

Recap: DOE's Produced Water Optimization Initiative – Project PARETO

Premise: Develop free and trusted decision-support tools to help organizations manage, treat, recycle and/or reuse produced water from onshore oil & gas operations.

"PARETO" framework can help with:

- 1) produced water **management** (2021 focus)
 - infrastructure buildout, fluid flow optimization
 - 2) produced water **treatment** (2022 focus)
 - systems integration of treatment solutions
 - 3) produced water **beneficial reuse** (2023 focus)
 - evaluation of beneficial water reuse options
- Views produced water from "systems" perspective
 - Addresses "macro" vs. "micro" challenges

"Project PARETO" was launched to make trusted decision-support tools available to the produced water community (e.g., upstream operators, regulators) and there is more we can do to help.

Overview

Goal: Wholistic Produced Water Optimization

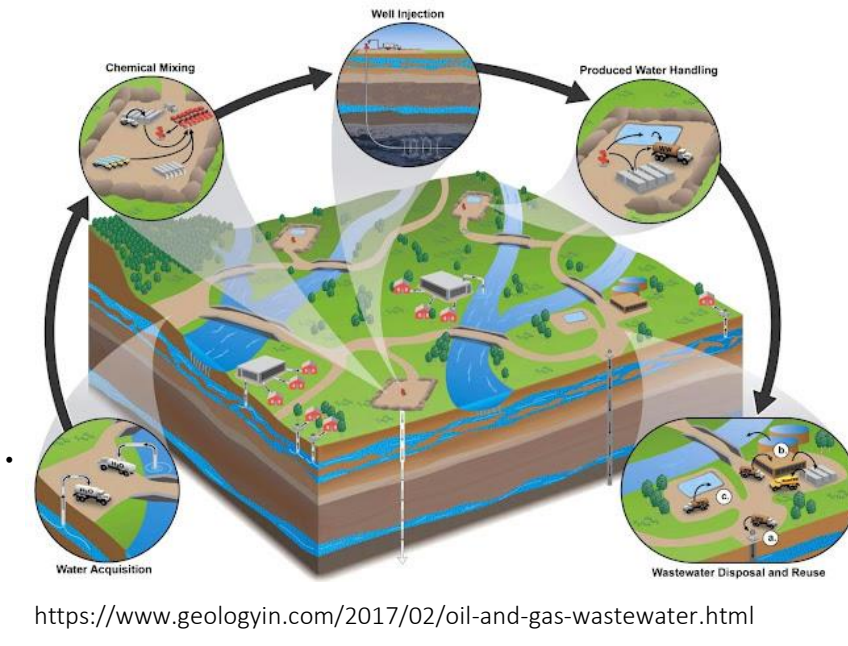
- 1) **Intra-Organizational Optimization of Produced Water Management**
 - Get the most out of existing infrastructure (e.g., pipeline/SWD utilization)
 - Strategic build-out of systems and design for "flexibility" (e.g., interconnects)
 - the "core" PARETO toolset helps address these challenges
- 2) **Inter-Organizational Optimization of Produced Water Movements**
 - "Ad-hoc" water transfers between neighboring/competing organizations do occur
 - Reality: there are many more opportunities for **mutually beneficial water "trades"**
 - opportunity: explore opportunities for **water sharing across operators**



GWPC and DOE jointly exploring opportunities for produced water movements *between* organizations (i.e., upstream/midstream services).

Produced Water Realities

- Most operators already (**strive to**) recycle
 - Recycling lowers need for freshwater
 - Recycling reduces reliance on disposal
- Challenge: **timing, volumes, and logistics**
- Need to be completing and producing wells
 - (1) at the **same time**,
 - (2) in the **same area**,
 - (3) at **similar rates**.
- More wells improve odds
- Issues: Knowledge & Logistics
 - current practice: calls, texts, etc.



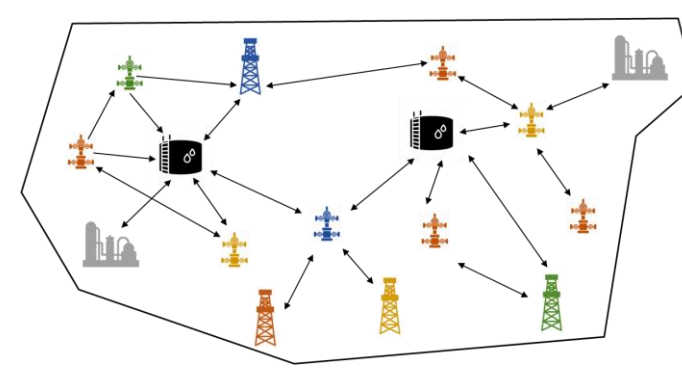
There is an opportunity to build a free & online portal to identify mutually beneficial recycle opportunities.

