

Hazen



Sanitary Sewer & Water Distribution System Condition Assessment

January 9, 2020

Agenda

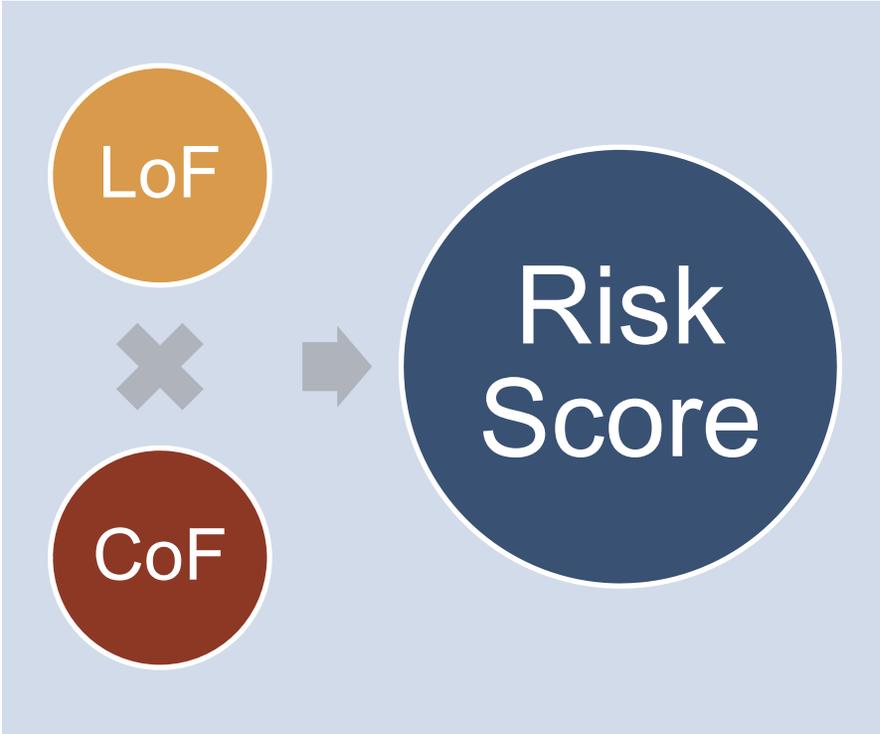
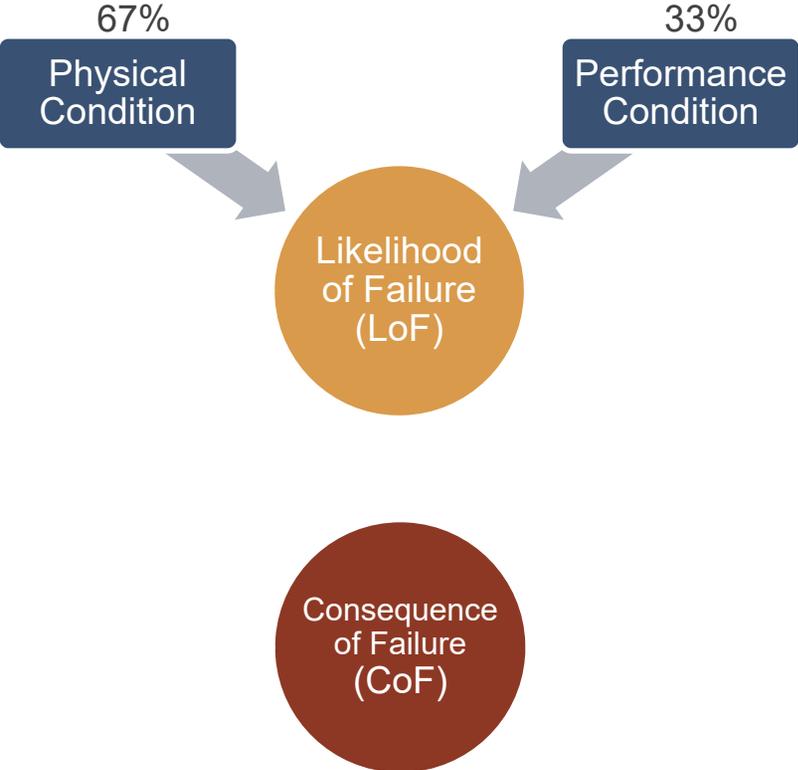
- Risk Assessment Purpose and Background
- Risk Assessment Approach and Results
- CIP Recommendations
- Next Steps

