Challenges in Water Management Solutions in the Lee-Hendry County Regional Solid Waste Disposal Facility

Solid Waste Association of North America (SWANA) Conference
February 24th, 2024

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Outline

- History of Injection Wells in Florida
- Introduction to the Facility
- Rehabilitation
  - Well integrity
  - Permitting challenges
  - Regulatory Compliance
- Questions

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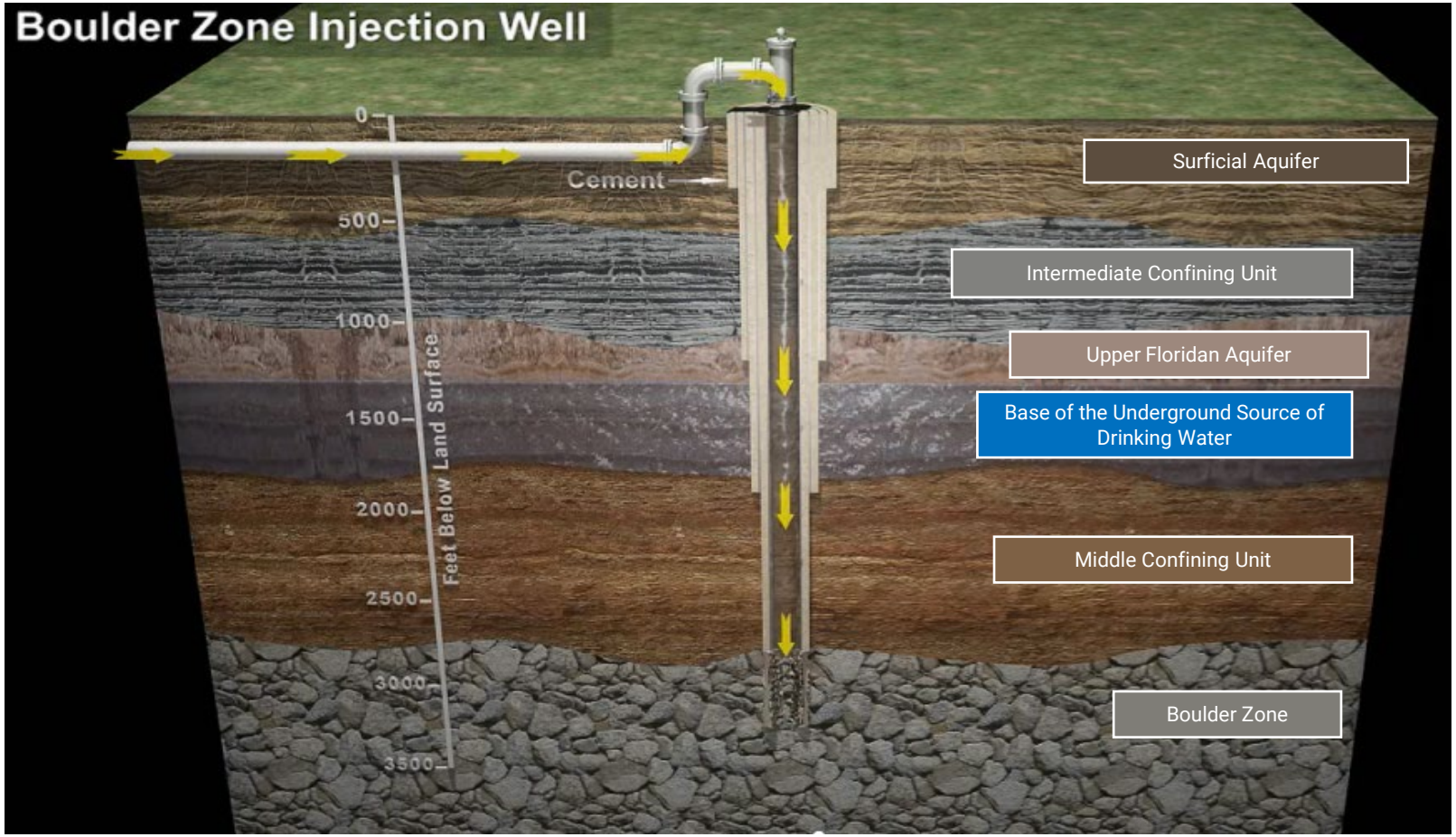
What is an Injection Well system?



