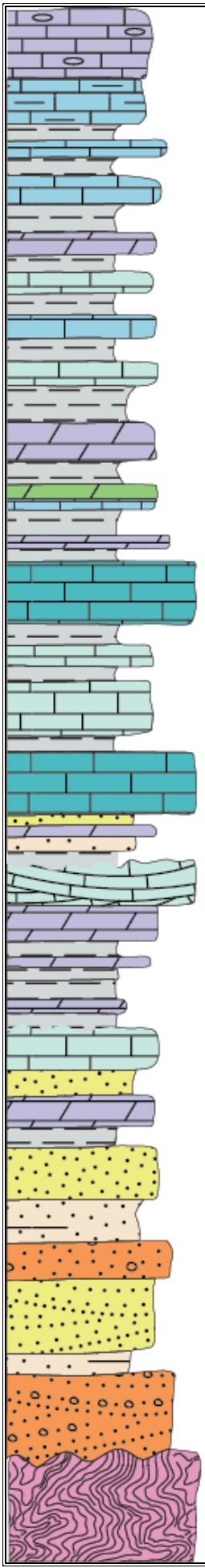


2021 Annual Report

Hays Trinity Groundwater Conservation District

2021 Board of Directors

Holly Fults – President

Linda Kaye Rogers – Vice President

John Worrall – Secretary/Treasurer

Doc Jones

Toby Shelton

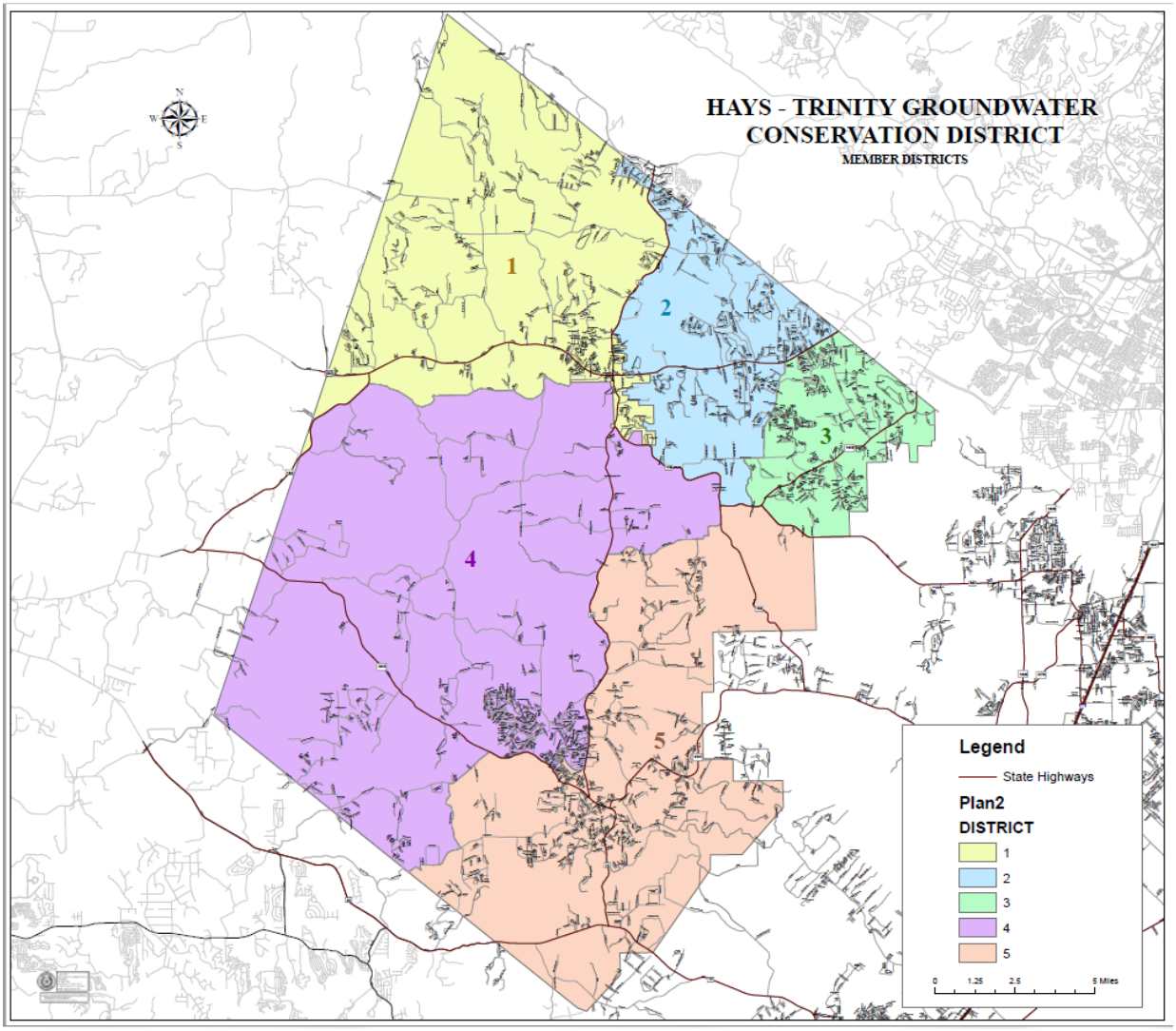
2021 Staff Members

Charlie Flatten – General Manager

Philip Webster – Hydrogeologist

Keaton Hoelscher – Geo-Technician

Laura Thomas – Assistant General Manager



Researched and compiled in 2022 by:

Charlie Flatten, General Manager
Laura Thomas, Assistant General Manager
Radu Boghici, P.G., Hydrogeologist
Keaton Hoelscher, Geoscience Technician

2022 Board of Directors:

Holly Fults, President; Linda Kaye Rogers, Vice President; John Worrall, Secretary/Treasurer; Doc Jones; Toby Shelton.

2021 ANNUAL REPORT

HAYS TRINITY GROUNDWATER CONSERVATION DISTRICT
MANAGEMENT GOALS, OBJECTIVES, & PERFORMANCE STANDARDS

Executive Summary

The 2021 Annual Report is an account of the Hays Trinity Groundwater Conservation District's (District or HTGCD) management and protection of the Trinity Aquifer through the development of science, data gathering, regional groundwater planning, permitting, education, and outreach.

In 2021, the District initiated and participated in numerous activities including the development and refinement of local hydrogeologic science, education & outreach, policy directives, capital projects, and drought management in order to fulfill its objectives.

The financial health of the District in the short term is secure. However, due to revenue structures, a reduction in economic growth would negatively impact the District's budgets and its ability to effectively protect the groundwater resource. A move away from growth-based revenue is recommended.

The HTGCD Board of Directors held 14 Board meetings and 3 Public Hearings in 2021 (Appendix, Section 1).

The District registered 137 new wells in 2021; 134 are exempt from regulation and 3 are non-exempt. The District added three observation/monitor wells to its network. The District issued no new permits for non-exempt withdrawals, unchanged from 2020 at 94 active permits. There were 636 new public water supply connections reported to the District (Appendix, Section 2). Permitted plus Exempt volumes of withdrawal rose from an estimated 7,782 to 7,840 acre-feet/year leaving 1,258 acre-feet/year available from the Texas Water Development Board's (TWDB) Modeled Available Groundwater (MAG) allotment[1] in the year 2060 of 9,094 acre-feet/year for the District. It should be noted that the 1,258 acre-feet volume remainder must be shared by future exempt (domestic and agriculture[2]) and non-exempt (commercial and other) users.

[1] TWDB MAG model run GR 16-023 stipulates a decreasing MAG over time.
[2] By Enabling Legislation design (and unlike most GCDs in the State), Agriculture is exempt from permitting in the HTGCD.

Rules, Bylaws, Enabling Legislation, and other regulatory structures of the District can be found on the District website's Regulatory page.

Effective September 1, 2021, at 12:01am, Governor Abbott lifted the Texas Open Meetings Act suspensions that had allowed certain governmental bodies to hold video and teleconference meetings. The District resumed in-person Board Meetings and Public Hearings beginning in September, alternating locations between Dripping Springs and Wimberley.

In addition to the following prescribed Objectives and Performance Standards, the District maintains a robust Education and Outreach Program. 2021 highlights include the creation of the Water Wise Speaker Series, creation of a new website, and a stakeholder outreach project called Strategic Water Vision 2021 designed to assemble District metrics and to gather information from stakeholders in order to sharpen the focus of District Goals. See Appendix Section 5 for details.

Introduction

The Hays Trinity Groundwater Conservation District was created by the 77th Texas State Legislature (S.B. 2, 2001) in order to compile and develop sound hydrologic data and to manage and protect the aquifers that supply safe water in western Hays County as illustrated by the Map on page 2. The District is governed by a locally elected Board of Directors and s managed by District Staff as listed on the title page.

As required by District Bylaws (4.2, a) an annual report shall be prepared for and provided to the Board of Directors by District Staff on the status of the District and its programs. The *2021 Groundwater Management Plan* serves as a guide for the District's annual reports. The *2021 Annual Report* describes a methodology for tracking progress in achieving management goals. The headings in the report are prescribed by the Texas Water Development Board TWDB: TAC 356.52 (a)(2), (a)(3), TAC 356.52(a)(1), and in TWC 36.071. The District shall use this Report to document other business, such as Financial Reports.

Management Objectives and Performance Standards

1. Goal: Providing the Most Efficient Use of Groundwater

1.1. *Management Objectives*

Each year, the District will hold at least one educational event.

