Texas Water Solutions Management Group LLC

Texas Water Solutions Management Group is a networked team of field-tested, experienced industry managers from across the spectrum of nationally recognized oil and gas exploration and production companies, service operators, equipment and technology firms, and capital investors.

The team has a combined base of licensed, certified, and degree-awarded capabilities in the water reuse, reclamation, conservation, and infrastructure sectors nationally and internationally. Our thinking and approach is entrepreneurial, innovative, and economical for clients and consortia.

With a proven efficiency, our team has successfully supported clients in proving out and testing technologies in the U.S.; as well as in Mexico with Pemex. There is an extensive history with our success in the water sector spanning across municipal, industrial and oil & gas.

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Enhanced Evaporation As Alternative to Disposal

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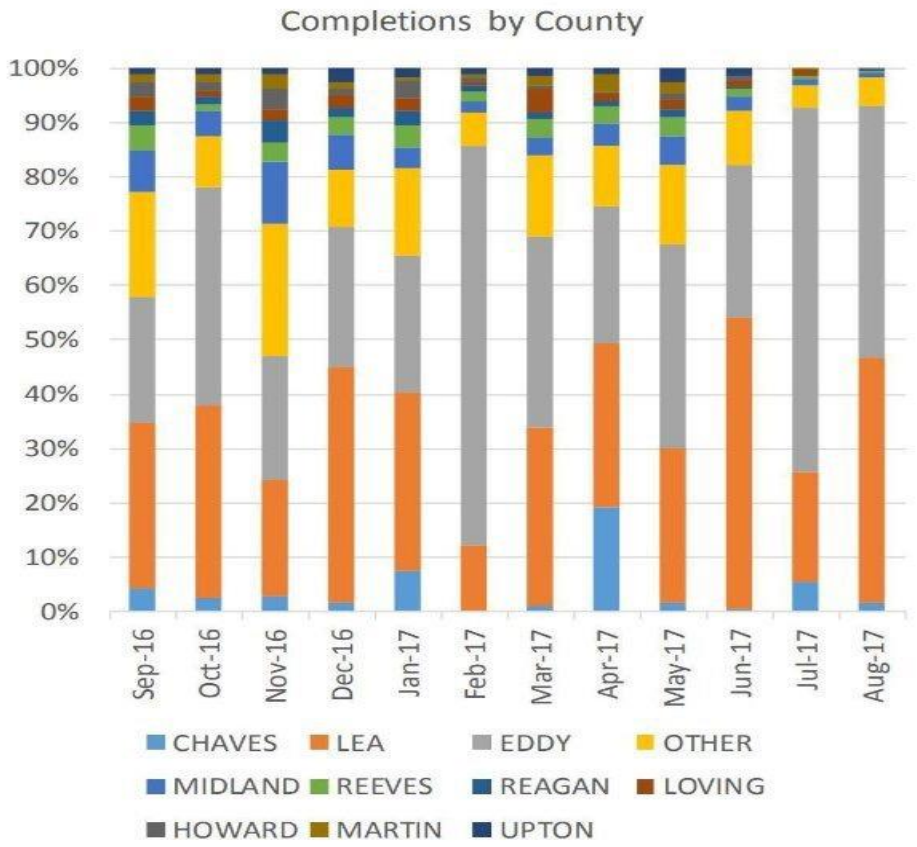
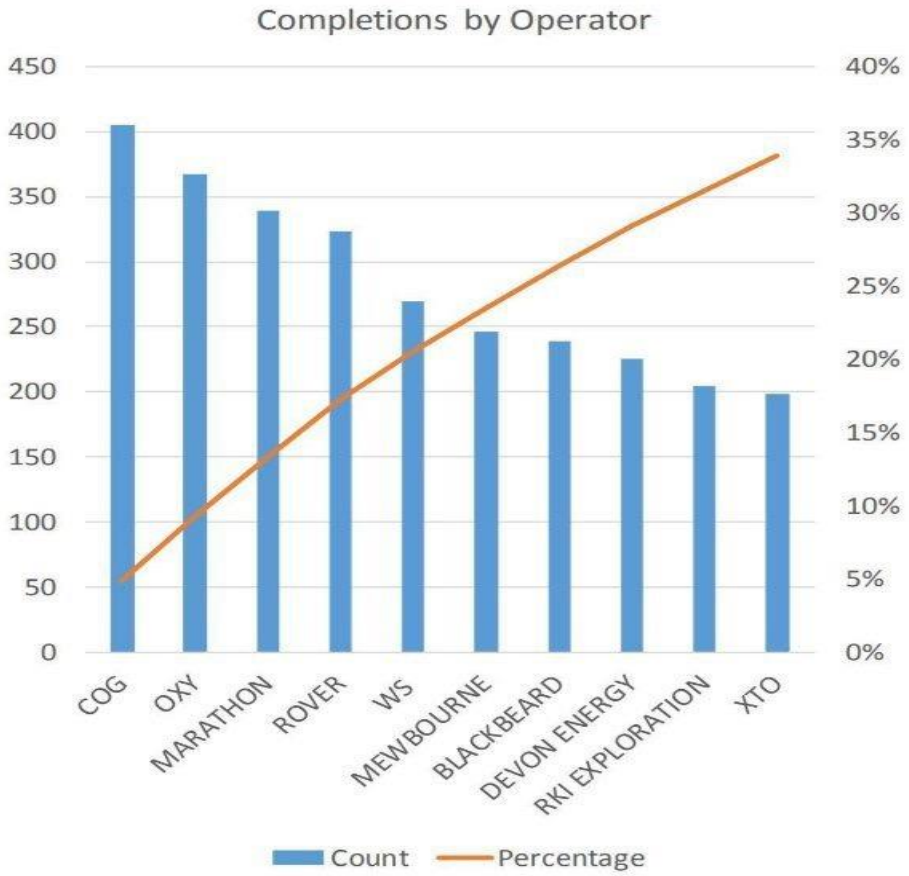
Heavy Activity in Arid Climates

