

# Assessment of a Glass-Lined Digested Sludge Force Main

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# Assessment of a Glass-Lined Digested Sludge Force Main

## Agenda

- \* Typical challenges with inspecting force mains
- \* Remote Field Testing Electromagnetic Technique (RFT) overview
- \* How to inspect a force main
- \* Case Study:
  - \* 1.67 mile 8-inch FM Inspection for Nashville (TN) MWS



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# Assessment of a Glass-Lined Digested Sludge Force Main

- \* Difficult to Inspect

- \* Long, partially surcharged/static head, defects not visible
- \* Often no existing pigging infrastructure

- \* How can we inspect a force main and what do we want?

- \* In-Line RFT EM
- \* Location, size and depth of defects



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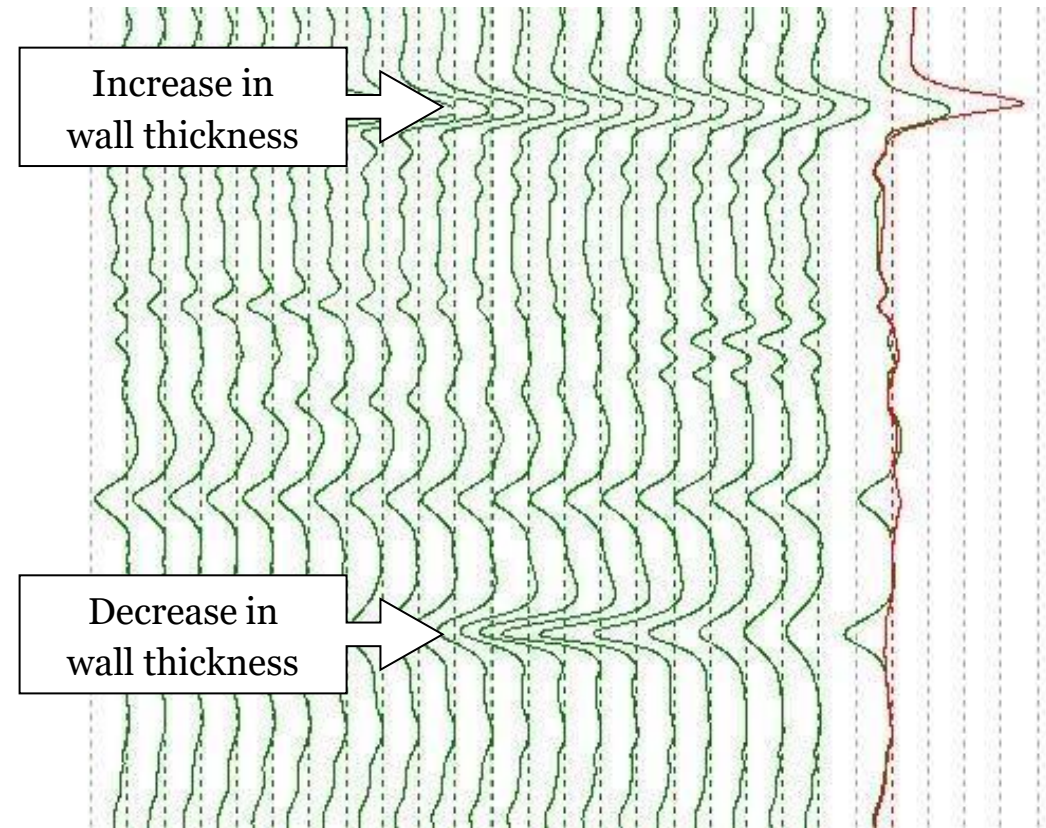
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# Assessment of a Glass-Lined Digested Sludge Force Main



