

# Pinpointing the Problem

Mansfield's Phase 2 Approach to Targeted I/I Reduction

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Henry B. Gonzalez Convention Center, San Antonio, Texas



# City of Mansfield

- Located in DFW metroplex
- Approximately 90,000 residents
- Large conveyance system across three counties (~365 miles)



# Mansfield & FNI History

- 25-year professional relationship
- Regular master plans updates
- 20+ successful projects
- Emphasis on proactive asset management & long-term planning

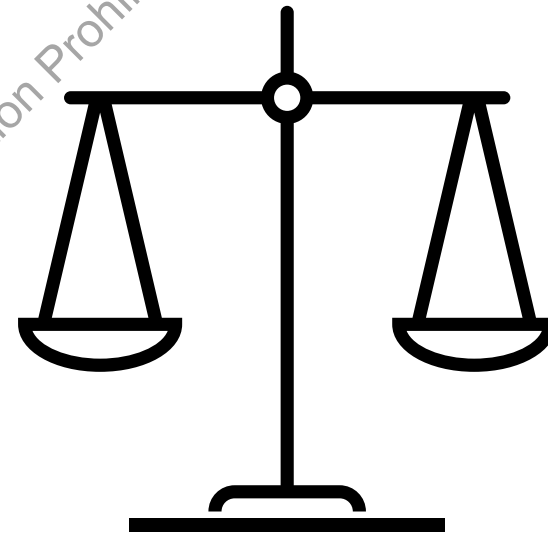


The cover page for the 'Water and Wastewater Master Plan Report Volume I' features a collage of images: a wastewater treatment plant interior, a large circular concrete structure under construction, a close-up of a 'SANITARY SEWER' manhole cover, and a tall water tower. The text on the cover includes the title, the date 'October 2024', the presenter 'Presented By: Freese and Nichols, Inc.', the Mansfield Texas logo, the Freese and Nichols logo, and the tagline 'Innovative Approaches Practical Results Outstanding Service'. A large diagonal watermark reads 'Confidential - UIC 2026 Provided to Registered Attendees Only Distribution Prohibited'.



# Why Perform SSES?

- Proactive system management
- Reduce the frequency and severity of SSOs
- Extend the life of existing infrastructure and delay capital investments
- Reduce peak flows and associated wholesale treatment costs



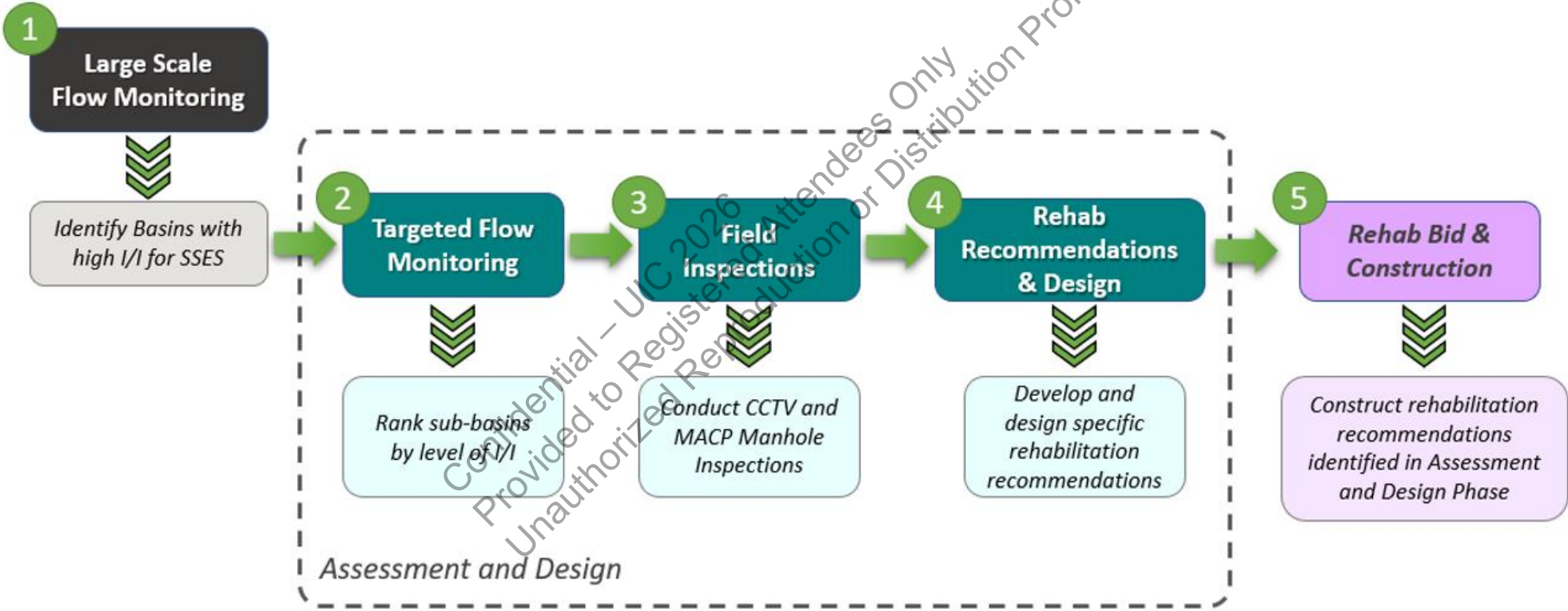
Cost of New  
Conveyance  
Projects

Cost of System  
Renewal to  
Reduce I/I

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# Proven SSES Program Workflow



# SSES Examples

- Acoustic testing
  - SL-RAT
- Digital Manhole Inspections
  - No manned entry required
- Micro-metering
- Smoke Testing
  - Identifies potential I/I access points
- Closed-Circuit Television
  - Non-destructive diagnostic tool



