

# Leander Springs: Technical & Operational Water Q&A

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Prepared for: City Council Submittal & Public Review; *By: The Leander Springs Team*

**Technical Alignment & Disclaimer:** This Q&A submittal synthesizes technical, environmental, and operational details for public and municipal review. All hydrogeological data and well impact modeling are derived directly from the official **Technical Memorandum by Senior Hydrogeologist Elizabeth Ferry, P.G. (President, R. W. Harden & Associates, Inc., dated August 7/17, 2026)**. All water treatment, filtration, and recycling specifications are aligned with engineering data from **VVater, LLC**. This summary is provided for convenience and does not replace the official technical and scientific submittals; reviewers should rely directly on the certified reports and documentation prepared by professional hydrogeology and engineering experts.

Certified hydrogeologist **Elizabeth Ferry, P.G.**, and technical/sales leadership from **VVater, LLC**, are available to assist City Staff and address any City Council questions prior to or during the upcoming meeting. The complete, certified reports are attached.

## Section I: Hydrogeology, Aquifer Identification, & Pumping Impacts

### 1. What drawdown impacts are predicted for surrounding residential wells during:

- Initial lagoon filling?
- Normal lagoon operations?
- Drought conditions?

**Answer:**

\* **a. Initial Filling:** To fill the VVater Beach [Lagoon] (total volume ~7.0 million gallons), the production well (State Well #609529) will pump at a rate of 100 gallons per minute (gpm) over a temporary period of approximately 3.5 months (~102 days under average conditions; up to 120 days under extreme drought conditions). Pumping is drawn exclusively from the deep, confined Middle Trinity aquifer horizon (572–737 ft).

- **For Shallow Upper-Zone Wells:** Physical drawdown impacts are negligible to zero due to vertical hydrogeologic isolation by overlying aquitards.
- **For Middle Trinity Wells:** Temporary artesian head drops during the fill phase are localized and managed, leaving the target formation completely saturated under artesian pressure.

\* **b. Normal Operations:** Under normal climatic conditions, the continuous make-up demand required to maintain lagoon levels is approximately **6 gpm**. Non-equilibrium analytical modeling ( $T = 1,500 \text{ gal/day/ft}$ ,  $S = 10^{-4}$ ) demonstrates that after **30 years of continuous pumping** at 6 gpm (Scenario 1):

- **For Shallow Upper-Zone Wells:** Zero physical impact due to stratigraphic isolation.
- **For Middle Trinity Wells:** Artesian pressure declines at surrounding well locations in the vicinity range up to 10 feet near the site and taper off to less than 0.1 foot at a 3-mile radial distance. *(Drawdown modeled within the project wellbore casing itself reaches 10.9 feet).*

\* **c. Drought Conditions:** Under worst-case, continuous 30-year extreme drought conditions (maximum evaporation loss, zero rainfall, requiring a make-up rate of **28 gpm**):

- **For Shallow Upper-Zone Wells:** Hydrogeologically isolated with zero physical

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interaction.

- **For Middle Trinity Wells:** Modeled artesian pressure declines at surrounding well locations range up to 16 feet near the site and decrease to less than 0.1 foot at a 3-mile radius. (Drawdown modeled within the project wellbore casing itself reaches 48.7 feet).

**\* Aquifer Saturation Protection:** Because static artesian water levels in the confined target formation stand **~180 feet above the top of the formation**, the target aquifer remains 100% fully saturated even under worst-case 30-year drought pumping, preserving regional pump submergence and well yields for all neighboring Middle Trinity users.

## 2. What evidence supports the conclusion that pumping from the target deep aquifer will not negatively impact existing Trinity Aquifer users?

