

# An Update on SAWS Wastewater Modeling and Capacity Management Program

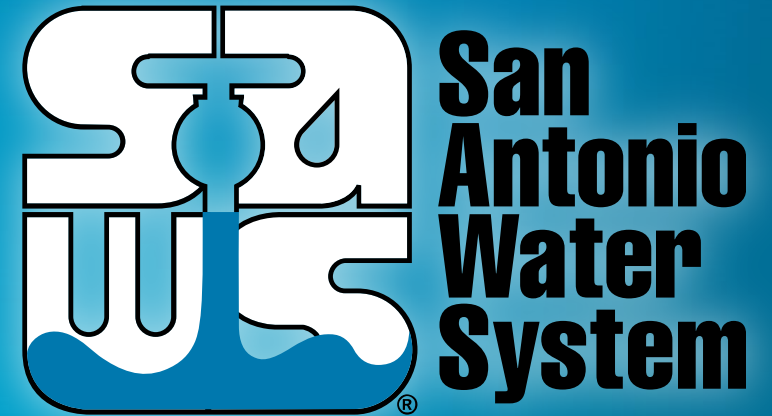
Bob King Johnson, P.E., PMP, San Antonio Water System

Steven Rhodes, P.E., Freese and Nichols

Abel Borunda, P.E., San Antonio Water System (SAWS)

TACWA Meeting

October 10, 2022



MAKING SAN ANTONIO  
**WATERFUL**



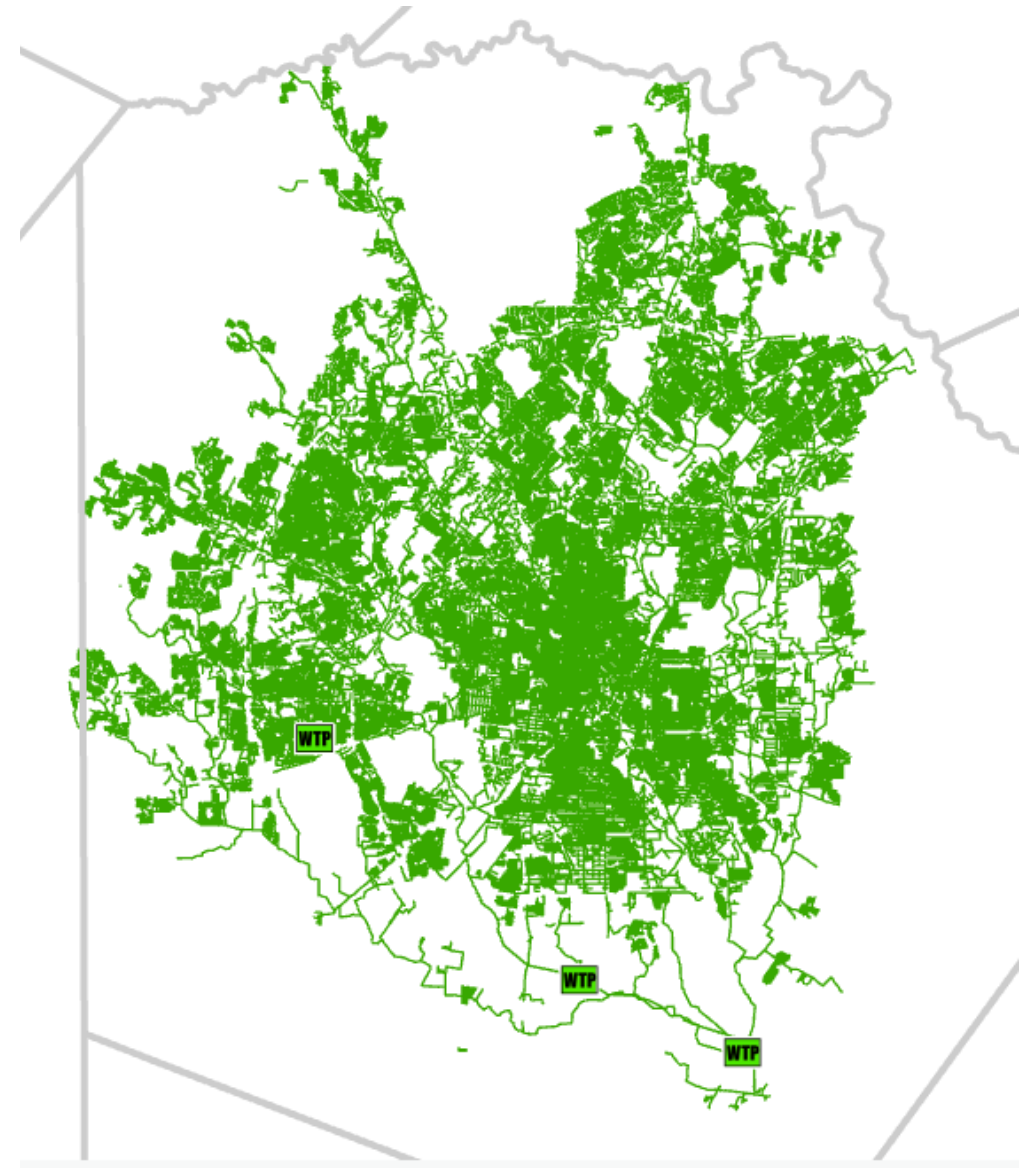
# Agenda

- SAWS Wastewater System and SSORP Overview
- SAWS Current Capacity Program
- Central Basin Calibration and System Assessment
- I/I Reduction Program
- Capacity Program Moving Forward



# SAWS Wastewater System

- 5800 miles of sewer main
- Population: 1.8 million
- 3 water recycling facilities
- More than 100 MGD daily
- 4 Major Wastewater Basins
  - East: Salado Creek
  - Central: San Antonio River
  - West: Leon Creek
  - Far West: Medio Creek



# Consent Decree Overview



**1. ASSESS**



**2. PLAN**



**3. REPORT**



**4. Ongoing REHAB**

**& Ongoing Capacity Projects**

UNITED STATES DISTRICT COURT  
WESTERN DISTRICT OF TEXAS  
SAN ANTONIO DIVISION

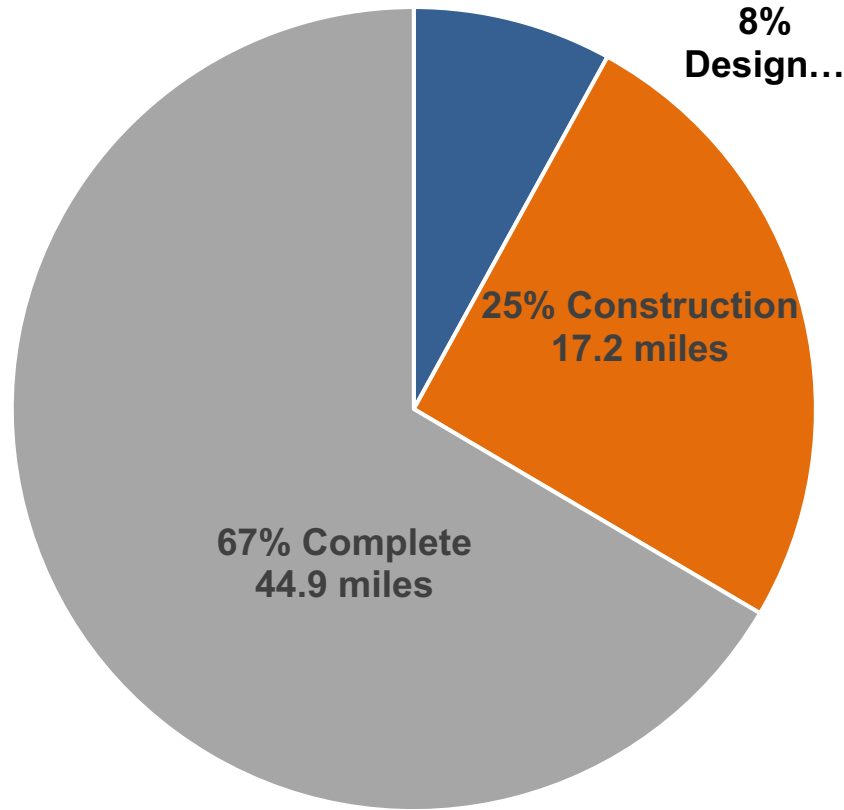
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UNITED STATES OF AMERICA,  
and  
STATE OF TEXAS,  
Plaintiffs,  
v.  
SAN ANTONIO WATER SYSTEM,  
Defendant.

