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

SAWS SSO Reduction Program Overview

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HDR Business Class Director – Pump Stations and Pipelines

San Antonio Water System

UCTA National Conference
January 28, 2020

Agenda

- SAWS Overview
- Consent Decree
- Key Elements
- Assessment Program
- Remedial Measures Plan
- CMOM
- Lessons Learned / Path Forward

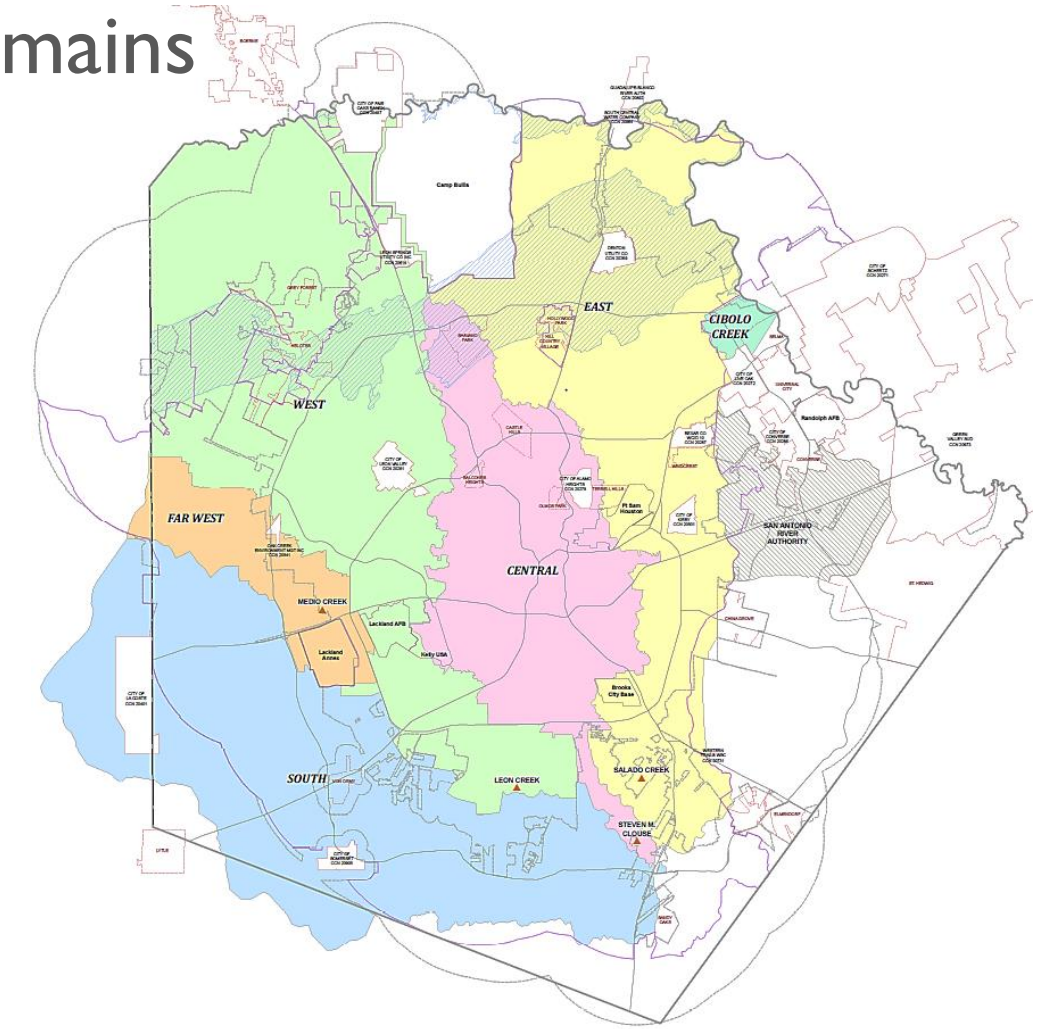
SAWS Overview

One of the nation's largest municipally owned utilities

- Created in 1992
  - Merger of three city departments
  - Separate Board of Trustees
- Serve 1.8 million people
- 12,000+ miles of pipe
- $2 billion 5-year capital program
- 1,700 employees

SAWS By the Numbers

- Approximately 5,500 miles of sewer mains
- Over 100,000 manholes
- 300 Siphons
- 80 miles of force mains
- 154 lift stations
- 3 wastewater treatment plants



San Antonio Water System

Consent Decree Overview

- Timeline
  - 2007-2013 Negotiations
  - July 23, 2013 Lodged
  - October 15, 2013 Entered
  - Term: 10-12 years
- Compliance Requirements
- Reporting

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
SAN ANTONIO DIVISION

UNITED STATES OF AMERICA,	§	
and	§	Civil Action No.
STATE OF TEXAS,	§	
Plaintiffs,	§	
v.	§	
SAN ANTONIO WATER SYSTEM,	§	
Defendant.	§	

CONSENT DECREE

CD Major Components

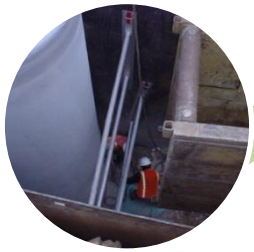
1. ASSESS ✓

2. PLAN ✓

3. REPORT ✓

Assessments Complete

Remedial Measures ongoing



4. Ongoing REHAB ✓

SSORP and the Consent Decree

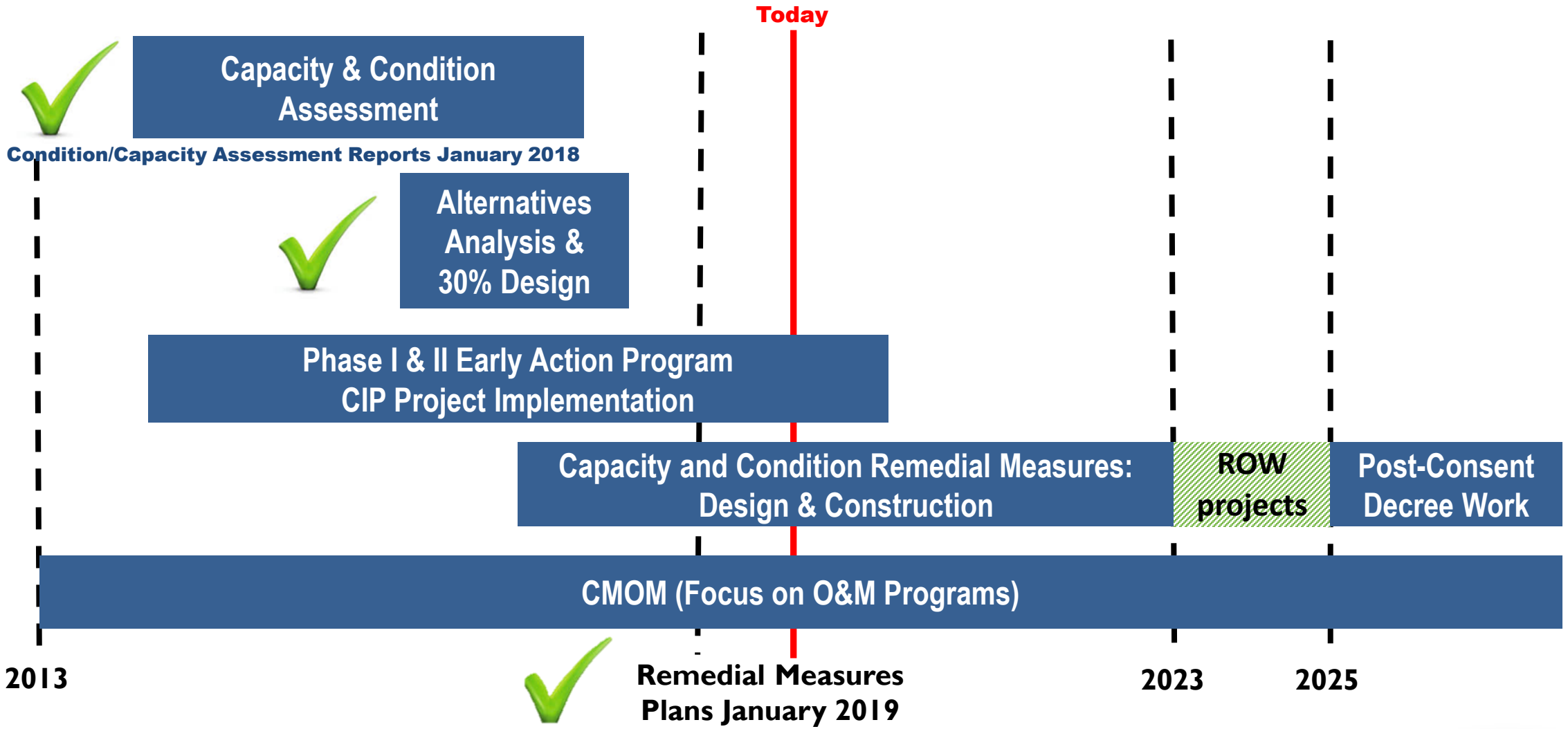
- Reduce SSOs and comply with the CD
- Implement sustainable business practices
- Enforce standards and ordinances
- Continue to manage capacity constraints and condition issues

Capacity & condition assessment

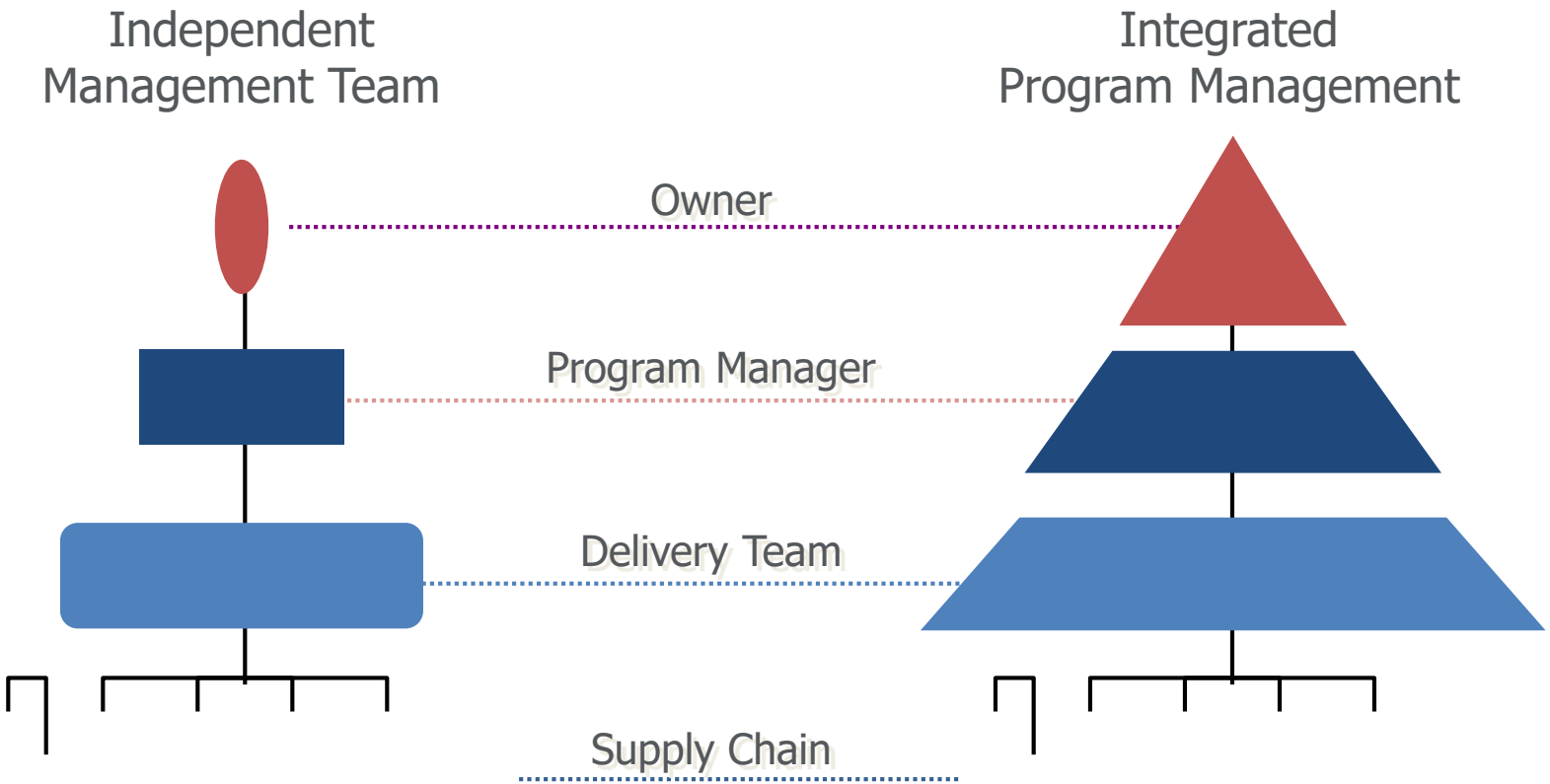
Alternatives analysis and planning

CIP implementation, design and construction

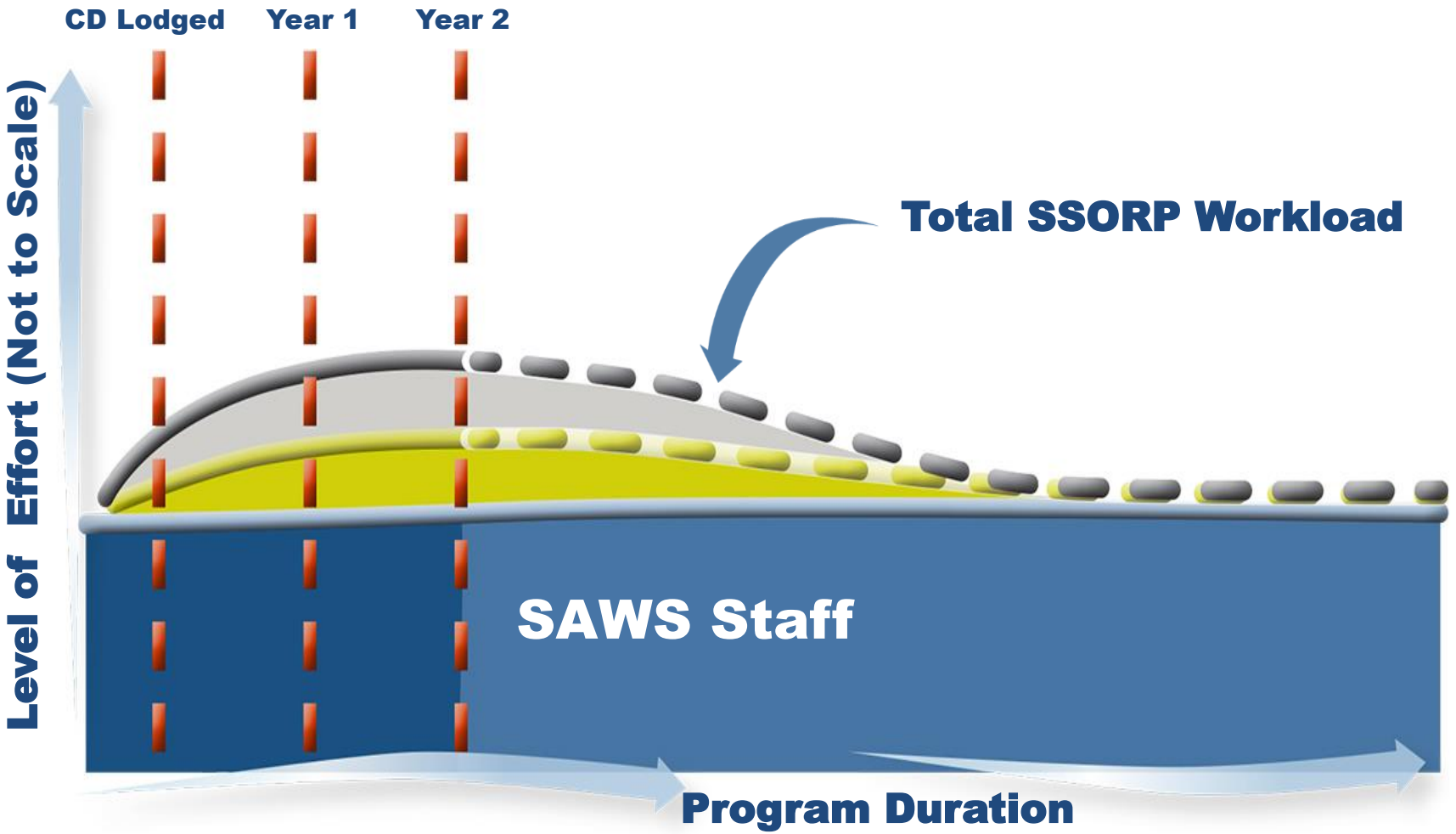
Consent Decree Timeline



The PgM models include a full spectrum from independent to integrated teams



Workload Analysis/Staffing Strategies



Integrated Program Management Team

Develop Contracts for Support

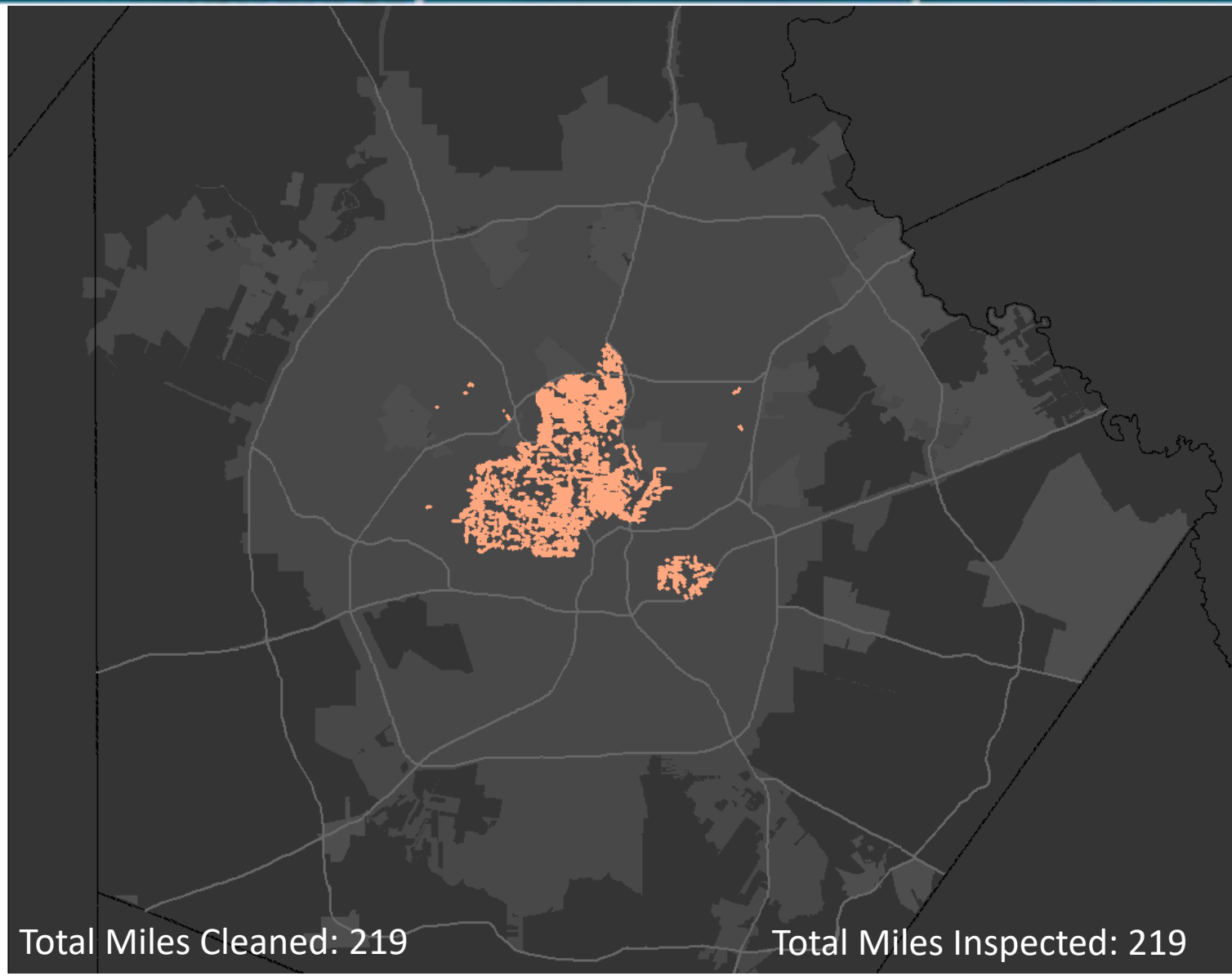
First Step

- Inspection & Cleaning

San Antonio Water System

2013 - Year 1

Small Mains: Clean/TV Inspect



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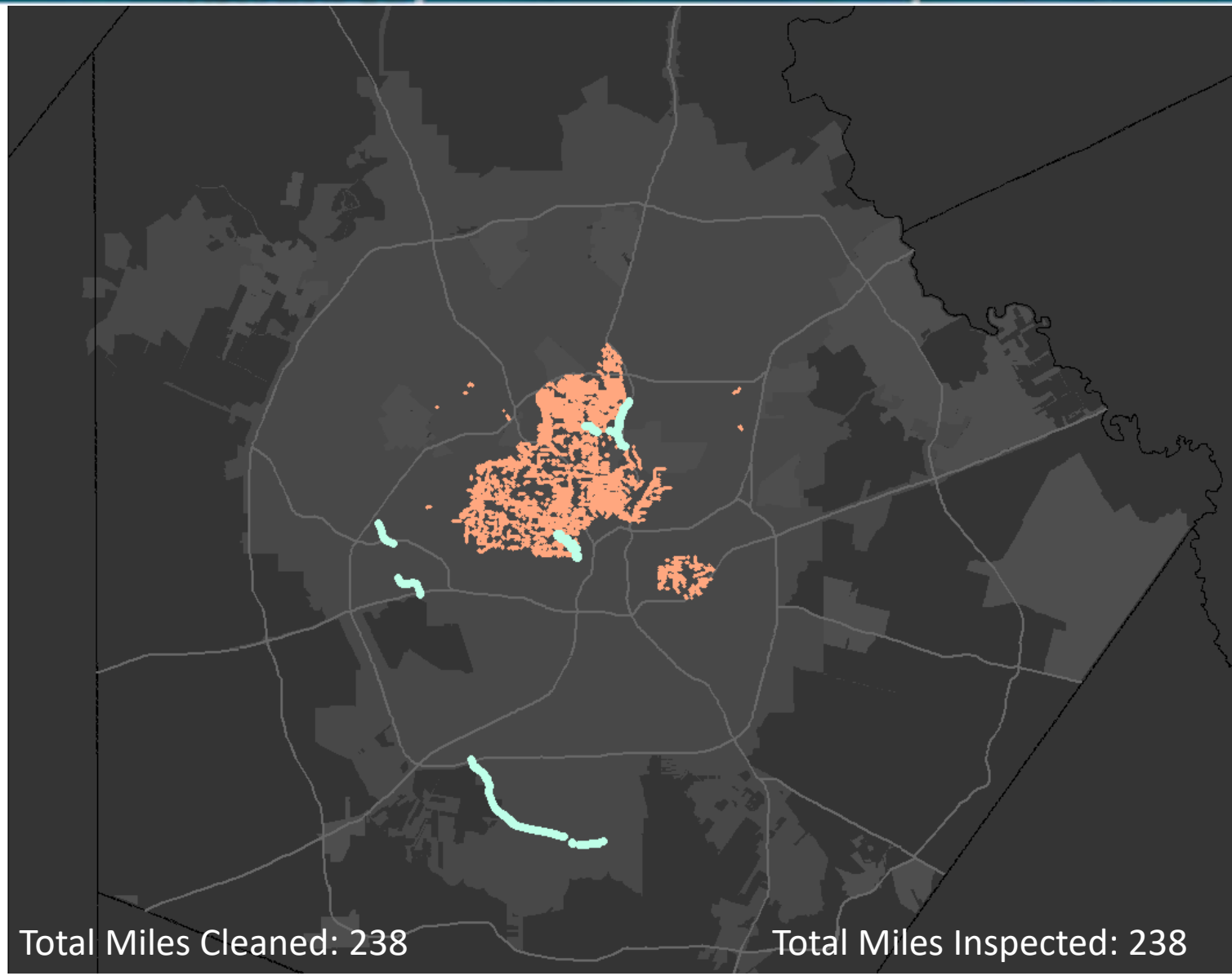

