Decadal Change in Groundwater Quality Viewer

USGS Oklahoma-Texas Water Science Center

Texas Groundwater Protection Committee Meeting

January 14, 2026

NAWQA to NWQN

NAWQA (National Water-Quality Assessment) Project (1991—2022) has *changed*.
The sampled groundwater wells became a part of the **NWQN (National Water-Quality Network)**

- As of 2025, the NWQN consists of 258 groundwater sampling locations throughout the United States.
- Groundwater sites are sampled once every 10 years, about 8 regional networks every year.
- The scientific data are used by national, regional, state, and local agencies to develop science-based policies and management strategies to improve and protect water resources used for drinking water, recreation, irrigation, energy development, and ecosystem needs.

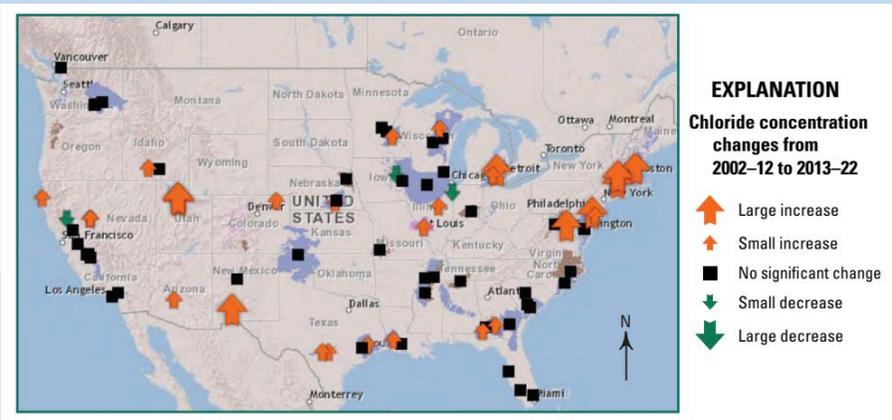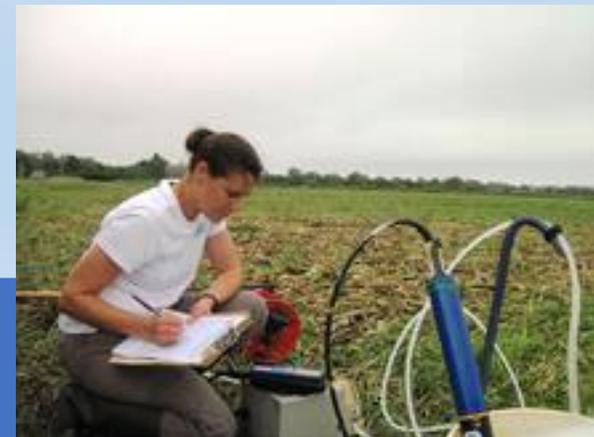More info:https://www.usgs.gov/mission-areas/water-resources/science/usgs-national-water-quality-network

EXPLANATION

Chloride concentration changes from 2002–12 to 2013–22

- Large increase
- Small increase
- No significant change
- Small decrease
- Large decrease

Photo on left:
https://pubs.usgs.gov/gip/256/gip256.pdf

Photo on right:
https://www.usgs.gov/media/images/sentinel-monitoring-new-and-legacy-pesticides-long-island-ny

National Water Quality Network: Groundwater is a three-dimensional resource

The 81 groundwater trend networks in the National Water Quality Network are Land Use studies or Major Aquifer Studies and each is sampled once per decade
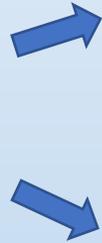
Land Use Studies
typically observation wells
~ 20 to 50 feet

Major Aquifer Studies
typically domestic wells
~ 50 to 150 feet

Almost one-half of the U.S. population rely on groundwater for their water supply, and demand for groundwater for public supply, irrigation, and agriculture continues to increase.

USGS

Trends in groundwater quality

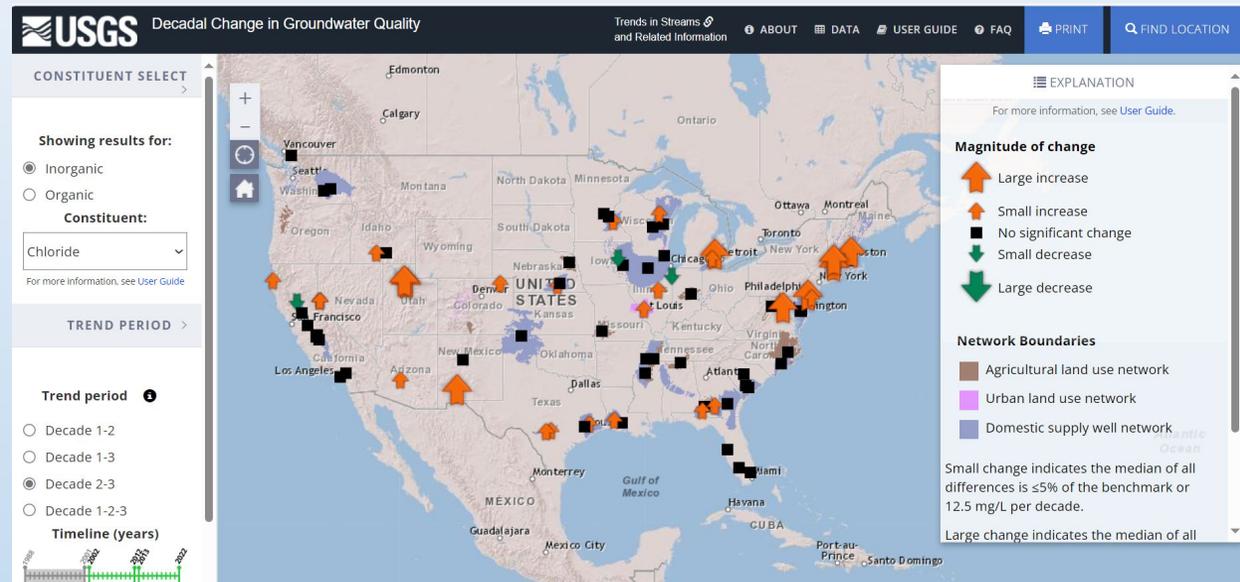Lindsey, B.D., Fleming, B.J., Goodling, P.J., and Dondero, A.M., 2023, Thirty years of regional groundwater-quality trend studies in the United States: Major findings and lessons learned, J.of Hydrol.

