PACP® Based ~~Asset~~ Management

Presented by:

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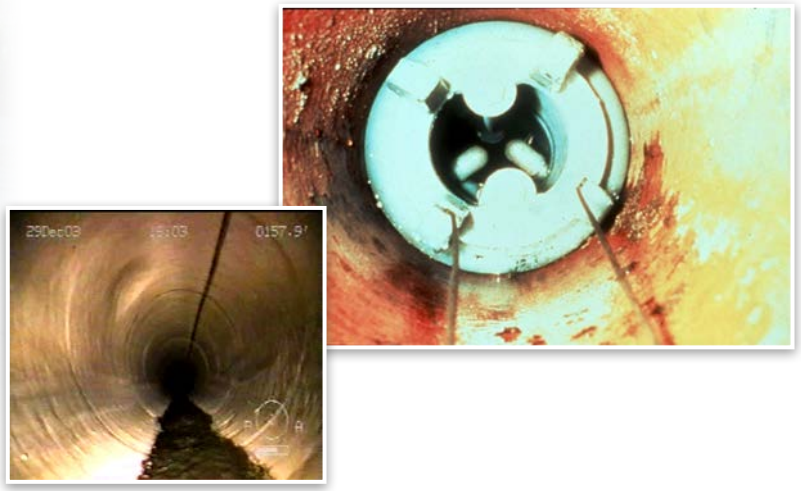
WRIGHT-PIERCE
Engineering a Better Environment
70 YEARS 1947 - 2017

NASSCO
Setting the industry standards for the rehabilitation of underground utilities since 1975

Objectives of Asset Management

- Maintain function or level of service as cost effectively as possible
- Maintain individual components (assets) at lowest life cycle cost possible



Key Asset Management questions:

- What types of assets do we own?
- Where are they located?
- What is the condition?
- Which are critical?
- What are my best O&M and CIP investment strategies?
- What are costs? Impact to budget?

PACP in Asset Management

PACP can assist in developing an asset management plan by collecting asset information such as:

- Pipe segment length
- Relative location details
- Pipe size, shape, material
- Upstream manhole data
- Consequence of failure
- Defect codes (Structural and O&M)
- Condition grades

General Information

1. Surveyed by	2. Certificate No.		3. Reviewed by	4.Reviewer Certificate No.
5. Owner	6. Customer		7. P/O Number	8. Work Order Number
9. Media Label	10. Project	11. Date	12. Time	13. Sheet Number
14. Weather	15. Pre-Cleaning	16. Date Cleaned YYYMMDD	17. Flow Control	18. Purpose of Survey
19. Direction of Survey	20. Inspection Technology Used		21. Inspection Status	
22. Consequence of Failure	23. Pressure Value			

Location

24. Drainage Area	25. Pipe Segment Reference	26. Street (Name & Number)
27. City	28. Location Code	29. Location Details

Pipe

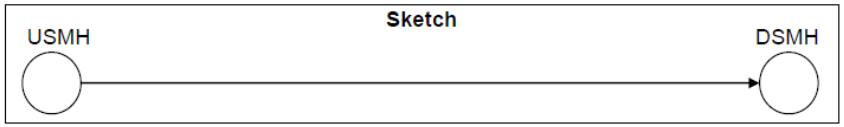
30. Pipe Use	31. Height	32. Width	33. Shape
34. Material	35. Lining Method	36. Coating Method	37. Pipe Joint Length
38. Total Length	39. Length of Pipe Surveyed	40. Year Constructed	41. Year Renewed

Measurements

42. Upstream MH Number	43. Upstream MH Rim to Invert	44.Upstream MH Rim to Grade	45.Upstream MH Grade to Invert
46. Upstream MH Northing	47. Upstream MH Easting	48. Upstream MH Elevation	
49.Downstream MH Number	50.Downstream MH Rim to Invert	51.Downstream MH Rim to Grade	
52. Downstream MH Grade to Invert	53. Downstream MH Northing	54. Downstream MH Easting	
55. Downstream MH Elevation	56. MH Coordinate System	57. MH Vertical Datum	58. GPS Accuracy

59. Additional Information

Red = Mandatory; Black = Non-mandatory



Risk in Asset Management

Risk = Calculation that takes into account

- ***Likelihood*** of something bad happening

  and

- Severity of ***consequence(s)*** of failure

Risk = LoF x CoF

Likelihood of Failure (LoF)

- PACP condition grades can determine ***segment scores***

- Segment scores can be used to calculate ***Likelihood of Failure*** for pipelines

- The *Modified PACP Quick Rating* based upon highest grade defect observed within a particular pipe segment

