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Enbridge Gas Inc.
500 Consumers Road
North York, Ontario M2J 1P8
Canada

October 21, 2020

VIA EMAIL and RESS

Ms. Christine Long
Board Secretary
Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, ON M4P 1E4

Dear Ms. Long:

Re: Enbridge Gas Inc. (Enbridge Gas)
Ontario Energy Board (OEB) File: EB-2020-0136
NPS 20 Replacement Cherry to Bathurst – Interrogatory Responses

In accordance with the Procedural Order No. 2 dated October 8, 2020, enclosed please find Interrogatory Responses from Enbridge Gas in the above noted proceeding.

Enbridge Gas will file responses to the following interrogatories as soon as possible:

- Exhibit I.ED.5
- Exhibit I.EP.2
- Exhibit I.EP.3
- Exhibit I.EP.8
- Exhibit I.EP.10
- Exhibit I.EP.12
- Exhibit I.EP.18
- Exhibit I.FRPO.5
- Exhibit I.PP.13
- Exhibit I.STAFF.3

Please contact the undersigned if you have any questions.

Yours truly,

(Original Digitally Signed)

Joel Denomy
Technical Manager, Regulatory Applications

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit B, Schedule 1, Page 1

"In 2016 and 2018, Inline Inspections (ILI) using a robotic crawler tool were performed on approximately 1.9 km of the 4.5 km section of pipeline being replaced by the Project."

Question**:**

(a) Please provide the inspection reports prepared as a result of these 2016 and 2018 inline inspections.

(b) Has Enbridge conducted other inline inspections of the Cherry to Bathurst segment in the past 20 years? If yes, please describe each inspection, summarize the results, and file any inspection reports prepared therefrom.

(c) Has Enbridge conducted other inline inspections of the Kipling Oshawa Loop other than the Cherry to Bathurst segment in the past 20 years? If yes, please describe each inspection, summarize the results, and file any inspection reports prepared therefrom.

(d) Has Enbridge conducted other inspections of the Cherry to Bathurst segment in the past 20 years other than "inline" inspections? If yes, please describe each inspection, summarize the results, and file any inspection reports prepared therefrom.

Response:

a) Please see Exhibit I.TORONTO.12 a).

b) No other inline inspections have been conducted on the Cherry to Bathurst segment of the NPS20 in the past 20 years.

c) In 2013 Enbridge Gas completed a short in-line inspection of the NPS 20 portion of the KOL directly south of Station B (located at 405 Eastern Avenue). The inspection length was 143 meters. There were corrosion features identified in this segment of

pipeline by the inline inspection tool. Please refer to the attached inspection report (Attachment 1).

d) No full-length pipeline inspections other than the inline inspections have been conducted on the Cherry to Bathurst segment in the past 20 years. Integrity digs have been conducted for localized inspections. Integrity dig locations were identified based on results from the completed inline inspections. Enbridge Gas also performed an above ground External Corrosion Direct Assessment (ECDA) using Close Interval Potential Survey and a Direct Current Voltage Gradient Survey (CIPS and DCVG) on selected portions of the NPS20 KOL pipeline in 2011. The segment inspected was from Sherway Gardens Gate Station to Station B (and therefore included the entire Cherry to Bathurst segment). The report is attached for reference (Attachment 2). The results indicated that there were a number of locations with potential issues with the cathodic protection levels and the coating condition. Preliminary digs, however, did not find the issues that were anticipated by the report, and consequently further digs were postponed. There were many reasons to believe that the data from the report was not as precise as needed: the area is subject to very high levels of stray current from the DC transit system, soils are potentially contaminated, backfill conditions around the pipe are suspect, many utilities exist in the area, disbonded coating or backfill could be shielding cathodic protection as well as surface readings, surface conditions such as asphalt may be interfering with the data collection, etc. As an alternative to continuing the excavation program, a program to validate the cathodic protection criteria was developed. This included installing corrosion coupon probes to achieve more accurate cathodic protection evaluation, as well as to collect 24-hour chart recording on selected test points to better understand the influence of the DC transit system stray current.

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NYSEARCH/NGA

Final Data Analysis Report

Client: NYSEARCH/NGA
InvoDane Project No: 812
Pipeline Name: 20 in Station B
Operated by Enbridge Gas Distribution Incorporated.
405 Eastern Ave Toronto ON
Demonstration Type: Explorer 20/26
Demonstration Date: November 1, 2012
Report Date: October 30, 2014
Revision No: 2

Prepared by: Jim Hare
Approved by: Paul Laursen

Revision Control

Revision No.	Date	Description	Prepared by	Approved by
1	January 25, 2013	Initial release	Jim Hare	Paul Laursen
2	October 30, 2014	Revisions to inspection indication sizing and pressure calculations (Sections 2.1, 2.3.1, 2.4, 4.1, 4.3.1, 4.4, 4.6, 4.7, and 4.8). Table 4.7 now ordered in decreasing severity.	Jim Hare	Paul Laursen

Table of Contents

List of Figures

List of Tables

1 Introduction

This inspection report describes the NYSEARCH/NGA demonstration inspection carried out by InvoDane Engineering in the 20 in Station B pipeline operated by Enbridge Gas Distribution Incorporated (Enbridge) in Toronto, ON. The demonstration was part of the development of the Explorer 20/26 robotic inspection system and its commercialization. Metal loss data was collected from the 20 in Station B pipeline south of Eastern Ave. (referred to herein as 20 in pipeline) with the Explorer 20/26 inspection robot.

1.1 The Explorer 20/26 Inspection Robot and Reporting Specifications

Explorer 20/26 is a pipeline inspection robot designed for use in 20 in to 26 in pipelines. It features Magnetic Flux Leakage (MFL) sensors to evaluate metal loss and front and rear video cameras. Explorer 20/26 Robot 001 was used for this inspection, referred to herein as Explorer 20/26. The robot was configured for 20 in pipe with 240 circumferentially distributed MFL sensors.

The reporting specifications of Explorer 20/26 in standard pipelines are:

- minimum anomaly size: 10% wall loss with a diameter of 3x pipe wall thickness
- anomaly length (axial) sizing accuracy: ±0.5 in with 80% confidence
- anomaly depth sizing accuracy: ±10% pipe wall thickness with 80% confidence

The reporting specifications of Explorer 20/26 in cased pipelines are:

- minimum anomaly size: 20% wall loss with a diameter of 3x pipe wall thickness
- anomaly length (axial) sizing accuracy: ±0.5 in with 80% confidence
- anomaly depth sizing accuracy: ±20% pipe wall thickness with 80% confidence

Some anomalies that do not meet the minimum reporting specifications may be listed. These anomalies are presented with the understanding that their reported dimensions do not adhere to the accuracy specifications listed above. These anomalies are identified as Below Reporting Specifications (BRS) in this report.

Explorer 20/26 can identify dents with both the MFL sensors and cameras on the robot, but is not capable of evaluating dent dimensions. Any identified dents are listed without dimensions.

1.2 Units and Reported Values

All values herein are reported in imperial units. Positions are reported relative to Launch Site 1, shown in Figure 3.1. Flow in the 20 in pipeline was from north to south at the time of inspection. Positions downstream of the reference location are reported as positive (+). Positions upstream of the reference location are reported as negative (−).

O'clock positions are reported looking downstream along the pipeline. The 6:00 position is taken in the direction of gravity, toward the bottom of the pipeline.

A summary of inspection results is provided in Section Summary of Inspection Results. Detailed inspection results are given in Section Detailed Inspection Results.

2 Summary of Inspection Results

This section describes the general condition of the inspected pipeline. Refer to Section Detailed Inspection Results for more detailed findings.

2.1 Summary Statement

A pipeline length of 468.9 ft was inspected for metal loss over one (1) day, from 8.4 ft to 477.3 ft relative to Launch Site 1.

The results of this inspection indicated that the 20 in pipeline has 19 metal loss anomalies: 13 anomalies < 20% pipe wall thickness (WT), 4 anomalies between 20% and 39% WT, 2 anomalies between 40% and 59% WT, 0 anomalies between 60% and 79% WT, and 0 anomalies > 80% pipe WT. No metal gain anomalies were identified in the inspected pipeline. No possible dents were identified in the inspected pipeline.

2.2 Feature Distribution

Pipeline features are classified into three (3) categories: anomalies, installations, and other features. Anomalies are features associated with a change, either an increase or decrease, in pipe wall thickness. Installations are features built into the pipeline, such as valves, taps, tees, and casings. Any features that cannot be classified as anomalies or installations are classified as other features. Features were identified with the MFL sensors or the cameras on Explorer 20/26.

Pipeline features identified by the sensor and cameras on Explorer 20/26 are listed by type in Figure 2.1. The anomalies, installations, and other features shown in Figure 2.1 are described further in Section Inspection Findings Summary and Section Detailed Inspection Results.

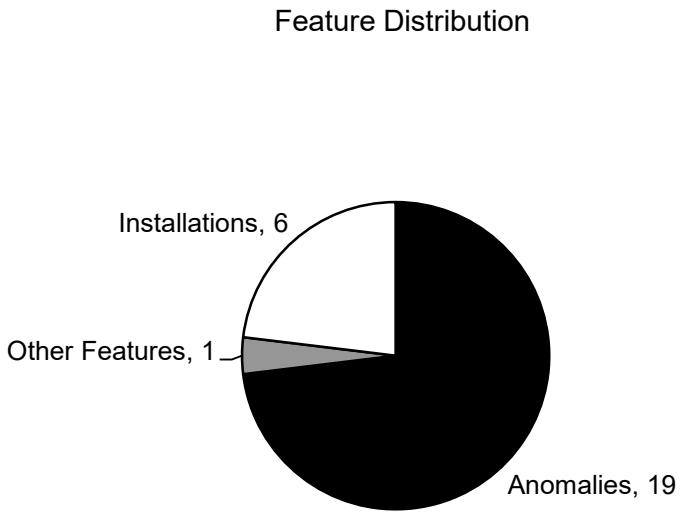


Figure 2.1: A summary of identified features

2.3 Inspection Findings Summary

The findings of this inspection are listed below. These findings were identified in the MFL sensor data or with the cameras on Explorer 20/26.

2.3.1 Metal Loss Anomalies

Metal loss anomalies identified in the inspected pipeline are listed in Table 2.1. Detailed metal loss anomaly information is provided in Section Anomaly List.

Table 2.1: Metal loss anomalies identified in the inspected pipeline

Metal Loss Depth		Pipe Wall Location			Total
% Wall Thickness	Inches	Internal	External	Unknown/NA	
< 20%	< 0.062	0	13	0	13
20% to 39%	0.062 to 0.125	0	4	0	4
40% to 59%	0.125 to 0.187	0	2	0	2
60% to 79%	0.187 to 0.250	0	0	0	0
≥ 80%	≥ 0.250	0	0	0	0
	Total	**0**	**19**	**0**	**19**

2.3.2 Metal Gain Anomalies

No metal gain anomalies were identified in the pipeline. The metal gain anomaly list (Table 2.2) was intentionally left empty.

Table 2.2: Metal gain anomalies identified in the inspected pipeline

Metal Gain Thickness		Pipe Wall Location			Total
% Wall Thickness	Inches	Internal	External	Unknown/NA	
< 20%	< 0.050	0	0	0	**0**
≥ 20%	≥ 0.050	0	0	0	**0**
Unknown		0	0	0	**0**
	Total	**0**	**0**	**0**	**0**

2.3.3 Installations

The installations identified in the pipeline are summarized by type in Table 2.3. Detailed installation information is provided in Section Installation List.

Table 2.3: Installations identified in the pipeline

Installation Type	Quantity
Valve	0
Tap	4
Tee	1
Fitting	1
Casing	0
CP/ETS	0
Cap	0
Support	0
Other	0
Total	**6**

2.3.4 Other Features

Other features are features that are not anomalies or installations. They are divided into four (4) categories: objects, chips, dents, and unknown. Objects are items located in the pipeline, such as rocks. Chips are metal shavings. Explorer 20/26 can identify dents, but is unable to assess their dimensions. Unknown other features are signals that do not follow known signal patterns but do not appear to be noise. Other features identified in the pipeline are listed in Table 2.4. Detailed other feature information is provided in Section Other Feature List.

Explorer 20/26 can identify dents with both the MFL sensors and cameras on the robot. No dents were identified in the inspected pipeline.

Table 2.4: Other features identified in the pipeline

Other Feature Type	Pipe Wall Location			Total
	Internal	External	Unknown/NA	
Objects	0	0	0	**0**
Chips	0	0	0	**0**
Dents	0	0	0	**0**
Unknown	0	0	1	**1**
Total	**0**	**0**	**1**	**1**

2.4 Anomaly Depth Distribution

The depth distribution of metal loss anomalies is shown in Figure 2.2.

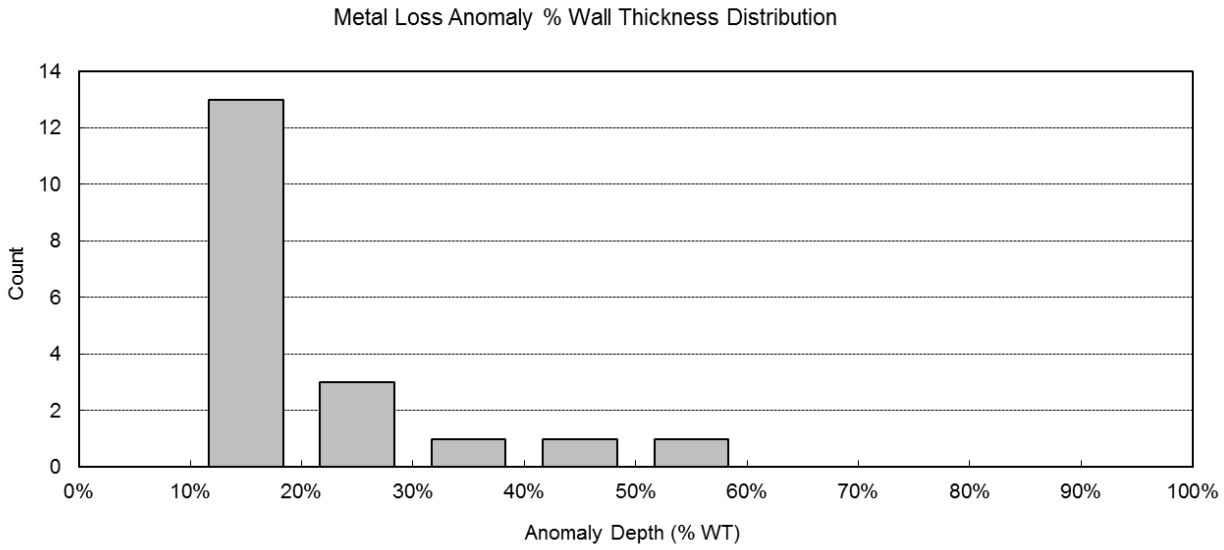


Figure 2.2: The percent wall thickness distribution of metal loss anomalies

3 Demonstration Details and Pipeline Parameters

This demonstration was part of the development of the Explorer 20/26 robotic inspection system and its commercialization. Gas flow in the 20 in pipeline was stopped during the demonstration due to pipeline vibrations experienced after the valve from the launcher into the pipeline was opened. Following the launch of Explorer 20/26, the demonstration was halted at a bend group 477.3 ft from the launch tee.

A schematic of the inspected 20 in pipeline is shown in Figure 3.1. The extremes of the inspection were Launch Site 1 and Limit A, representing the inspection upstream and downstream limits respectively. The approximate locations of features of interest associated with the pipeline are indicated on the figure. The 20 in pipeline was inspected twice with the sensors at different o'clock orientations, with the result that acceptable metal loss data could be collected from the pipeline even if a group of metal loss sensors failed.

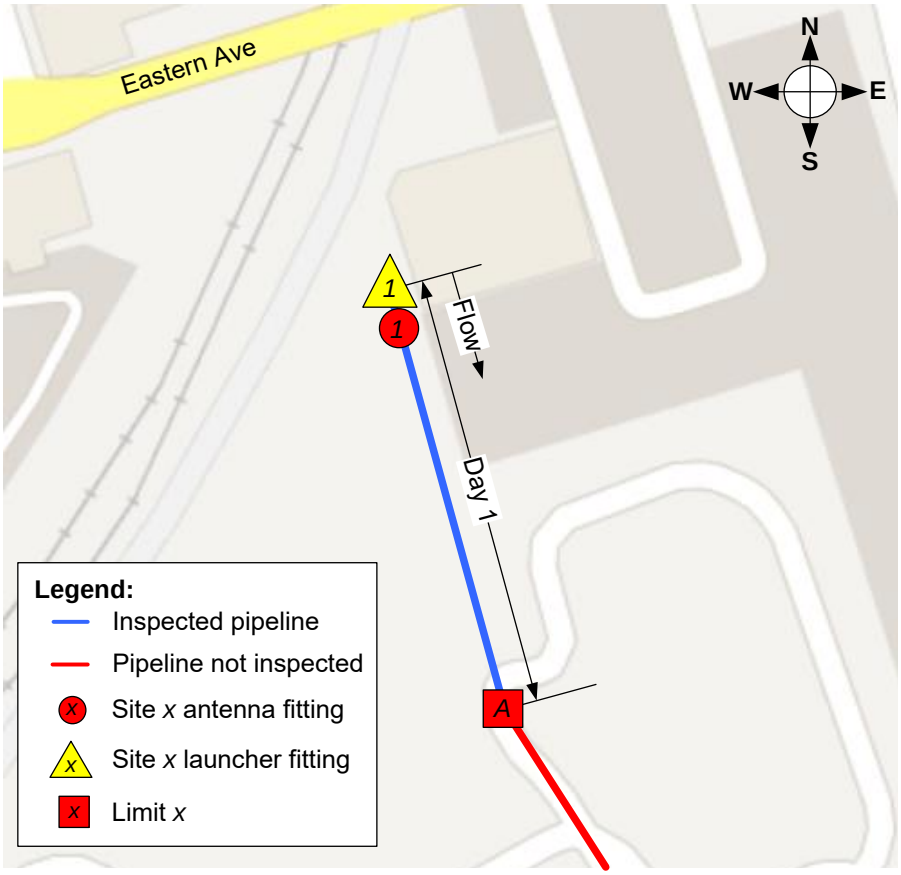


Figure 3.1: A schematic of the inspected pipeline (schematic not to scale)

3.1 Daily Demonstration Activities

The inspection of the 20 in pipeline was scheduled to take place over one (1) day which was organized as follows (refer to Figure 3.1 for launch site and limit locations):

Day 1 Explorer 20/26 was launched from the Site 1 Launcher. The pipeline between Launch Site 1 and Limit A was inspected for metal loss. The sensor body was rotated, and the pipeline was inspected a second time during the return trip to Launch Site 1. Explorer 20/26 exited the 20 in pipeline through the Site 1 Launcher fitting.

3.2 Data Recording

The data recorded during the demonstration inspection is summarized in Table 3.1. Explorer 20/26 collected a total of 468.9 ft of unique metal loss data from the 20 in pipeline, beginning 8.4 ft from Launch Site 1 and ending 477.3 ft downstream. Video was collected for the entire "Max Odometer Distance from Launch Site" indicated in Table 3.1, from the Site 1 launcher to Limit A. Metal loss data was collected between a point 8.4 ft downstream from Launch Site 1 and Limit A due to the physical distance between the end of Explorer 20/26 and its sensor body (refer to Specification of The Explorer 20/26 Inspection Robot).

The 20 in pipeline was inspected twice. The sensor body was rotated between inspections so that different metal loss sensors passed over the same pipe clock position, with the result that acceptable metal loss data could be collected over the full inspection distance even if a group of metal loss sensors failed. This is shown in Table 3.1 where the "Total Metal Loss Data Collected" is greater than the "Max Odometer Distance from Launch Site".

A total of 18 sensors failed at some point during the inspection. Furthermore, there were three (3) sensor assemblies that did not fully magnetize, resulting in having 36 successive sensors in an area with a lowered magnetization level.

Table 3.1: A daily demonstration data summary

Day	Date (YYYY-MM-DD)	Launch Site	Receive Site	Max Odometer Distance from Launch Site (ft)	Total Metal Loss Data Collected (ft)	Accepted Unique Metal Loss Data (ft)	Functioning Sensors
1	2012-11-01	Site 1	Site 1	477.3 ft	937.1 ft	468.9 ft	222/240
Complete Demonstration				477.3 ft	937.1 ft	468.9 ft	222/240

3.2.1 Sensor Orientation

Since the sensor body was rotated between outgoing and incoming portions of the inspection, the failed and low magnetization level sensors passed over different clock positions of the pipe circumference, as shown in Figure 3.2. When both directions of the inspection are overlaid to estimate coverage, there are no areas where failed or low background sensor groups coincide. Gravity is located at 6:00 and the top of the pipe is at 12:00. O'clock positions are reported looking downstream along the pipeline.

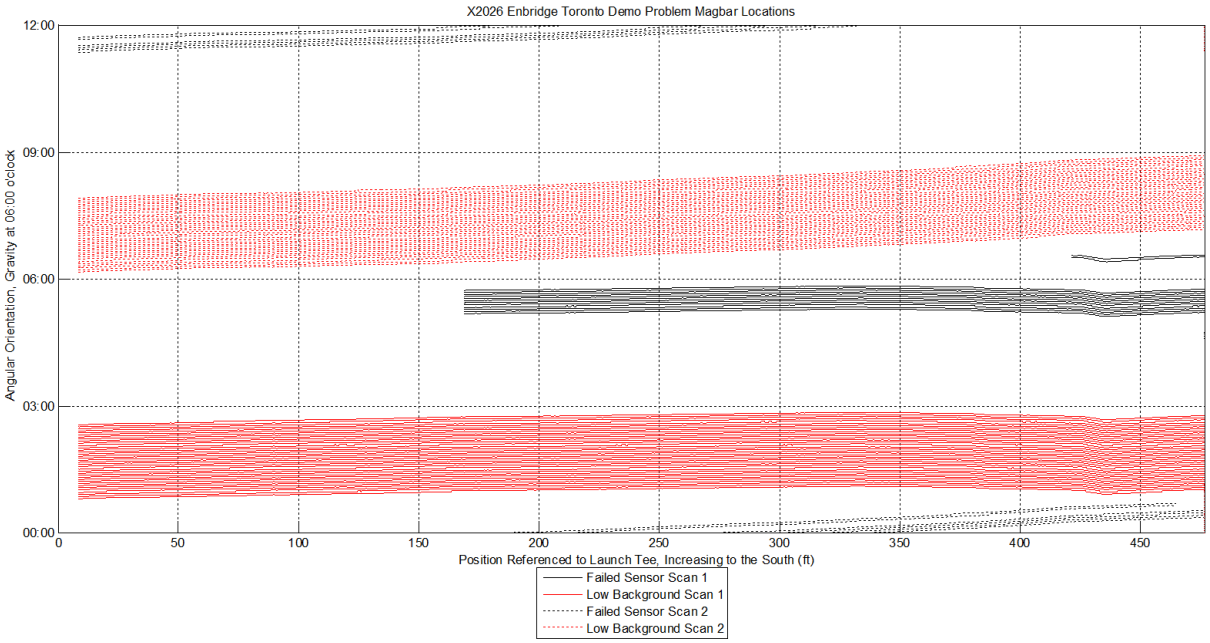


Figure 3.2: Malfunctioning sensor o'clock positions

3.2.2 Metal Loss Data Coverage

The 20 in pipeline was inspected two (2) times for metal loss with different MFL sensor orientations, with the result that the 18 failed MFL sensors and three (3) low magnetization sensor assemblies did not adversely affect the data collected from the 20 in pipeline. Metal loss data collected for this demonstration provided 100% pipeline coverage for anomaly identification and sizing as there was at least one (1) of the two (2) scans where sensors are working optimally for all locations in the inspection. Metal loss data in terms of maximum possible pipeline coverage is shown in Figure 3.3.

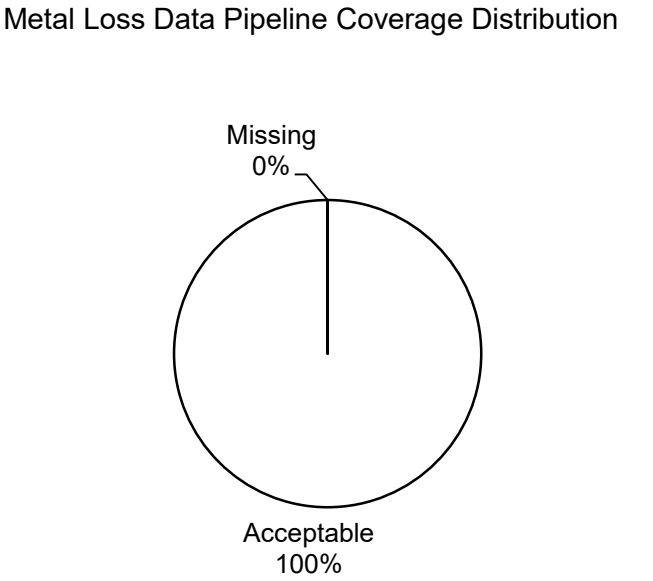


Figure 3.3: MFL data coverage distribution

3.3 Pipeline Information

Enbridge provided the following parameters for the 20 in pipeline:

Pipeline name:	20 in Station B
Product:	Natural gas
Pipeline construction year	1962
Nominal pipe size:	20 in
Pipe outer diameter (OD):	20.0 in
Nominal pipe wall thickness:	0.312 in
Measured pipe wall thickness:	NA
Pipe type:	NA
Grade[1]:	NA
SMYS:	NA
SMTS:	NA psi
Maximum allowable operating pressure (MAOP)[2]:	NA
Operating pressure during inspection (OP):	160 psi

A total of 15 pipe joints and 14 girth welds were identified in the inspected pipeline. The distribution of pipe joint lengths in the 20 in pipeline is shown in Figure 3.4. Pipe joints were found to have a mean length of 36.5 ft and a median length of 41.3 ft, with a maximum length of 44.4 ft and a minimum length of 0.9 ft.

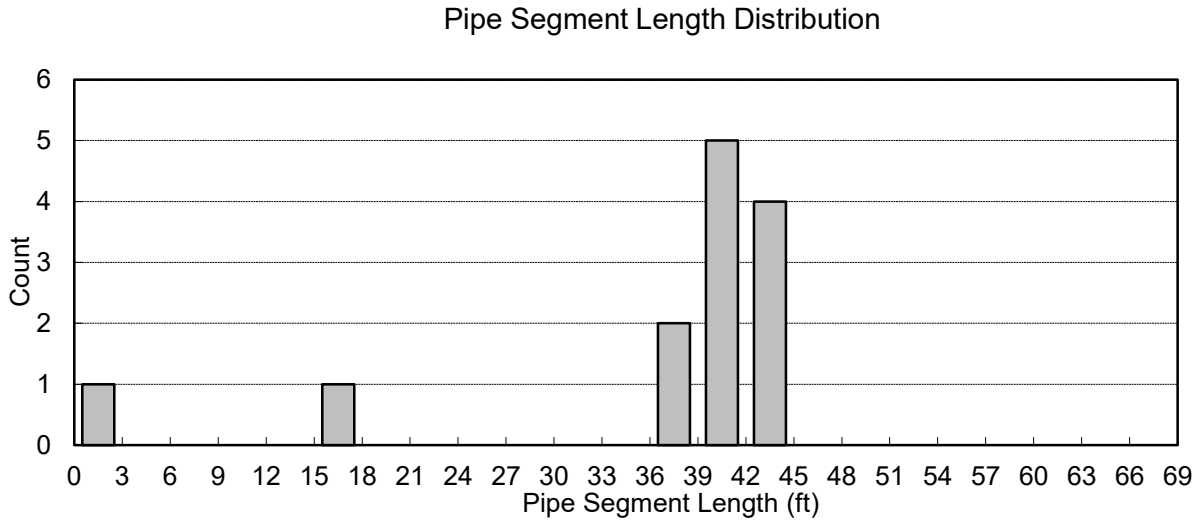


Figure 3.4: The distribution of pipe joint lengths.

[1] API 5L Grade B pipe is assumed for all remaining strength calculations if no pipe grade has been provided by the pipeline operator.
[2] A nominal MAOP value slightly greater than the operating pressure (MAOP = 175 psi) is assumed for all RPR calculations.

4 Detailed Inspection Results

Detailed information about the 20 in pipeline, including anomaly, installation, and other feature information are presented below. All feature locations are given relative to a stated reference location, in this case Launch Site 1. Positions downstream (south) of the reference are reported as positive (+) and positions upstream (north) of this reference are reported as negative (−).

Remaining strength calculations are provided for metal loss anomalies.

4.1 Metal Loss

The metal loss associated with anomalies identified in the pipeline is shown in Figure 4.1 as a percent of pipe wall thickness.

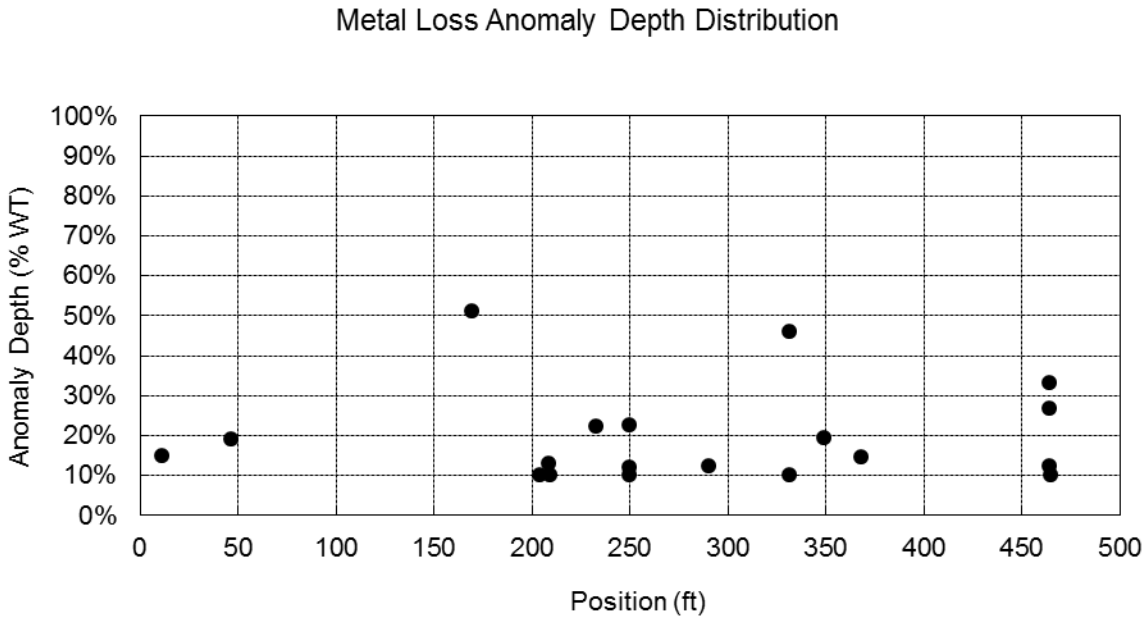


Figure 4.1: Metal loss as a percent of pipe wall thickness

4.2 Anomaly O'clock Positions

The o'clock positions of anomalies identified in the pipeline are provided in Figure 4.2. O'clock positions are reported looking downstream along the pipeline. The 6:00 position is taken in the direction of gravity, toward the bottom of the pipeline.

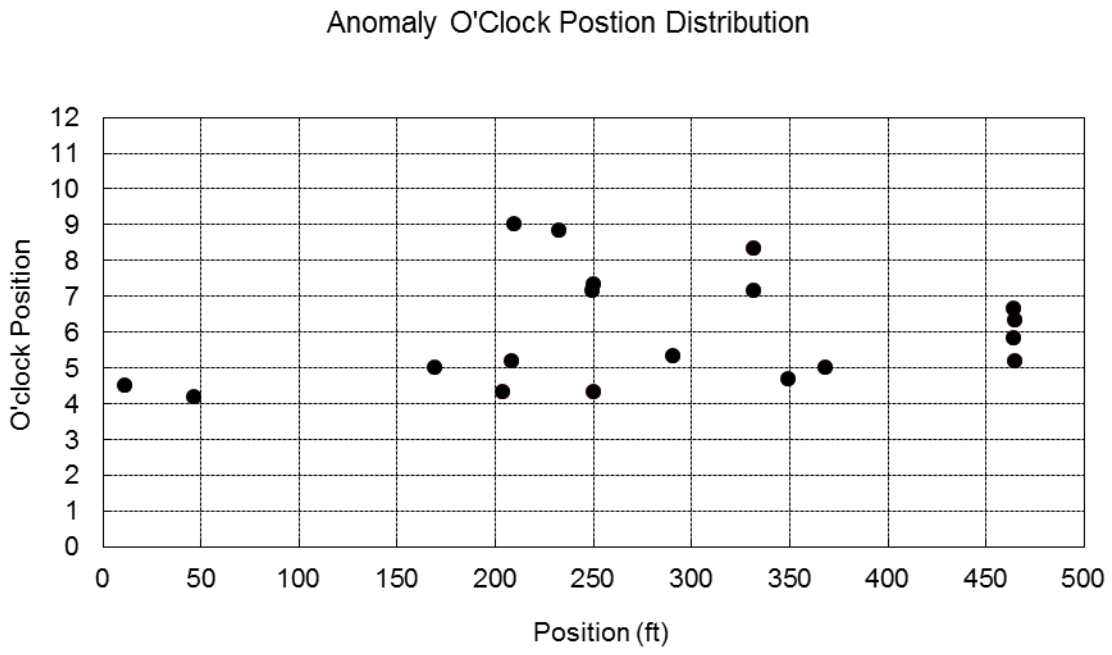


Figure 4.2: The o'clock position distribution of anomalies

4.3 Feature Lists

Anomalies, installations, and other features identified in the inspected pipeline are identified and described in detail in the following tables. All features identified within the pipeline are referenced to the upstream girth weld closest to the feature (abbreviated as USRW); all "USRW to Feature" distances are feature positions as distances downstream from reference weld positions. Feature positions are also provided relative to the stated reference location (indicated in Figure 3.1). O'clock positions are given looking downstream along the pipeline.

Some anomalies that do not meet the minimum reporting specifications may be listed. These anomalies are presented with the understanding that their reported dimensions do not adhere to the accuracy specifications listed above. These anomalies are identified as Below Reporting Specifications (BRS) in this report.

4.3.1 Anomaly List

Metal loss and metal gain anomalies identified in the pipeline are listed in Table 4.1. Metal gain anomalies were not sized. Relevant feature information, such as BRS, is listed under the 'Comments' heading.

Table 4.1: Anomalies listed with relevant details

Feature ID	Type	Feature Location							Feature Dimensions			Comments
		Reference Location	USRW	USRW Pos.	USRW to Feature (ft)	Feature Position (ft)	Pipe Wall Location	O'clock Position	Length (in)	Width (in)	Depth (% wt)	
A001	Metal loss	1	W001	8.4	2.8	11.2	External	4:30	0.5	0.8	15%	BRS
A002	Metal loss	1	W001	8.4	38.1	46.6	External	4:10	0.6	3.0	19%	BRS
A003	Metal loss	1	W005	168.8	0.7	169.5	External	5:00	1.0	3.2	51%	
A004	Metal loss	1	W005	168.8	35.2	204.1	External	4:20	2.4	3.0	10%	
A005	Metal loss	1	W006	207.7	1.1	208.8	External	5:10	1.8	3.4	13%	
A006	Metal loss	1	W006	207.7	2.1	209.8	External	9:00	2.4	3.3	10%	
A007	Metal loss	1	W006	207.7	25.1	232.8	External	8:50	2.7	1.9	22%	
A008	Metal loss	1	W007	249.3	0.6	249.9	External	7:10	1.3	2.5	23%	
A009	Metal loss	1	W007	249.3	0.8	250.0	External	7:20	0.6	2.3	12%	BRS
A010	Metal loss	1	W007	249.3	0.9	250.2	External	4:20	0.7	1.6	10%	BRS
A011	Metal loss	1	W007	249.3	41.3	290.5	External	5:20	1.5	1.7	12%	
A012	Metal loss	1	W008	291.8	40.0	331.8	External	7:10	0.6	1.9	10%	BRS

INVODANE ENGINEERING
Deceptively Simple Solutions

Client: NYSEARCH/NGA
Pipeline Name: Enbridge 20 in Station B
Demonstration Type: Explorer 20/26
Demonstration Date: November 1, 2012
Report Date: October 30, 2014

Feature ID	Type	Feature Location							Feature Dimensions			Comments
		Reference Location	USRW	USRW Pos.	USRW to Feature (ft)	Feature Position (ft)	Pipe Wall Location	O'clock Position	Length (in)	Width (in)	Depth (% wt)	
A013	Metal loss	1	W008	291.8	40.0	331.8	External	8:20	0.5	0.6	46%	BRS
A014	Metal loss	1	W009	335.7	13.9	349.6	External	4:40	0.5	0.7	19%	BRS
A015	Metal loss	1	W009	335.7	32.5	368.2	External	5:00	0.6	0.6	15%	BRS
A016	Metal loss	1	W011	421.4	43.0	464.4	External	6:40	1.0	2.6	12%	
A017	Metal loss	1	W011	421.4	43.1	464.5	External	5:50	2.6	3.8	33%	
A018	Metal loss	1	W011	421.4	43.3	464.7	External	5:10	1.1	1.8	27%	
A019	Metal loss	1	W011	421.4	43.4	464.8	External	6:20	0.4	4.6	10%	BRS

4.3.2 Installation List

Installations identified in the inspection are listed in Table 4.2.

Table 4.2: Installations with listed with relevant details

Feature ID	Type	Feature Location						Comments
		Reference Location	USRW	USRW Position (ft)	USRW to Feature (ft)	Feature Position (ft)	O'clock Position	
I001	Tee	1	-	-	-	0.0	0:00	Explorer 20/26 launcher tee.
I002	Fitting	1	-	-	-	6.5	0:00	Explorer 20/26 antenna fitting. 2 in TOR.
I003	Tap	1	W003	89.3	32.8	122.1	2:50	Tap
I004	Tap	1	W004	127.8	31.4	159.1	3:00	Tap.
I005	Tap	1	W011	421.4	42.7	464.1	0:00	Tap.
I006	Tap	1	W012	465.0	7.4	472.4	0:00	Tap.

4.3.3 Other Feature List

Other features, including dents, identified during the inspection are listed in Table 4.3. This list is included in the event that any other features develop into anomalies at later inspection dates. Explorer 20/26 can identify dents with both the MFL sensors and cameras on the robot. No dents were identified in the inspected pipeline.

