Toledo Regional Water Commission Meeting

August 18, 2022

City of Toledo

Successful partnerships start with Fluid thinking®

Jones & Henry Engineers, Ltd. 3103 Executive Parkway, Suite 300, Toledo, OH 43606

Study Objectives

- Review previous condition assessment reports
- Develop recommendations for repair or replacement of 78-inch raw water main

Study Findings

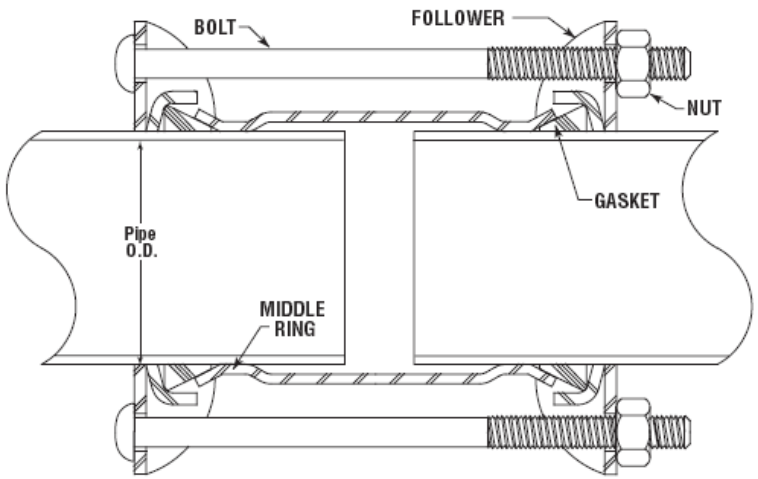
- All segments of 78-inch raw water main require repair or replacement

Study Findings

- All segments of 78-inch raw water main require repair or replacement
- Leaks are likely to occur with increasing frequency

Study Findings

- All segments of 78-inch raw water main require repair or replacement
- Failure of 'Dresser' coupling (pipe joint) is the most catastrophic risk to pipeline



Study Findings

- Condition Assessment Ranking
  - Repair or replace East segment first
  - Repair or replace West segment second
  - Repair or replace Center segment last
- Evaluated Alternatives for Repair or Replacement
- Recommendation
- Project Cost

Condition Assessment Technical Criteria

Technical Criteria (Quantitative)				Scoring		
Item	Category		Weighting Factor	Section 1 East	Section 2 Central	Section 3 West
Total Transient Pressure	PSI	----	----			
	0 - 50	----	1			
	51 - 100	----	2		2	2
	101- 150	----	3	3		
Failures	Total	----	----			
	0	----	0	0	0	0
	≥ 1	----	20			
Leaks	1 - 4	----	2			2
	5 - 10	----	4		4	
	11 - 20	----	7			
	> 20	----	10	10		
Reduction of Flow	None	----	0			
	Any	----	5	5	5	5
Pipe Deflection	Deflection	% Pipe Segments	----			
	< 2.5%	< 33%	3	3	3	3
		33% - 66%	6			
		> 66%	9			
	2.5% - 5%	< 33%	6			
		33% - 66%	9		9	9
		> 66%	12	12		
	> 5%	< 10%	9	9		
		10% - 20%	12		12	12
		> 20%	15			
Joint Spalling or Cracking	% Joints	----	----			
	< 33%	----	3			
	33% - 67%	----	6			
	> 67%	----	9	9	9	9
Pipe CML Cracks or Spalling	Total Pipe Sections	----	----			
	< 15	----	1			1
	16 - 30	----	2		2	
	> 30	----	3	3		
Corrosion Staining	Total Pipe Sections	----	----			
	< 10	----	2	2		
	11 - 20	----	4		4	4
	> 20	----	6			
External Corrosion	Any	----	20	20	20	20
Soil Resistivity < 5,000 ohm-cm	% Pipe Sections	----	----			
	< 50%	----	2			
	50% - 90%	----	4			4
	> 90%	----	6	6	6	
			Total	82	76	71
			Ranking	1	2	3

Condition Assessment Technical Criteria

Technical Criteria (Quantitative)				Scoring		
Item	Category		Weighting Factor	Section 1 East	Section 2 Central	Section 3 West
Total Transient Pressure	PSI	----	----			
	0 - 50	----	1			
	51 - 100	----	2		2	2
	101- 150	----	3	3		
Failures	Total	----	----			
	0	----	0	0	0	0
	≥ 1	----	20			
Leaks	1 - 4	----	2			2
	5 - 10	----	4		4	
	11 - 20	----	7			
	> 20	----	10	10		
Reduction of Flow	None	----	0			
	Any	----	5	5	5	5
	Deflection	% Pipe Segments	----			
	< 2.5%	< 33%	3	3	3	3
		33% - 66%	6			
Joint Spalling or Cracking	< 33%	----	3			
	33% - 67%	----	6			
	> 67%	----	9	9	9	9
Pipe CML Cracks or Spalling	Total Pipe Sections	----	----			
	< 15	----	1			1
	16 - 30	----	2		2	
	> 30	----	3	3		
Corrosion Staining	Total Pipe Sections	----	----			
	< 10	----	2	2		
	11 - 20	----	4		4	4
	> 20	----	6			
External Corrosion	Any	----	20	20	20	20
Soil Resistivity < 5,000 ohm-cm	% Pipe Sections	----	----			
	< 50%	----	2			
	50% - 90%	----	4			4
	> 90%	----	6	6	6	
			Total	82	76	71
			Ranking	1	2	3

