Information Item

Water Supply Technical Advisory Committee

Meeting Date: June 18, 2024

Topic

Proposed definition of water supply sustainability for the updated Metro Area Water Supply Plan

District(s), Member(s):	All
Policy/Legal Reference:	Minnesota Statute 473.1565
Staff Prepared/Presented:	Lanya Ross, Environmental Analyst, 651-602-1803
Division/Department:	Environmental Services

Background

Our region continues to wrestle with a definition for water supply sustainability, as conditions and values continue to evolve.

TAC is asked to review and recommend revisions to the high-level regional definition for water supply sustainability included in the draft Metro Area Water Supply Plan update, to clarify and ensure it is aligned with the higher-level definition of water sustainability in the Water Policy Plan.

TAC input will be shared with MAWSAC to inform the draft Metro Area Water Supply Plan to be released for public comment. Once finalized, this definition can help inform outreach, performance evaluation, and assessments.

The second page of this document includes the two definitions, and the remainder includes supporting information on how they were developed.

Request for TAC

Review and recommend revisions to a high-level regional definition for water supply sustainability to include in the updated Metro Area Water Supply Plan, which is connected to the 2050 Water Policy Plan. Consider the following questions:

- Does the definition of water supply sustainability resonate with you and how you feel it should be considered at a local and regional scale?
- If the definition does not resonate, why?
  - Is it missing some key element from statute or experience?
  - Is wording unclear?
  - Does it need to be more measurable?
- Does the proposed 2050 Water Policy Plan definition of water sustainability sufficiently create space for or include the water supply plan definition?

Proposed definition for water supply sustainability, which was first described in the 2015 Metro Area Water Supply Plan

The current draft of the Metro Area Water Supply Plan includes a definition for water supply sustainability that was first developed for the 2015 Metro Area Water Supply Plan.

This definition incorporated statutory descriptions of sustainability from that time, considers infrastructure, and is described in a way that can be translated into more quantifiable terms to support technical analyses.

The 2015 Metro Area Water Supply Plan describes water supply sustainability as:

Water use is sustainable when the use does not harm ecosystems, degrade water quality, or compromise the ability of future generations to meet their own needs.

Considering the statutory definitions and Thrive MSP 2040, 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, and use water in a way that:

- Is efficient and conserves water
- Maintains aquifer levels consistent with safe-yield conditions defined in Minnesota statutes
- Maintains surface water by managing withdrawals, including diversions of groundwater that support them, to maintain projected flows and water levels
- Minimizes impacts to groundwater flow directions in areas where groundwater contamination has, or may, result in risks to the public health
- Recognizes uncertainty and seeks to minimize risk

Proposed 2050 Water Policy Plan explanation of general water sustainability

The introductory text of the draft 2050 Water Policy Plan includes this high-level description for water sustainability in general:

"The region's waters are not sustainable when more water is used than is available, when more is used than is returned to the source, when use harms the environment, and when water is polluted by human activities. Likewise, if stormwater, water supply, and wastewater infrastructure that treats and moves water throughout the region is put at risk, the essential services provided by these built water systems cannot be sustainable. Sustaining natural waters and the services that provide clean and plentiful water is essential for public and ecosystem health, and to ensure a high quality of life for present and future generations."

Legislative definitions related to water sustainability

The following statutes and rules should inform the definition of water supply sustainability. It is important to note, however, that the definitions should not be limited to these statutes and rules. For example, they do not include elements related to infrastructure. A Community Technical Advisory Group and the Metro Area Water Supply Advisory Group in 2014 identified a need to include consideration of infrastructure in the definition of water supply sustainability.

Minnesota Statues 103G.005 defines a sustainable diversion limit as a maximum amount of water that can be removed directly or indirectly from a surface water body in a defined geographic area on a monthly or annual basis without causing a negative impact to the surface water body.

Minnesota Statutes 103G.287, subdivision 2 prohibits groundwater appropriations that negatively impact surface waters. Subdivision 5, includes a sustainability standard for groundwater appropriation permits that prohibits uses that harm ecosystems, degrade water, or reduce water levels beyond the reach of public water supply and private wells constructed according to Minnesota Rules, chapter 4725.

Minnesota Statutes 103G.223 limit water appropriation impacts on calcareous fens.

Minnesota rules, chapter 6115.0630 define groundwater safe-yield for water table and artesian conditions.

- "Safe yield for water table condition" means the amount of groundwater that can be withdrawn from an aquifer system without degrading the quality of water in the aquifer and without allowing the long-term average withdrawal to exceed the available long term average recharge to the aquifer system based on representative climatic conditions.
- "Safe yield for artesian condition" means the amount of groundwater that can be withdrawn from an aquifer system without degrading the quality of water in the aquifer and without the progressive decline in water pressures and levels to a degree which will result in a change from artesian condition to water table condition.

Minnesota rules, chapter 8420.0935 define standards and criteria for identification, protection, and management of calcareous fens. Subpart 1 states that calcareous fans must not be impacted or otherwise altered or degraded unless the commissioner, under an approved management plan, decides some alteration is necessary.

Example of translating water supply sustainability definition into quantitative analysis of sustainable groundwater limits

In 2014, the Community Technical Work Group (pre-cursor to TAC) considered an approach to estimating the sustainable limits on the region's water supply sources. The following is a high-level summary of that work, which was shared with MAWSAC at a February 25, 2015, workshop. Project details are included in Appendix 4 of the 2015 Metro Area Master Water Supply Plan.

