Evaluating Proposed Texas Reservoirs

Photo Source: Texas Public Radio

April 4, 2025

Authored by:
Jordan Furnans, PhD, PE, PG
LRE | A Spheros Environmental Company

Table of Contents

Objective Statement

This report details research into the surface reservoir strategies in the State of Texas' water planning process. **The objective of this effort is to assess proposed surface water reservoir projects and whether they should be planned and incorporated into future water management scenarios.** The assessment was made by focusing on the planned reservoirs included within the 2022 State Water Plan and 2021 Regional Water Plans. No judgment has been placed on rural habitat conservation versus municipal development needs. Instead, the report analyzes the engineering and economic aspects of reservoirs and the overall planning process. It also looks at some project costs, which are an inescapable metric in water planning. All projects can be implemented with sufficient funds and time, yet neither quantity is in infinite supply. Appropriate water planning can lead to prioritized growth, prosperity, and environmental soundness for Texas.

Introduction

Water is a pressing topic in Texas, especially during the 89th Texas Legislative Session, where lawmakers are poised to make generational investments in water infrastructure and address the State's growing water needs. The Legislature's leader on water issues, State Senator Charles Perry (R-Lubbock) has been vocal about the need for significant investment in water projects to ensure future prosperity for Texas[i]. Perry is focused on developing funding mechanisms for the expensive large-scale water projects needed to meet projected demands. Those projects include widespread repair of our leaky pipeline infrastructure, brackish and seawater desalination, and potentially new transmission pipelines to bring water to where it is most needed. Perry has not been focused on the construction of new water supply reservoirs and has referred to existing reservoirs as providing a "declining" supply. **Clearly, new reservoir construction is not high on the priority list of Texas water supply strategies.**

The Oxford Dictionary defines a reservoir as "a large natural or artificial lake used as a source of water supply." In Texas, the vast majority of reservoirs are artificial lakes, created by construction efforts to prevent water from passing downstream. These reservoirs capture streamflow, stormwater runoff, and direct rainfall, and store the water until it is released though gates or diversion structures to be put toward a beneficial purpose, including providing environmental flows downstream.

Historically, however, Texas has relied heavily on reservoirs for ensuring reliable water supplies. The Texas Water Development Board (TWDB), a state agency charged with financing, monitoring, and managing water resources projects, classifies “major” reservoirs as those capable of storing over 5,000 acre-feet of water. The TWDB currently regularly monitors and reports on the status of 122 major water supply reservoirs, making data available via the Water Data For Texas website[ii]. As of January 19, 2025, the TWDB reports that statewide reservoirs are 74.3% full, storing over 23.4 million acre-feet.

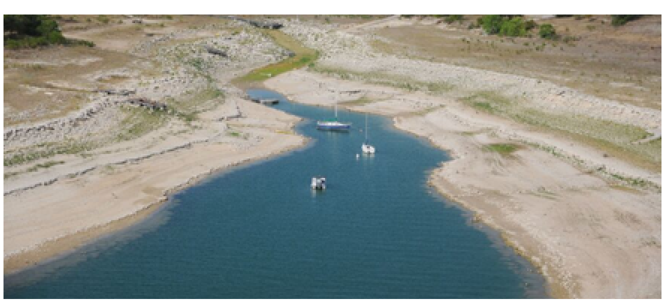
Dot = Major Water Reservoir Supply

Did you know?

One acre-foot of water is 325,828 gallons, which is enough to meet the average daily water needs of more than 1,000 American households. It is also sufficient to submerge an entire standard size football field in nine inches of water.

The largest reservoir in Texas is **Toledo Bend Reservoir**, which stores nearly 4.5 Million acre-feet when at conservation capacity. Texas has rights to only half of this valuable resource, as the reservoir is shared equally with Louisiana. Most of the water within Toledo Bend Reservoir is unallocated and not put to beneficial use for the prosperity of Texans or Louisianans. Transporting this available water to where it is needed remains an obstacle to be overcome.


Source: KGOT.com

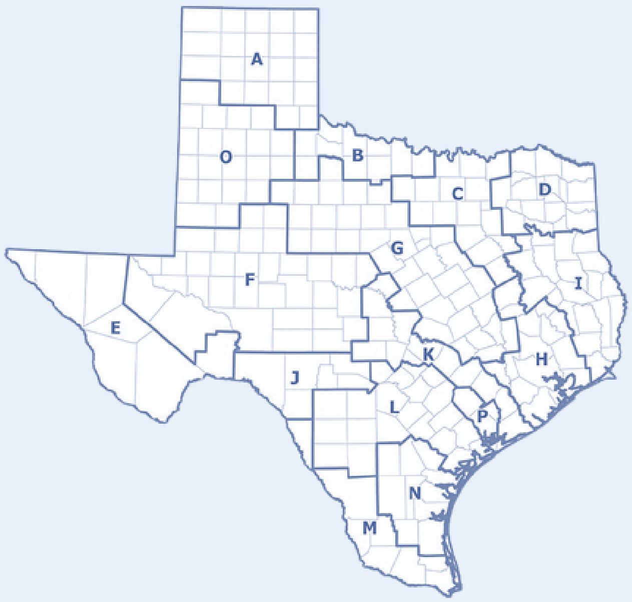

Source: KUT News

Aside from storing water for future use, some reservoirs offer flood control protections, provide recreational opportunities, generate electricity, serve as fisheries, and enhance the surrounding economies. For example, the reservoirs of the **Highland Lakes** on the Colorado River were initially created to mitigate the often-catastrophic flooding which would occur within the watershed, including within the City of Austin. The Lower Colorado River Authority (LCRA) manages the Highland Lakes, carefully monitoring inflows, storm events, and lake levels to ensure people and property are protected from flood devastation to the greatest extent possible. While historically, reservoirs were designed for flood control, more recently their primary purpose has been to enhance water supplies.

Water Supply Planning

Careful planning is needed to cost-effectively and efficiently develop the water resources of a given region. In Texas, the Legislature statutorily designates this role to the TWDB. Water plans have been developed periodically since 1961 and systematically since 2001.

TWDB has divided the state into 16 planning regions, requiring each to develop localized regional water plans for their jurisdictions that consider their population projections, existing supplies, and existing water supply infrastructure. The regional water plans are essentially compendiums of water supply and demand data, coupled with strategies that could be implemented to develop supplies and meet future demands as needed. Regional plans are developed and updated on a five-year cycle, and the 16 regional plans are compiled into a single "State Water Plan" the year after regional plans are completed. The State Water Plan contains a prioritized ranking of potential water projects detailed in the regional plans. TWDB uses this ranking to evaluate project funding requests and then provides low-cost loans to spur development of planned water projects.



Essential components of the water planning process are:

1. Water Demand assessments
2. Water Supply assessments
3. Water Management Strategy development
4. Strategy cost estimates

Water Management Strategies are water project ideas that might help lessen or eliminate any differences between water supplies and water demands identified for a particular location or water user group. Each strategy must contain an estimate of the expected volume of water produced from strategy implementation, as well as an estimated cost for construction and operation of the strategy. The strategy descriptions must also include information on potential project impacts to the environment, the socio-economic value of the project, impacts to existing cultural resources, and other factors. The planning horizon typically extends 50 years into the future, such that full implementation of each regional water plan would theoretically result in the satisfaction of expected water needs over the next five decades.

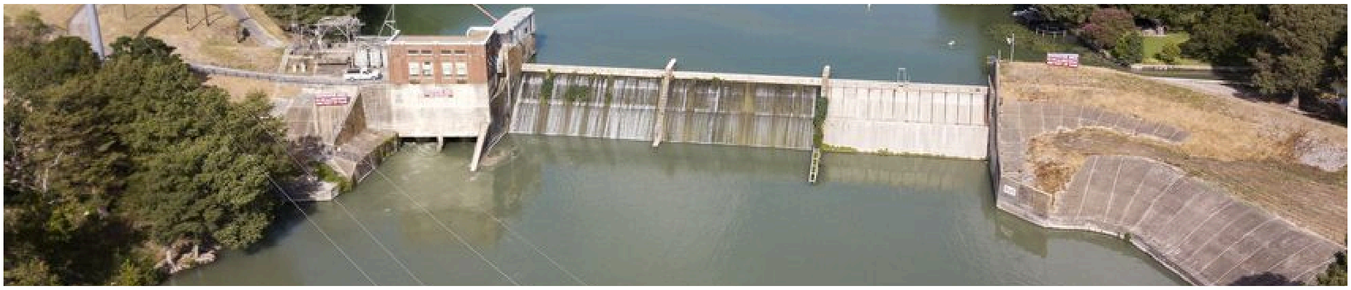
The water planning process should lead directly into water management strategy development, engineering, construction, and operation. **Many of the planned strategies, however, are not implemented. Often strategy costs are too high for project sponsors to support, or strategy implementation is delayed into the future to a date closer to when the resulting water supply is expected to be needed.** Rarely, however, are water management strategies fully abandoned and forgotten, unless the strategy is found to be infeasible.

