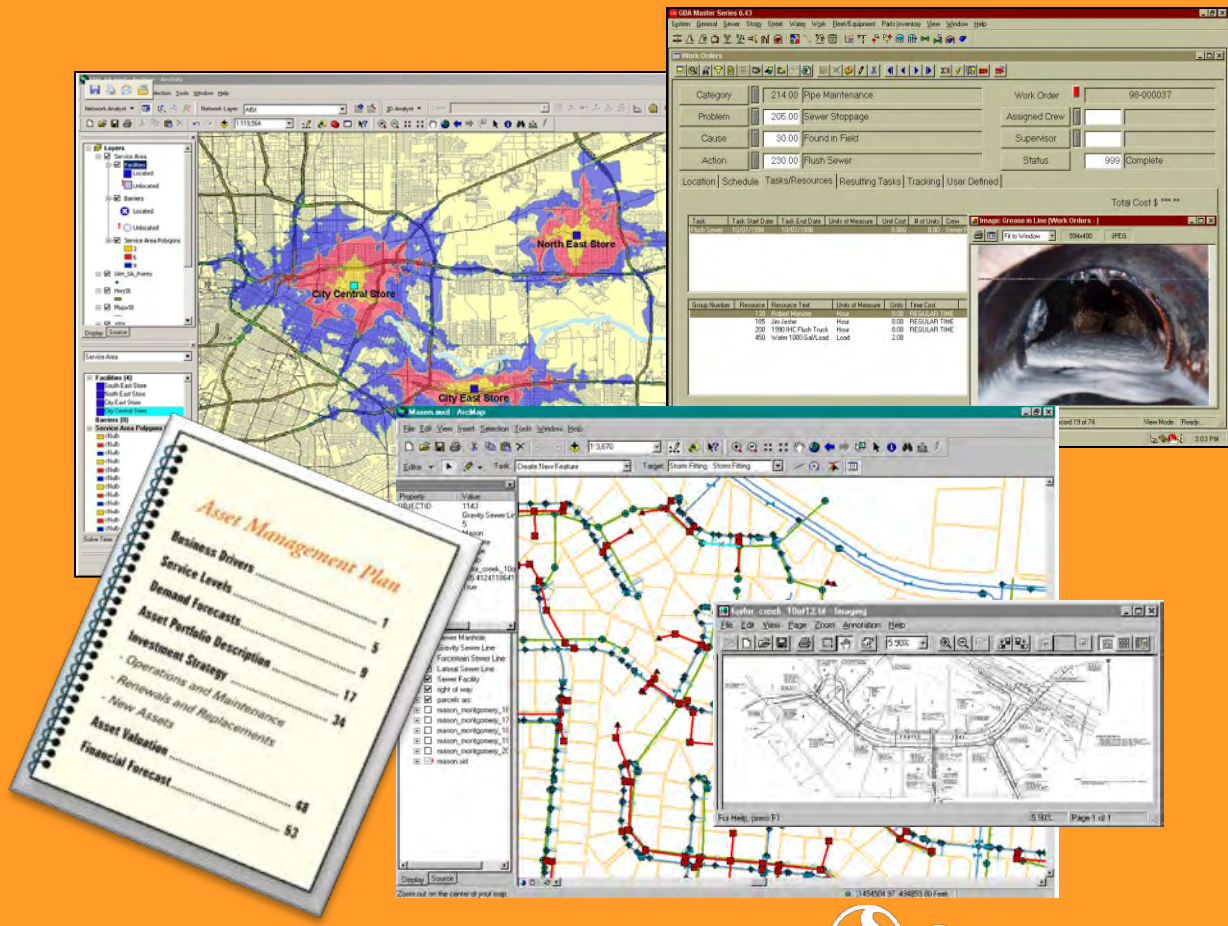
GIS in Asset Management: NE Ohio GIS Symposium

August 31, 2017



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Agenda

1. Introduction / Benchmark
2. What is GIS?
3. What is Asset Management?
4. GIS within Asset Management
5. Case Studies/Examples
6. Ohio Senate Bill 2

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Introduction / Benchmark

- Asset Management
  - Familiarity with Asset Management?
    - Telephone Game…
  - Developing Asset Management? To what degree?
- Points to Ponder:
  - How is GIS used to support Asset Management ?
  - What aspects in the Asset Management can GIS be leveraged?
  - Is Asset Management the same as Work Order Management?
  - Does Asset Management and GIS Program Development have similar principles?
  - Does GIS and Asset Management come up against similar hurdles to implementation?

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2 What is GIS?

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Two Mindsets of GIS

- A **tool**:
  - manage, analyze, edit and display all forms of information based on a location (geographic).

- A **discipline**:
  - Provide benefits and value to all facets of an organization
    - Local government, Utility, Private, etc.
  - Improves business through increased work performance
    - Efficiency, Productivity, Quality

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Two Mindsets of GIS

- Drivers for GIS:
  - Demand to "do more with less"
  - Streamline / Efficiency in Business Processes
  - Improved Response Time
  - Improved Decision Making
  - Move from a reactive to a proactive work environment
  - Justification / Support
  - Transfer of Institutional Knowledge / Knowledge Capture
  - Save Time / Money

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3 What is Asset Management?

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What is Asset Management?

- Framework being widely adopted as a means to pursue and achieve sustainable infrastructure.

- Practice of managing infrastructure capital assets to minimize the total cost of owning and operating them while delivering the desired service levels of service.

- Doing the Right Thing;
  to the Right Asset;
  at the Right time…

What is Asset Management?

Does any of this sound familiar?

Drivers for Asset Management

- Growing list of aging and expensive assets with conditions worsening while demand has increased;
- Justification for infrastructure investments;
- Transfer of institutional knowledge from retiring workforce;
- Transition from building and operating to managing assets by moving to proactive work environment;
- Improve decision making throughout the life cycle of the asset;
- Understand future renewal expenditures / Define optimal investment strategies.

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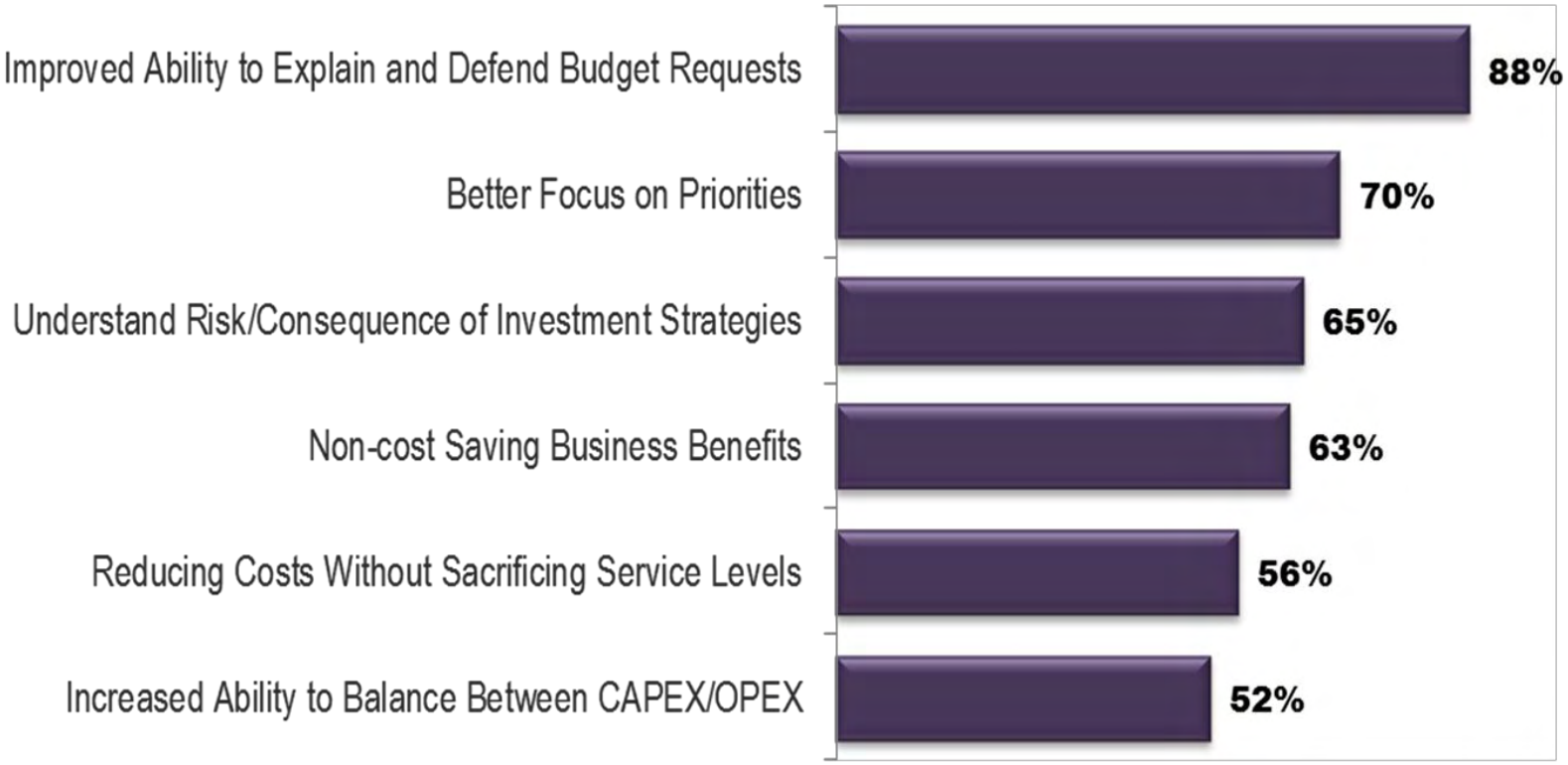
What is Asset Management?

Benefits of "doing" Asset Management



Source: Water Infrastructure Asset Management Study (2012)

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What is Asset Management?

ACSE Infrastructure Report Card

	2009	2013	2017
Roads	D-	D	D
Bridges	C	C+	C+
Transit	D	D	D-
Aviation	D	D	D
Schools	D	D	D+
Drinking Water	D-	D	D

	2009	2013	2017
Wastewater	D-	D	D+
Dams	D	D	D
Solid Waste	C+	B-	C+
Hazardous Waste	D	D	D+
Navigable Waterways	D-	D-	D
Energy	D+	D+	D+

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What is Asset Management?

Five Core Management Questions:

- What is the **current state** of my assets?
- What is my required sustained **level of service**?
- Which of my assets are **critical for sustained performance**?
- What are my best minimum lifecycle cost **CIP and O&M strategies**?
- What is my best **long-term funding strategy**?

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What is Asset Management?

What we want to avoid…

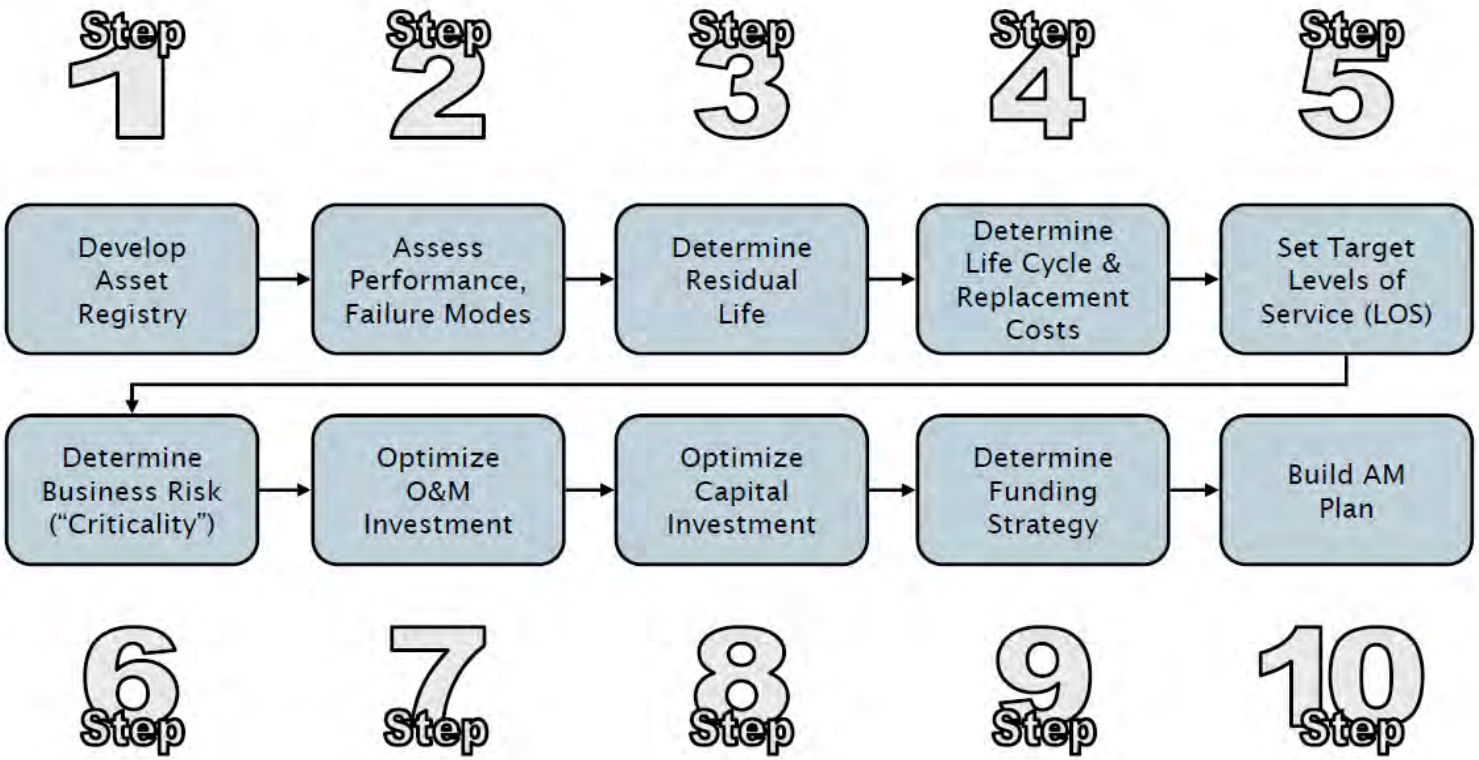
What is Asset Management?

Asset Management Principles

- What do we have and where is it?
- What is it worth?
- What is it's condition/expected remaining service life?
- What is the Level of Service expectation and what needs to be done?
- When do you need to do it?
- How much will it cost and what is the acceptable level of Risk/Consequences?
- How do you ensure long-term affordability?
- * What tools can you use to manage the assets data?

What is Asset Management?