Performance Standard

Each year, a summary of the District educational events schedule will be included in the Annual Report

HTGCD attended, participated, hosted, or presented in the following educational, outreach, and planning events:

January 2021

- Participated: Regional Water Quality Protection Program
- Participated: Region K Water Planning Group (State Water Plan)
- Attended: Region 11 Flood Planning Group
- Attended: Dripping Springs Utility Commission
- Attended: Woodcreek Citizens Planning Group
- Participated: Texas Association of Groundwater Districts (TAGD) Business Meeting
- Participated: Texas Hill Country Conservation Network Water Workshop
- Participated: Kent Butler Summit Land Conservation panel discussion
- Participated: GMA-9 DFC & Explanatory Report
- Participated: GMA-10 DFC & Explanatory Report

February 2021

- Participated: UTEP Education/Outreach Geology student interview
- Attended: SGMA continuing education
- Attended: Region 11 (Guadalupe) Flood Planning Group
- Participated: Region L Water Planning Group
- Hosted: HTGCD Board
- Attended: BSEACD/HTGCD GM consultation
- Attended: JWGMZ DFC consultation
- Attended: Pedernales Water Team

- Participated: Q&A w/Dr. Mace's graduate student
- Participated: SwTGCD Board
- Attended: Region 10 (Colorado) Flood Planning Group
- Participated: HTGCD/DSWSC select consultation
- Participated: Foaming Well site visit – down hole camera
- Participated: Foaming Well site visit – sample grab
- Attended: TAGD Legislative update
- Hosted: HTGCD Special Board Meeting

March 2021

- Participated: Bureau of Reclamation Water Makers grant information
- Attended: Region 11 (Guadalupe River) Flood Planning Group
- Participated: HTGCD/DSWSC select consultation
- Hosted: HTGCD Regular Board Meeting
- Participated: GMA-10
- Attended: SwTCGCD Regular Board Meeting
- Participated: Lower Trinity Monitor Well for the Northern Sector Recon
- Participated: ACC Environmental Science & Tech Advisory Committee
- Participated: Hill Country Master Naturalist Hydro-Geo 101 Lecture
- Participated: GMA-9
- Participated: Bratwurst
- Participated: RWQPP
- Attended: Region 10 (Lower Colorado River) Flood Planning Group
- Attended: Region 11 (Guadalupe/Blanco River) Flood Planning Group
- Participated: HTGCD/DSWSC select consultation
- Participated: Cypress Creek WPP Speakers series
- Participated: Cypress Creek Stakeholder Group

April 2021

- Hosted: HTGCD Regular Board Meeting and Public Hearing
- Participated: PWS Well Inspection and Westcave Preserve site visit
- Participated: Community outreach with Radu Bogici PG
- Attended: SwTCGCD Regular Board Meeting
- Participated: Hill Country Conservation Network Water Panel
- Participated: Hydrogeologic survey of new DS parkland
- Attended: Central Texas Water Conservation Symposium
- Participated: Hydrogeologic survey of the Polo Grounds
- Participated: Region L subcommittee
- Participated: RWQPP
- Participated: Texas State University Alumni Panel (w/Dr.s Mace & Sansom)
- Hosted: Marshal Jennings meeting re: science and HB 4618
- Attended: House Natural Resources Committee hearing

May 2021

- Hosted: EDF/Tony Smith assessment of need for HTGCD Availability Study
- Attended: House Natural Resources Committee testimony
- Participated: Region L
- Hosted: HTGCD Regular Board Meeting
- Hosted: Beth McConnell / website proposal
- Hosted: Rusty Tarver
- Attended: TML webinar
- Participated: RWQPP meeting
- Participated: Jackson School presentation
- Participated: Jackson School well core observation
- Participated: KM meeting for monitor well development
- Hosted: Fall Creek Vineyards Permit Amendment
- Participated: Mirasol Site Inspection
- Participated: Reimers Ranch well boring inspection

June 2021

- Hosted: Horseshoe Ridge RV Park
- Hosted: HTGCD Board Meeting
- Attended: Groundwater Sustainability Summit
- Hosted: TWDB/Wierman DFC
- Participated: Friday Mountain Karst Survey
- Participated: Sustainable Source -- Website
- Participated: RWQPP meeting
- Attended: Roy Creek Site Inspection
- Attended: Texas Groundwater Summit
- Participated: Region L RFQ Committee
- Attended: Region 11 Flood Planning

July 2021

- Hosted: HTGCD Board Meeting
- Attended: Texas GW Conference
- Participated: Region L Subcommittee
- Participated: Serenity Farmhouse Site Visit
- Participated: CYJ Baseline Meeting
- Participated: Region K Regular Meeting
- Participated: Region L Subcommittee
- Participated: THCCN Core Group Meeting
- Participated: THCCN Meeting
- Participated: Cypress Creek WPP Core Group Meeting
- Participated: Cypress Creek WPP Presentation

August 2021

- Attended: Region 11 Flood Plan Meeting Wimberley
- Participated: Region L Regional Water Plan
- Hosted: HTGCD Board Meeting
- Attended: JWNA Site visit

- Participated: Wimberley Springs Partners
- Participated: Understanding Our River – Blanco
- Participated: Aqua Texas – Brent Reeh – Wimberley
- Participated: RWQPP
- Attended: TAGD Summit

September 2021

- Attended: TAGD Summit
- Hosted: HTGCD Board Meeting
- Hosted: Website designer update
- Attended: Karst Seminar w/George Veni
- Hosted: HTGCD GM/Treasurer Budget
- Participated: WWSC baseline workshop
- Participated: HTGCD GM/LKR – Woodcreek/Aqua
- Participated: Region K
- Participated: Trebled Waters Foaming Well site visit
- Participated: Senator Campbell office visit
- Participated: Region L
- Participated: GMA-9 committee
- Attended: Little Blanco River Gain-Loss kick-off (MCWE)
- Attended: Horseshoe Ridge RV drilling site visit
- Participated: GMA-9 Bandera
- Hosted: HTGCD GM/President
- Attended: HCA Leadership Summit

October 2021

- Participated: EDF/HTGCD Sustainable Trinity
- Hosted: HTGCD Board Meeting
- Attended: SwTCGCD Board Mtg.
- Participated: Horseshoe Ridge Pre-Pump
- Hosted: JWGMZ Implementation Presentation

- Attended: Blue Hole School Presentation
- Attended: Analytical Tools Presentation
- Attended: GeoGulf Conference
- Attended: Texas GW Invertebrate Conference
- Participated: RWQPP

November 2021

- Participated: EDF/JWGMZ
- Participated: Region L planning meeting
- Hosted: HTGCD Board Meeting
- Attended: DS Planning & Zoning
- Attended: SwTCGCD Board Mtg.
- Attended: DS Utility Commission
- Participated: Goldenwood West Site Visit
- Participated: Horseshoe RV Site Visit
- Participated: GMA-9
- Participated: WWSC Board Meeting
- Attended: WTCPUA
- Participated: Woodcreek
- Participated: Region K By-laws Committee
- Participated: Cypress Creek Executive Committee

December 2021

- Participated: orientation meeting
- Hosted: HTGCD Board Meeting
- Attended: DS Planning & Zoning
- Attended: SwTCGCD Board Mtg.
- Attended: DS Utility Commission
- Participated: Region K By-laws Committee

2. Goal: Controlling and Preventing Waste of Groundwater

2.1. Management Objectives

Each year, the District will take complaints from any concerned citizen or entity in the District on cases of waste or possible waste.

Performance Standard

In each Annual Report, the District will include a discussion of the recent issues with waste and recommend any amendments to the rules to prevent the waste of groundwater.

District Staff reports to the Board of Directors during public meetings on the topic of waste. No official public complaints were submitted to the District office concerning waste or possible waste during 2021. However, the District offices did field complaints about excessive irrigation and vanity ponds.

The District relies on the online Quarterly Reporting process that allows all District operating permit holders instant access to enter and review their own production, sales, connections, and percent losses. Communication concerning loss is tied directly to each quarterly report. This gives the permit holder and the District an electronic record of reasons for loss including circumstances such as line-breaks, meter replacement, fires, or flushing. It also gives an indication of historic line loss and information on permittees who have habitually high line loss due to inadequate maintenance[3]. An example of a Quarterly Report can be found in **Figure 1,** below.

Quarterly Pumpage Report

Forms | My Profile | Log off

Non-Exempt Well - Quarterly Reporting - FORM #: 2009-1A

Permit Holder [redacted] Year 2019 Quarter [redacted] Go

Water Level Information			April		May		June	
Well Id / Name			Water Level	Water Level Date	Water Level	Water Level Date	Water Level	Water Level Date
1050111			0.0		0.0		0.0	

Add Another Well | Remove Well

	YTD Totals	Qtr Totals	April	May	June
Groundwater Pumped Total	3,741,800	1,992,000	567,800	680,900	743,300
Other Water Sources	0	0	0	0	0
Sold / Used	3,435,900	1,854,200	530,300	638,800	685,100
Total # Service Connections			102	102	102
New Service Connections			0	0	0
Notes / Comments, New Connection Addresses			Leaks, broken lines.	Leaks, broken lines.	Leaks, broken lines.
Loss	305,900	137,800	37,500	42,100	58,200
Loss Percent	8.18 %	6.92 %	6.6 %	6.18 %	7.83 %

SAMPLE

[3] Rule 2.1 Waste B, E.

Figure 1: Quarterly Report showing an example of how line loss is calculated.

3. Goal: Controlling and Preventing Subsidence

The rigid geologic framework of the region precludes significant subsidence from occurring. Therefore, this goal is not applicable to the operations of Hays Trinity Groundwater Conservation District.

4. Goal: Addressing Conjunctive Surface Water Management Issues

4.1. *Management Objective*

Each year, the District will promote the use of surface water or other alternatives to groundwater in growing areas where groundwater demand is projected to lower the water tables and to reduce stream and spring flow to unacceptable levels.

Performance Standard

The District will strive to meet with the planning departments of major surface water providers within the District at least once per year. The District will summarize these meetings and their outcomes in the Annual Report.

Dripping Springs Water Supply Corporation (DSWSC) and the West Travis County Public Utility Authority (WTCPUA) are the two major surface water providers in the northern portion of the District. They supply wholesale and retail water sourced from the Lower Colorado River Authority (LCRA) Highland Lakes resource. Below is a list of meetings held with DSWSC.

Meetings*:*

- Charlie Flatten and select Board members met on a more than monthly basis with DSWSC General Manager Kyle Dannhaus and select Board members on conservation, legislation, permitting, and fee definitions.
- Charlie Flatten and WTCPUA Director met to discuss the PUA's potential expansion of services and/or expansion of supplies to the DSWSC.
- Charlie Flatten serves on both of the District's Regional Water Planning Groups (Blanco/Guadalupe and Colorado River basins) where he monitors future plans to move surface water up into the HTGCD.
- District Staff promotes the use of rainwater at every available interaction with the public in order to reduce the use of groundwater.

5. Goal: Addressing Natural Resource Issues Which Impact the Use and Availability of Groundwater and Which are Impacted by the Use of Groundwater

5.1. *Management Objective*

Each year, the District will make at least one endorsement or contribution to ongoing studies of geologic, environmental, or hydrogeologic studies being performed in the district area.

Performance Standard

Each year, a summary of the District's contributions or endorsements of ongoing studies will be included in the Annual Report.

July 2021 Potentiometric Surfaces of the Lower and Middle Trinity Aquifers in Southwestern Hays County, Texas: *Led by District Hydrogeologist Philip J. Webster in collaboration with the Comal Trinity GCD and the Wimberley Valley Watershed Association.*

This study of the Regional Recharge Study Zone increased monitoring and data collection of the Middle and Lower Trinity Aquifers. This study collected 53 Middle Trinity and 18 Lower Trinity water elevations and 46 Middle Trinity and 11 Lower Trinity basic water quality field parameters. The study has also allowed for the assessment of new long-term monitoring wells.

The newly created July 2021 potentiometric maps for the Middle and Lower Trinity Aquifers provide helpful insights into the current state of groundwater flow paths and water level trends for both aquifers in western Hays County. The Lower Trinity map is the first potentiometric map within the study area at this resolution. Both maps display a general flow towards the Balcones Fault Zone from the northwest to the southeast. Consistent with previous studies, the Middle Trinity potentiometric surface has a significant trough and ridge near Jacob's Well, while the Lower Trinity indicated a depression around the Mustang Ranch development.

