UCT The Underground Utilities Event
Underground Construction Technology | January 28-30, 2020 | Fort Worth, TX

**Track I-A**
**Sewer Construction & Rehabilitation**
**(10:30 AM to 10:55 AM)**
**January 28, 2020**

# M-245 48-inch Sanitary Sewer Inverted Siphon Failure

## Partial Collapse of 48-inch Single Barrel Siphon Crossing of the Trinity River Floodway

**Presented By:**

**Chris Brooks, P.E.**

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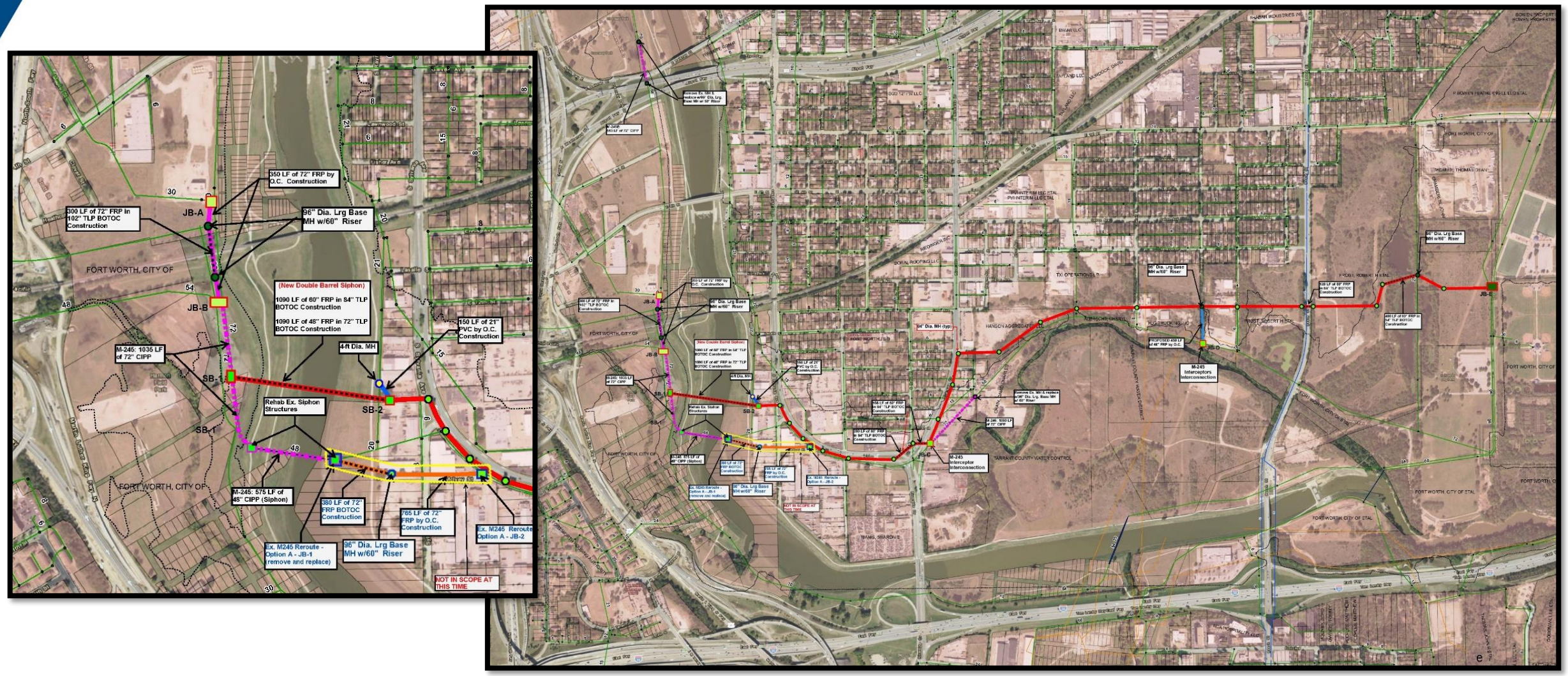
rjngroup Engineering infrastructure for tomorrow

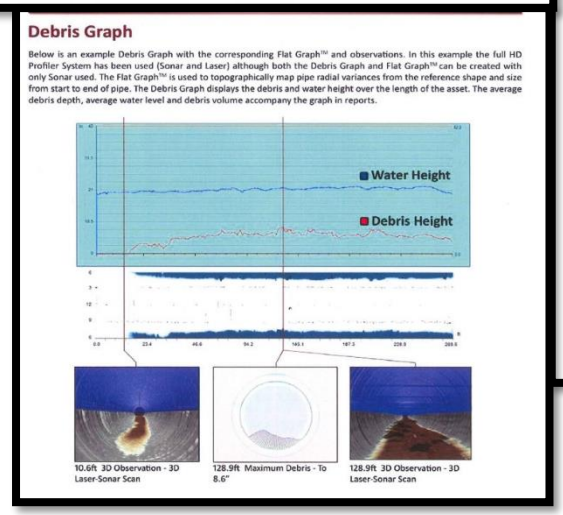
# M-245 Parallel Relief Pipeline Project

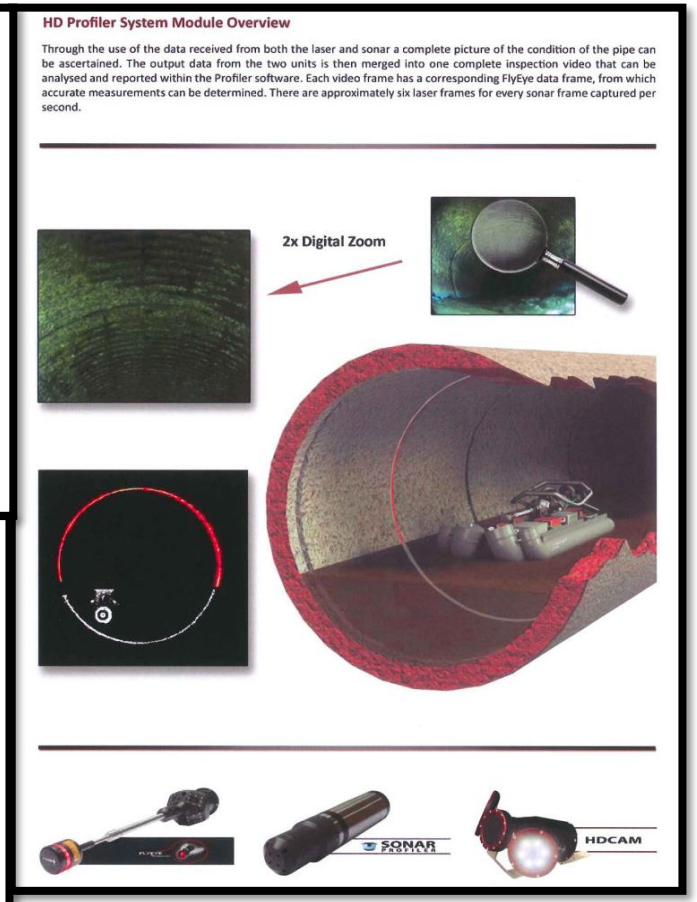


# City of Fort Worth Interceptor Condition Assessment Program

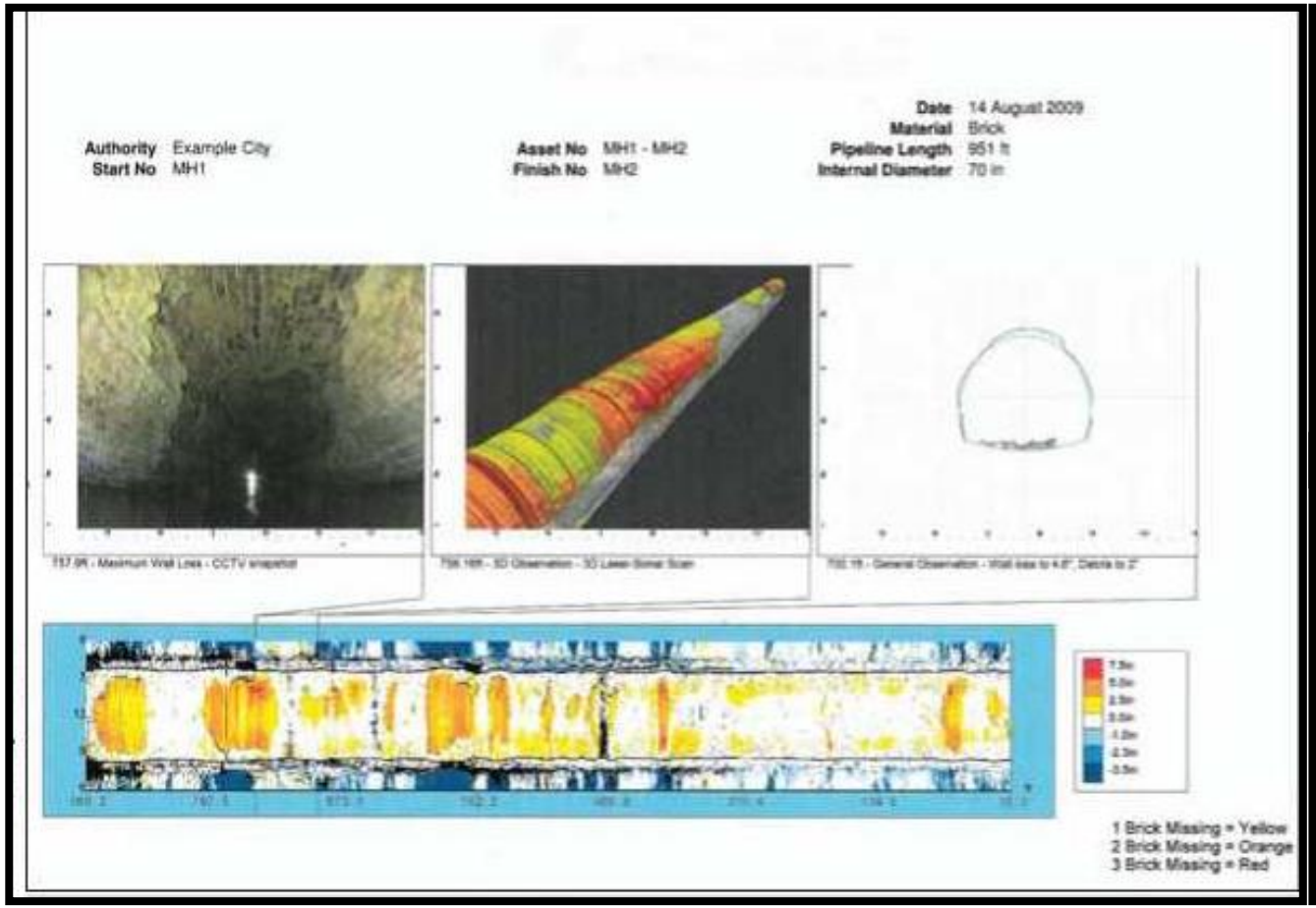
***Proactive Identification of Collection System Risks***

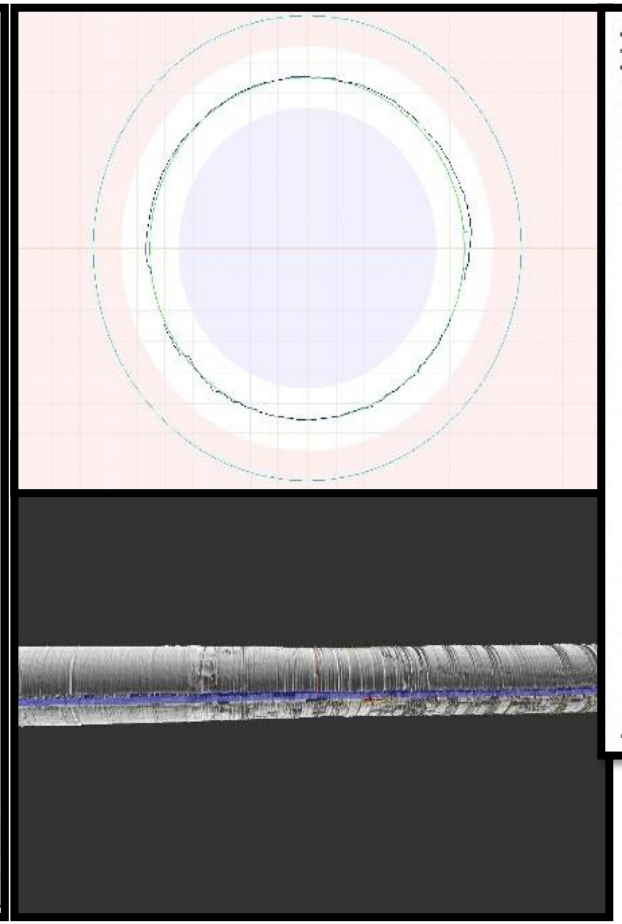
- **ICAP began in 2010 and is Ongoing**
- **Targeted high priority drainage basins in the City – e.g. West Fork Trinity, Village Creek, Big Fossil Creek...**
- **Typically Uses MSI tools (laser, sonar and high definition video) to inspect pipelines.**
- **CUES Fly Eye inspection and evaluation system.**
- **Inspection of Inverted Siphons – *How's it Done?***

