RECOMMENDATIONS FOR

WATER SUPPLY PLANNING IN THE METRO AREA

METROPOLITAN AREA WATER SUPPLY ADVISORY COMMITTEE

FEBRUARY, 2022

The Metropolitan Area Water Supply Advisory Committee's purpose is to provide advice and assistance to the Metropolitan Council in its water supply planning activities.

Metropolitan Area Water Supply Advisory Committee (MAWSAC) Members

Wendy Wulff	Met Council, Committee Chair	**Jamie Schurbon**	Anoka Conservation District, Anoka County
Jeff Berg	Department of Agriculture	**Mike Huang**	City of Chaska
Sandeep Burman	Department of Health	**Tonja West-Hafner**	City of Brooklyn Park
John Gleason	Department of Natural Resources	**Phil Klein**	City of Hugo
Catherine Neuschler	Pollution Control Agency	**Kevin Watson**	City of Vadnais Heights
Mark Daleiden	Commissioner, Wright County	**Brad Larson**	City of Savage
Susan Morris	Commissioner, Isanti County	**Lisa Vollbrecht**	St. Cloud Public Utilities
Michael Robinson	Commissioner, Chisago County	**Patrick Shea**	St. Paul Regional Water Services
Valerie Neppl	Environmental Resources, Dakota County	**Annika Bankston**	Water Treatment & Distribution Services, City of Minneapolis

MAWSAC includes local representatives of the 11-county metropolitan area in addition to Minnesota's departments of agriculture, health, natural resources, and pollution control agency. A 15-member Water Supply Technical Advisory Committee (TAC), appointed by MAWSAC, provides scientific and engineering expertise to inform MAWSAC's work.

State statute establishing the Metropolitan Area Water Supply Planning Advisory Committee: Minnesota Statutes, Section 473.1565

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WATER SUPPLY PLANNING
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Executive Summary

The Minnesota Legislature created the Metropolitan Area Water Supply Advisory Committee (MAWSAC) through Minnesota Statute 473.1565 to assist the Metropolitan Council in its water supply planning activities. The legislature also created a Technical Advisory Committee (TAC) to inform the policy advisory committee's work by providing scientific and engineering expertise.

Together, MAWSAC and TAC pool collective expertise to address increasingly complex water problems that require a collaborative approach in the Twin Cities metropolitan area. Our report reflects that, and it should inform the range of legislation, policies, and plans developed at the state and regional level that have the potential to impact the water supplies of the Twin Cities metropolitan area.

Based on discussions of the varied water supply challenges that the region faces, we have identified four areas of focus that are important for maintaining a safe, sustainable water supply across jurisdictional boundaries: water quality, land use and water supply connections, understanding and managing groundwater and surface water interactions, and water supply infrastructure.

We have set the following goals within each area of focus:

1. **Goal for water quality:** All the region's communities have the resources they need to provide a safe water supply. They are prepared to both respond to contaminants of emerging concern that may impact water quality and continue supporting efforts addressing existing contamination. Communities, water utilities, and regulators collaboratively develop a shared process to respond in a more coordinated and effective way to contamination in the water supply. Such a process should be inclusive and take a long-term, integrated water management approach.
2. **Goal for land use and water supply connections:** Public water suppliers, land use planners, and developers have tools and are empowered to work together to guide and support development in ways that balance communities' economic needs while protecting the quantity and quality of source waters that are vital to the region's communities. Local and regional actions that enhance and protect water supplies are better understood, coordinated, and incentivized in the region.
3. **Goal for understanding and managing groundwater and surface water interactions:** Water resource managers and community planners and leaders understand how groundwater and surface water interact and how those interactions impact the sustainability (relating to both quality and quantity) of water supply systems and resources. Collaborative management strategies, research, and monitoring provide better understanding of these interactions and more effective implementation to reduce impacts.
4. **Goals for water supply infrastructure:** Communities act quickly, thoughtfully, and equitably to address aging infrastructure, contamination, changing groundwater conditions, changing water demand, and financial challenges. This maximizes the value the region receives from existing and future water supply infrastructure investments.

Key findings and recommendations

To achieve the goals for the four priority focus areas, we discussed a wide range of actions (Table 1) to be taken across the entirety of the water supply system – from source through use to reclamation and back to the environment – and identified key steps that must be taken for this work.

Building from the risk management and water safety plan concept proposed in the report ”Future of Minnesota Drinking Water: A Framework for Managing Risk,” committee-recommended actions are organized into a framework with four general steps with related objectives (Figure 16).

The proposed actions, taken in the order described below, support better risk management and advance the goals set by the committees. Each action has the potential to build upon previous work, strengthening the region’s response and maximizing efforts.

As a next step, we request legislative and Metropolitan Council support for the activities below:

A. Collaboration and capacity building

- ❑ Continue engaging leaders across the water sector
- ❑ Connect diverse technical experts
- ❑ Build and maintain capacity for collaborative work over the long-term

B. System assessment

- ❑ Describe, document, and diagram the water supply system at a multi-community scale
- ❑ Identify potential hazards
- ❑ Determine potential risks

C. Mitigation measure evaluation

- ❑ Identify and evaluate existing and potential mitigation measures
- ❑ Prioritize risks

D. Planning and implementing risk reduction practices

- ❑ Establish a new subregional water supply planning approach
- ❑ Target regional guidance and incentives
- ❑ Better prepare for the unexpected
- ❑ Support local planning and implementation
- ❑ Check outcomes and adapt to continuously improve

Regional Water Supply Context

The Twin Cities metropolitan area, home to 3.2 million people (more than half of Minnesota's population) and more than 85,000 businesses, is fortunate to have relatively abundant groundwater and surface water supplies. The region is unique among major metropolitan areas in that it rests atop a groundwater flow system—the bowl-shaped Twin Cities basin—that does not extend far beyond the region's boundaries. This unique geologic situation provides the region the ability and responsibility to manage much of its own water resource.

Significant portions of the metropolitan area have been designated as source water protection areas (Figure 1) by communities and the Minnesota Department of Health. In these areas land use and water resource management decisions should be made with consideration of drinking water protection in the forefront.

More than 100 different water utilities and 60,000 private wells use groundwater and/or surface water to supply domestic and commercial needs (Figure 2 illustrates water use by source over time). The Twin Cities region is unique for its large number of individual municipal water utilities that each draw on a different combination of sources for their water supply (Figure 3 illustrates sources by community). The region currently uses about 300 million gallons of water per day.

In recent decades, most water demand in the region was supplied by groundwater, particularly in growing suburban communities. The maximum amount of groundwater that can be sustainably withdrawn from the region's existing source water areas is approximately 400-500 million gallons per day, based on regional groundwater modeling, although quantity is more limited in some parts of the region than others. This estimate provides a starting place to understand the capacity of the region's aquifers to meet current and future water demand and sustain natural resources.

Residents value the protection of wetlands, lakes and streams and hold a deep commitment to ensuring that plenty of water will be available to future generations. They also value a balance between multi-community cooperation and local control.

About this Report

This report offers key technical information, guidance for local water supply systems and future regional investments, and recommendations. It should inform the range of legislation, policies, and plans developed at the state and regional level that have the potential to impact the water supplies of the Twin Cities metropolitan area. Water impacts should be considered for decisions related to economic development, climate resilience, the environment, health, recreation, infrastructure costs (construction and long-term maintenance), land use, and transportation.

This report contributes input and updates to the regional development guide and related policy and system plans for which the Metropolitan Council (Council) is responsible. The Council's regional development guide (currently Thrive MSP 2040) is a 30-year vision for the orderly, economical development of the seven-county metro area. Three regional system plans support the guide: transportation (including aviation), water resources (including wastewater collection and treatment), and regional parks and open space. Regional system plans include information about each system as well as plans and policies for their operation, maintenance, upgrade, and expansion to guide the work of the Council and its partners.

This report includes a diverse set of recommended actions that, taken together, support the maintenance of safe and sustainable water supplies across the region through better risk management and by helping address water supply issues that cross jurisdictional boundaries.

MAWSAC: Regional Water Supply Guidance

The Minnesota Legislature created the Metropolitan Area Water Supply Advisory Committee (MAWSAC) through Minnesota Statute 473.1565 to assist the Metropolitan Council in its water supply planning activities. The legislature also created a Technical Advisory Committee (TAC) to inform the policy advisory committee's work by providing scientific and engineering expertise. MAWSAC:

- Informs the Council's water supply planning activities and preparation of its regional development guide.
- Pools collective expertise to address increasingly complex water problems that require a collaborative approach

Since 2005, MAWSAC has guided the work of the Metropolitan Council and its member agencies. A 2020 Metropolitan Council report to the Minnesota Legislature summarizes the Council's MAWSAC-directed research, planning, and implementation work that helps support the goals and recommendations presented here.

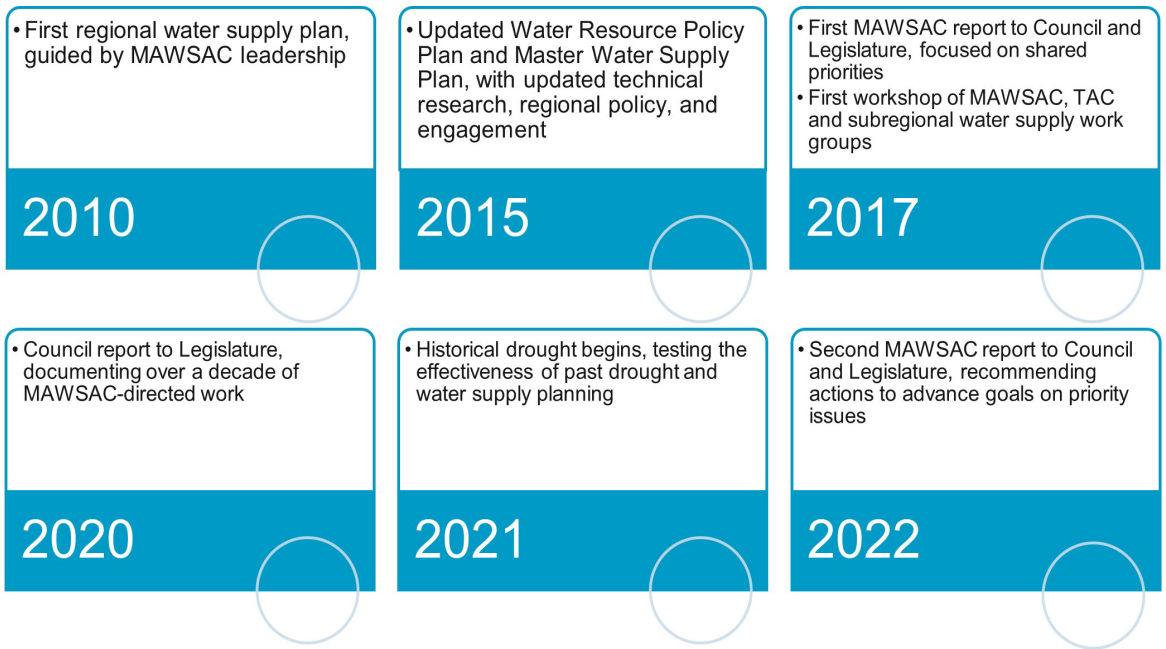
Report Foundation

This report provides guidance to key decision makers for how to approach priority water supply challenges in the Twin Cities metropolitan area over the coming years. It emphasizes conservation, interjurisdictional cooperation, and long-term sustainability. Its recommendations build on work started after the severe drought in the late 1980s when state officials realized that even the Land of 10,000 Lakes can face water supply challenges. Current challenges like PFAS contamination and the historical drought that began in the summer of 2021 reemphasized the need to continue this work.

Timeline of key milestones

A timeline of regional water supply milestones and committee work over the past decade is presented below.

Figure 4. A decade of regional water supply planning milestones and MAWSAC work.

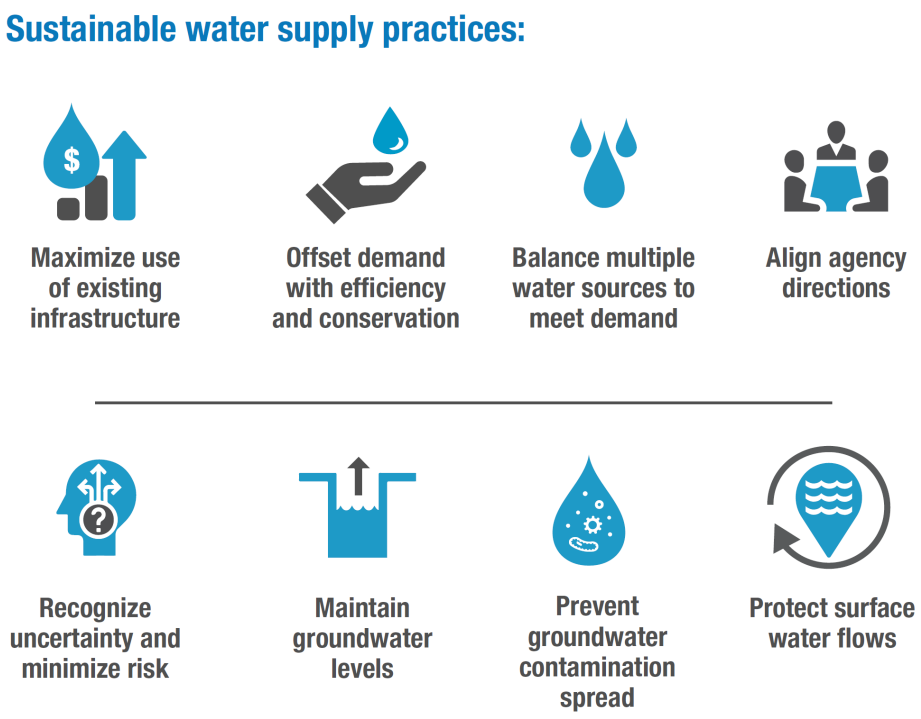


Vision for sustainable water supplies

The overarching goal of MAWSAC's approved 2015 Master Water Supply Plan is for a sustainable water supply now and in the future. The region's water supply may be considered sustainable when water users maximize their use of existing water supply infrastructure investments within the sustainable limits of available sources. Where water demand exceeds the sustainable limit of sources currently being used, water conservation and other approaches are developed. Alignment around agency direction supports sustainable water supply decision-making. Sustainable water supply decisions recognize uncertainty and seek to minimize risks; groundwater levels are maintained to prevent interference with other users, protect aquifers, and prevent and the spread of contamination; and surface water flows and levels are protected (Figure 5).

MAWSAC operates under this definition of sustainability and continues to view issues though this lens.

Figure 5. Eight conditions that define regional water sustainability, as described in the MAWSAC-approved Twin Cities metropolitan area master water supply plan.



Guiding principles for achieving sustainability

Whether public or private, all water supplies are drawn from an essential natural resource that is shared by the entire region. All people should have access to clean, safe, affordable water and wastewater services. All water and wastewater systems should have sufficient funding to provide affordable, inclusive services. And all communities should share in the economic, social, and environmental benefits of investment in water systems.

The present and future challenge of providing citizens with an adequate, safe supply of water extends across community boundaries. The contributions of all participants—utilities, communities, environmental groups, and others—have value in how communities manage water.

MAWSAC's seven principles guide how the Council and its partners approach work to achieve sustainable water supplies for the region:

1. Water supply planning is an integral component of long-term regional and local comprehensive planning.
2. An understanding of the region's long-term water supply availability and demand is necessary to identify a specific community's or subregion's water sources.

3. All hydrologic system components, naturally occurring and human-built, must be carefully evaluated when planning water infrastructure.
4. The quality of the region's water is a critical component of water supply planning.
5. Interjurisdictional cooperation is a viable option for managing short-term water supply disruptions and for sustainably meeting long-term water supply needs.
6. Regional and local cost-effectiveness and fair cost-sharing are considered when identifying water supply options.
7. Wise use of water supplies is critical to ensuring adequate supplies for future generations.

Using this Report to Inform Polices and Plans

Policy makers and planners should use report recommendations to ensure a safe, sustainable water supply for the Twin Cities region now and in the future.

With opportunities such as legislation (including the 'Infrastructure Investment and Jobs Act'), leaders will be asked to consider investment between various water-related initiatives and projects.

Minnesota will receive around $700 million over five years to improve water infrastructure and ensure clean, safe drinking water for all communities. It is through the support and advocacy of legislators like you that will secure those funds to support this work.

Legislators and state agency leaders should consider the following as they propose legislation, program development, funding, and support work made possible by the 2021 Infrastructure Investment and Jobs Act to address water supply:

- Adequate funding is needed to support public water suppliers' and partners' emergency responses to contamination, natural disasters, and cyber security.
- Impacts of proposed legislation or programs on water supply are rarely considered or fully understood. Request information from water utilities and resource managers to craft the most effective legislation.
- Coordination across political boundaries is critical, because water moves freely between communities and one community's water supply decisions will impact others who were not involved in the decision-making process.
- Proposals have the most impact when they can advance multiple MAWSAC goals at once, recognizing the nexus between water quality, land use, groundwater-surface water interaction, and water supply infrastructure. Look for opportunities to remove regulatory barriers to help advance MAWSAC's goals for the region.
- Communities across the region need and are seeking funding for proactive infrastructure upgrades and expansion, such as water treatment improvements or serving rural areas to meet multiple goals beyond just responding to infrastructure failure or regulatory violations.

The Metropolitan Area Water Supply Advisory Committee (MAWSAC) encourages legislators to share information from this report in their committee conversations – particularly those with jurisdiction over environment, natural resources, commerce, and public health.

Metropolitan Council members should consider the following as they direct policy and plan updates:

- Water supply goals identified in this report are essential to consider as the high-level goals for the region are developed. It is in everyone's interest to support the success of these water supply goals so that the region can continue to thrive and grow.
- Ongoing and strong support for funding, cooperation, and education is needed to further water supply goals and address the recommendations in this report.
- Land use, water, parks, transportation, economic development, and other policies should recognize the opportunities that our region's rich water supplies provide while also acknowledging that supplies are not unlimited; a wide range of proposed development and programs will be successful with thoughtful consideration of water demand, water supply sources, and water infrastructure.
- Coordination and accountability where community water supplies overlap is critical, because water withdrawals or contamination in one area could have consequences for multiple users across multiple political and geographic boundaries.
- Water-related policies specifically should address all aspects of the water supply system including interactions between groundwater, surface and storm water, and reclaimed wastewater resources. Water-related policies and plans need to consider long-term changes (30 years and longer).
- Local land use decisions can affect both private and public water supply infrastructure and potential contamination sources in vulnerable drinking water supply management areas. Local water utilities and their partners may have the resources to adapt infrastructure plans and implement risk mitigation, or they made need additional support such as updated land use controls or incentive programs.

