Clearwater Source

Clearwater Underground Water Conservation District

www.cuwcd.org

2020 Annual Newsletter | December 2020 | Volume 16, Issue 1

Upcoming TWDB Projects

The TWDB contracted with LRE Water, WSP, Thornhill Group, and Michelle Sutherland to improve the current estimated historical volume, location, and timing of groundwater pumpage from the Pecos Valley Aquifer, Edwards-Trinity (Plateau) Aquifer, Trinity (Hill Country) Aquifer, Edwards (Balcones Fault Zone) Aquifer (located south of the Colorado River), and the Lipan Aquifer. The TWDB also contracted with WSP, LRE Water, IRP Water, and Dr. Raghavan Srinivasan to develop estimates of recharge and stream baseflow conditions (or groundwater-surface water interactions) for the same aquifers, except the Lipan, and study area. The study area for these projects includes portions of 56 counties (Figure 1), 35 conservation districts (Figure 2), eight groundwater management areas (Figure 3), and five regional water planning areas (Figure 4).

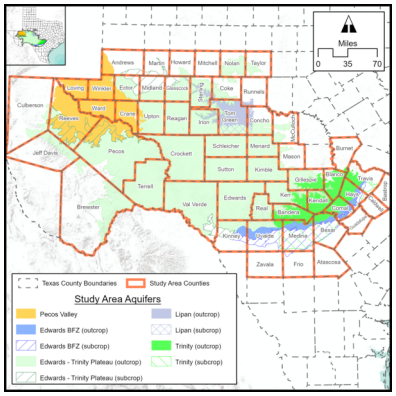


Figure 1. Study area map illustrating the counties and aquifers included as part of this project.

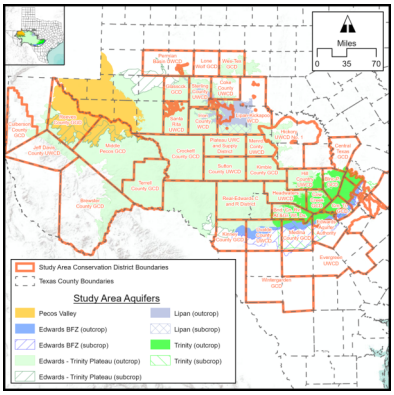


Figure 2. Study area map illustrating the conservation districts and aquifers included as part of this project.

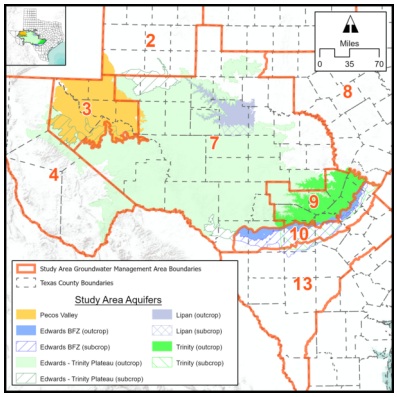


Figure 3. Study area map illustrating the groundwater management areas and aquifers included as part of this project.

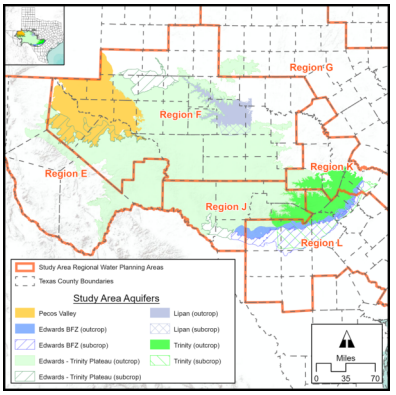


Figure 4. Study area map illustrating the regional water planning areas and aquifers included as part of this project.

Clearwater UWCD Expresses Deep Concerns

The Texas Water Development Board (TWDB) recently contracted and will pay ***$650,000*** with the following very credible geoscience consultants (LRE Water, WSP, Thornhill Group, and Michelle Sutherland) to improve their knowledge by determining: *the current estimated historical volume of pumping from the aquifers, location of wells in the prescribed aquifers, and timing of groundwater pumping from the aquifers.*

The study is looking at specifically the following aquifers: Pecos Valley Aquifer, Edwards-Trinity (Plateau) Aquifer, Trinity (Hill Country) Aquifer, Edwards (Balcones Fault Zone) Aquifer, and the Lipan Aquifer.

The TWDB also contracted, spending an additional $650,000, with geoscience consulting firms and individual consultants (WSP, LRE Water, IRP Water, and Dr. Raghavan Srinivasan) to develop estimates of recharge and stream baseflow conditions (or groundwater-surface water interactions) for the same aquifers in the same study area. The study area for these projects includes portions of 56 counties, 35 conservation districts, but does not include Bell, Williamson and northern Travis Counties nor the jurisdiction of Clearwater UWCD (Figure 1.).

It is clear that the TWDB in hiring a group of superior geoscientists, missed the boat by failing to include the highest growth counties along IH35 in the United States pumping collectively more than *50,000* ac-feet of groundwater a year. This must mean the TWDB lacks the same sense of urgency Clearwater's Constituents have for Groundwater Assessment in and around our backyard. Spending *$1.3 million* and to not incorporate those Counties and following a decade of drought thus unforeseen depletions is simply not defendable.