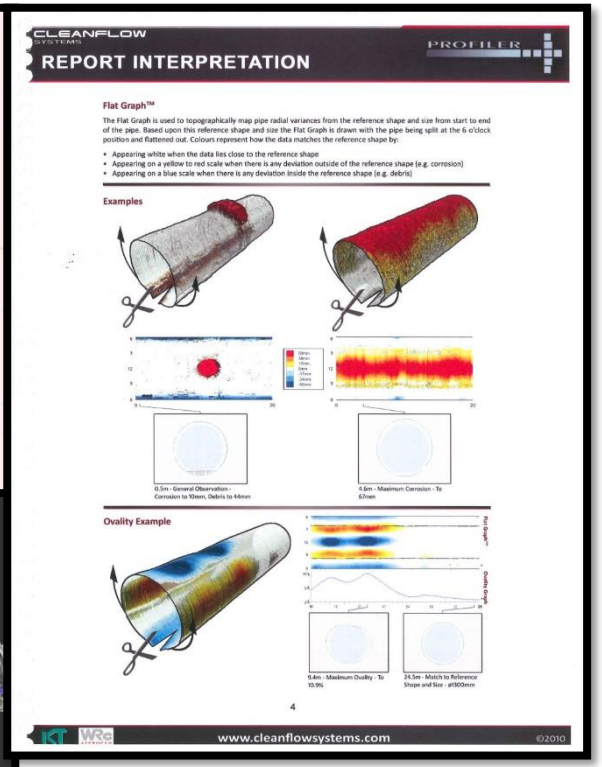



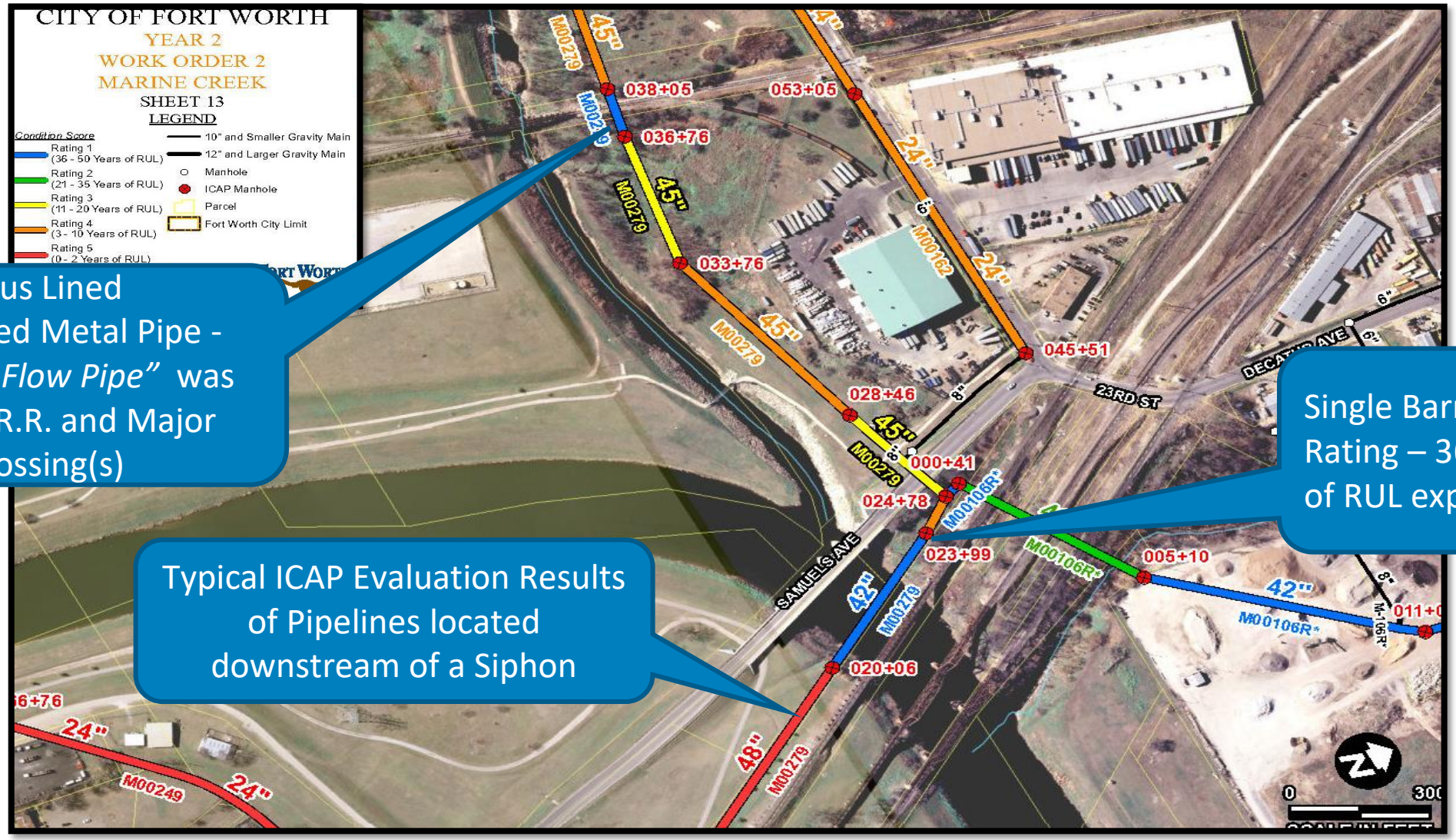
# ICAP MSI Report Exhibits





# ICAP FINDINGS - MSI Report Ratings Exhibits

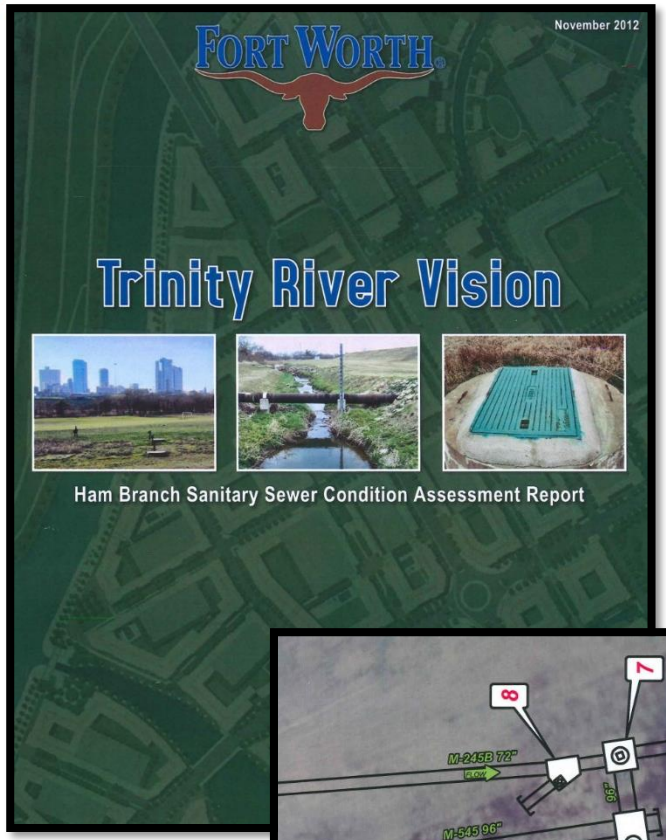


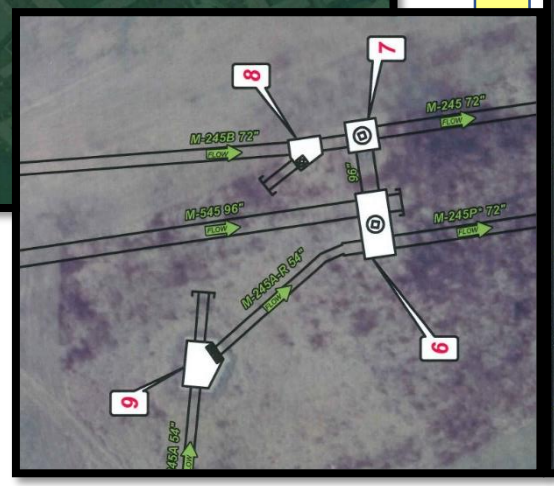

Cementous Lined Corrugated Metal Pipe - *"Smooth Flow Pipe"* was used for R.R. and Major Street Crossing(s)

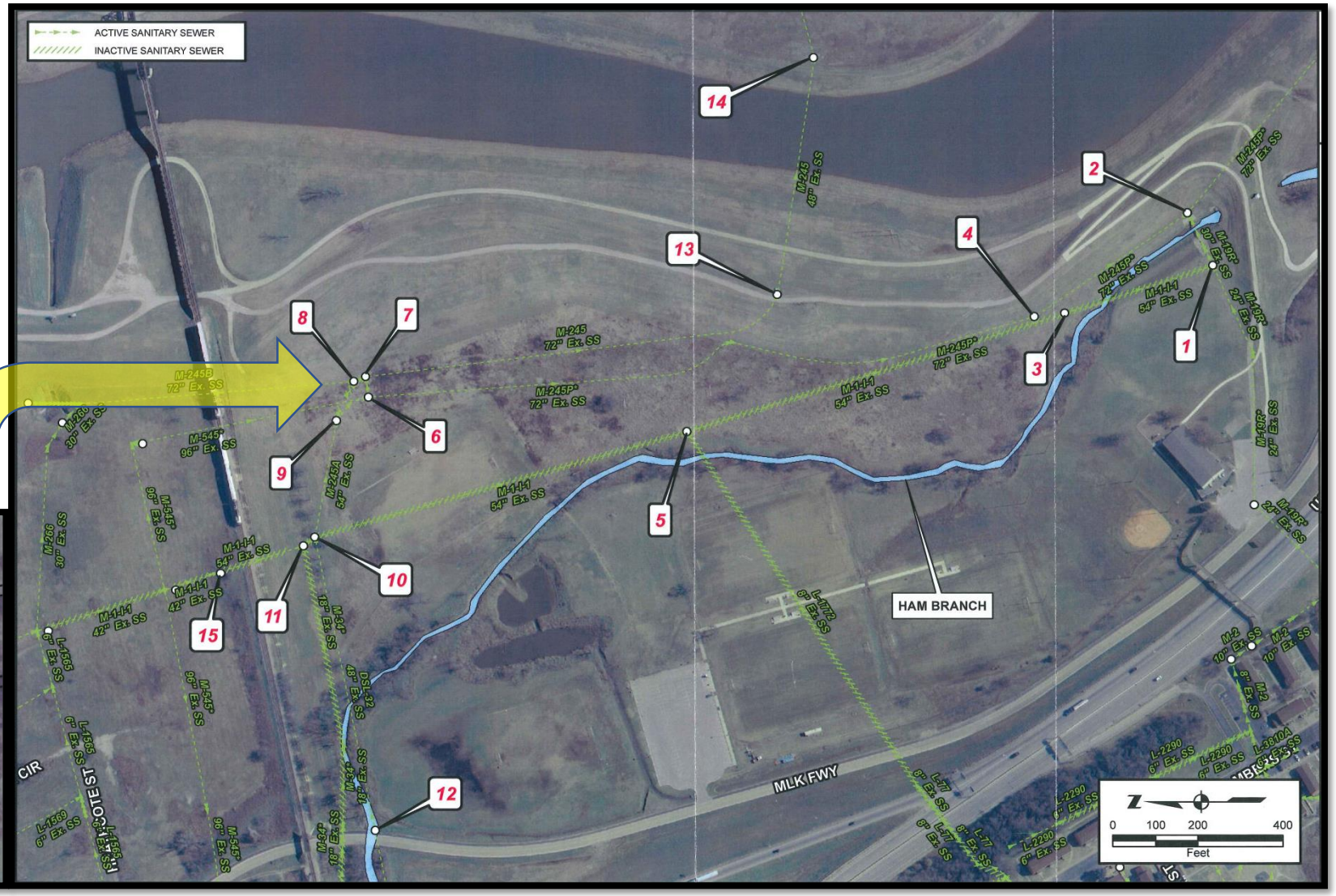
Single Barrel Siphon Rating – 36 to 50 years of RUL expected