**Answer:**

Independent site exploration, geophysical logging, constant-rate pumping test data, and analytical groundwater modeling conducted by R. W. Harden & Associates, Inc. confirm that existing users—whether completed in shallow formations or the deep Middle Trinity Aquifer—will not be adversely affected:

**\* Full Aquifer Saturation Maintained (For Middle Trinity Wells):** Pre-pumping artesian pressure stands approximately 180 feet above the top of the target formation. For neighboring wells completed in the same Middle Trinity interval within 3 miles, 30-year modeling proves maximum artesian pressure declines range up to 10 feet under normal conditions and up to 16 feet under worst-case extreme drought. Because artesian head remains ~164+ feet above the top of the rock formation, the aquifer stays **100% saturated**, preserving regional pump submergence depths and water yields.

**\* Stratigraphic & Hydrogeologic Isolation (For Shallow Wells):** Overlying confining units (aquitards) isolate shallow domestic water wells in upper formations from the deep production interval, resulting in negligible to zero physical interaction.

**\* Conservative Model Assumptions:** The analytical Theis modeling does not factor in inter-aquifer leakage or natural recharge, and **assumes non-stop continuous pumping over 30 years.** Real-world pressure changes will likely be less than modeled estimates.

## 3. Has a site-specific hydrogeologic study been completed?

**Answer:**

Yes. An initial evaluation was completed by R. W. Harden & Associates, Inc. in November 2020. In June 2022, RWH&A oversaw the drilling, sampling, and geophysical logging of a site

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production well (State Well #609529). Following well completion, RWH&A conducted a constant-rate pumping test and 12-hour recovery test to establish site-specific aquifer parameters. On August 7, 2026, Senior Hydrogeologist Elizabeth Ferry, P.G., issued an updated technical evaluation featuring 30-year analytical flow modeling and a 3-mile surrounding well inventory.

**3a (Question 4 in Technical Memo). What is the predicted drawdown at the project well after:**

- i. 1 year
- ii. 5 years
- iii. 10 years
- iv. 30 years

**Answer:**

Based on site-specific aquifer parameters (Transmissivity = 1,500 gal/day/ft, Storage Coeff =  $10^{-4}$ ) and non-equilibrium analytical modeling within the wellbore casing itself (1-foot radius), predicted artesian pressure declines are:

| Model Duration | Scenario 1: Average Conditions (100 gpm fill / 6 gpm maintain) PDF | Scenario 2: 30-Yr Extreme Drought (100 gpm fill / 28 gpm maintain) PDF |
|----------------|--------------------------------------------------------------------|------------------------------------------------------------------------|
| 1 Year         | 11.7 ft                                                            | 44.8 ft                                                                |
| 5 Years        | 10.5 ft                                                            | 46.3 ft                                                                |
| 10 Years       | 10.6 ft                                                            | 47.4 ft                                                                |
| 30 Years       | 10.9 ft                                                            | 48.7 ft                                                                |

Note: In Scenario 1, higher drawdown in Year 1 (11.7 ft) reflects the initial 100 gpm VWater Beach [Lagoon] filling phase before dropping to the long-term 6 gpm average rate. Under all scenarios, including 30 years of continuous drought pumping, the primary production zone remains completely full of water under artesian pressure.

**4 (Question 5 in Technical Memo). How many existing wells are expected to fall within the projected cone of depression?**

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## Answer:

R. W. Harden & Associates queried the Texas Water Development Board (TWDB) database and identified approximately **140 reported wells** within a 3-mile radial area of influence.

**Hydrogeologic Context & Boundary Selection:** The 3-mile evaluation radius was specifically designated as the cone of depression boundary due to nearby mapped faulting identified by the Bureau of Economic Geology (BEG) and radial distance to the aquifer's outcrop areas.

**Impact Evaluation:** The presence of a reported well in the TWDB database within 3 miles does not indicate that it will be adversely impacted. The TWDB database includes unverified locations, plugged wells, and shallow wells completed in non-connected upper strata. Modeled artesian pressure changes at a 3-mile radius approach less than 0.1 foot, meaning active, properly constructed wells in the region will experience no noticeable operational change.

