The Water We Already Have: Scaling Municipal Reuse for a Water Resilient Texas

TEXAS LIVING WATERS

NATIONAL WILDLIFE FEDERATION

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Learn more @ www.texaslivingwaters.org

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TABLE OF CONTENTS

SUMMARY AND KEY FINDINGS

Texas is facing a growing water supply gap, driven by rapid population growth, increasing demand, and intensifying droughts. By 2080, municipal water demand is expected to outstrip supplies by 2.8 million acre-feet per year (MAFY). Municipal water reuse offers one of the most significant and underutilized opportunities to help close that gap while strengthening drought resilience, supporting economic growth, and protecting rivers and aquifers.

This report examines the role that water reuse can and will play in advancing statewide sustainability, including the role water reuse plays in the State Water Plan, case studies for successful water reuse planning and implementation, opportunities for accelerating water reuse, and policy recommendations at the state and local levels to help scale water reuse.

1 **Water reuse is essential for closing Texas' growing municipal water supply gap, yet it remains underutilized across the state.**

The 2027 State Water Plan anticipates that water reuse – including potable and non-potable reuse – will triple by 2080, with municipal water reuse accounting for 72% of all planned reuse. However, there remains a significant opportunity to expand water reuse in cities throughout the state. The state currently utilizes approximately 12% of its municipal wastewater for water reuse, as compared to upwards of 50% in other western states. Case studies across Texas demonstrate that water providers are successfully incorporating water reuse into their water supply portfolios, and even more is possible to support cost-effective, locally available supplies.

2 **Direct Potable Reuse is becoming a practical, cost-effective, and socially accepted water supply strategy.**

Direct Potable Reuse (DPR) – the process of treating municipal wastewater to drinking-water quality – is expected to expand by more than 80 times, from 1,600 acre-feet per year (AFY) to 134,000 AFY by 2080. Investments in DPR are particularly cost-effective for communities facing rapid growth, necessary wastewater infrastructure upgrades, and rising costs of new supplies. Case studies from Kyle, Marble Falls, and others show that DPR is increasingly accepted by the public, particularly with early public engagement and transparent communication.

3 Installing purple pipe systems is particularly beneficial in new development, at large commercial and industrial facilities, and on campuses.

Non-Potable Reuse, including Direct Non-Potable Reuse (or "purple pipe") and Decentralized Non-Potable Reuse (e.g., building- or campus-scale systems), supply non-potable water for golf courses and irrigation, decorative fountains, toilet flushing, cooling towers, and more. Purple pipe systems enable the wastewater and water providers to centralize collection, treatment, and distribution of non-potable water. By 2080, purple pipe water is expected to make up approximately 3% of Texas' new water needs.

Decentralized Non-Potable Reuse enables water users to collect, treat, and reuse water on their own properties. While the State Water Plan does not fully account for these strategies, there are substantial opportunities to normalize and scale Decentralized Potable and Non-Potable Reuse throughout the state.

4 Indirect Reuse provides the greatest proportion of total reuse, accounting for between 65 and 70% of current and planned reuse now and through 2080

Water providers are relying on nature to help treat and store reclaimed water for future use. These reuse strategies, referred to as Indirect Reuse, involve discharging treated wastewater into a natural water body where it is further cleaned through natural processes and diverted for subsequent treatment and use, usually for potable water. Indirect reuse can also provide environmental benefits such as enhanced wildlife habitat and recreation opportunities.

5 Effective local and state policy, programs, and funding are needed to scale water reuse

State and local entities have an important role in expanding water reuse across Texas. State entities should provide clear guidance and technical assistance to facilitate implementation, prioritize funding for reuse, support strategies to build public trust, and establish workforce training programs. At the local level, success relies on early interagency coordination, incentives for projects such as affordable housing, developer partnerships, and proactive public education to ensure long-term adoption and water security.

Funding is a key consideration for any water supply project. The Texas Water Fund provides an important downpayment on our water future, but it cannot fund all of Texas' water needs. Water reuse should be elevated as a priority because this strategy utilizes locally available water to provide resilient and cost-effective supply to communities throughout the state.

Walnut Creek Wastewater Treatment Plant Reclaimed Line. Photo courtesy of Austin Water.

INTRODUCTION

Texas relies on water to sustain its communities, economy, and environment. Rapid population growth and a drying climate are placing pressure on communities as they work to ensure that people and nature have adequate water supplies. By 2080, the state's population is expected to grow from approximately 31 million people to more than 52 million people, amounting to approximately 1,150 new Texans every day. Texas is experiencing deeper and longer droughts adding additional strain to already fragile water systems. Texas' existing supplies are expected to decline by more than 10% over the coming decades, leading to potentially tremendous water shortfalls for communities and ecosystems throughout the state.

These challenges are acutely felt by municipalities, where water demands are growing at the fastest rate and outpacing the available water supplies. Municipal water demand is currently about 6 million acre-feet per year (MAFY), equating to 34% of total water demand for the state. By 2080, municipal water demand is projected to increase to about 8.8 MAFY million acre-feet per year and 48% of total water demand in the state. Texas communities will need to expand current water supplies or develop new water supplies to fill the 2.8 MAFY million acre-feet per year gap, including by reducing per capita water use and/or implementing water supply strategies such as reuse in all its forms.

In the face of this tremendous water supply challenge, wastewater is one of Texas' most valuable resources.

Water reuse provides a critical opportunity to not only build more resilient, local water supply, but also to support healthy watersheds by reducing the total amount of water withdrawn from an ecosystem (surface water or groundwater) for treatment and use. At the same time, water reuse requires careful consideration of watershed dynamics and downstream users. In some watersheds, treated return flows from wastewater facilities are critical in maintaining rivers, especially in areas where upstream diversions, impoundments, or groundwater depletion have reduced natural flows. In these cases, water managers should consider how reuse projects, regardless of the source, will impact the potential for achieving resilient water supplies while maintaining healthy waterways.

Water reuse has the potential to provide a significant boost to water supply, enabling suppliers to enhance their reliance on local water supplies while providing affordable water and protecting local ecosystems. However, while Texas is planning to increase water reuse significantly, **there is an even greater role for reuse in current and future water supply planning.** Texas can remain a leader in water reuse by investing in this essential tool for closing the gap on needed water supplies.

The purpose of this report is to highlight the critical role that water reuse plays in advancing statewide water resilience and sustainability, to provide case studies for successful water reuse planning and implementation, and to showcase opportunities for further accelerating water reuse projects and programs. We rely on regional and state data in the 2027 State Water Plan[1] to quantify the role water reuse plays in ensuring Texas' future water supply. Finally, we offer policy recommendations at both the state and local levels that support the expansion of water reuse.

DEMYSTIFYING WATER REUSE

Water reuse or water recycling is **intentionally capturing "waste" water, such as municipal wastewater (i.e., greywater and blackwater), oil and gas produced water, and other industrial or mining wastewater, and cleaning it for beneficial uses,** such as for drinking water, landscape irrigation, industrial processes, surface water or groundwater replenishment, and watershed restoration.[2] The 2027 State Water Plan indicates that water reuse will account for 13.4% of new supplies by 2080 in Texas.[3]

In this report, we focus on **municipal water reuse** (i.e., water reuse in a city, town, or village incorporated under the Texas Local Government Code or a municipal utility district "MUD") for two reasons. First, it is the fastest growing sector in terms of water demand (Figure 1). Second, municipal water reuse represents the greatest *proportion* of existing and planned water reuse across Texas (Figure 2).

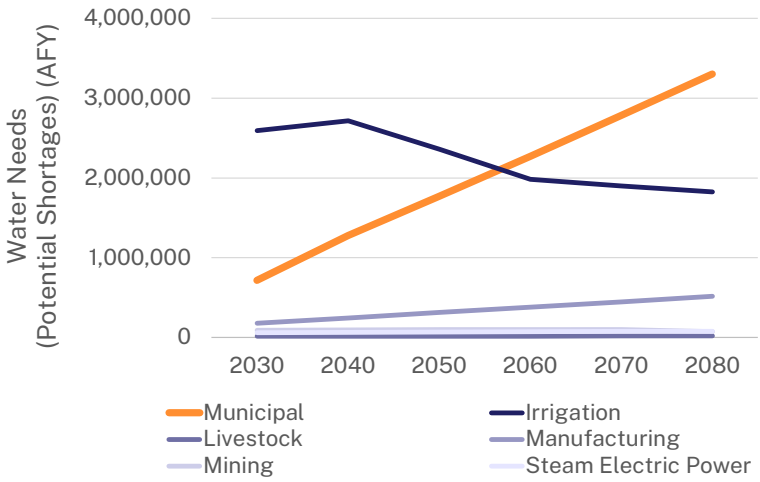


Figure 1. The unmet municipal water needs (or potential shortages) are expected to grow by 3.6 times between now and 2080, representing the fastest growing sector in the State. Source: 2027 State Water Plan.