PACP Grading System for Pipelines, Manholes and Laterals

5 – Most significant defect grade

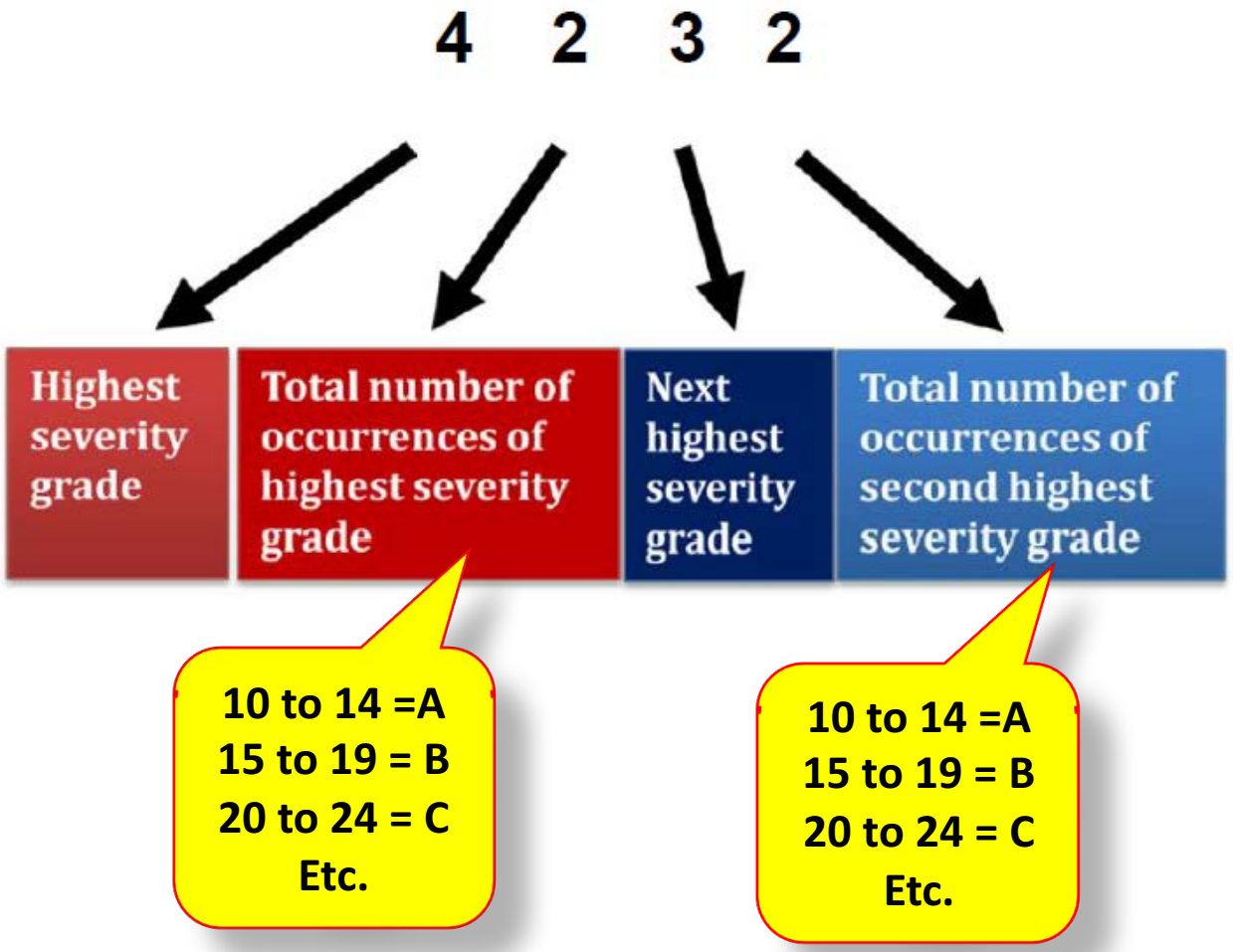
4 – Significant defect grade

3 – Moderate defect grade

2 – Minor to moderate defect grade

1 – Minor defect grade

PACP Quick Rating



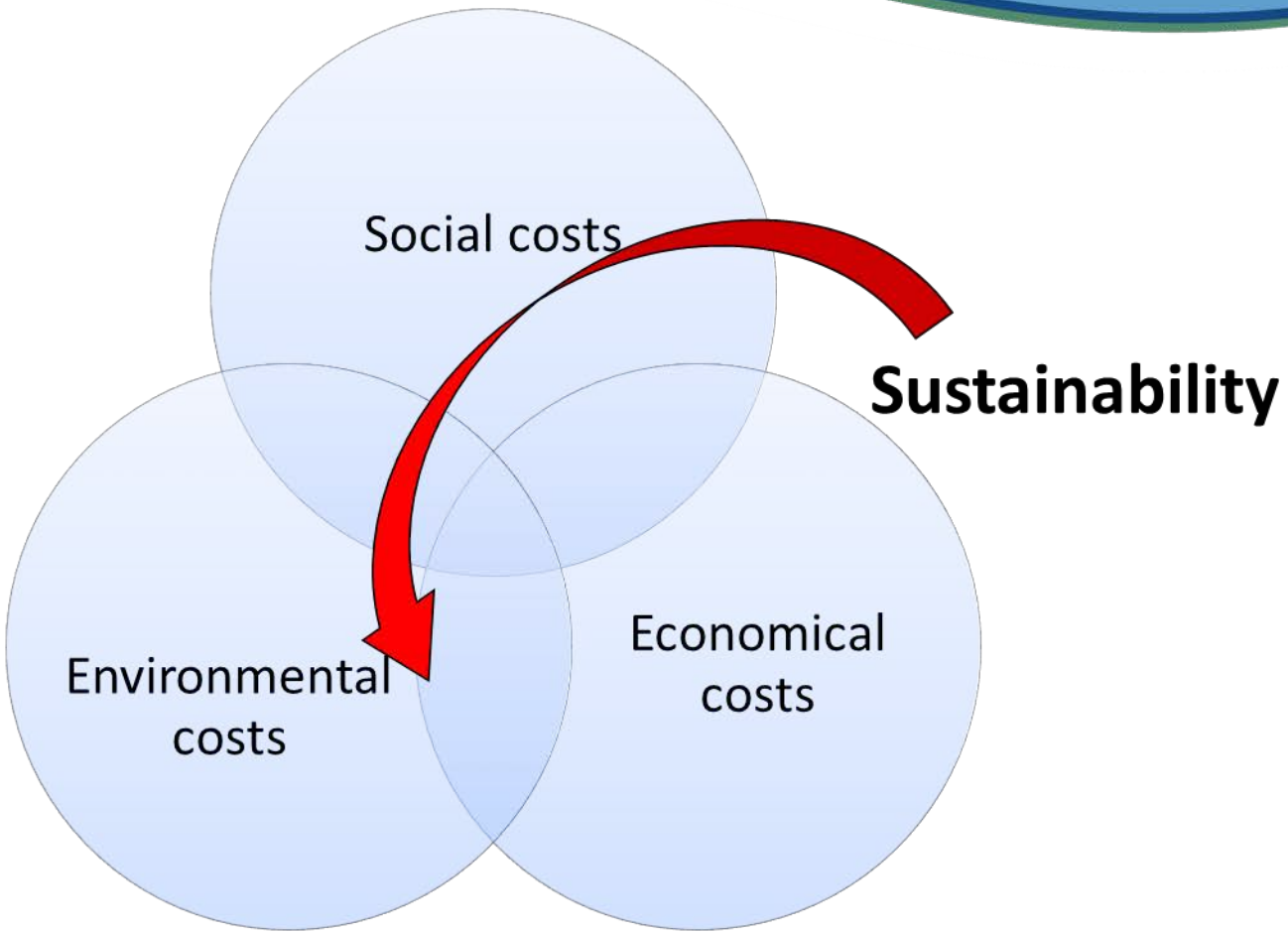
Likelihood of Failure Rules

An asset's Likelihood of Failure is determined based on the following scenarios:

- No condition assessment data is available
- Condition assessment data is available and there are no defects
- There are no more than 9 occurrences of the highest condition grade
- The second character is a letter (indicating more than 9 occurrences)

In all cases we divide the first two digits of the quick rating by 10 LoF assigned on a scale of 1-6

Consequence of Failure



Triple Bottom Line

Economical Impacts

- Impact of Direct and Indirect economic losses
  - Direct costs
    - Asset Repairs
    - Legal Fees
    - Fines
  - Indirect costs
    - Property Values
    - Increased Insurance Rates
    - Utility's Credibility

- Typically expressed in dollars and include property damage, repair cost, production loss, etc.

Social Impacts

- Impact on Society due to asset failure
- Factors include
  - Number of properties/clients affected
  - Types of affected properties (hospitals, schools, businesses, parks, “critical services”, etc.)
  - Duration of Failure
  - Utility’s Credibility
  - Public Health and Safety

- In addition, there must be consideration for safety issues (i.e. public exposure to health-threatening problems, injuries, or even fatalities)

Environmental Impacts

- Impact to ecological conditions occurring as a result of asset failure
- Environmentally cost considerations based on
  - Proximity to wetlands and waterways
  - Federal Emergency Management Agency (FEMA) flood zones
  - Possible contamination of potable water sources
  - Sensitivity of nearby soils

Rating Methodology

- 60 inch combined trunk sewer 100 feet downstream of a Combined Sewer Overflow (CSO) that crosses a body of water

Vs.

