased stormwater runoff volumes and rates, flooding, erosion, sedimentation, and pollutant loading, resulting in degradation of natural resources, fish and wildlife habitat, groundwater, surface water, and recreational areas. Standards and ordinances are needed to prevent and mitigate degradation to these resources.

Groundwater Quality and Quantity

Land use and increased development within and adjacent to the watershed threaten the quantity and quality of groundwater that is essential for drinking water supply, sustaining unique groundwater dependent natural resources, and maintaining the base flow and thermal stability of watershed streams. Groundwater quality in the watershed is highly susceptible to surface activity due to karst features, bedrock faulting, and thin surficial deposits. Implementation of the County Groundwater Plan and recommendations from current groundwater studies is needed to ensure successful management of groundwater resources.

Protection of Key Natural Resources

Rare and high quality natural communities have been identified within the watershed and are discussed in more detail in Section III. Land and Water Resource Inventory of this Plan. While many of the highest quality resources are adjacent to the surface waters of the watershed, high quality upland areas are also found. These areas, in addition to providing critical wildlife habitat and recreational opportunities, are important to the protection and preservation of the water resources of the watershed. As development increases, these features are at increasing risk of degradation and/or loss.

Land and Water Resource Inventory

The Land and Water Resource Inventory includes a summary of existing data that is available on watershed resources. Comprehensive data has been collected, analyzed, and included in this Plan. Data are organized into the following categories:

- Climate and Precipitation;
- Topography and Geomorphology;
- Soils;
- Hydrology;

- Geology;
- Groundwater Resources;
- Surface Water Resources;
- Federal Emergency Management Act Designation;
- Fish and Wildlife Habitat;
- Unique Features and Scenic Areas;
- Land Use;
- Status of Local Comprehensive Plans; and
- Potential Environmental Hazards.

Additionally, studies performed or currently underway in or adjacent to the watershed were compiled and summarized. The studies include:

- Cottage Grove Area Nitrate Study Report;
- City of Cottage Grove Natural Resource Inventory;
- City of Afton Natural Resource Inventory and Water Resource Evaluation;
- Denmark Township Natural Resource Inventory and Water Resource Evaluation;
- Detailed Assessment of Phosphorus Sources to Minnesota Watersheds;
- Intercommunity Groundwater Protection, Sustaining Growth and Natural Resources; and
- Integrating Groundwater and Surface Water Management –Southern Washington County.
- Karst Feature Inventory and Management Plan
- Kelle's Coulee Stream Management Plan
- O'Conner's Stream and Lake Management Plan

Goals and Policies

The Watershed Goals and Policies were developed by the Board of Managers and the Advisory Committee. Watershed Goals are based on the issues identified during the planning process and overall watershed management strategies. The Watershed Goals are presented below.

Goal 1. Maintain or improve the surface water quality of water resources within the watershed with a specific emphasis on Kelle's Coulee, Trout Brook, O'Conners Creek and Lake and the St. Croix and Mississippi Rivers.

Goal 2. Prevent the degradation of water resources as a result of excess runoff volume and high peak flow rates.

Goal 3. Prevent the degradation of resources and the loss or damage of property due to erosion and sedimentation.

Goal 4. Maximize groundwater recharge as a means of maintaining drinking water supplies, preserving base flows in streams, and limiting discharges of stormwater to downstream receiving waters.

Goal 5. Protect existing groundwater supplies to private wells and groundwater dependent natural resources.

Goal 6. Maintain or improve groundwater quality within the watershed.

Goal 7. Encourage and enhance natural resource based, passive use recreational opportunities within the watershed consistent with overall water management goals.

Goal 8. Protect and improve key natural resources within the watershed to prevent the loss or degradation of fish and wildlife habitat.

Goal 9. Maintain, enhance, and restore, where possible, the functions and values of existing areas and wetlands within the watershed.

Goal 10. Provide information, knowledge and skills to those who live, work and/or recreate in the watershed to foster the protection of local land and water resources.

Specific policies have been developed for each of the watershed goals and are presented in Section IV. Goals and Policies.

Implementation Plan and Management Standards

The Implementation Plan is focused on providing implementation activities to address each issue that was identified during the Issue Identification Process, presented in Section II. Watershed Issues and Issue Statements. The implementation activities generally focus on conducting more

in-depth, issue specific analyses and management plans and implementing the capital improvements and standards identified in completed management plans. Capital improvement projects may be completed by the WMO in conjunction with the municipality where the project is located.

Each program or project is grouped into one of three areas including:

- General Watershed Projects and Programs;
- Watershed Wide Implementation Activities; and
- Subwatershed Implementation Activities.

The following programs and projects are proposed as part of the 10-year Implementation Plan:

General Watershed Projects and Programs

- Watershed administration;
- Rule development;
- Development review program;
- Education and information program.

Watershed Wide Implementation Activities

- Landlocked Basin Management Plan;
- Watershed Pollutant Loading Study;
- Karst Feature Inventory and Management Plan Implementation Items; and
- Wetland Management Plan.

Subwatershed Implementation Activities

- Trout Brook Fisheries Assessment;
- Kelle's Coulee Stream Management Plan Implementation Items; and
- O'Conners Creek & Lake Management Plan Implementation Items.

Page viii is a schedule of estimated costs and timelines for the proposed implementation activities.

The LSCWMO will utilize existing funding mechanisms outlined in the JPA to fund watershed activities. A detailed description of these mechanisms can be found in Section V-3. Funding of Watershed Activities. Denmark Township and the Cities of Afton, Cottage Grove and Hastings will be required to determine individual funding mechanisms through any means currently available to that municipality. Municipal funding mechanisms may include an existing stormwater utility or general fund allocation.

IMPLEMENTATION ACTIVITY EXPENDITURES / COST PROJECTIONS / SCHEDULE

IMPLEMENTATION ACTIVITY	2005 Spent	2006 Spent	2007 Spent	2008 Budget	2009 Estimate	2010 Estimate	2011 Estimate	2012 Estimate	2013 Estimate	2014 Estimate	Actual Through 2007 / Projected Thru 2014 Cost
Watershed Administration	22,349	34,477	46,993	40,422	30,000	30,000	30,000	30,000	30,000	30,000	**324,241**
Rule Development	16,392	16,933	11,815	0							**45,140**
Development Review Program	3,530	2,325	3756	19,000	4,000	4,000	4,000	4,000	4,000	4,000	**52,611**
Monitoring Program		13,899	10,906	16,700							**41,505**
Education & Information Program	1,513	1,272	560	5,000	5,000	5,000	5,000	5,000	5,000	5,000	**38,345**
Landlocked Basin Management Program							10,000				**10,000**
Implementing - Landllocked Basin Mgmt Plan								5,000			**5,000**
Watershed Pollutant Loading Study						25,000					**25,000**
Implementing - Load Reduction Recommendations							5,000	5,000	5,000	5,000	**20,000**
Karst Feature Inventory & Mgmt Plan		10,070	11,656								**21,726**
Implementing - Groundwater Monitoring Program					10,000	10,000	10,000	10,000	10,000	10,000	**60,000**
Implementing - Work w/ Wash Co				4,000							**4,000**
Implementing - Acquire 2 ft topography data					1,000	1,000	1,000	1,000	1,000	1,000	**6,000**
Implementing - Spring Inventory								6,000			**6,000**
Wetland Mgmt Plan					12,000						**12,000**
Implementing - Wetland Mgmt Plan						5,000	5,000	5,000	5,000	5,000	**25,000**
Trout Brook Fisheries Assmt/Mgmt Plan				16,000	10,000						**26,000**
Implementing - Trout Brook Mgmt Plan						10,000	10,000	10,000	10,000	10,000	**50,000**
Implementing - Monitoring					8,333	8,333	8,333	8,333	8,333	8,333	**49,998**
Kelle's Coulee Stream Mgmt Plan		16,446	7,043								**23,489**
Implementing - Monitoring					9,633	8,333	8,333	8,333	8,333	8,333	**51,298**
Implementing - Stewardship					2,500	2,500	2,500	2,500	2,500	2,500	**15,000**
Implementing - Education/Outreach					2,500	500	500	500	500	500	**5,000**
Implementing - Streambank Stabilization						2,500	2,500	2,500	2,500	2,500	**12,500**
O'Conners Creek & Lake Mgmt Plan	15,406	3,813	4,262								**23,481**
Implementing - Lake Level Mgmt					1,000	1,000	1,000	1,000	1,000	1,000	**6,000**
Implementing - Monitoring					8,333	8,333	8,333	8,333	8,333	8,333	**49,998**
Implementing - Water Quality Assessment								2,000			**2,000**
Implementing - Stream Riparian Zone Restorations						1,250					**1,250**
Implementing - Lake Outlet Feasibility										30,000	**30,000**
TOTALS	**59,190**	**99,235**	**96,991**	**101,122**	**104,299**	**122,749**	**111,499**	**114,499**	**101,499**	**131,499**	**1,042,582**

LSCWMO rules and management standards have been developed. A development review program will be established as part of the proposed Implementation Plan. This program will allow for the implementation of watershed standards through the ongoing LGU permit program, with review and comment from the the LSCWMO.

Management standards have been developed for the following areas:

- Rate Control;
- Volume Control and Groundwater Recharge;
- Water Quality;
- Flooding;
- Erosion and Sediment Control; and
- Wetland Management.

Watershed Administration

The LSCWMO recognizes the need to amend the Plan to reflect changes in proposed land uses, updating of technical data as more accurate site information becomes available, new issues and problems, and changes to in goals, policies, standards and implementation procedures which may be required as a result of future legislation or as enforcement or other problems become evident.

Significant changes involving goals, policies, standards, administrative procedures, or capital improvements will require a thorough review process as described in MN Rules 8410.0140 and presented in Section VI. Watershed Administration.

Upon completion and adoption of the Plan and amendments, each municipality must amend an existing Local Water Management Plan (LWMP) to conform to the requirements of the Plan or prepare a new LWMP which is in conformance with the Plan. Watershed municipalities may adopt the LSCWMO plan by reference and use it to fulfill, in part, the requirement that they develop a LWMP. The LWMP must be submitted to the LSCWMO for approval within two years of adoption of the LSCWMO Plan.

I. Introduction and Plan Requirements

The Lower St. Croix Watershed Management Organization (LSCWMO) was organized on June 21, 1985 to fulfill the watershed planning and management responsibilities of what is now Minnesota Statutes Chapter 103B. The first generation Watershed Management Plan (Plan) was written and adopted in 1991. The LSCWMO is organized under a Joint Powers Agreement (JPA) between Denmark Township and the Cities of Afton, Cottage Grove, and Hastings, which was updated in 2005. It will be updated again in 2008. Figure I-1 identifies the watershed location and municipalities within the LSCWMO. Figures I-2 through I-5 illustrate the portion of each community within the LSCWMO.

I-1. General Information

2005 Board of Managers

Bob Eddy, City of Cottage Grove Alternate
James Fitzpatrick, Denmark Township
Cheryl Kohls, City of Cottage Grove
Kuchen Meyer, City of Afton Alternate
Tim Power, City of Afton
Peg Powers, Denmark Township Alternate

2008 Board of Managers

Vacant, City of Cottage Grove
Jim Keller, Denmark Township
Zac Dockter, City of Cottage Grove Alternate
Julia Welter, City of Afton Alternate
Tim Power, City of Afton
Kathy Higgins, Denmark Township Alternate

Figure I-1. Map of the LSCWMO

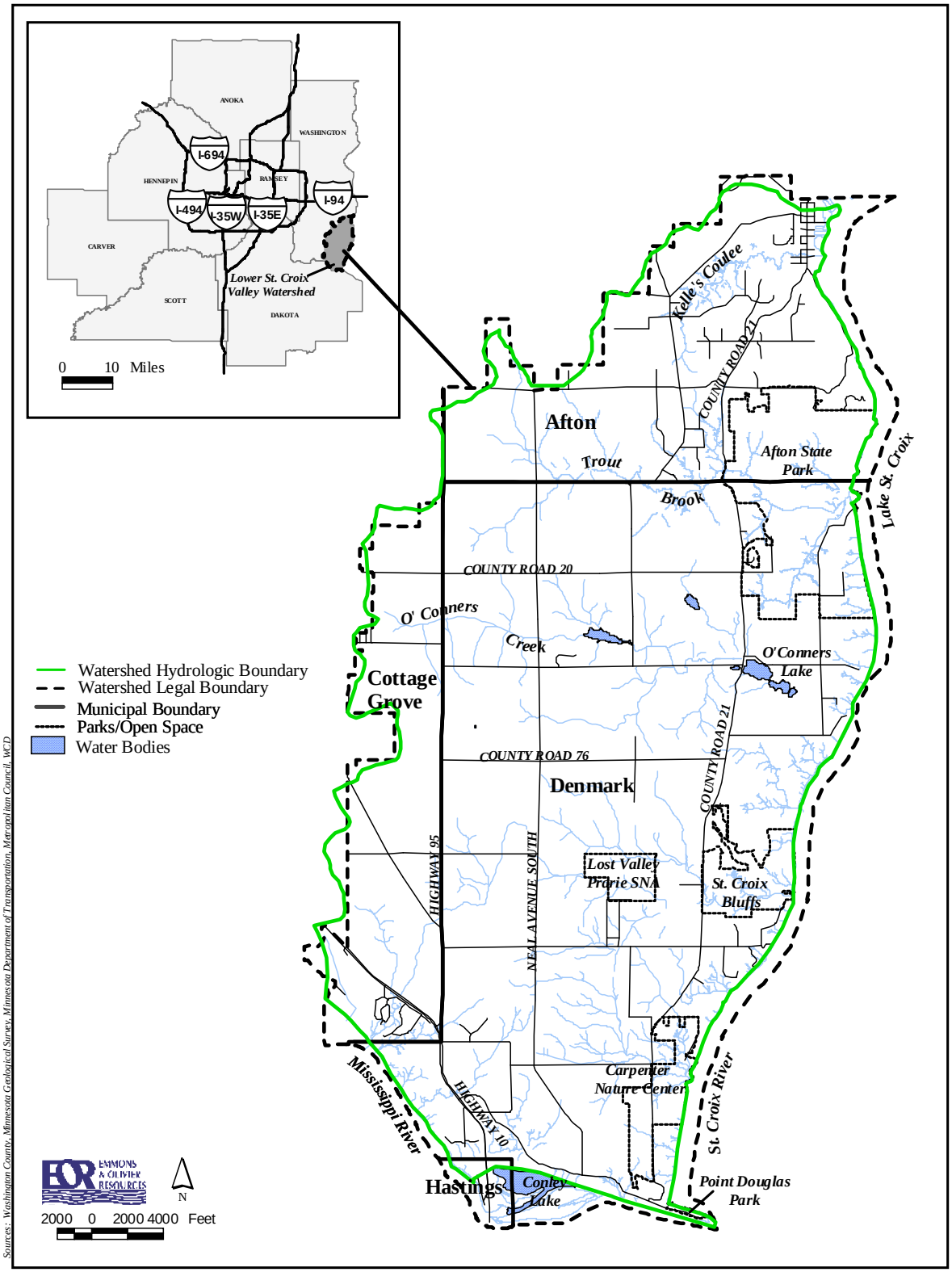


Figure I-2. Afton

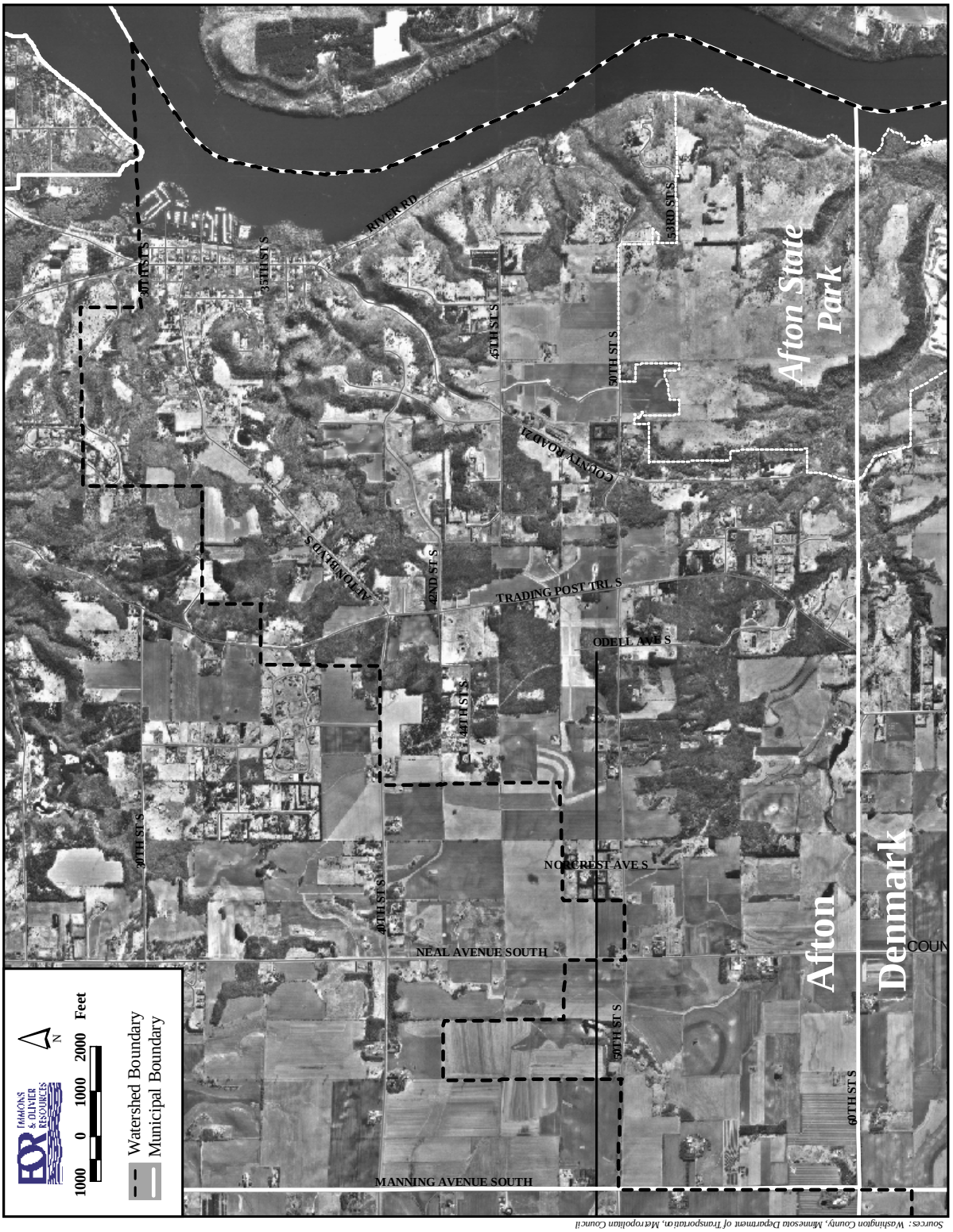


Figure I-3. Denmark Township

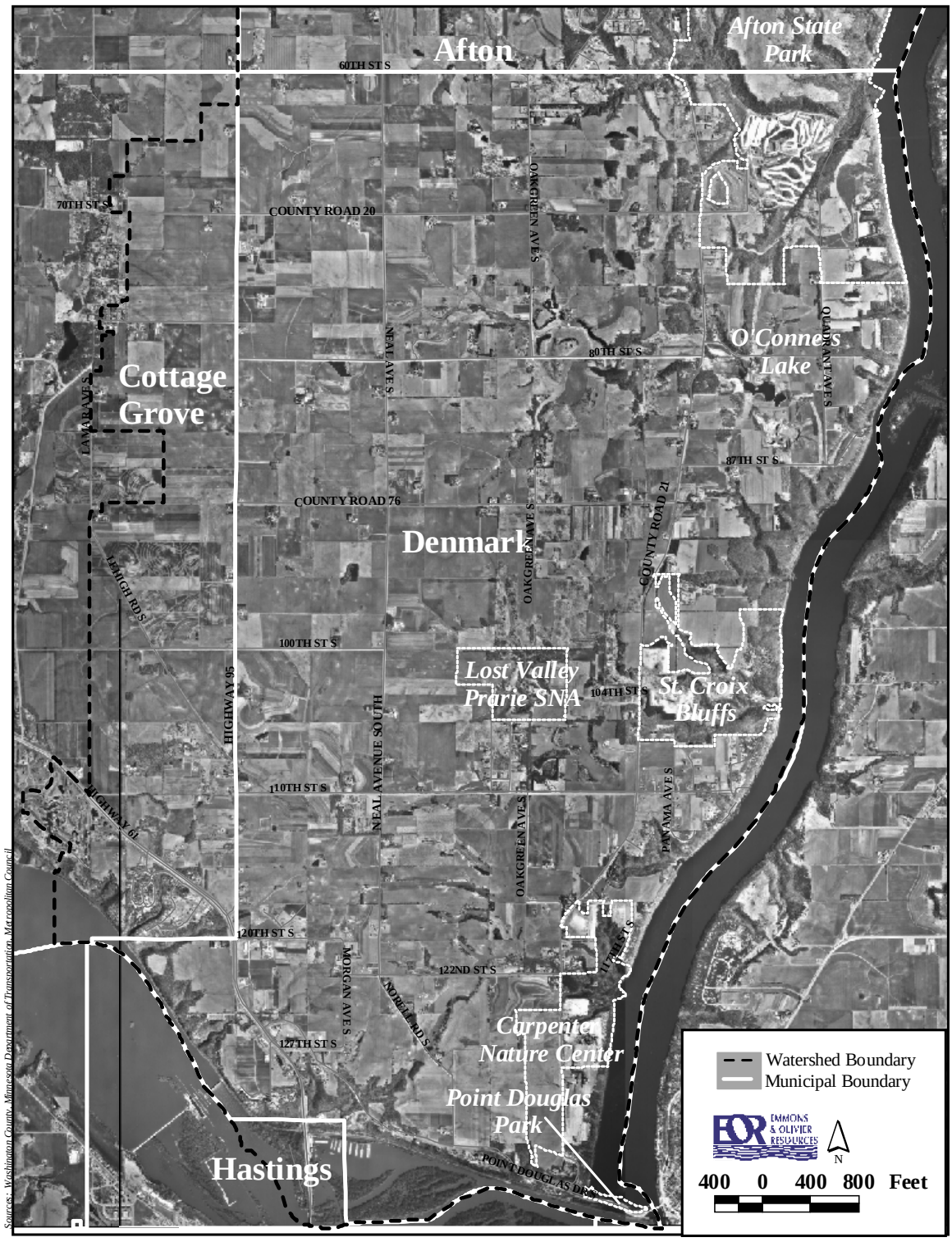


Figure I-4. Cottage Grove

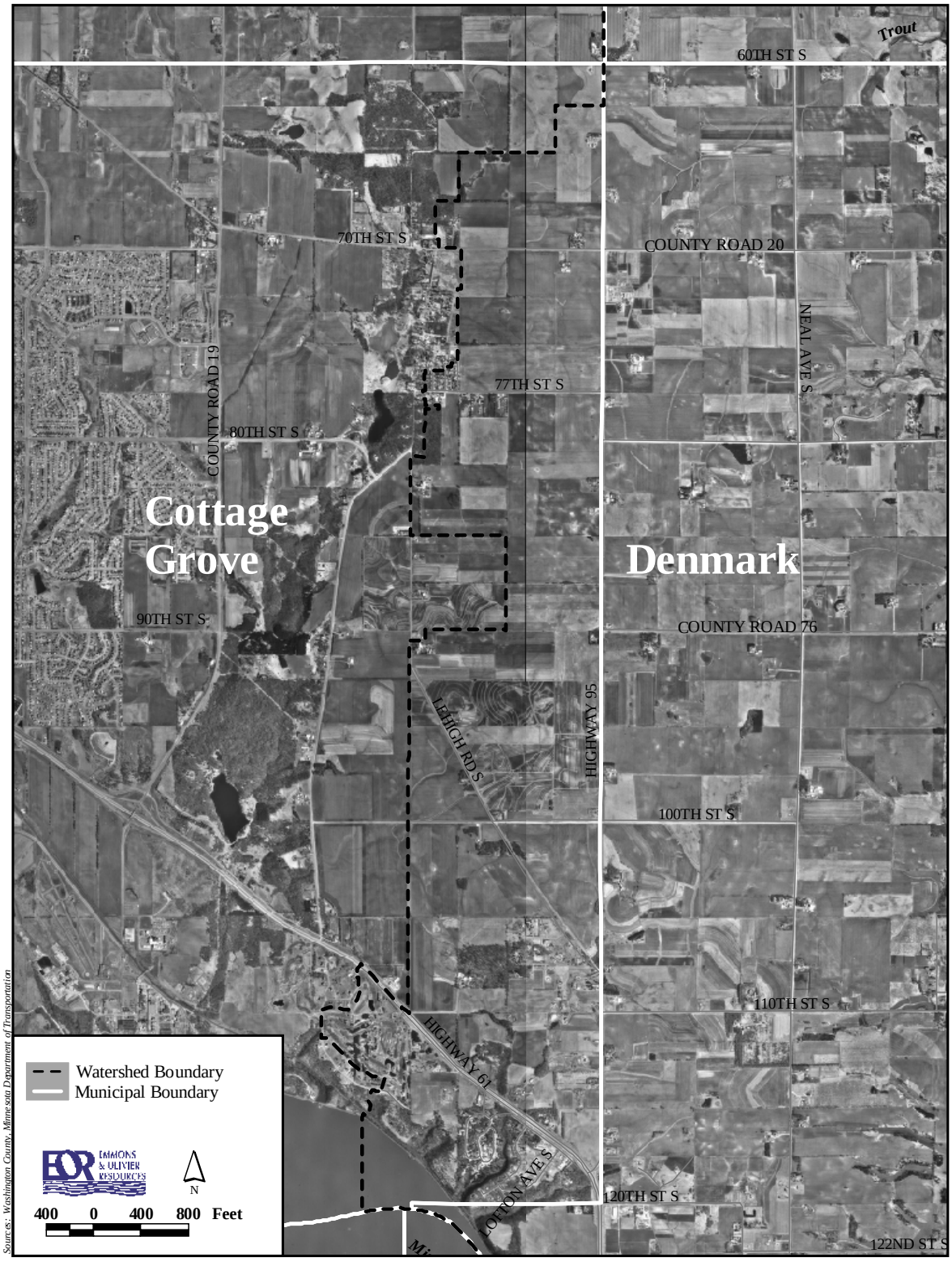
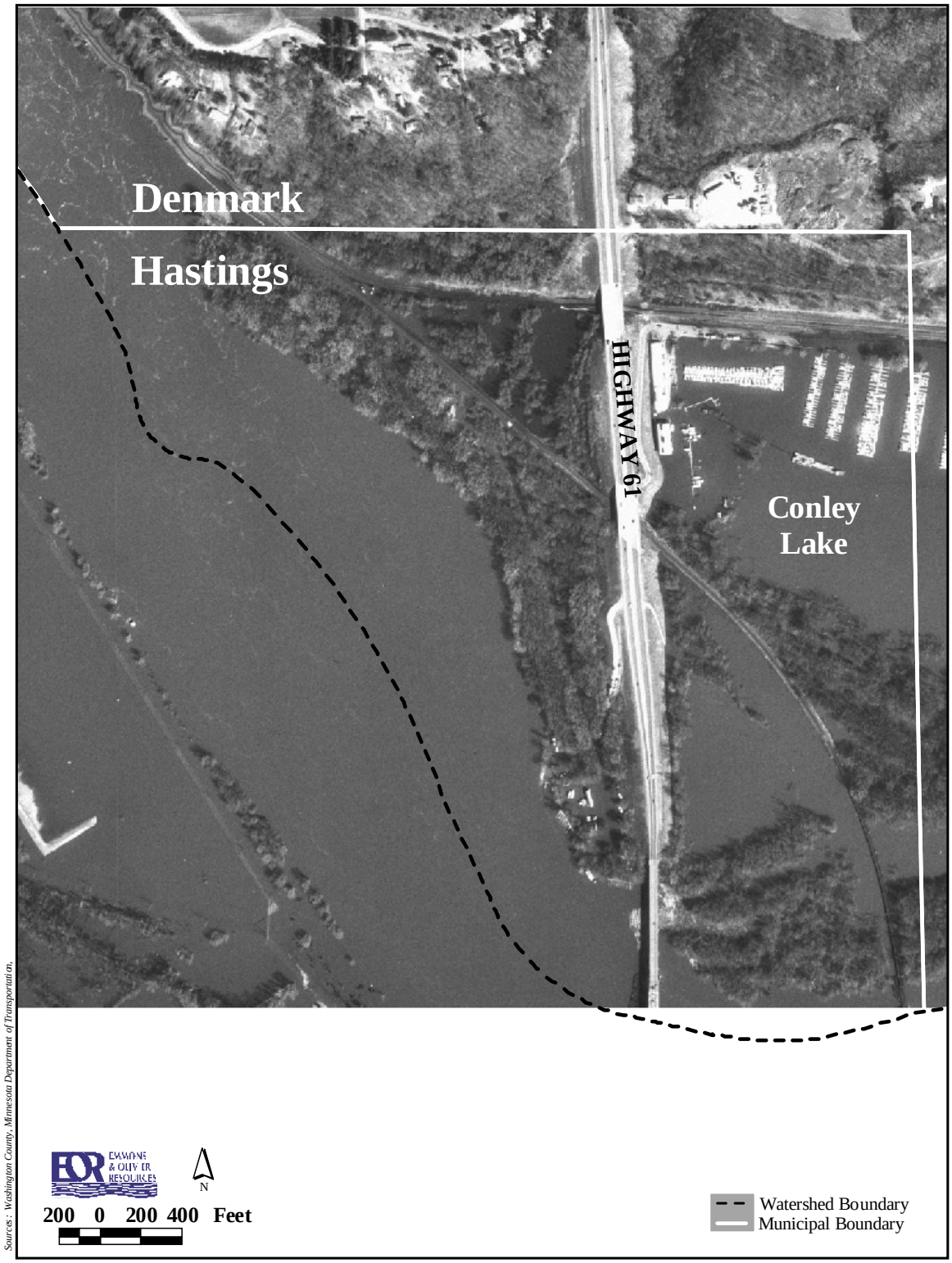


Figure I-5. Hastings



Mailing Address

Lower St. Croix Watershed Management Organization
c/o Emmons and Olivier Resources, Inc.
651 Hale Avenue North
Oakdale, MN 55128
Tel: 651.770.8448
Fax: 651.770.2552

Plan Consultants

Emmons and Olivier Resources, Inc.
651 Hale Avenue North
Oakdale, MN 55128
Tel: 651.770.8448
Fax: 651.770.2552
Web: www.eorinc.com

I-2. Vision Statement

The vision of the LSCWMO is to:

- Focus activities on resource preservation and management;
- Protect high quality natural resources through active participation in development activities;
- Operate in a fiscally responsible manner; and
- Maintain a high degree of cooperation and responsibility among community members.

I-3. Watershed Advisory Committee

A watershed Advisory Committee (AC) was formed early in the planning process to provide input and guidance on Plan development. This AC acted as a technical and citizen's advisory committee. Each community nominated potential citizen advisors to serve on the AC. In addition, agency representatives, city, county, and township staff and environmental interest groups were asked for their participation on the AC. The following individuals were invited to participate on the AC throughout the Plan development.

Watershed Residents

Charlie Johnson – Denmark Township
Jim Keller – Denmark Township
Tim Mathison – City of Cottage Grove
Kevin Murphy – City of Afton
Lisa Ring – Denmark Township
Peter Vujovich – City of Afton

Technical Representatives

Craig Affeldt, Minnesota Pollution Control Agency
Becky Balk, Minnesota Department of Agriculture
Whitney Clark, Friends of the Mississippi River
Charlotte Cohn, Minnesota Department of Natural Resources
Pam Davis, St. Croix Bain Planning Team
Randy Ferrin, National Park Service
Jack Frost, Metropolitan Council
John Hensel, Minnesota Pollution Control Agency
Calvin Kontola, Afton State Park Manager
Les Lemm, Board of Water and Soil Resources
Art Persons, Minnesota Department of Health

Tom Polasik, Minnesota Department of Natural Resources
Molly Shodeen, Minnesota Department of Natural Resources
Ron Struss, University of Minnesota Extension Service
Steve Woods, Board of Water and Soil Resources

City, County, and Township Staff

Jeff Berg, Washington Conservation District
Mitch Berg, Afton Administrator
Howard Blin, Cottage Grove Community Development Director
Amanda Goebel, Washington County
Jane Harper, Washington County
Kathleen Miller, Afton Interim Administrator
Ann Pung- Terwedo, Washington County

I-4. Lower St. Croix Watershed Management Organization Joint Powers Agreement

The LSCWMO updated the JPA between Denmark Township and the Cities of Afton, Cottage Grove, and Hastings in 2005. It will be updated again in 2008. The city council or town board of each community approved the JPA. The current JPA outlines the establishment of the LSCWMO, the powers and duties of the Board, and available funding mechanisms. A copy of the JPA is included in Appendix A.

I-5. Statutory Requirements of a Watershed Management Plan

In addition to the local interests of the LSCWMO, the watershed also has broader guidelines and issues that it has to address. MN Statutes Chapter 103B identifies watershed management organization's responsibilities and authorities.

The purposes of the Metropolitan Water Management Program as defined in MN Statutes Section 103B.201 are to:

- protect, preserve, and use natural surface and groundwater storage and retention systems;
- minimize public capital expenditures needed to correct flooding and water quality problems;
- identify and plan for means to effectively protect and improve surface and groundwater quality;
- establish more uniform local policies and official controls for surface and groundwater management;
- prevent erosion of soil into surface water systems;
- promote groundwater recharge;
- protect and enhance fish and wildlife habitat and water recreational facilities; and
- secure the other benefits associated with the proper management of surface and groundwater.

The LSCWMO has the responsibility to assess and manage land and water resources for the purposes listed above. Issues or concerns that have not been identified in the development of this Plan can be identified and brought to the LSCWMO's attention at any time for consideration.

I-6. Washington County Water Governance

The Washington County Water Governance Study (Washington County, 1999), completed in 1999 and revised in 2002, provides an implementation plan and set of criteria that outlines the

expectations for Watershed Management Organizations (WMO) taking on an active role in managing the water resources of the County. This Study provides a recommendation of enlarging the Valley Branch Watershed District to include the LSCWMO, but the timing of this enlargement is dependent on the WMO's ability and willingness to take on an active water management role. The following criteria were established on which to base the need for enlarging the Valley Branch Watershed District to include the LSCWMO. Each of these criteria is addressed within the Plan and will be referenced throughout. A summary of LSCWMO actions is included in italics after the corresponding criteria below.

Criteria #1: "The organization has a current joint powers agreement that meets the standards established by the Board of Water and Soil Resources".

The current JPA of the LSCWMO, which satisfies established Board of Water and Soil Resources (BWSR) standards, is included in Appendix A.

Criteria #2: "The organization has a current management plan that meets the content requirements and schedule established by the Board of Water and Soil Resources".

BWSR approval of this Plan will fulfill the requirements of this criterion.

Criteria # 3: "The organization is actively implementing the water resources management plan. At a minimum:

A. The current water issues in the area are being addressed.
B. The organization is actively implementing programs and projects that address both water quantity and quality issues.
C. The organization is actively implementing programs to prevent problems from occurring.

D. The organization has set performance standards for priority water bodies and has an ongoing monitoring program to assess whether the standards are being met".

The LSCWMO has l begun Plan implementation. Annual reports have been submitted to Washington County and BWSR . The Plan includes a summary of current watershed issues developed as part of a public involvement process and an implementation plan that includes projects and programs to address each of the issues raised during the issue identification process; development review program to prevent future water resource problems; comprehensive monitoring program; and studies to develop resource based performance standards.

Criteria #4: "The organization is actively implementing the recommended actions defined for the watershed districts and water management organizations in the Washington County Groundwater Management Plan".

This Plan includes management standards and implementation actions that address the recommended actions of the County Groundwater Plan (Washington County, 2003b). Implementation Action 5 describes the Landlocked Basin Management Study & Management Plan; Activity 6 the Watershed Pollutant Loading Study; Activity 7 describes the Karst Feature Inventory & Management Plan; Activity 8 the Wetland Management Plan; Activity 9 the Trout Brook Fisheries Assessment; Activity 10 describes the Kelle's Coulee Stream Management Plan; Activity 11 describes the O'Conner's Lake & Stream Management Plan In addition, Implementation Action 4 is an education and information program that includes promoting best management practices and low impact development, the education of citizens and public officials of the interaction of groundwater and surface water, and the importance of groundwater recharge and groundwater dependent natural resources. Also identified in Section V of this Plan are management standards that have been developed by the LSCWMO. Criteria #5:

"The organization has mechanisms in place for citizens to advise the organization on planning, budgeting, and projects that may benefit the area".

