



## National Ground-Water Monitoring Network

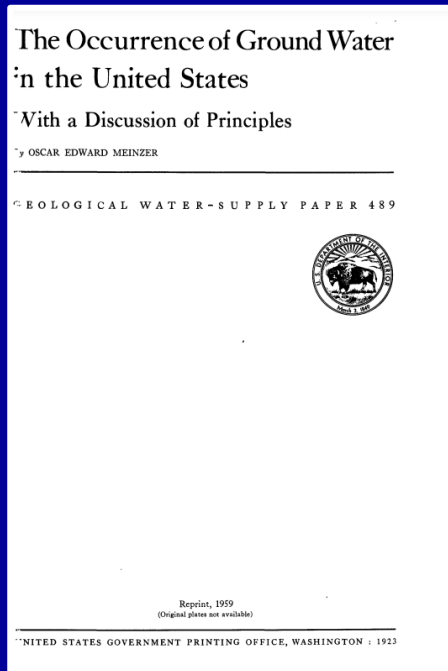
# The USGS National Groundwater Monitoring Network and the USGS Climate Response Network

*Groundwater Protection Council Annual Forum 2023*

*Jason Fine, USGS Water Mission Area, Raleigh, North Carolina*

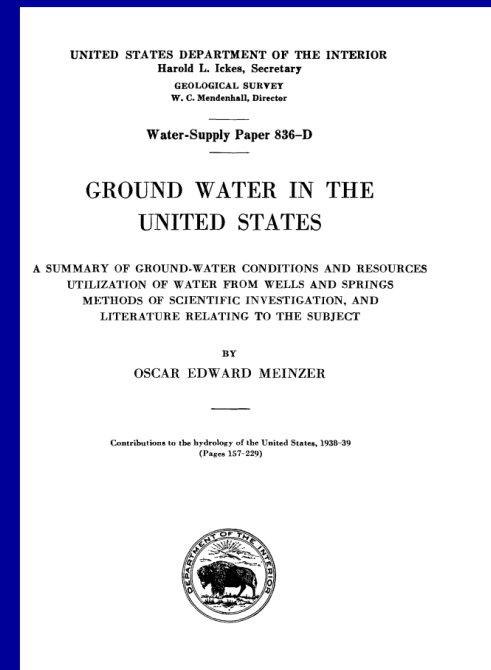
*Rodney Caldwell, USGS Montana-Wyoming Water Science Center, Helena, Montana*

# History of USGS GW Monitoring



Meinzer, 1923

- Late 1800s thru early 1900s
- 1920s thru 1940s
- 1950s thru 1970s
- 1980s and 1990s
- 2000's: "Inadequate for National Reporting"
- 2015 NGWMN



Meinzer, 1939  
"Work of the GS and  
Cooperating Agencies"

# State Ground-Water Monitoring Networks “Inventory Work Group”

Surveys of ongoing groundwater monitoring were completed by the SOGW

(1) A survey of State programs (via AASG, GWPC, ICWP, and NGWA)

- Level – information from 43 states
- Quality – information from 48 states

(2) Evaluation of National or Regional networks operated by federal agencies (USGS, US EPA, Park Service, Forest Service, ARS and others)

# Summary: Inventory Work Group

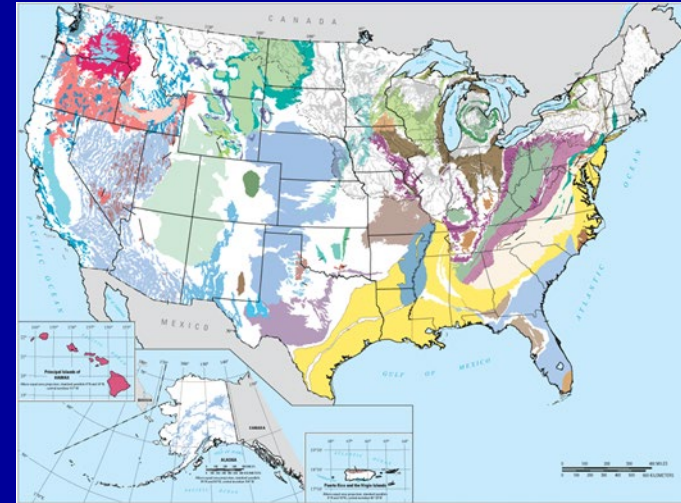
- Large amount of ground water level and quality data are being collected
- Some states had little or no program. These were the initial “data gaps”.
- Data are collected by many different agencies for many different purposes. Often not the same agency for water levels and water quality.
- Additional work was needed by the Inventory WG to:
  - Coordinate inventory among State responses and Federal monitoring programs
  - Gather necessary metadata
  - Use metadata and Design Framework to evaluate data gaps

# What is the National Groundwater Monitoring Network?

- Network of groundwater monitoring wells where water-level and/or water-quality data is collected and served on the NGWMN Portal.
- Data Providers to the Network are mainly state and local governments, but federal agencies and private companies can contribute data as well. However, they are not eligible to receive funding.
- NGWMN distributes approximately \$1.7 million per year through a grant program to eligible data providers.

# NGWMN Design Elements

- Principal and major aquifers
- GW levels and quality, with a focus on availability
- Priority on sites with long-term data
- It's a network, not a Warehouse or Master Database
- Sites classified and selected by local experts/data providers
- Data provider remains the authoritative data source
- Data of known quality (not uniform quality)