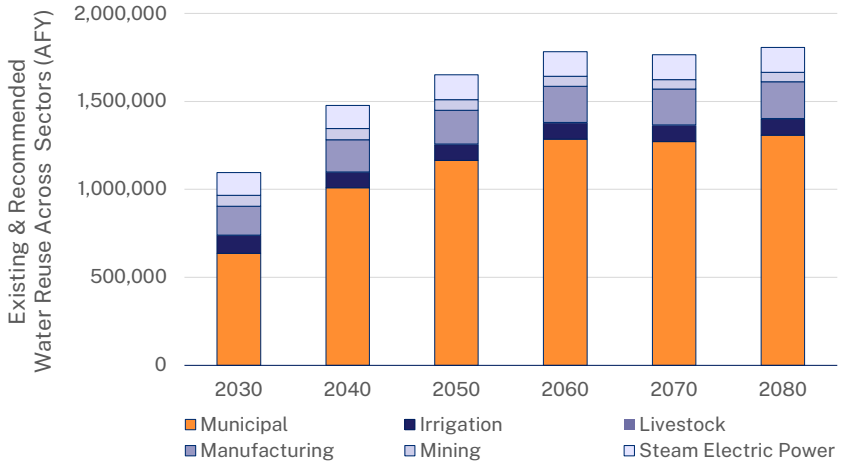


Figure 2. Municipal water user groups are planning to double water reuse by 2080, constituting the greatest proportion of water reuse among sectors. Municipal water reuse is expected to account for 58% of total water reuse in 2030 and up to 72% of water reuse in 2080. Source: 2027 State Water Plan.

Forms of Municipal Water Reuse

Municipal water reuse is flexible and can take on many forms. Generally, it is classified as potable or non-potable. The water can originate from a centralized water treatment and distribution system, or it can be treated and distributed through decentralized methods such as a smaller package plant or treated onsite at a building or campus. For the purposes of this report, we are aligning categories as defined in the 2027 State Water Plan. For detailed definitions of each component of reuse, we refer you to the Definitions section.

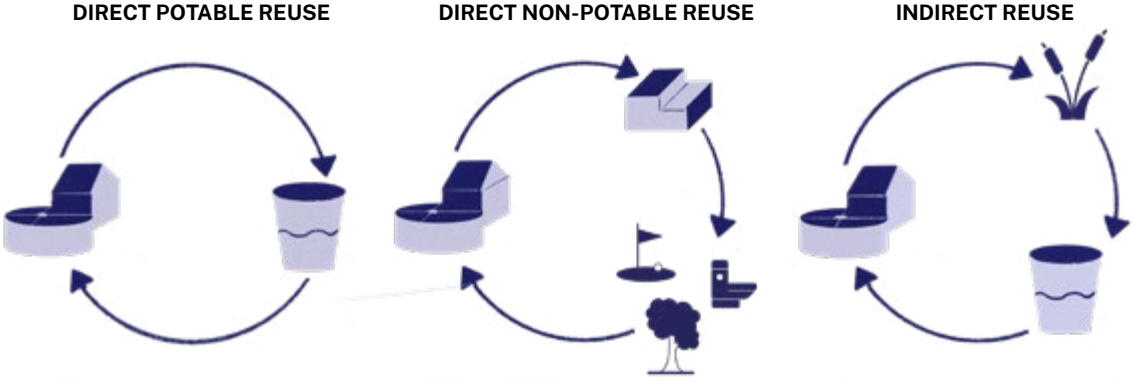
Direct Potable Reuse involves further treating wastewater from a community's wastewater system through advanced treatment systems and then either introducing it ahead of the drinking water treatment plant or directly into the potable water distribution system.

Direct Non-Potable Reuse is included in the State Water Plan as "Other Direct Reuse," but is more commonly referred to as "purple pipe" or "Centralized Reuse." This strategy includes conveying highly treated wastewater directly from a treatment plant to the end-user via a distribution system (purple pipe) to fulfill non-potable water demands such as outdoor landscape irrigation indoor uses such as toilet flushing and cooling towers makeup water, or industrial processes.

Indirect Reuse involves discharging highly treated wastewater effluent into a natural water body, such as a reservoir or artificial wetland, where it is further cleaned through natural processes and diverted for subsequent treatment and use, usually for potable water.

Water Recycling represents water supplies that are used and recycled on site, including the reuse of graywater, blackwater, foundation drain water, oil and gas produced water, and other mining/industrial water. This water is generally used for non-potable uses. In the 2027 State Water Plan, most of the water included under this strategy is onsite recycling of oil and gas produced water or other mining and industrial waste. The volume of water attributed to these uses is expected to remain relatively stable and accounts for less than 0.5% of the state's total water supply.[4] While there are municipal onsite water recycling projects underway in cities throughout Texas, it is difficult to quantify the current or expected municipal water supply provided by building-or campus-scale water recycling based on the current data provided.

What Water Reuse does not include: In this report and in Texas more broadly, water reuse does not include unplanned or *de facto* reuse, where water supplies may include treated wastewater discharged from upstream users. In addition, this report does not include rainwater harvesting or aquifer storage and recovery projects as part of water reuse. In the State Water Plan, rainwater harvesting is categorized under "other" strategies, which collectively provide less than 2% of recommended water management supplies out to 2080 while aquifer storage and recovery projects (which can include injecting stormwater or reclaimed water for future use) are a stand-alone (and rapidly growing) water management strategy.



Direct Potable Reuse, Direct Non-Potable Reuse, and Indirect Reuse make up the vast majority of planned municipal water reuse in Texas over the next 50 years.

Municipal Water Reuse Across Scales

Municipal water reuse also operates across different scales, including **centralized municipal water reuse**, **campus-scale reuse**, and **onsite or building scale water reuse**.

Centralized municipal water reuse includes reuse of wastewater from a centralized wastewater treatment plant. Centralized reuse comprises the majority of existing and planned water reuse. It includes both Direct Potable Reuse, as well as Direct Non-Potable Reuse or "purple pipe."

Campus-scale water reuse includes decentralized water systems that collect, treat, and reuse wastewater across a specific site, for example on university campuses, corporate parks, or large residential developments. Campus-scale reuse often includes building-scale water reuse, as well as other decentralized water reuse strategies, such as sewer mining.

Onsite or building-scale water reuse is the process of collecting, treating, and reusing water within a building, including repurposing rainwater, blackwater, rainwater, stormwater, A/C condensate, and foundation drainage (Figure 3). While there are some examples of potable onsite water reuse, most building-scale water reuse projects are designed to provide non-potable water for landscape irrigation, cooling towers, toilet flushing, or decorative fountains. Case studies have shown that buildings incorporating a variety of onsite water reuse strategies can reduce water use by 70% or more.[5]