The LSCWMO currently has a Citizen's Advisory Committee (CAC. Policy 50 in Section IV of this Plan identifies the continuation of an active CAC as a mechanism for providing information, knowledge, and skills to those who live, work, and/or recreate in the watershed to foster the protection of local land and water resources. Additionally, Implementation Action 4 in Section V of this Plan is an education and information program that identifies the continuation of the current CAC. The JPA also mandates an ongoing CAC.

Criteria #6: "The organization has a clear point of contact for customers. The point of contact is able to answer questions about the organization and is able to assist local governments and citizens in resolving their concerns".

The point of contact for the LSCWMO is identified at the beginning of this section. The point of contact will be updated in the annual report prepared for Washington County and BWSR.

Criteria #7: "The organization is using the Washington County Standardized Chart of Accounts for Water Management Organizations to track its revenues and expenditures".

The LSCWMO is utilizing the Washington County Standardized Chart of Accounts for Water Management Organizations to track its revenues and expenditures.

Criteria #8: "The organization submits, to the County, an annual report that includes a financial statement, work accomplishments, and how the organization is implementing the goals of the Water Governance Project".

Implementation Action 1 identified in Section V of this Plan addresses the necessary annual administration of the watershed which includes the completion and submittal of an annual report.

II. Watershed Issues and Issue Statements

The purpose of this section as defined in MN Statutes Section 103B.201 is to present information on existing and potential problems related to the hydrologic system. The Lower St. Croix Watershed Management Organization (LSCWMO) has developed a set of issue statements for the management of the water and natural resources in the watershed. These issue statements were drafted by the Board of Managers with input from the watershed Advisory Committee (AC). These issue statements serve to focus the preparation of this Watershed Management Plan (Plan) and as a guide for developing the management goals and implementation strategies presented in this Plan. The Board of Water and Soil Resources (BWSR), state review agencies, Metropolitan Council, Denmark Township and the cities of Afton and Cottage Grove were asked to review and comment on the final list of watershed issues prior to development of the Implementation Plan presented in Section V.

II-1. Issue Identification

LSCWMO issues, or problem areas, were defined by a cross section of the community, agency representatives, and environmental organizations. Early in the planning process, an AC was formed to assist the Board of Managers in the planning process, as described in Section I. A series of public meetings were conducted throughout the planning process as a means to identify existing issues and problems in the watershed that should be considered for inclusion in the Plan. An open house was also held to obtain additional public input. All watershed residents were encouraged to attend. Table II-1 summarizes the meetings.

Table II-1. Summary of Issue Identification Meetings

Meeting	Date	Goal	Participants
Plan kick-off meeting	12-10-03	Develop AC and obtain initial input from citizens and agency representatives	Managers and AC
Letter to agencies, county, municipal staff	12-16-03	Obtain specific agency, county, and municipal staff input on issues	Agency, county, municipal staff
Board meeting	1-14-04	Review and prioritize issues	Managers and watershed citizens
Board meeting	2-11-04	Review issue statements	Managers and watershed citizens
AC meeting	2-25-04	Review issue statements, provide additional input on prioritized issues	Managers and AC
Board meeting / open house	3-10-04	Obtain additional public input on issue prioritization and issue statements	Managers and watershed citizens

The issues identification process began with a Plan kickoff meeting with the Board of Managers, interested watershed citizens, and agency representatives which took place on December 10th, 2003. This meeting was held to organize the project AC and obtain valuable insight for the Board of Managers regarding the issues and concerns held by the residents of the watershed as well as the state agencies. Following the kickoff meeting, a letter was sent to each of the state review agencies and city, county and township representatives to request specific input on the issues to be addressed in the Plan. A complete listing of all the issues identified in the process described above is included in Appendix B.

Following compilation of the issues, the Board of Managers met to discuss and prioritize the issues. The first level of issue examination resulted in categorizing the issues into one of three tiers.

Tier 1 includes issues that are of the highest priority to be addressed in the Plan. The majority of issues identified during the Issue Identification Process are included in this Tier. Tier 2 includes issues that are not included in the Plan at this time for various reasons or are included in other sections of the Plan. Tier 3 includes those issues that are currently not within the scope of the watershed planning process. Only one issue is included in Tier 3. This issue, "St. Croix River

flooding at south end of Village of Afton", was determined to be a regional issue which is better addressed by municipalities and regional authorities.

Each Tier 1 issue was reviewed and divided into four watershed management areas including:

- Protection of Surface Water Resources
- Mitigation of Stormwater Impacts
- Groundwater Quality and Quantity
- Protection of Key Natural Resources

Table II-2 includes each issue identified as part of the Plan process and its associated watershed management area. The LSCWMO principal area of interest is summarized for each of the watershed management areas and reflects the goals for watershed management in addition to the relevance to the watershed.

Protection of Surface Water Resources

The LSCWMO contains numerous high quality surface water resources. Protection of these resources is critical to maintaining the ecological integrity of the watershed, providing diversity of fish and wildlife habitats, maintaining unique natural communities, and contributing to the protection of key recreational areas including the St. Croix and Mississippi Rivers. As identified in the Inventory Section, the key surface water features of the Watershed include:

- Kelle's Coulee
- Trout Brook
- O'Conners Creek and Lake
- St. Croix River
- Mississippi River and Conley Lake

Mitigation of Stormwater Impacts

Land use alterations and development can result in increased stormwater runoff volumes and rates, flooding, erosion, sedimentation, and pollutant loading, resulting in degradation of natural resources, fish and wildlife habitat, groundwater, surface water, and recreational areas. Standards and ordinances are needed to prevent and mitigate degradation to these resources.

Groundwater Quality and Quantity

Land use and increased development within and adjacent to the watershed threaten the quantity and quality of groundwater that is essential for drinking water supply, sustaining unique groundwater dependent natural resources, and maintaining the base flow and thermal stability of watershed streams. Groundwater quality in the watershed is highly susceptible to surface activity due to karst features, bedrock faulting, and thin surficial deposits. Implementation of the County Groundwater Plan and recommendations from current groundwater studies is needed to ensure successful management of groundwater resources.

Protection of Key Natural Resources

Rare and high quality natural communities have been identified within the watershed and are discussed in more detail in Section III. Land and Water Resource Inventory of this Plan. While many of the highest quality resources are adjacent to the surface waters of the watershed, high quality upland areas are also found. These areas, in addition to providing critical wildlife habitat and recreational opportunities, are important to the protection and preservation of the water resources of the watershed. As development increases, these features are at increasing risk of degradation and/or loss.

Table II-2. Issues and Watershed Management Area

Issue ID Number	Issue	Tier	Watershed Management Area
1	Questionable impervious areas within developments along St. Croix River and subsequent erosion along bluffs.	1	Mitigation of Stormwater Impacts, Protection of Surface Water Resources
2	Need for controlled development within areas draining to Mississippi and St. Croix River bluffs.	1	Mitigation of Stormwater Impacts, Protection of Surface Water Resources
3	Increased popularity of animal agriculture practices in Washington County and potential threat to resources and water quality.	1	Protection of Surface Water Resources, Groundwater Quality and Quantity
4	Individual septic tank systems and potential impact on groundwater resources.	1	Groundwater Quality and Quantity
5	Sediment loads in Trout Brook.	1	Mitigation of Stormwater Impacts, Protection of Surface Water Resources
6	Potential designation of Trout Brook as a Metro Trout Stream by DNR.	2	
7	Concern for growth in neighboring watersheds and their impact on watershed boundaries.	2	
8	Consistency with Comprehensive Plans and potential future conflicts over water and sewer needs, particularly with neighboring communities.	1	Groundwater Quality and Quantity
9	Phase II stormwater issues and need for stormwater ordinances at the local level including erosion control and rate control.	1	Mitigation of Stormwater Impacts
10	Impact that large recreational complexes are having on soil erosion, groundwater resources and surface water quality of Trout Brook.	2	
11	St. Croix River flooding at south end of village of Afton.	3	
12	Gully erosion along St. Croix and Mississippi Rivers.	1	Mitigation of Stormwater Impacts
13	Historical dumping within ravines and coulees and potential impact of clean up or restoration.	1	Mitigation of Stormwater Impacts
14	Nitrates in groundwater and need for policies that limit nitrate application for residential and agricultural uses.	1	Groundwater Quality and Quantity
15	Kelle's Coulee and Trout Brook are identified as high quality natural resources in need of protection.	1	Protection of Surface Water Resources, Mitigation of Stormwater Impacts, Protection of Key Natural Resources
16	Flood protection for future developments.	1	Mitigation of Stormwater Impacts
17	Mining activities impacting surface water quality of O'Conners Creek.	1	Protection of Surface Water Resources
18	Standards and rules are needed to regulate mining activities at the local level.	2	Protection of Surface Water Resources, Mitigation of Stormwater Impacts, Protection of Key Natural Resources, Groundwater Quality and Quantity
19	O'Conners Lake is a high quality groundwater dependent landlocked lake.	1	Mitigation of Stormwater Impacts, Protection of Surface Water Resources, Groundwater Quality and Quantity

Table II-2. Issues and Watershed Management Area (cont.)

Issue ID Number	Issue	Tier	Watershed Management Area
20	Protection of natural resources is a key issue.	1	Protection of Surface Water Resources, Mitigation of Stormwater Impacts, Protection of Key Natural Resources, Groundwater Quality and Quantity
21	Protection of groundwater dependent natural resources and private water supply systems as a result of private and large scale municipal pumping.	1	Groundwater Quality and Quantity
22	Implementation of the County Groundwater Plan.	1	Mitigation of Stormwater Impacts, Protection of Surface Water Resources, Groundwater Quality and Quantity
23	Karst features in the watershed threaten groundwater quality.	1	Groundwater Quality and Quantity
24	The negative effect of infiltration on groundwater quality.	1	Groundwater Quality and Quantity
25	Need to explore alternative funding mechanisms including special legislation in the future.	2	n/a
26	Federal funding programs including FARM Aid should be used to fund initiatives. Funding also available through WCD to develop/install BMPs, nutrient management strategies, buffer strips, conservation tillage initiatives, etc.	2	n/a
27	Nutrient and sediment management plan (*St. Croix Basin Water Resources Planning Team, MPCA, DNR*)	1	Mitigation of Stormwater Impacts, Protection of Surface Water Resources
28	Need to address MPCA list of impaired waters. (*BWSR*)	1	Mitigation of Stormwater Impacts, Protection of Surface Water Resources
29	Coordination with Washington County Water Governance strategies. (*BWSR*)	2	n/a
30	Need for an updated JPA at the time of plan submittal to review agencies. (*BWSR*)	1	n/a
31	Need for an Administrative Implementation Plan (AIP) that will document minimum standards, procedures for membership, and tapestry of authorities. (*BWSR*)	2	n/a
32	Need for a focused plan that addresses WMO priorities and develops long term vision for water management. (*BWSR*)	2	n/a
33	Need for standards for floodplain and freeboard requirements, impervious surface limits, wetland management roles, stormwater runoff controls, erosion and sediment control, and coordination with the MPCA. Also include requirements for buffers, overlay districts near priority resources, and wellhead protection areas. (*BWSR*)	1	Mitigation of Stormwater Impacts, Groundwater Quality and Quantity, Protection of Surface Water Resources, Protection of Key Natural Resources

Table II-2. Issues and Watershed Management Area (cont.)

Issue ID Number	Issue	Tier	Watershed Management Area
34	Need to review Washington County ISTS ordinance and administration within the watershed to provide a synopsis of conditions, applicable ordinances, permitting, construction practices, etc. to users of the plan. *(MPCA)*	1	Groundwater Quality and Quantity
35	Need to utilize stormwater management practices that are specialized for karst regions. *(MPCA)*	1	Mitigation of Stormwater Impacts, Groundwater Quality and Quantity
36	Need to define groundwater sheds in order to appropriately identify and address potential contaminant sources. *(MDH)*	2	n/a
37	Need to collaborate with public water suppliers and the Minnesota Department of Health on the development and implementation of Wellhead Protection Plans (WHP). *(MDH)*	1	Groundwater Quality and Quantity
38	Need to maintain groundwater quantity through appropriate stormwater management. *(MDH)*	1	Mitigation of Stormwater Impacts, Groundwater Quality and Quantity

n/a – Watershed Management Area not applicable, issue addressed in Plan elsewhere

II-2 Watershed Issue Statements

Issue statements have been developed to describe in detail the identified issues and serve to focus the Plan. Each Tier 1 issue has been combined with similar issues and refined to develop a set of Issue statements. Issue statements are organized by the four watershed management areas below.

II-2.1 Protection of Surface Water Resources

Kelle's Coulee

Kelle's Coulee is a groundwater supported stream that has been identified by the LSCWMO as one of the highest priority surface water resources in the watershed. It was also identified as a key natural resource in the City of Afton's Natural Resource Inventory (EOR, 2001). Increased development within the Kelle's Coulee watershed has

the potential to increase the rate and volume of flow within the stream, thus leading to increased erosion of the streambed, potential flooding in the downstream reaches and an overall loss of habitat. Water quality within Kelle's Coulee may also be impacted by development within the watershed. Additional evaluation of Kelle's Coulee is available in the LSCWMO Kelle's Coulee Management Plan.

Trout Brook

Trout Brook has been identified by the LSCWMO as one of the highest priority surface water resources in the watershed. This stream is groundwater supported and provides habitat and water temperatures suitable for trout. Due to urbanization, trout streams are rare in the Metro Area and their protection has been identified as a priority by the MN Department of Natural Resources (DNR). Increased development within the Trout Brook watershed has the potential to increase the rate and temperature of flow as well as nutrient concentrations within the stream, thus threatening its ability to support trout. Identification and protection of the groundwater recharge area for Trout Brook will also be important to its long-term management.

O'Conners Creek and Lake

O'Conners Creek receives drainage from a considerably large watershed. The creek discharges into O'Conners Lake, a landlocked basin. The landlocked nature of this lake makes it extremely sensitive to increased stormwater volumes that may result from development within the watershed. O'Conners Creek is also groundwater fed. Identification and protection of the groundwater recharge area for this stream will be important to its long-term management. Additional evaluation of O'Conner's Creek and Lake and their management is available in the LSCWMO O'Conner's Creek and Lake Management Plan.

St. Croix River

The St. Croix River forms the eastern boundary of the watershed with approximately 12 miles of shoreline. The River is not only a key resource of the LSCWMO but also a key resource regionally. The primary issues concerning the St. Croix River are bluffline/streambank erosion and watershed nutrient loading. Several erosion areas have been identified along the St. Croix and it is likely that many other eroded or erosion prone areas exist.

In addition to Kelle's Coulee and Trout Brook, there are several small coulees, ravines and intermittent streams which outlet into the St. Croix from the Lower St. Croix (LSC) watershed. The St. Croix River Basin Planning Team has identified a goal of improving the water quality in the St. Croix River. (St. Croix Basin Water Resources Planning Team, 2004). Cooperation with local watershed authorities is needed to achieve this goal and protect the St. Croix River as an outstanding regional water resource.

Mississippi River and Conley Lake

The Mississippi River forms the southern boundary of the watershed with approximately 5 miles of shoreline. Conley Lake is located within the River floodplain just upstream of the confluence with the St. Croix River. The LSC watershed drains into the Mississippi River through several small coulees, ravines and intermittent streams. In addition to bluffline erosion, which is prevalent along the River, sedimentation from the watershed is a concern. This reach of the Mississippi River is on the Minnesota Pollution Control Agency list of impaired waters for turbidity. A Total Maximum Daily Load study (TMDL) will be developed for this River reach. Cooperation with local watershed authorities is critical to implementing the turbidity TMDL as well as reducing nutrient inputs to the River to improve water quality in the River.

Development Pressures

Beyond management of the specific water resources listed above, there is a need for watershed wide surface water management efforts. Development pressure within the

watershed is likely to increase substantially in the coming years. As the watershed becomes developed and more impervious surfaces are created, the rate, volume and nutrient concentration of runoff will increase unless controls are in place. These stormwater controls are discussed in greater detail in the next section; Mitigation of Stormwater Impacts.

Water Resource Monitoring

Developing a database of water quality and flow data for each resource is necessary to assess the need for improvement projects, evaluate effectiveness of current standards for protecting these resources and generally assessing trends within the watershed. Monitoring can also be used to demonstrate compliance with regional standards or goals.

Agricultural Practices

Animal agriculture, is increasing in popularity within Southern Washington County . Animal and non-animal agriculture can lead to degraded surface water and groundwater quality from increased animal waste, reductions in vegetative cover, nutrient loading, and pesticides. Agriculture within and adjacent to wetlands and waterways can be a significant threat to water quality. Groundwater contamination from agriculture can be particularly significant in an active karst region.

II-2.2 Mitigation of Stormwater Impacts

Erosion and sedimentation along Trout Brook, O'Conners Creek and Kelle's Coulee

Trout Brook, O'Conners Creek and Kelle's Coulee contain areas of significant erosion and sedimentation as described in the Afton and Denmark Township Water Resource Inventories (WCD, 2002; WCD, 2001) resulting in impacts to fish habitat, degraded water quality, changes in channel morphology, and loss of property.

Gully erosion along the St. Croix and Mississippi Rivers

Gully erosion as a result of stormwater is prevalent along the bluffs of the St. Croix and Mississippi Rivers. Erosion within gullies and ravines leads to sedimentation downstream causing a reduction in water quality and destruction of habitat. In addition, historical dumping within these ravines and gullies has led to concerns regarding potential clean up measures and impacts on steep slopes and erosion.

Protection of surface water quality

Increased development and land use changes may result in increased pollutant loadings, specifically sediment and nutrients, which can negatively impact downstream receiving waters including groundwater resources. New developments need to provide water quality treatment for stormwater. Stormwater practices specialized for karst areas should be implemented. Limited data are available that define the existing water quality of surface water resources. These data are necessary for evaluating the impact of existing land use on water quality.

Flood protection for future developments

Potential flood prone areas along watershed streams and rivers and within landlocked subwatersheds may lead to a loss of property. Floodplain standards and minimum building elevations are needed to ensure flood protection for future developments.

Limiting stormwater rates and volumes

Increases in impervious surfaces lead to increased stormwater volumes and rates which negatively impact the natural resources and hydrologic system of the watershed. Increased stormwater rates and volumes result in erosion and sedimentation, decreased

stream channel stability, degraded water quality, thermal impacts to streams, loss of groundwater recharge and stream base flow, and increased flooding potential.

II-2.3 Groundwater Quality and Quantity

Nitrate contamination of groundwater

Nitrate contamination has been identified in private water supplies within the watershed. The cause of this contamination has been identified as fertilizer application from both residential and agricultural uses (Barr, 2003). Subsurface Septic Treatment Systems (SSTS) and animal agricultural are additional sources of potential nitrate contamination in the watershed. Groundwater resources require protection from degradation as a result of these land uses.

Karst topography and aquifers

Karst features in the watershed including sinkholes, springs, and caves require special protection from surface water contamination to ensure groundwater quality protection.

Effect of infiltration on groundwater quality

The process of infiltrating surface water to the groundwater system can have a negative effect on groundwater quality. Appropriate pretreatment practices should be utilized to mitigate any potential negative effects. Policies and standards are needed to protect groundwater resources in sensitive recharge areas from water quality degradation that could occur as a result of infiltrating untreated stormwater.

Protection of groundwater dependent natural resources and private water supply systems

Development in southern Washington County may lead to future conflicts between municipal groundwater pumping activities, private well supplies, and protection of groundwater dependent natural resources. Baseline data and proactive management are needed to resolve these conflicts.

Implementing existing and future groundwater studies

The collaboration on the development of existing and future groundwater studies, management plans, and wellhead protection plans and the implementation of recommendations is needed, when applicable, to ensure the successful management of the watershed's groundwater resources. Existing studies and management plans include:

- Afton Natural Resource Inventory and Stewardship Plan Natural Community Evaluation, (EOR, 2001);
- City of Afton Water Resource Evaluation, (WCD, 2001);
- Maintaining and Enhancing Environmental Quality in Denmark Township; A Natural Resources Inventory with Stewardship Recommendations, (Barr, 2002);
- Denmark Township Water Resource Evaluation, (WCD, 2002);
- Cottage Grove Natural Resource Inventory, (BRAA, 1997);
- Washington County Groundwater Plan, (Washington County, 2003);
- Cottage Grove Area Nitrate Study Report, (Barr, 2003);
- Intercommunity Groundwater Protection Woodbury/Afton Area, 2005; and
- Southern Washington County Groundwater Study, 2005.
- LSCWMO Karst Feature Inventory and Management Plan, (EOR, 2007)

II-2.4 Protection of Key Natural Resources

Protection of rare and native plant and animal species

The wetland and upland plant communities adjacent to Kelle's Coulee and Trout Brook consist of native plant communities which display limited human disturbances. These plant communities have rare and native plant and animal species that significantly contribute to the ecological integrity of the watershed.

Forest fragmentation

The Kelle's Coulee watershed contains large areas of Maple Basswood forest and the Trout Brook watershed has a very large area of Oak forest. These large tracts of forest have a critical function in defining the quantity and quality of water reaching watershed streams. Clearing or fragmentation of these areas is a likely consequence of development and may diminish this function.

Invasive non-native species

Development in and adjacent to natural areas typically produces negative impacts. Foremost is the introduction of invasive non-native species. Ornamental landscaping plants and trees commonly used in residential areas may become destructive once introduced into native plant communities. The introduction of invasive non-native plants occurs through natural processes; the spreading of seeds from wind, plants, and insects. Once established in natural plant communities, invasive non-native species spread rapidly and crowd out native species. An example of the impact invasive non-native species can have on natural communities is the understory destruction caused by buckthorn in woodlands. Buckthorn grows as a sub-canopy tree or large shrub in woodlands. Their growth typically becomes so dense that understory vegetation, grasses and forbs, no longer have adequate sunlight for growth. Ultimately the understory becomes completely

denuded resulting in bare soil. The consequence is increased erosion and sediment loading to downstream water resources.

Protection of significant natural communities and wetlands

Additional significant resources in the watershed include large oak forests along the St. Croix River, the floodplain forest located in the Mississippi bottomlands near Conley Lake and large areas of dry prairie. The most notable dry prairie is located in and adjacent to the Lost Valley Prairie Scientific and Natural Area. Protection of these high quality natural areas is a priority of the LSCWMO. Protection of key natural resources in the watershed can be done through establishing ordinances or through purchasing land or conservation easements.

Regulations are already in place to protect the wetlands of the watershed but additional local ordinances could provide additional protection by requiring buffer areas adjacent to wetlands.

III. Land and Water Resource Inventory

This section contains a general inventory of the hydrologic and physical features of the watershed and an inventory of existing studies completed in the watershed.

III-1. General Inventory

The Lower St. Croix Watershed Management Organization (LSCWMO) is located in Washington County, Minnesota, identified in Figure III-1. It encompasses portions of the Cities of Afton, Cottage Grove, and Hastings; and Denmark Township in its entirety. Table III-1 lists each city and township and its contributing area to the watershed. These contributing areas were determined using the legal boundary of the LSCWMO. The legal boundary was updated and approved in April 2003 by the Board of Water and Soil Resources (BWSR).

Table III-1. Cities and Townships Located in the LSCWMO

City/Township	Area [Acres]	Area [Square Miles]	Percentage of Total Area [%]
Afton	6,391	9.99	22%
Cottage Grove	3,430	5.36	12%
Denmark Township	19,269	30.11	66%
Hastings	254	0.40	1%
Total	29,344	45.85	100%

The entire watershed is approximately 45.85 square miles in size. The watershed includes a major surface and groundwater hydrologic divide for the Mississippi River and St. Croix River basins. The main hydrologic features of this watershed are Trout Brook, Kelle's Coulee, O'Conners Creek and Lake, and numerous tributaries to the Mississippi and St. Croix Rivers. The watershed is bound on two sides by the Mississippi and St. Croix Rivers.

III-1.1 Climate and Precipitation

The climate of the LSCWMO is consistent with the climate for the Seven County Metropolitan Area. The summers are fairly short with an average temperature of 70 degrees Fahrenheit. Snowfall covers much of the ground from late fall to early spring. The average winter temperature is 17 degrees Fahrenheit. The average annual temperature is 46.4 degrees Fahrenheit and the average annual precipitation is 34.1 inches.

Thirty year average temperature and precipitation for Stillwater, Minnesota are summarized in Table III-2. This information is collected by the National Weather Service cooperative program and is available at the following Climatology Working Group (State Climatology Office - DNR Waters, Extension Climatology – MES, and Academic Climatology - U of Minnesota) web site at http://climate.umn.edu.

Table III-3 illustrates the standard values assumed for the probability of a rainfall event occurring in any given year. The recurrence interval is a measure of the probability of occurrence of a storm event. For example, a rainfall event of 6.0 inches has a 1% probability of occurring in any given year which is expressed as once in every 100 years; the 3.6-inch rainfall event has a 20% probability of occurring in any given year which is expressed as once in every 5 years.

Figure III-1. Location of LSCWMO

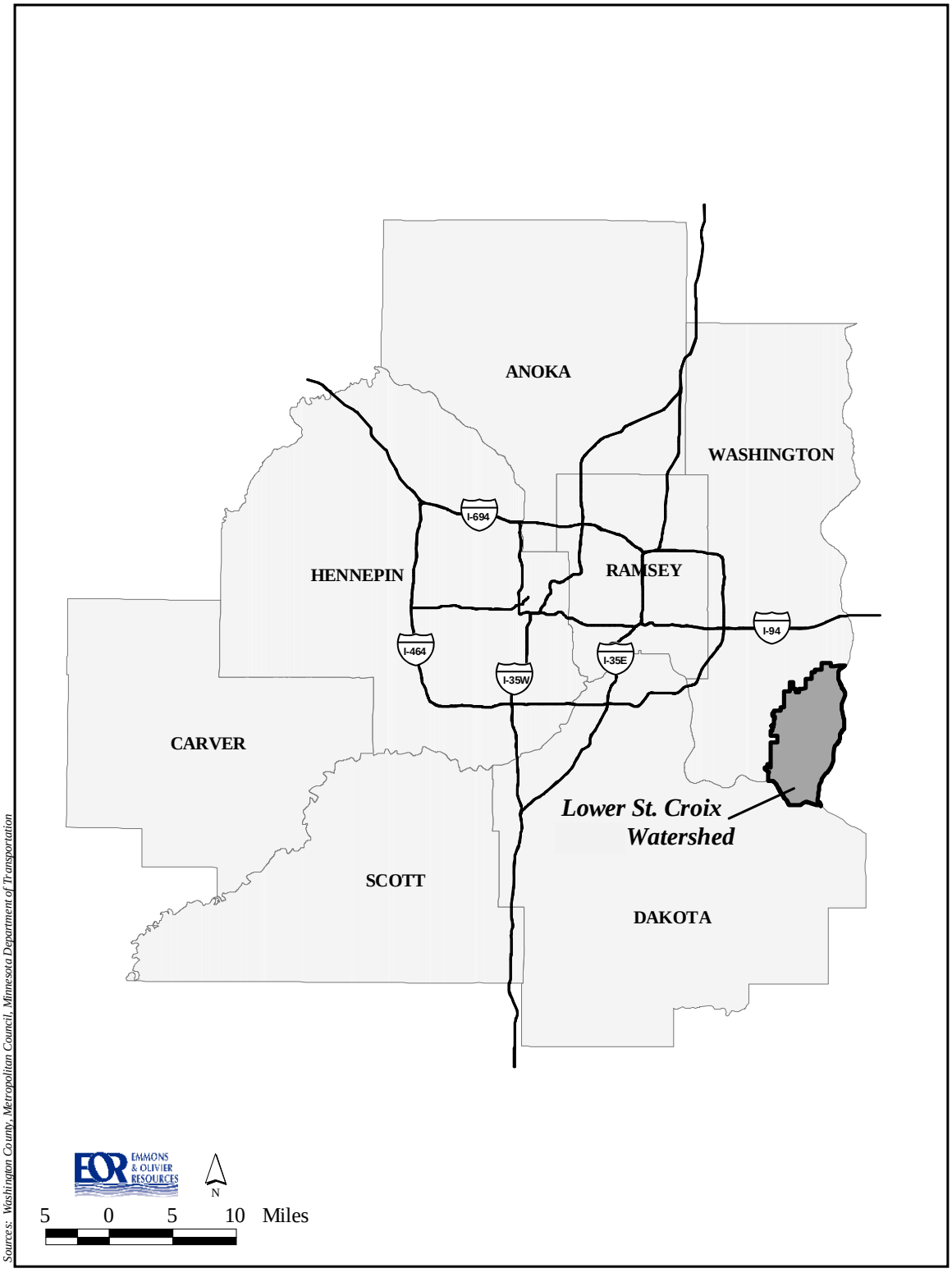


Table III-2. Stillwater, Minnesota (30-Year Record) Average Temperature and Precipitation

Month	Temperature (°F)	Precipitation (in)
January	13.5	1.08
February	18.7	0.69
March	32.7	1.83
April	46.9	2.90
May	61.7	3.60
June	68.6	4.81
July	75.8	4.74
August	73.2	4.77
September	61.7	3.67
October	51.0	2.86
November	33.2	2.17
December	19.8	1.00
Annual Mean	**46.4**	**34.12**

Table III-3. Storm Events (USDA, 1975)

Recurrence Interval [Years]	24-Hour Rainfall Amount [Inches]
1	2.4
2	2.8
5	3.6
10	4.2
25	4.8
50	5.3
100	6.0

III-1.2 Topography and Geomorphology

The topography of the LSCWMO was formed by glacial and post-glacial processes. The drainage pattern is well established and dendritic (USDA, 1977). The watershed is dominated by exposed bedrock and dissected till and outwash plain known as the Kenyon-Taopi Plain. This plain is a sloping, silt mantled, eroded till plain characterized by long swells and swales. The significant geomorphic features in the watershed are characterized by numerous well-defined stream channels, steep ravines, and river bluff and terrace deposits. In addition, the presence of karst features including sinkholes and springs define many of the watershed landforms. Additional information on karst features within the LSCWMO is available in the LSCWMO Karst Feature Inventory and Management Plan.

III-1.3 Soils

A soils map of the LSCWMO is shown on Figure III-2. As this map illustrates, the soils are classified into groups based upon the hydrologic features of the soils. Hydrologic soil groups are used to estimate the amount of runoff generated for a given rainfall event. Vegetation, soils composition, and slope all contribute to the runoff potential of a soil. There are four hydrologic soil groups: A, B, C, and D. Combinations of these soil groups also result in A/D and B/D type soils and indicates two distinct soils with depth (USDA, 1977). Table III-4 presents a description for each of the hydrologic soil groups and identifies the predominant soil type in the watershed for each group.

The erodability of the soils was determined as part of the Denmark and Afton Natural Resource Inventories (NRI). The method to determine the erodability used a shortened version of Revised Universal Soil Loss Equation (RUSLE) to assess the potential for erosion in the watershed. This shortened equation omits the land cover and remedial factor of the equation, but includes rainfall, slope length, gradient, and soil characteristics. The calculation of potential for soil loss is referred to as the erosivity index (EI). In order to develop ranking criteria, EI values were categorized into high, medium, and low.

Figure III-2. LSCWMO Soils Based on Soil Hydrologic Group

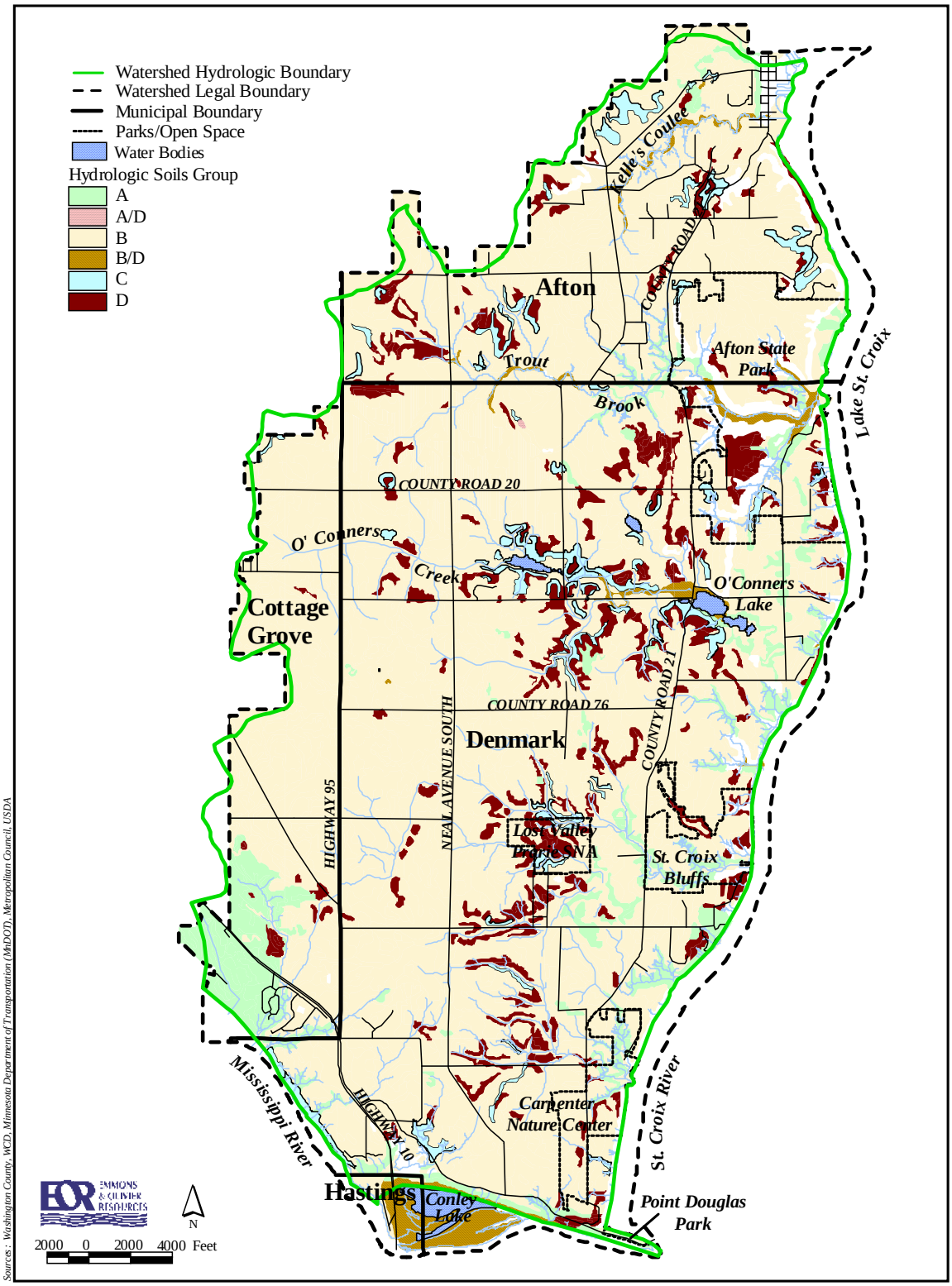


Table III-4. Soil Classification

Hydrologic Group	Description	Predominant Soil Type in LSCWMO
A	Soils having high infiltration rates when thoroughly wet (low runoff potential). Deep, well drained to excessively drained sand or gravelly sand.	Sparta, Dickman
B	Soils having a moderate infiltration rate when thoroughly wet. Moderately deep or deep, moderately well drained or well drained with moderate to moderately coarse texture.	Waukegan, Baytown, Ostrander
C	Soils having a slow infiltration rate when thoroughly wet: soils have a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture.	Brodale
D	Soils having very slow rates of infiltration when thoroughly wet (high runoff potential): soils consist of clays with high shrink-swell potential; soils have a high permanent water table; soils that have a claypan or clay layer at or near the surface and soils that are shallow over nearly impervious material.	Channahon, Copaston
Urban Land	Areas of development that are covered by asphalt, concrete, and buildings.	