D&C Activity Stable, Heavy in NM





- Majority of recent completion activity has occurred in Lea and Eddy counties

Source: Digital H2O Analysis, Texas RRC, NM OCD

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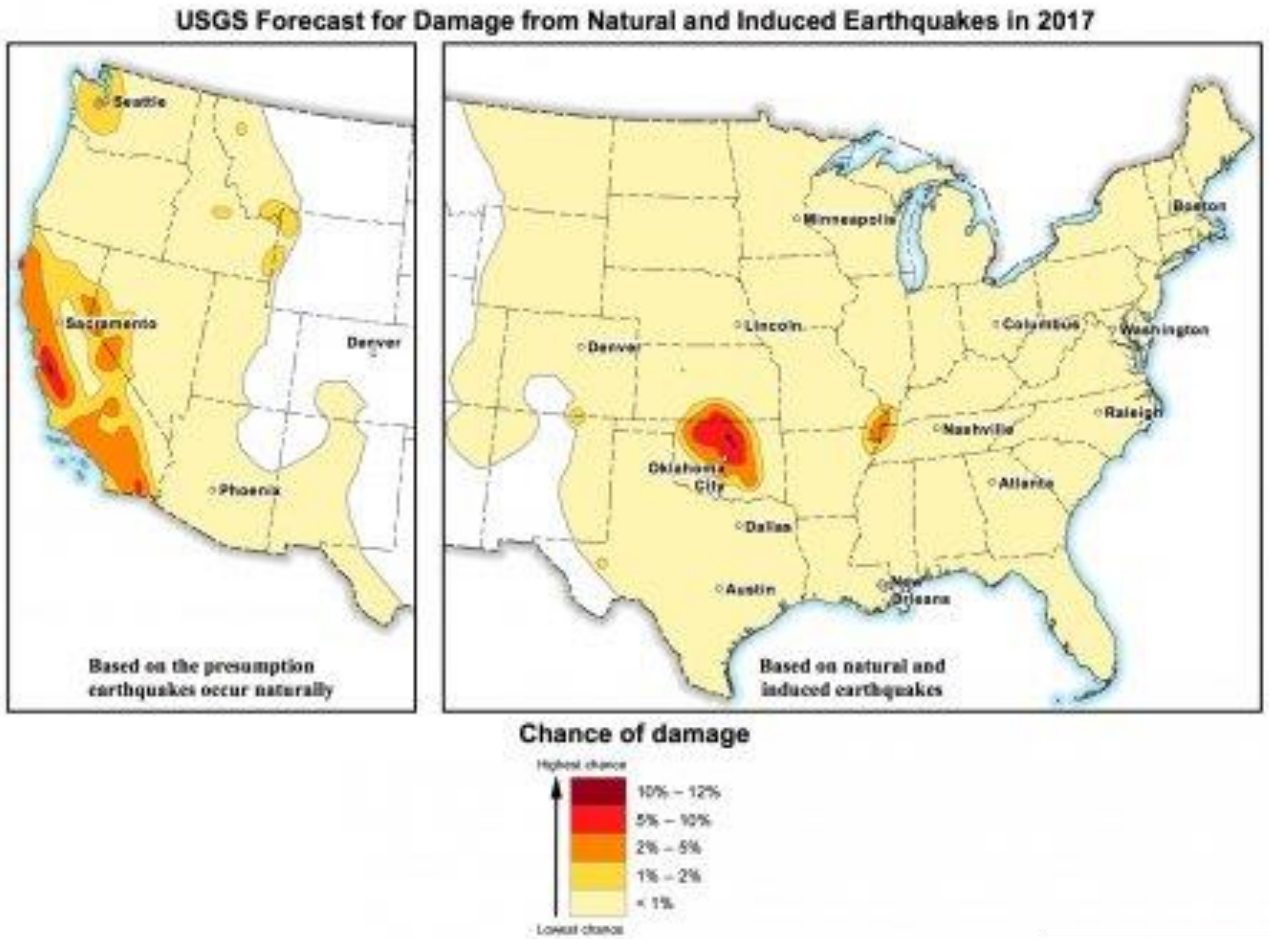
7 earthquakes struck Oklahoma in 28 hours for a disturbing reason



