ACME Water District
36-inch BWP Aqua Connector
Condition Assessment Report, Standard Analysis

PICA – Pipeline Inspection & Condition Analysis Corporation
(A Subsidiary of Russell NDT Holdings Ltd.)

Remote Field-Testing RAFT Tool

36-inch Aqua Connector

Bar Wrapped Pipe

Metropolis, IL

PICA Project: 7654

Inspection Date:	January 6th – January 19th, 2020
Report Submission:	March 31st, 2020
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Reviewer:	A. Lincoln, G. Washington
Report Revision:	1.0

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Condition Assessment Report, Standard Analysis

Executive Summary

In January of 2020, PICA (USA), under contract with the ACME Water District (AWD), inspected 11,576.58ft of the Aqua Connector pipeline using Remote Field Testing (RFT) technology. The inspected sections are comprised of 36-inch Bar Wrapped ACCP of various pressure classes.

The RFT inspection was conducted using PICA's RAFT tool, which can be inserted into the pipeline through standard 18-inch manholes, and then inflated to the required inspection diameter of 36-inches. The majority of the line was inspected continuously over several days, with PICA able to secure the RAFT tool inside the line at the end of each shift minimizing the need for disassembly and rebuild. There were a few isolated sections that required the extraction of the tool, necessitating a rebuild in each new section. The inspection was broken down into six individual sections, as detailed below in Table 1.

Table 1: Inspected Sections

Section	Construction Contract/Work Order	Inspection Date(s)	Approx. Start Station	Approx. End Station
Aqua Control Facility to 1970 Valve Complex	WO01970	January 15th, 2020	-0+07.70	0+23.00
MH#1 to MH#3	WO01970, WO1980	January 7th & 8th, 2020	7+20.37	25+98.02
MH#3 to Excavation	WO1980	January 6th & 11th, 2020	25+98.02	45+23.37
Excavation to MH#7	WO1980	January 12th & 14th, 2020	45+23.37	78+97.07
MH#7 to Plug Valve	WO1980	January 13th, 2020	78+97.07	95+50.45
Plug Valve to WYE	WO1980, WO01970, WO01960	January 19th, 2020	96+12.49	112+99.18

The RAFT tool was conveyed through the pipeline using winches stationed above ground. Each section was scanned twice, with the first pass using the primary frequency setting and the second with a different frequency setting. The initial scans were conducted with the tool operating at 21Hz, which provided optimal data for the assessment of the steel cylinder. The secondary scans were conducted with the tool operating at a lower frequency of 14 Hz, which was intended for the thicker (double) walled Carnegie joints. AWD was particularly interested in learning more about the condition of the joints, due to recently discovered corrosion at the joint connections.

At the completion of each scan, the RFT data was immediately downloaded on-site to confirm acceptable data quality. An on-site analyst also conducted a cursory review of the data, working to provide AWD with preliminary results that highlighted the most significant corrosion indications. AWD then planned several field verifications as well as repairs shortly after receiving the preliminary results. *In general, the reported RFT results closely matched the field verification findings (details provided in Appendix A).*

Figure 1 and Figure 2 summarize the distribution of localized wall loss indications along the inspected section. Defects measuring ≥80% Wall Loss (LW) are highlighted in red. There may be some (partially) overlapping data points due to defect proximity.

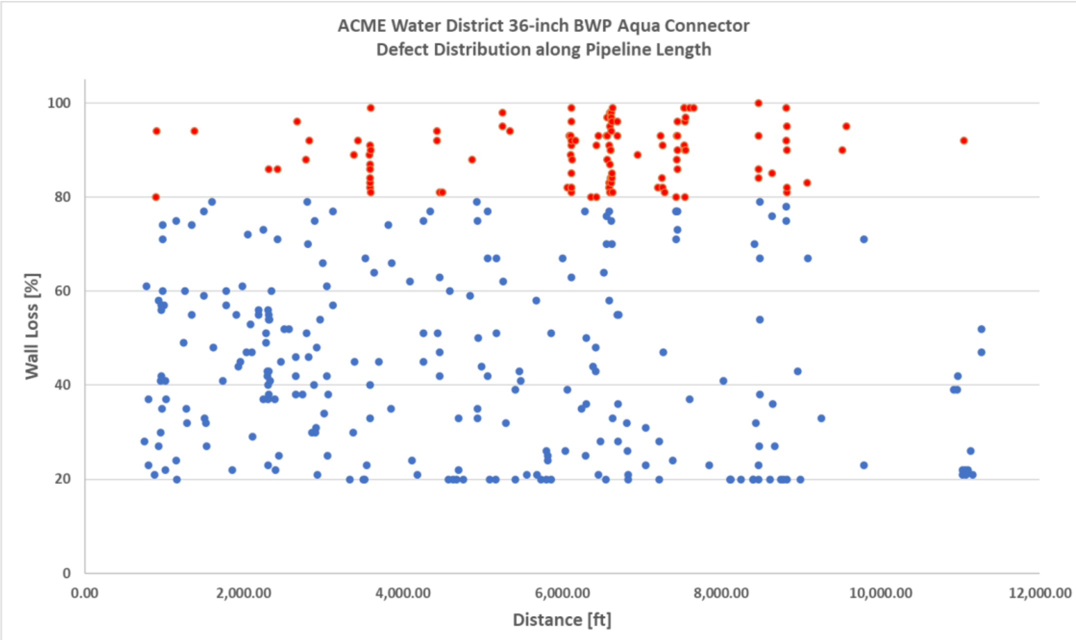


Figure 1 – Distribution of localized wall loss along the 36-inch BWP Aqua Connector.

