Improving the Effectiveness of Interceptor Trench for Hydraulic Containment of Chloride Impacted Groundwater at a Natural Gas Liquid Storage Facility South Central, Kansas, USA

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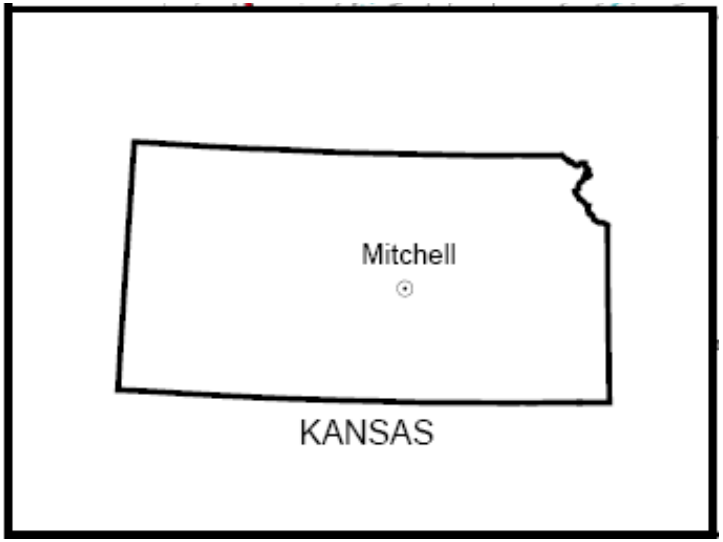
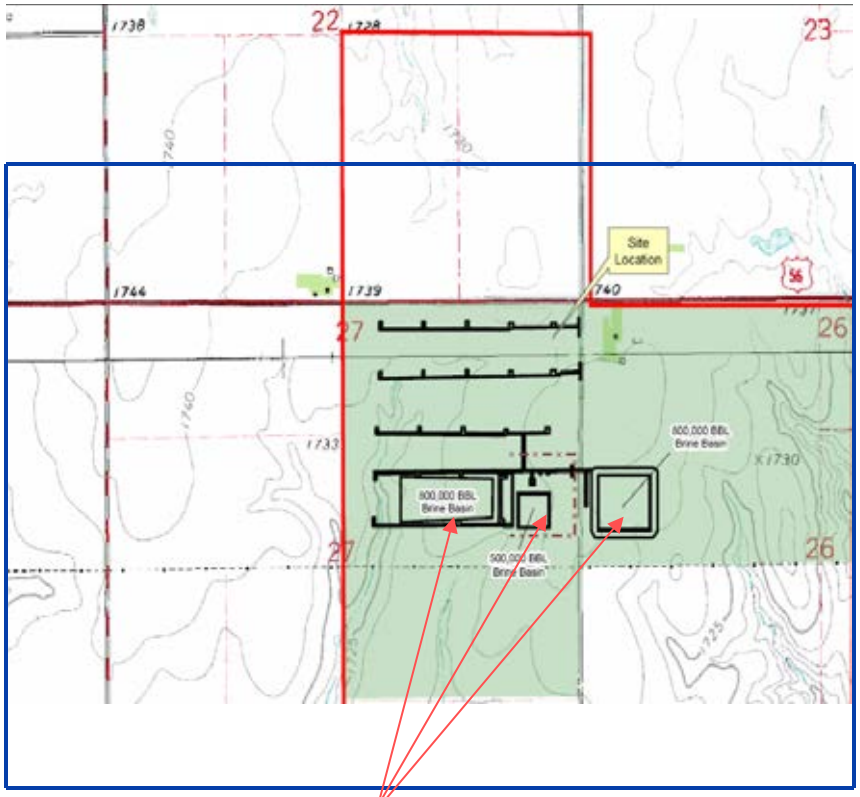
BURNS McDONNELL