- Used to place fluid underground into porous geologic formations
- Injected fluids may include water, wastewater, brine (salt water), or even leachate.
- Telescopic design to protect the different existing aquifers

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Why Injection Wells?

- **Concerns about the environmental and public health impacts** of open ocean, estuarine, and inland surface water discharges.
- **Regulatory environment moving more away from surface water discharge**, demand for efficient wastewater management, and the need to sustain groundwater resources.
- **The Floridan Aquifer System is the main source of freshwater** for agricultural, irrigation, industrial and public water supply in Florida, Georgia and parts of Alabama and South Carolina (Williams and Kunianski, 2016)
- Florida has also experienced **significant population and demand growth in recent years.**
- **Favorable geologic and subsurface conditions across the state**

Boulder Zone

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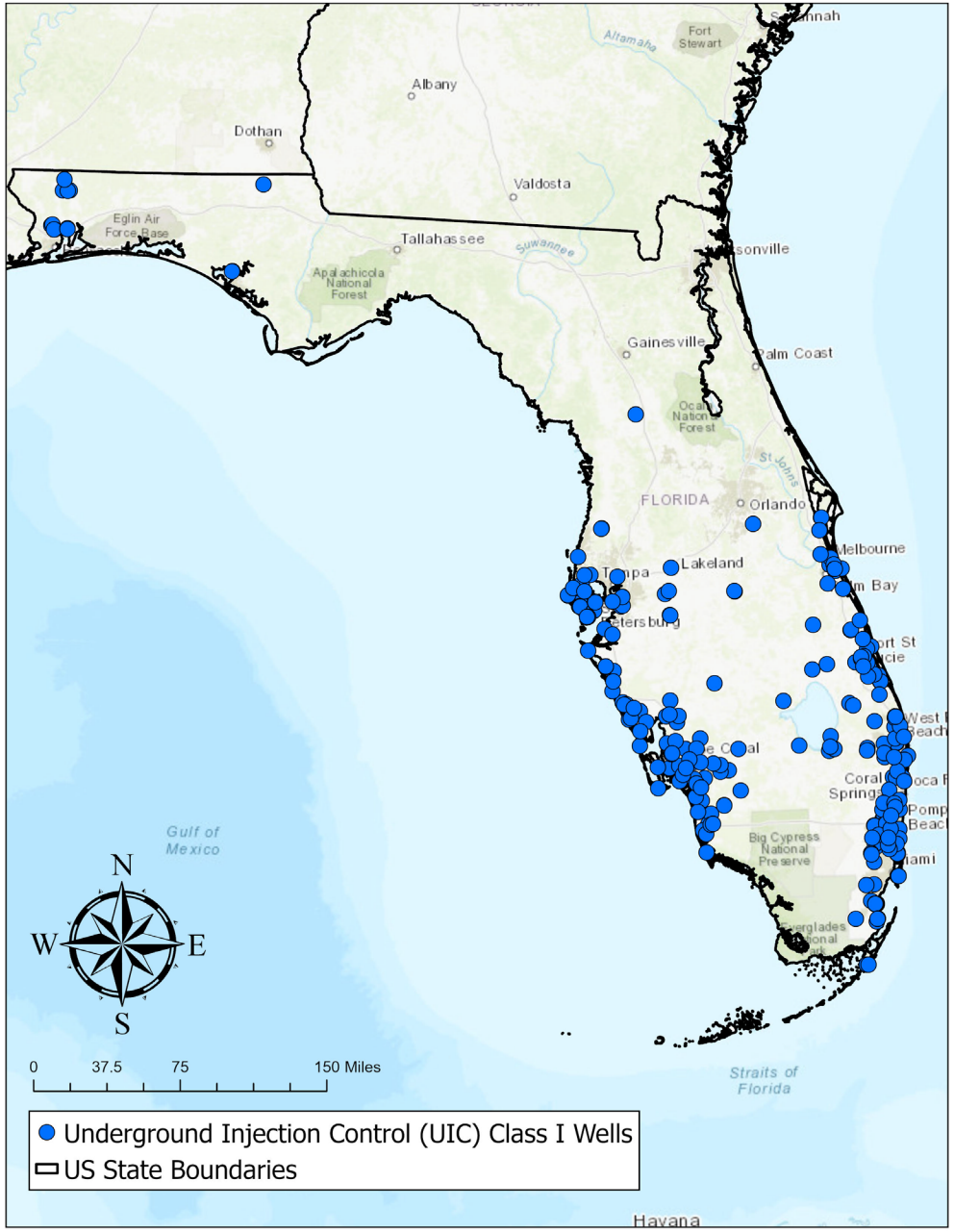
Why Injection Wells?