Typical ICAP Evaluation Results of Pipelines located downstream of a Siphon

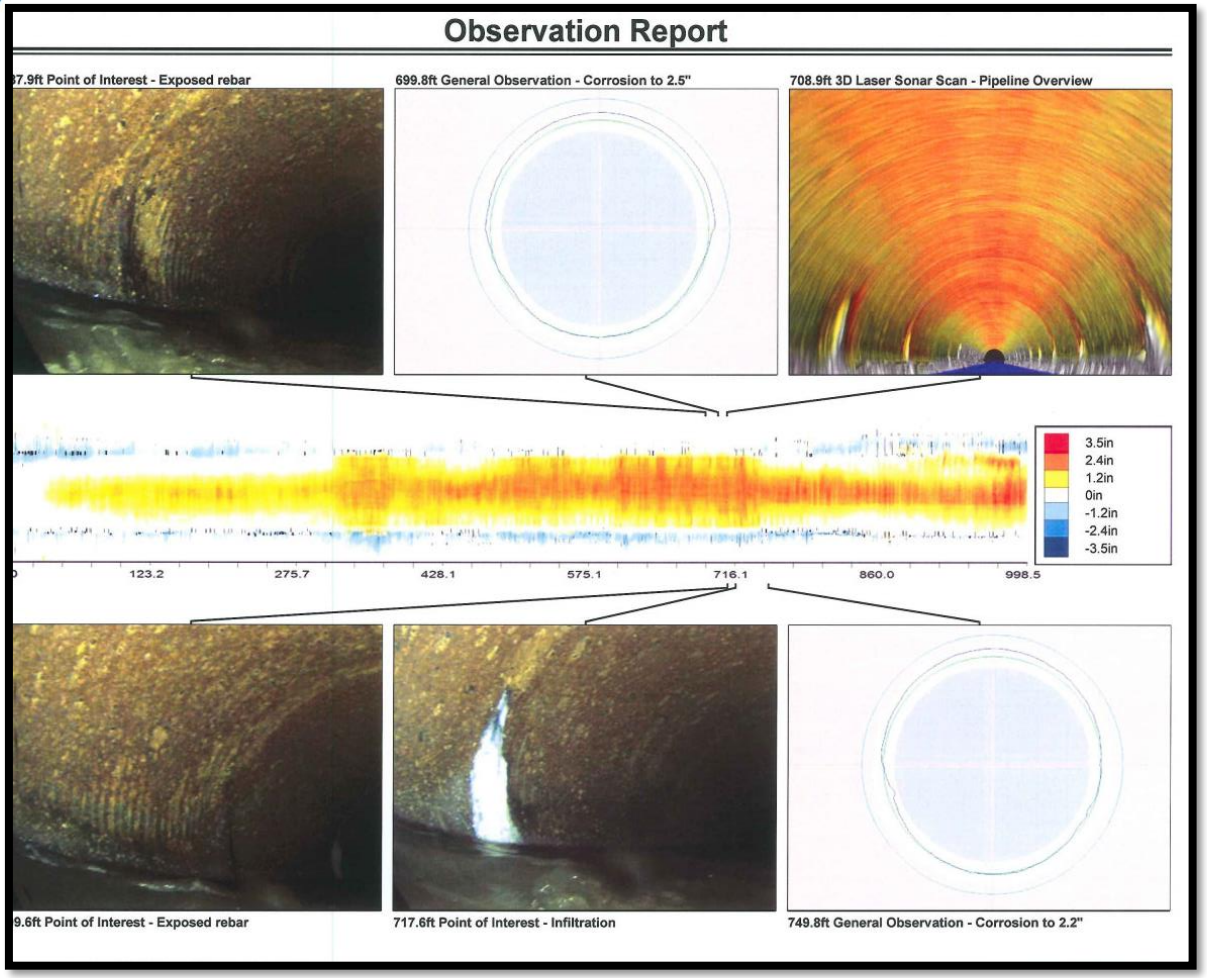
# West Fork Trinity Interceptors – M245/M245B Assessments

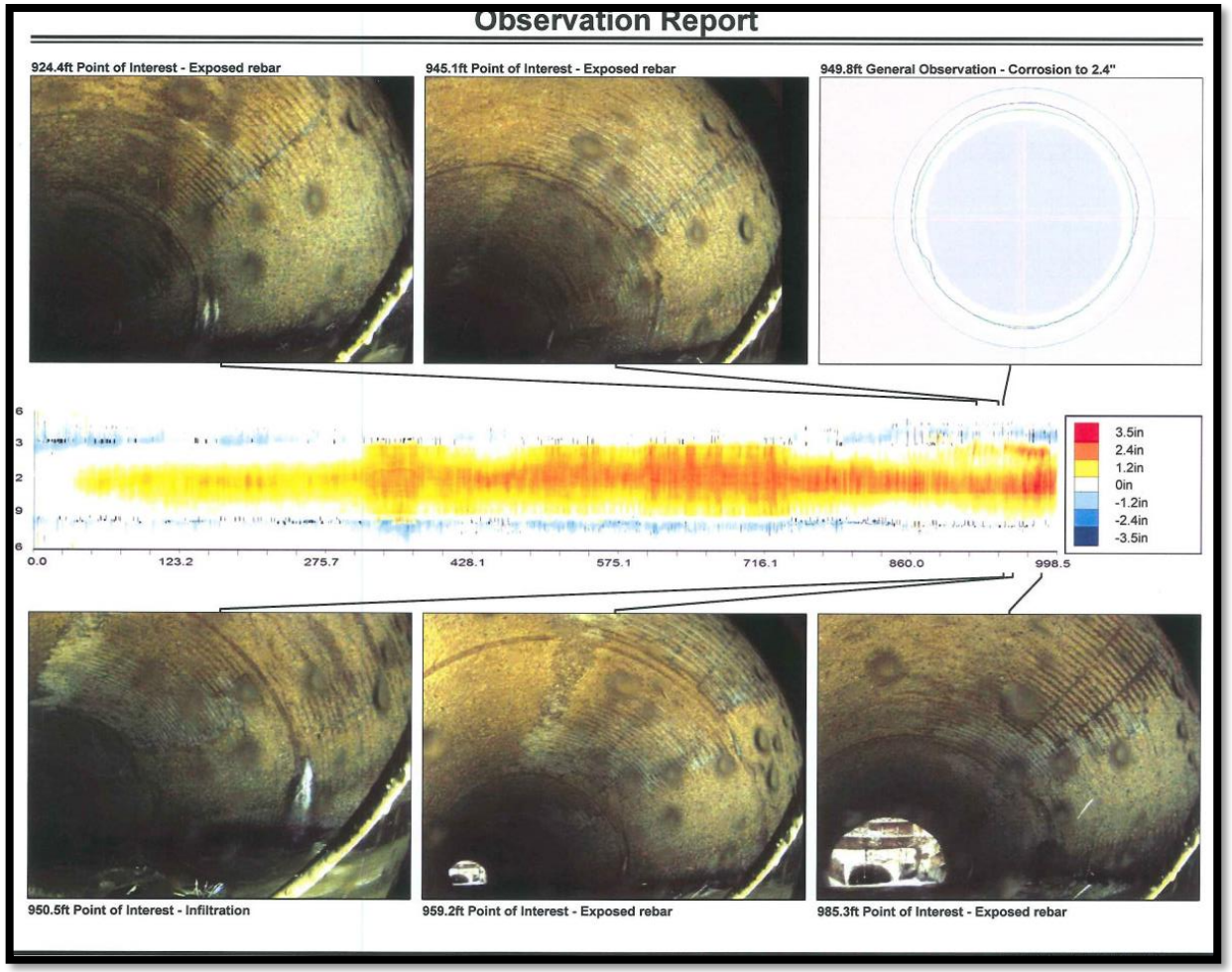


# M-245 MSI Assessment Results



# Ham Branch Interceptors Air Quality Investigations

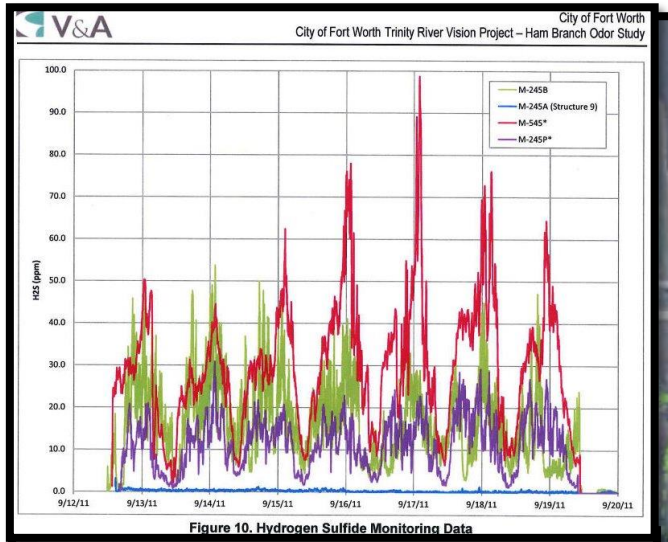


Figure 10. Hydrogen Sulfide Monitoring Data

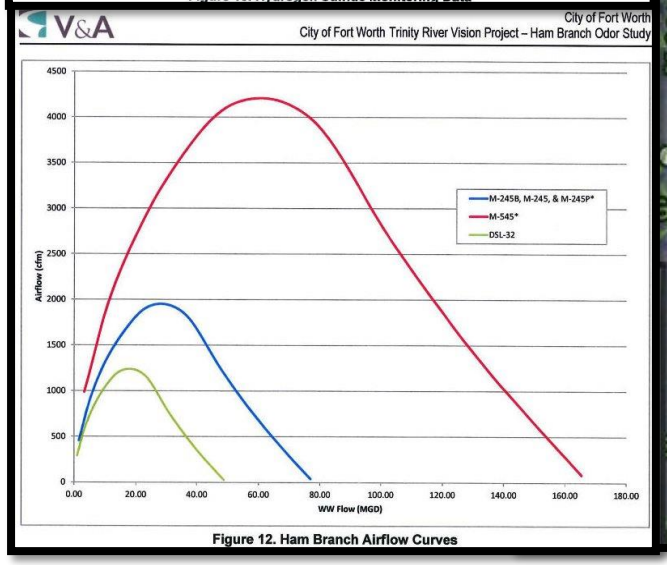
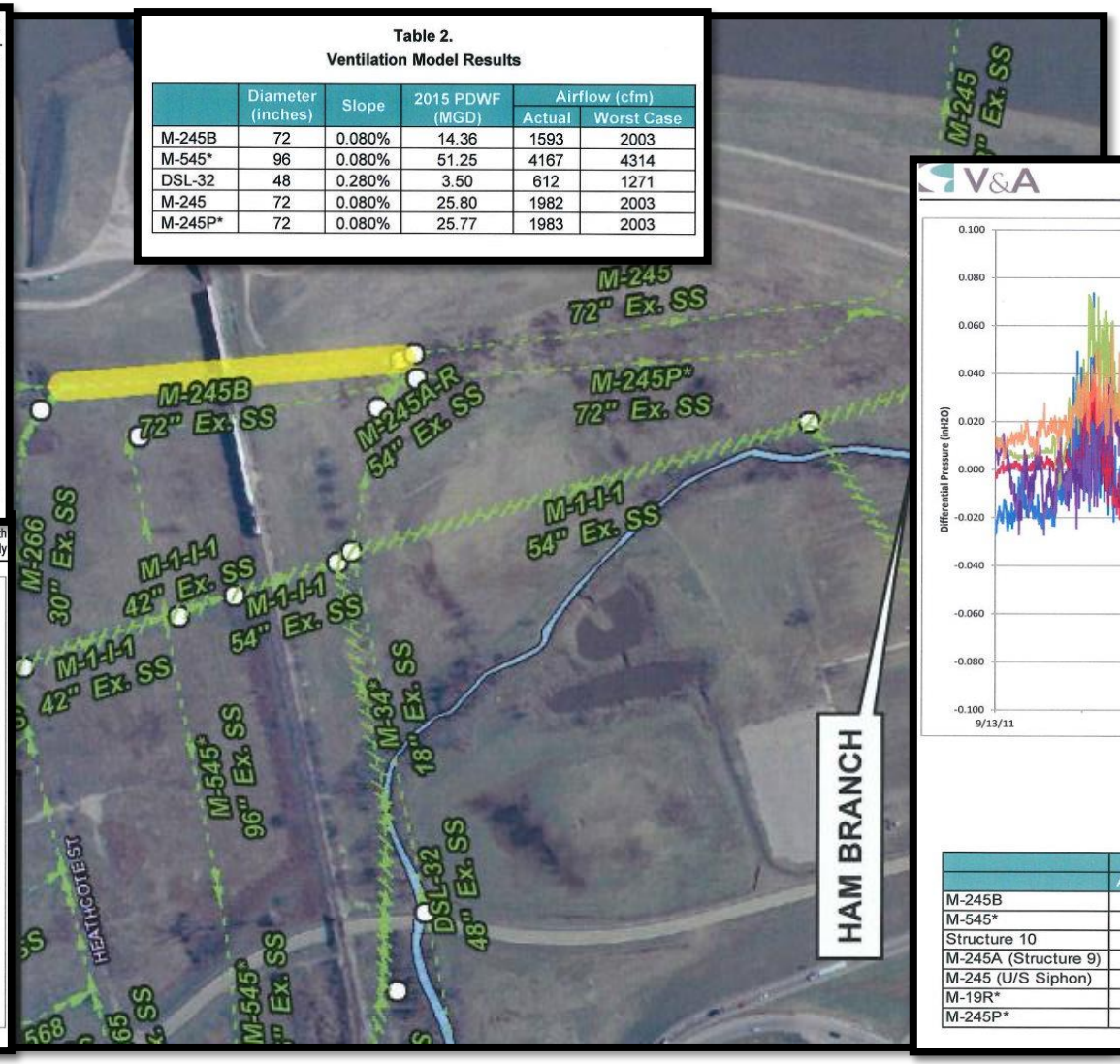