## A National Framework for Ground-Water Monitoring in the United States

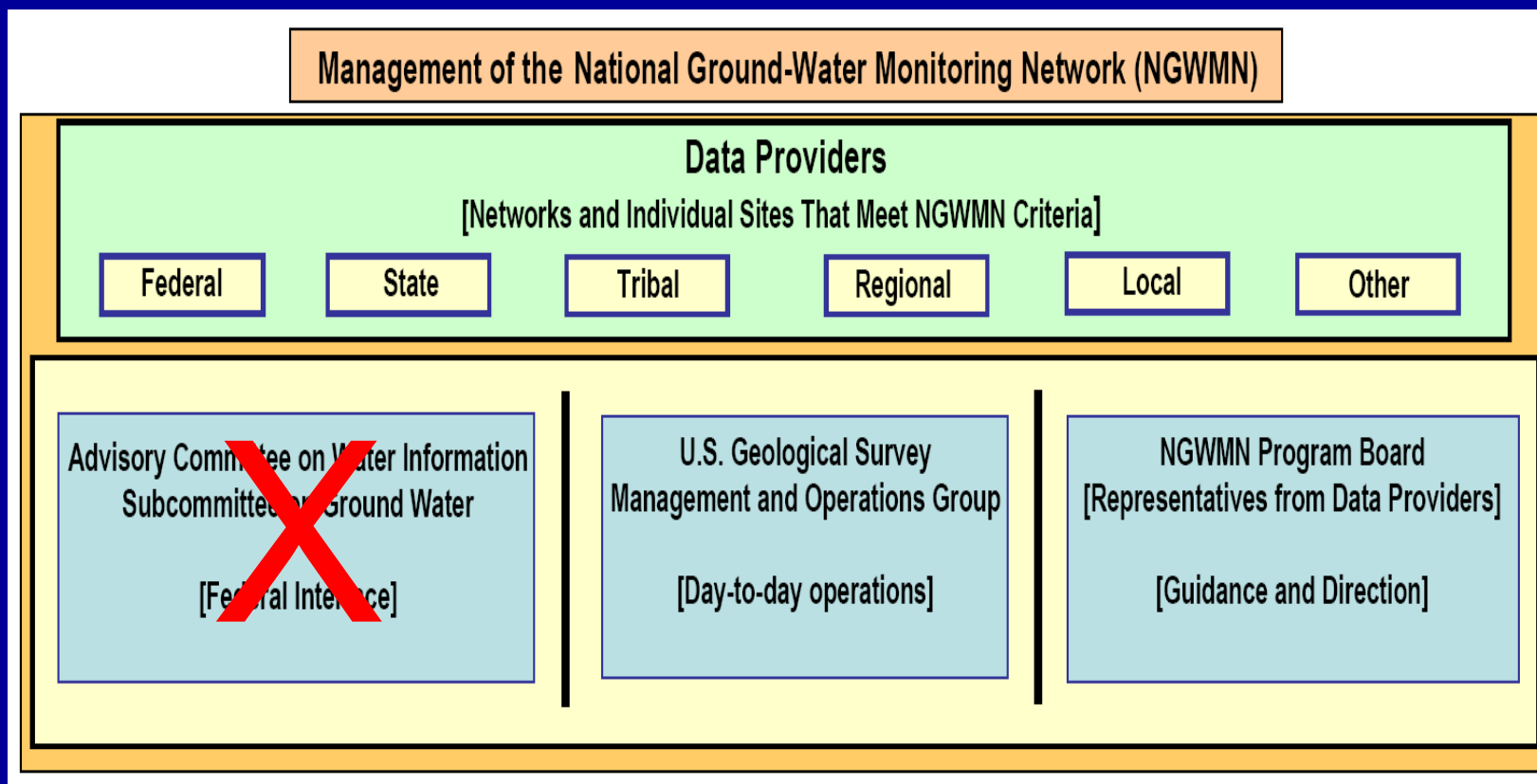
Prepared by The Subcommittee on Ground Water of The Advisory Committee on Water Information