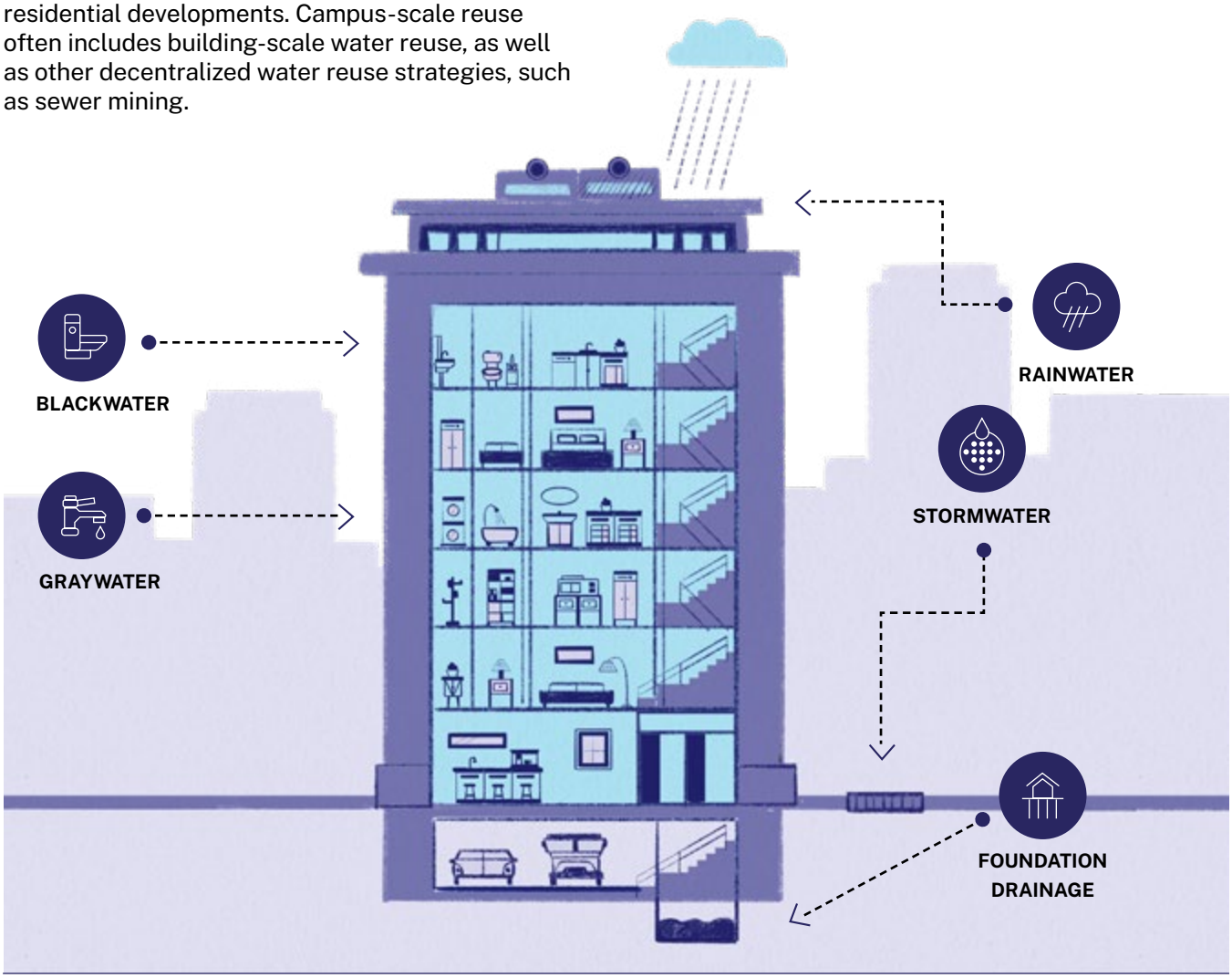


Figure 3. Building-scale water reuse enables water managers to collect, treat, and reuse water within a building for non-potable and/or potable water uses. Source: Worthen Foundation's Onsite Non-potable Water Reuse Practice Guide (2018).

Water Reuse Across Texas: Regional Analysis

The fastest growing areas in Texas are also the regions with the greatest focus on water reuse. Ninety-four percent of the population growth in the state is expected in just five of the sixteen regions: Dallas-Fort Worth (Region C), Houston (H), Austin (K), San Antonio (L), and Central Texas (Region G). According to the 2027 State Water Plan, 91% of the projected growth in water reuse will occur in these regions.

Examining the regions provides important insights into how water reuse is employed throughout the state. Dallas-Fort Worth and Houston are largely focused on expanding Indirect Reuse through large-scale projects, while San Antonio, Austin, and Central Texas are focusing on Direct Potable Reuse and Direct Non-potable Reuse. For San Antonio and Austin, in particular, the figures included in the State Water Plan may be underestimates of their reuse investment, given that it is challenging to quantify the building and campus-scale onsite reuse underway across their regions.

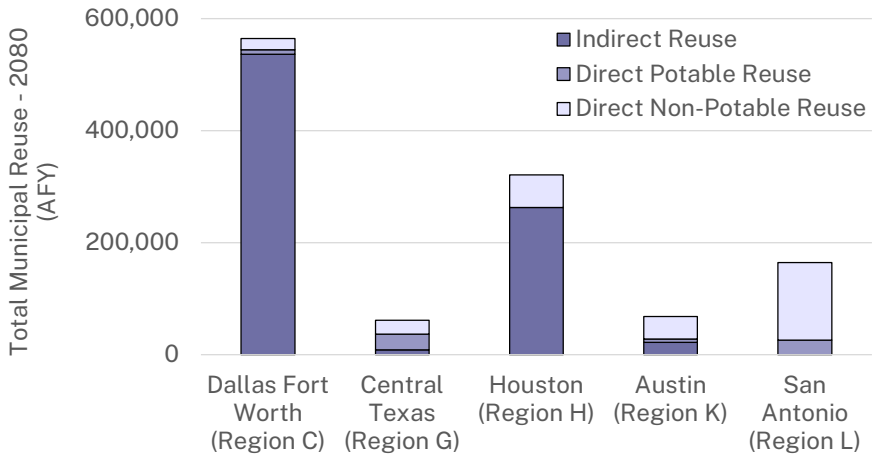


Figure 4. Total volume of water (AFY) provided by reuse in each region by 2080, including existing and planned reuse projects. Source: 2027 State Water Plan.

Regions also differ in how they are incorporating water reuse to support growth and unmet water supply needs between now and 2080. For example, Region H (Houston) is planning to meet more than half of its 540,000 AFY in unmet water supply needs by greatly expanding Indirect Reuse (Figure 4). As a result of investments over the coming decades, 20% of Region H's total supplies in 2080 will come from water reuse. On the other hand, Region G, stretching along the Brazos River, and Region C, covering Dallas-Fort Worth, are relying on water reuse to meet only 9% and 24% respectively of their unmet water needs. **Given their tremendous population growth (and the corresponding increase in wastewater availability), Dallas and Houston are likely well-positioned to expand water reuse opportunities.**

GROWING DEMAND & GROWING OPPORTUNITY FOR WATER REUSE

Water reuse accounts for approximately 6% of existing municipal water supplies in Texas, amounting to 372,000 AFY. Over the coming decades, water suppliers are working to expand water reuse by three times, providing an additional 873,000 AFY. By 2080, water reuse is expected to make up approximately 15% of total municipal supplies in Texas.

While the volume of water reuse in Texas is expected to grow significantly, it will remain a relatively small proportion of total water supply – indicating substantial room for further expansion. In addition, recent data suggest there is a significant volume of wastewater available for reuse. Texas generates approximately 3.2 MAFY of centralized, municipal wastewater, and reuses only approximately 12% of this available supply.[6] For comparison, Arizona reuses 52% of all treated wastewater, and Nevada reuses as much as 85% of wastewater for Direct and Indirect Reuse.[7] With growing population and wastewater flows, Texas has an opportunity to substantially expand its water supply by relying on available wastewater flows and reusing it to meet community needs.

> **" Water reuse has to be the vision for the state."**
>
> **– Mayor John Parker,** City of Marble Falls

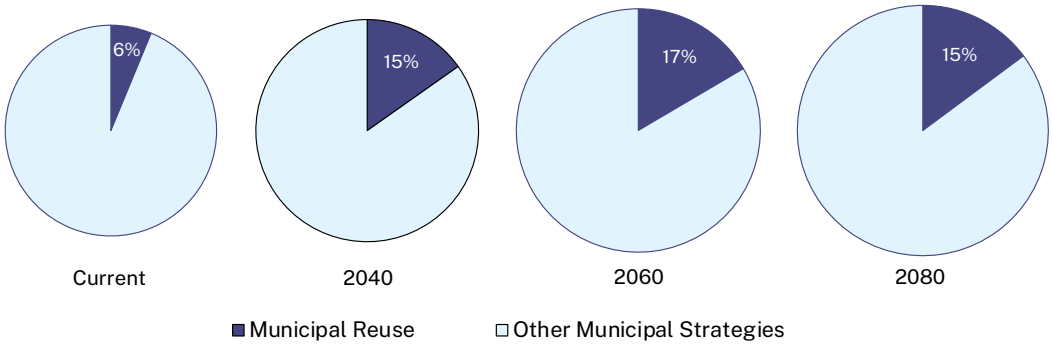


Figure 5. Total municipal water reuse (existing supplies and recommended strategies) as a percentage of municipal water demand. Municipal water reuse is expected to grow by 671,000 AFY through 2080, while the total municipal water demand will grow from 6.0 to 8.8 MAFY. There is opportunity to shift the water supply portfolio toward more water reuse as a percent of total demand. Source: 2027 State Water Plan.