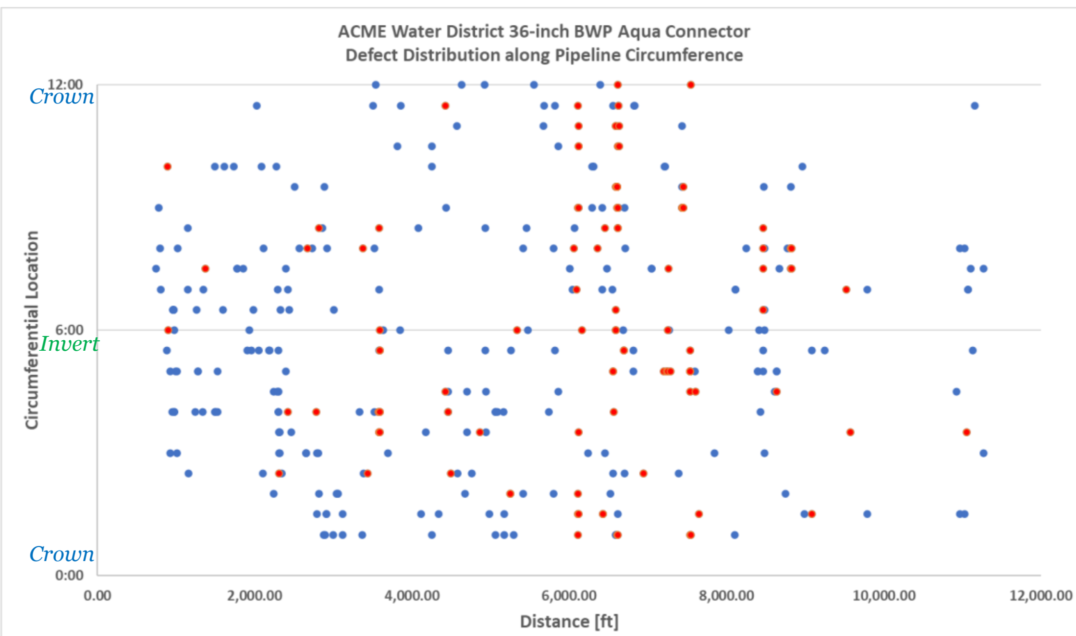


Figure 2 – Distribution of localized wall loss with respect to circumferential location along the 36-inch BWP

The supplementary Excel file "***ACME 2020 – 36in Aqua Connector RESULTS (FULL)***", provided separately from this report contains complete results from the inspection, with detailed information on the individual pipe segments and all identified corrosion indications. Note that this supersedes the preliminary results table that was submitted in February 2020, shortly after the RFT inspection.

Daily Summary

Table 2: Job Notes

Date	Job Notes
January 5th, 2020 (Calibration)	• Equipment preparation and safety overview (lock-out/tag-out completed, meeting to discuss safe work procedures). • A series of calibration scans are conducted in order to determine the optimum inspection frequency settings for both steel cylinder and joint connections.
January 6th, 2020 (Excavation to MH#3)	• RFT tool inserted into upstream end of Excavation at STA 44+91.95 and programmed to an operating frequency of 21Hz. Tool is winched towards MH#3. • RFT tool arrives at MH#3 (25+98.02). Data is downloaded and confirmed to be of acceptable quality for analysis. Tool is secured and left at MH# 3 overnight.
January 7th, 2020 (MH#3 to MH#1)	• RFT tool at MH#3 (STA 25+98.02) is turned on and programmed to a frequency of 21Hz. Tool is winched towards MH #1. • RFT tool arrives at MH#1 (STA 7+20.37). Data is downloaded and confirmed to be of acceptable quality for analysis. Tool is secured and left at MH#1 overnight.
January 8th, 2020 (MH#1 to MH#3)	• RFT tool at MH#1 (STA 7+20.37) is turned on and programmed to a frequency of 14Hz. Tool is winched towards MH#3. • RFT tool arrives at MH#3 (STA 25+98.02). Data is downloaded and confirmed to be of acceptable quality for analysis. Tool is secured and left at MH#3 overnight.
January 11th, 2020 (MH#3 to Excavation)	• RFT tool at MH#3 (STA25+98.02) is turned on and programmed to an operating frequency of 14Hz. Tool is winched towards the Excavation. • RFT tool arrives at upstream end of the Excavation at STA 44+91.95. Data is downloaded and confirmed to be of acceptable quality for analysis.
January 12th, 2020 (Excavation to MH#7)	• RFT Tool inserted into downstream end of Excavation at STA 45+23.37 and programmed to an operating frequency of 21Hz. Tool is winched towards MH#7. • RFT tool arrives at MH#7 (STA 78+97.07). Data is downloaded and confirmed to be of acceptable quality for analysis. Tool is secured and left at MH#7 overnight.
January 13th, 2020 (MH#7 to Plug Valve) **Bi-directional scan completed.*	• RFT tool at MH#7 (STA 78+97.07) is turned on and programmed to an operating frequency of 21Hz. Tool is winched towards the Plug Valve. • RFT tool arrives at the Plug Valve (STA 95+50.45). Data is downloaded and confirmed to be of acceptable quality for analysis. Tool is reprogrammed to an operating frequency of 14Hz, and then winched towards MH#7. • RFT tool arrives at MH#7. Data is downloaded and confirmed to be of acceptable quality for analysis. Tool is secured and left at MH#7 overnight.
January 14th, 2020 (MH#7 to Excavation)	• RFT tool at MH#7 (STA 78+97.07) is turned on and programmed to an operating frequency of 14Hz. Tool is winched towards the Excavation. • RFT tool arrives at the downstream end of the Excavation at STA 45+23.37. Data is downloaded and is confirmed to be of acceptable quality for analysis • RFT tool is removed from the Excavation.
January 15th, 2020 (Control Facility to Valve Complex) **Bi-directional scan completed.*	• RFT tool inserted into the pipeline through the open tee near the valve complex. • Tool is turned on and programmed to an operating frequency of 21Hz. Tool is winched towards the Control Facility, then back to the valve complex. • RFT tool arrives back at the valve complex and is reprogrammed to an operating frequency of 14Hz. • Tool is winched towards the Control Facility, then back to the valve complex. • Data from both scans is downloaded and confirmed to be of acceptable quality for analysis. RFT tool is removed from the pipeline.
January 16th - 18th, 2020	• Tool maintenance (16th) and rest (17th) days. January 18th was spent evaluating the risk of pulling the tool through the wye, deciding to pull up to it, but not past it.
January 19th, 2020 (MH#9 to WYE)	• RFT tool inserted into MH#9 (STA99+35.00) and pushed back to the Plug Valve. Tool is turned on and programmed to an operating frequency of 21Hz. Tool is winched towards the wye. • Tool is stopped just short of the wye, then winched back to MH#9 where it is reprogrammed to 14Hz, and the inspection repeated. • After reaching MH#9 following completion of the second scan, data is downloaded and confirmed to be of acceptable quality for analysis. RFT tool is removed from the pipeline.