Approved by The Advisory Committee on Water Information





# NGWMN Management Structure

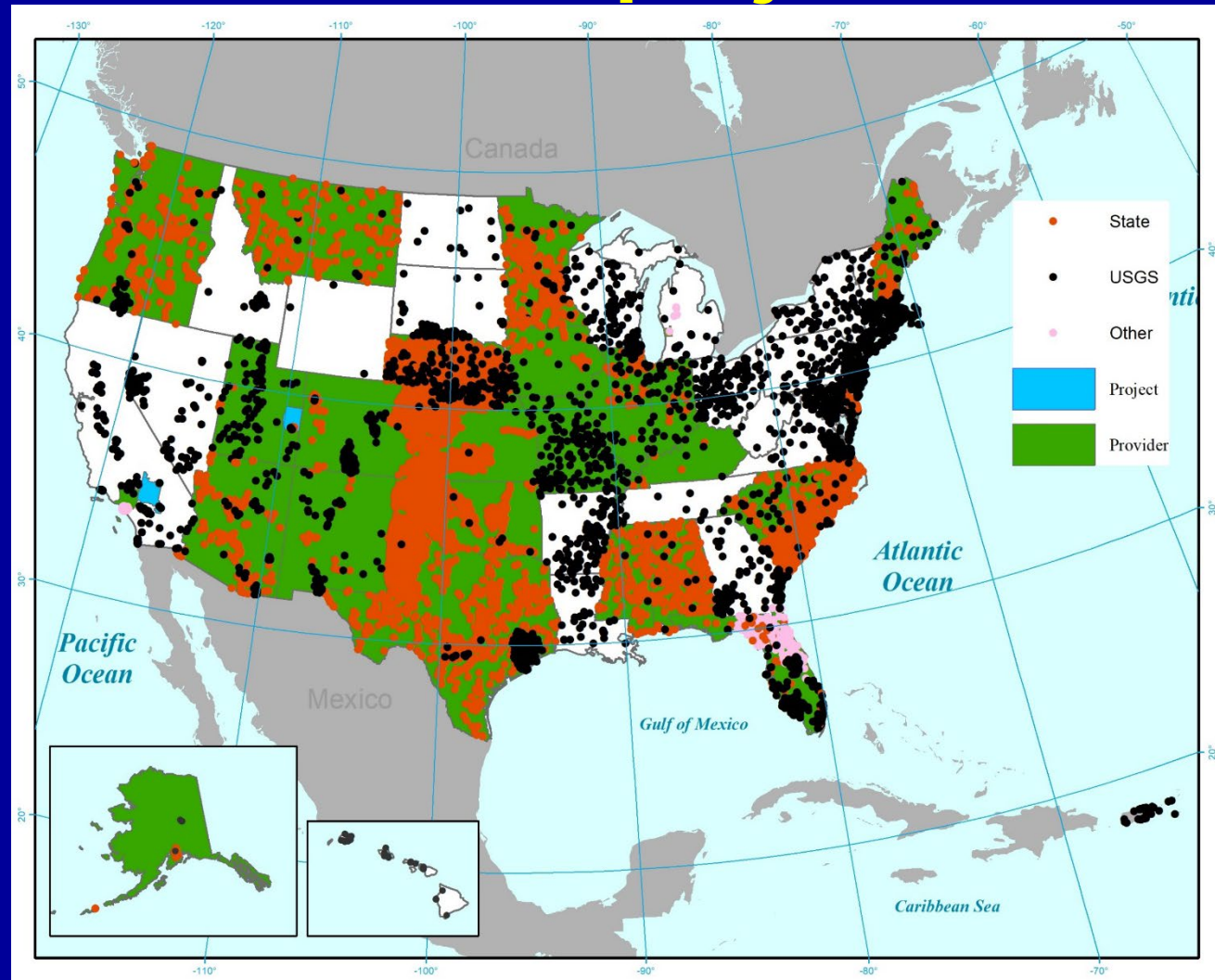


# NGWMN Program Board

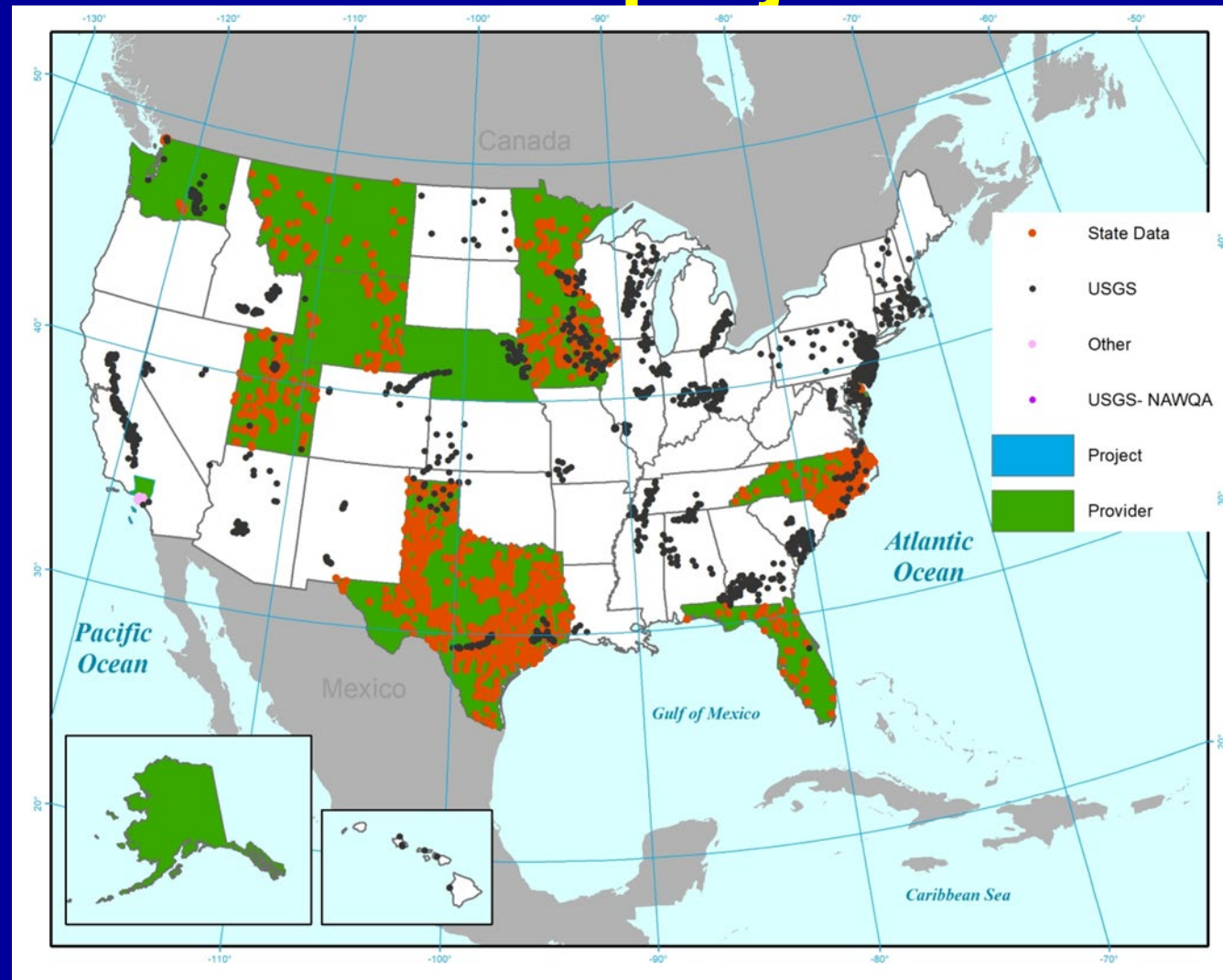
- Purpose:
  - Provides input on issues related to network growth, development, and operation
  - Assist in evaluating proposals submitted to the NGWMN for cooperative funding
  - Provides input into annual Program Announcement used for funding opportunity
  - Represents the NGWMN data providers
- Board is guided by the Structure and Operating Principles. Still available on SOGW web page.
- Membership
  - Ten total members
  - Six data providers from the three regions
  - Federal and at-large representation
  - Rotating membership



