North & East Metro Groundwater Management Area Plan

November 2015

Minnesota Department of Natural Resources
Ecological and Water Resources Division

MNDNR

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The Clean Water Fund, which receives 33 percent of the sales tax revenue from the Clean Water, Land and Legacy Amendment, approved by voters in November 2008. The Clean Water Fund's purpose is to protect, enhance and restore water quality in lakes, rivers, streams and groundwater.

At least 5 percent of the money is targeted for the protection of drinking water sources. The Legislature allocates funds for water quality work and drinking water protection based on recommendations from the Clean Water Council.

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North & East Metro Groundwater Management Area: Designation and Plan

Minnesota is rich in water resources. With more than 10,000 lakes, thousands of miles of rivers and streams, and many thousands of acres of wetlands, it might be natural to think that our water is essentially unlimited. But in some parts of the state, the unseen, underground aquifers that make up our groundwater resources are under pressure to meet growing needs for domestic water supplies, irrigation, industrial and other uses. These groundwater resources also are interconnected with lakes, streams and wetlands that we value for commerce, recreation, and water supplies. Those surface waters also provide the habitat needed by many animals and plants. If we are not careful in how we use water, both economic development and ecosystems could be put at risk.

These concerns led the Minnesota Department of Natural Resources to explore a different approach to groundwater management in three areas around the state where trends suggest groundwater use might be unsustainable. Working over the past two years with an advisory team of nearly two dozen people representing local government, industry and other agencies, the DNR has established the North & East Metro Groundwater Management Area, which is hereby designated to include all of Washington and Ramsey counties and parts of Anoka and Hennepin counties, as delineated in the plan accompanying this letter. We have created this five-year plan to guide our work in this area to ensure that groundwater supplies remain adequate to meet human needs while protecting lakes, streams and wetlands.

I believe this plan is a very positive step for Minnesota. It draws upon a wealth of technical expertise across a variety of sectors. It has been informed and improved by extensive input and feedback from major water users, local government, concerned citizens and other interests. The plan is comprehensive yet achievable. It lays out clear objectives and specific actions the DNR will take to ensure sustainable use of groundwater. It also acknowledges that DNR cannot be successful alone, and describes the important roles of water users and other agencies.

I want to thank the volunteers who served on the Project Advisory Team and the people who actively participated in meetings throughout the process. The many hours you dedicated are very much appreciated. This plan provides a good starting point, but working to maintain the north and east metro area's water resources will require many more people, agencies and interests continuing to work together in the years to come. I'm confident that will happen, because Minnesotans have shown their commitment to natural resource conservation and stewardship.

Tom Landwehr
Commissioner

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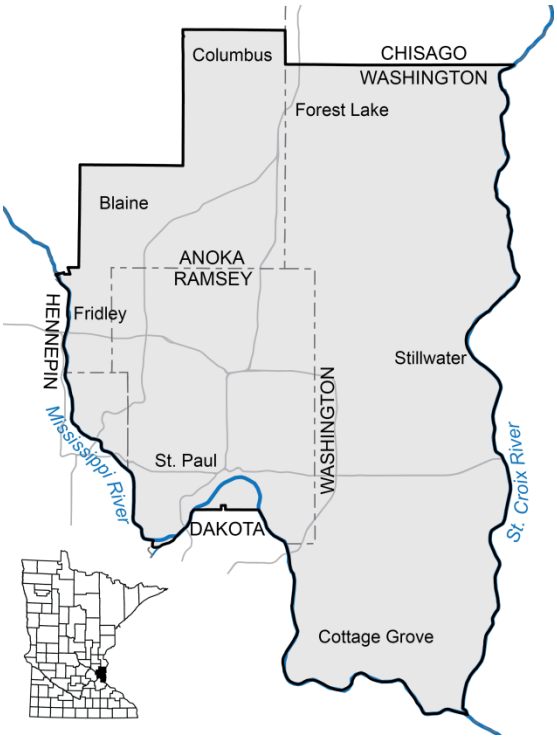
Background and purpose

Minnesota's groundwater resources are vital to its ecological health, economic prosperity and quality of life. But in some parts of the state, our underground supplies of water are under increasing demands for irrigation, industry and domestic needs, putting them at risk of overuse and degradation.



Boundary of the North & East Metro GWMA

A statewide analysis of groundwater resources identified the north and east metro region of the Twin Cities as an area where such concerns exist. This area is growing in population, and water use is increasing. At the same time, it is rich in surface waters that are connected to and affected by groundwater levels. In portions of the area existing groundwater contamination further limits water availability to meet human needs. Communities, businesses, and agriculture in much of the region are entirely reliant on groundwater as a source of water supply. They are connected to one another through their use of the same aquifers and the cumulative effects of that use.

To better address these issues, the DNR has designated all of Washington and Ramsey Counties, along with portions of Anoka and Hennepin, as the North and East Metro Groundwater Management Area. This designation in November 2015 allows a more comprehensive and focused approach to ensuring that groundwater supplies remain adequate to meet human needs while protecting lakes, streams and wetlands.

The North and East Metro Groundwater Management Area Plan will guide the DNR's efforts to manage groundwater appropriations sustainably in this area over the next five years. The Plan establishes sustainability goals to help appropriation permit holders plan for their future water use. This Plan does not get into details of water management for any individual business or community. It proposes no immediate changes to particular permits, but it sets the stage for managing appropriations more carefully and comprehensively in the years ahead.

How the Plan was developed

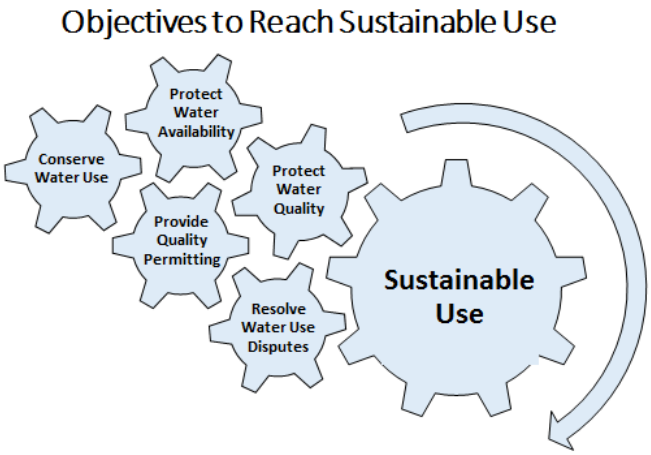
The North and East Metro Groundwater Management Area Plan is the product of over two years of work. To broaden and supplement the DNR's technical expertise, the DNR established a Project Advisory Team with representatives of city, township and county governments, industrial water users, a lake conservation district, a watershed district, the Metropolitan Council, and state and federal agencies. This team met 15 times between October 2013 and May 2015, providing input and advice on

the Plan. The DNR also held several public meetings and met in smaller groups with stakeholders to receive feedback. The Plan underwent numerous revisions based on internal and external review.

Implementation

To ensure that groundwater use is sustainable in the North and East Metro Area, the Plan lays out five broad objectives that must be achieved:

- Identify and embrace water conservation best practices
- Protect surface waters
- Preserve water quality
- Improve appropriations permitting
- Protect water availability



Section Five of the North and East Metro Groundwater Management Area Plan describes specific actions the DNR will take to meet these objectives and thereby achieve the overall goal of sustainable groundwater use. These actions include:

- Increase monitoring and evaluation of groundwater and groundwater-dependent natural resources
- Improve communications around water use and impact on natural systems
- Evaluate water appropriations relative to established sustainability thresholds
- Develop sustainability thresholds where they do not exist
- Improve the appropriations permitting process

Over the Plans first five years, the DNR will meet periodically with a newly configured Project Advisory Team to provide updates and hear concerns. At the end of the initial five-year implementation period, the agency will conduct a comprehensive review of the Plan and its results to determine future actions and any needed revisions. The Project Advisory Team will play an important role in that review.

Toward a sustainable future

Reliable water supplies are critical both for economic wellbeing and environmental health. Increasing demands on groundwater resources in the North and East Metro Area require new approaches to groundwater use and management. While conditions do not add up to a crisis yet, warning signs are becoming evident. “Business as usual” is no longer an option.

By moving ahead with the comprehensive management framework laid out in the Plan, it is possible to plan for change and avoid disruption. The area’s businesses will be able to continue to prosper, communities will be assured of a reliable water supply, and the water features and natural resources that make the area such a good place to live will continue to function and provide their many benefits.

For more information about the North and East Metro Groundwater Management Area, contact the DNR Ecological and Water Resources Division at (651) 259- 5100, on the web at http://www.dnr.state.mn, or visit the project webpage at http://www.dnr.state.mn.us/gwmp/areas.

1. Introduction

The Minnesota Department of Natural Resources (DNR) works with citizens to manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for sustainable commercial uses of natural resources. The DNR works to integrate and sustain a healthy environment, a sustainable economy, and livable communities. This strategy shares stewardship responsibility with citizens and partners to manage for multiple interests.

The DNR is responsible for managing the state's water resources to sustain healthy waterways, basins and groundwater resources. The DNR plays an important role in supporting sustainable groundwater use through its permit programs, information collection and analysis activities, law enforcement responsibilities, education, and technical assistance opportunities.

The DNR is one of several state and local agencies and organizations with responsibility to develop, protect and manage our water resources. The following briefly describes some of the key roles of state agencies in water:

- Board of Water and Soil Resources (BWSR): provides resources and technical assistance to local governments, manages conservation easements, and provides oversight to local water management entities.
- Department of Natural Resources: collects and analyzes information on water, regulates water use and riparian land use activities, manages public land, and oversees water supply plans.
- Metropolitan Council: operates state's largest wastewater treatment system, provides surface water and water supply planning support and direction, and provides regional water quality and quantity monitoring.
- Department of Agriculture (MDA): responsible for fertilizer and pesticide regulation and management, including implementing the state Nitrogen Fertilizer and Pesticide Management Plans to protect groundwater; developing voluntary best management practices; monitoring groundwater in agricultural settings; product registration; and applicator training and licensing.
- Department of Health (MDH): ensures public drinking water systems protect sources and meet federal drinking water standards, regulates water well construction and sealing to protect groundwater, assesses drinking water contaminant risks to public health and licenses professions impacting drinking water.
- Pollution Control Agency (MPCA): develops water quality standards, monitors surface water and groundwater quality, and restricts discharges of pollutants through use of permits.
- Public Facilities Authority: manages municipal financing programs to help communities build and upgrade drinking water, wastewater and storm water infrastructure.

Groundwater is at risk of overuse and contamination throughout the state and in some specific areas of the state this risk is a more urgent issue. Conflicts arising from overuse have the potential to pit diverse groundwater dependent uses, such as drinking water supply, agriculture, economic growth, and ecosystem needs, against one another. To address concerns about long term sustainable use of

groundwater in these areas, and to help assure adequate supplies for future uses, the DNR is defining Groundwater Management Areas (GWMA) and developing management plans. The purpose of the GWMA Plan (Plan) is to guide DNR actions in managing the appropriation and use of groundwater within the GWMA over the five years following adoption of the Plan. The Plan will be updated as needed to allow it to continue guiding sustainable groundwater use beyond the initial five years addressed in this first authorization of the Plan.

The GWMA represents a geographic area within which groundwater users share a distinct aquifer system or groundwater resource. Users include both those who are required to have appropriation permits and those who do not require permits to use groundwater.

Problem

As part of a statewide analysis of groundwater resources the DNR identified the north and east Twin Cities metropolitan area as an area of specific concern where groundwater resources are at risk of overuse and degraded quality. Several factors led to this decision, the projected population growth and water use in the area, the presence of surface waters that are sensitive to fluctuations in aquifer levels, and the occurrence of known contamination that limits opportunities to use groundwater. The DNR believes that the north and east metro area will benefit from the creation of the GWMA plan to direct permitting and other actions to sustainably use groundwater for current and future generations.

The DNR manages water resources to assure an adequate supply largely through permitting and tracking water appropriation and use and water levels. The Water Appropriation Permit Program is required to balance competing management objectives that include use and protection of Minnesota's water resources. Key challenges for the DNR in managing groundwater appropriations and use in the North & East GWMA include the following:

- Demand: projected growth in water demand, particularly in Washington County and parts of southern Anoka County
- Natural Resources: potential for negative effects on groundwater-dependent natural resources such as wetlands, lakes, and streams
- Conservation: a need for improved and expanded application of water conservation and improved water use efficiency
- Contamination: reduction in the availability of clean groundwater
- Information: gaps in the information needed to determine the sustainability of groundwater use

Purpose

The purpose of the GWMA Plan is to guide DNR actions in managing the appropriation and use of groundwater within the GWMA over the next five years. The following points help summarize the purpose of the GWMA Plan by identifying what it is and what it is not:

- The Plan directs the actions of the DNR and is not a plan for others to implement.
- The Plan establishes actions to guide the improvement of the DNR's appropriation permitting process, to ensure sustainable groundwater use.
- The Plan calls for the development of sustainability thresholds for groundwater use in the GWMA, where thresholds do not already exist.
- The Plan covers a five year period, with the expectation that actions will be revised to continue the work beyond the initial 5-year period.
- The Plan directs actions to improve communication with stakeholders within the GWMA.
- The Plan calls for regular review of progress by the Project Advisory Team of stakeholders.
- The Plan is not a comprehensive study of the area, but instead uses information from completed studies and suggests future studies to inform the plan and actions.
- The Plan does not establish any new or broader regulatory authority. The actions proposed in the Plan are based on current statutes and rules.
- The Plan calls for coordination between the DNR and the Metropolitan Council in the preparation and review of the legislatively mandated metropolitan Twin Cities master water supply plans and individual community water supply plans.
- The Plan itself is not an individual or a collective water supply plan for individual permit holders, industries, or municipalities.

The GWMA is intended to be in place for the long term, which will require regular review and updates. During the initial five year implementation period, the Plan, actions and progress will be reviewed annually, evaluated, and revised with the help of an Advisory Team and stakeholders. The Plan identifies actions for the DNR to take, in collaboration with other agencies, organizations and individuals active in the GWMA. Those state agencies and organizations have an important role in supporting the DNR's actions in the Plan. The MPCA, MDH, MDA and BWSR provided specific commitments and actions in support of the DNR's North & East Metro GWMA. Those commitments are included in Appendix A.

Many of the DNR actions described in Section 5 will result in new information, tools, and processes that will form the foundation for future decisions. The Plan does not establish or include a total allocation limit. Rather, it lays the path for determining sustainable thresholds, now and in the future, and managing appropriations to stay within sustainability thresholds in a planned and transparent framework. Actions oriented toward all five Plan objectives are integral to this process.

Planning Process

The Plan lays out a framework for addressing the groundwater management goals and objectives of the DNR Groundwater Management Program (Strategic Plan) in light of the particular challenges within the

area. A project team of DNR including members from the Division of Ecological and Water Resources (EWR) and the Division of Fish and Wildlife drafted the Plan. In order to gain insight into specific interests of the diverse groundwater users in the area, the DNR established a Project Advisory Team (PAT) to provide feedback and advice. The PAT is comprised of stakeholders from state agencies, the Metropolitan Council, county and city/township governments, a lake conservation district, a watershed district (WSD), industry, and the federal government (Table 1-1). In response to legislative changes made in 2014 (Minn. Stat., sec. 103G.287, subd. 4) the DNR expanded the membership of the PAT during the planning process to increase the number of team members holding water appropriation permits.

The role of the PAT is to provide advice and feedback on the process and the Plan during Plan development, and during the five-year implementation period. DNR asked PAT members to be two-way conduits of information about the process and Plan to other stakeholders. The PAT was not established to provide consensus on the Plan, and participation on the PAT does not imply consent of the Plan or specific elements of the Plan. For implementation of the Plan, the DNR will establish a formal charter for the PAT and reestablish membership to match the needs of the project going forward.

Fifteen PAT meetings were held from October 2013 through May 2015. Following development of the draft Plan with input from the PAT, the DNR sought wider stakeholder review and comments through March 2015.

DNR staff participated in discussions with a variety of stakeholders about regional groundwater issues, water supply challenges, lake levels and the potential to establish a GWMA. These discussions provided valuable feedback and perspectives about a GWMA planning process. A list of selected meetings that the DNR participated in is included in Appendix B.

At the end of the five year initial implementation period, the DNR will conduct a comprehensive review of the process, actions and results for the GWMA Plan, determine future actions, and if needed, revise the Plan. The Project Advisory Team will be an important part of the comprehensive review.

Table 1-1 Project Advisory Team

Name	Affiliation	Permit Holder
Project Advisory Team		
Mike Bailey	Bailey Nurseries	Yes
Brad Barott	Barott Drilling	No
Bryan Bear	City of Hugo	Yes
Larry Bohrer[1]	City of Columbus	Yes
John Bumgarner[1]	U.S. Geological Survey	No
Jessica Collin-Pilarski	Washington County	No
Brian Davis	Metropolitan Council	Yes
Jo Emerson[1]	City of White Bear Lake	Yes
Mike Grochala	City of Lino Lakes	Yes
Barbara Haake[1]	Rice Creek Watershed District	No
Jane Harper	White Bear Lake Conservation District	No

Name	Affiliation	Permit Holder
Ryan Lemickson	Minn. Dept. of Agriculture	No
Jennifer Levitt	City of Cottage Grove	Yes
Mark Maloney	City of Shoreview	Yes
James Markoe[2]	White Bear Lake Homeowners Association	No
Greg McNeely[2]	White Bear Lake Restoration Association	No
Terry Noonan	Ramsey County	Yes
Paul Putzier	Project Manager - DNR, EWR	No
Jay Riggs	Washington County Conservation District	No
Steve Robertson	Minn. Dept. of Health	No
Bill Short	White Bear Township	Yes
James Stark[3]	*USGS*	*No*
Brian West[4]	RockTenn	Yes
Jim Westerman[1]	City of Woodbury	Yes
DNR Staff Support to the Project Advisory Team		
Glen Champion	DNR, EWR	N/A
Kate Drewry	DNR, EWR Central Region	N/A
Brian Nerbonne	DNR, Fisheries Section	N/A
Hannah Texler	DNR, EWR Central Region	N/A

[1] Joined the Advisory Team in September/October 2014
[2] Joined the Advisory Team in December 2014
[3] Replaced on the Advisory Team by Jon Bumgarner in October 2014
[4] Replaced by Kimberly Doverspike, in February 2015

Plan Structure

The remainder of the Plan is divided into five additional sections.

SECTION 2 - DESCRIPTION OF THE BOUNDARY AND THE GWMA summarizes background information on groundwater connected natural resources, water use, and governance that were used to select the GWMA boundaries. The information also sets the stage for identifying the groundwater management challenges in the area.

SECTION 3 - THE GOAL AND OBJECTIVES states the Plan goal and describes five objectives that the DNR will pursue to achieve the overall goal of long term, sustainable groundwater use in the GWMA. Together, the five objectives describe sustainable groundwater appropriation and use based on directives given in Minnesota Statutes.

SECTION 4 - STATUS OF THE GWMA in Terms of the Objectives provides additional information about conditions within the GWMA that relate specifically to the five objectives. This information includes a summary of current understanding of the status of each objective within the GWMA, discussion of gaps in knowledge or activities, and recommendations for how to fill those gaps.

SECTION 5 - ACTIONS states the actions that the DNR will take over the next five years toward achieving the five objectives. These actions address the highest priority needs identified from the evaluations described in Section 4.

SECTION 6 - IMPLEMENTATION provides a schedule for the DNR to perform the Plan actions as well as goals for achieving measureable outcomes. This section also describes the review and revision process for the Plan.

SECTION 7 - GLOSSARY of terms used in the Plan.

2. Description of the Boundary and the GWMA

A geographic area was defined within which to manage groundwater resources. The boundary for this GWMA was selected by using a combination of physical, governmental, and planning elements. Establishing a boundary allows us to identify and analyze factors that affect long term water use, and to identify specific actions that reduce the risk of unsustainable groundwater use.

Elements considered in selecting the boundary of the GWMA included the following:

- Hydrogeology
- Water use
- Water dependent natural resources
- Water quality
- Jurisdictions, governance and planning

The boundary selected for the North & East Metro GWMA includes all of Washington and Ramsey counties, 10 cities in southeastern Anoka County, and the portion of Hennepin County east of the Mississippi River (Figure 2-1). Vertically, the boundary includes all parts of the groundwater system above the Eau Claire geologic formation. A more detailed description of the elements listed above is given in the documents: *Draft Working Boundary N & E Metro GWMA* and *Updated Draft Working Boundary N & E Metro GWMA*. Section 2 of this Plan provides summary information on the elements that were used to select the boundary for the North & East Metro GWMA.

Hydrogeology

Hydrogeology defines the natural conditions and boundaries of the groundwater system. The boundary includes the following:

- The horizontal extent of the Prairie du Chien–Jordan aquifer between the hydrologic boundaries formed by the Mississippi and St. Croix rivers, except for localized outliers of these bedrock formations (Figure 2-2)
- The hydrogeological transition area in southeastern Anoka County and Forest Lake in Washington County adjacent to the margin of the Prairie du Chien–Jordan aquifer
- All aquifers above the Eau Claire Formation confining unit (Figure 2-3). The Mt. Simon aquifer (located below the Eau Claire Formation) is not included because it is hydrologically separated from the shallower aquifers within the area. Appropriations from the Mt. Simon are also restricted by statute in the seven-county Twin Cities metropolitan area.

Topographic watershed boundaries were reviewed. The watersheds are integral to groundwater health but generally do not match the hydrogeologic boundaries to the regional groundwater system.

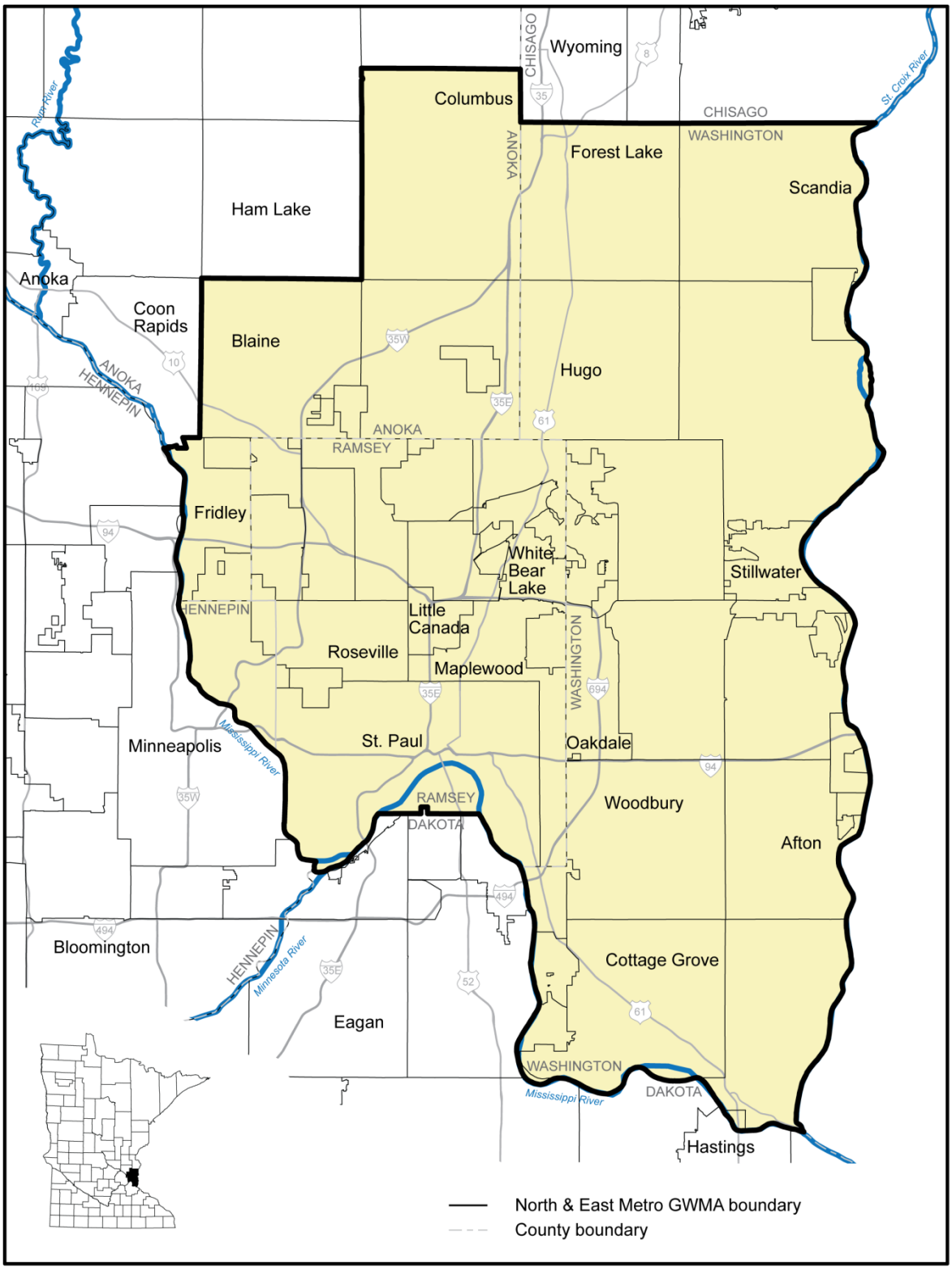


Figure 2-1 Boundary of the North & East Metro GWMA

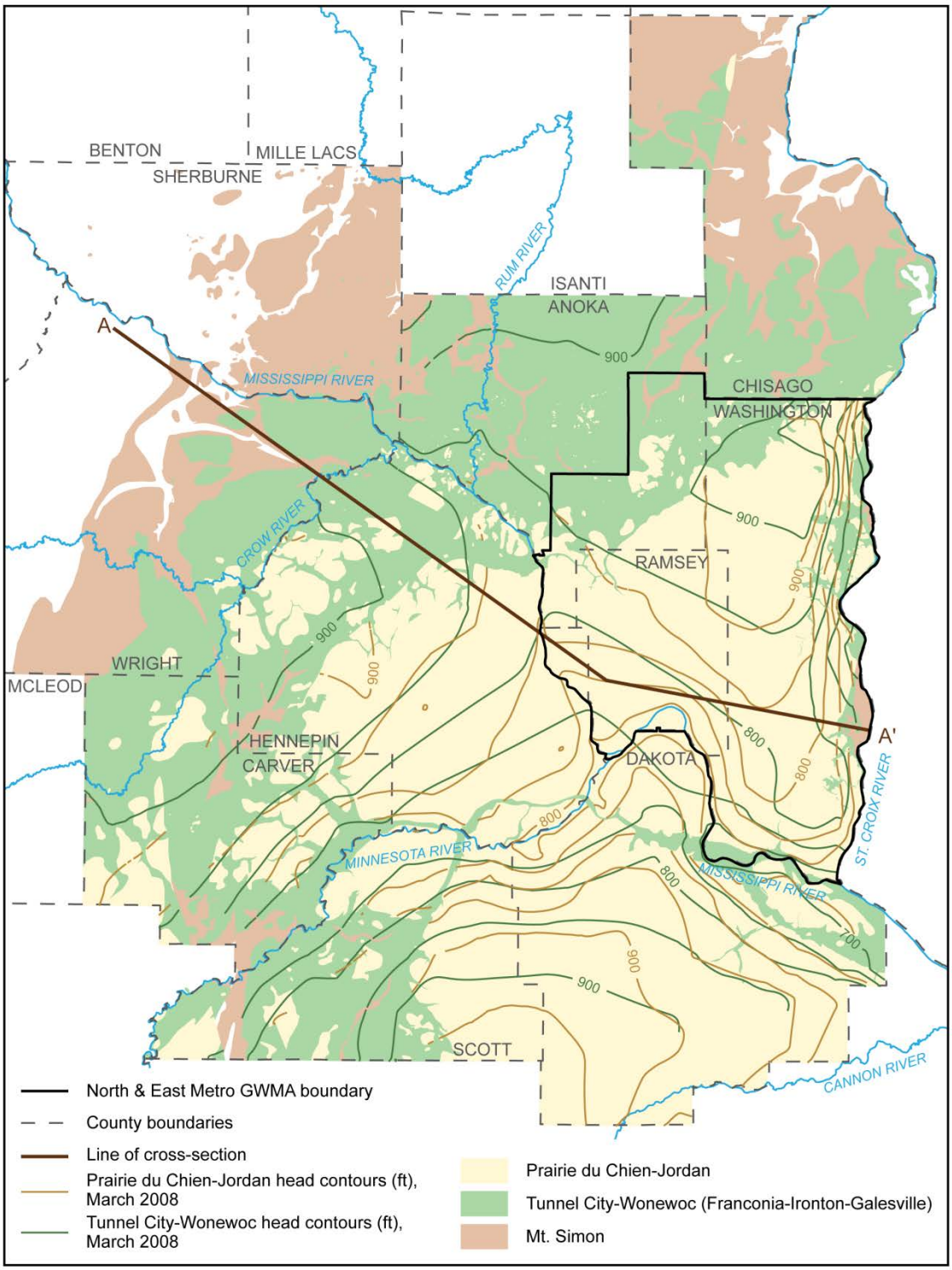


Figure 2-2 Bedrock aquifers
Modified from Mossler[1], potentiometric head contours from Sanocki et al.[2], and cross section location.

[1] Mossler, J.H., 2013. Minnesota Geological Survey Miscellaneous Map M-194, 1:125,000 scale.
[2] Sanocki, et al., 2009. U. S. Geological Survey Scientific Investigations Report 2009-5226.