Lindsey, B.D., Johnson, T.D., Privette, L.M., and Estes, N.J., 2018, Decadal changes in groundwater quality: U.S. Geological Survey Web page, https://nawqatrends.wim.usgs.gov/Decadal/

Lindsey, B.D., May, A.N., and Johnson, T.D., 2022, Data from Decadal Change in Groundwater Quality Web Site, 1988-2021: U.S. Geological Survey data release, https://doi.org/10.5066/P9FZT1WO
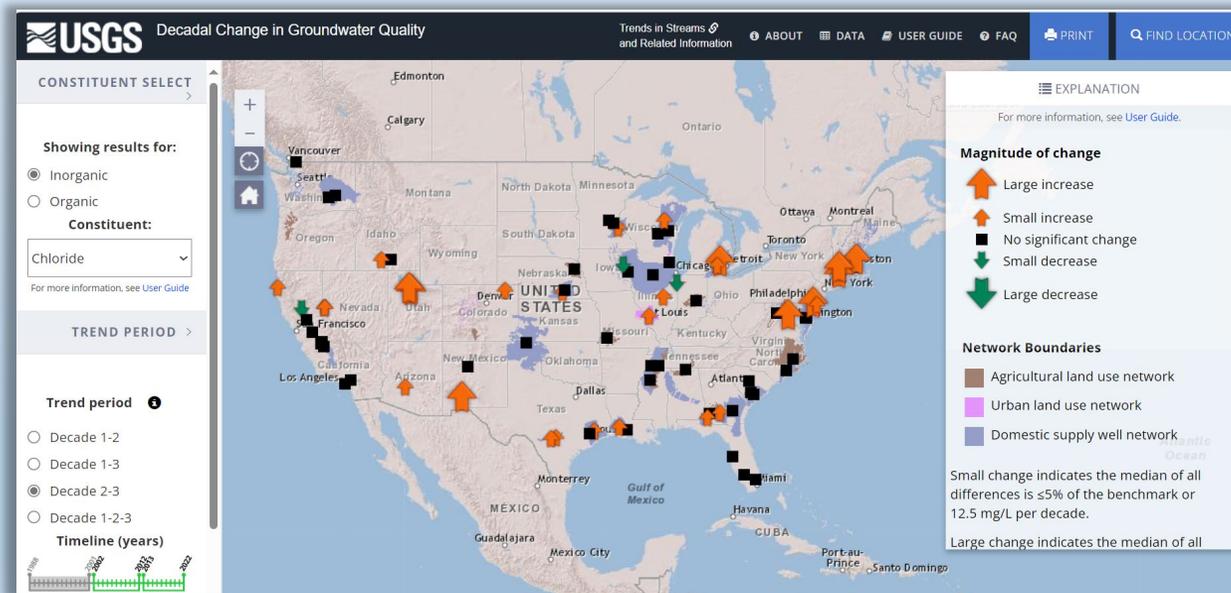
Demonstration and Features

The **Decadal Change in Groundwater Quality** mapper* shows how concentrations of pesticides, nutrients, metals, and organic contaminants in groundwater are changing during decadal periods across the Nation.

First published March 3, 2019   * designed for desktop use
https://www.usgs.gov/tools/groundwater-quality-decadal-change

Currently Version 4

Lindsey, B.D., Johnson, T.D., Privette, L.M., and Estes, N.J., 2018, Decadal changes in groundwater quality: U.S. Geological Survey Web page, https://nawqatrends.wim.usgs.gov/Decadal/

A first of its kind, national assessment of an unseen, valuable resource.

Decadal Change in Groundwater Quality

A first of its kind, national assessment of an unseen, valuable resource

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About 140 million people—almost one-half of the Nation's population—rely on groundwater for public supply, and demand for groundwater for public supply, irrigation and agriculture continues to increase.

This mapper shows how concentrations of pesticides, nutrients, metals, and organic contaminants in groundwater are changing during decadal periods across the Nation.

Tracking changes in groundwater quality and investigating the reasons for these changes is crucial for informing management decisions to protect and sustain our valuable groundwater resources.
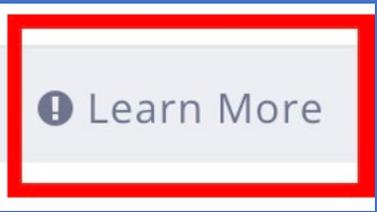
IMAGE: An image of a USGS scientist collecting data.

Close

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❓ About   **❗ Learn More**   **💧 Related Resources**   **✅ What's New**   **⊘ Disclaimer**
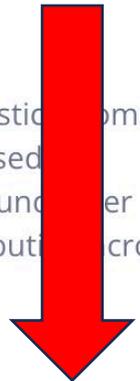
Learn More

Evaluating Decadal Changes in Groundwater Quality

Groundwater-quality data were collected from 5,000 wells between 1988-2001 (first decadal sampling event) by the U.S. Geological Survey's National Water-Quality Program. Samples are collected in groups of 20-30 wells with similar characteristics called networks. About 1,500 of these wells in 67 networks were sampled again approximately 10 years later between 2002-2012 (second sampling event) to evaluate decadal changes in groundwater quality. Between 2012 and 2021 (third sampling event), a subset of these networks was sampled again, allowing additional results to be displayed on the web page: Decadal changes in groundwater quality. This is the sixth iteration of data added to the website. With the additional data, it is possible to evaluate changes in water quality between the 2nd and 3rd sampling events for 73 networks, changes in water quality between the 1st and 3rd sampling events for 61 networks, and changes across all 3 sampling events for 58 networks. Samples were obtained from monitoring wells, domestic-supply wells, and some public-supply wells before any treatment on the system.

Groundwater samples used to evaluate decadal change were collected from networks of wells with similar characteristic some networks, consisting of domestic or public supply wells, were used to assess changes in the quality of groundwater used drinking water supply. Other networks, consisting of monitoring wells, assessed changes in the quality of shallow ground er underlying key land-use types such as agricultural or urban lands. Networks were chosen based on geographic distributi cross the Nation and to represent the most important water-supply aquifers and specific land-use types.

Decadal changes in groundwater quality were assessed for these

Decadal changes in groundwater quality were assessed for these constituents:

Inorganics	Organics
Arsenic	Atrazine
Boron	Chloroform
Chloride	Deethylatrazine
Fluoride	Dieldrin
Iron	Methyl tert-butyl ether
Lithium	Metolachlor
Manganese	Prometon
Molybdenum	Simazine
Nitrate	Tetrachlorothene
Orthophosphate	Toluene
Radium	Trichloroethene
Sodium	1,2-Dibromo-3-chloropropane (DBCP)
Strontium	
Sulfate	
Total Dissolved Solids	
Uranium	

For more information about constituents and why they were chosen click here.