# Water-level data providers and current projects



# Water-quality data providers and current projects



# Water-Level Data Providers

Alabama GSA

Arizona DNR

Alaska DNR

Colorado DWR

Delaware GS

Florida DEP

Grand County, Utah

Illinois State Water Survey

Indiana GS

Iowa GS

Kansas GS

Kentucky GS

Maine GS

Michigan EGEL

Minnesota DNR

Mississippi DEQ

Mojave Water Agency

Montana BMG

Missouri DNR

Nebraska CSD

New Hampshire GS

New Mexico BMG

North Carolina DEQ

Ohio WRD

Oklahoma Water Resources Board

Oregon WRD

Ottawa County Michigan

Presidio County, Texas

South Carolina DNR

St Johns River WMD, Florida

Suwannee River WMD, Florida

Texas Water Development Board

USGS

Utah GS

Washington State DOE

WRD of Southern California

Ice Mountain

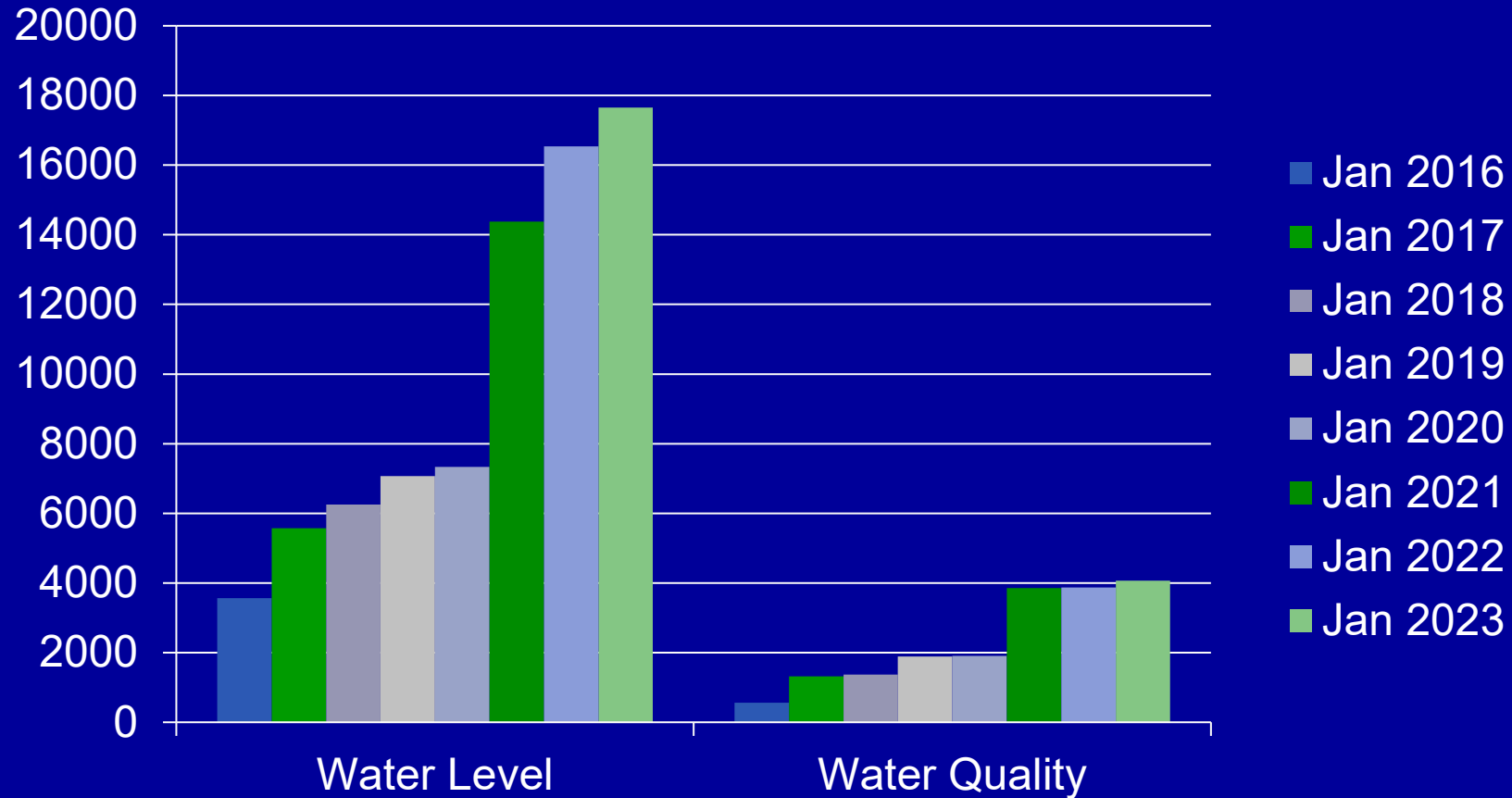
## Water-Quality Data Providers

Delaware GS  
Florida DEP  
Iowa DNR  
Minnesota PCA  
Montana BMG  
Nebraska NDEE  
North Carolina DEQ  
Oklahoma Water Resources Board  
Texas Water Development Board  
USGS  
Utah GS  
Washington Department of Ecology  
Wyoming DEQ  
WRD of Southern California

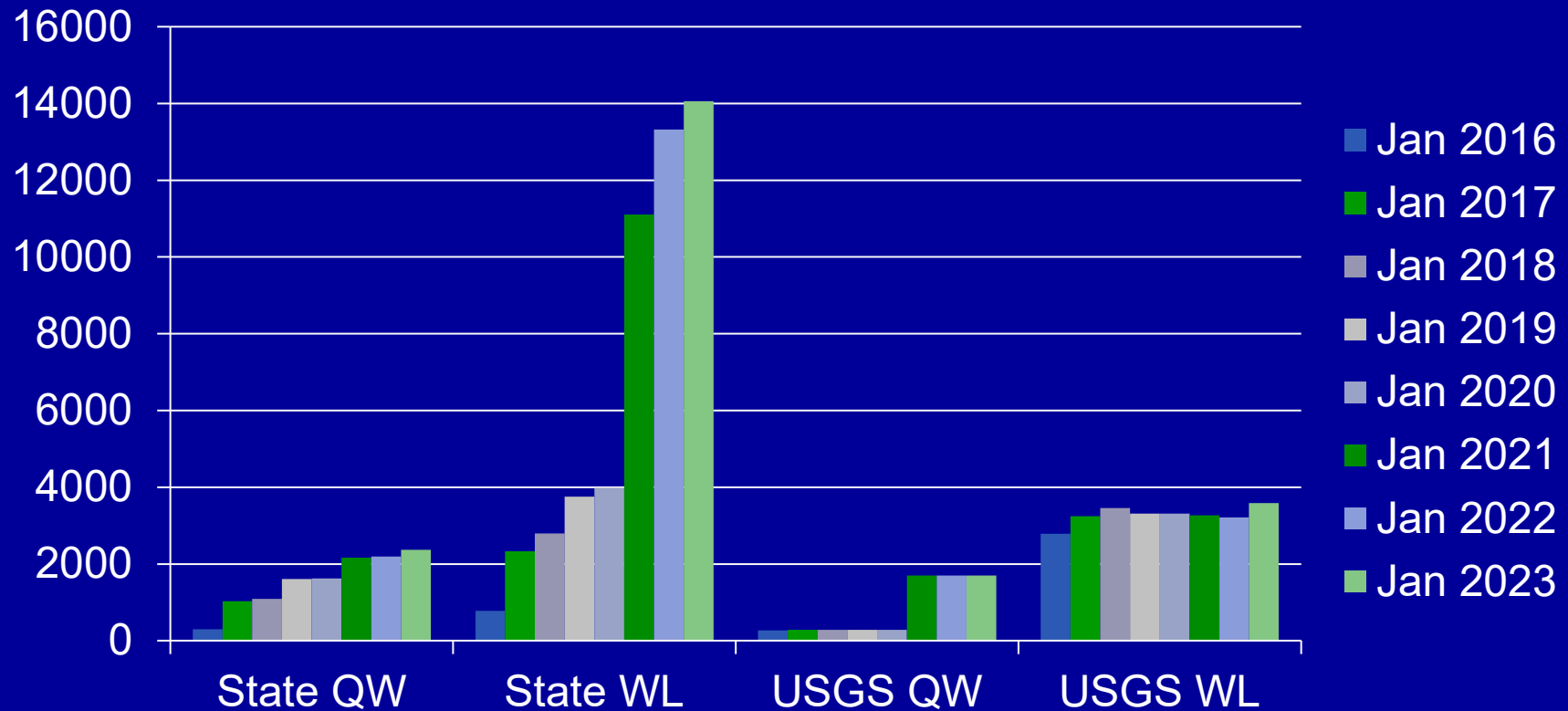
## Cooperative Partner Agencies

Maryland GS  
Massachusetts DCR  
Missouri DNR  
New Jersey GS  
Ohio DNR  
Wisconsin GNHS

