WATER QUALITY SUMMARY 2020

EDWARDS AQUIFER
AUTHORITY

Background

The Edwards Aquifer Authority (EAA) monitors the quality of water in the Edwards Aquifer by sampling streams, wells, and springs across the region.

The Edwards Aquifer is a karst groundwater system formed by the dissolution of limestone bedrock. Dissolution occurs as rainwater or groundwater chemically reacts with limestone. This process significantly enhances the permeability of the Edwards Aquifer by creating caves, sinkholes, and other features through which water moves. The Aquifer can be divided into three main hydrologic zones, each with distinct characteristics: perennial and intermittent streams in the Contributing Zone, rapid recharge and fast groundwater velocities in the Recharge Zone, and highly productive wells and large spring systems in the Artesian Zone.

Water quality in the Contributing Zone is affected by both rainfall and evaporation and may change rapidly in response to storm events. Similarly, water quality in the Recharge Zone can change quickly and vary significantly due to stream infiltration from the Contributing Zone, direct rainfall, and rapid groundwater velocities. However, water quality in the deep Artesian Zone is generally more stable because of slower groundwater velocities and larger volumes of water available for dilution.

How We Monitor

The Edwards Aquifer is a unique and vulnerable asset. Therefore, the EAA established a comprehensive monitoring program to assess the quality of water throughout the Aquifer system. Water quality sampling consists of "grab" samples taken from streams, wells, and springs at specific times throughout the year. Grab samples are small discrete volumes of water that represent the composition of water present at a particular site and time.

Streams are generally sampled over the Recharge Zone. The resulting data is used to monitor the quality of water entering the Aquifer. Wells located throughout the Recharge and Artesian zones are sampled to assess the quality of groundwater within the Aquifer. Samples taken at springs provide composite data on water quality across the entire Aquifer system, reflecting contributions from recharge, groundwater, and surface water. Map 1 shows the locations of sampling sites and boundaries of each hydrologic zone.

Sampling in 2020

On March 13, 2020, Texas Governor Greg Abbott declared a state of disaster due to the COVID-19 pandemic. On March 17, 2020, the EAA's General Manager Roland Ruiz adopted the Stay Home/Work Safe protocols issued by the Mayor of San Antonio Ron Nirenberg and Bexar County Judge Nelson Wolff. As a result, the remainder of the 2020 sampling plan was condensed. EAA staff collected grab samples from 28 wells and three spring groups between January and September 2020 (see Map 1). Sampling of streams was postponed to 2021. Water quality information for previous years can be accessed online at www.edwardsaquifer.org/science-maps/research-scientific-reports/hydrologic-data-reports.

The results of laboratory analysis show that high quality water enters and is produced by the Edwards Aquifer, making it suitable for a wide range of uses. Although most samples in 2020 contained no detectable contaminants, compounds of concern that were detected typically had concentrations less than their maximum contaminant levels (MCLs) established by the US Environmental Protection Agency (US EPA).