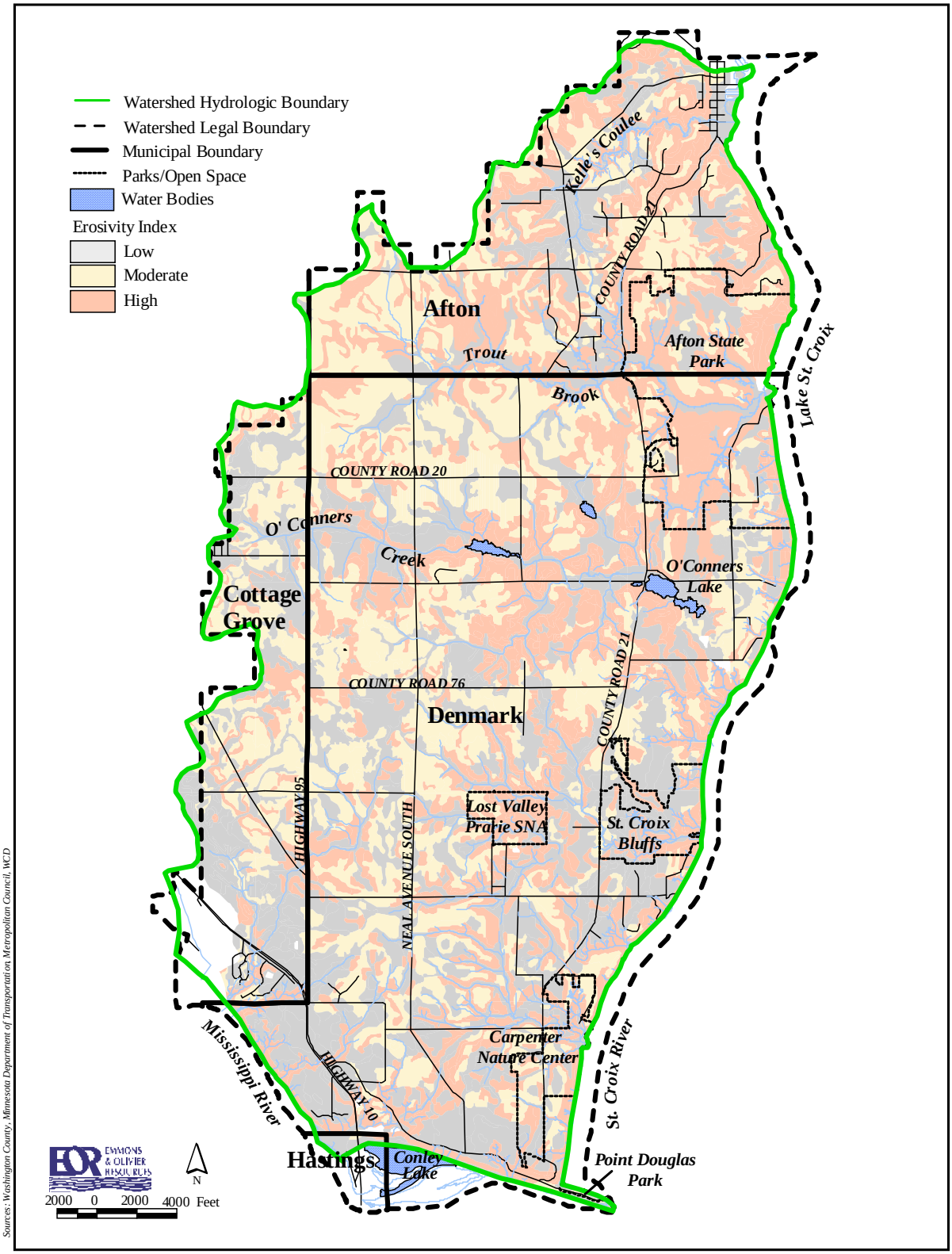
Source: USDA, 1977

EI ranking will be helpful in determining the susceptibility of areas to erosion and can be used to:

- Direct actions away from high erosion potential areas;
- Consider measures more carefully in areas determined to be sensitive; and
- Establish acceptable land uses for defined areas.

Figure III-3 illustrates the assigned EI ranking values throughout the watershed. Additional information regarding EI values can be found in the Denmark Water Resource Evaluation (WCD, 2002) and Afton Water Resource Inventory (WCD, 2001).

Figure III-3. Soil Erosivity Index



III-1.4 Hydrology

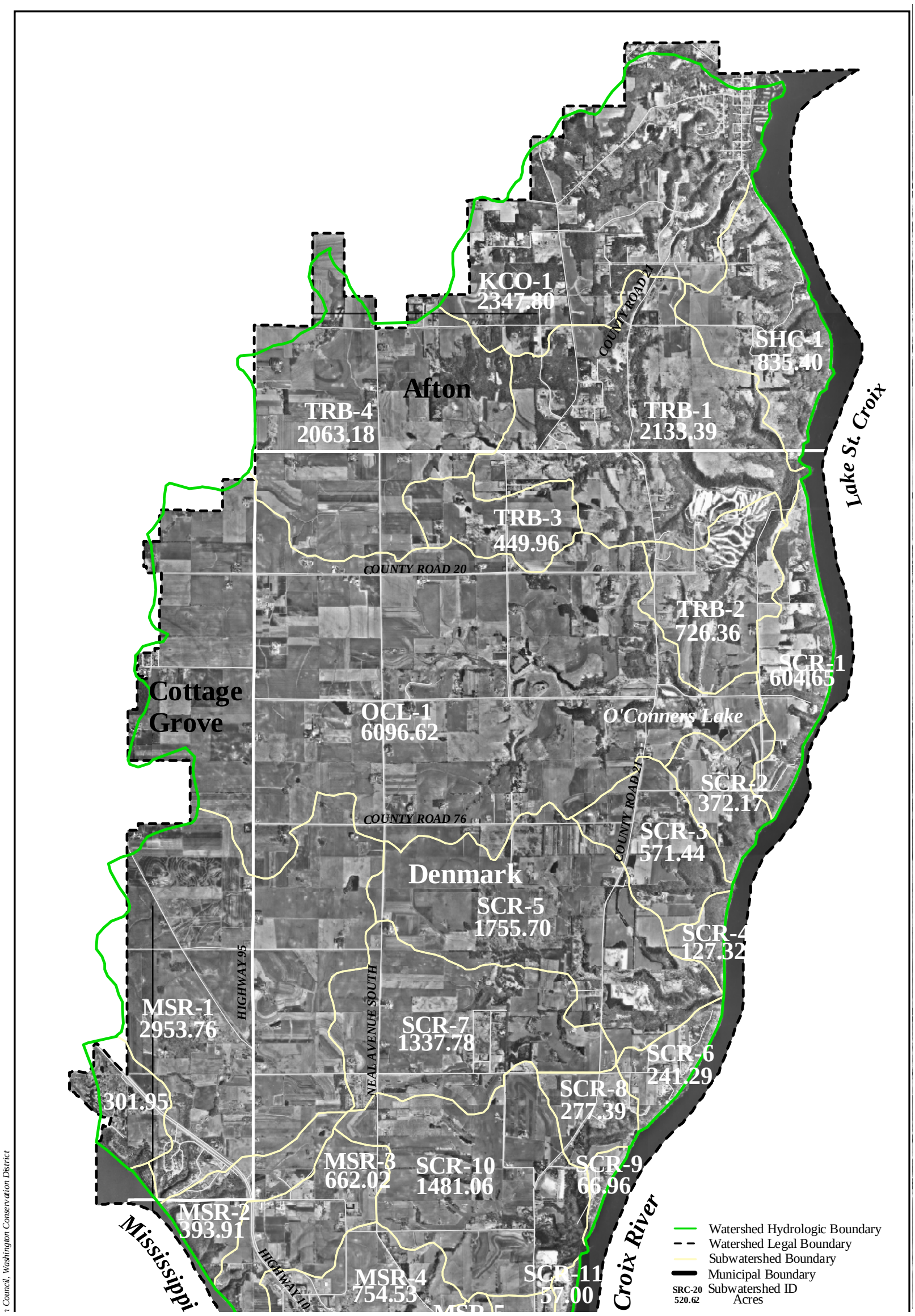
The Lower St. Croix (LSC) watershed is generally well drained through a series of streams to the Mississippi and St. Croix Rivers. The drainage system is characterized by numerous streams and creeks including the three main perennial drainage ways, Trout Brook, Kelle's Coulee, and O'Conners Creek, and more than twenty smaller intermittent and perennial tributaries. Due to the rural character of the watershed, there are few constructed stormwater ponds and stormwater management practices. Some ravines within the watershed have constructed earthen dams that stabilize the grade and control erosion and sedimentation. Additionally, new developments in the watershed have implemented stormwater management practices.

The LSC watershed contains subwatersheds that drain to the Mississippi River, St. Croix River, or are landlocked. Subwatersheds are identified on Figure III-4. Subwatersheds that drain to the Mississippi River include approximately 5,600 acres of the watershed and subwatersheds that drain to the St. Croix include approximately 15,660 acres of the watershed. The O'Conners Lake (OCL-1) subwatershed is landlocked and is approximately 6,100 acres. Additionally, subwatershed St. Croix River (SCR) 7 is landlocked and approximately 1,340 acres in size.

III-1.5 Geology

The LSCWMO geology is divided into surficial and bedrock geology. The surficial geology contains sediments that were deposited during glacial and post glacial times. Remnant glacial deposits in the watershed consist of eroded till and outwash plains, relics of the Illinoisan Glaciation which ended 130,000 years ago. Surficial geology is illustrated in Figure III-5. Detailed description of each surficial deposit can be found on the Geologic Atlas of Washington County, Minnesota available online at http://www.geo.umn.edu/mgs.

Figure III-4. LSCWMO Major Subwatersheds



Bedrock is commonly found at or near the surface throughout most of the watershed. Lying beneath the surficial sediments are marine sedimentary rocks of Early Paleozoic age (525 to 400 million years old). Shallow seas covered Southeastern Minnesota and parts of adjacent states during most of this period. Sand accumulated on near shore beaches and sand dunes, clay and silt accumulated in offshore deeper water areas, and carbonate which forms limestone and dolostone formed in banks and reefs just off shore.

The nine bedrock groups which subcrop (are exposed in the subsurface directly below the surficial sediment) or outcrop (are exposed directly at the surface) are from youngest to oldest: Platteville-Glenwood Formations, St. Peter Sandstone, Prairie du Chien Group, Jordan Sandstone, St. Lawrence Formation, Franconia Formation, Ironton-Galesville Sandstone, Eau Claire Formation, and the Mt. Simon Sandstone.

Notable bedrock features include the Hudson-Afton Anticline which extends across the watershed from the southwest through the city of Afton and a series of faults. The anticline overlies a block-fault zone of Proterozoic material. The uplift of the anticline resulted in selective stream erosion that has exposed deep bedrock units along the St. Croix River near Afton (Swanson and Meyer, 1990).

As part of the Cottage Grove Area Nitrate Study Report (Barr, 2003), faults were mapped by the Minnesota Geological Survey (MGS) and the Minnesota Pollution Control Agency (MPCA) throughout most of the watershed. Faulting may extend northward through the city of Afton, but this area was out of the extent of this study and was therefore not evaluated. Faults trend generally northeast-southwest. Faulting has displaced the Jordan Sandstone as much as 175 feet within the watershed. Displacement has resulted in the Jordan abutting the permeable Shakopee Dolomite of the Prairie du Chien. Faults were found to be areas of high horizontal and vertical permeability. Bedrock geology is illustrated in Figure III-6 and described in Table III-5.

There is currently one active limestone quarry within the watershed. The quarry is approximately 50 acres and is located southeast of O'Conners Lake. An additional quarry has been permitted and will begin operations in 2008.

Figure III-5. Surficial Geology

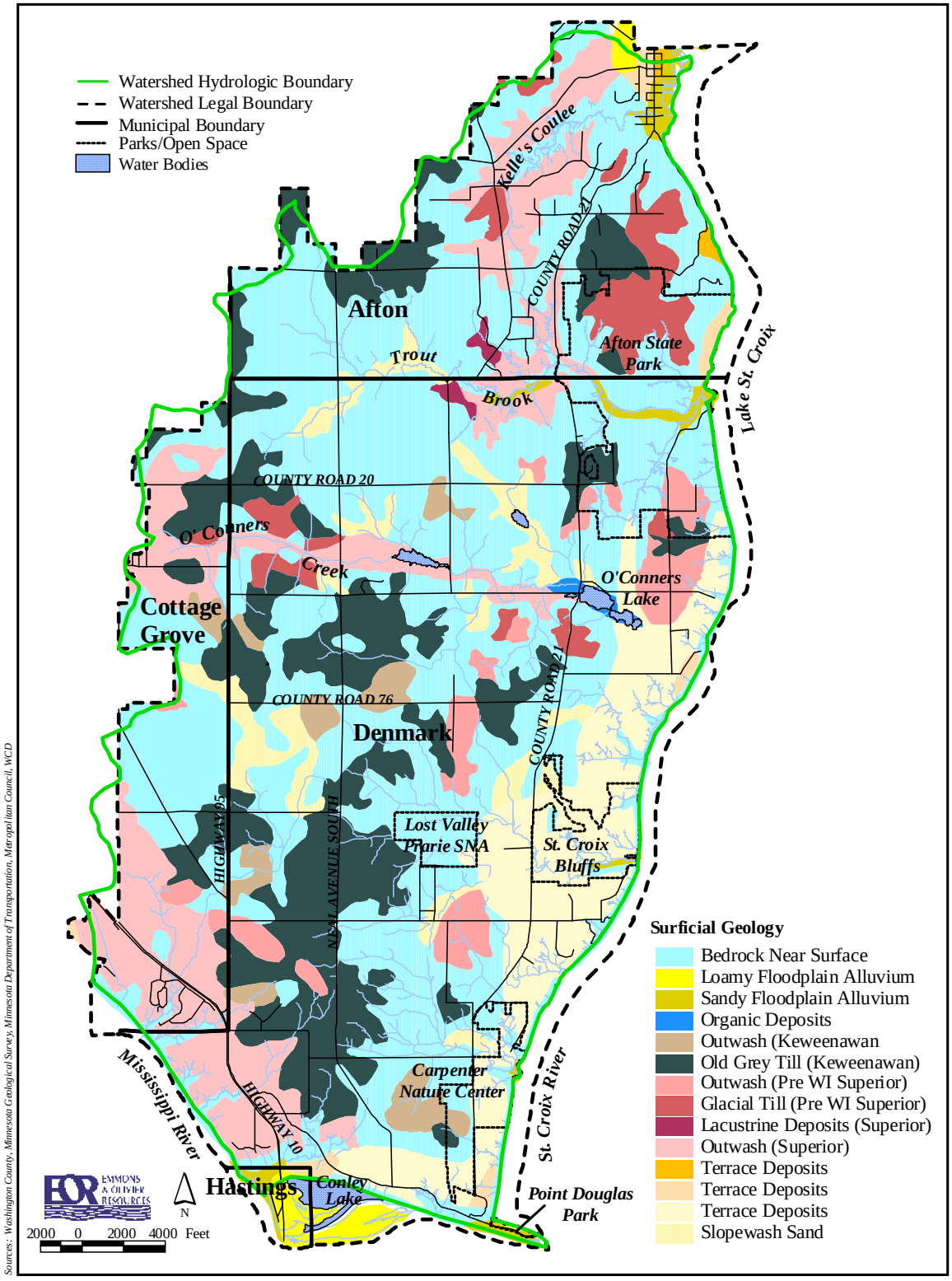


Figure III-6. Bedrock Geology

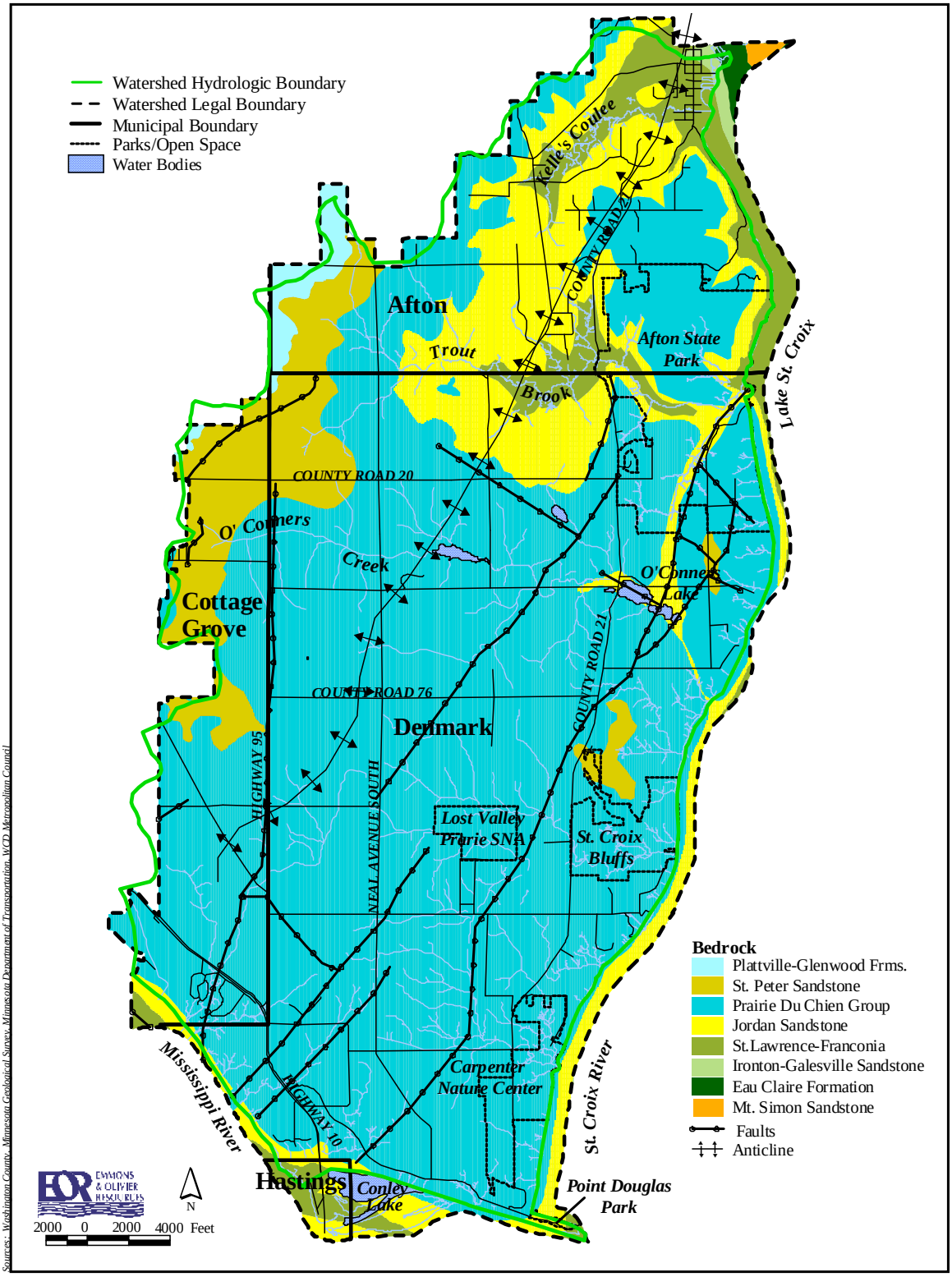


Table III-5. Bedrock Geology Description

Age	Bedrock Formation or Groups	Description	Thickness (Feet)
Middle Ordovician	**Platteville and Glenwood Formations**	These two formations make up the youngest or uppermost bedrock found in Washington County. They are found only in southern portions of the County and consist of dolostone, limestone, and sandy shale.	0-35
	St. Peter Sandstone	The St. Peter Sandstone consists of poorly cemented medium-grained, pure quartz sandstone. The lower portions contain inter-layered beds of shale and coarse sand. The St. Peter subcrops in much of the western portion of the County, and there are scattered remnants of the unit found throughout the northern and eastern parts of the County.	0-66
Lower Ordovician	**Prairie du Chien Group**	Dolostone dominates most of this unit. Minor sandstone and shale layers are found in the lower portions. The Prairie Du Chien is known to contain abundant fractures and openings and, in some areas, active karst. The Prairie Du Chien underlies most of Washington County. Notable absences of this unit occur in deeply incised bedrock valleys and in the extreme northwest and eastern parts of the County.	134-203
Upper Cambrian	**Jordan Sandstone**	The Jordan Sandstone consists of poorly layered, poorly cemented, medium to course sand. The Jordan is found throughout Washington County with notable exceptions in deeply incised bedrock valleys in the north and east and a region in the extreme northwest.	66-96
	St. Lawrence Formation	The St. Lawrence Formation is composed of thin layers of shale and siltstone and is found under all of Washington County except in some areas along the St. Croix River and in the far northwest.	30-58
	Franconia Formation	The Franconia Formation consists mostly of fine-grained sand in southern Washington County and ranges from medium to coarse grained in the north. These units underlie the entire County except a minor area in the St. Croix Valley.	165-166
	Ironton-Galesville Sandstone	These sandstone units are composed of fine to course-grained sand. The Ironton/Galesville unit is found underlying all of Washington County except in one deeply incised portion of the St. Croix Valley in Lakeland.	56
	Eau Claire Formation	This formation consists of shale, siltstone and very fine-grained sandstone. This unit underlies all of Washington County.	63-114
	Mt. Simon Formation	The upper third of this unit consists of very fine-grained sand and siltstone beds. The lower two-thirds are composed of medium to course-grained sandstone. The Mt. Simon underlies all of Washington County.	160-255

III-1.6 Groundwater Resources

Aquifers, groundwater flow, karst features, groundwater monitoring, and individual septic tank systems are discussed in the following sections. Locations of key groundwater resources are identified on Figure III-7.

Aquifers

There are five aquifers used in the LSCWMO. The aquifers, from youngest to oldest, include the: Quaternary, Prairie du Chien-Jordan, Franconia-Ironton-Galesville, the Eau Claire, and Mt. Simon (Swanson and Meyer, 1990).

The Quaternary Aquifer is located in surficial deposits. Because these deposits tend to be thin and bedrock is close to the surface, this aquifer is not significantly used as a source of drinking water in the watershed.

The bedrock aquifers of principal importance in the LSCWMO are the combined Prairie Du Chien-Jordan and the combined Franconia-Ironton-Galesville**.** These formations provide the major source of well water and also provide regional groundwater discharge to the St. Croix and Mississippi Rivers.

The Prairie du Chien-Jordan Aquifer system provides for most of the groundwater uses in the LSCWMO. This aquifer lies directly below the surficial deposits in the LSCWMO except in cases where remnant St. Peter or Platteville Glenwood Formations overly the Prairie du Chien-Jordan Aquifer. The recharge zone for the Prairie Du Chien-Jordan aquifer occurs both within and outside the surface watershed. Fractures, joints, faults, and solution cavities control the flow in the aquifer.

The Franconia-Ironton-Galesville (FIG) Aquifer is confined on the top by the St. Lawrence Formation. This formation provides a boundary between the Prairie du Chien-

Jordan Aquifer and the FIG Aquifer and consists of siltstone and dolomitic shale. This unit exhibits very low permeability and typically acts as a confining layer.

The Eau Claire and Mt. Simon aquifers are not significantly used sources of drinking water in the watershed, with just a few wells screened in each aquifer.

Groundwater Flow

Groundwater flow in the watershed is characterized by Quaternary and bedrock aquifer systems. Both systems provide for movement of groundwater toward regional discharge areas. A portion of the groundwater within the Quaternary and bedrock system discharges to surface water bodies supplying "base flow" to the surface water system. Groundwater flow is generally towards the Mississippi and St. Croix Rivers.

Faults, identified by the MGS as part of the Cottage Grove Area Nitrate Study Report, were concluded to have an active role in groundwater flow in this area and are identified on Figure III-6. Faults were found to have higher hydraulic conductivity than surrounding areas, allowing for rapid migration of water from the ground surface to bedrock aquifers. Groundwater was also found to migrate down gradient along the north-south fault trend, discharging to the Mississippi River (BARR, 2003).

Quaternary aquifers discharge to the bedrock aquifers in regions where connections exist between the two. The principal bedrock aquifer that would receive groundwater from the Quaternary system would be the Prairie du Chien-Jordan Aquifer. This would occur in areas where the Prairie Du Chien subcrops beneath permeable Quaternary sediment.

There are currently nine groundwater appropriations permits overseen by the DNR in the LSCWMO. The locations of the groundwater wells associated with these permits are identified in Figure III-7. The appropriations are for crop and golf course irrigation, snow generation, and the dewatering of the Tiller-Davies quarry.

Additionally, there are currently thirteen public water supply wells within the watershed, identified in Figure III-7. These wells do not currently have delineated wellhead protections areas or established management plans.

Groundwater Quality

Karst features, thin surficial deposits, and faults make groundwater quality in the watershed highly susceptible to surface activity. Nitrates are an identified water quality concern and were found to be in high concentrations in groundwater in southern Washington by the Minnesota Department of Health (MDH) and Washington County. Sources of nitrate were identified as part of the Cottage Grove Area Nitrate Study. Additional information regarding this study is included in this section under III-2 Summary of Existing and Future Studies.

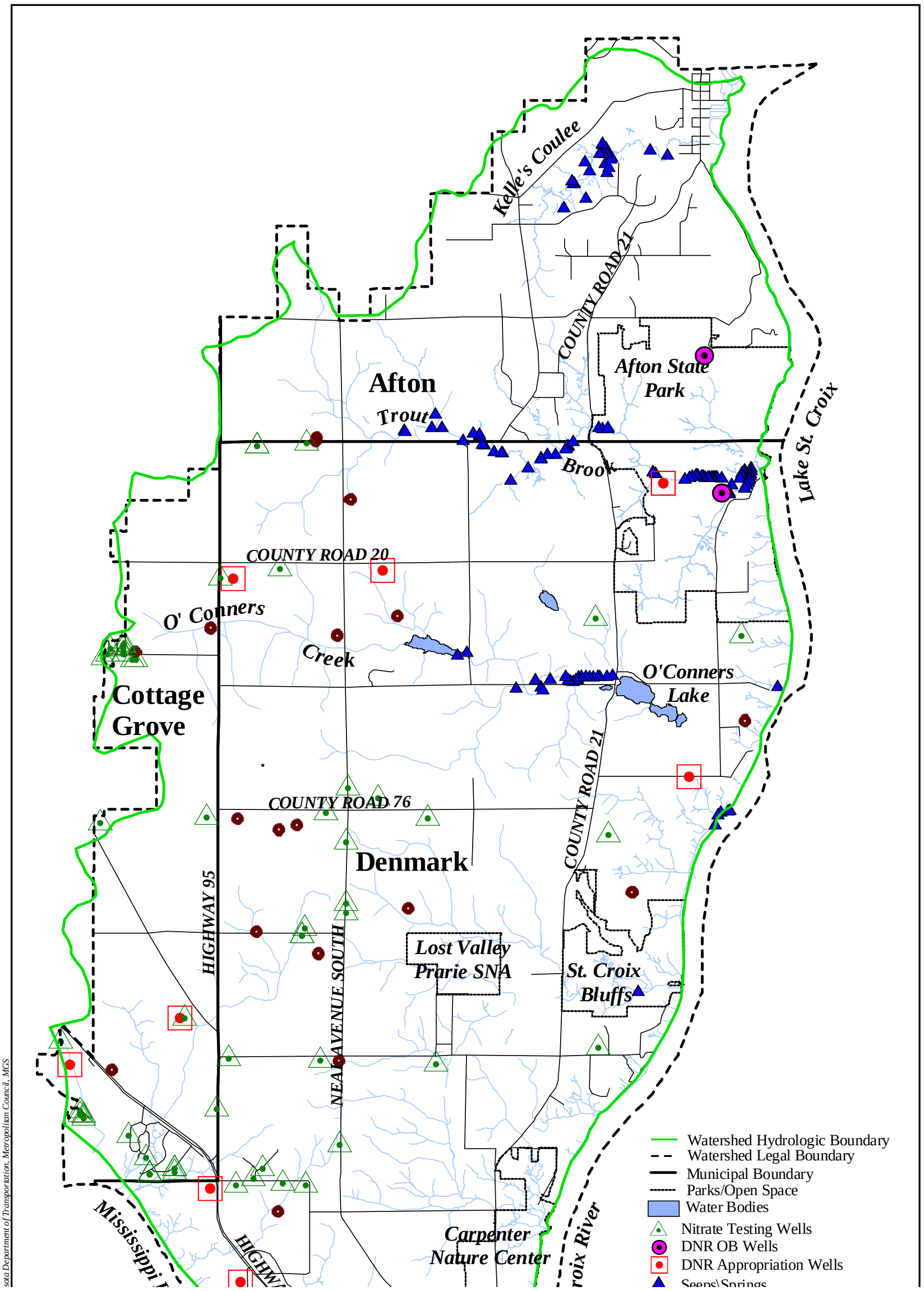
Karst Features

A large portion of the LSCWMO has been identified as an active karst region (Alexander, 2004). Karst regions are the result of soluble bedrock that is slowly dissolved by infiltrating rainwater. Surface water systems are typically very well connected to the groundwater system in karst regions. This allows for surface contaminants to reach bedrock aquifers quickly. Additional information on karst features and their management within the LSCWMO is available in the LSCWMO Karst Feature Inventory and Management Plan

Groundwater Monitoring

There are currently 4 observation wells located in the LSCWMO. These wells are monitored by the Washington Conservation District (WCD) for the DNR Observation Well Program. Groundwater level data are available since 1979. Water level data are available online at http://www.climate.umn.edu/obwell/ObWlCh.asp.

Figure III-7. Groundwater Resources



Subsurface Septic Tank Systems

Communities are required by Minnesota Rules Chapter 7080 to adhere to the minimum standards set forth by the MPCA for the proper location, design, installation, use, and maintenance of Subsurface Septic Tank Systems (SSTS). Communities comply with MPCA standards by adopting a state approved SSTS ordinance. Washington County has a state approved ordinance that is more stringent than state standards. More information regarding the county ordinance is available at the following website: http://www.co.washington.mn.us/client_files/documents/ORD-0128.pdf.

The communities in the majority of the watershed have all adopted the Washington County SSTS ordinance. The regulation and permitting for this ordinance is performed by Washington County within these communities. The City of Hastings, located in Dakota County, is the only community that has adopted their own ordinance.

III-1.7 Surface Water Resources

The LSCWMO contains a number of valuable water resources. The main surface water features include the Mississippi River, St. Croix River, Trout Brook, O'Conners Creek and Lake, Kelle's Coulee, and a number of small, unnamed tributaries to the major rivers. There are also several small wetlands located in the watershed. The location of all identified surface water resources are found on Figure III-8.

Mississippi River

The Mississippi River is one of the world's great rivers. The portion of the River flowing in and along the border of Minnesota is considered part of the Upper Mississippi River Basin. In Minnesota, the Upper Mississippi River Basin drains approximately 25% of the State. The Mississippi is an important navigational route and recreational destination, as well as a home to a diverse population of fish and wildlife. Within the 1,859,000 acres of

water, wetlands, and floodplain of the main stem River between St. Paul, Minnesota, and Cairo, Illinois, there are 118 species of fish, and over 40 species of freshwater mussels. Up to 40% of North America's ducks, geese, swans, and wading birds use the Mississippi flyway (Waters, 1977).

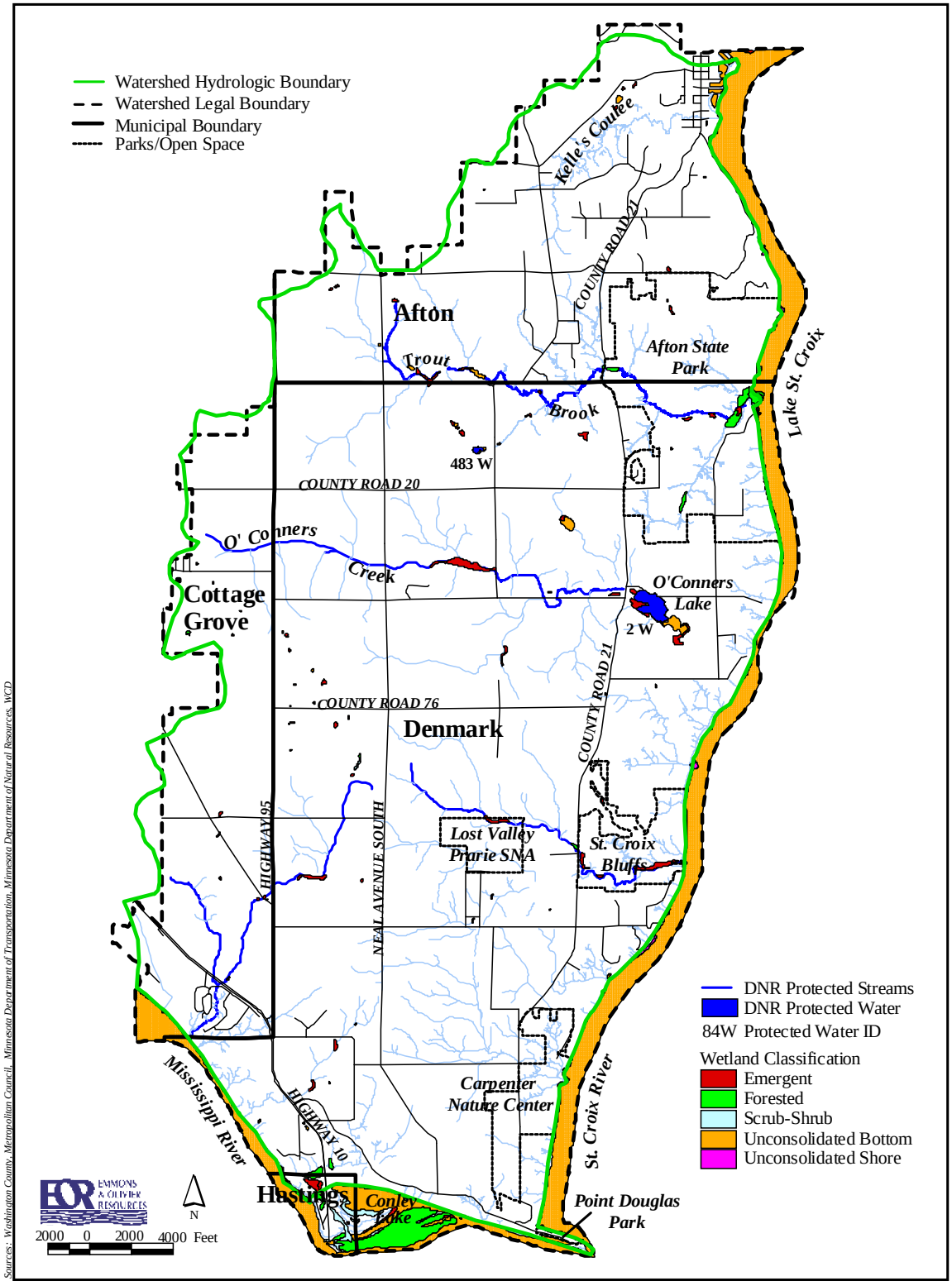
In 1976, a narrow 72-mile corridor of land on either side of the Mississippi River extending from Dayton, MN on the north boundary through the Minneapolis/St. Paul area and downstream to Hastings, MN was designated as a State Critical Area. In 1988, the same section of land was designated as the Mississippi National River and Recreation Area, a unit of the National Park Service.

The portion of the Mississippi River that forms the southern boundary of the LSCWMO has been listed on the MPCA Draft 2004 Impaired Waters List per the federal Clean Water Act Section 303(d). This part of the River is identified as impaired for aquatic life by turbidity, PCBs, and mercury.

St. Croix River

The St. Croix River joins with the Mississippi River at Point Douglas, MN / Prescott, WI and then flows south to the Gulf of Mexico. The portion of the St. Croix River within the LSCWMO is also known as Lake St. Croix. This portion of the River is more closely related to a lake environment than a river due to its width and slow current. The St. Croix River is currently classified as an Outstanding Resource Value Water – Restricted. The restricted classification stems from its very high water quality. The Lower St. Croix River was designated as a National Wild & Scenic Riverway by Congress in 1972. In 2000, a Cooperative Management Plan was developed for the Lower St. Croix by the Lower St. Croix Management Commission with the assistance of the Lower St. Croix Planning Task Force. For more information on this Task Force access http://www.dnr.state.mn.us/waters/watermgmt_section/wild_scenic/wsrivers/lscmgtplan.html.