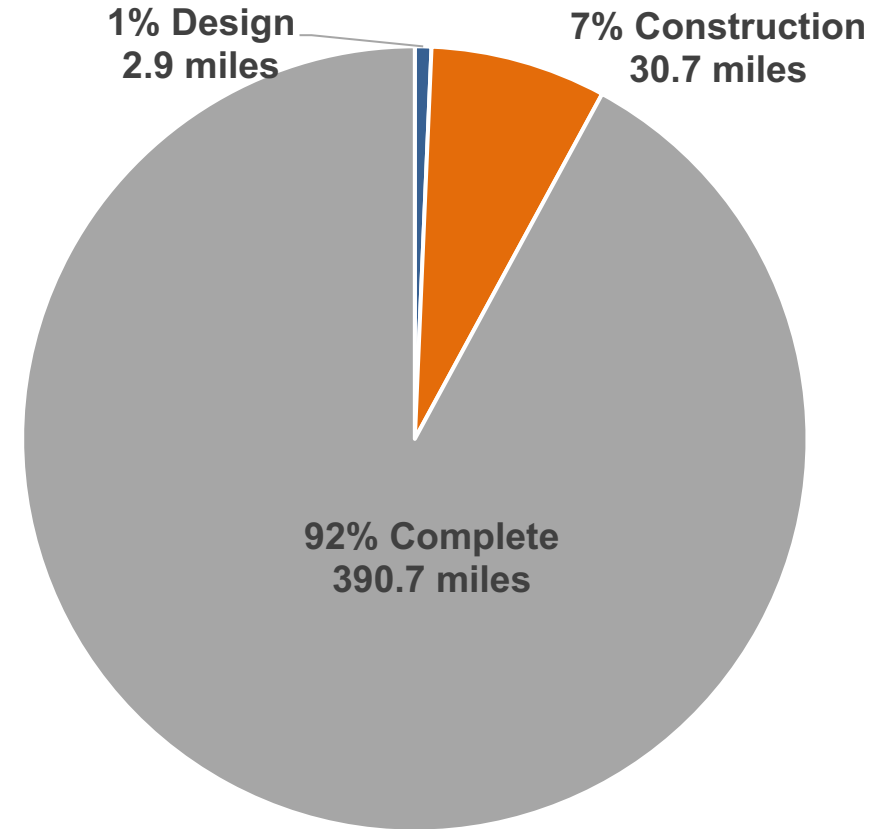
Civil Action No. \_\_\_\_\_

CONSENT DECREE

# Consent Decree Program Status

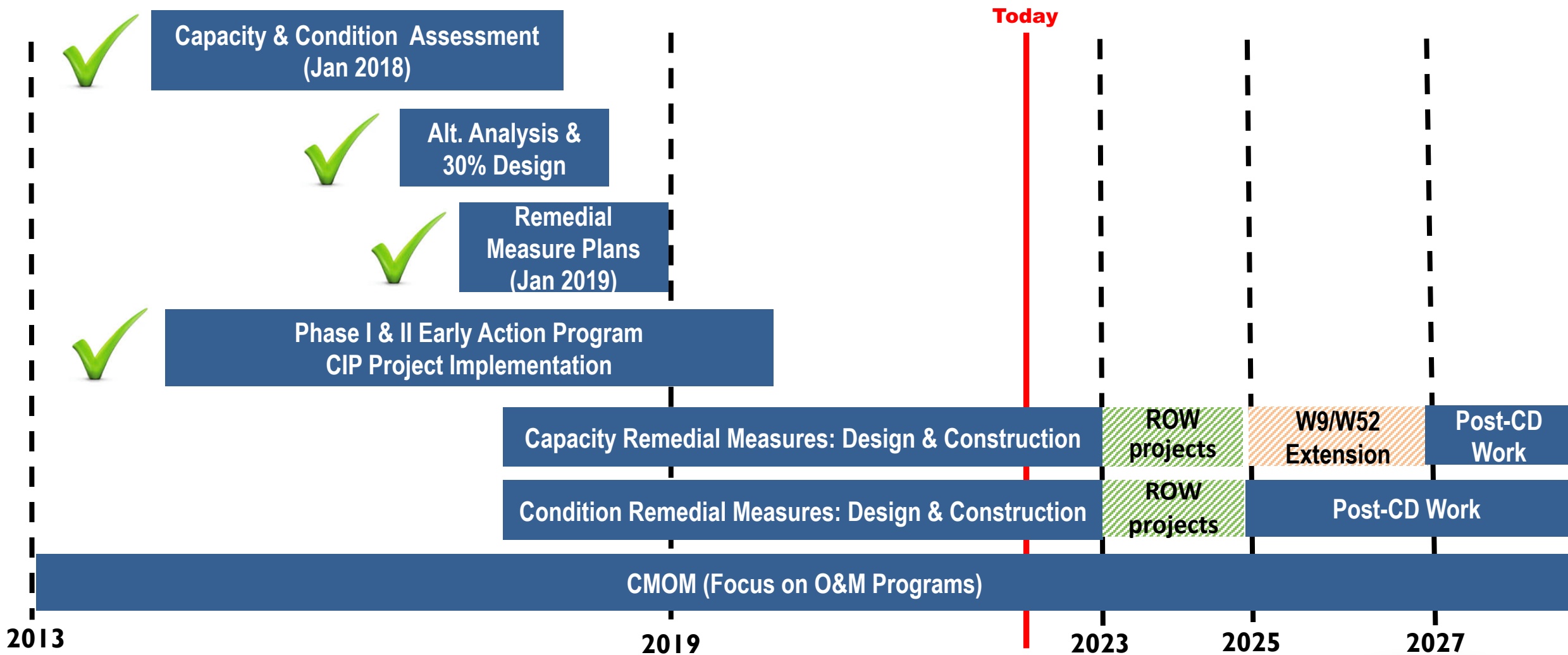


Capacity



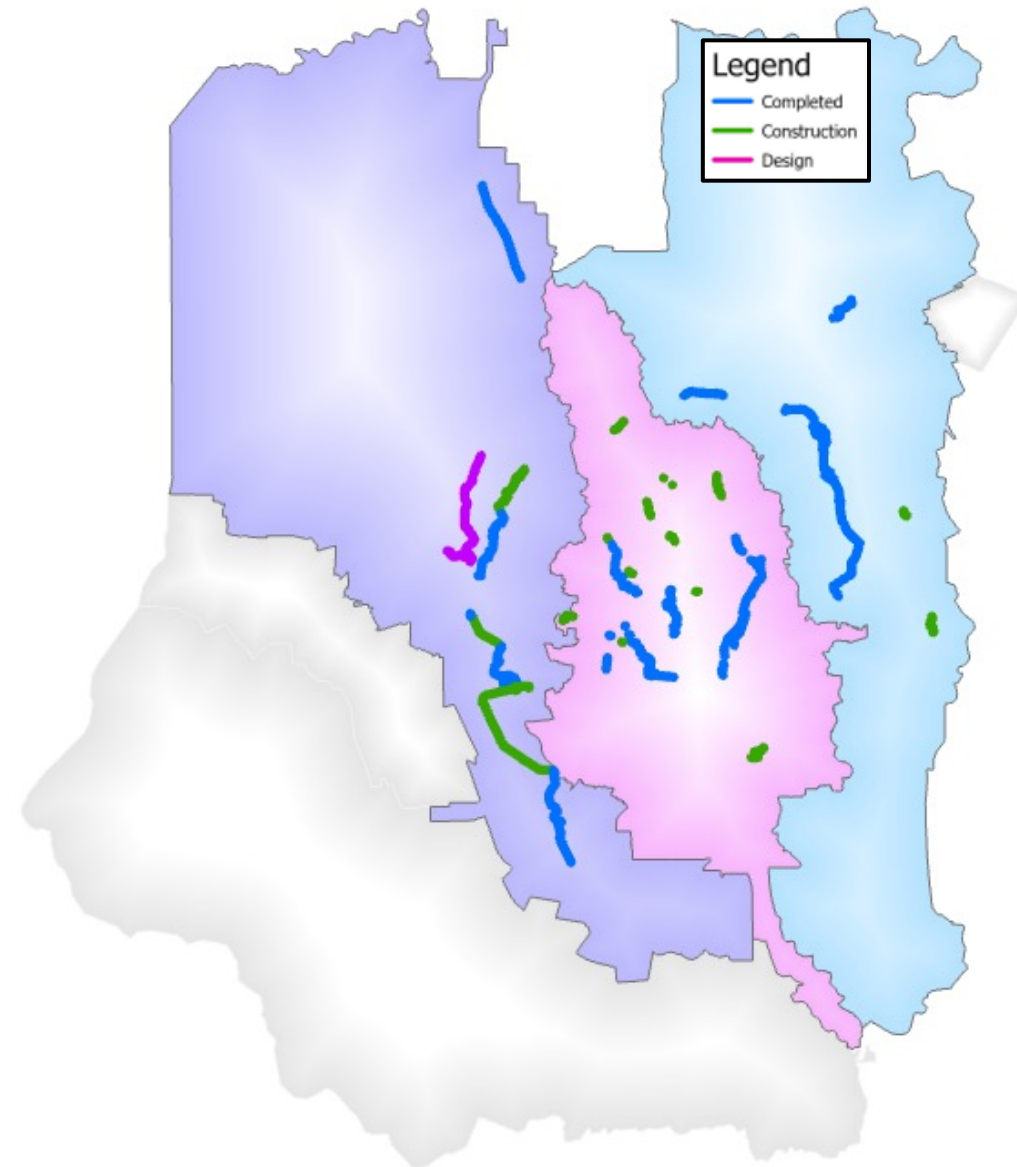
Condition

# Consent Decree Program Status



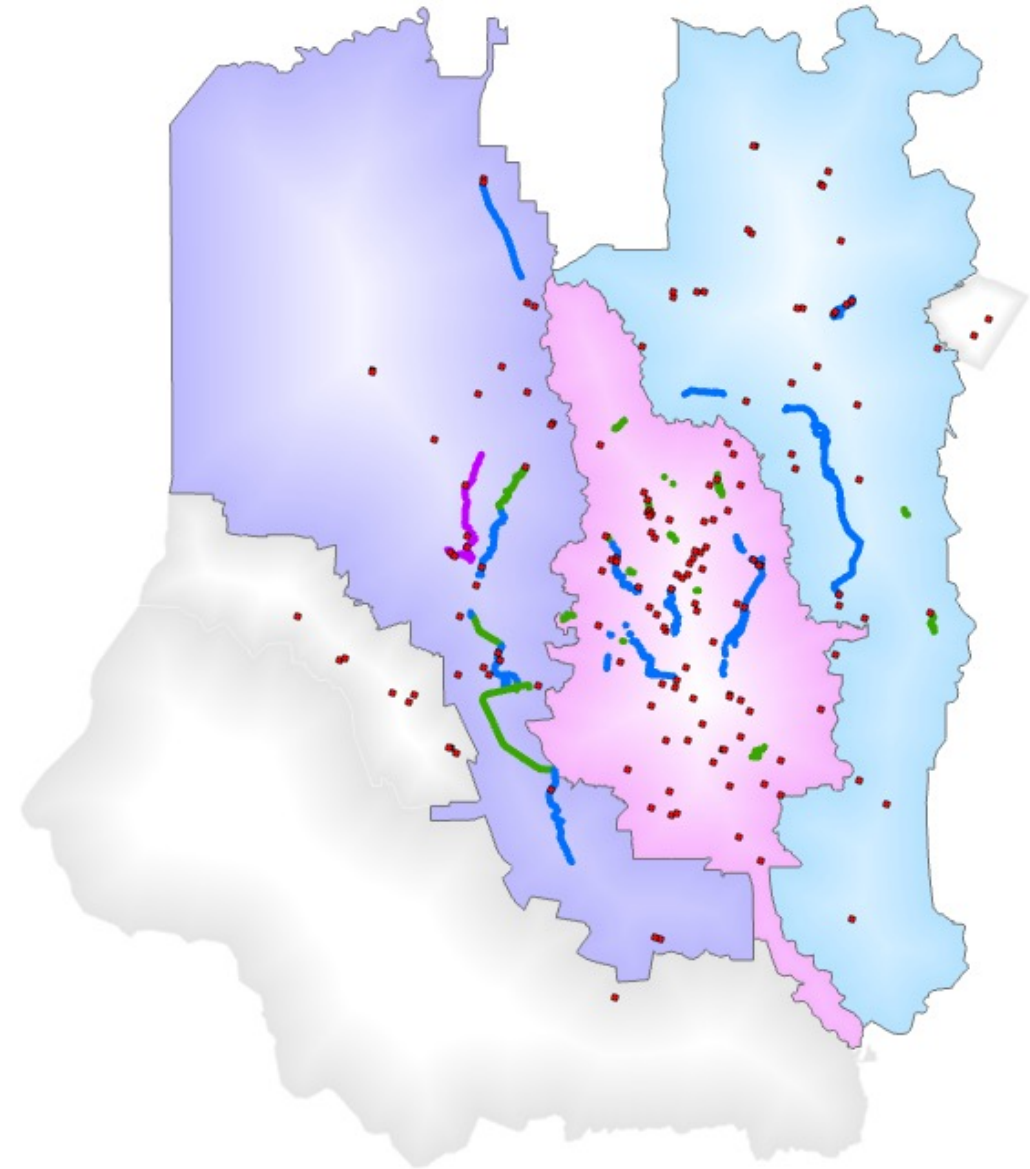
# Capacity Program

- Guiding Documents
  - Consent Decree
  - Capacity Remedial Measures Plan
  - CMOM
- **Conveyance projects**
  - \$778 million
  - 68 miles of main
- Long-term Monitoring
  - SSOs
  - Capacity constraints
  - Post-rehab performance assessment
- Inflow and Infiltration (I&I) Reduction
  - Reduce conveyance projects
  - Primary focus: Central Basin



# Capacity Program

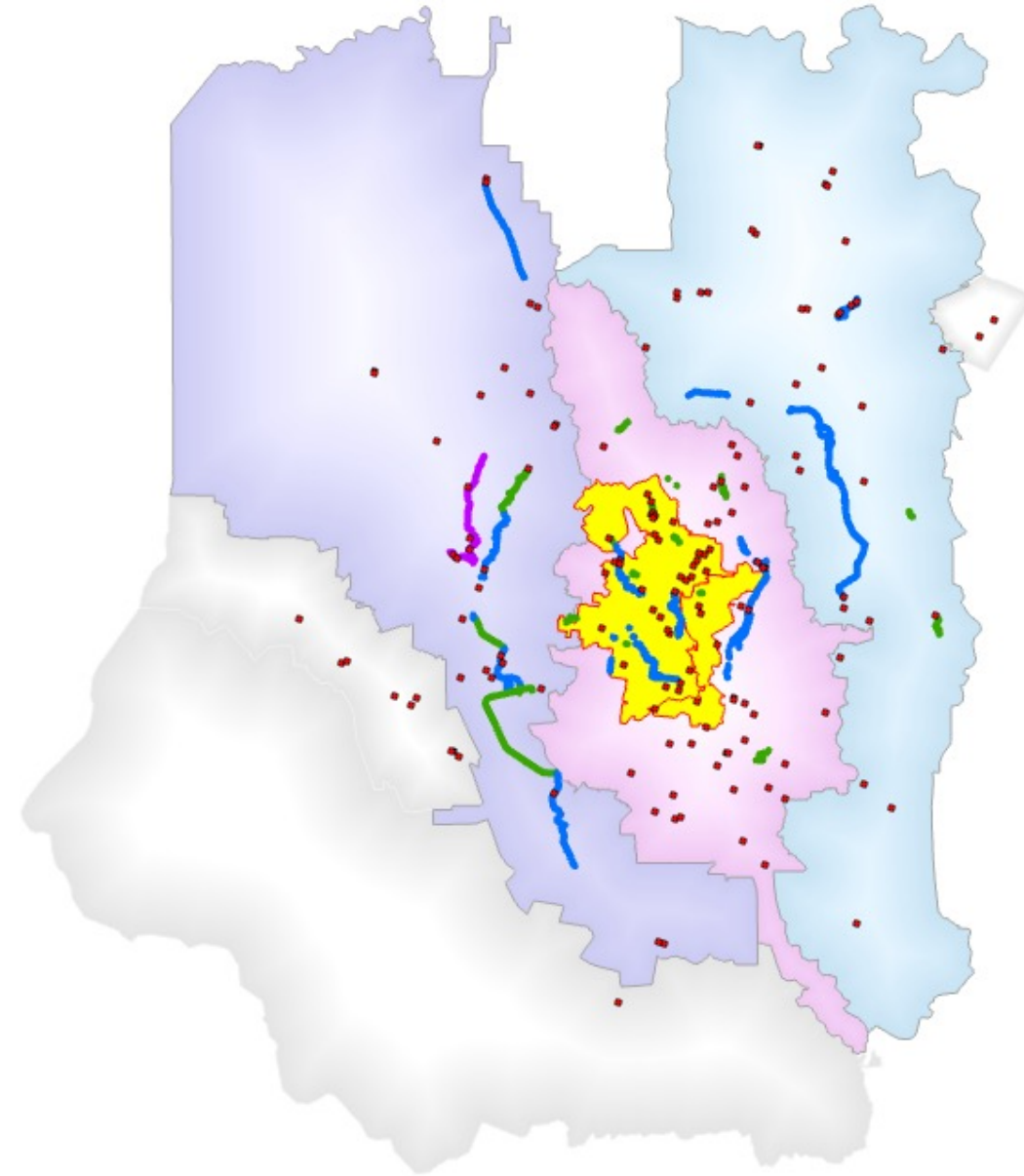
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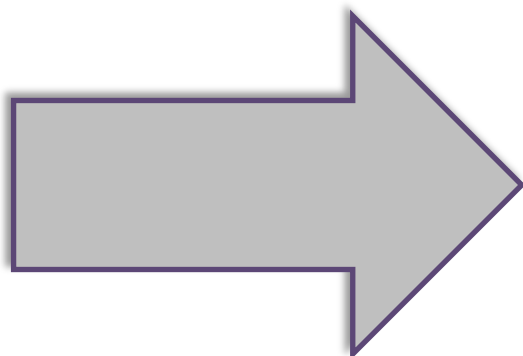
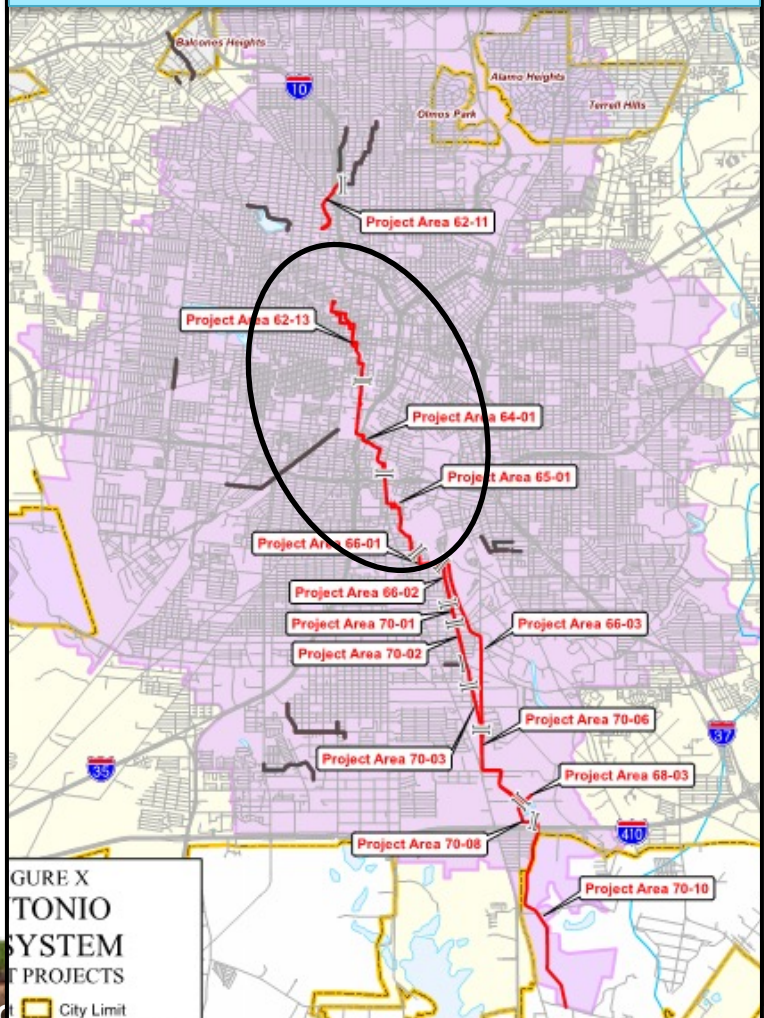


