McHenry County Groundwater Monitoring Network Report Findings and Applications

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McHenry County Groundwater Monitoring Network (MCGMN)

McHenry County has concerns regarding the sustainability and quality of their groundwater resources due to rapid population growth

- Purpose of Network: acquire groundwater level and groundwater quality data that can be used to ensure and promote resource conservation, environmental protection, and land development planning.

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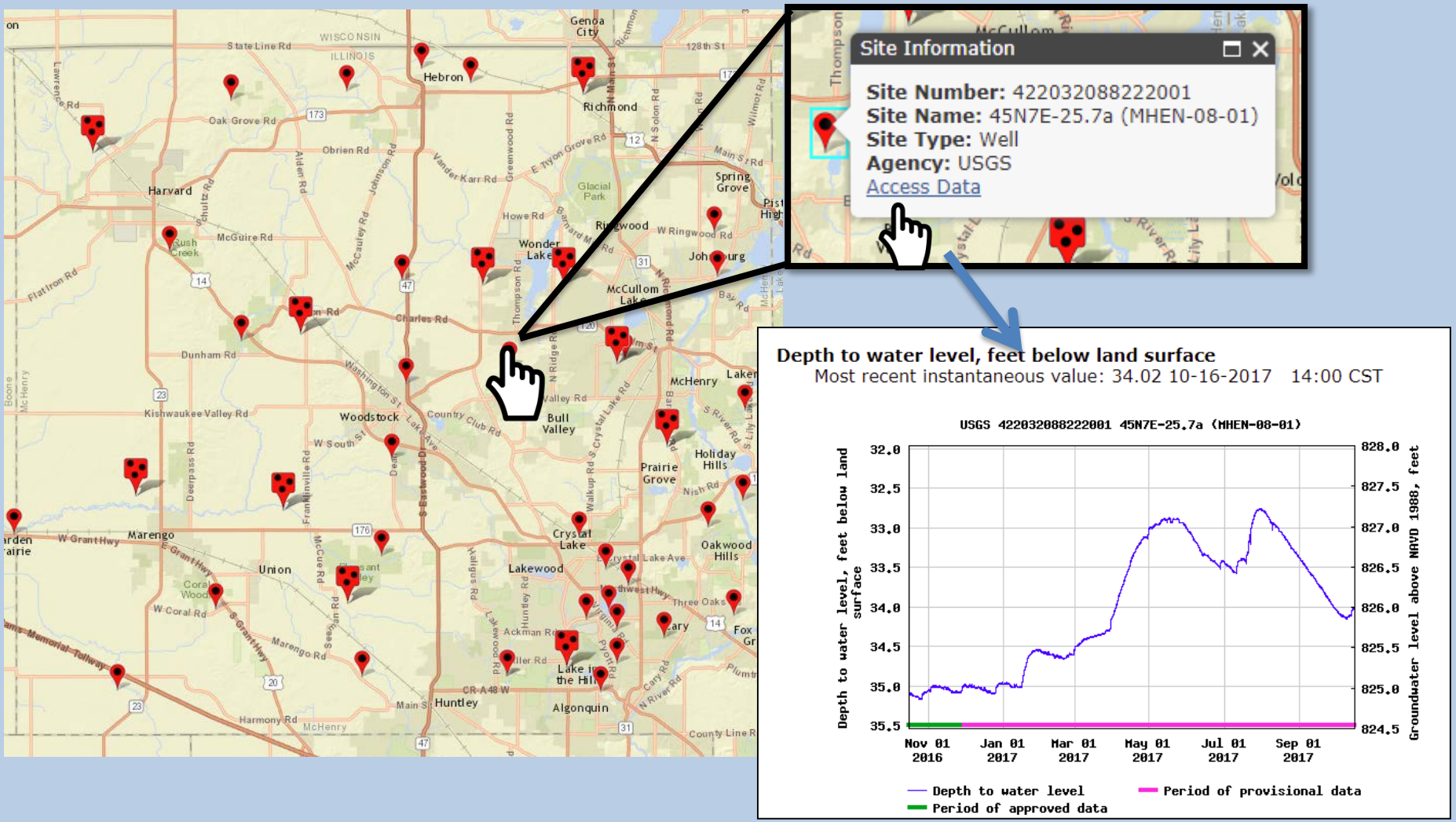
National Water Information System: Web Interface

https://maps.waterdata.usgs.gov/mapper/



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“Real-Time” Telemetry and well set-up