Site Location Map





Brine Ponds

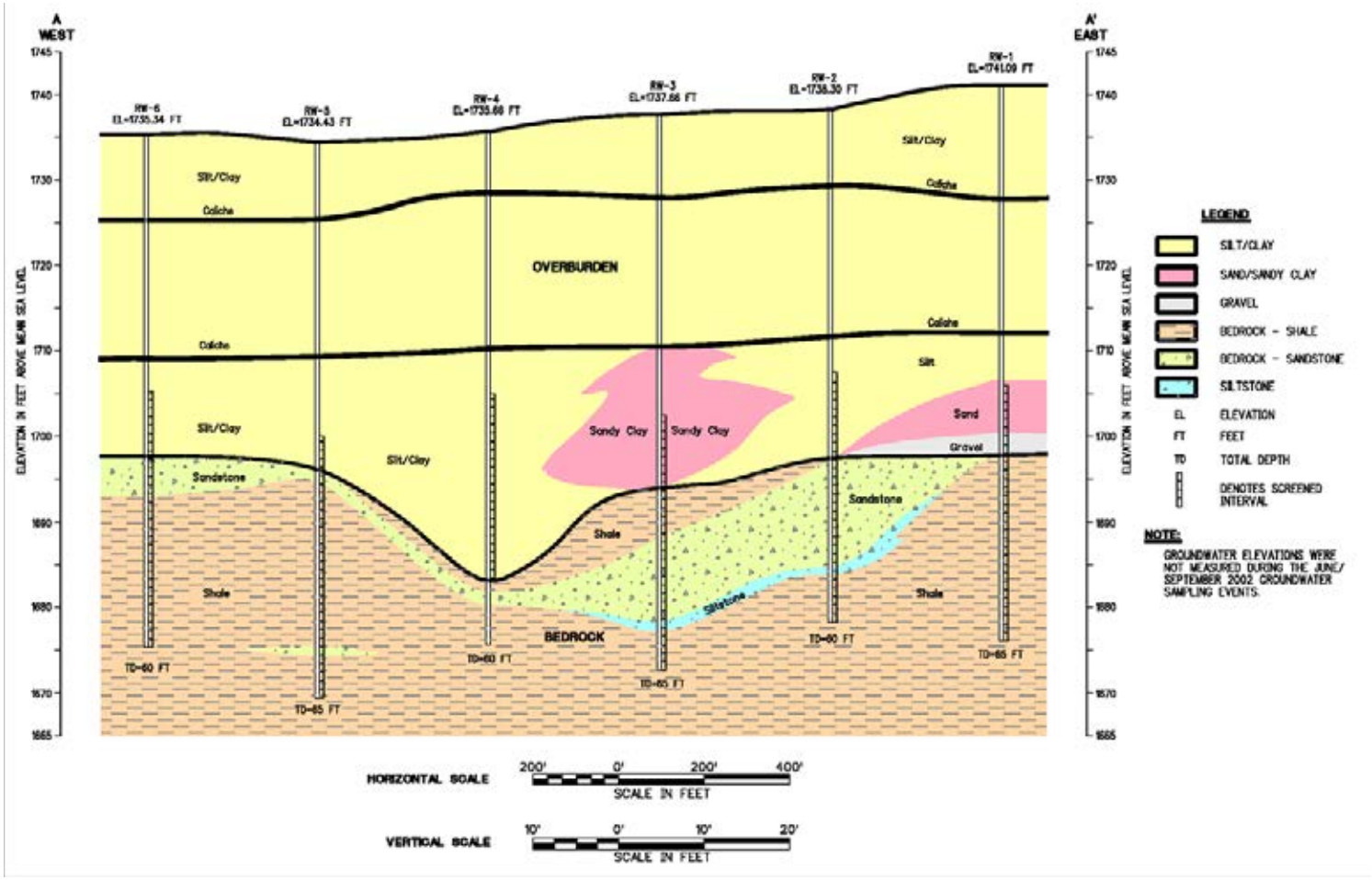
Site Overview

- Located in rural south central Kansas
- Natural gas liquid (NGL) storage facility with brine storage ponds
- NGL stored in salt caverns 700 ft. bgs
- Groundwater contamination as a result of release from previously unlined brine ponds
- Chloride concentrations in excess of acceptable levels (SMCL 250 mg/L)

Geology and Hydrogeology

- Site consists of loess overburden deposits
- The uppermost bedrock consists of shale, siltstone and sandstone of the Cretaceous Kiowa Shale
- Groundwater yield to wells is limited to 0.25 to 1.5 gpm
- Groundwater movement controlled by flow along preferential pathway in soil and bedrock
- Relatively tight soil/rock matrix