EPA 10 - Step Process



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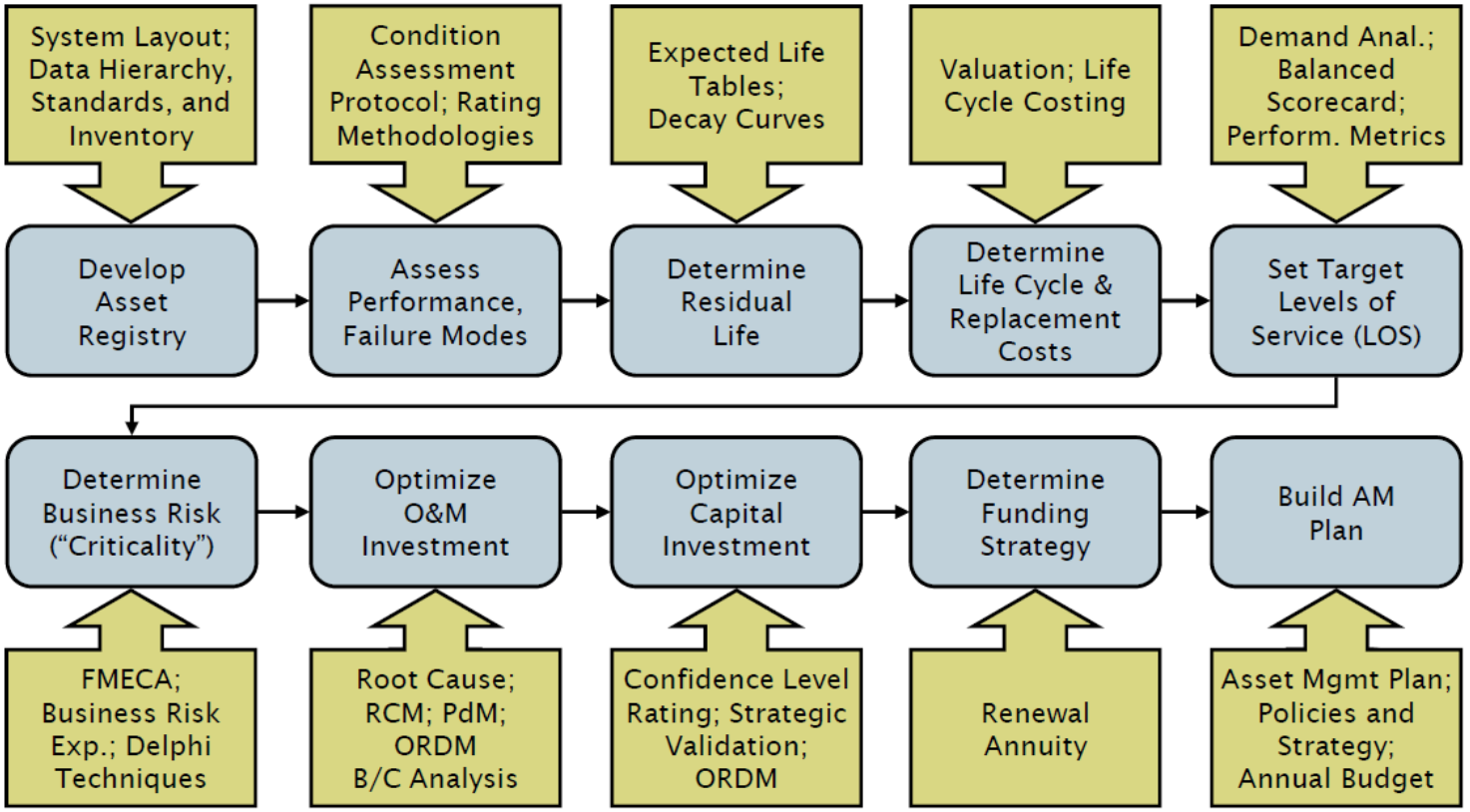
What is Asset Management?

EPA 10 - Step Process



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4 GIS in Asset Management

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GIS in Asset Management

How can GIS support Asset Management ?

- Program Development
  - Asset Inventory
  - Condition Assessment
  - Remaining Useful Life
  - Capital Improvement Plan
- Program Management
  - Managing the Assets
    - Asset/Work Order Management Solution
  - Analysis

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GIS in Asset Management

Asset Inventory

- Physical components that make up the utility system:
  - Pipelines, valves, vaults, pumps, hydrants, storage tanks, etc.
- Provides location as well as the characteristics that are important for managing the life cycle of the assets.
- Industry Best Practices Data Models
- Example:
  - Pipes: manufacturer, pipe material, diameter, date of installation, type of lining, etc.

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GIS in Asset Management

Asset Inventory - GIS

- GIS used to create inventory.

Identify from: <Top-most layer>

Catch Basin
BWSC

Location: 767,618.986 2,928,810.733 Feet

Field	Value
OBJECTID	9580
ANCILLARYROLE	<null>
ENABLED	True
Feature ID	1109910228
Owner	BWSC
Placed By	MIGRATED
Date Placed	4/27/2007 12:28:41 AM
Updated By	blundonr
Date Updated	11/11/2009 10:35:17 AM
Sync Flag	<null>
Symbol Rotation	253.283
Facility ID	11ICB123
Basin Type	Type 5
Trace Classification	Unclassified
Sewer System	Storm
Scupper and Downspout	No
Grate Type	E1 Basin Grate
Cover Type	Not Applicable
Don`t Dump Type	None
Curb Opening Size (In.)	2 Inch
Material	Brick
Hood and Trap Code	Hood and Trap
Basin Diameter (Ft.)	4 Ft.
Depth to Outlet (In.)	59
Depth to Bottom (In.)	100
Outlet 1 Diameter (In.)	10 in.
Outlet 2 Diameter (In.)	Unknown
Address Number	24
Street Feature Code	4151
Cross Street Feature Code	<null>
Shape	Point

Identified 1 feature

GIS in Asset Management

Asset Inventory

- What do I own?
- Where is it located?
- Who does it serve?
  - Number and types of customers?
  - Critical customers?
- What is the condition?
- Where are my CRITICAL assets?
- What is its maintenance history?
- What assets are close to its end of useful life?

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GIS in Asset Management

Asset Inventory

- Assets can be captured in a number of ways:
  - Field Collection
  - Data Conversion
    - Engineering Drawings
    - As-Built Drawings
    - Tap Cards

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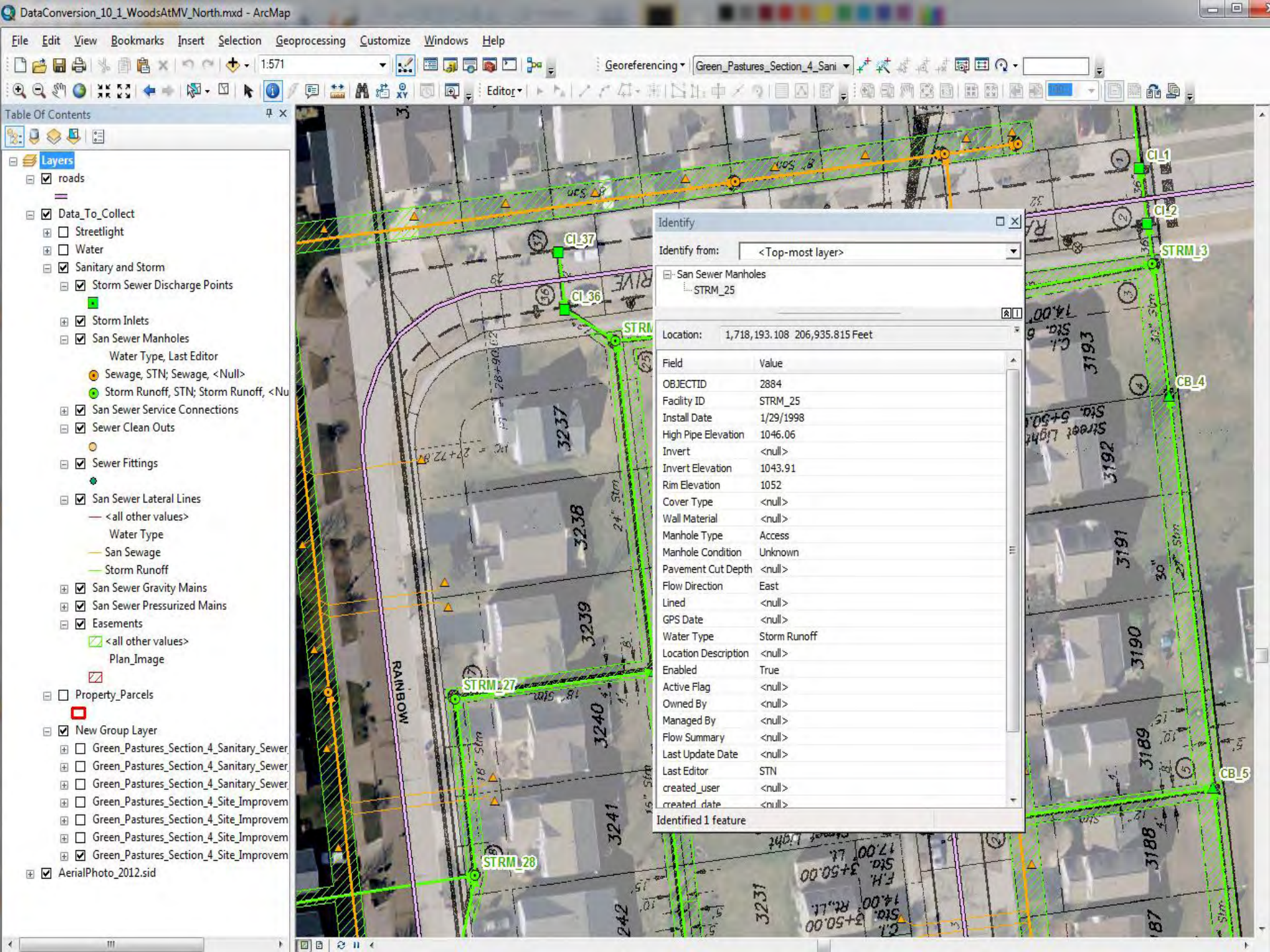
DataConversion_10_1_WoodsAtMV_North.mxd - ArcMap
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
Table Of Contents
Layers
roads
Data_To_Collect
Streetlight
Water
Sanitary and Storm
Storm Sewer Discharge Points
Storm Inlets
San Sewer Manholes
Water Type, Last Editor
Sewage, STN; Sewage, <Null>
Storm Runoff, STN; Storm Runoff, <Nu
San Sewer Service Connections
Sewer Clean Outs
Sewer Fittings
San Sewer Lateral Lines
<all other values>
Water Type
San Sewage
Storm Runoff
San Sewer Gravity Mains
San Sewer Pressurized Mains
Easements
<all other values>
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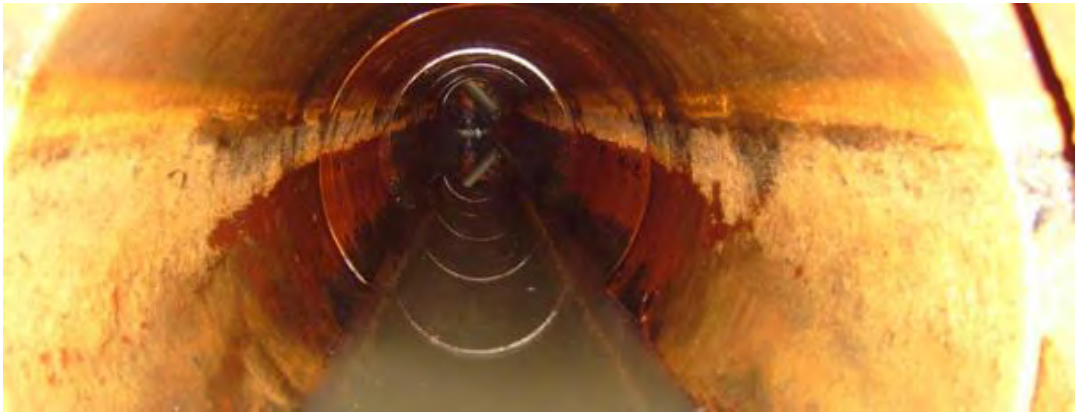
Property_Parcels
New Group Layer
Green_Pastures_Section_4_Sanitary_Sewer
Green_Pastures_Section_4_Sanitary_Sewer
Green_Pastures_Section_4_Sanitary_Sewer
Green_Pastures_Section_4_Site_Improvem
Green_Pastures_Section_4_Site_Improvem
Green_Pastures_Section_4_Site_Improvem
Green_Pastures_Section_4_Site_Improvem
AerialPhoto_2012.sid
Identify
Identify from:
<Top-most layer>
San Sewer Manholes
STRM_25
Location:
1,718,193.108 206,935.815 Feet
Field
Value
OBJECTID 2884
Facility ID STRM_25
Install Date 1/29/1998
High Pipe Elevation 1046.06
Invert <null>
Invert Elevation 1043.91
Rim Elevation 1052
Cover Type <null>
Wall Material <null>
Manhole Type Access
Manhole Condition Unknown
Pavement Cut Depth <null>
Flow Direction East
Lined <null>
GPS Date <null>
Water Type Storm Runoff
Location Description <null>
Enabled True
Active Flag <null>
Owned By <null>
Managed By <null>
Flow Summary <null>
Last Update Date <null>
Last Editor STN
created_user <null>
created_date <null>
Identified 1 feature
CI_1
CI_2
STRM_3
CI_37
CI_36
CB_4
CB_5
STRM_27
STRM_28
RAINBOW

GIS in Asset Management

Condition Assessment

- What is the condition of the asset?
  - Condition Codes (1-5)
    - 1 = New/Excellent; Operates as designed
    - 5 = Unserviceable; Requires replacement



GIS in Asset Management

Condition Assessment

- What is the condition of the asset?
  - Installation Date
  - Assets Typical Useful Life
    - Extrapolate on where the asset should be within its useful life.
  - Remaining Service Life
    - Failure = Point where assets fail to achieve required levels of service

