Restructuring Capital and Operating Budgets using Asset Management Concepts: Progress and Challenges

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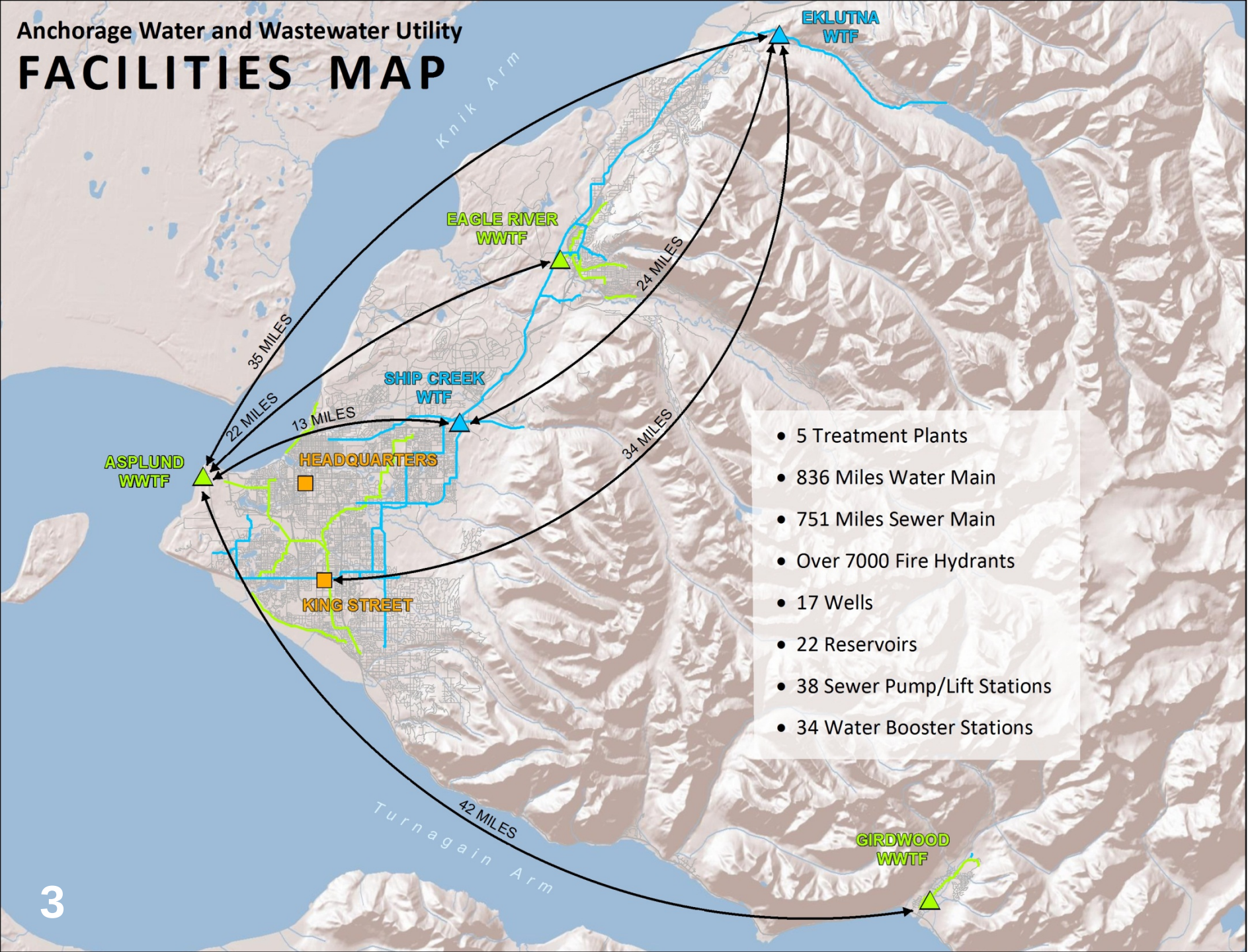
Fairbanks
Anchorage
Wasilla
Bethel
Kenai
Juneau
Kodiak

Anchorage Water and Wastewater Utility

FACILITIES MAP



- 5 Treatment Plants
- 836 Miles Water Main
- 751 Miles Sewer Main
- Over 7000 Fire Hydrants
- 17 Wells
- 22 Reservoirs
- 38 Sewer Pump/Lift Stations
- 34 Water Booster Stations