Table 4.3: Other features listed with relevant details

Feature ID	Type	Feature Location							Comments
		Reference Location	USRW	USRW Position (ft)	USRW to Feature (ft)	Feature Position (ft)	Pipe Wall Location	O'Clock Position	
O001	Unknown	1	W010	380.1	40.3	420.4	Unknown	6:10	Unknown Other Feature. Possibly debris.

4.4 Dig Sheets

A dig sheet for metal loss anomalies and other features of interest showing the location of the zero (0) position reference location(s) for positioning reference is provided as Table 4.4.

Table 4.4: Feature dig sheet

Feature ID	Type	Feature Location							Feature Dimensions			ASME B31G-2009 Calculations			
		Ref. Loc.	URSW	USRW Pos. (ft)	USRW to Feature (ft)	Feature Pos.(ft)	Pipe Wall Location	O'clock Position	Length (in)	Width (in)	Depth (% wt)	B31G P_F (PSI)	B31G *RPR*	Mod B31G P_F (PSI)	Mod B31G *RPR*
I001	Launch Tee	1	-	-	-	0.0	NA	0:00	-	-	-	-	-	-	-
A001	Metal loss	1	W001	8.4	2.8	11.2	External	4:30	0.5	0.8	15%	1,199	6.85	1,402	8.01
A002	Metal loss	1	W001	8.4	38.1	46.6	External	4:10	0.6	3	19%	1,197	6.84	1,399	8.00
I003	Tap	1	W003	89.3	32.8	122.1	NA	2:50	-	-	-	-	-	-	-
I004	Tap	1	W004	127.8	31.4	159.1	NA	3:00	-	-	-	-	-	-	-
A003	Metal loss	1	W005	168.8	0.7	169.5	External	5:00	1	3.2	51%	1,166	6.66	1,355	7.74
A004	Metal loss	1	W005	168.8	35.2	204.1	External	4:20	2.4	3	10%	1,181	6.75	1,378	7.87
A005	Metal loss	1	W006	207.7	1.1	208.8	External	5:10	1.8	3.4	13%	1,184	6.76	1,382	7.90
A006	Metal loss	1	W006	207.7	2.1	209.8	External	9:00	2.4	3.3	10%	1,181	6.75	1,378	7.87
A007	Metal loss	1	W006	207.7	25.1	232.8	External	8:50	2.7	1.9	22%	1,146	6.55	1,330	7.60
A008	Metal loss	1	W007	249.3	0.6	249.9	External	7:10	1.3	2.5	23%	1,182	6.75	1,379	7.88
A009	Metal loss	1	W007	249.3	0.8	250.0	External	7:20	0.6	2.3	12%	1,199	6.85	1,401	8.01
A010	Metal loss	1	W007	249.3	0.9	250.2	External	4:20	0.7	1.6	10%	1,199	6.85	1,401	8.01
A011	Metal loss	1	W007	249.3	41.3	290.5	External	5:20	1.5	1.7	12%	1,189	6.79	1,388	7.93
A012	Metal loss	1	W008	291.8	40.0	331.8	External	7:10	0.6	1.9	10%	1,199	6.85	1,402	8.01
A013	Metal loss	1	W008	291.8	40.0	331.8	External	8:20	0.5	0.6	46%	1,193	6.82	1,393	7.96
A014	Metal loss	1	W009	335.7	13.9	349.6	External	4:40	0.5	0.7	19%	1,198	6.85	1,401	8.00
A015	Metal loss	1	W009	335.7	32.5	368.2	External	5:00	0.6	0.6	15%	1,198	6.85	1,400	8.00
I005	Tap	1	W011	421.4	42.7	464.1	NA	0:00	-	-	-	-	-	-	-
A016	Metal loss	1	W011	421.4	43.0	464.4	External	6:40	1	2.6	12%	1,195	6.83	1,396	7.98
A017	Metal loss	1	W011	421.4	43.1	464.5	External	5:50	2.6	3.8	33%	1,116	6.38	1,289	7.37
A018	Metal loss	1	W011	421.4	43.3	464.7	External	5:10	1.1	1.8	27%	1,183	6.76	1,381	7.89

INVODANE ENGINEERING
Deceptively Simple Solutions

Client: NYSEARCH/NGA
Pipeline Name: Enbridge 20 in Station B
Demonstration Type: Explorer 20/26
Demonstration Date: November 1, 2012
Report Date: October 30, 2014

Feature ID	Type	Feature Location							Feature Dimensions			ASME B31G-2009 Calculations			
		Ref. Loc.	URSW	USRW Pos. (ft)	USRW to Feature (ft)	Feature Pos.(ft)	Pipe Wall Location	O'clock Position	Length (in)	Width (in)	Depth (% wt)	B31G P_F (PSI)	B31G *RPR*	Mod B31G P_F (PSI)	Mod B31G *RPR*
A019	Metal loss	1	W011	421.4	43.4	464.8	External	6:20	0.4	4.6	10%	1,200	6.86	1,403	8.02
I006	Tap	1	W012	465.0	7.4	472.4	NA	0:00	-	-	-	-	-	-	-

4.5 Pipe Book

The pipe book is a complete list of all pipe joints identified in the pipeline, shown in Table 4.5. All pipe bends are reported looking downstream along the pipeline.

Table 4.5: The pipe book for the inspected pipeline

Pipe Joint ID	USRW	USRW Ref. Loc.	USRW Pos. (ft)	DSRW	DSRW Ref. Loc.	DSRW Pos. (ft)	Seam Weld O'Clock	Pipe Joint Length (ft)	Comments
P000	-	-	-	W001	1	8.4	-	-	Launcher located in this pipe. No metal loss data.
P001	W001	1	8.4	W002	1	47.4	-	39.0	
P002	W002	1	47.4	W003	1	89.3	-	41.9	
P003	W003	1	89.3	W004	1	127.8	-	38.4	
P004	W004	1	127.8	W005	1	168.8	-	41.1	
P005	W005	1	168.8	W006	1	207.7	-	38.9	
P006	W006	1	465.0	W007	1	249.3	-	41.5	
P007	W007	1	249.3	W008	1	291.8	-	42.6	
P008	W008	1	291.8	W009	1	335.7	-	43.9	
P009	W009	1	335.7	W010	1	380.1	-	44.4	
P010	W010	1	380.1	W011	1	421.4	-	41.3	
P011	W011	1	421.4	W012	1	465.0	-	43.6	
P012	W012	1	465.0	W013	1	482.6	-	17.6	
P013	W013	1	482.6	W014	1	483.5	-	0.9	No metal loss data
P014	W014	1	483.5	-	-	-	-	-	No metal loss data. Unknown bend group starts in this pipe joint

4.6 Remaining Strength Calculations

Remaining strength calculations were performed on the metal loss anomalies listed in Table 4.1 according to the ASME B31G-2009 manual paragraph 2.2(a) (abbreviated to B31G) and paragraph 2.2(b) (abbreviated to modified or mod B31G). The results of these calculations are provided in Table 4.6.

Flow stress (S_{flow}) was computed as S_{flow} = 1.1*SMYS* for B31G and S_{flow} = (*SMYS*+10,000 psi) for modified B31G calculations. A standard safety factor (*SF*) value of 1.39 was used if no safety factor was provided.

Table 4.6: Remaining strength calculations for metal loss anomalies

Feature ID	Pipeline Properties			B31G				Modified B31G			
	SMYS (PSI)	MAOP (PSI)	Safety Factor	Flow Stress, S_{flow} (PSI)	Estimated Failure Stress, S_F (PSI)	Estimated Failure Pressure, P_F (PSI)	RPR[3]	Flow Stress, S_{flow} (PSI)	Estimated Failure Stress, S_F (PSI)	Estimated Failure Pressure, P_F (PSI)	RPR
A001	35,000	175	1.39	38,500	38,434	1,199	6.85	45,000	44,920	1,402	8.01
A002	35,000	175	1.39	38,500	38,376	1,197	6.84	45,000	44,848	1,399	8.00
A003	35,000	175	1.39	38,500	37,365	1,166	6.66	45,000	43,434	1,355	7.74
A004	35,000	175	1.39	38,500	37,847	1,181	6.75	45,000	44,165	1,378	7.87
A005	35,000	175	1.39	38,500	37,934	1,184	6.76	45,000	44,288	1,382	7.90
A006	35,000	175	1.39	38,500	37,847	1,181	6.75	45,000	44,165	1,378	7.87
A007	35,000	175	1.39	38,500	36,717	1,146	6.55	45,000	42,640	1,330	7.60
A008	35,000	175	1.39	38,500	37,869	1,182	6.75	45,000	44,203	1,379	7.88
A009	35,000	175	1.39	38,500	38,425	1,199	6.85	45,000	44,910	1,401	8.01
A010	35,000	175	1.39	38,500	38,418	1,199	6.85	45,000	44,901	1,401	8.01
A011	35,000	175	1.39	38,500	38,094	1,189	6.79	45,000	44,496	1,388	7.93
A012	35,000	175	1.39	38,500	38,439	1,199	6.85	45,000	44,926	1,402	8.01
A013	35,000	175	1.39	38,500	38,237	1,193	6.82	45,000	44,648	1,393	7.96
A014	35,000	175	1.39	38,500	38,411	1,198	6.85	45,000	44,891	1,401	8.00
A015	35,000	175	1.39	38,500	38,407	1,198	6.85	45,000	44,887	1,400	8.00
A016	35,000	175	1.39	38,500	38,300	1,195	6.83	45,000	44,756	1,396	7.98
A017	35,000	175	1.39	38,500	35,778	1,116	6.38	45,000	41,312	1,289	7.37
A018	35,000	175	1.39	38,500	37,926	1,183	6.76	45,000	44,272	1,381	7.89

[3] Rupture Pressure Ratio, defined in Section 4.7.

INVODANE ENGINEERING
Deceptively Simple Solutions

Client: NYSEARCH/NGA
Pipeline Name: Enbridge 20 in Station B
Demonstration Type: Explorer 20/26
Demonstration Date: November 1, 2012
Report Date: October 30, 2014

Feature ID	Pipeline Properties			B31G				Modified B31G			
	SMYS (PSI)	MAOP (PSI)	Safety Factor	Flow Stress, S_{flow} (PSI)	Estimated Failure Stress, S_F (PSI)	Estimated Failure Pressure, P_F (PSI)	RPR[3]	Flow Stress, S_{flow} (PSI)	Estimated Failure Stress, S_F (PSI)	Estimated Failure Pressure, P_F (PSI)	RPR
A019	35,000	175	1.39	38,500	38,472	1,200	6.86	45,000	44,967	1,403	8.02

4.7 Rupture Pressure Ratio

The rupture pressure ratio (RPR) for all metal loss anomalies was computed according to ASME B31G-2009 using the original[4] (abbreviated to B31G) and modified[5] (abbreviated to modified or mod B31G) B31G methods. RPR is defined as RPR = P_F/MAOP, where P_F is the estimate failure pressure of the pipeline computed from ASME B31G-2009 and MAOP is the maximum allowable operating pressure of the pipeline specified by the client (refer to Section Pipeline Information). Figure 4.3 shows the RPR computed for metal loss anomalies identified in the pipeline.

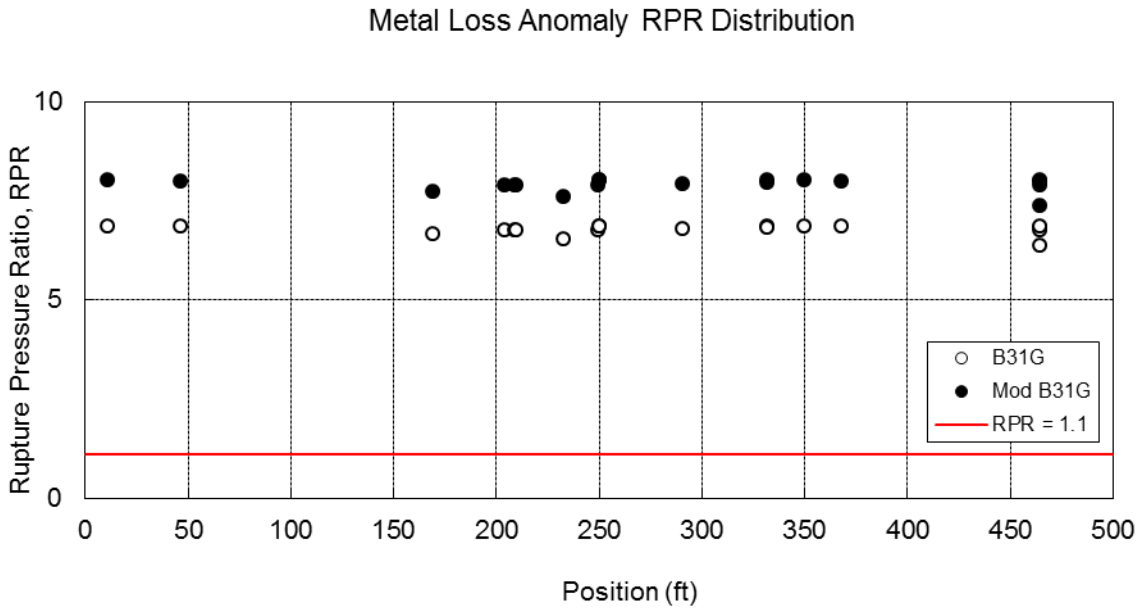


Figure 4.3: Metal loss anomaly RPR computed from B31G and modified B31G equations

[4] ASME B31G-2009 paragraph 2.2(a)
[5] ASME B31G-2009 paragraph 2.2(b)

4.8 RPR Breakdown

Metal loss anomalies were organized into four (4) categories based on their RPR and depth. The categories defined were:

- anomalies with RPR < 1.1
- anomalies with 1.1 ≤ RPR < 1.39
- anomalies with depth ≥ 50% WT
- anomalies with depth < 50% WT

Anomalies are grouped into these categories in Table 4.7 in order of decreasing severity.

Table 4.7: Metal loss anomaly RPR breakdown

Severity Category	ID Code	Depth (% wt)	MAOP (PSI)	B31G		Mod. B31G	
				RPR	Failure Pressure (PSI)	RPR	Failure Pressure (PSI)
Depth < 50% WT	A017	33%	175	6.38	1,116	7.37	1,289
Depth < 50% WT	A007	22%	175	6.55	1,146	7.60	1,330
50% WT ≤ Depth	A003	51%	175	6.66	1,166	7.74	1,355
Depth < 50% WT	A004	10%	175	6.75	1,181	7.87	1,378
Depth < 50% WT	A006	10%	175	6.75	1,181	7.87	1,378
Depth < 50% WT	A008	23%	175	6.75	1,182	7.88	1,379
Depth < 50% WT	A018	27%	175	6.76	1,183	7.89	1,381
Depth < 50% WT	A005	13%	175	6.76	1,184	7.90	1,382
Depth < 50% WT	A011	12%	175	6.79	1,189	7.93	1,388
Depth < 50% WT	A013	46%	175	6.82	1,193	7.96	1,393
Depth < 50% WT	A016	12%	175	6.83	1,195	7.98	1,396
Depth < 50% WT	A002	19%	175	6.84	1,197	8.00	1,399
Depth < 50% WT	A015	15%	175	6.85	1,198	8.00	1,400
Depth < 50% WT	A014	19%	175	6.85	1,198	8.00	1,401
Depth < 50% WT	A010	10%	175	6.85	1,199	8.01	1,401
Depth < 50% WT	A009	12%	175	6.85	1,199	8.01	1,401
Depth < 50% WT	A001	15%	175	6.85	1,199	8.01	1,402
Depth < 50% WT	A012	10%	175	6.85	1,199	8.01	1,402
Depth < 50% WT	A019	10%	175	6.86	1,200	8.02	1,403

5 Inspection Activities

Activities associated with inspection of the 20 in pipeline are summarized below.

5.1 Pre-Inspection Activities

Antenna and launcher fittings were installed in the 20 in pipeline prior to inspection. Launch site GPS coordinates were not provided by Enbridge Gas Distribution. Table 5.1 was intentionally left blank.

Table 5.1: Launch site GPS coordinates.

Launch Site	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)
1	-	-

Photo of the Site 1 launcher attached to 20 in pipeline at the Eastern Ave Station B launch site (Launch Site 1) is shown in Figure 5.1.

Figure 5.1: Site 1 launcher at excavation site.

5.1.1 Inspection Personnel

InvoDane personnel that participated in demonstration inspection activities are listed in Table 5.2. Please communicate with the President regarding this report.

Table 5.2: InvoDane demonstration inspection personnel

Name	Role
Paul Laursen	President
Dale Maenpaa	Crew Chief
Shahzeb Zaidi	Field Engineer
Kris Morra	Field Engineer
Jim Hare	Data Analyst

5.1.2 Explorer 20/26 Parameters

The specifications of Explorer 20/26 can be found in Specification of The Explorer 20/26 Inspection Robot. The following configuration and settings were used during the inspection:

Number of sensors:	240
Explorer 20/26 inspection speed:	1 to 4 in/s (5 to 20 ft/min)
Axial sampling resolution:	0.05 in

6 Attachments

6.1 Preliminary Report

Revision one (1) of the NGA812 Preliminary Data Analysis Report was submitted electronically December 13, 2012. Revision one (1) of the Preliminary Data Analysis Report is included as an electronic attachment to this report.

6.2 Electronic Data

The following data was submitted on electronic storage:

- .pdf format of this report
- Explorer 20/26 calibration certificates
- Datatel software for viewing data acquired from this pipeline
- A user guideline titled "Datatel User Guidelines.pdf"
- .pdf format inspection map
- .xls or .xlsx format pipe book
- .xls or .xlsx format pipe tally compliant with NGA specifications

6.3 Inspection Verification Results

A 20 in 0.375 in WT spool piece with 11 metal loss anomalies manufactured by Enbridge was inspected by Explorer 20/26 on November 28, 2012. The anomalies were configured in two (2) rows of 8 and 3 anomalies each. A screenshot of the anomalies in Pipetel's Datatel data analysis and viewing software is shown in Figure 6.1.

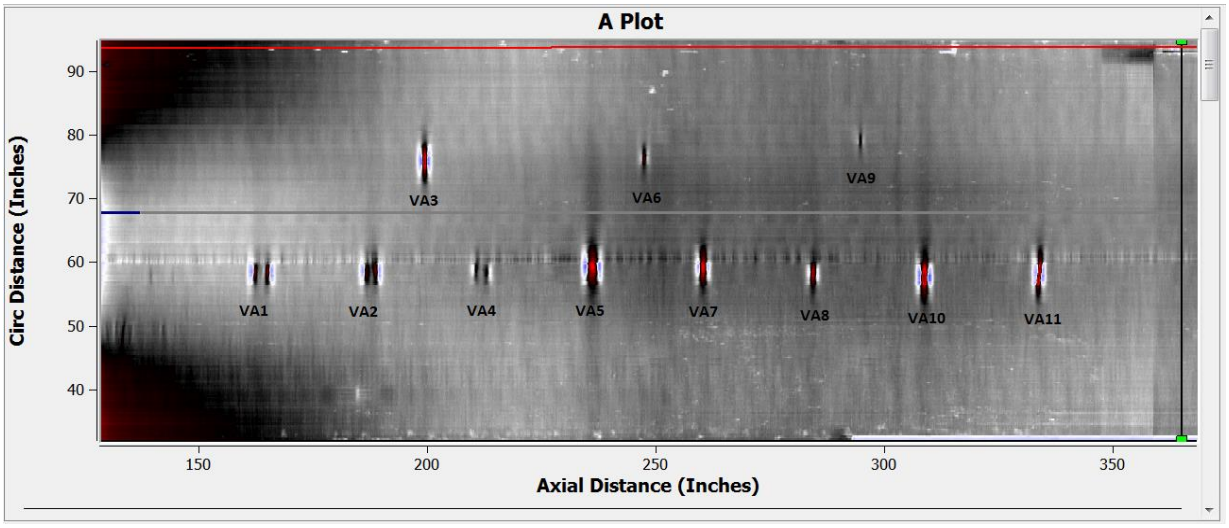


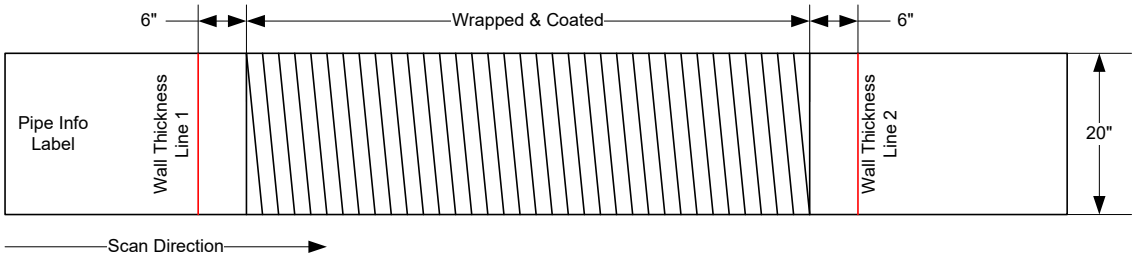
Figure 6.1: The validation anomalies manufactured into a spool piece of NPS20x0.375 in WT pipe

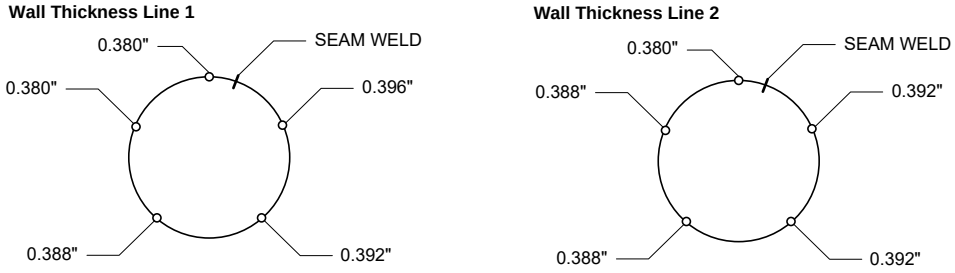
The dimensions of the validation anomalies are provided in Table 6.1. Anomaly o'clock positions were determined looking from VA1 to VA11 (left-to-right), with gravity at 6:00 o'clock. A diagram of wall thickness measurement locations is shown in Figure 6.2. Validation anomaly depth was computed using the median pipe wall thickness of 0.380 in.

Table 6.1: Validation anomaly dimensions

ID Code	O'clock Position (HH:MM)	Length (in)	Width (in)	Depth (in)	Depth (% WT)
VA1	00:36	3.5	1.6	0.100	26%
VA2	00:34	3.1	1.9	0.090	24%
VA3	09:16	1.1	1.2	0.186	49%
VA4	00:32	3.2	1.3	0.047	12%
VA5	00:34	2.7	2.6	0.135	35%
VA6	09:16	1.0	1.0	0.041	11%
VA7	00:28	1.8	2.0	0.101	27%
VA8	00:42	1.5	1.5	0.065	17%
VA9	08:50	0.7	0.8	0.029	8%
VA10	00:46	2.0	2.1	0.154	41%
VA11	00:42	1.0	1.9	0.134	35%

Enbridge Validation/Blind Test Pipe:
Ultrasonic Testing (UT) Wall Thickness Measurements





Five (5) UT pipe WT measurements performed around the pipe at each wall thickness measurement line, located 6±1" from the ends of the "wrapped & coated" section of the pipe. The measurement uncertainty on all UT measurements is ±0.004".

Figure 6.2: UT measurements for the Enbridge validation pipe.

Appendix A Definitions and Identification Codes

The following terms, appearing herein, are defined as follows:

anomaly	A signal that is believed to be associated with a change in pipe wall thickness or mechanical damage to the pipeline. Anomalies are a subset of features.
antenna	A wireless antenna installed in the inspected pipeline for communication with Explorer 20/26.
ARS	Abbreviation for Above Reporting Specifications
BRS	Abbreviation for Below Reporting Specifications
ETS	Abbreviation for Electrolysis Test Station
Explorer 20/26	A pipeline inspection robot that features metal loss and video recording capabilities. May appear abbreviated to X20/26.
feature	A signal that is of interest. Welds are not considered features.
girth weld	A bond joining adjacent pipe joints.
host pipe	The pipe in which a specific feature is located.
ID code	A unique identification code assigned to a feature, pipe, or weld.
installation	A pipeline feature installed during the construction of the pipeline or as a modifications to the pipeline. Examples of installations are valves, tees, taps, casings, etc. Installations are a subset of features.
launch	The process associated with the insertion of the robot into the pipe.
launch site	The location at which the robot is inserted into the inspected pipe. The launch site may be the same location as the receive site.
launcher	A housing for Explorer 20/26 used to launch and receive the robot.
MFL data	Data gathered with the metal loss sensor on Explorer.
MFL	Acronym for Magnetic Flux Leakage.
o'clock position	The location at which the hour hand of a clock must point in order to point at the center of the object of interest.

other feature	A feature that is not believed to be an anomaly or installation. Other features are a subset of features.
pipe joint	A continuous length of pipe that is attached to the pipeline with welds or fittings.
RFEC	Acronym for Remote Field Eddy Current.
RPR	Abbreviation for Rupture Pressure Ratio
robot	The mechanism used to inspect the pipeline, in this case the Explorer 20/26 inspection robot.
receive	The process associated with the extraction of the robot from the pipe.
receive site	The location at which the robot is extracted from the inspected pipe. The receive site may be the same location as the launch site.
video	Data gathered with the video capture system on the robot.

Features, welds, and pipe joints are assigned unique identification codes (abbreviated to ID codes). All ID codes consist of a letter prefix followed by a three (3) digit number. The prefixes represent:

A	Anomaly
I	Installation
O	Other feature
P	Pipe joint
W	Girth weld

ID codes take the form:

Pipe joint:	P(3 digit number)	example: P044
Girth weld:	W(3 digit number)	example: W044
Anomaly:	A(3 digit number)	example: A003

The three (3 digit number) following ID code prefixes increase sequentially downstream within each prefix group. For example, pipe joint P048 is four (4) pipe joints further downstream than pipe joint P044. Pipe joints and the upstream girth welds of those pipe joints share the same (3 digit number), meaning W044 is upstream girth weld of P044. The downstream girth weld of P044 is W043.

Feature locations cannot be obtained from ID codes. A003 occurs downstream south than A002, but no other information about the relationship between the two (2) anomalies can be obtained from their ID codes. Because ID code numbers increase sequentially only within a

prefix group there is no way of obtaining the relationship between A003 and I008 from their ID codes alone.

Appendix B Pipetel Pipeline Questionnaire

A standard Pipetel Pipeline Questionnaire was not completed for this demonstration inspection.

INVODANE ENGINEERING
Deceptively Simple Solutions

Client: NYSEARCH/NGA
Pipeline Name: Enbridge 20 in Station B
Demonstration Type: Explorer 20/26
Demonstration Date: November 1, 2012
Report Date: October 30, 2014

Appendix C Specification of The Explorer 20/26 Inspection Robot

Explorer 20/26		
General Information	tool applications	Metal loss and feature detection, identification, and sizing
	detection technologies	MFL and video
Mechanical Specifications	tool length	15 ft
	operational tool weight	1,500 lbs
Pipeline Requirements	pipe diameters	20, 22, 24 or 26 inch
	maximum inspectable wall thickness	0.5 in
	minimum bend radius	Miter
	minimum clearance diameter	15 in
Technical Specifications	maximum inspection range	0.6 mi per single launch/un-launch site
	speed range	0 - 4 in/s
	maximum operating pressure	750 psig
	launch method	hot tap
	un-launch method	hot tap
Detection Technology Details	MFL sensor count	200 to 260
	MFL axial resolution	0.06 in
	MFL circumferential resolution	0.3 in (0.25 in pipe wall thickness)
	video module count	2
	video module locations	front and rear
General Metal Loss Reporting Specifications	minimum anomaly size	10% wall loss with a diameter of 3x pipe wall thickness
	anomaly length (axial) sizing accuracy	±0.5 in with 80% confidence
	anomaly depth (radial) sizing accuracy	±10% pipe wall thickness with 80% confidence
General Metal Loss Reporting Specifications in Case Pipes	minimum anomaly size	20% wall loss with a diameter of 3x pipe wall thickness
	anomaly length (axial) sizing accuracy	± 0.75 in with 80% confidence
	anomaly depth (radial) sizing accuracy	±20% pipe wall thickness with 80% confidence

External Corrosion Direct Assessment (ECDA) Report

Placeholder: The Attachment has been filed separately

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit B, Schedule 1, Pages 17-25

Preamble:

Exhibit B, Schedule 1, Page 19 states: “Enbridge Gas ran scenarios to determine if the C2B segment could be downsized and therefore lower the overall cost of the Project. Three scenarios were examined. The scenarios were selected as they represent situations where gas supply from a particular source is cut to the KOL. Each scenario examined the performance of the KOL assuming a smaller pipe size, NPS 16, is constructed for the C2B segment, in order to determine if the KOL could maintain gas supply under conditions that the KOL has either experienced in the past or to simulate a major supply disruption.”

Question**:**

(a) Please list and describe each instance in which the three scenarios occurred. Please include the date and temperature for each instance.

(b) An NPS 20 pipe would ensure redundancy in the event of a failure of one of the pipelines feeding it. What percentage of Enbridge’s pipeline system has this level of redundancy built in? Please explain. Please provide a map illustrating the answer.

(c) An NPS 20 pipe would ensure redundancy in the event of a failure of one of the pipelines feeding it. What percentage of Enbridge’s pipeline system has this level of redundancy built in? Please explain. Please provide a map illustrating the answer.

(d) Please summarize the results of the scenario analysis in the following table:

Summary of Pipe Downsizing (NPS 16) Scenario Analysis		
	Pressure required	Pressure with NPS 16
Scenario 1: No Feed From MSL Line		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 2: No Feed From West Mall Feeder Station		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 3: Isolation of DV Line		
NPS 20 P_{low} at Station B		

(e) Please redo the scenario analysis on the assumption that all cost-effective DSM had been implemented in the area served by the pipeline since 2015. Please make and state assumptions as necessary. Please state caveats as necessary. Please estimate the cost-effective DSM potential based on the 2016 or 2019 DSM potential studies. Please provide the estimated reduction in peak demand. Please summarize the results of the updated scenario analysis in the following table:

Summary of Pipe Downsizing (NPS 16) Scenario Analysis **Assuming all Cost-Effective DSM Since 2015 (Per Potential Study)**		
	Pressure required	Pressure with NPS 16
Scenario 1: No Feed From MSL Line		
NPS 20 P_{low} at West Mall Tie-In (psig)		

NPS 20 P_{low} in Downtown (psig)		
Scenario 2: No Feed From West Mall Feeder Station		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 3: Isolation of DV Line		
NPS 20 P_{low} at Station B		

By answering this question, Enbridge is not acknowledging that the assumptions are reasonable. The analysis is intended to be illustrative.

(f) Please redo the scenario analysis on the assumption that all cost-effective DSM per EB-2012-0451, EB-2012-0433, EB-2013-0074, Exhibit L.EGD.ED.1 had been achieved between 2015 and 2020.[1] Please make and state assumptions as necessary. Please state caveats as necessary. Please estimate the cost-effective DSM potential based on the 2016 or 2019 DSM potential studies. Please summarize the results of the updated scenario analysis in the following table:

Summary of Pipe Downsizing (NPS 16) Scenario Analysis **Assuming all Cost-Effective DSM (Toronto Specific, per EB-2012-0451 Evidence)**		
	Pressure required	Pressure with NPS 16
Scenario 1: No Feed From MSL Line		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		

[1] Enerlife Consulting, *Enbridge Gas Pipeline Hearing EB-2012-0451 Evidence concerning Demand Side Management Potential in GTA* (Note: the potential is summarized in Table 1)

Scenario 2: No Feed From West Mall Feeder Station		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 3: Isolation of DV Line		
NPS 20 P_{low} at Station B		

By answering this question, Enbridge is not acknowledging that the assumptions are reasonable. The analysis is intended to be illustrative.

If the area covered by Exhibit L.EGD.ED.1 differs from the area served by the proposed project, please assume the DSM potential is proportional between the two areas.

(g) Please redo the scenario analysis on the assumption that Redpath Sugar and the Portlands Energy Centre have no demand during the period of upstream interruption. Please make and state assumptions as necessary. Please state caveats as necessary. Please estimate the cost-effective DSM potential based on the 2016 or 2019 DSM potential studies. Please summarize the results of the updated scenario analysis in the following table:

Summary of Pipe Downsizing (NPS 16) Scenario Analysis Excluding Redpath and Portlands		
	Pressure required	Pressure with NPS 16
Scenario 1: No Feed From MSL Line		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 2: No Feed From West Mall Feeder Station		

NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 3: Isolation of DV Line		
NPS 20 P_{low} at Station B		

By answering this question, Enbridge is not acknowledging that the assumptions are reasonable. The analysis is intended to be illustrative.

(h) Please provide comparison of the cost of completing the project with an NPS 16 vs NPS 20 pipe.

Response:

a) The first two scenarios detailed in the pre-filed evidence (No Feed From the MSL Line and No Feed from West Mall Feeder Station) are potential (but hypothetical) situations. They were selected to illustrate the impact on gas supply in the event that the Cherry to Bathurst segment was downsized to an NPS 16 pipeline. The third scenario (Isolation of DV Line), as indicated in the pre-filed evidence, has occurred on three separate occasions in recent years. The DV Line was isolated on: September 2013, September 2015 and April 2020.

b) The need for redundancy or flexibility in a distribution system is important. The distribution system in and around the Greater Toronto Area has been constructed over the course of many decades and provides gas distribution service to many customers. Like other main lines such as the Mississauga Southern Link pipeline and the Canadian National Railway NPS 26 pipeline, the KOL provides services to customers along the line and also can be supplied from different points and as such offers operational flexibility to parts of the distribution system in the event of a supply disruption. Enbridge Gas does not have a map or listing of its main pipelines classified by the level of “redundancy” that they offer. The analysis conducted for this Project was focused on the Cherry to Bathurst segment of NPS 20 gas main.

c) Please see the response to b) above.

d) Please refer to Exhibit B, Tab 1, Schedule 1, Tables 7, 8 and 9.

e) ED has put forward a number of questions that seek to have Enbridge Gas create

new evidence such as new potential forecast demand scenarios based on a number of hypothetical assumptions put forward by ED. The information requested is not available to Enbridge Gas or cannot be produced within a reasonable timeframe. These potential alternate hypothetical scenarios are not relevant to the Application evidence given this is a project driven by integrity issues and is a like-for-like replacement for part of a major pipeline (the KOL) that provides reliability and flexibility to the distribution system in the City of Toronto. It is Enbridge Gas's view that the scenarios would not be useful, even to the extent they could be created.

f) See response to e) above.

g) See response to e) above.

h) Please see Exhibit I.FRPO.5.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

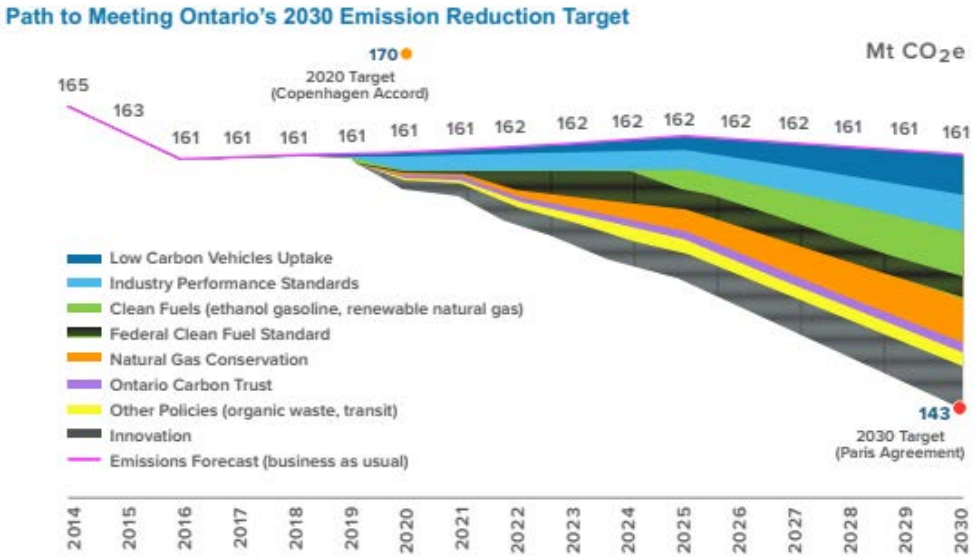
INTERROGATORY

Reference:

Exhibit B, Schedule 1, Pages 17-25

Preamble:

Ontario's Environment Plan includes targets for carbon emissions to decline from natural gas use over the coming decade and by 3.2 MT by 2030. The decline is illustrated in orange in the below excerpt from the Environment Plan:



[2]

Question:

(a) Please redo the scenario analysis (Exhibit B, Schedule 1, Pages 17-25) on the assumption that it is 2030 and the reductions in natural gas use via energy efficiency set out in Ontario's Environment Plan have been achieved. Please make and state assumptions as necessary. Please state caveats as necessary. Please assume the percent reduction in gas use for the project area is same as the percent reduction targeted province-wide in the Environment Plan. Please summarize the results of the

[2] Government of Ontario, *A Made-in-Ontario Environment Plan*, November, 2018, p. 23.

updated scenario analysis in the following table:

Summary of Pipe Downsizing (NPS 16) Scenario Analysis As of 2030 Assuming Environment Plan Targets are Met		
	Pressure required	Pressure with NPS 16
Scenario 1: No Feed From MSL Line		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 2: No Feed From West Mall Feeder Station		
NPS 20 P_{low} at West Mall Tie-In (psig)		
NPS 20 P_{low} in Downtown (psig)		
Scenario 3: Isolation of DV Line		
NPS 20 P_{low} at Station B		

(b) If the natural-gas-related emission reduction targets in the Environment Plan are met, what proportion, if any, of the capacity of the proposed pipeline will be needed: (i) five years after it comes in service and (ii) ten years after it comes in service? Please explain in detail. Please provide underlying assumptions and calculations. Please provide an answer on best-efforts basis with any necessary caveats.

By answering these question, Enbridge is not acknowledging that the assumptions are reasonable. The analysis is intended to be illustrative.