Inspection Activities

Pre-Inspection Activities

Prior to PICA's mobilization, ACME Water District (AWD) dewatered the 36-inch Aqua Connector such that there was no more than 4-inches of standing water. In addition, AWD crews ensured a double-braided polyester tagline was run through each section of the pipeline to be inspected.

An excavation was made northeast of Poseidon Place at ~STA 44+91.95 to STA 45+23.37, where a ~5ft spool piece of pipe was removed. Upon arrival on site, PICA technicians assembled the RFT tool above ground near the excavation. The tool was then lowered into the pit and inserted into the full-bore opening into the pipeline. A series of calibration scans were conducted to determine the tool's optimal operating frequencies for inspection of both the cylinder body of the pipe, and of the Carnegie joints.

Figure 2 – The RAFT inspection tool is fully assembled above ground and lowered into the excavation where full bore pipe access is available.

Pipeline Access Locations

ACME crews provided top-side support and air quality monitoring throughout the project. Top-side support included traffic control (as needed), lifting support with boom and crane (as needed), confined space entry monitoring, and general assistance.

A series of access locations were determined prior to the commencement of fieldwork. Locations were chosen to minimize the number of times the tool needed to be inserted/extracted to/from the pipeline, while maximizing the inspection distance for each section.

The excavation created by AWD served as a primary access point, allowing for easy insertion and removal of the RFT through the open pipe ends. Manholes, which provided more restricted access, were also used. Manholes required each module of the RFT tool to be deflated in order to fit through the manhole's 18-inch opening. Once inside the pipeline, the modules were inflated and assembled by a 3-to-4-person crew. This process was reversed for tool extraction.

Figure 3 – The RAFT inspection tool inside the 36-inch Aqua Connector with trailing winch line attached.

Inspection Operations

For each inspected pipeline section, PICA and ACME crews would station one skidsteer-mounted winch at each access point. The RFT tool was inserted into the pipeline through the designated launch access, assembled by PICA technicians, and connected to both leading and trailing winch lines.

The tool was powered on and programmed to the desired operating frequency, then winched towards the receive location at a speed of approximately 7 ft/min when operating at 14 Hz, and 10 ft/min when operating at 21 Hz. The RFT tool was tracked by PICA using above ground monitoring equipment, as well as the winch-mounted odometers. After completing the inspection of the section, data was downloaded and checked for quality. If the section scheduled for inspection the following day was a continuation of the scan that was just completed, the tool was secured in the pipeline overnight with its batteries charging. Skidsteers were repositioned, with one leapfrogged to the next access point in preparation for the next day's inspection.

Each section was scanned twice. The initial pass was for collecting RFT data for the steel cylinder (body of the pipe) using the primary frequency setting. The 2nd pass required the use of the secondary frequency setting, which was intended for the Carnegie joints that are known to have double the wall thickness compared to that of the steel cylinder.

For isolated sections that are not part of the longer and continuous span of the line, the RFT tool was extracted, relocated, and reassembled in the new section. These sections typically required the use of access manholes, so each tool component was inserted through the manhole and then reassembled inside the line. Scanning then continued following the same procedure.

Figure 4 – PICA's skidsteer mounted winch stationed near MH #3 (top) and MH#9 (bottom). Rollers guided the winch line down into the manhole to prevent contact against abrasive surfaces and sharp edges.

In-field Analysis and Reporting

At the completion of each scan, data was downloaded from the inspection tool on-site to confirm the data quality. Preliminary analysis of the data was performed on site, with significant corrosion indications urgently reported to AWD. This cursory review was performed for all sections.

At the conclusion of the preliminary analysis, tabulated results were submitted to AWD to allow for immediate rehabilitation decisions and planning. These preliminary results were further refined following the comprehensive analysis that was performed in house.

Remote Field Testing (RFT) Technology

The 36-inch Aqua Connector pipeline was inspected using PICA's Restricted Access Flexible Tool or "RAFT" in-line inspection tool. The RAFT's modular, inflatable mechanical design allows it to access a dewatered pipeline via ports 18-inches or greater. Individual components are lowered into the pipeline and technicians inflate and build the tool from within the pipeline. The RAFT is lightweight and supported by wheels, protecting the condition of any internal liners.

The RAFT is based on Remote Field Testing (RFT) technology. RFT technology works by detecting changes in AC electromagnetic field generated by the tool by interacting with the metal in the pipe, becoming stronger in areas of metal loss. These electromagnetic field interactions are measured by on board detectors. All data is processed using A/D converters and digital processors and then stored on the tool itself. Data was downloaded from the tool in the field, with an analyst on-site to confirm data quality. Figure 4 shows the assembled tool above ground prior to the inspection of a 36-inch line.

Figure 5 - RAFT in-line inspection tool used for the 36-inch Aqua Connector.

In the basic RFT probe shown, there is one exciter coil and one detector coil. Both coils are wound co-axially with respect to the examined pipe and are separated by a distance greater than two times the pipe diameter. The actual separation depends on the application but will always be a minimum of two pipe diameters. It is this separation that gives RFT its name: the detector measures the electromagnetic field remote from the exciter. Although the fields have become very small at this distance from the exciter, they contain information on the full thickness of the pipe wall.

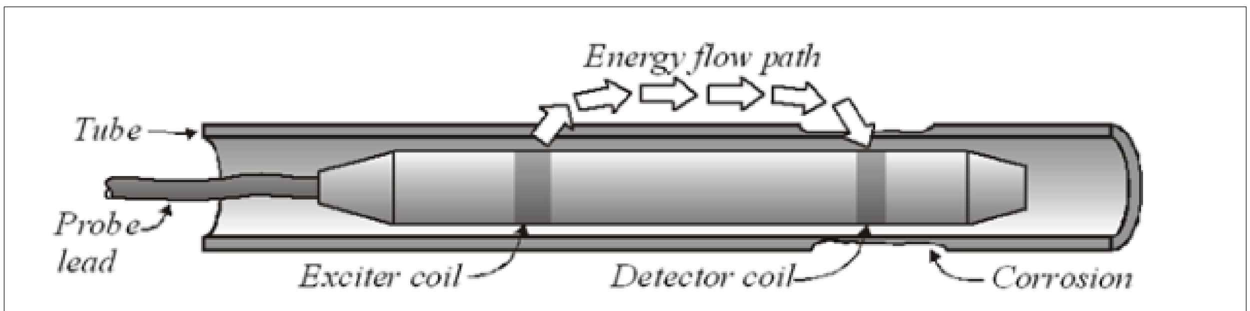


Figure 6 - A basic probe utilizing Remote Field Testing (RFT) technology.

