2012-2022
Watershed Management Plan

Black Dog Watershed
Management Organization

December 2012

Prepared by
Barr Engineering Co.

Watershed Management Plan

for the

Black Dog Watershed Management Organization
2012 – 2022

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List of Acronyms

BDWMO	Black Dog Watershed Management Organization
BMP	Best management practice
BWSR	Minnesota Board of Water and Soil Resources
CAMP	Metropolitan Council's Citizen Assisted Monitoring Program
CLMP	Minnesota Pollution Control Agency's Citizen Lake Monitoring Program
CLP	U.S. Environmental Protection Agency's Clean Lakes Program
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
CWP	Minnesota Pollution Control Agency's Clean Water Partnership program
DWSMA	Drinking Water Supply Management Area
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statements
EPA	U.S. Environmental Protection Agency
EQB	Minnesota Environmental Quality Board
EQIP	NRCS Environmental Quality Incentives Program
EQuIS	MPCA Environmental Quality Information System
FEMA	Federal Emergency Management Agency
FiN	MDNR Fishing in the Neighborhood Program
FIRM	Flood insurance rate map
FIS	Flood insurance study
HEC	USACOE Hydrologic Engineering Center
HEC-RAS	USACOE Hydrologic Engineering Center's River Analysis System
JPA	Joint powers agreement
LA	Load allocation
LCA	US COE Local Cooperation Agreement; see also PCA
LCCMR	Legislative Citizen Commission on Minnesota Resources

LGU	Local governmental unit
LMRWD	Lower Minnesota River Watershed District
LOMR	Letter of map revision
LUST	Leaking underground storage tanks
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MGS	Minnesota Geological Survey
MIDS	MPCA Minimum Impact Design Standards
Mn/DOT	Minnesota Department of Transportation
MNRAM	Minnesota Routine Assessment Methodology
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer System
MSL	Mean sea level
MSP	Minneapolis/ St. Paul International Airport
MUSA	Metropolitan Urban Service Area
NAPP	National Aerial Photography Program
NAWCA	North American Wetlands Conservation Act
NCHF	North Central Hardwood Forest ecoregion
NGVD29	National Geodetic Vertical Datum of 1929
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
OHWL	Ordinary High Water Level
PCA	US COE Project Cooperation Agreement; see also LCA
PWI	Public waters inventory
RCP	Reinforced concrete pipe
SCS	Soil Conservation Service
SIC	Standard Industrial Classification

SSTS	Subsurface sewage treatment system
SWCD	Soil and Water Conservation District
SWCS	Soil and Water Conservation Society
SWMM	Stormwater Management Model
SWPPP	Stormwater Pollution Prevention Program
TMDL	Total maximum daily load
TSI	Trophic State Index
TSS	Total suspended solids
US EPA	United States Environmental Protection Agency
UAA	Use attainability analysis
USACOE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VIC	MPCA Voluntary Investigation and Cleanup Program
VRWJPO	Vermillion River Watershed Joint Powers Organization
WCA	Minnesota Wetland Conservation Act
WHEP	Wetland Health Evaluation Program
WHPP	Wellhead protection plan
WLA	Waste load allocation
WMO	Watershed management organization
WOMP	Watershed Outlet Monitoring Program

Executive Summary

Executive Summary

The Black Dog Watershed Management Organization (BDWMO) *Watershed Management Plan* (WMP) sets the vision and guidelines for managing surface waters within the boundaries of the BDWMO. The WMP provides data and other background information, outlines the applicable regulations, assesses watershed-wide and resource-specific issues, sets goals and policies for the BDWMO and its members, and lists implementation tasks to achieve the goals. The WMP is organized into five major sections. The general content and highlights of each section follows:

Section 1 - Introduction

Section 1 provides background information on the BDWMO as well as the regulatory environment in which the BDWMO operates. Background content includes information on the location and history of the BDWMO as well as the vision, mission, and management structure of the organization. Regulatory information includes the regulatory authority of the BDWMO, and an overview of the major federal, state, and regional regulatory agencies with authority over water resources.

Section 2 - Physical Environment Inventory

This section provides technical information describing the surface and subsurface conditions of the Black Dog watershed. This data provides the context for understanding the issues and management challenges the BDWMO faces. Section 2 presents a watershed-wide inventory of land use, climate and precipitation, topography, soils, geology, groundwater, MDNR public waters, wetlands, natural communities and rare species, and a description of the major surface water bodies and drainage systems. Section 2 also includes information on water quality monitoring programs and studies within the BDWMO, local flooding issues and the water body classification system used for managing water bodies. This section also provides specific information on many of the BDWMO's water bodies including:

- Water body classification
- Amenities
- Impairment status
- Outlet information
- Land uses within the water body watershed
- Fisheries survey results

Section 3 – Assessment of Issues and Opportunities

This section identifies and discusses the status of problems and major issues within the watershed, in the following topic areas:

- Water quality
- Water quantity and flooding
- Erosion and sedimentation
- Wetlands and habitat
- Shoreland, habitat, and open space management
- Groundwater protection
- Implementation responsibility

Within each topic area, general issues are discussed first, followed by more specific issues. Issues are addressed through relevant policies (Section 4) and the implementation program (Section 5). The major unresolved or ongoing management issues discussed in Section 3 include:

Water Quality

Under this topic, the WMP discusses general stormwater runoff quality issues (e.g., nonpoint source runoff and phosphorus loadings), impaired waters, and TMDL issues. Information on the water quality and impairment status of significant BDWMO water bodies is also included in this section.

Water Quantity and Flooding

Under this subtopic, the plan discusses general issues (e.g. impacts of land development on stormwater rates and volumes, landlocked basin issues, flooding damages, and level of service/level of protection) and flooding concerns with respect to specific water bodies.

Section 4 – Goals and Policies

Section 4 presents the WMP's goals and the policies or strategies for achieving the stated goals. This section also includes stormwater performance standards for member cities. The policies and performance standards in this section are intended to address the problems and issues identified in Section 3. The plan's goals by each topic are:

Water Quality

- Maintain or restore the water quality of the BDWMO water resources to meet state water quality standards and allow for the continuation or enhancement of existing intended uses.

- Improve the quality of stormwater runoff reaching the Minnesota River by reducing nonpoint source pollution (including sediment) carried with stormwater runoff.

- Maintain or improve the quality of stormwater runoff reaching the calcareous fen (Black Dog fen) and the nearby trout streams.

Water Quantity and Flooding

- Manage intercommunity stormwater flows.
- Minimize flood damage to private and public property, and protect against increased flooding caused by development and redevelopment activities.

Erosion/Sedimentation

- Limit and/or decrease erosion and sedimentation through controls to protect water quality, habitat, and infrastructure.

Wetland and Habitat Management

- Preserve the ecological quality of wetlands for water retention, recharge, soil conservation, habitat, aesthetics, and natural enhancement of water quality.
- Achieve no net loss of wetlands in the BDWMO, while conforming to the Minnesota Wetland Conservation Act (WCA) and associated rules (Minnesota Rules 8420).

Shoreland, Habitat and Open Space Management

- Protect and enhance fish and wildlife habitat within the BDWMO.
- Maintain or improve shoreland integrity, preserving and enhancing the ecological quality of shoreland areas as it relates to wildlife habitat, aesthetics, soil conservation, and natural improvement of water quality.
- Preserve and enhance the quality of open spaces.
- Protect and increase recreation opportunities within the BDWMO.

Groundwater

- Protect the quality and quantity of groundwater resources.

Administration

- Promote local regulation of water resources by delegating day-to-day management of the BDWMO’s water resources to the member cities.
- Provide administrative guidance to member cities through this plan and the review and approval of local water management plans.
- Provide periodic review of projects proposed to meet policies/goals for strategic waterbodies established in this plan.

- Minimize duplication of federal and state rules and standards.

- Supplement existing federal and state regulations with specific design standards and criteria that address unique needs of BDWMO resources described in this plan.

Education and Public Involvement

- Increase awareness and education level of residents, local officials, and city staff regarding water resources and stormwater management.

- Provide the public with data they need to protect water resources and to understand the impact of land use decisions on water resources.

Section 5 – Implementation Program

This section describes the significant components of the BDWMO's WMP implementation program. The program is shaped by the BDWMO's current authority and goals. The BDWMO is not a permitting authority and thus uses the following methods for implementing its program:

1. Ensuring that the member cities adopt and implement the policies and standards in the BDWMO Plan
2. Managing, and assisting member communities with, intercommunity runoff and water management issues
3. Assessing the performance of the BDWMO and the member cities and their progress toward achieving the goals stated in the BDWMO Plan

The implementation program is presented at the end of Section 5 in a table (Table 5-1) that lists the projects, studies, and the programs and official controls implemented by the BDWMO. The table shows the cost estimate, proposed year of implementation, and proposed financing method for each element of the implementation program. Table 5-2 summarizes the costs of Table 5-1 by member city. Potential future projects are described in Table 5-3, including projects described in the TMDL implementation plan for Crystal, Keller, and Lee Lakes (Barr, 2011). Minor plan amendments will be performed as necessary to move potential projects from Table 5-3 to Table 5-1. Another table (Table 5-5) lists the various implementation activities that have been completed since the development of the 2002 BDWMO Plan. This section also discusses the various funding approaches available to WMOs and the approaches used by the BDWMO.

Section 1

Introduction

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List of Figures

1.0 Introduction

The Black Dog Watershed Management Organization (BDWMO) *Watershed Management Plan* sets the vision and guidelines for managing surface water within the boundaries of the BDWMO. This section summarizes the history, purpose, mission and vision of the BDWMO as well as the responsibilities of the other regulatory agencies.

1.1 THE ROLE OF WATERSHED MANAGEMENT ORGANIZATIONS

Like all watershed management organizations (WMOs), the BDWMO is a special purpose unit of local government that manages water resources on a watershed basis. Watershed management organization boundaries generally follow natural watershed divides, rather than political boundaries.

Recognizing that water does not follow political boundaries, the State of Minnesota established the Watershed Act (Minnesota Statutes 103D) in 1955, which provided for the creation of watershed districts anywhere in the state. In 1982, the Minnesota Legislature enacted the Metropolitan Surface Water Management Act (Minnesota Statutes 103B.201 – 103B.255). This act required the formation of a watershed management organization (WMO), and the development and implementation of a watershed management plan, for each of the watersheds in the seven county Twin Cities metropolitan area. WMOs can be organized as joint powers agreement organizations among municipalities (e.g., BDWMO), as watershed districts (e.g., Lower Minnesota River Watershed District (LMRWD)), or under county government (e.g., Scott WMO).

The Metropolitan Surface Water Management Act states that the purposes of watershed management organization water management programs are as follows (quoted from Minnesota Statutes 103B.201):

1. Protect, preserve, and use natural surface and groundwater storage and retention systems.
2. Minimize public capital expenditures needed to correct flooding and water quality problems.
3. Identify and plan for means to effectively protect and improve surface and groundwater quality.
4. Establish more uniform local policies and official controls for surface and groundwater management.

5. Prevent erosion of soil into surface water systems.
6. Promote groundwater recharge.
7. Protect and enhance fish and wildlife habitat and water recreational facilities.
8. Secure the other benefits associated with the proper management of surface and groundwater.

1.2 BLACK DOG WATERSHED MANAGEMENT ORGANIZATION

Watershed planning is an important function for developing a coordinated approach for identifying and resolving water resource management problems. Addressing these problems at the watershed scale is important because water does not respect political boundaries. Since water flows from place-to-place, problems in one community may be caused by activities and land uses in another community. By managing water resources on a watershed basis, communities within the watershed can jointly plan to prevent, minimize, and correct problems, and coordinate and equitably pay for projects. Updates to plans are important to address new or emerging problems by developing policies to direct the actions of the WMO and member cities and to create a useful implementation program.

1.2.1 Location and History

The BDWMO is located in northwestern Dakota County. Figure 1-1 shows the location of the BDWMO in relation to the other watershed management organizations in the seven-county metropolitan area. The majority of the BDWMO discharges through the Lower Minnesota River Watershed District (LMRWD) before reaching the Minnesota River. However, the Murphy Hanrehan, Kingsley Lake and Orchard Lake subwatersheds are tributary to the Credit River. Water management activities in these subwatersheds are of particular interest to Scott County (Scott WMO) and the City of Savage.

The original joint powers agreement (JPA) between the member cities of the BDWMO went into effect in 1985. At the time of its formation, the BDWMO covered 12,900 acres (20.2 square miles) covering parts of the cities of Apple Valley, Burnsville, Eagan, Lakeville and Savage. In 1999, the JPA was revised and restated along with a new memorandum of understanding with Scott County, when the portion of the former Credit River WMO in Dakota County was incorporated into the BDWMO, increasing the BDWMO area to 16,600 acres (25.9 square miles). In 2010, a new JPA went into effect as did an additional memorandum of understanding between the BDWMO and Scott County when the City of Savage was removed from the BDWMO and incorporated into the Scott WMO. Currently, the BDWMO boundary covers an area of approximately 16,600 acres (25.9 square miles). The JPA will continue to be revised as necessitated by the policies of this Plan, future amendments, or other actions taken by the Commission (e.g., jurisdictional changes, membership, funding formulas).

These agreements and memoranda of understanding are included in Appendix A.

1.2.2 Management Structure

The BDWMO Board of Commissioners consists of five commissioners and three alternates appointed by the member cities to a three-year term. The City of Burnsville appoints three commissioners, the cities of Apple Valley and Eagan appoint the fourth commissioner, and the City of Lakeville appoints the fifth commissioner. Member city staff attend board meetings on a regular basis as informal technical advisors. Regular meetings are held on the 3rd Wednesday of the month at the City of Burnsville offices. The public is invited to attend the BDWMO Commission meetings.

1.2.3 BDWMO Vision and Mission

Within the context of the statutory authority granted to WMOs and contained in the JPA, the BDWMO Board has established the following vision to provide strategic direction to its work. The following vision helps to focus the organization’s efforts and is a reminder of what the BDWMO is working to achieve:

> ***Water resources and related ecosystems are managed to sustain their long-term health and aesthetic beauty in order to contribute to the well-being of the citizens within the watershed.***

In addition to the statutory authority and functions identified in the JPA, the BDWMO has further clarified its mission in relationship to it members. The following guiding principles of the BDWMO helped the organization establish its Goals and Policies in Section 4.0:

- Keep regulation at the local level—the BDWMO will not administer a permit program.

- Assist member communities with intercommunity floodplain and runoff planning and with mediation of water management disputes between communities.

- Monitor, classify and manage strategic water resources to meet their intended use. Strategic resources are waterbodies that have broad watershed significance.

- Monitor, evaluate and/or model stormwater runoff quality.

- Improve the quality of the stormwater runoff reaching the Minnesota River.

- Manage intercommunity stormwater runoff, flooding and other water quantity issues.

- Develop policies to be implemented by the cities to protect the BDWMO's water resources.

- Assess performance of the BDWMO and the member cities toward achieving the goals stated in this plan.

- Provide member cities with useful information about the BDWMO, its activities, and water resource management.

- Educate all watershed citizens and member cities in water resource issues and BDWMO activities.

- Assist member cities with funding water quality projects through grants and other funding available directly to watershed organizations.

1.2.4 Authority Granted by the Joint Powers Agreement

The authority of the BDWMO is established by Minnesota Statutes 103B and by the JPA. The responsibilities of the BDWMO, taken from the JPA, include, but are not limited to:

1. Prepare and adopt a watershed management plan.

2. Review and approve municipal water management plans.

3. Provide any member city with technical data or other information to assist the city in preparing its local water management plan.

4. Regulate use and development of land in the watershed, either as authorized by a member city, or in the absence of an approved local water management plan, or for projects requiring a variance from the local water management plan or implementation program of the member city.
5. Publish and distribute a newsletter at least annually.
6. Establish and maintain devices for acquiring and recording hydrological and water quality data.
7. Enter upon lands to make surveys and investigations to accomplish the BDWMO's purposes.
8. Order any member city to carry out the BDWMO-approved local water management plan, including any capital improvements.
9. Acquire, operate, construct and maintain only the capital improvements, if any, delineated in the adopted BDWMO plan.
10. Obtain an annual audit of the books and accounts of the BDWMO.
11. Adopt an annual work plan.
12. Accumulate reserve funds and invest funds not currently needed for BDWMO operations.
13. Collect money from the BDWMO members and from any other BDWMO-approved source.
14. Make contracts, employ consultants, incur expenses and make expenditures.
15. Enter into contracts or cooperate with governmental agencies, private/public organizations, or individuals to accomplish the purposes for which the BDWMO is organized.
16. Contract for or purchase insurance, as needed.
17. Exercise all other powers necessary and incidental to the implementation of the purposes and powers set forth in the joint powers agreement.

18. Investigate complaints relating to water pollution and take appropriate action to alleviate the pollution and to assist in protecting and improving the water quality of surface water in the watershed.

19. Coordinate its planning activities with contiguous WMOs and counties conducting water planning and implementation under Minnesota Statutes 103B.

1.3 REGULATORY FRAMEWORK/AGENCY RESPONSIBILITIES

Various units of government are involved in regulating water resource related activities. The BDWMO does not administer a permit program. Rather, the BDWMO relies on the member cities to maintain regulatory control and responsibility for water resource management related activities in the BDWMO. As the BDWMO is one of many entities regulating water resources, the BDWMO will make every effort to avoid duplication of reporting requirements between the WMO and other regulatory agencies.

This section includes a general discussion of the responsibilities of local, regional and state agencies.

1.3.1 The Metropolitan Council

The Metropolitan Council provides regional planning and wastewater services (collection and treatment) for the seven-county metropolitan area. The Metropolitan Council provides review and comment on watershed management plans, local water management plans, and local comprehensive (land use) plans; conducts lake monitoring (including the Citizen Assisted Monitoring Program); and conducts river and stream monitoring. More information is available at the Council’s website: www.metrocouncil.org/water/index.htm

1.3.2 Dakota County and Scott County

Counties (including Dakota County and Scott County) have a wide variety of duties, including property assessment, record-keeping, road maintenance (including street sweeping, and snow/ice control), administration of election and judicial functions, social services, corrections, child protection, library services, hospitals and rest homes, public health services, planning and zoning, economic development, parks and recreation, water quality, and solid waste management and recycling (including yard waste and compost sites).

All of the BDWMO is located within Dakota County. Dakota County's responsibilities directly related to the BDWMO include:

- Construction and maintenance of county highways/roads
- Groundwater management, including preparing and adopting groundwater plans (see the Dakota County *Groundwater Protection Plan*, 2000)
- Adopting and implementing the county's MS4 SWPPP

More information is available at the Dakota County website: www.co.dakota.mn.us/default.htm

Scott County and the BDWMO have two memoranda of understanding that specify the role of each party with respect to managing two areas. One memorandum (1999) addresses an area within the BDWMO that is ultimately tributary to the Credit River, located in Scott County. The other memorandum (2010) addresses an area in the City of Savage within the Scott WMO, which is ultimately tributary to the Black Dog watershed.

1.3.3 Minnesota Department of Natural Resources (MDNR)

The MDNR Division of Waters (Waters) manages water resources through a variety of programs in its Water Management Section, Surface Water and Hydrographics Section, and Ground Water and Climatology Section. MDNR Waters administers the public waters work permit program, the water appropriation permit program, and the dam safety permit program. MDNR Fisheries administers the aquatic plant management control permit program and other fishery related permits.

In addition to permit programs, the MDNR oversees the floodplain management program, the public waters inventory program, the shoreland management program, the flood damage reduction grant program, the wild and scenic rivers program, various surface and groundwater monitoring programs, and the climatology program. The MDNR is involved in enforcement of the Wetland Conservation Act (WCA) and is responsible for identifying, protecting, and managing calcareous fens.

The MDNR's public waters work permit program (Minnesota Statutes 103G) requires a MDNR public waters permit for work below the MDNR designated Ordinary High Water Level (OHWL) that will alter or diminish the course, current, or cross-section of any public waters or public waters wetlands, including lakes, wetlands and streams. For lakes and wetlands, the MDNR's jurisdiction extends to designated U.S. Fish and Wildlife Service Circular #39 Types 3, 4, and 5 wetlands which are 10 acres or more in size in unincorporated areas, or 2.5 acres or more in size in incorporated areas. The program prohibits most filling of public waters and public waters wetlands for the purpose of creating upland areas. The public waters work permit program was amended in 2000 to reclassify public waters and to make the administrative program more consistent with the WCA administrative program. Under certain conditions, work can be performed below the OHWL without a public waters work permit. Examples include docks, watercraft lifts, beach sand blankets, ice ridge removal/grading, riprap, and shoreline restoration.

The MDNR regulates groundwater usage rate and volume as part of its charge to conserve and use the waters of the state. For example, suppliers of domestic water to more than 25 people or applicants proposing a use that exceeds 10,000 gallons per day or 1,000,000 gallons per year must obtain a water appropriation permit from the MDNR. Appropriation permits from the MDNR are not required for domestic uses serving less than 25 persons for general residential purposes. The MDNR is also responsible for mapping sensitive groundwater areas, conducting groundwater investigations, addressing well interference problems, and maintaining the observation well network.

More information is available at the MDNR website: www.dnr.state.mn.us

1.3.4 Minnesota Board of Water and Soil Resources (BWSR)

BWSR oversees the state's watershed management organizations (joint powers, county and watershed district organizations), oversees the state's Soil and Water Conservation Districts, and administers the rules for the WCA and metropolitan area watershed management.

More information is available at the BWSR website: www.bwsr.state.mn.us

1.3.5 Minnesota Pollution Control Agency (MPCA)

The MPCA administers the State Discharge System/National Pollutant Discharge Elimination System (NPDES) Permit program (point source discharges of wastewater), the NPDES General Stormwater Permit for Construction Activity, the NPDES General Industrial Stormwater Permit program, the NPDES Phase I and Phase II Storm Water Permit program, and the subsurface sewage treatment system regulations (MN Rules 7080-7083).

The MPCA also reports the state's "impaired waters" to the U.S. Environmental Protection Agency. The Clean Water Act requires states to monitor waterbodies and assess whether those waterbodies support designated uses.

The Minnesota Pollution Control Agency (MPCA) administers and enforces laws relating to pollution of the state's waters, including groundwater. Spills should be reported directly to the MPCA. The MPCA monitors ambient groundwater quality, and administers subsurface sewage treatment system (SSTS) design and maintenance standards. The MPCA requires an inspection program for SSTS that meets MPCA standards. Minnesota Rules 7080-7083 govern administration and enforcement of new and existing SSTS. The Tanks and Spills Section of the MPCA regulates the use, registration and site cleanup of underground and above ground storage tanks.

In 2007, the MPCA resumed selective administration of Section 401 of the Clean Water Act - Water Quality Certification program, which is primarily administered by the U.S. Army Corps of Engineers (COE). Section 401 certification is required to obtain a federal permit for any activity that will result in a discharge to navigable waters of the U.S. Formal applications for 401 certification must be sent to the MPCA.

More information is available at the MPCA website: www.pca.state.mn.us

1.3.6 Minnesota Department of Health (MDH)

The MDH is the official state agency responsible for addressing all environmental health matters, including groundwater protection. The MDH administers the Well Management Program, the Wellhead Protection Program, and the Safe Drinking Water Act rules. The MDH also issues fish consumption advisories. The MDH is responsible for preventing pollution of water supplies to ensure safe drinking water sources and limit public exposure to contaminants. Through implementation of the federal Safe Drinking Water Act, the MDH conducts the Public Water Supply Program, which allows the MDH to monitor groundwater quality and train water supply system operators. The 1996 amendments to the federal Safe Drinking Water Act require the MDH to prepare source water assessments for all of Minnesota's public water systems and to make these assessments available to public.

Through its Well Management Program, the MDH administers and enforces the Minnesota Water Well Code, which regulates activities such as well abandonment and installation of new wells. The MDH also administers the Wellhead Protection Program, which is aimed at preventing contaminants from entering the recharge zones of public water supply wells.

In 1997, the Wellhead Protection Program rules (Minnesota Rules 4720.5100 to 4720.5590) went into effect. These rules require all public water suppliers that obtain their water from wells to prepare, enact, and enforce wellhead protection plans. The MDH prepared a prioritized ranking of all such suppliers in Minnesota. Regardless of the ranking, Rules 4720 require all public water suppliers to initiate wellhead protection measures for the inner wellhead management zone prior to June 1, 2003. If a city drills a new well and connects it to the distribution system, the city must begin development of a wellhead protection plan. Wellhead protection plans include: delineation of groundwater "capture" areas (wellhead protection areas), delineation of drinking water supply management areas (DWSMA), assessment of the water supply's susceptibility to contamination from activities on the land surface, and management programs, such as identification and sealing of abandoned wells, and education/public awareness programs. As part of its role in wellhead protection, the MDH developed the guidance document *Evaluating Proposed Stormwater Infiltration Projects in Vulnerable Wellhead Protection Areas* (MDH, 2007).

More information about these programs is available at the MDH website: www.health.state.mn.us/divs/eh/water/index.html

1.3.7 Minnesota Environmental Quality Board (EQB)

The EQB administers the state's environmental review program, including Environmental Assessment Worksheets (EAW) and Environmental Impact Statements (EIS).

More information is available at the EQB website: www.eqb.state.mn.us

1.3.8 Minnesota Department of Transportation (Mn/DOT)

When NPDES Phase II became effective in 2003, Mn/DOT was required to apply for a NPDES permit to discharge stormwater from its right-of-way. As part of the NPDES Permit, Mn/DOT Metro District was required to develop and implement a Stormwater Pollution Prevention Program (SWPPP) to reduce the discharge of pollutants from their storm sewer system to the maximum extent practicable.

Within the Metro District there are 114 local government MS4s that are designated for the NPDES permit coverage under the Phase II stormwater program. Any work done adjacent to and draining to Mn/DOT property must be approved by Mn/DOT through the Mn/DOT Permits Office.

More information is available at the Mn/DOT website: www.dot.state.mn.us/metro/waterresources/index.htm

1.3.9 U.S. Army Corps of Engineers (COE)

The COE administers the Section 10 of the Rivers and Harbors Act permit program, and the Section 404 permit program.

Section 404 Authorizations. The Federal Clean Water Act requires that anyone who wants to discharge dredged or fill material into U.S. waters, including wetlands, must first obtain a Section 404 permit from the COE. Examples of activities that require a Section 404 permit include: construction of boat ramps, placement of riprap for erosion protection, placing fill in a wetland, building a wetland, construction of dams or dikes, stream channelization, and stream diversion.

When Section 404 permit applications are submitted to the COE, the applications are typically posted for the U.S. Fish and Wildlife Service, the U.S. Forest Service, the U.S. EPA, and other federal agencies to review and provide comments on the application. The COE evaluates permit requests for the potential impact to various functions and values of the wetland.

Section 401 Water Quality Certifications. A Section 401 water quality certification may be granted if an applicant demonstrates that a proposed activity “will not violate Minnesota’s water quality standards or result in adverse long-term or short-term impacts on water quality.” Greater protection is given to a category of waters designated as Outstanding Resource Value Waters. The waters in this category have received this designation because of their exceptional value. These include such groups as scientific and natural areas, wild, scenic and recreational river segments and calcareous fens.

More information is available at the COE website: www.usace.army.mil

Section 1 Figures

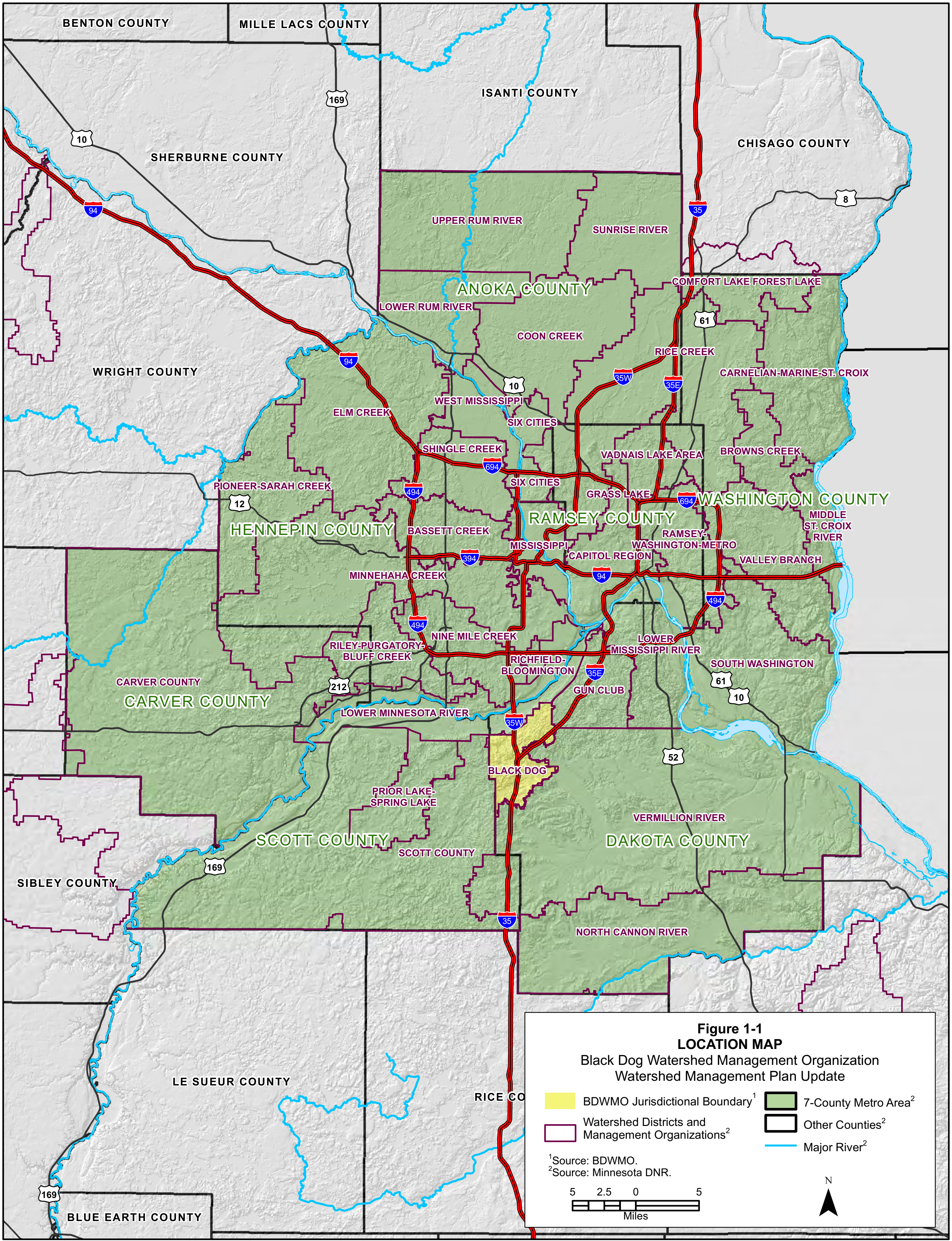

Figure 1-1
LOCATION MAP
Black Dog Watershed Management Organization
Watershed Management Plan Update

Barr Footer: ArcGIS 10.0, 2012-06-12 14:26 File: I:\Client\Blackdog\23191083_WMPUpdate\Maps\Report\Figure 1-1 Location Map_8.5x11.mxd User: kac2

Section 2

Physical Environment Inventory

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2.0 Physical Environment Inventory

2.1 LAND USE

The majority of the BDWMO is fully-developed with the few remaining undeveloped areas being in the southern portion of the watershed. Figure 2-1 shows the current (2005) land use information from the Metropolitan Council. The map shows that most of the higher intensity land uses (typically commercial and industrial development) is clustered along I-35W, County Road 42 and Highway 13. Figure 2-2 shows the anticipated future (2030) land use in the BDWMO, also based on land use information from the Metropolitan Council.

Redevelopment provides the opportunity to improve stormwater management and implement various management techniques. Redevelopment will occur within the BDWMO, as identified by the cities.

The cities of Burnsville, Apple Valley and Eagan are completely within the Metropolitan Urban Service Area (MUSA), the area delineated by the Metropolitan Council for sanitary sewer service. The only lands in the BDWMO outside the MUSA are two small areas located in Lakeville in the southwest portion of the BDWMO.

Land cover data in the BDWMO was last updated in 2000 and may be useful for member cities as they consider development and redevelopment opportunities. Land cover data through the Minnesota Land Cover Classification System is available online from the MDNR’s Data Deli (http://deli.dnr.state.mn.us).

2.2 CLIMATE AND PRECIPITATION

Because of its location near the center of the North American continent, the BDWMO (and Minnesota) has a continental climate, meaning it experiences a wide variation in climate conditions (e.g., droughts and floods, heat and cold).

The mean annual temperature for the BDWMO is 45°F, as measured at the Minneapolis/ St. Paul (MSP) airport station (1971-2000). Mean monthly temperatures vary from 13.1°F in January to 73.2°F in July (1971-2000). Extreme temperatures recorded were a high of 108°F on July 14, 1936 and a low of -34°F on January 1, 1936 and January 19, 1970. For the period 1948-2005, the average date for latest occurrence of freezing temperatures is April 29, while the average date for the first autumn frost is October 7. The average frost-free period (growing season) is 161 days.

Table 2-1 summarizes precipitation data for the MSP airport station. Average total annual precipitation (1971-2000) is 29.4 inches at the MSP airport station and has ranged from a low of 11.5 inches in 1910 to a high of 40.2 inches in 1911. The mean monthly precipitation (1971-2000) varies from 4.3 inches in June to 0.8 inches in January. From May to September, the growing season months, the average rainfall (1971-2000) is 18.4 inches at MSP or about 62 percent of the average annual precipitation. Average annual lake evaporation is about 31 inches. Figure 2-3 shows the average monthly temperature and precipitation expected for the BDWMO.

Average annual snowfall (1971-2000) is 56 inches at the MSP airport station. Extreme snowfall records range from 98.6 inches during the 1983-1984 season to 14.2 inches at MSP during the 1930-1931 season.

The amount, rate, and type of precipitation are important in determining flood levels and stormwater runoff rates, all of which impact water resources. In urbanized watersheds, shorter-duration events tend to play a larger role in predicting high water levels on basins. Shorter-duration events are generally used by hydrologists to study local issues (sizing catch basins, storm sewer pipes, etc.). Longer-duration events are generally used by hydrologists to study regional issues, such as predicting high water levels for regional basins and basins that have no outlets (landlocked), or have small outlets relative to their watershed size.

Snowmelt and rainstorms that occur with snowmelt in early spring are significant in this region. The volumes of runoff generated, although they occur over a long period, can have significant impacts where the contributing drainage area to a lake or pond is large and the outlet is small (or where there is no outlet).

Average weather imposes little strain on the typical stormwater drainage system. Extremes of precipitation and snowmelt are important for design of flood control systems. The National Weather Service has data on extreme precipitation events that can be used to aid in the design of flood control systems. Extremes of snowmelt most often affect major rivers, the design of large stormwater storage areas, and landlocked basins, while extremes of precipitation most often affect the design of conveyance facilities.

In contrast with stormwater drainage facilities, stormwater quality treatment systems are designed based on the smaller, more frequent storms. These more frequent storms account for the majority of the annual pollutant loadings from urban watersheds. Analysis of rainfall data (1971-2000) from the MSP station found that 90 percent of the storms produced 1.05 inches or less of rainfall (The MN Stormwater Manual, 2005 as revised).

The major sources of information regarding rainfall in the region are publications TP-40 and TP-49 issued by the National Weather Bureau (now the National Weather Service) in 1961 and 1964, respectively. These data are generally consistent with the specific analysis of Minneapolis-St. Paul intensity-frequency data compiled by Yarnell (USDA Miscellaneous Publication 204.) The sources give information on storm durations of up to 10 days. The Soil Conservation Service's (now the Natural Resource Conservation Service (NRCS)) National Engineering Handbook, Hydrology, Section 4, presents maps of regional runoff volume. The information from all of these sources (except for the Yarnell analysis) is summarized in the Hydrology Guide for Minnesota, published by the USDA's Soil Conservation Service. Table 2-2 lists many of the precipitation and runoff events used for design purposes.

Even with wide variations in climate conditions, climatologists have found four significant recent climate trends in the Upper Midwest (Minnesota Weather Almanac, Seeley, 2006):

- Warmer winters
- Higher minimum temperatures
- Higher dew points
- Changes in precipitation trends – more rainfall is coming from heavy thunderstorm events and increased snowfall

According to the Soil and Water Conservation Society's (SWCS) 2003 report on climate change, total precipitation amounts in the United States (and in the Great Lakes region) are trending upward, as are storm intensities. Precipitation records in the Twin Cities area show the annual average precipitation has increased, as shown in the following examples:

- **Minneapolis-St. Paul Airport station** – the average annual precipitation has increased from 28.32 inches (1961-1990 average) to 29.41 inches (1971-2000 average), a 3.8% increase (data from the Climatology Working Group website: http://climate.umn.edu/).
- **St. Paul station** – the average annual precipitation has increased from 30.30 inches (1961-1990 average, from the MDNR State Climatology Office) to 32.59 inches (1971-2000 average), a 7.6% increase (data from the Midwestern Regional Climate Center website

http://mcc.sws.uiuc.edu/climate_midwest/mwclimate_data_summaries.htm#).

As noted by the SWCS, increased storm intensities result in increased soil erosion and increased runoff. Increased flooding could also result from more intense precipitation events.

Climate information can be obtained from a number of sources, such as the following websites:

- For climate information about the Twin Cities metropolitan area: http://climate.umn.edu/doc/twin_cities/twin_cities.htm
- For a wide range of Minnesota climate information: http://climate.umn.edu/
- For other Minnesota climate information: http://www.MDNR.state.mn.us/climate/index.html

2.3 TOPOGRAPHY

In general, the land within BDWMO slopes from south to north toward the Minnesota River. At the southern end of the watershed, an upland ridge slopes down to Crystal Lake. Continuing north, the upland transitions into an undulating glacial outwash plain. This area is pitted with shallow depressions surrounded by mounds of glacial till. Further north, the pitted outwash plain gives way to an outwash terrace, just above the Minnesota River floodplain. This transition corresponds roughly to the political boundary between the BDWMO and the Lower Minnesota River Watershed District. The total relief of the watershed is approximately 475 feet. The highest point is Buck Hill, at an elevation of 1,195 feet above sea level. The lowest point in the watershed is just above the Minnesota River flood plain, at an approximate elevation of 720 feet.

Dakota County has 2-foot contour interval topographic mapping available for the entire county. The member cities may have earlier or more recent topographic mapping available. There are also 10-foot contour interval 7-½ minute series topographic maps available from the U.S. Geological Survey.

Figure 2-4 shows the steep slopes (slopes greater than 12 percent) throughout the BDWMO.

2.4 SOILS

Soils information available for the area within the BDWMO can be found in the *Soil Survey of Dakota County Minnesota* (USDA-NRCS (SCS), 1983) which includes information concerning the classification of the soils.

Soil composition, slope and land management determine the effect of soils on stream and lake water quality. Soil composition and slope are important factors affecting the rate and amount of storm water runoff. The shape and stability of aggregates of soil particles—expressed as soil structure—influence the permeability, infiltration rate, and erodibility of soils. Slope is important in determining storm water runoff rates and hence susceptibility to erosion.

Infiltration capacities of soils affect the amount of direct runoff resulting from rainfall. The higher the infiltration rate for a given soil, the lower the runoff potential. Conversely, soils with low infiltration rates produce high runoff volumes and high peak discharge rates.

Four general soil hydrologic groups have been established by the Natural Resources Conservation Service (NRCS—formerly the Soil Conservation Service (SCS)). These groups are:

Group A	Low runoff potential—high infiltration rate
Group B	Moderate infiltration rate
Group C	Slow infiltration rate
Group D	High runoff potential—very slow infiltration rate

The hydrologic grouping symbols (A-D) are combined with land use and used to estimate the amount of runoff that will occur over a given area for a particular rainfall amount. The Dakota County soil survey lists the hydrologic soil groups.

As land is developed for urban use, much of the soil is covered with impervious surfaces, and soils in the remaining areas are significantly disturbed and altered. Development often results in consolidation of the soil and tends to reduce infiltration capacity of otherwise permeable soils, resulting in significantly greater amounts of runoff.

Most of the soils in the BDWMO are well to excessively drained. Silty and loamy sediments over glacial till can be found throughout the watershed. According to the Dakota County soil survey, there are four general soil types in the BDWMO: (1) nearly level, silty and loamy soils (on flood plains); (2) level to very steep, silty, loamy, and sandy soils (on outwash plains and terraces);

(3) nearly level to steep, loamy and silty soils (on uplands); and (4) gently sloping to very steep, loamy and sandy soils (on uplands and pitted outwash plains).

Figure 2-5 shows the mapping of the soils in the BDWMO by hydrologic soil groups. However, because of significant urban development and land use, significant portions of the BDWMO are mapped as undefined hydrologic soil groups. The map is intended to provide general guidance about the infiltration capacity of the soils throughout the BDWMO. However, soils should be inspected on a site-by-site basis as projects are considered.

2.5 GEOLOGY AND GROUNDWATER RESOURCES

2.5.1 Geology

Bedrock underlies the BDWMO at a depth of between 0 to 500 feet, but averages between 100 and 200 feet. Bedrock at a depth of 0 corresponds to locations where the rock is exposed at the ground surface. This occurs in the watershed primarily at the bluffs along the Minnesota River. The bedrock is deepest (400 feet or more) beneath steep peaks of glacial till, such as Buck Hill. The rock underlying the watershed is a sedimentary formation with the oldest layer dating back to the Paleozoic era, approximately 600 million years ago. Over time with deposition of more sediment, the bedrock has reached a thickness of over 1,000 feet. The top of this formation is rock, formed during the Ordovician period about 400 million years ago. Beneath the uplands of the watershed are the youngest sedimentary bedrock deposits. These shale and limestone beds transition to St. Peter sandstone beneath the outwash plain, finally to Prairie du Chien group dolomite and sandstone under the outwash terrace. 100 to 200 feet of glacial till covers most of the bedrock in the watershed. Much of the glacial till was deposited during the Pleistocene epoch beginning approximately 2 million years ago. The most recent glacial deposits were laid down about 10,000 years ago by the Wisconsin glaciation. Figure 2-6 shows the generalized regional stratigraphic column, the vertical relationship of the units, their approximate thickness and their water-bearing capabilities.

There are minor buried bedrock valleys in the BDWMO. Buried bedrock valleys are carved into the bedrock underlying the watershed. They are called buried since they are filled in as a result of glacial deposition. There may be little or no relationship between the location of surface valleys and buried bedrock valleys.

More information about the geology of the BDWMO can be found in the *Dakota County Geologic Atlas* (Minnesota Geological Survey (MGS), 1990).

2.5.2 Groundwater Resources

Two types of aquifers are present in the BDWMO: surficial and bedrock aquifers. The following paragraphs provide general information about the aquifers in the BDWMO; for more information, see the *Dakota County Geologic Atlas* and the *Dakota County Groundwater Protection Plan* (Dakota County, 2000).

2.5.2.1 Surficial (Quaternary) Aquifers

Surficial aquifers are water-bearing layers of sediment, usually sand and gravel, which lie close to the ground surface. Many domestic and some irrigation wells in the watershed draw water from these aquifers. Since the surficial aquifers are more susceptible to pollution, they are not used for municipal or public supply wells. In some locations in the BDWMO, the aquifer could provide sufficient water yield for some nonpotable industrial uses. The typical depth of the water table beneath the watershed is approximately 200 feet.

Recharge to the surficial aquifers is primarily through the downward percolation of local precipitation. Some surficial aquifers may also be recharged during periods of high stream stage. Surficial aquifers may discharge to local lakes, streams or to the underlying bedrock.

The ponds and lakes scattered throughout the watershed recharge the groundwater. Some of these water bodies are landlocked and their only outlet is to the groundwater. Some of the landlocked lakes are probably perched above the regional level of the shallow groundwater in the watershed.

2.5.2.2 Bedrock Aquifers

Five major bedrock aquifers are available for water supply in the BDWMO. The major bedrock aquifers are, in order of use and development: (1) Prairie du Chien-Jordan, (2) Mount Simon-Hinckley, (3) Ironton-Galesville, (4) St. Peter, and (5) Platteville. The aquifer used most often for water supply in the area is the Prairie du Chien-Jordan aquifer. The Prairie du Chien-Jordan aquifer is high yielding, more easily tapped than deeper aquifers, has very good water quality and is continuous throughout most of the area. The MDNR closely reviews permits for groundwater withdrawals from the Prairie du Chien-Jordan aquifer in northwestern Dakota County and northern Scott County to ensure that the withdrawals will not cause drawdown effects on the Savage fen and the Black Dog fen.

The groundwater level in the Prairie du Chien-Jordan aquifer varies from 700 feet to more than 900 feet above mean sea level as shown in the *Dakota County Geologic Atlas*. The aquifer is recharged in areas where thin permeable drift overlies the limestone layers. Some recharge of this aquifer occurs locally from percolation through the overlying glacial deposits or St. Peter sandstone. However, hydrogeologic considerations suggest this recharge would be a minimal contribution to the aquifer flow. Regional recharge of the Prairie du Chien-Jordan aquifer occurs to the south, in Freeborn and Mower Counties. Groundwater movement in the aquifer is generally from south to north, toward the Minnesota and Mississippi Rivers.

The aquifer with the highest water quality and highest possible yields is the Mt. Simon-Hinckley aquifer, but it is more expensive to use than the Prairie du Chien-Jordan because of its greater depth and there are limitations to its use. Minnesota statutes limit appropriations from the Mt. Simon-Hinckley aquifer to potable water uses, where there are no feasible or practical alternatives, and where a water conservation plan is incorporated with the appropriations permit. The water level of the Mt. Simon-Hinckley has been nearly constant, at about 700 feet above mean sea level. Recharge of the Mt. Simon-Hinckley takes place far north of the watershed, where the bedrock is closer to the surface, and occurs by percolation through the overlying drift and bedrock. Groundwater movement in the aquifer is generally to the southeast. The local direction of groundwater flow in the Twin Cities area tends to be toward the western suburbs, due to pumping of the aquifer.

2.5.3 Wellhead Protection Areas

The increasing population in the Twin Cities metropolitan area has put increased pressure on groundwater supplies. Increased impervious surfaces also reduce the amount of groundwater recharge. Many of the communities within the BDWMO obtain their public water supplies from groundwater sources. The Minnesota Department of Health (MDH) is responsible for the protection of groundwater supplies and aims to prevent contaminants from entering the recharge zones of public water supply wells. This can result in the restriction of certain stormwater BMPs within these areas to protect groundwater supplies. Figure 2-7 shows the location of the municipal water supply wells as well as the delineated wellhead protection areas within the BDWMO. Each of the communities within the BDWMO has an MDH-approved wellhead protection plans.

2.6 MDNR PUBLIC WATERS

The MDNR designates certain water resources as public waters to indicate those lakes, wetlands, and watercourses over which the MDNR has regulatory jurisdiction. By statute, the definition of public waters includes “public waters” and “public waters wetlands.”

Public waters are all basins and water courses that meet the criteria set forth in Minnesota Statutes, Section 103G.005, subd. 15 that are identified on public water inventory maps and lists authorized by Minnesota Statutes, Section 103G.201. Public waters wetlands also include all type 3, type 4, and type 5 wetlands, as defined in U.S. Fish and Wildlife Service *Circular No. 39,* 1971 edition, that are 10 acres or more in size in unincorporated areas or 2 ½ acres or more in size in incorporated areas (see Minnesota Statutes Section 103G.005, subd. 15a and 17b.) A MDNR permit is required for work within designated public waters.

The MDNR uses county-scale maps to show the general location of the public waters and public waters wetlands (lakes, wetlands, and water courses) under its regulatory jurisdiction. These maps are commonly known as public waters inventory (PWI) maps. The regulatory boundary of these waters and wetlands is called the ordinary high water level (OHWL). PWI maps are available on a county-by-county basis. Additionally, county-by-county lists of these waters are available in tabular form. The PWI maps and lists are available on the MDNR’s website: http://www.MDNR.state.mn.us/waters/watermgmt_section/pwi/maps.html.

Public waters (e.g. lakes) are identified with a number and the letter “P”. Public waters wetlands are identified with a number and the letter “W”. Public wetlands include, and are limited to, types 3, 4, and 5 wetlands that have not been designated public waters.

Table 2-3 summarizes the MDNR public waters within the BDWMO, as well as the physical characteristics of the water bodies. Figure 2-8 shows the location of PWI waters, wetlands, and watercourses within the BDWMO. Also shown on Figure 2-8 is the nearby Black Dog fen wetland complex and the MDNR-designated trout streams. These trout streams (and most of their watersheds) are located within Lower Minnesota River Watershed District, not in the BDWMO.

2.6.1 Public Ditches

Judicial ditches and county ditches are public drainage systems established under Chapter 103E of Minnesota Statutes and are under the jurisdiction of the county or a watershed management organization. The purpose of these ditches was typically to drain wetlands to provide additional land for agriculture and development. There are no public ditches within the BDWMO.

2.7 WETLANDS

2.7.1 National Wetlands Inventory (NWI)

The U.S. Fish and Wildlife Service (USFWS) is responsible for the mapping of wetlands across the country. To date, the NWI coverage includes more than 90 percent of the contiguous United States, including the State of Minnesota. Using National Aerial Photography Program (NAPP) imagery (typically dated from 1978 through 1988) in conjunction with limited field verification, the USFWS identified and delineated wetlands, produced detailed maps on the characteristics and extent of wetlands, and constructed a national wetlands database as part of the NWI. Figure 2-9 shows the location of all NWI wetlands within the BDWMO. There may be additional wetlands (especially those smaller than 0.5 acre) in the BDWMO that are not included in the NWI.

2.7.2 City Wetland Management Plans

2.7.2.1 City of Apple Valley Wetland Inventory (2007)

As part of the development of the City of Apple Valley Surface Water Management Plan (2007), the City developed a wetland inventory based on the NWI within the BDWMO and performed a wetland function and value assessment using a method similar to the Minnesota Routine Assessment Methodology (MNRAM) v3.0. Potential for restoration was also evaluated. Wetlands were classified into several management categories including: Protect, Manage 1, Manage 1 Restore, Manage 2, Manage 2 Restore, and Manage 3. Additionally, the wetland sensitivity to stormwater was evaluated using the State of Minnesota Stormwater Advisory Group technical paper "Guidance for Evaluating Urban Stormwater and Snowmelt Runoff Impacts to Wetlands" as a guide.

2.7.2.2 City of Burnsville Comprehensive Wetland Protection and Management Plan (2008)

The City of Burnsville performed an update to their wetland inventory and classification as part of their *Comprehensive Wetland Protection and Management Plan* (2008). This plan included an updated wetland inventory and functions and values assessment. The wetland quality assessment method used the Minnesota Routine Assessment Methodology Version 3.0 (MNRAM). The wetlands were evaluated and given numerical scores, based on physical and biological characteristics of natural communities.

The wetlands were then assigned one of four wetland management classifications: Protect, Improvement, Management, and Management II. The classification system took into consideration the numerical scores and other information, such as endangered species, sensitivity to stormwater impacts, and the proximity to other wetlands and parks. The wetland management standards include buffer strip width, amount of pretreatment required for total suspended solids removal, and storm bounce restrictions.

2.7.2.3 City of Lakeville *Wetland Management Plan* (2003)

The City of Lakeville *Wetland Management Plan* (May 2003) was developed to identify, classify, and develop a wetland inventory within the City of Lakeville and identify wetland functions and resources important to the city. This inventory could then be used to develop a long-term wetland management strategy. The wetland inventory was originally based on information from the NWI as well as additional information from Dakota County and the Metropolitan Mosquito Control District. The presence or absence of wetlands was field-verified using the criteria for wetland delineation as set forth by the *Manual for Delineating and Identifying Jurisdictional Wetlands* (USACOE, 1987).

The wetland function and value assessment method used was similar to the Minnesota Routine Assessment Methodology (MNRAM) 2.0. The wetlands were evaluated and given numerical scores, based on vegetative diversity, fish and wildlife habitat, water quality protection, flood/stormwater attenuation, shoreline protection, groundwater recharge/discharge, and aesthetics, recreation, and education. Once this assessment was completed, the wetlands were classified into six different management categories: Preserve, Manage 1, Manage 2, Utilize, Restore, and South Creek. Wetland management standards were developed based on the six management categories including criteria for buffers, stormwater management, and wetland mitigation and sequencing.

2.7.2.4 City of Eagan Local Comprehensive Wetland Protection and Management Plan (2007)

The City of Eagan's *Local Comprehensive Wetland Protection and Management Plan* (May 2007) inventoried and assessed wetlands in currently undeveloped areas of the city along with wetland in areas likely to be redeveloped within a few years. The location of the wetlands were field-verified and approximate wetland boundaries were outlined. The wetland functions and values assessment was performed using the Minnesota Routine Assessment Methodology (MNRAM) 3.0. Using the output from MNRAM, the wetlands were classified into six management categories including: Protect, Priority, Priority A, Manage, Manage A, and General Use.

2.8 SURFACE WATER SYSTEM

Figure 2-10 shows the major watersheds, watershed names, tributary areas, subwatersheds, and drainage patterns. This subwatershed information was obtained from each member city's stormwater management plan (local plan) as well as from recent water quality studies. See Table 2-3 for a summary of available physical characteristics for selected water bodies within the BDWMO. Figure 2-11 shows the recreational areas and public access to water bodies within the BDWMO. For more information on the BDWMO and MPCA classifications of the water bodies, see Section 2.10.

2.8.1 Lakes and Wetlands

2.8.1.1 Crystal Lake

Crystal Lake is a 292-acre lake located in the cities of Burnsville and Lakeville in the southern portion of the BDWMO. The lake is a major recreational resource for the area. A public beach and public boat landing provide opportunities for swimming, fishing, water skiing and aesthetic viewing. Crystal Lake is a BDWMO Category I strategic water body and is classified as a deep lake by the MPCA and is currently listed on the 303(d) impaired waters list.

Crystal Lake consists of five basins: Bluebill Bay, Mystic Bay, Maple Island Bay, Buckhill Bay, and the main lake basin. The lake outlet is located at the northwest end of the lake in Buckhill Bay, and consists of a box weir with an overflow elevation of 933.5 feet NGVD29. Overall, the lake has 5.3 miles of shoreline, a mean depth of 10 feet, and a maximum depth of 35 feet. The area of the lake shallow enough for aquatic plants to grow (the littoral area) is approximately 208 acres. Crystal Lake is a dimictic lake meaning it mixes two times per year (during the spring and fall turnover events). The lake thermally stratifies during the growing season.

Its 3,852-acre tributary watershed (including the lake surface area) includes both the Crystal Lake direct watershed and the Keller Lake, Lee Lake, and Lac Lavon watersheds. Without the Lac Lavon watershed, which is landlocked, the Crystal Lake watershed is 3,667 acres. Portions of the cities of Apple Valley, Burnsville, and Lakeville drain to Crystal Lake. Crystal Lake receives outflows from Keller Lake as well as Lee Lake and drains northwest through a series of storm sewer pipes to Twin and Earley Lakes, ultimately reaching the Minnesota River via Sunset Pond.

The Crystal Lake watershed (including both the Keller and Lee Lake watersheds) is almost fully-developed, with only a few small parcels available for new development. Low density residential land use is the major land use (41%), followed by highway (20%) and open water (11%). Other land uses include: medium density residential, natural, park, and open space, commercial, developed parks, golf course, high density residential, institutional, and industrial/office. The portion of the watershed located in Lakeville has developed since the completion of the 2002 BDWMO Plan, with the most intense development occurring along I-35, where the undeveloped land was converted to commercial use. For the commercial area of Lakeville within the Crystal Lake watershed, the city restricts the maximum amount of impervious cover to 70% for new development sites.

The BDWMO began operating a ferric chloride treatment system in 1996 to remove phosphorus from the deepest part of Crystal Lake. The treated water was then discharged to a nearby storm sewer and conveyed to Keller Lake. The Crystal Lake water quality demonstration project was a cooperative venture of the BDWMO, the MPCA, and the United States Environmental Protection Agency (U.S. EPA) under the Clean Lakes Program (CLP). The system operated during the 1996 and 1997 recreation seasons and half of the 1998 season. A side effect of the phosphorus removal system was a “rotten egg” odor. Operation was suspended in July 1998 after strong neighborhood opposition to the odor. The BDWMO decided to discontinue operation of the treatment system in April 1999. The BDWMO reached this decision after considering public input, the seasonal operating costs of $20,000, and the marginal improvements to the water quality of Crystal Lake during the recreation season.

A recommendation of the *Crystal & Keller Lake Use Attainability Analysis(UAA)* (Barr, 2003) was to modify the ferric chloride treatment system to withdraw surface waters and resume operating the system. The recommendation implemented to reduce the total phosphorus concentration and suppress the growth of curlyleaf pondweed in Keller Lake was an effort to reduce the phosphorus loading to Crystal Lake. Operation of the ferric chloride treatment system was resumed for varying time periods during the summers of 2003, 2004, 2005, 2006, 2007, and 2008. The system only operated for a short period during the summer of 2008 due to low water levels in Crystal Lake, and it was not operated at all during 2009 due to low water levels. In 2009, the BDWMO decided to terminate operation of the ferric chloride system because of concerns over the limited impact on the water quality in Crystal Lake and the cost of operating the system.

Lake monitoring data suggest that operation of the ferric chloride treatment system was successful in reducing the total phosphorus concentration in the deepest portions of Crystal Lake. However, the overall benefit to Crystal Lake water quality was insignificant. The decrease in phosphorus in the lower lake levels did not affect the phosphorus concentrations at the lake surface, nor did it increase the water clarity during the summer season. The operation of the hypolimnetic withdrawal system did however, play a significant role in maintaining water levels and improving water quality in Keller Lake.

2.8.1.2 Keller Lake

Keller Lake is a 52-acre lake (at normal water level) located in the cities of Burnsville and Apple Valley in the southern portion of the BDWMO. The lake is used primarily for fishing, canoeing, and wildlife viewing by the local residents. There is a park on the south side of Keller Lake but no beach or public access. Keller Lake is a BDWMO Category III strategic water body and is considered a shallow lake by the MPCA and is currently listed on the 303(d) impaired waters list.

Keller Lake currently discharges to the northeast side of Crystal Lake over a weir structure, at an elevation of 934.3 feet NGVD29, through a 72-inch RCP arch. Keller Lake has an average depth of 4.8 feet and a maximum depth of about 8 feet. Because the lake is so shallow, aquatic plants can grow over the entire lake bed and a summer thermocline is not usually present. The lake may also be subject to intermittent wind mixing, meaning the lake is polymictic (mixes several times per year).

The Keller Lake watershed is 1,447 acres (including the lake surface area). The Keller Lake watershed is fully-developed, and currently runoff from roughly 46 percent of this drainage district enters Keller Lake without first passing through some form of water quality treatment. Low density residential land use is the major land use (52.6%), followed by highway (20.5%) and natural, park, and open space (8%). Other land uses include: medium density residential, open water, commercial, developed parks, high density residential, and institutional. There is a large wetland area adjacent to the southwest side of Keller Lake.

2.8.1.3 Orchard Lake

Orchard Lake is a 243-acre lake located in Lakeville, in the southwest portion of the BDWMO. The lake is used primarily for fishing, but swimming, boating and aesthetic and wildlife viewing are also popular recreational uses of the lake. Over seventy private homes are located on the lake. Three city parks—a public boat access on the south shore (Orchard Lake Park), one public beach on the west shore (Orchard Lake Beach), and Wayside Park—are located on Orchard Lake. Orchard Lake is a BDWMO Category I strategic water body and is classified as a deep lake by the MPCA and can be listed on the 303(d) impaired waters list.

Orchard Lake's water surface area is 243 acres, with 75 percent of the area less than 15 feet deep. The lake's maximum depth is 33 feet, and its average depth is 10 feet.

Its 2,260-acre tributary watershed includes the Orchard Lake watershed and the Kingsley Lake watershed. The lake outlet is located on the west shore and discharges to the Credit River through Murphy Hanrehan Park Reserve so it is part of the Credit River hydrologic watershed.

Existing watershed land use conditions consist of a mixture of residential, commercial, institutional, park, golf course and undeveloped land. The commercial and high-density residential land uses are in the central portion of the watershed. Much of the Orchard Lake watershed is developed at low density or undeveloped, but the portion of the watershed along the I-35 corridor is undergoing rapid development.

2.8.1.4 Kingsley Lake

Kingsley Lake is a 51-acre lake located in Lakeville, in the southwest portion of the BDWMO. The lake is used primarily as an aesthetic resource. There is no public beach or access on Kingsley Lake, but the lake provides boating and canoeing opportunities for lake residents. Kingsley Lake is a BDWMO Category II strategic water body and is considered a shallow lake by the MPCA and can be listed on the 303(d) impaired waters list.

Kingsley Lake's water surface area is 51 acres, with a maximum depth of about 10 feet. The lake is shallow enough that aquatic plants could grow over the entire lake bed so the entire lake is littoral area. Also, because it is so shallow, a summer thermocline never develops. Kingsley Lake flows to Orchard Lake and ultimately to the Minnesota River via the Credit River. As a result, Kingsley Lake is also part of the Credit River hydrologic watershed. The natural outflow of Kingsley Lake is to Orchard Lake via a culvert under the roadway and railroad tracks. The City of Lakeville constructed a new outlet from Kingsley Lake in 1993.

The Kingsley Lake watershed is 216-acres. Existing land use conditions in the Kingsley Lake watershed include low density residential, undeveloped, commercial, and a small amount of institutional and very low density residential. Undeveloped land in the watershed is expected to convert to institutional and commercial land uses.

2.8.1.5 Lac Lavon

Lac Lavon is a 60-acre lake created from an inundated gravel pit. The lake is located on the Burnsville/Apple Valley border and is used primarily for fishing, swimming, aesthetics and wildlife viewing. The City of Burnsville no longer maintains a public beach on the west side of the lake, however this area will continue to be managed as a park and a public fishing pier on the northeast shore, but there is no public boat access. Because Lac Lavon is a former gravel pit, it is not part of the original MDNR public waters inventory. However, in recent years, it has been viewed as a fully-supporting lake by the MPCA. Lac Lavon is a BDWMO Category I strategic water body and is classified as a deep lake by the MPCA and can be listed on the 303(d) impaired waters list.

Lac Lavon typically acts as a land-locked basin. The only surface water outlet from Lac Lavon is a 12-inch diameter emergency overflow outlet to Keller Lake. A valve controls the flows in the overflow pipe and under normal conditions, the valve is closed. Water levels are primarily maintained by groundwater.

Its 184-acre tributary watershed (including the lake surface area) includes portions of the cities of Apple Valley and Burnsville. The existing watershed is primarily low-density residential and park land. Two city parks—a city of Burnsville park and a city of Apple

Valley park with a path to a fishing pier on the northeast shore—are located on Lac Lavon. Very little, if any, change is expected in the Lac Lavon watershed.

2.8.1.6 Sunset Pond

Sunset Pond is a 60-acre water body located in Burnsville in the western portion of the BDWMO. Sunset Pond is located at the downstream end of a series of water bodies that includes Keller Lake, Lee Lake, Lac Lavon, Crystal Lake, Wood Pond, Twin Lake, and Earley Lake.

Sunset Pond is primarily a stormwater detention basin. Although there are park areas around Sunset Pond, recreational activities on the waters of Sunset Pond are not planned, and except for a fishing pier, there are no current recreational facilities located on the lake. Recreational use of Sunset Pond is expected to be aesthetics, wildlife viewing, and fishing. The MDNR manages Sunset Pond as a children's fishing pond, through its Fishing in the Neighborhood (FiN) program.

Sunset Pond is a not a BDWMO strategic waterbody. By MPCA definition, Sunset Pond would be considered a shallow lake. However, because it is a constructed water body, it is not part of the MDNR PWI inventory, and is currently not classified as a lake by the MPCA.

The City of Burnsville created Sunset Pond in 1983 by constructing a dam along the northern end of a natural low marshy depression. The pond is shallow (with a maximum depth of about 10.5 feet) and includes areas of open water, islands, and aquatic plants. The shallowness of the pond means aquatic plants could grow over the entire pond bed and the entire lake area is considered littoral. The Sunset Pond outlet is located on the north side of the pond, and outflows drain north out of the BDWMO, through the Kraemer Nature Preserve (in the Lower Minnesota River Watershed District), eventually reaching the Minnesota River.

The direct watershed to Sunset Pond is 1,019 acres and includes land in Burnsville and a small amount of Savage. It receives water from not only the Sunset Pond watershed, but also the Crystal Lake, Keller Lake, Lee Lake, Lac Lavon, Earley Lake, Twin Lake, and

Wood Pond watersheds as well. As a result, the total Sunset Pond tributary area is 6,311 acres. Without the Lac Lavon watershed, which is land-locked, the Sunset Pond tributary area is 6,127 acres.

Existing watershed land use is a mixture of mostly industrial, low density residential and undeveloped/park land. The undeveloped areas will ultimately develop into industrial. The City of Burnsville developed park areas around Sunset Pond, and intends to maintain them as a nature preserve.

2.8.1.7 Lee Lake

Lee Lake is a 19-acre water body (at water elevation 946.1 feet NGVD29 (Lakeville, 2008)) located entirely within the City of Lakeville in the southern portion of the BDWMO. The lake has no public swimming beaches or public access. The lake is surrounded by privately owned property. Lee Lake is not a BDWMO strategic water body and is currently not classified. It is considered a shallow lake by the MPCA and is currently listed on the 303(d) impaired waters list. The City of Lakeville is currently working with the MPCA to remove Lee Lake from the impaired waters list based on recent data that indicates its water quality supports recreational and aquatic life uses.

Originally, Lee Lake was landlocked and experienced high flood levels until 1993 when a gated outlet to Crystal Lake was constructed. The Lee Lake outlet is located on the east side of the lake and is a stop log weir (at elevation 948.5 feet NGVD29) followed by a 36 inch gated structure (at an elevation of 947 feet NGVD29). The outlet was installed in 1993 to alleviate high flood levels. Water level monitoring shows that the lake levels are typically a foot to several feet below the installed outlet (948.5 feet NGVD29), with an average water level at 946.7 feet NGVD29 (based on available lake level data available from the MDNR Lake Finder website). The average depth of the lake is 7 feet and the maximum depth is about 15 feet (from the average water level). Lee Lake is dimictic lake; it mixes two times each year (during the spring and fall turnover events). The lake thermally stratifies throughout the growing season.

The Lee Lake watershed is 206 acres (including the lake surface area). The Lee Lake watershed is nearly fully-developed. Low density residential land use is the major land use (38%), followed by highway (29%) and open water (12%). Other land uses include: natural, park, and open space, commercial, and institutional.

2.8.1.8 Earley Lake

Earley Lake, located in the City of Burnsville in the central portion of the BDWMO, covers an area of approximately 23 acres, excluding the wetland adjacent to the lake on the northwest side. The primary uses of Earley Lake are aesthetics and wildlife viewing. There are no public beaches or boat access points on the lake. Earley Lake is not a BDWMO strategic water body and is not classified. It is considered a shallow lake by the MPCA, Earley Lake was previously listed on the 303(d) impaired waters list, but was removed from the list in 2010 based on water quality data.

Earley Lake is a shallow lake, with a mean depth of 3.8 feet and a maximum depth of 7.8 feet. As a result of the shallow conditions, macrophyte growth is prevalent throughout most of the lake, and the entire lake can be considered littoral area. The lake outlet is located at the southwest side of the lake, and consists of a three-sided box weir, with a total length of 12 feet and an overflow elevation of 905.0 feet above MSL. Earley Lake discharges into the Sunset Pond watershed; the discharge from the lake is conveyed westward through a 36-inch RCP pipe to Judicial Pond prior to reaching Sunset Pond, and ultimately the Minnesota River.

The direct watershed to Earley Lake is approximately 757 acres, including the surface area of the lake, and the lake also receives inflows from Lee Lake, Keller Lake, Crystal Lake, Lac Lavon, Wood Pond, and Twin Lake. The total Earley Lake watershed is 5,292 acres. Without Lac Lavon, which is land-locked, the total watershed area to Earley Lake is 5,108 acres. The Earley Lake watershed is characterized by heavy commercial land use (including all of Burnsville Center), as well as low-, medium-, and high-density residential use. Most of the undeveloped land in the watershed will be converted to commercial land in the future.

2.8.1.9 Wood Pond

Wood Pond is approximately 14 acres and is located in the City of Burnsville in the central portion of the BDWMO. The primary uses for the lake are canoeing, fishing, aesthetic viewing and wildlife habitat. There is currently no public boat landing on the lake. The lake has been listed as a kids' fishing pond since 1996. In 2007, a public fishing dock was constructed at Wood Park, as part of the MDNR FiN Program. Wood Pond is not a BDWMO strategic water body and is not classified. It is also classified as a public waters wetland.