Decadal Change in Groundwater Quality

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❎

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Related Resources

Related U.S. Geological Survey (USGS) Web Applications

Water-Quality Changes in the Nation's Stream's and River's
Tracking Water Quality of the Nation's Rivers and Streams

Other Related USGS Information

USGS homepage
USGS National Water Quality Program
USGS Water Resources Programs
USGS Science in Your Watershed
USGS Water Mission Area
USGS Ecosystems Mission Area
USGS Energy and Minerals Mission Area
USGS Natural Hazards Mission Area
USGS Coastal and Marine Geology Program
USGS Energy Resources Program Environmental Aspects of Energy Production and Use

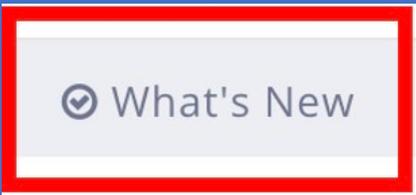**Links to Other Federal Agencies**

U.S. Environmental Protection Agency (USEPA) homepage
USEPA Water Data and Tools
USEPA Recommended Water Quality Standards
USEPA National Aquatic Resource Surveys

USGS

Decadal Change in Groundwater Quality

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Updates to Decadal Changes in Groundwater Quality

This web mapping application is based on a data release that updates Decadal changes in groundwater quality: U.S. Geological Survey Web page, Lindsey and others, 2018. The initial data release documented decadal changes in groundwater quality for 67 networks that had been sampled by the National Water-Quality Program. The results were based on analysis of 1,515 wells in the 67 networks that had been sampled during 1988-2001 and again between 2002-2012. Subsequent data releases updated the website with results from 2012-2014, 2015-16, 2017-18, 2019-20 and 2021. The U.S. Geological Survey's National Water-Quality Assessment Project ended in 2021, but monitoring is continuing as a part of the National Water Quality Program. The table below shows the numbers of wells and networks that can be compared across any 2 or 3 time periods:

	Sample pairs in Decade 1 and 2	Sample pairs in Decade 1 and 3	Sample pairs in Decade 2 and 3	Sample sets in Decade 1, 2, and 3	Number of wells or networks with at least 2 decadal sampling pairs
Numbers of wells sampled	1,520	1,168	1,594	1,565	2,242
Numbers of Networks sampled	67	61	73	58	89

New data added from the time period 2021 include: 165 wells sampled in 7 networks that could be compared to the same wells and networks sampled during 1988-2001; 138 wells sampled in 6 networks that could be compared to the same wells and networks sampled during 2002-2012; and 138 wells in 6 networks with sufficient data to evaluate changes across all three events. The results across multiple time periods allow the user to select the time period of interest for display. The comparison of 1988-2001 to 2002-2012 displays the same results as all previous versions, with exception of the errata listed below. The new options

Decadal Change in Groundwater Quality

CONSTITUENT SELECT ›

TREND PERIOD ›

BASEMAPS ›

MAP LAYERS ›

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≡ EXPLANATION

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⬇ Download the Data   ⓘ Technical Information   🔖 References Cited

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Helsel, D.R., Mueller, D.K., and Slack, J.R., 2006, Computer program for the Kendall family of trend tests: U.S. Geological Survey Scientific Investigations Report 2005-5275, 4 p. [Also available at https://pubs.usgs.gov/sir/2005/5275/pdf/sir2005-5275.pdf

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1:4,622,324
34.120 | -92.839

CONSTITUENT SELECT >

TREND PERIOD >

BASEMAPS >

MAP LAYERS >

CONSTITUENT SELECT >

Showing results for:

⦿ Inorganic

◯ Organic

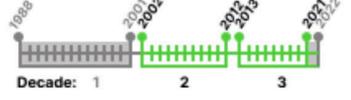**Constituent:**

Chloride ▾

For more information, see User Guide

TREND PERIOD >

Trend period ⓘ

⦿ Decade 1-2

◯ Decade 1-3

◯ Decade 2-3

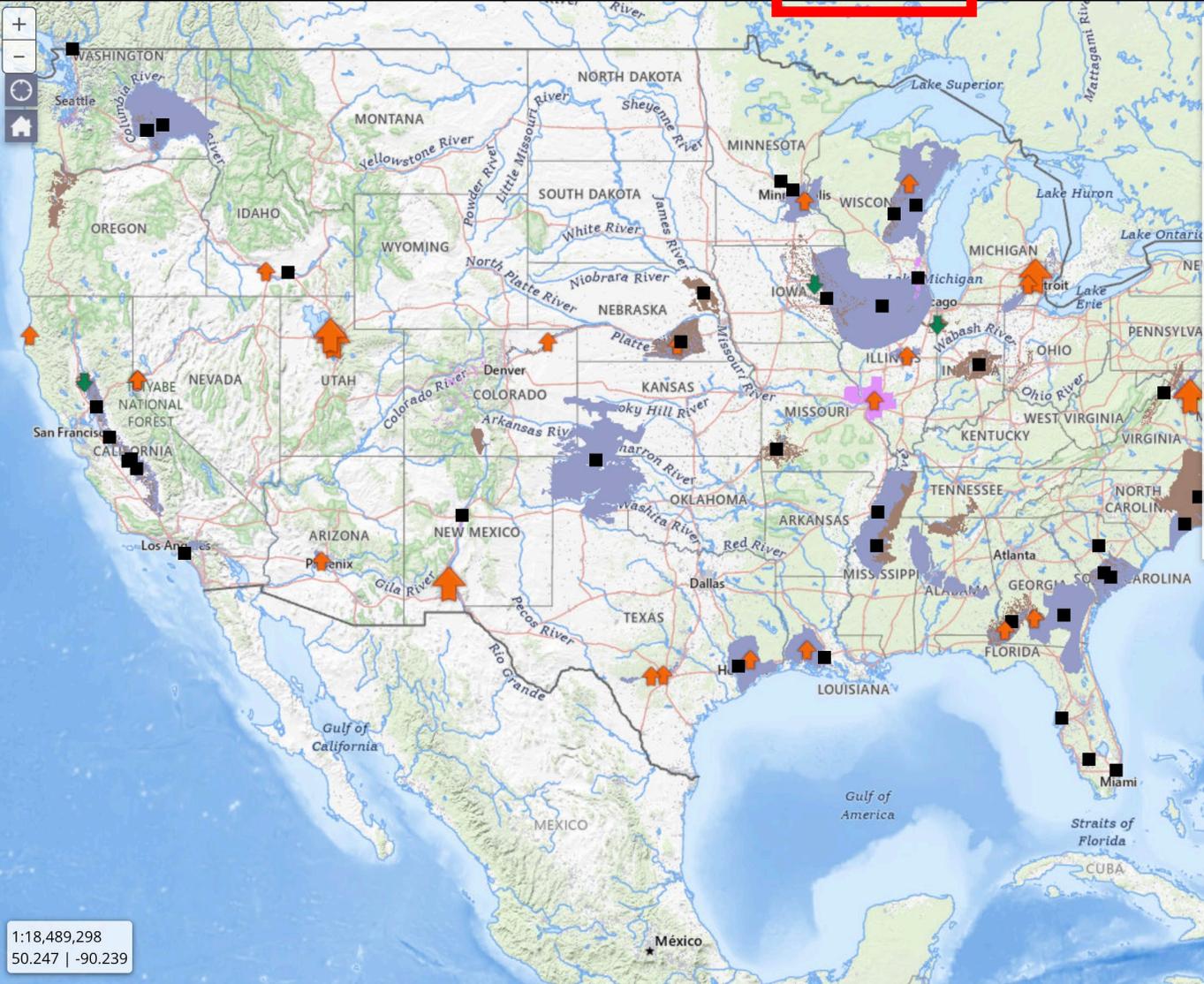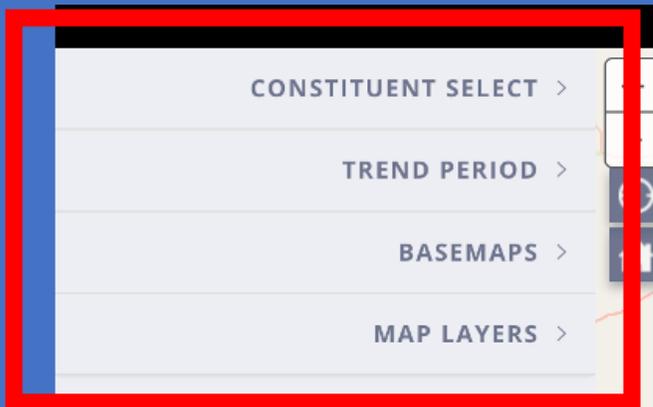◯ Decade 1-2-3