Purpose & Background – Infrastructure Strategy

- Know what assets you own
- Understand asset condition and criticality
- Understand performance and serviceability, remaining life, and economic value/replacement cost
- More accurately plan for and prioritize long-term capital needs
- Proactively reduce overall infrastructure risk



Risk Assessment Methodology



Risk Assessment Methodology

Likelihood of Failure (LoF)

Likelihood of Failure

- Vertical Assets (pump stations and water tanks)
 - Physical Condition (67%)
 - Performance Condition (33%)
- Linear Assets (pipes)
 - Age (35%)
 - Soil Corrosivity (20%)
 - Pipe Material (10%)
 - Failure History (35%)

Consequence of Failure

- Vertical Assets
 - Regulatory Compliance (20%)
 - Level of Service (40%)
 - Safety (25%)
 - O&M Impacts (15%)
- Linear Assets
 - Diameter (20%)
 - Pipe Depth (20%)
 - Cost Impact (20%)
 - Proximity to Water Bodies (20%)
 - Population Density (20%)

Approach

- **Field investigation** to determine physical condition
- **Onsite interviews** with operations staff to determine performance condition
- **Desktop analyses** to determine pump station resiliency and consequence of failure
- Development of **renewal and replacement costs and timing**

Vertical Assets Risk Matrices

Assets Projected for Replacement within 25 YRs

Risk Matrix - # of Vertical Assets for Replacement in 25 Yrs									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Pump Station & Water Tank Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	6 2.0%	15 4.9%	21 6.8%	4 1.3%	1 0.3%	47 15%	Low	65 21%
	2	3 1.0%	18 5.9%	82 26.7%	22 7.2%	2 0.7%	127 41%		Medium
	3 Moderate Impact	2 0.7%	1 0.3%	20 6.5%	8 2.6%	1 0.3%	32 10%	Medium	11
	4	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0%	High	4%
	5 High Impact	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0%	High	1 0%
Condition Totals		11 4%	34 11%	123 40%	34 11%	4 1%	206 67%		206 67%

Risk Matrix - \$ of Vertical Assets for Replacement in 25 Yrs									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Pump Station & Water Tank Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	\$90,000 1.10%	\$61,920 0.76%	\$83,320 1.02%	\$14,120 0.17%	\$1,600 0.02%	\$250,960 3%	Low	\$408,640 5%
	2	\$22,000 0.27%	\$132,400 1.62%	\$571,500 6.98%	\$308,000 3.76%	\$0 0.00%	\$1,033,900 13%		Medium
	3 Moderate Impact	\$19,000 0.23%	\$15,000 0.18%	\$398,750 4.87%	\$381,000 4.65%	\$9,500 0.12%	\$823,250 10%	Medium	\$382,600
	4	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0%	High	5%
	5 High Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0%	High	\$9,500 0%
Condition Totals		\$131,000 2%	\$209,320 3%	\$1,053,570 13%	\$703,120 9%	\$11,100 0%	\$2,108,110 26%		\$2,108,110 26%

Vertical Assets Risk Matrices

Entire Pump Station & Water Storage Tank System

Risk Matrix - # of Vertical Assets									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Pump Station & Water Tank Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	7 2%	21 7%	21 7%	4 1%	1 0%	54 18%	Low	136
	2	29 9%	51 17%	101 33%	25 8%	2 1%	208 68%	Medium	44%
	3 Moderate Impact	7 2%	3 1%	22 7%	8 3%	1 0%	41 13%	Low	156
	4	1 0%	0 0%	4 1%	0 0%	0 0%	5 2%	Medium	15
	5 High Impact	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	High	5%
Condition Totals		44 14%	75 24%	148 48%	37 12%	4 1%	308 100%		308 100%