Wood Pond is a shallow water body and is technically classified as a wetland as part of the MDNR PWI. The average water depth is 10 feet and the maximum water depth is 14 feet. The lake is shallow enough that aquatic plants could grow over the entire lake bed, meaning it is entirely littoral area. Wood Pond typically acts as an offline basin. The water level in the lake is controlled at elevation 1000.9 ft MSL by an 18-inch inlet/outlet pipe located at the west side of the lake. Discharge from the lake is conveyed southward through the trunk storm sewer system beneath Portland Avenue and eventually flows into Twin Lake.

The Wood Pond watershed is approximately 110 acres, including the lake's surface area. Wood Pond ultimately drains to Sunset Pond and the Minnesota River. The watershed is fully developed, with no significant changes in land use classification expected for the foreseeable future. The Wood Pond watershed is predominantly low- and medium-density residential land use. There is also some right-of-way land use in the watershed as well as some commercial land use southeast of the lake along County Road 42. Wood Park is located along the northeast shoreline of Wood Pond.

2.8.1.10 Twin Lake

Twin Lake, which consists of a North and South basin separated by Southcross Drive, covers an area of approximately 17 acres. South Twin Lake covers approximately 12 acres while the surface area of North Twin Lake is approximately 5 acres. The lake is located within the City of Burnsville in the central portion of the BDWMO. The primary uses for the lake are canoeing, fishing, aesthetic viewing and wildlife habitat. Although there is no public beach or boat landing on the lake, there is a park adjacent to the lake. Twin Lake is not a BDWMO strategic water body and is currently not classified. It is also classified as a public waters wetland.

Twin Lake is a shallow water body and is technically classified as a wetland as part of the MDNR PWI. South Twin is shallow, with a mean depth of 3.6 feet and a maximum depth of 11 feet. As a result of the shallow conditions, macrophyte growth is often prevalent throughout much of the lake. Although slightly deeper than South Twin, North Twin is also shallow, with a mean depth of 6.6 feet and a maximum depth of 12 feet.

Inflow from Crystal Lake enters the south side of South Twin via a 48-inch RCP storm sewer, along with local stormwater runoff. Twin Lake is also downstream of Wood Pond, a 14 acre basin located northeast of Twin Lake. Wood Pond is generally ‘offline’ from Twin Lake and discharges to Twin Lake only under extreme high water conditions. South Twin is connected to North Twin via a 36-inch diameter culvert underneath Southcross Drive, which generally acts as an equalizer pipe. Under normal circumstances, water flows from South Twin to North Twin, where it is discharged to a storm sewer system draining to Earley Lake. However, during significant storm events, the watershed runoff to North Twin exceeds the outlet capacity, and stormwater flows from North Twin to South Twin. The outlet from Twin Lake is located at the southwest side of North Twin, and consists of a three-sided box weir, with a total length of 12 feet and an overflow elevation of 918.0 feet above MSL. Discharge from Twin Lake is conveyed in a westward direction through a 36-inch RCP to Earley Lake.

The Twin Lake watershed is part of the Sunset Pond watershed. The direct watershed to Twin Lake watershed covers approximately 574 acres (excluding the Wood Pond watershed). The total watershed that flows to Twin Lake, including Lee Lake, Keller Lake, Lac Lavon, Crystal Lake, and Wood Pond is 4,536 acres. Not including Lac Lavon, which is land-locked, the area flowing to Twin Lakes is 4,352 acres. The land use is predominantly residential and park land, with the exception of a large commercial area between I-35W and I-35E that drains to North Twin Lake.

2.8.2 Streams and Open Channels

Although there are many lakes and wetlands throughout the BDWMO, there are very few natural streams within the watershed. The majority of the watershed is fully-urbanized and flows that were once conveyed through surface drainages and streams now flow through underground storm sewer.

Flows from the southwestern portion of the BDWMO that pass through Kingsley Lake, Orchard Lake, and the Cam Ram Wetland ultimately reach the Credit River (07020012-517) in the Scott WMO. Flows from the remainder of the BDWMO discharge to the Minnesota River (07020012-505) in the Lower Minnesota River Watershed District (LMRWD).

In addition, flows from the northern portion of the watershed reach two MDNR-designated trout streams (in the LMRWD) that flow into Black Dog Lake and eventually the Minnesota River.

2.9 WATER QUALITY MONITORING & STUDIES

Water quality data has been collected for many of the lakes and larger wetlands within the BDWMO. This data has been collected by several sources through a variety of programs. Table 2-4 summarizes the years water quality monitoring has been performed on water bodies within the BDWMO and Figure 2-12 shows the locations of both water quality and water quantity monitoring locations within the BDWMO.

2.9.1 BDWMO Monitoring Program

The BDWMO monitors the water quality for all strategic water resources. For more information about the BDWMO strategic waterbodies and waterbody classification, see Section 2.10.2. The following sections describe the various types of water body monitoring programs.

2.9.1.1 Survey Level Water Quality Monitoring

The BDWMO survey level water quality monitoring program is equivalent to the Metropolitan Council’s Citizen Assisted Monitoring Program (CAMP) (see Section 2.9.2). This is the basic requirement for water quality monitoring of the BDWMO strategic waterbodies and should be conducted annually. In practice, the BDWMO has performed CAMP monitoring on all strategic water bodies. An aquatic plant survey should be completed as part of the survey level monitoring that focuses on identifying exotic invasive aquatic plants.

2.9.1.2 Management Level Water Quality Monitoring

The BDWMO management level monitoring program involves collecting surface water samples on a biweekly basis from mid-April to mid-October (approximately 14 sampling events), but involves obtaining more detailed total phosphorus concentration data (i.e. samples at depths throughout the water column and more precise results). This type of monitoring is needed to assess problems (diagnostic) and is appropriate for regular monitoring (e.g. every three years) of a regionally important water body, such as Crystal Lake and/or Orchard Lake.

2.9.1.3 Intensive Water Quality Monitoring

The BDWMO intensive water quality monitoring program involves more sample collection dates and analyzing additional parameters at depth (besides total phosphorus) than the management level monitoring. This type of monitoring is needed to calibrate water quality models.

2.9.2 Citizen Assisted Monitoring Program (CAMP)

The Metropolitan Council's Citizen Assisted Monitoring Program (CAMP) has been collecting water quality data on a number of Twin Cities metropolitan area lakes since 1980. On a bi-weekly basis (April-October), citizen volunteers collect a surface water sample for laboratory analysis of total phosphorus, total Kjeldahl nitrogen, and chlorophyll-*a*, obtain a Secchi transparency measurement, and provide some user perception information about each lake's physical and recreational condition. Several waterbodies within the BDWMO have been monitored as part of the CAMP program including Crystal Lake, Keller Lake, Orchard Lake, Kingsley Lake, Lac Lavon, Sunset Pond, Lee Lake, Horseshoe Lake, Earley Lake, Wood Pond, Twin Lake, and Goose Lake. In recent years, funding for the CAMP monitoring of strategic water bodies comes from the BDWMO and from the respective cities for the non-strategic water bodies.

For more information about the CAMP program, please see the following website:
http://www.metrocouncil.org/environment/RiversLakes/Lakes/index.htm.

2.9.3 Member City Lake Monitoring

The BDWMO member cities are responsible for managing non-strategic Category I and II lakes and ponds to achieve the cities' goals. City management of these water bodies includes classifying, monitoring, tracking trends, conducting studies, and implementing other lake water quality management actions.

The cities have outlined their water quality monitoring programs in their approved water management plans. The City of Apple Valley participates in the CAMP program, monitoring water quality in all of their priority water bodies. The City of Burnsville water quality monitoring program includes involvement in the CAMP program including the following BDWMO water bodies: Keller, Crystal, Lac Lavon, Wood Pond, Earley Lake, Twin Lake, and Sunset Pond. The City of Lakeville has developed monitoring and management plans, including participation in the CAMP program, for their priority lakes, which include Orchard, Lee, and Kingsley Lakes in the BDWMO.

2.9.4 Other Programs

2.9.4.1 WOMP Monitoring

The BDWMO began operating a Watershed Outlet Monitoring Program (WOMP) station (Willow Creek) in spring 1999. The station was constructed and operated using cost-share funding from the Metropolitan Council. The station was located along the main discharge route from the BDWMO, downstream of Sunset Pond. The purpose of the station was to collect data regarding the quality of stormwater runoff discharging from a large portion of the BDWMO. In addition, water quality, streamflow and precipitation data were also collected at the Willow Creek WOMP station. The BDWMO operated the Willow Creek WOMP station through 2003. Operations of the WOMP station were turned over to the LMRWD in 2004 and the site was operated through 2009 and decommissioned in 2010 after collecting 10 years of data.

2.9.4.2 Sediment Core Analysis

In additional to pollutant (phosphorus) loading from external sources such as watershed runoff and atmospheric deposition, it is estimated that many water bodies experience loading from internal sources (such as the bottom sediments), especially when the bottom of the lake is very low in oxygen.

In order to better understand the potential loading from the bottom sediments, a number of lakes within the BDWMO have had sediment cores collected and analyzed for mobile phosphorus (which contributes directly to internal phosphorus loading).

Table 2-5 lists the years of sediment core analysis for water bodies with the BDWMO.

2.9.4.3 MPCA Citizen Lake Monitoring Program

The MPCA's Citizen Lake Monitoring Program (CLMP) is a cooperative program combining the technical resources of the MPCA and the volunteer efforts of citizens who collect water quality data on their lakes. This program provides low-cost Secchi discs to participants for measuring water clarity on an approximate weekly basis.

2.9.5 Water Quality Studies

A number of water bodies within the BDWMO have had water quality studies completed. The following includes a list of the various water quality studies that have been completed including the title, the year completed, the source of funding for the study, and who completed the study.

- *Crystal and Keller Lake Use Attainability Analysis* (July 2003); prepared for the BDWMO by Barr Engineering
- *Orchard Lake Diagnostic Feasibility Study* (August, 1998); prepared for the City of Lakeville by Barr Engineering
- *Twin and Earley Lake Use Attainability Analyses* (December 2007); prepared for the City of Burnsville by Barr Engineering
- *Wood Pond Use Attainability Analysis* (September 2008); prepared for the City of Burnsville by Barr Engineering
- *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Report and Earley Lake Water Quality Assessment* (November, 2011); prepared for BDWMO and the MPCA by Barr Engineering
- *Lac Lavon Water Quality Assessment* (January 2011); prepared for the BDWMO by Barr Engineering

2.10 WATER QUALITY MANAGEMENT CLASSIFICATION

2.10.1 Current Water Quality

The summer average water quality data (total phosphorus, chlorophyll-*a,* and Secchi disc transparency) for the most recent sampling year are included in Table 2-6 for the lakes and wetlands with monitoring data available. Summer average conditions are defined in accordance with the MPCA definition and span the period from June through September. Also included in this table is the Trophic State Index (TSI) based on the summer average Secchi depths.

2.10.2 BDWMO Classification System

The BDWMO set criteria for determining which water bodies should be managed by the BDWMO ("strategic" water resources). Strategic water resources are water resources of broad watershed significance that are important to a larger population than just the municipalities in which they are located. Water bodies need to meet certain criteria to be considered strategic water resources. Table 2-7 summarizes the criteria used to help define the strategic water resources. During the development of the 2002 WMP, the BDWMO identified six strategic water resources: Crystal Lake, Keller Lake, Orchard Lake, Kingsley Lake, Lac Lavon, and Sunset Pond. However, during the development of this plan, the BDWMO revisited the criteria used to define strategic water resources, and the BDWMO determined that Sunset Pond will no longer be managed as a strategic water resource. The BDWMO manages the strategic water resources while the cities are responsible for managing the other (non-strategic) lakes, ponds and wetlands in the BDWMO, including Sunset Pond, Earley Lake, Lee Lake, Wood Pond and Twin Lake.

The BDWMO classified the strategic resources (Category I – IV) based on their existing and projected future use, taking into account their existing water quality, and/or the presence of ecologically or biologically unique resources. These classifications may be revised, based on existing and desired uses of the water bodies and the results of future water quality and aesthetic/habitat monitoring.

A Category I water body has the highest water quality and supports swimming and other direct contact recreational activities, such as water skiing, scuba diving, and snorkeling. These water bodies have the highest/best water quality and are usually the most popular water bodies with the public. Category II water bodies support indirect recreational activities such as boating and fishing. These water bodies have poorer water quality than Category I water bodies, but are still popular with the public. Category III water bodies provide wildlife habitat, aesthetic enjoyment, and possibly warm water fishing, provided winter kill does not occur. Summer algal blooms are more common in Category II and Category III water bodies than in Category I water bodies. Water bodies classified as Category IV are typically water quality ponds used as nutrient and sediment traps to reduce downstream loading of sediment and/or phosphorus and other nutrients that contribute to degradation of water quality.

Table 2-6 includes a summary of the most recent water quality data for various water bodies within the BDWMO and the associated BDWMO classification, the BDWMO action levels, the MPCA classification and standards, impairments, including the year listed on the impaired waters list, reason for impairment, and the status of the associated TMDL analyses. Table 2-8 compares the BDWMO classification with the MPCA water quality classifications and standards. More information about the MPCA classification and impaired waters is included in Section 2.10.3.

2.10.2.1 Water Quality Trend Analyses & Action Levels

As part of its annual reporting, the BDWMO performs water quality trend analyses on the strategic water bodies, including Crystal Lake, Keller Lake, Orchard Lake, Kingsley Lake, and Lac Lavon. Prior to the development of this plan, the BDWMO managed Sunset Pond as a strategic waterbody and performed trend analyses on data for Sunset Pond through 2010. The trend analysis performed for each of the water quality parameters (total phosphorus, chlorophyll-*a,* and Secchi disc transparency) is the linear least squares regression method, and it determines if the changes in the water quality over the past 10 years are statistically significant. Significant differences from a slope of zero (no trends in water quality over time) were determined at the 90 percent confidence level. The change in water quality is deemed significant if a statistically significant trend is observed in total phosphorus and one of the dependent variables (chlorophyll-a or Secchi disc transparency). The period of analysis spans the most recent 10 years (pending data availability). For more information about the results of the trend analyses, see Section 3.1.6 and Appendix B.

In addition to performing trend analyses on the water quality data, the BDWMO used the water quality data and trend analyses to establish action levels for the strategic water bodies. This action level is based on the analysis of Secchi depths. The action level defines the threshold when additional management activities need to be considered should the most recent summer average water quality be worse than the established action level. Table 2-6 summarizes the action levels for the various water bodies within the BDWMO. Section 4.1 and Table 4-1 summarizes the management actions to be implemented when the action levels are not met.

2.10.3 MPCA Impaired Waters

The MPCA has developed eutrophication criteria for Minnesota lakes to help establish water quality goals and determine appropriate uses of the lakes, as outlined in the guidance document *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List* (MPCA, 2009).

The lake eutrophication criteria are based on several factors, including the ecoregion of Minnesota that the lake is found in as well as the depth of the lake. The MPCA defines shallow lakes as lakes with a maximum depth of 15 feet or a littoral area (area of lake 15 feet deep) of 80 percent or more. The BDWMO is entirely located in the North Central Hardwood Forest (NCHF) ecoregion of Minnesota.

Several water bodies within the BDWMO have been listed on the MPCA impaired waters (303(d)) list for a variety of impairments. Typically, lakes are listed as impaired when they exceed the MPCA ecoregion eutrophication criteria for a given water body. Water bodies on the impaired waters list are required to have an assessment completed that addresses the causes and sources of the impairment. This process is known as a total maximum daily load (TMDL) analysis. Water bodies on this list have exceeded the water quality criteria established by the MPCA for one or more measured parameters.

Figure 2-13 shows the location of the impaired waters within the BDWMO, and Table 2-6 includes a summary of the most recent water quality data for various water bodies within the BDWMO, the BDWMO classification, the BDWMO action level, the MPCA classification and standards, impairments, including the year listed on the impaired waters list, reason for impairment, and the status of the associated TMDL analyses. See Sections 3.1.3 and Section 4.1 for a more detailed discussion about the role of the BDWMO in the TMDL analyses required for those water bodies listed on the MPCA impaired waters list.

2.11 WATER QUANTITY/FLOODING

Water quantity monitoring, such as lake level monitoring and flow monitoring, has happened at various locations within the BDWMO. Figure 2-12 shows the locations of both water quantity as well as water quality monitoring locations within the BDWMO.

2.11.1 Water Quantity Monitoring

2.11.1.1 Water Level Monitoring

Water level data has been collected on several of the BDWMO water bodies and is available for Crystal Lake, Keller Lake, Lac Lavon, Lee Lake, Wood Pond, Twin Lake, Earley Lake, Goose Lake, Kingsley Lake, and Orchard Lake.

For more information regarding lake level data, see the MDNR Lakefinder website.

2.11.1.2 WOMP Monitoring

The BDWMO began operating a Watershed Outlet Monitoring Program (WOMP) station (Willow Creek) in spring 1999 that monitored streamflows downstream of Sunset Pond. For more information about the WOMP monitoring program, see Section 2.9.4.1.

2.11.2 Flood Insurance Studies

The Federal Emergency Management Agency (FEMA) performs flood insurance studies (FIS) and develops flood maps to determine areas prone to flooding during the 100-year (and sometimes 500-year) storm events. FEMA has not completed a FIS for the City of Apple Valley. The original FIS of the City of Burnsville was completed in September, 1977 (FEMA, 1977); however, there have been more recent updates in 2004 and 2005 (in the form of two letters of map revision (LOMR)) which updated base flood elevations for Twin and Early Lakes as well as for the Cam Ram Wetland area. The original FIS of the City of Eagan was completed in August, 1978 (FEMA, 1978). The revised FIS of the City of Lakeville was completed in April, 1998

(FEMA, 1998). Figure 2-14 shows the FEMA mapping of the 100-year floodplain in the BDWMO.

Dakota County has been in the process of updating the county-wide flood insurance rate maps (FIRM). Drafts of the updated FIRM maps are available and they are expected to be finalized in 2012.

2.11.3 Local Flooding Issues

High water levels on several of the BDWMO lakes have been identified as issues including Crystal Lake, Keller Lake, and Twin Lakes. For more information on flooding issues within the BDWMO, see Section 3.2.

2.11.4 Water Quantity Modeling Summary

2.11.4.1 City of Apple Valley Hydrologic and Hydraulic Modeling

The City of Apple Valley developed a HydroCAD model to evaluate its flood storage and conveyance system and estimate the flood elevations in lakes, wetlands, and ponds throughout the city using the 100-year, 24-hour storm event.

See the City of Apple Valley *Surface Water Management Plan* for more details.

2.11.4.2 City of Burnsville Hydrologic and Hydraulic Modeling

In 1994, the City of Burnsville developed a city-wide HydroCAD model to evaluate its flood storage and conveyance system and estimate the flood elevations in lakes, wetlands, and ponds throughout the city using the 100-year, 24-hour storm event and for the 10-year, 24-hour storm event.

Additionally XP-SWMM and HEC-RAS modeling was completed in 2004 and 2005 as part of the updates to the FEMA floodplain mapping.

See the City of Burnsville *Water Resources Management Plan* for more details.

2.11.4.3 City of Lakeville Hydrologic and Hydraulic Modeling

As part of the development of the City's *Stormwater Management Plan* (1995), the City of Lakeville developed a HEC-1 model to evaluate the flood storage and conveyance system within the City.

The peak flows and flood elevations were estimated for the critical durations of the 2-, 10-, 50-, 100-, and 500-year storm events.

The updated *Water Resources Management Plan* (2008) stated that the city will begin updating its hydrologic and hydraulic models using XP-SWMM.

See the City of Lakeville's *Water Resources Management Plan* for more details.

2.11.4.4 City of Eagan Hydrologic and Hydraulic Modeling

The results of a city-wide hydrologic and hydraulic analysis using HydroCAD were included in the City's *Stormwater Management Plan* (2007). The peak high water levels and peak outflow rates were summarized for the 100-year rainfall and snowmelt events for those ponds and water bodies that were modeled as part of the analysis.

See the City of Eagan's *Stormwater Management Plan* for more details.

2.12 NATURAL COMMUNITIES AND RARE SPECIES

The MDNR produces the Minnesota County Biological Survey identifying natural communities and rare species. Completed in 1997, the Dakota County survey map identifies where evidence indicates the presence of rare plants and animals. The survey shows the presence of rare plants and animals in BDWMO in the following locations (all are in Burnsville): along the western border of the BDWMO, in and near Murphy-Hanrehan Regional Park; in southern Burnsville, west of Crystal Lake and I-35; and just east of I-35W, between Highway 13 and Burnsville Parkway. See Figure 2-9 for the available Minnesota County Biological Survey data within and near the BDWMO. The survey also identifies the original vegetation in the area of the BDWMO as a mixture of brush prairie, oak openings and barrens, aspen-oak land, and upland deciduous forest.

Additional information, including native plant communities and Central Region Regionally Significant Ecological Areas is available on the MDNR's Data Deli (http://deli.dnr.state.mn.us). Records of rare species, which includes threatened and endangered species throughout the BDWMO, are maintained in the Rare Features Database (part of the Natural Heritage Information System). This information is considered sensitive, is protected under the Minnesota Data

Practices Act, and is only available through a NHIS Data Request Form or a License Agreement available on the MDNR website.

The City of Burnsville's *Natural Resources Master Plan* (2008) categorized a number of natural resource areas within the BDWMO as "high priority sites." Sites with a high number of native communities, any sites with rare species, and sites with complete community structure were given this designation. These high priority sites include:

- Crystal Lake, Keller Lake, Lac Lavon and neighboring areas (Crystal/Keller Resource Management Unit (RMU))
- Cam Ram Wetland, nearby areas, and Horseshoe Lake (Southwest RMU)
- Park within the City Center RMU
- Terrace Oaks Park and neighboring areas (Terrace Oaks RMU), and
- Sunset Pond and nearby areas (Sunset RMU)

The *Natural Resource Master Plan* also identified prioritized management tasks recommended within each of the management areas.

The Black Dog Scientific and Natural Area, calcareous fens and additional rare plants and animals are located just outside BDWMO, in the LMRWD.

2.13 FISH AND WILDLIFE HABITAT

2.13.1 MDNR Fisheries Surveys

The MDNR has completed fishery surveys for a number of the lakes within the BDWMO.

2.13.1.1 Crystal Lake

The MDNR classified Crystal Lake as a Class 34 fishery. Lakes in this category are good/fair permanent fish lakes, with rough fish such as carp and bullhead present.

The most recent MDNR fishery survey was completed in 2005. The fish survey found that bluegill and pumpkinseed sunfish were the most abundant fish captured, but were considered relatively small. Black bullhead, black crappie, green and hybrid sunfish, largemouth bass, northern pike, sauger, yellow bullhead, and yellow perch were also present.

The MDNR has actively stocked the lake with tiger muskies and black crappies in the past 10 years.

2.13.1.2 Keller Lake

The MDNR classified Keller Lake as a Class 37 lake. Lakes in this category are subject to occasional winter kill.

The most recent MDNR fishery survey was completed in 1985. The fish survey found that black bullhead, black crappie, and bluegill were the most abundant fish captured, but were considered relatively small. Green and hybrid sunfish, northern pike, and pumpkinseed sunfish were also present.

The MDNR does not have a current fish stocking program for Keller Lake.

2.13.1.3 Orchard Lake

MDNR classified Orchard Lake as a Class 29 lake. Lakes in this category are good, permanent fish lakes.

The most recent MDNR fishery survey was completed in 2006. The fish survey found that bluegill, hybrid sunfish, and pumpkinseed sunfish were the most abundant fish captured. Other fish species sampled included black bullhead, black crappie, brown bullhead, golden shiner, green sunfish, largemouth bass, northern pike, tiger muskies, walleye, white sucker, yellow bullhead, and yellow perch.

The MDNR has actively stocked the lake with tiger muskies and walleye in the past 10 years.

2.13.1.4 Kingsley Lake

The MDNR has not established a fisheries classification for Kingsley Lake and a fishery survey had not been completed. Kingsley Lake is a shallow lake most likely subject to winterkill of fish. There is no evidence to support the presence of a complex fish community in Kingsley Lake. The lake continues to be home to nesting loons, a rarity for a southern Minnesota lake.

2.13.1.5 Lac Lavon

The MDNR classified Lac Lavon as a Class 33 fishery. Lakes in this category are good, permanent fish lakes.

The most recent MDNR fishery survey was completed in 2004. The fish survey found that bluegill, northern pike, and hybrid and pumpkinseed sunfish were the most abundant fish captured. Other fish species sampled included black bullhead, black crappie, green sunfish, and largemouth bass.

The MDNR has actively stocked the lake with smallmouth bass and lake herring (cisco) in the past 10 years. The MDNR historically stocked Lac Lavon with rainbow trout, one of only six lakes in the metropolitan area that the MDNR stocked with trout; however this stocking was discontinued in 2000.

2.13.1.6 Sunset Pond

The MDNR has not established a fisheries classification for Sunset Pond. The shallowness of Sunset Pond indicates it may be subject to frequent winterkill.

The most recent MDNR fishery survey was completed in 2009. The fish survey found that bluegill and pumpkinseed sunfish were the most abundant fish captured. Other fish species sampled included black bullhead, black crappie, brown bullhead, hybrid sunfish, largemouth bass, northern pike, and yellow bullhead.

The MDNR has actively stocked the lake with black crappie, bluegill, northern pike and yellow bullhead in the past 10 years.

As noted in Section 2.8.1.6, the MDNR manages Sunset Pond as a children’s fishing pond, through its FiN program.

2.13.1.7 Lee Lake

The MDNR has not established a fisheries classification for Lee Lake.

The most recent MDNR fishery survey was completed in 1991. The fish survey found that bluegill and black bullhead were the most abundant fish captured. Winterkills appear to be frequent.

The MDNR does not have a current fish stocking program for Lee Lake.

In a fishery survey conducted by Blue Water Science in August 2004 for the City of Lakeville, extremely high numbers of bluegill, sunfish, and black bullheads were observed, potentially impacting the observed water quality. Fish removal activities began in late 2004 and continued in 2005, 2006 and 2008.

2.13.1.8 Earley Lake

The MDNR has not established a fisheries classification for Earley Lake or conducted any fish surveys on Earley Lake. Residents report catching black crappie, largemouth bass, and bluegill in the lake.

2.13.1.9 Wood Pond

The MDNR has not established a fisheries classification for Wood Pond. Wood Pond is subject to winter kill because of its shallow depth.

The most recent MDNR fishery survey was completed in 2004. The fish survey found that bluegill and black bullhead were the most abundant fish captured. Other fish species sampled included black crappie and yellow perch. A snapping turtle was also observed.

The MDNR has actively stocked the lake with black crappie, bluegill, walleye, yellow perch, and largemouth bass in the past 10 years.

The MDNR manages Wood Pond as a children's fishing pond, through its FiN program.

2.13.1.10 Twin Lake

The MDNR has not established a fisheries classification or conducted any fish surveys on Twin Lake. Twin Lake is subject to winter kill because of its shallow depth.

2.13.2 BDWMO Habitat Monitoring Program

In 2002, the BDWMO created a habitat monitoring program for strategic water resources within the watershed and implementation began in 2003 and has continued. The program includes monitoring of biological and physical indicators, such as upland and aquatic vegetation, buffer zones, erosion, sedimentation, and non-native species as well as recommending management actions based on monitoring results.

In 2010, based on feedback from city staff, the BDWMO approved changes to the habitat monitoring program to provide more effective monitoring, more useful and holistic results, and to reduce the monitoring costs. The proposed changes, which began in 2011, reduce the monitoring and reporting for each strategic water body to once every five years, rather than annually. This will allow for more in-depth habitat monitoring and can be used to develop an individual habitat management report for each water body. Habitat monitoring was performed for Kingsley Lake in 2011. Kingsley Lake was rated as "high" for overall submergent vegetative quality, overall emergent vegetative quality, and overall buffer quality. Recommended lake management actions resulting from the habitat monitoring are described in the *2011 Habitat Monitoring of Kinglsey Lake* (Barr, 2011).

Table 2-9 summarizes the BDWMO habitat monitoring program including the lakes and years surveyed. Each habitat monitoring report includes a table summarizing data from previous habitat monitoring. Habitat monitoring reports are available from the BDWMO website.

2.13.3 Macrophyte Monitoring

Aquatic plants, or macrophytes, are a natural and integral part of most lake communities. A lake's aquatic plants, generally located in the shallow areas near the shoreline of the lake provide habitat for fish, insects, and small invertebrates, provide food for waterfowl, fish and wildlife, produce oxygen, provide spawning areas for fish, help stabilize and protect shorelines from wave erosion, and provide nesting sites for waterfowl.

Macrophyte surveys have been completed in a number of the water bodies within the BDWMO. Table 2-10 summarizes the years that macrophyte monitoring was completed for the various water bodies within the BDWMO. Also included are the key invasive macrophytes (curlyleaf pondweed and Eurasian watermilfoil) that are present in the water bodies.

Curlyleaf pondweed is an invasive aquatic macrophyte that displaces native aquatic species. Because of the timing of its growth and die-back cycle, curlyleaf pondweed can be a significant source of phosphorus in a lake during the mid-summer months. Eurasian watermilfoil is another invasive macrophyte that can displace native species and significantly interfere with the recreational uses of a lake by forming dense mats at the water surface.

The member cities and the MDNR have been involved in mechanical harvesting and chemical treatment of macrophytes in certain BDWMO water bodies. Years when harvesting occurred is also summarized in Table 2-10.

2.13.4 Wetland Health Evaluation Program

Dakota County coordinates the Wetland Health Evaluation Program (WHEP) in conjunction with Hennepin County. Through the program, volunteers are trained and work as part of a community-based team to collect data on wetland plants and macroinvertebrates using sampling methods and evaluation metrics developed by the MPCA to evaluate wetland health. The wetland sampling efforts began in 1997 in Dakota County and up to 11 cities/citizen teams have participated in the project. Dakota County cities taking part in the program are Apple Valley, Burnsville, Eagan, Farmington, Hastings, Lakeville, Mendota Heights, Rosemount, and South St. Paul.

Figure 2-12 shows the location of the WHEP monitoring sites within the BDWMO, along with the other water quality and quantity monitoring locations. Cities within the BDWMO utilize WHEP data as baseline data for specific sites to monitor changes over time.

2.14 POLLUTANT SOURCES

2.14.1 Hazardous Materials

There are many permitted sites, hazardous waste generators, and contaminated sites within the BDWMO. The MPCA maintains a database of these sites which includes permitted sites (air, industrial stormwater, construction stormwater, wastewater discharge), hazardous waste generating sites, leak sites, petroleum brownfields, tank sites, unpermitted dump sites, and sites enrolled in the Voluntary Investigation and Cleanup (VIC) program. This information is available online through the MPCA's What's In My Neighborhood program. The location of these potentially contaminated or hazardous waste sites should be considered as sites are redeveloped and BMPs are implemented.

There are no active Superfund sites within the BDWMO. The Superfund program is a United State Environmental Protection Agency (EPA) program established to address and clean-up abandoned hazardous waste sites.

2.14.2 Subsurface Sewage Treatment Systems

There are many parcels with the BDWMO that are still served by subsurface sewage treatment systems (SSTS). Approximately 229 properties in southwest Burnsville continue to be served by SSTS, all of which are located within the BDWMO. There are still many properties served by SSTS within the City of Lakeville, 129 of which are located within the BDWMO. There are two SSTS in Apple Valley within the BDWMO. Failing or substandard SSTS may be a non-point source of pollutants. Improperly sited, installed or maintained systems may achieve inadequate treatment of sewage. In addition to the public health risks of untreated or inadequately treated sewage (e.g., contamination of wells), sewage contains the nutrient phosphorus, which if discharged into water bodies can cause excessive algae and aquatic plant growth leading to degradation in water quality. The MPCA implements an SSTS regulatory program to manage the environmental and public health impacts of SSTS (see Section 3.1.2).

2.14.3 Non-Point Pollution Sources

Non-point source pollution cannot be traced to a single source or pipe. Instead, pollutants are carried from land to water in stormwater or snowmelt runoff, in seepage through the soil, and in atmospheric transport (see Section 3.1 and Appendix D). Discharge from stormwater pipes is considered a non-point source discharge as the pollutants coming from the pipe are generated across the watershed contributing to the pipe, not at a single location. Non-point sources of phosphorus come from urban runoff, construction sites, subsurface sewage treatment systems (SSTS or septic systems), and, in agricultural areas, from fields and feedlots. Point sources frequently discharge continuously throughout the year, while non-point sources discharge in response to precipitation or snowmelt events.

For most water bodies, non-point source runoff, especially stormwater runoff, is a major contributor of pollutants (see Section 3.1 and Appendix D). Land use changes resulting in increased imperviousness or land disturbance (e.g., urbanization, construction or agricultural practices) also may increase the amount of stormwater runoff. Nonpoint source runoff affects not only the water resources located within the BDWMO, but also (ultimately) the Minnesota River and other downstream waters.

Section 2 Tables

Table 2-1: Precipitation Summary—Minneapolis/St. Paul Airport Station

Averages: 1971-2000 Extremes: 1891-2001

Total Precipitation, Inches					Snow, inches		# Days with Precip		
Month	Mean	High — Yr	Low — Yr	1-Day Max	Mean	High — Yr	≥ .10	≥ .50	≥ 1.0
Jan	1.04	3.63 1967	0.05 1892	1.21 1/24/1967	13.7	46.4 1982	3.6	0.3	0
Feb	0.79	3.25 1922	0.03 1894	1.90 2/4/1930	8.2	26.5 1962	2.7	0.3	0
Mar	1.86	4.75 1965	0.09 1910	1.62 3/1/1965	10.5	46.1 1965	5.1	0.8	0.2
Apr	2.31	7.00 2001	0.16 1987	2.22 4/27/1975	3.1	21.8 1983	5.5	1.4	0.2
May	3.24	10.33 1906	0.21 1934	3.16 5/21/1906	0.1	2.4 1954	7.2	2.2	0.7
Jun	4.34	9.82 1990	0.22 1988	2.91 6/7/1984	0	0.0 1949	7.5	3	1.1
Jul	4.04	17.90 1987	0.11 1936	9.15 7/23/1987	0	0.0 1948	6.2	2.4	0.9
Aug	4.05	9.31 1977	0.20 1925	7.28 8/30/1977	0	0.0 1948	6.5	2.6	0.9
Sep	2.69	7.77 1903	0.41 1940	4.96 9/12/1903	0	0.4 1985	5.6	1.7	0.6
Oct	2.11	6.42 1911	0.01 1952	2.75 10/19/1934	0.6	8.2 1991	4.4	1.3	0.4
Nov	1.94	5.29 1991	0.02 1939	2.52 11/11/1940	10	46.9 1991	4.5	1.1	0.2
Dec	1	4.27 1982	0.00 1943	1.50 12/14/1891	10.2	33.5 1969	2.9	0.2	0.1
Annual	29.41	40.15 1911	11.54 1910	9.15 7/23/1987	56.3	101.5 1983	61.8	17.1	5.3
Winter	2.83	6.24 1967	0.69 1958	1.90 2/24/1930	32.1	71.7 1967	9.3	0.8	0.2
Spring	7.41	16.13 1965	2.12 1910	3.16 5/21/1906	13.7	48.1 1965	17.8	4.3	1
Summer	12.43	23.52 1987	1.73 1894	9.15 7/23/1987	0	0.0 1949	20.2	8	3.2
Fall	6.74	13.50 1911	1.71 1952	4.96 9/12/1903	10.6	55.1 1991	14.5	4	1.3

Source: Midwest Regional Climate Center Website (http://www.mcc.sws.uiuc.edu) – Climate of the Midwest

Table 2-2: Selected Precipitation and Runoff Events

Type of Event and Frequency	Duration	Amount (Inches)
Rainfall		
1-year	24 hour	2.35
2-year		2.75
5-year		3.5
10-year		4.2
25-year		4.8
50-year		5.3
100-year		6.0
25 year	10 day	8.8
50-year		10.0
100-year		11.0
Runoff (snowmelt)		
10-year	10 day	4.7
25-year		5.7
50-year		6.4
100-year		7.1

Source: Hydrology Guide for Minnesota (USDA Soil Conservation Service)

Table 2-3: Summary of BDWMO PWI and Physical Characteristics

			MDNR Identification		Physical Characteristics								
BDWMO Water Body	Municipality	Downstream Receiving Water	MDNR Public Waters ID Number	PWI Class	Water Area (acre)	Perimeter (mi)	Littoral Area (acre)	Average Depth (feet)	Max Depth (feet)	Direct Watershed Area, including Lake Surface Area (acre)	Total Watershed Area including All Upstream Lakes (acre)	Normal Water Level (ft MSL)	100-Year Flood Elevation (ft MSL)
Lakes													
Crystal	Burnsville & Lakeville	Minnesota River	19-0027	P	292	5.3	208	10	35	2013	3852	933.5	935.8
Keller	Burnsville	Minnesota River	19-0025	P	52	1.2	52.0	4.8	8	1447	1447	934.3	938.6
Orchard	Lakeville	Credit River	19-0031	P	243	4.7	177	10	33	2045	2260	N/A	979.1
Kingsley	Lakeville	Credit River	19-0030	P	51	3.0	51.0	N/A	10.2	216	216	N/A	982.4
Lac Lavon	Apple Valley & Burnsville	Minnesota River	19-0446	N/A	60	2.1	39	N/A	32	184	184	Landlocked	933.1
Sunset Pond	Burnsville	Minnesota River	19-0451	N/A	60.0	2.5	60.0	N/A	10.5	1019	6311	N/A	854.8
Lee	Lakeville	Minnesota River	19-0029	P	19.0	1.2	19.0	7.0	15	206	206	948.5/ 947.0	951.9
Earley	Burnsville	Minnesota River	19-0033	P	23.3	1.1	23.3	3.8	7.8	757	5292	905	910.1
Horseshoe	Lakeville	Credit River	19-0032	P	11.7	0.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wetlands													
Wood Pond	Burnsville	Minnesota River	19-0024	W	14.0	0.6	14.0	10	14	110	110	1000.9	1003.6
Twin (South)	Burnsville	Minnesota River	19-0028	W	11.7	1.0	11.7	3.6	11	574	4536	918	920.2
Twin (North)					5.1		5.1	6.6	12				
Unnamed (Cam Ram Wetland)	Burnsville	Credit River	19-0380	W	51.2	2.3	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0113	W	5.6	0.5	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0114	W	6.9	0.7	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0115	W	4.7	0.5	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0116	W	4.3	0.5	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0152	W	3.3	0.4	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0170	W	3.0	0.3	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0171	W	1.0	0.2	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0172	W	2.5	0.3	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0174	W	2.2	0.2	--	--	--	--	--	--	--
Unnamed	Burnsville & Eagan	Minnesota River	19-0191	W	8.6	0.8	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0192	W	2.5	0.4	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0193	W	5.7	0.5	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0194	W	2.4	0.3	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0195	W	3.4	0.3	--	--	--	--	--	--	--
Unnamed	Burnsville	Credit River	19-0197	W	0.2	0.1	--	--	--	--	--	--	--

Table 2-3: Summary of BDWMO PWI and Physical Characteristics

			MDNR Identification		Physical Characteristics								
BDWMO Water Body	Municipality	Downstream Receiving Water	MDNR Public Waters ID Number	PWI Class	Water Area (acre)	Perimeter (mi)	Littoral Area (acre)	Average Depth (feet)	Max Depth (feet)	Direct Watershed Area, including Lake Surface Area (acre)	Total Watershed Area including All Upstream Lakes (acre)	Normal Water Level (ft MSL)	100-Year Flood Elevation (ft MSL)
Unnamed	Burnsville	Minnesota River	19-0210	W	4.2	0.3	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0211	W	1.2	0.2	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0359	W	5.7	0.5	--	--	--	--	--	--	--
Unnamed (Goose Lake)	Lakeville	Minnesota River	19-0360	W	5.3	0.4	--	--	--	--	--	--	--
Unnamed	Lakeville	Minnesota River	19-0361	W	3.2	0.3	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0362	W	4.9	0.5	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0363	W	11.4	0.9	--	--	--	--	--	--	--
Unnamed	Burnsville	Minnesota River	19-0364	W	7.3	0.4	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0365	W	2.9	0.3	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0369	W	5.8	0.5	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0371	W	10.1	1.2	--	--	--	--	--	--	--
Unnamed	Burnsville	Credit River	19-0381	W	2.3	0.2	--	--	--	--	--	--	--
Unnamed	Burnsville	Credit River	19-0382	W	2.2	0.4	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0383	W	6.9	0.5	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0384	W	2.4	0.4	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0385	W	3.3	0.3	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0386	W	2.6	0.4	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0387	W	11.2	1.3	--	--	--	--	--	--	--
Unnamed	Lakeville	Credit River	19-0388	W	2.7	0.3	--	--	--	--	--	--	--

Table 2-4: Summary of Water Quality Monitoring of Water Bodies in the BDWMO

BDWMO Water Body	MDNR Public Waters ID Number	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Keller	19-0025																								c	c	v	v	v	v	v,d	v	v	v	v,d	v2,d	v2,d	d	v2	v2
Crystal	19-0027	x	x	x	x	x	x	x	c	x	x	c	x	x	x	x	x	c	x	x	x		c	c,d	c,d	c,d	c	v	v	v	v,d	v	v	v	v,d	v2,d	v2,d	v2,d	v2	v2
Lee	19-0029																						v	v	v	v			v	v	v	v	v	v	v	v1,d	v1,d	v1	v2	v1
Kingsley	19-0030																					c		v	v	v			v	v	v	v	v	v	v	v2	v2	v2	v2	v2
Orchard	19-0031								c	c		c						c				c		x	x		c	v	v	v	d	v	v	v,d	v,d	v2	v2	v2	v2	v2
Horseshoe	19-0032																							v	v												v			
Earley	19-0033																						v	v	v	v	v	v	v	v	v	v	v	v	v	v1	v1	v1	v1	v1
Lac Lavon	19-0446																	x	x	x						v	v	v	v	v	v	v	v	v	v	v2	v2,d	v2	v2,d	v2
Sunset Pond	19-0451																						v	v	v	v	v		v	v	v	v	v		v	v2	v2	v2	v2	v2
Wood Pond	19-0024																								v	v	v	v	v	v	v	v	v	v	v	v1	v1	v1	v1	v1
Twin	19-0028																											v		v	v	v	v	v	v	v1	v1	v1	v1	v1
Unnamed (Goose Lake)	19-0360																							v	v															

c - CAMP data

v - CAMP data collected by volunteers

1 - CAMP funded by respective cities in which the water body is located

2 - CAMP funded by the BDWMO

d - Detailed water quality data (Management Level) collected by the BDWMO and member cities

x - Monitoring data collected by other agencies

Table 2-5: Summary of Sediment Core Collection and Analysis of Water Bodies in BDWMO

BDWMO Water Body	Sampling Year			
	2006	2007	2009	2010
Keller			x	
Crystal			x	
Lee			x	
Lac Lavon				x
Earley	x			
Twin	x			
Wood Pond		x		

Table 2-6: Summary of Water Quality, BDWMO Classifications, MPCA Classifcation and Standards, and Impaired Waters

			MDNR Identification		Most Curent Water Quality Data - Summer Averages[1]							BDWMO Classifications			MPCA North Central Hardwood Forest Water Quality Standard				Impaired Waters				
BDWMO Water Body	Municipality	Downstream Receiving Water	MDNR Public Waters ID Number	PWI Class	Year	TP (ug/L)	Chl *a* (ug/L)	Secchi Disc Transparency (m)	TSI_{SD}	TSI_{SD} Classification	Lake Grade (TP-Chl*a* -SD)	BDWMO Strategic Water Bodies	BDWMO Classification	BDWMO Action Level - Secchi Depth (m)	MPCA Classification	TP (ug/L)	Chl a (ug/L)	Secchi Disc Transparency (m)	Year Listed	Impairment	TMDL Status	Public Access	Comment
Lakes																							
Crystal	Burnsville & Lakeville	Minnesota River	19-0027	P	2010	28.9	24.3	1.6	53	Eutrophic	B-C-C	Strategic	Category I	N/A[2]	Deep	< 40	< 14	> 1.4	2002	Excess Nutrients	Approved TMDL - 2010	Yes - Boat Launch, Beach, Park	
																			1998	Mercury	Approved Statewide TMDL - 2007		
Keller	Burnsville	Minnesota River	19-0025	P	2010	76.0	62.0	0.6	67	Hypereutrophic	D-D-F	Strategic	Category III	N/A[2]	Shallow	< 60	< 20	> 1.0	2002	Excess Nutrients	Approved TMDL - 2010	Yes - Park	
Orchard	Lakeville	Credit River	19-0031	P	2010	27.0	6.6	3.0	44	Mesotrophic	B-A-B	Strategic	Category I	< 1.8	Deep	< 40	< 14	> 1.4	2004	Mercury	Approved Statewide TMDL - 2007	Yes - Boat Launch, Beach, Park	
Kingsley	Lakeville	Credit River	19-0030	P	2010	15.0	2.0	3.0	44	Mesotrophic	A-A-A	Strategic	Category II	< 2.2	Shallow	< 60	< 20	> 1.0	Not Listed			No - Residents only	
Lac Lavon	Apple Valley & Burnsville	Minnesota River	19-0446	N/A	2010	15.1	2.7	3.6	41	Mesotrophic	A-A-A	Strategic	Category I	< 3.5	Deep	< 40	< 14	> 1.4	2004	Mercury	Approved Statewide TMDL - 2007	Yes - Park (formerly a beach)	Viewed as fully-supporting lake (since 2008) and thus can be listed on the Impaired Waters List
Sunset Pond	Burnsville	Minnesota River	19-0451	N/A	2010	66.9	6.6	2.2	49	Mesotrophic	D-A-B	Non-Strategic	N/A	N/A	Shallow	< 60	< 20	> 1.0	Cannot Be Listed as not part of original PWI - Will be Reviewed again in 2016			Yes - Park	Not viewed as a "lake" by the MPCA as they do not have the tools to access right now. Will review in 2016.
Lee	Lakeville	Minnesota River	19-0029	P	2010	27.8	8.8	3.1	44	Mesotrophic	A-A-A	Non-Strategic	N/A	N/A	Shallow	< 60	< 20	> 1.0	2002	Excess Nutrients	Approved TMDL - 2010	No - Residents only	
Earley	Burnsville	Minnesota River	19-0033	P	2010	40.1	14.4	1.4	55	Eutrophic	C-B-C	Non-Strategic	N/A	N/A	Shallow	< 60	< 20	> 1.0	Not Listed			No - Residents only	
Horseshoe	Lakeville	Credit River	19-0032	P	2008	Only 1 day was sampled in 2008						Non-Strategic	N/A	N/A	N/A	N/A	N/A	N/A	Not Listed			Yes - Park	
Wetlands																							
Wood Pond	Burnsville	Minnesota River	19-0024	W	2010	39.9	25.5	2.0	50	Mesotrophic	C-C-C	Non-Strategic	N/A	N/A	N/A	N/A	N/A	N/A	Cannot Be listed - Wetland			Yes - Park	
Twin (South)	Burnsville	Minnesota River	19-0028	W	2010	35.9	19.1	1.5	54	Eutrophic	C-B-C	Non-Strategic	N/A	N/A	N/A	N/A	N/A	N/A	Cannot Be listed - Wetland			Yes - Park	
Twin (North)																							
Rivers and Streams																							
Minnesota River		Minnesota River	07020012-505		--	--	--	--	--	--	--	--	--	--	--	--	--	--	1994	Fecal Coliform			
					--	--	--	--	--	--	--	--	--	--	--	--	--	--	1998	PCB in Fish Tissue			
					--	--	--	--	--	--	--	--	--	--	--	--	--	--	2004	Mercury	Approved Statewide TMDL - 2007		
					--	--	--	--	--	--	--	--	--	--	--	--	--	--	1998	Dissolved Oxygen	Approved TMDL - 2004		
Credit River		Minnesota River	07020012-517		--	--	--	--	--	--	--	--	--	--	--	--	--	--	Not Listed				

1 - This data represents the summer average of the most recent year water quality data was collected, not the 10-year summer average as used by the MPCA

2 - No action levels set as currently being studied as part of a TMDL. Action level will be set once the data meets the MPCA water quality standards.

Table 2-7: BDWMO Criteria Defining Strategic Water Bodies

Water Body Name (Bold type indicates a strategic water body)	Criteria and Rating (had to meet 4 out of 5 criteria to be strategic)				
	Major subwatershed receives drainage from more than one city.	Important regional resource for either 1) recreation (i.e. swimming, boating, adjacent regional park, etc.), or 2) wildlife/natural resource reasons	Directly discharges into a significant downstream resource such as the Minnesota River, a trout stream, or another significant resource as determined by the WMO	Has average or higher water quality (i.e. grade "C" in CAMP) than typically found in similar lakes, ponds, or streams	Has a surface area of at least 50 acres
[1]**Crystal Lake (19-27)**	X	X		Yes (B-C-C)	X
[1]**Keller Lake (19-25)**	X	X	X	No (D-D-F)	X
[1]**Kingsley Lake (19-30)**		X	X	Yes (A-A-A)	X –Including wetland areas around lake
[1]**Lac Lavon**	X	X		Yes (A-A-A)	X
[1]**Orchard Lake (19-31)**	X[2]	X		Yes (B-A-B)	X
[3]Sunset Pond		X		Yes (D-A-B)	X
Earley Lake (19-33)		X		Yes (C-B-C)	
Horseshoe Lake (19-32)	X			Unknown	
Lee Lake (19-29)			X	Yes (A-A-A)	
Twin Lakes (19-28)		X		Yes (C-B-C)	
Wetland 19-381 (CamRam)		X		Unknown	X
Wood Lake (19-24)		X		Yes (C-C-C)	

[1] Meets four out of the five criteria - BDWMO Strategic Water Body

[2] Part of tributary watershed lies within Credit River Township, which is not part of the BDWMO Joint Powers Agreement

[3] Only receives a very minor amount of runoff from the City of Savage therefore assumed to meet three out of the five criteria; was removed from the BDWMO Strategic Waterbodies.

Table 2-8: Comparison of BDWMO Strategic Water Body Classification and MPCA Lake Water Quality Standards

MPCA Lake Classification and Water Quality Standards	Existing BDWMO Water Body Classification Categories				Not Classified as Strategic by BDWMO
	I Direct Contact Recreational Activities	II Non-contact Recreational Activities	III Habitat, Aesthetics, Fishing	IV Nutrient & Sediment Traps	
Deep Lakes (15 Ft and greater) **TP <40 ug/L** **Chl *a* <14 ug/L** **Secchi Disc >1.4 meters**	Crystal Lake Orchard Lake Lac Lavon				
Shallow Lakes (less than 15 Ft) **TP <60 ug/L** **Chl *a* <20 ug/L** **Secchi Disc >1.0 meters**		Kingsley Lake	Keller Lake		Lee Lake Earley Lake Horseshoe Lake
					Sunset Pond Twin Lakes Wood Lake CamRam Wetland

Table 2-9: Summary of the BDWMO Habitat Monitoring Program

BDWMO Water Body	Habitat Monitoring Year								
	2003	2004	2005	2006	2007	2008	2009	2010	2011
Keller	x	x	x	x	x	x	x		
Crystal	x	x	x	x	x	x	x		
Lee	x	x	x	x	x	x	x		
Kingsley	x	x	x	x	x	x	x		x
Orchard	x	x	x	x	x	x	x		
Lac Lavon	x	x	x	x	x	x	x		
Sunset Pond	x	x	x	x	x	x	x		

Note: *habitat monitoring reports are available from the BDWMO website and includee a table summarizing previous monitoring results*

Table 2-10: Summary of the Macrophyte Monitoring in Water Bodies in the BDWMO

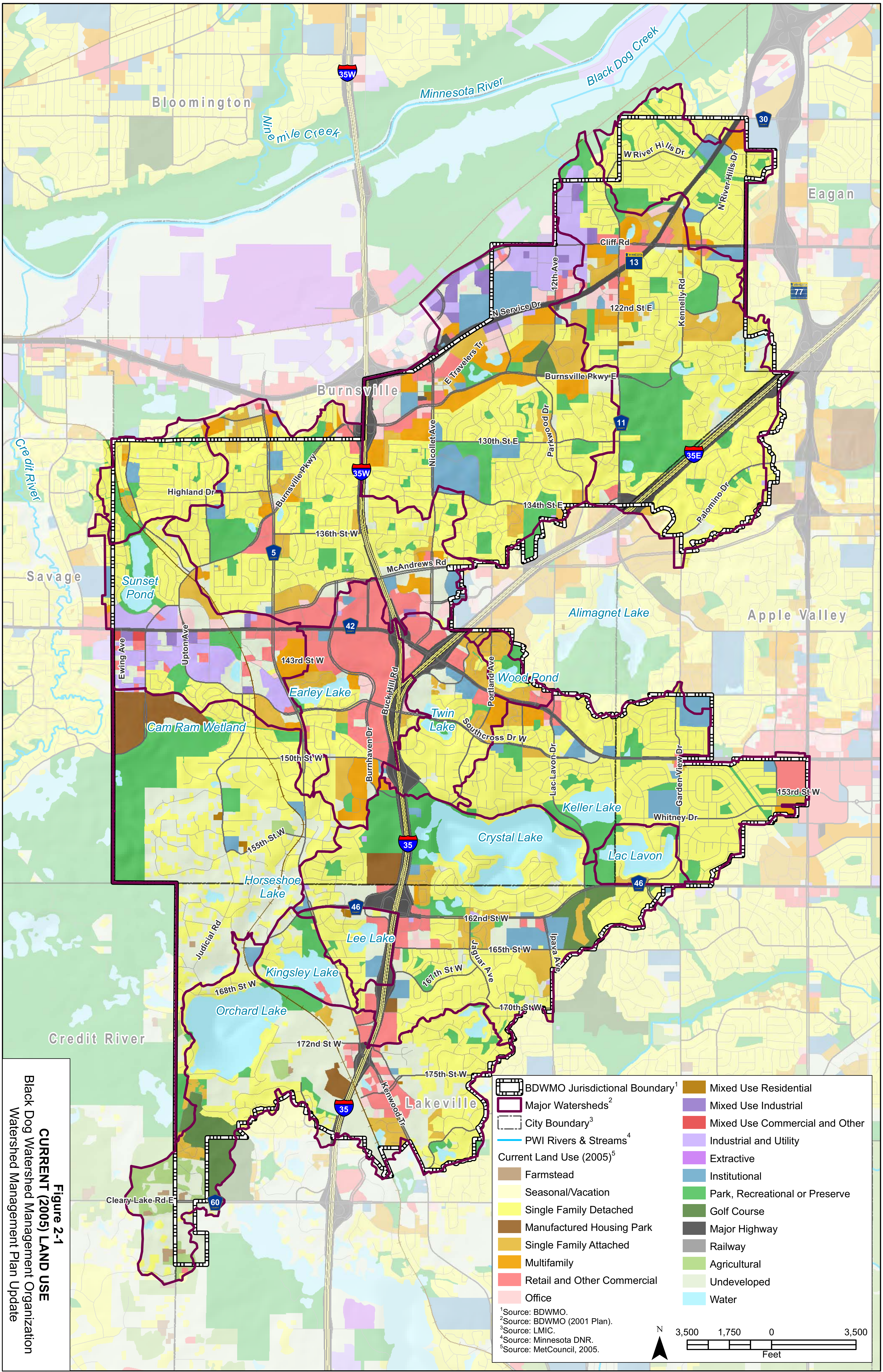
BDWMO Water Body	Monitoring Year																	Invasive Species Present	Macrophyte Harvesting/ Herbicide Treatment
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
Keller				x	x	x			x	x	x	x	x	x	x	x	x	Eurasian watermilfoil; Curlyleaf pondweed	2004-2008, 2010
Crystal			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Eurasian watermilfoil; Curlyleaf pondweed	2002-2010
Lee									x					x	x	x	x	Curlyleaf pondweed	No treatment
Kingsley																			
Orchard	x				x	x	x	x	x	x	x	x	x	x	x	x	x	Curlyleaf pondweed	2004-2010
Lac Lavon		x	x	x	x	x	x	x	x	x	x	x	x			x		Eurasian watermilfoil; Curlyleaf pondweed	2005
Sunset Pond																		Eurasian watermilfoil	
Earley									x	x	x	x	x	x	x	x	x	Eurasian watermilfoil; Curlyleaf pondweed	2005-2008
Twin					x			x	x	x	x	x	x	x	x	x	x	Eurasian watermilfoil	2006
Wood Pond													x						

Note: results of macrophyte monitoring (including past monitoring) are included in aquatic survey reports available from the BDWMO.

Note: native species identified in past macrophyte monitoring include: white waterlily (*Nymphaea sp*), coontail (*Ceratophyllium demersum*), chara (*Chara sp*), elodea (*Elodea canadensis*), duckweed (*Lemna trisulca*), buttercup (*Ranuculus sp*), bladderwort (*Utricularis sp*), water stargrass (*Zosterella dubia*), and others.

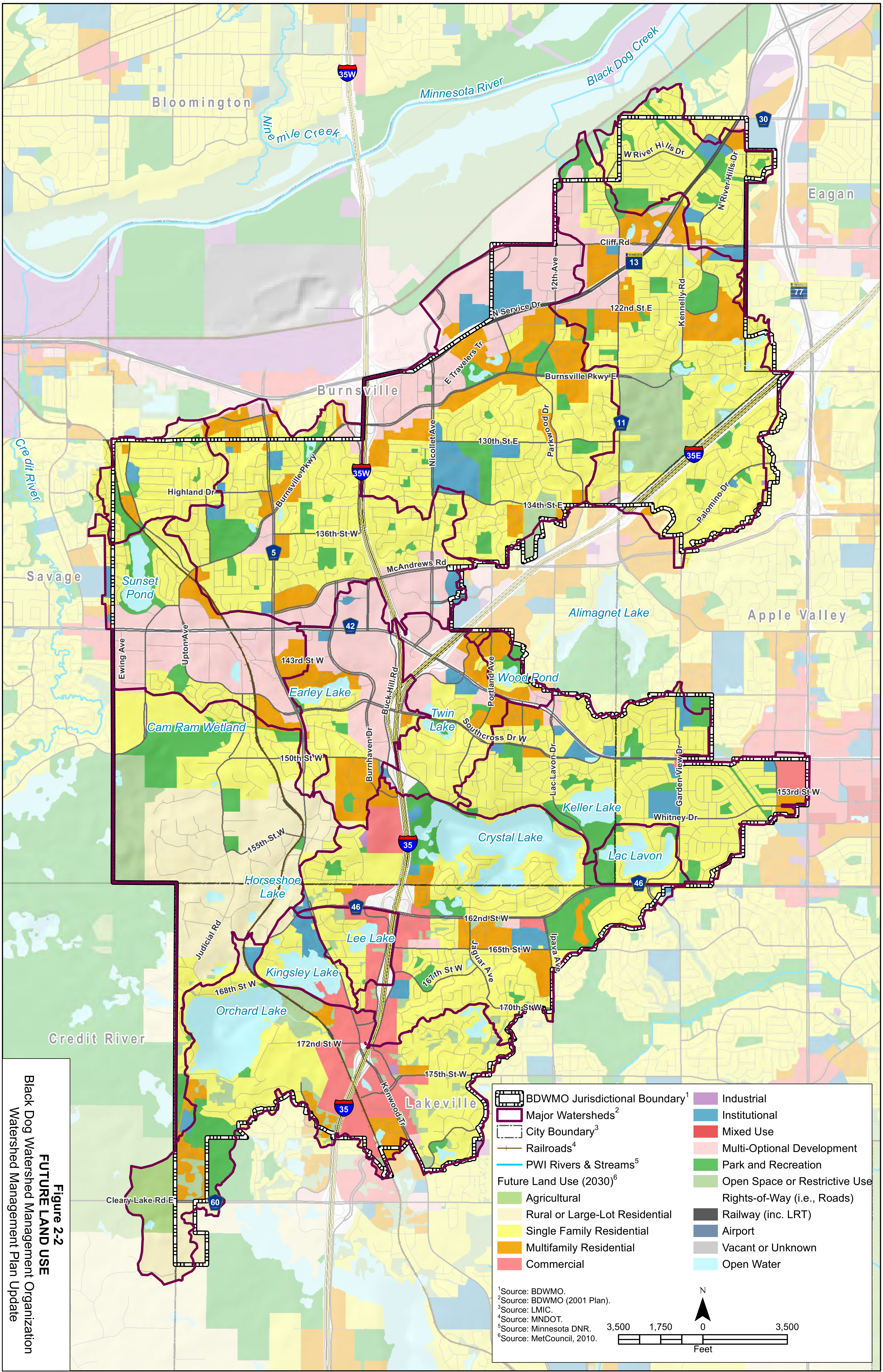
December, 2012

Section 2 Figures



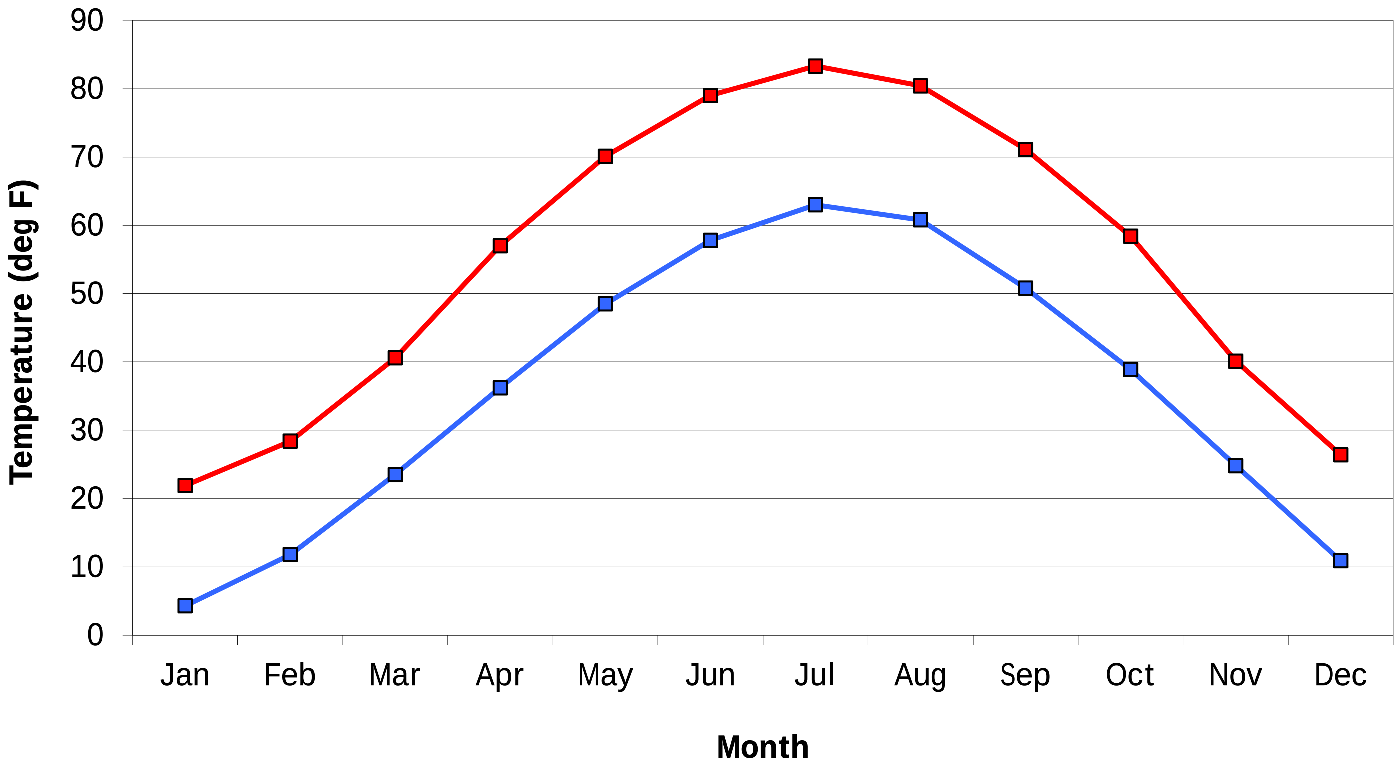
[1] Source: BDWMO.
[2] Source: BDWMO (2001 Plan).
[3] Source: LMIC.
[4] Source: Minnesota DNR.
[5] Source: MetCouncil, 2005.

Figure 2-1
CURRENT (2005) LAND USE
Black Dog Watershed Management Organization
Watershed Management Plan Update



[1] Source: BDWMO.
[2] Source: BDWMO (2001 Plan).
[3] Source: LMIC.
[4] Source: MNDOT.
[5] Source: Minnesota DNR.
[6] Source: MetCouncil, 2010.