Versus



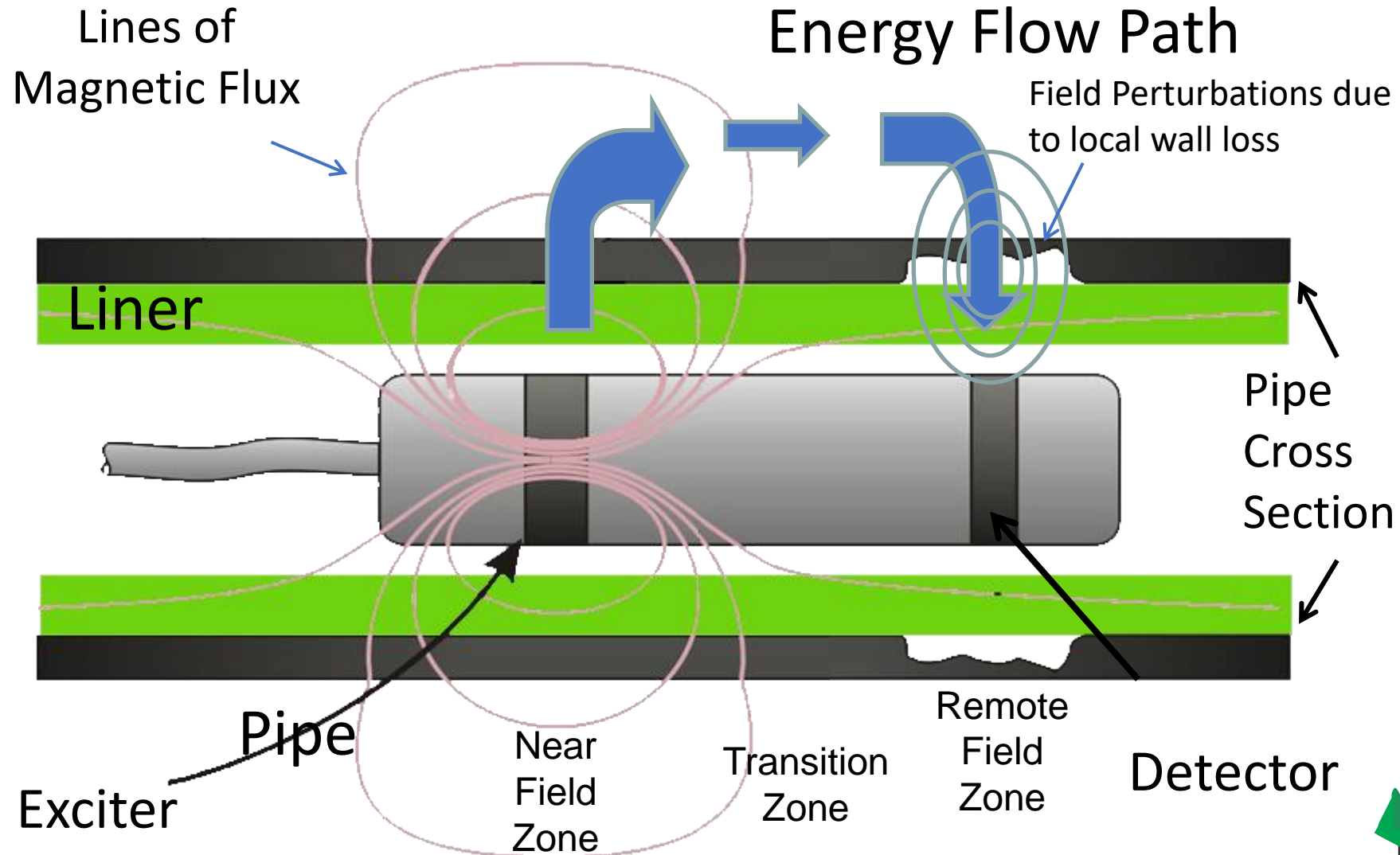
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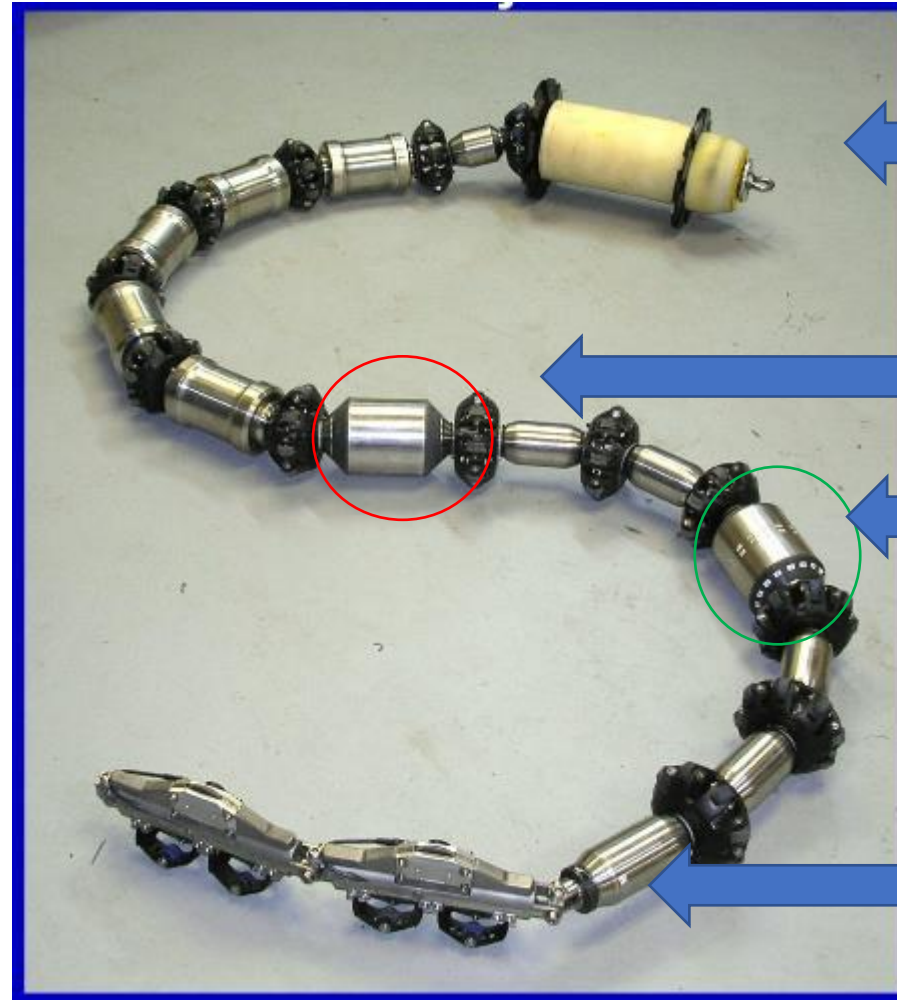
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# Assessment of a Glass-Lined Digested Sludge Force Main

