



Groundwater Level Monitoring McHenry County Illinois - Value of Long-Term Data

Judith Thomas

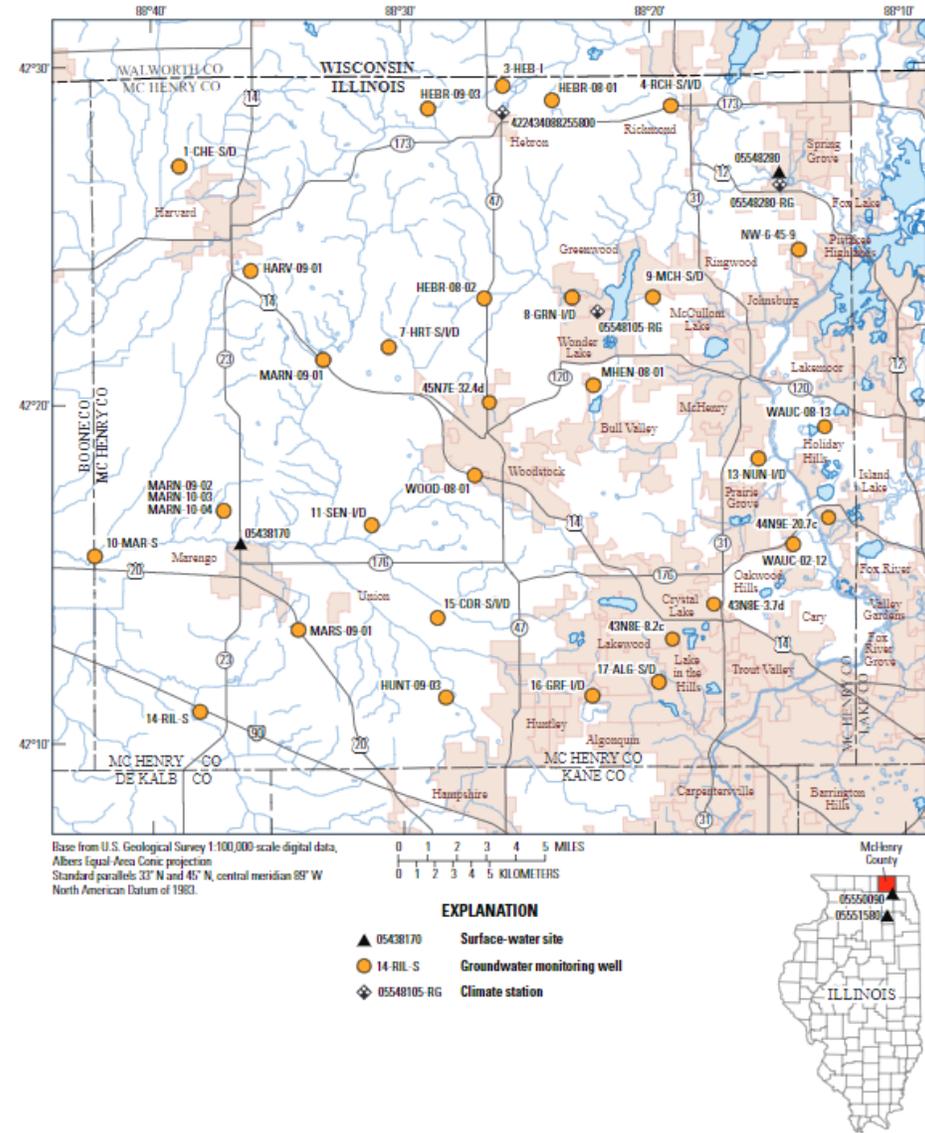
Groundwater and Geophysics Section Chief

USGS Central Midwest Water Science Center

Presented at the NWPA TAC meeting on October 26, 2021

Overview of network

- 42 wells in the network, 37 collecting real-time water-level data
- Well depths range from 20 – 344 feet
- Wells are completed in Quaternary unconsolidated deposits with 3 completed in the Silurian Bedrock and Quaternary interface.
- Period of record (POR) from 2009 to present at most wells
- Water level depths range from -13 feet above land surface to 99 feet below land surface (geometric mean POR)



USGS Groundwater Watch *

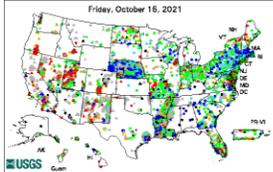
* **Note:** This is an interim version of Groundwater Watch. [Details...](#)

The USGS has a distributed water database that is locally managed. Surface water, groundwater, and water quality data are compiled from these local, distributed databases into a national information system. The groundwater database contains records from about 850,000 wells that have been compiled during the course of groundwater hydrology studies over the past 100 years. Information from these wells is served via the Internet through NWISWeb, the National Water Information System Web Interface. NWISWeb provides all USGS groundwater data that are approved for public release. This large number of sites is excellent for some uses, but complicates retrievals when the user is interested in specific networks, or wells in an active water-level measurement program.

These "groundwater watch" web pages group related wells and data from these active well networks, and provide basic statistics about the water-level data collected by USGS water science centers for Cooperative Programs, for Federal Programs, and from data supplied to us by our customers through cooperative agreements.