Generalized Geologic Profile

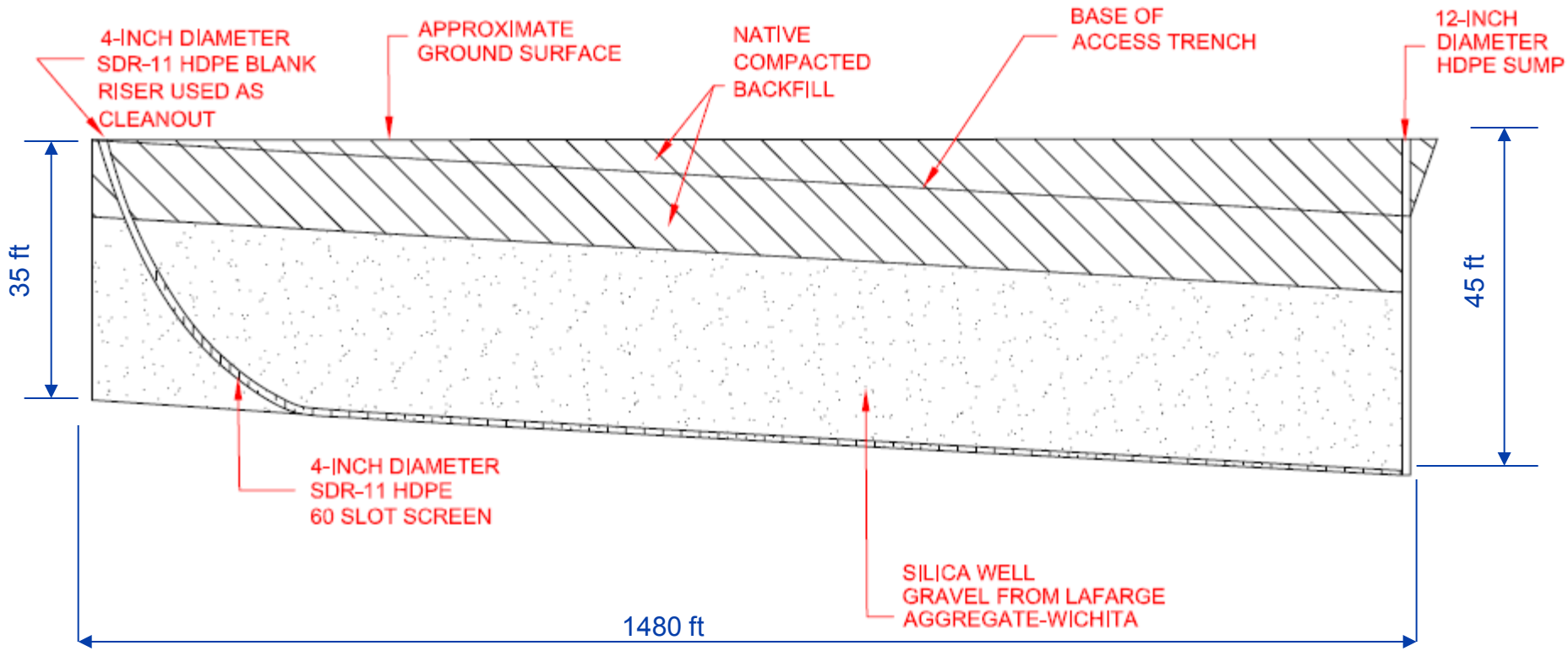


Hydrogeologic Testing

- Historically several attempts to perform pump tests in vertical wells
- Previous tests indicated yields between 0.25 to 1.5 gpm
- ROI was 10 to 30 feet
- Evaluation led to installation of the collection trench as hydraulic containment alternative to maximize the interconnection of preferential groundwater flowpaths