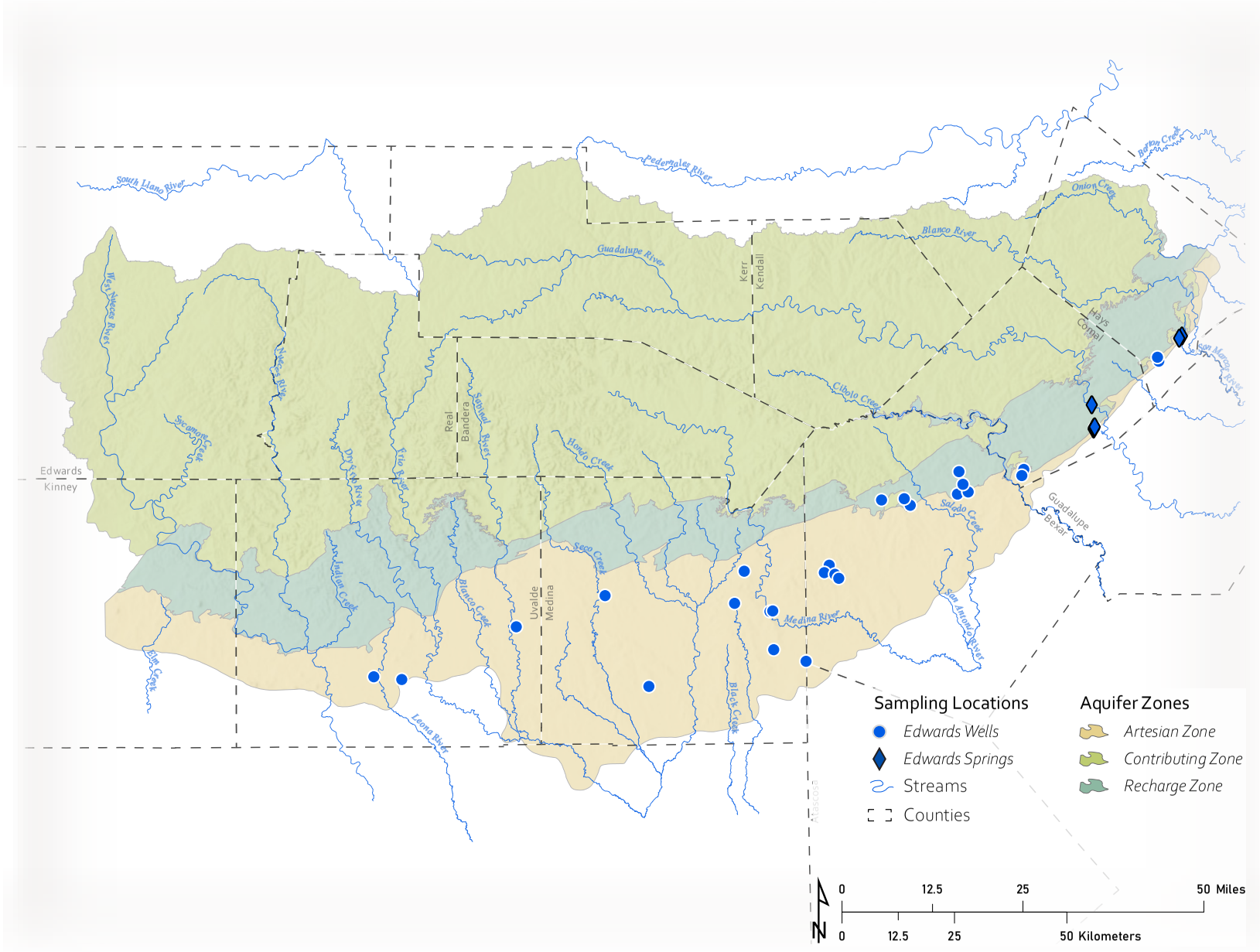
Understanding Results

Water quality samples were analyzed for bacterial (E. coli), nutrient, dissolved metal, volatile organic compound (VOC), semivolatile organic compound (SVOC), pesticide, herbicide, and polychlorinated biphenyl compound (PCB) content.

Concentrations of individual chemical compounds (analytes) are reported in micrograms of chemical per liter of sampled water (µg/L). This unit is equivalent to parts per billion (ppb). Bacterial content is reported in units of most probable number per 100 milliliters of water (MPN/100 mL), a statistically informed value produced by laboratory analysis. This unit estimates the E. coli population per 100 mL of sampled water.

Above: Exposed Edwards Limestone outcrops characterize the Contributing Zone, where streams flow overland to recharge the Edwards Aquifer.

On the cover: View at Comal Springs, showing ongoing successful habitat restoration. These conservation efforts and others ensure the long-term quality and supply of Edwards Aquifer water.



Map 1. The map shows the locations for water quality samples collected by EAA staff in 2020. The samples represent 28 wells and 3 spring groups. Samples were obtained from the Recharge and Artesian zones of the Edwards Aquifer.

Disclaimer: This map was created for demonstrative use by the Edwards Aquifer Authority (EAA) and not intended for other purposes. This map is to be used as an informational tool only.

Wells

Thousands of wells throughout south central Texas pump water from the Edwards Aquifer to support municipal, agricultural, industrial, and livestock uses. The Aquifer is well known for yielding large volumes of high quality water. In order to monitor water quality trends near these wells and across the system, a selection of wells is sampled each year. In 2020, 28 wells were sampled across the Recharge and Artesian Zones of the Aquifer.