# Network growth by site



# Growth details by source





# NGWMN Data Portal

## National Ground-Water Monitoring Network

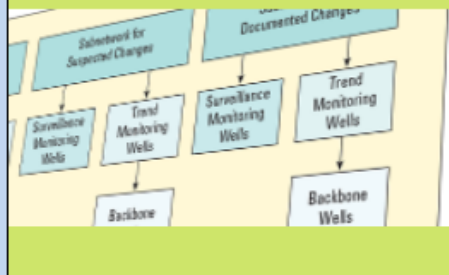
The National Ground-Water Monitoring Network (NGWMN) started as a product of the Subcommittee on Ground Water of the Federal Advisory Committee on Water Information (ACWI). The NGWMN is a compilation of selected groundwater monitoring wells from Federal, State, and local groundwater monitoring networks across the nation. The design for the National Ground-Water Monitoring Network is presented in the document '[A National Framework for Ground-Water Monitoring in the United States](#)'.

The [NGWMN Data Portal](#) provides access to groundwater data from multiple, dispersed databases in a web-based mapping application. The portal contains current and historical data including water levels, water quality, lithology, and well construction. The NGWMN is currently in the process of adding new data providers to the Network. Agencies or organizations collecting groundwater data can [find out more about becoming a data provider for the Network](#).

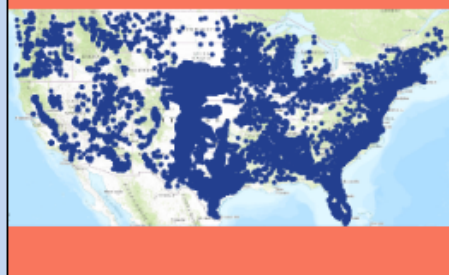
Funding to support data providers to the National Ground-Water Monitoring Network is provided through USGS Cooperative Agreements. Agencies can also find information about the status of the [USGS cooperative agreements](#).

**New (4/5/2023):** The 2023 NGWMN Funding Opportunity is closed. The 2024 NGWMN will be open in late September 2024. For more information see the NGWMN Cooperative Agreements page [NGWMN Cooperative Agreements page](#).

### LEARN about the Network



### EXPLORE the Network



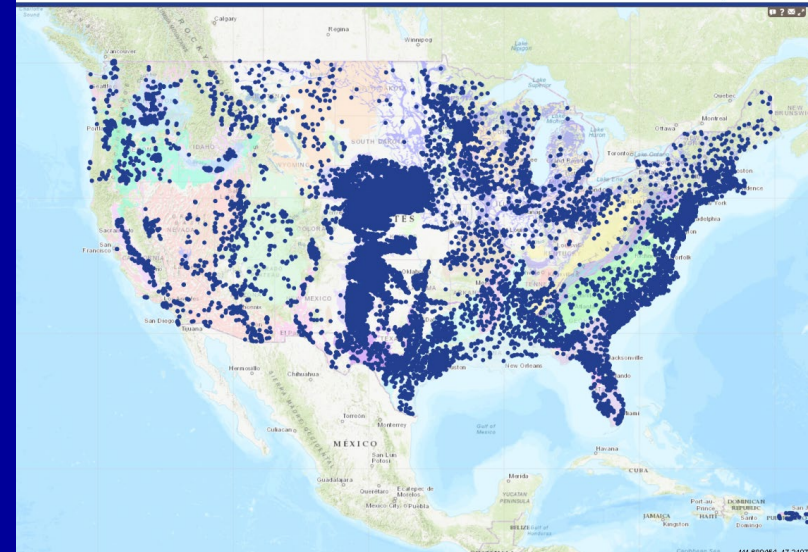
#### CURRENT NETWORK:

17 646 water-level wells  
4066 water-quality wells  
10 subnetworks  
36 contributing agencies  
54 administrative units  
65 principal aquifers

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#### National Ground-Water Monitoring Network





# NGWMN Cooperative Funding Opportunity Projects

- Open to state and local agencies who collect groundwater data
- Next round will be open from October 2023 through January 2024
- As of Summer 2023
  - 172 projects funded
  - 44 Agencies
    - 26 are State Geological Surveys
    - 7 are working with USGS WSC's to collect data
    - 2 Counties
    - 5 Water Districts
    - 1 Private Company
- Two major types of work funded
  - Support NGWMN
  - Enhance NGWMN



# Support the NGWMN

- New Data Providers (Objective 1)
- Persistent Data Services Continuation of Data Services (Objective 2)
  - Add Sites
  - Expand Services
  - Upgrade Services



# Enhance the NGWMN

- Can only occur at NGWMN sites
  - Site Information Gap Filling
    - 4026 Wells
  - Well Maintenance
    - 749 wells
  - Well Drilling
    - 238 wells
  - Continuous Water-Level Monitoring Equipment
    - 355 wells



# Site Information Gap Filling

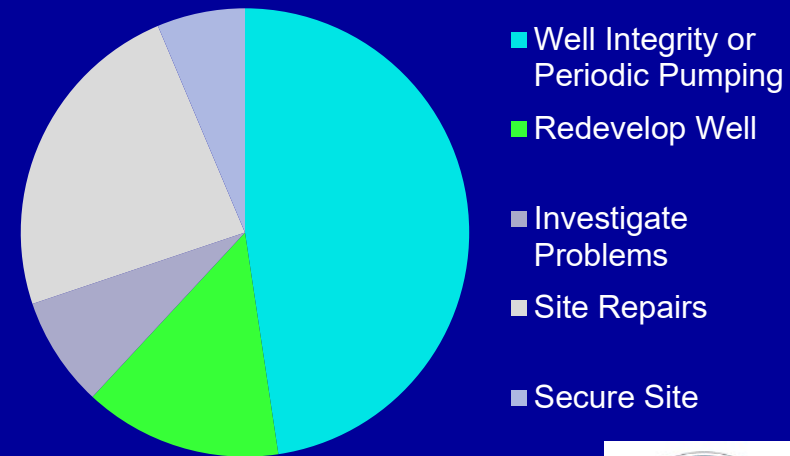
- Objective 3
- 4026 Wells
  - Data entry to fill gaps at 3254 wells
    - Historic Data Entry
    - Lithologic Log Entry
    - Metadata Updates
      - Well Construction
  - Data collection to fill gaps at 772 wells
    - Lithology
      - Borehole Camera Logging
    - Well Construction Details
      - Borehole Camera Logging
    - GPS