The detector electronics include high-gain instrumentation amplifiers and steep noise filters. These are necessary in order to retrieve the remote field signals. The detector electronics output the remote field signal to an on-board storage device. The data is recalled for display, analysis and reporting purposes after the examination process is completed.

Analysis Results

Overview

At the completion of each inspection day, data was reviewed by an on-site analyst, with the most significant corrosion indications reported to AWD immediately. AWD was able to successfully conduct verification and repair work on corrosion indications identified in ***Segments 149 and 153***, while PICA was still on site. The wall loss extent identified in these segments correlated accurately with the reported results. This cursory review continued as the RFT inspection progressed, with the first iteration of PICA's tabulated results submitted to AWD shortly after the completion of the inspection work.

Following demobilization from site, detailed analysis of all collected data sets was conducted in-house by PICA's team of analysts. A detailed and comprehensive version of the tabulated results was submitted in February, with several revisions to follow resulting from AWD's verification work on several defects. The detailed version of the tabulated results, supplied separately from this report, contained all identified signal anomalies in the RFT data.

Confidence Ranking

Note that the signal characteristics of the observed anomalies in the 36-inch Aqua Connector varied significantly. As a result, a confidence ranking was applied to each anomaly in order to distinguish the prominent corrosion indications from the lesser signals. Each corrosion indication was assigned a confidence rating of **Low**, **Medium**, and **High** depending on the characteristics of the signal. Below is a list of the factors that were considered during the confidence assignment process:

- **Signal Strength:** Signal strength is a parameter related to a defect's total area. Defects with a high signal strength value typically have large volumetric footprints that are often associated with extensive wall loss. On the contrary, low signal strength values are normally from small volume defects, that may be near the RFT tool's detection threshold. While other factors were also considered in conjunction with signal strength values, the following categories were used for the initial confidence ranking assignment:
    - *High-Confidence: Signal strength value of 21 or higher.*
    - *Medium-Confidence: Signal strength value between 8 and 20.*
    - *Low-Confidence: Signal strength value below 8.*

- **Data Quality:** RFT data can be impacted by travel-induced noise, caused by the tool surging through the line or poor ride quality during the inspection. Travel-induced noise frequently occurs when the tool encounters ID obstructions such as mis-aligned joints, debris or when the tool navigates pipeline features such as bends, tees and manholes.

- **Signal Repeatability:** Two (2) data sets were collected during the inspection of the 36-inch Aqua Connector – one (1) at 21Hz for analysis of the steel cylinder, and one (1) at 14Hz for analysis of the thicker (double) walled Carnegie joints. While the 14Hz was intended for the evaluation of the joints, it was also used to confirm the repeatability of defect signals identified in the 21Hz data. Doing so, minimizes the possibility of mis-reporting travel-induced noise and localized magnetic permeability changes as these events don't normally manifest in both 14Hz and 21Hz.

- **Field Verification:** Ground truth results provided by AWD after the completion of verification and repair work allowed PICA analysts to reevaluate defects that shared similar characteristics to those investigated during the verifications. Confidence rankings for several defects were adjusted based on the results of on-going verification work.

Results Summary – Defect Totals and Distribution

A total of 365 defect indications were identified following the comprehensive analysis of all collected data. A total of 117 defect indications measured at least 81% Wall Loss (WL) in depth, 53 defects measured between 61 and 80% WL, 77 defects between 41 and 60% WL, and the remaining 118 indications measured less than 40% WL. More specifically, the distribution of defects between major feature locations are as follows:

- *Flow Control Facility to Valve Complex*: Only 1 defect was reported in this section, with the indication measuring at least 80% deep.
- *MH1 (7+20) to MH2 (16+53)*: A total of 39 defects were reported within this section, with 3 measuring between 81% and 100% WL, 7 between 61% and 80% WL, 13 between 41% and 60% and 16 between 20% and 40 WL.
- *MH2 (16+53) to MH3 (25+98)*: A total of 41 defects were reported within this section, with 2 measuring between 81% and 100% WL, 4 between 61% and 80% WL, 25 between 41% and 60% and 10 between 20% and 40 WL.
- *MH3 (25+98) to MH4 (39+92)*: A total of 53 defects were reported within this section, with 15 measuring between 81% and 100% WL, 10 between 61% and 80% WL, 10 between 41% and 60% and 18 between 20% and 40 WL.
- *MH4 (39+92) to MH5 (52+92)*: A total of 37 defects were reported within this section, with 5 measuring between 81% and 100% WL, 9 between 61% and 80% WL, 11 between 41% and 60% and 12 between 20% and 40 WL.
- *MH5 (52+92) to MH6 (66+00)*: A total of 63 defects were reported within this section, with 28 measuring between 81% and 100% WL, 7 between 61% and 80% WL, 9 between 41% and 60% and 19 between 20% and 40 WL.
- *MH6 (66+00) to MH7 (79+50)*: A total of 73 defects were reported within this section, with 48 measuring between 81% and 100% WL, 8 between 61% and 80% WL, 3 between 41% and 60% and 14 between 20% and 40 WL.
- *MH7 (79+50) to MH8 (92+50)*: A total of 40 defects were reported within this section, with 12 measuring between 81% and 100% WL, 7 between 61% and 80% WL, 3 between 41% and 60% and 28 between 20% and 40 WL.
- *MH8 (92+50) to MH9 (97+05)*: A total of 3 defects were reported within this section, with 2 measuring between 81% and 100% WL, none between 41% and 80% WL, and 1 between 20% and 40 WL.
- *MH9 (97+05) to MH10 (5+00)*: A total of 2 defects were reported within this section, with none measuring between 81% and 100% WL, 1 between 61% and 80% WL, none between 41% and 60% and 1 between 20% and 40 WL.
- *MH10 (5+00) to WYE (End of Inspection)*: A total of 13 defects were reported within this section, with 1 measuring between 81% and 100% WL, none between 61% and 80% WL, 3 between 41% and 60% and 9 between 20% and 40 WL.