Timeline (years)

1988   2001 2002   2012 2013   2021 2022

Decade: 1   2   3

MAP LAYERS >

☐ All Networks   ◐

☐ Network Boundaries   ❓

☐ Magnitude of change   ❓

☐ Land use 2001   ◐

☐ Principal Aquifers   ◐ ❓

≋ **USGS**

CONSTITUENT SELECT >

Showing results for:

⦿ Inorganic

◯ Organic

Constituent:

Chloride ▾

For more information, see User Guide

CONSTITUENT SELECT >

Showing results for:

⦿ Inorganic

Constituent:

Arsenic

Boron

✓ Chloride

Fluoride

Iron

Lithium

Manganese

Molybdenum

Nitrate

Orthophosphate

Radium 226 plus Radium 228

Sodium

Strontium

Sulfate

Total Dissolved Solids

Uranium

CONSTITUENT SELECT >

Showing results for:

◯ Inorganic

⦿ Organic

Constituent:

✓ 1,2-Dibromo-3-chloropropane (DBCP)

Atrazine

Chloroform

Deethylatrazine

Dieldrin

Methyl tert-butyl ether

Metolachlor

Prometon

Simazine

Tetrachloroethene

Toluene

Trichloroethene

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Decadal Change in Groundwater Quality

Find Location   Print   FAQ   USER GUIDE   DATA   ABOUT

Showing results for:
- ( ) Inorganic
- ( ) Organic

Constituent:

Chloride

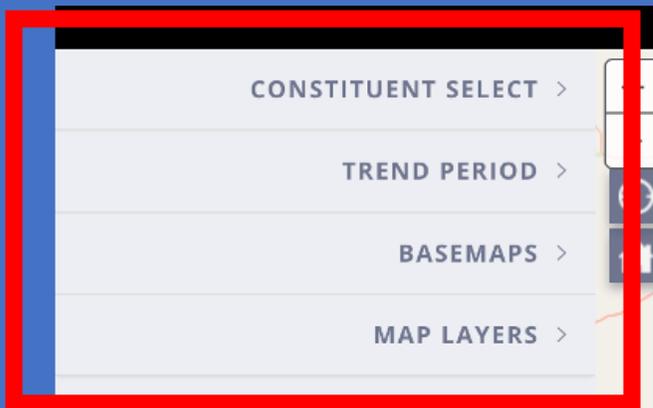For more information, see User Guide

TREND PERIOD >

Trend period ⓘ
- ( ) Decade 1-2
- ( ) Decade 1-3
- ( ) Decade 2-3
- (•) Decade 1-2-3

Timeline (years)

1988   2001 2002   2012 2013   2021 2022
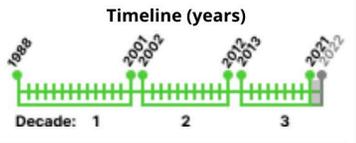
Decade: 1   2   3

BASEMAPS >

☑ All Networks
☑ Network Boundaries
☐ Magnitude of change
☐ Land use 2001
☐ Principal Aquifers

