Groundwater Assessment

2024 State of Texas Water Quality Inventory

Prepared by
TCEQ Water Availability Division

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY • PO BOX 13087 • AUSTIN, TX 78711-3087

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Summary

Groundwater in Texas is produced from numerous aquifers, which provide water for many purposes, including domestic and livestock uses, municipal use, industrial activities, irrigation, and agriculture. Texas Water Development Board (TWDB) recognizes nine major aquifers and 22 minor aquifers which underlie about two thirds of the state's 268,596 square miles of surface area. Major aquifers produce substantial amounts of water over large areas and minor aquifers produce either minor amounts of water over large areas or substantial amounts of water over small areas.

In 2021, Texans used approximately 14.4 million acre-feet (ac-ft) of water, with approximately 54% (7.8 million ac-ft) from groundwater sources, 42% (6.1 million ac-ft) from surface water, and less than 4% (500,000 ac-ft) from reuse.[1] Irrigation and livestock users relied on groundwater for over three fourths (6 million ac-ft) of their water supply,[2] and groundwater is the source of approximately one third of municipal water use in Texas.[3]

The 71st Texas Legislature created the Texas Groundwater Protection Committee (TGPC) in 1989 to bridge gaps between existing state groundwater programs and to optimize water quality protection by improving coordination among agencies involved in groundwater activities. By statute,[4] TGPC's membership is composed of the following individuals or their designated representatives:

- Executive Director of TCEQ
- Executive Administrator of TWDB
- Executive Director of the Railroad Commission of Texas (RRC)
- Commissioner of Health of the Texas Department of Health (TDH)
- Deputy Commissioner of the Department of Agriculture (TDA)
- Executive Director of the State Soil and Water Conservation Board (TSSWCB)
- Director of Texas A&M AgriLife Research (AgriLife Research)
- Director of the Bureau of Economic Geology of The University of Texas at Austin (UTBEG)
- A representative selected by the Texas Alliance of Groundwater Districts (TAGD)
- A representative of the Water Well Drillers and Water Well Pump Installers Program of the Texas Department of Licensing and Regulation (TDLR) selected by the executive director of the department.

[1] www.twdb.texas.gov/waterplanning/waterusesurvey/dashboard/index.asp
[2] Ibid.
[3] www.twdb.texas.gov/groundwater/aquifer/index.asp
[4] statutes.capitol.texas.gov/Docs/WA/htm/WA.26.htm#26.403

TCEQ, the lead agency for the TGPC, administers its activities. TCEQ's executive director serves as TGPC's chairperson, and TWDB's executive administrator serves as TGPC's vice-chairperson.

TGPC's member agencies provide data for its groundwater quality inventory. In 1996, TGPC began conducting an inventory of groundwater quality of the state's aquifers through the partnership of two member agencies: TCEQ and TWDB. This information was published in the *State of Texas Water Quality Inventory 1996*, which precedes this report. Additional aquifers were included in subsequent reports until inventories of all 30 of the state's aquifers were completed for the 2002 report.

In subsequent Water Quality Inventory reports, TCEQ has used information from the TWDB groundwater database to inventory ambient water quality in each of the state's major and minor aquifers for the most recent 10-year period. In 2017, TWDB named a new minor aquifer, the Cross Timbers aquifer, which is now included in this assessment.

Each year TGPC publishes the *Joint Groundwater Monitoring and Contamination Report (Joint Report)*,[5] describing the documented cases of groundwater contamination in the state resulting from activities regulated by Texas state agencies. Groundwater contamination is defined in TGPC rules[6] as the detrimental alteration of the naturally occurring physical, thermal, chemical, or biological quality of groundwater, based on the definition of "pollution" in the Texas Water Code (TWC), Section 26.001.[7] Further, TGPC describes groundwater contamination in the *Joint Report* as contamination suspected of having been caused by activities of entities under the jurisdiction of the TGPC member agencies, as identified in TWC, Section 26.406,[8] TGPC rules, and subsequent legislative amendments. Reported contamination cases are typically limited to those affecting usable quality groundwater, defined as less than 10,000 milligrams per liter of dissolved solids.

The most recently published *Joint Report* for 2022 (TGPC, 2023) includes 2,943 groundwater contamination cases documented or under enforcement during the 2022 calendar year. Approximately 81% (2,387) of the documented cases fall under TCEQ's jurisdiction, with the remainder (556 cases) under the jurisdiction of RRC.

The groundwater contamination cases in the *2022 Joint Report* were documented primarily through regulatory requirements for compliance monitoring, with most identified by release-detection monitoring in the TCEQ Petroleum Storage Tank (PST) Program. The report also identifies cases documented through permit monitoring requirements, investigations of groundwater contamination complaints, or self-reporting. According to the *Joint Report*, groundwater contamination is often detected during site-specific groundwater monitoring at sites with waste disposal activities or product storage.

The most common contaminants in the *2022 Joint Report* are gasoline, diesel, and other petroleum products such as benzene, toluene, ethylbenzene, and xylenes. These constituents reflect that 43% of TCEQ's documented contamination cases were reported by the PST Program. Some of the other contaminants at impacted sites in this

[5] tceq.texas.gov/groundwater/groundwater-planning-assessment/sfr-056-joint-groundwater-monitoring-contamination-report
[6] texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=4&ti=31&pt=18&ch=601
[7] statutes.capitol.texas.gov/Docs/WA/htm/WA.26.htm#26.001
[8] statutes.capitol.texas.gov/Docs/WA/htm/WA.26.htm#26.406

report include heavy metals and organic compounds such as phenols, trichloroethylene, carbon tetrachloride, dichloroethylene, naphthalene, creosote constituents, various solvents, and pesticides.

This 2024 groundwater assessment shows that ambient groundwater quality in Texas is good, but it varies among the state's aquifers. The ambient concentration in a small percentage of wells exceeds the drinking water maximum contaminant level (MCL) for some parameters such as nitrate and arsenic, and secondary standards for parameters such as sulfate and total dissolved solids. Dissolved fluoride, naturally occurring in Texas, appears as a secondary contaminant of concern sporadically throughout the wells sampled during this period.

Groundwater contamination at regulated facilities is found most often in heavily populated areas, such as Houston, Dallas, Fort Worth, San Antonio, and El Paso, especially due to the number of PST and industrial facilities in those areas. Geographic data for the *Joint Report* suggests that a high concentration of regulated surface activity sites with groundwater contamination does not necessarily correlate with area-wide ambient groundwater degradation. In general, contamination from regulated surface activities tends to impact shallow, local water-bearing zones separated from the major and minor aquifers. While some wells in aquifer outcrop areas show elevated levels of certain constituents of concern; those wells typically draw water from deeper aquifers rather than the aquifer outcrop area.

Overview – Groundwater Resources

Each year TWDB estimates the water used in Texas by reviewing water use surveys of public water systems and industrial facilities. According to the *Texas Water Use Estimates Summary for 2021*,[9] Texans used approximately 14.4 million acre-feet of water, most of which was from groundwater sources (approximately 54%, or 7.8 million acre-feet). Approximately 42% came from surface water sources (about six million acre-feet) and less than 4% was from reuse (0.5 million acre-feet).

Aquifers produce most of the groundwater used by Texans. An aquifer is made of underground layers of rock that store and can transmit water through the pore spaces, cracks, or voids in the rock. Texas aquifers are composed of a variety of rock types, such as limestone, dolomite, sandstone, gypsum, alluvial gravels, and igneous rocks. Major aquifers produce large quantities of water over large areas of the state. Minor aquifers may produce large quantities of water over small areas or small quantities of water over large areas, and in some regions of the state may constitute the only significant source of water supply. In addition, groundwater provides a significant amount of the base flow for many Texas rivers and streams, which adds to the reasons why groundwater is important to maintaining the state's environment and economy.

The major aquifers include (see Figure 1):

1. Carrizo–Wilcox
2. Edwards (Balcones Fault Zone/BFZ)
3. Edwards–Trinity (Plateau)

[9] www.twdb.texas.gov/waterplanning/waterusesurvey/dashboard/index.asp

4. Gulf Coast
5. Hueco–Mesilla Bolson
6. Ogallala
7. Pecos Valley
8. Seymour
9. Trinity

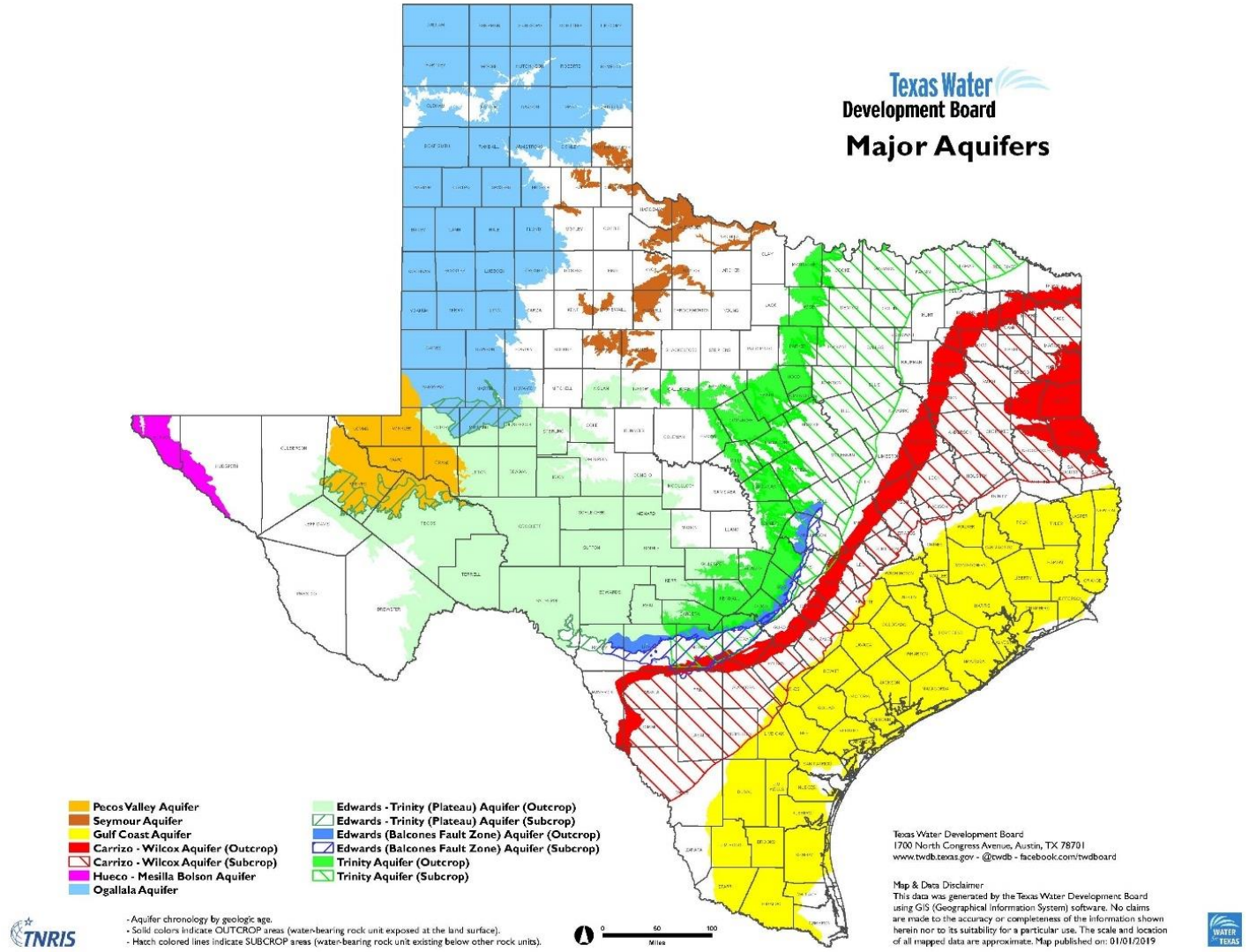
The minor aquifers include (see Figure 2):

1. Blaine
2. Blossom
3. Bone Spring–Victorio Peak
4. Brazos River Alluvium
5. Capitan Reef Complex
6. Cross Timbers
7. Dockum
8. Edwards–Trinity (High Plains)
9. Ellenburger–San Saba
10. Hickory
11. Igneous
12. Lipan
13. Marathon
14. Marble Falls
15. Nacatoch
16. Queen City
17. Rita Blanca
18. Rustler
19. Sparta
20. West Texas Bolson
21. Woodbine
22. Yegua–Jackson

In addition to the major and minor aquifers, smaller local aquifers may provide groundwater for an area.[10] Groundwater quality of these smaller sources is not directly addressed in this report, as they are too small and numerous to be characterized within the scope of the groundwater assessment.

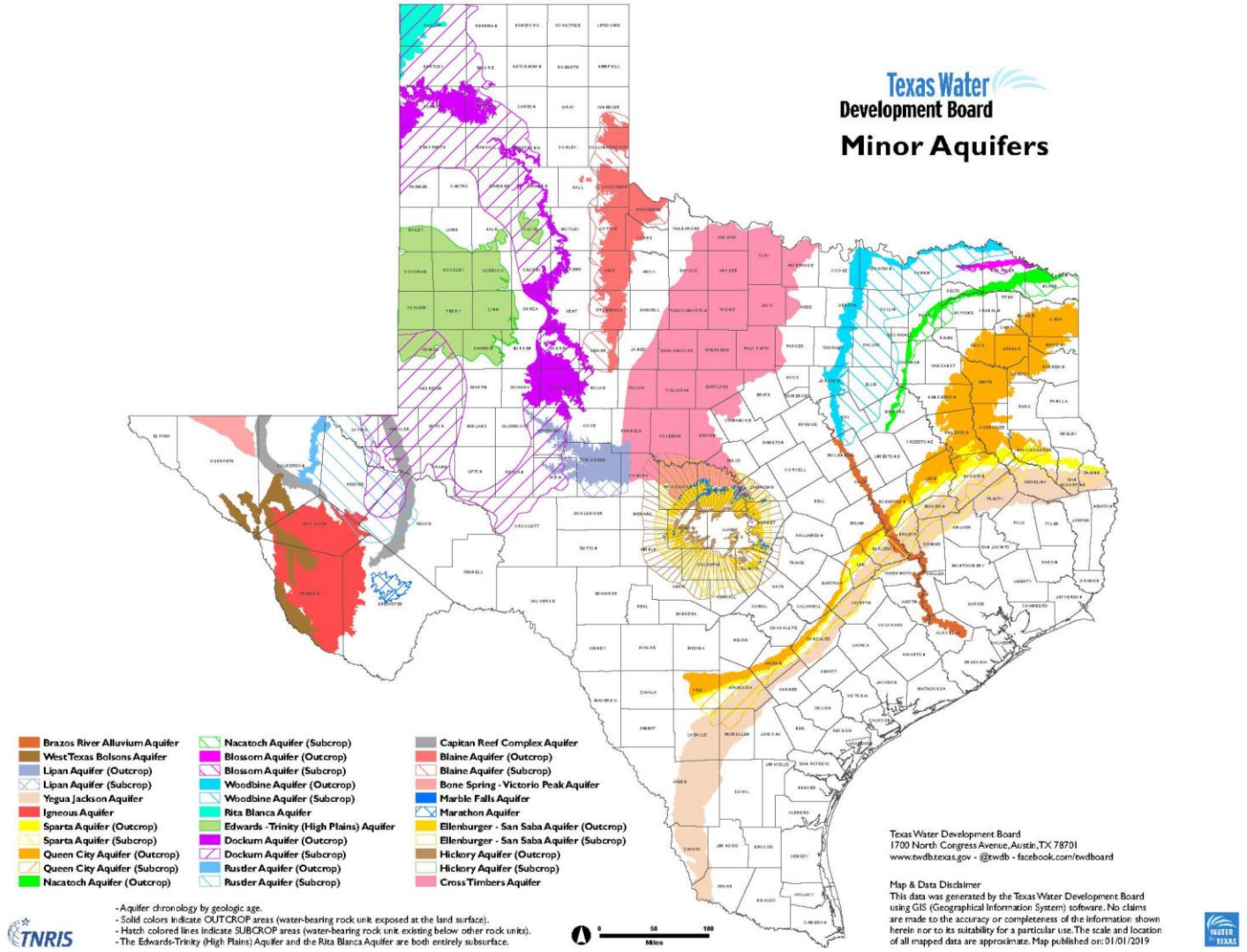
[10] TWDB Report #380, *Aquifers of Texas*, 2011, www.twdb.texas.gov/publications/reports/numbered_reports/doc/R380_AquifersofTexas.pdf

Figure 1. Major Aquifers in Texas[11]



[11] data.tnris.org/ebdac427-62d1-4ab6-96ee-63a4fa168872/assets/1bd68f22-e11d-4551-aa6c-3995126a743f-Major_Aquifers_8.5x11.pdf

Figure 2. Minor Aquifers in Texas[12]



[12] data.tnris.org/ebdac427-62d1-4ab6-96ee-63a4fa168872/assets/db7b9747-f88b-45dc-900d-169ff52907b6-Minor_Aquifers_8.5x11.pdf

Groundwater Protection

Texas Groundwater Protection Committee

TGPC was created by the 71st Texas Legislature in 1989 to bridge gaps between existing state groundwater programs and to optimize water quality protection by improving coordination among agencies involved in groundwater activities. The resulting statute, TWC Sections 26.401–26.408, sets out the state's groundwater protection policy and provides legislative recognition for TGPC.[13] The statute requires TGPC to accomplish the following:

- Coordinate the groundwater protection activities of its members.
- Develop and update a comprehensive state groundwater protection strategy.
- Study and recommend to the legislature groundwater protection programs for each area in which groundwater is not protected by current regulation.
- File a report of the TGPC's activities and recommendations for groundwater protection legislation to the governor, lieutenant governor, and speaker of the House of Representatives before the beginning of each biennial legislative session.
- Publish the *Joint Report* each year.

TGPC includes representatives from 10 agencies. TCEQ administers the activities of TGPC and is designated as the lead agency for the committee. TCEQ's executive director serves as the committee's chairperson and TWDB's executive administrator serves as the vice-chairperson.

Coordination with Federal Agencies

TGPC actively coordinates with federal agencies on groundwater protection issues that affect the state. Past coordination included working with federal agencies on a core assessment for a comprehensive state groundwater protection program and on the development of pesticide management plans to prevent groundwater contamination.

In March 1985, U.S. Environmental Protection Agency (EPA) provided a grant to the Texas Department of Water Resources, predecessor to TCEQ and TWDB, to improve the coordination of groundwater protection activities undertaken by state agencies. In response to this federal initiative, the state formed the interagency Groundwater Protection Committee, predecessor of TGPC. Since then, through grants administered under the Clean Water Act (CWA), Section 106, EPA has funded the coordination of groundwater protection activities of the various state programs and agencies and the development of a groundwater protection strategy.

[13] statutes.capitol.texas.gov/Docs/WA/htm/WA.26.htm#26.401

TGPC and the member agencies regularly provide national-level input to federal agencies on groundwater protection and program issues through the Ground Water Protection Council (GWPC), an association of directors for state, groundwater, and Underground Injection Control (UIC) programs; the State Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Issues Research and Evaluation Group, which includes state agricultural regulatory officials; and other state and federal stakeholder and regulatory guidance groups.

TGPC and its members also work closely with the U.S. Geological Survey (USGS), a federal agency with responsibilities that include geologic mapping and hydrologic studies. USGS staff participate in TGPC-sponsored projects and TGPC subcommittees, provide groundwater expertise to TGPC, and allow opportunities for agencies to provide input on federal research.

Groundwater Protection Programs

Agencies and entities who are members of TGPC participate in groundwater monitoring. Detailed information on individual programs is provided and updated each year in TGPC's *Joint Report*.[14]

Table 1 following summarizes existing groundwater monitoring programs and activities and describes the groundwater protection programs performed by TGPC member agencies.

Table 1. Summary and Status of State Groundwater Protection Programs

Groundwater Protection Program	Implementation Status	Responsible Agency(ies)
Active SARA Title III Program	Fully established	TCEQ and other agencies
Ambient Groundwater Monitoring System	Fully established	TWDB
Aquifer Vulnerability Assessment	Continuing efforts	TCEQ and other agencies
Aquifer Mapping	Fully established	TWDB
Aquifer Characterization	Fully established	TWDB
Comprehensive Data Management System	Continuing efforts	TGPC; multiple agencies
State Groundwater Protection Strategy	Continuing efforts	TGPC; multiple agencies
Dry Cleaner Remediation Program	Fully established	TCEQ
Groundwater Best Management Practices	Continuing efforts	TGPC; multiple agencies
Groundwater Legislative Goal	Fully established	TGPC; multiple agencies
Groundwater Classification	Fully established	TGPC; multiple agencies
Groundwater Quality Standards	Fully established	TCEQ
In-situ Uranium Mining	Fully established	TCEQ

[14] tceq.texas.gov/groundwater/groundwater-planning-assessment/sfr-056-joint-groundwater-monitoring-contamination-report

Groundwater Protection Program	Implementation Status	Responsible Agency(ies)
Interagency Coordination for Groundwater Protection Initiatives	Fully established	TGPC; multiple agencies
Municipal Setting Designations	Fully established	TCEQ
Municipal Solid Waste (Subtitle D) State Authorized Program	Fully established	TCEQ
Nonpoint Source Controls/Agricultural & Silvicultural	Continuing efforts	TSSWCB
Nonpoint Source Controls/All Others	Continuing efforts	TCEQ
Pesticide State Management Plan (Generic)	Received EPA concurrence	TGPC; multiple agencies
Pesticide-Specific Regulation Programs	Fully established	TDA
Pollution Prevention Program	Fully established	all agencies
Radiation Control Program	Fully established	DSHS
Radioactive Waste Disposal Program	Fully established	TCEQ
Resource Conservation and Recovery Act (RCRA) – State Authorized Program	Fully established	TCEQ
State Hydrocarbon Exploration/Production Regulations	Fully established	RRC
State Superfund	Fully established	TCEQ
State Oilfield Cleanup Fund	Fully established	RRC
State Petroleum Storage Tank Remediation Fund	Fully established	TCEQ
State Septic System Regulations	Fully established	TCEQ and other agencies
Surface Mining and Reclamation Regulations	Fully established	RRC
Underground Storage Tank (UST) Installation Requirements	Fully established	TCEQ
UST Registration Program	Fully established	TCEQ
Underground Injection Control (UIC) Program/Industrial and Municipal	Fully established	TCEQ
UIC Program/Oil & Gas	Fully established	RRC
Vulnerability Assessment for Drinking Water/Source Water Protection	Fully established	TCEQ

Groundwater Protection Program	Implementation Status	Responsible Agency(ies)
Wellhead Protection Program (EPA-approved)	Fully established	TCEQ
Wastewater Discharge and Disposal Permits	Fully established	TCEQ
Water Well Abandonment Regulations	Fully established	TDLR
Water Well Installation Regulations	Fully established	TDLR

Texas Commission on Environmental Quality

TCEQ is responsible for regulatory groundwater protection programs that aim to prevent contamination and to identify, assess, and remediate existing problems. TCEQ implements these programs through education, voluntary action assistance, permitting, and enforcement. As the state's lead agency for water quality protection, TCEQ administers both state and federally mandated programs. Federal programs that TCEQ administers include the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the Clean Water Act (CWA); and the Safe Drinking Water Act (SDWA). TCEQ also develops state management plans under the FIFRA aimed to prevent the contamination of groundwater by pesticides.

Multiple programs within TCEQ have responsibilities related to the protection of groundwater resources, including the Office of Compliance and Enforcement, the Office of Waste, and the Office of Water.

Texas Water Development Board

The Texas Water Development Board (TWDB) conducts an active groundwater resource assessment program. TWDB identifies boundaries and various characteristics for all of the state's major and minor aquifers including geologic information, water availability, and recharge. In addition, TWDB collects information on the major entities using groundwater within each river basin, the aquifer(s) from which they pump, the quality of water being developed, and the quantity of water needed for a 50-year planning period. To provide information for future planning, TWDB collects data on the occurrence, availability, quality, and quantity of groundwater present and the current and projected demands on groundwater resources. TWDB groundwater studies and the TWDB Groundwater Monitoring Program,[15] including a statewide groundwater level measurement program and groundwater quality sampling program, are vital to the state's regional water planning.

The purpose of the ambient groundwater quality sampling program is to collect data to monitor changes, if any, in the quality of groundwater over time and to establish, as accurately as possible, the baseline quality of groundwater occurring naturally in the state's aquifers. TWDB staff and cooperators typically collect about 400 samples each year from a subset of the major and minor aquifers, covering all of the aquifers in a four-year period. TWDB conducts the groundwater quality monitoring program in accordance with procedures established in its Field Manual for Groundwater

[15] www.twdb.texas.gov/groundwater/data/index.asp

Sampling,[16] and they obtain data collected by other entities, such as GCDs, USGS, and other state and federal agencies that follow these and similar procedures.

TWDB staff process and store collected data by state well number in the TWDB Groundwater Database. Using the geographical coordinates stored in the TWDB Groundwater Database, statewide water quality data are analyzed using geographical information systems software. Through the TWDB Water Data Interactive portal, these data are available on the TWDB Groundwater Data Viewer,[17] an internet-based mapping application. The data are also available from specific reports[18]on the portal.

Railroad Commission of Texas

RRC regulates the disposal of certain oil and gas wastes by underground injection.[19] RRC's Statewide Rule (SWR) 9 describes the requirements to dispose of oil and gas wastes generated from activities associated with the exploration, development, and production of oil, gas, or geothermal resources by injection of the waste into a disposal well. RRC also regulates the injection of fluid for enhanced oil recovery (SWR 46) and the underground storage of hydrocarbons (SWRs 95, 96, and 97). As of December 31, 2022, the inventory of active wells in these categories was 28,541 out of 52,877 currently permitted wells. RRC administers the UIC Program for these Class II wells under authority provided by U.S. EPA under the federal Safe Drinking Water Act (SDWA). The main purpose of the UIC program is to protect underground sources of drinking water. Class II wells must meet permitting standards and be tested and monitored to demonstrate mechanical integrity.

Brine mining injection wells (Class III) are typical of solution mining wells. The RRC Class III Brine Mining Injection Well Program was approved on March 29, 2004. Since then, all active brine-mining facilities were re-permitted per the provisions of Statewide Rule 81. As of December 31, 2022, there are 213 currently permitted brine mining injection wells in Texas. Most brine-mining facilities are required to monitor groundwater quality and submit groundwater-monitoring reports from approximately 218 total monitoring wells. Groundwater monitoring is not conducted at facilities where usable quality groundwater is not present, typically located on salt domes along the Gulf Coast.

Under 16 TAC Part 1, Chapter 3, Subchapters 3.8 (SWR 8, Water Protection), 3.57 (SWR 57, Reclamation Activities),[20] and Chapter 4, Subchapter B[21] (Commercial Recycling), RRC regulates the acceptance, handling, treatment, storage, reclamation, recycling, and disposal at or near ground surface of oil and gas wastes. The waste streams are generated from activities associated with the exploration, development, and production of oil, gas, or geothermal resources. SWR 8 prohibits the waste of hydrocarbon resources and the pollution of surface and subsurface waters of the state, and requires permits for various pits, waste haulers, and other waste management practices, such as landfarming and land treatment, that are not specifically authorized by rule. SWR 57 specifies the permitting and reporting requirements for the

[16] www.twdb.texas.gov/groundwater/docs/UMs/UM-51.pdf?d=34787.40000000037
[17] www3.twdb.texas.gov/apps/WaterDataInteractive/GroundwaterDataViewer/
[18] www.twdb.texas.gov/groundwater/data/gwdbrpt.asp
[19] www.rrc.texas.gov/oil-and-gas/publications-and-notices/manuals/injection-storage-manual/injection-storage-narrative/
[20] texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=4&ti=16&pt=1&ch=3&rl=Y
[21] texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=16&pt=1&ch=4&sch=B

reclamation of hydrocarbons from tank bottoms and other hydrocarbon wastes. 16 TAC Chapter 4, Subchapter B specifies permit requirements and provides guidance for the recycling of generated fluids and solids into recycled product(s) that has legitimate commercial reuse.

Oil-field cleanup activities fall under the jurisdiction of RRC and are subject to regulations under SWR 8, SWR 20, SWR 91, and RRC Special Orders. Other rules that protect groundwater and influence cleanup activities include: SWR 13 (well completion requirements), SWR 14 (plugging requirements), SWR 9 (disposal via injection into a non-productive zone), SWR 46 (injection into a productive zone), SWR 57 (reclamation plants), SWR 93 (water quality certification), SWR 98 (standards for management of hazardous oil and gas waste), and 16 TAC 4.601-4.632[22] (disposal of oil and gas [naturally-occurring radioactive material] NORM waste). Through SWR 30, Memorandum of Understanding (MOU), RRC maintains jurisdiction over natural gas plants and compressor stations.

The Surface Mining and Reclamation Division (SMRD) of RRC is authorized to enforce state laws and regulations consistent with the Texas Surface Coal Mining and Reclamation Act, Texas Natural Resources Code (TNRC), Chapter 134, and the Texas Uranium Surface Mining and Reclamation Act, TNRC 131. As part of the groundwater information required in the regulations, the determination of the quality of subsurface water includes the analysis of common inorganic groundwater constituents plus certain trace metals. Monitoring plans for pre-mining, mining, and post-mining conditions are required, normally on a three-month basis, to track variations in water quality parameters.

Monitoring by RRC is generally conducted only during investigations for a specific reason, such as water quality complaints. RRC no longer maintains a laboratory, and samples collected by enforcement personnel are sent to a commercial laboratory under contract with the division for chemical and physical analyses. Typically, between one and five water quality and quantity complaints are investigated annually by RRC field personnel.

Texas Department of State Health Services

The Texas Department of State Health Services (DSHS) is responsible for promoting and protecting the health and well-being of Texans. Regarding groundwater issues, DSHS has several programs related to groundwater safety and public health concerns.

The DSHS Health Assessment and Toxicology Program is responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health in Texas. The program offers support when issues arise regarding potential contamination of drinking water, including drinking water that is produced from a groundwater source. DSHS performs public health assessments (PHAs) and health consultations to determine if adverse health effects might result from exposures to hazardous substances. Through a cooperative agreement with the Agency for Toxic Substances and Disease Registry, DSHS performs PHAs for all sites on or proposed for listing on the National Priorities List (NPL) of Superfund sites. DSHS provides toxicological and epidemiological support with the goal of protecting public health.

[22] texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=16&pt=1&ch=4&sch=F&rl=Y

The DSHS Radiation Control Program (RCP) regulates radioactive materials in Texas. Intermittently, RCP samples groundwater based on an incident, complaint, or situation that leads the RCP to believe there may be groundwater contamination.

The DSHS Laboratory Services Section is the principal drinking water laboratory in the state. The laboratory performs water quality testing, including chemical and radiological analyses required by the U.S. EPA Safe Drinking Water Act, and other analyses in support of any DSHS program requiring testing of drinking water samples. For a fee, the Laboratory Services Section also accepts water samples from the public for routine microbiological analysis.

Texas Department of Agriculture

The Texas Department of Agriculture (TDA) has lead authority for pesticide regulation in Texas. TDA recognizes certain pesticides as potential groundwater contaminants and is responsible for preventing unreasonable risk to human health and the environment from the use of pesticides.

The agency conducts a variety of activities designed in part or entirely to reduce the potential of groundwater contamination by pesticides:

- Product Registration – All pesticide products sold and used in Texas must be registered with TDA. This process ensures these products have met all EPA requirements for pesticide product labeling.

- Pesticide Label Compliance and Enforcement – The agency has responsibility and authority under the Texas Agricultural Code to enforce pesticide labels, which include usage information and precautions that directly or indirectly reduce the potential of groundwater contamination.