Results Summary – Defect Totals and Confidence Ranking Assignments

Sorting the defects based on the three confidence ranking levels, approximately 47% of the reported total (172 of 365) have been classified as ***Medium*** to ***High confidence defects***. These defects present the highest probability of the observed signal anomaly being legitimate corrosion. ***Medium*** confidence defects are reported as such due to their slightly weakened signal response compared to the more prominent signals associated with ***High*** confidence defects. While the sizing accuracy between ***Medium*** and ***High*** confidence defects is expected to be similar, it is possible for the ***Medium*** confidence defects to measure slightly less accurately than the ***High*** confidence defects.

Consequently, the remaining 193 defects were reported as ***Low*** confidence. These indications are typically found with weaker signal responses, with the resulting signal length suspected to be near the RFT tool's detection threshold. Note that the occurrence of the majority of these indications was confirmed in both 14Hz and 21Hz data sets. The signal characteristics also strongly resemble that of corrosion, and therefore were reported as wall loss rather than anomalies. The classification of ***Low*** confidence defects may be subject to change if these are investigated in future field verifications.

Results Summary - Carnegie joints

Due to AWD's concern of joint failures, PICA performed a secondary scan using a lower frequency of 14Hz to collect RFT data specifically for the thicker (double) walled Carnegie joints. The 14Hz data was analyzed in search of corrosion at or near the joint connections. In particular, the zone within 1.5ft of the bell and spigot connection was evaluated for possible corrosion.

While the reporting of any observed wall loss indications was included in the main list of defects, a separate list of defects within the noted 1.5ft zone was provided. In total, 35 defect indications were identified at/near the joint. A total of 12 defects measured at least 80% deep, with all reported as ***High*** confidence due to their strong signal response. At the time of writing this report, a total of four defects near joint connections have been field-verified and repaired, all of which closely matched the reported wall loss depths with two defects confirmed as through-holes in Segments 112 and 152.

The supplementary Excel file "***ACME 2020 – 36in Aqua Connector RESULTS (FULL)***", provided separately from this report contains complete results from the inspection, with detailed information on the individual pipe segments and all identified corrosion indications. Note that this supersedes the preliminary results table that was submitted in February 2020, shortly after the RFT inspection.

Verification Results

AWD conducted a number of verification and repair activities based on PICA's RFT results. PICA remotely assisted in these verification efforts by providing detailed location information on the corrosion indications, along with colour maps that offered a visual representation of the RFT data. In some cases, the reported results were refined based on the verification findings.

A summary of the field verification work that is **<u>currently known to PICA</u>** has been summarized in the following pages in Appendix A, with each verified anomaly detailed in terms of the ground truth findings. This work is provided in chronological order for ease of reference. Note that there are likely additional verification and/or repairs performed by AWD since PICA's inspection. *<u>Contact your PICA representative if the following account needs to be expanded to include additional verification or repair information. Do ensure that detailed information regarding the Pipe ID, anomaly location and verified results are supplied along with photos.</u>*

Appendix A: Verification Summary

Segment 149 – January 2020

Verification work on Segment 149 occurred in January 2020, immediately following the RFT inspection of the respective section. The RFT data indicated the presence of two (2) significant wall loss indications on this pipe.

Table A1: Segment 149 – Verified Defects

Anomaly ID	Location (ft) *From MH1 (7+20)*	Clock Position	RFT Reported Wall Loss (%)	UT Measured Wall Loss (%)	Verified Clock Position	Confidence Ranking*
21009	4,427.93	11:30	80%+	~64%	11:30	High
20948	4,428.44	4:30	80%+	~64%	4:30	High

**Confidence rankings were not provided in the preliminary results submission but were later added in the finalized version following the comprehensive analysis.*

As this segment was fully exposed within the excavated access pit, AWD was able to investigate the reported corrosion indications both internally and externally. Visual inspection of the pipe revealed the external mortar liner to be in good condition, with no evidence of corrosion. Subsequent removal of the mortar liner at the location of the reported anomaly revealed extensive damage and corrosion to approximately 9 bar wraps in the immediate area. AWD also discovered external corrosion on the cylinder using Ultrasonic Testing (UT). The indications, measured as 80%+ wall loss in the RFT data, were estimated to be approximate 64% wall loss based on the UT readings.

Figure A1. The mortar liner was removed by AWD technicians at the reported site of the corrosion (left). A UT probe was then used to measure the depth of the observed external corrosion in Segment 149 (right).

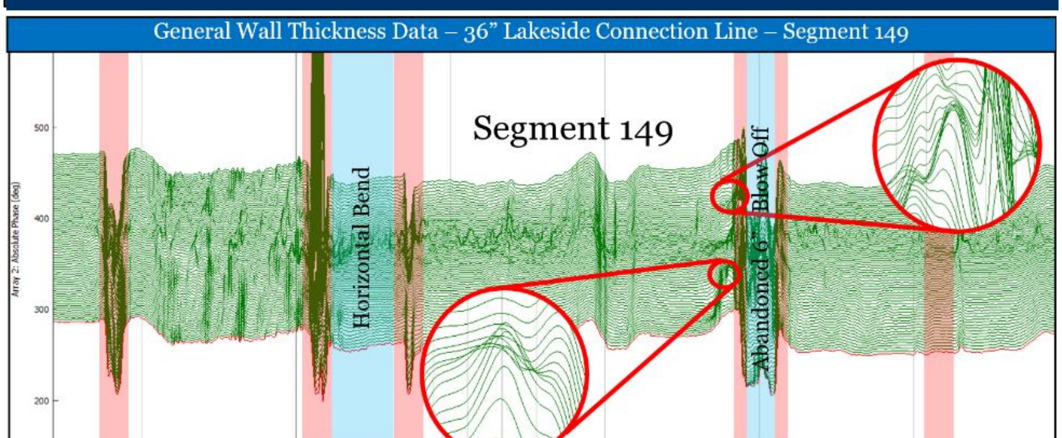


Figure A2. RFT data of the verified corrosion signals in Segment 149, with the defects magnified for clarity.

Segment 153 – January 2020

Verification work on Segment 153 occurred in January 2020, immediately following the RFT inspection. The RFT data indicated the presence of one (1) significant wall loss indication.