## Why RFT?

- Validated as accurate
- Repeatable
- Does not require couplant
- Does not require contact
- Full Bore/Cleaning



Tow Pig

Exciter

Detector

Odometer



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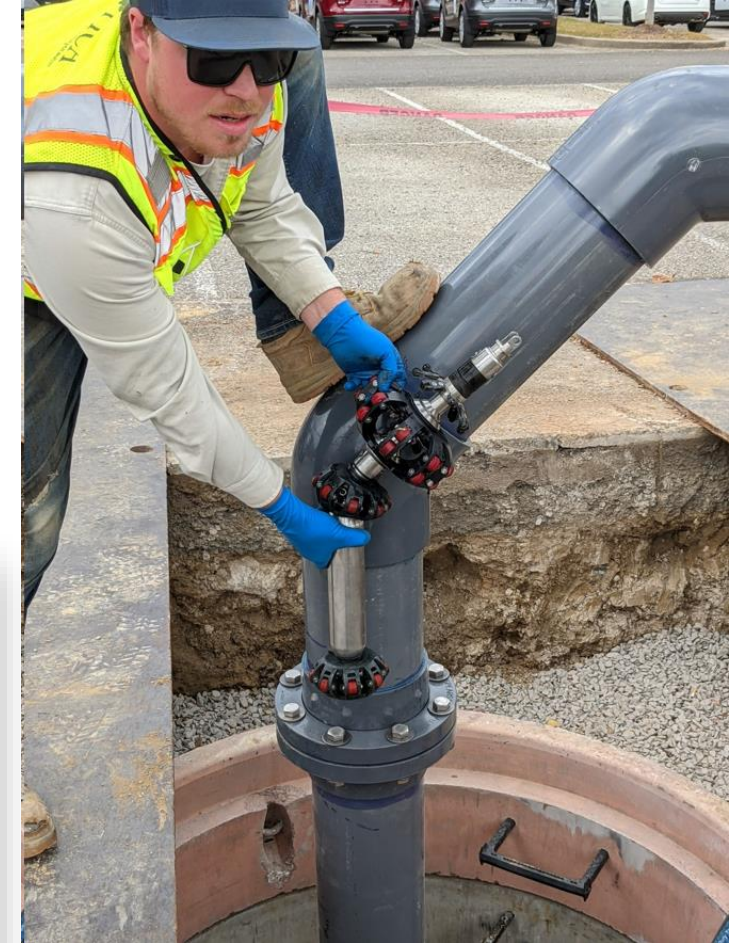
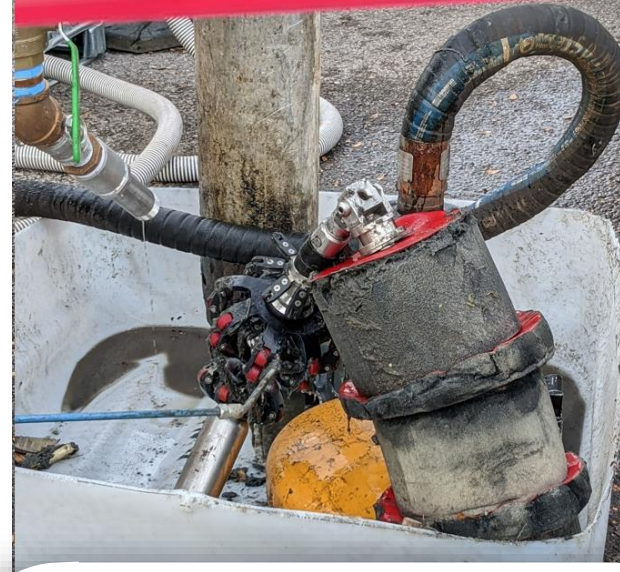
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# Assessment of a Glass-Lined Digested Sludge Force Main

## How to Inspect:

1. Ensure line is “pigable”
2. Clean with progressive pigging
3. Gauge/Prove bore restrictions
4. Scan with RFT EM Tool
5. Validate/Repair/Replace



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Nashville Metro Water Services

### 4.7-mile 8" Whites Creek DIP Sludge Force Main Inspection

- November 30 – December 2, 2021
- Nashville, TN
- Inspected 1.6 miles of 4.7 miles (valves)
- The longest section of pipe with minimal valves replacements and the areas with the most breaks was selected. Area of interests included an old landfill (Soccer fields after the golf course) with corrosive soils.



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Overview 8" Whites Creek DIP Sludge Force Main Inspection

- November 30 – December 2, 2021
- Pump: Progressive Cavity Pump
- 8-inch DIP sludge forcemain
- Total Length: 24,777 LF; Inspection Length: 8,845 LF
- Installed in 1973
- Multiple peaks and valleys
- It has never been mechanically cleaned or inspected. Operators flush the line with plant water after each use.
- Launch barrel at Ted Rose Golf Course & receive barrel in manhole at Downtown Nissan parking lot.



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Overview 8" Whites Creek DIP Sludge Force Main Inspection

- Previous breaks in force main occurred in highly congested areas and golf course.
- MWS addressed clogging issues by using higher pressures and plant water to push the clog through.



