Mid-Continent Water Management for Stimulation Operations

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July 10, 2013
Unconventional Oil & Gas Water Management Forum
Grapevine, TX
Water

- Water, like religion and ideology, has the power to move millions of people. Since the very birth of human civilization, people have moved to settle close to it. People move when there is too little of it. People move when there is too much of it. People journey down it. People write, sing and dance about it. People fight over it. And all people, everywhere and every day, need it.

Mikhail Gorbachev
Why Is Water Important to the Petroleum Industry?

- Water is the most common and most heavily used fluid in the petroleum industry
- Water is produced along with oil and gas from nearly every well
- Water is used as a base fluid in production, drilling, and completion operations
- Water will be produced, recycled, injected, mixed, cleaned, and reinjected
- Water’s use and protection are emotionally charged subjects in many communities
Significance of Water to Our Business

- More than ever, water is an integral part of the success of oil and gas operations. Consider this

  - No Water
  - No Hydraulic Fracturing
  - No Oil and Gas Resource Plays
Water Management Cycle

- **Water source**
  - Subsurface aquifers
  - Rivers, lakes or ponds
  - Rural or urban water supplies
  - Gray Water
  - Acid Mine Drainage

- **Water transport**
  - Pipeline
  - Trucking

- **Water storage**
  - Frac Tanks (500 bbls)
  - Modular Tanks (up to 40,000 bbls)
  - Portadam (size as required)
  - Pits or ponds (100,000+ bbls)

- **Water treatment and reuse**
  - Physical
  - Chemical

- **Water disposal**
  - Evaporation
  - Water disposal wells
Water Sources

- Subsurface Aquifers using water wells
- Ground Water from naturally occurring or man made ponds
Water Sources
Water Transportation
Water Transport – Pipeline and Pump
Water Transport - Trucking
Poly Pipe Cross Sections

12” SDR 11 HDPE

8” SDR 11 HDPE
Water Storage
Why Is Water Storage Important?

- Water is the base fluid and biggest component of any hydraulic fracturing operation.
- Water volumes required for typical completions range from 100,000 to 500,000 barrels per well.
- Water must be stored near the operation in sufficient quantities to finish a job at the desired pump rate.
- In the first 90 days after fracturing, a well can produce from 30 to 80% of its load back.
- To recycle water there has to be enough storage for both the produced water and the processed water.
- Water must be stored in a manner that is economically and environmentally sound.
Frac Tanks

Capacity

500 barrels

Transported by Truck

Number needed for a 250,000 BBL slick water frac

500

Normally use 15 to 20 frac tanks on a job
Fresh Water Impoundment – Lined

Size can vary

Operational Requirements
Terrain

Cost to Construct

$150,000 to $200,000

Number needed for a 250,000 BBL slick water frac

1
Recycled Water Impoundment - Lined

**Impoundments**

*Designed by professional engineer*

*Permitted by the state*

**Size can vary**

*Operational requirements*

*Terrain*

*This pit is 480,000 barrels*

**Cost to Construct**

*$500,000 including engineering, land, legal and construction*
Fresh Water Impoundment - Unlined

Impoundments can be
- Naturally occurring
- Man made

Size can vary
- Operational Requirements
- Terrain

Cost to Construct
- $75,000 to $150,000

Number needed for a 250,000 BBL slick water frac
- 1
Large Capacity Above Ground Moveable Tanks

Size Can Range by type and make of tank

Rectangular
2,200 to 15,400 BBL

Circular
4,500 to 42,000 BBL

Portadam
Determined by user
Rhinokore Tank

Capacity

2,200 to 15,000 BBL

Transported by Truck

Purchase or Lease Options

Estimated Cost of Storage

$0.083 to $0.089/BBL/d

Number needed for a 250,000 BBL slick water frac

16+
Large Capacity Circular Tanks

Capacity
4,500 to 42,000 BBL

Transported by Truck

Purchase or Lease Options

Estimated Cost of Storage
$0.064 to $0.080/BBL/d

Number needed for a 250,000 BBL slick water frac
6+
Portadam

**Size can vary**

*Storage Required (Larger More Economical)*

*Terrain*

**Good for Long Term Application**

**Estimated Cost of Storage**

$0.018 to $0.04/BBL/d

**Number needed for a 250,000 BBL slick water frac**

1 or more depending on size
Water Treatment and Reuse
Recycling Challenge – Water Quality

- Fresh water
  - No problems with frac

- Produced water & flow back water
  - Minerals can cause scale
  - Minerals can interfere with frac gel
  - Water quality varies widely
  - Newfield has fractured wells with 100% produced water with no problems

- Study to determine water quality limits for recycling
  - Results specific to portion of basin
  - Results will point to type of water treatment needed

- Regulations are becoming more stringent
  - Recycle or produced water pits have to be permitted
  - OK and TX require design and certification by a professional engineer
Load Recovery

Flow Back
- Using pipeline and transfer pumps
- Capacity over 500 BPH
- Replenish frac water supply

Trucking
- Could have 100 trucks per day to haul water from a well flowing 500 BPH
- Determine break even between pumping/pipeline changes and trucking costs plus disposal fees
Water Disposal

- Accelerated Evaporation
- Salt Water Disposal Well
Water Disposal

Saltwater Disposal
Water Type %

- Production: 87%
- Flowback: 13%

Disposal Delivery
Method %

- Trucked: 88%
- Pipeline: 12%

Source: Bosque Systems, LLC
South Cana Water Handling Project
Newfield SWD Well Facility Layout
Newfield SWD Well Facility
Granite Wash Example Completion (2 Well Pad)

- Frac water requirement – 800,000 bbls
- Closest recycle water pit – 300,000 bbls
- Closest fresh water pit – 120,000 bbls
- To move water to the right place at the right time required:
  - 14 transfer pumps
  - 16 miles of 8” poly
  - 10 miles of 4” poly
  - 2 miles of 10” aluminum
K Pad 800,000 bbl
Primary Water Source 300,000 bbl
Standby Water Source 120,000 bbl

4” Poly Pipe
8” Poly Pipe
8” Poly Permanent Pipe
10” Irrigation Pipe

Fresh Water Pits
Recycle Water Pits
How Much Water Newfield Recycled

During the Last 5 years Newfield’s Britt Ranch Fracturing Operations

50 Million Barrels Fresh Water Saved

and

$ 250 Million Saved
Questions!?!?!?

THERE IS NO LIFE WITHOUT WATER.

BECAUSE WATER IS NEEDED TO MAKE COFFEE.