Dirk Aaron, General Manager
Clearwater UWCD

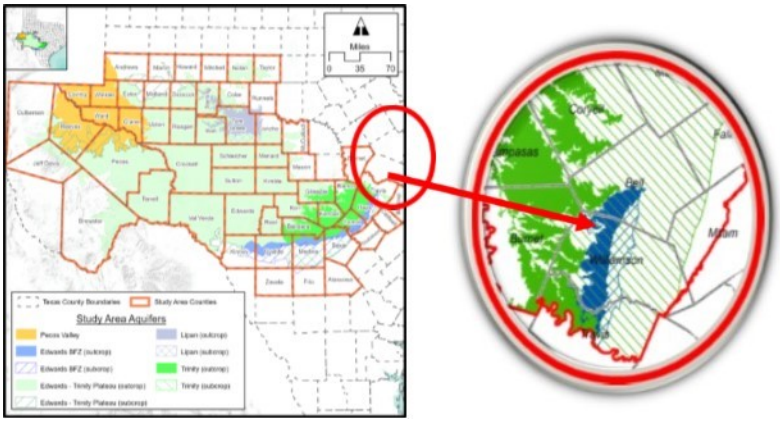


Figure 1. Study area map illustrating that Clearwater UWCD, Bell Country, Williamson County and Northern Travis County are not included with the other conservation districts and counties .

Board of Directors

Leland Gersbach - Precinct 1
2013-Present (President)

Jody Williams - Precinct 3
2018-Present (Director)

Gary Young - Precinct 2
2014-Present (Secretary)

Scott Brooks - Precinct 4
2018-Present (Director)

David Cole - At large
2013-Present (Vice-President)

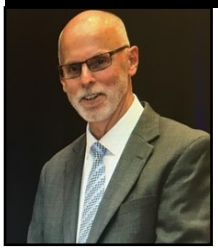
Mission Statement

To implement an efficient, economical, and environmentally sound groundwater management program to protect and enhance the water resources of the District.

Water Quality Screening

The District's in-house lab offers registered well owners free screening for common constituents and bacteria. Annual screening is recommended.

Williamson and Northern Travis Counties Combined Used 13 Billion Gallons of Groundwater in 2019



Clearwater Underground Water Conservation District canceled the 20th Annual Water Bell County Water Symposium planned for November this "The Year of COVID", but the 20th will occur in the fall of 2021 in Killeen at the campus of Texas A&M University - Central Texas. The theme will be related to "Best Available Science" and the need for policy to align with such local discernment.

The most recent studies conducted by Clearwater addressed many of the unknowns concerning the depletion of artesian pressure in the Trinity Aquifer in the most southwestern portions of our county. Our own State Senator Dawn Buckingham, Representative Brad Buckley and Representative Hugh Shine carried legislation in both the house and senate two years ago to simply have the State fund a study to determine if the aquifer system is sustainable in Bell, Williamson and Northern Travis Counties. The proposed legislation failed, even though the Texas Water Development Board testified that their current data was from 1999 and needed to be updated. The bill would have provided less than $200,000 to accomplish the necessary studies. This issue has been discussed in a collaborative effort with our legislators and the county judges and commissioners of both Bell and Williamson Counties. When our concerns got nowhere last session because of opposition and fear from the leadership to the south, that the true pumping numbers would see the light of day, Clearwater was justified in funding parts of the necessary science ourselves. Thanks to our legislators we have been able to keep the concerns of our well owners in the forefront. Yes, the counties to the south use more than **42,000-acre feet** of groundwater per year from the Edwards BFZ and Trinity aquifers.

The following studies quantify the groundwater use and validate the concerns:

1) Evaluation of Groundwater Pumping in Travis & Williamson Counties
The above study validates two issues: 1) Pumping from the Middle Trinity at current levels in both Bell and Williamson Counites is of major concern and 2) the concern of our Board of Directors is that Williamson County being unmanaged (meaning they have no groundwater district) is justified. This has been a hot issue at the Capital this last session, but now is the time to talk, discuss, and move forward with shared resolutions. The study shows the two counties to the south used a combined amount of more than ***42,000 acre feet of groundwater in 2019 (or more than 13 billion gallons).*** Compare that to Bell County's use from the same two aquifer systems, we used ***5,662-acre feet in 2019 (or 1.8 billion gallons)***. The study proves that we cannot sustain our aquifer system with this kind of production to the south which is more than 7 times larger than our production in Bell County.

2) Drawdown Analysis of the Local Middle and Lower Trinity Aquifers in Bell, Travis and Williamson Counties validates that extreme declines continue at nearly ***10 feet per year*** and if the trend continues, pumps will likely have to be lowered in wells with water levels reaching the top of the aquifer in about 30 years in some of the higher developments in the areas to the west of I35. These declines are illustrated in monitoring wells shown on the map prepared in 2019 in figure 2 below. In northwestern Williamson County, the Middle Trinity aquifer water levels are near the top of the aquifer. Landowners in this area have reported difficulties accessing groundwater from the Middle Trinity. It is likely that many well owners will soon, if they do not already, have pumps set near the bottom of their wells and will have to adjust to limited groundwater availability or find alternative water supplies. Conditions in the Lower Trinity are better than in the Middle Trinity, but it is a somewhat more expensive alternative that may not exist in some areas due to the unknown structure and challenges to drilling. A robust risk assessment is in-order and must first be evaluated by landowners before expending resources before drilling.

Clearwater UWCD, Board President, Leland Gersbach stated that Clearwater is a leader in fostered local collaboration and opened the 2019 Water Symposium by focusing on the biggest issue in our region and that is that "***Water will be what moves us forward or holds us back.***" Once we completed the above mentioned studies, it's apparent that local groundwater resources are being unfairly withdrawn from our shared aquifer systems.

