WHITE PAPER · PERMIAN BASIN WATER · SEPTEMBER 2026

The Permian Makes More Water Than Oil. Texas Is Running Out of Places to Put It.

Every barrel of Permian crude arrives with roughly 3.3 barrels of brine that must be put somewhere. Texas has already suspended every deep disposal permit in two seismic zones, and the alternative costs six times more and would draw 13 percent of the state grid's record peak.

Why Produced Water Disposal — Not Resource Quality, Oil Price, or Rig Availability — Is the Binding Constraint on Permian Production

3.3 : 1	56	11.8 GW	ZERO
BARRELS OF BRINE PER BARREL OF CRUDE	DEEP DISPOSAL PERMITS SUSPENDED SINCE 2021	TO TREAT THE WATER RATHER THAN INJECT IT	DISCHARGE PERMITS ISSUED SINCE 2024

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September 2026 · For discussion with operators, water midstream, regulators, and capital partners

WHAT THIS PAPER FINDS

56

PERMITS ALREADY SUSPENDED

The Railroad Commission has suspended every deep disposal well permit inside two seismic response areas — 33 wells in Gardendale effective 31 December 2021 and 23 in Northern Culberson-Reeves effective 12 January 2024. Inside Northern Culberson-Reeves, operators committed to cutting deep disposal to 162,000 barrels a day, a 68 percent reduction against January 2022. This is not a forecast of a constraint. It is an enforcement record.

2×

THE PRESSURE TO MOVE THE SAME WATER

One major operator now requires nearly twice the wellhead pressure to dispose of the volume it was handling two years ago. Permitted capacity is a paper number: B3 Insight puts operational capacity roughly 40 percent below permitted capacity, because a permit authorises a volume while rock only accepts fluid at a pressure.

59%

OF THE WATER, IN THE BEST ROCK

The Delaware Basin generates about 59 percent of Permian produced water at 5 to 10 barrels per barrel of oil, against 3 to 5 in the Midland. The constraint does not bind at the basin margin. It binds first and hardest in the acreage that carries the entire growth narrative.

6×

THE COST OF THE ESCAPE HATCH

Injection costs $1.95 to $4.07 per barrel of oil produced. Treating the same water to a standard fit for use outside the oilfield costs $13.03 to $22.80 — roughly six times more, and a fifth to a third of gross revenue at plausible crude prices. That gap, not indifference, is why the industry keeps injecting.

ZERO

PERMITS THROUGH THE RELIEF VALVE

Texas legislated tort immunity for beneficial reuse effective 1 September 2025, while its environmental agency has issued no final river-discharge permit since it began accepting applications in 2024. Five applications covering more than 18 million gallons a day remain pending. The policy response reallocated risk rather than creating capacity.

CONTENTS

FIGURES

EXECUTIVE SUMMARY

The Permian Basin is discussed as a rock story. Tier-one inventory, well spacing, parent-child interference, breakevens against Brent. Production ceilings get built out of geology and rig counts. That conversation is analysing the wrong fluid.

By volume, the Permian does not primarily produce oil. It produces salt water. The Bureau of Economic Geology puts 2025 produced water at 20 to 21 million barrels a day — about one million acre-feet a year — against roughly 6.6 million barrels a day of crude, a ratio near 3.3 to 1 basin-wide and 5 to 10 to 1 in the Delaware, which is where the growth is supposed to come from.[1]

That water has nowhere to go but back underground. The formations receiving it are pressuring up. The chairman of the agency that regulates Texas oil and gas described his own jurisdiction to lawmakers this way: “We're basically trying to stuff 20 ounces of fluid in a 12-ounce can.”[2]

The thesis is blunt. This paper argues that produced water disposal — not resource quality, not oil price, not rig availability — is the binding constraint on Permian production over the next decade. Any production forecast that does not carry an explicit water-handling constraint is an unconstrained forecast of a constrained system.

The constraint is already binding rather than projected. The Railroad Commission has suspended all deep disposal well permits inside two seismic response areas — 33 wells in Gardendale and 23 in Northern Culberson-Reeves — and secured a 68 percent cut in deep disposal volume inside the latter. Its demonstrated remedy for subsurface pressure is to stop accepting water, and it has now used that remedy twice at scale.[3]

Permitted capacity is not the relevant number. B3 Insight puts operational capacity roughly 40 percent below permitted capacity, because operational capacity is governed by injection pressure rather than by what a permit allows. One major operator now requires nearly twice the wellhead pressure to move the volume it disposed of two years ago.[4]

Stated as an identity, maximum oil equals water-handling capacity divided by the water-oil ratio. At 2025 values — 21.5 million barrels a day of water against a ratio of

[1] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian Basin Will Remain a Long-Term Challenge”, Water Resources Podcast, transcript; U.S. Energy Information Administration, “United States on track for record crude oil production in 2026”, Today in Energy, 10 September 2026; PermianProducedWater.com, “Permian Basin produced water market data”, basin data updated May 2026 (industry pricing reference).
[2] Heated, “Oil executives just accidentally exposed the industry's greatest weakness”, Saul Elbein, 4 September 2026.
[3] Railroad Commission of Texas, “Seismicity Response”, seismic response area record.
[4] B3 Insight, “Is the Permian “Glass” Half-Full of Produced Water?”, 10 July 2023; B3 Insight, “What Operator-Level Disposal Data Reveals About the Permian Water Market”.

3.26 — the identity returns 6.6 million barrels a day of oil, which is exactly what the basin produced. The basin is already at its water ceiling. Even a 30 million barrel per day water system, a 40 percent expansion of the largest industrial fluid-handling network on earth, cannot sustain today's oil production at a 5-to-1 ratio.

Both escape hatches are real and neither is sufficient. Recycling already meets about 60 percent of basin frac water demand, but completions demand is bounded by drilling activity and cannot absorb a growing stream. Treatment costs roughly six times more per barrel of oil than injection, and treating the full stream at the measured energy intensity of a working Permian facility would require approximately 11.8 gigawatts of continuous load — 13 percent of ERCOT's all-time peak demand, as baseload, in the most transmission-constrained corner of the state.[5]

Texas has legislated around the consequences rather than the cause. House Bill 49, effective 1 September 2025, grants broad tort immunity for beneficial use of treated produced water. The permitting that would actually relieve the constraint has not moved: no final river-discharge permit has been issued since applications opened in 2024.[6]

The single metric to watch: Injection efficiency, measured in barrels disposed per psi of wellhead pressure. It is the leading indicator of the ceiling, B3 Insight now tracks it precisely because the volume metric stopped being informative, and it is degrading.[7]

1 INTRODUCTION AND THESIS

1.1 The proposition

Chevron's chief executive told an industry conference that US shale has probably plateaued, and the conversation turned immediately to acreage quality. The upstream industry still reaches for geology when it wants to explain a ceiling. This paper argues that the ceiling is already here, that it is hydraulic rather than geological, and that it is visible in an enforcement record rather than in a model.