Higher CoF

Lower CoF

- 8 inch sanitary sewer at the upstream end of the system that only serves one resident

Rating Methodology

- Considers ***locational*** and ***demographical*** information
  - Network position
  - Location of pipe
  - Proximity to environmentally sensitive features
  - Service to customer of significant importance
  - Accessibility for maintenance and inspection

- GIS can help determine these considerations

- CoF assigned on a scale from 1 to 6

CoF Examples

- CoF Factors and Examples
  - Pipe depth
  - Pipe diameter
  - Distance between pipe and waterway
  - Customers of high importance
  - *Others: Network Position, Asset Location, Accessibility*

The system owner must decide upon CoF factors and weighting

Pipe Depth

Typically an ***economic*** consideration since deeper pipe is generally more expensive to repair/replace

Depth	CoF Factor
Less than 6'	1
≥ 6' - < 10'	2
≥ 10' - < 14'	3
≥ 14' - < 18'	4
≥ 18' - <24'	5
≥ 24'	6

* Assets with no CoF assigned shall be given a value of 0 (zero)

Pipe Diameter

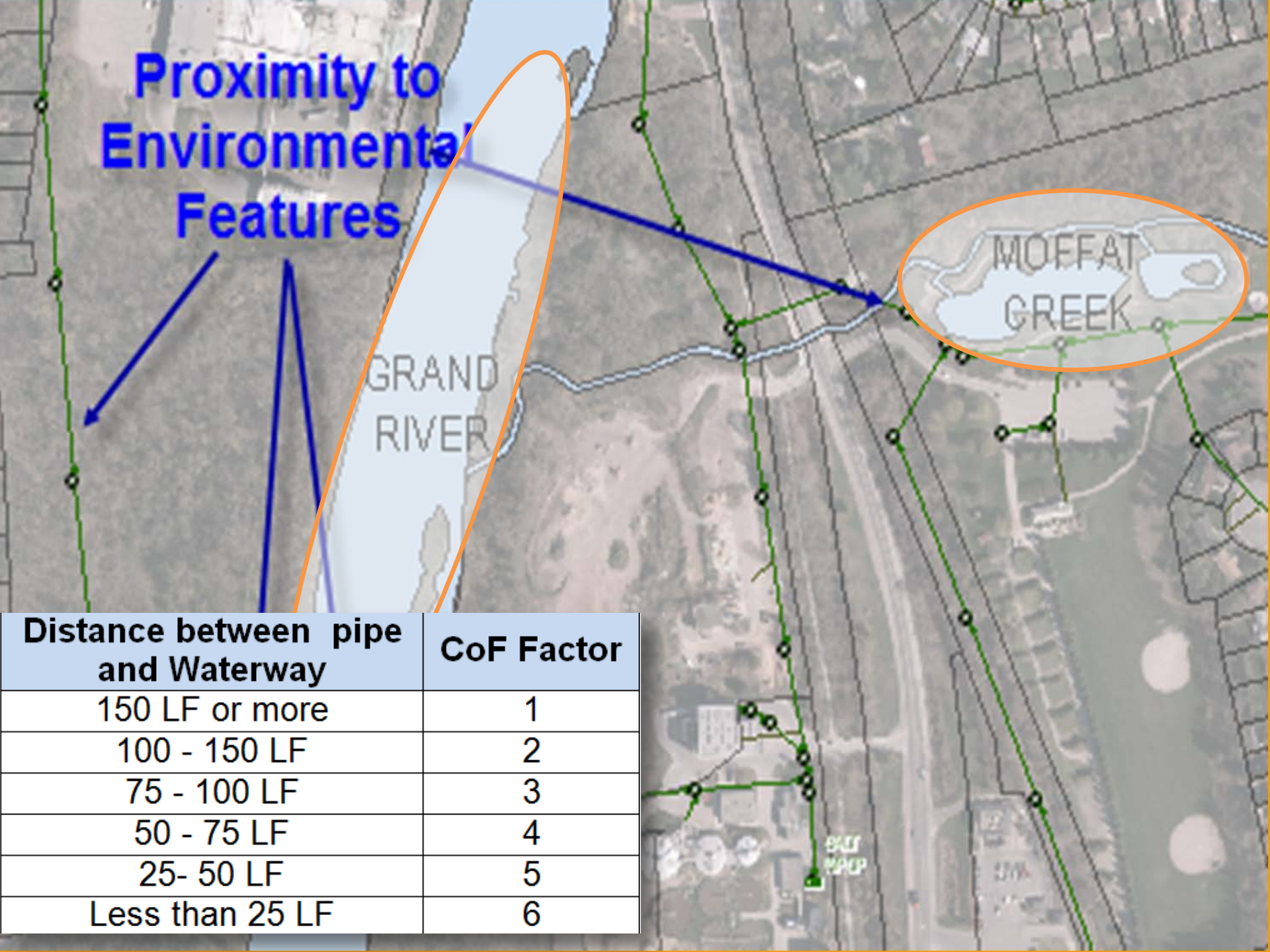
- Affects ***Economic, Environmental*** and ***Social*** costs
- Larger diameter pipes generally
  - Serve more customers
  - Cost more to rehabilitate