Policy Dance

Moving from Policy to Approach

Condition Assessment

Risk Analysis

Service Levels

Operating Program

Capital Program

Risk Policy – Response to Risk

RISK: Likelihood x Consequence

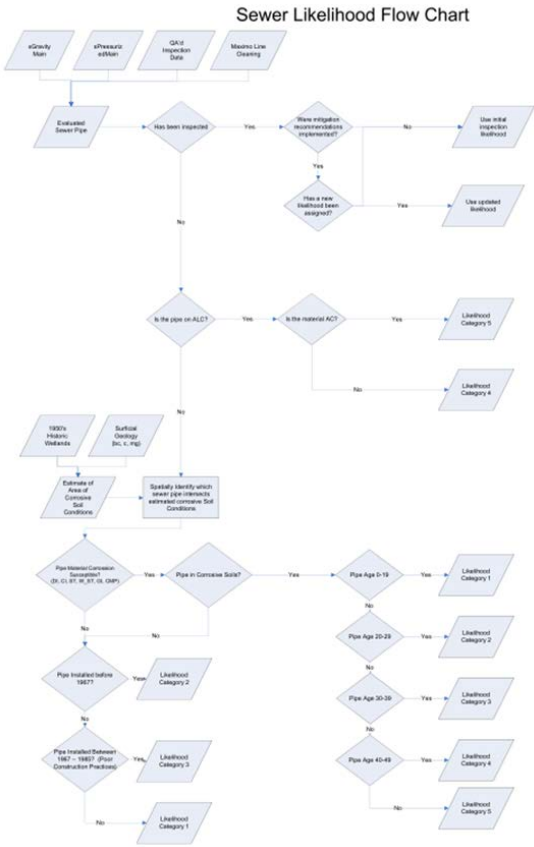
Risk Based Approach -- Likelihood

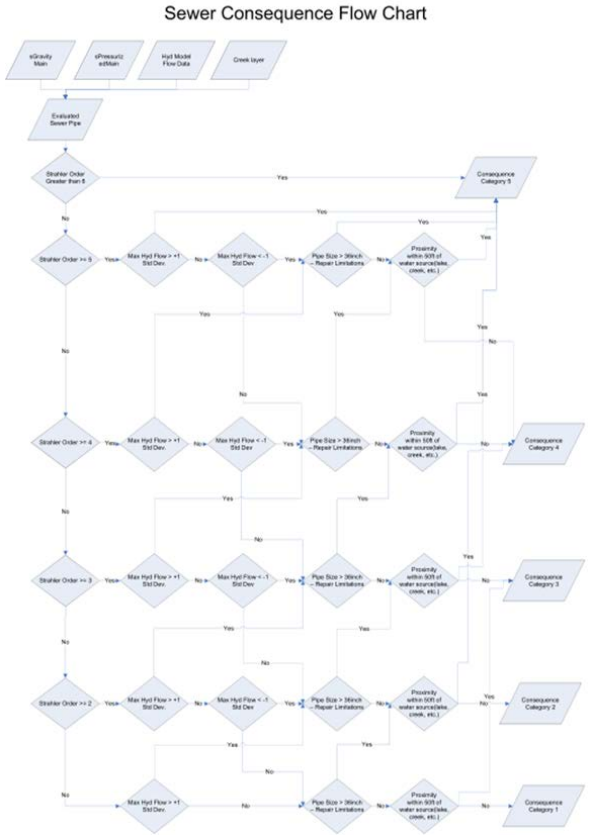
- Likelihood: Condition Assessment Types
  - Field/Physical Inspection
  - Data Mining/Cleanup

Risk Based Approach -- Consequence

- Customer Type
- Location/function in pipe network
  - Size
  - Redundancy
  - Size of population/customer base served
- Surrounding Area
  - Environmentally Sensitive Areas
  - Traffic
  - Difficulty of Access

“AM practices” – the Risk Assessment and Response plan





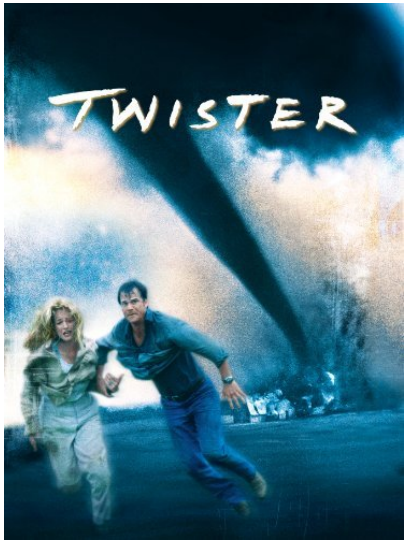
Risk Based Approach – Sewer Results

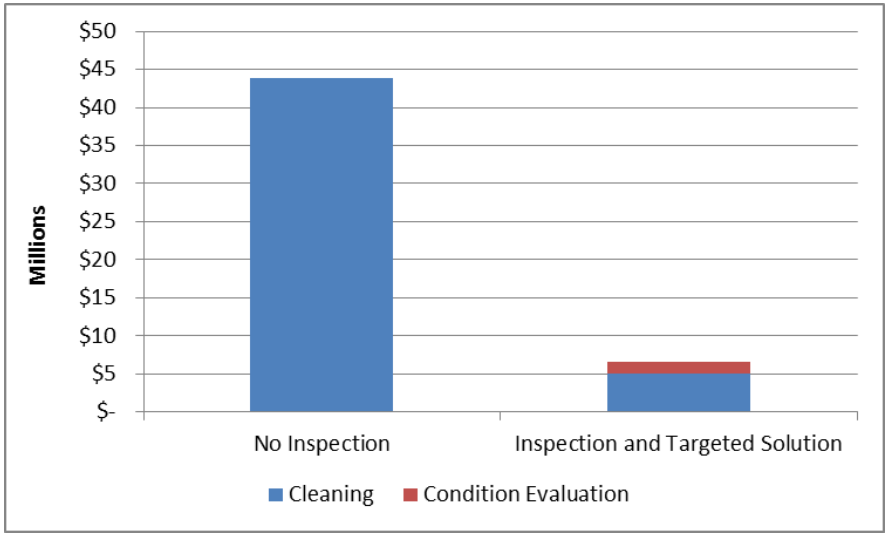
Sewer Pipe Risk Matrix – All Sewer Main

Likelihood		Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
High	5	5.9	0.8%	2.0	0.3%	1.6	0.2%	0.2	0.0%	0.4	0.1%
	4	9.2	1.2%	1.8	0.2%	2.0	0.3%	1.4	0.2%	1.0	0.1%
	3	238.2	31.9%	40.9	5.5%	31.8	4.3%	24.6	3.3%	14.4	1.9%
	2	132.0	17.7%	24.0	3.2%	20.7	2.8%	12.0	1.6%	14.8	2.0%
Low	1	111.5	14.9%	17.2	2.3%	13.3	1.8%	11.1	1.5%	14.2	1.9%
		1		2		3		4		5	
		Low		**Consequence**						High	