- Near real-time
  - Satellite transmission using GOES
    - Geostationary Operational Environmental Satellite
  - Data collected at 15-minute intervals are transmitted once every hour
  - Data hosted on real-time page, except in instances of equipment malfunction
  - The Data Collection Platform, pressure transducer, and related instrumentation is contained in a steel security box attached to the well housing and is self-powered with a battery and solar panel

https://maps.waterdata.usgs.gov/mapper/

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Data Collection for the Report

- MCGMN monitors water levels every 15 minutes at 44 wells
- Continuous Water Quality at 5 wells:
  - collected specific conductance to estimate chloride concentrations
- Water Quality Samples collected in 2010 and analyzed for major ions, metals, nutrients; a subset of all MCGMN wells were analyzed for volatile organic compounds, pesticides, and herbicides
- Sources of chloride also were estimated
- Comparison to 1979 residential well data and resampling of selected residential wells

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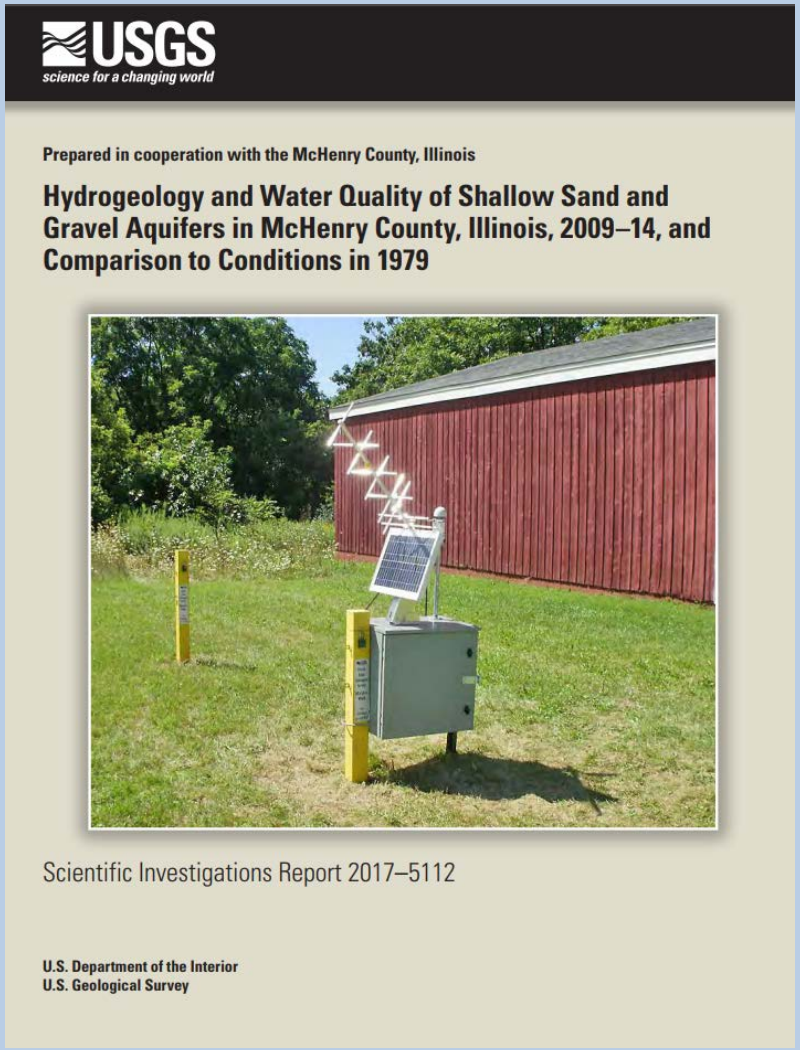

https://pubs.er.usgs.gov/publication/sir20175112

- **Baseline Water Level Data** (max, min, mean)
  - Trends in response to drought and pumping (demand)
  - Recharge quantity and recharge/discharge areas
  - Aquifer interconnection

- **Baseline Water Quality Data**
  - Chloride—including source-tracing and seasonal trends
  - sodium
  - arsenic
  - iron
  - manganese
  - total dissolved solids
  - nitrates