Response:

a) and b)

Please see the response to Exhibit I.ED 2 e). For current planning purposes Enbridge

Gas is unable to assume that future forecast reductions in natural gas demand will actually occur. The Ontario government's draft Made in Ontario: Environment Plan (the "Environment Plan") sets a target for 2030 and discusses the policies and programs that are anticipated to contribute to meeting that target. The Environment Plan states that "The actual reductions achieved will depend on how actions identified in our plan are finalized based on feedback we get from businesses and communities".[3] The Auditor General's report on the Environment Plan states that "the Ministry estimated the additional required funding for this scenario from 2021 to 2030 would be $6.6 billion".[4] Further, the Environment Plan states that emission reductions from natural gas conservation "assumes a gradual expansion of programs delivered by utilities, which would be subject to discussions with the Ontario Energy Board".[5] Presumably policy guidance from the Board may take place in the Post-2020 Natural Gas Demand Side Management Framework consultation (EB-2019-0003) which is currently active and under consideration.

At the time of this submission, it remains unclear what changes to existing conservation programs will be necessary or the timing of any such changes.

The Environment Plan also includes many measures to reduce vehicle emissions including "low carbon vehicles" and "clean fuels". Future natural gas demand growth will factor into implementing many of these emission reductions targets including CNG facilities to fuel transport trucks, transit buses and refuse vehicles. In addition, increased use of renewable natural gas and other clean fuels is anticipated moving forward which utilizes natural gas infrastructure.

The Cherry to Bathurst segment needs to be replaced due to integrity concerns with this segment of pipeline. Enbridge Gas's continued focus, as it is obligated to serve the firm demands of its customers, is to ensure it has the assets required to safely meet its customer's immediate and long-term demand requirements on an annual and Design Day basis and that remains its top priority. Even where future natural gas consumption is reduced, replacement of the Cherry to Bathurst segment will be required.

[3] Made in Ontario Environment Plan, p. 23.
[4] Auditor General's report, Chapter 3, p. 151
[5] Ibid

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit B, Schedule 1, Pages 17-25

Question**:**

(a) Please complete the following table. When estimating the gas demand for the scenario consistent with Environment Plan targets, please do so on a best-efforts basis, state any necessary caveats, and make and state all assumptions as necessary.[3] We suggest the following assumptions for the Environment Plan scenario: (i) a CO2e to m3 conversion rate of 0.001966 tonnes CO2e/m3 natural gas; and (ii) a straight-line increase in gas savings leading to the 2030 3.2 Mt target (note that the figures on page 23 of the Environment Plan and 142 of the Auditor General report appear to show a straight-line increase). Please use different assumptions if Enbridge believes those to be more appropriate, but explain the choice. Please explain in particular detail the assumptions used to generate the average and design day demands from the forecast DSM savings.

Forecast Project Area Demand – Status Quo vs. Meeting Environment Plan Targets				
	2020	2021	…	2035
Status Quo Demand (consistent with figures in pipeline application)				
Annual Demand (TJ)				
Average Day Demand (TJ/d)				
Design Day Demand (TJ/d)				
Environment Plan Demand (consistent with 3.2 Mt CO2e reduction by 2030)				
Annual Demand (TJ)				
Average Day Demand (TJ/d)				
Design Day Demand (TJ/d)				

(b) The Environment Plan targets require declining carbon emissions from gas and thus declining gas use:

(i) If this comes to pass, would an NPS 16 pipe be sufficient? Please explain.

[3] Government of Ontario, *A Made-in-Ontario Environment Plan*, November, 2018

(ii) If gas usage declines in accordance with the Environment Plan, at what point will the proposed NPS 20 be unnecessary to meet customers' needs? Please explain.

(c) For ease of reference via an exhibit number, please file a copy of the Ontario Government's Environment Plan4 and the Auditor General's recent review of the plan (2019 Annual Report, volume 2, chapter 3), which provides further details regarding the calculations underlying the natural gas DSM portions of the Environment Plan. Filing these materials will ensure that these important policy documents are on the record andcan be referred to efficiently.

Response:

a) See response to Exhibit I.ED.2 e.

b) See response to a) above. Please also see Exhibit I.ED.5.

c) The requested documents are included as attachments to this response (Attachments 1 and 2, respectively).

Preserving and Protecting our Environment for Future Generations

A Made-in-Ontario Environment Plan

Ministry of the Environment,
Conservation and Parks

Ontario

Minister's Message

Rod Phillips
Minister of the Environment, Conservation and Parks

The people of Ontario are passionate about the great outdoors and the natural spaces our communities offer. We recognize the importance of a clean environment to our health, our wellbeing and our economic prosperity for future generations. We also recognize the important responsibility we all have to our environment.

Ontario boasts hundreds of thousands of parks, hiking trails and forests to explore with our families and friends. Ontarians can camp in protected areas like Quetico Provincial Park in Northern Ontario and see firsthand the magnificence of a moose. We can also enjoy a family picnic at Victoria Park in Kitchener and enjoy local fresh fruits, vegetables and dairy products that were grown and produced on nearby farms. Ontario is home to hundreds of thousands of lakes, rivers and waterways that are the lifeblood of our province, where people fish, kayak and swim. We also rely on our waters to transport goods, feed our crops, and have a safe, reliable source of drinking water.

These waterways are under increasing pressure as urban development expands along their shorelines, invasive species expand on land and in water, and climate change causes changing weather patterns that can bring heavier rains resulting in damage to homes, businesses and public infrastructure.

Preserving and protecting our environment begins with a new vision for Ontario. One where hardworking taxpayers are protected and respected, and where environmental stewardship connects with the people of this province.

I am pleased to present the following made-in-Ontario plan to keep our province beautiful by protecting our air, land and water, preventing and reducing litter and waste, supporting Ontarians to continue to do their share to reduce greenhouse gas emissions, and helping communities and families prepare for climate change.

This plan will ensure we balance a healthy environment with a healthy economy, and will be reviewed on a four-year basis.

This is a plan that represents a clean break from the status quo.

We understand the pressure Ontarians feel with rising costs of living as well as skyrocketing energy costs that have hurt our economy and our competitiveness. They are understandably frustrated to see their hard-earned tax-dollars being put towards policies and programs that don't deliver results.

That's why a cap-and-trade program or carbon tax that seeks to punish people for heating their home or driving their cars remains unacceptable to the people of Ontario.

When the government does invest in environmental programs, taxpayers should not have to watch their hard-earned dollars be diverted towards expensive, ineffective policies and programs that do not deliver results.

The people of Ontario deserve recognition for the sacrifices they have made and the ones they continue to pay for.

Our plan reflects our province's specific needs and opportunities, and it does not include a carbon tax. We will continue to do our share to reduce greenhouse gases and we will help communities and families prepare to address climate change. With hard work, innovation and commitment, we will ensure Ontario achieves emissions reductions in line with Canada's 2030 greenhouse gas reduction targets under the Paris Agreement.

We will tap into the resourcefulness and creativity of our diverse and thriving private sector by helping them invest in and develop clean solutions to today's environmental challenges.

We have consulted extensively with the public, receiving more than 8,000 ideas and recommendations through our online portal. These comments have been considered alongside submissions from stakeholders and information from Indigenous communities who provided feedback on fighting climate change and other areas of environmental focus. We will continue to consult and engage on the proposals contained within this plan in the coming weeks and months.

All of us have a role to play in protecting the environment, and there are many great ideas across our province and country. It will be important that we continue to have constructive dialogue with other jurisdictions to tackle these environmental challenges together. One thing that has become particularly clear over the past few months is the fact that no one solution fits all provinces, regions or communities.

Our plan describes the actions Ontario is proposing to take and the ways we will enable industry, business, communities and people to continue to do their part.

Ontario families understand that we have a personal responsibility to leave behind a province better off than the one we inherited; not just environmentally, but financially as well.

I invite you to read our plan and join with us today, and every day, to create a better future for Ontario.

Table of Contents

Our Province Today

Those of us who call Ontario home couldn't ask for a better place to live, work and raise a family. The quality of life in our communities and the success of our businesses depends to a great extent on the clean air we breathe, the safe water we drink, and the well-protected lands and parks we enjoy.

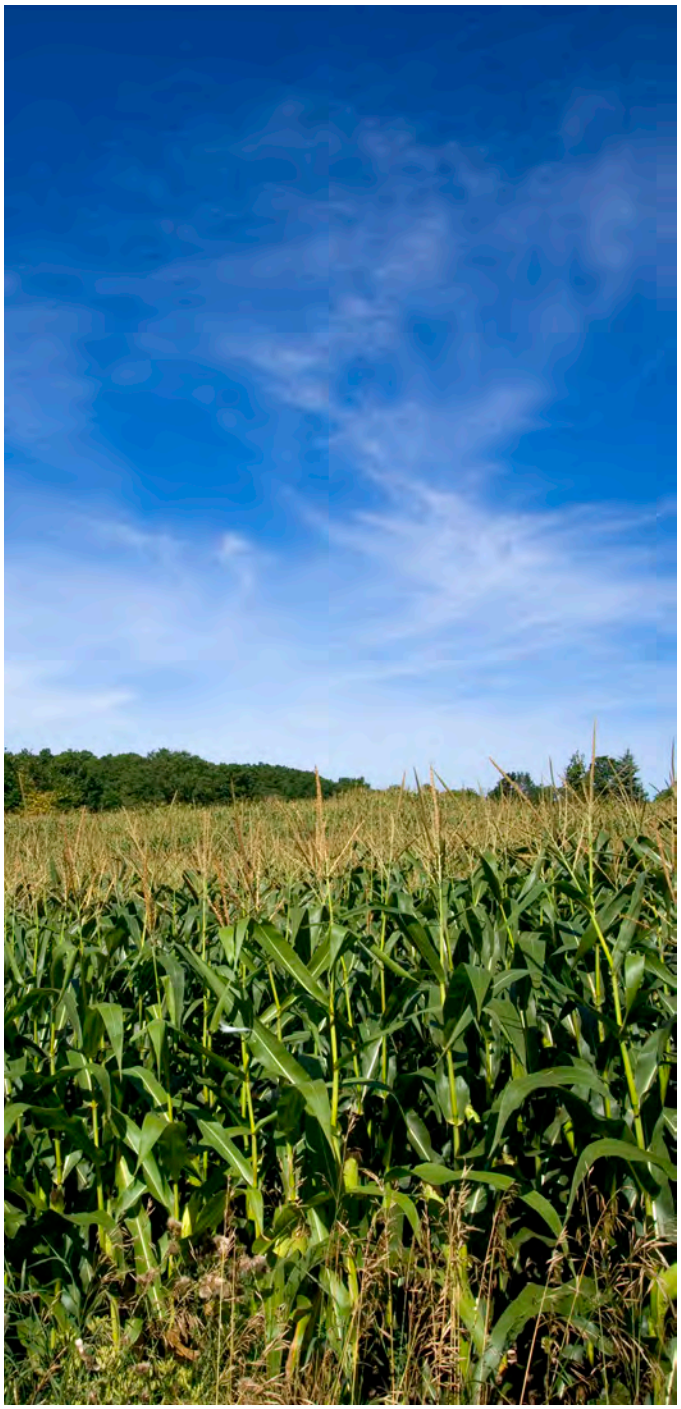
Today, the people of Ontario are breathing cleaner air with large reductions in levels of many harmful pollutants. In 2001, Ontario began the process of closing its coal plants and in the years since, we have significantly reduced pollutants such as nitrogen dioxide, sulphur dioxide, mercury and particulate matter.

Our Great Lakes attract millions of residents and visitors to waterfront communities around the province each year. These lakes provide safe drinking water to more than 70% of Ontarians and their watersheds are home to more than 4,000 species of fish, birds and other living things. They, along with all of our waterways and groundwater, underpin our province's economic prosperity and wellbeing – supporting Ontario's manufacturing, power generation, fisheries, tourism, agriculture and drinking water.

Parks and greenspace across our province provide individuals, families and tourists with opportunities to canoe in lakes, hike in forests and camp on protected lands.

THE CHALLENGE AHEAD

At the same time, climate change threatens these resources and our homes, communities and businesses, infrastructure, and our locally grown food and crops. It also threatens food security and road access for remote First Nations, as well as the health of ecosystems across our great province.



We can do more to protect ourselves from the extreme weather events that have flooded houses, buildings and roads, overwhelmed aging stormwater and wastewater systems, damaged crops, and brought heavy ice and wind storms that knocked out power for hundreds of thousands of people, including those who are most vulnerable.

Heat waves and recent drought conditions in some areas of the province, coupled with anticipated impacts of climate change and population growth, have intensified concerns related to water security for farmers, Indigenous communities, industry and municipalities.

We also recognize that there is much more that can still be done to keep our lands and waterways clean and free of litter. Nobody wants to see plastic and litter polluting our waterways, neighbourhoods and parks. No one wants sewage and wastewater overflowing into our lakes and rivers or salt making its way into our waterways. These issues are happening now and need to be addressed. There is also a need to address specific air quality concerns in communities that continue to face air quality challenges. True environmentalism begins with a sense of civic responsibility that we foster through meaningful action close to home.

Our environment plan reflects our government's commitment to addressing these pressing challenges. We will use the best science, real-time monitoring where available, and strong, transparent enforcement to protect our air, land and water, prevent and reduce litter and waste, support Ontarians to continue to do their share to reduce greenhouse gas emissions, and help communities and families prepare for climate change.

DOING OUR PART

In 2001, the government of the day announced the closure of the Lakeview Generating Station, setting the stage for the phase out of coal-fired electricity generation which remains the largest single greenhouse gas reduction in Canadian history. Ontario's low-emission combination of hydroelectric, nuclear, natural gas and non-hydro renewable generating capacity has enabled the province to avoid up to 30 megatonnes of annual greenhouse gas emissions, equivalent to taking up to seven million vehicles off our roads. In 2017, approximately 96% of the electricity generated in Ontario was emissions-free.

The combination of nuclear, hydro, other renewables and efficient natural gas has given Ontario one of the cleanest energy grids in North America. Ontario's supply of clean electricity is one of its unique strengths. Ontario is currently a net exporter of electricity, with our clean power offsetting a higher emitting mix of coal and natural gas generation in neighbouring states, such as Michigan and New York.

Measured against the same base year of Canada's target under the Paris Agreement (2005), the province's total greenhouse gas emissions have dropped by 22% – even while the rest of Canada saw emissions increase by 3% during that same time.

Doing Canada's heavy lifting on greenhouse gas emission reductions came at a cost that was too high for Ontario families and businesses. In 2017, prior to the introduction of the Fair Hydro Plan Act, 2017, the cost associated with transitioning to Ontario's low emission electricity system was an estimated $33 per month for a typical residential electricity consumer and about $435 per month for a small business, such as a restaurant. Since 2005, about $40 billion has been spent in capital investments to transition the province to an electricity system that is virtually emissions-free. Now is not the time to add further costs to the price of electricity that is already very clean.

We will continue to do our share to address climate change and protect our environment. We will do so in a way that protects our economy and respects the people.

We will hold polluters accountable by ensuring strong enforcement with real consequences and penalties, especially for repeat offenders.

We will also help our urban and rural communities and landscapes become more sustainable and resilient. We will help others do their part, whether it's leveraging private sector investments to drive environmental solutions or making it easier for people and companies to go the extra mile to reduce emissions, clean up their communities, protect waterways, conserve lands and restore habitats.

Ontario has a long history of working cooperatively with other provinces and territories, as well as with the federal government through formal agreements such as the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health and through intergovernmental forums such as the Canadian Council of Ministers of the Environment. There are also global environmental issues on which Ontario will continue collaborating with the federal government and participating in international meetings and agreements.

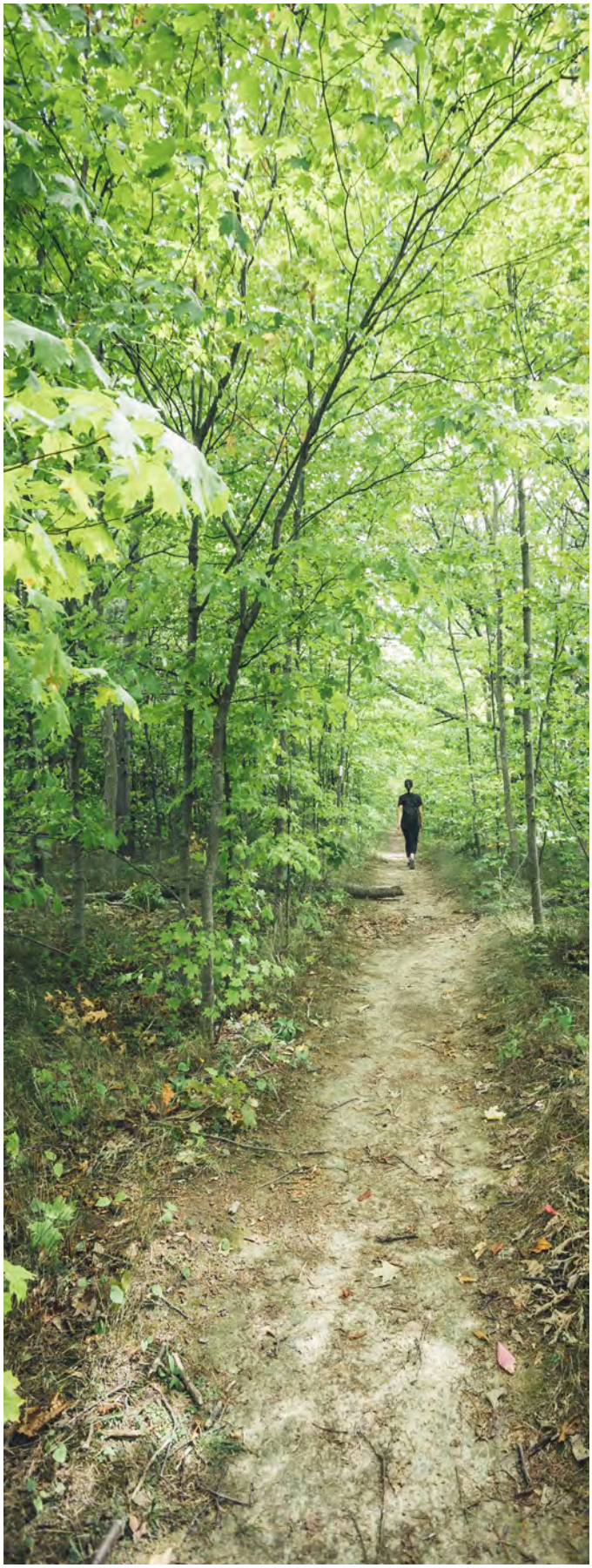
Protecting the environment is a responsibility of all of us who call Ontario home.

We will continue to work in partnership with other provinces, neighbouring jurisdictions, the federal government, municipalities, Indigenous communities, business and local partners to help protect our environment and ensure we pass on a cleaner environment to future generations.

GUIDING PRINCIPLES

Our guiding principles will help us address our most serious environmental challenges in a responsible, effective, measurable and balanced way.

- **Clear Rules and Strong Enforcement:** We will ensure that polluters are held accountable with tougher penalties, while reducing regulatory burden for responsible businesses.
- **Trust and Transparency:** We will provide Ontarians with the information and tools required – with a particular focus on real-time monitoring – to understand the current environmental challenges we face and how these challenges impact individuals, businesses and communities across the province.
- **Resilient Communities and Local Solutions:** We recognize that environmental impacts faced by communities across Ontario may be very different. We will work with these communities and use best scientific practices and other evidence-based methods to develop unique solutions to their challenges.



Protecting our Air, Lakes and Rivers

Ontario's water and air are life support systems for our province and our people. Pollution in our air and water increases healthcare costs, affects the enjoyment of our outdoors and contributes to lost economic opportunity. We will protect these critical systems by keeping our water and air clean while growing our economy.

Our plan will make it easier for people to report pollution that is impacting their lives by developing an online platform for reporting incidents that allows photos or video to be sent in, as well as reporting an incident by e-mail, phone or through an app.

Additionally, we will put in place an improved complaint response system that sets out the services Ontarians can expect from inspectors and investigators when they file a complaint, and new standards on the response time they can expect based on the type of incident they report. We will be transparent about pollution incidents and spills, and provide real-time information where it is available so that people can see if a spill or incident has already been reported, as well as the status of the ministry's response.

CLEAN AIR

Although Ontario's air quality has improved significantly, some areas of the province still experience poorer air quality due to pollution. We are committed to protecting our air, ensuring we have strong environmental standards that are protective of human health and the environment, and taking action to enforce local air quality standards.

Quick Fact: Ontario initiated the first closure of a coal plant in 2001. This action and the subsequent closure of 19 coal-fired units in five plants contributed to reducing the number of smog days in Ontario from a peak of 53 in 2005 to zero in 2017.

Actions

Improve air quality in communities by creating unique solutions to their individual challenges

- Focus on parts of the province that continue to experience air quality challenges due to pollution from transportation, industry and other sources.
- Work in partnership with municipalities, industry, public health units, other community stakeholders and Indigenous communities to address local air quality concerns and achieve clean air objectives.

Reduce emissions from heavy-duty vehicles

- Redesign the emissions testing program for heavy-duty vehicles (e.g. commercial transport trucks) and strengthen on-road enforcement of emissions standards.

Improve understanding of different sources of air pollution and their impact

- Monitor pollutants to evaluate long-term trends so we can gather the information we need to take action on air pollution.
- Increase road-side monitoring of traffic pollution and expand road-side monitoring of pollutants beyond the Greater Toronto Area to other heavily urbanized communities such as Sarnia, Sudbury and Hamilton.

Strengthen collaboration on addressing air pollution that comes from outside of Ontario's borders

- Call on the federal government to proactively address the impacts of air pollution from outside Ontario, including from the United States and international sources, and ensure continued cooperation and commitment to improve air quality.
- Expand collaboration with Michigan and Ohio to reduce the emission of contaminants of concern that impact southern Ontario, Michigan and Ohio airsheds.

Success story: Sarnia's air quality is improving

In partnership with industry, the Clean Air Sarnia and Area (CASA) advisory panel launched the website cleanairsarniaandarea.com so users could view contaminant levels from seven air monitoring stations in the Sarnia community. Air quality information is refreshed every hour on an interactive map so users can find out whether air quality is good, moderate or poor compared to provincial standards. While Ontario and industry have been monitoring air quality in the Sarnia area for decades, the CASA initiative marks the first time that data has been accessible to the public in real-time and in one location.

Ontario is also moving forward with a Sarnia Area Environmental Health Project to help address concerns about air pollution and other environmental stressors from local industries in the Sarnia area. The project will help enhance our understanding of the links between the environment and health in the community, with a focus on assessing exposures to air contaminants.

These projects are great examples of the collaborative efforts of local industry, the municipality, the Aamjiwnaang First Nation and interested community groups.

CLEAN WATER

Our lakes, waterways and groundwater are the foundation of Ontario's economic prosperity and wellbeing – supplying water to our communities, sustaining traditional activities of Indigenous peoples, supporting Ontario's economy, and providing healthy ecosystems for recreation and tourism.

Over past decades, Ontario has seen significant improvements in Great Lakes water quality due to efforts by governments and other partners. These partnerships have achieved a 90% reduction in releases of mercury, dioxins and polychlorinated biphenyls (PCBs), resulting in fish that are safer to eat, clean-up of polluted areas and the restoration of species.

Water resources in Ontario are facing many pressures. Population growth, rapid urban development, aging infrastructure and invasive species are threatening our waterways through pollution and loss of natural heritage. For example, excess road salt can damage roads, cause vehicle corrosion and be harmful to fish in our waterways. The changing climate is compounding these stresses with droughts, floods and extreme storms. Declining ice cover is causing shoreline erosion, warmer water is creating conditions for blooms of harmful algae, and shifting water conditions are changing when and where fish spawn.

Working together, we can help conserve and manage our water resources. Ontario's drinking water, for example, is among the best protected in the world as a result of the province's strong monitoring, reporting and enforcement activities and programs.

We will take strong enforcement action to protect our lakes, waterways and groundwater from pollution.

We will also work with municipalities and other partners to increase transparency through real-time monitoring of the sewage overflows from municipal wastewater systems, which too often flow into Ontario's lakes and rivers. We must step up efforts to ensure the public is aware and that proper monitoring occurs.

Quick Fact: 99.8% of more than 518,000 test results from municipal residential drinking water systems meet Ontario's strict drinking water quality standards.

Our plan focuses on key areas of action to protect our waters and keep our beaches clean for swimming, recreation, enjoyment and traditional use.

Actions

Continue work to restore and protect our Great Lakes

- Build on previous successes and continue efforts to protect water quality and ecosystems of the Great Lakes. This includes keeping coastlines and beaches clean, protecting native species and safeguarding against invasive species such as Asian carp or Phragmites, and reducing harmful algae by continuing partnerships and negotiations with the federal government under agreements and plans such as the Canada-Ontario Great Lakes Agreement (COA) and the Canada-Ontario Lake Erie Action Plan. Since signing the eighth COA in 2014, Ontario has directly invested $15.3 million per year in programs. This includes supporting the Lake Erie Action Plan and restoring geographic areas, known as areas of concern, where significant impairment or contamination has occurred as a result of human activities at the local level.
- Review and update Ontario's Great Lakes Strategy to continue to protect fish, parks, beaches, coastal wetlands and water by reducing plastic litter, excess algae and contaminants along our shorelines, and reducing salt entering waterways to protect our aquatic ecosystems.

Asian Carp:
A threat to the Great Lakes Fisheries and Economy

Asian carp typically weigh two to four kilograms but can weigh up to 50 kilograms and can grow to a length of more than one metre. They consume a significant amount of food and can eat up to 20% of their body weight each day, which harms the Great Lakes ecosystem. Asian carp were introduced to aquaculture facilities in the southern U.S. in the 1970s to remove algae and suspended solids from their ponds. They escaped when the Mississippi River flooded and have spread northward in the Mississippi watershed towards the Great Lakes.

Asian carp pose a significant threat to recreational and commercial fisheries in Ontario which are worth almost $2.5 billion combined. Ontario is working with many partners including the Asian Carp Regional Coordinating Committee, a committee including all Great Lakes states and provinces, U.S. federal agencies, and Fisheries and Oceans Canada to facilitate collaboration on prevention, early detection, response, and monitoring activities.

Quick Fact: Ontario's more than 250,000 lakes, including the Great Lakes, contain about one fifth of the world's fresh water.

Continue to protect and identify vulnerable waterways and inland waters

- Build on previous successes and continue to implement the Lake Simcoe Protection Plan to protect and restore important natural areas and features of the lake. Ontario has invested annually in the implementation of the Lake Simcoe Protection Plan.
- Protect the quality of the Lake of the Woods by continuing to work with partners on reducing phosphorus that, in excessive quantities, can cause toxic blue-green algae.
- Build on the ministry's monitoring and drinking water source protection activities to ensure that environmental impacts from road salt use are minimized. Work with municipalities, conservation authorities, the private sector and other partners to promote best management practices, certification and road salt alternatives.
- Work with Indigenous communities and stakeholders, including the public, on the remediation of mercury contaminated sediments in the St. Clair and English-Wabigoon Rivers, including efforts such as:
  - ensuring clean-up of the remaining mercury contaminated sediments located in three areas downstream of the former Dow Chemical site.
  - participating in the work of the English and Wabigoon Rivers Remediation Panel to fund remediation activities from a trust that was established with $85 million under the *English and Wabigoon Rivers Remediation Funding Act, 2017*.

Action in Progress:
Protecting the Muskoka watershed

Through the Muskoka Watershed Conservation and Management Initiative, the community and province will work together to protect this vital area by identifying the issues facing the region. Ontario will invest $5 million and commit up to an additional $5 million in matching contributions.

Effective watershed management is important to the people in our communities, especially at times when watersheds are facing stresses such as increased development and flooding caused by severe weather events.

This initiative will also help us develop a more comprehensive approach to watershed management, which can inform current actions and future development.

Success story:
Celebrating recovery of freshwater fish in Lake Simcoe

Over the years, many organizations alongside the provincial and federal governments have worked hard to protect and restore the Lake Simcoe watershed against contaminants and excess nutrients like road salt and phosphorus that have had a negative effect on water quality. The Lake Simcoe ecosystem is showing encouraging signs of recovery and demonstrating that efforts to restore and protect the lake are having an impact. For example, populations of sensitive aquatic life such as lake trout, lake whitefish and cisco are trending upward.

Ensure sustainable water use and water security for future generations

- Thoroughly review the province's water taking policies, programs and science tools to ensure that vital water resources are adequately protected and sustainably used.
- Enhance how we manage water takings to ensure we have sustainable water resources in the face of a changing climate and continued population growth. We will do this by examining approaches to assessing and managing multiple water takings, establishing priorities for different water uses, and preparing and responding to drought conditions.
- Ensure the knowledge gained through the drinking water source protection program helps inform our water management programs.

Quick Fact: Thanks to local source protection committees and conservation authorities, Ontario has source protection plans being implemented across 38 watershed-based areas. These locally developed plans identify and protect areas where drinking water is vulnerable to contamination and depletion.

Help people conserve water and save money

- Promote the use of technologies and practices to ensure water is used more efficiently. This includes water conservation planning; water use tracking and reporting; improving standards for household fixtures and appliances, such as dishwashers or washing machines; and profiling provincial and broader public sector leadership in this area.

Improve municipal wastewater and stormwater management and reporting

- Increase transparency through real-time monitoring of sewage overflows from municipal wastewater systems into Ontario's lakes and rivers. Work with municipalities to ensure that proper monitoring occurs, and that the public is aware of overflow incidents.
- Update policies related to municipal wastewater and stormwater to make them easier to understand. We will consider how wastewater and stormwater financing could be updated to improve investment and support new and innovative technologies and practices.
- Encourage targeted investment and innovation in managing wastewater that overflows into our lakes and rivers.

Quick Fact: There were a total of 1,327 bypasses and/or overflows from all municipal wastewater sources in the 2017/18 fiscal year, as reported to the Ministry of the Environment, Conservation and Parks.

Success story: City of Kingston shows environmental leadership

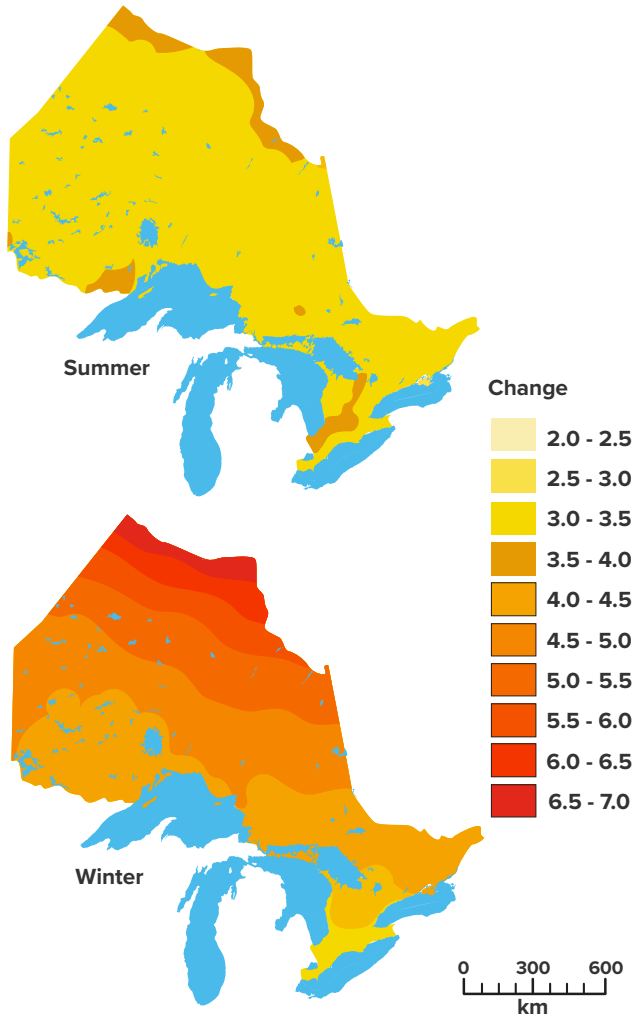
Utilities Kingston and the City of Kingston have shown leadership by providing real-time public reporting of sewage overflows, reducing pollution, and working with partners such as Swim Drink Fish Canada and the W. Garfield Weston Foundation to create the Gord Edgar Downie Pier at Breakwater Park, giving the community a new place to swim and enjoy a cleaner Lake Ontario waterfront.

Addressing Climate Change

Quick Fact: As of 2013, Canada is responsible for 1.6% of global emissions, with Ontario responsible for less than 0.4% of global emissions.

The climate is changing. Severe rain, ice and wind storms, prolonged heat waves and milder winters are much more common. Forests, waters and wildlife across the province are and will continue to be significantly impacted by these changes. People across the province – especially Northern communities – and all sectors of the economy are feeling the impacts of climate change and paying more and more for the costs associated with those impacts.

The following graph shows projected seasonal summer and winter temperature changes in Ontario by the 2050s.



Source: Ontario Climate Data Portal – http://lamps.math.yorku.ca/OntarioClimate/index_v18.htm.
Projected seasonal (summer and winter) temperature changes by the 2050s (relative to the average of 1986-2005), under the Inter-governmental Panel for Climate Change (IPCC) 5th assessment report (AR5) business as usual emission scenario (RCP8.5).

The people of Ontario have already made significant contributions to meaningful climate action. We have played an important role in fighting climate change and mitigating the threats to our prosperity and way of life, implementing significant changes to drastically reduce our greenhouse gas emissions.

The government of the day initiated the first closure of a coal plant in 2001. This action and the subsequent closure of 19 coal fired units in five plants by 2014 led to the largest single reduction of greenhouse gas emissions, not just in Ontario, but across Canada. It was also one of the largest actions to reduce emissions in North America.

Emission-free electricity generation also plays a significant role in Ontario. Nuclear power, along with our hydroelectric fleet, continues to generate the lion's share of our clean electricity.

Today, Ontario has one of North America's cleanest electricity grids. We also have effective natural gas conservation programs, helping homeowners, businesses and industry reduce their carbon footprint.

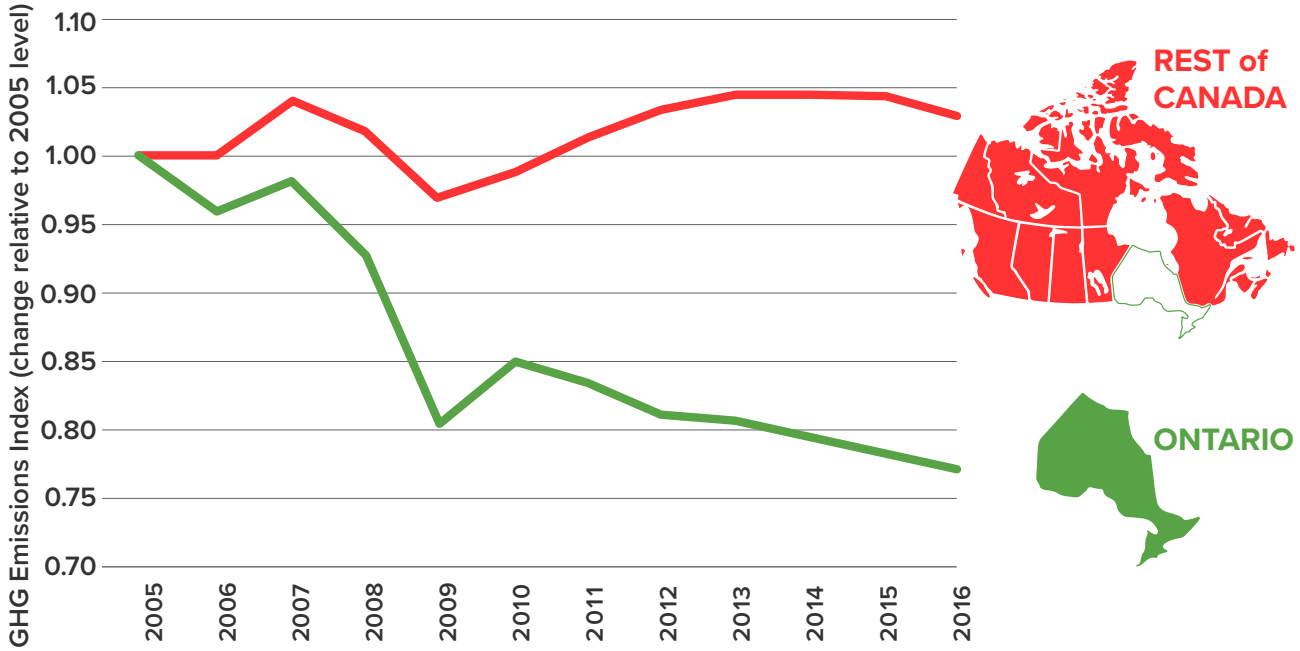
Quick Fact: Almost all of Canada's progress towards its 2030 Paris Agreement targets has been driven by Ontario.

But doing Canada's heavy lifting on greenhouse gas emission reductions has come at a cost to Ontario families. Our government understands the part that Ontarians have played and continue to play in reducing their emissions.

We have already been a leader when it comes to climate. **Indeed, we are on track to meet Canada's commitment under the Copenhagen Accord of 17% below 2005 levels by 2020.**

Now, we must look to find a balanced approach to reducing our emissions and prepare families for the impact of climate change in order to maintain both a healthy economy and healthy environment. This plan is our alternative to a carbon tax. It means finding effective and affordable ways to slow down climate change and build more resilient communities to prepare for its effects.

Ontario and the Rest of Canada's Greenhouse Gas Emissions from 2005 to 2016



We will work to unlock private capital to give Ontario businesses and residents new and more affordable ways to invest in energy efficiency, save money and reduce greenhouse gas emissions. One of the most effective ways we can combat climate change is encouraging innovation and reducing regulatory barriers to climate solutions. Through this plan, our government will focus on smart regulatory and policy approaches to facilitate and enable innovation rather than hindering it.

The following chapter of our environment plan acts as Ontario's climate change plan, which fulfills our commitment under the *Cap and Trade Cancellation Act, 2018*.