Total	82	76	71
Ranking	1	2	3

Condition Assessment Subjective Criteria

Subjective Criteria (Social/Economic/Environmental Consequences)

Criteria	Category	Weighting Factor	Scoring: Section 1 East	Scoring: Section 2 Central	Scoring: Section 3 West
Distruption to Public Services and Critical Life/Safety Facilities	High	2			
	Medium	1.5			1.5
	Low	1.25	1.25	1.25	
Damages to Public Utilities & Roadways	High	2			2
	Medium	1.5	1.5	1.5	
	Low	1.25			
Damages to Landfill	High	2			2
	Medium	1.5			
	Low	1.25	1.25	1.25	
Damages to Natural Systems	High	2			
	Medium	1.5	1.5	1.5	
	Low	1.25			1.25
Impact/Damage to Commercial Businesses	High	2			
	Medium	1.5			1.5
	Low	1.25	1.25	1.25	
Impact/Damage to Industrial Business & Major Private Utilities	High	2			2
	Medium	1.5		1.5	
	Low	1.25	1.25		
Impact to Agricultural Properties	High	2	2	2	
	Medium	1.5			
	Low	1.25			1.25
Proximity to Alternate Water Source	High	2			
	Medium	1.5	1.5	1.5	1.5
	Low	1.25			
		Average	1.44	1.47	1.63
		Ranking	3	2	1

Condition Assessment Final Ranking

	Section 1 East	Section 2 Center	Section 3 West
Adjusted Total	117.9	111.6	115.4
Ranking	1	3	2

Rehabilitation and Replacement Options Summary

- Option A – Do Nothing Leave As Is for Remaining Service Life
- Option B – Rehabilitation Cement Mortar Lining
- Option C – Rehabilitation Carbon Fiber Reinforced Polymer Lining
- Option D – New 78” Steel & Abandon Existing 78” In Place
- Option E – Third Pipeline – New 78” Steel & Leave Existing 78” As Is
- Option F – Third Pipeline – New 78” Steel & HDPE Line Existing 78”

Discarded Rehabilitation/Replacement Options

- Option G – New 78-Inch Pipeline and New 60-Inch Pipeline in Segment 3
- Option H – Hybrid Option – Rehab with CML Segments 1 & 2, New 78-Inch Segment 3
- Option I – Hybrid Option – Rehab with CFRP Segments 1 & 2, New 78-Inch Segment 3

Discarded Rehabilitation/Replacement Options

- Option J – Sliplining of Existing 78-Inch Pipeline
- Option K – Segmented Steel Lining of Existing 78-Inch Pipeline
- Pipe Material for 78-inch Pipe
  - Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe (FRP)
  - High-Density Polyethylene Pipe (HDPE)
  - Prestressed Concrete Cylinder Pipe (PCCP)
  - Ductile Iron Pipe (DIP)

Cost Matrix

Replacement / Rehabilitation Options		Costs						Risks							
		Construction Cost	Expected Service Life[3]	Repair Cost During Expected Lifespan	Repair Cost After Expected Lifespan up to 100 years [4]	Total Service-Year Cost [1]	Cost per Service Year	Surface Disruption / Property Issues	Provides Redundancy	Leaks During Expected Service Life	Catastrophic Failure During Expected Service Life	Leaks After Expected Service Life	Catastrophic Failure After Expected Service Life	Pipe Adjacent to Landfill	Construction Changes
"Do Nothing"	Option A - Continue to Operate in Current Condition for Another 100 Years of Service Life	$ -	30	$ 6,000,000	$ 28,000,000	$ 34,000,000	$ 1,133,333	High	No	Do Nothing (High)	Do Nothing (High)	Do Nothing (High)	Do Nothing (High)	Yes	N/A
Rehabilitate in Place	Option B - Rehabilitation - for 30 Year Service Life, but operate for 100 years Cement Mortar Lining (CML)	$ 51,324,000	30	$ 525,000	$ 5,950,000	$ 57,799,000	$ 1,926,633	Low	No	High	Low	High	Med	Yes	High
	Option C - Rehabilitation - for 50 Year Service Life but operate for 100 years Carbon Fiber Reinforced Polymer (CFRP)	$ 262,730,000	50	$ 500,000	$ 4,250,000	$ 267,480,000	$ 5,349,600	Low	No	Med	Low	High	Med	Yes	High
Replace Pipe	Option D - Replacement - for 100 Year Service Life New 78-inch, Abandon In Place Exist 78-inch	$ 154,201,000	100	$ 400,000	$ -	$ 154,601,000	$ 1,546,010	High	No	Low	Low	Low	Low	Yes	Low
	Option E - New (3rd Line) - for 100 Year Service Life New 78-inch, Leave Exist 78-inch in Service for 100 Years	$ 154,201,000	100	$ 6,400,000	$ 28,000,000	$ 188,601,000	$ 1,886,010	High	Yes	Low	Low	High	High	Yes	Low/High
	Option F - New (3rd Line) - For 100 Year Service on Both Lines New 78-inch, HDPE Lining Exist 78-inch	$ 227,521,000	100	$ 600,000	$ -	$ 228,121,000	$ 2,281,210	High	Yes	Low	Low	Low	Low	Yes	Low

