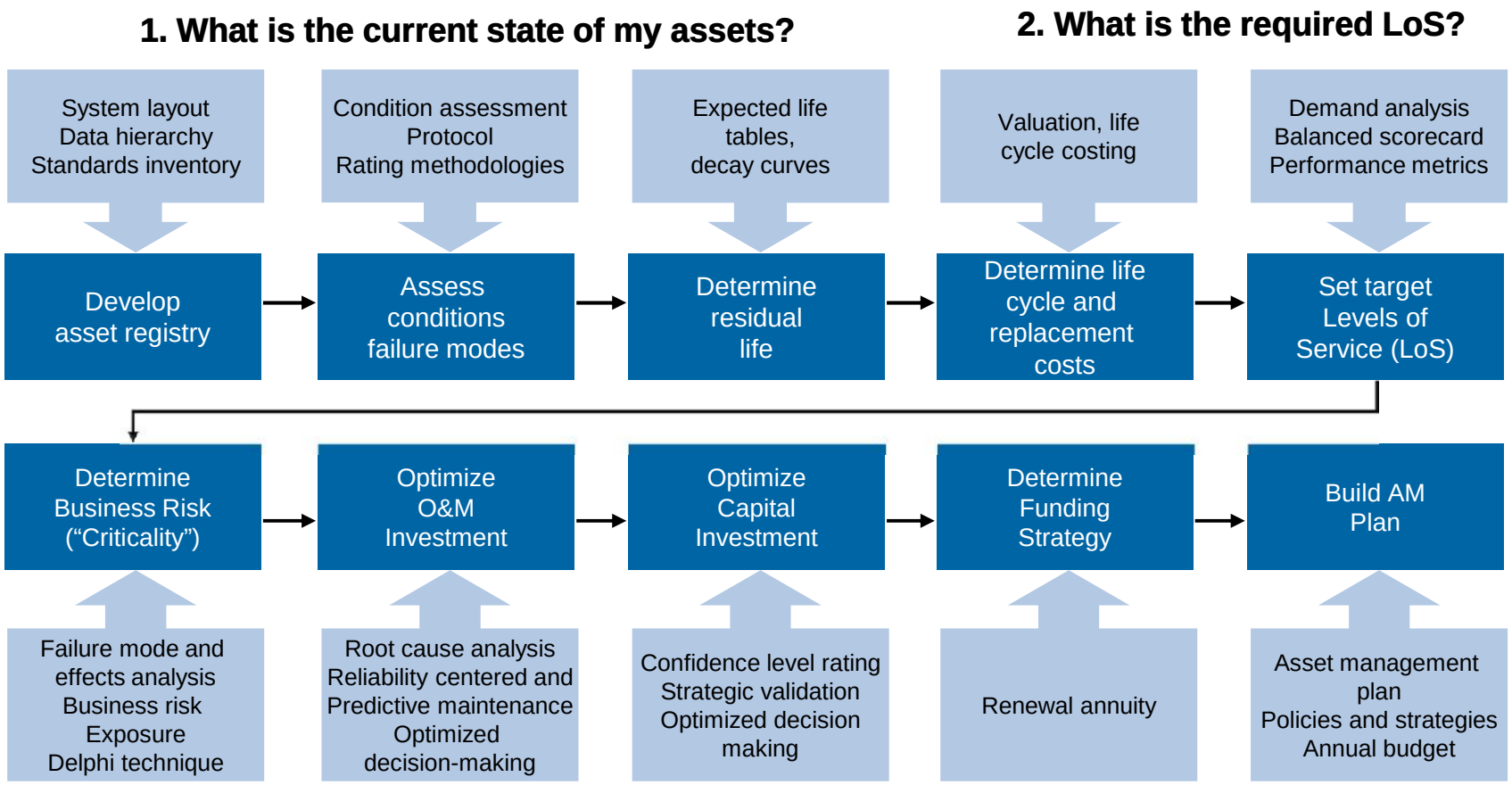
Annapolis Water & Sewer System Evaluation – Asset Management Strategies

City Council Update-July 2016

Project approach objectives

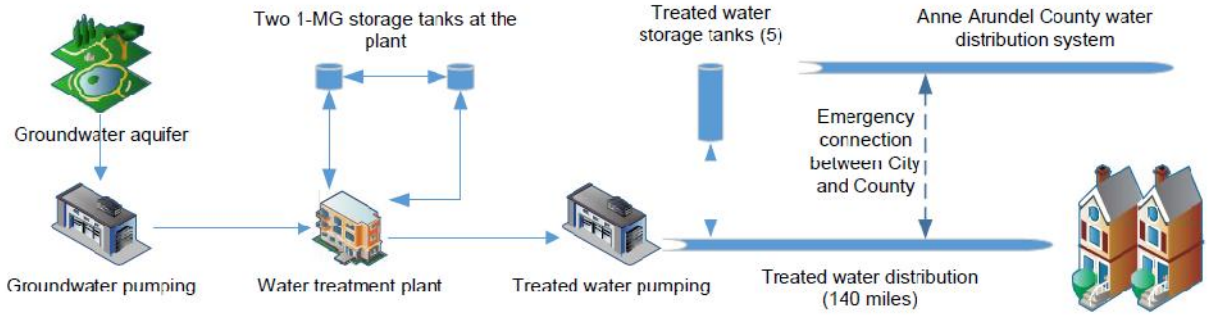
- Complete a desktop condition assessment to support initiation of high priority projects.
- Development of a comprehensive plan for prioritization and for long-term asset management strategies for repair and replacement.

Asset Management Framework

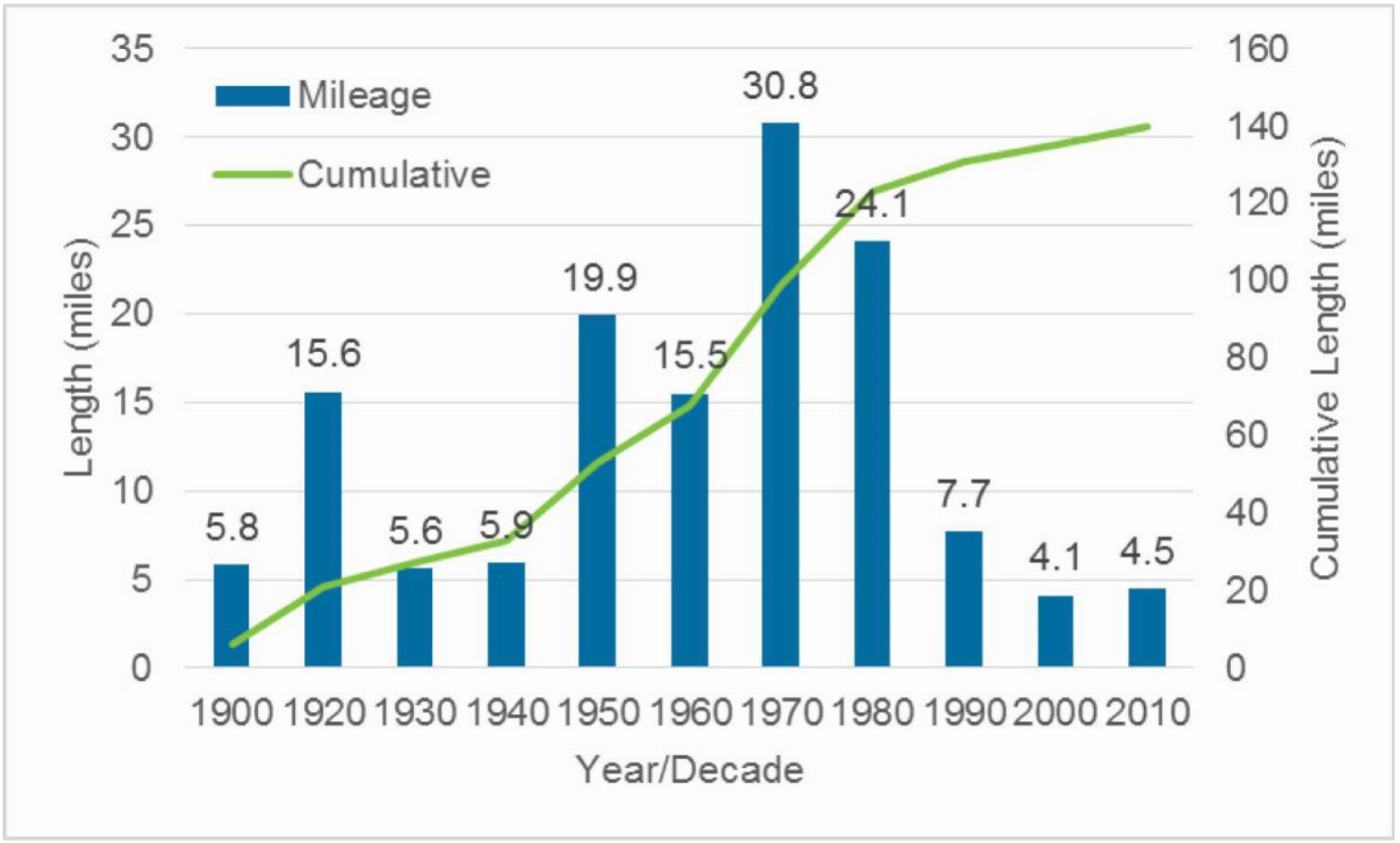


Water pipe data

1.5 billion gallons of potable water produced per year	**8 mgd** water treatment capacity	**140** miles/7,185 segments of water pipes
1 water treatment plant	**5** elevated water storage tanks	**2,900** water valves
8 groundwater wells (**3** aquifers)	**2** 1-MG/each finished water storage tanks	**1,240** fire hydrants