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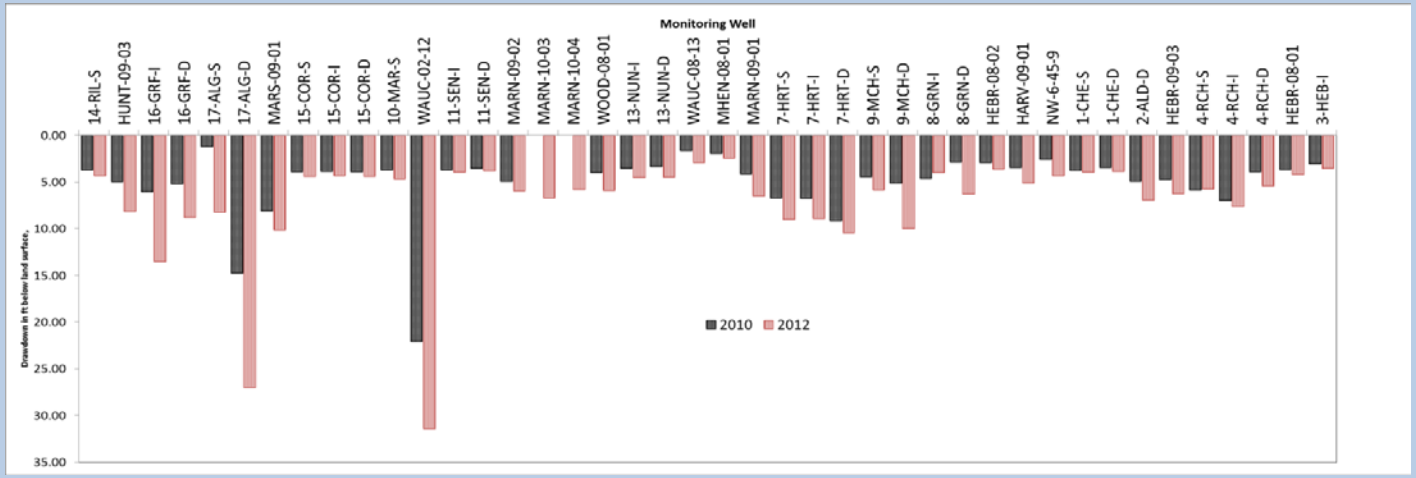
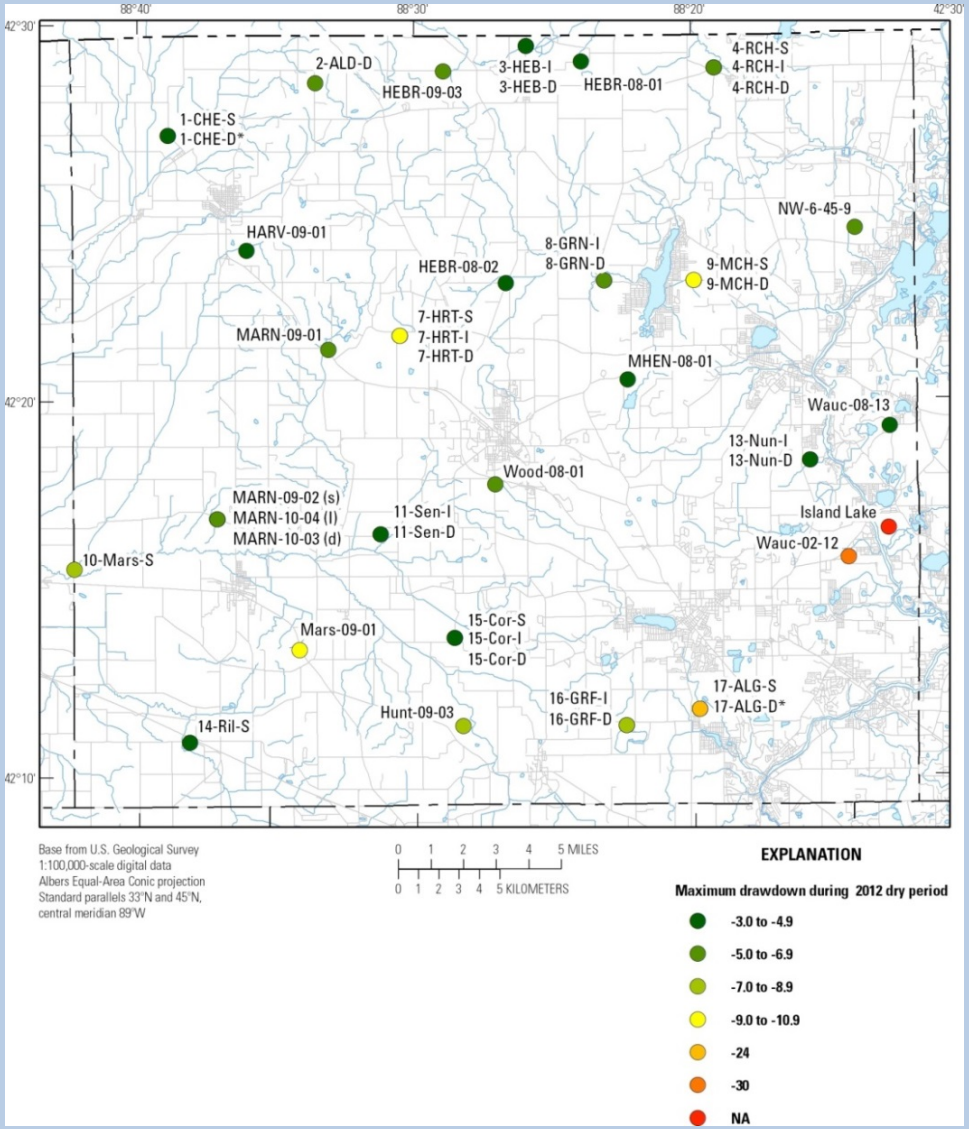
Maximum drawdown during 2012 drought