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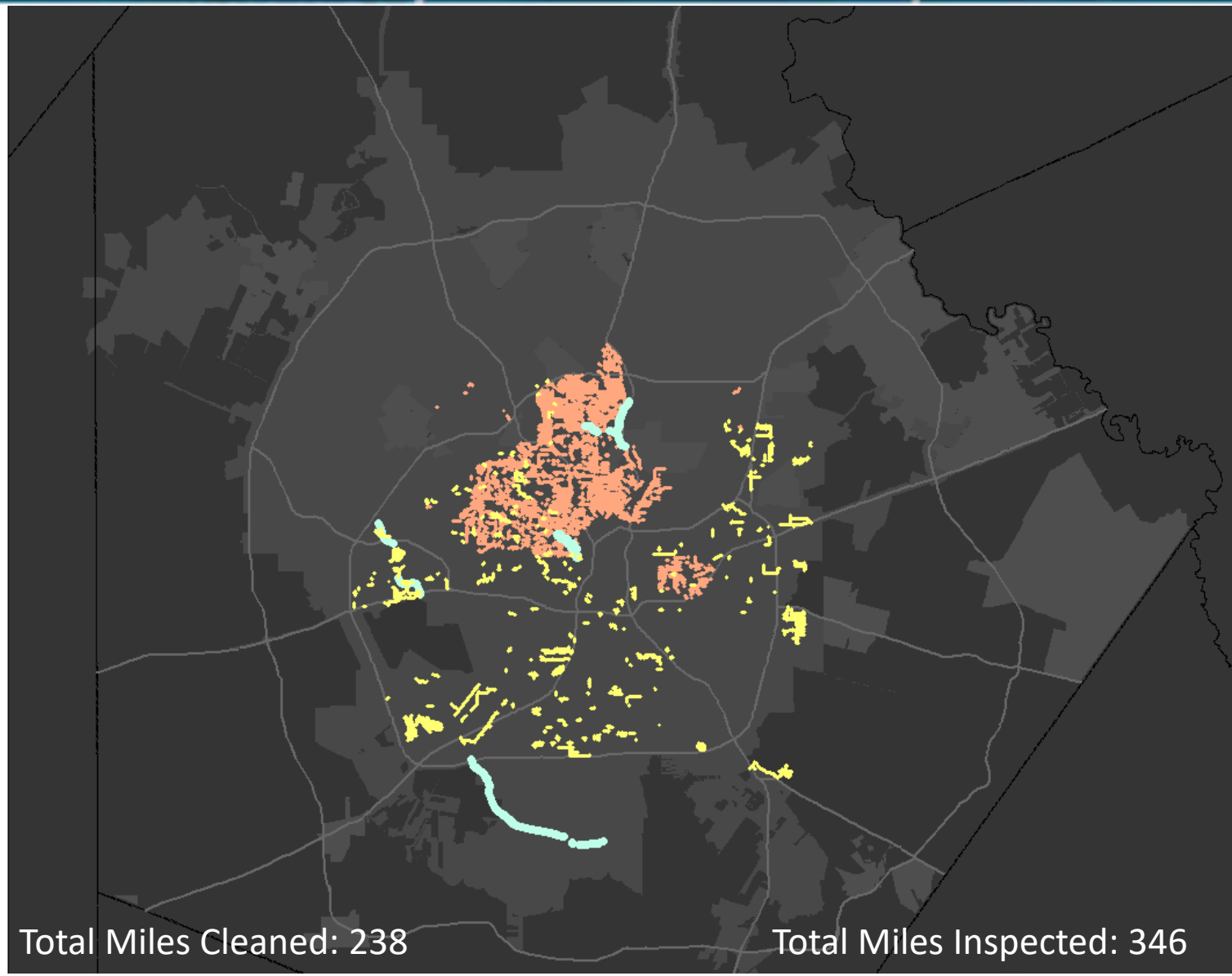

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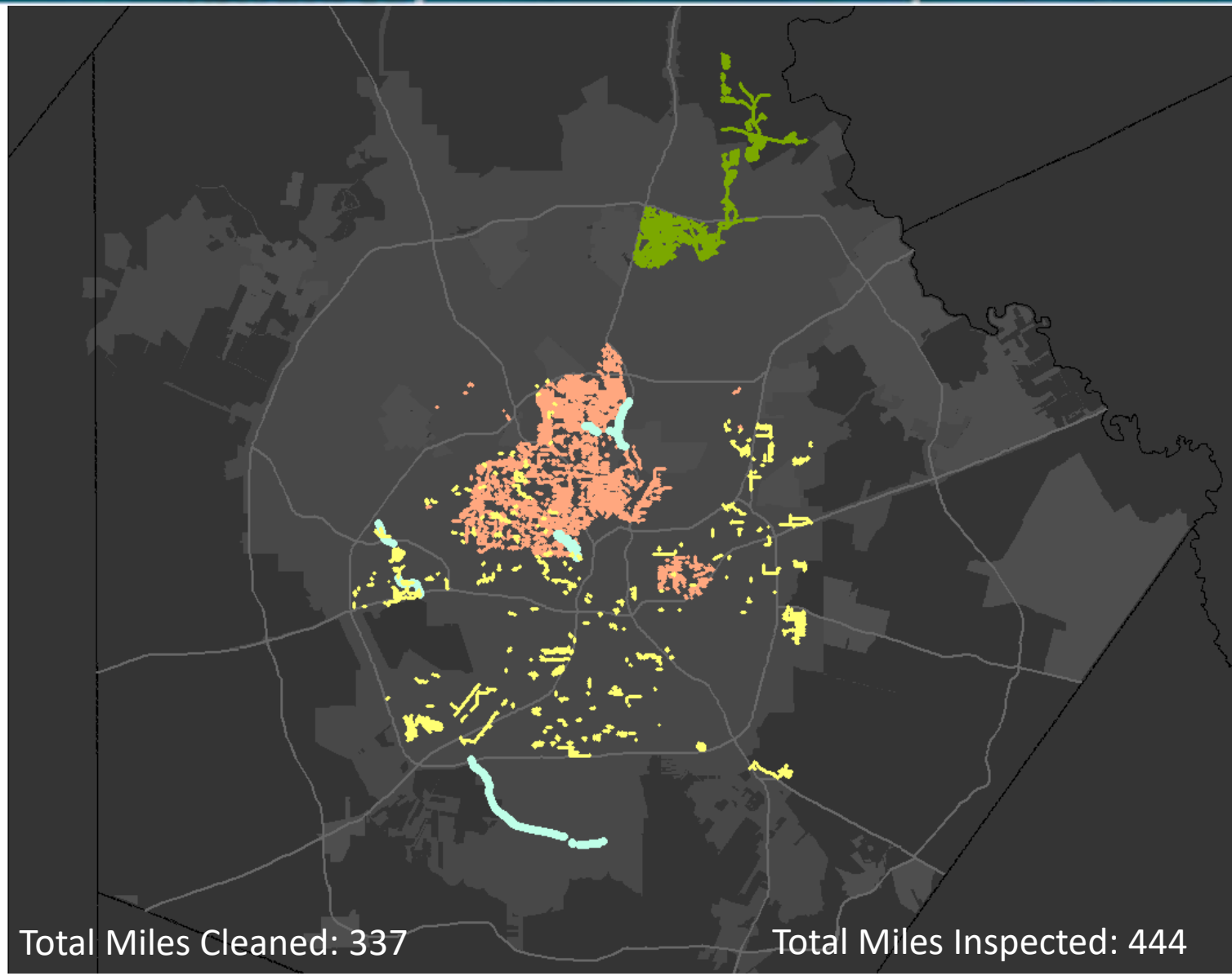

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2014 - Year 2

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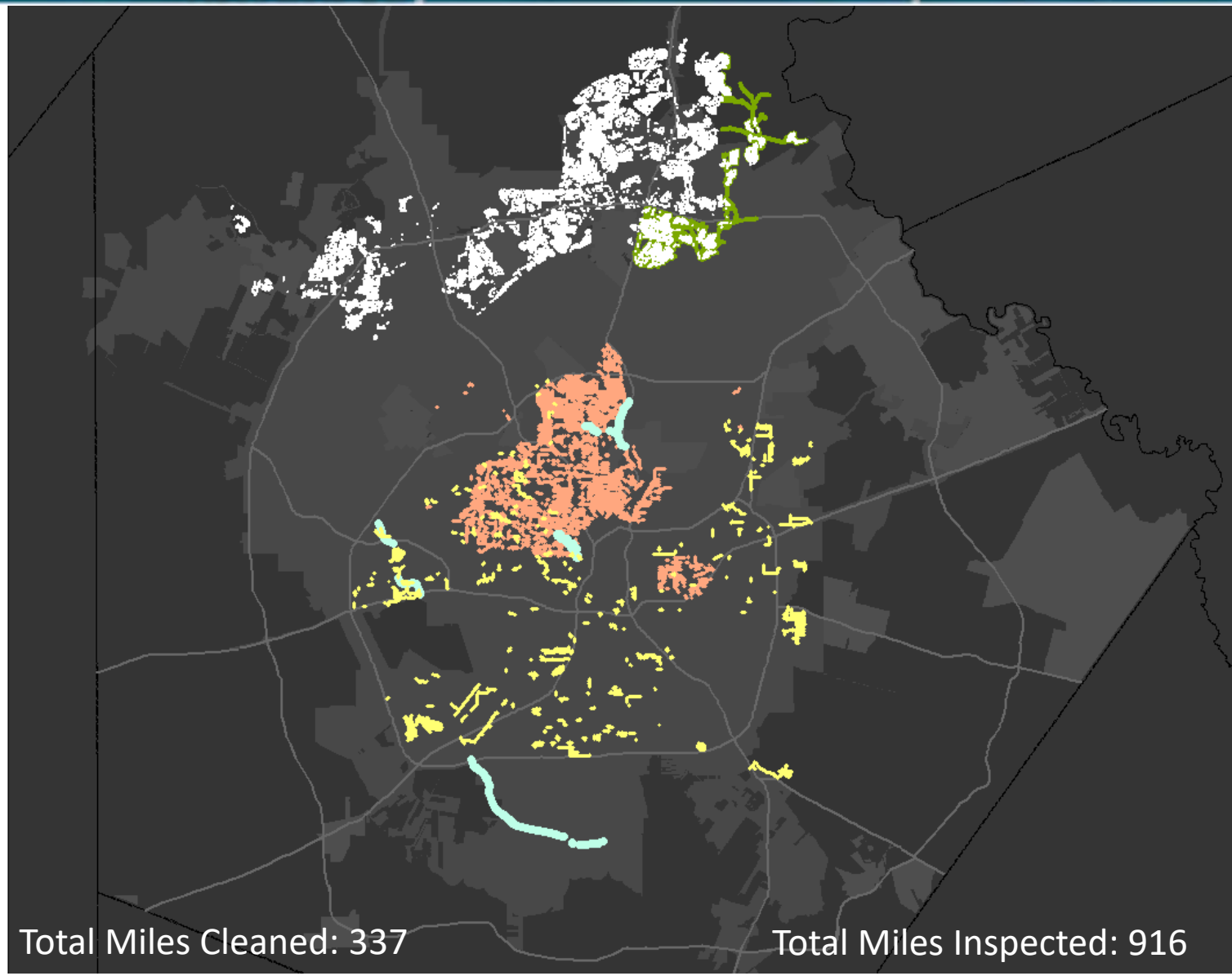

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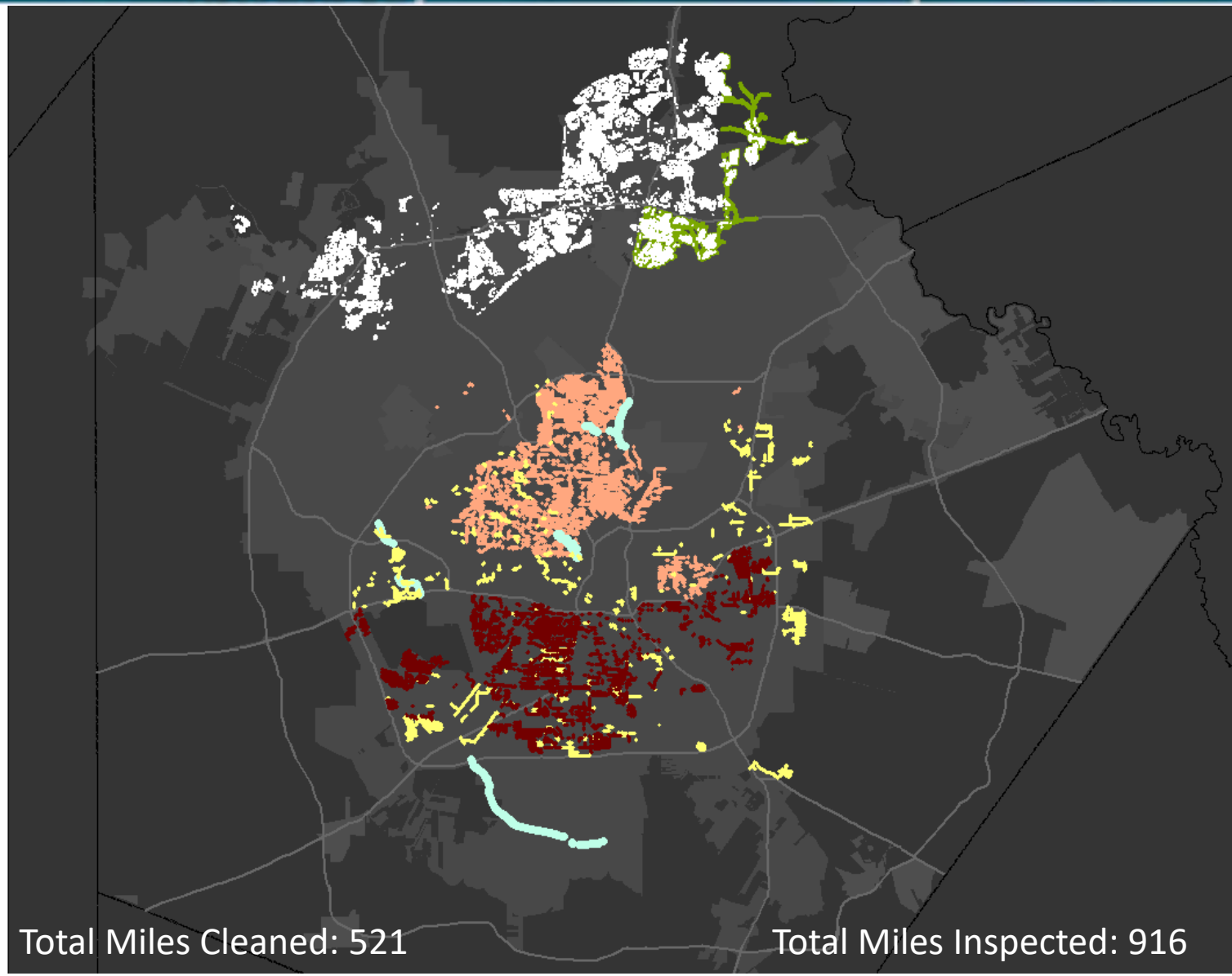

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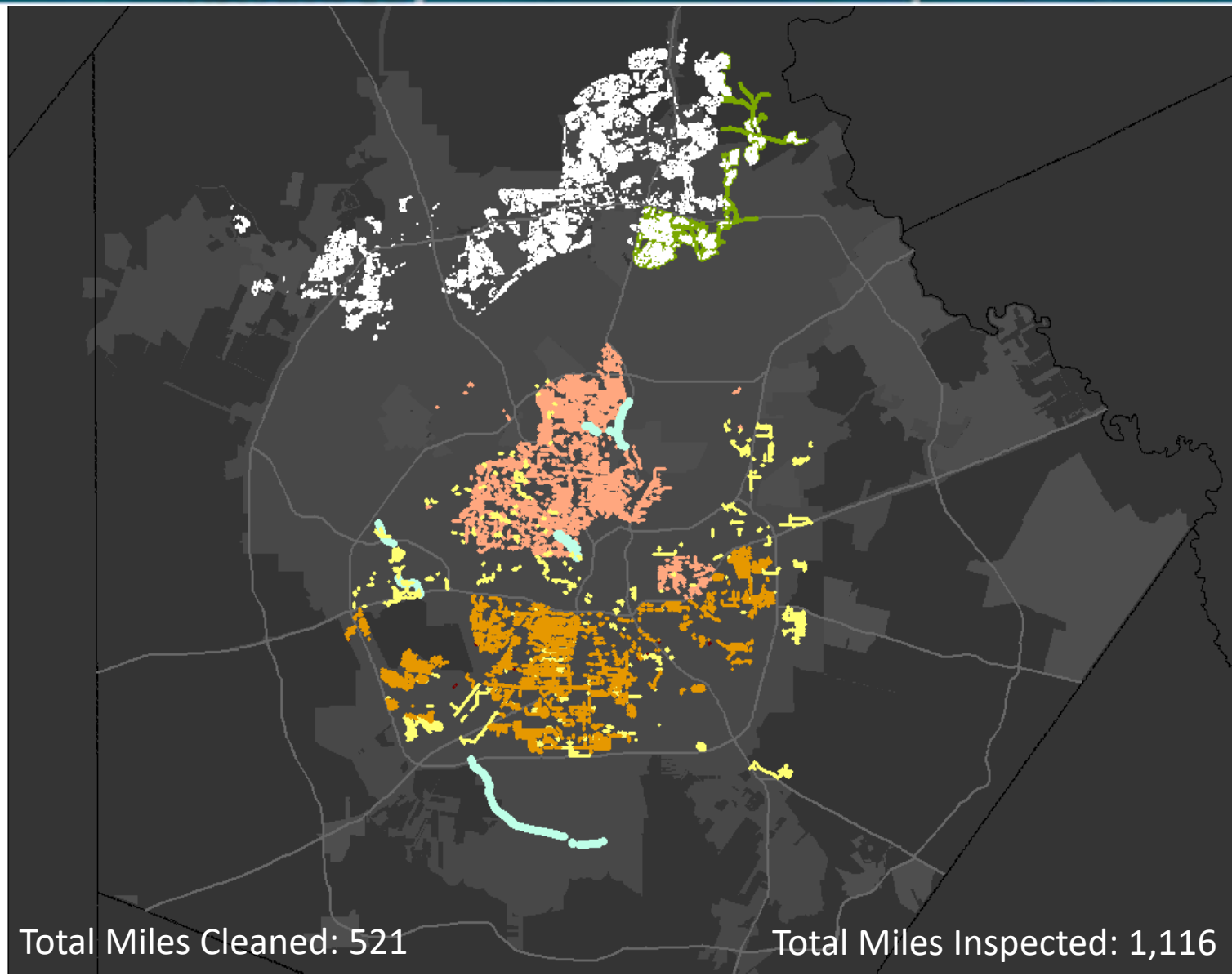

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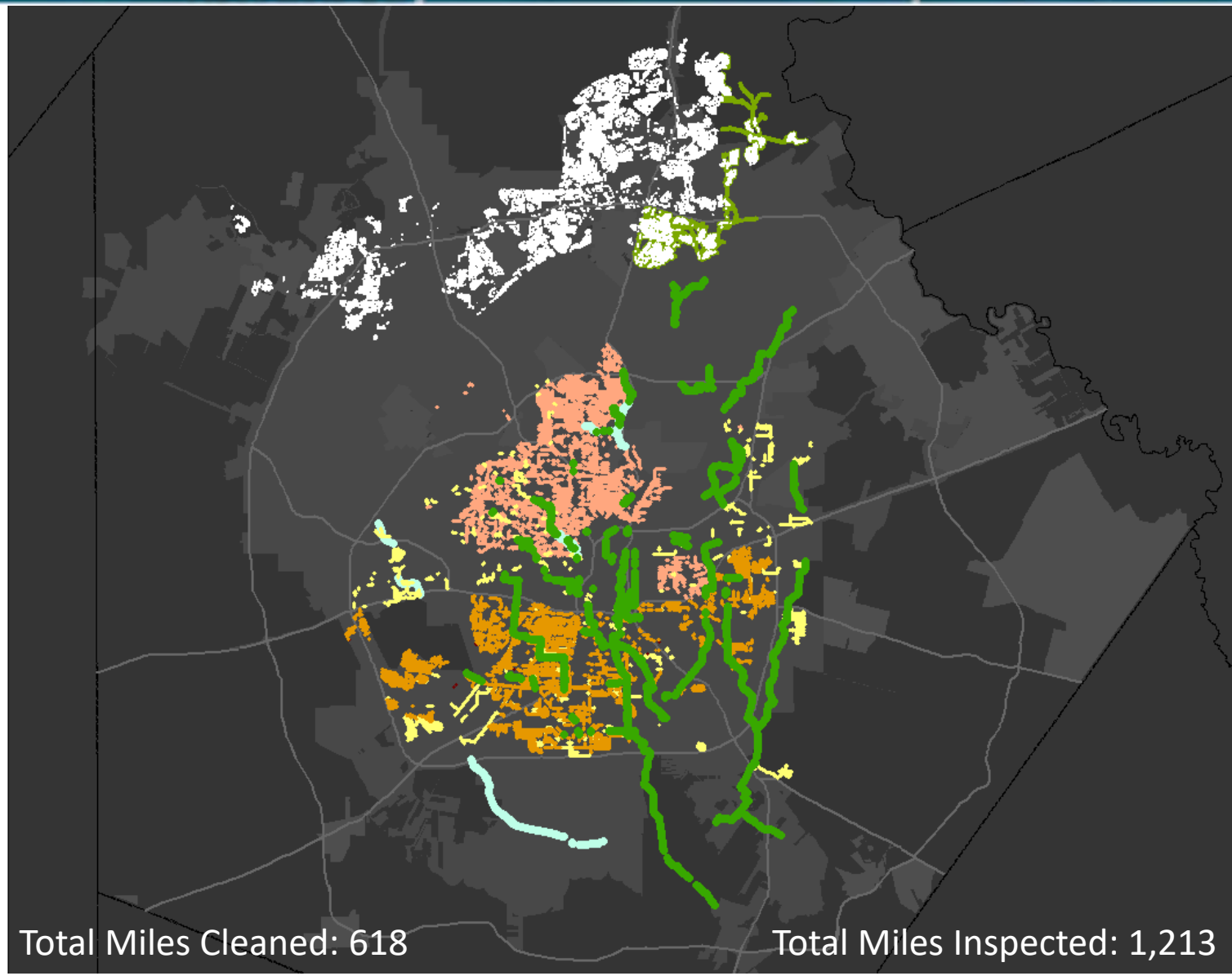