# Well Maintenance

- Objective 4
- 749 wells
  - Well Integrity Testing or periodic pumping: 463 wells
  - Borehole Video investigation: 68 wells
  - Well Redevelopment: 94 Wells
  - Site repairs: 68 wells
    - Reconstruction
    - Rehabilitation
    - Well Head Repairs
  - Secure Site: 40 wells
    - Surface Casing
    - Fencing

Number of Projects

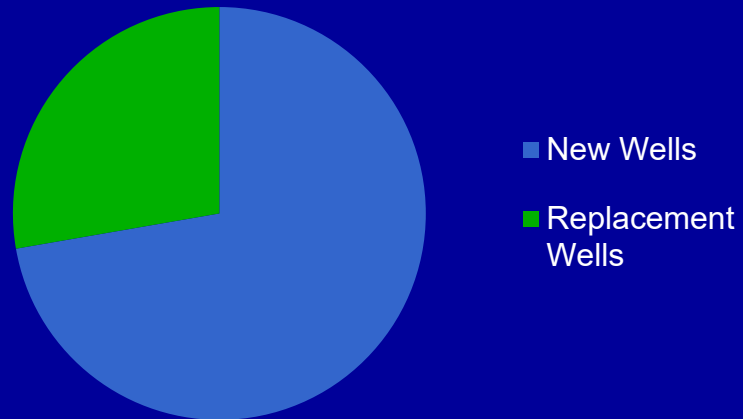


# Well Drilling

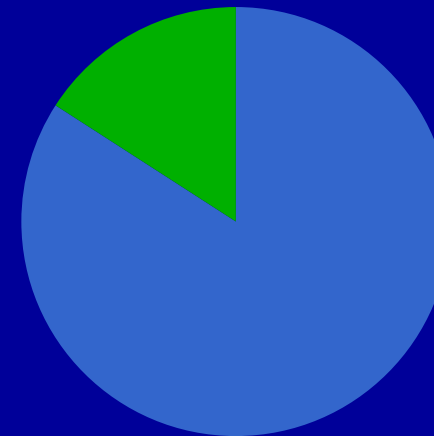
- Objective 5
- 238 wells
  - Drill new wells to fill gaps: 172 Wells
  - Drill wells to replace existing NGWMN sites: 66 Wells



Number of Wells



Funding



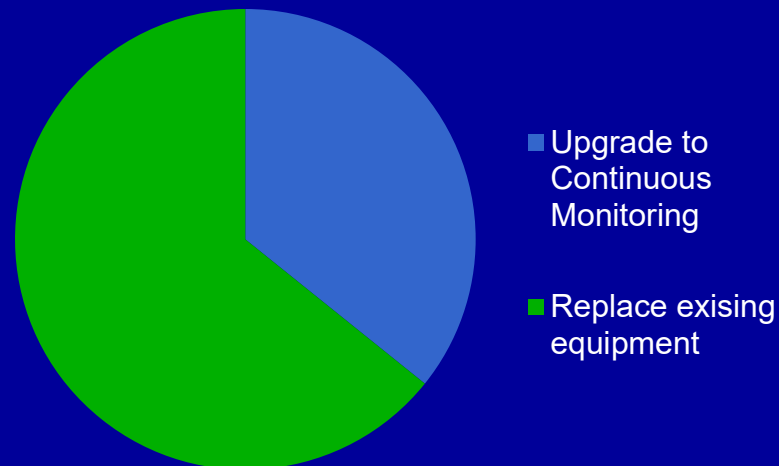


# Continuous Water-Level Monitoring Equipment

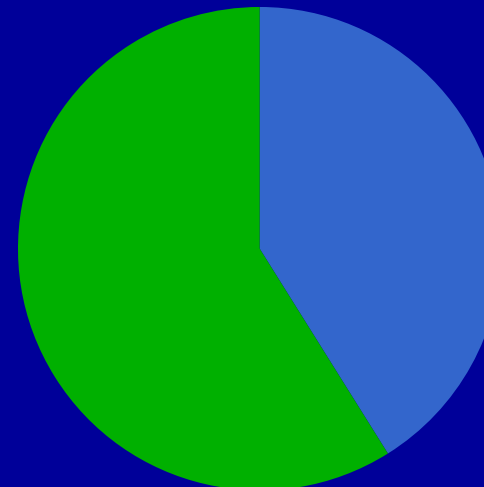
- Objective 6
- Began in FY 2021
- 355 wells
  - Equip 127 wells
  - Replace equipment at 228 wells



Number of Wells



Funding



- Upgrade to Continuous Monitoring
- Replace existing equipment



# 2024 Program Announcement

- We are just beginning to prepare the 2024 Program Announcement
- There will be webinars in the Fall to discuss the Program Announcement and any changes that were made
- The Program Announcement will be open in late September and close at the end of January 2024
- The Program Board will meet in March 2024 to review the proposals.