- Pesticide Applicator Training – All prospective users of restricted-use or state limited-use pesticides are required to obtain an applicator's license. Obtaining a license includes receiving training in the proper and legal use of pesticides, applicator testing, and continuing education. This includes both agricultural pesticide applicators as well as those for structural pest control. Each structural pest control applicator must be properly registered, trained, and supervised or properly licensed to make applications regardless of the classification of the pesticide.

- Pesticide Laboratory Services – Although TDA does not routinely conduct groundwater monitoring for pesticides, the agency maintains a fully equipped laboratory at Texas A&M University. The lab conducts pesticide residue analysis to assist the department's enforcement of pesticide laws and regulations and as a participant in USDA's Pesticide Data Program.

Texas State Soil and Water Conservation Board

TSSWCB is the state agency that administers Texas' soil and water conservation law and delivers coordinated natural resource conservation programs through the state's 216 Soil and Water Conservation Districts.

TSSWCB administers several programs as the lead state agency for the planning, management, and abatement of agricultural and silvicultural (forestry) nonpoint source pollution. TSSWCB has a Nonpoint Source Grant Program that provides funding for assessment, demonstration, implementation, education, and research related to nonpoint source pollution.

The Water Quality Management Plan (WQMP) Program offers landowners and operators of agricultural and silvicultural lands a voluntary mechanism for being protective of state water quality with respect to nonpoint source pollution. This program offers cost-share funding for the installation of soil and water land improvement measures to serve as an incentive for participating.

TSSWCB also works to ensure that the state's network of 2,000 flood control dams is protecting lives and property by providing operation, maintenance, and structural repair grants to local government sponsors.

TSSWCB continues to partner with Texas A&M AgriLife Extension Service and provide Clean Water Act, Section 319(h) grant funding to support the Texas Well Owner Network Program. This program focuses on helping private well owners care for their wells and learn about water quality issues in the watershed. Topics covered during the training include: aquifers in Texas, private water well basics, onsite wastewater treatment, water quality and quantity and protecting your water supply.

Texas Alliance of Groundwater Districts

The Texas Alliance of Groundwater Districts (TAGD), formerly the Texas Groundwater Conservation Districts Association, was formed on May 12, 1988. TAGD's core district membership is restricted to groundwater conservation districts (GCDs, or districts) in Texas who have the powers and duties to manage groundwater as defined in TWC Chapter 36.[23] Other organizations and individuals with an interest in groundwater management may become associate members. TAGD is organized exclusively for charitable, educational, or scientific purposes within the meaning of Section 501(c)(3) of the Internal Revenue Code.[24] As such, it can accept tax-deductible donations and use these donations to educate the public to the growing need for water conservation and groundwater protection.

The purpose of TAGD is to educate the public, further groundwater conservation and protection activities, and provide a communications vehicle for the exchange of information between GCDs and the public. TAGD maintains contact with members of the private sector and various local, state, and federal officials and their agencies to obtain and provide timely information on activities and issues relevant to GCDs. To date, there are 90 district members of TAGD. TCEQ's GCD website includes a map with all the current GCDs, including those which are members of TAGD.

Texas law authorizes the creation of GCDs. The districts are created either by the Legislature or TCEQ to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater with the purpose and responsibility of preserving and protecting groundwater. GCDs can be created by one of three procedures: (1) special law districts can be established by the legislature; (2)

[23] statutes.capitol.texas.gov/Docs/WA/htm/WA.36.htm#36
[24] uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title26-section501&num=0&edition=prelim

districts can be created through a property-owner petition filed with TCEQ; and (3) districts can be created in priority groundwater management areas through procedures initiated by TCEQ. Districts are local or regional in their jurisdiction and typically have elected boards of directors. Among other things, GCDs have been granted authority to monitor groundwater quality. Several districts also have the authority to bring civil court proceedings for injunctive relief against an entity causing groundwater contamination.

Texas A&M AgriLife Research

AgriLife Research is the state's premier research and technology development agency in agriculture, natural resources, and the life sciences. Headquartered in College Station, AgriLife Research has a statewide presence, with scientists and research staff on other Texas A&M University System campuses and at the 13 regional AgriLife Research and Extension Centers around the state.

The agency conducts basic and applied research to improve the productivity, efficiency, and profitability of agriculture, with a parallel focus on conserving natural resources and protecting the environment. AgriLife Research has more than 550 doctoral-level scientists, many of whom are recognized internationally for their work. The Texas Water Resources Institute is an administrative unit of AgriLife Research and coordinates much of the internal water-related research.

Broad goals of the AgriLife Research program include those specifically targeted to protect, preserve, and efficiently use groundwater resources. Groundwater programs of AgriLife Research stress the development of management strategies, technologies, and educational programs to support sustainable quality water supplies.

AgriLife Research scientists are working to address a variety of groundwater planning, supply, quality, and use issues:

- Planning:
    - aquifer characterization
    - policy analysis
    - modeling
    - irrigation water conservation
- Supply:
    - water conservation methods
    - enhancing aquifer recharge
    - rainwater harvesting for aquifer recharge
- Water quality:
    - waste and wastewater management

  - proper use of agriculture chemicals (nutrients and pesticides)
  - pathogens
  - remediation of contaminated groundwater
- Use:
  - irrigation systems research and development
  - economics of water use
  - efficiency of irrigation and water management
  - crop selection keyed to water availability
  - development of drought-resistant crop varieties
  - conservation in urban and agriculture sectors

Some of the recent AgriLife Research groundwater-related research activities include:

- Assessing transboundary aquifers along the United States–Mexico border, studying borderland water resources and the role of groundwater in ensuring resiliency and water security.
- Studying the thicketization of Oak Savannas, analyzing the impact of restoration on regional groundwater recharge rates.
- Researching cotton production in the southern Ogallala aquifer region, studying drought tolerance, conservation strategies, and water management strategies.
- Evaluating the relationships between land use, groundwater, and provision of ecosystem services in a semiarid karst landscape.
- Developing technologies, procedures, and strategies for deficit irrigation applications and effective water management policies to efficiently use and protect the Ogallala aquifer as well as decrease pumping from the aquifer.
- Training future groundwater professionals through undergraduate and graduate education and research programs at Texas A&M University and other Texas A&M System institutions. Many AgriLife Research scientists at Texas A&M in College Station also hold joint teaching appointments, thus providing the latest research results to students.

AgriLife Research is complemented by the outreach educational programs of the Texas A&M AgriLife Extension Service (AgriLife Extension). AgriLife Extension specialists provide groundwater public outreach and education, training programs and meetings, and easy-to-read fact sheets and other publications for specific targeted clientele, such as landowners interested in pumping and desalinating brackish groundwater, and proposed guidelines for injection wells, and groundwater management. Other AgriLife

Extension activities include partnering with groundwater conservation districts (GCDs), field demonstrations, and educational programs for youth and adults.

Specifically, through the Texas Well Owners Network (TWON), AgriLife Extension provides leadership for programs that educate private water well owners about potential pollutant sources, steps they can take to lessen potential impacts from these sources, and how to plug abandoned wells to protect groundwater quality. The programs also include information on working with local GCDs, characterizing potable water hazards, and providing resources for well owners in communities impacted by extreme flooding.

Extension specialists also provide technical leadership for developing pesticide-specific management plans adapted to Texas.

Other examples where AgriLife Extension's work complements AgriLife Research's groundwater efforts include the Healthy Lawns and Healthy Waters (HLHW) project and several programs related to on-site sewage facilities (OSSFs). HLHW provides Texas homeowners with practical information on lawn care and rainwater harvesting that directly benefits local watersheds.

Similarly, OSSF-related programs work with OSSF owners and service providers to inspect and repair or replace failing septic systems in impaired watersheds, thereby helping to protect and improve area water quality. Projects like these and others are the result of AgriLife Research partnerships with GCDs, river authorities, county extension agents, cities, counties, and more.

The Bureau of Economic Geology of The University of Texas at Austin

Established in 1909, the Bureau of Economic Geology of The University of Texas at Austin (UTBEG, or Bureau) is a research entity of the University of Texas (UT) and functions as the State Geological Survey. The Bureau is also a research unit within UT Austin's Jackson School of Geosciences. The Bureau conducts basic and applied research, including projects related to groundwater resources and quality, water and energy issues, and brackish groundwater assessments in support of other state agency missions and for Federal agencies and industry. Research activities include original field research, data collection, sample collection, chemical analyses, and evaluation of water quality data from existing databases.

Recent UTBEG groundwater-related research topics include the following:

- Assessment of community water system noncompliance issues relative to EPA Safe Drinking Water Act regulations in Texas and the U.S.
- Relationship between community water system noncompliance and social vulnerability parameters.
- Regional groundwater quality issues related to nitrate, arsenic, fluoride, and other contaminants.
- Analysis of water quality issues related to aquifer storage and recovery, particularly arsenic mobilization and guidelines for ASR related to potential water quality issues.

- Development and updating of the Surface Casing Estimator[25] to protect groundwater, which includes mapping critical hydrogeologic intervals across Texas counties using RRC-provided data, Q-logs, as well as water quality data from the TWDB and RRC.
- Brackish groundwater resource assessment for the Carrizo/Wilcox and Queen City/Sparta aquifers in southwest Texas.
- Water quality impacts of energy production, focusing on methane sources using isotopes.
- Characterization of the quality of produced water based on samples from major unconventional oil and gas reservoirs in the state.
- Quantification of groundwater use for hydraulic fracturing in Texas.
- Groundwater or surface water interactions and impacts on endangered species.

Texas Department of Licensing and Regulation

The need for identification and protection of the state's groundwater resources was recognized by the Legislature through the creation of the Water Well Drillers Board (Board) in 1965. In 1991, the 72nd Legislature expanded the Board's functions to include licensing and regulation of water well pump installers.

Senate Bill 1955 (75th Legislature, 1997) transferred the Water Well Driller Advisory Council (Council) and the Water Well Drillers and Pump Installers (WWDPI) Program from TNRCC to TDLR effective September 1, 1997.

The WWDPI Abandoned Well Referral and Notification Program maintains communications with the Council, industry, various state agencies, and GCDs. Program staff investigate all alleged violations of Title 12, Texas Occupations Code (TOC), Chapters 1901 and 1902 (12 TOC 1901 and 1902), and 16 TAC 76. They also investigate consumer complaints filed against well drillers and pump installers, perform compliance investigations of water, and monitor closed loop geothermal injection, and dewatering wells to ensure compliance with well construction standards.

Investigations include, but are not limited to, surface completions, depth of annular cement, regulated distances from contamination sources and property lines, abandoned and deteriorated water wells, and licensing requirements. In addition, rules requiring isolation of zones containing undesirable or poor-quality water are enforced to prevent commingling with and degradation of freshwater zones.

TDLR's WWDPI Program staff also administer the Abandoned Well Notification Program, which is authorized by 12 TOC 1901 and 1902. Investigations are conducted and landowners are notified that within 180 days of notification, the abandoned or deteriorated water well must be plugged, completed, or capped per 16 TAC 76 specifications.

Violations of 12 TOC 1901 and 1902 and agency rules are enforced by TDLR's Enforcement Division through TDLR orders requiring administrative penalties and

[25] www.beg.utexas.edu/sce

corrective actions, cease and desist orders, or referral to the Office of the Attorney General. Investigations that involve groundwater contamination are referred to the appropriate state agency with jurisdiction for the activity believed to be the cause of the contamination.

State Groundwater Protection Policy

TWC Section 26.401[26] establishes the state's groundwater protection policy, which includes a goal of nondegradation of groundwater resources for all state programs. This policy recognizes the variability of the state's aquifers, the importance of maintaining water quality for existing and potential uses, the protection of the environment and public health and welfare, and the maintenance and enhancement of the long-term economic health of the state. Further, the policy recognizes that groundwater contamination may result from many sources, including current and past oil and gas production and related practices, agricultural activities, industrial and manufacturing processes, commercial and business endeavors, domestic activities, and natural sources that may be influenced by, or may result from, human activities. The use of the best professional judgment by the responsible state agencies in attaining the goal and policy is also recognized.

The policy states that discharges of pollutants, disposal of wastes, and other regulated activities should be conducted in a manner that will maintain present uses and not impair potential uses of groundwater or pose a public health hazard. The programs of the various state agencies are generally coordinated to attain this goal.

Groundwater Classification System

TGPC and its member agencies recognize that groundwater classification is a valuable tool for implementing the state's groundwater protection policy. Through classification, the groundwater in the state can be categorized and protection or restoration measures can then be specified by member agencies according to the quality and present or potential use of the groundwater.

TGPC developed a groundwater classification system for use by state agencies, which defines four classes of groundwater based on the concentration of total dissolved solids (TDS). The names and concentration ranges are based on traditional nomenclature associated with each class. Fresh groundwater is classified as having a TDS concentration range from zero to 1,000 milligrams per liter (mg/l); slightly saline groundwater has a TDS concentration range from greater than 1,000 to 3,000 mg/l; moderately saline groundwater, a TDS concentration range from greater than 3,000 to 10,000 mg/l; and very saline groundwater to brine, a TDS concentration greater than 10,000 mg/l. Quality also determines usability; however, it is implicit in the classification that a water-bearing zone must be able to produce sufficient quantities of water to meet its intended use. The annual *Joint Report*[27] describes in detail the groundwater classification system developed by TGPC.

[26] statutes.capitol.texas.gov/Docs/WA/htm/WA.26.htm#26.401
[27] tceq.texas.gov/groundwater/groundwater-planning-assessment/sfr-056-joint-groundwater-monitoring-contamination-report

The classification system applies to all groundwater in the state. In assigning a classification, the member agencies attempt to use the natural quality of the groundwater that is unaffected by discharges of pollutants from human activities. All usable and potentially usable groundwater is subject to the same protection provided by the state's groundwater protection policy. Starting with the nondegradation goal, protection or restoration measures can vary according to the response level set by the classification so long as all the following conditions are met:

- Current and potential groundwater uses are not impaired.
- A public health hazard is not created.
- The quality of groundwater is restored, if feasible.

An agency considers all present or potential beneficial uses of groundwater of a given quality in determining protection or restoration measures. Generally, drinking water for human consumption would require the highest degree of protection or restoration, so protection for drinking water standards should be protective of other uses. These considerations resulted in two response levels for assigning protection or restoration measures, commensurate with the potential to impact human health and the environment:

- Level I response for fresh, slightly saline, and moderately saline classes should be based on the current or potential use as a human drinking water supply.
- Level II response for very saline to brine class should be based on indirect exposure (i.e., by means other than drinking) or no human consumption.

In specifying a protection or restoration measure, member agencies should apply the best professional judgment case-by-case. Evaluations should include such factors as productivity, the availability of alternate sources of water, background concentrations of naturally occurring constituents, the effect of constituents on usability, traditional and potential beneficial uses of the water, economic and technical feasibility of treatment, and projected needs for and types of impacts on the groundwater.

The classification system is intended to be implemented by member agencies as an integral part of their groundwater protection programs. In addition to its response-setting function, the classification system fosters consistency among the various programs.

State Groundwater Protection Strategy

The Texas Water Code requires TGPC to develop a comprehensive strategy that documents what needs to be done to protect groundwater in the state of Texas and coordinates the activities of all the participating agencies. TGPC addressed this duty directly in 1988 by publishing the *Texas Ground Water Protection Strategy (Strategy)*. Since that time, there have been several documents published that describe changes to the groundwater protection programs and authorities of state agencies with respect to groundwater. This includes the Texas Ground Water Protection Profiles, 1991, and later, the annual *Joint Report*. There have been many changes in agencies and the

programs that they administer since 1988. The more recent publications have focused on the water quality aspects of various programs rather than the state strategy for groundwater protection.

Recognizing the changes that had occurred since the state's first groundwater protection strategy was developed, TGPC decided in January 2001 to begin an update. That process resulted in the development of *Texas Groundwater Protection Strategy* (TCEQ Publication AS-188, February 2003).[28] The 2003 *Strategy* provided a road map for the activities of the TGPC. It was divided into thematic sections designed to highlight the state's protection activities, and importantly, to identify any gaps that may have needed filling among those programs. The 2003 *Strategy* included:

- The state's groundwater protection goal as established by the Texas Legislature.
- The statewide groundwater classification system and how the state identified contamination and quantity issues.
- The roles and responsibilities of the various state agencies involved in groundwater protection and discussion on the TGPC as a coordinating mechanism.
- Examples of how the various state agencies implemented groundwater protection programs through regulatory and non-regulatory models.
- How the local, state, and federal agencies coordinated management of groundwater data for the enhancement of groundwater.
- The role research played in understanding the importance of groundwater and of coordinating research.
- Public education related to groundwater being performed in the state.
- Public participation in establishing and implementing groundwater policy.
- A plan to update the groundwater strategy.
- Proposals for the next document to identify and rank significant threats to the state's groundwater resources, consideration of the vulnerability of groundwater resources, and a prioritization of actions to address those threats.
- Recommendations and actions that could be taken to protect groundwater.

TGPC began updating the *Strategy* again in 2017, and at its quarterly public meeting in October 2018, adopted the updated *Strategy* (TCEQ Publication AS-188, November 2018).[29] This comprehensive strategy for protecting groundwater in Texas includes both the TGPC members' internal programs and the TGPC's internal processes.

The 2018 updates streamlined the *Strategy* for better integration into TGPC's vision for the committee's mandated reports. By streamlining the documents, TGPC has sought

[28] tgpc.texas.gov/tgpc-publications/publication-history-of-the-texas-groundwater-protection-committee/
[29] tceq.texas.gov/groundwater/groundwater-planning-assessment/prot_prog.html

to reduce redundancy and increase the interdependency between the mandated products of the legislation that created the committee. The 2018 updates also represent an initial move toward a dynamic document that can be updated rapidly to respond not only to advances in groundwater technology and contaminant detection and forecasting, but also to unanticipated issues. TGPC believes that a dynamic strategy, which facilitates addressing not only the "known" groundwater issues, but emerging issues, is critical to maintaining the protection of the resource.

The principles and mechanisms that characterize groundwater for protection and conservation identified in the previous *Strategy,* (AS-188, February 2003), were not in any way invalidated, amended, modified, or "repealed," and remain in effect. Similarly, no existing groundwater protection measure acquired, adopted, or incurred; nor any rule or order adopted; nor any proceeding instituted by the program areas of any member agency that were pursuant to AS-188 (February 2003), were affected by the adoption of the updated *Strategy*.

The *2018 Strategy* addresses a new approach to the contents of the remaining chapters in AS-188 (February 2003), and, as mentioned previously, is the initial framework for a dynamic *Strategy* moving forward.

Groundwater Assessment

Methodology Used

The member agencies of TGPC provide data for groundwater quality inventory. In 1996, the TGPC began conducting an inventory of groundwater quality of the state's aquifers through the partnership of two of the TGPC member agencies: TCEQ and TWDB. This information was published in the *State of Texas Water Quality Inventory 1996*, which is a predecessor to this report.

EPA representatives requested that the 1998 report's update emphasize the spatial and graphical representation of the most recent available groundwater quality data, with maps showing examples of groundwater quality in wells located in the selected aquifers. Subsequent reports continued this spatial and graphical representation as additional aquifers were inventoried.

In subsequent *Water Quality Inventory* reports, TCEQ has used reports and downloads from the TWDB's groundwater database[30] to inventory ambient water quality in each of the state's major and minor aquifers for the most recent 10-year period.

For this report, TCEQ evaluated ambient groundwater data for Fiscal Year (FY) 2013 through FY2023 (September 1, 2013, through August 31, 2023) from the TWDB groundwater database. The following constituents were chosen from all the analyses conducted because they are listed in state rules related to drinking water standards and there is sufficient sampling throughout the state's aquifers to generally assess water quality: arsenic, barium, cadmium, chromium, copper, iron, manganese, selenium, zinc, sulfate, chloride, nitrate-nitrogen, total dissolved solids, and alpha radiation.

[30] www.twdb.texas.gov/groundwater/data/gwdbrpt.asp

In evaluating these constituents, staff sorted the data and filtered the results to eliminate duplicate samples for any given well, giving a "snapshot" of the highest concentration value for each well that is available during the 10-year period. The purpose for choosing the highest concentration at each sampled well was to conservatively estimate constituent concentrations within each aquifer. Concentrations illustrated in previous reports may have changed at specific sampling sites since each report looks at the most recent 10-year period.

For each constituent, results were evaluated to determine how many wells within each sampled aquifer were above an accepted regulatory value, typically the maximum contaminant level (MCL) for drinking water established by EPA. For those aquifers in which a considerable number of samples demonstrated concentrations above the MCL, the values were imported into a geographic information systems (GIS) application and presented spatially on a map of the aquifer (Figures 3 through 40). There is no specific number or percentage of samples that demonstrated what a "significant" quantity of samples above the MCL would be. Instead, staff examined the data and weighed the numbers of samples, the extent of the aquifer, the demand in or use of the aquifer, and the distribution of the concentrations to determine the relative importance of the concentration data. After these constituents were identified for each aquifer, staff generated GIS-based maps for those select aquifers and constituents (see Figures 3 through 40, Constituents of Interest in Selected Aquifers). In general, maps were developed when staff identified a concern with a parameter that exceeded a primary drinking water MCL; though maps were also included for some aquifers where analyses exceeded a secondary MCL.

For those analyses that are not represented spatially, Section 4 of this report, "Ambient Groundwater Monitoring," includes tables for each aquifer showing the total number of wells sampled for each constituent and the number of wells that exceeded the MCL. The TWDB Groundwater Data webpage[31] provides detailed water quality data of a particular well, aquifer, or county.

Limitations

The TWDB ambient groundwater quality database contains a large amount of data collected over a span of several decades. Quantitative laboratory methods used to analyze water samples have changed over time, and even in recent years, analysis may be performed by a lab, or by Hach "kits." Consequently, the data is not directly comparable without qualification.

Additionally, wells are sampled on a cycle, and there may be several intervening years between sample events. The sampling program does not consider differences in aquifer conditions due to drought, seasonal variation, or local flow directions. Therefore, the analytical results, even if performed using the same laboratory methods, may still not be directly comparable over time due to cyclical variation in aquifer conditions. The data presented in this report is intended as an overview of areas where there could be potential water quality issues and presents a "snapshot" of groundwater quality conditions for each of the major and minor aquifers.

While MCLs for drinking water are based on "total" values for a constituent, most data available is for "dissolved" concentrations. Because of the amount of data available,

[31] www.twdb.texas.gov/groundwater/data/index.asp

this report described the dissolved concentrations of each constituent. In general, dissolved concentrations are slightly lower than the total values. The tables and figures in this report might portray a slightly lower concentration of constituents in groundwater than exists in the field; nonetheless, they serve to illustrate a general trend or areas of potential concern.

The groundwater assessment has historically used analyses for "Gross Alpha (total)" as an indicator for naturally occurring radioactive elements. A concentration of 15 picocuries per liter (pCi/l) at a public drinking water system is typically used as a screening value that may warrant additional analysis to determine the source. In this 10-year period evaluation, like the previous *Groundwater Assessment* of 2022, very few data points for gross alpha were available to review. Because of this, staff used analyses for "dissolved alpha" to estimate the concentration of radionuclides. Additional information on naturally occurring radioactive materials in Texas is available in the following publications:

- *Drinking Water Problems: Radionuclides* (Texas A&M Agrilife Extension)[32]
- *TWDB Groundwater Database Reports and Downloads*[33]
- *Naturally Occurring Groundwater Contamination in Texas* (2011 TWDB Report)[34]

Another limitation is the relative simplicity of the methodology for this assessment. The data is evaluated using a qualitative approach to the character of water quality. However, given the size of the state and the volume of data available, this approach is adequate to present general information on ambient groundwater quality and identify areas of potential concern.

The groundwater assessment is a general water quality inventory, and the limitations discussed should restrict the conclusions that can be drawn from this data. This report may help future investigations better characterize aquifer quality; and water resource planners, water suppliers, and regulators could use the information for future planning.

[32] agrilifeextension.tamu.edu/asset-external/drinking-water-problems-radionuclides/
[33] www.twdb.texas.gov/groundwater/data/gwdbrpt.asp
[34] www.twdb.texas.gov/publications/reports/contracted_reports/doc/1004831125.pdf

Ambient Groundwater Monitoring

Summary of Ambient Groundwater Monitoring

TWDB administers an ambient groundwater monitoring program which collects data on the occurrence, availability, quality, and quantity of groundwater present. The purposes of the ambient groundwater quality sampling program are to collect data to 1) monitor any changes in the quality of groundwater over time and 2) establish as accurately as possible the baseline quality of groundwater occurring naturally in the state's aquifers. This information helps assess the current and projected demands on groundwater resources, and accordingly, is vital to the state's regional water planning.

TWDB conducts the groundwater quality monitoring program according to procedures established in the TWDB *Field Manual for Groundwater Sampling*.[35] TWDB performs ambient groundwater monitoring on water wells throughout the extent of an aquifer, such that each of the major and minor aquifers of the state are monitored approximately every four years. This data is available on TWDB's Groundwater Database Reports and Downloads webpage.[36] Ambient groundwater quality data is also collected by other entities that follow these or similar procedures, including GCDs, USGD, and other state and federal agencies. TWDB's "Water Data Interactive"[37] contains information on selected water wells, springs, oil/gas tests, water levels, and water quality data.

TWDB staff entered those water quality data reports into the Groundwater Database (GWDB). TGPC relies upon ambient monitoring data available from this database, which is maintained by TWDB and includes years of sampling and analysis. According to TWDB, the GWDB contains information for approximately 140,000 sites, including water wells, springs, oil/gas tests that were originally intended to be or were converted to water wells, water levels, and water quality. In 2022, TWDB sampled 239 sites (wells and springs) and cooperators sampled 57 sites for a total of 350 sampling sites. This report includes data from more than 2,100 water wells across Texas that were sampled between September 1, 2013, and August 31, 2023.

Ambient monitoring groundwater quality data for the major and minor aquifers used in this report are summarized in Tables 2, 3, and 4 following, with detailed data for each aquifer in Tables 5 through 35. In addition to the ambient water quality data tables in this assessment, the TWDB Numbered Reports webpage[38] includes detailed information on some of its collected groundwater quality data in hydrologic atlases of certain individual aquifers.

[35] www.twdb.texas.gov/groundwater/docs/UMs/UM-51.pdf
[36] www.twdb.texas.gov/groundwater/data/gwdbrpt.asp
[37] www3.twdb.texas.gov/apps/waterdatainteractive/groundwaterdataviewer
[38] www.twdb.texas.gov/publications/reports/numbered_reports/index.asp

Table 2. Summary of Ambient Monitoring Groundwater Quality Data for Primary Drinking Water Constituents, FY2013 – FY2023

Parameters with a Primary MCL	Primary MCL[39]	Number of Wells	<MDL[40]	<MCL (except <MDL)	≥MCL
Arsenic, dissolved	10 µg/l	2,055	1,345	622	88
Barium, dissolved	2 mg/l	2,062	6	2,055	1
Cadmium, dissolved	5 µg/l	2,034	1,953	80	1
Chromium, dissolved	100 µg/l	2,054	558	1,496	-
Fluoride, dissolved	4 mg/l	2,113	17	2,008	88
Mercury, dissolved	2 µg/l	2,046	2,006	39	1
Nitrate-Nitrogen, dissolved	10 mg/l	2,099	746	922	431
Selenium, dissolved	50 µg/l	2,055	1,580	433	42

Table 3. Summary of Ambient Monitoring Groundwater Quality Data for Secondary Drinking Water Constituents, FY2013 – FY2023

Parameter	Secondary Standard[41]	Number of Wells	<MDL	<Secondary Standard (other than <MDL)	≥Secondary Standard
Chloride	300 mg/l	2,149	1	1,920	228
Copper	1 mg/l	2,055	818	1,237	-
Fluoride	2 mg/l	2,113	17	1,672	424
Iron	0.3 mg/l	2,096	1,463	379	254
Manganese	50 µg/l	2,078	820	1,073	185
Sulfate	300 mg/l	2,149	98	1,711	340
Dissolved Solids	1,000 mg/l	2,093	-	1,708	385
Zinc	5 mg/l	2,054	905	1,148	1

Table 4. Summary of Ambient Monitoring Groundwater Quality Data for Radioactivity, FY2013 – FY2023

Parameter	Screening Level[42]	Number of Wells	<MDL	<Screening Level (other than <MDL)	>Screening Level
Alpha, dissolved	15 pCi/L	881	446	318	117

[39] "MCL" or maximum contaminant level, is the maximum concentration of a regulated contaminant that is allowed in drinking water before the public water system is considered in violation of Public Drinking Water rules. Units of concentration are in micrograms per liter (µg/l) or milligrams per liter (mg/l).
[40] "MDL" or method detection limit is the lowest analysis value available for a parameter at a particular sampling event, as determined by the analyzing laboratory. "<MDL" shows the number of wells with concentrations less than the MDL.
[41] "Secondary Standard" is a concentration above which water in a public system may only be used with written approval from the TCEQ. Note that fluoride has both an MCL and a secondary standard. Units of concentration are in micrograms per liter (µg/l) or milligrams per liter (mg/l).
[42] "Screening Level" means, for the purpose of this assessment, a concentration that is generally comparable to drinking water standards. Units are in picocuries per liter (pCi/L)

Tables 5 through 35 – Ambient Groundwater Monitoring Data in Texas Aquifers

Tables 5 through 35 show ambient groundwater monitoring data tabulated by aquifer for FY2013 through FY2023. For each table, the following notes and definitions apply:

- **Columns for each table**
  - "Constituent (dissolved)" is the analyzed parameter. For this report, each constituent is reported as "dissolved" unless otherwise noted.
  - "Criterion" is the level by which the concentration in groundwater is compared.
  - "Source of Criterion" refers to the following:
    - "MCL," or maximum contaminant level, is the maximum concentration of a regulated contaminant that is allowed in drinking water before the public water system is considered in violation of public drinking water rules.
    - "Secondary Standard," or secondary constituent level, is a concentration above which water in a public system may only be used with written approval from TCEQ. Note that fluoride has both an MCL and a secondary standard.
    - "Screening Level" means, for the purpose of this assessment, a concentration generally comparable to drinking water standards.
  - "Number of Wells" means the number of unique wells sampled for the constituent between September 1, 2013, and August 31, 2023.
  - "<MDL" is the number of wells below the MDL for the constituent.
  - "<Criterion (except <MDL)" is the number of wells below the criterion but not including those wells below the MDL.
  - "≥Criterion" is the number of wells at or above the criterion.
- **Other definitions**
  - MDL, or method detection limit, is the lowest analysis value available for a parameter at a sampling event, as determined by the analyzing laboratory.
  - mg/l means milligrams per liter.
  - µg/l means micrograms per liter.
  - pCi/l means picocuries per liter.