## 5 (Question 6 in Technical Memo). Please identify impacts to:

- a. Residential wells
- b. Exempt wells
- c. Other groundwater users

## Answer:

- **a & b. Residential and Exempt Wells:** Shallow domestic wells completed in upper unconfined limestone units are hydrogeologically isolated from the deep production zone, resulting in zero physical impact. For any domestic wells completed in the same deep Middle Trinity formation within 3 miles, modeled artesian pressure changes range from negligible to a maximum of 10 ft (average conditions) or 16 ft (extreme 30-year drought conditions). Because the aquifer remains under artesian head, pump performance and water availability will not be affected.
- **c. Other Groundwater Users:** Modeled hydraulic impacts depend strictly on completion depth, distance, and structural connectivity rather than well classification. Regional deep users will experience minor artesian head changes that leave the target formation fully saturated.

## 6. How does the project's groundwater withdrawal compare to existing groundwater users in the area?

## Answer:

The long-term average operational draw for the project is remarkably low. While initial filling requires a temporary withdrawal of 100 gpm over ~3.5 to 4 months, **ongoing make-up demand to maintain lagoon levels under average weather conditions is approximately 6**

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gpm.

A continuous draw of 6 gpm (~8,640 gallons per day) represents a minor fraction of typical commercial or municipal water footprints. In commercial real estate terms, maintaining a 4-acre recreational feature at 6 gpm requires substantially less water than traditional turfgrass irrigation for a standard commercial development or multi-family complex of equivalent acreage.

## 20. If nearby private wells begin experiencing declines, what mitigation measures are required of the developer?

**Answer:**

Certified hydrogeologic modeling by R. W. Harden & Associates demonstrates that groundwater production from State Well #609529 is **not anticipated to adversely affect water availability** for nearby well owners:

- **For Shallow Wells:** Upper unconfined formations are hydrogeologically isolated from our deep production interval (572–737 ft) by overlying aquitards.
- **For Middle Trinity Wells:** For neighboring wells completed in the same Middle Trinity interval, 30-year modeling proves that maximum artesian pressure declines range from **negligible to 10 feet** under normal conditions (and **up to 16 feet** under worst-case 30-year extreme drought). Because the formation retains **~180 feet of artesian head pressure**, the aquifer remains **100% fully saturated**, preserving regional pump submergence and water yields.

To ensure community confidence and operational transparency, the developer will coordinate a voluntary groundwater monitoring protocol (logging static water levels in State Well #609529) and provide a direct technical liaison for neighboring well owners to evaluate individual well construction details, pump depth settings, and verified hydrogeologic data with our professional hydrogeology team, when and where applicable.

## 22. Confirmation of whether the well targets the Middle or Lower Trinity Aquifer.

**Answer:**

State Well #609529 produces from the **Middle Trinity Aquifer**. During initial pilot drilling into the Lower Trinity, conductivity increased with depth; consequently, the lower interval was plugged back. The completed production well is screened exclusively across the Middle Trinity Group (specifically the Lower Glen Rose, Hensell Sand, and Cow Creek Limestone, with primary production from the Hensell Sand and Cow Creek members).

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## 23. Total well depth and screened or open interval.

### Answer:

As documented in State of Texas Well Report #609529, the well has a total depth of ~740 feet and is screened across the Middle Trinity interval between **572 feet and 737 feet below ground level**. Solid steel casing is cemented from ground surface down to 572 feet, completely sealing off all shallow water strata.

## 32. Was there an impact study on the existing wells?

### Answer:

Yes, Please find the TECHNICAL MEMORANDUM prepared by Senior Hydrogeologist - Liz Ferry, P.G., R. W. Harden & Associates, Inc. provided along with this questionnaire.

