Advancing Groundwater Sustainability in Texas

A Guide to Existing Authorities and Management Tools for Groundwater Conservation Districts and Communities

Authors

Vanessa Puig-Williams
Director, Texas Water Program
Environmental Defense Fund

Jennifer Diffley
Culp & Kelly LLP

Graham Pough
2022 J.D. Candidate
University of Texas School of Law

November 2020

ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

This report was developed by Environmental Defense Fund with support from the Cynthia and George Mitchell Foundation, the Meadows Foundation, and the Jacob and Terese Hershey Foundation.

One of the world's leading international nonprofit organizations, Environmental Defense Fund creates transformational solutions to the most serious environmental problems. To do so, EDF links science, economics, law and innovative private-sector partnerships. With more than 2.5 million members and offices in the United States, China, Mexico, Indonesia and the European Union, EDF's scientists, economists, attorneys and policy experts are working in 28 countries to turn our solutions into action.

Contents

Executive Summary

Groundwater provides about 60% of our yearly water supply in Texas — it is a vital, yet limited, resource that supports Texas communities, economies, and natural systems. Despite its importance, across most of Texas, groundwater is being managed in a way that allows for its eventual depletion, putting communities, rivers and streams and the ecosystems that depend on groundwater at risk. A recent report from the Meadows Center for Water and the Environment concluded groundwater conservation districts, Texas' preferred method of managing groundwater, have an opportunity to change course and to manage groundwater sustainably.

Fortunately, the Texas Legislature wisely imparted management obligations on GCDs that are imperative for long-term water security and livability of Texas' communities. And the Legislature has equipped GCDs with a full toolbox of planning, rulemaking, and permitting authorities to carry out their management obligations. GCDs have flexibility within their existing authorities to integrate sustainability principles into management goals, desired future conditions, management plans, and rules. Although GCDs face challenges managing a common pool resource that is privately owned and many suffer from a lack of funding and state investment in local data and modeling, GCDs can still move toward sustainable management by actively engaging the public and implementing new approaches through smaller, targeted programs, enabling GCDs to fully utilize the tools already available to them.

Introduction

Groundwater provides about 60% of our yearly water supply in Texas — it is a vital, yet limited, resource that supports Texas communities, economies and natural systems. Groundwater is the primary and often only water supply available to many rural residents and businesses and is the source of year-round flow in most rivers, streams and springs. However, groundwater is being used faster than it is replenished.[1] **Sustaining groundwater supplies is essential for protecting rural livelihoods, property rights, sustaining communities' quality of life, and enabling and maintaining economic vitality and growth.**

Groundwater levels are declining across Texas[2]. Some consequences of declining groundwater are:

- Wells drying up or needing to be deepened, with increasing costs to access groundwater.
- Conflicts arising among neighbors.
- Depletion of groundwater storage that communities rely on as their 'emergency savings account' for drought periods.
- Subsidence causing costly property damage.
- Disconnecting springs and groundwater dependent ecosystems from aquifers, with associated impacts to community, recreational, aesthetic, and cultural values.

To ensure continued availability of groundwater for our communities and natural systems, we must manage the valuable resource for **long-term sustainability,** or in other words, sustainable yields, **with consideration of the unique community, economic and environmental values** that make our Texas communities vibrant places to live and work.

At a high level, sustainability involves "development and management of groundwater in a manner that can be maintained for an indefinite time **without causing unacceptable environmental, economic or social consequences**."[3] In Texas, however, many aquifer-specific management goals, referred to as desired future conditions (DFCs), allow for unsustainable volumes of pumping, as they are defined in terms of allowable drawdown over time. This essentially allows planned depletion or aquifer mining. A recent statewide analysis of DFCs reveals that 95% of aquifer-county-groundwater management area DFCs allow for

[1] Although some groundwater declines have been reversed locally, such as in the Houston area, in general groundwater levels in all major and minor aquifers in the state have declined from predevelopment levels in response to human uses, meaning more water is being used than is being replenished. Median water levels have declined statewide less than 2 feet per year between 1995 and 2015, although localized declines in some areas have been significantly higher. Texas Water Development Board, *Texas Aquifers Study: Groundwater Quantity, Quality, Flow, and Contributions to Surface Water* (2016).

[2] Texas Water Development Board, *Texas Aquifers Study: Groundwater Quantity, Quality, Flow, and Contributions to Surface Water* (2016).

[3] William M Alley, Thomas E Reilly & O. Lehn Franke, Sustainability of Ground-Water Resources, US Geol. Surv. Circ. 1186 (1999), https://pubs.usgs.gov/circ/circ1186/pdf/circ1186.pdf.

water-level declines in the state's aquifers.[4] This can have a variety of negative impacts for communities, like impacts to community livability and loss of valuable ecosystem services.[5] To avoid these potential consequences, planning and budgeting groundwater use based on *sustainability* or sustainable yields call for:

- Setting holistic, multi-generational goals.[6]
- Incorporating local social, economic and environmental values.[7]
- Accounting for and conjunctively managing groundwater and connected surface water.[8]
- Identifying and implementing a variety of management programs and tools that are designed to achieve the basin-specific goals.[9]

Failing to manage groundwater sustainably risks creating unintended consequences to community, property rights, economic, and environmental values.

Texas' groundwater management framework already provides for many of these sustainability principles. However, there continue to be challenges in achieving long-term sustainability as defined above. For example, as described more in EDF's *Beneath the Surface* report,[10] sustainable management is challenged by the lack of integrated planning of interconnected groundwater and surface water resources, disagreement regarding how much groundwater can or should be removed from an aquifer, and conflicts between competing uses of limited resources, among other things.

Recently, the Meadows Center for Water and the Environment released a study calculating the maximum sustainable production of aquifers in Texas – which the report defines as the volume of groundwater that can be pumped in perpetuity while maintaining aquifer levels (not allowing drawdown). It is important to clarify that the maximum sustainable production

---

[4] Mace, Robert, Groundwater Sustainability in Texas, The Meadows Center for Water and the Environment, Texas State University (2021).

[5] "Healthy ecosystems provide a range of critical services that we largely take for granted. Created by the physical processes of ecosystems as well as by the interactions of living organisms in their environments, these 'ecosystem services' underpin society and always have. The benefits ecological resources provide to humans bay be usefully divided into four categories: regulating services (e.g., flood control and water purification by riparian habitat); provisioning services (e.g., timber and crops); cultural services (e.g., recreation and spiritual connection); and supporting services (e.g., nutrient cycling)." J.B. Ruhl & James Salzman, Ecosystem Services and Federal Public Lands: A Quiet Revolution in natural Resources management, 91 U. Colo. L. Rev. 677 (2020) (internal citations omitted).

