

# City of Winnipeg 2014:

## 500mm (20in) Northeast Interceptor Siphon

Condition Assessment Report, Standard Analysis



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

**RFT ILI Tool**  
**500mm (20in) Steel**

**Red River Crossing**  
**Between Whellams Lane & Kildonan Golf Course**  
**Winnipeg, MB**

**PICA Project: Winnipeg 8007**

Inspection Date: September 22, 2014  
Report Submission: May 01, 2016 (Rev 2.0), December 19, 2014 (Rev 1.0)  
Operators: P. Ryhanen, G. Bouchard, S. Popovic, D. Burton, R. Asuncion, C. Garrett  
Analyst: J. Kim  
Reviewers: J. Regala  
Report Revision: 2.0

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# The City of Winnipeg: 500mm (20in) Northeast Interceptor Siphon

*Condition Assessment Report, Standard Analysis*

## Executive Summary

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PICA, under contract with AECOM, inspected a number of Wastewater River Crossings for the City of Winnipeg using Remote Field Technology (RFT) between September 15 and September 24, 2014. This report documents the results for the 500mm (20-in) steel Northeast Interceptor Siphon, which crosses the Red River. The inspected portion spanned between the Siphon Inlet Chamber near Whellams Lane and the Siphon Outlet Chamber located at the northeast corner of the Kildonan Golf Course. The inspection was performed on September 22<sup>nd</sup>, 2014 and the results reported here document PICA's findings.

All but one of the 28 identified defects are located in Pipes 0040-0070. The defects in these pipes range in depth (wall loss) between 39% and 81% (19% and 61% remaining wall). There is an isolated defect in Pipe 0130 with a measured remaining wall (RW) thickness of 79%. There were no through-holes (0% RW) or near through-holes ( $\leq 5\%$  RW) found in this line.

A recent investigation in the reported run length for the 800mm (32in) Northeast Interceptor siphon led to an examination of the initially reported length for the 500mm (20in) Northeast Interceptor. *The original 2014 reported length for the 800mm Northeast Interceptor siphon was 219.7m, which was based on the on-board odometer system on the Chimera tool. AECOM records indicated the measured length for the 800mm siphon was short by more than 10m. PICA investigated the discrepancy and discovered that the onboard odometer system appeared to have intermittently slipped.* This led PICA to also investigate the 500mm NE interceptor, and PICA subsequently adjusted the measured length for the 500mm siphon to 229.9m (from 226.4m reported in 2014).

Following the initial submission of the results (Dec 2014), the analysis of the 500mm (20-in) data was also revisited using PICA's most current analysis software. In doing so, it was determined that, contrary to the two nominal wall types that were previously reported for this line, the condition of the line is more accurately represented using a single nominal type. What was originally interpreted as a thinner nominal wall type (previously reported as Pipe Type I for Pipes 0020-0070) is better reported as general wall thinning/corrosion. As a result, Pipes 0020-0070, which are found with lower PARW values, are being reported with 5-10% general wall loss. In addition, the remaining wall values of all reported defects have all been slightly refined. In general, the refined defect depths are now between 2 to 6% deeper than those previously issued.

Table 1 provides an overview of the RFT findings for the 500mm (20in) Northeast Interceptor Siphon.

| <b>Table 1: Feature Indication Summary</b>                      |  |
|---|--|
| <b>Inspected Length</b>   | 229.9m (out of 232.8m)   |
| <b>Number of Pipe Sections:</b>                                 | 22   |
| <b>Number of Analyzed Pipe Sections:</b>                        | 22   |
| <b>Average Wall Thickness:</b>                                  | 93.4%  |
| <b>Thinnest circumferential pipe wall (Tcircmin):</b>           | 75.6% (in Pipe 0040)   |
| <b>Number of pipes without localized wall loss indications:</b> | 17   |
| <b>Number of pipes with localized wall loss indications:</b>    | 5  |
| • Number of pipes in 'good' condition (>75% RW):                | 16   |
| • Number of pipes in 'fair' condition (50-74% RW):              | 0  |
| • Number of pipes in 'poor' condition (<50% RW):                | 4  |
| <b>Total number of wall loss indications reported:</b>          | 11 (28)*<br>*Only 11 pits are detailed in Table 3 (pages 9-10). However, 17 additional pitting indications are also mentioned providing a total of 28 reported pits. |
| <b>Number of Girth Welds:</b>                                   | 21   |

Figures 1 and 2 illustrate the distribution of localized wall loss along the 500mm (20in) Northeast Interceptor inspection with respect to remaining wall and circumferential location respectively. Note that there may be some (partially) overlapping data points due to defect proximity.

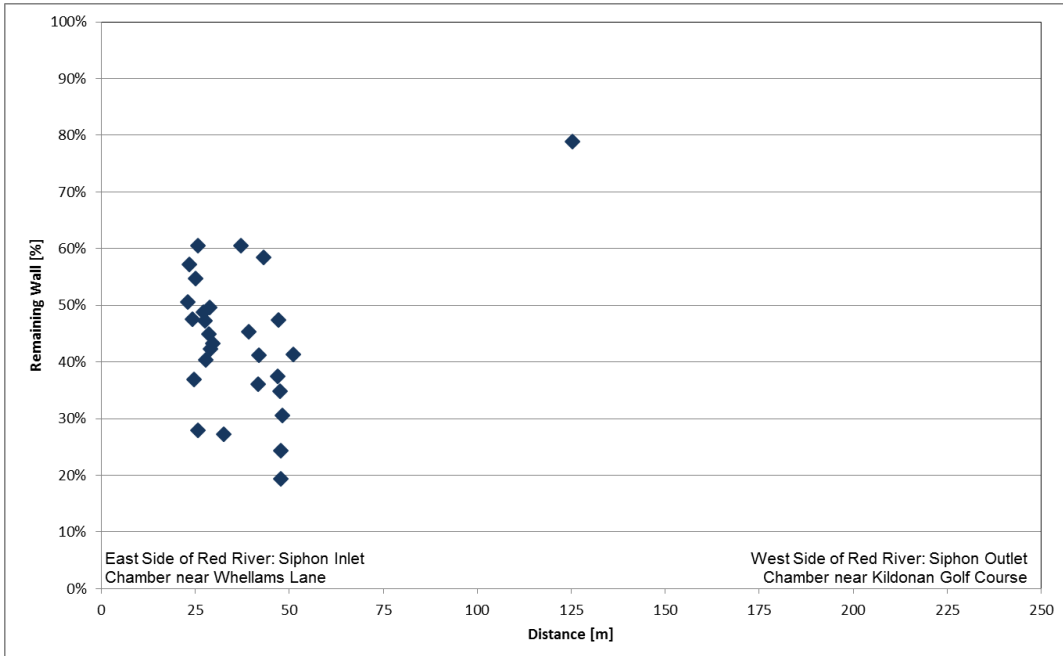


Figure 1: Distribution of wall loss with respect to remaining wall (%NWT) in pitting regions along the 500mm (20in) Northeast Interceptor Siphon.

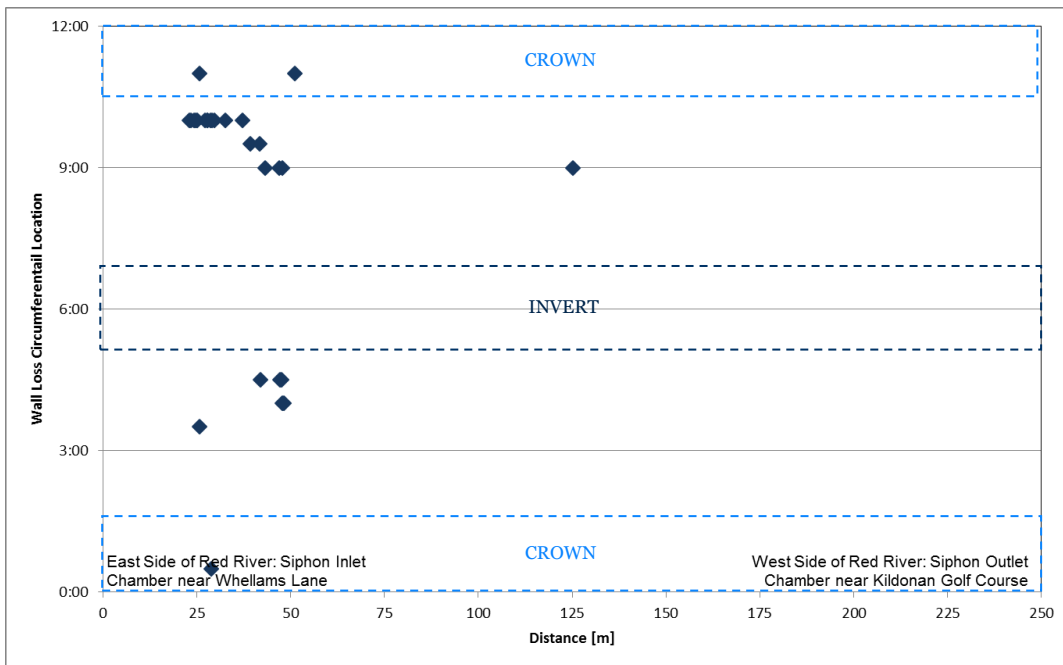


Figure 2: Circumferential distribution of the pitting regions along the 500mm (20in) Northeast Interceptor.

