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October 6, 2016

I Have A GIS and Asset Data, Now What?

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The Choice for Collection System Solutions

Tristan Nickel, PE

Core Questions

1. What is the current state of my assets?
2. What is my required level of service?
3. Which assets are critical to sustained performance?
4. What are my best O&M and CIP investment strategies?
5. What is my best long-term funding strategy?

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Ten Steps

1. Develop asset registry
2. Assess condition, failure modes
3. Determine residual life
4. Determine life cycle & replacement costs
5. Set target levels of service
6. Determine business risk "criticality"
7. Optimize O&M investment
8. Optimize capital investment
9. Determine funding strategy
10. Build asset management plan

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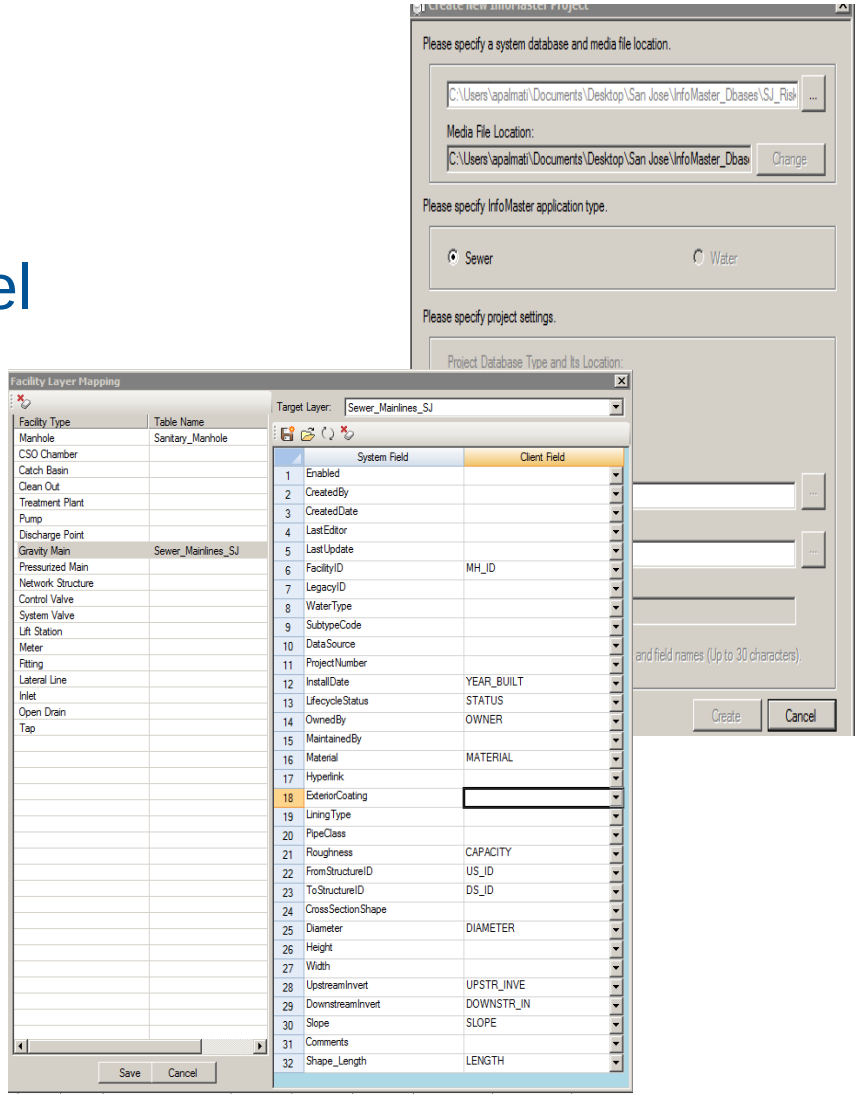
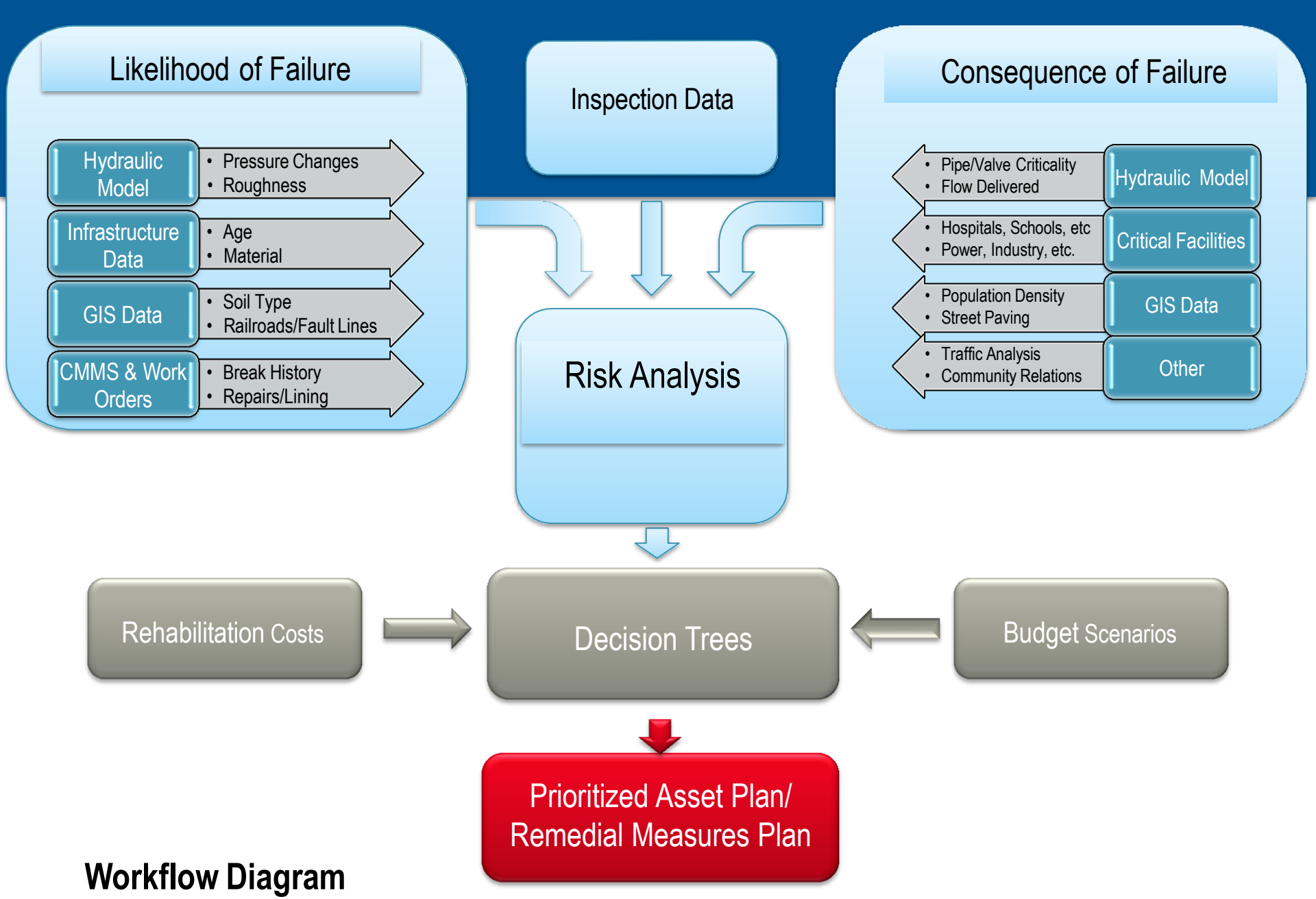
InfoMaster Decision Process

Data Wizard	Data Wizard does a quality check of the data, scores defects, and develops a draft rehabilitation plan
Consequence of Failure (COF)	Consequence of Failure of an asset based on parameters set by user
Likelihood of Failure (LOF)	Likelihood of Failure of an asset based on parameters set by user
Risk	Customizable Matrix of the Consequence of Failure to the Likelihood of Failure
Rehabilitation Plan	Rehabilitation Plan for the Asset

InfoMaster – Getting Started

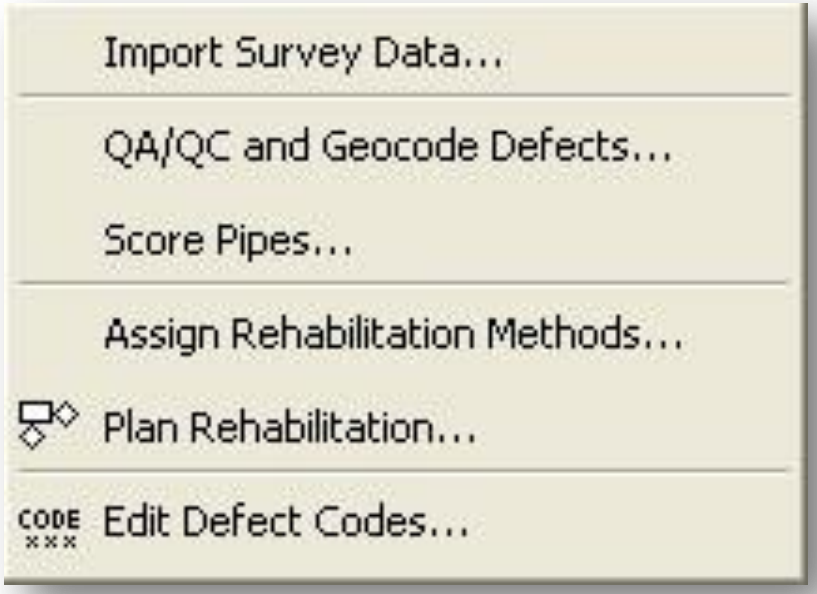
- InfoMaster Setup
  - Databases
- Mapping Asset Attribute
  - Based on ESRI Data Model
  - Connects to SDE or GDB
- Inspection Defect Coding
  - PACP
  - MACP
  - Other (MSI?, ElectroScan)