Water management strategies are ostensibly researched and revised over time during each planning cycle. This is especially true for planned reservoirs, with the reservoir yield modeling typically updated using new reservoir sedimentation rate estimates. Surface water reservoirs as a water management strategy are often favored as they are relatively large sources of water, capable of meeting substantial portions of planned water needs. They are also proven and readily understood strategies, with existing reservoirs largely providing demonstrable benefits for local communities and users. As such, their inclusion as supply strategies provides water planners with an "easy" mechanism for meeting the requirements of the planning process, specifically that planned strategies meet planned needs.

> **Sedimentation is the process where sediments, such as soil and rock, transported by rivers and streams, settle and accumulate in reservoirs**. Sedimentation results in reduced storage capacity, reduced lifespan and can also impact water quality, recreation and downstream wildlife habitats. Sedimentation rates are expressed as the percentage of storage capacity lost per year. For example, an annual storage loss of 1% means a reservoir will be filled with sediment in 100 years.

Researcher's Note: *During my 20-plus year career in the Texas water resources arena, I have observed how the regional water planning process itself has limited the utility of the planning effort. It is my assertion that the planning process is under-funded, which has several consequences related to plan efficacy.*

The first consequence is that consultants hired to develop the plans are under enormous time and budgetary constraints and must complete numerous tasks with limited resources. This necessarily prevents deep research into new ideas, strategies, and practices to meet planning objectives. Consultants are also limited in their ability to collaborate with Water User Groups (WUGs) in their planning region, who may be independently developing water strategies outside of the formal water planning process. The planning process simply does not include sufficient time and resources for planners to adequately engage with all WUGs in their regions and to ensure that all potential strategies are properly evaluated and included.



Source: Houston Public Media

The second consequence of the planning process being under-funded is that consultants hired to perform the planning are essentially incentivized to re-use material from prior planning cycles, thereby saving project funds by minimizing time and effort expended on new, potentially better, ideas. Re-using already developed strategies in each successive water plan is a relatively easy way to develop "on-paper" means for meeting anticipated water needs, as the analysis effort is less intensive. This second consequence leads to the third consequence of plan efficacy, namely that the same consulting firms are often hired to complete the planning process every cycle, as those firms have established knowledge and "expertise" applicable to the planning region. This expertise could benefit the planning region; however the repeated planning efforts of individual firms may simply lead to further rehashing of old material in each successive plan, without including new ideas. This concept was one reason that David Collingsworth, General Manager of the Brazos River Authority, sponsor of the Region G planning effort, was persuaded to hire Carollo Engineers to create the 2026 regional water plan, after HDR had developed the Region G plans for the prior 20 years[iii].

Source: Texas Water Development Board

The fourth consequence of under-funding in the water planning process is that firms performing the planning work may be incentivized to develop water management strategies which they may be hired to design, build, and/or operate in the future. This is one reason why the consulting firm may feel confident in taking on the planning process work knowing they cannot do so profitably, but with the likely reassurance that they can achieve overall profit by designing planned projects at some point in the future. Often revenues from designing or building planned projects would greatly exceed lost revenues from the planning process. Given the underfunding of the planning process, it is typical that only those consulting firms who can use the planning process as a way to develop future business can afford to serve as consultants to the regional water planning groups.

Source: Brazos River Authority

Most of the firms doing the planning efforts tend to be larger engineering companies, often with design and construction divisions (as well as a planning division) who also construct and oversee the types of water management strategies being considered by the planners. This is certainly true for companies like Freese and Nichols, Inc., who are well entrenched in the regional water planning process but also have a history of designing and constructing many of the surface water reservoirs in Texas. Of course, there is no publicly available proof that companies like Freese and Nichols, Black & Veatch, Carollo Engineers, or HDR are purposefully undertaking water planning projects to better position themselves for future, potentially lucrative engineering design/build projects. However, there is the potential for planning firms to recommend projects based, at least in part, upon their firm's ability and desire to complete the projects and earn future profits.

Greater funding for the planning process would allow more specialized planning firms to better complete all planning tasks. Such firms would be sufficiently compensated so that they would not need to undertake the lucrative design/build/operate aspects of their planned projects. Regulations preventing planning firms from implementing the planned projects (like the proposed HB 2114[iv]) may also lead to greater planning efficacy and implementation.

Reservoir Yield Assessment

Reservoirs serve as water storage "buckets" that capture water during high flow periods and make that water available to users during average- or low-flow periods.

Water planners and reservoir engineers utilize a "**water balance**" computation in designing and operating reservoirs, so that appropriate water supply estimates may be made to understand the expected benefit from the reservoir project. This estimated water supply, commonly referred to as the reservoir "**firm yield**," is essentially the amount of water that can be supplied from the reservoir after accounting for expected inflows, evaporative losses, and seepage losses. For a given potential reservoir location, planners must determine net evaporation rates, seepage losses, and inflows in order to compute reservoir firm yields.

The State of Texas has developed detailed water availability models (WAMs[v]) which implement the water balance equations for all reservoirs, subject to state law. These models are applied separately to individual watersheds across the state and require knowledge of both streamflows and net evaporation rates at all locations within a watershed's stream network. For simplicity, these models typically assume seepage losses to be negligible, yet model users may specify seepage rates if such data are known. Inflows are typically based on historical records from streamflow gauges within the watershed. Net evaporation rates are computed from measurements or estimates of gross evaporation from existing reservoirs, with measured precipitation subtracted out.

A **water availability model** is a computer-based simulation predicting the amount of water that would be in a river or stream under a specified set of conditions.

Water availability models are used to compute the firm yield of each reservoir subject to the priority system and patterns of historical inflows and net evaporation. The historical patterns are defined over the "period of record" simulated within each WAM, referring to the time period over which streamflow and net evaporation data have been included within the model. In planning a new reservoir, the firm yield provides an indication of the ability of the reservoir to provide water for beneficial uses. **The firm yield, however, is based only upon historical inflow and net evaporation data and is not necessarily reflective of conditions expected to be present in a given watershed at some time in the future.**

Within the regional planning process, firm yields are typically used to satisfy projected water demands and add to existing water supplies. Occasionally regional water planning groups will compute reservoir "safe yields" which are yields attainable while keeping reservoir storage at or above a specified non-zero level. Reservoir firm and safe yields are dependent upon the modeled reservoir inflows, net evaporation rates, and reservoir capacities. Planners may be able to increase yields by increasing the size (or height) of the reservoir dam.

Planners are also inherently assuming that future inflows and net reservoir evaporation rates will equal or mimic those included in the modeled period of record. This assumption is not always valid yet has been a staple principle in Texas regional water planning since the WAMs were created in 2001.

Design Yields V. Actual Yields

Numerous factors may contribute to a reservoir's actual yield being lower than the expected firm or safe yield. These factors, listed in the order of increasing importance, are:

1. **Incorrect modeling of yields**
2. **Leakage from the reservoir into the subsurface**
3. **Extra water releases (for hydropower generation or other purposes)**
4. **Greater evaporative losses (than modeled evaporative losses)**
5. **Actual inflows being lower than modeled inflows**

Factor #1 largely pertains to older reservoirs which were designed and constructed prior to development of the WAMs or the establishment of a sufficient period of record of likely inflows.

Factor #2 may be significant for some reservoirs, especially any constructed over recharge zones for aquifers.

Factor #3 reflects the possibility that reservoir releases could be made for purposes other than designed uses, including for the maintenance of instream flows or freshwater inflows to the coastal system. “Releases for hydropower generation also may be made without specifically tying the released water to a water right or to a beneficial downstream use for the released water. Hydropower operators, like the LCRA, often coordinate hydropower releases with water requests from downstream water users, thereby maximizing the benefit of the releases.