Figure III-8. Surface Water Resources



The portion of the St. Croix River that forms the eastern boundary of the LSCWMO has been listed on the MPCA Draft 2004 Impaired Waters List per the federal Clean Water Act Section 303(d). This part of the River is identified as impaired for aquatic life by mercury. A portion of the St. Croix River is also on the 2008 Impaired Waters list for Nutrients.

Streams

Trout Brook, Kelle's Coulee, and O'Conners Creek are the three most significant perennial streams in the watershed. Trout Brook is a DNR protected waterbody with seeps and spring discharges typical along the stream channel and its tributaries. Stream bank erosion and erosion from adjacent land use is prevalent. Land use in the upper reach of the stream is principally agricultural. The stream passes through Afton Alps and Afton State Park before discharging to the St. Croix River.

Kelle's Coulee is a high quality spring creek with rare plants, animals, and natural communities in its lower reach. This perennial creek is within a deep ravine that runs through the City of Afton before outletting to the St. Croix. Streambank erosion is prevalent.

O'Conners Creek is a perennial stream with documented springs and seeps within an agriculturally dominated watershed. The creek begins as an intermittent stream in the City of Cottage Grove and then outlets to O'Conners Lake with no documentation of significant streambank erosion.

Lakes

O'Conners Lake and Conley Lake are the only lakes within the watershed. O'Conners Lake is located at the terminus of perennial O'Conners Creek and discharges into adjacent bedrock. A field inventory by the WCD determined the lake to be landlocked, shallow, and without fish. The lake has fairly static water levels and is relatively small

for the size of its subwatershed with a subwatershed to water surface ratio of 138:1. Conley Lake is a floodplain lake located adjacent to the Mississippi River.

Wetlands

The majority of wetlands within the watershed are located within the O'Conner Lake subwatershed along the perennial stream and near O'Conners Lake. The wetlands are dominated by cattails. There are also floodplain wetlands located along Trout Brook, Kelle's Coulee, and the Mississippi and St. Croix Rivers. Additionally, some wetlands have been created through impoundment and/or excavation.

Surface Water Appropriations

There are currently no surface water appropriations within the watershed.

Monitoring

The WCD monitored surface water in the LSCWMO as part of the Southern Washington County Groundwater Study. Data collection included flow data at one location along Kelle's Coulee and O'Conners Creek, and two locations along Trout Brook. In addition, surface water levels were monitored at O'Conners Lake. This monitoring program ended in 2004 and was continued by the LSCWMO beginning in 2005. No data prior to 2004 have been identified.

A 1980 Metropolitan Council study estimated that the LSC watershed exceeded water quality guidelines for Total Suspended Solids (TSS), Chemical Oxygen Demands (COD), Total Phosphorus (TP), and Total Nitrogen (TN).

The United States Geological Survey (USGS) monitors the Mississippi River at Hastings and Nininger Minnesota, and the St. Croix River at Prescott and Hudson Wisconsin.

Monitoring includes the collection of chemistry and flow data. Additional data are available online at http://mn.water.usgs.gov/umis/index.html.

A fish survey was conducted in 1999 by the DNR and results are summarized in the section entitled Fish and Wildlife Habitat.

III-1.8 Shoreland Ordinances

In the Twin Cities Metropolitan Area, communities that are notified by the DNR must adopt a shoreland ordinance that is consistent with MN State Rules. The municipalities within the watershed have not been notified to adopt a state approved shoreland ordinance but they all have adopted shoreland overlay districts within their respective comprehensive plans. In addition, Hastings and Cottage Grove, as well as Washington County, all have Critical Area Ordinances which function as a type of shoreland program. Additional information regarding community shoreland overlay districts is available by contacting the member community.

Denmark Township adopted the shoreland ordinance of Washington County which is state approved. The intent and purpose of the Washington County Shoreland Management Ordinance includes the designation of suitable shoreland land use, the conservation of natural resources, the improvement of surface water quality, reduction of erosion and flooding, and the preservation of fish and wildlife habitat. Additional information regarding the county shoreland ordinance is available by contacting the county.

The City of Afton administers a shoreland program through ordinance. The City of Afton has also adopted a scenic easement prohibiting detrimental activities on any slopes greater than or equal to 18 %, as well as in wetlands, drainageways, and other fragile lands and soils. Prohibited activities include dumping, burning, grading, grazing of domesticated farm animals, vegetative cutting, motorized vehicles, and construction of any structure.

Both the City of Cottage Grove and Denmark Township do not permit new structures to be built within 100 feet landward of the Mississippi River bluff line or on slopes greater than 18%.

The City of Hastings has a shoreland ordinance that requires structures be setback 150 feet from rivers and a minimum of 30 feet from the top of bluffs. Development on steep slopes is determined on a case-by-case basis.

Additionally, Washington County has adopted the Lower St. Croix River Bluffland and Shoreland Management Ordinance. Definitions within this ordinance include minimum setbacks, and SSTS and floodway requirements. Denmark Township has also adopted the Lower St. Croix River Bluffland and Management Ordinance. Additional information is available online at http://www.co.washington.mn.us/info_for_residents/board_of_commissioners/ordinances/.

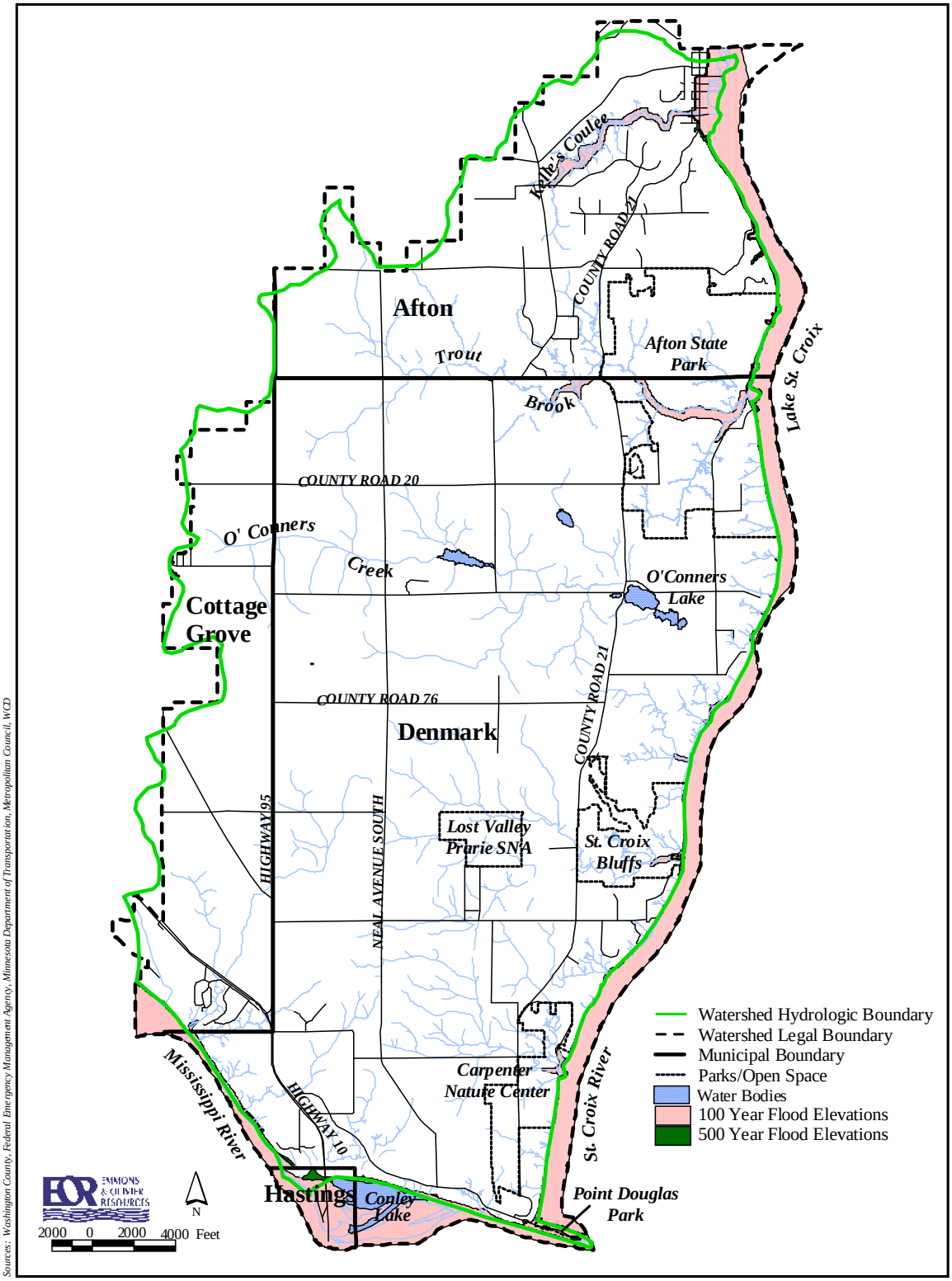
III-1.9 Federal Emergency Management Act Designation

The current Federal Emergency Management Agency (FEMA) map for the LSCWMO is shown in Figure III-9. This map identifies the 100- and 500-year flooding potential in the watershed. Flood information is limited to FEMA coverage and includes primarily areas adjacent to the St. Croix and Mississippi Rivers, Kelle's Coulee, and Trout Brook. Each community in the watershed also has state approved floodplain ordinances.

III-1.10 Fish and Wildlife Habitat

The LSCWMO contains one surveyed trout stream and significant areas of wildlife habitat. The DNR conducted a fish community survey within Trout Brook, O'Conners Creek, and Kelle's Coulee as part of an overall fish community survey conducted in 1999 in the Twin Cities (Schmidt and Talmage, 2001). Several brown trout were found within Trout Brook as part of this study. The presence of brown trout indicates the relatively undisturbed nature and high quality of this creek. Groundwater seeps and springs along the creek provide a source of cold water suitable for trout development. Three additional fish species were identified in Trout Brook as part of the study. No fish were found in Kelle's Coulee and one fish species was identified in O'Conners Creek.

Figure III-9. FEMA Designations



A fish community survey was also conducted within Trout Brook in 1996 by the MPCA (data available online at http://www.pca.state.mn.us/data/eda/index.cfm) although no cold water fish species were found.

Significant areas of wildlife habitat were identified in the Natural Resource Inventories (NRI) performed in Demark Township and the Cities of Afton and Cottage Grove.

III-1.11 Unique Features and Scenic Areas

The watershed contains a number of unique features and scenic areas which contribute to the overall quality of life within the watershed. These features include parks and open spaces, rare species, unique habitats, and rivers of regional significance.

Parks and open spaces include Afton State Park, Point Douglas Park, St. Croix Bluffs Regional Park, Lost Valley Prairie Scenic and Natural Area, Carpenter Nature Center. In addition to the parks and open space, there are numerous acres of prime farmland as defined by the Natural Resources Conservation Service (NRCS).

Numerous rare biological features have been surveyed by the DNR through the Minnesota County Biological Survey (MCBS) for Washington County (DNR, 1990). The goal of the MCSB is to identify significant natural areas and to collect and interpret information on the distribution and ecology of rare plant species, animals, and native plant habitats. Products of this program result in a map for each county assessing the status and distribution of the state's flora, fauna, and native plant communities. Rare species found in the LSCWMO include vascular plants, birds, colonial water birds, amphibians and reptiles, and mussels. A list with approximate locations of the rare species and natural communities identified by the Minnesota Natural Heritage and Nongame Research Program of the DNR is included in Appendix C.

These rare species are predominantly found along the Mississippi and St. Croix Rivers and smaller tributary streams. Native plant habitats identified in the LSCWMO include dry prairie,

floodplain forest, moist cliff, oak forest, maple-basswood forest, white pine-hardwood forest, and oak woodland-brushland. These habitats are identified on Figure III-10.

Additionally, rare biological features were identified in the Natural Resource Inventories (NRI) performed in Demark Township and the Cities of Afton and Cottage Grove. Additional information is included in this section under III-2 Summary of Existing and Future Studies.

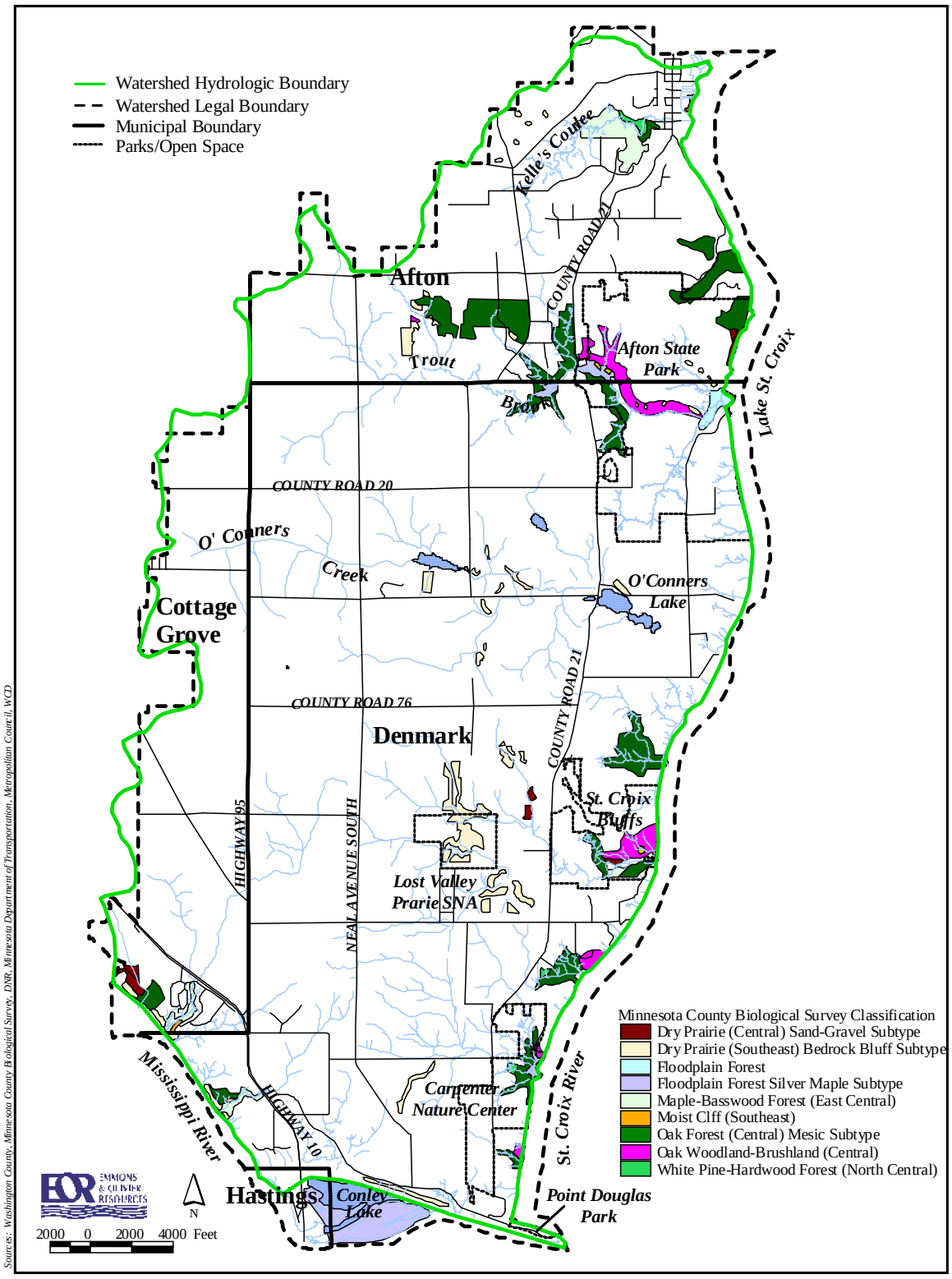
The St. Croix and Mississippi Rivers as well as their confluence provide for scenic views and unique features. The portion of the St. Croix River within the LSCWMO is classified as recreational and includes a large portion of Lake St. Croix. This lake within the River stretch extends from Stillwater to the confluence with the Mississippi River at Point Douglas, MN. The portion of the Mississippi River within the LSCWMO is included in the Mississippi National River and Recreation Area Program.

III-1.12 Land Use

The current land uses of the LSCWMO are predominantly agricultural and undeveloped. The LSCWMO is unique in that it is located adjacent to a developing watershed and contains a number of natural resources. Development pressures and changes in agricultural land uses within the LSCWMO will likely increase over the next five to ten years.

The LSCWMO is not included in the current Metropolitan Urban Service Area (MUSA). The MUSA is the outer edge of the metropolitan urban area, that part of the region which local and regional services are committed and which have urban levels of regional sewer and transportation service.

Figure III-10. Minnesota County Biological Survey Inventory



The LSCWMO currently consists of several land uses. These include commercial, industrial, farmsteads, highways, residential, extractive, open water, parks and recreation, and agriculture. Trends in land use and zoning regulations within the watershed have promoted animal agriculture. An inventory of animal agriculture was performed in the mid 1990s by the WCD. Additional information regarding this inventory is available through the WCD.

Table III-6 outlines the land use classifications and their percentage within the watershed. Figure III-11 illustrates the existing land use classification for the LSCWMO. This information was obtained from the Metropolitan Council's 2000 Generalized Land Use Classification.

Table III-6. Land Uses in the LSCWMO

Land Use Classification	Area [Acres]	Percent of Total Land Use [%]
Agriculture	15,915	54.24
Farmsteads	332	1.13
Single Family Residential	1,495	5.09
Other Residential	2	0.01
Commercial	115	0.39
Industrial	7	0.02
Extractive	53	0.18
Institutional	28	0.10
Parks and Recreation	2,888	9.84
Railways	85	0.29
Undeveloped	6,611	22.53
Open Water	1,549	5.28
Unspecified*	264	0.90
Total	**29,344**	**100**

*Areas not specifically classified, primarily portions of the Mississippi River.
Source: Metropolitan Council, 2000.

The definitions for each land use category provided by the Metropolitan Council are included in Appendix D of this Plan.

Figure III-12 illustrates the planned 2020 land use based on the comprehensive plan of each community. The planned 2020 land use from each comprehensive plan was compiled by the Metropolitan Council into one data set and continues to maintain the rural character of the watershed.

III-1.13 Land Cover

Additional work was completed within the LSCWMO to map land cover through the Minnesota Land Cover Classification System (MLCCS). MLCCS categorizes natural areas as well as urban and rural areas and provides additional detail on land use categories. MLCCS distinguishes between different types and amounts of land cover, vegetation, and impervious surfaces. There are five levels of MLCCS with Level 5 being at the greatest level of detail. The Denmark Township study was performed to a Level 5 and the Afton NRI was performed to a Level 4. The City of Cottage Grove NRI was performed before the establishment of the MLCCS. Efforts are currently being made by the DNR to classify all of the metro area based on the MLCCS. Detailed MLCCS data are available in community NRIs as well as online at http://www.dnr.state.mn.us/mlccs/index.html.

Figure III-11. 2000 Land Use

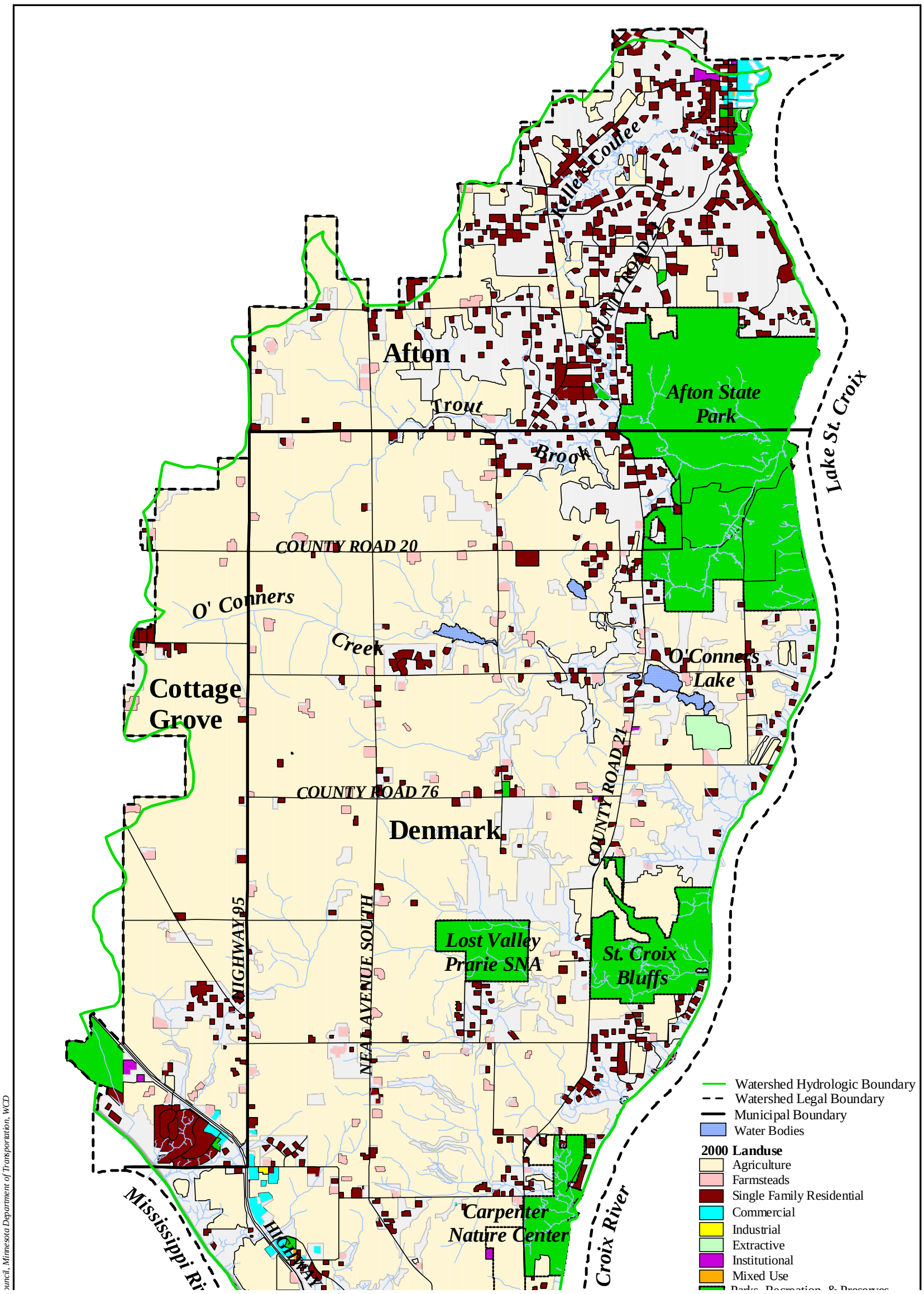
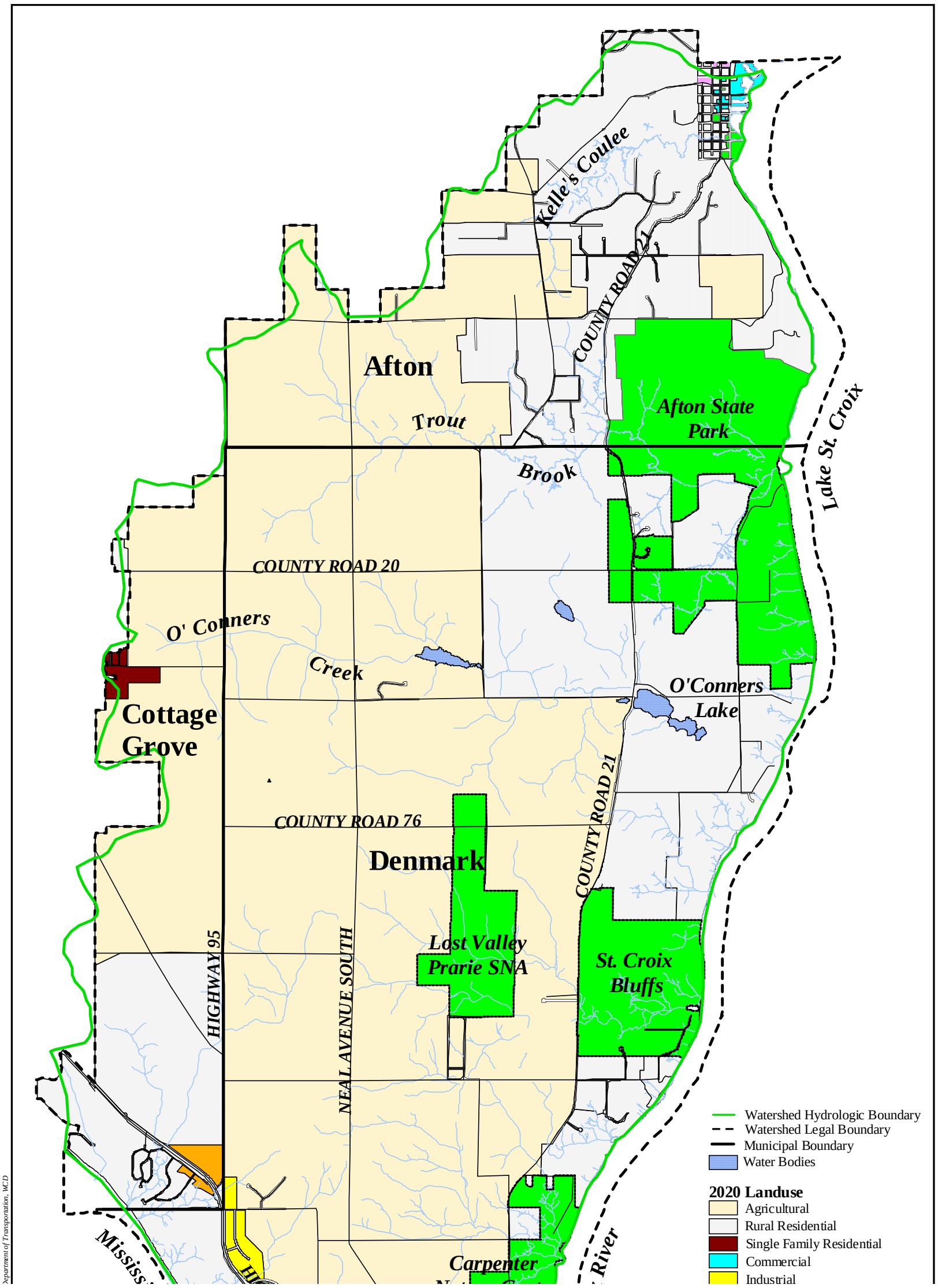


Figure III-12. 2020 Land Use



III.1.14 Status of Comprehensive Plans

The Metropolitan Land Planning Act requires local governments within the Seven County Metropolitan Area to prepare comprehensive plans. These comprehensive plans contain information including existing and future land use, growth forecasts, housing, surface water management, transportation, aviation, sewers, parks, water supply, etc. The Metropolitan Council reviews these plans to determine their conformity with metropolitan system plans (aviation, transportation, recreation and open space and water resources management), apparent consistency with other adopted plans of the Council, and compatibility with the plans of other local jurisdictions in the Metropolitan Area (MN Stat. §473.175, Subd, 1).

Table III-7 identifies each of the communities within the watershed and the status of their comprehensive plan.

Table III-7. Status of Comprehensive Plans

Community	Comprehensive Plan Status	Local Contact
City of Afton	Metropolitan Council accepted plan February, 1999.	City Clerk 3033 St. Croix Trail South PO Box 219 Afton, MN 55001 Telephone: (651) 436-5090
City of Cottage Grove	Metropolitan Council accepted plan September, 2000.	City Clerk 7516 80th Street South Cottage Grove, MN 55038 Telephone: (651) 458-2800
City of Hastings	Currently in the planning process.	City Planner 101 4th Street East Hastings, MN 55033-1955 Telephone: (651) 480-2350
Denmark Township	Metropolitan Council accepted plan 1999.	Township Clerk 14008 90th St. So. Hastings, MN 55033 Telephone: (651) 436-1704

All communities are currently in the process of preparing their 2030 Comprehensive Plans. Deadline for submission to the Metropolitan Council is December, 2008.

III-1.15 Potential Environmental Hazards

Potential sources of groundwater contamination include municipal, commercial, and industrial dumps, old or unregulated landfills, leaking underground storage tanks, accidental spills, disposal of household wastes, fertilizers, pesticides, animal wastes, and road salts. The MPCA monitors the locations of potential contamination sources such as Leaking Underground Storage Tanks (LUST), Hazardous Waste Generator/Investigation and Cleanup sites, and Metropolitan Area Waste Disposal Sites. Additional information is available from the MPCA. The Washington County Groundwater Plan identifies locations and types of potential hazards and discusses the county's policies for contaminant prevention. Specific locations of potential point sources of groundwater contamination identified by the plan within the watershed included ISTS, pipelines, and community septic systems (Washington County, 2003b).

III-2. Summary of Existing and Future Studies

The following studies have been completed or are currently in progress within the LSCWMO watershed. In addition to the studies listed here, studies have been performed that relate specifically to the St. Croix and Mississippi Rivers.

III-2.1 Cottage Grove Area Nitrate Study Report

The Washington County Cottage Grove Area Nitrate Study Report (Barr, 2003) was initiated to address drinking water quality concerns in Southern Washington County. Private well testing conducted prior to 2003 by the MDH and Washington County in the Cottage Grove area revealed high concentrations of nitrate in the groundwater system. High nitrate concentrations are particularly dangerous for infants less than six months old. The intake of nitrate leads to a reduced ability of the blood to carry oxygen, causing a condition known as methemoglobinemia, or "blue baby syndrome". The purpose of the Cottage Grove study was to investigate sources of nitrate contaminant and identify optimal areas for siting future water supplies.

Significant conclusions of the Study include:

- Nitrate contamination in the Prairie du Chien Aquifer is caused by commercial fertilizer application. This conclusion indicates that groundwater is highly susceptible to nitrate contamination where agriculture is the primary land use.
- Numerous unmapped faults and bedrock valleys were identified and were found to play a key role in groundwater flow in southern Washington County. In particular, faults were found to provide a previously unknown mechanism for rapid horizontal and vertical nitrate migration.
- Ponds and wetlands that overlie bedrock valleys are believed to be infiltrating stormwater runoff from agricultural areas. This has manifested in high concentrations of nitrate in groundwater west of these infiltration areas.

Study recommendations include:

- Continued monitoring of groundwater quality parameters in order to identify contamination sources in the eastern region of the study area.
- Water quality monitoring of the ponds and wetlands that overlay bedrock valleys in order to determine their role in high nitrate concentrations in groundwater.
- Conduct aquifer pump tests adjacent to fault areas in order to determine the hydraulic conductivity of the faults.
- Evaluate farming practices in order to determine which practices could reduce nitrate concentrations.

III-2.2 City of Cottage Grove Natural Resource Inventory

The Cottage Grove NRI (BRAA, 1997) was a citywide inventory completed in 1997. Natural areas were identified and classified based on Minnesota's Native Vegetation, A Key to Natural Communities (DNR, 1993). Natural areas were then mapped and assigned an ecological ranking. Land protection and stewardship options were also identified within the report.

Many of the natural communities in the LSCWMO had the lowest possible ecological ranking. These areas have been disturbed by logging, urbanization, fragmentation, agricultural activities, and invasive species. Extensive sedimentation along the Mississippi River was noted within a dry oak forest down slope of a residential development and golf course.

Good quality natural communities were identified along the southeast edge of the Cottage Grove municipal boundary within the LSC watershed. These include a maple basswood forest with the highest species diversity of any community in the city, a moist cliff community, a white pine hardwood forest, a mesic oak forest with groundwater seepage, and the best quality bedrock bluff prairie within the City.

III-2.3 Afton Natural Resource Inventory and Water Resource Evaluation

The Afton Natural Resource Inventory and Stewardship Plan (EOR, 2001) and Water Resource Evaluation (WCD, 2001) were citywide inventories of both natural communities and water resources completed in 2001. Plant communities and land cover were mapped with the MLCCS and provided the final product along with stewardship recommendations. Additionally, seeps, springs, and areas of streambank erosion were identified within the Trout Brook and Kelle's Coulee subwatersheds. Detailed mapping was completed identifying potential sediment delivery pathways to Trout Brook and Kelle's Coulee.

Within the LSCWMO, Kelle's Coulee was identified as the most important and highest quality natural resource within the City of Afton. Kelle's Coulee was found to contain native white pine/hardwood forest, mesic oak forest, bedrock bluff prairie, and lowland hardwood forest. The small creek was identified as a high quality spring creek. Additionally, several documented rare plants, animals, and natural communities were identified in the Coulee. Management recommendations of the report identified the Coulee as the city's highest priority. The Coulee was determined to be highly sensitive to erosion and several significant erosion areas were identified.

The report recommends that conservation easements and bluff setbacks be implemented and that direct or upstream watershed discharge of stormwater be avoided. The report also recommends a follow-up survey and the development of a detailed management plan. Furthermore, the establishment of a greenway corridor linking the St. Croix River with Kelle's Coulee was suggested.

III-2.4 Denmark Township Natural Resource Inventory and Water Resource Evaluation

Maintaining and Enhancing Environmental Quality in Denmark Township; A Natural Resources Inventory with Stewardship Recommendations Denmark NRI (BARR, 2002) and Water Resource Evaluation (WCD, 2002) were citywide inventories of both natural communities and water resources completed in 2002. Plant communities and land cover were identified and mapped with the MLCCS throughout the Township. Additionally, seeps, springs, and areas of streambank erosion were identified within the Trout Brook and O'Conners Creek subwatersheds. Detailed mapping of potential sediment delivery pathways to Trout Brook and O'Conners Creek were also completed.

Outcomes of the report included water quality rankings and erosion potential of each subwatershed. All subwatersheds identified in the report received a high water quality ranking that outlet to either the St. Croix or Mississippi Rivers. The O'Conners Lake subwatershed received a moderate ranking because it does not have a surface outlet to the St. Croix River. Trout Brook received a high water quality ranking and recommendations to restore it to a trout-producing stream.

III-2.5 Detailed Assessment of Phosphorus Sources to Minnesota Watersheds

The Detailed Assessment of Phosphorus Sources to Minnesota Watersheds (BARR, 2004) was completed in 2004 for the MPCA. A study of all sources and amounts of phosphorus entering

wastewater treatment facilities and Minnesota surface waters was required by newly enacted legislation initiated by concerns of the phosphorus content of automatic dishwashing detergents. This assessment was conducted to provide the information necessary for MPCA compliance with this legislation.

Point and non-point sources and amounts of phosphorous during low (dry), average, and high (wet) flow conditions were identified for each of the ten major basins in Minnesota and for the entire state. Additionally, phosphorus source reduction options to improve water quality were identified.

Significant conclusions of the assessment include:

- During low flow conditions, unsewered communities contributed between 10 and 20 percent of the total phosphorus and more than 20 percent of the bioavailable phosphorus loadings to the St. Croix River basin.
- Under all flow conditions, cropland and pasture runoff contributed more than 20 percent of the total and bioavailable phosphorus loadings to the St. Croix River basin.

III-2.6 Intercommunity Groundwater Protection, Sustaining Growth and Natural Resources

This study is sponsored by Washington County with funding from the Legislative Committee on Natural Resources (LCMR). The project will investigate the potential impact of groundwater pumping on water resources in the Woodbury and Afton area. The City of Woodbury has proposed construction of several new production wells to serve new residential and commercial development in the east part of the city. Concerns were raised that the high-volume production wells could draw water away from surface water resources, particularly Valley Creek in Afton, which is a high quality trout stream. The results of the project will provide scientific data for future planning and management decisions.

III-2.7 Integrating Groundwater and Surface Water Management – Southern Washington County

This is a project funded by Washington County, local watersheds, and the BWSR. The study will collect data on surface water and groundwater resources in the southern portion of the county (south of Highway 36). The study will be very similar to "Integrating Groundwater and Surface Water Management - Northern Washington County" completed in 2003 (EOR, 2003). The study will identify important groundwater recharge and discharge areas, groundwater dependent natural resources, and connections between groundwater and surface water resources. Management tools will be developed including a model groundwater management ordinance for use by cities, townships, or watersheds.

IV. Watershed Goals and Policies

The Watershed Goals and Policies were developed by the Lower St. Croix Watershed Management Organization (LSCWMO) Board of Managers and the Advisory Committee. Watershed goals are based on the issues identified during the planning process and overall watershed management strategies. The policies represent a comprehensive list of possible actions that could be taken to achieve the goals. It is understood that not all of the policies identified in this section can be addressed within the ten-year timeframe of this Watershed Management Plan (Plan). They are, however, included for future planning efforts in the event that the LSCWMO obtains outside funding for these projects. Those policies that are specifically addressed within this Plan are identified in italics.