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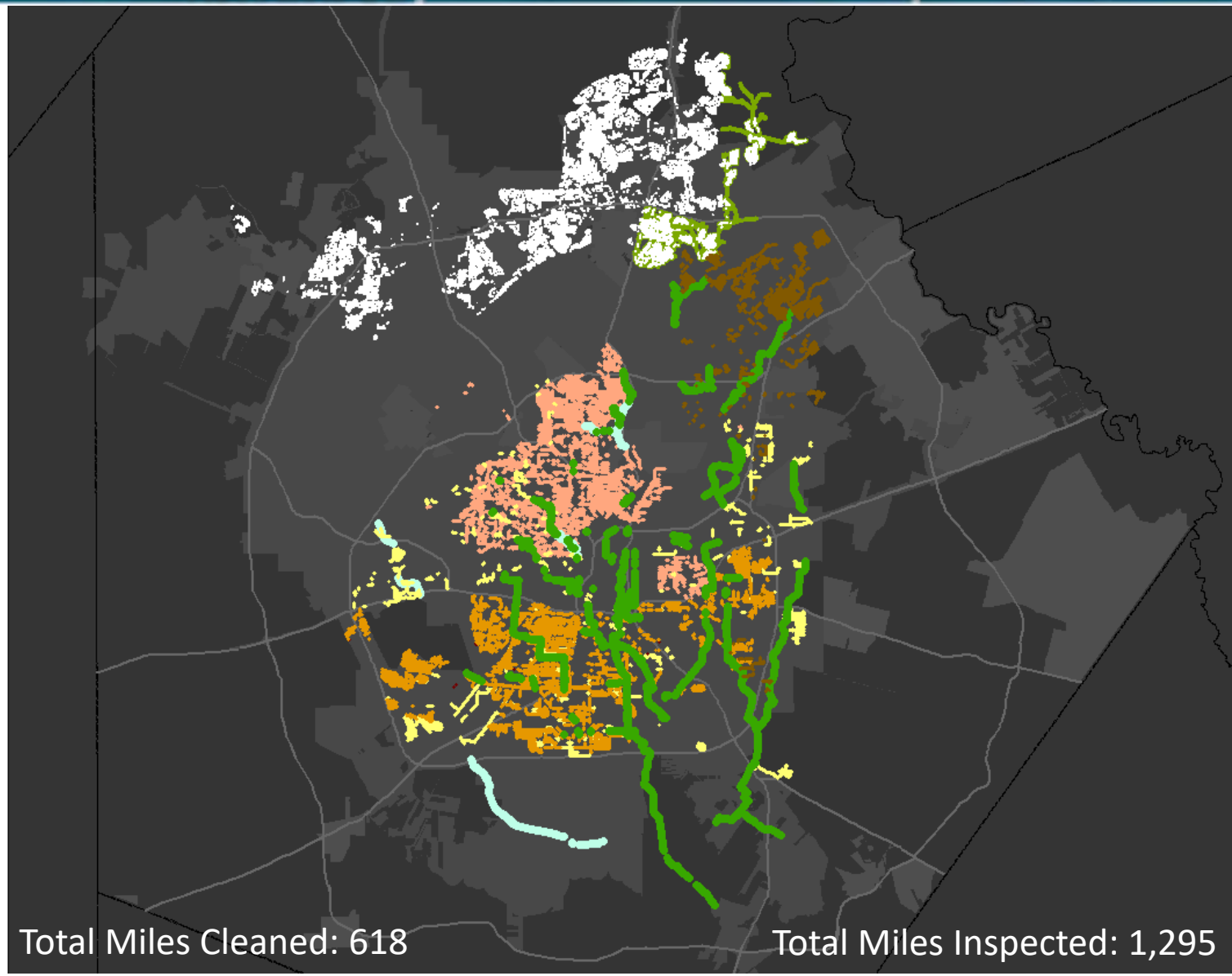

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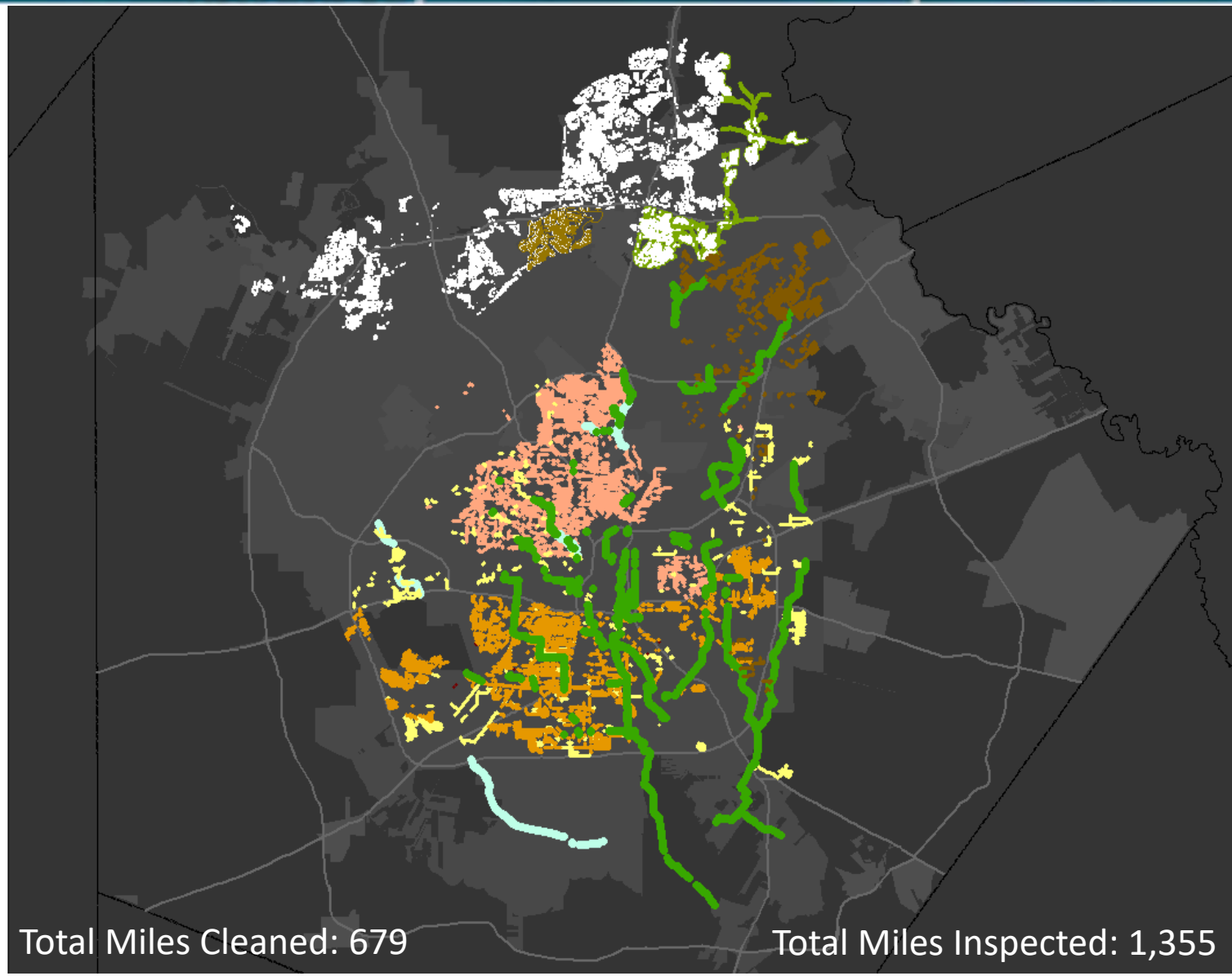

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2015 - Year 3

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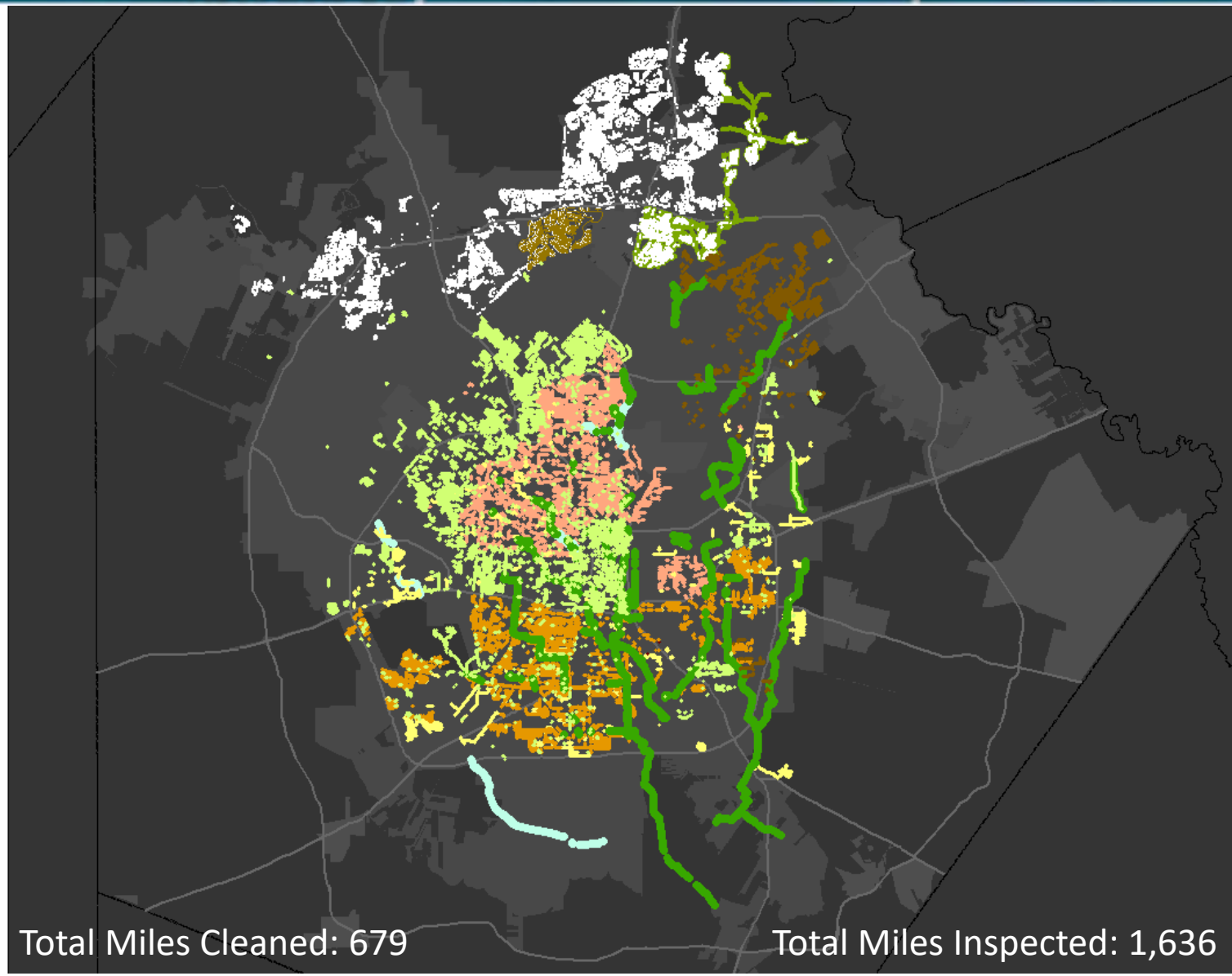

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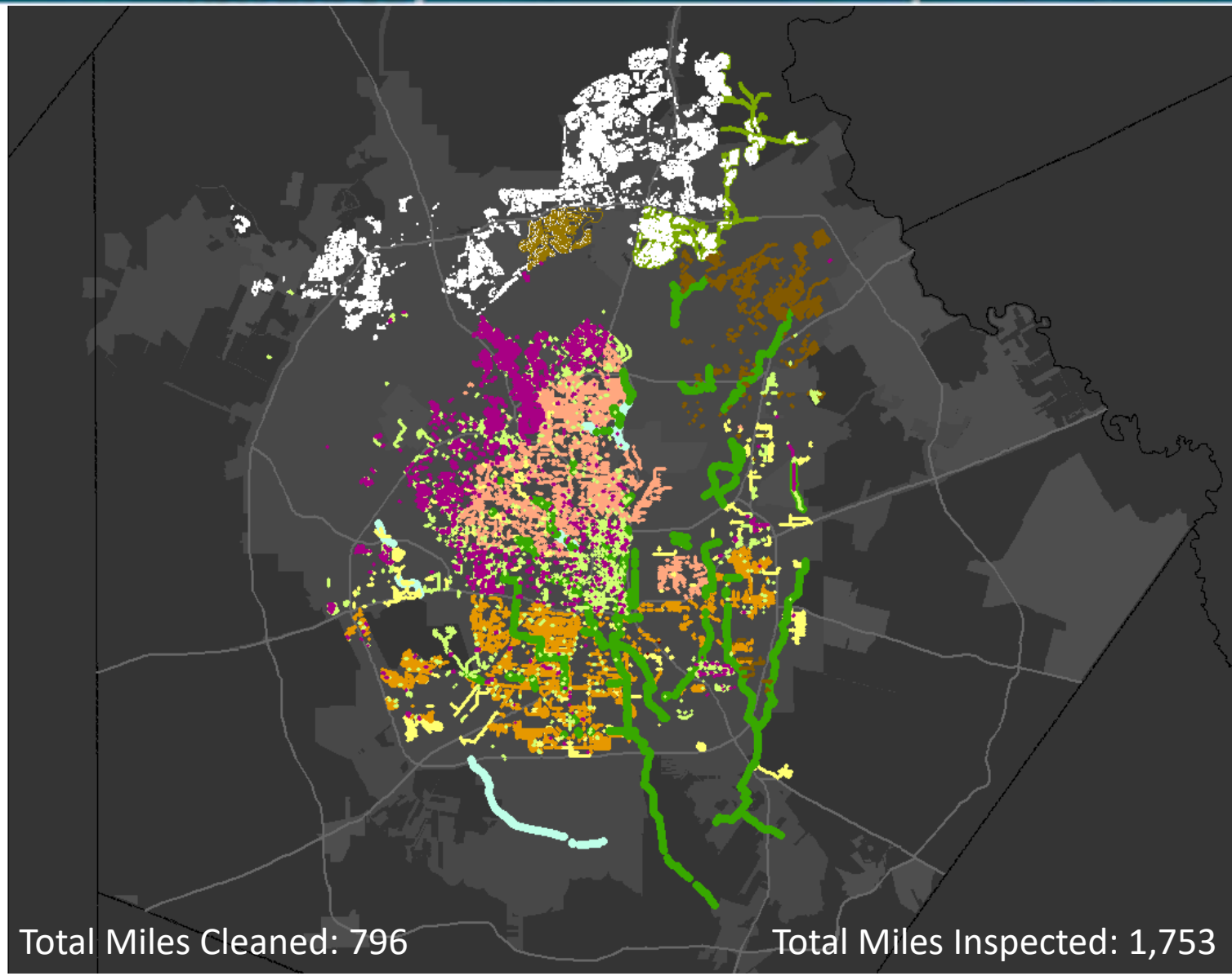

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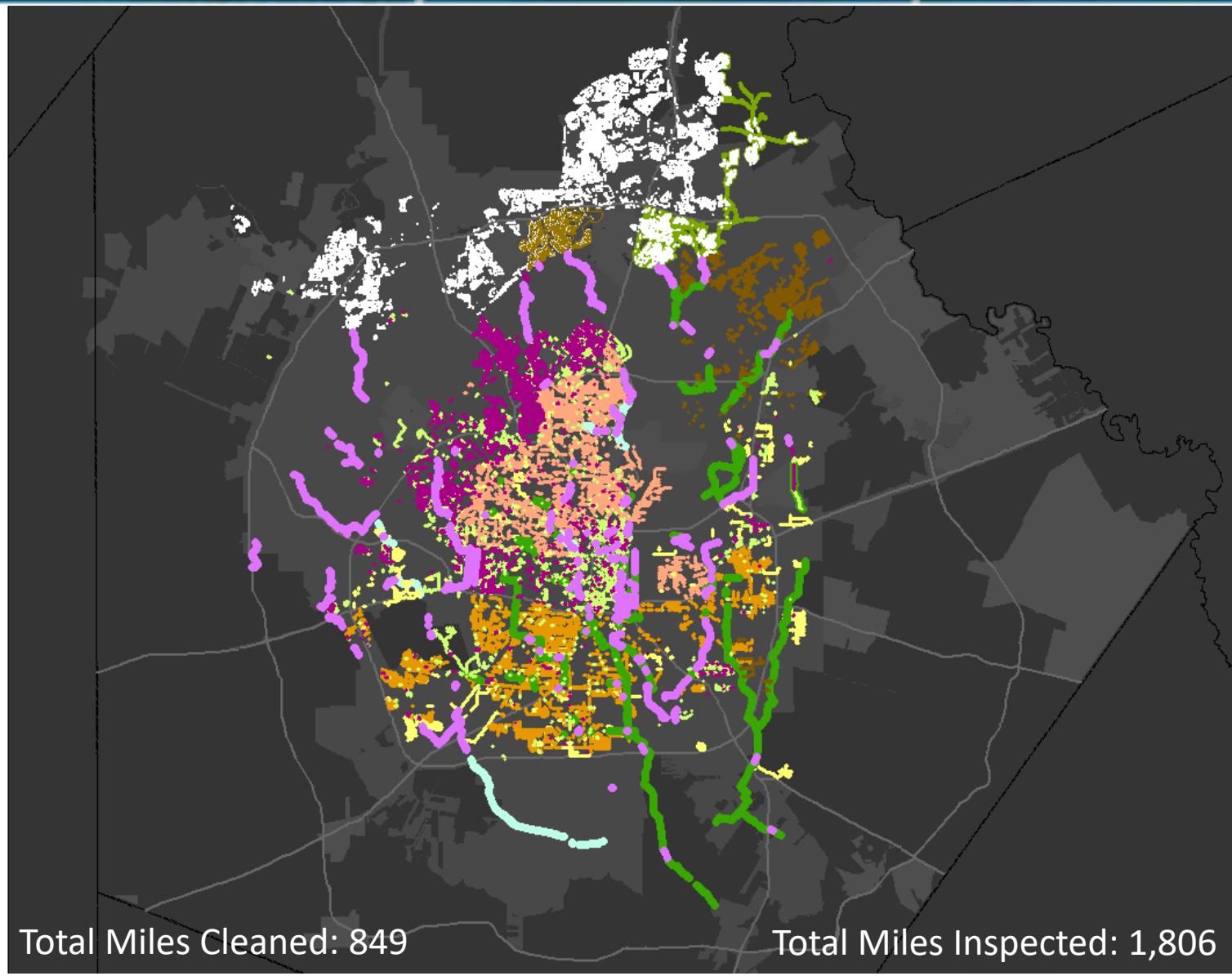

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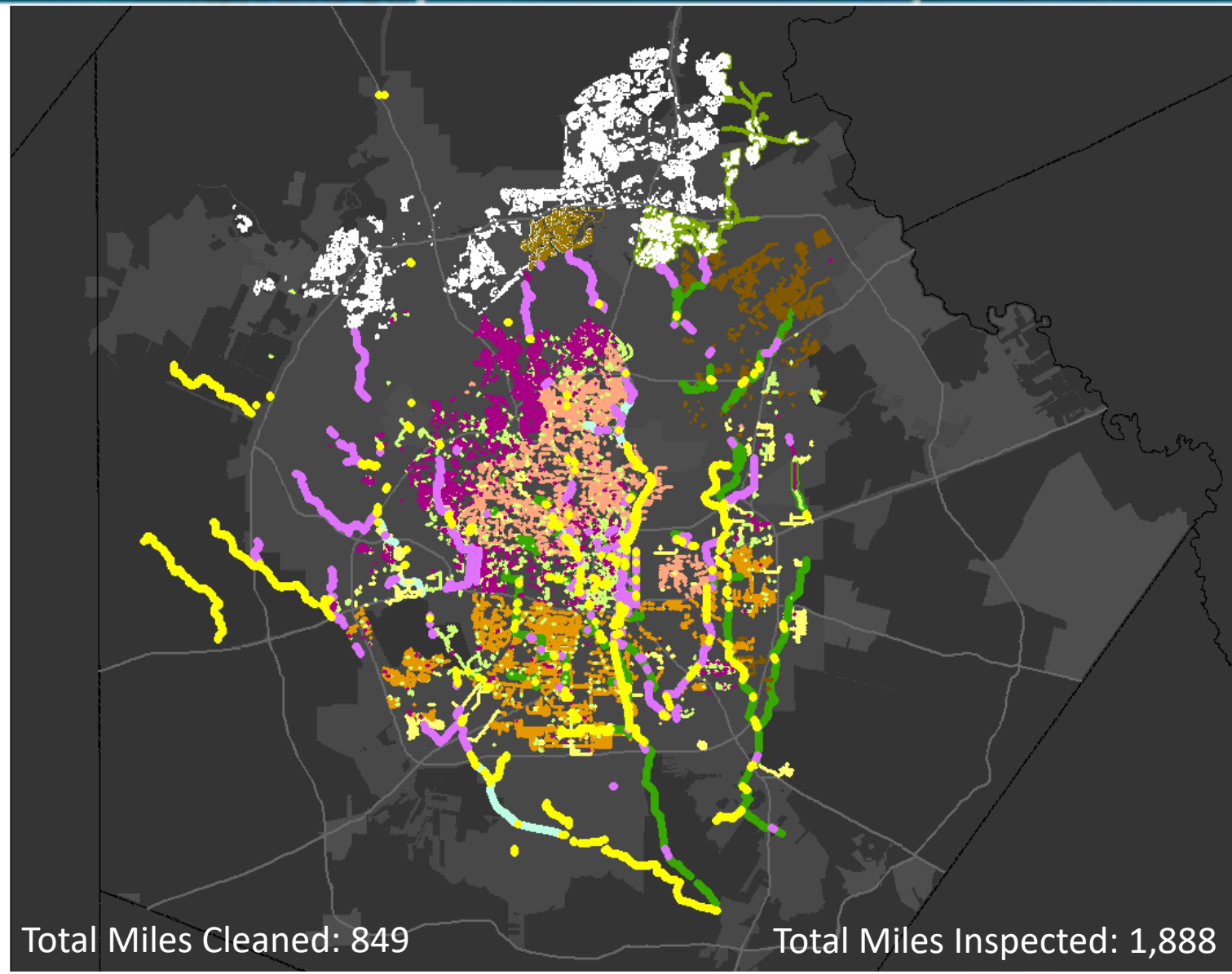

