Valuing Groundwater: A Tricky Business

Gabriel Collins, J.D.
Baker Institute for Public Policy, Rice University
23 February 2018

*Note* The views and opinions expressed in this talk are mine alone and do not necessarily reflect the views and opinions of the Baker Institute for Public Policy or Rice University.
Groundwater valuation is Eminently Doable

This is not as bad as it might appear, contingent upon the responses to two key questions:

1. How widely did the estimates vary?
2. What methodologies and assumptions did the analysts use to reach their valuations?

Whether we are valuing a business, and oil & gas property, or a groundwater asset, there is generally going to be a degree of subjectivity, fact-specific analysis, and professional judgment that each analyst applies.
Illiquid Assets Are Successfully Valued In Many Different Sectors

Source: HoopsHabit.com
But Water Prices Are All Over the Map in Texas
Valuation Methods

Use value
- Comparable sales
- Avoided cost
- Market surveys
- Land Value Method

Existence value
- Conservation

Water as the final good.
Water as an intermediate input.

Use value
- Residual value
- Income capitalization

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.

Comparable sales
Avoided cost
Market surveys
Land Value Method

Residual value
Income capitalization

Existence value
Conservation

Water as the final good.
Water as an intermediate input.
Comparative Transactions Method Historically Dominates

Making Sense of “Fair Market Value” a/k/a Comparable Transactions:

1. **Level 1**: “Quoted prices in active markets for identical assets or liabilities.”

2. **Level 2**: “Inputs other than Level 1 that are observable, either directly or indirectly, such as quoted prices for similar assets or liabilities; quoted prices in markets that are not active; or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities,” and

3. **Level 3**: “Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the assets or liabilities.”

---

6.04. **Fair Market Value Alternative.** If Lessee (i) purchases the groundwater or (ii) enters into a contract for the disposition of groundwater from the Premises with an Affiliate or which is otherwise not negotiated on an arms-length basis, Lessor shall be entitled, at Lessor’s election, to receive the fair market value of Lessor’s Royalty Share of groundwater produced and saved from the Premises as reasonably established by Lessor. For purposes of the foregoing, it shall be presumed that Lessor has reasonably established the fair market value of the groundwater if Lessor identifies three or more contracts for the disposition of groundwater from properties having reasonably similar characteristics as the Premises and then averages the price paid under the identified group of contracts.

---


---
Attempting to Rationalize and Standardize Groundwater Valuation: Ten Key Variables

1. Location (relative to end users and competing water sources)
2. Existence of infrastructure
3. Infrastructure cost
4. Quality
5. Extraction & treatment costs
6. Political & regulatory barriers
7. Protection from drainage
8. Intended use of the water
9. Time sensitivity of the end use
10. Resource dependability/drought resistance
Proximity to Market and Pricing: I

Implied Water Value in North Texas Panhandle Using Land Value Method, $/acre

II. Consideration

2.01 Purchase Price. The purchase price ("Purchase Price") to be paid by Purchaser to Seller for the sale and conveyance of the Groundwater Estate shall be as follows:

- $1.16 per average saturated foot of Groundwater per acre of Groundwater Rights being purchased out of the Real Property for acreage determined to have an average saturated thickness of 258 feet or greater;
- $300.00 per acre of Groundwater Rights being purchased out of the Real Property for acreage determined to have an average saturated thickness between 200 and 257 feet; and
- $250.00 per acre of Groundwater Rights being purchased out of the Real Property for acreage determined to have an average saturated thickness of less than 200 feet. (Pursuant to Section 5.04 a. below, Purchaser has the option to reject any acreage determined to have an average saturated thickness of less than 200 feet.)

