

# **Integrate CCTV data to enterprise GIS work flows**

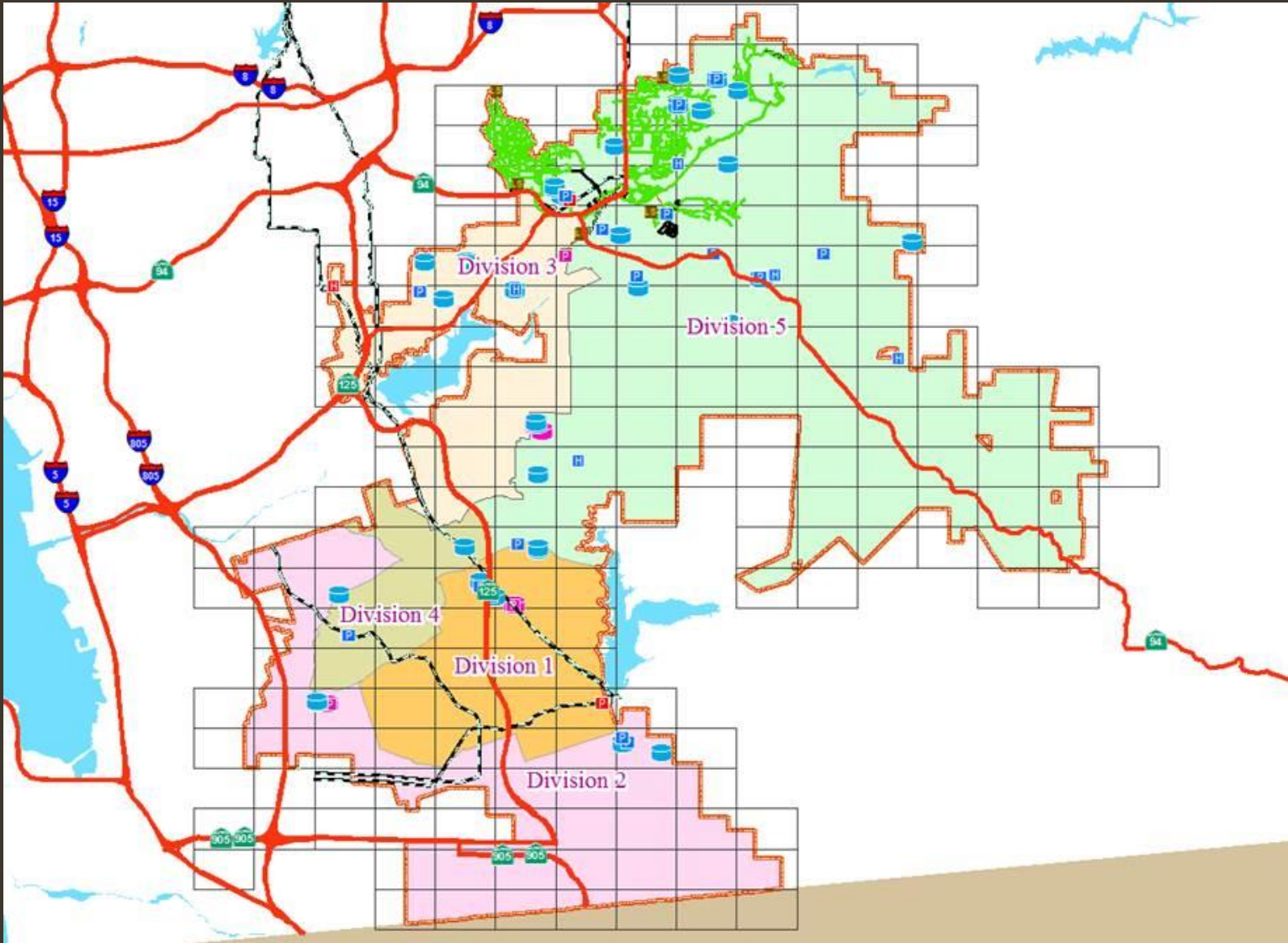
**Otay Water District**



# Introduction

- Background of Otay Water District
- GIS at Otay
- CCTV for Sewer Collection System
- Integrate CCTV and Inspection data with GIS
- NASSCO standard (PACP, MACP and LACP) rating in GIS and for Asset Management
- Inter-department workflows