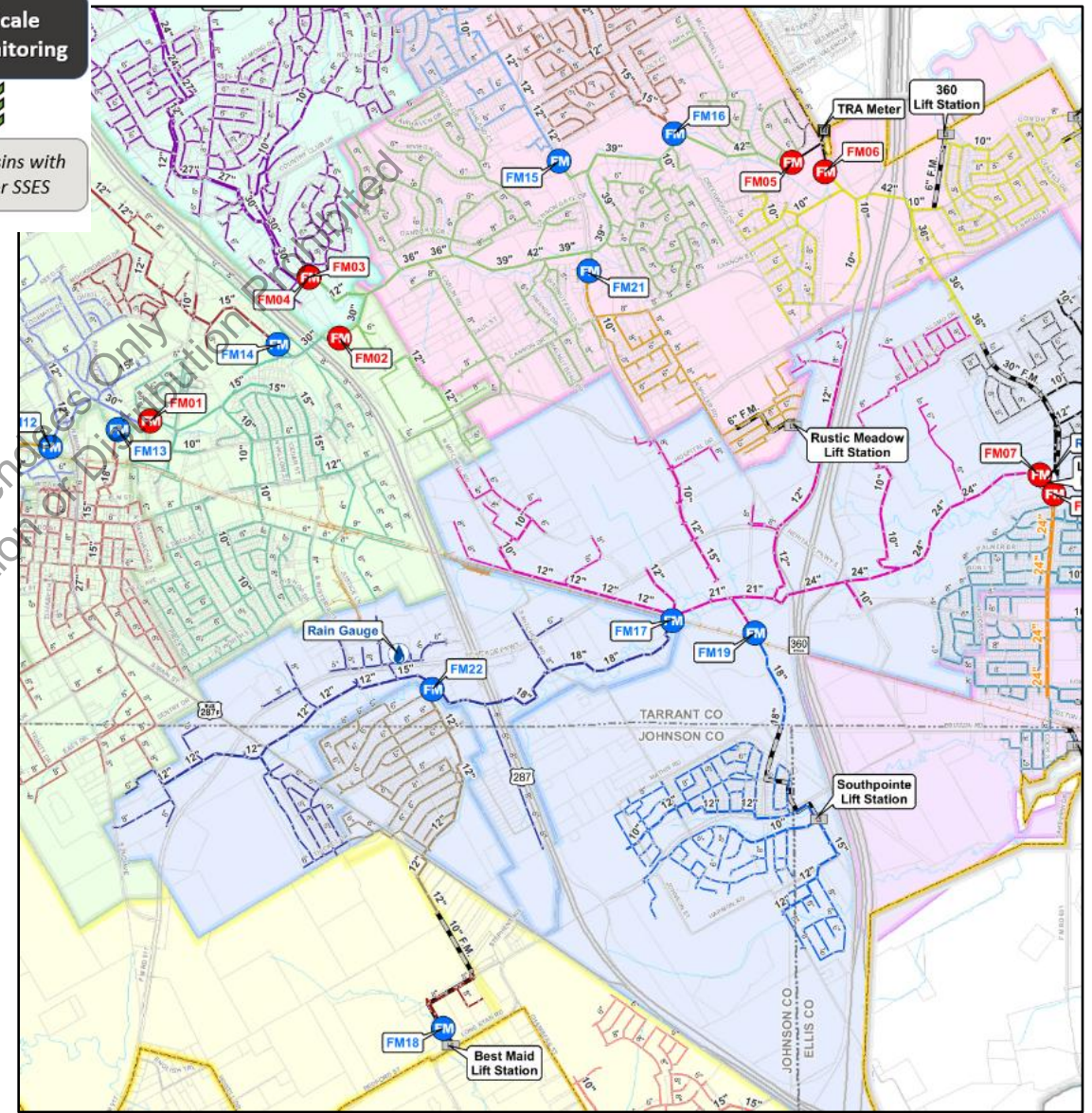
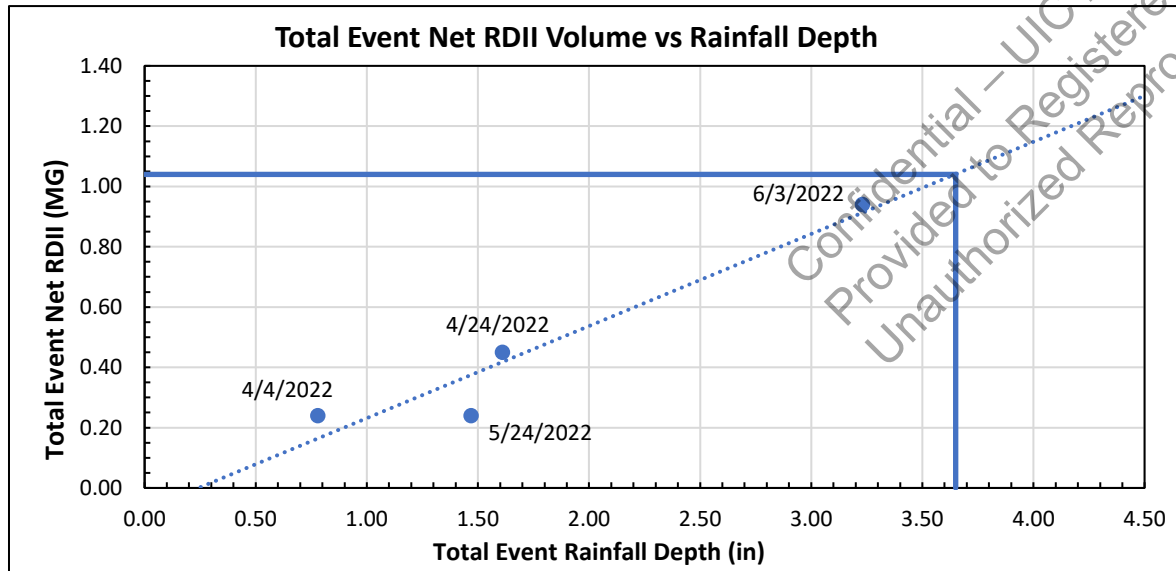
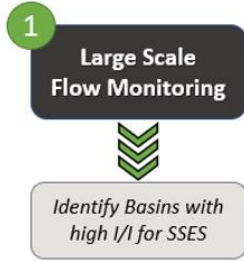
# Field Resources & Crew

- 4 Service Trucks (F-550 with full crane bodies)
  - Running SL-Rat, replacing manhole lids
- 1 Gap Vax Combination Truck
  - Suction and Cleaning
- CCTV Camera Van
  - NASSCO Trained staff
  - CCTV software
- Field Operations – 16 field personnel