Figure 12. Ham Branch Airflow Curves

**Table 2.**
**Ventilation Model Results**

| | Diameter (inches) | Slope | 2015 PDWF (MGD) | Airflow (cfm) | |
|---|---|---|---|---|---|
| | | | | Actual | Worst Case |
| M-245B | 72 | 0.080% | 14.36 | 1593 | 2003 |
| M-545* | 96 | 0.080% | 51.25 | 4167 | 4314 |
| DSL-32 | 48 | 0.280% | 3.50 | 612 | 1271 |
| M-245 | 72 | 0.080% | 25.80 | 1982 | 2003 |
| M-245P* | 72 | 0.080% | 25.77 | 1983 | 2003 |



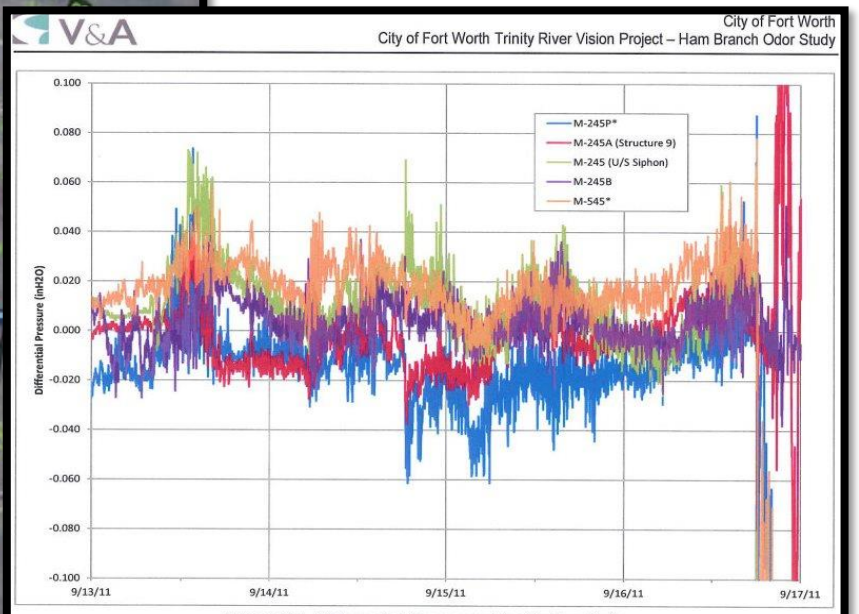
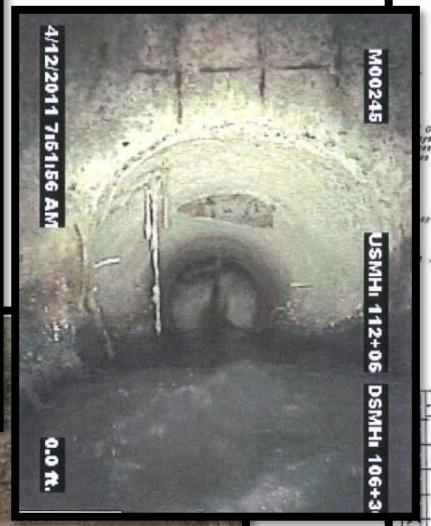



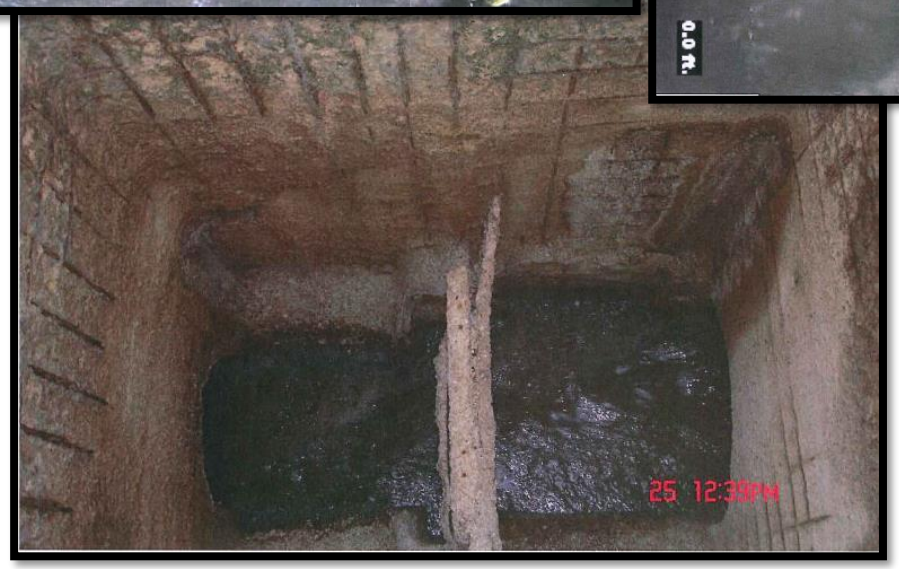
Figure 11. Differential Pressure Monitoring Data

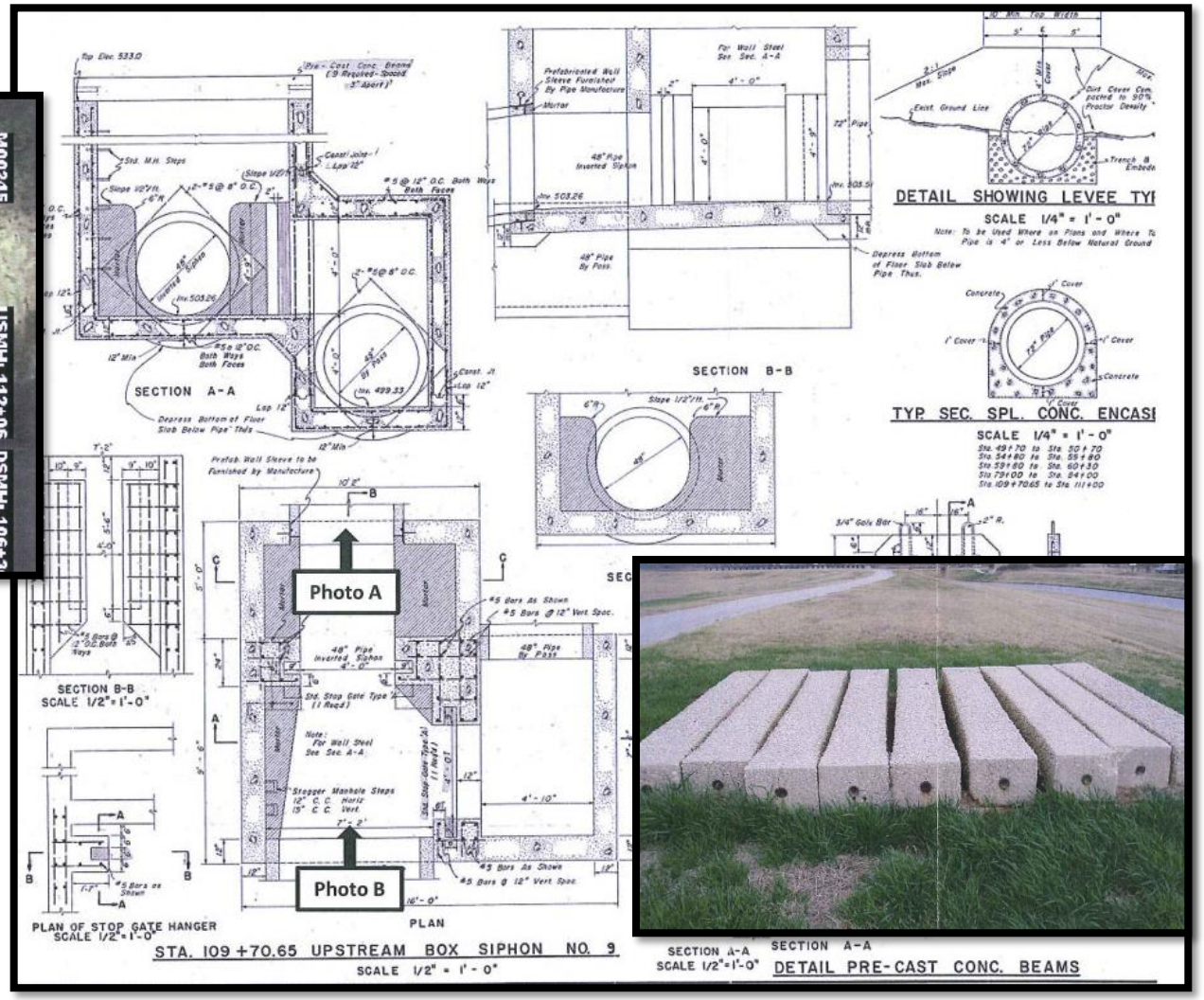
**Table 1.**
**Sampling Data Summary**

| | H2S (ppm) | | | Dissolved Sulfide (mg/l) | Observations |
|---|---|---|---|---|---|
| | Average | Max | Min | | |
| M-245B | 17 | 54 | 2 | --- | |
| M-545* | 30 | 99 | 1 | 2.0 | |
| Structure 10 | --- | | | N/D | Solids Too High for Reading |
| M-245A (Structure 9) | 0 | 1 | 0 | N/D | Solids Too High for Reading |
| M-245 (U/S Siphon) | --- | | | --- | |
| M-19R* | --- | | | N/D | |
| M-245P* | 12 | 31 | 1 | N/D | |