Workflow Diagram

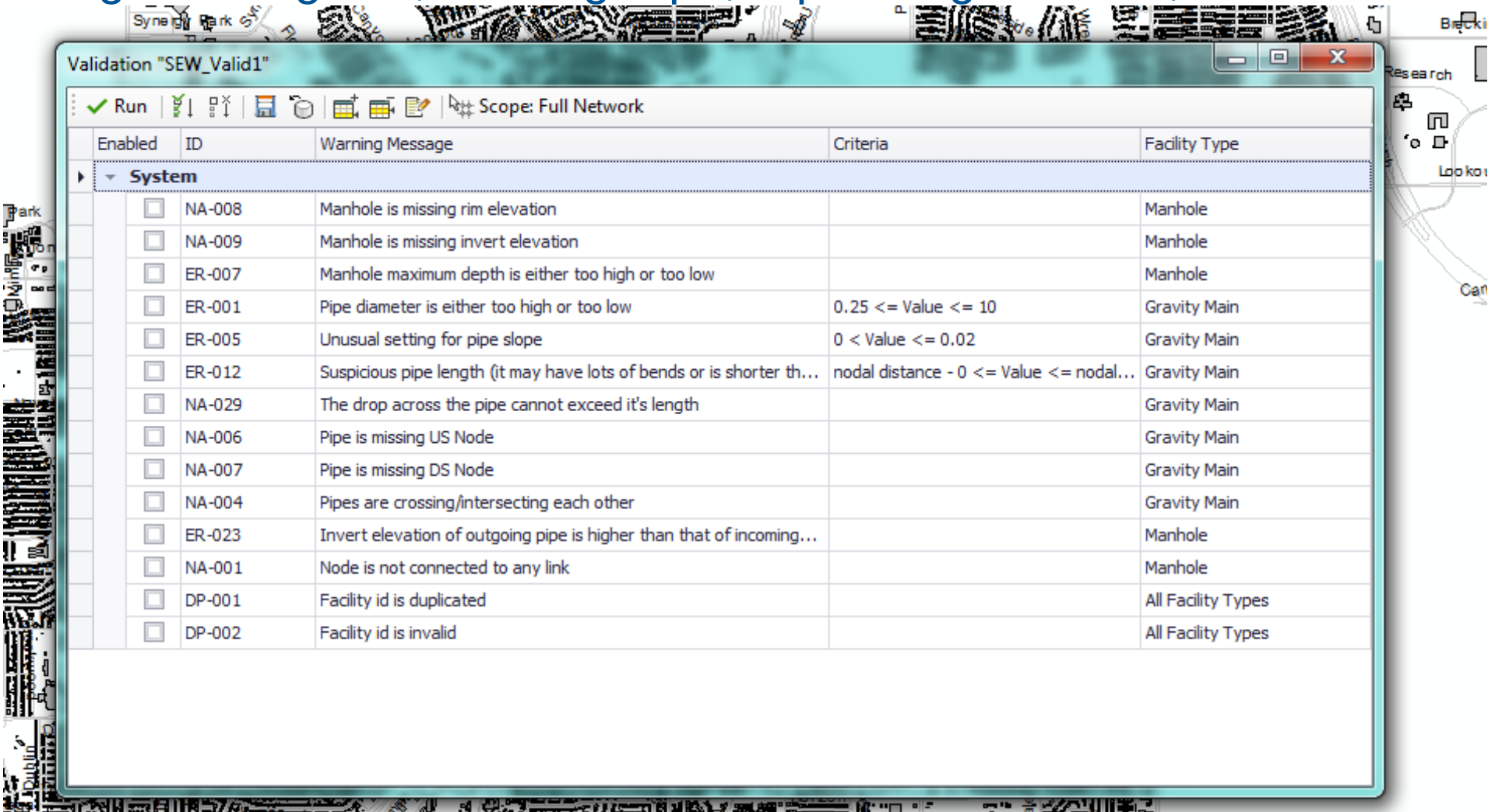
CCTV QA/QC and Geocode Defects



- Simplified CCTV import
- Streamlined CCTV QA/QC and geocode
  - Performed in one step
  - Checks for continuous defects that are not closed
- Enhanced QA/QC
- Pre-loaded with all the PACP defect codes

Validation Errors

- E.g. Missing MH, Missing Pipe, Pipe Length Errors, etc.



Enabled	ID	Warning Message	Criteria	Facility Type
System				
☐	NA-008	Manhole is missing rim elevation		Manhole
☐	NA-009	Manhole is missing invert elevation		Manhole
☐	ER-007	Manhole maximum depth is either too high or too low		Manhole
☐	ER-001	Pipe diameter is either too high or too low	0.25 <= Value <= 10	Gravity Main
☐	ER-005	Unusual setting for pipe slope	0 < Value <= 0.02	Gravity Main
☐	ER-012	Suspicious pipe length (it may have lots of bends or is shorter th...	nodal distance - 0 <= Value <= nodal...	Gravity Main
☐	NA-029	The drop across the pipe cannot exceed it's length		Gravity Main
☐	NA-006	Pipe is missing US Node		Gravity Main
☐	NA-007	Pipe is missing DS Node		Gravity Main
☐	NA-004	Pipes are crossing/intersecting each other		Gravity Main
☐	ER-023	Invert elevation of outgoing pipe is higher than that of incoming...		Manhole
☐	NA-001	Node is not connected to any link		Manhole
☐	DP-001	Facility id is duplicated		All Facility Types
☐	DP-002	Facility id is invalid		All Facility Types

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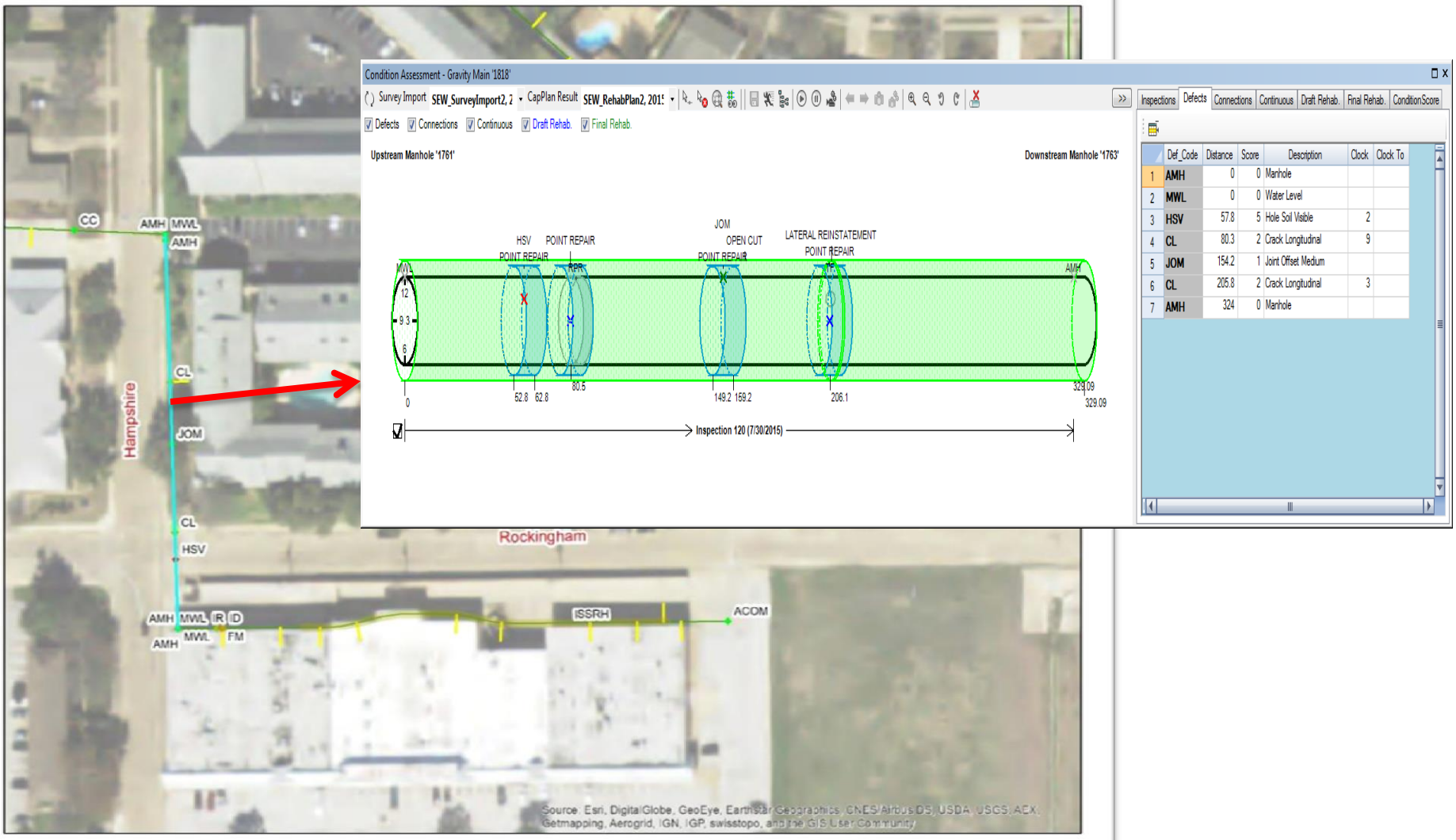
Generates CCTV / MSI Defect Layers in GIS