## Otay Water District

South San Diego County, California

125.5 square miles,

52,000 customers

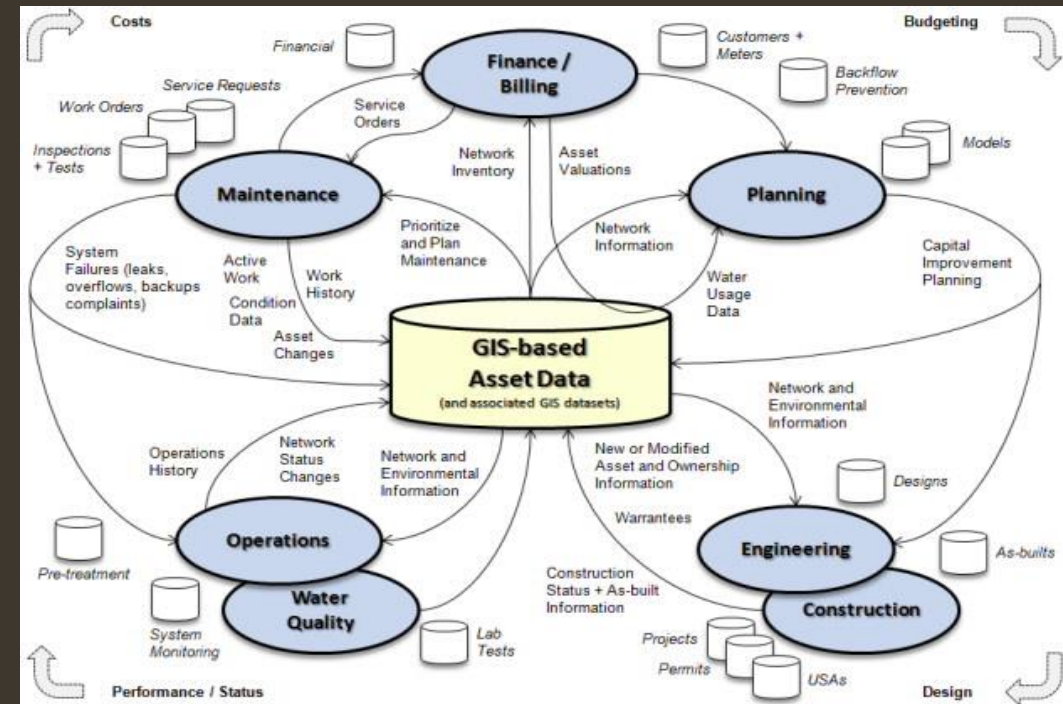
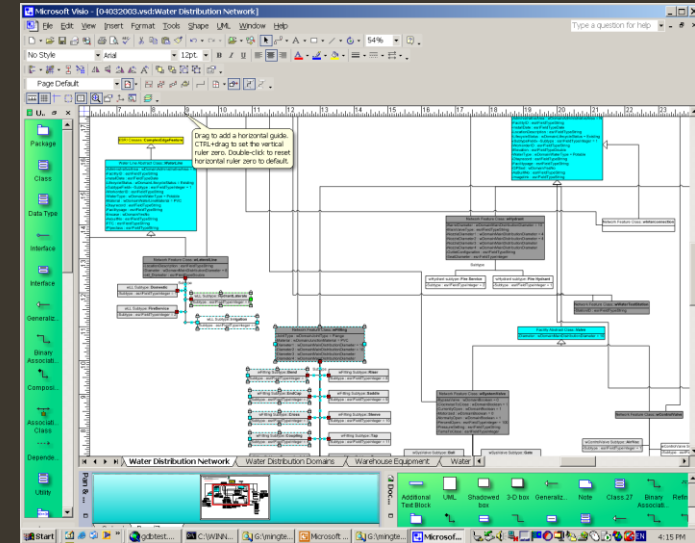
- Potable
- Recycle
- Sewer

Second largest in San Diego County.

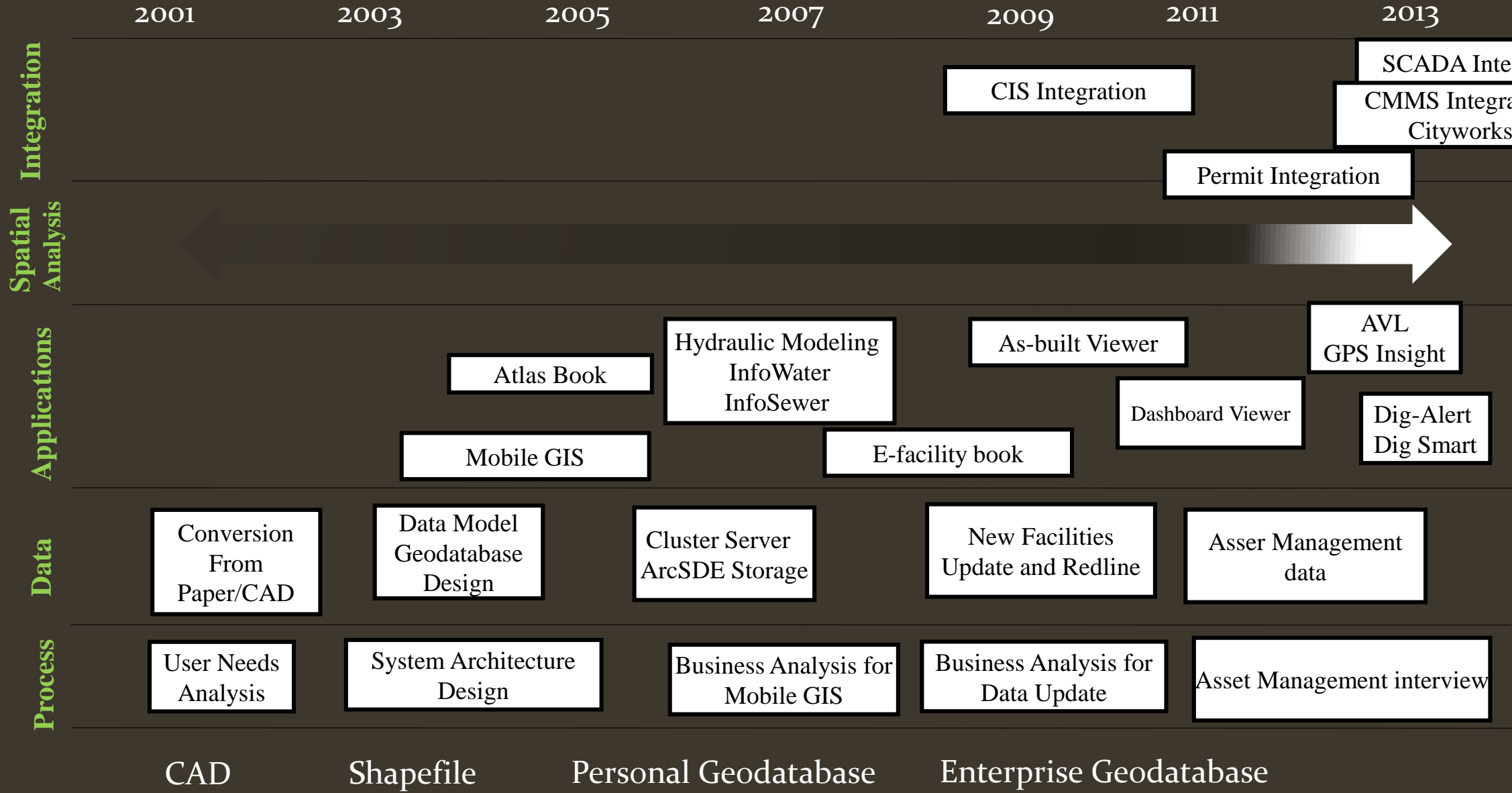
Only District with lands for future development

# GIS at Otay

- Data collection –Survey grade
- ArcGIS suite as the platform
- Enterprise GIS architecture design
- Data models
- Applications
- System integration
- Workflows



