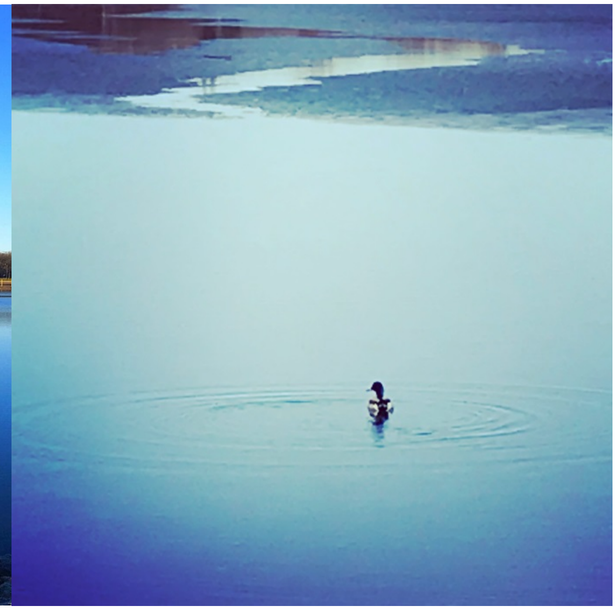
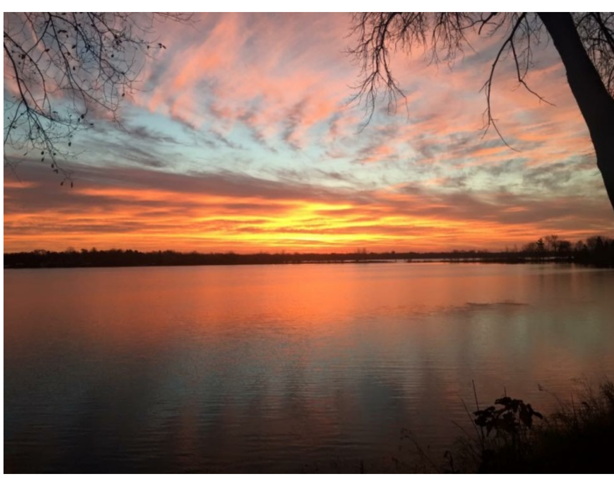



Water in Big Lake:

Wetlands, Groundwater, Wastewater, and the Causes Behind Water Bills

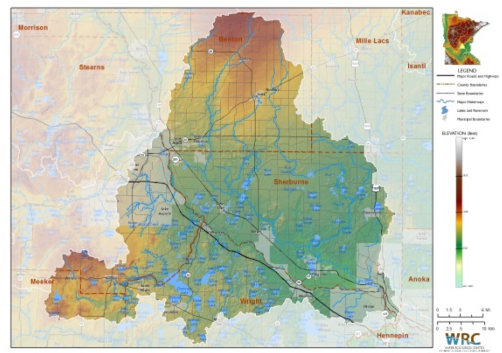



Put succinctly: Higher water bills are caused by citywide growth and stricter water quality goals and standards which have been put in place because of polluted and impaired water bodies, which in turn are caused by wetland destruction and both point and nonpoint source pollution. Big Lake's goal is to maintain our water quality and stop our lakes, river, and wetlands from becoming polluted.

But it is actually much more complicated than that simple answer. The City of Big Lake has characteristics which make water treatment a necessary priority. This document will explain the causes behind our water treatment facilities, some of the causes behind water bills, and how individuals can help to protect our valuable water.

History

- Big Lake is in the Mississippi River -St. Cloud Watershed. Rivers and creeks in the watershed drain surface water to the Mississippi River. Thus, land use, including farming and urban development, affects the water quality in all of the streams, lakes, and wetlands of the watershed.
- Watershed quality is important because water from the lakes, rivers, and streams (in addition to rainwater) is what populates the aquifers and supplies groundwater to the City.