[6] William M Alley, Thomas E Reilly & O. Lehn Franke, *Sustainability of Ground-Water Resources*, U.S. GEOLOGICAL SURVEY CIRCULAR : 1186 (1999), https://pubs.usgs.gov/circ/circ1186/pdf/circ1186.pdf; Tom Gleeson et al., *Towards Sustainable Groundwater Use: Setting Long-Term Goals, Backcasting, and Managing Adaptively*, 50 GROUND WATER 19–26 (2012).

[7] Alley, Reilly, and Franke, *supra* note 5; William M Alley & Stanley A. Leake, *The Journey from Safe Yield to Sustainability*, 42 GROUND WATER 5 (2004).

[8] Thomas C. Winter et al., *Ground Water and Surface Water: A Single Resource*, U.S. GEOLOGICAL SURVEY CIRCULAR 1139 87 (1998); Alley, Reilly, and Franke, *supra* note 5.

[9] Gleeson et al., *supra* note 5.

[10] Vanessa Puig-Williams, *Beneath the Surface: Key Issues Underlying Groundwater Management in Texas*, ENVIRONMENTAL DEFENSE FUND (2020), https://www.edf.org/sites/default/files/documents/EDF%20Beneath%20the%20Surface%20Report%20November%202020.pdf (last visited Jun 9, 2021).

that is calculated in the study does not necessarily equate to sustainable management or sustainability, as it is possible to maintain aquifer levels and still negatively impact surface water. The report's findings, however, are important in understanding how groundwater conservation districts can begin moving away from management goals that allow for aquifer depletion and toward sustainability. The report concluded:

> Overall, the maximum sustainable production for the major and minor aquifers of the state amounts to about 4.0 million acre-feet per year while production (current use) is about 7.01 million acre-feet per year and modeled available groundwater (allowable maximum use) is 8.9 million acre-feet. That means that Texas is currently producing its aquifers 1.8 times the sustainable rate and makes available 2.4 times the maximum sustainable production rate. [11]

When the Ogallala, which in 2019 provided 64% of all the groundwater in the state, is removed from the analysis the study concluded:

> the maximum sustainable production for the major and minor aquifers of the state without the Ogallala amounts to about 3.3 million acre-feet per year, while current production is about 2.6 million acre-feet per year and modeled available groundwater (allowable maximum use) is 6.33 million acre feet. That means that Texas is currently producing these aquifers (without the Ogallala) .8 times the sustainable rate but makes available 1.9 times the maximum sustainable rate.[12]

The takeaway from this analysis is that groundwater management is headed in the wrong direction in Texas. We are managing the slow and eventual depletion of our aquifers. However, there is an opportunity to change course and ensure, at a minimum, that groundwater pumping does not result in continued drawdown and that the groundwater that landowners' and natural systems depend on is protected in the future.

This report describes the existing authorities that GCDs have to plan and manage groundwater resources under the Texas Water Code. It explores the ways these authorities are being implemented, related both to general sustainability principles and to the purpose behind the management framework crafted by the Texas Legislature. . Finally, this report suggests approaches that GCDs could take to utilize and bolster their existing authorities in order to plan and manage groundwater resources for long-term sustainability.

---

[11] Mace, Robert, Five Gallons of Water in a Ten Gallon Hat: Groundwater Sustainability in Texas, The Meadows Center for Water and the Environment, Texas State University (2021) at 32.

[12] *Id.*

GCD Authorities to Sustainably Manage Groundwater

As previously mentioned, to sustainably manage groundwater, regulators must be able to set holistic, multigenerational goals that consider local social, economic, and environmental values; they must be able to account for interconnected surface water resources;[13] and then utilize a variety of management tools to achieve basin-specific goals. Chapter 36 of the Texas Water Code, which outlines GCDs management authorities and constraints, provides GCDs with the powers needed to sustainably manage groundwater.

Chapter 36's purpose is "to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater…consistent with Section 59, Article XVI of the Texas Constitution."[14] Section 59, Article XVI of the Texas Constitution, also referred to as the Conservation Amendment, declares that the conservation of the natural resources of the state of Texas is a public right and duty.

To accomplish Chapter 36's purpose and "to protect property rights, balance the conservation and development of groundwater to meet the needs of this state,"[15] Chapter 36 confers certain powers to local GCDs. GCDs are the state's preferred method of managing groundwater, and GCDs' responsibility to and authorities around managing local groundwater resources are central to sustainable groundwater management. Within these powers, GCDs have many opportunities to sustainably manage groundwater. This section identifies GCDs' existing statutory authorities related to the sustainability principles, including powers related to planning, rulemaking, permitting and enforcement. It also explores how these existing authorities could be more effectively utilized to achieve sustainable management.

Planning authorities

Long-term management for sustainability starts with defining objectives for management of the hydrologic system. A hallmark of sustainable groundwater management is defining management goals on multigenerational time horizons, considering connected social, economic, and environmental values/impacts.[16] In Texas, groundwater management starts with high-level management goals established at both local and regional/aquifer levels. These goals become the foundational policies that are implemented through district-level management plans, rules, permitting decisions and management programs.

[13] Thomas C. Winter et al., Ground Water and Surface Water: A Single Resource 87 (1998); Alley, Reilly, and Franke, supra.

[14] Tex. Water Code § 36.0015(b).

[15] *Id.*

[16] Alley, Reilly, and Franke, *supra* note 5; Alley and Leake, *supra* note 6; Gleeson et al., *supra* note 5.