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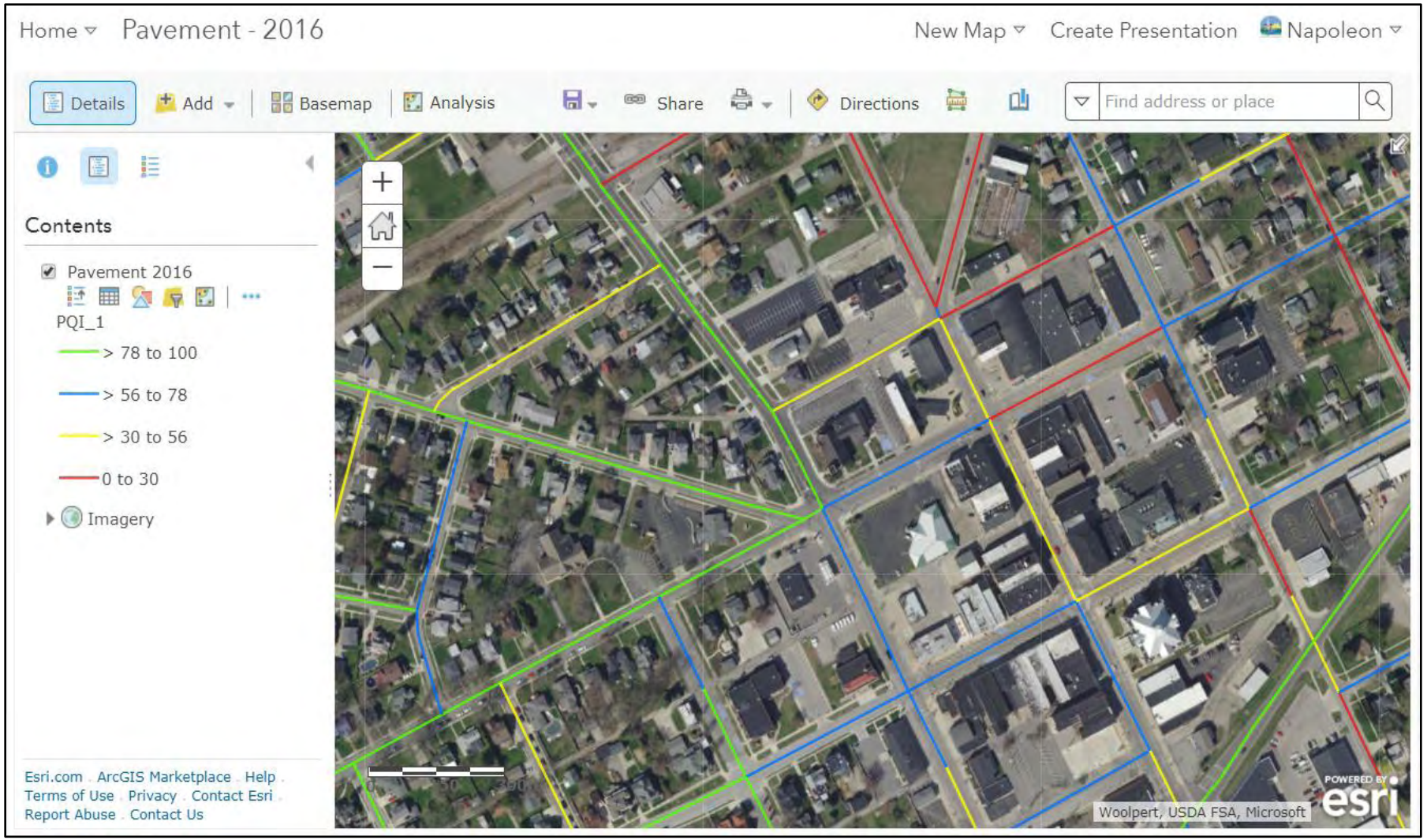
GIS in Asset Management



GIS in Asset Management

Capital Improvement Plan

- What asset do we address first?
  - Lifecycle Approach
  - Financial Analysis
- How much money do we need?
  - Sustainable Funding Requirements
    - Maintaining
    - Rehabilitating
    - Replacing
  - Analysis
    - Timing/Cost

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GIS in Asset Management

Asset/Work Order Management Solution

- GIS-Centric Asset Management Solutions
  - Asset Inventory/Mapping
    - Tie directly to GIS (ex. ArcGIS)
    - Link other data (photos, video, etc.)
  - Inspections/Work Orders
  - Report Generation
    - Linear feet of mains cleaned
    - Number of valves or meters replaced
    - Total number of laterals repaired

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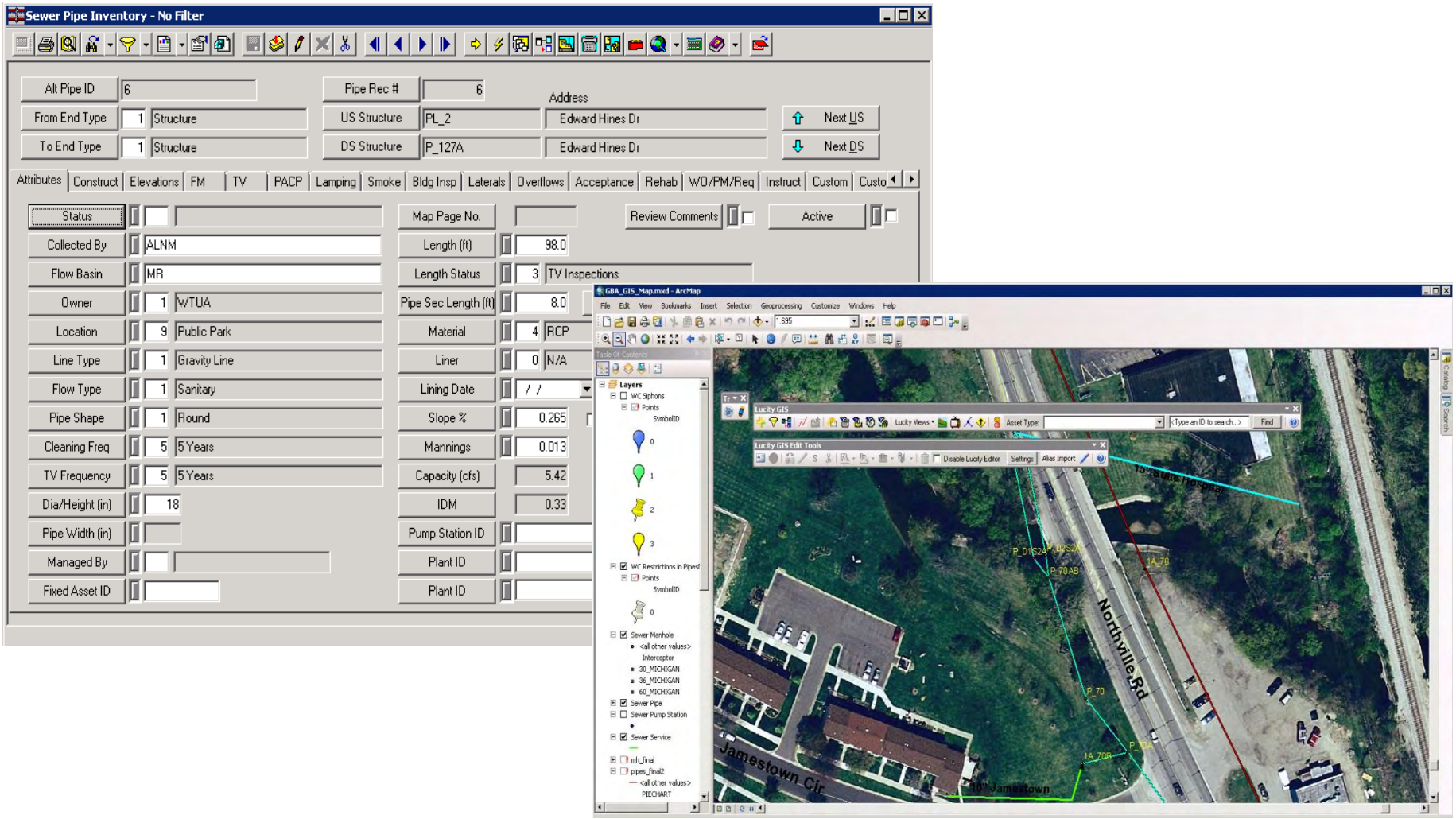
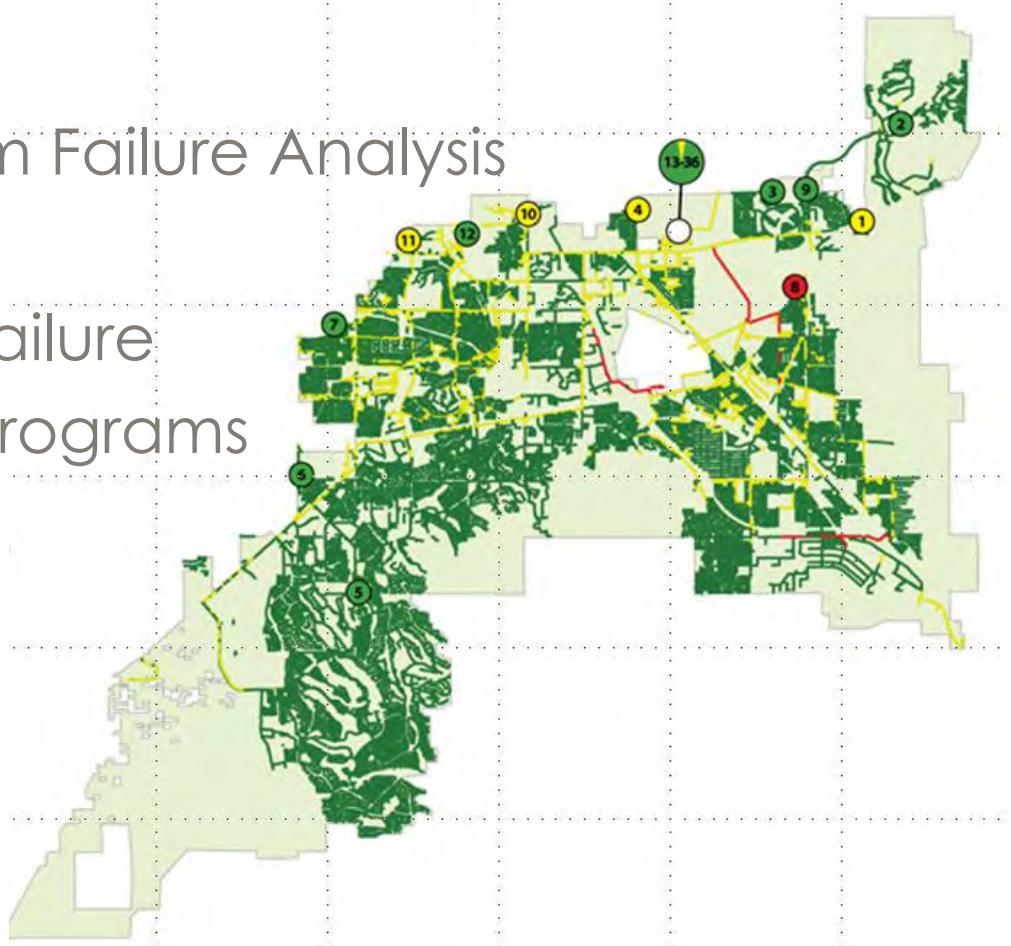
GIS in Asset Management



GIS in Asset Management

Analysis Support

- Thematic Mapping
- Likelihood of System Failure Analysis
- Risk Scoring
- Consequence of Failure
- Future Inspection Programs



5 Case Study: Utility Condition Assessment & CIP

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Case Study

Capital Improvement Planning

- City of Upper Arlington, OH
- Wanted to be able to add "intelligence" to their data.
- This intelligence would allow the City to use the data to support them within their CIP (Capital Improvement Program)
- Focus of analysis was on:
  - **Likelihood of Failure**: Physical, Environmental, History
  - **Consequence of Failure**: Customer Outage, Traffic/Customer Impact, Potential Property Damage

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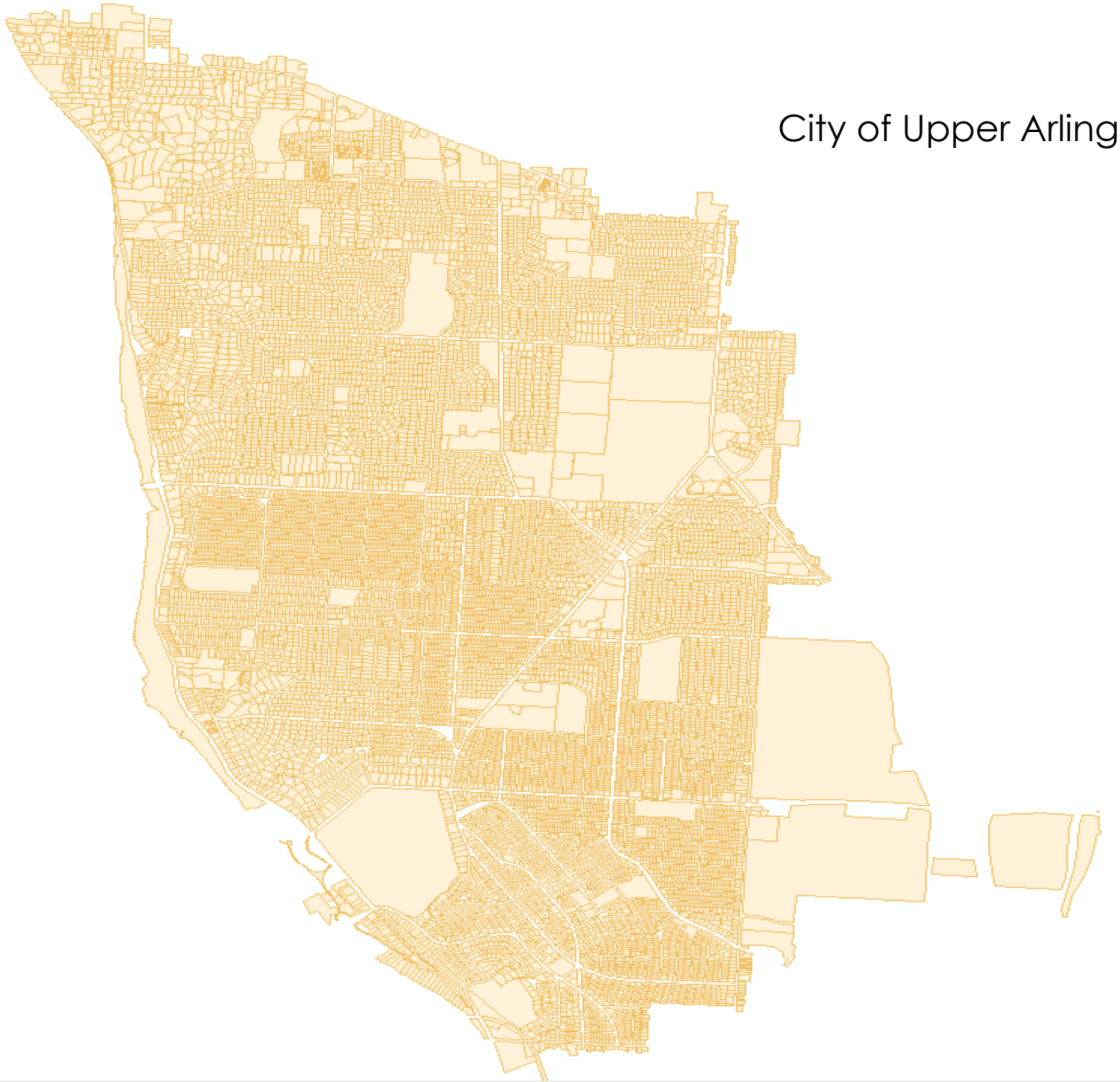
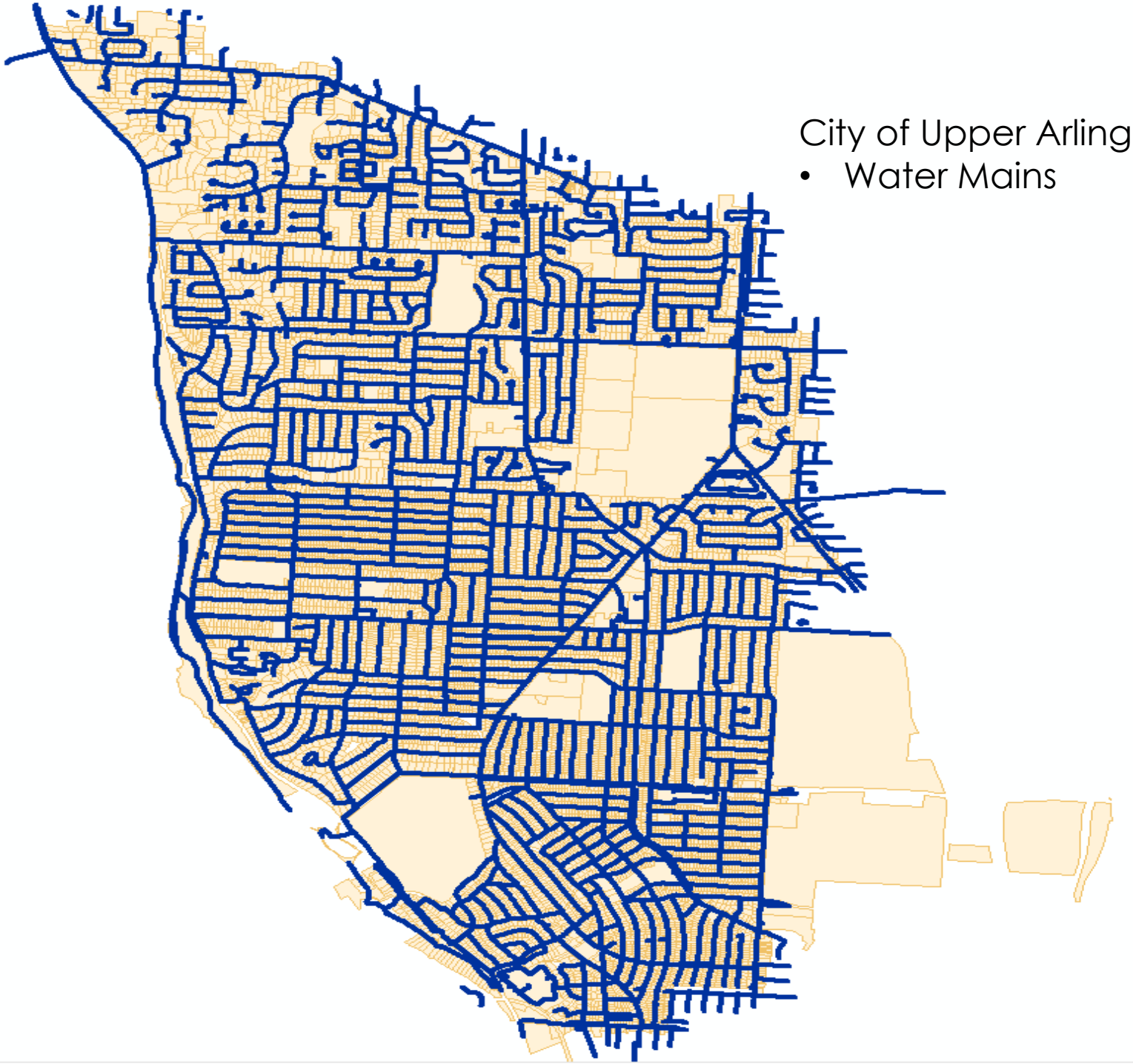