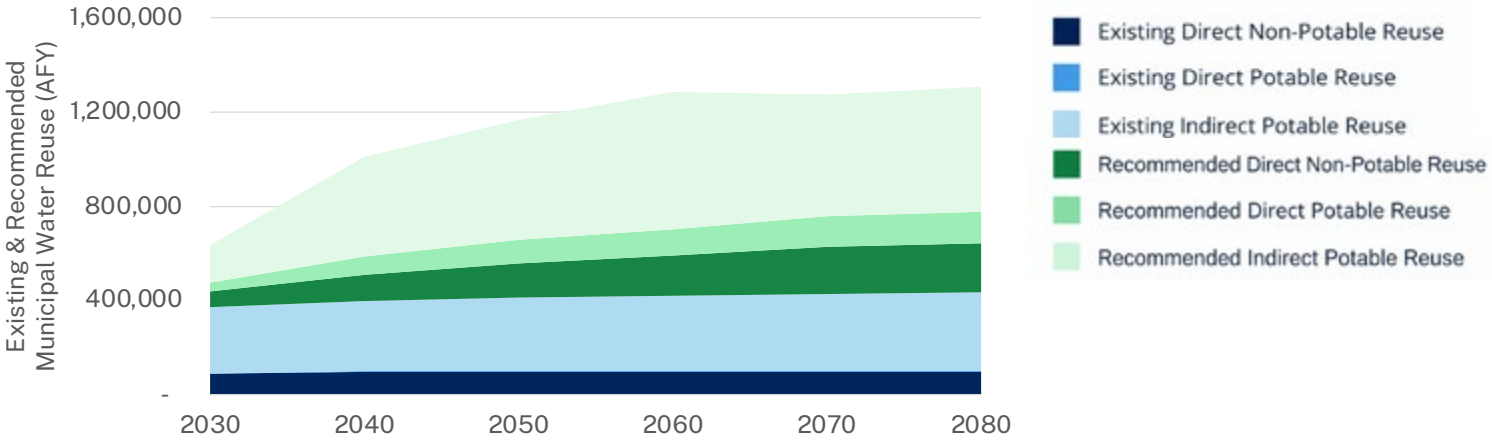
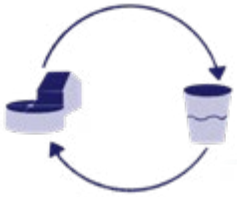


Figure 6. Existing and Recommended Municipal Water Reuse by Type (i.e., Indirect Reuse, Direct Non-Potable Reuse, and Direct Potable Reuse). There is no existing or planned Water Recycling as part of municipal water supplies. Source: 2027 State Water Plan.

Opportunities for Direct Potable Reuse



Texas is a national leader in Direct Potable Reuse. In 2013, the Colorado River Municipal Water District opened the country's first Direct Potable Reuse facility: the Raw Water Production Facility in Big Spring, Texas. The facility produces approximately 1.5 million gallons per day (MGD) of treated reclaimed water, which is blended with incoming raw water and treated again across the region's five water treatment plants.[8] The City of Wichita Falls temporarily operated a Direct Potable Reuse plant from 2014–2015 during drought conditions.[9] The city converted the DPR facility into an Indirect Reuse project once the drought emergency was over. Construction is underway at El Paso Water's Pure Water Center, which will be the nation's first Direct Potable Reuse facility that provides water directly to customers. The facility is expected to provide 10 MGD to El Paso residents starting in 2027.[10]

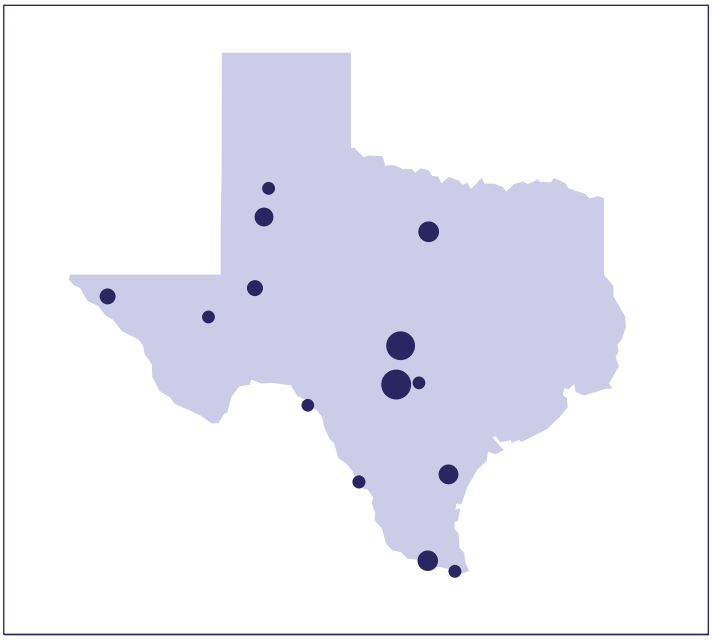


Figure 7. Planned Direct Potable Reuse Projects by 2080. Source: 2027 State Water Plan.

Planning for Direct Potable Reuse is accelerating. In the next decade alone, six water user groups are planning to invest in Direct Potable Reuse, including in El Paso, Lubbock, Georgetown, Liberty Hill, Mustang SUD, and Midland. By 2080, an additional 28 water user groups across 10 regions are planning to implement Direct Potable Reuse and serve nearly 7 million additional customers (Figure 7).[11] As a result of these investments, Direct Potable Reuse is expected to provide at least 134,000 AFY in additional water supply by 2080.

Water managers in Marble Falls and Kyle, Texas are implementing Direct Non-Potable Reuse (i.e., purple pipe) and exploring Direct Potable Reuse facilities to bolster their local water supplies.

▲
Aerial photo of new Wastewater Treatment Plant Site in Marble Falls. Photo courtesy of City of Marble Falls.

CASE STUDY:*

Marble Falls, Texas

Population: 9,633 (not including large tourist population on weekends

Population Growth: 7% per year

Total Water Demand: 3,497 AFY in 2030 → 4,488 in 2080

Existing Water Reuse in 2030

- Direct Non-Potable Reuse: 977 AFY

Total Expected Water Reuse (Existing & Planned) by 2080

- Direct Non-Potable Reuse: 1,977 AFY

Marble Falls's existing wastewater treatment plant (WWTP) is in a floodplain and flooded in 2017. Thankfully, the WWTP did not discharge sewage into local waterways; however, the municipality began planning for the plant's expansion and relocation. At the same time, the region is receiving less rain, particularly as the dry line moves further east. Finally, the city is not able to discharge treated wastewater to the nearby Highland Lakes and therefore must dispose wastewater by applying it to land via a Texas Land Application Permit (TLAP). This method is increasingly expensive, especially as the volume of wastewater increases, due to the rising cost of land and competition for development. Accordingly, the city has pivoted to outdoor irrigation through purple pipe, or reuse through DPR.

Considering the confluence of challenges and the WWTP relocation and upgrades, Direct Potable Reuse was an obvious solution for the city. In addition, DPR provides the added benefit of diversifying water supplies. The City has access to groundwater wells and surface water through the Lower Colorado River Authority (LCRA), but the allocations from these two sources are outside of the City's control and considered less stable, particularly during droughts.

To bring the DPR plant closer to reality, the city began a vision and marketing campaign to engage with the community around their water challenges and opportunity to bring DPR online. In addition, they proactively amended their permit with Texas Commission on Environmental Quality (TCEQ) to explore a DPR facility, issued a Request for Qualifications (RFQ), and secured funding for a comprehensive feasibility study. Once implemented, this plant will be able to reuse up to 60% of wastewater for DPR, with additional water provided to their Direct Non-Potable Reuse system for irrigation.

