

Test	Description	Tests For	Cost	Description of Cost	Destructive?	Disruptive?
Transient Model	Transient modeling can replicate field conditions then evaluate alternatives (valve installation, surge tanks, modify pump operations) to mitigate issues.	Investigation Alternative C (Effects from hospital lift station), D (Cla-Val Operation)	\$23,000.00	100 hours for design with additional (10) hours for QA/QC. This accounts for the unknowns/risks of the system	N	N
Pressure Monitoring	Place additional pressure monitors along the pipe (in addition to the 2 permanent pressure sensors that are now operational) to better capture any transient pressure waves (i.e. water hammers) or other pressure changes.	Investigation Alternative C (Effects from hospital lift station), D (Cla-Val Operation)	\$5,976.00	Renting loggers (\$500 per logger, per month, assumed at one per mile) + analysis hours (10 hours per month)	N	N
Geotech - Trenching to Investigate Bedding	Trenching along areas of the water main that have not broken since installation will help reveal the condition of the backfill and bedding along the pipe's alignment.	Investigation Alternative B (Construction Methods), Investigation Alternative E (Effects from Seismic Activity)	\$54,000.00	\$4k per day for trenching equipment (3 days of trenching); CCTV (\$40k for entire line); testing (1 day compaction testing - \$800, grain size testing - \$300, 6 moisture tests - \$600, attenure tests (25 proctors, \$250, 1 per foot below grade, assume 5 ft below grade average - \$300); no bypass pumping	Y	Y

1. Perform non-destructive testing such as: Visual inspection Workmanship Inspection ASTM D2122 Dimensions determination (per AWWA C905) 2. ASTM D1784 Cell Classification Testing ASTM D256 IZOD Impact Test ASTM D638 Tensile Properties (Strength at Yield and Modulus) Note that some of the above listed material property tests are contained within the ASTM D1784 PVC Cell Classification material requirements sub-referenced within C905. This document will be used as a guideline for evaluating test results but cannot be used to determine non-conformance since the test samples will be harvested from the field harvested samples and the sample preparation will not meet the explicit D1784 requirements. 3. ASTM F1057 Heat Reversion 4. AWWA C900/ASTM D2152 Acetone Immersion 5. ASTM D5630 Ashing or ASTM D2584 LOI 6. AWWA C900 Hoop Tensile in lieu of quickburst 7. AWWA C900 Flattening 8. ISO 18373-1 Differential Scanning Calorimetry (DSC)	Flattening/Pipe Burst Strength	Investigation Alternative A (Pipe Condition)	\$10,000 for Product Specification Type Testing, Additional \$3,000-\$5,000 for failure analysis on fractured samples	2 broken lengths of pipe and 2 unbroken lengths of pipe, with additional testing beyond what was performed in previous lab tests.	Y	Y
CCTV	Videoring the line will show the interior condition of the pipe - the lab report says the samples display fully developed slow crack growth through 90% of the wall thickness, so it is possible the CCTV test will show breaks prior to them occurring and confirm the lab test.	Investigation Alternative A (Pipe Condition)	\$40,000.00	CCTV only (no bypass pumping)	N	Y

Criteria	Weight -100%	Transient Model		Additional Pressure Sensors		Geotech – Trenching		Lab Tests on Pipe		CCTV	
		Scale	Total	Scale	Total	Scale	Total	Scale	Total	Scale	Total
Likelihood of Determining Failure	30%	3	0.9	3	0.9	4	1.2	2	0.6	2	0.6
Disruptive vs. Non- Disruptive	30%	4	1.2	3	0.9	3	0.9	2	0.6	2	0.6
Destructive vs. Non- Destructive Testing	20%	4	0.8	4	0.8	3	0.6	1	0.2	3	0.6
Cost of Testing	20%	3	0.6	4	0.8	1	0.2	2	0.4	2	0.4
Total	100%	14	3.5	14	3.4	11	2.9	7	1.8	9	2.2