POWE

USGS
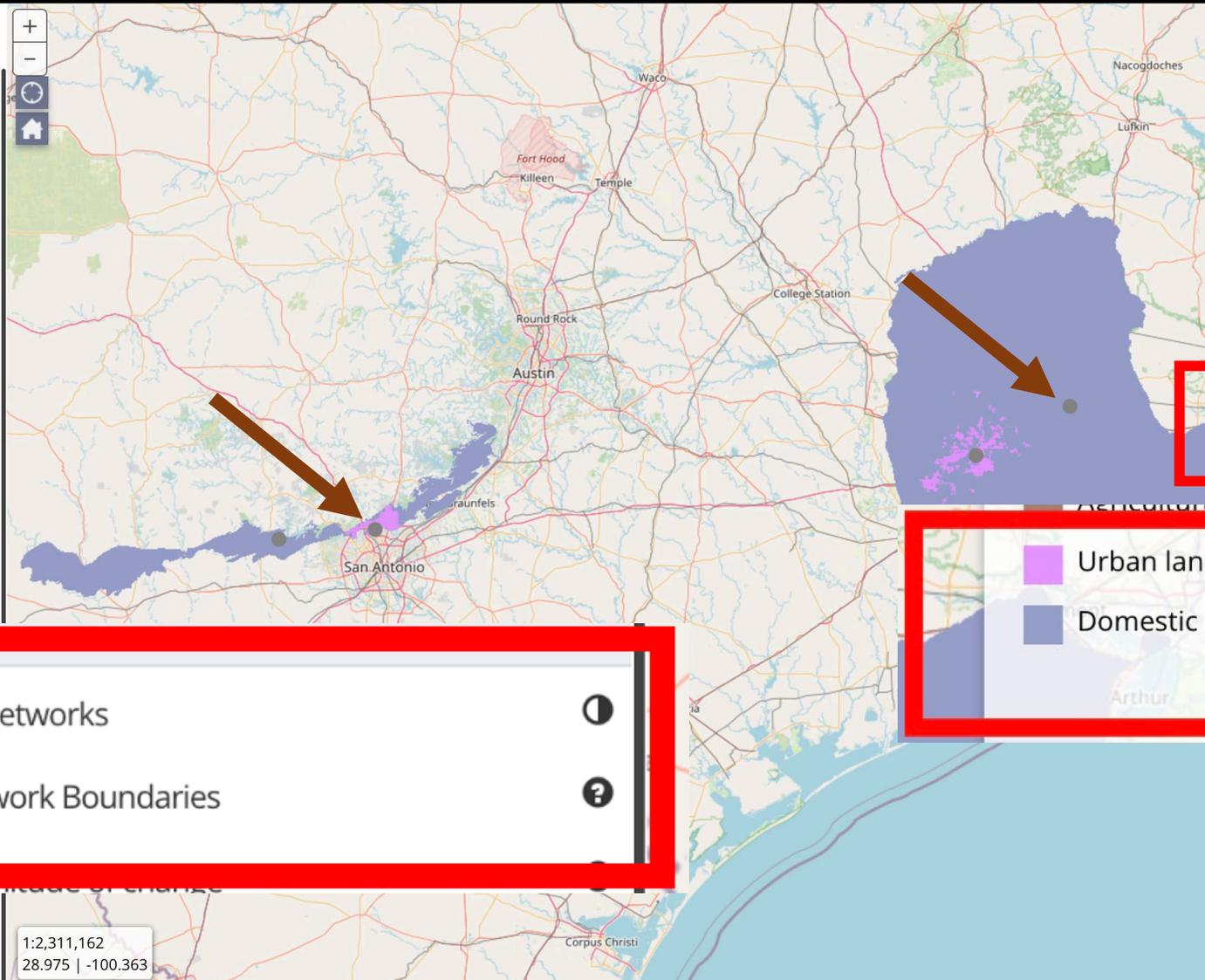
☰ EXPLANATION

For more information, see User Guide.

All Networks
⬤ Network

Network Boundaries
▢ Agricultural land use network
▢ Urban land use network
▢ Domestic supply well network

Agricultural land use network

▢ Urban land use network
▢ Domestic supply well network

☑ All Networks ◑

☑ Network Boundaries ❓

1:2,311,162
28.975 | -100.363

Chloride

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Decadal Change in Groundwater Quality

Find Location | **Print** | **FAQ** | **USER GUIDE** | **DATA** | **ABOUT**

Showing results for:
- ○ Inorganic
- ○ Organic

Chloride ▾

For more information, see User Guide

TREND PERIOD ＞

Trend period ⓘ
- ○ Decade 1-2
- ○ Decade 1-3
- ○ Decade 2-3
- ● Decade 1-2-3

Timeline (years)

1988   2001 2002   2012 2013   2021 2022

Decade: 1   2   3

BASEMAPS ＞

MAP LAYERS ＞

- ☐ All Networks
- ☑ Network Boundaries
- ☑ Magnitude of change
- ☐ Land use 2001
- ☐ Principal Aquifers

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1:2,311,162
28.493 | -94.881

≡ EXPLANATION

For more information, see User Guide

Magnitude of change
- ⬆ Large increase
- ⬆ Small increase
- ■ No significant change
- ⬇ Small decrease
- ⬇ Large decrease

Network Boundaries
- ⬛ Agricultural land use network
- ⬛ Urban land use network
- ⬛ Domestic supply well network

Small change indicates the median of all differences is ≤5% of the benchmark or 12.5 mg/L per decade.

Large change indicates the median of all

ⓘ Site Information   X

Chloride	no change
Network type	Major aquifer study
Types of wells	Mixed domestic and stock
Typical depth range	260 to 405 feet
Principal aquifer	Edwards-Trinity aquifer system
Regional aquifer	Unconfined Edwards aquifer
Aquifer material	Sandstone and carbonate rock
Additional information	none
Network code	sctxsus1
Sample dates	1996, 2006, 2018

ZOOM TO NETWORK

For explanation of table entries click here

● = Well

DOI Privacy Policy   Legal   Accessibility   Site Map
U.S. Department of the Interior   DOI Inspector General   White House   E-Gov   No Fear Act   FOIA

Site Information ⓘ   X

Chloride	no change
Network type	Major aquifer study
Types of wells	Mixed domestic and stock
Typical depth range	260 to 405 feet
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Regional aquifer	Unconfined Edwards aquifer
Aquifer material	Sandstone and carbonate rock
Additional information	none
Network code	sctxsus1
Sample dates	1996, 2006, 2018

ZOOM TO NETWORK

For explanation of table entries click here

🟢 = Well

NOTE: When you click on centroid of the network, the well locations populate

← Major Aquifer Study

← sctxsus1
← 1996, 2006, 2018

USGS

Texas Networks
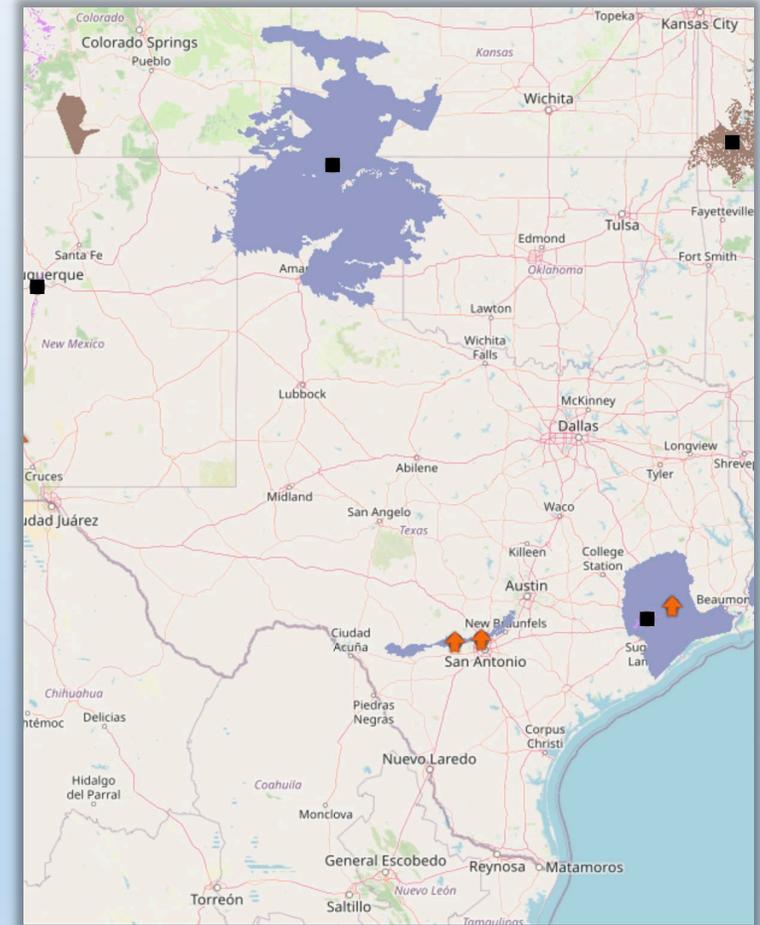
High Plains

Major aquifer study (Domestic supply well network)