# Capacity Program

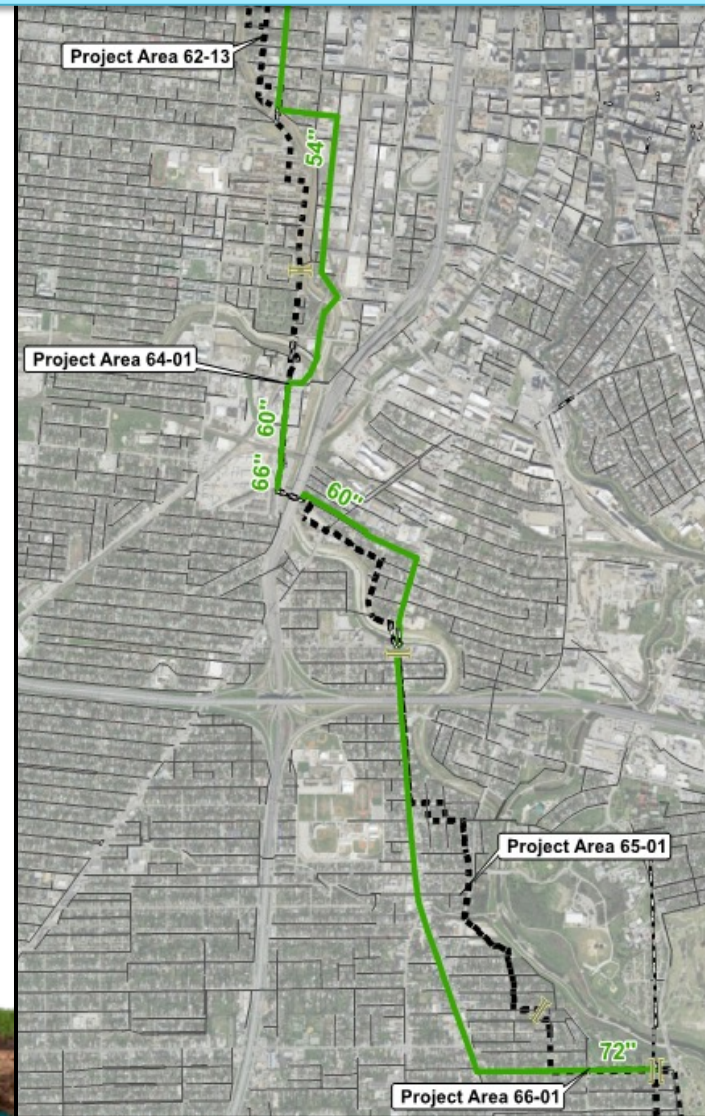
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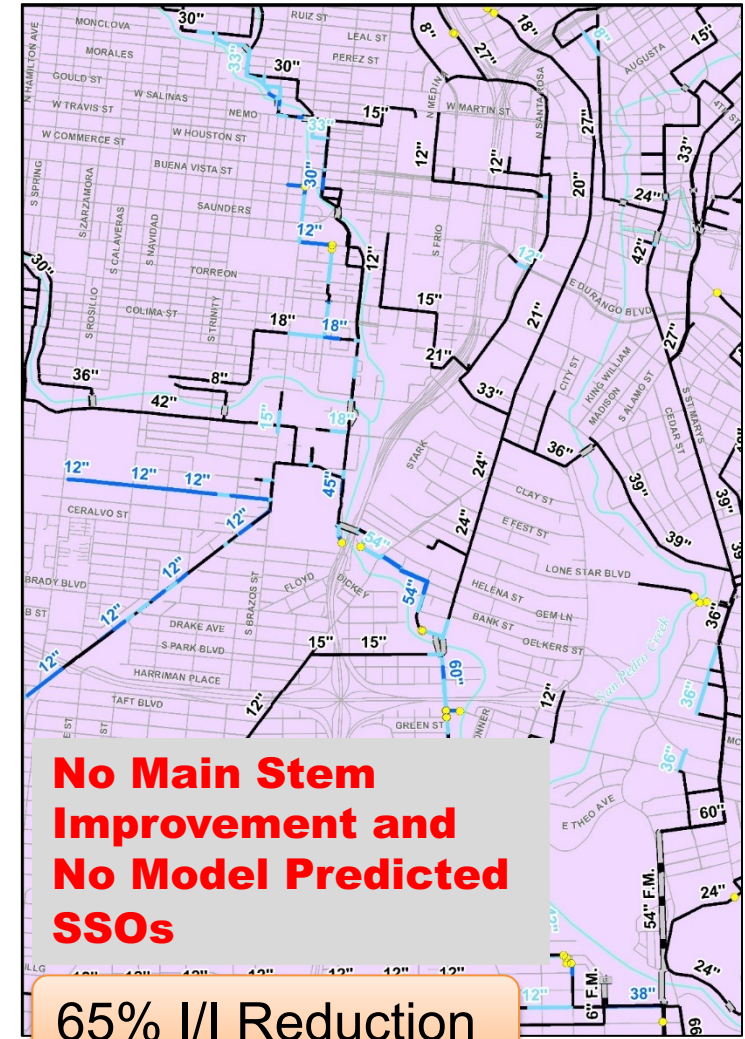
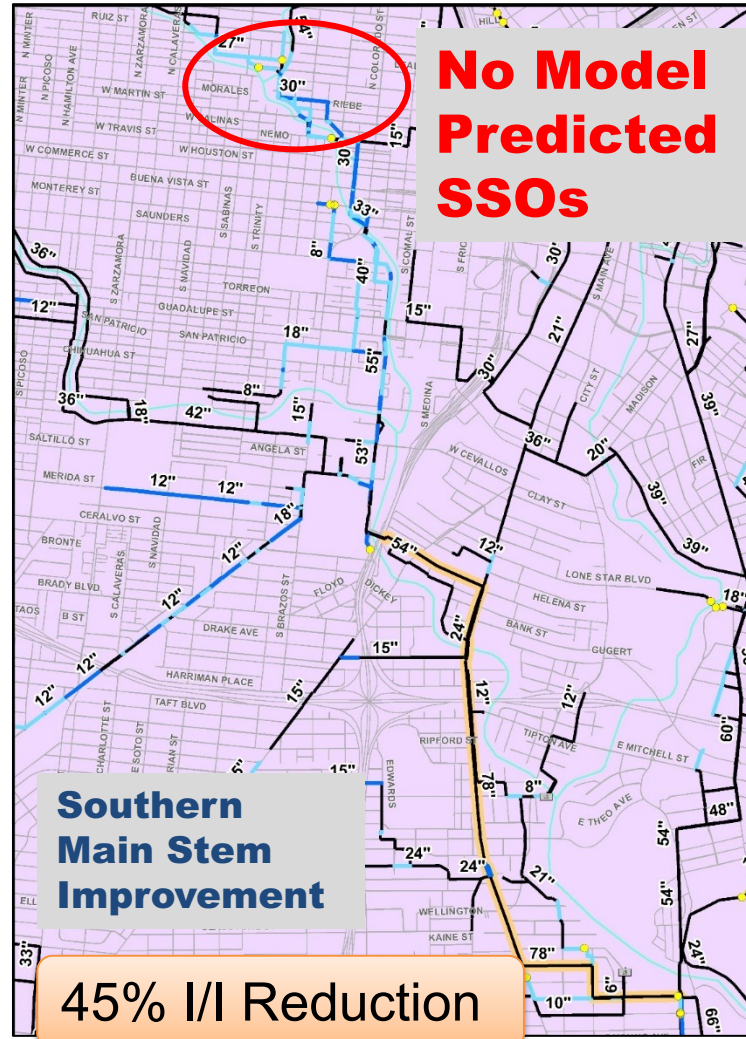
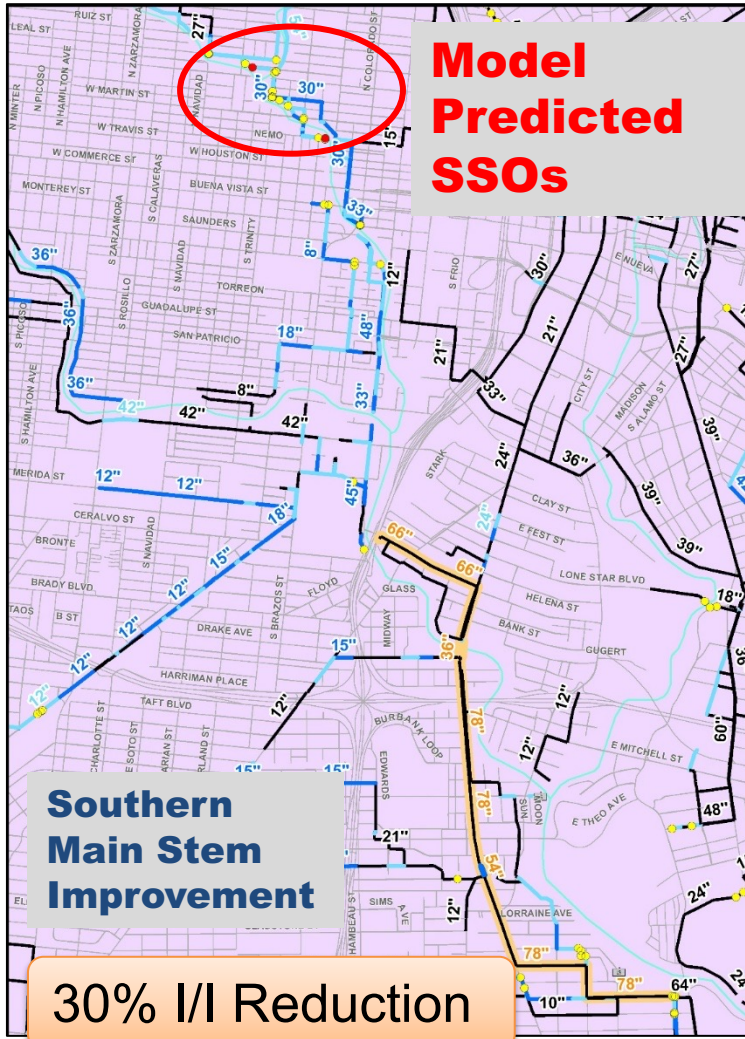