Dirk Aaron, General Manager
Clearwater UWCD

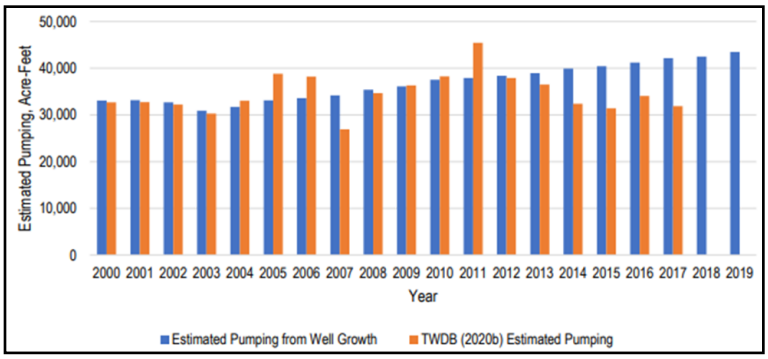


Figure 1. Travis and Williamson counties estimated groundwater pumping from the Edwards BFZ, Trinity and other aquifers.

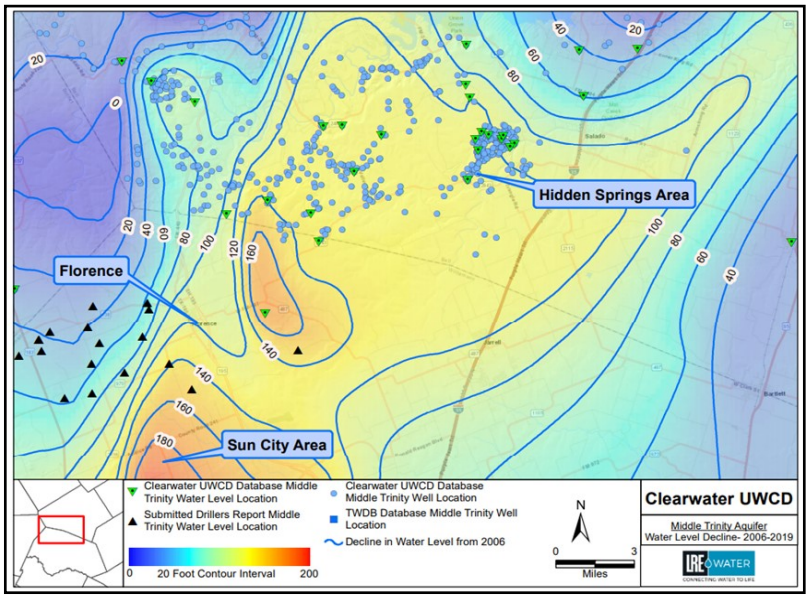


Figure 2. Middle Trinity Aquifer water level declines since 2006.

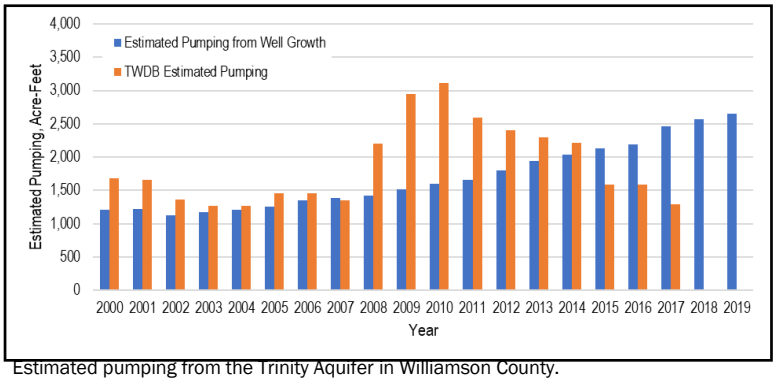
New Organization Focuses on Quarry Operations

Limestone quarry operations continue to expand along the I-35 Corridor from San Antonio area to Bell County, and beyond. Also, increased fracking has led to numerous new sand mining operations along several watersheds in Texas. These quarry and mining operations are not currently subject to the Texas Railroad Commission rules imposed on lignite and uranium mines. During the 2019 legislative session, various citizen groups supported proposed legislation to strengthen regulation of these activities (called Aggregate Production Operations, or APOs). In late 2019, these groups joined together to form Texans for Responsible Aggregate Mining (TRAM). This coalition, comprised of 15 member groups covering 32 counties and about 42% of the TX population across the state, seeks to work with lawmakers, state agencies, and industry operators to create statewide standards (Best Management Practices) for APOs, and to adopt those standards into law. During October, TRAM actively participated in public hearings held by the House Interim Committee on APOs, whose report is expected by year end. Although TRAM focuses on a range of issues including air quality, noise, light, and buffer zones for blasting, TRAM's key issues also include

(continued on page 7)

Evaluation and Estimation of Groundwater Pumping

The amount of pumping from an aquifer can be one of the least understood stresses on a groundwater system but we can easily observe its impacts as changes in water level. Within Bell County, pumping is reasonably well known thanks to the management efforts by Clearwater UWCD. However, south of Bell County reported pumping is less reliable and has a higher degree of uncertainty. As such, we must rely on other data to evaluate the pumping data and inform our estimates of how pumping may have changed over time.



Estimated pumping from the Trinity Aquifer in Williamson County.

