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# Evaluating Treatment Alternatives for Produced Water Treatment

## Oil & Gas Client

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## BACKGROUND

ClearBakk conducted a technical assessment on treatment of produced water for storage in an open pond and reuse in fracking applications. Water analysis revealed challengingly high levels of TDS, oil content, TOC, and NORM contaminants. However, ClearBakk was able to provide both a cost-effective short-term solution and outline the final treatment requirements in a comprehensive report for the client.

As release to open water ponds can impact many different ecological systems such as birds landing in the pond and water escaping to groundwater, it is heavily regulated, and the codes can vary from region to region. The problem is further complicated with the substantial number of technologies and combinations, where a broad understanding is required to develop the most optimal solution. Both established and new technologies were assessed, and a novel combined system showed promise with high recovery, reduced use of consumables, a smaller footprint, and lower capital and operating costs. Pilot testing was used to confirm the effectiveness of the treatment and optimize the operating conditions.

With ClearBakk's specialization in water treatment and industry connections to solutions providers, we provide not only the experience required to turn such a problem into a simple solution, but also the expertise required to identify emerging technologies.

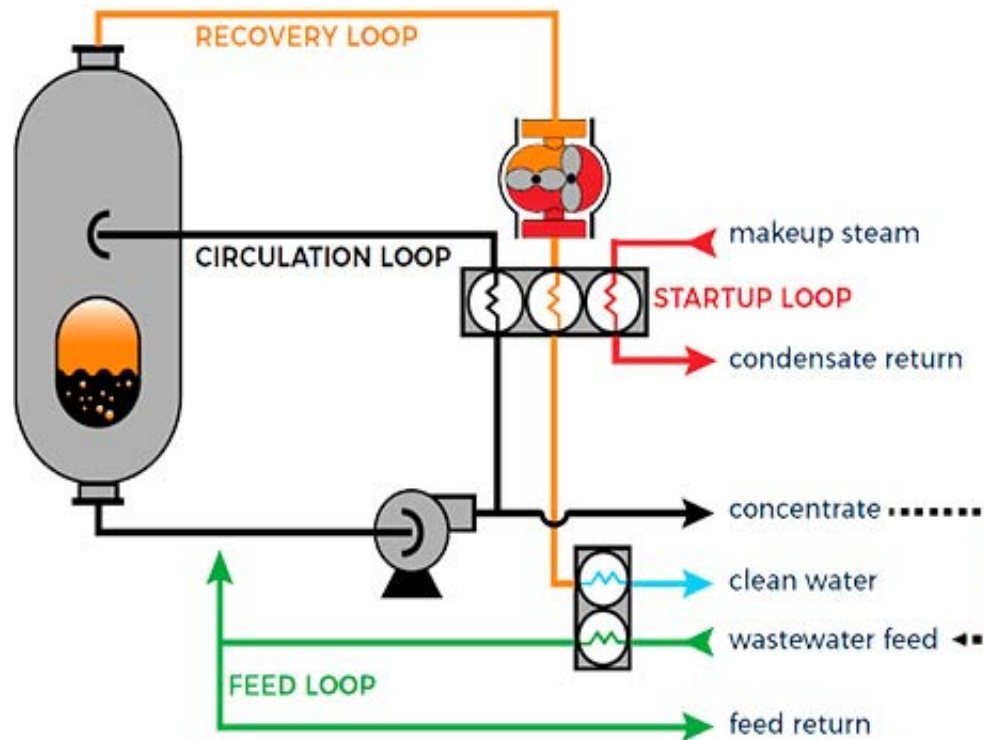
## APPLICATION BREAKDOWN

### Water treatment for open pond storage

- Combined evaporation/crystallization reactor
  - Easy to operate
  - High tolerance to varied feed compositions
  - Recovery limited by naturally occurring radioactive materials
  - Can be used for product concentration and recovery from brines. One example is salt or as part of lithium extraction from produced water.

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Combined Evaporation / Crystallization Process (Oil Polishing Missing)

- Filtration (oil polishing)
  - Removes residual organic material
  - Nut shell or ceramic membrane filtration