Use of Simulation-Optimization Modeling to Assess the Regional Groundwater System in the Twin Cities Metropolitan Area

Background

In 2014, the Community Technical Work Group requested that Met Council explore how much groundwater can be sustainably pumped in the region.

A regional groundwater model – which simulates groundwater flow throughout the region - exists for the Twin Cities metropolitan area (Metro Model 3). This model was linked to an optimization model, sometimes called a management model, to incorporate groundwater management goals and constraints into the modeling process (Barlow 2005).

An optimization problem has three key elements:

1. The objective – what is the goal?
2. The constraints – what limits how the goal can be achieved?
3. The decision variables – what can be changed to achieve the goal?

The optimization elements are translated into mathematical functions, and the groundwater model is then run thousands of times to identify the solution that best fits the three elements.

The result is an estimate of regional and subregional groundwater pumping that is likely to maintain desired groundwater conditions. This amount can be compared against current and projected water demand to estimate the amount of water that may be more sustainably supplied by alternatives to groundwater pumping.

The model is not expected to provide a guaranteed best solution, but it provides useful information about the sustainability of the region's groundwater supply.

Objective – what is the goal?

The objective of this effort is to maximize groundwater pumping in areas around existing permitted high-capacity wells (figure 1).

This objective recognizes the value of past investments in water supply infrastructure and seeks to maximize their use and reduce the cost of expanding infrastructure into new areas.

Constraints – what limits how the goal can be achieved?

While we want to maximize groundwater use, it must be done in a way that does not cause unacceptable: aquifer level decline, reduction in groundwater going to connected surface waters, changes in flow direction across areas of significant groundwater contamination.

Decision Variables – what can be changed to achieve the goal?

During the optimization model process, pumping rates were allowed to change at permitted wells in the seven-county metropolitan area, with some exceptions.

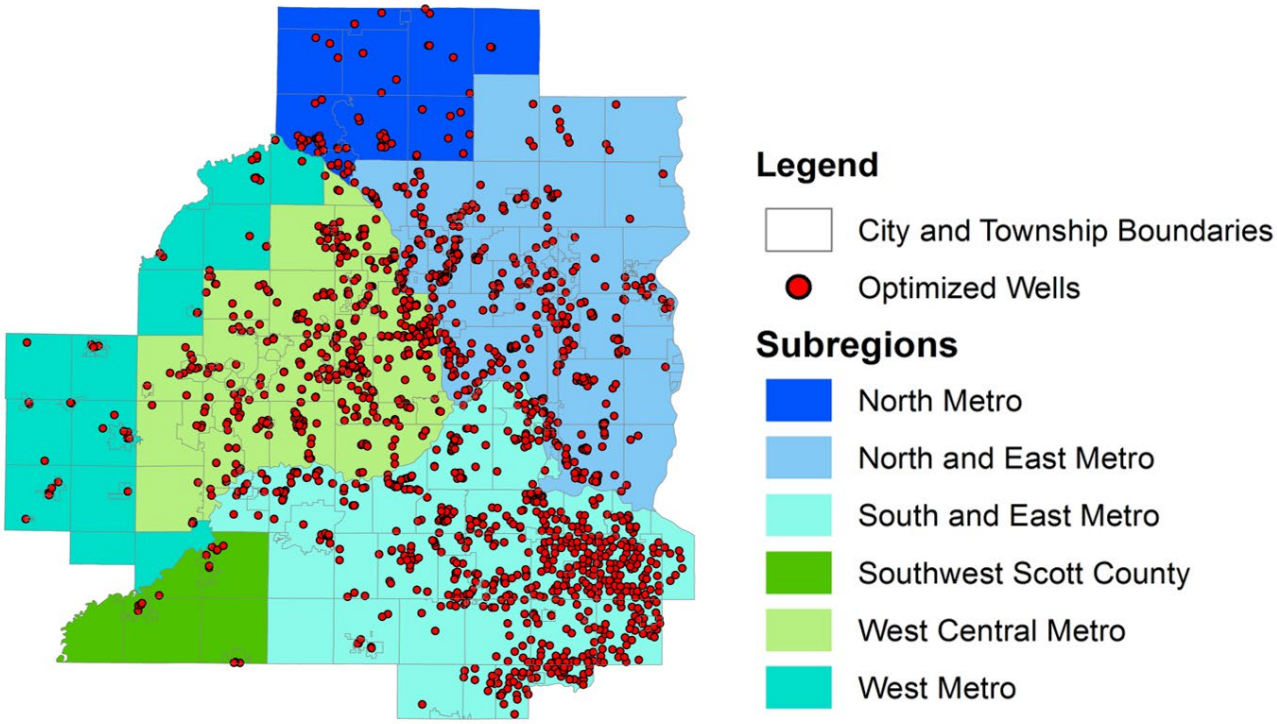

Figure 1. Map of high-capacity wells used in the simulation.

References

1. Use of Simulation-Optimization Modeling to Assess Regional Ground-Water Systems, 2005, Paul M. Barlow, U.S. Geological Survey Fact Sheet 2005-3095 (http:l/pubs.usgs.gov/fs/2005/3095/)

2. Simulation-optimization approach to management of ground-water resources in the Albuquerque area, New Mexico, 2006 through 2040, 2004,Bexfield,Laura M.; Danskin, Wesley R.; McAda, Douglas P., USGS Scientific Investigations Report: 2004-5140 (http://pubs.er.usgs.gov/publication/sir20045140)