Factor #4 reflects the difficulty in assessing evaporative losses from reservoirs or streams. The effect of uncertainty in net evaporation rates will likely be documented and detailed during the upcoming revision of the water management plan for the LCRA. During that effort, WAM results using traditional pan evaporation data should be contrasted with WAM results using alternative evaporation data computed using new techniques partially invented by LCRA staff[vi]. Preliminary investigations by stakeholders[vii] suggest that utilizing updated evaporation rates will lead to a decrease in computed reservoir firm yields by under 2%. It is unclear whether the LCRA or the TCEQ will require use of new evaporation rates in the WAM modeling. There is also not any statewide directive to update all WAM modeling using the newly available and arguably more accurate evaporation rates.

Factor #5 is likely to be the most significant factor regarding the accuracy of WAM-determined firm yield values. WAMs are run using naturalized inflows, which are mathematical estimates of what streamflows would have been historically prior to the construction of reservoirs or any streamflow diversions. The process for creating naturalized flow datasets has undergone significant scrutiny, and is generally accepted as being “as good as possible” by the scientific community. The flow naturalization process and results are thoroughly reviewed by qualified hydrologists at the Texas Commission on Environmental Quality (TCEQ), which has developed guidance documents detailing the procedures. The naturalized flow datasets, however, are only reflective of past hydrology that occurred during the modeled period of record.

The modeled flow data may not match flows that occur in the future, and therefore modeled firm yields may be overstated if future flows are lower.

Source: Texas Observer

Two examples of potentially overstated firm yields include 1) **Cedar Ridge Reservoir** within the Brazos Basin and 2) **Highland Lakes** in the Colorado River Basin. Modeling of Cedar Ridge included a period of record from 1940 to 1997 and suggested that the reservoir firm yield was 36,300 acre-feet/year[viii]. Severe droughts between 1997 and 2020 led to lower inflows than ever witnessed during the period of record, which led to a lower firm yield of 22,500 acre-feet/year. The second instance stems from the current drought occurring in the Colorado River Basin. Since 2019, cumulative inflows to the Highland Lakes have been 75% less than cumulative inflows during the 2008-2016 drought period of record for the basin. Similarly, the 2008-2016 drought of record period had lower inflows than those from the prior 1950's drought of record.

These both demonstrate that future inflows are in no way guaranteed to mimic historically observed inflows, neither in magnitude nor in year-to-year inflow patterns. For the Colorado River Basin, nine out of the top 10 lowest-inflow years have occurred since 2006. This strongly suggests a decreasing inflow trend that should be accounted for in future modeling.

Source: Todd Hower Realty

Reservoir Planning - Key Considerations

Water availability for reservoir storage and operations is certainly a key consideration in water planning. Yet it is not the only consideration. All considerations must be addressed in the reservoir permitting and planning process if proper decisions regarding proposed water supply strategies are to be made and all strategies are to be properly compared and contrasted.

Aside from being located where water is at least periodically available for storage, ideal reservoir sites are:

- **in close proximity to water users,**
- **in areas with minimal critical habitat for endangered or listed species and that minimize impacts to sensitive environmental resources,**
- **in areas lacking in cultural significance,**
- **in areas that minimize impact to existing development, and**
- **in areas where the underlying geology promotes water retention and dam construction.**

Proximity to water user locations would limit the need for additional conveyance infrastructure (pipelines, pump stations, etc.), thereby reducing the overall cost of construction and eventual operation. Habitat loss due to inundation can be extremely environmentally damaging, and can also result in lost cropland or timber production areas. Existing infrastructure (housing, roads, or other man-made structures) would either need to be removed or simply abandoned, with owners displaced and (ideally) having been provided suitable compensation, which thereby increases the project cost. Archaeological investigations are needed as well, to verify that the inundated areas do not contain significant artifacts or cultural heritage sites. Formal environmental impact statements and Section 404 permits from the US Army Corps of Engineers (USACE) are often required and often necessitate years of diligent site study subject to public scrutiny and litigation.

Planned Reservoirs - 2022 State Water Plan

In 2025, the State of Texas is developing the 2026 Regional Water Plans, which will be amalgamated into the 2027 State Water Plan. These plans will likely bear considerable resemblance to the 2021 Regional Water Plans and 2022 State Water Plan, as often older ideas are brought forward and possibly (but not always) updated over time. This section reviews the 20 recommended new surface water reservoirs detailed within the 2021 Regional Water Plans and 2022 State Water Plan. The following includes an objective analysis of each proposed reservoir with respect to viability and other proposed strategies for local supply development. This review is not comprehensive, and more information may be obtained through review of the pertinent regional water plans. In this analysis we highlight what we consider to be important project aspects related to the likelihood that any given project should be constructed and put into active operation.

Allens Creek Reservoir

Allens Creek Reservoir is a proposed water supply storage reservoir planned for construction near the City of Wallis in Austin County. If permitted, the off-channel reservoir will be owned, constructed, and operated by the Brazos River Authority, and would receive water diverted from the Brazos River during high flow events. Water would be released from the reservoir to meet contractual water needs held by the Gulf Coast Water Authority, NRG, Dow, Inc., Brazosport Water Authority, and potentially other customers within the Lower Brazos basin. For the Authority, the primary advantage of Allens Creek Reservoir is that it would provide water to lower basin customers without having to release water from upper basin reservoirs, thereby allowing upper basin water to be provided to upper basin customers. The reservoir is expected to provide 100,000 acre-feet of firm water to Brazos River Authority customers, and to cost $500M for construction. The project is currently in the permitting phase, with the preparation of the Clean Water Act 404 permit application currently underway. Reservoir construction is not anticipated to commence prior to 2030.

Source: Brazos River Authority

Cedar Ridge Reservoir

Cedar Ridge Reservoir is a large proposed reservoir to be located upstream from Possum Kingdom Reservoir within the Brazos River Basin. The reservoir was included within the 2001-2021 Region G water plans, and was labeled as Breckenridge Reservoir in the 1968 and 1984 water plans. The reservoir was not included within the 1961 plan. The reservoir would inundate 6,635 acres, to impound 227,127 acre-feet, and to yield 36,300 acre-feet/year per the Brazos Basin WAM with modeling extended only until 1997. The reservoir would supply water to the City of Abilene, which has negotiated a subordination agreement with the Brazos River Authority. The City also commissioned a Clean Water Act 404 permitting effort[1]. During that permitting process, it was determined that severe droughts after 1997 led to the reduction of the firm yield to 22,500 acre-ft/year, and further reductions were to be expected, assuming more severe future droughts. It is notable, however, that the “Brazos G Initially Prepared Plan Volume I” recently published by the Brazos G Regional Water Planning Group lists Cedar Ridge Reservoir as providing a reliable supply of up to 26,342 acre-feet/year and continues to include the reservoir as a recommended water supply strategy[ix].

Source: City of Abilene

It is notable that a 2020 Abilene Reporter News article[x] details a 50-year water supply agreement between the City of Abilene, the City of San Angelo, the City of Midland, and Fort Stockton Holdings. This agreement would provide Abilene with 8,400 acre-feet of water per year and led then-City Mayor Anthony Williams to state that "Plans for a future reservoir, Cedar Ridge, may change." There isn't any mention of Fort Stockton Holdings as a potential water supply strategy for the City of Abilene within the 2021 Brazos G regional water plan, nor is the potential supply strategy included in the initially prepared plan from the current planning cycle. The City of Midland reported entering into a "memorandum of understanding[xi]" regarding the Fort Stockton Holdings water deal in May of 2024, and various news outlets reported including this deal within the City of Midland 100-year water plan as of June and July 2024. These reports all suggest that the Fort Stockton Holdings water supply project is still in development.

If the Fort Stockton Holdings supply is viable and under development for the City of Abilene and others, it remains curious as to why the project is not included in the Region F or Region G water plans. This highlights the need for continuous planning and re-evaluation of water supply strategies as new, updated information and possibilities come to light. In essence, the City of Abilene has developed a new supply strategy (i.e. obtaining water from Fort Stockton Holdings) outside of the regional and state water planning process, and thereby at least reduced the need for the Cedar Ridge Reservoir supply project as identified within the regional and state water planning process.

This illustrates one flaw of the planning process, namely that it is slow to adapt to the needs and actions of individual water user groups (such as the City of Abilene), who may undertake water development projects that are not explicitly included within official water plans. This brings into question the relevance and utility of the entire state water planning process, as well as the need for Cedar Ridge Reservoir.

Dow OCR

The Dow, Inc. Off-Channel Reservoir is essentially an expansion of the existing Harris Reservoir in Brazoria County. The reservoir expansion will add 80,000 acre-ft/year of yield under Dow's existing water rights, and will be used to support Dow's manufacturing operations as well as provide local municipal supplies. Per personal communication with Dow engineer Tim Finley (12/7/2024), the project has been permitted, land acquired, and construction is moving forward.