Risk Matrix - \$ of Vertical Assets									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Pump Station & Water Tank Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	\$94,220 1.15%	\$97,920 1.20%	\$83,320 1.02%	\$14,120 0.17%	\$1,600 0.02%	\$291,180 4%	Low	\$1,127,960
	2	\$350,300 4.28%	\$288,500 3.52%	\$611,250 7.47%	\$311,600 3.81%	\$0 0.00%	\$1,561,650 19%	Medium	14%
	3 Moderate Impact	\$213,700 2.61%	\$37,000 0.45%	\$420,750 5.14%	\$381,000 4.65%	\$9,500 0.12%	\$1,061,950 13%	Low	\$2,144,720
	4	\$750,000 9.16%	\$0 0.00%	\$4,522,000 55.24%	\$0 0.00%	\$0 0.00%	\$5,272,000 64%	Medium	\$4,904,600
	5 High Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0%	High	60%
Condition Totals		\$1,408,220 17%	\$423,420 5%	\$5,637,320 69%	\$706,720 9%	\$11,100 0%	\$8,186,780 100%		\$9,500 0%
									\$8,186,780 100%

Sanitary Sewer Risk Matrices

Pipe Segments Projected for Replacement within 25 YRs

Risk Matrix - LF of Sanitary Sewer for Replacement in 25 Yrs									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Sanitary Sewer Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0%	Low	0 0%
	2	0 0.00%	0 0.00%	40,869 7.63%	1,353 0.25%	0 0.00%	42,222 8%	Medium	258,578 48%
	3 Moderate Impact	0 0.00%	0 0.00%	216,356 40.40%	9,268 1.73%	0 0.00%	225,624 42%	Low	29,279 5%
	4	0 0.00%	0 0.00%	20,011 3.74%	0 0.00%	0 0.00%	20,011 4%	High	0 0%
	5 High Impact	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0%	High	0 0%
Condition Totals		0 0.0%	0 0.0%	277,236 51.8%	10,621 2.0%	0 0.0%	287,857 54%		287,857 54%

Risk Matrix - \$ of Sanitary Sewer for Replacement in 25 Yrs									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Sanitary Sewer Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	\$0 0%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.0%	Low	\$0 0%
	2	\$0 0.00%	\$0 0.00%	\$19,850,060 6.03%	\$629,200 0.19%	\$0 0.00%	\$20,479,260 6.2%	Medium	\$135,633,650 41%
	3 Moderate Impact	\$0 0.00%	\$0 0.00%	\$115,154,390 34.95%	\$4,831,100 1.47%	\$0 0.00%	\$119,985,490 36.4%	Low	\$23,410,150 7%
	4	\$0 0.00%	\$0 0.00%	\$18,579,050 5.64%	\$0 0.00%	\$0 0.00%	\$18,579,050 5.6%	High	\$0 0%
	5 High Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.0%	High	\$0 0%
Condition Totals		\$0 0.0%	\$0 0.0%	\$153,583,500 46.6%	\$5,460,300 1.7%	\$0 0.0%	\$159,043,800 48%		\$159,043,800 48%

Sanitary Sewer Risk Matrices

Entire Sanitary Sewer System

Risk Matrix - LF of Sanitary Sewer									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Sanitary Sewer Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0%	Low	39,066
	2	849 0.16%	32,158 6.00%	49,836 9.30%	1,353 0.25%	0 0.00%	84,195 16%	Medium	461,361
	3 Moderate Impact	6,059 1.13%	110,399 20.61%	288,440 53.86%	9,268 1.73%	0 0.00%	414,166 77%	Low	86%
	4	306 0.06%	11,028 2.06%	25,887 4.83%	0 0.00%	0 0.00%	37,221 7%	Medium	35,155
	5 High Impact	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	High	0
Condition Totals		7,214 1%	153,585 29%	364,163 68%	10,621 2%	0 0%	535,583 100%		535,583 100%