National Networks

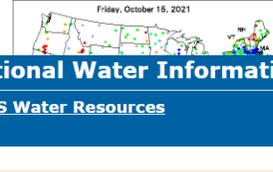
Active Groundwater Level Network



Climate Response Network



Real-Time Groundwater Level Network



Below Normal Groundwater Levels



Active Spring Monitoring Sites



National Water Information System: Web Interface
[USGS Water Resources](#)

- Click to hide News Bulletins**
- Explore the *NEW* [USGS National Water Dashboard](#) interactive map to access
 - [Full News](#) 

USGS Water Data for the Nation

Search for Sites With Data

- Current Conditions** Sites with real-time or recent surface-water, groundwater, or water-quality data.
- Site Information** Descriptive site information for all sites with links to all available water data for individual sites.
-  Map of all sites with links to all available water data for individual sites.

Frequent Searches By Data Category

Accessing the network

USGS Groundwater Watch

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

USGS National Water Information System (NWIS) database

<https://waterdata.usgs.gov/il/nwis/current/?type=gw>



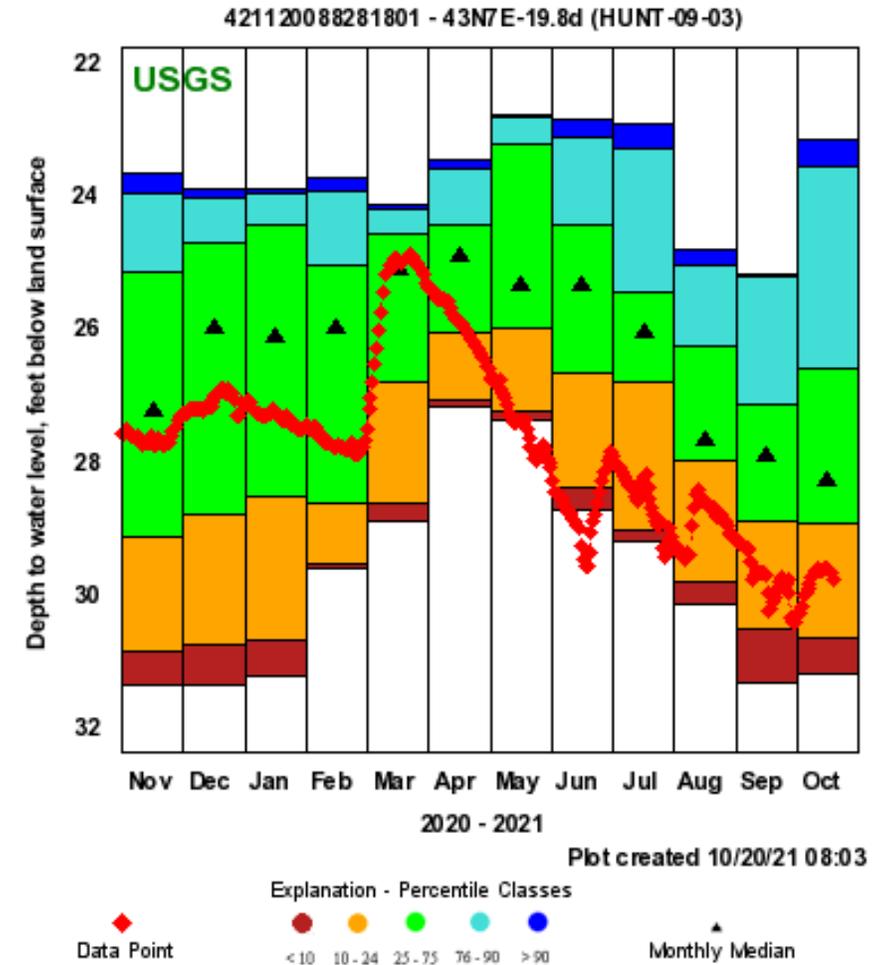
Next Generation Monitoring Location Page

Replacing NWIS Legacy Real Time Pages

- Available now ([demonstration](#))
- 5 Key Differences
 - Data-first: Hydrograph at top, except for key alerts
 - Interactive: Featuring a clickable, zoomable hydrograph with the ability to compare data
 - Compact & Mobile-First: More things on one page – monitoring location metadata, water-data inventory, groundwater data, interactive map, etc., all summarized on one page
 - Geo-located: Featuring a map with flowlines, shaded watershed area, and nearby monitoring locations
 - Affiliated networks: A monitoring location belonging to larger groupings of monitoring locations and these pages let you explore those groupings to see the bigger picture of water resources

Why collect long-term data?

- Provide context for current conditions within long-term data
- Define extremes
- Illustrate general and statistical trends



Source USGS Groundwater watch

Site Statistics explained

- Percentile is defined as a value on a scale of 100 that indicates the percentage of a distribution that is equal to or below it
- Median is the same as 50th percentile
- Median monthly values are derived from median daily values from any given month
- Because we have over 10 years of data, we can compare these median monthly values to each other

Most recent data value: **29.76** on 10/19/2021
 Period of Record Monthly Statistics for 421120088281801
 Depth to water level, feet below land surface
 All Approved Continuous & Periodic Data Used In Analysis
 Note: **Highlighted** values in the table indicate closest statistic to the most recent data value.