Regional Challenges

The Twin Cities metropolitan area is a growing, thriving area. The population is predicted to reach 4 million in 2050. Using a conservative estimate, the region may need to supply an additional 10 million gallons of water per day, above the 300 million gallons being used today on a daily basis. This number is only an estimate; many unforeseen events could occur, and certain events – such as climate change – are likely to have an impact on water supply needs, but the extent and magnitude of that impact is yet unknown.

In 2020 and 2021, MAWSAC and TAC described key challenges within each of their four areas of focus and approaches needed to best respond to them, including coordination and readiness to respond to uncertainties and emergencies.

Contamination and water quality. Contaminants can put our water supply at risk anytime and anywhere. Regional planning and coordination today can help the Twin Cities area better prepare to prevent the spread of known contamination or respond effectively when new sources or new types of contamination are discovered. There are a wide range of potential contaminants from point sources (Figure 6) and nonpoint sources (well-known examples of non-point contaminants are chloride and agricultural chemicals). The sensitivity of the landscape to these potential contaminants varies (Figure 7). In some areas, groundwater contamination is so severe that special management areas have been established (Figure 8).

Managing the complex system of interactions between land use and water supply sources and infrastructure. What is on the land's surface, or how the land is used – whether a business, park, residential or retail area – may impact the quality and quantity of our water supply through choices such as agricultural and industrial practices, snow and ice removal, stormwater infiltration and others. Many of our current water quality problems came about because we did not realize the implications of our land use. Our choices about current and proposed land use can help prevent this kind of long-lasting contamination in the future (Table 2, Figures 6 and 9). Figure 9 illustrates current varied land uses across the region, which are expected to change through 2040 (Figure 10). New development and redevelopment create opportunities for more efficient water use as well as to manage water quantity. For example, more efficient indoor appliances and water fixtures and drought-tolerant landscapes minimize increases in both indoor and outdoor water use and summer-to-winter use ratios (Figure 11).

Understanding and managing groundwater and surface water interactions. Planning for water supply sustainability requires an understanding of how water flows in and out of the system – our "water budget." More information is needed to improve decision making, including: the amount of water moving through the different parts of the regional water cycle; how water flow affects water quality and contaminant migration through and between ground and surface waters; how water can be used or reused without adversely impacting connected resources; and how different environmental and use conditions affect water availability. For example, recent modeling suggests that projected climate change may reduce the amount of water recharging aquifers, impacting future groundwater supplies (Figure 12).

Stewardship of water supply infrastructure. Utilities face ongoing challenges to providing affordable, safe, and trusted water supply. These include aging infrastructure, changing water demand, decreased revenue, and more awareness of contamination. Community decisions around growth and development are not always aligned with long-term public infrastructure investments and can add complexity to maintaining sustainable water supply infrastructure across the region. Building and sustaining support for the region's critical water supply infrastructure investments is made more challenging because the scope of the need is not readily apparent. For example, unlike regional wastewater infrastructure (Figure 13), no complete region-wide map of local water supply infrastructure exists to communicate the magnitude of investments (both made and needed) by the 100+ public water utilities and 60,000 private well owners.

Coordinating work among overlapping jurisdictions. Hydrologic systems extend beyond jurisdictional boundaries. Rather than focus only on the perspective of a single community or water supplier, actions and proposed solutions need to support a more regional perspective. A regional perspective on hydrologic systems reveals information about interactions between groundwater and surface water, impacts on neighboring resources, and opportunities for organizations to more consistently manage water resources.

Responding to unpredictable changes and emergencies. The challenges described above shift in an ever-changing environment, and solutions that are too prescriptive and not flexible may slow down water supply managers' ability to respond effectively to unexpected emerging conditions. Effective actions recognize the implications of climate, land use, population, regulatory and other changes.

Goals and Recommendations for a Safe Water Supply

Identifying Priorities and Setting Goals

Metropolitan Council staff facilitated a planning process with MAWSAC and TAC that identified four priority focus areas that are critical for maintaining a safe, sustainable water supply: water quality and contamination, land use and water supply connections, groundwater and surface water interactions, and infrastructure. MAWSAC and TAC set the following goals for these priority focus areas:

1: Water quality

Goal: All the region's communities have the resources they need to provide a safe water supply. They are prepared to both respond to contaminants of emerging concern that may impact water quality and continue supporting efforts addressing existing contamination. Communities, water utilities, and regulators collaboratively develop a shared process to respond in a more coordinated and effective way to contamination in the water supply. Such a process should be inclusive and take a long-term, integrated water management approach.

2: Land use and water supply connections

Goal: Public water suppliers, land use planners, and developers have tools and are empowered to work together to guide and support development in ways that balance communities' economic needs while protecting the quantity and quality of source waters that are vital to the region's communities (Figure 3). Local and regional actions that enhance and protect water supplies are better understood, coordinated, and incentivized in the region.

3: Understanding and managing groundwater and surface water interactions

Goal: Water resource managers and community planners and leaders understand how groundwater and surface water interact and how those interactions impact the sustainability (relating to both quality and quantity) of water supply systems and resources. Collaborative management strategies, research, and monitoring provide better understanding of these interactions and more effective implementation to reduce impacts.

4: Water supply infrastructure

Goal: Communities act quickly, thoughtfully, and equitably to address aging infrastructure, contamination, changing groundwater conditions, changing water demand (Figures 14 and 15), and financial challenges. This maximizes the value the region receives from existing and future water supply infrastructure investments.

Framework for Action and Recommendations to Achieve Goals

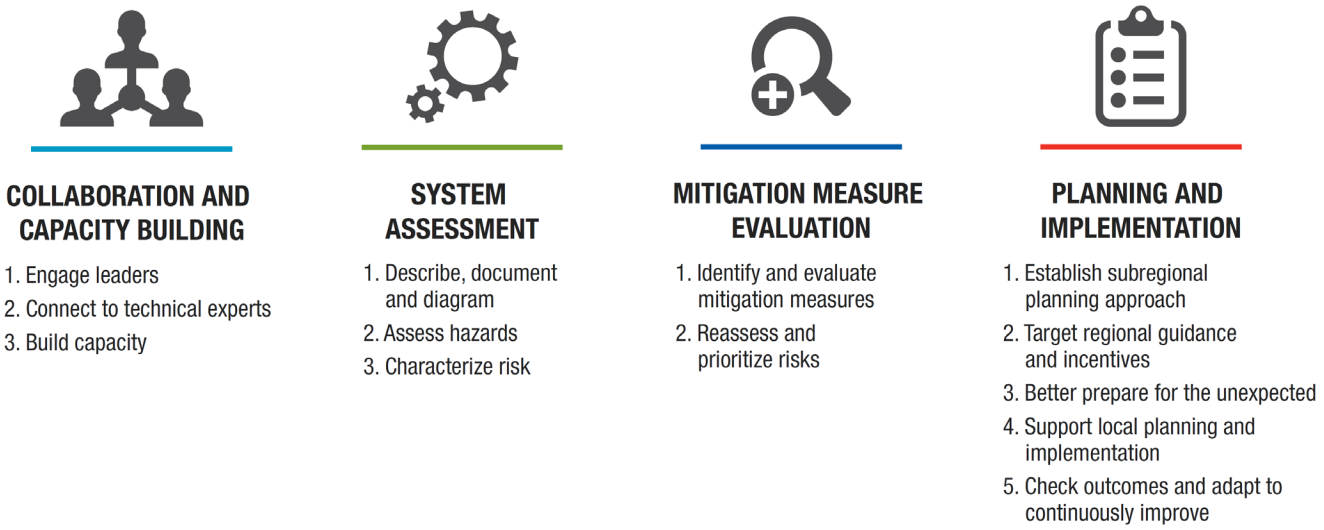
To achieve the goals for the four priority focus areas, MAWSAC and TAC discussed and prioritized a wide range of actions to be taken across the entirety of the water supply system – from source through use to reclamation and back to the environment – and key steps that must be taken in doing this work.

MAWSAC recognizes local control and responsibility for owning, maintaining, and operating water supply systems. Where water supply challenges extend beyond those jurisdictional boundaries, regional water supply planning efforts can help by providing information, guidance, and programs that are developed in cooperation and consultation with municipal water suppliers, regional stakeholders, and state agencies.

Building from the risk management and water safety plan concept proposed in the report "Future of Minnesota Drinking Water: A Framework for Managing Risk," committee recommendations are organized into a logical order for action.

When strategically planned, committee recommendations inform one another and work together to advance the goals. Figure 16 illustrates the framework to achieve progress on MAWSAC goals. Table 1 relates committee-recommended activities to the framework objectives and goals.

Figure 16: The framework for action to achieve MAWSAC goals includes four general steps and related objectives.



COLLABORATION AND CAPACITY BUILDING

1. Engage leaders
2. Connect to technical experts
3. Build capacity

COLLABORATION AND CAPACITY BUILDING

Formal groups like MAWSAC and TAC, and less formal subregional water supply work groups and tasks forces, bring together much of the technical expertise needed from state, regional and local levels to maintain a sustainable water supply in the Twin Cities metropolitan area.

With leadership support, these core groups are well suited to understand and advocate in both regional and local water supply contexts, from water source to use to reclamation and back to the environment (a hypothetical conceptual diagram of key components is presented in Figure 17).

Recommendations

1. Continue engaging leaders across the water sector to set the scope and direction of regional water supply planning work. Leaders like MAWSAC, TAC, and subregional water supply work groups are just the beginning of a collaborative network for water supply planning support.

- ❑ Organize and facilitate MAWSAC and TAC with strong participation by agency and community leaders.
- ❑ Regularly convene water supply work groups (Figure 18) with participation by diverse local leaders.

2. Connect technical experts with a wide range of perspectives and skills to collaborate on water supply challenges and goals.

- ❑ Convene task forces and focus groups to provide direction on persistent and emerging water supply challenges and opportunities.

3. Build and maintain capacity for collaborative work over the long-term.

- ❑ Develop a regional education and outreach campaign to promote a strong and shared understanding of issues.
- ❑ Provide inter-organizational trainings focused on subregional challenges to build strong working relationships and open dialogue.
- ❑ Expand career development programs as a mechanism to meet staffing needs and transfer knowledge as individuals join and leave the work.

Considerations

See Table 1 for specific examples of MAWSAC-recommended collaboration and topics for task forces and focus groups. A current example of this work is a pilot project in the west metro for a multi-community wellhead protection plan update.

The committee highlighted valuable partners to join in this work including water utilities; watersheds; researchers like those at the University of Minnesota; programs like Minnesota Geological Survey (MGS) and Minnesota Extension; professional organizations such as American Public Works Association (APWA), City Engineers Association of Minnesota (CEAM), American Water Works Association (AWWA), and Minnesota Ground Water Association (MGWA); educators; and city leaders.

Together, these people have different perspectives and the skills to work on facets of water supply work such as:

- System assessment, monitoring, hydrologic analyses, or modeling
- Monitoring water infrastructure, risk mitigation measures
- Management planning of groundwater, surface water, wastewater and community development
- Finance of water utilities, watersheds, and community development
- Community engagement and technical assistance
- Public health and risk assessments
- Long-term strategic planning
- Economic development

SYSTEM ASSESSMENT

1. Describe, document and diagram
2. Assess hazards
3. Characterize risk

SYSTEM ASSESSMENT

Policy makers and planners need to understand the current regional water supply system to understand information gaps, risks, and actions that prioritize the highest risks to the system.

For the purposes of this work, “water supply system” includes natural and man-made components from water supply source through use to reclamation and back to the environment. It includes the landscape and land use in the water supply source area, intakes and wells, treatment and storage, distribution, use, and discharge back into the environment - with or without reuse for other purposes. (Figure 17).

Effective water supply planning also recognizes that several sources of water supply risk lie outside of water supply infrastructure, such as potential contaminants on the landscape, climate change, or drivers of water demand/use.

Much water supply system information has already been compiled locally and submitted to regional and state agencies – in community water supply risk assessment and emergency response plans, wellhead protection plans, watershed plans, sanitary surveys, and comprehensive plans.

A regionwide compilation of key data will benefit communities across the Twin Cities area. It will provide a base of technical information to evaluate the regional value of drinking water systems and challenges to repair/maintain them, and to prioritize risks and mitigation measures. A more comprehensive and regional look at existing water availability and infrastructure information can also help communicate with decision-makers about the value and investment needs for local water supply systems.

Recommendations

1. **Describe, document, and diagram the water supply system at a multi-community scale** and in a way that acknowledges and respects water utility security needs.

   ❑ Fill gaps, or assemble where needed, information such as:

   - Water supply sources, recharge and runoff processes, and availability of groundwater and surface water
   - Hydrology, water chemistry, geology, land use, and other landscape information in source water areas
   - Sensitivity of source water quality and/or quantity to key conditions that could affect them like changing water demand, landscape changes, climate, and the ease of interaction between groundwater and surface water
   - Generalized public and private water infrastructure information for the full water supply system, such as:
     - Wells and surface water intakes
     - Water supply and wastewater treatment
     - Storage
     - Water supply and wastewater distribution

- Documentation of water quality and treatment methods for both public systems and private wells
- Water users and uses
- Staff resources
- Documentation about water supply system interconnections, emergency response and/or other operational procedures

2. Identify potential hazards:

❑ Document existing water supply hazards, or potential stressors, across the region in technical studies. Hazards to be documented may include:

- Contamination – from point sources like unlined landfills, nonpoint sources (particularly related to land use such as agriculture), and unidentified sources as may be the case for newly discovered contaminants
- Rates of water withdrawals from groundwater and surface water, which may potentially cause declines in water availability
- Lead service lines or other water supply system conditions

❑ Conduct outreach to fill information gaps (for example, private well water quality, groundwater-surface water interaction, modeling potential climate change impacts on water)

3. Determine potential risks:

❑ Evaluate the level of risk posed by known hazards, including how risks vary across the region.

Figure 19. The difference between a hazard and a risk. Hazards are conditions and events with the potential to cause harm. Risks are the likelihood of different hazards to cause harm.

Considerations

See Table 1 for specific examples of MAWSAC-recommended topics for projects.

Information compiled through the water supply system assessment can be used to determine which hazards pose a risk for water supplies. The following are examples of how hazards may pose different levels of risk:

- Hazards like potential contaminant sources create a high risk if they are in vulnerable drinking water supply management areas because water may quickly carry contamination in these areas to a water supply well or intake. Risk may be lower outside of vulnerable drinking water supply management areas.
- Hazards like increased pumping from a well may be a higher risk if occurring in an aquifer used by many neighboring wells. Risk would be lower in an aquifer not used by many.

A collaborative regional or subregional approach will provide the best thinking about risk and trade-offs by pooling a wide range of experience and expertise across the full water supply system. The team could choose to assess risk using quantitative or semi-quantitative approaches, or a more simplified approach based on expert judgement.

MITIGATION MEASURE EVALUATION

1. Identify and evaluate mitigation measures
2. Reassess and prioritize risks

MITIGATION MEASURE EVALUATION

While hazards and risks are being identified and evaluated, existing and potential control or mitigation measures that reduce the risk of contaminated groundwater or diminished supply should also be documented, and their effectiveness determined. This is critical information to better prepare the region to respond to identified risks.

Recommendations

1. **Identify and evaluate existing and potential mitigation measures** that could help reduce the risk of identified hazards and hazardous events. Examples:
   - ❑ Technical studies of water treatment options, effectiveness, and costs (opportunities to improve water quality), rural water system feasibility, in-home vs. public water supply system water softening, guided by subregional groups.
   - ❑ Technical studies of the effectiveness of land management techniques in source water areas on water quality and quantity, specifically in those areas that have vulnerable groundwater and surface water sources.
   - ❑ Expand technical studies with U of M on the effectiveness of current and past water efficiency practices (turfgrass, industrial, and commercial practices).
   - ❑ Evaluate the effectiveness and impacts of stormwater infiltration BMPs on water quality and quantity.
2. **Prioritize risks**, after taking into consideration the effectiveness of mitigation measures. A risk assessment can be used to prioritize risks in terms of their likely impacts on the ability of the system to deliver safe water and result in wise water supply management investments.
   - ❑ Convene subregional water supply groups and task forces to conduct risk assessments.
   - ❑ Address highest priority shared risks in each subregion and region-wide using collaborative approaches.

Considerations

See Table 1 for specific examples of MAWSAC-recommended topics for projects.

Both local and regional efforts to evaluate and deploy effective mitigation measures should be supported by:

- Creating and sharing outreach materials for audiences such as water resource and source water protection managers, local planning and zoning staff, and others to promote protection and mitigation activities.
- Identifying gaps in our understanding of best management practices (BMP) effectiveness in maintaining water quality and quantity, to guide future work.
- Supporting regional policies and guidance around water monitoring and assessment programs, land use and redevelopment planning, and incentive programs.

PLANNING AND IMPLEMENTATION

1. Establish subregional planning approach
2. Target regional guidance and incentives
3. Better prepare for the unexpected
4. Support local planning and implementation
5. Check outcomes and adapt to continuously improve

PLANNING AND IMPLEMENTING RISK REDUCTION PRACTICES

Where water challenges are identified through the risk assessment process discussed above, all impacted communities should have a voice at the table for in decision-making about water management, including prioritization, planning, funding, implementation, and evaluation.

Some issues are too large for one entity or water supplier to tackle on their own. Drawing on subregional partners for guidance and leveraging state and regional resources to develop and implement effective local plans can make a larger impact on regional issues.

Acknowledging water as a single regional resource will also support more effective and coordinated risk mitigation projects and programs at the local, regional, and state level.

Funding is needed for the following work that builds on a shared understanding and prioritization of water supply system risks and mitigation measures.