- Nowadays, approximately 800 operational injection wells exist in the United States, with **270 of these wells being in the state of Florida** (EPA, 2024).

- 231 “Active” Wells (FDEP database)

- Proven to be a **technologically feasible alternative of water disposal**, being designed to prevent impacts on Florida’s underground source of drinking water.

- Ensuring these wells are **actively monitored and being responsive to changes** is crucial for their efficient operation and environmental safety.



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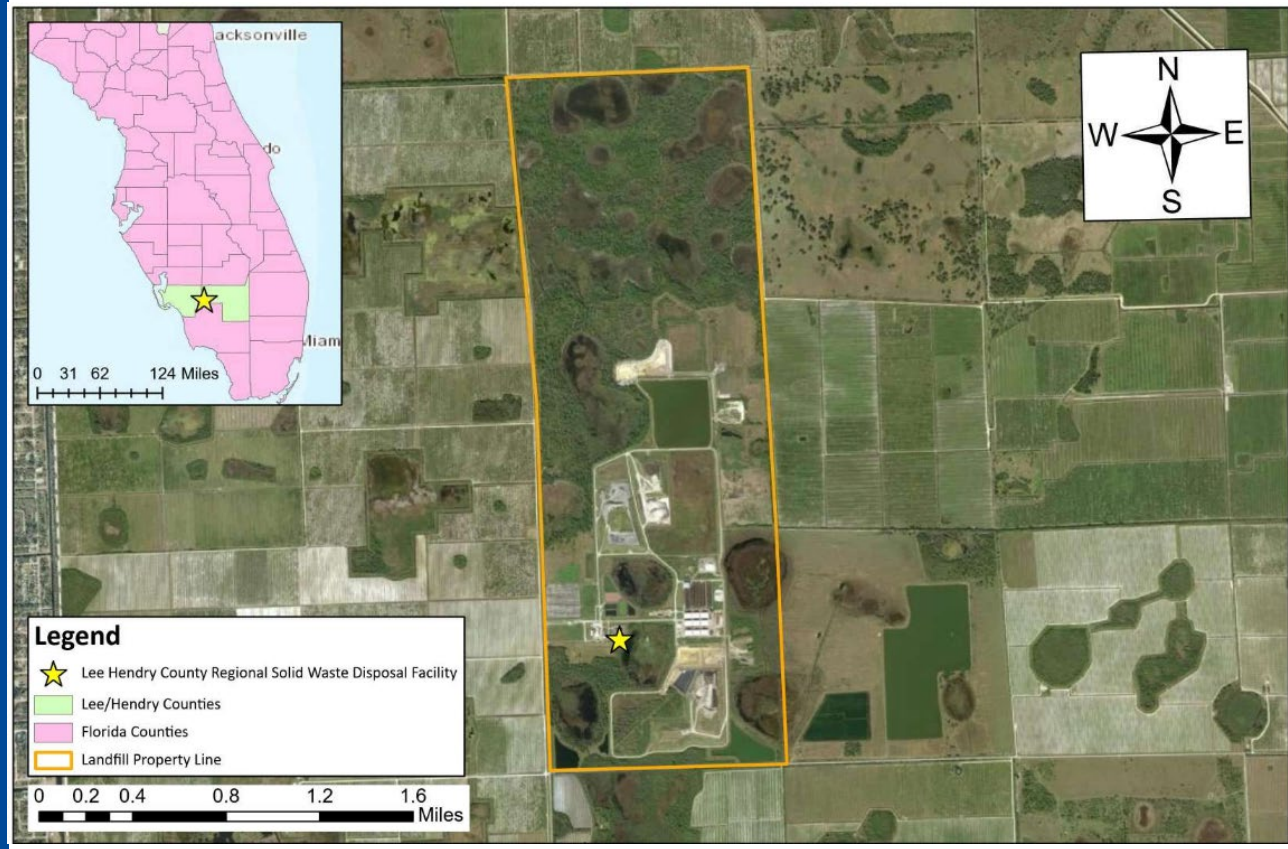
History of the Facility