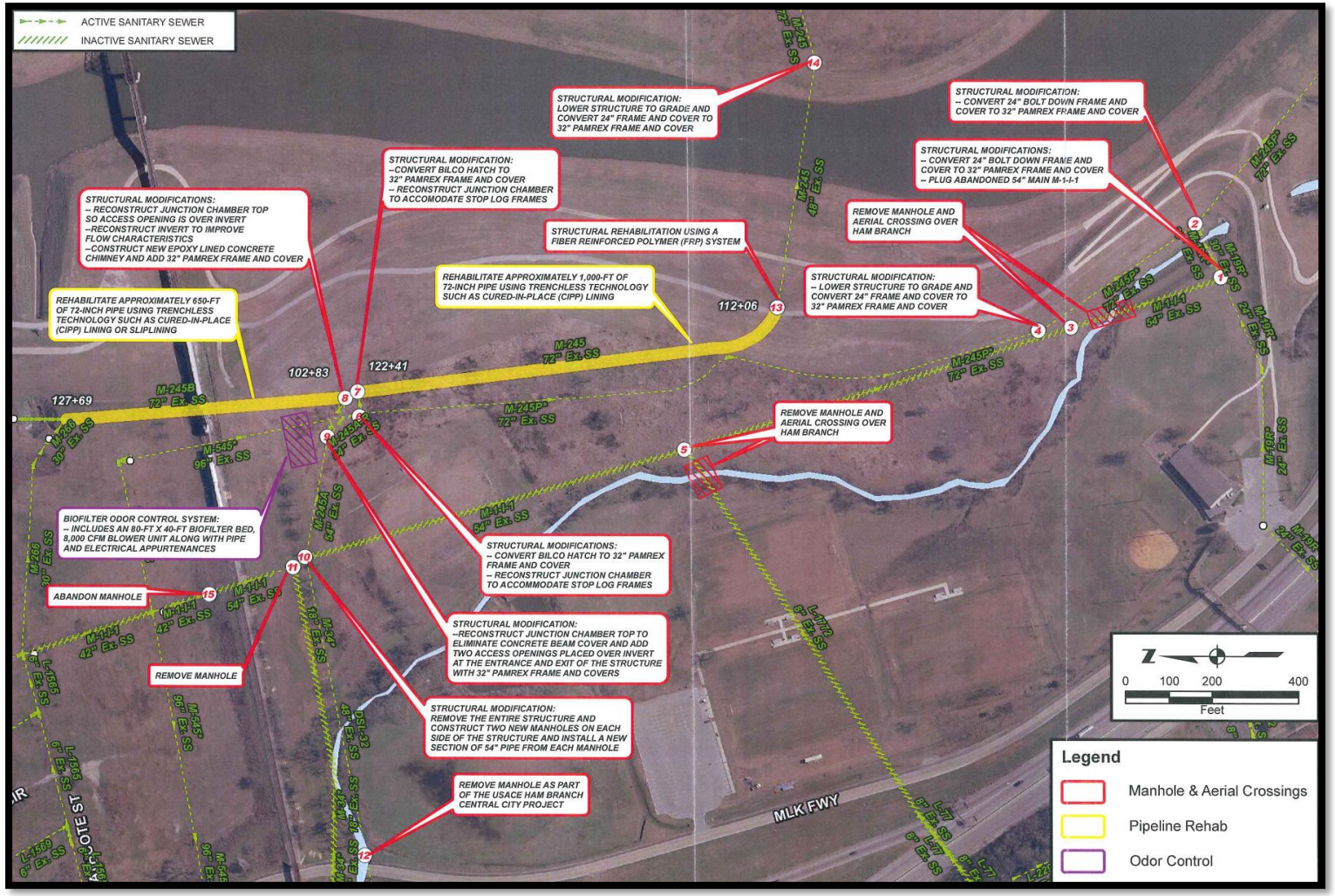
# M-245 US Siphon Box Condition Assessment

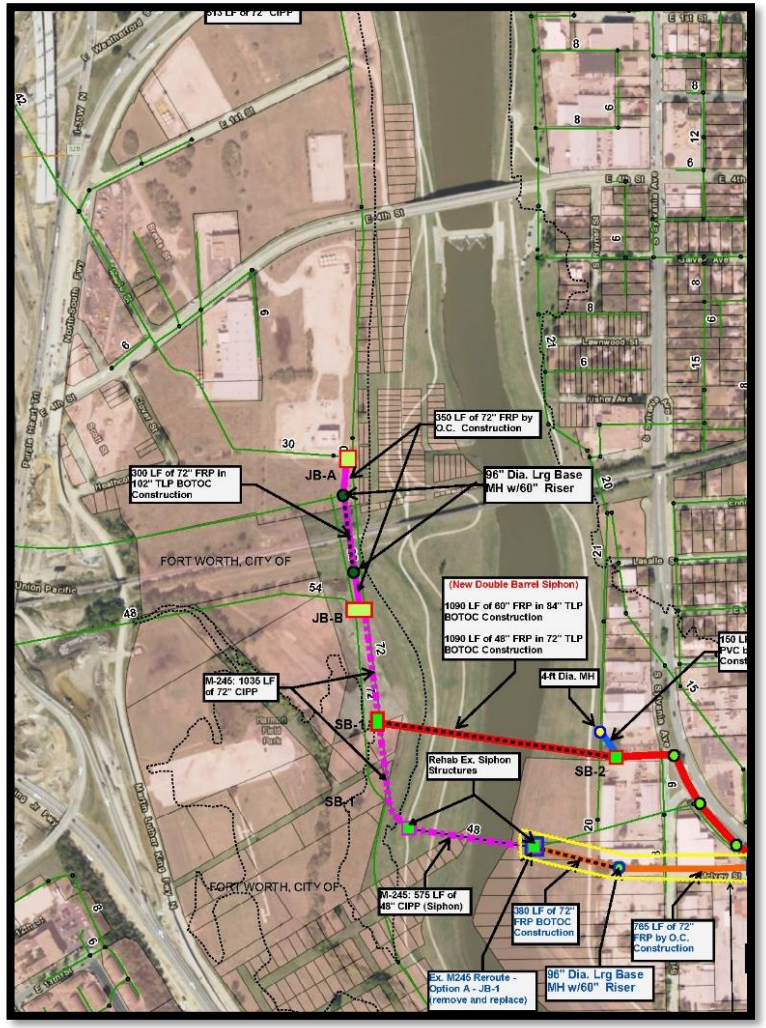


# Ham Branch Interceptors ICAP Recommendations



# "Fort Worth – You have a Problem"

December 6, 2018

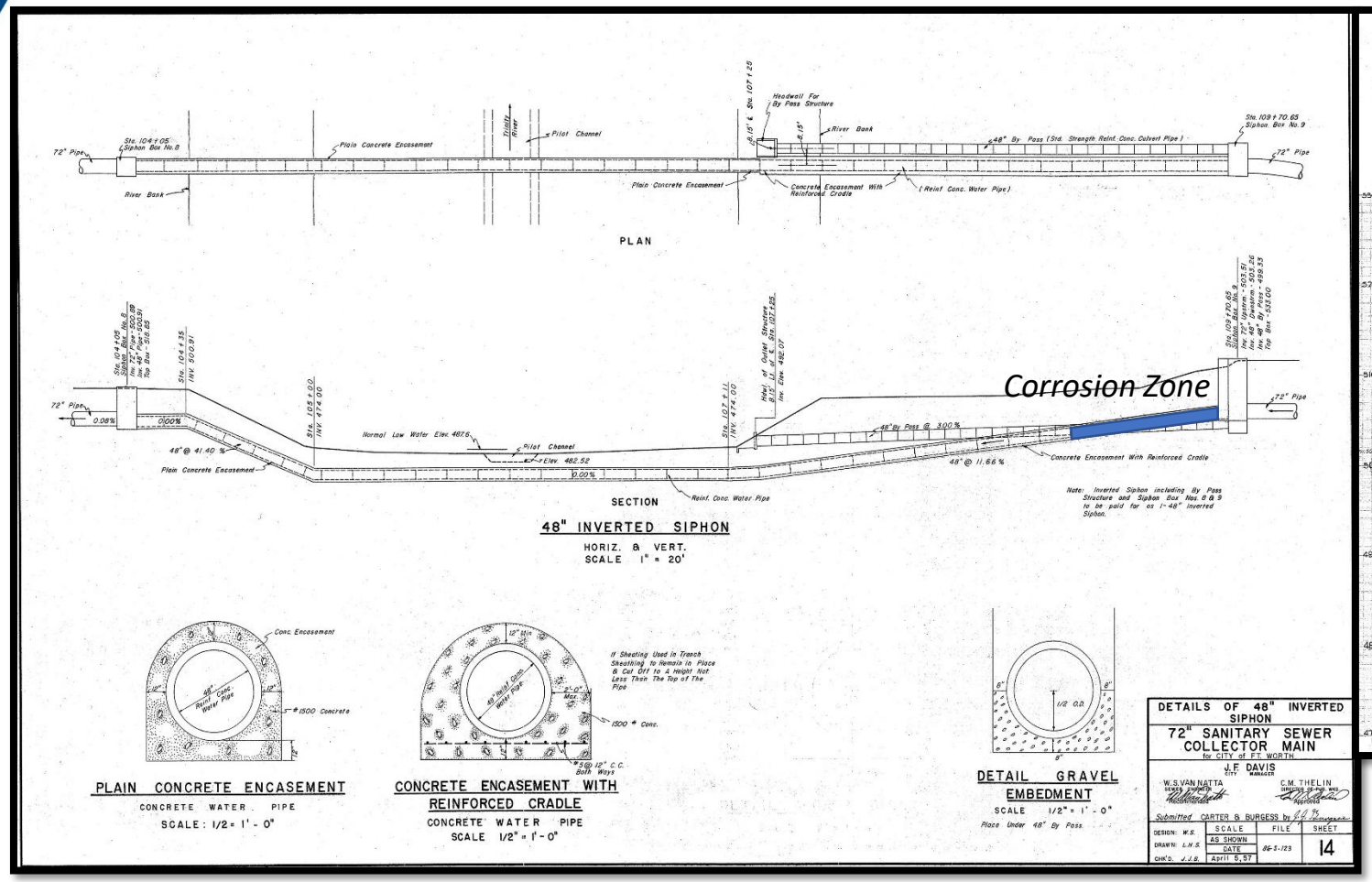
The Fort Worth Water Department (FWWD) was notified of two (2) sink holes in the WF Trinity River Floodway Levee by Tarrant Regional Water District (TRWD). Upon visiting the site, we observed this…..

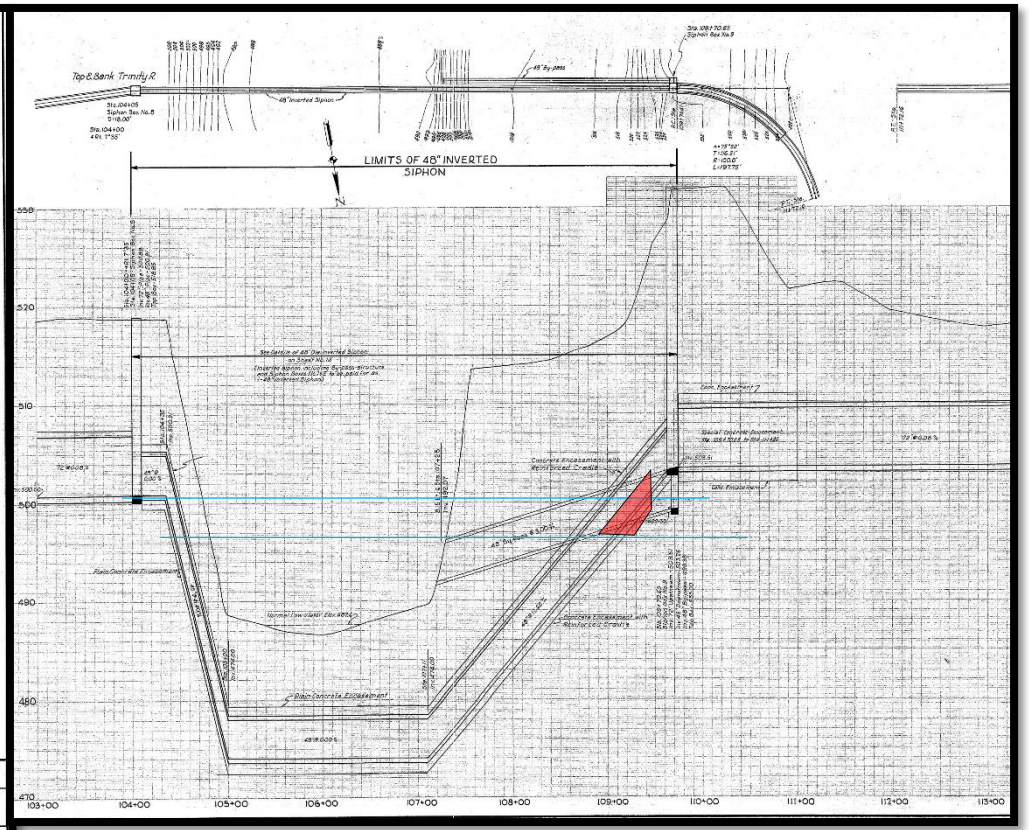
# M-245 WF Trinity River "Levee" US Siphon Box