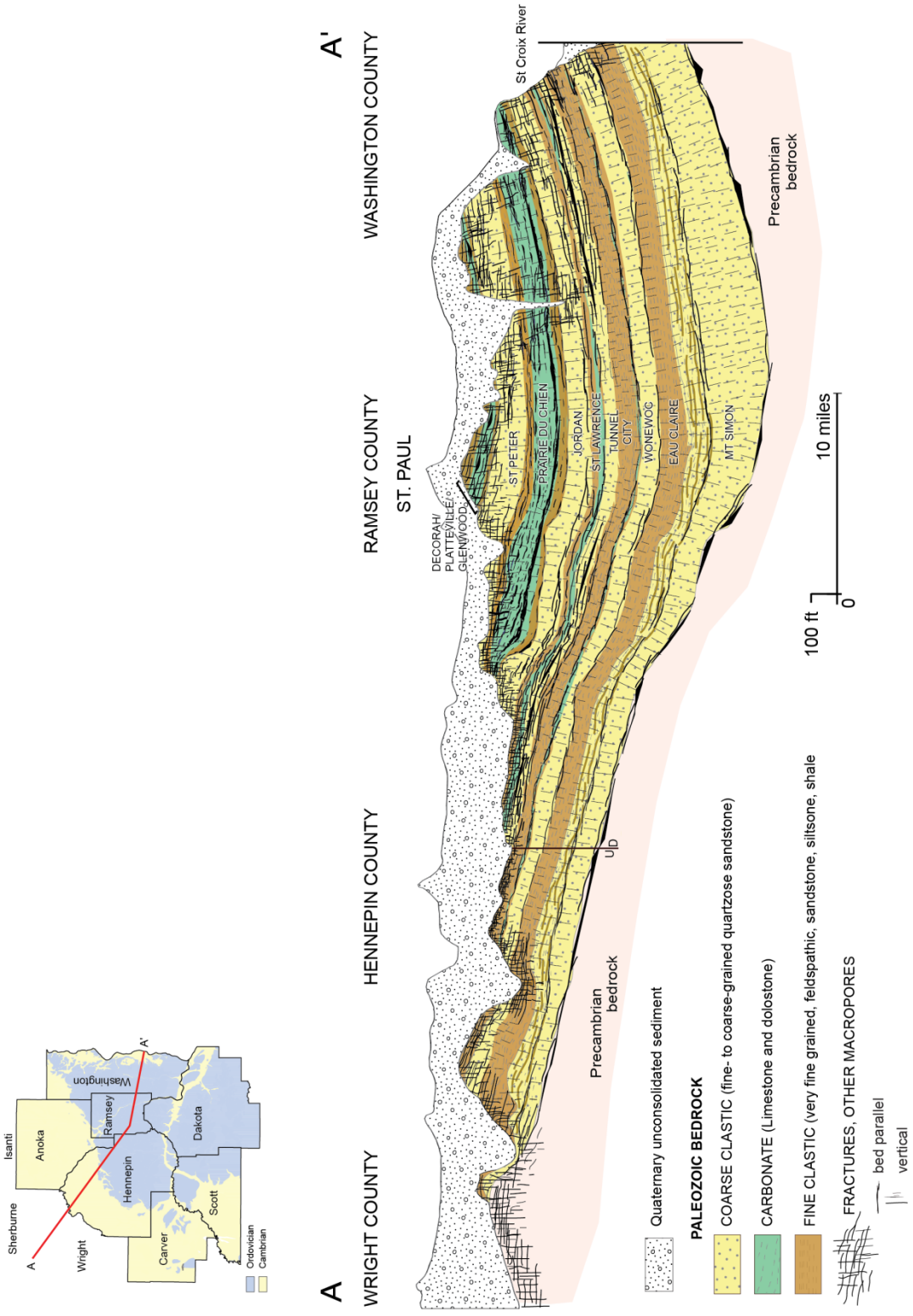


Figure 2-3 Geologic cross section
Modified from Runkel et al.[3] Note the position of the Eau Claire Formation, a regional confining unit.

[3] Runkel et al., 2006. Minnesota Geological Survey Open File Report 06-04.

Water Use

Current and projected water use informed the boundary recommendation in the following ways:

- The boundary includes areas with intensive groundwater use, and it includes the majority of the largest permitted users in the hydrogeologic system bounded by the Mississippi and St. Croix rivers (Figure 2-4).
- Substantial growth in water demand is projected in areas served by the aquifer system. The boundary includes the areas where the largest growth in water demand is expected.

Groundwater appropriations and use

There were 259 active permits to appropriate groundwater in the area at the beginning of 2014. The average reported groundwater use in the area over the 5-year period from 2008 through 2012 was approximately 29.0 billion gallons per year (BGY). This compares to total permitted groundwater appropriations of 62.5 BGY in 2012. Total average groundwater use over the 5-year period was 30.6 BGY after adding domestic well use estimated by Metropolitan Council for 2010[4] (1.6 BGY). Groundwater use is shown in several categories in Figure 2-5.

Projected Water Demands

Water supply plans and water use projections compiled by the Metropolitan Council in 2008 projected total water use will increase 20 percent by 2030 compared to average use reported for 2008–2012. Municipal water use was projected to increase 23 percent over the same time period. The largest increases in municipal water demand by 2030 were projected in Woodbury, Hugo, Cottage Grove, Blaine, and Forest Lake. The Metropolitan Council is in the process of updating and extending projected water demands through 2040, using input from public water suppliers. Municipalities and public water suppliers prepare Comprehensive Plans and individual Water Supply Plans that detail expected changes and plans to meet the changing needs of the communities. The Metropolitan Council and the DNR review and approve those plans, and the municipalities use them to guide their planning. The Water Supply Plans are general in nature and specific appropriation requests, even when based upon approved Water Supply Plan, must be evaluated individually at the time of the request.

There is always uncertainty in the population projections used to make the water use projections. The most recent population forecasts suggest that water demands in some suburban cities may not grow as fast as was projected by the Metropolitan Council in 2008. What is clear is that population and water-use will continue to grow in several suburban communities that use groundwater. Substantially increased permit volumes and/or new permits would be needed to meet previously projected 2030 demands with locally supplied groundwater.

The Metropolitan Council projections did not anticipate large increases in surface-water use. Growth in supply was assumed to come from local groundwater supplies. Privately owned, domestic groundwater use is projected to increase slightly but will make up less than one percent of total water use in 2030.

[4] Metropolitan Council, 2013. Public Water Supply System Demand Projections – Twin Cities Metropolitan Area, Minnesota: www.datafinder.org/cafe.

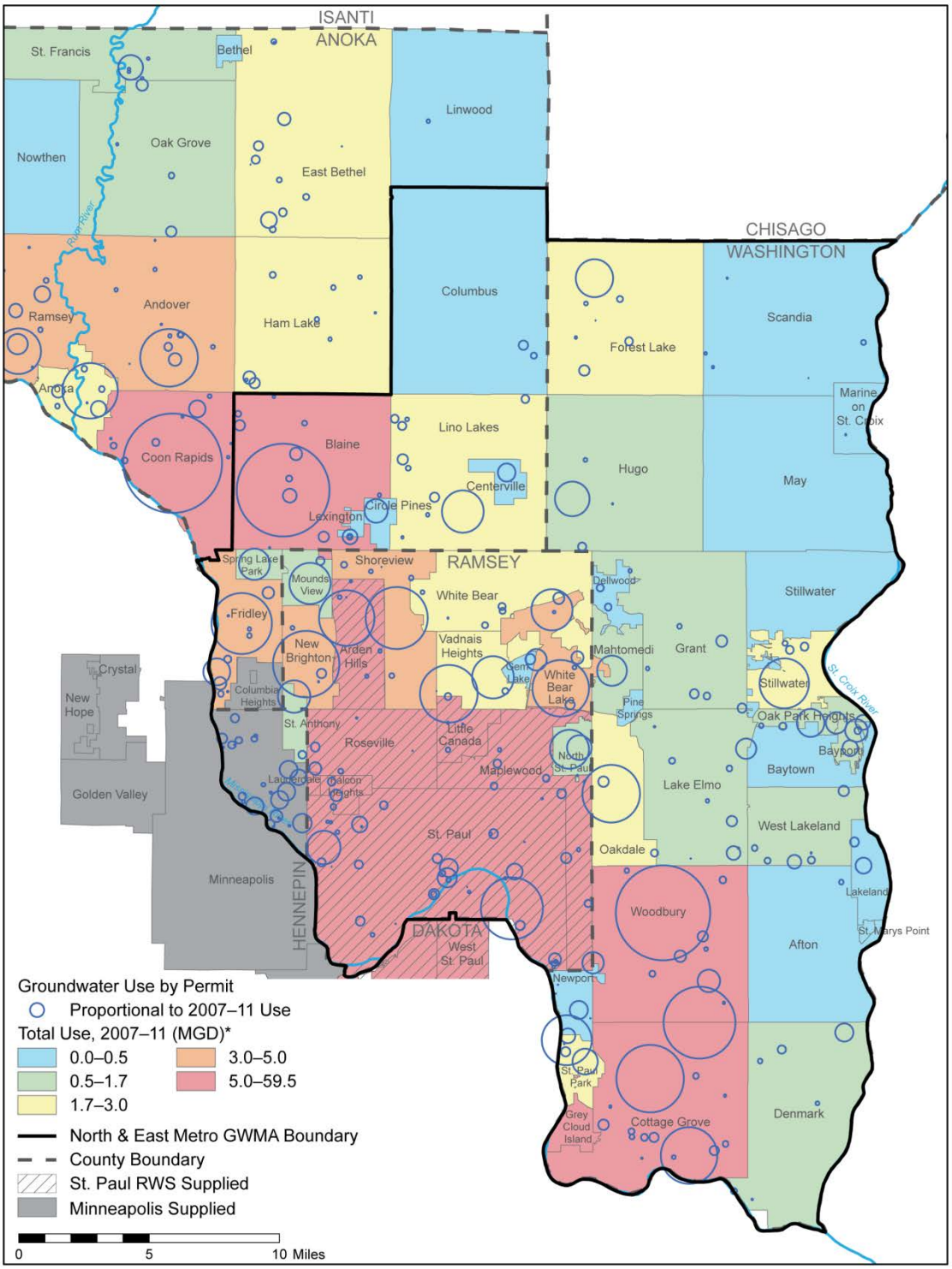


Figure 2-4 Water use

Total water use (2007—2011) aggregated by cities/townships sharing a public water supplier (including private domestic use estimated by Metropolitan Council), in average millions of gallons per day and groundwater use by permit.

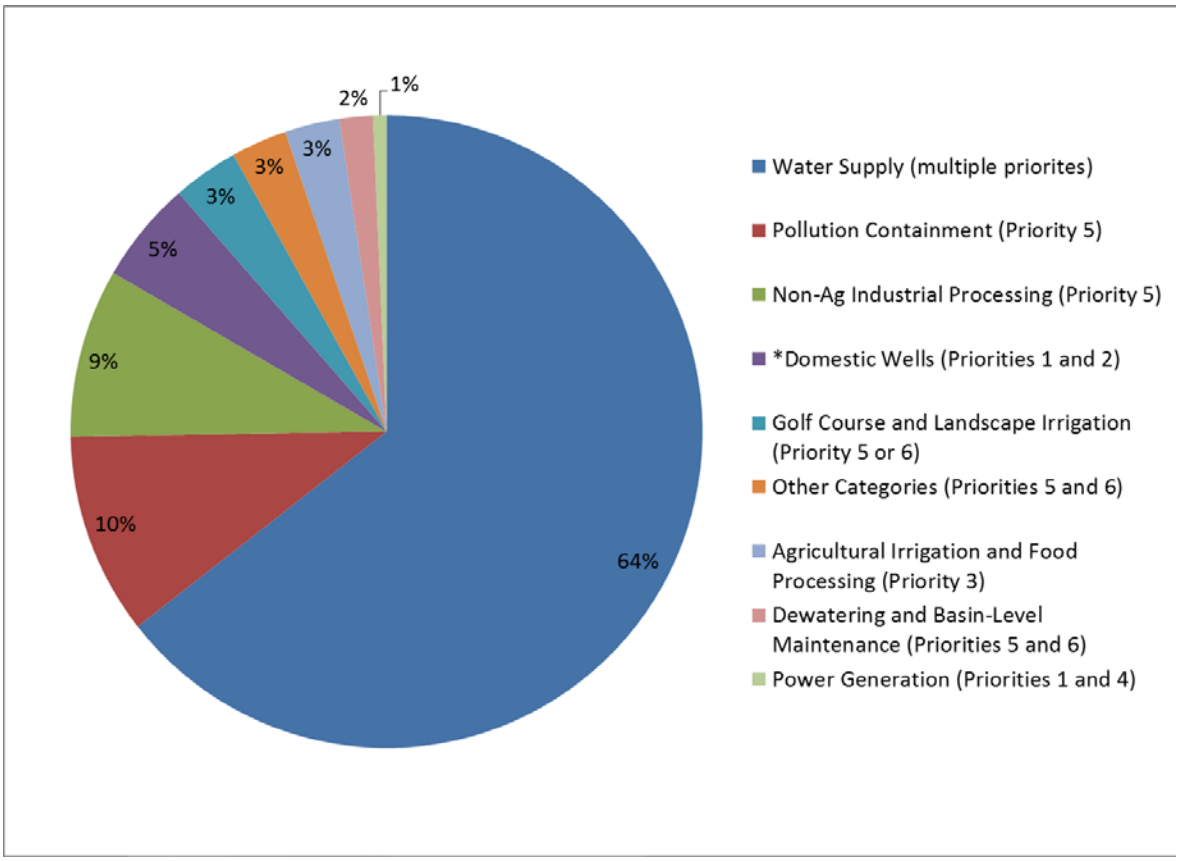


Figure 2-5 Groundwater use by category (2008 – 2012)
The figure presents average groundwater use (2008–2012) by several categories. Note that domestic well use was estimated, whereas uses in other categories were reported by permit holders. Allocation priorities shown in parentheses are based on Minn. Stat., sec. 103G.261.

Water Dependent Natural Resources

The GWMA boundary was influenced by natural resources in the area, particularly the surface water features that are sensitive to changes in groundwater levels. The boundary includes surface water and ecological features connected to the hydrogeology. Managing groundwater appropriations will have a direct impact on the health of these natural resources. The following features within the North & East Metro GWMA are included:

- Trout streams: Six designated trout streams of eastern Washington County, along with 7 nondesignated streams that support a coldwater community including trout
- Wetland complexes across the entire area
- Lakes that may be sensitive to changing aquifer levels
- Native plant communities: 16 types associated with groundwater
- Plant and animal species:
  - State-listed rare species associate with groundwater
  - Numerous additional species that inhabit streams, lakes, and wetlands that are associated with groundwater

Trout Streams

The DNR has the authority to designate trout streams. Designation provides increased protection from alterations and appropriations. In addition, the MPCA maintains higher water quality standards for coldwater streams to protect these sensitive systems.

Designated trout streams

DNR has designated six trout streams in Washington County: Falls Creek, Gilbertson Creek, Old Mill Stream, Willow Brook, Brown's Creek, and Valley Creek (Figure 2-6). They range in size and character based on geology and land use. Tributaries to listed trout streams within the same sections are also designated as trout streams (Minn. Rules, part 6264, subp. 4), although the tributaries may not support trout or have perennial flow.

Falls Creek, Gilbertson Creek, Old Mill Stream, and Willow Brook are all small streams that support self-sustaining brook trout populations, along with an occasional burbot, a fish species that also requires coldwater habitat. These streams have a mixture of public and private land in their watershed, and appear to be in good health based on the fish communities present. These streams are all spring-fed from bedrock aquifers along the St. Croix River Valley.

Valley Creek in Afton is also spring-fed from bedrock aquifers. In the headwaters, there are predominantly brook trout and slimy sculpin (a small coldwater fish species), while in the middle and lower portions of the stream brown and rainbow trout predominate. American brook lamprey, nonparasitic lamprey species found in coldwater streams, is also present. This fish community is indicative of a healthy coldwater stream.

Brown's Creek differs from the other Washington County trout streams because it originates in a large wetland complex. The upper reaches of Brown's Creek are unsuitable for trout because of the relatively

warmer water temperature flowing from the wetland in summertime and the low dissolved oxygen levels. Further downstream, springs from the surficial aquifer flow into the stream and create marginal conditions for brown trout. Where the stream begins to flow down into the St. Croix Valley, it intercepts groundwater from bedrock aquifers and conditions become most suitable for trout. Brown's Creek is currently listed as impaired for aquatic life due to a fish community that includes many warmwater fish species. The brown trout population occasionally shows some natural reproduction, but is supplemented by annual stocking of yearling trout to maintain a population that is large enough to support a fishery.

Non-designated trout streams

There are seven streams in Washington County that have not yet been designated as trout streams but that support small populations of trout and other coldwater organisms (Figure 2-6). Most are completely surrounded by private land. The MPCA classifies these streams as coldwater streams for water quality and aquatic life standards.

Six of these streams are in northern Washington County in the vicinity of Falls, Gilbertson, and Willow creeks, and are similar in their geology and fish communities. The exception is Trout Brook near Afton State Park. It is similar to Brown's Creek, in that it originates as a warmwater stream that is cooled by groundwater from deeper aquifers as it flows into the St. Croix Valley. Trout Brook has a fish community of warmwater species, as well as a low-density brown trout population.

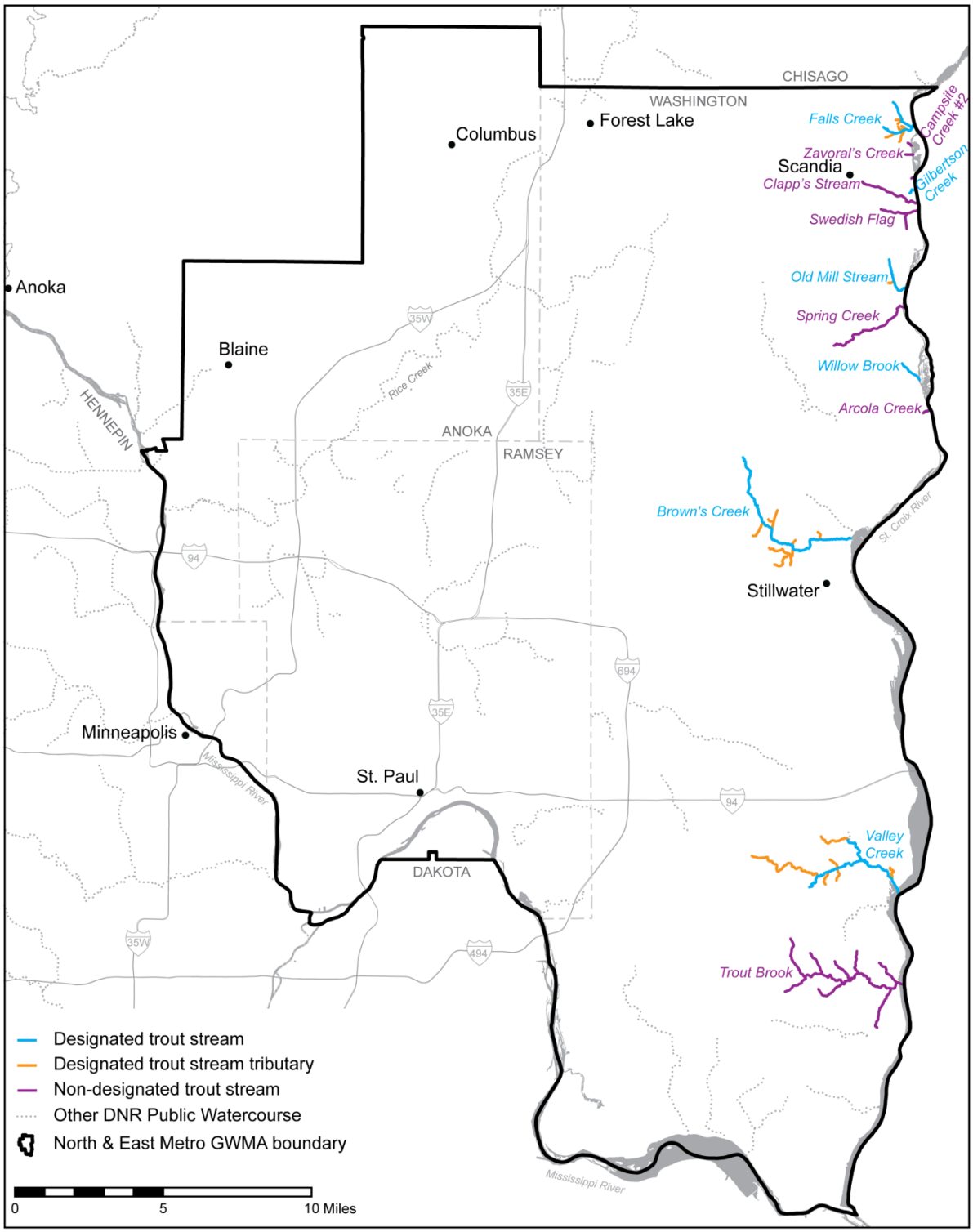


Figure 2-6 Designated trout streams and other coldwater streams

Rare Natural Features in the North & East Metro Groundwater Management Area

Three groups of native plant communities in the North & East Metro GWMA are closely associated with groundwater: wetland complexes in the Anoka Sand Plain, seepage plant communities, and wetland plant communities associated with lakes and streams. Some of these communities contain rare plants and rare animals. The DNR's Minnesota Biological Survey identified and mapped many of these native plant communities and rare species, but more comprehensive surveys are needed to complete the picture of where these features occur in the North & East Metro GWMA.

The Anoka Sand Plain (Figure 2-7, Table 2-1) is a broad sandy lake plain with level to gently rolling topography that includes many types of wetlands. Especially significant are complexes of open, shallow wetland native plant communities. These complexes of Wet Prairie, Graminoid Rich Fen, Low Shrub Poor Fen, and Sedge Meadow (referred to collectively as Wet Prairie Complex in this Plan) contain some of the most significant populations in the state of 17 state-listed rare plant species (Figure 2-8, Table 2-3).

Seepage plant communities are associated with St. Croix River bluffs and terraces (Figure 2-7, Table 2-1). These communities are rare in the state and contain a number of rare plant and animal species (Figure 2-8, Table 2-3, and Table 2-4).

There are also a number of wetland plant communities associated with lakes and streams that can also be influenced by groundwater (Figure 2-7, Table 2-2). They range from tamarack swamps and hardwood-dominated wet forests to open herbaceous vegetation-dominated communities such as Sedge Meadow and Northern Mixed Cattail Marsh.

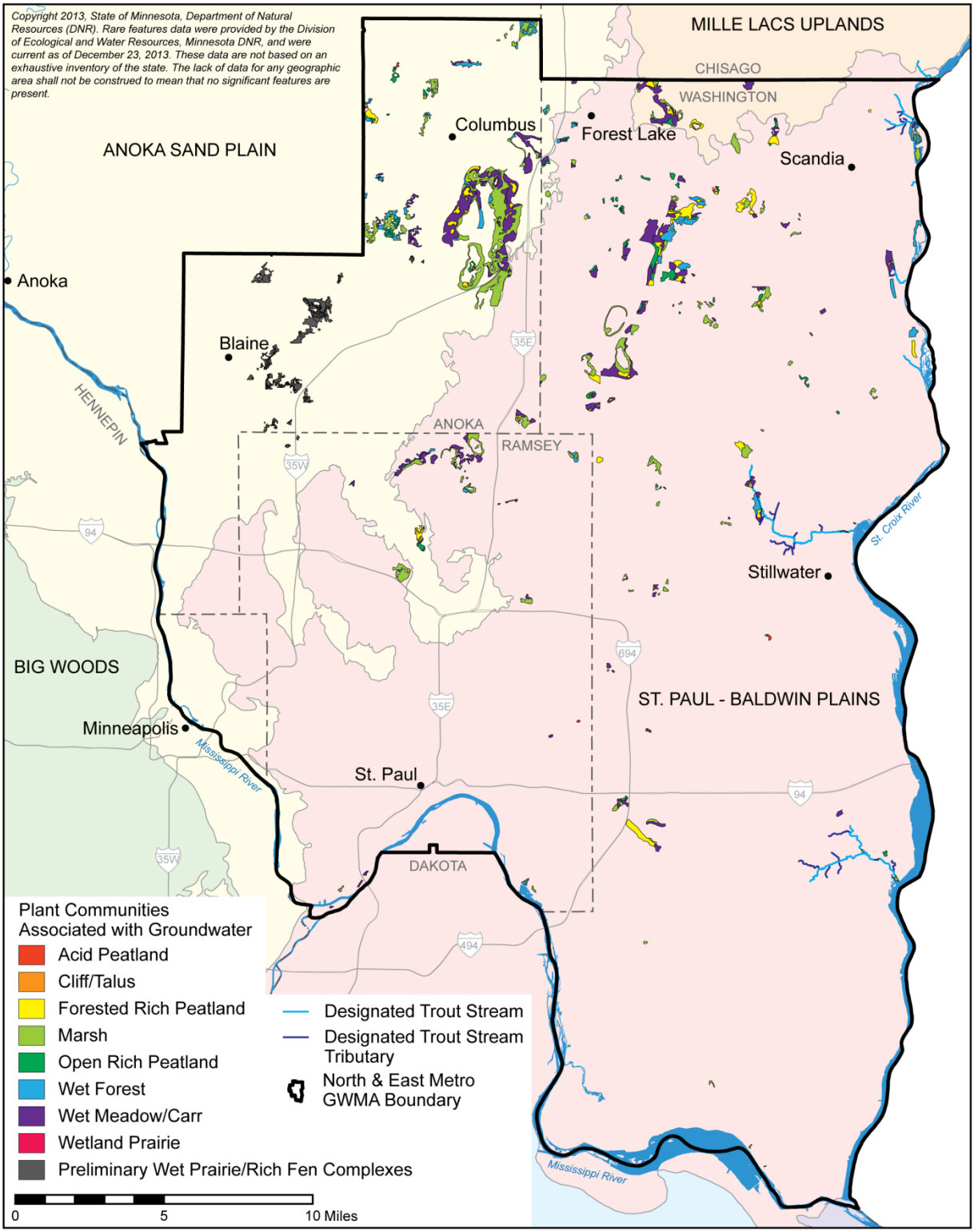


Figure 2-7 Native plant communities associated with groundwater grouped by Ecological Systems

Table 2-1 Native plant communities in the GWMA closely associated with groundwater

Native Plant Community Name	Ecological System	*Conservation Status Rank	Associated with Seepage Areas?
Black Ash–Yellow Birch–Red Maple–Alder Swamp (East central)	Wet Forest	S3	no
Black Ash–(Red Maple) Seepage Swamp	Wet Forest	S1, S2	yes
Wet Sandstone Cliff (Southern)	Cliff/Talus	S1	yes
Wet Limestone–Dolomite Cliff (Southern)	Cliff/Talus	S2	yes
Graminoid Rich Fen (Basin)	Open Rich Peatland	S4	no
Graminoid–Sphagnum Rich Fen (Basin)	Open Rich Peatland	S4	no
Low Shrub Poor Fen	Acid Peatland	S5	no
Seepage Meadow/Carr	Wet Meadow/Carr	S3	yes

*S1 = critically imperiled; S2 = imperiled; S3 = vulnerable to extirpation; S4 = apparently secure, uncommon but not rare; S5 = secure, common, widespread, and abundant.

Table 2-2 Native plant communities in the GWMA often associated with groundwater

Native Plant Community Name	Ecological System	*Conservation Status Rank	Associated with Seepage Areas?
Black Ash–Yellow Birch–Red Maple–Alder Swamp (East central)	Wet Forest	S4	no
Tamarack Swamp (Southern)	Forested Rich Peatland	S2, S3	no
Willow–Dogwood Shrub Swamp	Wet Meadow/Carr	S5	no
Sedge Meadow	Wet Meadow/Carr	S4 or S5	no
Wet Prairie (Southern)	Wetland Prairie	S2	no
Alder–(Maple–Loosestrife) Swamp	Forested Rich Peatland	S5	no
Northern Mixed Cattail Marsh	Marsh	S2	no
Northern Bulrush–Spikerush Marsh	Marsh	S2 or S3	no

*S1 = critically imperiled; S2 = imperiled; S3 = vulnerable to extirpation; S4 = apparently secure, uncommon but not rare; S5 = secure, common, widespread, and abundant.