OnePass Trencher

Trench Installation

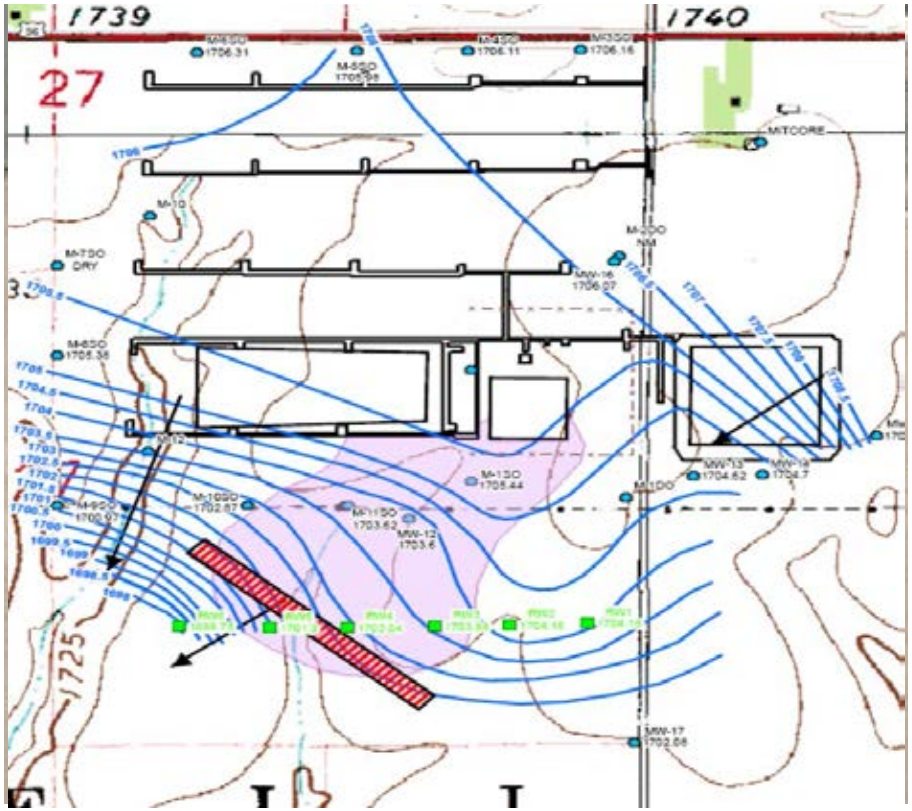


Concerns

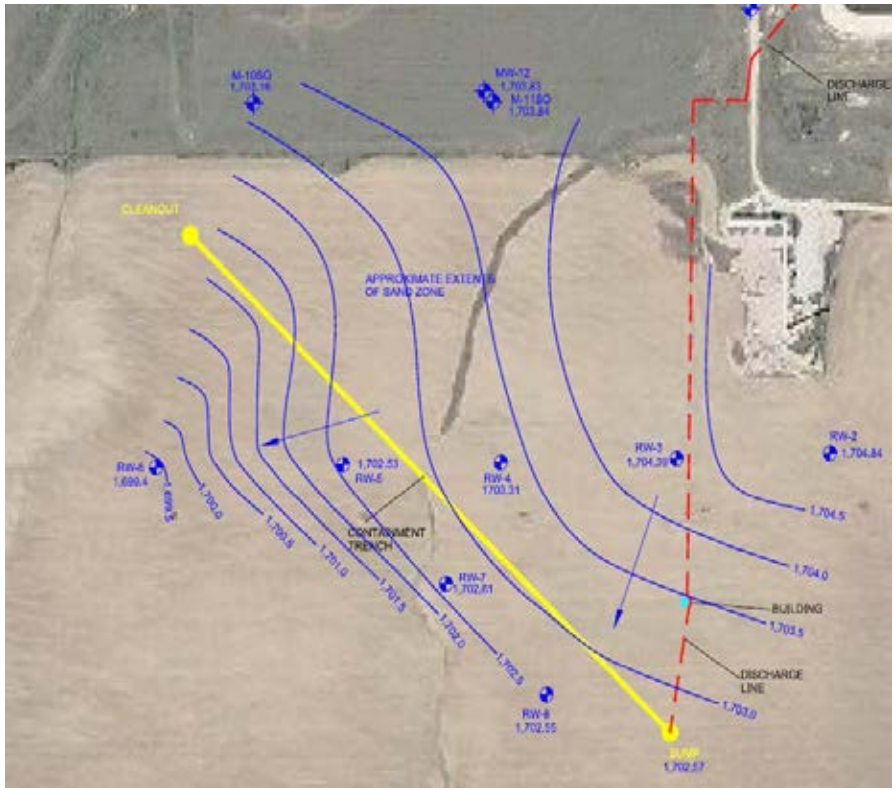
- System didn’t provide capture and only provided minimal recovery of impacted fluids
- Maximum rate was 10 gpm with operation at around 8 gpm (system installed 2007-2008)
- KDHE wasn’t satisfied with the lack of hydraulic containment/control
- Requested that aquifer testing be performed to prove or disprove effectiveness of trench