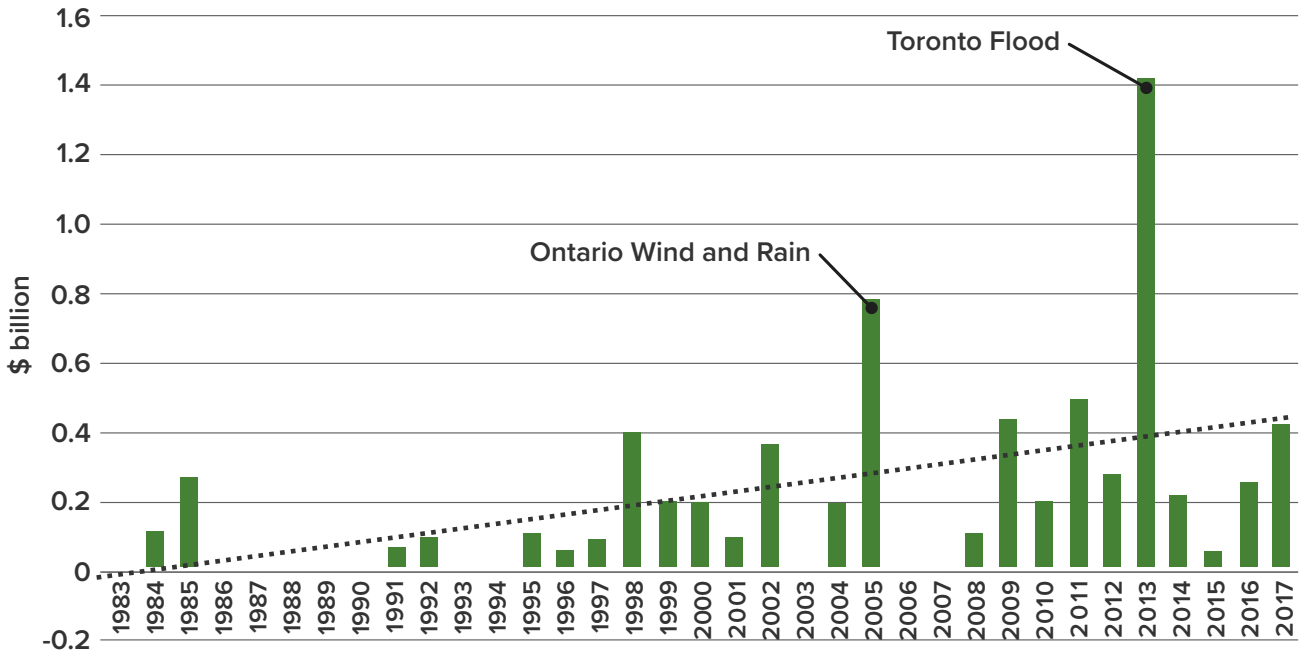
BUILDING RESILIENCE: Helping Families and Communities Prepare

We are committed to preparing families and communities for the costs and impacts of climate change, and to protecting our natural environment, communities, businesses and municipalities.

While our actions are important in the global fight to reduce emissions, we all understand the need to strengthen our resilience to the impacts of climate change such as more frequent extreme weather events.

The following graph shows the rising costs of insured property damage in Ontario between 1983 and 2017, providing an indication of the costs of climate change. The financial costs associated with extreme weather events in Ontario have increased over this period. Chief among factors affecting the increasing costs to Ontarians is the phenomenon of flooding, and more specifically, residential basement flooding.

Costs of Insured Property Damage in Ontario Between 1983 and 2017



Source: Insurance Bureau of Canada.

Building resilience is about having the right information, tools and resources to adapt and respond to our changing climate. We will access the best science and information to better understand where the province is vulnerable and know which regions and economic sectors are most likely to be impacted. Through this enhanced understanding, the province, local communities, businesses, Indigenous communities and the public will be more prepared for the impacts of a changing climate.

Case study:
Climate change impact assessments

Ontario has never completed a provincial-level climate change impact assessment. Since 2008, the United Kingdom has conducted two assessments using best available data and an up-to-date understanding of climate science and future climate impacts. Each assessment provides detailed analysis of the risks, vulnerabilities and impacts of climate change on key economic sectors, infrastructure, the environment and societal health and well-being.

Each assessment gives the government a roadmap to "high" and "low" climate change risks now and in future years.

Actions

Improve our understanding of how climate change will impact Ontario

- Undertake a provincial impact assessment to identify where and how climate change is likely to impact Ontario's communities, critical infrastructure, economies and natural environment. The assessment would provide risk-based evidence to government, municipalities, businesses, Indigenous communities and Ontarians and guide future decision making.
- Undertake impact and vulnerability assessments for key sectors, such as transportation, water, agriculture and energy distribution.

Help Ontarians understand the impacts of climate change

- Develop a user-friendly online tool that makes practical climate change impact information available for the public and private sectors. This tool will help developers, planners, educators, homeowners and others understand the potential impacts of climate change in their communities.
- Work closely with climate science modelling experts, researchers, Indigenous communities, and existing climate service providers to identify and create adaptation solutions.
- Support communities by demonstrating how climate science can be applied in decision making to improve resilience.

The graphics below illustrate practical actions that homeowners can take – simply and affordably – to lower their risk of basement flooding. Home flood protection can include property level initiatives such as disconnecting downspouts from weeping tile systems, placing plastic covers over window wells, outfitting sump pumps with battery back-up supply, and installing back water valves on drain lines.

10 Ways to Prevent Home Basement Floods

Source: Home Flood Protection Program, Intact Centre on Climate Adaptation, University of Waterloo

Ontario will work with the real estate and insurance industries to raise awareness among homeowners about the increasing risk of flooding as we experience more frequent extreme weather events. Flooding damage is the leading cause of insured property damage in Ontario. The risk of home flooding is also increasingly the reason why homeowners are unable to adequately insure their homes.

Flood damages can cost homeowners tens of thousands of dollars to repair. According to the National Flood Insurance Program in the U.S., a 15-centimetre flood in a 2,000-square-foot home is likely to cause about USD $40,000 in flood damage. Once flooding occurs, securing insurance will become more difficult and may become unaffordable for individual homeowners.

However, simple steps, such as removing debris from nearby storm drains, ensuring correct grading around home foundations, clearing eaves troughs, and installing extended downspouts and window well covers can significantly mitigate basement flood risks.

Update government policies and build partnerships to improve local climate resilience

- Modernize the Building Code to better equip homes and buildings to be better able to withstand extreme weather events. This could include affordable adaptation measures such as requiring backwater valves in new homes that are at risk of backflow, which would significantly reduce the impacts of basement flooding.
- Review the Municipal Disaster Recovery Assistance program to encourage municipalities to incorporate climate resilience improvements when repairing or replacing damaged infrastructure after a natural disaster. Since the Municipal Disaster Recovery Assistance program was launched in 2016, over $2.6 million has been provided to 11 municipalities.
- Consult on tax policy options to support homeowners in adopting measures to protect their homes against extreme weather events, such as ice and wind storms and home flooding.

- Review land use planning policies and laws to update policy direction on climate resilience. This will help make the way our communities are planned and designed more responsive and adaptive to changing weather conditions, such as improving the way that stormwater is managed.
- Build resilience in the province's critical infrastructure, through better technology as well as back-up generation and energy storage options, so that our vital services and infrastructure, such as hospitals, can better withstand and remain operational during extreme weather events.
- Support improvements to existing winter roads where they may be required to replace roads that are deteriorating as a result of changing weather conditions and shortened winter seasons, and develop a strategy to enhance all-season road connections to northern communities.
- Continue to support programs and partnerships intended to make the agriculture and food sectors more resilient to current and future climate impacts. We will support on-farm soil and water quality programming and work with partners to improve agricultural management practices.

Lake Erie Action Plan and 4R Nutrient Stewardship

Ontario's farmers continue to demonstrate leadership in environmental stewardship, which is important to their livelihood. Farmers are also embracing and championing innovative farming practices, such as 4R Nutrient Stewardship (Right Source @ the Right Rate, Right Time, and Right Place®), and other initiatives under the Canada-Ontario Lake Erie Action Plan, that are designed to enhance environmental protection and improve sustainability.

CONTINUING TO DO OUR SHARE: Achieving the Paris Agreement Target

One of the key ways we are defining our vision for climate action in Ontario is by setting an achievable greenhouse gas reduction target. This will help us focus our efforts and provide a benchmark for our province to assess its progress on the climate change mitigation components of our plan.

Ontario will reduce its emissions by 30% below 2005 levels by 2030.

This target aligns Ontario with Canada's 2030 target under the Paris Agreement.

This is Ontario's proposed target for the reduction of greenhouse gas emissions, which fulfills our commitment under the *Cap and Trade Cancellation Act, 2018*.

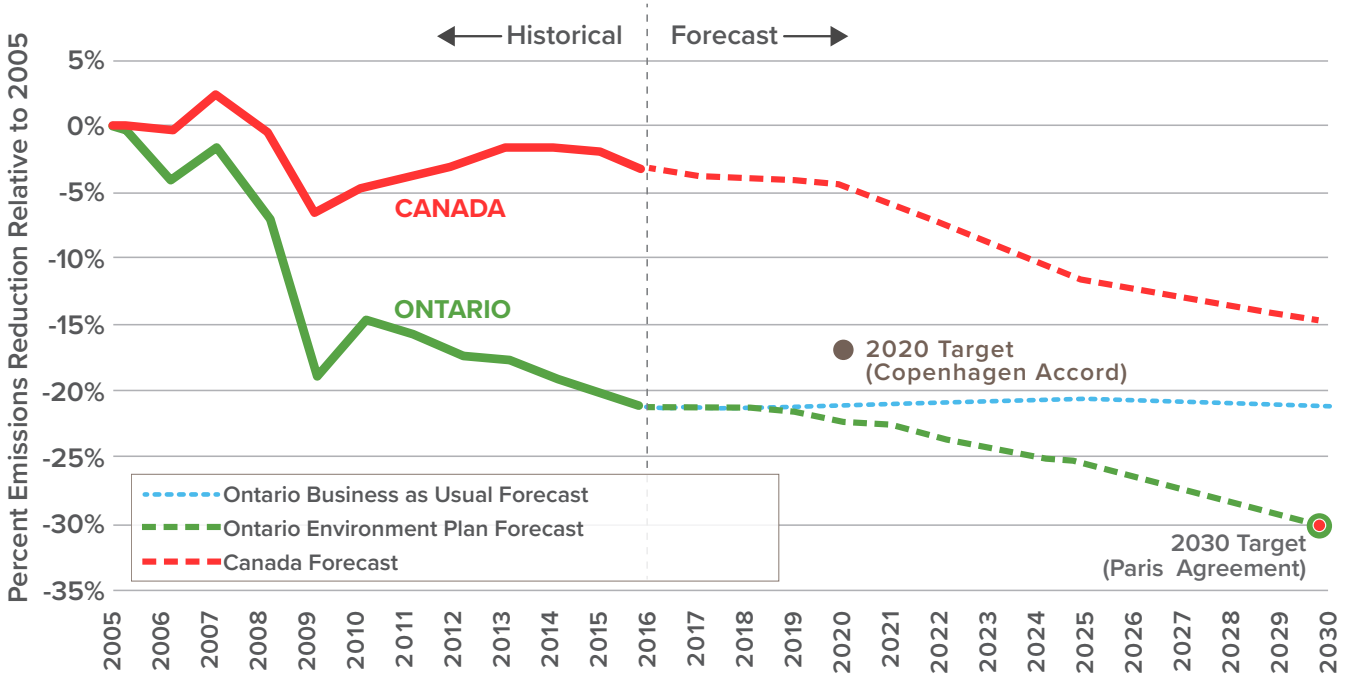
Quick Fact: The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change. Its goal is to keep the increase in global average temperature to well below 2 °C above pre-industrial levels, and pursue efforts to limit the increase even further to 1.5 °C, in order to reduce the risks and impacts of climate change.

This target takes into consideration the commitment the people of Ontario have already shown in reducing emissions, as well as our commitment to growing Ontario's economy while doing our part to tackle climate change.

There has been a steep decline in emissions from 2005, driven in large part by improvements in the electricity sector, including closing coal-fired electricity generation. As a result, we are on track to do better than the federal 2020 target set under the Copenhagen Accord in 2010.

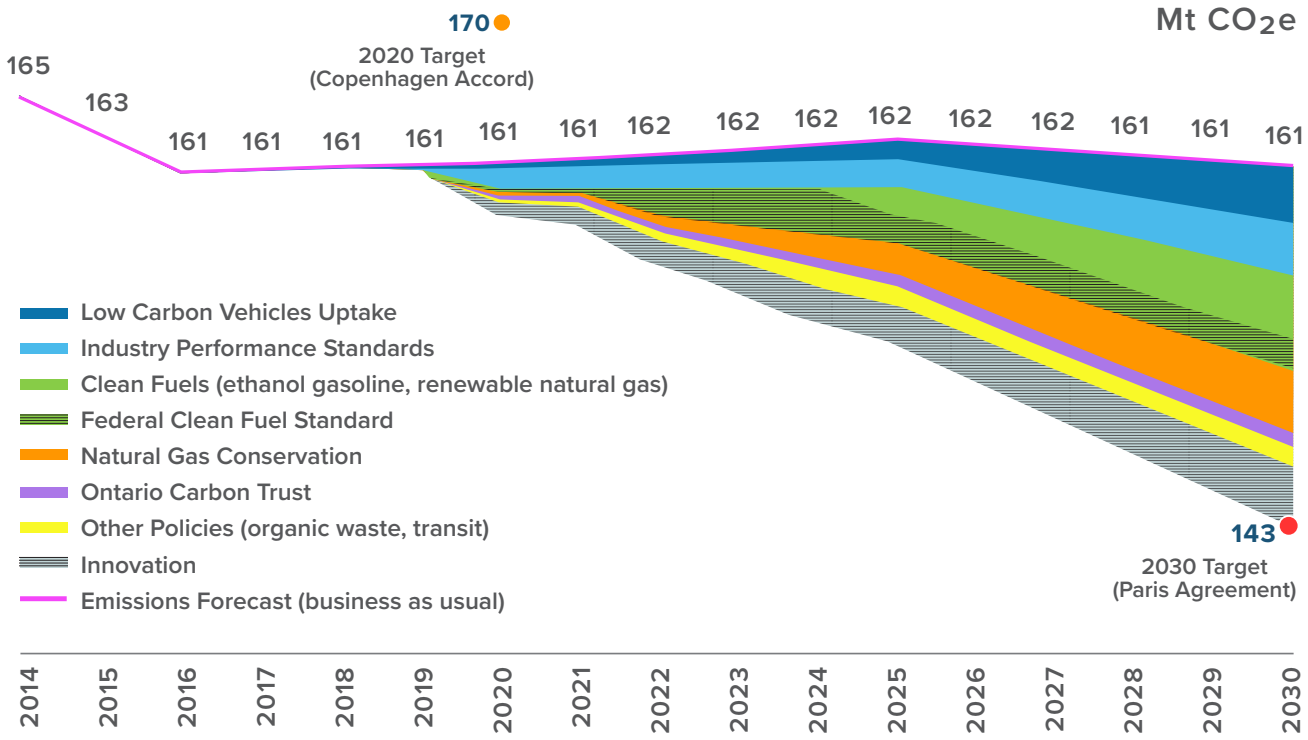
The following graph shows our 2030 target is achievable. The policies within this plan will put us on the path to meet our 2030 target, and we will continue to develop and improve them over the next 12 years. This plan will be reviewed and revised on a four-year basis.

Past and Projected Greenhouse Gas Emission Reductions for Canada and Ontario



Source: Environment and Climate Change Canada (2018) National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada. Canada 2017 Biennial Report and internal Ontario modelling.

Path to Meeting Ontario's 2030 Emission Reduction Target



The chart above shows where we expect Ontario's emissions to be if we take no action (161 megatonnes) compared to where we expect our emissions to go if we take actions in specific sectors. Our target is equivalent to 143 megatonnes in 2030 and we will need reductions in key sectors identified in the graph to get there.

The coloured portions of the chart above refer to emissions reductions we expect to see from actions in this plan and the shaded portions represent the potential we have to enhance some of those actions.

The actual reductions achieved will depend on how actions identified in our plan are finalized based on feedback we get from businesses and communities. The estimated reductions are explained in more detail below.

The **Low Carbon Vehicles** uptake portion refers primarily to electric vehicle adoption in Ontario and in small part to the expansion of compressed natural gas in trucking.

Industry Performance Standards refer to our proposed approach to regulate large emitters of greenhouse gas emissions, as described later in this plan. The final impact of this approach will depend on consultation with industry partners.

Clean Fuels refer to increasing the ethanol content of gasoline to 15% as early as 2025, and encouraging uptake of renewable natural gas and the use of lower carbon fuels.

The Federal **Clean Fuel Standard** is an estimate of the additional impact of the proposed federal standards, which could expand the use of a broad range of low-carbon fuels, energy sources and technologies, such as ethanol, renewable natural gas, greener diesel, electricity, and renewable hydrogen.

The Natural Gas Conservation action reflects programs that are well established in Ontario to conserve energy and save people money. This case assumes a gradual expansion of programs delivered by utilities, which would be subject to discussions with the Ontario Energy Board.

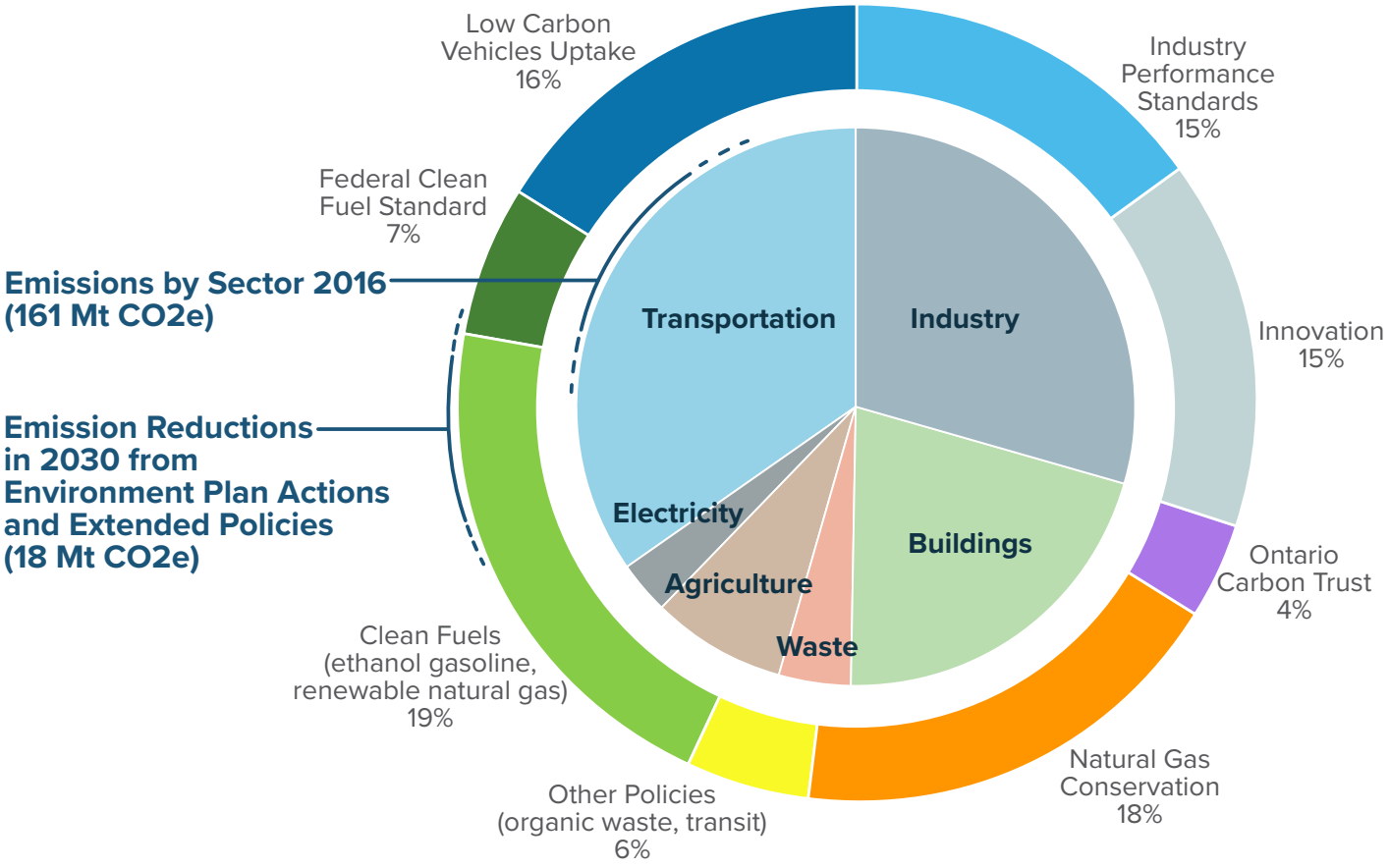
The **Ontario Carbon Trust** is an emission reduction fund that will use public funds to leverage private investment in clean technologies that are commercially viable. For this action we estimate a fund of $350 million will be used to leverage private capital at a 4:1 ratio. Estimates will depend on the final design and mandate of the trust. The estimates also include the potential emission reductions associated with a $50 million Ontario Reverse Auction designed to attract lowest-cost greenhouse gas emission reduction projects.

Other policies include the emission reductions associated with investments in public transit, and our commitment to improve diversion of food and organic waste from landfills, as described later in this plan.

Innovation includes potential advancements in energy storage and cost-effective fuel switching from high intensive fuels in buildings to electricity and lower carbon fuels.

As part of our commitment to transparency, the government is committed to updating and reporting on these estimates once program details are finalized to ensure we are making progress to the 2030 targets.

Planned Emission Reductions in 2030 by Sector



The chart above shows how the plan is tailored to address Ontario's greenhouse gas emissions. The inner pie shows the breakdown of Ontario's 2016 greenhouse gas emissions by sector. The outer ring colours show the policies from the environment plan that are targeted at reducing emissions in each sector.

The government is committed to balancing emissions reductions and economic growth. Ontario's economy has been growing, even as emissions are declining.

Tracking this improvement is an important part of Ontario's climate change plan. In coming months we will consult on the development of an economy wide carbon intensity target as a complementary metric to our absolute emissions target and to ensure that our climate change plan helps us to continue this positive trend.

The below areas are where we will focus our initiatives and actions to tackle and be more resilient to climate change and to meet our balanced target.

MAKE POLLUTERS ACCOUNTABLE

We know job creators in this province have made great strides to reduce greenhouse gas emissions, some leading their industry globally. We will ensure polluters pay their fair share for their greenhouse gas emissions, while also ensuring industry continues to make advances to help Ontario achieve its share of reductions.

Greenhouse gas emissions from the industrial sector, including smaller industrial facilities, accounted for 29% of Ontario's total emissions in 2016. We plan to regulate large emitters with a system that is tough but fair, cost-effective and flexible to the needs and circumstances of our province and its job creators. We will also ensure strong enforcement of these rules.

This system will recognize the unique situation of Canada's manufacturing and industrial heartland. Ontario depends on many industries that compete internationally. Our made-in-Ontario standards will consider factors such as trade-exposure, competitiveness and process-emissions, and allow the province to grant across-the-board exemptions for industries of particular concern, like the auto sector, as needed.

Actions

Implement emission performance standards for large emitters

We will create and establish emission performance standards to achieve greenhouse gas emissions reductions from large emitters. Each large industrial emitter will be required to demonstrate compliance on a regular basis. The program may include compliance flexibility mechanisms such as offset credits and/or payment of an amount to achieve compliance.

An emissions performance standard establishes emission levels that industrial facilities are required to meet and is tied to their level of output or production. This approach does not enforce a blanket cap on emissions across Ontario and takes into consideration specific industry and facility conditions while allowing for economic growth. It also recognizes industries in Ontario that are best-in-class while requiring improvements from sectors that have room to improve.

Case study: Saskatchewan's output-based performance standards (OBPS) system

In December 2017, Saskatchewan introduced a comprehensive Prairie Resilience climate change strategy, which included a plan to implement an OBPS system in 2019. The OBPS will apply to facilities in regulated sectors that emit more than 25,000 tonnes of greenhouse gas emissions per year. The OBPS is expected to be implemented by January 1, 2019, and the Government of Saskatchewan estimates it will cut annual emissions of covered sectors by 10% by 2030.

In addition, Saskatchewan is regulating emissions from electricity generation to achieve a 40% reduction in electricity emissions, and is regulating flared and vented methane emissions in the upstream oil and gas sector, which will lead to additional annual reductions of 40 to 45% in that sector by 2025.

ACTIVATE THE PRIVATE SECTOR

Ontario is home to the hub of the Canadian financial industry – banks, investment firms, pension funds and insurance companies. Ontario hosts the head offices of Canada's five largest banks, three of which rank among the world's largest 25 banks by market capitalization.

We recognize that our private sector has the capital, capability and know-how to transform clean technology markets and transition Ontario to a low-carbon economy. This is why we intend to help facilitate the private sector's best projects and ideas to drive emission reductions at the lowest cost to taxpayers. Our plan will ensure the prudent and responsible use of public resources to drive private sector investment.

We also want to enable consistent disclosure about financial risks associated with climate change so that companies can provide information to investors, lenders, insurers and other stakeholders.

Together, these actions will help improve the capacity of the sustainable finance sector in Ontario and position us as a global leader in this area.

Actions

Launch an emission reduction fund – The Ontario Carbon Trust – and a reverse auction to encourage private investment in clean technology solutions

Ontario will commit to ensuring funding of $400 million over four years. These funds will complement penalties paid into The Ontario Carbon Trust by polluters. This will ensure that over the next four years, The Ontario Carbon Trust should be able to leverage over $400 million to unlock over $1 billion of private capital.

If Canada's federal government returns to the Pan-Canadian Framework agreement with the people of Ontario, The Ontario Carbon Trust could be increased by $420 million through the Low Carbon Economy Leadership Fund. This would increase the fund to $820 million and unlock more than $2 billion of private capital. It would also ensure that the people of Ontario are provided the most cost-effective approach to reducing greenhouse gas emissions. Canada's commitment to partner with the people of Ontario through supporting The Ontario Carbon Trust would allow Ontario to reduce emissions beyond what is forecasted in this plan, and help Canada meet its Paris target.

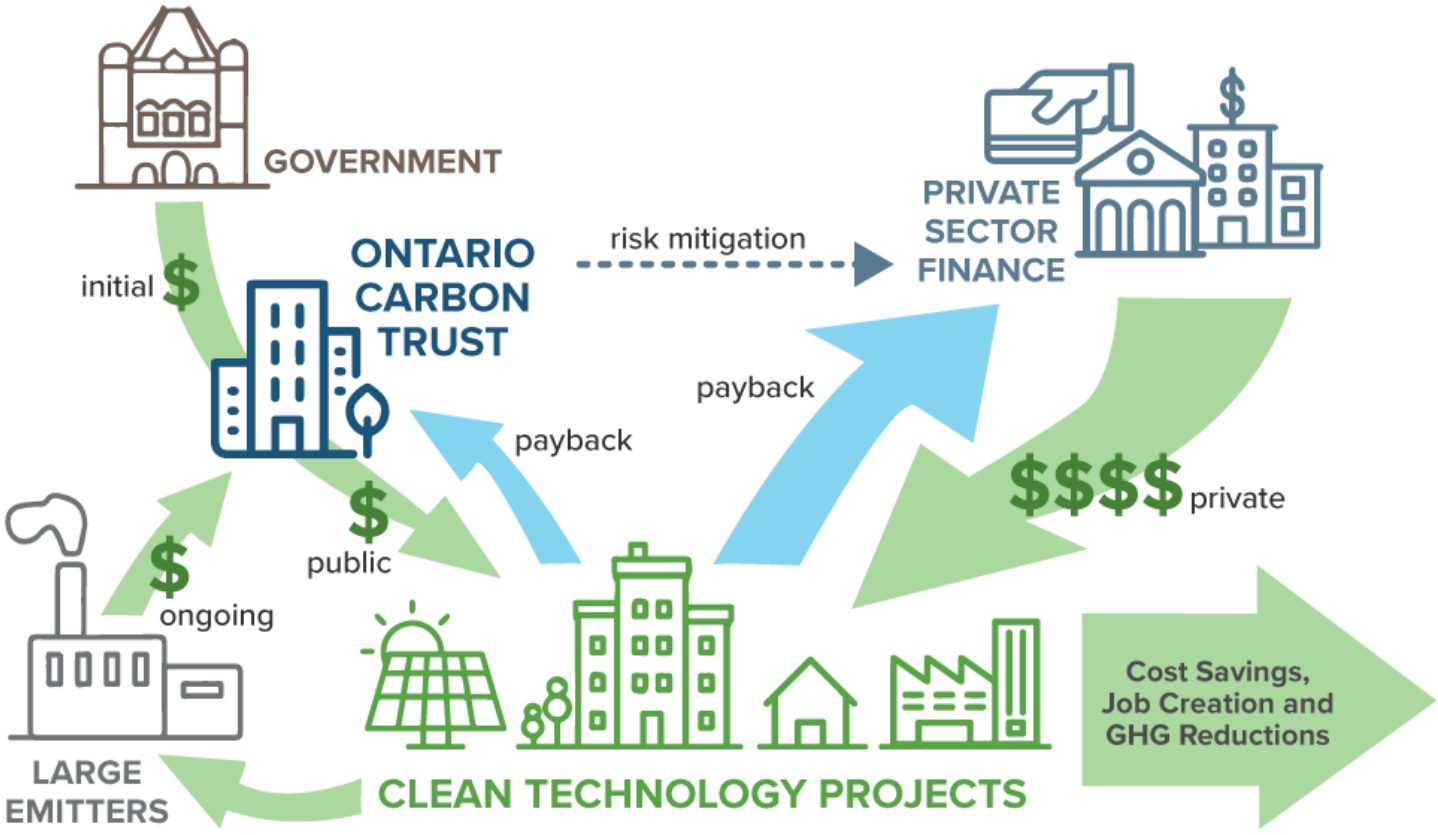
The Ontario Carbon Trust will use innovative financing techniques and market development tools in partnership with the private sector to speed up the deployment of low-carbon solutions. It will use public funds to leverage private investment in clean technologies that are commercially viable and will have a widespread presence. It will also seek to reduce energy costs for ratepayers, stimulate private sector investment and economic activity, and accelerate the transition to a low-carbon economy.

The Ontario Carbon Trust could consider investing in cost-effective projects from various sectors, such as transportation, industry, residential, business and municipal.

We will establish an independent board with the appropriate expertise, with a mandate to form The Ontario Carbon Trust, which will be tasked with working with the private sector to identify projects that will reduce emissions and deliver cost savings. We will:

- Create an emission reduction fund to support and encourage investments across the province for initiatives that reduce greenhouse gas emissions. The fund will leverage an initial investment from the government ($350 million) to attract funds from the private sector in order to drive investment in clean technologies.
- Launch an Ontario Reverse Auction ($50 million), allowing bidders to send proposals for emissions reduction projects and compete for contracts based on the lowest-cost greenhouse gas emission reductions.

The Ontario Carbon Trust



Source: Adapted from Coalition for Green Capital, Growing Clean Energy Markets with Green Bank Financing: White Paper, page 2, http://coalitionforgreencapital.com/wp-content/uploads/2015/08/CGC-Green-Bank-White-Paper.pdf.

Case study:
NY Green Bank

Created as a division of the New York State Energy Research and Development Authority, NY Green Bank is a state-sponsored, specialized financial entity that works with the private sector to increase investments in clean energy markets.

NY Green Bank's flexible approach to clean energy financing helps reduce the need for government support and increase investments into New York's clean energy markets, creating a more efficient, reliable and sustainable energy system.

By investing funds at market rates, NY Green Bank is able to cover its own costs and keep its funding base for future projects. As of September 30, 2018, NY Green Bank has committed $580.1 million to support clean energy projects with a total cost of between $1.44 and $1.68 billion.

What is a reverse auction? The buyer, in this case government, sends out a request for proposals, services or contracts. Bids are assessed and chosen based on the lowest cost, which in this case is the lowest cost per tonne of greenhouse gas emission reductions. The "bidders" in the auction compete to win the project or contract, often underbidding each other, resulting in lower costs for the buyer.

Enhance corporate disclosure and information sharing

- Work with the financial sector to promote climate-related disclosures in Ontario.
- Encourage the Ontario Securities Commission to improve guidance on climate-related disclosures.

Globally, many financial institutions are adopting the recommendations of the Task Force on Climate-Related Financial Disclosures. Ontario's financial sector is also working to improve disclosures.

Encourage private investments in clean technologies and green infrastructure

- Ontario will parallel federal changes to the Accelerated Capital Cost Allowance, which will make technology investments in clean energy generation and energy conservation equipment more attractive.
- Work with the Ontario Financing Authority to issue Green Bonds by the end of the fiscal year, after realigning the Green Bond program to support our approach to addressing environmental challenges. This action was included in the Fall Economic Statement.
- Consider tax policy options to encourage the creation of clean technology manufacturing jobs in Ontario.

Green Bonds serve as an important tool to help finance projects that will help us address our environmental challenges. Project categories include transit initiatives, extreme-weather resistant infrastructure, and energy conservation and efficiency projects (including health and education-related projects). By capitalizing on low interest rates, Ontario's Green Bonds enable the Province to raise funds while respecting the taxpayers of Ontario and without adversely impacting businesses.

Success story:
Algae carbon capture

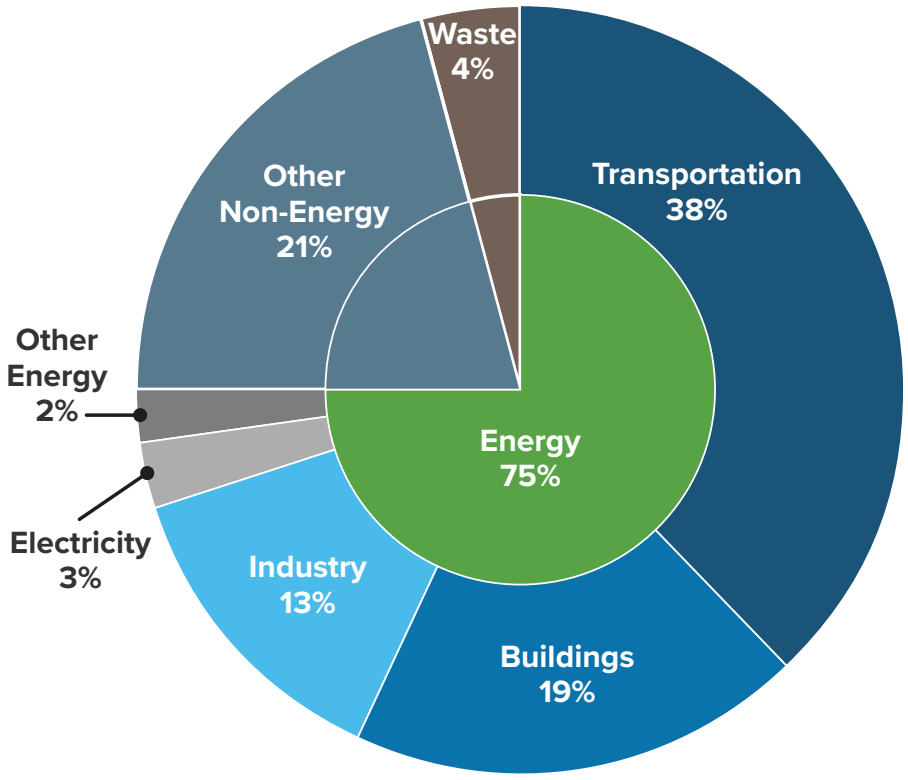
In 2012, Pond Technologies, an Ontario technology company, partnered with St. Marys Cement to run a pilot using CO2 generated by its cement plant to grow algae. Like plants, algae absorb carbon as they grow. Revenue generated from the sale of algae-derived bioproducts provide the economic basis for the adoption of this technology. Pond's pilot proved that reducing greenhouse gas emissions can generate revenue.

USE ENERGY AND RESOURCES WISELY

We will develop climate solutions that will save energy, resources and money.

About 75% of Ontario's greenhouse gas emissions come from using energy in our homes, buildings, vehicles and industry while 4% comes from waste.

Ontario's Energy Use by Sector



Source: Data from Environment and Climate Change Canada, 2018 National Inventory Report

We use gasoline and diesel fuel almost exclusively for transportation, while our main energy source for space and water heating is natural gas. Even though Ontario's vehicles have become more efficient, the number of vehicles on the road has increased.

Today, the transportation sector remains our largest source of emissions. That means we need to focus on using energy more efficiently, including in transportation, on expanding access to cleaner energy.

Our government will ensure the Ontario Energy Board keeps pace with consumer demands and the adoption of innovative energy solutions in this time of unprecedented technological change.

We also know that just over 60% of Ontario's food and organic waste is sent to landfills. In a landfill, it breaks down to create methane, a potent greenhouse gas that contributes to climate change. In fact, methane is 25 times more potent as a greenhouse gas than carbon dioxide. When food and organic waste is sent to landfill, opportunities are lost to preserve valuable resources that could be used to heat our homes, support healthy soils and reduce greenhouse gas emissions.

We will work with partners on ways to make it easier for residents and businesses to waste less food or reuse it for beneficial purposes such as compost.

Quick Fact: About 60% of Ontario's food and organic waste is sent to landfills which emits methane – a potent greenhouse gas – when it decomposes. Efficient diversion of household waste from landfills is an important tool in the fight against climate change. To read more about our plan to fight litter and waste, see page 40.

Actions

Conserve energy in homes and buildings to cut costs and reduce emissions

- Increase the availability and accessibility of information on energy and water consumption so that households, businesses and governments understand their energy use (e.g. collection of data related to electric vehicles, household-level energy and water consumption data). For example, provide customers with access to their energy data by working with electricity and natural gas utilities to implement the Green Button data standard. We will support water utilities to implement Green Button on a voluntary basis.
- Work with the Ontario Real Estate Association to encourage the voluntary display of home energy efficiency information on real estate listings to better inform buyers and encourage energy-efficiency measures.
- Review the Building Code and support the adoption of cost effective energy efficiency measures that can lower the cost of electricity and natural gas needed to operate buildings. Ontario is currently a leading jurisdiction in Canada when it comes to energy efficiency standards in its Building Code. Today, Ontario's Building Code ensures new homes built after 2017 use 50% less energy to heat and cool than houses built before 2005, resulting in a much lower carbon footprint than older homes.
- Work with the Ontario Energy Board and natural gas utilities to increase the cost-effective conservation of natural gas to simultaneously reduce emissions and lower energy bills.
- Ensure Ontario's energy-efficiency standards for appliances and equipment continue to be among the highest in North America.

Quick Fact: Enbridge Gas Distribution and Union Gas offer gas conservation programs that offer incentives for homeowners to complete upgrades that make their homes more energy efficient. Each dollar spent results in up to $2.67 in reduced energy bills for program participants.