To assist the District in understanding the amount of pumping to the south of Bell County, we evaluated groundwater production relative to the number of completed water wells. While published pumping estimates showed decreasing use in some areas and aquifers, the number of wells consistently increased suggesting pumping should also be increasing or at least relatively stable. For example, when looking at the Trinity Aquifer in Williamson County, our analysis suggests that the Texas Water Development Board (TWDB) data may underestimate pumping for recent years.

Recently, we started a project supporting TWDB groundwater modeling efforts for aquifers extending from west to central Texas. This project involves applying many of the same methods we used to evaluate pumping data and develop estimates of pumping for Williamson and Travis counties. The experience we gained working with Clearwater UWCD was invaluable to supporting the efforts of the TWDB to accurately simulate pumping in future groundwater model updates.

Mike Keester, Senior Project Manager/Hydrogeologist
LRE Water

Update on Receding Middle Trinity Wells in Southwest Bell County

In Volume 14, Issue 1 of this newsletter (published in October 2018), I shared with readers my personal story of dealing with a troubled well in the Middle Trinity aquifer in southwest Bell County, and how those troubles were the impetus for my becoming a District Director. In this issue, I would like to give readers an update on the situation.

In the two years since that article was written, a lot of activity has occurred due to those well troubles some of us have experienced or are currently experiencing. Many of us are lowering or have lowered our pumps, if we are lucky enough to be able to do so, and some of us are having to give up on our wells altogether because they are no longer viable. Personally, the water level in our home's well continues to steadily drop, and as a result, we have begun building a rainwater collection system to eventually replace the well when it becomes no longer viable (likely in the next few years, if the trend of the last 8 years continues.)

Since my last article, in which I asked for well owners to report troubles to Clearwater staff, many of you have done so, and we thank you for taking time to do so. In addition to the data provided by well owners, your District has invested wisely in gathering additional data to better understand the problem. These additional data were developed by three consultants contracted by the District, and soon they will be collaborating to put it all together in a coordinated attempt to understand the uniqueness of the Middle Trinity aquifer in southwest Bell County. For more information on that effort, please refer to Mike Keester's article in this issue.

One of the efforts by the District consulting team of Allan R. Standen LLC and Michelle A. Sutherland LLC involved examining existing well driller's reports for data to add to the District's 3-D model of the aquifer. After adding these data to the model, something unusual was detected in southwest Bell County. Although much work is still needed to understand the situation, it appears as though two previously-unknown faults exist in this area. These faults may likely explain why this region's groundwater conditions are so different from the conditions just a few miles away.

It is still going to take some effort to understand all the new data that the District has received after investing in the scientific collection and analysis of new data. Our consultants' work will eventually yield a more complete understanding of the aquifer conditions using the scientific process. After a more complete scientific understanding is revealed, your Board will then begin the process of refining the policies of the District in order to better manage this most precious of resources, so that the needs of all the users of groundwater in the District can be realized for generations to come.

Scott Brooks, P.E., Director Pct. 4
Clearwater UWCD

Springshed Delineation for the Downtown Salado Spring Complex

This study focuses on the Downtown Salado Spring Complex (DSSC) to identify important recharge zones which will support groundwater management efforts and help protect the aquifer. Synoptic water-level measurements collected in 2010, 2013, and 2019 by CUWCD were used to hypothesize a springshed for the DSSC. Due to flow path variability characteristic of karst aquifers, the synoptic maps were analyzed in conjunction with groundwater chemistry.

Water samples were collected from springs and wells and analyzed for the major ions. The water chemistry patterns confirm interpretations made from the estimated springshed. Calcium-bicarbonate water was found in the aquifer outcrop within the springshed and sodium-bicarbonate water was found from a well outside of the springshed (Figure 1). These results indicate the deeper, confined aquifer does not contribute to groundwater discharging at the DSSC. However, in a karst aquifer the springshed boundaries may not include all the contributing flow paths.

Clara Smith-Salgado, Master's Student, Baylor University
Stephanie Wong, Doctoral Student, Baylor University
William Anderson, Intern, Clearwater UWCD
Dr. Joe C. Yelderman, Jr., P.G., Professor of Geology
Baylor University

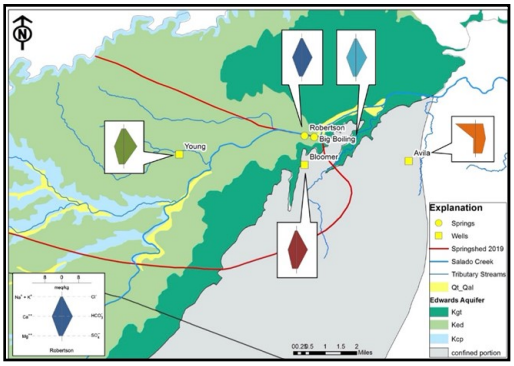


Figure 1. Hypothesized springshed to the Downtown Salado Spring Complex with ionic chemistry of the springs and selected wells displayed with Stiff diagrams.

Interactive Tool for Evaluating Aquifer Status

In 2014 the Clearwater UWCD began looking at their monitoring data in a new way to ultimate visualize data Clearwater wanted a scientific tool to better understand how the monitoring data they were collecting correlated to the desired future conditions for the aquifers and to improve communication of the status of the managed aquifers.

What began as a spreadsheet tool has evolved into an interactive web-browser based tool that provides a visual representation of measured water levels for the Upper, Middle, and Lower Trinity aquifers in Bell County.