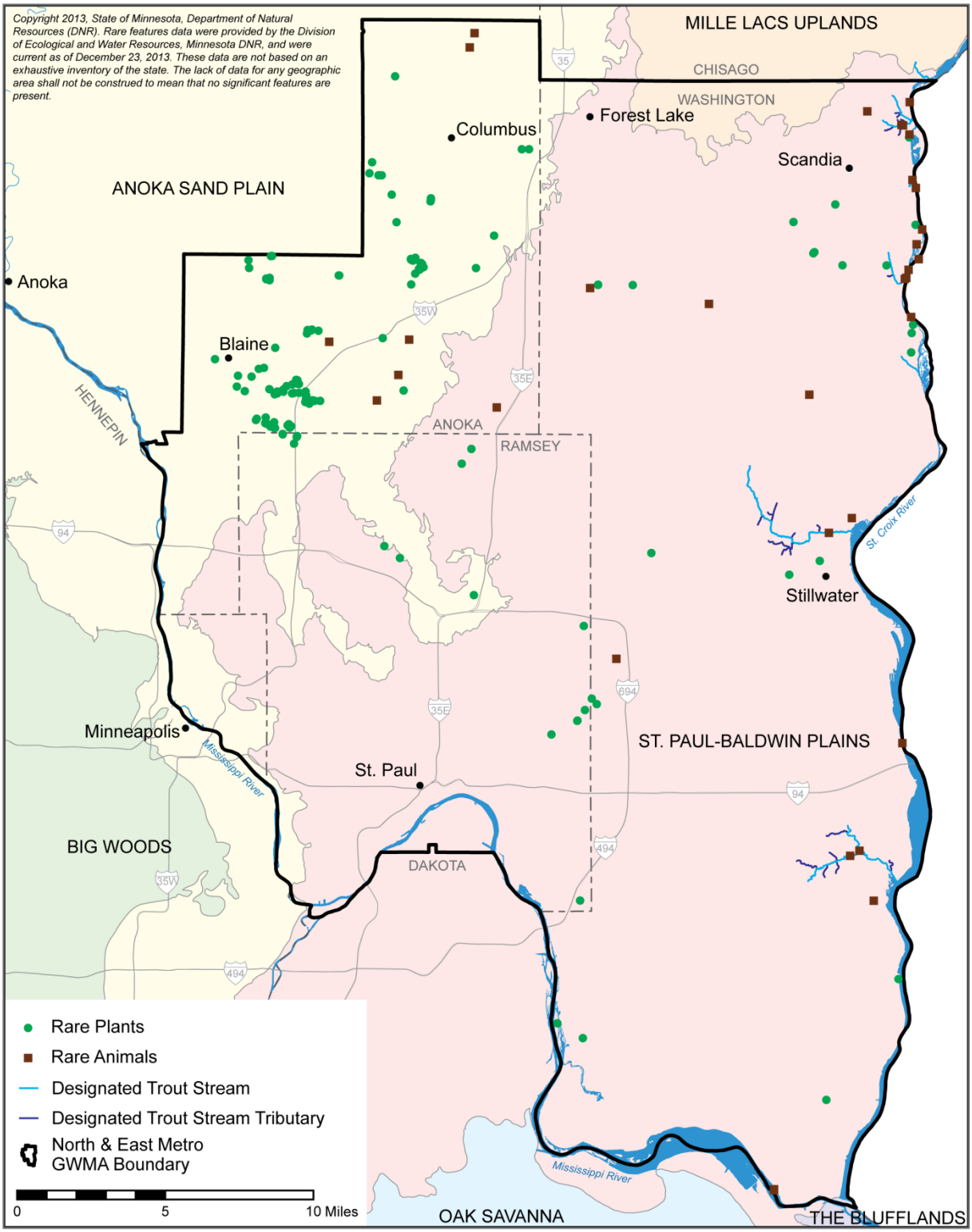


Figure 2-8 Rare species associated with groundwater

Table 2-3 Rare plant species closely associated with groundwater

Rare Plants	Common Name	**Rarity Rank	General Habitat Type
Poa paludigena	Bog bluegrass	T	Seepage swamps
Hydrocotyle americana	American water-pennywort	SC	Seepage swamps
Decodon verticillatus	Waterwillow	SC	Small lake margins, stream edges, floating mats
Potamageton bicupulatus	Snailseed pondweed	E	Small lakes
Potamageton diversigolius	Diverse-leaved pondweed	E	Small lakes
Rotala ramosior	Tooth-cup	T	Small lakes, sandy shores
Agalinis purpurea	Purple gerardia	Watch list	Wet prairie complexes
Agrostis hyemalis	Winter bentgrass	E	Wet prairie complexes
Aristida longespica var. geniculate	Slimspike three-awn	E	Wet prairie complexes
Botrychium rugulosum	St. Lawrence grapefern	SC	Wet prairie complexes
Fimbristylis autumnalis	Autumn fimbristylis	SC	Wet prairie complexes
Juncus marginatus	Marginated rush	E	Wet prairie complexes
Platanthera flava var. herbiola	Tubercled rein-orchid	T	Wet prairie complexes
Polygala cruciata	Cross-leaved milkwort	E	Wet prairie complexes
Rubus fuller	Bristleberry	T	Wet prairie complexes
Rubus missouricus	Missouri dewberry	E	Wet prairie complexes
Rubus semisetosus	Swamp blackberry	T	Wet prairie complexes
Rubus stipulatus	Bristle-berry	E	Wet prairie complexes
Scirpus pedicillatus	Woolgrass	Watch list	Wet prairie complexes
Scirpus triglomerata	Tall nut-rush	E	Wet prairie complexes
Tricophorum clintonii	Clinton's bulrush	T	Wet prairie complexes
Viola lanceolata	Lance-leaved violet	T	Wet prairie complexes
Xyris torta	Twisted yellow-eyed grass	E	Wet prairie complexes

**E = Endangered; T = Threatened; SC = Special Concern; Watch list = Not on endangered species list but tracked in the Natural Heritage Information System

Table 2-4 Rare animal species closely associated with groundwater

Rare Birds	**Common Name**	****Rarity Rank**	**General Habitat Type**
Parkesia motacilla	Louisiana waterthrush	SC	Seepage streams
Phalaropis tricolor	Wilson's phalarope	T	Wet prairie, rich fen, sedge meadow
Gallinula chloropus	Common gallinule	SC	Marshes
Sterna forsteri	Forster's tern	SC	Marshes
Setophaga cerulea	Cerulean warbler	SC	In this area: hardwood forests with streams and/or ephemeral wetlands
Rare Mussels			
Simpsonaias ambigua	Salamander mussel	E	Rivers, dependent on mudpuppies as host
Rare Salamanders			
Necturus maculosus	mudpuppy	SC	Rivers and streams
Jumping Spiders			
Paradamoetas fontana	A species of jumping spider	SC	Seeps, marshes, wet prairies
Caddisflies			
Limnephilus rossi	A species of northern caddisfly	T	Springs, streams, lake margins, marshes
Ochrotrichia spinosa	A species of purse casemaker caddisfly	E	Streams (other habitat unknown)
Parapsyche apicalis	A species of netspinning caddisfly	T	Fast-moving cold small streams
Dragonflies and Damselflies			
Ophiogomphus susbehcha	St. Croix snaketail	T	Large, fast, warm-water streams with cobble, gravel, sand substrates
Amphiagrion saucium	Red damsel	Proposed SGCN	Seepage areas
Cordulegaster oblique	Arrowhead spiketail	Proposed SGCN	Seepage areas, spring-fed forest streams
Butterflies			
Lycaena epixanthe	Bog copper	SGCN	Acid peatlands

**E = Endangered; T = Threatened; SC = Special Concern; SGCN = Species of Greatest Conservation Need

Lakes and Wetlands

The GWMA is rich in lakes and wetlands. The specific characteristics of each feature are highly variable (depth, acreage, watershed, etc.). All of these surface water features are subject to natural variations in water levels in response to precipitation and evaporation. Surface water features with connections to groundwater are also affected by changes in aquifer levels.

In 2010 the Metropolitan Council applied a screening method to categorize the potential vulnerability of surface waters to pumping from bedrock or buried Quaternary aquifers[5]. Lakes and wetlands were categorized into four categories based on the relationship between surface water and shallow groundwater levels and underlying geology.

- *Discharge* lakes and wetlands are expected to be most influenced by regional aquifers. Discharge lakes and wetlands primarily receive groundwater inflow with limited groundwater outflow. These basins are likely to be affected by changing groundwater levels (natural or human induced) in areas where they are not protected by underlying, low permeability aquitards.
- *Flow-through* lakes and wetlands are also expected to be strongly influenced by regional aquifers. Flow-through lakes and wetlands receive groundwater inflow and discharge groundwater outflow. These features are likely to be affected by changing groundwater levels (natural or human induced) in areas where they are not protected by underlying, low permeability aquitards.
- *Indeterminate or recharge* water bodies mostly lose water to the regional groundwater system. These features are typically less responsive to pumping from bedrock or deep aquifers, but changes in aquifer heads (pressure) may diffuse to these water bodies in areas where they are not underlain by sufficiently low permeability aquitards.
- *Disconnected* water bodies, are very weakly connected to the regional groundwater system and are not considered vulnerable to pumping impacts.

In the 2010 Metropolitan Council report, discharge, flow-through and indeterminate or recharge type water bodies were considered to be potentially *connected* to the shallow groundwater system. Those water bodies that were also considered to be connected to deeper aquifers were rated as potentially *vulnerable*.

This initial screening could be modified or refined with site-specific data and/or updated regional models. Lakes and wetlands that were rated as potentially vulnerable are distributed throughout the GWMA (Figure 2-9). There are some larger zones of water bodies rated as not vulnerable, such as the southern part of Woodbury and adjacent areas, most of Grant, and the southwestern half of Blaine. While potentially vulnerable lakes and wetlands in general could be affected by regional groundwater

[5] Barr Engineering, 2010. Evaluation of groundwater and surface-water interaction—guidance for resources assessment: prepared for Metropolitan Council.

level decline, water levels in smaller basins could also be vulnerable to localized drawdown due to their small area and storage volume.

The method used in the Metropolitan Council 2010 study was a conservative approach. Some features were rated as vulnerable based on a possible connection to the regional aquifer system but may not be highly sensitive to pumping from bedrock or deeper buried Quaternary aquifers. The analysis did not consider other factors that can influence the sensitivity of lakes and wetlands to drawdowns in the major aquifers.

For example, there are large differences between water elevations in some vulnerable water bodies and the heads in the underlying Prairie du Chien aquifer. This indicates limited hydraulic connection at those locations and was not discerned from the hydrologic and geologic data used.

Surface water runoff and outflow versus groundwater inflow and outflow were also not considered in the analysis. Lakes and wetlands that include groundwater as a significant source or natural outflow will be more sensitive to aquifer fluctuations.

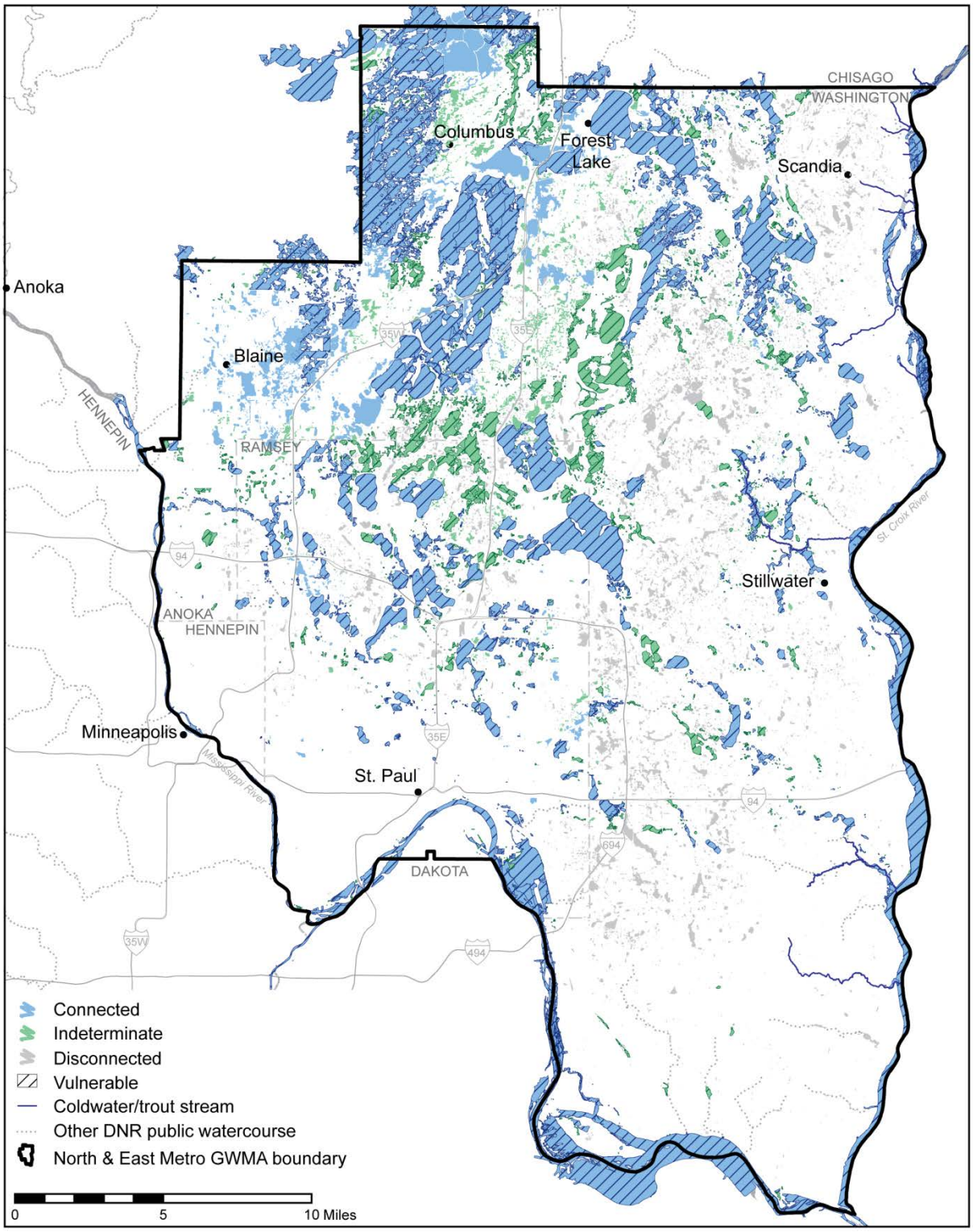


Figure 2-9 Lake and wetland connection to the regional groundwater system
Classification by Barr for Metropolitan Council (2010)

Water Quality

Water quality affects the availability and cost of supplying groundwater. Contaminated groundwater may not be available for use by individuals, industry or cities unless it undergoes treatment. Consumers may have to use deeper aquifers or rely on surface water sources (e.g., the Mississippi River). Contaminated groundwater also presents a risk to the connected ecosystems (lakes, streams and wetlands), impacting the species that live there and the people who use these water bodies to hunt, fish, and recreate.

Although locations of groundwater quality concerns were not used to define the GWMA boundary, the boundary does not divide or cross major areas of groundwater quality problems or limitations. Special Well Construction Areas (Figure 2-10) and Southern Washington County PFC (perfluorochemicals) contamination plumes are included in the GWMA boundary. Special controls on the construction or modification of wells are enforced in the MDH designated areas to protect water supplies from known contamination.

The MPCA maintains a record of plumes that may impact water availability in the GWMA, including both smaller plumes and the large (multi-acre) groundwater contamination plumes in bedrock aquifers identified in Figure 2-10. In some cases pollution containment wells are used to limit movement of contaminated groundwater into less contaminated or uncontaminated areas of the aquifers. Pollution containment wells with DNR appropriation permits are indicated on Figure 2-10.

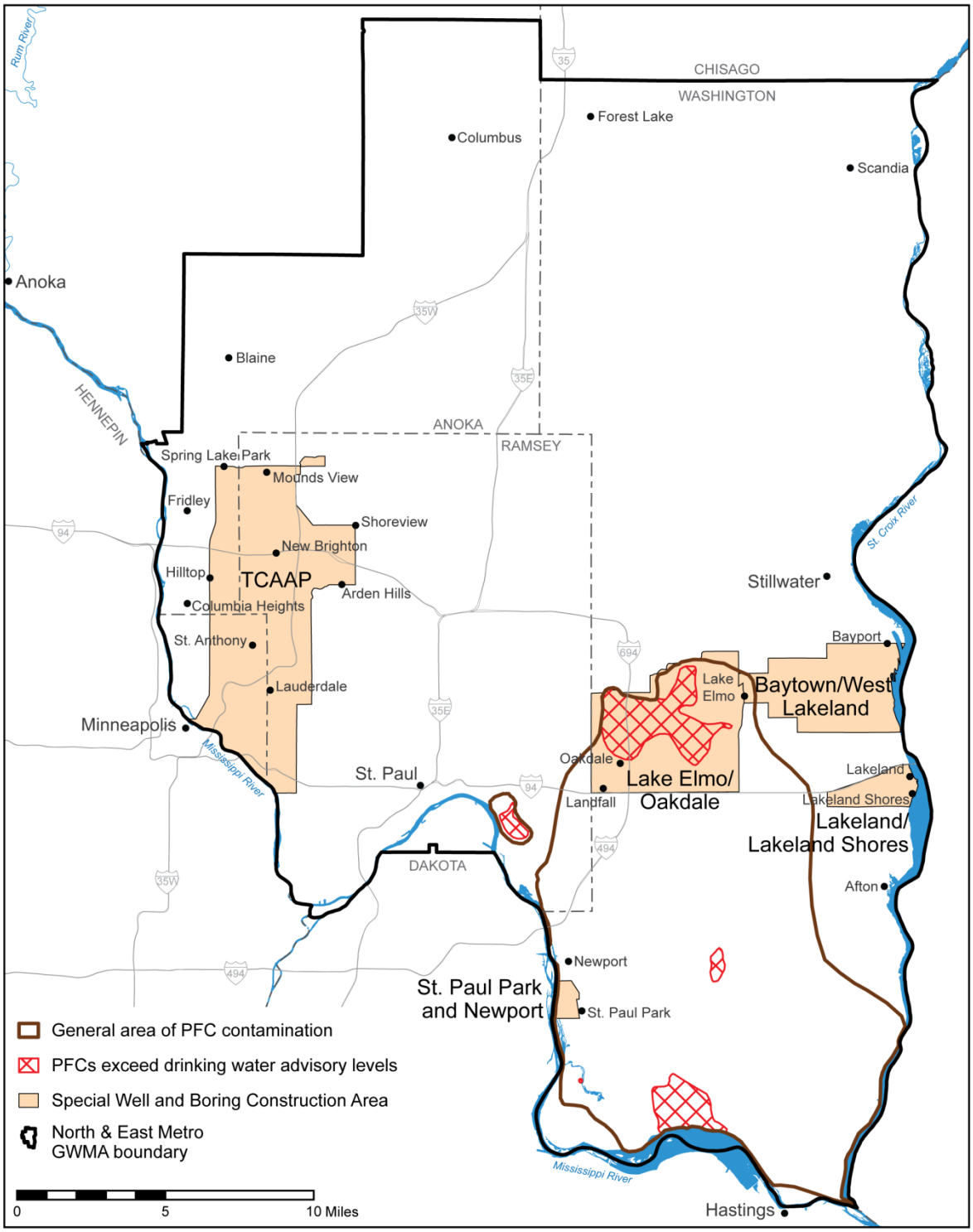


Figure 2-10 Selected areas with groundwater contamination
Special Well and Boring Construction Areas, areas of PFC contamination, and DNR permitted pollution containment wells

Jurisdictions, governance and planning

Cities and counties play a critical role in planning and managing for long term water supply and water sustainability. The DNR determined that the GWMA boundary should not 'cut' or 'bisect' those important governance boundaries, to the degree possible and in the context of the natural hydrogeologic boundaries. The legislature has also designated a specific water-supply planning role for the Metropolitan Council within the seven county Twin Cities metropolitan area.

Jurisdictional, governance, and planning frameworks informed the boundary recommendation in the following ways:

- The boundary conforms to city and county boundaries where possible to connect directly with municipal water supplies and land-use planning jurisdictions (Figure 2-1).
- The exceptions:
    a. Anoka County – selected hydrogeological boundaries cross Anoka County, but current and/or projected increases in water use are relatively low in areas of the county not included in the GWMA.
    b. Hennepin County and the City of Minneapolis – only the portions of the city & county east of the Mississippi River are within the major hydrogeological boundaries of the GWMA.
- The boundary is within the Metropolitan Council jurisdiction, connecting the GWMA with the water supply planning functions of the Metropolitan Council.

Watershed Districts and Watershed Management Organizations (WMO) play an important role in both surface and groundwater management in the GWMA. However, the watershed boundaries do not directly conform to the groundwater system boundaries. The DNR recognizes the important role surface water management will have in developing long term sustainable use of groundwater, but the GWMA boundaries do not conform to watershed management district or organization boundaries where those boundaries cross the Mississippi River or city or county boundaries.

3. The Goal and Objectives

Section 3 describes the goal and objectives for groundwater management, including supporting statutes and rules. The goal for the GWMA expresses a future desired condition for the area.

The goal for the GWMA is:

> *In the North & East Metro Groundwater Management Area, the use of groundwater is sustainable and therefore does not harm ecosystems, water quality, or the ability of present and future generations to meet their needs.*

The goal is drawn directly from the Minnesota Statutes for groundwater appropriations, Minn. Stat., sec. 103G.287, subd. 3, 4 and 5. These statutes describe protection of groundwater supplies, designation of groundwater management areas, and a standard of sustainability. Groundwater use is defined in state statute as sustainable if that use:

- Does not harm aquifers and ecosystems
- Does not negatively impact surface waters
- Is reasonable[6], efficient and meets water conservation requirements
- Does not degrade water quality
- Does not create unresolved well interferences or water use conflicts

To attain the goal for the GWMA, this Plan sets five management objectives that define how these statutory requirements can be met. All of the management objectives must be achieved simultaneously to ensure sustainability of groundwater use.

These objectives are:

I. *Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.*
II. *Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.*
III. *Groundwater use in the GWMA does not degrade water quality.*
IV. *Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.*
V. *All groundwater users in the GWMA have the necessary permits to use groundwater.*

The remainder of Section 3 describes each of the objectives in more detail. References to the additional statutes and rules specific to the objectives are provided in this section.

[6] "Reasonable" as used in the statute and this Plan cannot be comprehensively defined for all situations, and must by nature be evaluated based on specific and changing situations.

Objective I. Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.

Groundwater and surface waters together make up a connected hydrologic system that is affected by climate, geology and soils, land use and land cover, water use, and water quality changes. Therefore, impacts to aquifers, ecosystems, and surface waters resulting from water appropriations are related under this objective.

Aquifer Sustainability

The first part of this objective deals with preventing harm to aquifers. The purpose is to ensure that groundwater continues to be available for use in the future while protecting ecosystems and surface waters (described below). Groundwater use always reduces storage unless there is an equivalent increase in recharge through surface-water infiltration. Limits on appropriations and increased recharge can help ensure aquifer sustainability.

In Minnesota Rules, parts 6115.0630 and 6115.0670, the concept of *safe yield* is used as the measure of limits on allowable groundwater use. The concept looks at the impact that water withdrawals from an aquifer have on aquifer water quality, levels, and pressure (sometimes referred to as 'heads'). It does not address potential impacts to other resources such as surface waters. Safe yield is defined separately for water-table aquifers and for artesian (confined) aquifers (see Section 7 for glossary of terms).

For artesian aquifers, a water elevation level in an observation well (obwell) at some distance from the high capacity well may be set as a threshold for aquifer protection that ensures compliance with safe yield (Figure 3-1). To protect the aquifer from being drawn down too far, 25 percent of the available head (water height above the top of the aquifer, before pumping, measured and recorded for future reference) must remain in an observation well at some distance from the high capacity well. A warning threshold of 50 percent of the available head may be established to allow time for contingency plans to be put in effect if water levels continue to decline. The warning thresholds provide the DNR and permit holders with adequate warning to make adjustments before heads are below the top of the confined aquifer.

For water-table aquifers, safe yield is a total-use rate that does not exceed the long-term average recharge rate (Minn. Rules, part 6115.0630). In short, output (pumping) for the aquifer does not exceed input (recharge) over the long term. Again, this does not account for impacts surface waters, which are addressed in the next section. Pumping from artesian aquifers (such as the Prairie du Chien and Jordan aquifers) typically causes water from the water-table aquifer to flow down into the artesian aquifers. Therefore, safe yield should be determined based on both direct and indirect withdrawals from water-table aquifers.

Water levels that have stabilized to a pattern of variations above the threshold indicate compliance with safe yield. Understanding pumping history and measured water levels is important when evaluating compliance with safe yield. Declining water levels that remain above the threshold are expected in some situations, even while use remains within the safe yield. This occurs if pumping rates gradually increase

over time, the system has not come into equilibrium with recent pumping rates, or natural fluctuations create a temporary downward trend.

In most circumstances limits on groundwater pumping will be defined by the protection of surface-water resources and dependent ecosystems or by preventing water use conflicts rather than by safe yield for water-table aquifers.

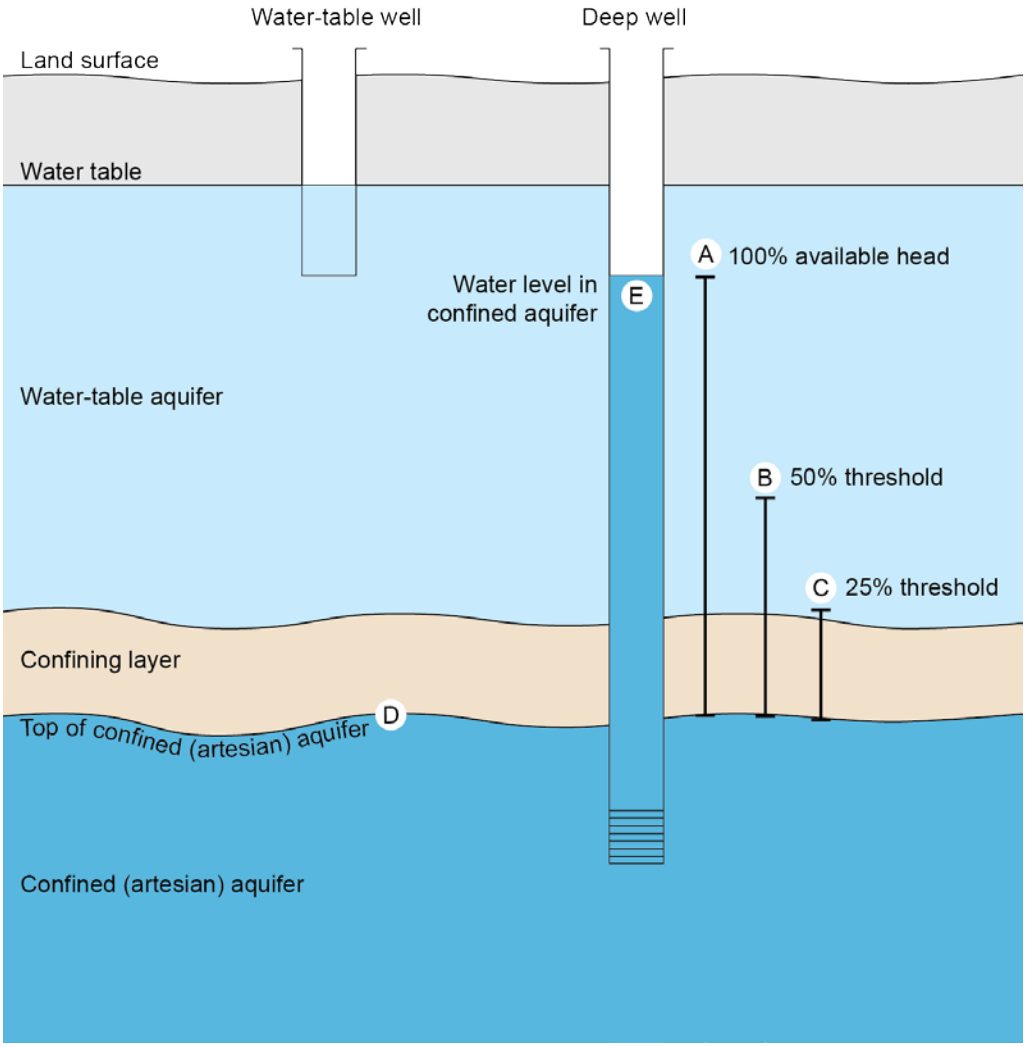


Figure 3-1 Safe yield thresholds for artesian (confined) aquifers
The available head (A) is the distance between the top of the confined aquifer (D) and the water level (E) in the deep well. The 50-percent threshold (B) is halfway between these same points; the 25-percent threshold (C) is one-fourth of the way. Water levels in a confined aquifer must not stabilize below the 25-percent safe yield threshold.

Ecosystems and Surface Waters

The second part of Objective I addresses harm to ecosystems and negative impacts to surface waters when groundwater is overused. The groundwater system is part of the water cycle, eventually destined to discharge to surface waters such as rivers, lakes, wetlands, or springs. Taking groundwater from water table and most artesian aquifers diverts water from surface waters or wetlands. Overuse of groundwater can significantly alter surface water features and the biological communities, recreation, and other uses that those waters support.

Surface water appropriations are governed by Minn. Stat., sec. 103G.285. Groundwater appropriations are governed by Minn. Stat., sec. 103G.287. Groundwater appropriations may also be subject to additional limits based on their surface water impacts as follows (Minn. Stat, sec. 103G.287, subd. 2):

> *Groundwater appropriations that will have negative impacts to surface waters are subject to applicable provisions in section 103G.285.*

Surface-water pumping (appropriation) has a direct and immediate effect on flow or water level in the surface water features from which the water is withdrawn. When a surface appropriation is suspended there is an immediate effect on the water levels. The same is not true for groundwater appropriations. Determining whether groundwater appropriations have negative impacts to surface waters is complex. Generally, the effect on connected surface water features is both delayed and spread out or 'flattened' in time and is typically distributed among multiple water features.