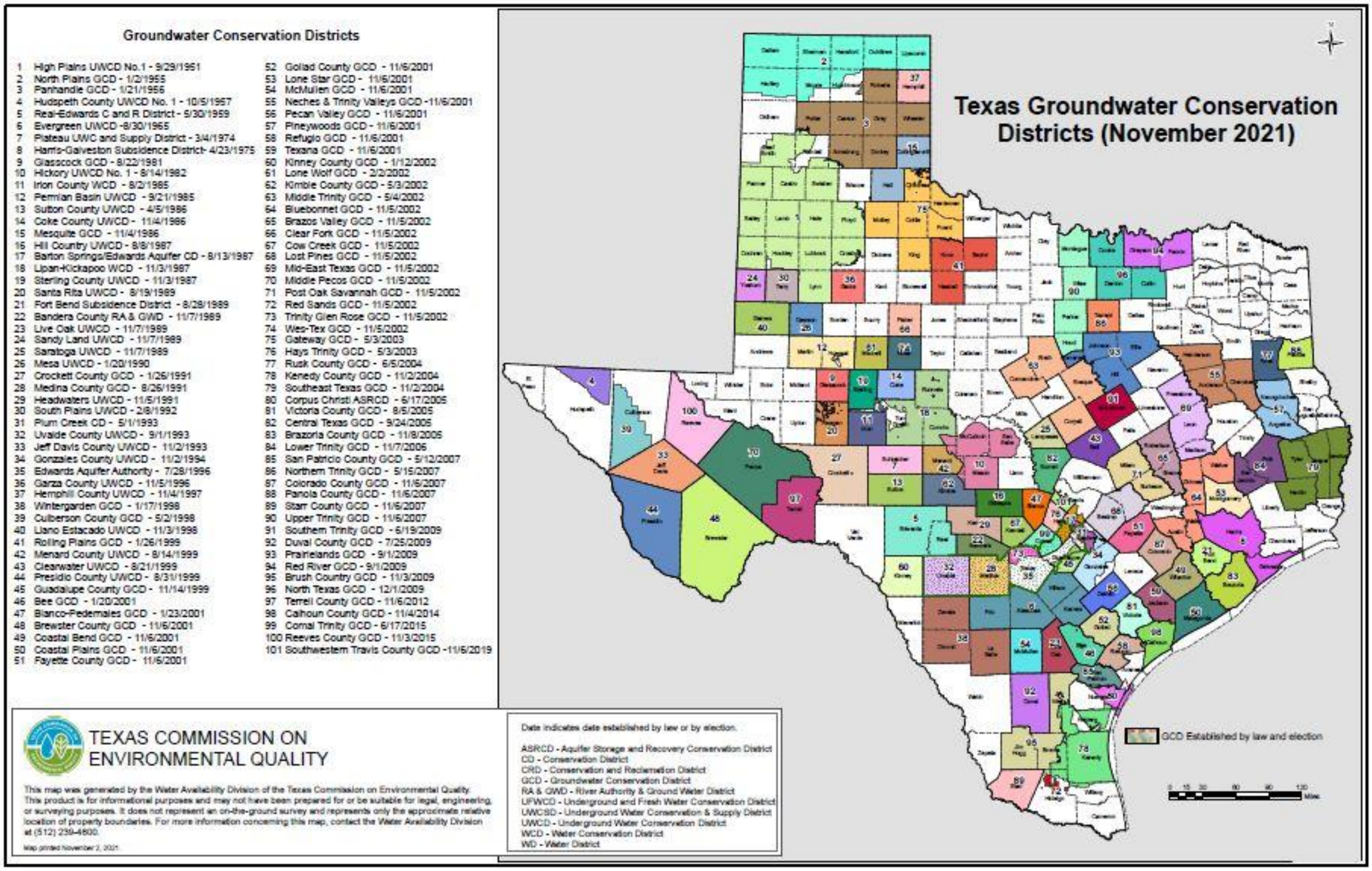

Figure 1: Groundwater Conservation Districts in Texas, Texas Water Development Board. (https://www.tceq.texas.gov/downloads/groundwater/maps/gcd-map.pdf)

Local management goals and management plans

Every GCD must develop a management plan within three years of its creation and submit the plan to the executive administrator of the Texas Water Development Board for approval.[17] Chapter 36 requires GCDs to develop management plans in coordination with regional surface water entities, theoretically allowing for consideration of groundwater and surface water connections in the planning process. While coordination could be more meaningful throughout river basins, importantly, Chapter 36 recognizes the need for groundwater and surface water managers to collaborate.

[17] Tex. Water Code § 36.107(f).

Once approved, GCDs can vote to amend their management plans.[18] GCDs must review and readopt the plan with or without revisions every 5 years, which importantly, provides GCDs with flexibility to adapt their goals and objectives with changing circumstances. This is crucial to developing a management framework that can adapt to changing conditions and avoid unacceptable impacts, as groundwater uses and aquifer conditions may shift over time.

Eight goals to be included in management plans

(Tex. Water Code § 36.1071(a)(1-8))

1. Most efficient use of groundwater.
2. Controlling and preventing waste.
3. Controlling and preventing subsidence.
4. Addressing conjunctive surface water management issues.
5. Addressing natural resource issues.
6. Addressing drought conditions.
7. Addressing conservation, recharge enhancement, rainwater harvesting, precipitation. enhancement or brush control, where appropriate and cost-effective.
8. Addressing the desired future conditions adopted.

Consistent with sustainability principles, these eight goals require GCDs to develop management plans designed to address a variety of hydrologic, community, economic, and environmental considerations. GCDs have statutory obligations to, at a minimum, *control and prevent* waste and subsidence and *address* conjunctive management, natural resource, drought, conservation, and aquifer-specific desired future conditions (described more in the following section). It is important to note that the statute's requirements are a floor, not a ceiling. Nothing in the statute prevents a GCD from including additional or more aspirational goals in its management plan.

Importantly, management plans must also identify performance standards, management objectives, and the actions, procedures, or avoidance necessary to achieve these goals.[19] These expressly delegated authorities provide a significant amount of room to develop a variety of management tools and programs to achieve districts' statutory management obligations and local resource management goals.

Joint planning and desired future conditions

Another component of GCDs' Chapter 36 planning obligations is collaborating with other GCDs within defined Groundwater Management Areas (GMAs) on research and planning over shared aquifers, a process referred to as joint planning.[20] Ideally, the joint planning process

---

[18] Tex. Water Code § 36.1073 (contingent on the Texas Water Development Board Executive Administrator's approval).

[19] Tex. Water Code § 36.1071(e)(1).

[20] Tex. Water Code § 36.108.

serves as a foundation for a framework premised on sustainable management. This collaboration enables joint management goals and holistic management of aquifers where GCDs' jurisdictions overlie the same aquifer. Under Chapter 36, GCDs within the same GMA share and review each other's management plans and participate in meetings at least annually.[21] Importantly, in reviewing each other's management plans, the districts are tasked with considering "the effectiveness of the measures established by each district's management plan for conserving and protecting groundwater and preventing waste," and "any other matters that the boards consider relevant to the protection and conservation of groundwater and the prevention of waste in the management area."[22] Essentially, Chapter 36 has created a process for GCDs managing different parts of the same aquifer to ensure that their local management goals are consistent with the code's stated purpose of protecting and conserving groundwater.

The most significant task that GCDs undertake as part of the joint planning process is the development and adoption of Desired Future Conditions (DFCs). After considering adequate data, including groundwater availability modeling conducted by the Texas Water Development Board (TWDB), GCDs within the same GMA establish DFCs for partial and whole aquifers within the boundaries of a management area.[23] In its most basic form, a DFC is a long-term management goal for an aquifer "that captures the philosophy and policies addressing how an aquifer will be managed."[24]

The DFC process and the factors the code requires GCDs to consider when adopting DFCs imbue GCDs with a variety of opportunities to set holistic, long-term management goals designed to avoid unacceptable environmental, economic, or social consequences. In adopting DFCs, GCDs must consider nine factors set forth in Chapter 36. Sustainability principles are embedded in several of the nine factors, providing GCDs with the opportunity to adopt DFCs based on sustainability goals.