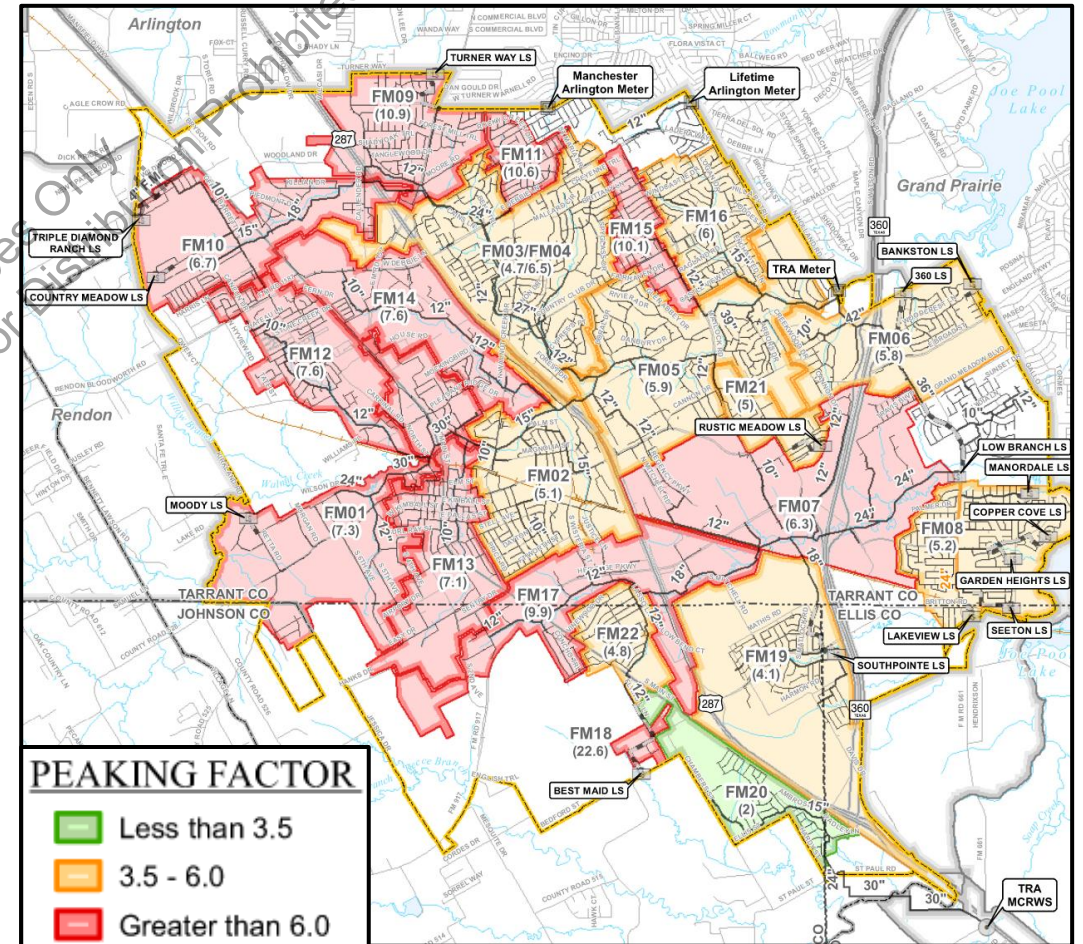
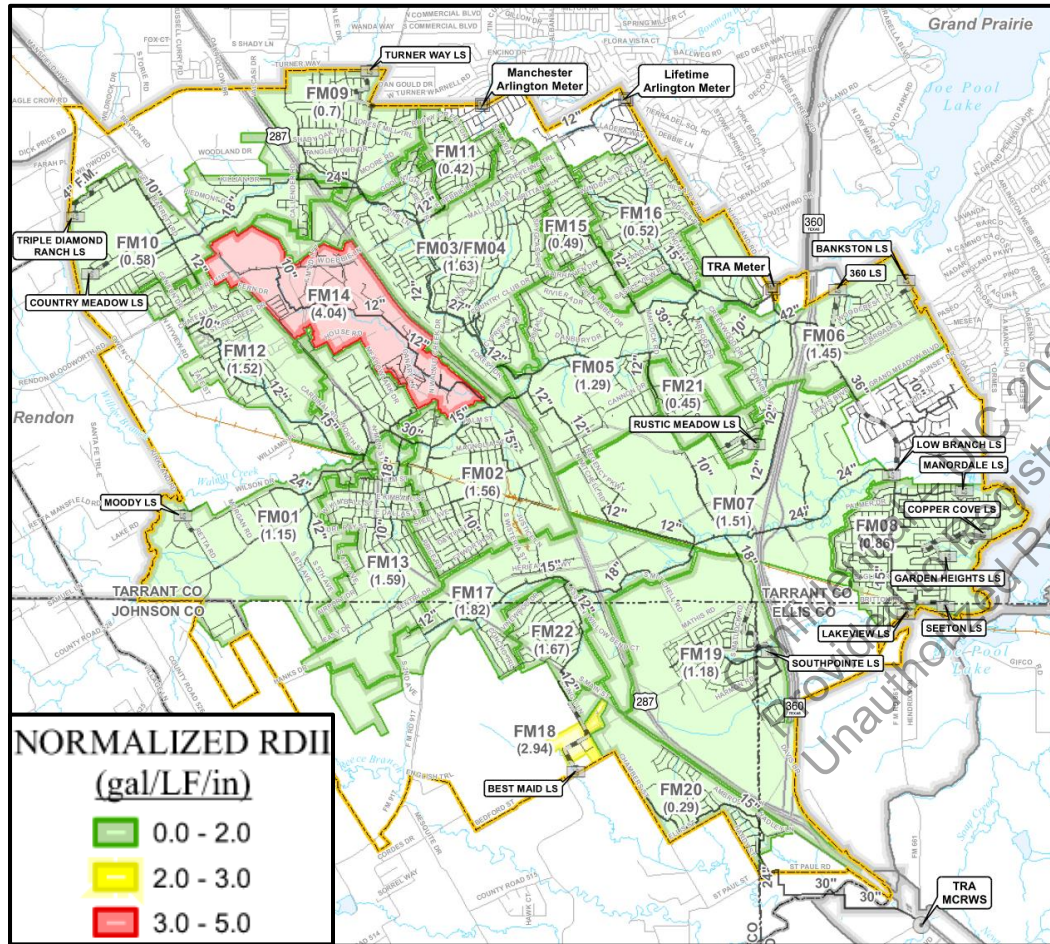


# Phase 1 Effort

- System wide flow monitoring (2022)
- Flow meter data analysis
- I/I characterization and ranking



# Phase 1 Results



# Phase 1 SSES Prioritization Plan

- Comprehensive SSES plan
- High priority (1-5 years)
- Intermediate-term (5-10 years)
- Long-term (10-15 years)

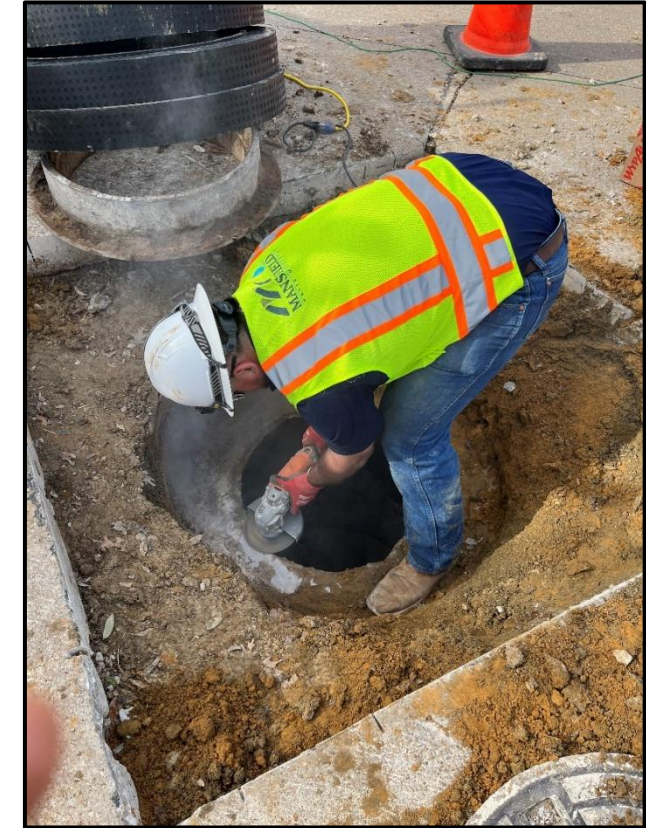
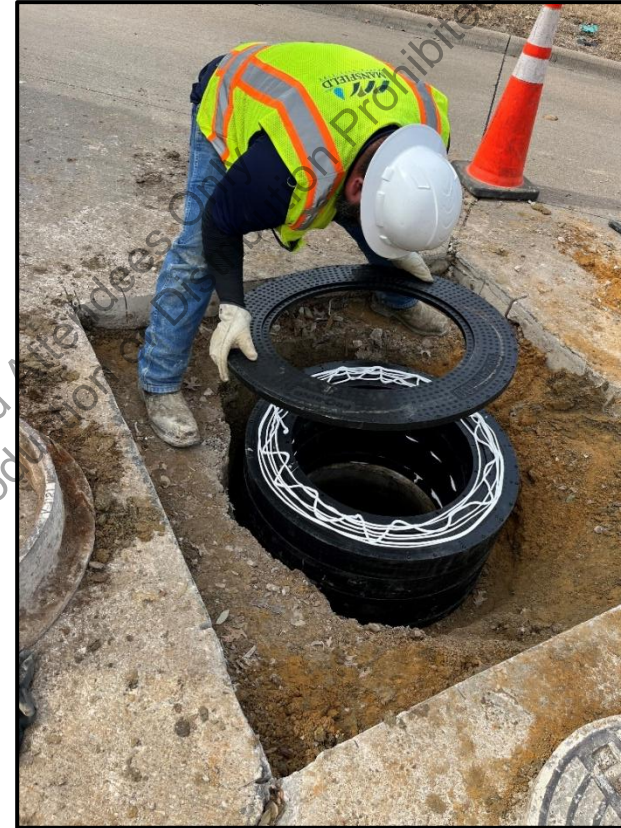
# of FM Basins	# Manholes to Inspect	LF of Pipe to Inspect	Budgetary Cost
<b>High Priority Rehabilitation</b>			
7	1,049	361,291	\$2,723,700
<b>Intermediate Rehabilitation</b>			
6	1,648	564,087	\$4,254,400
<b>Long-Term Rehabilitation</b>			
8	1,711	569,057	\$4,303,800
<b>Reduction Strategy Program Totals</b>			
<b>21</b>	<b>4,408</b>	<b>1,494,435</b>	<b>\$11,281,900</b>