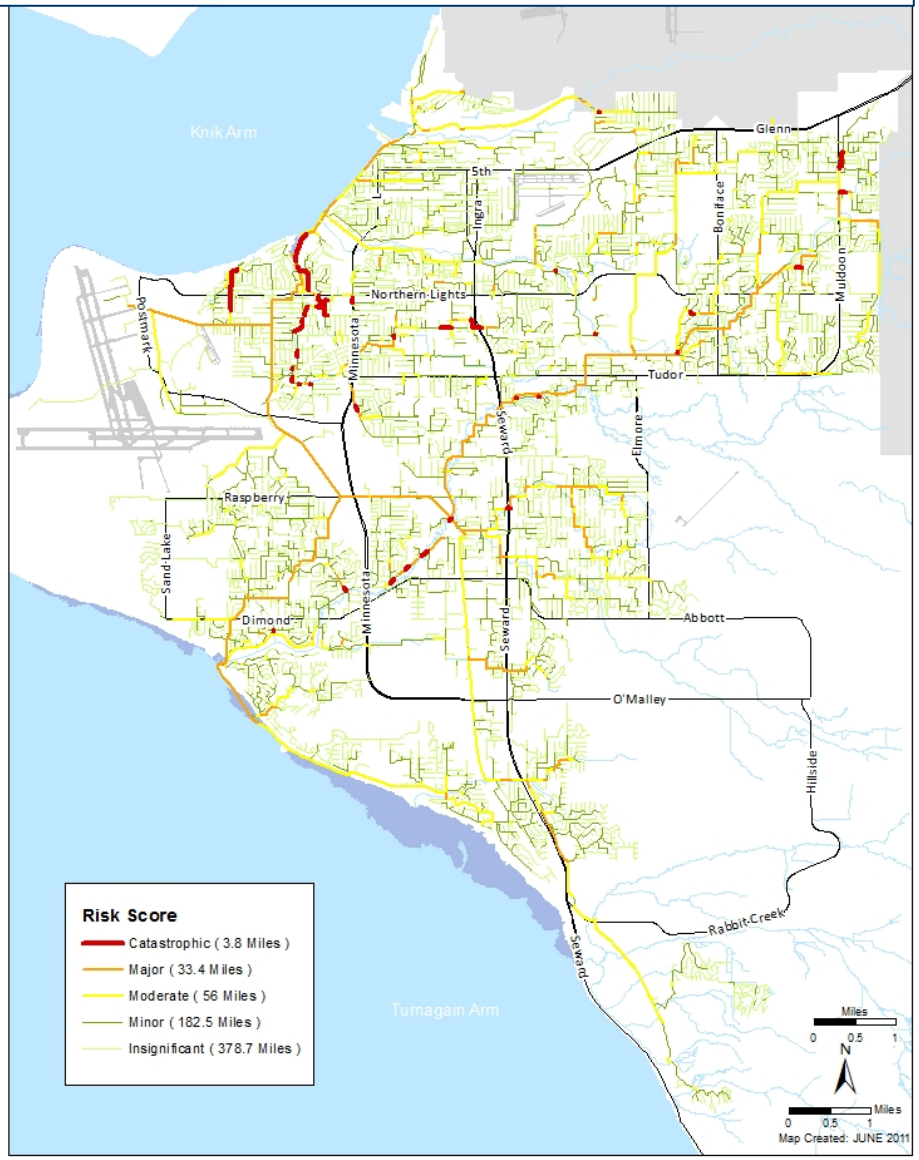
AWWU Strategy for meeting system challenges

- More inspection to identify problems
- Stay one step ahead of disaster!