District Recharge Review: Report 2021-0104: *Philip J. Webster*

The focus of this review is on the influence of geology on the recharge to the Middle Trinity Aquifer within the Hays Trinity Groundwater Conservation District (HTGCD or District) boundary. Recharge zones are delineated following watershed boundary lines. The Onion Creek and Blanco River watersheds were each separated into upper and lower segments to capture the differing recharge mechanisms.

Throughout Blanco County, diffused recharge occurs where the Middle Trinity units are exposed to the surface, providing the aquifer with regional flow. Potentiometric surface maps suggest the aquifer has two main flow regimes (1) eastern direction across Hays County and towards the Colorado River in Travis County and (2) southeast across Hays County towards the Balcones Fault Zone.

The surface geology throughout the Blanco River, Cypress Creek, and Pedernales River watersheds all have outcropping Middle Trinity units, allowing infiltration to the aquifer units. Throughout the Blanco and Cypress Creek watersheds, the Lower Glen Rose is heavily fractured with common karstic features, often allowing for water to infiltrate and percolate through impermeable units. With the semi-confining nature of the Hensel, where the Lower Glen Rose is on the surface, surface water may infiltrate and contribute to the Cow Creek. To a lesser degree fractures throughout the Upper Onion Creek have also been shown to allow water to recharge the Middle Trinity.

Streamflow measurements can indicate where creeks are losing or gaining flow, combined with dye trace studies, water quality data, and water level data, surface water within the Blanco River, Dry Cypress Creek, and Onion Creek were determined to be recharging Middle Trinity.

Hays Trinity Groundwater Conservation District: Model Scenario: 2011-like Drought with Current Production. Report 2021-0104: *Philip J. Webster*

Rapid growth trends in the Hays Trinity Groundwater Conservation District (HTGCD or District) necessitated a groundwater modeling scenario that asked how the Trinity Aquifer within the District will respond to a recurrence of the single drought of record of 2011 at current 2018 pumping rates.

Four scenarios were developed to calculate the influence of a 2011-like drought during current production amounts. The final scenario (Scenario D) incorporated 2011 recharge conditions with 2018 production plus an additional 25-percent in production increase typically observed during severe droughts. 2008 pumping and recharge inputs were used as a baseline for comparison. Scenario D resulted in an average drawdown of 20 feet for the Middle Trinity Aquifer within the Groundwater Management Area 9 modeled area over a 1-year period, while the Middle Trinity within the HTGCD boundary had an average drawdown of 14-feet and a maximum drawdown of 36-feet over the same period.

The 14-foot average drawdown represents nearly 75% of the District's Desired Future Condition (DFC) of 19-feet of average drawdown (GMA 9, 2016).

ONGOING STUDIES

Dedicated Monitor Well Project: The HTGCD Dedicated Monitor Well Project continued in 2021. The Dedicated Monitor Well Project is designed to provide long-term water-level monitoring and ongoing groundwater quality data from carefully selected well sites in western Hays County. A complete aquifer formation evaluation program was carried out at each borehole, including core and cutting samples analyses, geophysical logging, down-hole video, aquifer testing, and water sample recovery. An extensive technical report was completed for each location and posted to the District website. Funding for the project came from HTGCD, Hays County, Dripping Springs Water Supply Corporation, and Barton Springs Edwards Aquifer Conservation District (BSEACD). Technical support and assistance were provided by District Staff, the Blanco Pedernales Groundwater Conservation District, BSEACD, Edwards Aquifer Authority, Texas Water Development Board, the University of Texas Bureau of Economic Geology, and the Texas State University Meadows Center for Water & the Environment. There is also outstanding cooperation and assistance from local landowners who allow District access to their properties.

As a result, continuous water level data and periodic water quality samples are collected from the dedicated monitor wells and made available to the public. Through ongoing monitoring of the dedicated wells, the District continues to expand the reliable long-term record of water levels and groundwater quality, a critical dataset for informing groundwater management decisions.

Blanco River Aquifer Tool for Water and Understanding Resiliency and Sustainability Trends (BRAAT): HTGCD technical staff worked with a group of geoscientists led by the Meadows Center to develop the second phase of this surface-groundwater interaction-based model. Phase 2 will include the development of a numerical model from the conceptual model, which will have the capabilities to simulate groundwater recharge, spring discharge, flow in the Trinity Aquifer, and surface water-groundwater interactions. The groundwater flow model will provide HTGCD, BSEACD, and Hays County with a valuable tool for evaluating groundwater availability in Hays County and pumping impacts to the Trinity Aquifer, springs, and surface water. See *Blanco River Aquifer Assessment Tool A Tool to Assess How the Blanco River interacts With Its Aquifers: Creating the Conceptual Model* (Martin et al., 2019).

District Hydrogeological Analyses of the Trinity Aquifer System: Hydrogeologic data from the Trinity Aquifer was collected and analyzed during 2021. This is an ongoing project designed to acquire and interpret pertinent technical data and to apply this information to District operational management. Data includes geophysical well logs, cuttings samples,

groundwater levels, groundwater samples & chemical analyses, pumping test reports, surface geology, and groundwater use (pumpage). This information is maintained in the District's growing database and is used in conjunction with the TWDB groundwater database. Local and regional modeling projects such as the TWDB Conceptual Model of the Hill County Trinity Aquifer and more local modeling will incorporate this data into their analyses.

Jacob's Well Groundwater Management Zone: In March 2020, HTGCD Board of Directors approved the creation of the Jacobs Well Groundwater Management Zone (JWGMZ) via Rule 15. This project was the culmination of technical staff, an interagency group of groundwater scientists, and stakeholder collaboration. Staff began an implementation process to guide permittees in the regulatory process. The Board also began JWGMZ specific Drought Stage declarations based on triggers set by rule. Rule 15 expressly specifies that the Board will take no enforcement action until March 2021. Note: An April 2021 Public Hearing and Board action delayed enforcement until March 2022 due to Covid concerns. 2021 Board action made several changes to Rule 15's drought management and curtailment provisions to create a more predictable assessment of annual production during drought. Board action also recognized previous conservation achievements by permittees through the grant of conservation credits that are applied to curtailment baselines.

HTGCD Surface Water Monitoring Project: Groundwater-surface water interactions are a critical component of the story of recharge and discharge within the Trinity Aquifer in western Hays County. By periodically measuring surface water flows, hydrogeologists develop a greater understanding of how these interactions impact the aquifer and change over time. This ongoing project will rely on continued data gathering. Technical staff. will continue to collect surface water flow data in the Blanco, Onion Creek, and Barton Creek basins to develop a greater understanding of groundwater-surface water interactions in the District.

Lower Trinity Project: The Project was initiated in 2012 to evaluate the potential for an alternative groundwater source for western Hays County. Previous Lower Trinity studies have consisted of aquifer testing to define aquifer parameters and overall groundwater availability and adding Lower Trinity wells to the District's Monitoring network. The hydrogeological evaluation of the Lower Trinity Aquifer continued in 2021 with the addition and analyses of geophysical logs and water samples. The northeastern part of the District is an area of ongoing study due to rapid development where the Middle Trinity Aquifer appears to be dewatered, and new wells are finding minimal production from the Lower Trinity Aquifer.

6. Goal: Addressing Drought Conditions

The continued health and potential sustainability of the Trinity Aquifer is the primary informer of the (**Figures 6, and 7)**. District's outlook and actions. Drought is the most difficult variable in the hydrologic equation to manage. In order to protect drinking water wells and thus property values, the District employs a variety of drought management tools ranging from education to prescribed curtailment.

The District declared drought in response to triggers defined in its Drought Management Plan. 2021 saw the District in 20% Alarm Drought Stage from January through July, and the Jacobs Well GMZ in 30% from January through May, and 20% from June through October. A wet fall relieved the District of Drought in November and December of 2021 and January of 2022. **Figure 2** shows how drought impacted Texas in 2021 (Source: U.S. Drought Monitor).

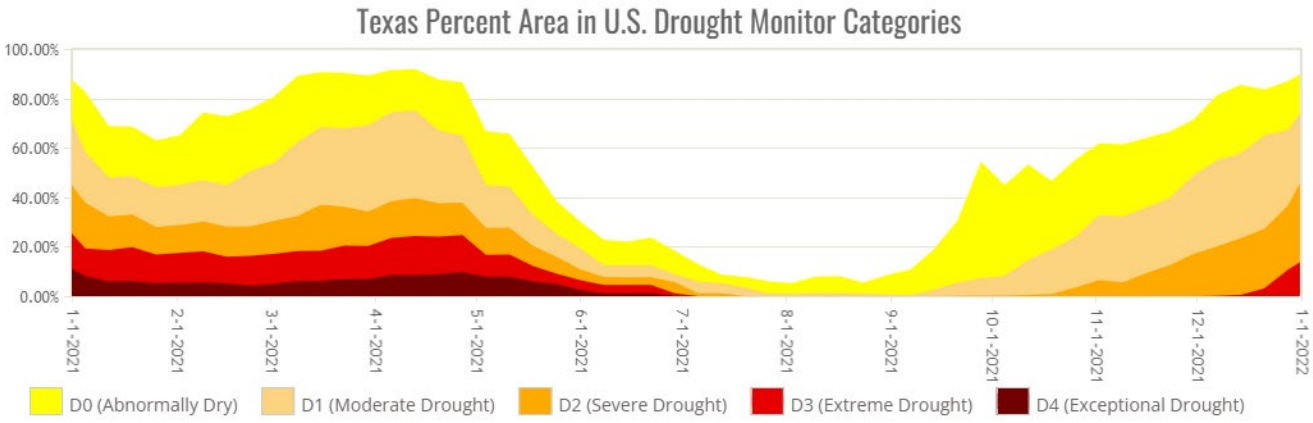


Figure 2: Percent of Texas in Drought Throughout 2021. D0 = No Drought, D4 = Max Drought

The District fulfilled its Annual Requirements described below and began implementing the Rules associated with the Jacob's Well Groundwater Management Zone, which was created to protect Trinity Aquifer resources in the Jacob's Well Springshed. Those Rules provide for stronger drought restrictions in the Management Zone. The District is fulfilling its Rule 16 requirement to gather scientific data on the 56-square mile Regional Recharge Study Zone. See Appendix, Section 3:

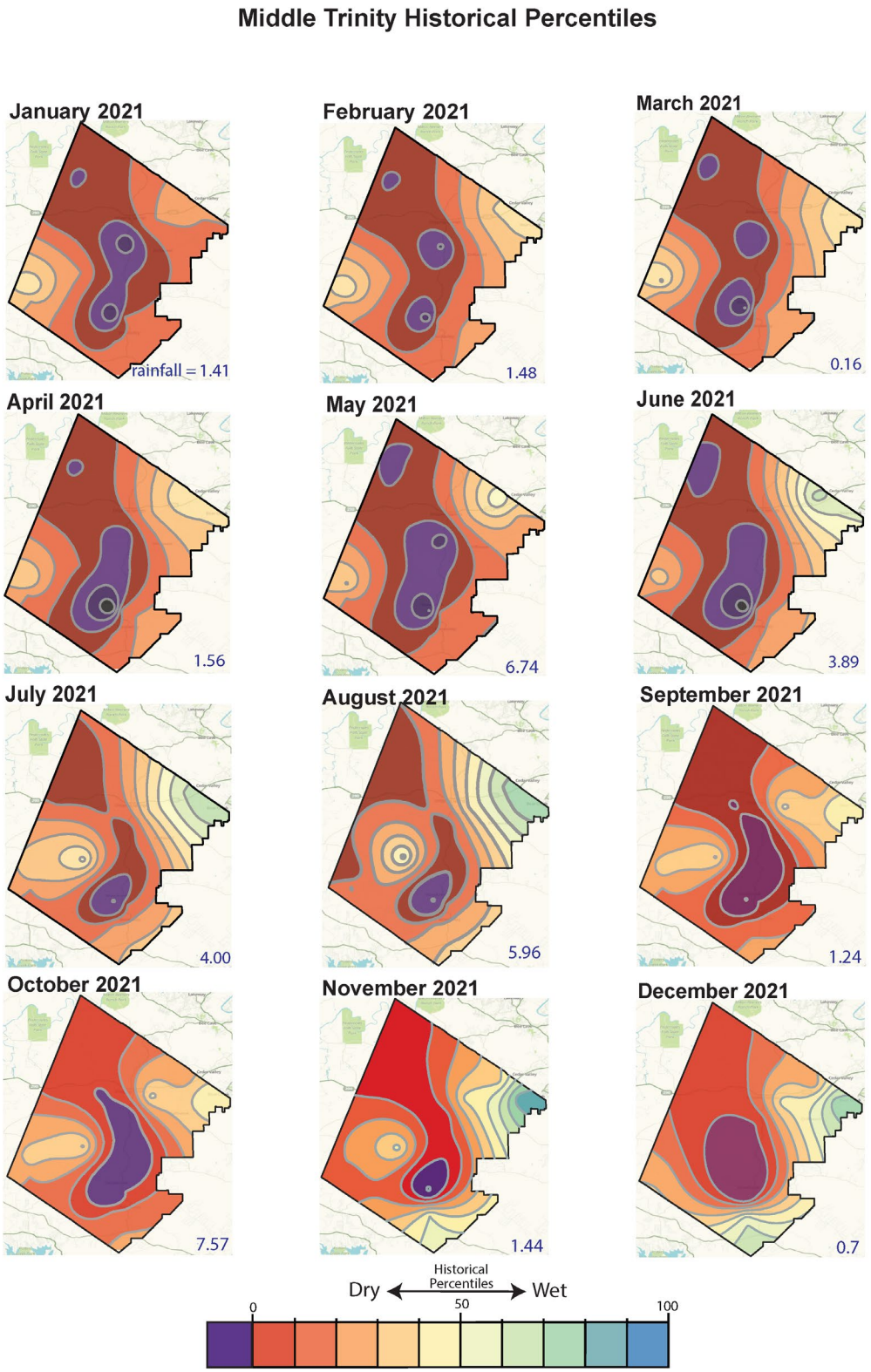


Figure 3: Timestep Water Level Percentiles for the Middle Trinity Aquifer

Water level percentiles in **Figure 3** represent the current water level elevations as a percentage relative to the maximum historical water levels. Historical values are from 2008 to 2019. A percent of zero would represent the lowest historical water level, while 100 percent represents the highest historical water level. Shades of purple represent negative values, signifying water levels below the 2008-2019 minimum.

6.1. *Management Objective*

The District has developed individual permit specific User Drought Contingency Plans to protect and conserve groundwater during critical drought conditions. The plan will be updated as additional data becomes available.

Performance Standard

The District will post a copy of the plan on the HTGCD website and will include an updated Drought Contingency Plan, available to end-users, in the Annual Report.

The District updated its Drought Contingency Plan in 2021 to reflect new drought requirements for the JWGMZ (see Appendix, Section 3).

The District updated its User Drought Contingency Plan (UDCP) for all non-exempt operating permit holders (see Appendix, Section 3). The UDCP is available for review on the District's website under Forms.

The District updated its Water Conservation Plan (see Appendix, Section 3) which is also part of the paperwork required by the District for all new and amendment operating permit applications to be administratively complete.

A Drought Production Cutback Chart is included with each new permit, amended permit, and permit renewal. An example of a Drought Production Cutback Chart can be seen in **Figure 4**, below. The cutback chart divides the permitted amount of each permit to show an exact monthly production, in gallons, for every possible drought stage so permit holders can prepare for Board-declared drought conditions.

Drought Production Cutback Chart

[Permittee]			5.12 Acre-ft.				Tier:	2
2021			1,668,357 Gallons					
Month	Gallons Produced	Monthly % of Annual Permit	Drought Stage	Suggested Allotment	Drought Stage 1 Voluntary 10%	Drought Stage 2 20%	Drought Stage 3 30%	Drought Stage 4 40%
January		6%		100,101	90,091	80,081	70,071	60,061
February		7%		116,785	105,106	93,428	81,749	70,071
March		7%		116,785	105,106	93,428	81,749	70,071
1st Quarter		*20%*						
April		7%		116,785	105,106	93,428	81,749	70,071
May		8%		133,469	120,122	106,775	93,428	80,081
June		10%		166,836	150,152	133,469	116,785	100,101
2nd Quarter		*25%*						
YTD		*45%*						
July		12%		200,203	180,183	160,162	140,142	120,122
August		12%		200,203	180,183	160,162	140,142	120,122
September		10%		166,836	150,152	133,469	116,785	100,101
3rd Quarter		*34%*						
YTD		*79%*						
October		8%		133,469	120,122	106,775	93,428	80,081
November		7%		116,785	105,106	93,428	81,749	70,071
December		6%		100,101	90,091	80,081	70,071	60,061
4th Quarter		*21%*						
TOTALS		*100%*						

SAMPLE

Figure 4: Example of a Drought Production Cutback Chart

6.2. *Management Objective*

Each quarter, the District will check the National Weather Service – Climate Prediction Center website (https://www.ncdc.noaa.gov/temp-and-precip/drought/weekly-palmers/) for updates of the Palmer Drought Index. The District will download the updated Palmer Drought Severity Index (PDSI) map and check for periodic updates on www.waterdatafortexas.org/drought.

Performance Standard

Quarterly, the District will assess the status of drought in the District and prepare a quarterly briefing to the Board of Directors. The downloaded PDSI maps will be included with copies of the quarterly briefing in the District Annual Report to the Board of Directors.

The General Manager's Monthly Report includes a briefing on the status of drought within the District and is given to the Board of Directors during Board Meetings. The briefing includes maps from the US Drought Monitor and the Palmer Drought Severity Index, monitor well level averages, and HTGCD drought trigger updates (see Appendix, Section 3). HTGCD Staff records and addresses all filed complaints of waste or possible waste during the drought briefing. HTGCD Staff provides a monthly review of the current drought status to the Board of Directors at regular open meetings.

6.3. *Management Objective*

Each year, the District will collect monthly water level data from a network of monitoring wells.

Performance Standard

Each year, a report of the District water level collection activities, including a table of the water levels measured in District monitoring wells, will be included in the annual report.

Monthly, District Staff collects water levels from dedicated District monitor wells (**Figure 5,** page 22). The information collected is entered into and displayed on the District's website as hydrographs transposed with rainfall data collected from NOAA The public can access the District's website for more specific data by scrolling over the hydrographs to see elevation above mean sea level and surface to top of water level measurements. Hydrographs for Mount Baldy and Henly Church wells (**Figures 6** and **7**, page 23), and the flow rates from the Blanco and Pedernales Rivers are used to measure the current health of the aquifer. One can find current flow rates of the Blanco and Pedernales Rivers on the District Drought Management webpage.

In addition, District staff downloads quarterly data from 18 transducer wells within western Hays County. This information is located on the District's website for public use.

See Appendix, Section 3 for the 2021 Monitor Well Levels chart describing monthly water level measurements.