Figure 2-2
FUTURE LAND USE
Black Dog Watershed Management Organization
Watershed Management Plan Update


Average High and Low Temperatures

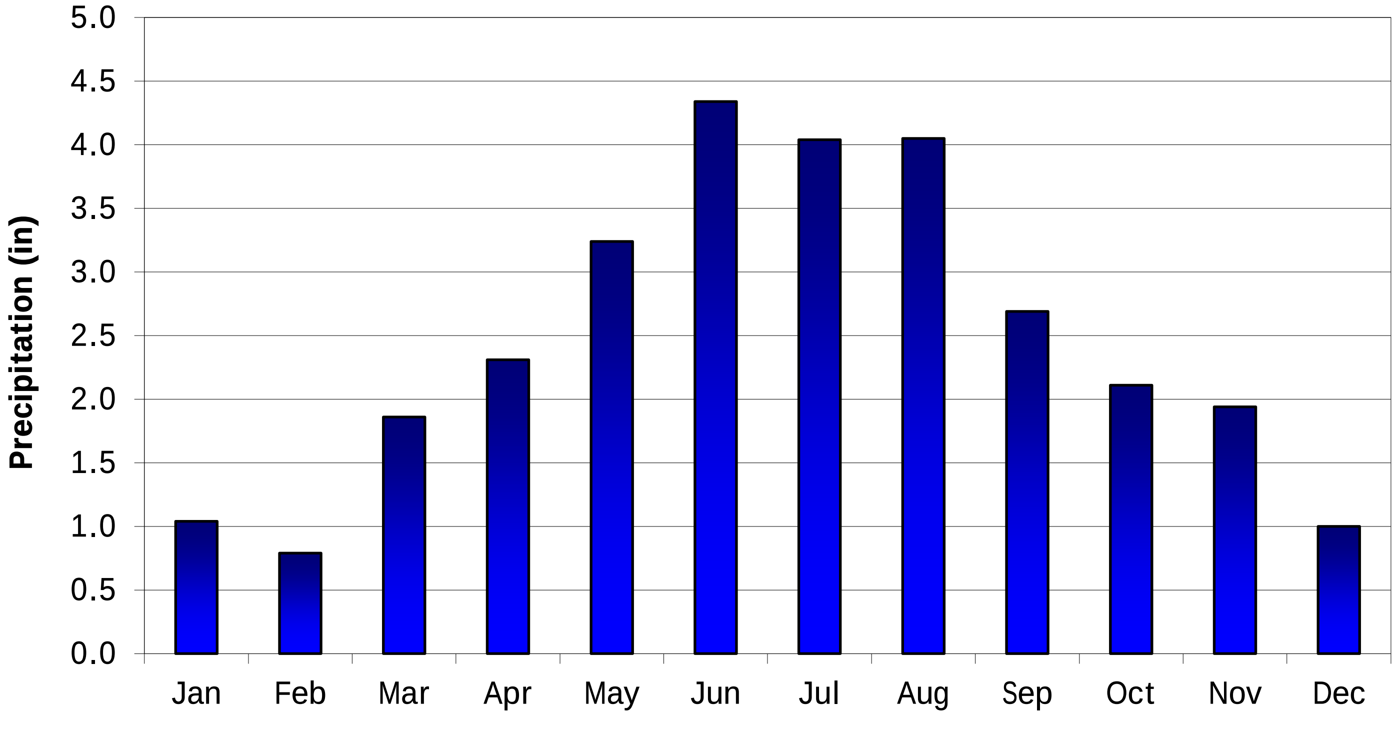

Average Monthly Precipitation

Figure 2-3
Average Monthly High & Low Temperatures and Precipitation for Minneapolis-St. Paul International Airport (1971-2000)

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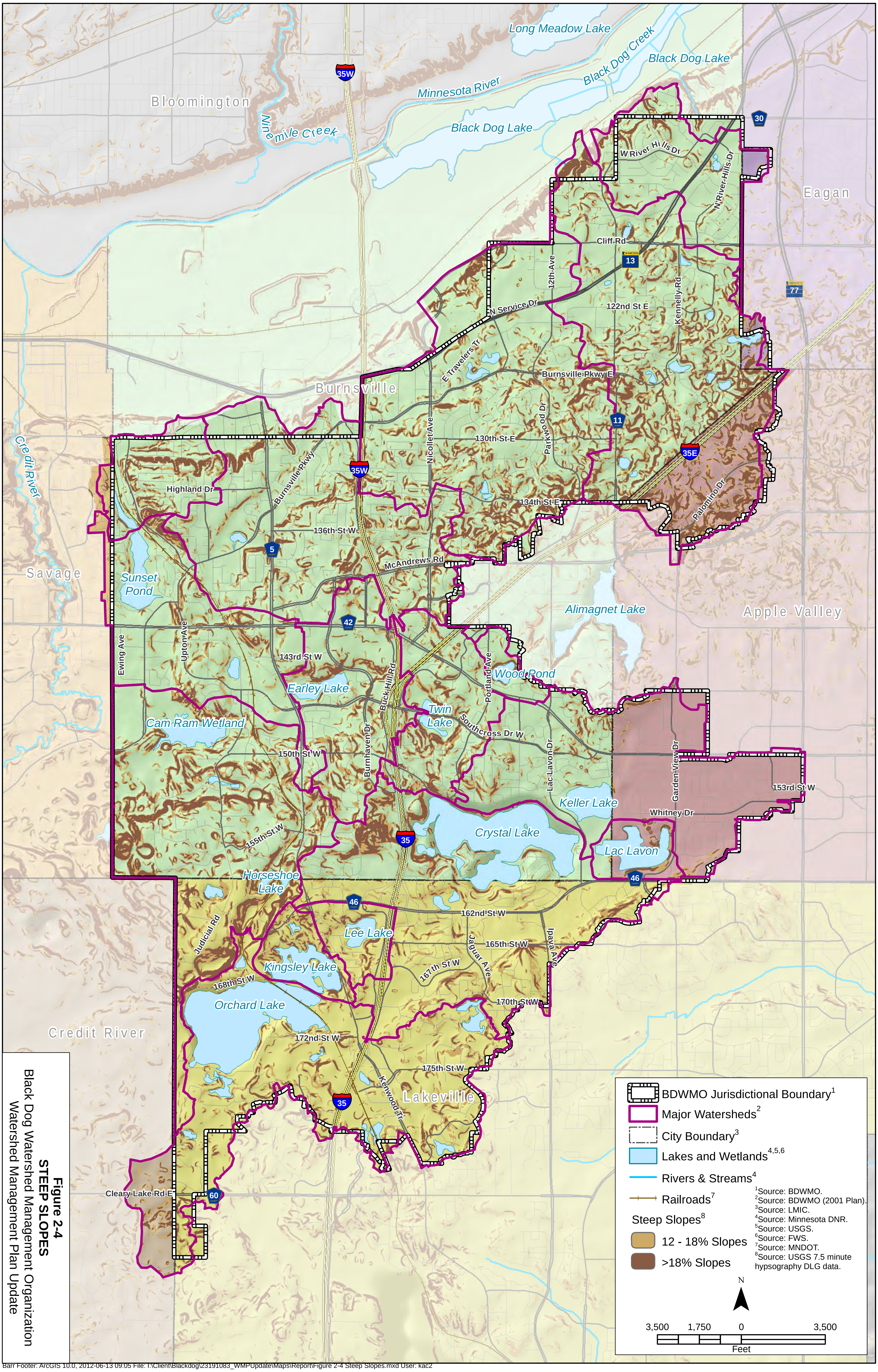


BDWMO Jurisdictional Boundary[1]

Major Watersheds[2]

City Boundary[3]

Lakes and Wetlands[4,5,6]

Rivers & Streams[4]

Railroads[7]

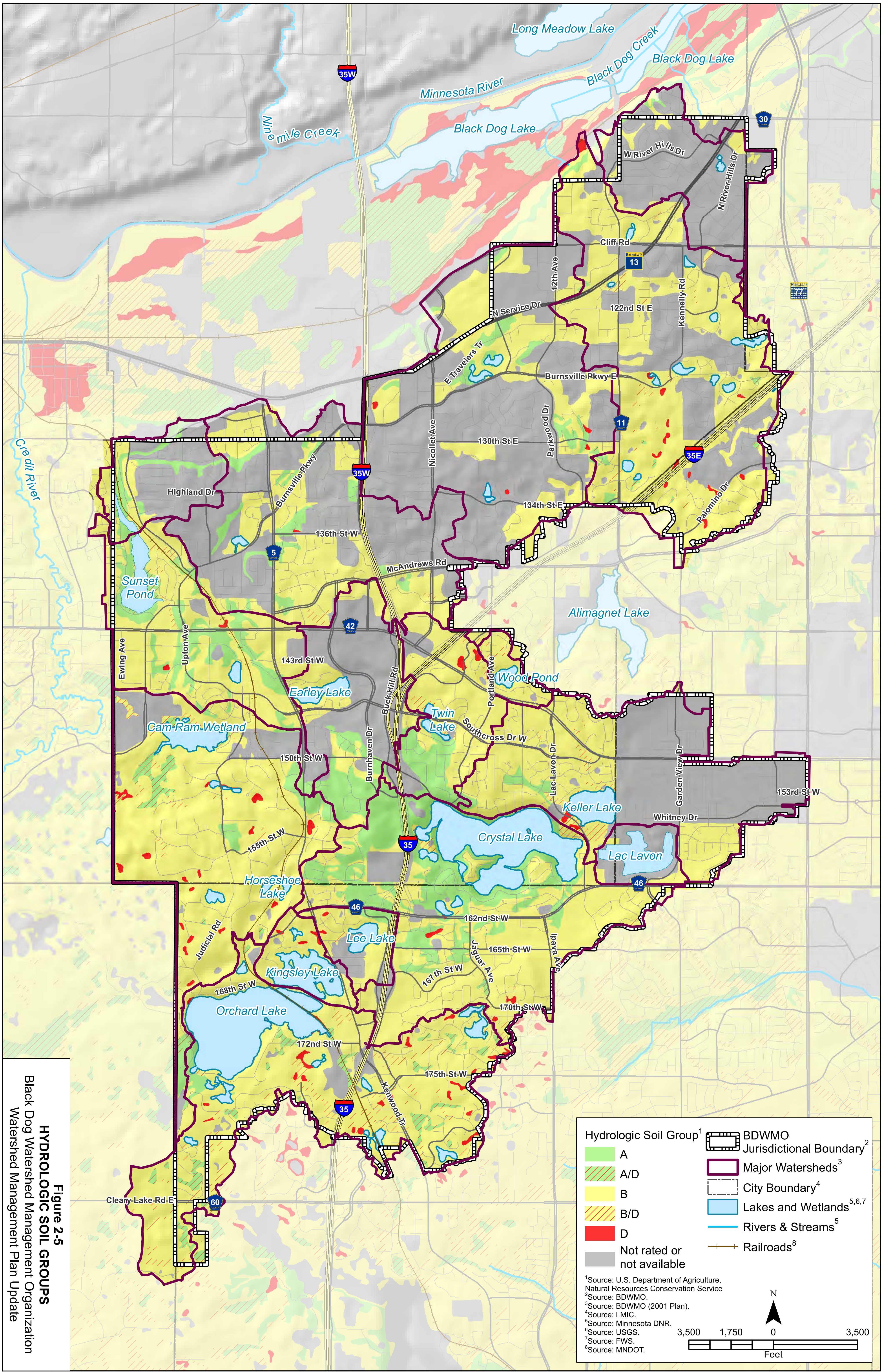
Steep Slopes[8]

▨ 12 - 18% Slopes

■ >18% Slopes

[1] Source: BDWMO.
[2] Source: BDWMO (2001 Plan).
[3] Source: LMIC.
[4] Source: Minnesota DNR.
[5] Source: USGS.
[6] Source: FWS.
[7] Source: MNDOT.
[8] Source: USGS 7.5 minute hypsography DLG data.

Figure 2-4
STEEP SLOPES
Black Dog Watershed Management Organization
Watershed Management Plan Update



[1] Source: U.S. Department of Agriculture, Natural Resources Conservation Service
[2] Source: BDWMO.
[3] Source: BDWMO (2001 Plan).
[4] Source: LMIC.
[5] Source: Minnesota DNR.
[6] Source: USGS.
[7] Source: FWS.
[8] Source: MNDOT.

Figure 2-5
HYDROLOGIC SOIL GROUPS
Black Dog Watershed Management Organization
Watershed Management Plan Update

Barr Footer: ArcGIS 10.0, 2012-06-13 08:58 File: I:\Client\Blackdog\23191083_WMPUpdate\Maps\Report\Figure 2-5 Hydrologic Soils Group.mxd User: kac2

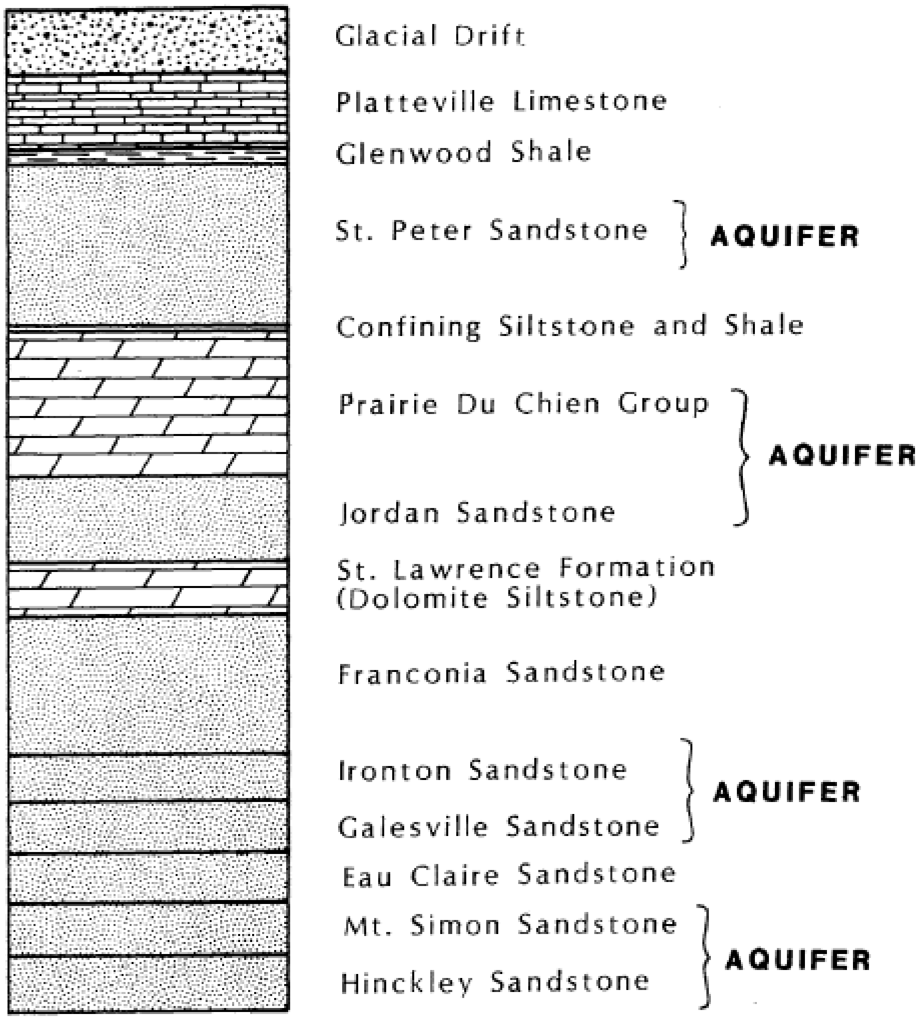


Figure 2-6
Generalized Geologic Section

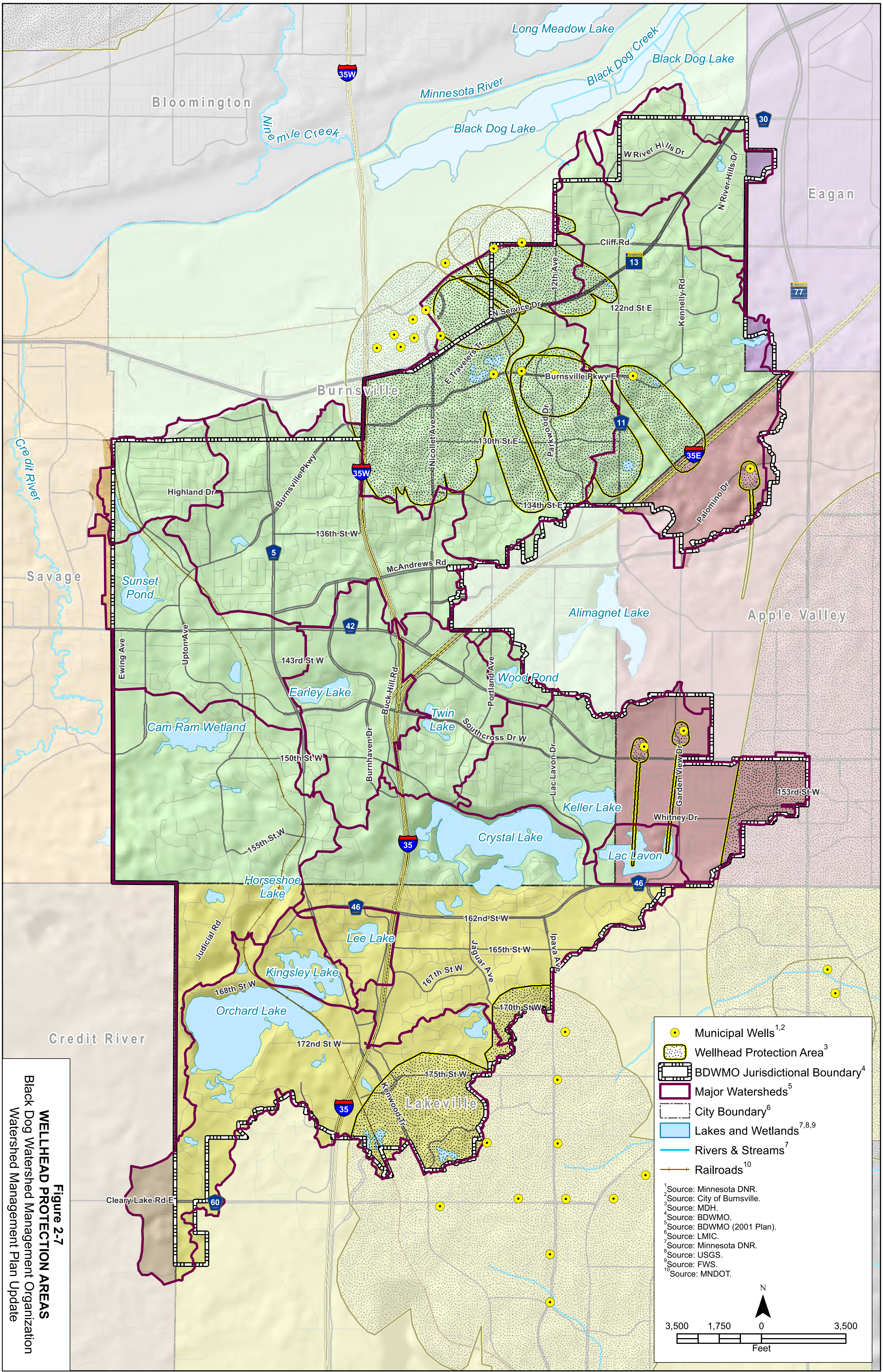


Figure 2-7
WELLHEAD PROTECTION AREAS
Black Dog Watershed Management Organization
Watershed Management Plan Update

Barr Footer: ArcGIS 10.0, 2012-06-13 09:05 File: I:\Client\Blackdog\23191083_WMPUpdate\Maps\Report\Figure 2-7 Wellhead Protection Areas.mxd User: kac2

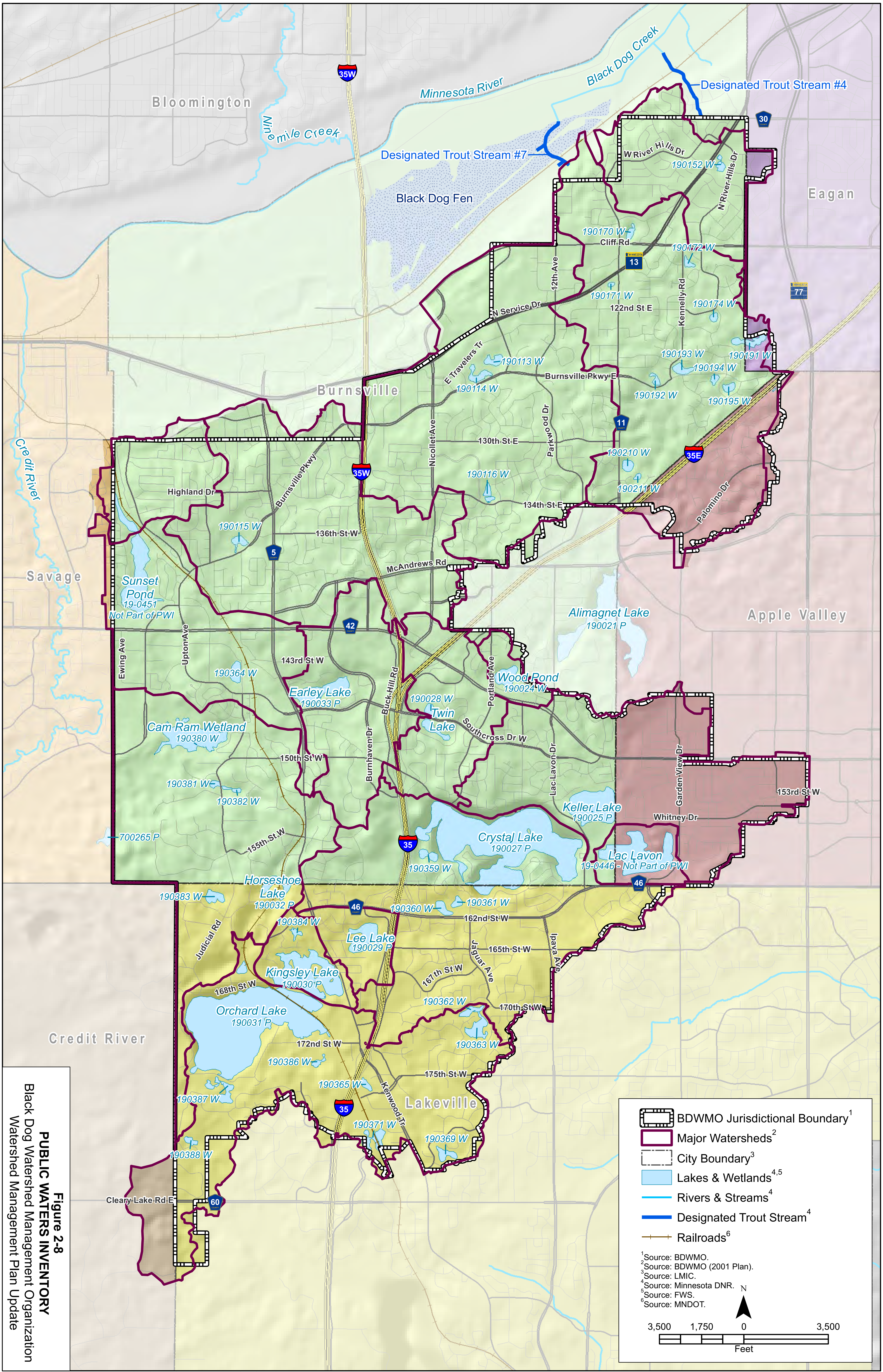


Figure 2-8
PUBLIC WATERS INVENTORY
Black Dog Watershed Management Organization
Watershed Management Plan Update

Barr Footer: ArcGIS 10.0, 2012-06-13 09:22 File: I:\Client\Blackdog\23191083_WMPUpdate\Maps\Report\Figure 2-8 Public Waters Inventory.mxd User: kac2

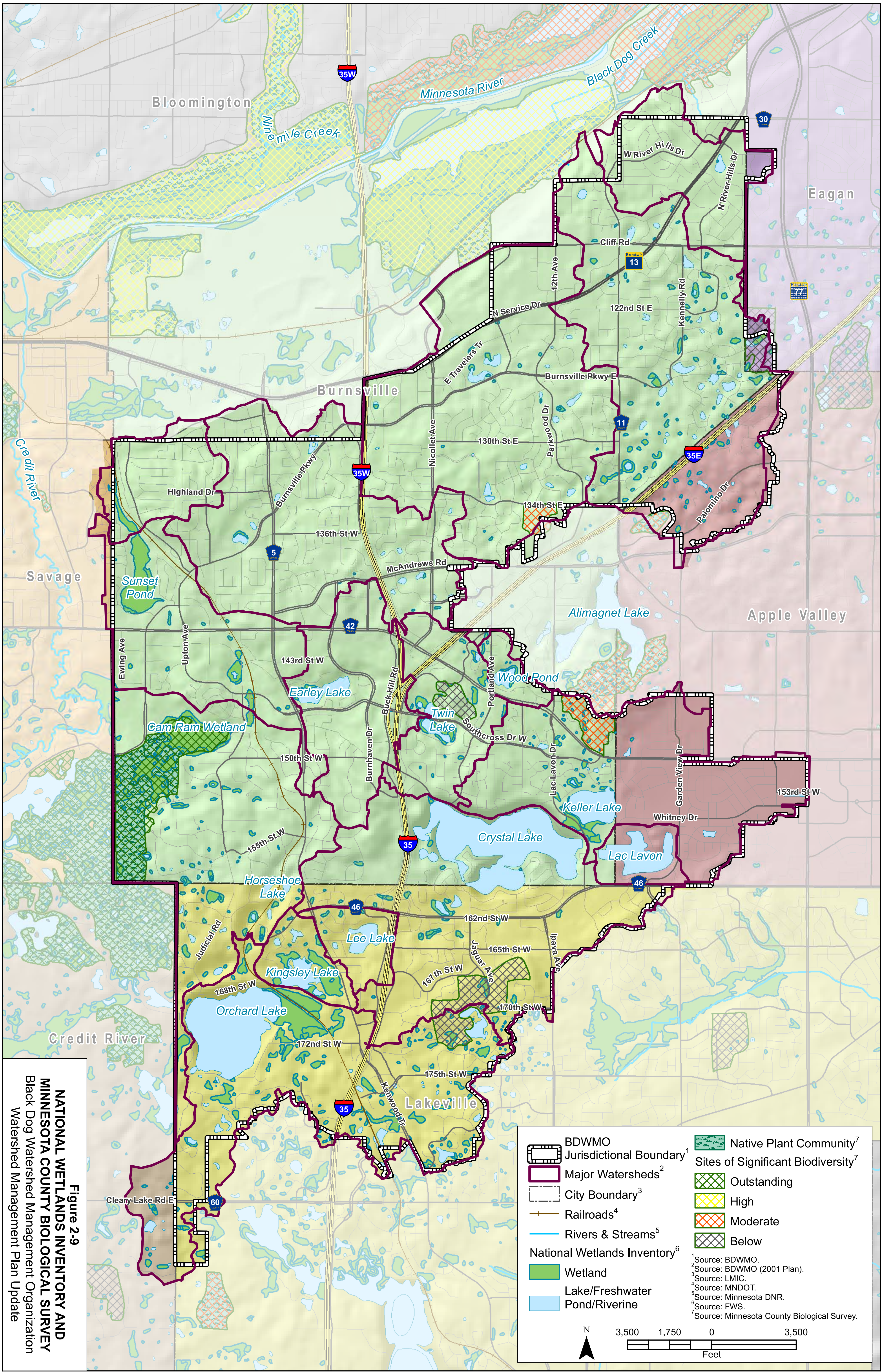


Figure 2-9
NATIONAL WETLANDS INVENTORY AND MINNESOTA COUNTY BIOLOGICAL SURVEY
Black Dog Watershed Management Organization
Watershed Management Plan Update

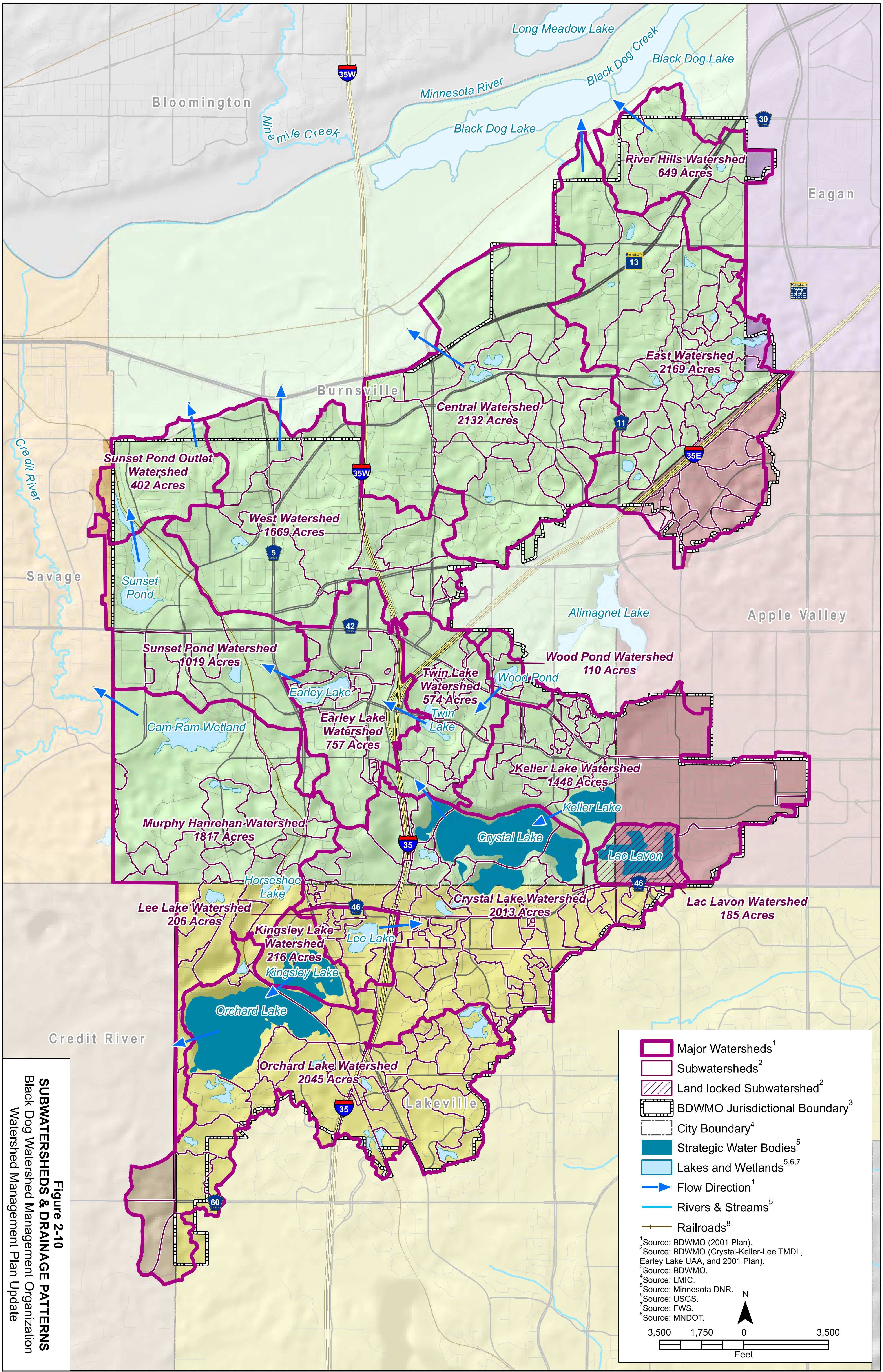


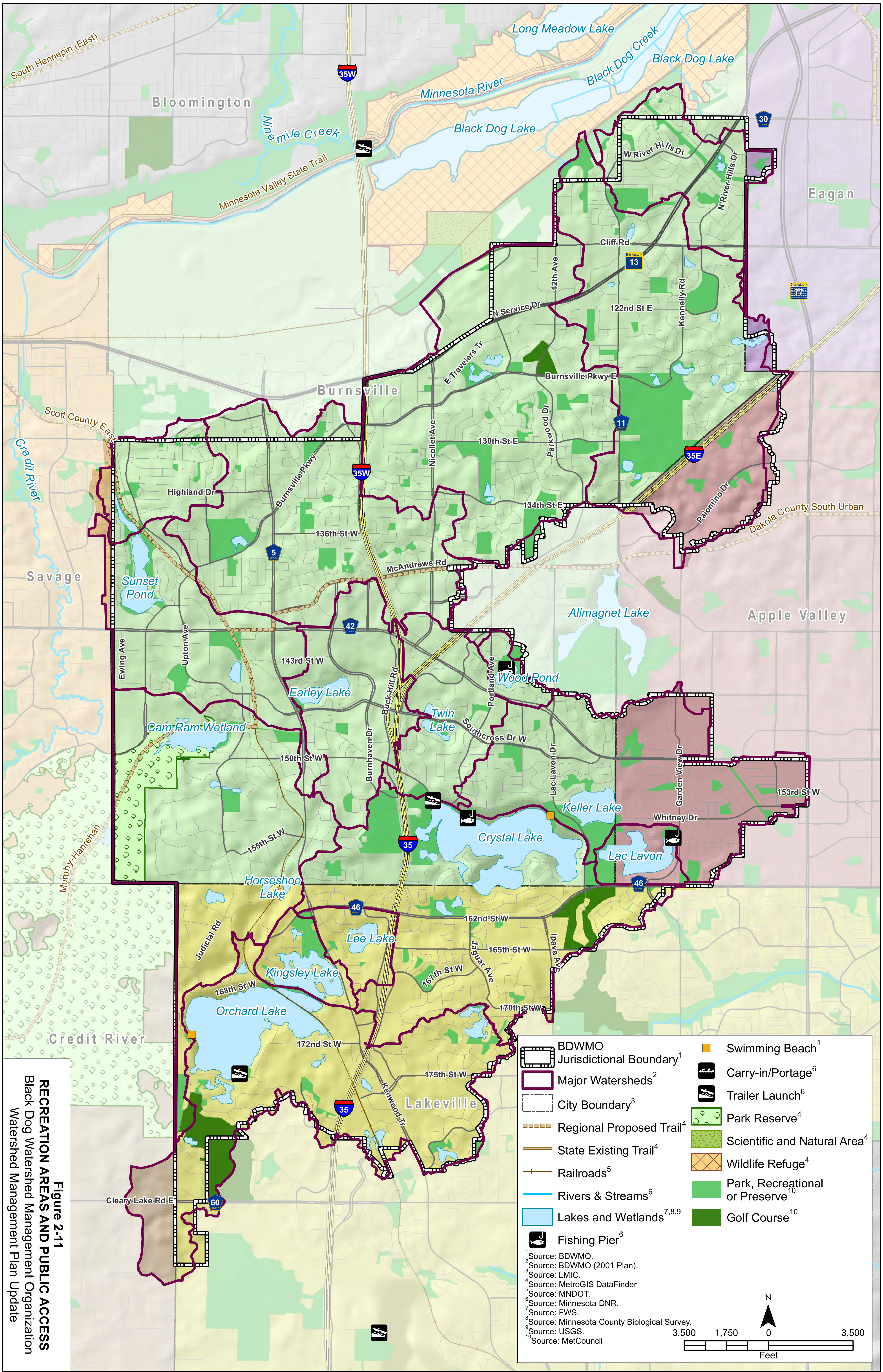
Figure 2-10

SUBWATERSHEDS & DRAINAGE PATTERNS

Black Dog Watershed Management Organization

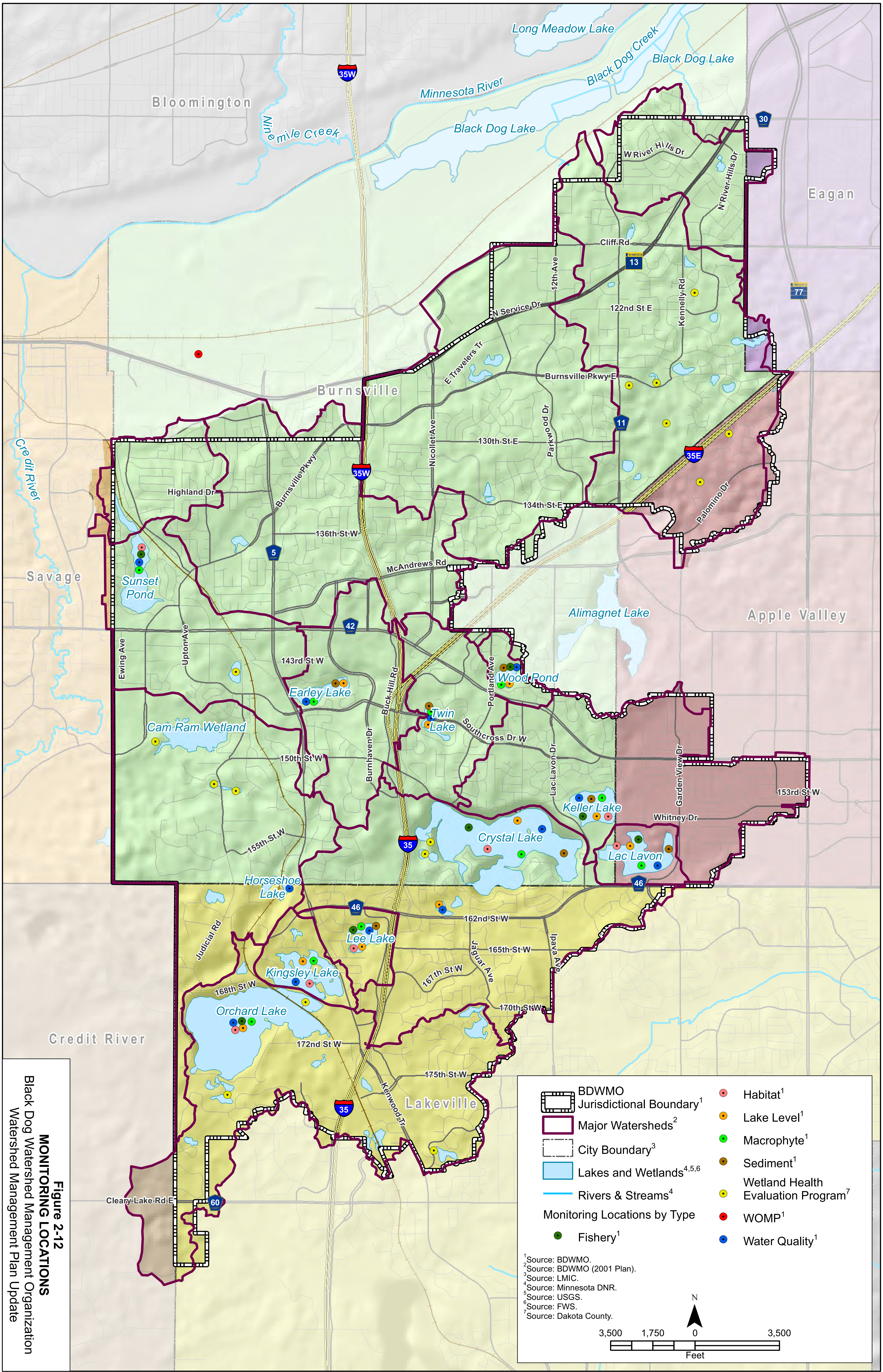
Watershed Management Plan Update

Barr Footer: ArcGIS 10.0, 2012-06-13 09:45 File: I:\Client\Blackdog\23191083_WMPUpdate\Maps\Report\Figure 2-10 Subwatersheds and Drainage Patterns.mxd User: kac2



[1] Source: BDWMO.
[2] Source: BDWMO (2001 Plan).
[3] Source: LMIC.
[4] Source: MetroGIS DataFinder
[5] Source: MNDOT.
[6] Source: Minnesota DNR.
[7] Source: FWS.
[8] Source: Minnesota County Biological Survey.
[9] Source: USGS.
[10] Source: MetCouncil

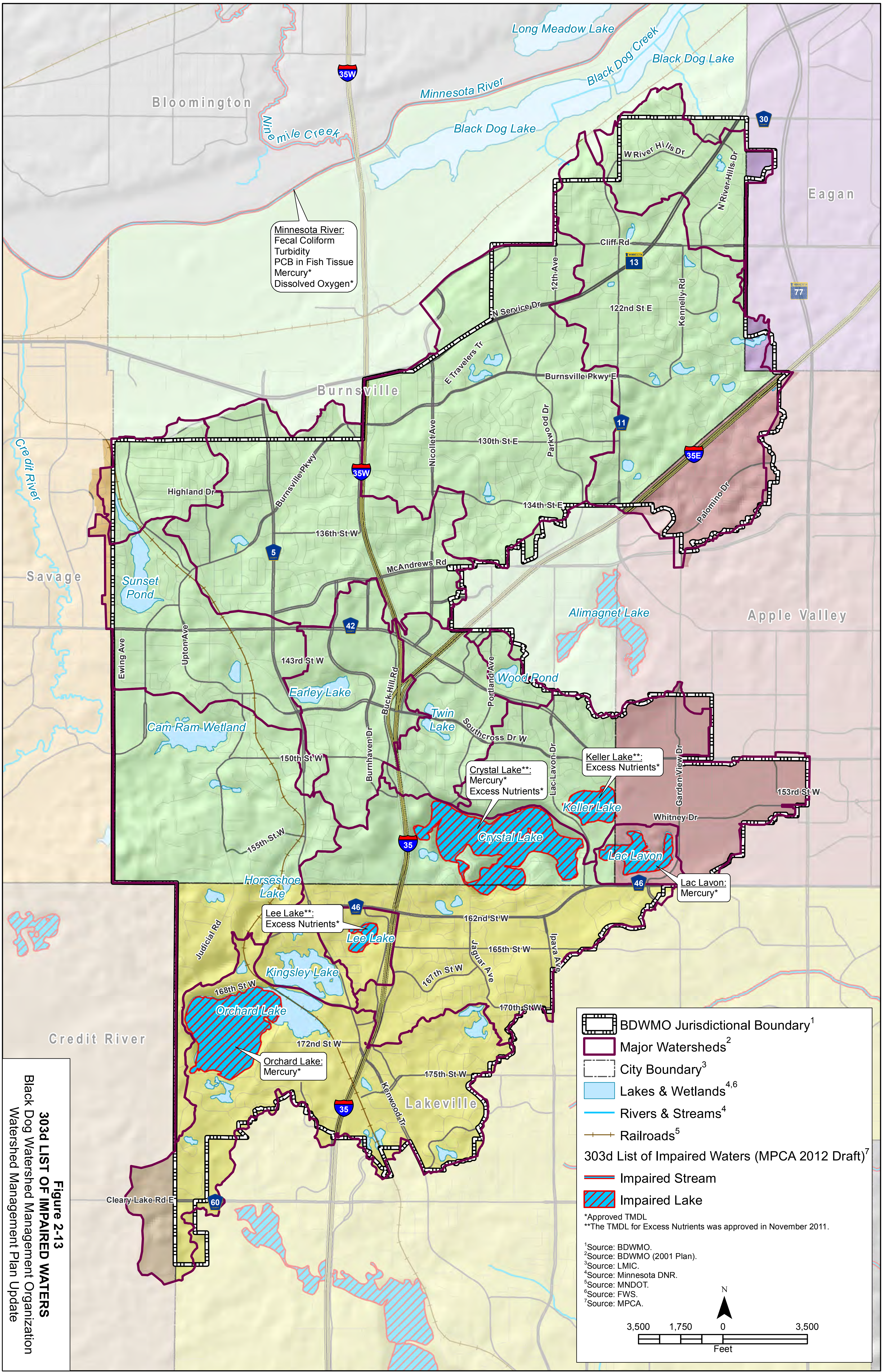
Figure 2-11
RECREATION AREAS AND PUBLIC ACCESS
Black Dog Watershed Management Organization
Watershed Management Plan Update



[1]Source: BDWMO.
[2]Source: BDWMO (2001 Plan).
[3]Source: LMIC.
[4]Source: Minnesota DNR.
[5]Source: USGS.
[6]Source: FWS.
[7]Source: Dakota County.

Figure 2-12
MONITORING LOCATIONS
Black Dog Watershed Management Organization
Watershed Management Plan Update

Figure 2-13
303d LIST OF IMPAIRED WATERS
Black Dog Watershed Management Organization
Watershed Management Plan Update



Minnesota River:
Fecal Coliform
Turbidity
PCB in Fish Tissue
Mercury*
Dissolved Oxygen*

Keller Lake**:
Excess Nutrients*

Crystal Lake**:
Mercury*
Excess Nutrients*

Lac Lavon:
Mercury*

Lee Lake**:
Excess Nutrients*

Orchard Lake:
Mercury*

▭ BDWMO Jurisdictional Boundary[1]
▭ Major Watersheds[2]
▭ City Boundary[3]
▭ Lakes & Wetlands[4,6]
— Rivers & Streams[4]
— Railroads[5]

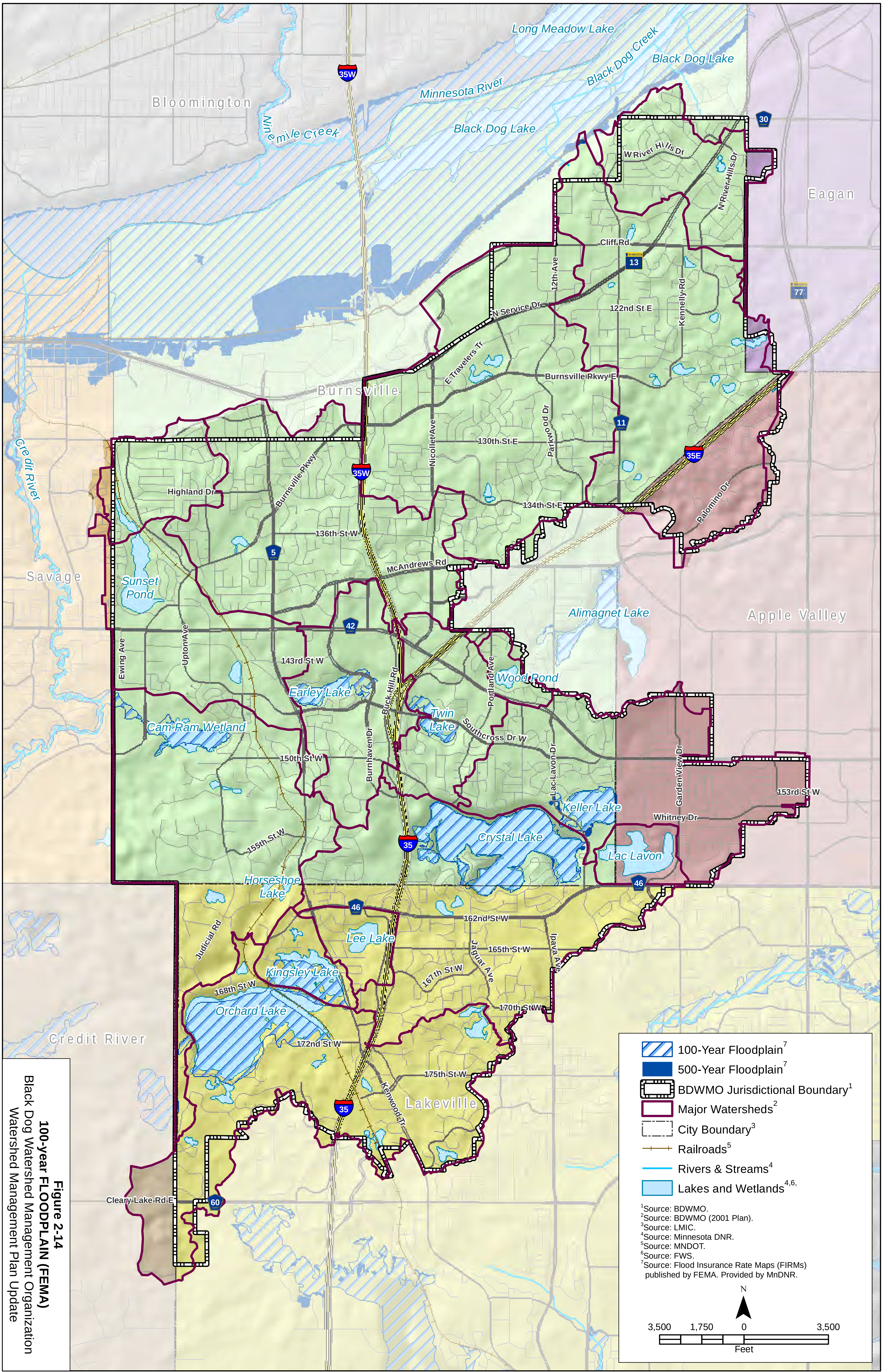
303d List of Impaired Waters (MPCA 2012 Draft)[7]

— Impaired Stream
▨ Impaired Lake

*Approved TMDL
**The TMDL for Excess Nutrients was approved in November 2011.

[1] Source: BDWMO.
[2] Source: BDWMO (2001 Plan).
[3] Source: LMIC.
[4] Source: Minnesota DNR.
[5] Source: MNDOT.
[6] Source: FWS.
[7] Source: MPCA.

Barr Footer: ArcGIS 10.0, 2011-06-03 15:43:51.376000 File: I:\Client\Blackdog\23191083_WMPUpdate\Maps\Report\Figure 2-13 Impaired Waters.mxd User: arm2



[1]Source: BDWMO.
[2]Source: BDWMO (2001 Plan).
[3]Source: LMIC.
[4]Source: Minnesota DNR.
[5]Source: MNDOT.
[6]Source: FWS.
[7]Source: Flood Insurance Rate Maps (FIRMs) published by FEMA. Provided by MnDNR.

Figure 2-14
100-year FLOODPLAIN (FEMA)
Black Dog Watershed Management Organization
Watershed Management Plan Update

Barr Footer: ArcGIS 10.0, 2011-03-31 15:50:01.908000 File: I:\Client\Blackdog\23191083_WMPUpdate\Maps\Report\Figure 2-14 100-Year Floodplain.mxd User: arm2

Section 3

Assessment of Issues and Opportunities

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List of Tables

3.0 Assessment of Issues and Opportunities

This section of the plan presents and discusses the problems and issues facing the Black Dog Watershed Management Organization (BDWMO), organized by various water topic categories. Issue identification was an important task completed at the first PAG meeting on December 15, 2010. Seventeen participants organized into three groups responded to a list of pre-identified issues and developed their own issues. All issues were weighted and rated to provide insight into the most important issues or challenges the BDWMO and the plan update need to address. Appendix C includes a memorandum summarizing this work. Overall, water quality concerns topped the list of the most important issues facing the organization. The key issues identified through this process are in the following topic areas: 1) water quality; 2) water quantity and flooding; 3) erosion/sedimentation; 4) wetlands and habitat; 5) shoreland, habitat and open space management; 6) groundwater protection; and 7) implementation responsibility. The issues are discussed in the respective topical subsections below.

3.1 WATER QUALITY

There are many factors that affect the water quality of lakes, streams and wetlands, and may contribute to the degradation of water quality. Several of these factors are discussed generally in Appendix D, including:

- Pollutant sources
- Eutrophication and trophic states
- Limiting nutrients
- Stratification
- Nutrient recycling and internal loading

These concepts are not unique to the BDWMO. However, the interaction of these elements in BDWMO water bodies may result in water quality issues unique to each water body.

For lakes, ponds, and wetlands within the BDWMO, phosphorous is typically the pollutant of major concern, because it often results in summer algal blooms and reduced water clarity. Phosphorus may come from municipal and industrial discharges to surface waters, urban runoff, construction sites, subsurface sewage treatment systems (SSTS or septic systems), and, in agricultural areas, from fields and feedlots.

Urbanization causes nutrient (e.g., phosphorus, nitrogen) and sediment inputs (i.e., loadings) from stormwater runoff to far exceed the natural inputs to the BDWMO's water bodies. As phosphorus and other nutrient loadings increase, it is likely that water quality degradation will accelerate (eutrophication), resulting in unpleasant consequences, such as profuse algae growth or algal blooms. This can be magnified in shallow lakes, where stratification is weak and wind-induced mixing may move nutrients from deeper waters (e.g., from internal loading) to the surface waters, increasing the potential for algae growth.

Other aquatic pollutants have negative impacts on water quality and human health while not significantly contributing to eutrophication. Mercury can accumulate in fish tissue, requiring limits on fish consumption to protect human health. Other metals, although biologically necessary in small concentrations (e.g., copper, zinc) can have toxic effects on aquatic biota at higher concentrations.

3.1.1 NPDES Program and MPCA Issues

The Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) to regulate point sources of pollution, with the MPCA as the delegated permitting authority. This program was later expanded to include both point and nonpoint sources of pollution, including the regulation of stormwater runoff, and created a two-phase comprehensive national program to address stormwater runoff. Phase I of the program was implemented in 1990 and covered two general categories of stormwater discharge including 11 categories of industrial activities (including construction) and Municipal Separate Storm Sewer Systems (MS4s) serving populations of 100,000 or more. A few years later, Phase II of the program was implemented. Phase II is a broader program that includes smaller construction sites, municipally owned or operated industrial activities, and many more municipalities (MS4s).

The BDWMO member cities of Apple Valley, Burnsville, Eagan, and Lakeville are required to maintain MS4 permits for managing nonpoint stormwater as part of the NPDES Phase II program. The current Phase II permits are discussed in more detail below as well as at the following website: www.pca.state.mn.us/water/stormwater/index.html

3.1.1.1 MS4 General Permit

The stormwater program for MS4s is designed to reduce the amount of sediment and pollution that enters the surface and groundwater from storm sewer systems to the maximum extent practicable. The stormwater discharges from MS4s are regulated through the use of NPDES permits, requiring the permittee to develop a stormwater pollution prevention program (SWPPP) that incorporates best management practices applicable to their MS4. The SWPPP covers six components (also known as minimum control measures) including public education and outreach, public participation, elimination of illicit discharges, construction site runoff controls, post-construction runoff controls, and pollution prevention and good housekeeping measures. Additionally, many of the MS4s within the Twin Cities metropolitan area, including all of the BDWMO member cities, were required to develop non-degradation studies (see Section 3.1.1.2). Annual non-degradation reporting is also required as part of the permit.

The MPCA is currently in the process of reissuing the MS4 General Permit. The current revisions will shift from permit program development to an emphasis on measuring progress and implementation. The draft MS4 General Permit was placed on public notice for comment in May 2011. The revised draft permit was placed on public notice in May 2012, and is anticipated to become effective later in 2012.

3.1.1.2 Nondegradation

The MPCA revised the General NPDES permit for MS4s in 2006 to include non-degradation requirements. Appendix D of the revised permit covers the non-degradation requirements for selected MS4s, including the development of the loading assessment and non-degradation report. The BDWMO member cities of Apple Valley, Burnsville, Eagan, and Lakeville are subject to the MS4 non-degradation requirements and are required to submit non-degradation reports. In compliance with non-degradation rules, each city must conduct a loading assessment, write a non-degradation plan, and incorporate each into the SWPPP. Loading assessments typically focus on significant discharges of phosphorus, total suspended solids (TSS), and runoff volume, and compare baseline (~1990) conditions to current and future (e.g., 2020) conditions. Non-degradation reports evaluate options to reduce loading through best management practices (BMPs), which can be incorporated into the city's SWPPP.

In the near future, the MPCA will issue another revised General NPDES permit. In this next revision, non-degradation will become anti-degradation, and changes will be made to the associated requirements.

3.1.1.3 General Construction Permit

The MPCA issues NPDES permits to construction site owners and operators to address the potentially significant amounts of sediment and other pollutants being transported by runoff from construction sites. As part of the application for the permit, the owner and operator must also develop a stormwater pollution prevention plan (SWPPP) to manage stormwater runoff from the site. Elements of the NPDES general construction permit are discussed in Section 3.3.1.

3.1.1.4 Industrial Stormwater Permit

The goal of the Industrial Stormwater program is to reduce the amount of pollution that enters the surface and groundwater from industrial facilities in the form of stormwater runoff. The program requires facilities to develop a stormwater pollution prevention plan (SWPPP), which outlines the best management practices used to manage stormwater. Additionally, the permit requires the elimination of stormwater contact with potentially polluting materials and/or treating the stormwater runoff, and it requires monitoring of stormwater discharges.

The NPDES permit for Industrial Stormwater was revised in 2010. The permit regulates 11 categories of industrial activities, including construction (which is covered in the general construction permit discussed above). These categories are defined in the regulations using the Standard Industrial Classification (SIC) code. There are 29 industrial sectors in the remaining 10 categories. The permit describes 13 stormwater control best management practices. The permit is discussed more fully on the MPCA website: www.pca.state.mn.us/water/stormwater/stormwater-i.html

3.1.1.5 MPCA Guidance for Stormwater Ponds and Dredged Materials

- The MPCA requires MS4 permit holders (including those in the BDWMO) to develop and maintain an inventory of ponds, wetlands and other waterbodies impacted by the collection, conveyance and treatment of stormwater. This inventory is required by Chapter 172, Sec. 28 of the 2009 Session Laws and will be incorporated in the revised MS4 General Stormwater permit, expected in 2012. Inventory data requirements will be specified in the revised MS4 General Stormwater permit.

In addition to inventory requirements, material removed from stormwater ponds may be considered dredged material. The MPCA considers material excavated below the MDNR's ordinary high water level to be dredged material. Because dredged material is defined as a waste and is regulated by the MPCA, a guidance document developed for managing dredged material is available from the MPCA website: www.pca.state.mn.us/water/dredgedmaterials.html.

The MPCA's guidance document *Managing Dredge Materials in the State of Minnesota* (MPCA, 2011) provides assistance in determining what type(s) of regulatory oversight and/or permit is required at projects and sites involving the removal and management (storage, treatment, disposal and/or reuse) of dredged materials, once excavated, as well as what is required for discharges from the project site and/or management control site(s), including stormwater. The MPCA's guidance document includes specific management guidance for projects involving sediment removal from municipal or urban stormwater systems.

Because the MPCA's guidance is not mandatory, it does not establish or affect legal rights or obligations. However, should a permit be needed for managing the dredged material, such as in the event of short-term or long-term storage of dredged material on site, any generation of runoff from the stored materials (including stormwater runoff, dewatering runoff, etc.), then following the guidance will help ensure a project is in compliance. If a permit is required, it needs to be submitted at least 180 days before the anticipated date of dredging. Types of dredging projects that do not require a permit from the MPCA for the management of dredged material are described in the guidance, along with any requirements for MPCA notification.

3.1.2 Subsurface Sewage Treatment Systems (SSTS) and Groundwater Quality

Subsurface sewage treatment systems (SSTS) treat wastewater from small sites or individual homes. If the system does not adequately treat the wastewater, pollutants and disease-carrying pathogens may enter groundwater and surface water. The majority of SSTS treat wastewater from individual homes and are located in rural or very low-density residential areas. SSTS must be maintained and operated in accordance with local ordinances and Minnesota State Rules 7080-7083 to ensure that the systems function properly. Dakota County estimates that 60 percent of the SSTS within the county do not comply with these requirements. Dakota County's Ordinance No. 113 applies to individual SSTS and incorporates the Minnesota rules, plus additional provisions. Dakota County requires cities to adopt Ordinance 113 or a similar ordinance. The BDWMO requires member cities to adopt an SSTS management plan that includes the following:

- Procedures needed for developing a three-year maintenance program
- Procedures for addressing failing systems
- A notification system to remind residents to pump their systems
- A tracking system to identify SSTS locations, store inspection/pumping records, and monitor the condition of the systems

The cities of Apple Valley, Burnsville, and Lakeville have ordinances that comply with Dakota County's requirements.

In the BDWMO, numerous SSTS are located in the rural residential areas of northwest Lakeville and southwest Burnsville. Only a few SSTS are located in the remainder of the BDWMO. In addition to SSTS, leaking underground storage tanks (LUST) and unsealed, unused wells pose risks to groundwater quality. The MDH estimates that there are 24,000 to 31,000 unsealed, unused wells in Dakota County (Dakota County Groundwater Protection Plan, 2000).

3.1.3 Impaired Waters and TMDLs

The federal Clean Water Act (CWA) requires states to adopt water quality standards to protect the nation's waters. Water quality standards designate beneficial uses for each water body and establish criteria that must be met within the water body to maintain the water quality necessary to support its designated use(s). Section 303(d) of the CWA requires each state to identify waters that do not meet the water quality standards. Waterbodies not meeting water quality standards associated with their designated uses are listed on the MPCA's impaired waters 303(d) list and a total daily maximum load (TMDL) is developed for those waterbodies. The list of impaired waters, or 303(d) list, is updated by the state every two years.

For the MPCA to list a water body (besides a river or creek) on the impaired waters list, it must meet the MPCA's listing criteria and there must be sufficient data to determine if the lake is impaired (see MPCA guidance manual, 2010). The criteria established by the MPCA to determine if a lake is impaired vary according to the lake's ecoregion within the state of Minnesota and whether the waterbody is classified as shallow or deep. The BDWMO lies within the North Central Hardwood Forest (NCHF) ecoregion. The MPCA defines shallow lakes as lakes with (a) a maximum depth of 15 feet or less; or (b) 80% or more of the lake is littoral (the percent of the lake that is 15 feet deep or less). All other lakes are classified as deep lakes. MPCA eutrophication standards for shallow and deep lakes in the NCHF ecoregion are presented in Table 2-8.

For impaired water bodies, the CWA requires the development of a total TMDL. A TMDL is a threshold calculation of the amount of a pollutant that a water body can receive and still meet water quality standards. This is done through a TMDL study. A TMDL study establishes the pollutant loading capacity within a specific water body and develops an allocation scheme amongst the various contributors, which include point sources, nonpoint sources and natural background, as well as a margin of safety. As a part of the allocation scheme, a waste load allocation (WLA) is developed to determine allowable pollutant loadings from individual point sources (including loads from storm sewer networks), and a load allocation (LA) to establish allowable pollutant loadings from nonpoint sources and natural background levels in a water body.

Lakes within the BDWMO that are listed on the MPCA 2010 impaired waters 303(d) list (see Table 2-6):

- Crystal Lake
- Keller Lake
- Lee Lake (the City of Lakeville is currently working with the MPCA to remove Lee Lake from the impaired waters list)
- Lac Lavon
- Orchard Lake

Earley Lake was removed from the impaired waters 303(d) list in 2010. For the waterbodies listed above, Table 2-6 lists the affected MPCA designated use, the pollutant or stressor that is not meeting the MPCA water quality criteria, and the MPCA target for starting and completing the TMDL process. Specific actions to remove these bodies from the impaired waters list will be undertaken by the BDWMO and/or its members. Completed TMDLs identify potential actions. The watersheds contributing runoff to some of these water bodies are located in multiple member cities. Determining an equitable and cost-effective approach for implementing these actions is a key issue for the BDWMO and its members.

There are also several impaired waters located downstream of the BDWMO that are indirectly affected by runoff or discharge from the watershed. These water bodies include:

- Minnesota River
- Lake Pepin
- South Metro Mississippi River

The South Metro Mississippi River is impaired due to turbidity and was originally listed on the impaired waters 303(d) list in 1998. The target completion year is 2012. The TMDL focuses on the river between Fort Snelling and Lake Pepin. The MPCA issued a draft TMDL report for public comment in the spring of 2012. Modeling performed as part of the TMDL study indicates sediment reductions of approximately 50 percent from the Minnesota River are needed to restore the Mississippi River in this area. The TMDL implementation plan resulting from this TMDL study may include proposed actions for the BDWMO and/or its member cities.

The Credit River was listed on the 2002 impaired waters 303(d) list for turbidity. During the TMDL process, it became evident that the river did not exceed the turbidity standard. The Credit River has been removed from the impaired waters 303(d) list. A Protection Plan has been developed for the Credit River to protect the river's unimpaired condition. The Credit River Protection Plan does not propose any additional action by the BDWMO to protect the Credit River.

Although not a TMDL, the MPCA recently completed a Metro Chloride Feasibility study to further understand the extent, magnitude, and causes of chloride contamination within the metro area (including Dakota County). Road salt application was identified as a major source of chloride. Road salt application in the BDWMO is approximately 190 to 360 tons per square mile. The study explores options for addressing chloride impairments. The MPCA plans to ultimately develop a restoration and protection plan to satisfy TMDL requirements for impaired waters, address waters not yet listed, and protect waters that are not yet impaired. Elements of this plan may be applicable to the BDWMO and/or its member cities.

3.1.3.1 TMDL Implementation and Tracking (Adequacy)

During the planning process, members suggested that the BDWMO review its monitoring and reporting of member city activities in order to minimize duplication. This was specifically noted regarding cities' MS4 activities related to TMDLs. The cities already report progress to the MPCA and this could be an area to reduce redundancy. Under the Crystal-Keller-Lee TMDL (see Section 3.1.3.4), waste load allocations are assigned to each MS4, including the BDWMO member cities. Thus, the individual MS4s are responsible for implementing BMPs and reporting progress to the MPCA. Depending upon its role in future TMDLs, the BDWMO may be responsible for reporting BMP implementation and TMDL progress to the MPCA as the TMDL implementation authority. Under such an arrangement, efforts may be made to eliminate any redundancies between the BDWMO and member cities in TMDL reporting to the MPCA.

The EPA approved TMDLs for the following waterbodies and impairments within and immediately downstream of the BDWMO:

- Crystal, Keller, and Lee Lakes (impaired due to nutrients, see Section 3.1.3.4)
- Orchard Lake (impaired due to mercury in fish tissue)
- Lac Lavon (impaired due to mercury in fish tissue)
- Minnesota River (impaired due to the following):
    - Mercury in fish tissue
    - Mercury in the water column
    - Dissolved oxygen

3.1.3.2 External Loading (WLA)

In the BDWMO, the watershed runoff pollutant loads to Crystal, Keller, and Lee Lakes come from multiple communities and governmental entities which are all defined as MS4s. As MS4s, each is required to maintain an NPDES permit for the discharge of stormwater and report annually to the MPCA. Once the TMDL is complete, these MS4s will be responsible for the implementation of actions in order to meet the WLA established in the TMDL. Determining an equitable and cost-effective approach for implementing these actions may be an issue for the BDWMO and its members.

3.1.3.3 Internal Loading

Internal loading of phosphorus from lake sediments under anoxic conditions and aquatic vegetation (e.g. curlyleaf pondweed) can be a major source of nutrients to lakes, leading to water quality issues. These impacts may be amplified in shallow lakes where wind action can mix the resuspended phosphorus into the epilimnion (see Appendix D).

In terms of impaired waters and TMDLs, internal loading presents a unique problem in that the load is already present in the water body, resulting from the cumulative effect of past loading, often from multiple sources. The typical approach of identifying point or nonpoint sources of phosphorus loading to an impaired water and reducing the load from those sources is not applicable to internal loading. Determining an equitable and cost-effective approach for implementing actions to address internal loading is a key issue for the BDWMO and its members. In the BDWMO, this is an issue for Crystal Lake, Keller Lake, and Lee Lake.

3.1.3.4 Crystal-Keller-Lee TMDL

In November, 2011 the MPCA approved a TMDL for Crystal, Keller, and Lee Lakes to address excess nutrient impairments. The TMDL was developed with assistance from the BDWMO and approved by the EPA in September, 2011. Originally, the TMDL was to include Earley Lake; however, the MPCA removed Earley Lake from the 303(d) Impaired Waters List in 2010. In addition to the TMDL study, an implementation plan (Barr, 2011) was developed outlining BMPs and other management activities and studies that will help the MS4s achieve the required LA and WLA. For more information, see the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Report and Earley Lake Water Quality Assessment* (Barr, 2011).

3.1.4 BDWMO Major and Strategic Water Bodies

Major water resources located within the BDWMO are shown in Figure 2-8. These include several water bodies classified as strategic water bodies by the BDWMO. The BDWMO uses several criteria to classify a water body as strategic. The current criteria, of which a strategic water body needs to meet four of five, are listed in Table 2-7.

As noted in Section 2.10.2, the BDWMO's strategic water bodies now include Crystal Lake, Keller Lake, Orchard Lake, Kingsley Lake, and Lac Lavon (Sunset Pond is no longer considered a strategic water body). The BDWMO may revise its criteria for strategic water bodies, and may identify additional water bodies as strategic. The BDWMO manages strategic water bodies to prevent water quality degradation by assigning action levels to these water bodies. Exceedence of action levels may trigger response actions by the BDWMO.

3.1.4.1 Strategic Water Body Action Levels

The BDWMO-calculated action levels are based on the most recent 10 years of water quality data, according to the methods described in Section 4.1.2 (Policy 6), and at a minimum are set at the MPCA's eutrophication standards (see Table 2-8). Action levels are thus variable and will be updated each year. For lakes where TMDLs are underway (see Section 3.1.3), no action levels have been established. Section 4.1.2 (Policy 6) also describes the procedure for determining the course of action if an action level is exceeded.

3.1.5 Water Body Classification Systems

The BDWMO currently implements a waterbody classification system based on the existing and projected future use, taking into account the existing and projected water quality, and/or the presence of ecologically or biologically unique resources. This classification system is summarized in Section 2.10.2, Table 2-8, and Section 4.1.2. The designated use classifications are correlated with the MPCA's numeric water quality standards including total phosphorus concentration, chlorophyll-a concentration, and Secchi depth (see Table 2-8). These classifications may be revised, based on existing and desired uses of the water bodies and the results of future water quality and habitat monitoring.

In addition to the BDWMO classification system, other regulatory agencies use different criteria to classify water resources, and may apply rules based on those classifications. The MDNR classified lakes throughout the state based on the fish communities they are likely to support. The MPCA also assesses waterbodies according to their ability to fully, partially or not at all meet certain uses, such as aquatic life and aquatic recreation. Waterbodies that do not meet water quality standards, and thus are not meeting their intended use, are listed as "impaired" (see Section 2.10.3). The Metropolitan Council's Recreational Suitability Index (RSI) describes the relative recreational status of the lakes and ranges from 1 (best) to 5 (worst). The Metropolitan Council's "lake quality report card" classification system ranks lakes from "A" (best) to "F" (worst). The BDWMO member cities may also maintain water body classifications unique to the city.

3.1.6 Water Quality Trend Analyses

To assess historical trends and the need to take preventive action, the BDWMO performs trend analyses on strategic water resources (see Section 2.10.2.1). Water quality issues identified by trend analyses are described by each strategic water resource in the following sections. Action levels have been defined for several lakes (see Appendix B and Table 2-6). This threshold is used to determine whether action is warranted to prevent further declines in water quality.

3.1.7 Water Quality of Significant BDWMO Water Bodies

3.1.7.1 Crystal Lake

Crystal Lake is currently listed on the MPCA's impaired waters (303(d)) list due to mercury and excess nutrients (see Section 2.10.3). Crystal Lake is currently part of a three lake TMDL to address excess nutrients (see Section 3.1.3.4). The most recent water quality and habitat quality data for Crystal Lake are included in the BDWMO's annual report and included as Appendix B. The trend analyses for Crystal Lake are also presented in Appendix B.

The BDWMO classifies Crystal Lake as a Category I water. This classification means Crystal Lake is to be used for swimming and other full body contact activities, which coincides with the current recreational uses of the lake. The MPCA lists Crystal Lake as impaired for aquatic recreation uses due to nutrients. The Metropolitan Council's RSI of 1.9 for 2010 indicates that, during some parts of the summer, algae levels may limit swimming and other recreational activities.

The BDWMO and the member cities have implemented several capital improvement projects to improve Crystal Lake's water quality. The BDWMO operated a ferric chloride (FeCl) treatment system intermittently from 1997 until 2009. The BDWMO permanently shut down the system in 2009 because of concerns over the limited impact of the system on water quality relative to operational costs. The ferric chloride system was dismantled in 2011 and is not expected to be used in the future. Other activities performed by the member cities include the addition of regional infiltration basins upstream of Crystal Lake and the ongoing mechanical harvesting of curlyleaf pondweed. In addition, Keller Lake improvements (see Section 3.1.7.2) may benefit Crystal Lake.

3.1.7.2 Keller Lake

Keller Lake is currently listed on the MPCA's impaired waters (303(d)) list due to excess nutrients (see Section 2.10.3). Keller Lake is currently part of a three lake TMDL to address excess nutrients (see Section 3.1.3.4). The most recent water quality and habitat quality data for Keller Lake are included in the BDWMO's annual report (and as Appendix B). Water quality trend analyses for Keller Lake are also presented in Appendix B. Keller Lake is classified by the BDWMO as a Category III water (supporting wildlife habitat and aesthetics). In the past, residents used Keller Lake for non-contact recreational activities (e.g., canoeing), although aquatic plants may interfere with this use. The MPCA lists Keller Lake as impaired for recreational uses due to nutrients.

The BDWMO member cities have implemented several capital improvement projects to improve water quality in Keller Lake. These include upgrades to enhance infiltration in Redwood Pond, additional excavation of several stormwater detention ponds to meet NURP criteria, and ongoing curlyleaf pondweed management.