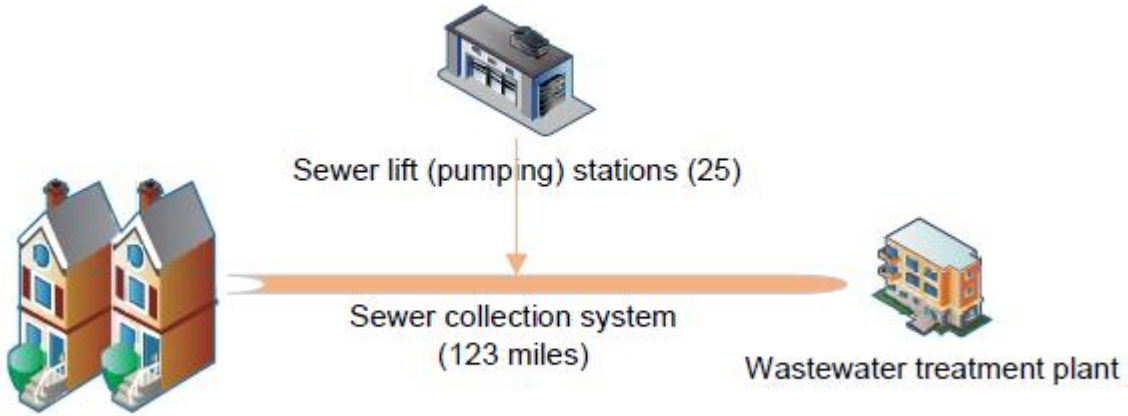


Water Distribution Pipe In-Service per Installation Decade

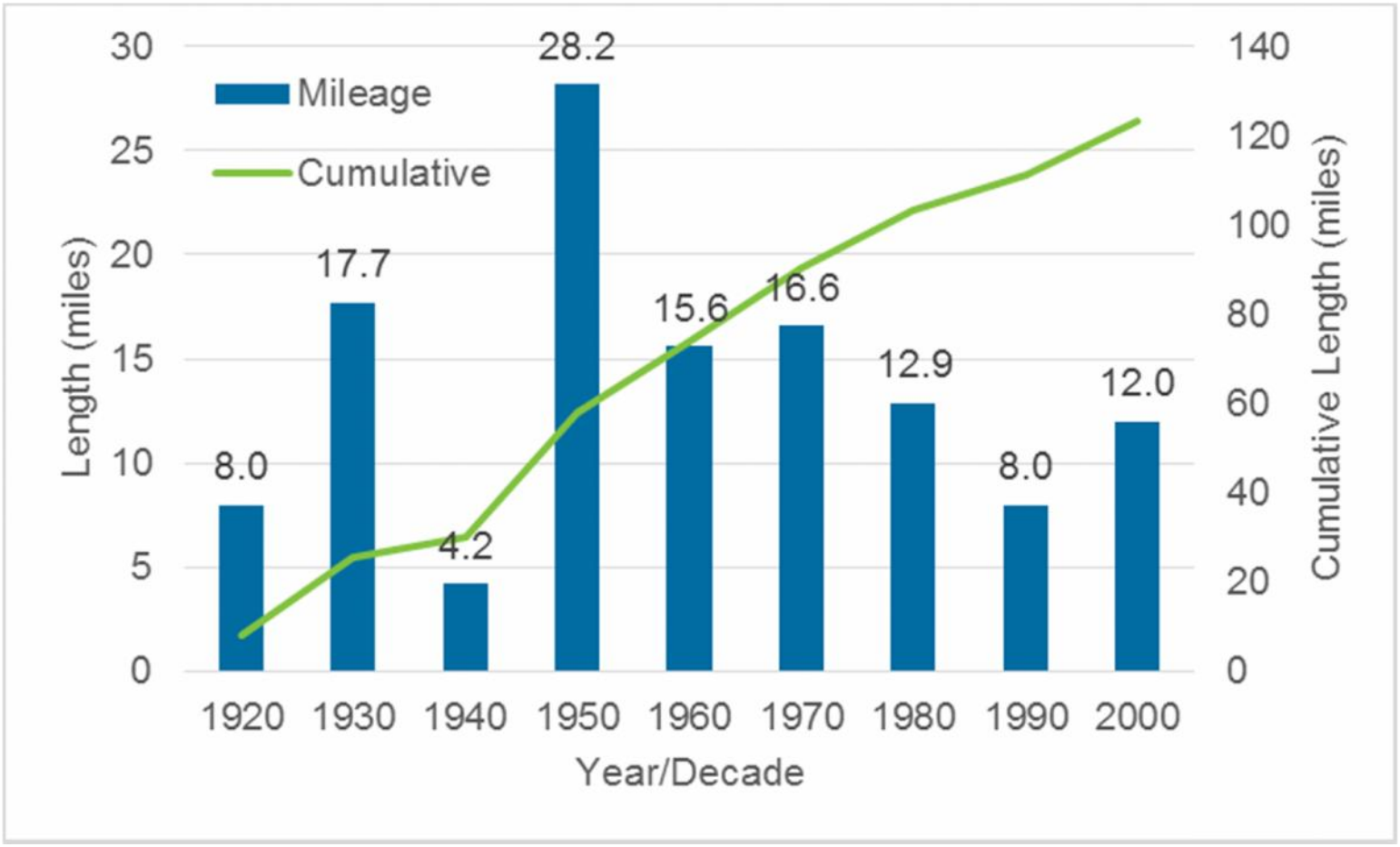


Sewer pipe data (129 miles / 3,618 segments)

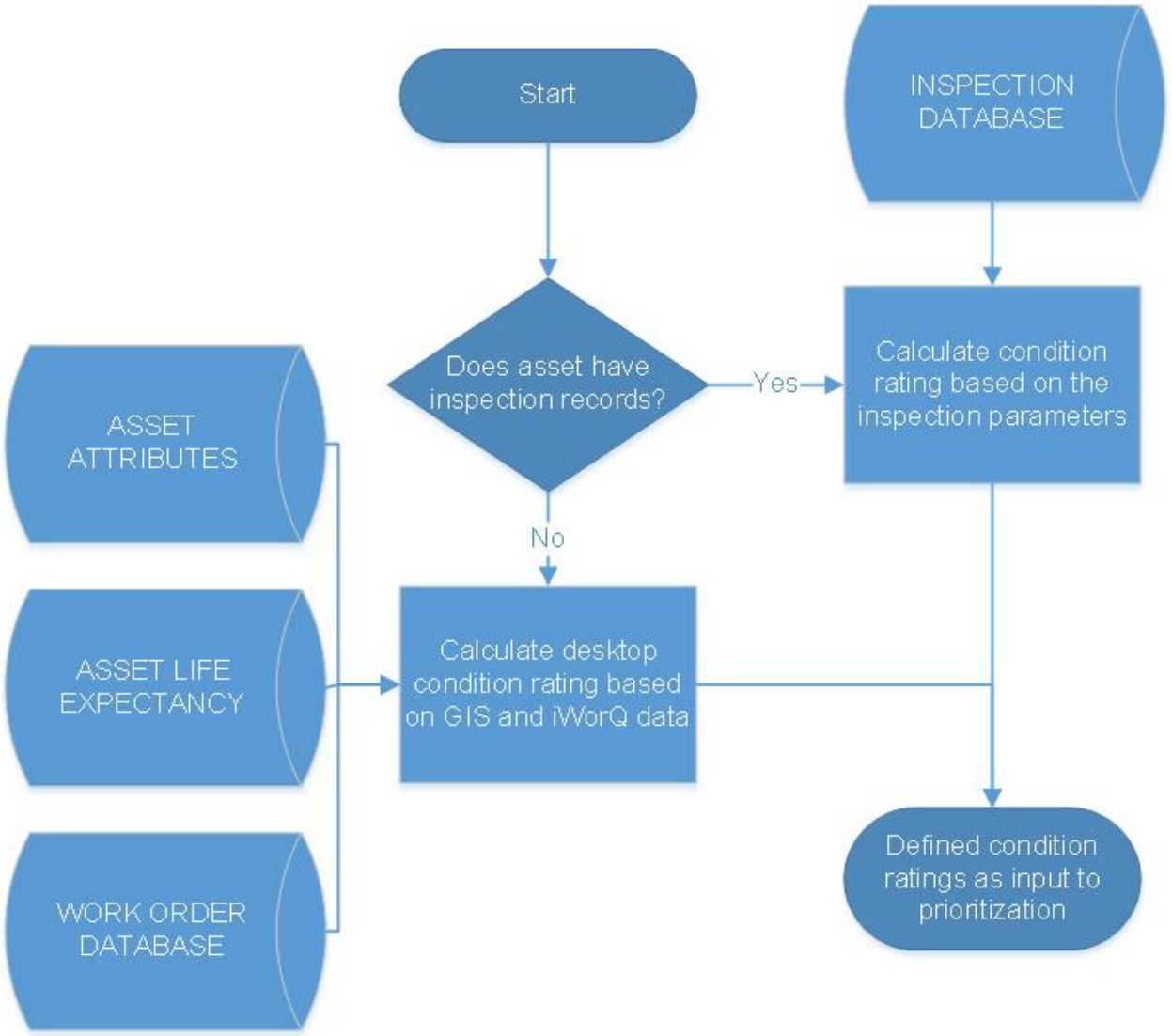
11,200 sewer accounts	5.0 mgd average sewer collection system flow	4,892 acre sewer service area in the City
123 miles of pipes and 3,542 manholes	1 wastewater treatment plant (co-owned with the County)	25 sewer lift stations



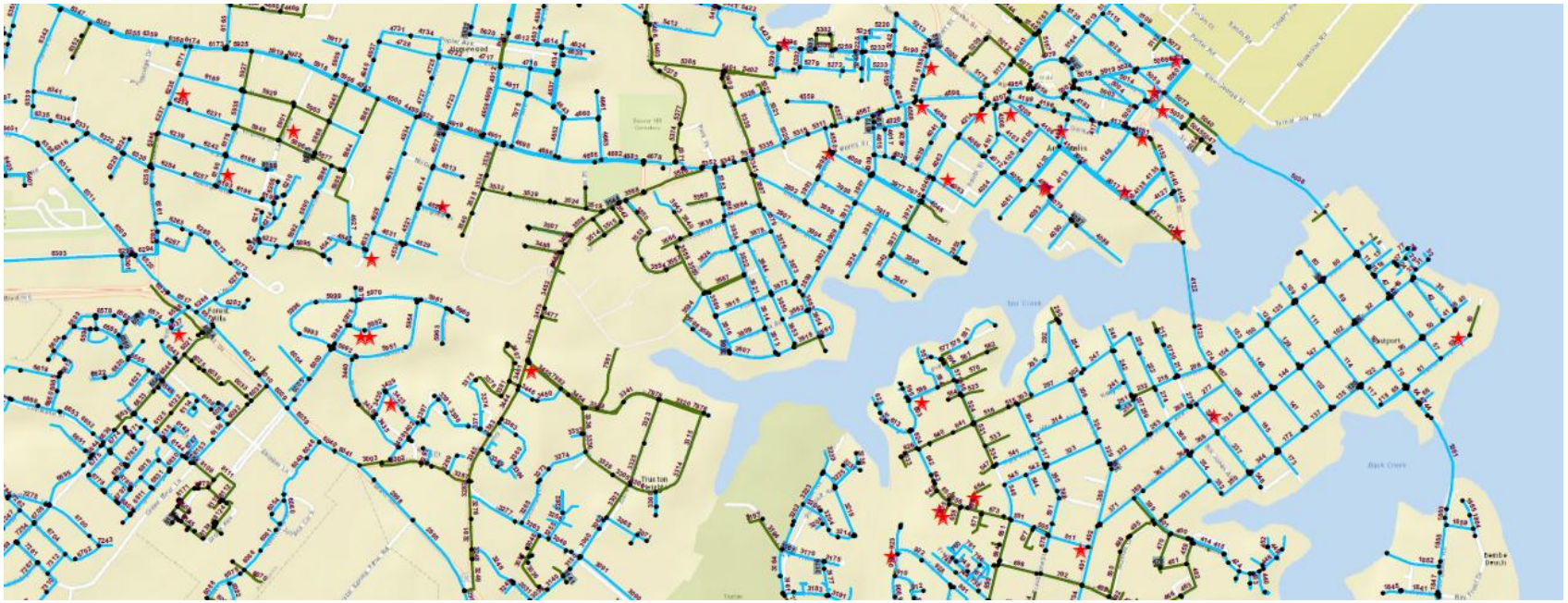
Sewer Collection Pipe In-Service per Installation Decade