Diameter	CoF Factor
Less than 8"	1
≥ 8" - < 10"	2
≥ 10" - < 15"	3
≥ 15" - < 21"	4
≥ 21" - <30"	5
≥30"	6

* Assets with no CoF assigned shall be given a value of 0 (zero)

Proximity to Environmentally Sensitive Features

- Consequence of Failure factor is set based on the distance between a pipe and an environmentally sensitive feature
- Factor affected by the nature of the sensitive environment
- GIS can be set-up to assign CoF based on distance to environmentally sensitive features

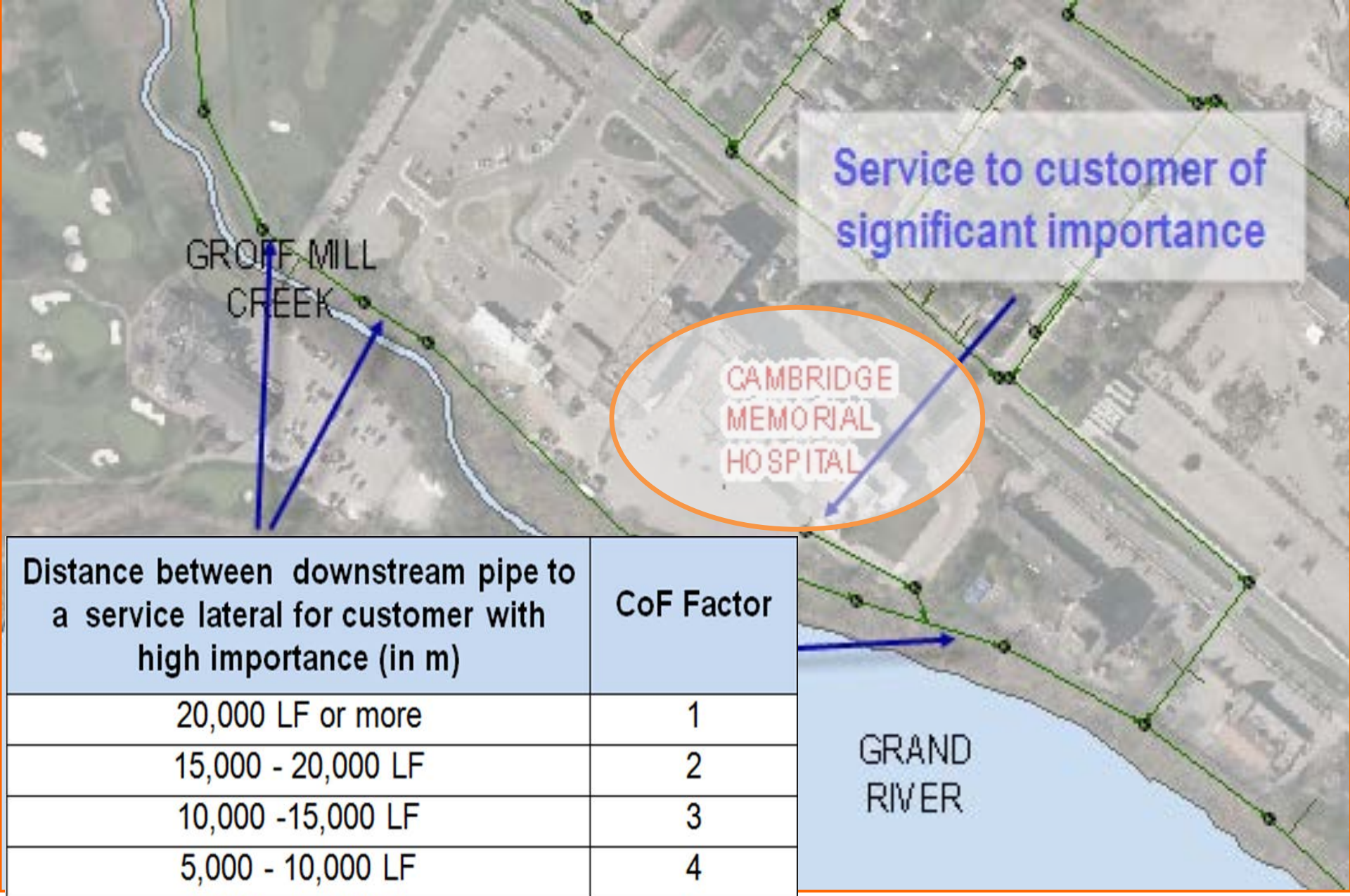


Distance between pipe and Waterway	CoF Factor
150 LF or more	1
100 - 150 LF	2
75 - 100 LF	3
50 - 75 LF	4
25- 50 LF	5
Less than 25 LF	6

Critical Customers

- Hospitals, schools, manufacturing facilities, emergency services, etc., as determined by utility

- Providing uninterrupted service to these facilities may be a priority for the utility



Distance between downstream pipe to a service lateral for customer with high importance (in m)	CoF Factor
20,000 LF or more	1
15,000 - 20,000 LF	2
10,000 -15,000 LF	3
5,000 - 10,000 LF	4
1,000 - 5,000 LF	5
Less than 1,000 LF	6

Consequence of Failure Computation

Weighting Factor	Economic	Social	Environmental
	1/4	1/4	1/2
Network Position			
Diameter (12")	3	3	