Recommendations

1. **Establish a new subregional water supply planning approach** that leverages subregional water supply working groups (Figure 18) and informs regional and local policy and plan updates.
   - ❑ Compile information and communicate about the shared understanding of each subregion's unique socioeconomic needs, water supply setting, and water supply issues.
   - ❑ Co-create subregional planning goals, objectives and strategies.
   - ❑ Make shared recommendations for regional and local (multi-community) implementation programs and projects to reduce water supply risks for multiple communities. This could take the form of a sub-regional collaborative approach to water safety planning as suggested in the report "Future of Minnesota Drinking Water: A Framework for Managing Risk."
   - ❑ Make shared recommendations to establish a funding program to help communities currently dealing with water quality and contamination issues.
2. **Target regional guidance and incentives** through updated Council policies and programs.
   - ❑ Update the 2050 regional development guide and related policy and system plans to support MAWSAC goals, customized for subregional and local conditions. Figures 20, 21, 22, and 23 illustrate potential connections for water supply and parks, community designations (land use planning), and water monitoring and prioritization.
   - ❑ Provide technical assistance to local partners to support MAWSAC goals (for example, grant programs for water efficiency, BMP guidance, model ordinances, training events).

3. **Better prepare for the unexpected:**

   ❑ Funding to mitigate water quality and contamination issues is a high priority for the committee, who strongly recommend increasing state funding for resilient community infrastructure and emergency response, so that metro communities of all sizes and level of development can quickly respond to emerging challenges.

   ❑ Facilitate a task force to develop a generic emergency water safety plan for more coordinated response to changing regulations and emerging contamination that poses a risk to human health. Developing a streamlined protocol or procedures for new contamination or changed contamination limits might include:

   - Criteria to determine what contaminants need action
   - Response actions, including increased monitoring
   - Responsibilities, authorities and required expertise
   - Plans for emergency water supplies
   - Communication protocols and strategies
   - Mechanisms for increased public health surveillance

4. **Support local planning and implementation** to address high priority risks within the community and provide information for neighboring communities to accurately assess and plan for their own risks and help their neighbors manage their risks.

   ❑ Address long-term infrastructure resiliency and source water protection needs in comprehensive plans and budgets.

   ❑ Support use and expansion of efficiency and source water protection programs.

   ❑ Where groundwater quality is a concern, support regular water quality testing of private wells and connection of private well owners to municipal systems, if feasible. Existing models could be expanded such as those developed by metro counties, the Minnesota Well Owners Organization and others.

   ❑ Aid in identifying and marketing economic growth potential for appropriate future water use from particular sources

   ❑ Guide and stage land use planning around existing water supply infrastructure investments and source water protection plans. Regarding source water protection, consider information such as Figure 9 illustrating current land use, and Table 2 information about potential contaminants commonly associated with different land cover categories.

5. **Check outcomes and adapt to continuously improve.** Establishing and maintaining a process to track performance throughout each step of the framework, to keep attention and resources focused on planned work and adapt to improve outcomes. A culture of continuous improvement increases the likelihood that plan updates incorporate lessons learned, knowledge is being shared among staff, and procedures are effective and up to date. Examples of this in action could include:

   - Analyzing water conservation statistics to determine and report on the effectiveness of existing best management practices
   - Periodic surveys and focus groups to evaluate plan development and implementation processes
   - Updates on plan implementation progress at subregional water supply work groups
   - Tracking participation in staff training events like tabletop emergency preparedness exercises

Considerations

See Table 1 for specific examples of MAWSAC-recommended projects, grant programs, outreach, and other planning activities to consider.

Subregions may have similar water-related issues and concerns; therefore, a new subregional water supply planning approach can target specific issues or goals for different parts of the metro area.

The Council has valuable regional planning resources for research, financial support, and convening. These resources are more effective if customized to subregional and local conditions. The Council's full range of planning responsibility can be better leveraged to provide guidance and incentives that enhance and protect water supply. The Council's technical assistance programs should also be better leveraged to support MAWSAC's water supply goals.

Regional and local plans and programs should consider near-term (10 years), mid-term (30 years), and long-term (life span of water supply infrastructure) infrastructure and treatment needs. Acknowledging a range of future forecasts scenarios (for example, water demand, climate) is also useful.

Local Perspectives

Subregional water supply work groups

In December 2021, water suppliers and water resource managers from across the region met to exchange perspectives around the persistent and emerging water supply challenges they are focused on. They shared the following thoughts:

Aging infrastructure is a huge, costly issue. Funding is needed to maintain systems. It is easier to get funding for new infrastructure than repair of existing, aged infrastructure.

How do we educate about the cost and value of water? Accurate pricing can build a fund for routine repair and replacement, leaving other funds for emergency purposes. High water bills from the drought are shocking residents that did not follow conservation restrictions.

The Future of Drinking Water report focuses on water safety, from source to tap. Can we build upon work by other organizations and pool expertise?

The federal infrastructure bill holds high potential for improvements. But too many strings attached make the funds burdensome and costly to use.

We need more interagency collaboration to improve submittal requirement redundancy, pool knowledge, not duplicate efforts, and have strength in numbers.

Need for water reuse, both wastewater and stormwater.

PFAS have been found across the metro. Funding must be made available for all communities facing this challenge.

Let's learn from the drought this year. How can we better prepare for next time? Can we have better alignment between drought plans and water supply plans? State and local levels.

Funding and direction on use and procedures are needed.

Staffing is an issue. The pool of qualified candidates is small.

Water is a regional resource and should be managed as such. Examples: White Bear Lake case and PFAS in the East Metro. How will we deal with regional issues in the future?

Older cities are concerned about the new lead and copper rules. How can assistance be given for this monumental task?

Joint service might be the more cost-effective options for communities facing water quality issues.

Cleanup of existing pollution and water contamination is needed and costly. Can federal dollars be available for cleanup activities?

Chloride is still a big issue.

Collaboration is needed to address and solve these big issues. Legislation can help bridge those gaps.

Local examples

Addressing changing water tables and climate in Minnetonka, Minnesota

Leslie Yetka, Natural Resources Manager

Minnetonka, Minnesota covers 50 square miles and is home to 53,000 residents. The community is primarily residential and almost built out in a rolling landscape with a lot of rolling hills, wetlands, and a small piece of Lake Minnetonka. It is a community with a lot of water, and one thing that is indicative of changing water tables is how it impacts people on their residential properties.

Two years ago, the community was dealing with consistently high rainfall events. Flooding was the topic of the day for many people – they had questions and concerns with high water. Impacts from that included dead and dying trees, changes in vegetation along shorelines, and erosion. All of those things are very noticeable for people. Fast forward to the drought of 2021: ponds and wetlands dried up and low lake levels.

The wide fluctuation is obviously very perceptible to people, and they react to it in very different ways. With high water levels, the city heard concerns that they were not maintaining infrastructure properly or something must be broken. During the drought, the city fielded questions form people asking if they could use hoses to fill up ponds, because people want to be able to see the water.

One project is at Shady Oak Lake, which is adjacent to Nine Mile Creek. Until the drought of 2021, the lake has experienced consistently high water levels causing property damage to neighboring residents.

To address the problem, the city is undertaking a $980,000 capital project to construct an automated control structure to release water from the lake in a way that doesn't damage Nine Mile Creek flows and habitat and downstream neighbors. The city is partnering with the watershed district, MN Department of Natural resources, and neighbors.

Groundwater and surface water interaction in Nokomis Neighborhood, Minneapolis, Minnesota

Tiffany Schafer, Project and Land Manager, Minnehaha Creek Watershed District

Minnehaha Watershed District is in the west metro and includes 29 communities ranging from very urban Minneapolis to more rural but rapidly developing Victoria.

A recent project the watershed district has partnered on was a multi-year investigation to identify factors contributing to neighborhood water concerns around Lake Nokomis in 2014-2019. In 2014 property owners began reporting water concerns to the City of Minneapolis such as wet basements and backyards, impacts to private sewer laterals, and occasional settling of soil. The impact of highest concern was to private sewer laterals and related costs to address.

The City of Minneapolis responded by assembling a multi-agency team to look at factors contributing to concerns and understanding data gaps. The main gap was lack of groundwater level data for the water table aquifer. Hennepin County, DNR and the Park Board installed six monitoring wells. Combining this new data with existing information about geology, groundwater modeling tools, and land use history shed light on the problem.

The pre-development landscape around Lake Nokomis was dominated by wetlands. Landscape alternation to allow residential development occurred during a long period of historically dry conditions, which informed perceptions about a low water table in the area. 2010 to 2019 was the wettest decade on record, which led to a return of high water tables in this historically wet landscape.

This work highlighted the value of groundwater monitoring and modeling of shallow aquifers and research about the interactions between groundwater and surface water under different climate conditions. Community planners and water resources managers should be aware of the increased risks of changing water tables.

Resources to understand your own local water supply story

Find information about your community's water supply sources with the Minnesota Department of Health's Consumer Confidence Report and Source Water Assessment search tools and the Source Water Protection Web Map Viewer.

Explore environmental information about your neighborhood using the Minnesota Pollution Control Agency's What's In My Neighborhood application.

In the metropolitan area, explore community information with the Metropolitan Council's Community Profiles tool. To compare your water rates to neighbors, use the Metropolitan Council's Water Rate comparison tool.

Supporting Figures and Tables

Figure 1. Source water protection areas have been designated across the region by communities and the Minnesota Department of Health (MDH). Water flowing through these areas to wells and river intakes supplies about 90% of the region's population. Some areas, such as the southern part of Hennepin County and northern Ramsey County, supply water to multiple communities and benefit from resources for multi-community source water planning and implementation. Explore more on the MDH Source Water Protection Web Map Viewer.

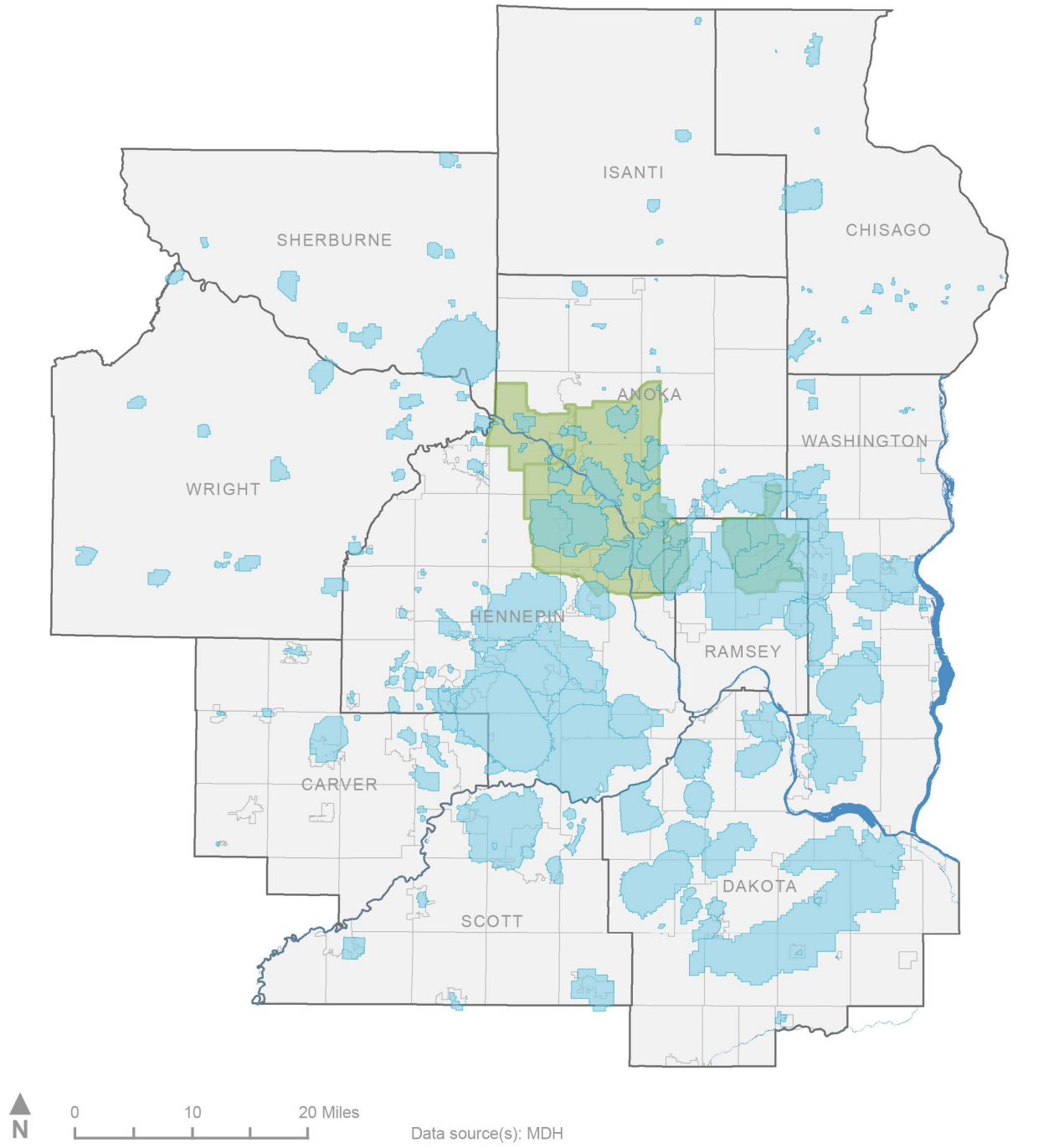


Figure 2. Annual water use in the Twin Cities metropolitan area has grown over time. Today, the region uses approximately 100 billion gallons each year (an average of about 300 million gallons each day). As a region, use has shifted away from surface water toward more groundwater. Financially, most communities prefer to use only one source of water. As water quality and treatment approaches change, however, the costs and benefits of alternative approaches can be periodically reviewed. Water usage data over time also suggests that water may have been used more efficiently over the past decade.

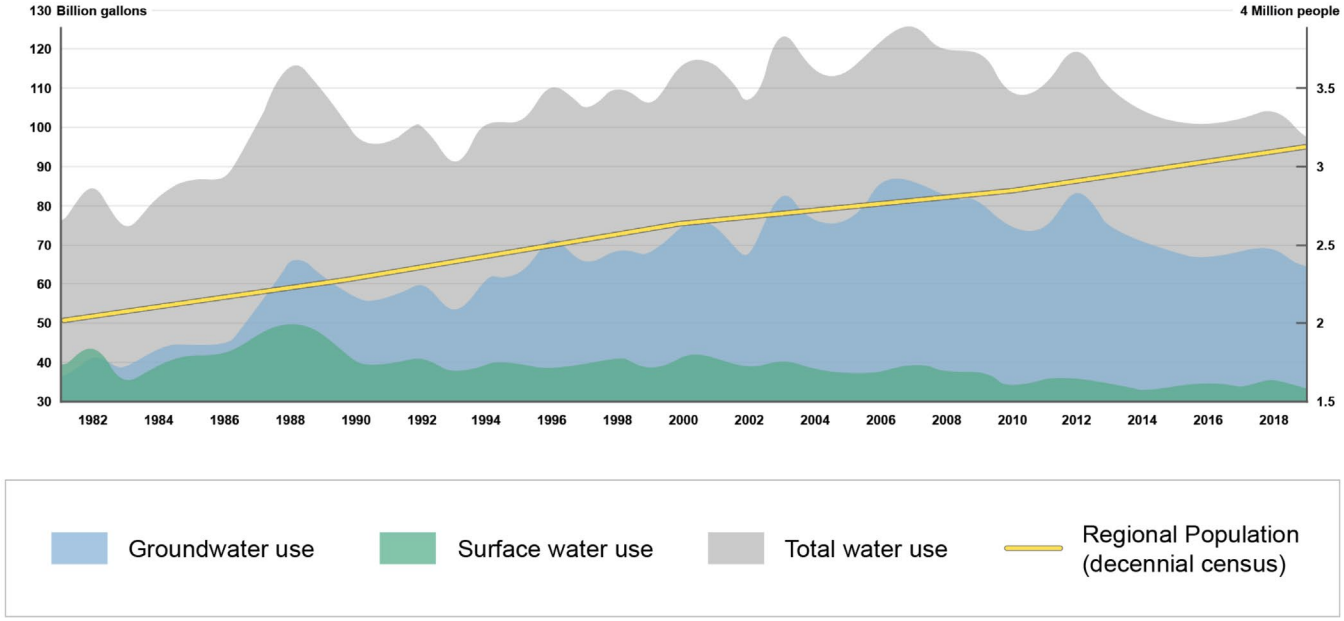


Figure 3. Source of water for communities in the Twin Cities metropolitan area. Over 100 different public water utilities and 60,000 private wells use groundwater, surface water, or a combination of both. Effective regional water supply planning and implementation recognizes that communities face very different opportunities, challenges, and limitations. For example, smaller metro communities have a small customer and tax base and very different water customer needs than larger communities like Bloomington.