The goals and policies section is organized by LSCWMO watershed management areas including:

- Protection of Surface Water Resources
- Mitigation of Stormwater Impacts
- Groundwater Quality and Quantity
- Protection of Key Natural Resources

In addition, goals and policies are developed for Public Participation, Information, and Education. LSCWMO policies follow corresponding goal statements.

IV-1. Protection of Surface Water Resources

Goal 1. Maintain or improve the surface water quality of water resources within the watershed with a specific emphasis on Kelle's Coulee, Trout Brook, O'Conners Creek and Lake and the St. Croix and Mississippi Rivers.

Goal 1A: Achieve short-term (by the year 2010) goals for O'Conner's Stream and Lake (see also LSCWMO O'Conner's Stream and Lake Management Plan):

- *Maintain O'Conner's Lake water quality at the current TSI level.*
- *Implement Best Management Practices (BMPs) along O'Conner's Lake shoreline.*
- *Avoid hydrologic alterations that would raise or lower water levels in O'Conner's Lake or would increase stormwater bounce.*
- *Monitor and manage invasive/exotic species within O'Conner's Lake and subwatershed.*
- *Manage upland areas to prevent lake degradation and limit phosphorus load.*

Goal 1B: Achieve long-term (by the year 2020) goals for O'Conner's Stream and Lake (see also LSCWMO O'Conner's Stream and Lake Management Plan):

- *Improve water quality within O'Conner's Lake. Achieve a mesotrophic rating for O'Conner's Lake.*
- *Implement Best Management Practices (BMPs) along 100% of the shoreline and stream corridor.*
- *Establish rooted aquatic vegetation along 100% of the shoreline.*

Goal 1C: Achieve short-term (by the year 2010) goals for Kelle's Coulee (see also LSCWMO Kelle's Coulee Stream Management Plan):

- *Maintain the water quality of Kelle's Coulee.*
- *Obtain water quality data on creek in spring, runoff, and base flow condition.*
- *Provide landowners with information and education on creek and buffer management and invasive species control.*
- *Fix high priority stream bank and erosion issues.*

Goal 1D: Achieve long-term (by the year 2020) goals for Kelle's Coulee (see also LSCWMO Kelle's Coulee Stream Management Plan):

- *Improve the water quality of Kelle's Coulee.*
- *Beyond the rules, water quality can be improved through constructing of small scale stormwater BMPs in critical areas in the watershed.*
- *Promote establishment of a buffer along Kelle's Coulee to the St. Croix River.*
- *Fix lower-priority stream bank erosion problems and gully erosion throughout the watershed.*

Policy 1 *Determine pollutant loads and establish water quality goals for all water bodies.*

Policy 2 *Maintain the stability and natural condition of stream channels.*

Policy 3 *Determine and preserve 100-year floodplain storage of all water bodies.*

Policy 4 Support the EPA Total Maximum Daily Load (TMDL) program though cooperation with agencies and local stakeholder groups, participation in TMDL studies, and implementation of recommendations from TMDL studies when applicable.

Policy 5 Cooperate with the St. Croix Basin Planning Team to improve the water quality of the St. Croix Basin.

Policy 6 Cooperate with local and regional interests to mitigate existing flooding conditions along the St. Croix and Mississippi Rivers.

Policy 7 Minimize the impact of mining activities on surface water quality.

Policy 8 Implement a biological, physical, and chemical monitoring program for surface waters.

Policy 9 Identify stream and wetland restoration opportunities.

IV-2. Mitigation of Stormwater Impacts

Goal 2. Prevent the degradation of water resources as a result of excess runoff volume and high flow rates.

Goal 3. Prevent the degradation of resources and the loss or damage of property due to erosion and sedimentation.

Policy 10 Continue implementation of a surface water monitoring program to determine peak and base flow conditions on watershed streams.

Policy 11 Maintain a minimum of two feet separation between the lowest opening elevation in new construction and the 100-year flood level of adjacent water bodies or one foot over the emergency overflow elevation, whichever is greater.

Policy 12 Require that land use changes maintain pre-development peak stormwater flow rates for the 2-, 10-, and 100-year storm events.

Policy 13 Promote the use of low impact development practices.

Policy 14 Identify landlocked basins within the watershed and develop a management plan for each basin to prevent flooding.

Policy 15 Prevent transfer of surface water runoff across established watershed and subwatershed divides without evaluation of hydrologic impacts and approval of the LSCWMO Board of Managers.

Policy 16 Manage land use activities throughout the watershed in a manner which reduces non-point source loading of pollutants and soil erosion.

Policy 17 Prevent erosion and sedimentation due to construction, development, or agricultural practices through the use of structural and non-structural practices.

Policy 18 Require land use changes and development to utilize BMPs outlined in the MPCA Manual "Protecting Water Quality in Urban Areas; Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban and Developing Areas of Minnesota" and the Metropolitan Council Urban Small Sites BMP Manual.

Policy 19 Protect slopes greater than twelve percent from activities that increase erosion potential.

Policy 20 Work with local municipalities to protect areas with high erosion potential or areas that are highly sensitive to erosion as identified by the Washington Conservation District erosivity mapping and by the Washington County Shoreland Management and Lower St. Croix River Bluffland and Shoreland Management Ordinance.

Policy 21 Restore and manage currently eroding areas within the watershed, specifically streambank and channel erosion occurring within key water resources of the watershed.

Policy 22 *Prevent or require mitigation for increases in impervious area in the upland areas of bluffs and ravines through development regulations in these areas.*

IV-3. Groundwater Quality and Quantity

Goal 4. Maximize groundwater recharge as a means of maintaining drinking water supplies, preserving base flows in streams, and limiting discharges of stormwater to downstream receiving waters.

Goal 5. Protect existing groundwater supplies to private wells and groundwater dependent natural resources.

Goal 6. Maintain or improve groundwater quality within the watershed.

Policy 23 *Utilize existing monitoring programs when possible to develop a comprehensive groundwater monitoring program to establish baseline data on the quantity and quality of groundwater in the watershed in order to protect drinking water supplies and groundwater dependent resources.*

Policy 24 *Protect active karst regions, particularly sinkholes, and sensitive recharge areas from potential sources of contamination.*

Policy 25 *Require groundwater recharge and volume control as a stormwater management tool in suitable areas to reduce runoff volumes and rates and reduce pollutant loadings to surface waters.*

Policy 26 *Collaborate on the development of existing and future groundwater studies, management plans, and wellhead protection plans and implement recommendations when applicable.*

Policy 27 Cooperate with Washington County in their efforts to mitigate for high nitrate concentrations present in the groundwater.

Policy 28 Review existing Washington County Subsurface Septic Treatment System (SSTS) ordinance and administration within the watershed to provide a synopsis of conditions, applicable ordinances, permitting, construction practices, and to identify the necessity for additional requirements that would consider the local karst geology. Goal accomplished with implementation of Karst Plan.

Policy 29 *Support and participate in the implementation of the Washington County Groundwater Plan.*

Policy 30 Minimize the impact of mining activities on groundwater quality.

Policy 31 *Review community feedlot ordinances and develop watershed standards that incorporate local karst geology.*

IV-4. Protection of Key Natural Resources

Goal 7. Encourage and enhance natural resource based, passive use recreational opportunities within the watershed consistent with overall water management goals.

Goal 8. Protect and improve key natural resources within the watershed to prevent the loss or degradation of fish and wildlife habitat.

Goal 9. Maintain, enhance, and restore, where possible, the functions and values of existing areas and wetlands within the watershed.

Policy 32 *Manage land and water resources within the watershed to improve habitat for fish and wildlife species.*

Policy 33 *Evaluate the capability of Trout Brook, to support fish habitat, identify restoration opportunities, and develop a management plan for Trout Brook.*

Policy 34 *Support greenway and wildlife corridor linkages in the watershed.*

Policy 35 Prevent the loss of rare and unique plant and animal species.

Policy 36 Support the recommendations presented in the Afton Natural Resource Inventory and Stewardship Plan; Maintaining and Enhancing Environmental Quality in Denmark Township, A Natural Resources Inventory with Stewardship Recommendations; and the City of Cottage Grove Natural Resource Inventory.

Policy 37 Promote landscaping that utilizes native vegetation to enhance wildlife habitat.

Policy 38 *Promote the use of management tools such as buffers and setbacks to preserve the quality of natural resources.*

Policy 39 *Determine appropriate areas for passive and non-passive recreational activities in order to minimize impact on land and water resources.*

Policy 40 Coordinate and collaborate with park master planning efforts within the watershed.

Policy 41 *Determine the role of public and non-public land in providing wildlife habitat and recreational opportunities.*

Policy 42 *Inventory and assess the functions and values of existing wetlands and identify historic wetland sites.*

Policy 43 *Develop and implement a management program that maintains wetland functions and values.*

Policy 44 *Develop wetland management plans for existing wetlands and restoration plans for drained and negatively altered wetlands.*

Policy 45 *Determine feasibility for the construction of new wetlands in the watershed.*

Policy 46 Ensure LSCWMO goals are consistent with existing and future wetland regulation.

Policy 47 *Support the administration of the Wetland Conservation Act (WCA).*

Policy 48 *Identify upland plant community restoration opportunities.*

IV-5. Public Participation, Information, and Education

Goal 10. Provide information, knowledge and skills to those who live, work and/or recreate in the watershed to foster the protection of local land and water resources.

Policy 49 Develop a stewardship program which empowers watershed residents to implement management practices on a small scale.

Policy 50 Develop an educational outreach program to addresses the impacts of animal agriculture including feedlots.

Policy 51 Facilitate training for volunteers in watershed monitoring programs.

Policy 52 Participate in existing water resource educational programs with the Carpenter Nature Center, Afton State Park, St. Croix Bluffs Regional Park, and area schools.

Policy 53 *Promote the education of City and Township staff and elected officials including the coordination of Nonpoint Education for Municipal Officials (NEMO) presentations for staff, officials, and local citizens.*

Policy 54 *Utilize existing municipal web pages to disseminate information about the LSCWMO.*

Policy 55 *Maintain an active Citizen's Advisory Committee for the WMO.*

Policy 56 Publish an annual newsletter to watershed residents and prepare paper articles to educate the residents on particular resource issues.

Policy 57 Be an active member of the Washington County Water Consortium.

V. Implementation Plan and Management Standards

The Implementation Plan is focused on providing implementation activities to address each issue that was identified during the Issue Identification Process, presented in Section II. Watershed Issues and Issue Statements. Appendix E includes each of the Issues identified in Section II with corresponding Implementation Actions. The implementation activities generally focus on conducting more in-depth, issue specific analyses and management plans and the subsequent implementation of the standards and capital improvements identified in those plans. The implementation plan includes annual funding for the implementation of these specific plans.

The Lower St. Croix Watershed Management Organization (LSCWMO) will consider additional regional projects and programs as new problems and issues are identified. Regional projects and programs will be considered on a subwatershed or watershed basis. They will typically cross municipal boundaries and require the authority of the LSCWMO to solve. Issues and problems on a very small scale, for example flooding associated with a small subdivision, will be directed to the appropriate municipality for action.

Activities identified in the Implementation Plan are intended to serve as a road map for planning purposes. The table associated with the Implementation Plan identify projected implementation dates, estimated project costs, and proposed collaborators. Information presented in the implementation tables does not commit the Board of Managers to completing projects as they are laid out in the tables. The Board of Managers has the flexibility to re-evaluate priorities and strategies on an annual basis.

In addition to the implementation activities described below, a set of management standards is included in this section. These standards will form the basis for managing activities within the LSCWMO prior to establishing Watershed Rules.

V-1. Implementation Activities

Fourteen implementation activities are proposed within this Plan. Each implementation activity is grouped into one of three areas including:

- General Watershed Projects and Programs;
- Watershed Wide Implementation Activities; and
- Subwatershed Implementation Activities.

General watershed projects and programs are overall programmatic in nature and apply to the entire watershed. Watershed wide implementation activities include watershed specific studies and implementation activities that apply to the entire watershed. Subwatershed implementation activities include implementation activities focused on a key water resource in the watershed including Trout Brook, Kelle's Coulee, and O'Conners Creek and Lake. These three groups correspond to funding mechanisms discussed within Section V-3. Funding of Watershed Activities.

V-1.1 General Watershed Projects and Programs

The following implementation activities are identified as General Watershed Projects and Programs:

- Watershed administration;
- Rule development;
- Development review program;
-
- Education and information program.

Each of these activities is described below.

Implementation Activity 1. Watershed Administration

This implementation activity will include the day to day administration of the watershed including accounting, general technical services, annual audit, annual report to Washington County and the BWSR, insurance premiums, and legal counsel.

Implementation Activity 2. Rule Development

Watershed Rules were developed based on the issues, goals, policies, and management standards outlined in this Plan and revised through a public and municipal input process. These Rules provide a framework for the Watershed to review new developments. Rule development includes defining the roles of local governments, identifying gaps in the current regulatory structure, setting the threshold for watershed review, and developing administrative controls to ensure monitoring and enforcement. The development of Watershed Rules was based on the recommendations included in the Comparative Review of Watershed District Rules and Recommendations for Standardization completed by the Washington County Water Consortium in 2003 (Washington County, 2003a).

Rules were developed for the following areas:

- Water quality treatment requirements for the removal of nutrients and sediment and mitigation for thermal impacts;
- Buffer requirements for stream channels, wetlands, and lakes;
- Erosion and sediment control;
- Volume control and groundwater recharge;
- Groundwater protection;
- Wetlands;
- Floodplain protection;
- Landlocked basins;
- Water appropriation;
- Rate control; and
- Channel and shoreline stability.

Implementation Activity 3. Development Review Program

This project consists of developing the review process. Guidance information will be developed for implementation of the watershed Rules for coordination between communities and adjacent watersheds, required review submittals, and templates for BMPs when necessary. Procedures will be developed in coordination with adjacent watersheds to account for minor changes in the watershed legal boundary as a result of land subdivisions. The program will likely require a fee for services to be charged to applicants.

Implementation Activity 4. Education and Information Program

An education and information program will be established and will include the following components:

- Participation in existing water resource educational programs including Nonpoint Education of Municipal Officials (NEMO), Carpenter Nature Center programs, and local park programs.
- Work with municipalities to include LSCWMO information on web sites.

- Maintain a Citizen's Advisory Committee with a minimum of two meetings per year.
- Publish a yearly newsletter to all watershed residents with an update on LSCWMO projects, programs, and general water resources information.
- Publish a minimum of two articles a year in local newspapers on the status of LSCWMO projects and programs and general water resources information.
- Participate on the Washington County Water Consortium.
- Participate in the East Metro Water Resource Education Program.

Key educational items that will be focused on include animal agriculture, fertilizer application, water quality, best management practices, low impact development, groundwater dependent resources, importance of groundwater recharge, and surface water groundwater interactions.

V-1.2 Watershed Wide Implementation Activities

The following implementation activities are identified as Watershed Wide Implementation Activities:

- Landlocked Basin Management Plan;
- Watershed Pollutant Loading Study;
- Karst Feature Inventory & Management Plan; and
- Greenway and Recreation Management Plan; and
- Wetland Management Plan.

Each of these activities is described in detail below.

Implementation Activity 5. Landlocked Basin Management Plan

The purpose of this project is to develop a plan to protect landlocked areas from flooding hazards and protect groundwater quality beneath landlocked basins. Steps will include an inventory of landlocked areas; baseline data collection including drainage areas, land uses, future land uses, hydrology and hydraulics, and presence of karst features; and development of performance standards. In addition, outlet and management policies, including volume control, will be developed. Those recommendations within the Washington County Landlocked Basin Plan which are applicable to the LSCWMO will be considered at this time. An information and education component will also be included in this plan.

Implementation Activity 6. Watershed Pollutant Loading Study

The purpose of this study is to identify the current pollutant loadings from the landscape to watershed lakes, wetlands, streams, groundwater and major Rivers; and develop water quality performance based standards based on the quality and value of the receiving water. Specifically, performance standards will be developed for all subwatersheds draining to the St. Croix River in cooperation with the the St. Croix Basin Planning Team's goal of reducing nutrient loads to the St. Croix River. Project tasks will also include an inventory of animal agriculture practices and development of guidance on the use of best management practices for agricultural practices and fertilizer application. An information and education component will also be included in this study.

Implementation Activity 7. Karst Feature Inventory & Management Plan

This project identified existing gaps with regard to local karst features in the "Southern Washington County Groundwater Study" conducted by Washington County. The Plan identifies Karst-specific policies, Rules and guidance for water quality treatment within subwatersheds draining to active karst areas were developed. An information and education component was also included in this plan. The Plan contains maps identifying karst sensitive areas and known sinkholes and springs. Additionally, the Plan provides guidelines for stormwater management in karst sensitive areas including detailed

guidelines for geotechnical investigation prior to land use alteration and considerations for use of stormwater BMPs in karst settings. The specific implementation items of the Plan are:

1. *Groundwater Monitoring Program*

   A groundwater monitoring program will provide the LSCWMO with data on the quality and quantity of groundwater resources. There is currently little monitoring of groundwater resources in the LSCWMO. Monitoring groundwater chemistry over time may show trends in the quality of groundwater in the watershed and allow the LSCWMO to identify any threats to drinking water supplies and groundwater dependent resources.

   The WMO will install or acquire the use of existing groundwater monitoring wells within the primarily used aquifers of the watershed. The WMO will actively monitor groundwater chemistry and level to assess changes in groundwater quality and hydrology. Groundwater analysis could include pesticides, volatile organic compounds, gasoline range organics, lead, cadmium, manganese, nickel, copper, zinc, nitrate, nitrite, and chloride. The WMO will determine the scope of this program in terms of the number of wells monitored and the frequency of monitoring during program initiation. Final number and siting of wells will be determined based on distribution of existing wells, funding, and access.

   Project Timeline – 2008-ongoing

2. *Work with Washington County to Amend their Ordinances to Reference Karst Regions*

   Currently Washington County stormwater ordinances do not address the potential for karst landscapes and features. The LSCWMO will work with Washington County to amend the County ordinances to include karst specific protection strategies and groundwater quality protection.

   Project Timeline – 2007-2008

3. *Purchase digital 2-foot contour data*

   The availability and use of two-foot contour data will allow the LSCWMO to further identify potential karst investigation areas. Specifically, two-foot data will assist the LSCWMO and member communities with identifying downstream drainage paths during the development review process, if a site drains to an off-site existing sinkhole, or potential sinkhole, additional analysis will be required. Two-foot contour data are available from Washington County for purchase. Contour data will also be available for use in future and ongoing studies and will strengthen the accuracy of future modeling output. These data are available in digital format

(GIS/CADD) and in hard copy format. These data can be purchased as needed, by section or half-section.

Project Timeline – 2007-on-going

4. *Spring Inventory*

Springs are the natural discharge points of aquifers and as such represent prime locations to monitor the integrated, regional condition of groundwater resources. Most springs are not shown on maps, and must be found via fieldwork. A search for springs along the eastern and southern perimeter of the LSCWMO along the banks of the St. Croix and Mississippi Rivers is proposed to complete an initial spring search started in 2004. The 2004 search covered the region between Afton State Park and St. Croix Bluffs Park along the banks of the St. Croix River. The spring search should be conducted in winter time when temperatures are below freezing, it is under this condition that spring and seep resurgence of groundwater is the only unfrozen features on the landscape and provides clear unambiguous locations of these features.

Project Timeline - 2011-2012

Implementation Activity 8. Greenway and Recreation Management Plan

The WMO intends to partner with the Washington County Land and Water Legacy Program by providing in-kind services evaluating potential projects with an emphasis on sites that develop an greenway through the watershed, connect existing open spaces and that help protect surface water resources.

Implementation Activity 9. Wetland Management Plan

The purpose of this project is to develop a wetland management plan that will assign performance standards for protection of wetlands and include water quality, bounce, and hydrologic restrictions and identify potential wetland restoration sites. Steps may include an inventory of existing and historic wetlands and assignment of a function and value to existing wetlands. An information and education component will also be included in this plan.

V-1.3 Subwatershed Implementation Activities

The following implementation activities are identified as Subwatershed Implementation Activities:

- Trout Brook Fisheries Assessment;
- Kelle's Coulee Stream Management Plan Implementation Items; and
- O'Conners Creek & Lake Management Plan Implementation Items.

Each of these activities is described in detail below.

Implementation Activity 10. Trout Brook Fisheries Assessment

This study will identify the potential for Trout Brook to support cold water trout species and develop options for management of the stream. The study will include a comprehensive monitoring program, fish population survey, preliminary design of stream channel and fish habitat improvements, identification of restoration opportunities, and development of subwatershed performance standards. Existing land uses, including animal agriculture, and potential threats to Trout Brook within its subwatershed will be inventoried. An information and education component will also be included in this plan.

Implementation Activity 11. Kelle's Coulee Stream Management Plan

This project consisted of additional inventory and assessment work to supplement the data found in the Afton NRI. The Kelle's Coulee Stream Management Plan consisted of two primary phases. The first phase consisted of data collection, data review, and analysis including a Rosgen stream analysis, riparian vegetation evaluation, and macroinvertebrate assessment in addition to evaluation and modeling of stream flow and water quality. The second phase, the public participation process, consisted of two community meetings where stream data and a draft Stream Management Plan were presented to the group and residents discussed concerns and future goals for the stream. The plan provides management activities aimed at enhancing the stream and its corridor

and resource based performance standards. An information and education component is also included in this plan. The specific implementation items of the Plan are:

1. *Monitoring*

   Monitoring of the stream will include continued flow measurements. Water quality sampling of spring snow melt and storm events will also be taken to establish baseline water quality characteristics and to analyze trends. An automated sampling station will be installed at the location of the existing flow monitoring station. In addition to flow and water quality a volunteer stream monitoring program will be developed with a local school or with local residents. This monitoring will focus on the fish and invertebrates within the stream.

2. *Stewardship*

   A stewardship program will be developed to enable local residents to implement small scale projects aimed at improving the ecological integrity of the coulee and the habitat and quality of the stream such as invasive species control, native plant restoration, streambank bio-engineering and stream shading. Priority areas and activities and program funding options will be established to focus the funding for the WMO.

3. *Education Outreach*

   Educational information would be developed specific to the unique character of the Coulee and stream. This information would then be used to refine the WMO's overall educational effort. The information would be used to educate residents on the sensitivity of the coulee and to publicize the Stewardship Program.

4. *Streambank Stabilization*

   Several erosion areas have been identified along the stream and its primary tributaries either through the SWMM modeling, Rosgen analysis or the City of Afton Natural Resource Inventory Water Resource Evaluation. The areas have been rated on severity and size (see Inventory section). A feasibility study to stabilize these areas should be developed. This feasibility study would identify the areas that are either too large or too complex to be stabilized using the stewardship approach. The feasibility study would prioritize the erosion areas and develop a range of appropriate stabilization techniques with associated cost estimates. Implementation of each specific stabilization projects would then become an annual effort of the WMO. Final design, construction plans and specifications would be developed for each project.

Implementation Activity 12. O'Conners Creek & Lake Management Plan

The O'Conners Creek & Lake Management Plan consists of additional inventory and assessment work to supplement the data found in the Denmark Township NRI. The O'Conners Creek & Lake Management Plan consisted of two primary phases. The first phase consisted of data collection, data review, and analysis including a Rosgen stream analysis, fisheries assessment, riparian vegetation evaluation, and macroinvertebrate assessment in addition to evaluation and modeling of stream flow and water quality. The second phase, the public participation process, consisted of two community meetings where stream data and a draft Stream Management Plan were presented to the group and residents discussed concerns and future goals for the stream. The project identifies threats to the stability of the system and potential restoration opportunities and management activities aimed at enhancing the stream and lake.

The Management Standards and Capital Improvements were prioritized by the WMO Board after receiving significant input from residents within the subwatershed. The prioritization is as follows: Priority 1: These activities are a priority for the WMO, will be funded in the WMO's annual budgeting process and will be implemented within the timeline of the Plan. Priority 2: The activities are a lesser priority but the WMO acknowledges the benefit in conducting them. These activities will be implemented only if outside funding sources are procured. Priority 3: These activities are not a priority for the WMO and will not be conducted. The specific implementation items of the Plan and their Priority Ranking are:

1. *Lake Level Management*

   Lake level management is identified as a Priority 1 management strategy, indicating that the activity will be implemented annually within LSCWMO programs and projects. The WMO will actively monitor the level of O'Conner's Lake and use these data to assess changes in hydrology. Significant changes in the lake hydrology, i.e. increases in the normal water level of the lake, may create a situation whereby the lake will overflow into the mining operation to the east causing flooding and erosion problems. Minimizing these overflows is a goal of the WMO.

2. *Monitoring*

- *Stream flow monitoring and periodic water quality sampling at St. Croix Trail should continue into the future. This data set will be vital to assess long-term changes in the hydrology of the system. Monitoring of stream flow at St. Croix Trail is identified as a Priority 1 activity, and will be implemented on an annual basis.*
- *Manual lake level measurements at O'Conner's Lake taken by volunteer readers will be conducted in coordination with the DNR lake level program. Monitoring lake levels at O'Conner's Lake manually is identified as a Priority 1 activity and will be implemented on an annual basis.*
- *An automated monitoring station will be installed in the lake to provide level measurements. Automated level monitoring at O'Conner's Lake is identified as a Priority 2 activity indicating it will only be accomplished if outside funds are obtained or manual measurements are no longer feasible.*
- *Periodic stream flow measurements will be taken at the Oakgreen Road crossing to determine stream flow fluctuations in the stream's headwaters. This station does not need to be permanent; rather it could be installed at periodic intervals to determine if there are hydrologic changes. Periodic measurements at Oakgreen Road is a Priority 1 activity indicating that it will be implemented periodically in the future.*

3. *Education Outreach*

   No specific educational program is recommended for the subwatershed. The overall education and outreach approach for the LSCWMO will apply to this subwatershed. This activity is a Priority 1 activity and will be implemented on an annual basis as part of the overall watershed education and information program.

4. *Water Quality Assessment*

   Generally, water quality within the watershed will be addressed through the Watershed Rules. The WMO will assess the water quality impacts of two existing developed areas in the subwatershed. The assessment is a Priority 1 activity and will be funded during implementation of this Plan.

   Project Timeline – 2012-2014

5. *Water Quality Feasibility Study*

   If a WMO assessment determines that water quality is being impacted by a specific developed area, a feasibility study will be conducted to determined recommendations for addressing the problem. The feasibility study is a Priority 2 activity and will not be conducted unless outside funds are obtained.

6. *Stream Riparian Zone Restorations*

   The stream reach downstream of the two crossings of 80th Street has been identified as having inadequate riparian zones and buffers from adjacent land use. The LSCWMO will provide technical expertise for design of riparian restoration including plant installation. Riparian zone restorations are a Priority 1 activity. This activity will be funded and conducted during implementation of this Plan.

   Project Timeline - 2010-2011

7. *Stream Structure Improvements*

   There are four structures within the stream which convey flow through road crossings. Each has been identified as having a unique role in the formation of the downstream stream reach. In addition, each structure provides a barrier to fish migration to a varying degree. Design and construction of stream structure improvements are a Priority 3 activity, and funding will not be planned.

8. *Lake Outlet Feasibility Study*

   A feasibility study to determine the options for a lake outlet at O'Conner's Lake is a Priority 1 activity. Construction of an emergency overflow from O'Conner's Lake, through the downstream mining operation and eventually down to the St. Croix River may someday become a necessity. The feasibility study will identify the potential route in coordination with the eventual restoration of the mine. The LSCWMO will fund this activity during implementation of this Plan.

   Project Timeline – 2014

V-2. Implementation Schedule and Costs

The schedule associated with implementation activities, timelines, and project and program costs is illustrated in Table V-1. .

Table V-1. Implementation Schedule and Costs

	IMPLEMENTATION ACTIVITY EXPENDITURES / COST PROJECTIONS / SCHEDULE										
IMPLEMENTATION ACTIVITY	2005 Spent	2006 Spent	2007 Spent	2008 Budget	2009 Estimate	2010 Estimate	2011 Estimate	2012 Estimate	2013 Estimate	2014 Estimate	Actual Through 2007 / Projected Thru 2014 Cost
Watershed Administration	22,349	34,477	46,993	40,422	30,000	30,000	30,000	30,000	30,000	30,000	**324,241**
Rule Development	16,392	16,933	11,815	0							**45,140**
Development Review Program	3,530	2,325	3756	19,000	4,000	4,000	4,000	4,000	4,000	4,000	**52,611**
Monitoring Program		13,899	10,906	16,700							**41,505**
Education & Information Program	1,513	1,272	560	5,000	5,000	5,000	5,000	5,000	5,000	5,000	**38,345**
Landlocked Basin Management Program							10,000				**10,000**
Implementing - Landllocked Basin Mgmt Plan								5,000			**5,000**
Watershed Pollutant Loading Study						25,000					**25,000**
Implementing - Load Reduction Recommendations							5,000	5,000	5,000	5,000	**20,000**
Karst Feature Inventory & Mgmt Plan		10,070	11,656								**21,726**
Implementing - Groundwater Monitoring Program					10,000	10,000	10,000	10,000	10,000	10,000	**60,000**
Implementing - Work w/ Wash Co				4,000							**4,000**
Implementing - Acquire 2 ft topography data					1,000	1,000	1,000	1,000	1,000	1,000	**6,000**
Implementing - Spring Inventory								6,000			**6,000**
Wetland Mgmt Plan					12,000						**12,000**
Implementing - Wetland Mgmt Plan						5,000	5,000	5,000	5,000	5,000	**25,000**
Trout Brook Fisheries Assmt/Mgmt Plan				16,000	10,000						**26,000**
Implementing - Trout Brook Mgmt Plan						10,000	10,000	10,000	10,000	10,000	**50,000**
Implementing - Monitoring					8,333	8,333	8,333	8,333	8,333	8,333	**49,998**
Kelle's Coulee Stream Mgmt Plan		16,446	7,043								**23,489**
Implementing - Monitoring					9,633	8,333	8,333	8,333	8,333	8,333	**51,298**
Implementing - Stewardship					2,500	2,500	2,500	2,500	2,500	2,500	**15,000**
Implementing - Education/Outreach					2,500	500	500	500	500	500	**5,000**
Implementing - Streambank Stabilization						2,500	2,500	2,500	2,500	2,500	**12,500**
O'Conners Creek & Lake Mgmt Plan	15,406	3,813	4,262								**23,481**
Implementing - Lake Level Mgmt					1,000	1,000	1,000	1,000	1,000	1,000	**6,000**
Implementing - Monitoring					8,333	8,333	8,333	8,333	8,333	8,333	**49,998**
Implementing - Water Quality Assessment								2,000			**2,000**
Implementing - Stream Riparian Zone Restorations						1,250					**1,250**
Implementing - Lake Outlet Feasibility										30,000	**30,000**
TOTALS	**59,190**	**99,235**	**96,991**	**101,122**	**104,299**	**122,749**	**111,499**	**114,499**	**101,499**	**131,499**	**1,042,582**

V-3. Funding of Watershed Activities

The LSCWMO intends to fund its current Implementation Plan activities through the existing Joint Powers Agreement (JPA). The LSCWMO may also pursue additional financial resources such as grants, donations, in-kind services, and/or participation by other governmental units or agencies. These funding opportunities can greatly decrease the required financial contribution by watershed residents. The operating budget each year will be presented for comment to each of the LSCWMO municipalities.

The LSCWMO intends to fund implementation activities through a variety of mechanisms. The following mechanisms will be used to fund watershed projects and programs:

- General watershed project and program expenses will be allocated to each member community based on 50% of their net tax capacity for all properties within the watershed and 50% on their total area within the watershed;
- Watershed wide implementation activity expenses will be allocated to each member community based 50% on the net tax capacity of all property within the watershed and 50% on the total area within the watershed; and
- Subwatershed specific implementation activity expenses will be allocated to each member community based 100% on the subwatershed area within the watershed.
- An appropriate fee will be charged to the applicant for costs incurred as part of a development review program established by the LSCWMO.

Table V-4 summarizes the cost distribution between each community for watershed wide and subwatershed specific activities.

Table V-4. Cost Distribution between Communities

Watershed Wide Land Area Method	**Land Area**	**Budget Contribution**
Afton	22%	22.07%
Cottage Grove	12%	11.98%
Denmark Township	66%	65.95%
Hastings	1%	0%
Trout Brook Subwatershed Land Area	**Land Area**	**Budget Contribution**
Afton	49%	49%
Cottage Grove	0%	0%
Denmark Township	51%	51%
Hastings	0%	0%
Kelle's Coulee Subwatershed Land Area	**Land Area**	**Budget Contribution**
Afton	100%	100%
Cottage Grove	0%	0%
Denmark Township	0%	0%
Hastings	0%	0%
O'Conners Lake Subwatershed Land Area	**Land Area**	**Budget Contribution**
Afton	0%	0%
Cottage Grove	22%	22%
Denmark Township	78%	78%
Hastings	0%	0%
Mississippi River Subwatershed Land Area	**Land Area**	**Budget Contribution**
Afton	0%	0%
Cottage Grove	38%	38.5%
Denmark Township	61%	61.5%
Hastings	1%	0%
St. Croix River Subwatershed Land Area (excluding named subwatersheds)	**Land Area**	**Budget Contribution**
Afton	10%	10%
Cottage Grove	0%	0%
Denmark Township	90%	90%
Hastings	0%	0%

In addition, the following funding mechanisms are allowed under the current JPA and may be used to fund watershed projects and programs on a case by case basis:

- Special assessments to benefited properties;
- Levies for one or more taxing districts and/or fees based on contributing watershed only to the degree of specificity defined in the capital improvement program of the Plan;
- Storm water utility for capital improvement projects;
- Special legislation to obtain ad valorem taxing authority;
- Agreement between parties to fund capital improvement projects by responsible unit (s), or in absence of agreement by ad valorem tax levied within watershed (through special taxing districts or existing stormwater utilities in municipalities), agreement will be by:
    - Negotiated amount by members who have lands in the subwatershed OR
    - 50% based on land in watershed OR
    - 50% based on total net tax capacity UNLESS
        - any member community receives a direct benefit from the CIP defined as a lateral and trunk benefit OR
        - the CIP provides direct benefit to one or more community which is so disproportionate as the require a sense of fairness in the 50/50 formula OR
    - Credit system for lands acquired by communities to store or pond surface water can be used to fund their portion of the budget.

Any plan to have the County fund a project will be submitted to the County for review and approval on a case-by-case basis in accordance with Washington County Financial and Budget Policy #2403 regarding Water Management Organization Captial Projects. The County will not approve funding for any Implementation Activity listed in the Implementation Plan without the project first begin submitted to the County for project review and funding approval on a case-by-case basis. The submittal shall include detailed information on the scope and cost of the project and the timing of expenditures. This provision includes the eight Watershed-wide and Subwatershed Implementation Activities delineated in Section V. Implementation Plan and Management Standards, and any other projects identified and submitted into the future.

V-4. Management Standards

Management standards have been established through the Rule development process. It is the intention of the LSCWMO to implement the standards through a development review process and permitting program carried out by each municipality.

Implementation of the Management Standards will require a cooperative relationship with LSCWMO member cities and townships and adjacent watersheds. The goal for implementation of the management standards and Rules is to utilize existing development review programs to communicate watershed standards and review processes to potential applicants and for the municipality to adopt LSCWMO Rules. The LSCWMO will provide review and comment to the municipalities during the initial planning stages for activities regulated under the Rules. LSCWMO management standards and Rules do require member municipalities to upgrade their requirements where necessary. They do not preclude any existing county, state, or federal regulations including National Pollutant Discharge Elimination System (NPDES) requirements and Washington County shoreland and bluff requirements and setbacks.

The LSCWMO will work with its member communities and State agencies to ensure that standards and Rules are enforced. It shall be the duty of each LGU within the LSCWMO to enforce and implement the various requirements of the LSCWMO Rules and Plan through the development and implementation of Local Water Plans and applicable ordinances. Each LGU shall make such amendments to its official controls, regulations, and permitting processes as are necessary to provide it with the authority to enforce and implement the LSCWMO Rules.Management standards have been developed for the following areas:

- Rate Control;
- Volume Control and Groundwater Recharge;
- Water Quality;
- Flooding;
- Erosion and Sediment Control; and
- Wetland Management.