City of Upper Arlington, OH



City of Upper Arlington, OH

- Water Mains

Case Study

Likelihood Factors:

- Soils
- Breaks
- Age of Pipe
- Install Year

Consequence Factors:

- Land Use
- Addresses
- Diameter
- Road Proximity

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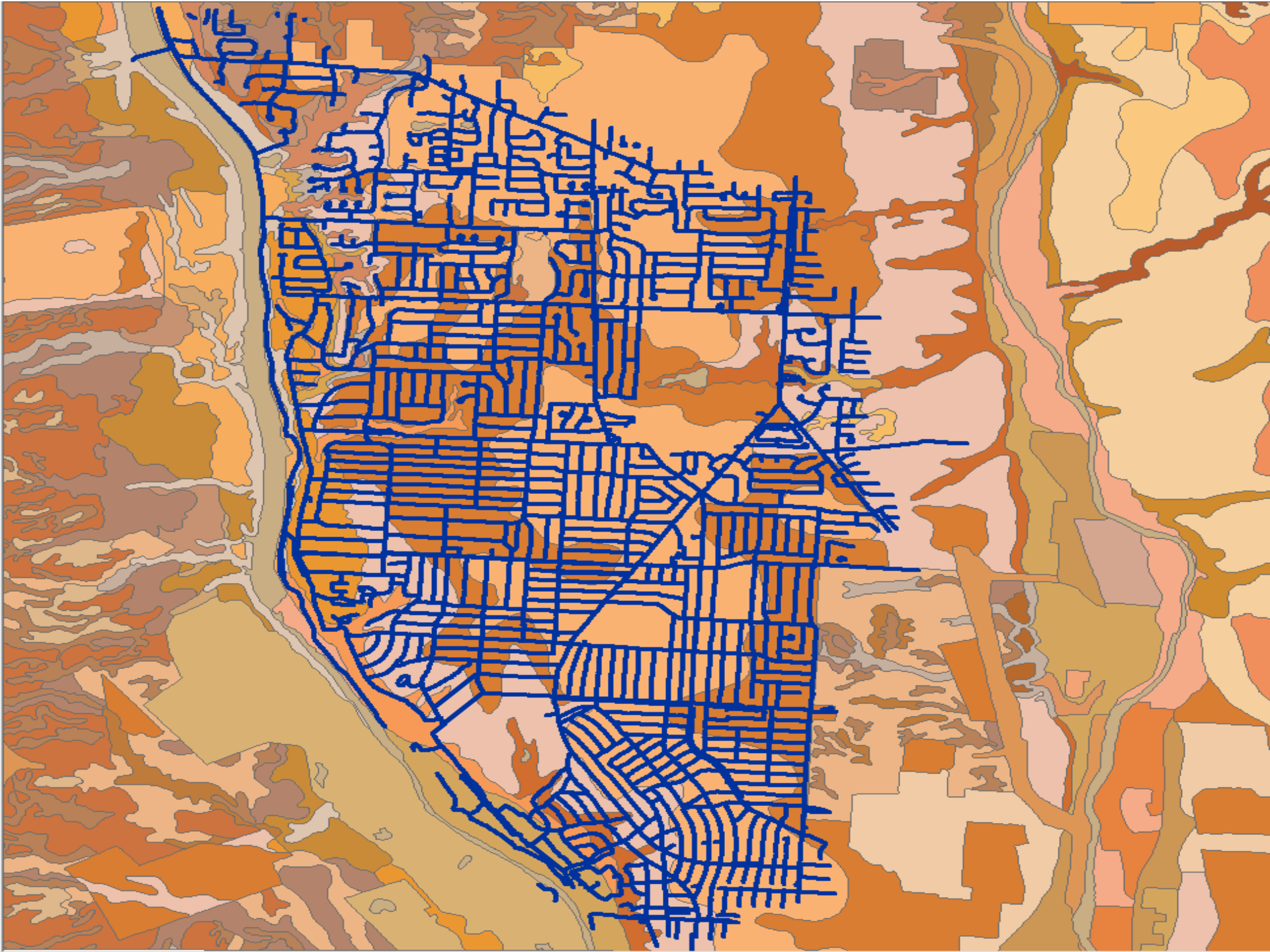
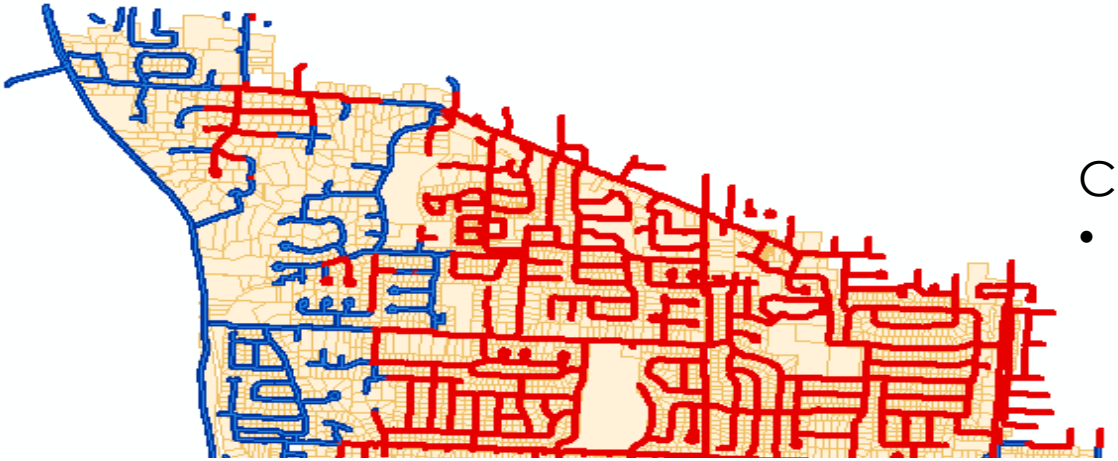
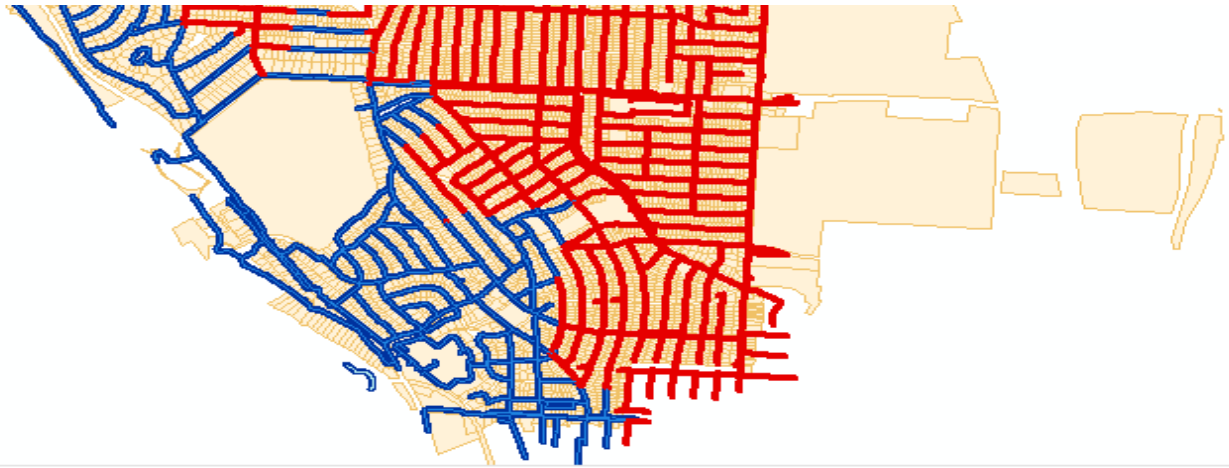


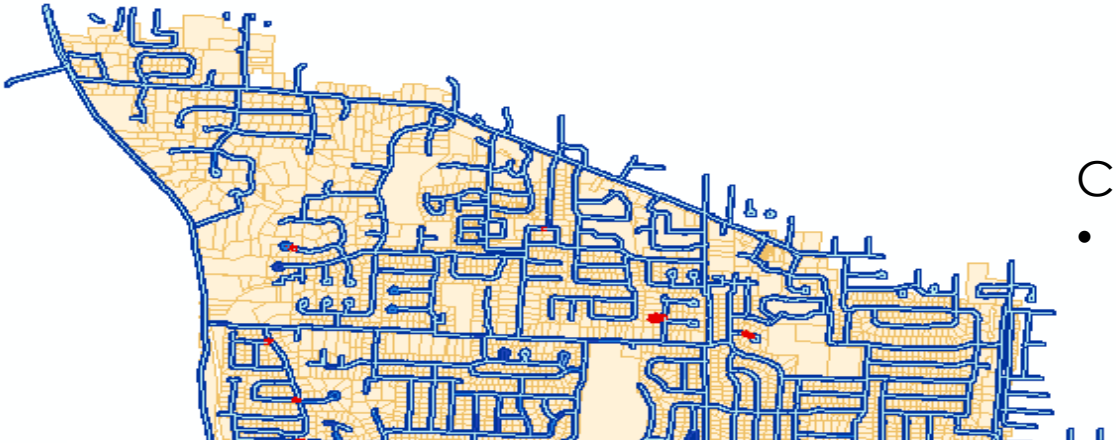


City of Upper Arlington, OH

- Likelihood Factor:
  - Soils

Failure Likelihood Category	NRCS Soil Types	Score	Pipe Length (ft)	% of Total Length
Medium	CeB, CfB, EmB, HeE2, Ko, Ku, MIC2, MID2, MkB, MnC, MpB, MpC, RhB, RhD2	1	331,009.59	31.9%
High	CrA, CrB, CsA, CsB	3	704,332.32	68.0%
Not Applicable	Pt (Pits), W (Water)	0	763.45	0.1%
		Total		100 %