Depth (9')	2		
Location of Pipe			
Collector road	4	4	
Proximity to sensitive environment			
40' from creek			5
Serves important customer			
2 miles downstream of hospital		3	
Accessibility			
Needs Traffic Control	2		
TOTAL	**11**	**10**	**5**
TOTAL(SUM) / POSSIBLE (6*#)	**11/24 = 0.458**	**10/18 = 0.555**	**5/6 = 0.833**
WEIGHTED (TOTAL * Weighting Factor)	**0.458 * 1/4 = 0.115**	**0.555 * 1/4 = 0.139**	**0.833 * 1/2 = 0.417**
COF = SUM(of WEIGHTED)***6**	**4.03**		

PACP Inspection Form - Header Section

General Information

Red font fields = Mandatory, Black font fields = Optional

1. Surveyed by	2. Certificate No.		3. Reviewed by	4.Reviewer Certificate No.
5. Owner	6. Customer		7. P/O Number	8. Work Order Number
9. Media Label	10. Project	11. Date YYYYMMDD	12. Time HH:MM	13. Sheet Number
14. Weather	15. Pre-Cleaning	16. Date Cleaned	17. Flow Control	18. Purpose of Survey
19. Direction of Survey	20. Inspection Technolog			
22. Consequence of Failure		2		

Enter Consequence of Failure value in Field 22 of the PACP Inspection Form Header Section

4.03

Location

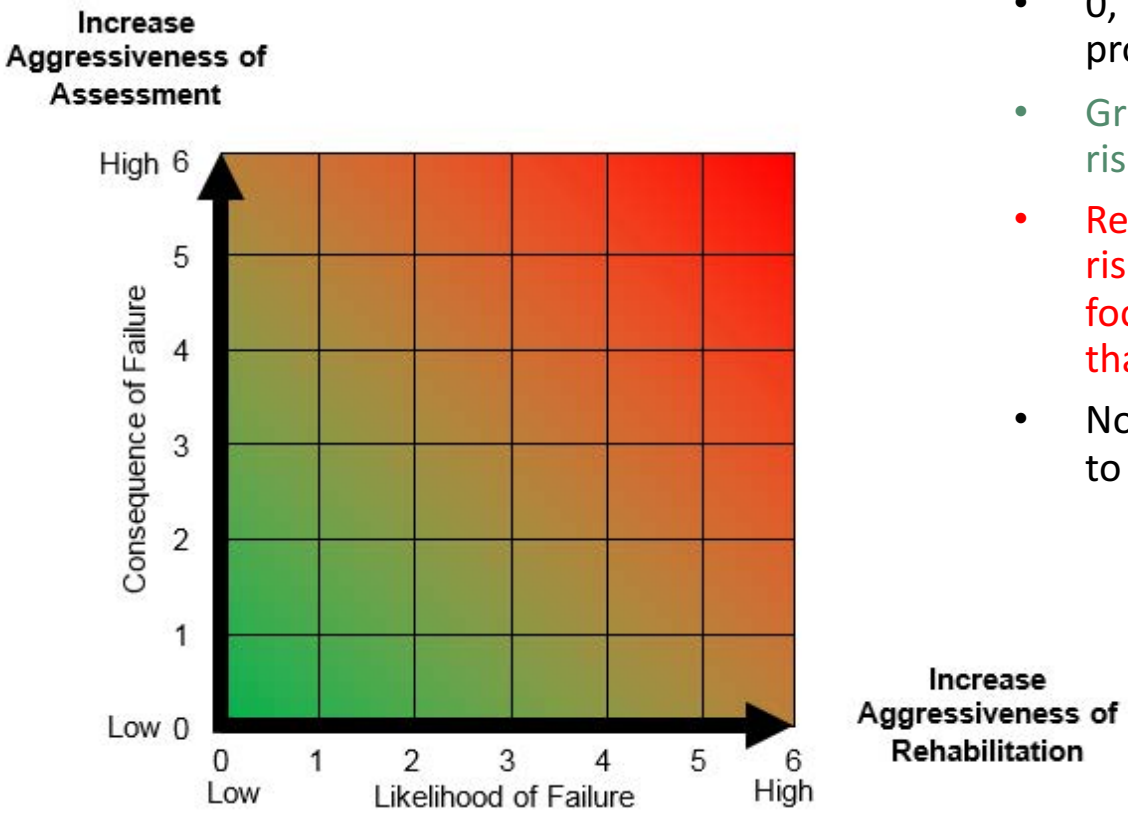
24. Drainage Area	25. Pipe Segment Reference	26. Street (Name & Number)
27. City	28. Location Code	29. Location Details