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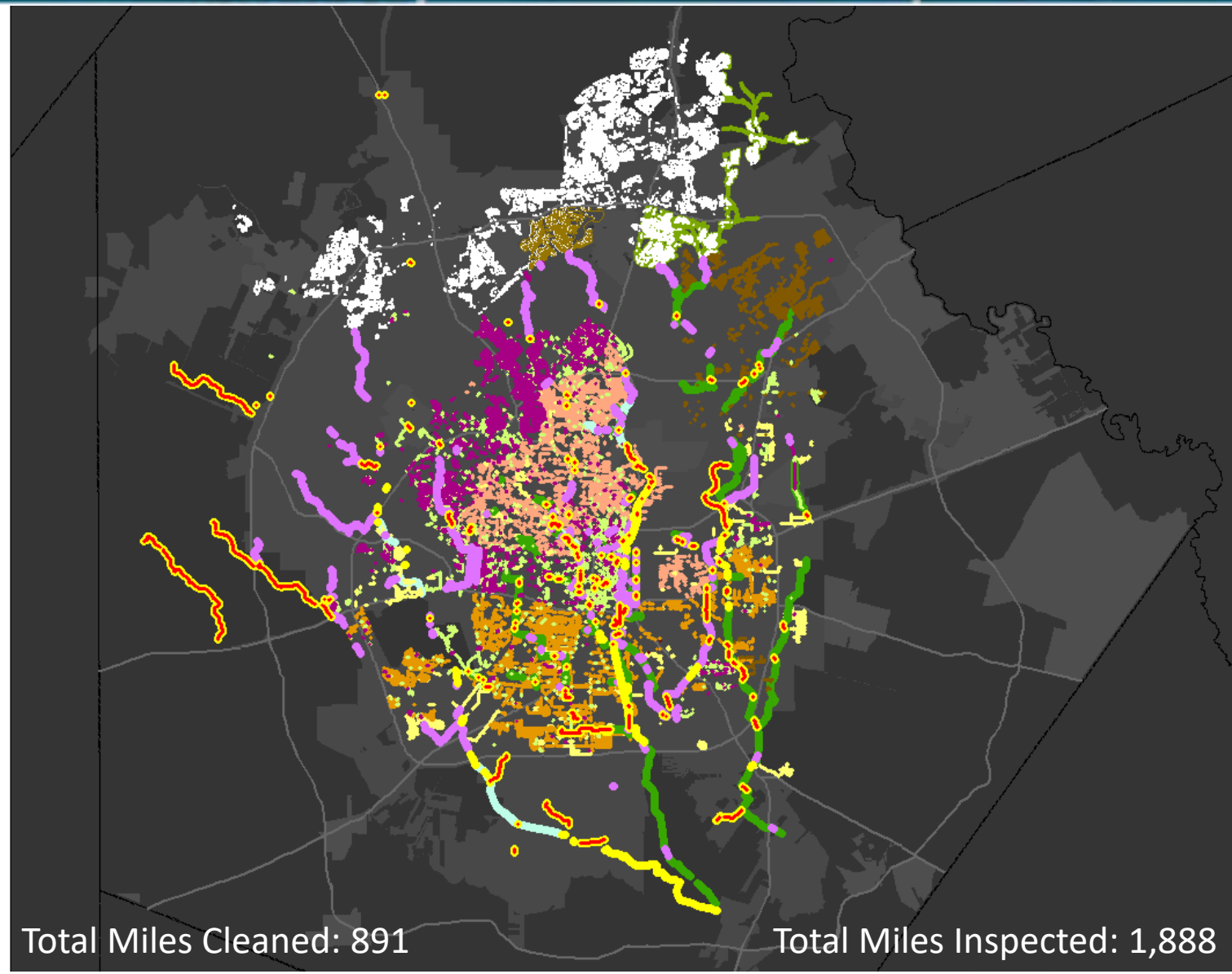

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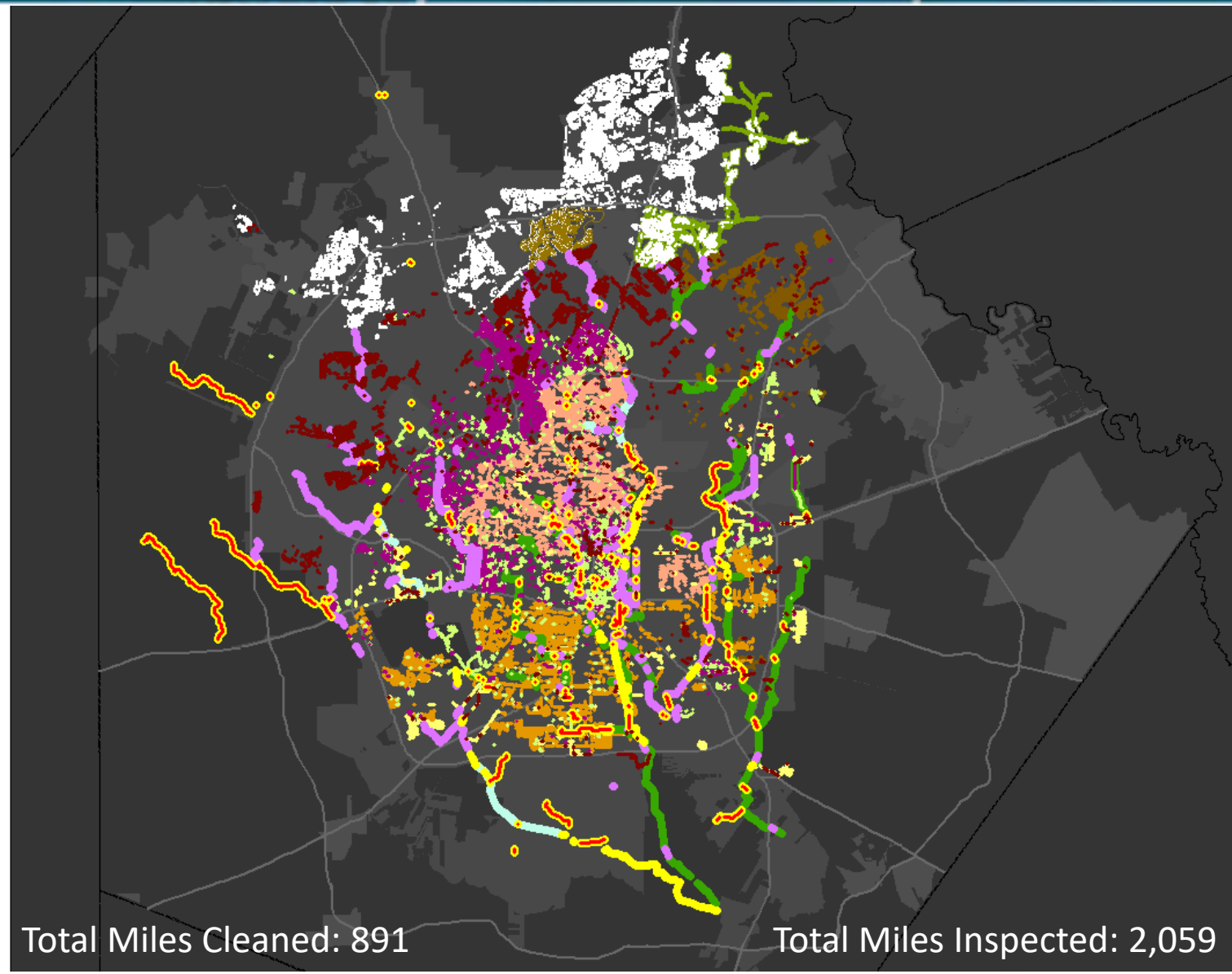

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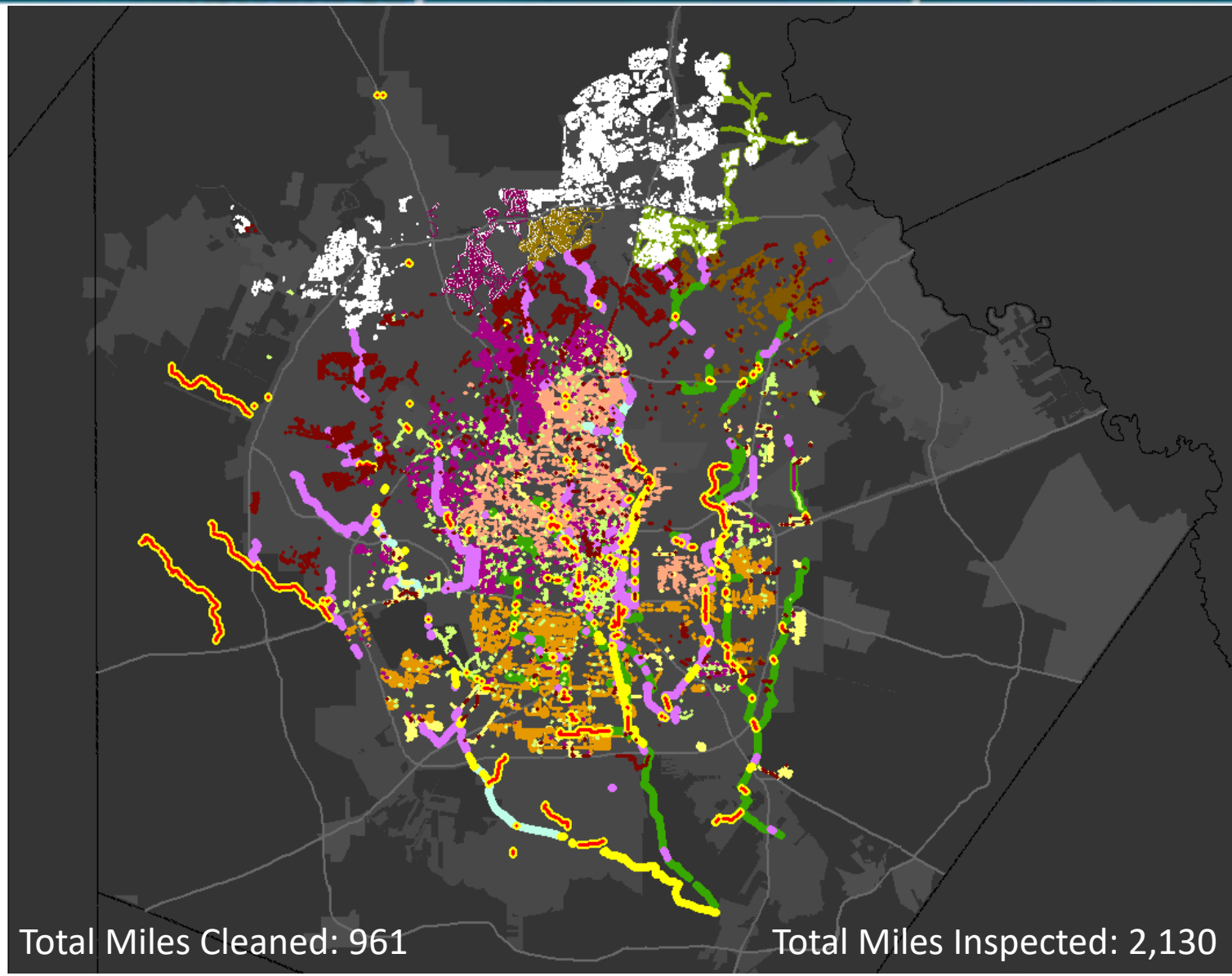

San Antonio Water System

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2016 - Year 4

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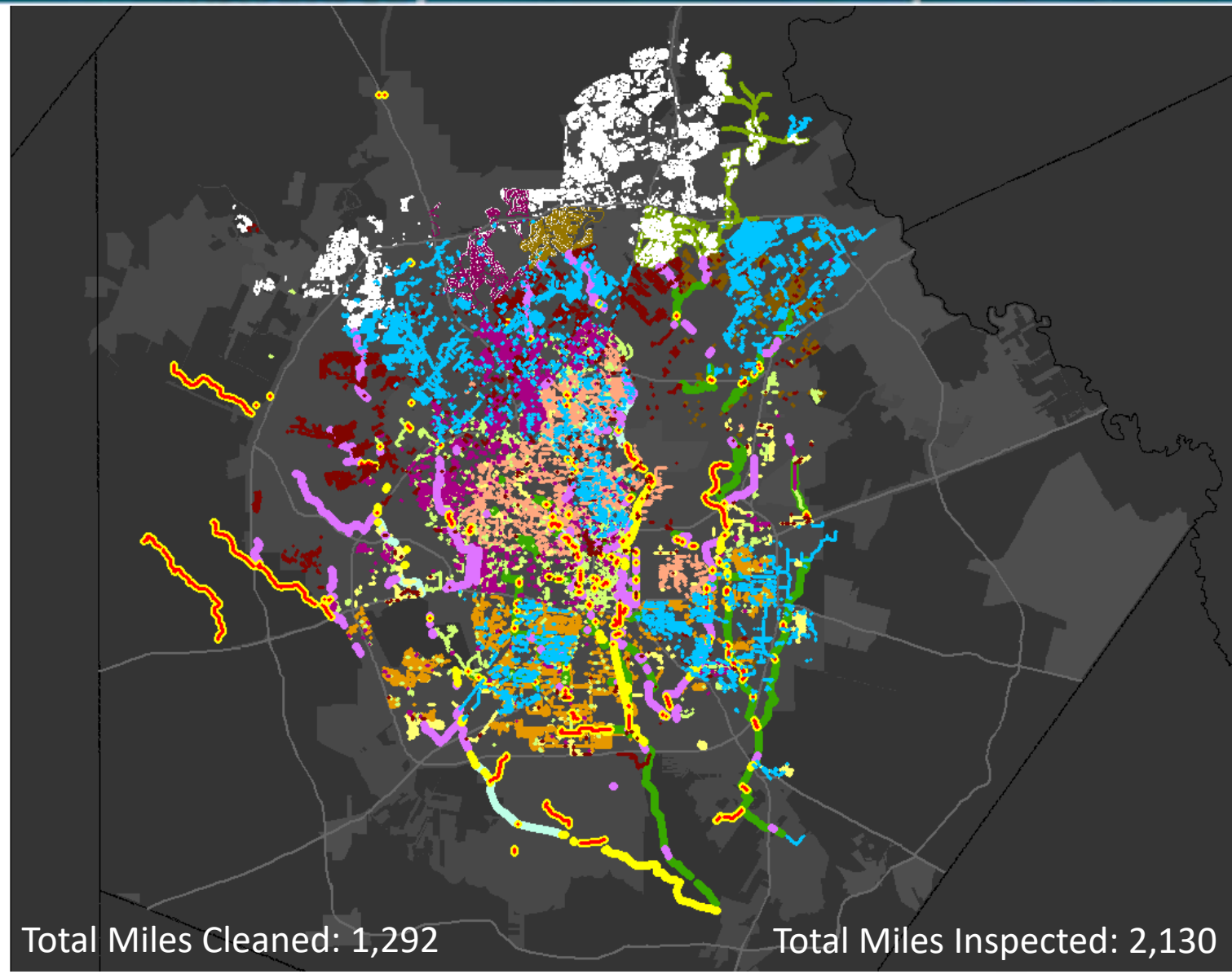

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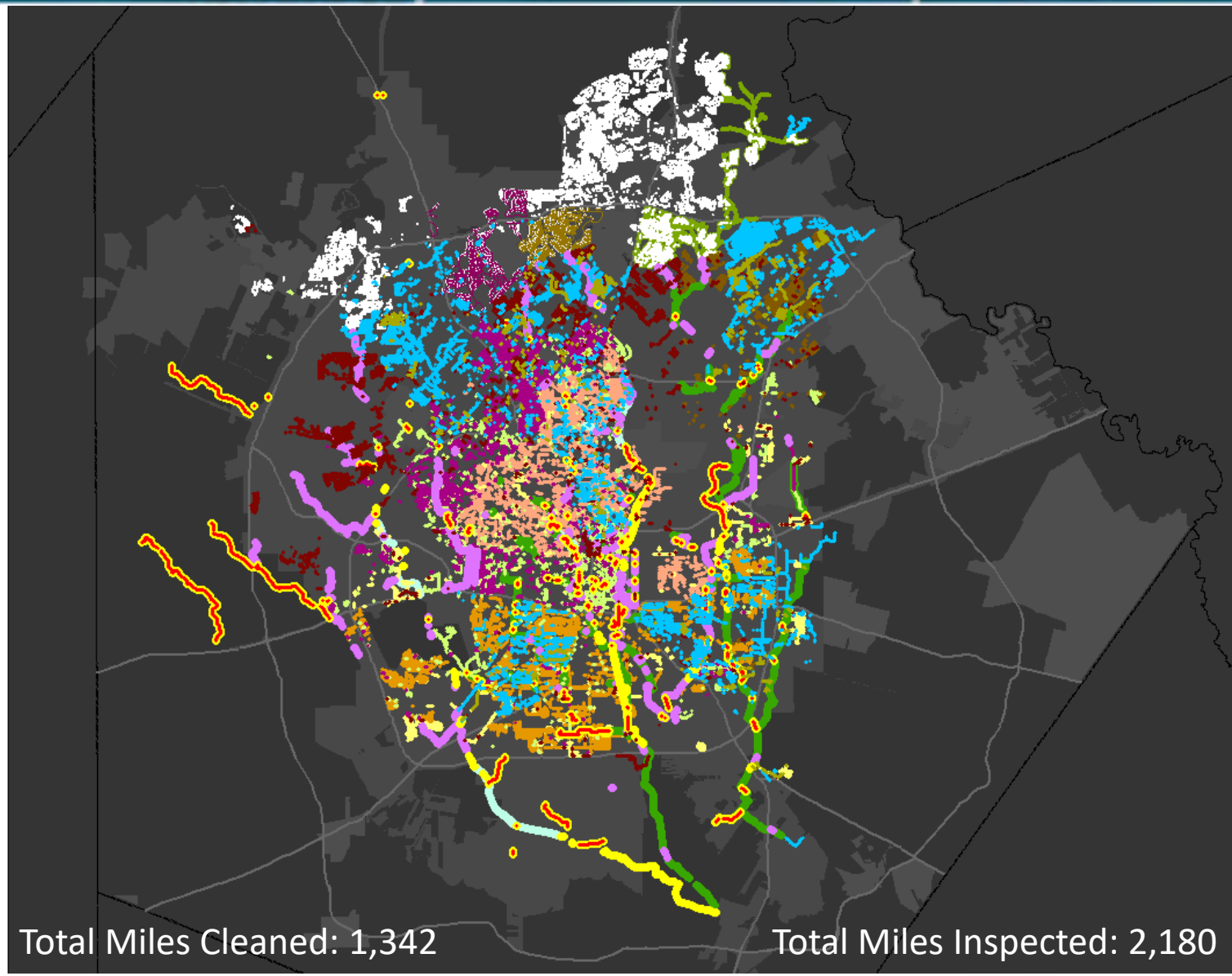

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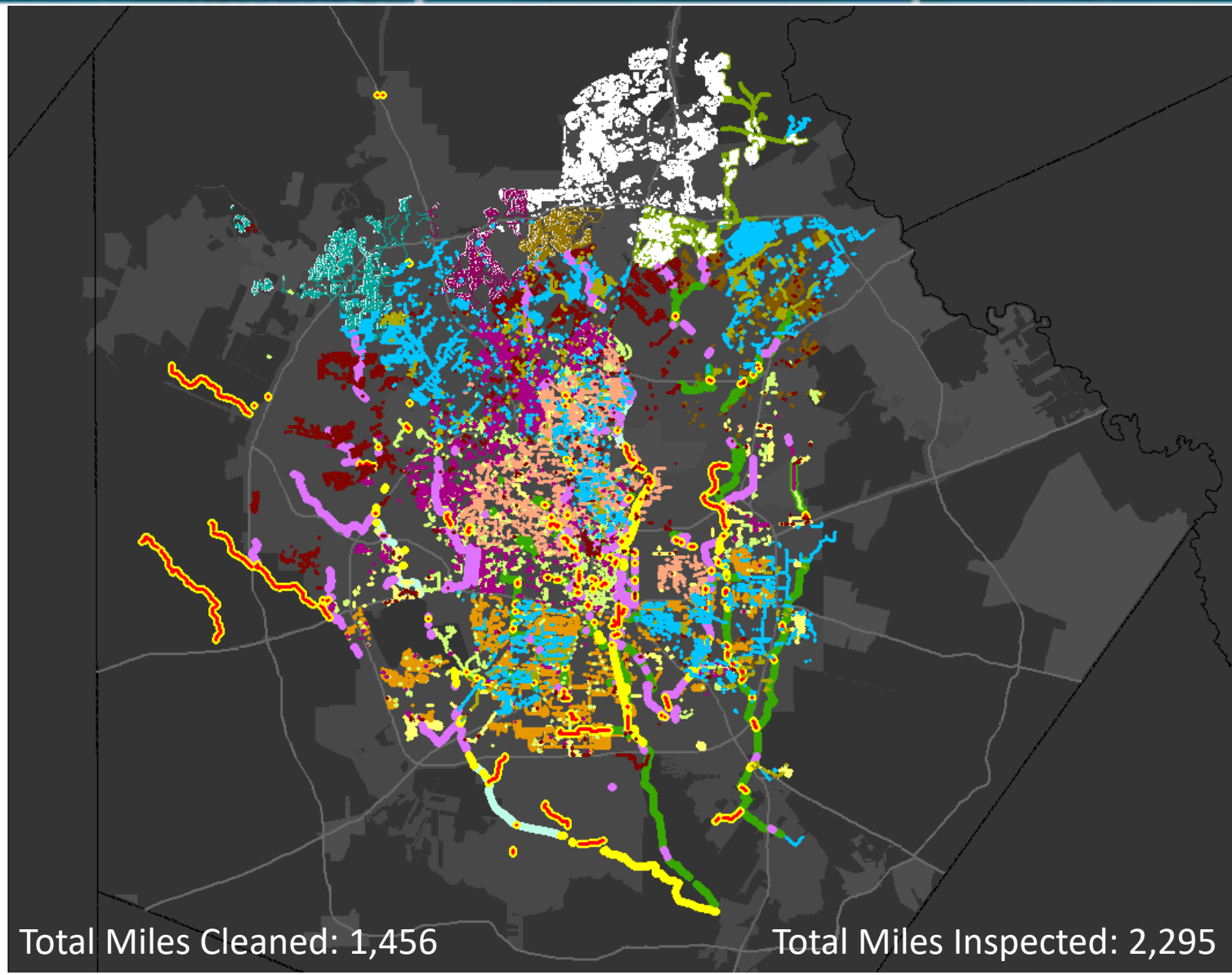

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Ad Hoc 2013-2016

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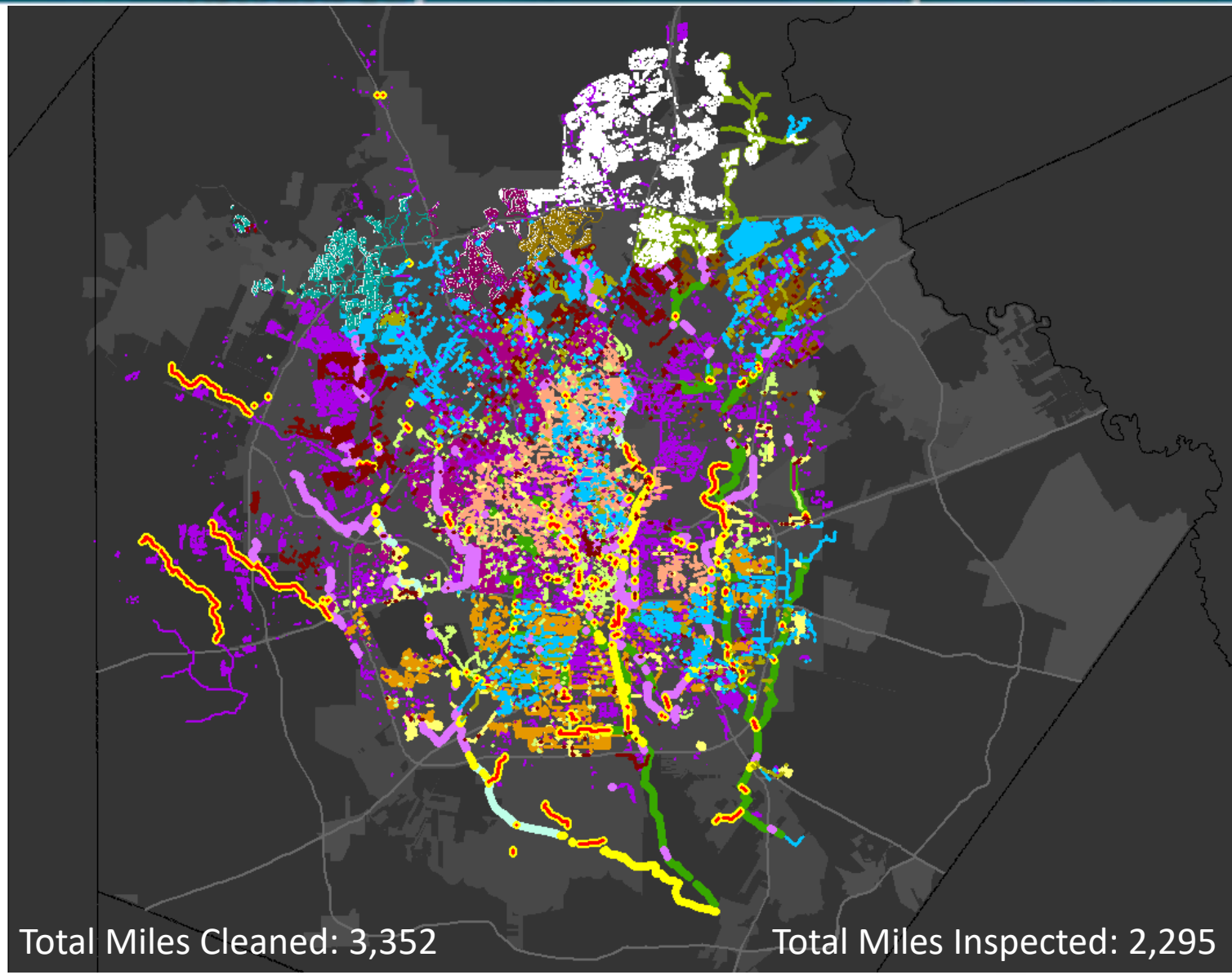