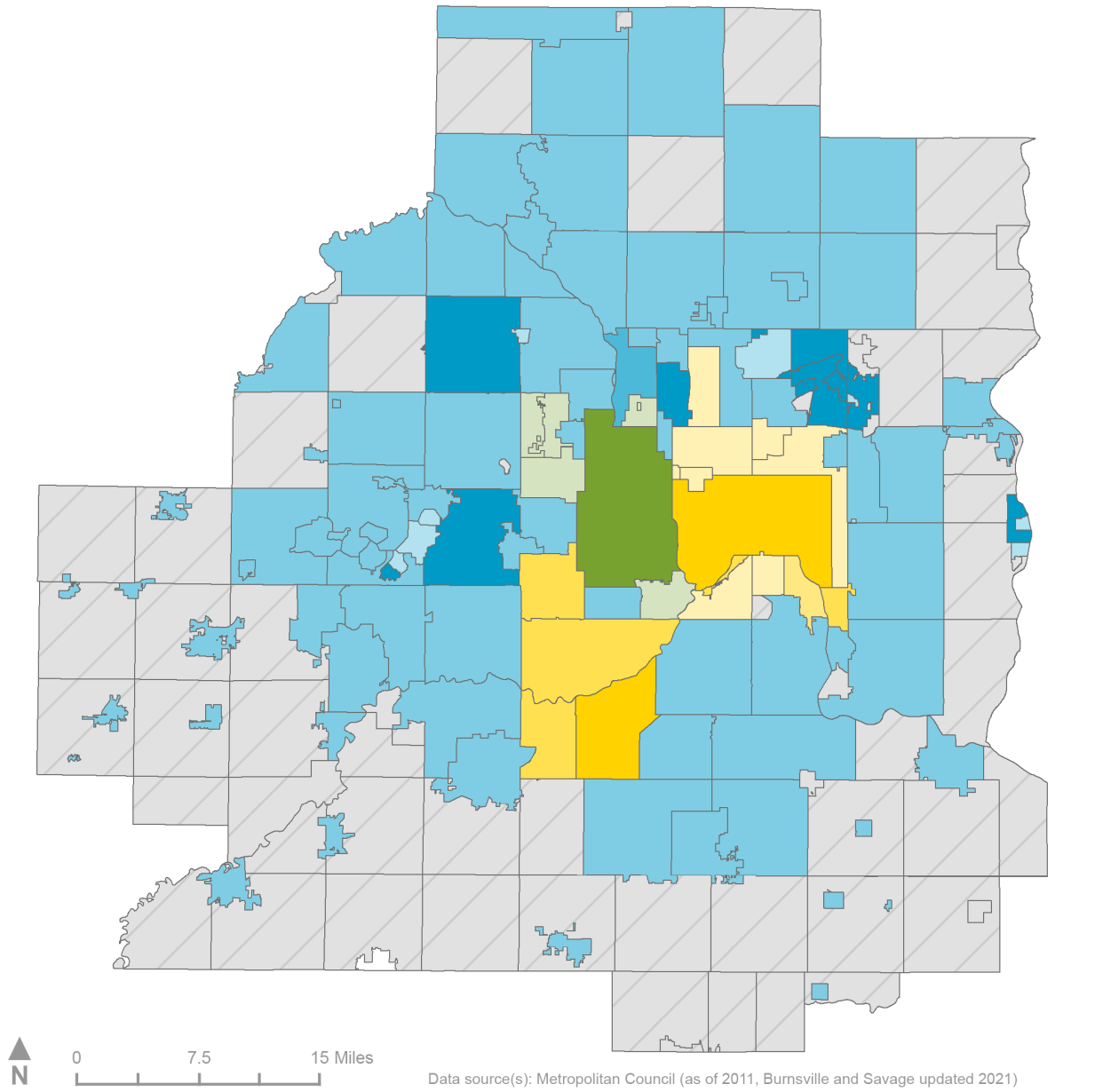


Figure 6. Similar to other major metropolitan areas, the potential for contamination is a hazard across the Twin Cities region. For example, the Minnesota Pollution Control Agency records thousands of different sites in the Minnesota Groundwater Contamination Atlas and 'What's in My Neighborhood' application. Nonpoint sources of contamination, like chloride and agricultural chemicals, are also a challenge. Looking at these sites alongside water supply information like source water protection areas or pollution sensitivity identifies areas to promote programs or prioritize funding such as (but not limited to) Minnesota Technical Assistance Program, Metropolitan Council Tax Base Revitalization Account, or others.

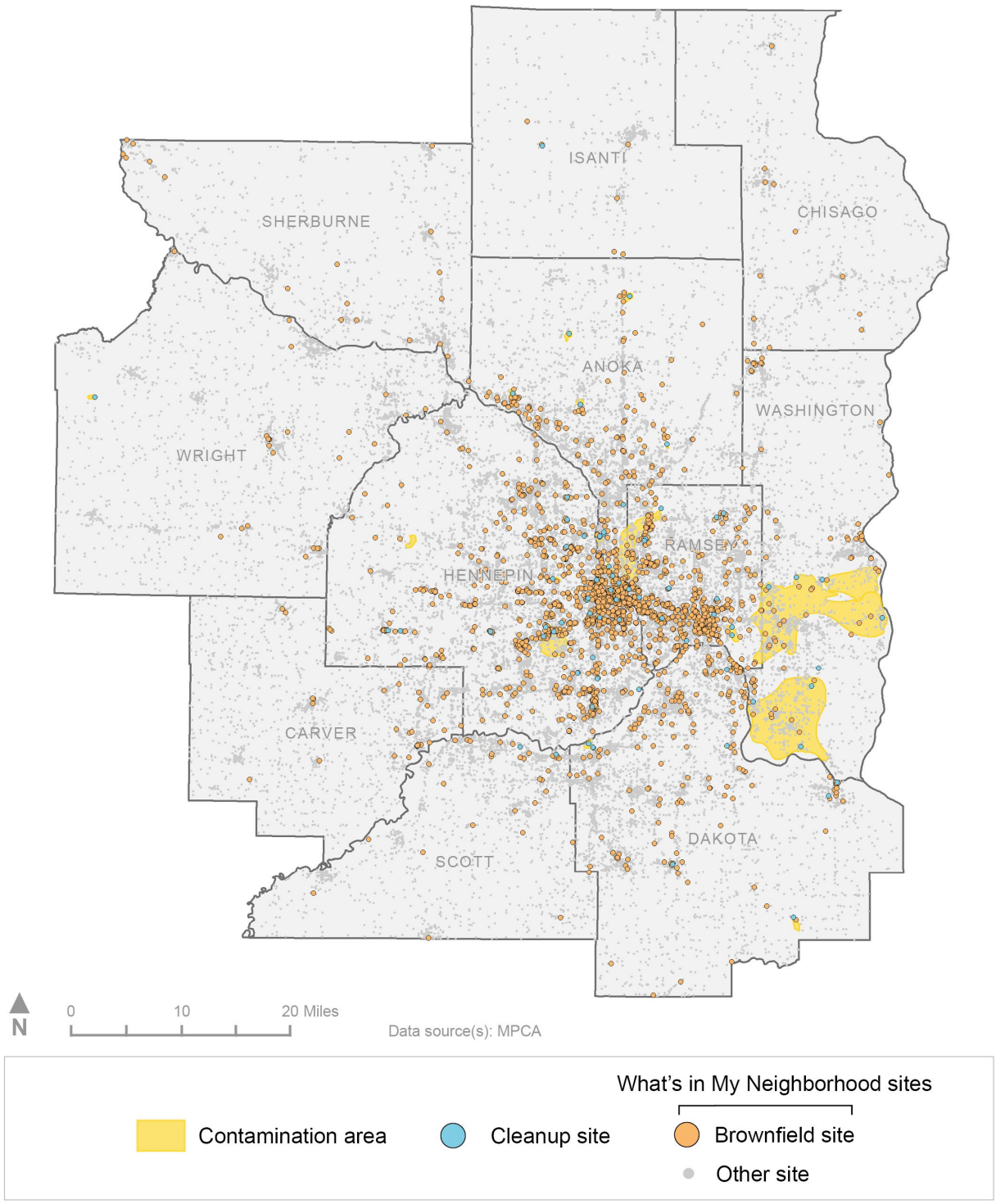


Figure 7. Pollution sensitivity of the landscape and near-surface materials. Soil type, depth to water, and deeper bedrock conditions vary across the region, making some areas more sensitive to pollution. Land use decisions, including best management practices to mitigate risks, are shaped by considerations like this. This information is also useful for prioritizing pollution prevention or remediation programs.

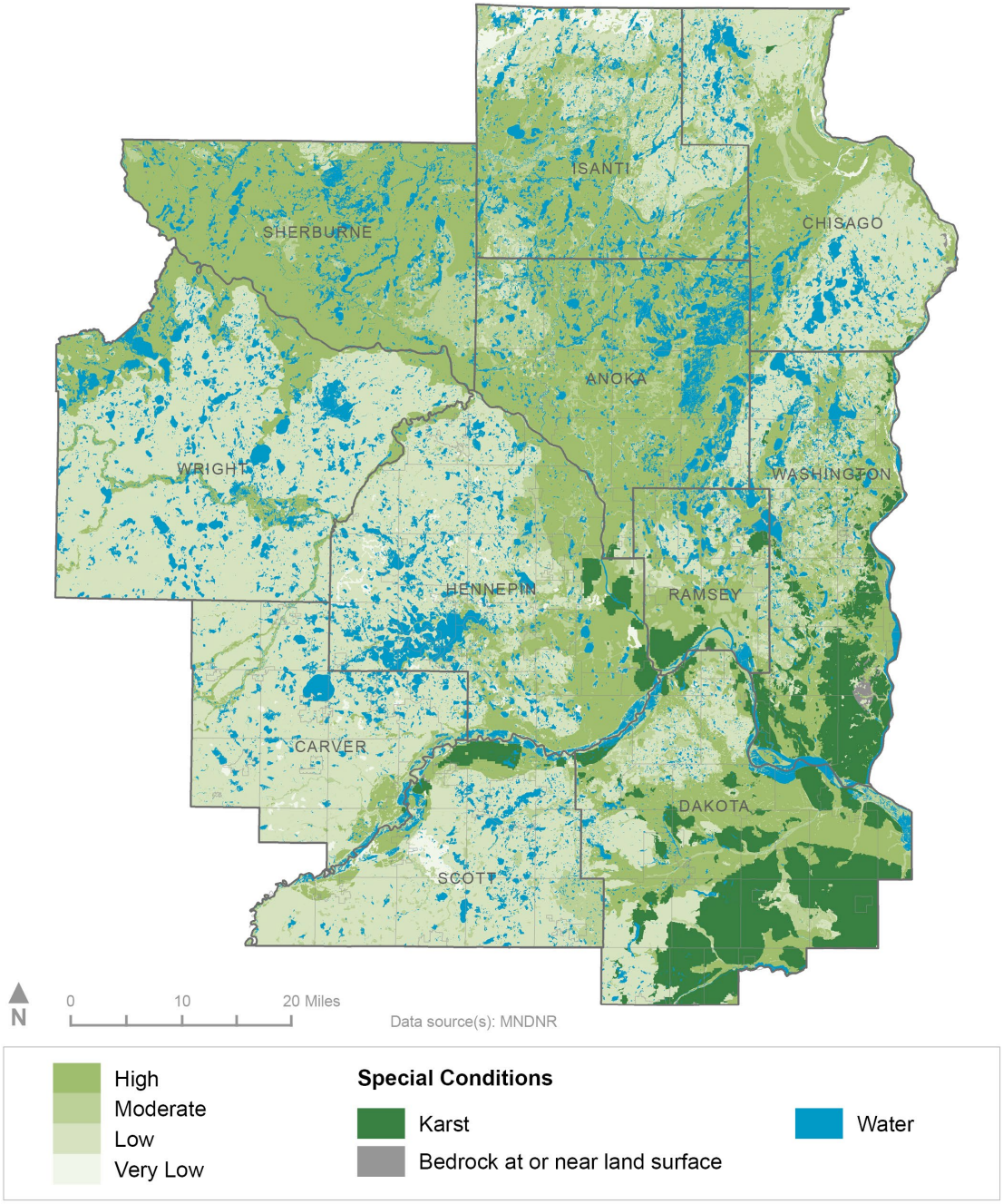


Figure 8. Groundwater management and special well and boring construction areas. Special Well and Boring Construction Areas are designated by Minnesota Department of Health to inform the public of potential public health risks in areas of groundwater contamination, provide for the construction of safe water supplies, and prevent the spread of contamination due to the improper drilling of wells or borings. In order to provide safe water it may be necessary to require the construction of deeper wells, employ special construction techniques, conduct specialized testing, or require special water treatment procedures. Groundwater Management Areas are a tool for the Minnesota Department of Natural Resources to address difficult groundwater-related resource challenges.

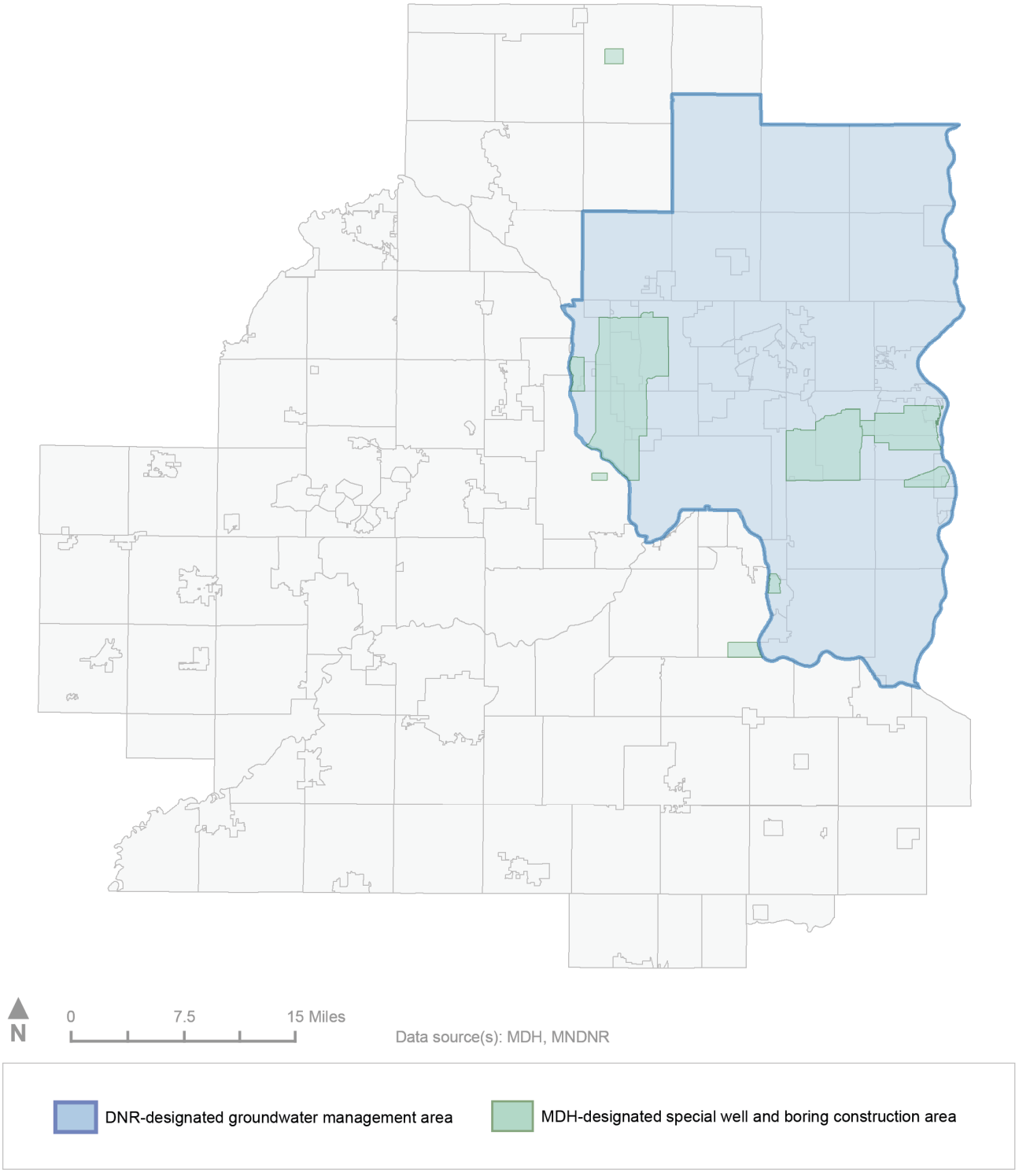


Figure 9. Generalized land use in 2020.

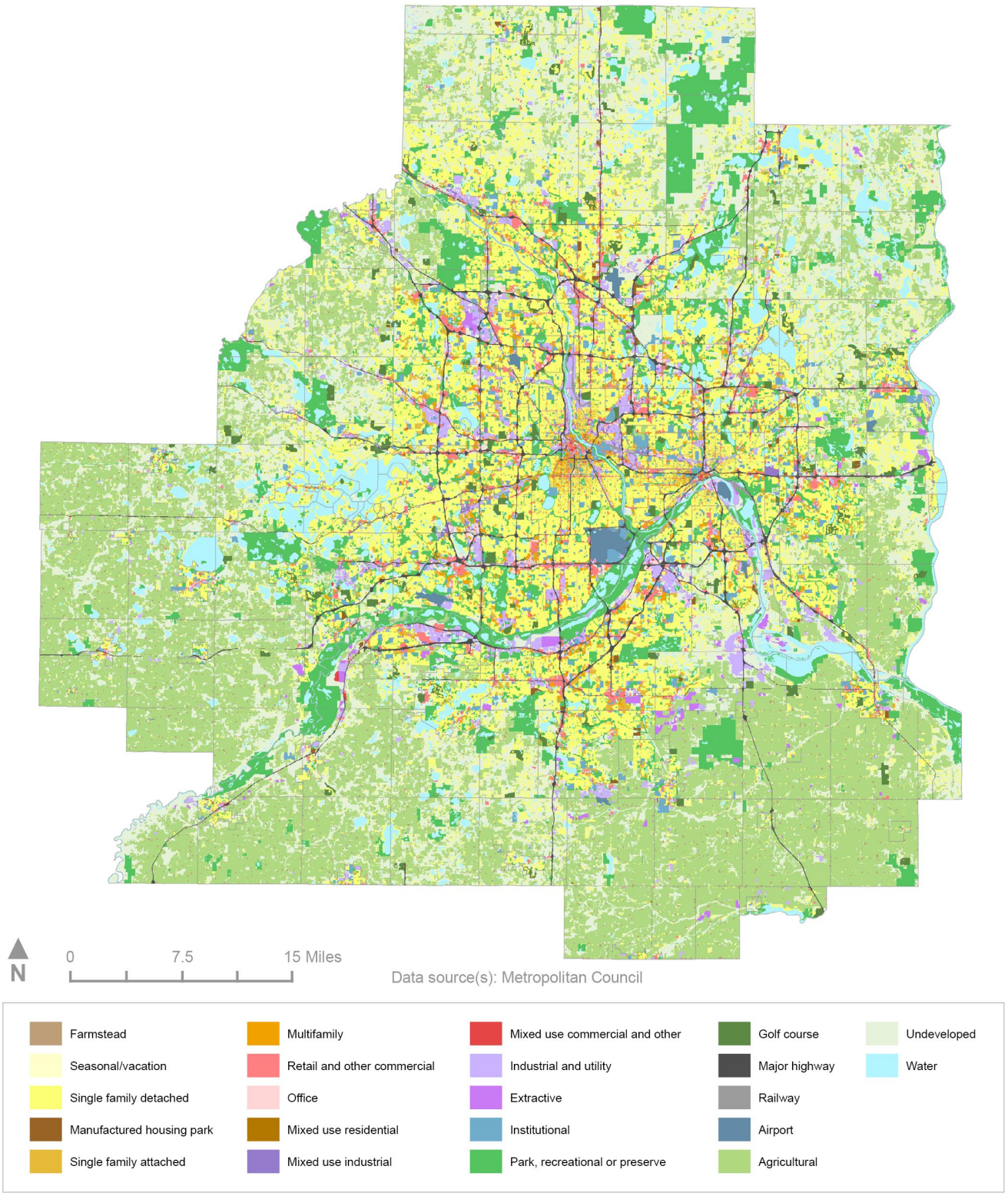


Figure 10. Planned development in the urban service area and by community designation in the Twin Cities metropolitan area, based on information provided through communities' 2040 local comprehensive plan updates.