Many of the management standards are interrelated. For example, the water quality standards will often require the same amount of infiltration as the volume control standard. Meeting the water quality and volume control standard will also mitigate for increased in rate control for small storm events.

When comparing pre-development to post-development scenarios, pre-development scenarios must be modeled using pre-development conditions. In the case of redevelopment, all standards are required to be met for new impervious surfaces. Maintenance of stormwater facilities will be the responsibility of the pond owner.

V-4.1 Rate Control

Control of stormwater runoff is necessary to ensure protection from flooding and maintaining the integrity of stream channels. Increases in flow rates are typically associated with increases in impervious surfaces and connected impervious surfaces. Increased flow rates in stream channels or natural swales commonly results in erosion and scouring of the channel bed, disturbance of vegetation, and destruction of biological communities and fish habitat. More water is delivered faster under developed conditions, which results in changes in hydrology including peak flow rates and timing of flows. Flooding is also typically associated with increases in peak flow rates and occurs when the peak flow rate cannot be handled by existing structures such as storm sewer.

The LSCWMO contains numerous streams and gullies; some of which have been identified as having significant erosion problems. Structures and ponds need to be sized to handle a variety of storms including small, common (1.5-year) and rare (100-year) storm events. All new developments and redevelopments will be required to provide rate control.

Standard

1. Pre-development peak stormwater flow rates must be maintained for the 2-, 10-, and 100-year 24 hour rainfall events.

V-4.2 Volume Control and Groundwater Recharge

Development typically results in increased impervious surfaces. These surfaces cover existing soils, resulting in less natural infiltration occurring within the development. An introduction of imperviousness within a watershed has been documented as having adverse changes in stream habitat and aquatic life.

Documentation of stream impacts resulting from impervious surface coverage has been shown to occur when imperviousness reaches only three percent. However, the degree of impact is somewhat ambiguous. Measurable stream impacts present a continuum of changes rather than a threshold at which urbanization has an initial effect. The most current research indicates that subcatchments with approximately 10% imperviousness result in demonstrable and probably irreversible loss of aquatic-system functioning (Schueler, 1994; Wang et.al, 2000). In most documents this statement is followed by a qualifier that states that even lower levels of urban development cause significant degradation in sensitive water bodies. Although the level of impact is not specified, multiple studies have found that in sensitive streams, (those providing salmon and trout habitat) the most significant rate of change of stream integrity occurs when imperviousness reaches approximately five to six percent (CWP, 2003).

The excess runoff associated with impervious surfaces needs to be managed to prevent flooding and water quality degradation including thermal impacts and maintain stream stability. Groundwater recharge, a result of infiltration, is also necessary to maintain stream base flow and groundwater dependent natural resources and replenish drinking water aquifers.

Water quality pretreatment is needed for all volume control practices. Pretreatment can consist of physical or biological treatment practices. Physical pretreatment includes the settling of pollutants in the water column through a sediment forebay or pond, sand filter, or oil and grit separator. Biological pretreatment includes the removal of pollutants by vegetation within a filter strip or vegetated swale.

Standard

1. Stormwater runoff volume retention for the volume equivalent to the runoff generated from one inch of runoff over the impervious surfaces of the development is required on all new developments. Volume control credits may be used to control up to one-half inch of runoff over the impervious areas.
2. Water quality pretreatment, operation and maintenance plan, and vegetation management plan are required for all infiltration practices.
3. Projects proposing stormwater facilities in Karst sensitive areas must complete a Karst sensitivity analysis consistent with the LSCWMO Karst Feature Inventory and Management Plan (2007).

V-4.3 Water Quality

Protection of water quality, both surface water and groundwater, is important for aquatic ecosystems, drinking water sources, and overall health of the watershed.

Karst features in the LSCWMO require special protection from stormwater pollutants. Active karst areas, specifically sinkholes, provide a direct conduit to the groundwater system. Groundwater quality requires special protection because it serves as a drinking water source to watershed residents and is closely linked to the quality of watershed streams and groundwater dependent resources.

Best management practices (BMPs) are required on all new development or redevelopment sites to reduce nonpoint source pollution. Removal rates for sediment and heavy metals closely correlate to phosphorus removals in typical water quality models. Phosphorus can be used as the indicator pollutant to determine overall water quality treatment.

Buffer requirements are used to preserve the function of a wetland and provide treatment of runoff from adjacent sites. No grading or clearing of vegetation is allowed within the buffer zone. Clearing of non-native vegetation is allowed as part of a buffer enhancement that includes

replacing non-native vegetation with native vegetation. Buffers should be clearly marked during and after site development.

Standard

1. No direct (untreated) discharges of stormwater to natural or improved waterbodies is allowed.
2. All stormwater facilities are required to use skimming devices to remove floatable pollutants prior to discharge.
3. Access to stormwater facilities to allow for maintenance must be provided.
4. A 30 foot naturally vegetated buffer must be preserved adjacent to all natural surface waters including wetlands, lakes, and stream channels.

V-4.4 Flooding

Flood protection for natural resources, permanent structures, and private lands is required. The 100-year flood level (1% chance occurrence in every 100 years) must be established for water bodies adjacent and downstream from any proposed development or redevelopment. Proposed stormwater facilities must also identify a 100-year high water level based on the 24-hour, 100-year rainfall event. In landlocked areas, special provisions are required to protect adjacent structures and land. The high water level in landlocked basins will be assumed to be the overflow elevation unless sufficient documentation is provided to ensure the risk of flooding has been addressed. These standards do not apply to the Mississippi or St. Croix River unless explicitly stated.

Standard

1. No filling is allowed within the 100-year floodplain without 1:1 mitigation.
2. The low opening elevations of proposed structures must be a minimum of two feet above the 100-year high water level of nearby surface waters or one foot above the emergency overflow elevation, whichever is greater.

3. Outlets from landlocked basins are not allowed unless subwatershed planning which results in no negative impacts to downstream resources has been approved by the LSCWMO.

V-4.5 Erosion and Sediment Control

Control of construction site erosion and the resulting sediment is required. Sediment has been identified as one of the most significant threats to the waters of the watershed.

Standard

1. Construction activities must minimize erosion and retain all sediment on site.
2. Erosion and sediment control plans for sites disturbing slopes greater than 12 percent require:
    a. Erosion control measures installed at 75 foot intervals along slopes greater than 12 percent.
    b. Slopes greater than 12 percent to be protected with temporary or permanent erosion control within seven (7) days.
3. Erosion and sediment control plans are required to conform to MPCA/NPDES requirements. The following are considered minimum requirements in preparing an erosion and sediment control plan.
    a. The smallest practical area of land shall be disturbed at any one time during development and the duration of such disturbance shall be kept to a practical minimum.
    b. Whenever feasible, natural vegetation and the natural ground surface shall be retained and protected. The top layer of soil for a depth of 6 inches of any disturbed areas shall be set aside for retention on the premises and shall be re-spread over the premises when the rest of the soil has been removed.

c. Temporary vegetative protection, plant cover or mulching, or a combination thereof, shall be used to protect erosion areas during development.
d. Diversions and outlets, both temporary and permanent, shall be constructed or installed to accommodate the runoff caused by the changed soil and surface conditions during and after development.
e. Disturbed soil shall be stabilized as quickly as practicable.
f. Until the disturbed area is stabilized, sediment in the runoff water shall be trapped and removed by the use of sediments basins, silt traps or other acceptable methods.
g. Adequate provisions shall be made to minimize surface water from damaging slopes and embankments. Diversions may be utilized for this purpose.
h. During grading, excavation and other construction activities, slopes and embankments shall be stabilized by mulching with straw, or erosion control blankets staked in position, or a seeding of annual rye grass, or a combination of the foregoing, or other acceptable method.
i. Permanent (final) vegetative protection, plant cover, lawn or ground cover, and mechanical erosion control devices and measures shall be installed or constructed and completed as soon as practicable.
j. Permanent improvements, such as pavement, catch basins, curbs and the like, shall be installed or constructed and completed as soon as practicable

V-4.6 Wetland Management

The functions and values of wetlands within the LSCWMO must be maintained. In addition to the standards outlined below, all other LSCWMO standards may be applicable to wetland projects. All new development sites that contain wetlands will be required to conduct an assessment of the wetland and evaluate the function and values of these wetlands. An assessment will also be conducted for the post-development wetland conditions on the site. The

applicant will be required to demonstrate that there is not a loss of wetland functions and values for the site following development.

Currently, each municipality is the Local Governing Units (LGU) for the Wetland Conservation Act, in addition, Mn/DOT is the Wetland Conservation Act LGU on its' own projects and for it's right-of-way. In addition, a Natural Resource Block Grant currently funds a position at the Washington Conservation District with the purpose of assisting watershed management organizations with services related to wetlands and the Wetland Conservation Act.

Standard

1. Support the administration of the Wetland Conservation Act.
2. Overall function and value of wetlands on a site must be maintained.
3. A 30 foot average buffer zone of native vegetation must be provided around all wetlands, natural and man made.

V-5. Impact on Local Governments

MN Rules 8410.0110 requires that the Plan assess the impact of local controls and programs required by the Plan. The assessment is to include an analysis of the financial impact of implementation of the proposed regulatory controls and programs identified under part 8410.0100 of the MN Rules.

V-5.1 Local Plan Requirements and Local Controls

The local planning requirement of MN Statutes Section 103B.235 will involve each local government in creating or updating and implementing a local water resource plan. The cost of this activity is mandated by the statute and is not a consequence of the Watershed Management Plan. Specific requirements for local plans are included in Section VI-2. Local Water Management Plans, Variances and Requirements.

This Plan requires, as a criterion of local plan approval, that the official controls of the local government, as adopted and enforced, be at least as protective of water resources as the Watershed's standards. Local governments will incur costs in implementing official controls for water resource protection. The LSCWMO expects local governments to assume sole responsibility for water resource permitting and enforcement. A listing of existing local controls excluding Hastings due its small area within the LSCWMO is summarized in Table V-5 in comparison to LSCWMO standards. Each LSCWMO standard is numbered. Corresponding local controls, if applicable, are identified by the same number. Those municipal local controls meeting or exceeding watershed standards are identified in italics. Local controls specified by Washington County are not required to be updated to reflect LSCWMO standards.

The LSCWMO management standards detailed in Section V-4 of this Plan require that runoff be no greater than pre-development peak stormwater flow rates for the 2, 10, and 100-year 24 hour rainfall events. This is consistent with the existing rate controls of the communities within the watershed.

Table V-5. Comparison of Local Controls (Current through October 20, 2004)

	LSCWMO	City of Afton	City of Cottage Grove	Denmark Township	Washington County
Rate Control	1. Pre-development peak stormwater flow rates must be maintained for the 2-, 10-, and 100-year 24 hour rainfall events.	*1. Restrict post-development surface water runoff from the site for the 2-, 10-, and 100-year storm events as well as the ten day 100-year snowmelt event to predevelopment rates.*	1. Development shall not increase the runoff rate.	*1. The post development runoff rate shall not exceed the pre-development rate. Pre-development peak stormwater flow rates must be maintained for the 2-, 10-, and 100-year 24 hour rainfall events.*	1. No land shall be developed or altered and no use shall be permitted that result in surface water runoff causing unreasonable flooding, erosion or deposit of materials on adjacent properties or water bodies. Such runoff shall be properly channeled into a storm drain, a natural watercourse or drainage way, a ponding area or other public facility.
Volume Control and Groundwater Recharge	1. Stormwater runoff volume retention for the volume equivalent to the runoff generated from one inch of runoff over the impervious surfaces of the development is required on all new developments. Volume control credits may be used to control up to one-half inch of runoff over the impervious areas. 2. Projects proposing stormwater facilities in Karst sensitive areas must complete a Karst sensitivity analysis consistent with the LSCWMO Karst Feature Inventory and Management Plan (2007).	1. The applicant shall prove that runoff volume equal to ¾ inch times the total impervious surface area minus ¾ inch times 20 percent of the impervious area (25 percent of the impervious area for Industrial District) shall infiltrate within 72 hours based on the infiltration rate of the soil. The bottom of all infiltration basins shall be a minimum of 2 feet above the seasonal high water table. 2. None	1. Development shall not decrease the natural rate of absorption of stormwater. The quality of water and runoff infiltrated to the groundwater system shall be as high as it was pre-development. 2. None Withdrawal of groundwater shall not result in reducing surface water levels.	1. Development shall not decrease the natural rate of absorption of stormwater. The quality of water and runoff infiltrated to the groundwater system shall be as high as it was pre - development. 2. None Withdrawal of groundwater shall not result in reducing surface water levels.	
Water Quality	1. No direct (untreated) discharges of stormwater to natural or improved waterbodies is allowed. 2. All stormwater facilities are required to use skimming devices to remove floatable pollutants prior to discharge. 3. Access to stormwater facilities to allow for maintenance must be provided. 4. A 30 foot naturally vegetated buffer must be preserved adjacent to all natural surface waters including wetlands, lakes, and stream channels.	1. No lawn chemicals, fertilizers or pesticides shall be applied within 200 feet of the high water mark of any protected water. New constructed stormwater outfalls to public waters must provide for filtering or settling of suspended solids and skimming of surface debris before discharge. Any discharge from development shall not increase sedimentation. 2. None 3. None 4. 50 foot buffer strip requirement around natural environment lakes and Type 3, 4, and 5 wetlands	1. Development shall not detrimentally affect the existing water quality, including chemical, biological, temperature, and turbidity characteristics of any water body or watercourse. 2. None 3. None 4. None	1. No use shall be permitted which will cause or result in pollution of any tributary of the St. Croix River, Mississippi River, any lake, stream, or other body of water in the community. New constructed stormwater outfalls to public waters must provide for filtering or settling of suspended solids and skimming of surface debris before discharge. Any discharge from development shall not increase sedimentation. 2. None 3. None 4. None	To prevent sedimentation of waterways, pervious and impervious sediment traps and other sediment control structures shall be incorporated throughout the contributing watershed.
Flooding	1. No filling is allowed within the 100-year floodplain without 1:1 mitigation. 2. The low opening elevations of proposed structures must be a minimum of two feet above the 100-year high water level of nearby surface waters including the Mississippi and St. Croix River and stormwater facilities or one	1, 2. *No structure, fill, deposit, obstruction, storage of materials or equipment, or other uses may be allowed as a special use that will cause any increase in the stage of the 100-year or regional flood or cause an increase in flood damages.* 3. Minimum building elevation must be	1, 2. No structure, temporary or permanent, fill, deposit, obstruction, storage of materials or equipment, or other uses may be allowed as conditional uses which, acting alone or in combination with existing or anticipated future uses, unduly affects the capacity of the floodway or unduly	1, 2. No land shall be developed or altered and no use shall be permitted that result in surface water run-off causing unreasonable flooding. Uses in the floodway are limited to agricultural uses which do not involve structures, fill or storage of materials or equipment. Buildings must be setback 200 feet from	Uses in the floodway are limited to agricultural uses such as general farming, pasture, grazing, forestry, sod farming and wild crop harvesting which do not involve structures, fill or storage of materials or equipment. The lowest floor including basement of any structure constructed in a shoreland area

	LSCWMO	City of Afton	City of Cottage Grove	Denmark Township	Washington County
	foot above the emergency overflow elevation, whichever is greater. 3. Outlets from landlocked basins are not allowed unless subwatershed planning which results in no negative impacts to downstream resources has been approved by the LSCWMO.	at least 3 feet above the highest known water level, or 3 feet above the ordinary high water level, whichever is higher. 4. None	increases flood heights. Lots abutting upon a watercourse, drainage channel or stream shall have additional depth or width to ensure that building sites are not subject to flooding. 3. The lowest floor elevation shall be at least three feet above the seasonal high water level of any wetland. 4. None	the ordinary high water mark of the St. Croix and Mississippi Rivers. 3. Lowest floor elevations must be a minimum of two feet above the 100-year high water lever for adjacent water bodies. 4. None	must be 2 feet above the 100 year flood elevation or 3 feet above the highest known water level whichever is greater. Buildings must be setback 100 to 200 feet from the ordinary high water mark of the St. Croix River.
Erosion and Sediment Control	1. Construction activities must minimize erosion and retain all sediment on site. Erosion and sediment control plans are required to conform to MPCA/NPDES requirements. 2. Erosion and sediment control plans for sites disturbing slopes greater than 12 percent require a) Erosion control measures installed at 75 foot intervals along slopes greater than 12 percent; and b) Slopes greater than 12 percent to be protected with temporary or permanent erosion control within seven (7) days.	*1. Erosion and Sediment Control Plans shall be in conformance with Best Management Practices (BMPs) as described in the following documents: the Minnesota Pollution Control Agency's NPDES General Permit to Discharge Stormwater from Construction sites, and the Met Council's Minnesota Urban Small Sites BMP Manual.* 2. None Scenic easements shall be required on slopes of 18% and greater, wetlands, drainage ways, and other lands and soils judged to be fragile by the soil conservation service. Such easements shall be required as a condition of subdivision approval, and shall prohibit the following activities: dumping, burning, grading, grazing of domesticated farm animals, vegetative cutting, motorized vehicles, and construction of any structure, including driveways. All structures, including the extension, enlargement or alteration, are set back at least 40 feet from the crest of 18% slope.	1. None 2. None No development shall be permitted on slopes of 18% or more. No structure will be constructed less than 100 feet landward from the bluff line of the Mississippi River.	1. Erosion Control plans must conform to MPCA/NPDES requirements. 2. None No development shall be permitted on slopes of 25% or more. No land shall be developed or altered and no use shall be permitted that result in surface water run-off causing erosion or deposition of minerals on adjacent properties or water bodies. On land within 30-40 feet of the top of a bluff there shall be no vegetative cutting of live trees or shrubs.	No structure shall be constructed on sites with slopes of greater than 25% or on easily erodible soils as defined on the community soils maps and compiled by the Washington County Soil and Water Conservation District. On land within 100 to 200 feet of the ordinary high water mark of the St. Croix River or on slopes greater than 12%, there shall be no vegetative cutting of live trees or shrubs. Setback 30 feet from top of bluff line, 100 feet from St. Croix River bluff line.
Wetland Management	1. Support the administration of the Wetland Conservation Act. 2. The function and value of existing wetlands are required to be maintained. 3. A 30 foot average buffer zone of native vegetation must be provided around all wetlands, natural and man made.	1. Administers the Wetland Conservation Act within the LSCWMO. 2. None. 3. None	1. Administers the Wetland Conservation Act. 2. None 3. None	1. Administers the Wetland Conservation Act. The alteration of wetlands shall comply with the rules and regulations of Federal, State and local agencies. Drainage easements required over wetlands. 2. None 3. None	Setback 50 feet from delineated wetland line. The alteration of wetlands shall comply with the rules and regulations of Federal, State and local agencies.

Local communities within the watershed currently have similar controls for volume control and groundwater recharge, often exceeding the standards of the LSCWMO. Communities and the LSCWMO also have similar standards for flooding and erosion and sediment control.

The LSCWMO water quality standards require treatment of stormwater discharges to surface waters, new development or redevelopment and that stormwater facilities are required to use skimming devices to remove floatable pollutants prior to discharge. The rate control and volume control standards also provide some level of water quality protection. The water quality controls of local communities vary but are generally consistent with those of the LSCWMO.

The LSCWMO minimum building opening elevation requirement is fairly consistent with each of the community's and county's requirement with the exception of landlocked basins which requires the minimum building elevation to be one foot above the emergency overflow elevation, which in the case of landlocked basins is the overflow elevation at this time. Floodplain fill is addressed by each of the entities and is similar in requirements to the LSCWMO.

The LSCWMO management standard requires a minimum 30 foot naturally vegetated buffer around all natural surface waters which is less restrictive than the City of Afton's 50 foot buffer strip requirement around natural environment lakes and Type 3, 4, and 5 wetlands and more restrictive than current ordinances within Cottage Grove and Denmark Township.

V-5.2 Watershed Projects and Programs

The Plan includes a number of programs that may involve local government participation. Examples include:

- Rule development;
- Development review program;
- Monitoring program;
- Education and information program; and
- Revised cooperative agreement.

In pursuing a specific activity under the Plan, the LSCWMO will seek the voluntary cooperation of affected local governments. If an affected local government does not wish to participate, the LSCWMO either will undertake the activity without the involvement of that organization or will forego the activity.

V-5.3 Funding

The nature of the LSCWMO, as a joint powers commission, requires the use of local government resources to determine funding mechanisms within each member community. Each community may collect funds as needed to fund the LSCWMO with any means available to that community and may include special taxing districts, special assessments, or stormwater utility. Activities related to setting up the funding mechanism within each community will be born by the community. Costs to develop these funding mechanisms will vary depending on the number of parcels and households within each community in the LSCWMO and the method used to collect funds.

VI. Watershed Administration

Plan implementation and enforcement is the responsibility of the Lower St. Croix Watershed Management Organization (LSCWMO). Responsibility for enforcement of standards and some implementation of projects could be given to the cities and townships once they have adopted the necessary controls and completed their local water management plans (LWMP). As provided for by MN Rules 8410.0110, Subd. 3, local units of government may meet certain local water planning requirements by adopting the LSCWMO Plan, or parts thereof, by reference. The local government unit will remain responsible to prepare all elements of the local plan not contained in the LSCWMO Plan and that have not been adopted from that plan. The LSCWMO may review municipal controls on an annual basis to assure compliance with each community's LWMP. Based on this review, the LSCWMO will enforce its standards and require an amendment to the LWMP to address any deficiencies in the implementation of LSCWMO standards, projects, and programs.

VI-1. Amendments to the Plan

This Watershed Management Plan (Plan) is anticipated to extend through the year 2014. The LSCWMO recognizes the need to amend the Plan to reflect changes in proposed land uses and capital improvement projects, updating of technical data as more accurate site information becomes available, and modifications in issues, goals, policies, standards and implementation procedures which may be required as a result of future legislation or as enforcement or other problems become evident.

A city or town may request that the Plan be amended to allow for revised land uses, site-specific stormwater runoff, ponding, and flood level data, and similar modifications. However, the prerogative to amend the Plan remains with the LSCWMO. The Board of Managers will look for substantiation from the local government either that the proposed amendment better advances the goals and policies of the Plan than the existing language, or that the goals and policies of the

Plan themselves should be amended to better further the LSCWMO's water resource protection mandate.

Necessary changes initiated by a municipality or its LWMP that do not significantly change the fundamental goals, policies, standards and administrative procedures of the WMO will be incorporated into the Plan as minor amendments according to the requirements of MN Rule 8410.0140 and then by resolution of the LSCWMO Board of Managers. The LSCWMO will keep records of all changes and supplemental data and will, as required for clarity, republish the Plan or portions there of from time to time to provide an updated document for referral by the municipalities and others.

Significant changes involving goals, policies, standards, administrative procedures, or capital improvements will require a thorough review process as described in MN Rule 8410.0140 and presented below.

VI-1.1 General Amendment Procedure

All amendments to the Plan must adhere to the review process provided in MN Statutes Section 103B.231, Subd. 11, except when the proposed amendments constitute minor amendments and:

- the watershed management organization has held a public meeting to explain the amendments and published a legal notice of the meeting twice, at least seven days and 14 days before the date of the meeting;
- the organization has sent copies of the amendments to the affected local units of government, the Metropolitan Council, and the state review agencies for review and comment; and
- the Board of Water and Soil Resources (BWSR) board has either agreed that the amendments are minor or failed to act within 45 days of receipt of the amendments.

VI-1.2 Minor Amendments to Capital Improvements

Amendments to the capital improvement program may be considered to be minor plan amendments if the following conditions are met:

- the original Plan set forth the capital improvements but not to the degree needed to meet the definition of "capital improvement program" as provided in MN Statutes Section 103B.205, Subd. 3; and
- the affected county or counties have approved the capital improvement in its revised, more detailed form.

VI-1.3 Form of Amendments

Unless the entire document is reprinted, all amendments adopted by the watershed management organization must be printed in the form of replacement pages for the Plan, each page of which must:

- on draft amendments being considered, show deleted text as stricken and new text as underlined;
- be renumbered as appropriate; and
- include the effective date of the amendment.

VI-1.4 Distribution of Amendments

The LSCWMO will maintain a distribution list of organizations and individuals who have received a copy of the Plan and shall distribute copies of amendments within 30 days of adoption. The LSCWMO will consider sending drafts of proposed amendments to all plan review authorities to seek their comments before establishing a hearing date or commencing the formal review process.

VI-2. Local Water Management Plans, Variances, and Requirements

Each municipality within the LSCWMO must update or complete a LWMP for approval by the LSCWMO. These plans are required to conform to MN Statues Section 103B.235 and MN Rules 8410.0160. Each watershed municipality may adopt relevant sections of the LSCWMO's Plan in partial fulfillment of its LWMP-development requirements in accordance with Minn. R. 8410.0110, subpart 3. To this end, the LSCWMO encourages the watershed municipalities to adopt relevant sections of its plan as they develop their LWMPs.

The policies and goals established by the LWMP must be consistent with the LSCWMO's Plan. The section in the LWMP covering the assessment of problems must include those problems identified in the Plan that affect the community. The implementation actions proposed by the cities and townships must be limited to those actions which can be implemented at the community level and must be consistent with the Plan. Local Water Management Plans are encouraged to include groundwater protection efforts that recognize the connection between surface water and groundwater resources and protect drinking water sources.

Cities and townships in the watershed must submit their LWMPs to the LSCWMO Board within 24 months after the BWSR approves the LSCWMO's Plan. LSMP's should also be sent to Washington County for review since Washington County has an approved and adopted Groundwater Plan. According to MN Statutes Section 103B.235, LWMPs must also be submitted to the Metropolitan Council at the same time they are submitted to the LSCWMO. Major amendments to the LWMP should also be submitted to the Metropolitan Council for review. Once a plan is received, the LSCWMO shall have 60 days to review the document and to approve or reject it (in whole or in part) based on its compliance with the Plan. If the LSCWMO fails to complete its review within 60 days, and if the municipality has not agreed to an extension, the plan will be deemed approved. Cities and townships are encouraged to solicit information for LSCWMO input and review before they submit their plans for formal review. Once the LSCWMO has responded to the initial submittal of the draft plan, additional review is conducted cooperatively and is not governed by a deadline.

After the LSCWMO approves a LWMP, the municipality shall adopt and implement the plan within 120 days and shall amend its official controls accordingly within 180 days. If a municipality later wishes to amend its plan, it must submit the proposed amendment to the Board of Managers for review of consistency with the Plan. The LSCWMO must approve or disapprove of the amendment (in whole or in part) within 60 days of submittal. A local plan must state that local ordinances will be amended within six months of a LSCWMO rule revision as necessary to ensure that the local official controls remain as strict as the LSCWMO standards and rules.

The following cities and townships will be required to revise or prepare local water management plans that conform to this Plan and in accordance with MN Statutes Section 103B.235 and MN Rules 8410.

Table VI-1. Status of Local Water Management Plans (as of May 1, 2004)

Community	LWMP Status	Relevant Information
Cottage Grove	Approved Plan	Approved by the Met Council July 1999.
Afton	No approved Plan	Comprehensive plan consistent with requirements for surface water management.
Denmark Township	No approved Plan	Comprehensive plan consistent with requirements for surface water management.
Hastings	No approved Plan	Currently in the planning process.

Following BWSR approval and the LSCWMO Board's final adoption, the LSCWMO will notify each municipality of the requirement to revise or prepare LWMPs that conform to this Plan. The LSCWMO will make available pertinent information to assist the cities and townships including drainage and water quality data and maps and a proposed timeline to follow for LWMP review, approval, and adoption.

The LSCWMO will discuss with each municipality the options that address its circumstances and will collaboratively determine the most practical approach to meeting the requirements of this Plan and MN Statutes Section 103B.235. The LSCWMO will work closely with municipalities

as needed in LWMP preparation, review, and implementation. The LSCWMO will apply its goals, objectives, and policies to its review of LWMPs.

The LSCWMO is especially interested in LWMP issues and implementation actions that affect the concerns stated in this Plan or require LSCWMO collaboration. Furthermore, the LSCWMO will work with cities and townships regarding financial considerations, implementation priorities, and programs for plan elements of mutual concern. Each municipality can assume as much management and regulatory control as it wishes through its approved LWMP. Each LWMP shall follow MN Rules 8410.0160 and 8410.0170 requirements for LWMPs. including the following major elements in enough detail to ensure conformance with the letter and the intent of this Plan:

- Describe existing and proposed physical environment and land use or submittal of latest comprehensive land use plan and maps. If any zoning changes proposed in a LWMP would result in changes to the approved rates and volumes of stormwater runoff, the LWMP will need to be amended.
- Identify the goals, objectives, policies, standards and guidelines for municipal water resource management.
- Define drainage areas and the volume, rates and paths of stormwater runoff or utilize the data generated by the LSCWMO.
- Add stormwater storage sites not identified in the Plan, including wetlands. Define storage volume, normal water elevation and outflow rates.
- Define water quality and protection methods (BMPs) adequate to meet performance standards established in this Plan or in the Rules or define a process of collaboration with the LSCWMO on striving to achieve these standards.
- Address maintenance issues and identify where cities and townships need to coordinate with LSCWMO maintenance activities.
- Identify regulations and specific regulatory provisions needed to satisfy the standards and criteria in the Plan and Rules.

- Set forth an implementation program, including a description of official controls and, as appropriate, a capital improvement program (CIP) that details the level of city involvement anticipated for the items listed in the LSCWMO's Implementation Plan.
- Outline city and township permitting processes for land and wetland alteration work in the LWMP. The LSCWMO reserves the right to recommend denial of a project that it considers inconsistent with the LWMP.
- Determine if any other management programs are necessary such as developing education programs to encourage city-wide participation in support of the LSCWMO's efforts.
- Support the Plan in its effort to establish common goals and collaborative ways to achieve these goals.

In accordance with MN Statutes Section 103B.235, the LSCWMO will approve or disapprove the LWMP or parts of it within 60 days; otherwise the LWMP is deemed approved if the LSCWMO does not respond within 60 days. The LSCWMO will review and approve all amendments to LWMPs in accordance to provisions of MN Statutes Section 103B.235, Subd. 3 for review of plans.

Glossary

AC	Advisory Committee
BMPs	Best Management Practices
BWSR	Board of Water and Soil Resources
CAC	Citizens Advisory Committee
CIP	Capital Improvement Program
COD	Chemical Oxygen Demands
CWI	County Well Index
DNR	Department of Natural Resources (M.N.)
EPA	Environmental Protection Agency (U.S.)
FEMA	Flood Emergency Management Act
JPA	Joint Powers Agreement
LSC	Lower St. Croix
LSCWMO	Lower St. Croix Watershed Management Organization
LUST	Leaking Underground Storage Tank
LWMP	Local Water Management Plan
MCBS	Minnesota County Biological Survey
MCES	Metropolitan Council Environmental Services
MDH	Minnesota Department of Health
MGS	Minnesota Geological Survey
MPCA	Minnesota Pollution Control Agency
NEMO	Nonpoint Education for Municipal Officials
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Services
NRI	Natural Resource Inventory
PCBs	PolyChlorinated Biphenyls
SONAR	Statement of Need and Reasonableness
SWWD	South Washington Watershed District
TMDLs	Total Maximum Daily Loads
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspend Solids
VBWD	Valley Branch Watershed District
VRWMO	Vermillion River Watershed Management Organization
VIC	Voluntary Investigation and Clean-up
WCA	Wetland Conservation Act
WCD	Washington Conservation District
WMO	Water Management Organization
USDA	United States Department of Agriculture

The definitions provided in this glossary have been included to provide assistance in reading this Watershed Management Plan. These are not to be used in interpreting or applying the Lower St. Croix Watershed rules.

Anticline A convex fold in rock, the central part of which contains the oldest section of rock.

Aquifer Rock or sediment in a formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield economical quantities of water to wells and springs.

Aquifer, confined A formation in which the groundwater is isolated from the atmosphere at the point of discharge by impermeable geologic formations. Confined groundwater is generally subject to pressure greater than atmosphere.

Aquifer, unconfined An aquifer whose upper boundary consists of relatively porous natural material which transmits water readily and does not confine water. The water level in the aquifer is the water table and is exposed to the atmosphere through openings in the overlying materials.

Aquitard (or confining layer) A geologic formation of low permeability that greatly inhibits the movement of groundwater.

Banks and shorelines Those areas along streams, lakes, ponds, rivers, wetlands, and estuaries where water meets land. The topography of banks and shorelines can range from very steep to very gradual.

Base flow Sustained low flow of a stream which is often due to groundwater inflow to the stream channel.

Bedrock A general term for the rock, usually solid, that underlies soil or other unconsolidated material.

Bedrock aquifer An aquifer composed of bedrock formations.

Bedrock valley A valley consisting primarily of a carbonate mineral such as calcite or dolomite, the chief minerals in limestone and dolostone, respectfully.

Best Management Practices or BMPs Techniques proven to be effective in controlling runoff, erosion and sedimentation including those documented in the Minnesota Construction Site Erosion and Sediment Control Planning Handbook (BWSR, 1988); Protecting Water Quality in Urban Areas (MPCA, 2000); the Minnesota Urban Small Sites BMP Manual (Metropolitan Council 2001); Minnesota Stormwater Manual (MPCA, 2005); and other sources as approved by the LSCWMO: as such documents may be amended, revised or supplemented.

Block-fault A section of rock separated from other rock by one or more faults.

Bluff A topographic feature such as a hill, cliff or embankment, the slope of which drains towards a water body, river, or adjoining watershed channel.

Bluffline A line along the top of a slope, connecting the points at which the slope, proceeding away from the river or adjoining watershed channel and which is not visually inconspicuous, becomes less than 12%. The location of the bluffline shall be certified by a registered land surveyor, soil scientist or landscape architect.

Buffer An area of natural, unmaintained, vegetated ground cover abutting or surrounding a watercourse, public waters wetland, or wetland.

BWSR The Minnesota Board of Water and Soil Resources.

Cave A naturally formed opening beneath the surface of the Earth, generally formed by dissolution of carbonate bedrock. Caves may also form by erosion of coastal bedrock, partial melting of glaciers, or solidification of lava into hollow tubes.

Channel morphology The general shape of a stream channel. Channel dimensions reflect magnitude of water and sediment discharges.

Confining unit An aquitard over an aquifer, with potentiometric head at higher elevation than the confining unit. A confining unit prevents groundwater from flowing upward.

Conservation easement An agreement negotiated on privately owned lands to preserve open space or protect certain natural resources.

Contact spring A spring located at the interface of an aquitard or confining layer and aquifer.

Contaminant In a broad sense, any physical, chemical, biological, or radiological substance or matter in water. In more restricted usage, a substance in water of public health or welfare concern. Also, an undesirable substance not normally present or an unusually high concentration of a naturally occurring substance, in water, soil, or other environmental medium.

Contour map A map displaying lines that connect points of equal value and separate points of higher value from points of lower value. Often used to show land or groundwater level surfaces.

Dendritic A drainage pattern in which tributaries branch irregularly in all directions from and at almost any angle to a larger stream. From an aerial view, it resembles the branching pattern of trees.

Development The construction of any public improvement project, infrastructure, structure, street, or road, or the subdivision of land.

Deviation from the mean The amount greater or less than the average.

Dolostone A carbonate rock (e.g. limestone) made up predominately of the mineral calcium magnesium carbonate.

Dry prairie A grassland community occurring on dry, often loess-derived soils, usually on steep south or west facing slopes or at the summits of river bluffs with sandstone or dolomite near the surface. Short to medium-sized prairie grasses are the dominants in this community.

Easement The right to use the land of another owner for a specified use. An easement may be granted for the purpose of constructing and maintaining walkways, roadways, individual subsurface sewage treatment systems, utilities, drainage, driveway, and other uses.

Ephemeral stream A stream that flows only in direct response to precipitation, and thus discontinues its flow during dry seasons. Such flow is usually of short duration.

Erosion The wearing away of the ground surface as a result of wind, flowing water, ice movement or land disturbing activities.

Erosivity index The calculation of potential for soil loss. The method uses a shortened version of Revised Universal Soil Loss Equation (RUSLE) to assess the potential for erosion in the watershed. This shortened equation omits the land cover and remedial factor of the equation, but includes rainfall, slope length, gradient, and soil characteristics.

Fault A fracture in rock along which movement can be demonstrated. A fracture in the earth's crust forming a boundary between rock masses that have shifted.

Floodplain The area adjacent to a waterbody that is inundated during a 100-year flood.

Flow The rate of water discharged from a source given in volume with respect to time.