The argument rests on five claims, each tested against primary data in the sections that follow.

[5] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”; Insurance Journal, “Texas Oil Industry Running Out of Space to Dispose Wastewater”, 25 August 2026; Electric Reliability Council of Texas, “ERCOT Yearly Peak Demand Records”, records unofficial until final settlement.
[6] Texas Legislature, *House Bill 49 bill analysis*, 89th Legislature, Regular Session; Heated, “Oil executives just accidentally exposed”.
[7] B3 Insight, “Operator-Level Disposal Data”.

1. **The basin is a water system that makes oil as a by-product.** Produced water runs roughly 3.3 times crude by volume basin-wide, and 5 to 10 times in the Delaware.[8]
2. **Permitted disposal capacity is not operational capacity.** Operational capacity is pressure-governed and sits roughly 40 percent below the permitted figure that reassurance is usually built on.[9]
3. **The constraint is binding now.** Fifty-six deep disposal permits have been suspended outright since 2021, and the permitting framework was rewritten in June 2025 after going essentially unchanged since 1982.[10]
4. **The arithmetic leaves no slack.** Water capacity divided by the water-oil ratio returns today's production exactly. Both inputs are moving the wrong way.
5. **Neither escape hatch scales this decade.** Reuse is bounded by completions demand; treatment is bounded by cost and by gigawatts of power that do not exist in West Texas.[11]

1.2 A note on the water number, because it will be attacked

Published Permian water volumes range from 20 to 26 million barrels a day, and that spread is the first thing a critic will reach for. The spread is real and explicable. The Bureau of Economic Geology reports 20 to 21 million barrels a day for 2025. The Texas Observer reports roughly 22 million as of early 2025. Basin market data compiled through May 2026 gives 22 to 24 million. Railroad Commission Chairman Jim Wright has cited approximately 25 million alongside 5.5 million barrels of oil.[12]

The differences come from basin boundary definitions, whether New Mexico volumes are included, and whether the figure is gross produced water or net of recycling. The Produced Water Society reconciles them directly: independent estimates applying the basin's observed three-to-five ratio place current volumes at 20 to 23 million barrels a day, trending toward 26 million by 2030.[13]

This paper uses 21.5 million barrels a day — near the bottom of the credible range. Every conclusion below is therefore conservative. Using the Commission chairman's own 25 million figure would strengthen every result in this analysis.

[8] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”; PermianProducedWater.com, Permian produced water market data (industry pricing reference).
[9] B3 Insight, “Is the Permian Glass Half-Full?”.
[10] Railroad Commission of Texas, Seismicity Response record; B3 Insight, “New RRC Guidelines Reshape SWD Permitting in the Permian”, Campbell Gough, 30 May 2025.
[11] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”; Insurance Journal, “Running Out of Space to Dispose Wastewater”.
[12] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”; Texas Observer, “Texas Has a Water Shortage and a Water Glut. They're the Same Problem”, Mezabahnur Masum, 23 June 2026; PermianProducedWater.com, Permian produced water market data (industry pricing reference); Produced Water Society, “The Permian's Next Boom Has a Water Problem”, 26 May 2026.
[13] Produced Water Society, “The Permian's Next Boom Has a Water Problem”.

2 A WATER SYSTEM THAT PRODUCES OIL

2.1 The scale

The Bureau of Economic Geology puts Permian produced water at about 20 to 21 million barrels a day in 2025, equivalent to roughly one million acre-feet a year, and notes that the basin produces three to five barrels of water for every barrel of oil. Rystad Energy counted 8.3 billion barrels of Permian produced water in 2024, up five percent year over year.[14]

Against that, oil. The EIA forecasts Permian crude at 6.8 million barrels a day in 2026, three percent above 2025, which places 2025 near 6.6 million.[15]

Set that beside the state's own water position. The Texas Water Development Board's 2027 state water plan calls for $174 billion of spending over fifty years, more than double the $80 billion in the previous plan four years earlier, and still projects supplies falling roughly 10 percent between 2030 and 2080. Voters approved $20 billion. A single industry's waste stream, running at roughly one million acre-feet a year, is not a footnote against that. It is a competing claim on the same scarce thing.[16]

2.2 The trend runs one way

Volumes are not merely large. They are growing while oil is not. Basin water is projected at 26 million barrels a day by 2030 and 32 to 38 million by 2035, a 39 percent increase.[17]

The mechanism is unglamorous and one-directional. Unconventional wells water out as they age, the basin's producing population is ageing, and mature conventional Permian wells run 10 to 15 barrels of water per barrel of oil. Every year the basin adds inventory to the high-ratio end of its own distribution. No technology on the horizon reverses this. Technology only changes what the water costs.[18]

2.3 The average hides the problem

Basin averages are where this argument usually goes to die, so it is worth disaggregating. The distribution is the finding.

[14] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”; Produced Water Society, “The Brine Is the Business”, 16 June 2026.
[15] U.S. Energy Information Administration, “Record crude oil production in 2026”.
[16] The Texas Tribune, “Texas needs at least $174 billion to avoid water crisis, state says”, Carlos Nogueras Ramos and Colleen DeGuzman, 16 April 2026; Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”.
[17] Produced Water Society, “The Permian's Next Boom Has a Water Problem”; PermianProducedWater.com, Permian produced water market data (industry pricing reference).
[18] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”.

Sub-basin	Produced water	Share of basin water	Water-to-oil ratio
Delaware (TX and NM)	~13–14 MMbbl/d	59%	5–10 : 1
Midland (TX)	~8 MMbbl/d	36%	3–5 : 1
Central Basin Platform	~1–2 MMbbl/d	5%	2–4 : 1
Total Permian	**22–24 MMbbl/d**	**100%**	**3–5 : 1 average**

Source: PermianProducedWater.com.[19] Basin data updated May 2026.