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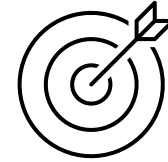


# Field Work Since Phase 1

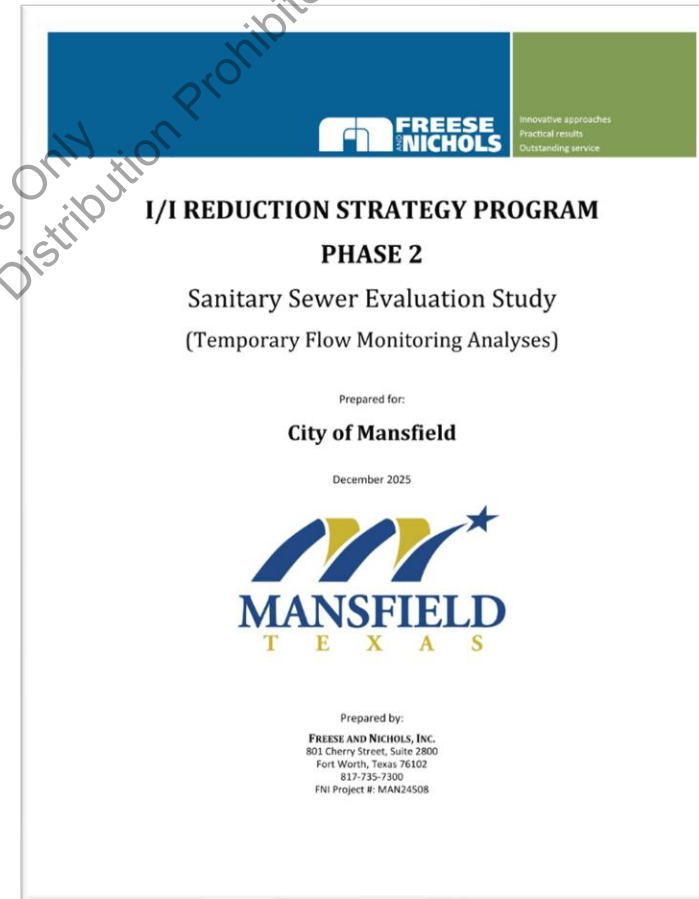
- Manhole and CCTV inspections
  - FM Basins 14, 17, 18, 22 and 3/4
- Epoxy coating applied to manhole rings
  - 2-part injectable epoxy
- Damaged manhole lids replaced, raised and readjusted manholes
- Continuous monitoring with SL-RAT
  - 1,000,000 LF per year goal



# Phase 2: Targeted Flow Monitoring



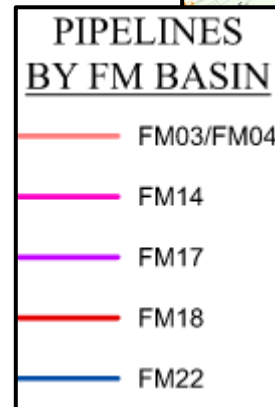
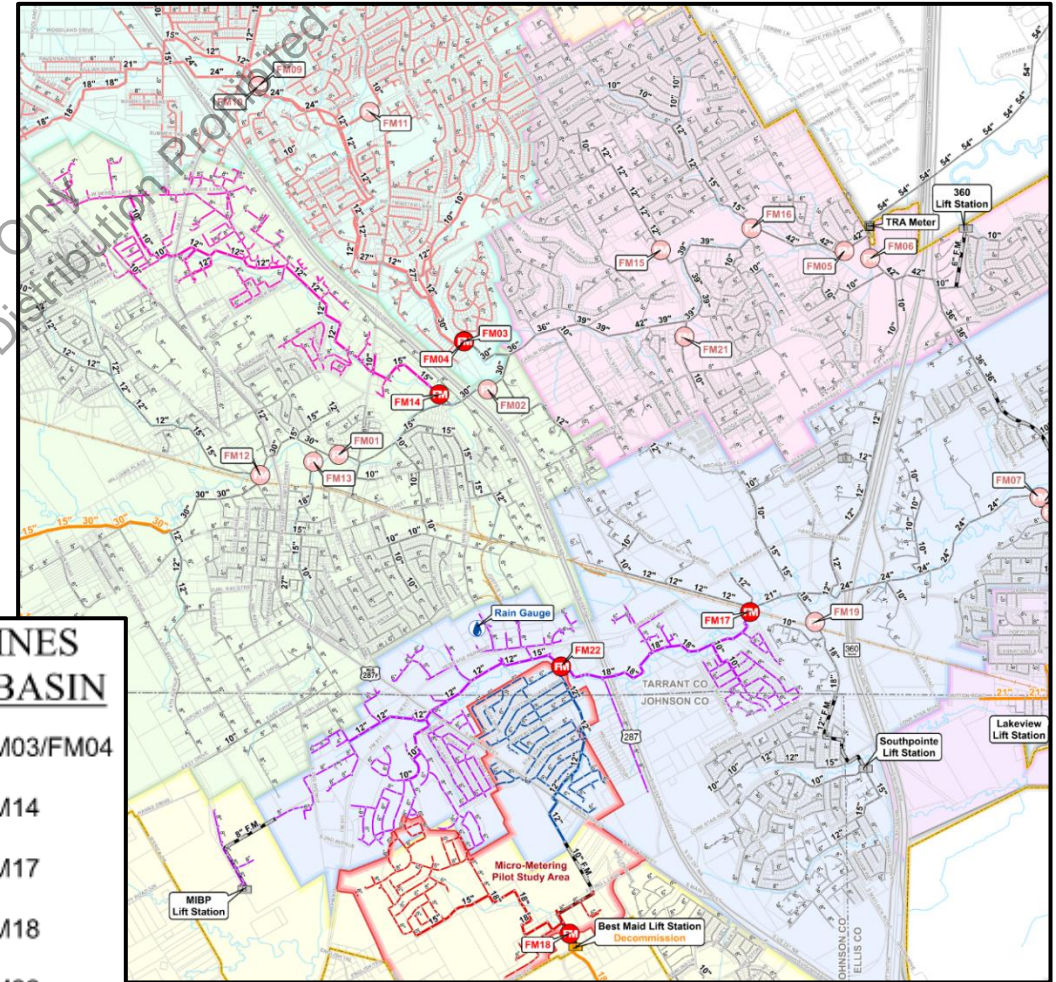
- Focus highest ranking I/I basins from Phase 1
- Measure effectiveness of ongoing rehabilitation
- Includes a micro-metering pilot study to pinpoint I/I sources