USGS map displaying potential to experience damage from natural or human-induced earthquakes in 2017. Chances range f
to 12 percent.

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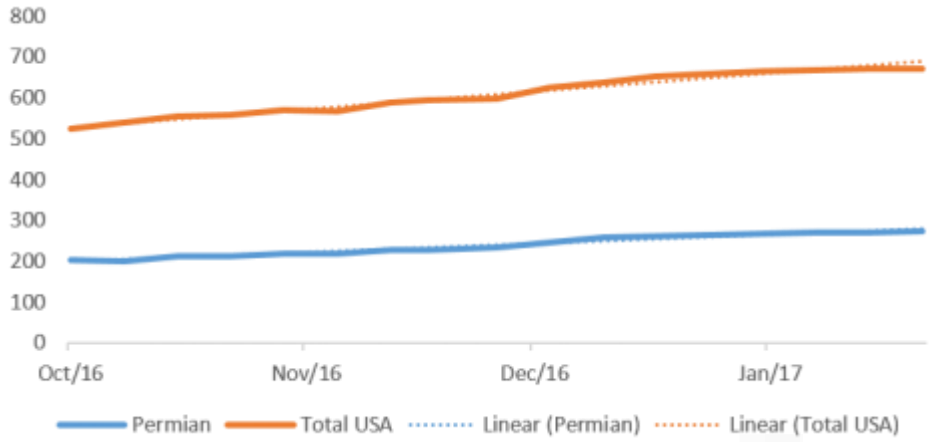
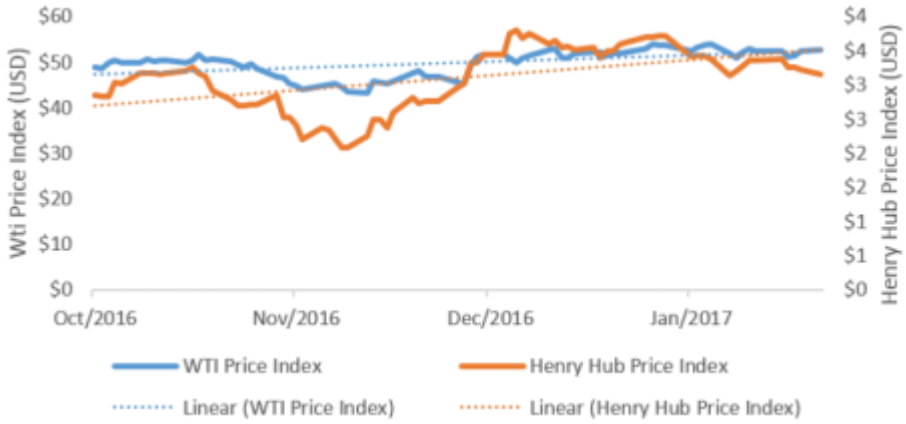