Comparison Pumping vs. Static

Static Condition 2006



Pumping Condition 2010



Comparison Pumping vs. Static

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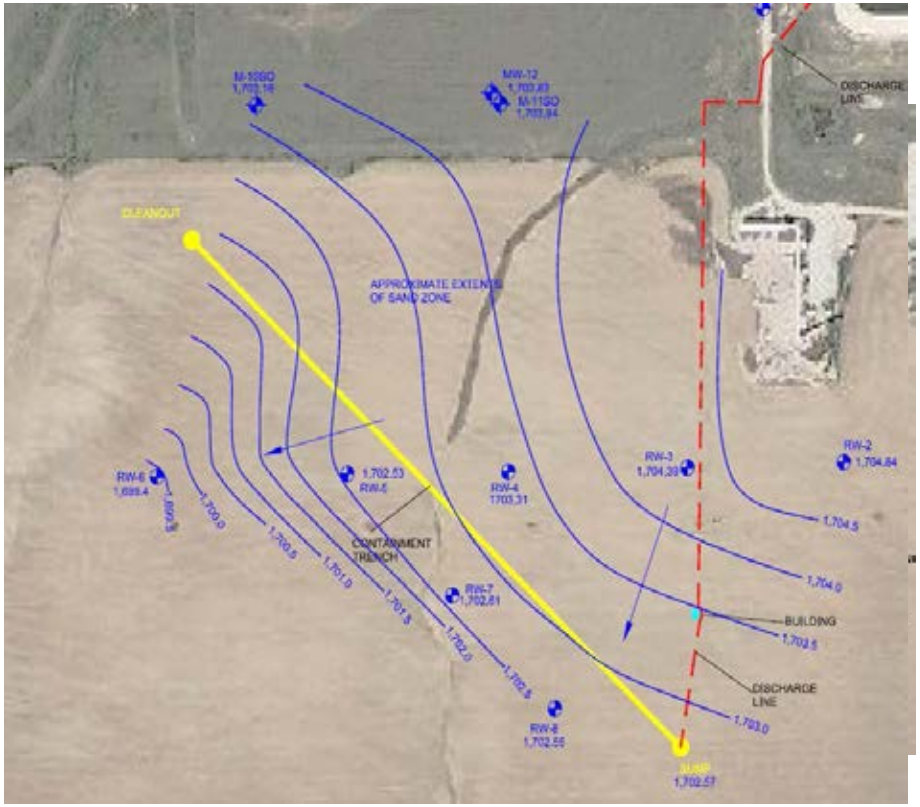
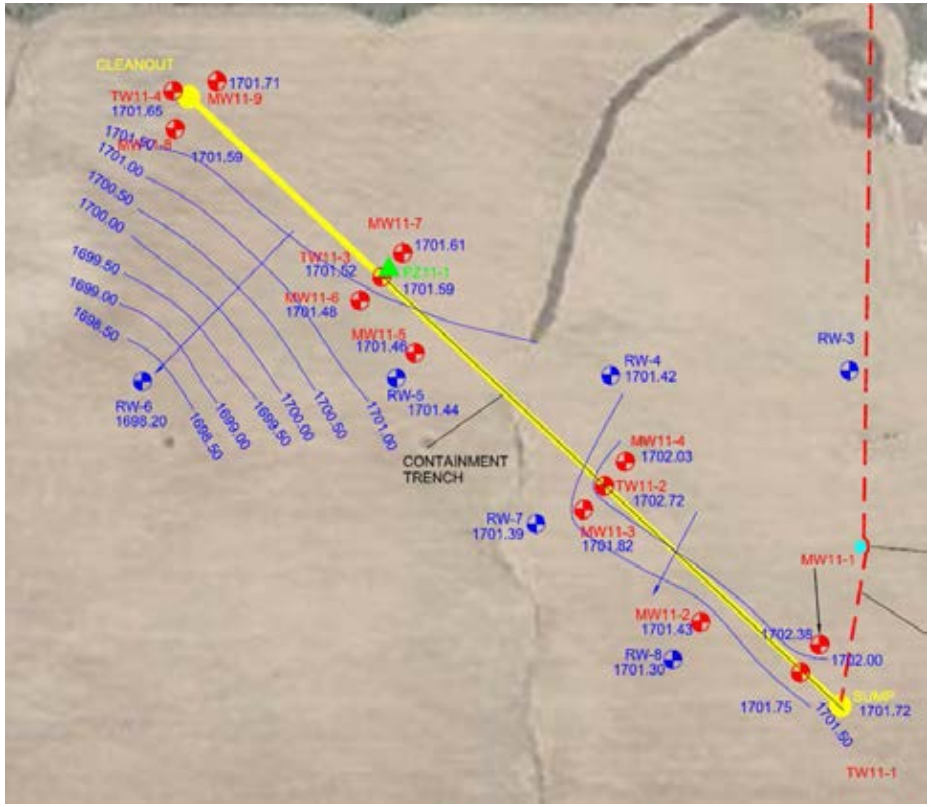