- The facility was developed pursuant to an Interlocal Agreement with Hendry County for solid waste management and disposal.
- Class III Landfill, the Class I Landfill and the Class I Ash Monofill to collect non-hazardous leachate.
- The leachate is transferred and mixed into the injectate/leachate pond for disposal in the Facility's deep injection well.
- The Lee County Solid Waste Department (SWD) is responsible for operation of the Facility.



Lee County Solid Waste

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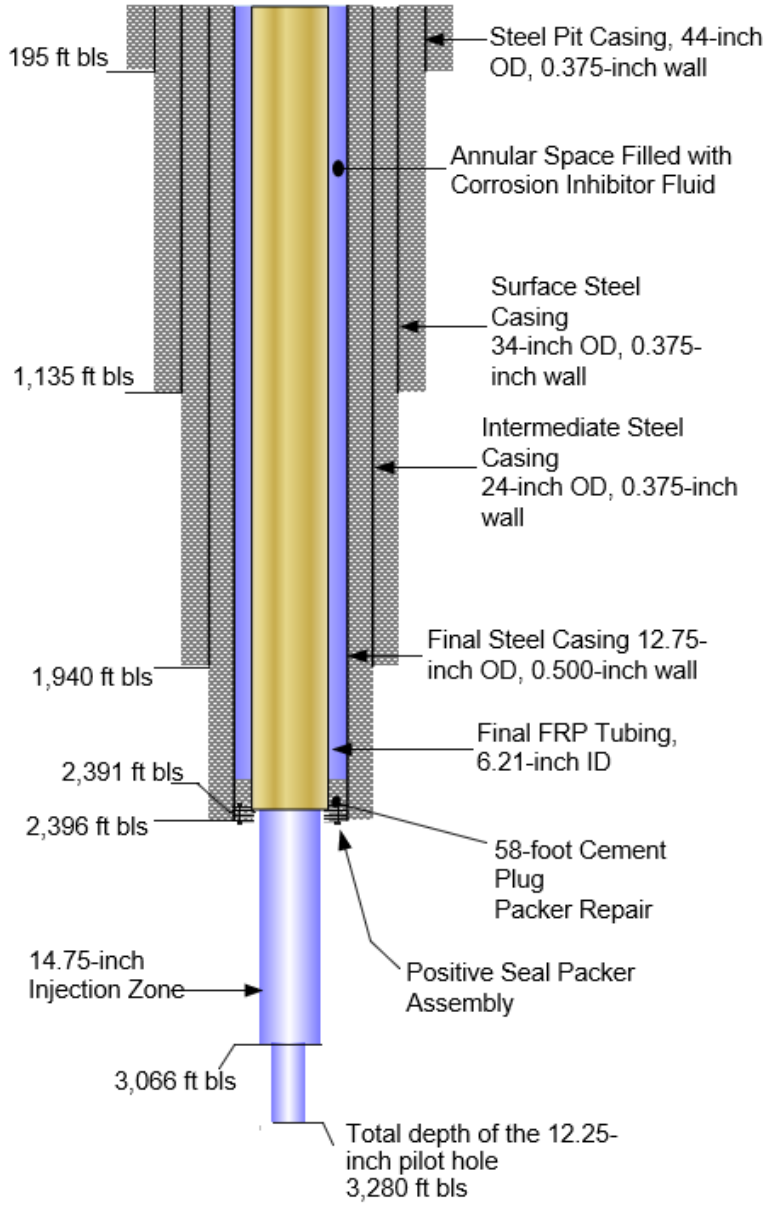
History of the Facility