Wells sampling

The EAA regularly participates in two interagency sampling efforts, in addition to providing sampling in support of locally focused projects. The National Water-Quality Assessment (NAWQA), a program of the United States Geological Survey (USGS), was established by the US Congress in 1991 to measure national water quality and track changes over time. As part of NAWQA, wells were constructed along the Recharge Zone in Bexar County and have been regularly sampled by both the USGS and EAA. In 2020, nine NAWQA wells were sampled by EAA staff. The EAA also participates in the Texas Water Development Board's (TWDB) groundwater quality sampling program. Like NAWQA, TWDB's sampling program monitors the quality of water in Texas aquifers through time. In 2020, 12 wells in Comal and Medina counties were sampled for the TWDB.

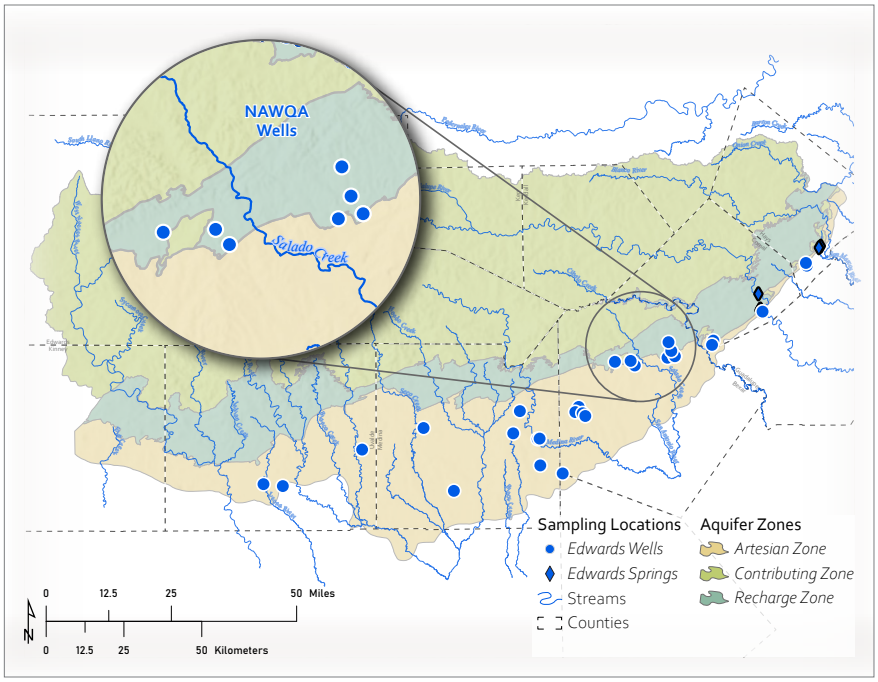
Additionally, the EAA collected water quality samples from wells throughout its jurisdiction that have been historically sampled. The overall selection of wells reflects a snapshot of the fresh Edwards Aquifer water used throughout the region. Sampled well locations are shown below in Map 2. Samples were analyzed for bacteria, dissolved metal, nutrient, volatile organic compound (VOC). semivolatile organic compound (SVOC), pesticide, herbicide, and polychlorinated biphenyl compound (PCB) concentrations.

Results of wells sampling

Since Edwards Aquifer well water is used for a variety of purposes, including household drinking water, sample results are compared to limits established in the Safe Drinking Water Act by the US EPA, which are also incorporated into the Texas Administrative Code. Maximum contaminant levels (MCLs) are legal limits on the concentrations of specific chemical compounds and are intended to protect public health. The US EPA has also established secondary maximum concentration limits (SMCLs), which are intended as guidelines for aesthetic properties such as taste and smell. Unlike MCLs, SMCLs are not binding and do not indicate health risk. In addition, several maximum contaminant level goals (MCLGs), which are non-enforceable public health standards, are listed for comparison.

Table 1 indicates the number of samples that were taken from wells and analyzed for levels of particular parameter groups. In the Edwards Aquifer wells sampled, no bacteria, dissolved metals, or nutrients were detected above their MCLs. Similarly, no chemicals in VOC, SVOC, herbicide and pesticide, or PCB groups were detected in concentrations exceeding their respective MCLs.