Increase access to clean and affordable energy for families

- Continue to support connecting Indigenous communities in Northern Ontario to Ontario's clean electricity grid, to replace local diesel and other types of electricity generation.
- Increase the renewable content requirement (e.g. ethanol) in gasoline to 15% as early as 2025 through the Greener Gasoline regulation, and reduce emissions without increasing the price at the pump, based on current ethanol and gasoline prices.
- Encourage the use of heat pumps for space and water heating where it makes sense, as well as innovative community-based systems like district energy.
- Require natural gas utilities to implement a voluntary renewable natural gas option for customers. We will also consult on the appropriateness of clean content requirements in this space.
- Consult on tax policy options to make it easier for homeowners to increase energy efficiency and save money.
- Streamline and prioritize environmental approvals for businesses that use low-carbon technology, while maintaining high standards for environmental protection.
- Support the integration of emerging smart grid technologies and distributed resources – including energy storage – to harness and make best use of Ontario's clean electricity.
- Improve rules and remove regulatory barriers that block private investors from deploying low-carbon refueling infrastructure that will help increase the uptake of electric, hydrogen, propane, autonomous and other low-carbon vehicles without government subsidies.
- Collaborate with the private sector to remove barriers to expanding 24/7 compressed natural gas refueling stations for trucks along the 400-series highways, and maintain the existing tax exemption (gasoline and fuel tax) on natural gas as a transportation fuel. This will provide heavy-duty vehicles (such as transport trucks) with a cost-effective path to lower on-road transportation emissions.

Quick Fact: Natural gas is exempt from the fuel tax in Ontario, and natural gas trucks have a smaller carbon footprint compared to diesel trucks.

Success story:
Niagara Falls pump generating station produces zero-emissions power

Ontario Power Generation's Sir Adam Beck Pump Generating Station is an important source of flexible zero-emissions power for Ontarians. The station fills a 750-acre reservoir when demand for power is low, storing the equivalent amount of energy as 100,000 electric car batteries. The filled reservoir can then be used to generate hydroelectric power when needed, displacing 600 megawatts of fossil fuel generation for up to eight hours.

Success story:
Partnering to fuel lower-carbon heavy-duty transportation

In April 2018, Union Energy Solutions Limited Partnership, an unregulated affiliate of Union Gas Limited (an Enbridge Company), announced a partnership with Clean Energy to build three compressed natural gas fueling stations along Ontario's Highway 401. The initiative will enable heavy-duty vehicles (such as transport trucks) that use natural gas as a transportation fuel to travel and refuel along the 401, leading to lower on-road transportation emissions.

Case study:
Electrify Canada building an electric vehicle charging network

Electrify Canada is a new company that will build ultra-fast charging networks for electric vehicles across Canada, which are anticipated to be operational starting in 2019. This includes the installation of 32 electric vehicle charging sites near major highways and in major metro areas in British Columbia, Alberta, Ontario and Quebec.

DOING OUR PART: Government Leadership

Ontario is committed to doing its part to address climate change. This includes leading by example. We will encourage local leadership on climate change, including municipal governments, the broader public sector, business associations, community groups, Indigenous communities and voluntary organizations to develop and promote climate solutions for their members and communities. We will continue to engage on international climate issues by providing Ontario's perspective to Canada's international climate negotiations.

As part of the government's commitment to curriculum renewal we will explore changes that embed learning about the environment in the classroom. Learning about protecting our air, land and water, addressing climate change, and reducing the amount of litter and waste in our communities will not only raise awareness in schools, it will also enable students to pass on this knowledge to their families.

Partnering with and enabling people, businesses, municipalities and schools will help us find ways to address local issues and needs, save energy and costs, and minimize climate risks to our schools, hospitals, highways and critical infrastructure.

Actions

Make climate change a cross-government priority

- Improve our ability to consider climate change when we make decisions about government policies and operations by developing a Climate Change Governance Framework that will:
  - Establish clear responsibilities and requirements for ministries to track and report on climate change measures.
  - Consider climate change when we purchase goods and services across government, where it is cost-effective (i.e. low-carbon intensity steel and cement).
  - Explore opportunities to enhance coordination and guidance for municipalities to help them consider climate change in their decision-making.
  - Update Statements of Environmental Values to reflect Ontario's environmental plan.

- Continue to execute a high-performance building automation strategy for government buildings. This strategy uses advanced automation and integration to measure, monitor, and control operations and maintenance at the lowest cost, also reducing greenhouse gas emissions during day-to-day building operations. The strategy includes, but is not limited to, HVAC and lighting controls, security, elevators, fire protection, and life safety systems in order to improve performance and to reduce energy consumption.
- Ensure investments in future renovations of government buildings maximize energy cost savings. For instance, Ontario is building new correctional facilities to meet LEED standards, which ensures high environmental performance and will improve efficiency while saving money.
- Undertake a review of government office space, with an eye to optimizing our physical and carbon footprint. Ontario will reduce its per employee real estate footprint to reduce energy costs and emissions, as recommended in the Auditor General's 2017 Report.
- Support the adoption of low-carbon technologies and climate resilience measures by working to reduce costly and time-consuming regulatory and operational barriers.
- Encourage the federal government to ensure that climate negotiations under Article 6 of the Paris Agreement improve our cleantech sector's access to emerging global markets for low-carbon technologies. Ontario is a leader in clean technology and more access to global markets will help our local companies create new green jobs in Ontario.
- Develop tools to help decision makers understand the climate impacts of government activities. For example, we will identify and report on emissions reductions from school capital investments and enable school boards to access energy efficiency data to inform their investment decisions.
- Provide guidance to public property owners of heritage buildings to help them reduce their energy use and save on operating costs while continuing to conserve these important cultural heritage resources for future generations.
- Continue to support the purchase of electric ferries which will be in service in 2020 and 2021 connecting Wolfe and Amherst Islands to the mainland.

Quick fact: The government's annual procurement budget to purchase goods and services is $6 billion.

Success story: Ontario's private sector leads the country in cleantech

Ontario has the largest and fastest-growing cleantech sector in Canada, with $19.8 billion in annual revenues and over 5,000 companies employing 130,000 people.

Ontario is home to 35% of Canada's innovative cleantech companies.

Ontario is a leading hub for water technologies with over 900 companies and 22,000 employees.

Success story:
Government building renovations to save energy and money

The Queen's Park Reconstruction Project is an eight-year initiative that involves the extensive reconstruction of the Macdonald Block Complex, which is located in downtown Toronto and includes the Macdonald Block Podium, Hearst, Hepburn, Mowat and Ferguson Towers.

The 47-year-old Macdonald Block Complex is home to the largest concentration of political and public service individuals in the province. It has never undergone a major renovation and the building's core systems, including electrical, water, cooling and heating, have reached the end of their useful life.

Following advice from an independent third-party expert panel, the government's Macdonald Block Complex is undergoing extensive reconstruction to achieve significant long-term cost and energy savings for the province over the next 50 years. Those savings will be achieved through reduced operating costs, lower energy and capital maintenance expenditures, and the reduction of costly third-party leases across the downtown Toronto core. The reconstructed Macdonald Block Complex will meet LEED silver certification.

Success story:
City of Toronto Green Fleet

The City of Toronto's Green Fleet Plan focuses on reducing emissions from almost 10,000 vehicles as well as by equipment owned and operated by the city. The consolidated plan, led by the Fleet Services Division, brings together all five major City of Toronto fleets – City of Toronto Fleet Services Division, Emergency Medical Services, Toronto Fire Services, Toronto Police Service, and Toronto Transit Commission – under one plan.

As of 2017, the city had 2,091 green vehicles and pieces of equipment in its fleet, representing 24% of the total number of vehicles in the city's fleet.

Empower effective local leadership on climate change

- Work with municipalities to develop climate and energy plans and initiatives to support building climate resilience and transformation to the low-carbon future.
- Support the efforts of Indigenous communities to integrate climate action into local plans and initiatives for community power, economic development, health and sustainability.
- Encourage local leadership by forming stronger partnerships and sharing best practices with community groups and business associations.

Improve public transportation to expand commuter choices and support communities

Commit $5 billion more for subways and relief lines. Ontario will also invest in a two-way GO transit service to Niagara Falls, as part of the existing plan to build a regional transportation system.

- Establish a public education and awareness program to make people more aware of the environmental, financial and health impacts of their transportation choices.
- Develop a plan to upload the responsibility for Toronto Transit Commission (TTC) subway infrastructure from the City of Toronto to Ontario. An upload would enable the province to implement a more efficient regional transit system, and build transit faster. Moreover, this would allow the province to fund and deliver new transit projects sooner.

Support green infrastructure projects

We're also greening the government's fleet of vehicles. The Ontario Public Service currently has 1,632 hybrid, plug-in hybrid and full battery electric vehicles, which represent 70% of its entire passenger vehicle fleet.

Work with federal and municipal governments through the green stream of the Investing in Canada Infrastructure Program to invest up to $7 billion in federal, provincial and municipal funding over the next 10 years. Funding could be for projects that lower greenhouse gas emissions, reduce pollution, and help make community infrastructure more resilient. Example investments could include improvements to transit and transportation infrastructure and improved local water, wastewater and stormwater systems.

Early actions: GO Train Service Increase

This government is expanding GO service and making it easier for commuters and members of the community to move around the GTHA. More riders in seats relieves congestion on the roads. We're providing more reliable, predictable journeys across the region – greatly improving the daily transit experience. These improvements bring us a step closer to our vision to deliver two-way, all-day GO service.

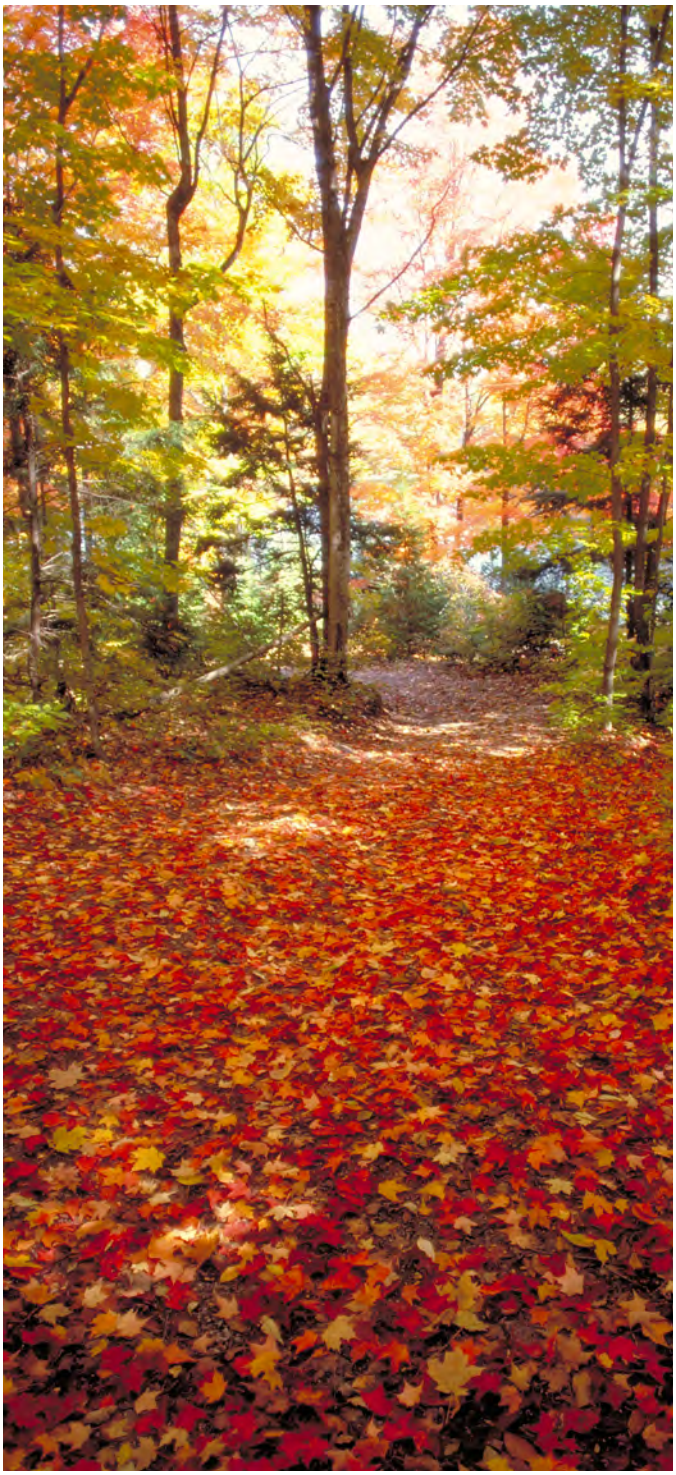
Reducing Litter and Waste in Our Communities & Keeping our Land and Soil Clean

Currently, Ontario generates nearly a tonne of waste per person every year and our overall diversion rate has stalled below 30% over the last 15 years. Ontario needs to reduce the amount of waste we generate and divert more waste from landfill through proven methods like Ontario's curbside Blue Box Program, existing and emerging municipal green bin programs and other waste recovery options. Existing and emerging technologies are increasingly allowing us to recover and recycle materials back into our economy rather than sending them to landfills. This is helping us to better protect our communities and keep our air, land and water clean and healthy.

To keep our land and water clean, we will take strong enforcement action to ensure waste, including hazardous waste, is properly stored, transported, recycled, recovered or disposed.

We are looking at proposed ways to:

- Reduce the amount of waste going to landfills or becoming litter
- Increase opportunities for Ontarians to participate in efforts to reduce waste
- Increase opportunities to use technologies, such as thermal treatment, to recover valuable resources in waste
- Manage excess soil and hauled sewage
- Redevelop brownfield sites to better protect human health and the environment



REDUCE LITTER AND WASTE

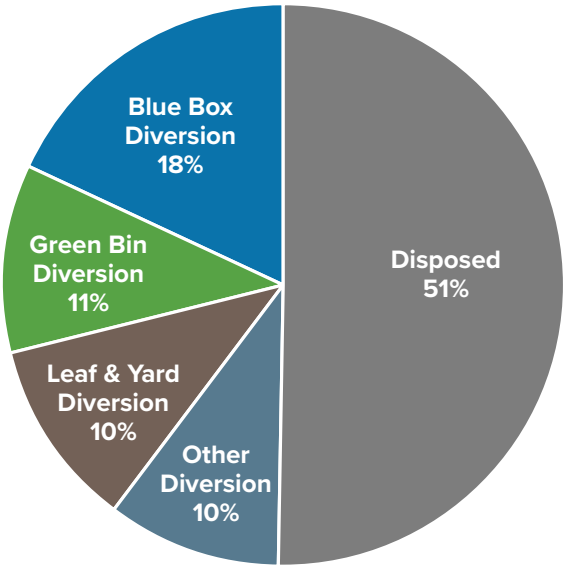
Today, some of the highest waste diversion rates in the province are in our homes. Ontarians divert almost 50% of their own household waste, through sorting what they throw away into their blue bin and, increasingly, their green bin.

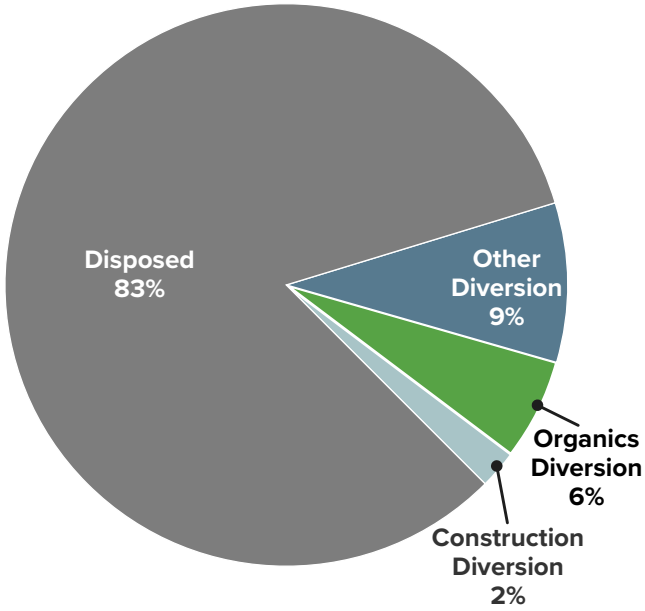
However, Ontario's general waste diversion rate (residential, commercial and industrial) has been stalled at below 30% over the past 15 years – meaning that over 70% of our waste materials continue to end up in landfills. Such heavy reliance on landfills will require the province to either focus on siting new landfills or look for new ways to reduce what we send to them.

While some individual municipalities and businesses have shown leadership, Ontarians know there is still a lot more that can be done to reduce the amount of waste we produce, recover valuable resources from our waste and better manage organics.

We believe that producers should be responsible for managing the waste they produce. Placing responsibility squarely on those who produce the waste will help unleash the creative talents and energies of the private sector. Making producers responsible for the full life-cycle of their products and the waste they produce will help companies to consider what materials they use in and to package their products, and find new and innovative cost-effective ways to recycle them and lower costs for consumers. It can also make recycling easier and more accessible right across the province, keeping it clean and beautiful.

Ontario's Residential and Industrial, Commercial and Institutional Waste Management





Residential Waste: Managed by municipalities. Includes waste generated by residents in single-family homes, some apartments and some small businesses. Mix of mandatory and voluntary diversion programs.

Business Waste: Managed by the private sector. Includes food processing sites, manufacturing facilities, schools, hospitals, offices, restaurants, retail sites and some apartments. Largely voluntary diversion programs.

Sources: Statistics Canada, Waste Management Industry Survey 2016 for non-residential data; Resource Productivity and Recovery Authority, Datacall data and residential diversion rates for residential data. Data on organic waste from 2018 study prepared for MECP by 2cg.

Actions

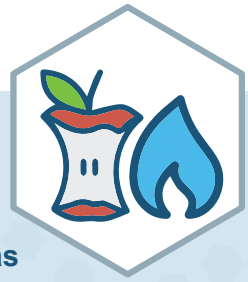
Reduce and divert food and organic waste from households and businesses

- Expand green bin or similar collection systems in large cities and to relevant businesses.
- Develop a proposal to ban food waste from landfill and consult with key partners such as municipalities, businesses and the waste industry.
- Educate the public and business about reducing and diverting food and organic waste.
- Develop best practices for safe food donation.

Success story: Farmers receive support for food donations

The rescue of surplus food helps ensure food does not go to waste. Ontario supports these efforts through the following mechanisms:

- The Ontario Community Food Program Donation Tax Credit for Farmers provides tax credits up to 25% to farmers who recover and donate agricultural products to eligible programs.
- The Ontario Donation of Food Act, 1994, encourages donations, with certain limitations, and protects food donors from liability as a result of injuries caused by the consumption of donated food.



Success story: City of Stratford turning organic waste into natural gas

Stratford, Ontario, is improving its wastewater treatment infrastructure to produce renewable natural gas from organic waste and feed it back into the local gas distribution system. Renewable natural gas is a clean, carbon-neutral energy source.

Reduce plastic waste

- Work with other provinces, territories and the federal government to develop a plastics strategy to reduce plastic waste and limit micro-plastics that can end up in our lakes and rivers.
- Seek federal commitment to implement national standards that address recyclability and labelling for plastic products and packaging to reduce the cost of recycling in Ontario.
- Work to ensure the Great Lakes and other inland waters are included in national and international agreements, charters and strategies that deal with plastic waste in the environment.

Reduce litter in our neighbourhoods and parks

Our environment plan reflects our government's commitment to keep our neighbourhoods, parks and waterways clean and free of litter and waste. When Ontarians walk their dog or take their children to the park they expect their time outdoors to be litter-free.

Ontario will establish an official day focused on cleanup of litter in Ontario, coordinated with schools, municipalities and businesses, to raise awareness about the impacts of waste in our neighbourhoods, in our waterways and in our green spaces.

- Work with municipal partners to take strong action against those who illegally dump waste or litter in our neighbourhoods, parks and coastal areas.

- Develop future conservation leaders through supporting programs that will actively clean up litter in Ontario's green spaces, including provincial parks, conservation areas and municipalities.
- Connect students with recognized organizations that encourage environmental stewardship so they could earn volunteer hours by cleaning up parks, planting trees and participating in other conservation initiatives.

Increase opportunities for Ontarians to participate in waste reduction efforts

- Work with municipalities and producers to provide more consistency across the province regarding what can and cannot be accepted in the Blue Box program.
- Explore additional opportunities to reduce and recycle waste in our businesses and institutions.

Make producers responsible for the waste generated from their products and packaging

- Move Ontario's existing waste diversion programs to the producer responsibility model. This will provide relief for taxpayers and make producers of packaging and products more efficient by better connecting them with the markets that recycle what they produce.

Explore opportunities to recover the value of resources in waste

- Investigate options to recover resources from waste, such as chemical recycling or thermal treatment, which have an important role – along with reduction, reuse and recycling – in ensuring that the valuable resources in waste do not end up in landfills.
- Encourage increased recycling and new projects or technologies that recover the value of waste (such as hard to recycle materials).

Provide clear rules for compostable products and packaging

- Ensure new compostable packaging materials in Ontario are accepted by existing and emerging green bin programs across the province, by working with municipalities and private composting facilities to build a consensus around requirements for emerging compostable materials.
- Consider making producers responsible for the end of life management of their products and packaging.

Success story: Making products compostable to reduce waste

Club Coffee makes a compostable coffee pod used by brands including Loblaw Companies Limited (President's Choice), Ethical Bean, Muskoka Roastery, Melitta Canada and Jumping Bean. Club Coffee works with municipalities so coffee drinkers can put these pods in their green bins; however they are not yet accepted in every program. We will work to support businesses that are trying to do the right thing and with leading municipalities that are working to reduce waste going to landfills. This will include working with industry and municipal partners to help ensure contamination of the Blue Box and green bin programs is minimized and that the public is provided with accurate information on how to properly manage compostable products and packaging.

Support competitive and sustainable end-markets for Ontario's waste

- Cut regulatory red tape and modernize environmental approvals to support sustainable end markets for waste and new waste processing infrastructure.
- Provide municipalities and the communities they represent with a say in landfill siting approvals. While we work to reduce the amount of waste we produce, it is recognized that there will be a need for landfills in the future. The province will look for opportunities to enhance municipal say while continuing to ensure that proposals for new and expanded landfills are subject to rigorous assessment processes and strict requirements for design, operation, closure, post-closure care and financial assurance.

CLEAN SOIL

Rural and urban communities benefit from healthy soil and land. Soils with contaminants need to be cleaned up to ensure new home owners or property users are safe, and contaminated soils are not relocated to farms where our food is grown. Having clear rules and standards around how extra soil from construction projects is managed, relocated and reused makes it easier for construction businesses to know what soils they can reuse and what soils need to be disposed of or treated before reusing.

Proper management of excess soil can reduce construction costs and unnecessary landfilling while ensuring soil from construction projects is safe for the environment and human health. By clarifying what soil can be reused locally, we can also reduce greenhouse gas emissions generated by trucking soil from place to place unnecessarily.

Redevelopment of underused, often contaminated sites (brownfields) also provides an opportunity to clean up historical contamination and put vacant prime land back into good use.

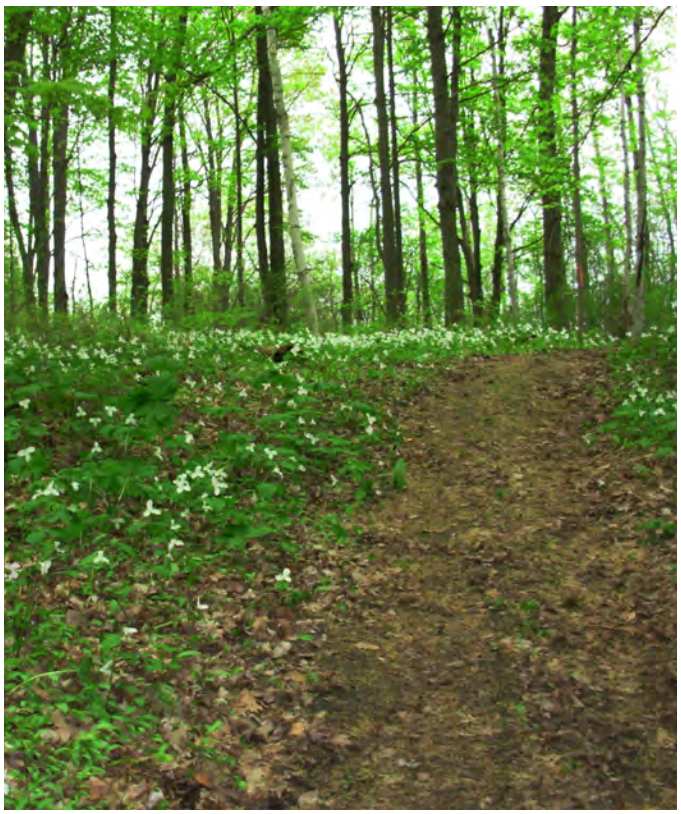
Actions

Increase the redevelopment and clean-up of contaminated lands in Ontario to put land back into good use

- Revise the brownfields regulation and the record of site condition guide to reduce barriers to redevelop and revitalize historically contaminated lands, putting vacant prime land back to good use.

Make it easier and safer to reuse excess soil

- Recognize that excess soil is often a resource that can be reused. Set clear rules to allow industry to reduce construction costs, limit soil being sent to landfill and lower greenhouse gas emissions from trucking by supporting beneficial reuses of safe soils.



- Work with municipalities, conservation authorities, other law enforcement agencies and stakeholders to increase enforcement on illegal dumping of excess soil.

Economic benefits of reusing soil

Traditional excess soil management using "dig and dump" approaches is substantially more expensive than using best practices for reusing soil from construction. According to a recent industry study, projects that use excess soil management best practices for reuse experienced an average of 9% in cost savings (Ontario Society of Professional Engineers, Greater Toronto Sewer and Watermain Contractors Association, Residential and Civil Construction Alliance of Ontario). Savings are due to reduced hauling distances and diverting soils away from landfills.

Improve management of hauled sewage

- Consider approaches for the management and spreading of hauled sewage to better protect human health and the environment (including land and waterways) from the impacts of nutrients and pathogens.

Conserving Land and Greenspace

People travel from around the world to experience the natural wonders that we often take for granted in the province of Ontario. The natural spaces across Ontario, such as forests, wetlands and parks purify our air and water, protect biodiversity and natural heritage, provide recreational opportunities and support Indigenous traditional practices.

We as Ontarians have a long history of putting a strong focus on expanding Ontario's parks and protected areas. In 1999, Ontario's Living Legacy Land Use Strategy was announced. A clear and major goal of this plan was to complete Ontario's system of parks and protected areas. Our government remains dedicated to maintaining the natural beauty of our province.

As mentioned earlier in the plan, we know that climate change poses a serious threat to Ontario's natural areas and that conservation of these areas can play an important role in mitigating and adapting to climate change. We will protect and enhance our natural areas, support conservation efforts, continue to conserve species at risk, develop adaptation strategies, and promote the importance of healthy natural spaces for future generations to use and enjoy.

Quick Fact: Ontario's Living Legacy commitment was one of the greatest expansions of Ontario's provincial parks and conservation reserves in recent history. Over the immediate years that followed, the commitment resulted in the creation of 58 new provincial parks and 268 new conservation reserves, a total area of 1,996,214 hectares.

Action Areas

Improve the resilience of natural ecosystems

- Collaborate with partners to conserve and restore natural ecosystems such as wetlands, and ensure that climate change impacts are considered when developing plans for their protection.
- Strengthen and expand grassland habitats by implementing the province's Grassland Stewardship Initiative that supports on-farm conservation activities to benefit grassland birds at risk.
- Protect against wildland fire incidents through the ongoing development of Community Wildfire Protection Plans and update technical guidance to protect people and property from flooding and water-related hazards.
- Work with leaders in land and water conservation, like Ducks Unlimited Canada and the Nature Conservancy of Canada, to preserve areas of significant environmental and ecological importance.

Success story:
Innovative Wetland in Middlesex County protects Lake Erie

Ducks Unlimited Canada, the Municipality of Southwest Middlesex, Ontario NativeScape and the Ministry of Natural Resources and Forestry built three retention ponds to capture water draining from more than 200 acres of farmland. The wetland acts as a filter to reduce excess nutrients (such as phosphorus that can create harmful algal blooms in water) reaching the Thames River and eventually Lake Erie.

Forest fires increase in Ontario in 2018

Prolonged dry conditions throughout Ontario made 2018 one of the most active forest fire seasons in recent years, with more than 1,300 forest fires burning over 265,000 hectares of forest, nearly double the 10-year average. While the number and intensity of fires varies greatly from year to year and it is difficult to connect any given forest fire to the effects of climate change, most research suggests that Ontario will experience more fires and longer fire seasons in the years ahead. While forest fires pose a serious threat to public safety, communities, and infrastructure, they are also an important natural process in Ontario's forest ecosystems. Managing forest fires in Ontario is about balancing the benefits of forest fires, and protecting public safety and communities.

Support conservation and environmental planning

- Work in collaboration with municipalities and stakeholders to ensure that conservation authorities focus and deliver on their core mandate of protecting people and property from flooding and other natural hazards, and conserving natural resources.
- Look to modernize Ontario's environmental assessment process, which dates back to the 1970s, to address duplication, streamline processes, improve service standards to reduce delays, and better recognize other planning processes.
- Protect vulnerable or sensitive natural areas such as wetlands and other important habitats through good policy, strong science, stewardship and partnerships.
- Improve coordination of land use planning and environmental approval processes by updating ministry guidelines to help municipalities avoid the impacts of conflicting land uses.

The Ontario government is committed to protecting the Greenbelt for future generations. The Greenbelt consists of over two million acres of land in the Greater Golden Horseshoe including farmland, forests, wetlands and watersheds. It includes the Oak Ridges Moraine and the Niagara Escarpment, and provides resilience to extreme weather events by protecting its natural systems and features.

Promote parks and increase recreational opportunities

- Support the creation of new trails across the province.
- Provide Ontario families with more opportunities to enjoy provincial parks and increase the number of Ontarians taking advantage of parks by 10% or approximately one million more visitors while protecting the natural environment.
- Look for opportunities to expand access to parks throughout the province, but ensure Ontario Parks has the tools it needs to conduct its business and create a world-class parks experience.
- Work to ensure that all fish and wildlife licence fees, fines and royalties collected in the Special Purpose Account go towards its stated purpose of conservation, with transparency for hunters and anglers in Ontario.
- Promote the link between nature and human health by supporting the worldwide movement for Healthy Parks Healthy People through Ontario Parks' events, education, and the development of a discussion paper to engage the public.
- Review management of provincial parks and conservation reserves to ensure effectiveness by exploring internationally recognized tools and best practices.
- Share the responsibility of conserving Ontario's protected lands by continuing to partner with municipalities, conservation authorities, Indigenous communities, conservation organizations and other community groups such as trail groups.

Conservation of Ontario's rich biodiversity and natural resources is a shared responsibility - success relies on Ontario working together with First Nation and Métis communities, hunters and anglers, conservation groups and other partners to achieve positive outcomes for our environment.

Quick Fact: Ontario manages and protects 340 provincial parks and 295 conservation reserves totalling 9.8 million hectares or 9% of the province – an area larger than the entire province of New Brunswick. In 2018, Ontario celebrated the 125th anniversary of the provincial parks system and of Algonquin Provincial Park.

Sustainable Forest Management

- Work with Indigenous organizations, the forestry industry and communities involved in managing Ontario's forests under sustainable forest management plans. Ontario will support forest managers to further reduce emissions and increase carbon storage in forests and harvested wood products. Ontario's sustainable forest management provides for the long-term health of Ontario's forests by providing potential opportunities to reduce and store greenhouse gases as trees capture and store carbon dioxide.
- Promote the use of renewable forest biomass, for example, in the steel industry and as heating fuel for northern, rural and Indigenous communities.
- Improve data and information, informed by Indigenous Traditional Knowledge where offered, on greenhouse gas emissions and carbon storage from forests, the changing landscape and permafrost.
- Increase the use of Ontario timber in building, construction and renovation to reduce emissions and increase long-term carbon storage.

What is carbon storage? Carbon storage refers to capturing carbon dioxide – and other greenhouse gases in the atmosphere – through vegetation and soils. Practices that remove carbon dioxide from the atmosphere include sustainable forest management, conserving and restoring natural ecosystems, and enhancing soil carbon in agriculture.

Forests begin to emit greenhouse gases as the trees age and die, while younger forests that are growing vigorously sequester carbon from the atmosphere. Sustainable forestry practices can encourage forests to grow and to increase carbon stored in forests and harvested wood products.

Quick Fact: Sandbanks Provincial Park is one of the busiest parks in the province, welcoming over 750,000 visitors every summer. To meet a growing demand for camping, Ontario Parks opened a new campground in Sandbanks Provincial Park in May 2017, featuring 75 campsites.

Protect species at risk and respond to invasive species

- Reaffirm our commitment to protect species at risk and their habitats, as we mark the 10th anniversary of Ontario's Endangered Species Act. We are committed to ensuring that the legislation provides stringent protections for species at risk, while continuing to work with stakeholders to improve the effectiveness of the program.
- Protect our natural environment from invasive species by working with partners and other governments and using tools to prevent, detect and respond to invasions.

Invasive species impact fish and wildlife, and hurt Ontario's economy

Invasive species like the emerald ash borer are killing our trees, phragmites (a type of grass) are taking over wetlands, and zebra mussels are clogging water intakes for industry and cottagers. Second to habitat loss, invasive species are recognized as the second leading global cause to the loss of biodiversity. In addition, invasive species are impacting our recreational opportunities such as boating, swimming, angling, and hunting, and their economic costs are staggering. A recent study estimated impacts of invasive species in Ontario at $3.6 billion annually with municipalities spending at least $38 million in 2017/18.

Preventing invasive species from arriving and establishing themselves is the single most effective and least costly method to manage invasive species. Ontario is working with a number of conservation partners to coordinate prevention, control, research and management activities to help address this serious threat. Raising public awareness and engaging individuals in taking preventive action is key in preventing new species from arriving and surviving.

Next Steps

IMPLEMENTING OUR PLAN

Ontario's environment plan presents new direction for addressing the pressing challenges we face to protect our air, land and water, clean up litter and waste, build resiliency and reduce our greenhouse gas emissions.

Our plan includes proposed incentives to stimulate growth in clean technologies, enhance leadership and collaboration to build a province-wide commitment to protecting the environment, and take action on climate change.

Our plan will help people and businesses across Ontario take actions that will save money, enhance communities, create new jobs and grow the economy.

Next steps

As part of our work on this plan, we are also undertaking several important steps to finalize our environment actions for Ontario. Over the coming months, we will:

- **Continue to consult with the public and engage with Indigenous communities** Throughout the environment plan we have identified areas of action and key initiatives. These are areas where we are engaging with stakeholders and Indigenous communities to develop new approaches that support our common goals for environmental and climate leadership.

- **Establish an advisory panel on climate change**
  An advisory panel on climate change will be established to provide advice to the Minister on implementation and further development of actions and activities in our plan specific to climate change.
- **Begin implementing priority initiatives**
  In the plan we have identified a number of priority initiatives. Some of these initiatives are already underway and we will begin implementation of the remaining initiatives following consultation.
- **Measure and report on progress**
  We want Ontarians to see how our plan is helping them save money and improve the quality of their lives and communities. We are committed to reporting regularly on the progress we make on our plan and to developing key indicators of progress because we believe that transparency is important to the success of this plan. We are also committed to reviewing the environment plan every four years.

Our consultations and engagement with various stakeholders, Indigenous communities and the public will help refine our environment initiatives by incorporating valuable insights that ensure the actions we adopt reflect the needs of Ontarians.

Comments, ideas and suggestions on the actions and initiatives in Ontario's plan to protect the environment can be made on the Environmental Registry.

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CLIMATE CHANGE: ONTARIO'S PLAN TO REDUCE GREENHOUSE GAS EMISSIONS

PLACEHOLDER: THE ATTACHMENT HAS BEEN FILED SEPARATELY

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit B, Schedule 1, Pages 8 & 25-30

Question**:**

(a) Please provide the underlying calculations used to arrive at the figures in Table 11, including the DCF tables.

(b) Please provide the total cost and NPV of the repair work that would be necessary over years 1 through 10 consistent with the assumption in Table 3 that this would require 30 integrity digs.

(c) Please provide the total cost and NPV of the repair work that would be necessary over years 1 through 10 consistent with the assumption in Table 3 that this would require 120 integrity digs.

(d) If the Board directs Enbridge to undertake the repair option, please estimate the number of repair digs that would be required until January 1, 2025.

(e) Please provide a breakdown of the 30 digs estimated for years 1 through 10 in Table 3, including the date required and estimated cost. Please do so on a best efforts basis with caveats as necessary.

Response:

a) Please refer to ExhibitI.Staff.3 b).

b) The total cost of the repair work that would require 30 integrity digs for year 1 through year 10 is $17.4 million, and the NPV of the repair work is ($14.9 million).

c) The total cost of the repair work that would require 120 integrity digs over years 1 through 30 consistent with the assumption in Table 3 is $132.0 million, and the NPV of the repair work is ($55.1 million).

d) Based on the analysis referred to in Exhibit B Tab 1 Schedule 1 Page 8, Enbridge

estimates 12 repair digs would be required until January 1, 2025.

e) Refer to Exhibit I.STAFF.3 b) for a cost breakdown on a yearly basis for the estimated inline inspections and anticipated integrity digs resulting from the inline inspections. The analysis was completed using 10 year intervals, so it was assumed the integrity digs were spread out evenly among years 1-10. Three integrity digs would be required per year during years 1-10.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit B, Schedule 1, Pages 8 & 25-30

Question**:**

(a) Please confirm the percentage of Ontario's annual greenhouse gas emissions that are attributable to natural gas combustion.

(b) Please estimate the probability (%) that electric heat pumps will be a significantly less expensive method to heat most buildings compared to natural gas (e.g. due to carbon pricing, improved equipment, etc.) in: (i) 2030, (ii) 2040, and (iii) 2050. Please provide a specific percentage with any caveats as necessary.

Response:

a) The percentage of Ontario's annual greenhouse gas emissions that are attributable to natural gas combustion is 31% as of 2018, the most recent year for which data was available.[1]

b) Please see Exhibit I.ED.2 e).