MISSISSIPPI RIVER - ST. CLOUD MAJOR WATERSHED

- Big Lake is spilt between two groundwater provinces (according to the Department of Natural Resources): the metro province and the central province. The geologic formation affects water quality in all cities and is thus important information.
    - Metro province: Sand aquifers in generally thick (greater than 100 feet) sandy and clayey glacial drift overlying Precambrian sandstone and Paleozoic sandstone, limestone, and dolostone aquifers.
    - Central province: Sand aquifers in generally thick (greater than 100 feet) sandy and clayey glacial drift overlying Precambrian and Cretaceous bedrock. Fractured and weathered Precambrian bedrock is used locally as a water source.
    - Big Lake is built upon sandstone, siltstone, and minor shale. It is located within the Lower Cretaceous Aquifer.
- Most of the soils in and around Big Lake are very sandy, which allows surface water to drain easily to the aquifer. This is why it is vital that we protect our surface water quality (lakes, rivers, and wetlands) in Big Lake. An aquifer is an underground layer of rock and gravel that holds water and may be tapped for drinking or crop irrigation.
- In contrast, soils near the Elk River and to the north of that stream tend to be "hydric," meaning that they hold much water. This is a result of their geologic history and the high ground water level.
- Until 1981, all of the housing and businesses in Big Lake used on-site, private wastewater treatment systems. These systems, in combination with small lots and soils that are either too well or too poorly drained, (particularly near the lakes and in the north), may have posed health risks. Now, a municipal sanitary sewer system has mitigated that problem.

Wetlands and Groundwater

What is a wetland?

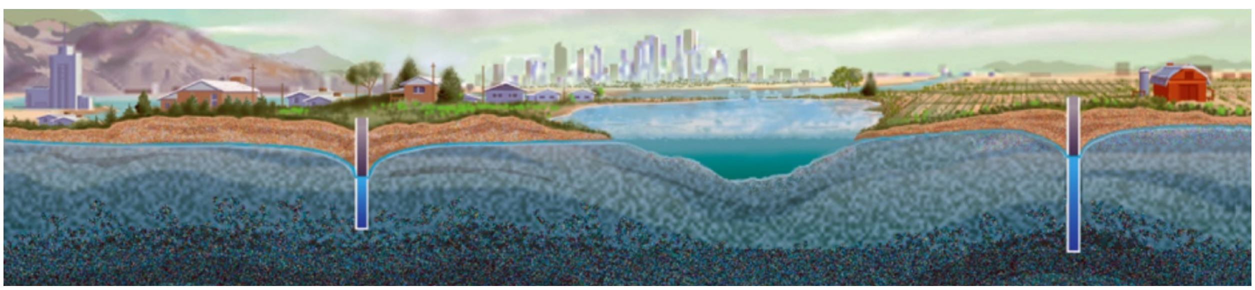
- Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season.

What is groundwater?

- Groundwater is fresh water (from rain or melting ice and snow) that soaks into the soil and is stored in the tiny spaces (pores) between rocks and particles of soil.

There is a long history of draining and filling Minnesota wetlands to accommodate settlement and development. Nearly 40% of the state was some form of wetland 150 years ago; now that percentage has been cut in half. The loss of wetlands has meant a loss of water quality benefits and has contributed to the degradation of streams, lakes, and groundwater.[1]

Groundwater is the source of drinking water for about 75% of all Minnesotans and provides almost all of the water used to irrigate crops.[2]



Groundwater in parts of the central and southwestern regions of the state is contaminated with high nitrate concentrations from agriculture and, to a lesser extent, failing septic systems. Nitrate levels are higher in groundwater under agricultural land than water below urban areas. This is because nitrate comes from nitrogen, a plant nutrient supplied by inorganic fertilizer and animal manure. Additionally, airborne nitrogen compounds given off by industry and automobiles are deposited on the land in precipitation and dry particles. Other nonagricultural sources of nitrate include lawn fertilizers, septic systems, and domestic animals in residential areas.

Beneath agricultural lands, nitrate is the primary form of nitrogen. It is soluble in water and can easily pass through soil to the ground-water table. Nitrates from cropland runoff can seep into groundwater, particularly into shallow wells drilled in sand-and-gravel soils. Nitrate can persist in ground water for decades and accumulate to high levels as more nitrogen is applied to the land surface every year.[3] The nitrate levels in Big Lake are currently quite low, and in order for it to stay this way, we need to protect our water quality.