Opportunity: A Produced Water Trading Portal

Goal: Extend the PARETO with an optimization-based produced water exchange portal to facilitate produced water "trades" within basins.

Ultimately, the extension is expected to identify:

- which parties could benefit from water trades
 - how much water each party delivers or receives
 - where water needs to be delivered to
 - when and how to leverage storage facilities
 - how credits/debits should be distributed fairly [optional]
 - which benefits the community can realize
- Quantify the benefits of water sharing to facilitate adoption
 - Draw on GWPC/DOE successes with states on data projects*



This tool will support the produced water community in maximizing produced water reuse, lowering freshwater consumption, and reducing disposal volumes.

Objectives, Collaboration, & Design

GWPC's Perspective on Water Sharing

- GWPC's mission is to work towards the **protection of the nation's water supplies** and ensure **best water management practices**
- DOE & GWPC have a rich history of **collaborating on technology solution**
- GWPC is experienced in managing **data-intense oil & gas platforms**
 - FracFocus.org
- GWPC is committed to addressing **produced water challenges**

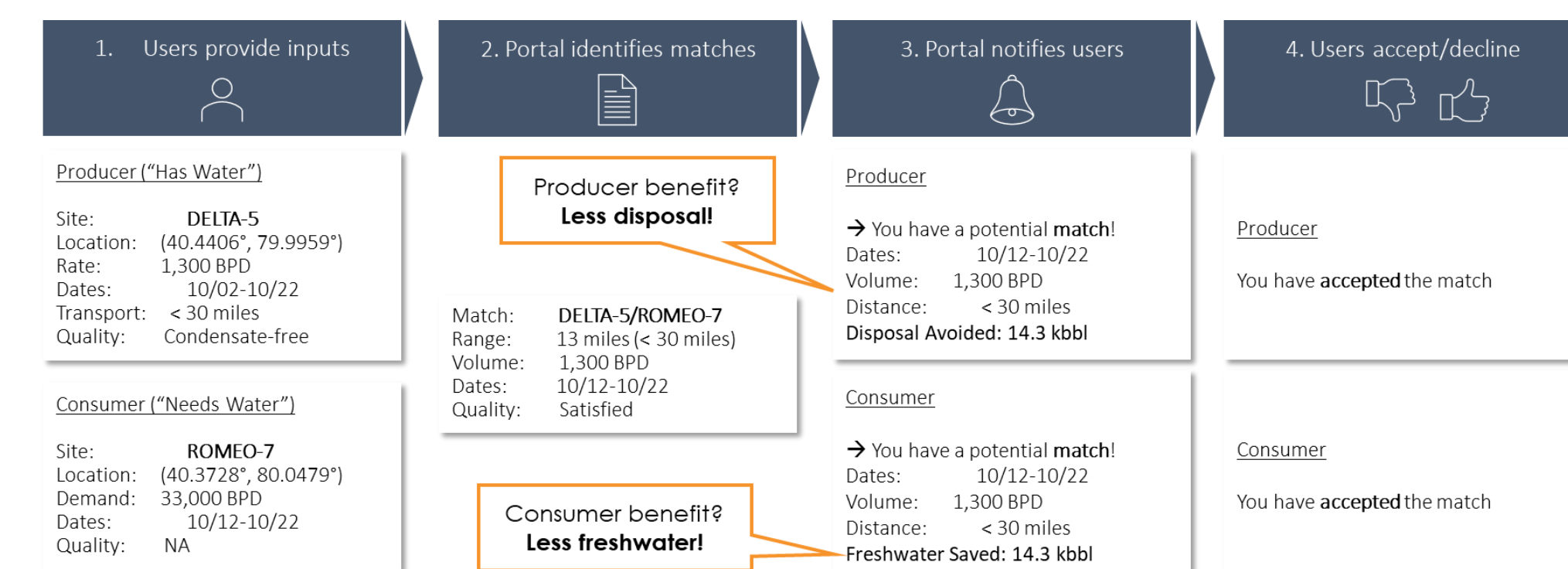


Produced water sharing can be a "win-win" situation for industry, the environment and communities surrounding oil & gas development activity.