Month	Lowest	10th	25th	50th	75th	90th	Highest	Number
	Median	%ile	%ile	%ile	%ile	%ile	Median	of
								Years
Jan	31.23	30.68	28.51	26.11	24.42	23.97	23.89	12
Feb	29.58	29.54	28.63	25.98	25.05	23.94	23.74	12
Mar	28.88	28.60	26.80	25.11	24.56	24.19	24.12	12
Apr	27.17	27.07	26.04	24.91	24.45	23.60	23.44	12
May	27.38	27.25	25.98	25.34	23.23	22.80	22.77	11
Jun	28.71	28.38	26.65	25.33	24.42	23.13	22.85	11
Jul	29.18	29.02	26.79	26.07	25.43	23.28	22.90	11
Aug	30.15	29.78	27.99	27.66	26.27	25.05	24.79	12
Sep	31.31	30.49	28.87	27.91	27.13	25.20	25.16	13
Oct	31.18	30.65	28.91	28.27	26.60	23.57	23.16	12
Nov	31.35	30.85	29.13	27.25	25.13	23.95	23.65	12
Dec	31.36	30.74	28.78	25.99	24.70	24.02	23.89	12



.As of 10/16/2021 10:18-2

Statistics Options



View month/year statistics

Source USGS Groundwater watch

Changes in groundwater levels over time

From Gahala, 2017

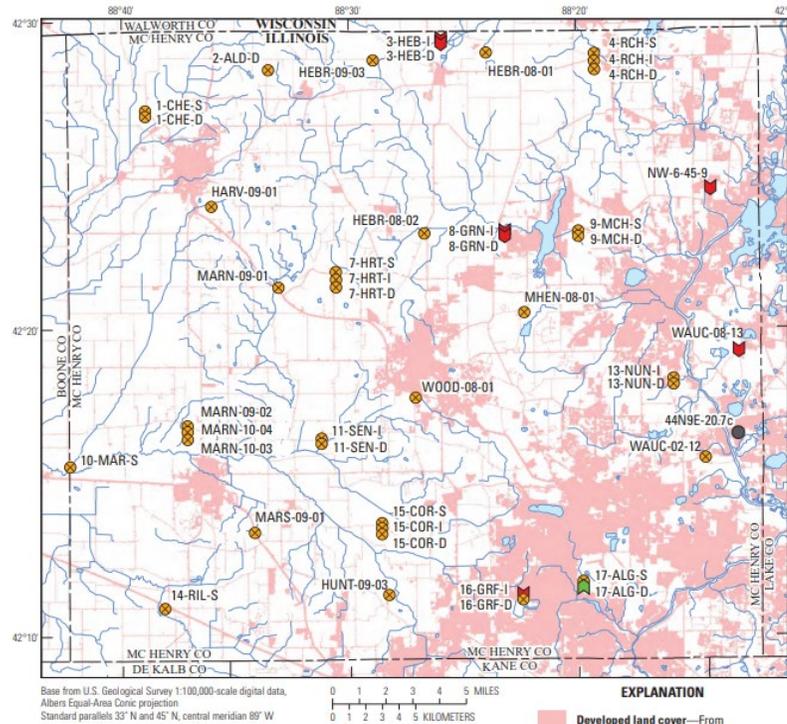


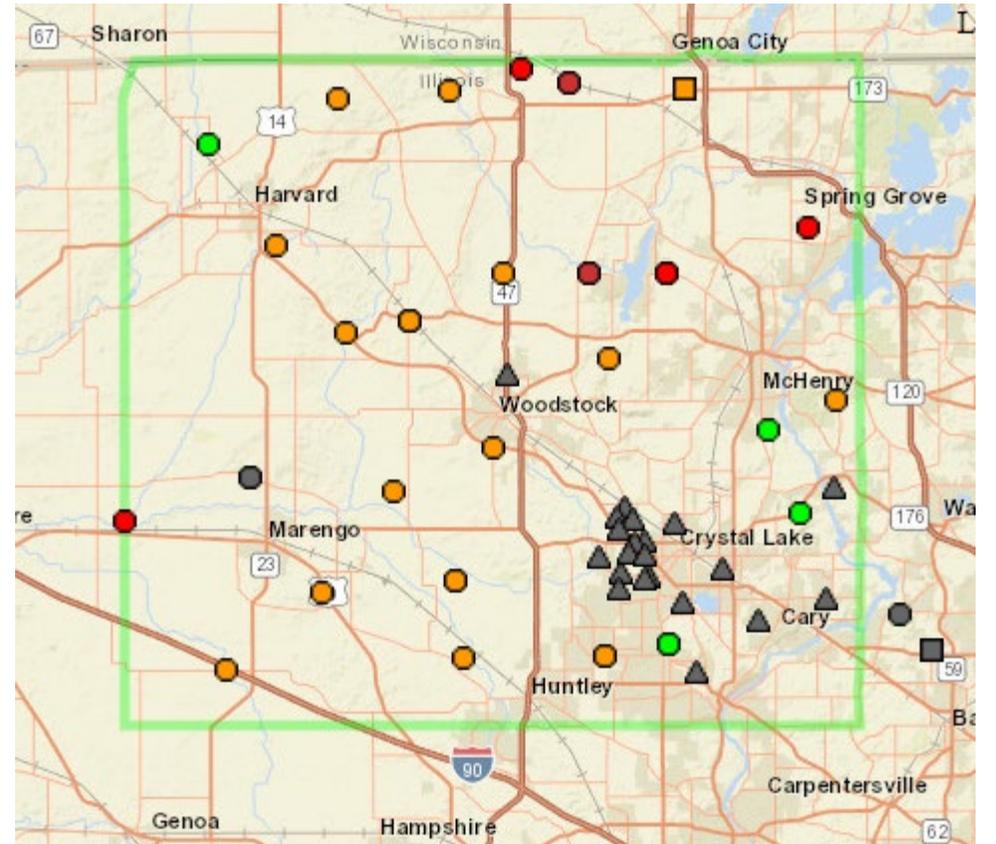
Figure 18. Water-level trends for the period of record for wells in the McHenry County groundwater monitoring network, Illinois, 2009–14.