San Antonio Water System

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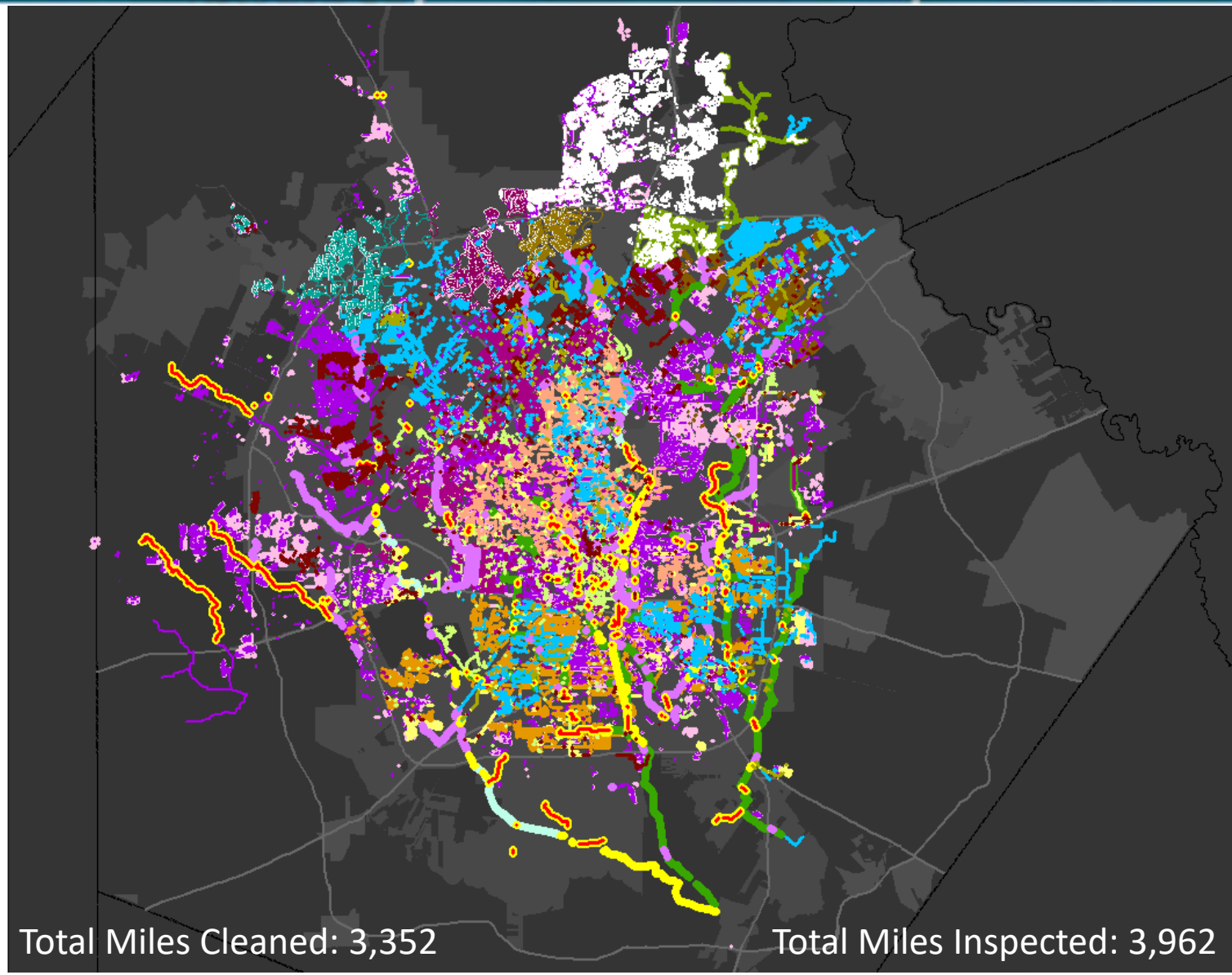


San Antonio Water System

Condition Assessment

CCTV, Sonar or Pole Cam

Asset Description To be Assessed by July 2017	Miles of Inspections Required Under CD	Miles of Inspections Completed	% Complete
Small Diameter Gravity Sewer - EARZ, Concrete Pipe and Clay Pipe Installed Prior to 1973	1,869	1,909	102%
Small Diameter Gravity Sewer - Clay Pipe Installed from 1973 through 1982	410	411	100%
Large Diameter Gravity Sewer	364	378	104%

Wachs Water SERVICES

TAPLIN GROUP, LLC Environmental Services

POLSTON APPLIED TECHNOLOGIES

APC ACE PIPE CLEANING, INC.

PROPIPE PROFESSIONAL PIPE SERVICES

SAWS LCTV San Antonio Water System

B&N BURGESS & NIPLE

rjngroup 40 years of collection system solutions

AIMS / PVIC

QPS underground infrastructure specialists out of sight, always in mind.

Maintenance, Monitor or Alternative Analysis

Condition Assessment: Rate A-E

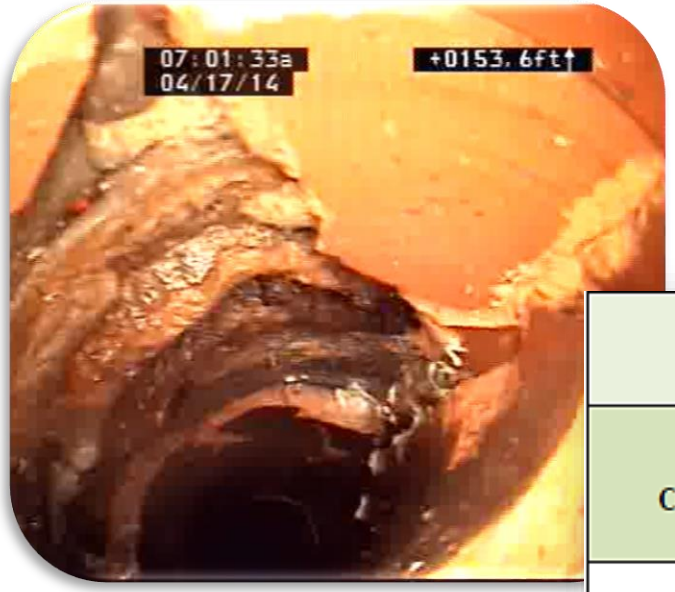


Table VII-I:
Condition Categorization Summary

Condition Category	Miles of Small Diameter Sewer Mains[1,2]	Miles of Large Diameter Sewer Mains[1,3]	Number of Manholes
Category A – Very Good	1,019.32	79.22	21,611
Category B – Good	415.67	52.72	32,406
Category C – Fair Condition	1,156.74	114.29	270
Category D – Poor	332.26	83.18	1,171
Category E – Very Poor	178.93	32.27	262
TOTAL	**3,102.92**	**361.68**	**55,720**

Alternatives Analysis CD Requirements

Condition

- "SAWS shall determine which solution is most likely to resolve the structural defects with the most practical solution…" Solutions include:
  - Repair
  - Rehabilitation
  - Replacement
  - Monitoring
  - Maintenance Analysis

Guidelines for Alternatives Analysis

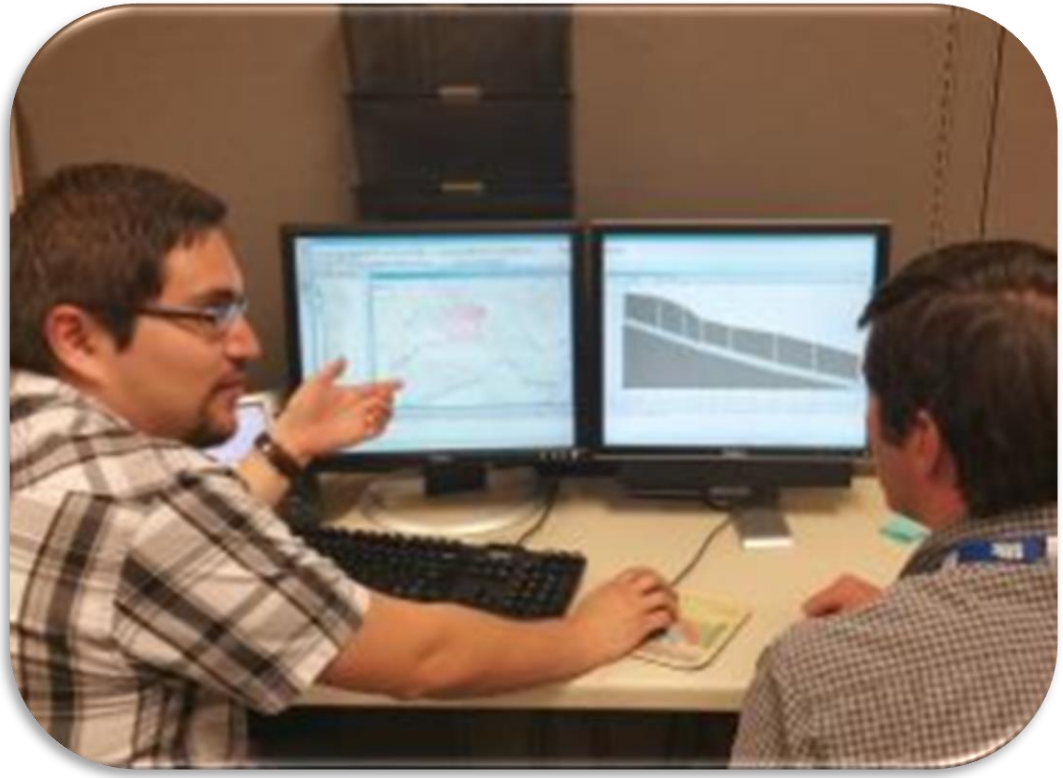
Condition

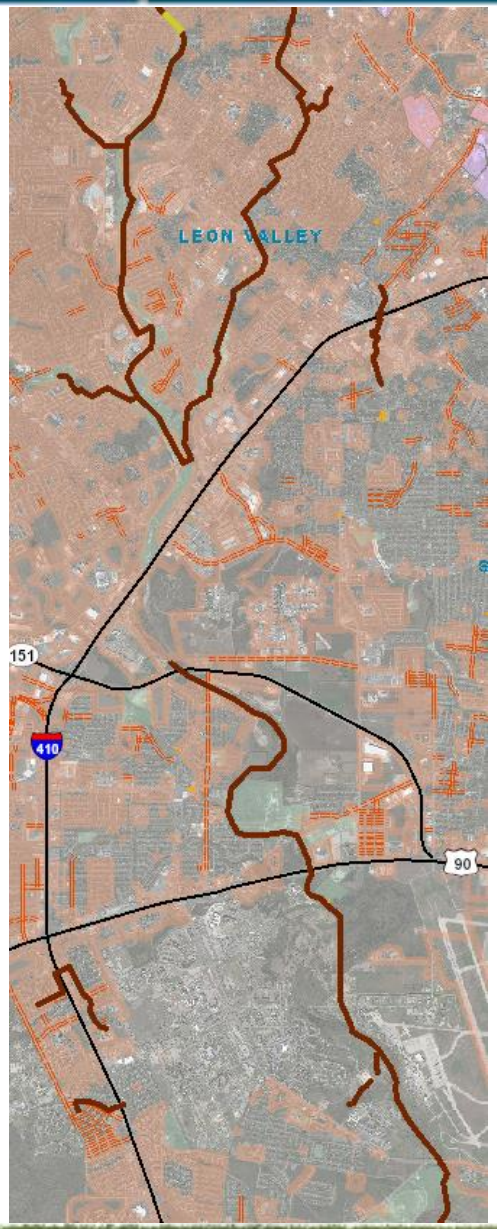
- Remedial measure was selected based on professional judgment
  - Repair where a repair alone would restore the pipe to "C" or better
  - Rehab where a lining would restore the pipe to "C" or better
  - Replacement
- Pipes selected for construction include:
  - Very poor (E) and some poor condition (D) pipe located in major roadways
  - Pipes associated with a Structural SSO
  - Very poor (E) condition concrete pipes
  - Very poor (E) condition pipes that located in low income areas

Condition Alternatives Analysis Results

Table VII-1: Results of Completed Remedial Measures Alternatives Analyses			
Result	**Miles of Gravity Main Sewer[1]**	**Number of Gravity Sewer Main Pipe Segments**	**Number of Manholes**
Replace[2]	149.6	2925	73
Rehabilitate[2,3]	98.5	1622	64
Repair[2,3]	75.3	1320	1104
Monitoring	337.3	5994	
Maintenance Analysis	3.2	81	115
Other (Capacity Rehab)	5.2	94	7
Other (Capacity Replace)	55.0	1015	24
Totals:	**724.1**	**13,051**	**1427**

Capacity Assessment





San Antonio Water System

Capacity Assessment

Table VII-I: Potential Capacity Constraints Summary	
Category	**Number of Potential Capacity Constraints**
Priority 1 – Category A SSO per Wet-Weather SSO Categorization and where model also predicts an SSO	45
Priority 2 – Where model predicts SSO, but with no observed SSO, or a Category A SSO per Wet-Weather SSO Categorization, but model does not predict an SSO	130
Priority 3 – Where model predicts HGL near ground elevation	87
Priority 4 – Category B SSO per Wet-Weather SSO Categorization	137
Priority 5 – Where pipe design capacity is exceeded for sustained 60 minutes or more but the HGL is not near the ground elevation	139
Total	**538**

Table IX-I: Capacity Assessment Results	
Capacity Assessment Result	**Number of Potential Capacity Constraints**
Remedial Measures Alternatives Analysis	170
Monitor in the Future per Capacity Assessment and Remediation Process and Guidelines Appendix (CMOM)	273
Not a Capacity Constraint	95
Total	**538**

Alternatives Analysis CD Requirements

Capacity

- "Use engineering analysis to determine which solution is most likely to resolve the constraint…"
  - Reduction in inflow
  - Re-routing flow
  - Upstream flow detention (Storage)
  - Increase capacity
  - Continue monitoring, if appropriate
  - Reducing flow entering the system (not considered)
  - Reduction in infiltration (not considered)

Guidelines for Monitoring

Capacity

- Continued capacity monitoring is appropriate for a constraint where:
  - The impact of other WCTS improvements on other constraints would result in a peak flow reduction sufficient to render an increase in capacity unnecessary, and;
  - Where wet weather SSOs have not occurred that were attributed to the lack of capacity

Alternatives Analysis Results

Capacity

Table VII-1: Results of Remedial Measures Alternatives Analyses	
Remedial Measures Alternatives Analysis Result[1]	**Number of Potential Capacity Constraints**
Re-route a portion of upstream wastewater flows	2
Reduce flows entering the WCTS	0
Reduce inflow	41
Reduce infiltration	0
Increase conveyance capacity	52
Upstream flow detention facilities	18
Continued monitoring	27
Other (Lift Station)	10
Other (Not a Constraint)	5
Other (Main Stem)	15
Totals:	**170**

Condition Assessment Report

January 19, 2018

San Antonio Water System

Capacity Assessment Report

January 19, 2018

San Antonio Water System

Goals for Remedial Measures Plans

- Answer the CD requirement to perform alternatives analysis on referred assets
  - Provide proof and results
- Provide timing and projects for remedial measures to be built
  - Place each asset to be remediated into only one project
  - Remove any assets that have been remediated from future projects
  - Identify a SAWS project for each asset to be remediated

Plan

Alternative Analysis
Remedial Measure

- Best Option “Alternative” to Resolve “Remediate”
- Most Practical Solution & Timeframe
- Long-term Performance and Life-Cycle Cost

- Coordinate both Condition & Capacity Projects
- Prioritize & Develop Schedule
- Determine Budget Requirements

Plan: Basin Planning

Overview: 2 Phases (10% and 30% Phases)

10% Design

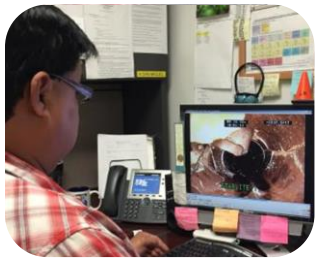
- Develop and finalize alternatives
- Assessment & design
- Recommendation to move forward to the 30%

30% Design

- Perform field verifications/evaluations
- Develop cost data
- Allows rapid progress in final Design & Construction

Assessment & Remediation Planning

CMMS Asset History



PACP Coding

InfoMaster Applies SAWS' Ratings Guidelines

Preliminary A-E

InfoMaster Supports Senior Reviewers in Prioritizing & Documenting Outcomes

Verified A-E

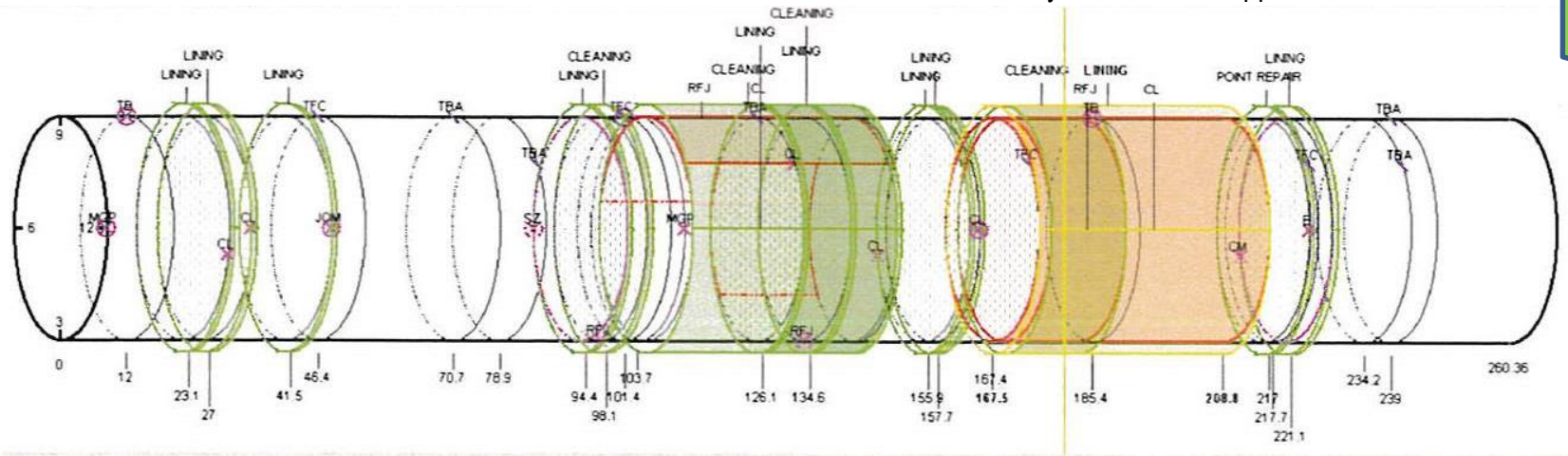
InfoMaster Applies SAWS' Remediation Decision Guidelines

Preliminary Remediation Approach

Engineering Confirms; Project Packaging & Design

Proposed Projects in CPMS

Program Cost Forecast



San Antonio Water System

Condition Remedial Measures Project List

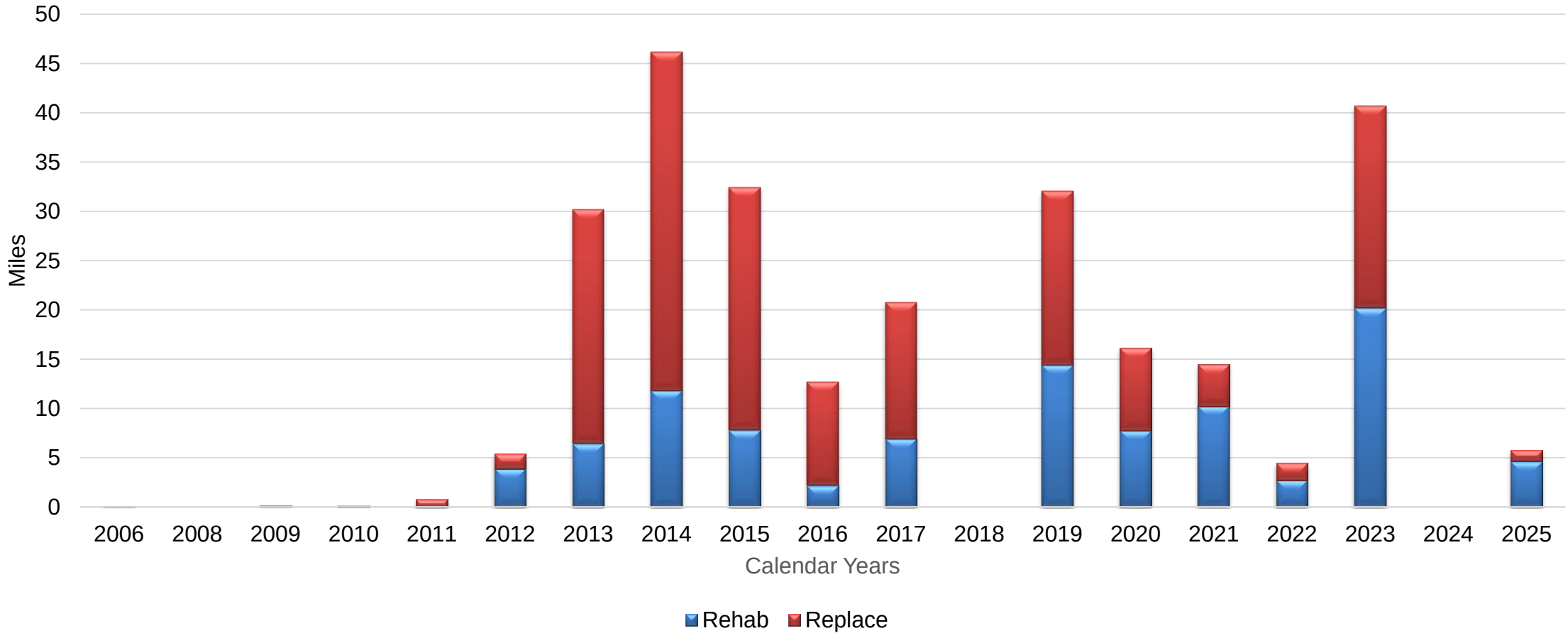
- Condition Table IX-2

269 miles completed through 2017

Table IX-2: Remediation Project List			
Project Name	**Project Miles**	**Completion Date**	**For Large Diameter Pipes, Schedule Justification for Completion Date After 4.5 Years from EPA Approval of Remedial Measures Plan**
Project 13 – 2019 SD Rehab Program	32.0	2019	
Project 14 – 2020 SD Rehab Program	16.2	2020	
Project 15 – 2021 SD Rehab Program	14.5	2021	
Project 16 – 2022 SD Rehab Program	4.4	2022	
Project 17 – 2023 SD Rehab Program	31.5	2023	
Project 18 – 2023 SD Rehab Program	9.3	2023	
Central Sewershed LD Rehab	2.9	2025	Easements
East and West Sewershed LD Rehab	2.9	2025	Easements
Main Point Repairs For D&C	2.0	2023	
Total	115.7		