1999, 2010, 2021

Edwards-Trinity Aquifer

Major aquifer study (Domestic supply well network)

1996, 2006, 2018

Urban land use network

1998, 2006, 2018

Coastal Lowlands (Gulf Coast)

Major aquifer study (Domestic supply well network)

1994, 2002, 2014, **2024**

Urban land use network

NA, 2003, 2015, **2025**

Sodium

Showing results for:
- ○ Inorganic
- ○ Organic

Sodium

For more information, see User Guide

TREND PERIOD >

Trend period ⓘ
- ○ Decade 1-2
- ○ Decade 1-3
- ● Decade 2-3
- ○ Decade 1-2-3

Timeline (years)

Decade: 1   2   3

BASEMAPS >

MAP LAYERS >

- ☑ All Networks   ◐
- ☑ Network Boundaries   ❓
- ☑ Magnitude of change ❓
- ☐ Land use 2001   ◐
- ☐ Principal Aquifers   ◐ ❓

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1:1,155,581
30.119 | -95.045

■ No significant change
↓ Small decrease
⬇ Large decrease

All Networks
● Network

Network Boundaries
- ▦ Agricultural land use network
- ▦ Urban land use network
- ▦ Domestic supply well network

Small change indicates the median of all differences is ≤5% of the benchmark or 1.5 mg/L per decade.

Large change indicates the median of all differences is >5% of the benchmark or 1.5 mg/L per decade.

Benchmark for sodium is 30 milligrams per liter (mg/L), which is a taste threshold.

ⓘ Site Information   X

Sodium	no change
Network type	Major aquifer study
Types of wells	Mixed domestic and public supply
Typical depth range	100 to 210 feet
Principal aquifer	Coastal lowlands aquifer system
Regional aquifer	Chicot and Evangeline aquifers
Aquifer material	Semiconsolidated sand
Additional information	none
Network code	trinsus3
Sample dates	1994, 2002, 2014

ZOOM TO NETWORK

For explanation of table entries click here

Decadal Change in Groundwater Quality

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Showing results for:

● Inorganic
○ Organic

Sodium

For more information, see User Guide

Sodium ▾

For more information, see User Guide

TREND PERIOD ›

Trend period ⓘ

○ Decade 1-2
○ Decade 1-3
● Decade 2-3
○ Decade 1-2-3

Timeline (years)

Decade: 1 2 3

BASEMAPS ›

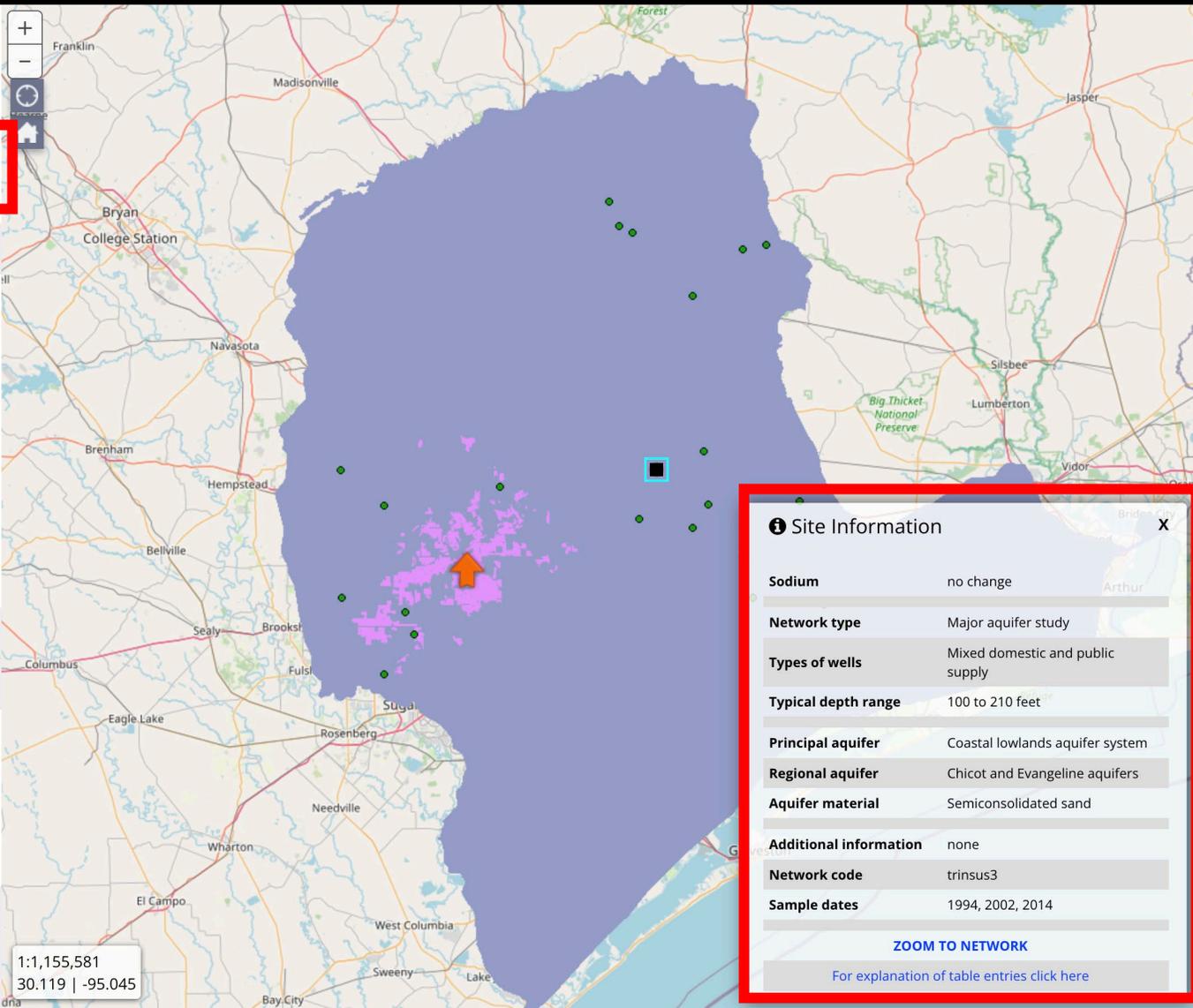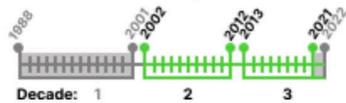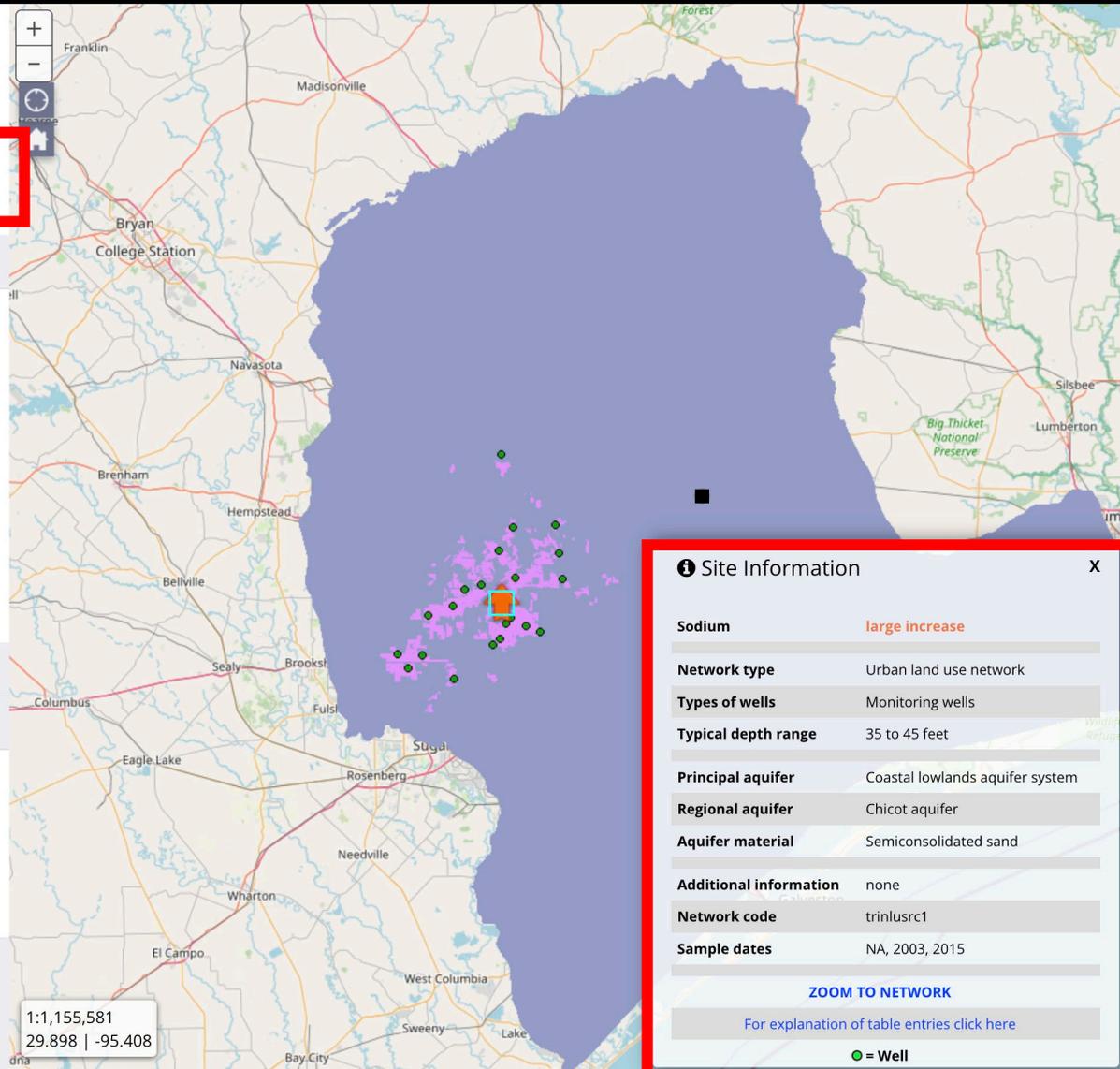MAP LAYERS ›