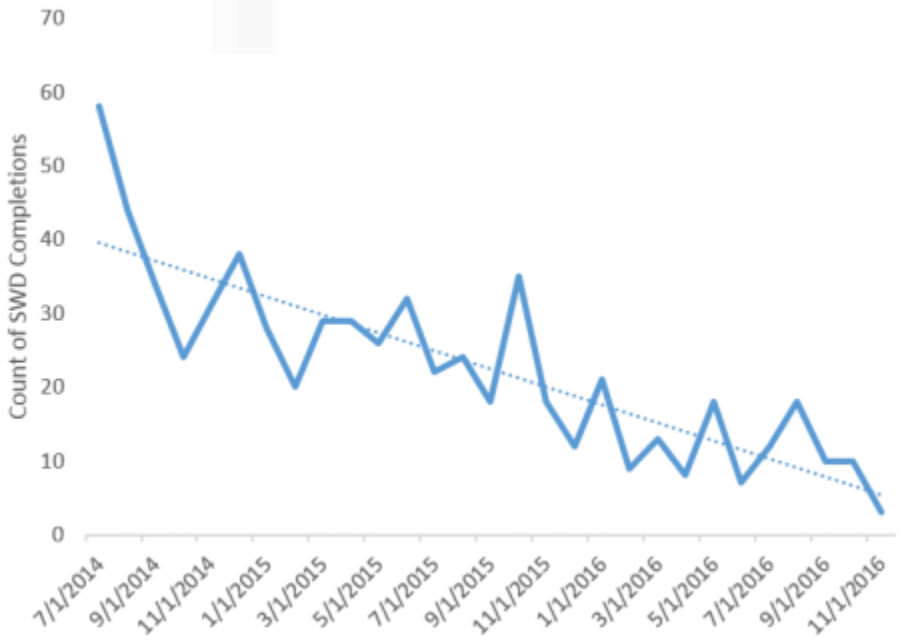
THE COMING PERMIAN BASIN WATER DISPOSAL BOTTLENECK







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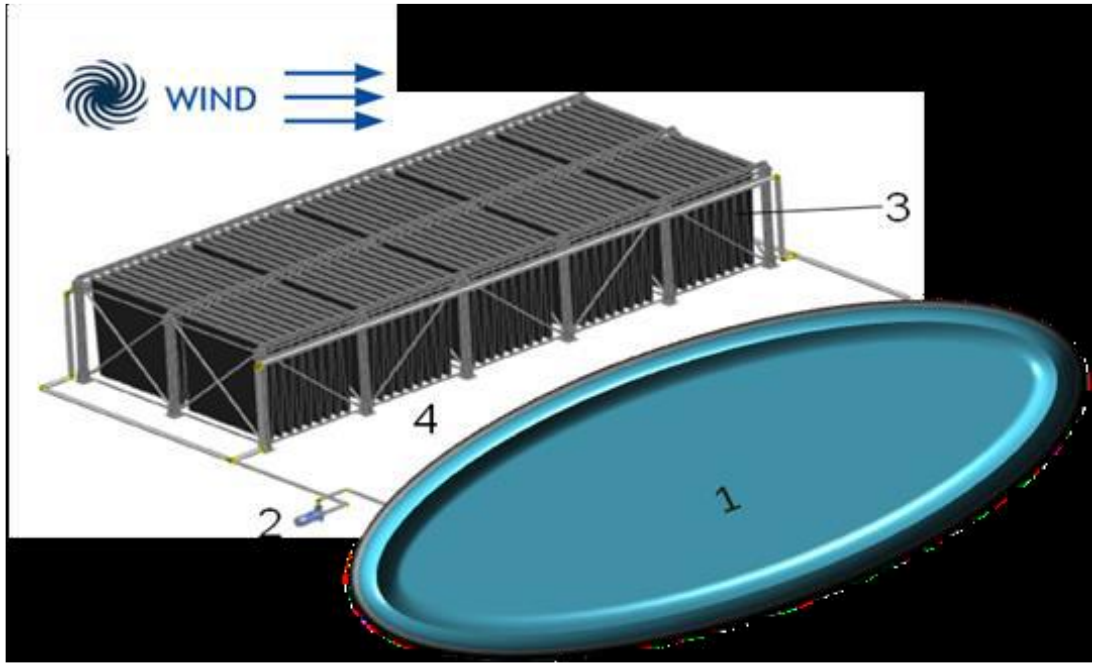
Enhanced Evaporation

How does it work?