[1] Based on natural gas consumption data from Statistics Canada (Canadian Monthly Natural Gas Distribution, Table 25-10-0059-01) and GHG emissions data from Environment Canada (2020 National Inventory Report, Table A11-12). Emissions from natural gas combustion in Ontario were 50,376 ktCO_2e in 2018. Total GHG emissions in Ontario were 165,000 ktCO_2e in 2018.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit B, Schedule 1, Pages 8 & 25-30

Question**:**

(a) Please estimate the probability (%) that an NPS 20 pipe will be required between Cherry to Bathurst versus an NPS 16 pipe in: (i) 2030, (ii) 2040, and (iii) 2050? Please provide a specific percentage with any caveats as necessary.

(b) Please estimate the probability (%) that any gas pipeline will be required between Cherry to Bathurst in: (i) 2030, (ii) 2040, and (iii) 2050. Please provide a specific percentage with any caveats as necessary.

(c) Is Enbridge willing to bear any of the risk that the proposed infrastructure will be underutilized or stranded in: (i) 2030, (ii) 2040, or (iii) 2050?

Response:

a) Please see Exhibit I.ED.2 e).

b) Please see Exhibit I.ED.2 e).

c) No. Enbridge Gas expects the proposed Project to be utilized for the foreseeable future.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit B, Schedule 1, Page 29; Exhibit D, Tab 1, Schedule 1, Page 5

Question**:**

(a) Please explain why the cost of the project is indicated as $107 million in Exhibit B, Schedule 1, Page 29 and $133 million in Exhibit D, Tab 1, Schedule 1, Page 5? Please provide a table showing a detailed line-by-line reconciliation of the difference.

(b) If the $107 million cost described in Exhibit B, Schedule 1, Page 29, includes only part of the project, please explain which parts are excluded and why. Please include a map clearly indicating this.

Response:

a) The cost of the project of $107 million in Exhibit B, Schedule 1, Page 29 is the project's direct capital cost as shown as Item No. 7.0 in Table 3, Exhibit D, Tab 1, Schedule 1, Page 5.

Consistent with the discounted cash flow methodology as described through E.B.O. 188, the financial assessment of both the repair and replacement options used direct capital costs. Indirect overheads for both options were accordingly excluded.

Below is a table showing the reconciliation of the difference: the highlighted line items are the direct capital costs of the replacement option used for cost comparison with the repair option based on the DCF analysis over a 40-year horizon.

Table 3: Estimated Project Costs

Item No.	Description	Cost
1.0	Material Costs	$3,486,320
2.0	Labour Costs	$71,820,730
3.0	External Permitting, Land	$1,055,700
4.0	Outside Services	$5,199,780
5.0	Direct Overheads	$950,975
6.0	Contingency Costs	$24,754,051
7.0	Project Cost	**$107,267,556**
8.0	Indirect Overheads	$24,073,159
9.0	IDC	$1,707,176
10.0	Total Project Costs	$133,047,891

b) As explained above, the $107 million is the direct capital cost for the Project used for the cost comparison.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit F, Tab 1, Schedule 1, Attachment 1, Page 2

Preamble:

"Approximately 4.5 km of the existing NPS 20 HP steel natural gas main along the same route will be abandoned."

Question**:**

(a) Will the 4.5 km of existing pipeline by abandoned in place or removed?

(b) How much will the abandonment cost? Please provide a breakdown of the abandonment costs.

(c) In what application will Enbridge seek approval for abandonment costs?

(d) Are the abandonment costs included in the project cost outlined in Exhibit D, Tab 1, Schedule 1, Page 5, Table 3? If yes, please indicate which line item they are included under.

(e) Are the abandonment costs included in the project cost outlined in Exhibit B, Tab 1, Schedule 1, Page 29, Table 11? If yes, please indicate which line item they are included under. If no, please reproduce the table including the costs for abandoning the 4.5 km segment.

(f) Please file a high resolution map showing the pipeline to be abandoned, the proposed new facilities, and any upstream or parallel pipelines.

(g) Please describe the specific steps that will be taken to abandon the pipeline (e.g. filling with grout). Please describe the impacts of this work on the street (e.g. noise, partitioning off part of the street, traffic impacts, duration of those impacts, etc.). Please provide a map summarizing where those impacts will be felt.

(h) Has Enbridge received agreement and approval from the City of Toronto regarding its proposed method of abandonment? Please list and describe the approvals that are required in this regard.

(i) Please file all permits and agreements potentially relevant to the method of abandonment in this case.

(j) If Enbridge abandons all or part of the 4.5 km of the pipeline in place, would Enbridge be liable/responsible for removing it in the future should it be necessary (e.g. to make room for other utilities)? If not, who would be liable/responsible for this removal?

Response:

a) The 4.5km of existing pipeline will be abandoned in place.

b) Abandonment costs are estimated to be approximately $2 million (plus 30% contingency for a total of $2.6 million). Abandonment costs are part of the material, labour and direct overheads line items included in the Project cost estimates at Exhibit D-1-1 Table 3. See part c) below for a discussion of the accounting treatment of abandonment costs.

c) Enbridge Gas will not seek specific approval of abandonment costs. The cost will be treated as described below.

In accordance with the Uniform System of Accounts for Class A Gas Utilities, gas utilities in Ontario recover (and ratepayers pay for) the net salvage cost (or abandonment cost, or cost to retire) of a pipeline through the depreciation charged on the pipeline over its life. Depreciation allocates the service value of the plant asset over its estimated life in a systematic and rational manner. The service value of the plant, for depreciation purposes, shall be its cost less its estimated net salvage value. Net salvage value means the salvage value less removal costs. In cases where removal costs exceed salvage value, the net salvage value will be negative. Whether pipeline abandonment is through removal or via being left in place, recovery is the same, but the quantum of the net salvage value to be recovered is impacted.

Consistent with the above guidance, Enbridge Gas has collected/recovered a provision for the costs to retire the NPS 20 steel main as part of depreciation expense recovered in rates over the life of the asset. The accounting offset to depreciation expense is accumulated depreciation (note: for financial reporting purposes, Enbridge Gas reclasses its outstanding provision for net salvage / abandonment / costs of retirement from accumulated depreciation to a regulatory liability). Therefore the actual cost of retirement will be charged to accumulated depreciation. To the extent that the actual retirement / abandonment cost exceeds the provision/amount recovered over the life of the asset, it will either be offset by lower costs incurred to retire other assets in the steel mains pool, or it will be recovered through subsequent depreciation charged on assets in the steel mains

pool (i.e. the depreciation rate on steel mains may need to be increased prospectively, through a depreciation study, to reflect and or compensate for a new higher actual average cost to retire mains, than the current depreciation rate provides for).

d) Please see the response to part b) above.

e) Please see the response to part b) above.

f) Please refer to Attachment 1.

g) Enbridge Gas will decommission the pipeline in place. The pipeline is cut into sections and all open ends are sealed, typically using grout or other approved forms of plugs. Abandonment is anticipated to occur during the month of October 2022. Excavations will be required to sectionalize the main, and traffic restrictions will be necessary to complete this work. Please see Attachment 2 for the requested map which shows the approximate locations where the pipeline will be sectionalized.

h) Please see Exhibit I.PP.8 c) and Exhibit I.PP.8 d).

i) Please see the response to h) above.

j) Enbridge Gas has and will continue to provide assistance when third parties come across an abandoned gas pipeline as part of their project(s). This typically takes the form of a confirmation that the pipeline is abandoned. Third parties are responsible for the cost and the coordination required to remove abandoned pipelines that conflict with their project(s).


Proposed NPS 20 Vital Gas Main
Proposed Station Inlet Piping
Existing Pressure Reducing Stations
Bathurst Street
Spadina Avenue
Lower Simcoe
Bay Street
Yonge Street
Lower Jarvis
Parliament Street
Cherry Street


Proposed Abandoned NPS 20 Pipe
Proposed Abandoned Station Piping
Existing Pressure Reducing Stations
Bathurst Street
Spadina Avenue
Lower Simcoe
Bay Street
Yonge Street
Lower Jarvis
Parliament Street
Cherry Street

Proposed Abandoned Gas Main
Proposed Sectionalization Points
Potential Traffic Disruption Areas
Existing Pressure Reducing Stations
Bathurst Street
Spadina Avenue
Lower Simcoe
Bay Street
Yonge Street
Lower Jarvis
Parliament Street
Cherry Street

ENBRIDGE GAS INC.
Answer to Interrogatory from
Environmental Defence (ED)

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1

Question**:**

(a) Please provide a high-resolution map showing all lane closures and public land use (e.g. sidewalk closures, park access agreements, etc.) required for the proposed project including the abandonment of the old pipe.

(b) Please provide a list of all: (i) lane closures, (ii) sidewalk closures, and (iii) any other public land use required for the proposed project, including the abandonment of the old pipe. For each item in the list, please include the estimated length of time associated with the item.

(c) Please list all impacts on TTC, Metrolinx, and other public transit routes (on a route-by-route basis). For each item in the list, please include the estimated length of time associated with the item.

(d) What is the least expensive route considered for the proposed project? Please compare the cost of that route to the $133 million cost outlined in Exhibit D, Tab 1, Schedule 1, Page 5.

Response:

a) Please see Exhibit I.Toronto.22 a).

b) Please see the response to a) above.

c) Please see the response to a) above.

d) Other than the Preferred Route, Enbridge Gas did not develop cost estimates for any other route examined by Golder or examined in the Environmental Report.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit A, Tab 1, Schedule 1, Page 1

Preamble:

Energy Probe would like to understand why Enbridge is proposing to replace this particular section of the Kipling Oshawa Loop at this time instead of some other section.

Question**:**

a) Does the Kipling Oshawa Loop (KOL) extend from Kipling Avenue in Toronto to the City of Oshawa? If the answer is no, please explain why not.
b) Please provide the following information about the KOL:
   i. Total length in km
   ii. Pipe diameter (s)
   iii. Pipe materials, type of steel, manufacturer, yield strength
   iv. Current operating pressure(s) and percent of SMYS of each section of the entire KOL
   v. Coating(s)
   vi. Cathodic protection

Response:

a) The KOL is a vast interconnected pipeline system that, did extend from Kipling Ave to the City of Oshawa when first constructed. It now extends from Mississauga to almost Bowmanville as a result of the expansion of the gas distribution system over several decades in and around the Greater Toronto Area. Currently the KOL is comprised of many different pipelines of different diameters and vintages. The segment of pipeline to be replaced by the Project is a critical component of the KOL and influences gas supply to the east of the City of Toronto although it does not physically extend all the way to Oshawa. It is part of the NPS 20 steel main portion of the KOL. Please see Exhibit I.Toronto.11 a) for a map of the KOL.

b) Information relating to the NPS20 portion of the KOL is set out below:
   i. 45.7 km (from Lisgar to Station B)

ii. NPS 20
iii. Steel Pipe: Grade X042; Pipe Component API 5L; Wall Thickness 7.94mm
iv. Operating Pressure is 1207 kPa (175 psi); SMYS is 14.7%
v. Coating is predominately Coal Tar.
vi. Cathodic Protection method is rectifier type with one area using anode which is currently bonded to the rectifier protected area

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, page 3, paragraph 6

Question**:**

Please file the section from the most recent Asset Management Plan where the KOL is discussed.

Response:

Please refer to Exhibit I.STAFF.3 e).

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, pages 3 and 4

Preamble:

"Since the C2B segment of the KOL was completed, certain segments have been replaced or relocated as a result of road work or developments along the running line of the pipeline."

Question**:**

a) Were any segments of the NPS20 line between Cherry Street and Bathurst Street replaced or relocated since 1990?

b) If the answer to a is yes, please list the segments by location and the length of each segment.

Response:

a) Yes, two sections.

b) The segments relocated are as follows:
   i. A 193.5m long section was relocated in 1996 on Lake Shore Boulevard spanning from Raptors Way to Bay Street to address the conflict with the construction of Air Canada Centre.

   ii. A 100.4m long section was relocated in 1997 on Lake Shore Boulevard spanning from approximately 30m west of Lower Simcoe Street to approximately 30m east of Lower Simcoe Street to address proposed municipal & utility conflict.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, page 4 and 5

Preamble:

"In 2016 and 2018, Inline Inspections (ILI) using a robotic crawler tool were performed on approximately 1.9 km of the 4.5 km section of pipeline being replaced by the Project."

Question**:**

a) What were the reasons for selecting the 1.9 km segment between Cherry Street and Parliament Street for ILI instead of some other segment of NPS20?

b) Was an analysis performed that would indicate that this particular segment of NPS 20 is representative of the condition of the 4.5 km section or of the entire KOL? If there is a report of the analysis, please file it. If there is no report, please explain how management was informed of the results of the analysis.

Response:

a) As noted in Exhibit B, Tab 1, Schedule 1, Pages 2 to 4, the NPS 20 KOL pipeline was one of three vintage steel pipelines identified via the asset health review exercise conducted through 2015 and 2016 demonstrating declining health and requiring further investigation. The NPS 20 KOL is located in a densely populated downtown area of the City of Toronto where a pipeline failure could result in loss of gas distribution service for thousands of customers or in the extreme place public safety at risk. The NPS 20 KOL pipeline was divided into 5 phases and prioritized using the results from the AHR, QRA and tacit knowledge. The results identified the C2B segment of pipeline as the priority segment for further investigation to ascertain the condition of the pipeline segment.

   The Company looked at available technologies to help obtain additional pipe condition information, such as External Corrosion Direct Assessment (ECDA) using the Close Interval Potential Survey or the Direct Current Voltage Gradient method,

Guided Wave Technology and Inline Inspection (ILI). As a standard ILI of the NPS 20 KOL pipeline could not be performed without major retrofit of the pipeline and fittings to allow for the standard ILI tools to be used for the entire length of the pipeline, the Company looked into crawler ILI tools. The Company engaged Pipetel Technologies to explore the use of their crawler ILI tool. Based on the requirements and limitations of the tool, the Company identified the easterly section of the C2B pipeline segment to pilot the crawler ILI in 2016. This section of pipe was identified to be first for the ILI, based on the fact that it is located in a high consequence area including characteristics such as wall-to-wall concrete, a densely populated downtown core with residential, commercial and critical customers, the Gardiner Expressway, utility congested road allowance, and close proximity to railway/public transportation.

In 2017, the company carried out the required integrity digs driven by the results of the 2016 crawler ILI and proceeded to develop the plan to conduct another crawler ILI for the section of pipe immediately west of the 2016 ILI section. Again, characteristics of the pipeline were factors used to determine the next segment of pipeline to be inspected. The section of pipeline west of the 2016 ILI section has all of the same characteristics as the section to the east of it. It is a section of pipeline within the highly congested area of downtown Toronto with the potential for large impacts to customers in the event of a pipeline incident. This second inspection activity was carried out in 2018.

b) Yes analysis were completed to determine if the section of pipeline inspected and the section of pipeline to be replaced were representative of the condition of the NPS 20 section of the KOL. The Asset Health Review and the Asset Management Plan determined that vintage steel mains, like the NPS 20 KOL line, were demonstrating declining health. This determination lead the Company to further examine specific vintage steel pipelines. Please refer to the response to Exhibit I.EP.2 and Exhibit I.EP.3 for the process the Company used to determine the condition of vintage steel mains and the process used to determine which vintage steel mains should be examined further, as well as to approve the Project. Please also see Exhibit I.EP.9 b) for a discussion of why it is reasonable to expect the condition of the pipeline that was inspected to be representative of the entire 4.5km section.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Page 7

Preamble:

"These projections were developed using an engineering forecasting model called PiMSlider".

Question**:**

a) Is PiMSlider a model that is used by other gas distributors and transmitters for engineering forecasting or is Enbridge Gas the only user of this model?

b) Please explain how the PiMSlider model works and why the OEB should have confidence in the forecasts produced by the model.

Response:

a) and b) PiMSlider is the application that Enbridge Gas Integrity uses for pipeline risk and integrity management assessments. The Company's corrosion assessment and forecasting model is built into PiMSlider by applying industry accepted methods to determine the reliability of assets in regards to corrosion. The model applies the ASME Modified B31G (0.85dL) feature assessment criteria which is applicable for corrosion assessments as per CSA Z662-19 – Clause 10.10.2.6. A linear deterministic model for corrosion growth is used along with Probability of Exceedance (POE) modelling to account for feature reliability including data uncertainties in accordance with CSA Z622-19 – Annex O.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Page 7

Preamble:

"Using the information provided by the ILIs, Enbridge Gas developed a forecast of the number of integrity digs that could be required on the full C2B segment over the next 40 years. In total, 171 integrity digs are expected over the next 40 years."

Question**:**

a) Please confirm that the forecast of 171 integrity is a simple arithmetic proration of 72 digs over 1.9 km prorated over 4.5 km length from Cherry Street to Bathurst Street.

b) Please explain why the OEB should have confidence in a forecasting model that uses a simple arithmetic proration.

Response:

a) Confirmed. The forecast of 171 integrity digs was arrived at by prorating 72 integrity digs predicted by PiMSlider from the 1.9km of inline inspected pipe over the entire length of the 4.5km section from Cherry Street to Bathurst Street.

b) Please refer to Exhibit I.EP.7 for details on how PiMSlider models integrity features over time. Extrapolation of data from the section of pipe that was inline inspected to the remaining 2.6km section of pipe is a reasonable assumption. Enbridge Gas believes it is reasonable to expect that the remaining 2.6 km of the C2B segment is in a similar condition to that of the segments of C2B for which ILIs were conducted. This is supported by the fact that comparable environmental conditions (such as high concentrations of petroleum hydrocarbons and volatile organic compounds) exist across the Project, and the year of construction for the pipeline is the same for the inspected and non-inspected portion of gas pipeline. As explained in Exhibit I.EP.6 a) it would be expensive and difficult to complete ILI on the remaining 2.6km of the Cherry to Bathurst segment.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Page 8

Preamble:

"Specifically, due to the location of the C2B segment relative to the parts of the segment for which ILIs were conducted, comparable environmental conditions (such as high concentrations of petroleum hydrocarbons and volatile organic compounds) and its year of construction, Enbridge Gas believes it is reasonable to expect that the remaining 2.6 km of the C2B segment is in a similar condition to that of the segments of C2B for which ILIs were conducted."

Question**:**

a) Please confirm that the old Station A, manufactured gas plant operated by Consumers Gas until 1955 was immediately to the north of the Cherry Street to Parliament Street segment and that the plant used coal and oil in the manufacture of gas.

b) Is it possible that the high concentrations of petroleum hydrocarbons and volatile organic compounds were caused by seepage from the plant and are therefore unique to this segment of NPS 20 pipeline from Cherry Street to Bathurst Street.

Response:

a) The site known as Station A, a former coal gas manufacturing facility operated by Consumers Gas, was located on several properties in the general area of Front Street East and Parliament Street.

b) Historically the waterfront of Toronto was an industrial hub dating back to the 1800s. Several different industrial manufacturing facilities have occupied the lands in and around the location of the pipeline to be replaced. Additionally, much of the area around the Project is landfill. There will be many factors that contribute to any contamination of the soils in the area. The 2018 ILI extended from Parliament Street to Bay Street (Exhibit B, Tab 1, Schedule 1, Figure 2), which is not an area

proximate to the former Station A. Contaminates similar to what were encountered as part of the 2016 and 2018 ILIs can be reasonably assumed to be found in the majority of the study area at the depths relevant to the KOL pipeline.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Page 11

Question**:**

a) Please confirm that the pipe joints on NPS 20 are welded and that compression couplings are only used on laterals that tap into the line.

b) How many compression couplings are on lines attached to the Cherry Street to Bathurst Street segment NPS20?

c) For how many years has Enbridge been aware of potential problems with compression couplings?

d) Please explain why Enbridge has not relaced compression couplings on laterals on NPS 20 when it became aware of the problem.

Response:

a) Confirmed. The pipe joints are all welded.

b) There are five confirmed compression couplings according to field notes on lines immediately attached to the Cherry Street to Bathurst segment of NPS20. The risks associated with these compression couplings have all been remediated through the installation of a welded pumpkin on each. Please see Exhibit I.EP.14.

c) Enbridge Gas recognized the safety implications of the use of compression couplings in 1991 (29 years ago).

d) There have been several programs to address compression couplings on laterals within the Enbridge Gas distribution network, specifically on higher pressure mains. One of the programs was to ensure compression couplings on high pressure gas mains were restrained once identified. In the case with the four compression couplings found on laterals coming off the NPS20, these were all restrained by use

of a welded pumpkin (an approved Enbridge Gas solution).

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, page 11

Preamble:

"Compression couplings on steel mains that are unknowingly isolated from the corrosion protection system could result in inadequate cathodic protection, leading to accelerated corrosion and potential loss of containment. Some vintage gas mains (such as the KOL) do not have sufficient records identifying the existence and location of these fittings."

Question**:**

a) Please confirm that the quoted passage is a generic statement which may not be indicative of the status of compression couplings on taps and laterals attached to the Cherry Street to Bathurst Street section of NPS 20.

b) Are there sufficient records for the Cherry Street to Bathurst Street section of NPS 20 to identify the existence and location of compression couplings fittings? If the answer is no, please explain why not and what would be required to create a record that would identify the location of compression couplings on the Cherry to Bathurst section of NPS 20. If the answer is yes, please file an exhibit that shows the location of compression couplings on that section of NPS 20.

Response:

a) Confirmed. The quoted passage is a generic statement. For documented compression couplings please refer to Exhibit I.EP.13 (b).

b) There are sufficient records for the Cherry to Bathurst street section of NPS20 to identify the existence and location of known compression couplings. These records exist because Enbridge Gas repairs these couplings when found or when a record indicates a compression coupling exists. However, in some instances the presence of compression couplings was not recorded and therefore is unknown to the Company unless it is discovered in the course of operations. Please see the

attachment to this response for a map showing the location of known compression couplings on laterals off of the Cherry to Bathurst segment. Since compression couplings were commonly used when the NPS 20 KOL line was installed there may be more compression couplings than those the Company is aware of (likely on lateral lines attached to the NPS 20 pipeline).


Proposed Abandoned NPS 20 Pipe
Proposed Abandoned Station Piping
Existing Pressure Reducing Stations
Bathurst Street
Spadina Avenue
Lower Simcoe
Bay Street
Yonge Street
Lower Jarvis
Parliament Street
Cherry Street
Area of Known Compression Couplings
4 restrained couplings on Cooper Street
Area of Known Compression Couplings
1 Restrained coupling on Stadium Road

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Page 28

Preamble:

“For the Repair Option analysis, Enbridge Gas assumed that 171 integrity digs would have to be conducted over the next 40 years. The integrity digs were assumed to be either repairs or replacements.”

Question**:**

Did Enbridge assume that the Replace Option would have no integrity digs over the next 40 years? Please discuss.

Response:

Enbridge Gas assumed that the Replace Option would have no integrity digs over the next 40 years as the pipeline being installed will be new and manufactured and constructed to today’s standards, which includes having a greater wall thickness, improved pipeline coating and implementing advanced corrosion mitigation practices.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1, Page 2

Preamble:

"Enbridge Gas has contacted the City of Toronto (City) and Toronto and Region Conservation Authority (TRCA) regarding the Project. The City and TRCA were also provided a copy of the ER as part of the OPCC review process. The City and theTRCA have not provided comments on the ER."

Question**:**

a) Did Dillon seek input from the City of Toronto, and the Toronto and Region Conservation Authority in the preparation of the ER? If the answer is yes, please explain how this input was sought and what information was obtained. If the answer is no, please explain why not.

b) Is Enbridge concerned that City of Toronto and the TRCA have not provided comments on the ER? If the answer is yes, please explain what Enbridge has done to obtain comments on the ER from the City of Toronto and the TRCA. If the answer is no, please explain why Enbridge is not concerned.

Response:

a) Yes. Dillon sought input from stakeholders such as the City of Toronto and the Toronto and Region Conservation Authority as part of the Environmental Assessment. This input was obtained through the consultation process for the Project. Please refer to section 3.0 Stakeholder Consultation Program and Appendix G Stakeholder Consultation Logs of the Environmental Report.

b) Please refer to Exhibit I.Staff.4 for an updated summary of input received as part of the OPCC review process. To date the City of Toronto has not provided any comments on the Project. However, as can be seen in various interrogatory responses to the City of Toronto, Enbridge Gas intends to work closely with the City throughout the Project.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1, Page 3

Preamble:

"Additionally, independent experts were hired to opine on the routes developed by Enbridge Gas, to recommend and evaluate alternative routes for the Project and to develop an ER for the Project."

Question**:**

a) Please list the names and file the CV's of independent experts.

b) Please file copies of all communications of all communications between independent experts and Enbridge.

Response:

a) Enbridge Gas retained Golder Associates Inc. (Golder) to perform a desktop corridor routing study to determine potentially feasible corridor options for the Project. Dillon Consulting Ltd. (Dillon) was retained by Enbridge Gas Inc. (Enbridge Gas) to undertake a route evaluation and environmental and socio-economic impact study, which included a cumulative effects assessment, of the proposed route options assessed by Golder.

   The individuals involved on behalf of Golder were Brad Novecosky, Kevin Seel, Massimo Dragan, Alyson Beal, Carla G. Evans, Michele Fernetti, Moise Coloumbe-Pontbrand, and Sean Kurash. The individuals involved on behalf of Dillion were Joe Muraca, Tristan Lefler, Merrilees Willemse, and Alissa Lee. CVs for each of these individuals are set out in the attachments to this response.

b) The conclusions and recommendations of the independent experts are set out in their respective reports, which have been filed in this proceeding.

Guiseppe (Joe) Muraca, MES, MCIP, RPP

PARTNER
gmuraca@dillon.ca

PERSONAL PROFILE

Joe is an environmental planner with almost 20 years' experience in large, multidisciplinary environmental and socio-economic impact assessment and stakeholder engagement projects. He has managed or directed over 60 pipeline projects with many more where he participated as a team member or Subject Matter Expert (SME). He has also been involved in environmental mitigation and inspection services and has provided expert testimony at the Ontario Energy Board and supported clients with hearings before the National Energy Board.

RELEVANT EXPERIENCE

NATURAL GAS AND LIQUIDS PIPELINES

Senior Technical Advisor, Waterdown to Finch Pipeline 2020 Archaeology Program, UPI on behalf of Exxon/Imperial Oil, Ontario (Ontario Energy Board)
Provided technical guidance and review for this program in support of a planned 62 km NPS 12 liquids pipeline to be installed between Waterdown to North York, Ontario. (ongoing).

Senior Technical Advisor, Facility Environmental Assessments, Enbridge Pipelines, Canada-wide (National Energy Board/Canadian Energy Regulator)
Provided guidance and review for a variety of facility upgrade projects across Canada (Mackenzie Station, Kerrobert Station, Gretna Station, and Westover Terminal) some of which were subject to a Section 58 application to the NEB. Undertook the environmental and socio-economic assessment, created the EPP, and provided monitoring during construction. (ongoing).

Senior Technical Advisor and Director, Excess Soil Planning and Visioning, Enbridge Gas Inc., Ontario
Provided assistance and training for understanding the impacts of proposed excess soils regulation updates. (ongoing).

Project Manager, Sarnia Terminal, Line 7 Replacement, Enbridge Pipelines Inc., Sarnia, Ontario
Developed an environmental and socio-economic impact assessment including all field studies. Provided support for an application to the NEB (Sec. 58), as well as permitting with the local

EDUCATION

M.ES. and Graduate Diploma, Business and the Environment, York University, 2001

B.ES. (Magna Cum Laude), York University, 1999

REGISTRATIONS/LICENCES

Ontario Professional Planners Institute (Full Member)

Canadian Institute of Planners (Full Member)

AFFILIATIONS/ASSOCIATIONS

Canadian Nuclear Association (Member)

Ontario Society for Environmental Management (President)

ADDITIONAL LANGUAGE(S)

Italian (fluent)

French (fluent)

conservation authority and Permit to Take Water. Prepared an Environmental Protection Plan to guide construction activities including training. Assisted with environmental inspection services including water and soil sampling activities. (complete).

Project Manager, Don River Project, Enbridge Gas Distribution Inc., Toronto, Ontario
Assisted with an application to replace an NPS 30 pipeline that crossed the Don River. Specific works included providing technical guidance and support with engagement and permitting with the Toronto Region Conservation Authority. (complete).

Planner, Line 10 Westover Segment Replacement, Enbridge Pipelines Inc., Hamilton, Ontario
Developed and implemented an environmental survey program including natural environment, species at risk, archaeology, groundwater well and private water well sampling to support an environmental and socio-economic assessment, an environmental protection plan, and permitting with provincial and local/municipal agencies. Extensive consultation with three First Nations, provincial and federal regulatory agencies and three conservation authorities was included. (ongoing).

Technical Advisor, Line 21 Replacement Environmental and Socio-Economic Impact Assessment, Enbridge Pipelines Inc., Northwest Territories
Assessed the potential impacts of the replacement of the 12-inch diameter Line 21 pipeline at the Mackenzie River through horizontal directional drilling. (complete).

Project Manager, Permit Streamline Review, Enbridge Gas Distribution Inc., Ontario
Provided facilitation, assistance and training for streamlining permits to regulatory agencies throughout Ontario. (complete).

Project Manager, Corunna East Compressor Station, Enbridge Gas Distribution Inc., Sarnia, Ontario
Conducted an environmental screening and options assessment for a proposed new compressor station. The study included a review of environmental and socio-economic features as well as cultural and built heritage. The new facility was subject to a future application to the Ontario Energy Board. (complete).

Project Manager, Line 10 Replacement and Decommissioning, Enbridge Pipelines Inc., Hamilton, Ontario
Coordinated and completed an environmental and socio-economic impact assessment for the replacement and decommissioning of the pipeline. The assessment was prepared for submission to the National Energy Board and included field studies to confirm current environmental conditions. Specific works included post-ESIA submission support, detailed field and desktop studies, and permitting. (complete).

Project Manager, Reinforcement Pipeline Environmental Assessment, Enbridge Gas Distribution Inc., York Region, Ontario
Conducted an environmental and cumulative effects assessment for a proposed natural gas pipeline completed to Ontario Energy Board requirements. The pipeline included 15 km of 20 inch diameter extra high pressure pipe. Public, agency and Indigenous consultation was included, as well as a routing a study. (complete).

Project Manager, Greater Toronto Area Reinforcement Pipeline Environmental Assessment, Enbridge Gas Distribution Inc., Toronto, Ontario
Completed an environmental and socio-economic impact assessment for the replacement of 50 km of NPS 42 and 36 pipeline. The project included permitting and approvals coordination, desktop and field studies of aquatic, soil, air, physical and acoustic characteristics along the pipeline route. The project also included construction and post-construction monitoring services. 2017 (complete).

Planner, East-West Tie Line Project, NextEra Energy Canada, ULC, Thunder Bay to Wawa, Ontario
Completed an Individual Environmental Assessment (EA) study for the transmission facility between Thunder Bay and Wawa. The project comprised ~430 km, double-circuit, 230 kV electric transmission line. The EA also included the development of a terms of reference, route selection and evaluation, natural heritage field studies and assessment, socio-economic assessment, public consultation, GIS/mapping services, and impact management plans. 2016 (complete).

Project Manager, Line 11 Replacement and Decommissioning Project, Enbridge Pipelines Inc., Hamilton, Ontario
Completed an environmental and socio-economic impact assessment for the replacement of a pipeline. The project included permitting and approvals coordination, desktop and field studies of aquatic, soil, air, physical and acoustic characteristics along the pipeline route. Specific works included managing environmental inspection services during construction and planning for year-two of post-construction monitoring. 2015 (complete).

Planner, Construction Work Plan/Reclamation Work Plan, Enbridge Pipelines Inc., Quebec
Monitored and observed the construction and post-construction reclamation of an excavation dig site. The project included on-call assistance for compliance with environmental permits' constraints and recommendations. 2014 (complete).

Project Manager, Line 10 Replacement and Decommissioning Project, Enbridge Pipelines Inc. Hamilton, Ontario
Completed an environmental and socio-economic impact assessment for the replacement of a pipeline. The project included permitting and approvals coordination, desktop and field studies of aquatic, soil, air, physical and acoustic characteristics along the pipeline route. 2013 (complete).

Planner, Innes Road Pipeline Replacement, Enbridge Gas Distribution Inc., Ottawa, Ontario
Completed an environmental assessment under the Ontario Energy Board Act for a 5 km length of natural gas pipeline. 2012 (complete).

Planner, Reinforcement Pipeline Environmental Assessment, Enbridge Gas Distribution Inc., Alliston, Ontario
Completed a route selection and environmental/cumulative effects assessment for a new pipeline preferred route identifying associated environmental/socio-economic. The proposed project included a total of 9 km of NPS 8 extra-high-pressure pipeline originating from Enbridge's Cookstown Gate Station and terminating at Highway 89/Sideroad 10, New Tecumseh. The project was designed to Class 4 standards, suitable for densely populated urban environments with a maximum operating pressure of 3,450 kPa. Specific works included the

completion of a natural environment assessment as part of the environmental assessment for a new natural gas pipeline. 2011 (complete).

Project Manager, Reinforcement Pipeline Environmental Assessment, Enbridge Gas Distribution Inc., Ottawa, Ontario
Completed a route selection and environmental and socio-economic impact study (including a cumulative effects assessment) to select a preferred route for a pipeline and to identify any potential environmental and/or socio-economic impacts. The pipeline was estimated to be a NPS 24 XHP steel line from the Enbridge Richmond Gate Station to West Hunt Club Road and Greenbank Road. 2011 (complete).

Project Manager, Fallowfield Reinforcement Pipeline Environmental Assessment, Enbridge Gas Distribution Inc., Ottawa, Ontario
Completed a route selection and environmental and socio-economic impact assessment to select a preferred route for the new pipeline and to identify any environmental or socio-economic impacts. The pipeline reinforced the existing distribution network in Fallowfield to supply the existing customer base, as well as provide additional supply to forecasted attachments. The proposed pipeline was estimated to be a NPS 12 XHP steel line. 2010 (complete).

Project Manager, Pipeline Easement, Enbridge Gas Distribution Inc., Mississauga, Ontario
Conducted an Environmental Assessment (EA) for a proposed pipeline easement located in Mississauga on lands that are managed by Ontario Realty Corporation. The EA is being conducted to facilitate the easement application and will conform to the process for Category "B" projects presented in the Class Environmental Assessment Process for Management Board Secretariat of Ontario Reality Corporation (April 2004). 2008 (complete).

Project Manager, Environmental Assessment and Inspection, Utilities Kingston, Ontario
Completed an environmental assessment and environmental inspection for a 15 km (12" and 8") natural gas pipeline to be constructed in Kingston, Ontario, to reinforce the supply of natural gas to the City of Kingston. Also prepared the "Leave to Construct" application submitted to the Ontario Energy Board and coordinated all permit applications. 2007 (complete).

Co-project Manager, Feasibility Study, Enbridge Gas Distribution Inc., Cornwall, Ontario
Conducted a feasibility study on behalf of Enbridge for the Three Nations Bridge Pipeline. The work involved the removal and replacement of a large diameter pipeline suspended on a bridge owned and operated by the Federal Bridge Corporation and the Seaway International Bridge Corporation. Conducted work and data collection toward an Application for a Project under the National Energy Board Guidelines. 2004 (complete).

SITE DEVELOPMENT

Planner, Regent Park Revitalization, Phase 3, Toronto Community Housing Corp., Ontario
Coordinated final design and composite utility drawings and obtained necessary approvals/permits for the reconstruction of the municipal services within the existing social housing neighbourhood. Provided construction administration, contract administration, site servicing and transportation planning. (complete).

Planner, North Etobicoke Off-sites, Lowe's Company Canada, ULC, Toronto, Ontario
Completed the environmental assessment, detailed design and PHM-125 signal drawings for the redevelopment of a former industrial site for commercial use near the Highway 401 and Islington Avenue. The project included a traffic impact study to document the impacts of development to the constrained road network, existing operational challenges and modifications required to interchange ramps. 2011 (complete).

POWER GENERATION AND TRANSMISSION

Project Manager, Darlington Nuclear Generating Station, Traffic Study, Ontario Power Generation Inc.
Reviewed previous TIS results and identified key mitigation measures and corrective actions. (complete).

Project Manager, Darlington Nuclear Generating Station Campus Plan Updates, Ontario Power Generation
Provided updates to the campus plan over three years. 2015 (complete).

Planner, Greenwich Wind Farm, Renewable Energy Systems Canada Inc., Thunder Bay, Ontario
Conducted an Environmental Assessment and coordinated the permitting process for a proposed 100 MW wind farm. The project included environmental screening, aboriginal and public consultation, and federal and provincial agency liaison. 2011 (complete).

Co-Project Manager, Generating Station Environmental Assessment, Pristine Power Inc., Milton, Ontario
Completed an environmental assessment for a new generating station. The project included air quality, noise, biological and risk assessments, public and agency consultation, permitting, water supply and transportation studies and land use planning. 2011 (complete).

Project Manager, Northwest Transmission Line Environmental Assessment, Hydro One Networks Inc., Ontario
Conducted an Individual EA for an ~400 km, 230 kV high-voltage transmission line in northern Ontario. 2010 (complete).

Planner, Talbot Wind Farm, Renewable Energy Systems Canada Inc., Chatham-Kent, Ontario
Conducted the environmental planning and coordinated the approvals process for a proposed 100 MW wind farm and related transmission line to connect to the grid. The project included avian and terrestrial biology surveys and assessments, environmental habitat mitigation, a Phase One Environmental Site Assessment and public consultation and federal and provincial agency liaison. 2010 (complete).

Planner, Northwest Transmission Line, Hydro One Networks Inc., Nipigon, Ontario
Assisted with the Aboriginal engagement program related to a proposed ~430 km new single circuit 230 kV transmission line in northwestern Ontario. The program included coordination and communication with Metis organizations, 12 First Nations, and a tribal council including information centres. Updates of the project were provided and discussions held regarding the First Nations' and Metis' interests, protocol agreements as well as next steps for engagement. 2010 (complete).

Planner, North York Region Generating Station Environmental Assessment, Pristine Power Inc., Georgina, Ontario
Undertook an environmental assessment and secured permits for a proposed 300 MW natural gas-fired generating station. The project included a due diligence Phase I Environmental Site Assessment on adjacent properties, purchased prior to construction to facilitate permitting. 2009 (complete).

Project Manager, General Motors Cogeneration Station, Northland Power Inc., Oshawa, Ontario
Completed an environmental assessment, and approvals and site plan for the planned 120MW gas-fired cogeneration station. The project included securing permits and site plan approval for the site, and a Phase I and II Environmental Site Assessment. 2009 (complete).

Project Manager, Nuclear Generating Station Campus Plan, Darlington, Ontario Power Generation
Developed a campus plan to integrate and optimize new land uses to ensure the long-term sustainability of the site. The plan focused on buildings; transportation, access and parking; ecology and the environment; servicing and utilities; and safety and security of the working community and facility operations. The plan was developed for selected horizon years over a 30-year timeframe and provides details on phasing the demolition and construction of new structures. 2009 (complete).