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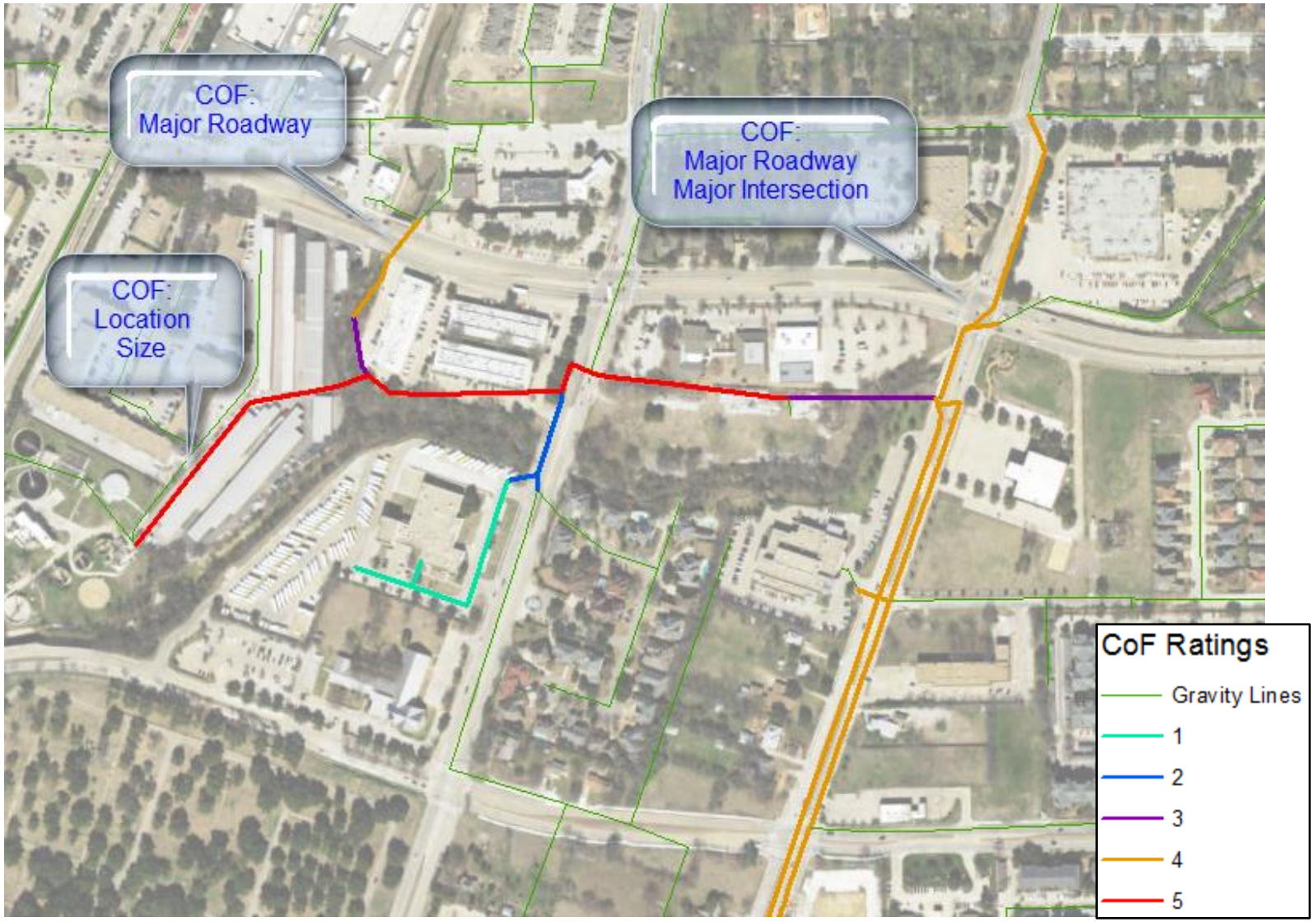
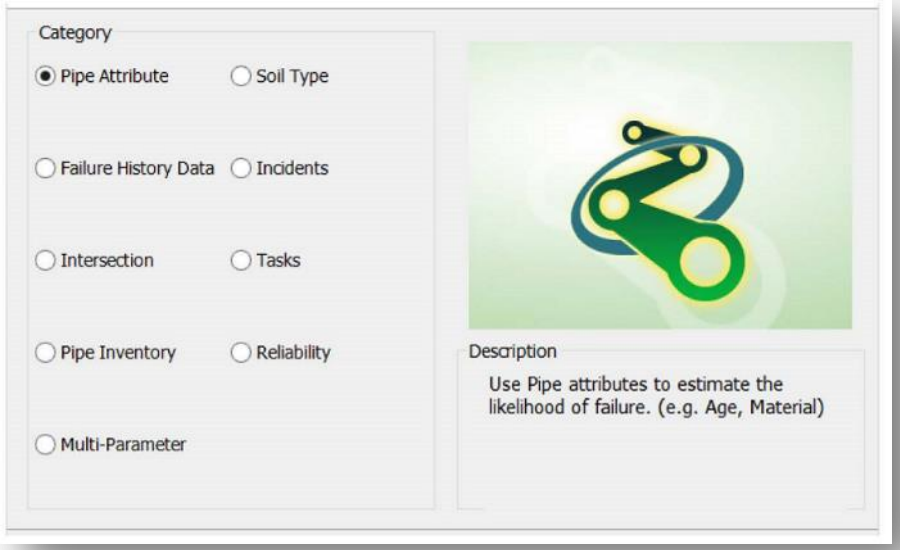
Consequence of Failure