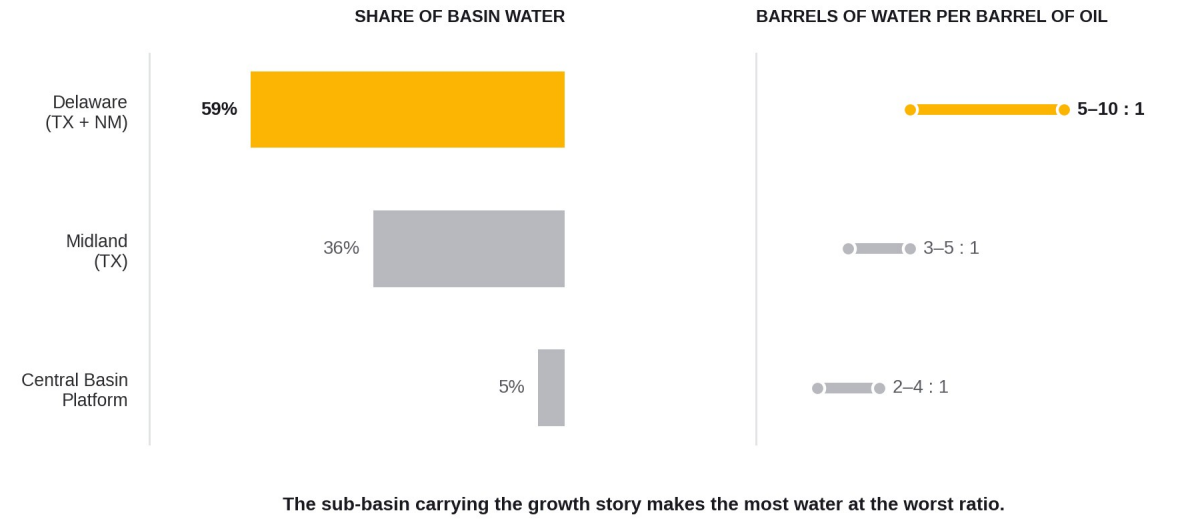

FIGURE 2 The Delaware Basin produces the majority of the basin's water at the worst ratio in the basin. This is the acreage that carries the growth narrative, and it is structurally the wettest.

The consistency check reinforces the point rather than undermining it. Multiply each sub-basin's water volume by the inverse of its stated ratio range and the implied oil totals reconcile with reported production of roughly 6.6 million barrels a day only if every sub-basin is currently operating near the low end of its stated range — Delaware near 5 to 1, Midland near 3 to 1, Central Basin Platform near 2 to 1, summing to about 6.1 million barrels of oil. At the high end of the same published ranges the implied total is 3.3 million. The high ends are not outliers to be dismissed. They are the direction of travel, and there is very little slack between here and there.[20]

[19] PermianProducedWater.com, Permian produced water market data (industry pricing reference).
[20] PermianProducedWater.com, Permian produced water market data (industry pricing reference); U.S. Energy Information Administration, “Record crude oil production in 2026”.

3 THE CENTRAL MISDIAGNOSIS: IT WAS NEVER A VOLUME PROBLEM

3.1 Permitted capacity is not operational capacity

Here is where most sell-side analysis and most trade coverage go wrong, in a way that happens to be comforting to operators. The standard reassurance is that permitted disposal capacity comfortably exceeds current injection volumes, therefore there is headroom. The premise is true and the conclusion does not follow.

B3 Insight's basin analysis puts operational capacity at around 31 million barrels a day, roughly 40 percent below permitted capacity, and explains why the two differ. Operational capacity is derived from the relationship between daily injection pressure and the authorised maximum injection pressure. A well permitted for 30,000 barrels a day but injecting 10,000 at its maximum authorised pressure has an operational capacity of 10,000, not 30,000. Where injection pressure is positive and the injection rate is zero, operational capacity for that well is null.[21]

A permit is an allowance to inject a volume. It is not a guarantee that rock will accept that volume at a pressure the pump and the permit will tolerate.

3.2 Pressure is the binding variable

The single most important operational datapoint in this debate is a pressure measurement, not a volume. B3 Insight's operator-level work reports that one major operator now requires nearly twice the wellhead pressure to move the same volume it was disposing two years ago.[22]

Twice the pressure for the same volume, in two years, is a physical statement about a reservoir approaching its limit. B3 now tracks injection efficiency in barrels disposed per psi of applied wellhead injection pressure precisely because the volume metric stopped being informative, and reports two operators already in outright volume decline.[23]

The Bureau of Economic Geology states the physics without hedging: formation pressure is filling up, and there is no quick way to empty it. Chairman Wright's own conclusion is that shallow injection alone is not a viable long-term solution.[24]

[21] B3 Insight, “Is the Permian Glass Half-Full?”.
[22] B3 Insight, “Operator-Level Disposal Data”.
[23] B3 Insight, “Operator-Level Disposal Data”.
[24] Produced Water Society, “The Permian's Next Boom Has a Water Problem”.

3.3 Optimised for the wrong variable

The most damning detail is that this was self-inflicted. Katie Smye of the Bureau of Economic Geology puts it plainly: injection historically has not been optimised to target the best geology, and injection operations have prioritised location over reservoir quality.[25]

Two decades of disposal siting driven by pipeline convenience rather than reservoir capability. An industry that built a global reputation on subsurface characterisation applied close to none of it to the fluid it produces most of. Reeves County absorbed 16.9 million barrels in 2010 and 1.2 billion barrels in 2024, roughly a seventyfold increase in fourteen years and more than 8.57 billion barrels cumulative from 2010 through 2025. The average permitted volume for a new disposal well rose from under 10,000 barrels a day in the early 2000s to over 20,000 by 2023. Bigger wells, into less-characterised rock, at accelerating rates.[26]

The subsurface has been filing its own reports. Earthquakes of magnitude 1.0 or greater near Pecos went from 19 in 2009 to more than 1,600 in 2017. Basin-wide, USGS data show more than 4,000 Permian events at magnitude 3.0 or above, ten events above magnitude 5.0, and more than 8,000 Delaware Basin events above magnitude 2.0 since 2017.[27]

The coupling is tighter than intuition suggests. Pore pressure changes of only tens of psi can trigger faults tens of kilometres away. An operator can be fully compliant at its own wellhead and still be loading a fault twenty miles off its acreage. That property is what makes this unmanageable permit by permit, and it is what the regulator has finally begun writing rules around.[28]

4 THE CAPACITY IS ALREADY GONE

4.1 The enforcement record

The strongest evidence that the constraint binds is not in any model. It is in the Railroad Commission's own seismicity response record.

Date	Trigger	Action
Sept–Oct 2021	Earthquake sequences in Culberson, Reeves and Midland counties	Gardendale and Northern Culberson-Reeves Seismic Response Areas established

[25] E&E News, “Fracking waste threatens Permian Basin water supplies, imperils oil industry plans”, Shelby Webb, 11 December 2025.
[26] E&E News, “Fracking waste threatens Permian Basin water supplies”.
[27] E&E News, “Fracking waste threatens Permian Basin water supplies”; Produced Water Society, “The Permian's Next Boom Has a Water Problem”.
[28] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”.