# and More Unpleasant Images like these….

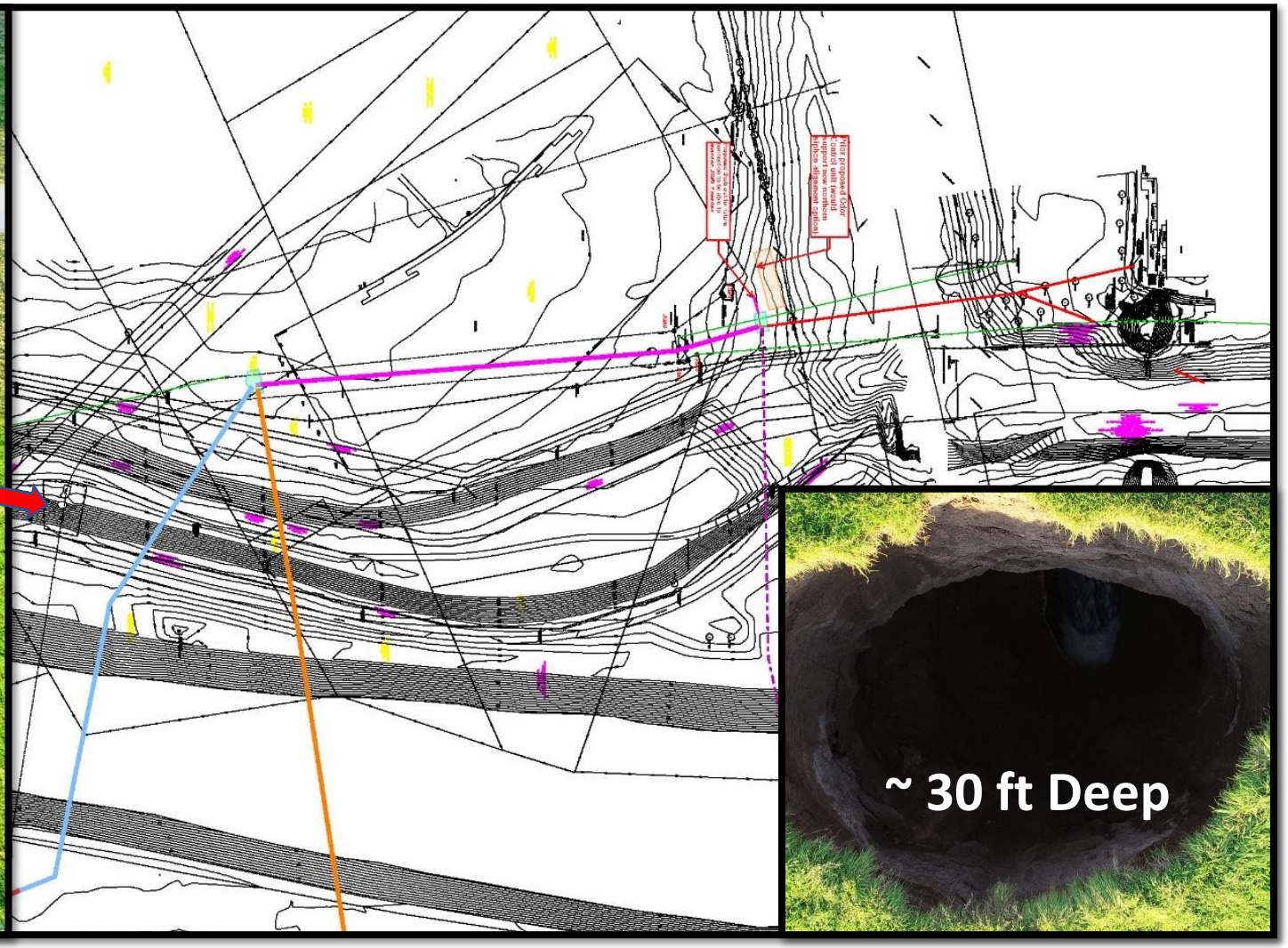
# Sink Holes on the Move….

# M-245 Trinity River Inverted Siphon 1957 As-Built



# WF Floodway Survey Captured by Drone and Traditional Survey

# Initial Remediation Action Plan Proposal to USACE/TRWD

Proposed 32-Ft Dia. Tunnel Liner Plate (TLP) Vertical Shaft to depths of approximately 30-ft

- **Install 16-ft Dia. TLP shaft for a Proposed 6-ft Dia. MH (23-ft deep) DS of the Pipe Failure for Bypass Discharge**
- **Design and Set up a 44-mgd bypass system to meet Peak Wet Weather Flows during Construction**
- **Dewater Ex. 48-inch Siphon to make the Force Main Discharge Connection (this required another manhole installed on the east side of the Trinity River prior to the DS Siphon Box)**
- **Comply with all USACE Design Criteria for Levee Repairs (6-in max soil lifts compacted to 90% (+) Std. Proctor Densities**
- **December 21, 2018 – TRWD/USACE Approved Vertical TLP Repair Plan**

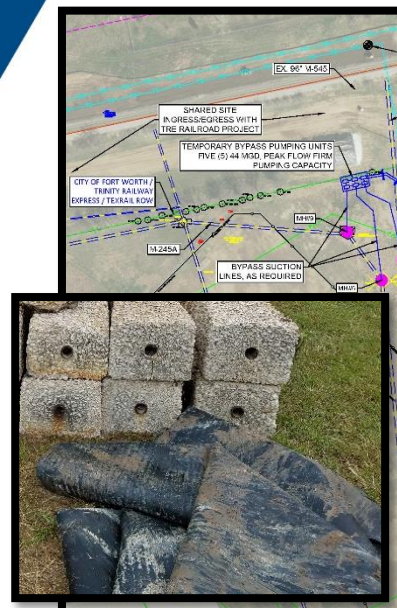
# Unacceptable Material Delays – What about Plan B?

- January 11, 2019 Meeting: TRWD/USACE were notified that the 32-ft Dia. TLP shaft would take approximately 8 weeks to arrive
- Plan B defined as…

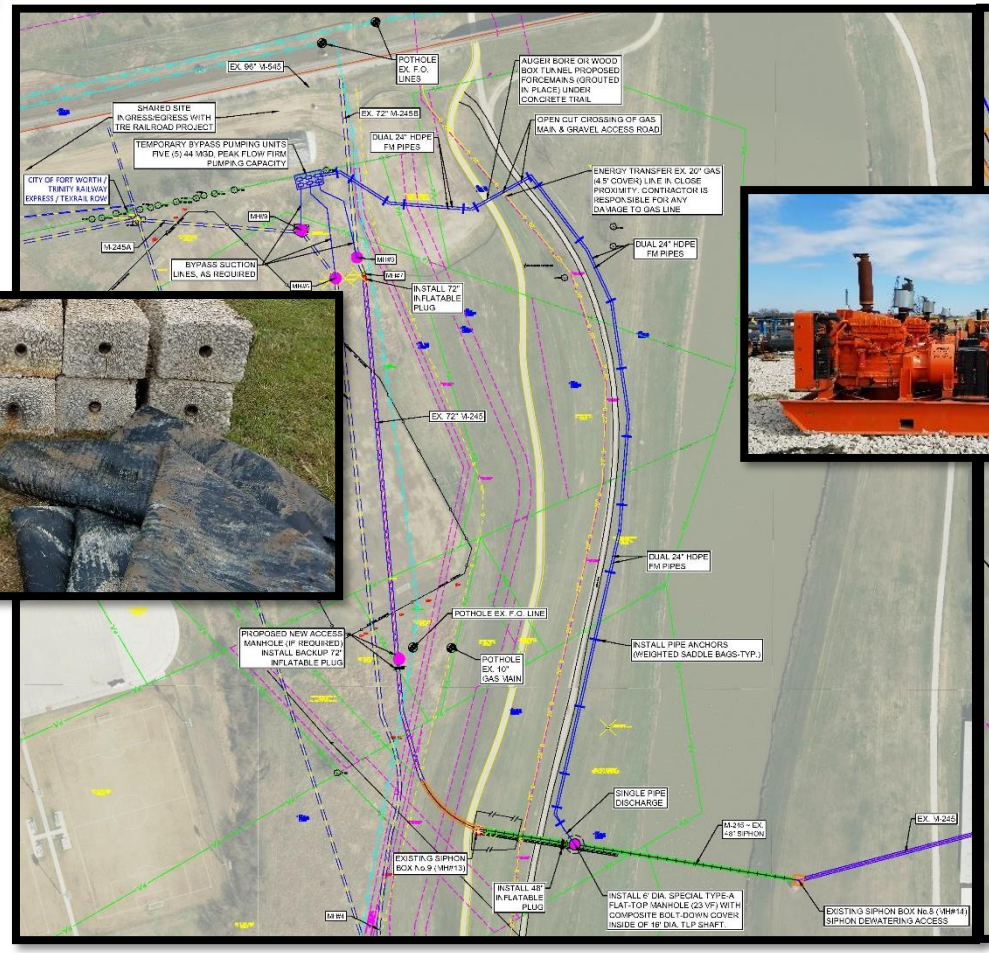
  *Implementation of an Old School Point Repair Plan*

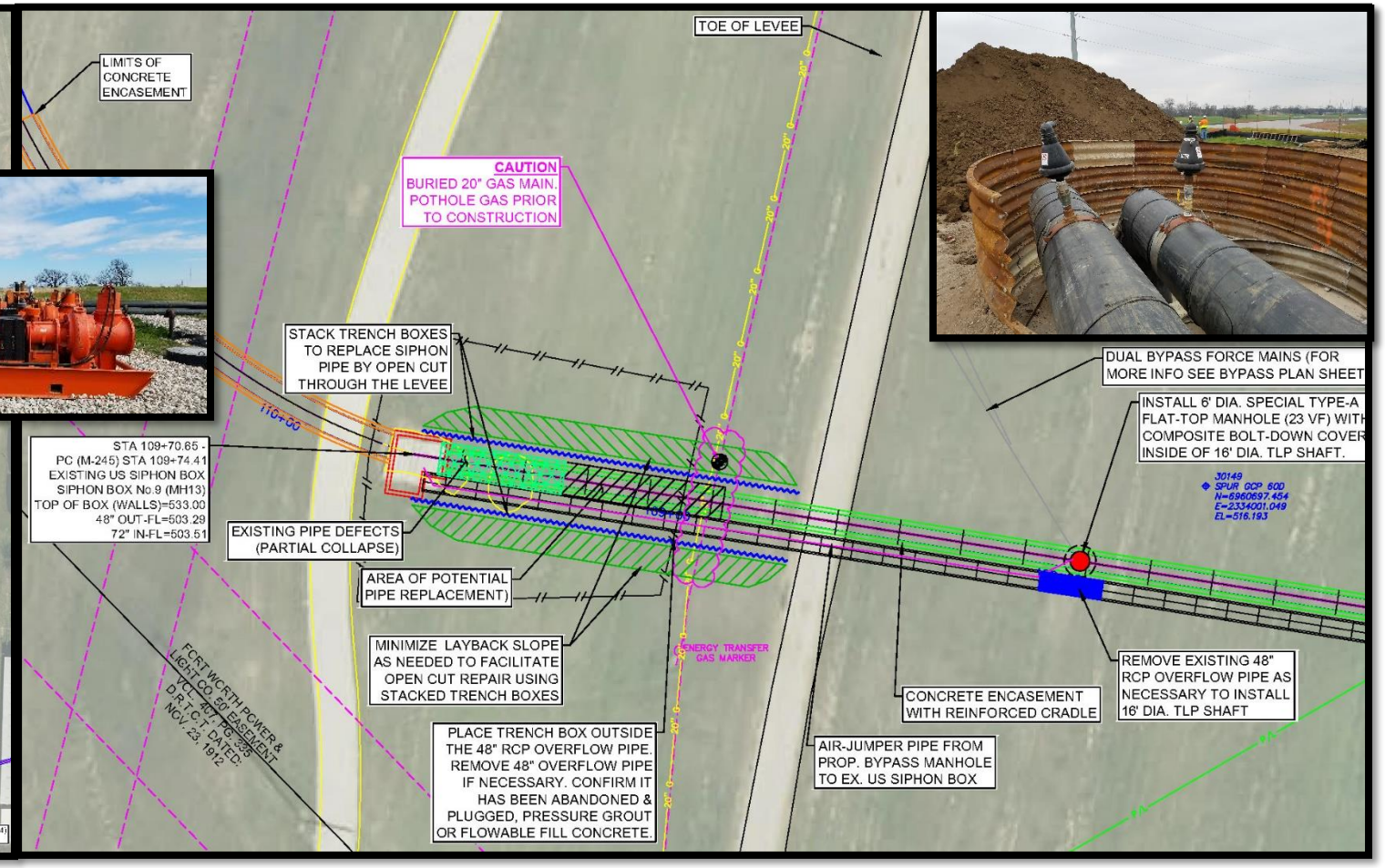
  - Contractor benches side cross slopes and stack trench boxes in the levee to excavate down to the pipe and make that point repair.
- Plan B was verbal authorized by the USACE and Open Cut and Bypass Preparations began immediately
- Step 1: Evaluate surcharging impacts of applying 15 MGD Flow Diversion into M-245P using a new 72-inch inflatable pipe plug.
- This didn't go quite as well as planned….