Table 5. Blaine Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	21	13	8	0
Barium	2 mg/l	MCL	21	0	21	0
Cadmium	5 µg/l	MCL	21	21	0	0
Chromium	100 µg/l	MCL	21	0	21	0
Fluoride	4 mg/l	MCL	20	3	17	0
Mercury	2 µg/l	MCL	21	21	0	0
Nitrate-Nitrogen	10 mg/l	MCL	21	1	4	16
Selenium	50 µg/l	MCL	21	4	16	1
Chloride	300 mg/l	Secondary Standard	21	0	12	9
Copper	1 mg/l	Secondary Standard	21	0	21	0
Fluoride	2 mg/l	Secondary Standard	20	3	17	0
Iron	0.3 mg/l	Secondary Standard	21	18	1	2
Manganese	50 µg/l	Secondary Standard	21	10	10	1
Sulfate	300 mg/l	Secondary Standard	21	0	0	21
Total Dissolved Solids	1,000 mg/l	Secondary Standard	19	0	0	19
Zinc	5 mg/l	Secondary Standard	21	4	17	0
Dissolved Alpha	15 pCi/L	Screening Level	14	2	0	12

Table 6. Blossum Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	1	1	0	0
Barium	2 mg/l	MCL	1	0	1	0
Cadmium	5 µg/l	MCL	1	1	0	0
Chromium	100 µg/l	MCL	1	0	1	0
Fluoride	4 mg/l	MCL	1	0	1	0
Mercury	2 µg/l	MCL	1	1	0	0
Nitrate-Nitrogen	10 mg/l	MCL	1	1	0	0
Selenium	50 µg/l	MCL	1	1	0	0
Chloride	300 mg/l	Secondary Standard	1	0	1	0
Copper	1 mg/l	Secondary Standard	1	1	0	0
Fluoride	2 mg/l	Secondary Standard	1	0	1	0
Iron	0.3 mg/l	Secondary Standard	1	1	0	0
Manganese	50 µg/l	Secondary Standard	1	0	1	0
Sulfate	300 mg/l	Secondary Standard	1	0	1	0
Total Dissolved Solids	1,000 mg/l	Secondary Standard	1	0	0	1
Zinc	5 mg/l	Secondary Standard	1	1	0	0
Dissolved Alpha	15 pCi/L	Screening Level	1	1	0	0

Table 7. Bone Spring-Victorio Peak Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	2	0	2	0
Barium	2 mg/l	MCL	2	0	2	0
Cadmium	5 µg/l	MCL	2	2	0	0
Chromium	100 µg/l	MCL	2	0	2	0
Fluoride	4 mg/l	MCL	2	0	2	0
Mercury	2 µg/l	MCL	2	2	0	0
Nitrate-Nitrogen	10 mg/l	MCL	2	0	1	1
Selenium	50 µg/l	MCL	2	0	2	0
Chloride	300 mg/l	Secondary Standard	2	0	0	2
Copper	1 mg/l	Secondary Standard	2	0	2	0
Fluoride	2 mg/l	Secondary Standard	2	0	1	1
Iron	0.3 mg/l	Secondary Standard	2	2	0	0
Manganese	50 µg/l	Secondary Standard	2	1	1	0
Sulfate	300 mg/l	Secondary Standard	2	0	0	2
Total Dissolved Solids	1,000 mg/l	Secondary Standard	2	0	0	2
Zinc	5 mg/l	Secondary Standard	2	0	2	0
Dissolved Alpha	15 pCi/L	Screening Level	1	1	0	0

Table 8. Brazos River Alluvium Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	6	4	2	0
Barium	2 mg/l	MCL	6	0	6	0
Cadmium	5 µg/l	MCL	6	6	0	0
Chromium	100 µg/l	MCL	6	0	6	0
Fluoride	4 mg/l	MCL	6	0	6	0
Mercury	2 µg/l	MCL	6	6	0	0
Nitrate-Nitrogen	10 mg/l	MCL	6	1	1	4
Selenium	50 µg/l	MCL	6	6	0	0
Chloride	300 mg/l	Secondary Standard	6	0	6	0
Copper	1 mg/l	Secondary Standard	6	1	5	0
Fluoride	2 mg/l	Secondary Standard	6	0	6	0
Iron	0.3 mg/l	Secondary Standard	6	4	1	1
Manganese	50 µg/l	Secondary Standard	6	1	1	4
Sulfate	300 mg/l	Secondary Standard	6	0	6	0
Total Dissolved Solids	1,000 mg/l	Secondary Standard	6	0	5	1
Zinc	5 mg/l	Secondary Standard	6	1	5	0
Dissolved Alpha	15 pCi/L	Screening Level	4	4	0	0

Table 9. Capitan Reef Complex Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	4	3	1	0
Barium	2 mg/l	MCL	4	0	4	0
Cadmium	5 µg/l	MCL	4	4	0	0
Chromium	100 µg/l	MCL	4	1	3	0
Fluoride	4 mg/l	MCL	4	0	3	1
Mercury	2 µg/l	MCL	4	4	0	0
Nitrate-Nitrogen	10 mg/l	MCL	4	2	1	1
Selenium	50 µg/l	MCL	4	1	2	1
Chloride	300 mg/l	Secondary Standard	4	0	2	2
Copper	1 mg/l	Secondary Standard	4	2	2	0
Fluoride	2 mg/l	Secondary Standard	4	0	1	3
Iron	0.3 mg/l	Secondary Standard	4	2	1	1
Manganese	50 µg/l	Secondary Standard	4	2	2	0
Sulfate	300 mg/l	Secondary Standard	4	0	0	4
Total Dissolved Solids	1,000 mg/l	Secondary Standard	4	0	0	4
Zinc	5 mg/l	Secondary Standard	4	2	2	0
Dissolved Alpha	15 pCi/L	Screening Level	1	1	0	0

Table 10. Carrizo-Wilcox Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	333	296	36	1
Barium	2 mg/l	MCL	333	0	333	0
Cadmium	5 µg/l	MCL	333	333	0	0
Chromium	100 µg/l	MCL	333	108	225	0
Fluoride	4 mg/l	MCL	333	1	329	3
Mercury	2 µg/l	MCL	333	333	0	0
Nitrate-Nitrogen	10 mg/l	MCL	360	263	90	7
Selenium	50 µg/l	MCL	333	283	41	9
Chloride	300 mg/l	Secondary Standard	359	0	343	16
Copper	1 mg/l	Secondary Standard	333	184	149	0
Fluoride	2 mg/l	Secondary Standard	333	1	323	9
Iron	0.3 mg/l	Secondary Standard	333	186	54	93
Manganese	50 µg/l	Secondary Standard	333	24	242	67
Sulfate	300 mg/l	Secondary Standard	359	47	306	6
Total Dissolved Solids	1,000 mg/l	Secondary Standard	332	0	316	16
Zinc	5 mg/l	Secondary Standard	333	198	135	0
Dissolved Alpha	15 pCi/L	Screening Level	216	183	31	2

Table 11. Cross Timbers Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	3	1	2	0
Barium	2 mg/l	MCL	3	0	3	0
Cadmium	5 µg/l	MCL	3	3	0	0
Chromium	100 µg/l	MCL	3	3	0	0
Fluoride	4 mg/l	MCL	3	0	3	0
Mercury	2 µg/l	MCL	3	3	0	0
Nitrate-Nitrogen	10 mg/l	MCL	3	0	1	2
Selenium	50 µg/l	MCL	3	3	0	0
Chloride	300 mg/l	Secondary Standard	3	0	3	0
Copper	1 mg/l	Secondary Standard	3	2	1	0
Fluoride	2 mg/l	Secondary Standard	3	0	3	0
Iron	0.3 mg/l	Secondary Standard	3	3	0	0
Manganese	50 µg/l	Secondary Standard	3	0	3	0
Sulfate	300 mg/l	Secondary Standard	3	0	2	1
Total Dissolved Solids	1,000 mg/l	Secondary Standard	3	0	2	1
Zinc	5 mg/l	Secondary Standard	3	1	2	0
Dissolved Alpha	15 pCi/L	Screening Level	1	0	1	0

Table 12. Dockum Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	23	11	12	0
Barium	2 mg/l	MCL	23	0	23	0
Cadmium	5 µg/l	MCL	23	19	4	0
Chromium	100 µg/l	MCL	23	3	20	0
Fluoride	4 mg/l	MCL	23	0	21	2
Mercury	2 µg/l	MCL	23	23	0	0
Nitrate-Nitrogen	10 mg/l	MCL	23	5	11	7
Selenium	50 µg/l	MCL	23	12	11	0
Chloride	300 mg/l	Secondary Standard	23	0	18	5
Copper	1 mg/l	Secondary Standard	23	5	18	0
Fluoride	2 mg/l	Secondary Standard	23	0	5	18
Iron	0.3 mg/l	Secondary Standard	23	16	7	0
Manganese	50 µg/l	Secondary Standard	23	6	17	0
Sulfate	300 mg/l	Secondary Standard	23	0	16	7
Total Dissolved Solids	1,000 mg/l	Secondary Standard	23	0	16	7
Zinc	5 mg/l	Secondary Standard	23	7	16	0
Dissolved Alpha	15 pCi/L	Screening Level	16	2	12	2

Table 13. Edwards (Balcones Fault Zone) Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	119	113	5	1
Barium	2 mg/l	MCL	119	0	119	0
Cadmium	5 µg/l	MCL	119	118	0	1
Chromium	100 µg/l	MCL	119	26	93	0
Fluoride	4 mg/l	MCL	152	2	142	8
Mercury	2 µg/l	MCL	118	118	0	0
Nitrate-Nitrogen	10 mg/l	MCL	141	12	102	27
Selenium	50 µg/l	MCL	119	116	2	1
Chloride	300 mg/l	Secondary Standard	141	0	139	2
Copper	1 mg/l	Secondary Standard	119	35	84	0
Fluoride	2 mg/l	Secondary Standard	152	2	136	14
Iron	0.3 mg/l	Secondary Standard	139	127	9	3
Manganese	50 µg/l	Secondary Standard	125	108	16	1
Sulfate	300 mg/l	Secondary Standard	142	0	136	6
Total Dissolved Solids	1,000 mg/l	Secondary Standard	139	0	135	4
Zinc	5 mg/l	Secondary Standard	119	59	60	0
Dissolved Alpha	15 pCi/L	Screening Level	16	10	5	1

Table 14. Edwards-Trinity (High Plains) Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	4	0	1	3
Barium	2 mg/l	MCL	4	0	4	0
Cadmium	5 µg/l	MCL	4	4	0	0
Chromium	100 µg/l	MCL	4	0	4	0
Fluoride	4 mg/l	MCL	4	0	1	3
Mercury	2 µg/l	MCL	4	0	4	0
Nitrate-Nitrogen	10 mg/l	MCL	4	0	2	2
Selenium	50 µg/l	MCL	4	0	4	0
Chloride	300 mg/l	Secondary Standard	4	0	3	1
Copper	1 mg/l	Secondary Standard	4	0	4	0
Fluoride	2 mg/l	Secondary Standard	4	0	1	3
Iron	0.3 mg/l	Secondary Standard	4	2	2	0
Manganese	50 µg/l	Secondary Standard	4	1	3	0
Sulfate	300 mg/l	Secondary Standard	4	0	3	1
Total Dissolved Solids	1,000 mg/l	Secondary Standard	4	0	3	1
Zinc	5 mg/l	Secondary Standard	4	0	4	0
Dissolved Alpha	15 pCi/L	Screening Level	4	2	2	0

Table 15. Edwards-Trinity (Plateau) Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	256	194	60	2
Barium	2 mg/l	MCL	256	0	256	0
Cadmium	5 µg/l	MCL	256	256	0	0
Chromium	100 µg/l	MCL	256	54	202	0
Fluoride	4 mg/l	MCL	256	0	255	1
Mercury	2 µg/l	MCL	256	256	0	0
Nitrate-Nitrogen	10 mg/l	MCL	252	13	126	113
Selenium	50 µg/l	MCL	256	207	49	0
Chloride	300 mg/l	Secondary Standard	258	0	229	29
Copper	1 mg/l	Secondary Standard	256	58	198	0
Fluoride	2 mg/l	Secondary Standard	256	0	205	51
Iron	0.3 mg/l	Secondary Standard	256	224	15	17
Manganese	50 µg/l	Secondary Standard	256	166	87	3
Sulfate	300 mg/l	Secondary Standard	258	0	193	65
Total Dissolved Solids	1,000 mg/l	Secondary Standard	257	0	196	61
Zinc	5 mg/l	Secondary Standard	255	63	192	0
Dissolved Alpha	15 pCi/L	Screening Level	85	51	28	6

Table 16. Ellenburger-San Saba Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	56	50	6	0
Barium	2 mg/l	MCL	56	0	56	0
Cadmium	5 µg/l	MCL	56	56	0	0
Chromium	100 µg/l	MCL	56	4	52	0
Fluoride	4 mg/l	MCL	56	0	56	0
Mercury	2 µg/l	MCL	56	55	1	0
Nitrate-Nitrogen	10 mg/l	MCL	56	7	38	11
Selenium	50 µg/l	MCL	56	52	4	0
Chloride	300 mg/l	Secondary Standard	56	0	55	1
Copper	1 mg/l	Secondary Standard	56	15	41	0
Fluoride	2 mg/l	Secondary Standard	56	0	52	4
Iron	0.3 mg/l	Secondary Standard	56	47	5	4
Manganese	50 µg/l	Secondary Standard	56	36	20	0
Sulfate	300 mg/l	Secondary Standard	56	0	54	2
Total Dissolved Solids	1,000 mg/l	Secondary Standard	57	0	54	3
Zinc	5 mg/l	Secondary Standard	56	29	27	0
Dissolved Alpha	15 pCi/L	Screening Level	18	11	6	1

Table 17. Gulf Coast Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	244	86	123	35
Barium	2 mg/l	MCL	244	0	243	1
Cadmium	5 µg/l	MCL	244	244	0	0
Chromium	100 µg/l	MCL	244	44	200	0
Fluoride	4 mg/l	MCL	244	5	239	0
Mercury	2 µg/l	MCL	244	244	0	0
Nitrate-Nitrogen	10 mg/l	MCL	244	138	80	26
Selenium	50 µg/l	MCL	244	197	43	4
Chloride	300 mg/l	Secondary Standard	244	0	175	69
Copper	1 mg/l	Secondary Standard	244	142	102	0
Fluoride	2 mg/l	Secondary Standard	244	5	225	14
Iron	0.3 mg/l	Secondary Standard	244	125	75	44
Manganese	50 µg/l	Secondary Standard	244	43	140	61
Sulfate	300 mg/l	Secondary Standard	243	40	175	28
Total Dissolved Solids	1,000 mg/l	Secondary Standard	242	0	178	64
Zinc	5 mg/l	Secondary Standard	244	117	127	0
Dissolved Alpha	15 pCi/L	Screening Level	208	92	75	41

Table 18. Hickory Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	23	18	5	0
Barium	2 mg/l	MCL	30	0	30	0
Cadmium	5 µg/l	MCL	23	23	0	0
Chromium	100 µg/l	MCL	23	3	20	0
Fluoride	4 mg/l	MCL	23	0	23	0
Mercury	2 µg/l	MCL	23	23	0	0
Nitrate-Nitrogen	10 mg/l	MCL	23	5	12	6
Selenium	50 µg/l	MCL	23	22	1	0
Chloride	300 mg/l	Secondary Standard	23	0	21	2
Copper	1 mg/l	Secondary Standard	23	5	18	0
Fluoride	2 mg/l	Secondary Standard	23	0	23	0
Iron	0.3 mg/l	Secondary Standard	24	17	3	4
Manganese	50 µg/l	Secondary Standard	23	11	10	2
Sulfate	300 mg/l	Secondary Standard	23	1	22	0
Total Dissolved Solids	1,000 mg/l	Secondary Standard	23	0	21	2
Zinc	5 mg/l	Secondary Standard	23	7	16	0
Dissolved Alpha	15 pCi/L	Screening Level	14	0	10	4

Table 19. Hueco-Mesilla Bolsons Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	8	0	5	3
Barium	2 mg/l	MCL	8	0	8	0
Cadmium	5 µg/l	MCL	8	8	0	0
Chromium	100 µg/l	MCL	8	1	7	0
Fluoride	4 mg/l	MCL	8	0	8	0
Mercury	2 µg/l	MCL	8	5	2	1
Nitrate-Nitrogen	10 mg/l	MCL	8	1	4	3
Selenium	50 µg/l	MCL	8	5	3	0
Chloride	300 mg/l	Secondary Standard	8	0	4	4
Copper	1 mg/l	Secondary Standard	8	5	3	0
Fluoride	2 mg/l	Secondary Standard	8	0	8	0
Iron	0.3 mg/l	Secondary Standard	8	5	2	1
Manganese	50 µg/l	Secondary Standard	8	1	6	1
Sulfate	300 mg/l	Secondary Standard	8	0	7	1
Total Dissolved Solids	1,000 mg/l	Secondary Standard	8	0	7	1
Zinc	5 mg/l	Secondary Standard	8	4	4	0
Dissolved Alpha	15 pCi/L	Screening Level	0	0	0	0

Table 20. Igneous Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	29	6	22	1
Barium	2 mg/l	MCL	29	2	27	0
Cadmium	5 µg/l	MCL	29	29	0	0
Chromium	100 µg/l	MCL	29	12	17	0
Fluoride	4 mg/l	MCL	29	0	28	1
Mercury	2 µg/l	MCL	29	29	0	0
Nitrate-Nitrogen	10 mg/l	MCL	28	3	16	9
Selenium	50 µg/l	MCL	29	28	1	0
Chloride	300 mg/l	Secondary Standard	29	0	28	1
Copper	1 mg/l	Secondary Standard	29	9	20	0
Fluoride	2 mg/l	Secondary Standard	29	0	18	11
Iron	0.3 mg/l	Secondary Standard	29	27	1	1
Manganese	50 µg/l	Secondary Standard	29	15	11	3
Sulfate	300 mg/l	Secondary Standard	29	0	28	1
Total Dissolved Solids	1,000 mg/l	Secondary Standard	29	0	28	1
Zinc	5 mg/l	Secondary Standard	29	8	21	0
Dissolved Alpha	15 pCi/L	Screening Level	4	0	2	2

Table 21. Lipan Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	9	0	9	0
Barium	2 mg/l	MCL	9	0	9	0
Cadmium	5 µg/l	MCL	9	9	0	0
Chromium	100 µg/l	MCL	9	2	7	0
Fluoride	4 mg/l	MCL	9	0	9	0
Mercury	2 µg/l	MCL	9	9	0	0
Nitrate-Nitrogen	10 mg/l	MCL	9	0	1	8
Selenium	50 µg/l	MCL	9	5	4	0
Chloride	300 mg/l	Secondary Standard	9	0	5	4
Copper	1 mg/l	Secondary Standard	9	0	9	0
Fluoride	2 mg/l	Secondary Standard	9	0	9	0
Iron	0.3 mg/l	Secondary Standard	9	9	0	0
Manganese	50 µg/l	Secondary Standard	9	6	3	0
Sulfate	300 mg/l	Secondary Standard	9	0	5	4
Total Dissolved Solids	1,000 mg/l	Secondary Standard	9	0	4	5
Zinc	5 mg/l	Secondary Standard	9	0	9	0
Dissolved Alpha	15 pCi/L	Screening Level	0	0	0	0

Table 22. Marathon Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	11	11	0	0
Barium	2 mg/l	MCL	11	0	11	0
Cadmium	5 µg/l	MCL	11	11	0	0
Chromium	100 µg/l	MCL	11	1	10	0
Fluoride	4 mg/l	MCL	11	0	11	0
Mercury	2 µg/l	MCL	11	11	0	0
Nitrate-Nitrogen	10 mg/l	MCL	11	1	6	4
Selenium	50 µg/l	MCL	11	9	2	0
Chloride	300 mg/l	Secondary Standard	11	0	11	0
Copper	1 mg/l	Secondary Standard	11	3	8	0
Fluoride	2 mg/l	Secondary Standard	11	0	11	0
Iron	0.3 mg/l	Secondary Standard	11	10	1	0
Manganese	50 µg/l	Secondary Standard	11	5	5	1
Sulfate	300 mg/l	Secondary Standard	11	0	9	2
Total Dissolved Solids	1,000 mg/l	Secondary Standard	11	0	11	0
Zinc	5 mg/l	Secondary Standard	11	4	7	0
Dissolved Alpha	15 pCi/L	Screening Level	1	0	1	0

Table 23. Marble Falls Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	7	5	2	0
Barium	2 mg/l	MCL	7	0	7	0
Cadmium	5 µg/l	MCL	7	7	0	0
Chromium	100 µg/l	MCL	7	1	6	0
Fluoride	4 mg/l	MCL	7	0	7	0
Mercury	2 µg/l	MCL	7	7	0	0
Nitrate-Nitrogen	10 mg/l	MCL	7	2	5	0
Selenium	50 µg/l	MCL	7	6	0	1
Chloride	300 mg/l	Secondary Standard	7	0	6	1
Copper	1 mg/l	Secondary Standard	7	5	2	0
Fluoride	2 mg/l	Secondary Standard	7	0	7	0
Iron	0.3 mg/l	Secondary Standard	7	7	0	0
Manganese	50 µg/l	Secondary Standard	7	2	5	0
Sulfate	300 mg/l	Secondary Standard	7	0	7	0
Total Dissolved Solids	1,000 mg/l	Secondary Standard	7	0	6	1
Zinc	5 mg/l	Secondary Standard	7	5	2	0
Dissolved Alpha	15 pCi/L	Screening Level	1	0	0	1

Table 24. Nacatoch Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	3	3	0	0
Barium	2 mg/l	MCL	3	0	3	0
Cadmium	5 µg/l	MCL	3	3	0	0
Chromium	100 µg/l	MCL	3	0	3	0
Fluoride	4 mg/l	MCL	3	0	3	0
Mercury	2 µg/l	MCL	3	3	0	0
Nitrate-Nitrogen	10 mg/l	MCL	3	1	2	0
Selenium	50 µg/l	MCL	3	3	0	0
Chloride	300 mg/l	Secondary Standard	3	0	3	0
Copper	1 mg/l	Secondary Standard	3	3	0	0
Fluoride	2 mg/l	Secondary Standard	3	0	1	2
Iron	0.3 mg/l	Secondary Standard	3	3	0	0
Manganese	50 µg/l	Secondary Standard	3	1	2	0
Sulfate	300 mg/l	Secondary Standard	3	1	2	0
Total Dissolved Solids	1,000 mg/l	Secondary Standard	3	0	3	0
Zinc	5 mg/l	Secondary Standard	3	2	1	0
Dissolved Alpha	15 pCi/L	Screening Level	0	0	0	0

Table 25. Ogallala Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	284	25	226	33
Barium	2 mg/l	MCL	284	0	284	0
Cadmium	5 µg/l	MCL	264	190	74	0
Chromium	100 µg/l	MCL	284	18	266	0
Fluoride	4 mg/l	MCL	284	0	246	38
Mercury	2 µg/l	MCL	276	248	28	0
Nitrate-Nitrogen	10 mg/l	MCL	283	1	189	93
Selenium	50 µg/l	MCL	284	73	191	20
Chloride	300 mg/l	Secondary Standard	276	0	258	18
Copper	1 mg/l	Secondary Standard	284	33	251	0
Fluoride	2 mg/l	Secondary Standard	284	0	135	149
Iron	0.3 mg/l	Secondary Standard	284	163	118	3
Manganese	50 µg/l	Secondary Standard	284	136	145	3
Sulfate	300 mg/l	Secondary Standard	276	0	250	26
Total Dissolved Solids	1,000 mg/l	Secondary Standard	285	0	252	33
Zinc	5 mg/l	Secondary Standard	284	51	232	1
Dissolved Alpha	15 pCi/L	Screening Level	154	17	112	25

Table 26. Pecos Valley Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	38	12	21	5
Barium	2 mg/l	MCL	38	0	38	0
Cadmium	5 µg/l	MCL	38	38	0	0
Chromium	100 µg/l	MCL	38	6	32	0
Fluoride	4 mg/l	MCL	38	0	38	0
Mercury	2 µg/l	MCL	38	38	0	0
Nitrate-Nitrogen	10 mg/l	MCL	38	1	19	18
Selenium	50 µg/l	MCL	38	19	19	0
Chloride	300 mg/l	Secondary Standard	38	0	26	12
Copper	1 mg/l	Secondary Standard	38	6	32	0
Fluoride	2 mg/l	Secondary Standard	38	0	27	11
Iron	0.3 mg/l	Secondary Standard	38	22	11	5
Manganese	50 µg/l	Secondary Standard	38	16	19	3
Sulfate	300 mg/l	Secondary Standard	38	0	18	20
Total Dissolved Solids	1,000 mg/l	Secondary Standard	38	0	19	19
Zinc	5 mg/l	Secondary Standard	38	14	24	0
Dissolved Alpha	15 pCi/L	Screening Level	27	10	10	7

Table 27. Queen City Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	24	23	1	0
Barium	2 mg/l	MCL	24	0	24	0
Cadmium	5 µg/l	MCL	24	24	0	0
Chromium	100 µg/l	MCL	24	10	14	0
Fluoride	4 mg/l	MCL	24	0	23	1
Mercury	2 µg/l	MCL	24	24	0	0
Nitrate-Nitrogen	10 mg/l	MCL	33	15	12	6
Selenium	50 µg/l	MCL	24	20	4	0
Chloride	300 mg/l	Secondary Standard	33	0	31	2
Copper	1 mg/l	Secondary Standard	24	8	16	0
Fluoride	2 mg/l	Secondary Standard	24	0	23	1
Iron	0.3 mg/l	Secondary Standard	24	14	2	8
Manganese	50 µg/l	Secondary Standard	24	3	16	5
Sulfate	300 mg/l	Secondary Standard	33	5	26	2
Total Dissolved Solids	1,000 mg/l	Secondary Standard	24	0	21	3
Zinc	5 mg/l	Secondary Standard	24	8	16	0
Dissolved Alpha	15 pCi/L	Screening Level	20	18	2	0

Table 28. Rita Blanca Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	3	1	2	0
Barium	2 mg/l	MCL	3	0	3	0
Cadmium	5 µg/l	MCL	3	3	0	0
Chromium	100 µg/l	MCL	3	0	3	0
Fluoride	4 mg/l	MCL	3	0	1	2
Mercury	2 µg/l	MCL	3	3	0	0
Nitrate-Nitrogen	10 mg/l	MCL	3	0	3	0
Selenium	50 µg/l	MCL	3	2	1	0
Chloride	300 mg/l	Secondary Standard	3	0	3	0
Copper	1 mg/l	Secondary Standard	3	1	2	0
Fluoride	2 mg/l	Secondary Standard	3	0	1	2
Iron	0.3 mg/l	Secondary Standard	3	1	0	2
Manganese	50 µg/l	Secondary Standard	3	0	2	1
Sulfate	300 mg/l	Secondary Standard	3	0	2	1
Total Dissolved Solids	1,000 mg/l	Secondary Standard	3	0	2	1
Zinc	5 mg/l	Secondary Standard	3	1	2	0
Dissolved Alpha	15 pCi/L	Screening Level	3	0	0	3

Table 29. Rustler Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	7	6	1	0
Barium	2 mg/l	MCL	7	0	7	0
Cadmium	5 µg/l	MCL	7	7	0	0
Chromium	100 µg/l	MCL	7	5	2	0
Fluoride	4 mg/l	MCL	7	0	7	0
Mercury	2 µg/l	MCL	7	7	0	0
Nitrate-Nitrogen	10 mg/l	MCL	7	4	2	1
Selenium	50 µg/l	MCL	7	1	4	2
Chloride	300 mg/l	Secondary Standard	7	0	2	5
Copper	1 mg/l	Secondary Standard	7	6	1	0
Fluoride	2 mg/l	Secondary Standard	7	0	1	6
Iron	0.3 mg/l	Secondary Standard	7	5	2	0
Manganese	50 µg/l	Secondary Standard	7	1	6	0
Sulfate	300 mg/l	Secondary Standard	7	0	1	6
Total Dissolved Solids	1,000 mg/l	Secondary Standard	7	0	0	7
Zinc	5 mg/l	Secondary Standard	7	6	1	0
Dissolved Alpha	15 pCi/L	Screening Level	1	0	1	0

Table 30. Seymour Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	31	10	20	1
Barium	2 mg/l	MCL	31	0	31	0
Cadmium	5 µg/l	MCL	31	31	0	0
Chromium	100 µg/l	MCL	31	0	31	0
Fluoride	4 mg/l	MCL	31	1	29	1
Mercury	2 µg/l	MCL	31	31	0	0
Nitrate-Nitrogen	10 mg/l	MCL	31	1	2	28
Selenium	50 µg/l	MCL	31	11	19	1
Chloride	300 mg/l	Secondary Standard	31	0	25	6
Copper	1 mg/l	Secondary Standard	31	1	30	0
Fluoride	2 mg/l	Secondary Standard	31	1	28	2
Iron	0.3 mg/l	Secondary Standard	31	30	1	0
Manganese	50 µg/l	Secondary Standard	31	23	8	0
Sulfate	300 mg/l	Secondary Standard	31	0	23	8
Total Dissolved Solids	1,000 mg/l	Secondary Standard	31	0	21	10
Zinc	5 mg/l	Secondary Standard	31	13	18	0
Dissolved Alpha	15 pCi/L	Screening Level	22	8	9	5

Table 31. Sparta Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	15	15	0	0
Barium	2 mg/l	MCL	15	0	15	0
Cadmium	5 µg/l	MCL	15	15	0	0
Chromium	100 µg/l	MCL	15	4	11	0
Fluoride	4 mg/l	MCL	15	0	15	0
Mercury	2 µg/l	MCL	15	15	0	0
Nitrate-Nitrogen	10 mg/l	MCL	22	13	9	0
Selenium	50 µg/l	MCL	15	13	2	0
Chloride	300 mg/l	Secondary Standard	22	0	19	3
Copper	1 mg/l	Secondary Standard	15	5	10	0
Fluoride	2 mg/l	Secondary Standard	15	0	14	1
Iron	0.3 mg/l	Secondary Standard	15	8	6	1
Manganese	50 µg/l	Secondary Standard	15	0	13	2
Sulfate	300 mg/l	Secondary Standard	22	2	16	4
Total Dissolved Solids	1,000 mg/l	Secondary Standard	15	0	11	4
Zinc	5 mg/l	Secondary Standard	15	10	5	0
Dissolved Alpha	15 pCi/L	Screening Level	11	8	3	0

Table 32. Trinity Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	434	394	38	2
Barium	2 mg/l	MCL	434	4	430	0
Cadmium	5 µg/l	MCL	433	433	0	0
Chromium	100 µg/l	MCL	433	242	191	0
Fluoride	4 mg/l	MCL	458	4	431	23
Mercury	2 µg/l	MCL	434	430	4	0
Nitrate-Nitrogen	10 mg/l	MCL	439	236	170	33
Selenium	50 µg/l	MCL	434	429	5	0
Chloride	300 mg/l	Secondary Standard	455	1	437	17
Copper	1 mg/l	Secondary Standard	434	259	175	0
Fluoride	2 mg/l	Secondary Standard	458	4	342	112
Iron	0.3 mg/l	Secondary Standard	454	357	46	51
Manganese	50 µg/l	Secondary Standard	451	195	242	14
Sulfate	300 mg/l	Secondary Standard	455	0	352	103
Total Dissolved Solids	1,000 mg/l	Secondary Standard	452	0	352	100
Zinc	5 mg/l	Secondary Standard	434	258	176	0
Dissolved Alpha	15 pCi/L	Screening Level	14	13	1	0

Table 33. West Texas Bolsons Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	7	0	6	1
Barium	2 mg/l	MCL	7	0	7	0
Cadmium	5 µg/l	MCL	7	7	0	0
Chromium	100 µg/l	MCL	7	0	7	0
Fluoride	4 mg/l	MCL	7	0	7	0
Mercury	2 µg/l	MCL	7	7	0	0
Nitrate-Nitrogen	10 mg/l	MCL	7	0	4	3
Selenium	50 µg/l	MCL	7	5	2	0
Chloride	300 mg/l	Secondary Standard	7	0	7	0
Copper	1 mg/l	Secondary Standard	7	3	4	0
Fluoride	2 mg/l	Secondary Standard	7	0	4	3
Iron	0.3 mg/l	Secondary Standard	7	7	0	0
Manganese	50 µg/l	Secondary Standard	7	5	2	0
Sulfate	300 mg/l	Secondary Standard	7	0	6	1
Total Dissolved Solids	1,000 mg/l	Secondary Standard	7	0	5	2
Zinc	5 mg/l	Secondary Standard	7	3	4	0
Dissolved Alpha	15 pCi/L	Screening Level	6	0	3	3

Table 34. Woodbine Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	28	26	2	0
Barium	2 mg/l	MCL	28	0	28	0
Cadmium	5 µg/l	MCL	28	28	0	0
Chromium	100 µg/l	MCL	28	4	24	0
Fluoride	4 mg/l	MCL	28	0	26	2
Mercury	2 µg/l	MCL	28	28	0	0
Nitrate-Nitrogen	10 mg/l	MCL	28	17	9	2
Selenium	50 µg/l	MCL	28	28	0	0
Chloride	300 mg/l	Secondary Standard	28	0	26	2
Copper	1 mg/l	Secondary Standard	28	12	16	0
Fluoride	2 mg/l	Secondary Standard	28	0	23	5
Iron	0.3 mg/l	Secondary Standard	28	15	10	3
Manganese	50 µg/l	Secondary Standard	28	2	25	1
Sulfate	300 mg/l	Secondary Standard	28	1	24	3
Total Dissolved Solids	1,000 mg/l	Secondary Standard	28	0	23	5
Zinc	5 mg/l	Secondary Standard	28	18	10	0
Dissolved Alpha	15 pCi/L	Screening Level	0	0	0	0

Table 35. Yegua-Jackson Aquifer – Groundwater Monitoring Data, FY2013 through FY2023

Constituent (dissolved)	Criterion	Source of Criterion	Number of Wells	<MDL	<Criterion (except <MDL)	≥Criterion
Arsenic	10 µg/l	MCL	22	18	4	0
Barium	2 mg/l	MCL	22	0	22	0
Cadmium	5 µg/l	MCL	22	20	2	0
Chromium	100 µg/l	MCL	22	6	16	0
Fluoride	4 mg/l	MCL	24	1	21	2
Mercury	2 µg/l	MCL	22	22	0	0
Nitrate-Nitrogen	10 mg/l	MCL	2	2	0	0
Selenium	50 µg/l	MCL	22	19	1	2
Chloride	300 mg/l	Secondary Standard	37	0	22	15
Copper	1 mg/l	Secondary Standard	22	9	13	0
Fluoride	2 mg/l	Secondary Standard	24	1	21	2
Iron	0.3 mg/l	Secondary Standard	22	6	6	10
Manganese	50 µg/l	Secondary Standard	22	0	10	12
Sulfate	300 mg/l	Secondary Standard	37	1	21	15
Total Dissolved Solids	1,000 mg/l	Secondary Standard	24	0	17	7
Zinc	5 mg/l	Secondary Standard	22	11	11	0
Dissolved Alpha	15 pCi/L	Screening Level	18	12	4	2

Figures 3 through 40 – Constituents of Interest in Selected Aquifers

Figures 3 through 40 illustrate the distribution of selected constituents for certain aquifers for the 10-year period beginning FY2013 and lasting through FY2023. Except for fluoride, constituents with concentrations above the MCL, secondary standard, or screening level are shown in red, while concentrations less than the standard are shown in blue. For fluoride, which has an MCL and a secondary standard, there are three levels shown: blue if below the secondary screening level, yellow if above the secondary screening level but below the MCL, and red if above the MCL.

