

Yellowstone Aquifer

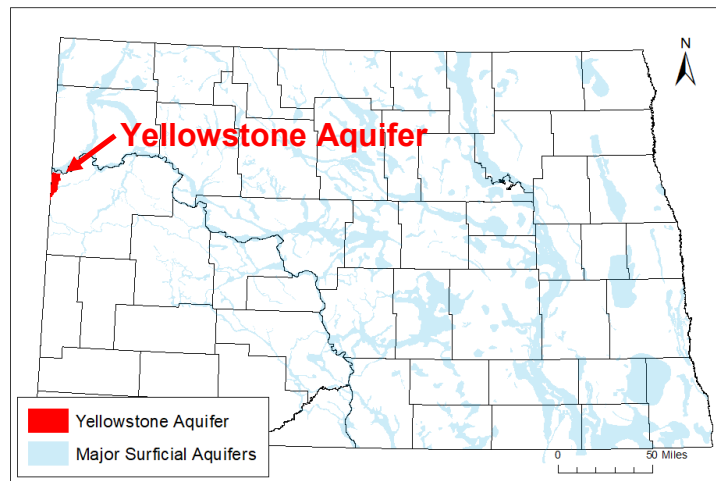
McKenzie County

Aquifer At-a-Glance

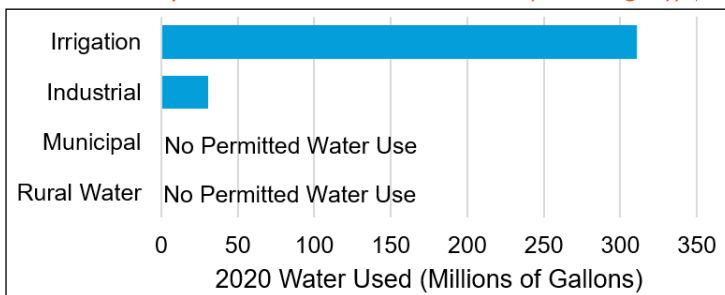
Area	45.6 square miles
Aquifer Type	Unconfined Surficial
Major Land Uses over Aquifer (percentage of aquifer area covered in 2017) ¹	Crops (66%) Open Water/Wetlands (22%)
Depth to Water (2014-2021)*	2-17 feet
Total Unique Wells Sampled	2
Wells Sampled in 2021	2
Years Sampled	2014, 2016, 2018, 2019, 2021

*Depths to water may vary seasonally, year to year, and across the aquifer

- Aquifer materials consist of sands and gravels. Most of these materials were deposited by the Yellowstone and Missouri Rivers when they were blocked by glaciers north of Williston during the last ice age.²
- The aquifer is up to 135 feet thick and averages 100 feet thick.²
- Domestic and industrial wells are common in the aquifer. Irrigation and stock wells are also installed in the aquifer.
- In North Dakota, permits are required to withdraw large quantities of groundwater. In 2020, 341 million gallons of permitted water were drawn from the aquifer; irrigation use consumed the largest quantity of water. For more information on water use and permits, contact the North Dakota Department of Water Resources (dwr.nd.gov).



2020 Yellowstone aquifer permitted water use (from North Dakota Department of Water Resources (dwr.nd.gov)) ↓



About the Western Groundwater Monitoring Program

- The North Dakota Department of Environmental Quality (NDDEQ) monitors a network of wells in approximately 20 surficial aquifers that are at elevated risk of oilfield contamination.
- Aquifers are sampled on a 1.5-year rotation.
- Monitoring began in 2013.
- The monitored aquifers are all within the oil-producing counties of northwestern North Dakota.
- Water is tested for general chemistry parameters, trace metals, diesel and gasoline range organics, benzene, toluene, ethylbenzene, and xylenes.