# GIS Development Timeline



CAD

Shapefile

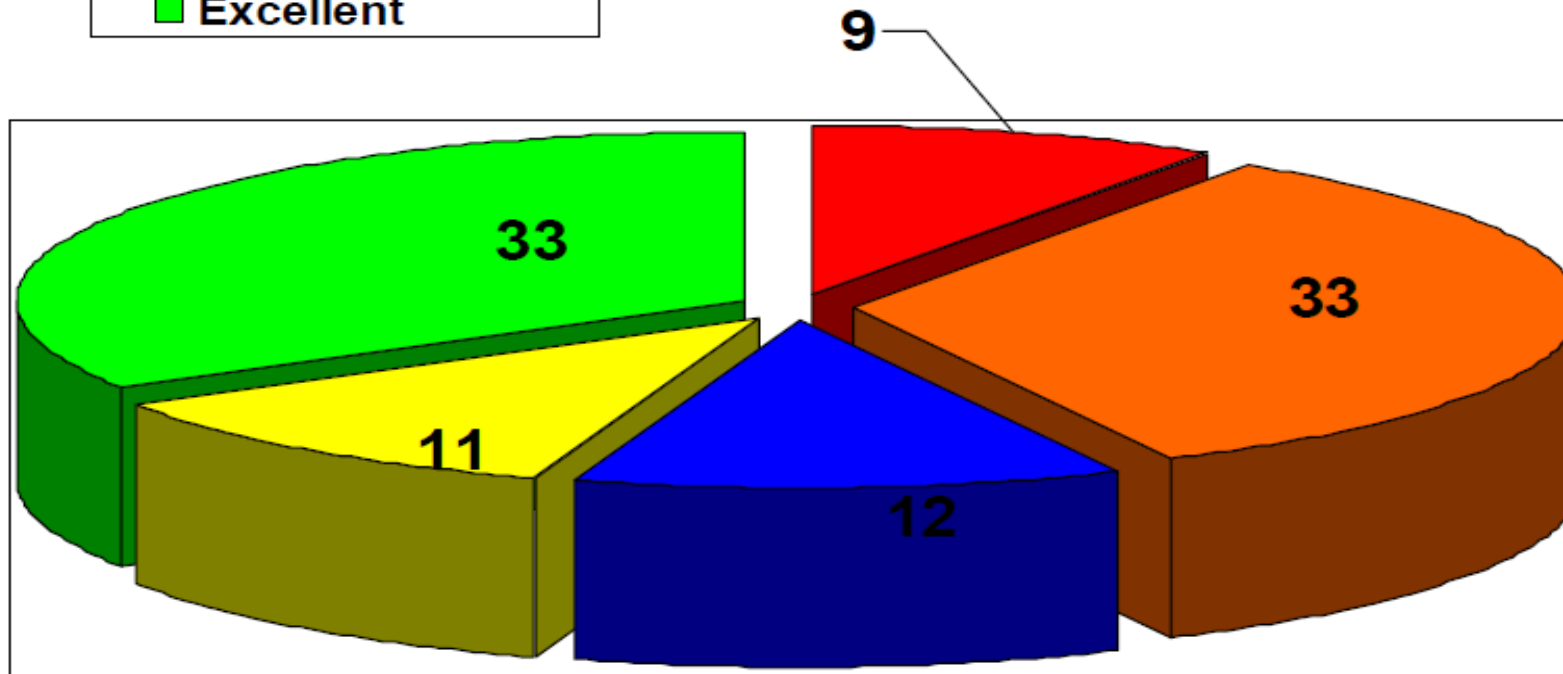
Personal Geodatabase

Enterprise Geodatabase

# Estimated Condition of Sewer Pipes In 2020



- Failure
- Poor/Very Poor
- Fair
- Good
- Excellent

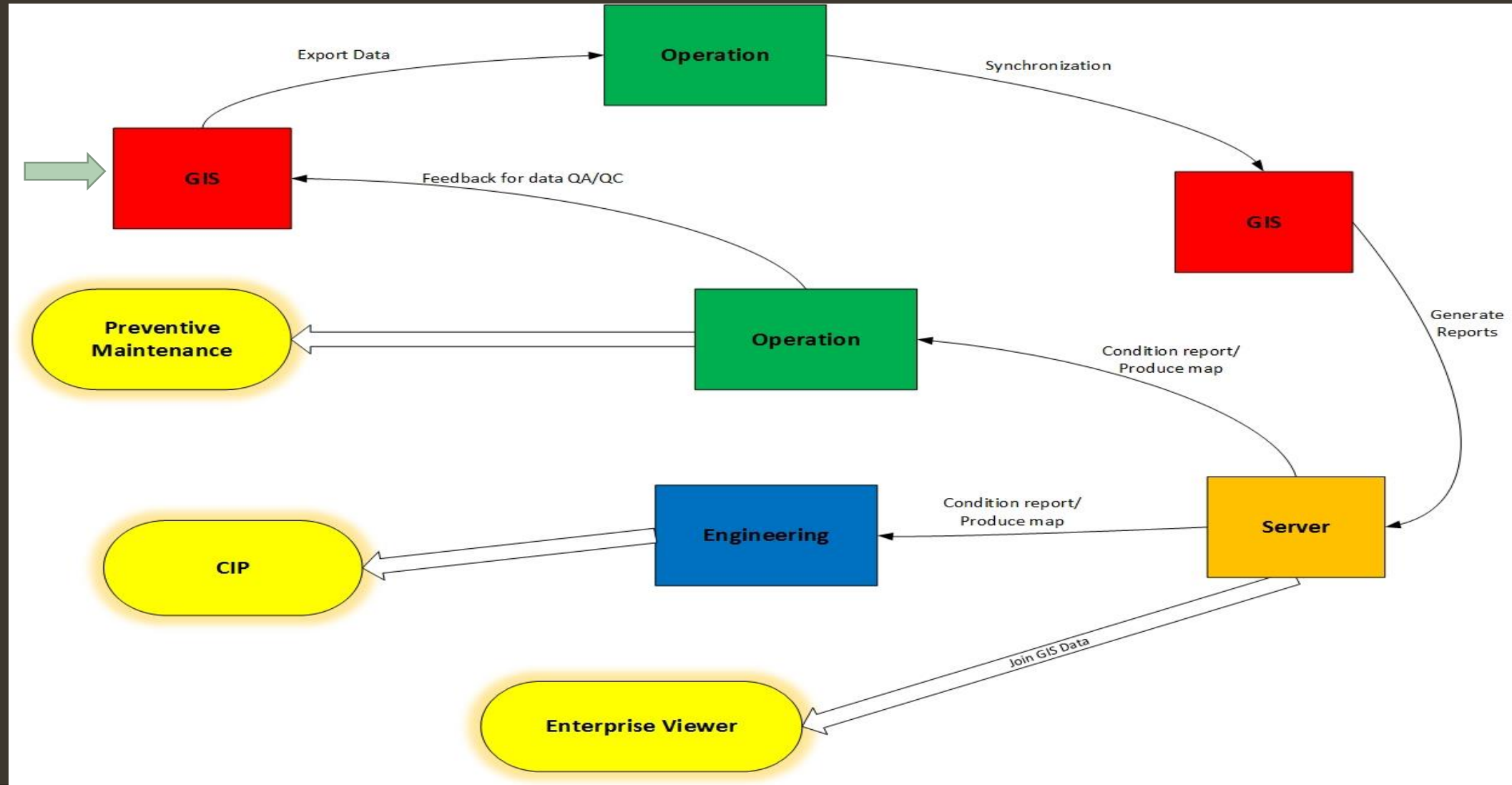


# CCTV (Closed-Circuit Television )

## Inspection and Condition Assessment - **Before**

- Multiple Contractors for different time periods.
  - Different rating systems
  - Different reporting systems
- Lack of access for District staff - video files were stored at district server
- Lack of QAQC

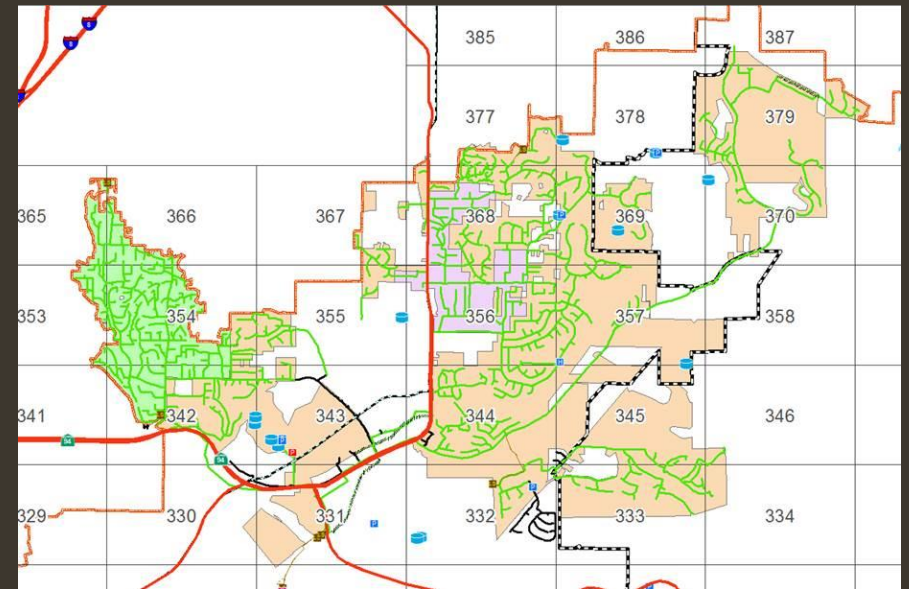
# CCTV Inspection and Condition Assessment - **Current**





# GIS data as the foundation

- District CCTV van with computer equipment and CCTV camera
- Unique ID was assigned to each pipe segment in GIS
- ArcReader application and CCTV interface /data management software (POSM) were installed in the van's computer
- GIS data was exported as the foundation to inspect the pipes



# Operation to collect the inspection data

- Locate the pipe through ArcReader
- Prepopulate pipe information from GIS automatically
- Enter the inspection info into POSM
- POSM controls the CCTV camera
- Observations are entered
- PACP and MACP codes are automatically populated



# PIPELINE OBSERVATION SYSTEM MANAGEMENT

- 376 - Completed - ANATOLIA 9A - m15 to m16 - 9/11/2006 2:3