* For all case studies: 1) Population estimates are provided by the US Census Bureau for 2024 (the most recent data available) with annual growth rates calculated from change between April 1 2020 and July 1 2025. In some cases, the population served is different than the population. However, the population information helps understand the scale and growth the water providers are facing in each example. 2) Total Water Demand, Existing Reuse, and Planned Reuse are data submitted through the regional water planning groups in 2025.

Purple pipe headed to Central Texas. Photo courtesy of Jennifer Walker.

CASE STUDY:*

Kyle, Texas

Population: 69,917

Population Growth: 10% per year

Total Water Demand: 5,929 AFY in 2030 → 14,261 in 2080

Existing Water Reuse in 2030

- Direct Non-Potable Reuse: 1,936 AFY in 2030

Total Expected Water Reuse (Existing & Planned) by 2080

- Direct Non-Potable Reuse: 6,722 AFY
- Direct Potable Reuse: 1,573 AFY

Water demand in Kyle, Texas is growing and likely to outstrip current water supplies by mid-century. Unfortunately, developing additional, new water supplies in Central Texas is increasingly expensive. For example, new water supply initiatives, such as the Guadalupe Basin River Authority (GBRA) WaterSecure Project and Nueces River Authority's Harbor Island Desalination Project, are dramatically more expensive than existing supplies. This has motivated cities to look inward to find more locally available supplies.

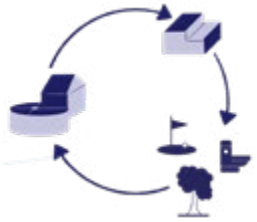
Kyle's Wastewater Treatment Plant is expanding from a 4.5 MGD facility to 6.0 MGD by the end of 2026, with a future expansion to 9 MGD in the works, as well. With this expansion, the City has an opportunity to expand their non-potable reuse capacity (i.e., purple pipe) and implement new Direct Potable Reuse simultaneously. Kyle's existing Direct Non-Potable Reuse system is supplying water landscape irrigation in some areas, and there are opportunities to expand the system in new development, golf courses, and for users along existing routes for irrigation. However, the system is difficult and expensive to expand within existing development. As a result, they are increasingly exploring DPR as a cost-effective and locally reliable solution. They expect these systems to provide approximately 57% of their total demand by 2080.

In addition to planning the engineering, Kyle is working to ensure that the public understand and are invested in the planned water supply strategies. They are hosting community forums to share information about their water supply projects and drought contingency planning and to gather community input.

Public Perceptions of Water Reuse

Both Marble Falls and Kyle recognize the value in gaining early public trust and buy-in for their planned Direct Potable Reuse projects. These efforts are not only anecdotally important, but they are also backed by research. Research shows that customers who have higher degrees of trust in their water utility and who understand the role of de facto reuse in their tap water are more likely to accept Direct Potable Reuse.[12] A recent study focused on small communities showed that people have a relatively high willingness to pay for water reuse, particularly when faced with water restrictions or potential shortages.[13] Finally, marketing plays an important role in building public trust and acceptance of water reuse. Water utilities are increasingly moving toward using "pure" or "purified" water in their language to discuss water reuse to increasingly move the public toward accepting it as an important and trustworthy water supply.

Opportunities for Direct Non-Potable Reuse ("Purple Pipe")



Direct Non-Potable Reuse (or "other direct reuse" in the State Water Plan) is increasingly part of municipal water supply planning, particularly for irrigation of golf courses and parks. By 2080, Direct Non-Potable Reuse is expected to make up approximately 3% of Texas' new water supplies.

While there are tremendous opportunities for expanding non-potable reuse, building new pipelines – including purple pipelines – remains expensive. For this reason, onsite non-potable reuse, the practice of incorporating reuse into new development, across large campuses, and at the neighborhood scale is a good opportunity to expand the utilization of this strategy.

New and Growing Water Demands: Data Centers in Texas

With the rapid growth of data centers in Texas, there are new and increasing water demands – both directly for data center cooling and indirectly through energy use – that may dramatically change the water demands in communities in Texas. Reports from the Bureau of Economic Geology, University of Texas at Austin and Houston Advanced Research Center estimate that data centers have a current water use of approximately 76,000 AFY.[14] By 2040, and across various data center capacity scenarios, water use for data centers could grow by 14 times to 1.1 MAFY, amounting to 3 – 9.2% of current water use in Texas.[15] These demands are not yet fully incorporated into the State Water Plan, particularly in areas where data centers are in early development. With the expected rapid growth comes an opportunity to consider how water reuse, in tandem with water conservation and efficiency, can help Texas communities meet data center demands while also maintaining water resilience.[16]

CASE STUDY:*

San Antonio Water System

Population of San Antonio: 1.5 million

San Antonio Water System (SAWS) Service Area: Approximately 2 million people

Population Growth: 2% per year

Total Water Demand: 268,649 AFY in 2030 → 358,791 AFY in 2080

Existing Water Reuse in 2030

- Direct Non-Potable Reuse: 30,000 AFY in 2030 → 35,000 AFY in 2080
- Indirect Reuse: 5,000 AFY in 2030 and beyond

Total Expected Water Reuse (Existing & Planned) by 2080

- Direct Non-Potable Reuse: 75,000 AFY
- Indirect Reuse: 5,000 AFY

San Antonio Water System (SAWS) boasts the nation's largest purple pipe system, delivering up to 25,000 AFY in recycled water through more than 130 miles of purple pipe around the city for parks and golf courses, industrial users, and commercial buildings. In addition, the recycled water helps to supplement baseflows in the local San Antonio River and Salado Creek.17

Map provided by SAWS

San Antonio's investment in a purple pipe system has also supported growth of building-scale water reuse, with this water serving as a back-up supply for non-potable uses. For example, the Credit Human Building in San Antonio is a 200,000 square foot, 12-story building showcasing an innovative approach to onsite water reuse that reduces the building's potable water demand by almost 97%.18 The building leverages a range of water sources, including rainwater, HVAC condensate, and geothermal wells, to meet non-potable water needs for toilet flushing, landscape irrigation, and cooling towers. With 130,000 gallons of storage capacity across above- and below-ground cisterns, the building can capture and treat water onsite. In addition, the building is connected to San Antonio's Recycled Water System, providing a back-up water supply to supplement onsite water supplies. This comprehensive water reuse system, coupled with energy-efficient features like rooftop solar, has lowered the building's water and energy costs by over 80%. The building serves as a model for how the private sector can champion holistic "One Water" principles that address water, energy, and community in an integrated way.

CASE STUDY:*

Boerne, Texas

Population: 24,047

Population Growth: 7% per year

Total Water Demand: 5,384 AFY in 2030 → 20,444 AFY in 2080

Existing Water Reuse in 2030

- Direct Non-Potable Reuse: 523 AFY in 2030 and beyond

Total Expected Water Reuse (Existing & Planned) by 2080

- Direct Non-Potable Reuse: 2,773 AFY

Like much of central Texas, Boerne is increasingly facing drought, diminished stream flow and groundwater challenges. At the same time, the city and surrounding area is growing dramatically. Developing additional water supply is tremendously expensive so Boerne is taking a comprehensive look at water conservation and low-impact development alongside opportunities to expand their Direct Non-Potable Reuse in new developments. The existing purple pipe system is being connected to new development in areas surrounding the City and is also used to support the flows in their local waterway, Cibolo Creek which flows through the Cibolo Nature Center and provides habitat and a public amenity within the city. As a result of investment in Direct Non-Potable Reuse, **the City of Boerne expects to meet 37.6% of their total demand through water reuse by 2030.**

> **"Properly done, water reuse will yield spectacular, crystal clear, usable water for our community."**
>
> **– Dr. Joseph Macaluso,** Mayor and City Council Member

CASE STUDY:*

Fort Worth, Texas

Population: 1.0 million (Fort Worth serves approximately 1.4 million people through direct and wholesale services)

Population growth: 2% per year

Total Water Demand: 217,247 AFY in 2030 → 330,866 by 2080

Existing Water Reuse in 2030

- Direct Non-Potable Reuse: 668 AFY
- Indirect Reuse: 30,148 AFY in 2030 → 40,764 AFY in 2080

Total Expected Water Reuse (Existing & Planned) by 2080

- Direct Non-Potable Reuse: 7,872 AFY
- Indirect Reuse: 80,424 AFY

Fort Worth provides water and wastewater services to approximately 1.4M people in the region, including 23 wastewater customer cities and 33 water customer cities. The City owns and operates the Village Creek Water Reclamation Facility, which has a permitted capacity of 166 MGD. In addition, the city operates a 12-mile Direct Non-Potable Reuse system that delivers non-potable water to wholesale customers, including Arlington, Euless, and DFW Airport, as well as several retail customers such as golf courses and parks. In total, Fort Worth can provide up to 12 MGD of non-potable water through a centralized purple pipe system, with peak demand during the summer months.