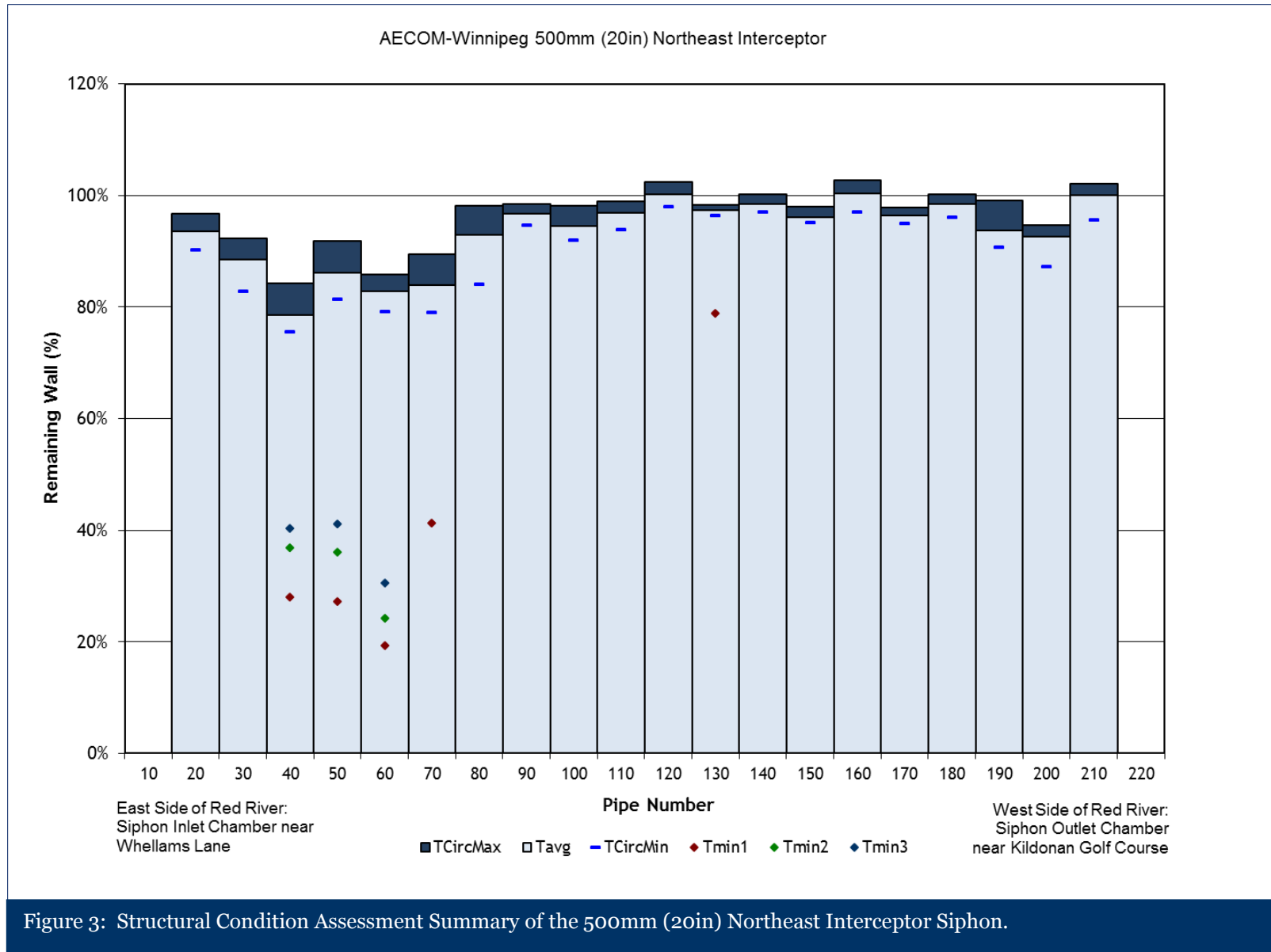


Figure 3: Structural Condition Assessment Summary of the 500mm (20in) Northeast Interceptor Siphon.

| Table 2: Inspection Overview  |   |
|---|---|
| <b>Client:</b>  | City of Winnipeg  |
| <b>Location:</b>  | Winnipeg, MB  |
| <b>Line Name/Identifier</b>   | 500mm (20in) Northeast Interceptor Siphon                   |
| <b>Pipe Diameter:</b>   | 500mm (20in)  |
| <b>Year Installed:</b>  | 1970  |
| <b>Nominal Wall Thickness (NWT):</b>  | 9.53mm  |
| <b>Material:</b>  | Steel   |
| <b>Inspected Length:</b>  | 229.9m  |
| <b>Reported Inspection Direction:</b>   | East to West  |
| <b>Break History:</b>   | None provided   |
| <b>Survey Date:</b> September 22, 2014  |   |
| <b>Lead Technician:</b>   | P. Ryhanen  |
| <b>Technician(s):</b>   | G. Bouchard, S. Popovic, D. Burton, R. Asuncion, C. Garrett |
| <b>Launch Access:</b>   | Siphon Inlet Chamber near Whellams Lane                     |
| <b>Swabbing Performed By:</b>   | PICA performed a pigging run prior to the RFT inspection.   |
| <b>Operational Comments:</b>  |   |
| <p><u>September 22, 2014</u></p> <p>7:20am: PICA field crew arrive at Tri-Core for initial prep.</p> <p>8:00 am: Arrived on site – east end at the siphon inlet chamber. Site still closed up. Awaiting backhoe. Commence with tool prep.</p> <p>9:17am: Chimera tool attached to lines.</p> <p>9:45 am: Tool launched.</p> <p>11:24am: Tool arrives on west end – siphon outlet chamber.</p> <p>11:36pm: Tool pulled back to east end.</p> <p>1:02pm: Tool arrives back to the launch chamber.</p> <p>1:24pm: Tool emerges from chamber.</p> <p>1:35pm: Tool on ground.</p> <p>1:59pm: Tool loaded onto truck.</p> <p>2:20pm: Field crew leave site.</p> |   |
|   |   |

Figure 4: Inspection path for 500mm (20in) Northeast Interceptor Siphon.

## Analysis Results

### Location Reporting, Pipe Lengths & Features

The total logged distance for the 500mm (20in) Northeast Interceptor inspection was 229.9m. The zero datum point is set 10.5in from the edge of the pipe at the launch site, Siphon Inlet Chamber (east side of the river). This 10.5in (0.3m) offset represents the distance between the tool's sensor and the odometer wheels at the rear of the tool. The end of the run is set 2.6m from the pipe edge in the Siphon Outlet Chamber where the tool stopped at the end of the inspection run (on the west side of the river). This 2.6m length is the distance from the tool's sensor to the front of the tool. The sum of all these distances together (229.9m plus 0.3m plus 2.6m) equals 232.8m.

A recent investigation in the reported run length for the 800mm (32in) Northeast Interceptor siphon led to an examination of the initially reported length for the 500mm (20in) Northeast Interceptor. *The original 2014 reported length for the 800mm Northeast Interceptor siphon was 219.7m, which was based on the on-board odometer system on the Chimera tool. AECOM records indicated the measured length for the 800mm siphon was short by more than 10m. PICA investigated the discrepancy and discovered that the onboard odometer system appeared to have intermittently slipped.* This led PICA to also investigate the 500mm NE interceptor, and PICA subsequently adjusted the measured length for the 500mm siphon to 229.9m (from 226.4m reported in 2014).

It is unusual for the on-board odometer to be off by more than 0.3% given the redundant configuration of the odometer wheels. Photos taken of the Chimera tool shortly after the inspection showed considerable debris accumulation (rags, hair, solids, etc.) by the tool. In addition, the inspection data exhibited substantial travel related noise believed to be due to internal debris. It is therefore possible that the on-board odometers were intermittently locking up due to grit, rags and other debris. The revised (longer) length of 229.9m was based on the wireline odometer, which is not impacted by build-up in the siphon.