- Visual evaluation of trends from 2009 to 2014
 - 7 sites with downward temporal trend in WL
 - 1 site with upward temporal trend in WL
 - 28 sites with stable temporal trend in WL
- Gahala, 2017, evaluation concluded generally stable conditions in McHenry County for that time period

Gahala, A.M., 2017, Hydrogeology and water quality of sand and gravel aquifers in McHenry County, Illinois, 2009–14, and comparison to conditions in 1979: U.S. Geological Survey Scientific Investigations Report 2017–5112, 91 p., <https://doi.org/10.3133/sir20175112>

USGS Groundwater Watch current conditions on October 20, 2021

- Below normal to much below normal at 32 sites
- Normal conditions at 5 sites
- Groundwater Watch provides a real time assessment of groundwater levels at the county level leveraging the long-term monitoring data



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENTAL

Explanation - Percentile classes (symbol color based on most recent measurement)						Wells		Springs	
●	●	●	●	●	●	○	○	□	□
Low	<10	10-24	25-75	76-90	>90	●	●	△	△
	Much Below Normal	Below Normal	Normal	Above Normal	Much Above Normal	High	Not Ranked	Periodic Measurements	Real-Time

Sand and gravel aquifers of McHenry County

- Alternating sand and gravel deposits in a till-dominated matrix
- Unconfined, semi-confined, and confined conditions
- Low permeability tills divide and limit the water bearing units

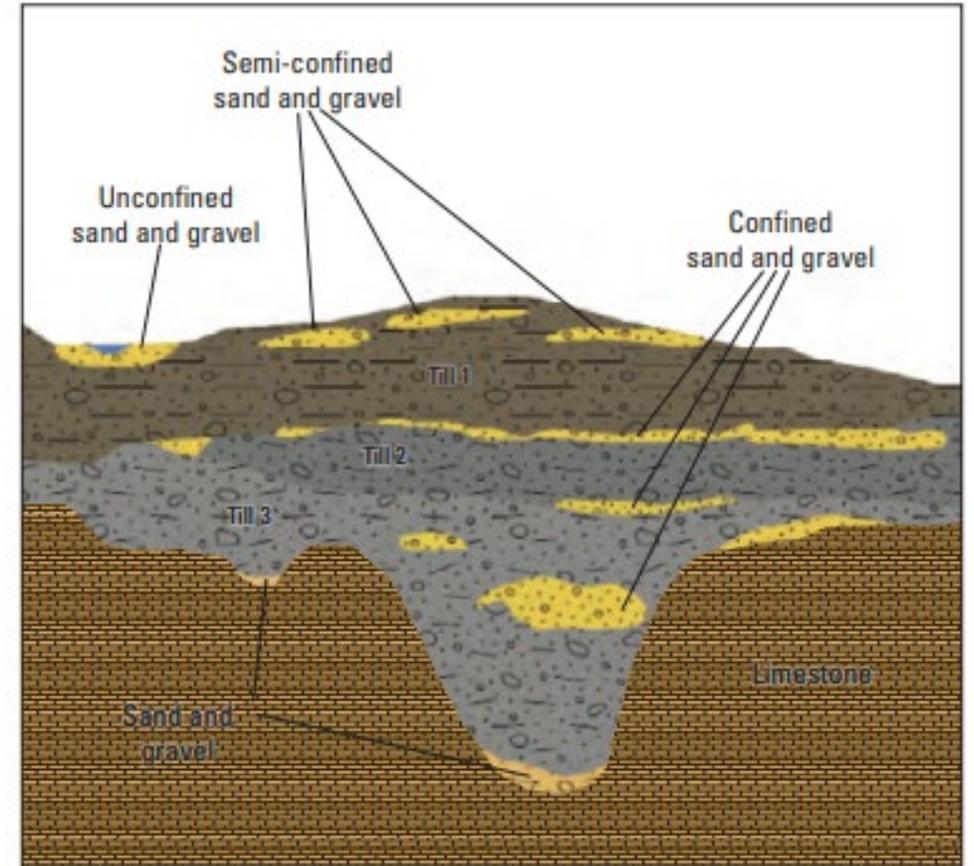
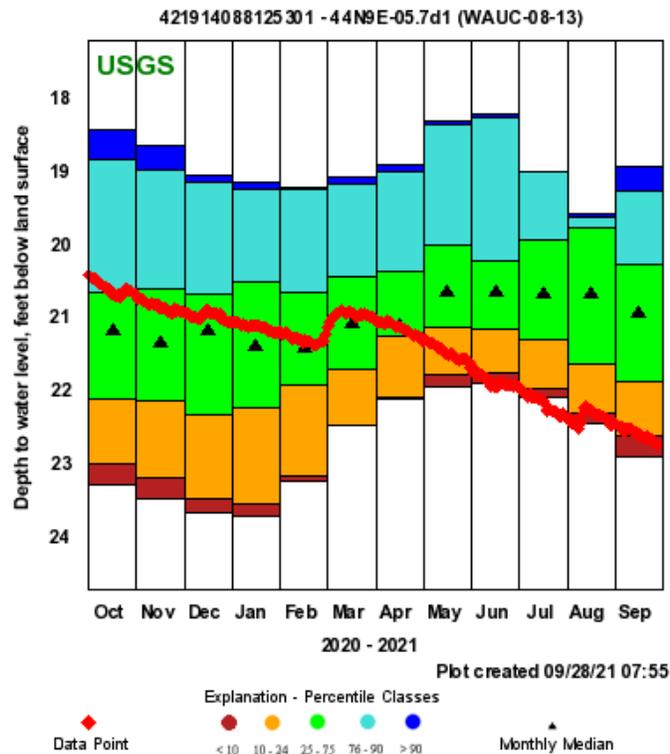