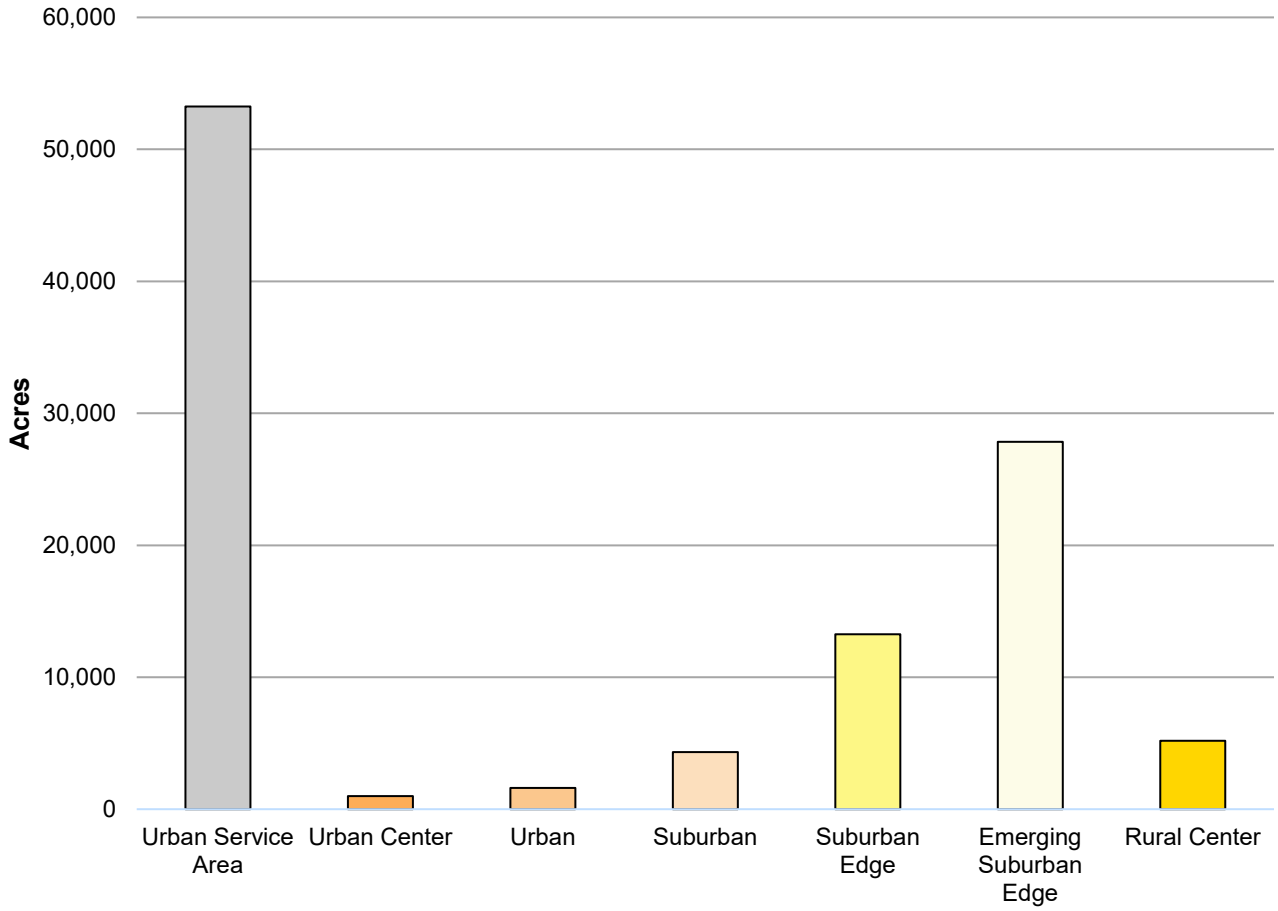


Figure 11. Ratio of summer versus winter water use. Values close to one mean that a similar amount of water is used in the summer and winter. Values higher than one mean that more water is used in the summer compared to the winter. Water supply infrastructure is generally built to meet peak demand. Factors that can affect summer water use include hot and dry weather and related outdoor water use, and summer businesses like water parks and nurseries.

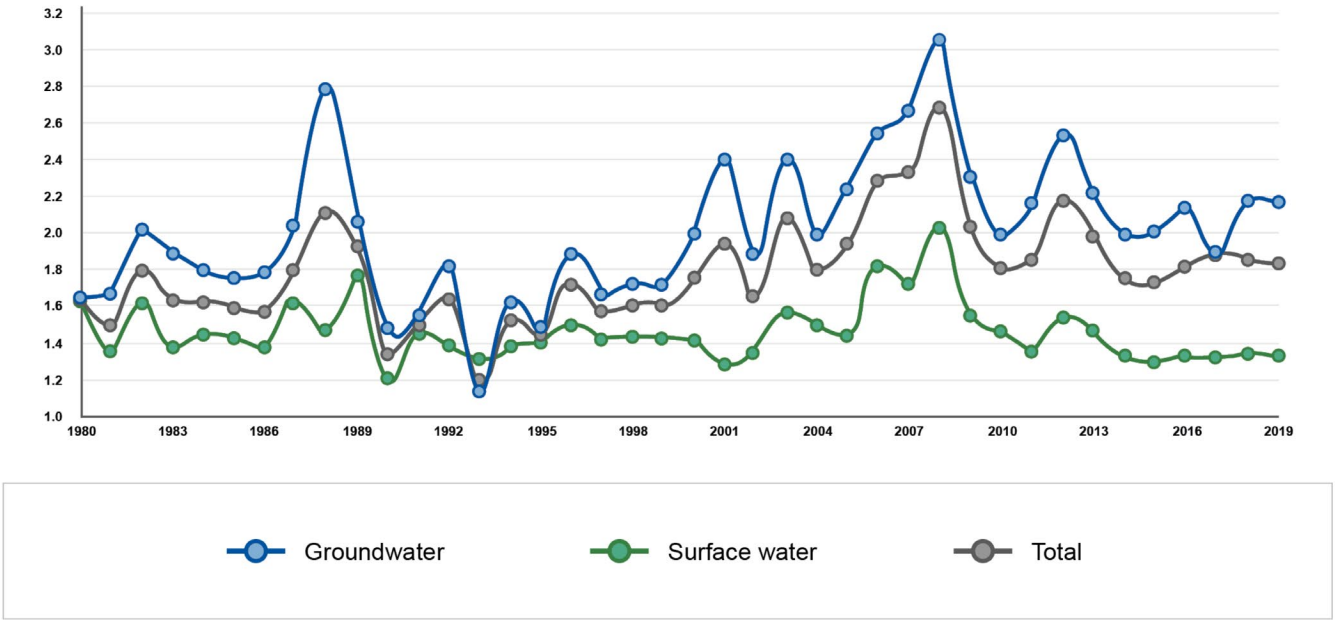


Figure 12. Model predictions of potential for reduced infiltration due to climate change. Although the region just experienced a historically wet decade from 2010-2019, a suite of global climate model projections still suggest that infiltration may go down, limiting the amount of water available to recharge drinking water aquifers. Policy makers and planners should consider a range of strategies that prepare for both wet and dry conditions. As more refined and downscaled climate projection data is developed for Minnesota and the region, this analysis should be updated; the current infiltration model does not simulate changes in intensive rainstorms, for example.

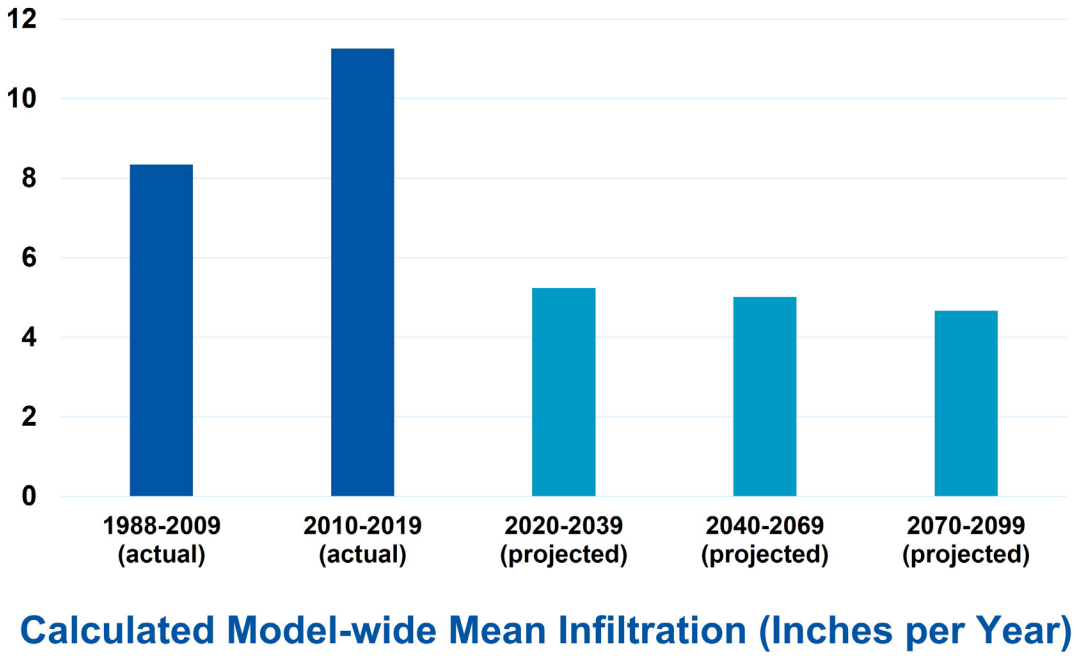


Figure 13. Approximate extent of local water supply distribution infrastructure across the Twin Cities metropolitan area. Across the region, over 100 community water suppliers and tens of thousands of private well owners have made huge investments in water supply infrastructure. Because most of this infrastructure is buried, it can be challenging to recognize the scope of these public assets. For example: together, the estimated extent of local water supply distribution pipes alone is over 10,000 miles, based on the similar distribution of local sanitary sewer pipe in the long-term service area. This map does not include the estimated extent of water supply distribution pipe for public water supply systems outside the long-term service area or in rural growth centers who rely on their own local wastewater treatment.

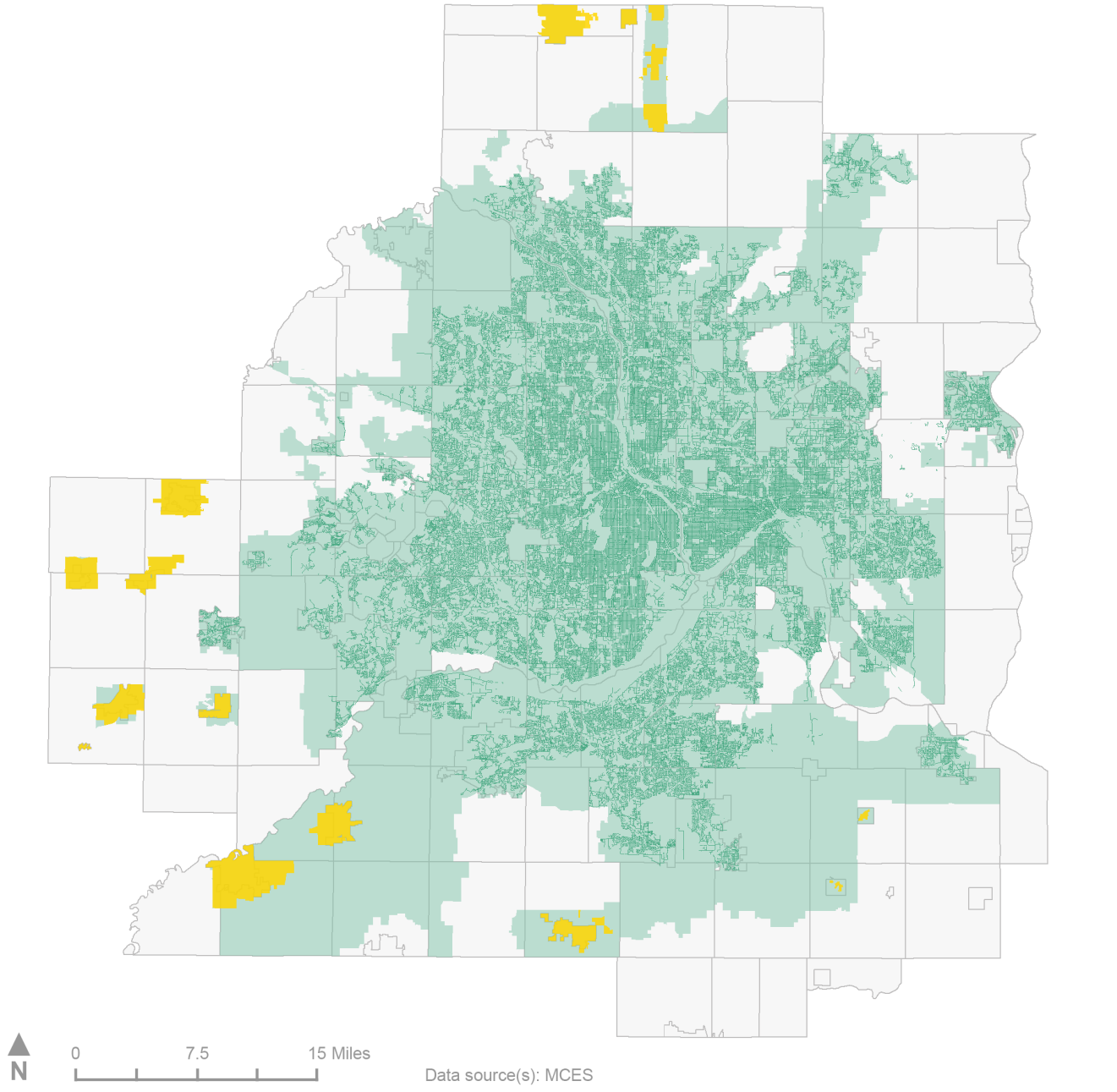


Figure 14. Total regional water use in gallons per person per day has gone down slightly since 2000, although this varies among communities.

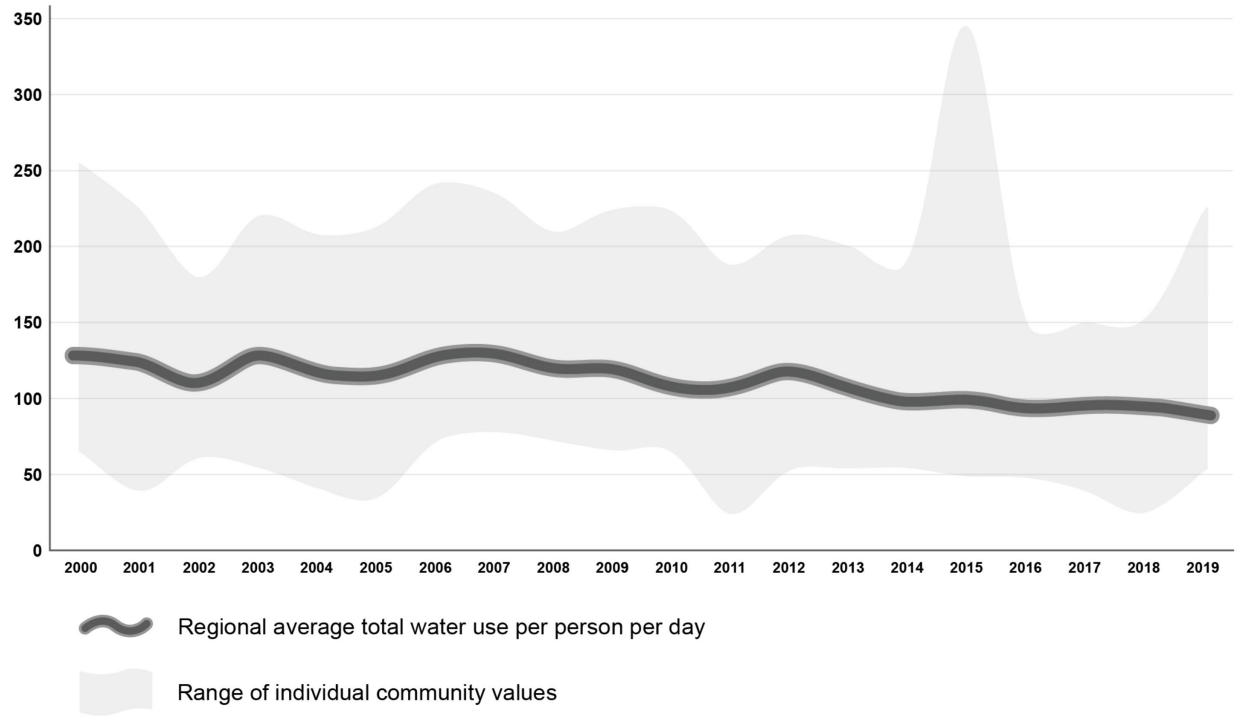


Figure 15. Average regional residential water use in gallons per person per day has generally gone down since 2000.