- 375 - Completed - ANATOLIA 9A - m07 to m08 - 9/11/2006 2:3
- 374 - Completed - ANATOLIA 9A - m07 to m05 - 9/11/2006 2:3
- 373 - Completed - NORTH DOUGLAS VILLAGE 4 - 330227M2
- 372 - NORTH DOUGLAS VILLAGE 4 - 330227M23 to 330227M
- 371 - Completed - NORTH DOUGLAS VILLAGE 4 - 330227M2
- 370 - NORTH DOUGLAS VILLAGE 4 - 328227M05 to 330227M
- 369 - Completed - NORTH DOUGLAS VILLAGE 4 - 32822700
- 368 - Completed - NORTH DOUGLAS VILLAGE 2 - 33023000
- 367 - Completed - NORTH DOUGLAS VILLAGE 2 - 33023000
- 366 - Completed - NORTH DOUGLAS VILLAGE 2 - 33023000

### Posm - Custom

Project: NORTH DOUGLAS VILLAGE 4

Asset ID:

Manhole: 330227M23 to 330227M11

Direction: Forward

Location: THORNBERG

Time: 9/13/2006 12:54:00 PM

Resume Selected

Print Reports for Selected

Delete Selected Session

Modify Session Information

Database Connection Manager

Session Management

Start New Session

Database Template Editor

Import CSV GIS Data

Import POSM Data

ReSync Database

Exit Posm

Hansen / Neztex Manager

Observation and Code Editor

Export GIS and HTML Data

Import Nassco Pacp Data

Edit Preferences



START: 0033-2304

END: 0032-2304

Length: 343



Deposits Attached Grease	252.2
Fracture Multiple	250.6
Roots Fine Joint	230.1
Roots Fine Joint	216.4
Deposits Attached Grease	210.7
Roots Fine Joint	206.1
Deposits Ingressed Fine	173