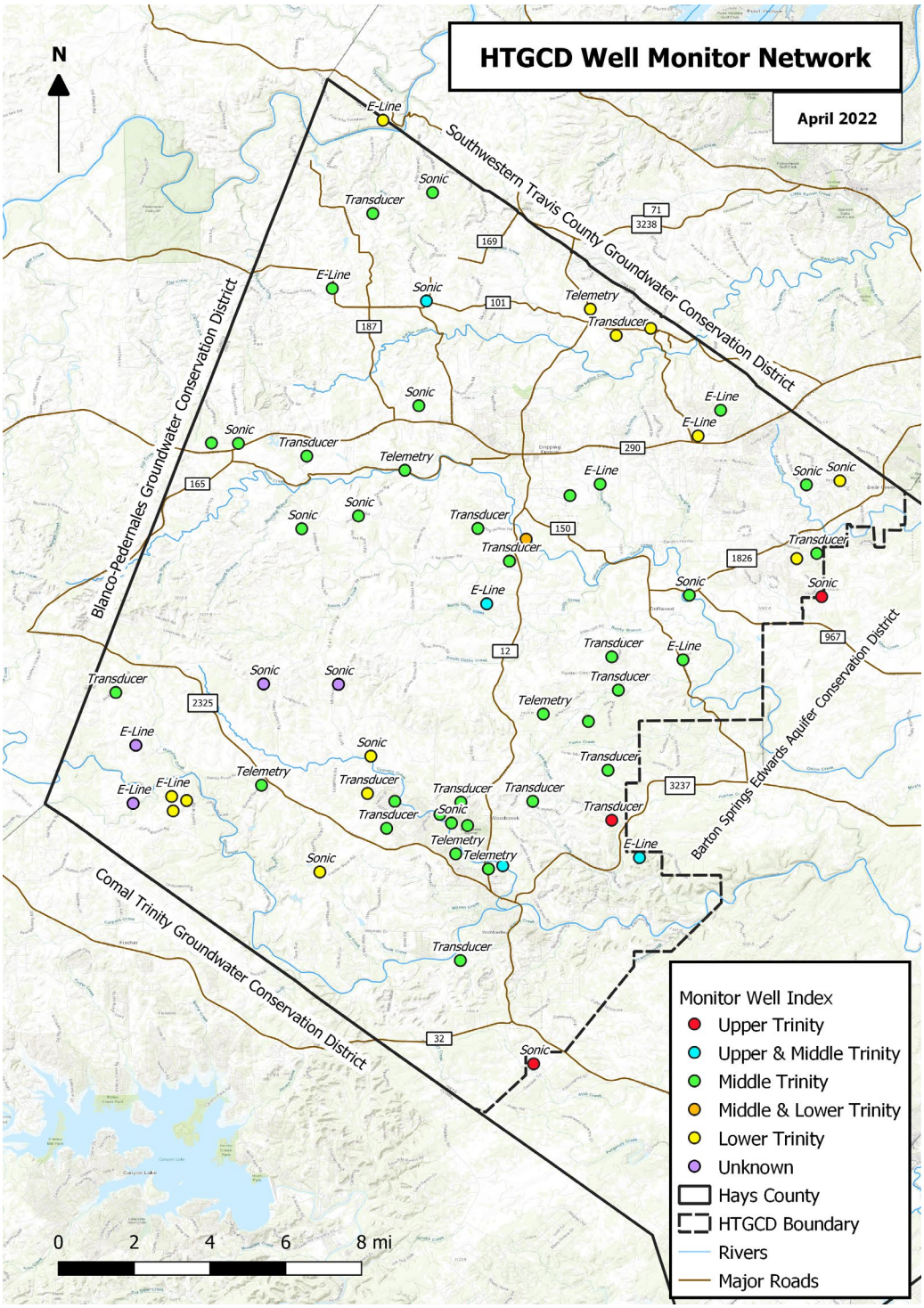


Figure 5: District Well Water Level Monitoring Network

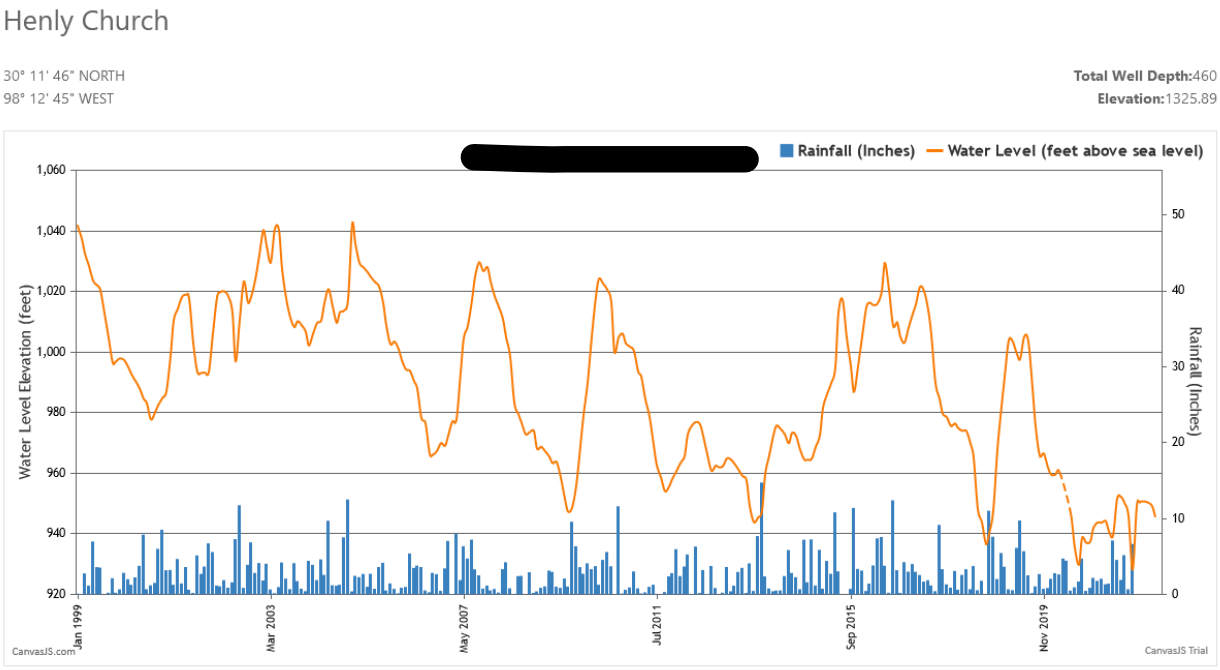


Figure 6: Henly Church Well Hydrograph Showing Water Level Elevations (Feet Above Sea Level) and Monthly Rainfall (inches).

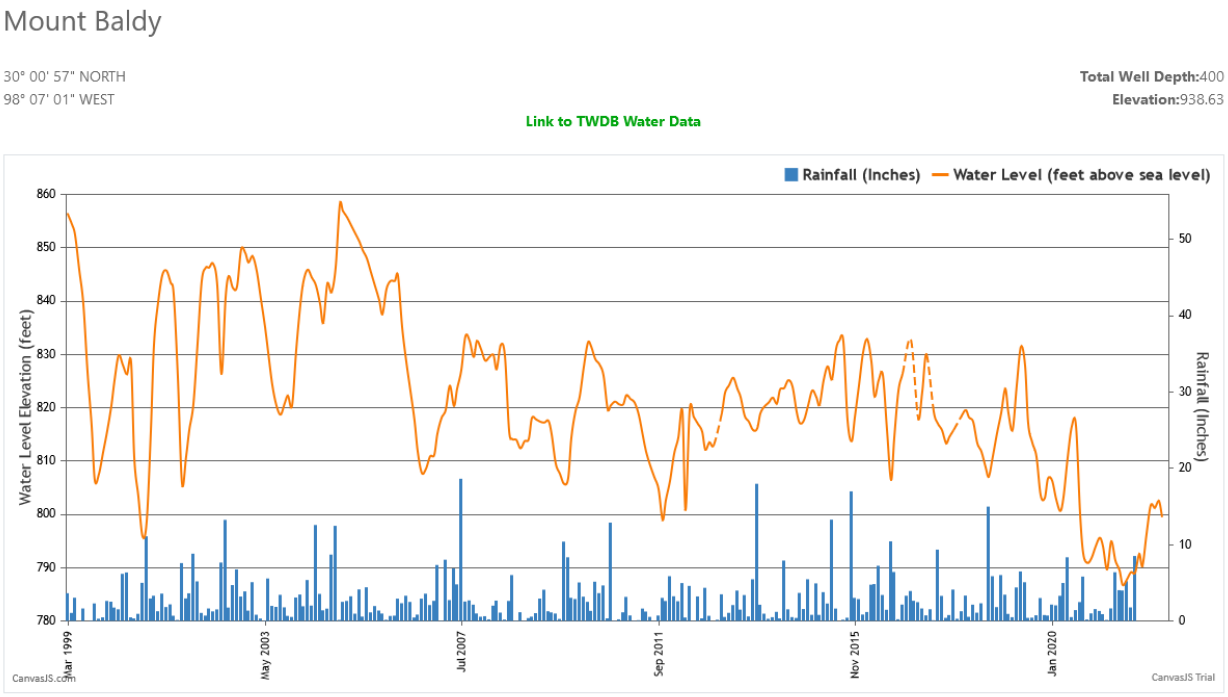


Figure 7: Mount Baldy Well Hydrograph Showing Water Level Elevations (Feet Above Sea Level) and Monthly Rainfall (inches).

6.4. *Management Objective*

Each year, the District will monitor data collected from the U.S. Geological Survey (USGS) water-flow monitoring stations on the Blanco River, Pedernales River, Onion Creek, and at Jacob's Well Spring.

Performance Standard

Each year, the District will review the prior year's monitoring data with local, state, or federal organizations and prepare a summary to be included in the Annual Report.

The Pedernales and Blanco River flow are HTGCD's Drought Indicators. Current conditions of the Drought Indicators are hosted on the Drought Management page of the District website.

Jacobs Well Spring flow is measured monthly for current conditions as a marker for drought curtailment in the JWGMZ.

7. Goal: Addressing Conservation

7.1. *Management Objective*

Each year, the District will submit one article for publication regarding water conservation to at least one newspaper of general circulation in Hays County.

Performance Standard

Each year, a copy of the article submitted for publication will be included in the Annual Report.

The District submitted the following articles for publication; (see Appendix, Section 6)

- *"2021 Water-20 Speaker Series"* February 22, 2021
- *"Jacobs Well Groundwater Management Zone Moves Out of Maximum Drought"* June 10, 2021
- *"State Climatologist to Speak at HTGCD Meeting"* June 10, 2021

In addition to press releases, the District maintains a robust Education and Outreach program. In 2021, the District introduced the Hays Trinity Groundwater Conservation District Water Wise Speakers Series (see Appendix, Section 6) which features presentations on conservation form local practitioners. 2021 saw four speakers.

- RAINWATER HARVESTING -- SCALABLE SOLUTIONS: James Grizzard, Harvest Rain
- WATER WISE LAWNS AND GARDENS: Jackie Mattice, Hays County Master Naturalists

- CLIMATE AND WEATHER TRENDS IN THE HILL COUNTRY: John Nielsen-Gammon, State Climatologist
- WIMBERLEY ONE WATER SCHOOL – INNOVATIVE CONSERVATION DESIGN: Nick Dornak, Meadows Center for Water and the Environment

District staff developed a series of presentation materials that illustrate the District's purpose. (see Appendix)

- Statement of Purpose

- Long-term Fiscal Sustainability & the Hays Trinity Groundwater Conservation District

- Practical groundwater drilling methods, lithography, stratigraphy, and GCD policy for the Jackson School of Geoscience Field Study class's annual trip to a coring site on Mt. Gainor Rd.

8. Goal: Addressing Recharge Enhancement

Due to the geologic and hydrostratigraphic structure of the Trinity sub-aquifers, the implementation of significantly effective recharge enhancement to the primary source aquifer may not be practical. Current interpretation of geologic data suggests that downward leakage within the Trinity Group is limited to specific reaches along the Blanco River and Onion Creek. The majority of recharge takes place west of the bounds of the HTGCD near the sedimentary wedge-edge of the water bearing rock units through diffuse infiltration. Given the location of suspected recharge and its nature, neither general land management nor focused enhancement practices may be feasible. Therefore, until additional Hydrogeologic data is available, this goal is not applicable to the operations of this District.

9. Goal: Addressing Rainwater Harvesting

9.1. *Management Objective*

Each year, the District will make at least one endorsement or contribution to programs that encourage, install, educate, or assist individuals in the implementation of rainwater harvesting systems in the District area.

Performance Standard

Each year, the District will provide records of contributions or promotions of rainwater harvesting events or companies in its Annual Report.

The HTGCD's Water Wise Speakers Series featured two presentations on rainwater harvesting.

- James Grizzard's *Scalable Solutions -- Rainwater Harvesting*
- Nick Dornak's *Wimberley One Water School – Innovative Conservation Design*

All Water Wise Presentations live on the Districts You-Tube Channel.

The District encourages the use of rainwater collection systems on all new homes, businesses, and existing buildings during every monthly Board Meeting as part of the General Manager's Report.

Additionally, District staff receive TCEQ mailings concerning new business development within the District's boundary. A review of the packets includes direct communication, not only with TCEQ about the project, but also with the developer and their engineer. This includes inquiry about the installation of rainwater harvesting on common buildings or the ability of residents to install rainwater harvesting equipment.