Figure 3. Blaine Aquifer – Distribution of Nitrate-Nitrogen

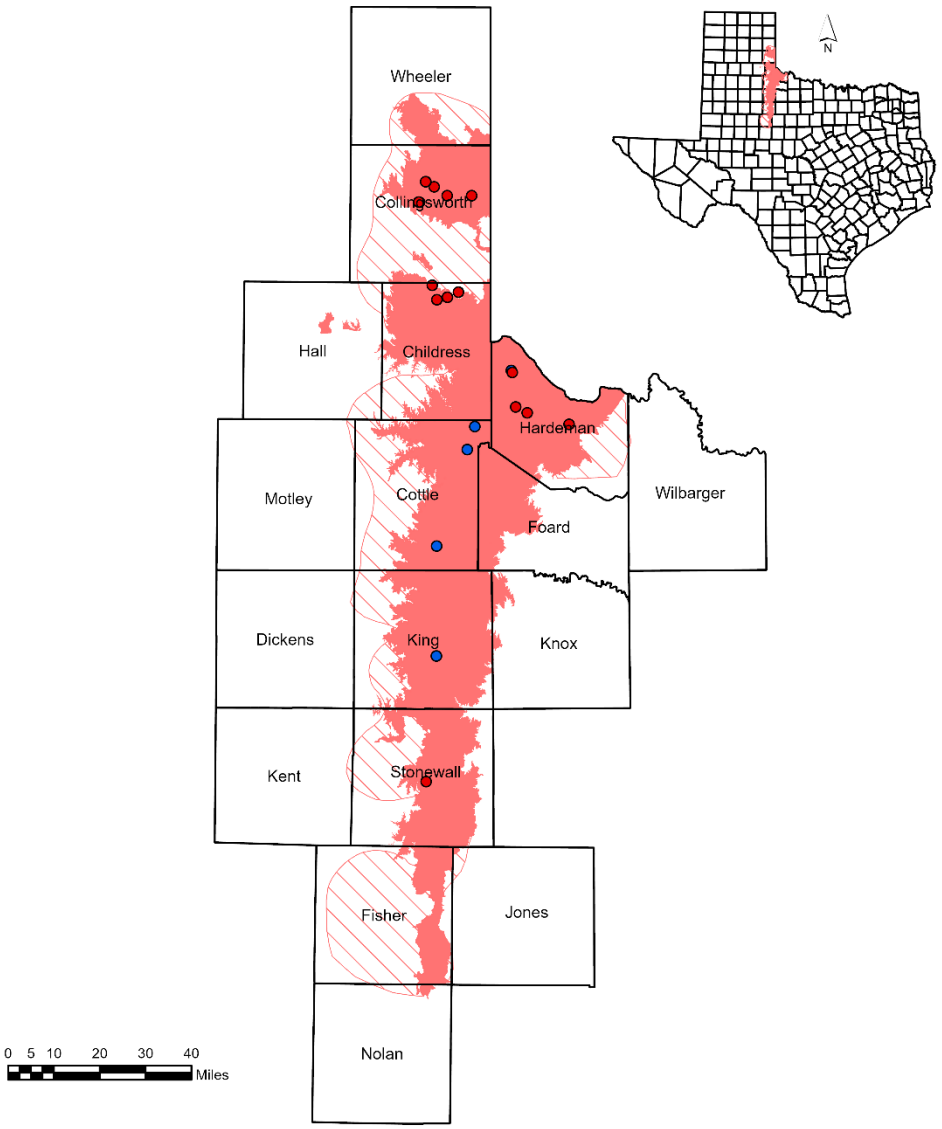
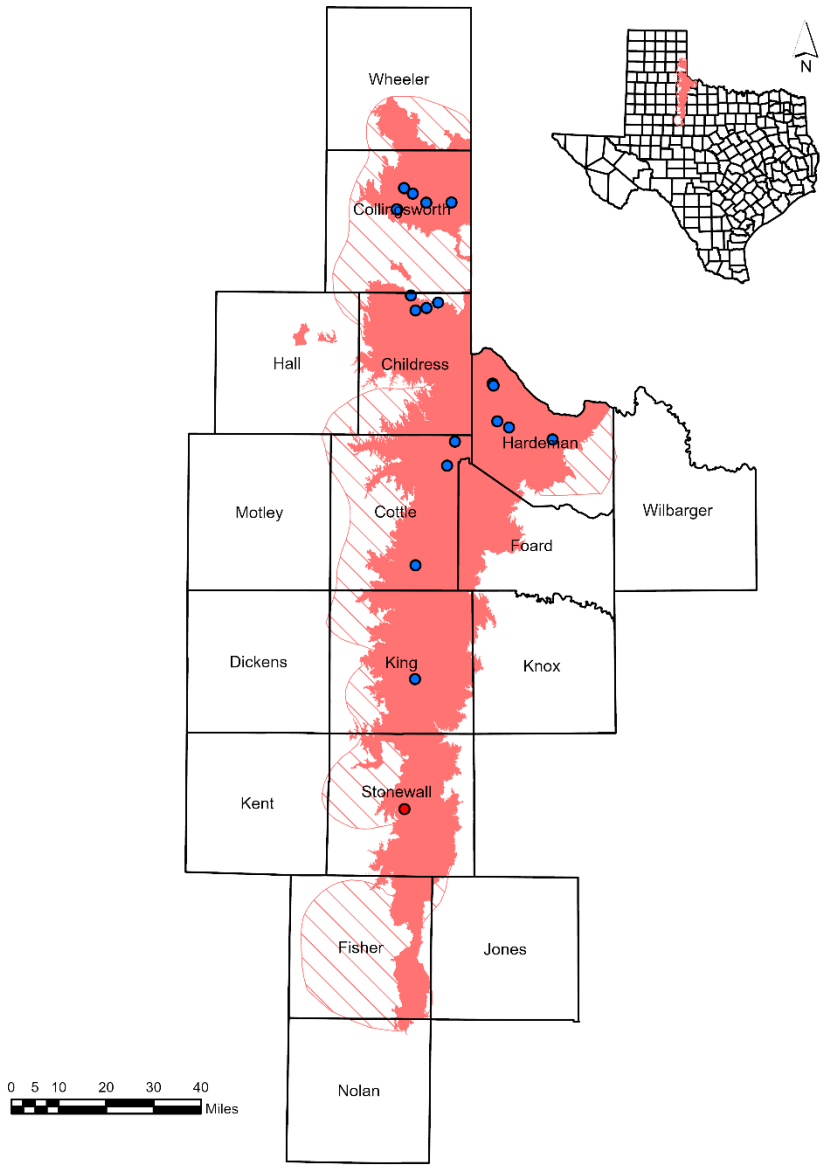


Figure 4. Blaine Aquifer – Distribution of Selenium



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Selenium Concentration in Blaine Aquifer Water Wells

- Less Than 50 ug/L
- 50 ug/L or greater

Figure 5. Carrizo-Wilcox Aquifer – Distribution of Nitrate Nitrogen

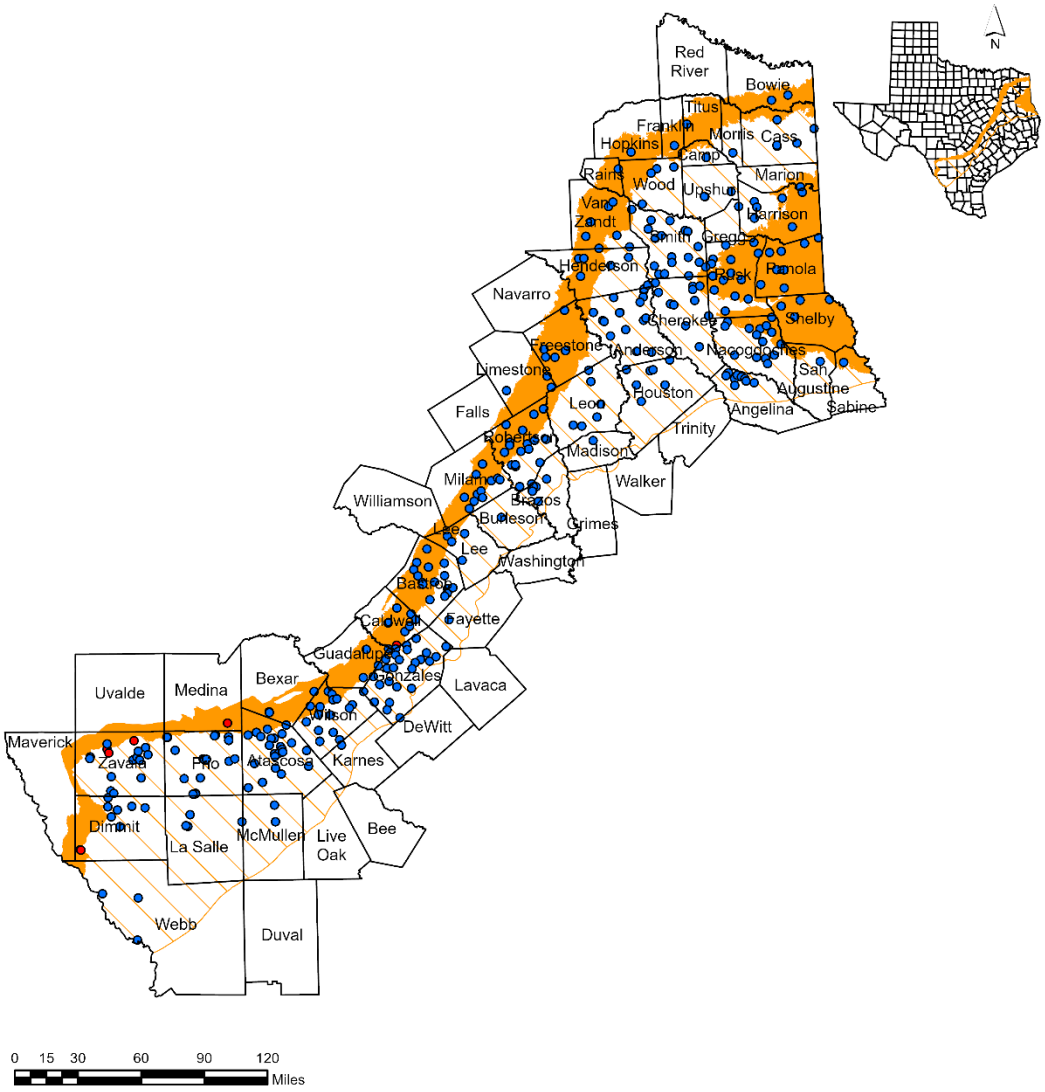
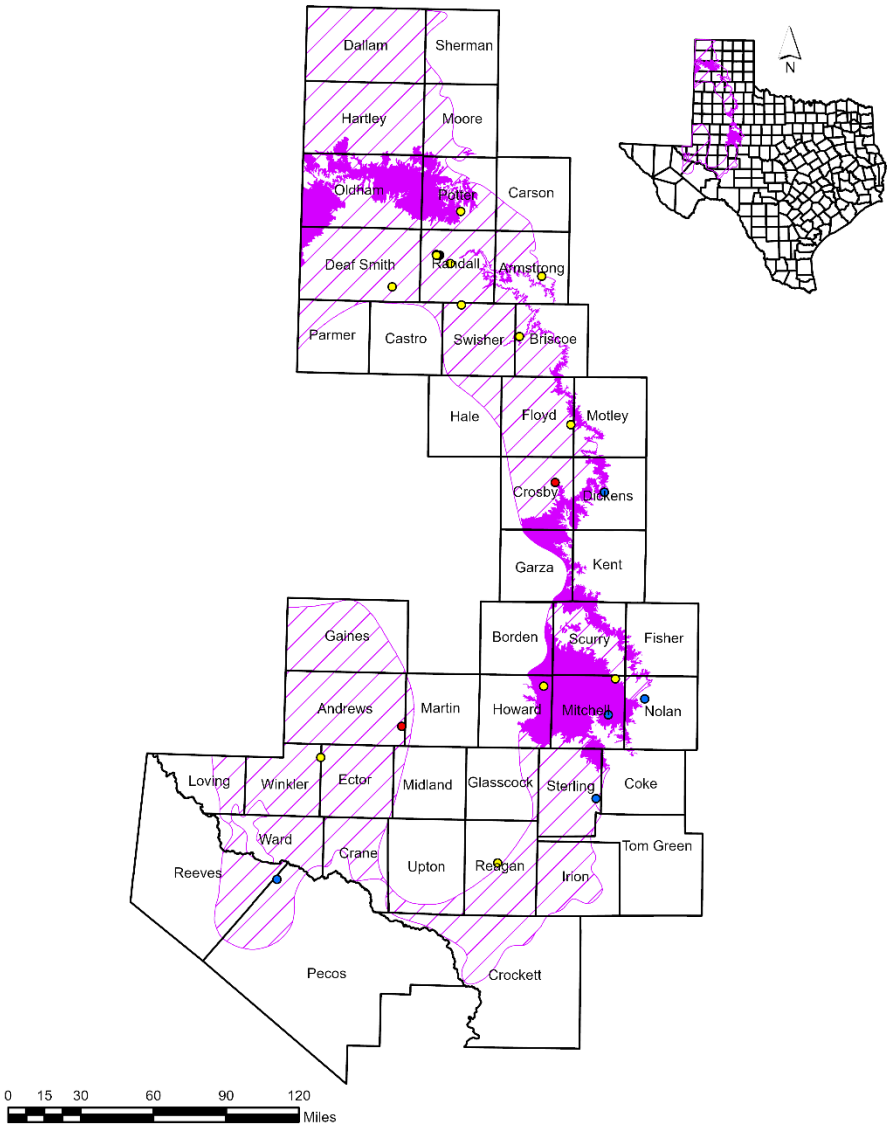


Figure 6. Dockum Aquifer – Distribution of Fluoride



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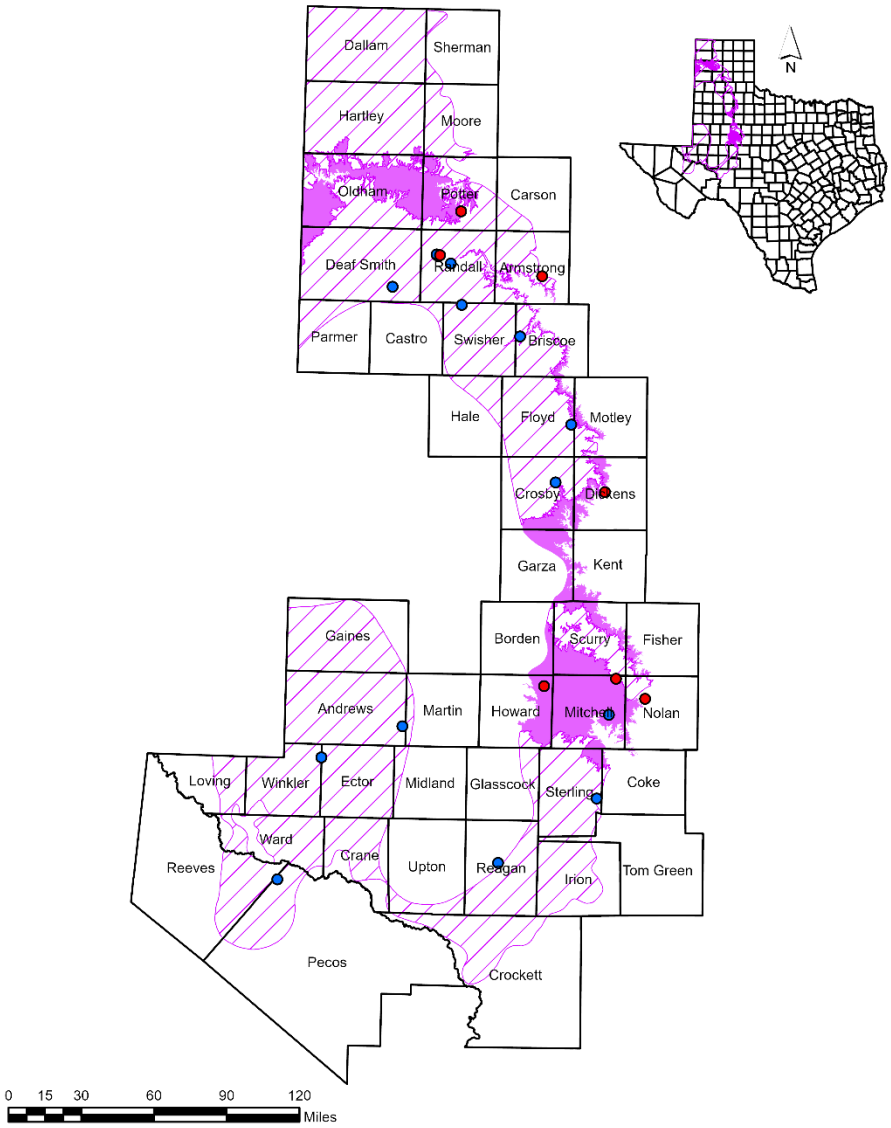
Fluoride Concentration in Dockum Aquifer Water Wells

- Less than 2 mg/L
- 2 mg/L to less than 4mg/L
- 4 mg/L or greater

Figure 7. Dockum Aquifer – Distribution of Nitrate-Nitrogen



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Nitrate Concentration in Dockum Aquifer Water Wells

- Less than 10 mg/L
- 10 mg/L or greater

Figure 8. Edwards (Balcones Fault Zone) Aquifer – Distribution of Fluoride

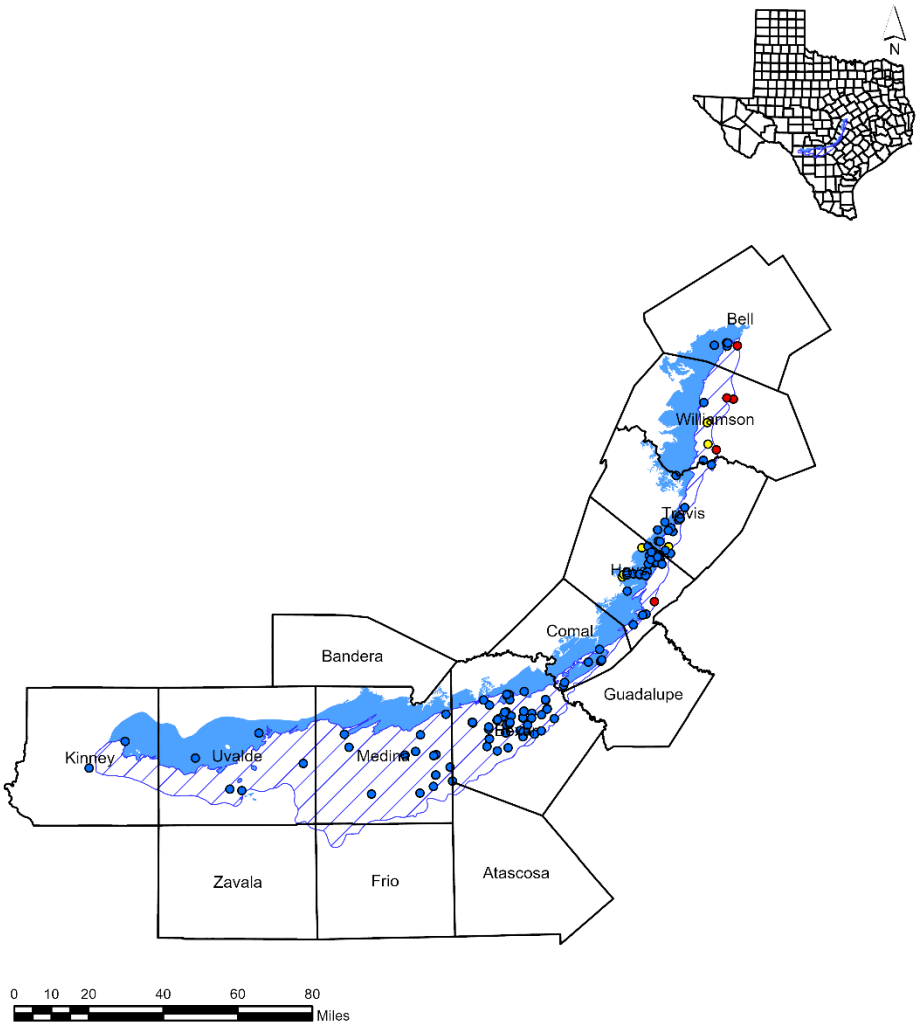


Figure 9. Edwards (Balcones Fault Zone) – Distribution of Nitrate-Nitrogen

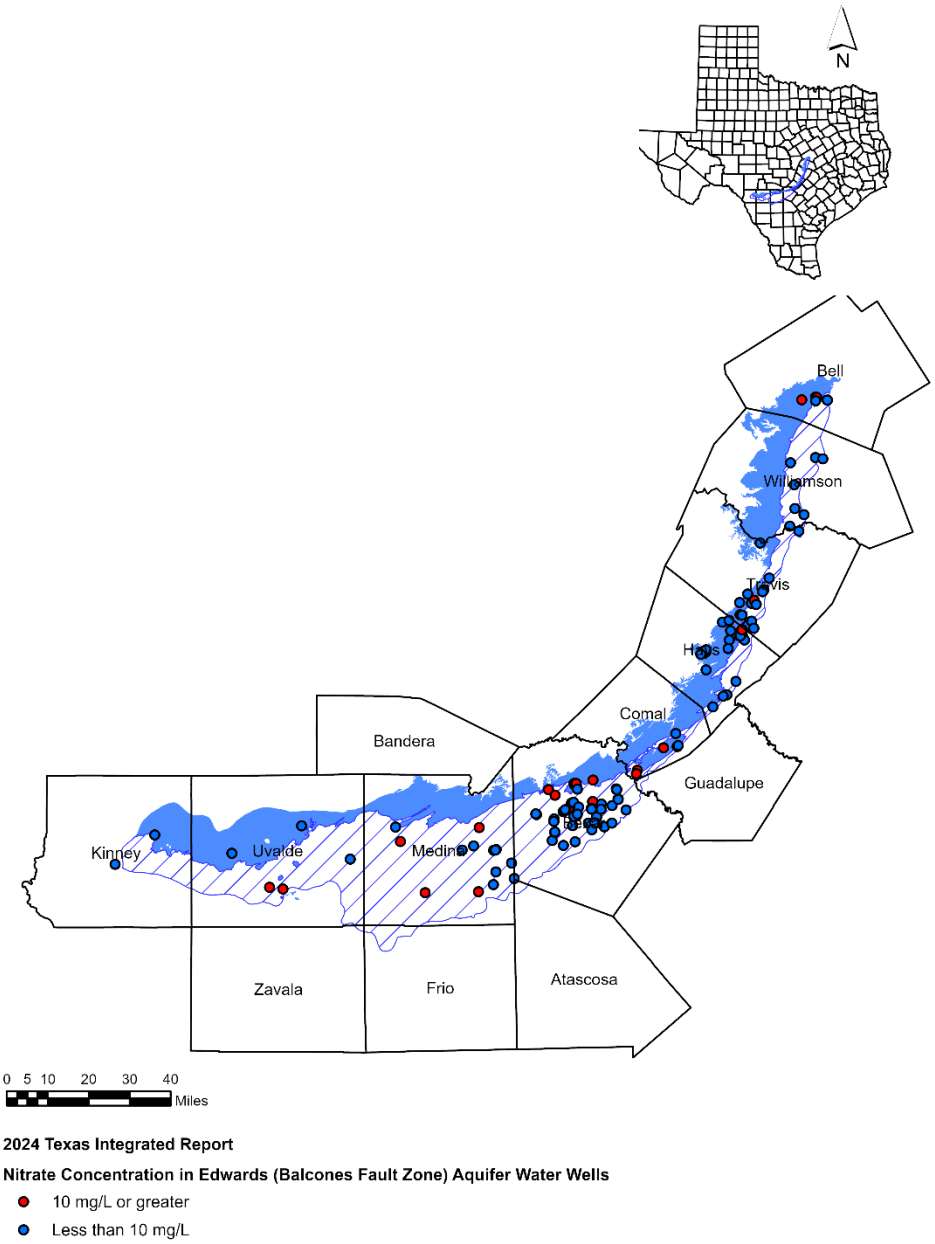
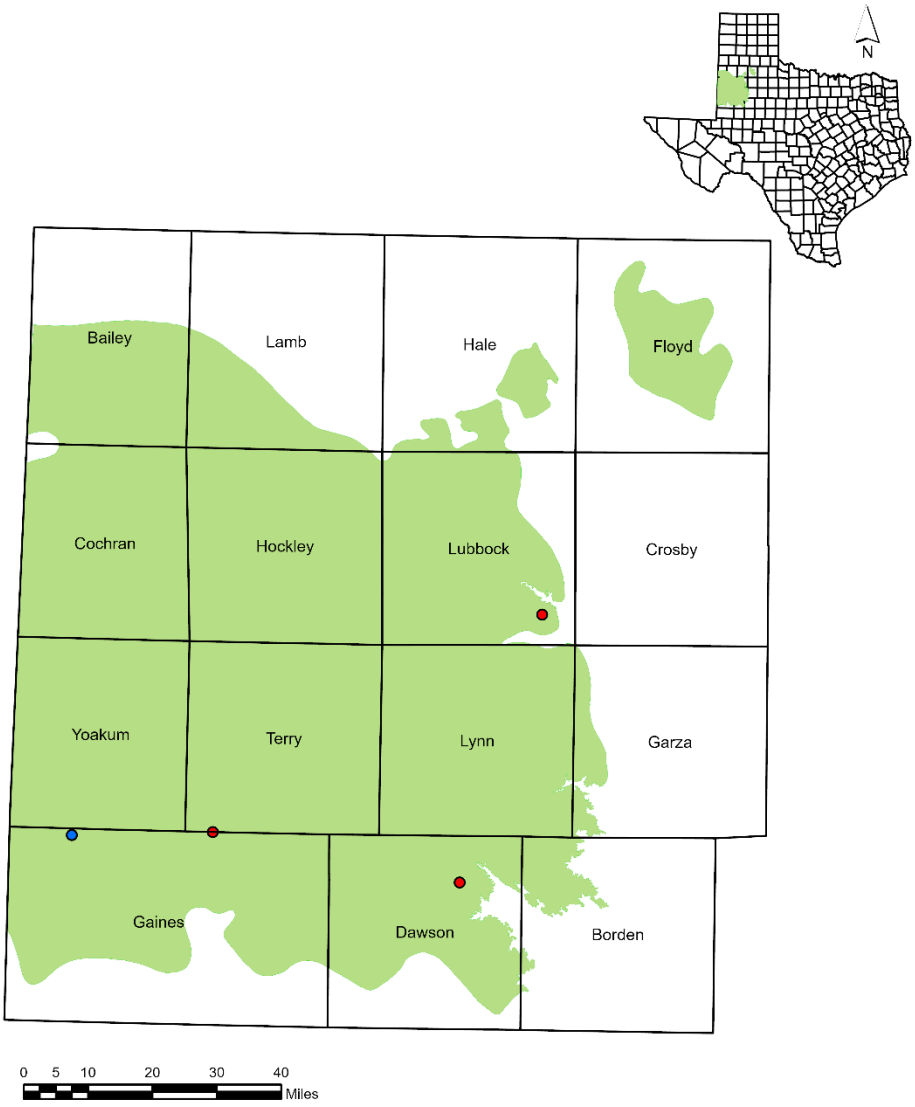