# USGS Climate Response Network (CRN)

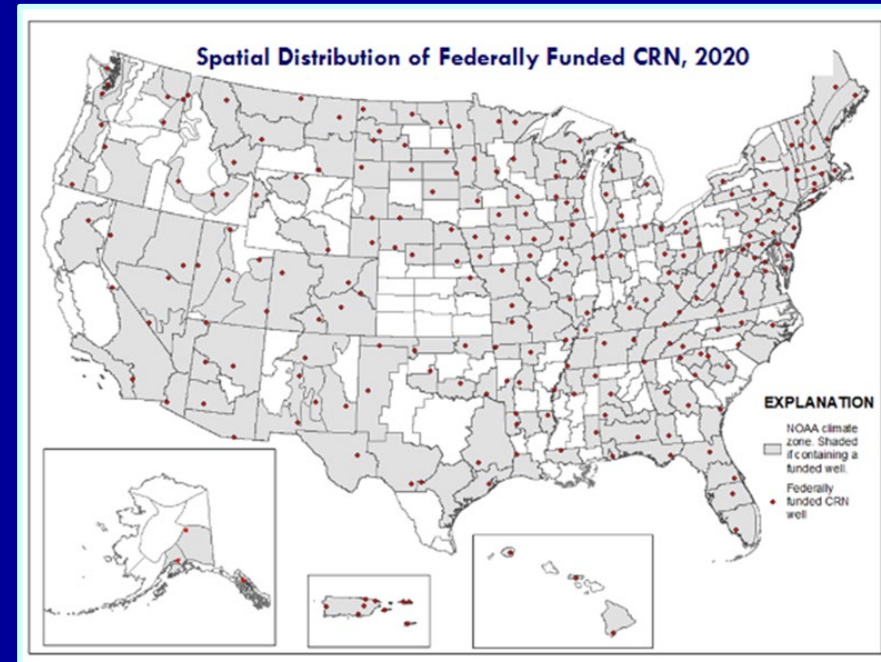
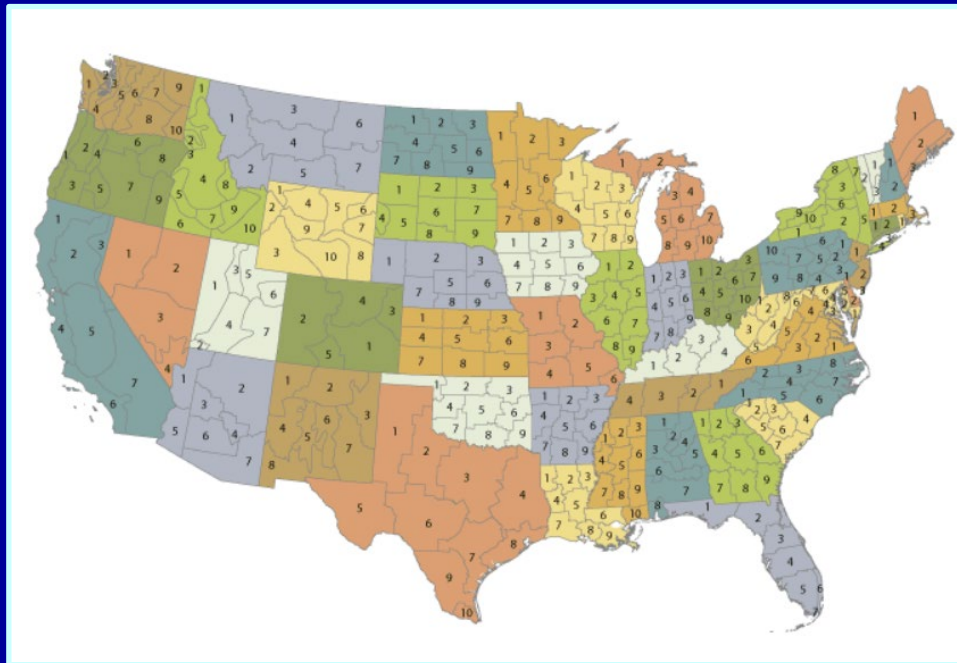
- A national network designed to monitor the response of groundwater systems to climate variations.
- Water-level changes should primarily reflect climatic variability and not human influences.
- The climate variations of interest are those that affect recharge on monthly and longer time scales.
- Sites should satisfy the following criteria:
  - Open to a single unconfined aquifer or near-surface confined aquifer
  - Known well construction that allows for good water-level measurements
  - Minimally affected by groundwater withdrawals and likely to remain so
  - Unaffected by irrigation, canals, and other sources of artificial recharge
  - Long-term accessibility
  - Well has never gone dry



# CRN: Distribution

Objective: a site in each of the National Weather Service 366 climate divisions.

Each climate division has monthly station temperature and precipitation values computed from daily observations.



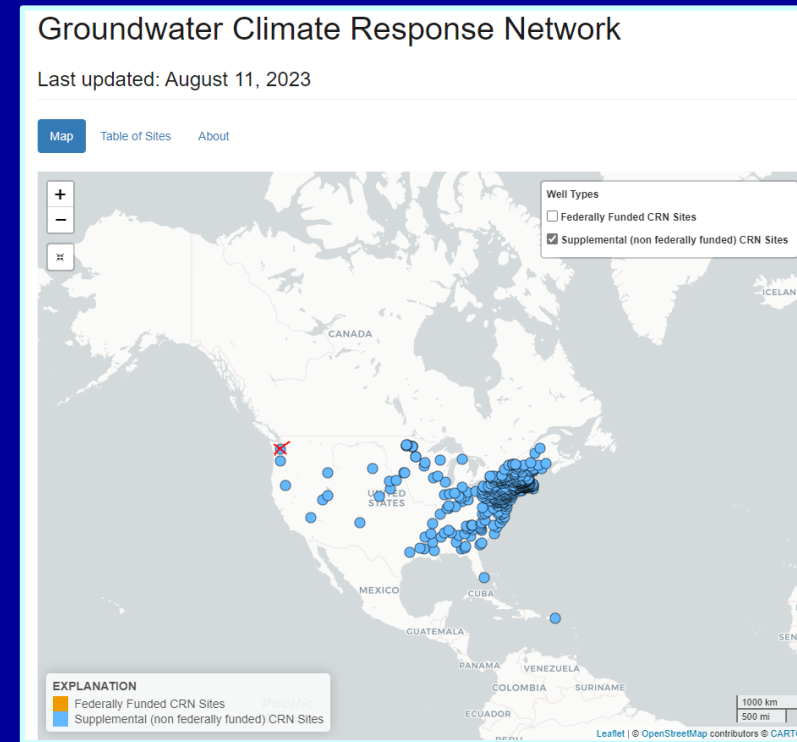
U.S. Climate Divisions (<https://www.ncei.noaa.gov/access/monitoring/dyk/us-climate-divisions>)

# CRN: 2023 Distribution

- 256 federally-funded sites that are continuously monitored and fully funded by the USGS (70% of climate zones)
- 408 supplemental sites monitored in cooperation with State, Local, Regional, Tribal, and other Federal partners fill an additional 34 climate zones (~80 % of climate zones)