☑ All Networks ◑
☑ Network Boundaries ❓
☑ Magnitude of change ❓
☐ Land use 2001 ◑
☐ Principal Aquifers ◑❓

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1:1,155,581
29.898 | -95.408

≈ **USGS**

⊞ EXPLANATION

For more information, see User Guide.

Magnitude of change

⬆ Large increase

⬆ Small increase

■ No significant change

⬇ Small decrease

⬇ Large decrease

All Networks

⬤ Network

Network Boundaries

■ Agricultural land use network

■ Urban land use network

■ Domestic supply well network

Small change indicates the median of all

ⓘ Site Information X

Sodium	large increase
Network type	Urban land use network
Types of wells	Monitoring wells
Typical depth range	35 to 45 feet
Principal aquifer	Coastal lowlands aquifer system
Regional aquifer	Chicot aquifer
Aquifer material	Semiconsolidated sand
Additional information	none
Network code	trinlusrc1
Sample dates	NA, 2003, 2015

ZOOM TO NETWORK

For explanation of table entries click here

⬤ = Well

More Recent Data and Information

ScienceBase (Data tab on the viewer):

Data Release: Lindsey, B.D., and Dondero, A.M., 2025, Data from Decadal Change in Groundwater Quality Web Site, 1988-2024: https://doi.org/10.5066/P13MEBWT

Fact Sheet: The U.S. Geological Survey National Water Quality Network—Groundwater, 2024, https://doi.org/10.3133/gip256

Fact Sheet: PFAS Sampling Activities in the U.S. Geological Survey National Networks, 2025, https://doi.org/10.3133/gip260
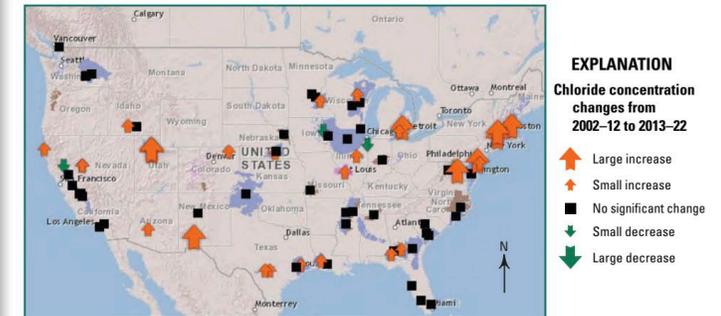
Scientific Investigations Report: Stackpoole, S.M., Lindsey, B.D., and Nell, C.S., 2025, Multidecadal Change in Pesticide Concentrations Relative to Human Health Benchmarks in the Nation's Groundwater, https://doi.org/10.3133/sir20255081

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The U.S. Geological Survey National Water Quality Network—Groundwater, 2024

Sampling of an observation well in Pennsylvania. Photograph by Natalie Schmer, USGS.