10. Goal: Addressing Precipitation Enhancement

This goal is not applicable to the operations of this District.

11. Goal: Addressing Brush Control

11.1. *Management Objective*

The District will attend or contribute to at least one event each year that promotes and educates the public on proper land management practices.

Performance Standard

Each year, the District will provide records of contributions or promotions of land management events or companies in its Annual Report.

District Staff participated in the Texas Hill Country Conservation Network's Collective Impact Approach to Conservation. This project is focused on determining conservation metrics in the Hill Country and advancing conservation measures moving forward. A full report is due in early 2022.

District staff attend and participate in the monthly Regional Water Quality Protection Program which focuses local agency and NGO capacity on a variety of land management best practices including brush control in the Edwards Aquifer Contributing and Recharge Zone.

District staff promotes recharge of the aquifer through such means as proper brush management and reestablishment of deep-rooted native grasses to promote infiltration into the aquifer during monthly Board Meetings in the General Manager's Report.

The District also provides educational materials for the public to take home on the subject of native plants, rainwater harvesting, aquifer storage and recovery, and other educational topics.

12. Goal: Addressing Desired Future Conditions (DFCs)

12.1. *Management Objective*

The District is working within the framework of Groundwater Management Area- 9 (GMA-9) to upgrade and maintain a well database map and files that will identify all District monitoring wells in the management area. The District will work with GMA-9 and their consultants on an acceptable method to analyze and report drawdown levels relative to the DFC. Deliverables may include potentiometric surface maps of the Middle and Lower Trinity Aquifers and selected hydrographs plus other documents generated by the consultants.

Performance Standard

Each year, the District will review the average drawdown of at least two Trinity Aquifer monitor wells, one in each Planning Region, against the DFC projected average regional drawdown for western Hays County. The District shall provide a summary in its Annual Report.

Texas Regional Water Planning requires that all Districts across the Hill Country Trinity Aquifer work together as a Groundwater Management Area (see **Figure 8**, page 28) to develop and monitor a 50-year aquifer level management goal. This planning goal is known as a Desired Future Condition (DFC). The DFC for the Trinity aquifer-wide is 30-feet of average drawdown over 50-years. The TWDB has scientifically quantified that average drawdown as a volume—and allotted the District 9,098 acre-feet/year of Modeled Available Groundwater (MAG).

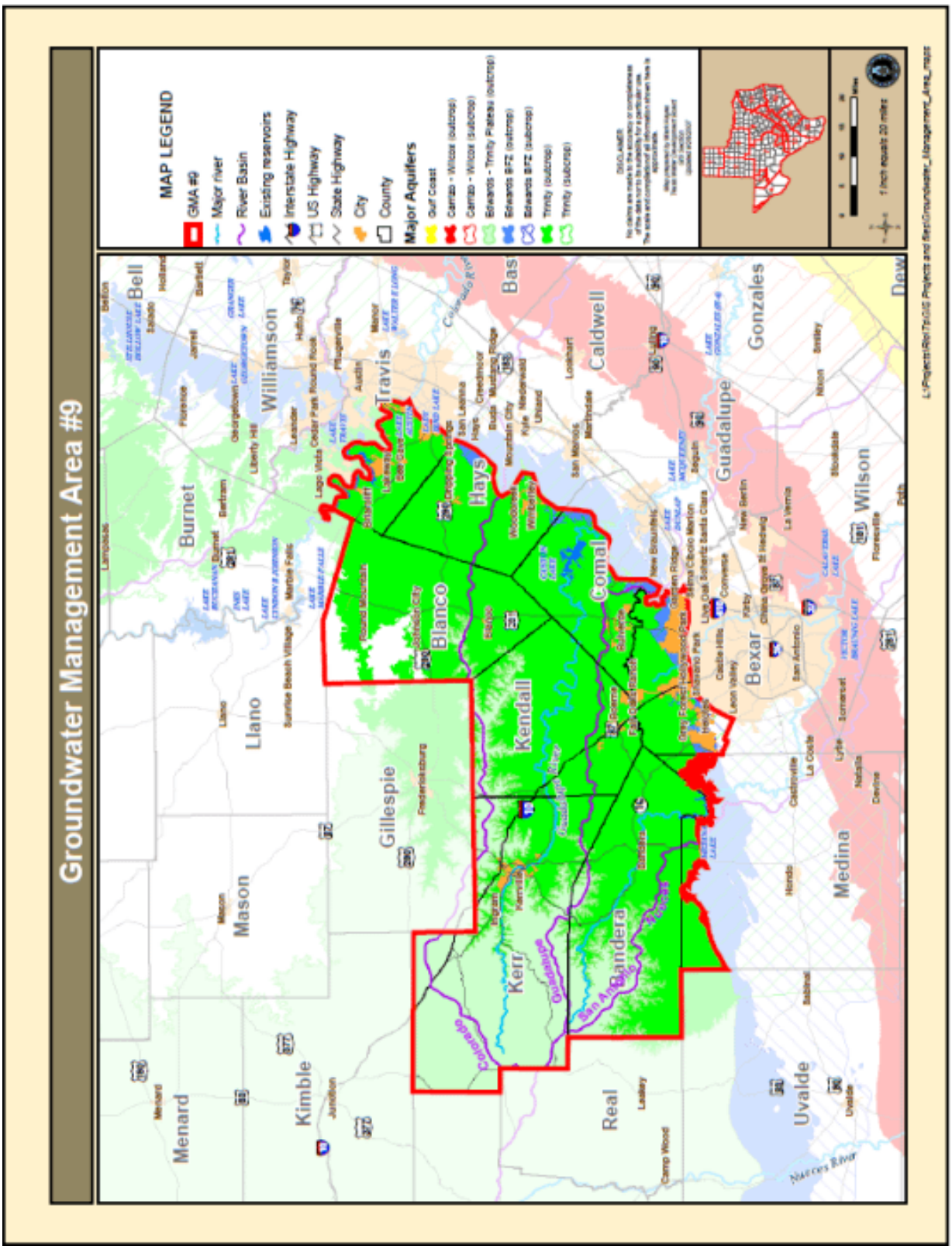


Figure 8: Map of Groundwater Management Area 9

Water Planning Region K: Henly Church Hydrograph

Applying a trendline to the Henly Church Well hydrograph from 2008 – 2021 (the period of interest for DFC analysis) displays slightly decreasing water levels for that period (-1.45 ft./yr.) (**Figure 9**). This would indicate a water level decrease of 18.85 ft. from 2008 – 2021. Evaluating the water level trendline for the entire period of record for this well (1999 – 2021) shows a historical trend that is still negative but has a *larger decrease* of -2.29 ft./yr., resulting in a 50.38 ft. drop in water level over that time period. **Figure 9** demonstrates the difficulties of applying a trend line to a small sample size.

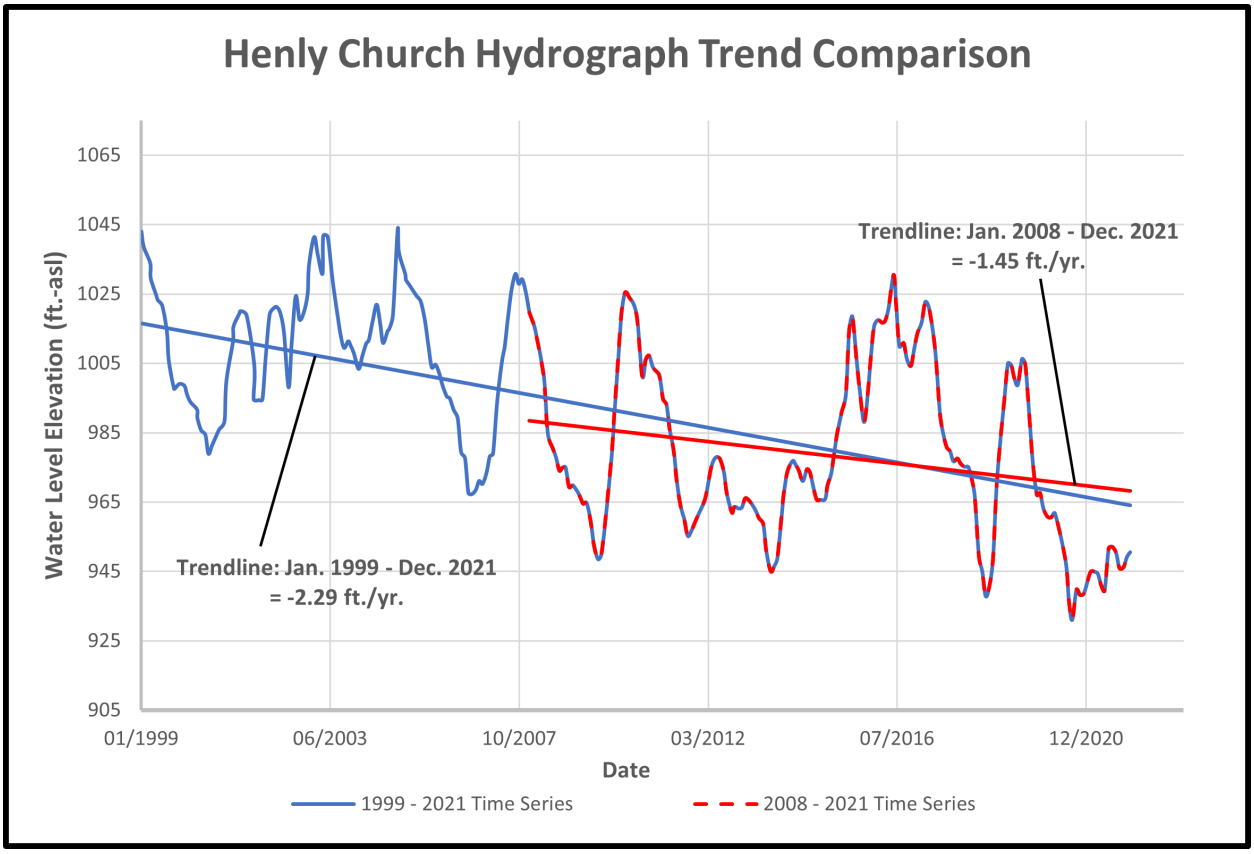


Figure 9: Henly Church Well Water Level Trendline Comparison showing data from January 1999 to December 2021. The graph shows two trendlines, the blue starting in January 1999, the red starting in January 2008.

Water Planning Region L: Glenn Hydrograph

The Glenn Well hydrograph trendline is positive (increase in water level over time) at a rate of +0.60 ft./yr. This would indicate an increase of 19.53 ft. during the 2008 – 2021 time period (**Figure 10**). Like the Henly well, the Glenn well experiences large seasonal fluctuations in water level that make accurate assessment of water level trends difficult to conduct. As such, caution should be exercised when using trendlines to evaluate long-term karst aquifer trends.