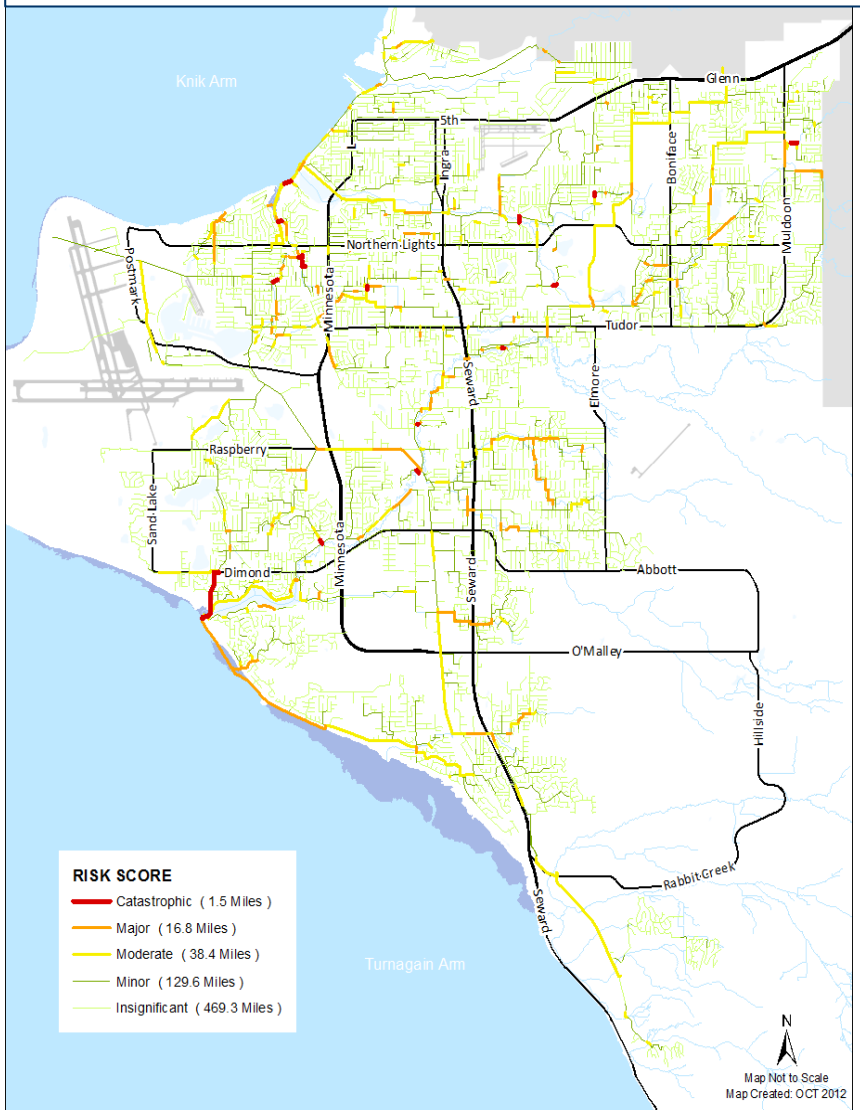




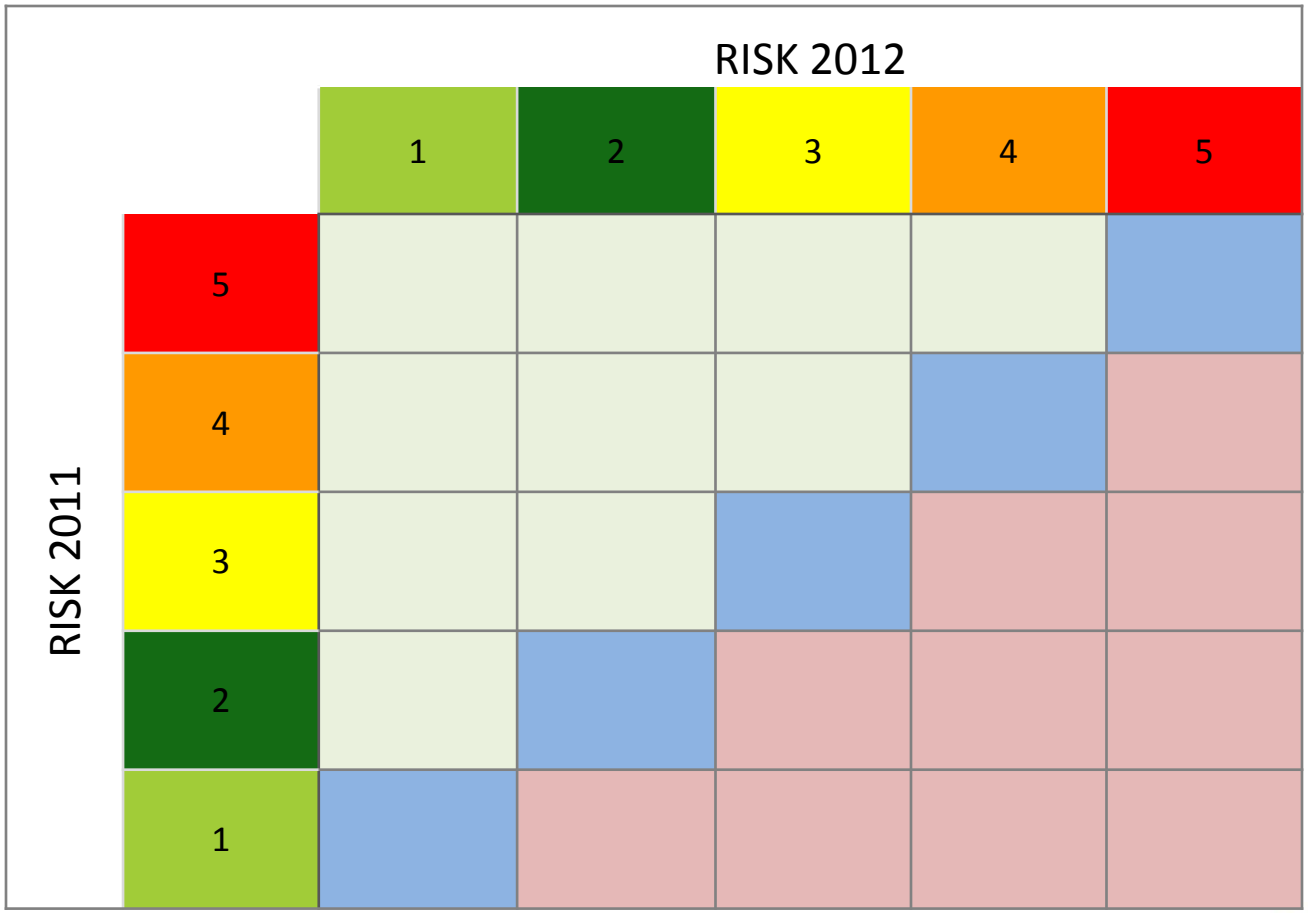
2011 Sewer Main Risk Analysis
Mainly Desktop Approach