---

[21] Tex. Water Code § 36.1086. (c).

[22] Tex. Water Code § 36.108(c)(2), (3).

[23] Tex. Water Code § 36.108(d-1)

[24] Robert E Mace et al., *A Streetcar Named Desired Future Conditions: The New Groundwater Availability for Texas (Revised)*, *in* THE CHANGING FACE OF WATER RIGHTS IN TEXAS 2008 (2008), https://www.twdb.texas.gov/groundwater/docs/Streetcar.pdf.

Nine factors that GCDs must consider when adopting desired future conditions

(Tex. Water Code § 36.108(d))

1. Aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another.
2. The water supply needs and water management strategies included in the state water plan.
3. Hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge.
4. Other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water.
5. The impact on subsidence.
6. Socioeconomic impacts reasonably expected to occur.
7. The impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under Section 36.002.
8. The feasibility of achieving the desired future condition.
9. Any other information relevant to the specific desired future conditions.

GCDs use groundwater availability models developed by the TWDB to help them evaluate optional DFC expressions, and then select the DFC(s) that a supermajority of the GCDs approves. DFCs must balance the highest practicable level of groundwater production against conserving and preserving groundwater and preventing waste and subsidence.[25] The TWDB then takes the DFC and uses it to develop the modeled available groundwater (MAG) for each relevant aquifer — the amount of groundwater that can be pumped and achieve the DFC. DFCs are adopted by multiple GCDs over shared aquifers and then integrated as specific goals into each individual GCDs management plans, allowing for holistic, basin-wide targets that individual GCDs then implement management programs to achieve.

Rulemaking

As described above, GCDs have the authority to set management goals and develop plans that address how these goals will be achieved. GCDs' rulemaking authority is critical to achieving these goals, both district specific goals, and the more holistic DFCs. The rulemaking authority, and specifically, the permitting standards described in Chapter 36, provide GCDs with the ability to develop rules "to provide for conserving, preserving, protecting, and recharging of the groundwater ... in order to control subsidence, prevent degradation of water quality, or

[25] Tex. Water Code § 36.108(d-1)

prevent waste of groundwater and to carry out the powers and duties provided by [Chapter 36]."[26]

GCDs have a great deal of latitude with respect to rulemaking, although the Code specifies a few requirements. In adopting rules, a GCD must consider all groundwater uses and needs; develop rules that are fair and impartial; consider groundwater ownership and rights; and consider the public interest in conserving and preserving groundwater and the goals of the management plan.[27] With these explicit authorities and through rulemaking procedures that involve public notice and hearings, GCDs have significant flexibility in determining the most appropriate approaches, management tools, and programs — implemented through district rules — to achieve their management obligations and sustainability goals.

One important caveat is that while Chapter 36 has endowed GCDs with a great deal of flexibility in crafting rules, legal disputes have created regulatory uncertainty over the point at which regulation rises to the level of a taking of private property requiring compensation.[28] The Texas Supreme Court has clearly validated GCDs authority to reasonably regulate groundwater[29] and pursuant to their police powers, GCDs may "take" private property to ensure the public interest is protected. But under Chapter 36, GCDs must protect landowners' property rights in groundwater as well, which means GCDs must balance both the public interest and private rights in groundwater. Managing for sustainability helps achieve this balance.

Permitting

The bulk of GCDs' rulemaking powers relate to permitting. GCDs must adopt rules to identify which activities require permitting, which permits require a hearing, and the standards for permit applications, among other things. Permitting rules can vary for different activities as well as for different aquifers within a GCD, and they can be a key management tool for achieving sustainability goals and addressing interrelated resource issues. Chapter 36 instructs GCDs to use well permitting standards to "prevent waste and achieve water conservation, minimize as far as practicable the drawdown of the water table or the reduction of artesian pressure, lessen interference between wells, or control and prevent subsidence." Permitting rules can support sustainability goals by quantifying and managing new and existing uses, and by establishing standards for avoiding or minimizing basin-wide or localized resource impacts.

GCDs must require a permit for drilling, equipping, operating, or altering wells, and GCDs are authorized to implement rules and permit conditions related to the spacing, maintenance, production and measurement of groundwater wells.[30] GCDs can require wells to be spaced a particular distance from property lines or adjoining wells. These spacing requirements can vary based on a well's production capacity, pump size, or other characteristics related to its construction, operation, and production. GCDs can pass rules to require the

---

[26] Tex. Water Code § 36.101 (a).
[27] *Id.*
[28] Day, Bragg, Fazzino
[29] See Edwards Aquifer Auth. v. Day, 369 S.W.3d 814 (Tex. 2012); Edwards Aquifer Auth. v. Bragg, 421 S.W.3d 118 (Tex. App. 2013); Fazzino v. Brazos Valley Groundwater Conservation District, No. 18-50994 at 9 (5th Circuit, May 29, 2020).
[30] Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 840-841 (Tex. 2012).

installation of casing, pipe, and fitting to prevent the escape of groundwater and to prevent the pollution or harmful alteration of the accessed water.[31] GCDs can also create specific requirements for the capping of open or uncovered wells when they are not in use.[32]

GCDs may regulate production of groundwater by setting production limits on wells, limiting the amount of water produced based on acreage or tract size, limiting the amount of water that may be produced from a defined number of acres assigned to an authorized well site, limiting the maximum amount of water that may be produced on the basis of acre-feet per acre or gallons per minute per well site, managed depletion, or any combination of these methods.[33] Additionally, GCDs can require well operators to monitor, record and report the production and conditions of their wells.

To better manage groundwater in specific areas within the district, GCDs may adopt different rules for aquifers or geographic area overlying aquifers (or portions thereof).[34] GCDs have fairly broad authority to create management areas/zones within the district. The district may do so if it determines that conditions in or use of an aquifer differ from one geographic area to another, or simply for better management of groundwater resources in a district.

Although GCDs are expressly prohibited from banning the export of groundwater outside of the district, GCDs may require permits for groundwater export.[35] GCDs cannot impose stricter limitations on exporters than the limitations applied to in-district users; however, GCDs may consider the effect of the proposed transfer on aquifer conditions and available groundwater within the district, may issue permits specifying the allowable period and amount of water to be exported, with periodic reviews of the amount transferred and impose an export fee.

Chapter 36 provides a list of standard information that GCDs may require to be included in well permit applications.[36] GCDs may also adopt permit requirements based on rules specific to each individual district, allowing for permit requirements to be tailored to the unique characteristics and concerns of local GCDs.