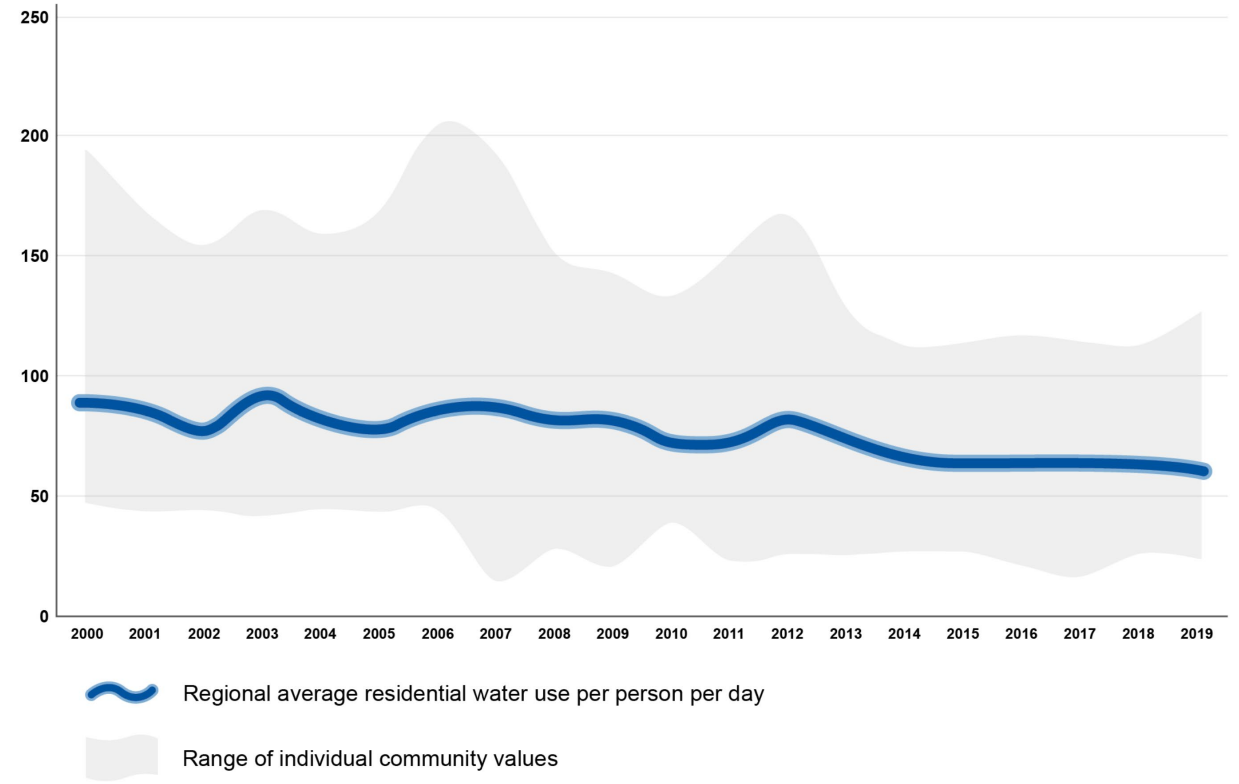


Figure 17. Hypothetical conceptual diagram of integrated components of a multi-community water supply system. A complete and illustrative flow diagram of the region-wide water supply system from the environment and landscape, source waters, through treatment, distribution, and water use, and through reclamation provides multiple benefits: a) supports the complete identification of hazards, risks and mitigation measures; b) informs monitoring and analyses to understand groundwater-surface water and other interactions of interest for water supply protection and management; c) illustrates relationships among the different organizations, the different roles they play and how they impact one another (example: utilities vs. regulators).

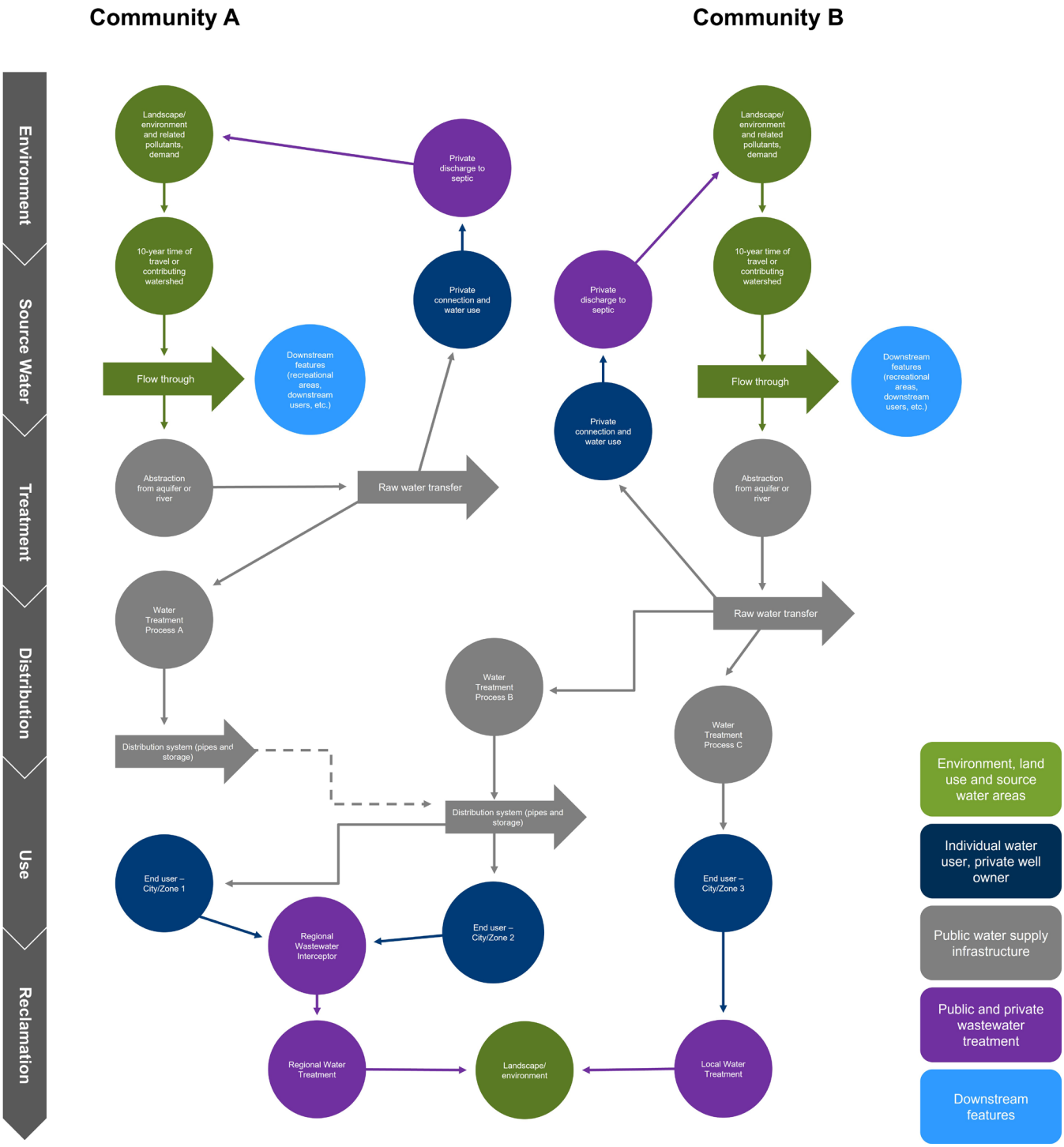


Figure 18. Subregional water supply work groups. These informal work groups provide a venue for neighboring communities and water utilities to exchange information about water supply-related projects and to collaborate on efforts too big for any one community to tackle alone. More information about work group membership and topics of interest are on the Council's website. Going forward, subregional water supply work groups can provide guidance and shared recommendations to regional and local policymakers and planners.

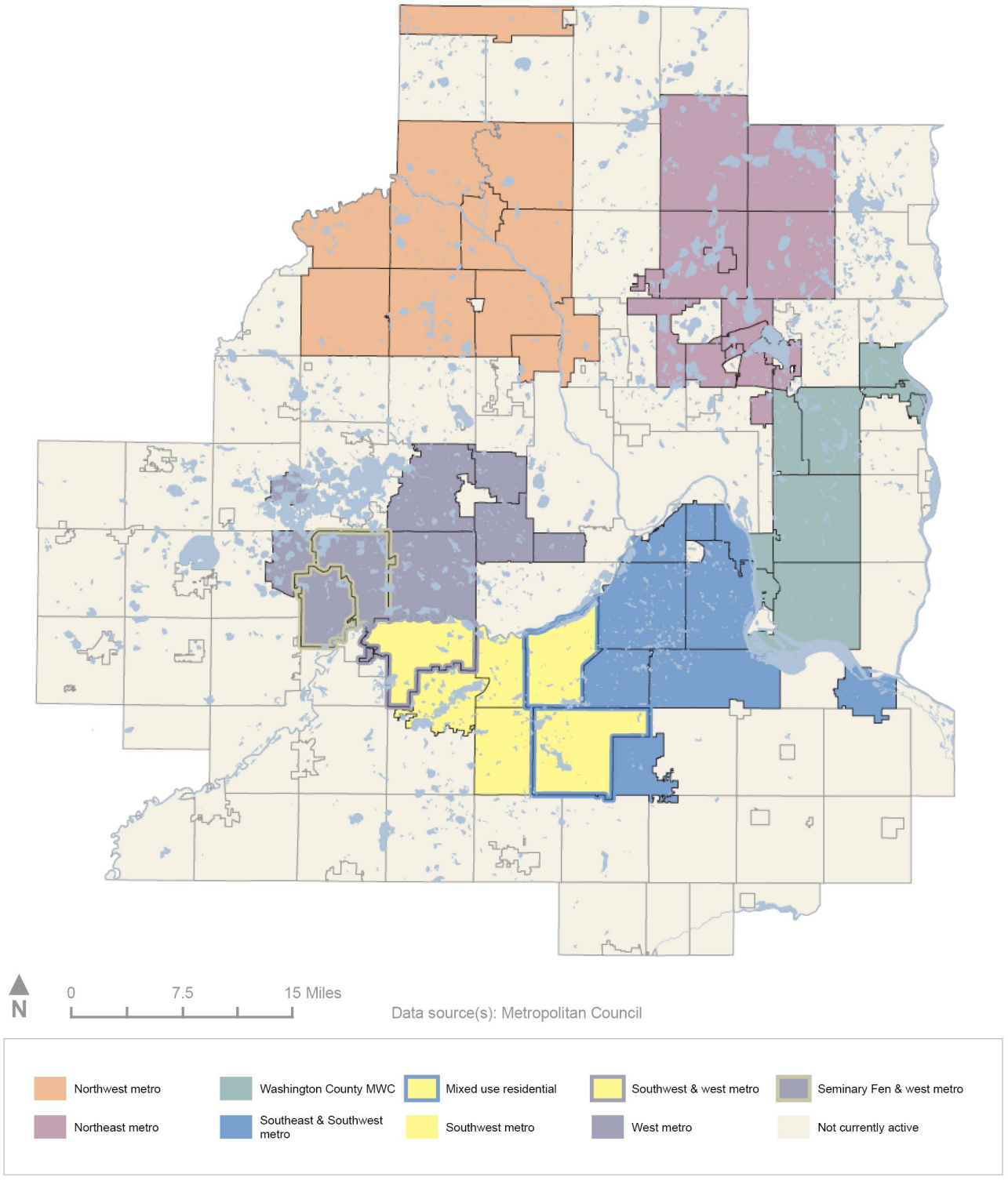


Figure 20. Regional parks and source water protection areas. The great majority of regional parks; state parks, trails, scientific and natural areas, and wildlife management areas; and national parks and federal wildlife refuges are adjacent to water. Regional trails also often follow rivers, streams, and creeks. There are opportunities for water quality protection through land management and outreach and engagement.

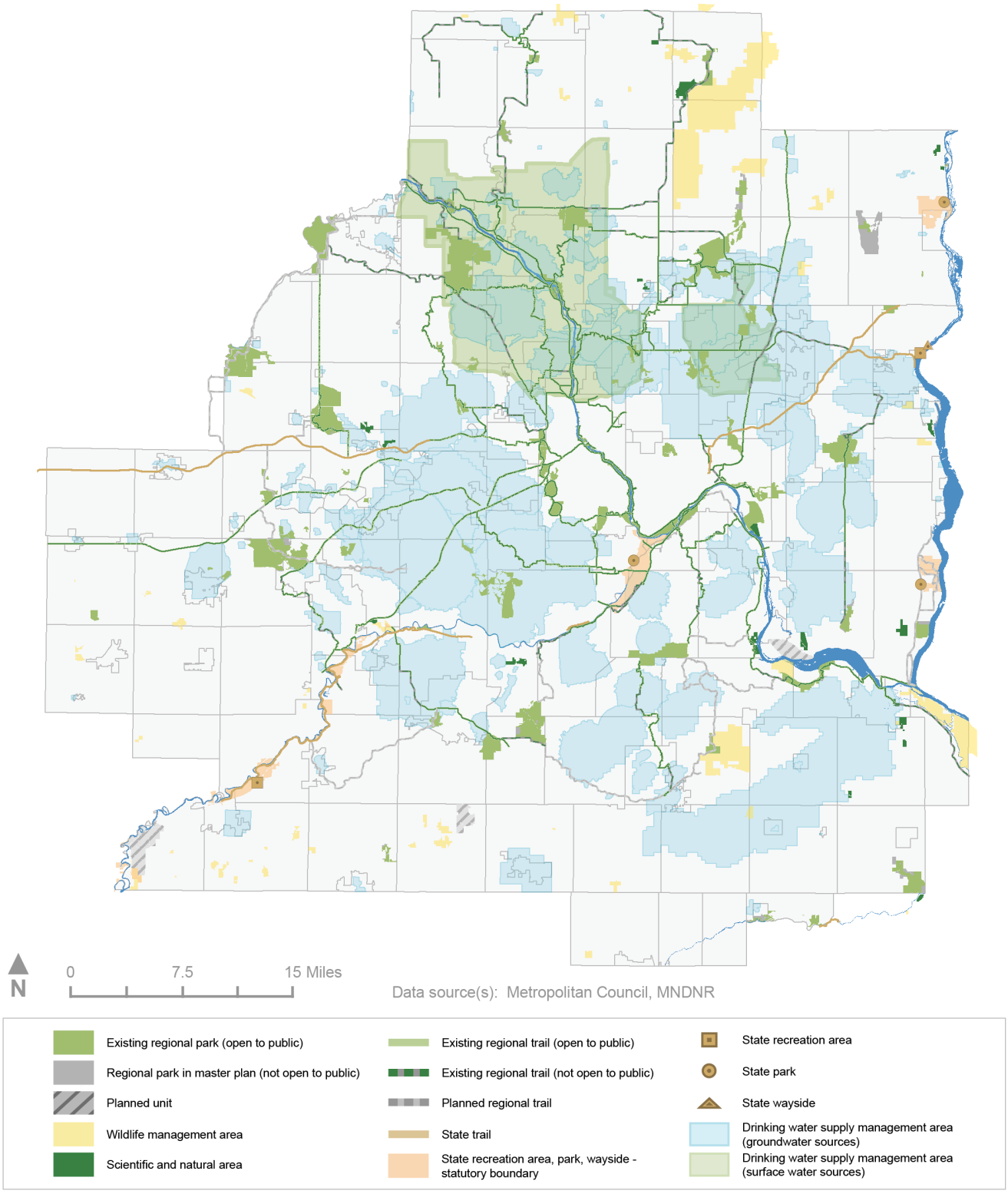
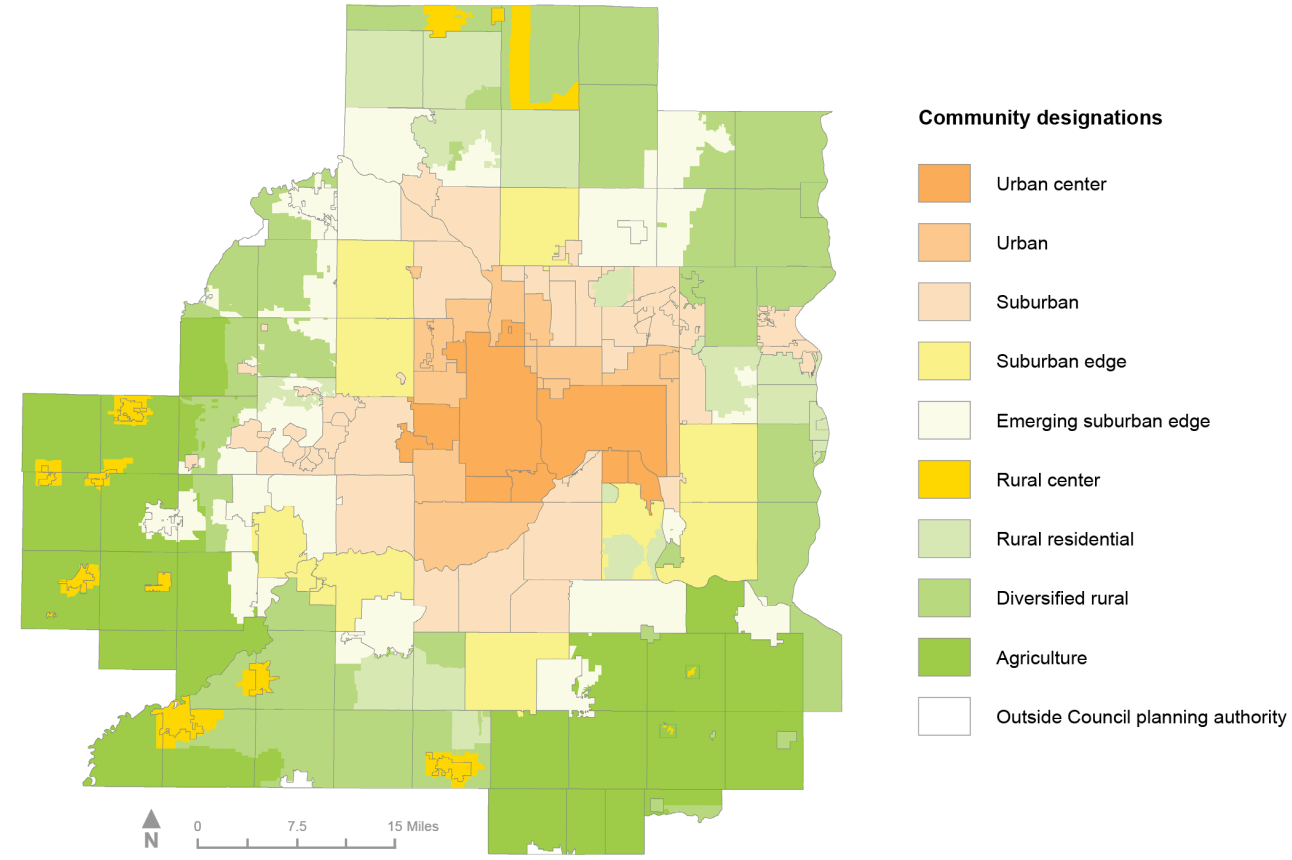
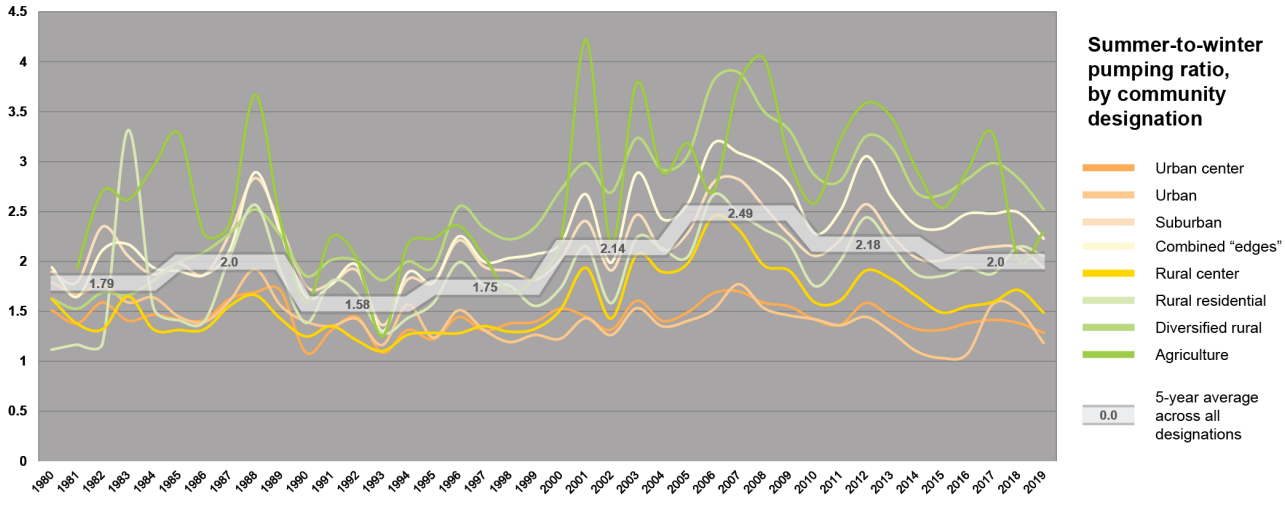