Forbs Broad-leaved herbs other than grasses, especially growing in a field, prairie, or meadow.

Forest fragmentation Interruption of large expanses of forest by man-made clearings. Generally used where roads or areas of cropland are cleared within forested areas, thereby breaking a large continuous area of forest into smaller parcels of forest.

Freeboard The vertical distance between a design maximum water level and the top of a structure. The freeboard is a safety factor intended to accommodate the possible effect of unpredictable obstructions, such as ice accumulation and debris blockage that could increase stages above the design water surface.

Function and value *Functions* generally refer to the ecological (physical, chemical, and biological) processes or attributes of a wetland without regard for their importance to society. *Values* refer to wetland processes or attributes that are valuable or beneficial to society.

Geomorphic regions Land areas divided into regions by common geologic and topographic features.

Geomorphology The study of the nature and origin of the processes that create the physical landscape and the landforms that result from these processes. The processes include the effects

of tectonic forces, weathering, running water, waves, glacial ice, and wind, resulting in erosion, transportation, deposition of rocks, etc.

Glacial deposits Material deposited as a result of glacial activity. See also Quaternary deposits.

Glacial lake deposits Flat-topped hills composed of silt, sand, and gravel deposited at the bottom of lakes that developed in potholes in glaciers. When the surrounding ice melted, the lakes drained and the lakebed deposits were left as hills on the surrounding landscape.

Glacial till Glacial deposits composed of mostly unsorted sand, silt, clay, and boulders deposited directly by the glacial ice.

Gradient Steepness or angle of a slope. Also the rate of change in hydraulic head over distance.

Groundwater Water located in inter-connected pores found beneath the water table.

Groundwater discharge The process of groundwater leaving an aquifer.

Groundwater discharge area The point or region where groundwater leaves an aquifer. Groundwater discharge areas include the land surface, streams, lakes, wetlands, springs, and seeps. Groundwater also discharges to wells.

Groundwater Recharge The replenishment of groundwater storage through infiltration of surface runoff into subsurface aquifers.

Groundwater recharge area The region or area in which groundwater recharge occurs.

Groundwatershed The hydrologic boundary within the groundwater system within which all groundwater flow to a certain point.

Habitat The place or environment where a plant or animal naturally or normally lives and grows.

Hydraulic conductivity A coefficient of proportionality describing the rate at which water can move through an aquifer or other permeable medium.

Hydraulic head The top elevation of a water body under normal atmospheric pressure.

Hydrogeology The science of water use, quality, occurrence, movement, and transport beneath the earth's surface.

Hydrology The study of water, especially its natural occurrence, characteristics, control, and conservation.

Hydrologic cycle Movement of water in and on the earth and atmosphere. Numerous processes such as precipitation, evaporation, condensation, and runoff comprise the hydrologic cycle.

Hydrologic soil groups The classification of soils by their reference to the intake rate of infiltration of water, which is influenced by texture, organic matter content, stability of the soil aggregates, and soil horizon development.

Ice contact deposits Sediment deposited beneath or adjacent to the glacier margin. Ice contact deposits are typically rich in sand and gravel.

Ice walled lake deposits and glacial lake deposits Sand and silt deposits, which were formed in bottoms of lakes within or at the margin of a glacier.

Impaired water A waterbody that does not meet water quality standards and designated uses because of pollutant(s), pollution, or unknown causes of impairment.

Impervious Surface A constructed hard surface that either prevents or retards the entry of water into the soil and causes water to run off the surface in greater quantities and at an increased rate of flow than prior to development. Examples include rooftops, sidewalks, patios, driveways, parking lots, storage areas, and concrete, asphalt or gravel roads. Impervious surfaces must be calculated on a site by site basis.

Infiltration The movement of water into soil or porous rock. Infiltration occurs as water flows through the larger pores of rock or between soil particles under the influence of gravity, or as a gradual wetting of small particles by capillary action.

Infiltration Practice A stormwater retention method for the purpose of reducing the volume of stormwater runoff by transmitting a flow of water into the ground through the soils, as described in the Minnesota Stormwater Manual, 2005, and as amended.

Intermittent streams A stream that carries water only part of the time, generally in response to periods of heavy runoff from either snowmelt or storms. Flow generally occurs for several weeks or months in response to seasonal precipitation due to groundwater discharge, in contrast to the ephemeral stream that flows but a few hours or days following a single storm. Also referred to as a seasonal stream.

Invasive non-native species A non-native plant that moves in and takes over an ecosystem to the detriment of other species.

Karst A topography developed largely by the dissolution of bedrock. Karst topography is often characterized by features such as springs, sinkholes, solution valleys, caves, and disappearing streams.

Karst Investigation Area Areas identified in the LSCWMO Karst Feature Inventory and Management Plan (2007) where possible Karst features may be present. These areas include features such as tree clusters in open active agricultural land, areas that appear to have terminated swales, and depressional lows.

Karst Sensitive Area Areas consisting of less than 50 feet of soil cover to fractured bedrock, and the first bedrock encountered is either unconsolidated St. Peter Sandstone or the soluble dolomitic Prairie du Chien group.

Kenyon-Taopi Plain An irregularly shaped area of long rolling hills of silt-mantled till plain located in southeastern Minnesota.

Lacustrine Refers to features (such as sediments, landforms, plant communities, or animal communities) that were formed by or are associated with a lake.

Landlocked Basin A basin that is one acre or more in size at the overflow elevation and does not have a natural outlet at or below the existing 100-year flood elevation.

Limestone A sedimentary rock composed mostly of the carbonate mineral calcium carbonate.

Loam Soil composed of sand, silt, clay, and possibly organic material.

Local Government Unit (LGU) Any city or township wholly or partly within the Lower St. Croix Watershed Management Organization.

Loess Fine material consisting predominantly of silt with fine sand and clay. Loess is often deposited by wind.

MUSA (Metropolitan Urban Service Area) The outer edge of the metropolitan urban area, that part of the region which local and regional services are committed and which have urban levels of regional sewer and transportation service.

Moraine Landform created by glacial deposits. A **ground moraine** is a broad and level or gently undulating landform composed of material that was deposited underneath and sometimes at the margin of a glacier as the ice sheet melted; also referred to as a till plain. An **end moraine** is a usually hilly landform composed of material deposited at a margin of a glacier.

Multiple use buffer zones Buffer zones may have multiple uses such as serving as natural filtering systems, habitat corridors, feeding corridors, or moderating water level fluctuations during storm events.

Native plant A plant species that is a part of an area's original flora.

Nitrate An organic chemical compound composed of one nitrogen and three oxygen molecules (NO3). Sources of nitrate include fertilizers, pesticides, animal and human waste. Nitrate easily dissolves in water and readily moves through soil and into regional aquifers.

Non-point source pollution Pollution originating from diffuse areas (land surface or atmosphere) having no defined source. Examples include field agricultural chemicals and urban runoff pollutants.

Nutrient Element essential for plant or animal growth. Major nutrients include nitrogen, phosphorus, carbon, oxygen, sulfur, and potassium.

Ordinary high water level The highest level reached by a body of water under normal conditions.

Outwash deposits Sediment deposited by the glacier meltwater away from the glacier margin. Outwash is usually composed of sand, sand and gravel, or fine sand and silt.

Outwash plain A region of relatively flat to undulating topography covered by glacial outwash.

Paleozoic An era of geologic time lasting from 570 to 245 million years ago.

Perched (Lake or Wetland) A surface water body that is underlain by a fine grained geologic unit or aquitard that restricts the downward movement of surface water. Perched lakes and wetlands are less connected to groundwater systems.

Perennial Persisting for more than one year. For plants, a plant that lives for 3 years or more.

Perennial stream A stream that flows from source to mouth during all seasons of the year.

Permeability The ability of a substance, such as rock or soil, to allow a liquid to pass or soak through it.

Phosphorus An element that is essential to plant life but contributes to an increased trophic level (eutrophication) of water bodies.

Point source pollution Pollution originating from a single identifiable source. Examples include waste disposal sites, leaking storage tanks, chemical spills, ruptured pipelines, and individual sewage treatment systems.

Pollutant Any solute or cause of change in physical properties that renders water unfit for a given use.

Pollutant load Quantity of a pollutant that a waterbody is carrying measured at a point in time.

Porosity The ratio of the volume of void spaces in a rock or sediment to the total volume of the rock or sediment.

Pre-development Condition The land use on a site that exists immediately prior to a proposed alteration. Under pre-development conditions, the following Runoff Curve Numbers must be used for all agricultural land-uses unless site specific replacements are agreed upon by the LSCWMO. All other pre-development Runoff Curve Numbers must reference the Minnesota Hydrology Guide.

Allowable Runoff Curve Numbers for Agricultural Land-use

Hydrologic Soil Group	A	B	C	D
Runoff Curve Number	39	61	74	80

Based on Minnesota Hydrology Guide for Pasture

Pretreatment The alteration and/or reduction of certain water pollutants prior to discharge into a water quality treatment facility. Examples include a sediment forebay or grassed filter strip.

Primary porosity Created by a high degree of porosity in geologic materials such as sand and gravel.

Proterozoic The younger of the two divisions of Precambrian time, extending from 2.5 billion to 540 million years ago. It is often divided into the Early Proterozoic Era (2.5 to 1.6 billion years ago), the Middle Proterozoic Era (1.6 billion to 900 million years ago), and the Late Proterozoic Era (900 to 540 million years ago).

Public Waters Any waters as defined in Minnesota Statutes, section 103G.005, subdivision 15.

Public Waters Wetlands "Public waters wetland" means all types 3, 4, and 5 wetlands, as defined in United States Fish and Wildlife Service Circular No. 39 (1971 edition), not included within the definition of public waters, that are ten or more acres in size in unincorporated areas or 2-1/2 or more acres in incorporated areas.

Quaternary period Geologic time beginning about 1.5 million years ago to present.

Quaternary deposits Unconsolidated soils deposited during the Quaternary (most recent) geologic period.

Recurrence interval Average length of time between a given discharge being equaled or exceeded.

Redevelopment The rebuilding, repair, or alteration of a structure, land surface, road or street, or facility.

Regional blueprint Regional development guide prepared by the Metropolitan Council for the metropolitan area consisting of a growth strategy into the year 2040.

River terrace A mostly level to gently rolling landform that developed along the region's major river valleys by vastly larger glacial melt-water rivers. River terraces contain abundant sand and gravel deposits.

Sandstone A sedimentary rock composed of abundant rounded or angular fragments of sand set in a fine-grained cemented matrix of silt or clay.

Secondary porosity Alteration of geologic materials creating highly fractured and broken materials.

Sedimentary rock Any rock composed of sediment. The sediment may be particles of various sizes such as gravel or sand, the remains of animals or plants as in coal and some limestones or chemicals in solution that are extracted by organic or inorganic processes. Sandstone, shale, siltstone, and limestone are common sedimentary rocks.

Sedimentation The process or action of depositing sediment caused by erosion.

Seeps Groundwater/surface water connections caused by river or stream erosion into a near-surface aquifer.

Setback The minimum horizontal distance between a structure, sewage treatment system, or other facility and a street right-of-way, ordinary high water level mark, sewage treatment system, bluffline, road, highway, property line or other facility.

(201) Sewer Use Ordinance Chapter 8 of the Washington County Development Code. Provides rules on the type of waste which may be disposed in community soil treatment units and provides the legal basis for taxing and fee structures to fund waste system construction and maintenance.

Shale A fine-grained sedimentary rock, formed by the consolidation of clay, silt, or mud.

Shoreland District Shoreland areas regulated by a local municipal or county Shoreland Ordinance, or by Minnesota Statues 103F. Generally Shoreland District consists of land located within a floodplain, within 1,000 feet of the OHW of a public water or public waters wetland, or within 300 feet of a stream or river.

Siltstone A sedimentary rock composed primarily of silt-size materials.

Sinkhole A depression in the earth's surface caused by dissolving of underlying bedrock. Drainage is provided through underground channels which may be enlarged by dissolution or the collapse of a cavern roof.

Special Well Construction Areas (SWCA) An area designated by the Minnesota Department of Health where groundwater contamination is known to exist. In these areas well construction, repair, and sealing practices are more stringent than the minimum requirements specified by Minnesota Rules, Chapter 4725 (Well Code) in order to prevent human health exposure to harmful contaminants.

Spring A concentrated discharge of groundwater coming out at the surface as flowing water; a place where the water table crops out at the surface of the ground and where water flows out more or less continuously. Its occurrence depends on the nature and relationship of rocks, especially permeable and impermeable strata, on the position of the water table, and on the topography.

Stratigraphy The study of rock strata distribution, deposition, and age.

St. Croix Moraine A broad band of rugged, rolling hills that extends from St. Paul, northeastward through Washington County and into Wisconsin. Formed by deposits left at the margin of the Superior lobe, as it advanced and retreated during the last glacial episode.

Streambank The usual boundaries, not the flood boundaries, of a stream channel.

Stormwater runoff Water falling as rain during a storm and entering a surface water body by flowing over the land.

Subcrop The first bedrock unit encountered beneath surficial or Quaternary deposits.

Subwatershed A portion of land contributing runoff to a particular point of discharge.

Subsurface Sewage Treatment System A sewage treatment system, or part thereof, serving a dwelling, or other establishment, or group thereof, and using sewage tanks followed by soil treatment and disposal or using advanced treatment devices that discharge below final grade. Subsurface sewage treatment system includes holding tanks and privies.

Superfund The common name for the Federal program established by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended in 1986. The Superfund Law authorizes the U.S. Environmental Protection Agency to investigate and clean up sites nominated to the National Priorities List.

Surface Water All streams, lakes, ponds, marshes, wetlands, reservoirs, spring, rivers, drainage systems, waterways, watercourses, and irrigation systems whether natural or artificial, public or private.

Surface water runoff Precipitation, snowmelt, or irrigation in excess of what can infiltrate or be stored in small surface depressions.

Surficial deposit Sediments, typically unconsolidated, deposited above bedrock units. Examples include loess, Quaternary deposits, and sand dunes. Also see Quaternary deposits.

Terrace deposits Sand and gravel deposited by vastly large post-glacial rivers that ran through the St. Croix and Mississippi River valleys.

Till Un-stratified and unsorted material deposited directly by a glacier. Till consists of clay, sand, gravel, or boulders mixed in any proportion.

Thermal impacts The influx of heated water into a stream, lake, bay, or ocean, disturbing the temperature of the given body of water. The resulting shift to a warmer aquatic environment can cause a change in species composition and lower the dissolved oxygen content of the water.

Total Maximum Daily Load (TMDL) The maximum quantity of a particular water pollutant that can be discharged into a body of water without violating a water quality standard. TMDL also refers to the process of allocating pollutant loadings among point and nonpoint sources.

Turbidity Measures particles in the water, such as sediment and algae. Related to the depth sunlight can penetrate into the water. Higher turbidities reduce the penetration of sunlight in the water and can affect species of aquatic life that survive in the waterbody. Turbidity may be caused by a wide variety of suspended materials, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton and other microscopic organisms and similar substances.

Understory Plants growing beneath the canopy of other plants. Usually refers to grasses, forbs, and low shrubs under a tree or shrub.

Unsaturated zone (or zone of aeration) The part of the soil profile in which the voids are not completely filled with water. The zone between the land surface and the water table.

Upland The ground above a floodplain; that zone sufficiently above and/or away from transported waters as to be dependent upon local precipitation for its water supplies.

Waterbody All surface waters, watercourses and wetlands as defined in these Rules.

Watercourse Any natural or improved stream, river, creek, ditch, channel, culvert, drain, gully, ravine, swale or wash in which waters flow continuously or intermittently in a definite direction.

Water table The point beneath the unsaturated zone where aquifer materials are fully saturated and the water levels are directly responsive to changes in atmospheric pressure. The water table level may also be reflected in lakes, streams, and wetlands.

Water table aquifer The uppermost unconfined aquifer in any given area. Water table aquifers are commonly found in surface or glacial sediment but can be formed in bedrock aquifers.

Watershed A region draining to a specific watercourse or water basin.

Wetland Habitats where the soil is saturated or covered with water for part of the year.

Wetland bounce The amount of fluctuation a wetland experiences above its normal water level as a result of stormwater run-off.

Wetland mosaic or wetland complex A wetland that consists of a variety of plant community types and hydrologic regimes.

Well An artificial excavation put down by any method for the purposes of withdrawing water from the underground aquifers.

Wellhead Protection Plan A document that provides for the protection of a public water supply, submitted to the Minnesota Department of Health, is implemented by the public water supplier, and complies with: A) the wellhead protection elements specified in the 1986 amendments to the Federal Safe Drinking Water Act, United States Code, title 42, chapter 6A, subchapter XII, part C, section 300h-7 (1986 and as subsequently amended); and B) Minnesota Rules parts 4720.5200 to 4720.5290.

Wetland Any wetland as defined in Minnesota Statutes, section 103G.005, subdivision 19.

Wetland Conservation Act or WCA The Minnesota Wetland Conservation Act of 1991, as amended.

Woodland Any land used primarily for growing trees and shrubs. Woodland includes, in addition to what is ordinarily termed "forest" or "forest plantations", shelterbelts, windbreaks, wide hedgerows containing woodland species for wildlife food or cover, stream and other banks with woodland cover, etc.

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Appendices

Appendix A

Lower St. Croix Watershed Management Organization Joint Powers Agreement

JOINT POWERS AGREEMENT

BETWEEN

CITY OF AFTON, MINNESOTA
CITY OF COTTAGE GROVE, MINNESOTA
TOWN OF DENMARK, MINNESOTA AND
CITY OF HASTINGS, MINNESOTA

ESTABLISHING AND EMPOWERING THE

LOWER ST. CROIX

WATERSHED MANAGEMENT ORGANIZATION

THIS AGREEMENT is made and entered into this _____ day of _____, 2005, by and between the TOWN OF DENMARK, CITY OF AFTON, CITY OF COTTAGE GROVE, and the CITY OF HASTINGS, hereinafter referred to collectively as the "Parties", all local government units in Washington and Dakota Counties, Minnesota.

WHEREAS, the Parties may jointly exercise common authority by adopting a joint powers agreement pursuant to M.S. 471.59; and

WHEREAS, by means of a joint powers agreement, the Parties may establish a water management organization pursuant to M.S. 103B.211; and

WHEREAS, a portion of each Party's territory lies within the geographical area hereinafter referred to as the "Watershed" which watershed is illustrated and described on "Exhibit A" attached hereto; and

WHEREAS, each of the Parties is desirous of jointly creating a water management organization that would adopt a watershed management plan to preserve and use natural water storage and retention systems, where possible, in order to:

a. protect, preserve, and use natural surface and groundwater storage and retention systems,

b. minimize public capital expenditures needed to correct flooding and water quality problems,

c. identify and plan for means to effectively protect and improve surface and groundwater quality,

d. establish more uniform local policies and official controls for surface and groundwater management,

e. prevent erosion of soil into surface water systems,

f. promote groundwater recharge,

g. protect and enhance fish and wildlife habitat and water recreational facilities, and

h. secure the other benefits associated with the proper management of surface water within the Watershed.

NOW, THEREFORE, in consideration of the mutual undertakings herein expressed, the Town of Denmark, City of Afton, City of Cottage Grove and City of Hastings agree as follows:

SECTION I

ESTABLISHMENT OF WATERSHED MANAGEMENT ORGANIZATION

The Lower St. Croix Watershed Management Organization is hereby established; the operation of the Organization shall be subject to the terms and conditions of this Agreement. The Organization shall be a public agency of the Parties.

SECTION II

DEFINITIONS

For purposes of this Agreement, the terms used herein shall have the meanings as defined in this section.

Subdivision 1. The "Organization" means the Watershed Management Organization established by this Agreement.

Subdivision 2. "Board" or "Board of Commissioners" means the governing body of the Organization.

Subdivision 3. "Watershed" means the geographical area described and/or illustrated on "Exhibit A" attached and made a part of this Agreement.

Subdivision 4. "Commissioner" means a member of the Board of Commissioners.

Subdivision 5. "Capital Improvement Program" means an itemized program for at least a five-year period and any amendments to it, subject to at least biennial review, setting forth the schedule, timing and details of specific contemplated capital improvements by year, together with their estimated costs, the need for each improvement, financial sources for the payment of such improvements and the financial effect that the program will have on the Parties or the Organization.

Subdivision 6. "Local Water Management Plan" means a plan adopted by the Town of Denmark, City of Afton, City of Cottage Grove and City of Hastings pursuant to M.S. 103B.235.

Subdivision 7. "Watershed Management Plan" means a plan adopted by the organization pursuant to M.S. 103B.231.

Subdivision 8. "Proportionate Share" means that portion of the total sum required that each Party's tax capacity of real property lying within the Watershed bears to the tax capacity of all real property lying within the Watershed. Part of the proportionate share may include property owned by the State of Minnesota.

Subdivision 9. "Subwatershed" means a hydrologic area less than the entire area under the jurisdiction of the Organization.

Subdivision 10. "Regional Project" means a capital improvement project that benefits more than one Party, involves several subwatersheds and impacts more than one water body of regional importance as defined in the Watershed Management Plan.

SECTION III

BOARD OF COMMISSIONERS

Subdivision 1. Appointment. The Organization shall be governed by a three (3) member Board of Commissioners and one ex-officio member from the City of Hastings, with each Commissioner and ex-officio being appointed by each of the Parties. Each Party may appoint an alternate Commission member to serve in the event that the regular member is unable to attend.

Subdivision 2. Eligibility. Each Commissioner or alternate Commission member may be elected or appointed by each of the Parties.

Subdivision 3. Term of Office. Each Commissioner shall be appointed for a term of three years.

Each Commissioner shall be entitled to serve the full term of three years for which he or she was appointed, subject only to removal by the appointing Party for just cause in accordance with M.S. 103B.227, Subdivision 3. Just cause includes, but is not limited to, failure of a Commissioner to attend three of any four consecutive meetings of the Board of Commissioners, including both regular and special meetings. In the event a Commissioner is removed from office under these conditions, the Party causing the removal shall appoint a new Commissioner to complete the term of the removed Commissioner. A Commissioner's term shall expire on his or her death, voluntary resignation or, in the case of an elected official, his or her ceasing to be an elected official.

In the event a Commissioner is removed from office under these conditions, or upon expiration of the term of a Commissioner, the appointing Party shall appoint a new commissioner within ninety (90) days of when the vacancy occurs. The appointing Party shall publish a Notice of Vacancy at least fifteen (15) days prior to the appointment in its legal newspaper. The notice must be published at least once in a newspaper of general circulation in the Watershed and must state that persons interested in being appointed to serve on the Board may submit their names to the Party for consideration all in accord with M.S. 103B.227.

The Organization shall notify the Board of Water and Soil Resources of member appointments and vacancies within thirty (30) days.

Nothing herein shall be deemed to require a Party to remove a Commissioner under any circumstances.

Subdivision 4. Vacancy. Any vacancy shall be filled for the unexpired term of any Commissioner by the Party who appointed said Commissioner.

Subdivision 5. Record of Appointment. Each Party shall, within thirty (30) days following the appointment of a Commissioner, file a written notice of such appointment with the Secretary of the Board.

Subdivision 6. Compensation. Each Party shall determine the rate of compensation, if any, of its Commissioners.

Subdivision 7. Officers of the Board. At the first meeting of the Board and in January of each year thereafter, the Board shall elect from its Commissioners a chairperson, a secretary, a treasurer and such other officers as it deems necessary to conduct its meetings and affairs. Each officer so elected shall serve until January 1st of the subsequent year, or until a respective successor is selected and qualifies.

Subdivision 8. Rules of the Board. Except as hereinafter provided, Board action shall be by a majority vote of the entire Board. The Board shall use Roberts Rules of Order in the conduct of its meetings.

Subdivision 9. Adoption of Rules. The Board may adopt rules and regulations and may amend such rules and regulations from time to time in either a regular or special meeting of the Board provided that notice of such proposed rule, regulation or amendment has been given to each Commissioner at least ten (10) days prior to the meeting at which the proposed amendment will be considered. A majority vote of the entire Board shall be necessary to adopt or amend such rules and regulations.

Subdivision 10. Quorum. A majority of the entire Board shall constitute a quorum, but less than a quorum may adjourn a scheduled meeting.

Subdivision 11. Project Recommendations. Board recommendations regarding capital improvement projects shall require a two-thirds (2/3) majority vote by the entire Board.

Subdivision 12. Meetings. Regular meetings of the Board shall be held at such times and dates as established by the Board. Meeting dates, times and locations will be posted in each Party's town or city hall. Special meetings may be held at the request of the Board Chairman or at the request of any two Commissioners provided that such special meeting shall be preceded by not less than three (3) business days posted and mailed or delivered notice to the residence of each Commissioner. All meetings of the Board shall be subject to the provisions of the Minnesota Open Meeting Law.

Subdivision 13. Location of Board Office. The Board shall maintain a business office at an address agreeable to the Board. All notices to the Board shall be delivered or served to such office. The Organization shall compensate the Parties for their respective services rendered to the Organization in conjunction with the maintenance of the Board Office.

SECTION IV

WATERSHED MANAGEMENT TAX DISTRICT

Each Party may establish a watershed management tax district for the portion of its community boundaries which lie within the Watershed pursuant to the provisions of M.S. 103B.245. Neither the provisions of this Agreement nor the establishment of a watershed management tax district shall prevent the Parties from electing to finance capital improvements within the Watershed by other means, such as establishing a storm water utility.

SECTION V

POWER AND DUTIES OF THE BOARD OF COMMISSIONERS

Subdivision 1. Organization. The Organization, acting by its duly appointed Board of Commissioners, shall have the powers and duties set forth in this section.

Subdivision 2. Watershed Management Plan. The Board shall prepare a Watershed Management Plan pursuant to M.S. 103B.231 for the Watershed, which shall be submitted to the parties for comment. The Plan shall:

a. describe the existing physical environment, land use and development in the Watershed and shall further describe the environment, land use and development proposed in the existing Comprehensive Plans for each of the Parties;

b. present information on the hydrologic system in the Watershed, the system's components and existing and potential problems relating thereto;

c. state objectives and policies, including management principles, alternatives and modifications, water quality and protection of natural characteristics;

d. set forth a management plan including the hydrologic and water quality conditions that will be sought and significant opportunities for improvement;

e. describe conflicts between the Watershed Management Plan and existing plans of the Parties;

f. identify high priority areas for wetland preservation, enhancement, restoration and establishment and describe any conflicts with wetlands and land use in these areas;

g. set forth an implementation program consistent with the management plan which includes a capital improvement program and standards and schedules for amending the Comprehensive Plans and official controls of the Parties in order to bring about conformance with the Watershed Management Plan for the Watershed;

h. set out procedures and timelines for amending the Watershed Management Plan.

Subdivision 3. Operating Budget. On or before July 1st of each year, the Board shall prepare an operating budget for the following year for the purpose of providing funds to operate the Commission's business. The portion of the operating budget for general administration owed by the City of Hastings shall be paid by the Town of Denmark as it represents less than one percent of the Watershed. The operating budget shall be submitted to the Parties for comment and approval. The operating budget must be approved by a majority of the City of Cottage Grove, City of Afton and Town of Denmark. The budget shall be approved by the Board pursuant to Section III Subdivision 8 hereof. The Secretary shall certify the approved budget on or before September 2 of each year to each of the Parties, until such time as special legislation is passed which would allow the Secretary to certify the approved budget to the auditor of Washington County. Upon authorization by law, the Secretary shall certify the approved budget to the Washington County Assessor. The Secretary shall certify the budget to the clerk of each member governmental unit together with a statement of the proportion of the budget to be provided by each member. Each member shall pay one-half of their portion of the annual operating budget by July 31 and the balance on December 31 of each year.

Each of the Parties agrees to contribute each year to a general fund, said fund to be used for general administration purposes including, but not limited to: salaries, rent, supplies, development of an overall plan, engineering and legal expenses, insurance, and bonds and to purchase and maintain devices to measure hydrological and water quality data. The parties will reach an agreement on their respective percentage and on an initial basis the Town of Denmark will pay 67 percent of the annual operating budget, the City of Afton will pay 21 percent of the annual operating budget and the City of Cottage Grove will pay 12 percent of the annual operating budget. In the event that the parties cannot come to an agreement, the annual contribution by each member shall be based fifty percent (50%) on the net tax capacity of all property within the watershed and fifty percent (50%) on the basis of total area of each member

within the boundaries of the watershed each year to the total area in the Lower St. Valley Watershed Management Organization governed by this Agreement. In no event shall any assessment require a contribution for general fund purposes to exceed one-half of one percent of the net tax capacity of lands within the watershed.

Subdivision 4. Board Authority. The board shall have:

a. the authority to prepare, adopt, and implement a plan for the watershed meeting the requirements of section 103B.231;

b. the authority to review and approve local water management plans as provided in section 103B.235;

c. the authority of a watershed district under chapter 103D to regulate the use and development of land in the watershed when one or more of the following conditions exists:

(i) the local government unit exercising planning and zoning authority over the land under sections 366.10 to 366.19, 394.21 to 394.37, or 462.351 to 462.364, does not have a local water management plan approved and adopted in accordance with the requirements of section 103B.235 or has not adopted the implementation program described in the plan;

(ii) an application to the local government unit for a permit for the use and development of land requires an amendment to or variance from the adopted local water management plan or implementation program of the local unit; or

(iii) the local government unit has authorized the organization to require permits for the use and development of land;

d. the authority of a watershed district under section 103D.625, to accept the transfer of drainage systems in the watershed, to repair, improve, and maintain the transferred drainage systems, and to construct all new drainage systems and

improvements of existing drainage systems in the watershed, provided that: (i) projects may be carried out under the powers granted in sections 103B.205 to 103B.255 or chapter 103D or 103E; and (ii) proceedings of the board with respect to the systems must be in conformance with the watershed plan adopted under section 103B.231;

e. the authority of a watershed district under section 103D.911 to adopt a budget and decide on the total amount necessary to be raised from ad valorem tax levies to meet the budget;

f. the authority of a watershed district under section 103D.915 to certify its budget with the auditor of Washington County, upon passage of special legislation;

g. the authority of a watershed district under section 103D.901 to file approved assessment statements with Washington County; and

h. other powers necessary to exercise the authority under clauses (a) to (c), including the power to enter into contracts for the performance of functions with governmental units or persons.

i. enact and promulgate rules and regulations along with determining the appropriate fees to be charged for any permitting programs established by the Water Management Organization.

Subdivision 5. Capital Improvements Projects. On or before July 1st of each year, the Commission shall prepare a capital improvements program for the purpose of funding improvements within the watershed. The City of Hastings shall be given written notice by the Board of any improvement projects and shall have the ability to vote on Capital Improvement Projects in the area geographically in the City of Hastings. The capital improvements program shall be submitted to the Parties for comment. Capital improvements may be funded by a responsible party or responsible Parties as it or they may choose. In the absence of a contrary

agreement, capital improvements shall be funded pursuant to Minnesota Statutes § 103B.251 by a county ad valorem tax levied within the Watershed.

The Organization shall apportion the costs of the capital improvements on the following basis:

1. A negotiated amount to be arrived at by the members who have lands in the subdistrict. It is anticipated that most capital improvements will be made under this provision; or

2. (a) Fifty percent of all capital costs or the financing thereof shall be apportioned to each member on the basis of the net tax capacity of each member within the boundaries of the watershed each year to the total net tax capacity in the Lower St. Croix Valley Watershed area governed by this agreement.

(b) Fifty percent of all capital costs or the financing thereof shall be apportioned to each member on the basis of the total area of each member within the boundaries of the watershed each year to the total area in the Lower St. Croix Watershed governed by this agreement.

(c) Capital costs allocated under the 50% area-50% net tax capacity formula herein set forth may be varied by the Commission by a 2/3 vote of all eligible members if:

(1) any member community receives a direct benefit from the capital improvement which benefit can be defined as a lateral as well as a trunk benefit, or

(2) the capital improvement provides a direct benefit to one or more members which benefit is so disproportionate as to require in a sense of fairness a modification in the 50/50 formula.

(d) Credits to any member for lands acquired by said member to pond or store storm and surface water shall be allowed against costs set forth in Subsections 1 or 2 of this Subdivision and if the project is constructed and financed pursuant to Minnesota Statutes 103B.251, the members understand and agree that said costs

will be levied on all taxable property in the watershed district as set forth in the statute.

The Organization may participate in the funding of capital improvements using special assessments to benefitted properties, levies for one or more taxing districts and/or fees based on contributing waters only to the degree of specificity defined in the capital improvement program of the Water Management Plan.

Subdivision 6. Review and Recommendations. The Board shall review and make recommendations where the Board is authorized or requested to review and make recommendations on any matter submitted to the Watershed Management Organization.

Subdivision 7. Data. The Board may establish and maintain devices for acquiring and recording water quality and hydrological data within the Watershed.

Subdivision 8. Right of Entry. The Board or its authorized agents may enter upon lands within or without the Watershed to make surveys and investigations to accomplish the purposes of the Board. Except to investigate violations of permits or in cases of emergency, entry upon lands within and without the watershed shall be upon permission of the land owner or upon 24 hours written notice from the Board. The Board shall be liable for actual damages resulting therefrom, but every person who claims damages shall serve the Chairperson or Secretary of the Board with a notice of claim as required by M.S. 466.05.

Subdivision 9. Legal and Technical Assistance. The Board may provide legal and technical assistance in connection with litigation or other proceedings between one or more of its members and any other political subdivision, commission, board or agency relating to the planning or construction of facilities to drain or pond storm waters within the Watershed. The use of Board funds for litigation shall be only upon a favorable vote of a majority of the eligible votes of the members of the Board.

Subdivision 10. Professional Services. The Board shall every two (2) years solicit interest proposals for legal, professional, or technical consultant services before retaining or extending the services of an attorney or consultant or extending an annual services agreement.

The Board may secure legal, professional or technical services for specific projects not to exceed an expenditure of $5,000.00 without solicitation of proposals.

Subdivision 11. Reserve Funds. The Board may accumulate reserve funds for the purposes herein mentioned and may invest funds of the Board not currently needed for its operations in the manner and subject to the laws of Minnesota applicable to statutory cities.

Subdivision 12. Monies Collectable. The Board may collect monies, subject to the provisions of this Agreement, from the Parties and from any other source approved by a majority of the Board.

Subdivision 13. Contracts. The Board may make contracts, incur expenses and make expenditures necessary and incidental to the effectuation of these purposes and powers and may disburse therefore in the manner hereinafter provided. Every contract for the purchase or sale of merchandise, materials or equipment by the Board shall be let in accordance with the Uniform Municipal Contracting Law. No member or employee of the Board or officer or employee of any of the Parties shall have a direct or indirect financial interest in any contract made by the Board.

Subdivision 14. Surveys. The Board may make necessary surveys or utilize other reliable surveys and data and develop projects to accomplish the purposes for which the Board is organized.

Subdivision 15. Other Governmental Units and Agencies. The Board may cooperate or contract with the State of Minnesota or any subdivision thereof or Federal Agency or private or public organization or person to accomplish the purposes for which it is organized.

Subdivision 16. Storm and Surface Waters. The Board shall regulate, conserve and control the use of storm and surface water within the Watershed pursuant to its adopted plan.

Subdivision 17. Insurance. The Board shall purchase insurance in order to cover the Commissioners, Board and Parties in an amount sufficient to satisfy the liability limitations as set forth in Minnesota Statutes, Chapter 466. The Board may also purchase such other insurance as the Board deems necessary for the protection of the Organization, Commissioners or Parties.

Subdivision 18. Amendments. The Board may recommend changes in this Agreement to the Parties.

Subdivision 19. Other Powers. The Board may exercise all other powers granted to joint powers watershed management organizations by Minn. Stat. §§ 103B.201 through 103B.211, as such laws may be amended in the future, except as explicitly restricted or limited in this agreement.

Subdivision 20. Gifts, Grants, Loans. The Organization may, within the scope of this Agreement, accept gifts, apply for use grants or loans of money or other property from the United States, the State of Minnesota or other governmental unit or organization or from any person or entity for the purpose described herein and may enter into any reasonable agreement required in connection therewith; it shall comply with any laws or regulations applicable thereto; and it shall hold, use and dispose of such money or property in accordance with the terms of the gift, grant, loan or agreement relating thereto.

Subdivision 21. Citizen and Technical Advisory Committees. The Board shall establish citizen and technical advisory committees or other such committees as it deems necessary.