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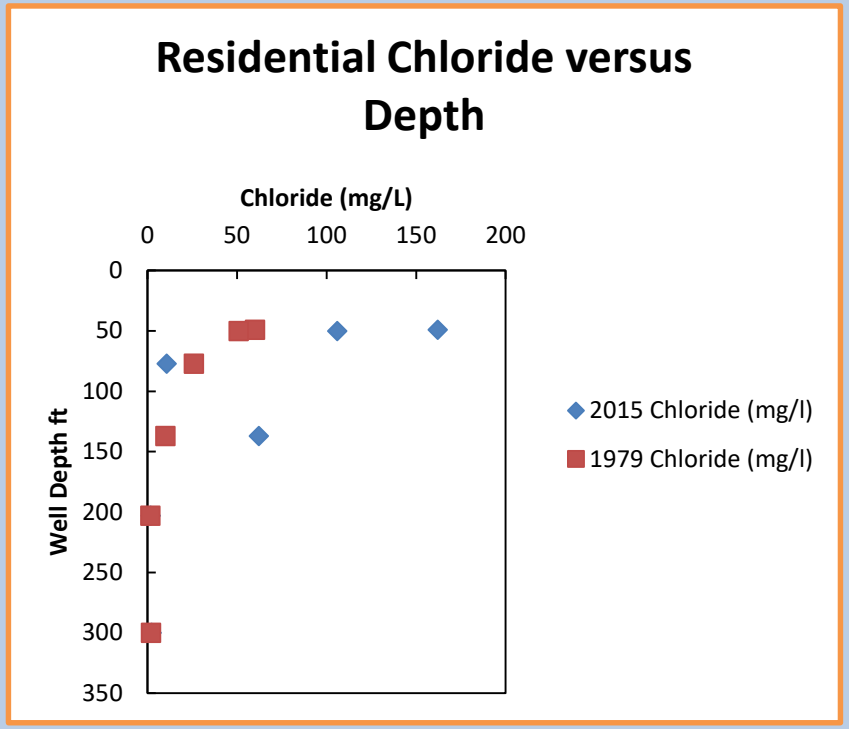
Chloride concentrations have more than doubled in most shallow residential wells

Resampled residential wells from 1979 network confirm increase in chloride concentration in most shallow groundwater (<138 ft below ground surface).

Residential Well	Well Depth (ft)	1979 Chloride (mg/L)	2015 Chloride (mg/L)
S	**49**	**60**	**162**
Y	**50**	**51**	**106**
E	77	26	10.7
L	**137**	**10**	**62.1**
Q	203	1.7	1.82
W	300	2	2.34