## Section II: VWater Technology, Treatment, Quality, & Lagoon Operations

## 12. What raw water quality is expected? Specifically, TDS, sulfate, chloride, iron, manganese, and hydrogen sulfide?

### Answer:

Certified laboratory analysis of raw water samples collected from State Well #609529 indicates the following raw groundwater baseline:

- **Total Dissolved Solids (TDS):** ~833 to 957 mg/L
- **Sulfate (SO<sub>4</sub>):** ~111 to 113 mg/L
- **Chloride (Cl):** ~98.6 to 106 mg/L
- **Iron (Total):** ~1.33 mg/L
- **Manganese (Total):** ~15.9 to 18.1 µg/L
- **Hydrogen Sulfide (H<sub>2</sub>S):** Present (aerated/degassed during pre-treatment).

## 13. What treatment plan is included in the project budget to achieve recreational/lagoon-quality water? Who is the operator of record?

### Answer:

Raw groundwater is pumped from the well into the VWater Beach at 100 gpm (output capacity of the well). Once the VWater Beach is at volume, the closed-loop treatment system treats to, and maintains, recreational water quality. It continuously recirculates

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and treats the water without dosed chemicals, removing all contaminants, and disinfecting the water to regulated standards. Makeup water to offset evaporation and blowdown is drawn from the same groundwater source and passes through the full treatment train to meet the same recreational water quality standards.

The developer will be the operator of record.

## 14. What are the plans for treatment residuals (backwash, brine, filter media)?

**Answer:**

Process backwash from filtration cycles is routed through an internal recycling loop to recover clean water under a Zero Liquid Discharge (ZLD) framework. Concentrated solid residuals or settled precipitates will be collected, dried, and legally disposed of at authorized off-site facilities in full compliance with TCEQ waste regulations. No direct, unpermitted discharge to Brushy Creek or local stormwater streams will occur.

## 15. What independent third-party field data demonstrates monolayer suppression performance on a swimmable recreational surface in Central Texas climate conditions?

**Answer:**

Hydrogeologic assessments provided by R. W. Harden & Associates, Inc. do **not** rely on unverified chemical monolayer suppression claims. **All technical models conservatively assume standard 100% full-surface pan evaporation rates (averaging ~58 inches/year gross up to 72 inches/year during extreme drought).** Any physical or operational boundary-layer evaporation controls implemented by the developer will provide an extra safety buffer above this conservative baseline. VWater does not use monolayer suppression chemicals: the platform is chemical-free.

## 17. Can the petitioner provide a complete annual water budget?

**Answer:**

- **Initial Fill Volume:** ~7.0 Million Gallons (one-time requirement over ~102–120 days at 100 gpm).
- **Gross Evaporation:** ~58 inches/year average gross loss (~19.3 acre-feet across 4 acres); worst-case drought gross loss ~72 inches/year.
- **Rainfall Capture:** Direct precipitation onto the 4-acre basin offsets gross loss by an average of 32–34 inches/year.

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- **Net Evaporative Loss:** ~24 to 26 inches/year net loss across 4 acres (~2.6 to 2.8 million gallons/year).
- **Filter Backflush & Reuse:** Closed-loop Advanced Water Treatment recycles 80% to 95% of process water back into the basin.
- **Scheduled Drain & Refill Cycles:** Zero (0) scheduled drain-and-refill cycles; water is continuously treated and maintained perpetually.
- **Net Make-Up Demand:** Averages **6 gpm** continuously (~3.15 million gallons/year) under normal weather conditions, scaling up to **28 gpm** under worst-case 30-year continuous extreme drought conditions.

## 21. What independent evidence supports the claimed 50–80% reduction in evaporation?

**Answer:** Our baseline hydrologic models by R. W. Harden & Associates, Inc. **do not rely on evaporation reduction claims**; all make-up rates (6 GPM normal / 28 GPM drought) conservatively assume **100% full-surface Texas pan evaporation losses**.

Additionally, we have **fully eliminated the prior developer's chemical monolayer suppressants** to keep the facility 100% chemical-free. Because our water budget is already proven sustainable assuming zero evaporation savings, any physical or boundary-layer operational efficiencies achieved through VWater's engineering serve as an extra safety buffer above our conservative baseline.