Desktop Condition Assessment



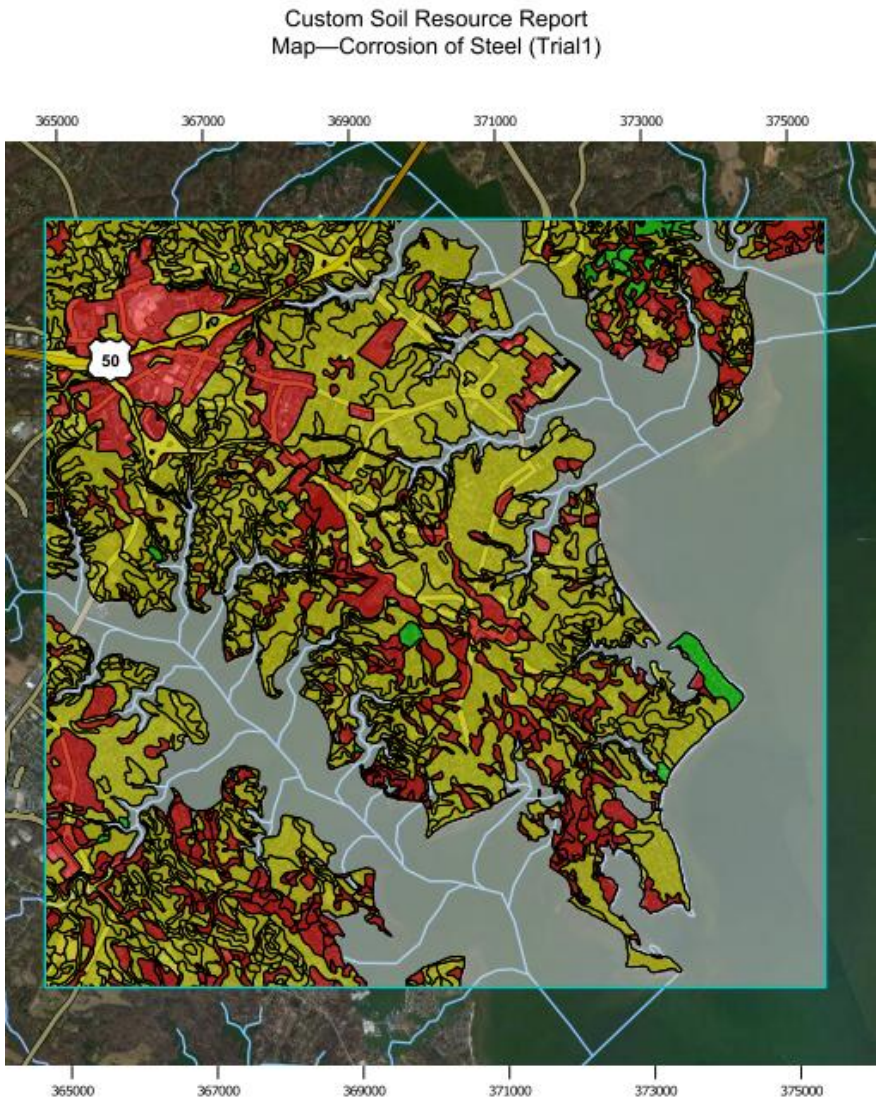
Water system assets



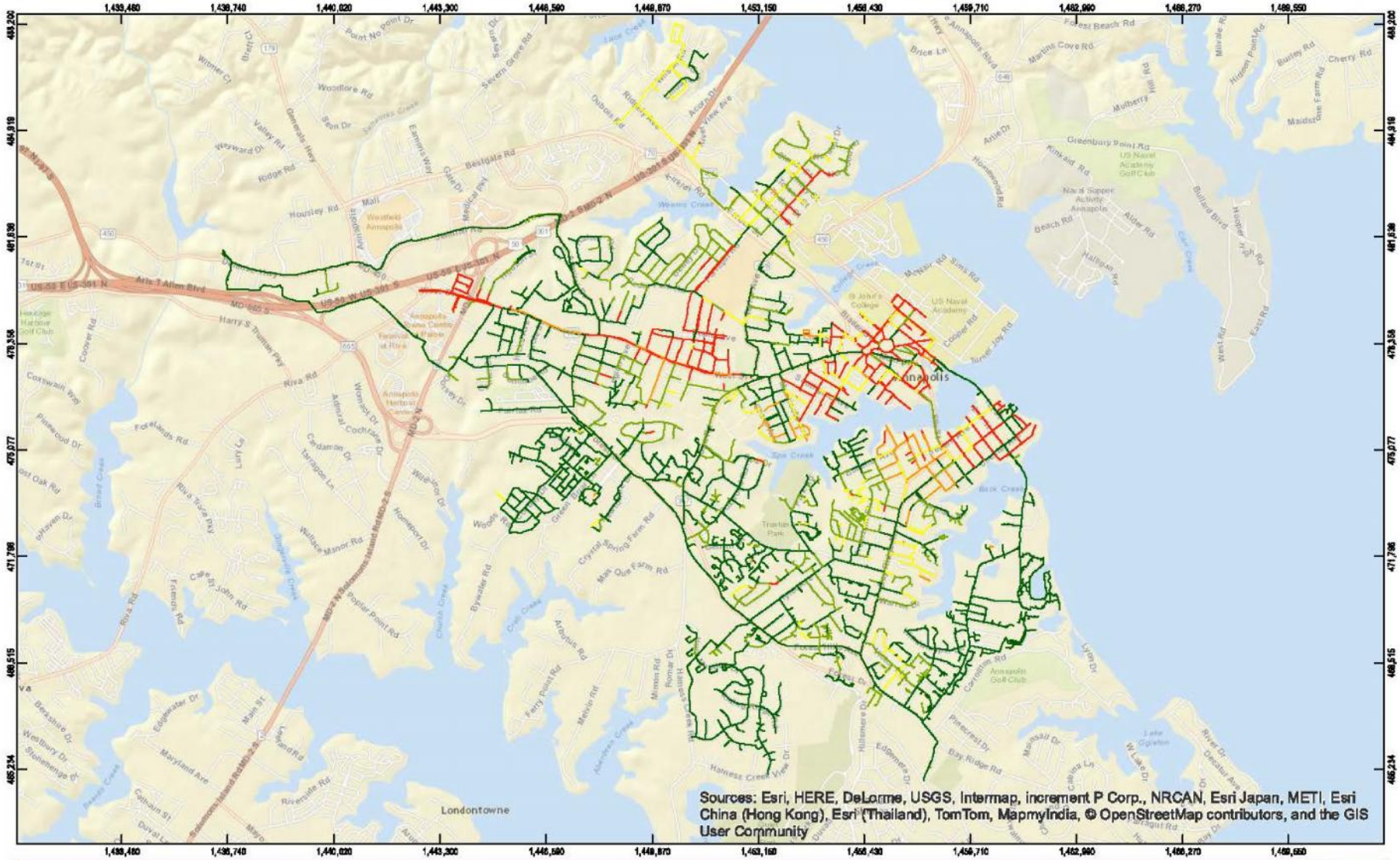
Correlated Water Main Break Historical Data with Asset Inventory Using GIS

Soil GIS data contains soil map units (e.g. AdA)

- Soil map units' corrosivity for steel from USDA for different soil type
- 77 different soil types in the selection area on the right
- Spatial link between pipes and soil corrosivity



Condition Rating – Water Distribution Piping



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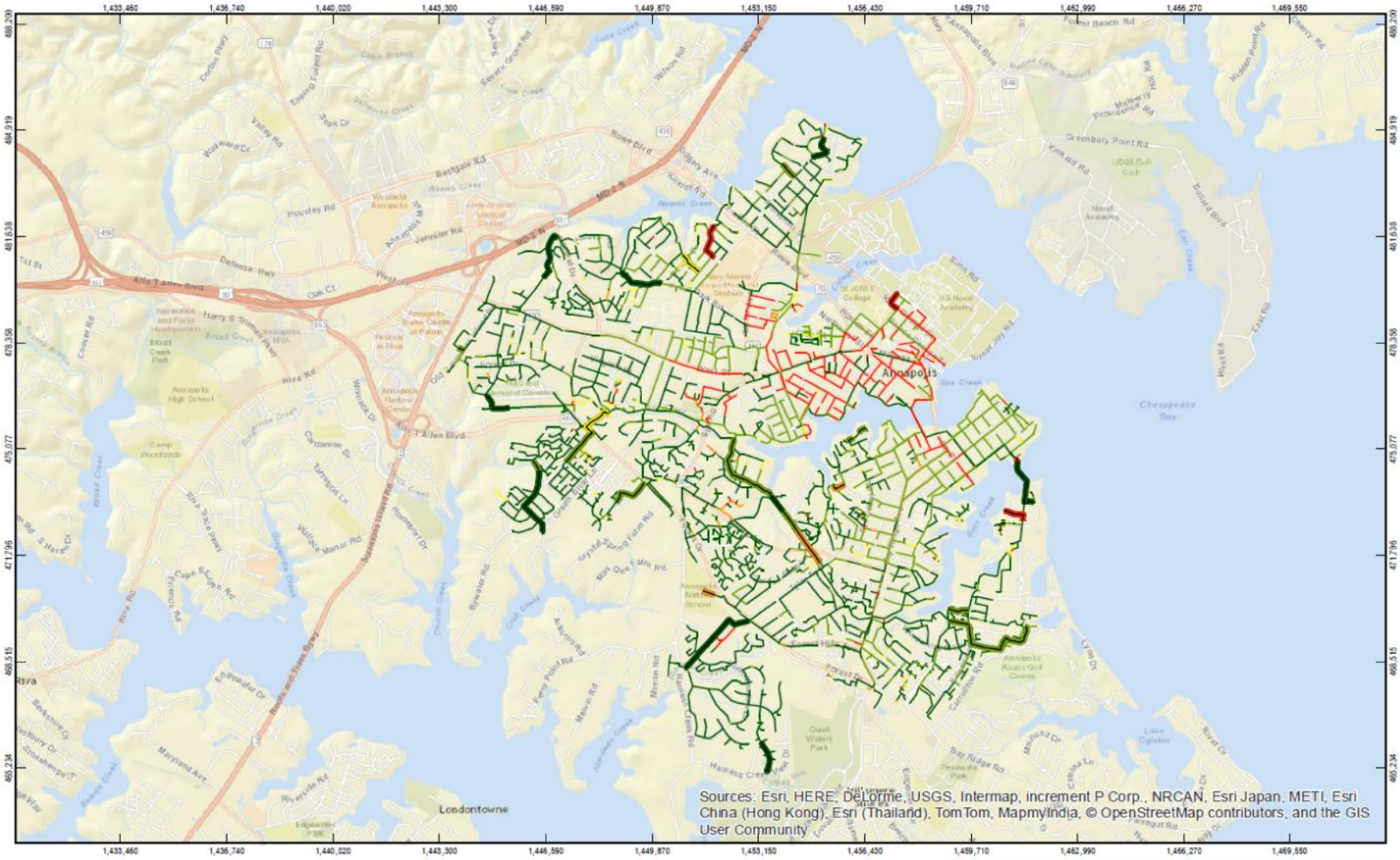