Figure 1 provides additional detail for individual analytes that were detected in well water samples. Bacteria, chemicals, nutrients, and dissolved metals that were detected at trace and measurable concentrations have been included. MCLs, SMCLs, and MCLGs are indicated where applicable for comparison. The VOC chloroform was detected in four samples, all below its MCLG. The dissolved metals barium, chromium, copper, lead, strontium, vanadium, zinc, and uranium were detected at concentrations ranging from trace to measurable. Many dissolved metals occur naturally in Edwards Aquifer groundwater, originating from minerals that comprise the host rock. Nitrate was detected in all samples at measurable concentrations below its MCL.



Map 2. Locations of 28 Edwards wells sampled in 2020 for water quality analysis. NAWQA wells are located in Bexar County, on the Recharge and Contributing zones. Wells sampled for the TWDB are located in Comal and Medina counties.

WELL WATER QUALITY SUMMARY, CALENDAR YEAR 2020

Water Quality Parameter Group	Number of Samples Collected	Number of Detections Exceeding Standard
Bacteria (E. coli)	15	0
Metals	28	0
Nutrients	28	0
Volatile Organic Compounds (VOCs)	9	0
Semivolatile Organic Compounds (SVOCs)	9	0
Pesticide and Herbicide Compounds	9	0
Polychlorinated Biphenyl Compounds (PCBs)	9	0

Table 1. Summary of water sampling and concentrations of analytes in seven water quality parameter groups. Results are compared to primary and secondary drinking water standards established by the US EPA and adopted by the State of Texas in Title 30 of the Texas Administrative Code, Chapter 290, Subchapter F, available online at www.sos.state.tx.us/tac/index.shtml. The complete set of water quality data used in the 2020 Water Quality Summary is available via an open records request through the EAA's Contact Us webpage www.edwardsaquifer.org/eaa/contact-us.