When evaluating permit applications, Chapter 36 requires GCDs to, among other things, consider whether the proposed use of water unreasonably affects existing groundwater and surface water resources, existing permit holders and whether the proposed use of water is consistent with the district's management plan.[37] GCDs can also require agreements by the permittee to avoid waste and achieve water conservation and to use reasonable diligence in protecting groundwater quality. In issuing permits, GCDs must consider total groundwater production on a long-term basis to achieve an applicable DFC.[38] This includes considering the

[31] Tex. Water Code § 36.117 (h).
[32] Tex. Water Code § 36.118.
[33] Tex. Water Code § 36.116.
[34] Tex. Water Code § 36.116(d).
[35] Tex. Water Code § 36.122.
[36] Tex. Water Code § 1131.
[37] Tex. Water Code § 36.113(d).
[38] Tex. Water Code § 36.1132.

modeled available groundwater, the impact of existing permits and permit exemptions, and yearly participation patterns.

Permits themselves may include a variety of terms and conditions, such as (depending on the type of permit) reporting withdrawals, requirements to avoid waste, conditions and restrictions on the rate and amount of withdrawal, and/or a district-prescribed drought contingency plan.[39] Districts may impose more restrictive permit conditions on new permits (or applications to increase an existing permitted use), so long as the restrictions apply to all subsequent new permits, bear a reasonable relationship to the existing district management plan, and are reasonably necessary to protect existing use.[40]

The rulemaking and permitting process together create a variety of points through which GCDs may ensure that groundwater development is consistent with the GCDs management obligations and sustainability goals. These points include rulemaking proceedings, determining what relevant activities should be permitted, setting permitting requirements and criteria, evaluating individual permit applications for approval, and setting terms and conditions in the permit to guide the permitted activities into the future. GCDs are also empowered with enforcement authority to monitor and investigate potential violations and enforce the GCD's rules or permit conditions.[41]

Tools to Achieve Sustainable Management Goals under Existing Authorities

A variety of tools are likely needed to comprehensively achieve a district's management goals and ensure long-term sustainability. The following list provides ideas for how GCDs can manage current and new groundwater uses and protect groundwater rights and resources under the existing authority described above in Chapter 36 of the Water Code. The authority for many of these tools is based in Chapter 36's broad delegation of rulemaking, management and permitting powers to GCDs. In some cases, individual GCD's enabling legislation may hinder the ability to utilize some of these tools.

Managing new and existing uses

Conservation rules

As discussed above, Section 36.1071 requires GCDs to include management goals that address conservation and drought conditions. Under Section 36.113, GCDs have the authority to require permittees to submit drought contingency plans, which describe how a permittee will

[39] Tex. Water Code § 36.1131.
[40] Tex. Water Code § 113(e).
[41] Tex. Water Code § 36.123 (authorizing GCD employees and agents to enter property to inspect and investigate compliance with district rules, regulations, permits or orders); § 36.102 (authorizing GCDs to enforce Chapter 36 and the GCD's rules against any person by injunction, civil penalties, or other appropriate remedy).

conserve water during district declared droughts, for example, by water conservation measures or utilizing alternative water supplies. Drought contingency plans are important tools to protect groundwater levels and in turn all groundwater users during times when groundwater levels are declining due to lack of rainfall.

Additionally, a GCD may adopt rules that specify how it will manage an aquifer during drought, including establishing drought triggers and associated pumping curtailments. Conservation rules could also encourage and incentivize things like rainwater harvesting or other actions to reduce withdrawals, and GCDs could include conservation rules as permit conditions where appropriate to achieve management objectives. Furthermore, GCDs can work with municipal providers within a GCD's boundaries to adopt conservation ordinances that align with drought triggers.

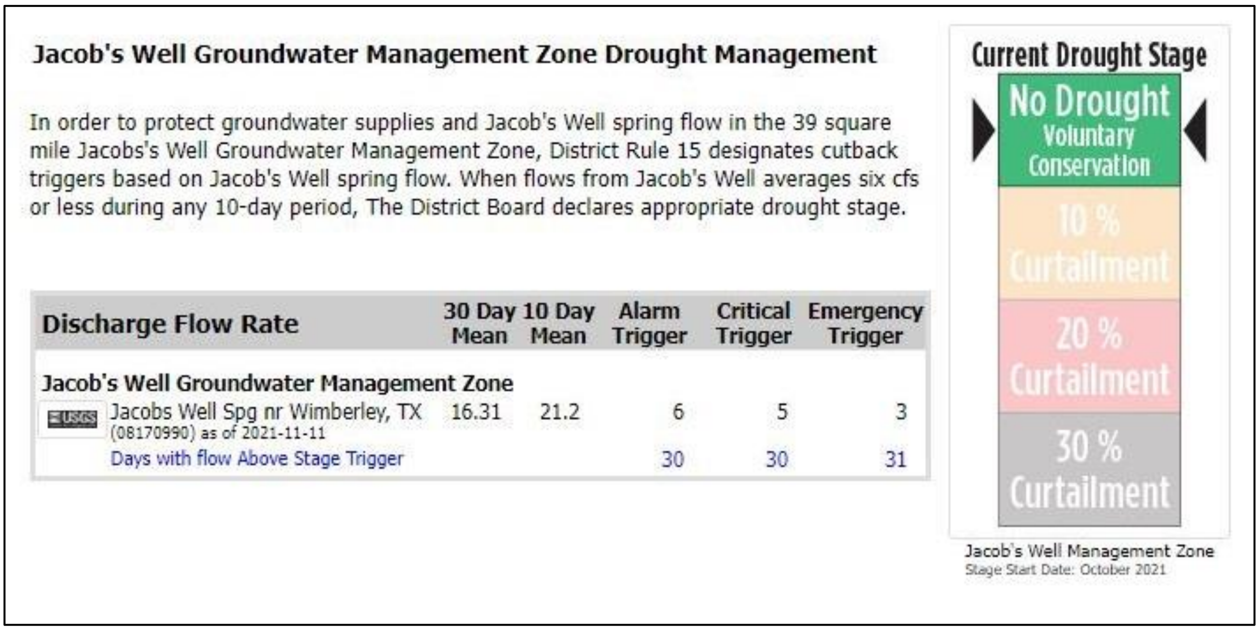

Figure 2: The Hays Trinity Groundwater District has developed drought triggers to protect groundwater supplies and Jacob's Well. (http://haysgroundwater.com/drought-management)

Best management practices

GCDs have broad authority to encourage conservation through best management practices.[42] For example, a GCD can identify best management practices and incentivize certain types of water users, like efficiency technologies for industrial, irrigation or municipal groundwater users.

[42] *See, i.e.*, Tex. Water Code. § 36.101 (authorizing a district to make and enforce rules to provide for conserving, preserving, protecting, and recharging of groundwater); § 36.1071 (directing a district to specify actions, procedures, performance, and avoidance to effect the management plan

One example is encouraging or requiring industrial users to use recycled water where safe and appropriate. Information on best management practices can be shared through education and outreach to groundwater users within the district.[43] Certain types of best management practices could potentially be included in permit conditions where appropriate to achieve management objectives.