Chloride increased 108 to 521 percent in 3 out of 6 residential wells

Data from SIR 2017-5112

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Major Findings

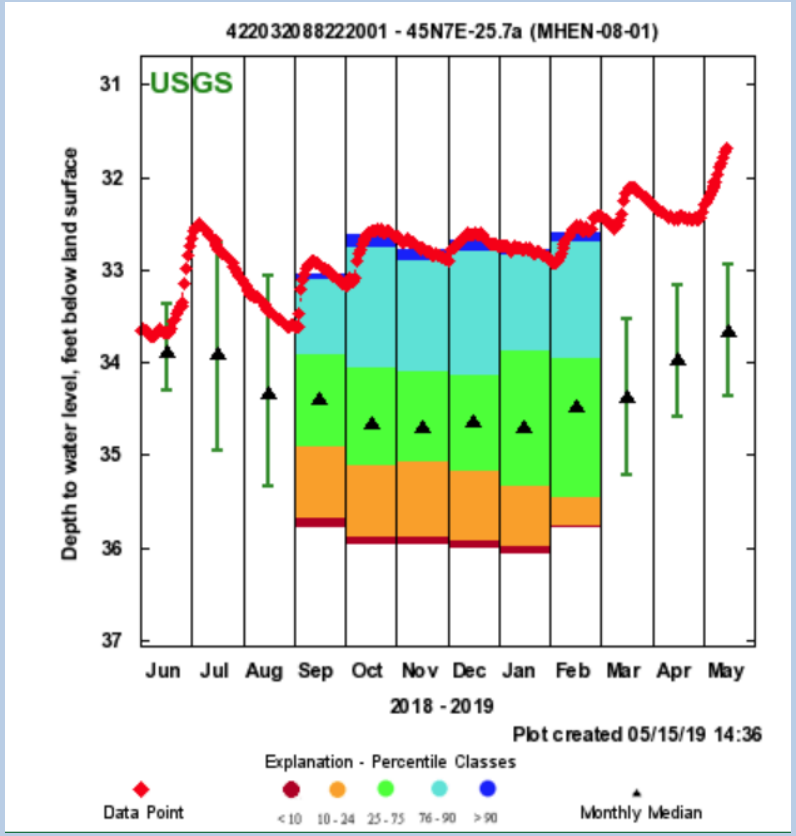
- Continuous water level data helped to identify degree of aquifer confinement and interconnections.
  - This helps water managers identify areas of water availability and potential vulnerability to surface pollutants and helps to ground-truth aquifer sensitivity and geology maps.
- Recharge estimates were calculated from water-table wells.
  - The eastern half of the county generally had higher average amounts of recharge
- Drought conditions disproportionately effect water levels in urban areas with extensive pumping.

Major Findings, continued

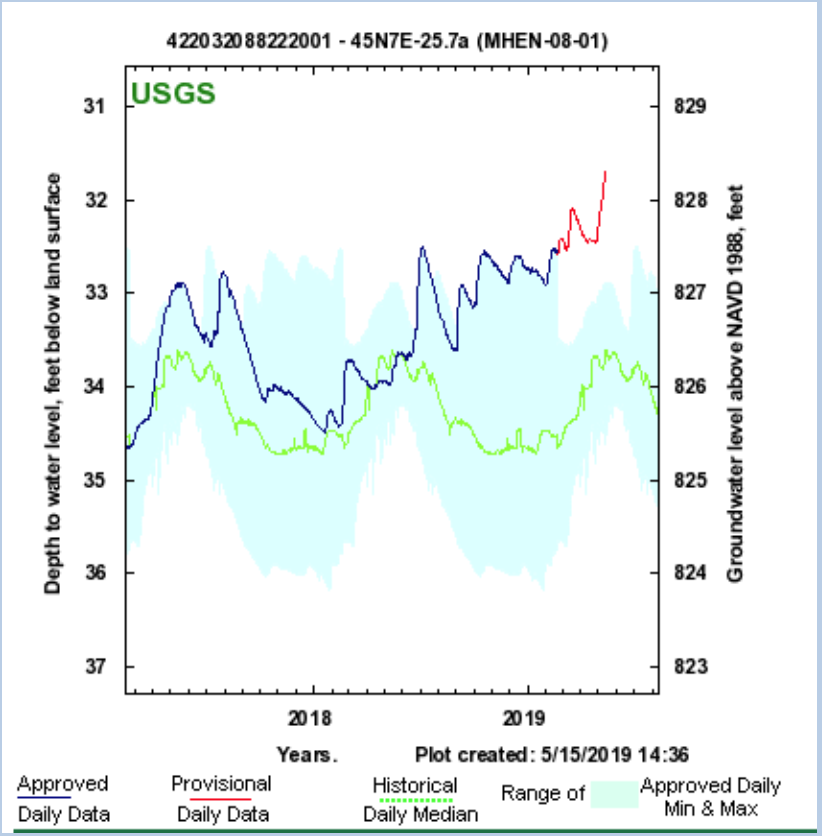
- Eastern half of the county shows sand and gravel areas with downward vertical gradients and interconnected aquifers.
  - This area is also the most developed and had traces of pesticides, VOCs and elevated chlorides at depths up to 138 ft below ground surface.
- Health-based drinking water-quality standards were exceeded for arsenic, nitrates, and sodium.
- Aesthetically-based standards were exceeded for total dissolved solids, chlorides, iron, and manganese.
- Chloride concentrations have increased primarily in shallow portions of the aquifer.