DETECTED ANALYTE CONCENTRATIONS IN WELLS

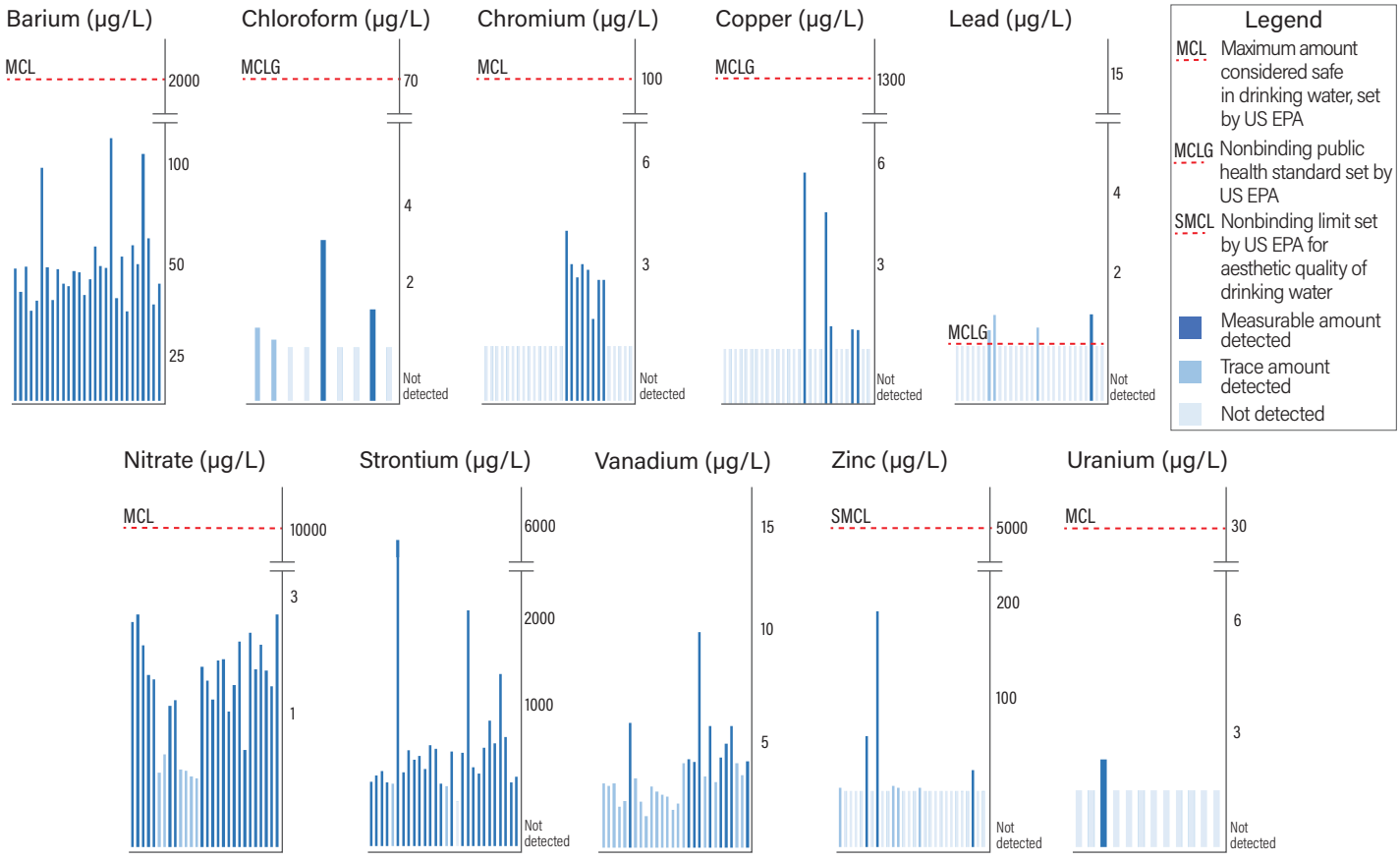


Figure 1. Barcharts of concentrations for individual analytes that had measurable detections from one or more samples.

Springs

Water that flows overland via the streams and rivers of the Contributing Zone and enters the Edwards Aquifer in the Recharge Zone emerges aboveground as numerous springs. These springs host diverse, unusual plant and animal communities and have anchored human settlements for hundreds of years. Water that is discharged at these springs is a composite of the many contributions to the Edwards Aquifer.

Seven federally listed endangered and threatened species depend on the Comal Springs and San Marcos spring systems, including Texas wild rice (*Zizania texana*) and the San Marcos salamander (*Eurycea nana*). To protect these species, the Edwards Aquifer Habitat Conservation Plan (EAHCP) implements habitat protection, springflow protection, and supporting measures in partnership with local and federal stakeholders. More information on the EAHCP is available online at www.edwardsaquifer.org/habitat-conservation-plan. Hueco Springs is located on the banks of the Guadalupe River, near Comal Springs. All three spring systems emerge in outcrops of the Edwards Limestone.

Springs sampling

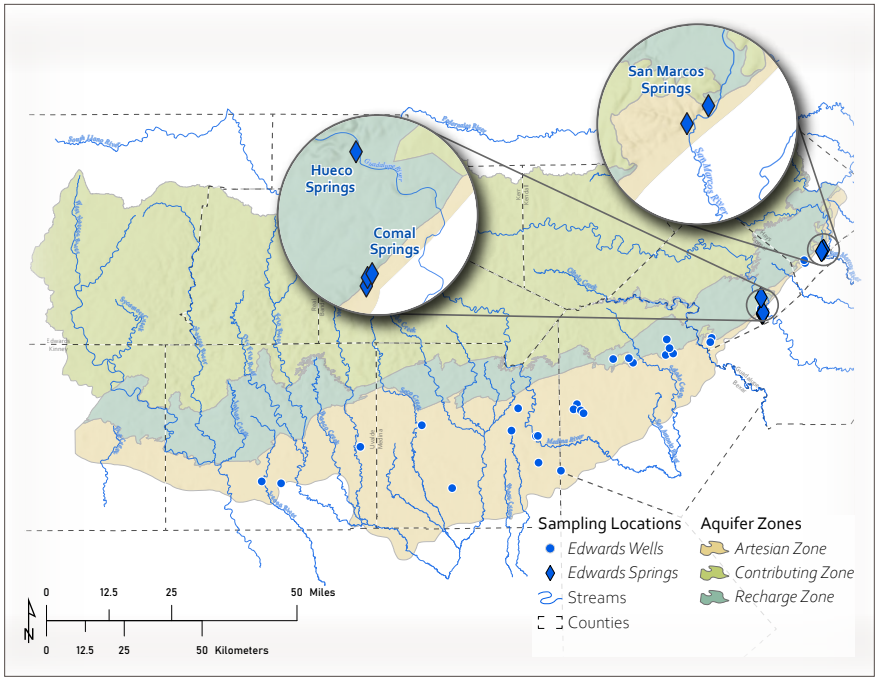
These three spring systems throughout the EAA's jurisdiction were sampled in 2020. A total of six samples were analyzed for bacterial (E. coli), nutrient, and dissolved metal concentrations. Biannual sampling is expected to resume in 2021.