Figure 21. How summer versus winter water use varies by community designation. This information illustrates the benefit of tailoring regional water policy development and technical assistance by community type or designation; different communities have significantly different water demand patterns and challenges.





Data source(s): Metropolitan Council

Figure 22. Water monitoring by state water agencies and Metropolitan Council. While both groundwater and surface waters are monitored by multiple organizations across the region, there are opportunities to better coordinate these efforts to address growing questions around the interaction of groundwater and surface water systems.

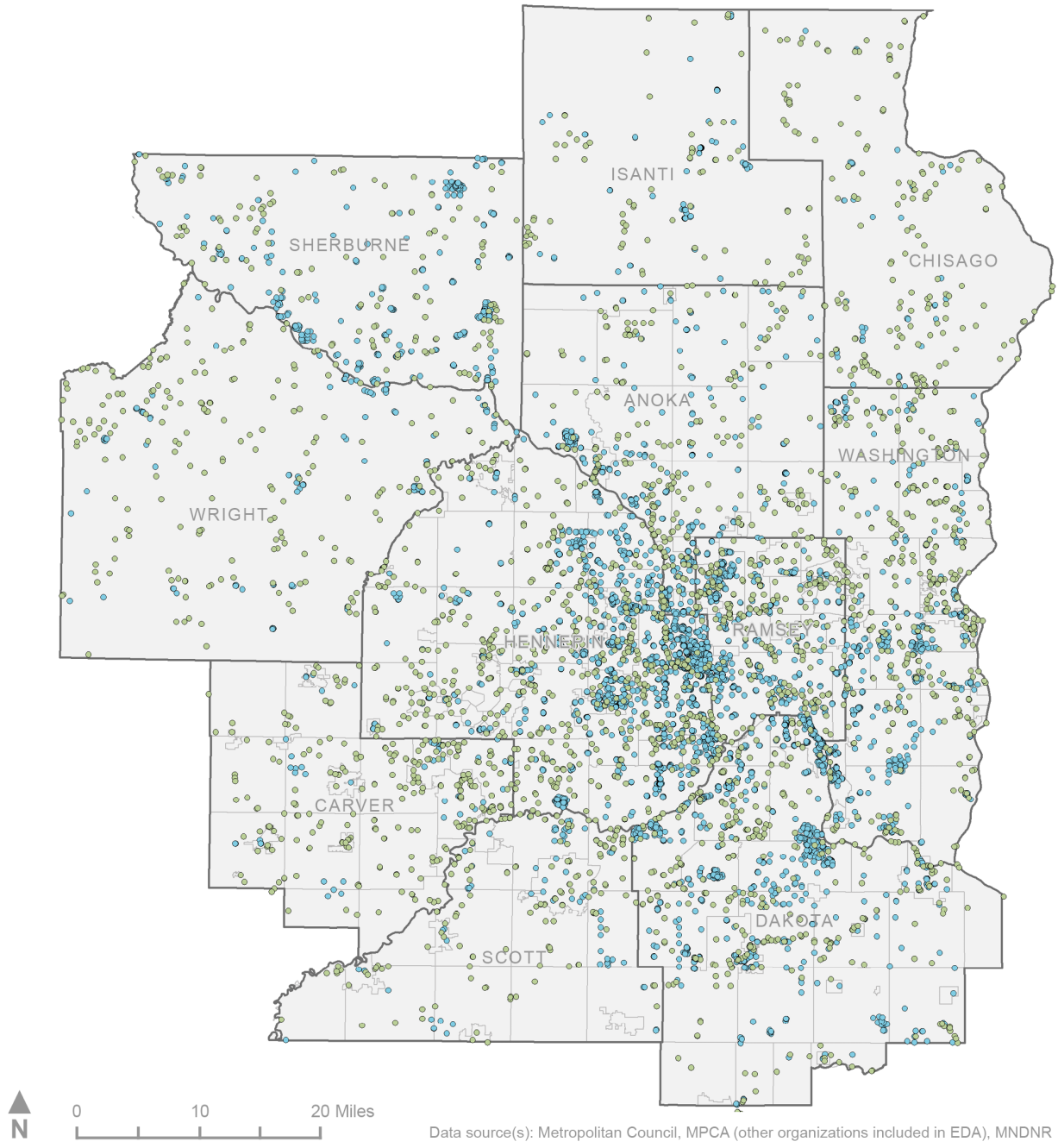


Figure 23. Waters evaluated for the Priority Waters List, highlighting surface water sources of drinking water. Information included in the Priority Waters list can guide resources to monitor, assess, plan for, and improve the region's water bodies to benefit drinking water supplies. It can also provide a key lens for developing regional policies and supporting activities.

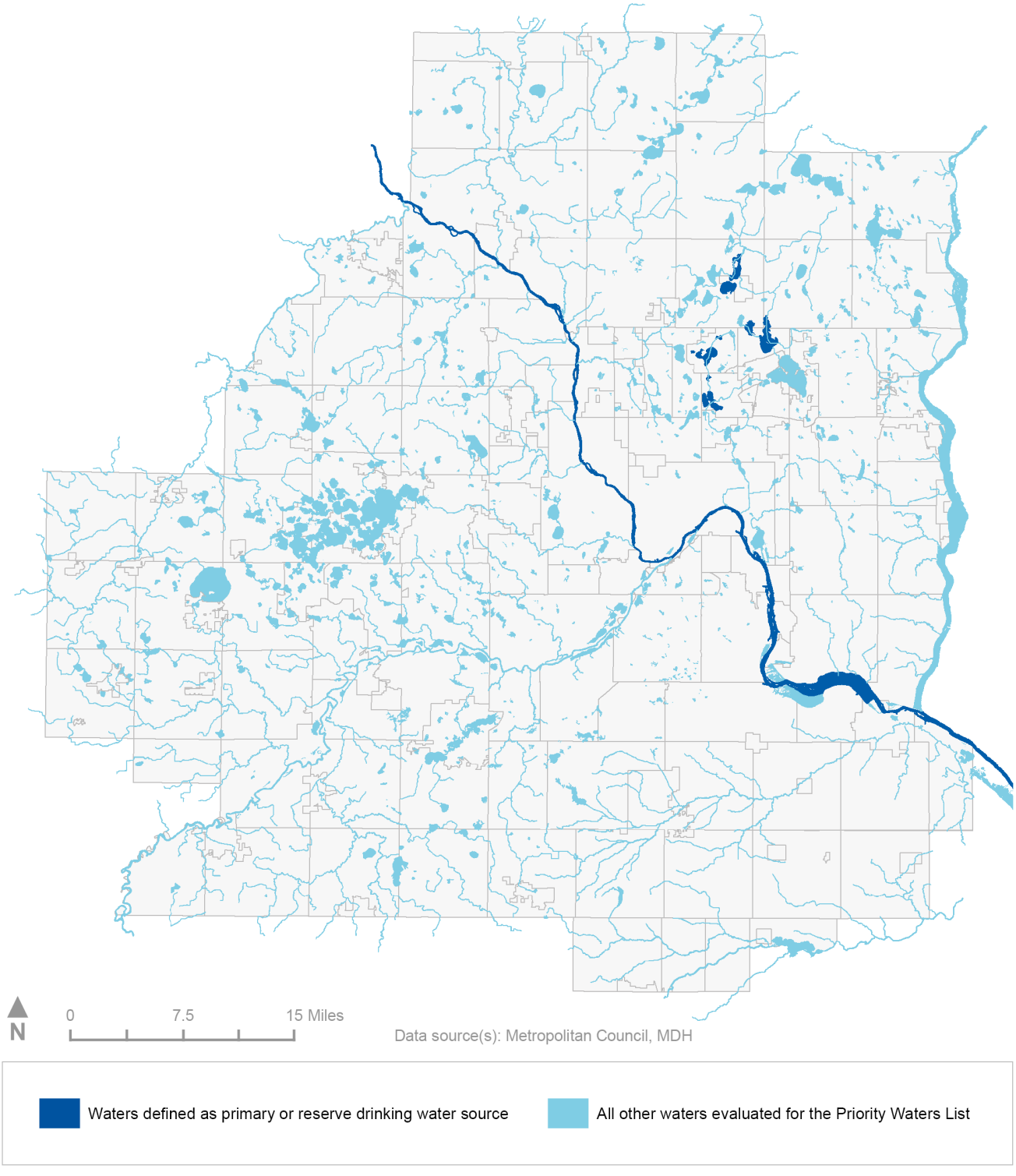


Table 1. Activities recommended by MAWSAC and TAC to address challenges and achieve goals in their four priority focus areas. Activities are listed by the steps of the framework for action and categorized by focus areas (light blue cells). When strategically planned, these committee-recommended activities inform one another and work together to advance committee goals. The scope of work on the activities below should be refined with input from the committees, subregional water supply work groups and other stakeholders.

#	Complete list of recommendations considered by MAWSAC and TAC in 2021	Highlighted Funding Need	Water Quality	Land Use & Water Supply	Groundwater-Surface Water Interaction	Water Supply Infrastructure
A.	**Collaboration and capacity building**					
1.	Pool collective expertise relationships among subregional workgroups, wellhead managers, land use planners and developers, and watershed management organizations to address increasingly complex water problems that extend outside their jurisdictions and require a system thinking approach. Examples: contamination mitigation and integrated consideration of water supply, watershed management, and wastewater.		✓	✓	✓	✓
2.	Participation in and support for Minnesota Source Water Protection Collaborative and subregional partnerships, including agricultural-related groups. Examples: proposed Dakota County Groundwater/Source Water Collaborative, Anoka County Municipal Wellhead Protection Group.		✓	✓		
3.	Support legislative and Clean Water Council recommendations. Example: MAWSAC or TAC input to Legislative Water Policy Committee process to prioritize and promote issues.		✓	✓	✓	✓
4.	MAWSAC and TAC share input on rules and guidance on key water supply contaminants with State agencies.		✓			✓
5.	Collaborate with and support PCA and other state agencies to identify and publish best management practices for communities interested in water reuse.		✓	✓	✓	✓
6.	Prioritize inter-agency collaboration to understand the effectiveness of infiltration as a stormwater management practice, particularly under a range of potential climate futures (high and low water tables).		✓	✓	✓	
7.	Support a multi-community approach to streamline and increase the impact of wellhead protection plan updates and implementation projects that extend beyond the political boundaries of one community. May include revisions to Minnesota Rules.		✓	✓	✓	
8.	Engage communities to understand residents' water values, to better understand the implications of the wide range of our region's citizens view their water and to support more targeted and effective outreach.		✓	✓	✓	✓
9.	Support regular multi-community emergency response planning and training such as table-top exercises.		✓			✓

#	Complete list of recommendations considered by MAWSAC and TAC in 2021	Highlighted Funding Need	Water Quality	Land Use & Water Supply	Groundwater-Surface Water Interaction	Water Supply Infrastructure
10.	Create and promote a regional campaign for local decision makers and residents with educational material and content customizable by communities. Useful information and resources to consider include: • The value and quality of treated water provided by utilities, building from work with Minnesota Department of Health (MDH) and communities on language in consumer confidence reports • The region's natural and built water systems including the connectedness of groundwater and surface water resources • Water related challenges such as emerging contaminants and climate change • Current understanding of potential climate change impacts to aquifer recharge, water tables, and water flows and need for additional work • Benefits and feasibility of water reuse • Regional and sub-regional/local water budgets with a visual tool • Unified message around contaminants with potential to impact public water supplies (example: DWSMAs) • Water system and geology programming for school systems (could include interpretation and use of County Geologic Atlases)		✓	✓	✓	✓
B.	**System Assessment**					
1.	Identify data gaps and information needs, and leverage State resources, professional organizations, and programs to compile common/shared water quantity and quality monitoring and other data to improve accessibility and value to water resource managers and metro residents (example: developing new approaches to fill gaps in metro area hydrogeologic mapping). • Consider community sharing of SCADA well pumping data for regional mapping of aquifer levels • Combine groundwater level data from USGA, state water agencies, and Met Council to evaluate interactions		✓		✓	✓
2.	Expand water level monitoring programs to increase local and regional understanding of groundwater – surface water interaction and the impact of aquifer drawdown on contaminant fate and transport mechanisms. Look for opportunities to leverage internet of things (IOT) technologies.		✓	✓	✓	✓

#	Complete list of recommendations considered by MAWSAC and TAC in 2021	Highlighted Funding Need	Water Quality	Land Use & Water Supply	Groundwater-Surface Water Interaction	Water Supply Infrastructure
3.	Research to better understand metro area water balances during both wet and dry periods. Examples: • Identify costs and barriers to better understand the State's water cycle budget. • Analyses to better understand water routing, the impact of land use changes and development on water routing, and how groundwater recharge, shallow groundwater, and surface flows are impacted. • Updated models of metro area's water cycle and budget to support better understanding of quantity and quality interactions between climate, water users and utilities, surface waters, and groundwater (examples: nitrate movement in Dakota County, impacts of artificial recharge on aquifers, projections of climate change).		✓	✓	✓	✓
4.	Research to understand how contamination moves between and impacts groundwater and surface water. Examples: research stations in areas of high groundwater-surface water interaction to study quality and quantity impacts of large-scale infiltration projects, pumping centers near sensitive groundwater-supported surface waters, etc..		✓		✓	✓
5.	Develop an exploratory research framework to identify regional and/or subregional water quality patterns and trends, using an aggregate approach to monitor drinking water, wastewater, and surface water.		✓		✓	
6.	Analyze feasibility of physical interconnections, given water quality implications, agreements, condition, goal of interconnection, and ownership.		✓			✓
7.	Identify and publish data about the presence of key contaminants in drinking water supplies throughout the metro area and develop shared criteria for what is a level of concern or when remediation is needed. Example: map of various monitoring, coded by if results exceed limits or not to help people better understand their risks.		✓			
8.	Enhance monitoring or join existing programs (like MN Depart of Agriculture's Township Testing Program) to monitor and analyze the quality of surface water, groundwater, and wastewater – including contaminants of emerging concern, as appropriate – to support the assessment and protection of the region's water resources (targeting Council-owned property management and system operations and priority waters).		✓		✓	
9.	Identify and publish presence of contaminants in drinking water supplies in metropolitan area.		✓	✓		✓
10.	Consistently delineate wellhead protection areas using updated data and analytical approaches.		✓	✓		
11.	Use forecasts that consider a range of future scenarios to support 2050 local comprehensive plan updates and longer-term water system options and alternatives guided by local needs and capabilities.		✓			✓
12.	Analyze relationships among equity and socioeconomic factors, water rates, and infrastructure investments (example: lead service line replacement).			✓		✓