Co-Project Manager, Environmental Screening and Review for the GTA Southwest Energy Centre, Pristine Power Inc.,
Completed a land use and socio-economic impact assessment for the environmental screening and review for the GTA Southwest Energy Centre. Involved in undertaking a socio-economic and land use assessment and developing the environmental reports. 2009 (complete).

MINING

Planner, Griffiths Mine Re-development, Northern Iron Corp., Ear Falls, Ontario
Prepared a federal environmental assessment for an iron ore mine, which is ~1 700 hectares in size and consists of 24 unpatented mining claims near Highway 105. 2013 (complete).

Planner, Josephine Cone Iron Ore Mine Environmental Assessment, Bending Lake Iron Group Limited, Ignace Township, Ontario
Completed the project description and Terms and Reference under provincial and federal EA processes for the proposed open pit iron ore mine. Also included is the upgrading of an access road to the site and the construction of a new high-voltage transmission line and tailings management and solid waste disposal. 2012 (complete).

MUNICIPAL INFRASTRUCTURE

Planner, Diesel and Motor Control Upgrades, City of Windsor, Ontario
Prepared contract drawings and specifications and provided contract administration for the diesel and motor control centre upgrades at both the Little River pollution control plant and the Lou Romano water reclamation plant. 2017 (complete).

Planner, Terry Fox Drive, Final Design, City of Ottawa, Ontario
Completed the preliminary design based on geotechnical and species at risk constraints related to the compressed construction schedule. The design, tendering and construction

administration process included updating the transportation planning model, a detailed traffic management plan, public consultation, natural environment inventory, a drainage strategy and stormwater management plan and full-time environmental monitoring. 2013 (complete). Award of Merit - Transportation, Consulting Engineers of Ontario, 2013.

OTHER RELEVANT EXPERIENCE

Planner, Liability and Compensation Studies, Environment Canada

Participated in several studies on liability and compensation mechanisms in the hazardous waste industry, focusing specifically on insurance and financial assurance mechanisms. 2001 (complete).

Planner, Management Guidelines, Environment Canada

Participated in a project to develop environmentally sound management guidelines for the ship dismantling industry in Canada. 2001 (complete).

Planner, Papers on Regulatory Reviews, Environment Canada

Completed several discussion papers on regulatory reviews for hazardous waste and hazardous recyclable materials under the technical support to CCME-HWTG on hazardous waste management issues. 2001 (complete).

Planner, Computer-based Training Course, Environment Canada

Developed a computer-based training course, based on the Export and Import of Hazardous Waste Regulations, involving the classification, sampling, transportation and management of hazardous wastes and hazardous recyclable materials. The target audience for this course was Canadian Environmental Protection Act inspectors, generators, receivers and carriers. 2001 (complete).

EMPLOYMENT HISTORY

DILLON CONSULTING LIMITED

2006 - Present Environmental Planner, Associate

SENES CONSULTANTS LIMITED

2001 - 2006 Environmental Scientist/Planner

METEOROLOGICAL SERVICE OF CANADA, ENVIRONMENT CANADA

1999 - 2001 Research Manager, Science Assessment and Policy Integration Branch; Manager, Environmental Management Systems

PROFESSIONAL DEVELOPMENT

- Screenings under the Canadian Environmental Assessment Act, Environment Canada, 2004
- Noise Modelling Course, Dr. Ramani Ramakrishnan (Ryerson University), 2003
- Environmental Management Systems, Standards, Practices and Aspects and Environmental Auditing, Legislation and other Canadian Requirements, Sustainable Enterprise Academy, York University, 2001
- Compliance 101: Environmental Compliance and Regulations in Canada and Ontario, Federal Programs Division, Environment Canada, 2001

- Alternative Dispute Resolution, Stitt, Feld, Handy, Houston, 2000

PUBLICATIONS

G. Muraca, Fog Climatology in Canada. Presented at the 2nd International Conference on Fog and Fog Collection, July 15-20, 2001, St John's Newfoundland Canada. (with D.C. Maciver, H. Auld, N. Urquizo.)

G. Muraca, Fog Hazards in Canada. Presented at the Conference of the Institute for Catastrophic Loss Reduction, June 15-18, 2001, The University of Western Ontario, Canada. (with D.C. Maciver, H. Auld, N. Urquizo.)

G. Muraca, Environmental Management Systems at the Meteorological Service of Canada: Is environmental management feasible in current organizational circles? Bridging the gap between theory and practicality. M.E.S. Thesis, York University, 2001.

Tristan Lefler, M.Sc.

ENVIRONMENTAL PLANNER

tlefler@dillon.ca

PERSONAL PROFILE

Tristan is an associate at Dillon who has successfully managed environmental programs for both Canada Energy Regulator (CER) and provincially-regulated pipeline projects in the Northwest Territories, Alberta, Saskatchewan, Manitoba and Ontario. Tristan has overseen environmental support programs for numerous large and small-diameter pipeline projects from the planning and permitting stage through to construction and post-construction monitoring.

EDUCATION

M.Sc., Planning, University of Guelph, 2010

B.A., Classical Studies, University of Waterloo, 2008

RELEVANT EXPERIENCE

NATIONAL ENERGY BOARD/CANADIAN ENERGY REGULATOR – FEDERALLY REGULATED PIPELINE PROJECTS

Project Manager, Line 21 KP158 Little Smith Creek Project, Enbridge Pipelines Inc., Northwest Territories

Managed the permitting and planning phases of the project, including completing baseline environmental studies (vegetation, fish, wildlife, archaeology), and developing various applications and associated plans including the Land Use Permit and Water Licence applications to the Sahtu Land and Water Board, the ESA, EPP, Waste Management Plan, Spill Contingency Plan, Erosion and Sediment Control Plan, and Closure and Reclamation Plan. Provided oversight of environmental inspection services and local Indigenous environmental monitoring services during the geotechnical program. (ongoing).

Project Manager, Integrity and Cathodic Protection Environmental Screening Program, TC Energy, Canada

Managed a national program to provide environmental desktop screenings to support pipeline integrity and cathodic protection programs across Canada (Alberta, Saskatchewan, Manitoba, Ontario). (completed).

Project Manager, Migratory Bird Nest Sweep Program, TC Energy, Canada

Managed a national program to provide pre-construction migratory bird nest sweeps to support pipeline integrity and cathodic protection programs across Canada (Alberta, Saskatchewan, Manitoba, Ontario). (completed).

Project Manager, Line 21 Segment Replacement, Enbridge Pipelines Inc., Northwest Territories

Managed the post-application phase of the project, including supporting Enbridge through oral hearings with the NEB and Mackenzie Valley Land and Water Board. Provided the full suite of hearing-related services (i.e., responding to Information Requests, responding to reply evidence, developing issue sheets, and attending the hearing in-person). Completed supplemental wildlife fieldwork and an Archaeological Impact Assessment. Developed various

applications and plans including a Section 44 ESA (deactivation), Section 45 ESA (reactivation), Closure and Reclamation Plan, Erosion and Sediment Control Plan, and EPP for both summer and winter construction. Managed a team of environmental inspectors during construction of the project. Currently managing the 7-year NEB Post-Construction Environmental Monitoring Program for the project. (ongoing).

Project Manager, Line 10 Westover Segment Replacement, Enbridge Pipelines Inc., Hamilton, Ontario
Currently managing the 5-year NEB Post-Construction Environmental Monitoring Program for the project. (ongoing).

Project Manager, Line 9 Pipeline Exposure Remediation Project, Enbridge Pipelines Inc., Burlington, Ontario
Managed environmental inspection services during construction of the Line 9 Pipeline Exposure Remediation Project, which involved installing a coffer dam in Bronte Creek, realigning the west bank of the creek, installing boulder riffle and river stone, and installing a live crib wall. Currently managing the Post-Construction Environmental Monitoring Program. (ongoing).

Project Manager, Line 10 Westover Segment Replacement, Enbridge Pipelines Inc., Hamilton, Ontario
Managed the delivery of the NEB Section 58 ESA application for a 35 km pipeline replacement. Included supporting an NEB oral hearing for the project. 2016 (completed).

Project Manager, Line 3 Replacement (Ex-Cromer), Enbridge Pipelines Inc., Cromer, Manitoba
Managed a team of approximately 10 rotating field staff in order to monitor the washing and disinfecting of pipeline construction equipment through an agricultural area that had tested positive for clubroot disease. Following a stop work order issued by the NEB, led a multidisciplinary team of environmental specialists who conducted field studies to support the development of a Work Plan to address reclamation deficiencies, which was subsequently accepted by the NEB and allowed work to continue on the project. Managed year 1 of the 5-year NEB Post-Construction Monitoring Program. 2016 (completed).

Project Manager, Regina Bypass, Enbridge Pipelines Inc., Regina, Saskatchewan
Managed the delivery of the NEB Notification to upgrade several pipelines that will be crossed by the Regina Bypass highway. Managed the compilation of Environmental Field Reports, Aquatic Habitat Protection Permits, Public Lands Checklists, Geotechnical Packages and Environmental Recommendations Summaries. 2016 (completed).

Project Delivery Lead/Assistant Project Manager, Line 3 Replacement Program, Enbridge Pipelines Inc., Alberta, Saskatchewan and Manitoba
Assisted in the delivery of the NEB Section 52 ESA application, supplemental ESAs and Information Requests. Managed ancillary developments including stockpile sites and shooflies. 2016 (completed).

PROVINCIALLY REGULATED PIPELINE PROJECTS

Project Manager, Archaeological Assessments for the Waterdown to Finch Project, Imperial Oil Limited, Hamilton to Toronto, Ontario
Currently managing the completion of Stage 2, Stage 3, and Stage 4 archaeological assessments in partnership with Timmins Martelle Heritage Consultants Inc. along 63 km of

pipeline right-of-way between Hamilton and Toronto. Project scope includes health and safety oversight of all archaeology field work, report review and coordination, and subcontracting as needed to support the archaeology program (ploughing, tree removal, drilling for deep fill soils). Negotiated and executed Field Liaison Representative and report review agreements with Mississaugas of the Credit First Nation, Haudenosaunee Development Institute, Six Nations of the Grand River Elected Council, and Huron-Wendat Nation. (ongoing).

Project Manager, NPS 20 Cherry to Bathurst Replacement, Enbridge Gas Inc., Toronto, Ontario
Managed the development of the Environmental Report (environmental and cumulative effects assessment) as part of the OEB LTC application for approximately 4.5 km of 20-inch natural gas pipeline. Included desktop and field environmental studies and a community engagement program. (completed).

Project Manager, Low-Carbon Energy Project, Enbridge Gas Inc., Markham, Ontario
Managed the development of the Environmental Report (environmental and cumulative effects assessment) as part of the OEB LTC application for approximately 7 km of natural gas pipeline and associated facilities required to blend hydrogen gas into Enbridge's existing natural gas network. Included desktop and field environmental studies and a community engagement program, which involved three public open house events. (completed).

Project Manager, St. Laurent Ottawa North Project (Phases 3 and 4), Enbridge Gas Inc., Ottawa, Ontario
Managed the development of the Environmental Report (environmental and cumulative effects assessment) as part of the OEB LTC application for approximately 13 km of natural gas main and distribution pipelines. Project traversed National Capital Commission Lands. Included desktop and field environmental studies and a community engagement program. (ongoing).

Project Manager, St. Laurent Project (Phase 2), Enbridge Gas Inc., Ottawa, Ontario
Managed the development of the Environmental Report (environmental and cumulative effects assessment) as part of the OEB LTC application for approximately 1.7 km of natural gas pipeline. Included desktop and field environmental studies and a community engagement program. (completed).

Project Manager, Kingsville Reinforcement Transmission Project, Enbridge Gas Inc., Kingsville, Ontario
Managed environmental inspection services during construction of approximately 20 km of natural gas pipeline. 2019 (completed).

Project Manager, Scugog Island Natural Gas Pipeline – Phase 2, Enbridge Gas Inc., Durham Region, Ontario
Managed the development of the environmental review for approximately 20 km of natural gas distribution pipeline. Included desktop and field environmental studies and an Indigenous engagement program with the Mississaugas of Scugog Island First Nation. (ongoing).

Project Manager, Scugog Island Natural Gas Pipeline, Enbridge Gas Inc., Durham Region, Ontario
Managed the development of the Environmental Report (environmental and cumulative effects assessment) as part of the OEB LTC application for approximately 7 km of small-inch natural gas pipeline. Included desktop and field environmental studies and a community

engagement program. Provided environmental inspection services during construction (completed).

Project Manager, Woodland Pipeline Extension, Enbridge Pipelines (Woodland) Inc., Northeastern Alberta
Managed the Post-Construction Reclamation Assessment (PCRA) along 218 km of pipeline right-of-way. 2016 (completed).

Project Manager, Athabasca Pipeline Twinning, Enbridge Pipelines (Athabasca) Inc., Northeastern Alberta
Managed multiple migratory bird nest survey crews along approximately 200 km of pipeline right-of-way during the final clean-up phase of construction and in support of contractor warranty work. 2016 (completed).

Project Manager; Cold Lake Foster Creek Mainline Loop; Inter Pipeline Ltd.; Northeastern Alberta
Managed environmental supporting studies and the compilation of the Environmental Field Reports (EFRs) and Conservation and Reclamation (C&R) application for 76 km of pipeline in northeastern Alberta. Managed environmental inspectors and environmental resource specialists during the clearing, construction and clean-up phases of pipeline construction. Managed the PCRA for the project. 2015 (completed).

Project Manager, Cold Lake Mainline South Loop, Inter Pipeline Ltd., Northeastern Alberta
Managed environmental supporting studies and compiled EFRs and the C&R application for 243 km of pipeline in northeastern Alberta. Conducted regulatory consultation with Alberta Environment and Sustainable Resource Development (AESRD), Fisheries and Oceans Canada (DFO) and Transport Canada. Managed environmental inspectors and environmental resource specialists during the clearing, construction and clean-up phases of pipeline construction. 2015 (completed).

Assistant Project Manager, CNR Kirby Connection; Inter Pipeline Ltd.; Northeastern Alberta
Managed environmental supporting studies and compiled EFRs for 56 km of pipeline in northeastern Alberta. Conducted regulatory consultation with AESRD, DFO and Transport Canada. Managed environmental inspectors and environmental resource specialists during the clearing, construction and clean-up phases of pipeline construction. 2014 (completed).

EMPLOYMENT HISTORY

DILLON CONSULTING LIMITED

2017 – Present Environmental Planner, Project Manager

CH2M HILL ENERGY CANADA, LTD.

2011 – 2017 Environmental Planner, Project Manager

N.T.YAP ENVIRONMENTAL SYSTEMS ANALYSTS

2009 – 2010 Environmental Consultant

THE UNIVERSITY OF GUELPH

2008 – 2009 Research Assistant

Merrilees Willemse, B.A., B.U.R.Pl., MCIP, RPP

ASSOCIATE
mwillemse@dillon.ca

PERSONAL PROFILE

Merrilees is an environmental planner with experience in environmental assessments and consultation programs throughout Ontario, focusing on transportation, energy and land development. She leads socio-economic studies, land use planning and consultation for environmental assessments and policy projects.

RELEVANT EXPERIENCE

CONSULTATION

Project Manager/Lead Facilitator, Official Plan Review - Transportation Policies, City of Toronto, Ontario

Led the public and stakeholder consultation for the City's five year Official Plan review of the transportation policies, focused on cycling, transit, shared mobility and automated vehicles. Specific works included designing, developing and delivering all consultation related meetings and reports to support City Planning. (ongoing).

Project Manager, Broadview Avenue Extension Environmental Assessment (EA) Phases 3 & 4, City of Toronto, Ontario

Led the Phase 3 and 4 EA planning and engineering services work for the extension of Broadview Avenue from Eastern Avenue to Lake Shore Boulevard East, the extension of a new east-west street in the Unilever Precinct from the Don Roadway to the future Bouchette Street extension, and for a new/reconfigured connection from Eastern Avenue to the Don Valley Parkway. Works included stakeholder and public consultation. (ongoing).

Consultation Manager and Planner, Official Plan Update, City of Barrie, Ontario

Lead the public and stakeholder consultation for the City's new Official Plan. Specific works included working collaboratively with the City's engagement and communications team, creating engagement strategy and design, and the development and delivery of consultation related meetings and reports. Events included interactive workshops, community round tables, walking tours and creative online engagement. (ongoing)

EDUCATION

Post-Grad. B.U.R.Pl., Urban and Regional Planning, Ryerson University, 2008

B.A. (Hons), Urban Economics and Social Geography, University of Toronto, 2005

REGISTRATIONS/LICENCES

Ontario Professional Planning Institute (Registered Professional Planner)

Canadian Institute of Planners (Member)

AFFILIATIONS/ASSOCIATIONS

Urban Land Institute (Member)

Women in Transportation (Toronto District Member)

Engagement Strategist, Danforth Planning and Complete Streets Study, City of Toronto, Ontario
Provided engagement for the planning, retail and complete streets integrated studies that the. Specific works included engagement plan preparation, Stakeholder Advisory Committee formation and facilitation, and public event planning and facilitation. (ongoing)

Project Manager/Lead Facilitator, Flood Awareness and Education Program, Toronto and Region Conservation Authority, Toronto, Ontario
Assisted the conservation authority with public engagement in areas of flood risk that exist throughout the TRCA watershed. Specific works included reviewing materials for public presentations and assisting in the development of education tools; assistance in event design; facilitation; reporting; and coordination of events with Fire Services, Regional and Local Municipalities. (ongoing).

Project Manager/Lead Facilitator, Five-Year Official Plan Review – Public Realm, City of Toronto, Ontario
Led the public and stakeholder consultation for the City's five year Official Plan review of the public realm and built form policies. Specific works included designing, developing and delivering all consultation related meetings and reports to support City Planning, and an online photo call activity to gather city-wide input on great public spaces and buildings in the city. 2019 (completed).

Facilitator, Broadview and Eastern Flood Protection Class EA Facilitation Services, Toronto and Region Conservation Authority, Toronto, Ontario
Planned and executed a consultation program in support of the Broadview Eastern Flood Protection Class EA. Included facilitation of a public open house and community liaison committee meetings. 2019 (completed).

EA Lead and Consultation Advisor, Fenelon Falls Second Crossing Environmental Assessment, City of Kawartha Lakes, Ontario
Undertook a municipal class EA to determine a solution to address traffic flow in Fenelon Falls related to crossing the Trent-Severn Waterway. The project included considering a new crossing, diverting traffic around the town, and/or improving the existing transportation network operations to address congestion concerns. Specific works included focus group meetings with local residents, businesses, Indigenous communities and agencies. The Trent-Severn Waterway is a national heritage system and is also governed by Parks Canada. (ongoing).

Project Manager, Eglinton East LRT Consultation and Communications Strategy, City of Toronto, Ontario
Undertook a community consultation and communications program to support the design and planning of the Eglinton East LRT project in Scarborough. Consultation included community members, businesses, residents, arts and culture organizations, landowners, utility companies, agencies, and various transit and Scarborough based stakeholder groups. The Eglinton East LRT will improve connections for more than 40,000 residents across three wards in Scarborough. 2018 (completed).

Stakeholder Consultation Lead, Unilever Precinct Planning Study, City of Toronto, Ontario
Assisted the City Planning Division and its Corporate Partners to develop and implement a public engagement and stakeholder consultation strategy and engagement process for the

Unilever Precinct Planning Study, including the consideration of First Gulf's East Harbour applications and the East Harbour SmartTrack Station. 2018 (completed).

Project Manager, The Bentway Municipal Class Environmental Assessment, Waterfront Toronto, Ontario
Completed a municipal class environmental assessment for a public space project underneath the Gardiner Expressway between Strachan Avenue and Spadina Avenue. Built around and under the concrete bones of the expressway, the project transformed the space into outdoor "rooms" including interactive public spaces, a multi-use trail, a grand staircase and performance space, other social gathering spaces and a new signature pedestrian and cycling bridge crossing of Fort York Boulevard. Specific works included project management of the multi-discipline team, consultation and issues management to help make this innovative public space a reality. 2017 (completed)

Planner, GO Hub and Transit Stations Study, Regional Municipality of Niagara, Ontario
Completed a study to prepare four Station Area Secondary Plans and Detailed Station Layouts for future GO Transit stations in Grimsby, Beamsville, St. Catherines, and Niagara Falls. The project included community, stakeholder and agency consultation, long-term planning (to 2041), land use, transit demand, urban design, built form, streetscaping, active transportation and station deign for the four station areas. 2016 (completed)

Consultation Manager, Post Construction Monitoring and Commitments Program, Enbridge Gas Distribution Inc., Greater Toronto Area (GTA), Ontario
Completed the planning and implementation of post construction monitoring along Segment A of the Enbridge GTA Project gas distribution pipeline in the City of Toronto. The project included meeting with residents who experienced impacts during construction and determining appropriate mitigation measures to compensate for damage or disruption. Included meetings and correspondence with residents, Councillors and construction teams. 2016 (completed)

Planner, Environmental Impact Assessment, Wartsila North America Inc., Acajutla, El Salvador
Completed an EIA for construction of an LNG marine terminal and power generation plant and a 50 km power transmission line to connect with the main transmission network within El Salvador. Included route identification/selection; socio-economic and biophysical data collection; social, cultural, physical and biological effects assessment; identification of risks to the project; preparation of an EMP; preparation of resettlement/community development action plans and extensive public consultation. Specific works included managing the report writing of the environmental impact assessment in accordance with IFC Performance Standards and the World Bank policies. 2015 (completed).

Consultation Coordinator and Planner, GTA Reinforcement Project, Enbridge Gas Distribution Inc., GTA, Ontario
Completed an environmental assessment for two segments of gas distribution pipeline in the GTA. This was the largest Enbridge Gas distribution pipeline project in the GTA in over 25 years. Consultation involved nine municipalities and included elected officials, residents, stakeholders, agencies and Indigenous communities. 2014 (completed)

Consultation Team Member, Comprehensive Planning Framework, Inspiration Port Credit, City of Mississauga, Ontario

Provided a comprehensive planning framework for the redevelopment of a former oil refinery. Also included a peer review of the master plan being developed as a parallel process for the Port Credit Harbour Marina. The project included the creation of a comprehensive urban design approach to the public and private realm of these lands and their relationship to the vibrant waterfront community. A unique public consultation method was used for collaboration on the vision of the sites. 2013 (completed).

Consultation Manager and Planner, Underground Pedestrian Tunnel Environmental Assessment, Toronto Port Authority, Ontario

Completed a federal EA screening for the implementation of a new pedestrian tunnel to the Billy Bishop Toronto City Airport at the foot of Eireann Quay of the city's waterfront. The proposed 8 m x 6 m tunnel is ~170 m in length and situated ~30 m belowground under the harbour's western channel. Carried out under Canadian Environmental Assessment Act (CEAA) requirements, this project included significant public and agency participation and the completion of a CEAA environmental screening. 2011 (completed).

Consultation Coordinator, Ridge Landfill Environmental Assessment, Progressive Waste Solutions, Blenheim, Ontario

Prepared the environmental assessment screening and Certificate of Approval amendment application for the increase in the fill rate to 1.3M t/year. Truck routing and associated impacts to the community were key considerations in this EA. Proposed specific mitigation measures to address the concerns of the local community in regards to this. 2011 (completed).

Consultation Manager, Greater Toronto Area Reinforcement Pipeline Environmental Assessment, Enbridge Gas Distribution Inc., Ontario

Provided environmental and socio-economic constraints and opportunities input for the installation of a reinforced natural gas supply line throughout the GTA. The project included several potential routes followed by additional work to ascertain the feasibility of installation with a marine environment and in northern areas of the GTA. Also provided environmental and due diligence support for the proposed pipeline route and potential alternatives. 2011 (completed).

LAND USE AND POLICY

Planner, Burlington Intensification Study, City of Burlington, Ontario

Prepared an intensification strategy and framework to be incorporated into the City's official plan. The program also included a scoped consultation program which included stakeholder workshops and Council workshops. 2016 (completed).

Planner, Development Options for Disposition of Surplus Properties, Town of Halton Hills, Ontario

Completed development recommendations for three key sites in Georgetown. Prepared a highest and best use study, several concept plans, a preferred concept recommendation and urban design guidelines. Also prepared a comprehensive development plan for the Civic Centre District in Georgetown. The project involved working with landowners and local stakeholders to determine a future development concept for the Civic Centre District that met the intensification and policy goals for the area. Specific works included preparing development concepts, testing density scenarios and preparing presentations for Council to recommend a

long-term vision for the area, and producing 3-D visualizations for the final concepts for two of the sites. 2015 (completed).

Planner, Cambridge to Milton Passenger Rail Feasibility Study, City of Cambridge, Ontario
Completed a business case and implementation strategy for providing passenger rail service between Cambridge and Milton and ultimately the Greater Toronto Area. 2015 (completed).

Planner, Nodes and Corridors Strategy, Regional Municipality of Niagara, Ontario
Conducted a study to provide a regional framework for nodes and corridors which supports transit and promotes compact mixed-use development in strategic locations. Completed a best practices analysis in physical and policy planning (examined PPS, Places to Grow and Greater Golden Horseshoe upper tier plans), analyzed the region's built form and socio-economic trends. The study was intended to provide the foundation for an amendment to the Regional Policy Plan. 2014 (completed).

Planner, Healthy Communities Policy, Municipality of Halton, Ontario
Reviewed existing policies and guiding documents for the Region (and local municipalities) to identify policy gaps in supporting healthy eating and physical activity. Analyzed planning documents for physical activity by reviewing the Region's Official Plan and those of local municipalities. 2014 (completed).

Planner, Brock Business Park Revitalization, City of Thorold, Ontario
Prepared a master plan to assist with the revitalization of the business park. The master plan involved a comprehensive assessment of land use, transportation, urban design and municipal infrastructure systems. Specific works included preparing design principles, completing a SWOT analysis of the existing land use, transportation, urban design and infrastructure of the business park and developing master plan concepts for public, stakeholder and Council review. 2013 (completed).

Planner, Regional Gateway Foundation Studies, Regional Municipality of Niagara, Ontario
Prepared an employment lands strategy for an area with over 400 parcels of land including 2,020 ha in five municipalities. Completed a comprehensive analysis and recommended strategy for economic and industrial development within the gateway. The strategy identifies six strategic locations for development and redevelopment and includes an implementation plan. Also prepared the Regional Official Plan Amendment. 2011 (completed).

Planner, Healthy and Sustainable Communities, City of St. Thomas, Ontario
Reviewed and assessed opportunities for incorporating best practices in sustainable development into the City's Official Plan. This project also included a scoped study of community gardens. Specific works included designing and conducting a workshop with all municipal department heads to determine what sustainability means to the City; auditing current policies and plans in relation to sustainability; and determining steps to update and implement sustainability goals and objectives. 2010 (completed).

Planner, City of Welland New Official Plan, Regional Municipality of Niagara, Ontario
Developed a new official (special) plan under two phases. The first phase focused on background research and analysis with the identification of policy issues and opportunities and constraints. The second phase included the preparation of the new OP policies. 2010 (completed).

Planner, West Don Lands Underpass Park and Public Realm Project, Waterfront Toronto, Ontario

Completed a CEAA Screening to receive federal funding for a public park and public realm improvement project in the West Don Lands redevelopment area under and adjacent to the Adelaide-Richmond-Eastern Avenue ramps and overpasses. Specific works included overseeing the project, preparing all draft and final reports, coordinating with city staff and urban designers to determine construction and operation plans and impacts on the surrounding area. 2009 (completed).

Planner, Integrated Community Sustainability Plan, City of Saint John, New Brunswick

Completed an ICSP to consolidate plans and policies for the city into a comprehensive vision and priority set for future action and planning. Specific works included planning, delivery and documentation of consultation activities for a city staff and political leaders workshop involving an interactive two-day session and included a conversation café, dotmocracy, round table presentations and prioritization matrix. 2008 (completed).

Transportation Planner, Urban Boundary Expansion Scenarios, City of Ottawa, Ontario

Evaluated alternative development scenarios for the growth of the city. The project evaluated the impacts on the proposed 2031 transportation system of the addition of 100,000 people to Ottawa's population beyond the horizon of the current official plan, assuming six different geographic distribution options. The project assessed the resulting screenline capacity deficiencies and identified capital projects required to provide the target level of service for each development scenario. 2008 (completed).

Planner, King Edward Avenue Study, City of Ottawa, Ontario

Investigated the possibility of reducing King Edward Avenue from six to four lanes. The second part of the study involved the creation of three lane reduction options through consensus-based dialogue including agreeing on what evaluation criteria would be used to select the preferred option; the options varied in terms of sidewalk widths, overall north/south lane configuration, specific acceleration/deceleration lanes and intersection design, and on-street parking. 2008 (completed).

ENVIRONMENTAL ASSESSMENT/REVIEW

Planner and Project Coordinator, Gardiner Expressway and Lake Shore Boulevard East Individual Environmental Assessment and Urban Design Study, Waterfront Toronto and City of Toronto, Ontario

Undertook a major individual Environmental Assessment (EA) and urban design study to determine the future of the eastern portion of the Gardiner Expressway and Lake Shore Boulevard east of Lower Jarvis Street. The project studied improving connections throughout the city through modifications to this corridor and enhancing the quality of life in the study area. Specific works included managing project deliverables, coordinating all input from the multi-disciplinary project team; working with the client team to track issues related to project progress and prepare materials to address stakeholder, public, agency and technical advisory questions. 2016 (completed).

Lead Planner, Runway Rehabilitation Environmental Review, Winnipeg Airport Authority, Manitoba

Conducted environmental baseline updates for the Impacted and Contaminated Areas Site Plan (drawing) of the Winnipeg James Armstrong Richardson International Airport (YWG)

property. Project involved working with Winnipeg Airport Authority to clarify the CEAA 2012 environmental review requirements and develop a standard form for assessing environmental impacts. 2014 (completed).

TRANSPORTATION

Planner, Port Lands and South of Eastern Transportation and Servicing Master Plan, City of Toronto, Ontario

Completed a TSMP for the Port Lands and south of Eastern area, in an integrated planning process with the City, in accordance with Municipal Class EA requirements. The plan identified streets, transit, watermains and sewers necessary to support revitalization in the Port Lands and continue economic growth in the area while applying sustainability principles. The project integrated innovative stormwater systems and a network of complete streets prioritizing transit and active transportation. 2016 (completed).

AIRPORTS

Planner, Noise Barriers Environmental Screening, Toronto Port Authority, Ontario

Conducted an environmental assessment for proposed acoustic barriers and engine run-up enclosure at the Billy Bishop Toronto City Airport. 2012 (completed).

ENERGY

Socio-Economic Planner, Ruhudji Power Project, Sithe Global Power LLP, Tanzania

Completed an environmental and social impact assessment for this 380 MW hydropower 100 km transmission line project. 2013 (completed).

EMPLOYMENT HISTORY

DILLON CONSULTING LIMITED

2008 – Present Planner, Associate

HEMSON CONSULTING LIMITED

2007 – 2008 Planning Assistant and Researcher

CANADIAN URBAN INSTITUTE

2006 – 2007 Research Assistant (Intern)

PROFESSIONAL DEVELOPMENT

Smart Cities Conference, Toronto, March 2014

Winner of the Urban Ideas Competition for a Waterfront Vision for Toronto, Urban Land Institute, 2014

MOVE! Transportation Charrette, Evergreen and The Institute without Boundaries, Nov 2011-May 2012 – Charrette Team Member

Transforming and Revitalizing Downtowns Summit, June 2010

Complete Streets Forum, April 2010

Dialectics of Planning, Ryerson University, February 2008

J.L. Beaton Planning Award, Ryerson University, 2008

Ryerson Planning Alumni Award, 2008

Rising Gap between the Rich and the Poor, March 2007

Toronto City Summit, February 2007
International Study, University of Queensland, 2004

Alissa Lee, MES, MLIS

ENVIRONMENTAL PLANNER

alee@dillon.ca

PERSONAL PROFILE

Alissa is an environmental planner with 7 years of experience in the oil and gas industry with expertise in project coordination, regulatory compliance, environmental and socio-economic impact assessment, and environmental mitigation planning.

RELEVANT EXPERIENCE

ONTARIO OIL AND GAS PROJECTS

Coordinator/EA Lead, Sparks Street Replacement Project, Enbridge Gas Inc., Ottawa, Ontario
Coordinated and led the development of the Environmental Report and a virtual Stakeholder Consultation Program for a Leave-to-Construct Application to the Ontario Energy Board to replace approximately 1 km of vital natural gas pipeline in downtown Ottawa. (ongoing).

Coordinator, Archaeology Services for the Waterdown to Finch Project, UPI Projects Canada Ltd., Ontario
Tracked and logged Indigenous consultation, reviewed archaeological reports, provided oversight of field staff when Project Manager was unavailable, and assisted with project management tasks (e.g., sub-contractor agreements, change orders). (ongoing).

Coordinator/EA Lead, St. Laurent Ottawa North Replacement Pipeline Project, Enbridge Gas Inc., Ottawa, Ontario
Coordinated and led the development of the Environmental Report and Stakeholder Consultation Program for a Leave-to-Construct Application to the Ontario Energy Board to replace approximately 13 km of natural gas pipeline in Ottawa. (ongoing).

Coordinator/EA Lead, NPS 20 Replacement Cherry to Bathurst, Enbridge Gas Inc., Toronto, Ontario
Coordinated and led the development of the Environmental Report and Stakeholder Consultation Program for a Leave-to-Construct Application to the Ontario Energy Board to replace a segment of natural gas pipeline in downtown Toronto. (ongoing).

Planner, Power2Gas Hydrogen Blending, Enbridge Gas Inc., Markham, Ontario
Conducted an Environmental Assessment Report in accordance with "Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario". Specific works included assisting with organizing new/unlogged correspondence in the project email inbox and updating consultation logs for the Stakeholder Consultation and

EDUCATION

MLIS, Library and Information Science, University of Western Ontario, 2012

MES, Environment and Sustainability, University of Western Ontario, 2011

BES, Environmental Studies, University of Windsor, 2010

CERTIFICATIONS

Institute of Asset Management (Certificate of Asset Management)

Engagement Program Update. Produced multiple Addendums and an Amendment to the Environmental Report. (completed).

FEDERALLY-REGULATED OIL AND GAS PROJECTS

Coordinator/EA Lead, Line 21 KP 158 Planned Maintenance Project near Little Smith Creek, Enbridge Pipelines (NW) Inc., Northwest Territories

Coordinated and led the development of supporting documentation for the client's application to the Sahtú Land and Water Board (SLWB) to replace a segment of the existing Line 21 pipeline near Little Smith Creek in the Northwest Territories. Supporting documentation was developed in accordance with SLWB guidelines included an Environmental and Socio-Economic Assessment, Spill Contingency Plan, Waste Management Plan, and Closure and Reclamation Plan. Provided support for permitting, regulatory review, and information requests. (ongoing).

QA/QC Technical Reviewer, Environmental Clearance Notifications, Enbridge Pipelines Inc., Alberta, Saskatchewan, and Manitoba

Responsible for QA/QC review of environmental clearances for integrity dig construction. Writing and reviewing environmental clearances requires desktop review and analysis of available information for a site, pulling from various client and web-based sources, and requires attention to detail, as well as a solid understanding of pipeline construction and environmental mitigation measures. (completed).

ESA Coordinator and Lead Assessment Writer, Line 1 Connectivity Project, Enbridge Pipelines Inc., Municipality of Rhineland, Manitoba

Responsible for writing the OAS documents (i.e., National Energy Board [NEB] interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 58 Application to construct various components within the Gretna Terminal and at a location 8 km upstream of the Gretna Terminal to bring Line 93 in Canada into production and mitigate the delay of Line 93 construction in the United States. (completed).

Lead Assessment Writer, Alberta Montana Meter Station Modification Project, NOVA Gas Transmission Ltd., Cardston County, Alberta

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 58 Application to construct and operate a new meter station and Section 45.1 of the NEB Onshore Pipeline Regulations to decommission an existing meter station at the same location. (completed).

Lead Assessment Writer, Sunchild Receipt Meter Station Project, NOVA Gas Transmission Ltd., Clearwater County, Alberta

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 58 Application to construct and operate a new meter station. (completed).

Contributing Writer, Trans Mountain Expansion Project Environmental and Socio-Economic Assessment Addendums, Trans Mountain Pipeline ULC, Edmonton, Alberta to Burnaby, British Columbia

Contributor to the Environmental and Socio-Economic Assessment Addendums for extra temporary workspace and infrastructure in various construction spreads. Responsibilities included review of maps and existing literature to determine environmental and socio-economic settings, coordinating metrics from GIS, and assessing whether proposed works result in a change to the assessment conclusions of the original Environmental and Socio-Economic Assessment and related filings submitted to the NEB for the Project. (completed).

Lead Assessment Writer, Copton Creek Receipt Meter Station Expansion Project, NOVA Gas Transmission Ltd., Northwestern Alberta

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 58 Application to expand an existing meter station and construct a new permanent access road within provincial caribou range. (completed).

Lead Assessment Writer, Clark Lake South Receipt Meter Station Project, NOVA Gas Transmission Ltd., Northwestern Alberta

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 58 Application to construct and operate a new meter station. (completed).

Lead Assessment Writer, 2018 Meter Station and Lateral Abandonment Project, NOVA Gas Transmission Ltd., Alberta and Saskatchewan

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 74 Application for abandonment of 15 meter stations and 19 associated lateral pipeline segments, 3 stand-alone meter stations, and 4 stand-alone lateral pipelines. (completed).

Lead Assessment Writer, Coquihalla River Crossing No. 15 Pipe Replacement Project, Trans Mountain Pipeline ULC, Hope, British Columbia

Responsible for writing the Environmental and Socio-Economic Assessment for the construction and operation of a new segment of replacement pipeline pursuant to Section 58 of the NEB Act and the decommissioning in-place of the corresponding existing pipeline segment pursuant to Section 45.1 of the NEB Onshore Pipeline Regulations. (completed).

Contributing Writer, Line 5 St. Clair River Horizontal Directional Drill Replacement Project, Enbridge Pipelines Inc., Sarnia, Ontario

Contributor to Enbridge's application pursuant to Section 58 of the NEB Act and Section 45.1 of the NEB Onshore Pipeline Regulations to construct and operate a replacement pipeline and for approval to decommission in place the corresponding segment of the existing pipeline. Responsibilities include input into various parts of the Environmental and Socio-Economic Assessment. (completed).