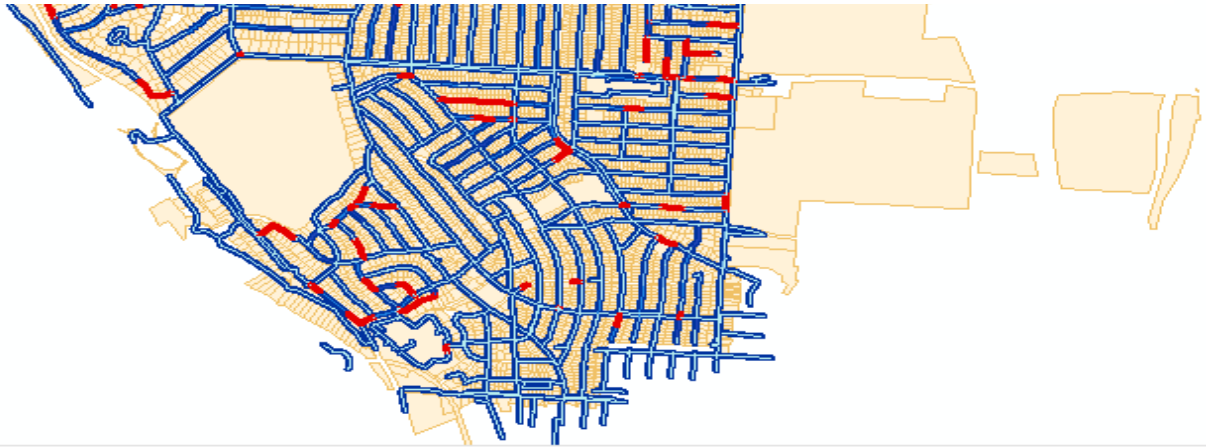


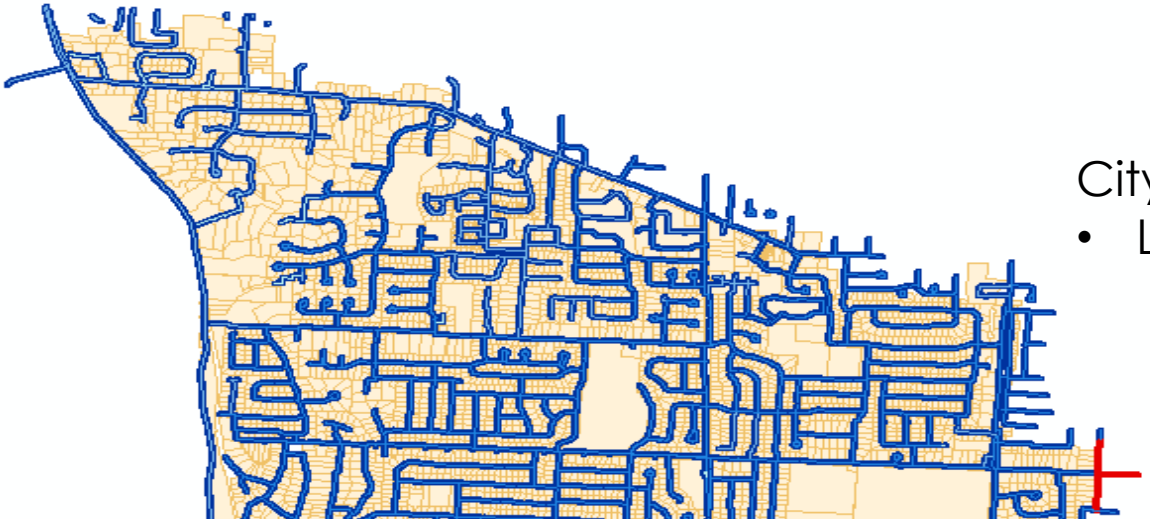


City of Upper Arlington, OH

- Likelihood Factor:
  - Breaks

Active Breaks per Thousand Feet	Score	Pipe Length (ft)	% of Total Length
0	0	783,954.37	75.7%
0.930 – 2.846	1	70,332.22	6.8%
2.847 – 4.338	2	51,865.49	5.0%
4.339 – 6.756	3	51,206.46	4.9%
6.757 – 11.251	4	48,179.93	4.6%
11.252 – 234.329	5	30,566.89	3.0%
	Total	1,036,105.36	100 %

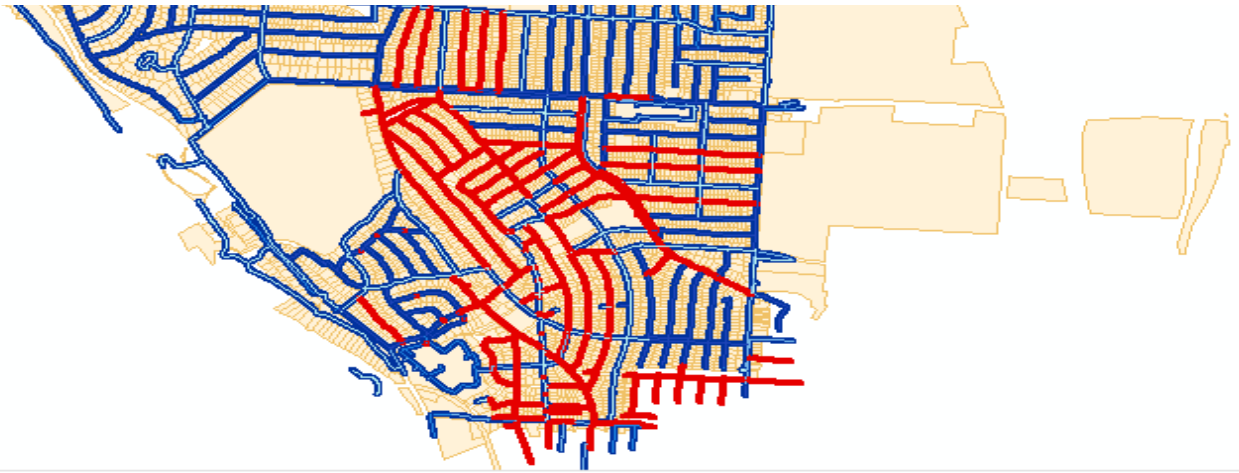


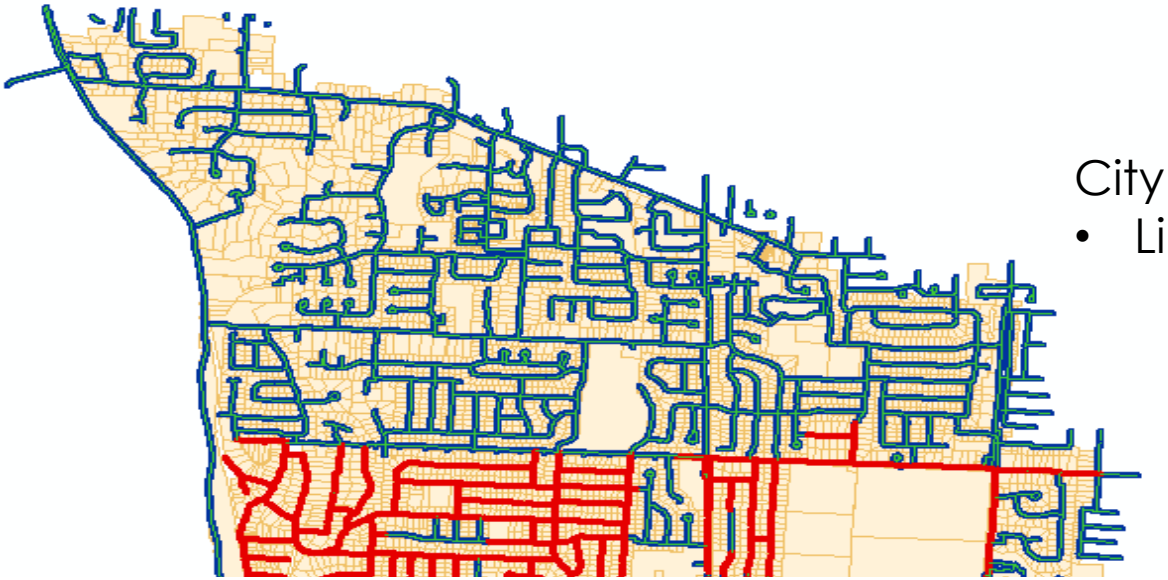


City of Upper Arlington, OH

- Likelihood Factor:
  - Pipe Age

Age of Pipe (years)	Score	Pipe Length (ft)	% of Total Length
0 - 20	1	136,156.78	13%
21 - 40	2	139,700.64	13%
41- 60	3	477,661.55	46%
61 - 80	4	193,915.89	19%
81 - 100	5	88,670.49	9%
	Total	1,036,105.36	100%

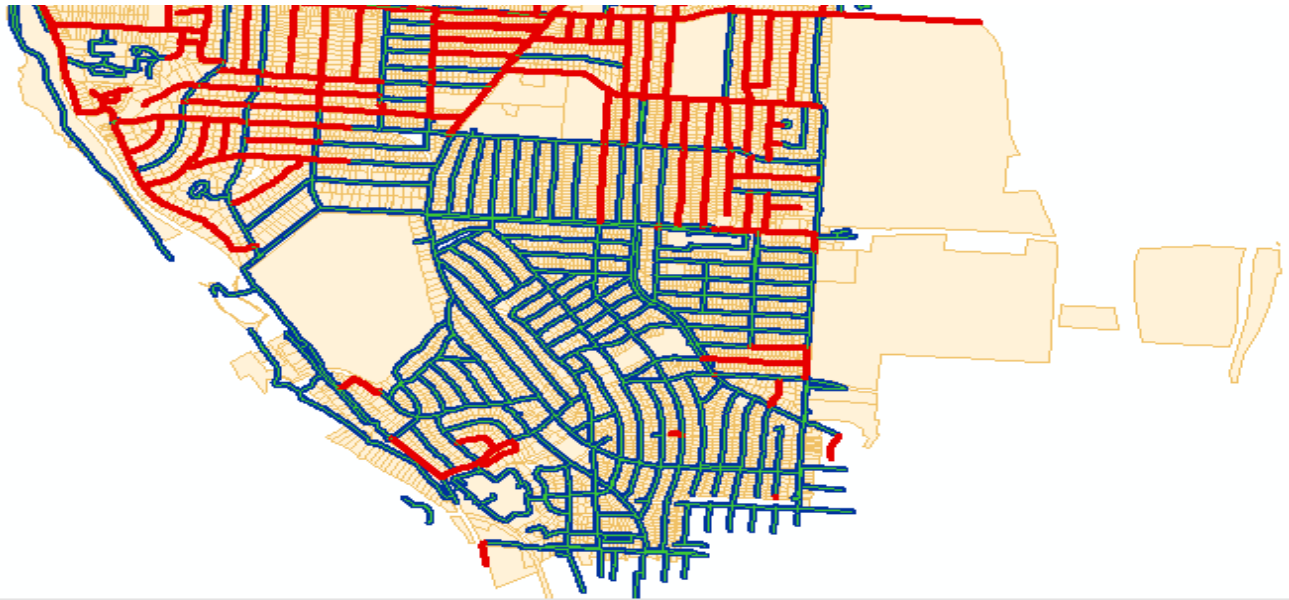


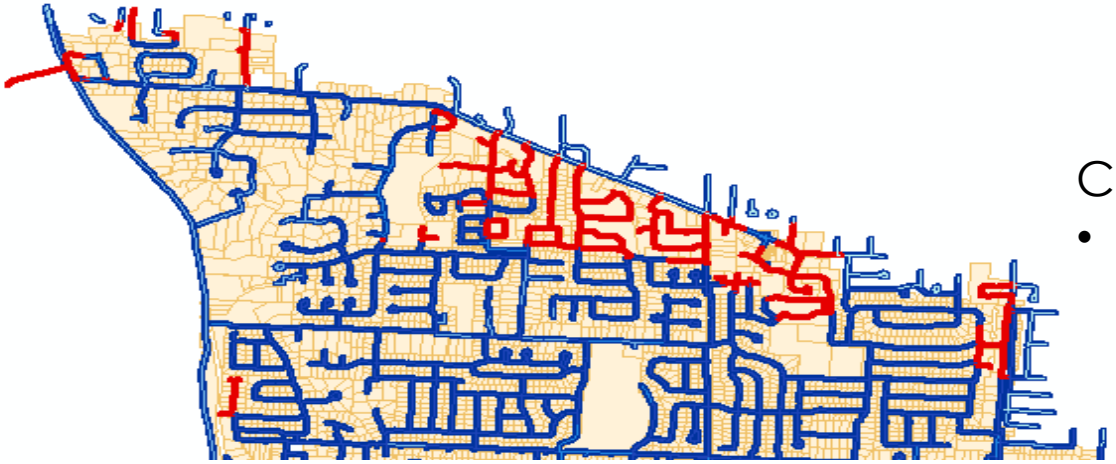


City of Upper Arlington, OH

- Likelihood Factor:
  - Install Year

Pipe Installation Year	Score	Pipe Length (ft)	% of Total Length
1940s and 1950s	3	674,031.69	65.1%
All other decades	0	362,073.66	34.9%
	Total	1,036,105.36	100 %

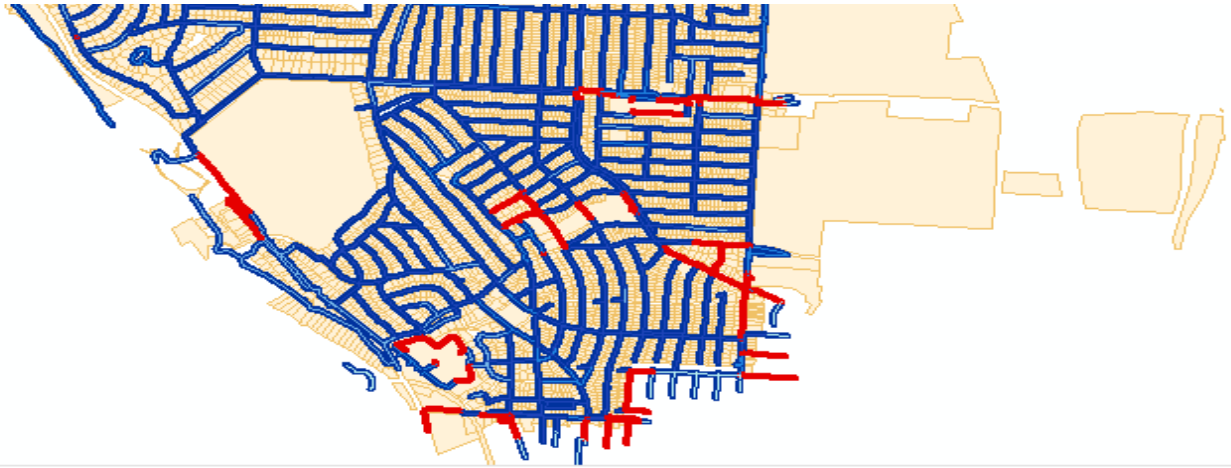


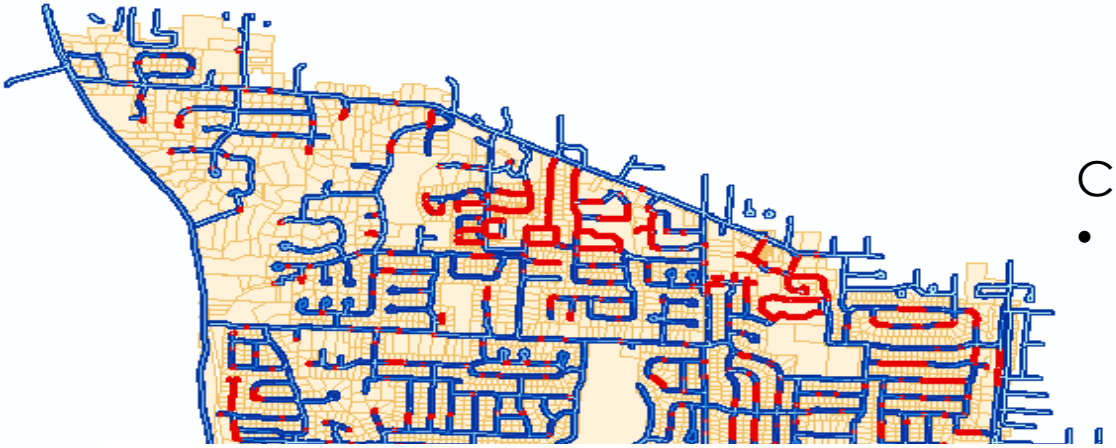


City of Upper Arlington, OH

- Consequence Factor:
  - Land Use

Land Use	Score	Pipe Length (ft)	% of Total Length
Outside UA Corp Boundary	0	44,259.19	4.3%
Vacant	1	79,852.72	7.7%
Golf Course/Parks/Exempt	2	82,698.65	8.0%
Single-Family	3	714,760.77	69.0%
Multi-Family	4	38,028.23	3.7%
School/Commercial/Hospital	5	76,505.80	7.3%
	Total	1,036,105.36	100%