Pipe

30. Pipe Use	31. Height (Diameter)	32. Width	33. Shape
34. Material	35. Lining Method	36. Coating Method	37. Pipe Joint Length
38. Total Length	39. Length Surveyed	40. Year Constructed YYYY	41. Year Renewed YYYY

PACP®-Based Risk Management

- Risk matrix provides a basis for a maintenance and rehabilitation program
- Overall risk a function of LoF and CoF



- 0, LoF or CoF - a data gap, promptly collect information
- Green area – assets with lower risk
- Red area - assets with higher risk; resources should be focused on rehabilitating assets that fall in the red area
- Non-zero risk scores can be used to prioritize projects

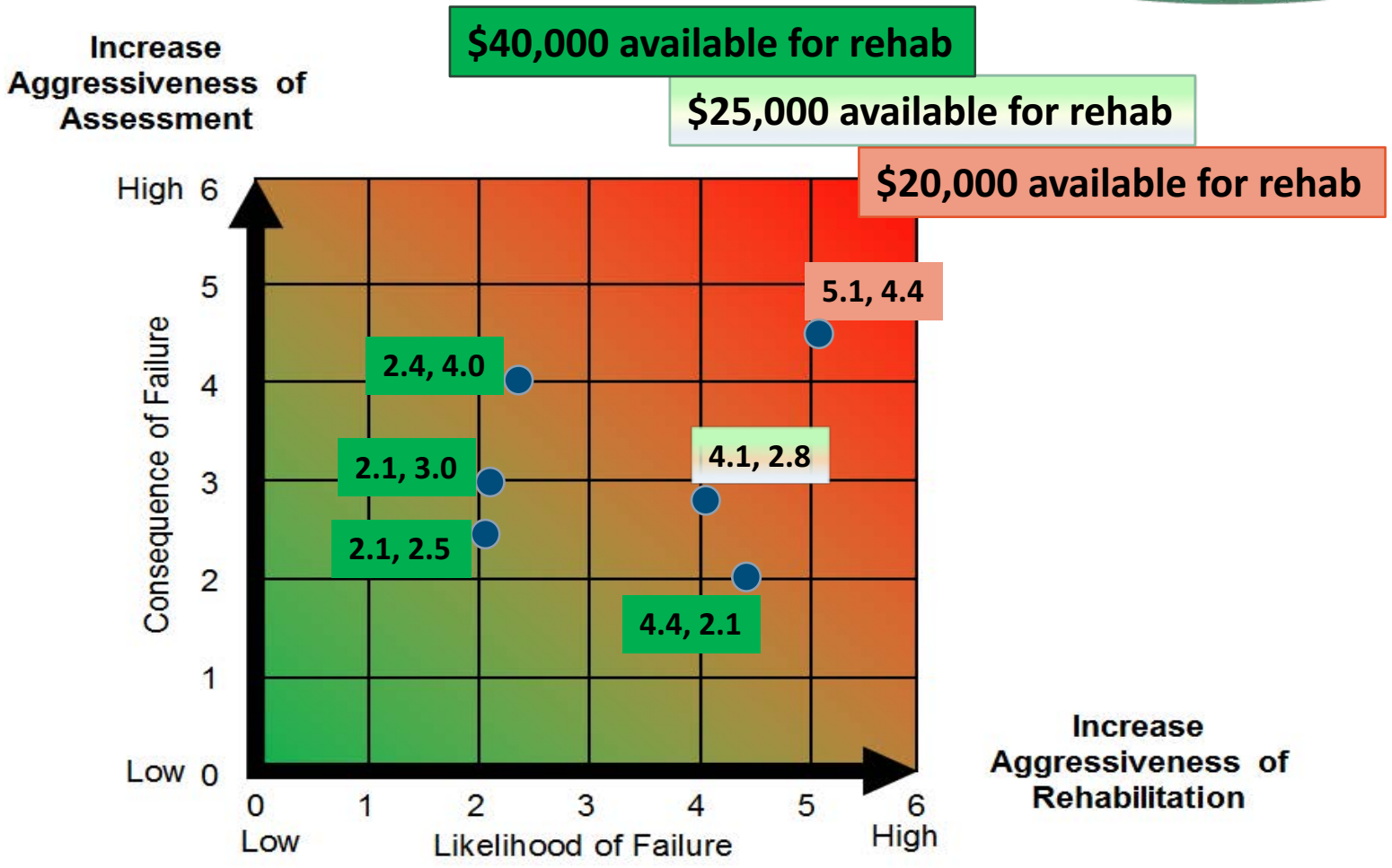
Sample Asset Management Plan

Collect asset condition information

Up MH	Dn MH	Street	Loc Code	Year Laid	Rehab Yr	Rehab Meth	LF	DIA	Material	Observed Defects	QOR	LoF	CoF	RISK	Rehabilita-tion	Later-als	Projected Cost
A001	T012	Lake O' Odonell Rd.	Light Highway	1921	1980	Slip Line	356	10	PE			0	3	0		2	
A002	A001	Easement Ball Park Rd.	Easement/ Right of Way	1921			92	10	VCP			0	3	0			
A003	A002	University Esmt	Easement/ Right of Way	1921	2004	Pipe Burst	188	10	PE	15% MWLS	2100	2.1	2.5	5.3			