Federally-funded CRN sites

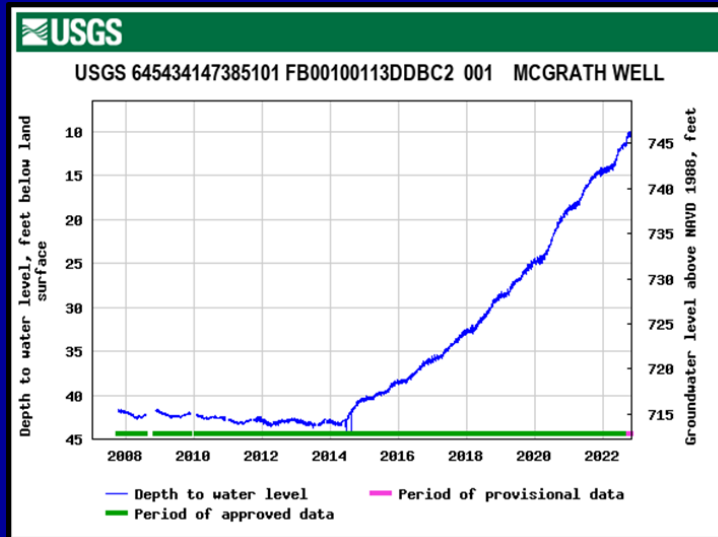


Supplemental CRN sites



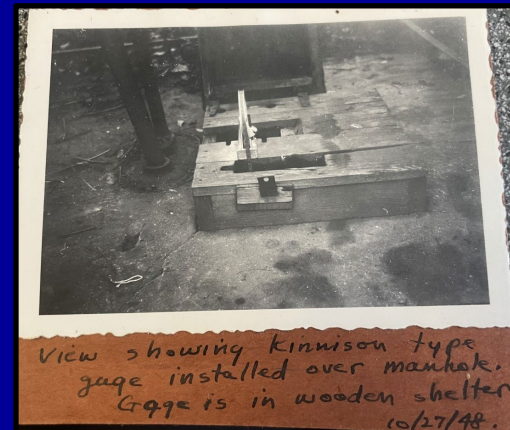
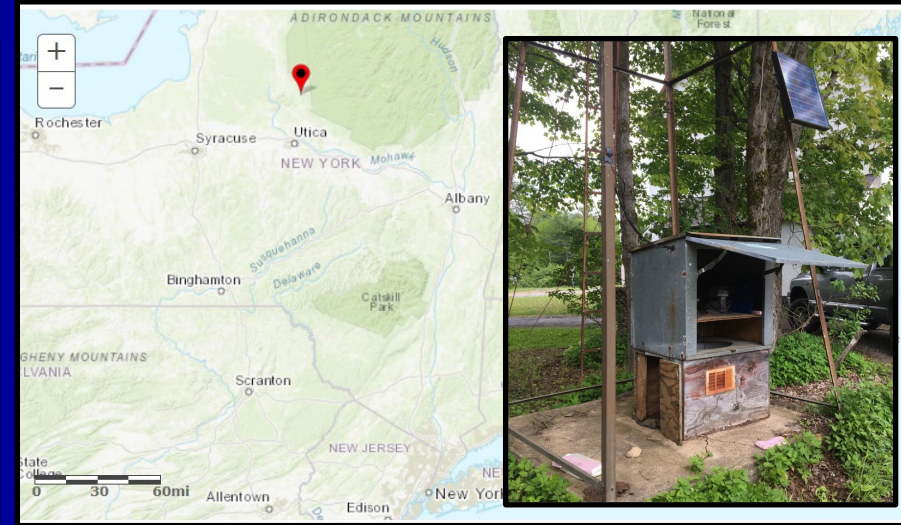
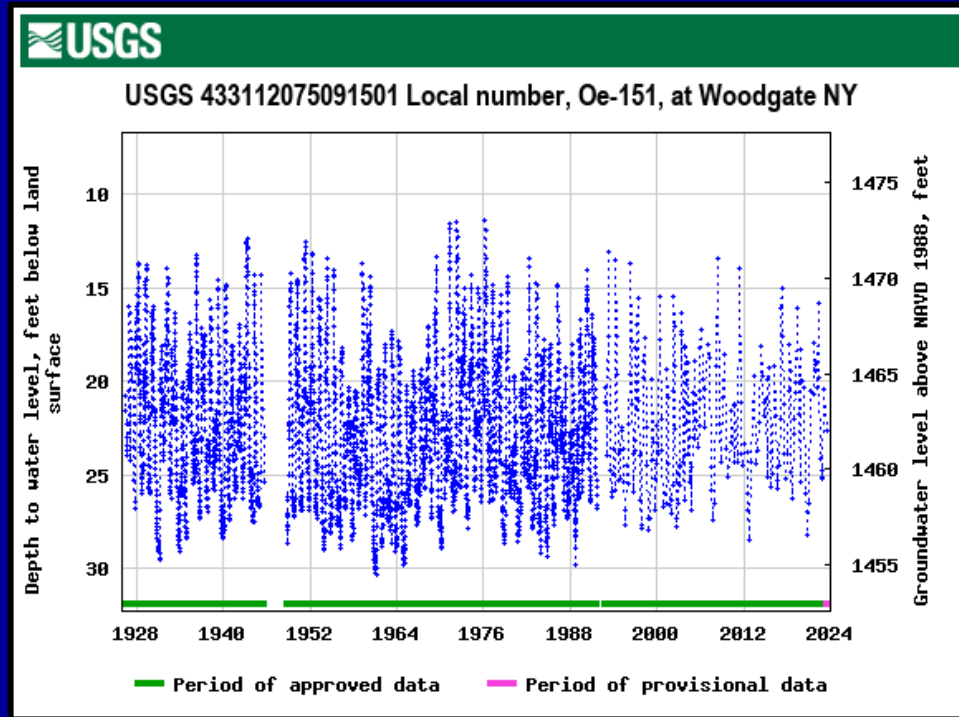
# CRN News: Recent

- A well near Fairbanks, Alaska was abandoned as it was rapidly transitioning into a flowing well due to melting permafrost ([Hydrograph below](#))
- New well drilled on the Blackfeet Reservation of Northwest Montana with multiple cooperators. Replaced a CRN well in the same climate zone affected by pumping.
- New groundwater application (<https://rconnect.usgs.gov/gwapp/>) – can select CRN sites
- New CRN web page (<https://rconnect.chs.usgs.gov/crnmap/CRNmap.html>)



# CRN News: Longest Running CRN well

- USGS 433112075091501, Oe-151 at Woodgate, New York
  - 3,385 field measurements back to 1926
  - 31 feet deep well completed in "Sand and gravel aquifers"



Photos provided by  
Alicia Gearwar NY  
WSC



# CRN – Moving Forward in FY2024

- New CRN Fact Sheet
- Verify sites continue to meet project objectives
- Review WY2023 data beginning ~1/2024
- Review and update Supplemental CRN site list
- Promote awareness and utilization of the CRN
  - Data visualizations
  - Trends

380616075380701 SO Cf 2 Somerset County, Maryland – 15 ft well completed in "Northern Atlantic Coastal Plain aquifer system" (S100NATLCP)





- Jason Fine                      [jmfine@usgs.gov](mailto:jmfine@usgs.gov)
- Rod Caldwell                      [caldwell@usgs.gov](mailto:caldwell@usgs.gov)

<http://cida.usgs.gov/ngwmn/>