Source: Texas Observer

DWU Main Stem Balancing OCR

The Dallas Water Utilities (DWU) Main Stem Balancing Off-Channel Reservoir (OCR) is slated for development in 2050. The reservoir would capture 95,829 acre-feet/year of reuse water from the Central and Southside wastewater treatment plants. The reservoir is planned for location within Ellis County, and would have a pipeline back to Joe Pool Lake (from which DWU can access the supply). As this strategy is entirely dependent upon DWU's wastewater discharges, the project has a reliable water supply without the need for additional state appropriations. This strategy will likely remain in future Region C water plans, to be implemented as needed. DWU expects to locate the reservoir where minimal environmental and cultural impacts will be incurred. Review of the Region C 2021 water plan does not indicate why this project could not be implemented sooner than 2050, yet does detail how the return flows directed into the reservoir are expected to increase in volume over time, from 45,980 acre-feet/year potentially available in 2020 to 78,457 acre-feet/year available in 2050 when the project is expected to be implemented[xii]. It is possible that the project could be implemented earlier than 2050, perhaps providing a lower yield initially until greater return flows are generated from other potential water sources.

Lake Columbia

The Lake Columbia project is part of the water supply strategies for the Angelina and Neches River Authority (ANRA). The lake would not have flood control or hydroelectric facilities, and would inundate 10,133 acres. The lake was first planned in 1978 (then named Lake EastTex). More than $1M was spent on feasibility studies [xiii] from 1984-1991, and $53.6M in loan requests were submitted to the TWDB through 2008. A draft environmental impact statement was published in the Federal Register in 2010, yet no additional project notations have been added to the ANRA website since that time. The USACE published a "Termination Notice" of the Lake Columbia process on April 29, 2016, signifying the official "halting" of the permitting effort on the proposed reservoir[xiv]. The last project update from ANRA is from August 2015, which includes statements of interest from Dallas Water Utilities and Tarrant Regional Water District, along with other interests attributed to smaller private entities. The ANRA project website seems to provide more of a "sales pitch" to prospective contributors, rather than real evidence of project viability from the expected project sponsor/coordinator.

Source: Angelina and Neches River Authority

Per the 2021 Region I water plan, ANRA is still planning to use Lake Columbia as a supply strategy to meet projected needs. The 2021 plan lists 17 participants with ANRA water contracts from Lake Columbia, with total supply commitments of 53,608 acre-ft/yr. The modeled yield of the planned lake has been reported at 75,700 acre-feet/year, yet LRE believes it should be reduced to 67,597 acre-feet/year based on currently available extended hydrology data. The reduction in yield due to more recent droughts further emphasizes the vulnerability of surface water reservoirs to unknown future climate conditions.

Lake Creek Reservoir

Formerly known as Miller's Creek off channel reservoir, Lake Creek Reservoir is proposed upstream of Possum Kingdom Reservoir within the Brazos River Basin. The lake would be used to help meet water needs for the North Central Texas Municipal Water Authority, and was not included in the 1984 set of planned reservoirs. The reservoir would inundate 2,866 acres and impound 58,560 acre-feet. Modeled yield for the reservoir amounts to 12,900 acre-feet/year with the Brazos Basin WAM run only through 1997 (not including the extended hydrology through 2018, which became available in 2021). Per the 2021 Region G plan, reservoir operators would need a subordination agreement from the Brazos River Authority to allow diversion into Lake Creek Reservoir, as otherwise water would need to pass downstream to Possum Kingdom Reservoir under the prior-appropriation system. Per the Brazos River Authority, subordination agreements are unlikely, given existing commitments for water from Possum Kingdom Reservoir and the rest of the reservoir system. As such, Lake Creek Reservoir does not seem to be a feasible water supply strategy.

Lake Ringgold

The proposed reservoir, Lake Ringgold, would be located downstream from Lake Arrowhead on the Little Wichita River, at a location approximately one-half mile from the confluence with the Red River. The lake was included within the 1961, 1968, 1984, and 1990 water plans, yet was not a recommended strategy in the 1997, 2001, or 2006 plans. The reservoir was mentioned as an alternate strategy in each of these plans, and has been a recommended strategy in the 2011, 2016, and 2021 plans. It is also a recommended strategy in the 2026 Initially Prepared Plan for the Region B water planning group.

Proposed Lake Ringgold reservoir

Photo Credit: Texas Conservation Alliance

As proposed, Lake Ringgold would inundate 16,000 acres and impound 275,000 acre-feet at conservation capacity. The expected lake yield based on the official Red River Basin WAM is 28,090 acre-feet/year, yet this model only utilizes hydrology through 1998. The Region B Water Planning Group opted to assess yield with an "Excel Model" using hydrology extended through 2015[xv], resulting in a firm yield of 23,450 acre-feet/year.

Researcher's Note: *I further estimated yield through an application of the reservoir mass balance equation using inflows from the USGS streamflow gauge on the Little Wichita River above Henrietta (Gauge #07314900), applying an appropriate drainage area ratio, and using net evaporation rates calculated for Lake Arrowhead. Through this analysis,* ***I estimate the actual yield to be closer to 16,430 acre-feet/yr*** *(Figure 1). This is slightly higher than the reservoir safe yield computed by Freese and Nichols as part of the City of Wichita Falls Long Range Water Supply Plan from 2016. Amazingly, the TCEQ granted a permit for the City of Wichita Falls to divert up to 65,000 acre-feet/year[xvi], which is a yield much greater than that computed from the official WAM, the regional water planning group efforts, the City's water supply plan, or my own assessment. It is also significantly larger than the 9,110 acre-feet/yr permit allowance discussed by the administrative law judge who presided over the contested case hearing related to this potential reservoir project.*

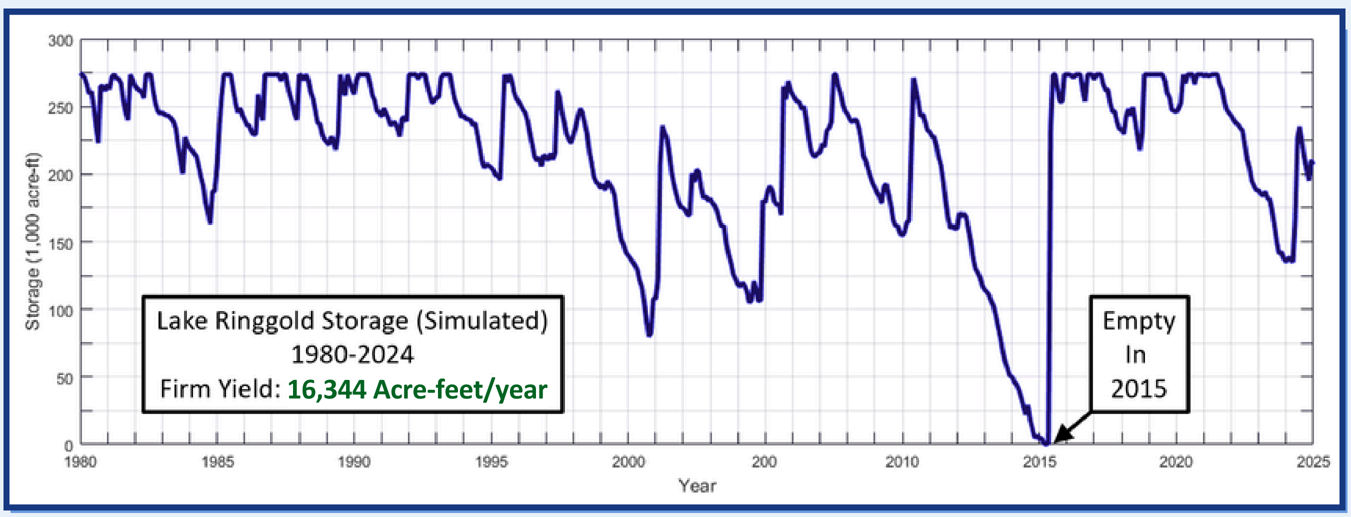


Figure 1– Modeled water levels in a hypothetical Lake Ringgold based on streamgauge data and an approximated water balance. The critical drought period is from 2010 through 2015.