Paper Size ANSI A

0 2,450 4,900

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Maryland FIPS 1900 Feet

N W E S

Force Mains		Gravity	
1	3	1	3
2	4	2	4
	5		5

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City of Annapolis
Water/Sewer Buried Asset Evaluation

Buried Sewer Asset Condition Ratings

Job Number 86-18182
Revision A
Date 15 Jul 2016

Sewer

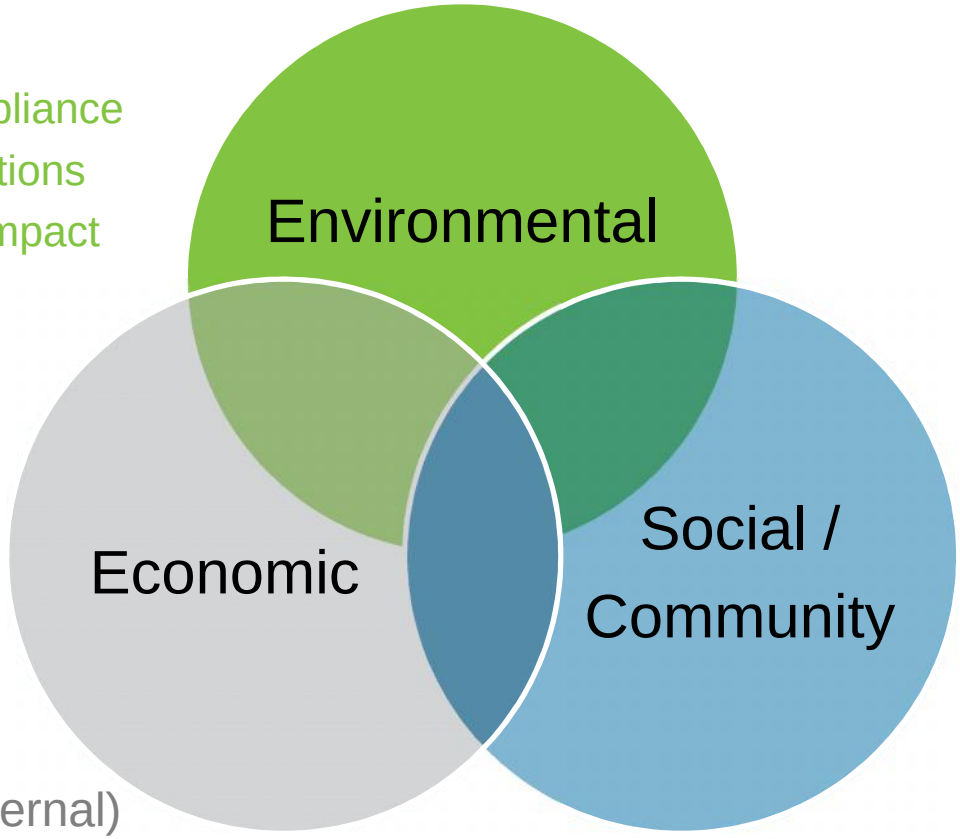
C:\Users\vrsekar\Desktop\City of Annapolis\July 2016 Maps\Sewer_Condition.mxd

16701 Melford Blvd Ste 330 Bowie MD 20715 USA T 240 206 6810 F 240 206 6811 E bowmail@ghd.com W www.ghd.com

Created by:vrsekar

Consequence of Failure

Regulatory compliance
Regulatory violations
Environmental impact



Health & safety
Levels of service
Public image

Direct cost (external)
Indirect cost (internal)

Triple Bottom Line

COF Scoring Guide for Each of the Six Elements

COF	Loss of Service Impact (E01)	Integrity & Dependability (E02)	Public Health & Safety (E03)	Fiscal (E04)	Resource & Operational Impact (E05)	Environment (E06)
0	No impact	No impact	No impact	Up to $500	No impact	No impact
1	Less than 100 customer-hours without service	Alert posted on website but no media attention; no critical customers affected	First aid only	Up to $5,000	Less than 8 resource hours required for correction	Imperceptible environmental impact
2	Up to 500 customer-hours without service OR one critical customer out of service	Minor media reporting and/or less than 10 complaints; commercial customers affected	Minor injury or sickness (e.g. sprains, bruises, sickness)	Up to $50,000	Between 8 and 24 resource hours required for correction	Regulatory sanction possible
6	Up to 1,000 customer-hours without service OR more than one critical customer out of service	Regional media coverage and/or concern from politicians and other stakeholders; business district customers affected	Moderate injury (e.g. broken bones)	Up to $100,000	Between 24 and 200 resource hours required for correction	Regulatory sanction likely
4	Up to 2,000 customer-hours without service	National media coverage and/or serious concern from politicians and other stakeholders; Gov't, schools, veterinary offices affected	Major injuries and/or some death	Up to $250,000	Between and 200 and 1,000 resource hours required for correction	Regulatory sanctions; damage reversible in less than one year
5	More than 2,000 customer-hours without service	Loss of a rate increase and/or an organizational restructuring; Critical care units, medical service providers; dialysis patients affected	Substantial death, widespread injury and sickness	Over $250,000	More than 1000 resource hours required for correction	Extensive regulatory sanction virtually assured; damage reversal over one year

Attributes Used in Calculation of Ratings for the Six COF Elements

	Elements					
Attributes	Loss of Service Impact (E01)	Integrity & Dependability (E02)	Public Health & Safety (E03)	Fiscal (E04)	Resource & Operational Impact (E05)	Environment (E06)
Affected critical customers	X	X	X			
Depth of pipe or manhole (sewer only)				X	X	
Operational flow rate (sewer only)	X	X	X	X		X
Outage (customer-hours)	X	X	X			
Proximity to and type of road		X	X	X	X	
Proximity to buildings		X	X	X		
Proximity to environmentally sensitive areas				X		X
Proximity to parking garages		X	X	X	X	
Proximity to gas stations			X			X
Proximity to historical district		X			X	
Repair costs				X	X	
Zoning or land use		X	X			

Business Risk Exposure and Criticality

GIS

Desktop Condition Model

- Proximity to environmentally sensitive areas
- Asset size
- Client type supported
- State vs local road
- Other attributes impacting COF