Likelihood of Failure

Risk Analysis



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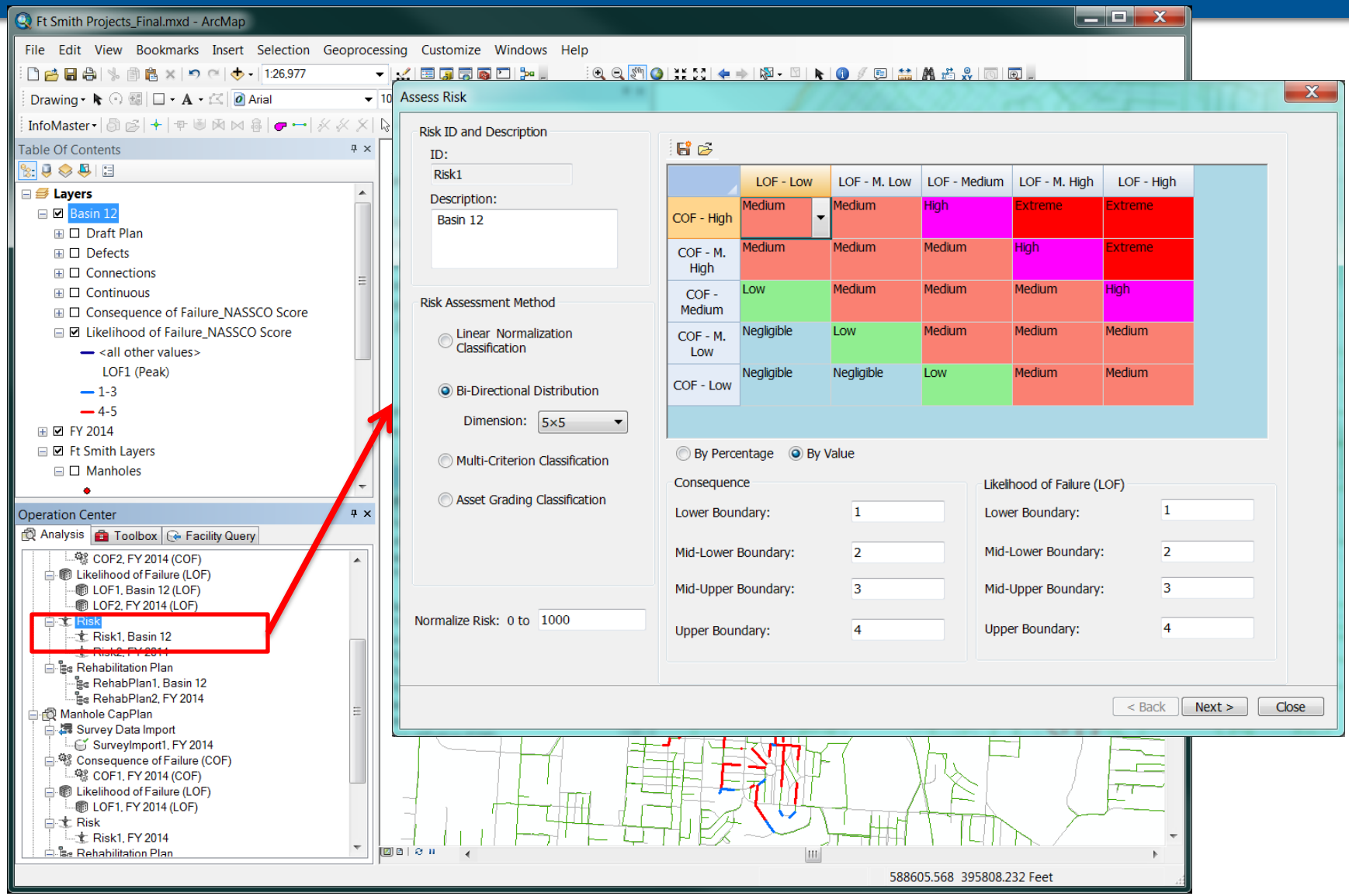
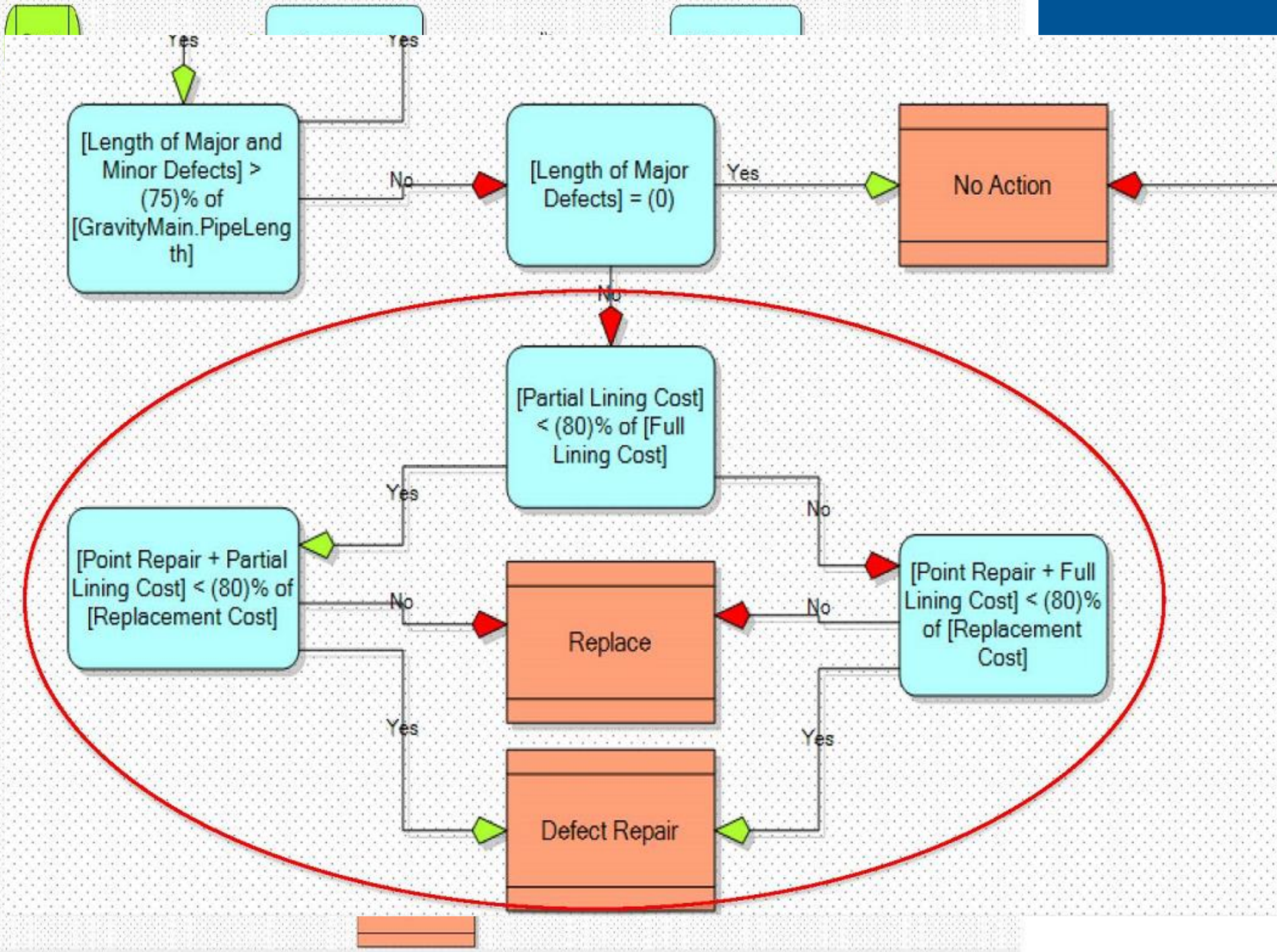
Risk Analysis



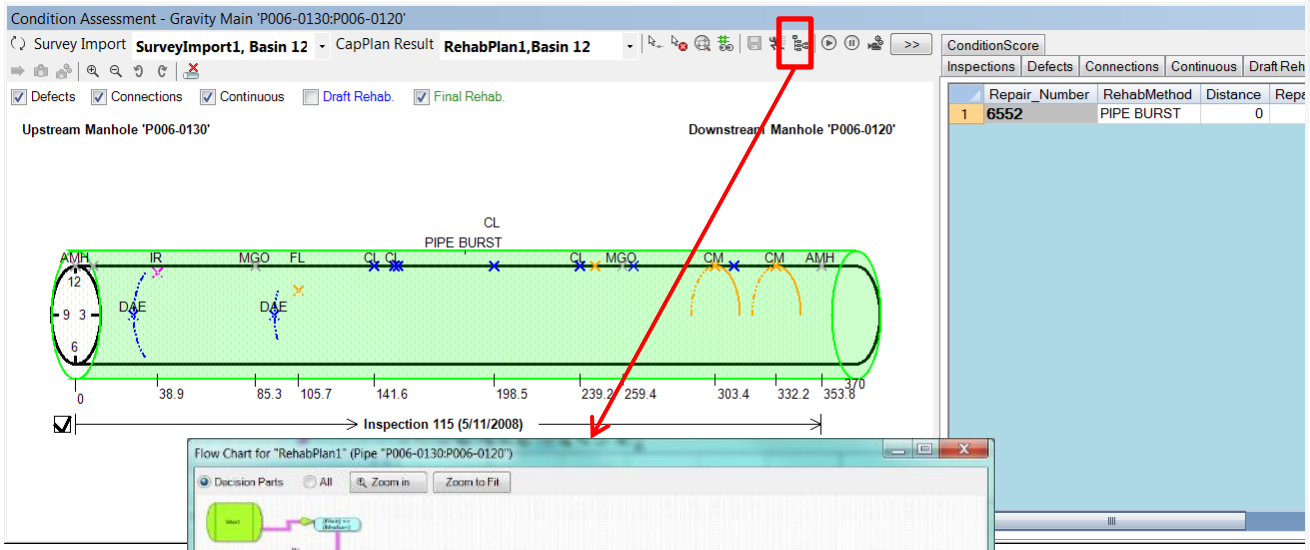

Yes
Yes
[Length of Major and Minor Defects] > (75)% of [GravityMain.PipeLength]
No
[Length of Major Defects] = (0)
Yes
No Action
No
[Partial Lining Cost] < (80)% of [Full Lining Cost]
Yes
No
[Point Repair + Partial Lining Cost] < (80)% of [Replacement Cost]
No
Replace
No
[Point Repair + Full Lining Cost] < (80)% of [Replacement Cost]
Yes
Yes
Defect Repair

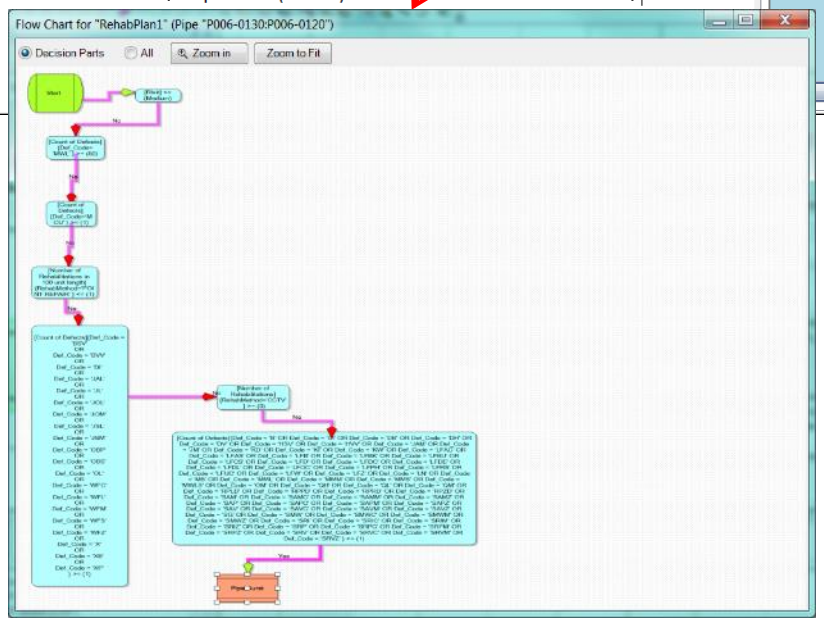
Rehabilitation Plan Summary - RehabPlan1