Given the capacity of Village Creek Water Reclamation Facility and the existing purple pipe infrastructure, there is tremendous opportunity to expand Direct Non-Potable Reuse to additional municipal, industrial, and irrigation customers. However, to successfully expand the system, the city will need to address two key challenges. First, recycled, non-potable water is currently priced at a similar rate to potable water, and as a result, most customers continue to rely on potable water. Second, there are no city mandates or incentive programs to encourage the adoption of recycled water.

Beginning in 2030, the city anticipates that they will have recouped the cost of the 12-mile Direct Non-Potable Reuse system infrastructure. At that time, the price of non-potable water is expected to decrease. With the addition of targeted incentive programs and public engagement, Fort Worth has a strong opportunity to leverage its existing infrastructure to significantly expand its purple pipe service across the region.

Opportunities for Indirect Reuse

For *Indirect Reuse*, treated wastewater is discharged into a natural water body and diverted for subsequent treatment and utilized for potable or non-potable uses. In Texas, Indirect Reuse accounts for between 65 and 70% of total existing and planned municipal water reuse now and through 2080, and it provides approximately 7% of current municipal water demand. As compared to *de facto* reuse (or water that is incidentally reused downstream), Indirect Reuse is an intentionally planned water supply strategy that enables the water rights permit holder, often the wastewater producer to discharge water into a stream of other body of water and to later reclaim the water for potable and non-potable uses.[19]

CASE STUDY:*

Tarrant Regional Water District Wetlands Project

The Tarrant Regional Water District (TRWD), a major provider in North Central Texas, provides wholesale water to more than 2.5M people in an 11-county service area, which includes Arlington, Fort Worth, Mansfield, and beyond. They operate the George W. Shannon Water Reuse Project, a 1,730-acre wetland that supports indirect reuse. The wetlands further clean already treated wastewater that has been discharged into the Trinity River (return flow) before being added to the Richland Chambers Reservoir for eventual use by North Texas communities.

The project is permitted to provide 100,465 AFY of water for Fort Worth and other North Central Texas communities.20 TRWD is also developing a second indirect reuse project. It is a 3,000-acre wetland at the Cedar Creek Reservoir, which is permitted to provide 88,059 AFY of supply using TRWD's own return flows and has the capacity to treat an additional 60,000 AFY of purchased return flow. In addition to removing sediment and nutrient loads from the water, the wetlands provide habitat for wildlife and recreation opportunities for residents.

CASE STUDY:*

Kerrville, Texas

Population: 25,578

Population Growth: 1% per year

Total Water Demand: 7,839 AFY in 2030 → 9,625 AFY in 2080

Existing Water Reuse in 2030

– Direct Non-Potable Reuse: 2,475 AFY

Total Expected Water Reuse (Existing & Planned) by 2080

– Direct Non-Potable Reuse: 4,975 AFY

The City of Kerrville is no stranger to water reuse. The City currently supplies seven users with 610 – 920 AFY of non-potable water for landscape irrigation. The customers include three golf courses, a sports complex, Schreiner University, soccer fields, and the local high school. The city believes that utilizing water in this manner water contributes to and enhances quality of life for residents because maintaining the golf course, sports complex and other areas that allow for outdoor activities would not be possible without reclaimed water. Further, reuse provides drought resilience and is a sustainable water resource management strategy. Water that the city reuses to meet non-potable needs reduces the amount of water that will need to be pumped from the aquifer and the surface water treatment plant, which supplies much of the city's potable water. The city strives to use water from the aquifer as efficiently as possible to maintain future supply.

To keep growing the City's reuse portfolio, Kerrville is exploring an Indirect Reuse project. The city is proposing to build a 1.6-mile pipeline to convey 500,000 gallons of highly treated wastewater per day from their treatment plant to Elm Creek where it will eventually flow into Nimitz Lake and mix with the existing surface water from the Guadalupe River and eventually be treated and used for drinking water for Kerrville. This project is still a preliminary concept, and the city is seeking public input on it. City leadership describes this project as a practical and cost-effective solution for the community and said that alternative solutions, such as developing remote wellfields, were estimated to cost upwards of $70 million.[21]

Spotlight: Using Policies and Programs to Accelerate Water Reuse in Austin, Texas

Local policies and programs can accelerate water reuse in municipalities across Texas, and perhaps no other city has done more than Austin. Austin has become a leader in water reuse, focused on both expanding city-owned infrastructure, as well as developing policies and programs that encourage and sometimes require water reuse across city facilities and commercial properties.

The Austin Water Forward Plan, adopted in 2018 and updated in 2024, outlines an approach to integrated water resource management to ensure sustainable, resilient, and reliable local water supplies into the future. Water reuse is a central component of the plan and is expected to yield 61,000 AFY of water supply by 2080, including 12,000 AFY from Decentralized and Onsite Reuse,[22] 27,000 AFY in Direct Non-Potable Reuse, and 22,000 AFY in Indirect Reuse. Implementing these practices will result in a fundamental shift in Austin's water portfolio, focusing on matching the right quality water with the right use (Figure 8).

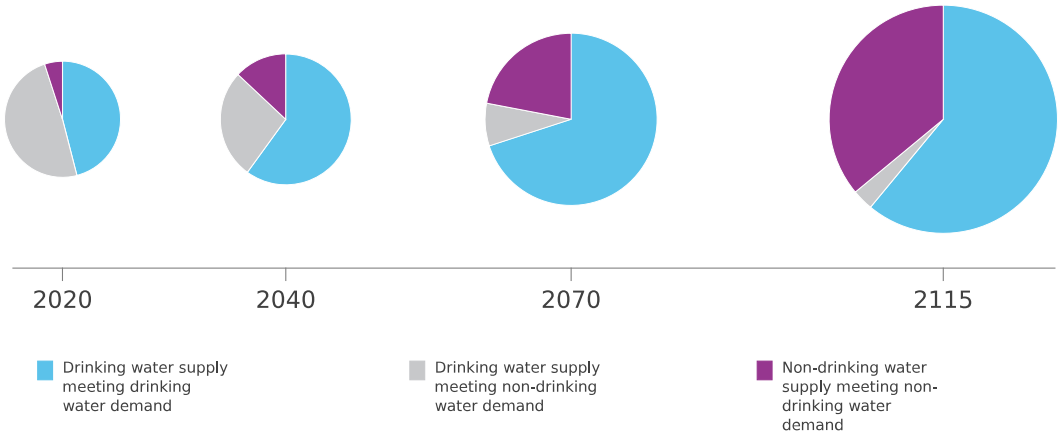


Figure 8. Austin is increasingly matching water quality to use. This graphic shows Austin's non-drinking water demand increasingly being met by non-drinking water sources over time. Source: Austin Water Forward Plan 2018.

Go Purple Program: Mandates and Incentives for New Development

Austin's Go Purple program, approved by City Council in 2024, expands incentives and requirements for new developments to implement onsite water reuse systems or connect to Austin Water's reclaimed water system.[23] The program requires that new commercial development that is 250,000 sq/ft or larger connect to the Direct Non-Potable Reuse system if they are within 250 feet of the purple pipeline and/or that they install an onsite water reuse system.

Austin is proactively working to address the additional, up-front cost required by onsite water reuse, particularly to ensure that it does not negatively affect affordable housing development in the city. While onsite water reuse is more cost-effective for the customer in the long run, the initial

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Austin's Closed-Loop Advanced Reclaimed Assembly (CLARA) system can treat up to 5,000 gallons of wastewater per day from the building's sinks, toilets and drinking fountains. CLARA is a hybrid membrane system with six stages of biological, physical, and chemical treatment. Photo courtesy of Austin Water.

cost of developing onsite water reuse or connecting to non-potable water systems can be challenging upfront.[24] For that reason, Austin Water provides incentives through cost sharing and expedited permit review, depending on the project size, to help support private properties. The program is funded through a Community Benefit Charge (CBC) that adds approximately $1.47 per month to residential customer bills (excepting those enrolled in customer assistance programs) and provides approximately $10M per year in new funding for reuse.