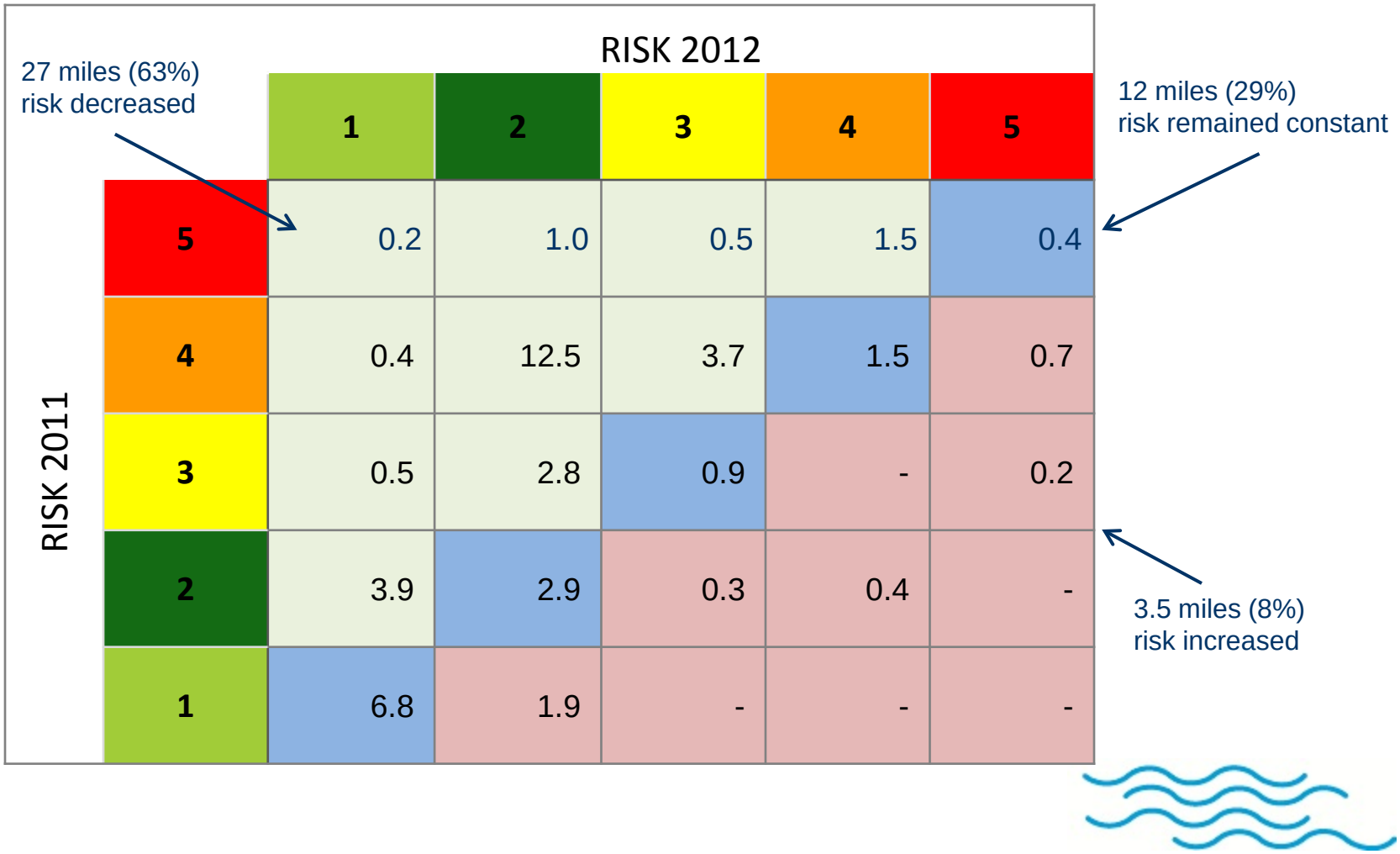
2012 Sewer Main Risk Analysis
Reduced Risk – Condition Assessment Results