The Purchase Price shall be payable to Seller in cash (in United States Dollars) at closing of the transaction contemplated hereby ("Closing") by cashier's check or wire transfer.
Infrastructure costs, which are a proxy for distance (primary) and scale (secondary driver) comprise a significant portion of the final delivered water cost.
Handling Water Quality Through Pricing

SCHEDULE 1
ROYALTY RATE

Buyer shall, in addition to the Cash Portion of Purchase Price, pay to Winkler Services a royalty for Groundwater produced, transported, used or sold from the Real Property by Buyer or its permitted assigns or successors, calculated and subject to further adjustment in accordance with the further terms of this Schedule, provided that such royalty shall not be added to any reduction or offset for any costs, expenses or item (including without limitation taxes or other governmental charges) incurred by Buyer, its permitted assigns or successors, or any other person or entity.

Subject to the further terms of this Schedule, for each 1,000 gallons of Groundwater produced from the Real Property by Buyer or its permitted assigns or successors, Buyer shall pay Winkler Services a base royalty of $0.00. In addition to the base royalty, the Buyer will pay an additional royalty based on the quality of the Groundwater produced as described below.

All Groundwater produced from the Real Property having a total dissolved solids (TDS) content less than 700 milligrams per liter (mg/L) will have a graduated additional royalty based on the following:

- 700 mg/L > TDS <= 400 Additional Royalty = $0.005/1,000 gallons produced
- 400 mg/L > TDS <= 200 Additional Royalty = $0.010/1,000 gallons produced
- 200 mg/L > TDS <= 100 Additional Royalty = $0.015/1,000 gallons produced
- 100 mg/L > TDS <= 50 Additional Royalty = $0.020/1,000 gallons produced
- 50 mg/L > TDS <= 0 Additional Royalty = $0.025/1,000 gallons produced

All Groundwater produced from the Real Property having a maximum contaminant level of arsenic (MCL As) less than 0.015 milligrams per liter (mg/L) will have a graduated increase in royalty based on the following:

- 0.015 mg/L > MCL As <= 0.050 Additional Royalty = $0.005/1,000 gallons produced
- 0.050 mg/L > MCL As <= 0.100 Additional Royalty = $0.010/1,000 gallons produced
- 0.100 mg/L > MCL As <= 0.150 Additional Royalty = $0.015/1,000 gallons produced
- 0.150 mg/L > MCL As <= 0.200 Additional Royalty = $0.020/1,000 gallons produced
- 0.200 mg/L > MCL As <= 0.250 Additional Royalty = $0.025/1,000 gallons produced

Prior to January 1, 2018, the Royalty to be paid to Winkler Services shall be based on the actual volumes of Groundwater produced from the Real Property and calculated as set forth above on this Schedule. For the period of time commencing January 1, 2018 and continuing through December 31, 2027 (the “Guaranteed Payment Period”), however, the Royalty to be paid shall be the greater of (1) a Royalty based on the actual volumes and quality of water produced from the Real Property and calculated as set forth above on this Schedule, and (2) $146,000.00 (“Royalty Floor”). If the aggregate Royalty paid for Groundwater produced from the Real Property during any calendar year of the Guaranteed
Risks Related to our Other Operations

Our water interests may require governmental permits, the consent of third parties and/or completion of significant transportation infrastructure prior to commercialization, all of which are dependent on the actions of others. Many jurisdictions require governmental permits to withdraw and transport water for commercial uses, the granting of which may be subject to discretionary determinations by such jurisdictions regarding necessity. In addition, we do not own the executory rights related to our non-participating royalty interest, and as a result, third-party consent from the executor rights owner(s) would be required prior to production. The process to obtain permits can be lengthy, and governmental jurisdictions or third parties from whom we seek permits or consent may not provide the approvals we seek. We may be unable to secure buyers at commercially economic prices for water that we have a right to extract and transport, and transportation infrastructure across property not owned or controlled by us is required for transport of water prior to commercial use. Such infrastructure can require significant capital and may also require the consent of third parties. We may not have cost effective means to transport water from property we own, lease or manage to buyers. As a result, we may lose some or all of our investment in water assets, or our returns may be diminished.
**Valuation Methods Often “Cross Pollinate” In Practice**

**ISSUE BRIEF 12.07.17**

**Valuation of Groundwater In Place at a Texas Frac Water Supplier**

Gabriel Collins, Ph.D., Baker Bates Fellow in Energy & Environmental Regulatory Affairs, Center for Energy Studies