Figure 5, (Gahala, 2017)

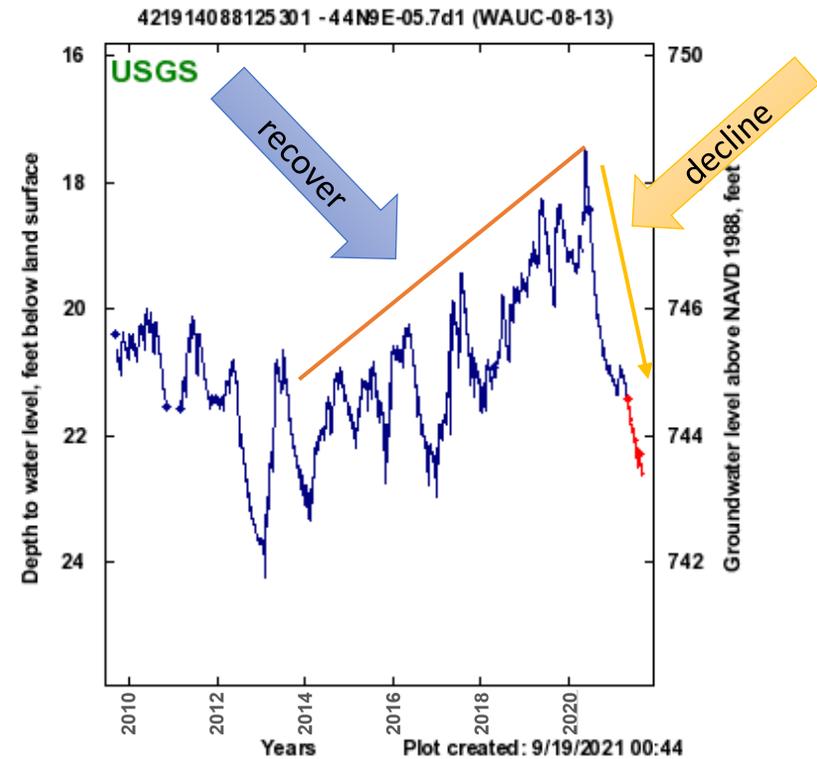
Aquifer vulnerability to climate

Magnitude of change in water level (~ 6 feet for POR)