Date	Trigger	Action
17 Dec 2021	Four earthquakes in northwest Midland County, 15–16 December	All deep disposal well permits suspended in Gardendale — 33 wells, effective 31 December 2021
Dec 2022	M5.4 in Northern Culberson-Reeves on 16 November; M5.4 in southwestern Martin County on 16 December	Response area expanded from 2,366 to 2,601 square miles; deep disposal target cut to 162,000 bbl/d by 30 June 2023, a 68% reduction against January 2022
19 Dec 2023	Seven earthquakes 8 November – 17 December 2023, including M5.2	All deep disposal well permits suspended in Northern Culberson-Reeves — 23 wells, effective 12 January 2024

Source: Railroad Commission of Texas.[29]

FIGURE 3 Four years of regulatory response. The gold markers are enforcement actions that removed disposal capacity. Three response areas were active as of the Commission's latest record: Gardendale, Stanton, and Northern Culberson-Reeves.

Note that the November 2022 and December 2022 magnitude 5.4 events are distinct earthquakes in different response areas within a month of each other. Note also that the December 2023 suspension of 23 wells followed the 2022 expansion and the 68 percent volume cut. Each remedy was followed by further seismicity requiring a further remedy.[30]

Read the sequence again. The demonstrated, effective, institutionalised regulatory response to subsurface pressure is to stop accepting water — and it works. Earthquake rates in Northern Culberson-Reeves are down about two-thirds since 2023.[31]

[29] Railroad Commission of Texas, Seismicity Response record.
[30] Railroad Commission of Texas, Seismicity Response record.
[31] Bureau of Economic Geology, University of Texas at Austin, "Managing Produced Water in the Texas Permian".

That success is precisely the problem for production forecasts. Seismicity management and volume growth are in direct opposition, and the regulator has already demonstrated which one it chooses.

4.2 June 2025: the permit math changed

The Commission's disposal permitting framework went essentially unchanged from 1982 until 2025. Effective 1 June 2025, new guidelines took effect across Districts 7C, 8 and 8A, applying to new and amended permits, shallow and deep. The Commission's stated purpose is to ensure injected fluids remain confined to the disposal formations in order to safeguard ground and surface fresh water.[32]

Provision	Before	After 1 June 2025
Area of review	0.25 mile radius	Dual buffer: 0.5 mile and 2.0 mile
Wellbore evaluation	Limited	Every penetration, plugged or unplugged, assessed as a potential conduit
Orphan or undocumented wells	Largely tolerated	Any one in the 0.5–2.0 mile buffer automatically cuts maximum surface injection pressure by 0.05 psi/ft
Volume limits	Permit-specific	Tiered to reservoir pressure gradient; zones at or above 0.7 psi/ft may be capped at 10,000 bbl/d
Rate limits	Daily volume only	New maximum instantaneous injection rate constraint

Source: B3 Insight.[33]

4.3 A century of drilling became a permitting liability

There is a second-order trap here that few models capture. Because any orphan or undocumented wellbore in the half-mile-to-two-mile buffer mechanically reduces allowable injection pressure, the Permian's century of legacy drilling is now a live encumbrance on its disposal capacity. A basin with more than a hundred years of penetrations, poor old records, and a growing orphan population has just made those wells a permitting liability.[34]

Meanwhile 264 approved but non-operational disposal wells sit across seven operators, representing more than $1.3 billion of capital at roughly $5 million per well. Steel on a permit is not capacity either.[35]

[32] Railroad Commission of Texas, “RRC Issues Enhanced Guidelines for Permian Basin Disposal Wells”, news release, 16 May 2025; B3 Insight, “New RRC Guidelines Reshape SWD Permitting”.
[33] B3 Insight, “New RRC Guidelines Reshape SWD Permitting”.
[34] B3 Insight, “New RRC Guidelines Reshape SWD Permitting”.
[35] B3 Insight, “Operator-Level Disposal Data”.

Permits are not capacity. Steel in the ground is not capacity. Rock that will still accept fluid at legal pressure is capacity, and that is the quantity in decline.

5 THE CONSTRAINT, STATED AS AN IDENTITY

5.1 The arithmetic

Strip away the narrative and the constraint is a division problem. Oil production cannot exceed water-handling capacity divided by the water-oil ratio. Maximum oil equals capacity over ratio.

At 2025 basin values — 21.5 million barrels a day of water and a ratio of 3.26 — the identity returns 6.6 million barrels a day of oil. That is exactly what the basin produced. The Permian is, definitionally, running at its water ceiling right now. The only question is what happens to the two inputs.[36]

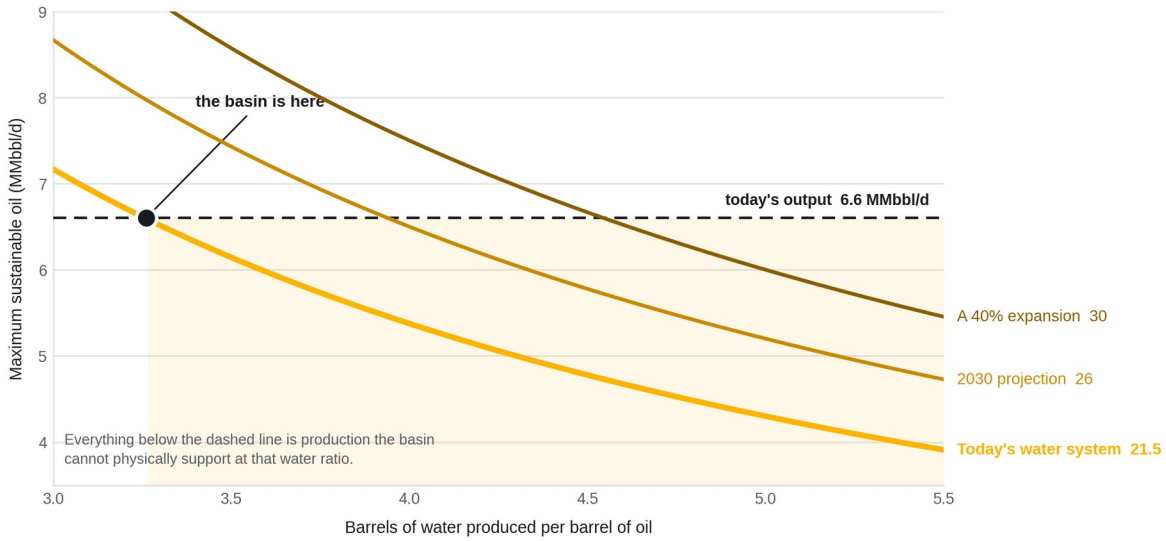

FIGURE 1 The water ceiling. Each curve is a water-handling capacity; the dashed line is today's output. The basin sits exactly on the intersection. Expanding the largest industrial fluid-handling network on earth by 40 percent still does not sustain current production if the ratio reaches 5 to 1.