Condition Mileage

Completed and Planned Rehab and Replace Mileage



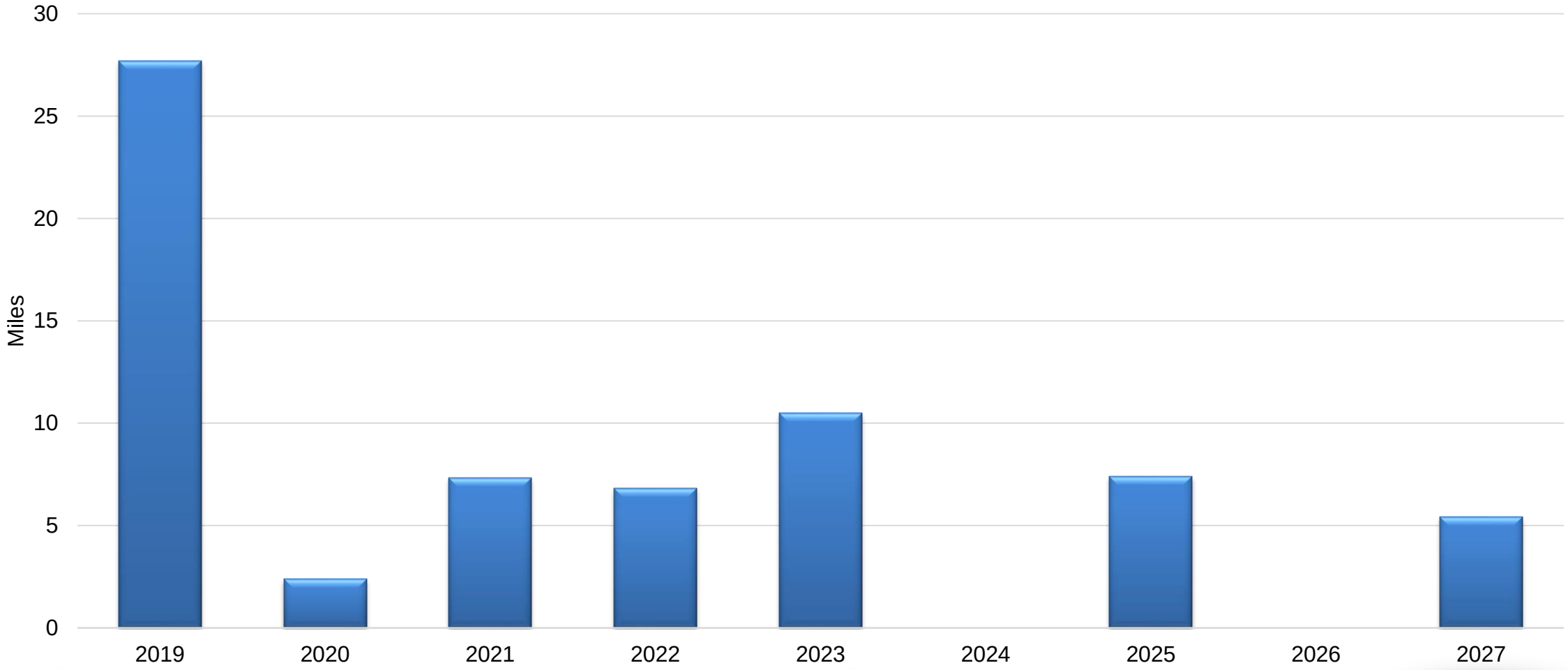
Capacity Remedial Measures Plan

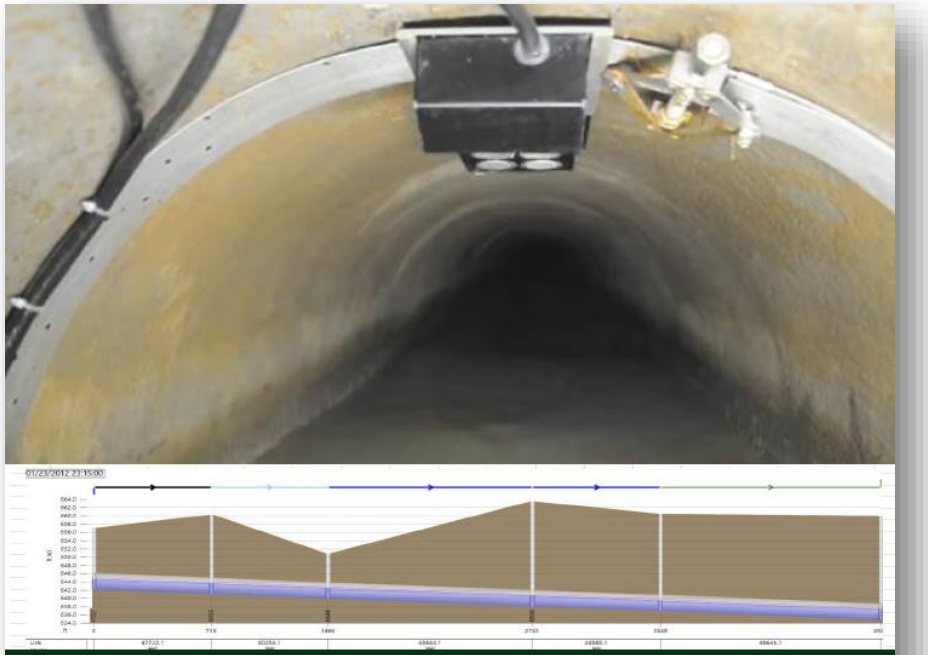
Plan Elements

- Guidelines for Alternatives Analysis
  - Guidelines for monitoring
- Alternatives analysis results
- Completed remedial measures
- Anticipated remediation timeframe
- Remediation project list

Capacity Projects

Miles of pipe to be completed by year





SAWS Consent Decree
Capacity Remedial Measures Plan

January 18, 2019

San Antonio Water System

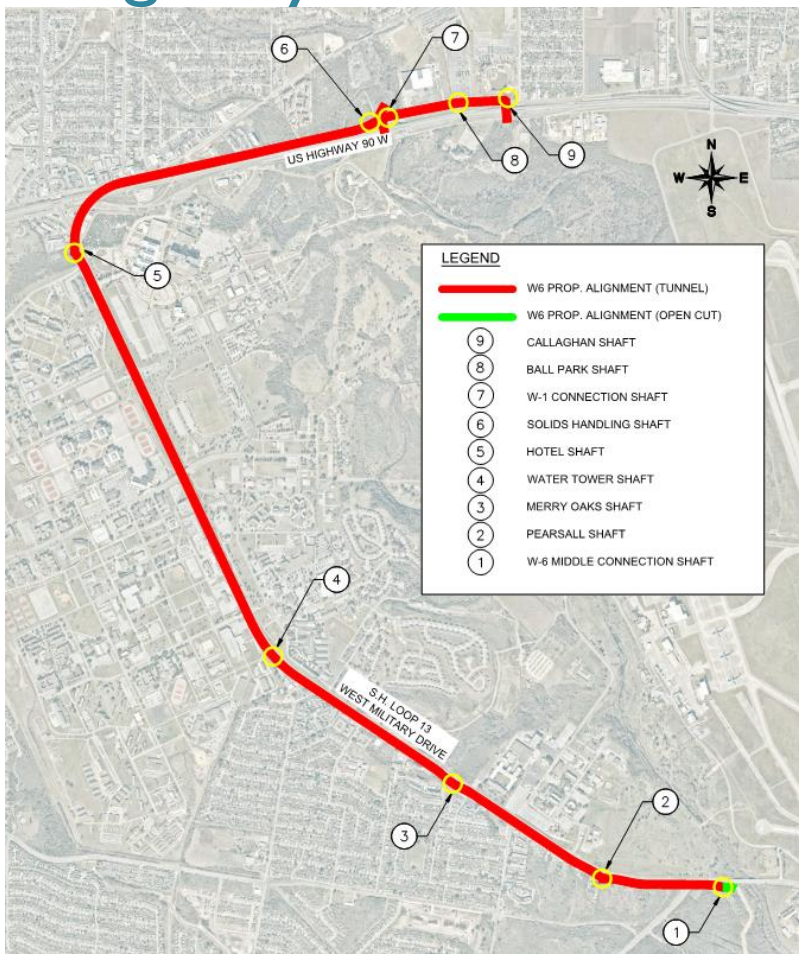
SAWS Consent Decree
Condition Remedial Measures Plan

January 18, 2019

San Antonio Water System

W-6 Upper Segment Project

Highway 90 to SW Military Drive Sewer Main



- Western Sewershed, along US 90 and W. Military Dr
- Pipe Diameter and Segment Length
  - 27,653 LF of ~144" tunnel in Navarro Group and Marlbrook Marl formations
  - 925 LF of ~78" hand mining construction
  - 1,137 LF of open cut construction at tie-in locations
- Installation along TXDOT right-of-way
- Nine shaft locations
- Solids Removal Structure
- Large Bypass (>60 MGD)

HDR

PAPE-DAWSON ENGINEERS

CP&Y

FOSTER CMGROUP

YPR

WSC WATER SYSTEMS CONSULTING, INC.

GONZALEZ DE LA GARZA SURVEYORS ENGINEERS CONTRACTORS

JACOBS

ch2m

FREESE AND NICHOLS

Strategic Initiatives Consulting

ARIAS GEOPROFESSIONALS

Stantec

MWH

garza emc

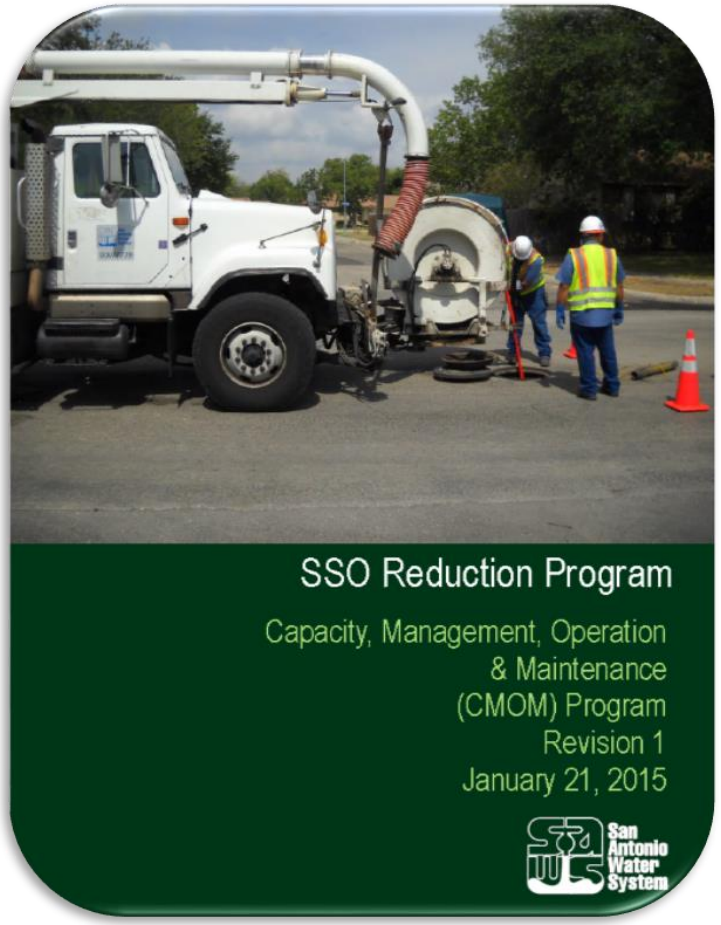
BAINMEDINABAIN ENGINEERS & SURVEYORS

Kimley»Horn

White Rock Consultants

Capacity, Management, Operations & Maintenance

- Condition & Capacity Monitoring Program
- System Wide Cleaning
- Smart Clean Program
- Large Diameter Sonar Cleaning
- Fats, Oils and Grease Management



Smart Clean Program

In Progress

- Smart Clean Covers have been installed on 200 manholes
- Resource optimization through trend analysis and remote alarm system integration
- "Clean the right pipe at the right time"

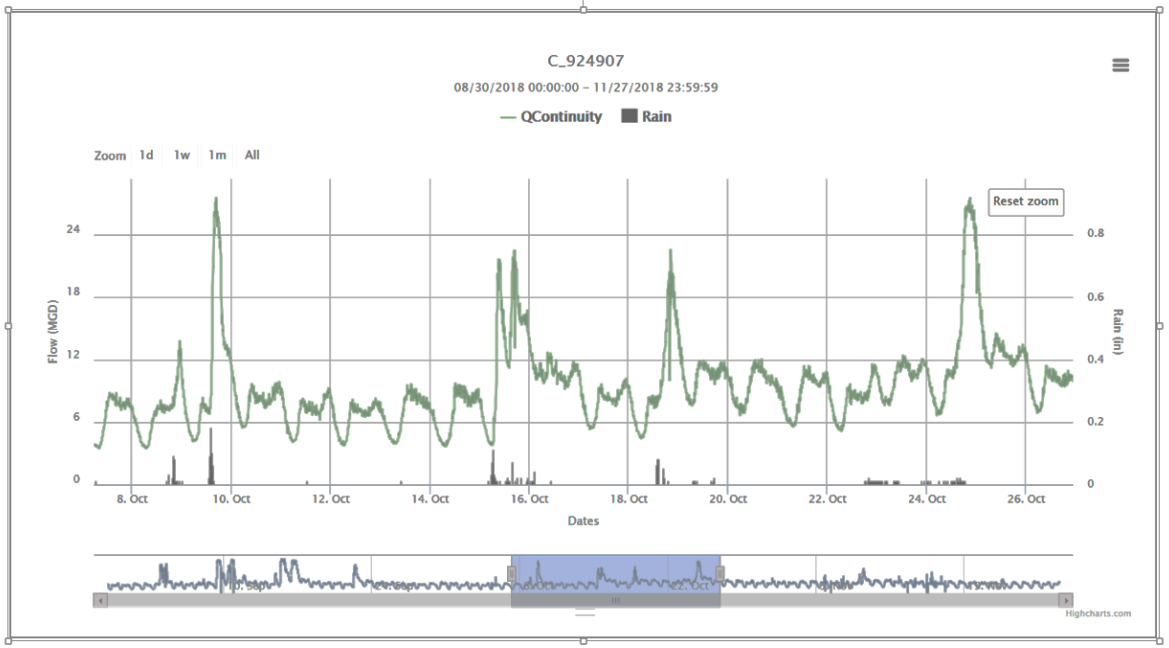
CMOM - Capacity Monitoring Plan

- Flow Monitoring Plan
- System-Wide Hydraulic Modeling
- Evaluation of Reported Wet Weather SSOs and Model Predicted SSOs
- Remedial Measures Alternative Analysis
- Plan and Implement Remedial Measures

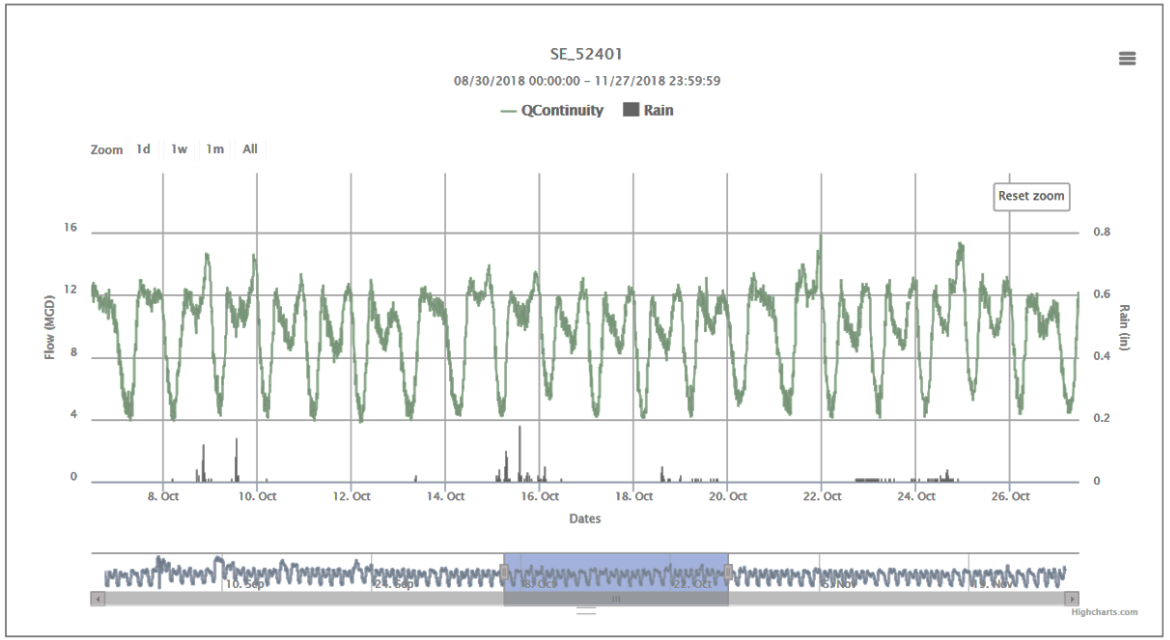
Major Sewer Trunk Lines

Flow Monitoring

Wet Weather Response – Poor Performing Area

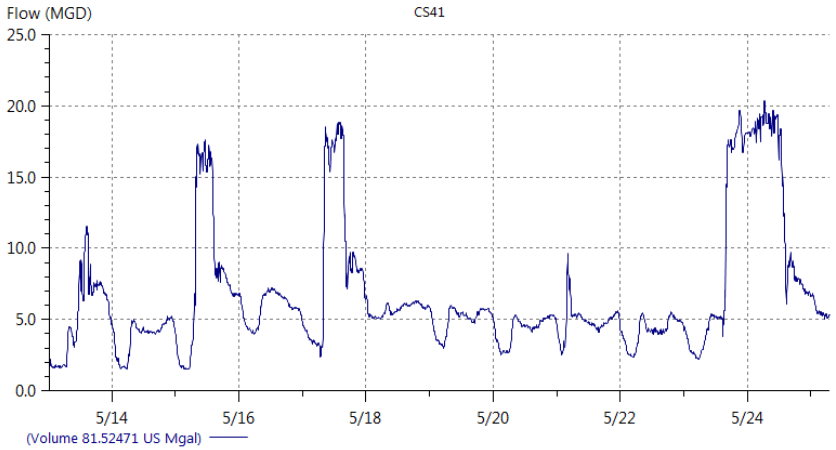


Wet Weather Response – Well Performing Area



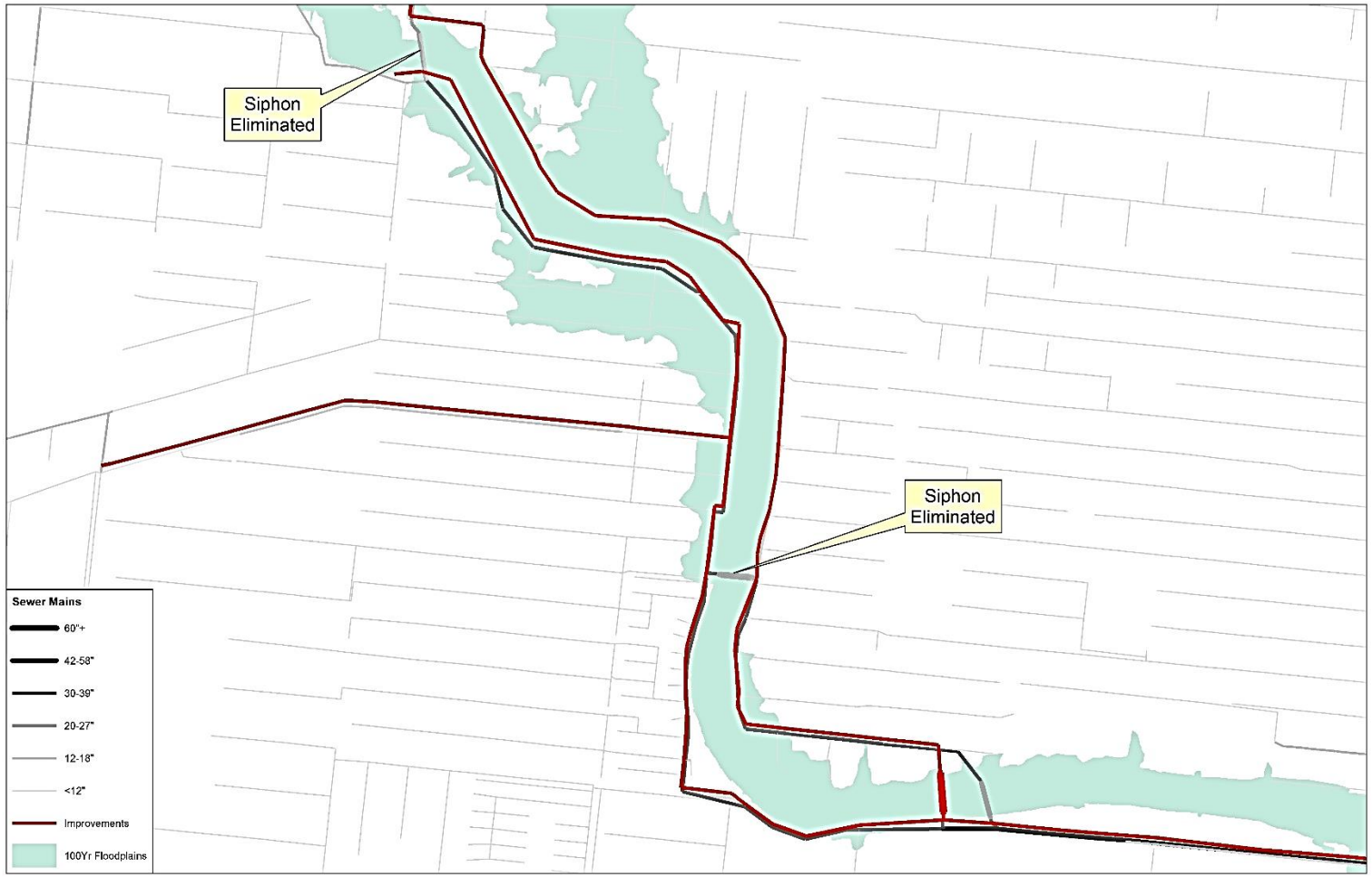
Rainfall Derived Inflow/Infiltration

- Sewer in the creek
- Cross connections
- Poor condition of pipes/manholes
- Maintenance (manhole lids)
- Other…

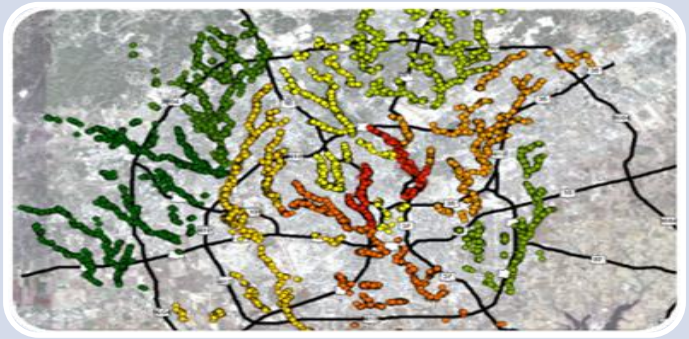


Capacity Lessons Learned

- Rerouting flows to minimize crossing of creeks and rivers
- Renewal of mains in floodways to minimize potential for inflow