- **Number of injection wells:** One (1) Industrial Injection Well
- **Well capacity (volume injected):** 1.32 MGD
- Constructed in year 2011
- Fluid-filled annular space



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History of the Facility

- Fluid-filled annular space with water containing a corrosion inhibitor solution (**1% Baracor**)
- Annulus pressure system provides pressure equalization in the annulus between the injection tubing and final casing
- Consists of an annulus pressure tank and two nitrogen cylinders.

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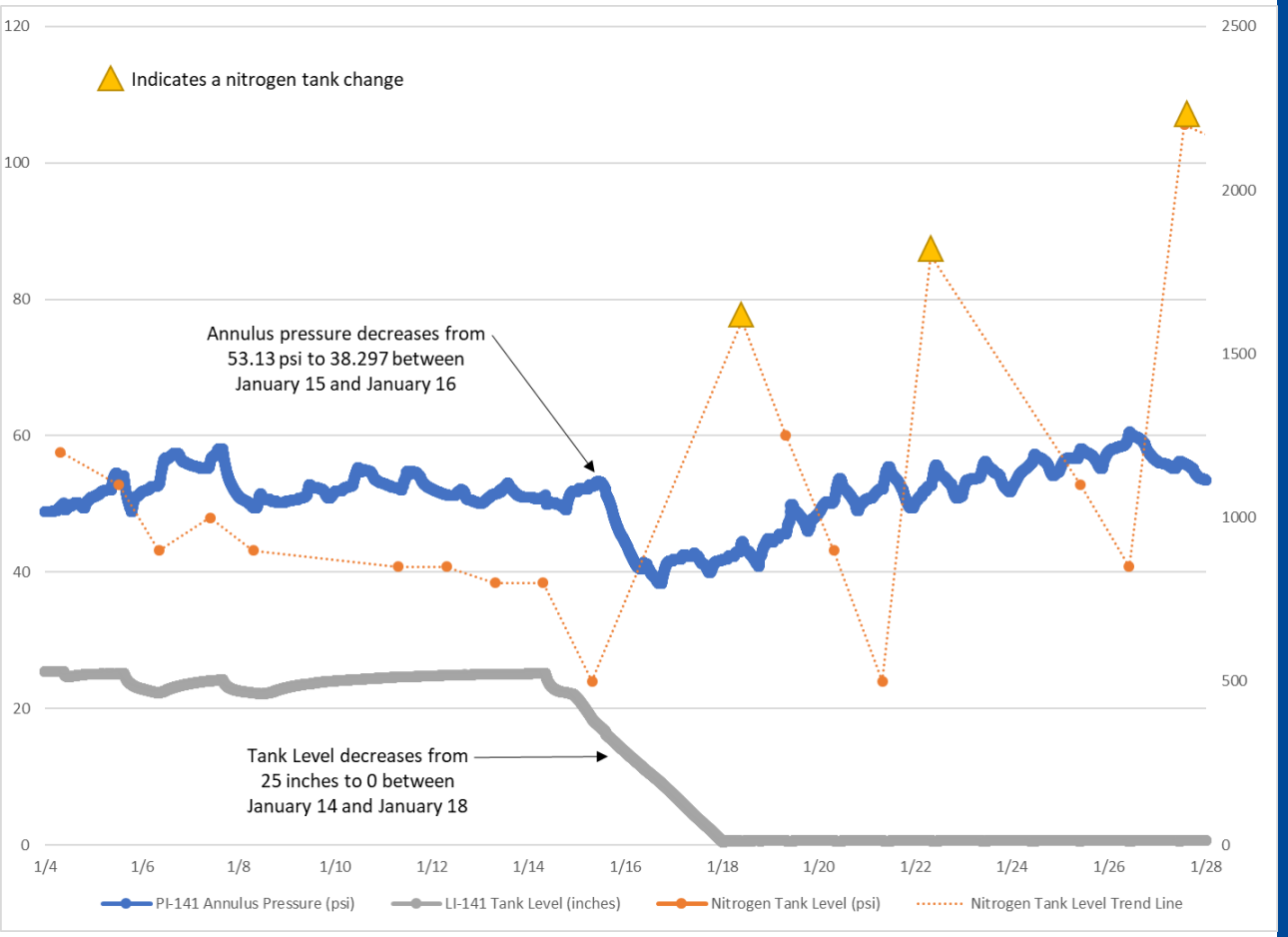