Figure 10. Edwards-Trinity (High Plains) Aquifer – Distribution of Arsenic



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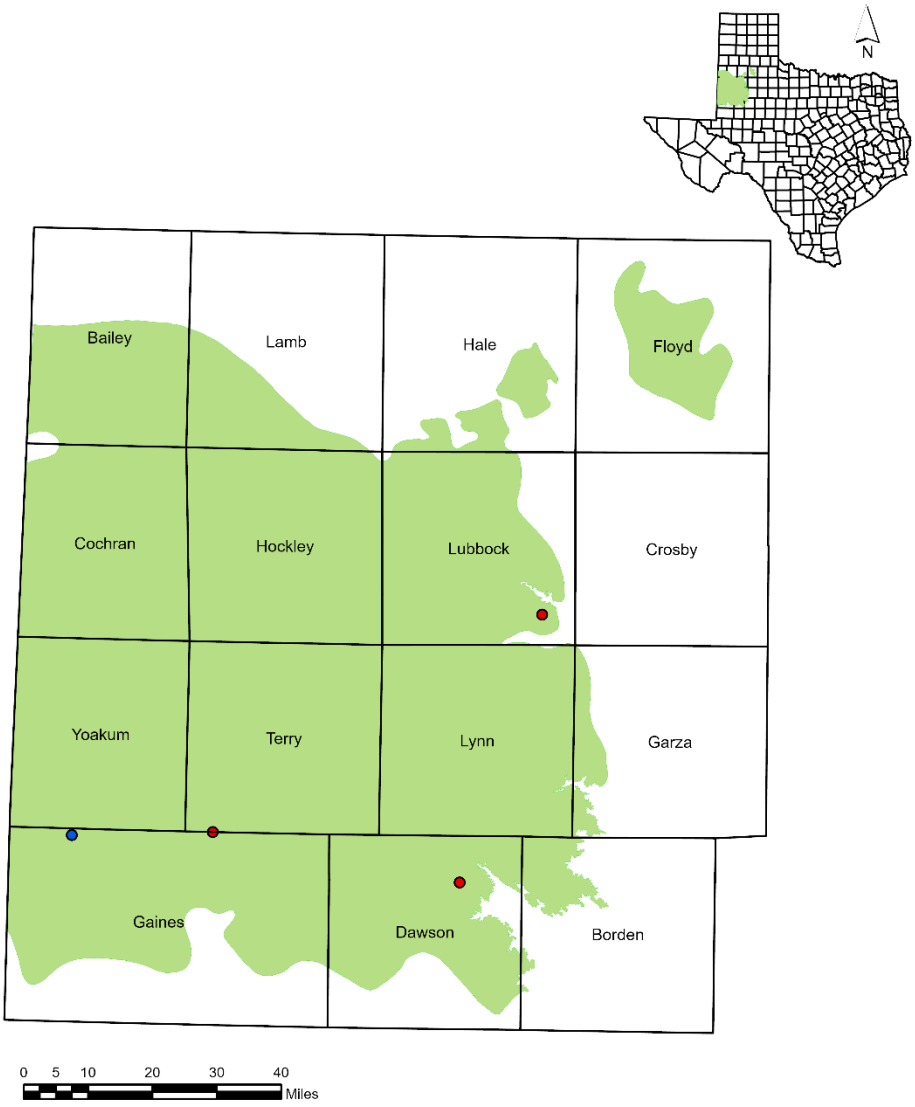
Arsenic Concentration in Edwards-Trinity (High Plains) Aquifer Water Wells

- Less than 10 µg/L
- 10 µg/L or greater

Figure 11. Edwards-Trinity (High Plains) Aquifer – Distribution of Fluoride



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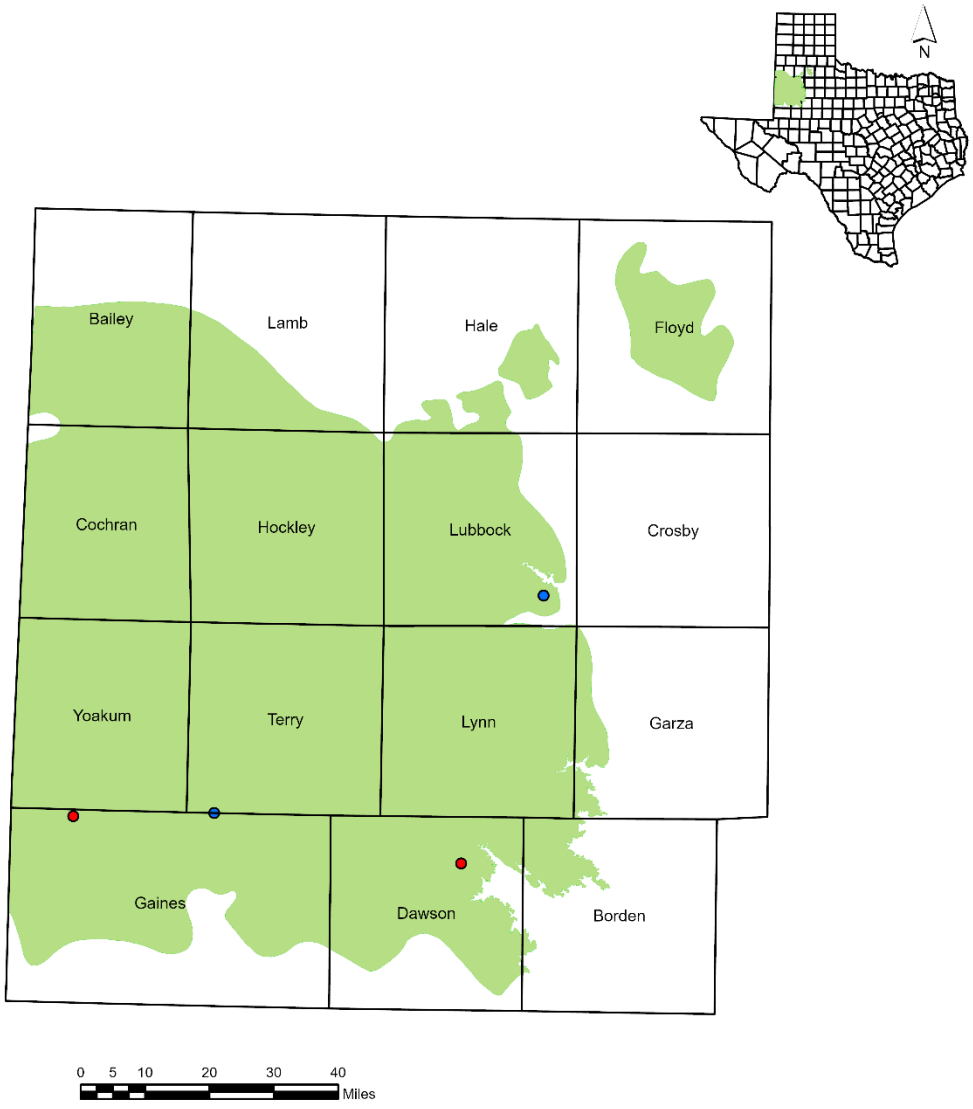
Fluoride Concentration in Edwards-Trinity (High Plains) Aquifer Water Wells

- Less than 2 mg/L
- 2 mg/L to less than 4 mg/L
- 4 mg/L or greater

Figure 12. Edwards-Trinity (High Plains) Aquifer – Distribution of Nitrate-Nitrogen



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Nitrate Concentration in Edwards-Trinity (High Plains) Aquifer Water Wells

- Less than 10 mg/L
- 10 mg/L or greater

Figure 13. Edwards-Trinity (Plateau) Aquifer – Distribution of Arsenic

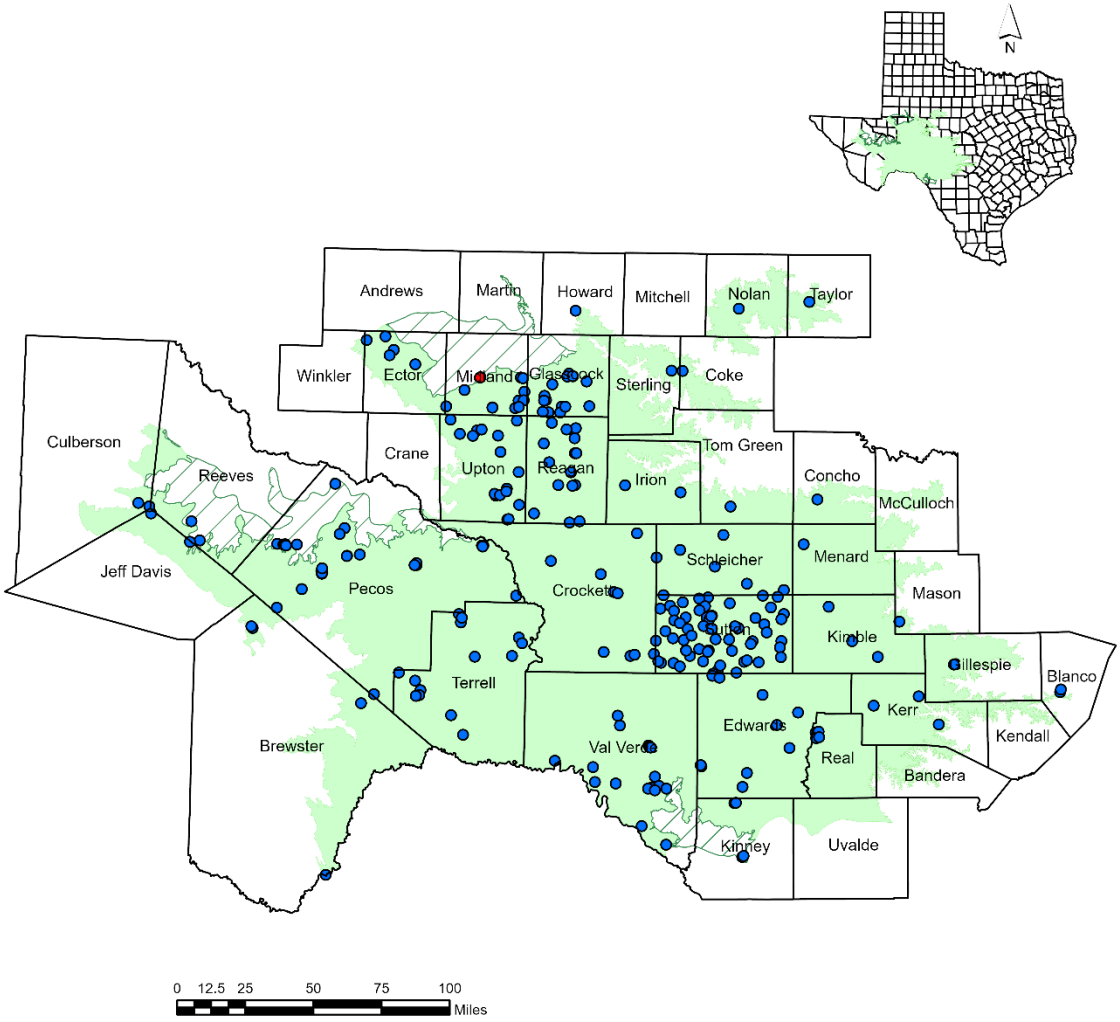


Figure 14. Edwards-Trinity (Plateau) Aquifer – Distribution of Fluoride

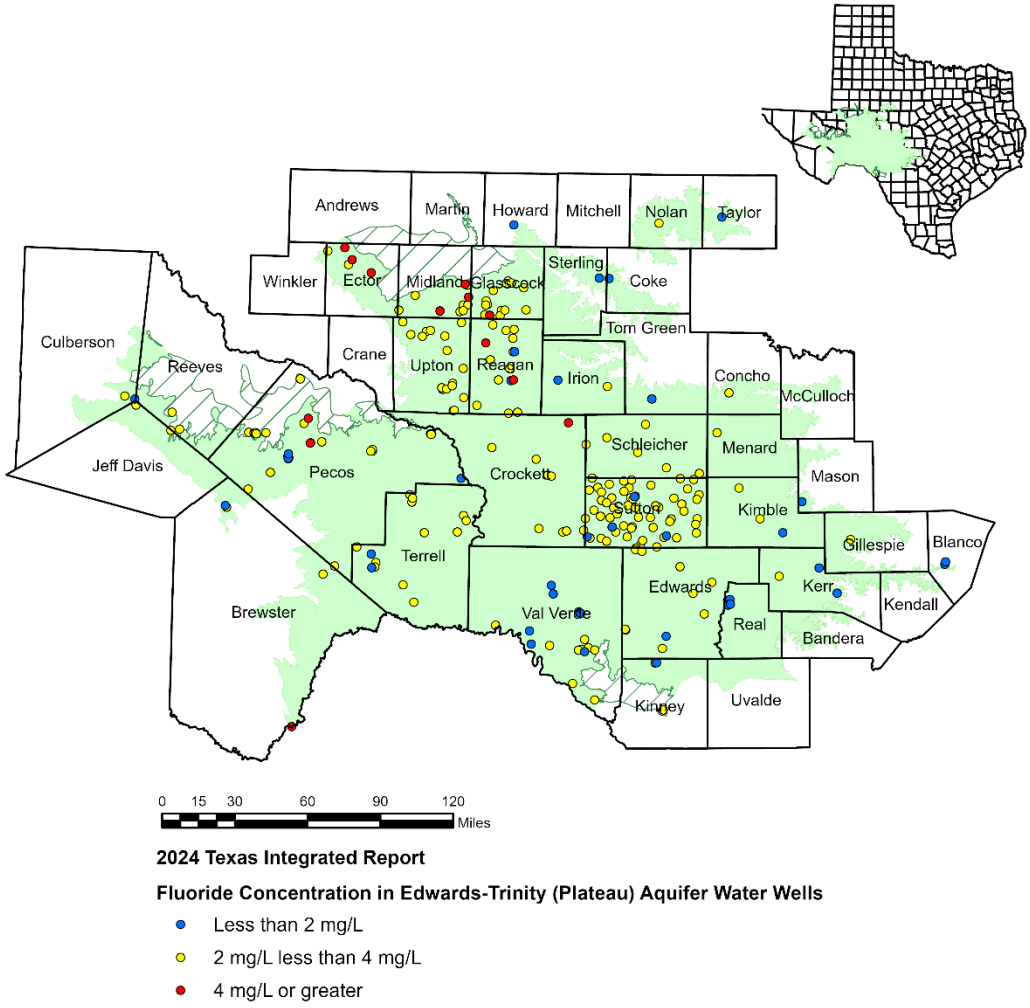
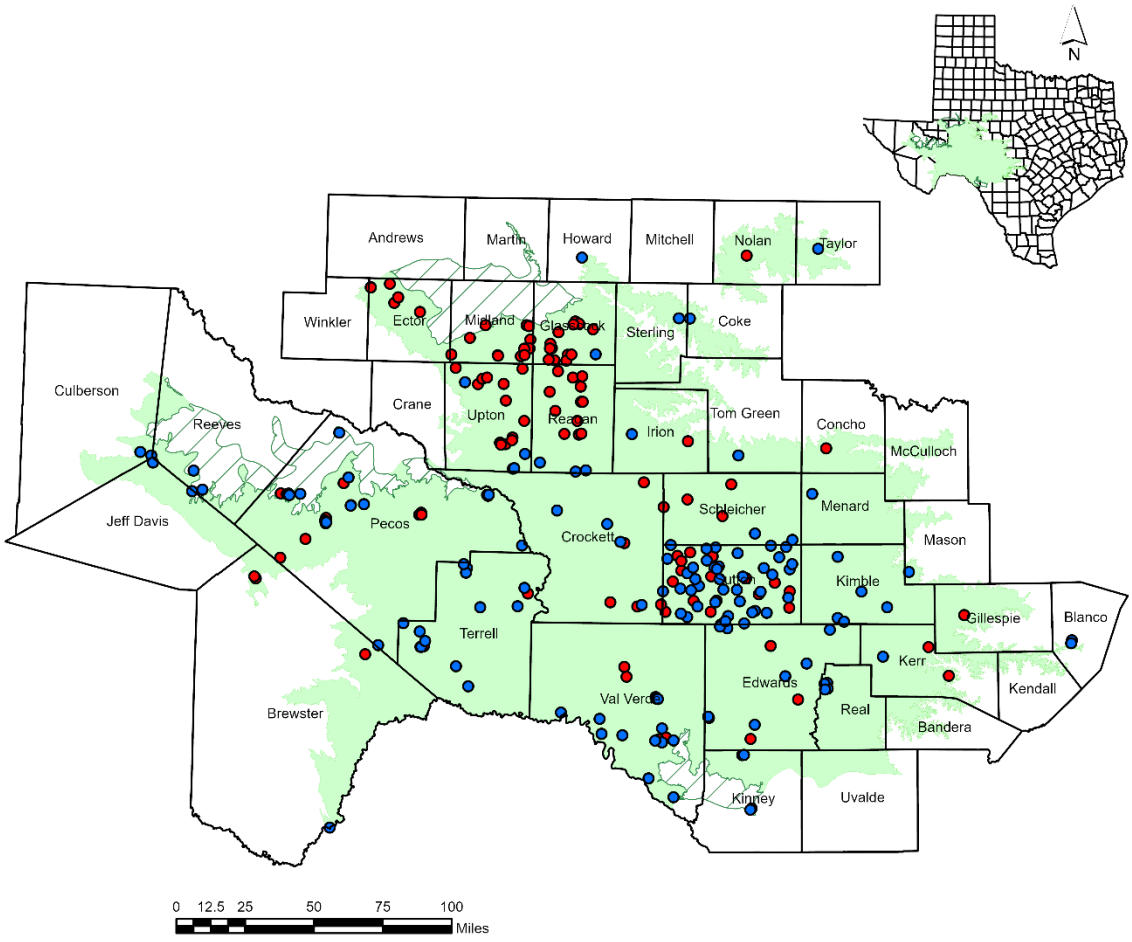


Figure 15. Edwards-Trinity (Plateau) Aquifer – Distribution of Nitrate-Nitrogen



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Nitrate Concentration in Edwards Trinity (Plateau) Aquifer Water Wells

- Less than 10 mg/L
- 10 mg/L or greater

Figure 16. Ellenburger-San Saba Aquifer – Distribution of Nitrate Nitrogen

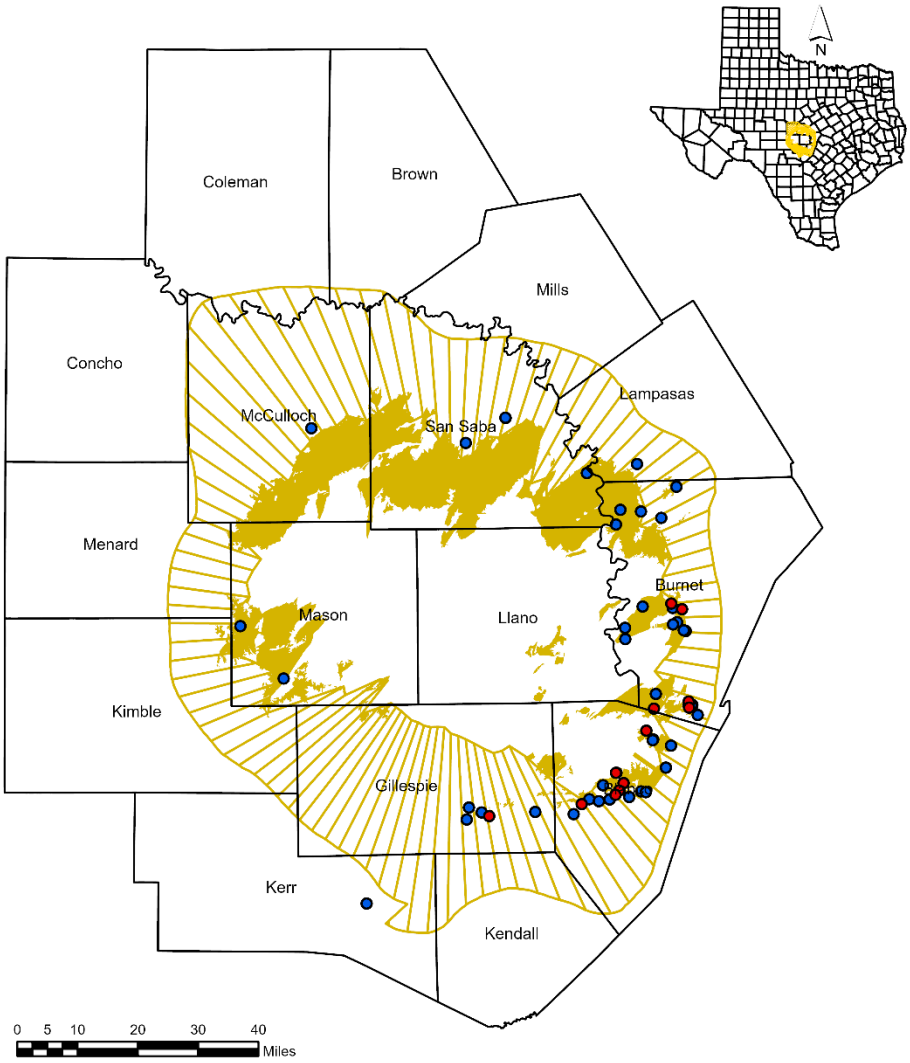


Figure 17. Gulf Coast Aquifer – Distribution of Arsenic

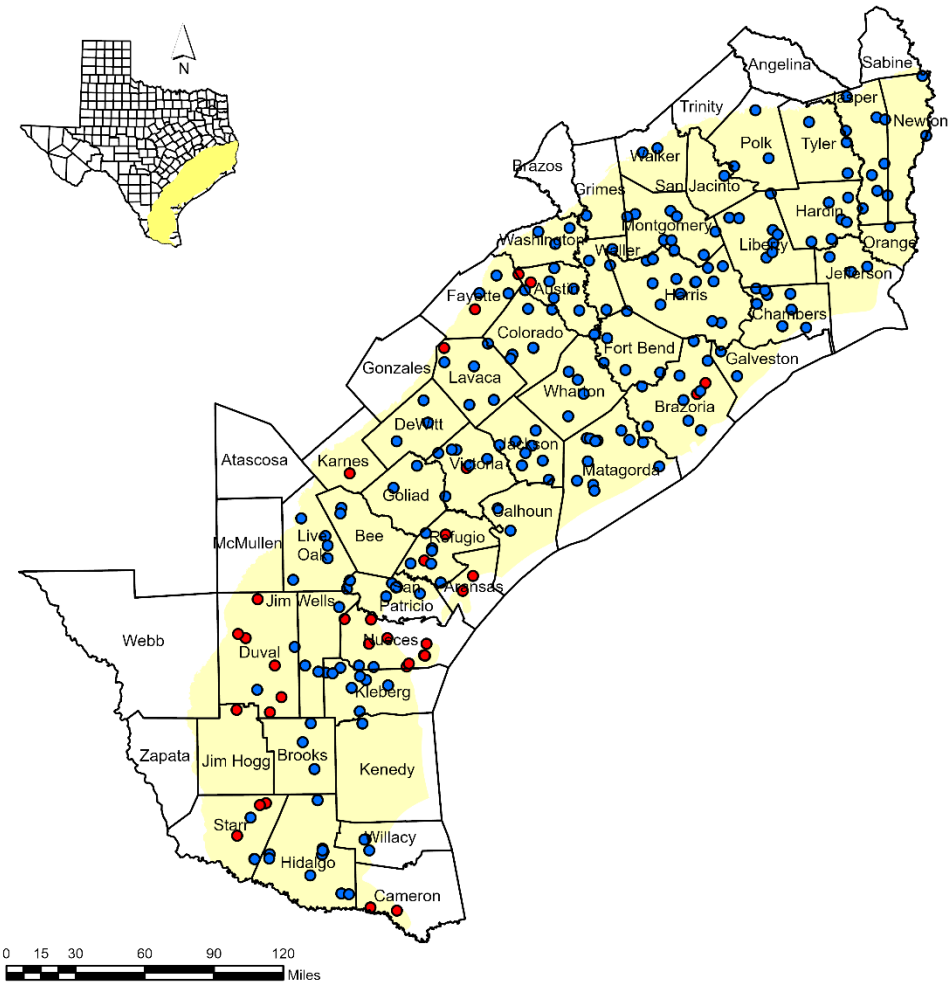


Figure 18. Gulf Coast Aquifer – Distribution of Chloride

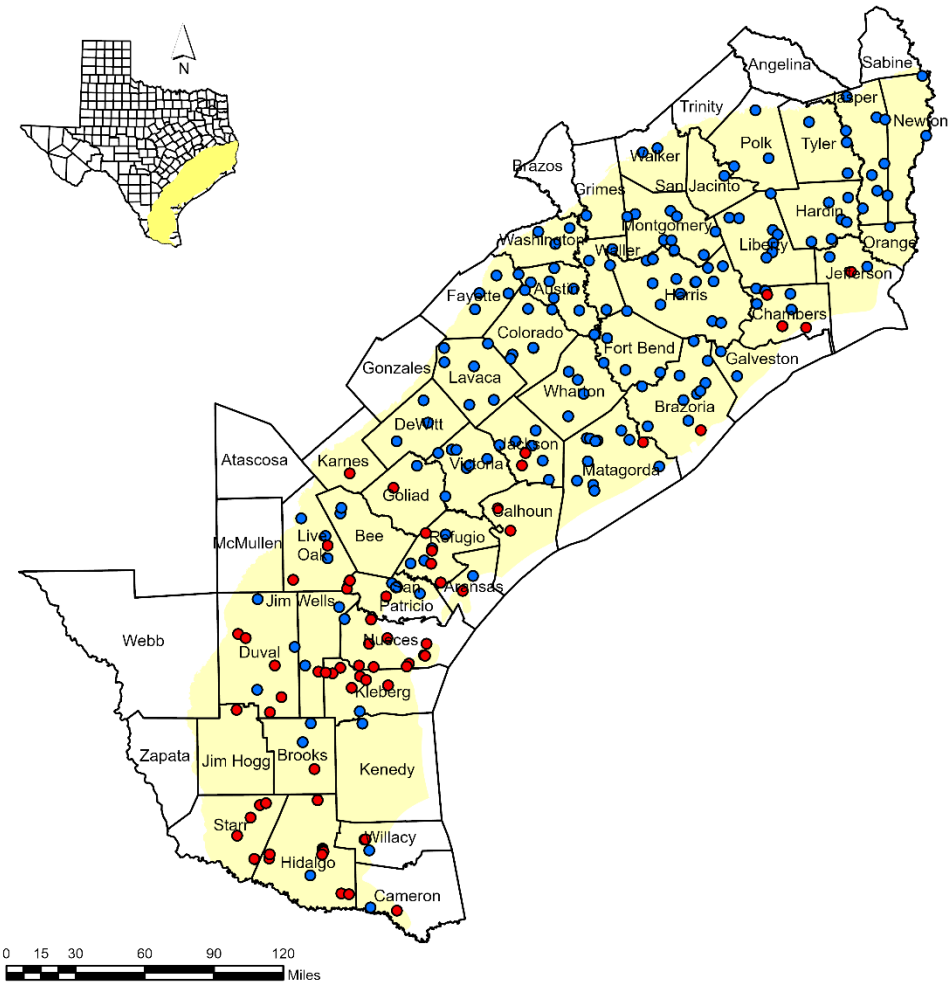
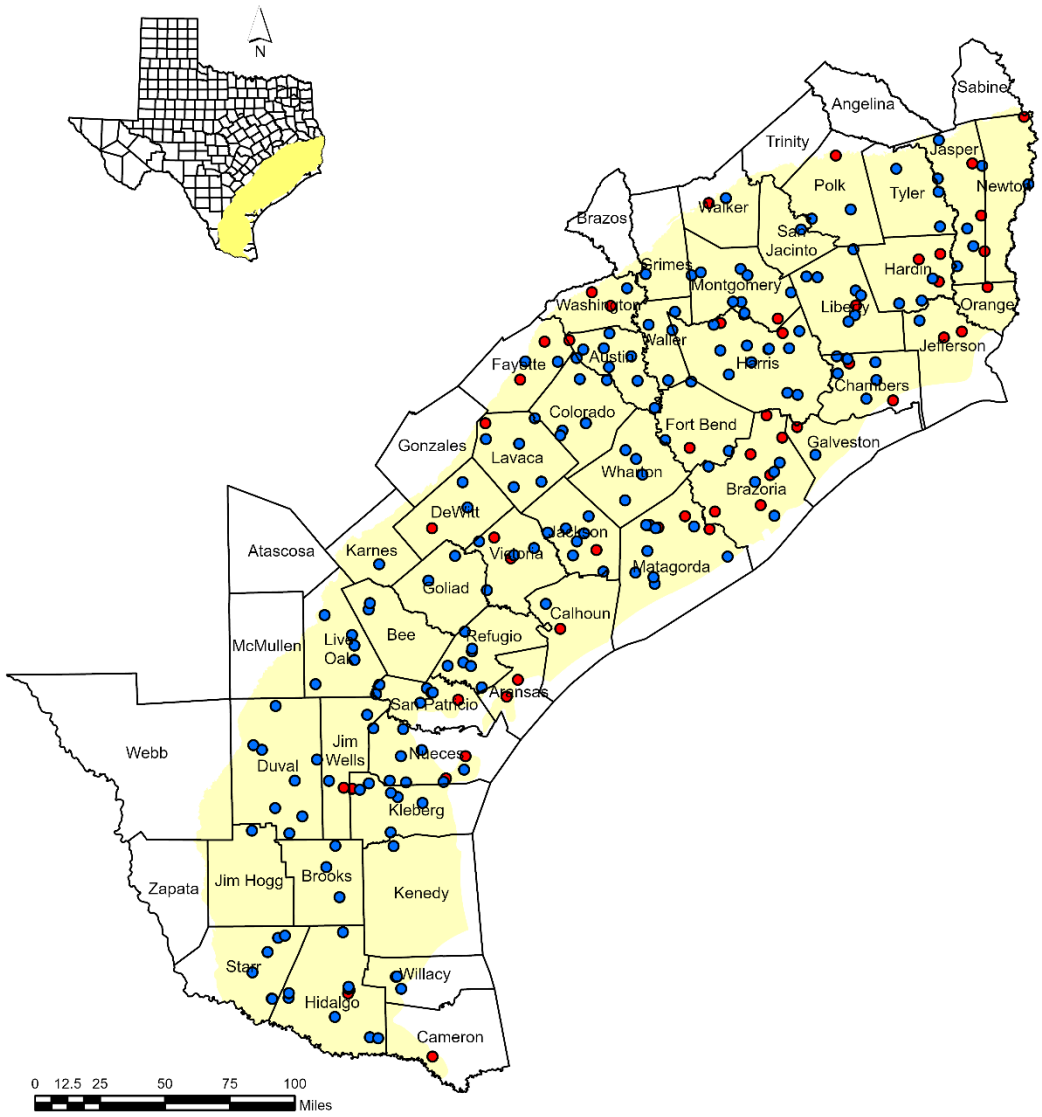