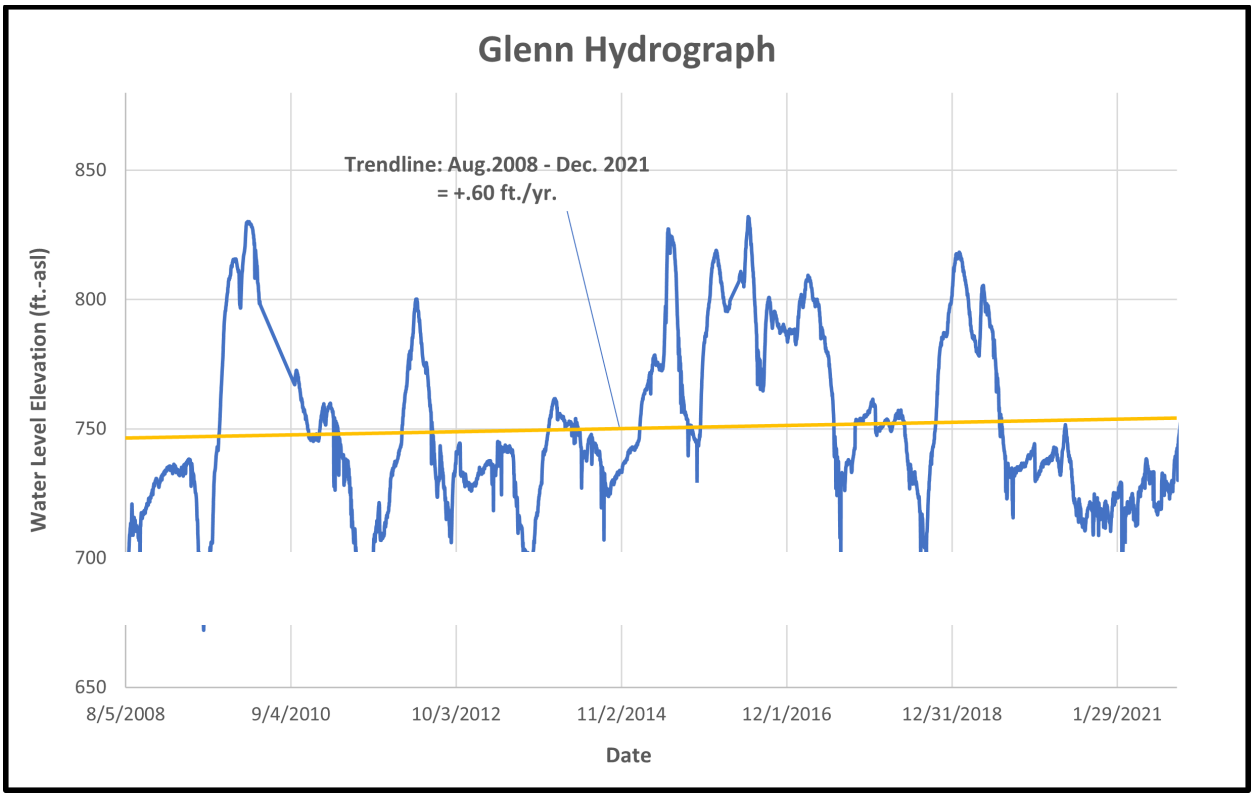


Figure 10: Glenn Well Hydrograph showing the trendline from August 2008 to December 2021.

12.2. *Management Objective*

The Modeled Available Groundwater (MAG) for the Trinity Aquifer in the District is derived from the DFC and requires frequent review against estimated pumpage.

Performance Standard

The District shall prepare an Annual Report of MAG estimated pumpage to monitor District compliance. A summary shall be presented to the District Board and made available to the public and included in the Annual Report.

The Available Groundwater HTGCD Trinity Aquifer System chart (**Table 1**, page 32) has been updated for 2021 and includes estimated exempt use production numbers and actual production reported from non-exempt permit holders from 2009 through 2021 A summary (**Figures 12** and **13**, pages 34-35) was provided to the District's Board of Directors during the annual report presentation. Special attention should be given to the following data:

During 2021, 137 new wells were registered within the District boundary. 134 of them are exempt wells. registered Using 330 gallons per day, calculations show that 50 acre-ft/year will be produced on average from the newly added 134 exempt wells. The total exempt use for domestic and agriculture use during 2021 was estimated to be 3,809 acre-ft/year.

The sum of permitted "non-exempt use" during 2021 is 3,931 acre-feet. The sum of "non-exempt use" and "exempt use" (3,809 acre-feet and 3,931 acre-feet) is 7,740 acre-ft allocated in 2021. The District estimates an additional 100 acre-feet of non-permitted non-exempt use bringing the allocated total to 7,840 acre-feet. Actual 2021non-exempt production reported to the District totaled 2,049 acre-feet.

Extrapolating a linear trend based on the previous 5-years of data, permitted plus exempt use will exceed the MAG (9,098 acre-feet per year), in 2030 (**Figure 11**).

The Texas Water Development Board set the Hays Trinity Groundwater Conservation District's total MAG (Modeled Available Groundwater) at 9,098 acre-feet. As of 2021 the District has committed 7,840 acre-feet. The remaining 1,258 acre-feet/year must be distributed between future new exempt and non-exempt commitments.

Available Groundwater HTGCD-Trinity Aquifer System as of December 31, 2021 (Acre-Feet/Year, AFY)

	Year-End 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Modeled Available Groundwater [1]		**9,109**	**9,109**	**9,109**	**9,109**	**9,109**	**9,109**	**9,109**	**9,109**	**9,109**	**9,109**	**9,098**	**9,098**
Exempt Use: Domestic/Agricultural	[2]3,300	3,322	3,358	3,398	3,448	3,495	3,542	3,577	3,616	3,663	3,716	3,758	3,809
Non-Exempt Use: Permitted[3]	1,860	1,877	2,442	2,451	2,854	2,989	3,310	3326	3,545	3,741	3,903	3,924	3,931
Non-Exempt Use: No Permit -Estimated[4]	100	100	100	100	100	100	100	100	100	100	100	100	100
Non-Exempt Use: Reporting - No Permit[5]	482	364	306	235	19	2	3	4	0	0	0	0	0
Sub-Total Committed	5,742	5,663	6,206	6,184	6,421	6,586	6,955	7,007	7,261	7,504	7,719	7,782	7,840
Net Available Groundwater (MAG-Sub-Total)		3,446	2,903	2,926	2,688	2,523	2,154	2,102	1,848	1,605	1,390	1,316	1,258
Non-Exempt Actual Production	1,987	1,796	2,004	1,691	1,599	1,532	1,537	1,586	1,815	1,904	1,940	2,231	2,049

2009 : 99 new Well Construction Notifications or 37AFY
2010 : 59 new Well Construction Notifications or 22 AFY
2011 : 96 new Well Construction Notifications or 36 AFY
2012 : 107 new Well Construction Notifications or 40 AFY
2013 : 135 new Well Construction Notifications or 50 AFY
2014 : 126 new Well Construction Notifications or 47 AFY
2015 : 127 new Well Construction Notifications or 47 AFY
2016 : 95 new Well Construction Notifications or 35 AFY
2017 : 105 new Well Construction Notifications or 39 AFY
2018 : 126 new Well Construction Notifications or 47 AFY
2019 : 144 new Well Construction Notifications or 53 AFY
2020 : 115 new Well Construction Notifications or 42 AFY
2021 : 137 new Well Construction Notifications or 51 AFY

[1] TWDB-calculated MAG pumping decreases over time, and incorporates assumptions on future use

[2] Approved by the HTGCD Board April 25, 2011 based on the HDR NA Case 5,784 (Water-Wastewater Plan for Hays Co., 2011)

[3] Total AFY permitted for pumping in existing operational permits

[4] Non-Exempt Use: not permitted and not reporting; Goal: permit users and move 100 AFY towards 0 AFY[*)]

[*)] 10 AFY calculated: Identified & Under Investigation = 50 cases @ 2 AFY each = 100 AFY

[5] Non-Exempt Use: reporting but not permitted; Goal: permit users and move 4 AFY towards 0 AFY

Numbers at a Glance

Total Registered non-exempt wells:	108
Total Registered exempt wells (estimated):	2,022
Total monitor wells:	59
Total registered producing wells:	**2,130**
Utility Connections:	8,697
Total Volume p**ermitted** (estimated):	4,031
Total non-exempt produced, AFY:	2,049
Total exempt use (estimated, AFY):	3,809
Total **produced** (estimated, AFY):	5,858
Total Modeled Available Groundwater, AFY:	**9,098**

Table 1: Modeled Available Groundwater in the Trinity Aquifer System within the Hays Trinity GCD Jurisdiction.