# Central Basin Capacity Constraint Areas



10% Design Main Stem Improvement with 30% I/I Reduction

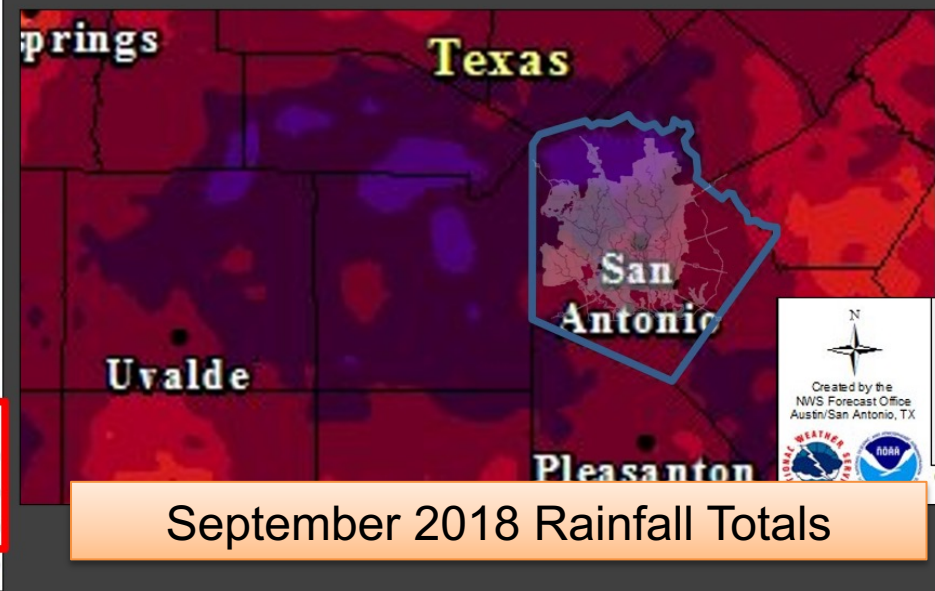




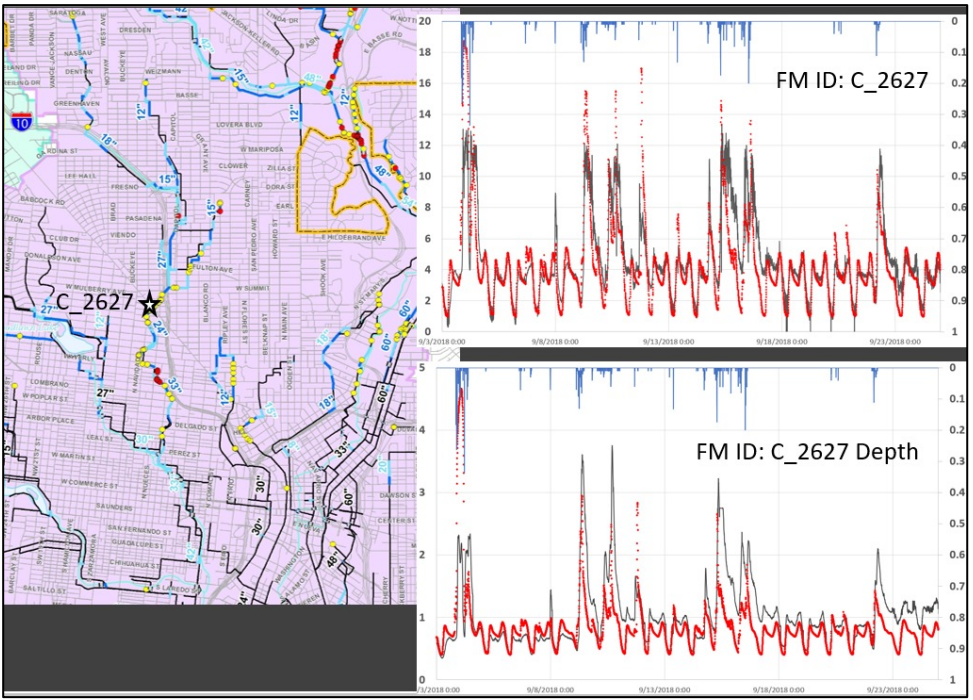
# Drivers for Model Update

An Update on SAWS Wastewater Modeling and Capacity Management Program



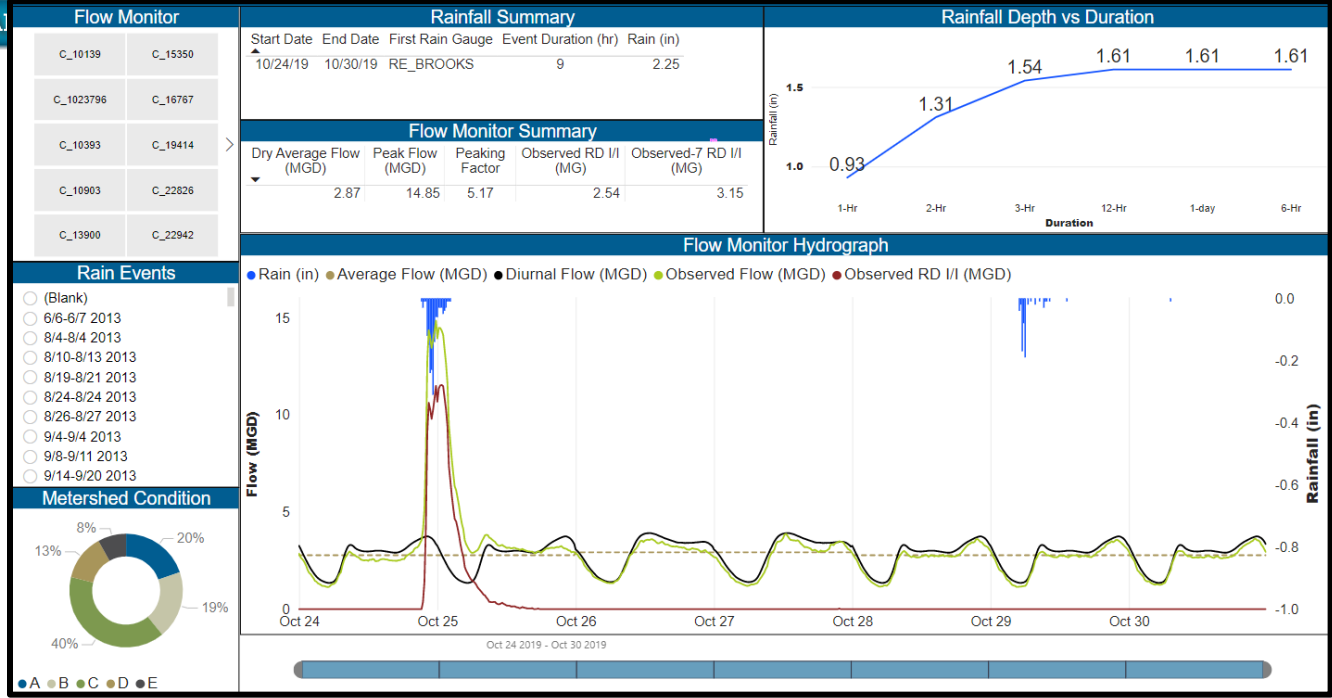


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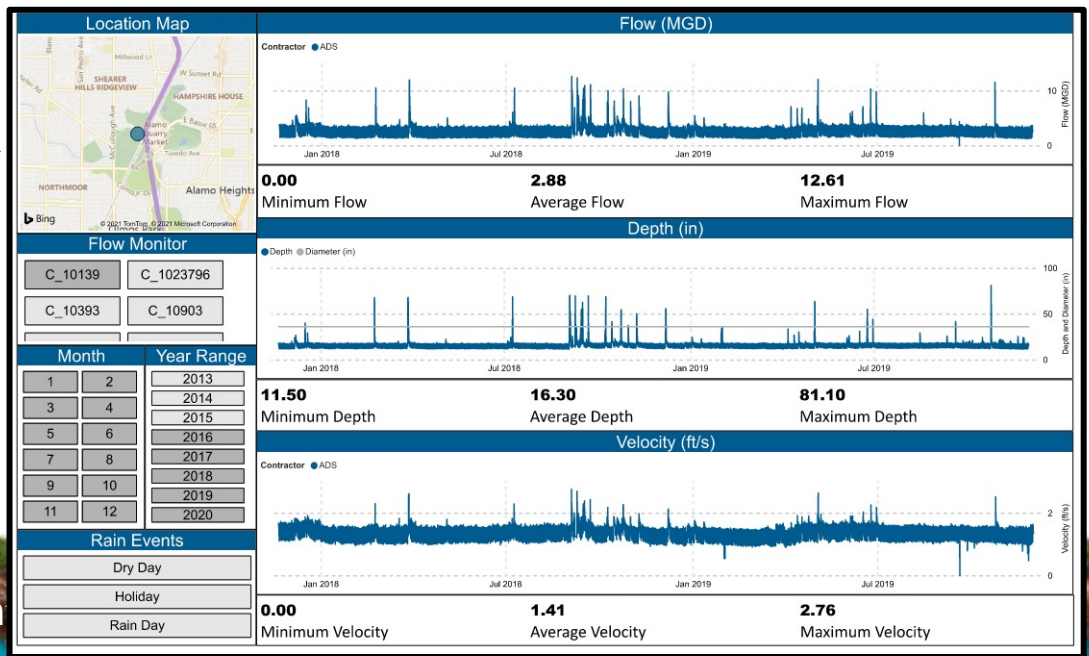
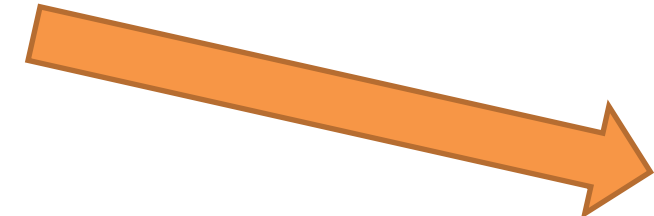
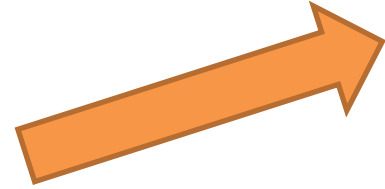
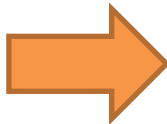


- ### Sept 2018 Capacity Assessment
- CD Model was overpredicting flow and depth along the Main Stem
  - Flow monitoring used to calibrate the CD Model was also used to identify and repair large inflow sources
  - CMOM Program requires model updates if model no longer reflects current conditions





**Flow Monitoring Database**



# Central Basin Collection System Monitoring

An Update on SAWS Wastewater Modeling and Capacity Management


# Hydraulic Model Calibration

### Summary of Metershed Calibration Parameters

Best Calibration Period	Per Capita (gpcd)	Discrete Population	Total Population	Base Flow (MGD)	Diurnal Pattern
Sunday, September 1, 2019	46	60K	196K	2.56	C_421430

Metershed: **C\_421430**

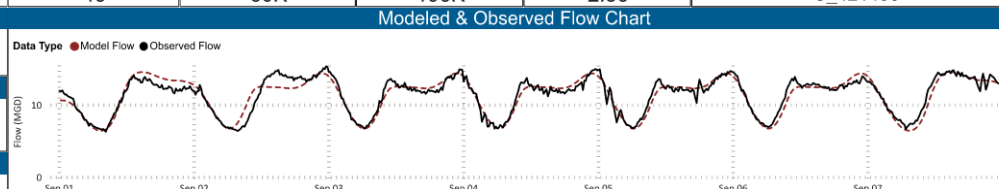
Calibration Type: **Dry Weather** | Event ID: **3**

Metershed Figure: 

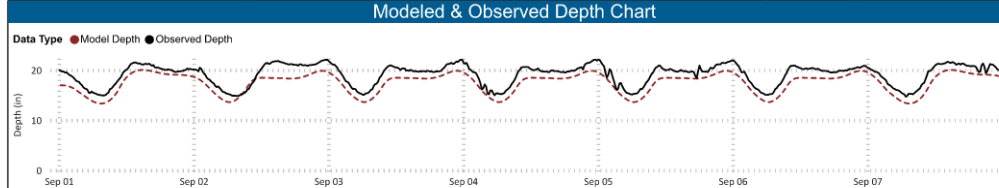
#### Calibration Notes

Calibrated to Event 3. Calibrated well to depth and velocity but observed velocity has a flat pattern. Good correlation to observed values without further adjustments.

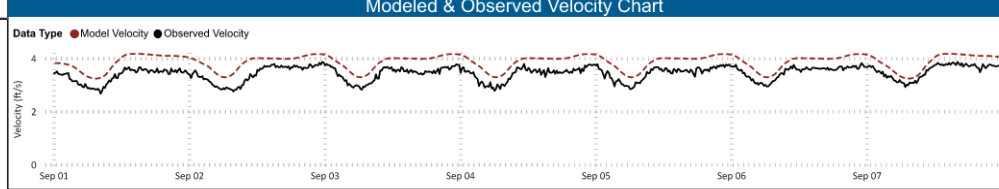
#### Modeled & Observed Flow Chart



#### Modeled & Observed Depth Chart



#### Modeled & Observed Velocity Chart



Data Type	Min	Avg	Max
Model Flow	6.47	11.39	14.58
Observed Flow	6.33	11.45	15.38
% Difference	2.21%	-0.52%	-5.20%

Data Type	Min	Avg	Max
Model Depth	13.40	17.55	20.11
Observed Depth	14.77	19.22	22.18
% Difference	-9.28%	-8.69%	-9.33%


Data Type	Min	Avg	Max
Model Velocity	3.25	3.88	4.18
Observed Velocity	2.68	3.44	3.88
% Difference	21.27%	12.79%	7.73%

- Calibrated to several different dry weather periods due to meter installation differences
- Able to calibrate 31 of 33 Metersheds within 10% of observed flow and volume values
- Utilized the GIM module in Infoworks ICM to better represent high infiltration driven metersheds
- Able to calibrate 29 of 33 Metersheds within 20% of observed flow and volume values

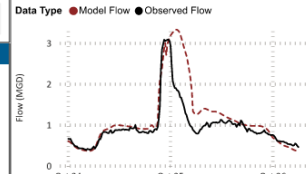
### Summary of Metershed Calibration Parameters

Area (Ac)	Contributing Area (Ac)	Runoff Area (Ac)	RS1(%)	RS2(%)	RS3(%)	Fast Resp.	Med. Resp.	Slo
897	204	11.22	1.1	0.7	3.8	2.0	20.0	

Metershed: **C\_10393**

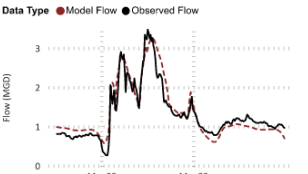
Metershed Figure: 

#### WWC - Calibration Event (10/24/2019)



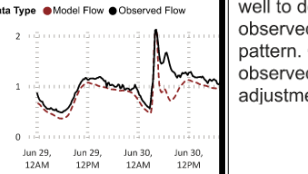
Data Type	Min	Avg	Max
Model Flow	0.37	1.10	3.34
Observed Flow	0.40	0.95	3.09
% Difference	-7.50%	15.79%	8.09%

#### WWC - Validation Event (3/28/2018)



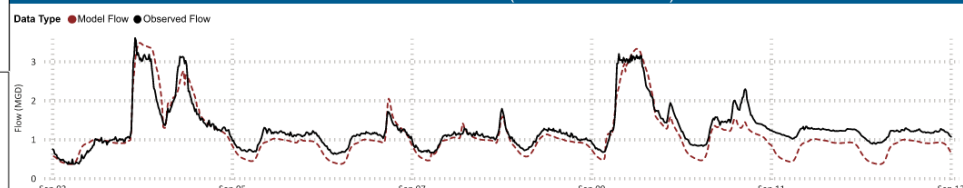
Data Type	Min	Avg	Max
Model Flow	0.37	1.13	3.26
Observed Flow	0.27	1.09	3.48
% Difference	37.04%	3.67%	-6.32%

#### WWC - Minor Event (6/30)



Data Type	Min	Avg
Model Flow	0.37	0.84
Observed Flow	0.49	0.95
% Difference	-24.49%	-11.58%

#### WWC - Verification Event (9/3/2018-9/14/2018)



Data Type	Minimum	Average	Maximum
Model Flow	0.37	1.08	3.49
Observed Flow	0.37	1.28	3.61
% Difference	0.00%	-15.62%	-3.32%