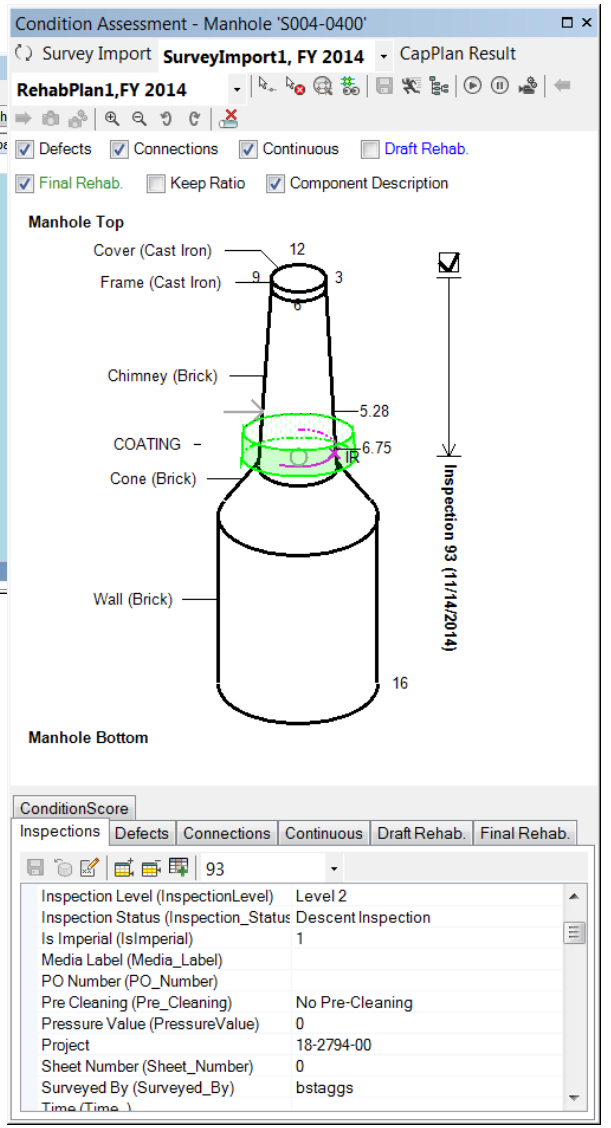
	Pipe ID	Rehab Actions	Reason	Flowchart Branch	Number of Rehab.	Total Cost	Task Created	Total Risk	Normalized Risk	Risk(By Grading)	Mean
2109	669194	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	1	70250.0000		5.0000	200.0000	3-Medium	11.087
2110	669870	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	3	1794.5006		12.0000	480.0000	4-High	0.044
2111	669921	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	1	252.2000		0.0000	0.0000	2-Low	0.019
2112	669942	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	1	570.0000		3.0000	120.0000	2-Low	0.339
2113	670032	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	1	485.0000		10.0000	400.0000	3-Medium	0.255
2114	670181	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	1	267.5000		8.0000	320.0000	2-Low	0.055
2115	670440	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	4	1940.0000		6.0000	240.0000	2-Low	0.042
2116	670548	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	1	770.0000		3.0000	120.0000	2-Low	0.011
2117	671219	Point Repair	[Number of Rehabilitations]{LINING} >= (1) is No	Y-N-N-Y-Y-N	1	570.0000		4.0000	160.0000	2-Low	0.149
2118	1328652	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	6	9238.3551		0.0000	0.0000	3-Medium	0.224
2119	573928	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	3	38696.4400		9.0000	360.0000	3-Medium	0.035
2120	574530	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	14	11752.3500		8.0000	320.0000	2-Low	1.049
2121	575093	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	20	23653.1593		20.0000	800.0000	5-Extreme	0.178
2122	575509	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	12	21376.8000		10.0000	400.0000	3-Medium	0.409
2123	575623	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	10	12524.8500		6.0000	240.0000	2-Low	3.316
2124	575655	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	6	6855.6500		12.0000	480.0000	4-High	0.129
2125	575872	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	7	11375.8000		6.0000	240.0000	2-Low	0.225
2126	576122	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	16	21766.3499		20.0000	800.0000	5-Extreme	0.345
2127	576348	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	13	9831.0000		16.0000	640.0000	5-Extreme	0.694
2128	576405	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	12	15640.1000		5.0000	200.0000	3-Medium	2.645
2129	576528	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	20	21815.9605		5.0000	200.0000	3-Medium	3.929
2130	576600	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	15	7302.2501		15.0000	600.0000	4-High	1.059
2131	576787	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	15	13932.8999		3.0000	120.0000	1-Negligible	0.266
2132	576945	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	19	12644.0300		15.0000	600.0000	4-High	0.199
2133	577116	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	9	19127.6400		10.0000	400.0000	3-Medium	0.881
2134	577410	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	5	15099.0900		10.0000	400.0000	3-Medium	4.251
2135	577997	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	19	15673.0000		10.0000	400.0000	3-Medium	0.182
2136	578365	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	3	13898.0400		3.0000	120.0000	1-Negligible	0.135
2137	578437	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	19	14328.9000		10.0000	400.0000	3-Medium	1.605
2138	578688	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	10	11709.3009		15.0000	600.0000	4-High	0.425
2139	579558	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	14	16933.4000		15.0000	600.0000	4-High	1.452
2140	579562	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	19	12869.1500		5.0000	200.0000	3-Medium	0.144
2141	580359	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	18	13681.4800		10.0000	400.0000	3-Medium	1.833
2142	580434	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	9	20931.5200		5.0000	200.0000	3-Medium	2.070
2143	580594	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	13	16950.6999		5.0000	200.0000	3-Medium	0.225
2144	580655	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	8	10576.1597		6.0000	240.0000	2-Low	0.640
2145	580759	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	8	14065.0397		12.0000	480.0000	4-High	3.733
2146	580946	Point Repair+Full Lining	[GravityMain.SURCHC_10Y] = (CapacityRelated) is No	Y-N-N-Y-Y-Y-Y-N	6	16244.0400		15.0000	600.0000	4-High	0.142

Full Network Selected 2716 Records Loaded (0 out of 97593 Gravity Main Selected in ArcMap)