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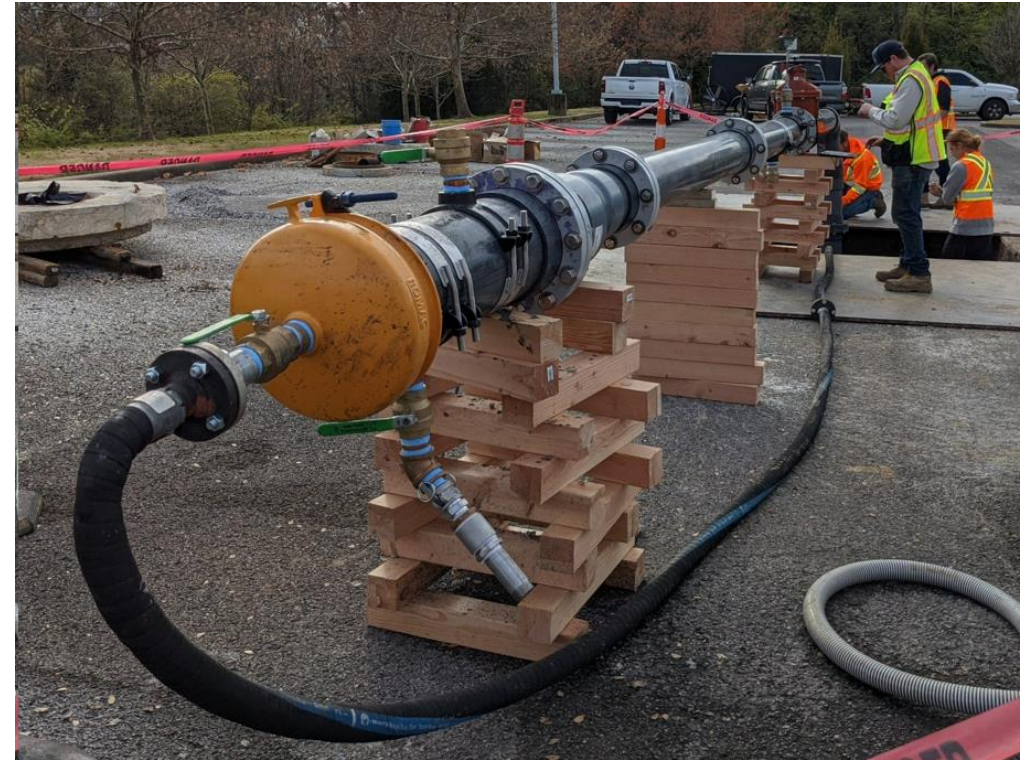
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# Assessment of a Glass-Lined Digested Sludge Force Main

## Overview 8" Whites Creek DIP Sludge Force Main Inspection

- Launch site was approximately 13,000 LF from the treatment plant.
- 10" launch barrel installed prior to PICA arrival, connecting to the force main through a wye fitting.
- Used plant water, treated plant effluent (non-potable), to propel tool.
- Had to monitor/communicate pressures at both the progressive cavity pump and launcher to ensure there was enough pressure to move the instrument through the launcher and receivers 45-degree bend without blowing the pipe by the plant.
- Low flow rates < 50gpm