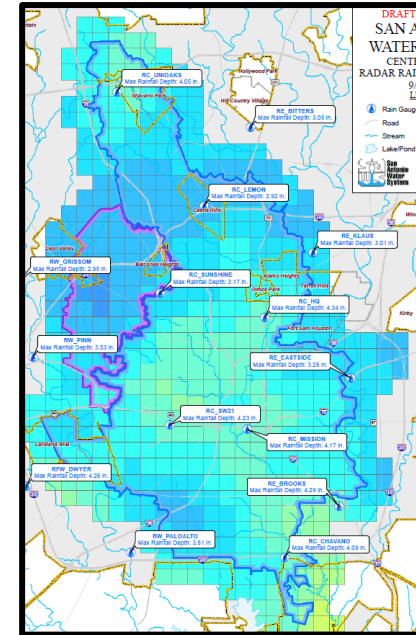
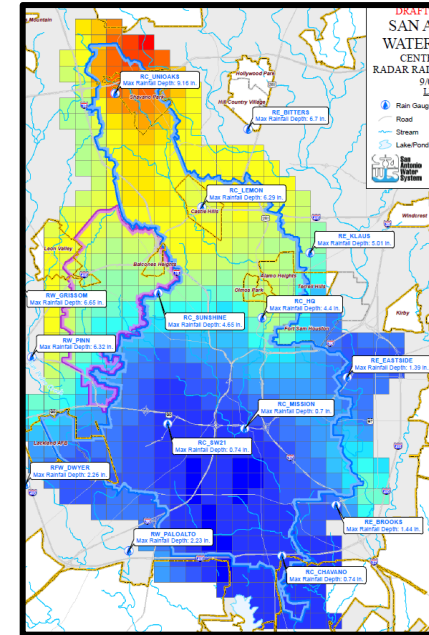
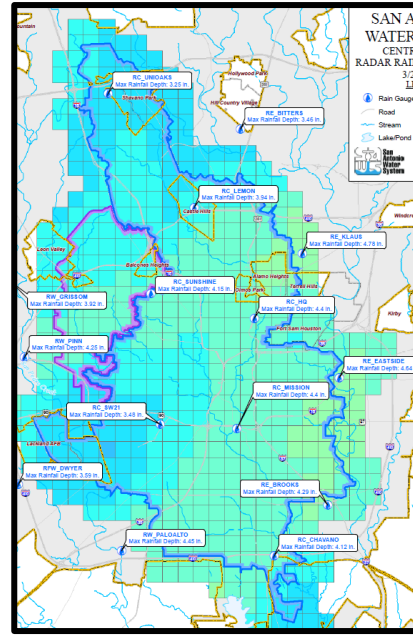
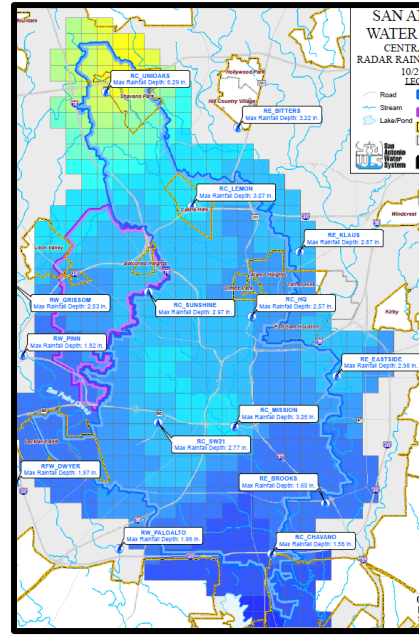
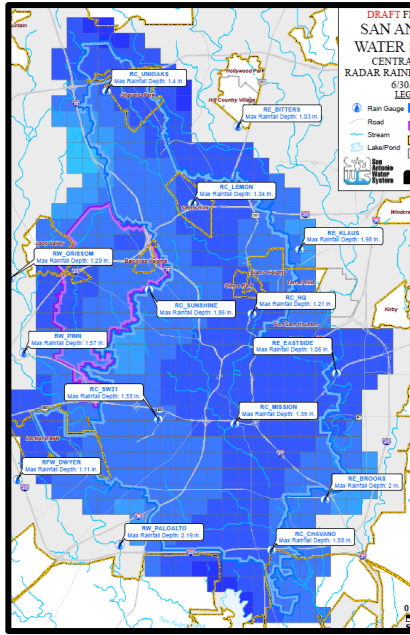
**WWC\_Notes**  
GIM Metershed. Slightly extended model predicted response during the Calibration event. However, the model predicted flow during the Validation and Verification events matches much better.

6/30/2019

10/24/2019

3/28/2018

9/3/2018 – 9/10/2018



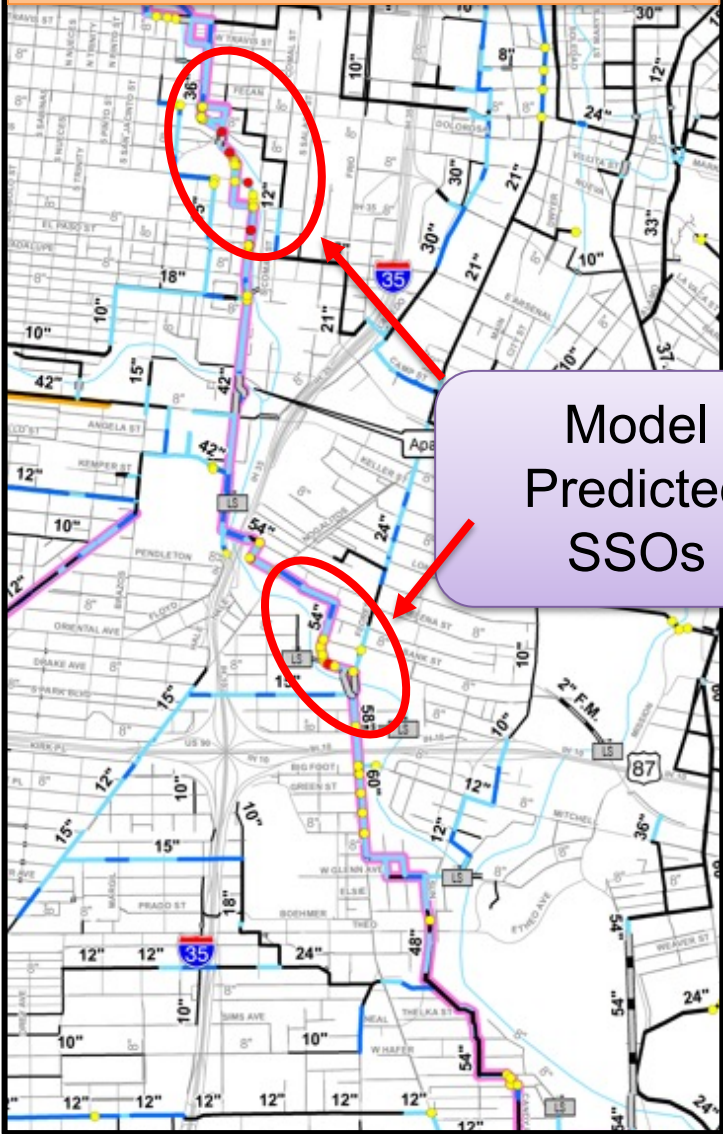
- Performed wet weather calibration to four rain events of varying rainfall amounts to ensure model accurately reflects observed conditions

# Wet Weather Hydraulic Calibration





# Upper Main Stem



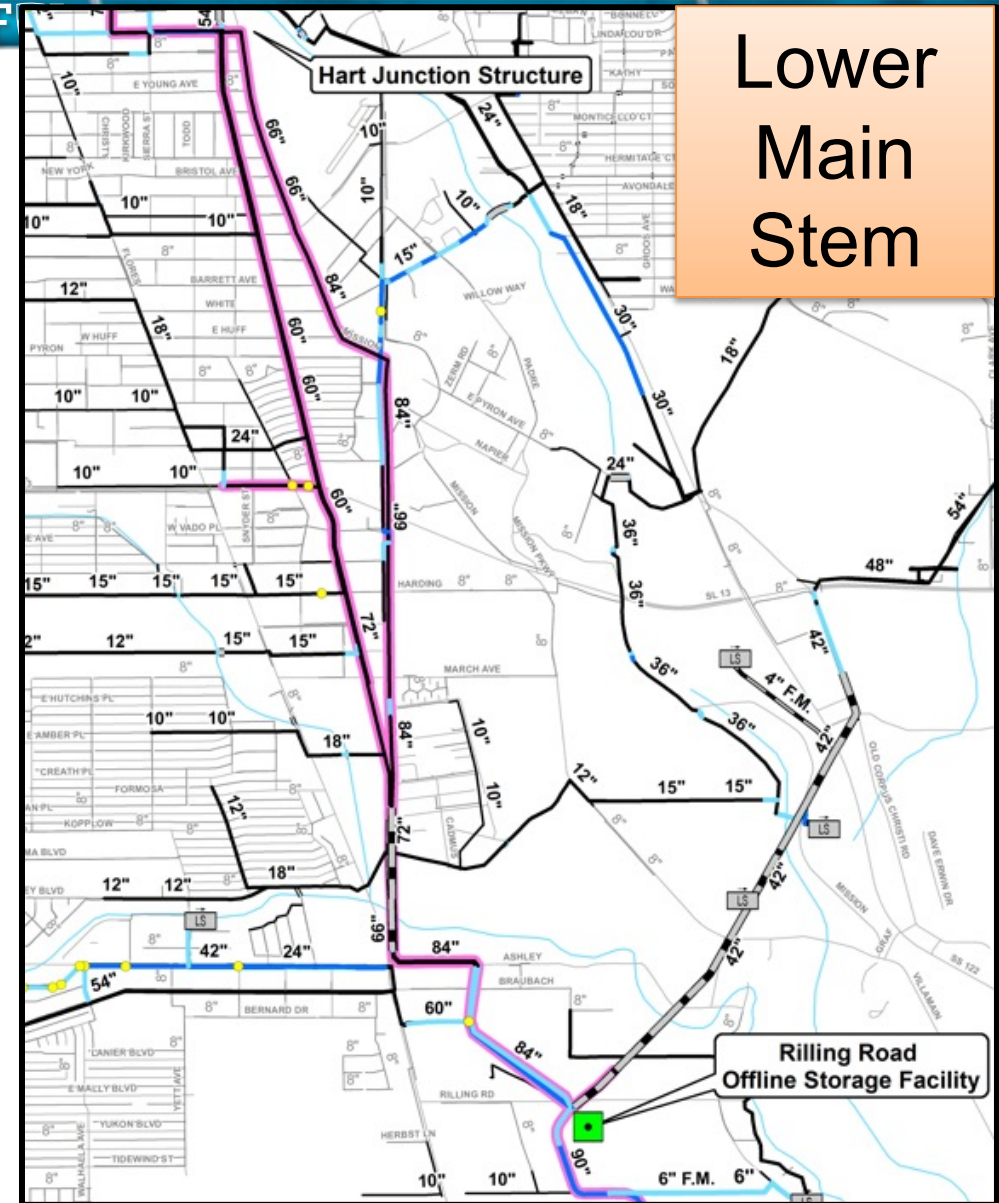
Model Predicted SSOs

### LEGEND

- Lift Station
- Model Predicted SSO
- Water Depth Within 3 ft
- Modeled Line
- Surcharging
- Capacity Restriction
- Siphon
- Early Action Project
- Capacity Constraint