The grid is unforgiving. Hold capacity at today's level and let the ratio drift to 3.75, a modest continuation of an established trend, and the implied ceiling falls to 5.73 million barrels a day — roughly 870,000 barrels below current output. Expand capacity all the way to 26 million barrels a day, matching the 2030 projection, and a ratio of 4.25 still puts the ceiling at 6.12 million, below today. Even a 30 million barrel per day water system cannot sustain 6.6 million barrels of oil at 5 to 1; it returns 6.0 million.[37]

[36] Bureau of Economic Geology, University of Texas at Austin, "Managing Produced Water in the Texas Permian"; U.S. Energy Information Administration, "Record crude oil production in 2026".
[37] Produced Water Society, "The Permian's Next Boom Has a Water Problem".

5.2 The Delaware case

Apply the same identity to the Delaware Basin alone, where the published ratio range is 5 to 10 to 1 and current water is roughly 13.5 million barrels a day. Absent an expansion of Delaware water capacity, that range implies a Delaware oil ceiling between 2.70 million barrels a day at 5 to 1 and 1.35 million at 10 to 1. The sub-basin carrying the growth narrative has the least room in the identity.[38]

5.3 The drilling treadmill

Shale is a treadmill requiring relentless new completions merely to hold production flat. That is not in dispute; it is the standard argument for permitting and access. Note what it concedes. Every new completion arrives with its own water, and its water cut rises from the day it is turned on. The drilling required to defeat decline is the same drilling that tightens the water constraint. That is the trap, and it has no rig-count solution.

Three caveats, stated plainly rather than buried. The identity is an identity, not a forecast — it describes what is arithmetically available, not what will occur. Capacity is not one number but a set of geographically fragmented local markets, which makes the aggregate view optimistic, since water stranded in Culberson County is not relieved by headroom in Loving County. And the ratio is a basin average concealing wide dispersion. All three caveats push in the same direction: the constraint binds sooner and harder than the aggregate math implies.

6 THE TWO ESCAPE HATCHES, PRICED

6.1 Reuse

Recycling produced water for completions is the genuine success story. Roughly 60 percent of basin frac water demand is already met by recycled produced water, and a 20 percent reduction in disposal implies a reuse market of about 4 million barrels a day worth on the order of $4 billion annually.[39]

The ceiling is structural. Completions demand is bounded by drilling activity, and drilling activity is flat to declining. Recycling absorbs a fixed slice of a growing stream; it cannot absorb the growth. Worse, it is countercyclical to the problem it solves: in a downturn, completions demand collapses precisely while produced water from the existing well stock keeps arriving.

[38] PermianProducedWater.com, Permian produced water market data (industry pricing reference).
[39] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”; Produced Water Society, “The Brine Is the Business”.

6.2 Treatment and discharge

Here the economics become difficult, and the sector's own numbers do the indicting. Saltwater disposal runs roughly $0.60 to $1.25 per barrel all-in including transport. Cleaning water to a standard fit for use outside the oilfield runs $4 to $7 per barrel.[40]

Multiply by the basin's 3.26 ratio and the cost lands on the crude barrel where it belongs. Injection costs $1.95 to $4.07 per barrel of oil. Treatment for beneficial reuse costs $13.03 to $22.80 per barrel of oil. At plausible prices that is a fifth to a third of gross revenue spent on waste disposal.

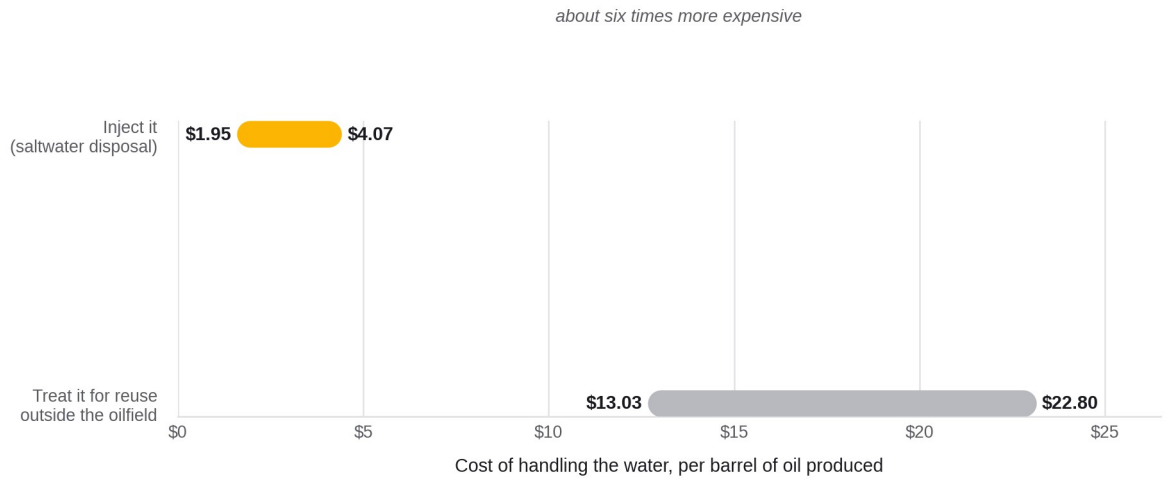

FIGURE 4 The same water, priced onto the crude barrel it came with. The industry is not injecting out of recklessness. It is injecting because injection is the only disposition path that clears at the margin.

No version of the shale business model survives the upper range, which is exactly why nobody adopts it voluntarily. The industry will keep injecting until physics or the regulator stops it. Both are now doing so.