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[1] https://www.pca.state.mn.us/water/threats-minnesotas-wetlands
[2] https://www.pca.state.mn.us/water/state-groundwater
[3] https://water.usgs.gov/nawqa/nutrients/pubs/wcp_v39_no12/

The quality of groundwater varies around the state. Even within an aquifer, the quality can change at different depths. The overuse of groundwater threatens surface water quality, and draws contaminated near-surface water into our drinking water aquifers.[4]

In general, water is being drawn out the state's aquifers faster than it is being replenished. If this overuse continues, groundwater may not be available as needed in the future. And groundwater availability is not only an issue for people; discharge of groundwater to surface waters allows streams to flow beyond rain and snowmelt periods and sustains lake levels during dry spells. The sustained lakes and streams in turn support a variety of plants and animals.[5]

Nitrogen/Nitrate

Nitrogen is a key, high-volume pollutant in state waters and its concentrations in both surface and groundwater have been increasing over time. Nitrate (a form of nitrogen) in lakes, rivers, and streams is toxic to fish and other aquatic life; in drinking water, it's potentially harmful to humans. Proposed reductions in nitrogen will benefit both Minnesota waters and water downstream from us, particularly the oxygen-depleted "dead zone" in the Gulf of Mexico.

Phosphorus

Phosphorus is a common element in agricultural fertilizers, manure, and organic wastes in sewage and industrial discharges. Excess phosphorus in lakes, rivers, and streams causes algae to grow. Algae-covered water is less attractive for fishing and swimming. In addition, phosphorus can fuel toxic blue-green algal blooms, which are harmful to people and pets.

Sediment

Sediment is composed of loose particles of sand, clay, silt, and other substances. It comes from eroding soil and from decomposing plants and animals. Much of the sediment in Minnesota lakes and rivers is contaminated by pollutants, particularly phosphorus. Sediment contributes to turbidity — cloudy water that is harmful to fish and plant life — and, in large quantities, can fill in bodies of water.

Chloride, sulfate, and other "salts"

Chlorides, sulfates, salinity, and dissolved minerals are all forms of "salts" that can harm fish and plant life at high concentrations. For example, the salt applied to roads, parking lots, and sidewalks during our icy winters contains chloride, a water pollutant. When snow and ice melts and runs into lakes and waterways, the salt goes with it.[6] We do not treat the water in Big Lake for chloride yet, but may need to do so in the future if chloride levels do not decrease statewide.

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[4] https://www.pca.state.mn.us/water/state-groundwater
[5] https://www.pca.state.mn.us/water/threats-minnesotas-groundwater
[6] https://www.pca.state.mn.us/water/pollutants-and-emerging-concerns

Costs to taxpayers

Municipalities, counties, and other local units of government often bear the cost of trying to improve water quality. City wastewater and drinking water plants must ensure clean drinking water is reaching residents, and that wastewater is thoroughly treated before being discharged into lakes or streams. Soil and water conservation districts and other local partners implement conservation and water quality-improvement practices. If water quality declines, even more resources will be needed to restore it to acceptable conditions. This will mean higher costs for taxpayers.[7]

Our infrastructure is badly in need of attention. Water systems are aging. Many equipment and pipes are at the end of or past their expected life span. Over the next 20 years, Minnesota will have some big bills to pay to upgrade wastewater and drinking water infrastructure.[8] Dependent upon state regulations, this could mean more water and wastewater treatment facility upgrades in Big Lake. We can prevent this by protecting water quality.

Wastewater and Water Treatment Plants

Wastewater Treatment

Wastewater treatment and disposal is an important part of protecting and preserving Minnesota's water resources. Wastewater can be treated at a city's treatment facility or in septic systems. Treating wastewater protects the environment and human health by removing pathogens and other contaminants before the water is discharged back into the environment.

Municipal wastewater typically refers to the collection and treatment of a community's wastewater. A city, or a group of cities, often have sewer pipes that serve all the properties in their community and deliver wastewater to a central treatment plant.