Future Direction: Water Level Trends

Continue water level monitoring



Groundwater Watch



https://groundwaterwatch.usgs.gov/countymap.asp?sa=IL&cc=111

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Future Direction: Water-Quality Sampling in 2020 decadal updates on water quality trends

Water Quality Taste Parameters

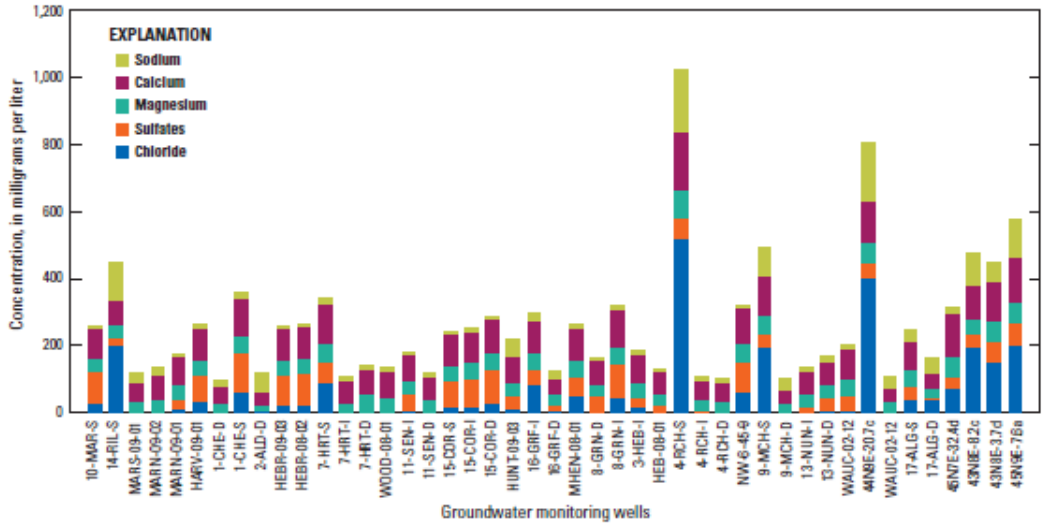

Figure 22. Distribution of major ions in water-quality samples collected from wells in the McHenry County groundwater monitoring network, Illinois, 2010. Maximum value of potassium (not shown) was 7.14 milligrams per liter.

Arsenic

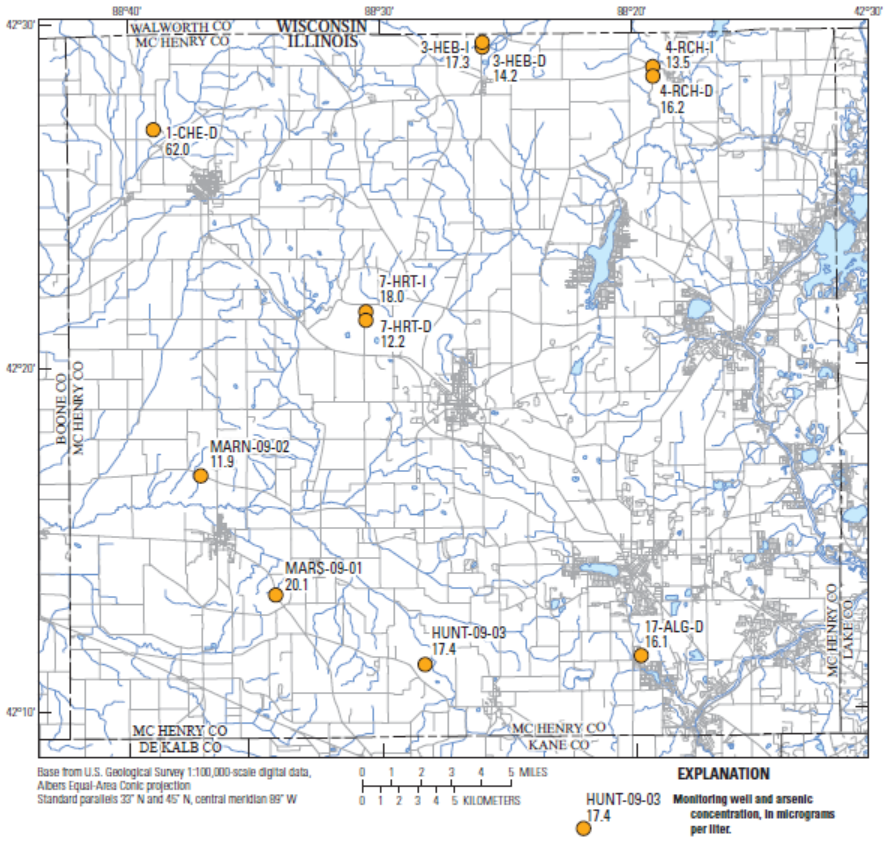

Figure 27. Arsenic concentrations greater than the U.S. Environmental Protection Agency Maximum Contaminant Level of 10 micrograms per liter from selected wells in the McHenry County groundwater monitoring network, Illinois, 2010.