# Design Plan B and Proposed Bypass Plan

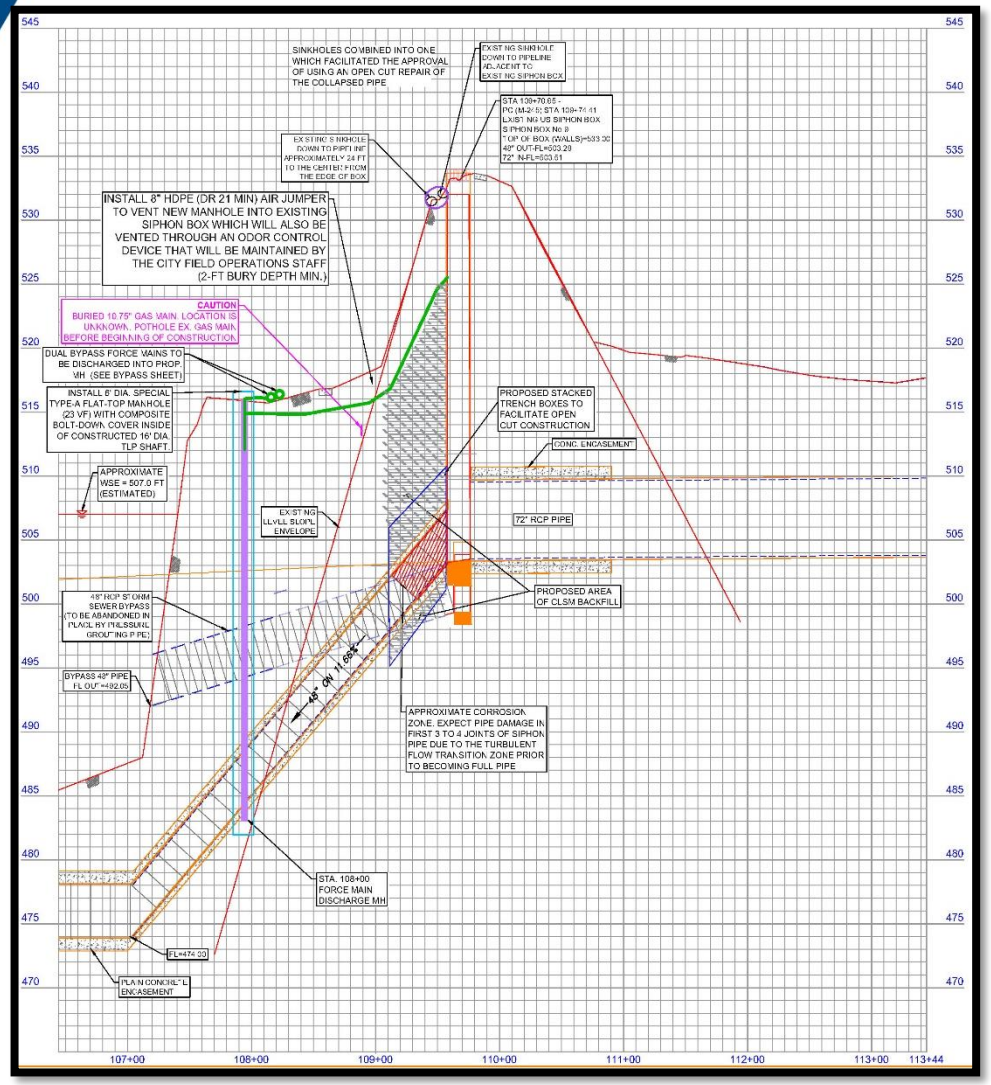


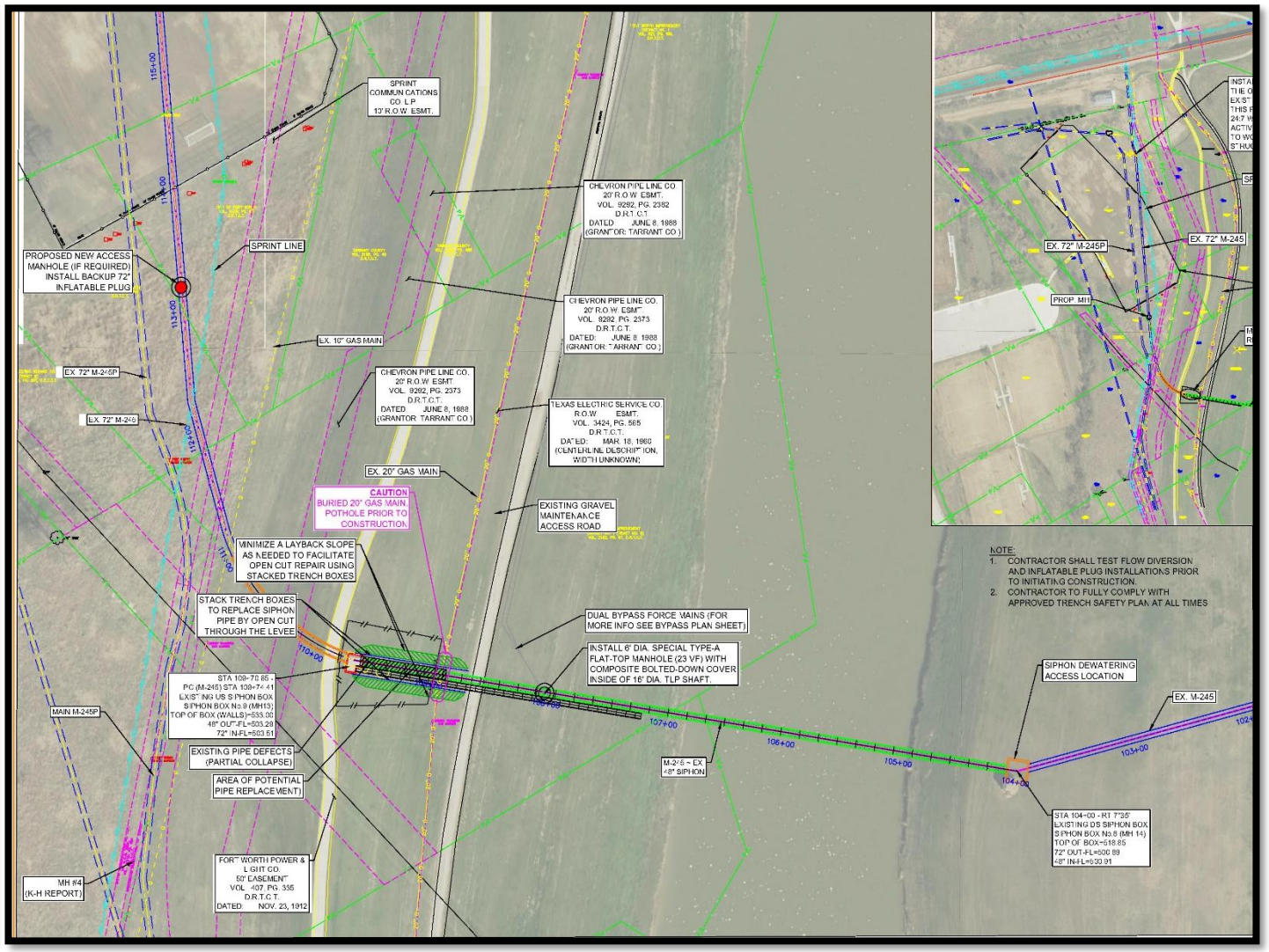




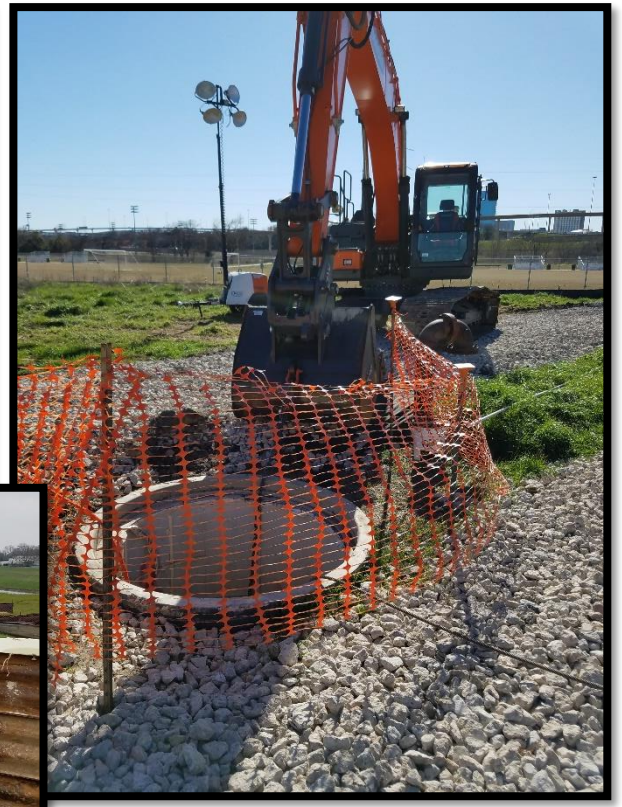



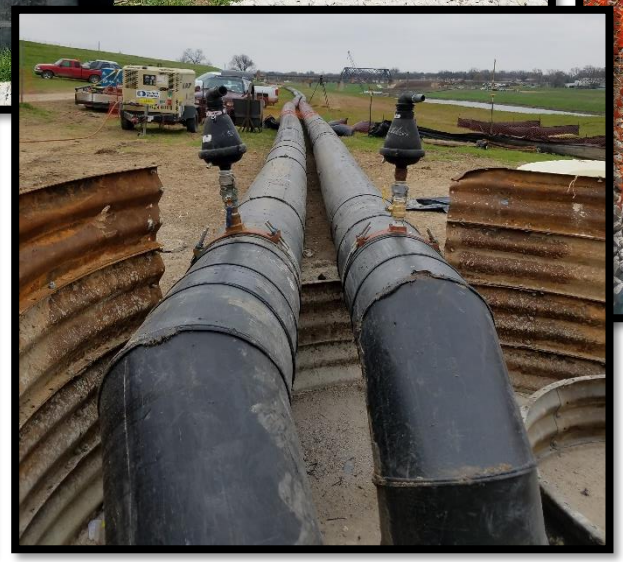
# Plan B Design and Siphon Repair Profile