Assessing Injection Well

- An annulus fluid loss was experienced between January 15 and January 16, 2021.
- By January 18, 2021, all the 1% Baracor was lost.
- Increased Nitrogen usage.

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Well Integrity and Permitting Challenges

- Development of a thorough Testing and Rehabilitation Plan
- Working closely with the Florida Department of Environmental Protection (FDEP) to restore the well's functionality.

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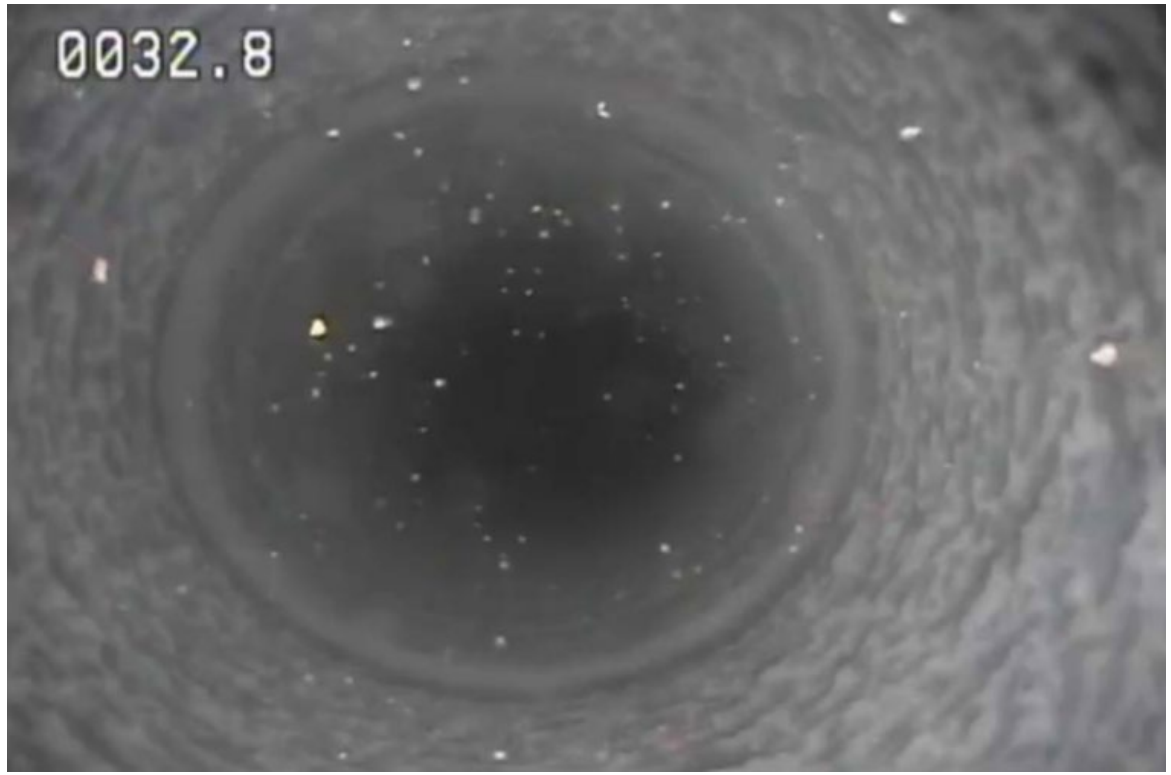
Well Integrity – Video survey