Results of springs sampling

Table 2 indicates the number of samples that were taken from springs and analyzed for levels of particular parameter groups. No bacteria, dissolved metals, or nutrients were detected above their MCL.

Figure 2 provides additional detail for individual analytes that were detected in spring water samples. Dissolved metals and nutrients that were detected at trace and measurable concentrations have been included. Measurable but low concentrations of nitrate were found in all six samples. One sample contained a measurable detection of E. coli, below its contact recreation standard (CRS) established by TCEQ. The dissolved metals barium, strontium, and vanadium were detected at concentrations ranging from trace to measurable. These dissolved metals frequently originate from minerals in the limestone host rock.

Above: Hydrologic Coordinators Jesse Chadwick and Taylor Bruecher collect water quality samples from San Marcos Springs in September 2020. To ensure safety during the COVID-19 pandemic, staff wore masks, practiced social distancing, and utilized separate vehicles while performing fieldwork. Well and spring sampling was limited to essential monitoring locations, while streams sampling was postponed to 2021.



Right: Map 3. Comal Springs feeds the Comal River, which winds through New Braunfels' Landa Park into the Guadalupe River. Nearby Hueco Springs also flow into the Guadalupe River. The San Marcos Springs are the headwaters of the San Marcos River, which flows through Texas State University and San Marcos City Park.

SPRING WATER QUALITY SUMMARY, CALENDAR YEAR 2020

Water Quality Parameter Group	Number of Samples Collected	Number of Detections Exceeding Standard
Bacteria (E. coli)	3	0
Metals	6	0
Nutrients	6	0

Table 2. Summary of springs sampling and concentrations of analytes in three water quality parameter groups. Results are compared to contract recreation standards (CRS) as published in Texas Water Quality Standards (Title 30, Chapter 307 of the Texas Administrative Code), available online at www.tceq.texas.gov/waterquality/standards/2014standards.html. The complete set of water quality data used in the 2020 Water Quality Summary is available via an open records request through the EAA's Contact Us webpage www.edwardsaquifer.org/eaa/contact-us.