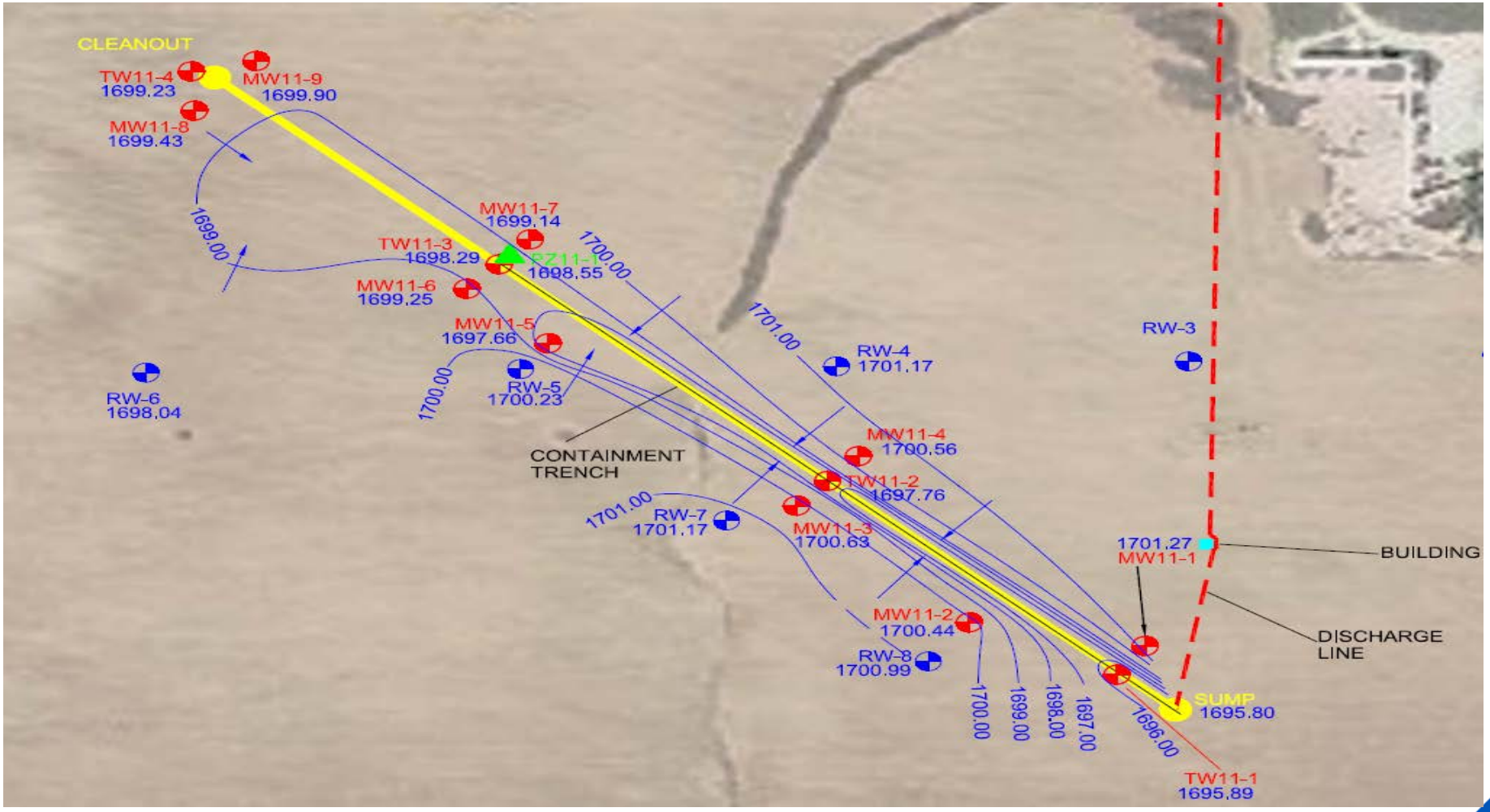
Static Condition 2012



Field Activities

- Series of piezometers and monitoring wells were installed (four inside and nine outside trench)
- Step test performed (40, 60, 80, & 93 gpm). 50 gpm selected for constant rate
- 76 hour constant rate test

Maximum Drawdown – 2012 Test



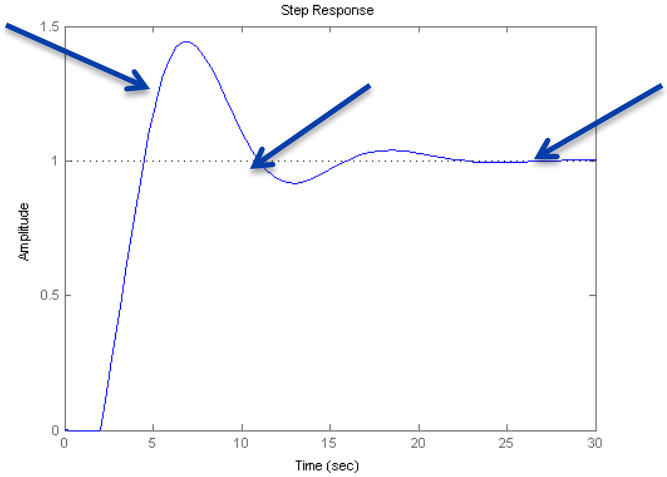
Conclusions from Aquifer Testing

- Data from the constant rate test proved that trench construction was viable
- Linear and radial zones of influence were obtainable and sustainable
- Regulators concurred
- Increasing pump size and collection infrastructure to accommodate higher flow/yield

Upgrades

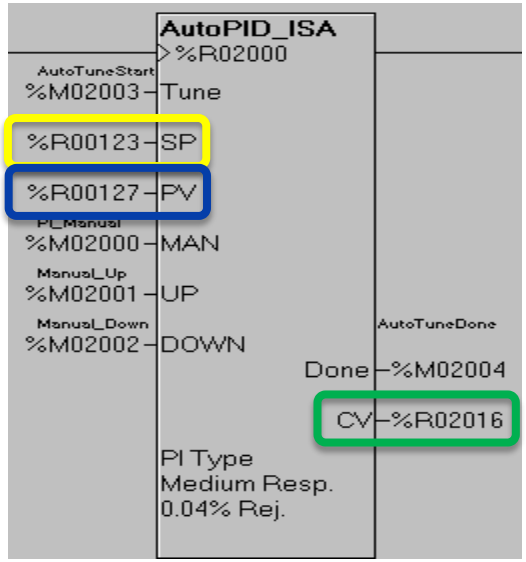
- New Control Panel
  - PLC/OIT Unit
  - VFD
  - dV/dT filter
- Submersible Pump
- Radio Network