Currently, the tool analyzes water-level data collected at District monitoring well locations in these aquifers to assess and visually represent the current groundwater conditions relative to the desired future conditions. LRE Water is excited about updates to the tool in 2021 to incorporate water-level data for the Edwards (BFZ) Aquifer and water quality data from all of the managed aquifers.

Just a few examples of the tool's illustration capabilities are in the few figures.

Micaela Pedrazas, Hydrogeologist
LRE Water

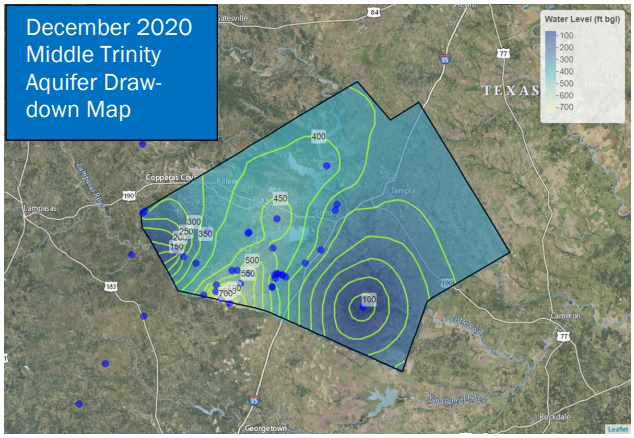


Figure 1. The tool has the ability to generate in an automated fashion, Drawdown Maps of the Middle Trinity Aquifer on December 4, 2020. Well owners can then better understand the trends per this visualized in their region, neighborhood and source aquifer.

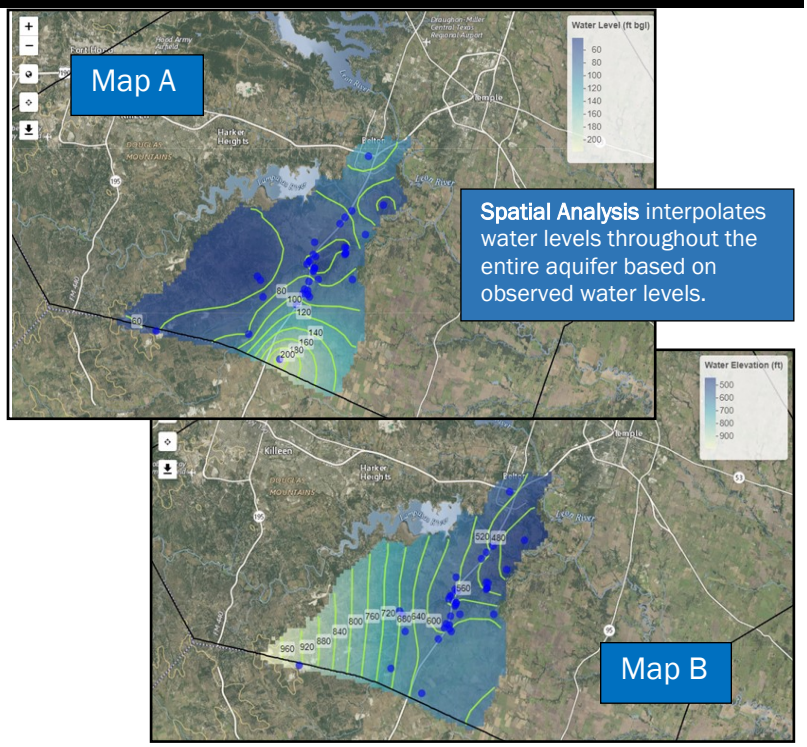


Figure 2. These maps illustrate the water levels of the Edwards BFZ Aquifer. Map A is a drawdown map and Map B is a synoptic water level map showing the flow direction of the Springs of Salado.

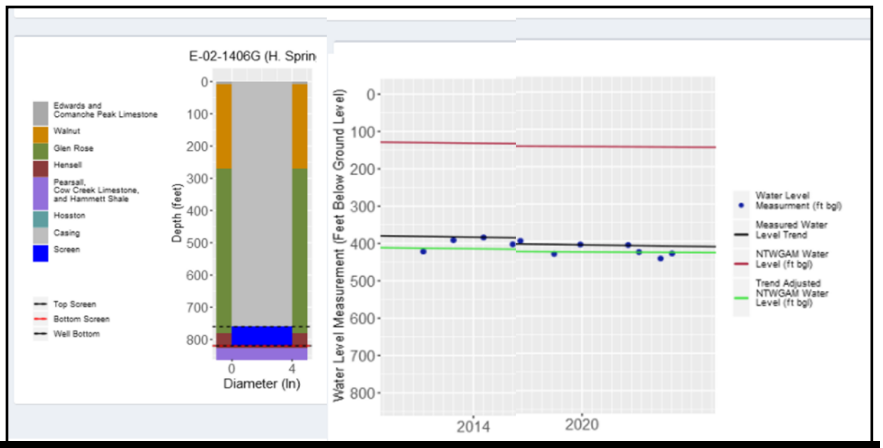


Figure 3. Illustrates the tool's ability to visualize specific monitor wells while comparing real time data with modeled data (GAM) and seeing the trends as we look toward Desired Future Conditions (DFC).