Table A2: Segment 153 – Verified Defect						
Anomaly ID	**Location (ft)** **From MH1 (7+20)*	**Clock Position**	**RFT Reported Wall Loss (%)**	**UT Measured Wall Loss (%)**	**Verified Clock Position**	**Confidence Ranking***
16248	4,493.73	2:30	80%+	100%	2:30	High

**Confidence rankings were not provided in the preliminary results submission but were later added in the finalized version following the comprehensive analysis.*

The verification on this pipe began with an internal visual inspection. The pipe's internal mortar liner was found to be in good condition at the reported defect location. Subsequent removal of the mortar liner confirmed the presence of a significant corrosion patch. The defect indication, reported as 80%+ wall loss, was confirmed by AWD to be a through-hole (100% wall loss) using UT.

Figure A3. AWD internally exposed the reported defect location in Segment 153 (left). The reported defect location was then verified to be 100% wall loss using UT (right).

Segment 112 & 113 – December 2020

Verification work on Segments 112 and 113 occurred in December 2020. The RFT data indicated the presence of three significant wall loss anomalies – two (2) in Segment 112 and one (1) in Segment 113.

Table A3: Segments 112 & 113 – Verified & Investigated Defects

Anomaly ID	Location (ft) *From MH1 (7+20)*	Segment #	Clock Position	RFT Reported Wall Loss (%)	UT Measured Wall Loss (%)	Verified Clock Position	Confidence Ranking*
150074	3,379.79	112	8:00	80%+	100%	8:30	High
149262	3,386.98	112	2:30	45%	*N/A*	*N/A*	Low
143832	3,435.80	113	2:30	80%+	100%	3:30	High

**Confidence rankings were not provided in the preliminary results submission but were later added in the finalized version following the comprehensive analysis.*

The internal and external mortar liner was found to be in good condition at the reported defect locations. Subsequent removal of the internal and external mortar liner confirmed the presence of two (2) of the three reported defect indications.

- **Anomaly # 150074:** Reported as 80%+ wall loss in the RFT results, visual inspection confirmed this indication to be a through-hole (100% wall loss), measuring approximately 2.5” H x 2” W.
- **Anomaly #149262:** Reported as 45% wall loss in the RFT results, AWD technicians were unable to find corrosion at this location. PICA has reclassified this indication as a manufacturing-related anomaly.
- **Anomaly #143832:** Reported as 80%+ wall loss in the RFT results, visual inspection confirmed the presence of two (2) pinholes (100% wall loss) at 3:00 and 3:30.

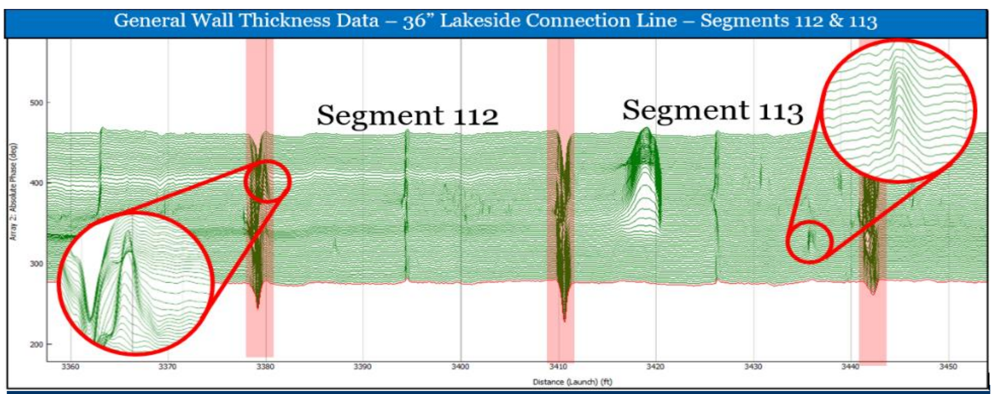


Figure A4. RFT data of the verified corrosion signals in Segments 112 and 113, with the defects magnified for clarity.

Figure A5. Segment 113 - AWD investigated the reported defect signal externally (left) and internally (right) and discovered two pinholes (100% through-holes) at this location.

Segments 41 & 44 – February 2020

Verification work on Segments 41 and 44 occurred in February 2020. The RFT data shows the presence of three (3) anomalies that were initially suspected as wall loss related. Note that compared to the previously verified defects which produced prominent signal responses, the anomalies in Segments 41 and 44 are different in that the observed signals were weaker.

Table A4: Segments 41 & 44 – Investigated Defects

Anomaly ID	Location (ft) *From MH1 (7+20)*	Segment #	Clock Position	RFT Reported Wall Loss (%)	UT Measured Wall Loss (%)	Verified Clock Position	Confidence Ranking*
194111	1,256.90	41	6:30	60%	*No corrosion found*	*N/A*	Low
184933	1,340.59	44	4:00	55%	*No corrosion found*	*N/A*	Low
184087	1,347.72	44	7:00	74%	*No corrosion found*	*N/A*	Low

**Prior to the verification, these defects were suspected to be wall loss related but weaker signal responses. PICA now suspects that the observed signals are manufacturing related magnetic permeability anomalies. As a result, these defects, and others with similar characteristics are reported with low confidence.*

Investigation of all three (3) indications did not reveal any corrosion at the reported locations on either the interior or exterior of the pipe. As a result, PICA reclassified these defects, as well as additional defects that shared similar signal characteristics, as low confidence indications. PICA suspects that the observed signals are manufacturing related magnetic permeability anomalies. *Contact your PICA representative if additional investigation of other low confidence defects is performed in the future so the results can be further refined.*

General Wall Thickness Data – 36" Aqua Connector, Segment 41

Figure A6. RFT data of the reported anomaly in Segment 41. AWD did not reveal any corrosion at the reported location.