Probability of failure

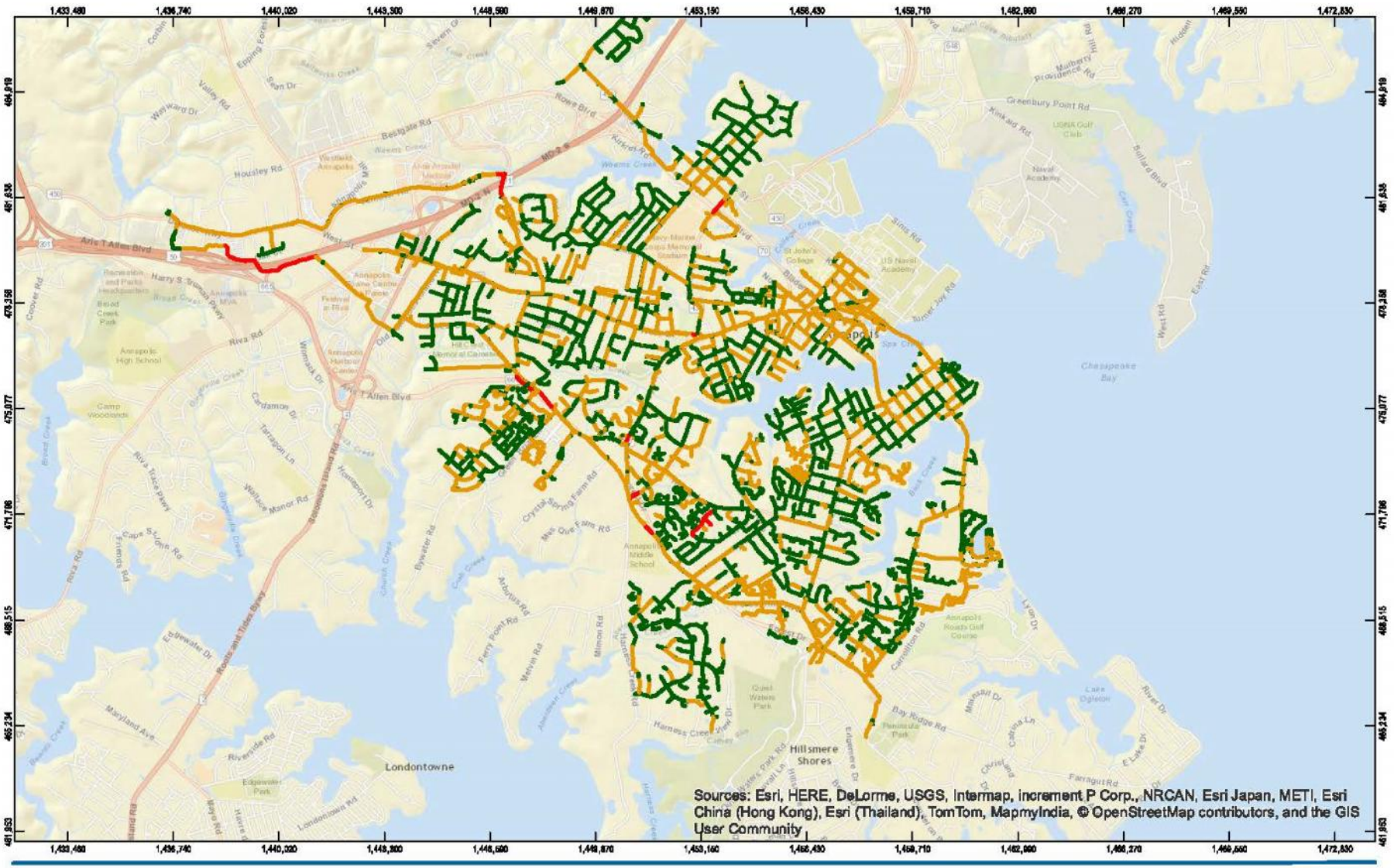
X

Consequence of failure

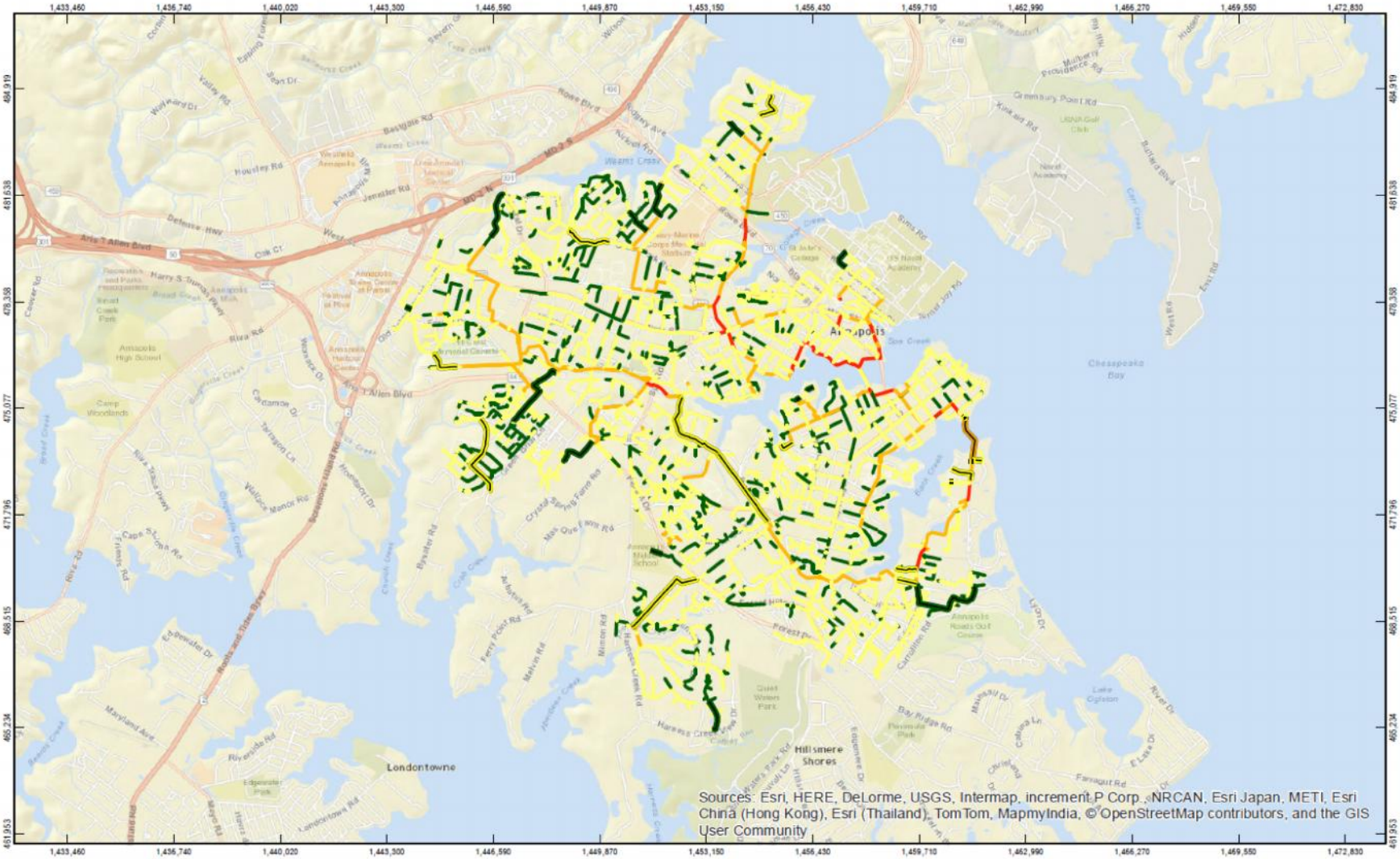
=

BRE Criticality

Consequence of Failure – Water Distribution Piping



Consequence of Failure – Sewer Collection Piping



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Feet

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N W E S

Force Mains	Gravity
<10	<10
>=10 & <19	>=10 & <19
>=19 & <24	>=19 & <24
	>=24

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City of Annapolis
Water/Sewer Buried Asset Evaluation