# Targeted Flow Monitoring

- 6 temporary flow meters
  - Highest I/I basins from Phase 1
  - Rehab work completed
- 1 rain gauge
- 60-day monitoring period

Flow Meter ID	Basin Size (linear footage)
FM03	413,363
FM04	
FM14	81,261
FM17	111,021
FM18	39,551
FM22	45,146
<b>Total</b>	<b>690,341</b>



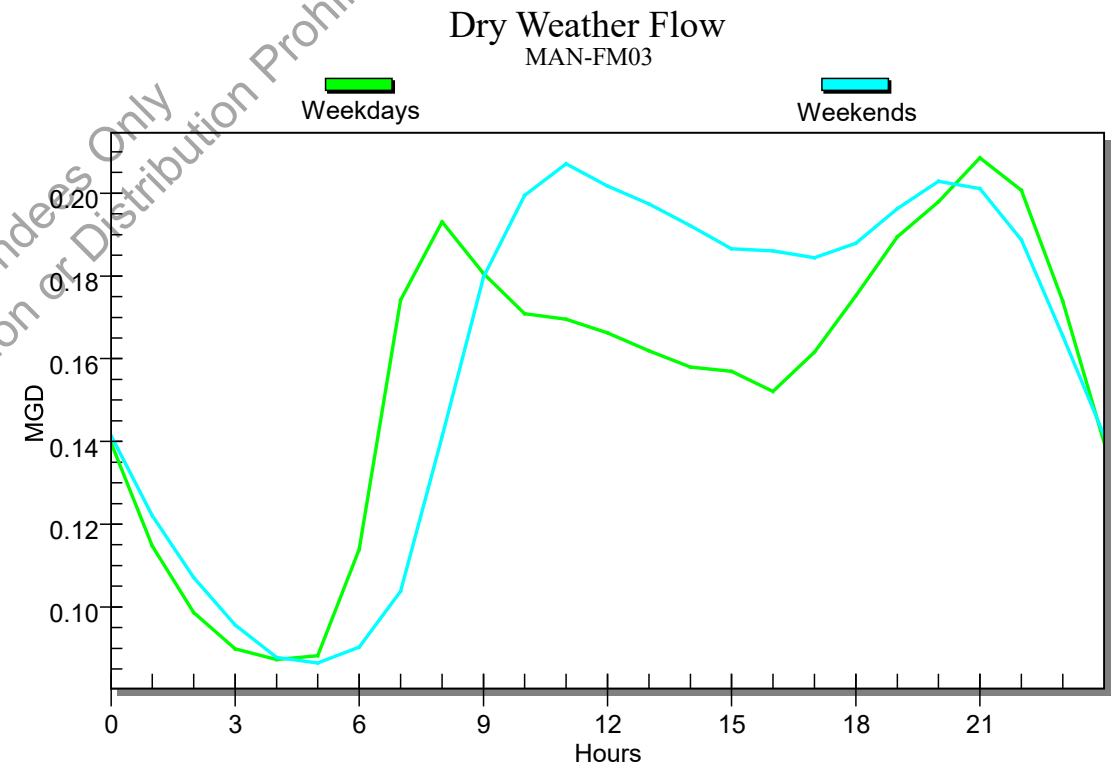
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# Dry Weather Performance

- Diurnals developed for each flow meter
- ASCE and WEF recommended criteria:
  - ✓ 15-inch and smaller:  $d/D < 60\%$
  - ✓ Larger than 15-inch:  $d/D < 75\%$

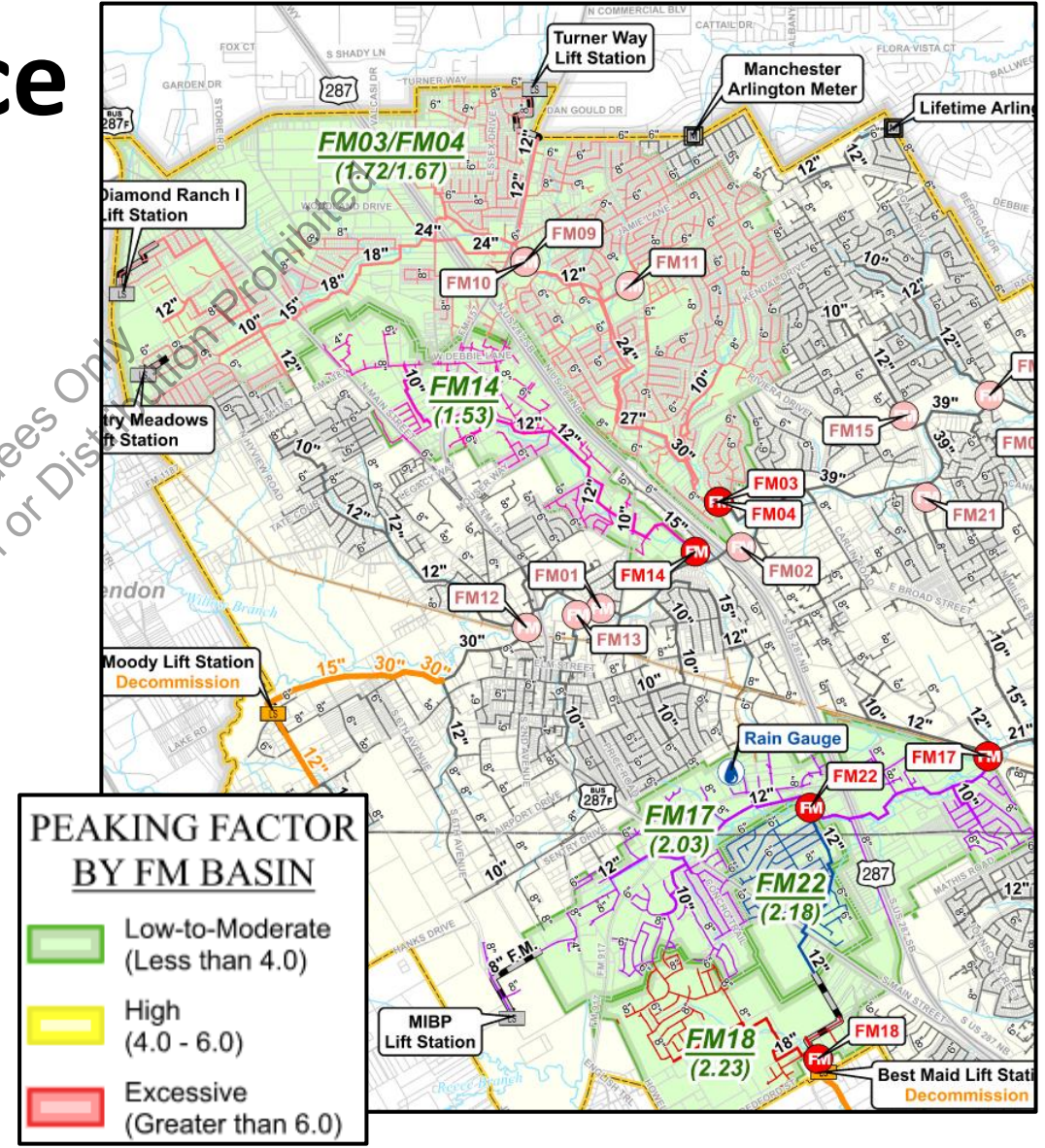
Flow Meter	Measured Diameter (in)	Maximum Dry Weather Depth (in)	Dry Weather d/D
FM03	11.25	4.67	22%
FM04	29.00	4.19	14%
FM14	14.50	4.53	31%
FM17	17.50	7.82	45%
FM18	11.75	2.52	21%
FM22	12.00	4.36	36%