AMH	MWL	TFA 9	TFA 3	CL
RBB	DAGS	B	TB	MSA

DAGS - Deposits Attached Grease  Observation

At/From  4  To

Joint  
 Continuous

5 Percent  Remark

2  Maint Weig

**Add Observation**

- Take Picture
- Take Clip
- Long Clip

sm Measurement  
 Pixel Length: 0

Darim Mpeg



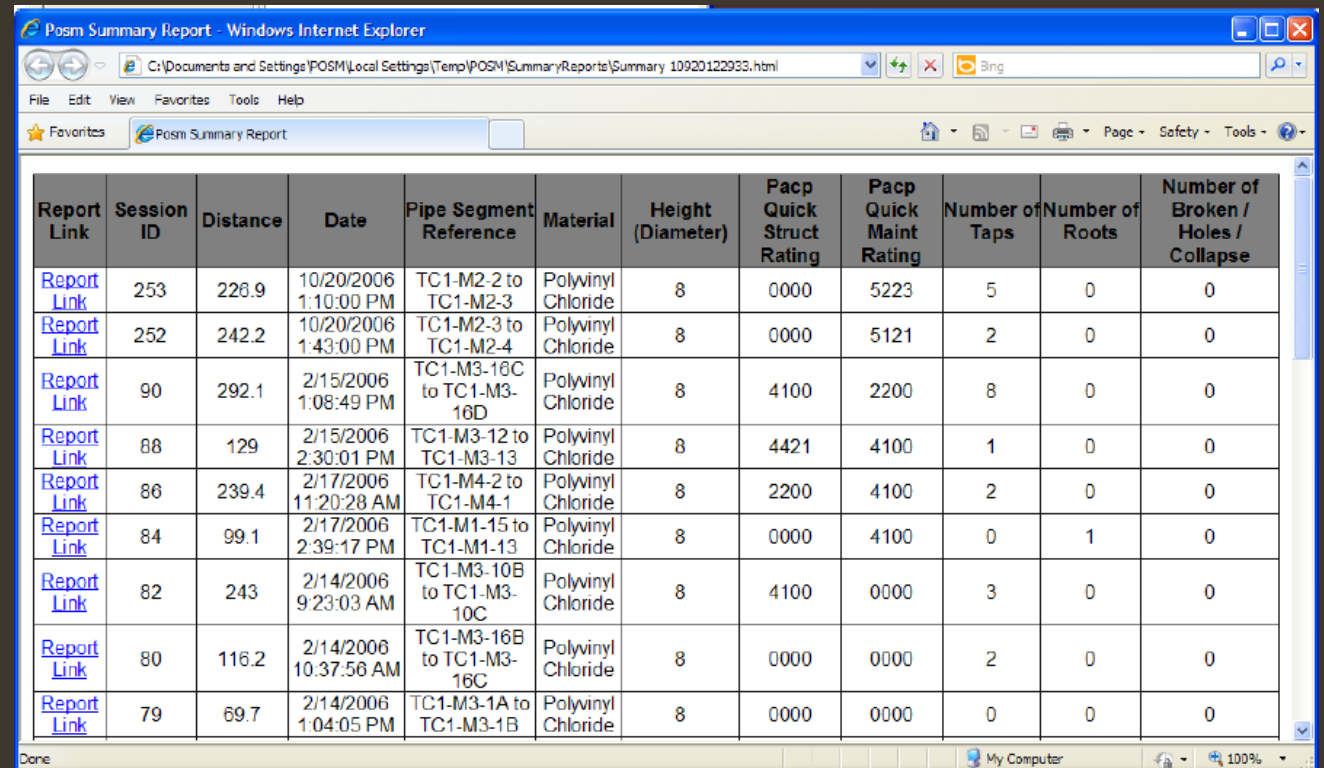
# Synch field data to GIS server

- Schedule the CCTV van to connect to network
- Synchronize the newly collected records into server database
- Maintain the database in the van periodically.



# POSM server based database

- SQL server based
- Use FacilityID as the unique key
- Create a unique URL for inspection report for each segment
- Adopt the NASSCO rating standard



The screenshot shows a web browser window titled "Posm Summary Report - Windows Internet Explorer". The address bar displays the URL: "C:\Documents and Settings\POSM\Local Settings\Temp\POSM\SummaryReports\Summary\_10920122933.html". The browser's menu bar includes "File", "Edit", "View", "Favorites", "Tools", and "Help". The main content area displays a table with the following data:

Report Link	Session ID	Distance	Date	Pipe Segment Reference	Material	Height (Diameter)	Pacp Quick Struct Rating	Pacp Quick Maint Rating	Number of Taps	Number of Roots	Number of Broken / Holes / Collapse
<a href="#">Report Link</a>	253	226.9	10/20/2006 1:10:00 PM	TC1-M2-2 to TC1-M2-3	Polyvinyl Chloride	8	0000	5223	5	0	0
<a href="#">Report Link</a>	252	242.2	10/20/2006 1:43:00 PM	TC1-M2-3 to TC1-M2-4	Polyvinyl Chloride	8	0000	5121	2	0	0
<a href="#">Report Link</a>	90	292.1	2/15/2006 1:08:49 PM	TC1-M3-16C to TC1-M3-16D	Polyvinyl Chloride	8	4100	2200	8	0	0
<a href="#">Report Link</a>	88	129	2/15/2006 2:30:01 PM	TC1-M3-12 to TC1-M3-13	Polyvinyl Chloride	8	4421	4100	1	0	0
<a href="#">Report Link</a>	86	239.4	2/17/2006 11:20:28 AM	TC1-M4-2 to TC1-M4-1	Polyvinyl Chloride	8	2200	4100	2	0	0
<a href="#">Report Link</a>	84	99.1	2/17/2006 2:39:17 PM	TC1-M1-15 to TC1-M1-13	Polyvinyl Chloride	8	0000	4100	0	1	0
<a href="#">Report Link</a>	82	243	2/14/2006 9:23:03 AM	TC1-M3-10B to TC1-M3-10C	Polyvinyl Chloride	8	4100	0000	3	0	0
<a href="#">Report Link</a>	80	116.2	2/14/2006 10:37:56 AM	TC1-M3-16B to TC1-M3-16C	Polyvinyl Chloride	8	0000	0000	2	0	0
<a href="#">Report Link</a>	79	69.7	2/14/2006 1:04:05 PM	TC1-M3-1A to TC1-M3-1B	Polyvinyl Chloride	8	0000	0000	0	0	0