Job Number 86-18182
Revision A
Date 15 Jul 2016

Buried Sewer Asset Consequence of Failure Ratings

Sewer

C:\Users\vrsekar\Desktop\City of Annapolis\July 2016 Maps\Sewer_COF.mxd

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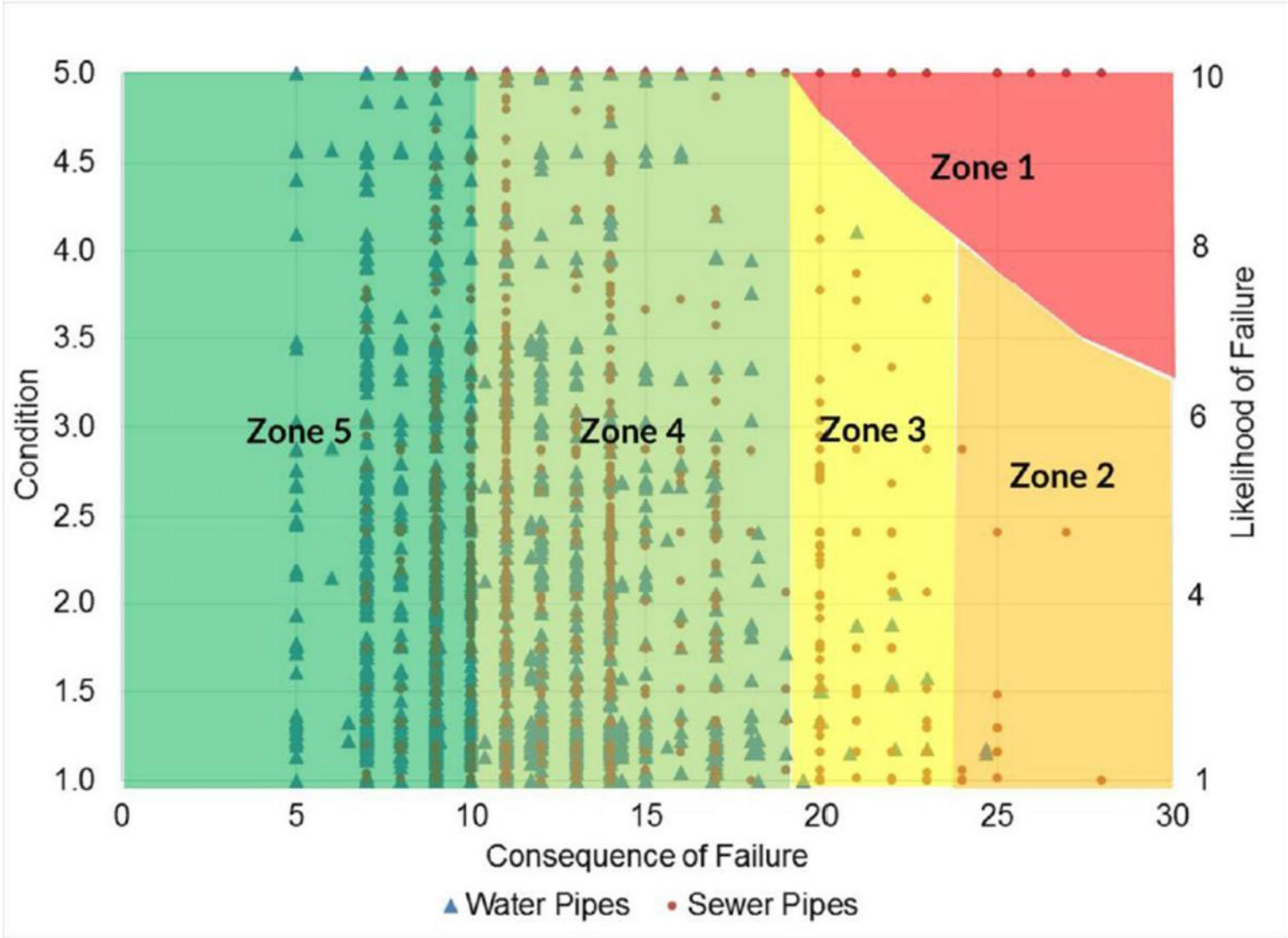
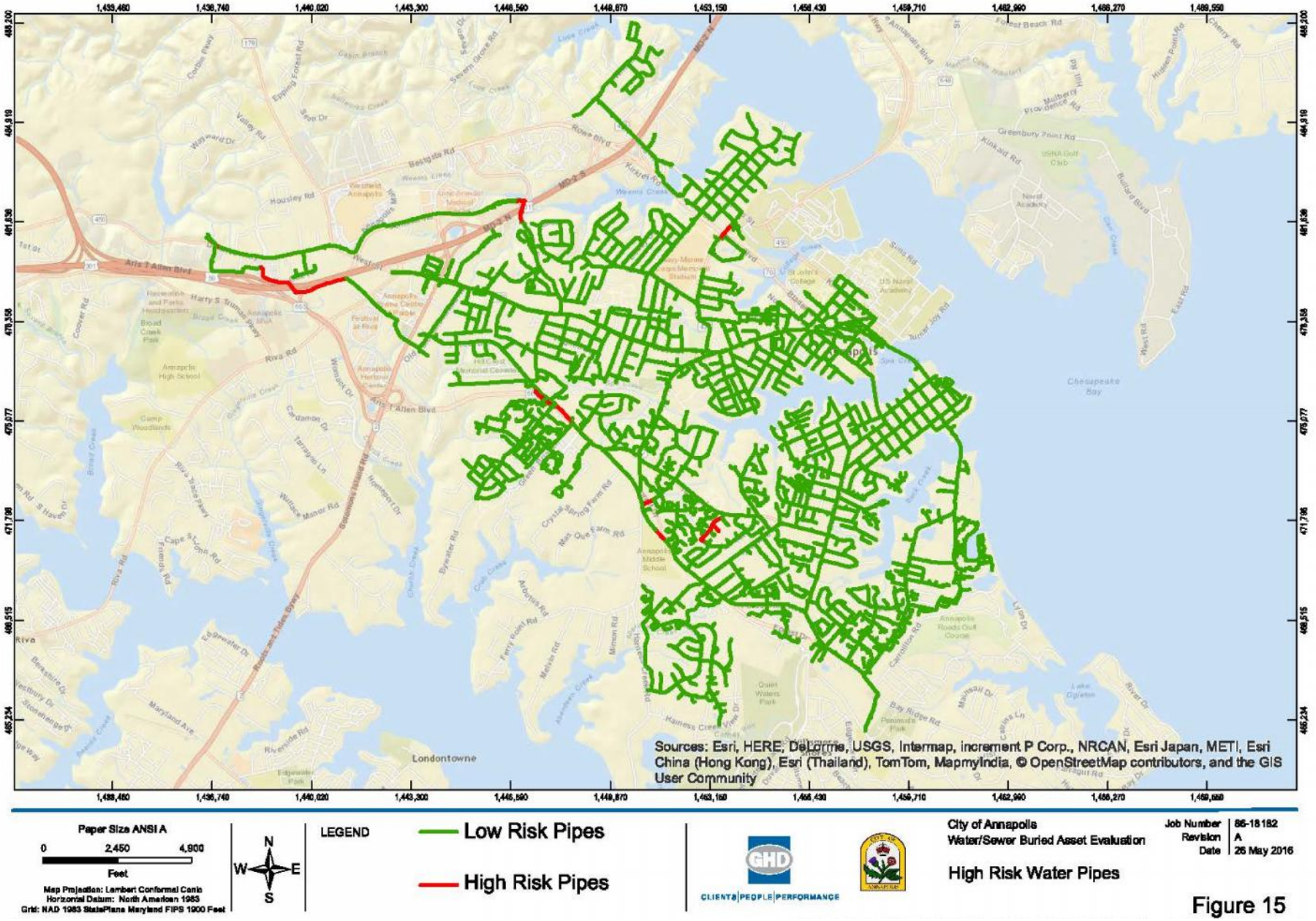
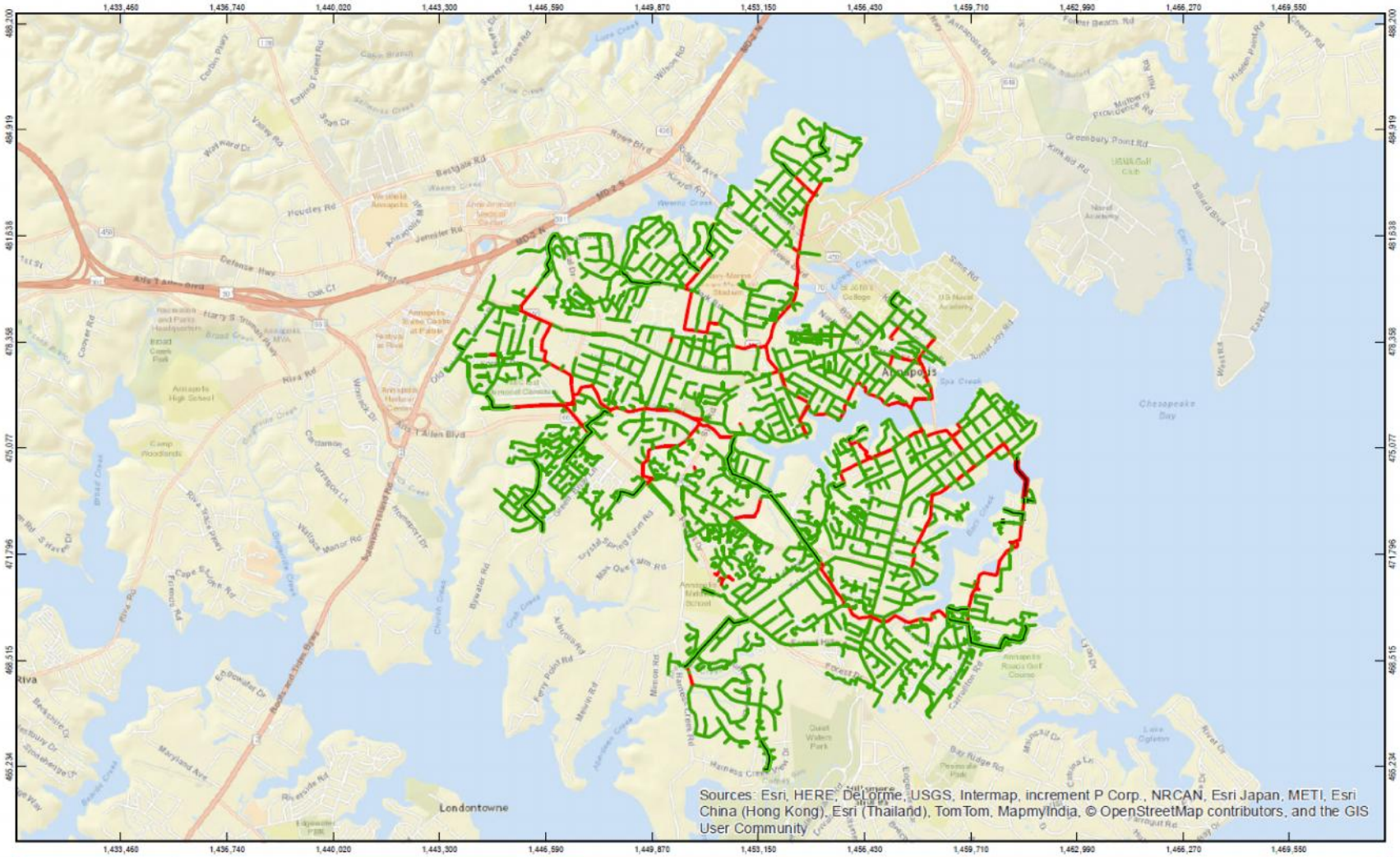
Business Risk Exposure Plot



High Risk Pipes – Water



High Risk Pipes – Sewer



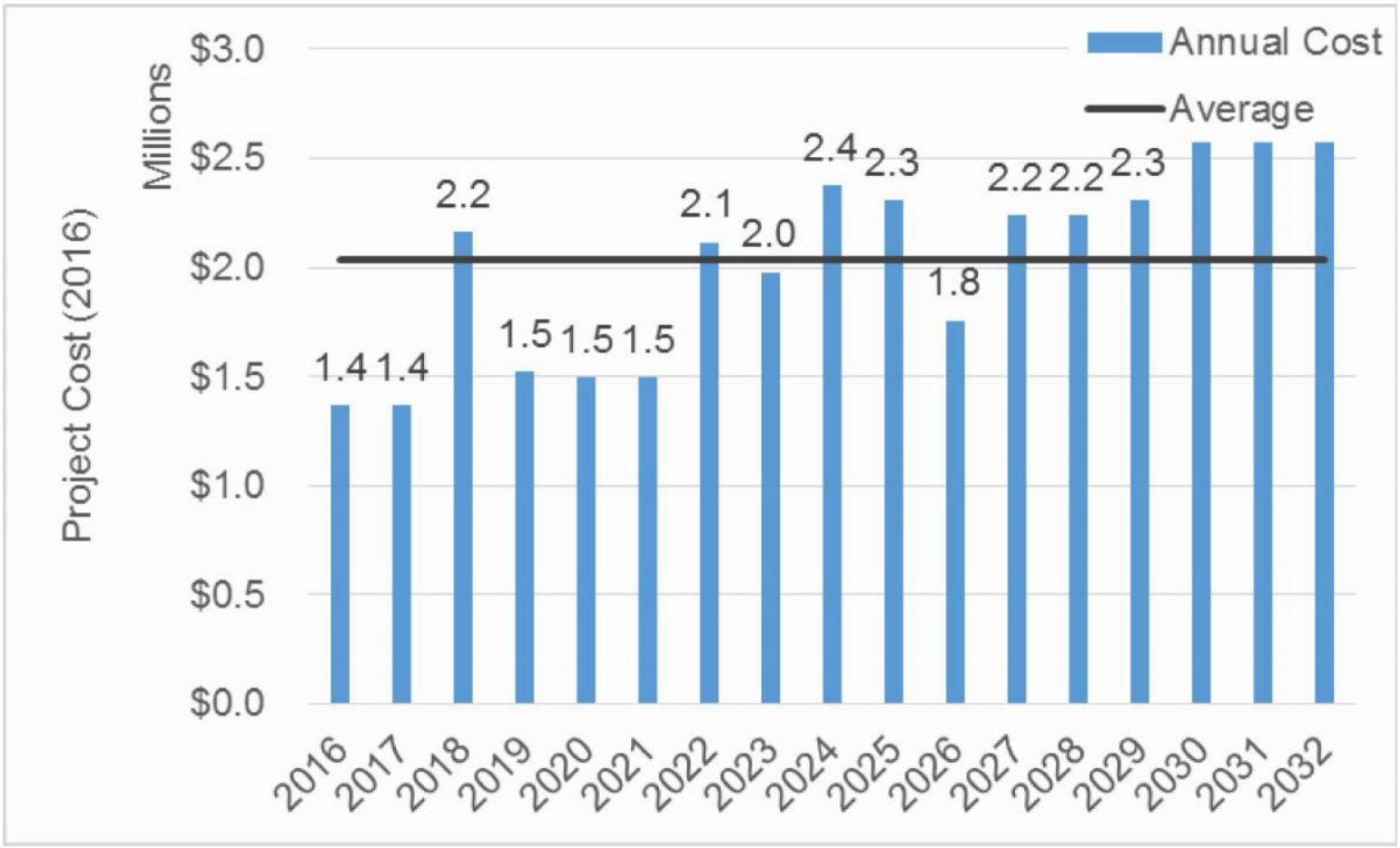
Asset Management Strategies Summary - Water

AM Strategy	Name	Activity Type	Performed By	Total Annual Cost
W-Con1	Acoustic condition assessment & leak detection	Condition assessment	Contractor	$160,000
W-Con2	Forensic analysis	Condition assessment	City	$6,000
W-Con3	Fire hydrant inspection and flow testing	Maintenance management & condition assessment	City/Contractor	$100,000
W-PM1	Valve exercising and inspection	Maintenance management & condition assessment	City/Contractor	$50,000
W-PM2	Unidirectional flushing	Maintenance management	City/Contractor	$20,000
W-Rp1	Replace pipe	Replacement	Contractor	Included in Priority Project Cost Projections
W-CM1	Repair broken main	Corrective maintenance	City	Included in City Budget
W-CM2	Repair broken valve	Corrective maintenance	City	Included in City Budget
W-CM3	Repair broken fire hydrant	Corrective maintenance	City	Included in City Budget
W-Rp2	Replace fire hydrant	Replacement	City/Contractor	Included in Priority Project Cost Projections
W-Rp3	Replace valve	Replacement	City/Contractor	Included in Priority Project Cost Projections
W-Rp4	Replace meter	Replacement	City	Included in Priority Project Cost Projections
W-Op1	Operating pressure range	Operations	City	Included in City Budget