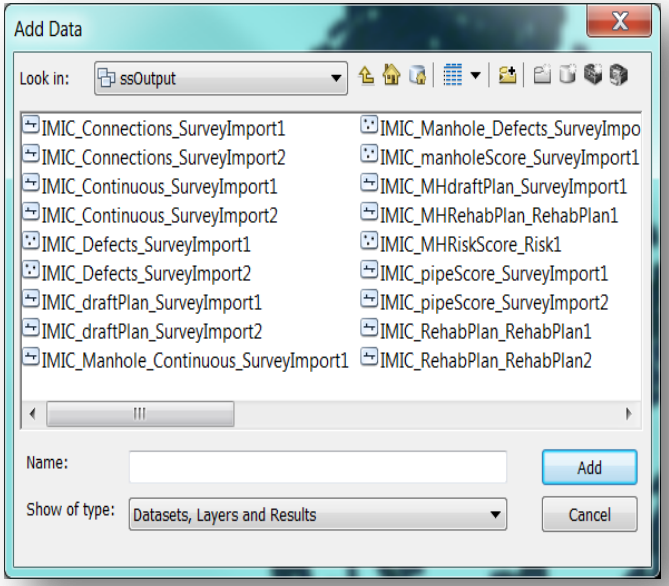
Quality Control & Assurance

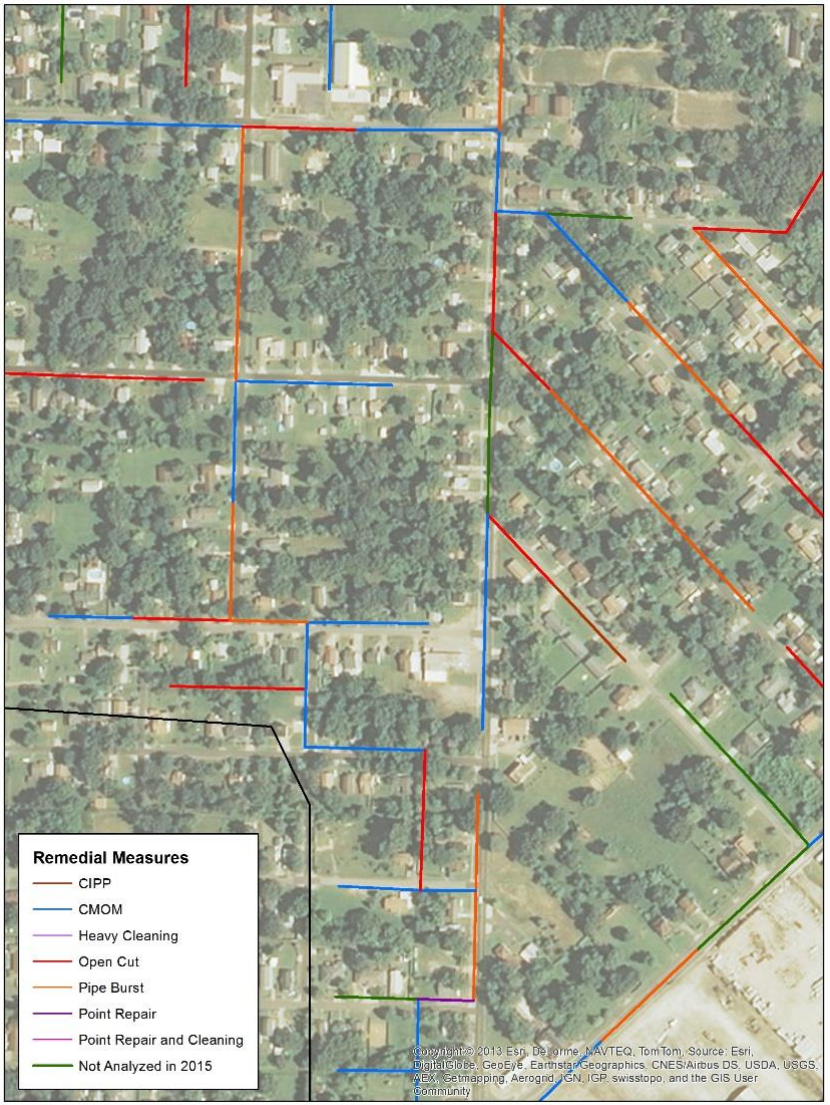






End User Data





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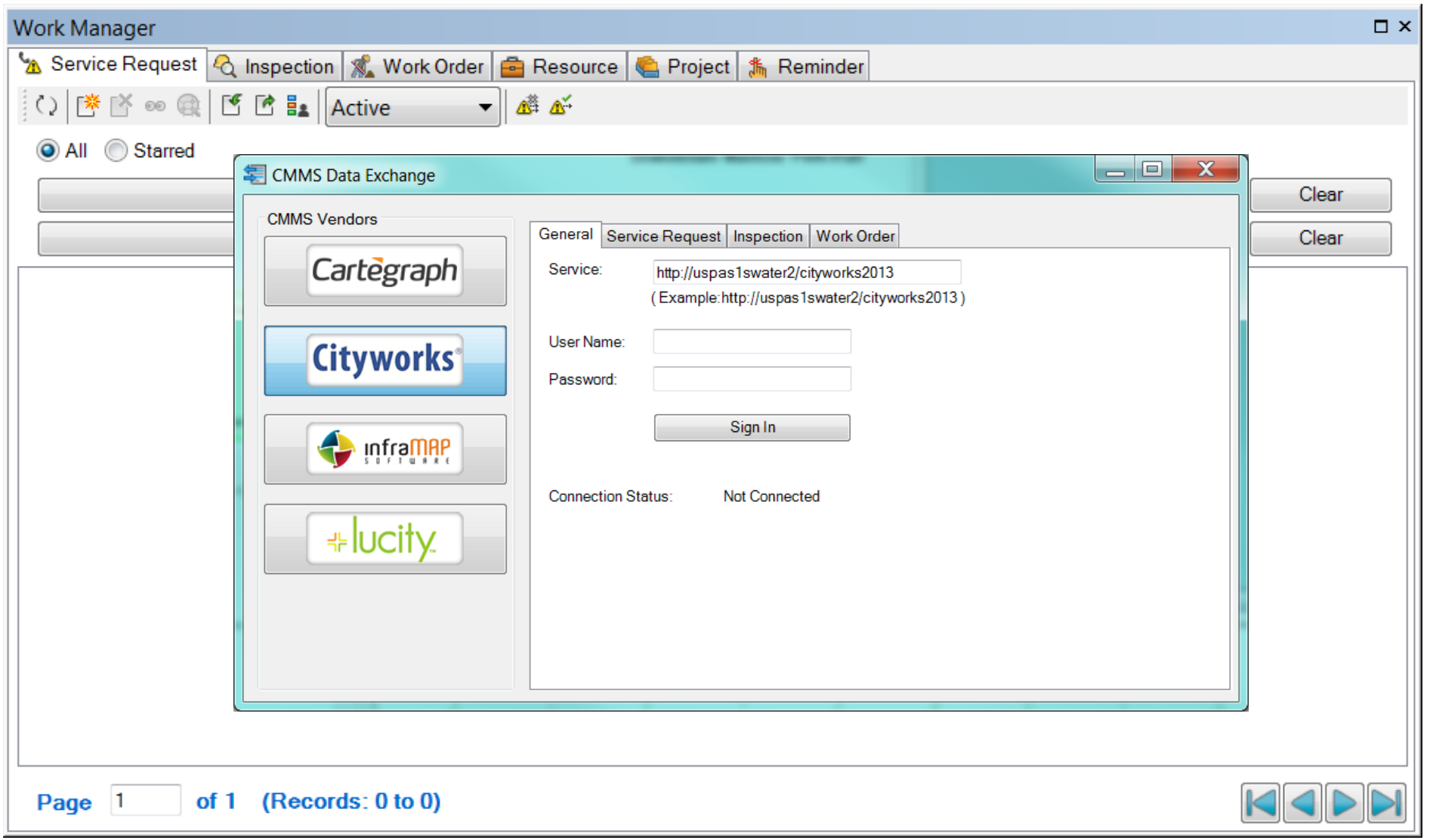
CMMS Intergration

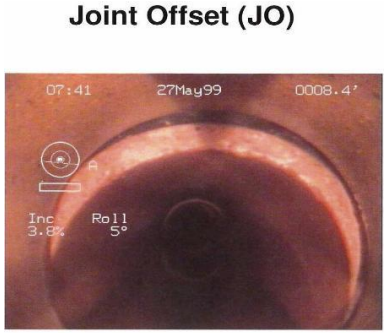


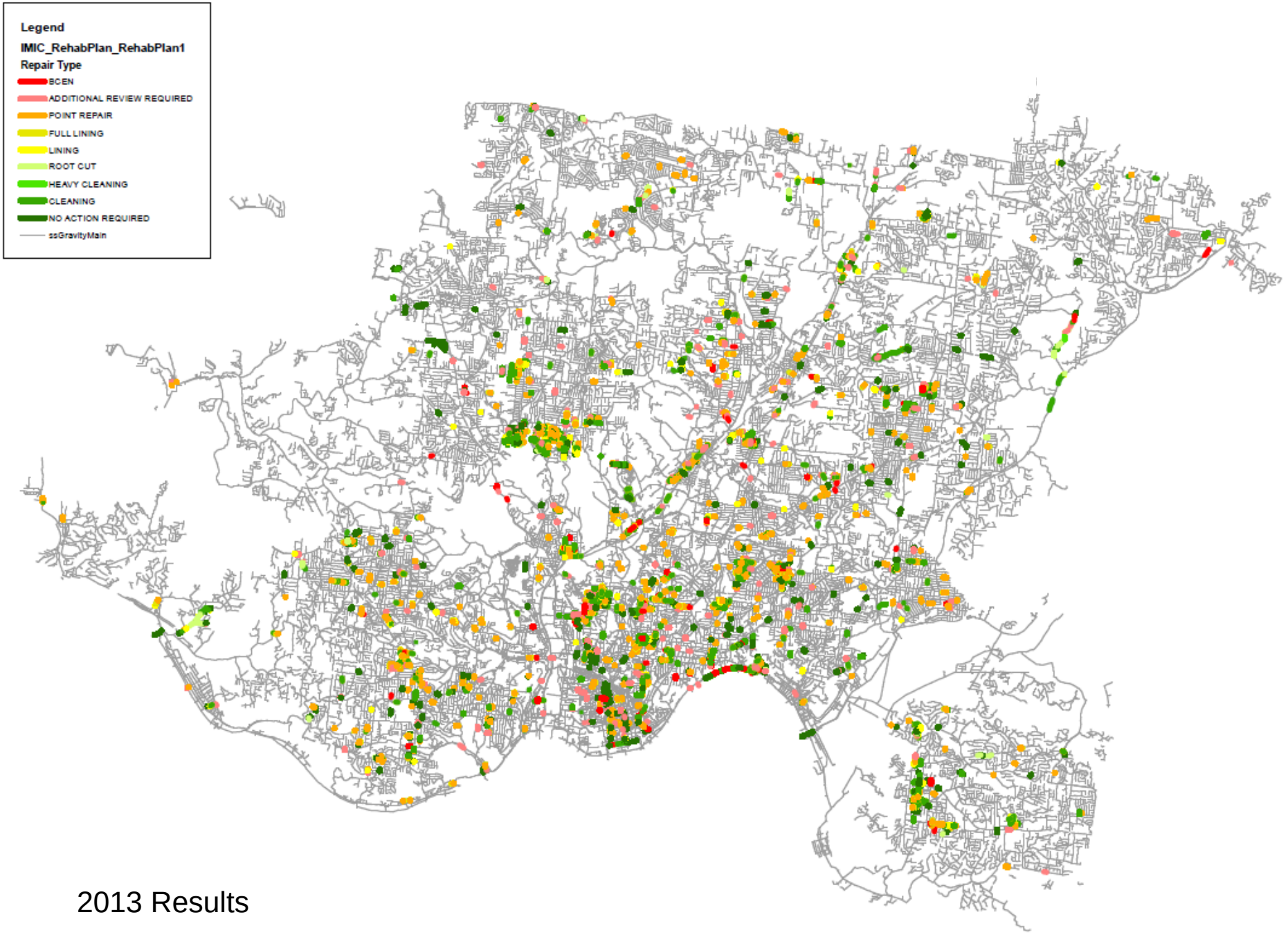
How is RJN Using InfoMaster?