The 2015 Minnesota Legislature directed the DNR to take the following actions concerning sustainability thresholds:

"By December 15, 2015, the commissioner of natural resources shall consult with interested stakeholders and submit a report to the Legislative Water Commission and the chairs and ranking minority members of the house of representatives and senate committees and divisions with jurisdiction over the environment and natural resources policy and finance on recommendations for statutory or rule definitions and thresholds for negative impacts to surface waters as described in Minnesota Statutes, sections 103G.285 and 103G.287, subdivision 2. Stakeholders must include but are not limited to agricultural interests; environmental interests; businesses; community water suppliers; state, federal, and local agencies; universities; and other interested stakeholders." (Laws of Minnesota 2015, First Special Session, chapter 4, article 4, section 143)

The DNR will use this report to help clarify how it determines negative impacts to surface water features from existing and proposed groundwater appropriations.

Several thresholds that exist in law are helpful and will be part of the evaluation in determining if negative impacts are occurring in surface waters:

1. Appropriations from lakes listed in Bulletin 25[7] are limited to a total annual volume of water amounting to 1/2 acre-foot per acre of water basin (6 inches over the surface area of the water body) (Minn. Stat., sec. 103G.285, subd. 3). Also, appropriations from lakes less than 500 acres must be discouraged (Minn. Stat., sec. 103G.261, item d).
2. Appropriations taken directly from surface water bodies are limited according to the requirements establishing and enforcing *protected flows* for streams and rivers or *protective elevations* for lakes and wetlands (Minn. Stat., sec. 103G.285). These are intended to accommodate the range of needs and uses of water bodies. For surface-water appropriations, consumptive appropriations may not be made from watercourses during periods of specified low flows (i.e. protected flows) or from lakes and wetlands when water levels are below the protective elevation (Minn. Stat., sec. 103G.285, subd. 2 and 3).
3. Minnesota Statutes protect trout streams from water appropriations (Minn. Stat., sec. 103G.285, subd. 5) because they are particularly dependent on steady flow, stable cold water temperatures, and sufficient oxygen levels. These conditions depend on a steady supply of groundwater from springs or diffuse seepage. The goal is to limit stream depletion due to groundwater pumping.
4. Calcareous fens[8] are a rare type of peat-forming, groundwater-dependent wetland that are also protected in statute (Minn. Stat., sec. 103G.223) because they host rare plants and are sensitive to impacts. Calcareous fens are very dependent on upwelling groundwater to maintain their unique chemical and physical characteristics. To meet the statutory requirement, the goal is to limit depletion of water moving to the fen as a result of groundwater pumping.
5. Public water wetlands may not be drained unless replaced (Minn. Stat., sec. 103G.221), and temporary drawdown is only allowed if certain conditions are met, including improving navigation and recreational uses, improving fish or wildlife habitat, exposing sediments in order to remove nutrients or contaminants, alleviating flooding of agricultural land or allowing mining of metals (Minn. Rules, part 6115.0270).

There are no applicable thresholds for some other features described in Section 2: native plant communities other than calcareous fens; and springs, seeps and wetlands that have saturated soil near the surface but do not have ponded water for much of the year.

Section 5 of the GWMA Plan provides a set of actions to meet Objective I.

[7] DNR Staff, 1968. An Inventory of Minnesota Lakes. Division of Water, Soils and Minerals, Minnesota Conservation Department

[8] There are no known calcareous fens in the North & East Metro GWMA.

Objective II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.

Water conservation and water use efficiency are key components of ensuring sustainability, and an important goal within the GWMA. Efficient use increases the water available for current and future uses and can help reduce stress on the water resource. Explicit conditions may be placed on appropriation permits that require conservation practices appropriate to a specific use.

Conservation Requirements for Municipal Systems

Minnesota Statute, sec. 103G.291 requires public water suppliers serving more than 1,000 people to implement demand reduction measures by January 1, 2015. This includes all but one of the municipal systems in the GWMA.

The measures must include a rate structure or outline a program that achieves demand reduction. They must also have a water supply plan that is approved by DNR. In the Twin Cities metropolitan area, including the GWMA, all communities that have public water supplies must prepare water supply plans (Minn. Stat., sec. 473.859). These plans must be consistent with the Metropolitan Council Master Water Supply Plan, providing an opportunity for cross-jurisdictional consistency and cooperation. The plans lay out future challenges and options for a community's water supply and the commitment of the community to its water use efficiency and conservation goals.

Minnesota Statute, sec. 103G.291 also requires public water suppliers to adopt and enforce water use restrictions when the governor declares a critical water deficiency. The restrictions must limit watering lawns, washing vehicles, irrigating golf courses and parks, and other nonessential uses.

Other Water Uses

Water conservation conditions may be placed on appropriation permits other than those for municipal water supply where reasonable use can be quantified, for example:

- The amount of water reasonably needed for a particular agricultural situation (soil types, climate, and crop type)
- Specific goals for water use for golf course operations in the GWMA
- Water use goals for specific industries

Non-permitted water users (not requiring appropriation permits) across the GWMA should also practice water conservation. The DNR supports conservation requirements for private and non-permitted use established through local jurisdictions such as watershed districts and municipal governments.

Section 5 of the GWMA Plan provides a set of actions to meet Objective II.

Objective III. Groundwater use in the GWMA does not degrade water quality.

Pumping groundwater does not directly degrade the quality of the water in the aquifer in most circumstances. However, some pumping can cause water levels in wells to fall below the top of an artesian aquifer (See Figure 3-1), resulting in conversion to a water-table condition. In some circumstances this can lead to changes in water chemistry and degradation of water quality. Compliance with safe yield for artesian aquifers prevents this situation from occurring as described under Objective I.

The effects of groundwater pumping on existing contamination must be considered when evaluating groundwater appropriation permits. Groundwater pumping can cause existing groundwater pollution to move or spread. Changes in groundwater levels and pressures can increase the movement of pollutants between aquifers or increase the spreading of pollutants within the same aquifer.

In some cases, pollution containment wells are used to limit movement of contaminated groundwater into less or uncontaminated areas of the aquifers (Figure 2-10). Any changes proposed to pollution containment pumping must have the goal of reducing overall groundwater appropriations, must not reduce the overall effectiveness of the containment, and must not increase the risk to public health. The MPCA, in cooperation with the responsible parties, determines duration and volume of pumping to contain pollution plumes and limit the movement or spreading of groundwater contamination. The MDH helps municipal and other water suppliers protect the quality and availability of drinking water supplies.

Finally, water quality considerations in surface-water features must be incorporated into groundwater appropriation thresholds for surface waters. Changes to the amount of groundwater flow into surface-water features can affect water quality items such as temperatures and oxygen levels in trout streams.

Section 5 of the GWMA Plan provides a set of actions to meet Objective III.

Objective IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.

DNR must also address competing demands for appropriation of water such that sustainable thresholds are not exceeded. The purpose of this objective is to manage water appropriations in accordance with the allocation priorities in Minn. Stat., sec. 103G.261. The first priorities for water allocation are domestic water use and use of surface water for power generation. The other five priority levels in order from higher to lower priority are: all other consumption of less than 10,000 gallons per day, agricultural irrigation and processing, other power production, other consumption greater than 10,000 gallons per day, and nonessential uses.

A well interference problem occurs when groundwater appropriation causes the water level in public water supply well(s) or private, domestic well(s) to fall below the reach of those wells (Minn. Stat., sec. 103G.287 subd. 5 and Minn. Rules, part 6115.0730). According to Minn. Stat., sec. 103G.287, subd. 5, this applies to public water supply and private domestic wells constructed according to the state well code (Minn. Rules, part 4725). An interference complaint can only be valid for a domestic well if that well was constructed before appropriation permits allegedly causing the interference were issued.

An interference problem may be resolved by modifying the affected well, replacing the well with a deeper well, replacing the well with an alternate water supply (e.g., connection to a public system), or modifying permitted pumping rates or schedules. Potential for well interference is considered when evaluating new water appropriation permits or amendment applications. The DNR follows procedures described in Minn. Rules, part 6115.0730 to mitigate potential interference that may be caused by new or increased appropriations and to respond to interference complaints.

A *water use conflict* occurs when water demands among existing and proposed users exceed the available waters. A water use conflict can only be resolved by limiting or restricting the rate, volume, and/or timing of water appropriations. The available waters must first be determined based on resource sustainability (Objectives I and II) before allocating the available waters among users. The DNR follows procedures described in Minn. Rules, part 6115.0740 to resolve water use conflicts.

Section 5 of the GWMA Plan provides a set of actions to meet Objective IV.

Objective V. All groundwater users in the GWMA have the necessary permits to use groundwater

Objectives I, II, III and IV (above) can only be tracked and achieved with an effective permitting system. The current process for obtaining a high-capacity appropriation permit is outlined in Appendix C.

Permits provide key data on groundwater use and the means to limit use if necessary to meet sustainability thresholds or objectives. To be in compliance with current state requirements, individuals and organizations must, at a minimum, do the following if requesting 10,000 gallons of water per day or one million gallons of water per year:

- Obtain a water appropriation permit
- Pay annual fees
- Report annual water use according to permit conditions

Permit holders must also comply with special conditions placed on their permits that are designed to ensure sustainability and/or monitor resource conditions. Some permits may include special conditions such as groundwater level monitoring from wells specifically constructed for that purpose.

When the DNR receives an application for a new water appropriation permit, or for an amended permit, notice is provided to local government units, watershed districts and soil and water conservation districts. In some circumstances notifications of the permit request may also be made to other interested stakeholders including the county, Metropolitan Council, Minnesota Pollution Control Agency, and Minnesota Department of Health and others. Parties to the White Bear Lake Settlement Agreement receive notice of applications for new or amended appropriation permits. The DNR reviews and considers comments received on permit applications.

Objective V is meant to emphasize the importance of permitting and permit compliance to meet the sustainability goals of the North & East Metro GWMA. Section 5 of the GWMA Plan provides a set of actions to meet Objective V.

4. Status of the GWMA in Terms of the Objectives

This section describes our current understanding of the status of the North & East Metro GWMA with respect to the five objectives described in Section 3. Based on the five objectives, the definition of sustainability with respect to groundwater is the following:

- Use does not harm aquifers and ecosystems
- Use does not negatively impact surface waters
- Use is reasonable, efficient and meets water conservation requirements
- Use does not degrade water quality
- Use does not create unresolved well interferences or water use conflicts

All of the objectives must be achieved to attain overall sustainability of groundwater use in the GWMA. The gaps, including development of additional sustainability thresholds need to be addressed to meet long term goals of groundwater sustainability in the GWMA.

Objective I. Aquifers, Ecosystems and Surface Waters

Groundwater levels fluctuate in response to a number of influences including climate, groundwater pumping, and land use. The following information is needed to make water-appropriations permitting decisions that protect aquifers, surface-water resources, and associated biological communities.

- First, acceptable levels of hydrological impacts must be determined for each type of feature. General considerations are discussed in Section 3.0, but site specific thresholds may be needed for particular surface-water features.
- Second, an estimate must be made of how existing or proposed water appropriations may change the hydrological regime. The projected or interpreted impacts may then be compared to the established thresholds.

Climate Data and Trends

Climate is the main driver of groundwater recharge variations. The climate in the North & East Metro GWMA is characterized by variable weather. The ‘normal’ condition includes substantial ups and downs in precipitation, evaporation, and other climatic factors that affect hydrology.

Although long term average annual precipitation has been higher in the Twin Cities since the mid-eighties compared to the previous decades, the Twin Cities experienced relatively lower precipitation in parts of the last decade. For example, the 1981-2010 ‘climate normal’ precipitation (red line on Figure 4-1) is higher than 30-year climate normal for previous decades. Below normal precipitation in several recent years is reflected in the declining five-year moving average precipitation (dotted gray line in Figure 4-1). This is consistent with hydrological data indicating a recent drier period.

In addition to changes in the amount of annual precipitation, the timing (wetter springs), nature (larger rain events over shorter periods), and distribution of precipitation also is changing in the Midwest[9].

Relatively small changes in precipitation and evapotranspiration over large areas can have a significant effect on groundwater recharge and groundwater levels. The current climate monitoring network may be inadequate for determining this important part of the water balance in the GWMA. The network should be evaluated and expanded to fill data gaps.

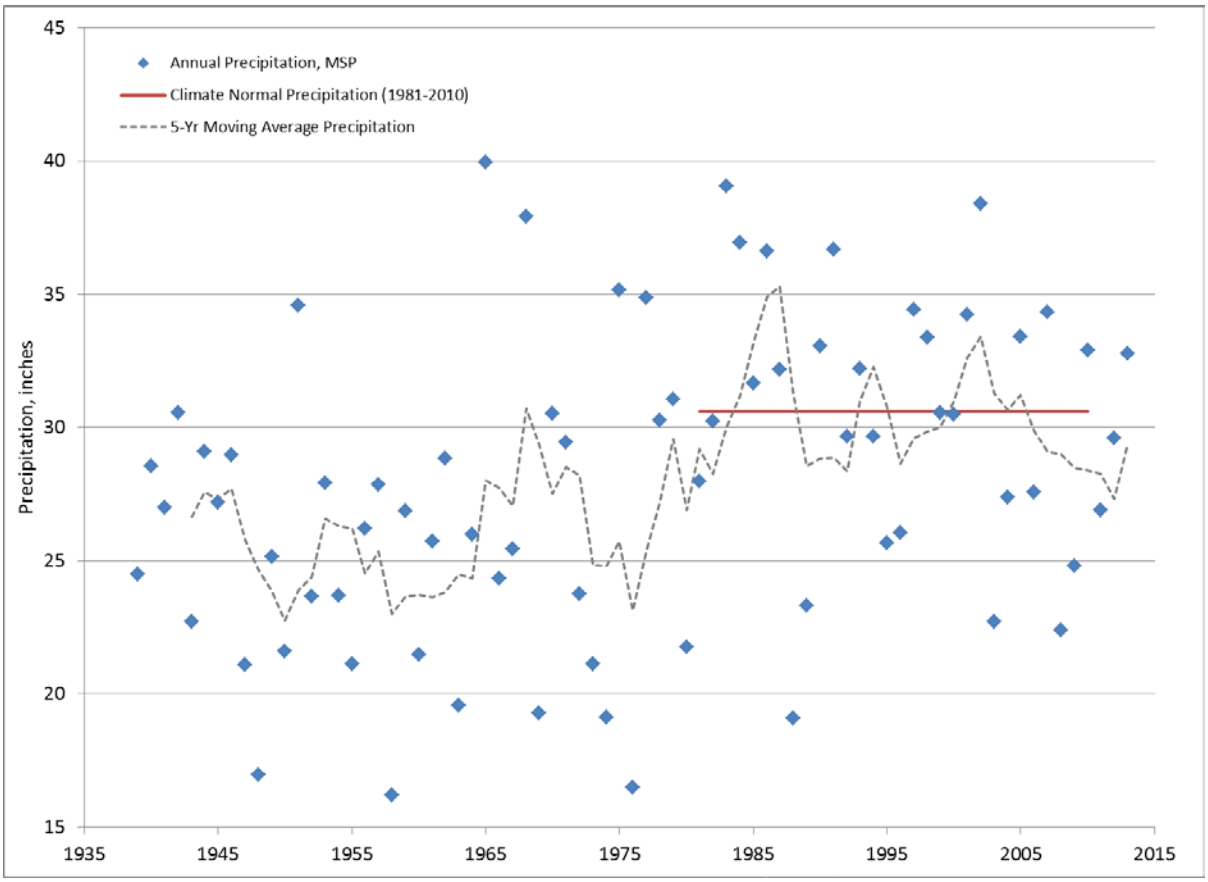


Figure 4-1 Example of historic precipitation patterns in the North & East Metro: precipitation at Minneapolis–St. Paul International Airport.

[9] Pryor, S. C., D. Scavia, C. Downer, M. Gaden, L. Iverson, R. Nordstrom, J. Patz, and G. P. Robertson, 2014: Ch. 18: Midwest. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 418-440. doi:10.7930/J0J1012N.

Groundwater-Level Data and Trends

Monitoring groundwater levels helps ensure compliance with the safe yield thresholds. Levels must be viewed in the context of natural climate fluctuations and groundwater pumping history.

The DNR has managed a statewide network of dedicated water-level observation wells since 1944. Water-level readings from these wells are available on the State Climatology Office web page (http://climate.umn.edu/ground_water_level). The GWMA contains 60 actively measured obwells (Figure 4-2). Nineteen of these wells have been constructed since 2009 and provide only short records. Some appropriation permit holders also maintain observation wells as required in permit conditions. Other organizations have also installed observation wells to understand groundwater elevation changes for their specific projects and areas of interest. For example the Valley Branch Watershed District measures water levels in 15 shallow observation wells three times per year to understand changing groundwater levels near the Valley Creek trout stream and its headwaters.

Additional useful information about changing groundwater levels over time is provided by historical data from inactive or sealed obwells and from obwells outside the GWMA.

DNR staff reviewed data from obwells throughout the state for statistically significant trends in annual minimum water levels for the 20-year period from 1993 through 2012. In the North & East Metro GWMA, sufficient data for analysis was available for 19 wells at 14 locations (3 locations include 'nested' obwells of different depths). These trended as follows: 4 upward, 3 no trend, and 12 downward (Figure 4-2).

In general, the available obwell data indicate that recent groundwater levels have been near or below low points of the previous 30 years regardless of proximity to areas of intensive groundwater pumping (The exception is rising groundwater levels in parts of Ramsey County as a result of reduced pumping). This leads to the conclusion that weather was a major factor in recent lower groundwater levels in the vicinity of the GWMA. Lower water levels in areas where groundwater use has substantially increased over the last 20 years appear to reflect a combination of climate and pumping effects. At observation wells completed in artesian aquifers, water levels are not currently exceeding the sustainability thresholds for safe yield.

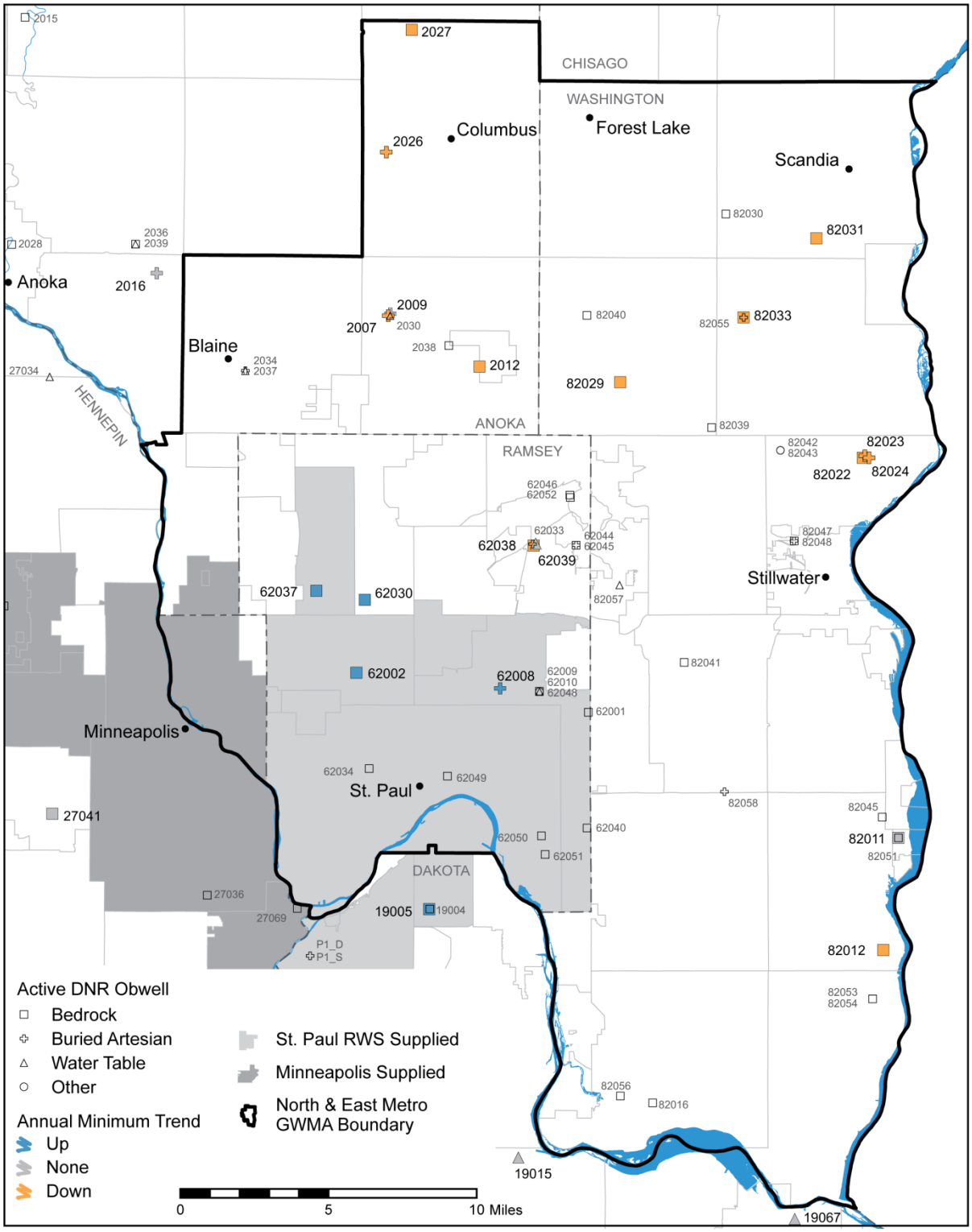


Figure 4-2 Active DNR obwells and trends in annual water level minima (1993 – 2012)

Based on observation well levels, lake levels, and stream gauging data, the 1990s to early 2000s was a wet period in this region with relatively high water levels and flows. The period 2007 through 2013 included at least one period of hydrologic drought. This determination is based on a comparison with measured water levels and stream flows during and following the last extreme drought in the region (1988-89[10]) at locations with low water use[11]. Relatively low water levels were most prevalent in groundwater conditions such as stream baseflow.

Figure 4-3 is one example of the gradual fluctuations in groundwater levels in a 'nest' of observation wells open to several different aquifers at different depths. This obwell nest is in northeastern Washington County, 4 miles from the nearest municipal well where there is little groundwater use in the vicinity. Water levels gradually declined in these observation wells from 2003 through 2010 and remained low through 2013. Water levels in the shallower obwell (82024) dropped below the minimum level of the previous extended drought that occurred in 1991, and water levels in the deeper obwells overlapped with levels previously measured in 1990 to 1991 from 2009 through 2013.

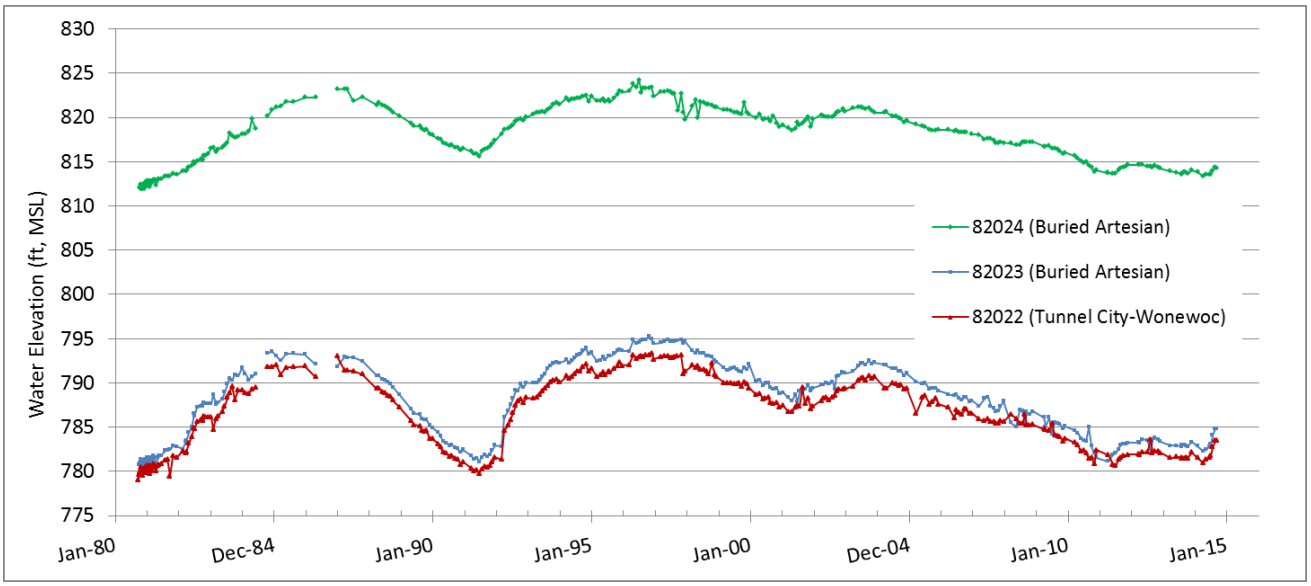


Figure 4-3 Observation well hydrographs, northeastern Washington County
The three observation wells are completed in three different aquifers: a shallower buried Quaternary aquifer (82024), a deeper buried Quaternary aquifer in a bedrock valley (82023) and a bedrock aquifer (82022).

Seasonal water level fluctuations have increased in the buried Quaternary and bedrock aquifers in areas of intensive groundwater pumping. Seasonal fluctuations at these locations increased due to

[10] Some of the effects of this drought are described in: Minnesota DNR, 1989. *Drought of 1988*; and in Holmstrom and Ellefson, 1990. *The Effects of the 1988 Drought on Water Resources in Wisconsin*: USGS Open-File Report 90-149.

[11] Data sets used: DNR observation wells 13007/18, 13009/13, 82024, 82031, and 82033; North Center Lake; Wisconsin USGS observation well PK-35/17W/08-0040 (USGS Station 453013092314601); Apple River near Sommerset, Wisconsin (USGS Station 05341500); and St. Croix River at St. Croix Falls, Wisconsin (USGS Station 05340500)

groundwater pumping but appear to have become stable over the last 6 to 10 years at obwell locations. An example is shown in Figure 4-4. Groundwater levels are expected to be stable or to rise if average or wet hydrological conditions prevail in the next several years and pumping rates remain stable. If dry conditions continue, we should expect additional water level drops in aquifers of the GWMA.

Other historical groundwater measurements were compared to more recent measurements in the GWMA, such as water levels measured at the time of municipal well construction. Recent water levels measured in municipal wells in the northeastern part of the GWMA when they were not pumping are mostly above or close to the historical measurements made at the time of construction (Table 4-1). For the recent measurements, water levels in the pumping wells may not have fully recovered from pumping and may be lower than in the aquifer nearby. These data do not necessarily show that long term pumping influence is negligible at these locations, but the data suggest that pumping has not pushed water levels substantially outside of their historical range. The water-level measurements listed in Table 4-1 vary from 96 to 172 feet above the top of the Prairie du Chien in those wells, indicating that water levels are clearly within the safe yield thresholds (Figure 3-1).

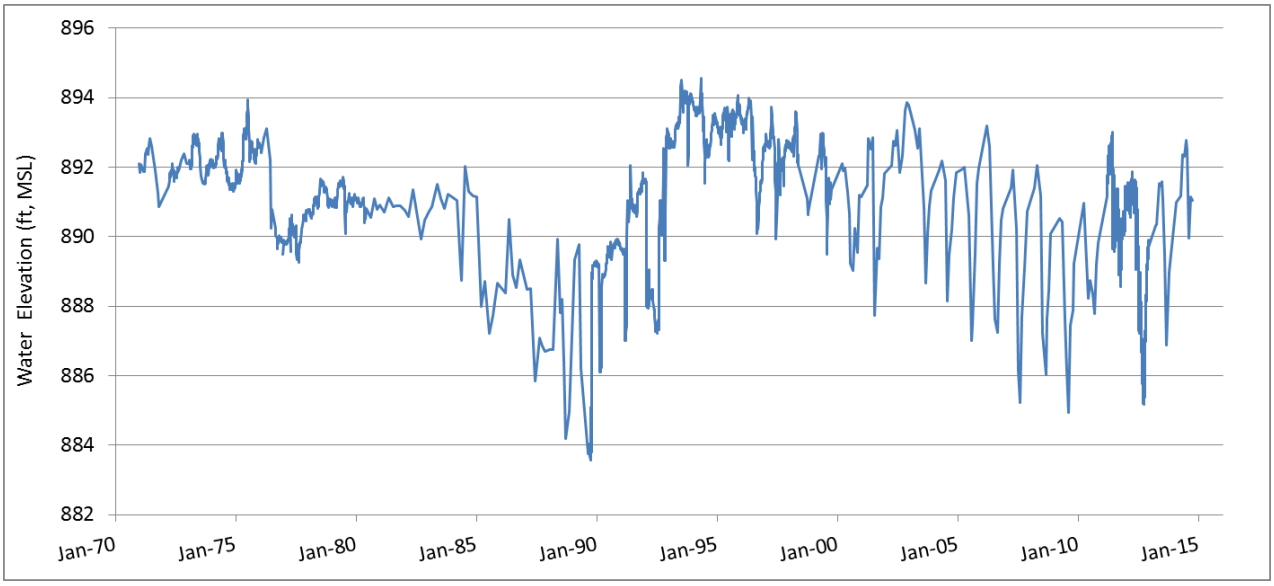


Figure 4-4 Observation well hydrograph (2012), Jordan aquifer, southern Anoka County

Table 4-1 Historical and recent water levels in older municipal wells

City	Well Unique No.	Aquifer(s)[1]	Date of Historic Measurement	Date of Synoptic Measurement	Difference in Water Level (feet)
North St. Paul	208222	PCJ	1942	3/30/2011	11
North St. Paul	208223	PCJ	1942	3/30/2011	4
North St. Paul	205744	CJDN	11/23/1964	3/30/2011	13
North St. Paul	208224	CJDN	12/0/1957	3/30/2011	-9
White Bear Lake	14005	CJDN	8/14/1959	8/28/2012	21
White Bear Lake	226567[2]	CJDN	6/2/1965	3/30/2011	-2
White Bear Lake	205733	PCJ	3/31/1966	3/30/2011	7
White Bear Lake	226566	PCJ	1969	3/27/2012	20
White Bear Twp.	226570	CJDN	9/1956	8/9/2011	-12
Vadnais Heights	224790	PCJ	11/1972	3/29/2011	-6
Lino Lakes	240171	PCJ	11/10/1971	3/24/2011	-1
Mahtomedi	208507 / 208506[3]	PCJ/CJDN	1933	8/9/2011	-26
Oakdale	208454	CJDN	6/24/1969	3/28/2011	5
Oakdale	208462	CJDN	10/1958	3/28/2011	0
Oakdale	208463	CJDN	4/20/1964	3/28/2011	4

[1] Aquifer codes: CJDN (Jordan), PCJ (Prairie du Chien and Jordan)

[2] This is a standby or backup well that has not been pumped in recent years.