3.1.7.3 Orchard Lake

Orchard Lake is currently listed on the MPCA's impaired waters (303(d)) list due to mercury (see Section 2.10.3). A mercury TMDL applicable to impaired water bodies statewide was approved in 2007. The most recent water quality and habitat quality data for Orchard Lake are included in the BDWMO's annual report and in this report as Appendix B. The water quality trend analyses for Orchard Lake are also presented in Appendix B. The BDWMO classifies Orchard Lake as a Category I water, meaning the lake should support swimming and other full body contact activities. The MPCA has not assessed Orchard Lake according to its ability to support aquatic recreational use.

Curlyleaf pondweed, which was detected in 2009, continues to be an issue in Orchard Lake. The City of Lakeville has performed ongoing curlyleaf pondweed management, including mechanical harvesting from 2004 to 2008 and application of iron filings to two small areas of Orchard Lake in 2004. Chemical treatments were performed in 2009, 2010, and 2011, with a 15% littoral area treatment planned for 2012.

3.1.7.4 Kingsley Lake

Kinglsey Lake is not included on the MPCA's impaired waters (303(d)) list. The most recent water quality and habitat quality data for Kingsley Lake are included in the BDWMO's annual report and in this report as Appendix B. Water quality trend analyses for Kinglsey Lake are also presented in Appendix B. Kingsley Lake is classified as a Category II water by the BDWMO. Recent water quality results indicate the lake could support full body contact (Category I), although residents have not historically used the lake for these purposes. The MPCA lists Kingsley Lake as fully supporting aquatic recreational use.

3.1.7.5 Lac Lavon

Lac Lavon is currently listed on the MPCA's impaired waters (303(d)) list due to mercury (see Section 2.10.3). A mercury TMDL applicable to impaired water bodies statewide was approved in 2007. The most recent water quality and habitat quality data for Lac Lavon are included in the BDWMO's annual report and in this report as Appendix B. Water quality trend analyses for Lac Lavon are also presented in Appendix B. The BDWMO classifies Lac Lavon as a Category I water. As such, Lac Lavon supports swimming and other full body contact activities, which coincides with the current recreational uses of the lake. The MPCA lists Lac Lavon as fully supporting aquatic recreational use.

Eurasian watermilfoil was detected in Lac Lavon as early as 1996. Herbicide treatments have been applied to the lake in the past to eliminate Eurasian watermilfoil, which still remains in the lake and has been documented since 2004. Upland buffer areas have previously been rated as poor due to the presence of manicured lawns (habitat monitoring is planned for 2014).

3.1.7.6 Sunset Pond

Sunset Pond is not included on the MPCA's impaired waters (303(d)) list. The most recent water quality and habitat quality data for Sunset Pond are included in the BDWMO's annual report and included as Appendix B. Water quality trend analyses for Sunset Pond are also presented in Appendix B. The BDWMO classified Sunset Pond as a Category II water body in the 2002 Plan, but Sunset Pond is no longer managed by BDWMO as a strategic water body. Recent water quality data indicate the pond could support full body contact, although residents have not historically used the lake for these purposes. The MPCA has not assessed Sunset Pond according to its aquatic recreational use support.

3.1.7.7 Lee Lake

Lee Lake is included on the MPCA's impaired waters (303(d)) list due to excess nutrients. Lee Lake is currently part of a three lake TMDL to address excess nutrients (see Section 3.1.3.4). The most recent water quality and habitat quality data for Lee Lake are included as Appendix B. Water quality trend analyses for Lee Lake are also presented in Appendix B. Lee Lake is not currently classified by the BDWMO, although recent water quality data suggests it is consistent with other Category I waters. The MPCA assessed Lee Lake and found the lake not supporting aquatic recreational uses. The City of Lakeville is working with the MPCA to remove Lee Lake from the impaired waters 303(d) list due to recent data.

The City of Lakeville has used barley straw in Lee Lake since 2002 to improve water clarity. However, water clarity did not significantly improve through 2004, and it was speculated that fish activity was limiting the effectiveness of the barley straw. The city performed fish removal in 2005, 2006, and 2008. Since 2005, water quality has improved relative to 2003 and 2004 (*Barley Straw Installation Report for Lakeville,* BlueWater Science, 2009). The presence of curlyleaf pondweed is a continuing problem in Lee Lake. Iron filings were added to two half-acre plots in Lee Lake in 2004 to reduce curlyleaf pondweed density. Overall, the curlyleaf pondweed growth in 2008 is less than was observed in 2003 (*Aquatic Plant Survey for Lakeville*, BlueWater Science, 2008). An alum treatment was performed on Lee Lake in 2009.

3.1.7.8 Earley Lake

Earley Lake was removed from the MPCA's impaired waters (303(d)) list in 2010 (it had previously been listed due to excess nutrients). The most recent water quality and habitat quality data for Earley Lake are included as Appendix B. Water quality trend analyses for Earley Lake are also presented in Appendix B. Earley Lake is not classified according to the BDWMO classification system, although recent water quality data suggests it is consistent with other Category I or II waters. The MPCA has assessed Earley Lake as not supporting swimming. Eurasian watermilfoil and curlyleaf pondweed are present in Early Lake.

3.1.7.9 Wood Pond

Wood Pond is not included on the MPCA's impaired waters (303(d)) list. The most recent water quality and habitat quality data for Wood Pond are included as Appendix B. Water quality trend analyses for Wood Pond are also presented in Appendix B. Wood Pond is not classified according to the BDWMO classification system, although recent water quality data suggests it is consistent with other Category I or II waters. The MPCA has not assessed Wood Pond with respect to its ability to support aquatic recreational use.

3.1.7.10 Twin Lake

Twin Lake is not included on the MPCA's impaired waters (303(d)) list. The most recent water quality and habitat quality data for Twin Lake are included in as Appendix B. Water quality trend analyses for Twin Lake are also presented in Appendix B. Twin Lake is not classified according to the BDWMO classification system, although recent water quality data suggests it is consistent with other Category II waters.

3.2 WATER QUANTITY AND FLOODING

In a natural, undeveloped setting, the ground is often pervious, allowing infiltration of water (including stormwater runoff) into the soil. Land development can dramatically affect stormwater runoff. During construction or redevelopment, clearing and grading of the site results in less infiltration, higher rates and volumes of stormwater runoff, and increased erosion. Ground surfaces covered with impervious materials (e.g., asphalt and concrete) prevent infiltration of water into the soil, further increasing the rate and volume of stormwater runoff. Increased runoff rates and volumes can create significant problems for downstream water resources. In addition, the reduced amount of groundwater recharge via infiltration can result in decreased base flows in creeks and affect the long-term sustainability of groundwater drinking supplies.

If the land drains to a landlocked basin, the additional volume of runoff can increase the water level and flood level of the basin. If the land drains to a creek, the additional runoff volume can cause the creek to flow full for longer durations, which increases the erosion potential. The increase in runoff rates from sites can also increase flooding risks and erosion.

Although both high water levels (flooding) and low water levels are of concern, more concern and attention is usually paid to flooding because it is a greater threat to public health and safety, and can be more costly. Damages caused by flooding include:

- Damage to homes, businesses, and other buildings.
- Damage to infrastructure (e.g., roads, bridges).
- Flooding of individual septic systems, rendering them unusable.
- Damage or destruction of recreational trails and bridges.

Flooding may cause other damages that are harder to quantify, including the following:

- Flooding of roads so they are impassable to emergency vehicles, residents, and school buses.
- Shoreline erosion.
- Destruction of vegetation, such as grass, shrubs, and trees.
- Unavailability of recreational facilities for use by the public (e.g., inundation of shoreline) and/or restricted recreational use of water bodies.
- More strain on budgets and personnel for repairing flood-damaged facilities and controlling public use of facilities during flooding events.
- Alterations to mix and diversity of wildlife species as a result of inundation of upland habitats.

Floodplain management is the management of development and other activities in or near the floodplain to prevent flood damages. The MDNR defines floodplain management as "the full range of public policy and action for ensuring wise use of the floodplains. It includes everything from collection and dissemination of flood control information to actual acquisition of floodplain lands, construction of flood control measures, and enactment and administration of codes, ordinances, and statutes regarding floodplain land use."

Minnesota law defines the floodplain as the land adjoining lakes, water basins, rivers, and watercourses that have been or may be covered by the "100-year" or "regional" flood. Floodplains of larger basins and creeks are mapped by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps (FIRMs), which are included in community Flood Insurance Studies (FISs).

There are local flooding and other stormwater system capacity issues within the BDWMO. Stormwater runoff rate and volume issues relevant to specific water bodies within the BDWMO are described later in this section.

3.2.1 Level of Service/Level of Protection

It is important to define the difference between level of service and level of protection when designing and analyzing stormwater systems. The level of service is defined as the system's capacity to convey runoff without unusual hardship or significant interference with routine public activities. Typically, this means flows remain in the storm sewer system and there is no street flooding. The level of protection is defined as the total system capacity required to avoid flooding of structures and provide for public safety. Typically, the level of protection is the level at which street flooding, overflow swales, piping systems, and ponds work as a total system to prevent flooding of homes/businesses and to prevent dangerous flooding of streets.

A system's level of protection is determined by combining the capacity of the storm sewer and ponding system with the overland flow channels that carry water not carried by the storm sewer system. For example, if a storm larger than the storm sewer's level of service design event occurs, some of the runoff will not be captured by the storm sewer, and will instead flow in streets or natural swales. In higher areas or in areas with well-defined overland flow patterns, this surface flow may not cause flooding. However, in low areas drained only by the storm sewer, the water may collect and flood adjacent properties. In the first case, the overall drainage system provides a level of protection greater than the level of service provided by the storm sewer. In the latter case, the level of protection is essentially the same as the level of service.

In general practice, the design event used for level of service (storm sewer design event) corresponds to a return period of 10 years or less, while the design event used for level of protection (total system design event) corresponds to a return frequency of 100 years.

3.2.2 Water Quantity Regulation in the BDWMO

One of the BDWMO's general goals is to keep regulation at the local level, which means the BDWMO does not administer a permit program. The member cities have the responsibility of managing stormwater runoff consistent with the goals and policies of the BDWMO (see Section 4.2). For subwatersheds that drain to the Black Dog fen wetland complex and the trout streams, the BDWMO requires that cities maintain or reduce the size of the tributary watersheds.

The BDWMO recognizes that there is a role for the organization in intercommunity flood control issues—where the tributary watershed spans more than one city or outflows cross city/county/WMO boundaries. As facilitator, the BDWMO will assist in fairly allocating costs among the member cities for intercommunity flood control projects. The BDWMO will allocate the costs based strictly on hydrology.

3.2.3 Crystal, Keller, Twin, and Earley Lakes

Crystal Lake has experienced sustained high water levels in the past. The City of Burnsville evaluated several options for reducing water levels in Crystal Lake, including the replacement of about 1,000 feet of pipe with larger diameter pipe downstream of the Crystal Lake outlet. A capital improvement project has not yet been implemented. However, since Crystal Lake receives water from areas outside of Burnsville, the BDWMO will assist in allocating the project costs among the member cities if a project is undertaken. The City of Lakeville has considered additional permit restrictions for projects tributary to Crystal Lake due to this issue. Similar to Crystal Lake, Keller Lake has experienced high water problems in the past. Future water quantity improvements in Crystal Lake could alleviate flooding issues in Keller Lake, as the lakes are connected via an equalizer culvert.

Flows from Crystal Lake travel downstream to Twin Lake. Residents of south Twin Lake have expressed concerns about high water levels in the past. Outflows from Twin Lake are carried downstream to Earley Lake. The City of Burnsville evaluated several options to reduce flooding in and around Earley Lake (*Earley Lake Flood Control and Water Quality Improvements*, SEH, 2001). In 2002, a portion of the watershed previously tributary to Earley Lake was diverted to Sunset Pond. The City has since constructed water quality/stormwater retention ponds upstream of Earley Lake. Some flooding issues remain between Twin Lake and Earley Lake. The City of Burnsville is addressing these issues in its local water management plan. The full extent of reducing water levels in Crystal Lake and Twin Lake has not yet been evaluated.

3.2.4 Lee Lake

Lee Lake was landlocked until 1993, when the City of Lakeville constructed a stoplog weir to convey flows to Crystal Lake and reduce peak flood levels.

Water levels in Lee Lake rarely reach the outlet elevation. Thus Lee Lake typically acts as a landlocked basin. An adjustable gate controls outflow from Lee Lake during larger events. The City of Lakeville may close the gate when downstream ponds are at or near flood levels and during short duration storms to prevent downstream flooding.

3.2.5 Kingsley Lake

In 1994, the City of Lakeville constructed an outlet from Kinglsey Lake to Orchard Lake under County Road 44 (at Elevation 981.2) to relieve flooding issues on the lake. Since that time, Kingsley Lake water levels have remained near the outlet elevation, but the city has not experienced significant flooding issues. The outlet can be closed to manage flows for water quality.

3.2.6 Watersheds Tributary to Scott WMO

In 1999, the BDWMO boundary was expanded to include the portion of the former Credit River WMO located in Dakota County. The Scott Watershed Management Organization (WMO) was created to manage the remaining watershed areas in Scott County not governed under an existing watershed management organization.

The Murphy Hanrehan, Orchard Lake, and Kingsley Lake subwatersheds are tributary to the Credit River in the Scott WMO. The flows from these subwatersheds must be managed to prevent increased flooding, excessive flowrate, and/or erosion problems downstream. In particular, there is concern about outflows from Orchard Lake causing a rise in water levels in downstream ponds. Discharge from Orchard Lake flows through open channels and several wetlands and a small lake in Credit River Township (in Scott County) before reaching the Credit River, about two miles downstream. As a result, there are many opportunities for flows to be detained before reaching the Credit River.

The Cities of Burnsville and Lakeville have agreements with the City of Savage regarding allowable intercommunity flows. As it is the policy of the BDWMO to require post-development discharges not to exceed existing discharges, the City of Lakeville's stormwater management plan calls for a restriction on the Orchard Lake outlet to maintain the peak outflow rate at 65 cfs. According to the City's local water management plan, the outlet restriction may increase the 100-year flood level on Orchard Lake 0.5 feet (from Elevation 978.4 to 978.9) based on anticipated future land use changes (Barr, 2007).

There is also concern about possible future outlets from landlocked ponds in the BDWMO's Murphy Hanrehan Subwatershed aggravating erosion and flooding problems downstream, especially in the Credit River. To address this and similar issues, the BDWMO regulates the discharge rates leaving the BDWMO (see Section 4.2).

3.3 EROSION/SEDIMENTATION

Sediment is a major contributor to water pollution. Stormwater runoff from streets, parking lots, and other impervious surfaces carries suspended sediment consisting of fine particles of soil, dust, and dirt in moving water. Abundant amounts of suspended sediment are carried by stormwater runoff when erosion occurs.

Although erosion and sedimentation are natural processes, they are often accelerated by human activities, including construction and redevelopment. Prior to construction, the existing vegetation on the site intercepts rainfall and slows down stormwater runoff rates, which allows more time for runoff to infiltrate into the soil. When a construction site is cleared and graded, the vegetation (and its beneficial effects) is removed. Also, natural depressions that provided temporary storage of rainfall are filled and graded, and soils are exposed and compacted, resulting in increased erosion, sedimentation, and decreased infiltration. As a result, the rate and volume of stormwater runoff from the site increases (Metropolitan Council, 2001). The increased stormwater runoff rates and volumes cause increased soil erosion, which releases significant amounts of sediment that may enter water resources.

Regardless of its source, sediment deposition decreases water depth, degrades water quality, smothers fish and wildlife habitat, and degrades aesthetics. Sediment deposition can also wholly or partially block culverts, manholes, storm sewers, etc., causing flooding. Sediment deposition in detention ponds and wetlands also reduces the storage volume capacity, resulting in higher flood levels and/or reducing the amount of water quality treatment provided.

Suspended sediment, carried in water, clouds lakes and creeks and disturbs aquatic habitats. Sediment also reduces the oxygen content of water and is a major source of phosphorus, which is frequently bound to the fine particles. Erosion also results in channelization of stormwater flow, increasing the rate of stormwater runoff and further accelerating erosion.

3.3.1 MPCA Erosion and Sedimentation Issues

To address the potentially significant amounts of sediment and other pollutants being transported by runoff from construction sites, the MPCA issues NPDES permits to construction site owners and operators to prevent pollution during and after construction.

Owners and operators of construction sites must obtain a National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit from the Minnesota Pollution Control Agency (MPCA), which was revised in 2008. A NPDES construction permit must be obtained for any construction activity disturbing:

- One acre or more of soil
- Less than one acre of soil if the activity is part of a "larger common plan development or sale" that is greater than one acre
- Less than one acre of soil but the MPCA determines that the activity poses a risk to water resources.

A key permit requirement is the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) with appropriate best management practices (BMPs). The SWPPP must be a combination of narrative and plan sheets that address foreseeable conditions, include a description of the construction activity, and address the potential for discharge of sediment and/or other potential pollutants from the site. The SWPPP must include the following elements:

- Temporary erosion prevention and sediment control BMPs
- Permanent erosion prevention and sediment control BMPs
- Permanent stormwater management system
- Pollution prevention management measures

The project's plans and specifications must incorporate the SWPPP before applying for NPDES permit coverage. The permittee must also ensure final stabilization of the site, which includes final stabilization of individual building lots.

3.3.2 Erosion and Sediment Control Issues in the BDWMO

The BDWMO member cities address erosion and sediment control in their local water management plans. The cities require erosion control plans for construction sites and adopt, administer, and enforce ordinances addressing erosion and sediment control for development activity. Some member city erosion and sediment control regulations apply to much smaller development activities than the one acre threshold of the NPDES construction permit (see Table 3-2).

The City of Burnsville currently contracts with the Dakota SWCD for construction-related erosion and sediment control services, at the request of the city. On specific projects, cities may request that the SWCD review grading and erosion control plans, attend pre-construction meetings, inspect construction sites, or work with contractors and developers to maintain erosion controls during construction.

The City of Apple Valley requires a cash deposit/escrow from developers to cover the costs of erosion control inspection and enforcement. It can be difficult for cities to enforce their erosion and sediment control ordinances/policies if they do not collect a cash deposit.

3.4 WETLANDS AND HABITAT

Shallow seasonal wetlands have equal value in the landscape compared with deep open water wetlands, but their designated uses are different from creeks, rivers, and lakes. It is generally recognized that damming a stream to form a ponded reservoir causes significant changes in the habitat, the hydrology and water quality downstream, and the plants and animals utilizing the resource.

In the same way, wetlands deserve careful consideration before they are converted to other types of wetlands or removed from the landscape altogether. Wetland uses such as nutrient uptake, stormwater storage, erosion control, low flow augmentation, wildlife habitat, and groundwater recharge are extremely valuable even in remote wetlands only distantly connected to the other resources in the watershed. Maintaining and/or restoring wetland buffers are an important strategy for maintaining wetland wealth and ecological functioning.

The goals of the BDWMO regarding wetland management are to preserve wetlands and achieve no net loss of wetlands. To achieve these goals, the BDWMO member cities maintain wetland protection ordinances based on comprehensive wetland management plans and wetland functions and values assessments. The member cities serve as the local governmental unit (LGU) for enforcement of the Wetland Conservation Act (WCA). Cities use a wetland classification system for managing wetlands. The classification system takes into account the susceptibility of the wetlands to degradation by stormwater inputs. BDWMO member cities also participate in the Wetland Health Evaluation Program (WHEP, see Section 2.13.4).

3.4.1 Wetland Classification Systems

All of the cities within the BDWMO have developed wetland management plans that have inventoried and performed a functions and values assessment classifying the wetlands into various management categories, typically using the Minnesota Routine Assessment Methodology (MNRAM) v 3.0 (or a similar variant of the methodology). Wetland management actions are developed according to the management categories. For more information about the wetland management plans within the BDWMO, see Section 2.7.2.

3.4.2 Member City Performance Standards

Wetland management performance standards are a primary means for protecting BDWMO wetlands. Member city performance standards (e.g. ordinances, wetland management plans) have been revised in recent years to address the requirements of a variety of federal, state, and local regulations. Table 3-1 compares BDWMO member city performance standards for vegetative buffers, hydrology (e.g. bounce), and water quality. The standards for vegetative buffers are strong and fairly consistent among member cities. However, levels of protection vary for hydrology and water quality standards. Eagan and Apple Valley do not have hydrology standards for all or most of their wetland management classes. For water quality, most communities specify a numerical reduction target for phosphorus and suspended solids or refer to the NPDES standard. Lakeville’s water quality standard is “pretreatment for sediment and nutrients” for nearly all wetland classes.

3.5 SHORELAND, HABITAT, AND OPEN SPACE MANAGEMENT

Shoreland development may have negative impacts on water bodies. Areas immediately adjacent to lakes, rivers, and wetlands are critical to preserving water quality, wildlife habitat, and the overall aesthetic quality of these resources. Vegetative buffers between developed areas and water bodies may prevent erosion and sedimentation of water bodies while reducing nutrient loads.

The MDNR maintains a statewide shoreland management ordinance to protect shoreland areas. Within the BDWMO, member cities may institute their own ordinances that are equivalent or more restrictive than the MDNR's standards. The Cities of Burnsville, Lakeville, and Eagan have shoreland management ordinances based on the MDNR ordinance; the standards do not differ significantly from the MDNR standards. The City of Apple Valley has adopted a shoreland management ordinance, but it does not apply to any waterbodies within the BDWMO. The quality of upland buffer areas around BDWMO strategic water bodies are evaluated as part of the BDWMO's habitat monitoring program.

3.6 GROUNDWATER PROTECTION

Various agencies such as the DNR, MDH, MPCA, the Minnesota Geological Survey, and Dakota County are responsible for groundwater management and protection. Dakota County's Site Assessment and Site Response Program inventories, identifies, evaluates and restores contaminated sites. This program complements existing state and federal programs. The *Dakota County Groundwater Protection Plan* (2000) notes that there are not enough funds and resources available to investigate and remediate all contaminated sites. Alternative funding methods include voluntary clean-up programs, grant and loan programs for site clean-up, and other economic incentives.

Minnesota Statute 103B.201 lists groundwater management and protection as one of the purposes of WMO programs. With so many other units of government already addressing groundwater management and protection issues, the practical role of WMOs (especially joint powers WMOs) in groundwater management is to support and coordinate with other agencies.

The BDWMO member cities of Apple Valley, Burnsville, and Lakeville obtain their water supplies from municipal wells located within the BDWMO (Eagan's municipal wells are located outside the BDWMO). In compliance with MDH regulations (Minnesota Rules 4720), these cities must delineate wellhead protection areas (see Figure 2-7) and develop wellhead protection plans (WHPP). Each city's WHPP will identify areas where aquifers have a high sensitivity to contamination due to the local geological setting and provide a relatively low level of protection. Source water susceptibility refers to the likelihood that a contaminant will reach the source of drinking water. It reflects the assessment of well sensitivity, aquifer sensitivity, and water quality data.

In some cases, desirable surface water management practices (e.g., infiltration) may conflict with groundwater management. In Lakeville, for example, the city may prohibit infiltration in areas where it could cause adverse effects to the local drinking water supply or require additional BMPs to mitigate the impact. In an effort to reduce the potential adverse effects of pollutants from surface infiltration, BDWMO member cities will consider the Minnesota Department of Health's *Evaluating Proposed Stormwater Infiltration Projects in Vulnerable Wellhead Protection Areas,* as amended, as guidance in evaluating all proposed infiltration projects within or adjacent to vulnerable portions of the Drinking Water Supply Management Areas (DWSMA).

3.7 IMPLEMENTATION RESPONSIBILITY

As a joint powers organization, most of the responsibility for implementing activities, programs and projects for managing water resources is delegated to the member cities. Coordinating these responsibilities to ensure that the goals and policies of this plan are implemented falls to the BDWMO Commission and administrator. The following sections address key management and coordination issues for successful plan implementation. Implementation policies (Section 4) respond to these issues and provide direction as to who is responsible for what activities.

3.7.1 Maintenance of Stormwater System

Member cities and other MS4 permit holders are generally responsible for maintaining the stormwater management system. MS4s within the BDWMO include:

- City of Apple Valley
- City of Burnsville
- City of Eagan
- City of Lakeville
- Minnesota Department of Transportation
- Dakota County

The system generally includes pipes, constructed ponds, lakes, wetlands, ditches, swales, and other overland conveyances. Member cities manage these systems according to system maintenance plans detailed in each city's SWPPP and local water management plan. Proper maintenance of the stormwater system will ensure that the stormwater system provides the necessary flood control and water quality treatment. Other units of government are responsible for maintaining the stormwater systems within the BDWMO. For example:

- MnDOT is responsible for maintaining the storm sewers, ponds, culverts, etc., located along I-35, I-35E, I-35W, and Highway 13.
- Dakota County is responsible for maintaining only the "mainline" culvert crossings in their county roads, such as County Road 42, County Road 32, County Road 11, and County Road 5; the cities are responsible for maintaining storm sewer catch basins and leads in the county roads.
- Owners of private stormwater facilities are responsible for maintaining their facilities in proper condition, consistent with the original performance design standards and any maintenance agreements with member cities.

For stormwater systems that are constructed as a BDWMO capital project and using funds allocated according to the BDWMO joint powers agreement, member cities may request reimbursement from the BDWMO for maintenance activities, according to the allocation given in the BDWMO joint powers agreement.

3.7.2 Funding/Financing

3.7.2.1 Adequacy of Existing Capital Improvement Programs to Correct Problems

In general, the BDWMO relies on the member cities to fund most capital improvements, although the BDWMO joint powers agreement allows the BDWMO to fund capital improvements as necessary. The primary role of the BDWMO with respect to funding is to assist in the fair allocation of the costs of capital projects to member cities.

Many of the BDWMO implementation tasks are targeted at the BDWMO strategic water bodies. The BDWMO also works with member cities to measure the success of improvement projects implemented by the member cities. The BDWMO also tracks progress using water quality monitoring data, trend analyses (see Section 2.10.2.1) and habitat monitoring results (see Section 2.13.2).

3.7.3 Monitoring

Monitoring responsibilities in the BDWMO are summarized in Section 4.1.2 (Water Quality Policies). The BDWMO monitors strategic water bodies, while member cities are encouraged to monitor non-strategic water bodies.

3.7.4 Requirements for Local Plans

Minnesota Rules 8410 specifies the general requirements for local water management plans. In addition the BDWMO recognizes issues of particular importance, including those described below:

3.7.4.1 Member City Performance Standards

Stormwater management performance standards are a primary means for protecting BDWMO surface waters. Member city performance standards (e.g. ordinances) have been revised in recent years to address the requirements of a variety of federal, state, and local regulations including the NPDES MS4 permit, the General Construction (Stormwater) Permit, non-degradation (anti-degradation) plans, and requirements of other adjacent watershed management organizations. Table 3-2 compares BDWMO member city and adjacent watershed management organization's performance standards for rate control, volume control, and water quality. While there is some variation in these standards, the level of protection provided by member city performance standards is fairly consistent. However, the development thresholds that trigger the performance standards do vary significantly. Lakeville's performance standards for stormwater management are applied to developments creating one or more acres of new impervious surface. Other member cities apply their standards to much smaller developments or all development projects.

Recognizing the existing regulations of other government jurisdictions and the sufficient level of protection provided by member city performance standards, any new BDWMO performance standards would likely duplicate these existing regulations. However, by setting a minimum threshold for the application of stormwater performance standards, the BDWMO could establish a consistent level of stormwater management protection across the watershed.

All member cities have performance standards and administrative procedures in place to control erosion and sedimentation from construction sites. Table 3-2 shows that member cities have thresholds far below one acre of land disturbance. One acre is the threshold for erosion and sediment control requirements of both the VRWJPO and the Scott WMO, as well as the NPDES general construction permit.

3.7.5 Public Education and Involvement

Public education plays an important role in protecting water resources. The goal of the BDWMO is to provide the public with the data necessary to help them make wise decisions affecting water resources. The BDWMO publishes an annual newsletter for public distribution that summarizes its activities. The BDWMO publishes the annual newsletter on its website and provides the member cities with copies for viewing at the city halls.

The BDWMO also provides meeting minutes, contact information, project plans, and reports, including the watershed management plan, on its website. The BDWMO website also contains links to other reference and educational material. More information is available at the BDWMO website: www.blackdogwmo.org/

The BDWMO cooperates with the Dakota County Soil and Water Conservation District (SWCD) Blue Thumb program to support educational workshops within the BDWMO. The BDWMO also contributes to the Dakota County SWCD community conservation cost share program, which provides grants BDWMO residents interested in installing water quality improvement projects (e.g. rainwater gardens).

All other educational activities are undertaken by the cities, which occasionally use newsletters, local newspapers, and other media to distribute educational materials regarding water quality. BDWMO member cities also implement education and public involvement programs as part of their SWPPP (see Section 3.1.1.1). Many of these activities are very similar and represent an opportunity for the BDWMO to provide the service for all members in a more cost-effective manner. During the planning process, members supported a greater role of the WMO in creating and distributing education material that members could use to meet their MS4 permit requirements for public education. These materials could be developed in collaboration with the members and produced for all cities at a lower cost than each member city on its own.

Through the Dakota County Water Resources Department, cities, including Burnsville, Apple Valley, Lakeville, and Eagan, are participating in the Wetland Health Evaluation Program (WHEP). This public involvement program uses local volunteers to assess the biological health of wetlands, based on protocols developed by the U.S. Environmental Protection Agency and the MPCA. The goal of the program is to increase awareness of wetland functions and values and to determine if the protocol for volunteers is effective enough for cities to continue the program on their own. The volunteers collect and analyze the data and then present it to their local decision-makers (e.g., city councils, WMO boards) so more effective decisions can be made. WHEP data is available online: www.mnwhep.org/id25.html.

The MPCA also implements the Citizen Lake Monitoring Program (CLMP), a cooperative program where citizen volunteers collect water-quality data on their lakes. The program greatly multiplies the MPCA water-quality sampling capabilities, while volunteers learn about the water quality of lakes in their region and the causes and effects of lake pollution. Crystal Lake and Lac Lavon have been monitored through this program.

The Metropolitan Council's Citizen Assisted Monitoring Program (CAMP) has been very successful at involving citizens in lake monitoring. The long-term goal of the lake monitoring program is to obtain and provide information that enables cities, counties, lake associations, and watershed management organizations to better manage Twin Cities Metro Area lakes, thereby protecting and improving lake water quality. Several lakes within the BDWMO are monitored by volunteers through the CAMP program (see Table 2-4). Camp data is available online: www.metrocouncil.org/environment/riverslakes/Lakes/index.htm

The MDNR maintains the Lake Level Minnesota program, in which volunteers and cooperative organizations collect and report lake levels throughout the state.

Section 3 Tables

Table 3-1: Comparison of Wetland Management Standards for BDWMO Member Cities

	Apple Valley		Burnsville		Eagan		Lakeville	
	Mgmt Class	**Standard**	**Mgmt Class**	**Standard**	**Mgmt Class**	**Standard**	**Mgmt Class**	**Standard**
Buffer		Average/Minimum (ft)		Average/Minimum (ft)		Minimum (ft)		Minimum (ft)
	Protect	50/30	Protect	50/30	W1	50	Preserve	50
	M1	40/30	Improve	35/25	W2	40	M1	25-35
	M2	30/25	M1	25/20	W3	40	M2	17-25
	M3	25/16.5	M2	20/20	W4	30	Utilize	17
	Redev.	16.5/16.5			W5	20	Restore	25
					W6	none		
Hydrology								
	P	Maintain existing hydrologic conditions for: • Bounce (10-year) • Inundation (1, 2 & 10-yr)	Protect	If wetland not receiving stormwater, maintain existing & divert increased flows. Otherwise: • Bounce (10-year) Existing +6” • Inundation: 1 & 2-yr - Existing + 1 day. 10-yr – Existing + 3 days. • Outlet control – no change	W1	None	Preserve	Maintain existing conditions for bounce (2-yr), if feasible.
	M1	None	Improve	• Bounce (10-year) Existing +9” • Inundation: 1 & 2-yr - Existing + 3 days. 10-yr – Existing + 5 days. • Outlet control – no change	W2	None	M1	Bounce (2-yr) Existing + 6”, if feasible.
	M2	None	M1	• Bounce (10-year) Existing +12” • Inundation: 1 & 2-yr - Existing + 5 days. 10-yr – Existing + 15 days. • Outlet control – 0 to 2.0 ft above existing	W3	None	M2	Bounce (2-yr) Existing + 12”, if feasible.
	M3	None	M2	Use criteria in WRMP	W4	None	Utilize	No limit on bounce
					W5	None	Restore	Bounce (2-yr) Existing + 12”, if feasible.
					W6	None		
Water Quality								
	P	NPDES standards	Protect	New Development: Treatment to 90% TSS & 60% TP removal Redevelopment: treatment to 70% TSS & 30% TP removal.	W1	Stormwater Performance standards apply **TP** New Development: No-net-increase from existing, or 50% removal from post-development, whichever is more restrictive. Redevelopment No-net-increase from existing. **TSS** New Development: No-net-increase from existing, or 80% removal from post-development, whichever is more restrictive. Redevelopment No-net-increase from existing.	Preserve	Pretreatment for sediment and nutrients
	M1	NPDES standards	Improve		W2		M1	Pretreatment for sediment and nutrients
	M2	NPDES standards	M1		W3		M2	Pretreatment for sediment and nutrients
	M3	NPDES standards	M2	Minimum of grit removal.	W4		Utilize	None
					W5		Restore	Pretreatment for sediment and nutrients
					W6			

Notes: Sources used include member city wetland ordinances, wetland management plans and surface water management plans.

Table 3-2: Comparison of Stormwater Management Standards

	Burnsville	Lakeville	Apple Valley	Eagan
Stormwater Management Performance Standards				
Threshold	Any project resulting in 0.5 acre or more of disturbance or 5,000 sf or more of new impervious surface.	1 acre or more of new impervious surface.	All developments	Required for building, grading, and excavation permits.
Rate Control	No increase over existing condition for the 2-yr, 10-yr and 100-yr events.	No increase over existing condition for the 1-yr, 10-yr and 100-yr events.	A maximum stormwater runoff coefficient of 0.6 for a 5-yr event (2.4 cfs per acre). A coefficient of up to 0.9 allowed where there is sewer capacity.	No increase over existing condition for the 2-yr, 10-yr and 100-yr events.
Volume Control	Infiltrate 1 inch from impervious surface for new development. Infiltration 0.5 inch from impervious surface from redevelopment projects(1).	Infiltrate (or retain) 0.5 inch from all new impervious surface.(2)	Infiltrate the first 0.5 inch from entire site for any event. No net increase in average volume from 1990 conditions for projects creating 0.2 or more acres of new impervious surface.	Infiltrate 0.5 inch from new impervious surface of redevelopment sites and entire site of new development.
Water Quality	Standard met if above volume control standard is met. Otherwise, for new development 90% TSS and 60% TP removal. For redevelopment 70% TSS and 30% TP removal.	Measures shall meet the standards for the NPDES Construction Permit. Using infiltration/filtration methods to meet these standards count toward volume control standards.	Managed through volume control standard. No net increase in TSS and TP for projects creating 0.2 or more acres of new impervious surface.	For new development creating more than 0.5 acre of new impervious surface, no net increase in TSS and TP, or 80% TSS and 50% TP removal, whichever is more restrictive. For redevelopment, no net increase in TSS and TP loading.
Erosion and Sediment Control Performance Standards				
Threshold	Movement of 90 cy or more of soil or installation of 5,000 sf of impervious surface.	Movement of 50 cy of soil	Movement of 20 cy or 3,500 sf of soil, installation of 0.2 acres of impervious surface, or loss of 10% or more of significant trees.	Disturbance of 10,000 sf or change in drainage pattern.

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(1) Projects in the Vermillion River Watershed that create 1 or more acre of new impervious surface, must control volume to the predevelopment volume for the 2-yr event (2.75 inches)

(2) 1.5 inch is required in the South Creek drainage district (trout stream tributary)

(3) Infiltration/filtration are the preferred methods for satisfying water quality requirements of the NPDES construction permit. Ponds allowed if no net increase in the temp of discharge for the 2-yr event, and it is designed for zero discharge for the 2-yr event, or the volume control requirements are met and ponds are designed to limit temp increases.

Section 4

Goals and Policies

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4.0 Goals and Policies

This section sets goals and policies that reflect the mission of the BDWMO and the vision for its water resources. The section also sets goals for specific waterbodies, managing stormwater runoff, controlling erosion, preserving wetlands, enhancing wildlife habitat and recreational opportunities, education and public involvement, performance evaluation, and financing of the implementation program. The goals are followed by policies that provide specific methods of achieving the goals and serve as decision making guidelines.

4.1 WATER QUALITY

4.1.1 Goals

- Maintain or restore the water quality of the BDWMO water resources to meet state water quality standards and allow for the continuation or enhancement of existing intended uses.

- Improve the quality of stormwater runoff reaching the Minnesota River by reducing nonpoint source pollution (including sediment) carried with stormwater runoff.

- Maintain or improve the quality of stormwater runoff reaching the calcareous fen (Black Dog fen) and the nearby trout streams.

4.1.2 Policies

1. All waterbodies in the BDWMO will be classified and managed according to either the BDWMO waterbody classification system or the city's wetland classification system (see member city management plans). The BDWMO will classify strategic waterbodies; member cities will classify all other waterbodies. The BDWMO waterbody classification is described in Section 2.10.2 and Table 2.7 and includes the following classifications:

   Category I. Waterbodies in this category are typically used for swimming and other direct contact recreational activities. These waterbodies have the highest/best water quality and are usually the most popular waterbodies with the public.

   Category II. Waterbodies in this category are typically used for indirect contact recreational activities (e.g., boating and fishing) that involve incidental contact with lake water. These waterbodies have poorer water quality than Category I waterbodies, but are still popular with the public.

Category III. Waterbodies in this category serve important functions for wildlife habitat and aesthetic enjoyment, and may also provide opportunities for warm-water fishing, provided winter kill does not occur. These waterbodies may have poorer water quality than Category I and II waterbodies and typically are not viewed as swimmable because of lower water quality or the nature of their shorelines.

Category IV—Nutrient & Sediment Traps. Waterbodies in this category are intended to reduce downstream loading of sediment and/or phosphorus and other nutrients that contribute to degradation of water quality. The phosphorus removal efficiency of these ponds will vary by size.

2. The BDWMO will cooperate with the affected communities and the MPCA in developing TMDLs and associated implementation plans for waterbodies within the BDWMO, as needed. BDWMO activities may include performing the TMDL, funding the TMDL, providing data to inform a TMDL, writing an implementation plan, and other appropriate activities.

3. At least biennially, the BDWMO will discuss water quality issues in the Credit River watershed downstream of the BDWMO with the Scott WMO.

4. The BDWMO will monitor the water quality of its strategic waterbodies and will submit its monitoring data to the MPCA for entry into the MPCA's water quality database, EQuIS (Environmental Quality Information System). The type of monitoring recommended for each waterbody varies according to its classification, as shown below:

Waterbody Classification	Type of Monitoring (see Section 2.9.1 and Section 2.13.2)
Category I	Survey level water quality monitoring (e.g., Metropolitan Council's Citizen Assisted Monitoring Program) and habitat monitoring—minimum requirement Management level water quality monitoring every 3 years Intensive water quality monitoring as needed for diagnostic and/or TMDL studies

Waterbody Classification	Type of Monitoring (see Section 2.9.1 and Section 2.13.2)
Category II	Survey Level water quality monitoring (e.g., CAMP) and habitat monitoring. Management level water quality monitoring as needed Intensive water quality monitoring as needed for diagnostic and/or TMDL studies
Category III	Survey Level water quality monitoring (e.g. CAMP) and habitat monitoring. Management level water quality monitoring as needed Intensive water quality monitoring as needed for diagnostic and/or TMDL studies
Category IV/V	As required by city maintenance plans and policies.

5. The BDWMO will perform habitat monitoring (see Section 2.13.2) of all strategic waterbodies at least once every five years. This program includes monitoring of biological and physical indicators.

6. The BDWMO will take actions to protect strategic waterbodies from degradation relative to certain thresholds, or "action levels." Table 4-1 outlines these actions. The BDWMO, with the involvement of member cities, will conduct diagnostic-feasibility studies for strategic waterbodies (see Table 4-1) to determine the needed water quality improvement projects and the estimated costs of the projects. The following "action levels" apply to these waterbodies, and will be updated annually (see Table 2-6):

   - For lakes with sufficient data, calculate the 25th and 75th percentiles of *average* summer Secchi disk transparency data from the last 10 sampling years to obtain the interquartile range. The action level should be set at the 25th percentile or the MPCA lake eutrophication standards, whichever is more stringent.

   - For lakes with insufficient (or no) water quality data, more data will need to be collected before setting lake-specific action levels. In the meantime, the following action levels would apply:

     Action level for Category I waterbodies: if the average summer Secchi disk reading drops below 1.6 meters or more than two individual readings are less than 1.1 meters.

     Action level for Category II waterbodies: if the average summer Secchi disk reading drops below 1.0 meters.

7. The BDWMO will limit its water quality management roles not explicitly defined in this Plan to those involving intercommunity watersheds, or those requested by the involved cities.

8. The BDWMO and member cities will continue to manage the "strategic" waterbodies. Strategic waterbodies are defined as meeting specific criteria (see Table 2.7). The strategic waterbodies are Crystal Lake, Orchard Lake, Keller Lake, Kingsley Lake, and Lac Lavon.

9. The BDWMO will recommend actions or projects for strategic waterbodies as necessary, following the process outlined in Table 4-1. Member cities will perform actions or projects recommended by the BDWMO. If a city does not include a recommended action or project for a strategic resource in its CIP within 18 months, the BDWMO will consider undertaking the recommended action or project. It may require a plan amendment to add a project to Table 5-1. In this situation, the BDWMO would assess the project costs back to the cities, in accordance with the joint powers agreement. For non-strategic resources, the cities are to take the recommended action.

10. The BDWMO will continue to cooperate with the member cities in resolving issues related to the member cities' implementation of BDWMO-directed or TMDL-recommended water quality improvement projects. The BDWMO's involvement could include assisting in allocating project costs among the member cities, participating in public informational meetings about the projects, obtaining grants, and updating the BDWMO at BDWMO Commission meetings. In accordance with the joint powers agreement, any member city may appeal cost allocation decisions made by the BDWMO.

11. The BDWMO will help facilitate in allocating costs for TMDL implementation tasks aimed at achieving the required load allocations (pollutant loads not assigned to permitted MS4s) outlined in the approved TMDL. MS4s within the BDWMO will be responsible for the implementation of BMPs that will help achieve the required wasteload allocations. The BDWMO will fund and implement internal load reduction projects stemming from TMDLs for lakes with intercommunity shoreline (see also Section 4.7.4, Policy 8).

12. The BDWMO will partner with the Dakota County SWCD or other organizations to sponsor and implement water quality improvement

projects on residential, commercial, or public properties through existing cost share and assistance programs (e.g. installing residential rain gardens through the Blue Thumb Program).

13. The BDWMO member cities are responsible for managing “non-strategic” waterbodies. City management of these waterbodies could include classifying, monitoring, tracking trends, conducting studies, and implementing water quality management actions. Waterbody management actions shall be reported in the city’s local water management plan.
14. Member cities will continue to manage all MDNR public waters for nondegradation as required by their MS4 permits.
15. All Category I-III waterbodies should be managed to preserve and promote biodiversity and improve habitat quality.
16. In general, the BDWMO supports implementation of in-lake chemical treatments only after watershed load reductions have been considered or implemented.
17. Member cities are encouraged to explore the outcome of the MPCA Minimum Impact Design Standards (MIDS) project study as a source of potential ideas/regulatory tools to manage water quality and address MPCA anti-degradation requirements.
18. The BDWMO and member cities will share water quality data and trend analyses.
19. The BDWMO encourages the member cities to take full advantage of redevelopment as an opportunity to achieve water quality improvements. The BDWMO will work with member cities to identify water quality improvement opportunities in redevelopment areas and help secure funding for such projects, as requested.

4.2 WATER QUANTITY AND FLOODING

4.2.1 Goals

- Manage intercommunity stormwater flows.
- Minimize flood damage to private and public property, and protect against increased flooding caused by development and redevelopment activities.

4.2.2 Policies

1. The BDWMO will serve as a facilitator for intercommunity flood control issues (issues where the tributary watershed spans more than one city or outflows cross city/county/WMO boundaries). As facilitator, the BDWMO will assist in fairly allocating costs among the member cities for intercommunity flood control projects (see Financing Policies, Section 4.7.4 #5).

2. The BDWMO will coordinate intercommunity stormwater runoff design and planning with the member communities by:

    - Reviewing each member city's local water management plan for consistency with the BDWMO goals and intercommunity planning.

    - Calculating the cost apportionment between cities for water resources projects with intercommunity participation at the request of the cities involved.

3. The BDWMO promotes stormwater volume reduction through infiltration practices (e.g., bioretention, porous pavement) on all new development and redevelopment sites where such practices are feasible and do not pose a risk to groundwater resources. The member cities will consider the Minnesota Department of Health's *Evaluating Proposed Stormwater Infiltration Projects in Vulnerable Wellhead Protection Areas*, as amended, as guidance in evaluating all proposed infiltration projects within or adjacent to vulnerable portions of the Drinking Water Supply Management Areas (DWSMA) (see Section 3.6). The member cities use infiltration and reductions in impervious surface coverage as methods to achieve TMDL load reductions (i.e., improve water quality). The member cities also use these measures to reduce runoff, especially in areas tributary to landlocked basins.

4. As part of updating local water management plans, member cities will review development regulations (zoning and subdivision ordinances). The BDWMO recommends cities amend regulations as practicable to remove/reduce obstacles to LID practices, including opportunities to reduce impervious surfaces. The BDWMO will assist member cities in amending regulations to the extent requested by the member cities. Examples of methods to reduce impervious surfaces include:

    - Reducing road widths, such as reducing drive and parking lanes widths and allowing parking on only one side of a residential street.

- Reducing the number and/or size of parking spaces required and the width of parking lot access lanes. Use of maximum parking requirements and required use of pervious pavement for parking spaces that exceed the maximum are encouraged.
- Eliminating pavement in the center of cul-de-sacs.
- Reducing sidewalk widths.
- Allowing greater flexibility to encourage shared parking.
- Creating a smaller building footprint (e.g., building two-story houses instead of one-story houses).
- Installing semipermeable/permeable paving, where feasible (e.g., overflow parking lots).
- Minimizing environmental impacts of street construction and reconstruction and creating streets safe for all ages, abilities, and modes of transportation.
- Planting trees.

5. The BDWMO encourages the member cities to reduce discharge rates wherever possible, with the goal of reducing discharge rates to pre-development levels (or lower) (see Section 4.9 – BDWMO Performance Standards).

6. The BDWMO encourages the member cities to recruit volunteers to participate in the MDNR's lake level monitoring program for MDNR public waters. The BDWMO will assist member cities through "call for volunteers" articles in the BDWMO newsletter, on the BDWMO website, or other appropriate means.

7. Member cities should evaluate the impact of increasing the drainage area to landlocked basins, including effects on flooding, as part of project review. If outlets are needed from landlocked basins, the BDWMO encourages cities to keep outflow rates low to allow for as much infiltration as appropriate, while not causing extended periods of high water levels that may have negative effects. Member cities shall consider the effects of water level fluctuations on trees, vegetation, erosion, and property values when establishing flood levels for landlocked basins.

8. The BDWMO requires member cities to analyze the water quality and flooding impacts of proposed outlets from landlocked basins on intercommunity flows or any downstream strategic waterbodies prior to construction of the outlets. If analyses indicate adverse effects on water quality or increased flood potential, the city must notify the BDWMO prior to construction.

9. The member cities shall consider the effects of events larger than the 100-year flood when setting minimum building elevations. Higher minimum building elevations should be considered for structures adjacent to ponding areas with large tributary watersheds and for structures adjacent to landlocked basins.

10. Member cities shall consider the possibility of long duration events, such as multiple-year wet cycles and high runoff volume events (e.g., snowmelt events that last for many weeks) when establishing high water elevations and the need for outlets from landlocked basins.

4.3 EROSION/SEDIMENTATION

4.3.1 Goals

- Limit and/or decrease erosion and sedimentation through controls to protect water quality, habitat, and infrastructure (see Section 4.9.1, policy 1 regarding implementation of controls).

4.3.2 Policies

1. The BDWMO will facilitate intercommunity erosion and sediment control projects by performing studies, preliminary designs, feasibility reports, and calculating the cost apportionment between cities, as requested by the cities.

2. The BDWMO requires conveyance system discharges to be designed so as to prevent or minimize the potential for bank, channel, or shoreline erosion.

3. Member cities shall consider the following for the design of shoreline stabilization measures, in addition to standard engineering and economic criteria: unique or special site conditions, energy dissipation potential, adverse effects, preservation of natural processes and habitat, and aesthetics.

4. Member cities shall continue managing erosion and sediment control permitting programs and ordinances as required by their NPDES MS4 permit and the NDPES Construction Stormwater General Permit. Procedures for reviewing, approving, and enforcing erosion and sediment control plans shall be described in local water management plans.

4.4 WETLAND AND HABITAT MANAGEMENT

4.4.1 Goals

- Preserve the ecological quality of wetlands for water retention, recharge, soil conservation, habitat, aesthetics, and natural enhancement of water quality.
- Achieve no net loss of wetlands in the BDWMO, while conforming to the Minnesota Wetland Conservation Act (WCA) and associated rules (Minnesota Rules 8420).

4.4.2 Policies

1. Member cities will continue to enforce wetland management standards as defined by each member city (see Table 3-1), but including at a minimum:
    - Buffer strip width requirements depending on protection level or management classification (no less than 16.5 feet).
    - Limits on water level bounce during storm events depending upon wetland protection level or management classification.
2. The BDWMO defers local governmental unit (LGU) authority for administering the Wetland Conservation Act (WCA) to member cities and MnDOT (which administers the WCA within its right-of-way). The BDWMO will not seek to manage individual wetlands. In compliance with WCA, LGUs must protect wetland from impacts in the following order: avoid, minimize, mitigate.
3. The BDWMO requires member cities to maintain wetland protection ordinances based on comprehensive wetland management plans or wetland functions and values assessments.
4. The BDWMO requires member cities to maintain an inventory of wetlands, including assessment of functions and values, either as part of a comprehensive wetland management plan or on an as-needed basis.

5. Member cities will continue to use wetland management systems to effectively manage the wetlands within the BDWMO. A wetland classification system similar to MnRAM3 is recommended.

6. The member cities may request that the BDWMO classify and set goals for certain wetlands; the BDWMO commissioners will decide whether to take on the responsibility.

4.5 SHORELAND, HABITAT AND OPEN SPACE MANAGEMENT

4.5.1 Goals

- Protect and enhance fish and wildlife habitat within the BDWMO.

- Maintain or improve shoreland integrity, preserve and enhance the ecological quality of shoreland areas as it relates to wildlife habitat, aesthetics, soil conservation, and natural improvement of water quality.

- Preserve and enhance the quality of open spaces.

- Protect and increase recreation opportunities within the BDWMO.

4.5.2 Policies

1. The BDWMO will promote and encourage protection of non-disturbed shoreland areas, restoration of disturbed shorelines, and the creation of buffer zones along shorelines. This will be done by sponsoring shoreline management and restoration workshops through the Blue Thumb Program or other similar programs, as opportunities allow.

2. Member cities shall minimize impacts to and will restore to the extent practicable lakeshore vegetation during and after construction projects.

3. The BDWMO will encourage public and private landowners to maintain wetlands and open space areas for the benefit of wildlife through education and by providing information on various grant programs.

4. The BDWMO encourages member cities to address disturbed shoreland areas in local water management plans, including lakeshore areas. This may include identification, ranking, and mapping of disturbed shoreland areas. The BDWMO will provide member cities with results from the BDWMO habitat monitoring program and information on various grant programs to assist with these activities.

5. The member cities are to maintain control and responsibility for shoreland regulation according to state and local regulations.

6. Member cities shall consider opportunities to maintain, enhance, or provide new open spaces and/or habitat as part of wetland modification, stormwater facility construction, redevelopment, or other appropriate projects that:

    - Increase beneficial habitat, wildlife and recreational uses; promote infiltration and vegetative water use; and

    - Decrease detrimental wildlife uses (such as beaver dams, goose overabundance) that damage water control facilities, shoreline vegetation, water quality, or recreational facilities.

4.6 GROUNDWATER

4.6.1 Goals

- Protect the quality and quantity of groundwater resources.

4.6.2 Policies

1. The BDWMO encourages member cities to provide increased green space, grassed waterways, native vegetation, and infiltration facilities wherever such actions are possible and do not pose a risk to groundwater resources, to allow for the infiltration of stormwater runoff and promote groundwater recharge.

2. The BDWMO will work with and encourage member cities to join Dakota County or other entities in efforts to promote awareness of groundwater resource issues through public education programs, data sharing, and other information programs.

3. The BDWMO will support all the policies in the Dakota County groundwater plan and will cooperate with Dakota County, Minnesota Department of Health, and the MDNR to protect sensitive groundwater areas. Cooperation may include providing education to member cities and residents, collaborating with agencies or cities on activities and events, and/or providing data, as requested.

4. The BDWMO encourages member cities to protect recharge areas and groundwater resources from potential sources of contamination, including contamination associated with the infiltration of stormwater. This can be

accomplished by enforcing appropriate spill and contamination prevention procedures, analyzing effects of infiltration BMPs prior to their construction, and other appropriate activities (see MDH guidance document *Evaluation Proposed Stormwater Infiltration Projects in Vulnerable Wellhead Protection Areas*, as amended).

5. Member cities shall continue their management programs and ordinances pertaining to subsurface sewage treatment systems (SSTS), consistent with state and local rules and shall follow the Metropolitan Council's Waste Discharge Rules regarding requirements and timing of connections to sanitary sewer service.

4.7 ADMINISTRATION

4.7.1 Goals

- Promote local regulation of water resources by delegating day-to-day management of the BDWMO's water resources to the member cities.
- Provide administrative guidance to member cities through this plan and the review and approval of local water management plans.
- Provide periodic review of projects proposed to meet policies/goals for strategic waterbodies established in this plan.
- Minimize duplication of federal and state rules and standards.
- Supplement existing federal and state regulations with specific design standards and criteria that address unique needs of BDWMO resources described in this plan.

4.7.2 Project Review Policies

1. The BDWMO will continue to review projects and programs of member cities as requested by member cities, or if projects warrant such consideration (e.g., TMDL studies, projects with intercommunity impacts, stormwater management and wetland ordinance revisions), and will provide comments to the member cities within a deadline specified by the city. In addition, the BDWMO requests that the member cities inform the WMO of their plans to implement projects identified in TMDL implementation plans.

2. The BDWMO will review any proposed changes to the intercommunity stormwater system to ensure that they are consistent with an approved local water management plan.

3. The BDWMO will consult with Scott WMO when reviewing proposed changes to the intercommunity stormwater system in the portion of the BDWMO tributary to the Credit River.

4. The BDWMO will review and approve any changes to the approved local water management plan to ensure the local plan is consistent with the BDWMO plan.

5. The BDWMO requires member cities to inform the BDWMO regarding revisions to their comprehensive plans that affect water management. The BDWMO requires that stormwater management elements of the city comprehensive plans conform to the BDWMO plan.

4.7.3 Evaluation and Accountability Policies

1. The BDWMO and the member cities will meet annually to discuss progress on the goals set the previous year and set goals for the coming year.

2. The BDWMO will use an evaluation concept that includes trend analysis, performance analysis and habitat quality analysis. This information will be presented in the annual report and newsletter.

    - Trend analysis will demonstrate water quality and other significant trends at selected waterbodies (see Section 2.10.2.1).

    - The performance analysis will evaluate the implementation of maintenance plans, capital improvement projects, programs, and other items.

    - Habitat quality analysis will be used to detect conditions that may trigger a need for management action (see Section 2.13.2).

3. The BDWMO expects the member cities to continue to share information with the BDWMO regarding monitoring/surveying of strategic waterbodies or MDNR public waters within the BDWMO and any management actions or projects performed for those waterbodies so that the BDWMO can compile an annual report.

4. The BDWMO may consider developing and/or strengthening standards through a major plan amendment (see Section 5.5) if such action is warranted. New standards may be specific to individual waterbodies or be applied to the entire watershed.

4.7.4 Financing Policies

1. The BDWMO will pay for implementation program elements through either the BDWMO general fund (the annual contributions of its member

cities) or some form of cost sharing, in accordance with the joint powers agreement.

2. The BDWMO will apportion the operation and maintenance costs associated with BDWMO improvement projects according to the BDWMO joint powers agreement.

3. The BDWMO will fund lake water quality and habitat monitoring, and tracking of water quality and habitat trends undertaken for the strategic water resources through the BDWMO general fund.

4. The BDWMO will fund diagnostic feasibility studies for strategic waterbodies through the BDWMO general fund.

5. The BDWMO will allocate the costs of intercommunity flood control projects based strictly on hydrology (e.g., stormwater runoff rates). By using hydrologic results (comparing hydrographs), cities/watersheds that control their stormwater rates will be rewarded by having a lower percentage of the project costs allocated to them.

6. In general, the BDWMO will fund more detailed monitoring, such as that required to prepare diagnostic-feasibility studies, only when necessary to meet a BDWMO goal for a strategic water resource.

7. The BDWMO will evaluate different cost allocation methods for water quality improvement projects to ensure equitable contributions from member cities. For strategic waterbodies where the tributary watershed is completely contained within one city, the costs of water quality improvement projects will be paid for by the individual city.

8. The BDWMO will fund internal load reduction projects stemming from TMDLs for lakes with intercommunity shoreline (Crystal Lake, Keller Lake, and Lac Lavon) by building up funds over time. The capital project costs will be apportioned among the member cities according to each city's annual contribution to the BDWMO General Fund, as specified in the Joint Powers Agreement. The City of Eagan will be excluded from the cost allocation. The joint powers agreement would have to be revised to allow this cost apportionment.

9. The BDWMO will pursue grants and work with member cities to take advantage of grants sought by the member cities. In cooperation with member cities, the BDWMO may serve as the grant applicant, act as a

fiscal agent for its member cities for grants that require WMO sponsorship, or assist member cities acting as the applicant, and may provide matching funds for grant applications.

10. Member cities may enter into individual joint powers agreements with one another regarding cost splits for lake water quality and habitat improvement projects, as an alternative to using the methods set forth in the BDWMO joint powers agreement.

11. The member cities may request and receive reimbursement from the BDWMO (in accordance with the joint powers agreement) for the costs of water quality monitoring, studies, projects, etc., that are undertaken for strategic water resources at the direction of the BDWMO.

4.7.5 Local Water Management Plan Policies

The cities must prepare and adopt (local) water management plans that conform to the goals, policies, and standards of the BDWMO plan, including BDWMO Performance Standards listed in Section 4.9. Additionally, member city local management plans shall include the following:

1. Water quality management actions performed or proposed by the member cities for strategic and non-strategic waterbodies or MDNR public waters (see Section 4.1.2, policy 14).

2. Maps of the existing stormwater system, as defined in Section III.D of the MPCA's NPDES Phase II MS4 permit. The cities may use maps prepared for their respective MS4 permits.

3. A list or map with areas likely to see the greatest benefit from potential water quality improvement projects. The cities are encouraged to develop (in the local plan or in the future) a water quality improvement program for these areas. The components of such a program could include the following:

    - Retrofit opportunities
    - Redevelopment opportunities
    - Site-specific BMPs, such as sump manholes or prefabricated structures (e.g., Stormceptors)
    - Special/targeted street-sweeping program

4. Description of operating and maintenance procedures for the cities' stormwater management system, including any underground or overland storage and conveyance components of that system (e.g., pipes, channels, pond outlets).

5. The 100-year flood peak flow rates at each intercommunity conveyor and overflow point included in the city's stormwater system. Hydrographs should be provided, if available.

6. Maps and tables showing subwatershed locations and sizes, drainage patterns, outlet elevations, existing or known future outlet information (to the level necessary to achieve the goals of the member city and the BDWMO) and the following information for the 5-year (or 10-year) and 100-year events: existing or known future water levels, existing or known future flow rates, runoff volumes, and live storage volumes.

7. Maps showing subwatersheds tributary to either the Black Dog fen wetland complex or the nearby trout streams (see Figure 2-8). The cities are to maintain or reduce the size of these tributary watersheds. The BDWMO encourages member cities to reduce stormwater discharge rates and volumes within trout stream and fen watersheds whenever possible, with the goal of reducing discharge rates to pre-development levels (or lower).

4.8 EDUCATION AND PUBLIC INVOLVEMENT

4.8.1 Goals

- Increase awareness and education level of residents, local officials, and city staff regarding water resources and stormwater management.

- Provide the public with data they need to protect water resources and to understand the impact of land use decisions on water resources.

The types of information to be provided may include water quality data, lake water level data, landscaping/lakescaping concepts, construction, development, and redevelopment issues and information, and education topics such as hydrology and rainwater gardens.

4.8.2 Policies

1. The BDWMO will publish an annual newsletter that summarizes its activities for public distribution.

2. The BDWMO will maintain its web site: http://blackdogwmo.org/. The website will be updated with meeting agendas, project updates and reports, annual reports, and educational links.

3. The BDWMO will consider the use of social media, email listserves, and other electronic means of communicating with the public.

4. The BDWMO will coordinate with member cities to use survey results (when available) or other available public feedback (e.g., public meetings) to assess the success of public education efforts.

5. The BDWMO will coordinate and communicate with lake homeowner associations and other appropriate citizen groups as needed. Communication efforts could include distributing BDWMO annual reports, lake report cards, meeting notices, and meeting agendas to these groups.

6. The BDWMO will form advisory committees on an as-needed basis.

7. In place of maintaining a formal Technical Advisory Committee, the BDWMO encourages the city technical staff and the agency representatives to attend the BDWMO meetings and provide the BDWMO with updates and provide input on technical issues.

8. The BDWMO and the member cities will disseminate other information to the public regarding the BDWMO, its water resources, stormwater management, etc. Possible methods include:

    - Presenting to target audiences (e.g., lake homeowners and other citizens) upon request.

    - Collecting and distributing information assembled by other groups.

    - Providing data to agencies upon request (e.g., provide MPCA and Met Council with water quality data to enter into database).

9. The BDWMO will continue to partner with the SWCD or similar organizations to achieve shared educational and water quality goals.

10. The member cities will seek citizen assistance in maintaining monitoring programs that rely on volunteers (e.g., CAMP and WHEP, see Sections 2.9.2 and 2.13.4).

11. The BDWMO relies on member cities to maintain public education and outreach programs, as outlined in their NPDES Phase II MS4 permits.

4.9 BDWMO PERFORMANCE STANDARDS

The BDWMO requires the policies, standards and criteria presented in this section, or an approved equivalent, to be incorporated into each city's local water management plan during the local plan's next revision. The BDWMO expects that member cities will implement the standards within two years of approval of the BDWMO plan, regardless of the local plan revision schedule.

4.9.1 Policies

1. Member cities shall maintain or strengthen stormwater, erosion and sediment control, wetland and shoreland regulations. The BDWMO website shall contain links to the city's regulations. The BDWMO reserves the right to review these regulations or other regulations affecting the BDWMO water resources for compliance with this Plan.

2. The BDWMO requires that any project (development or redevelopment of land) that results in 1 acre or more of disturbance shall be subject to/trigger the appropriate member city's stormwater management standards for rate control, volume control, and water quality, as shown in Table 3-2.

3. The BDWMO requires that all new stormwater management systems (e.g., pipes, ponds) or stormwater management systems replaced as part of redevelopment conform to the policies presented in this plan.

4. For new, redesigned, or replaced stormwater discharge points/outfalls, cities must provide pretreatment (at least grit removal) of stormwater prior to its discharge to category I-III waterbodies and wetlands, the Black Dog Fen, and trout streams.

5. The member cities are encouraged to provide or require (e.g., during redevelopment) pretreatment of stormwater runoff for existing inlets to the stormwater system that receive direct stormwater runoff (i.e., no pretreatment) and are likely to see the greatest benefit from water quality improvement BMPs.

6. The City of Lakeville will restrict the Orchard Lake outlet to maintain its peak outflow at 65 cfs to help prevent capacity and erosion problems downstream in Credit River Township and the City of Savage.

7. The BDWMO requires that the level of protection along all trunk conveyors, streams, and channels and around all wetlands, ponds, detention basins, and lakes be based on the critical-duration 100-year flood.

8. The BDWMO requires that non-trunk stormwater systems provide discharge capacity for the critical-duration runoff event that is not less than a five-year frequency event, preferably a 10-year frequency event (level of service).

9. The BDWMO allows that where the planned level of service would cause hardship in operation of a downstream system, the owner may design for a lesser level of service if the following circumstances are present:

    - The proposed new or replacement system will not have a longer life than that of the existing downstream system.

    - It is not practical to incorporate temporary measures into the new system to mitigate the effects of the new system on the downstream system.

10. The BDWMO requires member cities to ensure that proposed development, redevelopment, and/or infrastructure projects will not overtax the existing downstream stormwater drainage system capacity in terms of rate and volume.

11. The BDWMO requires that member cities incorporate emergency overflow structures (i.e., swales, spillways), where feasible, into pond outlet structure designs to prevent undesired flooding resulting from storms larger than the 100-year (one percent) event or plugged outlet conditions.

12. The BDWMO requires that the member cities secure easements or fee title (or maintenance agreements for private systems) to the stormwater system as areas develop or redevelop.

13. The BDWMO encourages the member cities to incorporate multi-stage outlets into their pond designs to control flows from smaller, less frequent storms and help maintain base flows in downstream open channels. The BDWMO will cooperate with member cities to identify or evaluate designs intended to achieve this goal.

14. The BDWMO requires cities to set minimum building elevations at least one foot above the critical 100-year flood elevation for structures adjacent to inundation areas.

15. The BDWMO requires the following rate control standards:

    - The peak rate of stormwater runoff from the developed subwatershed of the site shall not exceed the existing peak rate of runoff for the 2-year, 10-year, and the 100-year storm events. For new development, peak runoff rates will be maintained at or below pre-development rates for all events up to and including the 100-year storm event. "Subwatershed" may be the project site, or may be an area of greater size for which an approved local water management plan meets this criterion.

    - Rates may be further restricted when the capacity of the downstream conveyance system is limited.

16. The BDWMO requires member cities to limit runoff rates to levels that allow for safe and stable conveyance of flow through the watersheds in the BDWMO. To this end, the BDWMO requires the following:

    - A hydrograph method based on sound hydrologic theory shall be used to analyze stormwater runoff for the design or analysis of flows in conveyors, streams, and channels and flows to ponds and wetlands.

    - Reservoir routing procedures and critical duration 100-year runoff events shall be used for design of detention basins and outlets.

17. The BDWMO encourages member cities to limit runoff volumes by using designs that limit impervious surfaces and/or incorporate volume control practices such as infiltration to protect surface water quality and provide recharge to groundwater, except in cases where site-specific investigation suggests negative impacts resulting from limiting runoff or increasing infiltration. The BDWMO will cooperate with member cities to identify or evaluate designs intended to achieve this goal.

18. Member cities shall encourage reduced connectivity of impervious surfaces through education (e.g. Blue Thumb workshops and newsletter articles), developer agreements, or other appropriate methods.

19. The BDWMO requires member cities to limit nutrient loading into waterbodies to prevent them from impairment and/or to improve water quality so they are no longer impaired, to the extent practicable.

20. The BDWMO requires member cities to protect and maintain downstream drainage systems to provide permanent and safe conveyance of stormwater, and to reduce the frequency and/or duration of downstream flooding.

21. All projects disturbing one acre or more must submit an Erosion Control Plan to the MPCA that conforms to the MPCA's NPDES Construction Stormwater General Permit and shall incorporate the appropriate BMPs described in *Protecting Water Quality in Urban Areas* (MPCA, 2000).

22. Structural BMPs that treat stormwater must conform to standard engineering practices.

23. Member cities will continue to enforce wetland management standards as defined by each member city (see Table 3-1), but including at a minimum:

    - Buffer strip width requirements depending on protection level or management classification (no less than 16.5 feet).

    - Limits on water level bounce during storm events depending upon wetland protection level or management classification.

December, 2012

Section 4 Tables

Table 4-1: Recommended Lake Water Quality Management Actions for Strategic Waterbodies (Category I, II, & III)

Most Recent Summer Average Lake Water Quality, as Compared to Management Action Level	Statistically Significant 10-Year Water Quality Trend	Type(s) of Management Action Recommended		
		Watershed Management	**Lake Monitoring**	**Runoff Monitoring or Equivalent**
Better Than	**Improving**	No Action	Continue existing water quality monitoring program: Survey Level (CAMP) - Annually Management Level – Category I (every 3 years)	None
	No Trend	No Action	Continue existing water quality monitoring program: Survey Level (CAMP) - Annually Management Level – Category I (every 3 years)	None
	Degrading	No Action	Management Level	Watershed land use review
Worse Than	**Improving**	Implementation of Runoff BMPs assumed; no further action required	Continue existing water quality monitoring program: Survey Level (CAMP) - Annually Management Level – Category I (every 3 years)	None
	No Trend	Diagnostic study (e.g., P8 and lake modeling)	Management Level	Watershed land use review; and subsequent, focused runoff water quality monitoring in potential problem subwatersheds
	Degrading	Comprehensive lake/ watershed diagnostic-feasibility study	Intensive lake monitoring as part of diagnostic-feasibility study	Detailed runoff water quality monitoring as part of diagnostic-feasibility study

Note: The BDWMO will consider relationships between water quality, habitat, and physical conditions when determining appropriate management actions for strategic waterbodies.