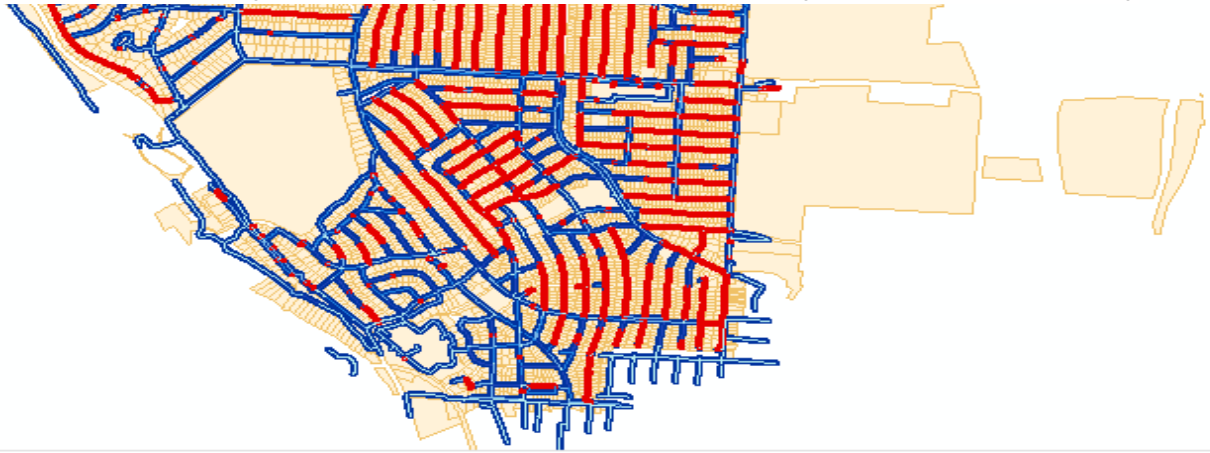


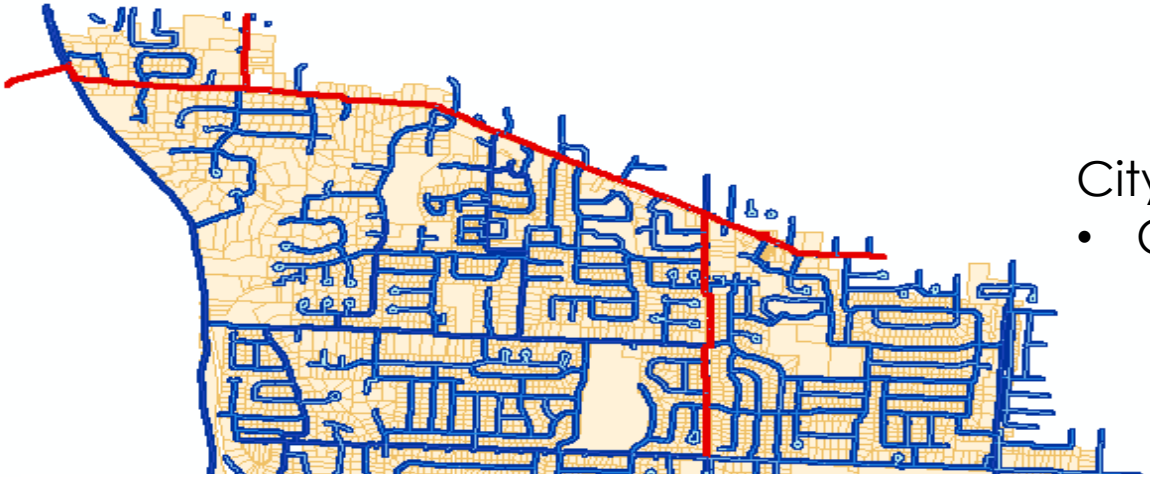


City of Upper Arlington, OH

- Consequence Factor:
  - Addresses

Address Points per Thousand Feet	Score	Pipe Length (ft)	% of Total Length
0	0	215,671.03	20.8%
0.232 – 9.452	1	209,183.34	20.2%
9.453 – 14.676	2	193,022.50	18.6%
14.677 – 21.299	3	205,277.60	19.8%
21.300 – 78.100	4	204,076.86	19.7%
78.101 – 1500.000	5	8,874.03	0.9%
	Total	1,036,105.36	100%

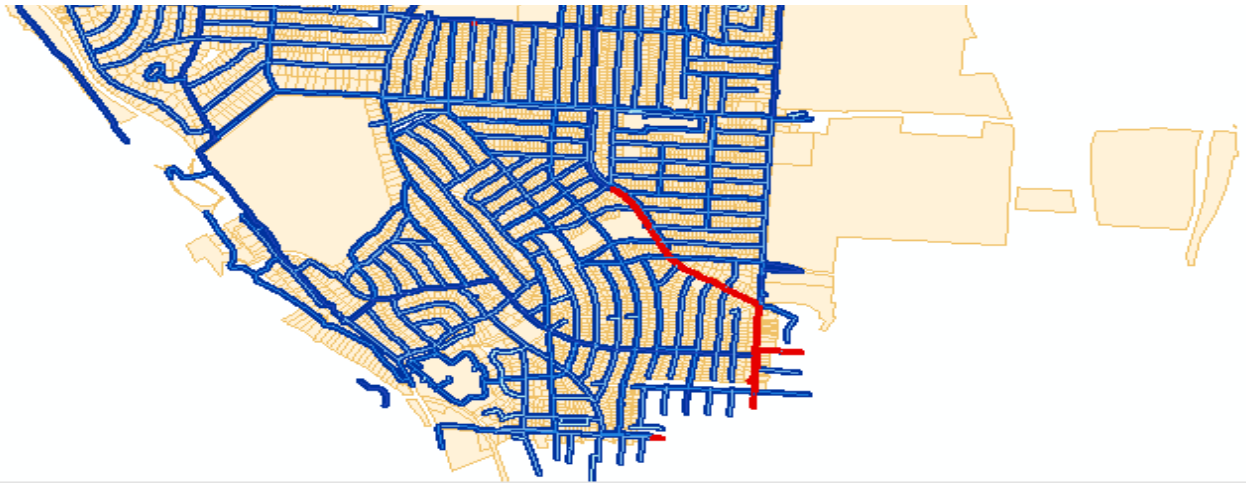


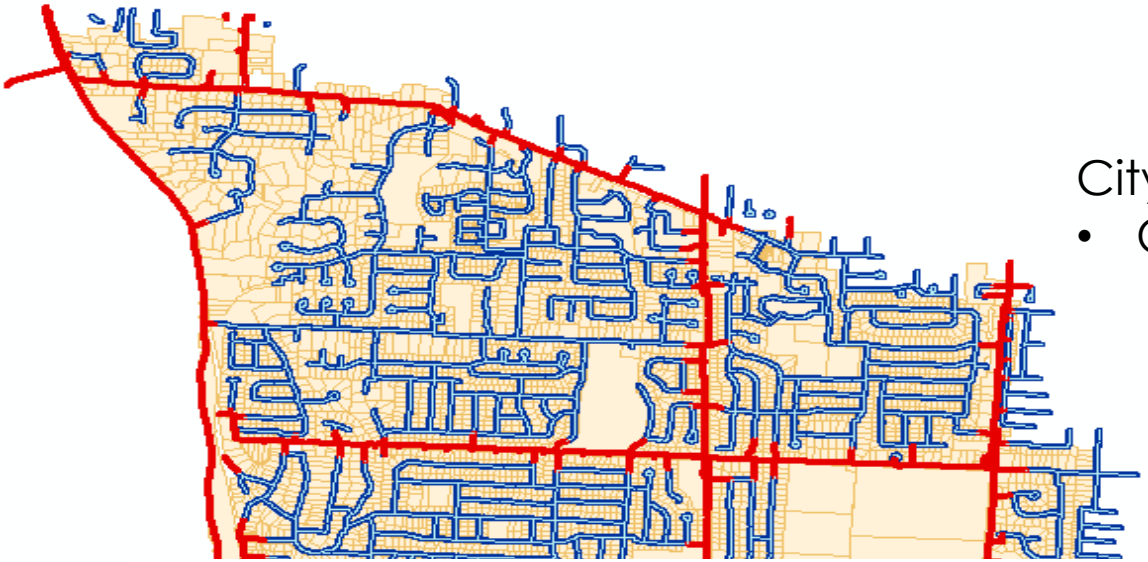


City of Upper Arlington, OH

- Consequence Factor:
  - Diameter

Pipe Diameter (inches)	Score	Pipe Length (ft)	% of Total Length
0.75 - 4	1	42,808.10	4.1%
6	2	410,957.27	39.7%
8	3	395,876.80	38.2%
10 - 12	4	148,712.39	14.4%
16 - 24	5	37,750.80	3.6%
	Total	1,036,105.36	100%





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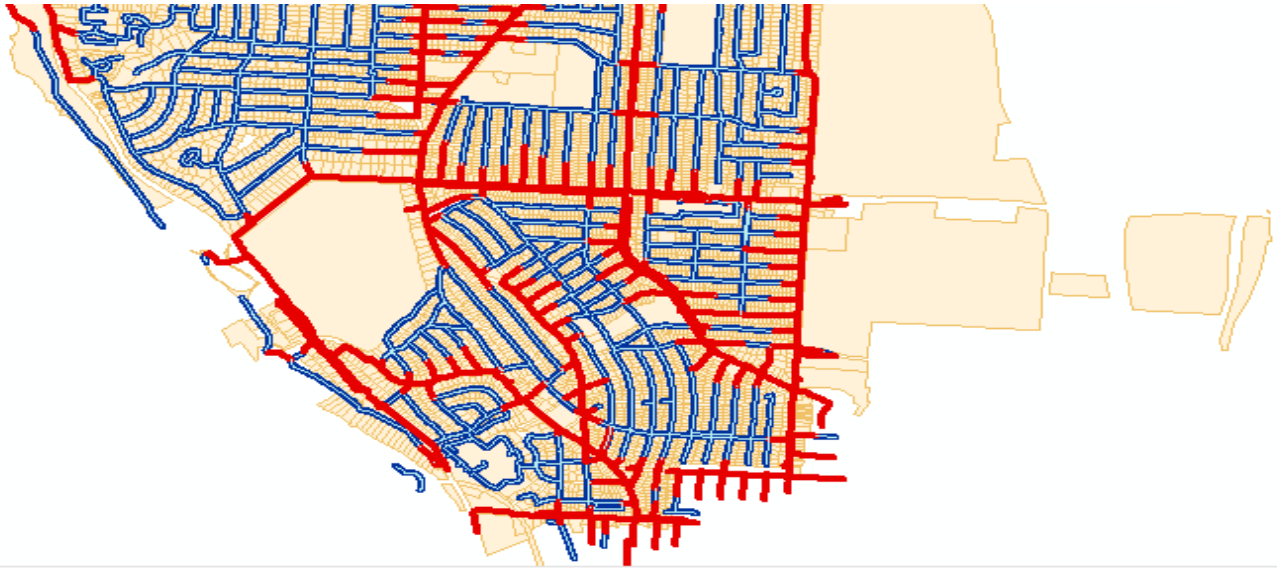
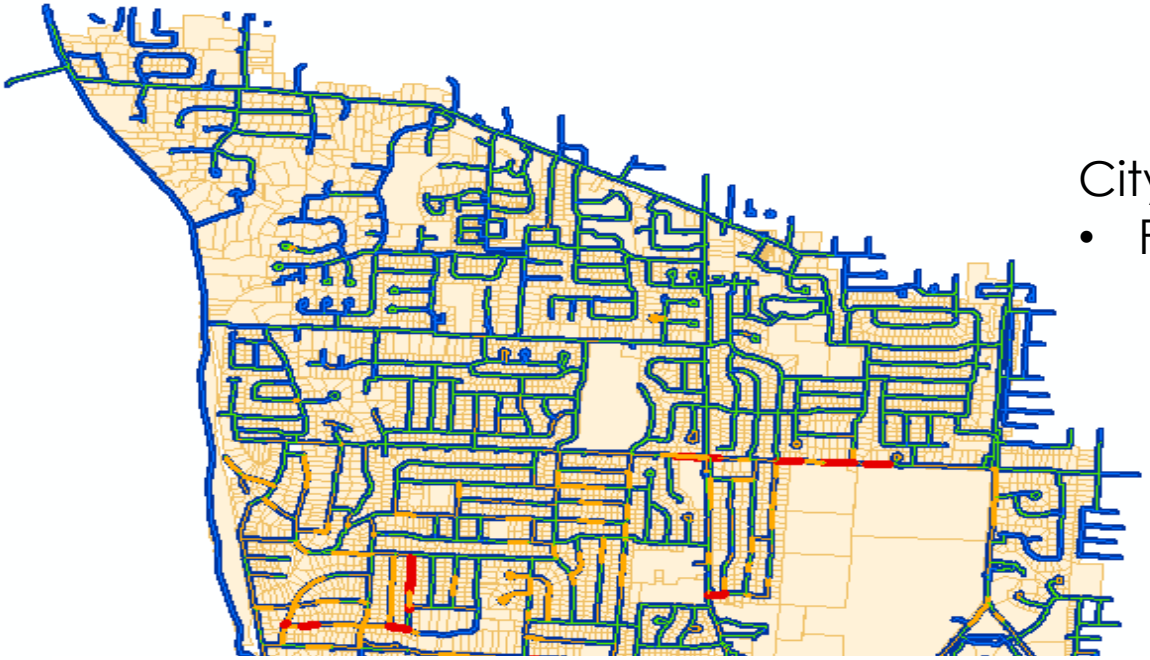
- Consequence Factor:
  - Road Proximity

Proximity to Major Roads (Score)	Pipe Length (ft)	% of Total Length
0	891,578.88	86.1%
3	144,526.48	13.9%
Total	1,036,105.36	100%