Groundwater allocations, production limits and transfers

Where new groundwater uses (or even existing uses) exceed available supplies, GCDs can utilize their authority under Sections 36.101 and 36.116 to set production limits on individual uses or particular types of groundwater uses through rules or conditions on permits. This is something that many GCDs already do but that may be increasingly needed to ensure that aquifers are not over pumped and supplies depleted. Outside of Texas, there are places that define certain preferred uses while limiting other uses based on the local management needs.[44] Production allowances or limits could be included in permit conditions where appropriate to achieve management objectives. Production allowances could also be tailored for certain management areas within the district to address any localized impacts or management concerns, such as avoiding potential impacts to springs or other groundwater-dependent habitat and recreational values.

In some cases, particularly where available supplies have been fully allocated, a useful management tool could be enabling trading of groundwater rights or production allocations. In Texas, trading is utilized by water users in the Edwards Aquifer to secure water, as production from the aquifer has been capped to protect spring flow. In places outside of Texas, trading of groundwater shares, rights or allowances have often been a community-driven, market-based way to reallocate existing supplies, avoid impacts to existing groundwater users, and enable community and economic growth even where existing groundwater supplies are already fully allocated. In some places, trading has been enabled and encouraged through groundwater mitigation or offset programs. To balance new uses within available supplies, new groundwater uses must "offset" their impact by, i.e., obtaining/purchasing an allowance from an existing user or paying a mitigation fee that is used to implement other conservation measures. As groundwater supplies across Texas decrease and are fully allocated, trading of groundwater rights or allowances is an innovative tool for GCDs to use to sustainably manage groundwater resources within their jurisdictions.

An important co-benefit of this tool is its ability to provide management flexibility while allowing water users agency over their own allowance. However, before any water is traded, it is imperative to understand environmental and community water needs and make sure those needs are taken care of first.

---

[43] For example, Middle Pecos GCD provides information on best management practices through newsletters and presentations (*see* MPGCD 202 Conservation Article, https://www.middlepecosgcd.org/pdf/misc/MPGCD%202020%20Conservation%20Article.pdf?_t=1614097693); Hays Trinity GCD provides links to a variety of water conservation practices on its website (*see* HTGCD, Conservation, http://haysgroundwater.com/conservation)

[44] For example, in Nevada, preferred uses or restrictions on certain new types of uses may be defined for designated groundwater basins. In Arizona, expansion of irrigated acreage may be prohibited in certain groundwater management areas.

The Comal River starts at Comal Springs, which is fed by the Edwards Aquifer. Trading is utilized in the Edwards Aquifer to secure water, as production from the aquifer has been capped to protect spring flow. Photo credit: Rei at English Wikipedia

Protecting resources and avoiding localized impacts

Well spacing requirements

Many GCDs already employ well spacing requirements, pursuant to their authority under Section 36.116, to prevent well interference and localized drawdown. GCDs could, however, utilize this authority in a more innovative way to protect baseflow in rivers from groundwater pumping by requiring groundwater wells to be located a certain distance from a surface waterway. This could be a tool GCDs could use to achieve conjunctive management goals.

Protection/management zones

Under Section 36.116(d), GCDs can create management zones with rules designed to protect a spring, river, riparian area or an area that is especially sensitive to impacts from groundwater pumping. For example, the Middle Pecos Groundwater Conservation District has established management zones in principal areas of irrigation where the GCD has recognized the potential for localized drawdown.[45] A management zone may define lower overall pumping allowances or could require offsets or other conservation/balancing tools as permit conditions to ensure that existing and new uses do not negatively impact the resource. GCDs could potentially work with municipal or county governments within the district to adopt complementary tools like conservation ordinances or zoning rules to ensure that any new development within the zone occurs in a way that is protective of the sensitive resource. Middle Pecos GCD includes special permit conditions on permits in certain management zones that require non-historic use pumping reductions if groundwater elevations drop below certain thresholds.

Sustainable desired future conditions

GCDs can sustainably manage groundwater resources through the adoption of DFCs that are designed to avoid undesirable impacts to wells and to surface water resources. This could be accomplished by allowing minimal or zero groundwater level declines in sensitive areas, such as an aquifer outcrop, by utilizing spring flow as a DFC, or by setting a quantitative volume of groundwater that the GCDs determine should remain in the aquifer in the future. For example, the Clearwater Underground Water Conservation District has adopted a DFC to maintain flow from Salado Springs and works with permittees to reduce groundwater use during times of drought when spring flow is diminished.[46]

Protecting and augmenting available supplies

Aquifer recharge

Aquifer recharge, also referred to as artificial recharge involves intentionally recharging water into an aquifer. Recharge often occurs through infiltration basins. In many arid regions, treated effluent is recharged back into aquifers (often referred to as indirect potable reuse). Many places are also exploring the benefits of “green infrastructure” to enhance stormwater recharge (i.e., slowing the movement of stormwater through a wash or other natural channel to increase the amount of stormwater that is recharged). Under Section 36.1071, GCDs can set management goals related to recharge enhancement and under Section 36.1086, GCDs can work with other GCDs in a GMA to develop recharge projects. GCDs could encourage aquifer recharge through voluntary best management practices in permit conditions. More broadly, these types of projects can often bring together multiple entities — such as municipal providers, county floodwater control districts and private landowners — and can sometimes generate multiple benefits like erosion control, flood control, wildlife habitat and park amenities, in addition to groundwater recharge.

Aquifer storage and recovery

When a water user injects water into an aquifer for later use, it is referred to as aquifer storage and recovery, or ASR. Unless specifically authorized under its enabling legislation, most

---

[45] *See* Middle Pecos GCD’s Management Plan: https://www.twdb.texas.gov/groundwater/docs/GCD/mpgcd/mpgcd_mgmt_plan2020.pdf

[46] *See* Clearwater Underground Water Conservation District’s Management Plan at 9: https://cuwcd.org/wp-content/uploads/2020/12/CUWCD_Final_GMP_11Nov2020.pdf

GCDs in Texas do not have the authority to permit ASR projects, which are under the purview of the Texas Commission on Environmental Quality (TCEQ). However, GCDs can encourage and work with large permittees to develop ASR projects and utilize stored water pursuant to a drought contingency plan.