# Wet Weather Performance

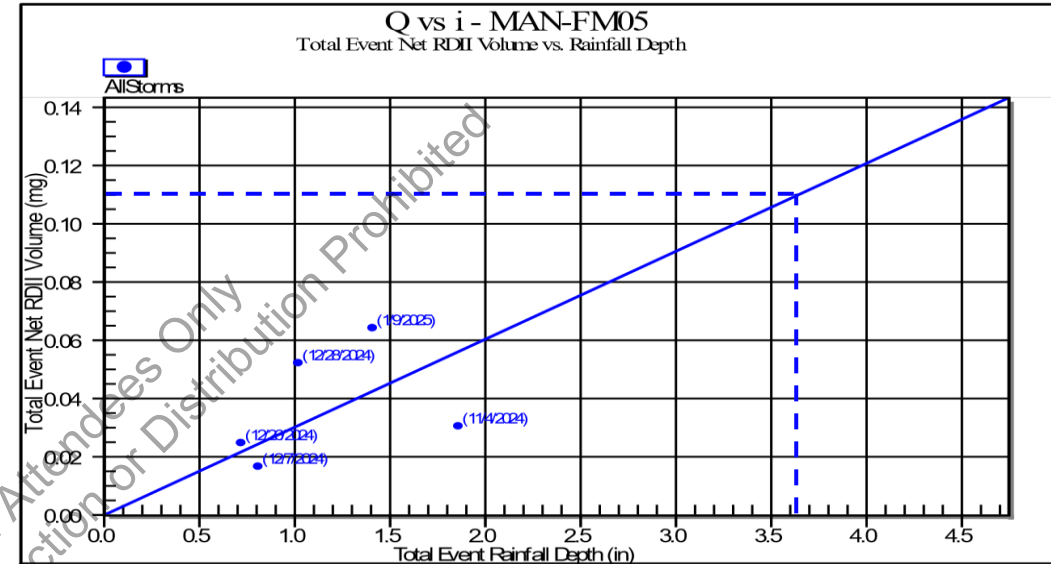
- 5 recorded rainfall events
  - Largest storm was 1.86 inches
- Low to moderate peaking factors
- ASCE and WEF recommended criteria:
  - ✓ All pipes  $d/D < 100\%$

Flow Meter	Measured Diameter (in)	Maximum Wet Weather Depth (in)	Wet Weather $d/D$
FM03	11.25	5.87	31%
FM04	29.00	6.53	31%
FM14	14.50	6.40	44%
FM17	17.50	10.98	64%
FM18	11.75	3.67	34%
FM22	12.00	5.91	50%



# RDII Calculations

- Rainfall Derived Infiltration and Inflow
  - Wet weather minus dry weather flow
- Projected for 3.65-inch design storm
- **3** of the 5 FM Basins saw decrease in I/I from Phase 1 monitoring
  - FM14, FM18, FM3/FM4

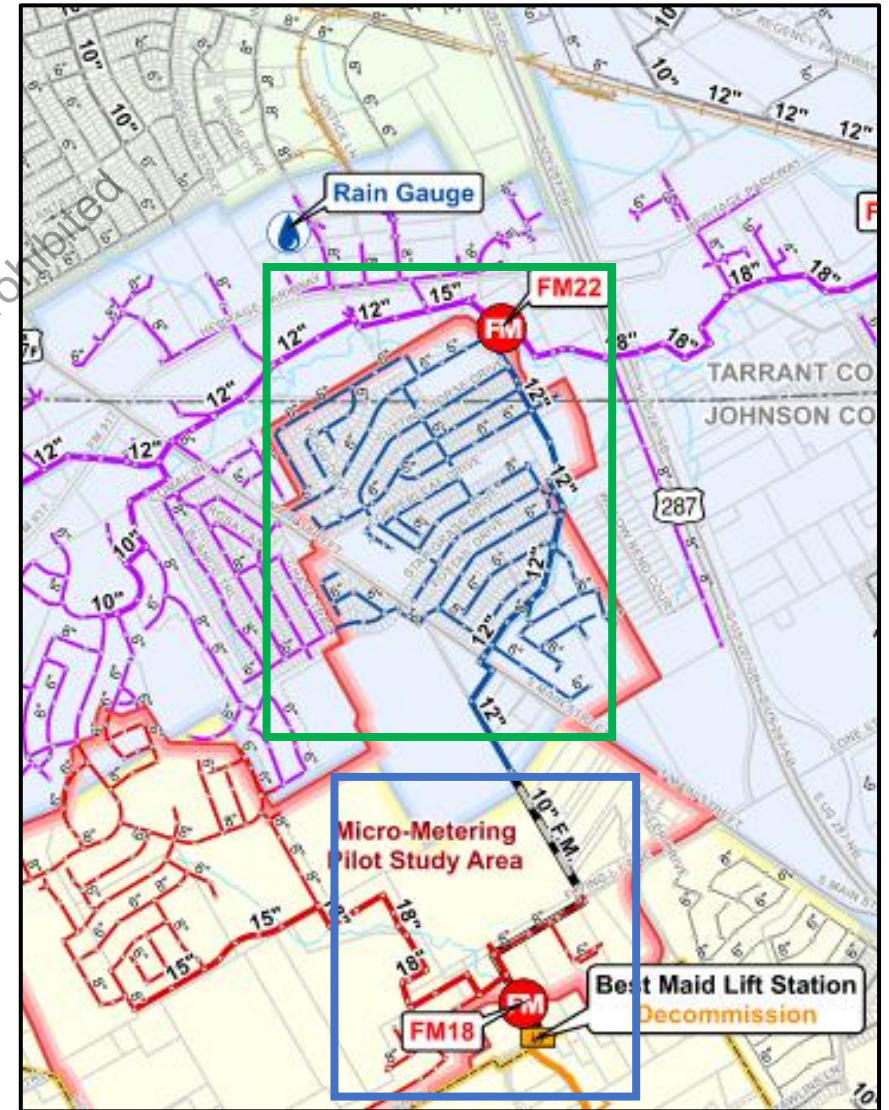
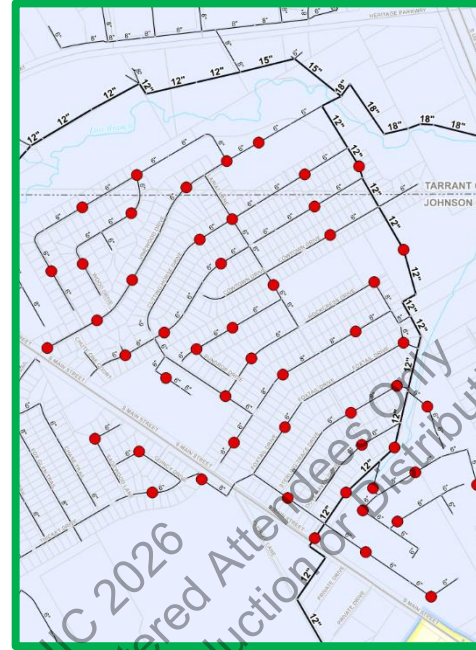