Condition Assessment: Reduce Risk by Reducing Likelihood



Reduction of Risk from Condition Assessment Results



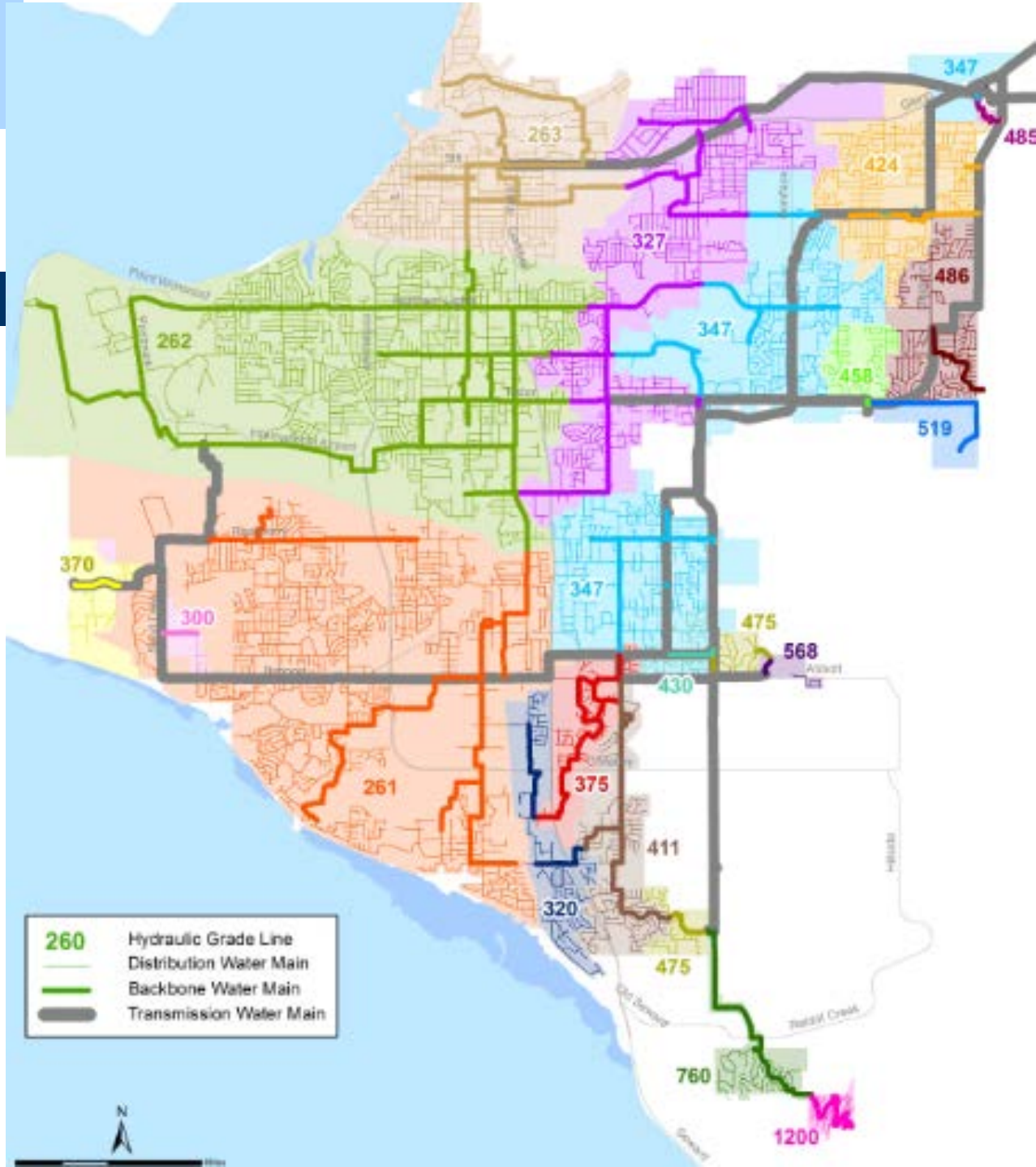
RISK 2011 \ RISK 2012	1	2	3	4	5
5	0.2	1.0	0.5	1.5	0.4
4	0.4	12.5	3.7	1.5	0.7
3	0.5	2.8	0.9	-	0.2
2	3.9	2.9	0.3	0.4	-
1	6.8	1.9	-	-	-

Likelihood: Water Pipe

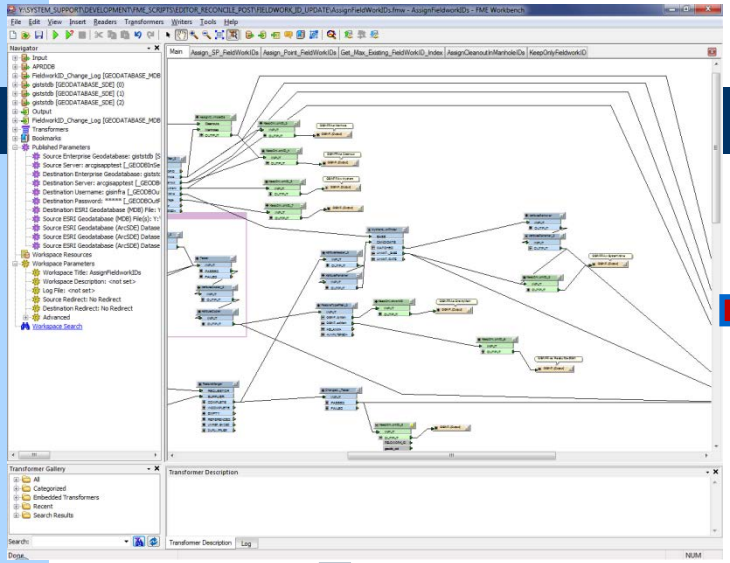
- 2012 Field Condition Assessment Projects
  - Large Diameter Leak Detection, BEM
    - Large Diameter Pipe Class Research
  - Small Diameter Echologics
- Data Mining/Validation
  - 20 Years of Small Diameter Break Data
  - Statistical Validation of Factors Influencing Failures
  - Failure Curves and Live Estimates

Supply Analysis (Consequence)