## 24. Initial lagoon-fill volume and proposed filling schedule.

**Answer:**

The initial fill volume is approximately 7.0 million gallons. The filling schedule spans approximately **102 days (~3.5 months)** under normal weather conditions, up to **120 days (~4 months)** under extreme drought conditions, pumping continuously at a managed rate of **100 gpm**.

## 25. Maximum pumping rate and annual groundwater demand.

**Answer:**

- **Maximum Initial Fill Rate:** 100 gpm (short-term, ~3.5 to 4 months).
- **Operational Make-Up Demand:**
  - **Average Climatic Conditions:** 6 gpm (~3.15 million gallons/year).
  - **Extreme Drought Conditions:** 28 gpm (~14.7 million gallons/year).

## 26. Evaporation, leakage, filtration, cleaning, and backwashing estimates.

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## Answer:

- **Gross Evaporation:** ~58 inches/year average (~19.3 acre-feet across 4 acres); up to ~72 inches/year maximum drought loss.
- **Leakage:** Negligible (<0.1%), built with an impermeable synthetic membrane liner.
- **Filtration & Backwash:** Continuous closed-loop treatment through VWater's advanced water treatment system.
- **Net Maintenance Requirement:** 6 gpm continuous average.

## 27. Whether the well may also serve irrigation, hotel, or commercial uses.

### Answer:

The primary purpose of State Well #609529 is supplying the VWater Beach. Secondary non-potable uses (such as targeted landscape irrigation within the immediate VWater Beach perimeter) may utilize raw well water.

All potable drinking water, commercial retail, hotel, and residential interior water needs will be served directly by City of Leander municipal water connections.

Should the City ever request or encourage expanded private water treatment for non-potable commercial applications, our partnership with **VWater, LLC** provides the technological capacity to assist, but our baseline master plan relies 100% on standard municipal utility service for all domestic and commercial drinking water needs.

## Section III: Permitting, Regional Water Planning, & Drought Management

### 8. Has Clearwater UWCD issued, or pre-cleared, a production permit for this well at the requested rate? If yes, what is the permitted annual volume in acre-feet?

#### Answer:

No permit is required or issued by Clearwater UWCD because the property is located in Williamson County. Williamson County sits entirely outside the statutory jurisdiction of Clearwater UWCD (which governs Bell County) and is not within any local Groundwater Conservation District (GCD). Groundwater rights are governed under Texas common law.

### 9. What is the well's status against the current Modeled Available Groundwater (MAG) determination for this GMA 8 sub-area?

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## **Answer:**

GMA 8 sets regional Desired Future Conditions (DFCs) and Modeled Available Groundwater (MAG) for regional planning. Because Williamson County lacks a local GCD to enforce pumping caps, individual wells are not subject to district permit allocations. However, the proposed long-term operational average (6 to 28 gpm) represents a minor fraction of the regional flow dynamics evaluated in GMA 8 Groundwater Availability Models (GAMs).

## **10. Assuming a permit is in place, if the production permit is reduced or denied, what is the contingency water source for the lagoon?**

### **Answer:**

Because the site is not located within a GCD, permit reduction or denial by a groundwater district is legally non-applicable and the well is already drilled and tested. As designated in the PUD Amendment, the VWater Beach [Lagoon] is classified as a non-essential water feature. In the event of primary well maintenance, contingency options include utilizing secondary private on-site well infrastructure or contractually trucking in water from commercial providers.

## **11. What CUWCD-required well interference analysis has been performed, against which inventory of neighboring wells, and what were the results?**

### **Answer:**

None, as the site lies outside CUWCD jurisdiction. However, a voluntary, professional well interference and 30-year analytical drawdown modeling analysis was completed by R. W. Harden & Associates, Inc. (evaluating 140 reported wells within a 3-mile radius) to support City Council review and the same report can be supplied to broader community.