Water from Lake Ringgold would be conveyed via a 30-mile pipeline to the City of Wichita Falls, or conveyed upstream to Lake Arrowhead, where existing infrastructure may be used to transport the water to the City of Wichita Falls. Evaporative losses from the lake, when full and using observed net evaporation rates from 2010-2024, would range from 10,929 to 66,645 acre-feet/year.

As such, it is possible that evaporative losses can greatly exceed the yield expected from the reservoir.

In its Long-Range Water Supply Plan developed by Freese and Nichols, the City of Wichita Falls ranked Lake Ringgold as its 3rd most optimal water supply strategy, behind indirect reuse and water conservation[xvii]. It is also listed as the preferred "long term" strategy yet with questionable scoring. In developing its ranking, Freese and Nichols weighted the strategy cost at "5," water quantity at "2," and most other ranking parameters at "1." This weighting system greatly emphasizes project cost, giving it 2.5x greater importance than the volume of water produced. Freese and Nichols ranked each potential City of Wichita Falls strategy according to 10 criteria, with scores for each criteria ranging from "1" (low) to "5" (high). Scores were multiplied by the criteria weight and then summed, with the strategy providing the highest score documented as being the "preferred" strategy. Table 1 presents the rankings as presented by Freese and Nichols and as re-evaluated by LRE.

	Freese & Nichols Strategy Ranking	LRE Water Strategy Ranking	
#1	Indirect Reuse	Indirect Reuse	Implemented Short-Term Strategies
#2	Water Conservation	Water Conservation	
#3	Direct Reuse	Direct Reuse	
#4	**Lake Ringgold**	HFSJ Groundwater	
#5	HFSJ Groundwater	Groundwater - Wilbarger	
#6	Groundwater - Wilbarger	**Lake Ringgold**	

Table 1 – Reduced ranking of Lake Ringgold Project when proper cost criteria are applied

The Freese and Nichols report did not provide justifications for their rankings, yet did provide data on each strategy in the appendix to the report. LRE utilized that data to revise strategy scoring based on the project cost per volume of water delivered. The Lake Ringgold project had a cost per MGD value of over $15M, making it comparable to the other strategies "Groundwater – Wilbarger" and "OK Arbuckle GW" (Note: strategies were renamed for simplicity). Freese and Nichols originally assigned the Lake Ringgold strategy a cost strategy of "4," however cost scores assigned to the strategies with comparable costs were assigned the lower value of "3." In addition, the strategy "HFSJ Groundwater" was originally assigned a "3" cost score, when its cost is comparable to that of the "Wichita River Supply" (which received a "4" cost score) and to that of "Indirect Reuse" (which received a "5" cost score). LRE revised the cost scores for the Lake Ringgold and HFSJ Groundwater proposed strategies, which resulted in altered rankings of the projects. In addition, the cost per MGD value for Lake Ringgold was created assuming the project yields 25 MGD. Revised estimates from LRE suggest the yield of Lake Ringgold would be approximately 16 MGD, which would result in a cost per MGD value worthy of a "2" cost score and further demotion of the ranking of the Lake Ringgold project relative to other considered projects. LRE considers these project rankings as presented in Freese and Nichols (2016) to be suspicious, especially when considering that Freese and Nichols has been responsible for constructing many of the large reservoirs currently in service in Texas.

Source: The Texas Tribune

Source: Wichita Falls Times Record News

Per the 2021 Region B water plan, the project is expected to cost $443M (in 2018 dollars – equivalent to $568M in 2025). This represents a significant cost increase above the nearly $298M cost reported in 2016 and nearly $285M cost reported in 2001[xviii]. Alternative supply strategies considered in 2021 included obtaining water from Lake Bridgeport, Lake Texoma, the Seymour Aquifer in Wilbarger County, and from conjunctive use of the Seymour Aquifer and the Wichita River. The 2021 plan did not discuss why the Lake Ringgold strategy was favored over these other potential strategies, but it is likely that the ranking from the Wichita Falls Long Range Plan[xix] was simply rehashed and re-used by the Regional B Water Planning Group (which had hired Freese and Nichols to complete the planning effort). The plan does note that safe supply needs for the City of Wichita Falls range from 5,134 acre-feet/year to 10,864 acre-feet/year from 2040 to 2070.

It is unfathomable why the TCEQ would have granted a permit for withdrawal and use of 65,000 acre-feet/year when this is over twice the computed yield and nearly six times as much as the City of Wichita Falls' stated water needs.

Administrative Law Judge Christiaan Siano stated "the City failed to establish a need for an appropriation of the requested amount" (of 65,000 acre-feet/yr) and recommended denying the City's permit application[xx].

On February 4th, 2025, the Wichita Falls City Council voted to designate over $3M for the hiring of a consulting firm to conduct section Clean Water Act 404 permitting activities related to Lake Ringgold[xxi]. The firm to receive the money and conduct the permitting activities was identified as Freese and Nichols. At the same City Council meeting, Russell Schreiber, Director of Public Works for the City of Wichita Falls said, "Freese and Nichols has been our engineer [] for the last 15 or 16 years. They are the only logical firm in staff's mind to even proceed forward with this project." Hence the project was awarded without a competitive bid process to the company who has been pushing for the reservoir development project for at least 20 years. Shane Cody, who spoke in opposition to the project, referenced proposed HB 2114, which would essentially prevent conflicts of interest by barring engineering firms from both identifying (i.e. planning) and constructing engineering projects.

LRE believes independent review of the City of Wichita Falls Long Range Supply plan is needed to ascertain whether Lake Ringgold is the highest-ranking strategy suitable for meeting the City's future water needs. This review should re-assess reservoir yield, re-evaluate project costs, and re-evaluate all proposed project alternatives as discussed in the original Long Range Supply plan. A truly independent review would be done by a firm other than Freese and Nichols or any engineering firm that may also financially benefit from the implementation or construction of any water supply project to be undertaken by the City. Such a review is essential to ensure potential conflicts of interest are avoided, and that all supply options are properly evaluated. This review could be performed as part of the USACE Clean Water Act 404 permitting process, including as part of USACE's formal review of material provided by Freese and Nichols in the 404 permit application currently under development.

Source: [Texas Conservation Alliance]

Marvin Nichols Reservoir

Marvin Nichols Reservoir is shown as "Naples Reservoir" in the 1968 Texas Water Plan and has been included in all Region C water plans from 2001-2021. Region C encompasses the Dallas-Fort Worth Metroplex and surrounding counties. The reservoir is not a recommended strategy in the 2021 Region D water plan, despite its location within the Sulphur River Basin in Northeast Texas within the Region D water planning area. Water from the reservoir would be transported to the DFW Area within Region C, which is why it is a strategy only within the Region C plan. This reservoir would potentially inundate 66,103 acres, store 1,532,000 acre-feet of water, and have a firm yield of 451,500 acre-feet/year. In the Region C plan[xxii], Freese and Nichols suggests that only 80% of the firm yield would be conveyed to the DFW Metroplex, with the remaining 20% used locally, despite the fact that the local water user groups within Region D do not show "needs" for this additional supply.

Yield reported for the project in the 2001 Region C water plan was 619,100 acre-feet/year, which is over 33% higher than the 2021 reported yield. This reduction in anticipated yield calls into question the actual water production capability of the proposed reservoir. The 2026 "Initially Prepared Region C Water Plan" now estimates a firm yield of only 400,020 acre-feet/yr, representing a further reduction in the stated project utility compared to prior computations.

Source: Dallas Observer

As of 2021, feasibility studies for the project have been conducted, yet no permit applications have been filed. Approximately 24,000 acres of existing wetlands, 11,000 acres of upland forest, and 10,000 acres of bottomland hardwood forests would be inundated by the project, thereby drastically altering the natural landscape. The capital cost of the project in 2021 was estimated at $4.4B, with an eventual cost of $0.73 per 1000 gallons after project debt service. Updated estimated costs for the project are $7 billion, with the largest expenditure being for the transmission pipeline between the reservoir site and the Dallas-Fort Worth Metroplex[xxiii]. As with Lake Ringgold, the reservoir planning process is being pushed by Freese and Nichols, Inc., the lead consultant developing the Region C plan. The reservoir is named after Marvin Nichols, who was a principal at Freese and Nichols, having joined the engineering firm in 1927[xxiv].

Figure 2 presents the modeled net evaporation (blue) from the Sulphur Basin WAM, used to estimate the firm yield of Marvin Nichols Reservoir, in comparison to the revised net evaporation computed using new methods[xxv]. Both net evaporation datasets pertain to the location of Wright Patman Reservoir, which is located downstream from the proposed Marvin Nichols Reservoir.