- No evidence of deterioration was visible.
- Findings discussed in a meeting between FDEP, Solid Waste Department and Black & Veatch.

Bottom of the 6.21-inch FRP



FRP Tubing joints

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Well Integrity – Injection Testing Attempt

- Annular space filled with water
- Nitrogen gas replaced with water inside the annular tank
- Annulus pressurized to 100 psi
- 24-hour monitoring period

- **Before injection started:**
  - Gradual decrease in pressure
  - 50 psi of nitrogen were used
  - Injection test ultimately aborted.

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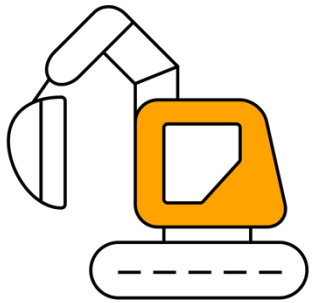
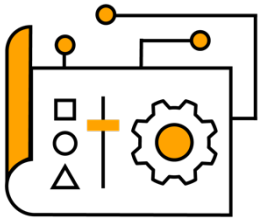
Back to the Drawing Board

- All Above ground system was isolated and tested.
  - No leaks or failures detected.

- **Development a 3-step approach** to test the FRP Tubing and annular space.
  1. Internal FRP Pressure test
  2. Repair the injection well
  3. Evaluate mechanical integrity after rehabilitation

- Working plan was submitted and approved by FDEP





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1. Internal FRP Pressure test

- Packer was lowered and installed inside the FRP Tubing.
- FRP tubing was pressurized to 201 psi
  - After 1-hour monitoring period, final pressure was 210 psi
  - 4.5% variation from initial pressure
- **Pressure test was successfully completed** within the 5-percent tolerance established by the FDEP permit and FAC Chapter 62-528.
- FDEP representatives witnessed the test.

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2. Rehabilitation - Cementing

- Elimination process led to the conclusion that **the leak came from the annular space**.
- March 18, 2021
  - Cementing tubing was lowered inside the annular space.
  - Hard tag the positive seal packer element to verify installation depth.
  - A total of 4.3 barrels of neat cement were pumped.