Sewer Mining and Campus-Scale Reuse on Public Universities and Businesses

Onsite water reuse remains an underutilized tool in the municipal tool chest; however, cities are permitting and expanding water reuse, particularly at a building scale. Some of the earliest examples of Onsite Reuse in Texas are in Austin, including the Austin Central Library, Travis County Courthouse, and the Austin Permitting and Development Center. There are a host of case studies and reports that focus on Onsite Reuse, including in the Texas Water Trade's *Net Zero Net Water Toolkit* (2024) and the William J Worthen Foundation's *Onsite Non-potable Water Reuse Practice Guide* (2018). Given the abundance of case studies available, this section focuses specifically on advances in campus-scale reuse, particularly through sewer mining.

The City of Austin is working closely with public and private entities in the City to expand water reuse, including through sewer mining and other onsite reuse projects. Sewer mining – the process of pumping municipal wastewater and treating it onsite for use – is a relatively new development for Texas water reuse. In 2023, the TCEQ amended the Texas Administrative Code to enable onsite treatment of blackwater (water that would otherwise enter the sewer) and subsequent use of that water for landscape irrigation and other non-potable uses.[25] These projects are particularly powerful at the campus scale, where there may be greater demand for recycled water across a campus than can be provided by blackwater generated onsite alone.

Austin Water is engaging on sewer mining projects in partnership the University of Texas at Austin (UT) and the Apple Campus. In many ways, these projects represent "win-win" strategies for Austin Water and for the customer. The UT WaterHub is an onsite wastewater reuse system that will intercept upstream municipal wastewater and convert it to non-potable water for use in cooling towers, irrigation, and more.[26] For UT, this project enables the campus to treat the water to standards that meet its needs and at a lower cost than purchasing reclaimed water from Austin Water. For Austin Water, the project frees up capacity in the sewer line and offsets the need for expanding sewer infrastructure.

The Apple Campus in Austin hosts one of Texas' early large-scale sewer mining projects, illustrating an emerging model for utilities and other public and private entities to partner on water reuse. Apple is aiming to achieve net zero water use on their Austin campus, through sewer mining, onsite wastewater reuse, capturing air conditioner condensate, and other practices.[27] The sewer mining system will divert municipal wastewater from the public sewer for onsite treatment and reuse, averaging approximately 63,000 gallons per day with capacity up to 288,000 gallons per day. The project required negotiated agreements with Austin Water, addressing utility cost recovery, backup treatment capacity, operations and maintenance responsibilities, and liability associated with integrating private reuse infrastructure with public systems.

These projects are more complex than more traditional onsite water reuse projects and require deep engagement between the utility and the public or private customer. Sewer mining requires the utility to allow a separate entity to tap directly into their infrastructure. As a result, developing clear liability rules and financial models is essential for successfully implementing these projects.

Building a Strong Water Reuse Workforce

One of the greatest barriers to building- and campus-scale water reuse is ensuring that there is a trained workforce to operate and maintain the systems once they are implemented. To help support trainings and workforce development for onsite water reuse, Austin Water developed the Onsite Water Reuse Operator Training Program and Manual.[28] They are currently working with partners to develop a certification program that will help ensure there are highly skilled operators available in Austin and throughout the country to operate these systems. Austin is making this curriculum available across Texas for free to ensure that there are trained operators for these systems.

POLICY AND FUNDING RECOMMENDATIONS

Water reuse is essential for building a more resilient water future and closing Texas' growing municipal water supply gap. By expanding Potable-, Non-Potable-, and Indirect Reuse, Texas municipalities can develop cost-effective, locally available water supplies while protecting rivers, aquifers, and communities.

The following recommendations outline how state agencies and local governments can work to accelerate planning, public acceptance, and implementation of water reuse throughout the state. Now is the time to prioritize and invest in water reuse to ensure Texas has the reliable water supplies it needs for communities, economic prosperity, and long-term sustainability

Recommendations for the Texas Water Development Board

Expand Funding and Support for Water Reuse

Elevate water reuse as a priority strategy in the Texas Water Fund. Texas will have a dedicated source of funding for water supply projects through the recently established Texas Water Fund.While the Texas Water Fund can't fund all of Texas' water needs, it's an important downpayment on our future. TWDB should elevate water reuse as a priority strategy by exploring opportunities to increase eligibility for funding programs. This will help ensure that locally available, resilient, and cost-effective water supplies are developed throughout the state.

Strengthen technical assistance and funding support. Water reuse is a growing, but still underutilized water supply. TWDB can assist water utilities in considering reuse as a potential water supply solution. TWDB, through their technical assistance program, should identify strategies to support communities as they work to development of water reuse strategies. This includes assistance with identifying state based and other funding solutions such as the Bureau of Reclamation's water recycling and desalination grants.

Invest in public education and outreach. Public opinion can be a hurdle to acceptance and adoption of reuse strategies, especially for Direct Potable Reuse. TWDB should support a public education campaign that highlights the safety of water reuse strategies for drinking water, as well as the water supply and environmental co-benefits of reuse.

Align Definitions and Reporting in the State Water Plan

Designate Onsite Reuse as a specific category within the State Water Plan. The State Water Plan currently has 4 categories for the various types of water reuse presented in the plan. The "Water Recycling" category is somewhat of a catch all. Designating Onsite Reuse as a category will allow water user groups to accurately account for onsite reuse as a water supply.

Require consideration of water reuse as a potential water management strategy. Regional Water Planning Groups (RWPG) that have water needs should be required to consider reuse as part of their water supply planning and management. If RWPGs do not recommend water reuse to meet an identified need, they should document the reason in the RWP.

Recommendations for the Texas Commission on Environmental Quality

Enhance the Regulatory Framework for Water Reuse

Promote consistent standards for Onsite Water Reuse. TCEQ should promote consistent standards, such as the recommendations developed by the National Blue Ribbon Commission for Onsite Water Systems, to support broader implementation of onsite reuse. This will give the public and utilities confidence that projects follow established, risk-based public health guidelines.

Require reuse-ready wastewater infrastructure. TCEQ should require that all new wastewater treatment plants install equipment during initial construction of the wastewater treatment plant site that would enable the reuse of effluent produced at the wastewater plant for beneficial reuse purposes.

Promote Beneficial Reuse through the Permitting Process. TCEQ should support the implementation of reuse through their wastewater permitting process (i.e., Texas Land Application Permit or Texas Pollution Discharge Elimination System) by helping to identify potential customers and/or recipients of treated wastewater effluent, including quarries, golf courses, and farms.

Invest in the Water Reuse Workforce

Support workforce training and certification for water reuse operators. For reuse to be implemented well, Texas needs to support operator certification, workforce training, and technical assistance programs to build capacity for designing, permitting, operating, and maintaining reuse systems. Texas should invest in and support workforce development and training. *Resource: Austin Water's Operation and Maintenance Training Manual for Onsite Non-potable Water Systems Training*

Recommendations for Local Governments

Support Local Water Reuse Planning and Implementation

Plan early and engage regulators. A proactive approach to planning and permitting is necessary for success when implementing reuse programs. If state permits are required, we recommend that entities engage early with TCEQ.

Strengthen local interagency coordination. At the local level, coordination between local planners and permitting between water, housing, zoning, development, and public health departments can enable proactive water reuse planning and cost-effective implementation. For example, working across departments can enable cities to incorporate purple pipe systems within new development in a more cost-effective way than in retrofits.

Incentivize water reuse in affordable housing. Local governments should explore providing incentive and grants to ensure that water reuse in included in affordable housing development. This provides an opportunity to reduce water and energy bills for future customers, helping to maintain long-term affordability and other co-benefits. *Resource: Ensuring One Water Works for All: Opportunities for Realizing Water Reuse in Affordable Housing*.

Build Public Trust and Invest in Long-Term Adoption of Reuse Strategies

Invest in community engagement and public education. Invest in early and ongoing community engagement, public education, and transparent communication to support understanding and acceptance of water reuse, particularly for potable reuse. Communities who understand water reuse are more likely to support it.