Condition Assessment on Large Diameter



Likelihood: Failure Prediction and Economics



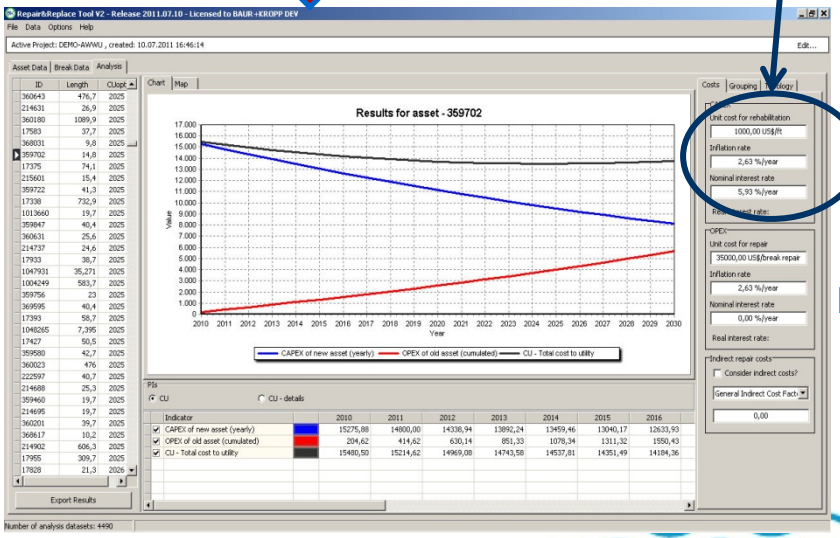
Scripting Process Does

Heavy Lifting

Triple Bottom Line

Consequence of Failure

Scripting tools also generate R&R costs

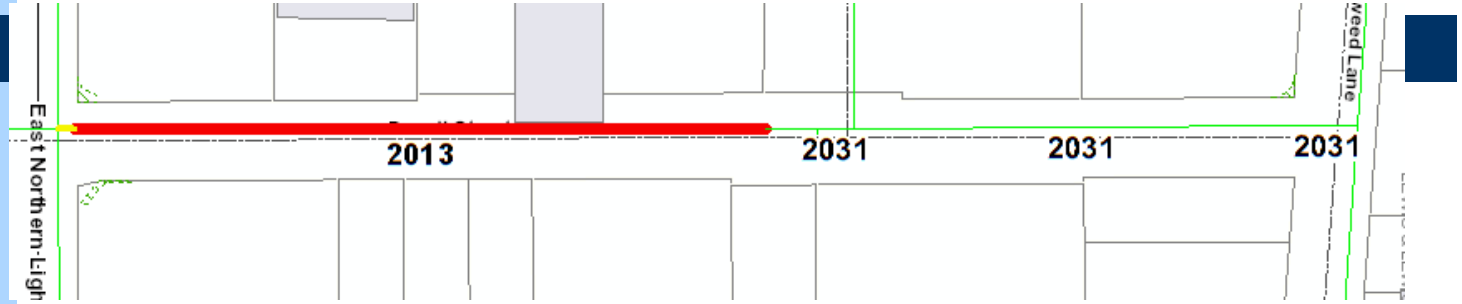


Likelihood of Failure Developed through Statistical Failure Model

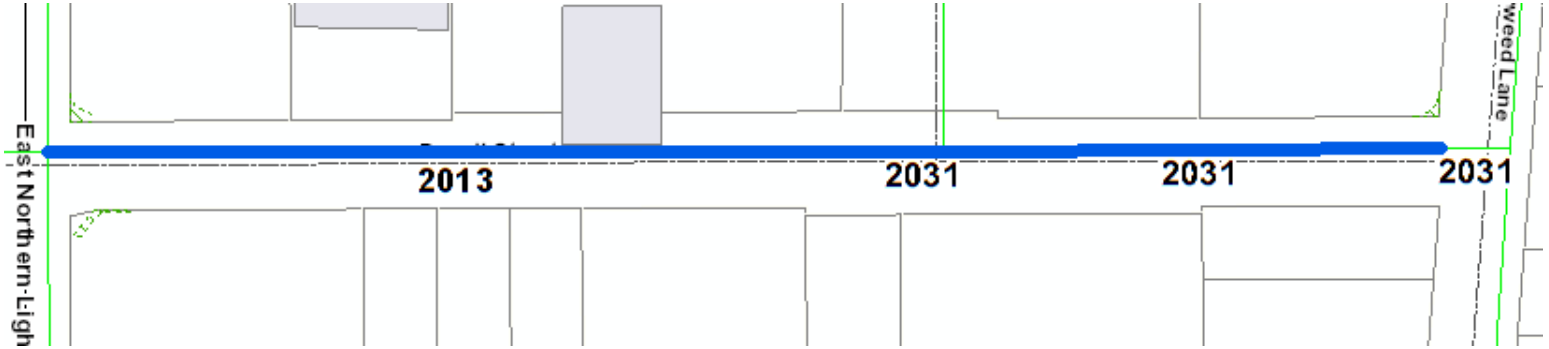
$$\lim_{h\to 0_+} \frac{P\{N(t+h)-N(t)=1 \mid N(t)=j\}}{h} = \underbrace{(1+\alpha j)}_{\text{Yule Factor}} \underbrace{\delta t^{\delta-1}}_{\text{Weibull Factor}} \underbrace{\exp(Z^T\beta)}_{\text{Cox Factor}}$$