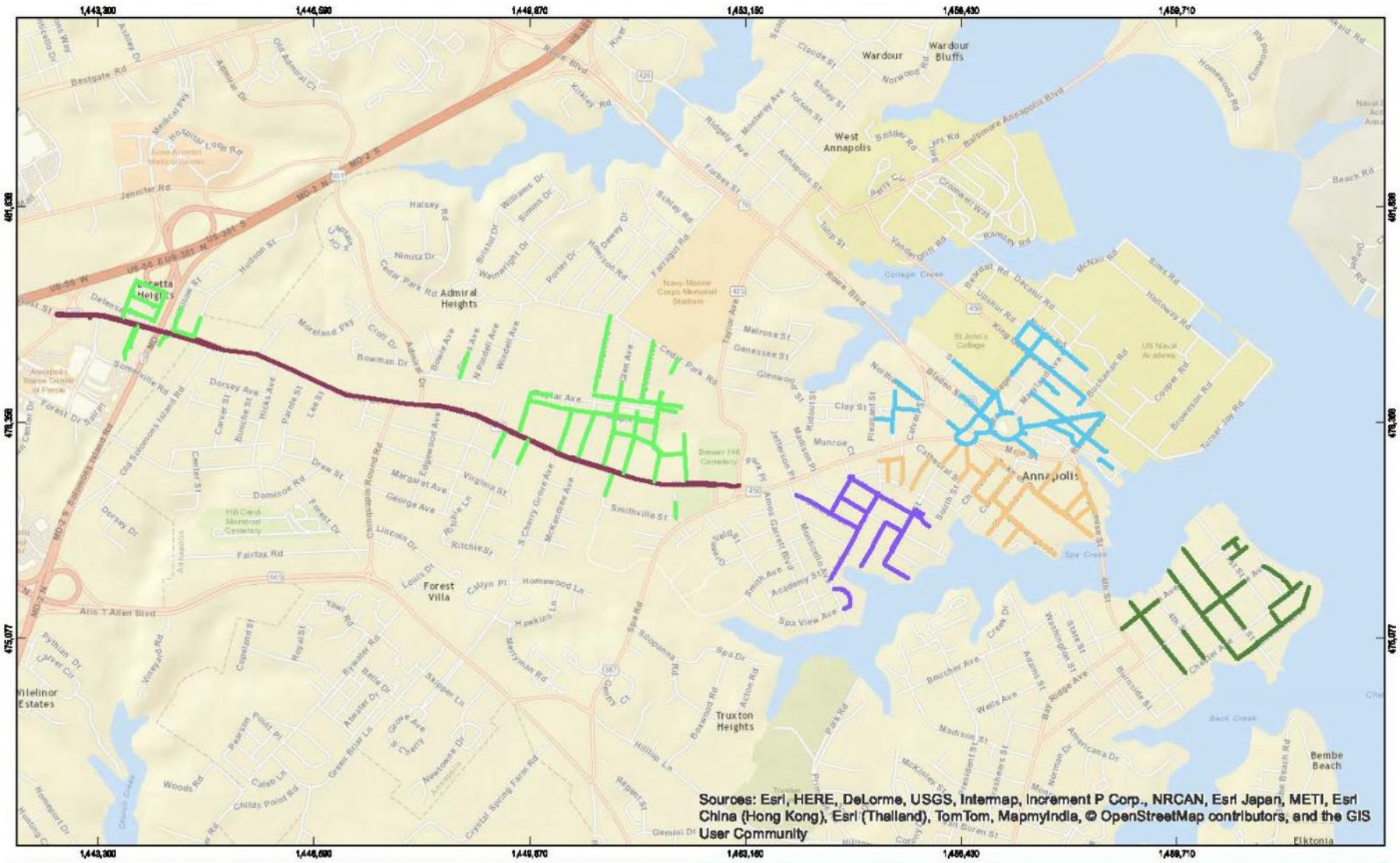
Asset Management Strategies Summary - Sewer

#	Name	Activity Type	Performed By	Total Annual Cost
S-Con1	Closed Circuit TV Inspection	Condition assessment	Contractor	$248,000 average over 15 years
S-Con2	Manhole Inspections	Condition assessment	Contractor	$34,000 average over 15 years
S-Con3	Smoke Testing	Condition assessment	Contractor	$25,000 average over 15 years
S-Op1	Flow Measurement	Operations	City	Included in City Budget
S-CM1	Spot repair	Corrective maintenance	Contractor	Included in City Budget
S-Rp1	Full replacement	Replacement – Pipe & MHs	Contractor	Included in Priority Project Cost Projections
S-PM1	Root Control	Maintenance management	City	Included in City Budget
S-PM2	Jetting	Preventive maintenance	City	Included in City Budget
S-Rh1	Cured in place pipe (full)	Rehabilitation - Pipe & MHs	Contractor	Included in Priority Project Cost Projections
S-PM3	Force main maintenance	Preventive maintenance & corrective maintenance	City/Contractor	$115,000

Water Projects Estimated Costs per Year between 2016 and 2032



Priority Projects – Water



Paper Size ANSI A

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Feet

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N W E S

LEGEND

Project No 1B 3 5
1A 2 4

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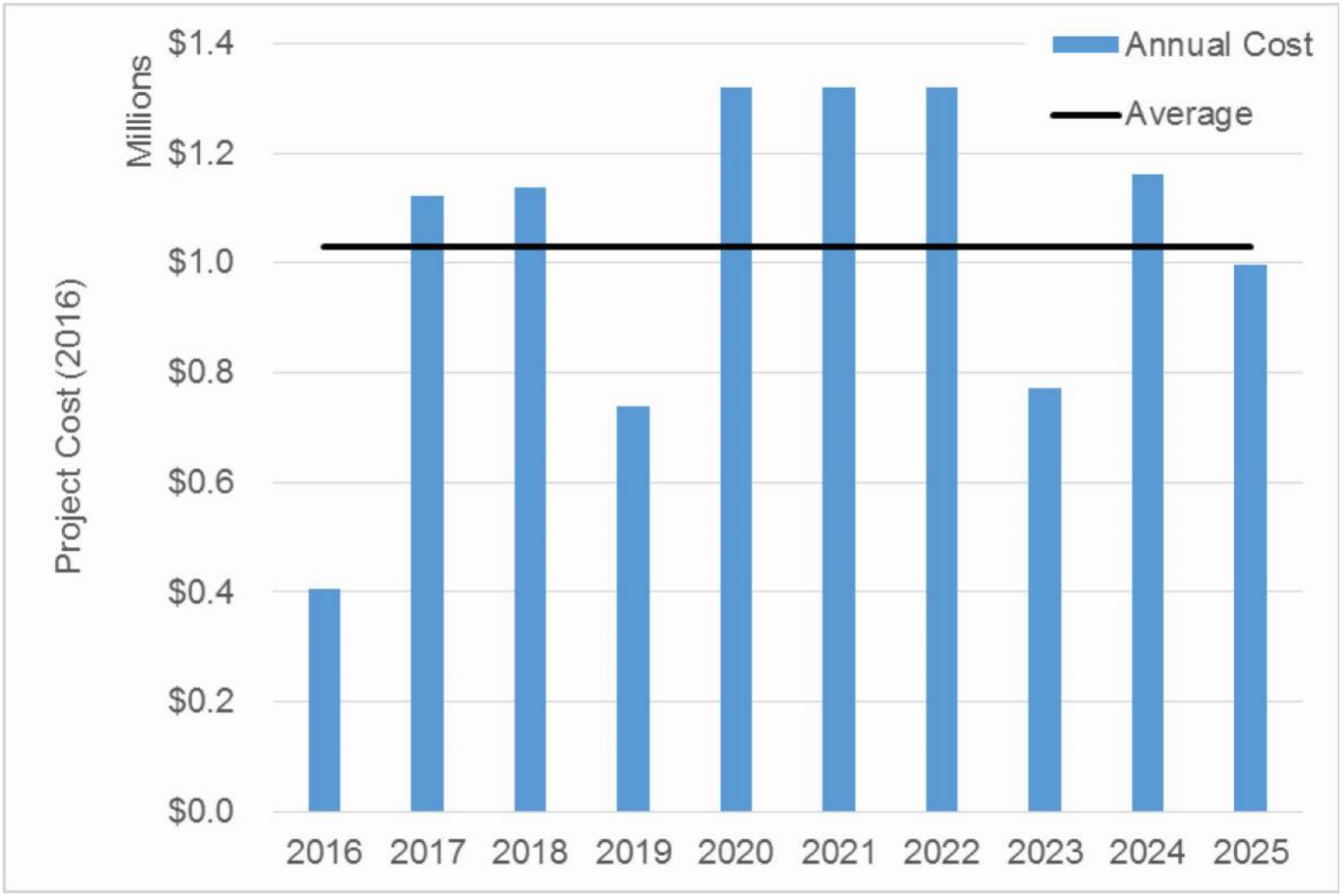
City of Annapolis
Water/Sewer Buried Asset Evaluation