#	Complete list of recommendations considered by MAWSAC and TAC in 2021	Highlighted Funding Need	Water Quality	Land Use & Water Supply	Groundwater-Surface Water Interaction	Water Supply Infrastructure
C.	**Mitigation Measure Evaluation**					
1.	Document benefits and drawbacks for water supply infrastructure from redevelopment versus new development in the metro area.			✓		✓
2.	Research to quantify how different land uses and development practices impact source water areas, water supply.		✓	✓		✓
3.	Identify and recommend opportunities to increase funding and outreach for agricultural practices to protect source water.	**$**	✓	✓		
4.	Analyze and create maps of areas where development should be guided for water supply sustainability. Example maps may include source water protection and availability challenges caused by the intersection of groundwater, geology, topography, infrastructure, current and future development density, water storage, etc.		✓	✓	✓	✓
5.	Identify and recommend opportunities to increase incentives for communities to conserve natural lands or shift land use to protect source waters, to help offset tax revenue that may be lost on conserving versus developing land. Example: fund investigation and programs to move unlined landfills out of source water areas.	**$**	✓	✓		
6.	Identify and recommend opportunities to fund grants or other incentives for communities that are prioritizing redevelopment and high-density housing. Example: Metropolitan Council Livable Communities Grants.	**$**		✓		
7.	Identify and recommend increased funding and incentives for communities working to reduce water use and clean up sources of contamination. Examples: • Improved water conservation technology • Wetland restoration in source water areas • Enhanced infiltration/recharge projects • Remediation efforts • Improved tools to communicate water savings with residents • Improved waste disposal practices to protect regional rivers • Improved tools to understand regional benefits of density changes/redevelopment	**$**	✓	✓	✓	
8.	Research whether past actions on water conservation and reuse have been beneficial to groundwater and surface waters.				✓	✓
9.	Identify possible costs and benefits/trade-offs in combined management of groundwater and surface water resources. Example: costs to rebuild trail if infiltration causes high water tables and lake flooding or costs to run water conservation campaign if pumping must stop in order to not damage valued lake.			✓	✓	

#	Complete list of recommendations considered by MAWSAC and TAC in 2021	Highlighted Funding Need	Water Quality	Land Use & Water Supply	Groundwater-Surface Water Interaction	Water Supply Infrastructure
10.	Use the latest research to improve and update stormwater infiltration requirements and recommendations around practices, particularly in vulnerable drinking water supply management areas. Prioritize inter-agency collaboration to understand the effectiveness of infiltration as a stormwater management practice, particularly under a range of potential climate futures (high and low water tables).		✓	✓	✓	
.11.	Support public water suppliers to work with and educate city councils and managers about the value and cost of their city's water supply system. Examples: • Determine what an equitable water rate structure looks like and means for the metro area • Set rates that reflect the need to prepare for treatment upgrades		✓			✓
12.	Provide guidance for regional agencies to support public water suppliers in addressing: • Prioritizing replacement of lead service lines • Securing more and consistent infrastructure funding • Investment in infrastructure improvements to reduce risks from droughts and flooding • Long term planning for new infrastructure for areas of development or redevelopment					✓
D.	**Planning and Implementing Risk Reduction Practices**					
1.	Subregional support for multi-community planning of infrastructure and source water protection projects, where challenges and benefits extend beyond political boundaries of one community.		✓	✓		✓
2.	Subregional recommendation and support to develop contaminant action framework and create funding sources to help communities with uncertainties such as contamination and sampling efforts. Examples: grant programs to communities and private well owners for CEC sampling and response, subregional feasibility assessments, plan development and projects that address unexpected events, guidance on contaminant response and actions.	**$**	✓			✓
3.	Subregional work groups collaborate with MDH and others to recommend ways to streamline wellhead protection plan update process and encourage communities with overlapping DWSMAs to work together through Minnesota Rules.			✓		

#	Complete list of recommendations considered by MAWSAC and TAC in 2021	Highlighted Funding Need	Water Quality	Land Use & Water Supply	Groundwater-Surface Water Interaction	Water Supply Infrastructure
4.	Update Metropolitan Development Guide to recognize source water protection as a crucial public health issue that should be recognized as appropriate and feasible in all the Council's work, not just in watershed and wastewater realms. Related regional policies and programs should consider vulnerable areas within source water protection areas for both surface water and groundwater sources. Examples: • Considering high priority source water protection in property acquisition and management criteria • Considering a range of future forecast scenarios in the context of water supply availability and other water system options • Considering downstream users of surface water and groundwater sources Note: source water protection plans were a required component of local comprehensive plans until 2007 when the Council supported changes to *MS 473.859, Subd. 3* and *103G.291* to clarify and consolidate water supply planning requirements.		✓	✓	✓	✓
5.	Regional support for Council to update expectations for local water supply plans and comprehensive plan content so that land use planners and developers better understand and are empowered to implement strategies for urban and agricultural land use practices to protect critical source water protection areas. Examples: • Working with water suppliers to understand critical source water protection areas • Supporting agricultural land use practices that protect ultimate source areas • Consideration of water supply issues in land use planning • Establishing emergency response plans to discovered contamination • Promotion and information about native plant species that reduce water use and protect source waters • Using forecasts that consider a range of future scenarios to support planning of comprehensive plans and water systems		✓	✓	✓	✓
6.	Enhance and target guidance and incentives through Council programs that create new and/or leverage existing contamination prevention and mitigation programs. Examples: MN Technical Assistance Program (MnTAP), Council Tax Base Revitalization Account.		✓	✓		
7.	Regional creation of grants for communities to support water efficiency and reuse programs or projects, particularly those that help respond to emerging contamination and/or reduce the amount of treated drinking water used for non-potable demands.	**$**	✓		✓	✓
8.	Regional support to increase state funding to augment existing sources of funding to implement water supply system plans, when rapid response is needed after low probability or unlikely events (significantly changing water tables, water quality).	**$**	✓		✓	✓

#	Complete list of recommendations considered by MAWSAC and TAC in 2021	Highlighted Funding Need	Water Quality	Land Use & Water Supply	Groundwater-Surface Water Interaction	Water Supply Infrastructure
9.	Support the use of Metropolitan Council's Local Planning Assistance program's resources for community planners and public water suppliers to protect source water areas. Resources include: • Information about the location, vulnerability, and population served by source water areas • Model ordinances and other best practices • Tools to target well sealing programs (examples: Fridley, Edina) • Checklist for source water protection analysis for new construction • Customizable education campaign materials for public water suppliers highlighting the value of protecting source water, water treatment methods and costs, and how community members' actions impact health. • Clearing house of suggestions from public water suppliers to join land use in water supply (example: review development codes and modify if it can benefit water supply)			✓		
10	Regional support for programs that fund the costs of infrastructure asset renewal and recommend increased state funding to better meet this need.	$				✓
.11.	State and regional support to develop a protocol/operating procedure for communities facing newly found contamination as well as responding to potential decreases in contamination limits, streamlining regulatory direction to communities, while increasing transparency in how those decisions are made.		✓			
12.	Subregional support for local coordination of land use planning and environmental benefits and protection. For example: wellhead protection plans included in become a required component of local comprehensive plan, require cleanup of vacant land that is threatening water supply		✓	✓		
13.	Establish and fund local programs for regular water quality testing at private wells, to ensure equitable access to information about water quality across the region. Example: at point of sale or through well testing clinics with partners such as MN Well Owners Organization.	$	✓			✓
14.	Local plans and funding for accelerated replacement of lead service lines and related programming and recommend increased state funding to better meet this need.	$	✓			✓
15.	Local funds and partnerships are used to leverage state and regional resources for development projects and incentive programs protect sources waters. Examples: funding investigation and programs to move unlined landfills out of source water areas, partnerships with MN Technical Assistance Program or other programs to target high-priority source water protection areas.	$	✓	✓		
16.	Local programs and Capital Improvement Plans to sustainably fund the costs of infrastructure asset renewal and save for future costs, supported by the State of Minnesota.	$				✓

Table 2. The following is adapted from a Minnesota Department of Health (MDH) summary of commonly associated potential contaminants found within common land covers/land use types. This information can be used to assess potential contaminants in source water areas and shape source water protection approaches.

National Land Cover Category	MDH Land Cover	Potential sources of contaminants
Barren Land	Barren Land	• Mining • Pit (aggregate) • Stormwater runoff
Open Water; Woody Wetlands; Emergent Herbaceous; and Wetlands	Wetlands and Open Water	• Stormwater runoff • Road or rail crossing over water
Pasture/Hay; Grassland/Herbaceous; and Cultivated Crops	Pasture/Hay/Cultivated Crops	• Land application (biosolids, septage, pesticides) • Nutrient application and management (commercial fertilizer, animal waste) • Feedlots • Storage and preparation area (tanks, ag chemicals, petroleum products)
Developed, Open Space	Developed-Open Space	• Wells • Septic systems • Turf management • Chemical application and storage
Developed, Low Intensity and Developed, Medium Intensity	Developed-Low and Medium Intensity	• Wells • Septic systems • Turf management • Chemical application and storage • Stormwater basins, drains, and infiltration practices • Stormwater runoff • Above ground storage tanks • Class V wells • Transportation corridor
Developed, High Intensity	Developed-High Intensity	• Wells • Septic systems • Turf management • Chemical application and storage • Stormwater basins, drains, and infiltration practices • Stormwater run off • Above ground storage tanks • Class V wells • Transportation corridor • Road and rail crossings (spills over water) • Solid waste management site • Pipeline • Gravel pit • Suspected contaminant of concern • Hazardous waste handler, generator
Deciduous Forest; Evergreen Forest; Mixed Forest; Shrub/Scrub	Forest	• At this time there are no potential contaminate sources identified

Definitions and Abbreviations

Aquifer – A saturated geologic formation that will yield enough water to serve as a private or public water supply.

Best management practices – A set of recommendations pertaining to the development and maintenance of varied land uses, aimed at limiting the effects of development, such as soil erosion and stormwater runoff, on the natural environment.

BWSR – Minnesota Board of Water and Soil Resources

Community designation – Community designations group communities with similar characteristics into typologies that help target policies for growth and development. For descriptions of specific community designations, refer to Metropolitan Council's Thrive MSP 2040 at: http://metrocouncil.org/Planning/Projects/Thrive-2040.aspx.

Contaminant/contamination – an impure or hazardous substance

Contaminant of emerging concern – People and industries use tens of thousands of unregulated chemicals in industrial and household products and applications. In the late 1990s, scientists began developing new methods to test for unregulated chemicals in the environment. The resulting research shows a vast array of previously unrecognized chemical contaminants in the environment. Most of these contaminants have not been evaluated for the risks they might pose to ecosystems, to plants, fish, wildlife — or to us, which is why we call them contaminants of emerging concern.

DNR – Minnesota Department of Natural Resources

Drinking water supply management areas – In Minnesota, this term usually refers to the areas that contributes groundwater to a public water supply well. It is the area most important to a public water supplier's drinking water source. Community water suppliers and the Minnesota Department of Health work together to designate these areas.

Equity – Equity refers to just and fair inclusion, a condition in which everyone has an opportunity to participate and prosper. Water equity occurs when all communities have access to safe, clean, and affordable drinking water and wastewater services; are resilient in the face of floods, drought, and other climate risks; have a role in decision-making processes related to water management in their communities; and share in the economic, social, and environmental benefits of water systems.

Framework – In this report, "framework" is defined as the ideas, information, and principles that form the structure of a plan or process.

Goal – Broad directional statement that describes a desired end state we strive to achieve.

Groundwater – Water stored in pore spaces of rocks and unconsolidated deposits found in the saturated zone of an aquifer.

Hazard – A biological, chemical, physical, or radiological agent in, or condition of water, with the potential to cause an adverse health effect. The potential to cause harm.

Hydrologic system – For the purposes of this report, this includes the landscape in the water supply source area, intakes and wells, treatment and storage, distribution, use, and discharge back into the environment - with or without reclamation. Also see "Water system".

Integrated water management – An approach to managing water that looks holistically at the planning and management of water supply, wastewater, and stormwater systems. Integrated water resource management focuses on the water cycle as a single connected system and promotes coordinated development and management of water, land, and related resources to maximize the economic and social benefits while minimizing impacts on the environment.

Infrastructure – The American Water Works Association (2010) defines infrastructure as a collection of assets on which the continuation and growth of a community depends, such as power, roads, wastewater and water plants, and transportation and communication systems.

MC – Metropolitan Council

MDA – Minnesota Department of Agriculture

MDH – Minnesota Department of Health

Metropolitan Urban Service Area – The Metropolitan Urban Service Area includes a diverse set of communities ranging from the urban cores of downtown Minneapolis and Saint Paul to edge communities planning for staged growth and expansion. Developing at different times in the region's history, these communities include a variety of residential neighborhoods, housing types, and densities, as well as a varying mix of commercial and industrial areas. Metropolitan Council supports the Metropolitan Urban Service Area through investments such as regional wastewater services, regional highways, transit service, the Regional Parks System, and programs that support redevelopment.

Mitigation measure – A step in the water supply system that directly affects water supply quality and ensure the water consistently meets water quality targets. An activity or process applied to reduce or mitigate risk.

MNTAP – Minnesota Technical Assistance Program

MPCA – Minnesota Pollution Control Agency

Nonpoint-source pollution – Water and air pollution from diffuse sources.

Objective - Concise, measurable statement of a desired result or benefit (an output), that supports the achievement of a goal.

Point-source pollution – Any single identifiable source of pollution from which pollutants are discharged, such as a pipe.

PWS – Public water supplier

Recharge – Process by which water from rainfall, snowmelt or other sources infiltrates or seeps down through the soil below the root zone and into the saturated zone.

Reclaimed wastewater – wastewater effluent treated to a level that makes it available for use for other purposes (habitat, recreation, drinking water, or reuse)

Risk – The likelihood of harm taking place.

Risk assessment – The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for water safety and therefore should be addressed in water supply planning.

Runoff – Rainfall or snowmelt that has not evaporated or infiltrated into the soil but flows over the ground surface.

Safe yield – Safe yield is a balance between groundwater pumping and recharge. It is expressed as the amount of water that can be safely pumped from an aquifer system without damaging the aquifer, degrading the quality of the aquifer, and without allowing the long-term average withdrawal to exceed the long-term average recharge to the aquifer system.

Saturated zone – The zone below land surface with only water filling its pore spaces. The upper boundary of the saturated zone, open to atmospheric pressure, is generally known as the water table.

Source water protection – Activities, generally led by public water suppliers, to protect drinking water sources from contamination and other risks. Community water suppliers and the Minnesota Department of Health work together to designate areas to focus this work (see “Source water protection areas”).

Source water protection area – In Minnesota, this term usually refers to the area that contributes water to a surface water intake. For surface water sources (like the Mississippi River), the source water protection area is the land area in the watershed upstream of the intake that is most important to the drinking water source. This is the area where public water suppliers focus activities to protect drinking water sources from contamination and other risks. The term may also refer to the area contributing groundwater to a well. Community water suppliers and the Minnesota Department of Health work together to designate these areas.

Strategy: Statement indicating the actions to be taken to achieve an objective and support achievement of a goal.

Sustainable water supply – Use of water that does not harm ecosystems, degrade water quality, or compromise the ability of future generations to meet their own needs. More details in described in the 2015 Twin Cities area Master Water Supply Plan.

U of M – University of Minnesota

Water cycle – The path that water takes through its various states – vapor, liquid, solid – as it moves throughout the atmosphere, lakes and streams, groundwater, and water infrastructure.

Water safety plan – A comprehensive risk assessment and risk management approach to drinking water supplies that encompasses all steps in water supply from catchment to consumer. For the purposes of this MAWSAC report, it also recognizes the additional steps taken from consumer to wastewater treatment and back in to the environment where it is again available as a water supply source.

Watershed – The land area that drains or sheds water into a specific receiving waterbody, such as a lake or river. As rainwater or melted snow runs downhill in the watershed, it collects and transports sediment and other materials and deposits them into the receiving waterbody.

Water system – For the purposes of this report, this includes the landscape in the water supply source area, intakes and wells, treatment and storage, distribution, use, and discharge back into the environment - with or without reclamation. Also see “Hydrologic system.”

References

Asset Management Committee, American Water Works Association. *AWWA Asset Management Definitions Guidebook, Version 1.0*. American Water Works Association, 2018.

Bartram J, Corrales L, Davison A, Deere D, Drury D, Gordon B, Howard G, Rinehold A, Stevens M. *Water Safety Plan Manual: Step-by-step Risk Management for Drinking-water Suppliers*. World Health Organization. Geneva, 2009.

Calow P, Lewandowski A, Levers L, Kirby E. *The Future of Minnesota Drinking Water: A Framework for Managing Risk*. University of Minnesota, 2020.

Metropolitan Council. *Metropolitan Area Master Water Supply Plan: Twin Cities Metropolitan Area, Minnesota*. Metropolitan Council, 2010.

Metropolitan Council. *Thrive MSP 2040: One Vision, One Metropolitan Region*. Metropolitan Council, 2014.

Metropolitan Council. *2040 Water Resources Policy Plan*. Metropolitan Council, 2015.

Metropolitan Council. *Metropolitan Area Master Water Supply Plan: Twin Cities Metropolitan Area, Minnesota (Update)*. Metropolitan Council, 2015.

Metropolitan Area Water Supply Advisory Committee. *Water Supply Now and for the Future: Steps Toward Sustainable Water Supplies*. Metropolitan Council, 2017.

Metropolitan Council. *Water Supply Planning in the Twin Cities Metropolitan Area (2005-2020): Findings, Recommendations, and Continuing Planning Activities*. Metropolitan Council, 2020.

MetroStats, Metropolitan Council. *Twin Cities Region Forecasted to Reach Four Million Residents by 2050 (2021 Update)*. Metropolitan Council, July 2021.

Ross, Lanya, and Steinweg, Emily (2021, March 23). *2021-2022 Work Plan Process and Proposal [Presentation]. Metropolitan Area Water Supply Advisory Committee*, Saint Paul, MN, United States. https://metrocouncil.org/Council-Meetings/Committees/Water-Supply-Advisory-Committee/2021/March-23,-2021/Info-Item-Work-Plan-2021-2022-MAWSAC-TAC.aspx.

US Water Alliance. *An Equitable Water Future: A National Briefing Paper.* US Water Alliance, 2017.

Additional resources:

- MN Groundwater Association white paper 'Impacts of Stormwater Infiltration on Chloride in Minnesota Groundwater'
- MDH framework for protecting vulnerable source water areas: https://www.health.state.mn.us/communities/environment/water/cwf/protecting.html and https://www.health.state.mn.us/communities/environment/water/docs/cwf/vulnacres.pdf
- BWSR guidance on groundwater protection in agricultural areas: https://bwsr.state.mn.us/sites/default/files/2021-03/GW%20Protection%20Guide_accessible.pdf
- MN DNR Watershed Health Assessment Framework
- BWSR Guide for groundwater protection in agricultural areas
- Information about economic conditions in metro: https://mn.gov/deed/data/data-tools/county-profiles/