[3] Historical measurements in an adjacent well that has been sealed.

Available Groundwater Model Results

Computer or numerical models of groundwater systems can provide valuable insights and predictions of changes that might result from changing climate and pumping. Several regional computer groundwater flow models that include the North & East Metro GWMA have been developed since the late 1980s. A new, regional model (Metro Model 3) was released June 2014[12]. Metro Model 3 covers an 11 county area, and should not be used directly for more local decision making. However, the model provides a starting point for subregional or local analysis of aquifer conditions and effects of climate and cumulative groundwater appropriations. A local refinement of Metro Model 3 is planned by the Met Council and the U.S. Geological Survey (USGS) for the northeastern Metro area. The local refinement will provide valuable information about potential effects of pumping and weather variability in the GWMA.

Ecosystems and Surface Waters

Groundwater pumping rates may result in negative impacts to some surface waters, recreational and other uses of those resources, and their ecological communities. Several types of surface waters and wetlands that are potentially vulnerable to natural variations (drought) and to groundwater pumping influence were identified in Section 2. These include designated trout streams, non-designated trout

[12] Metropolitan Council, 2014. Twin Cities Metropolitan Area Groundwater Flow Model Version 3.0: prepared by Barr Engineering.

streams, wetland native plant communities associated with groundwater, and lakes and wetlands that are hydrologically connected to the regional aquifer system.

Groundwater use in the vicinity of the six designated trout streams (Figure 2-6) is briefly summarized here. There are no permitted wells within 1 mile of Falls Creek, Willow Brook, or Valley Creek. All of the trout streams except Willow Brook have at least one permitted well within 3 miles. There are a total of nine wells within 1 mile of a trout stream and those wells pumped a total of 109.2 million gallons in 2012. A majority of that pumping was from wells in the vicinity of Brown's Creek. The potential impact that groundwater pumping has on the trout streams has not been fully evaluated.

The City of Woodbury has conducted significant testing and analysis to evaluate the potential for impacts from its municipal wells in its eastern well field on Valley Creek. The results of those analyses were used to place limits on pumping these wells in the city's water appropriation permit. The DNR and Woodbury are working cooperatively to collect stream flow data near the headwaters of Valley Creek and evaluate potential negative impact of municipal pumping on the designated trout stream. This is one example of evaluations of pumping impacts applied to a specific water feature in the GWMA.

There are a large number of lakes and wetlands that the Metropolitan Council classified as connected to the regional groundwater system and potentially vulnerable to impacts from pumping from buried Quaternary and bedrock wells (Figure 2-9). These include a number of features near areas of relatively intensive groundwater use. A number of the wetland native plant communities that are associated with groundwater (Figure 2-7) are in or adjacent to these features.

As discussed in Section 2, the Metropolitan Council's classification system did not consider some factors that affect the sensitivity of lakes and wetlands to groundwater appropriations. Factors, such as the amount of surface inflow and outflow to a lake, can substantially affect the sensitivity of the feature to changing levels in underlying aquifers. For example, Washington County considered the factor of the relative importance of precipitation and surface water inputs in classifying water bodies in the northern part of the county[13]. The classifications by the Metropolitan Council are generally based on regional information and should be refined for more local, lake specific characteristics to better evaluate vulnerability.

It is beyond the scope of this Plan to review all hydrologic studies that provide useful information for evaluating groundwater-surface water interactions. Several studies and additional data that focus on particular water features have been developed by watershed districts, counties, DNR, the U.S. Geological Survey, and others. Permit holders have also developed important local information to help understand groundwater pumping impacts on surface waters and wetlands through aquifer testing and water monitoring. The U.S. Geological Survey, under contract with the Metropolitan Council, is conducting a project to improve understanding of groundwater-lake interactions in the northeastern

[13] Emmons and Olivier Resources, Inc., 2003. Integrating Groundwater and Surface Water Management – Northern Washington County: prepared for Washington County.

metro area[14]. The results of the study will be useful for prioritizing evaluation of groundwater pumping impacts.

Gap Analysis and Recommendations

Aquifers

The safe yield definitions in Minn. Rules, part 6115.0630 are the criteria used to evaluate the sustainability of aquifer levels in the North & East Metro GWMA. Safe yield defines an aquifer's long-term storage sustainability and its capacity to supply water. There are sufficient data available to evaluate compliance with safe yield at recent pumping rates in the North & East Metro GWMA. There are no indications that recent pumping rates present a risk for exceeding safe yield in the North & East Metro GWMA. This is supported by the available observation well data and water-level measurements in other wells. Metro Model 3 results also indicate that total pumping rates are below estimated average recharge for the aquifers included in the GWMA.

Continued collection of data from the obwell network, water use reports, and climate stations will allow for early detection of trends. . Additional obwell locations and climate stations may be needed to improve assessment of climate conditions, aquifer level sustainability and other management objectives.

The Metropolitan Council's new regional model, Metro Model 3, may serve as the foundation for improved assessments of future risk. Additionally, data collection and analysis typically required for new or amended permit evaluations will also provide more information where needed, such as performing and analyzing aquifer pumping tests. Further work is needed to evaluate the risk of exceeding safe yield under potential future scenarios.

Ecosystems and Surface Waters

Appropriations from water basins (lakes and wetlands) are limited by statute to a total annual volume of water amounting to ½ acre-foot per acre of water basin (6-inch depth over the surface area). This limit is protective of some water basins but is likely not sufficient for all water basins and biological communities associated with the North & East Metro GWMA. Some sensitive features may need site specific thresholds if they are likely to be influenced by groundwater appropriations.

Improved methods for determining the hydrological impacts of groundwater pumping on basins are under development, and additional studies are underway to identify basins particularly sensitive to appropriations.

Site specific maximum diversion thresholds (percentage of baseflow) are needed for sensitive water courses such as trout streams. Therefore, additional evaluation is required to identify impacts of groundwater appropriations on trout streams and other water courses within the GWMA.

[14] USGS Project: Characterizing Groundwater and Surface-Water Interactions in Selected Northeastern Twin Cities Lakes, Minnesota. Expected publication in 2016

In general, quantitative assessment of groundwater pumping impacts on surface waters is more demanding than assessing compliance with safe yield. Many surface waters and connected ecosystems are sensitive to relatively small hydrologic changes.

Monitoring data are the foundation for impacts assessment. There is a dense network of precipitation gauges, observation wells, lake gauges, and stream gauges in the North & East Metro GWMA. Nevertheless, monitoring gaps are likely to be identified as analysis methods improve. The planned data system should allow for more efficient assessment and use of monitoring data in the future. There is also an opportunity for the DNR to partner with other entities such as watershed districts and other local units of government on data collection and management.

Lake evaporation is a particular area of high uncertainty. The DNR is working with organizations to develop improved monitoring of lake evaporation on White Bear Lake and plans to extend what is learned to other lakes in the GWMA.

Groundwater recharge is another area of uncertainty. Recharge cannot be directly measured, but can be estimated using land use, climate, soils, and groundwater data. A comprehensive climate and water monitoring plan is under development by the DNR for the North & East Metro GWMA.

Pumping impacts to surface waters cannot be directly measured but must be interpreted from models developed using appropriate field data. To assess current impacts, one must interpret or extrapolate conditions that would have occurred without groundwater pumping. Projections of future conditions are needed to assess the future effects of existing appropriations and the potential effects of proposed appropriations. Improved modeling analysis is needed to quantify the impacts. At the same time, ongoing monitoring will be needed to evaluate and update model projections.

Metro Model 3 may serve as a valuable starting point for improved assessments of the risk to lakes from groundwater appropriations. It is a coarse, regional scale model and was not designed to be directly used for assessing pumping impacts on individual water bodies. The Metropolitan Council and U.S. Geological Survey are in the process of developing a refined, subregional model of the northeastern Metro to be completed in 2016. This project also includes developing information regarding groundwater-lake interactions, including a collection of related data and information describing characteristics that affect them.

Objective II. Water Conservation

Water appropriation permits incorporate water conservation so that volumes are reasonable and for a beneficial use. Explicit conditions may be placed on permits that refer to conservation practices appropriate to a specific use. Municipal systems require additional water-use data reporting supplemental to the monthly appropriation volumes, and include conservation goals in their water supply plans. Some permits for golf course irrigation and other uses also include conservation and water use efficiency requirements.

Municipal Systems

Minnesota Statute, sec. 103G.291 requires public water suppliers to adopt and enforce water-use restrictions when the governor declares a critical water deficiency. The restrictions limit watering lawns, washing vehicles, irrigating golf courses and parks, and other nonessential uses.

This statute also requires public water suppliers serving more than 1,000 people to implement demand reduction measures by January 1, 2015. These measures are intended to reduce water use and must include a conservation rate structure or a conservation program, as defined in Minnesota Statute, sec. 103G.291 subd.4.(a). Demand reduction measures established by January 1, 2015 by public water suppliers will be included in the next round of water supply plans. New, 10-year water supply plans will be due beginning in 2016. The DNR staff has confirmed conservation rate structures are in place in 21 out of 30 municipalities in the GWMA (Table 4-2).

In the Twin Cities metropolitan area, all communities with public water supply systems are required to develop water supply plans and must submit a municipal water-use information sheet with the annual water-use report. These data are tied to conservation goals required in the water supply plans. The data required in the reports include the following:

- Total water pumped divided into residential, industrial, commercial, agricultural, other and unaccounted use categories
- Total per capita demand (annual total pumped for all uses/population served)
- Residential per capita demand (annual residential use /population served). The current goal is 75 gallons per day[15].
- Maximum-day to average-day ratio (maximum use in a 24-hour period divided by total annual volume divided by 365 days). The current goal is less than 2.6[16].
- Unaccounted for water (total volume pumped minus volume sold or used by the utility as a percentage of total pumped). The current goal is less than 10 percent[17].

[15] The 7-County Metropolitan Area average for municipal systems in 2002. This measure was selected by a committee represented by DNR, Metropolitan Council, and the Minnesota Section of the American Water Works Association (AWWA).
[16] The 7-County Metropolitan Area average for municipal systems in 2002.
[17] AWWA Leak Detection and Water Accountability Committee, 1996. Committee Report – Water Accountability: *Journal AWWA*, 88(7) 108-111.

Two 5-year averages (2005-09 and 2010-14) of the data reported by thirty-two municipal water suppliers are summarized in Table 4-3. All of the municipal public water suppliers in the North & East Metro GWMA submitted the water use reporting information sheets as required, but a few suppliers left some items on the forms blank for one or more years or missed some yearly submissions. The Columbus and Marine on St. Croix water systems were new in 2009 and 2010, and, therefore, do not have data for the entire ten-year period.

Each public water supplier may track and categorize information differently based on differing billing systems. For example, one supplier may categorize an apartment building to be a commercial user, while another may categorize it as a residential user. Standardizing these categories would require that some suppliers change their billing or other information systems.

Of the thirty-two municipal systems in the North & East Metro GWMA that reported these data, 10 systems exceeded the residential use goal of 75 gallons per capita per day, 13 exceeded the maximum-day to average-day ratio goal of 2.6, and 13 exceeded the maximum unaccounted-for water goal of 10 percent for the 2010-14 period. Values for these three measures ranged from 38 to 94 gallons per capita per day, 1.4 to 16, and 0 to 30 percent, respectively.

Additional water-use data reporting that is supplemental to the monthly appropriation volumes is currently only required for municipal water systems, and not for most other appropriation permit holders. Additional reporting for non-municipal systems would fill a data gap under this objective.

Table 4-2 Municipal Water Use Rate Types

Water System[1]	Rate Type[2]	Conservation Rate?
Arden Hills	Increasing Block	Yes
Bayport	Increasing Block	Not confirmed
Blaine	Increasing Block	Yes
Centerville	Increasing Block	Yes
Circle Pines	Increasing Block	Yes
Columbus	Uniform	No
Cottage Grove	Increasing Block	Yes
Forest Lake	Seasonal	Yes
Fridley	Increasing Block	Yes
Hugo	Increasing Block	Yes
Lake Elmo	Increasing Block	Yes
Lakeland	Uniform	No
Lexington	Increasing Block	Yes
Lino Lakes	Increasing Block	Yes
Mahtomedi	Increasing Block	Yes
Marine on St. Croix	Uniform	No
Mounds View	Increasing Block	Yes
New Brighton	Uniform	No
Newport	Increasing Block	Yes
Oak Park Heights	Increasing Block	Not confirmed
Oakdale	Increasing Block	Yes
Shoreview	Excess Use	Yes
Spring Lake Park	Increasing Block	Yes
St Paul Park	Increasing Block	Not confirmed
St Paul Regional Water Services	Seasonal	Yes
Stillwater	Seasonal	Yes
Vadnais Heights	Increasing Block	Yes
White Bear Lake	Increasing Block	Not confirmed
White Bear Township	Increasing Block	Not confirmed
Woodbury	Increasing Block	Yes

[1] Water rate information was not readily available for all public supply systems in the GWMA.

[2] Increasing block – different rates for different ranges (blocks) of total use. Excess use – sharp increase in rate for use above a given 'excess' volume. Flat – a single water fee regardless of volume pumped. Seasonal – rate varies seasonally. Uniform – single volumetric rate.

Table 4-3 Municipal Water-Use Information

Summary of data reported on the Municipal Water-Use Information Sheet averaged for the 5-year periods 2005-2009 and 2010-2014.

Public Water Supplier	Water Pumped (million gallons)		Total Per Capita Demand (gallons/day)		Residential per Capita Demand (gallons/day)		Maximum Day/ Average Day		Unaccounted (percent of total)	
Period of Record	2005-09	2010-14	2005-09	2010-14	2005-09	2010-14	2005-09	2010-14	2005-09	2010-14
Goal*	-		-		<= 75		<= 2.6		<= 10	
Bayport	91.1	43.3	76.8	34.2	40.7	24.5	2.1	2.8	1.5	5.7
Blaine[1]	2420.4	2560.7	128.7	119.4	84.6	74.5	2.6	3.2	-0.7	7.0
Centerville	94.8	102.7	67.4	73.8	58.6	60.4	3.2	2.8	1.9	9.4
Circle Pines	177.1	158.5	94.6	86.4	78.1	69.5	2.5	2.9	11.2	8.1
Columbus	-	16.0	-	-	-	39.0	-	15.6	-	19.0
Cottage Grove	1424.8	1318.8	122.5	110.6	88.9	82.0	3.0	2.7	15.6	12.5
Forest Lake	403.0	442.2	105.5	118.4	70.2	77.8	2.3	2.0	9.3	11.9
Fridley[2]	1182.2	982.3	120.3	98.0	85.0	77.0	-	3.2	-18.9	21.8
Hugo	329.7	375.8	97.7	94.0	66.6	66.3	3.6	3.4	5.3	6.2
Lake Elmo	107.7	124.2	107.6	106.5	87.5	76.5	3.5	1.8	10.8	23.5
Lakeland[3]	85.3	82.2	67.7	68.4	50.6	49.6	3.5	2.3	8.9	11.7
Lexington[1]	61.6	71.0	78.4	94.2	56.3	74.5	-	-	1.0	6.5
Lino Lakes	555.0	515.9	107.1	88.7	87.2	71.1	3.4	3.7	1.8	1.5
Mahtomedi[4]	299.5	261.7	101.6	90.6	82.7	75.7	2.5	2.7	4.9	0.0
Marine on St. Croix	-	3.4	-	98.7	-	90.2	-	14.0	-	2.4
Minneapolis[5]	21788.2	20062.9	136.0	105.5	40.4	39.7	1.9	1.7	7.9	16.0
Mounds View	511.4	462.7	110.1	103.3	76.9	69.7	2.2	2.4	27.8	11.9
New Brighton[2]	1408.0	1265.9	173.6	158.8	66.1	74.2	1.7	1.4	23.5	23.9
Newport	111.7	99.5	82.3	78.2	52.4	51.9	2.0	1.8	14.8	3.9
North St. Paul[6]	477.4	415.3	95.0	86.8	64.9	58.3	2.6	2.3	28.8	30.1
Oak Park Heights	244.3	224.2	142.6	133.1	65.9	63.4	1.9	2.1	29.4	14.1
Oakdale[7]	1063.6	923.8	104.6	92.1	70.8	61.2	2.5	2.3	-1.8	12.2
Shoreview	1201.8	1003.0	120.1	99.3	69.7	67.9	2.5	2.6	17.8	8.9
Spring Lake Park	298.7	265.4	122.4	111.9	73.4	74.4	2.7	2.9	4.1	9.1
SPRWS (All)[8]	17410.8	15845.8	114.4	103.8	42.9	37.6	1.9	1.7	5.9	7.8
SPRWS (GW)	1464.4	1195.3								
SPRWS (SW)	15946.4	14650.5								

Public Water Supplier	Water Pumped (million gallons)		Total Per Capita Demand (gallons/day)		Residential per Capita Demand (gallons/day)		Maximum Day/ Average Day		Unaccounted (percent of total)	
St Paul Park	209.1	188.2	111.9	98.9	70.2	59.2	2.3	2.0	16.9	13.4
Stillwater	791.1	723.3	125.0	108.5	90.2	81.5	2.7	2.4	7.7	4.7
Vadnais Heights	544.7	474.2	112.6	105.1	77.1	86.4	2.8	2.4	5.7	3.7
White Bear Lake[9]	1070.9	890.7	118.7	100.9	71.3	65.6	2.3	2.2	9.4	6.4
White Bear Twp (two systems)[10]	51.9	39.3	111.2	84.1	109.3	82.2	3.8	4.2	-	-
	544.3	448.5	120.4	99.1	101.2	71.3	2.9	4.0	-	-
Woodbury	2748.7	2635.3	130.6	115.4	100.7	93.5	2.8	2.5	6.8	1.8

* The measures and goals are explained on page 4-11.

[1] Blaine provides a portion of the Lexington water supply.

[2] New Brighton provides a portion of the Fridley water supply.

[3] Supplies Lakeland, Lakeland Shores, and Lake St. Croix Beach. Source is the Mt. Simon aquifer.

[4] Supplies Mahtomedi and Willernie

[5] Supplies Minneapolis and the Morningside neighborhood of Edina, and sells water wholesale to Columbia Heights, Crystal, Golden Valley, Hilltop, New Hope, Bloomington, and MSP airport. Source is the Mississippi River.

[6] Supplies North Saint Paul and a portion of Maplewood

[7] Supplies Oakdale and Landfall

[8] St. Paul Regional Water Services (SPRWS) supplies St. Paul, Falcon Heights, Lauderdale, Maplewood, Mendota, Mendota Heights, and West St. Paul and sells water wholesale to Arden Hills, Little Canada, and Roseville.

[9] Supplies White Bear Lake and Birchwood Village

[10] Supplies White Bear Township and a portion of North Oaks

Other Appropriation Categories

The DNR does not specifically track conservation measures, other than those reported by municipal water suppliers. Typical permit language requires that the permittee shall, whenever practical and feasible, employ water conservation techniques and practices. Conservation and water use efficiency requirements have been developed for some specific categories (e.g., golf courses) and are applied to some permits or permit amendments.

An estimated 5 percent of groundwater use in the GWMA is met by wells that do not require a DNR appropriation permit. There are currently no conservation standards for groundwater users who do not require permits other than what individual communities may require.

Pollution containment pumping facilities are reviewed on a regular basis as part of overall site review under the applicable remediation program administered by the Minnesota Pollution Control Agency or Minnesota Department of Agriculture. For example, lower pumping rates were tested for the 3M pollution containment wells in Woodbury, but the lower rates were found to allow polluted groundwater to escape the containment system. In general, pumping more than is necessary is avoided because of the added costs for pumping, treatment and disposal.

Industrial users may seek assistance from trade associations and from the Minnesota Technical Assistance Program (MnTAP) of the University of Minnesota to help find industry-tailored ways to prevent pollution and reduce resource use. More efficient water use can save businesses money by reducing energy costs and wastewater fees. These measures usually must be tailored to an individual facility.

Gap Analysis and Recommendations

Community water supply plans provide the best opportunity for the DNR to engage with public water suppliers and the Metropolitan Council on conservation. The required demand reduction measures will be an important component of the plans. Goals for residential per capita demand, maximum-day to average-day demand, and unaccounted for water will also be set in these plans. These goals may need to be updated for water supply plans.

Annual reporting of water use by category (residential, industrial, commercial, agricultural) should be made consistent between municipalities to enhance the accuracy of water use tracking.

It is important for DNR to develop water use category and business-sector-specific techniques, practices and measures for all appropriation permits. Permit conditions for each category or sector should be more consistent. Information collected on these conservation-related permit conditions should be evaluated and reported to support management of groundwater appropriations.

Groundwater users not required to hold DNR permits should be responsible for conservation and reasonable water use measures. The DNR has the option to require general permits for wells that pump below the current regulatory limit (10,000 gallons per day or 1,000,000 gallons per year) within the GWMA (Minn. Stat., sec. 103G.287, subd. 4). If required, the fee to request authorization under a

general permit does not apply, and the DNR may waive measurement and volume reporting requirements.

Objective III. Water Quality

In the North & East Metro GWMA, movement of contaminant plumes is a concern. The Minnesota Department of Health has designated five Special Well and Boring Construction Areas in the GWMA where groundwater contamination is a risk. Additionally, there are concerns over perfluorochemicals (PFC) detected in groundwater in several areas of southern Washington County (Figure 2-10).

Special controls on the construction or modification of wells are enforced in the MDH designated areas to protect water supplies from known contamination. The potential effects of groundwater pumping outside of the plume boundaries on these contaminant plumes is also a concern and has been and will continue to be considered in evaluating of groundwater appropriation permit applications. These analyses are typically local in nature and address concerns for individual wells or groups of wells when they are proposed, but subregional scale analyses may also be employed, where needed.

Avoiding groundwater contamination or the further spread of contamination may reduce the availability of clean groundwater in the North & East Metro GWMA.

Gap Analysis and Recommendations

The current situation suggests that more integration between the DNR, MPCA and MDH would be beneficial in the GWMA.

Objective IV. Well Interferences and Water Use Conflicts

Well Interferences

A *well interference* problem occurs when groundwater appropriation causes the water level in public water supply well(s) or private, domestic well(s) to fall below the reach of those wells (Minn. Stat., sec. 103G.287 subd. 5 and Minn. Rules, part 6115.0730).There have been no confirmed well interferences[18] in the GWMA. The potential for a well interference is evaluated for new water appropriation permits and for amendment requests.

Gap Analysis and Recommendations

Well interference is almost always a local issue. Local data will continue to be needed to evaluate the risk for well interference due to new or amended appropriations. These evaluations will continue to use pumping tests and/or local aquifer monitoring where needed on a site-specific basis.

Water Use Conflicts

A *water use conflict* occurs when water demands among existing and proposed users exceed the available water. There are no known water use conflicts in the North & East Metro GWMA.

Gap Analysis and Recommendations

Protection of groundwater-dependent surface water features and biological communities may require limiting water appropriations in some areas. It is possible that water use conflicts could arise (or already exist) if cumulative impacts of more than one existing or proposed appropriation would risk negatively impacting these resources. There are ongoing studies to determine if surface waters in the management area are negatively impacted. Implementation of improved analysis methods and data for evaluating surface water impacts could reveal water use conflicts not previously identified.

[18] A well interference complaint is confirmed to be valid only after DNR receives a complete Water Well Information and Complaint Questionnaire and finds through an investigation that well interference caused a water outage.

Objective V. Permits

Water uses that exceed 10,000 gallons per day and/or 1,000,000 gallons per year, except for domestic supplies that serve 25 persons or fewer, require a water-appropriation permit. Some water uses that exceed one million gallons (MG) in a year may be reported under general permits.

Compliance

There are no known groundwater uses in the GWMA that require a permit that are not covered under an existing permit. Nevertheless, a thorough audit of water wells has not been conducted for the GWMA. It is possible that there are unidentified groundwater uses that require permits. Since July 2013, new wells that will require a water appropriation permit must receive preliminary well construction approval from the DNR prior to construction. This helps the DNR monitor compliance and assists permit applicants in the planning and capital investment process.

DNR staff obtains compliance reports from the Minnesota Permitting and Reporting System (MPARS) electronic permits database. When pumping volume exceeds the appropriation permit amount (overuse), the DNR investigates and takes appropriate action.

In 2012, 16 groundwater appropriation permits reported use exceeding their permitted appropriations by more than 10 percent[19]. That represents 6 percent of the permits in the GWMA.

Reported average use annual use from 2008 through 2012 exceeded the permitted volume for only 3 of the over 250 active groundwater appropriation permits in the area.

In general, compliance with permitted volumes is high in the North & East Metro GWMA. Special circumstances may lead to pumping exceeding permitted volume in a given year, such as waterline breaks, other system problems, or one-time uses. In other cases in which permitted volumes were exceeded for multiple years, a permit holder may have appropriated a reasonable volume for the use, but a permit amendment was needed and/or may have been pending.

In addition to the limits on annual volume and maximum pumping rate, some permits may include special conditions such as groundwater level monitoring. The DNR staff is working with permit holders who have monitoring conditions on compliance with both measurement and reporting requirements.

Gap Analysis and Recommendations

It is possible that high-capacity wells constructed before July 2013 could be appropriating groundwater without a required permit. To fill this data gap, the DNR staff will cross-check wells in the County Well Index with DNR water appropriation permits to identify potential unpermitted groundwater use. The DNR staff will then further investigate whether any high-capacity wells not associated with a DNR water appropriation permit are being used to pump more than 10,000 gallons per day or 1,000,000 gallons per year. Some permit holders that have the required appropriation permit may have replaced permitted

[19] Because water use must be measured or estimated with an accuracy of plus or minus 10 percent, overuses of less than 10 percent are considered to be within the range of potential measurement error.

wells without notifying DNR. The cross-checking could also identify these wells, and the permits could be updated with the new well information.

5. Actions

Prior sections of the North & East Metro GWMA Plan have described the area; introduced the sustainability goals, objectives and sustainability thresholds for the area and described some of the information and data gaps that need to be addressed to continue to manage groundwater sustainably. This section restates the sustainability goal for the GWMA, and introduces the specific actions by each objective that the DNR plans to take to meet the sustainability goal.

> *The GWMA Goal: In the North & East Metro Groundwater Management Area (GMWA), the use of groundwater is sustainable, and therefore does not harm ecosystems, water quality, or the ability of present and future generations to meet their needs.*

Broadly, the DNR considers the implementation and in some cases the completion of the actions presented in this Section to be the primary performance measures for the Plan. The degree to which these actions are implemented is a measure of the success of the Plan.

Role of Other Agencies, Organizations and Plans

In addition to the DNR actions listed in this section, other state agencies, local units of government and public and private organizations have an important role in supporting the DNRs actions in the Plan.

Executive Branch Agencies

The MPCA, the MDH, the MDA and the BWSR have provided specific commitments and actions in support of the DNR's North & East Metro GWMA. Those commitments are included in Appendix A.

Washington County Groundwater Plan

Minnesota Statute 103B provides counties with the authority and requirements for completing groundwater plans. Washington County adopted its most recent groundwater plan, the Washington County Groundwater Plan 2014-2024, on September 23, 2014. The overall goal of the plan is to manage the quality and quantity of groundwater in Washington County to protect the health and ensure sufficient supplies of clean water to support human uses and natural ecosystems. As part of the updating process, Washington County coordinated with the DNR such that the GWMA Plan and the Washington County plans would reflect common goals and actions. The Washington County groundwater plan provides an additional set of targeted and specific actions and measures of success for Washington County that this Plan acknowledges and supports.

White Bear Lake Settlement Agreement

In late 2012, several years after the DNR began to evaluate the potential development of a GWMA in the eastern Twin Cities metropolitan area, the DNR was sued over lake levels on White Bear Lake. The legal action is currently stayed through a legal settlement agreement (Agreement) signed in late 2014. At this point, the work on the GWMA Plan was well underway and a draft of the Plan had already been

prepared. Most of the actions detailed in the Agreement address issues and communities near White Bear Lake, but several actions also address broader regional goals of sustainable groundwater use. The Agreement and the GWMA Plan are distinct and separate, but have overlapping elements. The GWMA Plan is a comprehensive approach to a broad array of issues within a large geographic area that contains numerous natural resources in addition to White Bear Lake. The Plan will be implemented by DNR to ensure sustainable use of groundwater throughout the entire GWMA. By contrast, the Agreement articulates several specific steps that the parties to the Agreement (the DNR, plaintiffs groups, City of White Bear Lake and White Bear Township) have agreed to in the interest of avoiding further litigation. These steps include a source water shift for some communities and conservation measures. It is important, however, to understand that the Plan does not address whether cities should get their municipal water from surface waters or groundwater; and the DNR will continue to approve permits for groundwater use where sustainability objectives are met. The Plan commits DNR to more effective participation in municipal water supply planning. Because there is overlap between the Plan and the Agreement, several specific actions taken from the Agreement have been included in the Plan, including: actions I.2.c.i.a, I.2.c.i.b, I.2.c.i.c, and I.2.c.i.d.