The average length of the standard pipes in this section is 11.85m (38.88ft). A small number of shorter pipes were also found in the data.



Figure 5: Debris accumulation on 20-inch Chimera tool.

## General Wall Thickness

Pipe sections longer than 2.1m were analyzed to obtain the average remaining wall thickness calculated over the length of the section. The measured average wall thickness for this line is 93.4%.

Conventional manufacturing tolerances allow for fluctuations of  $\pm 15\%$  in the individual PARW values. Variations outside the normal  $\pm 15\%$  spread can be an indicator of a different nominal wall thickness or pipe type, or point towards a problem like aggregate pitting or general wall loss. Following the initial submission of the results (Dec 2014), the 20-in data was revisited using PICA's most current analysis software. In doing so, it was determined that, contrary to the two nominal wall types that were previously reported for this line, the condition of the line is more accurately represented using a single nominal type. What was originally interpreted as a thinner nominal wall type (previously reported as Pipe Type I for Pipes 0020-0070) is better reported as general wall thinning/corrosion. As a result, Pipes 0020-0070 which are found with lower PARW values, are being reported with 5-10% general wall loss.

In contrast, the wall thickness for Pipes 0080 to 0210 were closer to the nominal value in comparison. This particular section spans approximately 167m in length and starts approximately 62m from the launch site (Siphon Inlet Chamber). Correlating this span to the *Plan and Profile* drawings, it appears that this section is roughly located under the Red River.

## Local Wall Thickness

As a result of revisiting the data, the remaining wall values of all reported defects have all been slightly refined since the original submission. In general, the refined defect depths are now between 2 to 6% deeper than those previously issued.

With the exception of a single defect in Pipe 0130, all pitting indications in the line were identified between Pipes 0040 and 0070, which is located between 20m to 62m from the launch at the Siphon Inlet Chamber. The remaining wall thickness at the 27 defect locations ranged between 19% and 61% remaining wall (RW). The single defect in Pipe 0130 was measured with 79% RW.

One pitting indication is classified as shallow ( $\geq 65\%$  RW), 18 are medium (40%-64% RW), 8 are considered deep (20%-39% RW) and one is advanced ( $< 20\%$  RW). No through-holes (0% RW) or near through-holes ( $\leq 5\%$  RW) were found in this line.

Table 3, on page 9, details the three worst pitting indications per pipe ( $T_{min1}$ ,  $T_{min2}$  and  $T_{min3}$ ), as well as the average, minimum and maximum remaining wall values for the 500mm (20in) NE Interceptor line. The same results are shown graphically on page 4.

Table 4, on pages 10-12, provides additional detail for each defect with regards to its location relative to upstream and downstream features, axial length, signal quality index and analysis confidence level scoring.



## Data Quality

During the analysis, a higher level of background noise (than what is commonly present) was observed in most of the RFT data. It is believed that the noise is due to tool travel related factors, mainly because the channels along the invert of the pipe appear more impacted than other channels. Additionally, the noise disappears when the tool is stationary.

The observed noise is likely related to the large amount of debris in the line, which may be product remnants as well as tuberculation deposits. It is also possible that there is a greater amount of debris along the invert of the pipe, thus impacting the sensors closest to the bottom of the pipe.

In the noisiest sections of the data, the noise appears to be several times the regular background noise observed in the data from the tool; still the Threshold of Detection (TOD) of the tool in these noisy regions is not expected to be larger than 2x the regular TOD under optimal conditions as a result of mathematical noise filtering. For the Chimera tool, the normal TOD (90% or better probability of detection) is a 0.75”x50% deep defect as long as the tool settings are optimized to minimize noise.

**Table 3: Pipe List and Wall Thickness Readings – 500mm (20in) Northeast Interceptor Siphon**

| Pipe No. | Pipe Location |         |            | Tavg RW (%) | Circumferential Wall Thickness |                 | Local Wall Thickness<br><i>*Clock positions are with a perspective of East to West (e.g. 3:00=North, 9:00=South).</i> |              |                |        |              |                |        |              |                | Comments |   |   |
|----------|---------------|---------|------------|-------------|--------------------------------|-----------------|---|--------------|----------------|--------|--------------|----------------|--------|--------------|----------------|----------|---|---|
|          | Start (m)     | End (m) | Length (m) |             | Teiremax RW (%)                | Teiremin RW (%) | Tmin1   |              |                | Tmin2  |              |                | Tmin3  |              |                |          |   |   |
|          |               |         |            |             |                                |                 | RW (%)  | Location (m) | Clock Position | RW (%) | Location (m) | Clock Position | RW (%) | Location (m) | Clock Position |          |   |   |
| 0010     | 0.00          | 2.51    | 2.51       |             |                                |                 |   |              |                |        |              |                |        |              |                |          | Zero Datum Point is 10.5in from pipe edge in Siphon Inlet Chamber on East side of Red River |   |
| 0020     | 2.51          | 8.42    | 5.91       | 94%         | 97%                            | 90%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0030     | 8.42          | 20.31   | 11.89      | 88%         | 92%                            | 83%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0040     | 20.31         | 31.86   | 11.55      | 79%         | 84%                            | 76%             | 28%   | 25.64        | 3:30           | 37%    | 24.64        | 10:00          | 40%    | 27.87        | 10:00          |          | This pipe contains 11 additional defects between 42% and 61% RW.                            |   |
| 0050     | 31.86         | 43.43   | 11.56      | 86%         | 92%                            | 81%             | 27%   | 32.64        | 10:00          | 36%    | 41.62        | 9:30           | 41%    | 42.02        | 4:30           |          | This pipe contains 3 additional defects between 45% and 61% RW.                             |   |
| 0060     | 43.43         | 50.28   | 6.85       | 83%         | 86%                            | 79%             | 19%   | 47.67        | 4:00           | 24%    | 47.65        | 9:00           | 30%    | 48.17        | 4:00           |          | This pipe contains 3 additional defects between 35% and 47% RW.                             |   |
| 0070     | 50.28         | 62.11   | 11.83      | 84%         | 89%                            | 79%             | 41%   | 51.15        | 11:00          |        |              |                |        |              |                |          |   |   |
| 0080     | 62.11         | 74.13   | 12.03      | 93%         | 98%                            | 84%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0090     | 74.13         | 86.05   | 11.92      | 97%         | 98%                            | 95%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0100     | 86.05         | 98.01   | 11.96      | 95%         | 98%                            | 92%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0110     | 98.01         | 110.10  | 12.09      | 97%         | 99%                            | 94%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0120     | 110.10        | 122.22  | 12.13      | 100%        | 102%                           | 98%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0130     | 122.22        | 134.35  | 12.13      | 97%         | 98%                            | 96%             | 79%   | 125.23       | 9:00           |        |              |                |        |              |                |          |   |   |
| 0140     | 134.35        | 146.54  | 12.18      | 99%         | 100%                           | 97%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0150     | 146.54        | 158.82  | 12.28      | 96%         | 98%                            | 95%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0160     | 158.82        | 170.91  | 12.09      | 100%        | 103%                           | 97%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0170     | 170.91        | 183.06  | 12.15      | 96%         | 98%                            | 95%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0180     | 183.06        | 194.03  | 10.98      | 98%         | 100%                           | 96%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0190     | 194.03        | 204.81  | 10.77      | 94%         | 99%                            | 91%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0200     | 204.81        | 216.64  | 11.83      | 93%         | 95%                            | 87%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0210     | 216.64        | 228.65  | 12.01      | 100%        | 102%                           | 96%             |   |              |                |        |              |                |        |              |                |          |   |   |
| 0220     | 228.65        | 229.86  | 1.20       |             |                                |                 |   |              |                |        |              |                |        |              |                |          |   | End of run set 2.6m from the pipe edge in Siphon Outlet Chamber on West side of Red River |