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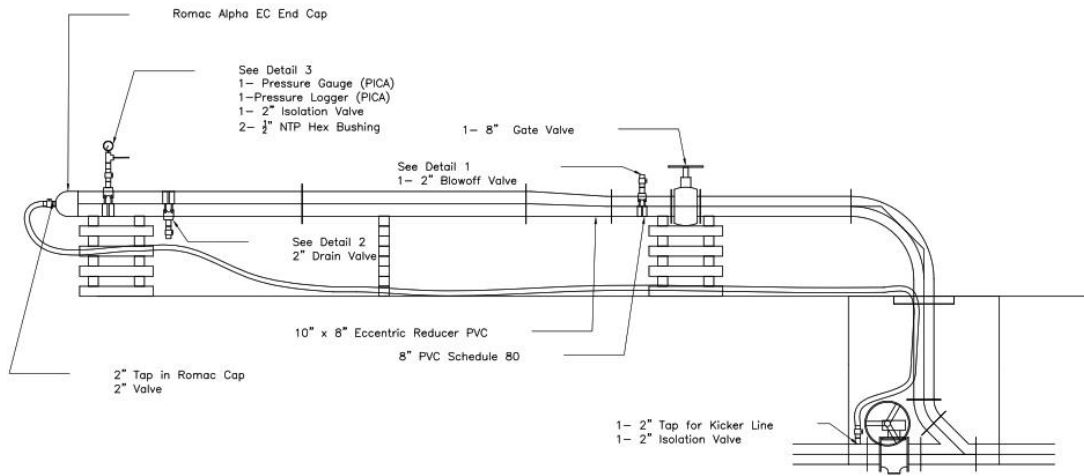
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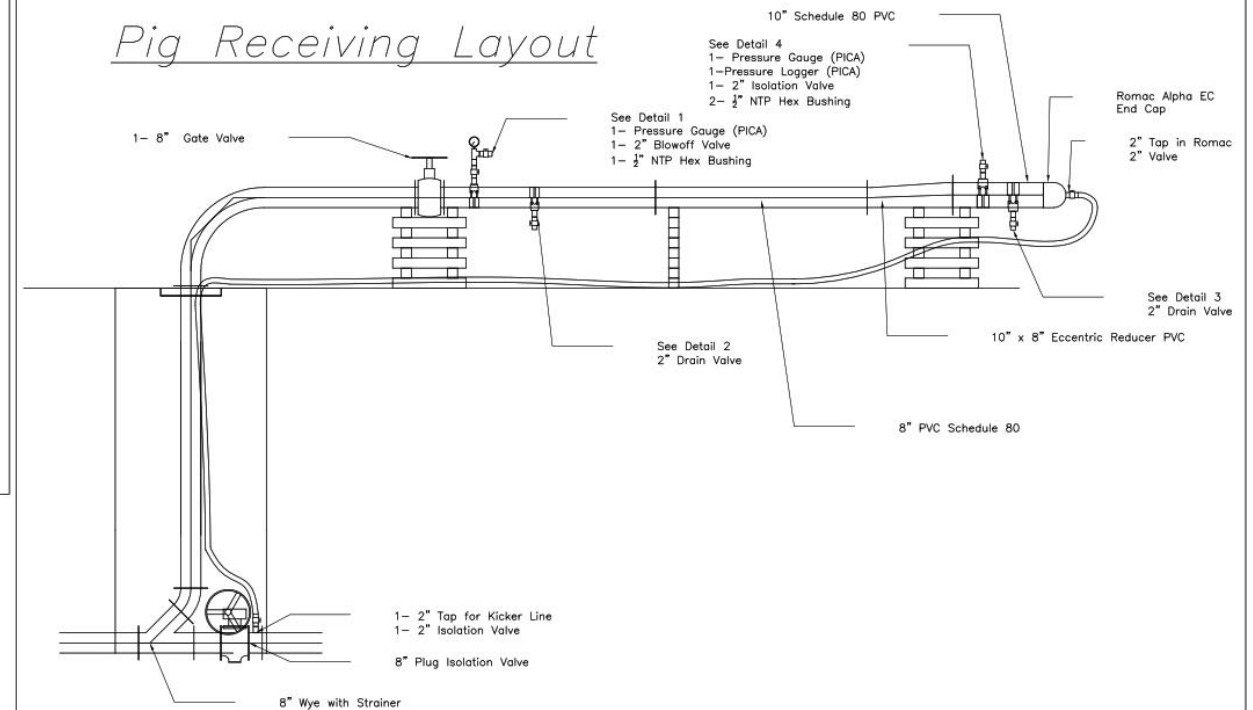


# Assessment of a Glass-Lined Digested Sludge Force Main

## Pig Launching Layout



## Pig Receiving Layout



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Pigging and Proving:

- All pigs were removed in satisfactory condition
- Launched gauge - 4.5 hours
- The gauge plates had minimum bending, indicating no major bore restrictions.
- After the pig and gauge runs Nashville MWS now has a clean pipe!



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Inspecting:

- Morning launch (less demand)
- Mild winter weather



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Inspecting:

- Used plant water, treated plant effluent (non-potable), to propel tool
- Tracked tool
- PICA noticed the tool initially moved through the pipeline faster than expected
- Adjusted to target inspection speed (approx. 17' per minute)



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Inspecting:

- Tracked tool w/ stakes every 500'
- Tracking through the golf course and along densely populated areas



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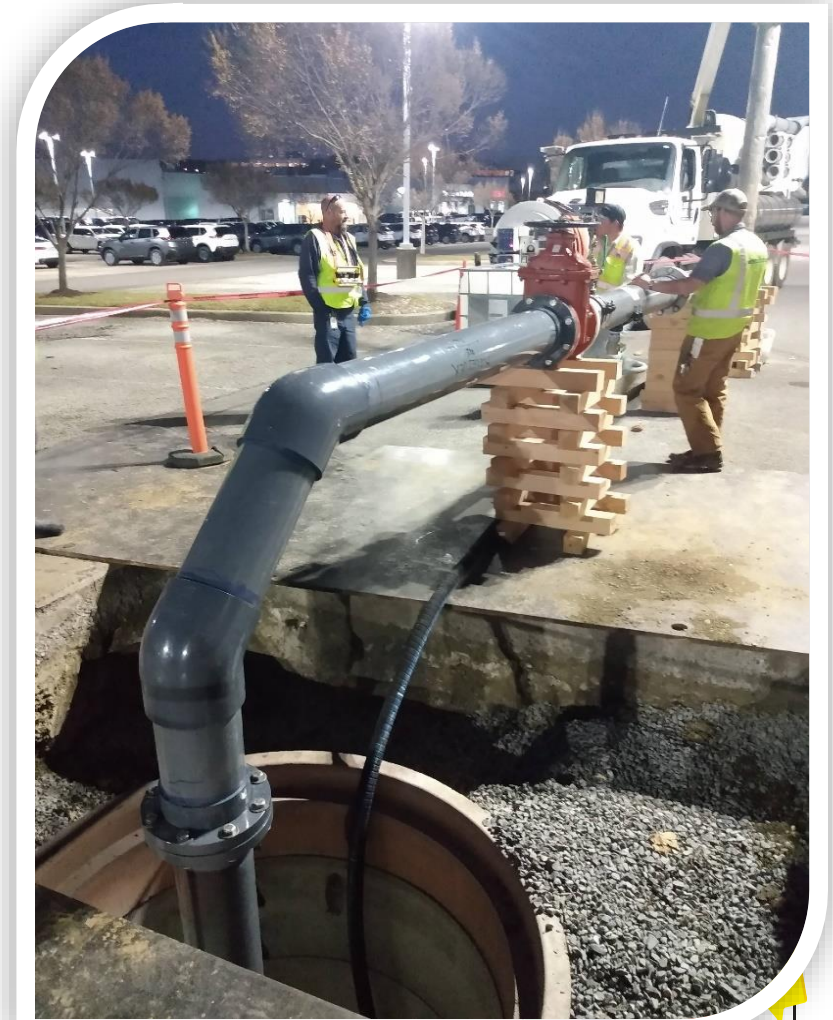