Watershed Management Plans

Watershed districts and watershed management organizations are local units of government that work to solve and prevent water-related problems. Watershed districts manage both surface water and groundwater. Watershed management organizations manage only surface water. Both watershed districts and watershed management organizations are required to conduct their activities according to an approved watershed management plan. Minnesota Rule Chapter 8410 outlines what is to be included in a watershed management plan and requires that plans be revised every 5 to 10 years. A watershed management plan includes goals, objectives, strategies, and polices toward surface and ground waters, an inventory and assessment of resources, implementation of projects and programs, resource management plans, and permitting and project performance standards. The DNR is committed to coordinating planning and implementation activities of the GWMA Plan with plans of WSDs and WMOs within the GWMA.

Objective I. Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.

1. **The DNR will improve monitoring of groundwater levels, basin water levels, stream flows, climate, groundwater associated biological communities and water use within the GWMA to inform DNR permit decisions.**

    a. The DNR will continue to build a comprehensive hydrological and climate monitoring system for the GWMA. The DNR will coordinate with federal, state, and local agencies in these efforts. The following are some initial efforts that may be adjusted over time:

i. Stream Flow Monitoring: by 2016 review Washington Conservation District, Valley Branch Watershed District, Metropolitan Council, and Rice Creek Watershed district stream flow monitoring stations and data with those agencies and evaluate opportunities for collaboration or data collection and maintenance improvements.

ii. Lake Level Monitoring: add lake gauges as needed to the existing 139 gauges.

iii. Groundwater Level Monitoring: by 2016, install 3 observation wells. These are in addition to the existing 60 DNR groundwater level observation wells. In addition, the DNR will continue to work with permit holders on reporting groundwater level data and adding observation wells as needed.

iv. Weather Stations: Identify additional climate monitoring requirements and add weather stations as needed to provide precipitation, temperature, solar radiation, dew point, and wind speed for improved evapotranspiration estimates.

i. The DNR will establish up to two weather stations in the GWMA to provide real time data.

ii. In cooperation with the White Bear Lake Conservation District and others, the DNR will participate in the establishment, maintenance and monitoring of a network of evaporation stations on White Bear Lake.

iii. The DNR will evaluate the benefits of evaporation monitoring networks on lakes in the GWMA.

iv. The DNR will summarize the available climatological data related to groundwater management for the new GWMA reporting system

b. The DNR will continue to improve information on water use within the GWMA.

i. Refine estimates of groundwater use that does not require a permit. Note: permits are not required for uses that are less than 10,000 gallons per day or 1 million gallons per year or other domestic supplies that serve 25 or fewer people.

ii. The DNR will develop guidance for categories of water use reporting that can be applied consistently by appropriation permit holders.

c. The DNR will develop and use groundwater models for use in the permit decision process

i. The DNR will use standard and accepted groundwater models and methods to predict volumes, rates and water level impacts from groundwater appropriations on surface water features.

ii. The DNR supports the ongoing work of the USGS and the Metropolitan Council to update, locally refine, and apply the Metro Model 3 to improve understanding of the effects of groundwater appropriations on the levels of White Bear Lake and other lakes in the GWMA.

d. Develop additional information on groundwater associated biological communities to inform permit decisions.
   i. A GIS-based model will be developed to map potential Wet Prairie Complexes on the Anoka Sandplain.
   ii. Field surveys will be conducted to refine the model described above in "I.d.i", and to document additional locations of native plant communities and populations of state-listed rare plant and animal species in the GWMA.

e. The DNR will create a new GWMA reporting system, to make the results of data collection and analysis in the GWMA available to the public.

2. The DNR will develop and apply sustainability thresholds for aquifers, ecosystems and surface waters in the GWMA[20].

a. The DNR will use established safe yield thresholds for aquifers to determine limits to appropriation permits in the GWMA.[21]

b. By December 15, 2015, as directed by Laws of Minnesota 2015, First Special Session, chapter 4, article 4, section 143, the commissioner of natural resources will consult with interested stakeholders and submit a report to the legislature on recommendations for statutory or rule definitions and thresholds for negative impacts to surface waters as described in Minnesota Statutes, sec. 103G.285 and 103G.287, subd. 2. *The DNR will use this report to help clarify how it determines negative impacts to surface water features from existing and proposed groundwater appropriations.*

c. The DNR will use thresholds for determining negative impacts to streams as a result of groundwater appropriations as required by Minnesota Statutes, sec. 103G.287, subd. 2. DNR will also continue to coordinate studies and work with permitted groundwater users having potential negative impacts on Valley Creek, Browns Creek, Trout Brook and other streams within the GWMA.

d. The DNR will use thresholds for determining negative impacts to water basins and wetlands as required by Minnesota Statutes, sec. 103G.287, subd. 2[22].

[20] Sustainability means that groundwater and surface water levels, water quality, and ecosystems are not harmed and that present and future generations will be able to meet their need for water.

[21] Safe yield for artesian conditions means the amount of groundwater that can be withdrawn without degrading water quality or causing a continual decline in groundwater levels that results in a change from artesian to water-table condition. Safe yield for water-table conditions means the amount of water that can be withdrawn without degrading the quality of the water in the aquifer and without allowing the long term average withdrawal to exceed the available long term average recharge to the aquifer system based on representative climatic conditions.

[22] DNR has not determined negative impact thresholds for wetlands and lakes. However, we recognize that this is a vital component of assessing sustainability of aquifers and surface water features such as lakes and wetlands. DNR is committed to working with stakeholders as these negative impact thresholds are established.

i. The DNR will work with USGS, Met Council, Soil and Water Conservation Districts (SWCDs), Watershed Districts and others to evaluate susceptibility of water basins in the GWMA to changing groundwater levels.
   a. The DNR will work with the USGS and others to model the total annual volume of water that is withdrawn from White Bear Lake due to permitted groundwater appropriations.
   b. If the total annual volume withdrawn from White Bear Lake is greater than the sustainable threshold, the DNR will work with permittees to adjust their permits guided by statute and rule.
   c. The DNR will use the procedures outlined in Minnesota Rules, part 6110.0740 to resolve any water use conflicts that are identified by this analysis of White Bear Lake.
   d. The DNR will set a protective elevation for White Bear Lake using the considerations listed in Minn. Stat. 103G.285, subd. 3, and evaluate value setting protective elevations on other water basins.

ii. The DNR will work with the BWSR, the USFWS, SWCDs, Watershed Districts and others to determine sustainability thresholds for withdrawals from wetlands in the GWMA due to groundwater appropriations as guided by statute and rule.

e. The DNR will manage water appropriations to meet the sustainability thresholds.

3. The DNR groundwater appropriation permits will integrate sustainability thresholds, individual and cumulative permit analysis, and will include evaluation of existing permits within the GWMA.

a. The DNR will evaluate each new permit application individually, and in conjunction with other permits in the related aquifer systems to address challenges of cumulative impacts.

b. The DNR will complete a review of all existing permits in the GWMA within 5 years, and if necessary adjust permits to achieve sustainable groundwater use[23].

c. Where needed, and in accordance with statutory requirements, the DNR will limit current and future appropriations.[24]

4. The DNR will communicate the status of Objective I (aquifers, ecosystems, surface waters) in the GWMA.

a. The DNR will create a new GWMA reporting system to make the results of data collection and analysis in the GWMA available to the public

[23] DNR has not determined the steps or timeline for to evaluate and implement necessary changes to existing permits. However, we recognize that this is a vital component of GWMA planning, and we are committed to working with permittees as we develop the process. See Appendix C for additional process details.

[24] DNR has not determined the steps or timeline for to evaluate and implement necessary changes to existing permits. However, we recognize that this is a vital component of GWMA planning, and we are committed to working with permittees as we develop that process. See Appendix C for additional process details.

b. The GWMA reporting system will include a listing of applications for new or amended water appropriation permits in the GWMA.

c. The DNR will hold at least two GWMA Advisory Team meetings per year. They will be open to the public.

d. The DNR will increase education and outreach to the public about groundwater use in the GWMA.

e. The DNR will encourage counties to participate in the County Geologic Atlas program.
    i. Anoka County in cooperation with the MGS and DNR is in the process of completing a Geologic Atlas
    ii. Invite Ramsey County to participate in an update for that county
    iii. Washington County in cooperation with the MGS and the DNR is in the process of updating its Geologic Atlas

5. The DNR will improve access to data collected and analyzed by other organizations in the GWMA.

a. The DNR will actively support and participate in the development of a more comprehensive and accessible data management system within the GWMA, including website improvements.

b. The DNR will pursue hydrologic data (stream flow, groundwater levels, lake levels, evaporation, etc.) being collected by organizations in the GWMA including but not limited to conservation districts, watershed districts, counties, Minnesota Departments of Health and Agriculture, BWSR and the Minnesota Pollution Control Agency.

6. The DNR will ensure that community water supply plans include actions that must be taken if cumulative aquifer withdrawals exceed sustainability thresholds or if negative impacts on surface waters are occurring due to groundwater withdrawals in the GWMA.

7. The DNR will promote groundwater recharge in the GWMA, consistent with sound water quality management.

a. The DNR will work with other organizations and agencies including SWCDs, watershed districts, counties and local units of government to identify groundwater recharge areas and opportunities to enhance recharge.

b. The DNR will support local government efforts to protect groundwater recharge through zoning, land use planning and where appropriate, additional funding mechanisms

c. The DNR will update the groundwater sensitivity maps for the GWMA within 5 years.

Objective II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.

1. **The DNR will ensure that groundwater users are complying with water conservation requirements in their water supply plans and permits.**

    a. The DNR will include water conservation requirements in appropriate permits as framed by statute, rule, and public water supply plans.
        i. The DNR will work with the Metropolitan Council to evaluate current conservation goals and update as needed in tabulated format.

    b. The DNR will evaluate compliance with water conservation requirements on permits that include them. The DNR will contact permit holders relative to these reviews.

    c. When considering a permit transfer request or amendment request to increase appropriations in this GWMA, the DNR will evaluate a permit holders' performance in meeting conservation requirements in their permit and the conservation goals contained in applicable water supply plans.

    d. The DNR will partner with local units of government such as SWCDs to assist in developing conservation requirements.

    e. The DNR will update the information it uses to develop water conservation requirements specific to each water use category (i.e. municipal water supply, non-crop irrigation, industrial processing, water level maintenance, special categories).

2. **The DNR will improve communication about and promote the values of water conservation in the GWMA.**

    a. The DNR will promote lessons learned about water conservation by municipalities, industries, and other water users in the GWMA.

    b. The DNR will include descriptions and evaluations of water conservation practices being used in the GWMA in the new GWMA reporting system.

    c. The DNR will provide assistance to local units of government and other organizations to encourage and implement water conservation measures for water uses that do not require a DNR water appropriation permit (e.g., private domestic wells).

    d. The DNR will update its website to include links to organizations with water conservation information (e.g., University of Minnesota Technical Assistance Program, Metropolitan Council Water Conservation Toolbox, and SWCDs).

3. **The DNR will work with other organizations to promote and remove barriers to appropriate water storage, water re-use (e.g., water used for pollution containment, stormwater, wastewater), and use of viable alternative water sources in the GWMA as a means to conserve of groundwater.**

4. **The DNR will promote the use of water conservation strategies in community water supply planning in the GWMA.**

    a. The DNR will require that water supply plans include measureable conservation goals.

Objective III. Groundwater use in the GWMA does not degrade water quality.

1. **The DNR will include compliance with local, state, and federal water quality regulations as permit conditions.**

   a. The DNR will coordinate with local, state, and federal agencies to identify water quality regulations that apply to groundwater use and clarify how best to include them in appropriation permits.

2. **The DNR will ensure that permitted appropriations do not degrade water quality by moving known contaminants.**

   a. The DNR will evaluate new permit applications in the GWMA for their potential to move known contaminants.

   b. The DNR will evaluate all existing permits in the GWMA for their role in moving known contaminants.[25]

3. **The DNR will ensure that community water supply plans take into account contaminant management.**

4. **The DNR will improve communication about known contaminants and pollution management in the GWMA.**

   a. The DNR will use a new reporting system to describe and evaluate status of contamination and pollution plume management in the GWMA.

[25] The DNR has not determined the detailed steps and timeline for how we will evaluate and implement any necessary changes to existing permits. However, we recognize that this is a vital component of GWMA planning, and we are committed to working with permittees as we develop that process.

Objective IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.

1. **The DNR will continue to review permit applications to identify and reduce the likelihood of well interferences and water use conflicts.**

2. **The DNR will resolve well interferences and water use conflicts applying the framework outlined in statute and rule.**

3. **The DNR will improve information on aquifer characteristics in the GWMA to improve its ability to identify and reduce the likelihood of interferences and conflicts prior to permit approval.**

4. **The DNR will increase education and awareness about resolving well interferences and water use conflicts.**

Objective V. All groundwater users in the GWMA have the necessary permits to use groundwater.

1. The DNR will improve its capacity to detect unpermitted groundwater use.

a. The DNR will complete a periodic analysis to identify potential unpermitted groundwater use in the GWMA and take appropriate action.

b. The DNR will conduct follow-up reviews of preliminary well approval actions to determine compliance with permit requirements.

c. The DNR will provide updated information to well drillers and consultants on existing laws and the water appropriation permit application process as it is available.

d. The DNR will facilitate the public's ability to identify and report unpermitted use.

2. The DNR will ensure that permitted volumes reflect actual use and that actual use does not exceed permitted volumes.

a. The DNR will evaluate water use reports and will contact permit holders whose reports indicate inaccuracies.

b. The DNR will work with permittees to bring them into compliance when reported use is higher than allowed by permit.

c. The DNR will work with permit holders to adjust permitted volume to better match actual use and need, consistent with other plan objectives.

3. The DNR will ensure that water users comply with conditions on appropriation permits.

a. The DNR will work with permit holders to bring them into compliance with their permit conditions. The DNR will focus on permits that have been reviewed to address challenges of cumulative impacts and sustainability thresholds (Objective 1, Action 3).

6. Implementation

DNR, considering input from the PAT and other interested parties, chose the actions described in Section 5 to address the most pressing challenges to meeting the five sustainability objectives around which the Plan is organized. As stated in Section 1, the purpose of the GWMA Plan is to guide DNR actions in managing the appropriation and use of groundwater within the GWMA over the next five years.

The Plan is not a Water Supply Plan for the GWMA, and has a different purpose and content compared to, for example, the Master Water Supply Plan for the Twin Cities metropolitan area developed by the Metropolitan Council or Water Supply Plans for individual cities or townships developed by public water suppliers. Rather the Plan is a description of how the DNR will develop and apply its groundwater management program within the GWMA.

Many of the actions described in Section 5 develop information, tools, and processes that will form the foundation for better decision making. The Plan does not begin with a detailed description of what sustainable groundwater use (appropriation amounts) should be throughout the GWMA. Rather, it lays the path for determining sustainable thresholds, now and in the future, and managing appropriations to stay within the sustainability thresholds in a planned and transparent framework. Actions oriented toward all five Plan objectives are integral to this process.

Table 6-1 provides details of the DNR's implementation plans for the GWMA. Table 6-1 is not a schedule, but provides information about who within the DNR is responsible for undertaking the actions identified in Section 5, and the general timeframes for implementation. Table 6-1 provides the following information:

- Action ID. The number of the action is taken directly from Section 5. The actions are listed under the Sustainability Objectives and in the order they are introduced in Section 5, and not according to the order of planned implementation.
- Action. The specific actions corresponding to the action IDs are described in this column. Highlighted rows introduce categories of actions that follow. Some actions are paraphrased from the actions presented in Section 5 to fit into Table 6-1. See the actions in Section 5 for the complete text of each action.
- Responsible Organization, Unit or Individual. The DNR division, section, unit or position primarily responsible for the implementation of the action is listed first and in bold type. Additional resources required to complete the action are listed, including organizations other than the DNR where appropriate.
- Existing or New Responsibilities. Plan actions are listed as either "New", "Existing" or "Existing but enhanced". New actions are considered actions that have not been taken previously by the DNR. Existing actions indicate the DNR has taken these actions previously and intends to continue. Existing but enhanced actions are those the DNR is currently taking but intends to enhance by adding additional resources or changing the approach.

- Plan Years(s). This column identifies when the actions will be implemented by plan year.
    - Plan Years 1 through 5 – These represent the calendar years following the authorization of the N&E Metro GWMA Plan that an action will be started or implemented. Plan Year 1 is the first 12 month period following authorization to proceed. Plan Year 2 is the following 12 month period.
    - Ongoing – The actions are ongoing, starting in plan year 1, or before, and continuing throughout the five year timeframe of the N&E Metro GWMA Plan and beyond the five-year GWMA Plan.
    - Semi-Annually – Actions will take place twice a year, at approximately 6 month intervals. Where appropriate the interval is specified by month.
    - Annually – Actions will take place once per year
    - Specific Dates – the specific date an action will be completed is identified for some actions where appropriate.
- Dependencies/Notes. Where initiation of an action is dependent upon initiation or completion of another action, the dependency is noted.

Table 6-2 graphically presents the general timing for initiation or continuing work on the actions. DNR resource managers responsible for each of the actions develop detailed work plans as needed.

Table 6-1 Implementation Plan

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
Objective I. Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.					
I.1	The DNR will improve monitoring of groundwater levels, basin water levels, stream flows, climate; groundwater associated biological communities and water use within the GWMA to inform the DNR permit decisions.				
I.1.a	Hydrological and climate monitoring system. The DNR will coordinate with federal, state, and local agencies in these efforts.				
I.1.a.i	Stream flow monitoring: Evaluate opportunities for stream flow monitoring collaboration or data collection	**EWR – Water Monitoring and Surveys Unit**, Met Council, Watershed Districts, other LGUs	New	1-2	
I.1.a.ii	Lake level monitoring: Add lake gauges as needed	**EWR – Water Monitoring and Surveys Unit** with input from Hydrogeology and Groundwater Unit. Coordinate with Division of FAW.	Existing but enhance	Ongoing	I.2.c.i
I.1.a.iii	Groundwater level monitoring: Install the DNR observation wells and work with permit holders on reporting groundwater data and adding observation wells	**EWR – Water Monitoring and Surveys Unit** with input from Hydrogeology and Groundwater Unit	Existing	1, Ongoing	
I.1.a.iv	Weather stations: Identify climate monitoring requirements and add weather stations as needed to provide precipitation, temperature, solar radiation, dew point, and wind speed for improved evapotranspiration estimates				
I.1.a.iv.i	Establish up to two weather stations to provide real time data from the GWMA	**EWR – Water Monitoring and Surveys Unit -State Climatology Office** with input from Hydrogeology and Groundwater Unit	New	2-3	
I.1.a.iv.ii	Participate with cooperators in the monitoring of White Bear Lake evaporation	**Univ. of Minnesota**, Water Monitoring and Surveys Unit, White Bear Lake Conservation District & Web Team	Existing	1-2	
I.1.a.iv.iii	Evaluate the benefits of evaporation monitoring networks on lakes in the GWMA	**EWR – Water Monitoring and Surveys Unit -State Climatology Office** with input from Hydrogeology and Groundwater Unit, external partners	New	2-4	I.2.c.i

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
I.1.a.iv.iv	Summarize the available climatological data related to groundwater management for the new GWMA reporting system	**Water Monitoring and Surveys Unit - State Climatology Office** supported by Hydrogeology and Groundwater Unit & EWR Web Team	New	Annually	
I.1.b	The DNR will continue to improve information on water use within the GWMA.				
I.1.b.i	Refine estimates of groundwater use that does not require a permit (<10,000 GPD or 1MM GPY)	**EWR Regional Appropriations staff**, Metropolitan Council	New	1	
I.1.b.ii	Develop guidance for consistent water use reporting categories	**EWR Water Regulations Unit,** with LGU input	New	1-2	
I.1.c	The DNR will develop and use groundwater models for use in the permit decision process				
I.1.c.i	Develop and use standard groundwater models and methods to predict impacts from groundwater appropriations	**EWR Hydrogeology and Groundwater Unit,** EWR Regional Appropriations staff.	Existing, but enhance	Ongoing, 1-2	I.2.d.i,iv
I.1.c.ii	Support Met Council/USGS refinements of the Metro Model 3 and use to understand groundwater-lake interaction where feasible.	**EWR – Hydrogeology and Groundwater Unit,** Metropolitan Council, USGS	Existing but enhanced	1-2	
I.1.d	Develop additional information on groundwater associated biological communities.				
I.1.d.i	Develop GIS model of wet prairie complexes	**EWR – Regional Plant Ecologist**	New	1-2	
I.1.d.ii	Wetland/native plant community field surveys	**EWR – Regional Plant Ecologist**	New	1-2	
I.1.e	Create GWMA reporting system for public access to data collected and analysis	**EWR Central Office and Web Team**	New	1, Ongoing	
I.2	The DNR will develop and apply sustainability thresholds for aquifers, ecosystems and surface waters in the GWMA.				
I.2.a	Use established safe yield thresholds for aquifers	**EWR Regional Appropriations staff**, Hydrogeology and Groundwater Unit	Existing but enhanced	Ongoing	I.1.c
I.2.b	Prepare report to legislature with recommendations for thresholds for negative impacts to surface waters	**EWR Hydrogeology and Groundwater Unit**	New	Dec. 15, 2015	
I.2.c	The DNR will use specified thresholds for determining negative impacts to streams from groundwater appropriations.				

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
I.2.c.i	Coordinate studies and work with permitted groundwater users having potential negative impacts on trout streams within the GWMA	**Water Monitoring and Surveys Unit EWR Regional Appropriations staff** supported by Hydrogeology and Groundwater Unit	Existing	Ongoing	I.2.b
I.2.d	The DNR will use sustainability thresholds (Objective I.2.b) for determining negative impacts to water basins and wetlands as required by Minn. Stat. sec. 103G.287, subd. 2.				
I.2.d.i	The DNR will work with others to evaluate susceptibility of selected water basins to groundwater-level changes in the GWMA	**EWR – Hydrogeology and Groundwater Unit and** USGS, Metropolitan Council	New	2-3	
I.2.d.i.a	Work with USGS to model total annual volume withdrawn from White Bear Lake due to permitted groundwater appropriations.	**EWR – Hydrogeology and Groundwater Unit and** USGS, Metropolitan Council **Regional Appropriations staff** and EWR – Hydrogeology and Groundwater Unit	New	2-3	I.1.c
I.2.d.i.b	Adjust permits if withdrawals exceed the sustainability (Obj. I.2.b) threshold from White Bear Lake	**Regional Appropriations staff** and EWR – Hydrogeology and Groundwater Unit	New	Complete by Nov. 2016	
I.2.d.i.c	Use procedures outlined in Minnesota Rules part 6110.074 to resolve water use conflicts identified in this analysis of White Bear Lake	**Regional Appropriations staff** and EWR – Hydrogeology and Groundwater Unit	New	Complete by Nov. 2016	
I.2.d.i.d	Set a protective elevation for White Bear Lake	**EWR Special Project Team**	New	Complete by Nov. 2016	
I.2.d.ii	Determine sustainability thresholds for withdrawals from wetlands in the GWMA due to groundwater appropriations	**EWR – Wetlands Program Coordinator**, Central Region staff, BWSR, USFWS, Watershed Districts, others	New	1	
I.2.d.ii.a	Manage water appropriations to meet the sustainability thresholds developed as part of Actions in I.2 above	**EWR – Regional Appropriations staff, EWR – Hydrogeology and Groundwater Unit**	Existing but enhanced	Ongoing	I.1.a,c; I.2.a,b,c

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
I.3	The DNR groundwater appropriation permits will integrate sustainability limits, individual and cumulative permit analysis, and will include evaluation of existing permits within the GWMA.				
I.3.a	Evaluate new permit applications individually and in conjunction with other appropriation permits	**EWR – Regional Appropriations staff**, Hydrogeology and Groundwater Unit, Water Monitoring and Surveys Unit	Existing but enhanced	Ongoing	I.1.a,c; I.2.a,b,c
I.3.b	Review existing permits in the GWMA within 5 years	**EWR – Regional Appropriations staff**, Hydrogeology and Groundwater Unit	New	2-5	I.1.a,c; I.2.a,b,c
I.3.c	Limit current and future appropriations where needed to meet sustainability limits	**EWR – Regional Appropriations staff**, Hydrogeology and Groundwater Unit, Water Monitoring and Surveys Unit	Existing but enhanced		I.1.a,c; I.2.a,b,c; I.3.a,b
I.4	The DNR will communicate the status of Objective I.				
I.4.a	Create a new GWMA reporting system	**EWR Central Office and Web Team**	New	2-5	I.1.f
I.4.b	List applications for new or amended water appropriation permits in the GWMA reporting system	**EWR Central Office and Web Team**	Existing but enhanced	1, ongoing	I.4.a
I.4.c	Hold two GWMA Advisory Team meetings per year	**EWR – Central Office or Regional GWMA Implementation Staff**	New	Semi-annual	
I.4.d	Increase education and outreach to the public about groundwater use in the GWMA	**EWR – Communications staff, Water Regulations Unit (Conservation Consultant), Hydrogeology and Groundwater Unit,** EWR Appropriations Staff and Web Team	Existing but enhanced	1-5	
I.4.e	The DNR will encourage counties to participate in the County Geologic Atlas program.				
I.4.e.i	Complete Anoka County Geologic Atlas	**EWR – Hydrogeology and Groundwater Unit**	Existing	1-2	
I.4.e.ii	Invite Ramsey County to participate in an update to County Geologic Atlas	**EWR – Hydrogeology and Groundwater Unit, Minnesota Geological Survey**	New	1-5	
I.4.e.iii	Complete Washington County Geologic Atlas	**EWR – Hydrogeology and Groundwater Unit, Minnesota Geological Survey**	Existing	1-4	

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
I.5	The DNR will improve access to data collected and analyzed by other organizations in the GWMA.				
I.5.a	Support and participate in a data management system, including website improvements	**EWR –Water Monitoring and Surveys Unit**, EWR Web Team, Hydrogeology and Groundwater Unit, MPCA, MDA	New	1-2	
I.5.b	Pursue hydrologic data collected by other organizations in the GWMA	**EWR – Water Monitoring and Surveys Unit**, other organizations	New	1, Ongoing	
I.6	Ensure that community water supply plans include actions that must be taken if cumulative aquifer withdrawals exceed sustainability thresholds or if negative impacts on surface waters are occurring due to groundwater withdrawals in the GWMA	**EWR – Regional Appropriations staff,** Water Regulations Unit (Conservation Consultant), Hydrogeology and Groundwater Unit, Area Hydrologists, Met Council	Existing but enhanced	2-4	I.1.a,c; I.2.a,b,c
I.7	The DNR will promote groundwater recharge in the GWMA, consistent with sound water quality management.				
I.7.a	Work with others to identify important groundwater recharge areas and opportunities to enhance recharge	**EWR – Central Region Staff**, Met Council, watershed districts, counties, other LGUs	New		
I.7.b	Support LGU efforts to protect important groundwater recharge areas through zoning and land use planning	**EWR – Central Region staff – Land Use staff** and Area Hydrologists	Existing but enhanced	Ongoing	1.7.a
I.7.c	Update groundwater sensitivity maps for the GWMA	**EWR – Groundwater and Hydrogeology Unit**	New	3-4	I.4.e
Objective II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.					
II.1	The DNR will ensure that groundwater users are complying with water conservation requirements in their water supply plans and permits.				
II.1.a	Include water conservation requirements in appropriate permits	**EWR – Regional Appropriations staff**, Water Regulations Unit	Existing but enhanced	2-5	II.1.a.i
II.1.a.i	Work with Met Council to evaluate and update conservation goals	**EWR – Regional Appropriations staff**, Water Regulations Unit, Met Council	Existing but enhanced	2-5	In coordination with Water Supply Planning process

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
II.1.b	Evaluate compliance with conservation requirements by permit	**EWR – Regional Appropriations staff**, Water Regulations Unit	Existing but enhanced	2-5	I.3.b
II.1.c	Evaluate conservation actions when considering amendment requests	**EWR – Regional Appropriations staff**, Water Regulations Unit	Existing but enhanced	Ongoing	II.1.a
II.1.d	Partner with LGUs to develop conservation requirements	**EWR – Water Regulations Unit (Conservation Consultant)**	Existing but enhanced	2-5	
II.1.e	Update information used to develop water conservation requirements	**EWR – Water Regulations Unit (Conservation Consultant)**	New	3-5	
II.2	The DNR will improve communication about and promote the values of water conservation in the GWMA.				
II.2.a	Promote lessons learned about water conservation by water users in the GWMA	**EWR – Conservation Consultant and Web Team,** Water Regulations Unit	New	1-5	I.4.a
II.2.b	Report on water conservation practices being used in the GWMA	**EWR – Conservation Consultant and Web Team**	New	1-5	I.4.a
II.2.c	Provide assistance to LGUs and others to encourage and implement water conservation measures for water uses that do not require a DNR appropriations permit	**EWR – Conservation Consultant and Web Team,** Area Hydro and Regional Appropriations staff	New	1-5	
II.2.d	Include links to organizations with water conservation information on the DNR website	**EWR – Conservation Consultant and Web Team**	New	1-5	
II.3	Work with other organizations to promote appropriate water storage, water re-use, and use of viable alternative water sources in the GWMA as a means to conserve of groundwater	**EWR – Conservation Consultant,** Area Hydro and Regional Appropriations staff	Existing but enhanced	Ongoing	
II.4	The DNR will promote the use of water conservation strategies in community water supply planning in the GWMA.				
II.4.a	Require that water supply plans include measureable conservation goals.	**EWR –Conservation Consultant,** Metropolitan Council, Regional Appropriations staff,	Existing but enhanced	2-4	In coordination with Water Supply Planning process; II1.a.i