The chemistry compounds the cost. The practical range for Permian unconventional produced water is 55,000 to 250,000 mg/L total dissolved solids — as much as ten times saltier than the ocean — carrying benzene, arsenic, cadmium, radium and PFAS. At a 50 percent recovery assumption, treating 20 percent of a 26 million barrel per day stream yields 2.6 million barrels a day of clean water and leaves the remainder as concentrated brine. The flagship solution does not eliminate the disposal problem. It halves it and concentrates the remainder into something harder to place.[41]

6.3 The power wall

The energy arithmetic has not been priced at all, and it may be the most important number here. The Texas Pacific Water Resources facility near Orla treats 10,000

[40] PermianProducedWater.com, Permian produced water market data (industry pricing reference); Texas Observer, “A Water Shortage and a Water Glut”.
[41] Produced Water Society, “The Brine Is the Business”; Heated, “Oil executives just accidentally exposed”.

barrels a day — 420,000 gallons — and requires 5.5 megawatts, enough for several thousand homes.[42]

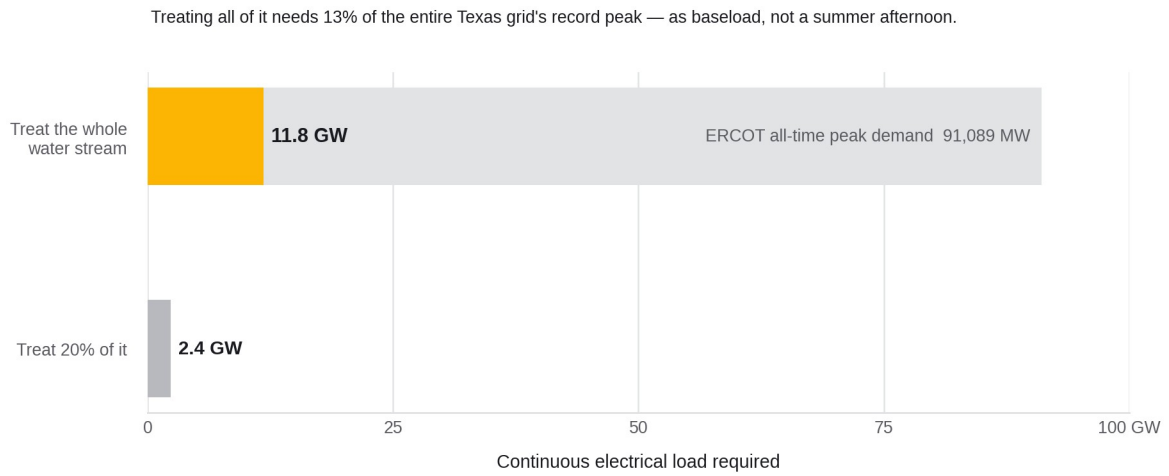

FIGURE 5 Scaling the measured energy intensity of a working Permian treatment facility across the basin's stream. ERCOT's all-time peak demand of 91,089 MW was set on 22 July 2026 and is unofficial pending final settlement.

Treating 20 percent of Permian produced water — a plausible reuse-and-discharge scenario — requires roughly 2.4 gigawatts of continuous load. Treating the full stream requires approximately 11.8 gigawatts, about 13 percent of ERCOT's all-time peak demand of 91,089 megawatts. That is continuous load, not a summer peak: an 11.8 gigawatt baseload addition in a grid already fighting data centre interconnection queues, in the most transmission-constrained corner of the state, to process a waste stream.[43]

Two clarifications, because this number will be attacked. The scaling is linear at constant energy intensity, which is generous to the industry: the Orla facility is comparatively efficient and a scaled buildout would face worse feedwater at many sites. And the 11.8 gigawatt figure still leaves roughly half the feed volume as concentrated brine requiring disposal. The honest reading is not that full-stream treatment is expensive. It is that full-stream treatment is architecturally unavailable this decade.

7 THE BILL IS ALREADY ARRIVING

This constraint is not abstract. It is arriving at specific addresses, with sample results and cleanup invoices.

[42] Insurance Journal, “Running Out of Space to Dispose Wastewater”.
[43] Insurance Journal, “Running Out of Space to Dispose Wastewater”; Electric Reliability Council of Texas, Yearly Peak Demand Records.

7.1 Grandfalls, Ward County

An old well in the First Baptist Church parking lot in Grandfalls began gushing oilfield wastewater and released roughly 1.5 million gallons over eight days, from 21 to 29 April 2026. Plugging the leak cost $1.49 million and disposing of the wastewater cost a further $1.16 million, a total of $2.65 million. The pastor's summary is as good as any engineering description in this paper: “We've turned a lot of the shale play into just one big crack. Everything's communicating.”[44]

7.2 Antina Ranch

At Antina Ranch, abandoned wells began spewing wastewater back to the surface under their own pressure, a water well tested positive for benzene and other contaminants, the herd was moved and the ranch was eventually sold. Wells plugged with cement still hold enough pressure to move a needle on a gauge.[45]

Well control specialist Hawk Dunlap found a gauge on a supposedly plugged well reading 800 psi, and reported having seen readings as high as 1,300 psi. His diagnosis is short: if there is positive or negative pressure on a well, it is not plugged, and you have a problem.[46]

7.3 What these events actually are

These are not spills. A spill is a containment failure at the surface. These are pressure-driven discharges from a reservoir system that has run out of room — fluid finding its own path to surface through century-old wellbores nobody mapped. That is what a full reservoir looks like once it stops being a modelling exercise, and it is the same physical mechanism that the June 2025 permitting rules now price into every new application through the two-mile area of review.[47]

8 THE POLICY RESPONSE: LIABILITY RELIEF INSTEAD OF CAPACITY

8.1 House Bill 49

Confronted with a physical constraint, Texas has largely legislated around the consequences rather than the cause. House Bill 49, effective 1 September 2025, is captioned as an act relating to the treatment and beneficial use of fluid oil and gas waste, including a limitation on liability for that treatment or use.[48]

[44] The Texas Tribune, “An old well began gushing oilfield wastewater in a West Texas church parking lot, sparking a costly cleanup”, Martha Pskowski, Inside Climate News, 18 June 2026.
[45] Texas Observer, “A Water Shortage and a Water Glut”.
[46] E&E News, “Fracking waste threatens Permian Basin water supplies”.
[47] B3 Insight, “New RRC Guidelines Reshape SWD Permitting”.
[48] Texas Legislature, *House Bill 49 bill analysis*.