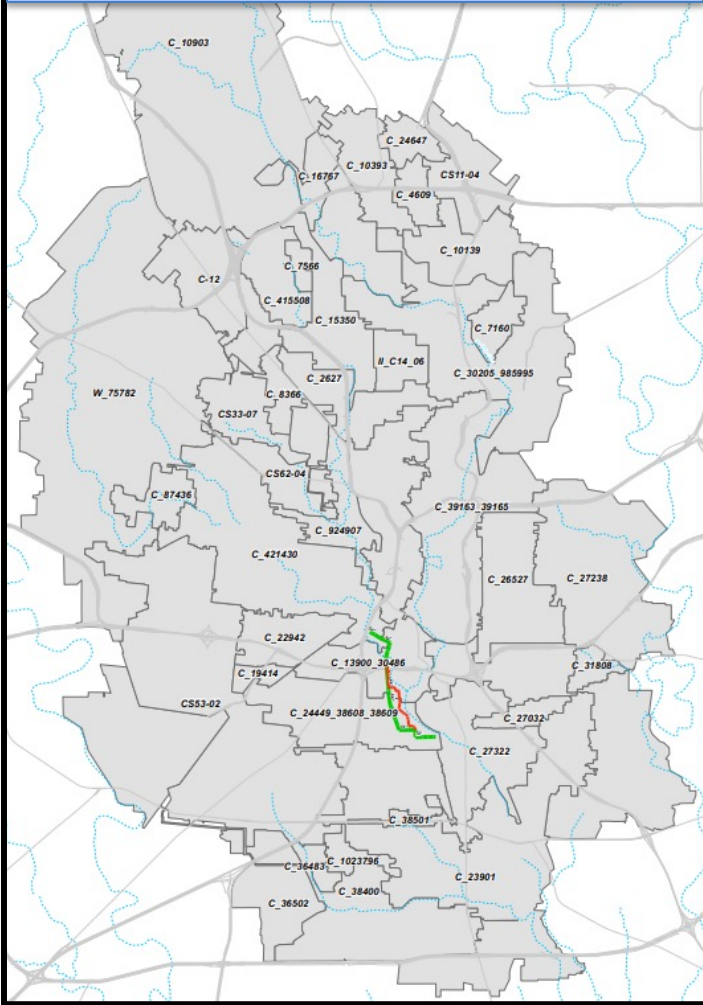
# Existing System Assessment

# Lower Main Stem

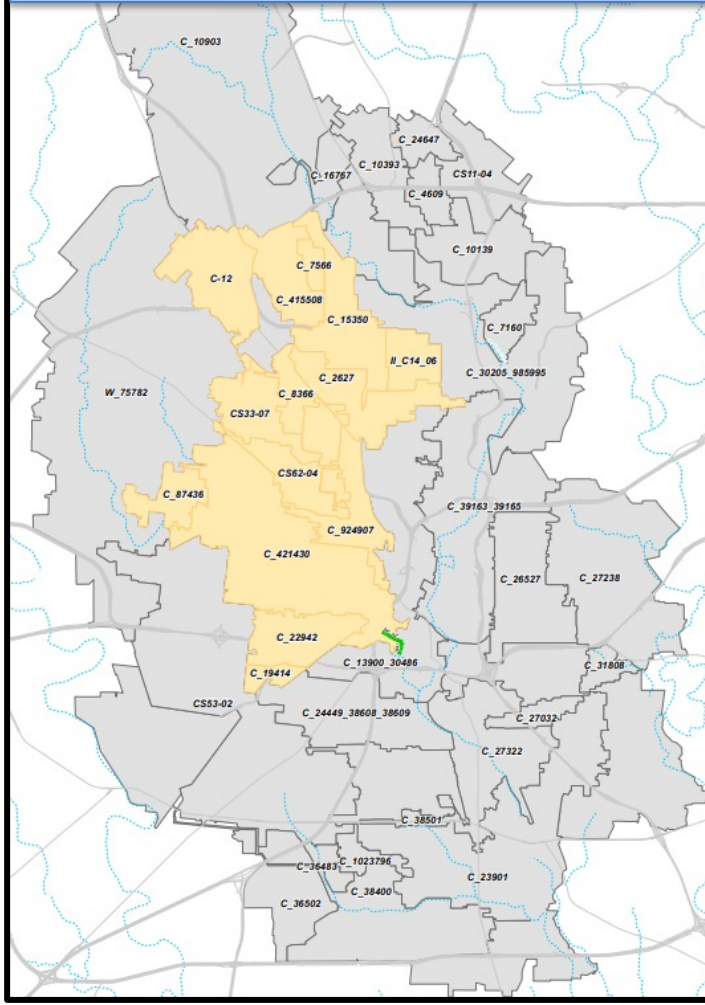


Rilling Road Offline Storage Facility

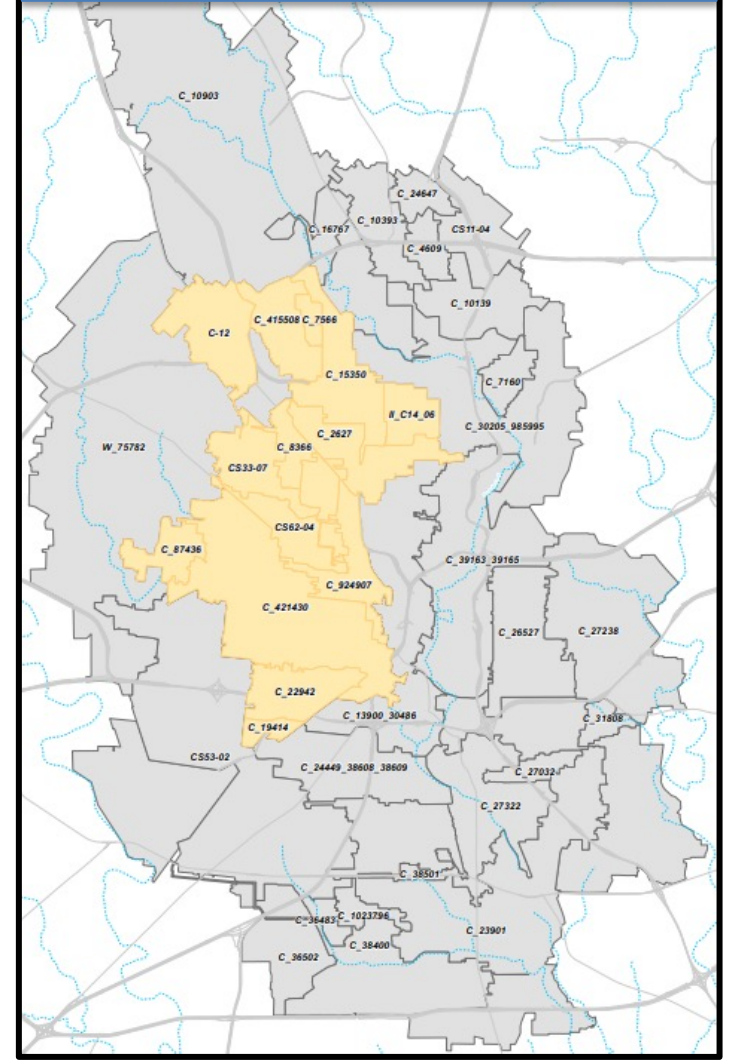
### Strategy #1: Conveyance Improvement & 0% Additional I/I Reduction



### Strategy #2: Conveyance Improvement & 25% Additional I/I Reduction



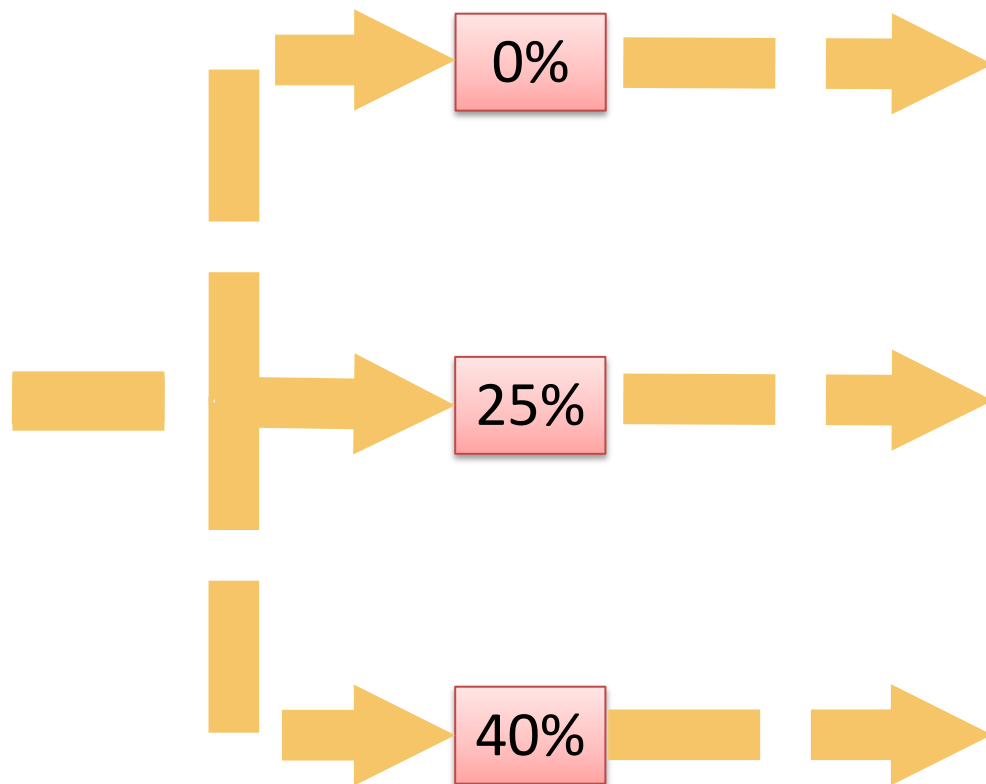
### Strategy #3: 40% Additional I/I Reduction Only



## Additional I/I Reduction

## Improvement Strategies

Updated Model Peak Flow  
Approximately 20%  
Lower than CD  
Model Peak Flow

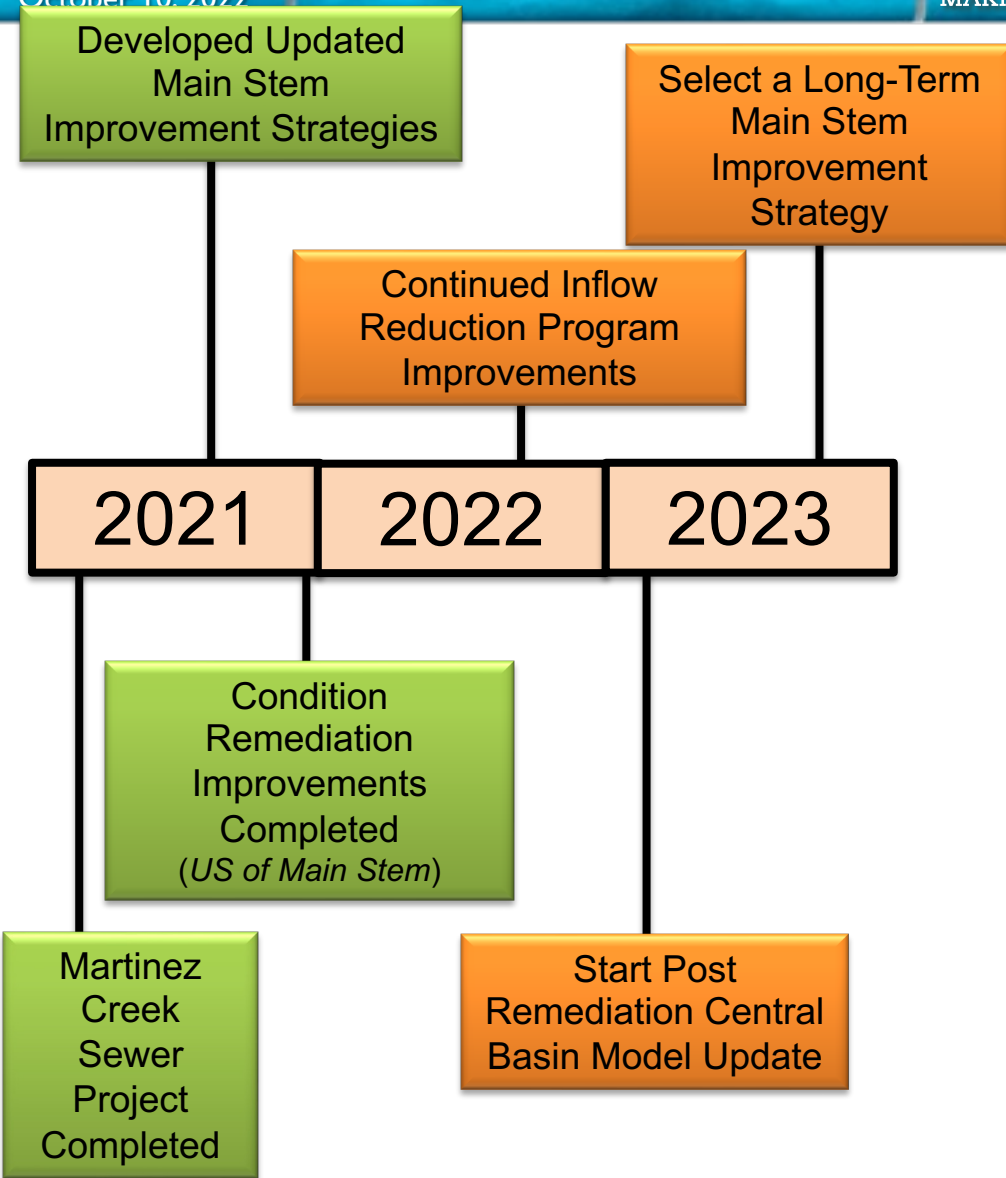


S1: Full Main Stem conveyance improvement but no metershed renewal improvements

S2: Some metershed renewal improvements and reduced Main Stem conveyance improvement or flow diversion