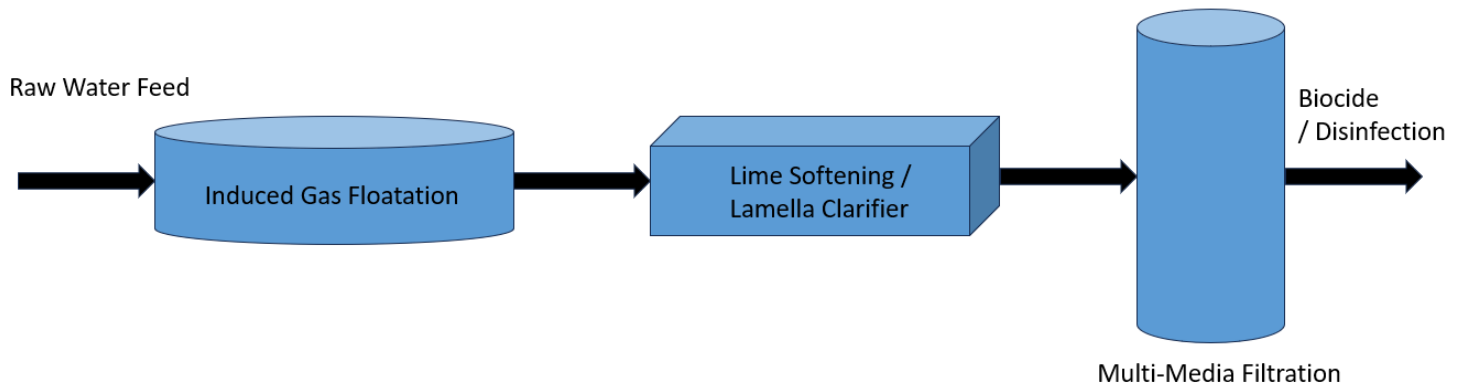
## Water treatment for reuse in fracking

- Induced Gas Flotation
- Lime Softening / Lamella Clarifier
- Multimedia filtration
- Disinfection
- All components are standard water treatment technologies that each manage different contaminants and are tuned to the feed water

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## SERVICES PROVIDED

- Sample Collection (regulatory requirements for shipping)
- Water Quality Testing (including summarization of results)
- Treatment Technologies Assessment
- Treatment Process Evaluation
- Pilot Testing

## PROJECT DRIVERS

- Regulatory requirements for discharge (open pond water storage) or fracking re-use
- Elevated concentrations of concerning constituents and ability to remove and concentrate (particularly NORMS)
- Remote Region / SCADA (supervisory control and data acquisition)

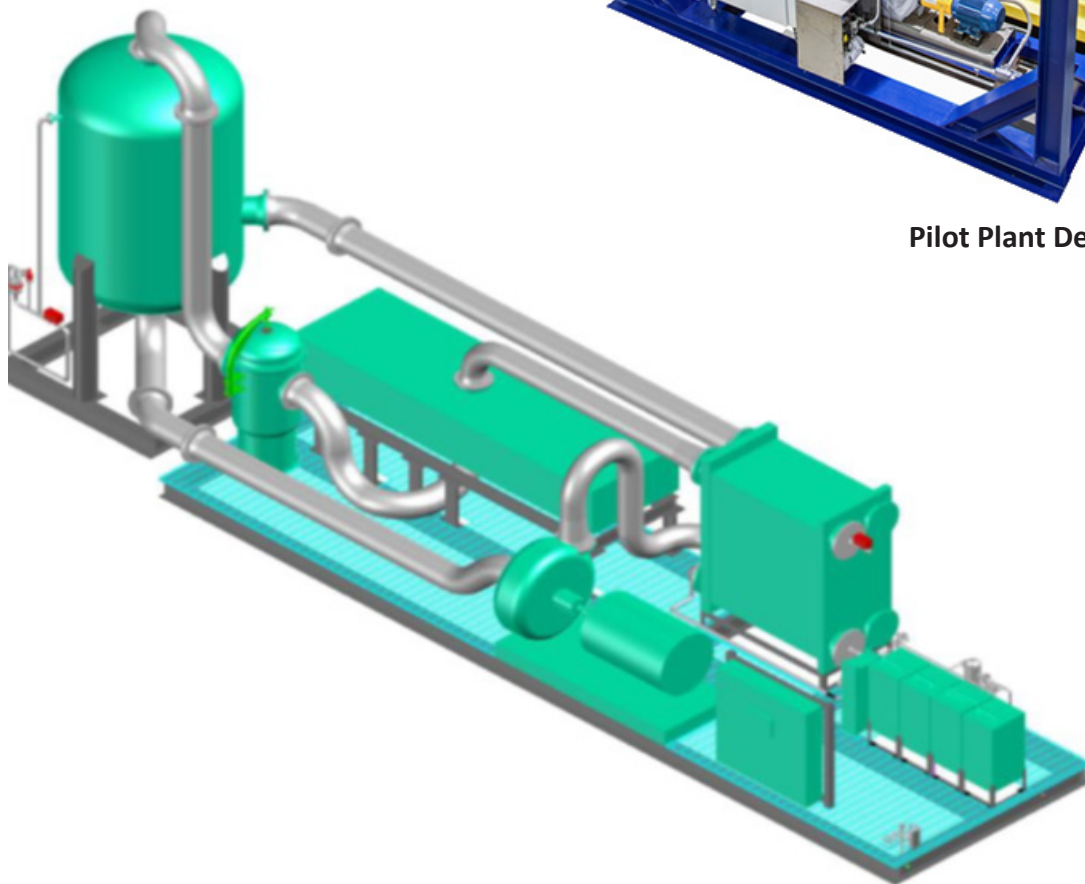
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Pilot Plant Design



Full Scale Modular Evaporation / Crystallization Train (3D Model)