As shown, the revised net evaporation is generally more extreme than the modeled evaporation, with either greater evaporative loss or water gains due to precipitation. It is also evident that higher net evaporation has occurred for the period after which Water Availability Modeling was performed. This suggests that the Sulphur Basin model should be updated to include more recent data, and that estimated yields for Marvin Nichols Reservoir may be overstated.

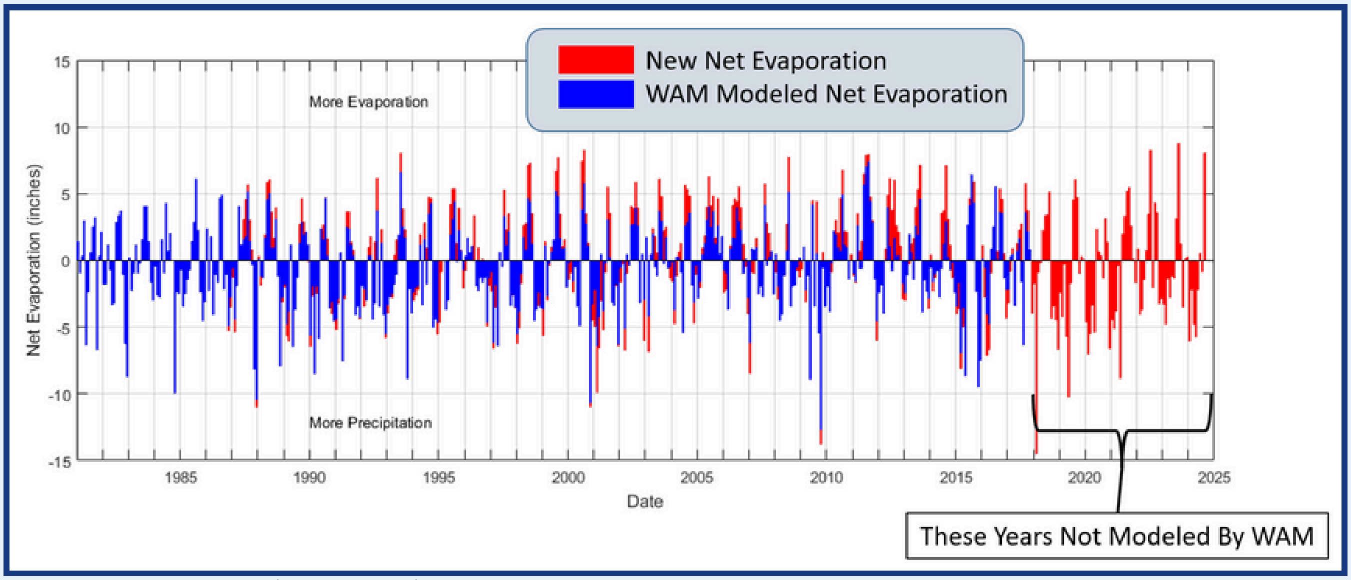


Figure 2 – Net Evaporation (inches/month) for Wright Patman Reservoir downstream from the proposed Marvin Nichols Reservoir.

It is unquestionable as to whether the reservoir could provide a large portion of the water needed to sustain and grow the Dallas-Fort Worth Metroplex. What is questionable, and what makes this project controversial, is the idea that the project is the most feasible supply alternative for the region.

Despite the project being included within State Water Plans since 1968, the Texas legislature required TWDB to conduct an additional feasibility review[xxvi] for the project. The report was made available in DRAFT form as of September 2024, and final form in January 2025[xxvii]. It is worth noting the changes made between the draft and final document, ostensibly indicating TWDB responses to public comments on the draft material. Changes include the clear detailing of opposition to the Marvin Nichols Reservoir project from the Region D Water Planning Group, which has expressed its opposition in every regional water plan since 2002. It is also notable that the draft report failed to acknowledge that the firm yield from the reservoir, as calculated during development of the 2026 Region C water plan, is 50,560 acre-feet/year (11%) less than that computed during the development of the 2021 Region C water plan (although no explanation for this reduction in yield has been provided). The final report made this acknowledgment in a footnote, yet did not update report text accordingly or reduce the volume of water projected to be delivered to Region C if the project were implemented.

The estimated $7 billion project cost (as detailed in the 2026 Region C water plan under development) is also not reflected in the evaluation of the strategy cost per yield presented in the feasibility study, thereby likely rendering the project ranking outdated. This leads to questioning the validity of this 2025 feasibility study review, and suggests that the review should be at least updated after the completion of the 2026 Regional Water Plans and 2027 State Water Plan.

The conclusions from the feasibility report are that:

1. **Marvin Nichols Reservoir may be feasibly constructed by 2050**
2. **Project costs do not make the project infeasible**
3. **Land acquisition requirements are significant, but not expected to make the project infeasible**
4. **No economic impacts were identified that would specifically render the project infeasible**

The report also acknowledges that uncertainties are significant for all aspects of water planning with respect to Marvin Nichols Reservoir, and that the uncertainties may affect project sponsor decisions. It is LRE's opinion that while this report satisfies the requirements imposed on TWDB by the legislative directive assigned in 2023, the report itself provides no useful information regarding the true need or value of Marvin Nichols Reservoir relative to other potential water supply strategies. To be useful, the feasibility study should be re-evaluated using data and strategy analyses included in the 2026 regional water plans and 2027 state water plan.

Source: Dallas Morning News

New Throckmorton Reservoir

The potential "New Throckmorton Reservoir" would be located in Throckmorton County, would inundate 1,161 acres, and provide a safe yield of 3,500 acre-feet/year as modeled using the Brazos Basin WAM with hydrology through 1997. This reservoir operation would require a subordination agreement with the Brazos River Authority, and would reduce the yield from Possum Kingdom Reservoir accordingly. As such, New Throckmorton Reservoir does not seem to be a feasible water supply strategy.

Source: Throckmorton County

Tehuacana Reservoir

The planned Tehuacana Reservoir is proposed on Tehuacana Creek near the existing Richland-Chambers Reservoir. It is expected to inundate 15,000 acres and provide a firm yield of 25,400 acre-feet/year. The water would be utilized by the Tarrant Regional Water District (TRWD) through existing conveyance infrastructure at Richland Chambers Reservoir. The reservoir would inundate 1,200 acres of bottomland hardwood, as well as upland deciduous forest and grasslands. Tehuacana Reservoir was included within the 1984 water plan, but not within the 1961 or 1968 plans. Using evaporation rates from Richland Chambers Reservoir for 2010-2024, net evaporative losses for Tehuacana Reservoir could range between 33,000 and 44,000 acre-feet/year, which exceeds the reservoir firm yield.

Source: Texas Water Resources Institute

Turkey Peak Reservoir

Located in the Brazos River Basin, the planned Turkey Peak Reservoir[xxviii] is an extension of the existing Lake Palo Pinto. The Turkey Peak Reservoir dam will be constructed on Palo Pinto Creek downstream from Lake Palo Pinto, and the resulting inundation will overtop the Lake Palo Pinto Dam, thus combining the two lakes into one larger reservoir. Per the 2021 Region G water plan, this project was anticipated to commence construction in 2025. The project is being undertaken by the Palo Pinto County Municipal Water District No. 1, which has secured partial project funding and has applied for a State Water Implementation Fund (SWIFT) loan for the remaining project balance.

Source: The Nature Conservancy

Other Planned Reservoir Projects

Other planned reservoir projects incorporated within the 2022 State Water Plan (and 2021 Regional Water Plans) include:

- **Austin Off Channel Reservoir** – 25,827 acre-feet/year (planned for 2070)
- **Baylor Creek Reservoir** – 18,000 acre-feet/year (planned for 2040)
- **Beaumont West Regional Reservoir** – 7,700 acre-feet/yr
- **Brushy Creek Reservoir** – 2,000 acre-feet/yr
- **GBRA Lower Basin New Appropriation Off Channel Reservoir** – 40,000 acre-feet/year
- **GBRA Lower Basin Storage Off Channel Reservoir** – 59,780 acre-feet/year
- **Jim Bertram Lake 7** – 11,975 acre-feet/year
- **Lavaca River Off Channel Reservoir** – 23,500 acre-feet/year (2030)
- **LCRA Mid-Basin Off Channel Reservoir** – 20,000 acre-feet/year

Most of these reservoirs remain in the planning or permitting stages, with yields likely dependent upon changing WAM models as climate conditions are altered into the future. The LCRA Mid-Basin OCR and Baylor Creek Reservoir are planned to be operated under existing LCRA water rights, in conjunction with the recently constructed Arbuckle Reservoir. Anticipated yields from this LCRA system of reservoirs will likely need to be revisited, as Colorado River streamflows tend to be diminishing (since 2008). It is unclear whether the reported yields are those that can be obtained by individual reservoirs, or whether the yields may be obtained with all reservoirs operating simultaneously (including Arbuckle Reservoir).