Monitoring, Surveys, and Education in the Middle Trinity Aquifer

Acoustic water level monitoring devices were installed almost 2 years ago on several domestic pumping wells in the Middle Trinity aquifer in Bell County. Shortly after the devices were installed, questionnaires that addressed water management opinions were distributed to well owners using the Middle Trinity aquifer. The average water levels from these devices were shared bi-weekly with selected well owners and a follow-up questionnaire was distributed after a seasonal pumping period. The monitor devices showed a strong seasonal drawdown that did not appear to recover to previous levels resulting in a long-term groundwater decline trend (Figure 1). The pattern from the average levels monitored by the acoustic devices in the active domestic wells was more detailed than the quarterly designated monitor well, but the patterns were generally similar. The results of the questionnaires are currently being analyzed to assess potential applications for this type of monitoring.

Will Brewer, Doctoral Student, Baylor University
Dr. Joe C. Yelderman, Jr., P.G., Professor of Geology
Baylor University

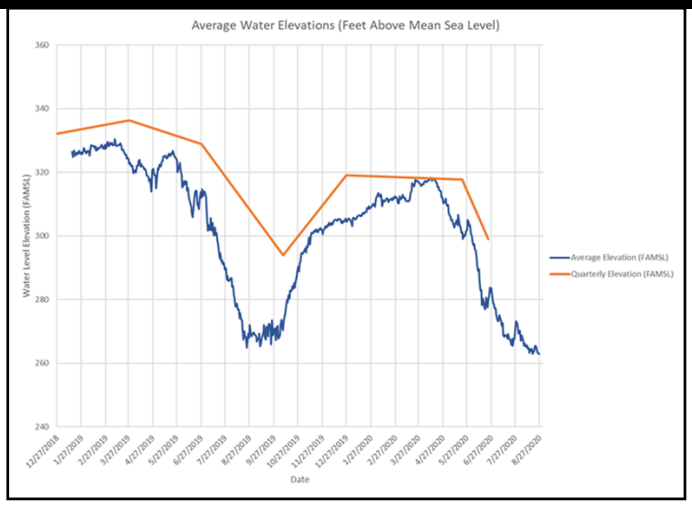


Figure 1. Average water levels from six nearby acoustic monitoring devices in the Middle Trinity aquifer exhibiting a strong seasonal drawdown pattern that did not recover to previous levels.

Groundwater Conservation Districts FAQs

What is a Groundwater Conservation District?

GCDs are political subdivisions of the state created to protect and balance private groundwater interests with the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and the control of subsidence caused by withdrawal.

What does a GCD do?

Establish rules for the spacing and drilling of all water wells
Consider and permit non-exempt water wells
Maintain records of non-exempt wells in a district
Submit management plans to Texas Water Development Board for approval
Collaborate regionally in joint planning for the establishment of DFCs
Collect water level and water quality data on aquifers
Educate stakeholders on water conservation
Work to prevent harm to the aquifer due to pumping or contamination

How do GCDs allocate their budgets?

Education & Outreach
Science & Research
Operations
Conservation
Regional Planning

How many GCDs are there in Texas?

Currently, there are **98** GCDs plus 2 subsidence districts.

What rules must a GCD follow?

GCDs are governed by Chapter 36 of the Texas Water Code. As political subdivisions of the state, they are also subject to Chapter 49 of the Texas Administrative Code. Based on the rules established by the State, each GCD creates policies to accomplish the goals of their District.

Do I have to register my well with my GCD?

Yes, state law requires all wells to be registered with the GCD. This does not mean that all wells require a permit. All domestic wells and livestock wells that produce less than 25,000 gallons per day are exempt from permits. A GCD has the ability to exempt others in their rules.

More GCD FAQs

What is a management plan?

A management plan outlines a GCD's goals and course of action to achieve those goals. The management plan is submitted to TWDB for approval, and rules necessary to implement the management plan are adopted by each district.

What is a Desired Future Condition?

The desired future condition is a metric that is established during the joint planning process by GCDs in a common Groundwater Management Area (GMA). The DFCs provide for consistency in groundwater management in the GMA and a balance between groundwater protection and production.

How are GCDs funded?

GCDs are funded through property taxes, permitting fees and/or usage fees.

Groundwater Terms

Aquifer

An underground geological formation able to store and yield water in useable amounts. Aquifers in Texas can consist of sand, gravel, limestone, granite, and many other rock types that have pores or spaces for water to pass through.

Aquitard

An aquitard, or confining layer, is a zone within the earth that restricts the flow of groundwater.

Total Dissolved Solids (TDS)

TDS refers to the total concentration of dissolved constituents in solution. A TDS level of less than 1000 ppm is often considered freshwater, although many Texans' drinking water has a higher TDS.

Cone of Depression

A cone of depression is a conically shaped area of decreased water level (or pressure) that occurs when water is withdrawn from an aquifer. If wells are too close to each other, these cones may overlap and cause interference resulting in abnormally low water levels in those wells. In areas that withdraw more water than is recharged or flows to that area, a semi-permanent regional cone of depression may occur.

Abandoned Wells & Water Quality

There is a high environmental risk associated with abandoned or deteriorated wells, as they are a direct conduit from the surface to our groundwater resources. Because of this risk, it is highly recommended to have abandoned or deteriorated wells plugged. Some GCDs have have established programs to assist landowners in plugging abandoned wells.

How often should I have my well water tested?

It is recommended that well owners have their water professionally tested annually or when an observed change in water quality occurs.

Who can disinfect my well water?

It is recommend to contact a licensed water well driller or a pump installer to professionally disinfect your well.

