



# **Desalination Technology for Coal-Bed Natural Gas Produced Water, Treatment, Riparian/Rangeland Rehabilitation**

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# Water Disposal from Coal-Bed Methane Wells is Costly

- Coal bed methane (CBM) supplies ~10% of US natural gas; expected to double in next decade
- To access methane, large volumes of brackish water must be removed; a severe environmental problem (water must be disposed of or treated)
- Disposal \$3-4+/bbl for producers in northern NM due to remoteness, lack of infrastructure, away from the electric grid
- To lower cost, methods for treating/reclaiming water sought





## *Primary Project Goal*

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- **Desalinate produced water from a ConocoPhillips coal bed natural gas well in the San Juan Basin, using optimum technology, and, at the same time provide desalinated water for alternative use meant for:**
  - **Riparian improvement (Joel Brown/USDA, Jornada Experimental Range, Las Cruces)**
  - **Rangeland improvement/Revegetation of Disturbed Land (Rick Arnold, Agricultural Science Center, Farmington)**
- **Produced water from the Coal Bed Methane Natural Gas will be desalinated by reverse osmosis in a pilot operation.**

Sauna, hot showers,  
recreation hall



**Overview of ConocoPhillips GBNG Well Pad  
Showing Wellhead, Separator, Produced Water Tank,  
Sandia Transportainer, and Tanks (to Right of  
Wellhead)**



**Generator , Transportainer and Treated, Untreated Water, and Concentrate Tanks on ConocoPhillips CBM Well Pad**



**Portion of ConocoPhillips CBM Well Pad.  
Treated, Untreated Water, Concentrate Tanks on Left,  
Grasses to be Watered with Treated/Untreated Water on Right**

# Removal of Coal Fines and Iron Precede RO



**Hydrocyclone separator**



**Progressive cartridge filtration**



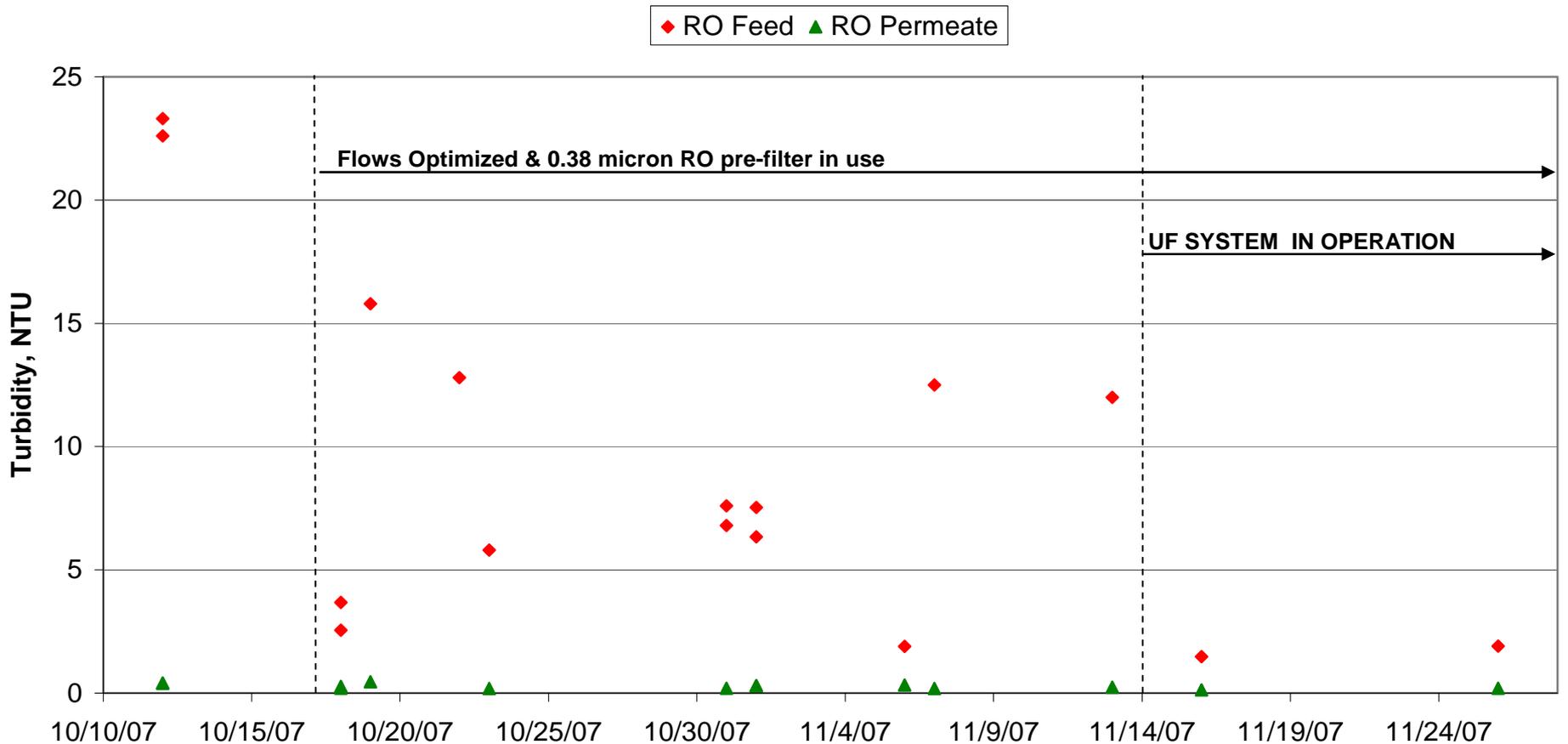
**Ultrafiltration and reverse osmosis pilot plant**



**Water Treatment Within Transportaine**  Sandia National Laboratories

# Ultra Filtration Removes Turbidity and Undissolved Organic Material

RO Turbidity Monitoring



# Summary of Reverse Osmosis Performance

| Analyte                          | RO Concentration Factor (Conc/Raw) |          | RO Removal Efficiency |          |
|----------------------------------|------------------------------------|----------|-----------------------|----------|
|                                  | 10/9/07                            | 11/28/07 | 10/9/07               | 11/28/07 |
| Specific Conductance (@ 25°C)    | 1.14                               | 1.18     | 98%                   | 98%      |
| Total Dissolved Solids (@ 180°C) | 1.11                               | 1.22     | 98%                   | 98%      |
| TDS (calculation)                | 1.20                               | 1.26     | 98%                   | 98%      |
| Total Suspended Solids           | 0.67                               | 1.07     | 27%                   | 53%      |
| Chloride                         | 1.06                               | 1.48     | 98%                   | 97%      |
| Sulfate                          | 1.00                               | 0.67     | 100%                  | 44%      |
| Silica                           | 1.10                               | 0.76     | 97%                   | 88%      |
| Total Alkalinity                 | 1.26                               | 1.23     | 98%                   | 99%      |
| Calcium                          | 0.80                               | 1.15     | 100%                  | 98%      |
| Iron                             | 3.96                               | 1.68     | 96%                   | 74%      |
| Magnesium                        |                                    | 0.21     |                       | 100%     |
| Potassium                        | 0.90                               | 1.26     | 100%                  | 99%      |