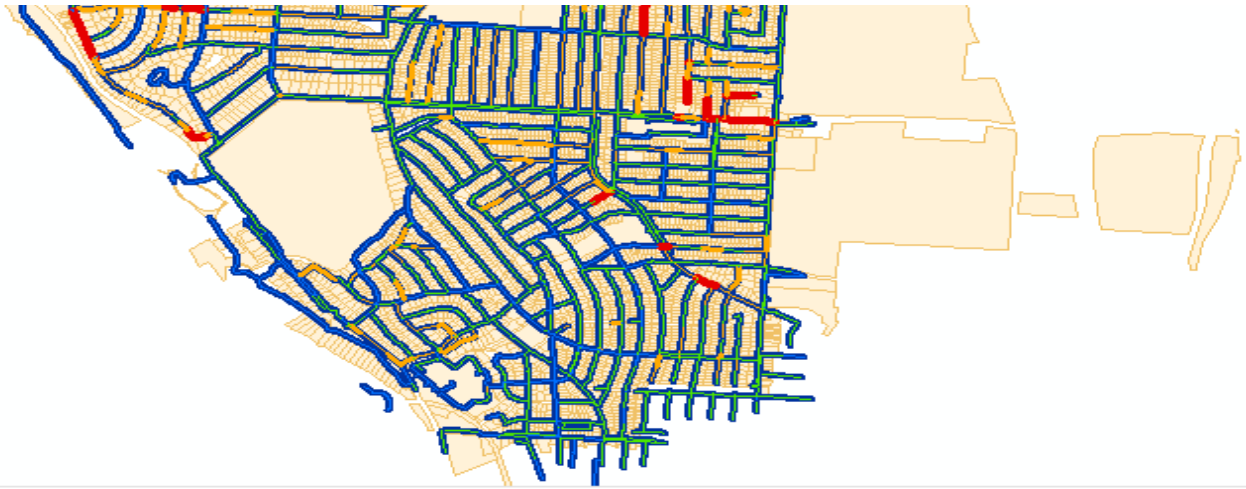


City of Upper Arlington, OH

- Final Score

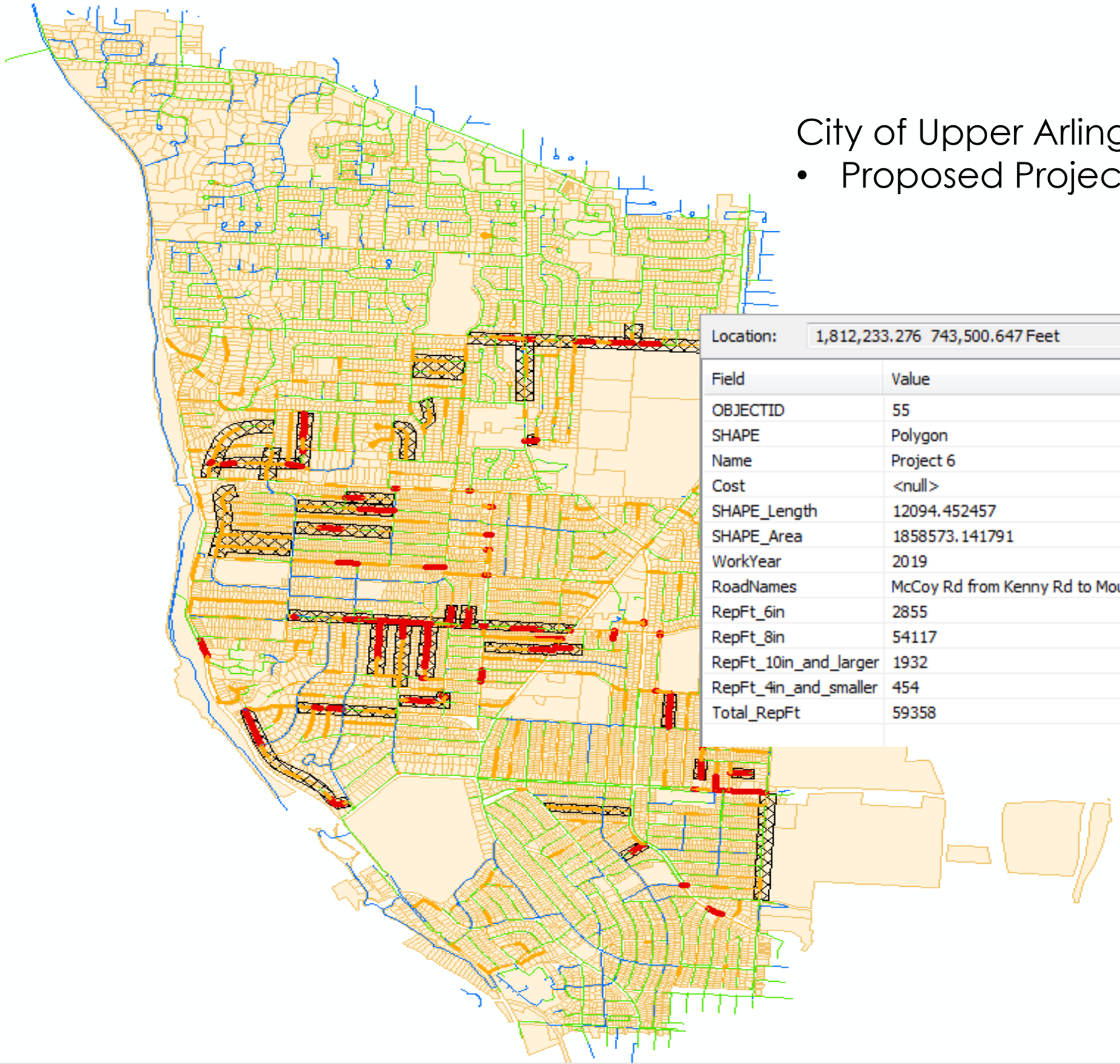
Total Likelihood Score = 0.2*(Age Score) + 0.2*(Installation Year Score) + 0.1*(Soil Score) + 0.5*(Active Breaks Score)

Total Consequence Score = 0.2*(Customer Score) + 0.2*(Diameter Score) + 0.2*(Major Road Score) + 0.2*(Land Use Score) + 0.2*(Project Score)



City of Upper Arlington, OH

- Proposed Projects

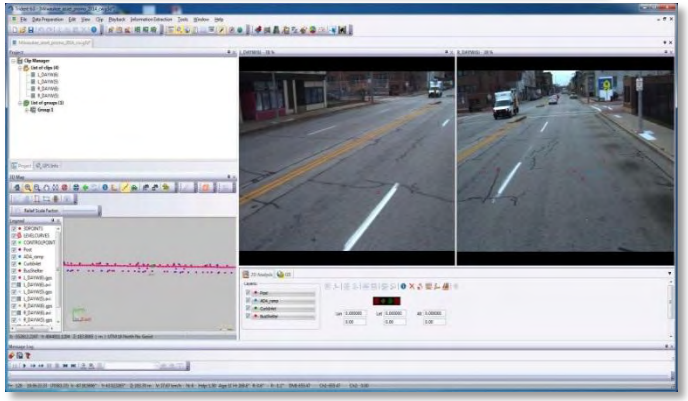


Location: 1,812,233.276 743,500.647 Feet

Field	Value
OBJECTID	55
SHAPE	Polygon
Name	Project 6
Cost	<null>
SHAPE_Length	12094.452457
SHAPE_Area	1858573.141791
WorkYear	2019
RoadNames	McCoy Rd from Kenny Rd to Mountview Rd
RepFt_6in	2855
RepFt_8in	54117
RepFt_10in_and_larger	1932
RepFt_4in_and_smaller	454
Total_RepFt	59358

GIS in Asset Management

- Pavement
  - Laser Road Imaging System
  - Image Data Collection
  - Location Referencing System
  - Roughness and Rutting
  - Surface Distress
  - Falling Weight Deflectometer



- Right of Way Inventory
  - Signs, Street Lights, Signals
  - Fire Hydrants
  - Curb/Gutter, Guard Rail, Sidewalks
  - Pavement Markings and Striping

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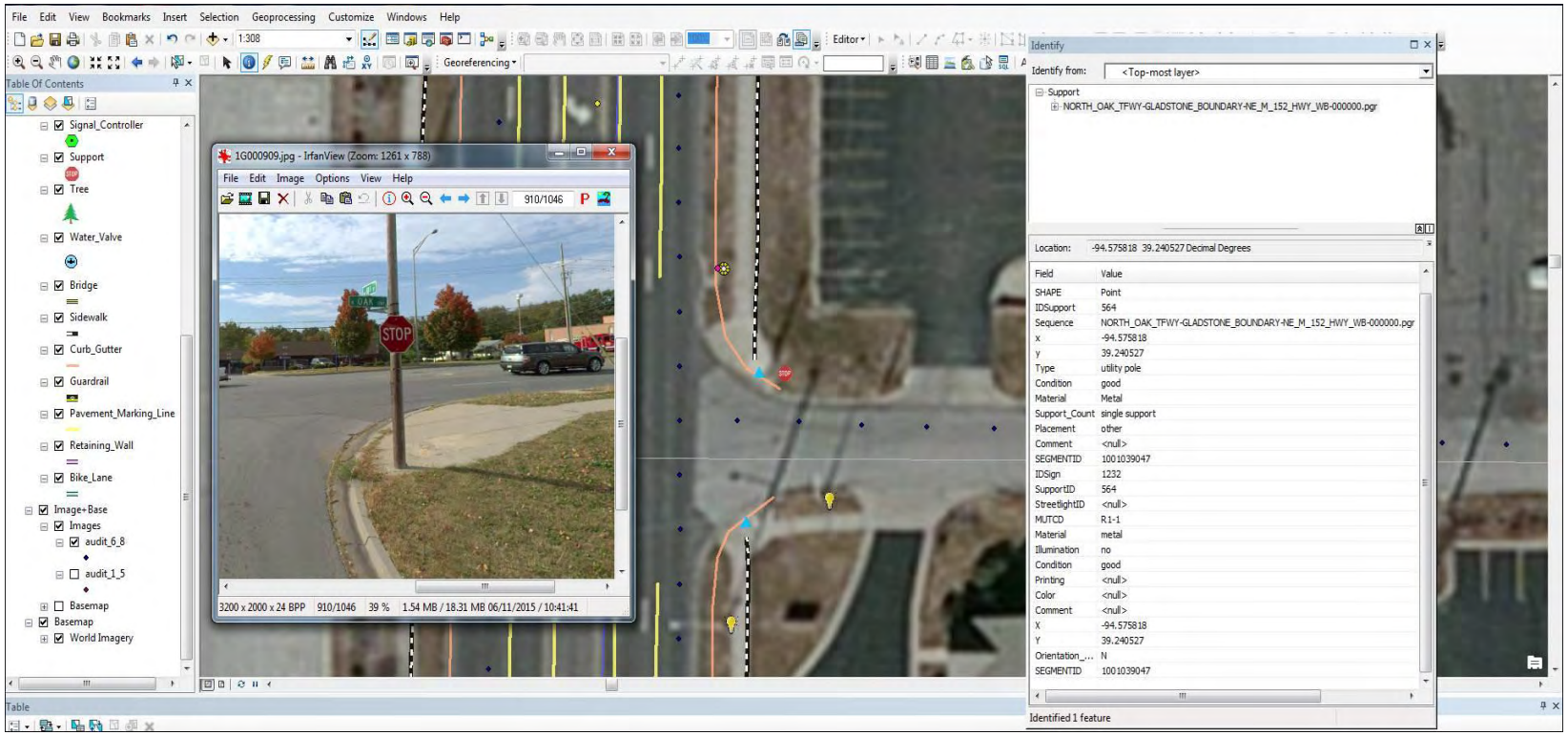
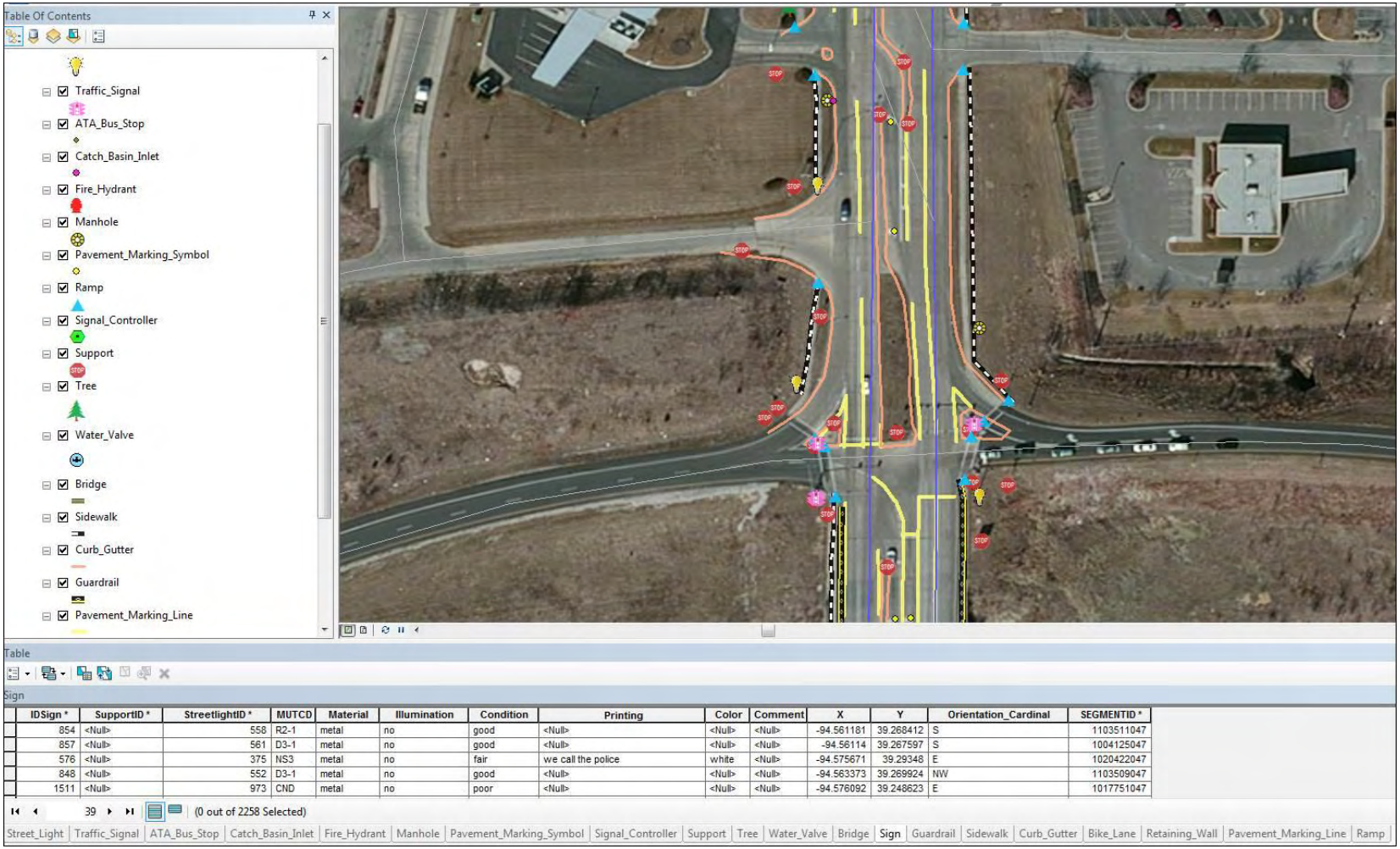
GIS in Asset Management

- Example ROW Inventory Collection

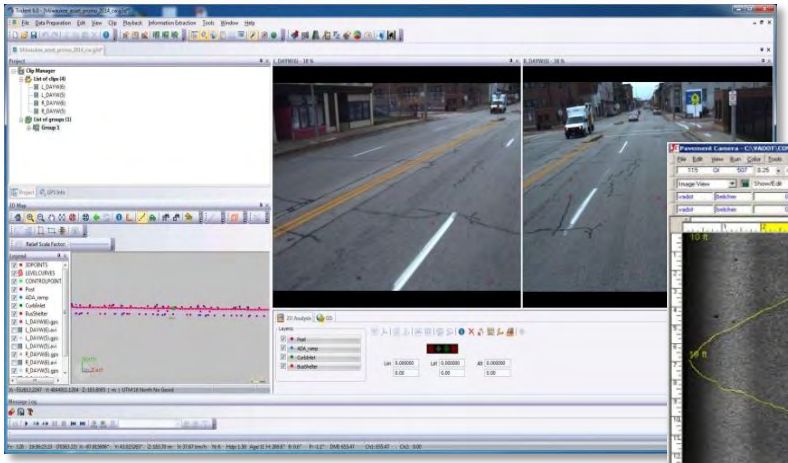


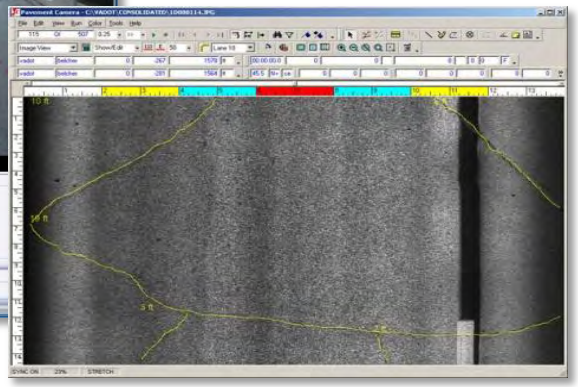
GIS in Asset Management

- Example ROW Inventory Collection



GIS in Asset Management





Stantec's Road Tester 3000 (RT3000):

- Fully mobile solution
- Accurately and efficiently collect pavement condition data
- Integrated with lasers, inertial GPS, and high-resolution digital imagery
- Simultaneously collect pavement profile, rutting, surface distress, roadway geometrics, pavement and ROW imagery.