# NASSCO standard for sewer system

- **NASSCO** - National Association of Sewer Service Companies
- Adopt the NASSCO Standard across the board
  - Operation
  - Engineering
  - Asset Management program
- Promote Training and Certification Program in the District
  - Pipeline Assessment and Certification Program (PACP)
  - Manhole Assessment and Certification Program (MACP)
  - Lateral Assessment and Certification Program (LACP)

# NASSCO'S PIPELINE ASSESSMENT & CERTIFICATION PROGRAM (PACP)©

## Section 4—Continuous Defect Coding

**“TRULY” 4-1**

“Truly” continuous defects run along the sewer without any interruption for more than three feet (1 meter).  
 Examples:  
 - Longitudinal Fractures  
 - Longitudinal Cracks

**“REPEATED” 4-1**

“Repeated” continuous defects occur at regular intervals along the sewer. These occur at pipe joints and include:  
 -Encrustation  
 -Open Joints  
 -Circumferential Fractures

**Code Changes in Version 6.0.1**

*Added:*  
 Buckling Wall (KW), Buckling Dimpling (KD), and Buckling Inverse Curvature (KI)

## Section 5—Structural Defect Coding (Module 6A)

<b>C CRACK 5-1</b> CL Longitudinal 5-2 CC Circumferential 5-2 CM Multiple 5-2 CS Spiral 5-2 CH Hinge 5-2	<b>F FRACTURE 5-7</b> FL Longitudinal 5-7 FC Circumferential 5-7 FM Multiple 5-7 FS Spiral 5-7 FH Hinge 5-7	<b>B BROKEN 5-15</b> BSV -Soil Visible 5-15 Beyond Defect BV V -Void Visible 5-15 Beyond Defect	<b>H HOLE 5-17</b> HSV -Soil Visible 5-17 Beyond Defect HV V -Void Visible 5-17 Beyond Defect	<b>D DEFORMED 5-19</b> DV Deformed 5-19 Vertically (brick) DH Deformed 5-19 Horizontally (brick)	<b>X COLLAPSE 5-23</b> XP Pipe Collapse 5-23 XB Brick Collapse 5-23	<b>J JOINT 5-26</b> JO Joint Offset 5-26 (Displaced) JS Joint Separated 5-26 (Open) JA Joint Angular 5-26
<b>S SURFACE DAMAGE 5-31</b> SRI Roughness Increased 5-31 SRI - M - Mechanical SRI - C - Chemical SRI - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SAV Aggregate Visible 5-31 SAV - M - Mechanical SAV - C - Chemical SAV - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SAP Aggregate Projecting 5-31 SAP - M - Mechanical SAP - C - Chemical SAP - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SAM Aggregate Missing 5-31 SAM - M - Mechanical SAM - C - Chemical Attack SAM - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SRV Reinforcement Visible 5-31 SRV - M - Mechanical SRV - C - Chemical Attack SRV - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SRP Reinforcement Projecting 5-31 SRP - M - Mechanical SRP - C - Chemical Attack SRP - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SRC Reinforcement Corroded 5-31 SRC - M - Mechanical SRC - C - Chemical Attack SRC - Z - Not Evident
<b>S SURFACE DAMAGE 5-31</b> SMW Missing Wall 5-32 SMW - M - Mechanical SMW - C - Chemical Attack SMW - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SSS Surface Spalling 5-32 SSS - M - Mechanical SSS - C - Chemical Attack SSS - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SZ Other 5-32 SZ - M - Mechanical SZ - C - Chemical Attack SZ - Z - Not Evident	<b>S SURFACE DAMAGE 5-31</b> SCP Corrosion (metal pipe) *no modifiers used	<b>K BUCKLING 5-45</b> KW Wall 5-45 KD Dimpling 5-45 KI Inverse Curvature 5-45	<b>LF LINING FAILURE 5-49</b> LFD Detached Lining 5-49 LFDE Defective End 5-49 LFB Blistered Lining 5-49 LFCS Service Cut Shifted 5-49 LFAC Abandoned Connection 5-49	<b>LF LINING FAILURE 5-49</b> (continued) LFOC Overcut Service 5-49 LFUC Undercut Service 5-49 LFBK Buckled Lining 5-49 LFW Wrinkled Lining 5-49 LFAS Annular Space 5-49
<b>LF LINING FAILURE 5-50</b> LFBU Bulges 5-50 LFDC Discoloration 5-50 LFDL Delamination 5-50 LFRS Resin Slug 5-50 LFPH Pinholes 5-50 LFZ Other 5-50	<b>WF WELD FAILURE 5-67</b> WFL Longitudinal 5-67 WFC Circumferential 5-67 WFM Multiple 5-67 WFS Spiral 5-67 WFZ Unidentified 5-67	<b>RP POINT REPAIR 5-71</b> RPR Pipe Replaced 5-69 RPR - D -Defective 5-69 RPP Patch Repair 5-69 RPP - D -Defective 5-69	<b>RP POINT REPAIR 5-71</b> RPL Localized Pipeliner 5-69 RPL - D -Defective 5-69 RPZ Other 5-69 RPZ - D -Defective 5-69	<b>BRICKWORK 5-77</b> DB Displaced 5-75 MB Missing 5-75 DI Dropped Invert 5-75	<b>BRICKWORK 5-77</b> MM Missing Mortar 5-75 S -Small 5-75 M -Medium 5-75 L -Large 5-75	Updated November 2010



# NASSCO Rating / Scoring System

- Structural Scoring
- Operational and Maintenance Scoring
- Number of Defects
- Pipe Rating
- Ratings Index