Operated by the wetting of evaporation surfaces, mounted on suitably constructed modules .

The driving power of the wind drives away excess humidity from the surfaces to intensify the evaporation process by a factor of X15-20 more than a solar pond!



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Enhanced Evaporation

A state-of-the-art enhanced evaporation technology for brine (highly saline water) volume reduction/minimization. The device is operated by the wetting of evaporation surfaces, mounted on suitably constructed modules. A pump brings the water from small holding pond or storage tank to a distribution network on top of the vertical surfaces from which the vertical surfaces are fed by gravity. The device uses the driving power of the wind, which drives away excess humidity from the surfaces to intensify the evaporation process by a factor of 15-20 more than an evaporation pond!

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Enhanced Evaporation

- Not dependent upon feed water quality
- EEVAP uses renewable energy for evaporation (low carbon footprint)
- EEVAP is modular and can cover small scale to large scale applications
- EEVAP requires very little maintenance
- EEVAP can potentially use wind/solar power for operation
- EEVAP= Simple, robust, and cost-effective brine management technology

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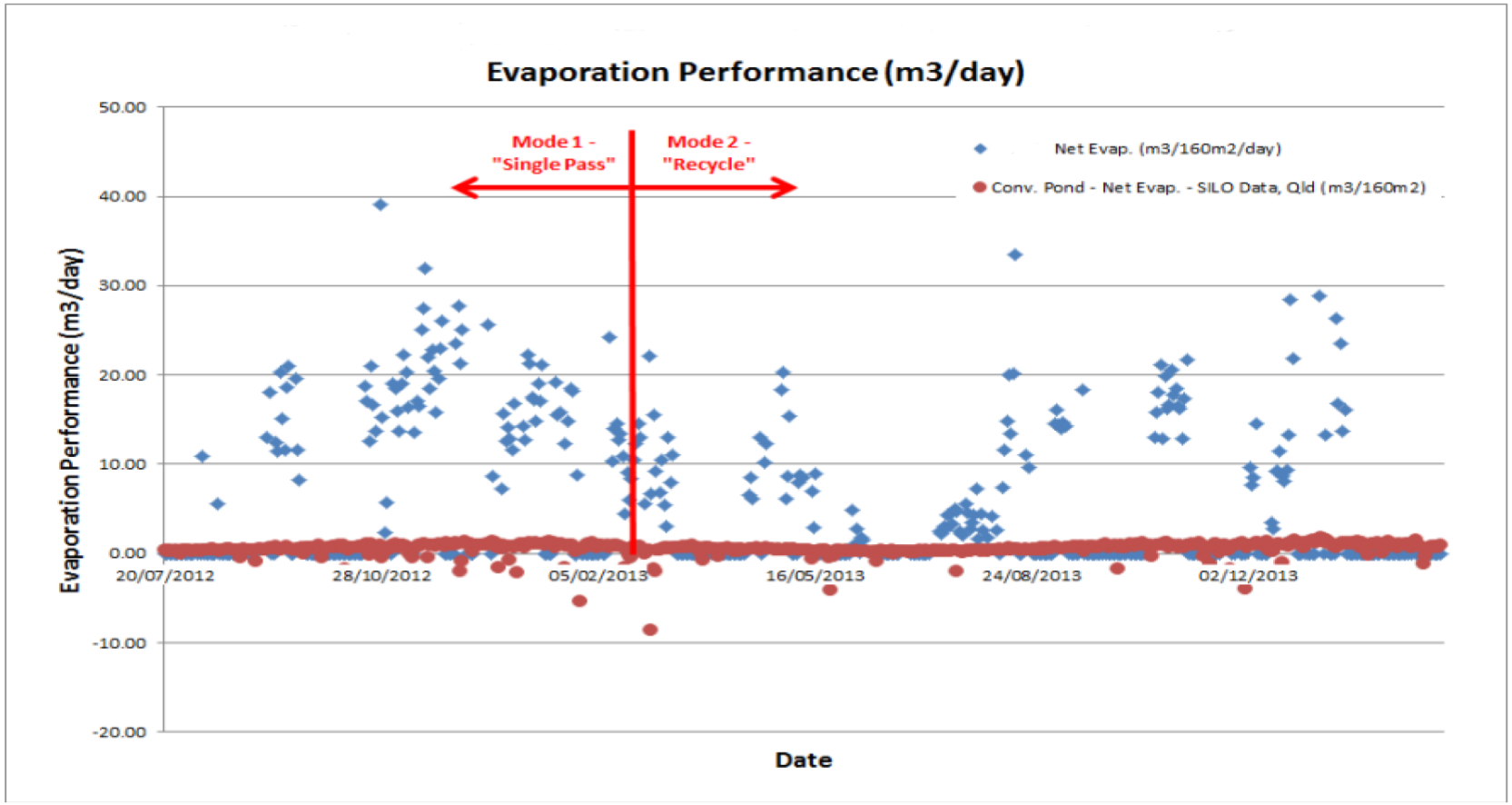
Enhanced Evaporation