Site statistics

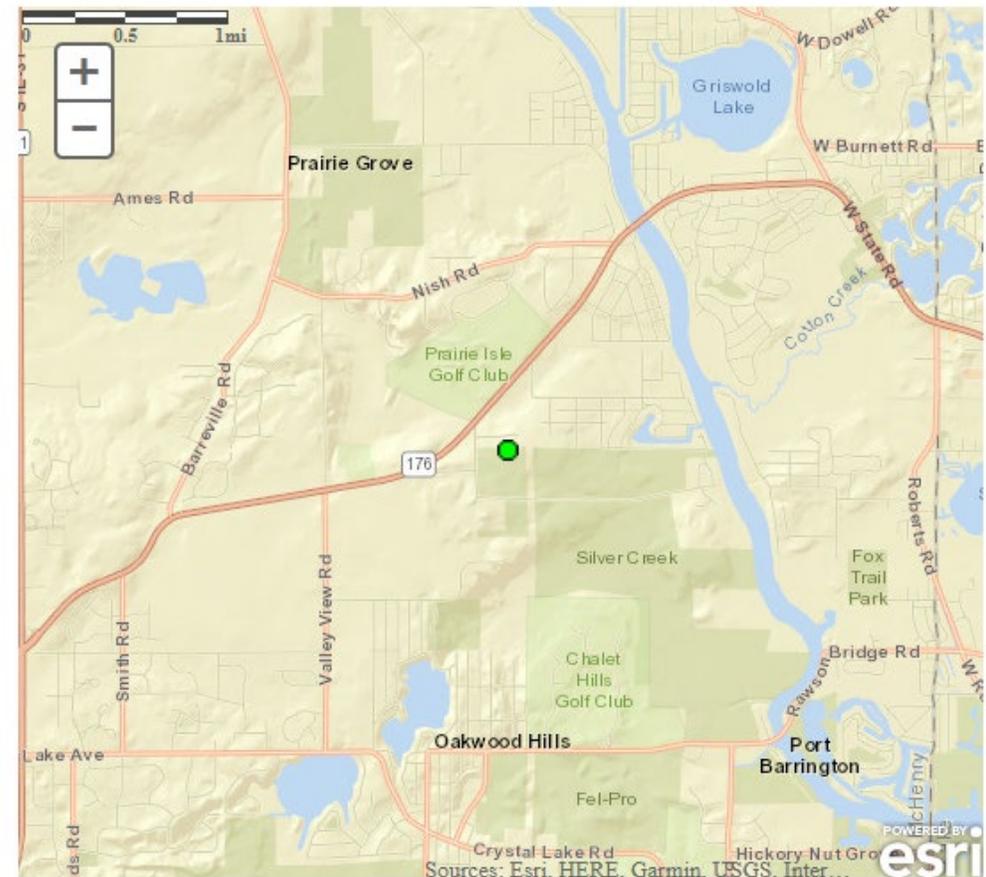
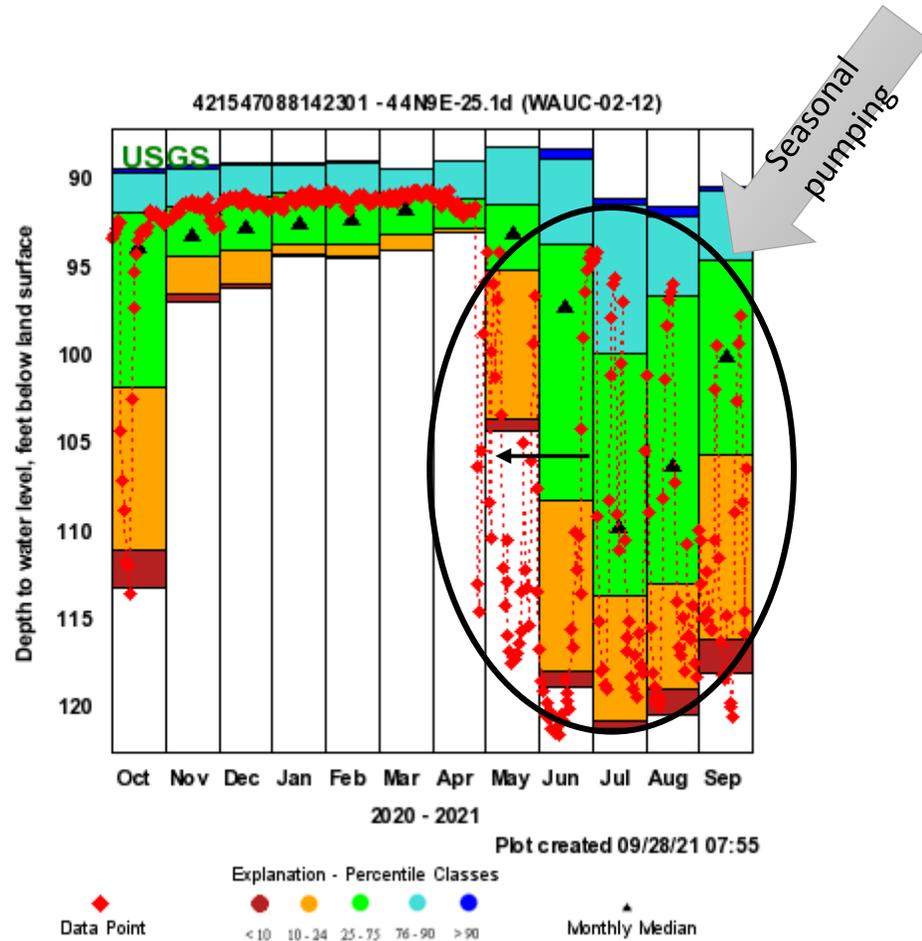