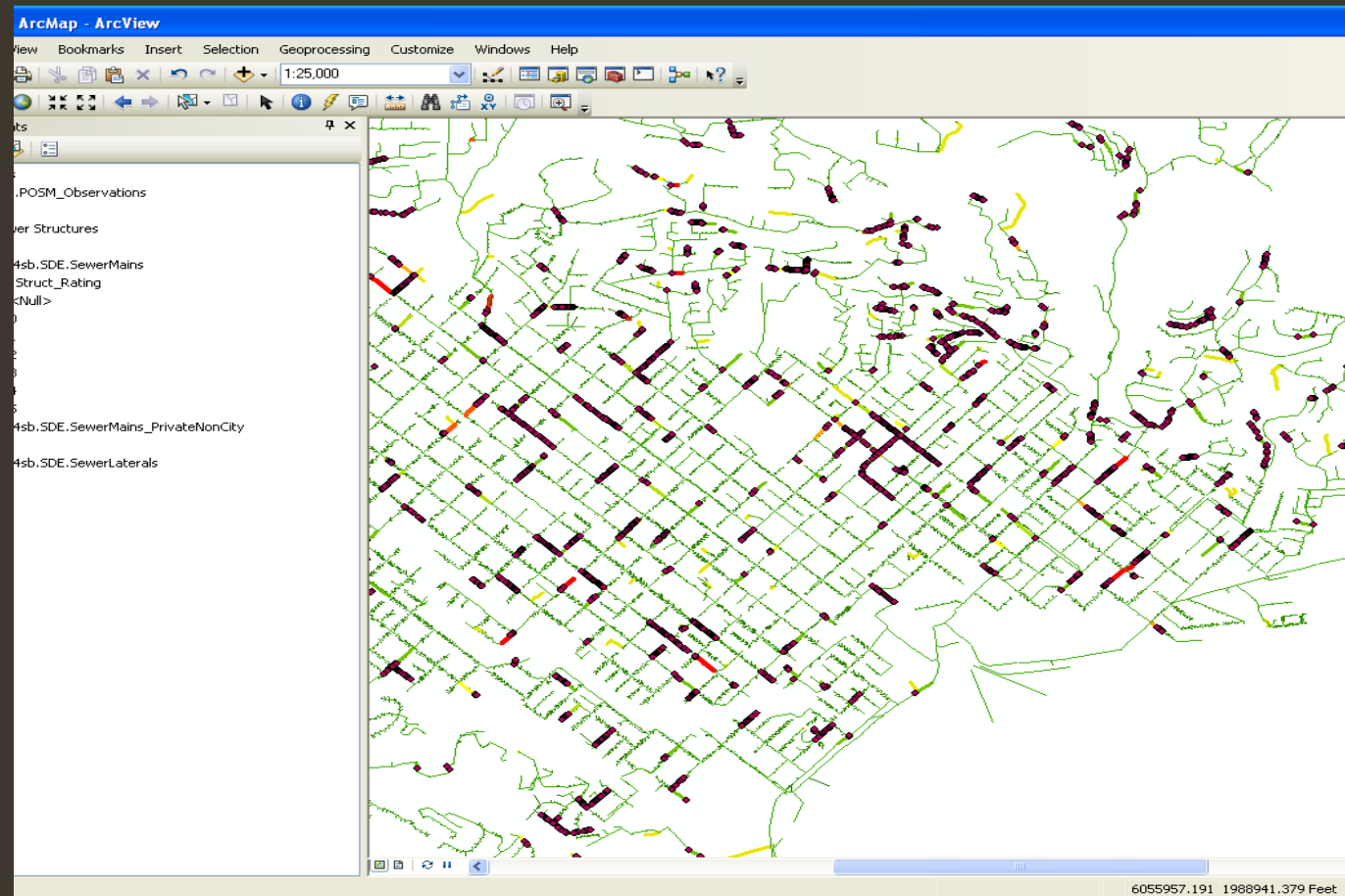
Grade	Structural	O&M	Overall
5	0	0	0
4	0	12	12
3	6	0	6
2	418	58	476
1	1	0	1
<b>Overall</b>	425	70	495
<b>Number of Defects</b>	212	32	244
<b>Pipe Rating</b>	<b>322Z</b>	<b>432E</b>	<b>4332</b>
<b>Pipe Ratings Index</b>	2	2	2

# Operation preventive maintenance

- Schedule the cleanup using the condition score
- Target more on the known area for high frequent maintenance
- Notify the property owner for lateral cleanup
- Develop a rehabilitation and replacement plan based on the inspection data
- Budget the replacement based on the condition score

# Engineering Capital Improvement Plan

- Access the CCTV data through GIS viewers
- Access the observation report through GIS viewers
- Produce critical pipe segment report
- Asset Management Program



Distance	Fault Observation	Time	Picture
87.1	Water Mark Severity: None Percent: 20	4:10	
134.4	Alignment Left Severity: None Percent: 10 Remarks: Slight bend to left Maint Weight: 1	06:12	
143.4	Camera Underwater Severity: None Cont Defect: S02 Maint Weight: 4	06:52	

Distance	Fault Observation	Time	Picture
160.9	Camera Underwater Severity: None Cont Defect: F02 Maint Weight: 4	08:03	



# Project Name:

Date: 5/23/2013 1:34:00 PM  
Street: 1112 Cadoglenn dr.  
Length Surveyed: 212.1  
Pacp Quick Overall Rating: 4C11  
Height (Diameter): 8  
Street: 1112 Cadoglenn dr.

Facility ID: MH-377-001\_MH-377-003  
Upstream MH: MH-377-001  
Downstream MH: MH-377-003  
Direction of Survey: Downstream  
Material: Polyvinyl Chloride