- Cincinnati, OH
  - Full system integration
- Fort Smith, AR
  - Analyze NASSCO Inspections (CCTV and MH Inspections)
  - Develop a Remedial Measures Plans for Assets receiving NASSCO 4 and 5 Scores
- Richardson, TX
  - Collaborating with City to configure InfoMaster to analyze CCTV data.
  - InfoMaster to be used to generate Remedial Measures and Maintenance Plans.
- City of San Antonio
  - Utilizing InfoMaster to Complete Stormwater GIS Mapping Inventory and CCTV Condition Assessment

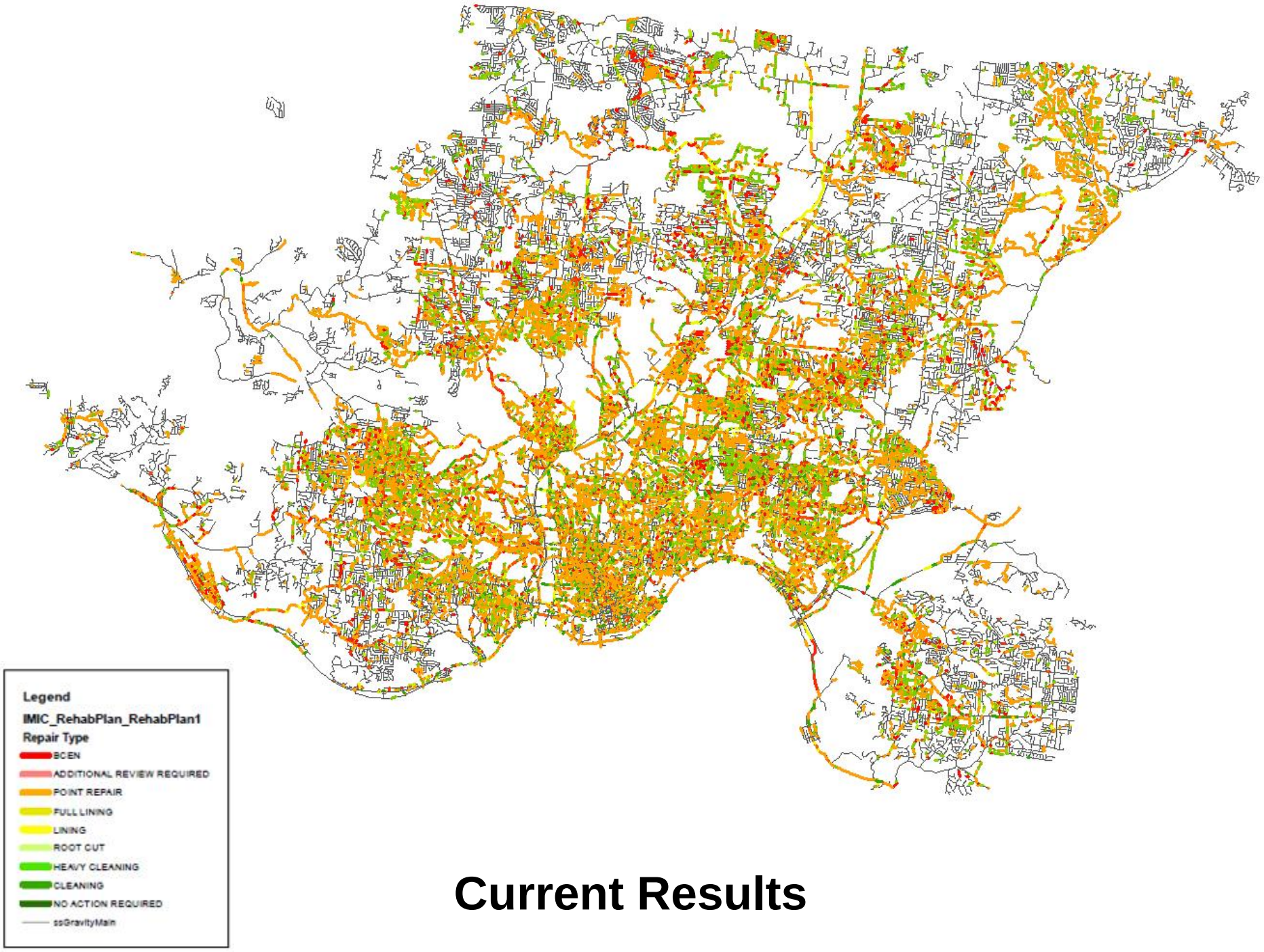
Implementation at MSDGC (Cincinnati)

- Maintenance Risk Likelihood of Failure (LOF) and Structural Risk w/ Maintenance category were created so one decision tree could be used to analyze Maintenance Risk and Structural Risk.
- Facilitated Discovery with MSDGC Staff to find Intersection of InfoMaster with each Department/Staff Role
- Developed a Workflow Diagram for MSDGC
- Developed a Customized User Guide
- Trained Cinci Staff on use of InfoMaster