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
Objective III. Groundwater use in the GWMA does not degrade water quality.					
III.1	The DNR will include compliance with local, state, and federal water quality regulations as permit conditions.				
III.1.a	Identify water quality regulations that apply to groundwater use and clarify how best to include them in appropriation permits	**EWR – Water Regulations Unit**, Regional Appropriations staff, federal, state, and local agencies	Existing but enhanced	Ongoing	
III.2	The DNR will ensure that permitted appropriations do not degrade water quality by moving known contaminants.				
III.2.a	Evaluate new permit applications for their potential to move known contaminants	**EWR – Regional Appropriations staff**, Hydrogeology and Groundwater Unit, MPCA, MDH, MDA	Existing but enhanced	Ongoing	
III.2.b	Evaluate all existing permits in the GWMA for their role in moving contaminants	**EWR – Regional Appropriations staff**, Hydrogeology and Groundwater Unit, MPCA, MDH, MDA	New	2-4	In coordination with Water Supply Planning process
III.3	Ensure that water supply plans take into account contaminant plume management	**EWR – Regional Appropriations staff**, Hydrogeology and Groundwater Unit, Metropolitan Council	Existing but enhanced	2-4	In coordination with Water Supply Planning process
III.4	The DNR will improve communication about known contaminants and pollution management in the GWMA.				
III.4.a	Use the GWMA reporting system to describe the status of pollution plume management in the GWMA	**EWR – Communications staff,** and EWR Web Team, Hydrogeology and Groundwater Unit, MPCA	New	1, Ongoing	
Objective IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.					
IV.1	Continue to review permit applications to identify and reduce the likelihood of well interferences and water use conflicts	**EWR – Hydrogeology and Groundwater Unit,** MPCA	Existing but enhanced	Ongoing	I.1,I.2
IV.2	Resolve well interferences and water use conflicts applying the framework outlined in statute and rule	**EWR – Regional Appropriations staff,** Water Regulations Unit	Existing	Ongoing	

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
IV.3	Improve information on aquifer characteristics in the GWMA to improve its ability to identify and reduce the likelihood of interferences and conflicts prior to permit approval	**EWR – Hydrogeology and Groundwater Unit**	Existing but enhanced	1-5	I.1, I.4.e
IV.4	Increase education and awareness about resolving well interferences and conflicts	**EWR – Water Regulations Unit,** EWR Communications Staff, Regional Appropriations staff,	Existing but enhanced	1-5	
Objective V. All groundwater users in the GWMA have the necessary permits to use groundwater.					
V.1	The DNR will improve its capacity to detect unpermitted groundwater use.				
V.1.a	Complete a periodic analysis to identify potential unpermitted groundwater use in the GWMA and take appropriate action	**EWR – Regional Appropriations staff**	New	1-5, Ongoing	
V.1.b	Complete follow-up review of applications made for preliminary well approvals	**EWR – Regional Appropriations staff**	New	On-going	
V.1.c	Provide updated information to well drillers and consultants on existing laws and the water appropriation permit application process as it is available	**EWR – Water Regulations Unit,** Regional Appropriations staff.	Existing but enhanced	2-5	
V.1.d	Facilitate the public's ability to report unpermitted use	**EWR – Water Regulations Unit**	New	2-5	
V.2	The DNR will ensure that permitted volumes reflect actual use and use does not exceed permitted volumes.				
V.2.a	Evaluate water use reports and will contact permit holders whose reports indicate inaccuracies	**EWR – Regional Appropriations staff,** Water Regulations Unit	Existing	Ongoing	
V.2.b	Bring permittees into compliance when reported use is higher than established in permit	**EWR – Regional Appropriations staff,** Water Regulations Unit	Existing	Ongoing	
V.2.c.	Work with permit holders to adjust permitted volume to better match actual use and need	**EWR – Regional Appropriations staff**	New	2-5	I.3.b

Action ID	Action	Responsible Organization, Unit or Individual (Primary in Bold)	Existing or New Responsibilities	Plan Year(s)	Dependencies/ Notes
V.3	The DNR will ensure that water users comply with conditions on appropriation permits.				
V.3.a	Work with permit holders to bring them into compliance with their permit conditions	**EWR – Regional Appropriations staff**	Existing but enhanced	Ongoing	I.3

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Table 6-2 Implementation Timing by Objective

Duration (Years) | Ongoing Work | Completed Annually | Completed Semi-Annually

Action ID	Action	Year 1	Year 2	Year 3	Year 4	Year 5
Objective I. Groundwater use in the GWMA does not harm aquifers and ecosystems and does not negatively impact surface waters						
I.1	The DNR will improve monitoring of groundwater levels, basin water levels, stream flows, climate, groundwater-associated biological communities, and water use within the GWMA to inform the DNR permit decisions					
I.1.a	Hydrological and climate monitoring system. The DNR will coordinate with federal, state, and local agencies in these efforts					
I.1.a.i	Evaluate opportunities for stream flow monitoring collaboration or data collection					
I.1.a.ii	Add lake gauges as needed					
I.1.a.iii	Install DNR observation wells and work with permit holders on reporting groundwater data and adding observation wells					
I.1.a.iv	Weather stations: Identify climate monitoring requirements and add weather stations as needed to provide precipitation, temperature, solar radiation, dew point, and wind speed for improved evapotranspiration estimates					
I.1.a.iv.i	Establish up to two weather stations to provide real time data from the GWMA					
I.1.a.iv.ii	Participate with cooperators in the monitoring of White Bear Lake evaporation					
I.1.a.iv.iii	Evaluate the benefits of evaporation monitoring networks on lakes in the GWMA					
I.1.a.iv.iv	Summarize available climatological data related to groundwater management for the new GWMA reporting system					
I.1.b	The DNR will continue to improve information on water use within the GWMA					
I.1.b.i	Refine estimates of groundwater use that does not require a permit (<10,000 GPD or 1MM GPY)					
I.1.b.ii	Develop guidance for consistent water use reporting categories					
I.1.c	The DNR will develop and use groundwater models for use in the permit decision process					
I.1.c.i	Develop and use standard groundwater models and methods to predict impacts from groundwater appropriations					
I.1.c.ii	Support Met Council/USGS refinements of the Metro Model 3 and use to understand groundwater-lake interaction where feasible.					
I.1.d	Develop additional information on groundwater associated biological communities					
I.1.d.i	Develop GIS model of wet prairie complexes					
I.1.d.ii	Wetland/native plant community field surveys					
I.1.e	Create GWMA reporting system for public access to data collected and analysis					
I.2	The DNR will develop and apply sustainability thresholds for aquifers, ecosystems and surface waters in the GWMA					
I.2.a	Use safe yield thresholds for aquifers					
I.2.b	Prepare report to legislature with recommendations for thresholds for negative impacts to surface waters					
I.2.c	The DNR will use specified thresholds (Obj I.2.b) for determining negative impacts to streams from groundwater appropriations					
I.2.c.i	Coordinate studies and work with permitted groundwater users having potential negative impacts on trout streams within the GWMA					
I.2.d	The DNR will develop thresholds of negative impacts to water basins and wetlands as required by Minn. Stat. sec. 103G.287, subd. 2					
I.2.d.i	Work with others to evaluate susceptibility of selected water basins to groundwater-level changes in the GWMA					
I.2.d.i.a	Work with USGS to model total annual volume withdrawn from White Bear Lake due to permitted groundwater appropriations					
I.2.d.i.b	Adjust permits if withdrawals from White Bear Lake exceed sustainability thresholds					
I.2.d.i.c	Use procedures outlined in MN rules part 6110.074 to resolve water use conflicts identified in analysis of White Bear Lake					
I.2.d.i.d	Set a protective elevation for White Bear Lake					
I.2.d.ii	Determine sustainability thresholds for withdrawals from wetlands in the GWMA due to groundwater appropriations					
I.2.d.ii.a	Manage appropriations to meet the sustainability thresholds					
I.3	The DNR groundwater appropriation permits will integrate sustainability limits, individual and cumulative permit analysis, and will include evaluation of existing permits within the GWMA					
I.3.a	Evaluate new permit applications individually and in conjunction with other appropriation permits					
I.3.b	Review existing permits in the GWMA within 5 years					
I.3.c	Limit current and future appropriations where needed to meet sustainability limits					
I.4	The DNR will communicate the status of Objective 1					
I.4.a	Create a new GWMA reporting system					
I.4.b	List applications for new or amended water appropriation permits in the GWMA reporting system					

Duration (Years) | Ongoing Work | Completed Annually | Completed Semi-Annually

Action ID	Action	Year 1	Year 2	Year 3	Year 4	Year 5
I.4.c	Hold two GWMA Advisory Team meetings per year					
I.4.d	Increase education and outreach to the public about groundwater use in the GWMA					
I.4.e	The DNR will encourage counties to participate in the County Geologic Atlas program					
I.4.e.i	Complete Anoka County Geologic Atlas					
I.4.e.ii	Invite Ramsey County to participate in update to County Geologic Atlas					
I.4.e.iii	Complete Washington County Geologic Atlas					
I.5	The DNR will improve access to data collected and analyzed by other organizations in the GWMA					
I.5.a	Support and participate in a data management system, including website improvements					
I.5.b	Pursue hydrologic data collected by other organizations in the GWMA					
I.6	Community water supply plans include actions in response to negative impacts on surface waters due to groundwater withdrawals					
I.7	The DNR will promote groundwater recharge in the GWMA, consistent with sound water quality management					
I.7.a	Work with others to identify to identify important groundwater recharge areas and opportunities to enhance recharge					
I.7.b	Support LGU efforts to protect important groundwater recharge areas through zoning and land use planning					
I.7.c	Update groundwater sensitivity maps for the GWMA					
Objective II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements						
II.1	The DNR will ensure that groundwater users are complying with water conservation requirements in their water supply plans and permits					
II.1.a	Include water conservation requirements in appropriate permits					
II.1.a.i	Work with Met Council to evaluate and update conservation goals					
II.1.b	Evaluate compliance with permit conservation requirements by permit					
II.1.c	Evaluate conservation actions when considering amendment requests					
II.1.d	Partner with LGUs to develop conservation requirements					
II.1.e	Update information used to develop water conservation requirements					
II.2	The DNR will improve communication about and promote the values of water conservation in the GWMA					
II.2.a	Promote lessons learned about water conservation by water users in the GWMA					
II.2.b	Report on water conservation practices being used in the GWMA					
II.2.c	Provide assistance to LGUs to encourage and implement water conservation measures that do not require a DNR appropriations permit					
II.2.d	Include links to organizations with water conservation information on DNR website					
II.3	Work with other organizations to promote water storage, water re-use, and use of viable alternative water sources to conserve groundwater					
II.4	The DNR will promote the use of water conservation strategies in community water supply planning in the GWMA					
II.4.a	Require that water supply plans include measureable conservation goals.					
Objective III. Groundwater use in the GWMA does not degrade water quality						
III.1	The DNR will include compliance with local, state, and federal water quality regulations as permit conditions					
III.1.a	Identify water quality regulations that apply to groundwater use and clarify how best to include them in appropriation permits					
III.2	The DNR will ensure that permitted appropriations do not degrade water quality by moving known contaminants					
III.2.a	Evaluate new permit applications for their potential to move known contaminants					
III.2.b	Evaluate all existing permits in the GWMA for their role in moving contaminants					
III.3	Ensure that water supply plans take into account contaminant plume management					
III.4	The DNR will improve communication about known contaminants and pollution management in the GWWA					
III.4.a	Use the GWMA reporting system to describe the status of pollution plume management in the GWMA					
Objective IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts						
IV.1	Continue to review permit applications to identify and reduce the likelihood of well interferences and water use conflicts					
IV.2	Resolve well interferences and water use conflicts applying the framework outlined in statute and rule					
IV.3	Improve information on aquifer characteristics in the GWMA to identify and reduce the interferences and conflicts prior to permit approval					

Duration (Years)	Ongoing Work	Completed Annually	Completed Semi-Annually

Action ID	Action	Year 1	Year 2	Year 3	Year 4	Year 5
IV.4	Increase education and awareness about resolving well interferences and conflicts					
Objective V. All groundwater users in the GWMA have the necessary permits to use groundwater						
V.1	The DNR will improve its capacity to detect unpermitted groundwater use					
V.1.a	Complete periodic analysis to identify potential unpermitted groundwater use in the GWMA and take appropriate action					
V.1.b	Complete follow-up review of applications made for preliminary well approvals					
V.1.c	Provide updated information to well drillers and consultants on existing laws and the water appropriation permit application process as it is available					
V.1.d	Facilitate the public's ability to report unpermitted use					
V.2	The DNR will ensure that permitted volumes reflect actual use and use does not exceed permitted volumes					
V.2.a	Evaluate water use reports and contact permit holders whose reports indicate inaccuracies					
V.2.b	Bring permittees into compliance when reported use is higher than established in permit					
V.2.c	Work with permit holders to adjust permitted volume to better match actual use and need					
V.3	The DNR will ensure that water users comply with conditions on appropriation permits					
V.3.a	Work with permit holders to bring them into compliance with their permit conditions					

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7. Glossary of Terms

Aquifer – any water-bearing bed or stratum of earth or rock capable of yielding groundwater in sufficient quantities that can be extracted (Minn. Rules, part 6115.0630, subp. 2)

Appropriating – withdrawal, removal, or transfer of water from its source regardless of how the water is used (Minn. Stat., sec. 103G.001, subd. 4)

Artesian aquifer or confined aquifer – a water body or aquifer overlain by a layer of material of less permeability than the aquifer. The water is under sufficient pressure so that when it is penetrated by a well, the water will rise above the top of the aquifer. A flowing artesian condition exists when the water flow is at or above the land surface (Minn. Rules, part 6115.0630, subp. 4).

Basin – a depression capable of containing water which may be filled or partly filled with waters of the state. It may be a natural, altered, or artificial depression (Minn. Rules, part 6115.0630, subp. 5)

Buried Quaternary Aquifer – an aquifer composed of glacially associated sands and/or gravels, over which a confining layer of clay or till was deposited

Conservation rate – a water fee (rate) structure that encourages conservation and may include increasing block fees, seasonal rates, time of use rates, individualized goal rates, or excess use rates (Minn. Stat., sec. 103G.291, subd. 4(a))

Demand reduction measures – actions that reduce water demand, water losses, peak water demands, and nonessential water uses. Demand reduction measures must include a conservation rate structure, or a uniform rate structure with a conservation program that achieves demand reduction (Minn. Stat., sec. 103G.291, subd. 4(a)).

Groundwater – subsurface water in the saturated zone. The saturated zone may contain water under atmospheric pressure (water-table condition), or greater than atmospheric pressure (artesian condition) (Minn. Rule, part 6115.0630, subp. 11)

Native plant community – a group of plants that interact with each other and with their environment in ways not greatly altered by modern human activity or by introduced organisms

Nested Obwells – Two or more adjacent water-level observation wells completed in different aquifers, or different depths within the same aquifer. Nested obwells are used to determine vertical differences in groundwater levels or heads.

Normal (climate) – the average of a climate variable such as precipitation or temperature over a standard 30-year period (e.g., 1981–2010)

Obwell – a water-level observation well in the DNR network

Potential evaporation or free water surface evaporation – evaporation from a thin film of water having no appreciable heat storage (Farnsworth et al., 1982).

Protected flow – the amount of water required in the watercourse to accommodate instream needs such as water-based recreation, navigation, aesthetics, fish and wildlife habitat, water quality, and needs by downstream higher priority users located in reasonable proximity to the site of appropriation (Minn. Rules, part 6115.0630, subp. 12)

Protective elevation – the water level of the basin necessary to maintain fish and wildlife habitat, existing uses of the surface of the basin by the public and riparian landowners, and other values which must be preserved in the public interest (Minn. Rules, part 6115.0630, subp. 13)

Recharge – the addition of water to the groundwater system

Safe yield – *water-table condition:* the amount of groundwater that can be withdrawn from an aquifer system without degrading the quality of water in the aquifer and without allowing the long term average withdrawal to exceed the available long term average recharge to the aquifer system based on representative climatic conditions (Minn. Rules, part 6115.0630, subp. 15)

artesian condition: the amount of groundwater that can be withdrawn from an aquifer system without degrading the quality of water in the aquifer and without the progressive decline in water pressures and levels to a degree that will result in a change from artesian condition to water-table condition (Minn. Rules, part 6115.0630, subp. 15)

Sustainability threshold - the maximum magnitude of change to a hydrological variable caused by water appropriation that does not harm or have a negative impact to a water resource or a dependent biological community. Examples of hydrological variables are flow rate, volume, water level or head, and water temperature.

Transpiration – the process of transport of water from plant roots to above ground parts where it is released to the atmosphere as vapor

Water-table aquifer or unconfined aquifer – an aquifer where groundwater is under atmospheric pressure (Minn. Rules, part 6115.0630, subp. 17)

Water use conflict – A situation where the available supply of waters of the state in a given area is limited to the extent that there are competing demands among existing and proposed users which exceed the reasonably available waters (Minn. Rules, part 6115.0740. subp. 1).

Well interference – A situation where an appropriation reduces water levels beyond the reach of public water supply and private domestic wells constructed according to Minn. Rules, part 4725 (Minn. Stat., sec. 103G.287, subd. 5; Minn. Rules, part 6115.0730).

Appendix A Minnesota Executive Agency Commitments to N&E Metro GWMA Plan

Appendix A

Metropolitan Council

June 2015

The Metropolitan Council has reviewed the North and East Metro Groundwater Management Area Plan and has determined that the agency can support the DNR's goals for the GWMA through the following actions organized by GWMA Plan Objectives and GWMA Actions:

Water Supply Planning Activities

Per Minn. Stat., Sec. 473.1565, the Metropolitan Council is required to "carry out planning activities addressing the water supply needs of the metropolitan area,"…[including] development and maintenance of technical information; recommendations for clarifying roles, streamlining decision-making and approval processes, and funding; and the development of a Twin Cities metropolitan area Master Water Supply Plan... that:

- Provides guidance for local water supply systems and future regional investments;
- Emphasizes conservation, interjurisdictional cooperation, and long-term sustainability; and
- Addresses the reliability, security, and cost-effectiveness of the metropolitan area water supply system and its local and subregional components."

Regional Policies

The Metropolitan Council's water supply planning activities are guided by the *Water Resources Policy Plan*. Four policies are directly related to water supply:

1. **Policy on Sustainable Water Supplies**. While recognizing local control and responsibility for owning, operating, and maintaining water supply systems, the Council will work with our partners to develop plans that meet regional needs for a reliable water supply that protects public health, critical habitat, and water resources over the long-term.
2. **Policy on Assessing and Protecting Regional Water Resources.** The Council will continue to assess the condition of the region's lakes, rivers, streams, and aquifers to evaluate impacts on regional water resources and measure success in achieving regional water goals.
3. **Policy on Water Conservation and Reuse.** The Council will work with partners to identify emerging issues and challenges for the region and solutions that include the use of water conservation, wastewater and stormwater reuse, and low impact development practices in order to promote a more sustainable region.
4. **Investment Policy.** The Council will strive to maximize regional benefits from regional investments.

Integration of Metropolitan Council planning initiatives with the DNR GWMA Plan

The Metropolitan Council's *Water Resources Policy Plan* will support the DNR's GWMA Objectives:

I. Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.

The Metropolitan Council supports this objective through implementation of *Water Resources Policy Plan* policies on sustainable water supplies and on assessing and protecting regional water resources.

While recognizing local control and responsibility for owning, operating, and maintaining water supply systems, the Council will work with our partners to develop plans that meet regional needs for a reliable water supply that protects public health, critical habitat, and water resources over the long-term.

> Example activities: Collaborating with partners to update the Twin Cities metropolitan area master water supply plan, reviewing and commenting on plans and permits, and facilitating discussions on water supply issues that transcend community boundaries.

The Council will continue to assess the condition of the region's lakes, rivers, streams, and aquifers to evaluate impacts on regional water resources and measure success in achieving regional water goals.

> Example activities: Conducting technical studies that fill data gaps, improve understanding of regional and sub-regional long-term water supply availability and demand, and support community efforts to identify and evaluate a variety of water supply approaches and best practices.

II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.

The Metropolitan Council supports this objective through implementation of a policy on water conservation and reuse.

The Council works with partners to identify emerging issues and challenges for the region and solutions that include the use of water conservation, wastewater and stormwater reuse, and low impact development practices in order to promote a more sustainable region.

> Example activities: Promoting and supporting water conservation measures through a demand reduction grant program and tool development; investigating reusing treated wastewater and stormwater; and promoting low impact development practices.

III. Groundwater use in the GWMA does not degrade water quality.
Please see response for Item V.

IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.
Please see response for Item V.

V. All groundwater users in the GWMA have the necessary permits to use groundwater.

The Metropolitan Council supports these objectives through implementation of a policy on assessing and protecting regional water resources.

The Council will continue to assess the condition of the region's lakes, rivers, streams, and aquifers to evaluate impacts on regional water resources and measure success in achieving regional water goals.

> Example activities: Conducting technical studies that fill data gaps, improve understanding of regional and sub-regional long-term water supply availability and demand, and support community efforts to identify and evaluate a variety of water supply approaches and best practices.

The Metropolitan Council also supports this objective through the development and periodic update of the Twin Cities metropolitan area Master Water Supply Plan with corresponding updates by communities of local water supply plans. One benefit of this update process is regional and local plans that are aligned for a clearer and more consistent application of the permitting and approval process. The regional and local issues identified in the Master Water Supply Plan were assessed in close cooperation with the DNR, and issues relevant to each community are outlined in the community's water supply profile in Appendix 1. When a community's local water supply plan reflects this Master Water Supply Plan and is subsequently approved by the DNR, requested water appropriation permit actions (that are consistent with the local plan) are more likely to be granted by the DNR. These appropriations will support ongoing efforts to achieve sustainable groundwater withdrawals throughout the region.

Appendix A

Minnesota Department of Agriculture

June 2015

The Minnesota Department of Agriculture has reviewed the North and East Metro Groundwater Management Area Plan and supports the DNR's goals for the GWMA through the following actions.

Overview of the MDA Role

The Minnesota Department of Agriculture (MDA) is committed to supporting Minnesota Department of Natural Resources (DNR) efforts to ensure use of groundwater is sustainable statewide, and especially in the Groundwater Management Areas (GWMA). MDA's support will be particularly helpful in addressing Objectives II and III within the GWMA plans. Objective II addresses water use efficiency; Objective III addresses water quality. The following outlines how MDA activities will support DNR efforts to ensure use of groundwater is sustainable.

The MDA is the lead state agency for addressing pesticides and nitrate from fertilizer in groundwater. MDA also has related responsibilities for pesticide and fertilizer management and including storage, handling and cleanup of contaminated facilities. The primary statutory authority for these activities comes from the Groundwater Protection Act (MN Statutes Chapter 103H), the Pesticide Control Law (MS 18B), and the Fertilizer, Soil amendment, and Plant Amendment Law (MS 18C).

The MDA is also the lead state agency helping farmers incorporate water use efficiency strategies in their agricultural operations. MDA often cooperates with local Soil and Water Conservation Districts and the University of Minnesota Extension in providing technical assistance to farmers on irrigation scheduling and other water use efficiency practices. As technologies improve, MDA, incorporation with SWCDs, the NRCS and the USDA, is a source of information about adoption and application of innovations within Minnesota's agricultural economy.

The MDA has developed a Pesticide Management Plan (PMP) and a Nitrogen Fertilizer Management Plan (NFMP) which outline a formal approach to addressing pesticide and nitrate contamination in groundwater. The MDA will provide assistance to the DNR within GWMAs primarily through the implementation of the NFMP and the PMP. The MDA will provide technical support for evaluating levels of pesticide and nitrate contamination, identifying potential sources and protective actions for nitrate and pesticides in groundwater, and other related work within a GWMA. The MDA approach emphasizes review of existing data on local agricultural practices and identifying appropriate voluntary Best Management Practices (BMPs) to ensure that the best available science is used for addressing local problems, and on working closely with local farmers, crop advisors, local government, other agencies, and other interested parties to address nitrate or pesticide issues.

Nitrogen Fertilizer

The Nitrogen Fertilizer Management Plan is the state's blueprint for prevention, evaluation and mitigation of the impacts of nitrogen fertilizer on groundwater. Within GWMAs, MDA will participate in issues related to nitrate in groundwater using the processes identified in the NFMP. This includes monitoring and assessment, development and implementation of BMPS, and other prevention and mitigation activities. Some specific activities are provided below.

Where nitrates in groundwater may be of concern within GWMAs, MDA assistance will be guided by the NFMP and could include:

- Conduct monitoring and assessment of groundwater for nitrates;
- Evaluate nitrate data;
- Engage with the agricultural community, extension and other local stakeholders to provide information and solicit feedback;
- Provide advice on appropriate nitrogen fertilizer BMPs and other practices;
- Survey of current adoption of BMPs and agricultural practices;
- Assist agricultural community through information and education activities such as farmer meetings, on farm demonstration, technical assistance on nitrogen management practices;
- Follow-up evaluation to determine BMP effectiveness and adoption; and,
- Evaluation of other practices that should be considered.

Pesticides

The Pesticide Management Plan is the state's blueprint for prevention, evaluation and mitigation of occurrences of pesticides or pesticide breakdown products in groundwater and surface waters of the state. The PMP includes components promoting prevention, developing appropriate responses to the detection of pesticides or pesticide breakdown products in groundwater and surface waters, and providing responses to reduce or eliminate continued pesticide movement to groundwater and surface water.

If pesticides in groundwater are a concern within GWMAs, the MDA will provide assistance using the processes identified in the PMP. This assistance may include:

- Collection and analysis of data on the presence of pesticides and degradates in groundwater;
- Evaluation of monitoring data for common detection determinations in groundwater;
- Evaluation of Best Management Practices (BMPs);
- Engaging the agricultural community, extension and other stakeholders in evaluating and implementing BMPs;
- Evaluating actions to mitigate the effects of specific pesticides in common detection for groundwater;
- Development of voluntary pesticide-specific BMPs; and,
- Evaluation of BMP use and effectiveness.

MDA point source authority

In addition to non-point source activities shown above, MDA has responsibilities for overseeing agriculture chemicals from point sources as directed in MN Statutes Chapters 18C (fertilizer storage, handling, distribution, use and disposal), 18D (agricultural chemical liability) and 18E (agricultural chemical response and reimbursement). As provided in these statutes, MDA will exercise these authorities as needed to address potential point sources of contamination such as releases from bulk storage facilities within GWMAs.

Innovations in Irrigation and Conservation

MDA staff may add a paragraph about support for irrigation scheduling and other BMPs related to irrigation and water use efficiency.

Variation based on unique circumstances for each GWMA

The above outlines the general approach of MDA involvement within GWMAs. This approach will be modified as appropriate to address the unique circumstances of each GWMA.

Appendix A

Minnesota Department of Health

June 2015

The Minnesota Department of Health (MDH) has reviewed the North and East Metro Groundwater Management Area Plan with DNR staff and determined that the agency can support the DNR's goals for the GWMA through the following actions organized by GWMA Plan objectives and GWMA Actions:

Overview of the MDH Role

MDH's specific programmatic objectives regarding groundwater pertain to its responsibilities in implementing the federal Safe Drinking Water Act (SDWA) in Minnesota and the State Well Code (MR 4725, Wells and Borings). Central to each of these is the tenet of public health protection, as accomplished through drinking water protection activities. MDH's engagement in groundwater management is thus focused on activities related to protecting drinking water, primarily as part of our authorities as defined in the SDWA and the State Well Code, but also in pursuit of the overall mission of the department to protect, maintain and improve the health of all Minnesotans.

Sustainability of water resources is grounded in concerns about both quality and quantity. Individual programmatic focus is often targeted narrowly – a comprehensive strategy to safeguard water resources in Minnesota requires coordinated efforts. To secure the integrity of our water resources for future generations, MDH is committed to forging long term working relationships with a wide range of partners committed to sustainable stewardship of our natural resources.

We have listed below some of the activities we already are doing, or will commit to do, as part of ongoing engagement within groundwater management area.

Objective I. Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.

1. MDH will act to implement the federal Safe Drinking Water Act by focusing on a 'source to tap' strategy of multiple protections to ensure the delivery of safe drinking water to all Minnesotans connected to a public water system.
2. MDH will enforce the Minnesota Well Code to ensure wells meet current construction and maintenance standards.
3. MDH will focus Wellhead Protection plan development and implementation efforts that protect drinking water resources and public health.
4. MDH will coordinate with state agency efforts to evaluate and improve local (e.g., LUGs, NGOs) capacity to manage groundwater and drinking water issues.
5. MDH will support and prioritize activities that protect both public and private groundwater resources that are used as a source of drinking water.