Section 5

Implementation Program

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5.0 Implementation Program

5.1 BDWMO RESPONSIBILITIES

The BDWMO is not a permitting authority. As a result, the BDWMO's major responsibilities are to: (1) ensure that the member cities adopt and implement the policies and standards in the BDWMO Plan; (2) manage, and assist member communities with, intercommunity runoff and water management issues; and (3) assess the performance of the BDWMO and the member cities and their progress toward achieving the goals stated in the BDWMO Plan.

The member cities are responsible for primary management of stormwater and water resources within their boundaries. The member cities will continue as the local government units (LGUs) responsible for administering the Wetland Conservation Act (WCA) within their boundaries, and will continue to implement and enforce their existing ordinances related to water resource management. Mn/DOT serves as the LGU for the WCA within its right-of-way. The cities, other units of government and private parties are responsible for maintaining their respective stormwater systems.

The BDWMO and the member cities will work together to achieve the goals established in the BDWMO Plan. The goal of the evaluation and accountability process is to assess the progress of the BDWMO and the member cities toward the agreed upon expectations (see Section 4.7.3). The BDWMO and the member cities will identify outcome-based goals for the watershed and specific resources, and will meet annually to discuss progress. Trend analyses will be used to track water quality trends (see Section 2.10.2.1). Habitat data will also be tracked. Performance analyses will be used to track the completion of implementation tasks.

5.2 IMPLEMENTATION PROGRAM COMPONENTS

Table 5-1 lists the projects, studies, programs and official controls that comprise the BDWMO implementation program. The BDWMO developed this list through reviewing existing information (Section 2), identifying potential and existing problems (Section 3), developing goals and policies (Section 4), consulting with member cities, and then assessing the need for programs, studies or projects. The BDWMO defined the conceptual scope of work for each implementation item and evaluated the total costs and funding sources. Table 5-2 summarizes the implementation costs in Table 5-1 by member city.

Table 5-3 lists potential future projects that the BDWMO or the member cities envision occurring outside the timeframe of this Plan, or that could be implemented earlier if funds (e.g., grants) become available. Table 5-3 includes “Reserve” projects from the Crystal, Keller and Lee Lakes TMDL Implementation Plan (Barr, 2011), as well as “Phase I” and “Phase II” projects from the TMDL implementation plan not listed in Table 5-1. In general, these projects will be considered for implementation only after completion of the TMDL implementation projects listed in Table 5-1 (Items 26A and 26B) and after sufficient monitoring has been performed to show that the lakes are not meeting the MPCA’s water quality goals. Projects listed in Table 5-3 would be transferred to Table 5-1 via a minor plan amendment (see Section 5.5.2) prior to implementation. Additional project definition (e.g., feasibility studies) may be required prior to moving potential projects in Table 5-3 to Table 5-1.

Prior to development of the *Crystal, Keller, and Lee Lakes Nutrient Impairment TMDL Implementation Plan and Earley Lake Protection Plan* (Barr, 2011) (Crystal, Keller, and Lee Lakes TMDL), a number of projects were recommended in the Crystal and Keller lakes use attainability analysis (UAA). The BDWMO and the member cities have been tracking the successful implementation of the UAA projects for several years in the BDWMO’s Annual Watershed Report. Table 5-4 lists these UAA projects.

The member cities have made significant investments to improve water quality in the Crystal and Keller lakes watersheds prior to and during the TMDL study. The Crystal, Keller and Lee Lakes TMDL Implementation Plan incorporates the remaining relevant implementation projects from the UAA. One of these projects, the construction of Whitney Pond in Lac Lavon Park, was completed in 2011. The City of Apple Valley constructed this project on park land located in, and donated by, the City of Burnsville. This $900,000 project will significantly decrease the amount of nutrients and solids entering Keller Lake and moving into Crystal Lake. However, the high cost of this single project precludes the city’s implementation of other major projects in the short term.

Other completed projects aimed at phosphorus reduction are described in the Crystal, Keller, and Lee Lakes TMDL. In 2009, the City of Lakeville constructed infiltration basins during the development of the Primrose School site, and performed an alum treatment of Lee Lake to reduce internal loading of phosphorus. In 2011, the City of Burnsville spent $100,000 constructing rainwater gardens in the Keller Lake watershed.

Additionally, a number of the projects identified in the Crystal, Keller, and Lee Lakes TMDL Implementation Plan will require more definition and/or analysis before specific projects and their costs can be listed in the Plan. A Plan amendment process may be utilized in the future to add appropriate projects.

Table 5-1 shows the cost estimate, proposed year of implementation and proposed financing method for each element of the implementation program. The implementation program identifies special projects through 2022; ongoing implementation components may continue past 2022. Table 5-1 may require revision as new issues or needs arise and projects are moved from Table 5-3 to Table 5-1. Major revisions or additions may require a plan amendment (see Section 5.5). The activities listed in Table 5-1 assigned to the member cities will be incorporated into each city's local water management plan and Capital Improvement Program.

Table 5-5 lists the various implementation activities that have been completed since the development of the 2002 BDWMO Plan.

5.3 FINANCIAL CONSIDERATIONS AND FUNDING SOURCES

This section provides a brief summary of the funding sources available to the BDWMO, followed by a discussion of the BDWMO proposed method(s) of funding the various items in its implementation program (Table 5-1).

5.3.1 Joint Powers WMO Funding Mechanisms

Minnesota Statute 103B.251 allows WMOs to certify capital improvements to the county for payment, if those improvements are included in the WMO's watershed management plan. To use this funding method, the project, program, or activity must be adequately described in the watershed management plan (MS 103B.231), including the scope of the project, program, or activity and the proposed funding mechanism. For such implementation activities, Minnesota law allows the WMO to apportion costs watershed-wide or by subwatershed unit, which may require the establishment of more than one tax district in the watershed (MS 103B.251). The cost apportionment must be prescribed in the WMO's capital improvement program. The county then issues bonds and levies an ad valorem tax on all taxable property in the WMO (or subwatershed unit of the WMO) to pay for the projects.

A WMO may also raise funds through direct ad valorem taxation (Minnesota Statutes 103B.241), but only if the WMO is specifically listed as a special taxing district in MS 275.066. If a WMO is given taxing authority, the WMO may also accumulate funds to finance improvements, as an alternative to issuing bonds (MS 103B.241). The BDWMO is not currently listed as a special taxing district per MS 275.066.

MS 103B.252 allows local governmental units (LGUs) or WMOs to declare an emergency and order work to be done without a contract. MS 103B.252 does not contain levy limits.

5.3.2 Past and Proposed BDWMO Funding Mechanisms

The BDWMO joint powers agreement call for implementation activities to be funded through either the BDWMO general fund or the BDWMO capital improvement fund.

5.3.2.1 BDWMO General Fund

Through the BDWMO joint powers agreement, each member city contributes annually to the BDWMO general fund. The annual contribution amount is split such that 50 percent of the total is apportioned based on the area within the BDWMO and 50 percent is apportioned based on the taxable market value. The general fund pays for operational and administrative costs, as well as implementation program items, including Watershed Management Plan development.

5.3.2.2 BDWMO Capital Improvement Fund

The BDWMO joint powers agreement calls for the establishment of a capital improvement fund for each improvement project ordered by the Commission not paid for out of the BDWMO general fund. In accordance with the current joint powers agreement, the project costs are to be apportioned according to property value, stormwater runoff generation, pollutant loading, ad valorem taxation (through MS 103B.251), or a combination thereof.

The BDWMO has financed its past administrative, program and project costs through the BDWMO general fund (the annual contributions paid by the member cities), and cost sharing, in accordance with the BDWMO joint powers agreement. The implementation program of this plan includes both non-structural and structural activities. The BDWMO will finance internal load reduction projects by building up funds (see Section 4.7.4 Policy 8 and Table 5-1). However, the joint powers agreement would have to be revised to allow for the specified cost apportionment.

The proposed funding method varies by the specific activity.

5.3.3 Municipal Funding Options

This section discusses the various funding mechanisms available to the member cities.

5.3.3.1 City General Fund

City general tax funds may be used to pay for various elements of stormwater management, which may include maintenance of the stormwater system and occasional projects.

5.3.3.2 Special Assessments

Special assessments can be used to finance special services ranging from maintenance to construction of improvement projects and are levied against properties benefiting from the special services. The philosophy of this method is that the benefited properties pay in relation to the benefits received. The disadvantages of using special assessments include the difficulty in determining and proving benefits; inability to assess runoff contributions; and the rigid procedural requirements.

5.3.3.3 Ad Valorem Taxes

Special taxing authorities, such as special taxing districts (MS 444.16-444.21) are available to cities to pay for projects. Other special taxing authorities are available, such as MS 103B.241, which allows the city to levy a tax to pay for projects identified in the city's local water management plan. The city may accumulate these levy proceeds as an alternative to issuing bonds to finance projects. Minnesota Statutes 103B.245 allows the city to establish a watershed management tax district in the city to pay for water management facilities described in the plan (including maintenance). The tax district must be established by ordinance and must be included in the city's plan. Similar to MS 103B.241, this statute allows the city to either accumulate funds or issue bonds to pay for the projects.

5.3.3.4 Stormwater Utility

Minnesota Statute 444.075 allows cities to establish and implement stormwater utilities. Under a utility system, a stormwater utility fee is charged against all parcels within the city. The fees are usually proportionate to the amount of runoff each parcel of land contributes to a drainage system. Many cities currently use this funding mechanism, including all BDWMO member cities. The fees can be used to finance drainage system projects, surface water quality improvements, infrastructure replacement, studies, operations and maintenance. The fees can be accumulated to pay for such activities, or they can be the revenue stream to pay for bonds sold to initially pay for such activities. Benefits of a stormwater utility include smaller financing costs for the city relative to other funding methods, and it may be easier for residents and businesses to pay a smaller, recurring fee than large special assessments.

5.3.3.5 Development Fees

Many cities impose impact or development fees such as connection charges, building permit fees, etc. to pay for the costs of providing stormwater management services to newly developing areas.

5.3.4 State and Local Funding Sources

In addition to stormwater utility fees, taxes, assessments, and the other funding sources discussed above, the cities and/or the BDWMO could obtain funding from various state sources, such as grant and loan programs. Member cities may use loans for projects instead of city-issued bonds. The following paragraphs list various state-funded sources, grouped according to the state agency that administers the various funding programs.

The **Board of Water and Soil Resources** administers several grant programs, some of which could be applied to WMOs and cities. The most applicable BWSR grant program is the Clean Water Fund program; WMOs and cities are eligible for this funding. Other possible applicable programs include cost-share grants, but BWSR funding is available only through the local SWCD.

The **Minnesota Pollution Control Agency** administers the Clean Water Partnership (CWP) program, EPA-funded Section 319 programs (including a TMDL implementation grant program), the Surface Water Assessment Grant program, TMDL Grant program, Phosphorus Reduction Grant program, and the Clean Water State Revolving Fund program.

The **Minnesota Department of Natural Resources** (MDNR) administers many grant programs that could be appropriate for the BDWMO and/or member cities, including the Flood Hazard Mitigation Grant program, the Parks and Trails Legacy Grant program, trail grants programs, aquatic invasive species prevention grants and other aquatic plan management grant programs, shoreland habitat restoration grant program, and dam safety program. However, funding for many of these programs changes after each legislative session.

The **Dakota County Soil and Water Conservation District** administers various grant programs for installing and retrofitting stormwater best management practices in urban areas. Technical and financial assistance is available to residents, cities, businesses and organizations for projects like restoring shorelines and installing infiltration practices. Grant programs change year to year depending on available funds. Visit www.dakotaswcd.org for details.

Other state funding programs include the Legislative Citizen Commission on Minnesota Resources (LCCMR) funds for non-urgent demonstration and research projects, the Minnesota Department of Trade and Economic Development's Contaminant Cleanup Development Grant Program, the Minnesota Department of Transportation State Aid Funds, and Federal transportation funds.

5.3.5 Federal Funding Sources

The BDWMO member cities could also receive funding from various federal sources, a few of which are discussed in the following paragraphs.

The **U.S. Environmental Protection Agency** (EPA) has discretionary funds available through each division and program area of the EPA and administers the Clean Lakes Program (CLP) established by Section 314 of the Clean Water Act; the CLP is similar to the MPCA’s CWP program. The EPA also administers the 604b grant program that targets water quality improvements in urban areas, and the Environmental Education Grant that finances local environmental education initiatives.

The **U.S. Army Corps of Engineers** administers the Planning Assistance to States (Section 22) program, the Project Cooperation Agreement (PCA) program, also known as the LCA (Local Cooperation Agreement) program for construction of flood control projects, the Section 14 bank protection program, the Flood Plain Management Services Program, and the Aquatic Plant Control Program and provides many GIS products through its GIS Center.

The **U.S. Fish and Wildlife Service** administers the North American Wetlands Conservation Fund, as part of the North American Wetlands Conservation Act (NAWCA).

The **Natural Resource Conservation Service (NRCS)** has funds available for technical assistance on various surface water projects, operations and maintenance, inspections and repairs. The NRCS also administers the Environmental Quality Incentives Program (EQIP), which was established through the 1996 Farm Bill Program.

The **Federal Emergency Management Agency (FEMA)** has funds available to restore areas (including water resources) damaged or destroyed by a disaster.

5.3.6 Private Funding Sources

In addition to state and federal funding sources, some private funding sources may be available.

Ducks Unlimited and **Pheasants Forever** funds are available for projects that enhance, create, or protect waterfowl or pheasant habitat.

Individual entities needing to provide wetland mitigation in compliance with the Wetland Conservation Act (WCA) may have funds and/or technical resources available to restore or create wetland function and values lost or intended to be destroyed as part of a project.

Other private funding sources include service organizations (i.e., Lions Club and Elks), youth groups (i.e., Boy/Girl Scouts), Adopt-a-Highway/River cleanup groups, and sportsman clubs.

5.4 IMPACT ON LOCAL GOVERNMENTS

This section discusses how the BDWMO’s implementation program will affect local government in terms of cost and administrative issues.

The BDWMO’s intention is to limit additional requirements imposed upon local units of government while accomplishing the BDWMO’s goals. Most of the BDWMO Plan’s implementation program elements will be implemented by the member cities. The BDWMO Plan will have a financial impact to the member cities and residents that reside within the watershed. Some of the implementation program elements reflect the goals, policies, and requirements of state and regional units of government that member cities would need to address regardless. With respect to these requirements, the BDWMO seeks to reduce redundancies to the extent possible.

There will be continued cost and effort on the part of the cities and the BDWMO to address water quality issues in the BDWMO. Ongoing water quality monitoring will be implemented by the BDWMO and the member cities and the results will be reported back to the BDWMO Commission. Table 5-1 includes studies, monitoring, reviews, and projects that are to be implemented by the BDWMO. These tasks may be funded through the BDWMO general fund or other sources (see Table 5-1).

Some of the member cities already have ordinances in place that address many of the BDWMO requirements. Applicable ordinances address shorelands, floodplains, wetland protection, stormwater management, erosion control, and stormwater system maintenance. Local governments must adopt the MDNR's shoreland regulations, if required by the MDNR.

The performance standards included in this Plan (see Section 4.9) generally reflect the current requirements, standards, and/or practices implemented by the member cities. As such, the implementation of this is not expected to create a significant additional cost or burden to local units of government. The BDWMO is not increasing the wetland regulation burden for the member cities since they are already acting as the LGU for the Wetland Conservation Act and this will not change.

5.4.1 Local Planning

According to MN Rules 8410.0160, local units of government must adopt local water management plans within 2 years of the BWSR's approval of the last water management organization plan that affects the unit of government (i.e., this plan). BWSR approved this plan on September 26, 2012. The member cities must therefore adopt local water plans by October, 2014, or 2 years from the date of approval of this plan. The BDWMO expects member cities to implement the BDWMO standards prior to the adoption of local plans, citing the possibility for a long "interim period" between the BDWMO plan adoption and local water management plan adoption.

The BDWMO member cities (Apple Valley, Burnsville, Eagan, and Lakeville) may need to revise their local water management plans to bring them into conformance with the BDWMO's revised plan and MN Rules 8410.

Within 30 days of the BDWMO Commission's adoption of the BDWMO plan, the BDWMO will notify each local governmental unit of these requirements regarding local plan revision and adoption.

A local governmental unit can assume as much management control as it wishes through its approved local water management plan. The BDWMO assumes that the member cities will continue to be the permitting authority for all land alteration activities. To continue as the permitting authority, the local government must outline its permitting process in its local water management plan, including the preliminary and final platting process. The BDWMO may appeal the local government's approval of a project if the BDWMO believes the project is not consistent with the local plan or BDWMO Plan.

The BDWMO will review proposed changes to an intercommunity stormwater system that are inconsistent with a city's approved plan, and/or changes to an approved city plan that would cause the plan to be inconsistent with the BDWMO plan.

5.4.2 Requirements for Local Water Management Plans

Local water management plans are required to conform to MS 103B.235, MN Rules 8410.0160, MN Rules 8410.0170 and the BDWMO Plan. MN Rules 8410.0160 requires (in part) that:

> "Each local plan must include sections containing a table of contents; executive summary; land and water resource inventory; establishment of goals and policies; relation of goals and policies to local, regional, state, and federal plans, goals, and programs; assessment of problems; corrective actions; financial considerations; implementation priorities; amendment procedures; implementation program; and an appendix. Each community should consider including its local plan as a chapter of its local comprehensive plan."

MN Rules 8410.0170 explains in more detail the general requirements given above.

The policies and goals established in each city's local water management plan must be consistent with the BDWMO Plan. The section of the local plan covering assessment of problems must include those problems identified in the BDWMO Plan that affect the city. The corrective action proposed must be limited to those actions that can be carried out at the local government level and must be consistent with the BDWMO Plan. A city may use all or part of the BDWMO Plan when developing its local plan.

Local units of government are to maintain stormwater systems (storm sewers, ponding areas, ditches, water level control structures, etc.) in good working order to prevent flooding and water quality problems. In accordance with MN Rules 8410.0100, Subp. 6, the BDWMO requires that local plans "...assess the need for periodic maintenance of public works, facilities and natural conveyance systems and specify any new programs or revisions to existing programs needed to accomplish its goals and objectives." The local plans must also assess, at a minimum, the following maintenance issues, taken from MN Rules 8410.0100, Subp. 6:

- The need and frequency for street sweeping of public and private streets and parking lots.
- The need and frequency for inspecting stormwater outfalls, skimmers, sumps, and ponds.
- The adequacy of maintenance programs for stormwater facilities and water level control structures owned by both the city and private parties.
- The need for other maintenance programs as considered necessary.

Besides the above maintenance issues, local water management plans will be required to assess the following (taken from MN Rules 8410.0100, Subp. 6):

- The need to establish a water body classification system different from the BDWMO's or to adopt the BDWMO water body classification system. If a different classification system is used, it must be correlated to the BDWMO classification system and approved by the BDWMO.
- The need to establish local spill containment cleanup plans.
- The need for any other necessary management programs.

Local water management plans must clearly identify when the management programs will go into effect. All local plan controls and programs must be developed and in effect within 2 years of adoption of the last WMO plan in the local governmental unit.

The BDWMO's general standards for local water management plans are as follows (taken from MN Statutes 103B.235, Subd. 2):

- Describe existing and proposed physical environment and land use.
- Define drainage areas and the volume rates and paths of stormwater runoff.
- Identify areas and elevations for stormwater storage adequate to meet performance standards established in the BDWMO Plan.
- Define water quality and water quality protection methods adequate to meet performance standards established in the BDWMO Plan.
- Identify regulated areas.
- Set forth an implementation program, including a description of official controls and, as appropriate, a capital improvement program.

The BDWMO also requires that the member cities outline their permitting process for land and wetland alteration work in their local water management plans. The BDWMO reserves the right to recommend to a member city that a project the BDWMO considers to be inconsistent with the local management plan be denied.

Several policies outlining the requirements for local plans are described in Section 4.7.5. In addition to those requirements, the BDWMO plan identifies numerous policies, practices, standards, etc. for the cities to consider. The local water management plans should show which of these non-mandatory actions the cities are implementing.

5.4.3 BDWMO Review of Local Water Management Plans

Before a member city adopts its local water management plan, the plan must be submitted to all of the affected WMOs for review. The city must also submit its plan to the Metropolitan Council, and to counties with adopted groundwater plans, for a 45-day review. Within 60 days of receipt of the local plan, the BDWMO will review the local plan for conformance with the BDWMO Plan. During the review, the BDWMO will take into consideration any comments received from the Metropolitan Council and the counties. The BDWMO will approve or disapprove all or part of the local plan within the 60-day time frame, unless the city agrees to an extension. If the BDWMO does not complete its review, or fails to approve or disapprove the plan within the allotted time, and the city has not given an extension, the local plan will be considered approved (MN Rules 8410.0170, Subp. 12 and MS 103B.235, Subd. 3 and 3a).

Once the BDWMO approves the local plan, the city must adopt and implement its plan within 120 days and amend its official controls within 180 days of plan approval. Each member city must notify the BDWMO (and the other affected WMOs) within 30 days of plan adoption and implementation, and adoption of necessary official controls.

If the BDWMO does not approve a local plan (or plans), this non-action could be considered by BWSR as a “failure to implement” the BDWMO plan. Another type of water management structure could then be formed, such as a watershed district or county management of the watershed.

Any amendments to the local plan must be submitted to the BDWMO for review and approval prior to their adoption by the member city. The BDWMO review process is the same as for the original local plan.

5.5 PLAN APPROVAL AND AMENDMENT PROCEDURES

The BDWMO submitted this Plan to the member cities, the Board of Water and Soil Resources, the Minnesota Pollution Control Agency, the Minnesota Department of Natural Resources, the Minnesota Department of Agriculture, the Minnesota Department of Health, the Minnesota Department of Transportation (courtesy review), the Metropolitan Council, the counties, and the Dakota County Soil and Water Conservation District for review, in accordance with Minnesota statutes. Prior to submitting this plan for formal review, the BDWMO solicited comments from a Planning Advisory Group (PAG); three PAG meetings were held. The BDWMO held a public hearing on the plan, BWSR approved the plan on September 26, 2012, and the BDWMO Commission formally adopted its plan on October 17, 2012.

This Plan remains in effect for ten (10) years from the date it was approved by BWSR, unless it is superseded by adoption and approval of a succeeding plan. All amendments to this plan must follow the procedures set forth in this section, or as required by revised laws and rules. Plan amendments may be proposed by any person to the BDWMO Commissioners, but only the BDWMO may initiate the amendment process. The BDWMO may amend its plan in the interim (interim plan amendment) if either minor changes are required or if problems arise that are not addressed in the plan.

In accordance with MS 103B.231, Subd. 3a, the BWSR developed (and occasionally revises) a priority schedule for the revision of water management plans. BWSR uses the schedule to inform WMOs of when they will be required to revise their plans. Minnesota Statutes 103B.231, Subd. 3a also states that once a WMO is notified by BWSR that a plan revision is required, the WMO has 24 months from the date of notification to submit a revised plan for review. If BWSR does not notify the BDWMO that a plan revision is required and the plan expires, MS 103B.231, Subd. 3a states that the existing plan, authorities, and official controls of the BDWMO remain in full force and effect until a revision is approved. The same statute also allows the BDWMO to submit a draft plan revision for review prior to BWSR's scheduled date.

5.5.1 General Amendment Procedure

If the BDWMO or BWSR decide that a general plan amendment is needed, the BDWMO will follow the general plan amendment process described in MN Rules 8410.0140, Subp. 2 and MS 103B.231, Subd. 11). The general plan amendment process is as follows:

1. The BDWMO must submit the amendment to the state review agencies (the BWSR, MDNR, MPCA, Minnesota Department of Agriculture, and MDH), Minnesota Department of Transportation (courtesy review), BDWMO member cities, the Metropolitan Council, the county boards, and the soil and water conservation districts within its territory for a 60-day review.
2. The BDWMO must respond in writing to any concerns raised by the reviewers.
3. The BDWMO must hold a public hearing on the proposed amendment no sooner than 14-days after the 60-day review period.
4. The BDWMO must submit the final revised amendment and a summary of changes resulting from the review process to the BWSR for final review to be completed within 90 days. Within that time, the BWSR may, by order, approve or prescribe changes in the amendment.

Following BWSR approval of the amendment, the BDWMO will adopt the amendment. The above process must be completed except when the proposed amendments constitute minor amendments (see criteria described in Section 5.5.2).

5.5.2 Minor Plan Amendments

Minor plan amendments follow an abbreviated version of the general plan amendment process, including only a single review period. MN Rules 8410.0140, Subp. 3 considers amendments to the approved capital improvement program to be minor plan amendments if the following conditions are met:

1. 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 Minnesota Statutes, Section 103B.205, subdivision 3; and
2. The affected county or counties approve the capital improvement in its revised, more detailed form.

The following examples of other minor plan amendments are given in Minnesota Rules 8410.0020, Subp. 10:

> "...recodification of the plan, revision of a procedure meant to streamline administration of the plan, clarification of the intent of a policy, the inclusion of additional data not requiring interpretation, or any other action that will not adversely affect a local unit of government or diminish a water management organization's ability to achieve its plan's goals or implementation program."

Prior to sending a proposed minor plan amendment out for review, the BDWMO Commission will obtain BWSR's concurrence that the proposed amendment is a minor plan amendment. The BDWMO will also consider sending drafts of proposed amendments to all plan review authorities to receive input before establishing a hearing date or beginning the formal review process. Minor plan amendments are not required to follow the general amendment procedure described in Section 5.5.1 provided that:

1. The BDWMO held a public meeting to explain the amendments and published a legal notice of the meeting twice, at least 7 days and 14 days before the date of the meeting;
2. The BDWMO 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
3. BWSR either agreed that the amendments are minor or failed to act within 45 days of receipt of the amendments.

The BDWMO will adopt the minor plan amendment following county board approval and BWSR concurrence. A minor plan amendment is required to move potential future projects (see Table 5-3) into the BDWMO's implementation program (see Table 5-1), better positioning these projects for grant funding.

5.5.3 Amendment Format

Upon completion of the plan amendment, the BDWMO will submit the plan amendment to the appropriate review authorities in a format consistent with Minnesota Rules 8410.0140, Subp. 4. The rule requires that, unless the entire document is reprinted, all amendments adopted must be printed in the form of replacement pages for the plan, each page of which must:

1. Show deleted text as stricken and new text as underlined (for draft amendments under consideration):
2. Be renumbered as appropriate; and
3. Include the effective date of the amendment.

5.5.4 Distribution of Amendments

The BDWMO will maintain a distribution list of everyone who receives a copy of the plan. Within 30 days of adopting an amendment, the BDWMO will distribute printed copies of the amendment to everyone on the distribution list. Electronic versions of the amendment will be made available at the BDWMO web site: http://blackdogwmo.org/. The BDWMO will also consider sending drafts of proposed amendments to all plan review authorities to receive input before establishing a hearing date or beginning the formal review process.

Section 5 Tables

Table 5-1: Implementation Tasks

Item #	Location and Task	Cost Estimate, Proposed Year of Implementation and Funding Method[1]									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Administrative and Operational – Watershed Wide											
1	General WMO administration, including reviewing and responding to issues and opportunities (not otherwise noted in this table) as they arise. This may include services performed by: • Administrator (City of Burnsville) • BDWMO consulting engineer • BDWMO Attorney	$47,000 BDWMO General Fund	$47,000 BDWMO General Fund	$47,000 BDWMO General Fund	$47,000BDWMO General Fund	$47,000 BDWMO General Fund	$47,000 BDWMO General Fund	$47,000BDWMO General Fund	$47,000 BDWMO General Fund	$47,000 BDWMO General Fund	$47,000 BDWMO General Fund
2	Revise Joint Powers Agreement (JPA) to allow cost apportionment specified in Section 4.7.4 – Policy 8.	$1,000 BDWMO General Fund									
3	Review Burnsville local water management plan				$3,000 BDWMO General Fund						
4	Review Lakeville local water management plan		$3,000 BDWMO General Fund								
5	Review Apple Valley local water management plan		$3,000 BDWMO General Fund								
6	Review Eagan local water management plan		$1,500 BDWMO General Fund								
7	Miscellaneous reviews including, but not limited to: • Review city comprehensive plan changes that require review by the Metropolitan Council • Review projects for consistency with the BDWMO plan, as requested by member cities or other governmental agencies • Review and approve any proposed changes to the intercommunity stormwater system that are inconsistent with an approved local plan • Review and approve changes to an approved local plan that would cause the local plan to be inconsistent with the BDWMO plan	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund	$5,000 BDWMO General Fund

Notes:

[1] All costs are in 2012 dollars, project timelines may vary, depending on availability of funds and project phasing.

[2] Total Estimated Costs do not include costs of future implementation tasks, such as lake water quality management actions, and intercommunity runoff, erosion control and sediment control projects. Total estimated cost also does not include city costs for implementation of projects.

[3] Capital Project Costs to be determined based on future project needs; capital projects will be added to Table 5-1 as necessary.

"BDWMO General Fund" means the annual BDWMO fund that each member city contributes to, based 50% on taxable market value and 50% on area.

"City cost" means the task will be funded entirely by the city in which the project is located with no participation/funding by the BDWMO.

Table 5-1: Implementation Tasks (continued)

Item #	Location and Task	Cost Estimate, Proposed Year of Implementation and Funding Method[1]									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
8	City technical staff (technical advisor) attendance at BDWMO meetings	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost	$0 BDWMO cost City cost
9	Facilitate intercommunity flood control, stormwater runoff, erosion, and sediment control projects	Future cost allocations determined as requested by member cities BDWMO General Fund									
10	Apply for grants and/or assist member cities with grant applications	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund	$2,000 BDWMO General Fund
11	Complete and submit annual audit to BWSR	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund	$4,000 BDWMO General Fund
12	Update BDWMO Watershed Management Plan								$20,000 BDWMO General Fund	$80,000 BDWMO General Fund	$25,000 BDWMO General Fund
13	Development of TMDL Studies and Implementation Plans	Future cost to be determined depending on level of BDWMO involvement BDWMO General Fund and/or grants									
14	Complete and publish watershed annual report (newsletter) and post to website	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund	$5,200 BDWMO General Fund
15	Complete and submit annual activity report to BWSR and post on website	$1,600 BDWMO General Fund	$1,600 BDWMO General Fund	$1,600 BDWMO General Fund	$1,600 BDWMO General Fund	$1,600 BDWMO General Fund	$1,600BDWMO General Fund	$1,600 BDWMO General Fund	$1,600 BDWMO General Fund	$1,600BDWMO General Fund	$1,600 BDWMO General Fund
16	Create, maintain and update website—put plan, data, meeting agenda and minutes, watershed annual reports, water quality monitoring reports, educational materials, project updates, etc. on the site	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund	$1,700 BDWMO General Fund
17	Educational outreach including, but not limited to: exploring social media and email list serves to expand communication with the public, sponsoring workshops in partnership with the Blue Thumb Program, the promotion of awareness of groundwater resource issues, and seeking volunteers to participate in water quality (e.g. CAMP, WHEP) and water quantity (e.g. MDNR lake level) programs.	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund	$7,200 BDWMO General Fund
18	Implementation of small-scale best management practices on private properties to improve water quality (e.g. funds supporting the Dakota County SWCD Community Conservation Cost Share Program)	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund	$9,000 BDWMO General Fund

Notes:

[1] All costs are in 2011 dollars, project timelines may vary, depending on availability of funds and project phasing.

[2] Total Estimated Costs do not include costs of future implementation tasks, such as lake water quality management actions, and intercommunity runoff, erosion control and sediment control projects. Total estimated cost also does not include city costs for implementation of projects.

[3] Capital Project Costs to be determined based on future project needs; capital projects will be added to Table 5-1 as necessary.

"BDWMO General Fund" means the annual BDWMO fund that each member city contributes to, based 50% on taxable market value and 50% on area.

"City cost" means the task will be funded entirely by the city in which the project is located with no participation/funding by the BDWMO.

Table 5-1: Implementation Tasks (continued)

Item #	Location and Task	Cost Estimate, Proposed Year of Implementation and Funding Method[1]									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
19	Implement recommended internal phosphorus load reduction projects identified in UAA and/or TMDL (e.g. chemical treatment, aquatic plant management) for non-strategic waterbodies (e.g. Lee Lake) or strategic waterbodies without intercommunity shoreline)	Cost varies depending on project and will be identified in study; City Cost (according to project location) and/or grant funding via BDWMO									
Monitoring and Studies – Strategic Waterbodies:											
20	Annual CAMP water quality monitoring, performing trend analyses, and establishing action levels for the following strategic waterbodies: • Crystal Lake • Keller Lake • Orchard Lake • Kingsley Lake • Lac Lavon	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)	$5,500 (BDWMO General Fund)
21	Management level water quality monitoring at 3-year intervals for the following strategic waterbodies: • Crystal Lake • Orchard Lake • Lac Lavon	$16,200 (Lac Lavon) (BDWMO General Fund)	$16,200 (Orchard Lake) (BDWMO General Fund)	$16,200 (Crystal Lake) (BDWMO General Fund)	$16,200 (Lac Lavon) (BDWMO General Fund)	$16,200 (Orchard Lake) (BDWMO General Fund)	$16,200 (Crystal Lake) (BDWMO General Fund)	$16,200 (Lac Lavon) (BDWMO General Fund)	$16,200 (Orchard Lake) (BDWMO General Fund)	$16,200 (Crystal Lake) (BDWMO General Fund)	$16,200 (Lac Lavon) (BDWMO General Fund)
22	Habitat monitoring at 5-year intervals for the following strategic waterbodies: • Crystal Lake • Keller Lake • Orchard Lake • Kingsley Lake • Lac Lavon	$8,300 (Crystal Lake) (BDWMO General Fund)	$8,300 (Lac Lavon) (BDWMO General Fund)	$8,300 (Keller Lake) (BDWMO General Fund)	$8,300 (Kingsley Lake) (BDWMO General Fund)	$8,300 (Orchard Lake) (BDWMO General Fund)	$8,300 (Crystal Lake) (BDWMO General Fund)	$8,300 (Lac Lavon) (BDWMO General Fund)	$8,300 (Keller Lake) (BDWMO General Fund)	$8,300 (Kingsley Lake) (BDWMO General Fund)	$8,300 (Orchard Lake) (BDWMO General Fund)
23	Implement lake water quality management actions recommended in Table 4-1, depending on water quality trends and comparison of recent water quality to action level, for the following strategic waterbodies: • Orchard Lake • Kingsley Lake • Lac Lavon	Cost will be dependent on management action required BDWMO General Fund									
Capital Projects (organized by waterbody)											
Crystal Lake Capital Projects:											
24	Implement recommended watershed projects to reduce runoff-borne phosphorus loads, as identified in the TMDL, that may include:										

Notes:

[1] All costs are in 2011 dollars, project timelines may vary, depending on availability of funds and project phasing.

[2] Total Estimated Costs do not include costs of future implementation tasks, such as lake water quality management actions, and intercommunity runoff, erosion control and sediment control projects. Total estimated cost also does not include city costs for implementation of projects.

[3] Capital Project Costs to be determined based on future project needs; capital projects will be added to Table 5-1 as necessary.

"BDWMO General Fund" means the annual BDWMO fund that each member city contributes to, based 50% on taxable market value and 50% on area.

"City cost" means the task will be funded entirely by the city in which the project is located with no participation/funding by the BDWMO.

Table 5-1: Implementation Tasks (continued)

Item #	Location and Task	Cost Estimate, Proposed Year of Implementation and Funding Method[1]									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	A. Street sweeping	Ongoing $0 BDWMO cost City cost (Lakeville, Burnsville)									
	B. Native shoreline buffers along Crystal Lake	Ongoing, funded through member cities' current cost share programs; some may go towards shoreline projects Member cities current city-wide annual cost share/assistance programs: Burnsville: $10,000, Lakeville: City staff provides technical assistance to residents $0 BDWMO cost City cost (Lakeville, Burnsville); possible grant funding via BDWMO									
	C. Public outreach and education	Ongoing, funded through member cities' current MS4 activities and through BDWMO current activities (see item #17 in this table) $0 BDWMO cost City cost (Lakeville, Burnsville); possible coordination with BDWMO efforts (see item #17 in this table)									
25	Implement recommended internal phosphorus load reduction projects identified in the TMDL, that may include:	Cost varies depending on project; BDWMO General Fund (City of Eagan not included in the cost allocation) and/or grant funding via BDWMO (See Table 5-3 and Section 4.7.4, Policy 8)									
	A. Reduction in total phosphorus load from Keller Lake	See Item 26 in this table									
Keller Lake Capital Projects:											
26	Implement recommended watershed projects to reduce runoff-borne phosphorus loads, as identified in the TMDL, that may include:	Cost varies depending on project; City Cost (according to project location) and/or grant funding via BDWMO									
	A. Construct water quality treatment pond in Crystal Beach	Implementation between 2013 and 2015 $650,000 - $980,000, City of Burnsville cost and/or grant funding via BDWMO									
	B. Construct water quality treatment pond on southwest side of Keller Lake						Implementation 2018 or later $260,000 - $390,000 City of Burnsville cost and/or grant funding via BDWMO				
	C. Street sweeping	Ongoing $0 BDWMO cost City cost (Apple Valley, Burnsville)									
	D. Native shoreline buffers along Keller Lake	Ongoing, funded through member cities' current cost share programs; some may go towards shoreline projects Member cities current city-wide annual cost share programs: Apple Valley: $4,000, Burnsville: $10,000 $0 BDWMO cost City cost (Apple Valley, Burnsville); possible grant funding via BDWMO									
	E. Public outreach and education	Ongoing, funded through member cities' current MS4 activities and through BDWMO current activities (see item #17 in this table) $0 BDWMO cost City cost (Apple Valley, Burnsville); possible coordination with BDWMO efforts (see item #17 in this table)									

Notes:

[1] All costs are in 2011 dollars, project timelines may vary, depending on availability of funds and project phasing.

[2] Total Estimated Costs do not include costs of future implementation tasks, such as lake water quality management actions, and intercommunity runoff, erosion control and sediment control projects. Total estimated cost also does not include city costs for implementation of projects.

[3] Capital Project Costs to be determined based on future project needs; capital projects will be added to Table 5-1 as necessary.

"BDWMO General Fund" means the annual BDWMO fund that each member city contributes to, based 50% on taxable market value and 50% on area.

"City cost" means the task will be funded entirely by the city in which the project is located with no participation/funding by the BDWMO.

Table 5-1: Implementation Tasks (continued)

Item #	Location and Task	Cost Estimate, Proposed Year of Implementation and Funding Method[1]									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
27	Implement recommended internal phosphorus load reduction projects identified in TMDL, that may include: • In-lake alum treatment • Aquatic macrophyte management (chemical or physical)	Cost varies depending on project; BDWMO General Fund (City of Eagan not included in the cost allocation) (See Table 5-3 and Section 4.7.4, Policy 8)									
Orchard Lake, Kingsley Lake, and Lac Lavon Capital Projects:											
28	Implement water quality improvement measures in Orchard Lake, Kingsley Lake, and Lac Lavon as identified in future diagnostic feasibility studies, that may include: A. Watershed projects (e.g. Stormwater treatment pond(s), Rainwater gardens, Infiltration basins/swales) B. Internal load reduction projects (e.g. In-lake alum treatment, Aquatic macrophyte management (chemical or physical))	Cost varies depending on project; cost will be identified in study City cost (according to project location) and/or grant funding via BDWMO									
Administrative and Operational Costs		**$83,700**	**$90,200**	**$82,700**	**$85,700**	**$82,700**	**$82,700**	**$82,700**	**$102,700**	**$162,700**	**$107,700**
Monitoring and Studies Costs		**$30,000**	**$30,000**	**$30,000**	**$30,000**	**$30,000**	**$30,000**	**$30,000**	**$30,000**	**$30,000**	**$30,000**
Capital Projects Costs		**TBD[3]**	**TBD[3]**	**TBD[3]**	**TBD[3]**	**TBD[3]**	**TBD[3]**	**TBD[3]**	**TBD[3]**	**TBD[3]**	**TBD[3]**
Total Estimated Costs[2]		**$113,700**	**$120,200**	**$112,700**	**$115,700**	**$112,700**	**$112,700**	**$112,700**	**$132,700**	**$192,700**	**$137,700**

Notes:

[1] All costs are in 2011 dollars, project timelines may vary, depending on availability of funds and project phasing.

[2] Total Estimated Costs do not include costs of future implementation tasks, such as lake water quality management actions, and intercommunity runoff, erosion control and sediment control projects. Total estimated cost also does not include city costs for implementation of projects.

[3] Capital Project Costs to be determined based on future project needs; capital projects will be added to Table 5-1 as necessary.

"BDWMO General Fund" means the annual BDWMO fund that each member city contributes to, based 50% on taxable market value and 50% on area.

"City cost" means the task will be funded entirely by the city in which the project is located with no participation/funding by the BDWMO.

Table 5-2 Summary of Implementation Costs by Year and Member City

Summary of Costs (in dollars) by Year and City												
Programs and Projects	Member City	Totals[2] (2013 – 2022)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Administrative and Operational Costs [1] - Watershed Wide (Lines 1 – 19, Table 5-1)	Apple Valley	82,216	7,142	7,697	7,057	7,313	7,057	7,057	7,057	8,763	13,883	9,190
	Burnsville	723,309	62,834	67,714	62,084	64,336	62,084	62,084	62,084	77,098	122,140	80,851
	Eagan	4,418	384	414	379	393	379	379	379	471	746	494
	Lakeville	153,554	13,339	14,375	13,180	13,658	13,180	13,180	13,180	16,368	25,930	17,164
Monitoring and Studies – Strategic Waterbodies[1] (Lines 20 – 23, Table 5-1)	Apple Valley	25,600	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560
	Burnsville	225,210	22,521	22,521	22,521	22,521	22,521	22,521	22,521	22,521	22,521	22,521
	Eagan	1,380	138	138	138	138	138	138	138	138	138	138
	Lakeville	47,810	4,781	4,781	4,781	4,781	4,781	4,781	4,781	4,781	4,781	4,781
Subtotal by City[1]	Apple Valley	107,816	9,702	10,257	9,617	9,873	9,617	9,617	9,617	11,323	16,443	11,750
	Burnsville	948,519	85,355	90,235	84,605	86,857	84,605	84,605	84,605	99,619	144,661	103,372
	Eagan	5,798	522	552	517	531	517	517	517	609	884	632
	Lakeville	201,364	18,120	19,156	17,961	18,439	17,961	17,961	17,961	21,149	30,711	21,945
Capital Projects[4]	Apple Valley	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Burnsville	TBD	$650,000 – $980,000			TBD	TBD	$260,000 - $390,000				
	Eagan	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Lakeville	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
GRAND TOTAL[3]		1,263,497	113,700	120,200	112,700	115,700	112,700	112,700	112,700	132,700	192,700	137,700

[1] Cost apportioned to member cities based on 2011 allocation

[2] Cost estimates are in 2012 dollars and are to be used for planning purposes only, subject to change

[3] Grand total excludes member city Capital Project costs

[4] Capital Project costs include project costs from Table 5-1 (with the exception of member cities' ongoing cost share programs). Additional costs to be determined based on future project needs (see Table 5-3)

Table 5-3: Potential Future Projects[1] from the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Implementation Plan and Earley Lake Protection Plan* (Barr, 2011)

Item #	Implementation Program Element	Potential Cost[2]	Funding Source
Crystal Lake			
Implement recommended watershed projects to reduce runoff-borne phosphorus loads:			
1	Retrofit BMPs – focus on implementing practices in areas that receive no treatment before discharging to Keller Lake	To be determined	City (Lakeville, Burnsville), MnDOT, and Dakota County cost; possible grant funding via BDWMO
2	Infiltration/filtration projects to treat 0.25" – 1.0" of runoff from impervious surfaces within the portion of the watershed without structural BMPs	$450,000 - $2,900,000	City (Lakeville, Burnsville), MnDOT, and Dakota County cost; possible grant funding via BDWMO
3	Redevelopment within the watershed – incorporate increased water quality treatment measures into redevelopment projects	To be determined	City (Lakeville, Burnsville), MnDOT, and Dakota County cost; possible grant funding via BDWMO
Implement recommended internal phosphorus load reduction projects:			
4	Inactivation of sediment phosphorus – alum treatment One-time application, likely 2022 or later, after implementation of Items 26A and 26B in Table 5-1 and Item 13 in this table.	$500,000 - $700,000	BDWMO Funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
5	Aquatic plant (macrophyte) management to control curlyleaf pondweed and Eurasian watermilfoil – chemically treat 15% of littoral area of lake Annually, likely 2022 or later, after implementation of Items 26A and 26B in Table 5-1 and Item 4 in this table.	$41,000 - $61,000/year	BDWMO Funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
6	Macrophyte management to control curlyleaf pondweed and Eurasian watermilfoil – whole lake chemical treatment over a 5-year period	$710,000 - $1,070,000	BDWMO Funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
7	Fisheries study and management plan	$50,000 - $200,000	BDWMO Funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
8	Conduct phytoplankton and zooplankton surveys	$5,000	BDWMO Funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
Keller Lake			
Implement recommended watershed projects to reduce runoff-borne phosphorus loads:			
9	Install iron-enhanced sand filter/retrofits to existing BMPs – use to treat the outflow from one to three stormwater ponds in the Keller Lake watershed	$330,000 - $3,000,000	City (Apple Valley, Burnsville), and Dakota County cost; possible grant funding via BDWMO
10	Retrofit BMPs – focus on implementing practices in areas that receive no treatment before discharging to Keller Lake	To be determined	City (Apple Valley, Burnsville), and Dakota County cost; possible grant funding via BDWMO
11	Infiltration/filtration projects to treat 0.25" – 0.50" of runoff from impervious surfaces within the portion of the watershed without structural BMPs	$2,000,000 - $7,200,000	City (Apple Valley, Burnsville), and Dakota County cost; possible grant funding via BDWMO

Table 5-3: Potential Future Projects, based on Recommendations from the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Implementation Plan and Earley Lake Protection Plan* (2011, Crystal Keller TMDL Implementation Plan) (continued)

Item #	Implementation Program Element	Potential Cost^2	Funding Source
12	Redevelopment within the watershed – incorporate increased water quality treatment measures into redevelopment projects	To be determined	City (Apple Valley, Burnsville), and Dakota County cost; possible grant funding via BDWMO
Implement recommended internal phosphorus load reduction projects:			
13	Inactivation of sediment phosphorus – alum treatment. One-time application, likely 2022 or later, after implementation of Items 26A and 26B in Table 5-1.	\$150,000 - \$250,000	BDWMO funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
14	Aquatic plant (macrophyte) management to control curlyleaf pondweed and Eurasian watermilfoil – chemically treat 15% of littoral area of lake. Perform annually, likely 2020 or later, after implementation of Items 26A and 26B in Table 5-1 and Item 13 in this table.	\$29,000 – \$44,000/year	BDWMO funding and/or grant funding via BDWMO See Section 4.7.4, Policy 8)
15	Macrophyte management to control curlyleaf pondweed and Eurasian watermilfoil – whole lake chemical treatment over a 5-year period	\$340,000 - \$515,000	BDWMO funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
16	Fisheries study and management plan	\$50,000 - \$200,000	BDWMO funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)
17	Conduct phytoplankton and zooplankton surveys	\$5,000	BDWMO funding and/or grant funding via BDWMO (See Section 4.7.4, Policy 8)

Notes:

[1] Potential future projects are identified as “Phase II”, “As opportunities arise”, and “Reserve” projects in the Crystal Keller TMDL implementation plan. They will be considered for implementation only after completion of the TMDL implementation projects listed in Table 5-1 and after sufficient monitoring has been performed to show that the lakes are not meeting the MPCA’s water quality goals.

[2] Cost ranges are based on the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Implementation Plan and Earley Lake Protection Plan* (Barr Engineering Company, 2011)

Table 5-4: Ongoing, Planned, or Completed Projects based on the Crystal and Keller Lakes Use Attainability Analysis (UAA)

Item #	Implementation Program Element	Date	Funding Source
1	Phosphorus fertilizer limitation	2003 and ongoing	NA
2	Excavate and enhance Redwood Pond	2005	City of Apple Valley
3	Add two regional infiltration basins • Regional infiltration basin north of Valley Middle School • Regional infiltration basin west of Buck Hill Park	Valley Middle School project modified in TMDL Implementation Plan[1]	City of Apple Valley
		2005	City of Burnsville, BDWMO, and $32K Metropolitan Council Metro Environment Partnership Grant
4	Upgrade selected existing stormwater ponds to National Urban Runoff Program (NURP) design criteria • Enlarge and excavate 153rd Street Pond • Excavate north of Southcross Drive and Keller Lake Drive • Excavate Keller Lake Pond • Excavate pond at northeast edge of Keller Lake • Excavate Bluebill Pond	153rd Street pond was addressed during Cedar Avenue reconstruction[2]	City of Apple Valley
		2007	City of Burnsville
		2007	City of Burnsville
		2007	City of Burnsville
		2005	City of Lakeville
5	Add regional water quality treatment pond – Whitney Pond (southeast edge of Keller Lake)	2011	City of Apple Valley and $60K Clean Water Legacy Nonpoint Source Restoration and Protection Fund Grant
6	Operate ferric chloride ($FeCl_3$) treatment system to perform near surface withdrawal and treatment	2003 – 2009[3]	BDWMO
7	Mechanical harvesting of curlyleaf pondweed in Crystal Lake	2003 and ongoing	Lakeshore homeowners and City of Burnsville
8	Mechanical harvesting of curlyleaf pondweed in Keller Lake	2003 and ongoing[4]	Lakeshore homeowners, City of Apple Valley, and City of Burnsville

Notes:

[1] TMDL implementation plan recommends multiple small-scale infiltration/filtration projects (watershed-wide) rather than a single large-scale regional infiltration basin. The City of Apple Valley may still construct a smaller infiltration project at this location

[2] As designed, the primary discharge from the 153rd Street Pond is to the Vermillion River and only high flows are routed to Keller Lake. As part of Cedar Avenue reconstruction, the contributing watershed area to the pond was reduced.

[3] System permanently shut down at end of 2009.

[4] Harvesting not completed in 2009 because of low water levels.

Table 5-5 Accomplishments since Completion of the 2002 BDWMO Plan

Location and Task	Comparable Item # in Current Plan (Table 5-1)	Implementation Date	Status
Watershed-Wide:			
Revise joint powers agreement to reflect updated boundaries and allow cost allocation based on phosphorus loading for water quality improvement projects	N/A	2009/2010	Revising the joint powers agreement (JPA) was postponed until the BDWMO and its neighboring WMOs updated their boundary maps. The JPA was revised in late 2009 to remove the City of Savage from the BDWMO and update the official BDWMO map. The JPA was signed in January 2010. In March 2010, the BDWMO and Scott WMO entered into a Memorandum of Understanding that allows the City of Savage to become part of the Scott WMO. The revised JPA includes allowing cost allocation based on pollutant loading.
Develop "report card"/checklist to evaluate the BDWMO's and cities' progress toward meeting goals and expectations	N/A	2003	Completed in 2003 (incorporated into 2003 Newsletter/Watershed Annual Report)
Annual BDWMO/city accountability "audit" to set goals/ schedule and discuss progress on earlier goals (report card/ checklist)	N/A	Ongoing	Completed annually, as part of work plan development/budgeting process and annual reporting.
Review Burnsville local watershed management plan	3	2002/2008	BDWMO approval in 2002; updated plan approved in 2008
Review Lakeville local watershed management plan	4	2008	BDWMO approval in 2008.
Review Apple Valley local watershed management plan	5	2007	BDWMO approval in 2007.
Review Eagan and Savage local watershed management plans	6	2007	BDWMO approval of both plans in 2007. As of 2010, Savage no longer part of the BDWMO.
Miscellaneous reviews including, but not limited to: • Review city comprehensive plan changes that require review by the Metropolitan Council • Review projects for consistency with the BDWMO plan, as requested by member cities or other governmental agencies • Review and approve any proposed changes to the intercommunity stormwater system that are inconsistent with an approved local plan • Review and approve changes to an approved local plan that would cause the local plan to be inconsistent with the BDWMO plan	7	Ongoing (as needed)	BDWMO continues to perform these reviews as needed/requested.
Operate stormwater runoff monitoring station (e.g. WOMP)	N/A	2003-2004	Operated Willow Creek WOMP station through 2003, turned over station to Lower Minnesota River Watershed District in 2004 and operated through 2009. The station is no longer in operation.

Table 5-5 Accomplishments Since Completion of the 2002 BDWMO Plan (continued)

Location and Task	Comparable Item # in Current Plan (Table 5-1)	Implementation Date	Status
City technical staff (technical advisor) attendance at BDWMO meetings	8	Ongoing	City technical staff regularly attend BDWMO meetings
Facilitate intercommunity flood control, stormwater runoff, erosion, and sediment control projects	9	Ongoing (as needed)	City of Burnsville did not proceed with Crystal Lake outlet project, so cost allocation not needed. No other cost allocations have been requested.
Facilitate the development of a cost sharing strategy for water quality improvement projects addressing internal loading (e.g. Crystal, Keller, and Lee Lakes)	N/A	2011	In summer 2011, the BDWMO and member cities agreed that costs for internal load reduction projects stemming from TMDLs would be shared according to the existing Joint Powers Agreement.
Apply for grants and/or assist in city application for grants	10	Ongoing	BDWMO successfully applied for a Metropolitan Council grant to offset the City of Burnsville's costs of constructing an infiltration basin west of Buck Hill Park. Continue to apply for grants and/or assist with city applications for grants.
Complete and submit annual audit to BWSR	11	Ongoing	Completed annually.
Update BDWMO Watershed Management Plan	12	2010-2012	The BDWMO began updating its 2002 Watershed Management Plan in late 2010; completion expected in 2012.
Complete and publish watershed annual report (newsletter) and post to website	14	Ongoing	Published annually; expanded format in 2003.
Complete and submit annual activity report to BWSR and post on website	15	Ongoing (since 2003)	Completed annually.
Create, maintain and update Internet website—put plan, data, meeting agenda and minutes, watershed annual reports, water quality monitoring reports, educational materials, etc. on the site	16	Ongoing (since 2001)	Created website in 2001 and revised website in 2008 (hosted by Dakota SWCD). BDWMO posts the BDWMO meeting agendas and minutes, watershed annual reports, habitat monitoring reports, water quality monitoring reports, etc. on website.
Educational outreach	17	Ongoing	Provided watershed annual report to member cities and posted to BDWMO website; maintained website (see above); budgeted funds for support of county and member city environmental education programs. Since 2009, BDWMO has partnered with the Dakota SWCD to fund Blue Thumb Program workshops in the BDWMO area.
Implementation of small-scale best management practices on private properties to improve water quality	18	Ongoing (since 2009)	Since 2009, BDWMO has partnered with the Dakota County SWCD by providing funding and support to install water quality improvement projects through the Blue Thumb and Community Conservation Cost Share Programs for Black Dog WMO residents. Through this program, 9 projects were installed in 2009, and 7 projects were installed in 2010. Projects included rainwater gardens, shoreline improvements, and a bioretention site .

Table 5-5 Accomplishments Since Completion of the 2002 BDWMO Plan (continued)

Location and Task	Comparable Item # in Current Plan (Table 5-1)	Implementation Date	Status
Crystal Lake:			
Water quality monitoring, performing trend analysis, and establishing action levels	20, 21	Ongoing CAMP monitoring annually; Management Level Monitoring every 3 years	CAMP monitoring completed annually BDWMO performed most recent management level monitoring in 2008 to support TMDL development. BDWMO also performed additional monitoring in 2009 to meet the requirements of the BDWMO's NPDES permit for the operation of the ferric chloride treatment system.
Habitat monitoring every 5 years	22	Ongoing (since 2002)	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program and did not conduct monitoring. Beginning in 2011, the program includes monitoring of each strategic water body on a cycle of once every five years. Crystal Lake is scheduled for habitat monitoring in 2013.
Diagnostic Feasibility Study: *Crystal and Keller Lakes Use Attainability Analysis (UAA)*	N/A	2001-2003	Completed diagnostic-feasibility study for Crystal and Keller Lakes in 2003 and prepared report *Crystal and Keller Lakes Use Attainability Analysis* (UAA). UAA identified and recommended a number of water quality improvement projects
Total Maximum Daily Load(TMDL) Study: *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Report and Earley Lake Water Quality Assessment*	13	2008-2011	TMDL study for Crystal, Keller, Earley and Lee Lakes began in 2008; the draft *Crystal, Keller, and Lee Lakes Total Maximum Daily Load (TMDL) Report and the Earley Lake Water Quality Assessment (TMDL Report)* was completed in 2010; in conjunction with the TMDL report, an implementation plan for Crystal, Keller and Lee Lakes and a protection plan for Earley Lake were developed in 2010; TMDL approval expected in 2011. Additional water quality improvement projects/initiatives may result from the TMDL study.
Implement recommended actions identified in TMDL	24, 25	Ongoing (since 2003)	Implementation of projects from the UAA began in 2003 and continues, including the member cities' construction of water quality improvement projects, the BDWMO's operation of the ferric chloride treatment system from 1997 – 2008 (system permanently shut down at the end of 2009), and the member cities' ongoing harvesting of curlyleaf pondweed. Implementation of additional water quality improvement projects/initiatives identified in the TMDL study expected after 2011.
Keller Lake:			
Water quality monitoring, performing trend analysis, and establishing action levels	20, 21	Ongoing CAMP monitoring annually; Management Level Monitoring as needed	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring). BDWMO performed most recent management level monitoring in 2008 to support TMDL development. BDWMO performed additional monitoring in 2009 to meet the requirements of the BDWMO's NPDES permit for the operation of the ferric chloride treatment

Table 5-5 Accomplishments Since Completion of the 2002 BDWMO Plan (continued)

Location and Task	**Comparable Item # in Current Plan (Table 5-1)**	**Implementation Date**	**Status**
			system.
Habitat monitoring every 5 years	22	Ongoing (since 2002)	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program and did not conduct monitoring. Beginning in 2011, the program will include monitoring of each strategic water body on a cycle of once every five years. Keller Lake is scheduled for habitat monitoring in 2015.
Diagnostic Feasibility Study: *Crystal and Keller Lakes Use Attainability Analysis (UAA)*	N/A	2001-2003	Completed diagnostic-feasibility study for Crystal and Keller Lakes 2003 and prepared report *Crystal and Keller Lakes Use Attainability Analysis* (UAA). UAA identified and recommended a number of water quality improvement projects
Total Maximum Daily Load(TMDL) Study: *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Report and Earley Lake Water Quality Assessment*	13	2008-2011	TMDL study for Crystal, Keller, Earley and Lee Lakes began in 2008; the draft *Crystal, Keller, and Lee Lakes Total Maximum Daily Load (TMDL) Report and the Earley Lake Water Quality Assessment (TMDL Report)* was completed in 2010; in conjunction with the TMDL report, an implementation plan for Crystal, Keller and Lee Lakes and a protection plan for Earley Lake were developed in 2010; TMDL approval expected in 2011.. Additional water quality improvement projects/initiatives may result from the TMDL study.
Implement recommended actions identified in TMDL	26, 27	Ongoing (since 2003)	Implementation of projects from the UAA began in 2003 and continues, including the member cities' construction of water quality improvement projects, the BDWMO's operation of the ferric chloride treatment system from 1997 – 2008 (system permanently shut down at the end of 2009), and the member cities' ongoing harvesting of curlyleaf pondweed. Implementation of additional water quality improvement projects/initiatives identified in the TMDL study expected after 2011.
Orchard Lake:			
Water quality monitoring, performing trend analysis, and establishing action levels	20, 21	Ongoing CAMP monitoring annually; Management Level Monitoring every 3 years	CAMP monitoring completed annually. Most recent management level monitoring performed in 2006 by the Metropolitan Council.
Habitat monitoring every 5 years	22	Ongoing (since 2002)	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program and did not conduct monitoring. Beginning in 2011, the program will include monitoring of each strategic water body on a cycle of once every five years. Orchard Lake is scheduled for habitat monitoring in 2011.

Table 5-5 Accomplishments Since Completion of the 2002 BDWMO Plan (continued)

Location and Task	Comparable Item # in Current Plan (Table 5-1)	Implementation Date	Status
Implement lake water quality management actions recommended in Table 4-1, depending on water quality trends and comparison of recent water quality to action level. Identify and implement feasible water quality improvement techniques/practices, as identified in the diagnostic feasibility study, the lake management plan, and/or future studies.	23, 28	Ongoing	Implementation continues, including the city's annual harvesting of curlyleaf pondweed (2004 – 2008) and its 2009 and 2010 herbicide treatments for curlyleaf pondweed.
Kingsley Lake:			
Water quality monitoring, performing trend analysis, and establishing action levels	20, 21	Ongoing CAMP monitoring annually	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring).
Habitat monitoring every 5 years	22	Ongoing (since 2002)	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program and did not conduct monitoring. Beginning in 2011, the program includes monitoring of each strategic water body on a cycle of once every five years. Kingsley Lake is scheduled for habitat monitoring in 2011.
Implement lake water quality management actions recommended in Table 4-1, depending on water quality trends and comparison of recent water quality to action level.	23	Ongoing As needed	No actions needed
Lac Lavon:			
Water quality monitoring, performing trend analysis, and establishing action levels	20, 21	Ongoing CAMP monitoring annually; Management Level Monitoring every 3 years	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring). In response to decreased Secchi disc readings in the lake, the BDWMO performed management level monitoring in 2008 and 2010. The 2010 monitoring included collection and analysis of sediment cores.
Habitat monitoring every 5 years	22	Ongoing (since 2002)	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program and did not conduct monitoring. Beginning in 2011, the program includes monitoring of each strategic water body on a cycle of once every five years. Lac Lavon is scheduled for habitat monitoring in 2014.
Implement lake water quality management actions recommended in Table 4-1, depending on water quality trends and comparison of recent water quality to action level.	23	Ongoing As needed	In 2008, the BDWMO conducted management level monitoring of Lac Lavon, reviewed the existing lake management plan for the lake, and performed a water quality assessment of Lac Lavon, as triggered by the lake's Secchi disc reading being worse than the "action level." The 2008 monitoring results and recommendations are summarized in the BDWMO's 2009 *Lac Lavon Water Quality Assessment* report. The report recommended additional monitoring of Lac

Table 5-5 Accomplishments Since Completion of the 2002 BDWMO Plan (continued)

Location and Task	Comparable Item # in Current Plan (Table 5-1)	Implementation Date	Status
			Lavon to better understand the reasons for the reduced transparency readings on the lake. In 2010, the BDWMO performed management level monitoring and collected and analyzed sediment cores. The 2010 data indicate that the phosphorus released from the sediments is not problematic. Also, 2009 and 2010 Secchi disc readings improved relative to 2008. The 2010 monitoring results and recommendations are summarized in the BDWMO's 2011 *Lac Lavon Water Quality Assessment* report. No additional action beyond the continued annual monitoring was recommended.
Sunset Pond:			
Water quality monitoring, performing trend analysis, and establishing action levels	N/A	1996-2010	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring). As part of the WMP update, Sunset Pond is no longer classified as a BDWMO strategic waterbody.
Habitat monitoring every 5 years	N/A	2002-2009	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program and did not conduct monitoring. Beginning in 2011, the program includes monitoring of each strategic water body on a cycle of once every five years. As part of the WMP update, Sunset Pond is no longer classified as a BDWMO strategic waterbody.
Implement lake water quality actions recommended in Table 4-1, depending on water quality trends and comparison of recent water quality to action level.	N/A	2002-2011	No actions needed. As part of the WMP update, Sunset Pond is no longer classified as a BDWMO strategic waterbody.
Lee Lake:			
Total Maximum Daily Load (TMDL) Study: *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Report and Earley Lake Water Quality Assessment*	13	2008-2011	TMDL study for Crystal, Keller, Earley and Lee Lakes began in 2008; the draft *Crystal, Keller, and Lee Lakes Total Maximum Daily Load (TMDL) Report and the Earley Lake Water Quality Assessment (TMDL Report)* was completed in 2010; in conjunction with the TMDL report, an implementation plan for Crystal, Keller and Lee Lakes and a protection plan for Earley Lake were developed in 2010; TMDL approval expected in 2011.. Additional water quality improvement projects/initiatives may result from the TMDL study.
Earley Lake:			
Total Maximum Daily Load (TMDL) Study: *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Report and Earley Lake Water Quality Assessment*	13	2008-2011	TMDL study for Crystal, Keller, Earley and Lee Lakes began in 2008; the draft *Crystal, Keller, and Lee Lakes Total Maximum Daily Load (TMDL) Report and the Earley Lake Water Quality Assessment (TMDL Report)* was completed in 2010; in conjunction with the TMDL report, an implementation plan for Crystal, Keller and Lee Lakes and a protection plan for Earley Lake were developed in 2010; TMDL approval expected in 2011. Additional water quality improvement projects/initiatives may result from the TMDL study.

Section 6

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Appendices

Appendix A

Joint Powers Agreement and Memoranda of Understanding

2010

REVISED AND RESTATED
JOINT POWERS AGREEMENT
FOR THE
BLACK DOG WATERSHED
MANAGEMENT ORGANIZATION

2010
REVISED AND RESTATED JOINT POWERS AGREEMENT FOR THE BLACK DOG WATERSHED MANAGEMENT ORGANIZATION

The parties to this Agreement are cities which have land in the Black Dog Watershed. This Agreement is made pursuant to the authority conferred upon the parties by Minn. Stat. §§ 471.59 and 103B.201, et. seq.

1. NAME. The parties hereby create and establish the Black Dog Watershed Management Organization.

2. GENERAL PURPOSE. The purpose of this Agreement is to provide an organization to regulate the natural water storage and retention of the Black Dog watershed to (a) protect, preserve, and use natural surface and ground water 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 ground water quality; (d) establish more uniform local policies and official controls for surface and ground water management; (e) prevent erosion of soil into surface water systems; (f) promote ground water 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 and ground water.

3. DEFINITIONS.

Subdivision 1. *"Commission"* means the organization created by this Agreement, the full name of which is "Black Dog Watershed Management Organization". It shall be a public agency of its members.

Subdivision 2. *"Board"* means the board of commissioners of the Commission.

Subdivision 3. *"Council"* means the governing body of a governmental unit which is a member of this Commission.

Subdivision 4. *"Governmental Unit"* means any city which is a signatory to this Agreement.

Subdivision 5. *"Member"* means a governmental unit which enters into this Agreement.

Subdivision 6. *"Black Dog Watershed"* or *"Watershed"* means the area contained within a line drawn around the extremities of all terrain whose surface drainage is within the mapped areas delineated on the map filed with the Board of Water and Soil Resources pursuant to Minn. Stat. § 103B.211, Subd. 2 attached hereto as Exhibit "A".

4. **MEMBERSHIP.** The membership of the Commission shall consist of the following governmental units:

Group A:	City of Burnsville
Group AA:	City of Apple Valley City of Eagan
Group AAA:	City of Lakeville

No change in governmental boundaries, structure, organizational status or character shall affect the eligibility of any governmental unit listed above to be represented on the Commission, so long as such governmental unit continues to exist as a separate political subdivision.

5. ADVISORS.

Subdivision 1. The Dakota County Soil and Water Conservation District shall be requested to appoint a non-voting advisory member to the Commission. The District shall not be required to contribute funds for the operation of the Commission except as provided in Minn. Stat. § 103B.251, but may provide technical services.

Subdivision 2. Citizen Advisory Committee. The Commission may establish a citizen advisory committee ("CAC") from the public at large to provide input on watershed management plan revisions and other matters as deemed appropriate. The CAC shall be appointed by the Commission considering individuals nominated by each member community.

6. BOARD OF COMMISSIONERS.

Subdivision 1. The governing body of the Commission shall be its Board which shall consist of five (5) commissioners. The Board of Commissioners on behalf of its member communities shall comply with the notice requirements of Minn. Stat. § 103B.227. All vacancies shall be filled within ninety (90) days after they occur. Notices of all vacancies shall be published in a newspaper of general circulation in the Watershed at least fifteen (15) days before the appointment is made. For purposes of appointing commissioners, each member in Group AAshall appoint a delegate. Group AA delegates shall meet upon ten (10) days' notice at a time and place selected by the City Clerk of Apple Valley and shall appoint one commissioner. . The delegates shall select a commissioner by majority vote. Tie votes shall be broken by the flip of a coin. Voting may also take place by mailed ballot, fax, e-mail, telephone calls, or any combination of these methods. In the alternative to appointing a delegate to vote on its behalf, a city council may vote directly. The City Council of Burnsville shall appoint three (3) commissioners. The City Council of Lakeville shall appoint 1 (1) commissioner. Vacancies in office shall be filled for the remainder of the term by the governing bodies who made the appointment.