Risk Matrix - \$ of Sanitary Sewer									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Sanitary Sewer Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	\$0 0%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0%	Low	\$27,015,320
	2	\$551,870 0.17%	\$21,935,760 6.66%	\$24,604,740 7.47%	\$629,200 0.19%	\$0 0.00%	\$47,721,570 14%	Medium	\$274,993,270
	3 Moderate Impact	\$4,527,690 1.37%	\$77,551,030 23.54%	\$162,761,260 49.40%	\$4,831,100 1.47%	\$0 0.00%	\$249,671,080 76%	Low	83%
	4	\$253,920 0.08%	\$9,193,120 2.79%	\$22,609,340 6.86%	\$0 0.00%	\$0 0.00%	\$32,056,380 10%	Medium	\$27,440,440
	5 High Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0%	High	\$0
Condition Totals		\$5,333,480 2%	\$108,679,910 33%	\$209,975,340 64%	\$5,460,300 2%	\$0 0%	\$329,449,030 100%		\$329,449,030 100%

Water Distribution Risk Matrices

Pipe Segments Projected for Replacement within 25 YRs

Risk Matrix - LF of Water Distribution for Replacement in 25 Yrs									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Water Distribution Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0%	Low	0 0%
	2	0 0.00%	0 0.00%	13,463 2.21%	14,092 2.31%	2,848 0.47%	30,403 5%	Medium	27,555 5%
	3 Moderate Impact	0 0.00%	0 0.00%	0 0.00%	17,811 2.92%	1,677 0.28%	19,488 3%	Medium	20,659 3%
	4	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0%	High	1,677 0%
	5 High Impact	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0%	High	0 0%
Condition Totals		0 0.0%	0 0.0%	13,463 2.2%	31,903 5.2%	4,525 0.7%	49,891 8%		49,891 8%

Risk Matrix - \$ of Water Distribution for Replacement in 25 Yrs									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Water Distribution Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.0%	Low	\$0 0%
	2	\$0 0.00%	\$0 0.00%	\$8,750,950 2.55%	\$7,217,000 2.10%	\$1,851,200 0.54%	\$17,819,150 5.2%	Medium	\$15,967,950 5%
	3 Moderate Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$8,014,950 2.34%	\$754,650 0.22%	\$8,769,600 2.6%	Medium	\$9,866,150 3%
	4	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.0%	High	\$754,650 0%
	5 High Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.0%	High	0 0%
Condition Totals		\$0 0.0%	\$0 0.0%	\$8,750,950 2.6%	\$15,231,950 4.4%	\$2,605,850 0.8%	\$26,588,750 8%		\$26,588,750 8%

Water Distribution Risk Matrices

Entire Water Distribution System

Risk Matrix - LF of Water Distribution									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Water Distribution Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	0 0.00%	0 0.00%	49 0.01%	0 0.00%	0 0.00%	49 0%	Low	129,706
	2	1,689 0.28%	127,968 21.01%	171,008 28.07%	14,410 2.37%	2,848 0.47%	317,923 52%		Medium
	3 Moderate Impact	0 0.00%	101,533 16.67%	163,027 26.76%	24,913 4.09%	1,677 0.28%	291,150 48%	Low	74%
	4	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0%	Medium	27,761
	5 High Impact	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	High	5%
Condition Totals		1,689 0%	229,501 38%	334,084 55%	39,323 6%	4,525 1%	609,122 100%		609,122 100%