Severity
Light
Moderate
Average
Heavy
Severe

ID Number: MH-377-001

(0.0) AMH - Manhole Remark: CCTV Downstream

(0.0) MWL - Water Level

(87.1) MWLS - Water Level Sag - Cont Def: S01 Remark: Start of sag

(87.1) MWM - Water Mark

(134.4) LL - Alignment Left Remark: Slight bend to left

(143.4) MCU - Camera Underwater - Cont Def: S02

(160.9) MCU - Camera Underwater - Cont Def: F02

(163.8) MWLS - Water Level Sag - Cont Def: F01 Remark: Start of sag

(210.3) MGO - General Observation Remark: Connection to manhole looks good

(212.1) MGO - General Observation Remark: Base of Manhole looks good

(212.1) MGO - General Observation Remark: Looking up to Manhole cover looks good

(212.1) AMH - Manhole Remark: End of inspection

Total Distance: 212.1



ID Number: MH-377-003



More... Basemap

**POSM Link**

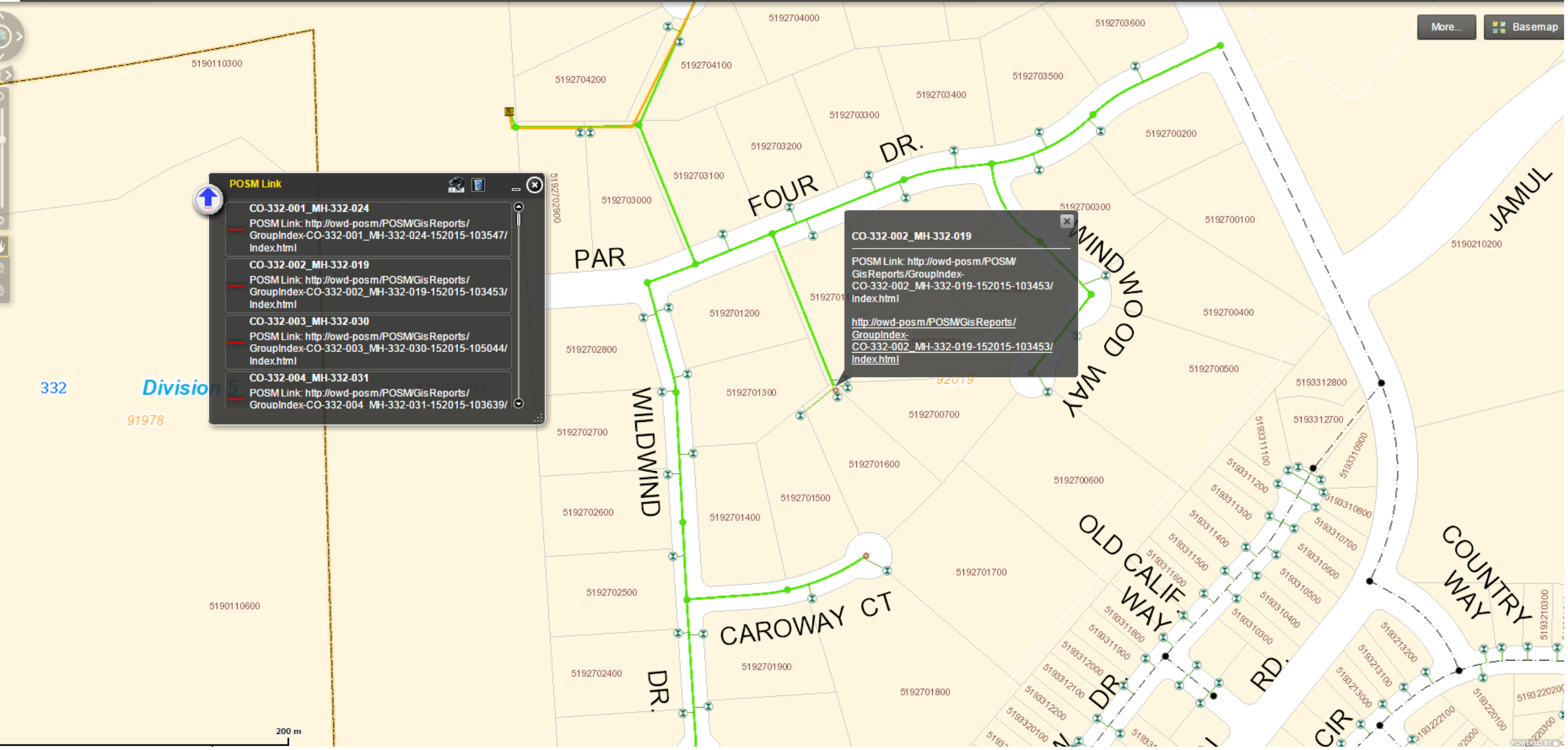
- CO-332-001\_MH-332-024  
POSM Link: [http://owd-posm/POSMGisReports/GroupIndex-CO-332-001\\_MH-332-024-152015-103547/Index.html](http://owd-posm/POSMGisReports/GroupIndex-CO-332-001_MH-332-024-152015-103547/Index.html)
- CO-332-002\_MH-332-019  
POSM Link: [http://owd-posm/POSMGisReports/GroupIndex-CO-332-002\\_MH-332-019-152015-103453/Index.html](http://owd-posm/POSMGisReports/GroupIndex-CO-332-002_MH-332-019-152015-103453/Index.html)
- CO-332-003\_MH-332-030  
POSM Link: [http://owd-posm/POSMGisReports/GroupIndex-CO-332-003\\_MH-332-030-152015-105044/Index.html](http://owd-posm/POSMGisReports/GroupIndex-CO-332-003_MH-332-030-152015-105044/Index.html)
- CO-332-004\_MH-332-031  
POSM Link: [http://owd-posm/POSMGisReports/GroupIndex-CO-332-004\\_MH-332-031-152015-103639/](http://owd-posm/POSMGisReports/GroupIndex-CO-332-004_MH-332-031-152015-103639/)

**CO-332-002\_MH-332-019**

POSM Link: [http://owd-posm/POSMGisReports/GroupIndex-CO-332-002\\_MH-332-019-152015-103453/Index.html](http://owd-posm/POSMGisReports/GroupIndex-CO-332-002_MH-332-019-152015-103453/Index.html)

332 Division 91978

200 m





PIPELINE OBSERVATION SYSTEM MANAGEMENT

### **Saved Reports for the Current Session**

[Title Page](#)

[Observation \(Fault\) Page](#)

[Plot of the Pipe](#)

[List of the Captured Video](#)

[Defect Header and Codes](#)

[Additional Reports](#)



# POS

PIPELINE OBSERVATION SYSTEM MANAGEMENT

Folder	Date	Direction	ID
<a href="#">AHT-TC1-M1-15-To-TC1-M1-13--07-10-2007-- 234551-6216</a>	3/10/2006 1:32:40 PM	Downstream	SMH_1350_SMH_1
<a href="#">AID-TC1-M1-15-To-TC1-M1-13--07-10-2007-- 234707-7792</a>	2/17/2006 2:39:17 PM	Upstream	SMH_1350_SMH_1



# Conclusion and Future plan

- Leverage GIS and other new technology to manage the traditional utility maintenance program
- Integrate with Field Mobile GIS application (InfraMap)
- Integrate with Sewer Master Plan
- Integrate with CMMS
- Asset Management

# Thank You !

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