# Emergency Bypass System



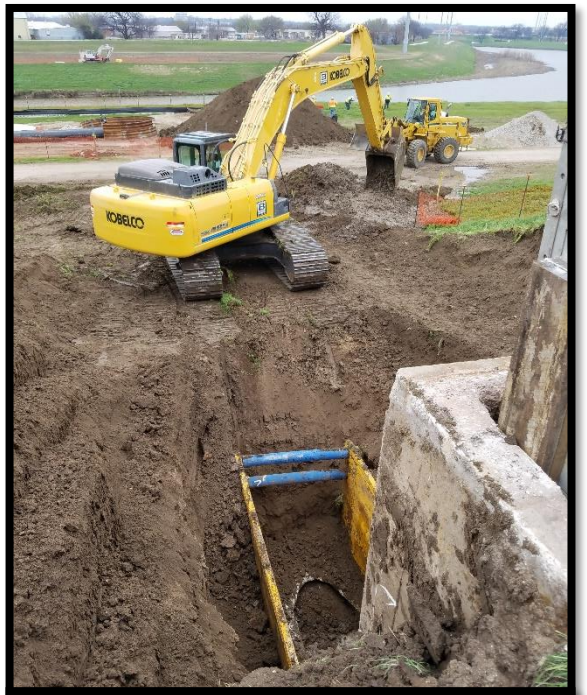


# Emergency Siphon Point Repair Construction

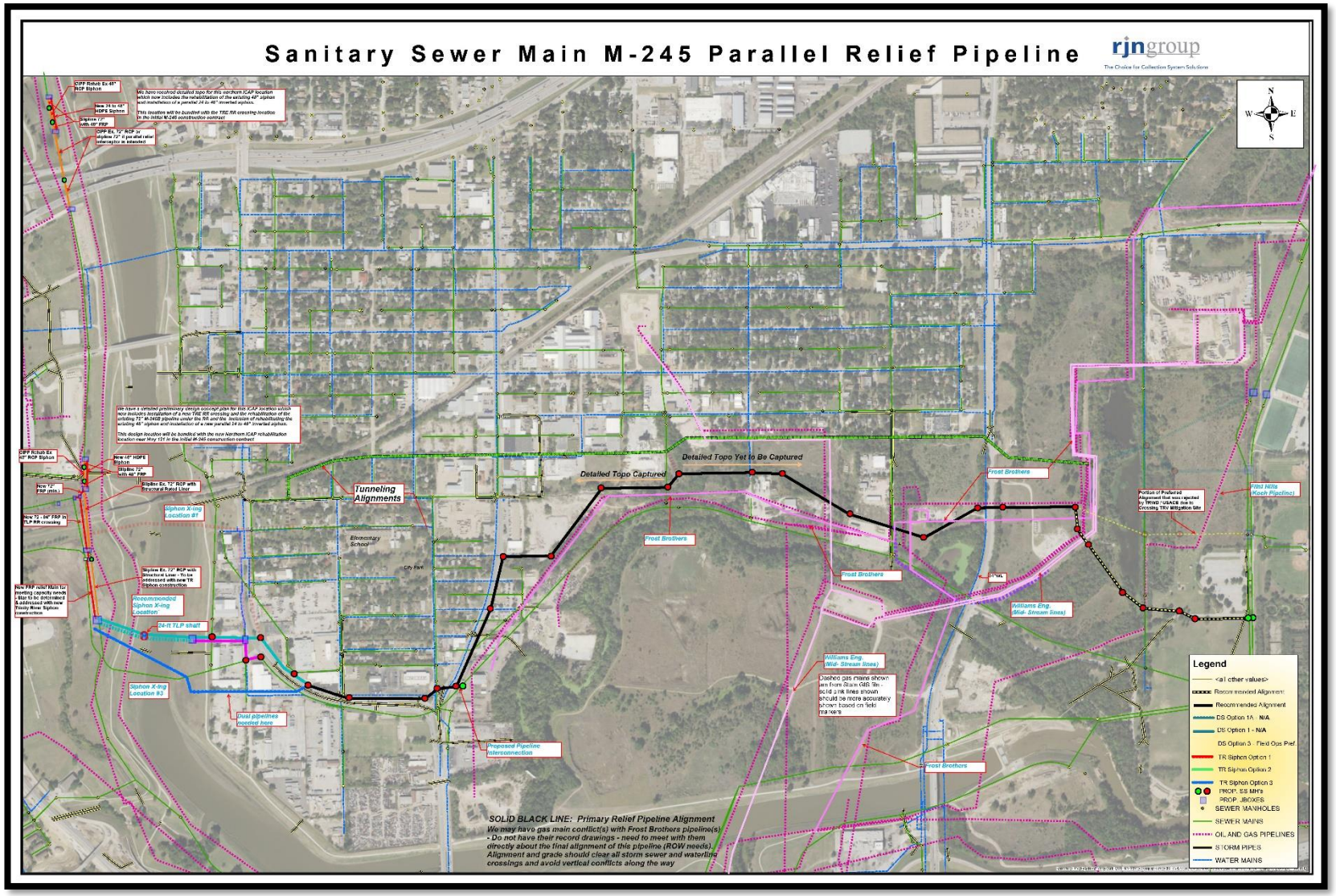


# Siphon Box Repairs

# Emergency Siphon Point Repair Construction


# M-245 Parallel Relief Pipeline Project – Next Steps



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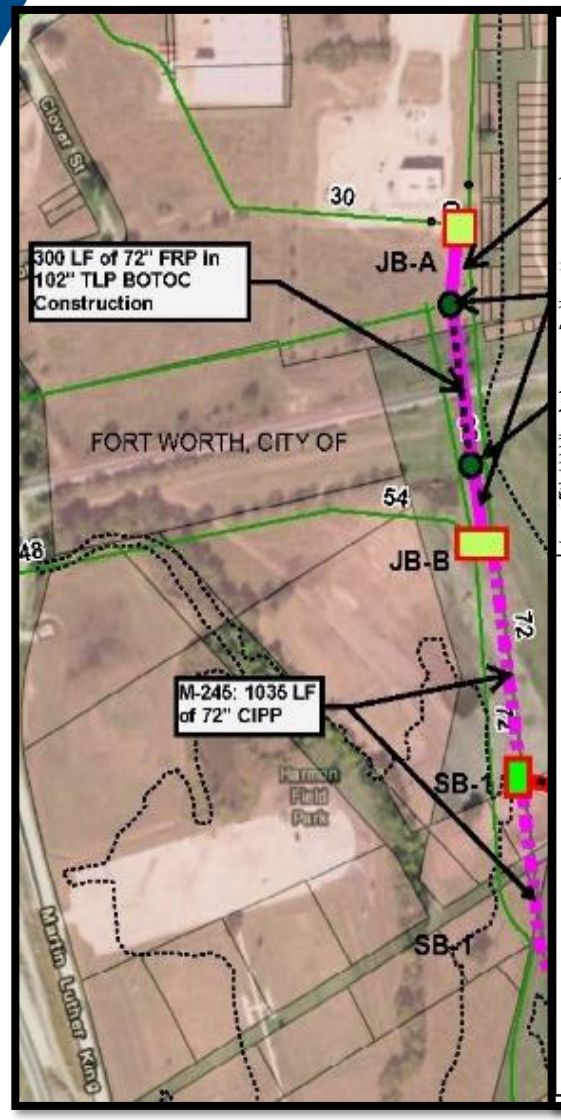


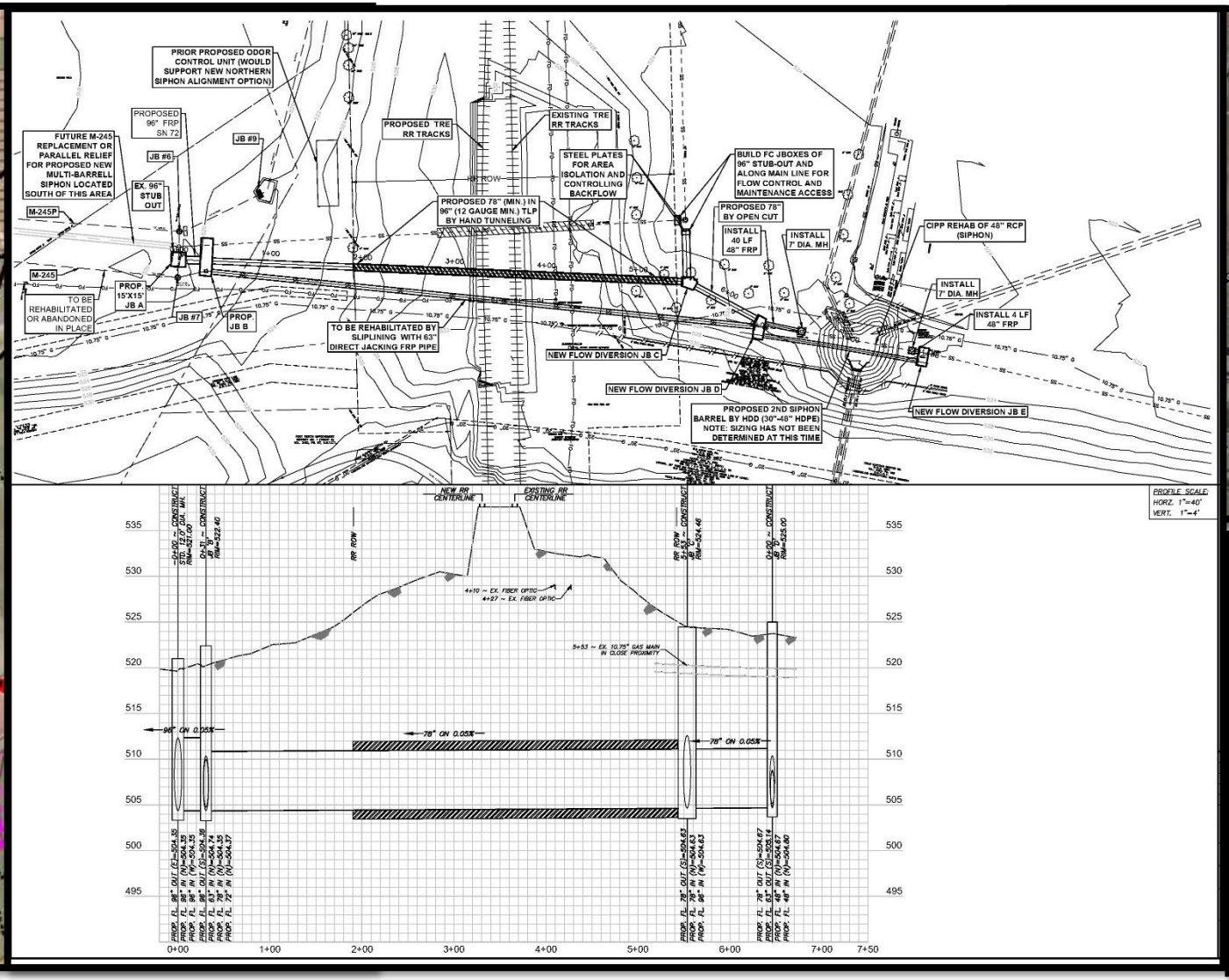


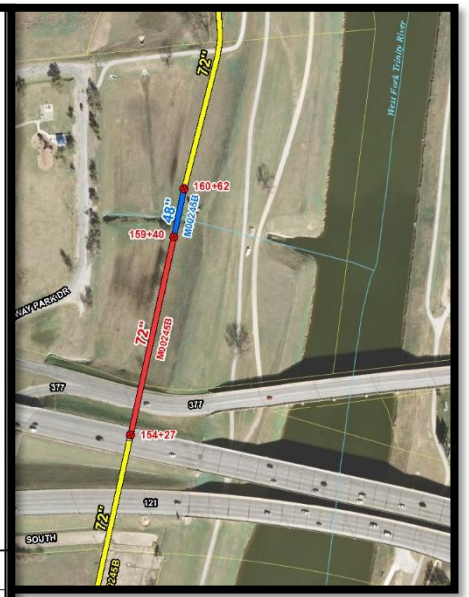


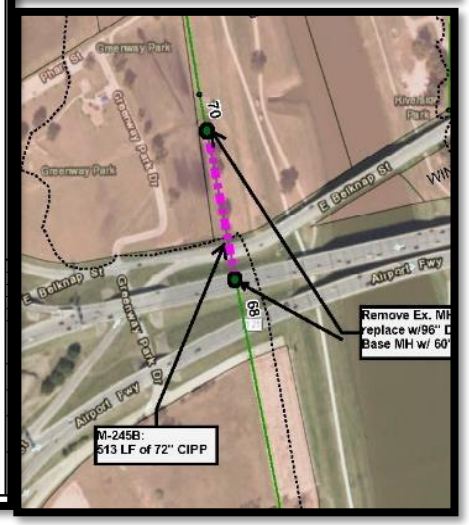

# QUESTIONS?

Thank You For Attending