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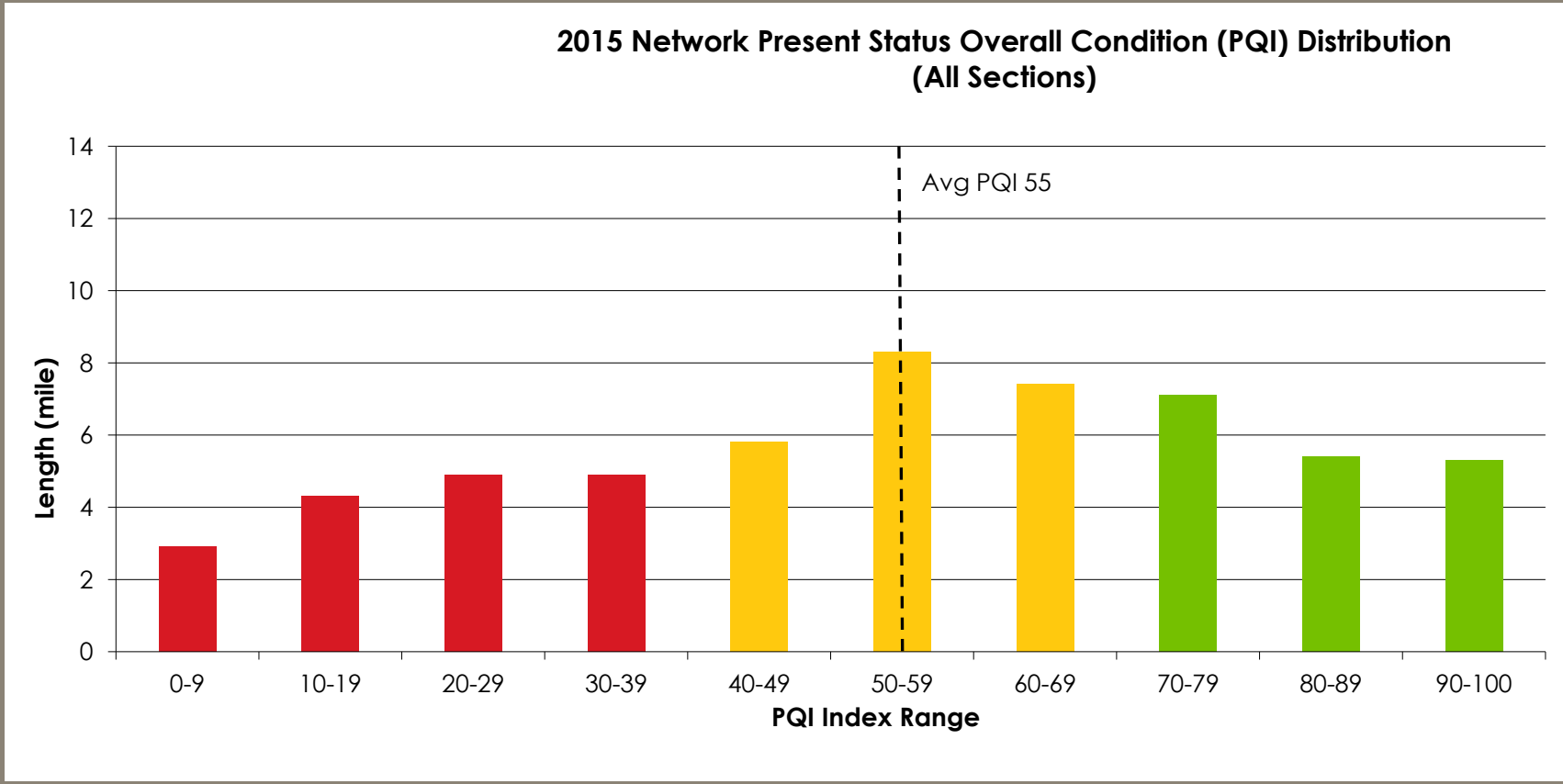
Overall Condition



- Local Avg PQI = 50
- Collector Avg PQI = 60

Typically, higher volume/higher use roads have a higher level of service.

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Excellent PQI 100

Appian Av (E Maumee Av – Short St)

Good PQI 80

Lemans Dr (Capri Dr – Duquesne Dr

Fair PQI 60

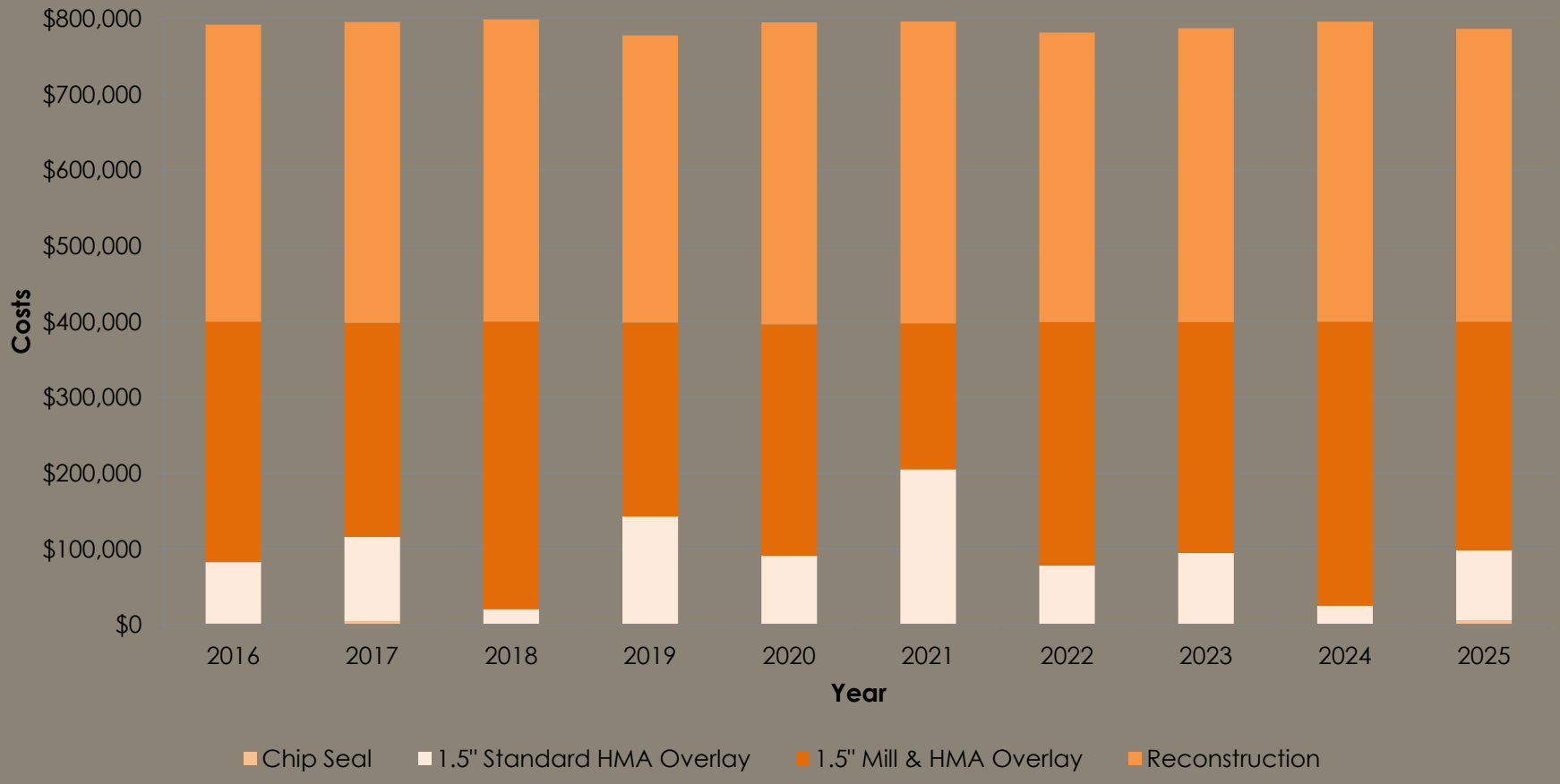
Wayne Park Dr (W Riverview Ave - Co Rd M 1)

Poor PQI 10

Clairmont Av (Glenwood Av – Kenilworth Av)

Treatment Recommendations

$400,000 Resurfacing + $400,000 Reconstruction



Note: It costs less to keep good roads in good condition.

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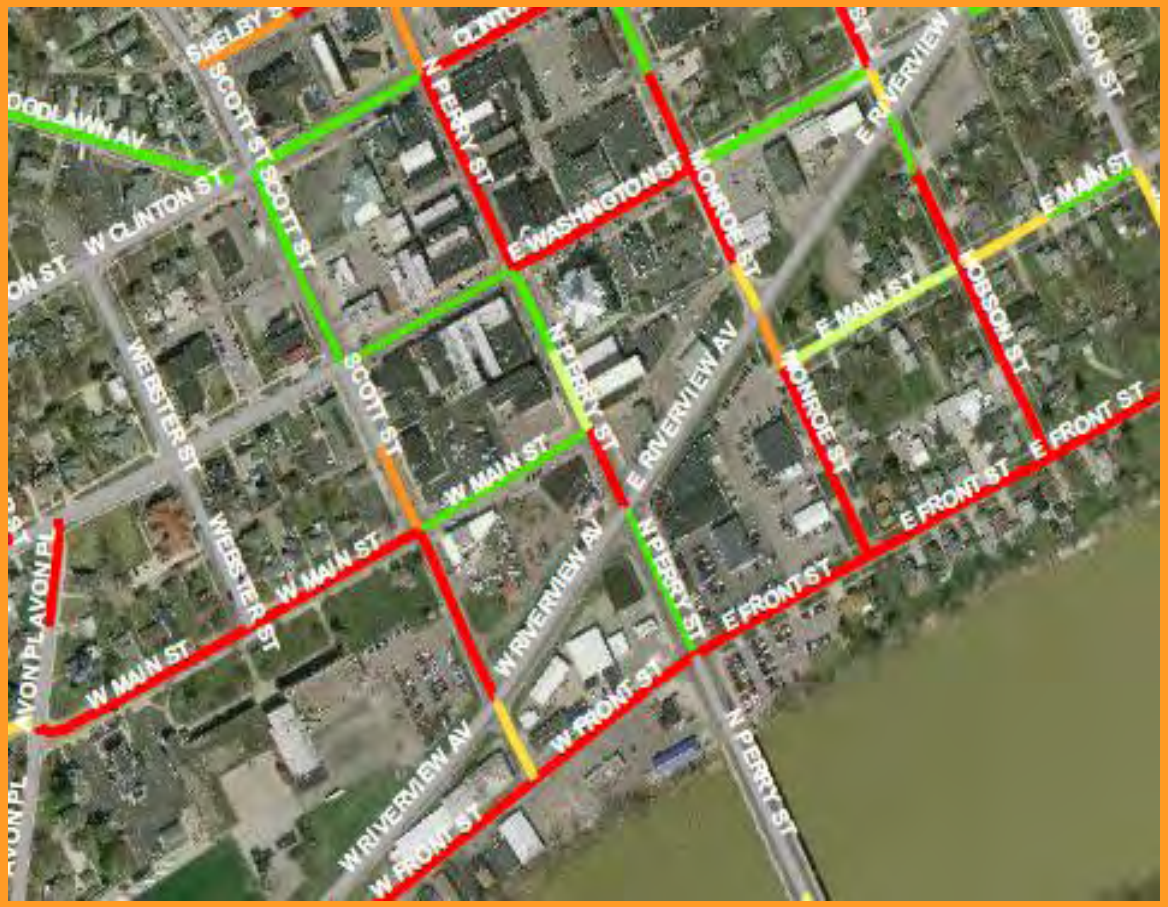
Integrated into GIS

- Use to visualize the results/current condition of the street
- Use to develop thematic maps for PQI, Year of Need, Year Planned, etc.
- Ability to update and maintain the attribute data to allow for continued management and update



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Ohio Senate Bill 2

Ohio Senate Bill 2

A public water system shall demonstrate the technical, managerial, and financial capability of the system to comply with this chapter and rules adopted under it by implementing an ***asset management program*** not later than October 1, 2018.

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Ohio Senate Bill 2

Why now? What is driving this from Ohio EPA?

- Harmful Algae Blooms affecting Lake Erie
- Toledo Algae Bloom Issues
- Flint, MI Lead Pipe Issues
- Sebring, Ohio Community Lead Pipe Issues
- Previously on Ohio House Bill 333

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Ohio Senate Bill 2

A public water system shall include in the asset management program all of the following:

- Inventory and evaluation of all public water system assets;
- Public water system operation and maintenance programs;
- Public water system emergency preparedness and contingency planning program;
- Criteria and timelines for public water system infrastructure rehabilitation and replacement;
- Approved public water system capacity projections and public water system capital improvement planning;
- A long-term funding strategy to support the public water system's asset management program implementation.

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GIS in Asset Management

GIS supports Asset Management in many ways:

- Asset Inventory
- Data Analysis
- CIP Planning
- Integration into Business Processes
  - Asset Management Solution
  - Work Order Management

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Questions?

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