Subdivision 2. The term of each commissioner shall be three (3) years and until their successors are selected and qualify.

Subdivision 3. A commissioner may not be removed from the Board prior to the expiration of his or her term unless the commissioner consents in writing or unless removed in accordance with Minnesota Rule 8410.0040.

Subdivision 4. Commissioners shall serve without compensation from the Commission, but this shall not prevent a governmental unit from compensating a commissioner for serving on the Board.

Subdivision 5. At the first Board Meeting each year, the Board shall elect from its commissioners a chair, a vice chair, a secretary/ treasurer, and such other officers as it deems necessary to conduct its meetings and affairs. The Commission may adopt rules and regulations governing its meetings. Such rules and regulations may be amended from time to time at either a regular or a special meeting of the Commission provided that at least ten (10) days' prior notice of the proposed amendment has been furnished to each person to whom notice of the Board meetings is required to be sent.

Subdivision 6. Each group shall appoint one alternate commissioner. The alternate commissioner shall be selected in the same manner as regular commissioners. The term of the alternates shall be three (3) years and until their successors are selected and qualify. In the absence of a regular commissioner, the alternate may vote and act in a commissioner's place. The alternate, however, shall have only one vote even if more than one regular commissioner from the group is absent.

Subdivision 7. Decisions by the Commission shall require a majority vote of all commissioners except that a decision to order a capital improvement project shall require a two-thirds (2/3) favorable vote.

7. POWERS AND DUTIES OF THE COMMISSION.

Subdivision 1. The Commission, acting by its Board of Commissioners:

(a) Shall prepare and adopt a watershed management plan meeting the requirements of Minn. Stat. § 103B.231;

(b) Shall review and approve local water management plans as provided by Minn. Stat. § 103B.235;

(c) Shall exercise the authority of a watershed district under Minn. Stat. Chapter 103D to regulate the use and development of land when one or more of the following conditions exist:

    (1) The local government unit exercising planning and zoning authority over the land under Minn. Stat. §§ 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 requirements of § 103B.235 or has not adopted the implementation program described in the plan.

    (2) An application to the local governmental 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.

    (3) The local governmental unit has authorized the Commission to require permits for the use and development of land.

(d) The Commission must publish and distribute a newsletter at least annually to watershed residents. The newsletter must explain the watershed's programs and list offices and telephone numbers.

Subdivision 2. The Commission shall use the city staff of Burnsville for assistance. Burnsville may pass through the direct cost, including salary and benefits, to the Commission and the Commission shall reimburse the City.

Subdivision 3. The Commission shall meet at least annually. Meeting notices shall be placed on a bulletin board at the Burnsville City Hall at least three (3) days before each meeting. Any office supplies the Commission needs shall be furnished by Burnsville. The direct cost for the supplies shall be billed to the Commission.

Subdivision 4. The Commission may cooperate or contract with the State of Minnesota or any subdivision thereof or federal agency or private or public organization to accomplish the purposes for which it is organized.

Subdivision 5. The Commission may order any governmental unit to carry out the local water management plan, including any capital improvement identified therein, which has been approved by the Board.

Subdivision 6. The Commission may acquire, operate, construct and maintain only the capital improvements, if any, delineated in the watershed management plan adopted by the Board which the plan states will be constructed by the Board.

Subdivision 7. The Commission may contract for or purchase such insurance as the Board deems necessary for the protection of the Commission.

Subdivision 8. The Commission may establish and maintain devices for acquiring and recording hydrological and water quality data within the watershed.

Subdivision 9. The Commission may enter upon lands within or without the watershed to make surveys and investigations to accomplish the purposes of the Commission.

Subdivision 10. The Commission may provide any member governmental unit with technical data or any other information of which the Commission has knowledge which will assist the governmental unit in preparing local water management plans within the watershed.

Subdivision 11. The Commission may accumulate reserve funds for the purposes herein mentioned and may invest funds of the Commission not currently needed for its operations.

Subdivision 12. The Commission may collect money, subject to the provisions of this Agreement, from its members and from any other source approved by a majority of its Board.

Subdivision 13. The Commission may make contracts, employ consultants, incur expenses, and make expenditures necessary and incidental to the effectuation of its purposes and powers.

Subdivision 14. The Commission shall cause to be made an annual audit of the books and accounts of the Commission and shall make and file a report to its members at least once each year including the following information:

(a) The financial condition of the Commission;

(b) The status of all Commission projects and work within the watershed;

(c) The business transacted by the Commission and other matters which affect the interests of the Commission. Copies of the report shall be transmitted to the Clerk of each member governmental unit.

Subdivision 15. The Commission's books, reports, and records shall be available for and open to inspection by its members at all reasonable times.

Subdivision 16. The Commission may recommend changes in this Agreement to its members.

Subdivision 17. The Commission may exercise all other powers necessary and incidental to the implementation of the purposes and powers set forth herein.

Subdivision 18. Each member reserves the right to conduct separate or concurrent studies on any matter under study by the Commission.

Subdivision 19. The Board may investigate on its own initiative or upon petition of any member, complaints relating to water pollution, as defined in the Commission's adopted water management plan, in the watershed. Upon a finding that the watershed is being polluted, the Board may take appropriate action to alleviate the pollution and to assist in protecting and improving the water quality of surface water in the watershed.

Subdivision 20. The Board must solicit proposals for all legal, engineering, auditing, and other technical services in accordance with Minn. Stat. § 103B.227.

Subdivision 21. The Board shall coordinate its planning activities with contiguous watershed management organizations and counties conducting water planning and implementation under Minn. Stat. Chapter 103B.

Subdivision 22. The Board shall file an annual report with the Board of Water and Soil Resources including a financial report on administration, projects, or other expenditures.

Subdivision 23. The Commission shall adopt an annual work plan.

Subdivision 24. The Commission shall designate an official newspaper.

8. POWERS AND DUTIES OF THE OFFICERS OF THE BOARD OF COMMISSIONERS.

Subdivision 1. It shall be the duty of the Chairperson of the Board of Commissioners to:

(a) Attend and preside at meetings of the Board;

(b) Assist in the preparation of meeting agendas and the annual work plan;

(c) See that orders and resolutions of the Board are carried into effect;

(d) Sign and execute documents as may be required for the Board's exercise of its powers, except in cases in which the authority to sign and execute is required by law to be exercised by another person; and

(e) Such other duties applicable to the office as necessary to fulfill the powers and duties of the Board of Commissioners as set forth in the Agreement.

Subdivision 2. It shall be the duty of the Vice Chairperson of the Board of Commissioners to:

(a) Perform the duties of the Chairperson in his or her absence; and

(b) Perform other duties as assigned from time to time by the Board of Commissioners;

Subdivision 3. It shall be the duty of the Secretary/Treasurer of the Board of Commissioners to:

(a) Keep and post a true and accurate record of the proceedings of all meetings of the Commission and Board of Commissioners;

(b) Keep a record of all amendments, alterations, and additions to the Joint Powers Agreement;

(c) Prepare and process all correspondence as needed;

(d) Prepare and file all reports and statements as required by law and this Agreement;

(e) Keep all financial accounts of the Commission, and prepare and present to the Board of Commissioners a full and detailed statement of the assets and liabilities of the Commissioner's financial accounts; and

(f) Perform other duties as assigned from time to time by the Board of Commissioners.

9. CONSTRUCTION OF IMPROVEMENTS.

Subdivision 1. The members acknowledge that most of the needed storm water drainage system is already in place. Any additional facilities which are needed shall be constructed by the member unit where the additional improvement is constructed, not by the Commission, unless the improvement is designated in the Board's watershed management plan for construction by the Board.

<u>Subdivision 2</u>. Before ordering an improvement, the Board shall secure from an engineer a preliminary report advising it whether the proposed improvement is feasible and as to whether it shall best be made as proposed or in connection with some other improvement and the estimated cost of the improvement as recommended. The Board shall then hold a public hearing on the proposed improvement after mailed notice to the Clerk of each member governmental unit and published notice in the Board's official newspaper. The Commission shall not be required to mail notice except by notice to the Clerk. The notice shall be mailed not less than forty-five (45) days before the hearing, shall state the time and place of the hearing, the general nature of the improvement, the estimated total cost, and the estimated cost to each member governmental unit.

If the Board orders the construction of an improvement, the order shall describe the improvement, shall designate the engineers to prepare plans and specifications, and shall designate who will contract for the improvement. The Board may not proceed with the project unless it receives written approval from the governing bodies of at least three (3) member governmental units approving the project.

<u>Subdivision 3</u>. <u>Contract for Improvements</u>. All improvement contracts ordered by the Board shall be let in accordance with State statutory requirements. The bidding and contracting of the work shall be let by any one of the member governmental units as determined by the Board of Commissioners after compliance with the statutes.

Subdivision 4. Supervision. All improvement contracts shall be supervised by the entity awarding the contract. Representatives of the Commission shall have the right to enter upon the place or places where the improvement work is in progress for the purpose of making reasonable tests and inspections.

Subdivision 5. Land Acquisition. The Commission shall not have the power of eminent domain. All easements or interest in land which are necessary will be negotiated or condemned in accordance with Minn. Stat. Chapter 117 by a governmental unit or by the entity awarding the contract as directed by the Board, and each member agrees to acquire the necessary easement or right-of-way or partial or complete interest in land upon order of the Board to accomplish the purposes of this Agreement. All reasonable costs of the acquisition, including attorney's fees, shall be considered as a cost of the improvement. If a member governmental unit determines it is in the best interests of that member to acquire additional lands, in conjunction with the taking of lands for storm and surface drainage or storage, for some other purposes, the costs of the acquisition shall not be included in the improvement costs of the ordered project.

10. FINANCES.

Subdivision 1. The Commission funds may be expended by the Board in accordance with this Agreement in a manner determined by the Board. The Board may designate one or more national or state bank or trust companies authorized to receive deposits of public monies to act as depositories for the Commission funds. In no event shall there be a disbursement of Commission funds without the signature of at least two (2) Board members. The treasurer shall be required to file with the Board a bond in the sum of at least $10,000 or such higher amount as shall be determined by the Board. The Commission shall pay the premium on the bond.

Subdivision 2. General Fund. Each member shall contribute each year to a general fund. The annual contribution by each member shall be based fifty percent (50%) on taxable market value and fifty percent (50%) on the basis of area in accordance with the following formula:

Annual Watershed Levy = L

Taxable Market Value of a
Member's Property in the Watershed = MV

Taxable Market Value of All Property in the Watershed = TV

Acres of Property a Member Has in the Watershed = A

Total Acres in Watershed = TA

Member Required Contribution = C

$$\tfrac{1}{2} L \times \frac{MV}{TV} + \tfrac{1}{2} L \times \frac{A}{TA} = C$$

Subdivision 3. On or before July 1 of each year, the Board shall adopt a budget for the ensuing year and decide upon the total amount necessary for the general fund. On or before July 1, the budget shall be sent to the Clerk of each member governmental unit, together with a statement of the proportion of the budget to be provided by each member. The Board shall, upon notice from any member received prior to August 1, consider objections to the budget. After considering the objections, the Board may amend the budget. The budget may not be adopted if the governing bodies of three (3) or more member units object to it.

Subdivision 4. Capital Improvement.

(a) An improvement fund shall be established for each improvement project ordered by the Commission not paid for out of the general fund.

(b) Each member agrees to pay its proportionate share of the cost of the improvement in accordance with the determination of the Board as set forth herein. The Board, in its discretion, may require members to make advance payments based upon estimated costs, subject to adjustment to reflect actual costs, or may bill the members as costs are actually incurred. Members agree to pay billings within thirty (30) days of receipt. The Board or the member awarding the contract shall advise other contributing members of the tentative time schedule of the work and the estimated times when the contributions shall be necessary.

Subdivision 5. All capital improvement costs of improvements designated in the Board's adopted watershed management plan for construction by the Board not paid for out of the general fund shall be apportioned on the following bases:

(1) The ratio of taxable market value of each member within the boundaries of the benefited area to the total taxable market value within the entire benefited area;

(2) The ratio of storm water runoff produced by each member within the boundaries of the benefited area to the total runoff of storm water produced by the entire benefited area;

(3) The ratio of targeted pollutants, as identified by the Board, from a member community to the total targeted pollutants contributed by all member communities. If more than one pollutant is targeted, the percentage of the ratio given to each pollutant shall be determined by the Board. This may only be used in conjunction with projects that are intended to improve water quality;

(4) Pursuant to Minn. Stat. § 103B.251.

(5) A combination of the above apportionment methods;

Subdivision 6. Any member governmental unit aggrieved by the determination of the Board as to the allocation of the costs of an improvement shall have thirty (30) days after the Board resolution ordering the improvement to appeal the determination. The appeal shall be in writing and shall be addressed to the Board asking for arbitration. The determination of the member's appeal shall be referred to a Board of Arbitration. The Board of Arbitration shall consist of three (3) persons: one to be appointed by the Board of Commissioners, one to be appointed by the appealing member governmental unit, and the third to be appointed by the two so selected. In the event the two persons so selected do not appoint the third person within fifteen (15) days after their appointment, then the chief judge of the District Court of Dakota County shall have jurisdiction to appoint, upon application of either or both of the two earlier selected, the third person to the Board. The third person selected shall not be a resident of any member governmental unit and shall be a person knowledgeable in the subject matter. The arbitrators' expenses and fees, together with other expenses, not including counsel fees, incurred in the conduct of the arbitration shall be divided equally between the Commission and the appealing member. Arbitration shall be conducted in accordance with the Uniform Arbitration Act, Minn. Stat. Chapter 572.

11. SPECIAL ASSESSMENTS. The Commission shall not have the power to levy special assessments.

12. DURATION.

Subdivision 1. Each member agrees to be bound by the terms of this Agreement until January 1, 2020, and it may be continued thereafter upon the agreement of all the parties.

Subdivision 2. This Agreement may be terminated prior to January 1, 2020, by the written agreement of a majority of the members.

Subdivision 3. In addition to the manner provided in Subdivision 2 for termination, any member may petition the Board to dissolve the Agreement. Upon thirty (30) days' notice in writing to the Clerk of each member governmental unit, the Board shall hold a hearing and upon a favorable vote, the Board may by resolution recommend that the Commission be dissolved. The resolution shall be submitted to each member governmental unit and if ratified by a majority of the governing bodies of all eligible members within sixty (60) days, the Board shall dissolve the Commission following 90 days notice to Dakota County and the Minnesota Board of Water and Soil Resources, and allowing a reasonable time to complete work in progress and to dispose of personal property owned by the Commission.

13. DISSOLUTION. Upon dissolution of the Commission, all property of the Commission shall be sold and the proceeds thereof, together with monies on hand, shall be distributed to the eligible members of the Commission. Such distribution of Commission assets shall be made in proportion to the total contribution to the Commission required by the last annual budget.

14. EFFECTIVE DATE. This revised Agreement shall be in full force and effect when all five (5) members, delineated in paragraph 4 of this Agreement, have executed this Agreement. All members need not sign the same copy. The signed Agreement shall be filed with the City Clerk of the City of Burnsville. Prior to the effective date of this revised Agreement, any signatory may rescind their approval.

IN WITNESS WHEREOF, the undersigned governmental units, by action of their governing bodies, have caused this Agreement to be executed in accordance with the authority of Minn. Stat. § 471.59.

Approved by the City Council __________________, 20__.	**CITY OF LAKEVILLE**
	BY: ____________________________
	ATTEST: ________________________

Approved by the City Council
Jan 19, 2010

CITY OF BURNSVILLE

BY:

ATTEST:

Approved by the City Council
____________________, 20__.

CITY OF EAGAN

BY: ______________________________

ATTEST: __________________________

Approved by the City Council
____________________, 20__.

CITY OF APPLE VALLEY

BY: ______________________________

ATTEST: __________________________

Approved by the City Council
____________________, 20__.

CITY OF BURNSVILLE

BY: ____________________________

ATTEST: __________________________

Approved by the City Council
____________________, 20__.

CITY OF EAGAN

BY: ____________________________

ATTEST: __________________________

Approved by the City Council
January 28, 2010.

CITY OF APPLE VALLEY

BY: Mary Hamann-Roland
Mary Hamann-Roland, Mayor

ATTEST: Pamela J. Gackstetter
Pamela J. Gackstetter, City Clerk

Approved by the City Council
____________________, 20__.

CITY OF BURNSVILLE

BY: ______________________________

ATTEST: __________________________

Approved by the City Council
January 19, 2010.

CITY OF EAGAN

BY: ______________________________

ATTEST: Maria Petersen

Approved by the City Council
____________________, 20__.

CITY OF APPLE VALLEY

BY: ______________________________

ATTEST: __________________________

Approved by the City Council
1/19, 2010

CITY OF LAKEVILLE

BY: Holly Dahl

ATTEST: Charlene Friedges

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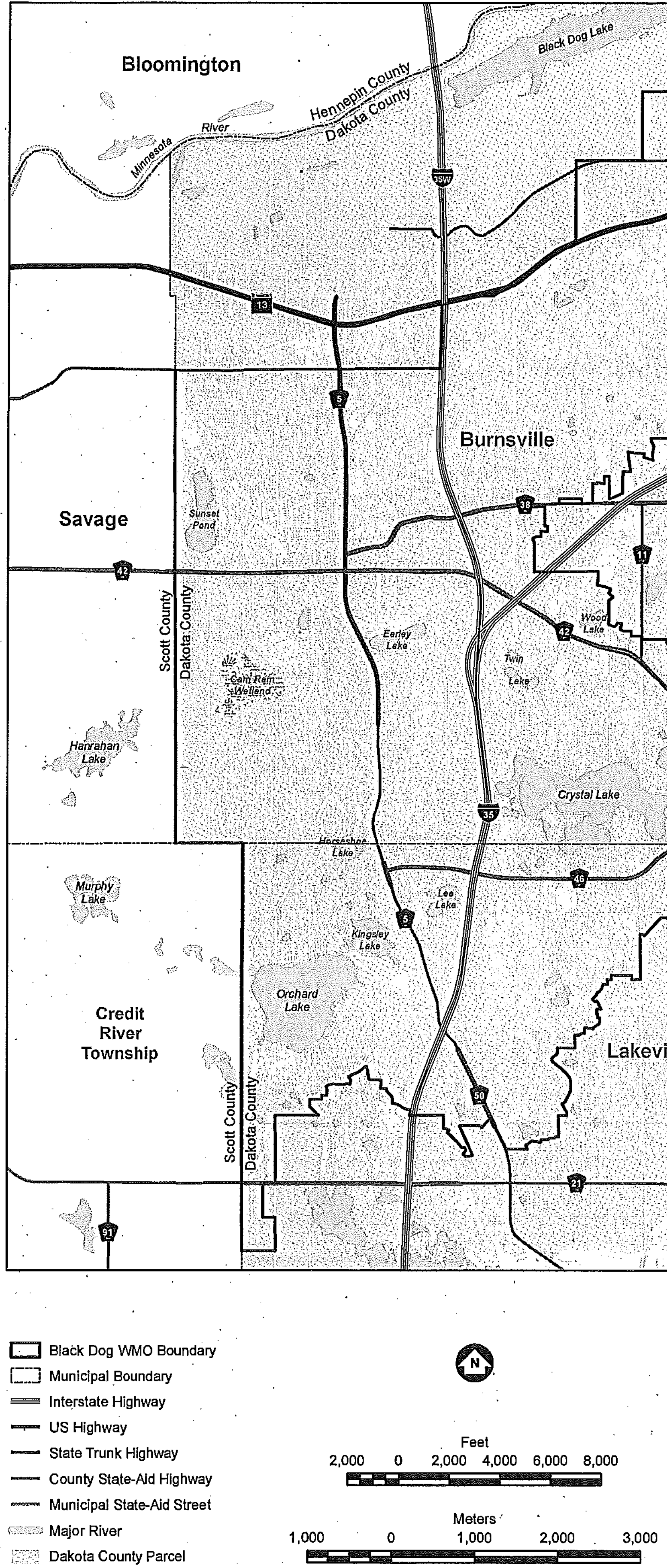

EXHIBIT A to JOINT POWERS AGREEMENT
BLACK DOG WMO BOUNDARY
December 2009

BARR

MEMORANDUM
OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING entered into this 12th day of March, 2010, by and between **SCOTT COUNTY** and the **BLACK DOG WATERSHED MANAGEMENT ORGANIZATION** ("Black Dog WMO").

RECITALS

A. The Black Dog WMO intends redraw its boundaries to delete the Mapped Area from its boundaries. The Mapped Area will be incorporated into the Scott County Watershed. See attached Exhibit.

B. The Mapped Area is part of the Black Dog a hydrological watershed.

C. If the Mapped Area is incorporated into the Scott County Watershed, the management of the hydrological watershed will be divided between Scott County and the Black Dog WMO.

D. To provide responsible management of the hydrological watershed the parties have entered into this Agreement.

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. **COORDINATING REPRESENTATIVES.** Each party shall appoint a representative to coordinate with the other body. Each party shall send copies of all meeting notices, agenda materials, draft plans and final plans to the representative designated by the other party. The designated representative shall be encouraged to attend the meetings of the other body and to provide pertinent input.

2. **JOINT PLANNING.** Prior to adopting a watershed management plan that affects the hydrological watershed or an amendment thereto, the parties shall consult with each other. If the parties cannot resolve their differences, if any, they shall request the Minnesota Board of Water and Soil Resources ("BWSR") to appoint a mediator. The mediator may not be an employee of BWSR or either of the parties. The parties shall attempt in good faith to mediate their differences. Disputes not resolved in mediation shall be decided by the BWSR in accordance with Minn. Stat. § 103B.231, subd. 9 and subd. 13.

3. **IMPROVEMENT PROJECTS.** Prior to constructing a watershed improvement that may impact the hydrological watershed outside its boundaries, the parties shall consult with each other. If the parties identify an improvement that should be a joint project, the cost shall be apportioned on one of the following bases unless the parties otherwise agree:

A. The ratio of the taxable market value of each member within the boundaries of the benefited area to the total taxable market value within the entire benefited area.

B. The ratio of storm water runoff produced by each member within the boundaries of the benefited area to the total runoff of storm water produced by the entire benefited area.

C. A combination of the above apportionment methods.

D. Pursuant to Minn. Stat. § 103B.251.

4. **TERM.** This Agreement shall terminate upon the happening of any of the following:

A. The mutual agreement of the parties; or

B. The termination of the Black Dog WMO; or

C. If the Mapped Area ceases to be part of the Scott County WMO; or

D. The termination of the Scott -WMO as it affects the Black Dog hydrological watershed in the Mapped Area.

5. **EFFECTIVE DATE.** This Agreement shall be effective after the Mapped Area has been incorporated into the Scott County WMO.

SCOTT COUNTY	**BLACK DOG WATERSHED MANAGEMENT ORGANIZATION**
BY: Barbara Marschall Barbara Marschall, Chair Scott County Board of Commissioners	BY: , Chair Black Dog Watershed Board
Dated: 3-2, 2010	Dated: 2/17, 2010
Attested: Gary Shelton, County Administrator	BY: Its Secretary

Approved as to form:

for Susan K. McNellis, Ass't County Att'y

Appendix B

BDWMO Annual Report

Black Dog Watershed Management Organization

2011 ANNUAL ACTIVITY REPORT

Prepared for:

BLACK DOG WATERSHED
MANAGEMENT COMMISSION

MAY 2012

2011 BOARD MEMBERS

The Black Dog Watershed Management Organization was established by a joint powers agreement. The member cities appoint Board Members (and alternates) to serve three-year terms. The 2011 Black Dog Watershed Management Organization Board Members and the city/cities they represent are listed below:

	Board Members:	**Term Ending**
1.	Roger Baldwin (Chair) Representing the City of Burnsville	November, 2014
2.	Mary Hamann-Roland (Vice-Chair) Representing the Cities of Apple Valley and Eagan	November, 2014
3.	Tom Harmening Representing the City of Burnsville	November, 2014
4.	Loren Knott (Secretary/Treasurer) Representing the City of Burnsville	November, 2014
5.	Scott Thureen Representing the City of Lakeville	November, 2014

	Alternate Board Members:	
1.	Greg Helms Representing the Cities of Apple Valley and Eagan (Greg Helms replaced Stephen David in November 2011)	November, 2014
2.	Mike Hughes Representing the City of Burnsville	November, 2014
3.	Tom Goodwin Representing the City of Lakeville (Tom Goodwin replaced Colleen LeBeau in November 2011)	November, 2014

CONSULTANTS

In accordance with Minnesota Statutes, Section 103B.227, Subdivision 5, the Black Dog Watershed Management Commission solicited interest proposals for engineering consulting, legal services, and auditor services in January 2010. As the statutes require the solicitation to occur every two years, the Black Dog Watershed Management Commission will solicit proposals again in 2012. The Black Dog Watershed Management Commission Board retains services from the following consultants:

Engineering:	Barr Engineering Company Karen Chandler 4700 West 77th Street Minneapolis, MN 55435-4803 Phone: (952) 832-2600
Legal:	Campbell, Knutson, Attorneys at Law Roger Knutson 317 Eagandale Office Center 1380 Corporate Center Drive Eagan, MN 55121 Phone: (651) 452-5000
Auditor:	MMKR Certified Public Accountants James Eichten 5353 Wayzata Boulevard Suite 410 Minneapolis, MN 55416 Phone: (952) 545-0424

The Black Dog Watershed Management Organization currently does not employ any staff. Administrative support is provided by the City of Burnsville.

Administrator:	City of Burnsville Daryl Jacobson 13713 Frontier Ct. Burnsville, MN 55337 Phone: (952) 895-4574
Website:	www.blackdogwmo.org

PERMITS AND VARIANCES

The Black Dog Watershed Management Organization does not have a permit program.

WETLAND BANKING

The Black Dog Watershed Management Organization does not have a wetland banking program.

STATUS OF LOCAL PLAN ADOPTION AND IMPLEMENTATION

All of the member cities have prepared local water management plans that conform to the 2002 Black Dog Watershed Management Organization (BDWMO) Watershed Management Plan. The following summarizes the status of local plans developed in compliance with the 2002 BDWMO Plan:

City	**Status of Local Planning & Year of BDWMO Approval**
Apple Valley	Plan approved by BDWMO on April 18, 2007
Burnsville	Plan approved by BDWMO in 2002, plan update (to meet Vermillion River Watershed Joint Powers Organization requirements) approved by BDWMO on May 21, 2008
Eagan	Plan approved by BDWMO on February 21, 2007
Lakeville	Plan approved by BDWMO on May 21, 2008

2011 Black Dog WMO Activities

- Completed work on the Total Maximum Daily Load (TMDL) Study for Crystal, Keller, and Lee Lakes, in partnership with the MPCA and the local communities. Work in 2011 included responding to and addressing public comments on the draft TMDL report, resubmitting the revised TMDL report to the EPA for their final review and approval, and submitting the TMDL implementation plan to the MPCA for their review and approval. The Environmental Protection Agency approved the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load (TMDL) Report and Earley Lake Water Quality Assessment* on September 30, 2011. Also, the MPCA approved the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Implementation Plan and Earley Lake Protection Plan* on November 3, 2011.

- Participated in the Metropolitan Council's Citizen-Assisted Lake Monitoring Program (CAMP) at the following Black Dog WMO-designated strategic water bodies: Crystal Lake, Keller Lake, Kingsley Lake, Lac Lavon, Orchard Lake, and Sunset Pond. Performed management level monitoring at Orchard Lake (see below). Completed water quality trend analyses on these lakes using the information gathered through CAMP and the more-detailed monitoring on Orchard Lake.

- Performed management level monitoring of Orchard Lake water quality, per guidance in the Black Dog WMO Plan. The monitoring consisted of collecting samples on 11 occasions—ice out and then May through September, twice per month. On each monitoring occasion, samples were collected at eight depths—a surface sample, plus seven samples at one-meter intervals. All of the samples were analyzed for total phosphorus and total dissolved phosphorus. Field measurements of temperature, dissolved oxygen, pH, and specific conductivity were taken at each depth. In addition, Secchi disc readings were taken, and the surface water samples were analyzed for chlorophyll-a. A memo summarizing the water quality monitoring results will be completed in 2012 and posted on the BDWMO website.

- Performed habitat monitoring of Kingsley Lake. 2011 was the first year of implementing the redesigned habitat monitoring program. The program now includes monitoring of a single water body on a cycle of once every five years. Monitoring included a meandering survey of the entire lake (in the submergent, emergent, and upland buffer zones), rather than only at sample plots, as done in the past. The habitat monitoring results are summarized in the report *2011 Habitat Monitoring of Kingsley Lake* (December 2011); the report is available on the BDWMO website.

- Partnered with the Dakota County SWCD by providing funding and support to install six water quality improvement projects through the Blue Thumb and the Community Conservation Cost Share Programs for Black Dog WMO residents.

- Partnered with the Dakota County SWCD to fund three Blue Thumb workshops in the Black Dog WMO area.

- Continued work on updating the Black Dog WMO Watershed Management Plan. The current Plan expires in May 2012. The most intense work of the planning process took place in 2011, including drafting and revising sections of the Plan document, implementing the public involvement process through the Planning Advisory Group, and submitting the Plan for formal review, work will extend through much of 2012.

- Continued to support Apple Valley's efforts to construct the Whitney Pond project, which was completed in the fall of 2011.

- Conducted an annual evaluation of the watershed programs and report the results to member communities via the Watershed Annual Report and Annual Activity Report.

- Formulated and approved the year 2012 Work Plan and Budget.

- Completed the 2010 Annual Audit.

- Developed an annual activity report and watershed annual report and distributed them via the Black Dog WMO website and through the member communities (see attached Watershed Annual Report). The annual activity report meets all of the State reporting requirements and is submitted to the Minnesota Board of Water and Soil Resources (BWSR).

- Reviewed and responded to any issues and opportunities brought to the attention of the Black Dog WMO.

- Maintained, updated, and revised the Black Dog WMO website.

Table 1 shows the Status of Implementation Tasks from the BDWMO *Watershed Management Plan*

2011 Black Dog WMO Expenditures

	BUDGET	**ACTUAL**
General Engineering Support: Consulting services for engineering support, such as attending meetings, review/respond to issues and opportunities, review/comment on proposed water quality implementation projects, EAWs, revisions to local water management plans, comprehensive plans, and other plans; communications with agencies, meetings with member cities and agencies, track and report on impaired waters and TMDL issues, and other miscellaneous consulting/reviews.	**$ 33,000**	**$ 31,674**
Special Projects: Projects undertaken by the Commission that are not ongoing.		
TMDL Studies Funding to pay consultant for retainage held until approval of TMDL	**0**	**17,437**
Orchard Lake Management Level Monitoring Funding to conduct "management level" monitoring of the lake's water quality, per guidance in the BDWMO Plan.	**13,300**	**13,041**
Watershed Management Plan Update Funding to cover work on updating the BDWMO watershed management plan.	**73,908**	**73,207**
Ferric Chloride Dosing System Final utility costs before shutdown of system	**0**	**$443**
Insurance:	**3,000**	**2,132**
Legal and Audit: Consulting fees for legal and annual audit services.	**7,950**	**10,979**
Administrative Support: City of Burnsville charges for providing administrative support to the Commission. This includes staff time, as well as printing and postage.	**12,000**	**13,333**
Public Education: Cost to produce and distribute the annual activity report and watershed annual report, funding support for the Dakota County SWCD Blue Thumb workshops and Community Conservation Cost Share grant program, and costs to maintain the BDWMO website	**14,600**	**15,023**
Water Quality Monitoring: Cost associated with water quality monitoring programs, including the habitat monitoring program, Metropolitan Council's CAMP, and analysis of water quality data.	**11,300**	**10,385**

Conference / Publications: Commissioner training and educational materials.	**500**	**230**
Contingency: Funding for unexpected expenses and/or new program opportunities approved by the Commission.	**1,500**	**0**
Expenditure Total:	**$ 171,058**	**$187,884**

2011 Black Dog WMO Revenues

	BUDGET	ACTUAL
Member City Contributions (Fees)	$ 135,000	$ 135,000
Interest	700	30
Grants (intergovernmental revenue)	0	17,437
Fund Balance Utilized	29,450	35,417
Revenue Total:	$ 165,150	$ 187,884

2012 Black Dog WMO Goals & Work Plan

1. Complete work on updating the Black Dog WMO Watershed Management Plan; work in 2012 is expected to include completion of the formal review process, culminating in BWSR approval of the Plan, followed by Black Dog WMO adoption and distribution of the Plan.
2. Participate in Metropolitan Council's Citizen Assisted Water Quality Monitoring Program (CAMP) for the following strategic water bodies:
   - * Crystal Lake
   - * Keller Lake
   - * Kingsley Lake
   - * Lac Lavon
   - * Orchard Lake

   Complete water quality trend analyses on these lakes using the information gathered through CAMP and the more detailed monitoring on Crystal Lake
3. Perform additional (management level) monitoring on Crystal Lake, as recommended in the Black Dog WMO Watershed Management Plan. The monitoring will consist of collecting samples on 11 occasions—ice-out and then May through September, twice per month. On each monitoring occasion, samples will be collected at seven depths—a surface sample, plus six samples at one-meter intervals. In addition, Secchi disc readings and other field measurements will be taken.
4. Implement the second year of the revised Habitat Monitoring Program. Habitat monitoring will be performed at one strategic water body per year, such that all five strategic water bodies will be completed over a five-year cycle. In 2012, the program will include monitoring of Orchard Lake. Monitoring will include a meandering survey of the entire lake (in the submergent, emergent, and upland buffer zones). If possible, the analysis and reporting of 2012 data will occur in 2012, but this may need to be carried over into 2013.
5. Conduct an annual evaluation of the watershed programs and report the results to member communities via a watershed annual report (this report is incorporated into the annual activity report submitted to the Minnesota Board of Water and Soil Resources).
6. Partner with the Dakota County SWCD by providing funding and support to install up to 18 water quality improvement projects through the Blue Thumb and the Community Conservation Cost Share Programs for Black Dog WMO residents.
7. Partner with the Dakota County SWCD to fund six Blue Thumb workshops in the Black Dog WMO area.
8. Complete the 2011 annual audit.
9. Apply for grants and/or assist member cities with grant applications.
10. Formulate and approve the year 2013 Work Plan and Budget.
11. Review and respond to any issues and opportunities brought to the attention of the Black Dog WMO.
12. Maintain and update web site.
13. Respond to requests to partner with member communities and Dakota County on educational outreach programs.
14. Keep abreast of changes to the TMDL program, including additions to/removals from the impaired waters list and the listing criteria.
15. Review revisions to local water management and comprehensive plans as needed.

- See Attached Watershed Annual Report for information on the 2012 Budget -

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
Watershed-wide		
Revise joint powers agreement to allow cost allocation based on phosphorus loading for water quality improvement projects	2002	Revising the joint powers agreement (JPA) was put on hold until the BDWMO and its neighboring WMOs updated their boundary maps. The JPA was revised in late 2009 to remove the City of Savage from the BDWMO and update the official BDWMO map. The JPA was signed in January 2010. In March 2010, the BDWMO and Scott WMO entered into a Memorandum of Understanding that allows the City of Savage to become part of the Scott WMO.
Develop "report card"/checklist to evaluate the BDWMO's and cities' progress toward meeting goals and expectations	2001	Completed in 2003 (incorporated into 2003 Newsletter/Watershed Annual Report)
Annual BDWMO/city accountability "audit" to set goals/ schedule and discuss progress on earlier goals (report card/checklist)	Ongoing	Completed annually, as part of work plan development/budgeting process and annual reporting.
Review Burnsville local watershed management plan	2002	BDWMO approval in 2002; updated plan approved in 2008
Review Lakeville local watershed management plan	2003	BDWMO approval in 2008.
Review Apple Valley local watershed management plan	2003	BDWMO approval in 2007.
Review Eagan and Savage local watershed management plans	2003	BDWMO approval of both plans in 2007.
Miscellaneous reviews: • Review city comprehensive plan changes that require review by the Metropolitan Council • Review projects for consistency with the BDWMO plan, as requested by member cities or other governmental agencies • Review and approve any proposed changes to the intercommunity stormwater system that are inconsistent with an approved local plan Review and approve changes to an approved local plan that would cause the local plan to be inconsistent with the BDWMO plan	Ongoing	BDWMO continues to perform these reviews as needed/requested.

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
Operate stormwater runoff monitoring station (e.g. WOMP)	~~Ongoing~~	Operated Willow Creek WOMP station through 2003, turned over station to Lower Minnesota River Watershed District in 2004. The station is no longer in operation.
Develop watershed runoff water quality models (i.e. P8) for the unmonitored watersheds that discharge to the Minnesota River	~~2002-2005~~	Determined unnecessary since all member communities were required to complete Non-degradation Reports that provided much of this information
City technical staff (technical advisor) attendance at BDWMO meetings	Ongoing	City technical staff regularly attend BDWMO meetings
Facilitate intercommunity flood control, stormwater runoff, erosion, and sediment control projects: • Crystal Lake outlet project—allocate costs • Future cost allocations determined as requested by member cities	~~2001 – Crystal Lake allocation~~ As needed – future allocations	City of Burnsville did not proceed with Crystal Lake outlet project, so cost allocation not needed. No other cost allocations have been requested.
Publish annual newsletter (now called watershed annual report)	Ongoing	Published annually; expanded format in 2003.
Create, maintain and update Internet web site—put plan, data, and educational materials on the site	2001 – create Maintain/update – ongoing	Created website in 2001 and revised website in 2008 (hosted by Dakota SWCD). BDWMO posts the BDWMO meeting agendas and minutes, watershed annual report, habitat monitoring reports, water quality monitoring reports, etc. on website.
Educational outreach	Ongoing	Provided watershed annual report to member cities and posted to BDWMO website; maintained website (see above); budgeted funds for support of county and member city environmental education programs. Since 2009, BDWMO has partnered with the Dakota SWCD to fund Blue Thumb Program workshops in the BDWMO area; 6 workshops were held in 2011.
Implementation of best management practices to improve water quality	Not included in implementation table	Since 2009, BDWMO has partnered with the Dakota County SWCD by providing funding and support to install water quality improvement projects through the Blue Thumb and Community Conservation Cost Share Programs for Black Dog WMO residents. Through this program, 9 projects were installed in 2009, 7 projects were installed in 2010, and 6 were installed in 2011. Projects included rainwater gardens, shoreline improvements, and a bioretention site.

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
Update BDWMO Watershed Management Plan	Not included in implementation table	In late 2010, the BDWMO began updating its 2002 Watershed Management Plan, which expires in 2012. In 2010, the planning process included a survey of the member cities, formation of a Planning Advisory Group, and holding a meeting with the PAG to identify issues. In 2011, the BDWMO developed the draft Plan document, implemented the public involvement process through the Planning Advisory Group, and submitted the Plan for formal review and comment.
Crystal Lake:		
Water quality monitoring & trend analysis	Ongoing CAMP monitoring and management level monitoring every 3 years	CAMP monitoring completed annually Management level monitoring was performed in 2008 by Barr Engineering Company to support TMDL development. Additional monitoring was also performed in 2009 to meet the requirements of the BDWMO's NPDES permit for the operation of the ferric chloride treatment system.
Habitat monitoring by volunteers (formerly aesthetic and habitat monitoring)	2002 and ongoing thereafter	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program. Implementation of the redesigned program began in 2011. The program includes monitoring of each strategic water body on a cycle of once every five years. Crystal Lake is scheduled for habitat monitoring in 2013.
Aquatic plant survey (completed by city)	2002 and every 3 years thereafter	Funded by city/cities, not by BDWMO. Latest survey completed in 2011.
Diagnostic-Feasibility Study:		• Completed diagnostic-feasibility study for Crystal and Keller Lakes 2003 and prepared report *Crystal and Keller Lakes Use Attainability Analysis* (UAA). UAA identified and recommended a number of water quality improvement projects • TMDL study for Crystal, Keller, Earley and Lee Lakes began in 2008; the draft *Crystal, Keller, and Lee Lakes Total Maximum Daily Load (TMDL) Report and the Earley Lake Water Quality Assessment*
• Watershed land use review (in preparation for diagnostic study)	2001	
• Diagnostic study of watershed runoff (e.g. P8 water quality model)	2001	
• Stormwater runoff monitoring in potential problem subwatersheds if P8 modeling indicates potential problems ("hot spots"). Use monitoring data to verify hot spots.	2002	

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
• Feasibility study	2001	*(TMDL Report)* was completed in 2010; in conjunction with the TMDL report, an implementation plan for Crystal, Keller and Lee Lakes and a protection plan for Earley Lake were developed in 2010. After addressing public comments, the TMDL was resubmitted in 2011 to the EPA and MPCA for final review and approval. The Environmental Protection Agency approved the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load (TMDL) Report and Earley Lake Water Quality Assessment* on September 30, 2011. Also, the MPCA approved the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Implementation Plan and Earley Lake Protection Plan* on November 3, 2011. Additional water quality improvement projects/initiatives may result from the TMDL study.
Implement recommended actions identified in feasibility study	2003 and thereafter	• Implementation began in 2003 and continued through 2011, including the member cities' construction of water quality improvement projects, the BDWMO's operation of the ferric chloride treatment system from 1997 – 2008 (system permanently shut down at the end of 2009), and the member cities' ongoing harvesting of curlyleaf pondweed. • The UAA was refined by recommendations in the TMDL. Implementation of additional water quality improvement projects/initiatives recommended in the TMDL study are expected after 2011.
Keller Lake:		
Water quality monitoring & trend analysis	Ongoing CLMP monitoring; CLMP is the MPCA's Citizen Lake (Secchi disc) Monitoring Program	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring). Management level monitoring was performed in 2008 by Barr Engineering Company to support TMDL development. Additional monitoring was also performed in 2009 to meet

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
		the requirements of the BDWMO's NPDES permit for the operation of the ferric chloride treatment system.
Diagnostic-Feasibility Study	2004	• Completed diagnostic-feasibility study for Crystal and Keller Lakes 2003 and prepared report *Crystal and Keller Lakes Use Attainability Analysis* (UAA). UAA identified and recommended a number of water quality improvement projects • TMDL study for Crystal, Keller, Earley and Lee Lakes began in 2008; the draft TMDL Report was completed in 2010; in conjunction with the TMDL report, an implementation plan for Crystal, Keller and Lee Lakes and a protection plan for Earley Lake were developed in 2010. After addressing public comments, the TMDL was resubmitted in 2011 to the EPA and MPCA for final review and approval. The Environmental Protection Agency approved the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load (TMDL) Report and Earley Lake Water Quality Assessment* on September 30, 2011. Also, the MPCA approved the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load Implementation Plan and Earley Lake Protection Plan* on November 3, 2011. Additional water quality improvement projects/initiatives may result from the TMDL study. • Implementation began in 2003 and continued through 2011, including the member cities' construction of water quality improvement projects, the BDWMO's operation of the ferric chloride treatment system from 1997 – 2008 (system permanently shut down a the end of 2009), and the member cities' ongoing harvesting of curlyleaf pondweed (harvesting not completed in 2009 due because of low water levels). • The UAA was refined by recommendations in the TMDL. Implementation of additional water quality improvement projects/initiatives recommended in the TMDL study are expected after 2011.

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
Habitat monitoring by volunteers (formerly aesthetic and habitat monitoring)	2002 and ongoing thereafter	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program. Implementation of the redesigned program began in 2011. The program includes monitoring of each strategic water body on a cycle of once every five years. Keller Lake is scheduled for habitat monitoring in 2015.
Orchard Lake:		
Water quality monitoring & trend analysis	Ongoing CAMP monitoring and management level monitoring every 3 years	CAMP monitoring completed annually. Management level monitoring performed in 2011 by Barr Engineering.
Habitat monitoring by volunteers (formerly aesthetic and habitat monitoring)	2002 and ongoing thereafter	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring. Implementation of the redesigned program began in 2011. The program includes monitoring of each strategic water body on a cycle of once every five years. Orchard Lake is scheduled for habitat monitoring in 2012.
Aquatic plant survey (completed by city)	2002 and every 3 years thereafter	Funded by city/cities, not by BDWMO. Latest survey completed in 2011.
Identify and implement feasible water quality improvement techniques/practices, as identified in the diagnostic feasibility study, the lake management plan, and/or future studies.	Ongoing	Implementation continues, including the city's annual harvesting of curlyleaf pondweed (2004 – 2008) and its herbicide treatments (2009 – 2011) for curlyleaf pondweed.
Kingsley Lake:		
Water quality monitoring & trend analysis	Ongoing CLMP monitoring; CLMP is MPCA's Citizen Lake (Secchi disc) Monitoring Program	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring).
Habitat monitoring by volunteers (formerly aesthetic	2002 and ongoing	Developed program in 2002, annual implementation began

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
and habitat monitoring)	thereafter	in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program. Implementation of the redesigned program began in 2011. The program includes monitoring of each strategic water body on a cycle of once every five years. Habitat monitoring of Kingsley Lake was performed in 2011. A report of the 2011 monitoring was prepared and uploaded to the BDWMO website.
Implement lake water quality management actions recommended in Table 5-3 in the BDWMO Plan, depending on water quality trends and comparison of recent water quality to action level.	As needed	No actions needed.
Lac Lavon:		
Water quality monitoring & trend analysis	Ongoing CLMP monitoring and CAMP monitoring every 3 years; CLMP is MPCA's Citizen Lake (Secchi disc) Monitoring Program	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring). In response to decreased Secchi disc readings in the lake, the BDWMO performed management level monitoring in 2008 and 2010. The 2010 monitoring included collection and analysis of sediment cores.
Habitat monitoring by volunteers (formerly aesthetic and habitat monitoring)	2002 and ongoing thereafter	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program. Implementation of the redesigned program began in 2011. The program includes monitoring of each strategic water body on a cycle of once every five years. Lac Lavon is scheduled for habitat monitoring in 2014.
Aquatic plant survey (completed by city)	2002 and every 3 years thereafter	Funded by city/cities, not by BDWMO. Latest survey completed in 2010.
Implement lake water quality management actions recommended in Table 5-3 in the BDWMO Plan, depending on water quality trends and comparison of recent water quality to action level.	As needed	In 2008, the BDWMO conducted management level monitoring of Lac Lavon, reviewed the existing lake management plan for the lake, and performed a water quality assessment of Lac Lavon, as triggered by the lake's Secchi disc reading being worse than the "action

Table 1. Status of Implementation Tasks from BDWMO *Watershed Management Plan* - through December 31, 2011

Implementation Task	Original Implementation Date from Plan	Status
		level." The 2008 monitoring results and recommendations are summarized in the BDWMO's 2009 *Lac Lavon Water Quality Assessment* report. The report recommended additional monitoring of Lac Lavon to better understand the reasons for the reduced transparency readings on the lake. In 2010, the BDWMO performed management level monitoring and collected and analyzed sediment cores. The 2010 data indicate that the phosphorus released from the sediments is not problematic. Also, 2009 and 2010 Secchi disc readings improved relative to 2008. The 2010 monitoring results and recommendations are summarized in the BDWMO's 2011 *Lac Lavon Water Quality Assessment* report. No additional action beyond the continued annual monitoring was recommended.
Sunset Pond:		
Water quality monitoring & trend analysis	Ongoing CLMP monitoring; CLMP is MPCA's Citizen Lake (Secchi disc) Monitoring Program	CAMP monitoring and trend analyses completed annually (CAMP monitoring is more comprehensive than CLMP monitoring). However, Sunset Pond is no longer considered a strategic water body by the BDWMO, so the BDWMO will no longer fund water quality monitoring; the last year of CAMP monitoring was 2011.
Habitat monitoring by volunteers (formerly aesthetic and habitat monitoring)	2002 and ongoing thereafter	Developed program in 2002, annual implementation began in 2003 and continued in 2004 - 2009. In 2010, the BDWMO redesigned the habitat monitoring program. Implementation of the redesigned program began in 2011. The program includes monitoring of each strategic water body on a cycle of once every five years. However, Sunset Pond is no longer considered a strategic water body by the BDWMO, so habitat monitoring will not be performed.
Implement lake water quality actions recommended in Table 4-1 in the draft 2012 BDWMO Plan, depending on water quality trends and comparison of recent water quality to action level.	As needed	No actions needed.

2011 Watershed Annual Report

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Black Dog Watershed Management Organization

2011 WATERSHED ANNUAL REPORT

Published March 2012

Our mission is . . .

To provide leadership in the management and stewardship of the water resources in northwestern Dakota County, Minnesota, through the cooperation of four cities and the involvement of local stakeholders.

Evaluating our Success

The BDWMO watershed management plan calls for the BDWMO and its member cities to identify outcome-based goals for specific water bodies found within the watershed, and to meet annually to discuss progress toward these goals. The BDWMO uses the following tools to track progress toward goals:

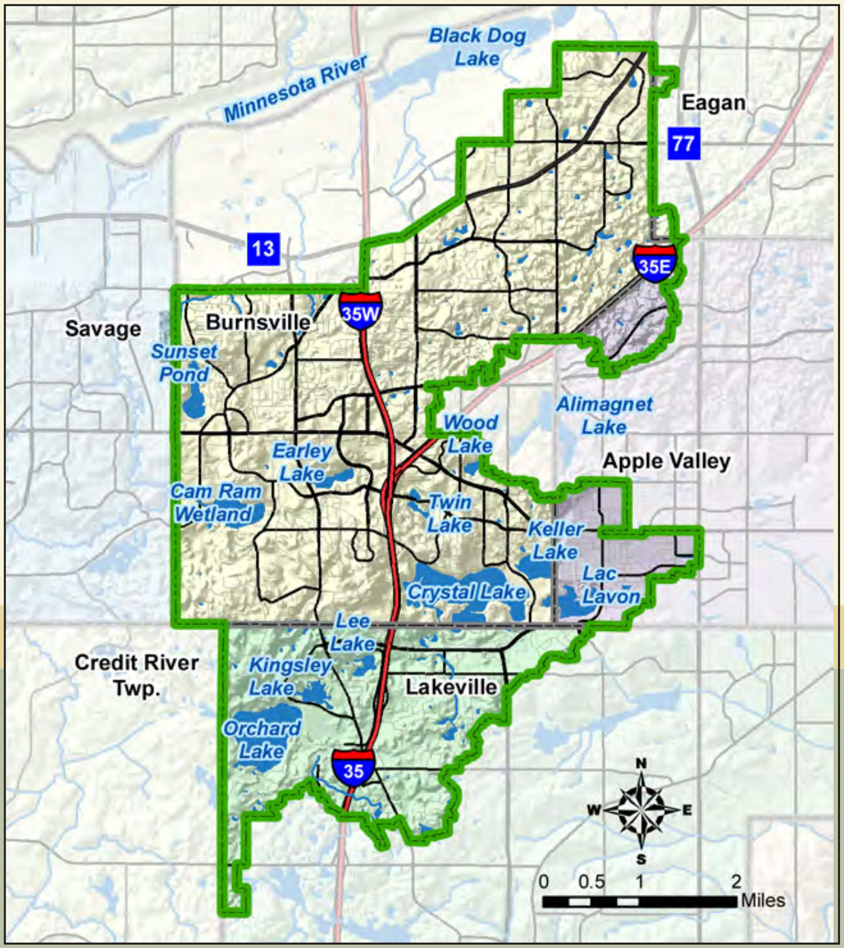
- **Trend Analysis**—The BDWMO collects water quality information to track water quality trends.
- **Performance Analysis**—The BDWMO works with the member cities to implement improvement projects, such as water quality treatment, and to measure the success of these projects.
- **Habitat Quality Analysis**—The BDWMO collects habitat quality data to detect conditions that would trigger a need for management actions.

This annual report outlines the BDWMO's goals, progress toward those goals in 2011, and plans for 2012 and beyond.

What is the Black Dog Watershed Management Organization?

The Black Dog Watershed Management Organization (BDWMO) actively manages surface water, such as that found in lakes, streams, and wetlands, located in the Black Dog and Credit River watersheds within Dakota County. To effectively manage surface water, the BDWMO develops and implements plans that address water quality, responds to drainage issues that cross multiple municipal boundaries, and assists cities within the watershed to manage surface water runoff. The BDWMO is represented by commissioners who are appointed by the cities within the watershed, which include Burnsville, Lakeville, Apple Valley, and Eagan.

The total area of the Black Dog watershed is 17,500 acres; 70 percent of the watershed lies within the city of Burnsville, 21 percent of the area is within the city of Lakeville, 8 percent is within the city of Apple Valley, and 1 percent is within the city of Eagan.



In this Issue

Update on Three-Lake TMDL

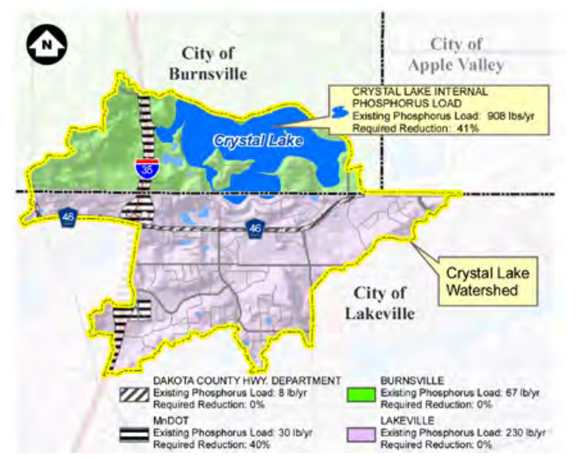
The Black Dog WMO, together with the Cities of Lakeville, Burnsville and Apple Valley have been monitoring and working to improve water quality in Crystal, Keller, Lee, and Earley lakes for many years. In 2002, these lakes were listed on the Minnesota Pollution Control Agency's (MPCA) Impaired Waters List for excess nutrients. As a result, the MPCA required that a TMDL analysis* be conducted to quantify the amount of phosphorus entering these lakes from their watersheds (runoff from surfaces such as roofs, driveways, streets, and lawns) and other sources, and the reduction in that phosphorus loading required for them to meet applicable MPCA water quality standards. Based on the most recent 10 years of water quality data, Earley Lake is now meeting state water quality standards and was removed from the TMDL.

From 2008 to 2011, the BDWMO, along with its member communities, the MPCA, and other state and local agencies, developed the *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load (TMDL) Report* and the *Earley Lake Water Quality Assessment (TMDL report)*. This report was approved by the MPCA and the EPA in September 2011. Additionally, a separate implementation plan, *Crystal, Keller,and Lee Lakes Nutrient Impairment Total Maximum Daily Load Implementation Plan and Earley Lake Protection Plan*, was developed and approved by the MPCA in October 2011.

As part of the TMDL development, phosphorus load allocations were established for each lake. To achieve the load allocations, phosphorus reductions are required. For Crystal Lake, a load reduction of 381 pounds per year is required to meet the MPCA water quality standards. For Keller and Lee Lakes, the required phosphorus load reductions are 450 and 60 pounds per year, respectively.

There are a variety of sources of phosphorus to each lake and include both external sources (runoff from the watershed, atmospheric deposition, and for Crystal Lake, discharges from upstream lakes) and internal sources (release from sediments and curlyleaf pondweed). To achieve the required phosphorus reductions, the intent is to first manage the external sources of phosphorus through the implementation of best management practices (BMPs) such as wet ponds, infiltration and filtration practices, hydrodynamic devices, and underground treatment systems. "Housekeeping" practices such as street sweeping can also reduce external loads. After the external phosphorus sources are addressed, internal sources of phosphorus can be managed through the treatment of lake sediments with alum or the management of curlyleaf pondweed.

The *Crystal, Keller, and Lee Lakes Nutrient Impairment Total Maximum Daily Load (TMDL) Report* and the *Earley Lake Water Quality Assessment (TMDL report)* and the associated implementation plan are available on the BDWMO's website at: http://blackdogwmo.org/index.html.



Phosphorus load reduction requirements for Crystal Lake, per draft TMDL.

*A total maximum daily load (TMDL) analysis is an assessment of how much of a specific pollutant a water body (lake, stream, or river) can receive and still meet established water-quality standards.

Draft Watershed Management Plan Completed

In late 2011, the Black Dog WMO submitted its draft Watershed Management Plan for 60-day agency review. The update of the 2002 Watershed Management Plan began in late 2010 and continued throughout 2011 with updates to key plan sections. These included the land and water resource inventory, regulatory considerations, assessment of issues and opportunities, goals and policies and implementation program. The Planning Advisory Group (PAG) met twice in 2011 to review and comment on changes to plan sections. The Black Dog WMO commissioners met throughout 2011 to oversee plan development, participate in PAG meetings, review PAG comments and provide strategic direction to development of goals, policies and implementation program development.

Key issues addressed in the planning process include selection of strategic waterbodies, stormwater management performance standards, allocation of costs for internal load reduction projects (per TMDL implementation plan), and strengthening of existing policies. The 60-day agency review ended on January 13, 2012. The next step will be to revise the plan based on comments received during the agency review. After this, a public hearing will be held by the commission in early 2012 to gather additional public input on the plan. With this input, final changes will be made to the plan. Approval of the final plan by the Board of Water and Soil Resources (BWSR) and adoption of the approved plan by the Black Dog WMO is expected by fall 2012, with final distribution thereafter.

The Watershed Management Plan provides the vision and guidelines for managing surface water within the boundaries of the WMO. BWSR requires WMOs to update their plans every 10 years. The new plan will be the BDWMO's third. The PAG has been advising the BDWMO commissioners on plan development. The PAG includes member city staff, citizens from the member cities and other stakeholders.

Water Quality Improvement Projects in Crystal and Keller Lakes Implementation Program

Based on the recommendations in the Crystal and Keller lakes use attainability analysis (UAA), the BDWMO developed an implementation program to improve the water quality of Crystal and Keller lakes. The table below summarizes the implementation program, the year of implementation, and funding source for each element of the program (www.blackdogwmo.org/attainability.html). The UAA was refined by the Three-Lake TMDL recommendations (see story page 2). Cities will be reporting on TMDL progress as part of their MS4 permits.

Implementation Program Elements		Implementation Date	Funding Source
1	Phosphorus fertilizer limitation	2003 & ongoing	N/A
2	Excavate and enhance Redwood Pond	2005	City of Apple Valley
3	Add two regional infiltration basins 3a Regional infiltration basin (north of Valley Middle School)	Modified by TMDL implementation plan[1]	City of Apple Valley
	3b Regional infiltration basin (west of Buck Hill Park)	2005	City of Burnsville, BDWMO, and $32,000 Metropolitan Council MetroEnvironment Partnership Grant
4	Upgrade select existing ponds to NURP design criteria 4a Enlarge and excavate 153rd St. Pond	Addressed by Cedar Avenue Reconstruction[2]	City of Apple Valley
	4b Excavate north of Southcross Drive & Keller Lake Drive	2007	City of Burnsville
	4c Excavate Keller Lake Pond	2007	City of Burnsville
	4d Excavate pond at northeast edge of Keller Lake	2007	City of Burnsville
	4e Excavate Bluebill Pond	2005	City of Lakeville
5	Add regional water quality treatment pond—Whitney Pond (southeast edge Keller Lake)	2011	City of Apple Valley and $60,000 Clean Water Legacy Nonpoint Source Restoration & Protection Fund Grant
6	Resume operation of ferric chloride ($FeCl_3$) treatment system in near-surface withdrawal mode	2003–2009[3]	Black Dog WMO
7	Mechanical harvesting of curlyleaf pondweed in Crystal Lake	2003 & ongoing	Lakeshore homeowners and City of Burnsville
8	Mechanical harvesting of curlyleaf pondweed in Keller Lake	2004 & ongoing[4]	Lakeshore homeowners, City of Apple Valley, and City of Burnsville

🟨 **Completed Projects**
🟩 **Ongoing Projects**
⬜ **Planned Projects**

[1] The TMDL implementation plan (see story on page 2) recommends multiple small-scale infiltration/filtration projects—watershed-wide—to reduce runoff-borne phosphorus, rather than a single large-scale regional infiltration basin. The City of Apple Valley may still construct a smaller rainwater garden project in this location.

[2] As designed, the primary discharge from the 153rd Street Pond is to the Vermillion River and only high flows are routed to Keller Lake. Additionally, as part of the Cedar Avenue reconstruction, the contributing watershed area to the 153rd Street Pond was reduced.

[3] System permanently shut down at the end of 2009.

[4] Harvesting not completed in 2009 because of low water levels.

If all of the recommended program elements are implemented, the Crystal and Keller lakes UAA predicts Crystal Lake water clarity would improve to a summer-average Secchi disc transparency of 2.1 m (6.9 ft), and Keller Lake would improve to a summer-average Secchi disc transparency of 1.8 m (6.0 ft).

Orchard Lake Experiences Good Water Clarity Four Seasons Running

The BDWMO is happy to announce that Orchard Lake—a 243-acre lake in the northwest corner of Lakeville—has experienced its fourth consecutive season of good grades for water quality. Prior to the 2008 season, the summer-average water clarity fluctuated above and below the BDWMO water clarity action level for Orchard Lake (see Orchard Lake figure on page 7). In 2008, water clarity improved substantially from the previous 2007 season, and has been better than the action level for four years in a row (2008-2011). Summer average water clarity, measured with a Secchi disc, has been better than 9 feet for the past four years (the BDWMO action level for Orchard Lake is 5.9 feet).

In addition to measuring water clarity with a Secchi disc, several other measurements of water quality were collected in 2011, including concentrations of phosphorus and chlorophyll *a* measured at the lake surface. Concentrations of phosphorus were measured at regular depth intervals in the lake as a way to gauge the degree to which internal loading of phosphorus from lake sediment might be occurring. Internal loading of phosphorus is a natural process that occurs in Minnesota lakes, but the rate of internal loading can increase substantially in lakes that have excessive amounts of phosphorus in the sediment. Depletion of levels of oxygen in the deeper water of the lake can also increase the rate of internal loading of phosphorus in a lake.

Improvements in lake water quality in recent years may be in part due to the City of Lakeville's efforts to manage curlyleaf pondweed. Curlyleaf pondweed is a non-native aquatic plant that is known to increase phosphorus concentrations in lakes during the summer months. Curlyleaf pondweed grows and dies earlier in the season than native aquatic plants. The die off of curlyleaf pondweed in mid-summer releases phosphorus into the lake, contributing to mid-summer algae growth. Additionally, aeration devices were installed in Orchard Pond, a wetland that contributes flow to Orchard Lake. The aeration devices have operated for the past two seasons.

Introducing Whitney Pond

In the fall of 2011, Burnsville gained a new 2-acre stormwater treatment basin. Whitney Pond is situated west of a long-standing tree line that divides Burnsville's Lac Lavon Park and Keller Park in Apple Valley.

The project is an excellent example of the inter-community cooperation that exists in the Black Dog WMO. Although the pond resides in Burnsville on land donated by the city, it actually treats stormwater from a significant portion of the Keller Lake watershed in Apple Valley that would otherwise drain to Keller Lake untreated. And since Keller Lake discharges to Crystal Lake, any improvement to Keller Lake's water quality will ultimately be good for both communities.

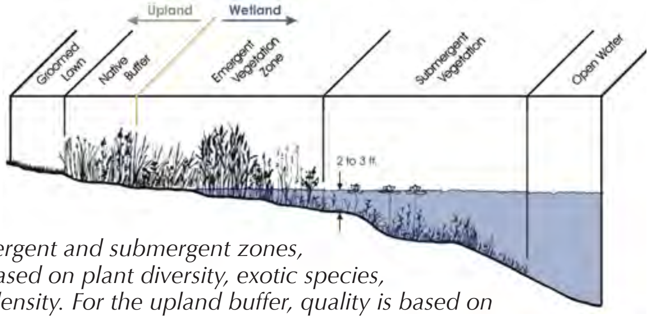
A portion of stormwater flow from a previously existing storm sewer pipe in Apple Valley is now diverted to the pond through a new storm sewer line. A special skimmer structure minimizes the amount of debris that is deposited in the new pond. Urban stormwater runoff generated within the WMO is rich in phosphorus, and has the potential to degrade lake water quality if not properly treated. Phosphorus concentration is directly related to the abundance of algae in lakes. The goal of the stormwater pond is to reduce the phosphorus load to Keller Lake to meet the MPCA's total maximum daily load requirements (see TMDL study on page 2).

The project, constructed and maintained by the City of Apple Valley, also included construction of a new trail loop around the pond and reconstruction of areas disturbed by the project. In the spring of 2012, pond slopes will be vegetated with a special seed mixture consisting of prairie grasses and wildflowers.

Habitat Monitoring Program

In 2002, the BDWMO created a program for monitoring the habitat quality of strategic water resources in the watershed, including biological and physical indicators, such as upland and aquatic vegetation, buffer zones, erosion, sedimentation, and the presence of non-native exotic species. The program also recommends management actions based upon monitoring results.

In 2010, the BDWMO redesigned the habitat monitoring program and did not conduct monitoring. Beginning in 2011, the program includes monitoring of each strategic water body on a cycle of once every five years, rather than every water body every year. Kingsley Lake was monitored in 2011. Monitoring included a meandering survey of the entire lake (in the submergent, emergent, and upland buffer zones—see figure below), rather than only at sample plots, as done in the past. The meandering survey results, along with parcel data, are used to identify possible locations for restoration and preservation.



For the emergent and submergent zones, quality is based on plant diversity, exotic species, and plant density. For the upland buffer, quality is based on vegetation density, exotic species, buffer width, and buffer continuity.

Modified from: Lakescaping for Wildlife and Water Quality

Water Quality Monitoring Program

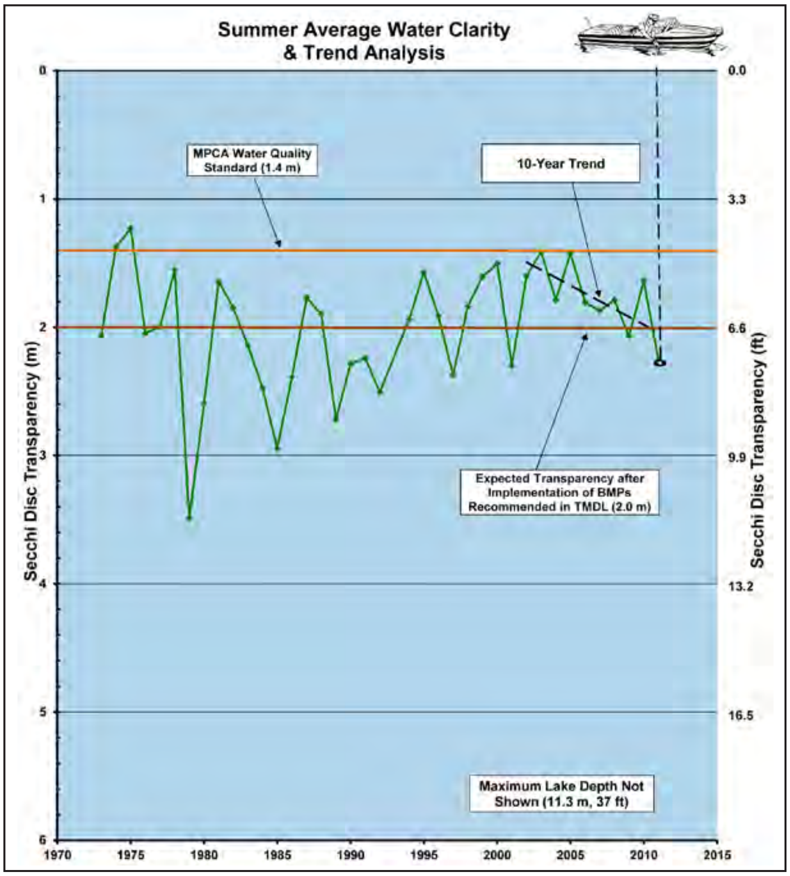
The Black Dog WMO and member cities continued to monitor several of its lakes during 2011 through the Metropolitan Council's Citizen-Assisted Monitoring Program (CAMP) to detect any water quality changes that would require management action by the WMO. The focus was on three water quality indicators—total phosphorus and chlorophyll *a* concentrations, plus Secchi disc transparency. All three correlate strongly to the open-water nuisance conditions of lakes (i.e., algal blooms).

Long-term monitoring is important because lakes can change from year to year. Only when several years of data are compiled do trends become apparent. Because the MPCA periodically evaluates water quality data from the most recent ten-year period to determine if a lake violates applicable swimmable use standards, the WMO has adopted the same time convention for conducting its annual trend analyses. Graphs on this page and subsequent pages show historic trends in water quality.