**Table 4: Anomaly Reference Distances – 500mm (20in) Northeast Interceptor Siphon**

| In Pipe # | Data Index | Defect Location [m] (measured from launch) | Defect Remaining Wall | Clock Position* | Axial Length (mm) | Signal Quality Index** | Confidence Level | Nearest Upstream Feature                                      | Distance to Nearest U/S Feature (m) | Nearest Downstream Feature                        | Distance to Nearest D/S Feature (m) |
|-----------|------------|--|-----------------------|-----------------|-------------------|------------------------|------------------|---|-------------------------------------|---|-------------------------------------|
| 0040      | 9017       | 22.90                                      | 51%                   | 10:00           | 71                | 1.5                    | Medium Low       | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 22.90 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 206.95 m                            |
| 0040      | 9245       | 23.48                                      | 57%                   | 10:00           | 91                | 2.0                    | Medium           | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 23.48 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 206.37 m                            |
| 0040      | 9558       | 24.28                                      | 48%                   | 10:00           | 104               | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 24.28 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 205.58 m                            |
| 0040      | 9700       | 24.64                                      | 37%                   | 10:00           | 156               | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 24.64 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 205.22 m                            |
| 0040      | 9898       | 25.14                                      | 55%                   | 10:00           | 146               | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 25.14 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 204.72 m                            |
| 0040      | 10094      | 25.64                                      | 28%                   | 3:30            | 69                | 2.0                    | Medium           | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 25.64 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 204.22 m                            |
| 0040      | 10130      | 25.73                                      | 61%                   | 11:00           | 106               | 1.0                    | Low              | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 25.73 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 204.13 m                            |
| 0040      | 10714      | 27.21                                      | 49%                   | 10:00           | 93                | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 27.21 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 202.64 m                            |
| 0040      | 10894      | 27.67                                      | 47%                   | 10:00           | 80                | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 27.67 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 202.19 m                            |
| 0040      | 10972      | 27.87                                      | 40%                   | 10:00           | 72                | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 27.87 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 201.99 m                            |
| 0040      | 11242      | 28.55                                      | 45%                   | 10:00           | 136               | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 28.55 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 201.30 m                            |
| 0040      | 11337      | 28.80                                      | 50%                   | 0:30            | 97                | 1.5                    | Medium Low       | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 28.80 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 201.06 m                            |

**Table 4: Anomaly Reference Distances – 500mm (20in) Northeast Interceptor Siphon**

| In Pipe # | Data Index | Defect Location [m] (measured from launch) | Defect Remaining Wall | Clock Position* | Axial Length (mm) | Signal Quality Index** | Confidence Level | Nearest Upstream Feature                                      | Distance to Nearest U/S Feature (m) | Nearest Downstream Feature                        | Distance to Nearest D/S Feature (m) |
|-----------|------------|--|-----------------------|-----------------|-------------------|------------------------|------------------|---|-------------------------------------|---|-------------------------------------|
| 0040      | 11456      | 29.10                                      | 42%                   | 10:00           | 75                | 2.5                    | Medium high      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 29.10 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 200.76 m                            |
| 0040      | 11664      | 29.63                                      | 43%                   | 10:00           | 73                | 1.5                    | Medium Low       | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 29.63 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 200.23 m                            |
| 0050      | 12852      | 32.64                                      | 27%                   | 10:00           | 118               | 2.0                    | Medium           | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 32.64 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 197.21 m                            |
| 0050      | 14587      | 37.05                                      | 61%                   | 10:00           | 91.0              | 1.0                    | Low              | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 37.05 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 192.81 m                            |
| 0050      | 15435      | 39.20                                      | 45%                   | 9:30            | 132.0             | 1.0                    | Low              | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 39.20 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 190.65 m                            |
| 0050      | 16386      | 41.62                                      | 36%                   | 9:30            | 94.0              | 2.5                    | Medium - High    | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 41.62 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 188.24 m                            |
| 0050      | 16545      | 42.02                                      | 41%                   | 4:30            | 85.0              | 2.5                    | Medium High      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 42.02 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 187.83 m                            |
| 0050      | 16959      | 43.08                                      | 58%                   | 9:00            | 121.0             | 1.5                    | Medium Low       | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 43.08 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 186.78 m                            |
| 0060      | 18492      | 46.97                                      | 37%                   | 9:00            | 78.0              | 1.5                    | Medium-Low       | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 46.97 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 182.89 m                            |
| 0060      | 18531      | 47.07                                      | 47%                   | 4:30            | 85.0              | 1.5                    | Medium Low       | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 47.07 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 182.79 m                            |
| 0060      | 18700      | 47.50                                      | 35%                   | 4:30            | 80.0              | 2.5                    | Medium High      | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 47.50 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 182.36 m                            |
| 0060      | 18760      | 47.65                                      | 24%                   | 9:00            | 75.0              | 3.0                    | High             | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 47.65 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 182.21 m                            |

**Table 4: Anomaly Reference Distances – 500mm (20in) Northeast Interceptor Siphon**

| In Pipe #   | Data Index | Defect Location [m] (measured from launch) | Defect Remaining Wall | Clock Position* | Axial Length (mm) | Signal Quality Index** | Confidence Level | Nearest Upstream Feature                                      | Distance to Nearest U/S Feature (m) | Nearest Downstream Feature                        | Distance to Nearest D/S Feature (m) |
|-------------|------------|--|-----------------------|-----------------|-------------------|------------------------|------------------|---|-------------------------------------|---|-------------------------------------|
| <b>0060</b> | 18769      | 47.67                                      | 19%                   | 4:00            | 84.0              | 2.5                    | Medium - High    | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 47.67 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 182.18 m                            |
| <b>0060</b> | 18965      | 48.17                                      | 30%                   | 4:00            | 109.0             | 2.0                    | Medium           | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 48.17 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 181.69 m                            |
| <b>0070</b> | 20138      | 51.15                                      | 41%                   | 11:00           | 34.0              | 1.0                    | Low              | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 51.15 m                             | End of Run set at 2.6m from Siphon Outlet Chamber | 178.71 m                            |
| <b>0130</b> | 49302      | 125.23                                     | 79%                   | 9:00            | 106.0             | 1.5                    | Medium Low       | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 125.23 m                            | End of Run set at 2.6m from Siphon Outlet Chamber | 104.63 m                            |

\*: Clock position and deflection definitions are from a flow perspective (i.e. looking downstream).

\*\* : Score between 1 and 4 based on signal strength and correlation with calibration defect signatures.

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# City of Winnipeg 2014: 800mm (32in) Northeast Interceptor Siphon

Condition Assessment Report, Standard Analysis



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

**RFT ILI Tool**  
**800mm (32in) Steel**

**Red River Crossing**  
**Between Whellams Lane & Kildonan Golf Course**  
**Winnipeg, MB**

**PICA Project: Winnipeg 8007**

|                    |   |
|--------------------|---|
| Inspection Date:   | September 24, 2014  |
| Report Submission: | May 1, 2016 (Rev 2.0) December 19, 2014 (Rev 1.0)                       |
| Operators:         | P. Ryhanen, G. Bouchard, S. Popovic, D. Burton, R. Asuncion, C. Garrett |
| Analyst:           | J. Kim  |
| Reviewers:         | J. Regala, A. Shatat  |
| Report Revision:   | 2.0   |

CONFIDENTIAL

# The City of Winnipeg: 800mm (32in) Northeast Interceptor Siphon

*Condition Assessment Report, Standard Analysis*

## Executive Summary

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PICA, under contract with AECOM, inspected a number of Wastewater River Crossings for the City of Winnipeg using Remote Field Technology (RFT) between September 15 and September 24, 2014. This report documents the results for the 800mm (32-in) steel Northeast Interceptor Siphon, which crosses the Red River. The inspected portion spanned between the Siphon Inlet Chamber near Whellams Lane and the Siphon Outlet Chamber located at the northeast corner of the Kildonan Golf Course. The inspection was performed on September 24<sup>th</sup>, 2014 and the results reported here document PICA's findings.

In general, the RFT analysis found the majority of pipes in this section to be in 'good' condition. A total of four pipes (out of 21) were found with localized wall loss, ranging in depth between 63% (37% remaining wall) and 35% (65% remaining wall). There were no through-holes (0% RW) or near through-holes ( $\leq 5\%$  RW) found.

In April of 2016, this report was updated with a revised length for the siphon. The initial (2014) reported length of 219.7m was based on the on-board odometer system on the Chimera tool, which appeared to have intermittently slipped. Because the odometer system consists of three independent odometers wheels, it is unusual for the on-board odometer to be short by more than 0.3%. It is believed that internal debris in the pipe caused the on-board odometer wheels on the Chimera tool to intermittently lock-up. The longer revised length of 228.8m is based on the external wireline odometer - see the analysis section for more details.

Following the initial submission of the results (Dec 2014), the analysis of the 800mm (32-in) data was also revisited using PICA's most current analysis software. In doing so, it was determined that, contrary to the two nominal wall types that were previously reported for this line, the condition of the line is more accurately represented using a single nominal type. What was originally interpreted as a thinner nominal wall type (previously reported as Pipe Type I for Pipes 0020, 0040-0070 and 0190-0210), is better reported as general wall thinning/corrosion. As a result, Pipes 0010-0070 and 0190-0210, which are found with lower PARW values, are being reported with 10-15% general wall loss. In addition, the remaining wall values of all reported defects have all been slightly refined since the original submission. In general, the refined defect depths are now between 1 to 3% shallower than those previously issued.