Objective II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.

1. MDH will focus Wellhead Protection plan development and implementation efforts to encourage sustainable land and water uses.
2. MDH will assist public water systems in identifying conservation activities when developing wellhead protection plans, especially activities that align with regional efforts within groundwater management areas.
3. MDH will continue to advise on stormwater infiltration practices in vulnerable wellhead protection areas.
4. Subject to legislative funding, MDH will conduct a thorough review of state rules, regulations, and policies relative to water reuse.
5. MDH will evaluate and encourage the adoption of conservation practices where multiple benefits can be achieved that conserve groundwater resources and improve the quality of drinking water in GWMAs.

Objective III. Groundwater use in the GWMA does not degrade water quality.

1. MDH will coordinate with state agency efforts to evaluate and improve local (e.g., LUGs, NGOs) capacity to manage groundwater and drinking water resources.
2. MDH will focus Wellhead Protection plan development and implementation efforts that encourage sustainable land uses and the adoption of conservation practices that result in reduced nutrient loss and other anthropogenic impacts that degrade drinking water quality and may impact human health.
3. MDH will assist public water systems in developing water monitoring networks, especially unconfined aquifer settings where drinking water sources are vulnerable.
4. MDH will promote the use of groundwater and land use modeling to demonstrate both the costs and benefits associated with changes in land use on both water quantity and quality.
5. MDH will coordinate with DNR, MPCA, MDA, USGS and others on monitoring, regulation, and prevention efforts for contaminants of emerging concern, including the development of health-based guidance, if appropriate.
6. MDH will coordinate with DNR and others to examine if regional aquifer management approaches might be of value to public water systems, local units of government, and other stakeholders concerned with drinking water protection.

Objective IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.

1. MDH will share with DNR staff the data and groundwater models developed for wellhead protection purposes. These may assist in evaluation of hydraulic impacts of potential new high capacity wells that are located in close proximity to drinking water supply management areas.

Objective V. All groundwater users in the GWMA have the necessary permits to use groundwater.

1. MDH will assist the DNR technical staff with the coordination and evaluation of compliance issues/impacts on the public water systems.
2. MDH will coordinate with DNR on data exchange for new potential high-capacity wells in groundwater management areas.

Appendix A

Minnesota Pollution Control Agency

June 2015

Minnesota Pollution Control Agency

The Minnesota Pollution Control Agency has reviewed the North and East Metro Groundwater Management Area Plan and determined that the agency can support the DNR's goals for the GWMA through the following actions organized by Plan objectives:

Objective I. Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.

A. MPCA - Monitor the waters of the state within the GWMA to assess their quality, using a systematic intensive watershed approach to determine physical, chemical and biological integrity.
B. MPCA - Identify and investigate groundwater – surface water interactions
C. Work with local government units to promote and implement best management practices to protect surface and groundwater quality
D. MPCA – Support development of shared data system with DNR, MDH, MDA and other organizations

Objective II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.

A. MPCA - Identify and investigate groundwater – surface water interactions with in the GWMA
B. MPCA - Pollution Prevention and MnTAP consultations for water conservation
C. MPCA - Participate with other agencies to encourage water re-use where appropriate
D. MPCA – participate in development of new groundwater models to better understand flows, recharge rates and water balances within the GWMA.

Objective III. Groundwater use in the GWMA does not degrade water quality.

A. MPCA - Monitor the waters of the state to assess their quality, using a systematic intensive watershed approach to determine physical, chemical and biological integrity.
B. MPCA – continue to monitor statewide ambient well network as an early warning system identifying contaminant threats to shallow and vulnerable aquifers in GWMAs and elsewhere. MPCA will make data/results available to interested parties via EQuIS or MPCA website. MPCA will consider installing additional wells if in GWMAs if needed, in conjunction with partner agencies who oversee groundwater monitoring (MDA, MDNR, MDH).
C. MPCA - Minimize and regulate, with local partners pollutant discharges via permits, technical/financial assistance, and enforcement. E.g. septic systems, feedlots, spray irrigation permits, landfills.
D. MPCA (w/MDH, MDA, USGS) –adapt monitoring, prevention, regulation and remediation efforts for contaminants of new/emerging concern
E. MPCA - Work with local government units to promote and implement best management practices to protect surface and groundwater quality, including stormwater management

Objective IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.

A. MPCA - Identify and investigate groundwater – surface water interactions
B. MPCA – help develop new groundwater models to better understand flows, recharge rates and water balances

Objective V. All groundwater users in the GWMA have the necessary permits to use groundwater.

A. MPCA – Support DNR efforts to identify all appropriate permit conditions related to MPCA regulatory authority.

Appendix A

Minnesota Board of Water and Soil Resources

June 2015

Minnesota Board of Water and Soil Resources

The Minnesota Board of Water and Soil Resources (BWSR) has reviewed the North and East Metro Groundwater Management Area Plan with DNR staff and determined that the agency can support the DNR's goals for the GWMA through the following actions organized by GWMA Plan Objectives and GWMA Actions:

Objective I. Groundwater use in the GWMA does not harm aquifers and ecosystems, and does not negatively impact surface waters.

GWMA Action I.2.c.ii The DNR will work with BWSR, USFWS, Watershed Districts and others to determine thresholds on withdrawals from wetlands due to groundwater appropriations as guided by statute and rule.

> *Consistent with BWSR's responsibility to administer the Wetland Conservation Act (WCA), BWSR will support DNR's effort to develop improved estimates of sustainable withdrawals from wetlands that protect the quantity, quality and biological diversity of WCA wetlands.*

GWMA Action I.4 The DNR will communicate the status of Objective I (aquifers, ecosystems, surface waters) in the GWMA.

> *In 2015-16 BWSR will conduct workshops for local officials to encourage best management practices that keep water on the land and that provide an opportunity for DNR to present information about groundwater management in the N&E Metro GWMA.*

GWMA Action I.7.a The DNR will work with other organizations and agencies including SWCDs, watershed districts, counties and local units of government to identify important groundwater recharge areas and opportunities to enhance recharge.

> *In 2015-16 BWSR will conduct workshops for local officials to encourage best management practices that keep water on the land consistent with GWMA objectives for groundwater recharge. Consistent with the pending revision of Minn. Rule 8410 BWSR will encourage local governments to consult with the DNR to obtain groundwater management information relevant to their plan updates. BWSR will support local governments' efforts to incorporate groundwater management objectives in their plans and to incorporate groundwater protection provisions in their regulatory programs.*

GWMA Action I.7.b The DNR will support local government efforts to protect groundwater recharge through zoning, land use planning, and where appropriate additional funding mechanisms.

In 2015-16 BWSR will conduct workshops for local government officials to encourage best management practices that enhance groundwater recharge and that include information for incorporating groundwater management objectives in their plans and policies.

Objective II. Groundwater use in the GWMA is reasonable, efficient, and complies with water conservation requirements.

GWMA Action II.3 The DNR will work with other organizations to promote and remove barriers appropriate water storage, water re-use (e.g., water used for pollution containment, stormwater, wastewater), and use of viable alternative water sources in the GWMA as a means to conserve groundwater.

BWSR will support local government efforts to understand groundwater-surface water connections, and through the use of 2015-16 grants, will develop projects and programs to keep water on the land for recharge/infiltration and for stormwater reuse.

Objective III. Groundwater use in the GWMA does not degrade water quality.

GWMA Action III.1.a The DNR will coordinate with local, state and federal agencies to identify water quality regulations that apply to groundwater use and clarify how best to include them in appropriation permits.

BWSR will support local units of government (Counties, Watershed Districts, Soil and Water Conservation Districts and others) in their development of local plans to address groundwater protections. BWSR will develop guidance to help these local governments to adopt plans, policies and actions that are consistent with objectives for management and protection of groundwater resources in the N&E Metro GWMA.

Objective IV. Groundwater use in the GWMA does not create unresolved well interferences or water use conflicts.

Does not apply to BWSR.

Objective V. All groundwater users in the GWMA have the necessary permits to use groundwater.

Does not apply to BWSR.

Appendix B Selected Stakeholder Meetings

Appendix B – Selected Stakeholder Meetings		
Date	**Meeting Description**	**Remarks**
2/10/2011	White Bear Lake (WBL) Chamber of Commerce	Concerned citizens gather about lake levels
2/14/2012	Multiple Agencies Meeting on GWMA	Met Council (MC), US Geological Survey (USGS), Minnesota Pollution Control Agency (MPCA), Board of Water and Soil Resources (BWSR), Minnesota Department of Health (MDH), Department of Natural Resources (DNR)
2/21/2012	White Bear Lake Conservation District (WBLCD)	Board Meeting - USGS Presented Preliminary Results of WBL study
4/17/2012	Ad Hoc Lake Level Committee	Discussion of White Bear Lake and regional water supply issues
5/3/2012	Ad Hoc Lake Level Committee	Discussion of White Bear Lake and regional water supply issues
5/18/2012	Ad Hoc Lake Level Committee	Discussed options to address lake level, USGS funding update and regional groundwater-surface water challenges
6/5/2012	Ad Hoc Lake Level Committee	Specific to Bald Eagle Option - WSB Engineering presentation to larger group
7/12/2012	Ad Hoc Lake Level Committee	Discussion of options relative to water supply and lake levels
7/25/2012	USGS Meeting	DNR & USGS meeting to discuss ongoing study of lake levels, water supply, pumping.
8/21/2012	WBL Chamber of Commerce	Government Affairs & Local Issues Meeting - Jeannette Leete presented on lake level issues, GWMA program.
9/6/2012	Ad Hoc Lake Level Committee	Discussion of options and USGS funding update
9/17/2012	Met Council	WBLCD Board pre-meeting of Ad Hoc Lake Level Committee
9/18/2012	WBLCD Board Meeting	Board Meeting - Present proposal to form a WBLCD Committee focused on lake level issues.
9/20/2012	WBL - Lake Tour	WBLCD Tour with representatives of several cities and other organizations.
10/5/2012	Ad Hoc Lake Level Committee	
10/11/2012	USGS Meeting	Update from USGS & discussion of regional groundwater issues. Attending: MPCA, BWSR, DNR, Met Council
10/16/2012	WBLCD Board Meeting	Ad Hoc Committee proposal to form WBLCD lake level committee tabled until next meeting
10/25/2012	Stakeholder Roundtable	Hosted by Representative Betty McCullum hosted - 25 attending. GWMA and Groundwater issues discussed.
11/15/2012	Ad Hoc Lake Level Committee	Update on WBLCD actions
11/20/2012	WBLCD Board Meeting	Passed resolution to form a Lake Level Resolution Committee (LLRC).
12/11/2012	Ad Hoc Lake Level Committee	Lake Level Options report prepared by Ad Hoc Committee members reviewed.
12/11/2012	WBLCD Lake Level Resolution Committee (LLRC) Various dates	LLRC weekly for 2 months - Discussion of Options, presentations by SPRWS, M-Food, DNR, Met Council.
1/23/2013	WBLCD Board Meeting	Ad Hoc Committee presented options report to board.
4/4/2013	OurWater/OurFuture	Educational Event: Groundwater: The Hidden Resource. Hosted by Met Council, USGS & DNR to discuss regional groundwater issues, GWMA program
4/29/2013	St. Croix Research Station Meeting	Discuss regional climate, recharge and water level changes: Jim Almendinger, others discussed WBL, Valley Creek
5/9/2013	OurWater/OurFuture	Planning meeting at Met Council - for second event
5/22/2013	WBLCD LLRC Meeting	Communication plan, conservation event

Appendix B – Selected Stakeholder Meetings		
Date	**Meeting Description**	**Remarks**
6/11/2013	OurWater/OurFuture	Educational Event: Restoring the Balance. Hosted by Met Council, USGS & DNR. Regional groundwater challenges.
6/12/2013	Meeting with Representatives & Senators	Peter Fisher initiated - Met Council, DNR: Discuss Legacy Appropriation, GWMA
7/2/2013	N&E Metro Groundwater Management Area Program	Meeting with Met Council & DNR to discuss factors to consider in GWMA Boundary, and concept in general
7/16/2013	OurWater/OurFuture	Educational Event: Focused on Water Conservation. Hosted by Met Council, USGS & DNR
7/16/2013	WBL Chamber of Commerce	DNR Commissioner Landwehr presentation/QA - discussion of GWMA in NE Metro
7/18/2013	USGS Meeting	Scope of work - meeting with USGS, Met Council, BWSR, WBLCD, others to discuss scope of work for a new project in NE Metro.
7/24/2013	Metro Area Water Supply Advisory Committee	MAWSAC - Met Council hosting - discussion of GWMA in NE Metro
7/24/2013	Washington County City Administrators	Hugo hosted city administrators for discussion of GWMA in NE Metro
7/25/2013	NE Metro Water Supply Working Group	Newly formed-first meeting - Met Council is organizing similar to SW Metro Groundwater Working Group.
8/12/2013	Ramsey Conservation District	Board Meeting - informal presentation to board on the GWMA.
8/13/2013	Washington County Board of Commissioners	Board Meeting - presentation to the Board of Commissioners on GWMA.
9/4/2013	Discussion with Groundwater Professionals	Meeting with professional hydrogeologists on GWMA boundary. Twenty independent and agency professionals met to discuss boundary.
9/11/2013	Washington County Conservation District	Meet with Board to discuss GWMA
9/13/2013	Anoka County Conservation District	Informal meeting with district staff to discuss GWMA
9/26/2013	Ramsey County State of Waters	Ramsey CD organized event - to bring together WSD/WSO discuss regional water issues and DNR GWMA
10/1/2013	NE Metro Water Supply Working Group	Second meeting of group - updates on Met Council projects, USGS, six cities, and DNR GWMA
10/11/2013	GWMA Project Advisory Team Meeting	Initial meeting - discussion on project purpose, products, working boundary
10/30/2013	Anoka County Local Elected Officials	Presentation by DNR on GWMA
10/30/2013	Meeting City of Lino Lakes	Meeting with City of Lino Lakes, Director of Development
11/7/2013	Meeting with Governor Dayton	Update Governor on WBL, GWMA and water supply issues.
11/12/2013	Met Council Environmental Committee	Presentation by DNR on GWMA
11/20/2013	Anoka County Water Resource Task Force	Meeting with administrators, utilities directors, city engineers - Presentation by DNR on GWMA
11/20/2013	Elected Officials Meeting – Groundwater Issues	Hosted by Representative Fischer - 50 in attendance - presentations by Jason Moeckel and Ali Elhassan, with Q/A
11/26/2013	WBL Chamber of Commerce	Legislative meet & greet - about 100 business and elected officials. Regional groundwater and water supply challenges.
12/11/2013	Rice Creek Watershed District Board	Presentation by DNR on GWMA
12/17/2013	Environmental Initiative	Policy Forum - GW - DNR presentation on NE Metro GWMA

Appendix B – Selected Stakeholder Meetings		
Date	**Meeting Description**	**Remarks**
12/20/2013	City of Woodbury	Discuss GWMA with city staff and the mayor.
1/7/2014	American Institute of Professional Geologists (AIPG) Seminar	Luncheon presentation - DNR made presentation to 50 geoscientists
1/8/2014	N&E Metro GWMA Stakeholder Kick-off Meeting	DNR sponsored event - Shoreview Community Center.
1/10/2014	DNR Roundtable	DNR sponsored event - DNR presented on GWMA.
1/16/2014	GWMA Project Advisory Team Meeting	Boundary & situation analysis discussion.
1/21/2014	Minnesota Association of Watershed Districts (MAWD)	Presentation by DNR on GWMA to metro area watershed districts
1/27/2014	Woodbury Meeting with MPCA/MDH	Update on PFC contamination, discussion of pollution containment volumes and status/priority and GWMA plan response.
1/30/2014	Metro Cities Forum	Water: Emerging Trends, challenges. DNR presented.
2/6/2014	NE Metro Water Supply Working Group	Met Council meeting. Update from Met Council, USGS, Cities, DNR.
2/6/2014	Washington County Consortium	Groundwater Focus - Update on GWMA by DNR.
2/13/2014	Coon Creek Watershed District	DNR meeting with District Manager.
2/14/2014	GWMA Project Advisory Team Meeting	Update on working boundary, management strategies 1 and 5
2/18/2014	Century College Forum	Elected officials discuss regional water supply challenges and lake levels, organized by Representative Fischer, Chamberlin, Scalze
2/19/2014	Professional Discussion	DNR meeting with independent professional statistician: Evaluation of data for GWMA.
3/3/2014	City of Minneapolis	New well field discussion and update on GWMA. Discussed proposal from Minneapolis for groundwater supply in relation to the GWMA
3/6/2014	Senator Franken's Staff	Requested by Senator Franken's office - discussion of water issues in east metro
3/14/2014	GWMA Project Advisory Team Meeting	Strategies 4 and 7 discussion, Woodbury presentation, and report to Legislature
3/26/2014	Metropolitan Area Water Supply Advisory Committee (MAWSAC)	Presentation by DNR - Update on N&E GWMA
3/28/2014	City of Cottage Grove	Meeting with Cottage Grove City Engineer
4/2/2014	Met Council Meeting	Discuss water supply planning process/coordinate with GWMA planning
4/7/2014	City of Shoreview	Meeting with City of Shoreview Director of Public Works
4/9/2014	Coon Creek Citizens Advisory Committee (CAC) Presentation	Presentation by DNR - Update on N&E GWMA
4/11/2014	GWMA Project Advisory Team Meeting	Strategies 4,5,7 discussion, intro to Strategy 2
4/15/2014	WBL Chamber of Commerce	Update from capital, brief update on GWMA
5/7/2014	NE Metro Water Supply Working Group	Update from working group members and GWMA update
5/16/2014	GWMA Project Advisory Team Meeting	Strategy 2 discussion, presentation on sensitive ecological resources in the GWMA

Appendix B – Selected Stakeholder Meetings		
Date	**Meeting Description**	**Remarks**
5/22/2014	WBL Chamber of Commerce	Legislative update, DNR update
6/11/2014	City of Columbus	City Council meeting – DNR presentation on GWMA
6/13/2014	GWMA Project Advisory Team Meeting	Strategy 2 and 3 discussion, presentations by DNR
6/17/2014	WBL Chamber of Commerce	Legislative update, and DNR update
6/24/2014	Met Council Forum	Last of three introductions to water supply planning and update on the process
6/25/2014	City of Hugo	Discuss supervisory control and data acquisition (SCADA) connection and GWMA
6/25/2014	St. Paul Regional Water Services	Discuss permit amendment request
7/1/2014	RockTenn	DNR meeting with General Manager to discuss GWMA and industrial groundwater use. Tour of processes and water use at the recycling/paper production plant in St. Paul.
7/2/2014	USGS meeting	Meeting with John Bumgarner, USGS new representative on the PAT.
7/8/2014	Legislative Forum	Forum on east metro water - at Century College, hosted by elected officials: Fischer, Scalze, Chamberlin
7/9/2014	Cottage Grove Environmental Commission	Presentation by DNR on GWMA
7/11/2014	GWMA Project Advisory Team Meeting	Strategy 6a discussion, pollution plumes, and water supply planning coordination
7/24/2014	Elected Officials Forum - NE Water Issues	General open forum - Century College - DNR, Met Council, BSWR, others
8/1/2014	WBL Evaporation Monitoring	Presentation by WBLCD attended by City of WBL, WBLCD, DNR
8/21/2014	Met Council Water Supply Forum	Discussion of water supply issues in the east metro.
8/27/2014	BWRS Tour & Presentations	All day tour of projects. Tour of White Bear Lake. DNR presented on GWMA.
9/3/2014	NE Metro Water Supply Working Group	Draft USGS report reviewed.
9/3/2014	Rice Creek Watershed District Board	Meeting with Barb Haake
9/12/2014	GWMA Project Advisory Team Meeting	Strategy 5 draft - four new PAT members.
9/20/2014	Mill City Farmer Market	DNR GWMA Booth - "Sustainable Water Harvest"
9/25/2014	Ramsey County State of the Waters Event	Ramsey CD Sponsored, DNR presentation.
10/10/2014	GWMA Project Advisory Team Meeting	Strategy 5 draft discussion.
10/30/2014	Met Council Forum	WRPP Workshop.
11/11/2014	Minneapolis Women's Club	Water Sustainability presentation by DNR.
11/14/2014	GWMA Project Advisory Team Meeting	Strategy 1-4 released - discussed Objective II, Washington County groundwater plan, METC industrial conservation
11/20/2014	American Public Works Association	200 attending, DNR presented
12/11/2014	Wisconsin DNR	MNDNR & WSDNR meeting to discuss permitting strategies and the use of management areas.
12/12/2014	GWMA Project Advisory Team Meeting	WBL settlement, stakeholder plans - discussion of PAT comments, two new PAT members.

Appendix B – Selected Stakeholder Meetings		
Date	**Meeting Description**	**Remarks**
12/18/2014	American Water Works Association (AWWA) Water Utility Council	Quarterly meeting - update on the GWMA by DNR.
1/7/2015	Washington County Consortium	Bob Tipping, MGS presentation on the chemistry and hydrology of the St. Lawrence
1/19/2015	NE Metro Water Supply Group	Update on Met Council Feasibility Study, GWMA, USGS
1/19/2015	WBL Chamber of Commerce	Government Affairs & Local Issues meeting - discussion of water issues in east metro
2/3/2015	Stakeholder Meeting	Shoreview - public meeting, elected officials and permit holders, introduction to Draft GWMA Plan
2/9/2015	Stakeholder Meeting	Woodbury - public meeting, introduction to Draft GWMA Plan
2/13/2015	GWMA Project Advisory Team Meeting	Review stakeholder public meetings & draft GWMA plan
2/18/2015	Stakeholder Meeting	White Bear Lake - public meeting, introduction to Draft GWMA Plan
2/19/2015	City of Blaine	Meeting with Mike Ulricht, public works director - planning for stakeholder meeting and update on GWMA
2/26/2015	Stakeholder Meeting	Blaine - public meeting, introduction to Draft GWMA Plan
3/4/2015	IonE Lunch Seminar	Panel presentation and Q/A - "Is aquifer drawdown a bad thing?" Presentations by Perry Jones, Sherry Enzler (DNR)
3/5/2015	UM Water Resource Center (WRC)	Presentation by DNR, update WRC Staff on DNR GWMA work, as follow up to "Sustainability Framework"
3/13/2015	GWMA Project Advisory Team Meeting	Discuss stakeholder engagement, draft of section 6, and Plan feedback
4/8/2015	Capital City Watershed District Citizens Advisory Committee (CAC)	Update on the GWMA by DNR
5/14/2015	Minnesota Environmental Health Association – Annual Meeting	DNR presentation on GWMA program
5/15/2015	GWMA Project Advisory Team Meeting	Discuss final draft of Plan and Advisory Team future meetings
5/19/2015	US EPA Region 5 – Source Water Protection Meeting	DNR presentation on GWMA program
5/21/2015	City of Cottage Grove	DNR meeting with city engineer to discuss N&E Metro GWMA draft plan
6/2/2015	City of St. Paul Water Resource Working Group Meeting	DNR presentation on GWMA program
6/17/2015	South Washington County Watershed District	Discussion of 10-year plan update and GWMA

Appendix C Process Summary: Preliminary Well Construction, Water Appropriation Permitting, Municipal Water Supply Plans, Permit Modification Procedures

Appendix C

Process Summary: Preliminary Well Construction, Water Appropriation Permitting and Permitting for Municipal Water Supply Plan

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Well Construction – Preliminary Assessment

The following provides a high-level summary of steps for a water appropriations permit applicant and the DNR will take to obtain a preliminary assessment of proposed well.

1. Applicant logs into MPARS to obtain approval for a new well.

2. The Appropriation Hydrologist reviews the approval request.

3. The approval request may be sent to the Groundwater Specialist for review.

4. The approval request may be sent to management for review in very complex cases.

5. A letter is sent to the applicant that may describe the resources of concern in the area (if any) and whether the anticipated appropriation is likely to meet the applicable requirements for obtaining a permit to pump water.

6. The applicant may be informed of the need to gather additional information, conduct aquifer tests, or install observation wells before applying for a DNR Water Appropriation Permit.

7. The DNR may follow up to ascertain if the applicant constructed of the well.

Appropriation Permit Actions

The following provides a high-level summary of steps to obtain a water appropriations permit.

1. Applicant completes the preliminary assessment for well construction.

2. Applicant logs into MPARS to request a DNR Water Appropriation Permit or to amend an existing Water Appropriation Permit.

3. The DNR Appropriation Hydrologist reviews the request and may send the initial request to the Groundwater Specialist for review at this point.

4. Additional information may be requested from the applicant to form a complete application, or to provide enough information with which to make a sound decision. The applicant may be informed of the need to conduct an aquifer test.

5. Meetings may be held with the applicant.

6. The Appropriation Hydrologist will generate the invoice for the permit application fee, or amendment application fee and it will be sent to the applicant using MPARS.

7. The applicant uses MPARS to pay the invoice.

8. When the application is complete and the fee is paid the application is forwarded to the County, SWCD, Watershed District, other relevant parties and other DNR staff for review. They are allowed 30 days to review the proposal and submit comments to the DNR.

9. If issues are identified, the applicant will be notified of the issues and provided the opportunity to address those concerns. DNR staff is available for discussion regarding any issues related to the permit application or natural resource concerns. Additional actions may need to be taken by the applicant to address the concerns. An aquifer test may need to be conducted by the applicant.

10. If the issues are addressed, the Appropriation Hydrologist will draft the Permit in MPARS. The appropriate conditions will be added to the permit to address the need for water level monitoring, or other actions, by the applicant.

11. A DNR representative will issue the DNR Appropriation Permit using MPARS.

High-Level Process for Community Public Water Supplies

The following provides a high-level summary of steps municipal water appropriations permit applicants and the DNR will take to obtain a high capacity well permit within the scope of an approved water supply plan.

1. City develops local Water Supply Plan, receives DNR approval & city adopts (approved WSP identifies future water needs & source water(s))

2. City submits Well Construction Preliminary Assessment to DNR prior to drilling well

3. DNR provides site-specific WCPA information to city

4. City drills well (MDH notification)

5. City submits permit amendment or application

6. DNR & city coordinate with other agencies (MDH, MPCA, Met Council, watershed districts, counties) and engage in comment period

7. DNR determines if aquifer testing is needed; if so,

a. City prepares and submits aquifer test plan; DNR must approve

b. City conducts aquifer tests with monitoring (input from DNR)

c. DNR reviews aquifer test results

8. DNR makes permit decision

9. Issued permits have applicable permit conditions

Water Appropriation Permit Modifications

Consistent with Minnesota Statute and Rule, the DNR Commissioner can modify water appropriation permits. However, statute and rule also protect the permit holder.

For instance, water appropriation permit holders are afforded due process through Minnesota Statute and Rule. If the permit holder does not agree with a permit decision, in many cases they may demand a contested case hearing.

Contested case hearings are used in many states as well as in federal matters. They are informal court proceedings governed by state law that can be used to protect rights, duties and privileges of the affected parties. The purpose of contested case hearings is to provide decision makers with the highest quality information available to render permit decisions, and to provide third party review of an appeal made to a state agency decision.

Modifications to water appropriation permits are described very specifically by Minnesota Statute and Rule:

- The DNR is prohibited from modifying or restricting the authorized amount of groundwater that is used for agricultural irrigation between May 1 and September 30, unless the DNR determines that the authorized amount of appropriation endangers a domestic water supply. [1] This is designed to provide some assurance of a water source to bring the crop through to harvest.
- Whenever a permit is proposed to be modified, there is an opportunity for the permit holder to demand a contested case hearing.
- From the initial decision whether to issue or deny a permit, to the proposed modification of an existing permit due to the establishment of a protected flow or protected elevation in nearby surface water feature, the applicant or permit holder has the opportunity to a public hearing.[2]
- If there is a water use conflict, where there is limited water availability, resulting in the commissioner proposing adjustments to permits in an area that are competing for the same inadequate water source, the action is taken by the DNR only after the permit holders or applicants are notified and given the opportunity for a hearing.[3]
- Most terminations are subject to advanced notice and opportunity for a hearing. An exception would be, for example, when a permittee requests termination.[4]
- The public hearings that can be requested are conducted as contested case hearings under Minn. Stat. Chapter 14, and are conducted by the Office of Administrative Hearings.[5]

[1] Minn. Stat., 103G.271, Subd. 3.
[2] Minn. Rules, 6115.0670, Subp. 3.
[3] Minn. Rules, 6115.0740, Subp. 3.
[4] Minn. Rules, 6115.0750, Subp. 8.
[5] Minn. Stat., 103G.311

- Permits that authorize appropriation from surface water sources may be temporarily suspended as a result of periods of extremely low rainfall. This is defined as when the flows measured in their watersheds fall below a certain point, typically the Q90 flow. Applicants for surface water appropriations are required to have a feasible contingency plan for these situations or agree to withstand the results of not being able to appropriate water (after suspension).[6]

It should be extremely rare for a permit holder to face a permit modification without significant advance warning. However, if a permit modification is necessary and the permit holder or applicant disagrees with the permit decision, Minnesota Statute and Rules provide for a hearing.

If the DNR found the existing authorized water use in an area to be unsustainable, DNR would provide advanced notice and involve permit holders in finding a solution.

[6] Minn. Stat., 103G.285, Subd. 6.

The DNR Information Center

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For more information please contact the DNR Division of Ecological and Water Resources at (651) 259- 5100, or on the web at http://www.dnr.state.mn.us

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