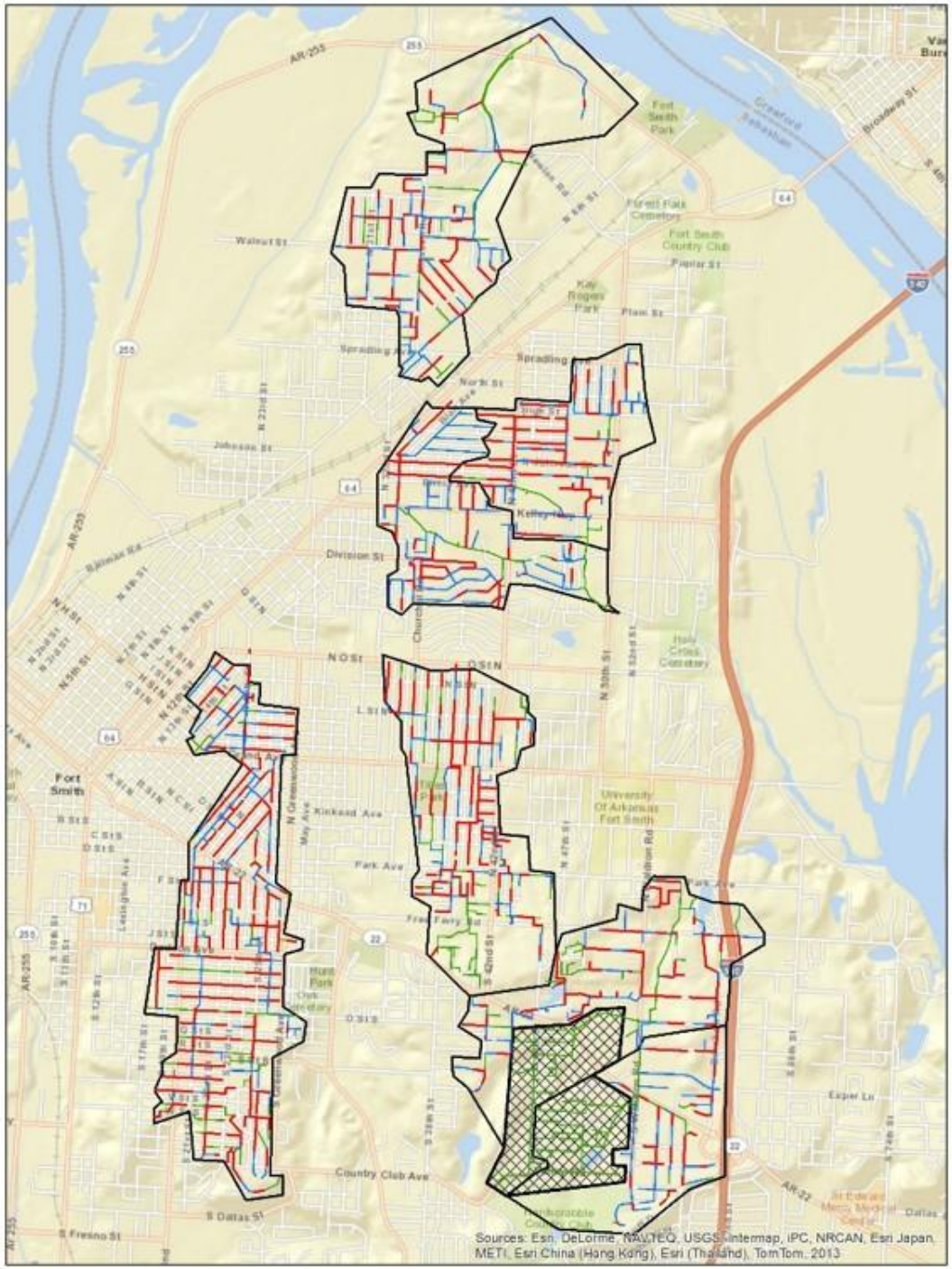




2013 Results

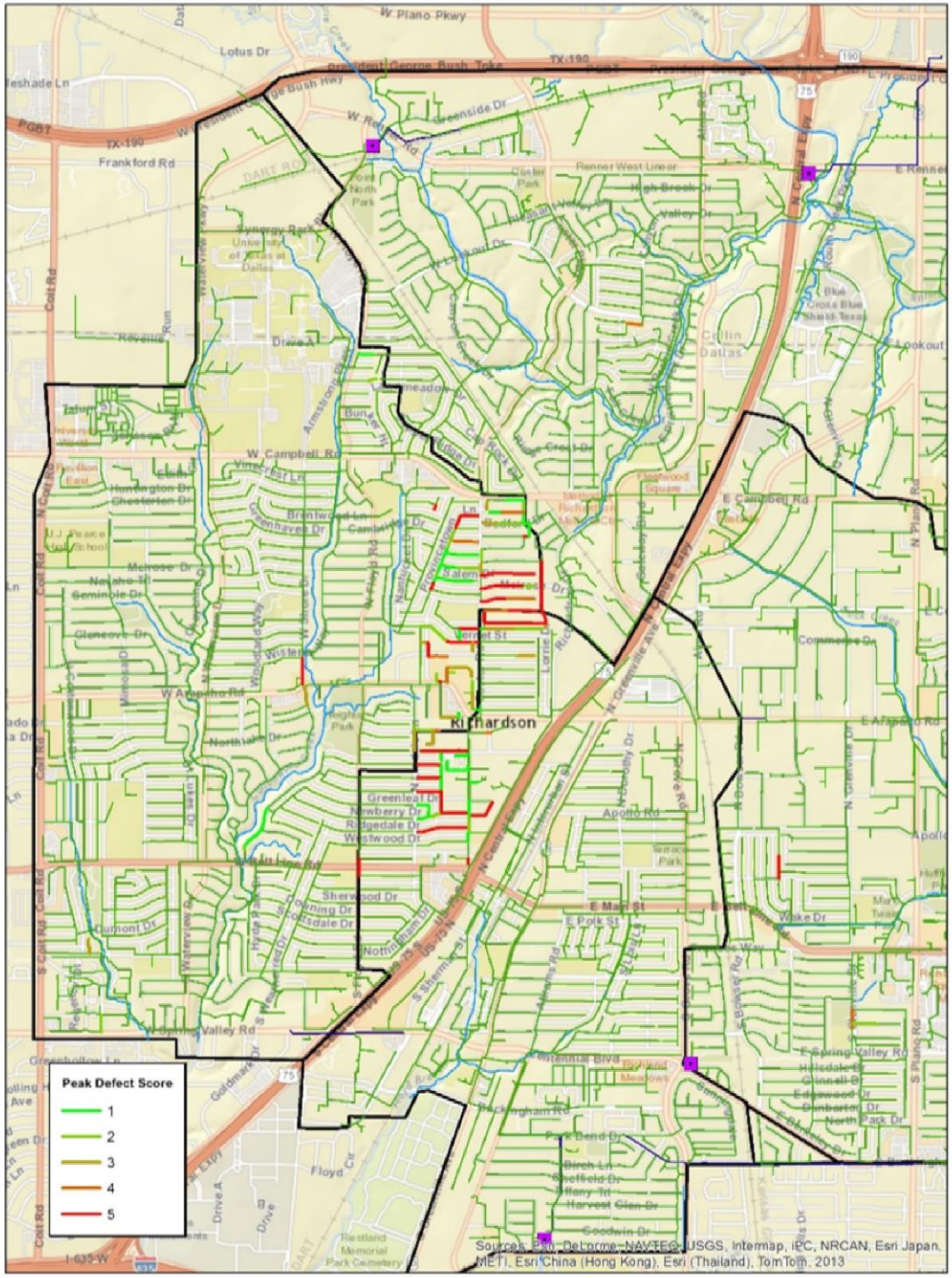


Current Results



Fort Smith, AR

- 7 Sub-Basins Studied
- 1,170 manholes inspected
  - MACP Defect Grading
- 250,019 lf of CCTV Investigation
  - PACP Defect Grading



Richardson, TX

- CCTV Review of 229,531 lf of sewer line – PACP.
  - 70,000 lf of CCTV provided by the City.
- Utilizing InfoMaster to provide NASSCO scoring and develop Remedial Measures.
- InfoWorks Hydraulic Model.

San Antonio, TX

- Perform GIS inventory, mapping and CCTV condition assessment of Stormwater infrastructure
- Integrate Stormwater data into Cartegraph system
- Currently in year 2 of 3 year contract

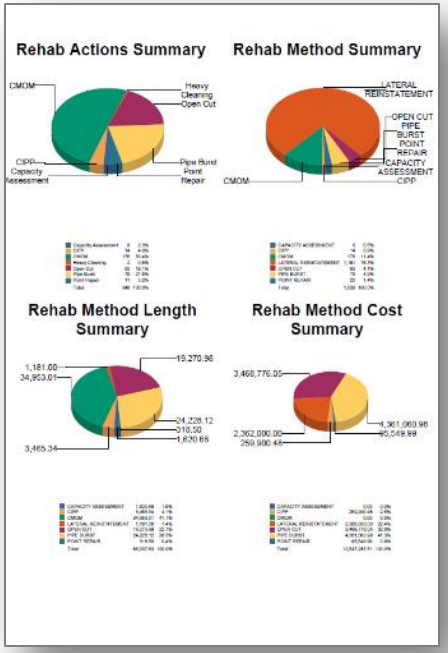
COSA Stormwater Infrastructure Pilot Area			
	Original COSA GIS	Post-Pilot GIS	Percent Increase
Inlets	266	298	12%
Manholes	100	181	81%
Pipe (linear feet of mains)	29,753	73,312	146%

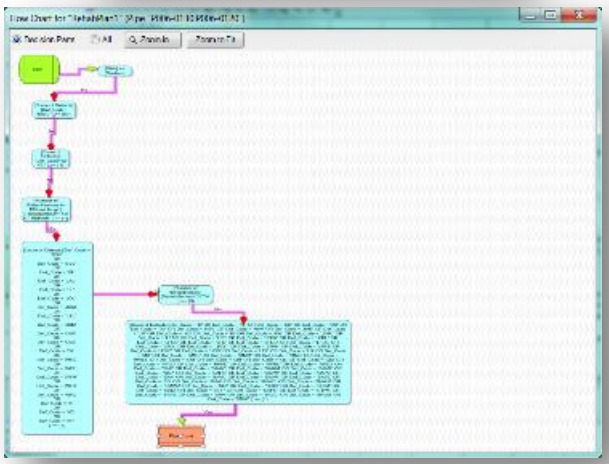
Original COSA GIS
- Inlets
- Manholes
- Storm Pipe

Post Pilot Project COSA GIS
- Inlets
- Manholes
- Storm Pipe

InfoMaster Adding Value

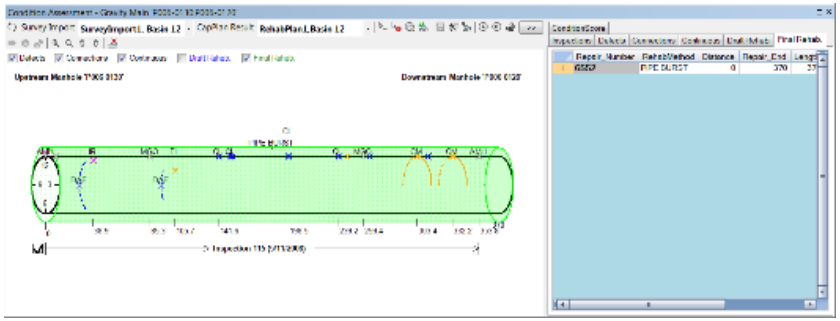
- Automated Checks of Inspection Data against GIS.
  - Labeling
  - Lengths
- Richer, More Inclusive GIS Deliverable
- Further Prioritization of defects based on COF and LOF
- Decision Tree Generates **Objective** Remedial Measure Recommendations.
- Cost Estimating Included





InfoMaster Adding Value

- Easier to Plan Improvement Strategy.
- Prioritizes the Assets **and** Produces a Conceptual Design Report.
  - More Information in the Analysis = More Resolution in Prioritization
- Know What Needs to be Fixed **and** What needs to be Inspected/Maintained



Core Questions

1. What is the current state of my assets?
   - Condition Assessment
   - LOF
2. What is my required level of service?
   - COF
3. Which assets are critical to sustained performance?
   - Risk Analysis
4. What are my best O&M and CIP investment strategies?
   - Decision Tree/Actions
5. What is my best long-term funding strategy?
   - Cost Estimating

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Questions?

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