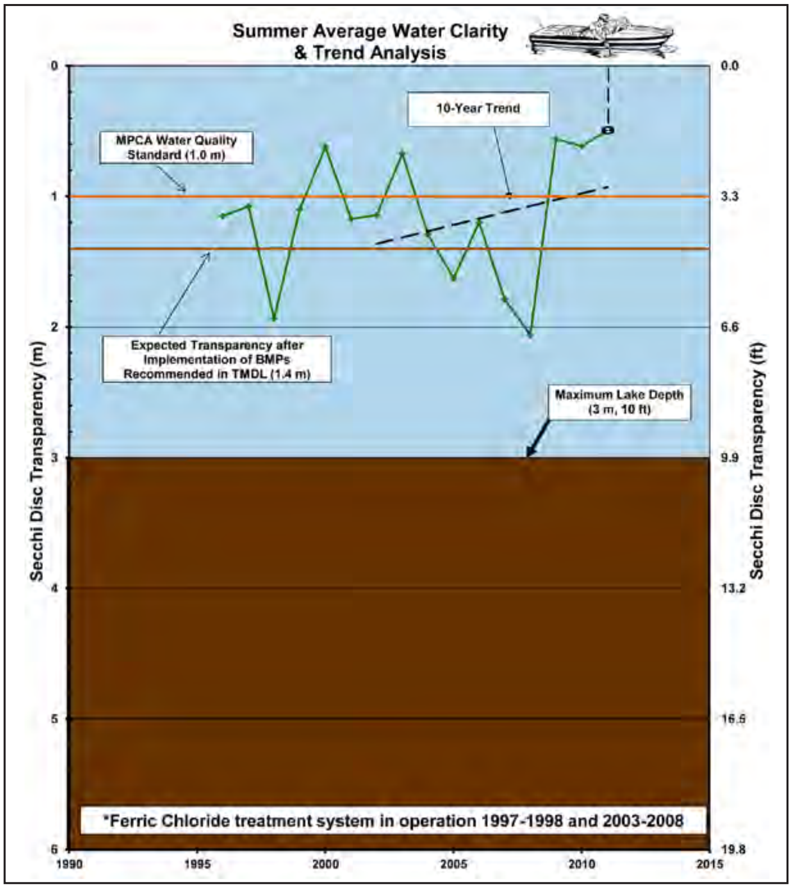
Crystal Lake Water Quality Monitoring—All three water quality indicators showed an improvement in water quality in 2011 when compared to 2010. Transparency readings increased and chlorophyll *a* concentrations and total phosphorus concentrations decreased. The ferric chloride treatment system was permanently shut down at the end of 2009. The three-lake TMDL study and implementation plan identifies the water quality improvement measures needed to achieve the BDWMO and MPCA goals for Crystal Lake (see story, page 2). Habitat monitoring is scheduled for Crystal Lake in 2013.

Keller Lake Water Quality Monitoring—All three water quality indicators showed a minor degradation in water quality in 2011 when compared to 2010. Transparency readings were lower and chlorophyll *a* concentrations and total phosphorus concentrations were higher. However, there is no significant trend in chlorophyll *a* or total phosphorous levels over the ten-year period from 2002 to 2011. The ferric chloride treatment system was permanently shut down at the end of 2009 and the water quality has generally degraded since then. The three-lake TMDL study and implementation plan identifies the water quality improvement measures needed to achieve the BDWMO and MPCA goals for Keller Lake (see story, page 2). Habitat monitoring is scheduled for Keller Lake in 2015.

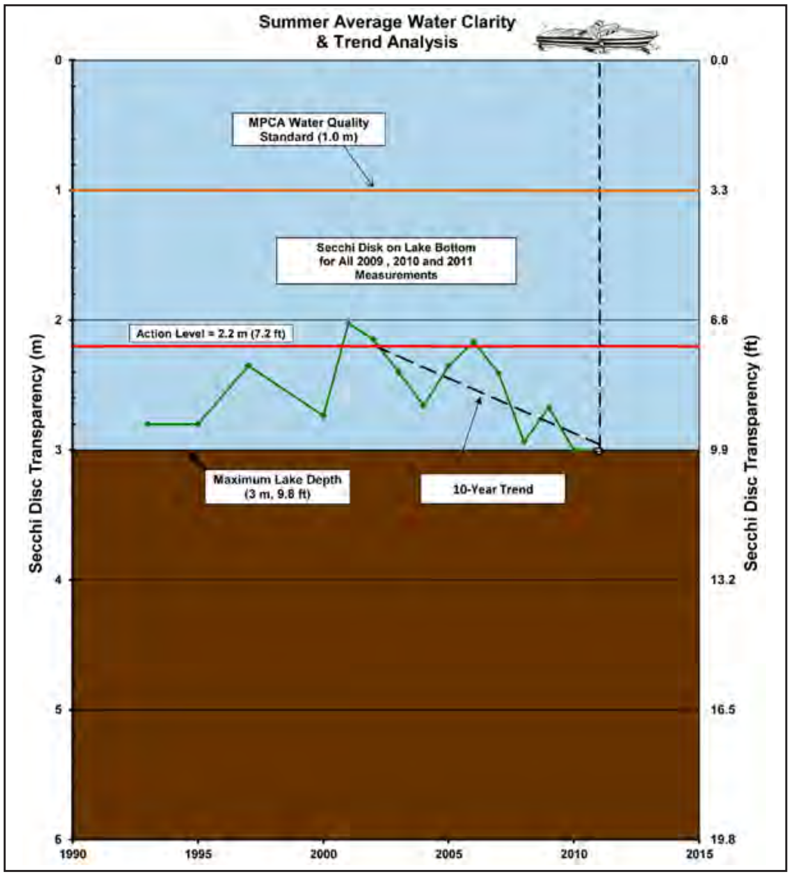
Crystal Lake



Keller Lake

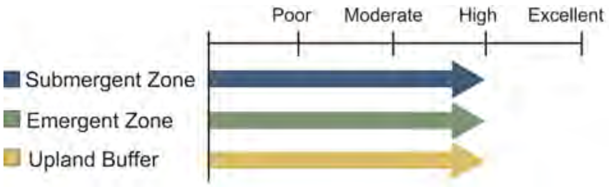


Kingsley Lake

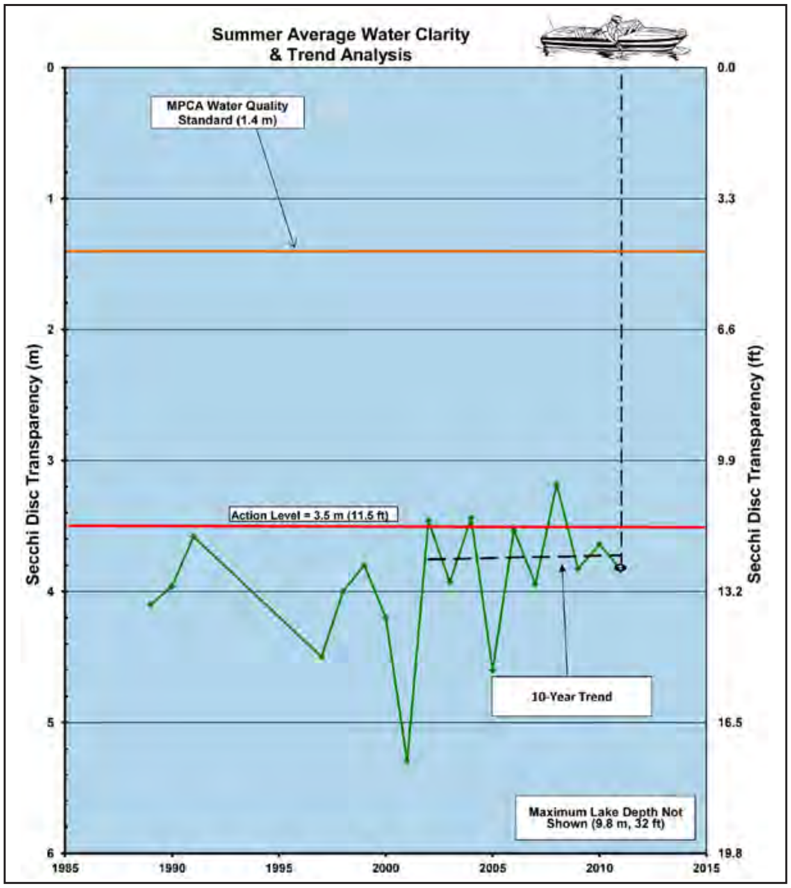


Water Quality Monitoring—Water quality monitoring data from 2010 show continued good water quality in Kingsley Lake, with transparency readings at the bottom of the lake and continued low chlorophyll *a* concentrations. Total phosphorus concentrations increased in 2011 from 2010, showing minor degradation in water quality, however, there is still an overall decreasing trend in total phosphorus concentrations over the ten-year period from 2002 to 2011. The BDWMO will continue to monitor the water quality of Kingsley Lake.

Habitat monitoring results for 2011 show continued high quality ratings within the submergent, emergent, and upland buffer zones for Kingsley Lake. Management of invasive vegetation such as common buckthorn, purple loosestrife, hybrid cattail, and reed canary grass was recommended to help improve wildlife habitat. Additional recommendations were made for stormwater management improvements, erosion control measures, and increased naturalized vegetation along the shoreline, which could help improve water quality. These improvements could be conducted in cooperation with residents and businesses who share the shoreline.

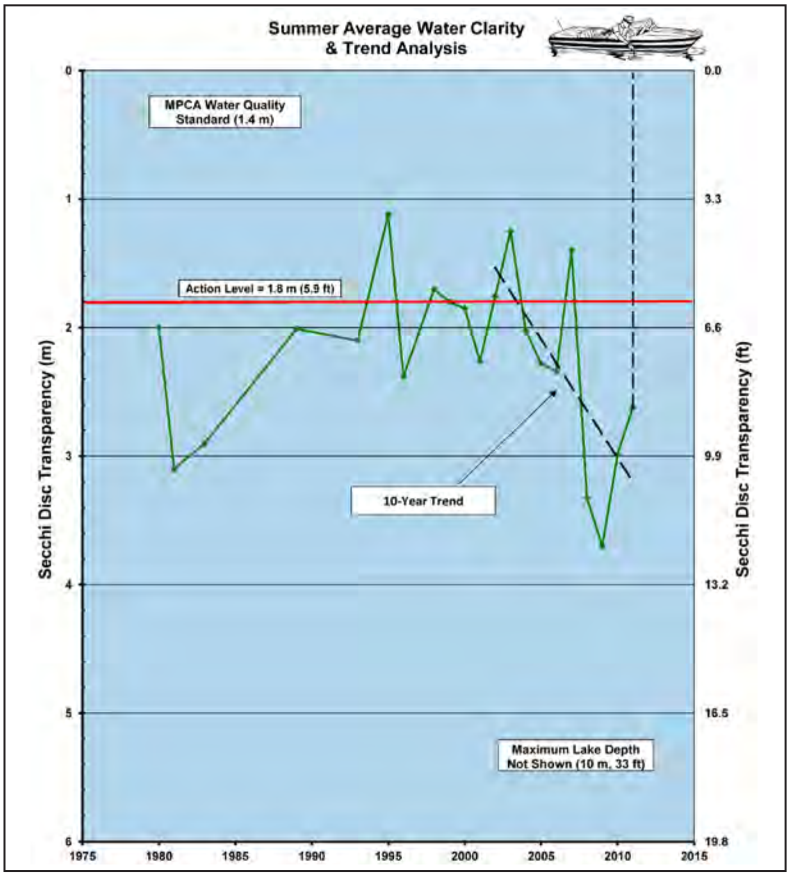


Lac Lavon



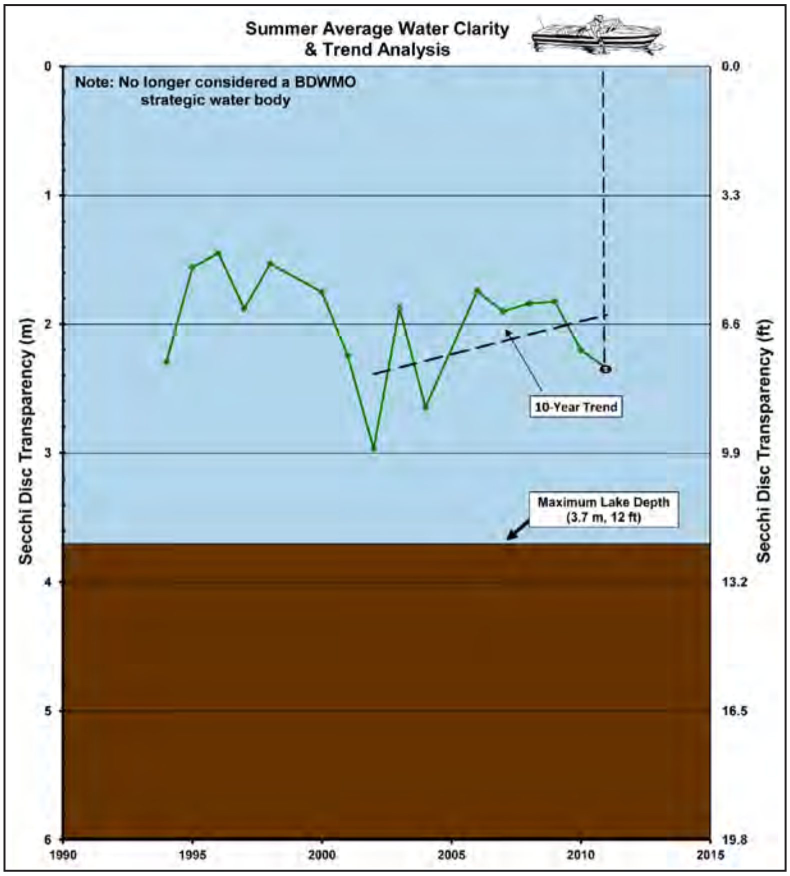
Water Quality Monitoring—Lac Lavon has excellent water quality. Transparency readings show an improvement in water quality in 2011 when compared to 2010. Total phosphorus concentrations increased slightly in 2011 from 2010, showing water quality degradation. However, chlorophyll *a* concentrations decreased slightly in 2011 from 2010, showing some water quality improvement. Habitat monitoring is scheduled for Lac Lavon in 2014.

Orchard Lake



Water Quality Monitoring—In 2011, the BDWMO performed more detailed management level monitoring on the lake (see story, page 4). Habitat monitoring is scheduled for Orchard Lake in 2012.

Sunset Pond



Water Quality Monitoring—Water quality monitoring data show continued improvements in the water quality of Sunset Pond in 2011, when compared to 2010, with total phosphorus concentrations decreasing and transparency readings increasing, and chlorophyll *a* concentrations remaining low. Sunset pond is no longer considered a BDWMO strategic water body, so monitoring data will not be analyzed in 2012.

Black Dog Watershed Management Organization

Board of Commissioners

Representing Burnsville:
Roger Baldwin, Chair
Loren Knott, Treasurer/Secretary
Tom Harmening, Commissioner
Mike Hughes, Alternate

Representing Apple Valley and Eagan:
Mary Hamann-Roland, Vice Chair
Greg Helms, Alternate

Representing Lakeville:
Scott Thureen, Commissioner
Tom Goodwin, Alternate

Engineering Consultant:
Karen Chandler, P.E., Barr Engineering Co.
Henry Runke, Ph.D., Barr Engineering Co.

Legal Consultant:
Roger Knutson, Campbell Knutson, P.A.

Regular board meetings . . .

are held at 5:00 p.m. on the third Wednesday of the month at the Burnsville Maintenance Facility at 13713 Frontier Court.

For more information, please contact:

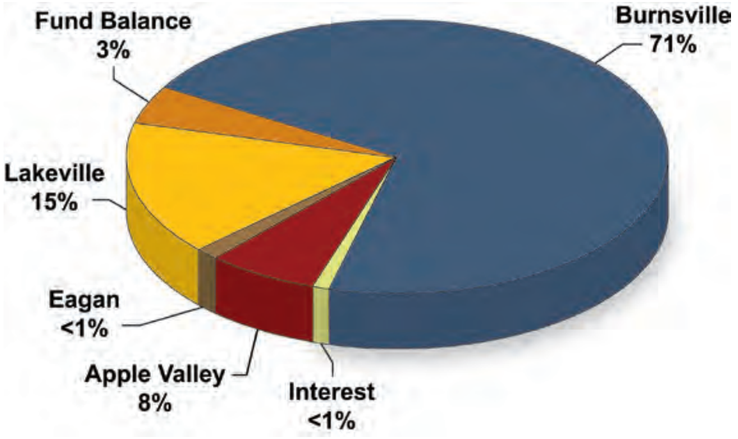
Daryl Jacobson, Administrator
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337
Telephone: 952-895-4574
Fax: 952-895-4531

Website: www.blackdogwmo.org

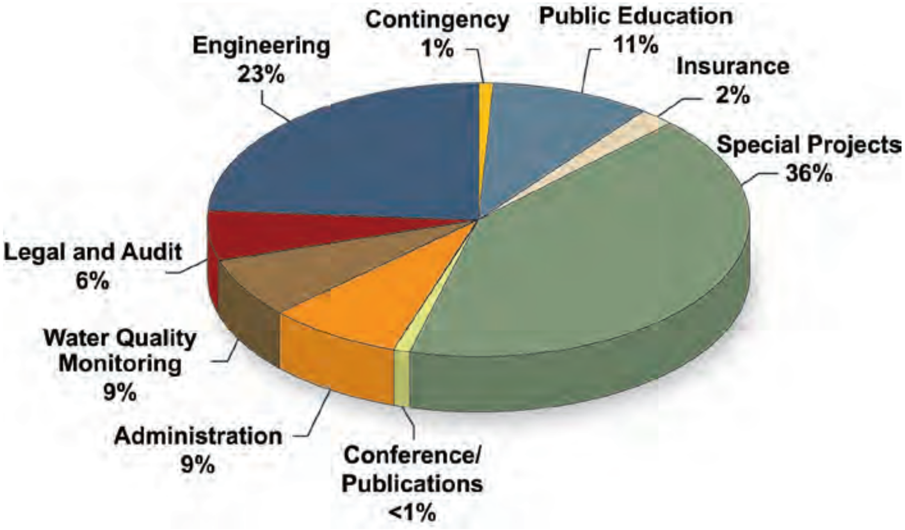
2012 Budget

Engineering Fees	$33,000
Legal and Audit Fees	$7,950
Administrative Services	$13,000
Public Education	$15,600
Insurance	$3,000
Special Projects	$51,602
Conference/Publications	$500
Water Quality Monitoring	$12,100
Contingency	$5,000
Total	**$141,752**

2012 Income



2012 Expenditures



2011 Water Quality Data

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The Black Dog WMO funds the water quality monitoring of its water bodies designated as “strategic” by the Black Dog WMO. In 2011, the strategic water bodies included:

1. Crystal Lake
2. Keller Lake
3. Kingsley Lake
4. Lac Lavon
5. Orchard Lake
6. Sunset Pond (as of 2012, no longer a Black Dog WMO strategic water body)

Some of the water quality data for the strategic water bodies is presented on the following pages. First are a series of figures that summarize the historical summer average (late-May through early-September) total phosphorus, chlorophyll *a*, and Secchi disc transparency data. The figures also display the trend lines for the past 10 years’ water quality data, if a trend was observed. The linear best-fits were determined using a “least squares” regression analysis of the summer averages of the past 10 years (2002 – 2011) of data.

Second are a series of tables that show the results of the water quality monitoring for each data collection date in 2011.

Water quality monitoring data is also available for other “non-strategic” water bodies in the Black Dog WMO. In 2011, the member cities funded participation in the CAMP program for the following non-strategic water bodies

- Earley Lake (City of Burnsville)
- Twin Lake (City of Burnsville)
- Wood Pond (City of Burnsville)
- Lee Lake (City of Lakeville)

Results of the 2011 water quality monitoring of these water bodies is available from the Metropolitan Council’s CAMP program.

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Historical Water Quality Data—Figures

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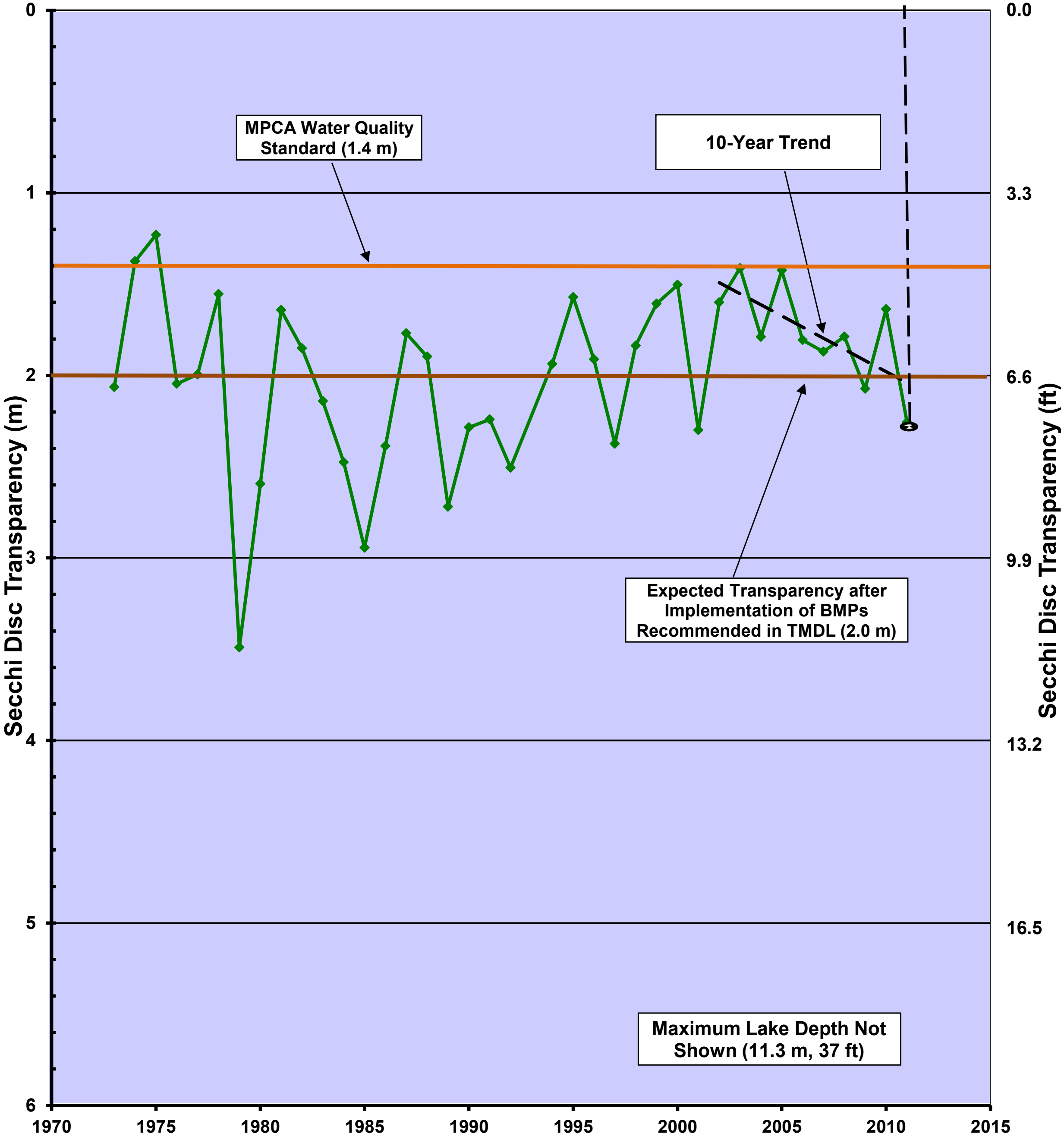
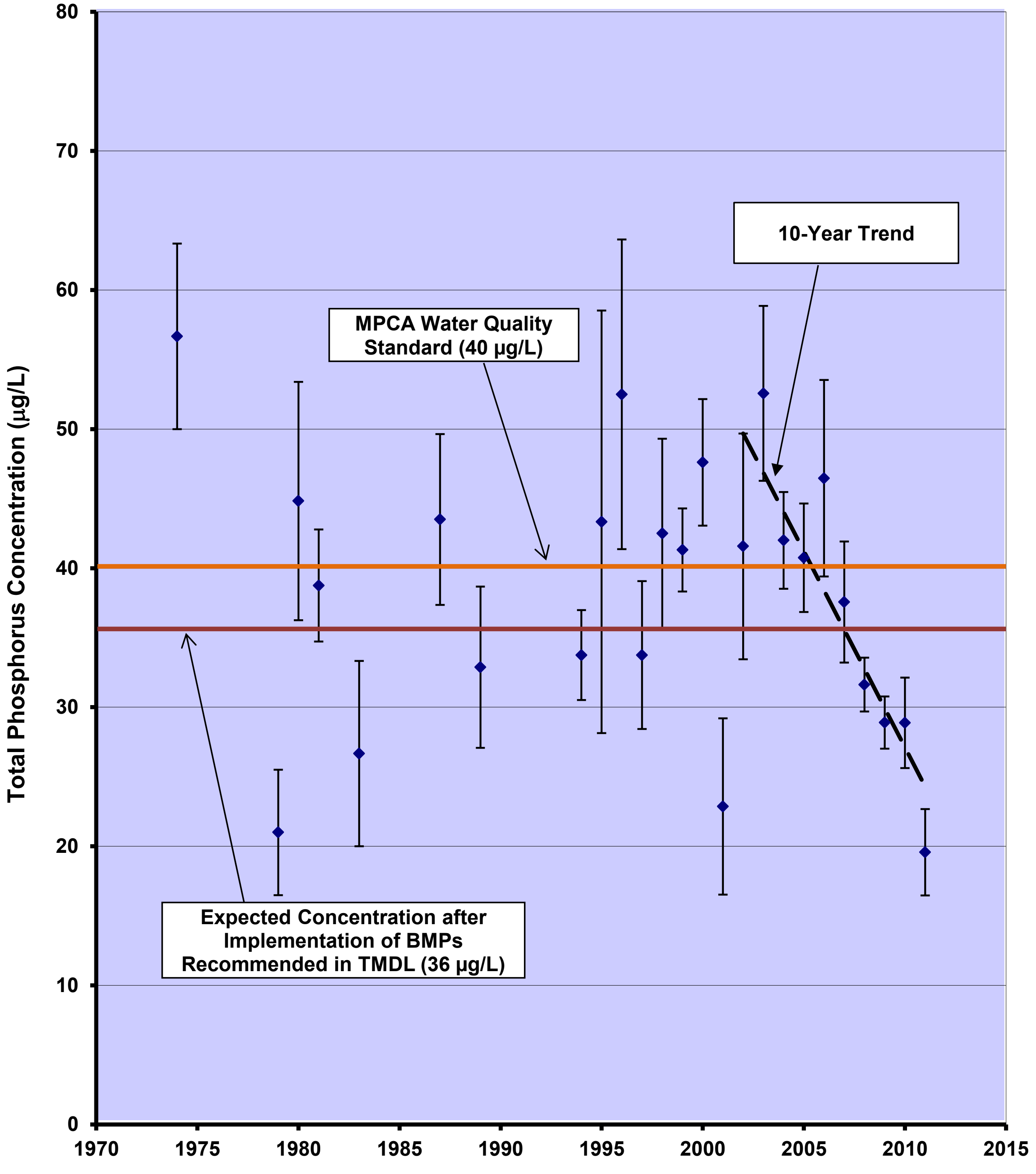
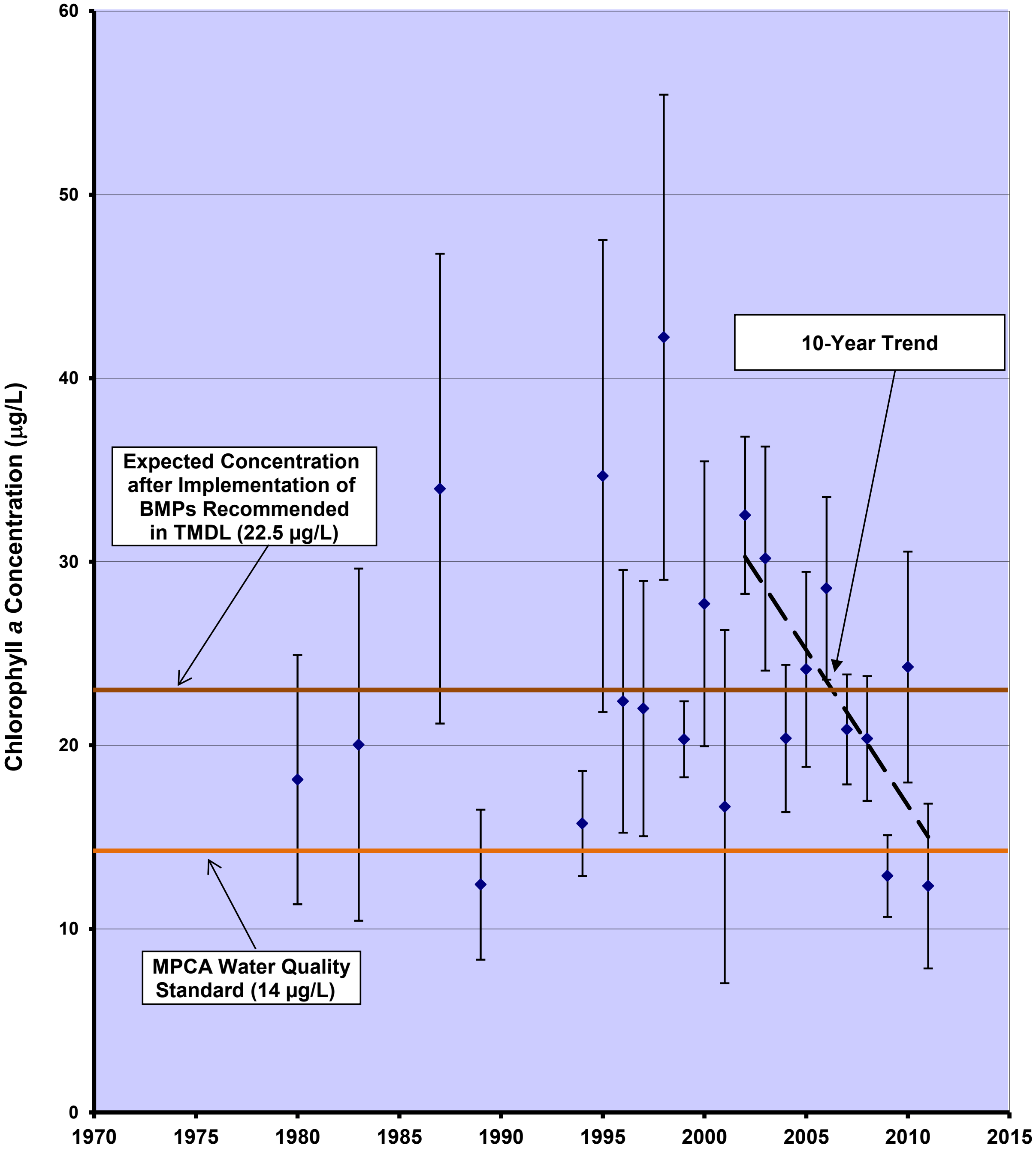
Crystal Lake (Burnsville & Lakeville) Summer Average Water Clarity & Trend Analysis

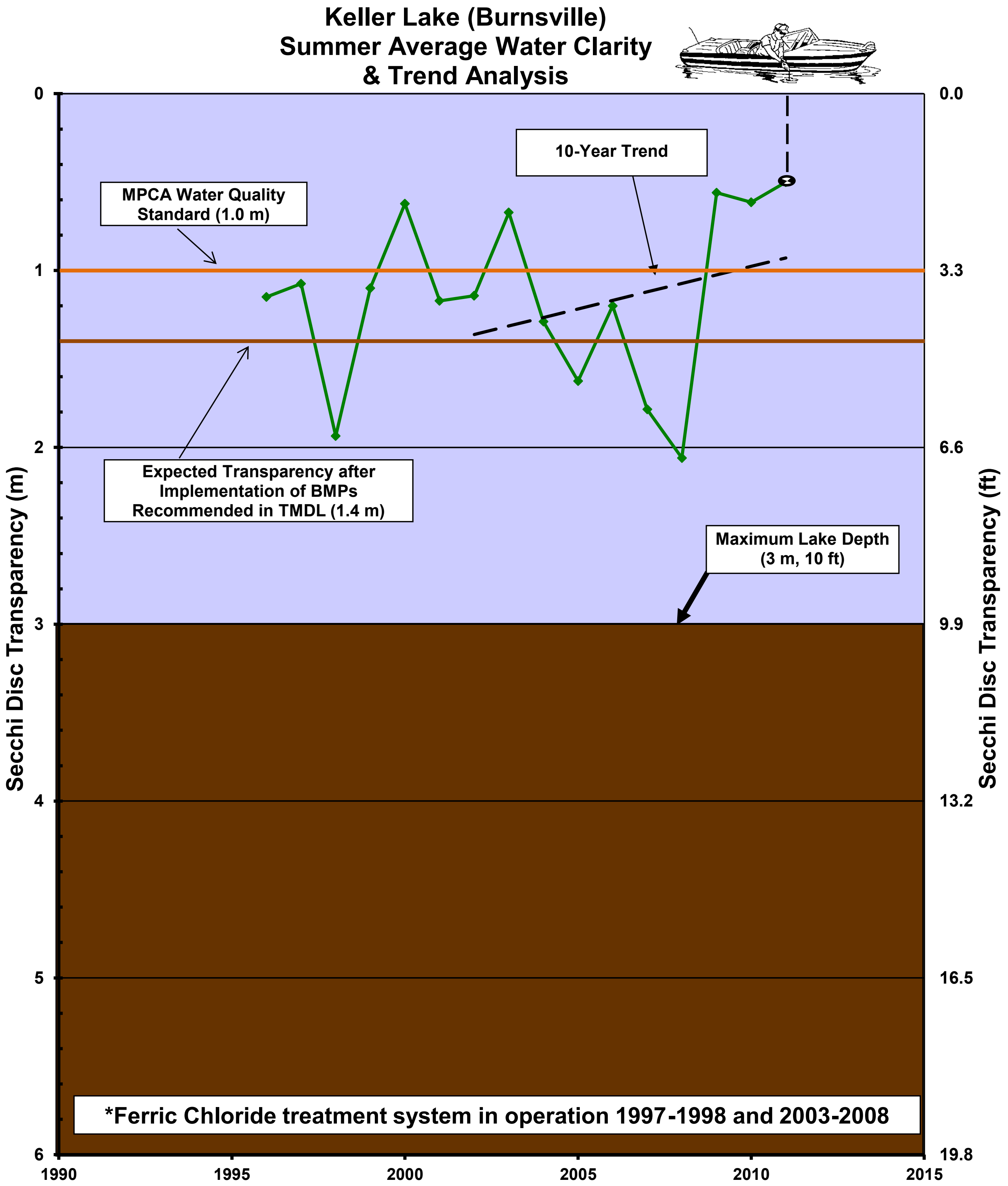


Crystal Lake (Burnsville & Lakeville)
Summer Average Surface Total Phosphorus Concentrations & Trend Analysis
BDWMO Category I & MPCA Deep Lake

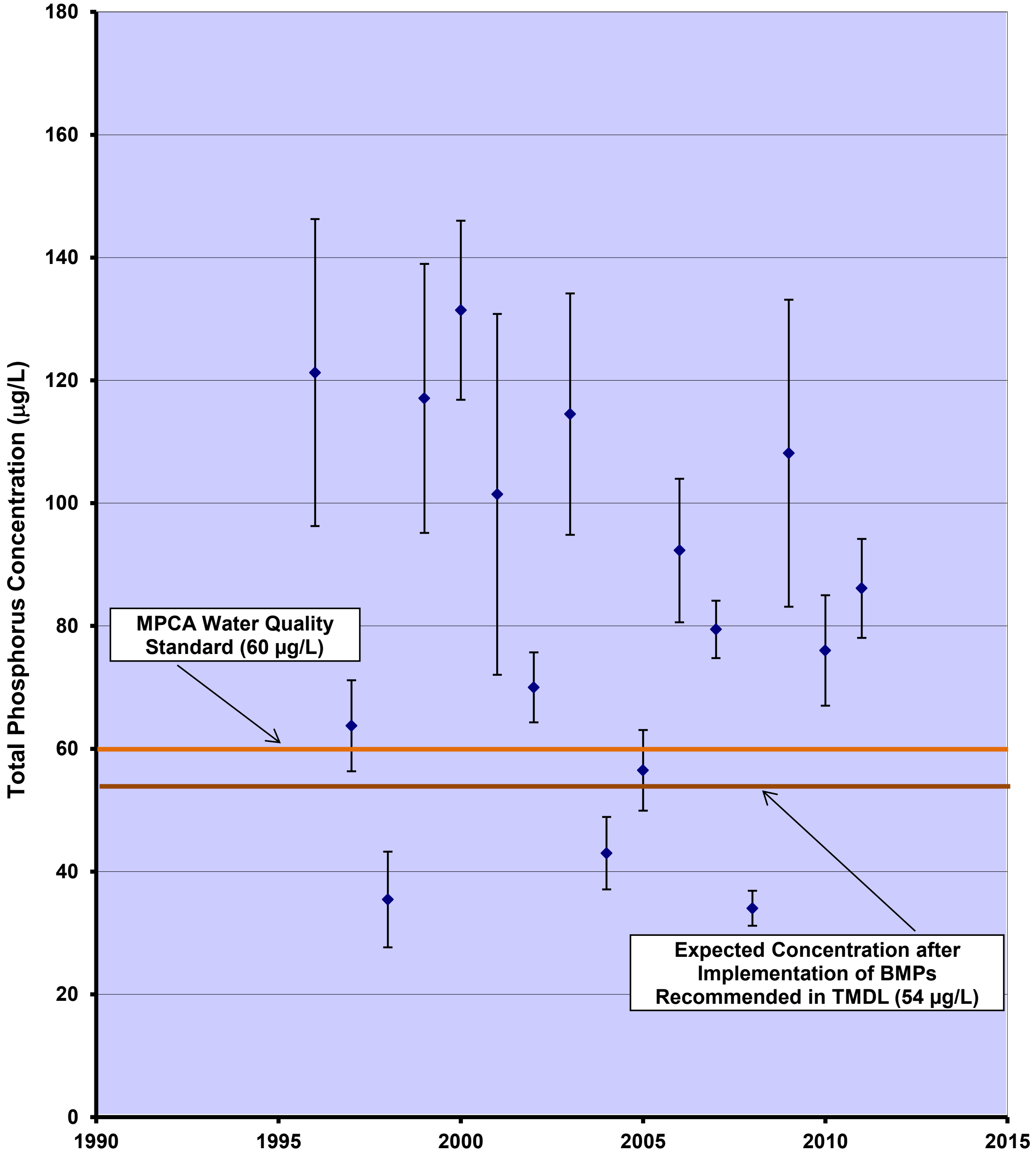


Crystal Lake (Burnsville & Lakeville)
Summer Average Surface Chlorophyll *a* Concentrations & Trend Analysis
BDWMO Category I & MPCA Deep Lake




Keller Lake (Burnsville)
Summer Average Water Clarity
& Trend Analysis
10-Year Trend
MPCA Water Quality Standard (1.0 m)
Expected Transparency after Implementation of BMPs Recommended in TMDL (1.4 m)
Maximum Lake Depth (3 m, 10 ft)
*Ferric Chloride treatment system in operation 1997-1998 and 2003-2008
Secchi Disc Transparency (m)
Secchi Disc Transparency (ft)
0
1
2
3
4
5
6
0.0
3.3
6.6
9.9
13.2
16.5
19.8
1990
1995
2000
2005
2010
2015

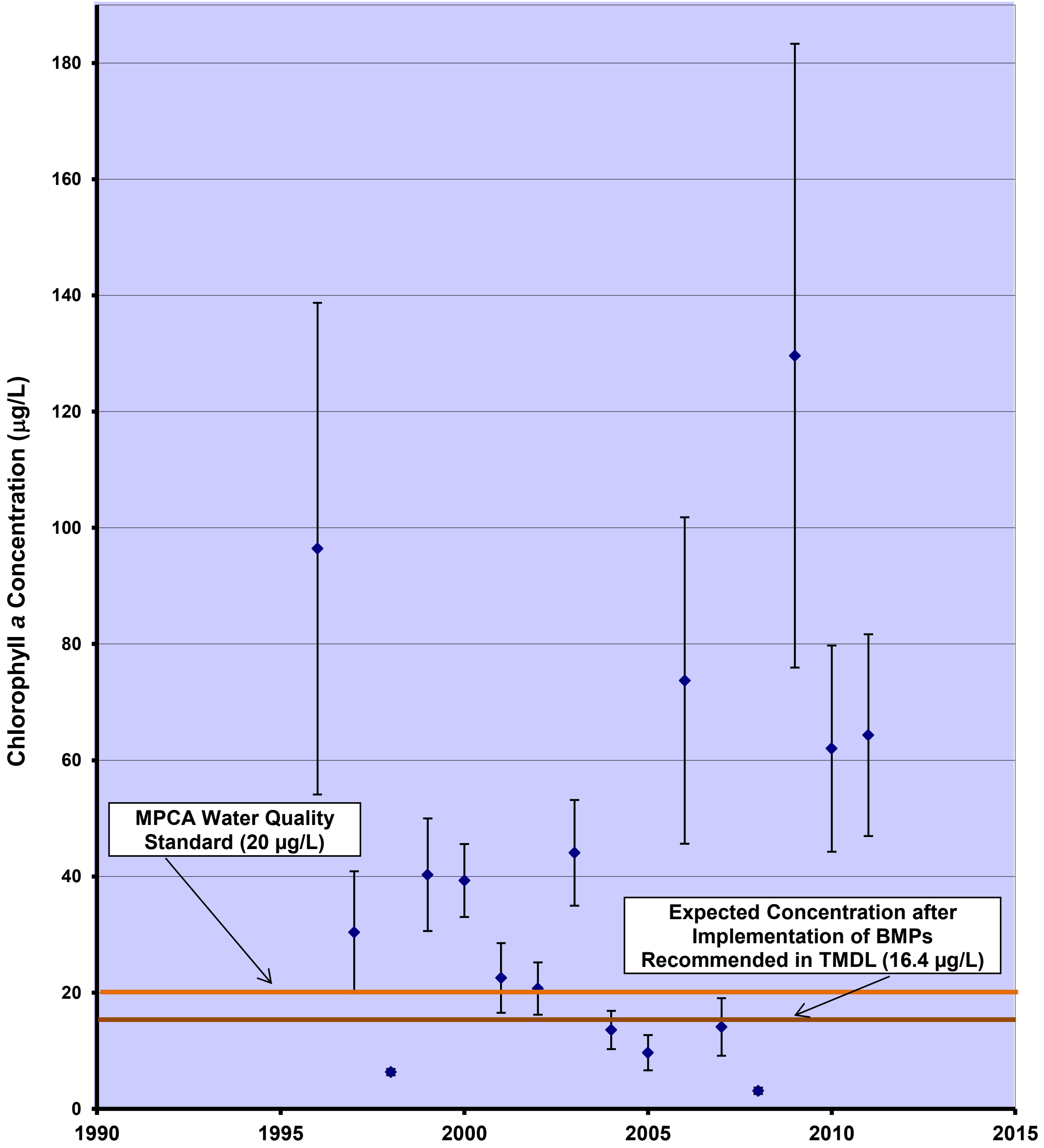
Keller Lake (Burnsville)
Summer Average Surface Total Phosphorus Concentrations & Trend Analysis
BDWMO Category III & MPCA Shallow Lake



MPCA Water Quality Standard (60 µg/L)

Expected Concentration after Implementation of BMPs Recommended in TMDL (54 µg/L)

Keller Lake (Burnsville)
Summer Average Surface Chlorophyll *a* Concentrations & Trend Analysis
BDWMO Category III & MPCA Shallow Lake



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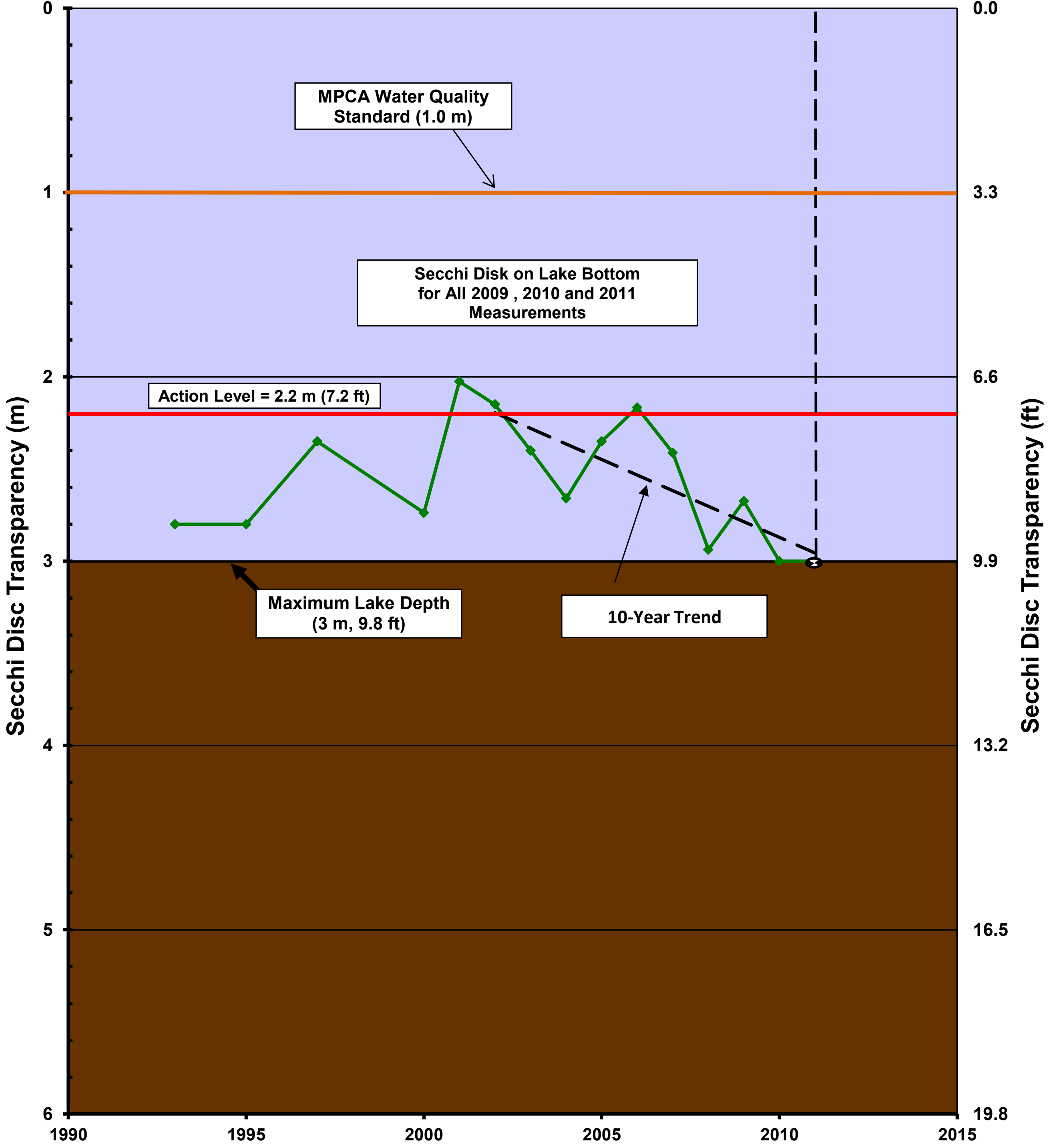
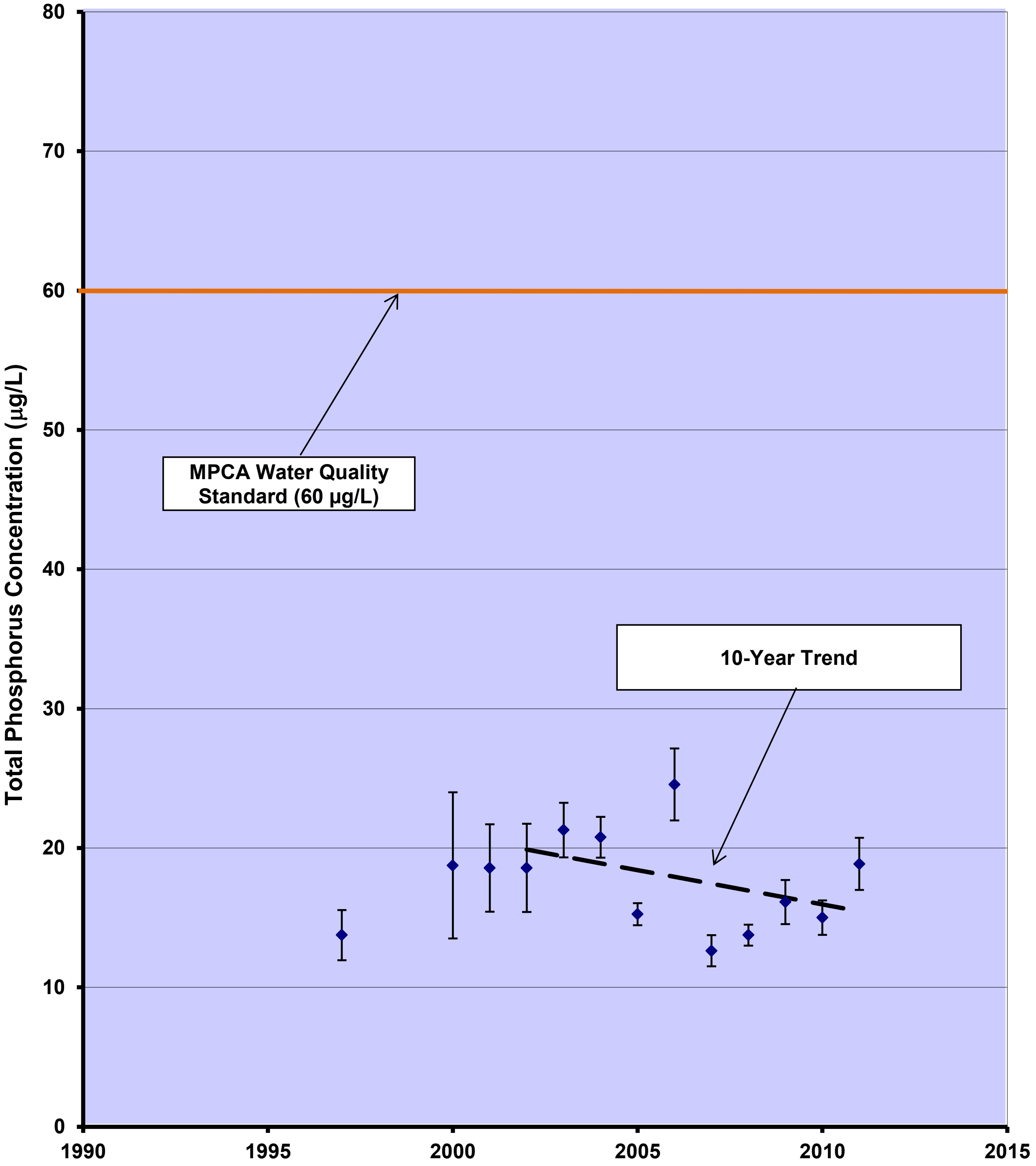
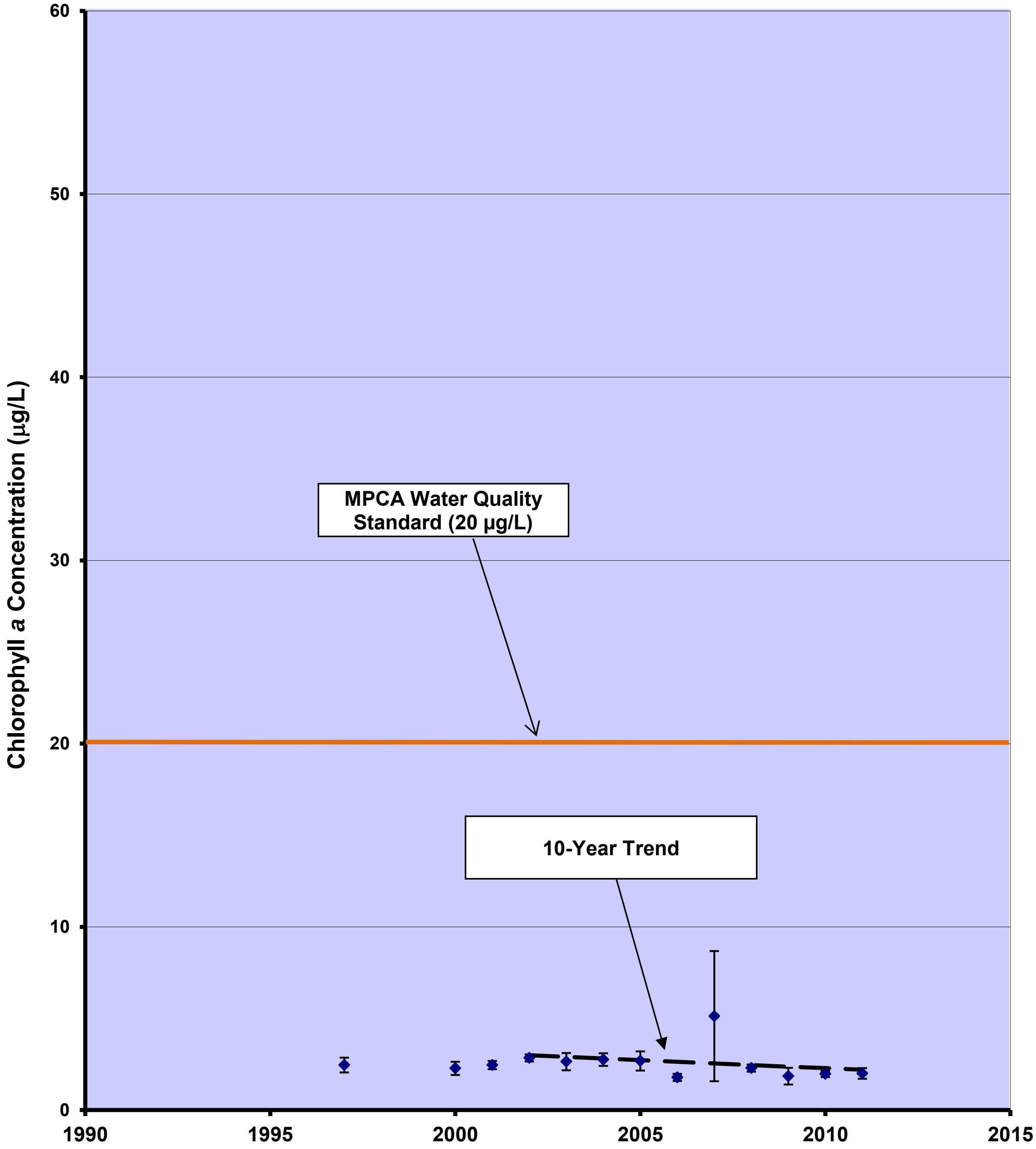
Kingsley Lake (Lakeville)
Summer Average Water Clarity
& Trend Analysis



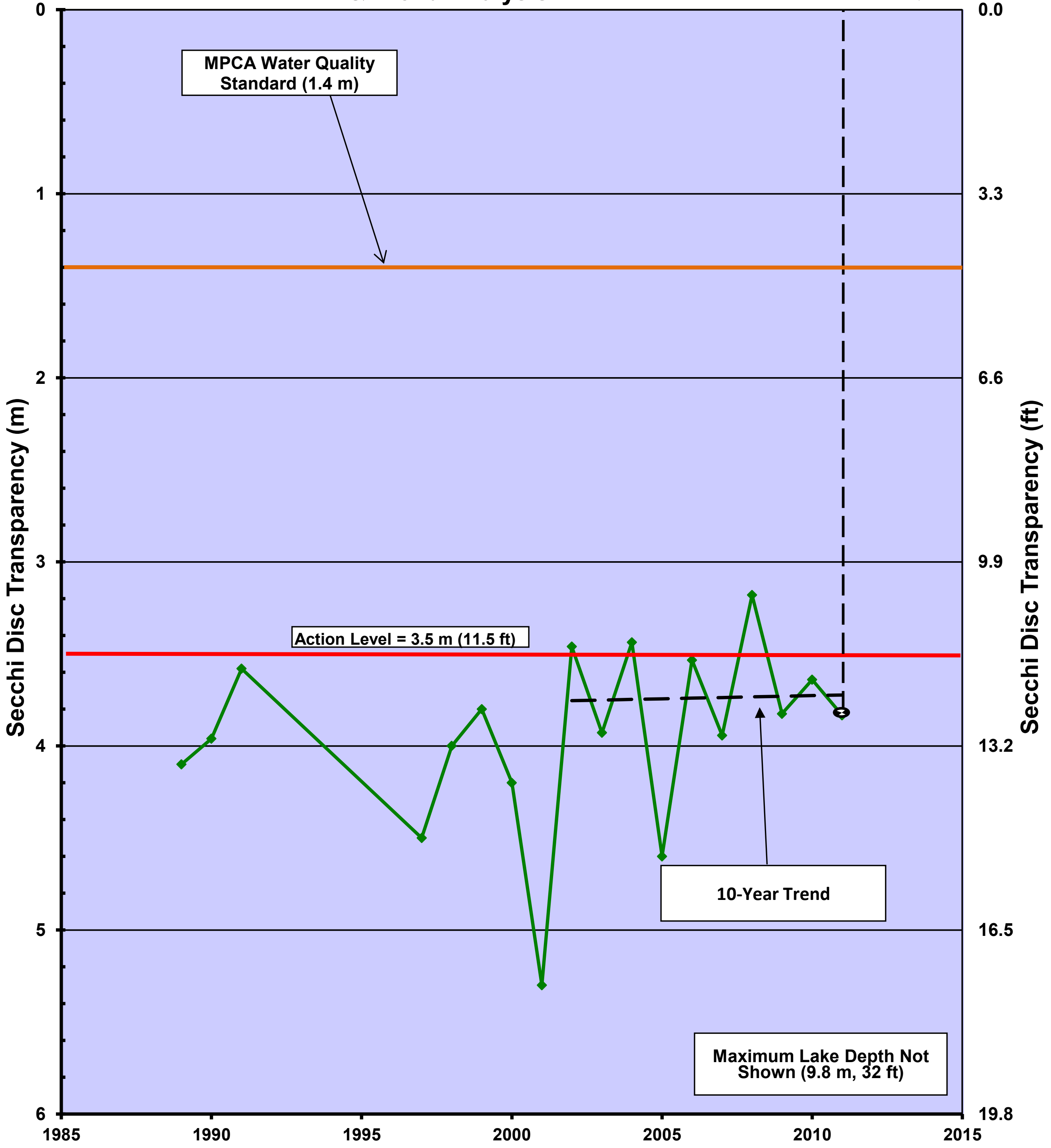
Kingsley Lake (Lakeville)
Summer Average Surface Total Phosphorus Concentrations & Trend Analysis
BDWMO Category II & MPCA Shallow Lake



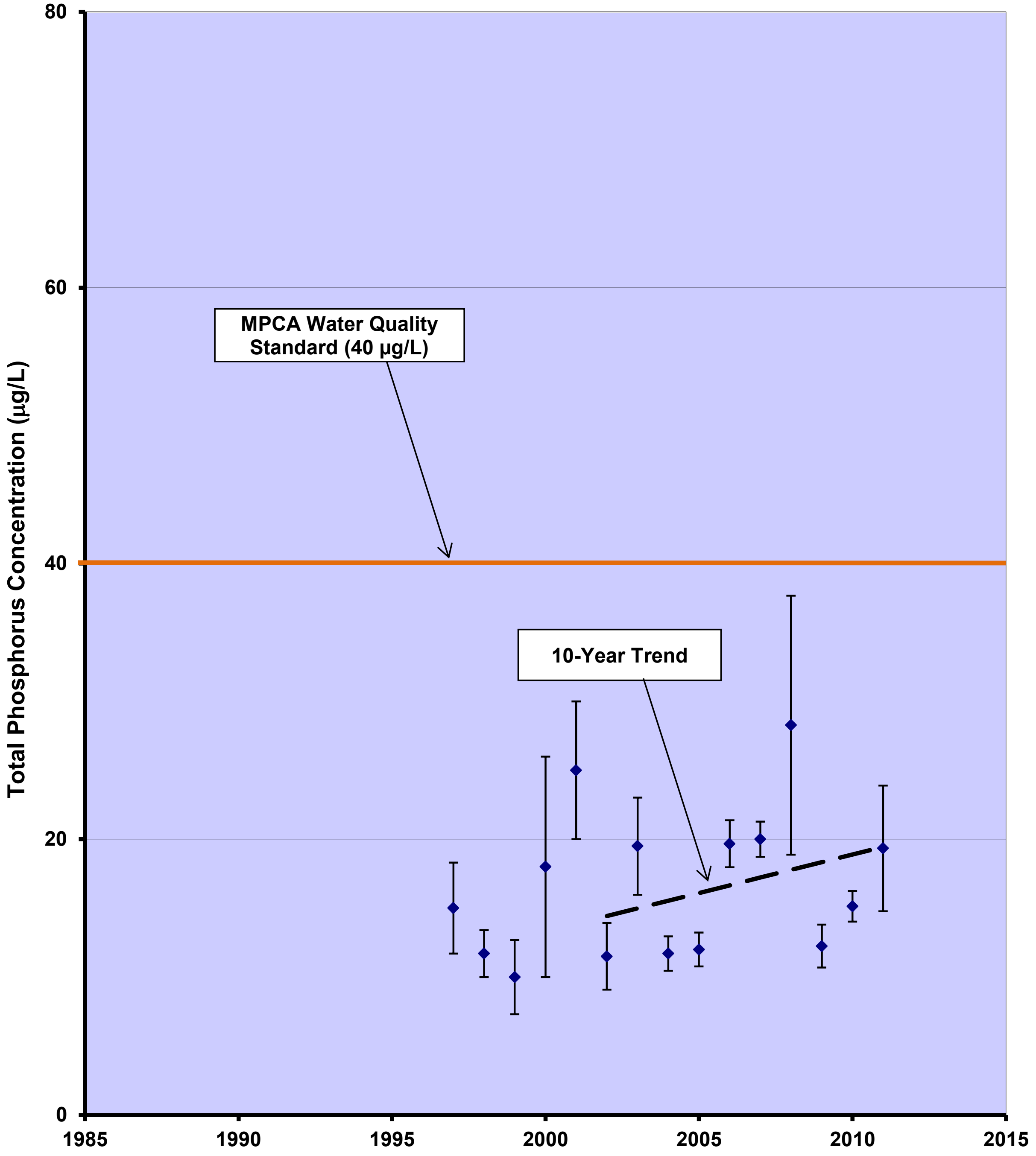
Kingsley Lake (Lakeville)
Summer Average Surface Chlorophyll *a* Concentrations & Trend Analysis
BDWMO Category II & MPCA Shallow Lake



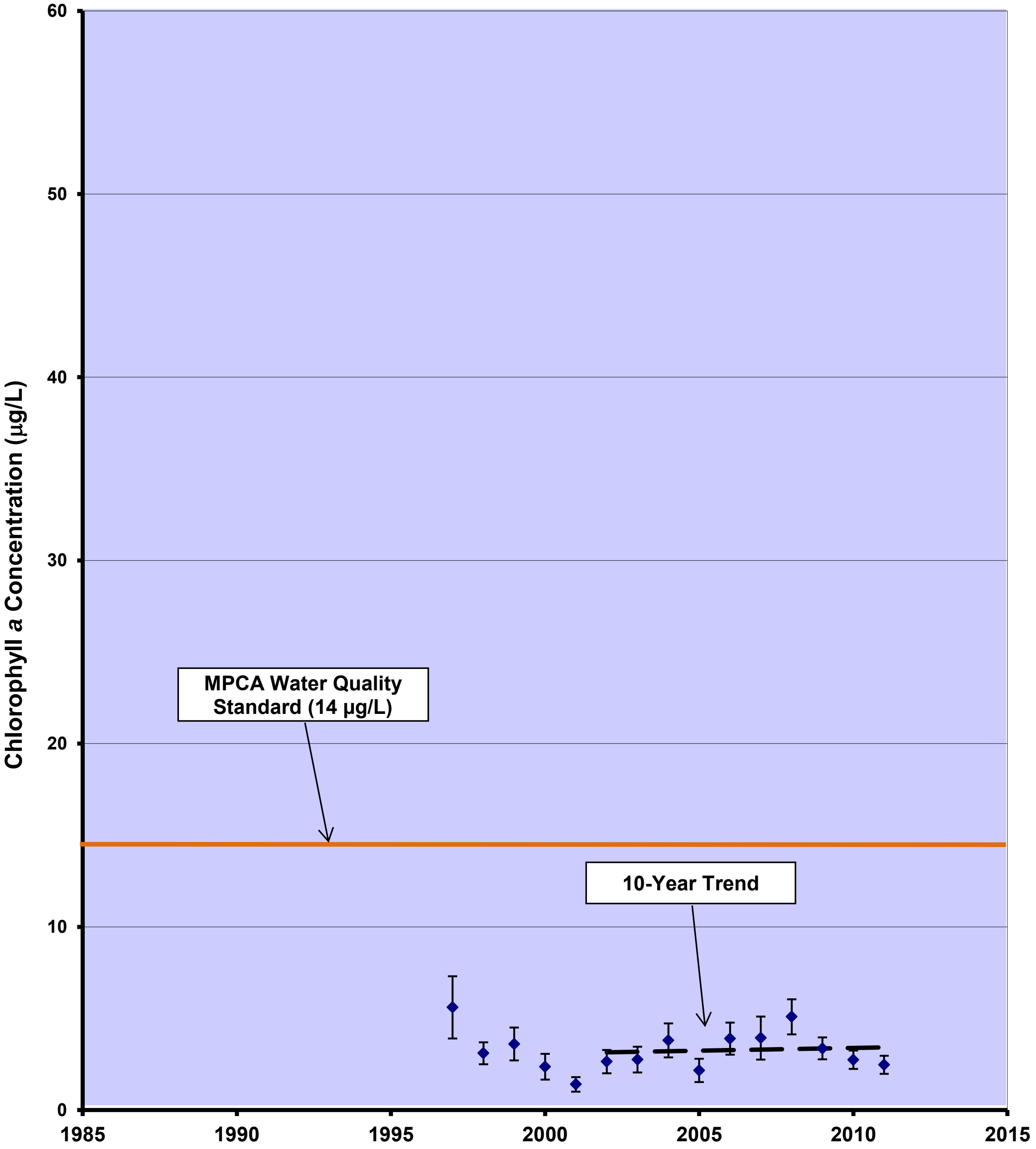
Lac Lavon Lake (Apple Valley & Burnsville)
Summer Average Water Clarity
& Trend Analysis



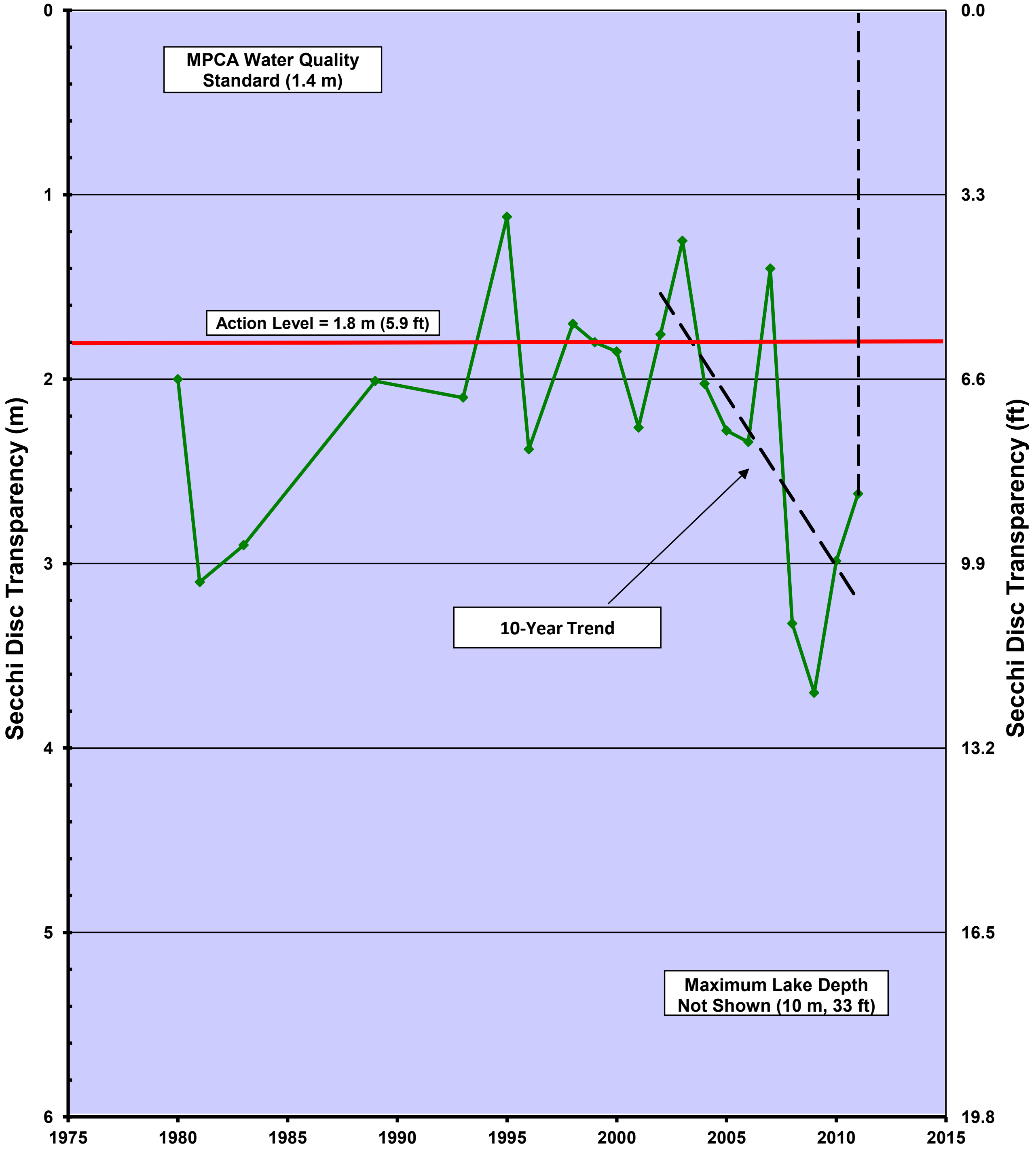
Lac Lavon Lake (Apple Valley & Burnsville)
Summer Average Surface Total Phosphorus Concentrations & Trend Analysis
BDWMO Category I & MPCA Deep Lake