References

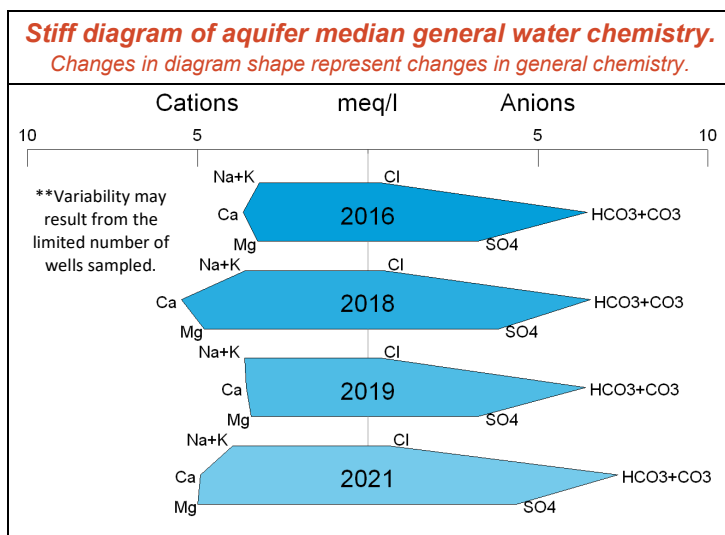
- (1) US Department of Agriculture, 2017, National Agricultural Statistics Service Cropland Data Layer.
 (2) Croft, M.G., 1985, Ground-Water Resources of McKenzie County, North Dakota, North Dakota State Water Commission County Ground Water Studies 37-Part 3, North Dakota Geological Survey Bulletin 80.

Water Chemistry

Is Aquifer Water High in...?	Analyte	Result	2021 Median Concentration	Potential Effects
	Arsenic	Locally	0.005 mg/L	Skin or circulatory system damage, increased cancer risk
	Iron	YES	7.16 mg/L	Metallic taste/odor, discoloration of surfaces
	Manganese	YES	0.64 mg/L	
	Sodium	Locally	87.9 mg/L	Taste, people with certain health conditions may need to limit intake
	Sulfate	Locally	210 mg/L	Taste/odor, laxative effect for people not used to the water
For more information about Maximum Contaminant Levels (MCLs), health effects, and treatment options for these contaminants and more, see the NDDEQ's fact sheets (deq.nd.gov/wq/1_Groundwater) or visit the US EPA website (epa.gov/ground-water-and-drinking-water).				

Dominant Water Type	Water Hardness
Calcium-Magnesium-Bicarbonate	Very Hard

Nitrate
<i>Percentage of Wells Exceeding the Nitrate Maximum Contaminant Level (MCL)* (10 mg/L as N).</i>
No Nitrate MCL Exceedances



Oilfield Compounds

Gasoline and Diesel Range Organics	
Gasoline and diesel range organics (GRO and DRO) are groups of chemical compounds containing carbon that are common in either gasoline or diesel fuel. Neither group has a regulatory limit, but the NDDEQ uses a screening level of 500 µg/L. Detections below this may be from other natural carbon sources such as decaying plant matter rather than oil byproducts.	
GRO Screening Level Exceedances	None
DRO Screening Level Exceedances	None

Chloride
Chloride is both a natural component of groundwater and a component of brine (salt water), a byproduct of oil production.
<i>Percentage of Wells Exceeding the Non-regulatory Chloride Secondary Water Quality Standard (250 mg/L).</i>
No Chloride Standard Exceedances

BTEX	
Benzene, toluene, ethylbenzene, and xylenes (BTEX) are a group of compounds that are naturally occurring in petroleum. All four have Maximum Contaminant Levels (MCLs)* that can be used as screening levels to determine the severity of any detection.	
Benzene Detections	None
Toluene Detections	None
Ethylbenzene Detections	None
Xylenes Detections	None

Bromide	
Bromide is a natural component of groundwater and can also be introduced through oil and gas extraction.	
Wells Exceeding NDDEQ's 3-5 mg/L Screening Level:	None

*Note that MCLs are for public drinking water systems; private wells are not regulated in North Dakota. MCLs still provide guidelines for drinking groundwater.

Feel free to use this information, but please credit the North Dakota Department of Environmental Quality.