The U.S. Geological Survey (USGS) operates a National Water Quality Network (NWQN) to monitor trends in groundwater quality and assess emerging contaminants of concern. It is a "network of networks" with 81 subnetworks being sampled on a decadal time scale. Each year, 8 of the subnetworks are sampled. Subnetworks have 20–30 wells each and include studies of domestic supply wells or shallow groundwater (20–50 feet deep) underlying urban land use or agricultural land use. Currently there are 2,089 wells in the network. All wells are sampled for physical properties, nutrients, major ions, trace elements, per- and polyfluoroalkyl substances (PFAS), and a subset of wells are sampled for pesticides, volatile organic compounds, radionuclides, and microbiological contaminants.

The USGS NWQN includes thousands of locations where USGS staff collect groundwater quality samples from wells (such as those shown in picture above) in order to evaluate trends in groundwater quality across the Nation. Trends are calculated for 16 constituents including nitrate, radium, and several major ions and trace elements.

EXPLANATION
Chloride concentration changes from 2002–12 to 2013–22
- Large increase
- Small increase
- No significant change
- Small decrease
- Large decrease

Decadal scale changes in groundwater quality calculated from NWQN data. Map links to decadal mapper website. Figure taken from Lindsey, B.D., Johnson, T.D., Privette, L.M., and Estes, N.J., 2018, Decadal changes in groundwater quality: U.S. Geological Survey web page, https://nawqatrends.wim.usgs.gov/Decadal/.

852	744	493
Wells in 33 subnetworks at the depth zone used for domestic supply	Wells in 29 subnetworks of shallow groundwater underlying agricultural land use	Wells in 19 subnetworks representing shallow groundwater underlying urban land use

For more information about the U.S. Geological Survey Water Monitoring Networks:
Visit https://www.usgs.gov/mission-areas/water-resources/science/national-water-monitoring-network
Contact the National Water Quality Network Coordinator at waternetworks@usgs.gov
[This product updates data within the same text from General Information Product 247]

U.S. Department of the Interior   ISSN (online) 2332-354X   General Information Product 256

Additional data for principal aquifers (public-supply wells)

The Quality of the Nation's Groundwater: Progress on a National Survey:
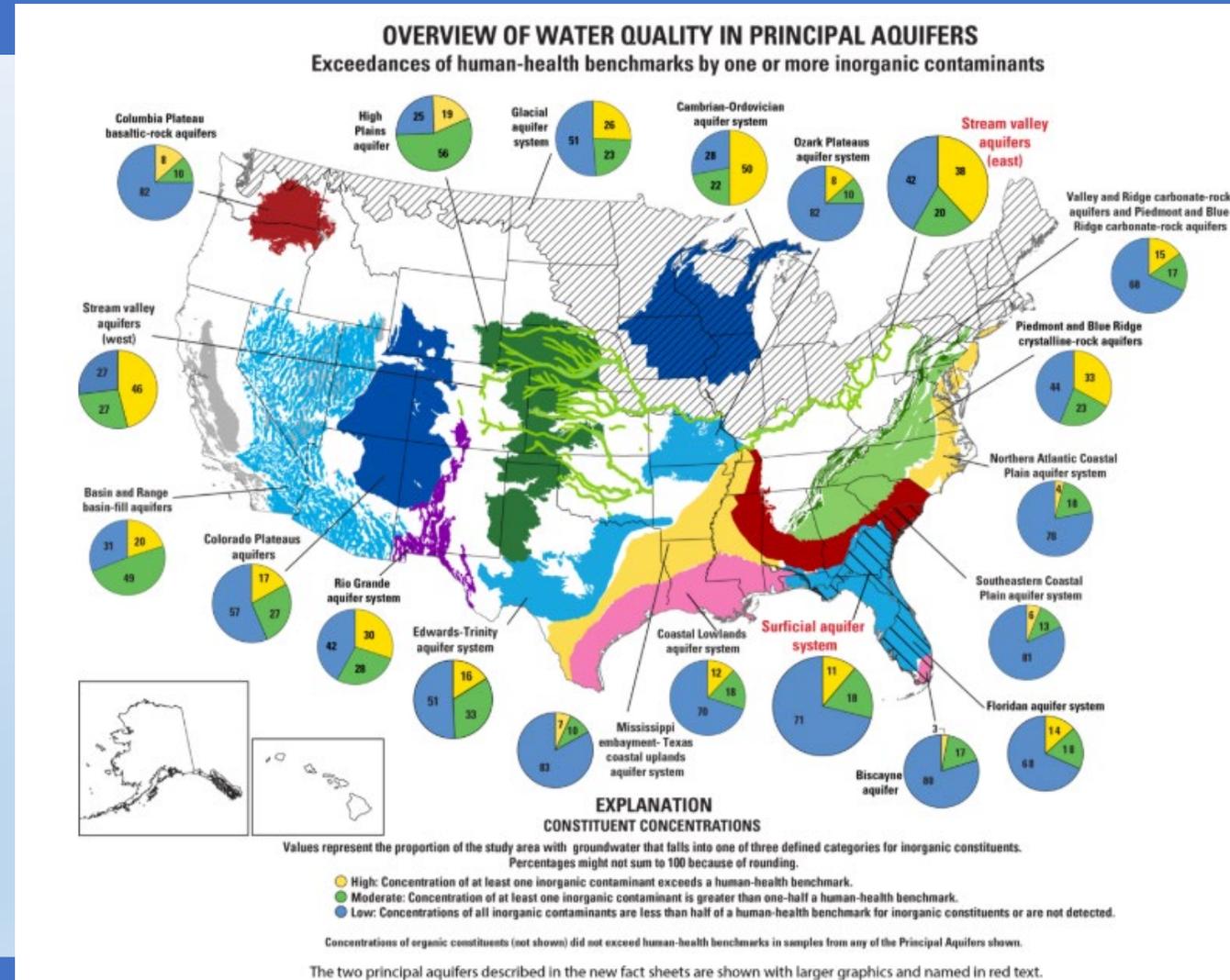https://www.usgs.gov/news/featured-story/quality-nations-groundwater-progress-national-survey

Between 2012 and 2021, the USGS sampled ~1,500 public supply wells in 20 regionally extensive aquifers (principal aquifers). These 20 principal aquifers supply ~75% of the nation's groundwater used for public supply.

Fact sheets summarize results for each principal aquifer.

For Texas aquifers:

- The Edwards-Trinity aquifer system: https://doi.org/10.3133/fs20213010

- The High Plains aquifer: https://doi.org/10.3133/fs20193055

- The Mississippi Embayment-Texas Coastal Uplands aquifer system: https://doi.org/10.3133/fs20183067

- Coastal Lowlands aquifer system: https://doi.org/10.3133/fs20163077

Questions?

About Texas sampling?

> Linzy Foster, PIO, lfoster@usgs.gov

> MaryLynn Musgrove, Research Physical Scientist, mmusgrov@usgs.gov

> Jim Kingsbury, Hydrologist, jakingsb@usgs.gov

About the NWQN?

> Melissa Riskin mriskin@usgs.gov

> Chad Wagner cwagner@usgs.gov