Table 1 provides an overview of the RFT findings for the 800mm (32in) Northeast Interceptor Siphon.

| <b>Table 1: Feature Indication Summary</b>                      |                        |
|---|------------------------|
| <b>Inspected Length</b>   | 224.9m (out of 228.8m) |
| <b>Number of Pipe Sections:</b>                                 | 21                     |
| <b>Number of Analyzed Pipe Sections:</b>                        | 21                     |
| <b>Average Wall Thickness:</b>                                  | 93.2%                  |
| <b>Thinnest circumferential pipe wall (Tcircmin):</b>           | 78.7% (in Pipe 0060)   |
| <b>Number of pipes without localized wall loss indications:</b> | 17                     |
| <b>Number of pipes with localized wall loss indications:</b>    | 4                      |
| • Number of pipes in 'good' condition (>75% RW):                | 17                     |
| • Number of pipes in 'fair' condition (50-74% RW):              | 2                      |
| • Number of pipes in 'poor' condition (<50% RW):                | 2                      |
| <b>Total number of wall loss indications reported:</b>          | 7                      |
| <b>Number of Girth Welds:</b>                                   | 20                     |

Figures 1 and 2 illustrate the distribution of localized wall loss along the 800mm (32in) Northeast Interceptor Siphon inspection with respect to remaining wall and circumferential location respectively. Note that there may be some (partially) overlapping data points due to defect proximity.

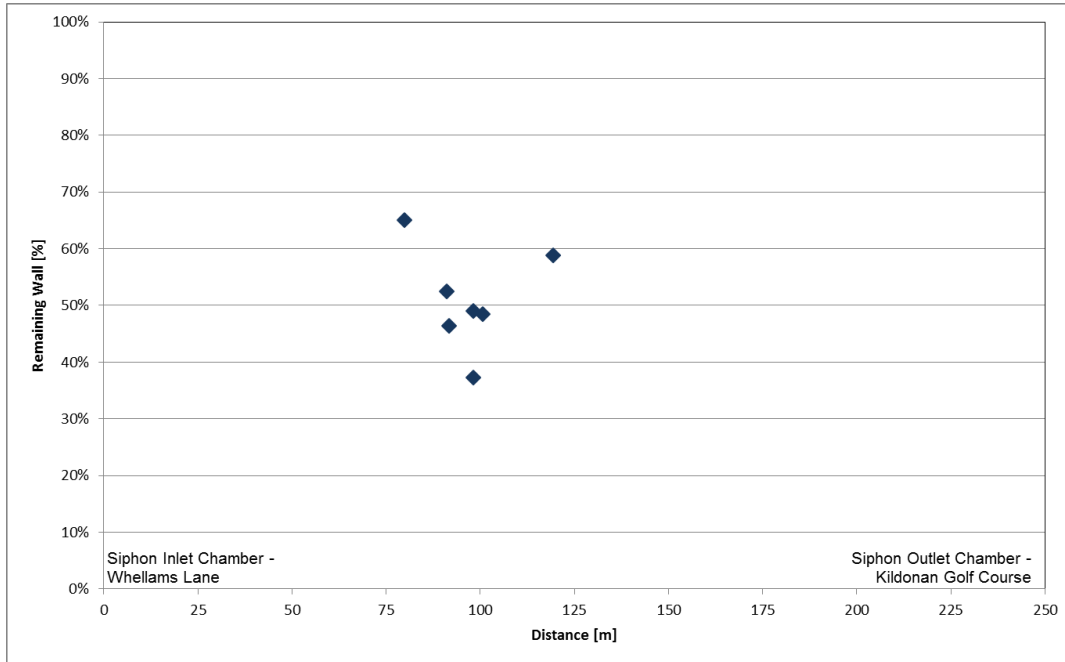


Figure 1: Distribution of wall loss with respect to remaining wall (%NWT) in pitting regions along the 800mm (32in) Northeast Interceptor Siphon.

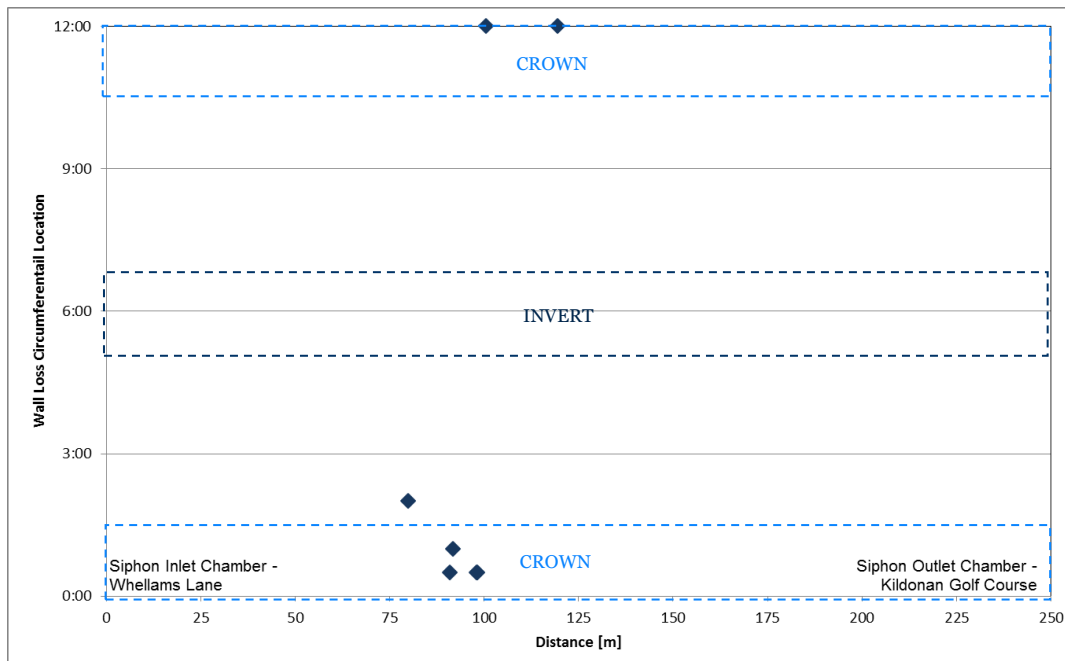


Figure 2: Circumferential distribution of the pitting regions along the 800mm (32in) Northeast Interceptor Siphon.