Enhanced Evaporation

- EEVAP appear to be one of the first companies to introduce an enhanced evaporation system which is not based on spray technique (e.g Mechanical Spray Evaporators, Fan Sprayers) but on wetting technique to mitigate risks associated with air pollution and soil contamination during periods of high winds

Enhanced Evaporation

- The primary advantage of the EEVAP system is in the energy savings (0.4-0.8 kWh/m3 evaporated) to substantially decrease high operational costs of typical Zero Liquid Discharge (ZLD) treatment scheme. Other advantages of the design include:
- Compact footprint - land requirements are 10% or less of those of Evap. Ponds
- Scalable –covers small scale to large scale applications
- Practical design (Modular)
- Can be installed as a retrofit
- Linkage with renewable source of energy (Wind) with low carbon footprint

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Global Installations

- Australia
- Israel
- Chile
- U.S.
- Mexico

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DOE Criteria

Criteria	Score	Rationale/Comments
Implementability	80	Installation of 50 modules for full flow may present implementability issues. Textile sheets are of proprietary materials and design, with a single source of manufacture
Technical Effectiveness	25	evaporation will meet all regulatory and stakeholder water treatment objectives, but will return no treated effluent for aquifer restoration.
Maintainability	80	Maintenance is similar to passive evaporation, but also includes periodic cleaning and eventual replacement of the textile sheets.
Reliability	100	evaporation is a relatively new technology, but is expected to be reliable, as the Site climate (windy and dry) is very conducive to enhanced passive treatment.
Operability	80	Very minimal operator involvement is needed.
Estimated Cost	100	Estimated CAPEX and OPEX are the lowest of all alternatives for treatment of full flow.
Flexibility	60	Enhanced passive evaporation is flexible with regard to water chemistry, but inflexible to flow rate beyond its designed maximum. Weather conditions also affect the evaporation rate. Flexibility could be increased by installation of excess capacity.
Safety	80	Process safety hazard associated with use of acid (if needed) to clean the textile sheets. Personnel hazards can be physically and administratively mitigated.
Environment	80	Textile sheets will require disposal and replacement. Acid may be required for cleaning of textile sheets if sodium chloride rinse solution is not adequate. A 1% citric or sulfamic acid solution would be used.
Schedule	80	Design is modular and should not present a schedule issue. All components except the textile sheets can be fabricated by a licensed technology partner in the United States. Textile sheets are only available from the manufacturer in Israel. Shipping may present schedule lag.

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DOE Funded Contaminated Ground Water Report

Alternative	Name	Weighted Score
4B	Enhanced Solar Evaporation Ponds	78
1B	Ion Exchange Softening Pretreatment and RO	75
3	Mechanical Vapor Recompression Evaporator	71
1A	Manganese Pretreatment and RO	69
2B	Standalone EC	56
2A	EC with RO Polishing	40

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