General Wall Thickness Data – 36" Aqua Connector, Segment 44

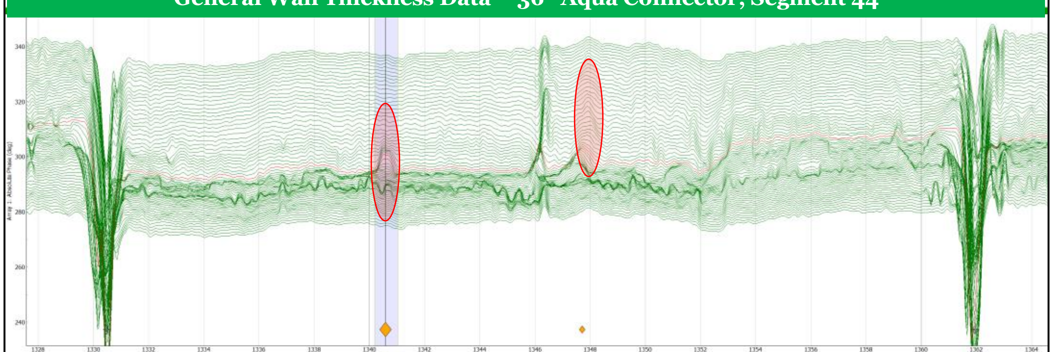


Figure A7. RFT data of the reported anomalies in Segment 44. AWD did not reveal any corrosion at the reported locations.

Segment 7 – February 2020

Verification work on Segment 7 occurred in February 2020. The RFT data indicated the presence of one (1) significant wall loss indication.

Table A5: Segment 153 – Verified Defect						
Anomaly ID	**Location (ft)** **From MH1 (7+20)*	**Clock Position**	**RFT Reported Wall Loss (%)**	**UT Measured Wall Loss (%)**	**Verified Clock Position**	**Confidence Ranking***
16564	107.72	1:00	80%+	100%	1:30	Medium

**Confidence rankings were not provided in the preliminary results submission but were later added in the finalized version following the comprehensive analysis.*

AWD's initial investigation found the pipe's interior to be in good condition, with no signs of corrosion through the mortar lining. Subsequent removal of the mortar lining at the reported defect location revealed a through-hole (100% wall loss), approximately 1.0" W x 1.5" H in dimension.

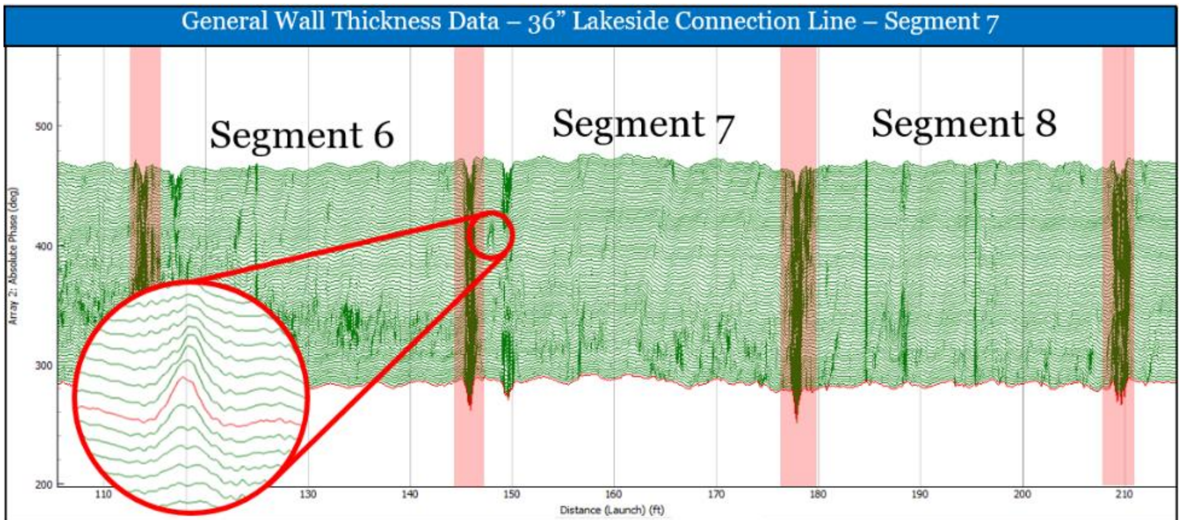


Figure A8. RFT data of the verified through-hole (100% WL) in Segment 7, with the defect signal magnified for clarity.

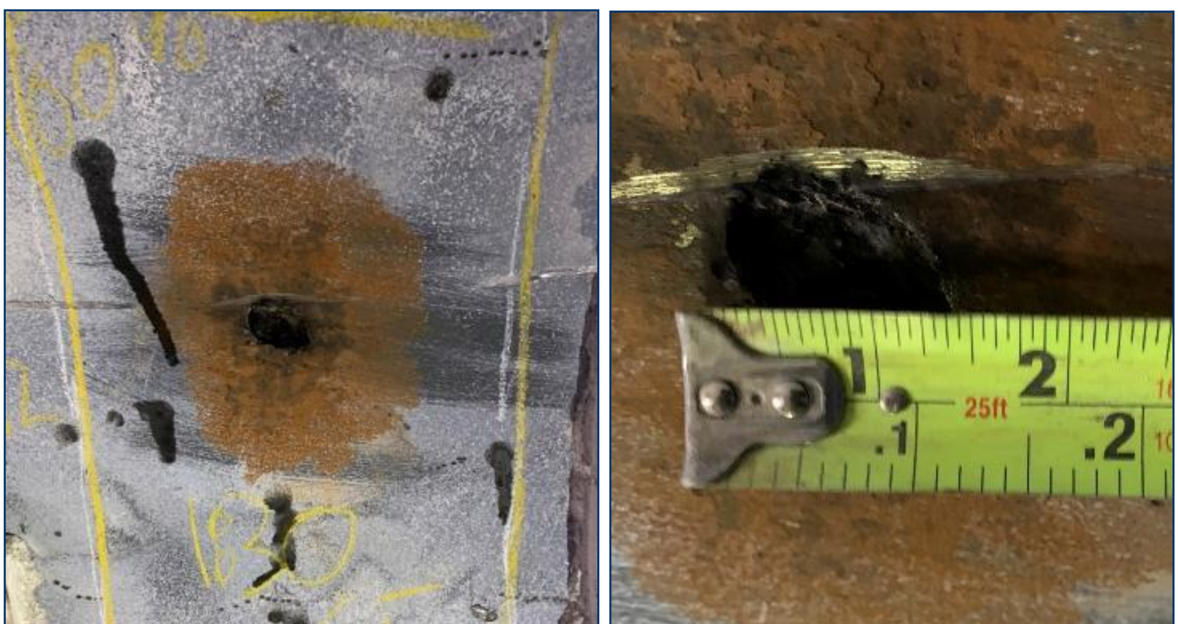


Figure A9. Verified through-hole (100% wall loss) defect in Segment 7, measuring approximately 1.0" W x 1.5" H.

