



**Climate Change and Groundwater:
A Public Health Concern**

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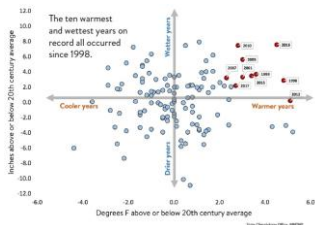
Climate Change Impacts to Groundwater occur at various time scales:

- Groundwater recharge responds to precipitation
- Immediate impacts on groundwater levels and water quality can occur within hours or days from flooding and in areas of rapid infiltration
- Intermediate impacts can occur within weeks, months or years from groundwater recharge of "sensitive aquifers"
- Long term impacts can occur within years to decades

The Minnesota Geological Survey and DNR map aquifers and sensitivity of groundwater to pollution in the County Geologic Atlas

- Groundwater supplies drinking water for 75% of Minnesotans
- Groundwater is a hidden resource that is often difficult to understand, monitor and manage

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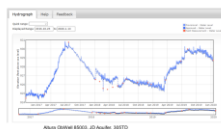


MNEQB: 2019 Environment and Energy Report Card: Climate

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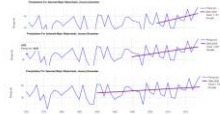
Minnesota DNR's Monitoring Well Network

Immediate Impacts on GW Levels



Intermediate and long term impacts on GW Levels

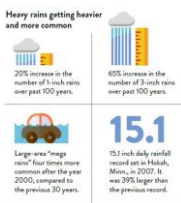
MNDNR Minnesota Climate Trends website - <https://arcgis.dnr.state.mn.us/ewr/climate Trends/>



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EQB 2019 Environment and Energy Report Card: Climate Impacts on Groundwater and Groundwater Dependent Ecosystems

- Changes in GW Depth
- Changes in GW Pressure
- Changes in GW Quality
- Changes in GW Flow Rate
- Wells and Drinking Water Supply
- Septic systems
- Basements, sub-grade structures
- Radon intrusion is caused by rising shallow groundwater
- Cropping Systems



Groundwater dependent ecosystems:

- Lakes
- Rivers and Streams
- Wetlands

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Immediate impacts of intense rains, flooding and rising GW

- Fluctuating water levels affect shorelines, water access, seeps and springs, wells, septic systems, structures and access roads.
- Houses don't float
- Flooded wells are a route to drinking water contamination
- Flooded septic systems are ruined and won't treat wastewater



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Recent Examples of public health threats from extreme rain events.

2007 Rushford Flood



- 17.5" of rain August 18, 2007
- 1700 people evacuated. 50% of homes and businesses were damaged
- WWTP and 2 of 3 Municipal wells were flooded
 - Wells were contaminated with bacteria and were disinfected and flushed 15 times.
 - One City well was sealed the other finally cleared 9 months later

Rushford Responds to Flash Flood that Submerges City and Knocks Out Utilities
From the Summer 2008 *Waterline* the Quarterly Newsletter of the Minnesota Department of Health Public Water Supply Unit

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2007 Rushford Flood

"After we worked on the problem of disinfecting wells and we were failing," said Nubbe of wells 3 and 4, "we started to wonder if there was something else than the flood water going down the well, a conduit or a channel for contamination. We weren't getting anywhere."

By March 2008 survey crews found more than 300 wells.
The wells were acting like a floor drain into the aquifers

- Rushford found wells drilled back in the 1800's that were 300 feet deep
- Old City Well #1 was beneath the floor of the Board room of the Rushford State Bank.
 - The well was 580 feet deep and only cased to 108 feet allowing contaminated flood water to flow into multiple aquifers
- An abandoned hand dug well at the old railroad depot was 14 feet across and was estimated to drain 450 gallons a minute for weeks.

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September 2019 Garvin Brook Fish Kill

Winona Post (9/30/19)

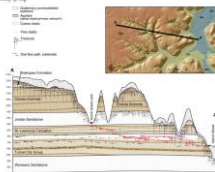
Chris Rogers

Fish kill decimates upper Garvin Brook



- Fish Kill in Garvin Brook threatens our local drinking water.

Figure 4. Hydrogeologic cross section A-A' (Hydrogeologic cross section of the Garvin Brook area in Winona County)



REPORT on the 2014-2015 dye trace conducted in the vicinity of Stockton Minnesota, Winona County, Mn Minnesota
Department/NaturalResourcesBy:JohnBarryandJeffGreen17November2015

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Private water wells were in the path of surface water infiltration

Over 50 private wells are known to exist downstream of the fish kill

- Many wells are shallow and uncased
- Some wells are hand dug

Public Health Officials were never alerted to the risk to private wells

A newly released multi-agency summary of the Garvin Brook fish claimed the incident to be a human-caused event or unknown origin related to recent heavy rains and "organic compounds" in the water.



MNWOO asked: "How much does the fish kill water need to be diluted to become safe for drinking water?"

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What do we need to do?

- Challenges:
 - We lack upscale models of GW impacts in time and space
 - We don't have good understanding of surface water/groundwater interactions
 - We don't understand the real impact of episodic events on GW resources
 - We don't have predictive models to forecast groundwater recharge
 - We lack guidance on remedial actions and mitigation
- Support MNDNR Groundwater Monitoring network and analysis of local and regional trends
- Support completion of the County Geologic Atlas
- Make Minnesota a leader in research and action to protect public health impacts of GW change
- Model and communicate the risk and the uncertainty
- Develop regional tools for defining the impact of climate change on water recharge and water quality.

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