https://pubs.er.usgs.gov/publication/sir20175112

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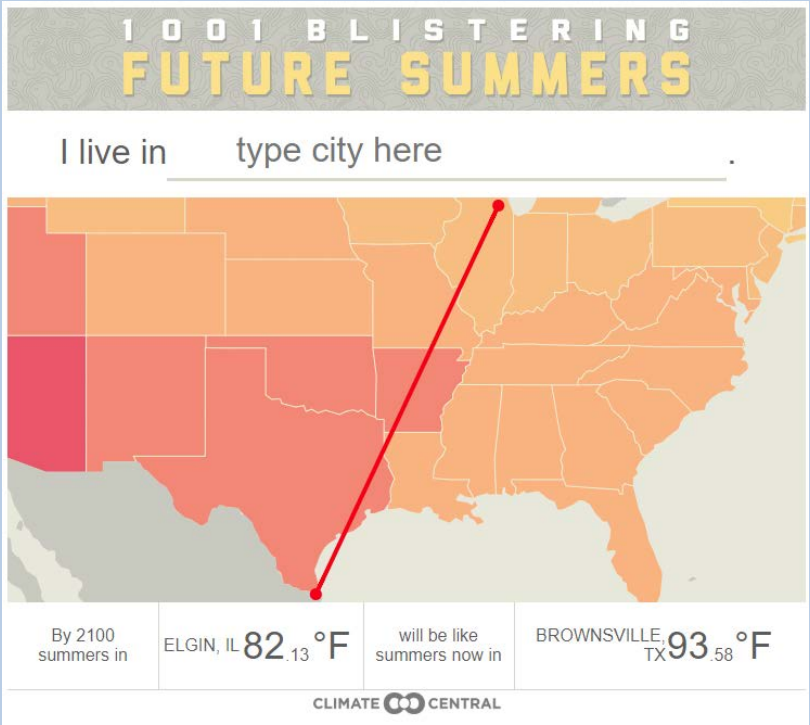
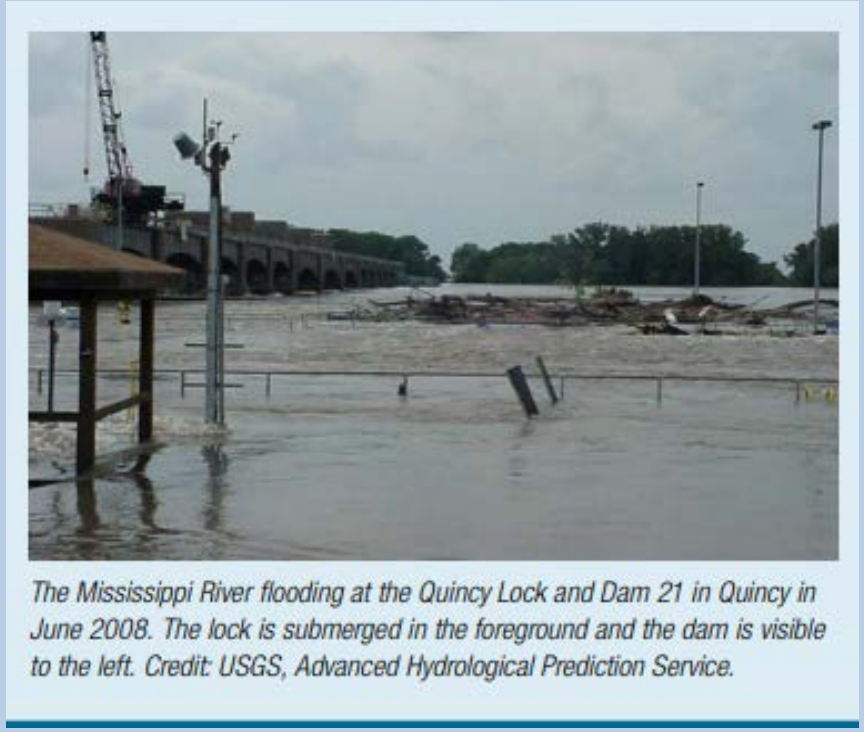
MCGMN provides the data to identify issues and help prepare for variations in the climate

- These variations can bring extremes with both droughts and flooding



https://www.climatecentral.org/news/summer-temperatures-co2-emissions-1001-cities-16583


The Mississippi River flooding at the Quincy Lock and Dam 21 in Quincy in June 2008. The lock is submerged in the foreground and the dam is visible to the left. Credit: USGS, Advanced Hydrological Prediction Service.