Segment 45 – March 2020

Verification work on Segment 45 occurred in March 2020. The RFT data indicated the presence of one (1) significant wall loss indication.

Table A6: Segment 45 – Verified Defect						
Anomaly ID	Location (ft) **From MH1 (7+20)*	Clock Position	RFT Reported Wall Loss (%)	UT Measured Wall Loss (%)	Verified Clock Position	Confidence Ranking*
180931	1,374.36	7:30	80%+	100%	8:30	High

**Confidence rankings were not provided in the preliminary results submission but were later added in the finalized version following the comprehensive analysis.*

AWD's initial investigation found the pipe's interior to be in good condition, with no signs of corrosion through the mortar lining. Subsequent removal of the mortar lining at the reported defect location revealed a through-hole (100% wall loss), approximately 0.5" in diameter.

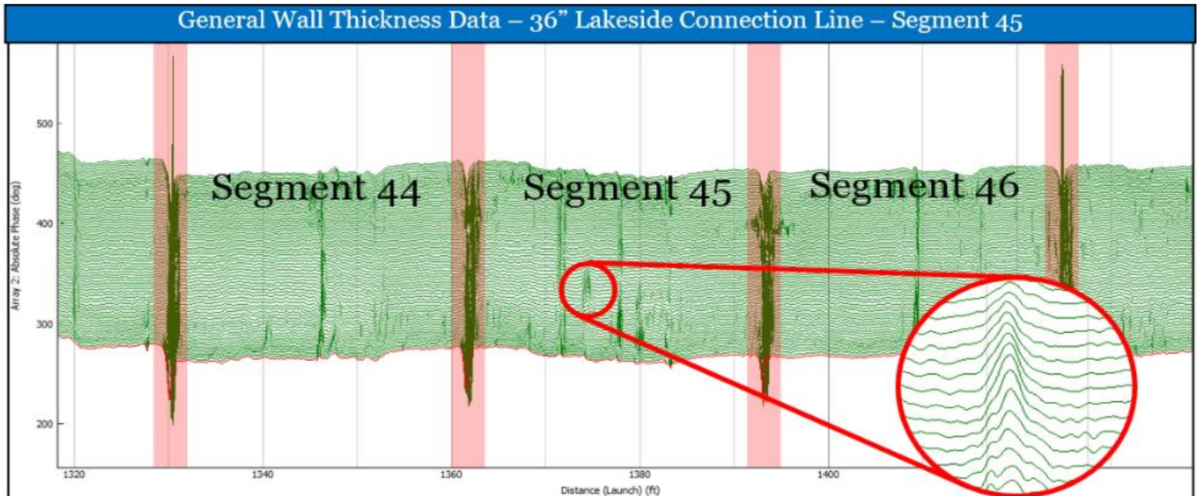
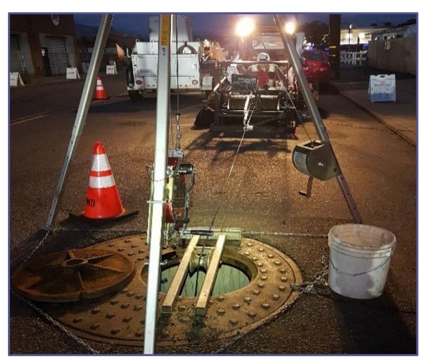


Figure A10. RFT data of the verified through-hole (100% WL) in Segment 45, with the defect signal magnified for clarity.

Figure A11. Verified through-hole (100% wall loss) defect in Segment 45, measuring approximately 0.5" in diameter.

Appendix B: Access Locations

Table B1: Access locations (36-inch BWP Aqua Connector)			
Access Location #1	**Description**	***Aqua Control Station***	
	Date	January 15th, 2020	
	Latitude	[redacted]°	
	Longitude	-[redacted]°	
	Altitude	383ft	
Access Location #2	**Description**	***South Access - Near BFV***	
	Date	January 15th, 2020	
	Latitude	[redacted]°	
	Longitude	-[redacted]°	
	Altitude	383ft	
Access Location #3	**Description**	***Manhole #1***	
	Date	January 7th - 8th, 2020	
	Latitude	[redacted]°	
	Longitude	-[redacted]°	
	Altitude	383ft	
Access Location #4	**Description**	***Manhole #3***	
	Date	January 6th, 7th & 11th, 2020	
	Latitude	[redacted]°	
	Longitude	-[redacted]°	
	Altitude	400ft	

Access Location #5	**Description**	***Excavation***	
	Date	January 6th, 11th, 12th & 14th, 2020	
	Latitude	[redacted]°	
	Longitude	-[redacted]°	
	Altitude	400ft	
Access Location #6	**Description**	***Manhole #7***	
	Date	January 12th - 14th, 2020	
	Latitude	[redacted]°	
	Longitude	-[redacted]°	
	Altitude	426ft	
Access Location #7	**Description**	***Manhole #9***	
	Date	January 19th, 2020	
	Latitude	[redacted]°	
	Longitude	-[redacted]°	
	Altitude	456ft	

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The agreement of PICA Corp to perform services extends only to those services provided for in writing. Under no circumstances shall such services extend beyond the performance of the requested services. It is expressly understood that all descriptions, comments and expressions of opinion reflect the opinions or observations of PICA Corp based on information and assumptions supplied by the owner/operator and are not intended nor can they be construed as representations or warranties. PICA Corp is not assuming any responsibilities of the owner/operator and the owner/operator retains complete responsibility for the engineering, manufacture, repair and use decisions as a result of the data or other information provided by PICA Corp. Nothing contained in this Agreement shall create a contractual relationship with or cause of action in favor of a third party against either the Line Owner or PICA Corp. In no event shall PICA Corp's liability in respect of the services referred to herein exceed the amount paid for such services.

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In performing the services provided, PICA Corp uses the degree, care, and skill ordinarily exercised under similar circumstances by others performing such services in the same or similar locality. No other warranty, expressed or implied, is made or intended by PICA Corp.