Texas law recognizes the existence of a distinct groundwater estate where water is owned as real private property while still in the ground. Groundwater’s unique private property status in Texas creates incentives for business transactions, but it also potentially gives rise to damage claims by water owners who believe another party’s actions have impaired their ability to access and/or use their groundwater. To either close deals or resolve disputes, parties and courts must be able to attach a credible economic value to water. In many cases, the water at issue may still be underground in the aquifer. Accordingly, the brief explores in this issue the demonstrable direct and indirect economic benefits that can be calculated using hydrological data to estimate the total value placed on water—one potential way to value groundwater in place.

This brief analyzes a unique Permian basin oilfield water supply asset that recently came to market. It leverages primary research and multiple publically available data sets to establish what the groundwater estate purchased was likely worth in place. Layne Christensen Company, a major global water drilling services provider, declared in June 2017 that its invested $80 million in a single infrastructure asset of delivering more than 100,000 barrels per day of fresh water to customers in the Delaware Basin. Layne’s stated capital expenditure (CAPEX) includes land acquisition costs. The project is located on a former cotton farm approximately 1,500 acres in size just west of Pecos, Texas (Figure 1).

![Image of a water supply asset](https://example.com/image)

**TABLE 1 — ESTIMATING THE LIKELY VALUE FOR THE GROUNDWATER ESTATE AT LAYNE’S HERMOSA OILFIELD WATER SUPPLY ASSET**

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Number</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wells ( בארון )</td>
<td>4</td>
<td>$65,000</td>
<td>$260,000</td>
<td></td>
</tr>
<tr>
<td>Storage pond (built and lined capacity)</td>
<td>750,000</td>
<td>$1,25</td>
<td>$937,500</td>
<td></td>
</tr>
<tr>
<td>Pumps (200 HP)</td>
<td>4</td>
<td>$35,000</td>
<td>$140,000</td>
<td></td>
</tr>
<tr>
<td>Booster pumps on pipeline</td>
<td>3</td>
<td>$10,000</td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>22-inch high-density polyethylene pipeline</td>
<td>feet</td>
<td>1,000</td>
<td>$80,000</td>
<td>$400,000</td>
</tr>
<tr>
<td>Pipe fusion</td>
<td>joint</td>
<td>500</td>
<td>$120,000</td>
<td>$360,000</td>
</tr>
<tr>
<td>Transmitter operation (Anthem 11195)</td>
<td>feet</td>
<td>1,000</td>
<td>$3,750</td>
<td>$3,750</td>
</tr>
<tr>
<td>Right-of-way</td>
<td>miles</td>
<td>10</td>
<td>$1,560</td>
<td>$15,600</td>
</tr>
<tr>
<td>River stations for water pipe</td>
<td>feet</td>
<td>1,000</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Labor</td>
<td>days</td>
<td>100</td>
<td>$5,000</td>
<td>$500,000</td>
</tr>
<tr>
<td>Branch lines linking wells to central</td>
<td>feet</td>
<td>2,000</td>
<td>$5,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Halves</td>
<td>square</td>
<td>6,000</td>
<td>$5,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Roads</td>
<td>miles</td>
<td>1</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Water well</td>
<td>acres</td>
<td>600</td>
<td>$100,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Water well</td>
<td>acres</td>
<td>400</td>
<td>$100,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Land for sale</td>
<td>acres</td>
<td>500</td>
<td>$167</td>
<td>$83,500</td>
</tr>
<tr>
<td>Land for sale</td>
<td>acres</td>
<td>150</td>
<td>$600</td>
<td>$9,000</td>
</tr>
<tr>
<td>Total</td>
<td>acres</td>
<td>750</td>
<td>$500,000</td>
<td>$375,000</td>
</tr>
</tbody>
</table>

**Total value (including land):** $15,307,044

**Sources:** Company reports, author’s interviews of relevant providers of goods and services.

Thank you!

Gabriel Collins, J.D.
Baker Institute for Public Policy, Rice University
gabe.collins@rice.edu