Source: Captain Experiences

Alternatives to New Reservoir Construction

Additional water supplies may be developed without large-scale reservoir construction, and alternative means may provide localized, and less environmentally disruptive supply solutions. Permitting requirements of alternative supplies may also be less onerous and time-consuming, thereby allowing projects to be implemented more quickly. **Alternatives include reuse/recycling, groundwater development, oceanic and brackish groundwater desalination, aquifer storage and recovery (ASR), and conservation.**

Groundwater Development & Brackish Desalination

Although fresh, directly potable groundwater is still prevalent across parts of Texas, supplies are becoming harder to obtain in many areas. The TWDB has been diligently studying the more brackish aquifers of Texas, which may be treated for total dissolved solids (TDS) removal and then used for human consumption. The TWDB defines brackish water as groundwater with a TDS level of 1,000–9,999 milligrams per liter (mg/L). This water exceeds the 1,000 mg/L TCEQ secondary standard for public drinking water supplies, yet is not as salty as seawater (which typically averages 35,000 mg/L). Brackish water desalination is becoming commonplace, and is used heavily by the City of El Paso, Brazosport Water Authority, and other entities. TWDB recently recognized the Cross Timbers Aquifer as an official minor aquifer in Texas, spanning numerous counties west of Fort Worth. This aquifer contains limited freshwater resources, underlain by large supplies of brackish water. Pumping and treating the brackish water could provide a plentiful water source for much of the north Texas region. Drawbacks to this type of supply development are that it is difficult to obtain water quantities as large as those from surface water reservoirs. However the available volume of brackish water is large and widespread, and would likely require less pipeline infrastructure to convey water to where it is needed.

Source: Hawkins Delafield & Wood LLP

Reuse/Recycling

Water reuse and recycling is utilizing water for multiple purposes, rather than simply discharging "used" water back into the environment. Many Texas cities have water reuse permits in place, which would allow for them to legally utilize water discharges from treatment plants and put the water toward local beneficial uses. The City of Dallas holds such permits, but currently does not utilize reuse as a significant strategy, instead allowing much of the discharged water to flow downstream within the Trinity River watershed, where it can be used by downstream communities, such as the City of Houston. The City of Houston also has the ability to reuse water from its various treatment plants, rather than simply discharging the water into bayous and the Houston Ship Channel. These discharges were once considered to be a viable supply option for the Gulf Coast Water Authority in Brazoria County, yet were deemed too expensive a supply based on the price the City of Houston would consider[xxix]. The City of Austin also discharges treated wastewater back into the Colorado River downstream from the City, and has been considering greater reuse of this water as part of its Water Forward strategies. Any such greater use, however, could adversely affect water supplies for Colorado River water users downstream of Austin, which in turn could affect how LCRA manages the Highland Lakes and makes water available for all users. Similarly, reuse of water discharged by the City of Dallas could potentially result in less water availability for the City of Houston. Such considerations need to be made prior to implementing reuse strategies.

Source: Texas Water Newsroom

Water reuse in any form often requires new treatment and transmission infrastructure, potentially including retrofitting of building plumbing. Any new building construction could develop means to capture greywater (slightly dirty water from sinks, showers) and utilize that water after perhaps a filtering process to irrigate local landscaping. It is also possible to capture water from air conditioning condensation lines and use it for landscaping purposes. Such actions on a building-by-building basis could substantially lower potable water needs for landscape irrigation, thereby making potable water available in greater quantities for other uses. Water reuse has been recognized as an important component of water management, and has garnered a nationwide effort at education and outreach among water planners and engineers. This is evident in the "Watereuse.org" website and associated trade association dedicated to advancing laws, policy, funding, and public acceptance of recycled water as a viable means of water supply enhancement.

Texas is already implementing numerous water reuse projects and has conducted studies detailing the investigation of both direct and indirect reuse as supply augmentation strategies.

Direct reuse involves reusing treated wastewater directly from the treatment plant. Alternatively, **indirect reuse** involves the discharge of treated wastewater into a waterbody, and diverting water from that waterbody for use in a potable water supply system.

According to the 2022 State Water Plan, there is only one operational direct reuse system within the state, yet approximately 15 systems were recommended. Similarly, per the 2022 State Water Plan, five indirect reuse facilities were operating in 2022, including the indirect reuse project for the City of Wichita Falls. This project was operational in January 2018 and required a $35M investment, yet yields up to 16 MGD in water supply. As detailed in Table 1, this strategy had a far lower cost per water volume value than other proposed strategies (including Lake Ringgold). Similar strategies could be utilized statewide to better manage available water supplies. Reuse strategies are also advantageous (when compared to new reservoir strategies) in that they do not require the inundation or condemnation of large swaths of land, and therefore rarely cause significant alterations to the natural environment.

Aquifer Storage & Recovery (ASR)

Ever since Hurricane Harvey, there has been a push to capture excess stormwater and store it within Texas aquifers for later retrieval and usage. While not possible on scales necessary to mitigate hurricane flooding, ASR is a viable option for supplementing groundwater and surface water supplies. ASR systems have been used successfully in Florida, Colorado, Arizona, and California. There are a handful of ASR applications in Texas, including a larger system operated by the San Antonio Water System, yet most applications have been relatively small in scale. The City of Austin is actively developing an ASR program as a means to limit its dependence upon Colorado River water. Their ASR program is a significant effort as part of the Water Forward integrated 100-year water plan.

Source: Texas Water Resources Institute

Under an ASR system, excess surface water is captured and treated as necessary, before being pumped underground into existing aquifers. The pumped water fills available space within the aquifer adjacent to the injection well. This water either remains in place or travels downgradient over time, and is eventually recovered by either additional wells or the same injection well operating in pumping mode. An advantage of an ASR system compared to a surface water reservoir is that evaporative losses are eliminated. Greater percent recovery can be achieved, if the ASR system is properly designed and operated. ASR systems also avoid the seizure and destruction of habitat common during surface reservoir construction, as they allow land use practices to remain relatively unchanged.

Ocean Desalination

Desalination of seawater along the Texas Gulf Coast could provide an unlimited supply of freshwater. Desalination plants are being planned from Brownsville to Galveston Bay, with the Port of Corpus Christi and the City of Corpus Christi competing to permit and construct the first facilities on Corpus Christi Bay. Oceanic desalination is an energy-intensive endeavor, yet is proven to be an effective technology with worldwide usage.

The Gulf Coast Water Authority (GCWA) is currently conducting a feasibility study for augmenting its water supplies using oceanic desalination. If successful, GCWA could offset usage of its freshwater supplies from the Brazos River, and could make those supplies available to customers further upstream in the Brazos Basin. This type of conjunctive use/partnership could prove beneficial in other coastal basins across Texas. It is not likely to be cost-effective, however, outside of the coastal basins, as pumping water uphill over longer distances is energy-intensive and requires networks of extensive pipelines. Any such projects are physically feasible, yet would require large capital investments and operating costs.

Conservation

Water conservation is always going to be a preferred water management strategy as it often requires less financial investment than other supply strategies. Conservation does not actively produce more water, but rather reduces usage for existing activities. This thereby extends the utility of existing supplies and delays the need for additional supply development. Conservation activities can include installation and usage of low-flow appliances, or the limiting of outdoor watering. For example, over 50%[xxx] of summer water usage in the Dallas-Fort Worth Metroplex may be attributed to lawn irrigation. Xeriscape, or using less water-intensive native plants when landscaping, can go a long way toward conserving existing water supplies.