The Minnesota Pollution Control Agency (MPCA) issues permits to wastewater treatment plants that put limits on what can be in their discharged water, and requires certain types of reporting. The agency works with plant operators to help them comply with regulations and address location-specific issues. Minnesota wastewater treatment operators must be certified in order to operate a treatment facility.[9]

More information about Big Lake's wastewater treatment facility is available on the City website: http://www.biglakemn.org/DocumentCenter/View/184

Water Treatment

The raw water in the City of Big Lake contains radionuclides above the maximum contaminant level as set forth by the Minnesota Department of Health and the U.S. Environmental Protection Agency and required treatment to meet these regulations. In addition, the raw water supply has higher concentrations of iron and manganese. It was determined that an iron and manganese removal plant should be constructed and the radionuclides would be filtered out with the oxidized manganese, thereby meeting the necessary treatment standards.

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[7] https://www.pca.state.mn.us/water/why-you-should-care-about-water-quality
[8] https://www.pca.state.mn.us/featured/improving-water-quality-25-2025
[9] https://www.pca.state.mn.us/water/citizens-guide-wastewater

More information about Big Lake's water treatment facility is available on the City website:
http://www.biglakemn.org/DocumentCenter/View/183

25 by 2025 – State Water Quality Goals

- *We are at a crucial moment – we can continue to let water quality become worse or we can work together to reverse the damage that has been done and prevent future water degradation.*
  -Governor Mark Dayton, June 2017
- There are dozens of rules and regulations concerning water quality in Minnesota. Some come from the federal government such as the Clean Water Act and policies of the Environmental Protection Agency. Others are rules set by the Minnesota Pollution Control Agency and the Minnesota Department of Health.
- MN Department of Health regulations
  - Maximum Contaminant Levels
    - All public water supplies in Minnesota must meet these levels
  - Maximum Contaminant Level Goals
    - Established through a scientific process that only considers the health impacts of a contaminant in water. They are very protective, even for sensitive populations like infants, children, and others who may be at increased risk of negative health impacts.
  - Health-based Values and Health Risk Limits
    - Health-Based Values (HBVs) and Health Risk Limits (HRLs) are developed using the peer-reviewed science and public health policies available at the time of their development. An HBV or HRL is the level of a contaminant that can be present in water and pose little or no health risk to a person drinking that water. HBVs and HRLs are developed to protect sensitive or highly exposed populations. HBVs and HRLs are guidance used by the public, risk managers, and other stakeholders to make decisions about managing the health risks of contaminants in groundwater and drinking water. HBVs and HRLs are based only on potential health impacts.[10]
- Some of the rules and regulations set by the MPCA are discussed below:
  - National Pollutant Discharge Elimination System
  - Minnesota Nutrient Reduction Strategy:
    - Nitrate standards
    - Phosphorus standards
    - Nutrient Reduction Strategies: No single solution exists for achieving the level of nutrient reductions needed to meet goals and milestones. It will take many actions and best management practices implemented over large areas of the state.
      - To support the needed widespread change, the Nutrient Reduction Strategy (NRS) includes two overarching strategies:

[10] http://www.health.state.mn.us/divs/eh/risk/guidance/gw/

        - Develop a Statewide NRS Education/Outreach Campaign: Develop and implement a coordinated NRS outreach campaign that integrates with other efforts to promote statewide stewardship of water resources. This statewide campaign is responsible for raising general public awareness about the need to reduce nutrients in Minnesota waters and will support Best Management Practice specific education activities.
        - Integrate Basin Reduction Needs with Watershed Planning Goals and Efforts: As part of Minnesota's Water Management Framework, ensure that downstream nutrient reduction needs are addressed by cumulative local level efforts. Watershed restoration and protection strategies and accompanying comprehensive watershed management plans should be developed to not only have the goal of protecting and restoring water resources within the watershed, but to also contribute to nutrient reductions needed for downstream waters both within Minnesota and those downstream of the state border.
- Wastewater Strategies: The current Phosphorus Rule and Strategy has, and will continue, to address phosphorus reductions in wastewater. The adoption of river eutrophication standards in 2014 is expected to result in additional wastewater phosphorus reductions in certain watersheds. Several steps used in the successful Phosphorus Strategy are also proposed for nitrogen:
    - Nitrogen monitoring and management plans at wastewater treatment facilities
    - Nitrogen removal capacity with facility upgrade; Big Lake has done this
    - Point source to nonpoint source trading
- An approximate 20 percent reduction in wastewater nitrogen loads, along with reductions from other sources, will enable achievement of the nitrogen milestone for the Mississippi River. As facilities move forward, assessment will help to identify changes needed to existing treatment processes and technologies. Major changes to treatment plants will require significant timeframes for design and construction.
- Cropland Strategies: The Nutrient Reduction Strategy includes select cropland best management practices (BMPs) and treatment options to guide implementation; however, any combination of BMPs and treatment options that achieve the load reduction goals can be used. Agricultural BMPs recommended for the Nutrient Reduction Strategy are grouped into the following four categories:
    - 1. Increase fertilizer use efficiencies, emphasizing:
        - a. Nutrient management through reduction of nitrogen losses on corn following soybeans
        - b. Switch from fall to spring fertilizer applications
        - c. Application of phosphorus in accordance with precision fertilizer and manure application techniques
    - 2. Increase and target living cover, emphasizing:
        - a. Cover crops on fallow and short season crops such as sweet corn, corn silage, peas, small grains, and potatoes
        - b. Perennials on marginal cropland