Lac Lavon Lake (Apple Valley & Burnsville)
Summer Average Surface Chlorophyll *a* Concentrations & Trend Analysis
BDWMO Category I & MPCA Deep Lake



Orchard Lake (Lakeville)
Summer Average Water Clarity
& Trend Analysis



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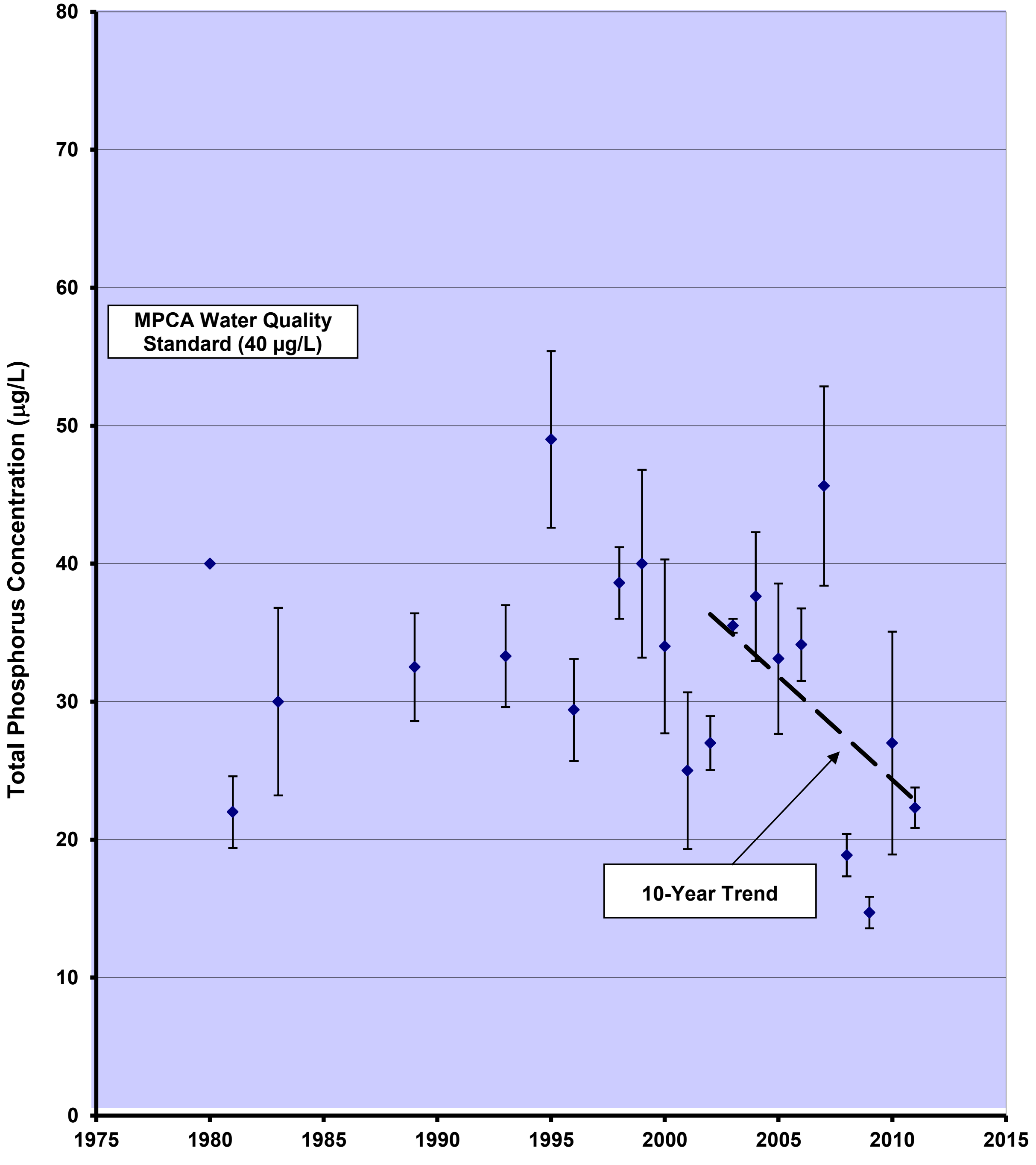
2/2/2012

Orchard Lake (Lakeville)
Summer Average Surface Total Phosphorus Concentrations & Trend Analysis
BDWMO Category I & MPCA Deep Lake



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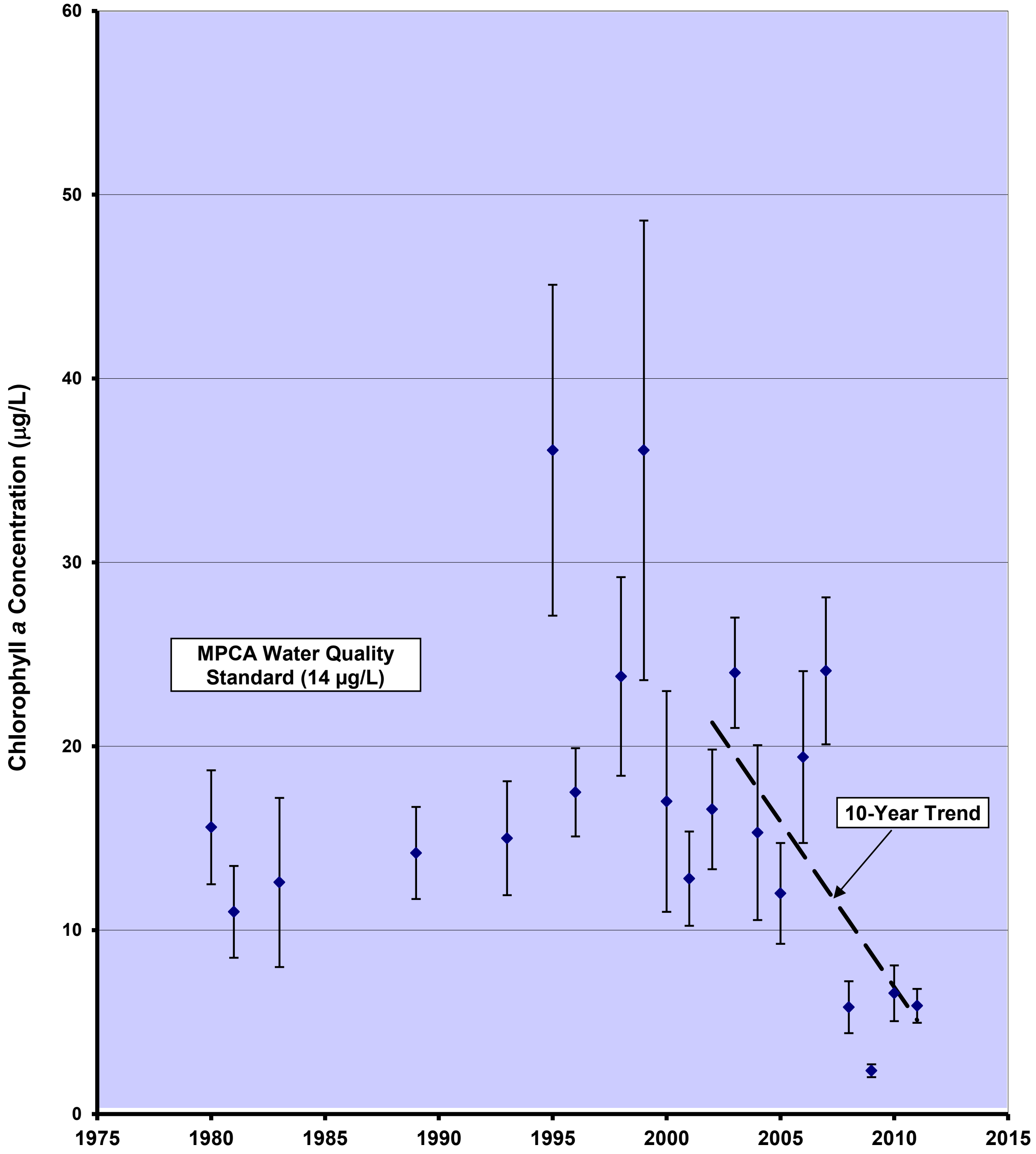
Orchard Lake (Lakeville)
Summer Average Surface Chlorophyll *a* Concentrations & Trend Analysis
BDWMO Category I & MPCA Deep Lake



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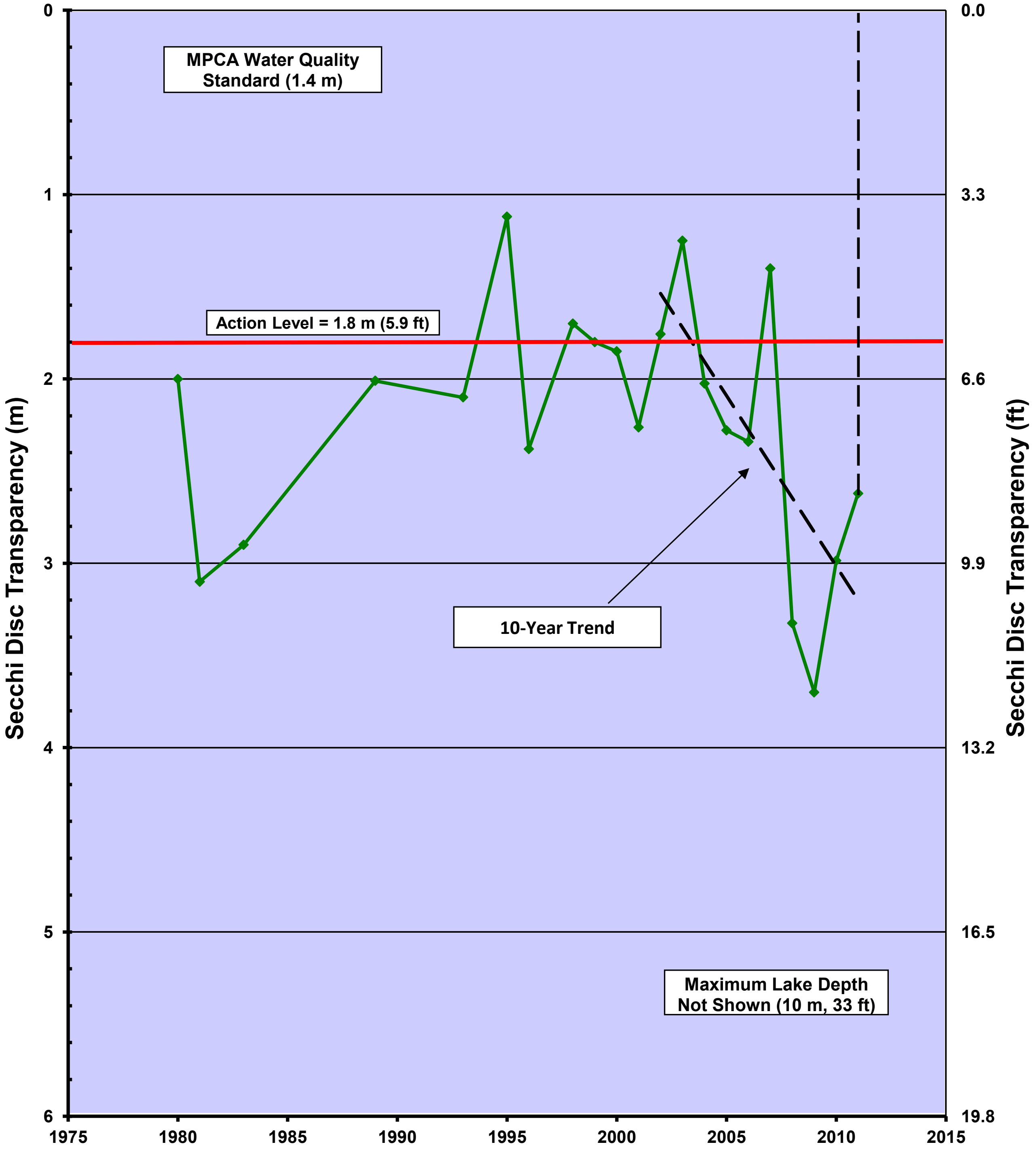
Sunset Pond (Burnsville)

Summer Average Water Clarity & Trend Analysis



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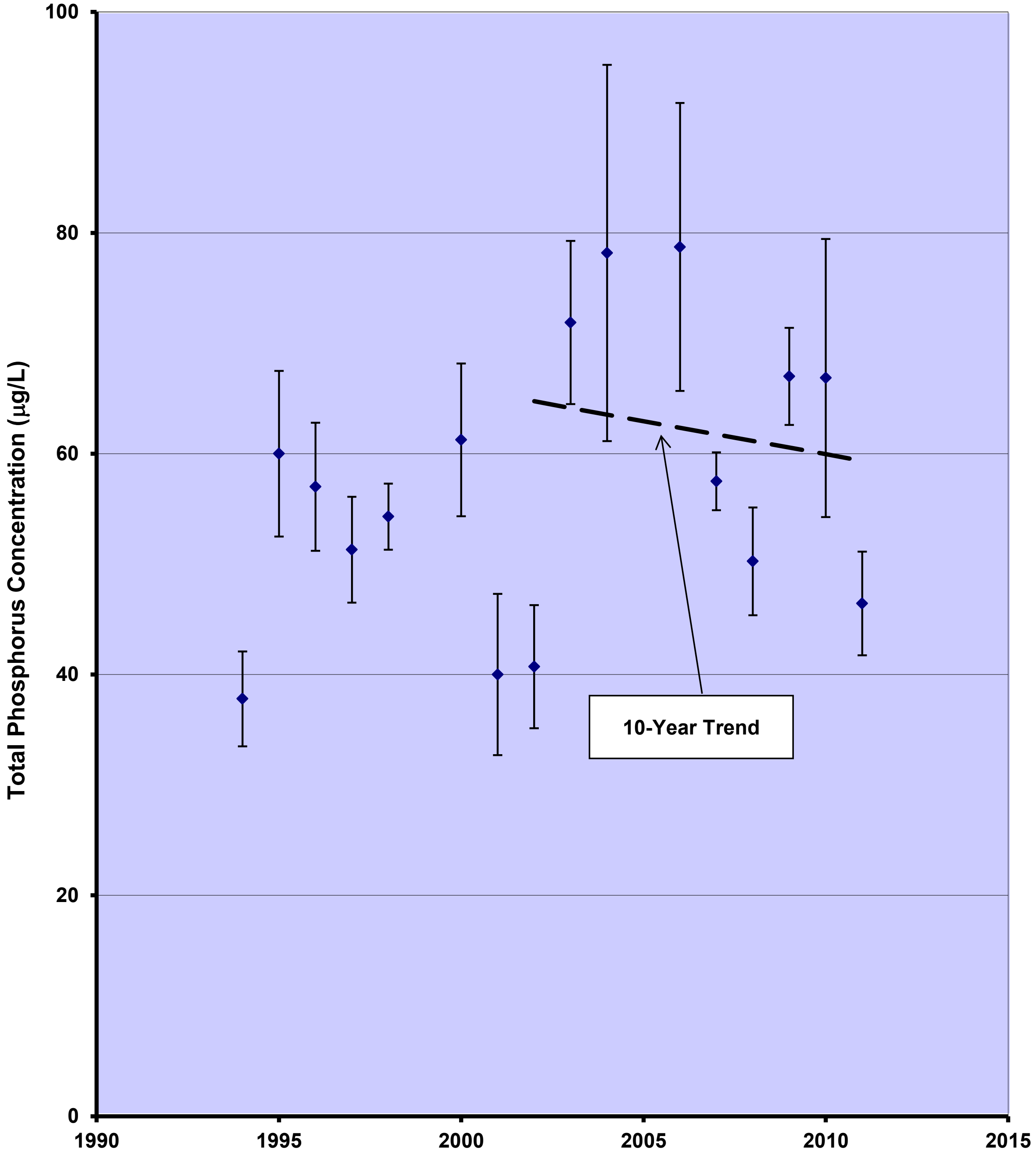
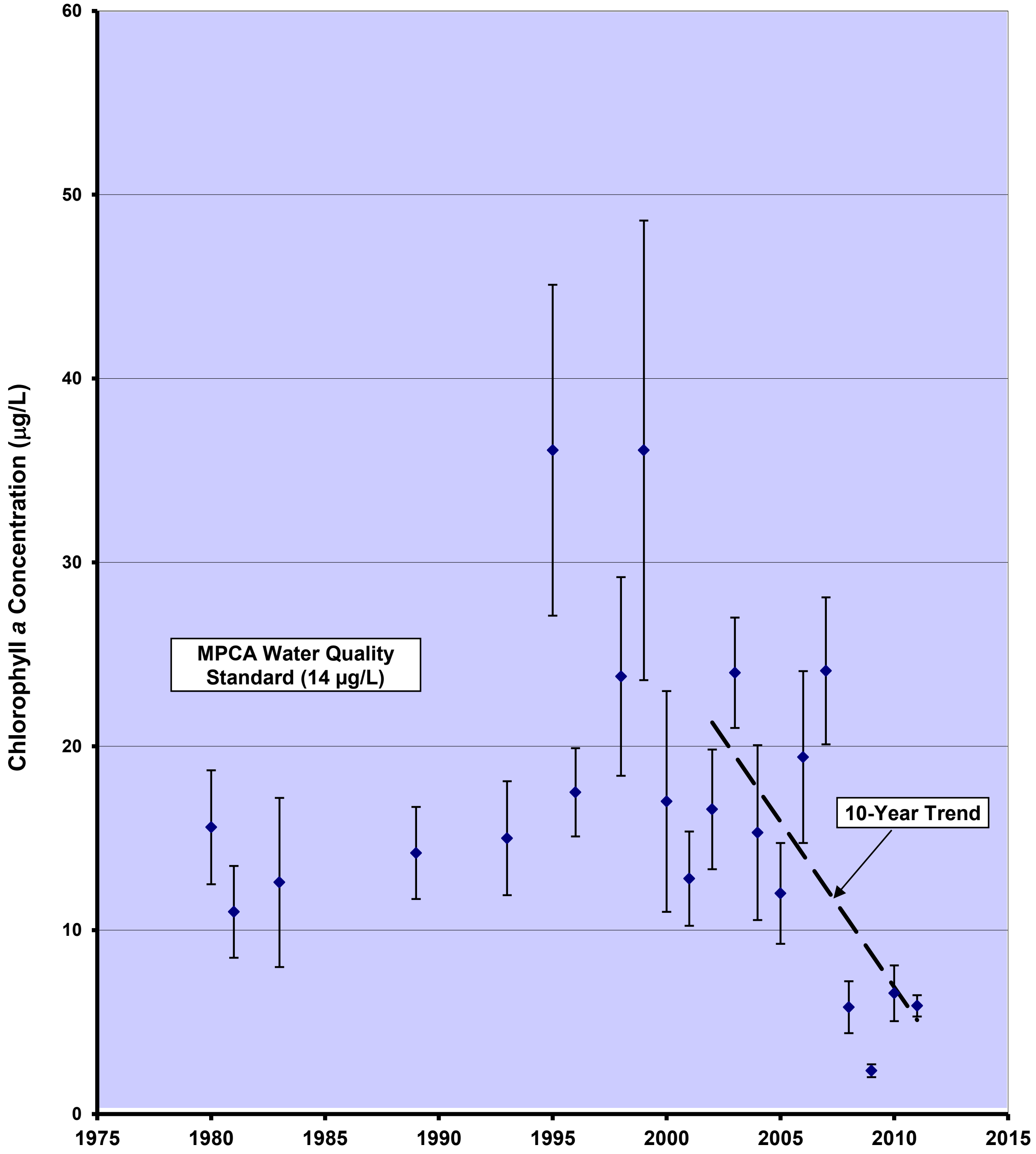
Sunset Pond (Burnsville)
Summer Average Surface Total Phosphorus Concentrations & Trend Analysis
Note: No longer considered a BDWMO strategic water body



Sunset Pond (Burnsville)
Summer Average Surface Chlorophyll *a* Concentrations & Trend Analysis
BDWMO Category I & MPCA Deep Lake



2011 Water Quality Data—Tables

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Table 1: Crystal Lake 2011 Water Quality Data
CAMP Data

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl. A (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (Celsius)	Specific Cond. (umho/cm @ 25 C)	Ortho P as P, Dissloved (mg/L)	Ortho P as P, Total (mg/L)	Total P (mg/L)	Total Fe (ug/l)	pH (Std. Units)	eh (mv)
4/23/2011	0	1.6	0	16			7.2				0.041			
5/7/2011	0	1.8	0	6			13.1				0.023			
5/22/2011	0	2.4	0	2.6			17.4				0.02			
6/4/2011	0	3.2	0	2.2			21.3				0.02			
6/19/2011	0	2.9	0	6.7			21.8				0.012			
7/2/2011	0	3.5	0	4.2			26.1				0.015			
7/16/2011	0	2.4	0	6.9			25.2				0.013			
7/30/2011	0	1.7	0	9.3			29.3				0.015			
8/11/2011	0	0.9	0	35			26.2				0.031			
8/27/2011	0	1.2	0	22			25.4				0.031			
9/10/2011	0	1.3	0	16			24.6				0.03			
9/24/2011	0	1.5	0	17			16.9				0.039			
10/8/2011	0	1.7	0	16			17.7				0.029			
10/22/2011	0	1.9	0	12			11.8				0.037			

Table 2: Keller Lake 2011 Water Quality Data
CAMP Data

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl. A (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (Celsius)	Specific Cond. (umho/cm @ 25 C)	Ortho P as P, Dissloved (mg/L)	Ortho P as P, Total (mg/L)	Total P (mg/L)	Total Fe (ug/l)	pH (Std. Units)	eh (mv)
5/7/2011	0	2.2	0	4			15.9				0.035			
5/17/2011	0	2	0	8.9			17.9				0.032			
5/29/2011	0	1.1	0	19			18.5				0.049			
6/15/2011	0	0.6	0	34			20.8				0.066			
7/2/2011	0	0.6	0	36			27.4				0.069			
7/10/2011	0	0.5	0	3.5			30.8				0.087			
7/23/2011	0	0.4	0	87			29.3				0.104			
8/7/2011	0	0.3	0	140			27.3				0.109			
8/21/2011	0	0.2	0	120			24.3				0.112			
9/7/2011	0	0.3	0	75			23.5				0.093			
9/19/2011	0	0.4	0	68			17.3				0.056			
10/2/2011	0	0.5	0	29			15.8				0.029			
10/21/2011	0	1.8	0	8.1			9.9				0.023			

Table 3: Kingsley Lake 2011 Water Quality Data
CAMP Data

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl. A (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (Celsius)	Specific Cond. (umho/cm @ 25 C)	Ortho P as P, Dissloved (mg/L)	Ortho P as P, Total (mg/L)	Total P (mg/L)	Total Fe (ug/l)	pH (Std. Units)	eh (mv)
5/3/2011	0	[1]	0	1.9			7.2				0.013			
5/16/2011	0	[1]	0	2.5			12				0.016			
6/3/2011	0	[1]	0	1.3			20				0.018			
6/15/2011	0	[1]	0	3.3			20				0.026			
6/27/2011	0	[1]	0	2.6			20				0.019			
7/18/2011	0	[1]	0	1.3			27				0.016			
7/25/2011	0	[1]	0	1.3			27				0.015			
8/8/2011	0	[1]	0	2.1			26				0.025			
8/25/2011	0	[1]	0	2.1			26				0.013			
9/9/2011	0	[1]	0	1.8			22				0.011			
9/19/2011	0	[1]	0	1.5			16				0.016			
10/6/2011	0	[1]	0	2.5			17				0.011			

1. Secchi disk on lake bottom

Table 4: LacLavon Lake 2011 Water Quality Data
CAMP Data

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl. A (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (Celsius)	Specific Cond. (umho/cm @ 25 C)	Ortho P as P, Dissloved (mg/L)	Ortho P as P, Total (mg/L)	Total P (mg/L)	Total Fe (ug/l)	pH (Std. Units)	eh (mv)
4/24/2011	0	2.2	0	10			10.2				0.022			
5/7/2011	0	2.1	0	11			14.2				0.024			
5/22/2011	0	2.6	0	5.9			17.7				0.016			
6/5/2011	0	4.4	0	1.1			25.3				0.009			
6/17/2011	0	3.6	0	4.5			22				0.015			
7/1/2011	0	3.4	0	1.9			27.6				0.023			
7/31/2011	0	4.2	0	1.7			30.3				0.017			
8/13/2011	0	3.9	0	2.6			25.6				0.012			
8/28/2011	0	3.5	0	3			24.8				0.04			
9/11/2011	0	3.8	0	2.2			24.1				0.012			
9/25/2011	0	3.1	0	5.1			17.5				0.218			
10/9/2011	0	3.7	0	3.7			18.6				0.08			
10/25/2011	0	2.4	0	5.8			11.6				0.098			

Table 5A: Orchard Lake 2011 Water Quality Data
Barr Engineering Company Data

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (°C)	Sp. Cond. (µmho/cm @ 25°C)	Total P (mg/L)	Total Dissolved Phosphorus (mg/L)	pH (S.U.)	ORP (mv)
4/27/11	9.8	0-2	1.9	4.0	2.9	--	--	--	0.022	0.022	--	--
		0.0				11.3	8.2	813	--	--	8.3	271
		1.0				11.3	8.2	814	--	--	8.3	269
		2.0				11.3	8.2	814	--	--	8.3	268
		3.0				11.3	8.2	814	0.025	0.018	8.4	268
		4.0				11.2	8.2	816	0.026	0.012	8.4	267
		5.0				11.2	8.2	815	0.023	0.021	8.4	267
		6.0				11.2	8.2	815	0.022	0.021	8.4	267
		7.0				11.0	8.0	817	0.049	0.020	8.4	268
		8.0				11.0	8.0	817	0.020	0.018	8.4	272
		9.3				10.9	7.9	817	0.024	0.016	8.4	275
5/10/11	9.1	0-2	2.0	6.7	1.8	--	--	--	0.020	<0.010	--	--
		0.0				10.7	13.3	826	--	--	8.2	233
		1.0				10.6	13.3	826	--	--	8.3	226
		2.0				10.6	13.2	826	--	--	8.4	220
		3.0				10.6	13.0	827	0.021	0.013	8.4	217
		4.0				10.6	12.9	828	0.019	0.013	8.4	215
		5.0				10.6	12.8	828	0.020	0.012	8.5	214
		6.0				10.5	12.8	827	0.018	0.011	8.5	213
		7.0				10.4	12.5	819	0.018	0.011	8.4	215
		8.0				8.7	9.6	829	0.021	<0.010	8.2	217
		8.6				6.50	9.4	831	0.020	0.011	8.0	35

Table 5A: Orchard Lake 2011 Water Quality Data
Barr Engineering Company Data

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (°C)	Sp. Cond. (µmho/cm @ 25°C)	Total P (mg/L)	Total Dissolved Phosphorus (mg/L)	pH (S.U.)	ORP (mv)
5/24/11	9.1	0-2	2.6	4.0	1.4	--	--	--	0.024	0.014	--	--
		0.0				9.4	17.7	819	--	--	8.1	124
		1.0				9.3	17.7	819	--	--	8.2	121
		2.0				9.2	17.7	819	--	--	8.2	119
		3.0				9.2	17.6	819	0.026	0.017	8.3	117
		4.0				9.2	17.6	819	0.030	0.021	8.3	117
		5.0				9.1	17.6	819	0.021	0.012	8.3	117
		6.0				6.8	15.0	830	0.022	0.015	8.0	123
		7.0				4.3	12.4	829	0.019	0.013	7.9	126
		8.0				3.1	11.7	832	0.024	0.013	7.7	127
		8.6				1.7	11.6	832	0.023	0.015	7.7	117
6/6/11	8.6	0-2	3.8	<0.50	1.2	--	--	--	0.019	0.013	--	--
		0.0				9.8	23.3	801	--	--	8.5	251
		1.0				10.0	22.5	803	--	--	8.5	246
		2.0				10.0	22.2	803	--	--	8.5	243
		3.0				10.0	20.8	803	0.022	0.013	8.5	240
		4.0				9.0	19.9	804	0.020	0.012	8.4	240
		5.0				8.0	19.2	804	0.019	0.014	8.4	240
		6.0				7.5	18.7	805	0.019	0.011	8.3	239
		7.0				4.6	17.3	806	0.019	0.014	8.1	243
		8.0				1.60	14.8	820	0.021	0.023	7.9	226

Table 5A: Orchard Lake 2011 Water Quality Data
Barr Engineering Company Data

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (°C)	Sp. Cond. (µmho/cm @ 25°C)	Total P (mg/L)	Total Dissolved Phosphorus (mg/L)	pH (S.U.)	ORP (mv)
6/20/11	9.0	0-2	2.3	5.3	2.1	--	--	--	0.023	<0.010	--	--
		0.0				9.0	21.7	785	--	--	8.5	214
		1.0				9.1	21.7	785	--	--	8.5	209
		2.0				9.1	21.7	785	--	--	8.5	206
		3.0				9.1	21.6	785	<0.010	<0.010	8.5	203
		4.0				9.1	21.5	785	0.019	0.012	8.5	198
		5.0				8.0	20.1	789	0.019	<0.010	8.4	199
		6.0				5.5	19.3	789	0.018	<0.010	8.1	202
		7.0				1.1	17.4	812	<0.010	<0.010	7.7	208
		8.0				0.24	14.8	827	0.041	<0.010	7.6	-16
		8.5				0.19	14.5	829	0.062	<0.010	7.6	-93
7/5/11	8.5	0-2	2.8	5.3	1.3	--	--	--	0.026	0.017	--	--
		0.0				9.8	26.7	784	--	--	8.6	206
		1.0				9.8	26.7	784	--	--	8.7	201
		2.0				9.8	26.7	783	--	--	8.6	193
		3.0				10.0	26.5	784	0.023	<0.010	8.5	194
		4.0				10.5	22.4	794	0.025	0.017	8.6	197
		5.0				6.7	20.8	798	0.025	0.017	8.1	207
		6.0				2.40	19.7	803	0.024	0.015	7.7	216
		7.0				0.60	18.4	811	0.026	0.017	7.6	218
		8.0				0.23	15.5	842	0.110	0.019	7.6	-52

Table 5A: Orchard Lake 2011 Water Quality Data
Barr Engineering Company Data

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (°C)	Sp. Cond. (µmho/cm @ 25°C)	Total P (mg/L)	Total Dissolved Phosphorus (mg/L)	pH (S.U.)	ORP (mv)
7/18/11	9.0	0-2	2.9	6.7	2.9	--	--	--	0.019	0.017	--	--
		0.0				8.4	27.2	744	--	--	8.3	227
		1.0				8.4	27.2	742	--	--	8.3	225
		2.0				8.4	26.6	728	--	--	8.3	224
		3.0				7.6	24.8	744	0.021	0.014	8.2	225
		4.0				5.4	24.1	741	0.023	0.016	7.9	227
		5.0				2.1	22.9	712	0.024	<0.010	7.5	223
		6.0				0.29	20.7	794	0.026	0.016	7.4	232
		7.0				1.10	18.5	811	0.045	0.018	7.4	228
		8.0				0.24	15.8	841	0.094	0.023	7.4	-115
		8.5				0.18	14.9	851	0.170	0.020	7.6	-206
8/8/11	9.4	0-2	1.8	9.3	2.8	--	--	--	0.026	<0.020	--	--
		0.0				8.6	27.5	731	--	--	8.5	183
		1.0				8.6	27.5	731	--	--	8.5	179
		2.0				8.5	27.4	730	--	--	8.4	178
		3.0				8.1	27.3	730	0.027	0.020	8.4	176
		4.0				1.6	27.0	745	0.028	<0.020	7.6	188
		5.0				0.24	24.1	734	0.032	<0.020	7.5	51
		6.0				0.21	20.4	788	0.031	<0.020	7.5	-3
		7.0				0.20	17.9	819	0.043	0.022	7.5	-86
		8.0				0.20	15.9	847	0.110	0.028	7.6	-168
		9.0				0.19	15.0	858	0.460	0.037	7.6	-188

Table 5A: Orchard Lake 2011 Water Quality Data
Barr Engineering Company Data

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (°C)	Sp. Cond. (µmho/cm @ 25°C)	Total P (mg/L)	Total Dissolved Phosphorus (mg/L)	pH (S.U.)	ORP (mv)
8/22/11	9.4	0-2	2.1	6.7	2.1	--	--	--	0.044	0.022	--	--
		0.0				8.1	21.2	743	--	--	8.3	211
		1.0				8.1	25.1	744	--	--	8.3	208
		2.0				7.8	24.8	745	--	--	8.3	206
		3.0				7.6	24.7	744	0.032	0.018	8.3	203
		4.0				7.7	24.5	743	0.037	<0.010	8.3	200
		5.0				7.1	24.2	743	0.026	0.022	8.2	200
		6.0				0.37	21.1	793	0.029	<0.010	7.4	209
		7.0				0.26	18.0	834	0.066	0.031	7.3	-76
		8.0				0.22	16.0	864	0.16	0.031	7.3	-156
		9.0				0.21	14.3	887	0.39	0.031	7.3	-167
9/6/11	9.4	0-2	2.6	11.0	2.9	--	--	--	0.018	0.015	--	--
		0.0				7.8	22.0	745	--	--	8.4	203
		1.0				7.8	22.1	746	--	--	8.4	200
		2.0				7.7	22.1	745	--	--	8.4	198
		3.0				7.7	22.0	746	0.025	0.017	8.5	196
		4.0				7.6	22.0	745	0.022	0.016	8.4	195
		5.0				7.7	21.7	744	<0.010	<0.010	8.5	193
		6.0				5.9	21.6	749	0.023	<0.010	8.2	194
		7.0				0.34	18.3	835	0.097	0.029	7.5	-4
		8.0				0.24	16.6	864	0.20	0.026	7.5	-134
		9.0				0.24	15.5	883	0.64	0.021	7.5	-159

Table 5A: Orchard Lake 2011 Water Quality Data
Barr Engineering Company Data

Date	Max Depth (m)	Sample Depth (m)	Secchi Depth (m)	Chl. a (ug/L)	Turbidity (NTU's)	D. O. (mg/L)	Temp (°C)	Sp. Cond. (µmho/cm @ 25°C)	Total P (mg/L)	Total Dissolved Phosphorus (mg/L)	pH (S.U.)	ORP (mv)
9/19/11	9.4	0-2	2.0	6.7	3.0	--	--	--	0.023	<0.010	--	--
		0.0				7.4	17.4	753	--	--	7.8	193
		1.0				7.2	17.4	753	--	--	8.0	193
		2.0				7.2	17.4	754	--	--	8.0	192
		3.0				7.2	17.4	754	0.021	0.011	8.1	192
		4.0				7.1	17.4	754	0.024	0.012	8.1	192
		5.0				7.1	17.4	754	0.025	<0.010	8.1	192
		6.0				7.0	17.4	754	0.025	0.012	8.1	192
		7.0				6.8	17.3	754	0.023	0.014	8.0	192
		8.0				4.8	17.2	758	0.024	0.011	7.9	196
		9.0				0.4	15.2	898	0.80	0.018	7.3	-170

Table 5B: Orchard Lake 2011 Water Quality Data
CAMP Data

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl. A (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (Celsius)	Specific Cond. (umho/cm @ 25 C)	Ortho P as P, Dissloved (mg/L)	Ortho P as P, Total (mg/L)	Total P (mg/L)	Total Fe (ug/l)	pH (Std. Units)	eh (mv)
4/24/2011	0	1.9	0	4.9			8.6				0.028			
5/7/2011	0	2.2	0	2.7			15				0.022			
5/27/2011	0	2.5	0	3.8			17.7				0.026			
6/20/2011	0	2.7	0	3.1			22.3				0.017			
6/29/2011	0	4.4	0	3.6			23.7				0.026			
7/13/2011	0	3.9	0	2.2			27.4				0.013			
7/29/2011	0	3	0	3.3			30.4				0.017			
8/11/2011	0	1.6	0	8.6			26.8				0.022			
8/22/2011	0	2.6	0	6.9			25.3				0.02			
9/7/2011	0	2.3	0	8.7			25.3				0.019			
9/23/2011	0	2.2	0	8.5			17.4				0.115			
10/6/2011	0	3.4	0	3.6			17.8				0.072			
10/19/2011	0	3.2	0	3.4			12.9				0.061			

Table 6: Sunset Pond 2011 Water Quality Data
CAMP Data

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl. A (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (Celsius)	Specific Cond. (umho/cm @ 25 C)	Ortho P as P, Dissloved (mg/L)	Ortho P as P, Total (mg/L)	Total P (mg/L)	Total Fe (ug/l)	pH (Std. Units)	eh (mv)
4/24/2011	0	2.5	0	4.4			7.4				0.031			
5/6/2011	0	2.1	0	6.4			12.9				0.028			
5/24/2011	0	1.7	0	11			19.7				0.046			
6/5/2011	0	2.2	0	5.8			23.7				0.036			
6/19/2011	0	2.5	0	3.6			22.5				0.043			
7/3/2011	0	2.3	0	25			27.3				0.061			
7/17/2011	0	2.3	0	2.7			25.6				0.054			
7/30/2011	0	2.4	0	3.8			28.4				0.043			
8/14/2011	0	2.4	0	2.3			26.1				0.028			
8/29/2011	0	2.3	0	2.8			22.3				0.06			
9/11/2011	0	1.8	0	4.5			22.5				0.042			
9/25/2011	0	2.2	0	3.8			14				0.056			
10/9/2011	0	2.3	0	1.8			19				0.03			
10/22/2011	0	2.4	0	3.6			8.8				0.079			

2011 Auditors’ Report

Appendix C

Memo Summarizing the Identification of Issues by the PAG

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Memorandum

To: Commissioners, Black Dog Watershed Management Organization
From: Karen Chandler and Dan Petrik
Subject: Summary of PAG Meeting #1
Date: January 11, 2011
Project: 23191083

The Black Dog Watershed Management Organization (BDWMO) Planning Advisory Group (PAG) met for the first time on December 15, 2010. The purpose of this meeting was to identify issues for consideration in the plan update and to gather insight for refining the existing BDWMO vision and mission. Three small groups were organized to identify and rate issues and provide feedback on the existing BDWMO vision and mission. The group members were as follows:

Name	**Representing**
Group 1	
Jack Frost	Metropolitan Council
Mary Hamann-Roland	BDWMO Commissioner – Vice Chair, Apple Valley
Greg Helms	Citizen member, Apple Valley
Daryl Jacobson	BDWMO Administrator
Jeff Kehrer	City of Apple Valley staff
Tony Nelson	Citizen member, Apple Valley
Group 2	
Mac Cafferty	City of Lakeville staff
Curt Enestvedt	Citizen member, Burnsville
Laura Jester	Dakota SWCD
Brian Johnson	Citizen member, Burnsville
Scott Threen	BDWMO Commissioner, Lakeville
Group 3	
Roger Baldwin	BDWMO Commissioner – Chair, Burnsville
Tom Harmening	BDWMO Commissioner, Burnsville
Ann Messerschmidt	City of Lakeville staff
Paul Nelson	Scott WMO
Terry Schultz	City of Burnsville staff
Craig Wills	Minnesota Department of Natural Resources

Although not in attendance, Melissa Lewis (Minnesota Board of Water and Soil Resources) and Chris Zadak (Minnesota Pollution Control Agency) provided comments for consideration at the PAG meeting.

Overall Summary

A number of new issues and recommendations were discussed during the PAG meeting, highlights include:

- Position the WMO to be eligible for Clean Water Funding
- Collaborate with residents and member cities to develop educational materials that all member cities could use to meet their MS4 permit requirements
- Broaden the vision statement
- Revisit the criteria and selection of strategic water bodies
- Ask the City of Eagan whether they wish to remain a member of the BDWMO

Issue Identification

A number of “pre-identified” issues were prepared for meeting participants to discuss and rate in their small groups. There were 16 pre-identified issues in the following topic areas:

- Water Quality
- Stormwater Runoff Quality, Rates and Volume
- Erosion and Sediment Control

The groups also identified new issues and rated those as well.

Each issue was rated by group consensus into one of three rating categories. Table 1 summarizes how the groups rated each issue. In order to quantify the results of this rating exercise, each category was assigned a numerical weight. An average score was calculated for each rated issue by multiplying the weight of each category by the number of groups giving that rating and dividing by three. The highest average score possible is 3.0 (e.g. each group rated the issue a 3.0) and the lowest score possible was a 1.0. The rating categories and weight include:

- Must Have: weight = 3
- Should Have: weight = 2
- Nice to Have: weight = 1

Results of Group Issue Rating Exercise

Water Quality of Lakes and Ponds

The following three issues were all rated as “Must Have’s” by all three groups (average score of 3.0):

- Water quality focus of the BDWMO should remain on the six strategic water bodies of Crystal, Keller, Kingsley, Lac Lavon, Orchard, and Sunset Pond.
- Determine responsibility for implementing and funding projects to reduce internal loadings of phosphorus in Crystal, Keller and Lee lakes (TMDL implementation). Explore alternative funding methods.
- The BDWMO should continue to facilitate cost allocation between member cities for water quality improvement projects affecting strategic water bodies. *(One group stated that this should be done with the possible exception of internal loading projects and other TMDL improvement plans.)*

Two other issues were also rated highly (average score of 2.33); however the ratings were split between “Must Have” (weight = 3) and “Nice to Have” (weight = 1). This represents a divergence in opinion.

- The water body classification system should be updated for consistency with MPCA water quality standards.
- Determine responsibility for implementing and funding additional projects to implement the Crystal, Keller and Lee lakes TMDL. Explore alternative funding methods/allocations, such as possible cost-sharing/trading.

One issue received a consistent rating (average score of 2.0) from all three groups of “Should Have”:

- Increase focus on aquatic plant and fisheries management to provide a more ecosystem-based approach to water quality management**.** *(One group qualified their rating by stating that this focus on aquatic plant and fisheries management should only be applied to the six strategic water bodies as funds allow.)*

The following two issues received the lowest ratings (average score of 1.66). There was divergence of opinion on these issues. Two groups rated these as “Nice to Have” and one group rated them as “Must Have.”

- Track progress of MS4s in implementing BMPs to meet their wasteload allocations, as set forth in the Crystal, Keller and Lee lakes TMDL.

- Improve BDWMO habitat monitoring program to better inform city actions**.**

Two **new** water quality issues were identified as very important or “Must Have’s.”

- Position the BDWMO to better obtain clean water legacy funds and incorporate the legacy criteria into the plan. *(two groups added this issue)*

- Revisit the criteria and selection of strategic water bodies. *(one group added this issue)*

Stormwater Runoff Quality, Rates and Volume

The following issue received the top rating (average score of 2.66) in this topic area.

- The BDWMO should continue to coordinate with Scott County/WMO regarding discharges from the BDWMO subwatersheds tributary to the Credit River (for example – require controls/restrictions on Orchard Lake outflows and discharges from the Murphy Hanrehan Subwatershed)

Three issues were also rated highly (average score of 2.33).

- City compliance with MS4 permit (current and future) should remain primarily an issue for cities to manage, with BDWMO having a role to play with respect to TMDL implementation (see water quality issues).

- The BDWMO should continue its role in facilitating cost allocation of inter-community flood control projects, should any arise.

- Update stormwater management performance standards. (How strict should the standards be? Should standards set by member cities or adjacent BDWMOs/WDs be a benchmark?) *(One group emphasized that standards set by adjacent WMOs/WD should be used as benchmarks.)*

This issue was rated as being moderately important (average score of 2.0); however, only two groups rated this issue:

- Update requirements for local (city) water management plans.

One issue was rated very low (average score 1.0).

- The boundaries and jurisdiction of the BDWMO should extend north all the way to the Minnesota River (the current BDWMO boundary stops at the Minnesota River bluffs, and discharges from the BDMWO must flow through the Lower Minnesota River Watershed District before discharging to the Minnesota River). *(One group suggested that a joint meeting with the LMRWD be held to discuss this issue, another group stated that the boundary should not be extended.)*

Erosion and Sediment Control

There were only two issues identified in this category and they are rated rather low. In general, it appears that this topic area is less important overall than the two preceding topics.

One issue received a moderate rating (average score of 2.0); however, there was significant divergence on this issue. Each of the three groups rated this issue differently.

- Erosion of streams, ravines and other natural resource areas should be addressed.

The other issue in this topic area was rated lower (average score of 1.66). There was also significant divergence in this area as well.

- Update erosion and sediment control performance standards (How strict should the standards be? Should standards set by member cities or adjacent BDWMOs/WDs be a benchmark?) *(One group rated this as a "Must Have" and stated that adjacent WMOs/WDs standards* ***should serve*** *as a* *benchmark. The other two groups rated this as a "Nice to Have" with one group stating that standards set by member cities or adjacent WMOs/WDs* ***should not serve*** *as a benchmark.*)

Other Issues Identified

Two new issues or actions were identified for consideration in the plan update. These include:

- Collaborate with members to prepare education materials that all member cities can use to meet their NPDES MS4 permit requirements. *(The group identifying this issue rated it as a "Must Have.")*
- Consider asking Eagan if they wish to remain part of the BDWMO. *(The group identifying this issue rated it as a "Must Have.")*

Vision and Mission

A vision and mission are important elements that provide strategic direction to an organization (e.g. a road map). A vision helps to focus planning efforts on what is important and reminds the organization why it exists. A mission states what an organization should be doing on a daily basis. The existing plan includes mission statements, but does not have an explicit vision for the BDWMO. The following vision has been drafted based on the BDWMO survey results and the results of the issue rating exercise and group discussion at the first PAG meeting.

Vision (a compelling picture of what is to be realized – a future state):

> *Water resources and related ecosystems of the strategic water bodies are managed to sustain their long-term health and aesthetic beauty in order to contribute to the well-being of the citizens within the watershed.*

Based on feedback received at the first PAG meeting, the existing mission retains its relevance. Only one new element (#10 below) is suggested.

Mission of the BDWMO (the fundamental purpose of the organization)

1. Keep regulation at the local level – the BDWMO will not administer a permit program.

2. Assist member communities with intercommunity floodplain and runoff planning and with mediation of water management disputes between communities.
3. Monitor, classify and manage strategic water resources to meet their intended use. Strategic resources are water bodies that have broad watershed significance.
4. Monitor, evaluate, and/or model stormwater runoff quality.
5. Manage intercommunity stormwater runoff, flooding and other water quantity issues.
6. Develop policies to be implemented by the cities to protect the BDWMO's water resources.
7. Assess performance of the BDWMO and the member cities toward achieving the goals stated in the plan.
8. Provide member cities with useful information about the BDWMO, its activities, and water resource management.
9. Educate all watershed citizens and member cities in water resource issues and BDWMO activities.
10. Assist member cities with funding water quality projects through grants and other funding available directly to watershed organizations (*New*).

BDWMO Planning Assumptions

Based on feedback received at the first PAG meeting, the planning assumptions presented at the meeting retain their relevance.

1. Cities will continue to be responsible for wetland protection and management, including compliance with WCA, and other state and local regulations)
2. Cities will continue to be responsible for shoreland protection and management, including applicable state and local regulations.
3. The BDWMO will continue to meet basic educational requirements and make educational resources available through its website and annual newsletter, as required by BWSR.
4. Cities will continue to be responsible for public outreach, as required by MS4 permits.

5. All jurisdictions (MS4, BDWMO) will continue to be responsible for their own projects (BMPs)

6. Cities will continue to be responsible for compliance with all current and future pond maintenance and monitoring requirements (per their MS4 permits).

7. Cities will continue to be responsible for groundwater protection, including compliance with MDH and MnDNR guidelines and regulations and county groundwater plans.

8. The BDWMO will continue to fund on-going monitoring (water quality, habitat) of strategic water bodies and tracking of trends.

9. The BDWMO will continue to apply for grants for projects requiring WMO sponsorship.

10. The BDWMO will continue to track and report on

    a. Status of water quality through trend analysis (strategic water bodies)

    b. Results of habitat monitoring (strategic water bodies)

    c. Progress on implementation of BDWMO-recommended water quality improvement projects

    d. Status of implementation items (see 2002 implementation table In BDWMO plan)

    e. Status of BDWMO activities (e.g. work plan and budget management)

11. Cities will continue to be responsible for implementing and funding BMP projects that treat non-point source runoff (e.g. external watershed sources of pollution).

12. The BDWMO will retain its existing governing structure (i.e. Joint Powers WMO).

Table 1: BDWMO Plan Update Issue Prioritization (Note: Numbers is parentheses indicate the number of groups rating the issue in each rating category. Underlined text is new text added by one or more groups)

Topic	**Issue Rating Categories**		
	Must Have	**Should Have**	**Nice to Have**
Water quality of lakes and ponds	Water quality focus of the BDWMO should remain on the six strategic water bodies of Crystal, Keller, Kingsley, Lac Lavon, Orchard, and Sunset Pond. (3)		
	Determine responsibility for implementing and funding projects to reduce internal loadings of phosphorus in Crystal, Keller and Lee Lakes (TMDL implementation). Explore funding methods. (3)		
	The BDWMO should continue to facilitate cost allocation between member cities for water quality improvement projects affecting strategic water bodies with the possible exception of internal loading projects and other TMDL improvement plan. (3)		
	The water body classification system should be updated for consistency with MPCA water quality standards. (2)		The water body classification system should be updated for consistency with MPCA water quality standards. (1)
	Determine responsibility for implementing and funding additional projects to implement the crystal, Keller and Lee lakes TMDL. Explore alternative funding methods/allocations, such as possible cost-sharing/trading. (2)		Determine responsibility for implementing and funding additional projects to implement the crystal, Keller and Lee lakes TMDL. Explore alternative funding methods/allocations, such as possible cost-sharing/trading. (1)
		Increase /broaden focus on aquatic plant and fisheries management to provide a more ecosystem-based approach to water quality management on six strategic water bodies as funds allow. (3)	
	Track progress of MS4s in implementing BMPs to meet their wasteload allocations, as set forth in the Crystal, Keller and Lee lakes TMDL. (1)		Track progress of MS4s in implementing BMPs to meet their wasteload allocations, as set forth in the Crystal, Keller and Lee lakes TMDL. (2)
	Improve BDWMO habitat monitoring program to better inform city actions. (1)		Improve /continue BDWMO habitat monitoring program to better inform city

Topic	**Issue Rating Categories**		
	Must Have	**Should Have**	**Nice to Have**
	<u>Position BDWMO to better obtain clean water legacy funds. Incorporate legacy criteria in plan</u>. (2) *(New Issue)* <u>Revisit criteria and selection of "strategic water bodies."</u> (1) *(New Issue)*		actions. (2)
Stormwater runoff qualify, rates and volume	The BDWMO should continue to coordinate with Scott County/WMO regarding discharges from the BDWMO subwatersheds tributary to the Credit River (for example – require controls/restrictions on Orchard Lake outflows and discharges from the Murphy Hanrehan Subwatershed). (2) City compliance with MS4 permit (current and future) should remain primarily an issue for cities to manage, BDWMO having a play role with respect to TMDL implementation (see water quality issues). (2) The BDWMO should continue its role in facilitating cost allocation of inter-community flood control projects, should any arise. (1) Update stormwater management performance standards. (How strict should the standards be? Should standards set by member cities or **adjacent BDWMOs/WDs be a benchmark?)** (1) *(one group said YES)* Update requirements for local (city) water management plans. (2)	The BDWMO should continue to coordinate with Scott County/WMO regarding discharges from the BDWMO ubwatersheds tributary to the Credit River (for example – require controls/restrictions on Orchard Lake outflows and discharges from the Murphy Hanrehan Subwatershed). (1) The BDWMO should continue its role in facilitating cost allocation of inter-community flood control projects, should any arise. (2) Update stormwater management performance standards. (How strict should the standards be? Should standards set by member cities or adjacent BDWMOs/WDs be a benchmark?) (2)	City compliance with MS4 permit (current and future) should remain primarily an issue for cities to manage, BDWMO having a play role with respect to TMDL implementation (see water quality issues). (1) The boundaries and jurisdiction of the BDWMO should extend north all the way to the Minnesota River (the current BDWMO boundary stops at the Minnesota River bluffs and discharges from the BDWMO must flow through the Lower Minnesota River Watershed District before discharging to the Minnesota River). (3) *(one group suggested a possible joint meeting with LMRWD,*

Topic	**Issue Rating Categories**		
	Must Have	**Should Have**	**Nice to Have**
			another group stated NO)
Erosion and sediment control	Erosion of stream, ravines and other natural resource areas should be addressed. (1) Update erosion and sediment control performance standards (How strict should the standards be?) Should standards set by member cities or **adjacent BDWMOs/WDs be a benchmark**? (1) *(one group said YES)*	Erosion of streams, ravines and other natural resource areas should be addressed. (1)	Erosion of stream, ravines and other natural resource areas should be addressed. (1) Update erosion and sediment control performance standards (How strict should the standards be?) Should standards set by member cities or adjacent BDWMOs/WDs be a benchmark? (2) *(one group said NO)*
Education and public involvement	<u>Education and partnership with citizens/residents to leverage the best management of the (BMPs which can be the clearinghouse)</u>. (1) *(New Issue)*		
Eagan	<u>Consider asking Eagan if they wish to remain part of BDWMO</u>. (1) *(New Issue)*		

Appendix D

General Concepts in Water Quality

December, 2012

Black Dog

Watershed Management Plan

Table of Contents

D. General Concepts in Water Quality

This section describes some of the concepts that govern lake and stream water quality. All of these topics are applicable to water resources within the BDWMO to varying degrees.

D.1 POLLUTANT SOURCES

Pollutants are discharged to surface waters as either point sources or non-point sources. Point source pollutants discharge to receiving surface waters at a specific point from a specific identifiable source. Discharges of treated sewage from a wastewater treatment plant or from an industry are examples of point sources. Unlike point sources, non-point source pollution cannot be traced to a single source or pipe (storm sewer pipes are considered a non-point source discharge as the pollutants coming from the pipe are generated across the watershed contributing to the pipe, not at a single location). Instead, pollutants are carried from land to water in stormwater or snowmelt runoff, in seepage through the soil, and in atmospheric transport. All these forms of pollutant movement from land to water make up non-point source pollution.

For lakes, ponds, and wetlands, phosphorous is typically the pollutant of major concern (see Section D.3). Point sources of phosphorus typically come from municipal and industrial discharges to surface waters, whereas non-point sources of phosphorus come from urban runoff, construction sites, subsurface sewage treatment systems (SSTS or septic systems), and, in agricultural areas, from fields and feedlots. Point sources frequently discharge continuously throughout the year, while non-point sources discharge in response to precipitation or snowmelt events.

For most water bodies, non-point source runoff, especially stormwater runoff, is a major contributor of phosphorus. As urbanization increases and other land use changes occur in the city, nutrient (e.g. phosphorus, nitrogen) and sediment inputs (i.e., loadings) from stormwater runoff can far exceed the natural inputs to the city’s water bodies. In addition to nutrients, stormwater runoff may contain pollutants such as oil, grease, chemicals, nutrients, metals, litter, and pathogens, which can severely reduce water quality. Nonpoint source runoff affects not only the water resources located within the BDWMO, but also (ultimately) the Minnesota River. As a result, it is very important to control, and reduce where feasible, nonpoint source pollution in the BDWMO.

Land use changes resulting in increased imperviousness or land disturbance (e.g., urbanization, construction or agricultural practices) also result in increased amounts of phosphorus carried in stormwater runoff. This is because phosphorus readily attaches to the surfaces of sediments. Erosion and sedimentation are significant impacts of land disturbance so it is very important to manage and control all land disturbance activity. In addition to watershed (stormwater runoff) sources, other possibly significant sources of phosphorus include atmospheric deposition, internal loading (e.g., release from anoxic sediments, algae die-off, aquatic plant die-back, and fish disturbed sediment), and failing SSTS (septic systems).

D.2 EUTROPHICATION AND TROPHIC STATES

The water quality problems caused by sediment and nutrients from a lake's watershed are described by the word "eutrophication." Eutrophication, or lake degradation, is the accumulation of sediments and nutrients in lakes. It is a natural "aging" process that causes a lake to become more fertile, resulting in increased algae and aquatic plant growth. The increasing biological production and sediment inflow from the lake's watershed eventually fill the lake's basin. Over a period of many years, the lake successively becomes a pond, a marsh and, ultimately, a terrestrial site. The natural eutrophication process results from the normal environmental forces that influence a lake. Human activities can accelerate the aging process – this is called cultural eutrophication. Nutrient and sediment inputs (i.e., loadings) from wastewater treatment plants, septic tanks, and stormwater runoff can far exceed the natural inputs to the lake. The accelerated rate of water quality degradation caused by these pollutants results in unpleasant consequences, such as profuse and unsightly growths of algae (algal blooms), and/or the proliferation of rooted aquatic plants (macrophytes).

D.2.1 Trophic States

Not all lakes are at the same stage of eutrophication; therefore, criteria have been established to evaluate the nutrient status of lakes. Trophic state indices (TSIs) are calculated for lakes on the basis of total phosphorus, chlorophyll a concentrations, and Secchi disc transparencies. TSI values range upward from 0, describing the condition of the lake in terms of its trophic status (i.e., its degree of fertility). All three of the parameters can be used to determine a TSI. However, water transparency is typically used to develop the TSI_{SD} (trophic state index based on Secchi disc transparency) because people's perceptions of water clarity are often directly related to recreational-use impairment. Water quality trophic status categories include oligotrophic (i.e., excellent water quality), mesotrophic (i.e., good water quality), eutrophic (i.e., poor water quality), and hypereutrophic (i.e., very poor water quality). For example, for a lake with medium fertility, the TSI rating system results in the placement of the lake in the mesotrophic trophic status category. Water quality characteristics of lakes in the various trophic status categories are listed below with their respective TSI ranges:

Oligotrophic – [$20 \leq TSI_{SD} \leq 38$] clear, low productivity lakes, with total phosphorus concentrations less than or equal to 10 µg/L, chlorophyll *a* concentrations of less than or equal to 2 µg/L, and Secchi disc transparencies greater than or equal to 4.6 meters (15 feet).

Mesotrophic – [$38 \leq TSI_{SD} \leq 50$] intermediately productive lakes, with total phosphorus concentrations between 10 and 25 µg/L, chlorophyll *a* concentrations between 2 and 8 µg/L, and Secchi disc transparencies between 2 and 4.6 meters (6 to 15 feet).

Eutrophic – [$50 \leq TSI_{SD} \leq 62$] highly productive lakes, with 25 to 57 µg/L, total phosphorus, chlorophyll *a* concentrations between 8 and 26 µg/L, and Secchi disc measurements between 0.85 and 2 meters (2.7 to 6 feet).

Hypereutrophic – [$62 \leq TSI_{SD} \leq 80$] extremely productive lakes which are highly eutrophic and unstable (i.e., their water quality can fluctuate on daily and seasonal basis, experience periodic anoxia and fish kills, possibly produce toxic substances, etc.) with total phosphorus concentrations greater than 57 µg/L, chlorophyll *a* concentrations of greater than 26 µg/L, and Secchi disc transparencies less than 0.85 meters (2.7 feet).

Determining the trophic status of a lake is an important step in diagnosing water quality problems. Trophic status indicates the severity of a lake's algal growth problems and the degree of change needed to meet its recreational goals. Additional information is needed to determine the cause of algal growth and the means to reduce it.

D.3 LIMITING NUTRIENTS

The quantity or biomass of algae in a lake is usually limited by the water's concentration of an essential element or nutrient – "the limiting nutrient." (For most rooted aquatic plants, the nutrients are derived from the sediments.) The limiting nutrient concept is a widely applied principle in ecology and in the study of eutrophication. It is based on the idea that plants require many nutrients to grow, but the nutrient with the lowest availability, relative to the amount needed by the plant, will limit plant growth. It follows then, that identifying the limiting nutrient will point the way to controlling algal growth.

Nitrogen (N) and phosphorus (P) are generally the two growth-limiting nutrients for algae in most natural waters. Analysis of the nutrient content of lake water and algae provides ratios of nitrogen to phosphorus (N:P). By comparing the ratio in water to the ratio in the algae, one can estimate whether a particular nutrient may be limiting. Algal growth is generally phosphorus-limited in waters with N:P ratios greater than 12. Laboratory experiments (bioassays) can demonstrate which nutrient is limiting by growing the algae in lake water with various concentrations of nutrients added. Bioassays, as well as fertilization of in-situ enclosures and whole-lake experiments, have repeatedly demonstrated that phosphorus is usually the nutrient that limits algal growth in freshwaters. Reducing phosphorus in a lake, therefore, is required to reduce algal abundance and improve water transparency. Failure to reduce phosphorus concentrations will allow the process of eutrophication to continue at an accelerated rate.

D.4 STRATIFICATION

Thermal stratification profoundly influences a lake’s chemistry and biology. The density of water decreases as it warms, which means warmer water tends to rise to the surface. As a result, lakes and ponds in temperate regions tend to form temperature layers, or “stratify,” when they are exposed to the heat of the sun. When the ice melts in the spring, the water temperature in a lake is usually around 4˚C (39˚F) from top to bottom. At this temperature, water is most dense (heaviest). During the spring and summer months, the sun warms the surface layer of the lake causing it to become warmer and less dense (lighter). In shallow portions of a lake, the sun’s rays are often able to reach the lake’s bottom in most places. During the summer, the water temperature in these portions of the lake (which are usually near the shore or in the “littoral zone”) may be warm throughout.

The deeper portions of lakes typically have a thermal/density structure that differs from the shallow regions. Because sunlight does not reach the bottom of the deeper portions of the lake, these waters remain cool and more dense. Therefore, the warmer, lighter water stays near the surface and the cooler, heavier water stays at the bottom of the lake.

The cooler, deeper water layer of the lake is called the hypolimnion, and the warm surface layer is known as the epilimnion. Between the warm epilimnion and the cool hypolimnion is a transitional layer of water known as the metalimnion. This layer of the lake is characterized by a rapidly-declining temperature with depth.

D.5 NUTRIENT RECYCLING AND INTERNAL LOADING

Thermal stratification in lakes is significant because the density change in the metalimnion (middle transitional water temperature stratum) provides a physical barrier to mixing between the epilimnion and the hypolimnion. While water above the metalimnion may circulate as a result of wind action, hypolimnetic waters at the bottom generally remain isolated. Consequently, very little transfer of oxygen occurs from the atmosphere to the hypolimnion during the summer. Because of the density differences between the lighter warm water in the epilimnion and the heavier cold water in the hypolimnion, stratification in a lake can become very resistant to mixing. When this occurs, generally in mid-summer, oxygen from the air cannot reach the bottom lake water and, if the lake sediments have sufficient organic matter, biological activity can deplete the remaining oxygen in the hypolimnion. The epilimnion can remain well-oxygenated, while the water above the sediments in the hypolimnion becomes completely devoid of dissolved oxygen (anoxic). Complete loss of oxygen changes the chemical conditions in the water and allows phosphorus that had remained bound to the sediments to re-enter the lake water.

Shallow water bodies may circulate many times during the summer as a result of wind mixing. Lakes possessing these wind mixing characteristics are referred to as polymictic lakes. In contrast, deeper lakes generally become well-mixed only twice each year. This usually occurs in the spring and fall. Lakes possessing these mixing characteristics are referred to as dimictic lakes. During spring and fall, the lack of strong temperature/density differences allows wind-driven circulation to mix the water column throughout. During these mixing events, oxygen may be transported to the deeper portions of the lake, while dissolved phosphorus is brought up to the surface, where it becomes available for plant and algal growth. As the summer progresses, phosphorus concentrations in the hypolimnion can continue to rise until oxygen is again introduced (recycled). Dissolved oxygen concentrations will increase if the lake sufficiently mixes to disrupt the thermal stratification. Phosphorus in the hypolimnion is generally not available for plant uptake because there is not sufficient light penetration to the hypolimnion to allow for growth of algae. The phosphorus, therefore, remains trapped and unavailable to the plants until the lake is completely mixed.

Phosphorus enters a lake from either watershed runoff or direct atmospheric deposition. Therefore, it would seem reasonable that phosphorus in a lake could decrease by reducing these external loads of phosphorus to the lake. All lakes, however, accumulate phosphorus (and other nutrients) in the sediments from the settling of particles and dead organisms. As previously discussed, this reservoir of phosphorus can be reintroduced in the lake water and become available again for plant uptake. This resuspension or dissolution of nutrients from the sediments to the lake water is known as “internal loading.” As long as the lake’s sediment surface remains sufficiently oxidized (i.e., dissolved oxygen remains present in the water above the sediment), its phosphorus will remain bound to sediment particles as ferric hydroxy phosphate. When dissolved oxygen levels become extremely low at the water-sediment interface (as a result of microbial activity using the oxygen), the chemical reduction of ferric iron to its ferrous form causes the release of dissolved phosphorus, which is readily available for algal growth, into the water column. The amount of phosphorus released from internal loading can be estimated from depth profiles (measurements from surface to bottom) of dissolved oxygen and phosphorus concentrations. Even if the water samples indicate the water column is well oxidized, the oxygen consumption by the sediment during decomposition can restrict the thickness of the oxic sediment layer to only a few millimeters. Therefore, the sediment cannot retain the phosphorus released from decomposition or deeper sediments, which results in an internal phosphorus release to the water column. Low-oxygen conditions at the sediments, with resulting phosphorus release, are to be expected in eutrophic lakes where relatively large quantities of organic material (decaying algae and macrophytes) are deposited on the lake bottom.

If the low-lying phosphorus-rich waters near the sediments remain isolated from the upper portions of the lake, algal growth at the lake’s surface will not be stimulated. Shallow lakes and ponds can be expected to periodically stratify during calm summer periods, so that the upper warmer portion of the water body is effectively isolated from the cooler, deeper (and potentially phosphorus-rich) portions. Deep lakes typically retain their stratification until cooler fall air temperatures allow the water layers to become isothermal and mix again. However, relatively shallow lakes are less thermally stable and may mix frequently during the summer periods. Shallow lakes are, therefore, frequently polymictic, experiencing alternating periods of stratification and destratification.

It is the destratification, brought about by wind-induced mixing of the water column, which re-introduces phosphorus to the upper (epilimnetic) portion of the lake.

The pH of the water column can also play a vital role in affecting the phosphorus release rate under oxic conditions. Photosynthesis by macrophytes and algae during the day tends to raise the pH in the water column, which can enhance the phosphorus release rate from the oxic sediment. Enhancement of the phosphorus release at elevated pH ($pH > 7.5$) is thought to occur through replacement of the phosphate ion (PO_4^{-3}) with the excess hydroxyl ion (OH^-) on the oxidized iron compound (James, et al., 2001).

Another potential source of internal phosphorus loading is the die-off of curlyleaf pondweed, an exotic (i.e., non-native) aquatic plant present in many BDWMO lakes. Curlyleaf pondweed grows vigorously during early spring, crowding out native species. It releases a small reproductive pod that resembles a small pinecone during late June. After curlyleaf pondweed dies out in early July, it may sink to the lake bottom and decay, causing oxygen depletion and exacerbating internal sediment release of phosphorus. This potential increase in phosphorus concentration during early July likely could result in an algal bloom during the peak of the recreational use season (the fourth of July).

Table 3-2 Comparison of Stormwater Management Standards

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