Capital Program Results

Optimal Replacement Year By Individual Pipe Segment

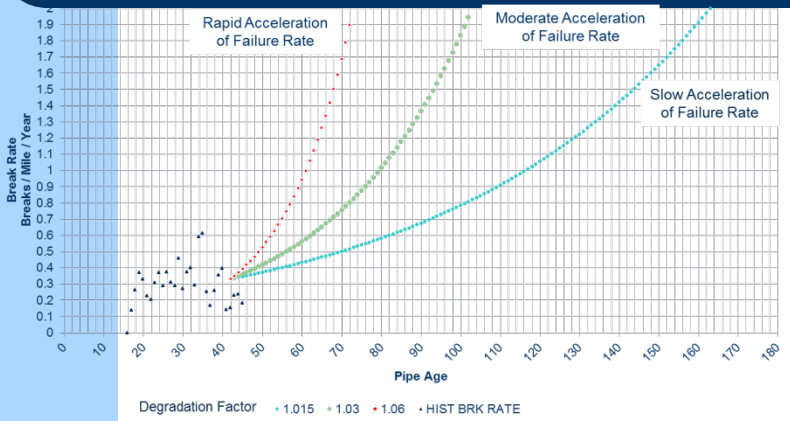


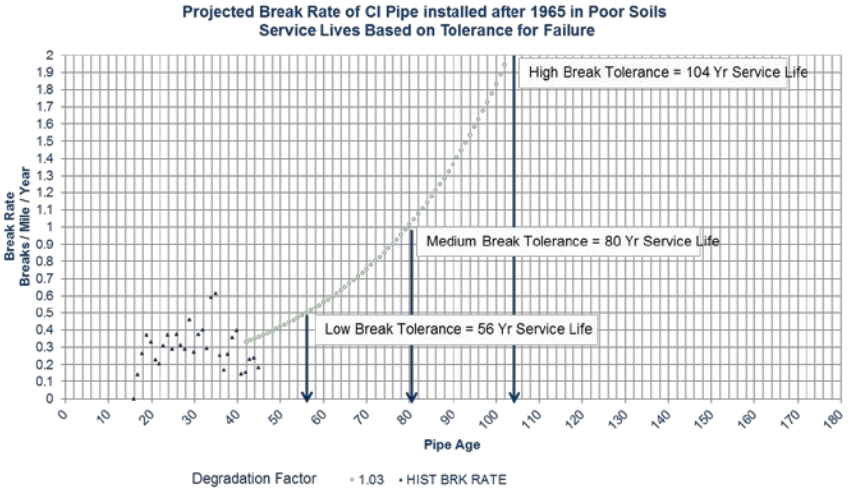
Final Sieve is Engineering Judgment on Final Project Scope



Define Your Service Level

Develop Break Rate Curves from Historic Break Data





Define Failure Tolerance Based on Consequence (same as previous)

Direct and Indirect Cost of Failure	Break Rate Tolerance Br/Mi/Yr
< $100,000	2
$100,001 to $200,000	1
$200,001 to $500,000	0.5
> $500,001	0.2

Service Lives should be defined in terms of Level of Service- i.e Risk Tolerance (BR's)

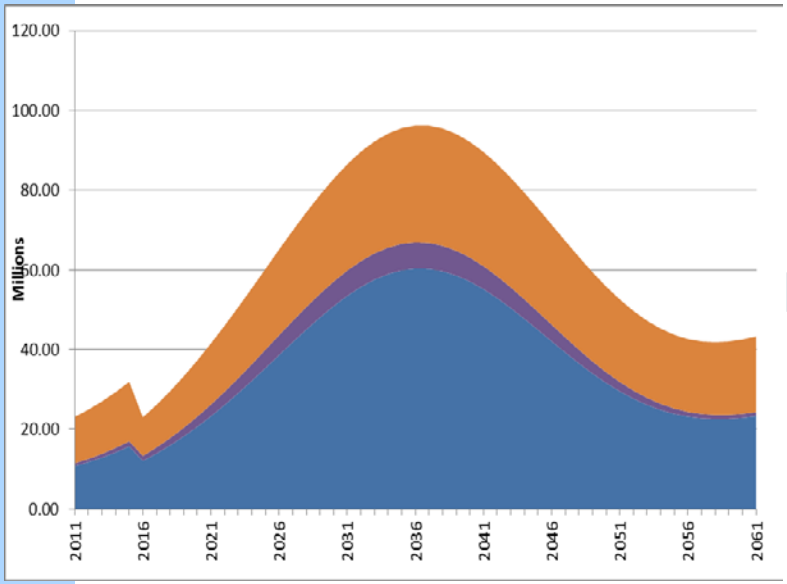
Informal Service Level:
3 breaks/3 blocks/ 3 years ~ 2 br/mi/yr

Long Term Financial Plan

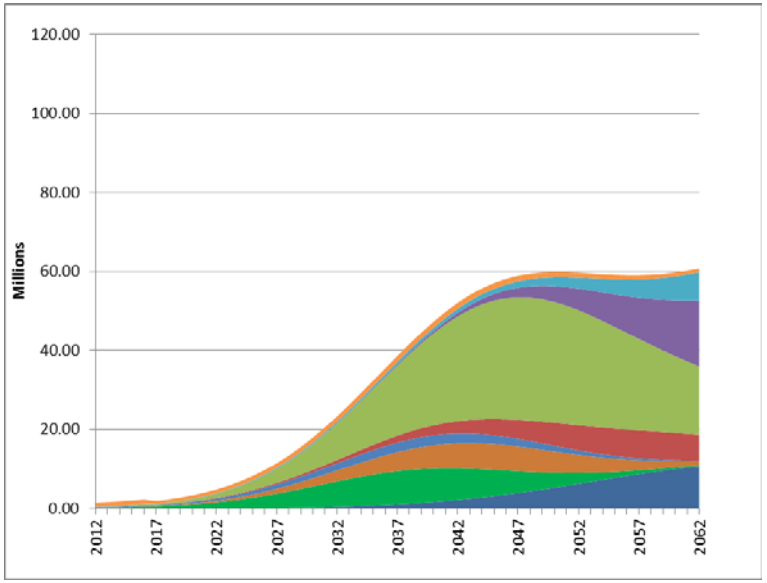
New Service Lives Based on Service Level

	Nessie	MBR 0.5	MBR 1	MBR 2
AC	75	125	150	170
CI_POST_65_BS	50-60	55	80	105
CI_POST_65_GS	60	85	110	135
CI_PRE_65_BS	50-60	75	100	125
CI_PRE_65_GS	75	100	125	150
DI_BS	50-70	105	130	150
DI_GS	60-75	135	155	180

2011 Nessie



2012 Updated Nessie



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