S3: Metershed renewal improvements but no Main Stem conveyance improvement

# Main Stem Improvement Strategies

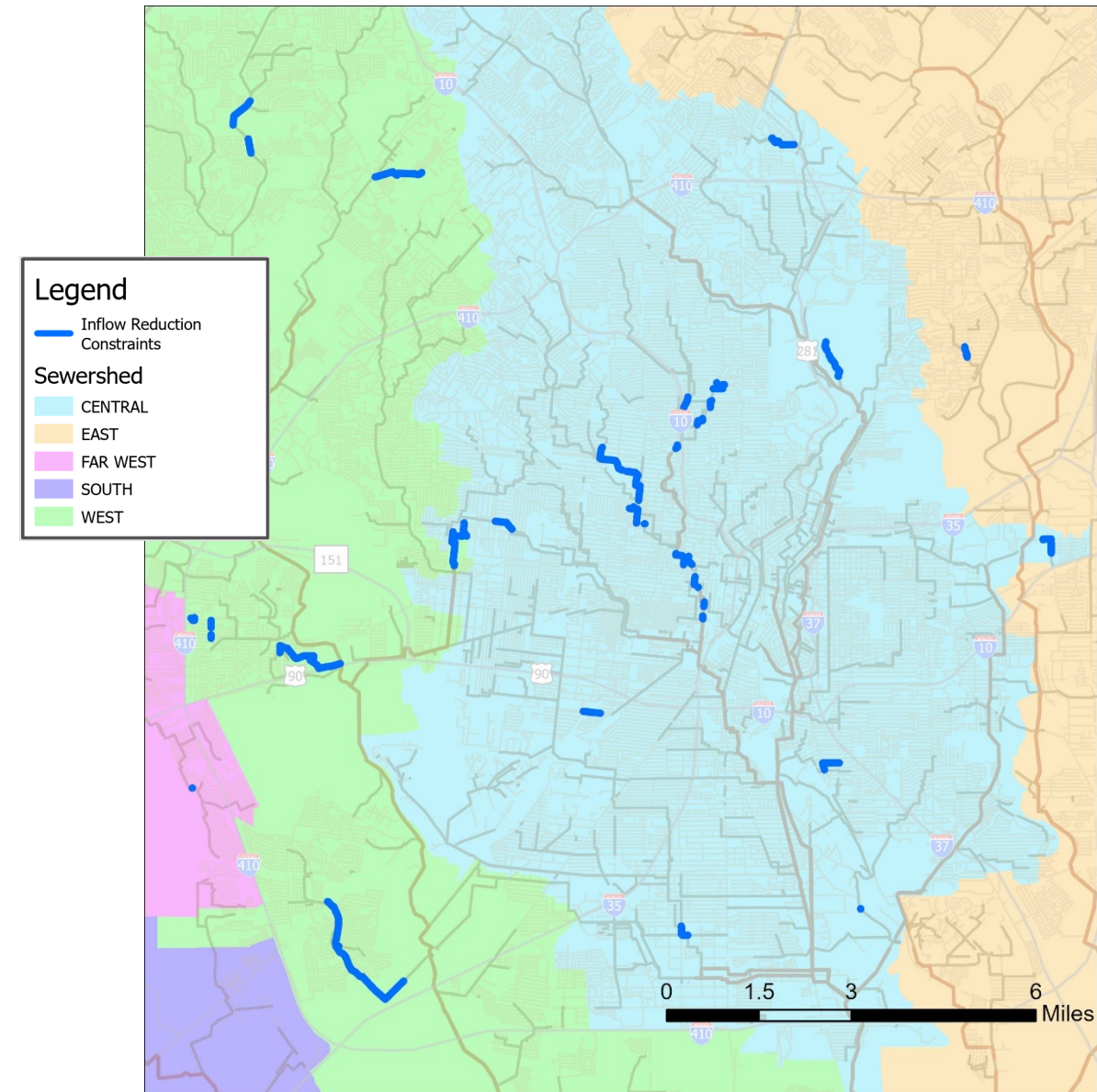


# Central Basin Path Forward

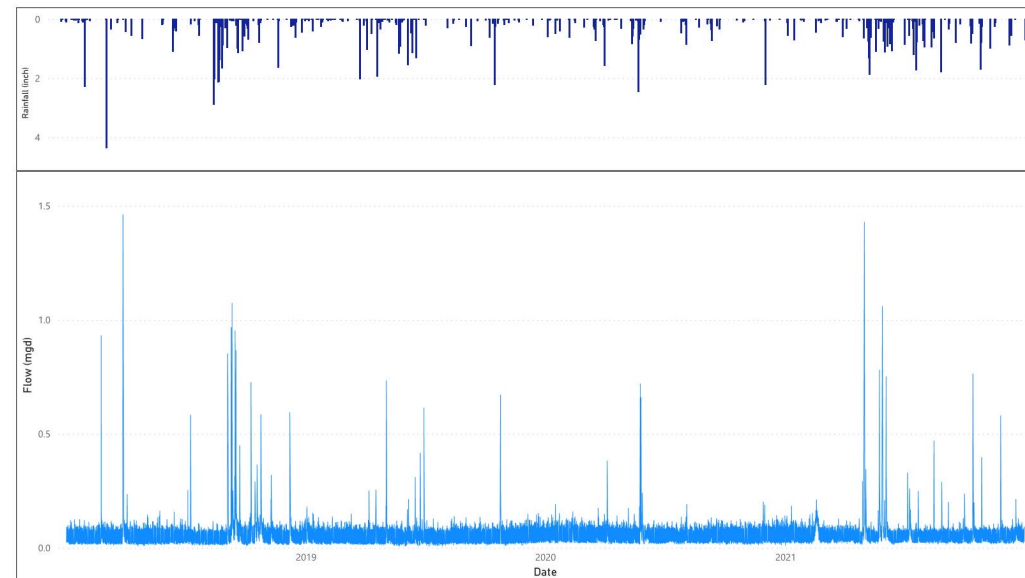
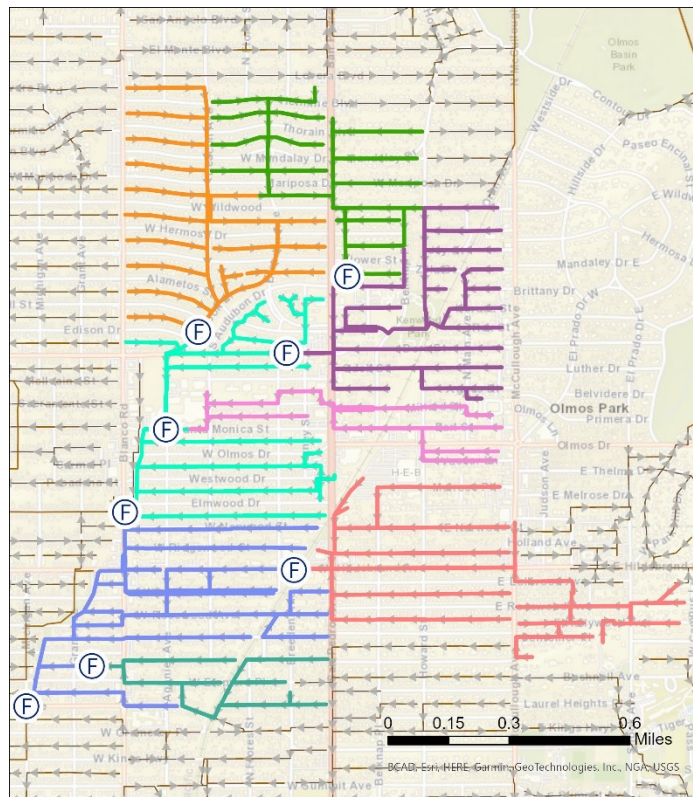
- Remediation improvements within Central Basin are in progress
- Updated Main Stem improvement strategies provide a snapshot of potential options based on updated hydraulic model
  - Provide input into impact of I/I reduction on conveyance improvement solutions
  - Provide targets for detailed I/I reduction improvements strategy
- Post remediation model update to provide revised Main Stem improvement strategies to support Long-Term decision making

# I/I Reduction Program

- 36 Capacity Constraints
  - 25 Central
    - 16 Main Stem
  - 2 East
  - 1 Far West
  - 8 West

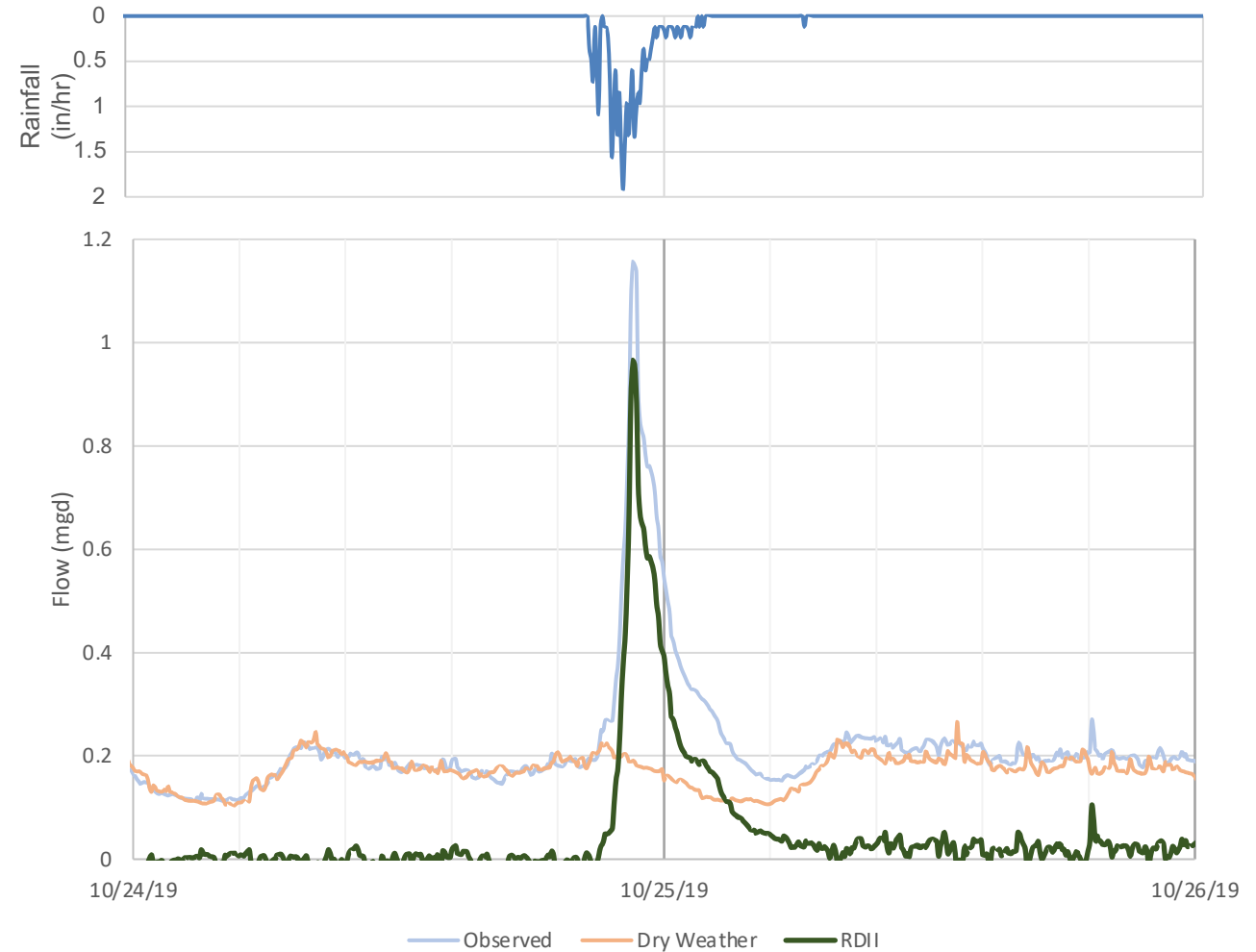


# I/I Reduction Program



# Rainfall Derived I/I (RDII) Analysis

- Volume of flow derived from rainfall
- 2.6", 130,000 gallons RDII
- Complete for multiple storms
- Plot on Scattergraph

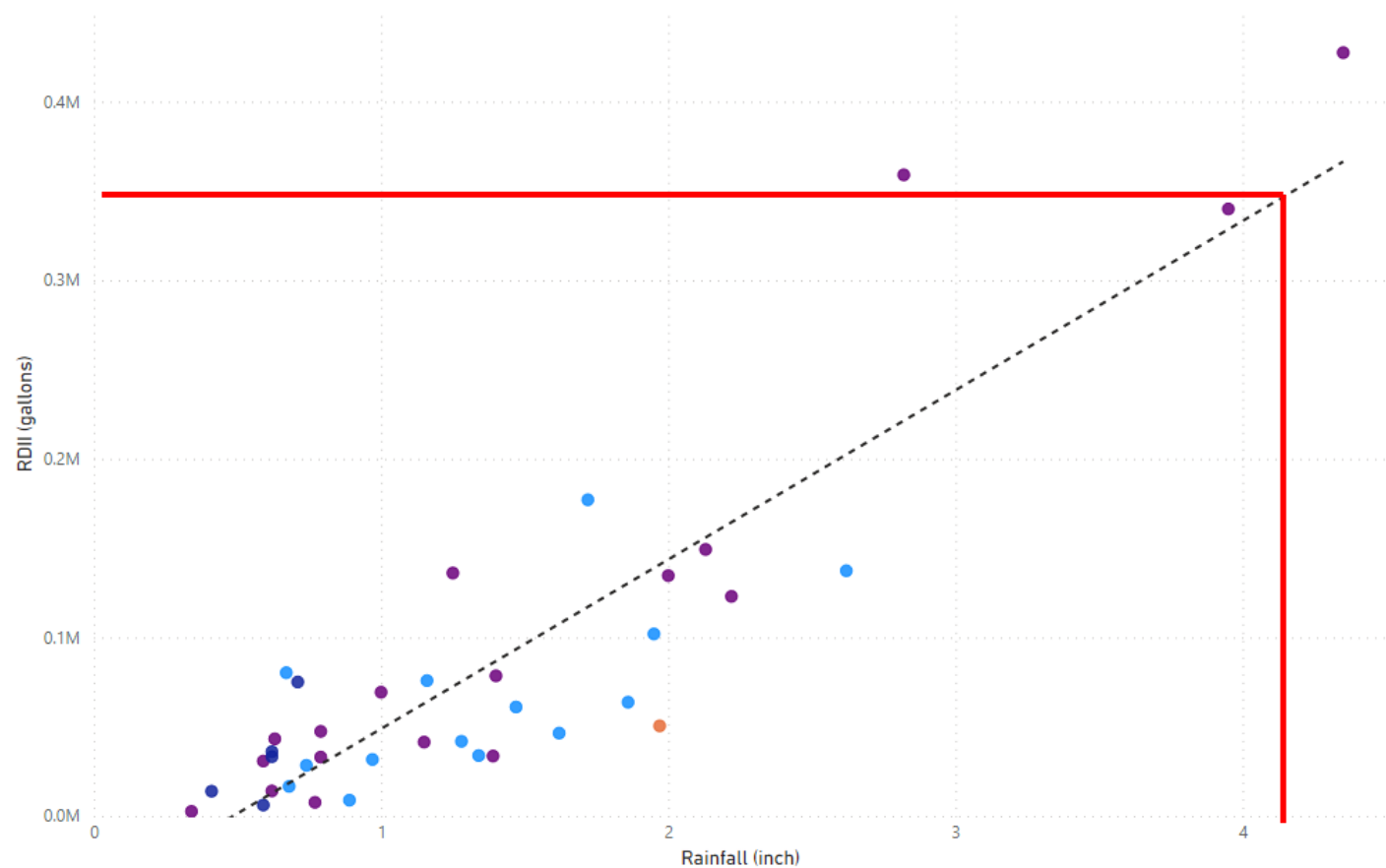




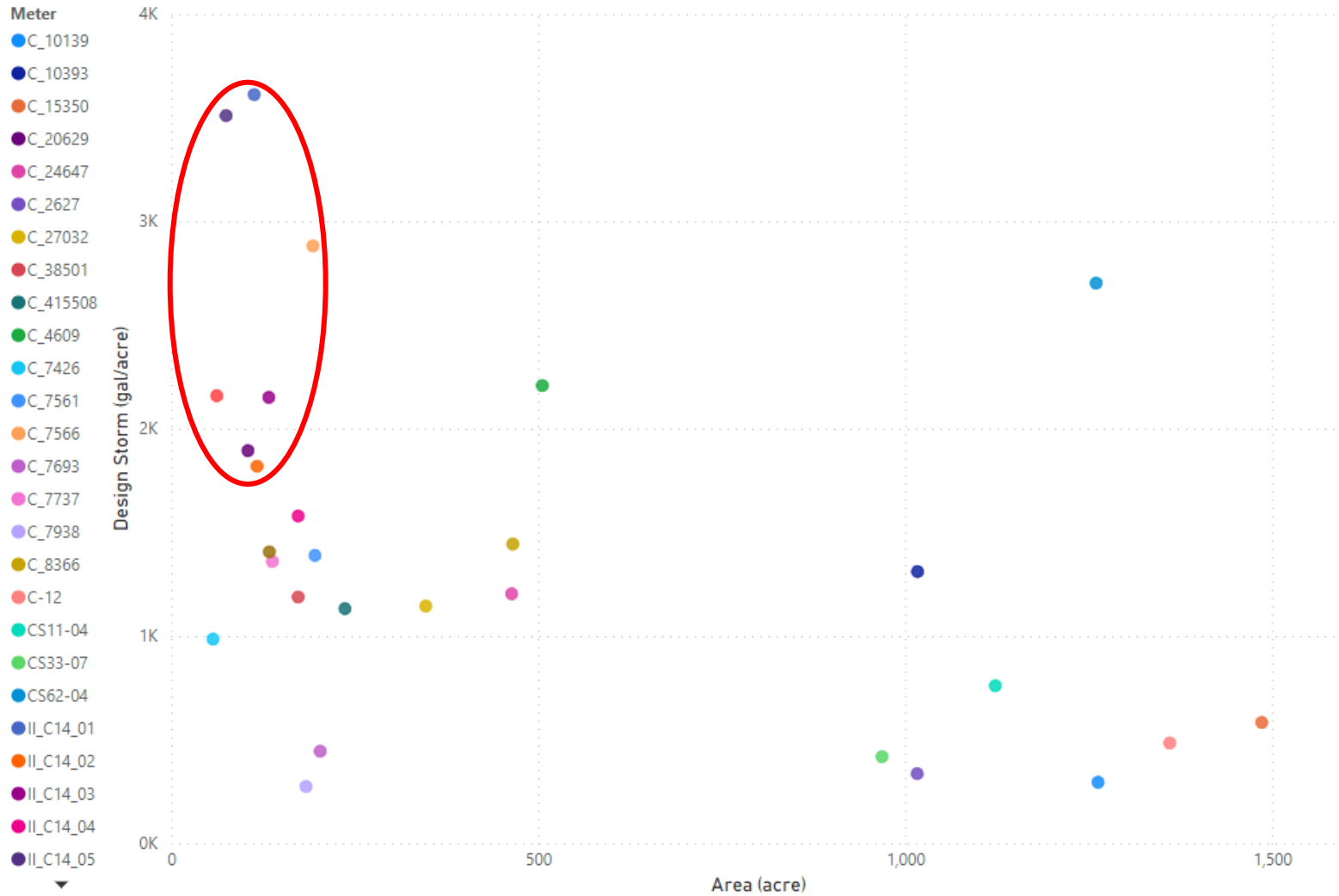
# RDII Analysis

- Regression line
- Repeat analysis for other meters
- Compare to common rainfall
  - 5 year – 6 hour (4.08")
- Normalize
  - Area
  - Linear foot
  - Inch diameter \* linear foot