Water Quality and Quantity in our Homes and Community

In 1995 the Texas Legislature consolidated groundwater conservation law into Chapter 36 of the Texas Water Code. The groundwater conservation districts (GCD), were created under Chapter 36 for the conservation, preservation, protection, recharging and prevention of waste of groundwater. Clearwater Underground Water Conservation District (CUWCD) was established in 1989, approved by voters in 1999 and opened its doors in 2002.

The Power & Duties of All GCDs:

Chapter 36, Texas Groundwater Code - All GCD's are obligated to develop and enforce rules to conserve and protect the ground water within its jurisdiction. A District must:

- Consider all groundwater uses and needs,
- Develop rules that are fair and impartial,
- Consider groundwater ownership rights,
- Consider the public's interest in conserving groundwater,
- Consider and set goals in a management plan.

Hidden Springs Community, Your Water Quality and Quantity are Critical Issues and Concerns

I am a property owner in the Hidden Springs subdivision and the Elected Director thus a member of the Board of Directors of Clearwater Underground Water Conservation District representing Precinct 2 of Salado and the Hidden Springs area.

The Hidden Springs subdivision contains approximately 326 lots and presently around 200 homes have been built. The last count showed 185+ wells of which draw from either the Edwards BFZ Aquifer or the Trinity Aquifer with an estimate of 50 to 85 wells to be added. As a property owner and Director, I am very focused and committed to protect all ground water rights and consider all groundwater uses and needs to maintain water quality and quantity.

A Critical Habitat – A Bell County Concern

In 2012 the US Fish and Wildlife Service (FWS) was challenged in a lawsuit (Center for Biological Diversity Case 1:19–cv-01607). The FWS was supposed to list proposed critical habitat. When FWS did not meet the agreed timeline a second lawsuit was filed (Center for Biological Diversity Case 1:19-cv-0167-KBJ). While the Salado salamander was listed as "threatened" in 2014, a critical habitat was never finalized. Since 2012, in its capacity as the local ground water regulator in Bell County, Clearwater (CUWCD) has taken on the role of repository of best available science. Clearwater together with the Bell County Adaptive Management Coalition (The Coalition) has funded a significant research campaign over a seven year period and the completion of a five year Salado Salamander Monitoring Study. This Coalition also includes a three phase comprehensive investigation seeking to better understand geo-hydrology of the Salado Springs Complex as it relates to the Salado Salamander. The combined effect of the Coalition efforts to designate a "Critical Habitat" for the Salado Salamander is unnecessary and not prudent. The Coalition along with the FWS and other stakeholders are submitting comments in response to this law suit. Our comments simply put are: "*The critical habitat designation currently proposed should not be adopted, as it results in unnecessary and burdensome designations in areas of Bell County that are being successfully managed by the District to support the stability of the Salado salamander. The proposed designation is based on science that cannot be supported.*

My Dear Friends and Neighbors the year 2020 has been incredibly challenging starting with the legislature, then federal regulatory challenges and compounded by COVID 19. Please know that as your elected Director, I stand firm on in Clearwater's commitment to protect and preserve groundwater availability and quality water.

C. Gary Young, Director Pct. 2
Clearwater UWCD

Towards Understanding Groundwater Flow with Isotopes and Dissolved Gases

Managing groundwater in complex karst terrain like the Northern Segment of the Edwards BFZ aquifer requires the use of multiple tools, methods, and avenues of investigation. Researchers at Baylor University have been working with CUWCD and the TWDB using isotopes of ^{2}H and ^{18}O, ^{3}H and ^{14}C as well as refrigerant gases of CFCs an SF_6 found in precipitation (Figure 1). The methods associated with these constituents can help detect interactions between groundwater and surface water as well as approximate apparent groundwater ages. Although the results of these studies have not been finalized, the preliminary interpretations support the inferences in other work by Clara Smith-Salgado and Stephanie Wong. Apparent groundwater ages are generally youngest in the Edwards outcrop west of Salado Creek, older near the unconfined/confined transition zone and oldest in the deeper confined portion of the aquifer. Both isotopes and dissolved gases indicate surface water contributions to the aquifer below Stillhouse Hollow Reservoir.

Figure 1. Will Anderson (CUWCD intern) in foreground with Will Brewer and Stephanie Wong sampling springs below Stillhouse hollow Reservoir for CFCs and SF_6 refrigerant gases.

Will Brewer, Doctoral Student, Baylor University
Clara Smith-Salgado, Master's Student, Baylor University
Stephanie Wong, Doctoral Student, Baylor University
Dr. Joe C. Yelderman, Jr., P.G., Professor of Geology
Baylor University

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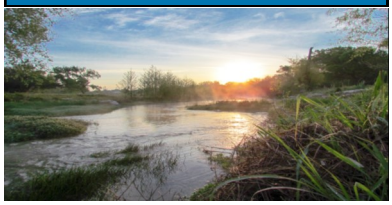
water supply and water quality. TRAM supports rules which would require APO groundwater supplies to meet the same regulatory criteria required for real estate developers, or to meet the requirements for lignite mines, including assessment of cumulative regional groundwater impacts of mining and other developments. TRAM supports creation of a Priority Groundwater Management area along the I-35 Corridor to focus on Edwards and Trinity Formation aquifers, including counties which do not have a groundwater conservation district. TRAM is currently preparing its advocacy plans for the upcoming 87th Texas Legislature.