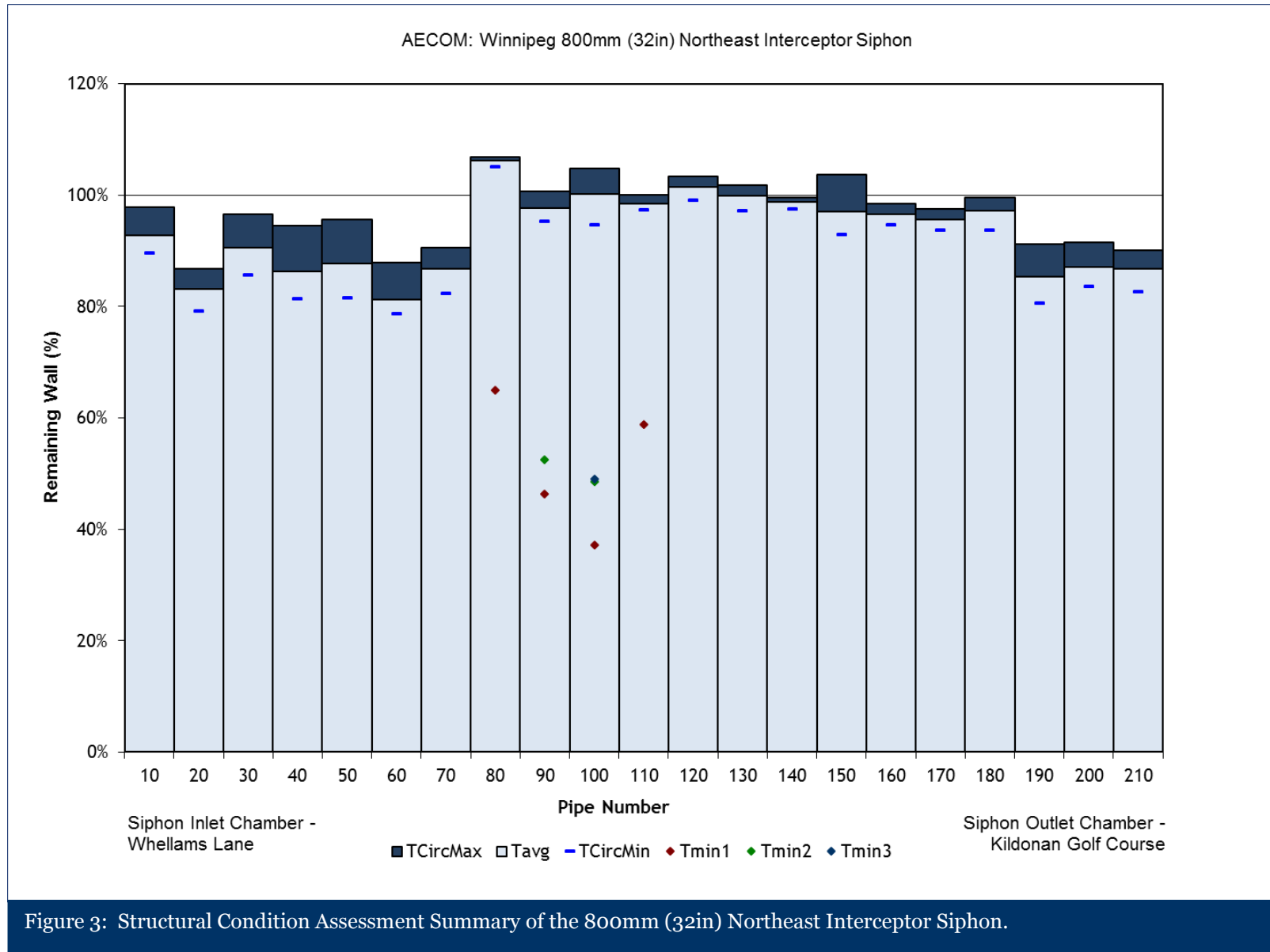


Figure 3: Structural Condition Assessment Summary of the 800mm (32in) Northeast Interceptor Siphon.

| Table 2: Inspection Overview   |  |
|--|--|
| <b>Client:</b>   | City of Winnipeg   |
| <b>Location:</b>   | Winnipeg, MB   |
| <b>Line Name/Identifier</b>  | 800mm (32in) Northeast Interceptor Siphon  |
| <b>Pipe Diameter:</b>  | 800mm (32in)   |
| <b>Year Installed:</b>   | 1970   |
| <b>Nominal Wall Thickness (NWT):</b>   | 9.55mm   |
| <b>Material:</b>   | Steel  |
| <b>Inspected Length:</b>   | 224.9m   |
| <b>Reported Inspection Direction:</b>  | East to West   |
| <b>Break History:</b>  | None provided  |
|  |  |
| <b>Survey Date:</b>  | September 24, 2014   |
| <b>Lead Technician:</b>  | P. Ryhanen   |
| <b>Technician(s):</b>  | G. Bouchard, S. Popovic, D. Burton, R. Asuncion, C. Garrett  |
| <b>Launch Access:</b>  | Siphon Inlet Chamber near Whellams Lane  |
| <b>Swabbing Performed By:</b>  | Pigging run performed by PICA on September 24 <sup>th</sup> , 2014. Refer to Operational Comments for further details. |
| <b>Operational Comments:</b>   |  |
| <p><u>September 24, 2014</u></p> <p>7:00am: PICA field crew arrive at Tri-Core for initial prep. Moved to site and commence equipment set up.</p> <p>8:45am: Commence setting up tag lines by sending a Uni-Jet hose down the pipeline, starting at the west side.</p> <p>9:17am: Attach tag line to hose and start pulling east to west.</p> <p>9:38 pm: Nozzle arrives on W side and discovered the line tangled. Start pulling line W-E shortly after untangling.</p> <p>11:33pm: Line arrives back on the east side.</p> <p>12:31pm: Gauge pig launched from east end.</p> <p>1:08pm: Gauge pig arrives on west end and heads back to launch.</p> <p>3:14pm: Chimera tool placed in pipe. After resolving air quality concerns, the tool launched east to west (4:15).</p> <p>5:09pm: Chimera tool arrives on W side. Begin retrieve W to E.</p> <p>6:35pm: Tool arrives back to E side.</p> <p>7:03pm: Tool pulled out of pipe, completely covered in debris and sent for cleaning.</p> <p>7:40pm: Crew leaves site and head to Tri-Core.</p> |  |
|  |  |
| <p>Figure 4: Inspection path for 800mm (32in) Northeast Interceptor Siphon.</p>  |  |

## Analysis Results

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### Location Reporting, Pipe Lengths & Features

The total logged distance for the 800mm (32in) Northeast Interceptor inspection was 224.9m. The zero datum point is set approximately 10.5in (0.3m) from the pipe edge at the Siphon Inlet Chamber (east side of the river). This 10.5in offset represents the distance between the sensor and the odometer wheels at the rear of the tool. The end of the run is set 2.9m from the pipe edge in the Siphon Outlet Chamber where the tool stopped at the end of the inspection run (on the west side of the river). This 2.9m length is the distance from the tool's sensor to the front of the tool. The sum of all these distances together (224.9m plus 0.3m plus 2.9m) equals 228.8m.

The original 2014 reported length for the Northeast Interceptor siphon was 219.7m, which was based on the on-board odometer system on the Chimera tool. AECOM records indicated the measured length was short by more than 10m. PICA investigated the discrepancy and discovered that the onboard odometer system appeared to have intermittently slipped. This revision of the report adjusts the measured siphon length to 228.8m.

It is unusual for the on-board odometer to be off by more than 0.3% given the redundant configuration of the odometer wheels. Photos taken of the Chimera tool shortly after the inspection showed considerable debris accumulation (rags, hair, solids, etc.) by the tool. In addition, the inspection data exhibited substantial travel related noise believed to be due to internal debris. It is therefore possible that the on-board odometers were intermittently locking up due to grit, rags and other debris. The revised (longer) length of 228.8m was based on the wireline odometer, which is not impacted by build-up in the siphon.

The average length of the standard pipes in the inspected portion is 11.9m (39.05ft). A number of shorter pipes were also found in the data.

Two different metal gain anomalies were identified in the data. The first type of anomaly was observed in the RFT data in Pipes 0080 and 0180 (refer to Table 3 for their approximate locations). It is possible that these anomalies resulted from external supports (i.e. anchor blocks). The second type of anomaly was observed in Pipe 0090 and is ~0.3m in length. Unfortunately, the supplied drawings did not contain sufficient details to accurately determine the nature of these wall gain anomalies. If additional information is available regarding these particular anomalies, PICA can further improve their interpretation of these signals.

## General Wall Thickness

Pipe sections longer than 2.9m were analyzed to obtain the average remaining wall thickness calculated over the length of the section. The measured average wall thickness for this line is 94.3%.

Conventional manufacturing tolerances allow for fluctuations of  $\pm 15\%$  in the individual PARW values. Variations outside the normal  $\pm 15\%$  spread can be an indicator of a different nominal wall thickness or pipe type, or point towards a problem like aggregate pitting or general wall loss. Following the initial submission of the results (Dec 2014), the 32-n data was revisited using PICA's most current analysis software. In doing so, it was determined that, contrary to the two nominal wall types that were previously reported for this line, the condition of the line is more accurately represented using a single nominal type. What was originally interpreted as a thinner nominal wall type (previously reported as Pipe Type I for pipes 0020, 0040-0070 and 0190-0210), is better reported as general wall thinning/corrosion. As a result, Pipes 0010-0070 and 0190-0210, which are found with lower PARW values, are being reported with 10-15% general wall loss.

In contrast, the measured wall thickness for Pipes 0080-0180 are closer to 100% nominal wall. This particular section spans approximately 119m in length and starts approximately 79m from the launch site (Siphon Inlet Chamber). Correlating this span to the *Plan and Profile* drawings, it appears that this section is located roughly under the Red River.

## Local Wall Thickness

As a result of revisiting the data, the remaining wall values of all reported defects have all been slightly refined since the original submission. In general, the refined defect depths are now between 1 to 3% shallower than those previously issued.

In general, the RFT analysis found the majority of pipes in this section to be in 'good' condition. A total of four pipes (out of 21) were found with localized wall loss, with the reported pitting depths ranging between 37% and 65% remaining wall. There were no through-holes (0% RW) or near through-holes ( $\leq 5\%$  RW) found in this line.

Table 3, on page 9, details the three worst pitting indications per pipe ( $T_{min1}$ ,  $T_{min2}$  and  $T_{min3}$ ), as well as the average, minimum and maximum remaining wall values for the 800mm (32in) NE Interceptor Siphon. The same results are shown graphically on page 3. Table 4 on page 9 provides additional information regarding the anomaly locations.

Table 4, on page 10, provides additional detail for each defect with regards to its location relative to upstream and downstream features, axial length, signal quality index and analysis confidence level scoring.

## Data Quality

During the analysis, a higher level of background noise (than what is commonly present) was observed in most of the RFT data. It is believed that the noise is due to tool travel related factors, mainly because the channels along the invert of the pipe appear more impacted than other channels. Additionally, the noise disappears when the tool is stationary.