Inflow Reduction Program



Flood Plain Analysis

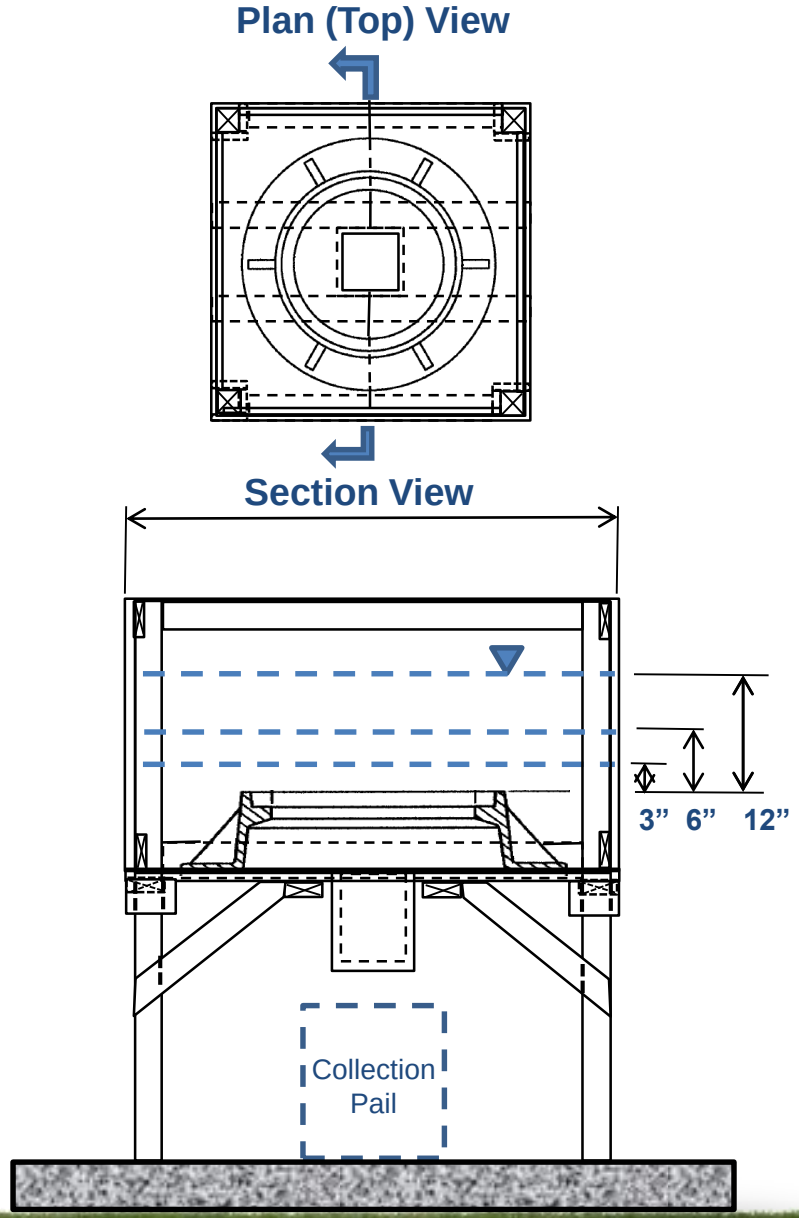
Manhole Lid Testing

Program Initiatives

- Quantifying Manhole Cover Inflow Contribution
- Prioritize manhole inspections
- Manhole Improvement Options
- Verification of Project Effectiveness

Leveraging Ideas

Manhole Inflow Testing

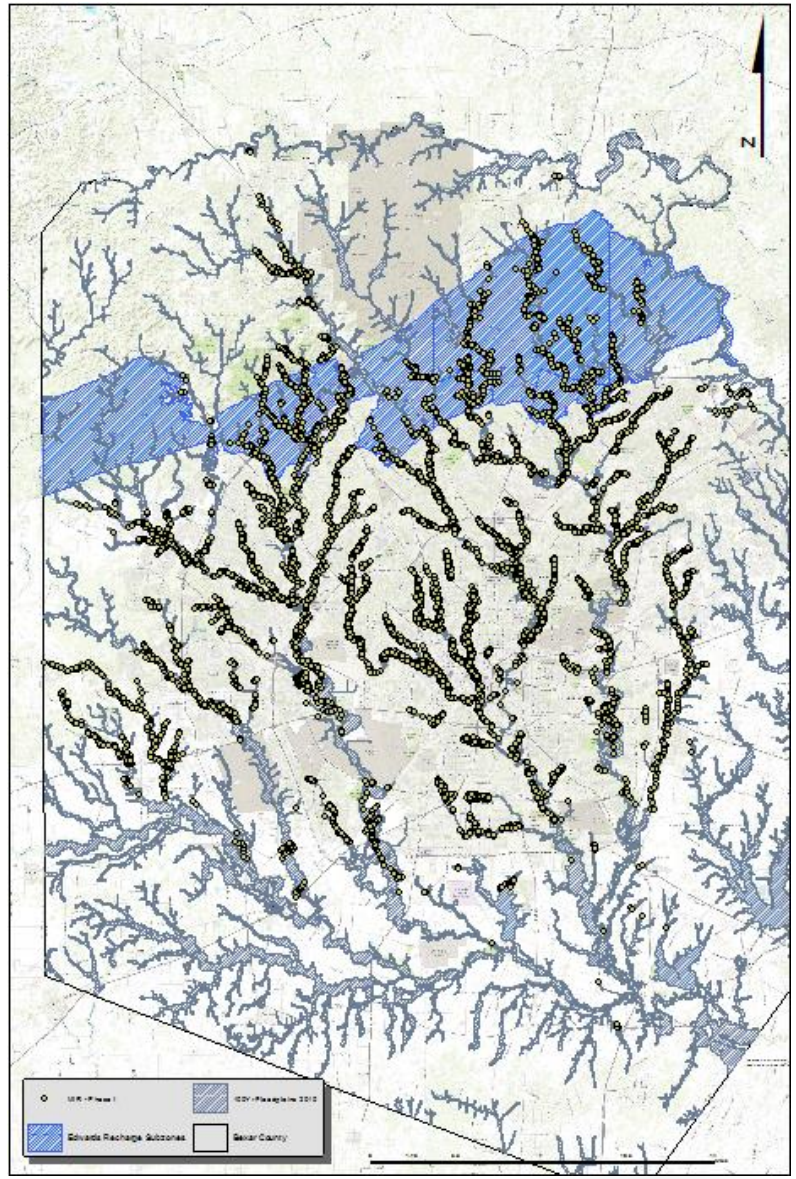


Bad Performance 122 GPM at 12” Submergence

Good Performance 0.005 GPM at 12” Submergence

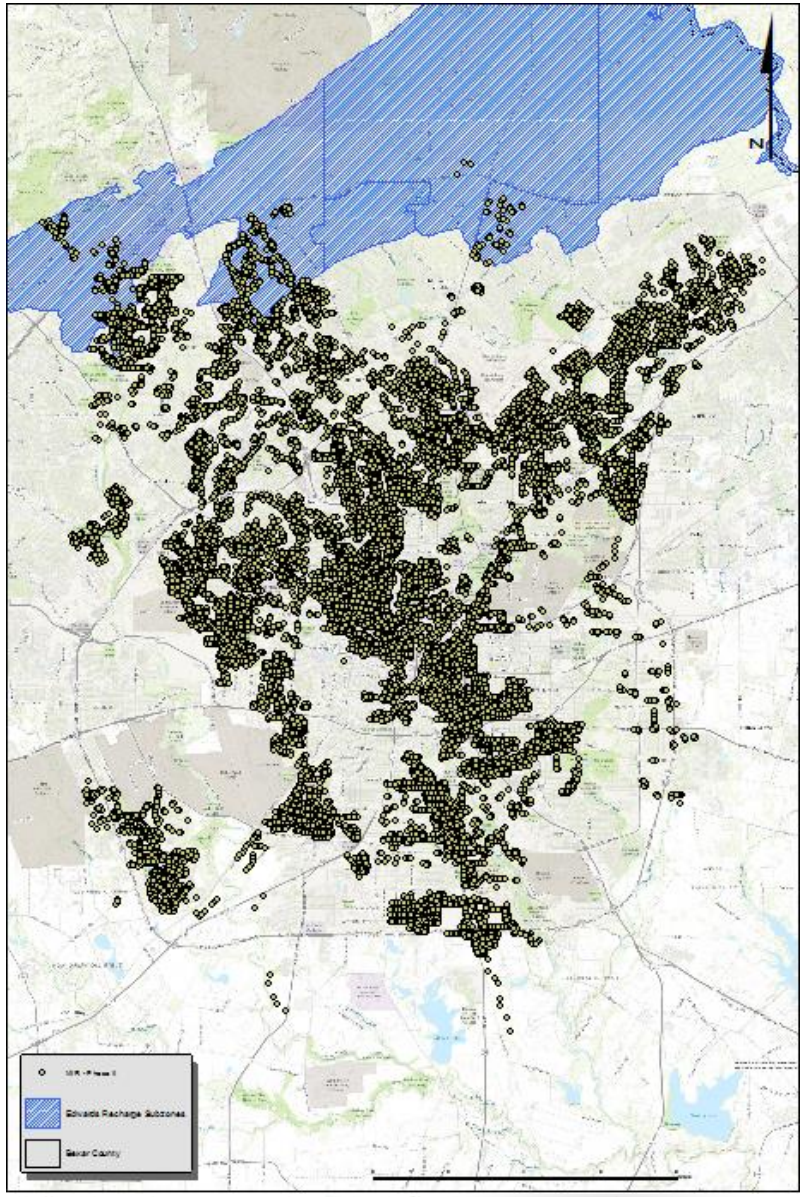
Phase I – Manhole Inspections

- 8885 Manholes within 100 year floodplain & creek beds
- 9% of SAWS manholes are located in the 100-year flood plain



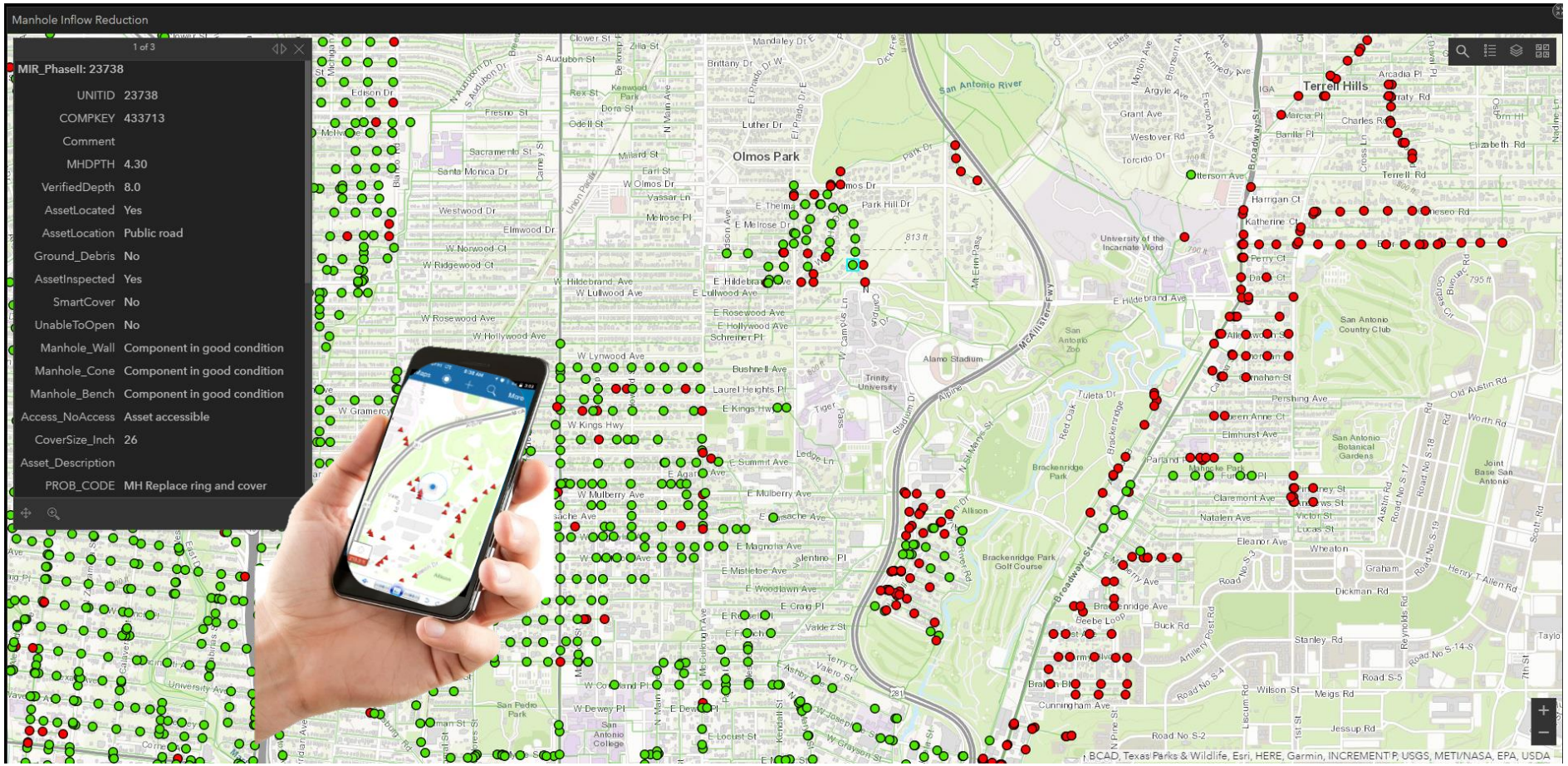
Phase 2 - Manhole Inspections

- ~20,000 manholes in flood prone areas
- Selection Criteria:
  - Upstream of capacity constraint
  - Rain event submergence



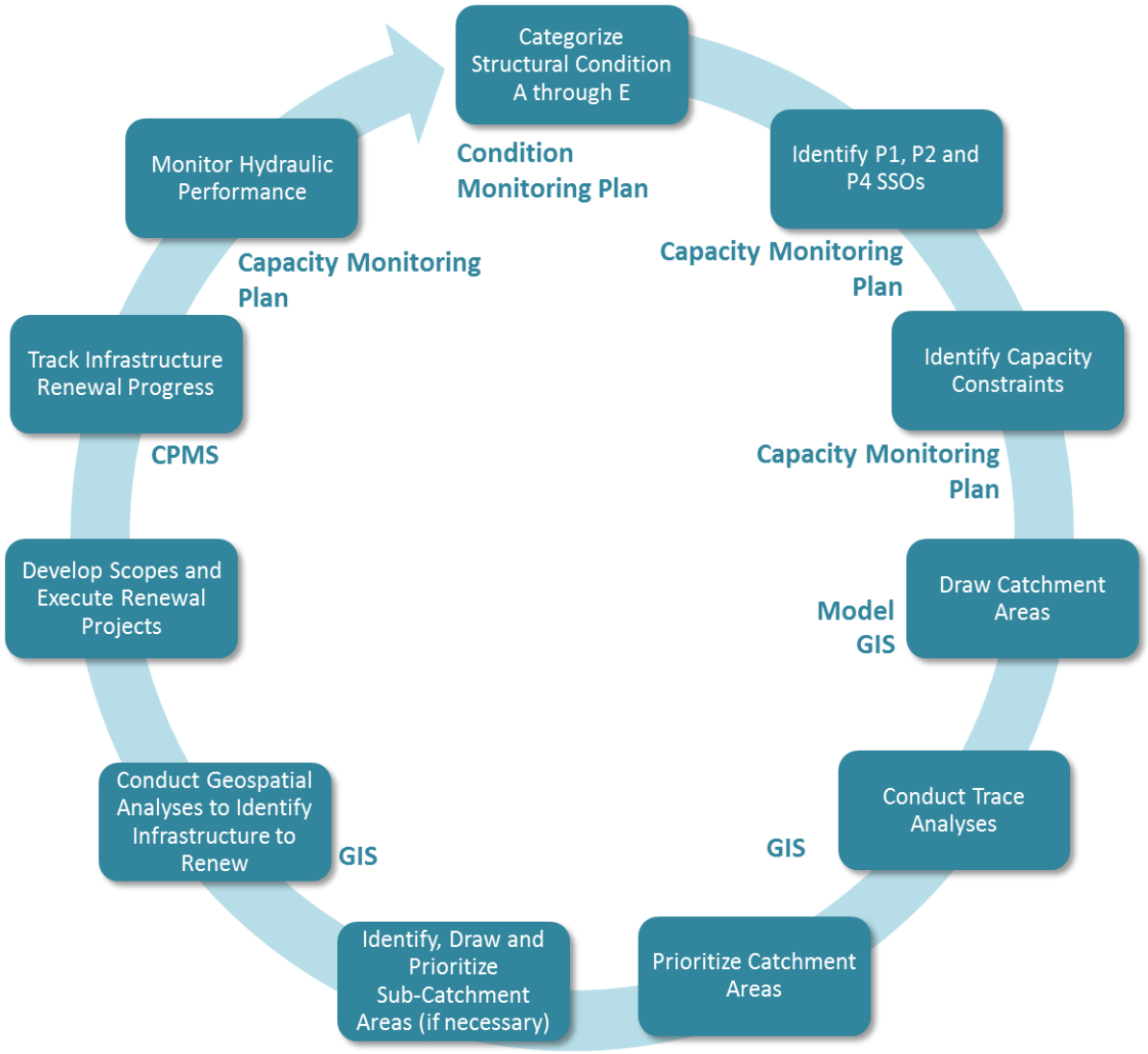
Innovative Solutions & Path Forward

Transition from Access database to ESRI's Collector Application and ArcGIS Online (AGOL)



San Antonio Water System

Inflow Reduction Work Plan



CMOM - Condition Monitoring Plan

- Ongoing inspection and reassessment
- EARZ assets - 5 year cycles
- Condition Assessment of Re-inspected Assets (3 buckets)
  - Maintenance Analysis –Cleaning Program
  - Monitoring
  - Remedial Measures Alternative Analysis

CCTV

PACP and SAWS Grading System

- Grading System
  - A – Very Good
  - B – Good
  - C – Fair
  - D – Poor
  - E – Very Poor
- PACP Coding
  - All CCTV is stored within a NASSCO compliant database

CMOM Program

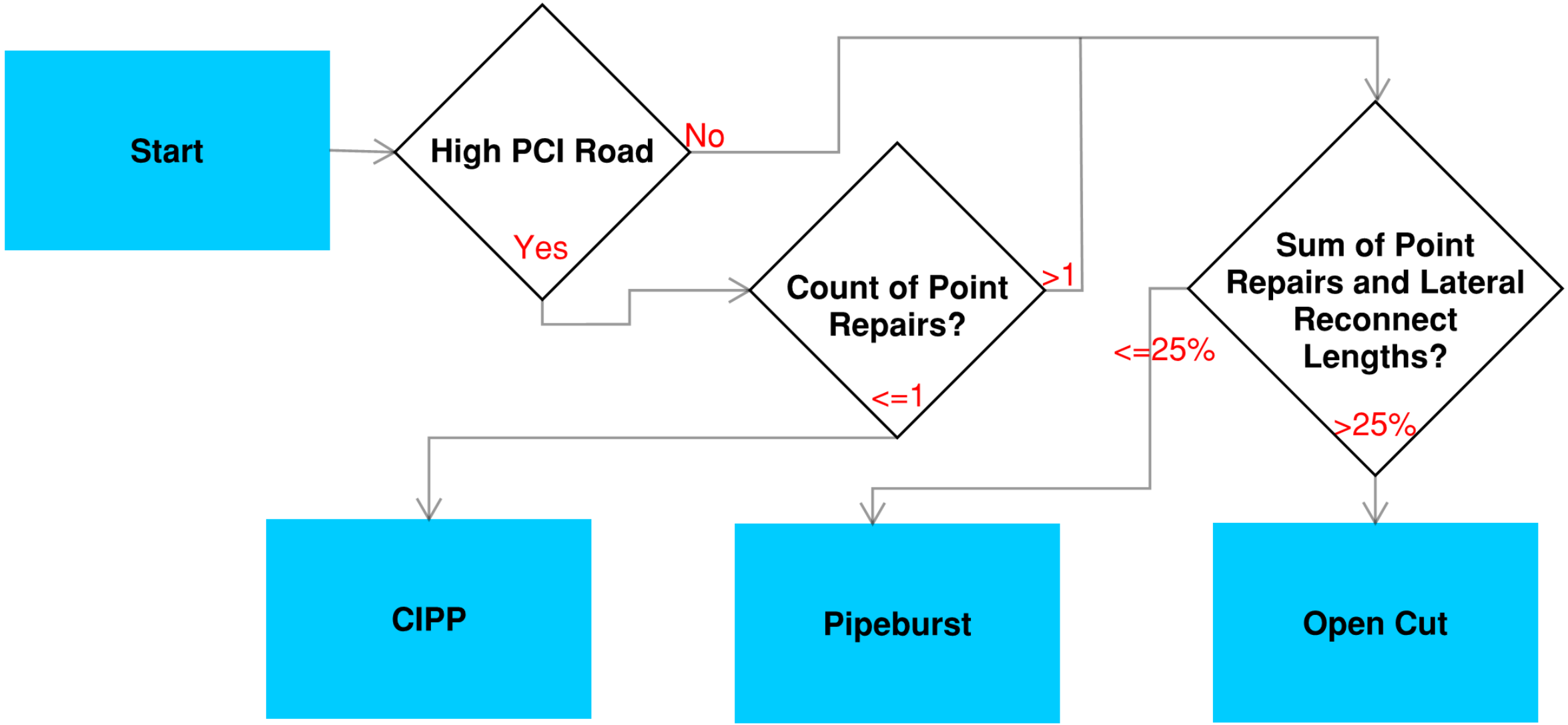
Planning Beyond the CD

- Creating Planned and Unplanned Projects
- Currently Modeling CMOM Mains
  - Main Deterioration
  - Likelihood of Failure
  - Consequence of Failure
  - Overall Risk

InfoAsset™ Planner

Logo Courtesy of Innovyze.com

Rehabilitation Plan



Here's the Breakdown

Scope

SSO Remedial Measures
91 Active/Future Projects
+23k Assets

CPMS
+23k Assets

Schedule

17 RFQ/Planned

74 under Construction/Design

Budget

2020 CIP
$315M
Sewer only

5 Year Total CIP
~$2.6B

Project Controls

Our goal is to attain and sustain a high level of project success by consistently meeting project schedules and budget, while maintaining scope and meeting stakeholder expectations.