Figure 19. Gulf Coast Aquifer – Distribution of Manganese



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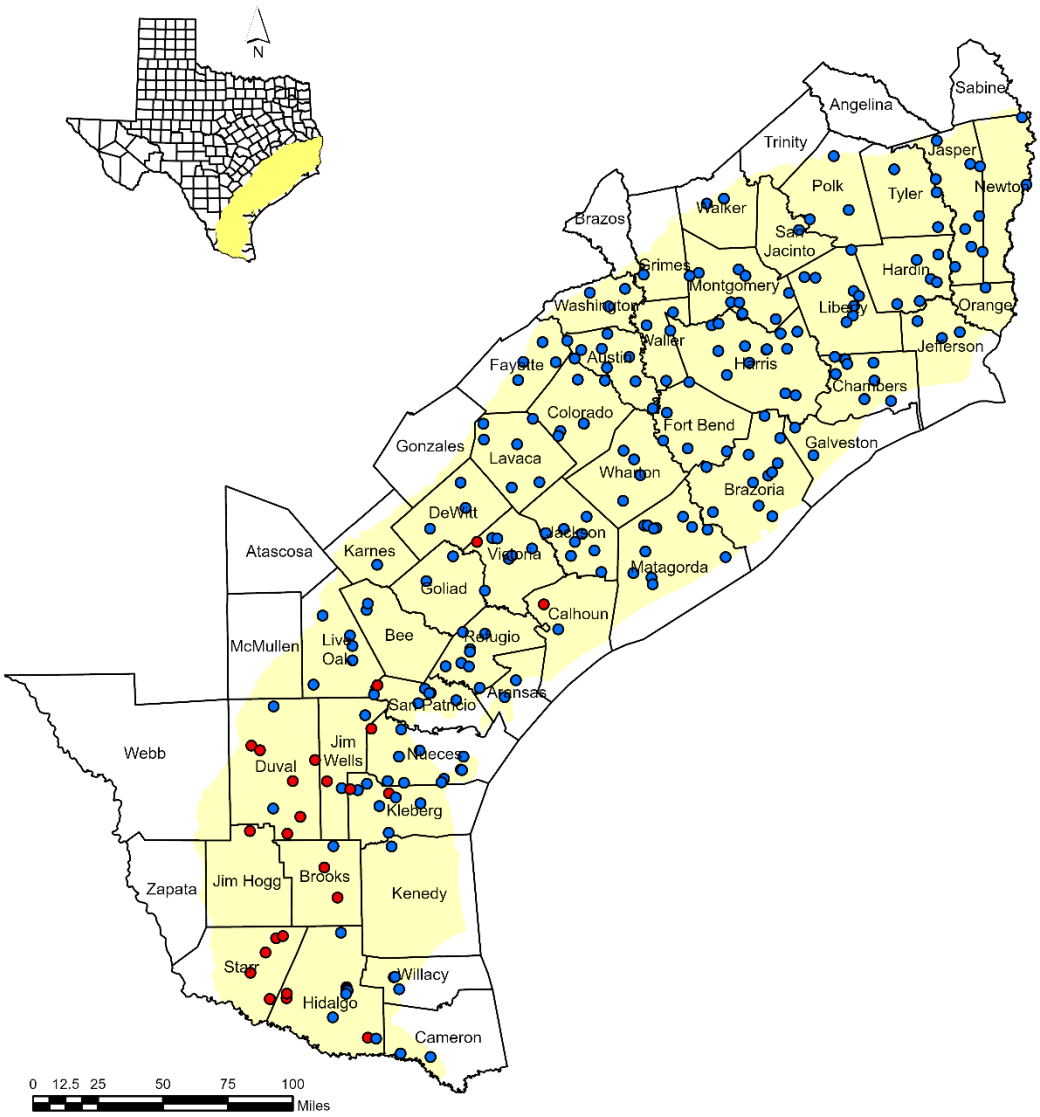
Manganese Concentration in Gulf Coast Aquifer Water Wells

- Less than 50 µg/L
- 50 µg/L or greater

Figure 20. Gulf Coast Aquifer – Distribution of Nitrate-Nitrogen



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Nitrate Concentration in Gulf Coast Aquifer Water Wells

- Less than 10 mg/L
- 10 mg/L or greater

Figure 21. Hickory Aquifer – Distribution of Nitrate-Nitrogen

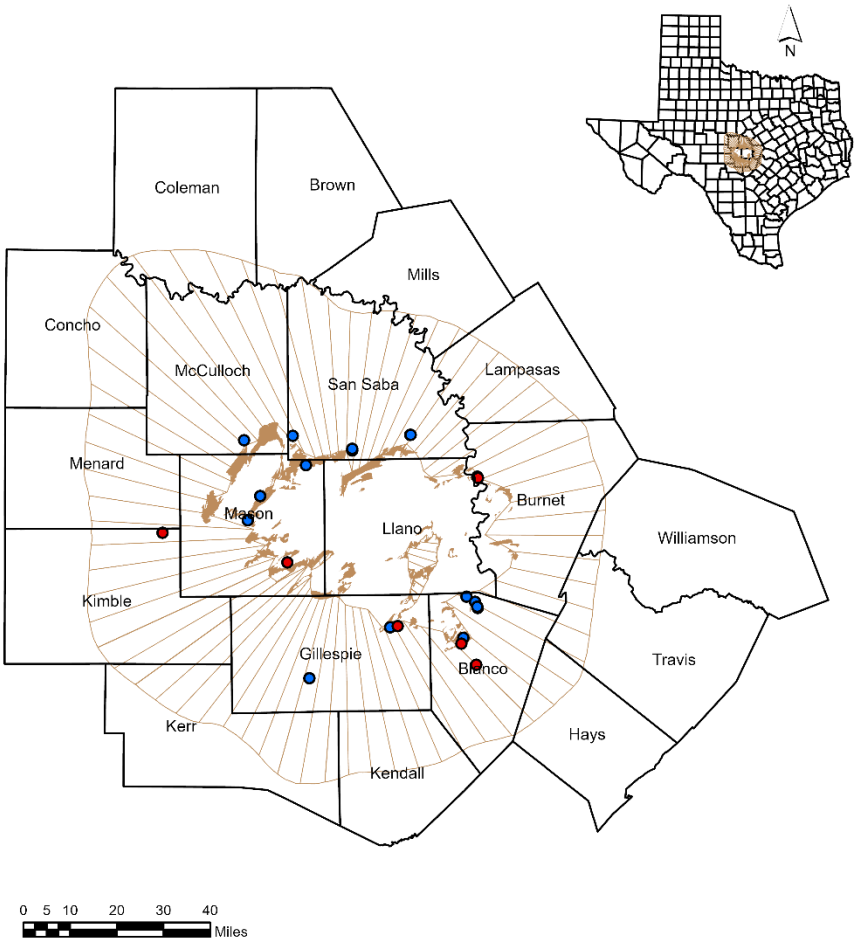


Figure 22. Hueco-Mesilla Bolson Aquifer – Distribution of Arsenic

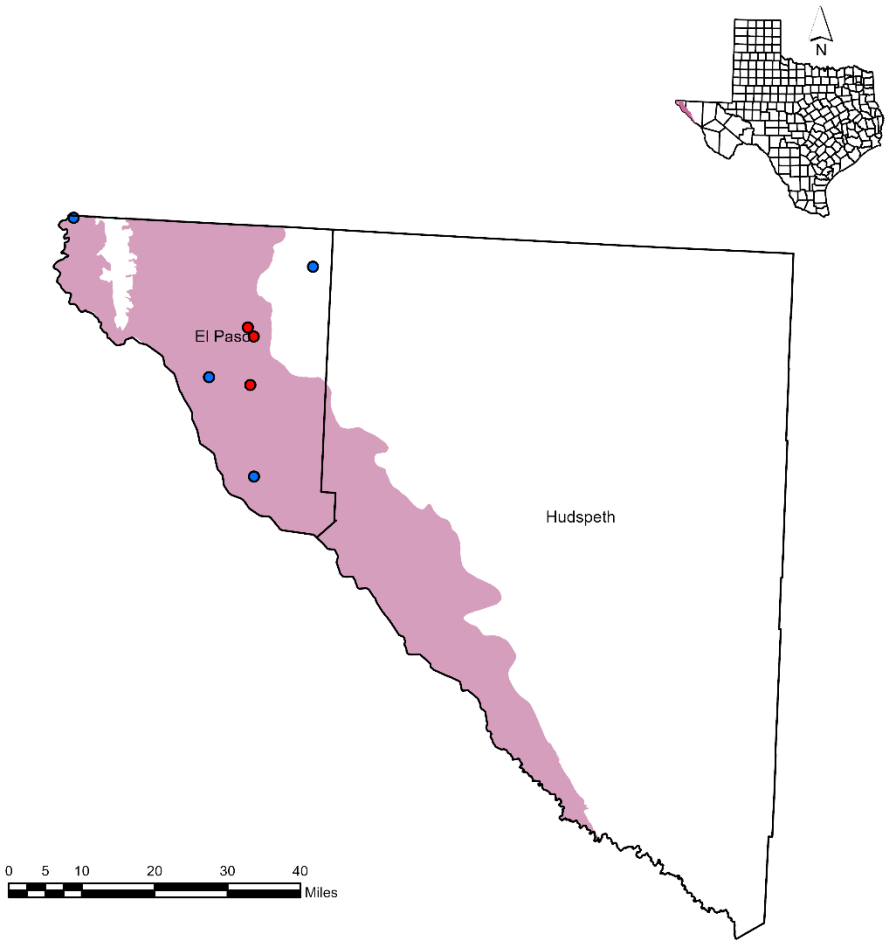


Figure 23. Lipan Aquifer – Distribution of Nitrate-Nitrogen

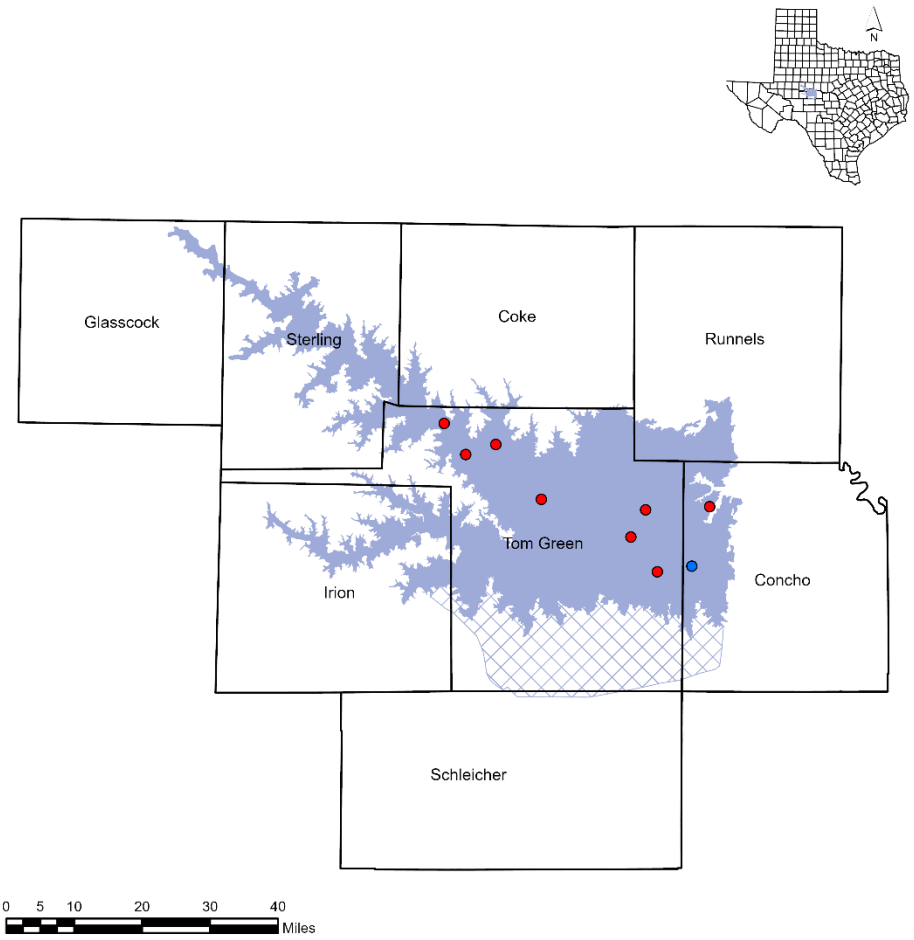
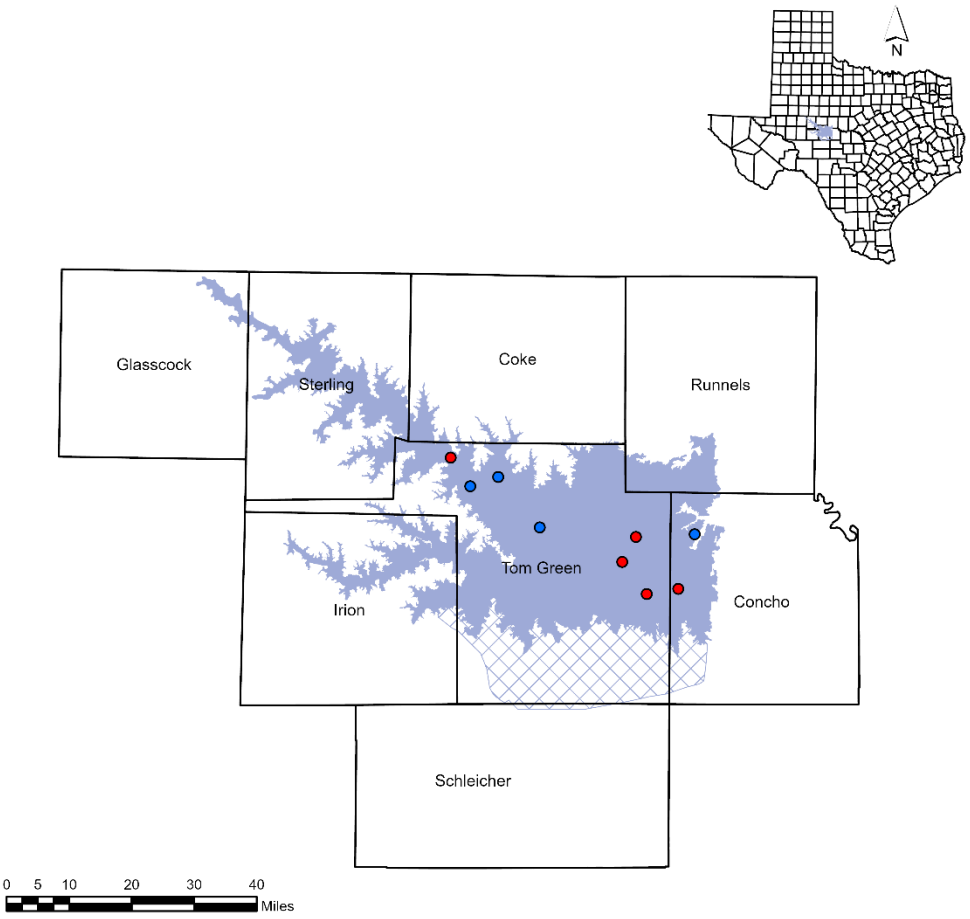


Figure 24. Lipan Aquifer – Distribution of Total Dissolved Solids



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TDS Concentration in Lipan Aquifer Water Wells

- Less than 1000 mg/L
- 1000 mg/L or greater

Figure 25. Marathon Aquifer – Distribution of Nitrate-Nitrogen

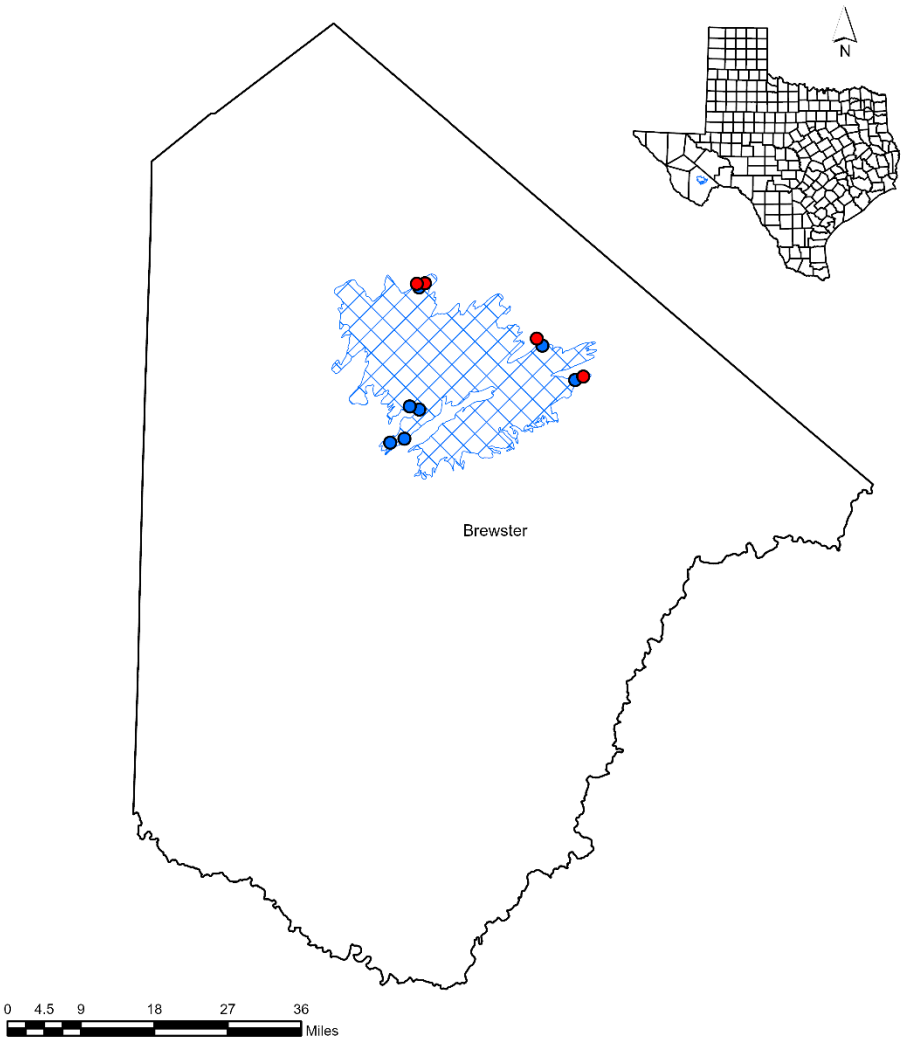


Figure 26. Ogallala Aquifer – Distribution of Arsenic

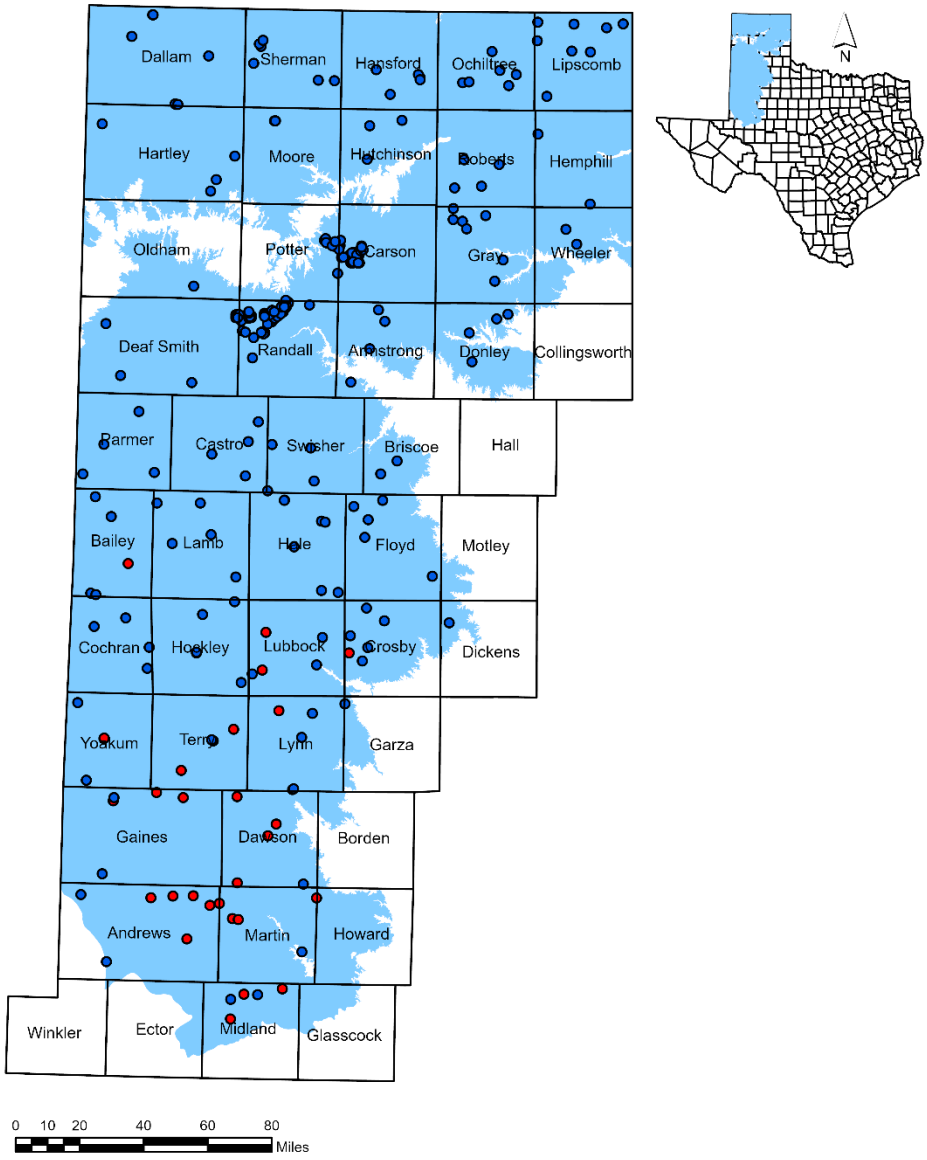
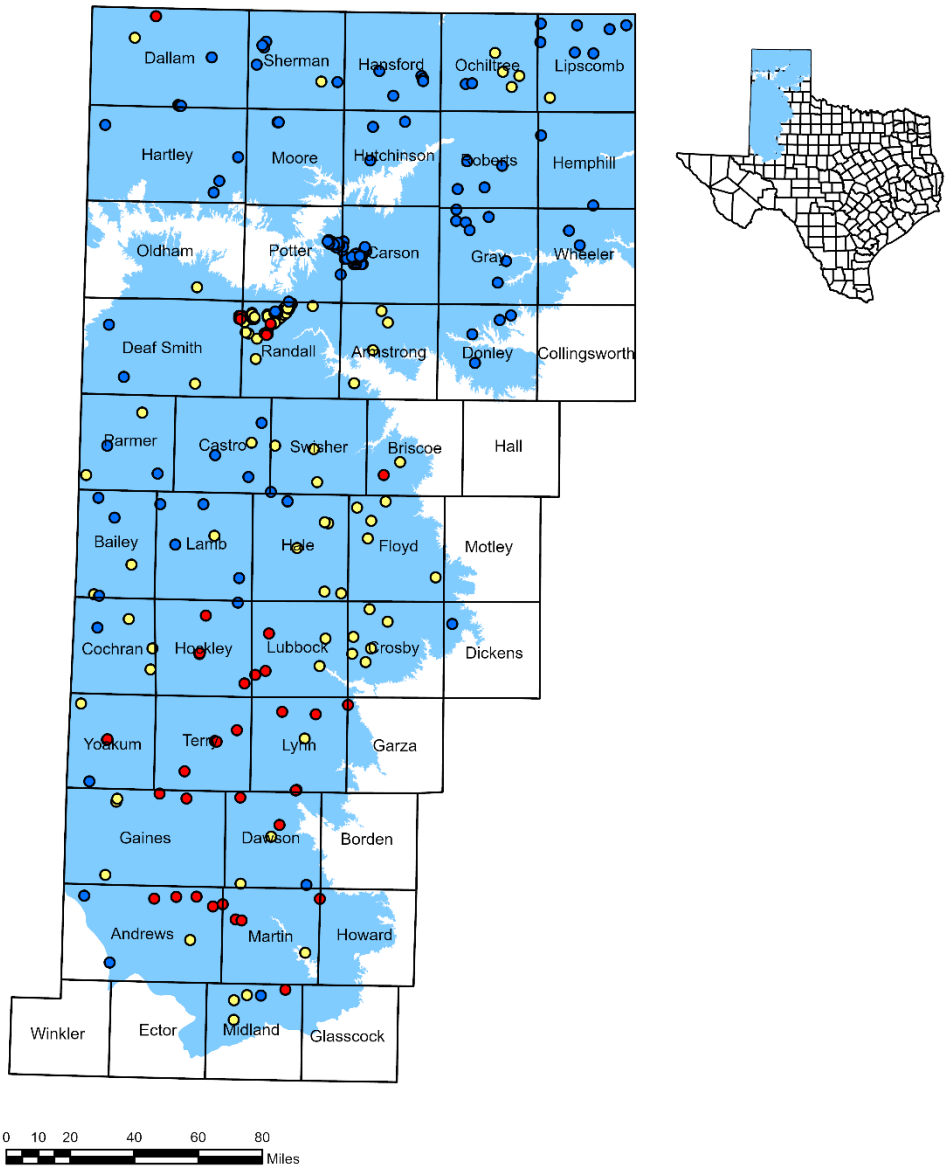


Figure 27. Ogallala Aquifer – Distribution of Fluoride



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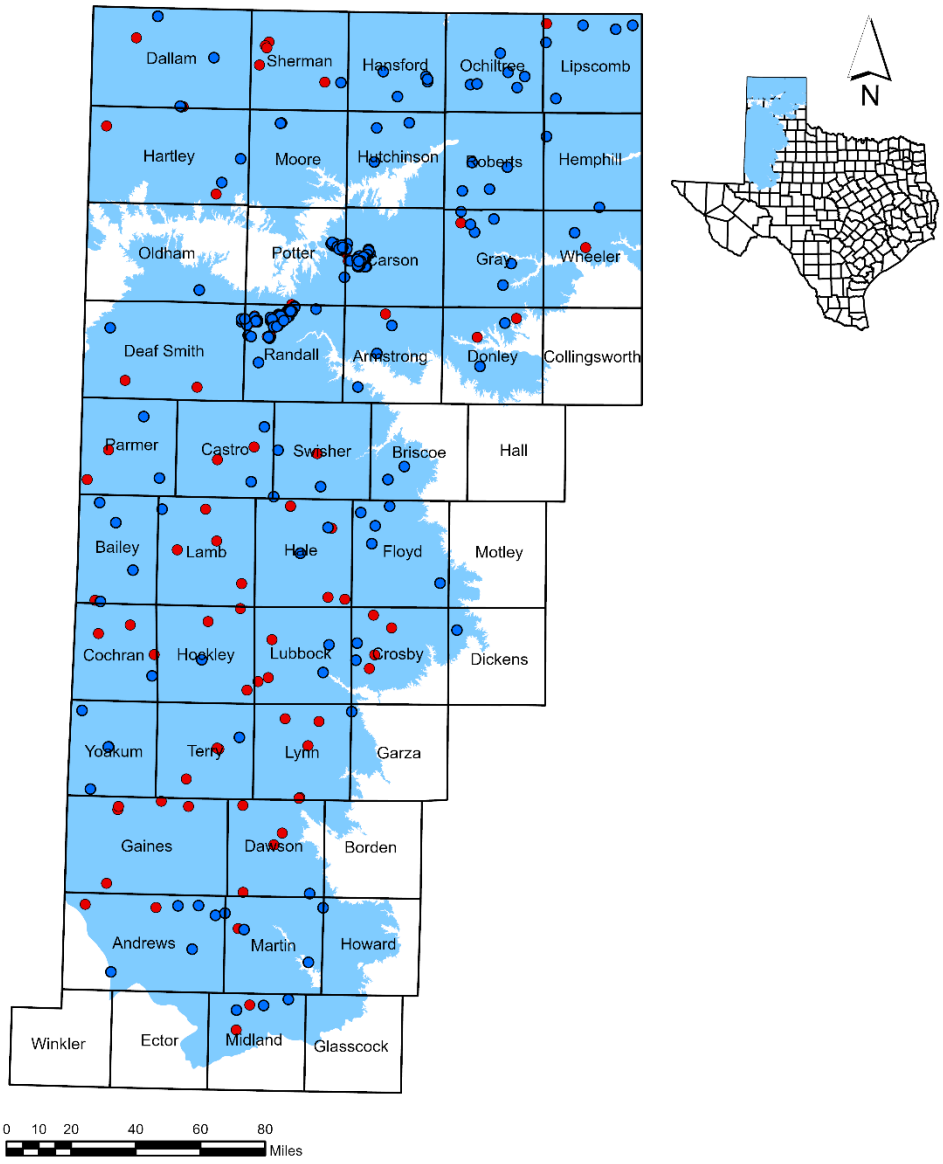
Fluoride Concentration in Ogallala Aquifer Water Wells

- Less than 2 mg/L
- 2 mg/L to less than 4 mg/L
- 4 mg/L or greater

Figure 28. Ogallala Aquifer – Distribution of Nitrate-Nitrogen



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Nitrate Concentration in Ogallala Aquifer Water Wells

- Less than 10 mg/L
- 10 mg/L or greater

Figure 29. Ogallala Aquifer – Distribution of Selenium

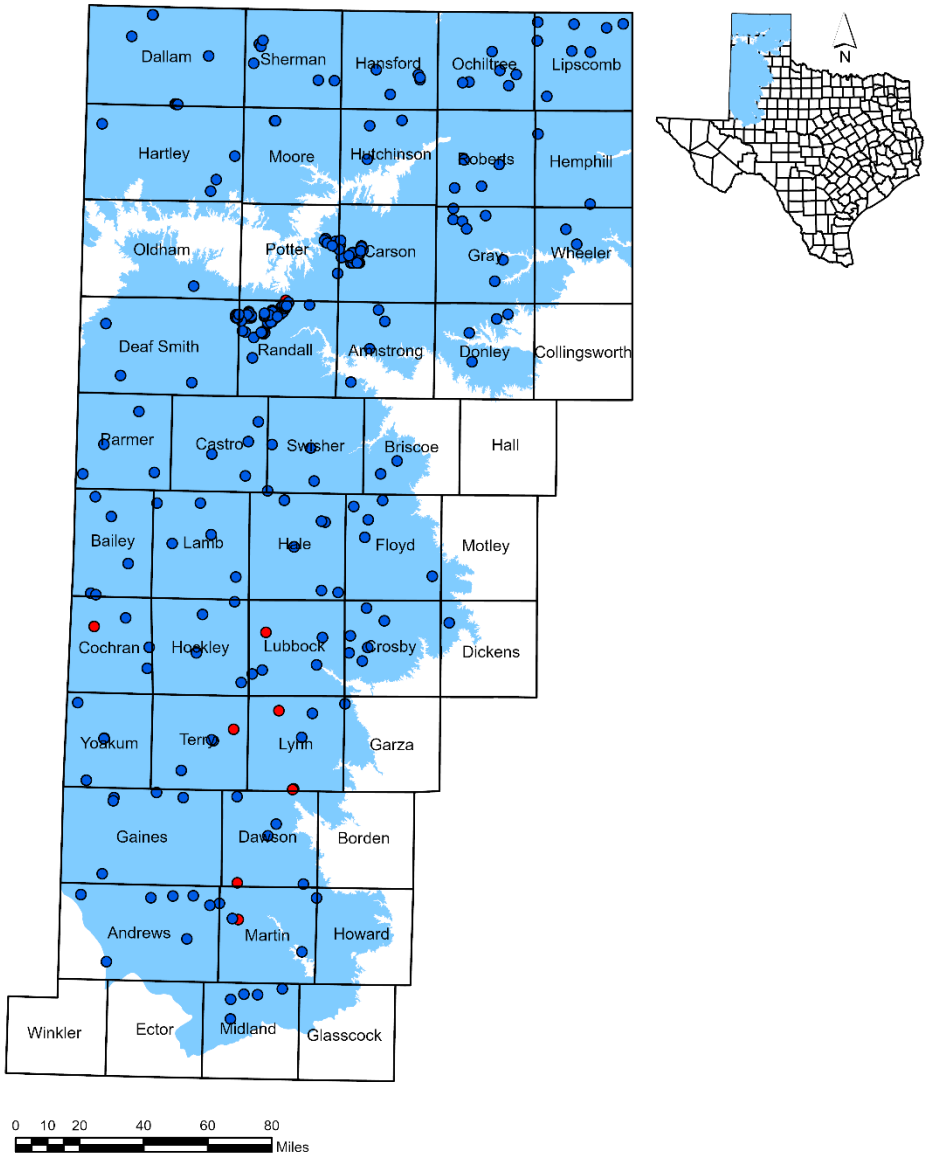
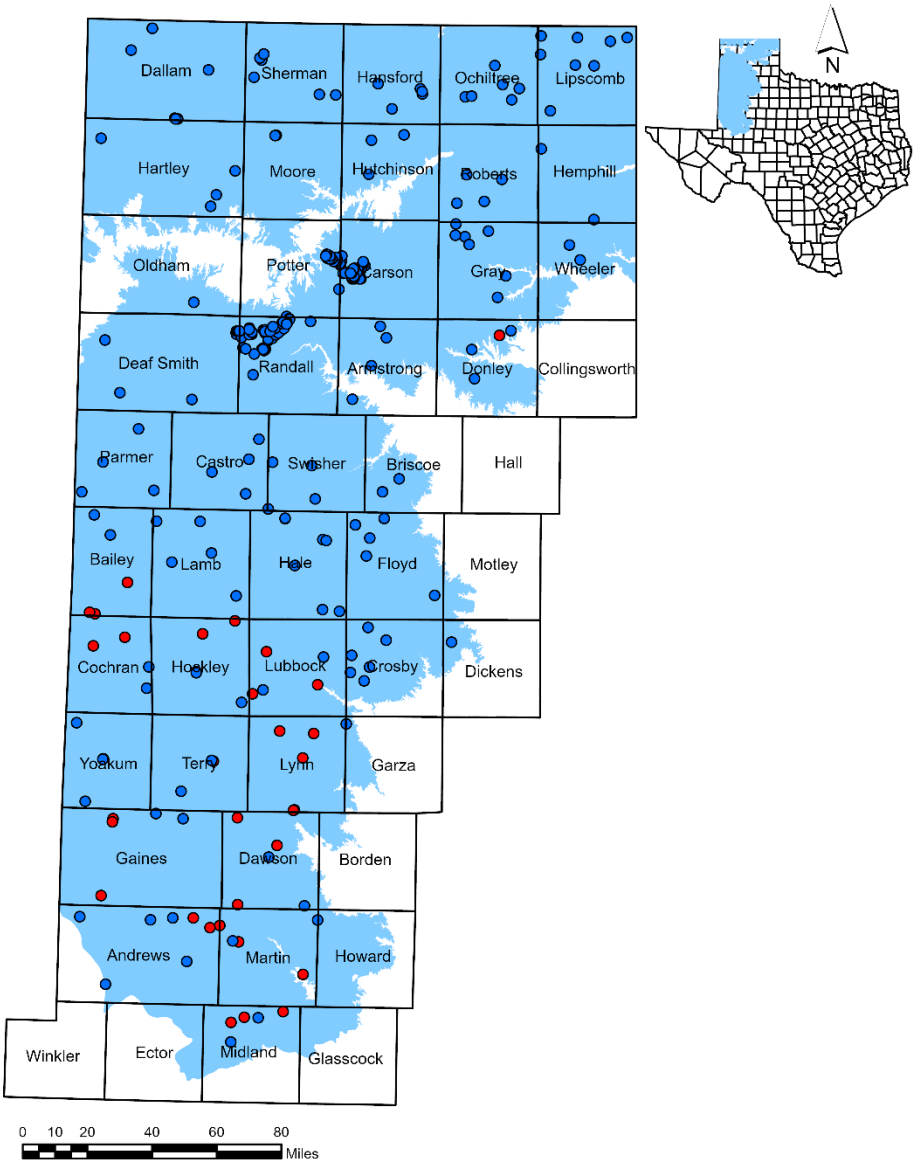