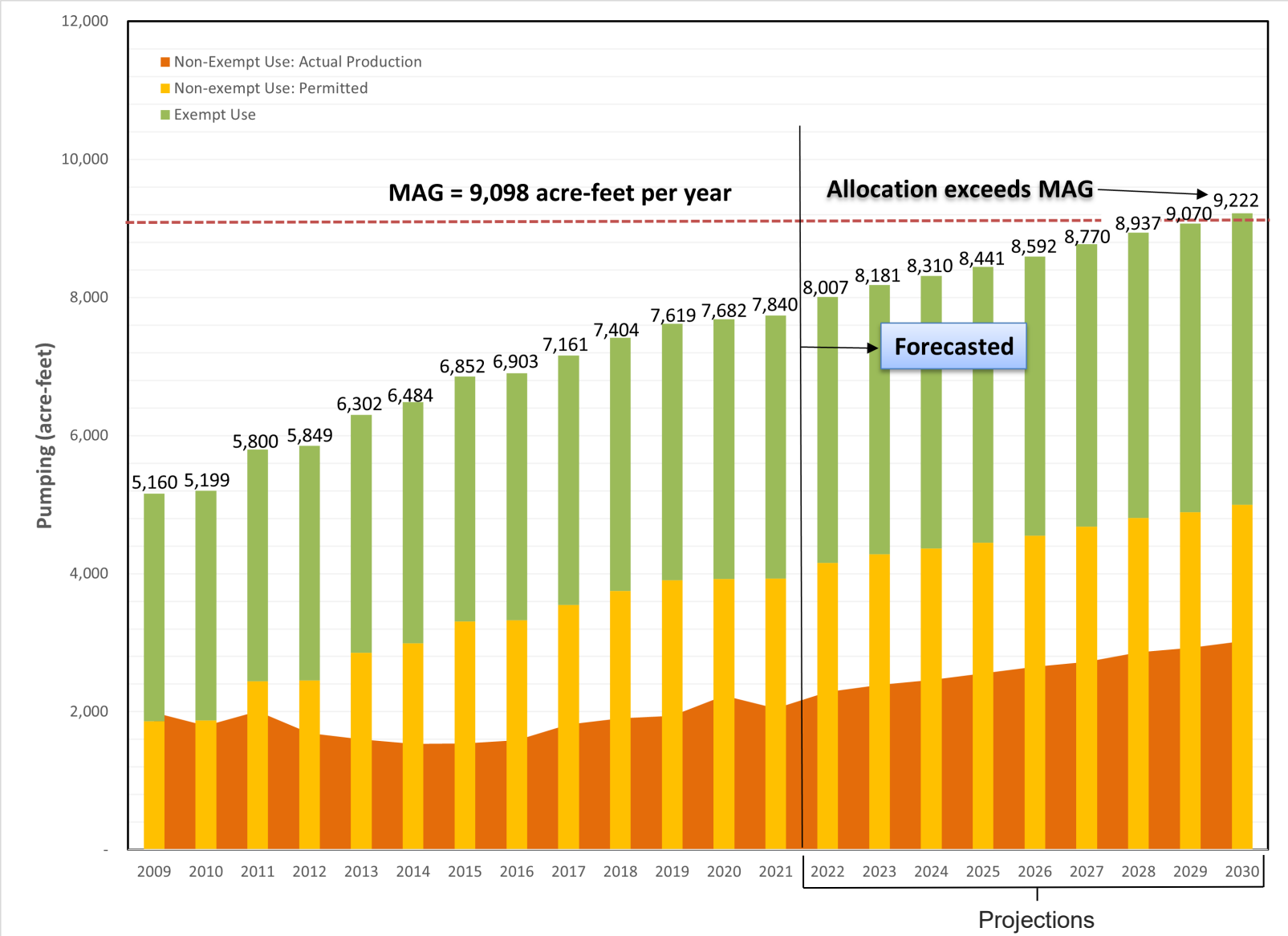


Figure 11: Estimated Exempt and Non-exempt Historical Groundwater Use. The Forecast is a Linear Extrapolation of the 2017-2021 Data in **Table 1**.

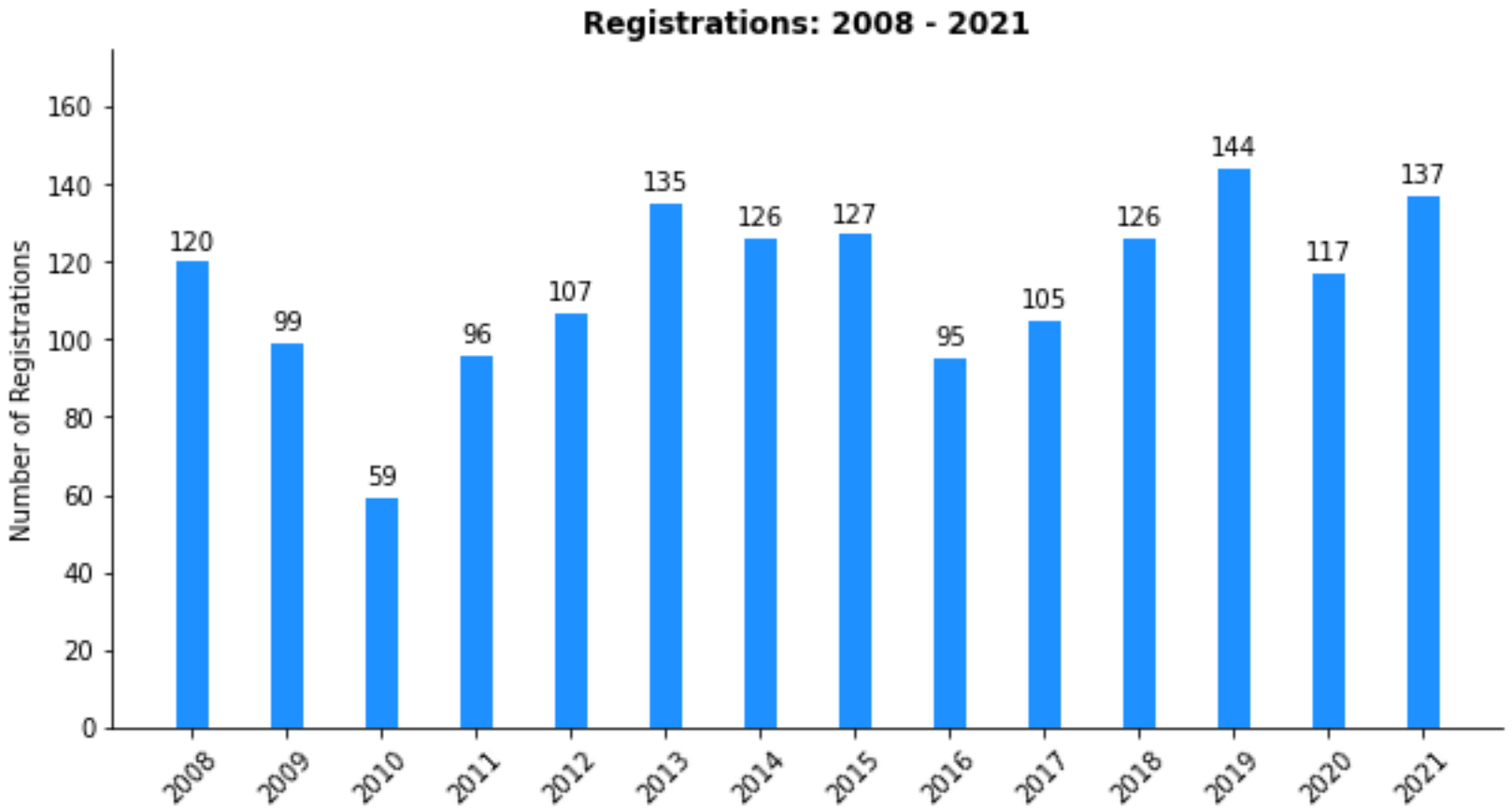


Figure 12: Wells Drilled by Year, Including Geothermal and Non-producing Monitoring Wells

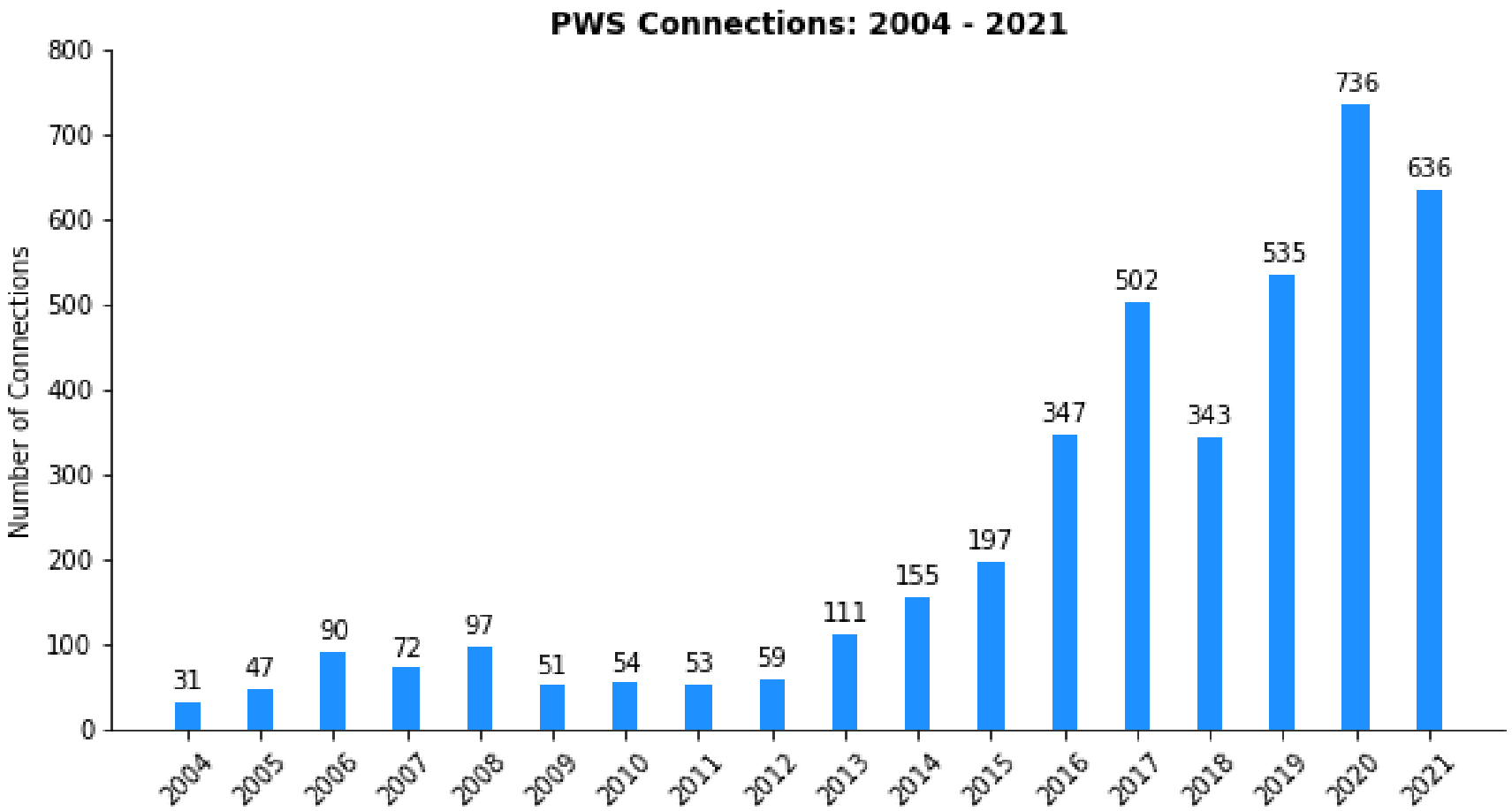


Figure 13. Public Water Supply Connections by Year.

Appendix:

Section 1.	Board Meeting and Public Hearing Agendas
Section 2.	Manager, Science, New Wells & Connections Reports
Section 3.	Drought Support Documents
Section 4.	Financial Statement, Mitigation Fund, 2021 Audit Summary
Section 5.	Project Reports
Section 6.	Rainwater Harvesting Support Documents
Section 7.	Newspaper Articles and Press Releases
Section 8.	Review of Professional Services

References:

Martin, N.M., Green, R.T., Nicholaides, K.D., Fratesi, S.B., Nunu, R.R., and Flores, M.E, 2019, Blanco River Aquifer Assessment Tool: A Tool to Assess How the Blanco River Interacts with Its Aquifer: Creating the Conceptual Model. Technical Report prepared for the Meadows Center for Water and the Environment. Texas State University at San Marcos, Texas. 136 p. + attachments.

Jones, I., 2017, GAM Run 16-023 MAG: Modeled Available Groundwater for the Aquifers in Groundwater Management Area 9, Texas Water Development Board, 26 p.

HDR Engineering Inc., 2011, Water And Wastewater Facilities Plan For The Portion Of Hays County West Of The IH-35 Corridor