It shields parties who take possession of fluid oil and gas waste for treatment and put it to beneficial use, producers who supply it, landowners whose property contains oil and gas operations, and third parties who convey it to a treatment facility. Protection extends to the consequences of subsequent use by any person.[49]

The protection is broad but not absolute, and the exceptions deserve fair statement. It does not apply where exposure resulted from gross negligence or an intentional wrongful act or omission, nor where negligence was combined with a failure to conform to certain regulatory provisions. It bars exemplary damages in suits premised solely on negligence and regulatory nonconformity. And it expressly does not affect a producer's or subsequent transferee's liability to the owner of the surface estate.[50]

Read the signal rather than the statute. The fastest-moving policy instrument aimed at the produced water problem does not create disposal capacity, does not fund treatment, and does not tighten monitoring. It reallocates risk away from the parties handling a fluid in which researchers have catalogued more than 1,100 chemicals, against a federal drinking-water framework that sets limits for roughly 90 contaminants and was written for treated municipal supplies rather than oilfield brine.[51]

8.2 The relief valve has not opened

Meanwhile the permitting that would actually relieve the constraint is stalled. No final river-discharge permit has been issued. Five applications covering more than 18 million gallons a day remain pending: NGL Water Solutions Permian, two from Solaris Water Midstream, Texas Pacific Water Resources, and Select Water Solutions. Texas Pacific's Salt Creek application, filed in 2024, was still awaiting a decision more than two years later.[52]

The sector has organised its 2030 water plans around a regulatory door that has not yet opened, and it spent its legislative capital on immunity rather than capacity. One industry objection quoted in the trade press — that “we can't have a $100,000-a-month sample fee” — is a reasonable operational complaint and a difficult public posture for an industry asking permission to put treated oilfield brine into a river that ranchers downstream depend on. A state commissioner has said a couple of the applications are close. None has been issued.[53]

[49] Texas Legislature, *House Bill 49 bill analysis*.
[50] Texas Legislature, *House Bill 49 bill analysis*.
[51] Texas Observer, “A Water Shortage and a Water Glut”.
[52] Heated, “Oil executives just accidentally exposed”; Insurance Journal, “Running Out of Space to Dispose Wastewater”.
[53] Insurance Journal, “Running Out of Space to Dispose Wastewater”.

9 WHO IS ACTUALLY POSITIONED

Follow the capital, not the commentary. It reached this conclusion before the analysts did. Western Midstream agreed to acquire Aris Water Solutions in August 2025, and the combined platform handles roughly 1.78 million barrels a day, overtaking WaterBridge and Deep Blue to become the second-largest water midstream operator in the basin.[54]

The unit economics explain the interest. Loving County alone is a 3.1 million barrel per day disposal market generating more than $2.3 million a day in gross revenue at $0.75 per barrel.[55]

The strategic logic follows directly from the pressure diagnosis. If permitted capacity overstates operational capacity by 40 percent, and what matters is rock that will still accept fluid at legal pressure, then disposal capacity in good geology, outside seismic response areas, with a clean wellbore inventory inside its area of review, is a scarce, appreciating, non-replicable asset. The June 2025 rules do more than restrict new entrants. They retroactively revalue every existing permit according to the quality of the rock beneath it and the tidiness of the two-mile radius around it. Very few operators can currently say which of their wells pass that test. The ones who can are buying.[56]

One adjacent option deserves mention without overclaiming. The Department of Energy estimates that over 15,500 metric tons of lithium a year could be recovered from the Permian, five times US annual consumption of 3,000 metric tons. That is a real revenue offset against treatment cost. It is not a volume solution: mineral recovery does not dispose of water.[57]

Note also the interstate flows, which show where the stress already is. Several million barrels a day of fluid move across the state line from New Mexico into Texas for disposal. Texas is not merely managing its own water. It is the region's disposal sink, which makes its regulatory tightening a multi-state production constraint.[58]

10 RISKS, COUNTERARGUMENTS, AND LIMITATIONS

An argument this pointed owes the reader its failure conditions. The thesis weakens if any of the following occur.

[54] B3 Insight, “Western Midstream + Aris: Data Shows a New Permian Water Midstream Powerhouse with Room to Grow”, 12 August 2025.
[55] B3 Insight, “Operator-Level Disposal Data”.
[56] B3 Insight, “Is the Permian Glass Half-Full?”; B3 Insight, “New RRC Guidelines Reshape SWD Permitting”.
[57] U.S. Department of Energy, *Produced Water from Oil and Gas Development and Critical Minerals*, fact sheet, June 2024.
[58] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”.

- **Injection efficiency stabilises.** If barrels-per-psi flattens across the operator base rather than continuing to degrade, the pressure story becomes local rather than a basin ceiling. This is measurable now and is the single metric analysts should track.[59]
- **The state begins issuing discharge permits at volume.** Five pending applications becoming a functioning pipeline would open a genuine relief valve. No final permit issued since 2024 is the current evidence.[60]
- **Treatment energy intensity falls sharply.** A step change well below 5.5 megawatts per 10,000 barrels a day would move full-stream treatment from architecturally unavailable to merely expensive.[61]
- **Deep disposal proves durably capable.** If formations below the Wolfcamp absorb large volumes for a decade without inducing seismicity, the ceiling moves materially higher. Two rounds of blanket permit suspensions are evidence against.[62]
- **Water-oil ratios flatten.** If completion design or artificial-lift changes bend the ratio curve, the denominator stops working against the industry.
- **Delaware ratios prove overstated.** If Delaware ratios sit durably at the low end of the published 5-to-10 range rather than trending up, the most acute version of the constraint relaxes.[63]

Four of the six are things the industry can influence, and none has yet been delivered. Note also what appears nowhere on that list: drilling inventory, acreage quality, and oil price.

10.1 Limitations of this analysis

Four gaps should be named rather than buried. First, the identity in Section 5 is an accounting relationship, not a forecast; it bounds what is available and says nothing about what operators will choose. Second, the pressure evidence that carries Section 3 rests substantially on one commercial data vendor's proprietary operator-level analysis; it is the best available series of its kind and it has not been independently replicated in the public literature. Third, published basin water volumes vary by up to 30 percent depending on boundary definitions and whether figures are gross or net of recycling, and this paper has used a figure near the bottom of that range. Fourth, capacity is treated here as a basin aggregate when it is in fact a set of fragmented local markets, which understates the constraint rather than overstating it.[64]

[59] B3 Insight, “Operator-Level Disposal Data”.
[60] Heated, “Oil executives just accidentally exposed”.
[61] Insurance Journal, “Running Out of Space to Dispose Wastewater”.
[62] Railroad Commission of Texas, Seismicity Response record.
[63] PermianProducedWater.com, Permian produced water market data (industry pricing reference).
[64] B3 Insight, “Operator-Level Disposal Data”; Produced Water Society, “The Permian's Next Boom Has a Water Problem”.