Figure 30. Ogallala Aquifer – Distribution of Total Dissolved Solids



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TDS Concentration in Ogallala Aquifer Water Wells

- Less than 1000 mg/L
- 1000 mg/L or greater

Figure 31. Pecos Valley Aquifer – Distribution of Nitrate-Nitrogen

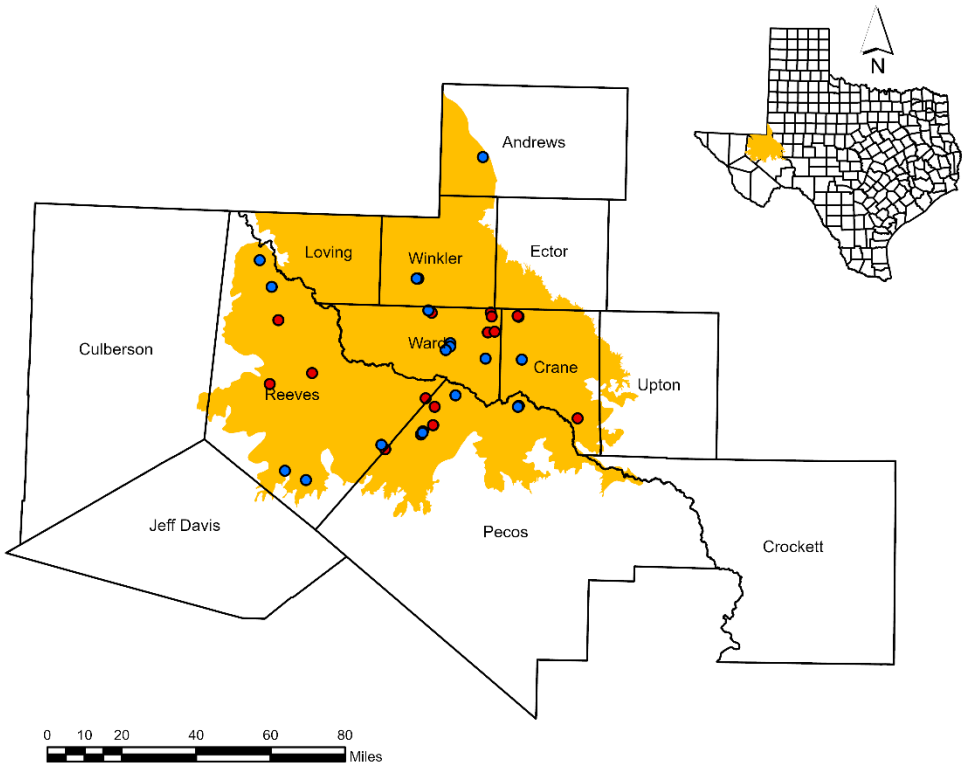
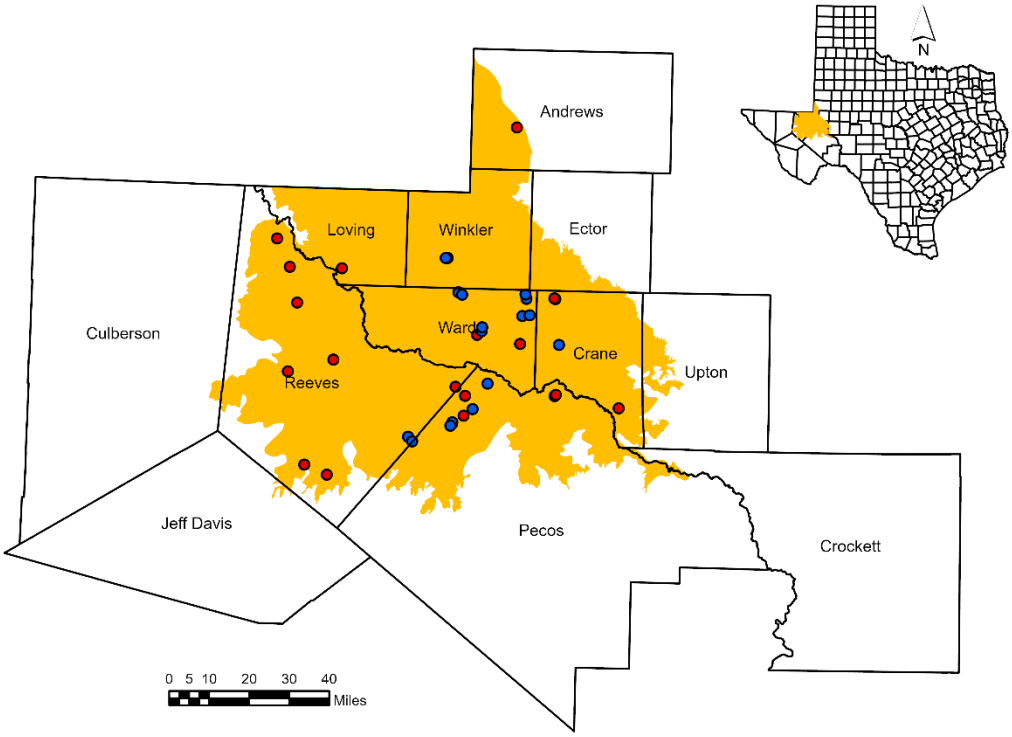


Figure 32. Pecos Valley Aquifer – Distribution of Sulfate



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Sulfate Concentration in Pecos Valley Aquifer Water Wells

- Less than 300 mg/L
- 300 mg/L or greater

Figure 33. Pecos Valley Aquifer – Distribution of Total Dissolved Solids

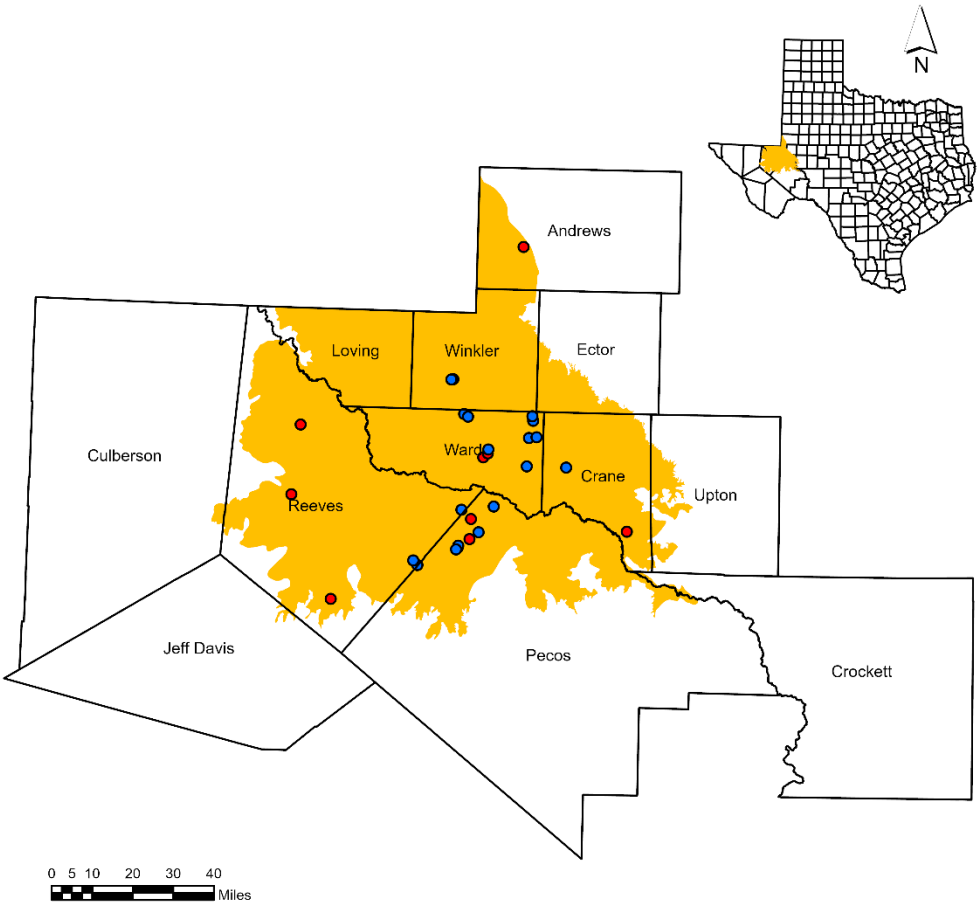
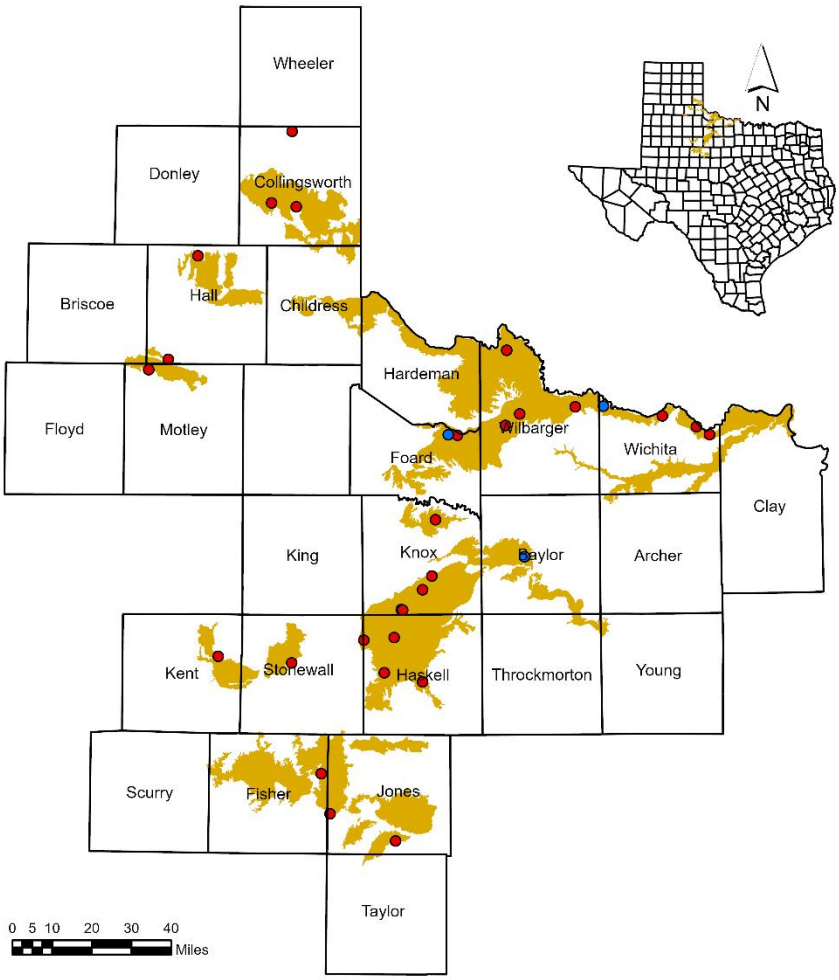


Figure 34. Seymour Aquifer – Distribution of Nitrate-Nitrogen



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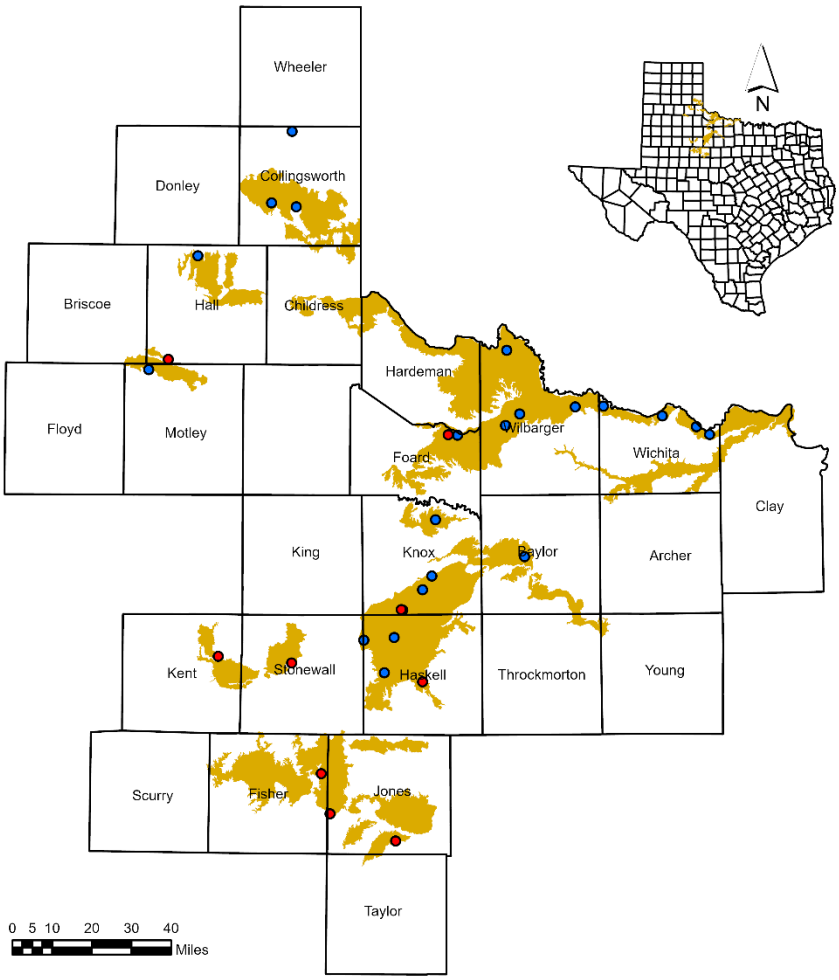
Nitrate Concentration in Seymour Aquifer Water Wells

- Less than 10 mg/L
- 10 mg/L or greater

Figure 35. Seymour Aquifer – Distribution of Total Dissolved Solids



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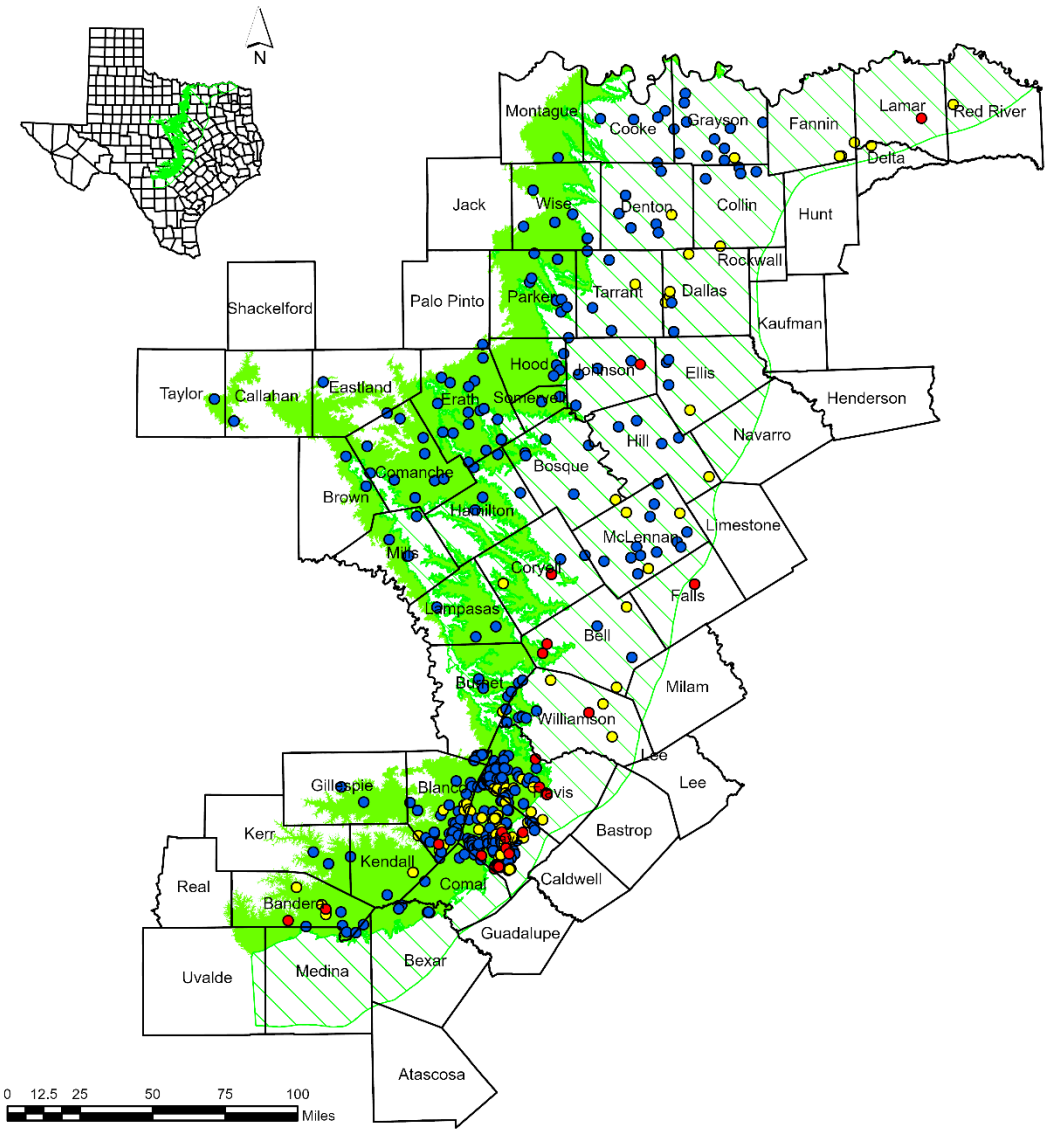
TDS Concentration in Seymour Aquifer Water Wells

- Less than 1000 mg/L
- 1000 mg/L or greater

Figure 36. Trinity Aquifer – Distribution of Fluoride



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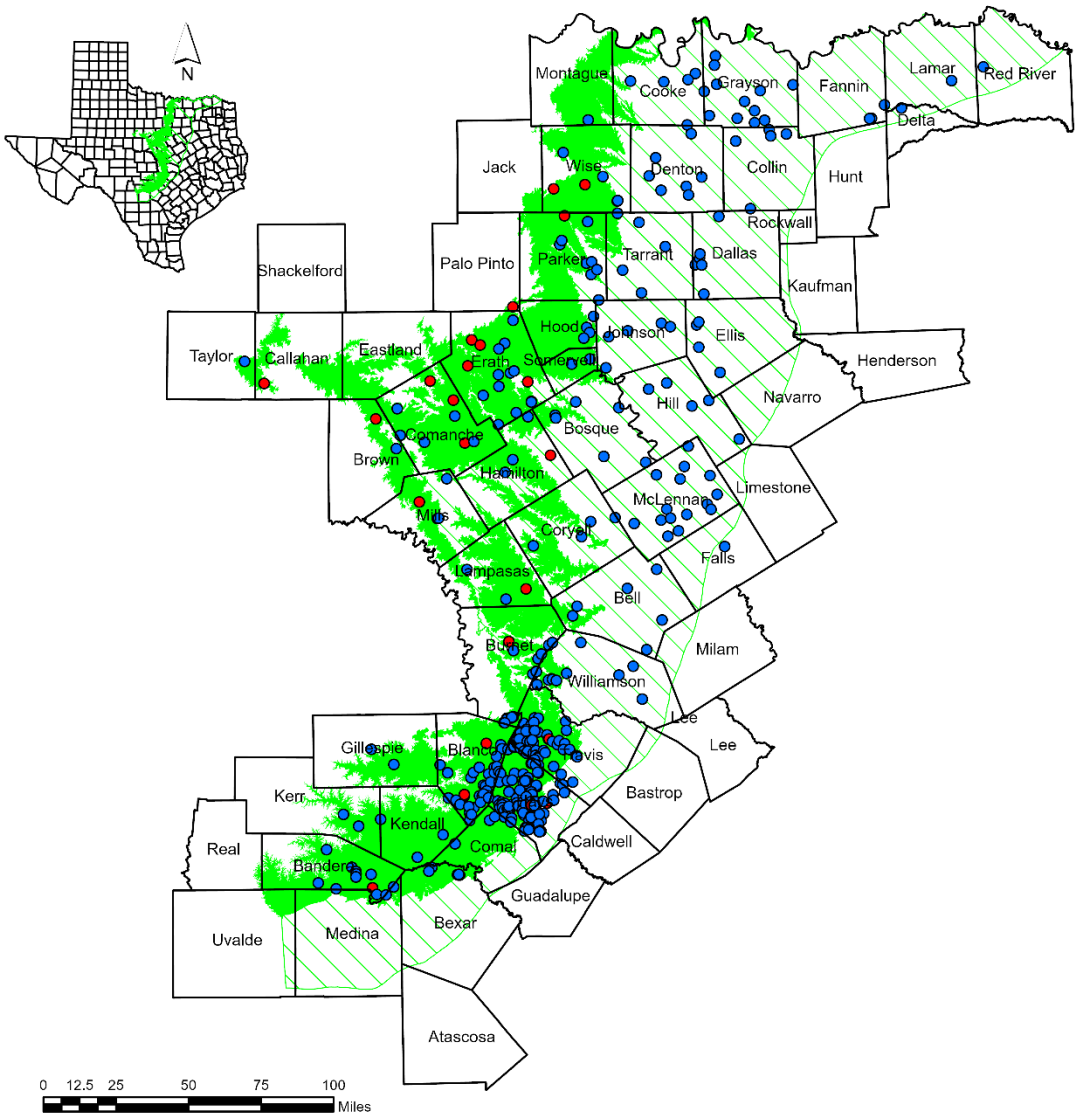
Fluoride Concentration in Trinity Aquifer Water Wells

- Less than 2 mg/L
- 2 mg/L to less than 4 mg/L
- 4 mg/L or greater

Figure 37. Trinity Aquifer – Distribution of Nitrate-Nitrogen



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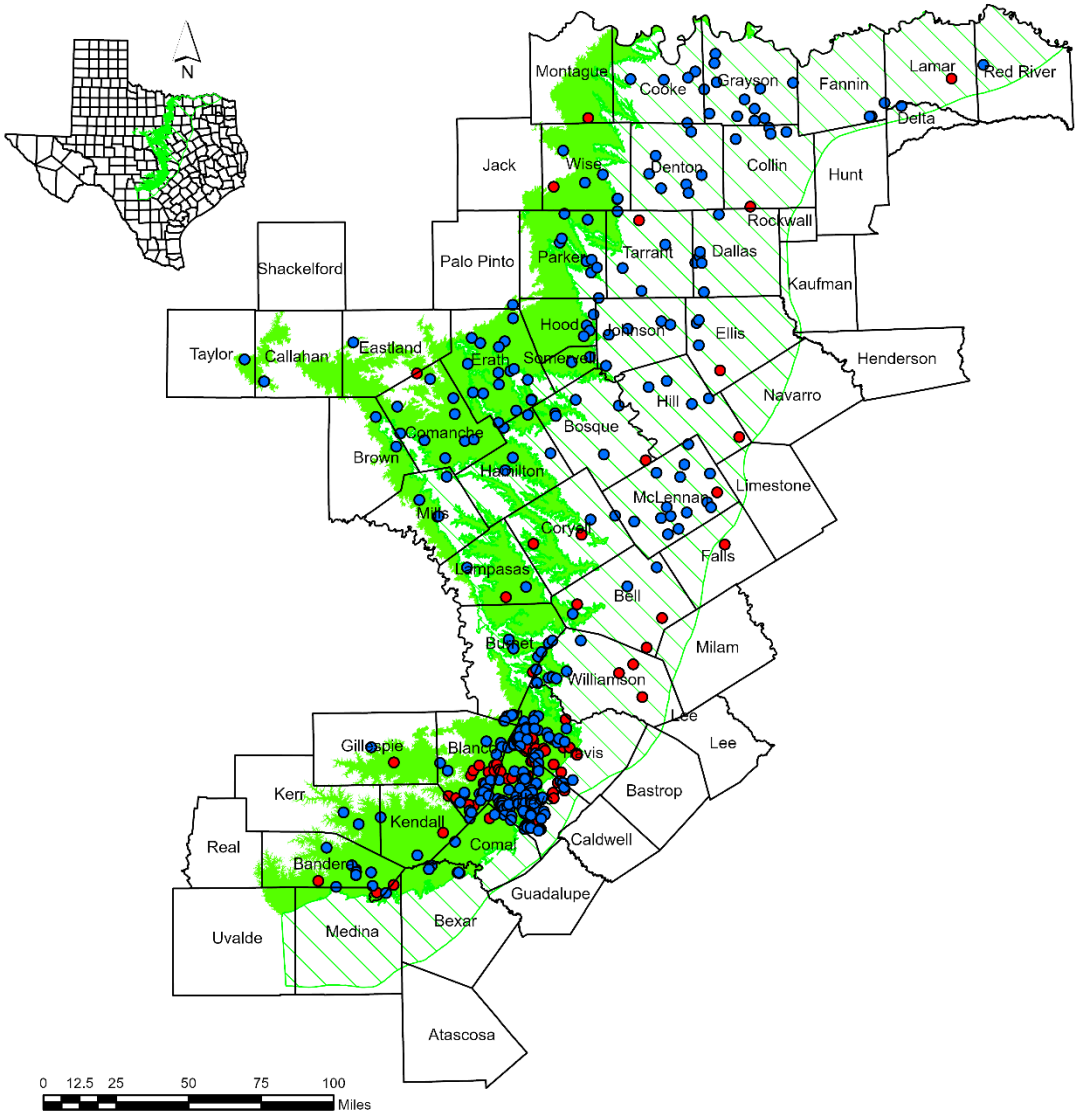
Nitrate Concentration in Trinity Aquifer Water Wells

- Less than 10 mg/L
- 10 mg/L or greater

Figure 38. Trinity Aquifer – Distribution of Total Dissolved Solids



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TDS Concentration in Trinity Aquifer Water Wells

- Less than 1000 mg/L
- 1000 mg/L or greater

Figure 39. West Texas Bolson Aquifer – Distribution of Arsenic

Figure 40. West Texas Bolson – Distribution of Nitrate

Regulatory Monitoring and Groundwater Contamination

Groundwater monitoring programs of the participating agencies or entities are typically in one of the following three categories:

- Regulatory compliance monitoring required or conducted by an agency to protect groundwater quality from contamination.
- Monitoring conducted by agencies or entities to assess ambient or existing groundwater quality conditions and track changes in water quality over time.
- Research activities related to groundwater resources and groundwater conservation.

Each regulatory agency that requires or conducts groundwater monitoring to ensure compliance with guidelines and regulations to protect groundwater from discharges of contaminants has its own monitoring program requirements and procedures. Criteria used to assess the need for groundwater monitoring vary among the regulatory entities. Major sources of documented or potential groundwater contamination are tabulated in Table 36 following.

More than 45,000 wells, including nearly 14,000 public drinking water wells, are used for groundwater monitoring in the state.[43] Most of those wells are under TCEQ's jurisdiction, and the remainder are under the jurisdiction of the RRC.

TWDB and the GCD members of TAGD monitor groundwater quality to assess ambient groundwater conditions and to track changes in water quality over time. However, the ambient groundwater monitoring network has historic limitations for the parameters that have been analyzed. For example, very few historical analyses exist for constituents typically attributed to anthropogenic (that is, human-influenced) sources. In addition, data for constituents such as volatile and synthetic organic compounds and certain heavy metals are somewhat limited.

Ambient monitoring has not traditionally targeted pesticides. Drinking water analyses conducted under the SDWA include some pesticides in their suite of chemicals; however, the SDWA targets "finished" water rather than ambient groundwater. Analyses conducted under the USGS National Water Quality Assessment program also include pesticides in a wide range of constituents. Since 2000, TCEQ, TWDB, and GCD members of TAGD have conducted a cooperative sampling program for atrazine and metolachlor, in which TCEQ analyzes ambient groundwater samples that TWDB and GCDs collect.

Entities may develop monitoring programs as part of water quality assessment studies that target specific geographic areas, specific contaminants or constituents, or specific

[43] tceq.texas.gov/groundwater/groundwater-planning-assessment/sfr-056-joint-groundwater-monitoring-contamination-report

activities. If during these studies or sampling an entity discovers groundwater contamination, it refers the case to the regulatory agency with appropriate jurisdiction.

In general, TCEQ and RRC's waste disposal programs monitor existing and permitted facilities. Groundwater monitoring requirements have been established for the following programs: petroleum storage tank (PST), industrial and hazardous waste (IHW), municipal solid waste (MSW), underground injection control (UIC), pollution cleanup, and enforcement programs.

In the municipal and industrial wastewater permitting program, initiatives have required groundwater monitoring at facilities where activities pose a higher risk to groundwater quality. Additionally, permits required for surface storage and disposal of oil and gas waste and brine retention ensure the protection of groundwater by requiring pond liners, leak detection systems, groundwater monitoring, or a combination of these methods.

The Water Supply Division (WSD) of TCEQ regulates public water supply wells. Public water systems receive sufficient monitoring to ensure that violations of drinking water standards are detected and addressed before water is distributed to consumers.