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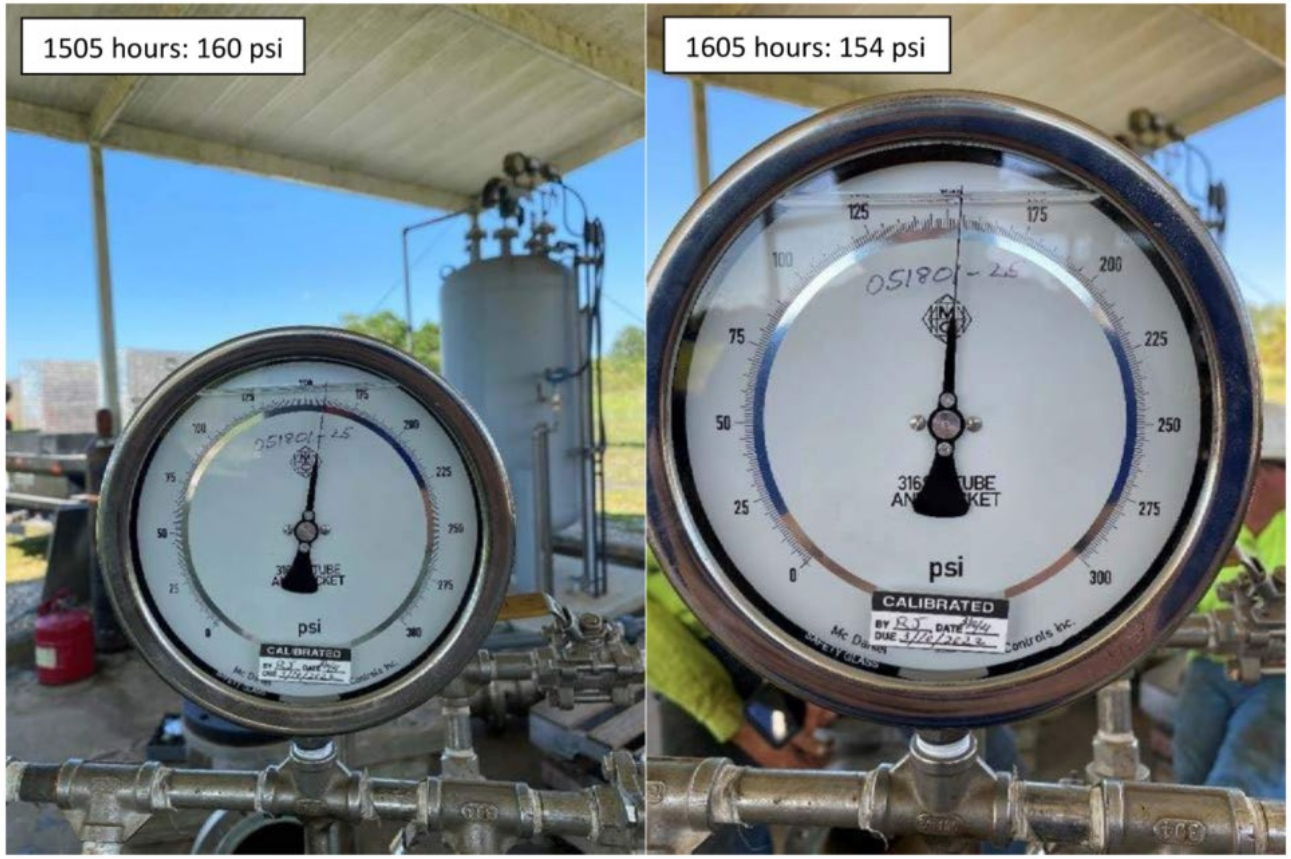
2. Rehabilitation – Pressure Testing

- March 19, 2021
  - Cement hard tagged
  - Total of 58-foot lift.

  - Annular space was pressurized to 160 psi
    - After 1-hour monitoring period, final pressure was 154 psi
    - 3.75% variation from initial pressure
    - **Pressure test was successfully completed** within the 5-percent tolerance established by the FDEP permit and FAC Chapter 62-528.



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3. Mechanical Integrity Evaluation

- Annular space was filled with 1% Baracor Solution

- MIT was conducted
  - Video survey
  - Annular pressure test
  - RTS and an HRT logs

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Permitting challenges & Regulatory Compliance

- **Evaluation and Rehabilitation Summary Report submitted to FDEP**

- Closely working with the FDEP to restore well's functionality
- Establishing a good working relationship

- This joint effort not only ensured the well's continued operation but also maintained full regulatory compliance, exemplifying a shared commitment to sustainable water management solutions.

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Discussion

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