Water Sharing Outline

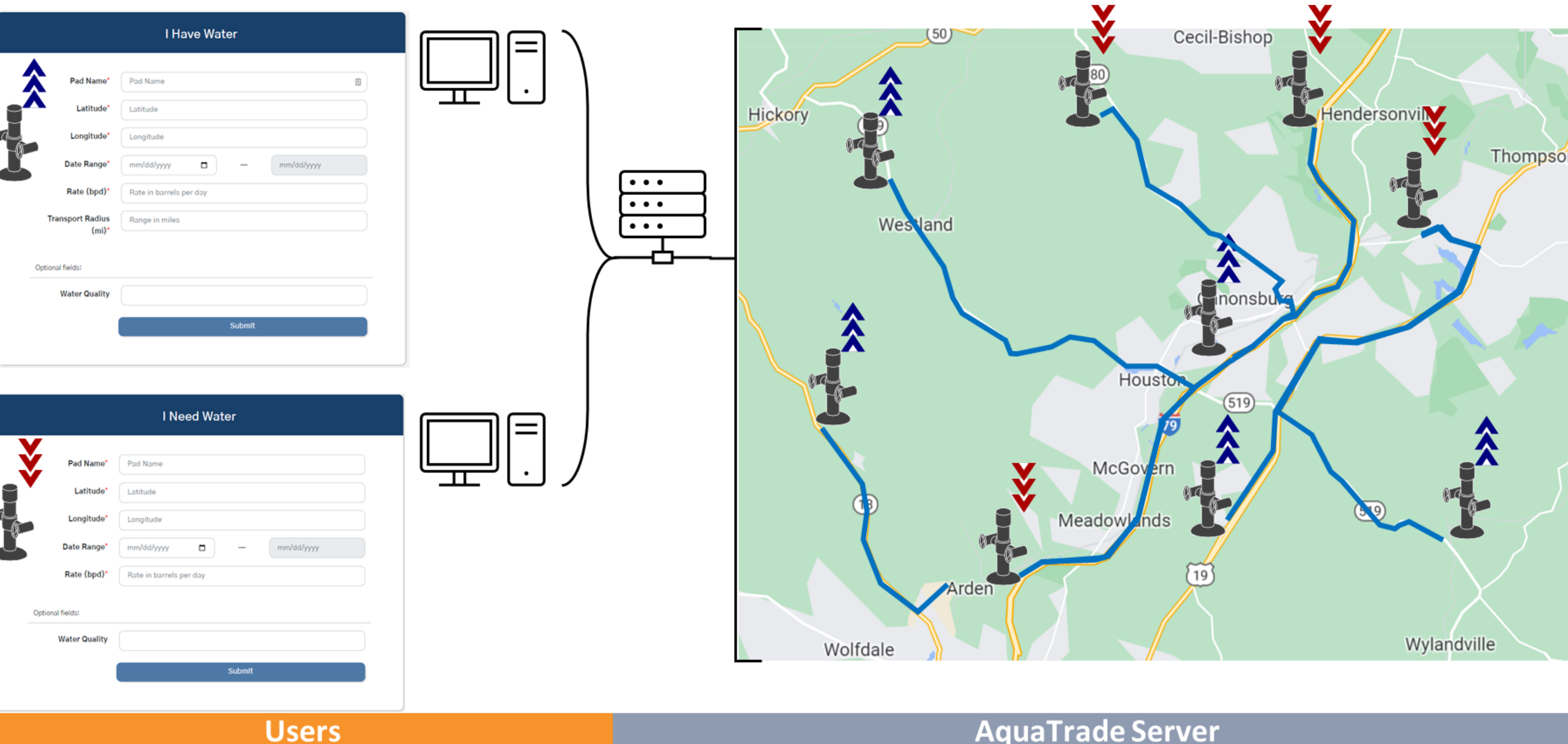
What workflow do we envision for this portal?