DETECTED ANALYTE CONCENTRATIONS IN SPRINGS

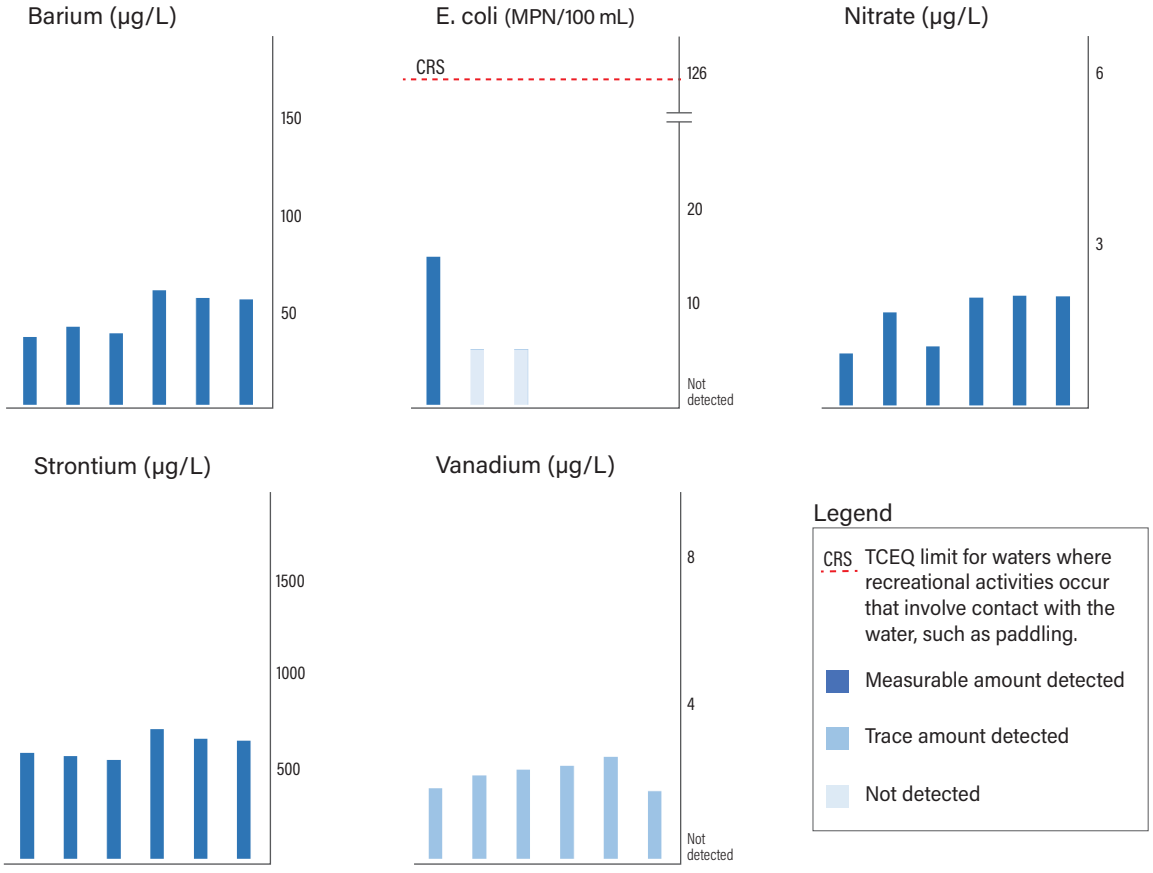


Figure 2. Barcharts of concentrations for individual analytes that had trace or measurable detections from one or more samples.

Summary

The EAA's sampling program provides data about the quality of water entering the Aquifer from surface streams, groundwater moving through the Aquifer, and the composite water that emerges at springs. The results of laboratory analysis for concentrations of bacteria, nutrient, dissolved metal, VOC, SVOC, pesticide, herbicide, and PCB compounds reveal that high quality water is present throughout the Edwards Aquifer system. Most water sampled from streams, wells, and springs did not have detectable levels of contaminants. Concentrations of dissolved metals were generally low and attributed to natural sources. In springs, bacterial detections were likely caused by contamination from stormwater runoff and non-point sources.

Overall, the Edwards Aquifer produces some of the highest quality groundwater in the State of Texas. The EAA will continue to monitor water quality of the Contributing, Recharge, and Artesian Zones in its mission to manage, enhance, and protect the Edwards Aquifer.

Resources

Edwards Aquifer Habit Conservation Plan: https://www.edwardsaquifer.org/habitat-conservation-plan/

Edwards Aquifer Hydrologic Reports: https://www.edwardsaquifer.org/science-maps/research-scientific-reports/hydrologic-data-reports/

Edwards Aquifer Open Records Request: https://www.edwardsaquifer.org/eaa/contact-us/

EPA Drinking Water Standards: https://www.epa.gov/dwreginfo/drinking-water-regulations/

National Water-Quality Assessment (USGS): https://www.usgs.gov/mission-areas/water-resources/science/national-water-quality-assessment-nawqa/

TCEQ Contact Recreation Standards: https://www.tceq.texas.gov/waterquality/standards/2014standards.html/

Texas Administrative Code: https://www.sos.state.tx.us/tac/index.shtml/

Texas Water Development Board groundwater quality sampling program: http://www.twdb.texas.gov/groundwater/data/index.asp/

Spotlight on Chloroform

Chloroform is a manmade volatile organic compound (VOC) that is part of the trihalomethane group. It is often observed as a byproduct of water disinfection. The EPA regulates total trihalomethanes in drinking water, but does not have an enforceable limit set for chloroform.

This year, chloroform was detected in four samples from wells in northern Bexar County. Two wells contained trace levels and two additional wells contained measurable levels. However, all of these detections fell below the EPA's nonenforceable goals for public health. Sampling for VOCs is part of the EAA's ongoing water quality monitoring efforts. Additional information about chloroform and trihalomethanes can be found on the EPA's website for primary drinking water regulations: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations/

Clockwise from top left: View of the Hill Country near Seco Creek, in the Contributing Zone. Array of sample collection containers. Clear, cool water at Comal Springs. Portable pump used to sample water from wells. Deep pool in the Nueces River.

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