Conclusions

While new surface water projects will likely remain part of the regional planning process, planners need to properly assess reservoir projects to best ensure their benefits, cons, and environmental impacts are properly understood. Specifically:

1. **Reservoir yields should be continuously recalculated using updated hydrology, thereby ensuring that strategy rankings and comparisons are properly evaluated.**
   - Utilizing only “old data” may result in over-statement of project yields, and therefore over-statement of project benefits.
   - Most of Texas has experienced more severe droughts during recent times, and hydrology from these recent times MUST be included in yield computations.
2. **Reservoir projects require extensive permitting, time and patience, which may not be compatible with short term drought response needs.**
3. **Water supply strategies should be fully vetted by independent planners not associated with project construction or implementation.**
4. **When performing plan reviews, agencies like the TWDB, TCEQ, and USACE should verify project plan components and not merely “check the box” for content inclusion.**

In general, water supply project ideas should always be re-considered during each planning cycle, as circumstances may change making projects more or less feasible over time. For example, the planned Austin OCR is not currently slated to come online until 2070, as other water supply strategies are currently more cost effective to implement. However, should circumstances change, the City of Austin could readily implement its OCR plan if needed.

From a hydrologic standpoint, a troubling aspect of developing new surface water reservoirs appears to be the uncertainty with respect to likely project yield. Firm yield calculations with the WAM should require use of updated hydrologic input (stream flows and net evaporation rates).

Usage of these updated inputs may indicate that projects become more or less favorable over time, depending upon climatic conditions. For example the City of Abilene was moving forward with the permitting for Cedar Ridge Reservoir, until it was determined that the expected reservoir yield had greatly diminished as a result of severe and ongoing regional drought.

The diminished yield made the project more expensive on a cost per unit basis, and made other projects (like the Fort Stockton Holdings project) more attractive. Accurate yield assessments are needed to accurately estimate project costs and evaluate project utility. As detailed for Lake Ringgold, uncertainty in the yield calculation could lead to a less favorable project ranking, elevating previously less favorable alternative supply projects into preferred projects. Unfortunately, yields seem to be constantly revised downward as new hydrologic data is added. This may not be true for all locations across Texas, but it is worth considering prior to project implementation.

Reservoir projects are essentially permanent, as they irrevocably alter the natural environment that is inundated. The State of Texas and regional water planners should recognize their responsibility as environmental stewards to ensure any such project will cause the minimum impact possible, as should be demonstrated through an extensive permitting and review process. That review process should be detailed and independent, and should not merely confirm project inclusion in planning reports and studies (which should also themselves be independently reviewed). Projects should be fully and properly vetted against all project alternatives and combinations of alternatives; otherwise potentially erroneous conclusions, as with Lake Ringgold, may be drawn, and less-favorable projects may be implemented. New surface water reservoirs remain potentially viable water supply options, yet they may not be the fastest, least expensive, or most desirable to implement.


Source: State Impact from NPR


Source: Phillips & Jordan, Inc.

References

[i] https://www.texastribune.org/2025/01/16/texas-water-legislation-charles-perry-supply-infrastructure/

[ii] https://www.waterdatafortexas.org

[iii] Personal Communication, David Collingsworth, 2021

[iv] https://capitol.texas.gov/tlodocs/89R/billtext/html/HB02114I.htm

[v] https://www.tceq.texas.gov/permitting/water_rights/wr_technical-resources/wam.html

[vi] Zhao, B., Huntington, J., Pearson, C., Zhao, G., Ott, T., Zhu, J., et al. (2024).Developing a general Daily Lake Evaporation Model and demonstrating its application in the state of Texas. Water Resources Research, 60, e2023WR036181. https://doi.org/10.1029/2023WR036181

[vii] Central Texas Water Coalition, Personal Communication, 2025

[viii] 2021 Brazos G Regional Water Plan. October 2020. HDR,Inc., Freese and Nichols, Inc., Susan Roth. https://brazosgwater.org/Planning-Documents/2021-Brazos-G-Regional-Water-Plan as of 3/28/2025

[ix] 2026 Brazos G Initially Prepared Plan Volume 1 (2025). Carollo, Advanced Groundwater Solutions, Plummer. https://brazosgwater.org/Portals/6/Meetings/2025-05-06-IPP-Volume-I.pdf as of 3/28/2025.

[x] https://www.reporternews.com/story/news/2020/05/12/abilene-midland-san-angelo-50-year-water-agreement-fort-stockton-holdings-edwards-trinity-aquifer/3115307001/

[xi] https://www.marfapublicradio.org/texas/2024-07-24/midland-officials-finalize-agreement-to-secure-the-citys-water-supply-for-100-years

[xii] 021 Region C Regional Water Plan. November 2020. Freese and Nichols, Inc., CP&Y, Inc., Plummer Associates, Inc., Cooksey Communications. https://regioncwater.org/planning-documents/ as of 3/28/2025

[xiii] https://www.anra.org/services-projects/lake-columbia/history/

[xiv] Termination of the Environmental Impact Statement for the Proposed Lake Columbia Regional Water Supply Reservoir Project, Federal Registrar Notice 4/29/2016 https://www.federalregister.gov/d/2016-09999 as of 3/28/2028

[xv] 2021 Region B Regional Water Plan. October 2020. Biggs & Mathews, Inc., Freese and Nichols, Inc., Alan Plummer Associates, Inc., Red River Authority of Texas. https://regionbwater.org/ as of 3/28/2025

[xvi] https://www.texomashomepage.com/news/local-news/fate-of-lake-ringgold-permit-decided-by-tceq/

[xvii] Freese and Nichols, Inc. (2016) Long-Range Water Supply Plan Prepared For: Wichita Falls. https://tx-wichitafalls3.civicplus.com/DocumentCenter/View/34377/Long-Range-Water-Supply-Plan-Study?bidId= as of 3/28/2025

[xviii] 2001 Region B Regional Water Plan. October 2020. Biggs & Mathews, Inc., Freese and Nichols, Inc., Alan Plummer Associates, Inc., Red River Authority of Texas. https://regionbwater.org/ as of 3/28/2025

[xix] FNI, 2016

[xx] https://txenvirolaw.com/judge-recommends-denial-of-wichita-falls-application-for-ringgold-reservoir/

[xxi] https://www.texomashomepage.com/news/local-news/city-of-wichita-falls-takes-next-to-build-lake-ringgold/

[xxii] 2021 Region C Regional Water Plan. November 2020. Freese and Nichols, Inc., CP&Y, Inc., Plummer Associates, Inc., Cooksey Communications. https://regioncwater.org/planning-documents/ as of 3/28/2025

[xxiii] https://fortworthreport.org/2024/10/02/controversial-7b-reservoir-could-move-forward-with-new-study-northeast-texans-push-back/

[xxiv] https://www.freese.com/news/the-1920s-mr-freese-mr-nichols-and-the-riverwalk/

[xxv] Zhou and Others, 2024

[xxvi] https://www.star-telegram.com/news/state/texas/article276221556.html

[xxvii] twdb.texas.gov/publications/reports/special_legislative_reports/doc/Marvin-Nichols-Reservoir-Project-Feasibility-Review.pdf

[xxviii] https://www.turkeypeakreservoir.com/

[xxix] Per personal communication with Gulf Coast Water Authority, 2017

[xxx] Dallas Water Utilities (2025). City of Dallas Water Conservation Ordinance. https://savedallaswater.com/resource-center/ordinance/ as of 3/28/2025

[1] Disclosure: The author of this report served as a third-party reviewer for this effort in 2016

Appendix

		Cost Score		Total Score		Strategy Ranking	
Proposed Strategy	Cost/MGD	Freese and Nichols Analysis	LRE Analysis	Freese and Nichols Analysis	LRE Analysis	Freese and Nichols Analysis	LRE Analysis
Indirect Reuse	$3,340,000	5	4	72	67	1	1
Water Conservation	$90,833	5	5	67	67	2	1
Direct Reuse	$2,675,000	3	4	60	65	3	3
Lake Ringgold	**$23,931,250**	4	**2**	58	**48**	4	**6**
HFSJ Groundwater	$6,380,000	3	4	50	55	5	4
Groundwater - Wilbarger	$17,873,333	3	3	49	49	6	5
Groundwater - Roberts	$40,541,667	1	1	47	47	7	7
Groundwater - Donley & Gray	$46,266,667	1	1	45	45	8	8
Wichita River Supply	$2,900,000	4	4	45	45	8	8
GW Denton	$41,833,333	1	1	41	41	10	11
Lake Texoma Water	$37,333,333	1	1	41	41	10	11
Lake Bridgeport	$26,780,000	2	2	40	40	12	13
OK Arbuckle GW	$16,520,000	3	3	38	38	13	14
GW Tillman OK	$26,540,000	2	2	38	38	13	14
GW Holiday	$10,000,000	2	3	37	42	15	10
GW Floyd	$64,800,000	1	1	36	36	16	16

Appendix 1 – Ranking of Proposed Strategies for the City of Wichita Falls (Modified from Freese and Nichols, 2016