- Consider **Appalachia**: exclusive trucking, BUT: water "trades" already common
- Users register for portal hosted by neutral third-party (to protect data)
- Distinguish between "producers" and "consumers"

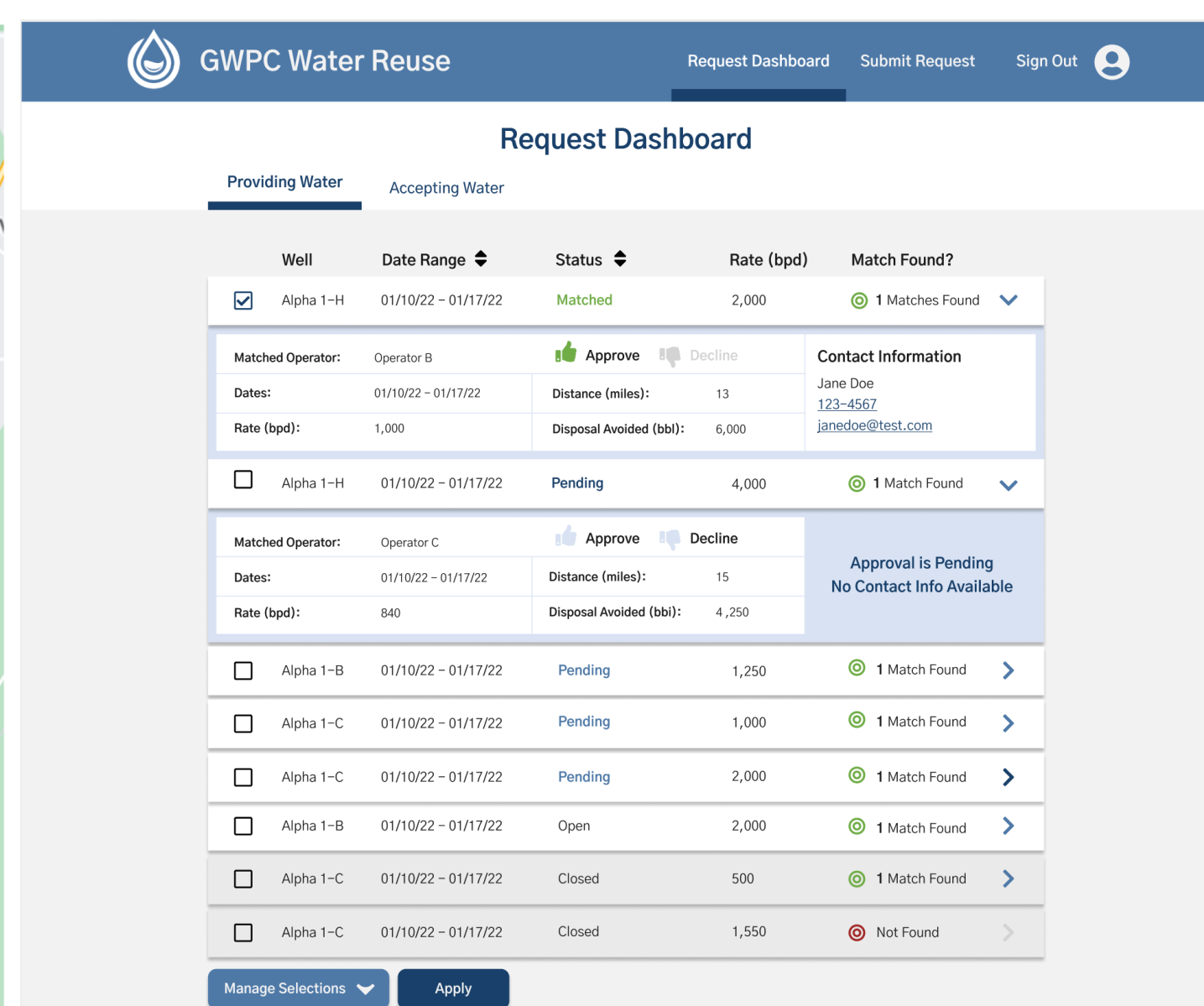


We have a simple workflow that matches users together and requires minimal data (protecting privacy) and creating benefits for producers and consumers