Flow Meter IDs	Phase 1 Net RDII (Gal/LF)	Phase 2 Net RDII (Gal/LF)	Change (+/-)	Increase / Decrease
FM14	14.70	7.14	-7.56	Decrease
FM17	6.69	7.30	+0.61	Increase
FM18	9.38	2.78	-6.60	Decrease
FM22	6.00	10.41	+4.41	Increase
FM03/FM04	3.80	2.32	-1.48	Decrease



# Micro-Metering Pilot Study

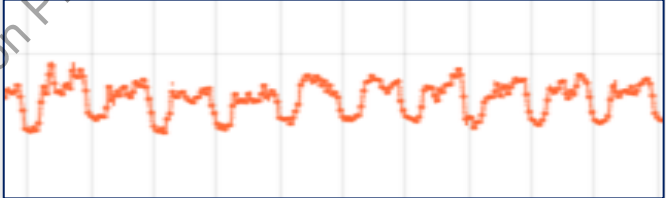

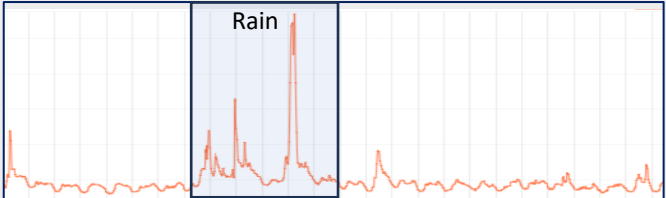
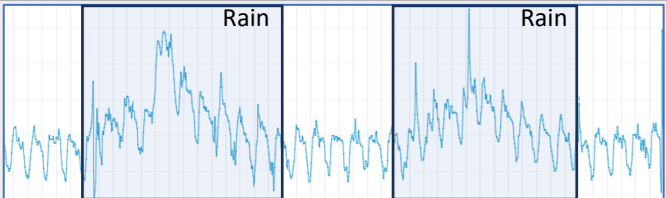
- 55 level sensors were deployed between March and June 2025
  - FM 18 and FM22 were analyzed
- Manhole Virtual Models used to analyze defects



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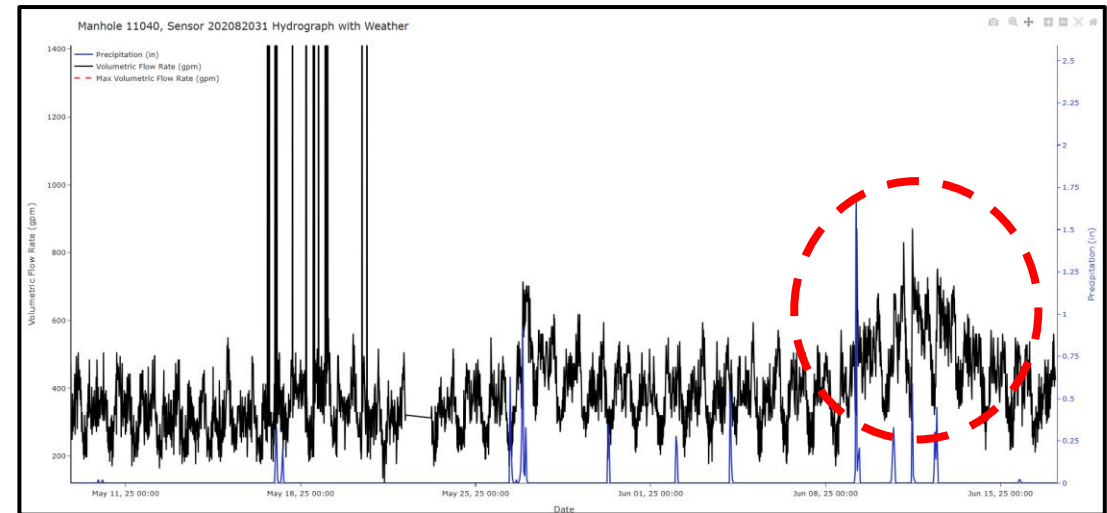
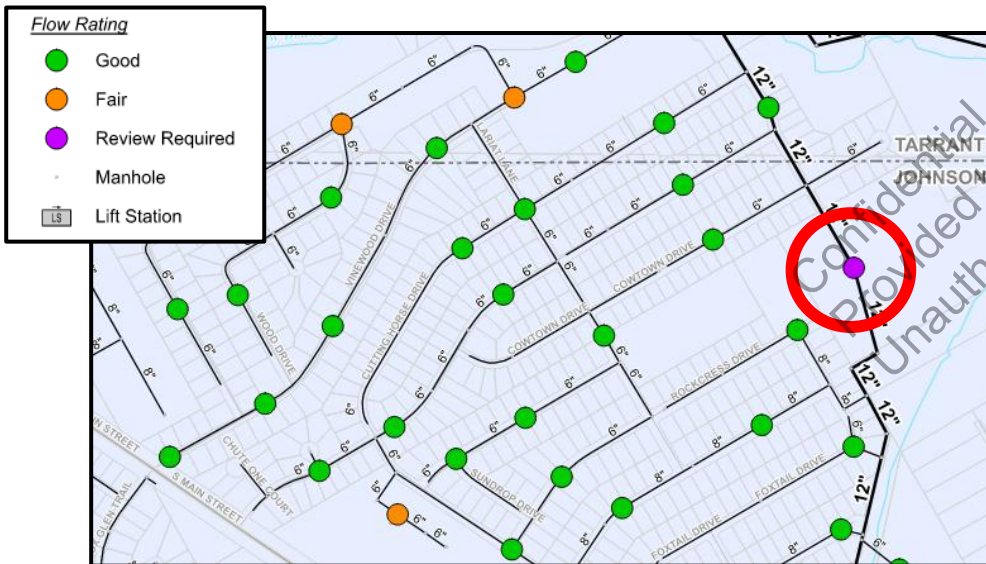
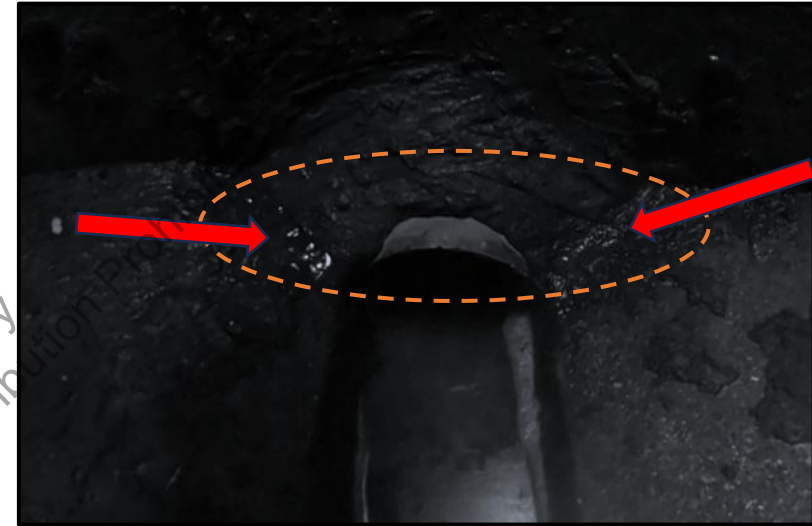
# Micro-Metering Pilot Study

Flow Condition	Level Signature
<p><b><u>Regular Flow:</u></b> Daily Diurnal Pattern of Flow</p>	
<p><b><u>Blockage:</u></b> Sharp Increase / Decrease in Diurnal Pattern</p>	
<p><b><u>Inflow (Open to Sky):</u></b> Spike in Level During Rain Event</p>	
<p><b><u>Infiltration (Underground):</u></b> Gradual Increase in Level During Rain Event</p>	