Subdivision 22. Administration. The Board may contract with any of the Parties or to have any of the Party's staff personnel perform clerical functions for the Board such as accounting, record keeping, maintaining of accounts or other administrative duties which the Board may specify. The Board may contract or hire staff, as needed, to perform any functions mentioned herein.

SECTION VI

DURATION

Subdivision 1. This agreement shall remain in effect until terminated by any of the Parties hereto according to the provisions set forth in Subdivision 2 of this Section. At least 90 days prior to termination, the organization must notify the Washington County Board of any

impending termination so that the responsibilities for implementing M.S. 103B.201 to 103B.251 are provided for in an orderly manner.

Subdivision 2. Any Party, except the ex-officio member, may petition the Board to dissolve the agreement. Upon 30 days' notice in writing to the clerk of each Party, the Board shall hold a hearing and upon a favorable vote of 2/3 of the Commissioners, the Board may by resolution recommend that the Watershed Management Organization be dissolved. The resolution shall be submitted to each member community and if ratified by 2/3 (2 out of 3 units of government) of the member communities within 90 days, the Watershed Management Organization shall dissolve. The Board shall complete work in progress and dispose of personal property owned by the Watershed Management Organization within the 90 day period.

Subdivision 3. Upon dissolution of the Organization, all property of the Organization shall be sold and the proceeds thereof, together with the monies on hand, shall be distributed to the Parties in proportion to the contributions made by each to the Organization.

SECTION VII

ARBITRATION

The Parties to this Joint Powers Agreement agree that any controversy that cannot be resolved between the Parties and the Organization shall be submitted to binding arbitration. The Uniform Arbitration Act (Minnesota Statutes Sections 572.08-572.30) is adopted by the Organization as the authority to be followed in submitting all controversies to arbitration. The results of the arbitration shall be binding on the Parties and the Organization. Arbitration shall be by a panel of three arbitrators. The Parties and the Organization shall each select one arbitrator to represent its position in the controversy. The two arbitrators shall then select a third arbitrator and, in the event they are unable to agree on a third arbitrator, either side may petition the District Court to appoint a third arbitrator. Thereafter, arbitration shall proceed as outlined in the Uniform Arbitration Act.

SECTION VIII

EFFECTIVE DATE

This agreement shall be in full force and effect after the date of execution of the same by authorized representatives of the Parties.

IN WITNESS WHEREOF, the Town of Denmark, City of Afton, City of Cottage Grove and City of Hastings have hereunto set their hands the day and year first above written.

TOWN OF DENMARK

BY_____

_____

CITY OF AFTON

BY___

_____

CITY OF COTTAGE GROVE

BY_____

_____

CITY OF HASTINGS

BY_____

_____

This agreement was drafted by:
Kevin K. Shoeberg
KEVIN K. SHOEBERG, P.A.
1805 Woodlane Drive
Woodbury, MN 55125
651.735.9340

Appendix B

Watershed Issues

Watershed Issues Identified at the Plan Kick-off Meeting

Issue 1. Questionable impervious areas within developments along St. Croix River and subsequent erosion along bluffs.

Issue 2. Need for controlled development within areas draining to Mississippi and St. Croix River bluffs.

Issue 3. Increased popularity of animal agriculture practices in Washington County and potential threat to resources and water quality.

Issue 4. Individual septic tank systems and potential impact on groundwater resources.

Issue 5. Sediment loads in Trout Brook.

Issue 6. Potential designation of Trout Brook as a Metro Trout Stream by DNR.

Issue 7. Concern for growth in neighboring watersheds and their impact on watershed boundaries.

Issue 8. Consistency with Comprehensive Plans and potential future conflicts over water and sewer needs, particularly with neighboring communities.

Issue 9. Phase II stormwater issues and need for stormwater ordinances at the local level including erosion control and rate control.

Issue 10. Impact that large recreational complexes are having on soil erosion, groundwater resources and surface water quality of Trout Brook.

Issue 11. St. Croix River flooding at south end of village of Afton.

Issue 12. Gully erosion along entire bluff line.

Issue 13. Historical dumping within ravines and coulees and potential impact clean up or restoration would have.

Issue 14. Nitrates in groundwater and need for policies that limit nitrate application for residential and agricultural uses.

Issue 15. Kelle's Coulee and Trout Brook are identified as high quality natural resources in need of protection.

Issue 16. Flood protection for future developments.

Issue 17. Mining activities impacting surface water quality of O'Conners Creek.

Issue 18. Standards and rules are needed to regulate mining activities at the local level.

Issue 19. O'Conners Lake is a high quality groundwater dependent landlocked lake.

Issue 20. Protection of natural resources is a key issue.

Issue 21. Protection of groundwater dependent natural resources and private water supply systems as a result of private and large scale municipal pumping.

Issue 22. Implementation of the County Groundwater Plan.

Issue 23. Karst features in the watershed threaten groundwater quality.

Issue 24. The negative effect of infiltration on groundwater quality.

Issue 25. Need to explore alternative funding mechanisms including special legislation in the future.

Issue 26. Federal funding programs including FARM Aid should be used to fund initiatives. Funding also available through the WCD to develop/install BMPs, nutrient management strategies, buffer strips, conservation tillage initiatives, etc.

Additional Watershed Issues Raised by State Review Agency, City, County, and Township Staff

Issue 27. Nutrient and sediment management plan to support the phosphorus reduction goal of the St. Croix Basin. (*St. Croix Basin Water Resources Planning Team, MPCA, DNR*)

Issue 28. Need to address MPCA list of impaired waters. (*BWSR*)

Issue 29. Coordination with Washington County Water Governance strategies. (*BWSR*)

Issue 30. Need for an updated JPA at the time of plan submittal to review agencies. (*BWSR*)

Issue 31. Need for an Administrative Implementation Plan (AIP) that will document minimum standards, procedures for membership, and tapestry of authorities. (*BWSR*)

Issue 32. Need for a focused plan that addresses WMO priorities and develops long term vision for water management. (*BWSR*)

Issue 33. Need for standards for floodplain and freeboard requirements, impervious surface limits, wetland management roles, stormwater runoff controls, erosion and sediment control, and coordination with the MPCA. Also include requirements

for buffers, overlay districts near priority resources, and wellhead protection areas. (*BWSR*)

Issue 34. Need to review Washington County ISTS ordinance and administration within the watershed to provide a synopsis of conditions, applicable ordinances, permitting, construction practices, etc. to users of the plan. *(MPCA)*

Issue 35. Need to utilize stormwater management practices that are specialized for karst regions. *(MPCA)*

Issue 36. Need to define groundwater sheds in order to appropriately identify and address potential contaminant sources. *(MDH)*

Issue 37. Need to collaborate with public water suppliers and the Minnesota Department of Health on the development and implementation of Wellhead Protection Plans (WHP). *(MDH)*

Issue 38. Need to maintain groundwater quantity through appropriate stormwater management. *(MDH)*

Appendix C

Rare Features Database, Minnesota Natural Heritage and Nongame Research Program, Department of Natural Resources

LOWER ST CROIX WATERSHED MANAGEMENT PLAN
WASHINGTON COUNTY
MnDNR, Natural Heritage and Nongame Research Program

Minnesota Natural Heritage Database
Element Occurrence Records

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TWP	RNG	PRIMARY SECTION	FED STATUS	MN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
T026N	R20W	04		SPC		ACIPENSER FULVESCENS (LAKE STURGEON) #200	
T026N	R20W	04		THR		BESSEYA BULLII (KITTEN-TAILS) #30	
T026N	R20W	04		SPC		BUTEO LINEATUS (RED-SHOULDERED HAWK) #29	CARPENTER NATURE CENTER
T026N	R20W	04		SPC		CYCLEPTUS ELONGATUS (BLUE SUCKER) #73	
T026N	R20W	04		SPC		CYCLEPTUS ELONGATUS (BLUE SUCKER) #99	CARPENTER NATURE CENTER
T026N	R20W	04		SPC		JUNIPERUS HORIZONTALIS (CREEPING JUNIPER) #35	CARPENTER NATURE CENTER
T026N	R20W	04		SPC		PANAX QUINQUEFOLIUS (AMERICAN GINSENG) #41	
T026N	R20W	05			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #22	
T026N	R20W	07		SPC		BUTEO LINEATUS (RED-SHOULDERED HAWK) #28	MISSISSIPPI NATL RIVER & RECREATION AREA
T026N	R20W	08			S3	FLOODPLAIN FOREST SILVER MAPLE SUBTYPE #14	MISSISSIPPI NATL RIVER & RECREATION AREA
T026N	R20W	08	LT	SPC		HALIAEETUS LEUCOCEPHALUS (BALD EAGLE) #942	MISSISSIPPI NATL RIVER & RECREATION AREA
T026N	R20W	09		SPC		ACIPENSER FULVESCENS (LAKE STURGEON) #95	
T026N	R20W	09		THR		ACTINONAIAS LIGAMENTINA (MUCKET MUSSEL) #118	
T026N	R20W	09		THR		CYCLONAIAS TUBERCULATA (PURPLE WARTYBACK MUSSEL) #36	LOWER ST. CROIX NSR
T026N	R20W	09		THR		ELLIPSARIA LINEOLATA (BUTTERFLY MUSSEL) #18	LOWER ST. CROIX NSR
T026N	R20W	09		END		ELLIPTIO CRASSIDENS (ELEPHANT-EAR MUSSEL) #5	LOWER ST. CROIX NSR
T026N	R20W	09		SPC		ELLIPTIO DILATATA (SPIKE MUSSEL) #60	LOWER ST. CROIX NSR
T026N	R20W	09		END		FUSCONAIA EBENA (EBONYSHELL MUSSEL) #12	LOWER ST. CROIX NSR
T026N	R20W	09	LE	END		LAMPSILIS HIGGINSI (HIGGINS EYE MUSSEL) #3	
T026N	R20W	09		SPC		LIGUMIA RECTA (BLACK SANDSHELL MUSSEL) #132	LOWER ST. CROIX NSR
T026N	R20W	09		THR		MEGALONAIAS NERVOSA (WASHBOARD MUSSEL) #1	LOWER ST. CROIX NSR
T026N	R20W	09				MUSSEL SAMPLING SITE #196	
T026N	R20W	09		SPC		NOTROPIS AMNIS (PALLID SHINER) #17	
T026N	R20W	09		SPC		OBOVARIA OLIVARIA (HICKORYNUT MUSSEL) #38	LOWER ST. CROIX NSR
T026N	R20W	09		END		PLETHOBASUS CYPHYUS (SHEEPNOSE MUSSEL) #3	LOWER ST. CROIX NSR
T026N	R20W	09		THR		PLEUROBEMA COCCINEUM (ROUND PIGTOE MUSSEL) #55	LOWER ST. CROIX NSR
T026N	R20W	09		THR		POLYODON SPATHULA (PADDLEFISH) #40	
T026N	R20W	09		THR		QUADRULA METANEVRA (MONKEYFACE MUSSEL) #30	
T026N	R20W	09		THR		TRITOGONIA VERRUCOSA (PISTOLGRIP MUSSEL) #34	LOWER ST. CROIX NSR
T026N	R21W	01			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #131	MISSISSIPPI NATL RIVER & RECREATION AREA
T026N	R21W	01			S3	MAPLE-BASSWOOD FOREST (EAST CENTRAL) #20	MISSISSIPPI NATL RIVER & RECREATION AREA
T026N	R21W	01			S3	MOIST CLIFF (SOUTHEAST) #9	MISSISSIPPI NATL RIVER & RECREATION AREA
T026N	R21W	01			S3	OAK FOREST (CENTRAL) DRY SUBTYPE #17	
T026N	R21W	02		END		AMMODRAMUS HENSLOWII (HENSLOW'S SPARROW) #38	AFTON STATE PARK
T027N	R20W	02		SPC		BAPTISIA ALBA (WHITE WILD INDIGO) #3	AFTON STATE PARK
T027N	R20W	02		THR		BESSEYA BULLII (KITTEN-TAILS) #23	AFTON STATE PARK
T027N	R20W	02		THR		BESSEYA BULLII (KITTEN-TAILS) #24	AFTON STATE PARK
T027N	R20W	02		SPC		BUTEO LINEATUS (RED-SHOULDERED HAWK) #325	AFTON STATE PARK
T027N	R20W	02			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #108	AFTON STATE PARK
T027N	R20W	02			S2	FLOODPLAIN FOREST #42	AFTON STATE PARK
T027N	R20W	03			S2	OAK FOREST (CENTRAL) MESIC SUBTYPE #43	AFTON STATE PARK
T027N	R20W	09			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #129	
T027N	R20W	10		THR		CROTALUS HORRIDUS (TIMBER RATTLESNAKE) #39	
T027N	R20W	10			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #125	
T027N	R20W	14				MUSSEL SAMPLING SITE #197	
T027N	R20W	14		THR		POLYODON SPATHULA (PADDLEFISH) #113	
T027N	R20W	16			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #114	
T027N	R20W	16			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #117	

Minnesota Natural Heritage Database
Element Occurrence Records

LOWER ST CROIX WATERSHED MANAGEMENT PLAN
WASHINGTON COUNTY
MnDNR, Natural Heritage and Nongame Research Program

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TWP	RNG	PRIMARY SECTION	FED STATUS	MN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
T027N	R20W	16		SPC		MINUARTIA DAWSONENSIS (ROCK SANDWORT) #12	
					S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #110	
T027N	R20W	20			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #113	LOST VALLEY PRAIRIE SNA
T027N	R20W	21				MINUARTIA DAWSONENSIS (ROCK SANDWORT) #11	
T027N	R20W	21		SPC		MUSSEL SAMPLING SITE #244	
T027N	R20W	22			S2	OAK FOREST (CENTRAL) MESIC SUBTYPE #49	
T027N	R20W	23		SPC		ACIPENSER FULVESCENS (LAKE STURGEON) #199	
T027N	R20W	26		THR		POLYDON SPATHULA (PADDLEFISH) #114	
T027N	R20W	27			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #25	
T027N	R20W	27			S2	OAK FOREST (CENTRAL) MESIC SUBTYPE #45	
T027N	R20W	28		THR		BESSEYA BULLII (KITTEN-TAILS) #100	
T027N	R20W	28			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #112	LOST VALLEY PRAIRIE SNA
T027N	R20W	28		SPC		MINUARTIA DAWSONENSIS (ROCK SANDWORT) #10	
T027N	R20W	29		SPC		AFLEXIA RUBRANURA (RED-TAILED PRAIRIE LEAFHOPPER) #9	LOST VALLEY PRAIRIE SNA
T027N	R20W	29		END		BOTRYCHIUM ONEIDENSE (BLUNT-LOBED GRAPEFERN) #22	LOST VALLEY PRAIRIE SNA
T027N	R20W	29		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #30	LOST VALLEY PRAIRIE SNA
T027N	R20W	29		SPC		CIRSIUM HILLII (HILL'S THISTLE) #31	LOST VALLEY PRAIRIE SNA
T027N	R20W	29		SPC		OPUNTIA MACRORHIZA (PLAINS PRICKLY PEAR) #19	LOST VALLEY PRAIRIE SNA
T027N	R20W	33			S2	OAK FOREST (CENTRAL) MESIC SUBTYPE #44	
T027N	R21W	11		THR		BESSEYA BULLII (KITTEN-TAILS) #109	
T027N	R21W	22		THR		BESSEYA BULLII (KITTEN-TAILS) #35	COTTAGE GROVE RAVINE REGIONAL PARK
T027N	R21W	22			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #14	
T027N	R21W	22			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #16	
T027N	R21W	22			S2	MIXED EMERGENT MARSH (PRAIRIE) #3	COTTAGE GROVE RAVINE REGIONAL PARK
T027N	R21W	23			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #17	COTTAGE GROVE RAVINE REGIONAL PARK
T027N	R21W	23		THR		EMYDOIDEA BLANDINGII (BLANDING'S TURTLE) #1012	COTTAGE GROVE RAVINE REGIONAL PARK
T027N	R21W	27		THR		LANIUS LUDOVICIANUS (LOGGERHEAD SHRIKE) #53	
T027N	R21W	35			S2	DRY OAK SAVANNA (SOUTHEAST) SAND-GRAVEL SUBTYPE #3	MISSISSIPPI NATL RIVER & RECREATION AREA
T027N	R21W	35			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #130	MISSISSIPPI NATL RIVER & RECREATION AREA
T027N	R21W	35			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #19	MISSISSIPPI NATL RIVER & RECREATION AREA
T027N	R21W	36			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #111	MISSISSIPPI NATL RIVER & RECREATION AREA
T027N	R21W	36			S3	MAPLE-BASSWOOD FOREST (EAST CENTRAL) #21	MISSISSIPPI NATL RIVER & RECREATION AREA
T027N	R21W	36			S3	MOIST CLIFF (SOUTHEAST) #10	MISSISSIPPI NATL RIVER & RECREATION AREA
T027N	R21W	36			S3	OAK FOREST (CENTRAL) DRY SUBTYPE #18	MISSISSIPPI NATL RIVER & RECREATION AREA
T028N	R20W	10		THR		BESSEYA BULLII (KITTEN-TAILS) #27	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	10		SPC		COLUBER CONSTRICTOR (RACER) #25	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	10		END		CRISTATELLA JAMESII (JAMES' POLANISIA) #2	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	10			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #20	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	10		THR		EMYDOIDEA BLANDINGII (BLANDING'S TURTLE) #288	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	10		SPC		SEIURUS MOTACILLA (LOUISIANA WATERTHRUSH) #51	
T028N	R20W	10			S4	SHRUB SWAMP UNKNOWN/UNRESOLVED SUBTYPE #2	
T028N	R20W	11				MUSSEL SAMPLING SITE #199	
T028N	R20W	14		SPC		BAPTISIA ALBA (WHITE WILD INDIGO) #4	
T028N	R20W	14			S3	FLOODPLAIN FOREST SILVER MAPLE SUBTYPE #19	
T028N	R20W	14			S2	MIXED EMERGENT MARSH (PRAIRIE) #2	
T028N	R20W	14		END		PARONYCHIA FASTIGIATA (FORKED CHICKWEED) #2	
T028N	R20W	15		THR		BESSEYA BULLII (KITTEN-TAILS) #36	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	15		THR		BESSEYA BULLII (KITTEN-TAILS) #71	

LOWER ST CROIX WATERSHED MANAGEMENT PLAN

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TWP	RNG	PRIMARY SECTION	FED STATUS	MN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
T028N	R20W	15		THR	S2	EMYDOIDEA BLANDINGII (BLANDING'S TURTLE) #30	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	15			S2	FLOODPLAIN FOREST #44	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	15			S3	OAK FOREST (CENTRAL) DRY SUBTYPE #21	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	15			S3	RICH FEN (TRANSITION) #32	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	15			S3	RICH FEN (TRANSITION) #35	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	15		THR		SPILOGALE PUTORIUS (EASTERN SPOTTED SKUNK) #1	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	15		SPC		WILSONIA CITRINA (HOODED WARBLER) #1	BELWIN OUTDOOR EDUCATION CENTER
T028N	R20W	16		SPC		ASYNARCHUS ROSSI (A SPECIES OF CADDISFLY) #1	
T028N	R20W	16		SPC		ASYNARCHUS ROSSI (A SPECIES OF CADDISFLY) #2	
T028N	R20W	16			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #120	
T028N	R20W	16			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #121	
T028N	R20W	17			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #128	
T028N	R20W	21			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #119	
T028N	R20W	21			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #132	
T028N	R20W	22		SPC		BAPTISIA ALBA (WHITE WILD INDIGO) #11	
T028N	R20W	22	LT	SPC		HALIAEETUS LEUCOCEPHALUS (BALD EAGLE) #739	
T028N	R20W	22			S3	MAPLE-BASSWOOD FOREST (EAST CENTRAL) #7	
T028N	R20W	22			S2	OAK FOREST (CENTRAL) MESIC SUBTYPE #58	
T028N	R20W	22		SPC		SEIURUS MOTACILLA (LOUISIANA WATERTHRUSH) #11	
T028N	R20W	23		THR		EMYDOIDEA BLANDINGII (BLANDING'S TURTLE) #465	
T028N	R20W	23			SU	RIVER BEACH SAND SUBTYPE #4	
T028N	R20W	32			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #115	
T028N	R20W	32			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #116	
T028N	R20W	34		END		AMMODRAMUS HENSLOWII (HENSLOW'S SPARROW) #41	AFTON STATE PARK
T028N	R20W	34		THR		BESSEYA BULLII (KITTEN-TAILS) #5	AFTON STATE PARK
T028N	R20W	34		SPC		PITUOPHIS CATENIFER (GOPHER SNAKE) #84	AFTON STATE PARK
T028N	R20W	35		THR		BESSEYA BULLII (KITTEN-TAILS) #32	AFTON STATE PARK
T028N	R20W	35			S3	DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE #109	AFTON STATE PARK
T028N	R20W	35			S2	DRY PRAIRIE (SOUTHEAST) SAND-GRAVEL SUBTYPE #23	AFTON STATE PARK
T028N	R20W	35		SPC		ELLIPTIO DILATATA (SPIKE MUSSEL) #1	AFTON STATE PARK
T028N	R20W	35		SPC		HESPERIA LEONARDUS LEONARDUS (LEONARD'S SKIPPER) #19	AFTON STATE PARK
T028N	R20W	35	LE	END		LAMPSILIS HIGGINSI (HIGGINS EYE MUSSEL) #20	AFTON STATE PARK
T028N	R20W	35		SPC		MARPISSA GRATA (A SPECIES OF JUMPING SPIDER) #7	AFTON STATE PARK
T028N	R20W	35				MUSSEL SAMPLING SITE #198	
T028N	R20W	35			S2	OAK FOREST (CENTRAL) MESIC SUBTYPE #51	AFTON STATE PARK
T028N	R20W	35		END		PARONYCHIA FASTIGIATA (FORKED CHICKWEED) #3	AFTON STATE PARK
T115N	R17W	21	LT	SPC		HALIAEETUS LEUCOCEPHALUS (BALD EAGLE) #1765	LAKE REBECCA PARK
T115N	R17W	21			S2	OAK FOREST (SOUTHEAST) MESIC SUBTYPE #290	
T115N	R17W	21		SPC		OBOVARIA OLIVARIA (HICKORYNUT MUSSEL) #99	MISSISSIPPI NATL RIVER & RECREATION AREA
T115N	R17W	22		THR		FALCO PEREGRINUS (PEREGRINE FALCON) #74	MISSISSIPPI NATL RIVER & RECREATION AREA
T115N	R17W	23		SPC		CYCLEPTUS ELONGATUS (BLUE SUCKER) #65	
T115N	R17W	23	LT	SPC		HALIAEETUS LEUCOCEPHALUS (BALD EAGLE) #2108	MISSISSIPPI NATL RIVER & RECREATION AREA
T115N	R17W	24	LE	END		LAMPSILIS HIGGINSI (HIGGINS EYE MUSSEL) #16	
T115N	R17W	25		SPC		BUTEO LINEATUS (RED-SHOULDERED HAWK) #107	
T115N	R17W	25				COLONIAL WATERBIRD NESTING SITE #189	GORES WMA
T115N	R17W	25		SPC		ELLIPTIO DILATATA (SPIKE MUSSEL) #150	
T115N	R17W	25			S3	FLOODPLAIN FOREST SILVER MAPLE SUBTYPE #53	GORES WMA
T115N	R17W	26			S2	FLOODPLAIN FOREST #84	HASTINGS SNA

Minnesota Natural Heritage Database
Element Occurrence Records

LOWER ST CROIX WATERSHED MANAGEMENT PLAN
WASHINGTON COUNTY
MnDNR, Natural Heritage and Nongame Research Program

20:52 Thursday, FEBRUARY 24, 2005 4
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TWP	RNG	PRIMARY SECTION	FED STATUS	MN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
T115N	R17W	27			S2	OAK FOREST (SOUTHEAST) MESIC SUBTYPE #291	
T115N	R18W	13		THR		BESSEYA BULLII (KITTEN-TAILS) #70	SPRING LAKE PARK RESERVE
T115N	R18W	13			S2	OAK FOREST (SOUTHEAST) MESIC SUBTYPE #205	SPRING LAKE PARK RESERVE
T115N	R18W	13		SPC		PANAX QUINQUEFOLIUS (AMERICAN GINSENG) #114	SPRING LAKE PARK RESERVE

RECORDS PRINTED = 148

Appendix D

Metropolitan Council Land Use Definitions

Historical Generalized Land Use (Metropolitan Council, 2004)

Definitions

The original categories used for land use breakdowns were established in 1962 and were modified only slightly prior to 2000. For 2000, the categories have been expanded significantly to better reflect the use of land. The Council does not specifically survey the rights-of-way of minor highways, local streets, parking lots, railroads, or other utility easements. The area occupied by these uses is included with the adjacent land uses, whose boundaries are extended to the center line of the adjacent rights-of way or easements. The classes for the 2000 land use dataset are as follows:

SINGLE FAMILY RESIDENTIAL

Land used exclusively for residential purposes and containing a single dwelling unit. Includes the following four codes:

111 - FARMSTEAD

Land that encompasses the single family residential dwelling and associated buildings of a farm. Associated buildings of a farm may include buildings used for animal husbandry (barns, chicken coops, grain silos, etc.) along with accessory uses, provided that such accessory uses are integral to the agricultural activities.

112 - SEASONAL/VACATION

Land meeting the general definition of residential and containing a single dwelling unit occupied seasonally or used as vacation property.

113 - SINGLE FAMILY DETACHED

Land meeting the general definition of residential and not having more than one dwelling unit on the same lot. It includes freestanding mobile homes or manufactured housing units.

116 - MANUFACTURED HOUSING (MOBILE HOME) PARK

Land meeting the general definition of residential dwelling and used for the multiple placement of manufactured housing or mobile homes.

MULTIFAMILY RESIDENTIAL

Land used exclusively for residential multiple-family dwellings containing a building or multiple buildings. Includes the following two codes:

114 - SINGLE FAMILY ATTACHED

Land meeting the general definition of residential containing two or more attached dwelling units, each of which has primary ground floor access to the outside. Examples: town home, double bungalow, etc.

115 - MULTIFAMILY

Land meeting the general definition of residential containing two or more attached dwelling units, one or more of which does not have primary ground floor access to the outside. Examples: Apartment building, condominium with a main entrance for all residents. Note: Where it was not possible to differentiate between these two categories based on aerial photography and assessors data, the next criteria for differentiation was the number of units. If an indistinguishable parcel contained two to four units, it was coded Single Family Attached. If it had 5 or more units, it was coded Multifamily. If the number of units also was not available, then the final distinction was made using the "house-like" test. If it looked like a house from the photo (e.g. large house split into apartments), it was classified as Single Family Attached, otherwise it became Multifamily.

130 - OFFICE

Land used predominantly for administrative, professional, or clerical services. Examples: law offices, accounting firms, clinics (but not hospitals), and veterinary clinics. Government office buildings are generally categorized as Institutional. However, where government offices are housed on a privately owned parcel (e.g. leased office space), they may be included in the Office category.

120 - RETAIL AND OTHER COMMERCIAL

Land used for the provision of goods or services. This category is for general sales and services that comprise the vast majority of establishments typically associated with commercial land use. This category is used as the default for commercial/retail land uses. Examples: stores, restaurants, hotels, banks, daycare facilities, mini-storage facilities. More specific examples would be: Metrodome, Excel Center, Canterbury Downs, YWCAs, YMCAs, American Legion Clubs, Skeet club/outdoor gun range under 80 acres are also included; the large game/gun clubs, 80 acres or more, are coded as Park and Recreation.

MIXED USE

Land containing a building or buildings with mixed uses. Includes the following three codes:

141 - MIXED USE RESIDENTIAL

Land containing a building with any residential units in addition to commercial or office uses. Examples range from Galtier Plaza to a small store with living space above it.

142 - MIXED USE INDUSTRIAL

Land containing a building with predominantly industrial use but also containing commercial or office use, but with no residential use. Example: a building containing a warehouse, offices, and stores.

143 - MIXED USE COMMERCIAL AND OTHER

Land containing a building with mixed uses but with predominantly commercial, office or other uses, but with no residential or industrial uses. Example: a building containing commercial

shops, childcare facility, offices, and/or restaurants. Downtown areas usually have buildings where the first and/or second floor is commercial and the rest is office (e.g. the Lawson Software Building), these types of buildings would be coded under this category.

151 - INDUSTRIAL AND UTILITY

Land containing manufacturing, transportation, construction, communications, utilities or wholesale trade. This category includes publicly owned industrial lands (e.g., wastewater treatment plants, water towers, large transit garages, local or state road sanding stockpiles or maintenance staging areas). Industrial also includes: warehouses, some special horticultural uses (e.g. large greenhouses that do not sell to the public), landfills, and automotive junk yards (even if they sell retail, SIC 5015). Radio and TV stations were also included in this category.

153 - EXTRACTIVE

Land containing extractive industry (gravel pits and quarries).

160 - INSTITUTIONAL

Land used primarily for religious, governmental, educational, social, cultural or major health care facilities (where they have beds for overnight stay). Examples: schools, synagogues, cemeteries, hospitals, nursing homes, city halls, county and state fairgrounds, and museums. This category includes all publicly owned land that is not clearly in any other category (e.g. not in Office, Parks, or Industrial, etc.). Clinics and health care facilities with only outpatient procedures will be classified as Office, not Institutional. Government office buildings are generally categorized as institutional. However, where government offices are housed on a privately owned parcel (e.g. leased office space), they may be included in the Office category.

170 - PARK, RECREATIONAL OR PRESERVE

Land used for parks, outdoor recreational sports (such as ball fields) and passive open space. This may occur at community level fields, regional or local public parks, private parks, campgrounds, small urban parks, playgrounds, rest areas, and other venues used for indoor and outdoor sporting events or like purposes. This category also includes recreational passive activities or land use areas, such as park preserves, wildlife refuges, habitat areas, public plazas, river walks, greenways or land owned by the Minnesota Department of Natural Resources or U.S. Fish and Wildlife Service. This category also includes a small number of areas designated as “non-developable” within a Planned Unit Development (PUD). These open areas are included along with urban development (e.g., housing) in a PUD in order to meet overall density guidelines set by the city.

173 - GOLF COURSE

Land used for golfing, including driving ranges and practice areas.

201 - MAJOR HIGHWAY

Major vehicular rights-of-way that meet one or more of the following conditions: interstate highway; 4-lane divided highway with right-of-way of 200 feet or greater in width; 4-lane road

with a Metropolitan Council functional class designation of Principal Arterial. NOTE: Frontage roads may be included in this category where they are closely aligned to a major highway and are and within its right-of-way. Areas within the legal right-of-way that clearly have a different use (such as agriculture) are not included in this category. Local streets, alleys, and other roadways not meeting these criteria are included with the adjoining use.

202 - RAILWAY

Land used and occupied or intended to be occupied by multiple railroad track lines or similar uses. This includes railroad classification, storage and repair yards; intermodal containerized freight and transload facilities; railroad depots, etc. that might otherwise be classified under as Industrial. Note: Single-track railroads are not delineated, but are included with the adjoining use.

203 - AIRPORT

Land used for the operation of aircraft and any related uses that are on the airport property. For example, a parking lot or car rental on airport property would be included since they are related to the airport, but ball fields on the airport property would not be included.

100 - AGRICULTURAL

Broad range of agricultural uses, including horse boarding and training, kennels, sod farms, tree farms, fish production and processing, storage areas or buildings, as well as land used for agricultural purposes having determined the existence of ground tillage or crop rows. Agricultural buildings (including feedlots) that are not surrounding a farmstead, were included in this category. Other areas of farming are also included, such as horticulture, floriculture (exotic flowers), viticulture (grapes) and pasture. NOTE: It is not possible to discern all agricultural lands based on the available data (aerial photography and assessors data). Thus, some agricultural land may be placed in the Undeveloped category.

210 - UNDEVELOPED

Land not currently used for any defined purpose that may or may not contain buildings or other structures. This also includes agricultural areas that have no discernable agricultural use based upon the available data (aerial photography and assessor's data).

220 - WATER

A body of open water or flowing waterway with a discernable shoreline. This typically does not include wetlands or periodically flooded areas. Generally only features three acres or greater in size were delineated. Areas definable as another land use type will not be depicted as in the Water category (e.g. major highway bridge over a river and marina).

Appendix E

Watershed Issues and Implementation Activities

Issue ID Number	Issue	Implementation Activity
1	Questionable impervious areas within developments along St. Croix River and subsequent erosion along bluffs.	2,3
2	Need for controlled development within areas draining to Mississippi and St. Croix River bluffs.	2,3
3	Increased popularity of animal agriculture practices in Washington County and potential threat to resources and water quality.	2,3,7
4	Individual septic tank systems and potential impact on groundwater resources.	2,3,4,5,7,8
5	Sediment loads in Trout Brook.	2,3,4,7,11
6	Potential designation of Trout Brook as a Metro Trout Stream by DNR.	11
7	Concern for growth in neighboring watersheds and their impact on watershed boundaries.	2,3
8	Consistency with Comprehensive Plans and potential future conflicts over water and sewer needs, particularly with neighboring communities.	2,3
9	Phase II stormwater issues and need for stormwater ordinances at the local level including erosion control and rate control.	2,3,4
10	Impact that large recreational complexes are having on soil erosion, groundwater resources and surface water quality of Trout Brook.	2,3,4,7,11
11	St. Croix River flooding at south end of village of Afton.	n/a
12	Gully erosion along St. Croix and Mississippi Rivers.	2,3
13	Historical dumping within ravines and coulees and potential impact of clean up or restoration.	2,3
14	Nitrates in groundwater and need for policies that limit nitrate application for residential and agricultural uses.	2,3,4,7
15	Kelle's Coulee and Trout Brook are identified as high quality natural resources in need of protection.	2,3,4,7,9,11,13
16	Flood protection for future developments.	2,3,4,6
17	Mining activities impacting surface water quality of O'Conners Creek.	2,3,4,6,7,13
18	Standards and rules are needed to regulate mining activities at the local level.	2,3
19	O'Conners Lake is a high quality groundwater dependent landlocked lake.	2,3,4,6,7,13

Issue ID Number	Issue	Implementation Activity
20	Protection of natural resources is a key issue.	2,3,4,8,9,10,11 12,13
21	Protection of groundwater dependent natural resources and private water supply systems as a result of private and large scale municipal pumping.	2,3,4,8,11,12,13
22	Implementation of the County Groundwater Plan.	2,3,8
23	Karst features in the watershed threaten groundwater quality.	2,3,4,6,7,8
24	The negative effect of infiltration on groundwater quality.	2,3,4,6,7,8
25	Need to explore alternative funding mechanisms including special legislation in the future.	n/a
26	Federal funding programs including FARM Aid should be used to fund initiatives. Funding also available through WCD to develop/install BMPs, nutrient management strategies, buffer strips, conservation tillage initiatives, etc.	n/a
27	Nutrient and sediment management plan (*St. Croix Basin Water Resources Planning Team, MPCA, DNR*)	2,3,4,7
28	Need to address MPCA list of impaired waters. (*BWSR*)	2,3,4,7
29	Coordination with Washington County Water Governance strategies. (*BWSR*)	1,5
30	Need for an updated JPA at the time of plan submittal to review agencies. (*BWSR*)	n/a
31	Need for an Administrative Implementation Plan (AIP) that will document minimum standards, procedures for membership, and tapestry of authorities. (*BWSR*)	1
32	Need for a focused plan that addresses WMO priorities and develops long term vision for water management. (*BWSR*)	n/a
33	Need for standards for floodplain and freeboard requirements, impervious surface limits, wetland management roles, stormwater runoff controls, erosion and sediment control, and coordination with the MPCA. Also include requirements for buffers, overlay districts near priority resources, and wellhead protection areas. (*BWSR*)	2,3
34	Need to review Washington County ISTS ordinance and administration within the watershed to provide a synopsis of conditions, applicable ordinances, permitting, construction practices, etc. to users of the plan. *(MPCA)*	2,3,5

Issue ID Number	Issue	Implementation Activity
35	Need to utilize stormwater management practices that are specialized for karst regions. *(MPCA)*	2,3,6,7,8,13
36	Need to define groundwater sheds in order to appropriately identify and address potential contaminant sources. *(MDH)*	4,11,12,13
37	Need to collaborate with public water suppliers and the Minnesota Department of Health on the development and implementation of Wellhead Protection Plans (WHP). *(MDH)*	5,8
38	Need to maintain groundwater quantity through appropriate stormwater management. *(MDH)*	2,3,4,6