11 CONCLUSION: THE DENOMINATOR WON

The Permian's constraint was never the numerator. Nobody seriously disputes that there is oil in the rock. The constraint is the denominator — the 3.3 and rising barrels of brine, 5 to 10 in the best acreage, that must be moved, priced and permanently placed for every barrel of crude that reaches a pipeline.[65]

That denominator is growing while the numerator is flat. The formations receiving it are pressuring up, with one major operator now needing twice the wellhead pressure it needed two years ago to dispose of the same volume. The regulator's proven remedy is to stop accepting water, and it has now used that remedy twice at scale — 33 wells, then 23 — alongside a 68 percent volume cut inside its most distressed response area.[66]

The escape hatches cost roughly six times more than injection and would require gigawatts of new baseload power in the most power-constrained corner of Texas. The permitting pathway that 2030 plans depend on has issued nothing. And the bill is already arriving as benzene in ranch water wells, as 1.5 million gallons of brine on church property, and as a $2.65 million cleanup invoice for a single well nobody was watching.[67]

Every Permian production forecast that treats water as an operating cost line rather than a capacity constraint should be discarded. The correct question is no longer how much oil is in the rock, or what price is required to lift it. The correct question is the one the Railroad Commission chairman already answered in front of the legislature: how much more fluid can be stuffed into a can that is full.[68]

The industry spent twenty years optimising the wrong variable — location over reservoir quality, permits over pressure, liability relief over capacity. The physics kept score the entire time, and the ledger is now open at 21.5 million barrels a day.

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[65] Bureau of Economic Geology, University of Texas at Austin, “Managing Produced Water in the Texas Permian”; PermianProducedWater.com, Permian produced water market data (industry pricing reference).
[66] B3 Insight, “Operator-Level Disposal Data”; Railroad Commission of Texas, Seismicity Response record.
[67] Texas Observer, “A Water Shortage and a Water Glut”; The Texas Tribune, “An old well began gushing oilfield wastewater”.
[68] Heated, “Oil executives just accidentally exposed”.

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BIBLIOGRAPHY

All sources were accessed in September 2026. Of the 20 sources cited, 4 are primary documents of state government and 2 of the United States government. Titles shown in square brackets are editorial descriptions rather than the publisher's own title.

STATE OF TEXAS

Bureau of Economic Geology, University of Texas at Austin. “Managing Produced Water in the Texas Permian Basin Will Remain a Long-Term Challenge”, Water Resources Podcast, transcript. https://wrp.beg.utexas.edu/script/managing-produced-water-in-the-texas-permian-will-remain-a-long-term-challenge

Railroad Commission of Texas. “RRC Issues Enhanced Guidelines for Permian Basin Disposal Wells”, news release, 16 May 2025. https://www.rrc.texas.gov/news/05162025-permian-disposal-wells-guidance-release/

Railroad Commission of Texas. “Seismicity Response”, seismic response area record. https://www.rrc.texas.gov/oil-and-gas/applications-and-permits/injection-storage-permits/oil-and-gas-waste-disposal/injection-disposal-permit-procedures/seismicity-review/seismicity-response/

Texas Legislature. *House Bill 49 bill analysis*, 89th Legislature, Regular Session. https://capitol.texas.gov/tlodocs/89R/analysis/html/HB00049E.htm

UNITED STATES GOVERNMENT

U.S. Department of Energy. *Produced Water from Oil and Gas Development and Critical Minerals*, fact sheet, June 2024. https://www.energy.gov/sites/default/files/2024-06/Produced%20Water%20from%20Oil%20and%20Gas%20Development%20and%20Critical%20Minerals%20Fact%20Sheet_6.18.24.pdf

U.S. Energy Information Administration. “United States on track for record crude oil production in 2026”, Today in Energy, 10 September 2026. https://www.eia.gov/todayinenergy/detail.php?id=68125

INDUSTRY, TRADE, AND RESEARCH

B3 Insight. “Is the Permian “Glass” Half-Full of Produced Water?”, 10 July 2023. https://www.b3insight.com/is-the-permian-glass-half-full-of-produced-water/

B3 Insight. “New RRC Guidelines Reshape SWD Permitting in the Permian”, Campbell Gough, 30 May 2025. https://www.b3insight.com/new-rrc-guidelines-reshape-swd-permitting-in-the-permian/

B3 Insight. “Western Midstream + Aris: Data Shows a New Permian Water Midstream Powerhouse with Room to Grow”, 12 August 2025. https://www.b3insight.com/western-midstream-aris-data-shows-a-new-permian-water-midstream-powerhouse/

B3 Insight. “What Operator-Level Disposal Data Reveals About the Permian Water Market”. https://www.b3insight.com/what-operator-level-disposal-data-reveals-about-the-permian-water-market/

E&E News. “Fracking waste threatens Permian Basin water supplies, imperils oil industry plans”, Shelby Webb, 11 December 2025. https://www.eenews.net/articles/fracking-waste-threatens-permian-basin-water-supplies-imperils-oil-industry-plans/

Electric Reliability Council of Texas. “ERCOT Yearly Peak Demand Records”, records unofficial until final settlement. https://www.ercot.com/static-assets/data/news/content/a-peak-demand/all-time-records.htm

Heated. “Oil executives just accidentally exposed the industry's greatest weakness”, Saul Elbein, 4 September 2026. https://heated.world/p/oil-executives-just-accidentally

Insurance Journal. “Texas Oil Industry Running Out of Space to Dispose Wastewater”, 25 August 2026. https://www.insurancejournal.com/news/southcentral/2026/08/25/882802.htm

Produced Water Society. “The Brine Is the Business”, 16 June 2026. https://producedwatersociety.com/the-brine-is-the-business/

Produced Water Society. “The Permian's Next Boom Has a Water Problem”, 26 May 2026. https://producedwatersociety.com/the-permians-next-boom-has-a-water-problem/

Texas Observer. “Texas Has a Water Shortage and a Water Glut. They're the Same Problem”, Mezabahnur Masum, 23 June 2026. https://www.texasobserver.org/permian-basin-oil-wastewater-glut/

The Texas Tribune. “An old well began gushing oilfield wastewater in a West Texas church parking lot, sparking a costly cleanup”, Martha Pskowski, Inside Climate News, 18 June 2026. https://www.texastribune.org/2026/06/18/texas-oil-fracking-wastewater-old-well-church-grandfalls-blowout/

The Texas Tribune. “Texas needs at least $174 billion to avoid water crisis, state says”, Carlos Nogueras Ramos and Colleen DeGuzman, 16 April 2026. https://www.texastribune.org/2026/04/16/texas-water-supply-crisis-corpus-christi-development-board/

COMMERCIAL MARKET-DATA AND PRICING REFERENCES

Commercial market-data publications cited for cost and volume ranges rather than for primary data. They are identified as pricing references at every point of use.

PermianProducedWater.com. “Permian Basin produced water market data”, basin data updated May 2026. https://www.permianproducedwater.com/basics.html