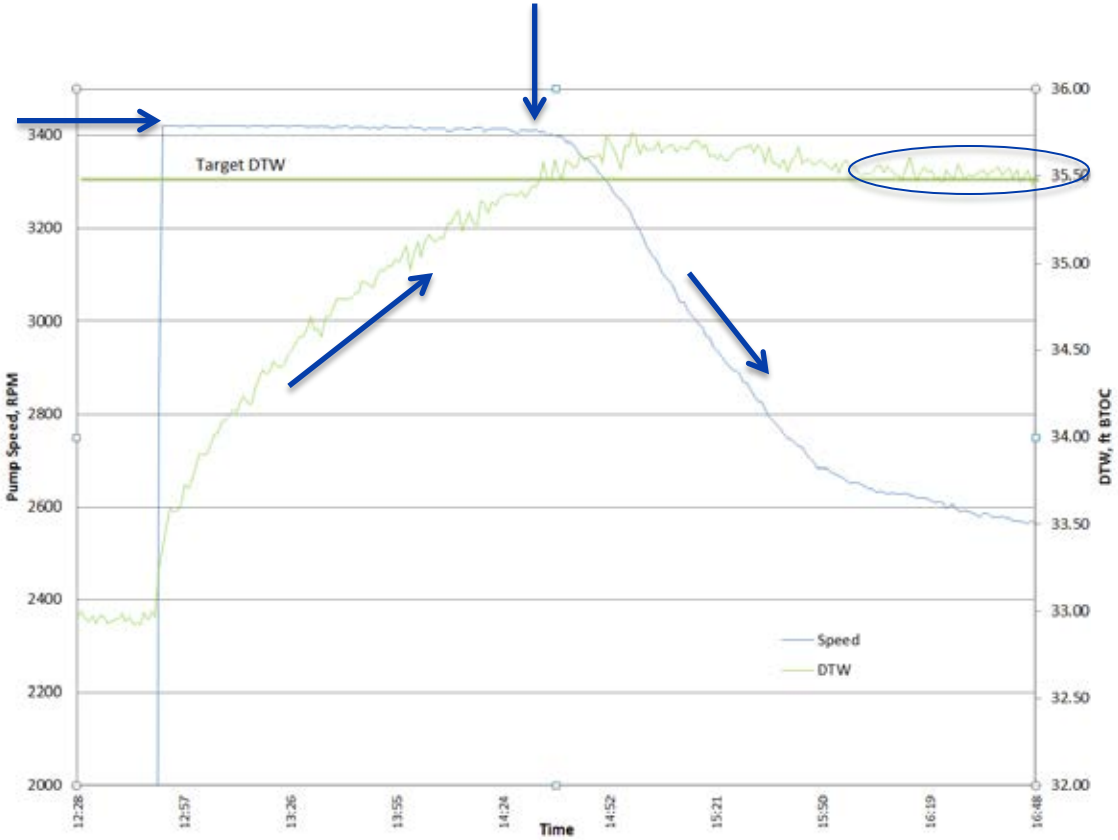
PID Program



- PID
  - Proportional
  - Integral
  - Derivative
- PLC Program uses a PI loop function block
- Controls Pump Speed via the VFD
  - Hard Limits