Rehabilitation/Replacement Options Ranking

Best (4) Above Average (3) Average (2) Below Average (1) Worst (0)	Maintain Flow Capacity (Yes or No)	Loss of Service Risk (Leak or Failure)	Construction Cost	Cost per Service Year	Service Impacts During Construction	Construction Risk	Potential for Future Leaks / Repairs	Redundancy (n+1)	Confined Space / Manned Entry Requirements	Construction Duration	Surface / Property Disruption		
Weighting Factor	**----**	**10**	**9**	**9**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**Total Score**	**Rank**
Option A - "Do Nothing" Leave "As-Is" for Remaining Service Life	Yes	0	4	4	0	0	0	0	0	4	0	**80**	**4**
Option B - Rehabilitation - 30 Year Service Life Cement Mortar Lining (CML)	Yes	2	3	2	0	1	1	0	0	0	4	**80**	**4**
Option C - Rehabilitation - 50 Year Service Life Carbon Fiber Reinforced Polymer (CFRP)	Yes	3	0	0	0	1	3	0	0	1	4	**57**	**6**
Option D - Replacement - 100 Year Service Life New 78-inch, Abandon In-Place Exist 78-inch	Yes	4	2	3	4	4	4	0	4	4	1	**178**	**1**
Option E - New (3rd Line) - 100 Year Service Life New 78-inch, Leave Exist 78-inch "As-Is" for Remaining Service Life	Yes	4	2	2	4	4	0	4	4	4	0	**164**	**2**
Option F - New (3rd Line) - 100 Year Service Life New 78-inch, HDPE Lining Exist 78-inch	Yes	4	1	1	4	4	4	3	4	2	1	**159**	**3**

Recommended Option D

- New 78-inch steel pipe
- Highest ranking alternative
- 100 year service life
- Lowest cost per year of service life
- Minimizes risk of interruption to service area

Cost – Option D

	Items		Amount
1	Segment 1: LSPS to Curtice Rd 78" Pipe Line (17,000 LNFT)		$30,260,000
2	Segment 2: Curtice Rd to Wynn Rd 78" Pipe Line (16,500 LNFT)		$29,370,000
3	Segment 3: Wynn Rd to WTP 78" Pipe Line (8,900 LNFT Open Cut)		$15,842,000
3	Segment 3: Wynn Rd to WTP 78" Pipe Line (4,600 LNFT Tunneling)		$18,400,000
4	Low Service Pumping Station -Modification		$4,837,440
5	North Curtice Road Crossover -New		$7,320,147
6	Wynn Road Crossover -New		$7,320,147
7	Collins Park Water Treatment Plant -Modification		$5,265,715
	Subtotal		$118,616,000
	Contingencies	30%	$35,585,000
	Subtotal Construction Cost		$154,201,000
	Inflation to Mid Point of Phasing	6%	$9,252,000
	Total Construction Cost		$163,453,000
	Engineering Services	6%	$9,807,000
	Total Probable Project Cost		$173,260,000

Recommended Phasing & Associated Cost

	Items		Amount
1	Segment 1: LSPS to Curtice Rd 78" Pipe Line (17,000 LNFT)		$30,260,000
2	Segment 3: Wynn Rd to WTP 78" Pipe Line (8,900 LNFT Open Cut)		$15,842,000
3	Segment 3: Wynn Rd to WTP 78" Pipe Line (4,600 LNFT Tunneling)		$18,400,000
4	Connections to Existing Wynn Rd, Curtice Rd, and LSPS 78" Pipe Line		$1,308,409
5	Collins Park Water Treatment Plant -Modification		$5,265,715
	Subtotal		$71,077,000
	Contingencies	30%	$21,323,000
	Subtotal Construction Cost		$92,400,000
	Inflation to Mid Point of Phasing	6%	$5,544,000
	Total Construction Cost		$97,944,000
	Engineering Services	6%	$5,877,000
	Total Probable Project Cost		$103,821,000