SCOPE SCHEDULE BUDGET

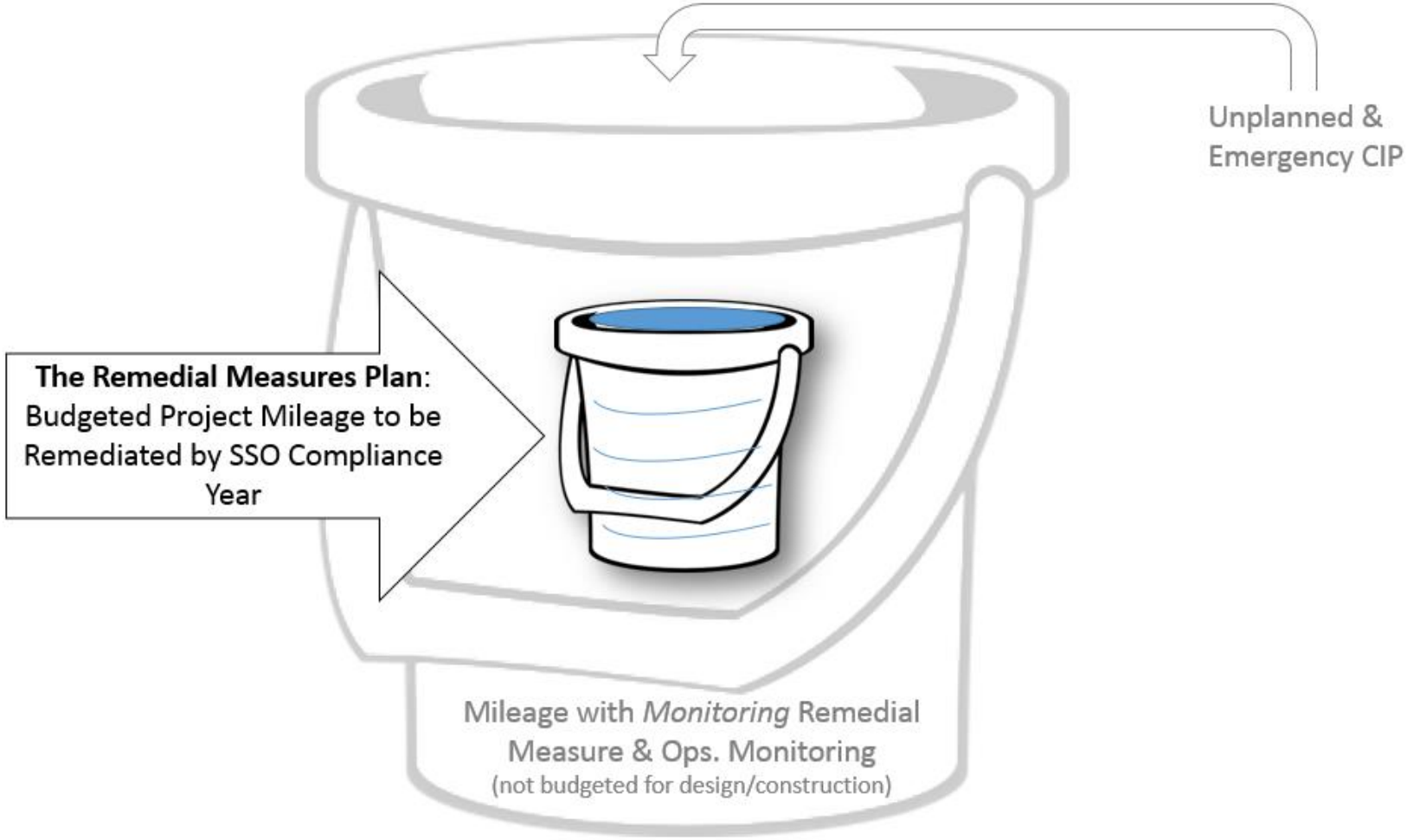
Project Cost Management

Controlling scope means controlling budget

Scope

Schedule

Budget

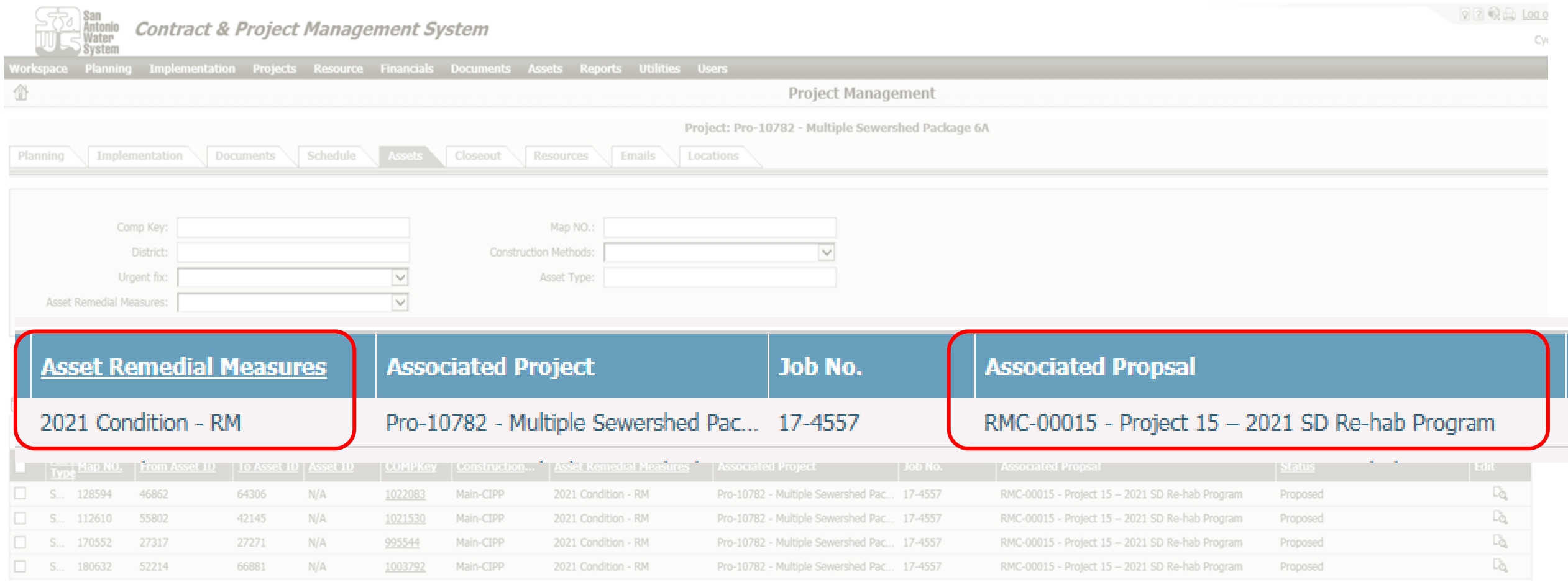


Leveraging Technology

- Contract & Project Management System (CPMS)
  - → Asset Information and Project Status/Contract
- Primavera P6
  - → Project Schedule
- Tableau
  - → Dashboarding

Asset Tracking

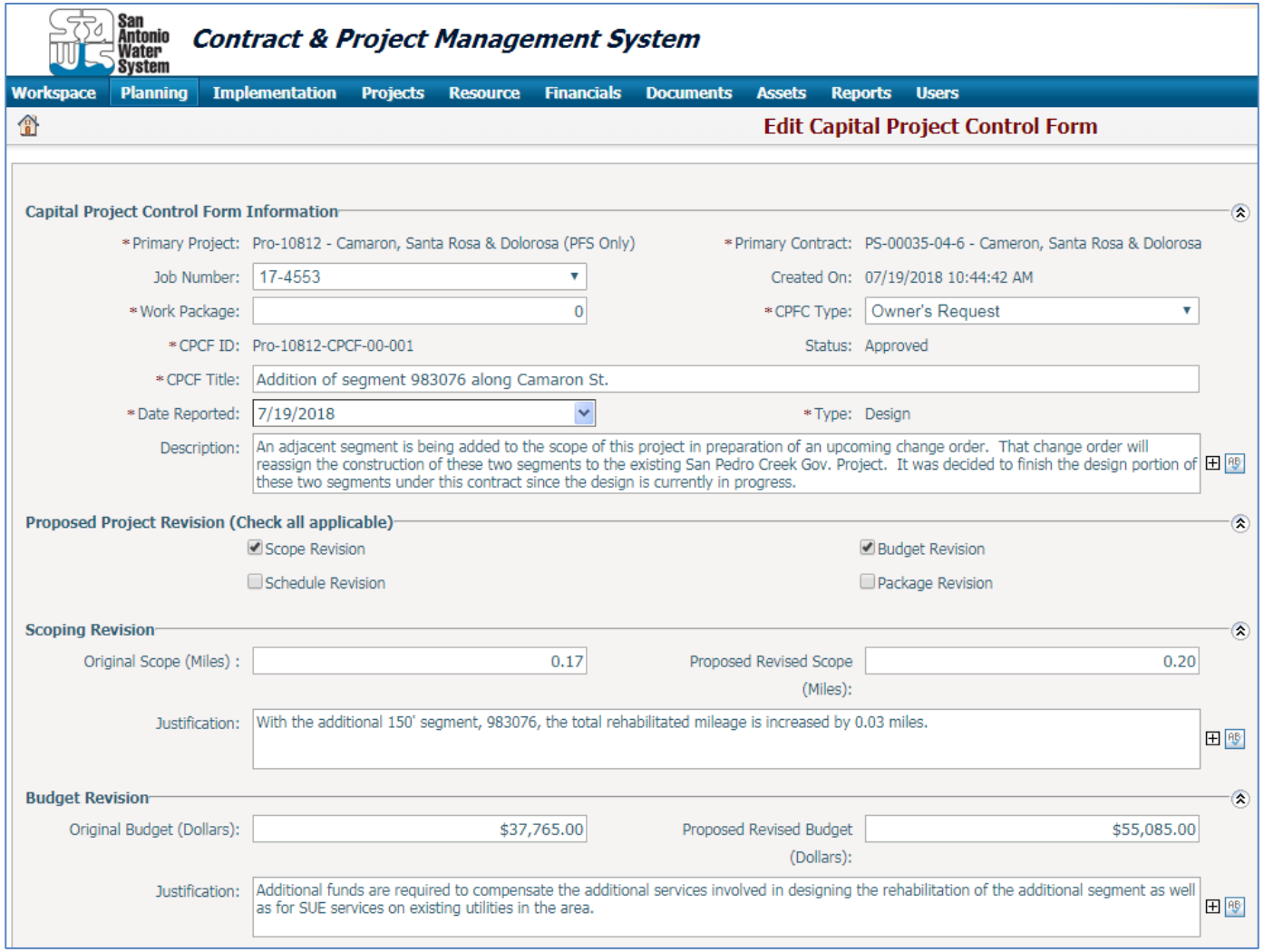
CPMS Asset Tab



Change Management

Capital Project Control Form (CPCF)

- Mechanism to capture
  - schedule delays
  - budget overruns
  - scope changes
- Workflow to enable approval by management



San Antonio Water System — Contract & Project Management System

Workspace | Planning | Implementation | Projects | Resource | Financials | Documents | Assets | Reports | Users

Edit Capital Project Control Form

Capital Project Control Form Information

*Primary Project:	Pro-10812 - Camaron, Santa Rosa & Dolorosa (PFS Only)	*Primary Contract:	PS-00035-04-6 - Cameron, Santa Rosa & Dolorosa
Job Number:	17-4553	Created On:	07/19/2018 10:44:42 AM
*Work Package:	0	*CPFC Type:	Owner's Request
*CPCF ID:	Pro-10812-CPCF-00-001	Status:	Approved
*CPCF Title:	Addition of segment 983076 along Camaron St.		
*Date Reported:	7/19/2018	*Type:	Design
Description:	An adjacent segment is being added to the scope of this project in preparation of an upcoming change order. That change order will reassign the construction of these two segments to the existing San Pedro Creek Gov. Project. It was decided to finish the design portion of these two segments under this contract since the design is currently in progress.		

Proposed Project Revision (Check all applicable)

- [x] Scope Revision
- [x] Budget Revision
- [ ] Schedule Revision
- [ ] Package Revision

Scoping Revision

Original Scope (Miles) :	0.17	Proposed Revised Scope (Miles):	0.20
Justification:	With the additional 150' segment, 983076, the total rehabilitated mileage is increased by 0.03 miles.		

Budget Revision

Original Budget (Dollars):	$37,765.00	Proposed Revised Budget (Dollars):	$55,085.00
Justification:	Additional funds are required to compensate the additional services involved in designing the rehabilitation of the additional segment as well as for SUE services on existing utilities in the area.		

Schedule Dashboard

Engineering Project Schedule Dashboard

Projects	Float
C-5 C-28 Phase 1B	
C-5 C-28 Phase 2	
C-5 C-28 Phase 3	
C-13 Broadway Corridor Pkg B.1 and B.2	
C-18 McCullough Avenue Sewer Rehab, Birch Leaf Drive to Oblate Drive	
C-22 Babcock Road Sewer Capacity Replacement, Crestview Drive to Concord Pl..	
C-30 San Joaquin to Gen McMullen	
C-36 Jackson Keller Rd Sewer Capacity Reroute, West Ave-Orland Park	
C-69 S Zarzamora St Sewer Upsize and Relief	
E-16 Wurzbach Pkwy Sewer Capacity Storage at Hwy 281	
E-19 Segment 1 - Seguin Road to Nacogdoches Road	
E-19 Segment 2 - Rittiman Road to Nacogdoches Road	
E-20 Seg 1 Wurzbach: Jones Malts to Naco	
E-74 Rosillo Creek Sewer Capacity Storage South of IH-10	
Helotes Creek Gravity Main and Lift Station #246 Elimination	
Install sewer main from LS 224 to SBSP	

"Getting It Done"

Remedial Measure Plan is Just the Beginning

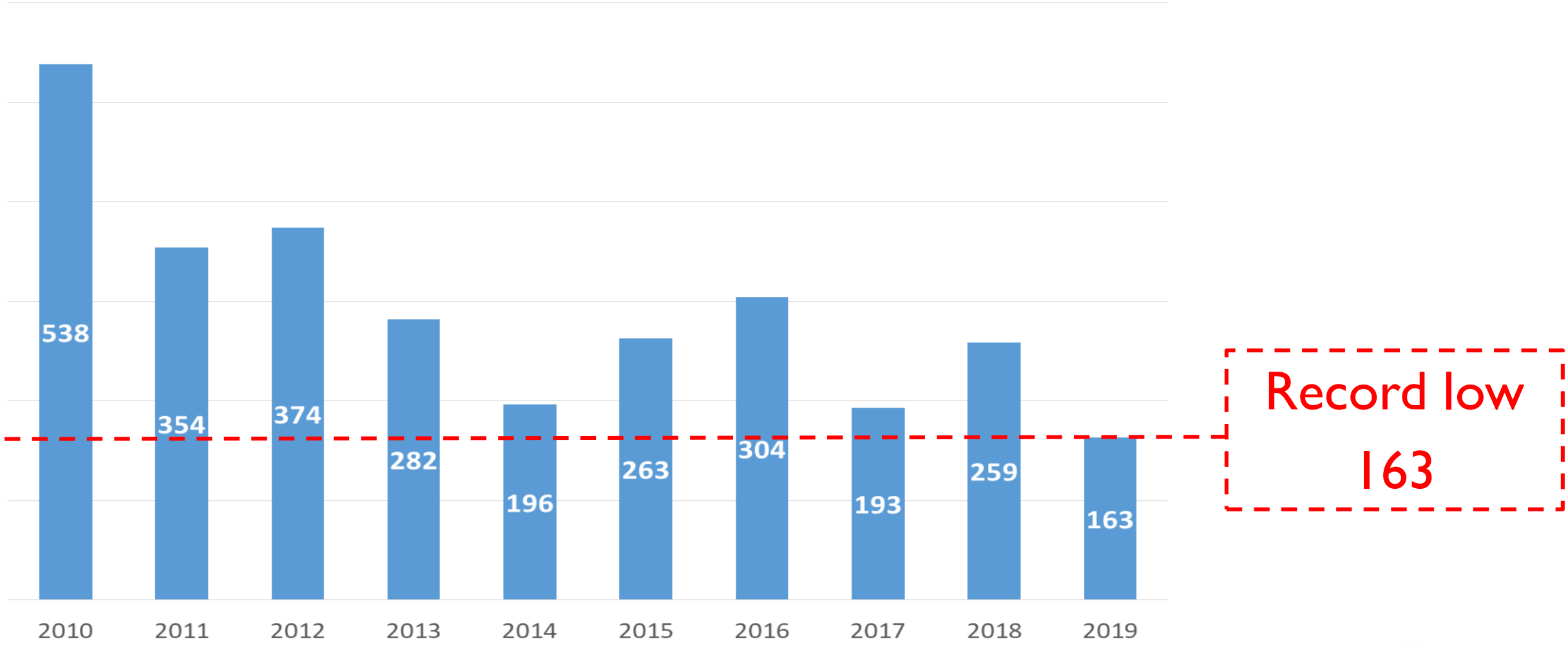
- Execute the Remedial Measures Plan
- Assets are not improving with age
- Continue to monitor mains during CD and beyond
- Expedite some mains through unplanned projects
- Planning packages requires fully leveraging our resources
  - Data, Software and Experience
- Renew the right main at the right time

Next Steps in the Program

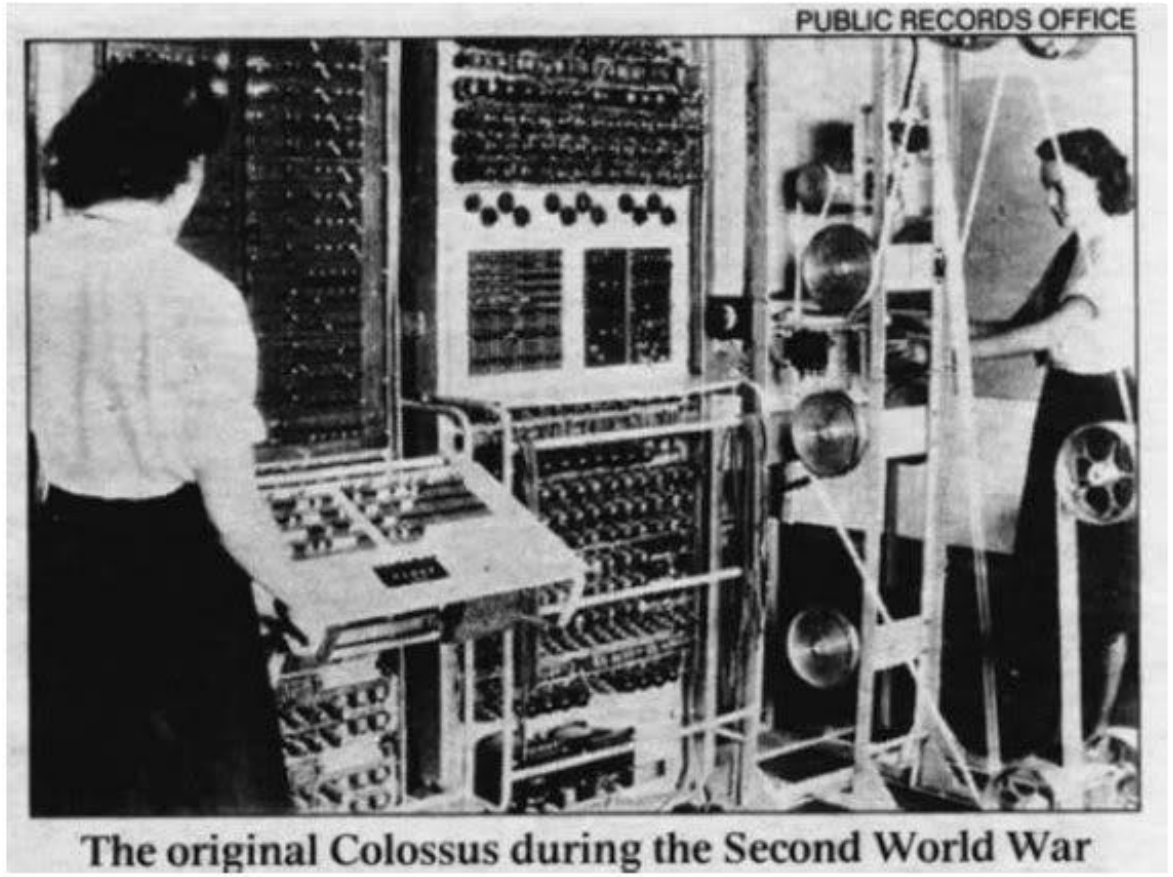
Manage Scope, Schedules and Costs

- Keys to our success
  - Project Controls Team is critical
  - Possibly create an Asset Management/Change Control Team
    - Always more that we want and need to do
  - Execute CMOM

SSORP Progress

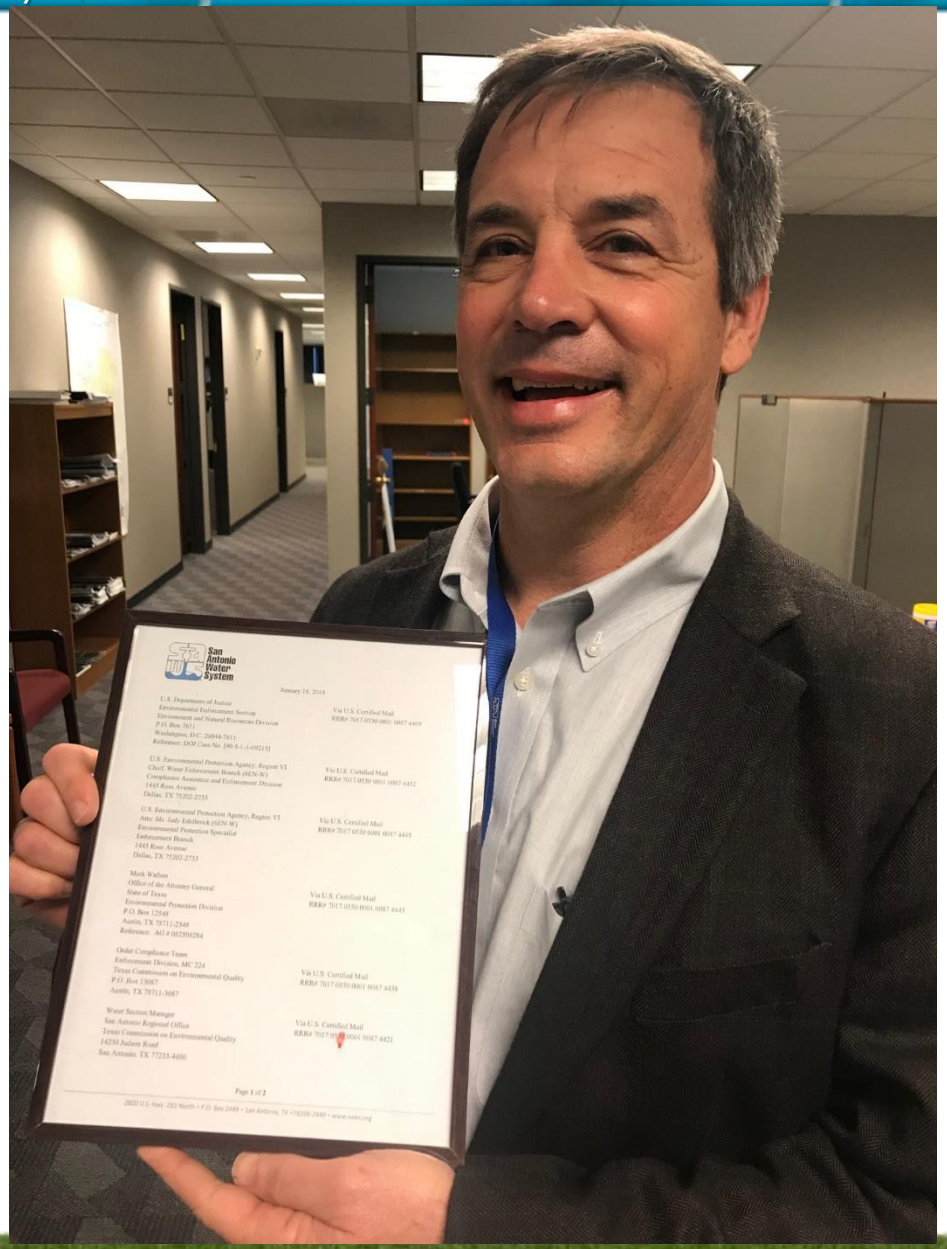


Lessons Learned:
Data Management & Document Control



The original Colossus during the Second World War

Colossus—the first electronic computer.



Final Thought:

- We take stuff serious around here
- We sign in blood

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

SAWS SSO Reduction Program Overview

Jeff Haby, P.E.
SAWS Vice President – Production and Treatment

Albert Rodriguez, P.E.
HDR Business Class Director – Pump Stations and Pipelines

San Antonio Water System

UCTA National Conference
January 28, 2020