There is currently no state program that requires monitoring of domestic wells, although some GCDs do have programs that routinely monitor private water wells for ambient conditions or suspected contamination. In addition, TWDB's Groundwater Monitoring program includes many types of wells, including domestic wells. TDLR licensed water well drillers respond to complaints and routinely check compliance with TDLR rules; while AgriLife Research provides water quality outreach, continuing education programs, and other educational services.

At facilities regulated by RRC, permits required for surface storage and disposal of oil and gas waste and brine retention ensure the protection of groundwater by requiring pond liners, leak detection systems, groundwater monitoring, or a combination of these methods.

Table 36. Sources of Groundwater Contamination[44]

Contaminant Source	Factors Considered in Selecting a Contaminant Source	Contaminants
Storage tanks (underground or above ground)	• Documented from mandatory reporting • Size of population at risk • Location of the sources relative to drinking water sources • Number or size of contaminant sources	• Halogenated solvents • Petroleum compounds
Surface impoundments	• Documented from mandatory reporting • Location of the sources relative to drinking water sources • Number or size of contaminant sources • Potential from state and other findings • Geographic distribution/occurrence	• Inorganic compounds • Organic compounds • Petroleum compounds • Salinity/brine • Metals

[44] tgpc.texas.gov/groundwater-contamination/

Contaminant Source	Factors Considered in Selecting a Contaminant Source	Contaminants
Landfills	• Documented from mandatory reporting • Number or size of contaminant sources • Hydrogeologic sensitivity • Potential from state and other findings • Geographic distribution/occurrence	• Inorganic compounds • Organic compounds • Halogenated solvents • Salinity/brine • Metals
Septic systems	• Size of population at risk • Location of the sources relative to drinking water sources • Number or size of contaminant sources • Hydrogeologic sensitivity • Potential from state and other findings • Geographic distribution/occurrence	• Inorganic compounds • Organic compounds • Nitrate
Agricultural activities	• Documented from mandatory reporting • Location of sources relative to drinking water sources • Number or size of contaminant sources • Hydrogeologic sensitivity • Potential from state and other findings • Geographic distribution/occurrence	• Inorganic compounds • Organic compounds • Nitrate
Abandoned wells	• Documented from mandatory reporting • Location of sources relative to drinking water sources • Number or size of contaminant sources • Hydrogeologic sensitivity • Potential from state and other findings • Geographic distribution/occurrence	• Contaminated surface water or groundwater • Agricultural chemicals
Oil and gas activities	• Location of sources relative to drinking water sources • Number or size of contaminant sources • Hydrogeologic sensitivity • Potential from state and other finding • Geographic distribution/occurrence	• Petroleum compounds • Salinity/brine
Grandfathered sites/past practices	• Documented from mandatory reporting • Number or size of contaminant sources • Hydrogeologic sensitivity • Potential from state and other findings • Geographic distribution/occurrence	• Inorganic compounds • Organic compounds • Petroleum compounds • Nitrate, salinity/brine • Metals

Contaminant Source	Factors Considered in Selecting a Contaminant Source	Contaminants
Natural occurrence	• Hydrogeologic sensitivity • Potential from state and other findings • Geographic distribution/occurrence • Other criteria	• Nitrate • Fluoride • Salinity/brine • Metals

Groundwater Contamination Cases in the Joint Groundwater Monitoring and Contamination Report

The *2022 Joint Report* includes 2,943 confirmed groundwater contamination cases in Texas. Of these, 2,387 are under the jurisdiction of various TCEQ programs, and 556 are under the jurisdiction of the RRC Oil and Gas Division. Table 37 summarizes the latest activity status for each of these cases and breaks down the numbers among the various programs. Note that the activity status codes are provided by the individual programs. If multiple codes were provided, this table includes the latest status. If no status codes were provided, the totals for each status may not add exactly to the overall total.

Table 37. Status of Groundwater Contamination Cases in 2022

Program	# of Cases	*New* Cases	ASC[45] "0"	ASC "1"	ASC "2"	ASC "3"	ASC "4"	ASC "5"	ASC "6"
TCEQ Office of Waste (OOW)/Remediation Division (REM)/Corrective Action	523	*38*	1	48	99	55	70	216	34
TCEQ OOW/REM/Dry Cleaners Remediation	248	*14*	102	0	78	0	0	61	7
TCEQ OOW/REM/Petroleum Storage Tanks	1,020	*184*	0	119	680	0	32	0	189
TCEQ/OOW/REM/Superfund Cleanup	84	*1*	0	0	19	11	10	43	1
TCEQ/OOW/REM/Superfund Site Discovery & Assessment program; and Preliminary Assessment & Site Inspection	5	*0*	0	0	4	0	0	0	1
TCEQ/OOW/REM/Brownfields Site Assessment	2	*0*	0	0	2	0	0	0	0
TCEQ OOW/REM/Voluntary Cleanup	359	*48*	4	65	103	38	32	72	45
TCEQ OOW/REM/Innocent Landowner	68	*25*	54	0	0	0	0	0	14
TCEQ OOW/Waste Permits Division (WPD)/Industrial & Hazardous Waste	0	*0*	0	0	0	1	0	0	0
TCEQ OOW/WPD/Municipal Solid Waste	55	*3*	0	0	55	0	0	0	0

[45] ASC means Activity Status Code: "0" No Activity; "1" Confirmed Contamination; "2" Ongoing Investigation; "3" Corrective Action Planning; "4" Corrective Action Implementation; "5" Monitoring Action; "6" Activity Completed.

Program	# of Cases	*New* Cases	ASC[45] "0"	ASC "1"	ASC "2"	ASC "3"	ASC "4"	ASC "5"	ASC "6"
TCEQ OOW/Radioactive Materials Division (RMD)	4	*0*	0	0	1	0	0	0	0
TCEQ Office of Compliance & Enforcement (OCE)/Enforcement Division	2	*0*	0	0	0	1	0	0	0
TCEQ OCE/Regional Offices	0	*0*	0	0	0	0	0	0	0
TCEQ Office of Water (OW)/Water Availability Division/Groundwater Planning & Assessment	0	*0*	0	0	0	0	0	0	0
TCEQ OW/Water Supply Division/Public Drinking Water	0	*0*	0	0	0	0	0	0	0
TCEQ OW/Water Quality Division	17	*0*	0	0	6	3	1	7	0
Railroad Commission (RRC) of Texas, Oil & Gas Division	556	*28*	0	14	39	73	225	178	27
TOTAL:	**2,943**	***341***	**161**	**246**	**1,070**	**182**	**370**	**591**	**320**

Table 38. Summary of Groundwater Contamination Sites on Aquifer Outcrops, 2022

For Table 38 following, and for subsequent tables, the following terms apply:

"Source Type" in the first column refers to the following categories: National Priority List (NPL), including state Superfund; Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) – for this report includes TCEQ programs VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS; U.S. Department of Defense/Department of Energy (US DOD/DOE); Leaking Petroleum Storage Tanks (LPST); Resource Conservation and Recovery Act (RCRA); Municipal Solid Waste (MSW); Industrial or Hazardous Waste (IHW); Radioactive Materials (RM) and Groundwater Planning and Assessment Team (GPAT).

The "Status" columns refer to Activity Status Codes (ASC): 1-Confirmed Contamination (for this table, may also include 0, No Activity); 2-Ongoing Investigation; 3-Corrective Action Planning; 4-Corrective Action Implementation; 5-Monitoring Action; 6-Activity Completed.

"Examples of Contaminants" include many of the constituents listed in the *2022 Joint Report* for each category, or source type: volatile organic compounds (VOCs); benzene, toluene, ethylbenzene, and xylenes (BTEX); total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), phase separated hydrocarbons (PSH), polyfluoroalkyl substances (PFAS), methyl tertiary butyl ether (MTBE), total dissolved solids (TDS), pentachlorophenol (PCP). These are not intended to be a complete list.

Source Type	Number of *Joint Report* Sites	Status 1	Status 2	Status 3	Status 4	Status 5	Status 6	Examples of Contaminants
NPL and State Superfund sites	73	0	17	7	9	39	1	chlorinated solvents, VOCs, TPH, metals, hexavalent chromium, BTEX, PAH, chlorobenzene, carbon tetrachloride, vinyl chloride
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	459	145	119	27	20	107	41	chlorinated solvents, VOCs, nitrate, pesticides, metals, PFAS, BTEX, TPH, MTBE, PAH, PCB, fecal coliform
US DOD/DOE	0 for the *2022 Joint Report*	-	-	-	-	-	-	(Not applicable for this report)
Leaking Petroleum Storage Tanks (LPST)	797	78	548	-	42	-	129	gasoline, diesel, waste oil, hydraulic fluid, jet fuel
RCRA Corrective Action: TCEQ CA	405	33	80	41	58	168	25	VOCs, SVOCs, metals, chlorinated solvents, PAH, PFAS, pesticides, MTBE, herbicides, BTEX, TPH
RM: TCEQ RMD	4	-	1	-	-	-	-	uranium, radium, gross alpha, tritium, metals
State Sites: TCEQ MSW, IHW, ENF	31	-	19	1	-	11	1	metals, VOCs, chlorinated solvents chloroform, vinyl chloride, benzene
Nonpoint Source: TCEQ GPAT	0 for the *2022 Joint Report*	-	-	-	-	-	-	(Not applicable for this report)
Oil and Gas (RRC)	548	16	40	67	220	179	26	BTEX, chloride, TPH, VOCs, metals, TDS, natural gas, PSH
Totals	**2,317**	**272**	**824**	**143**	**349**	**504**	**223**	

Figure 41. Map of Groundwater Contamination Sites Near Major Aquifer Outcrops

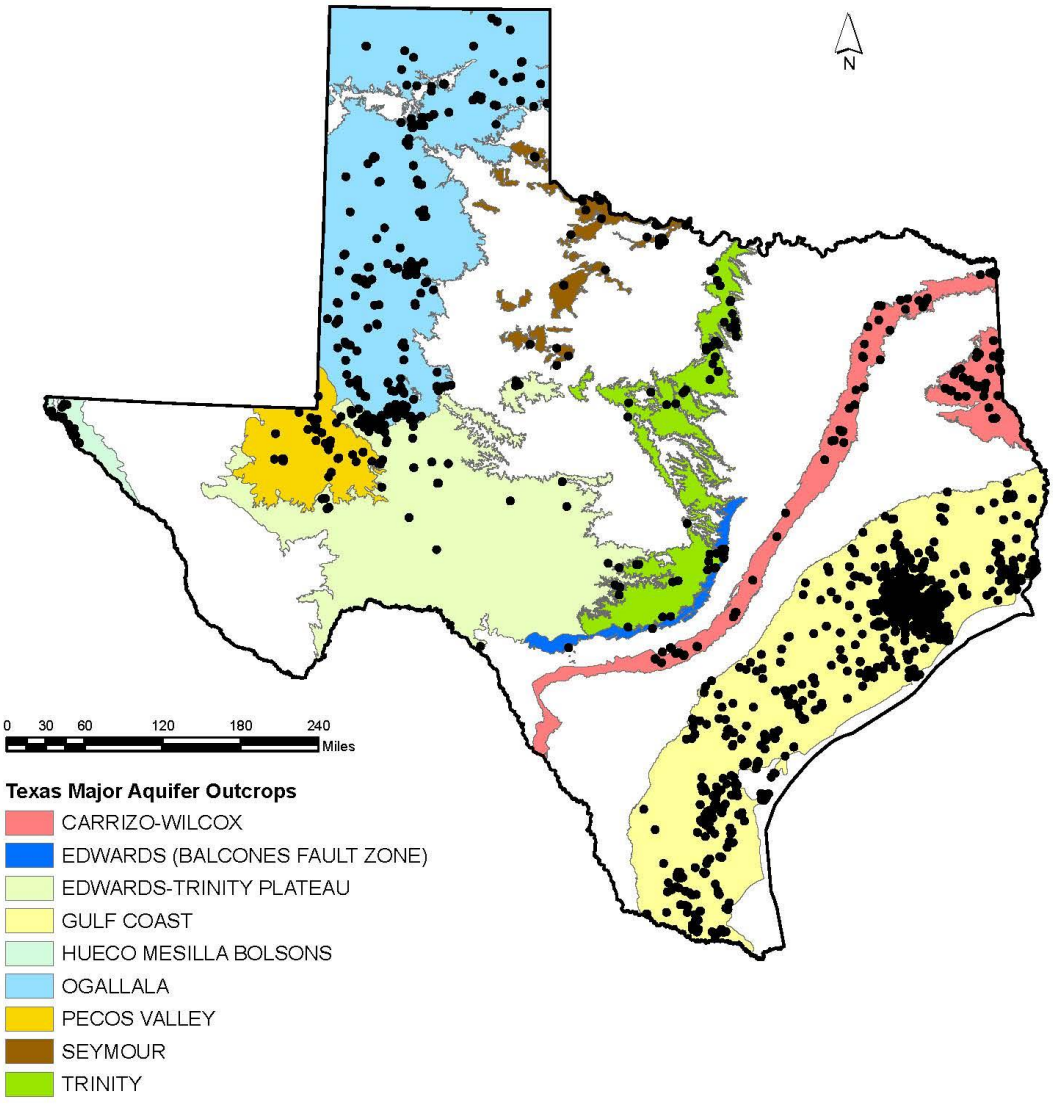
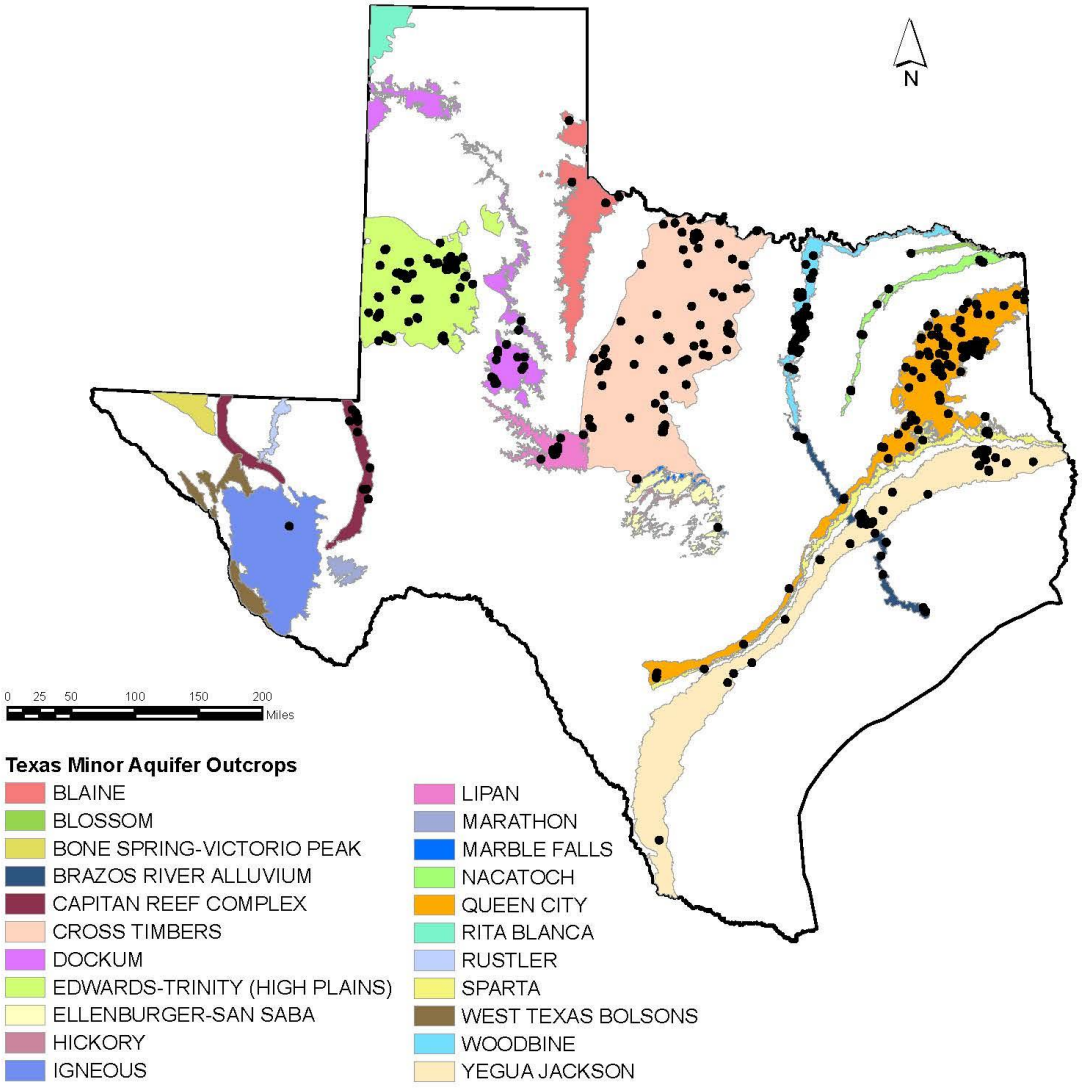


Figure 42. Map of Groundwater Contamination Sites Near Minor Aquifer Outcrops



Tables 39 through 63 – Status of Groundwater Contamination Sites Near Aquifer Outcrops in 2022

The following tables list the status of groundwater contamination cases that appear to be located over an aquifer outcrop area. For each of the tables, the following footnotes and definitions apply:

- A blank cell means there were zero cases for that category.
- Each table only includes rows for programs where *Joint Report* cases were located over an aquifer recharge area. If a row is not included in a particular table, it means that no groundwater contamination cases from the *2022 Joint Report* were included for that category or program.
- If a site has a zero for no activity in any of the status columns, it may be included in the count for status 1, which means that contamination has been confirmed but no additional activity had been reported at the time of the *2022 Joint Report*.

Table 39. Blaine Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
LPST	7	0	5	0	1	0	1	gasoline, waste oil, diesel
Oil and Gas (RRC)	2	0	0	0	1	1	0	TPH, BTEX, PSH
Totals:	**9**	**0**	**5**	**0**	**2**	**1**	**1**	

Table 40. Blossom Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
RCRA Corrective Action (TCEQ CA)	1	0	1	0	0	0	0	other
Totals:	**1**	**0**	**1**	**0**	**0**	**0**	**0**	

Table 41. Brazos River Alluvium Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	1	0	0	0	0	1	0	VOCs, BTEX, chlorinated hydrocarbons
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	1	1	0	0	0	0	0	chlorinated solvents
LPST	2	0	1	0	0	0	1	gasoline, diesel
RCRA Corrective Action (TCEQ CA)	4	0	1	2	1	0	0	VOCs, metals, BTEX, TPH
Oil and Gas (RRC)	6	0	1	2	1	2	0	TPH, BTEX, SVOCs, chloride, PSH, barium
Totals:	**14**	**1**	**3**	**4**	**2**	**3**	**1**	

Table 42. Capitan Reef Complex Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	1	0	1	0	0	0	0	VOCs
LPST	3	0	3	0	0	0	0	gasoline, diesel
Oil and Gas (RRC)	9	1	0	0	6	0	2	TPH, BTEX, PSH, chloride, TDS
Totals:	**13**	**1**	**4**	**0**	**6**	**0**	**2**	

Table 43. Carrizo-Wilcox Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	5	0	0	1	0	4	0	VOCs, metals, PAH, PCE, dioxin, pentachlorophenol
CERCLIS/Non-NPL (TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, PWS)	6	1	2	0	0	3	0	chlorinated solvents, metals, VOCs, SVOCs, TPH, PFAS, MTBE, BTEX, naphthalene
LPST	39	7	24	0	3	0	5	gasoline, diesel, waste oil, hydraulic fluid
RCRA Corrective Action (TCEQ CA)	18	3	0	3	2	6	4	TPH, BTEX, VOCs, SVOCs, metals, chlorinated solvents, PFAS
State Sites (TCEQ MSW, IHW, ENF)	2	0	1	0	0	0	1	metals, VOCs
Oil and Gas (RRC)	30	1	2	5	14	7	1	TPH, BTEX, chloride, PSH, natural gas, pH, metals
Totals:	**100**	**12**	**29**	**9**	**19**	**20**	**11**	

Table 44. Cross Timbers Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	2	0	0	1	0	1	0	VOCs, antimony
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	11	3	4	2	1	1	0	BTEX, VOCs, chlorinated solvents, metals, TPH
LPST	38	5	28	0	1	0	4	gasoline, diesel
RCRA Corrective Action (TCEQ CA)	17	3	5	1	3	4	1	metals, TPH, chlorinated solvents, VOCs, BTEX, PFAS
State Sites (TCEQ MSW, IHW, ENF)	1	0	1	0	0	0	0	VOCs
Oil and Gas (RRC)	20	0	6	1	8	5	0	TPH, BTEX, chloride, natural gas, PSH, VOCs
Totals:	**89**	**11**	**44**	**5**	**13**	**11**	**5**	

Table 45. Dockum Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	1	0	0	0	0	1	0	BTEX, PAH, VOCs, naphthalene, phenol
LPST	1	0	0	0	1	0	0	unknown
Oil and Gas (RRC)	19	0	1	2	9	7	0	chloride, TPH, BTEX, PSH, PAH
Totals:	**21**	**0**	**1**	**2**	**10**	**8**	**0**	

Table 46. Edwards (Balcones Fault Zone) Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	7	3	3	0	0	1	0	chlorinated solvents, TPH, PFAS
LPST	2	1	0	0	0	0	1	gasoline
RCRA Corrective Action (TCEQ CA)	1	0	0	0	0	1	0	chlorinated solvents
Totals:	**9**	**4**	**3**	**0**	**0**	**2**	**1**	

Table 47. Edwards-Trinity (High Plains) Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	2	0	1	0	0	1	0	arsenic, chlorinated hydrocarbons, benzene, vanadium, manganese
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	11	1	4	0	1	5	0	chlorinated solvents, BTEX, VOCs, nitrate, other
LPST	34	1	23	0	9	0	1	gasoline, diesel, hydraulic fluid
RCRA Corrective Action (TCEQ CA)	8	0	3	0	1	4	0	VOCs, PFAS, chlorinated solvents, metals, PAH, SVOCs
State Sites (TCEQ MSW, IHW, ENF)	1	0	0	0	0	1	0	VOCs, metals
Oil and Gas (RRC)	23	2	4	1	6	8	2	TPH, BTEX, chloride, PSH, VOCs, SVOCs, other
Totals:	**79**	**4**	**35**	**1**	**17**	**19**	**3**	

Table 48. Edwards-Trinity (Plateau) Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	3	0	1	0	1	1	0	chlorinated hydrocarbons, metals, hexavalent chromium
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	1	0	1	0	0	0	0	chromium, hexavalent chromium
LPST	12	0	9	0	0	0	3	gasoline, diesel
RCRA Corrective Action (TCEQ CA)	6	0	1	1	1	1	2	metals, VOCs, chlorinated solvents, BTEX
State Sites (TCEQ MSW, IHW, ENF)	1	0	1	0	0	0	0	metals, VOCs
Oil and Gas (RRC)	23	0	1	1	13	6	2	TPH, BTEX, chloride, PSH, Hg, amine
Totals:	**46**	**0**	**14**	**2**	**15**	**8**	**7**	

Table 49. Gulf Coast Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	37	0	3	3	5	26	0	BTEX, metals, PAH, chlorinated solvents, VOCs, SVOCs, dioxins, TPH, vinyl chloride
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	316	102	78	19	13	71	33	chlorinated solvents, VOCs, SVOCs, metals, TPH, pesticides, BTEX, MTBE, PFAS, dioxins/ furans
LPST	356	43	244	0	3	0	66	gasoline, diesel, waste oil, other
RCRA Corrective Action (TCEQ CA)	227	17	47	26	34	90	13	chlorinated solvents, metals, VOCs, BTEX, TPH, PAH, PFAS
RM (TCEQ RMD)	3	2	1	0	0	0	0	uranium, radium, gross alpha, tritium, selenium
State Sites (TCEQ MSW, IHW, ENF)	12	0	7	0	0	5	0	VOCs, metals
Oil and Gas (RRC)	268	6	16	46	91	99	10	TPH, BTEX, PSH, natural gas, VOCs, metals, chloride, NORM
Totals:	**1,219**	**170**	**396**	**94**	**146**	**291**	**122**	

Table 50. Hickory Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
Totals:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**n/a**

Table 51. Hueco-Mesilla Bolson Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	5	1	2	0	1	1	0	chlorinated solvents, BTEX, metals, TPH, VOCs, SVOCs
LPST	13	1	9	0	1	2	0	gasoline, diesel
RCRA Corrective Action (TCEQ CA)	7	0	1	0	1	5	0	BTEX, metals, TPH, VOCs
Totals:	**25**	**2**	**12**	**0**	**3**	**6**	**2**	

Table 52. Igneous Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	1	0	1	0	0	0	0	nitrate
Totals:	**1**	**0**	**1**	**0**	**0**	**0**	**0**	

Table 53. Lipan Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	3	1	0	0	0	2	0	MTBE, VOCs, chlorinated solvents
LPST	7	2	3	0	1	0	1	gasoline, diesel
RCRA Corrective Action (TCEQ CA)	3	0	1	0	0	2	0	metals, VOCs, chlorinated solvents, PFAS
State Sites (TCEQ MSW, IHW, ENF)	1	0	0	0	0	1	0	metals, VOCs
Oil and Gas (RRC)	1	0	0	0	1	0	0	chloride
Totals:	**15**	**3**	**4**	**0**	**2**	**5**	**1**	

Table 54. Marble Falls Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
LPST	1	0	0	0	0	0	1	unknown
Totals:	**1**	**0**	**0**	**0**	**0**	**0**	**1**	

Table 55. Nacatoch Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	1	0	0	1	0	0	0	chromium, hexavalent chromium, chlorinated hydrocarbons
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	1	1	0	0	0	0	0	chlorinated hydrocarbons
LPST	9	2	6	0	0	0	1	gasoline, diesel, unknown
RCRA Corrective Action (TCEQ CA)	2	0	0	0	0	2	0	chlorinated solvents, BTEX, VOCs
Totals:	**13**	**3**	**6**	**1**	**0**	**2**	**1**	

Table 56. Ogallala Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	12	0	6	1	2	3	0	hexavalent chromium, metals, chlorinated hydrocarbons, benzene
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	31	3	11	1	1	14	1	chlorinated solvents, VOCs, SVOCs, TPH, BTEX, nitrate, TDS, fecal coliform
LPST	92	3	65	0	18	0	6	gasoline, diesel, waste oil, hydraulic fluid, jet fuel
RCRA Corrective Action (TCEQ CA)	46	3	9	4	7	20	3	metals, VOCs, BTEX, TPH, chlorinated solvents, PAH, PFAS, other
State Sites (TCEQ MSW, IHW, ENF; may be combined with NPL and RCRA sites)	6	0	4	1	0	1	0	metals, VOCs, waste oils, other
Oil and Gas (RRC)	83	2	5	5	40	23	8	TPH, BTEX, chloride, PSH, PAH, TDS, SVOC, natural gas, other
Totals:	**270**	**11**	**100**	**12**	**68**	**61**	**18**	

Table 57. Pecos Valley Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	1	0	1	0	0	0	0	VOCs
LPST	16	15	0	0	1	0	0	gasoline, diesel
RCRA Corrective Action (TCEQ CA)	2	0	0	0	1	1	0	VOCs, TPH
Oil and Gas (RRC)	24	2	2	1	14	5	0	TPH, BTEX, PSH, PAH, chloride, natural gas, radionuclides
Totals:	**43**	**2**	**18**	**1**	**16**	**6**	**0**	

Table 58. Queen City Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	4	0	2	0	0	1	1	benzene, vinyl chloride, PCP, dioxins, mercury, arsenic, chlorinated hydrocarbons (1,2-DCE)
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	11	2	3	1	0	1	4	chlorinated solvents, VOCs, TPH, metals
LPST	59	6	40	0	0	0	13	gasoline, diesel, unknown
RCRA Corrective Action (TCEQ CA)	24	2	2	1	3	14	2	chlorinated solvents, metals, VOCs, BTEX, SVOCs
Oil and Gas (RRC)	22	2	1	1	9	8	1	TPH, BTEX, chloride, VOCs, metals, TDS, PSH, PCB
Totals:	**120**	**12**	**48**	**3**	**12**	**24**	**21**	

Table 59. Seymour Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	6	2	2	2	0	0	0	BTEX, TPH, metals, VOCs
LPST	16	0	14	0	2	0	0	gasoline, diesel, unknown
RCRA Corrective Action (TCEQ CA)	10	3	3	0	1	3	0	VOCs, SVOCs, metals, BTEX, TPH, chlorinated solvents
State Sites (TCEQ MSW, IHW, ENF)	1	0	1	0	0	0	0	VOCs
Oil and Gas (RRC)	5	0	0	1	2	2	0	TPH, BTEX, PSH, chloride
Totals:	**38**	**5**	**20**	**3**	**5**	**5**	**0**	

Table 60. Sparta Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	1	0	1	0	0	0	0	TPH, benzene, methylnaphthalene
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	1	0	0	0	0	1	0	other
LPST	4	0	3	0	0	0	1	gasoline
RCRA Corrective Action (TCEQ CA)	3	1	0	1	0	1	0	chlorinated solvents, other
Totals:	**9**	**1**	**4**	**1**		**2**	**1**	

Table 61. Trinity Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
NPL and state Superfund	2	0	1	0	1	0	0	chlorinated hydrocarbons
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	4	0	2	1	0	1	0	chlorinated solvents, TPH, metals, VOCs, fecal coliform
LPST	38	2	24	0	1	0	11	gasoline, diesel, unknown
RCRA Corrective Action (TCEQ CA)	4	0	0	0	1	3	0	chlorinated solvents, VOCs, metals
State Sites (TCEQ MSW, IHW, ENF)	3	0	2	0	0	1	0	metals, VOCs
Oil and Gas (RRC)	8	0	0	1	4	2	1	TPH, BTEX, PSH, chloride, metals
Totals:	**59**	**2**	**29**	**2**	**7**	**7**	**12**	

Table 62. Woodbine Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	34	20	5	1	1	4	3	chlorinated solvents, BTEX, VOCs, metals, TPH, PFAS
LPST	22	2	13	0	0	0	7	gasoline, diesel, unknown
RCRA Corrective Action (TCEQ CA)	8	0	3	0	0	5	0	VOCs, chlorinated solvents, metals, BTEX, TPH
State Sites (TCEQ MSW, IHW, ENF)	2	0	1	0	0	1	0	VOCs, metals
Totals:	**66**	**22**	**22**	**1**	**1**	**10**	**10**	

Table 63. Yegua-Jackson Aquifer Outcrop Area – Summary of Groundwater Contamination Sites from the *2022 Joint Report*

Source Type	Number of *Joint Report* Sites	Status "1"	Status "2"	Status "3"	Status "4"	Status "5"	Status "6"	Example(s) of Contaminants
CERCLIS/ Non-NPL (includes TCEQ VCP, IOP, DCRP, PASI, SSDAP, WQAS, and PWS)	9	4	1	0	2	2	0	chlorinated solvents, BTEX, VOCs, SVOCs, metals, TPH
LPST	26	3	19	0	0	0	4	gasoline, diesel, unknown, jet fuel
RCRA Corrective Action (TCEQ CA)	14	1	3	2	2	6	0	VOCs, TPH, BTEX, PAH, metals, chlorinated solvents
RM (TCEQ RMD)	1	1	0	0	0	0	0	uranium, cadmium, arsenic, radium, gross alpha
State Sites (TCEQ MSW, IHW, ENF)	2	0	1	0	0	1	0	VOCs, metals
Oil and Gas (RRC)	5	0	1	0	1	2	1	chloride, BTEX, PSH, metals, chlorides
Totals:	**57**	**9**	**25**	**2**	**5**	**11**	**5**	