The observed noise is likely related to the amount of debris in the line, which may be product remnants as well as accumulated tuberculation deposits. It is also possible that there is a greater amount of debris along the invert of the pipe, thus impacting the sensors closest to the bottom of the pipe.



Figure 5: Debris accumulation on 32-inch Chimera tool.

In the noisiest sections of the data, the noise appears to be several times the regular background noise observed in the data from the tool; still the Threshold of Detection (TOD) of the tool in the region along the bottom of the river is not expected to be larger than 2x the regular TOD under optimal conditions as a result of mathematical noise filtering. For the sections on the river banks, the noise is considerably worse, and the TOD is estimated to be 8x the regular TOD of the tool.

For the Chimera tool, the normal TOD (90% or better probability of detection) is a 0.75" x 50% deep defect as long as the tool settings are optimized to minimize noise.

**Table 3: Pipe List and Wall Thickness Readings – 800mm (32in) Northeast Interceptor Siphon**

| Pipe No. | Pipe Location |         |            | Tavg RW (%) | Circumferential Wall Thickness |                 | Local Wall Thickness<br><i>*Clock positions are with a perspective of East to West (e.g. 3:00=North, 9:00=South).</i> |              |                |        |              |                |        |              |                | Comments |  |
|----------|---------------|---------|------------|-------------|--------------------------------|-----------------|---|--------------|----------------|--------|--------------|----------------|--------|--------------|----------------|----------|--|
|          | Start (m)     | End (m) | Length (m) |             | Tciremax RW (%)                | Tciremin RW (%) | Tmin1   |              |                | Tmin2  |              |                | Tmin3  |              |                |          |  |
|          |               |         |            |             |                                |                 | RW (%)  | Location (m) | Clock Position | RW (%) | Location (m) | Clock Position | RW (%) | Location (m) | Clock Position |          |  |
| 0010     | 0.00          | 9.65    | 9.66       | 93%         | 98%                            | 90%             |   |              |                |        |              |                |        |              |                |          | Zero Datum point is 10.5in (0.3m) from the pipe edge at the Siphon Inlet Chamber |
| 0020     | 9.65          | 21.87   | 12.21      | 83%         | 87%                            | 79%             |   |              |                |        |              |                |        |              |                |          |  |
| 0030     | 21.87         | 33.71   | 11.84      | 90%         | 97%                            | 86%             |   |              |                |        |              |                |        |              |                |          |  |
| 0040     | 33.71         | 45.61   | 11.90      | 86%         | 94%                            | 81%             |   |              |                |        |              |                |        |              |                |          |  |
| 0050     | 45.61         | 58.40   | 12.79      | 88%         | 96%                            | 82%             |   |              |                |        |              |                |        |              |                |          |  |
| 0060     | 58.40         | 70.06   | 11.67      | 81%         | 88%                            | 79%             |   |              |                |        |              |                |        |              |                |          |  |
| 0070     | 70.06         | 78.82   | 8.75       | 87%         | 91%                            | 82%             |   |              |                |        |              |                |        |              |                |          |  |
| 0080     | 78.82         | 83.65   | 4.83       | 106%        | 107%                           | 105%            | 65%   | 79.91        | 2:00           |        |              |                |        |              |                |          | Wall gain anomaly between 78.8m and 80.5m  |
| 0090     | 83.65         | 96.96   | 13.30      | 98%         | 101%                           | 95%             | 46%   | 91.66        | 1:00           | 52%    | 91.01        | 0:30           |        |              |                |          | Two wall gain anomalies at 92.79m & 93.24m                                       |
| 0100     | 96.96         | 108.43  | 11.47      | 100%        | 105%                           | 95%             | 37%   | 98.08        | 0:30           | 49%    | 100.57       | 12:00          | 49%    | 98.19        | 0:30           |          |  |
| 0110     | 108.43        | 120.02  | 11.60      | 98%         | 100%                           | 97%             | 59%   | 119.45       | 12:00          |        |              |                |        |              |                |          |  |
| 0120     | 120.02        | 131.96  | 11.94      | 101%        | 103%                           | 99%             |   |              |                |        |              |                |        |              |                |          |  |
| 0130     | 131.96        | 143.82  | 11.86      | 100%        | 102%                           | 97%             |   |              |                |        |              |                |        |              |                |          |  |
| 0140     | 143.82        | 155.64  | 11.82      | 99%         | 100%                           | 97%             |   |              |                |        |              |                |        |              |                |          |  |
| 0150     | 155.64        | 166.89  | 11.25      | 97%         | 104%                           | 93%             |   |              |                |        |              |                |        |              |                |          |  |
| 0160     | 166.89        | 178.83  | 11.95      | 97%         | 98%                            | 95%             |   |              |                |        |              |                |        |              |                |          |  |
| 0170     | 178.83        | 189.87  | 11.04      | 96%         | 97%                            | 94%             |   |              |                |        |              |                |        |              |                |          |  |
| 0180     | 189.87        | 197.64  | 7.77       | 97%         | 100%                           | 94%             |   |              |                |        |              |                |        |              |                |          | Wall gain anomaly between 189.9m and 194.3m                                      |
| 0190     | 197.64        | 207.24  | 9.60       | 85%         | 91%                            | 81%             |   |              |                |        |              |                |        |              |                |          |  |
| 0200     | 207.24        | 215.30  | 8.07       | 87%         | 91%                            | 84%             |   |              |                |        |              |                |        |              |                |          |  |
| 0210     | 215.30        | 224.91  | 9.61       | 87%         | 90%                            | 83%             |   |              |                |        |              |                |        |              |                |          | End of Run is 3.6m from pipe edge at Siphon Outlet Chamber                       |



| <b>Table 4: Anomaly Reference Distances – 800mm (32in) Northeast Interceptor Siphon</b> |                   |  |                              |                        |                          |                               |                         |   |  |   |  |
|---|-------------------|--|------------------------------|------------------------|--------------------------|-------------------------------|-------------------------|---|--|---|--|
| <b>In Pipe #</b>  | <b>Data Index</b> | <b>Defect Location [m]</b><br>(measured from launch) | <b>Defect Remaining Wall</b> | <b>Clock Position*</b> | <b>Axial Length (mm)</b> | <b>Signal Quality Index**</b> | <b>Confidence Level</b> | <b>Nearest Upstream Feature</b>                               | <b>Distance to Nearest U/S Feature (m)</b> | <b>Nearest Downstream Feature</b>                 | <b>Distance to Nearest D/S Feature (m)</b> |
| <b>0080</b>   | 31288             | 79.91  | 65%                          | 2:00                   | 85                       | 2.0                           | Medium                  | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 79.91 m                                    | End of Run set at 2.9m from Siphon Outlet Chamber | 145.01 m                                   |
| <b>0090</b>   | 35599             | 91.01  | 52%                          | 0:30                   | 50                       | 1.5                           | Medium Low              | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 91.01 m                                    | End of Run set at 2.9m from Siphon Outlet Chamber | 133.90 m                                   |
| <b>0090</b>   | 35855             | 91.66  | 46%                          | 1:00                   | 70                       | 2.0                           | Medium                  | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 91.66 m                                    | End of Run set at 2.9m from Siphon Outlet Chamber | 133.26 m                                   |
| <b>0100</b>   | 38343             | 98.08  | 37%                          | 0:30                   | 75                       | 3.0                           | High                    | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 98.08 m                                    | End of Run set at 2.9m from Siphon Outlet Chamber | 126.83 m                                   |
| <b>0100</b>   | 38381             | 98.19  | 49%                          | 0:30                   | 44                       | 2.0                           | Medium                  | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 98.19 m                                    | End of Run set at 2.9m from Siphon Outlet Chamber | 126.72 m                                   |
| <b>0100</b>   | 39303             | 100.57   | 49%                          | 12:00                  | 52                       | 2.5                           | Medium High             | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 100.57 m                                   | End of Run set at 2.9m from Siphon Outlet Chamber | 124.34 m                                   |
| <b>0110</b>   | 46508             | 119.45   | 59%                          | 12:00                  | 40                       | 1.0                           | Low                     | Launch Point at 10.5in from pipe edge at Siphon Inlet Chamber | 119.45 m                                   | End of Run set at 2.9m from Siphon Outlet Chamber | 105.46 m                                   |

\* Clock position and deflection definitions are from a flow perspective (i.e. looking downstream).

\*\* Score between 1 and 4 based on signal strength and correlation with calibration defect signatures.