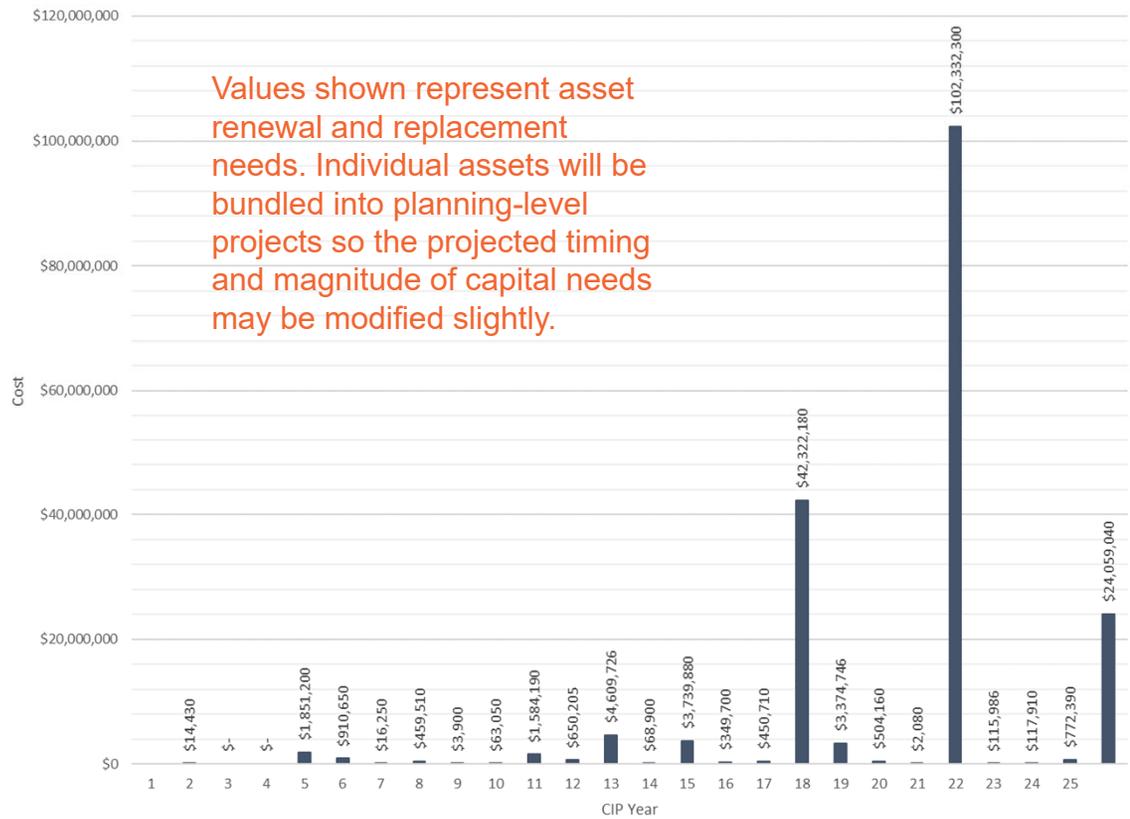
Risk Matrix - \$ of Water Distribution									
Risk Score = LoF * CoF		Likelihood of Failure (LoF)					Criticality Totals	Water Distribution Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	\$0 0.00%	\$0 0.00%	\$31,850 0.01%	\$0 0.00%	\$0 0.00%	\$31,850 0%	Low	\$78,916,810
	2	\$1,097,850 0.32%	\$77,787,110 22.69%	\$84,653,200 24.69%	\$7,423,700 2.17%	\$1,851,200 0.54%	\$172,813,060 50%		Medium
	3 Moderate Impact	\$0 0.00%	\$65,355,810 19.06%	\$89,566,490 26.12%	\$14,351,130 4.19%	\$754,650 0.22%	\$170,028,080 50%	Low	72%
	4	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0%	Medium	\$16,202,330
	5 High Impact	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0.00%	\$0 0%	High	5%
Condition Totals		\$1,097,850 0%	\$143,142,920 42%	\$174,251,540 51%	\$21,774,830 6%	\$2,605,850 1%	\$342,872,990 100%		\$342,872,990 100%

Capital Project Recommendations and Prioritization

Projected 25-Year Capital Needs

Total Cost:

- \$188 million (\$7.5M/yr) in today's dollars



Next Steps

- Finalize analysis and program annual budget limits into CIP plan in rate model
- Develop Draft Technical Memorandum

Discussion