# Assessment of a Glass-Lined Digested Sludge Force Main

## Inspecting:

- Tool arrives – 9 hours



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Results:

- 125 pits

|                          |            |
|--------------------------|------------|
| Total distance inspected | 8,845 feet |
|--------------------------|------------|

|                    |     |
|--------------------|-----|
| # of pipe segments | 505 |
|--------------------|-----|

|                    |     |
|--------------------|-----|
| # of pits detected | 125 |
|--------------------|-----|



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Results:

| Classification            | # of pits in each category | % of total pipeline |
|---------------------------|----------------------------|---------------------|
| Shallow ( $\geq 60\%$ RW) | 61                         | 49%                 |
| Medium (41 – 60% RW)      | 36                         | 29%                 |
| Deep (21% - 40% RW)       | 20                         | 16%                 |
| Advanced ( $< 20$ RW)     | 8*                         | 6%                  |
| Total                     | 125                        | 100%                |

\* Three advanced pits reported as possible through holes with 0% RW.



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Results:

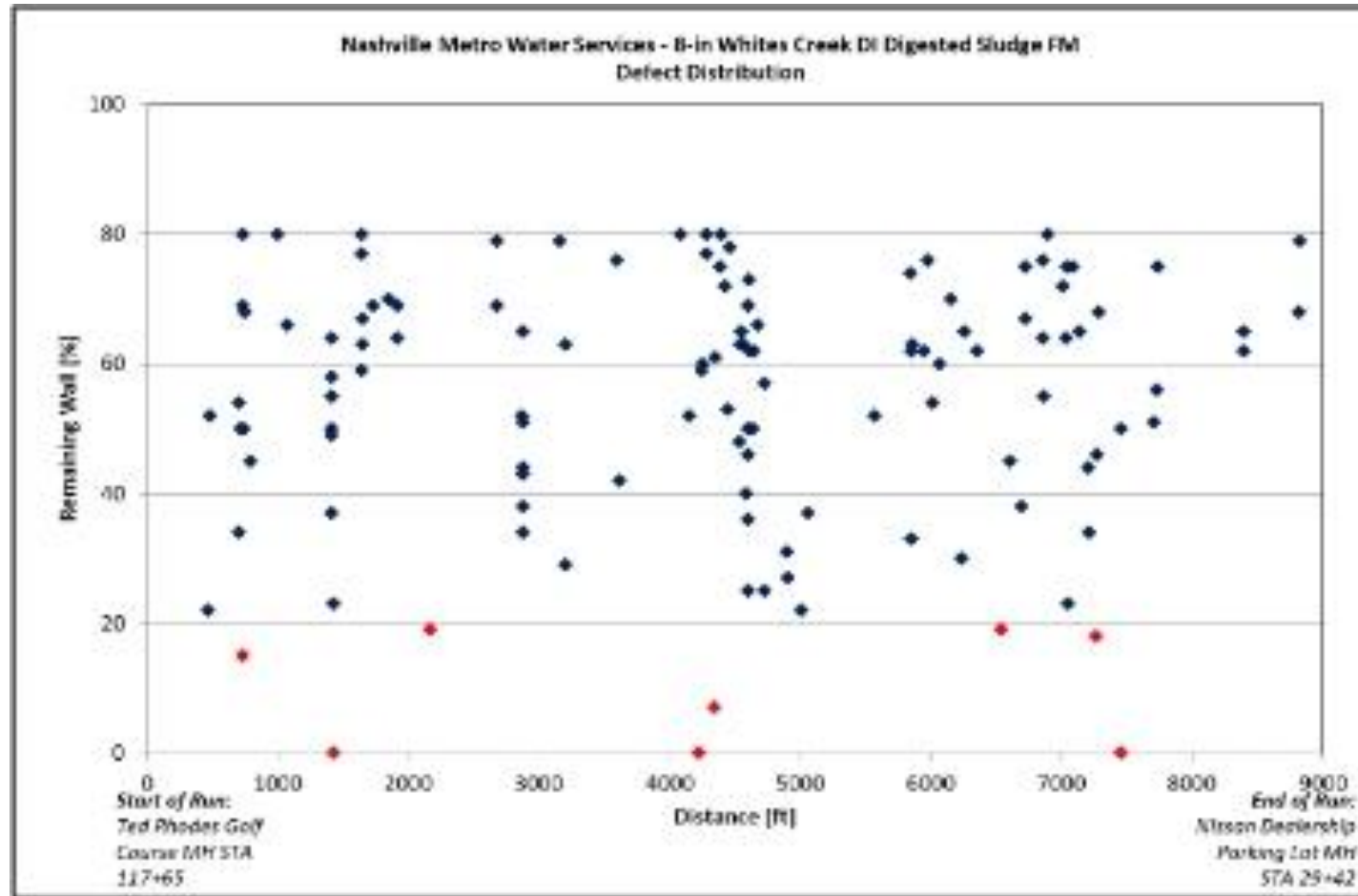


Figure 1. Distribution of localized wall loss with respect to remaining wall for the inspected portion of the 8" Whites Creek DI Digested Sludge Force Main.



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# Assessment of a Glass-Lined Digested Sludge Force Main

Results:

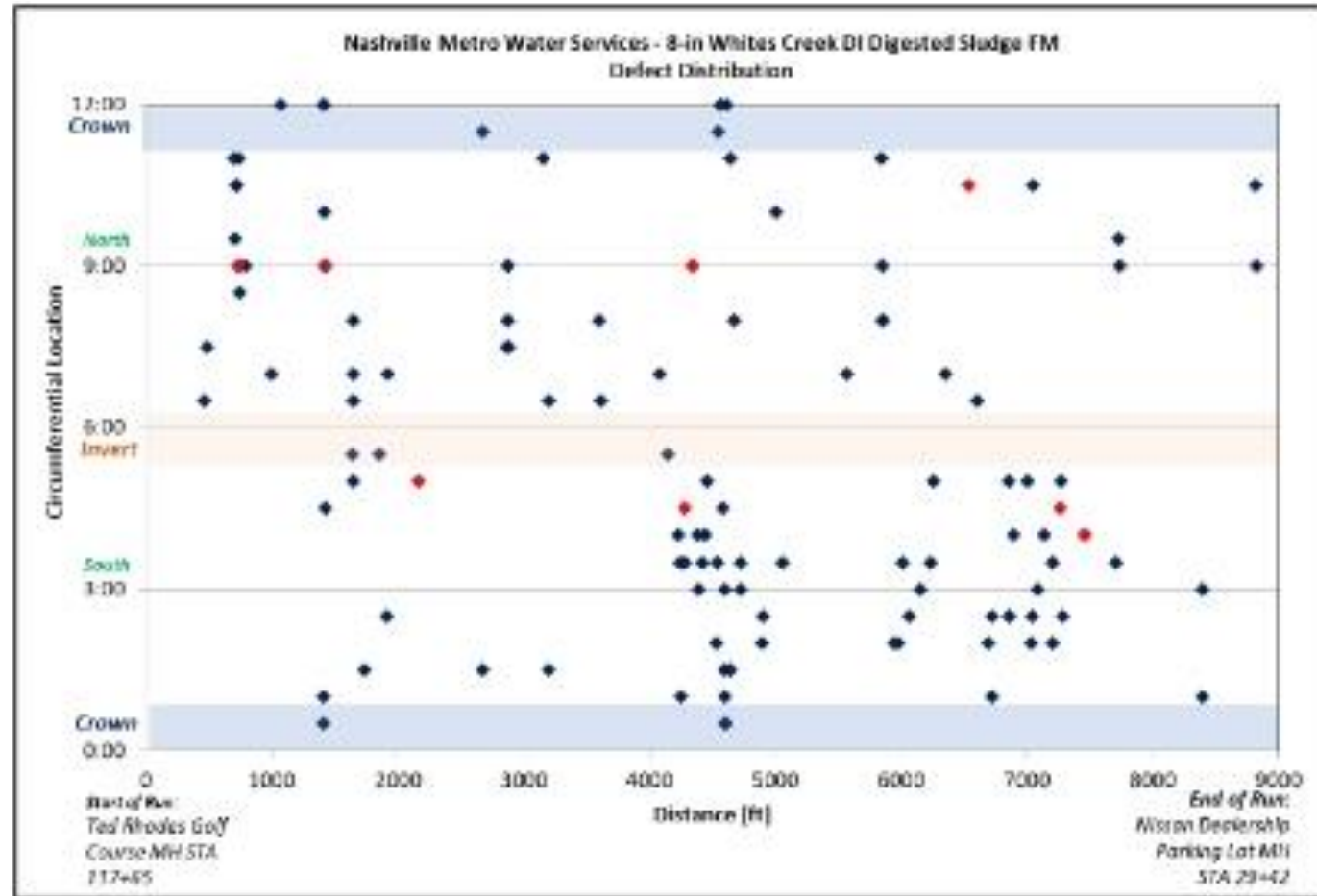


Figure 2. Distribution of localized wall loss with respect to circumferential location for the inspected portion of the 8" Whites Creek DI Digested Sludge Force Main.



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# Assessment of a Glass-Lined Digested Sludge Force Main

## Results:

All corrosion indications were found to be largely isolated, with no individual pipe segments exhibiting heavy concentrations of significant corrosion indications.

Table 4 provides a summary of all pipe segments containing defects measuring  $\leq 20\%$  RW.