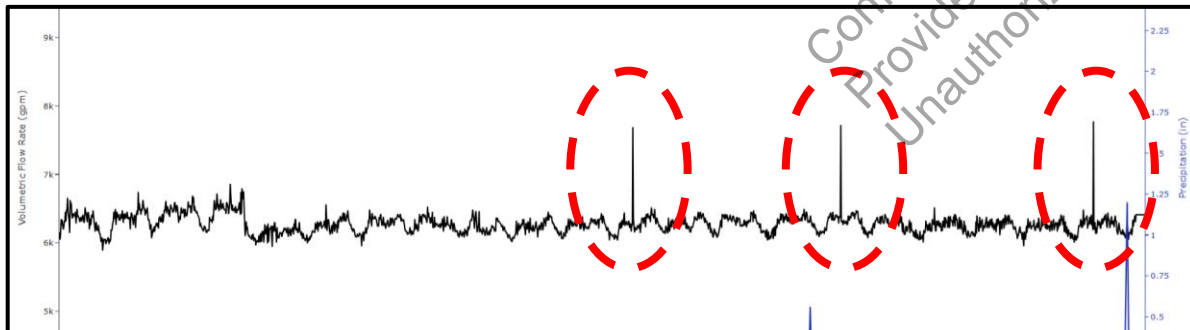
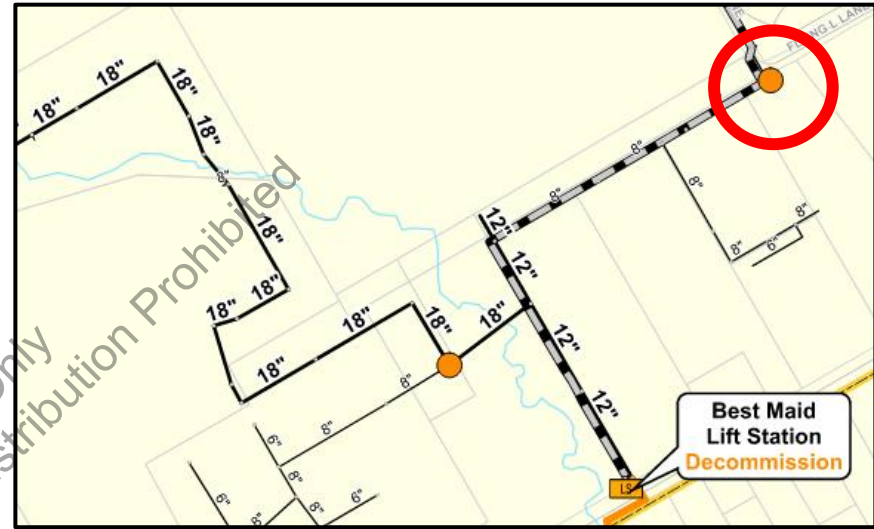
# Micro-Metering Pilot Study

- 8 primary I/I contributors identified
- Primarily ground infiltration detected



# Micro-Metering Pilot Study

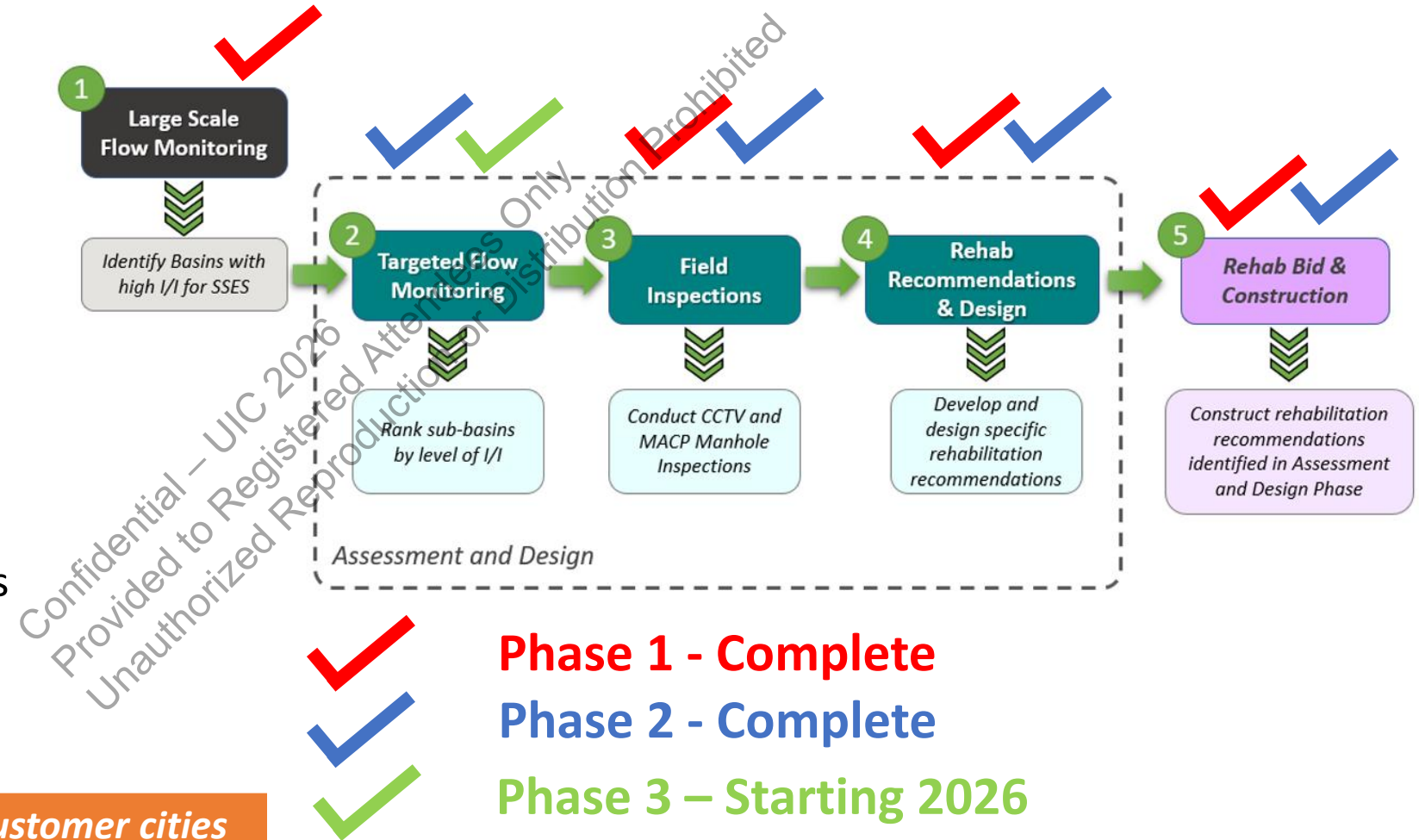
- Recommended to maintain sensors in high I/I lines
- Continue implementing intermediate and long-term rehab efforts
  - Focusing on areas with elevated I/I



# Next Steps

- Complete high-priority basin inspections and rehab
- Flow Monitoring Round 3
- Continue intermediate and long-term inspections
- Investigate infiltration findings from pilot study

## Status of Mansfield's SSES Program



*Note: Lowest I/I contributor out of 22 customer cities during 2024 study reported by TRA in December 2025.*



# Acknowledgements

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# Thank You!

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