Period of record

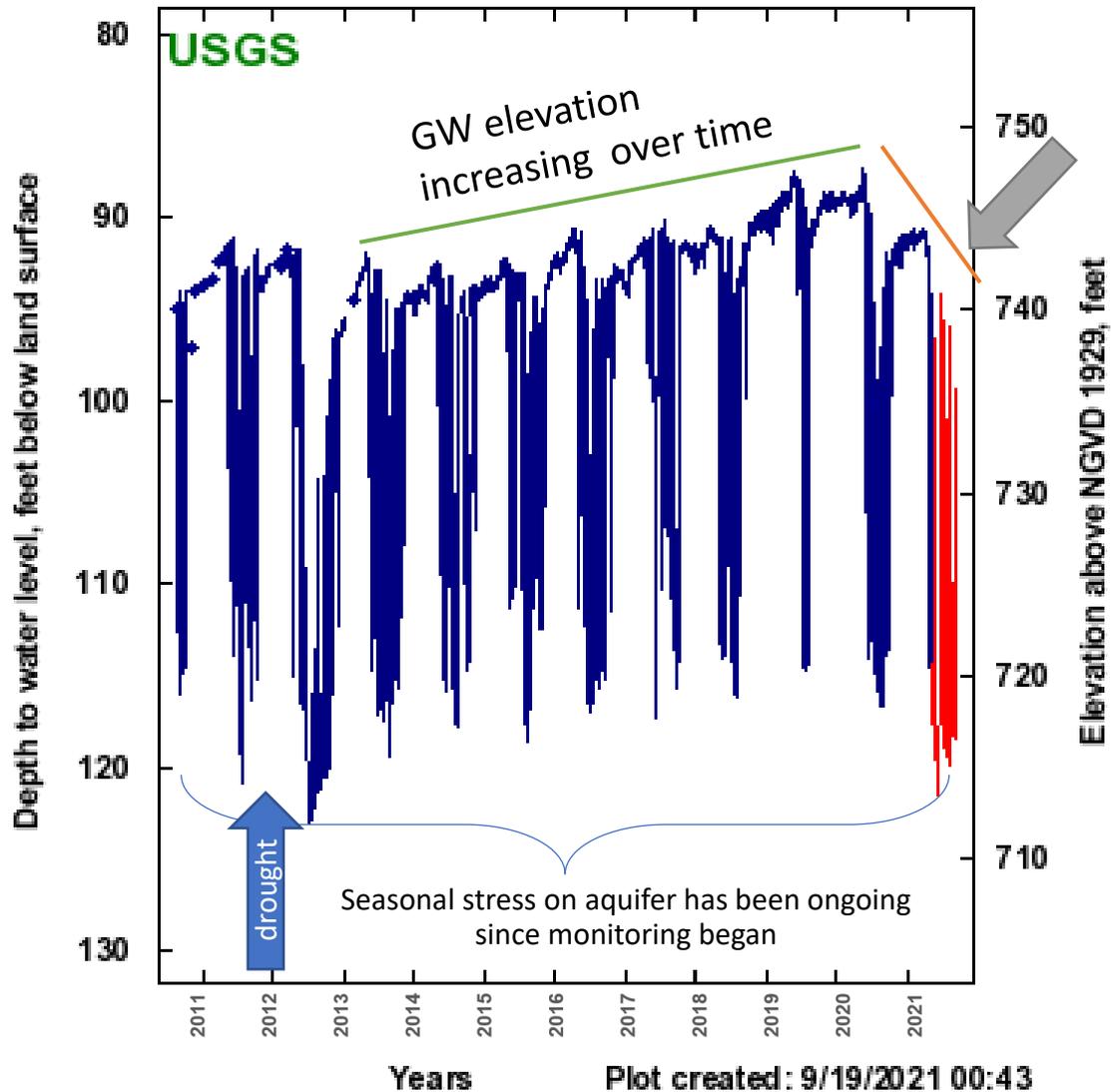


Aquifer vulnerability to land use

Confined aquifer vulnerable to drawdown during pumping



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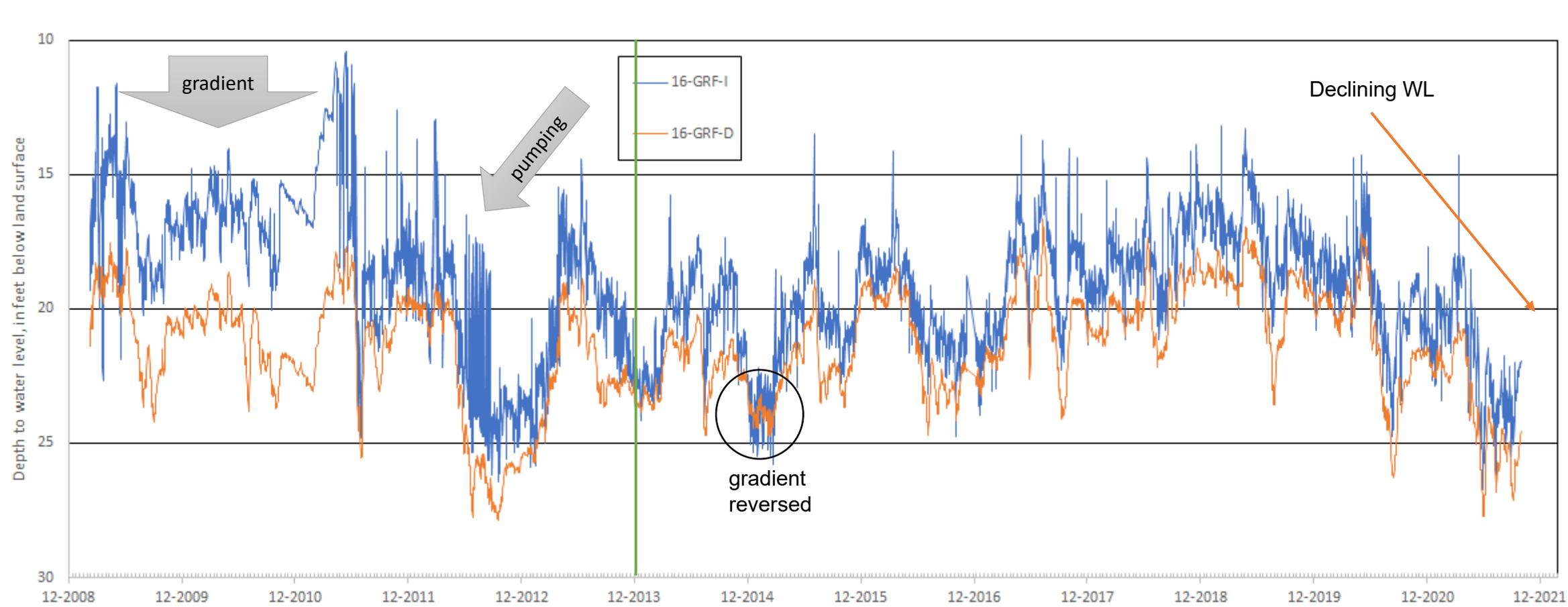
Aquifer vulnerability to land use