Water Distribution System Priority Project Areas

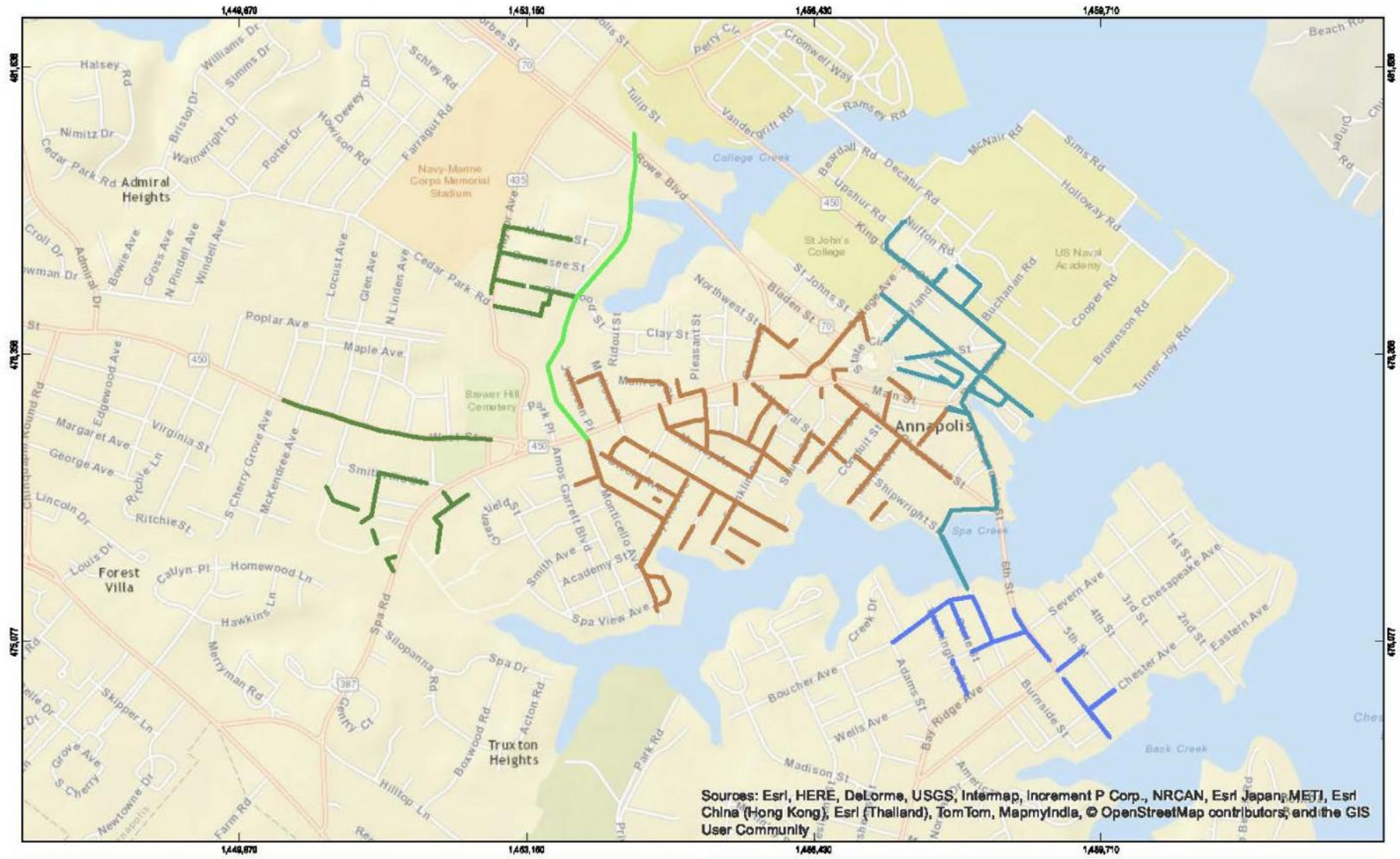
Job Number 86-18182
Revision A
Date 20 May 2016

Figure 17

Sewer Projects Estimated Costs per Year between 2016 and 2025



Priority Projects – Sewer



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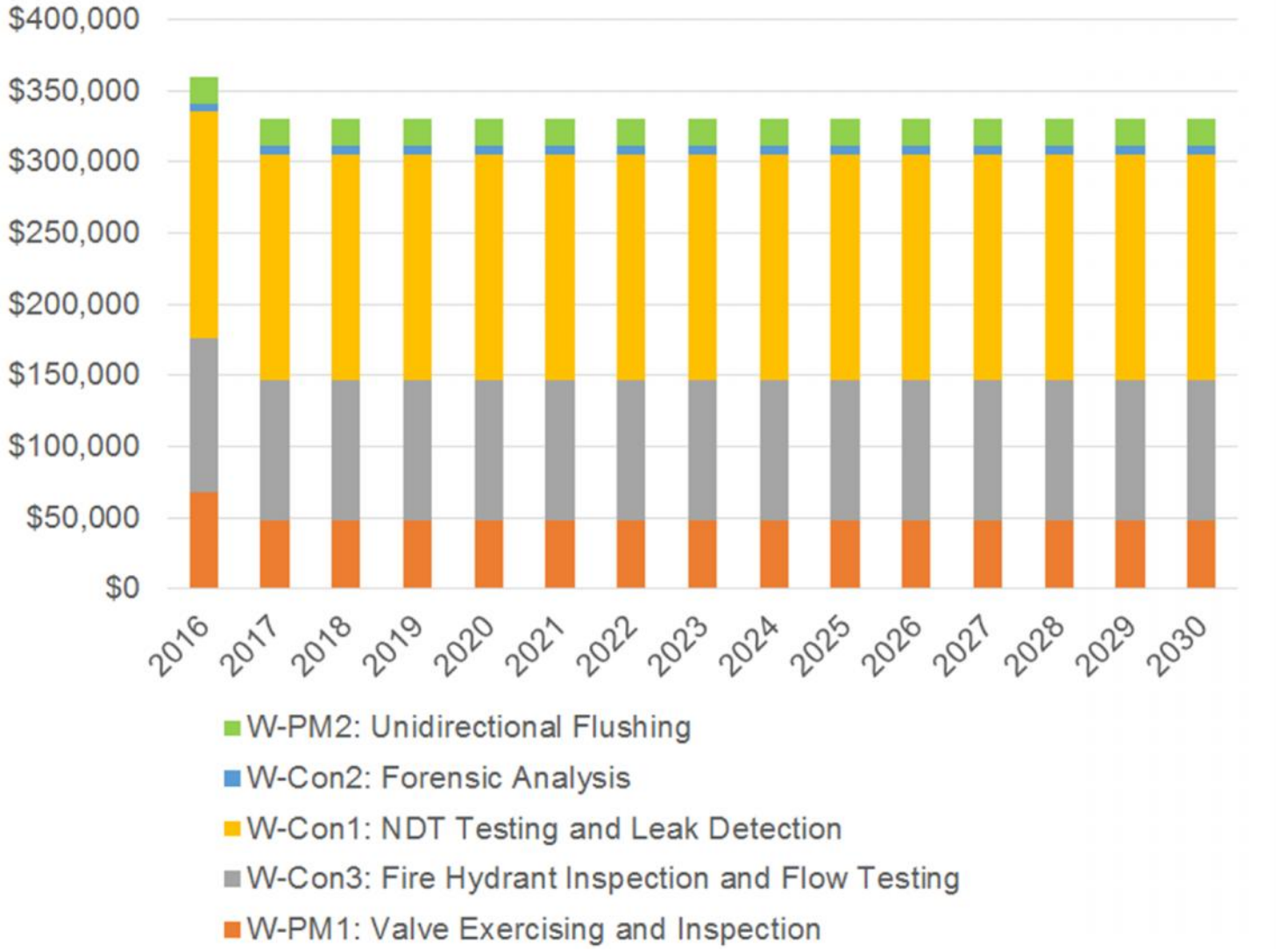
Annual Costs of Water Distribution System Asset Management Strategies for the Next 15 Years



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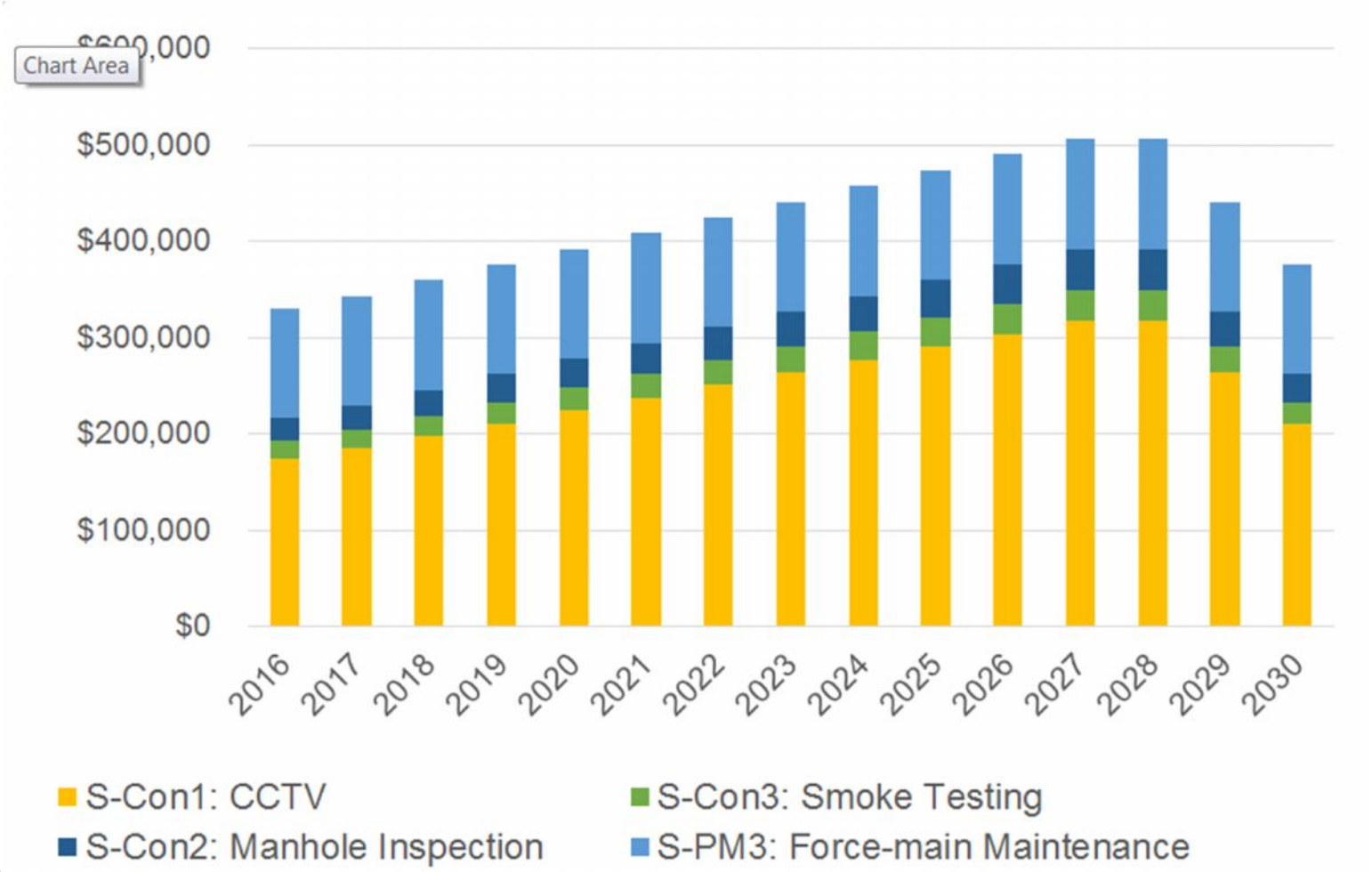
Annual Costs of Sewer Collection System Asset Management Strategies for the Next 15 Years



Next Steps

- Develop Team Charter to Implement Strategies
- Finalize Reports
- Continue/Initiation of Priority Projects
- Finalize Asset Management Software Review
- Identify AM Program Implementation Performance Measures

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