https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-il.pdf

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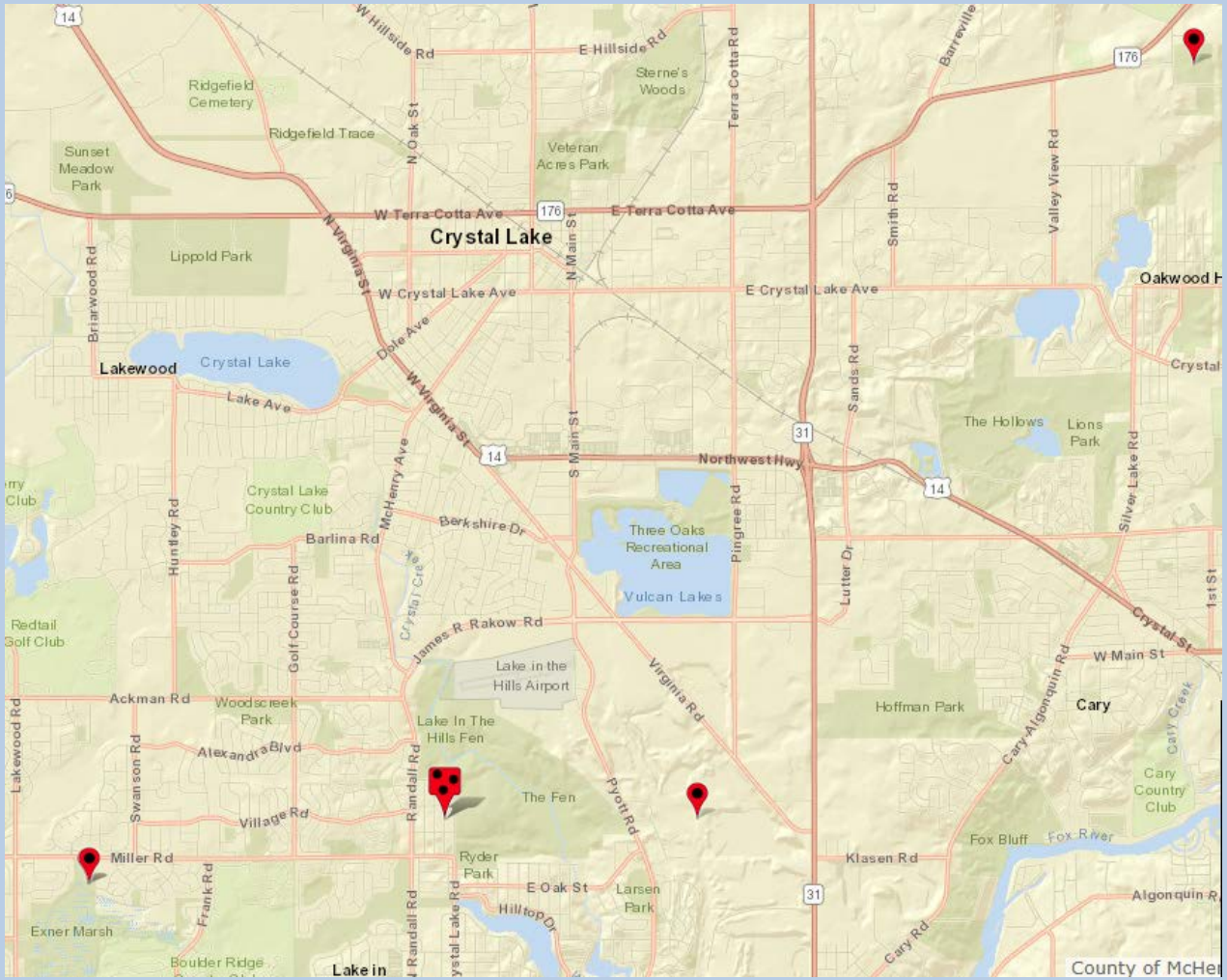
Recent Applications of MCGMN



The City of Crystal Lake owns and maintains the Three Oaks Recreation Area (TORA)—a former quarry turned into a popular summertime destination for swimming, kayaking, fishing, and more.

In 2012, the water levels dropped about 3 feet. A USGS study used nearby MCGMN well data, plus installed one extra well to determine the main influences on the water levels. The drought and hydrogeological influences contributed to the substantial drop. https://pubs.er.usgs.gov/publication/sir20185105

Today, the TORA is now experiencing record flooding and the surrounding and monitoring wells data indicated rising water levels throughout most of the aquifer in the county.

The City of Crystal Lake now is looking at engineering controls for maintaining the water levels at TORA for both extremes.

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Questions?

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