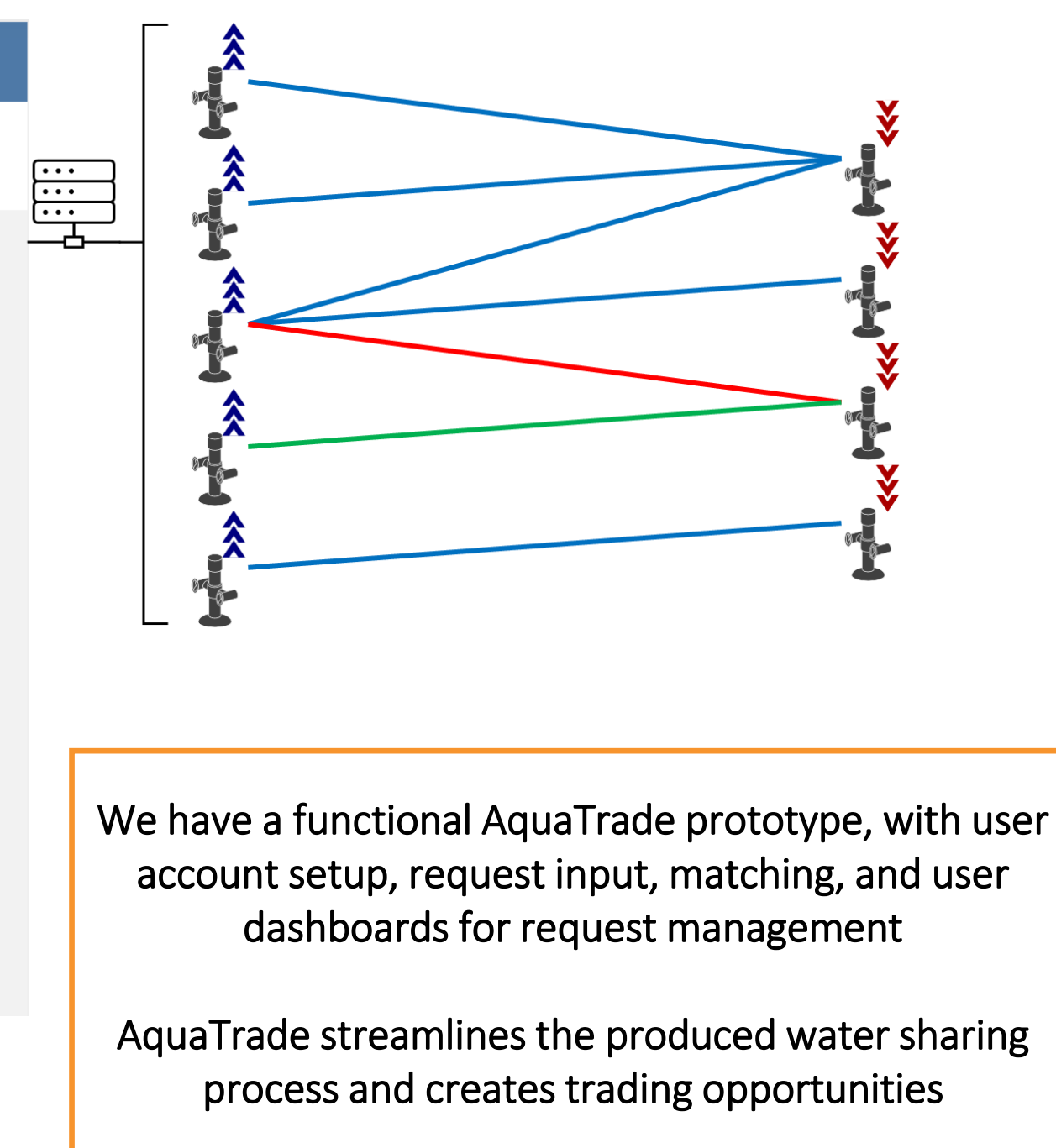
User input & Matchmaking



How does AquaTrade Work?



In-depth Analysis and Insightful Results



20 Day FracFocus Case Study

Production	Demand	
608 kbbbl of produced water in well pads	1,328 kbbbl of demand across 3 completion pads	
59 kbbbl of daily disposal limit amongst 5 sites	130 kbbbl of daily withdrawal limit amongst 5 sources	
Metrics		
	No Sharing	Max Shared
Total cost (k\$)	5,837	4,571 (-22%)
Freshwater consumption (kbbbl)	846	570 (-33%)
Produced water disposal (kbbbl)	419	143 (-66%)
Recycled water (kbbbl)	189	465 (+146%)
Distance driven* (mi)	85,269	81,302 (-4.7%)