Year ● 2017 ● 2018 ● 2019 ● 2020

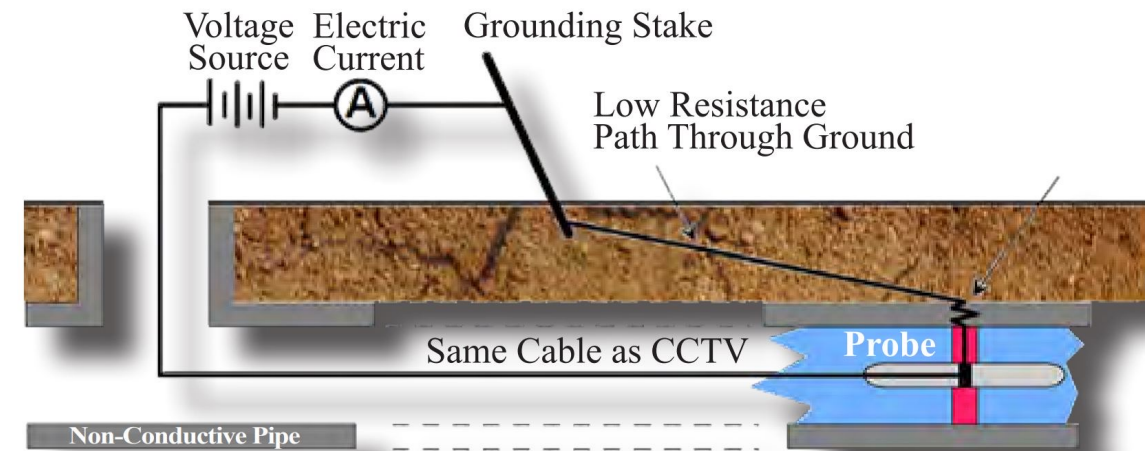


# RDII Analysis



# Focus Electrode Leak Location (FELL)

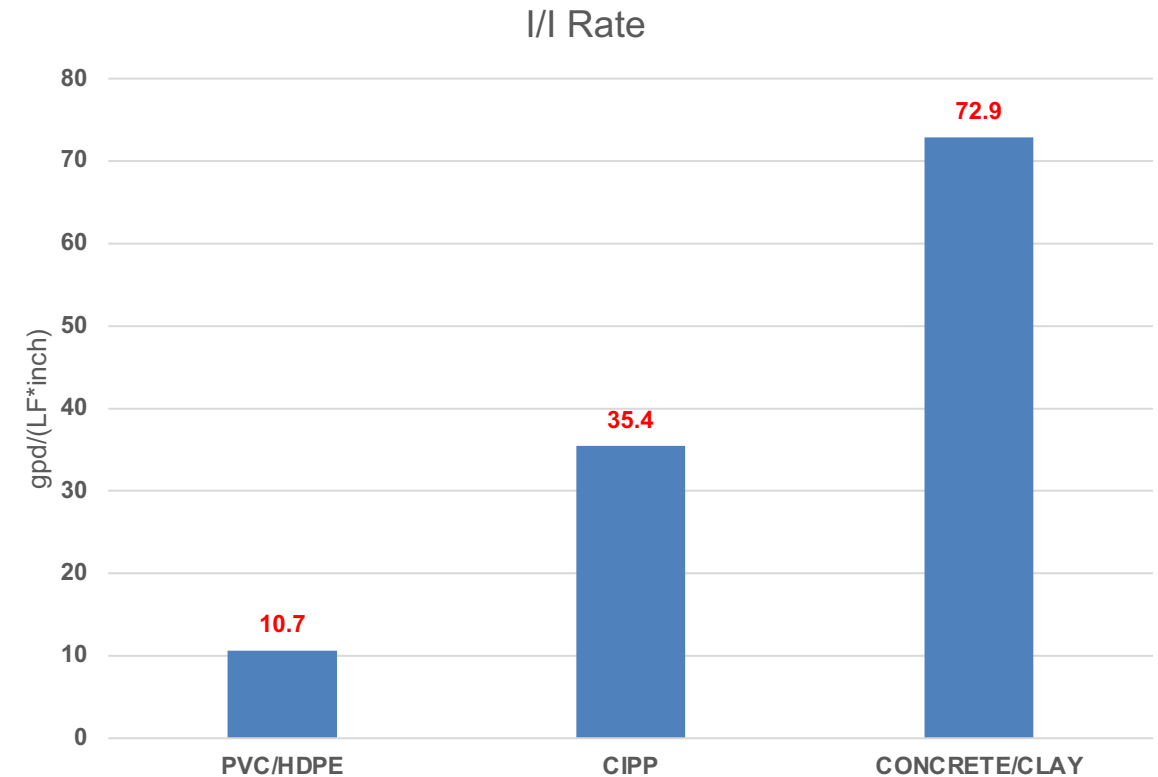
- Electrode ran through mains with water being sprayed circumferentially
- Low voltage applied allowing current to reach interior surface of pipe
- Any defects allow current to flow to the grounding stake
- Higher the current, larger the defect
- Electro Scan uses formula to translate current to infiltration flow rate



Source: ASTM F2550 (2006, 2013, and 2018).

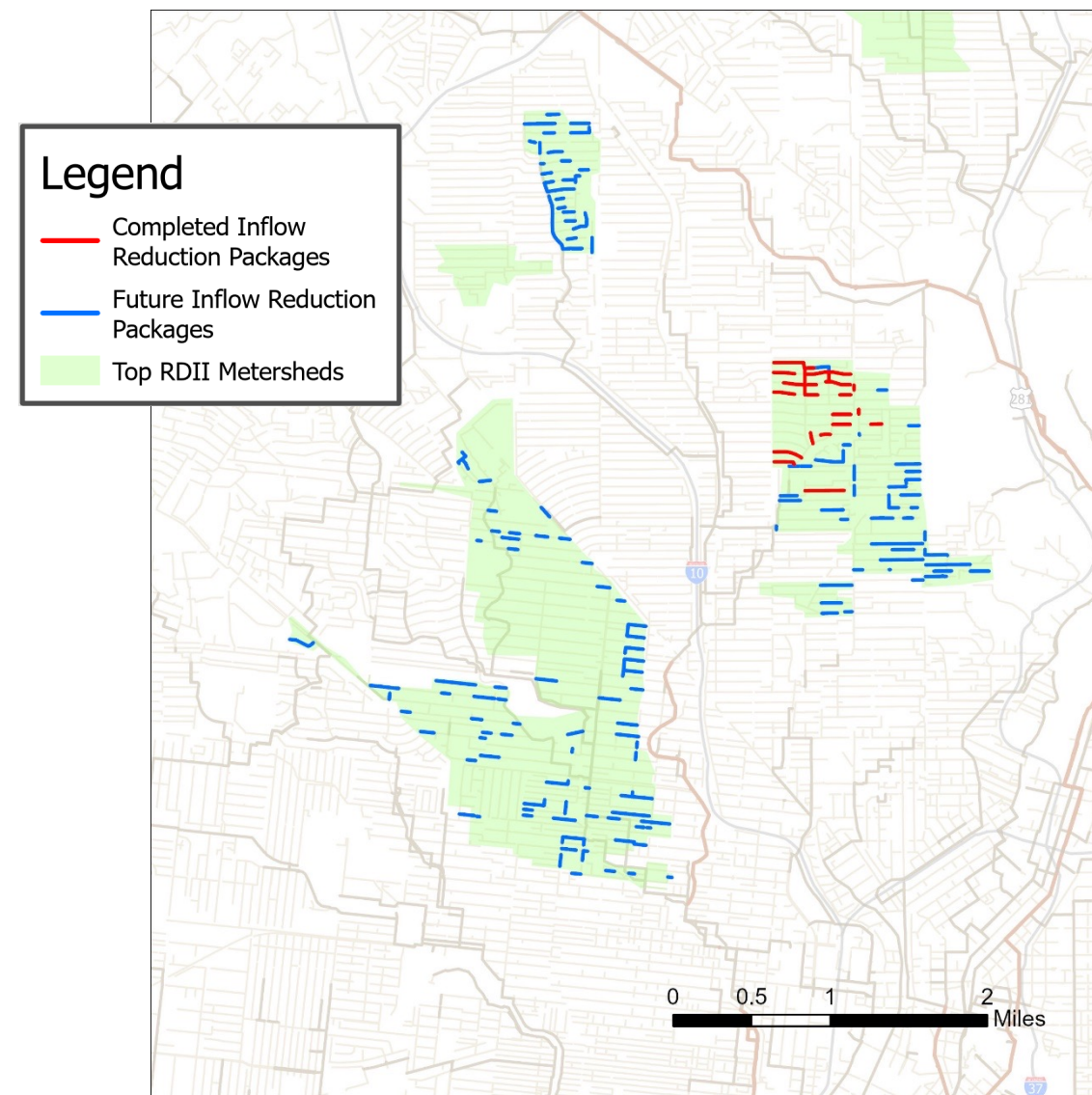
# FELL Results

- PVC/HDPE outperformed other materials
- CIPP allowed **3X** I/I
  - New pilot to improve results
- Concrete/Clay allowed **7X** I/I



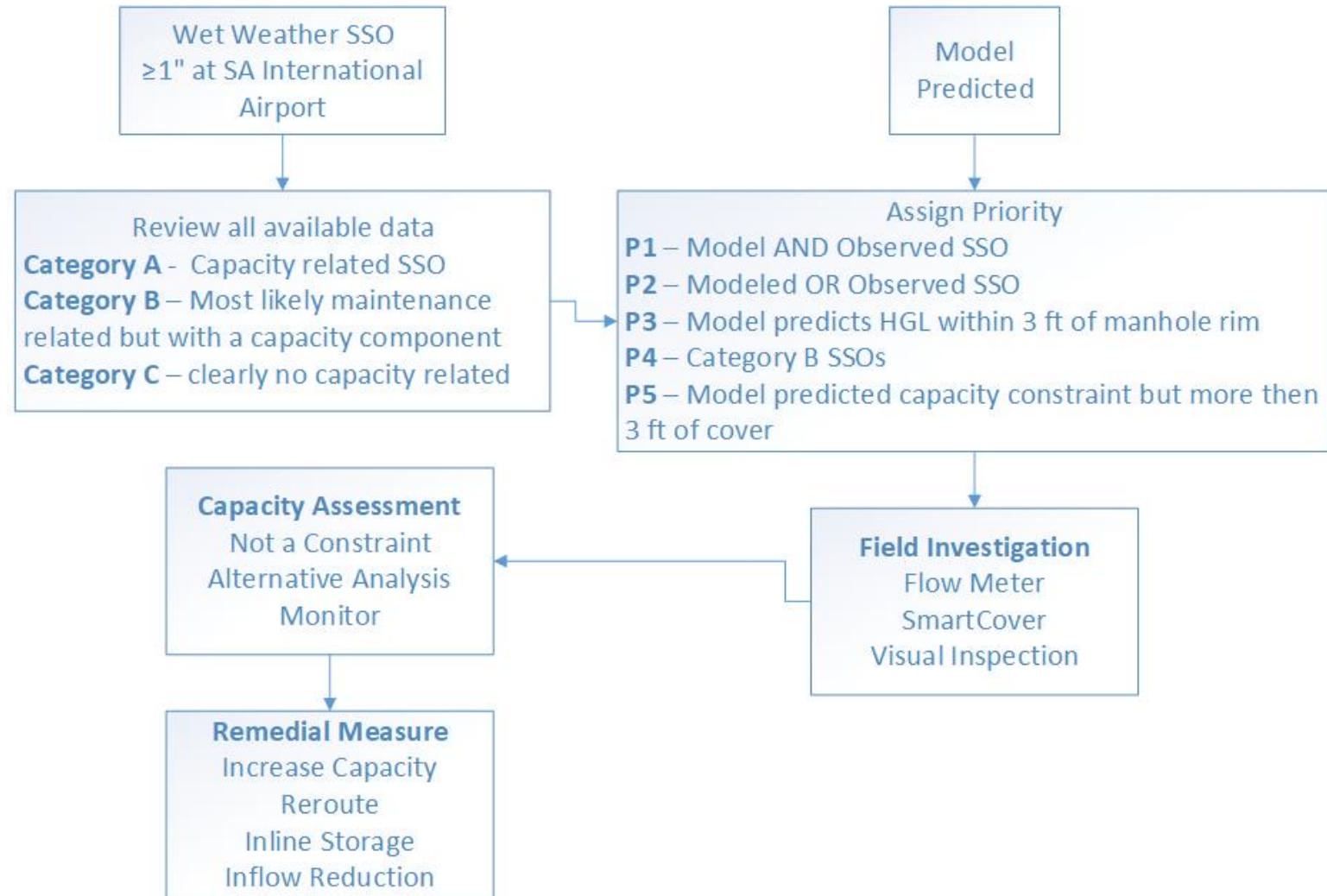
# I/I Packages

- InfoAsset Planner
  - Condition scores
  - FELL results
  - RDII Results
- Open cut/Pipe burst
- Avoid CIPP
  - Pending pilot study



# Capacity Program Moving Forward

- Recalibrate Model every 4-5 years
  - Central, East, Far West completed in 2021
  - West in progress
- Wet Weather SSOs





# Accomplishments

- Successful transition of Capacity Program
- Reduction in peak flows
- Creation of I/I Reduction Program
- Consolidation of Capacity and Condition Team
- Utility Service Agreements (Development) in Master Planning



# Questions?

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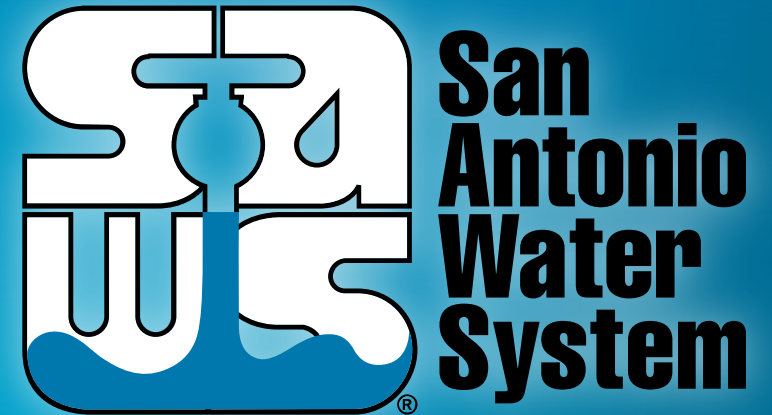
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