Partner with builders, developers, building owners, and system operators. Engage with the builder and developer community early to support broader understanding, acceptance, and implementation of onsite reuse with decentralized water systems. Once water reuse systems are installed, well-trained owners and operators are essential for maintaining their success. Educate and engage building owners and operators so they understand protocols and practices required to safely operate a building scale onsite reuse system for the long-term.

Incorporate Environmental Considerations into Reuse Planning

Evaluate environmental impacts and opportunities early: Local and regional entities should assess the environmental impacts and co-benefits of reuse, including effects on downstream users, during project design, before costs and configurations are locked in. This front-end planning can lead to proactive and cost-effective implementation of reuse strategies that includes broad benefits for communities and the environment. *Resource: Ensuring One Water Delivers for Healthy Waterways*

Build Expertise and Engage with the Water Reuse Community

Participate in state and national water reuse networks and associations: The Water Environment Association of Texas, WateReuse Association and WateReuse Texas each provide resources, networking, and learning opportunities to support water reuse at all scales.

Utilize and leverage best practices and technical guidance: Seek out resources developed by reuse professionals, including the WateReuse Association's National Blue Ribbon Commission for Onsite Water Systems and the associated program guidance, public health guidance, and tools for developing regulations, ordinances and rules; the Building Infrastructure Locally for Decentralized Water Systems (BILD) community of practice, and the US Environmental Project Agency also provides resources on water reuse and recycling through the Water Reuse Action Plan 2.0, Water Reuse Explorer, and more.

Aerial view of wastewater treatment plant. Photo provided Adobe Stock.

Definitions

Key Water Reuse Terms and Definitions

Potable Water – Water that is treated to meet or exceed federal drinking water standards and is safe for all uses. Typically delivered through a centralized distribution system.

Non-Potable Water – Water that is treated to be safe for landscape irrigation, industrial uses, cooling towers and other non-drinking water uses. Can be delivered through a Centralized, Decentralized, or Onsite system.

Centralized System – Water distribution through a common – typically large - pipeline that originates from a large water treatment plant(s). This is the traditional approach what we typically see in cities of all sizes.

Decentralized System – Smaller systems with local treatment and pipelines. Generally, part of a larger community but are not connected to the centralized system due to topography, geography, treatment capacity, growth patterns, or other factors.

Types of Water Reuse

Indirect Potable Reuse – Highly treated wastewater effluent is deposited into an environmental buffer such as a reservoir, artificial wetlands, or underground storage prior to treating and delivering water to end users.
Direct Potable Reuse – Water collected from a community's wastewater system is treated to meet or exceed federal drinking water standards and distributed to end users to meet all types of water needs.

Direct (or Centralized) Non-Potable Reuse – Water that collected from a community wastewater treatment plant ishighly treated and distributed to water customers through a dedicated water distribution system (typically referred to as purple pipe). This water is used for non-potable applications such as irrigation of golf courses, sports fields, and landscapes, toilet flushing, and cooling tower makeup water. Austin and San Antonio have extensive centralized non-potable reuse systems.

Onsite Non-Potable Reuse – Systems that capture, treat and use water that would otherwise be diverted to a treatment plant or water body. This water is used for non-potable uses such as toilet flushing, landscape irrigation and cooling tower makeup water. The source water for these systems can be air conditioning condensate, rainwater, graywater, foundation drain water, stormwater, or blackwater. The treatment requirements will be specific to the source water. Onsite non-potable water reuse systems are generally used at the building or district scale.

Source Water for Reuse

Air Conditioning Condensate – Heating, ventilation and air conditioning (HVAC) system as the result of evaporative cooling.

Rainwater – Precipitation collected from roof surfaces or other aboveground structures.

Stormwater – Precipitation collected at or below grade surfaces.

Graywater – Water that is collected and reused onsite (rather than entering that wastewater collection system). This water comes from showers, bathtubs, handwashing lavatories, sinks that are not used for food preparation or disposal, and clothes-washing machines.

Blackwater – Water that is collected from toilets, urinals, dishwasher, and sinks used for food preparation.

Foundation Drain Water – Groundwater that is extracted to maintain a buildings or facility's structural integrity and would otherwise be discharged to the storm sewer.

Oil and Gas Produced Water – Wastewater byproduct that occurs during the extraction of oil and gas from underground reservoirs.

Wastewater – Water from homes and businesses that flow into the sanitary sewer system and (ultimately) to a centralized wastewater treatment plant.

Endnotes

1 Texas Water Development Board: 2027 State Water Plan
2 This definition of water reuse was developed based on those provided by the Water Reuse Association, About Water Reuse; US Environmental Protection Agency, Basic Information about Water Reuse (2026), and the 2027 State Water Plan
3 Texas Water Development Board: 2027 State Water Plan
4 For more information on oil and gas produced water in Texas, we refer you to the recent report on the topic by Texas Living Waters partners and Environmental Defense Fund, entitled Oil and Gas Produced Water in Texas (2025).
5 Case Studies, Implementation Guides, and Examples of Onsite and Building-Scale Water Reuse Projects can be found at: Austin's Water Onsite Water Reuse website, Texas Water Trade's Net Zero Water Toolkit (2024), the Worthen Foundation's Onsite Non-potable Water Reuse Practice Guide (2018), and Texas Living Waters's Rapidly Scaling Water Reuse Across Texas: Using PACE Financing (2021)
6 Berhanu, Bruk, Emilio Mateo, Heather Cooley, Shannon Spurlock, and Sonali Abraham. 2026. Untapped Potential: An Assessment of Municipal and Industrial Wastewater Reuse Potential in the United States. Oakland, CA: Pacific Institute.
7 Garrison, Nina, Laura Stack, James McKay, and Mark Gold. 2025. Can water reuse save the Colorado? An analysis of wastewater recycling in the Colorado River Basin states. Los Angeles, CA: UCLA Institute of the Environment and Sustainability.
8 Colorado River Municipal Water District: Reclaimed Water
9 City of Wichita Falls: Wichita Falls Resource Recovery Facility
10 El Paso Water: Pure Water Center
11 Note: This includes new Direct Potable Reuse (DPR) supplies, as well as customers benefitting from Colorado River Municipal Water District's existing DPR in Big Spring, Texas.
12 Barnes et al. 2023. Public tap water perceptions and potable reuse acceptance: A cognitive dissonance theoretical understanding. Journal of Cleaner Production. 429: 139587. https://doi.org/10.1016/j.jclepro.2023.139587.
13 Morley et al. 2025. Willingness to Pay for Water Reuse in Small Communities in the United States. Water Resources Research. https://doi.org/10.1029/2025WR040116.
14 Cook, Margaret. 2026. Thirsty Data: Water Use and the Projected Data Center Boom in Texas. Houston Advanced Research Center.
15 Bureau of Economic Geology. 2025. Water Requirements for Data Centers. The University of Texas at Austin.
16 For more information on data center water demands, please see Texas Living Waters and Houston Area Research Center (HARC)'s Data Center Policy Recommendations
17 San Antonio Water System: Recycled Water Program
18 More info, see the Texas Living Waters profile on the Credit Human Building
19 Texas Water Development Board: Report 362, Chapter 8.3: Water Reuse (2004)
20 TRWD serves as the source water for 99 unique water user groups, including municipal, irrigation, manufacturing, mining, and steam electric power users. Given the complexity of these projects, the information provided here encompasses the total water reuse permitted through the projects, as provided by TRWD.
21 Valdez, Mia. 2026. "Texas County's Plan Would Recycle Wastewater Amid Drought. Here's How It Works." *San Antonio Express-News*, March 28, 2026.
22 As a note: In the 2027 State Water Plan, Austin's Decentralized and Onsite Water Reuse were not included under the "Water Reuse" Water Management Strategy, but rather, they were submitted under "Other Strategies." As a result, water supply provided by these systems was not included as part of overall water reuse in the state.
23 Austin Water: Go Purple Program
24 For more information on Water Reuse and Affordable Housing, we recommend Texas Living Water's report on Opportunities for Realizing Water Reuse in Affordable Housing.
25 Texas Legislature. 2023. Senate Bill 1289, *88th Legislature, Regular Session*.
26 University of Texas at Austin: UT WaterHub Project
27 Apple: Environmental Progress Report (2025)
28 Austin Water: Operation and Maintenance Training Manual for Onsite Non-potable Water Systems (2025)

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