Confined aquifer vulnerable to drawdown during pumping

- Seasonal stress on aquifer ongoing for POR
- GW levels recovered from 2012 drought and elevations increase over time during non-pumping period.
- 2020 to 2021 show vulnerability of aquifer to both climatic change and pumping where non-pumping elevations are decreasing

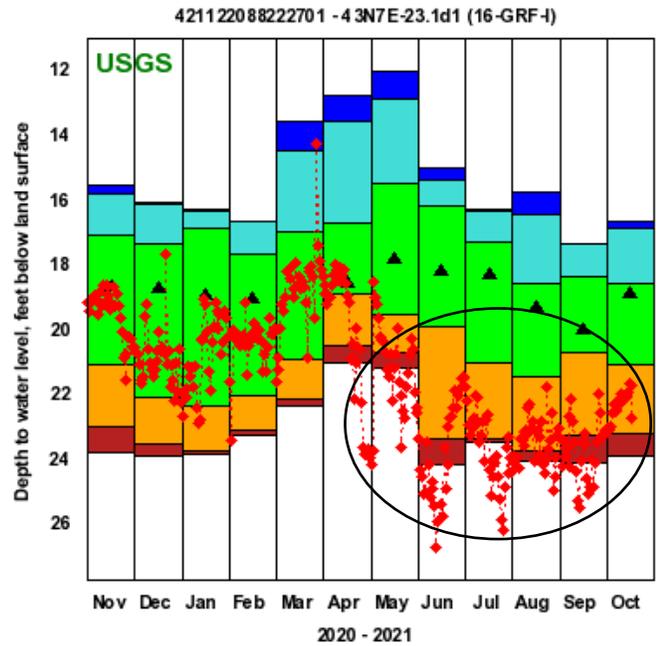
Vertical Gradients at nested wells

Semi-confined conditions



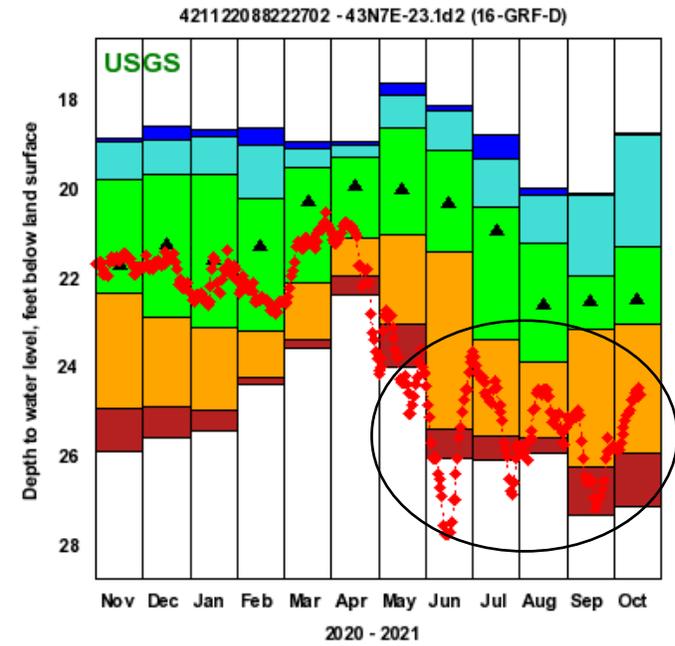
Current conditions in context with long term statistics: current conditions define new extreme

Site statistics 16-GRF-I



◆ Data Point
● < 10
● 10 - 24
● 25 - 75
● 76 - 90
● > 90
▲ Monthly Median

Site statistics 16-GRF-D



◆ Data Point
● < 10
● 10 - 24
● 25 - 75
● 76 - 90
● > 90
▲ Monthly Median



Additional directions for such a rich dataset

A few thoughts

Create products with the data:

- WL dashboard web application
 - Set up alerts
 - Provide “heat” map of WLS
 - User defined visualizations of data
- Trends in WL data over time – provides a statistical snapshot of the trends in water levels in a USGS publication

Use the data to:

- Build and improve steady state and transient local, countywide, and even regional groundwater models.
- Obtain aquifer properties such as recharge, hydraulic conductivity, groundwater velocity.

Questions?

Acknowledgements

- Many thanks to McHenry County Planning and Development for their continued support of groundwater level data collection.
- Thanks to ISGS for the use of monitoring wells to support the network
- Thanks to ISWS for continued collaboration



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