**Table 4. Pipe Segments with Defects Measuring  $< 20\%$  RW**

| Pipe Number | Start Location (ft) | End Location (ft) | Number of Possible Through-Holes | Number of $< 20\%$ RW Defects | Total Number of Defects | Comment   |
|-------------|---------------------|-------------------|----------------------------------|-------------------------------|-------------------------|---|
| 0420        | 731.48              | 749.49            | 0                                | 1                             | 5                       |   |
| 0810        | 1,421.16            | 1,439.32          | 1                                | 1                             | 2                       | Possible through-hole (0% RW) at 1,433.80 ft.   |
| 1220        | 2,165.40            | 2,183.63          | 0                                | 1                             | 1                       |   |
| 2370        | 4,224.06            | 4,241.89          | 1                                | 0                             | 1                       | Possible through-hole (0% RW) at 4,225.28 ft.   |
| 2470        | 4,342.74            | 4,361.04          | 0                                | 1                             | 2                       | The significant defect measuring 8% RW at 4,345.67 ft may be a construction feature related to the nearby manhole at STA 73+85. |
| 3730        | 6,540.09            | 6,558.24          | 1                                | 0                             | 1                       |   |
| 4140        | 7,250.84            | 7,268.97          | 0                                | 1                             | 2                       |   |
| 4250        | 7,450.67            | 7,468.89          | 1                                | 0                             | 2                       | Possible through-hole (0% RW) at 7,460.74 ft.   |



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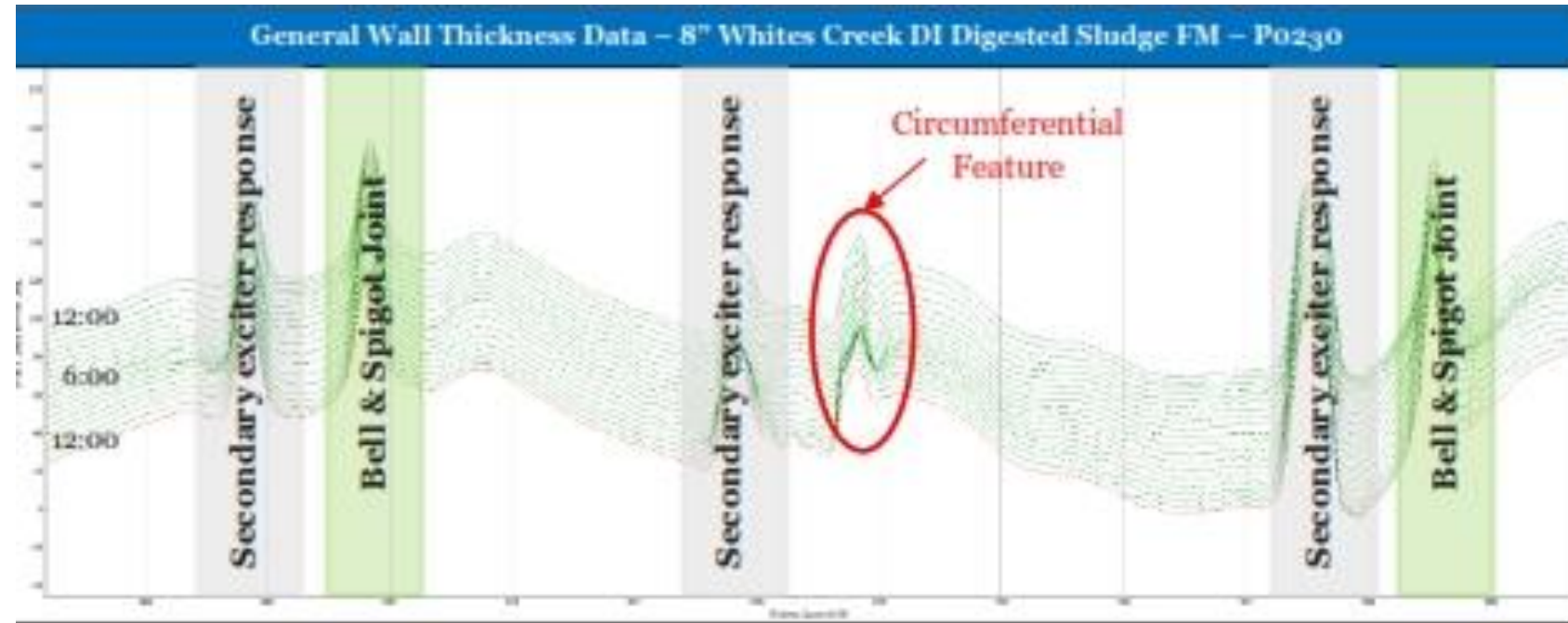
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## Results:

RFT strip chart data highlighting a circumferential signal located in P0230, 397.75 ft from the launch barrel. This signal was unique in the RFT data and did not correlate with any pipeline features in the provided drawing records. PICA suspects the signal is the result of a previous pipeline repair, or undocumented pipeline feature.



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## Next Steps:

### Short Term:

- Targeted replacement of section of pipe with a wall thickness less than 20%, and possibly expand to 40%

### Longer term:

- Force Main Replacement/Relocation with a redundant main.



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Thank you! Questions?

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