PI Loop

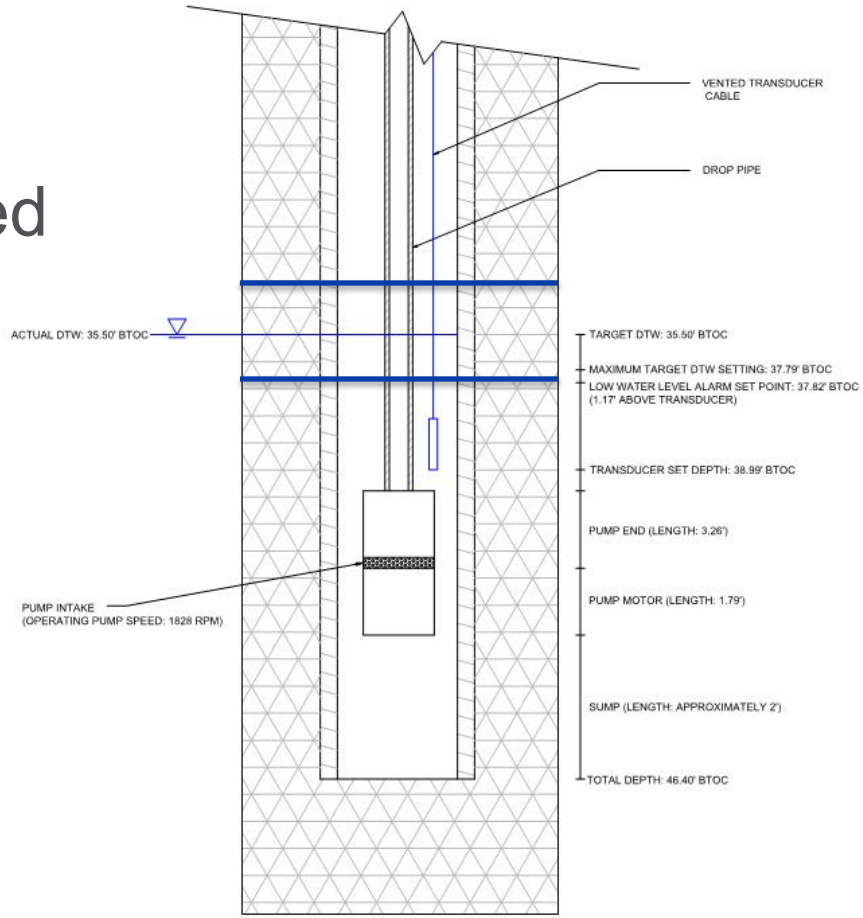




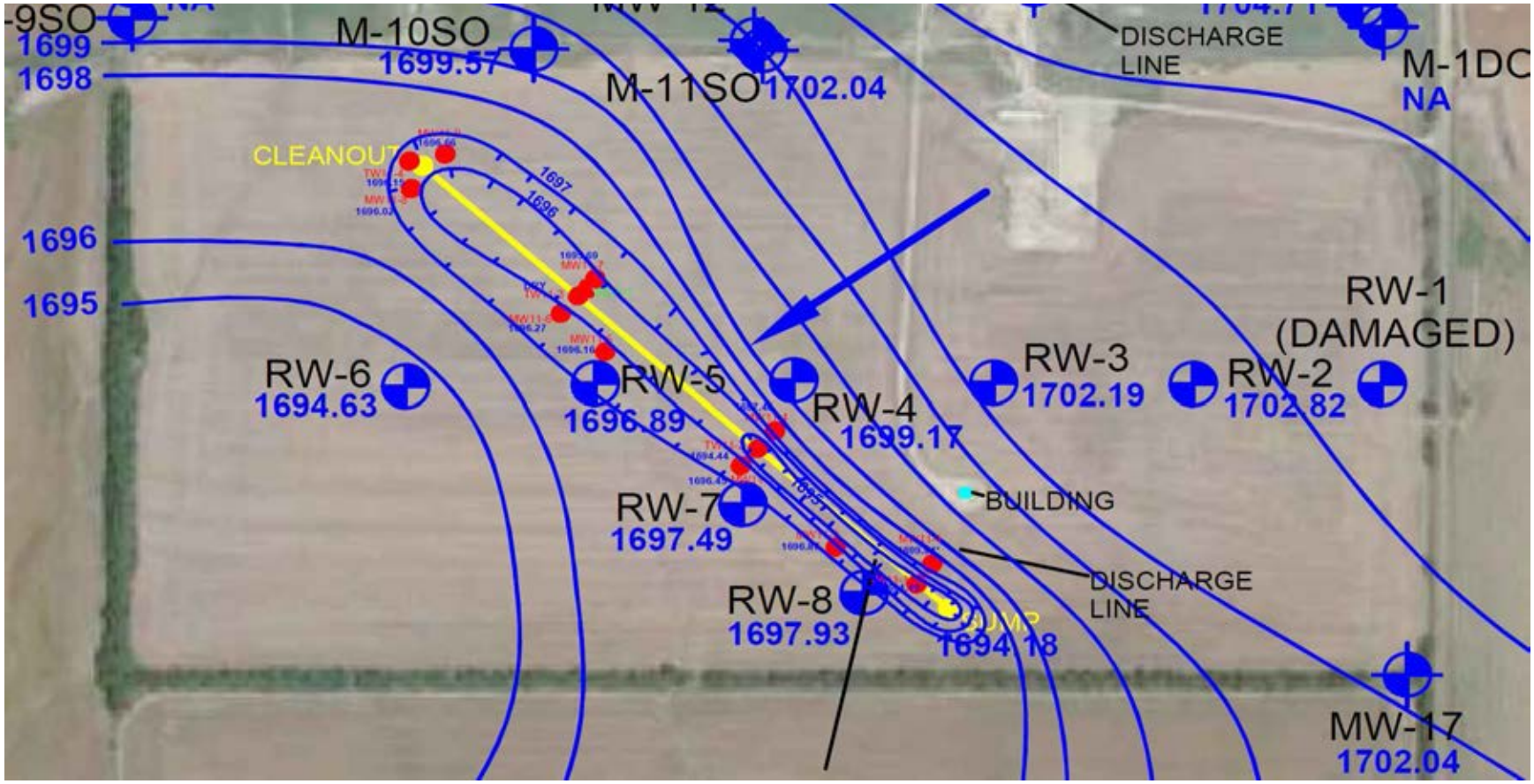
Approximately 4 hours

Well Cycling Logic

- System is providing capture
- Lower hard limit prevents pump from running at required speed.
- Implemented well cycling
  - Shuts down for one hour AND the well recovers



Groundwater Map May 2015



Conclusions

- Data from the constant rate test proved that trench construction was viable
- Linear and radial zones of influence were obtainable and sustainable
- Modifications and upgrades to system providing hydraulic control

Questions?