Jim Brown, TRAM's Hydrology Advisor
Clearwater UWCD WellIntel Program Participant

Clearwater Underground Water Conservation District
Every drop counts!
P.O. Box 1989
Belton, TX 76513



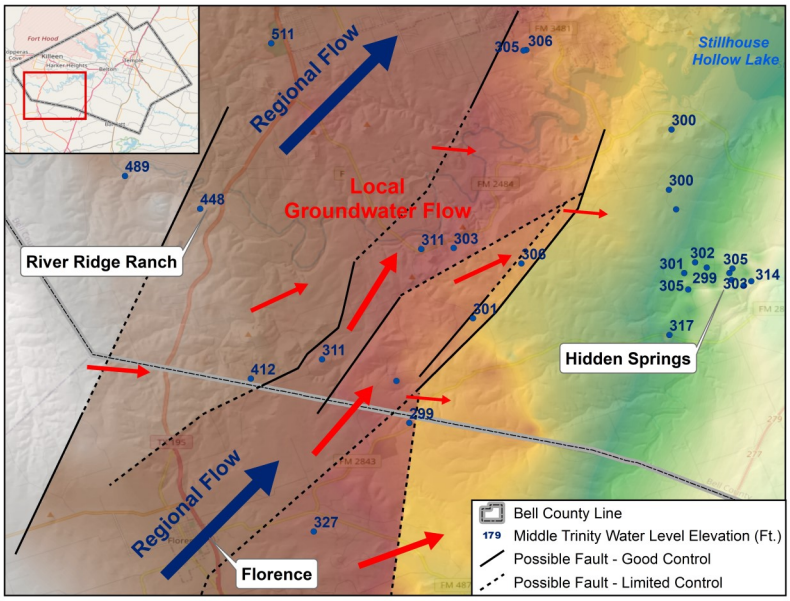
Developing a Conceptual Model for Groundwater Flow in Southwest Bell County

Over the last decade, landowners in Southwestern Bell County have observed local water level declines of over 100 feet in their wells. To address this public concern, Clearwater UWCD has invested in several studies aimed at understanding the Middle Trinity Hensell and Lower Trinity Hosston aquifer systems in this portion of the county. This has included the development and maintenance of the Clearwater 3D hydro-stratigraphic model.

Earlier this year Allan R. Standen, LLC completed a substantial update to the 3D hydro-stratigraphic model where an emphasis was placed on the subsurface geology in this area. Key findings from this update included identifying the Middle Trinity, Cow Creek Limestone as a possible aquifer below the Middle Trinity Hensell in western-southwestern Bell County and the identification of probable subsurface fault offsets impacting groundwater flow within the Middle Trinity Aquifer.

During September 2020, the Clearwater UWCD contracted Allan R Standen, LLC to expand on these findings. This new research will include a detailed review of all available water well driller reports and geophysical logs in an expanded study area to evaluate to what extent the underlying geology is a factor for these water level declines. This research will be completed in late 2020 and is part of a collaborative effort between Clearwater UWCD consultants and Baylor Geologic Studies to better understand the aquifer systems in Southwestern Bell County.

Vince Clause, Hydrogeologist
Allan R. Standen, LLC



Draft conceptual model framework for the Middle Trinity Aquifer in SW Bell County with possible fault/structural controls and grouwndwater flow paths.

Collaborative Project

The results of research directed by Clearwater Underground Water Conservation District along with the reports of local well owners and drilling contractors has confirmed that the hydrogeologic conditions and groundwater availability of the Trinity Aquifer are distinctly different in the southwestern area of Bell County from other parts of the county. Over the last few years, the District has invested in more than a dozen projects to investigate the Trinity Aquifer structure, lithology, hydraulic properties, and water-level changes in the area. This year, the District is upholding its dedication to science-based aquifer management through a collaborative project between the District's consultants to develop a holistic understanding of the Trinity Aquifer in southwestern Bell, northeastern Burnet, and northwestern Williamson counties.

One goal of this project is to synthesize the research in which Clearwater UWCD has invested into a single report documenting the consensus understanding of the District's hydrogeologic experts. During this coming year, the Clearwater UWCD consulting team will seek answers to specific questions regarding the faulting and configuration of the aquifer units in southwestern Bell, northeastern Burnet, and northwestern Williamson counties to arrive at a shared understanding on how these affect groundwater flow through the aquifer. The team will incorporate this information into the consensus report which will support Clearwater UWCD's policy refinement and dedication to science-based management of the groundwater resources within Bell County.

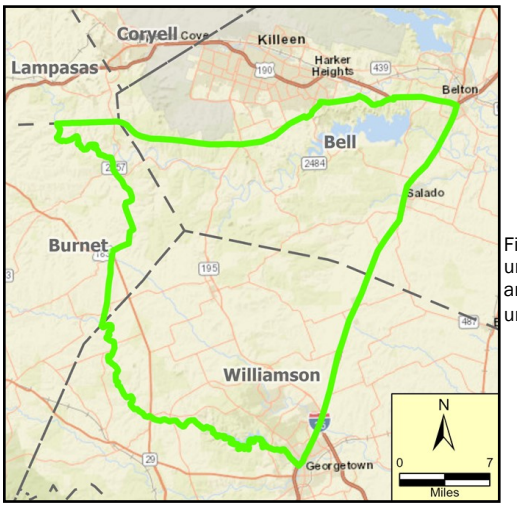


Figure 1. Study area to improve understanding of the faulting and configuration of the aquifer units.

Mike Keester, Senior Project Manager/ Hydrogeologist
LRE Water