## **16. Under the lagoon's "non-essential use" classification, at which city drought stage does lagoon make-up pumping cease, and how is the lagoon maintained (or drained) during that period?**

### **Answer:**

The VWater Beach's primary water supply is completely independent of the City of Leander's municipal potable drinking supply (0% municipal tap water impact). During severe municipal drought stages, the City holds full authority to restrict backup municipal utility connections. The VWater Beach will rely entirely on its private well and internal recirculation system. The VWater Beach will remain filled and continuously treated in closed-loop mode; it will not be drained, as maintaining water mass is required to preserve liner structural integrity.

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## 18. Has the project been reviewed against the city's own water supply plan and the regional water planning group (Region G/K) projections?

**Answer:**

Because the project relies strictly on a private deep groundwater well, it places **zero demand** on the City of Leander's surface water rights (LCRA/Lake Travis) or municipal treatment plant capacity, preserving 100% of municipal water allocations for Leander residents and commercial drinking needs. Should the City ever request or encourage expanded private water treatment for non-potable commercial applications, our partnership with VWater LLC provides the technological capacity to assist and potentially use our well water for some of these needs.

## 19. What is the maximum annual groundwater withdrawal permitted for the lagoon?

**Answer:**

While there is no state-mandated volumetric cap in this un-districted groundwater zone, the project self-caps its operational envelope based on hydrogeologic modeling:

- **Initial Fill Phase:** Capped at an operational withdrawal rate of 100 gpm over a 3.5 to 4 month window (~102 to 120 days).
- **Long-Term Operational Phase:** Capped at an operational make-up average of **6 gpm** (normal conditions) up to **28 gpm** (worst-case continuous drought).

## 28. Any city water-conservation review of the proposal.

**Answer:**

The project's water strategy directly advances the City of Leander's long-term water conservation goals. By supplying 100% of the VWater Beach's [Lagoon] initial fill and ongoing operational needs from an independent, deep groundwater well, the project preserves millions of gallons of treated municipal drinking water annually for Leander families and local businesses.

Moving forward, we are fully committed to collaborating with City staff and utility engineers to explore additional conservation mechanics. This includes evaluating advanced greywater recycling, rainwater harvesting, and on-site water reuse systems powered by VWater's advanced treatment technology to handle landscape irrigation and auxiliary non-potable demands, further minimizing the project's overall water footprint.

## 29. Any drought restrictions that would apply to filling or maintaining the lagoon.

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## Answer:

Initial filling will be scheduled outside of severe municipal drought declarations. Ongoing operational make-up pumping relies strictly on a private deep aquifer source that is hydrogeologically protected from surface drought impacts. Under the governing PUD agreement, because the VWater Beach [Lagoon] is classified as a non-essential water feature, any temporary request for backup municipal utility water remains 100% subject to all City of Leander emergency drought Stage restrictions and curtailment rules.

## 30. Whether municipal water could serve as a backup source.

### Answer:

Municipal water can serve as an emergency backup source only under standard operating conditions. Under severe municipal drought declarations, the City retains full authority to prohibit municipal water discharge into non-essential water features.

## Section IV: Public Access, Community Benefits, & Operational Transparency

### 7. Will the lagoon be open to the public or limited to residents of the development? If limited, what will access cost?

#### Answer:

The VWater Beach [Lagoon] will be fully open to the general public, subject to the operator's standard safety rules, capacity limits, and operational regulations. Upon the renewal and execution of the Chapter 380 Development Agreement with the City, Leander residents will receive a permanent **40% discount** off standard public gate fees. Specific admission pricing will be finalized by the commercial facility operator prior to grand opening.

### 31. Plans for continuous metering and public reporting.

#### Answer:

A certified totalizing water meter is installed on the wellhead of State Well #609529. Pumping volumes will be continuously recorded, and regular usage logs can be submitted to the City of Leander Public Works/Utilities department to ensure complete operational transparency.