        - c. Research and development of marketable cover crops to be grown on corn and soybean fields
    - 3. Field erosion control, emphasizing:
        - a. Tillage practices that leave more than 30 percent crop residue cover or alternative erosion control practices that provide equivalent protection
        - b. Grassed waterways and structural practices for runoff control
    - 4. Tile drainage water quality treatment and storage, emphasizing:
        - a. Constructed and restored wetlands
        - b. Controlled drainage when expanding or retrofitting drainage systems
        - c. Water control structures
        - d. Research and development of ways to store and treat drainage waters.

    - In general, the conceptual strategy for nitrogen includes increasing fertilizer and manure use efficiency through nutrient management, treating tile drainage waters, and implementing living cover BMPs. NRS phosphorus reductions from cropland are based largely on precision use of fertilizer and manure, reducing soil erosion, and adding buffers and other living cover on the landscape.[11]
- Plans for the Future
    - Public Input from the 25 by 25 Town Hall Meetings
        - In February 2017, Governor Mark Dayton asked Minnesotans for their input on how to increase the pace of progress to clean water, setting a goal of 25 percent improvement in water quality by 2025.
        - Between July and October 2017, the Governor and other state agency leaders traveled across the state to hear from Minnesotans in town hall meetings.
        - These are the proposals that came out of those meetings:

            - Education, communication, and engagement
                - Build statewide water literacy through K-12 education
                - Share knowledge among farmers and others working in agriculture to spread new approaches like cover crops, low till farming, and controlled drainage
                - Create broad media campaigns to build water ethic and promote shared values
            - Reducing runoff by holding more water on the land
                - Agricultural Areas: expand cover crops, reduce tillage, increase crop diversity, increase perennial crops, improve drainage management for better water retention, improve soil health

[11] https://www.pca.state.mn.us/sites/default/files/wq-s1-80.pdf

    - Urban Areas: expand rain gardens, improve stormwater management, expand green and permeable infrastructure, increase native landscaping
- Working together across levels of government with the public
- Locally led watershed planning
- Pollutants and drinking water
- Salt pollution
- Septic systems
- Funding
- Incentives and regulation
    - Voluntary programs
    - Regulations
    - Systemic change
    - Further study[12]

[12] http://mn.gov/gov-stat/pdf/2018_02_21_REPORT_Water_Quality_Town_Hall_Meetings.pdf

https://www.epa.gov/wetlands/what-wetland

http://files.dnr.state.mn.us/natural_resources/water/groundwater/provinces/GWProvincesnoxlines.pdf

https://www.epa.gov/sites/production/files/documents/groundwater.pdf

https://www.pca.state.mn.us/sites/default/files/wq-am1-06.pdf

https://www.pca.state.mn.us/water/watersheds/mississippi-river-st-cloud

https://water.usgs.gov/nawqa/nutrients/pubs/wcp_v39_no12/

http://www.groundwater.org/get-informed/basics/groundwater.html

http://www.health.state.mn.us/news/pressrel/2016/algae052616.html