A004	A003	Solace M Freeman	Easement/ Right of Way	1921	2004	Cured In Place	220	10	FRP	MWL (50%) DAGS	2100	2.1	3.0	6.3	Clean Line		$440
A005	A004	Solace M Freeman	Main Collector Highway	1921	2004	Cured In Place	223	10	FRP	30% MWLS, DAGS	2400	2.4	4.0	9.6	Clean Line		$1000
A006	A005	Alabama Esmt	Easement/ Right of Way	1921	2004	Cured In Place	410	10	FRP	DAGS, JOL stopped TV @343 ds. Reverse completed	4100	4.1	2.8	11.5	Point Repair Clean Line	2	$4,819
A007	A006	Sollace M Freeman Esmt	Easement/ ROW - 60 ft from stream	1969			359	10	VCP	MWL (40%), FL, CM, MCU, BVV	5141	5.1	4.4	22.4	Pipe Burst		$18,668
B001	A007	Sollace M Freeman Esmt	Easement/ ROW - Upstream end of System	1969			253	8	VCP	MWL (20%), TFD, FM, CM	4432	4.4	2.1	9.2	Pipe Burst		$11,623

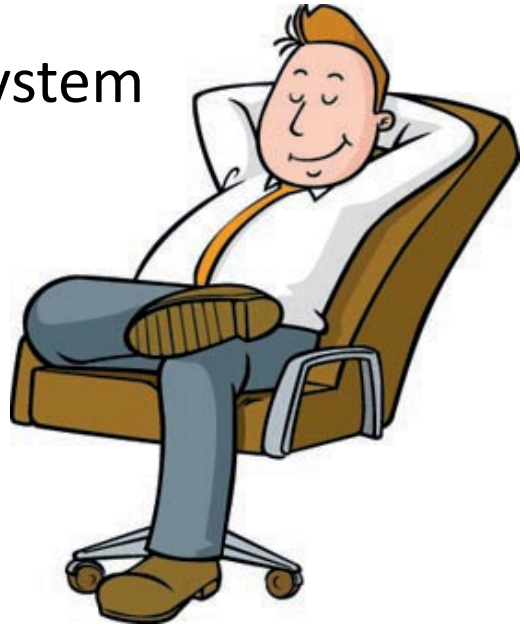
Graph this data to help set priorities

Managing Asset Risk (Examples)



Successful Asset Management Results

- Shift from emergency response to strategic risk-based management of critical assets
- Reduce the number of asset failures
- Minimize the negative impacts of failures when they occur
- Improve performance & reliability of the system
- Manage O&M costs more accurately



Questions / Discussions

More Information

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