Conservancy/Water trust programs

GCDs can create conservancy or water trust programs to provide a mechanism for water users to leave a portion of their groundwater right or production allowance unused. Because groundwater is privately owned in Texas and GCDs must protect groundwater rights, conservancy programs are good tools for GCDs to employ to protect both aquifer levels and property rights. For example, GCDs could partner with a land or water trust to encourage landowners to donate their water rights to protect them from development. Or a GCD could develop a program to pay landowners to forgo pumping under an existing permit or to agree to not to seek a groundwater permit. A few western states have introduced state-level water trust models, including Colorado, Washington, Montana and Oregon.[47] Texas has a water trust that TWDB oversees that could potentially be used to hold groundwater rights, but thus far, has not been used for this purpose. One Texas GCD has implemented a district-level conservancy program: Post Oak Savannah GCD recently implemented a new program to encourage conservation and stewardship of groundwater through economic incentives for landowners to place their groundwater into a GCD-managed conservancy.[48]

Like many of the other voluntary/incentive programs, conservancy programs provide a co-benefit of providing management flexibility and source protection while allowing water users agency over their own allowance.

Toward More Sustainable Management

As discussed above, GCDs have a variety of authorities and potential tools to sustainably manage groundwater under Chapter 36 of the Texas Water Code. Yet, in many areas of Texas, groundwater levels are declining, indicating that groundwater is not necessarily being managed sustainably. The reasons for this are numerous and complex; however, there are a variety of innovative pathways that could be pursued to more effectively utilize GCDs' existing authorities discussed above to achieve more sustainable management of Texas' groundwater resources.

[47] *See* Mary Ann King, *Getting Our Feet Wet: An Introduction to Water Trusts*, 28 Harv. Envtl. L. Rev. 495, 496 (2004).
[48] Texas Alliance of Groundwater Districts, *Post Oak Savannah GCD*, https://texasgroundwater.org/news-events/news/monthly-feature/post-oak-savannah-gcd/ (described in more detail in the next section).

Barriers to sustainable management

Although Chapter 36 imparts some management obligations on GCDs related to general sustainability principles and provides GCDs with the authority to sustainably manage groundwater, it does not require them to do so. And even if sustainability mandates did exist, they may be difficult for some GCDs to achieve.

First, GCDs' responsibility to conserve and preserve groundwater coupled with the responsibility of protecting property rights can create the appearance of conflicting management obligations. Additionally, in some places attempts to regulate groundwater have resulted in legal challenges and costly litigation. Uncertainty regarding management obligations plus fear of litigation risk can create powerful disincentives for district leadership to attempt any untested management paths.

Second and relatedly, in some places, reductions in overall existing pumping would be needed to bring the groundwater basin into balance. This is somewhat uncharted territory for GCDs in Texas who are faced with potential lawsuits for denying new groundwater permits or reducing existing ones.[49]

Third, many GCDs in Texas lack the local data that is needed to even set sustainable DFCs and management goals. While Chapter 36 requires GCDs to consider socioeconomic impacts or impacts to springflow, GCDs cannot make these considerations without adequate data. The TWDB does not provide GCDs with any economic analyses related to future impacts of DFCs on local economies. Additionally, the groundwater availability models that the TWDB develops are too regional in nature to provide any meaningful data on the impact that various levels of drawdown will have on localized springflow. The same holds true for data related to local permitting decisions – it is difficult for GCDs to consider how a potential permit will unreasonably impact surface water resources when data does not exist and local models have not been developed.

Finally, many GCDs lack the resources and funding to implement more innovative tools, such as conservancy programs, recharge enhancement projects, or to collect the data and science needed to sustainably mange aquifers.

Pathways to innovate and more fully utilize GCD authorities to sustainably manage groundwater

As discussed above, GCDs have a variety of existing authorities to implement sustainable management through their planning, rulemaking, and permitting powers. A variety of additional avenues could be pursued to address the barriers to sustainable management and ensure that GCDs are able to fully utilize their existing authorities.

---

[49] Puig-Williams, *supra* note 9.

Building public engagement and buy-in

The challenges described above have a common theme related to public engagement and local support/buy-in (or lack thereof) for management decisions. Supporting public engagement in GCD planning and management is critical for (1) defining the vision, objectives, and approaches for management that will be most effective for a particular geographic area and stakeholder interests, (2) accessing and utilizing local knowledge and expertise, and (3) building local support for adopted policies and implementation rules.

GCDs' management obligations between conserving and preserving groundwater and protecting property rights are sometimes perceived as conflicting obligations, but the barrier may arguably be more fundamentally based on issues of public perception and engagement. More often than not, protection of property rights in groundwater is synonymous with the right to *develop* groundwater resources rather than *conserve* them. However, there is a strong case to be made that these are complementary, nonconflicting management objectives and that *sustainable management is critical to protecting property rights*. For example, if you own the rights to the water beneath your property but unsustainable production results in draining your property, what rights do you really have? While rights to develop groundwater are indeed necessary for supporting Texas' communities, unregulated and unmitigated development of limited resources could result in significant community, economic, and environmental risks and costs, including long-term impacts and deterioration in value of local land and water rights.

Proactively engaging the public in planning a long-term vision and strategy for development can build a shared understanding of current conditions, today's challenges, and approaches needed to prepare for future growth and changing situations and conditions. Land use planning provides a similar example. As anecdotally described in a conference presentation, "Planning is a necessary evil of government. Without it you will have sheer chaos."[50] Without proper planning, there may not be infrastructure to support new development, and adjacent incompatible uses could cause a decline in property values.[51] Similar to GCD planning and rulemaking, land use planning typically begins with development of comprehensive plans to set community-scale policies, which are implemented through increasingly detailed zoning ordinances, subdivision rules, and other local policies. Together, the plans and implementation rules guide the physical, social and economic growth of communities. Public participation is critical through planning and implementation stages:

> ***Involvement increases understanding of the benefits of planning while decreasing the uncertainty about the negative effects of planning on personal freedom and property rights****. In turn, increased involvement contributes to political acceptance and success of the planning process. . . . involvement in the process assures that citizens are given a chance to become aware of the practical matters surrounding implementation of plans. Plans are most successful*

---

[50] Karen K. Mitchell and Robert Baldwin, *Planning in Small Towns*, American Planning Association Texas Chapter Conference (2012), https://texas.planning.org/documents/1961/TX_Conf-Meetings_Past-Conferences_Presentations_2012_Planning-in-Small-Town.pdf.

[51] *Id.*

when the citizens feel an ownership of the final product. Their realistic perspective helps keep the planning process on track and down-to-earth.[52]

Encouraging public participation can also be a path for addressing challenges related to local data availability. Residents "can aid the planner through their knowledge of the community. Often, citizens with professional expertise can contribute their talents to the technical aspects of planning."[53] Building engagement not only supports planning and management decisions, but also provides an opportunity for the public and GCDs to work together to develop the local information needed.

Navigating uncharted territory through small steps

Another common theme in the barriers to sustainable management is reticence to take new approaches to addressing management challenges, arising from perceptions of legal risks, such as uncertainty regarding the scope of a GCD's management authority, or political risks, such as potential unpopularity of a given management decision and resulting consequences for publicly elected GCD boards. Where perceived legal or political risks are a barrier to taking needed management actions, implementing actions in small steps through 'pilot' projects or through geographically limited programs could be a way to engage the public, explore and test new management approaches, learn lessons about implementation and potential outcomes, and refine the approach before a full-scale roll-out.