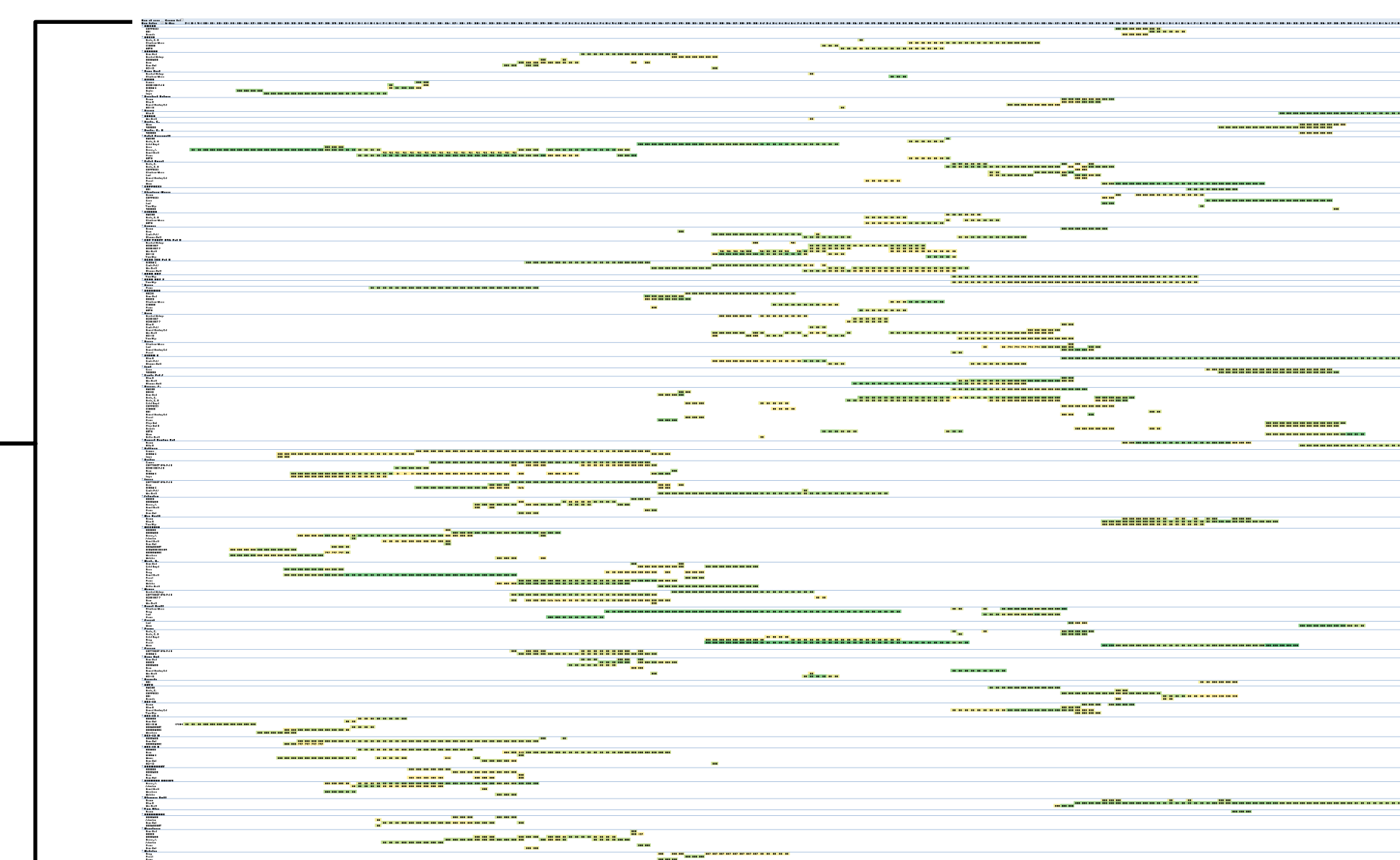
Using PARETO-Ops, we show that water sharing leads to a significant decrease in costs, and a reduction in the community impact

Case Studies

- Feed the full FracFocus data set in AquaTrade
 - 300 days of data, 65 stakeholders, each a producers and consumer at different times
- Each row is a match
 - 302 matches in the solution
 - Some matches non-contiguous
- AquaTrade handles complexity
 - Brings together data from a wide array of operators
 - Resolves a matching problem that creates industry-wide benefit
 - Works at scale!

AquaTrade manages complexity for industry benefit

300 Day AquaTrade Case Study



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