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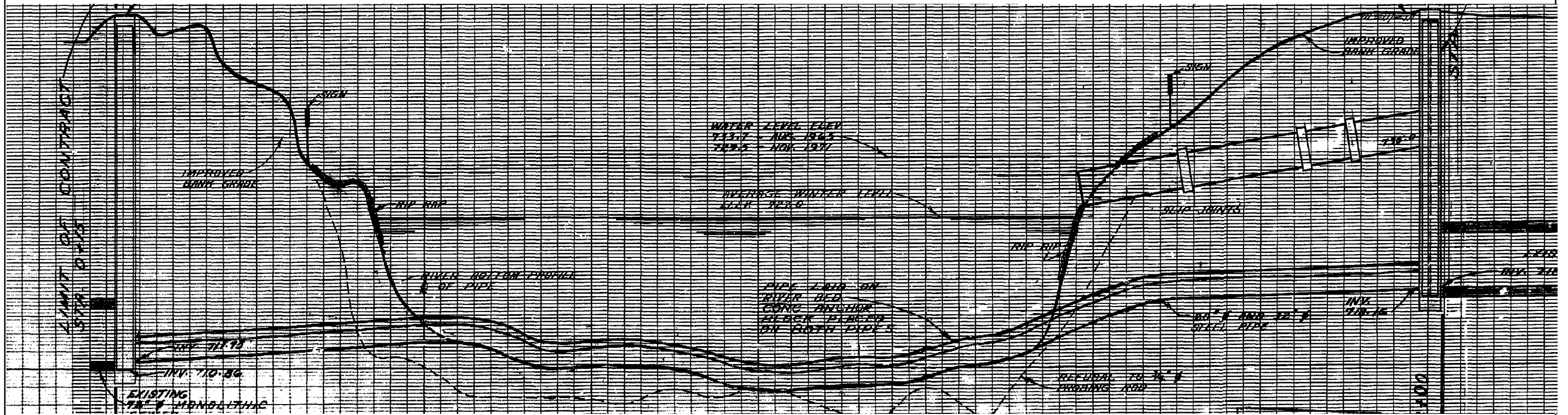
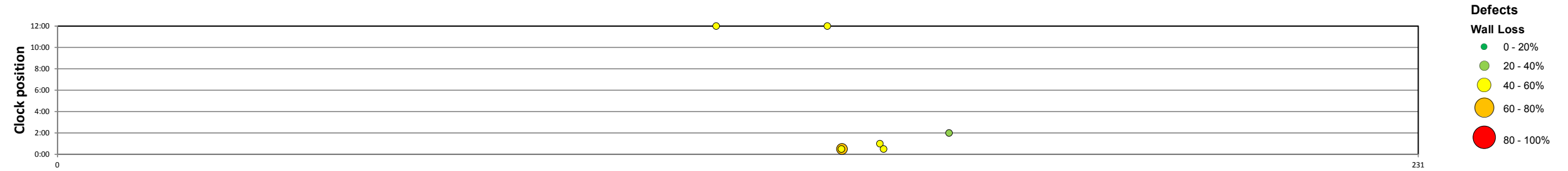
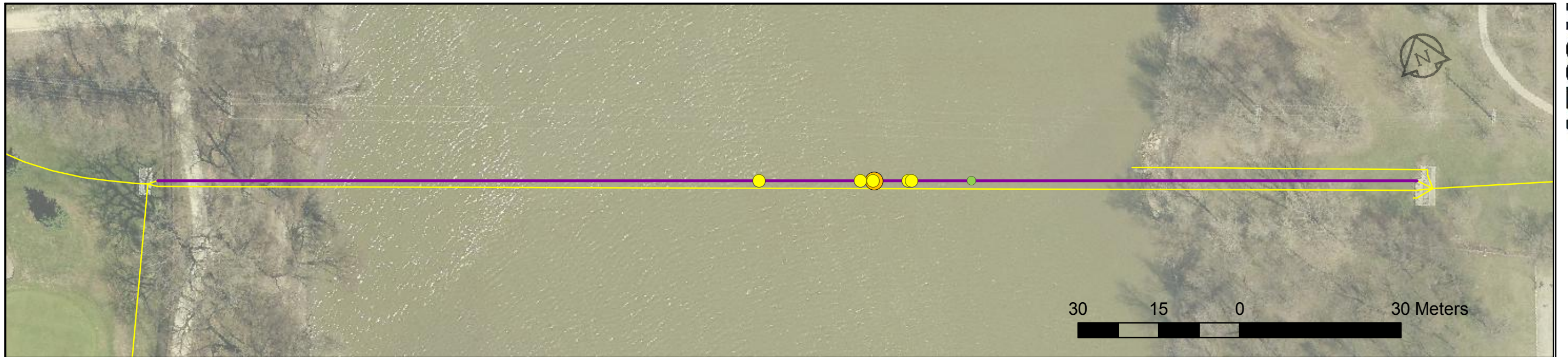
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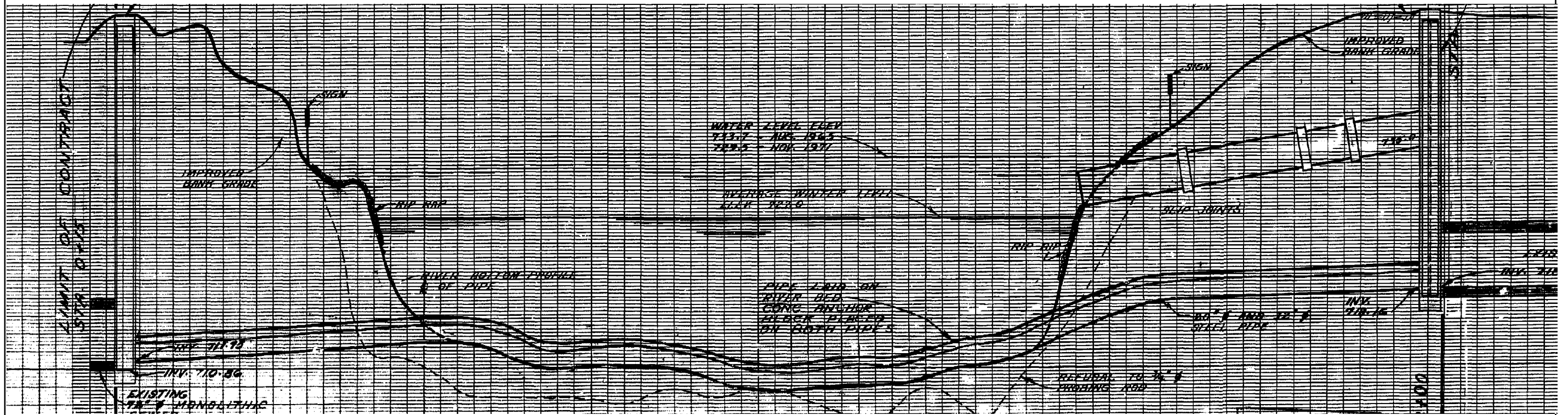
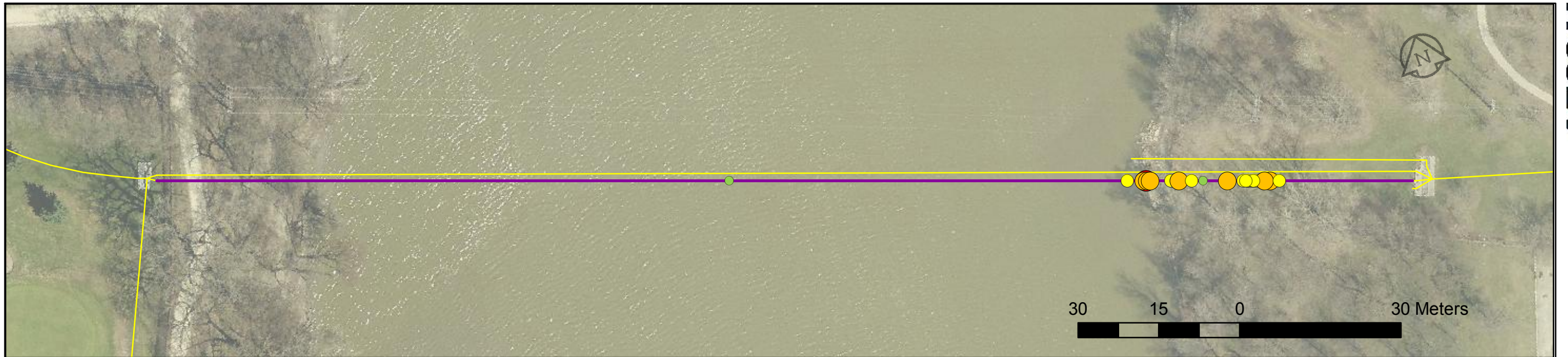
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