Involving stakeholders early and often can help identify and develop solutions for dealing with highly localized resource concerns and water use characteristics. In some cases, residents may already be feeling the effects of localized resource issues, such as lowering water tables, drying wells or drying springs. Working with a smaller stakeholder group that may be highly motivated to help find a solution could assist the planning and rulemaking processes needed to evaluate, adopt, and implement new management tools. Stakeholder processes may highlight management options that could achieve desired outcomes in different ways and with different regulatory versus incentive approaches. For example, the right combination of incentive-based tools (i.e., aquifer storage, mitigation/offset, conservation options), with enough stakeholder buy-in, could potentially achieve the same result and be more palatable to balancing over-pumping than regulatory approaches.

Similarly, implementing new management tools on an "opt-in' or voluntary/incentive basis could be an important mechanism for exploring and testing new options, gauging stakeholder interest and acceptance, and gathering information related to the anticipated outcomes of the new tool. For example, as noted above, the Post Oak Savannah GCD's Aquifer Conservancy Program provides economic incentives to landowners to conserve groundwater by placing it into conservancy with the GCD, "as a way for landowners to participate in the long

---

[52] Comprehensive Planning for Small Texas Communities, 3rd Ed. TEXAS DEPARTMENT OF HOUSING AND COMMUNITY AFFAIRS, OFFICE OF RURAL COMMUNITY AFFAIRS (2002), https://www.sanmarcostx.gov/DocumentCenter/View/2787/Comprehensive-Planning-for-Small-Texas-Cities-PDF (last visited Jun 11, 2021) (emphasis added).

[53] *Id.*

term conservation and stewardship of groundwater resources."[54] The program is still new and "while it is too early to tell how many landowners might participate, the reception so far has been very positive."[55] Another example from outside of Texas is the Verde River Exchange program in Arizona, a community-driven "water offset program" that creates a mechanism for groundwater users to voluntarily offset their pumping by funding conservation to reduce overall water use to protect a flowing river. [56] The program was built on the premise of creating collaborative, incentive-based solutions that respect water rights, property rights, economic values, and stewardship. The program has been operating since 2017 with the number of voluntary participants growing every year. In 2019, participants offset 4.6 million gallons of groundwater use through the program.[57]

Continually develop and refine local data, science and models

Limited availability of local data and decision-support tools like hydrologic studies and models presents significant challenges at all stages of planning and implementation. Without localized information, districts may be unable to adequately assess the potential outcomes of groundwater management decisions on interconnected resources (surface water, ecological systems, and wildlife) and community values (recreational areas, community aesthetics and amenities, and water to support homes and businesses). Continually building local data, science, and models builds knowledge about local current conditions, projected future conditions, and options that are likely to help the district and community achieve their desired long-term vision and sustainability goals.

Of course, GCDs need funding to develop and refine local data and models. Ideally, the state will invest in this local science in the future, but until then, GCDs can work with their county commissioners to fund technical needs, seek funding from private foundations, or apply for federal grants that support the development of local groundwater science. For example, Hays County has funded installation of a groundwater monitoring well network throughout Hays Trinity GCD's jurisdiction and the development of a groundwater/surface water model in the Blanco River Watershed. Presidio County GCD received funding from the Dixon Water Foundation to conduct a surface water/groundwater interaction study. And recently, the Culberson County GCD, Brewster County GCD, and Presidio County GCD partnered with the Big Bend Conservation Alliance on a successful Bureau of Reclamation grant application to fund a data sharing software system that all three districts can utilize.

Together, these three pathways — public engagement, small-scale pilots, and development of data and science resources — are powerful tools that GCDs have in supporting sustainable management decisions.

[54] Texas Alliance of Groundwater Districts, *Post Oak Savannah GCD*, https://texasgroundwater.org/news-events/news/monthly-feature/post-oak-savannah-gcd/.

[55] *Id.*

[56] *See generally,* Friends of the Verde River, *Verde River Exchange*, https://verderiver.org/verde-river-exchange/.

[57] Friends of the Verde River, *2020 Annual Report*, https://verderiver.org/our-mission-and-vision/annual-reports/.

Hays County funded the development of a groundwater/surface water model in the Blanco River Watershed. Photo credit: Molly258 https://flic.kr/p/7krGBi

The process to develop special groundwater management zones in Hays Trinity GCD illustrates all three of these approaches in tandem.[58] To better understand how decreasing groundwater levels were impacting wells and spring flow in a certain area within the district, the Hays Trinity GCD formed a scientific technical committee composed of technical staff from the GCD, neighboring management agencies, and the Meadows Center for Water and the Environment. The committee completed an evaluation of groundwater flow, delineated the area contributing flow to the spring, assessed geologic characteristics affecting recharge rates and flow gradients, and identified management zones and suggested approaches for each zone (such as new operating permit restrictions in certain areas, recharge zones, etc.). The recommendations also prioritize areas where additional studies should be conducted.

To assist the district in making the policy determinations related to implementing these recommended zones and management measures, Hays Trinity GCD formed a stakeholder task force. The task force consisted of a wide variety of representatives, including Hays County Commissioners, well owners, water supply corporations, business owners, and developers, who were tasked with considering the results and recommendations from a scientific technical committee. Over the course of more than fifteen meetings over eight months, the committee made a consensus decision on the scientific technical committee's recommendations, which were then crafted into rules and approved by the Hays Trinity GCD Board.

Through development of local science and studies, public engagement, and geographically targeted management approaches, Hays Trinity GCD is taking steps to more sustainably and holistically manage groundwater resources and connected community, economic, and environmental values.

---

[58] For more information, see Environmental Defense Fund, *Hays Trinity Groundwater Conservation District,* GROUNDWATER IN TEXAS: CASE STUDIES OF EFFECTIVE MANAGEMENT (2021), https://www.edf.org/sites/default/files/documents/Hays%20Trinity%20Case%20Study%20March%202021.pdf.

Conclusion

The Texas Legislature has imparted management obligations on GCDs that are imperative for long-term water security and the livability of Texas' communities. The Legislature has also equipped GCDs with a full toolbox of planning, rulemaking and permitting authorities to carry out their management obligations. GCDs have wide latitude within their existing authorities to integrate sustainability principles into management goals, DFCs, management plans and rules. Although there are many challenges facing GCDs in holistically and sustainably managing resources, building local data, science, and tools; actively engaging the public; and implementing new approaches through smaller, targeted programs together will enable GCDs to fully utilize the tools already available to them.

301 Congress Avenue, Suite 1300
Austin, Texas 78701
(512) 478-5161
edf.org