Contributing Writer, Line 10 Westover Segment Replacement Project, Enbridge Pipelines Inc., Hamilton, Ontario

Contributed to Enbridge's application pursuant to Section 58 of the NEB Act and Section 45.1 of the NEB Onshore Pipeline Regulations to construct and operate a replacement pipeline (Line 10 Westover Segment Replacement pipeline) and for approval to decommission in-place the corresponding segment of the existing Enbridge Line 10 pipeline. Responsibilities included input into various parts of the Environmental and Socio-Economic Assessment such as authoring the assessment of Accidents and Malfunctions, contributing to the writing and assessment of other environmental and socio-economic elements, assisting with the coordination of discipline inputs, and overall QA/QC. (completed).

Lead Assessment Writer, Burnt River Receipt Meter Station Replacement Project, NOVA Gas Transmission Ltd., Northwestern Alberta

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 58 Application to construct and operate a new meter station on an existing facility site. (completed).

Lead Assessment Writer, Clean Oil Pipeline Deactivations Project, Enbridge Pipelines (Westspur) Inc., Southeastern Saskatchewan

Responsible for writing the Environmental and Socio-Economic Assessment for an application pursuant to Section 44 of the NEB Onshore Pipeline Regulations to deactivate approximately 788.5 m of the AL08-3 pipeline located from 7 31-5-33 WPM to 12-32-5-33 WPM as well as approximately 940.6 m of the IG-03 pipeline located from 4-36-4-32 WPM to 9-26-4-32 WPM. (completed).

Lead Assessment Writer; 2015 Meter Station and Lateral Abandonment Project; NOVA Gas Transmission Ltd., Alberta

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 74 Application for abandonment of 18 meter stations and 17 associated lateral pipeline segments, as well as 1 stand-alone lateral pipeline. (completed).

Lead Assessment Writer, Gold Creek South Receipt Meter Station Project, NOVA Gas Transmission Ltd., Northwestern Alberta

Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessment for the NEB Section 58 Application to construct and operate a new meter station. (completed).

Contributing Writer, Vantage Expansion Project - Pump Station Additions, Pembina Prairie Facilities Limited, Southern Saskatchewan

Assisted with writing the Environmental and Socio-Economic Assessments for the NEB Section 58 Applications for the construction and operation of three proposed pump stations located along the Vantage pipeline right-of-way in Saskatchewan. Implemented edits from client and senior review and ensured consistency across the three pump station assessments. (completed).

Lead Assessment Writer, Elk River Divestitures and Brazeau Area Divestitures, NOVA Gas Transmission Ltd., Alberta
Responsible for writing the OAS documents (i.e., NEB interactions table, environmental self-assessment and environmental assessment summary) as well as the Environmental and Socio-Economic Assessments for the NEB Section 58 Applications. (completed).

Contributing Writer, Line 3 Replacement Program, Enbridge Pipelines Inc., Alberta, Saskatchewan, and Manitoba
Responsible for writing the settings and environmental assessment for the soils section of the Environmental and Socio-Economic Assessment for the NEB Section 52 Application. Coordinated and compiled all report references and coordinated and ensured consistency and quality of GIS figures. (completed).

Environmental Planner, Trans Mountain Expansion Project, Trans Mountain Pipeline ULC, Edmonton, Alberta to Burnaby, British Columbia
Assisted with reference checking and consistency checking the Environmental and Socio-Economic Assessment and technical reports for the NEB Section 52 Application. Assisted with land use plan summaries and incorporating soil unit information into the soils assessment of the Environmental and Socio-Economic Assessment. Assisted the Aboriginal Engagement department with Traditional Land Use study reports. (completed).

BRITISH COLUMBIA PROVINCIALLY-REGULATED PROJECTS

Contributing Writer, Tervita Silverberry Landfill Amendment Application Project, Tervita Corporation, Northern British Columbia
Responsible for assisting with the writing and coordination of the British Columbia Environmental Assessment Office (BC EAO) Environmental Assessment Certificate Amendment Application, including other pre-application regulatory documents (e.g., Amendment Application Information Requirements and Valued Components Selection), for the Silverberry Secure Landfill located approximately 50 km northwest of Fort St. John, BC. (completed).

Lead Writer and Coordinator, Aurora LNG Pipeline Environmental Constraints and Issues Review, Aurora LNG Limited, Northern British Columbia
Responsible for writing and coordinating a report for Aurora LNG reviewing multiple proposed pipeline corridors to ship gas from northeastern BC to the Prince Rupert area on the northwest coast. Interpreted GIS derived metrics in order to determine the potential environmental constraints along each potential route option. (completed).

Contributing Writer and Coordinator, Two Applications to Amend Environmental Assessment Certificate No. E14 03, Coastal GasLink Pipeline Limited, Northern British Columbia
Responsible for assisting with writing and coordinating two applications to the BC EAO to amend the Environmental Assessment Certificate for the Coastal GasLink Pipeline Project. (completed).

Lead Assessment Writer and Assistant Application Coordinator, Eagle Mountain – Woodfibre Gas Pipeline Project, FortisBC Energy Inc., Lower Mainland, British Columbia
Supported coordination of the BC EAO Environmental Assessment Certificate Application for the construction and operation an approximately 48 km gas pipeline and associated facilities. Responsible for writing, assessing, and incorporating client and sub consultant information into

key sections of the Application as well as reviewing reports from Jacobs disciplines and sub-consultants and ensuring consistency throughout the Application. (completed).

ASSET MANAGEMENT PROJECTS

Contributing Writer, Asset Management Current State and Roadmap, Ontario Power Generation, Toronto, Ontario

Responsibilities included compiling information from the client (policies, strategies, business plans) into a cohesive report outlining current state of asset management at the corporation and the future desired state, as well as manipulating data from workshops to create tables and charts presenting asset management maturity. (completed).

Writer, Asset Management Strategy, City of Airdrie, Alberta

Responsibilities included working with Airdrie to draft an Asset Management Strategy as part of their participation in the Federation of Canadian Municipalities' Leadership in Asset Management Program, using existing corporate strategic documents and information gleaned from meetings/workshops. (completed).

Writer, Infrastructure Strategy, City of Edmonton, Alberta

Responsibilities included reviewing and pulling together information from various sources to refresh the City's Infrastructure Strategy, as part of their participation in the Federation of Canadian Municipalities' Leadership in Asset Management Program, with a specific emphasis on tying-in the concept of sustainability. (completed).

Data Analyst/Writer, Asset Management Plan (AMP) and Strategic Asset Management Plan (SAMP), Town of Oakville, Ontario

Responsibilities for the development of the Town's AMP included analyzing and interpreting data from the Town on various asset types, using Excel to manipulate data and create charts, as well as writing up the results of the data analysis. Responsibilities for the development of the Town's SAMP included reviewing and pulling together information on the Town's corporate strategic documents and developing a roadmap graphic depicting the long, medium, and short-term initiatives for the Town's asset management program. (completed).

Data Analyst/Writer, Corporate and Departmental Asset Management Plans, City of Winnipeg, Manitoba

The project consisted of providing a series of asset management plans and a workable framework that managers and staff can use to achieve strategic and tactical goals within the City. Responsibilities included analyzing and interpreting data from the City on various asset types, using Excel to manipulate data and create charts, as well as writing up the results of the data analysis for reports. (completed).

Contributing Writer, Facility and Land Business Framework, Sustainment Plan, City of Calgary Corporate Properties and Buildings, Calgary, Alberta

Conducted a literature review of resources from facility management associations and institutions related to condition and performance assessment of buildings and properties. Assisted with a Technical Memo and presentation on the differences between MasterFormat and UniFormat building hierarchies. (completed).

EMPLOYMENT HISTORY

DILLON CONSULTING LIMITED

2019 – Present Environmental Planner

JACOBS formerly **CH2M HILL ENERGY CANADA LIMITED** formerly TERA ENVIRONMENTAL CONSULTANTS

2013 – 2019 Environmental Planner

UNIVERSITY OF WESTERN ONTARIO, ARCHIVES AND RESEARCH COLLECTIONS CENTRE

2012 Archives Assistant

PROFESSIONAL DEVELOPMENT

- Environmental Management Systems (ISO 14001:2015), BSI Group Canada – an Exemplar Global certified training provider, Calgary, AB, January 2016
- Management Systems Auditing, BSI Group Canada – an Exemplar Global certified training provider, Calgary, AB, January 2016
- Leading Management Systems Audit Teams, BSI Group Canada – an Exemplar Global certified training provider, Calgary, AB, January 2016
- Banff/2015 Pipeline Workshop: Building Trust, ASME and Calgary Chapter of OMAE, Banff, AB, April 2015
- Intro to the Canadian Environmental Assessment Act, 2012, Canadian Environmental Assessment Agency, Calgary, AB, June 2014
- Environmental Legislation and Certification Workshop, University of Western Ontario, London, ON, January 2011
- Geographic Information Systems (GIS) Workshop, University of Western Ontario, London, ON, September 2010
- Understanding Leadership Workshops, University of Western Ontario, London, ON:
- Foundational Leadership Skills, September 2010
- Facilitating Teams and Managing Conflict, January 2011
- The Natural Step Level One Certification - Sustainability for Leaders, University of Western Ontario, London, ON, November 2010
- International Joint Commission's Biennial Meeting on the Great Lakes Water Quality Agreement, Windsor, ON, October 2009

Resumé BRAD NOVECOSKY

Education

MA Department of Archaeology and Anthropology, University of Saskatchewan, Saskatoon, Saskatchewan, 2002

BA Department of Archaeology and Anthropology (High Honours), University of Saskatchewan, Saskatoon, Saskatchewan, 1998

Professional Affiliations

Board of Director for Prairie Chapter of the International Association of Public Participation (IAP2)

Golder Associates Ltd. – Saskatoon

Associate, Community Engagement Specialist, Bioscience Division Manager, Senior Archaeologist

Brad Novecosky is a Principal, project director and Enbridge client relationship manager with over 20 years of environmental consulting experience overseeing multi-disciplinary teams for environmental programs in the mining infrastructure, oil and gas, power, forestry, telecommunications, and transportation sectors. In addition, Brad has extensive experience with Indigenous and community engagement activities for a number of projects. Brad is the client account leader for Enbridge withing Golder's client program and is currently the project director on several Enbridge projects including the Line 3 Replacement Project in western Canada.

Employment History

Golder Associates Ltd. – Saskatchewan

Principal, Senior Archaeologist/Community and Aboriginal Engagement Specialist (2001 - Present)

Brad is an Associate, community engagement specialist, Bioscience Division Manager, and Senior Archaeologist at Golder Associates Ltd.'s Saskatoon office. Extensive experience in various large and small-scale heritage resources impact assessments and mitigation projects throughout northern western Canada as well as the United States. Brad has completed extensive Aboriginal and community engagement projects for various clients throughout Saskatchewan.

FMA Consultants – Saskatchewan

Archaeologist (2001)

Western Heritage Services – Saskatchewan

Archaeologist (1997 to 2000)

SELECT RELEVANT PROJECT EXPERIENCE

Enbridge
Saskatchewan/Manitoba

Project director for environmental construction monitoring for the Canadian portion of the Line 3 Replacement Program pipeline route. The scope of work includes supporting wildlife surveys, aquatics monitoring of watercourse crossings, wetlands delineation, soils and terrain monitoring, archaeological monitoring and vegetation monitoring for rare plants and weeds. Golder also provided support for biosecurity program. Our technical work was supported by the successful implementation of a socio-economic plan (SEP) where Golder was able to hire and train Indigenous participants from 5 communities.

Enbridge
Ontario

Involved as part of the executive steering committee of the Tract 73, Line 10 Archaeology project which was brought in to work along with senior Enbridge environmental managers to execute on the final stages of the ongoing archaeological mitigation activities at the site. The project is one of the largest hand excavations in the history of Ontario and involved significant interaction with local Indigenous communities.

Resumé BRAD NOVECOSKY

TransCanada (Nova Gas) Alberta	Project director and senior support for numerous pipeline and meter station projects that require regulatory submission to the Nation Energy Board (s.58). Worked with a multidisciplinary environmental team and an environmental permitting specialist to conduct baseline studies, prepare an ESA, EPP, Interactions Table and answer any Information Requests from the regulators.
SaskEnergy/TransGas Saskatchewan	Project director for comprehensive environmental assessment, construction monitoring, regulatory support (both provincial and federal), archaeological assessments and engagement for projects across Saskatchewan.
Canadian Natural Resources Ltd. Western Canada	Project director for a large program providing comprehensive services for environmental assessments, permits, approvals, construction monitoring, and archaeological assessments for hundreds of well pad, battery and flowline developments in western Canada.
SaskTel Saskatchewan	Project director for comprehensive environmental assessment, construction monitoring and regulatory services for SaskTel. Since 2014, Golder has completed approximately 500 projects for SaskTel including environmental screenings, regulatory and permitting submissions as well as archaeological assessments.
SaskPower Saskatchewan	Provided comprehensive environmental assessment, construction monitoring, regulatory support, archaeological assessments and engagement for transmission line, hydroelectric power, and renewable projects across Saskatchewan. We have 15 years of environmental experience with SaskPower.
Canadian National Railway & Canadian Pacific Railway Western Canada	Project director for a program of environmental screenings, field assessments and monitoring projects in Western Canada in support of rail maintenance, sidings and new projects including new 2 large bridge replacements, fish compensation plans, landslide remediation and reclamation project.
5530 Nunavut Inc. Nunavut	Archaeological Overview Assessment (AOA) at the Meadowbank Precious Metal Property near Baker Lake, NU.
Agnico Eagle Mines Nunavut	Baseline and Environmental Impact Statement for proposed Meliadine Gold project. Ongoing assessment and mitigation as required during the construction phase of the project.
Apex Geosciences Nunavut	Heritage Resources Overview for the Muskox Project, Nunavut.
AREVA Resources Canada Inc. Saskatchewan/Nunavut	Heritage resources impact assessment in the vicinity of AREVA's Midwest Project and McClean Lake Operation in northern Saskatchewan and on the Kiggavik/Sissons project in Nunavut.
Aurora Geosciences Northwest Territories	Heritage Resources Impact Assessment at the Kennady North Diamond project in Northwest Territories.
Aura Silver Nunavut	Heritage resources impact assessment at the Greyhound Lake property in Nunavut.
BNT Gold Resources Ltd. Northwest Territories	Archaeological Overview Assessment (AOA) at the Fox Lake Property for BNT Gold's exploration program.
Cameco Corporation Saskatchewan/Nunavut	Heritage resources impact assessment at the Rabbit Lake mine in northern Saskatchewan and at the Turquavik Project in Nunavut.

Resumé BRAD NOVECOSKY

Claude Resources Saskatchewan	Heritage resources impact assessment of proposed portal locations and access road at the SeeBee Gold Mine in northern Saskatchewan.
De Beers Exploration Saskatchewan	Heritage resources impact assessment of numerous kimberlite bodies and drill ponds in the Fort a la Corne Provincial Forest.
Denison Mines Corporation Saskatchewan	Heritage resources baseline survey at the Wheeler River uranium project in northern Saskatchewan.
Deze Energy Northwest Territories	Heritage resources impact assessment on proposed 700 km powerline from Twin Gorges to Diavik, Ekati, and De Beers diamond projects.
Dominion Diamond Northwest Territories	Heritage Resource Impact Assessment for proposed diamond project in Northwest Territories.
Dunnedin Ventures Inc. Nunavut	Heritage Resource Impact Assessment in support of proposed exploration activities at the Kahuna project, Nunavut.
Fission Energy Corporation Saskatchewan	Heritage resources impact assessment of Waterbury Lake Property on North McMahon Lake and South McMahon Lake in northern Saskatchewan.
Federal Department of Public Works Nunavut	DEW Line heritage resources impact assessment at James Bay and Victoria Island, Nunavut.
Great West Diamonds Saskatchewan	Heritage resources impact assessment at their Candle Lake property.
Great Western Minerals Group Saskatchewan	Heritage resources impact assessment and exploration area at Hoidas Lake and associated winter road to Uranium City.
IronOne Inc. Nunavut	Heritage resources impact assessment at the Maguse River Project in Nunavut.
NOR-EX Engineering Northwest Territories	Heritage resources impact assessment of the Tibbit to Contwoyto winter road, improvements at Portage 25 and 48A.
NorthQuest Ltd. Nunavut	Heritage resources impact assessment at the Pistol Bay Project in Nunavut.
Prosperity Goldfields Corp. Nunavut	Heritage resources impact assessment at the Kiyuk Lake Project in Nunavut.
Sabina Gold & Silver Corp. Nunavut	Archaeological site mitigation program for the Back River Project near the south end of Bathurst Inlet and near Goose Lake, Nunavut.
Saskatchewan Research Council Saskatchewan	Environmental monitoring program to support reclamation and remediation activities at the former Gunnar mine site in northern Saskatchewan.

Shore Gold Inc. Saskatchewan	Numerous heritage resources impact assessment at the Fort a la Corne Provincial Forest.
TerraX Minerals Inc. Northwest Territories	Heritage resources impact assessment for exploration activities at the Yellowknife City Gold Project in the Northwest Territories.
UEX Corporation Saskatchewan	Heritage resources impact assessment at the Hidden Bay and Raven properties in northern Saskatchewan.
UR Energy Inc. Northwest Territories/ Nunavut	Heritage sensitivity screening study at Screech Lake, Northwest Territories. Heritage resource impact assessment at the Bugs Project in Nunavut.

Resumé KEVIN SEEL

Education

Ph.D. GIS Modelling, University of Calgary, Calgary, 2005

Post Graduate Fellowship, Oak Ridge Institute of Science and Engineering, Tennessee, 1994

M.Sc./B.Sc. GIS Modelling / Biogeography, University of Calgary, Calgary, 1992

Languages

English – Fluent

Golder Associates Ltd. – Calgary

Senior Consultant

Kevin Seel has 26 years of environmental and business consulting experience helping clients find the best strategy for locating and developing their assets in a way that incorporates key social, environmental, economic and technical considerations. Specializing in linear infrastructure routing, and the siting of industrial facilities, he has applied these skills in a wide variety of industries including oil and gas, electricity, manufacturing, transportation, mining and retail. Kevin's contributions were recently recognized by the Consulting Engineers of Alberta as the recipient of the 2017 Award for Excellence in Innovation in decision support. He is a trained facilitator and project manager and is frequently invited to conferences as a presenter and moderator.

Employment History

Golder Associates Ltd. – Calgary Office
Senior Consultant (2013 to Present)

Focused on architecting and facilitating decision support solutions, with a technical specialization in linear infrastructure routing, and facility siting using multicriteria GIS optimization techniques. Kevin is a project manager, facilitator and senior advisor for an international team of decision modelling professionals, and the key contact for the routing and siting practice in North America.

Avalanche Canada – Revelstoke, BC
President (2012 to Present)

Kevin is the current, serving President, and Chair of the Board of Directors for Avalanche Canada, formerly the Canadian Avalanche Centre. Avalanche Canada is a national, $2M/yr., not-for-profit organization responsible for public avalanche safety, and the coordination of various federal and provincial agencies in the delivery of avalanche public safety information and programs across Canada. Kevin previously served as the Secretary and Treasurer until May, 2013 when he was elected to his current role.

UTR Inc. – Calgary, AB
Vice President of Operations (2005 to 2012)

Accountable for all operations from strategy development to execution including full-cycle product development, manufacturing, procurement, logistics (ocean, rail, TL/LTL), customs and distribution. Operations included oversight and coordination of two contract manufacturing facilities (China and Germany), several freight forwarders and two warehouses (Toronto and Fort Worth).

Encognis Inc. – Calgary, AB
Principal (2004)

Led engagements focusing on energy strategy, business transformation and governance. Facilitated several workshops and training seminars for executives and board members. Concluded a major research project on the effects of market pricing signals on potential "boom-and-bust" cycles of power plant

construction in the Alberta Interconnected Electrical System.

The Design Group – Calgary, AB
National Quality Manager (2002 to 2004)

In charge of operating an ISO 9001:2000 certified Quality and Continuous Improvement Program and Project Management Office for Canada's largest technical recruiting firm. Managed, executed and implemented corporate reengineering projects to reduce cost and improve order fulfilment rates, customer satisfaction and loyalty.

Arthur Andersen LLP – Calgary, AB
Manager, Business Consulting (1999 to 2002)

Local business strategy practice leader. Project manager for primarily energy strategy engagements. Key account manager for two of the firm's largest local clients.

Golder Associates Ltd. – Calgary Office
Senior Scientist (1992 to 1999)

Responsible for establishing and building Golder's geomatics capability for the Calgary office. Hired and supervised a team of geomatics professionals. Contributed to a number of environmental impact assessment and cumulative effects assessment projects related primarily to energy developments in western Canada.

SELECT RELEVANT PROJECT EXPERIENCE

Gas Pipeline Routing Project
Ontario, Canada

Project manager and technical lead on a confidential study to identify potential routes for a high-pressure gas pipeline through the entertainment district in downtown Toronto. The study used the GoldSET process and suite of modelling tools to successfully identify 5 potentially feasible corridors through a highly constrained and complex urban area. The results of the study will be used in further public consultation and the completion of an Environmental Assessment under the Ontario Energy Board.

Gas Pipeline Routing Project
British Columbia, Canada

Project director and technical lead on a pipeline routing project using GoldSET for a proposed 230 km high-pressure natural gas pipeline in north east BC. The project successfully modelled 4 different corridor route options through a socially and environmentally challenging area. The project deliverables were used in the early engagement of local Indigenous communities to gain additional input and feedback on the proposed routes to aid in the decision-making process.

Nexen Aurora LNG Pipeline Routing
British Columbia, Canada

Technical lead for Nexen's proposed Aurora midstream project to determine highest suitability routing corridors for a 500 km long natural gas pipeline running from northeast BC to tidewater, and connecting through several gas processing facilities. The approach involved the simulation of over 50,000 km of potential pipeline corridors based on 89 different routing criteria. The study successfully resulted in the selection of multiple options which were both feasible from an engineering, economic and regulatory perspective as well as lowest-impact with respect to sensitive environmental and social considerations.

Optimization of Upstream Unconventional Gathering System
Alberta, Canada

Project manager and technical lead on a confidential study to locate optimum sites for well pads, multiphase gathering pipelines and centralized gathering stations for a new play in the Willesden-Green Duvernay in central Alberta.

Optimization of Upstream Unconventional Facility Development and Planning
British Columbia, Canada

Project manager and technical lead on a confidential study to assist a client in the early phase of development planning of its unconventional assets in the Horn River Basin of northeastern British Columbia. The development involved modelling the optimal location of planned well pads and compressor stations, as well as the network of interconnected pipelines (including high pressure gas, fuel, source and disposal water) while avoiding or minimizing proximity to sensitive environmental and social factors such as critical caribou habitat. Pipeline routing also included a consideration of multi-phase flow in the routing using Golder's proprietary spatial hydraulic model. The study resulted in $50M of potential CAPEX savings.

Pipeline Route Suitability Benchmarking & Risk Analysis
Alberta, Canada

Project manager and technical lead for a confidential study to evaluate the potential risks and constraints of various routes for a 300 km replacement for a retiring petroleum products pipeline. The routes were subsequently evaluated by a team of Subject Matter Experts to determine the level of environmental, social, technical and regulatory risk along the proposed routes. The route which resulted in the highest overall suitability and lowest risk was presented to the client for further study and evaluation.

Unconventional Oil & Gas Footprint Development Planning
Alberta, Canada

Project manager and technical lead for a siting and routing optimization study focusing on unconventional oil and gas development in the Duvernay basin of north-western Alberta. The work involved determining highest suitability pipeline networks connecting 200 well pads and several gathering stations to between 4 and 12 main gathering stations. Water sourcing options were also explored utilizing a blend of surface and ground water sources. Total cost was calculated for each main gathering scenario such that a cost curve could be determined and the minimum overall cost estimated. The work resulted in an estimated 34% reduction in CAPEX for the project and saved several months off the internal review process.

Sour Gas Plant Siting
Alberta, Canada

Project manager and technical lead for a siting optimization desktop study for a sour gas facility based on a multi-criteria analysis of technical, economic, social and environmental constraints. The analysis resulted in a short list of 9 highest suitability sites, which were further validated through field studies to a final candidate list of 2 sites for further engineering level studies.

Resumé MASSIMO DRAGAN

Golder Associates S.r.l. – Torino

Education

Ph.D. Biomonitoring Methods and Environmental Quality, Dissertation, University of Trieste, Italy, 2001

Natural Sciences Summa cum laude, University of Trieste, Italy, 1994

Certifications

ESRI GIS Portal certified professional, 2005

Languages

Italian – Fluent

English – Fluent

Massimo Dragan, PhD, Principal, Information Management Services Group Manager

Massimo Dragan, PhD, is a Principal and Senior GIS analyst and information management specialist. Massimo leads the Information management group at Golder Associates in Italy and provides cross-sector support on data management and decision analysis.

Since 2009, Massimo is the Director of the Golder Medialab a team of professionals specialized in Project Communication services with the aim of effectively communicating technical content to non-technical audiences and fostering stakeholder engagement.

Massimo is Golder Technical Director of Golder suite of spatial analysis and sustainable decision support analysis tools (GoldSET (Golder's Sustainable Evaluation Tool) and GoldSET Spatial).

SELECT RELEVANT PROJECT EXPERIENCE

Renewable energies Feasibility Study
Albania (ongoing)

In 2020, Golder was retained by the European Bank of Reconstruction and Development to conduct a country wide analysis of suitability for the development of solar energy projects. Massimo was the lead of the GoldSET spatial modelling team for suitability analysis and candidate sites identification.

Little Smoky Caribou Rearing Facility Feasibility Study
Alberta, Canada

In 2017, Golder was retained by Alberta Environment and Parks (AEP) to undertake a study to determine possible feasible locations for a proposed caribou rearing facility in the Little Smoky Range in north-central Alberta. Massimo was the lead of the GoldSET modelling team for suitability analysis and fence routing. The study resulted in the successful identification and characterization of a number of suitable candidate sites for further consideration by the AEP

Heavy rail routing study
Minnesota, USA

In 2017, Golder was sub-contracted by a confidential client to complete a preliminary, desktop route selection process to determine the optimal corridor(s) for a proposed 35 km long heavy railway line in Itasca County, Minnesota. The work was undertaken with the direct involvement of a group of key regional stakeholders including Itasca County administration, as well as representatives from local mining, forestry and power companies. Massimo was the Technical lead for the modelling team and co-facilitator in the stakeholder meetings.

Nexen Aurora LNG Pipeline Routing
British Columbia, Canada

In 2017, Massimo was the Technical lead for the modelling team for Nexen's proposed Aurora midstream project to determine highest suitability routing corridors for a 500 km long natural gas pipeline and connecting through several gas processing facilities. The approach involved the simulation of over 50,000 km of potential pipeline corridors based on 89 different routing criteria. The study successfully resulted in the selection of multiple options which were both feasible from an engineering, economic and regulatory perspective as well as lowest-impact with respect to sensitive environmental and social considerations.

Pipeline routing
Florida, USA

In 2015, Golder has been contracted for the permitting and routing analysis of a pipeline in the State of Florida.
Massimo has been Project director and technical lead in the application of the siting module of GoldSET Spatial.

Pipeline routing
Canada

In 2014, Golder has been contracted to perform a pipeline routing feasibility analysis for an 800 km long infrastructure.
Massimo has been Project director and technical lead in the application of the siting module of GoldSET Spatial.

Gas Power Plant siting
Canada

In 2014, Golder supported the feasibility analysis to locate a sour gas power plant facility. A GIS based multicriteria evaluation framework was used to assess the impact of the project on agricultural, residential, environmental and visual indicators.

City of Edmonton Industrial Park planning
Alberta, Canada

In 2014, Golder has been contracted by the City of Edmonton to perform a scenario simulation for the optimal siting of three petrochemical facility types in the Industrial park area.
Massimo has been Project director and technical lead in the application of the siting module of GoldSET Spatial.

Power Line Route Alternatives Feasibility Study
California, USA

In 2013, Golder supported the evaluation of alternative routes for a 50 mile 500kv and 230kv transmission line in southeastern California. Data for over 30 environmental, social, technical, and economic indicators were gathered, evaluated, and input into GoldSET Spatial to identify a potential least cost transmission corridor within our project area of interest. Within that corridor, 25 alternative routes were created by technical experts. Massimo has been Project director and technical lead in the application of the siting module of GoldSET Spatial.

Education

B.A.Sc. Civil Engineering (Environmental Option), Queen's University, Kingston, Ontario, 2003

Certifications

International Association for Public Participation (IAP2), Certificate in Public Participation, Vancouver, British Columbia, 2011

CANDU Reactor Safety Course (Canadian Nuclear Society), Toronto, Ontario, 2008

First Aid Training, including CPR certification, Mississauga, Ontario, 2011

Small Non-pleasure Vessel Basic Safety (MED A3) Certification, Mississauga, Ontario, 2011

Buckman's Non-Freeway Traffic Control Training, Kingston, Ontario, 2002

Golder Associates Ltd. – Mississauga

Principal, Environmental Assessment Specialist

Alyson Beal, P.Eng., is a Principal and environmental assessment (EA) and permitting specialist in Golder's Mississauga, Ontario office. Alyson has led and participated in both small and large multi-disciplinary environmental studies and permitting projects across multiple sectors, including power (nuclear, transmission, and renewable and non-renewable sources), oil and gas, mining, infrastructure and waste sectors. This includes assessments completed to meet the federal EA requirements of the Canadian Environmental Assessment Act 2012 (CEAA 2012, and previous versions), the Nuclear Safety Control Act (NSCA) and the National Energy Board (NEB) Act, as well as provincial EA requirements under the Ontario Environmental Assessment Act (Individual EA and screenings/Class EAs). Frequently, her projects are higher profile and complex. To successfully execute these environmental planning and permitting projects, Alyson leads multidisciplinary teams, working with the various technical discipline leads, clients and regulators to integrate environmental activities with other project planning.

Alyson is certified by the International Association for Public Participation (IAP2) and has led a number of public and Aboriginal consultation and engagement programs integrated with environmental permitting processes. She advises clients regarding their strategy for successfully executing their project and managing risk, including integrating community input into submissions suitable for regulatory and public review. Her diverse sector and regulatory experience allow her to share lessons learned between sectors and recommend robust and defensible strategies for project execution.

Employment History

Golder Associates Ltd. – Mississauga, Ontario
Principal, Project Manager and Environmental Specialist (2003 to Present)

Golder Associates Ltd. – Mississauga, Ontario
Associate, Project Manager and Environmental Assessment Specialist (2003)

Project manager in the environmental assessment group, who leads the management of environmental assessment studies, including writing, reviewing and compiling various environmental assessment documents. Project responsibilities have included writing, reviewing, developing assessment methods, managing team members, and overall budget, schedule and quality control. Alyson has worked on projects in the power, nuclear, mining and waste sectors. Completed various public consultation activities in support of environmental assessments with regulatory authorities, members of the public and Aboriginal communities.

City of Kingston – Kingston, Ontario
Environmental Engineering Assistant (2002)

Environmental engineering assistant for the Environmental Division at the City of Kingston completing a study of dry weather flows in the City's storm water sewer systems. Responsible for collecting water samples, locating problems in the

stormwater system, and summarizing all results in report format.

Smithville Phase IV Bedrock Remediation Program – Smithville, Ontario
Assistant Project Manager (2001)

Assistant project manager for the Phase IV Bedrock Remediation Program to clean up a PCB contaminated site in Smithville, Ontario. Responsible for assembling and publishing 49 separate reports documenting the decision-making process used to find the best solution for the PCB contaminated site.

PROJECT EXPERIENCE – TRANSMISSION AND RELATED INFRASTRUCTURE

Hydro One, Burlington x Westover Pole Replacement
Hamilton/Halton, Ontario, Canada

Project director for the completion of an environmental screening for the Burlington × Westover Pole Replacement Project to meet the requirements of Hydro One's Class EA Process.

Hydro One, Wood Pole Replacement Projects
Various Locations, Ontario, Canada

Project director for the completion of numerous screening reports for Hydro One's annual wood pole replacement projects. Screenings are completed to meet the requirements of Hydro One's Class EA Process.

Glencore, Onaping Transformer Station
Onaping, Ontario, Canada

Class EA screening for the construction of a new 115 kV Transformer Station, and an approximately 1.6 km long 115 kV transmission line, near the Craig Mine site under the Hydro One Class EA for Minor Transmission Facilities.

Wataynikaneyap Power, Phase 1 and 2 Transmission Line
Northwestern Ontario, Canada

Environmental regulatory advice for the assessment of Wataynikaneyap Power's Phase 1 New Transmission Line to Pickle Lake Project and Phase 2 Project to connect 16 remote First Nations Communities north of Red Lake and Pickle Lake.

NextBridge Infrastructure, East-West Tie
Northern Ontario, Canada

Environmental regulatory advice for the EA for NextBridge's East-West Tie Project Transmission Project. This project will require more than 400 km of new 230 kV transmission line across Northern Ontario.

PROJECT EXPERIENCE – POWER (NON-NUCLEAR)

Northland Power, Redpath Cogeneration
Toronto, Ontario, Canada

Project manager for an EA of a proposed cogeneration facility at Redpath Sugar on Toronto's waterfront. Studies included a screening level EA, municipal planning and zoning requirements, and liaising with regulators.

Ontario Power Generation
Niagara Falls, Ontario, Canada

Environmental lead for the OPG Sir Adam Beck Pump Generating Station Remediation Project during detailed design and construction, including assessment of effects and regulatory engagement.

NRStor/Hydrostor, Compressed Air Energy Storage Goderich, Ontario, Canada	Project director for environmental permitting support of NRStor's Compressed Air Energy Storage project at the Compass Minerals site. Golder services include communications and consultation advice, environmental siting requirements, air quality and noise permitting, and ESA.
Various Clients Various locations, Ontario, Canada	Independent engineer review of 25 Site Considerations Reports for wind and solar projects proposed by various clients (RES, Leader, PowerStream, Samsung-Pattern, SWEB, Kruger, Saturn, Capstone). These reports were submitted as part of their Large Renewable Procurement Process applications to the IESO.
NextEra, Elmira and Parry Sound Energy Storage Woolwich and Seguin, Ontario, Canada	Project director for the completion of required environmental and municipal permitting associated with NextEra's proposed Elmira and Parry energy storage projects. Permits required include Environmental Compliance Approvals, archaeological assessments, and zoning amendments.
Sithe Global Holland Landing, Ontario	Public consultation lead for a Category B environmental assessment of a proposed 350 MW natural gas peaking station in Holland Landing, Ontario. The environmental assessment was completed under the Guide to EA for Electricity Projects. The environmental assessment included comprehensive consultation activities including open houses, mailings, agency meetings and First Nations communication. Was responsible for designing, implementing and maintaining the quality of the program.
Invenergy Corunna, Ontario	Public consultation lead for a Category B environmental assessment of a proposed natural gas-fired power station in St. Clair Township near Corunna, Ontario. Responsible for designing and implementing an extensive public and stakeholder consultation program, which included Open Houses, mailings and meetings. Also responsible for the assessment of effects on Aboriginal Interests, including compiling existing conditions, assessing potential effects and contacting Aboriginal associations.
Liberty Energy Hamilton, Ontario	Responsible for the assessment of Aboriginal interests, cultural heritage and landscapes and views for a proposed biomass power station in Hamilton, Ontario. Responsibilities included compiling existing conditions and assessing potential effects.

PROJECT EXPERIENCE – POWER SECTOR - NUCLEAR

Bruce Power Tiverton, Ontario, Canada	Strategic advice related to environmental activities in advance of licence renewal, which includes Major Component Replacement of Units 3 to 8 at the Bruce site and completion of an updated Environmental Risk Assessment, Predictive Effects Assessment and Community Interests reports to meet the needs of an EA under the NSCA.
Ontario Power Generation Pickering, Ontario, Canada	Predictive effects assessment lead for the assessment of potential effects of the stabilization and safe storage phase of the Pickering Nuclear Generating Station. Potential effects will be considered in the context of the NSCA, applicable CSA standards, and environmental assessment practice.

Resumé

ALYSON BEAL

Canadian Nuclear Laboratories Whiteshell, Manitoba, Canada	Project manager for the EA and decommissioning safety assessment of the in situ decommissioning of Whiteshell Reactor 1 (WR 1) at CNL's Whiteshell Laboratories near Pinawa, Manitoba. The assessment is subject to meeting the CNCS's requirements of CEAA 2012 and Regulatory Guidance G-320.
Canadian Nuclear Laboratories Chalk River, Ontario, Canada	Project director for a contract related to providing EA and licensing advice for the use of a bounding assessment for the siting of a Small Modular Reactor at Chalk River Laboratories. The CNCS's requirements of CEAA 2012, the NSCA and pending Impact Assessment Act were considered.
Canadian Nuclear Laboratories Chalk River, Ontario, Canada	Project director for the environmental assessment of a proposed Near Surface Disposal Facility for low-level radioactive waste at the Chalk River site in Eastern Ontario. The EA is subject to meeting the requirements of CEAA 2012.
Ontario Power Generation Tiverton, Ontario, Canada	Project manager and EA lead (CEAA 2012 Joint Review Panel) and continued environmental support through the regulatory phase, including hearing support, of the proposed Deep Geologic Repository Project for low- and intermediate-level radioactive wastes near Tiverton, Ontario.
Bruce Power Tiverton and Nanticoke, Ontario, Canada	Various roles including project engineering, EA reporting, cumulative effects assessment, project coordination, and public consultation lead for various environmental assessments for Bruce Power under CEAA, including the: · New Nuclear Power Plant Project at the Bruce Nuclear Site · New Nuclear Power Plant Project near Nanticoke, Ontario · Bruce A Refurbishment Project · Bruce B New Fuel Project · Hydrogen fuelled transportation applications in southern Ontario
Nuclear Waste Management Organization/Ontario Power Generation Tiverton, Ontario	Project manager for the environmental assessment of the proposed deep geologic repository for low- and intermediate-level radioactive wastes at the Western Waste Management Facility near Tiverton, Ontario. The environmental assessment is a Joint Review Panel being completed under the Canadian Environmental Assessment Act. Environmental assessment responsibilities include developing environmental assessment methods, coordinating the assessment team (including internal and external team members), reviewing, issuing and writing technical support documents and the Environmental Impact Statement and hearing support. Work closely with the client to manage project risks, budgets and schedule.
Port Hope Area Initiative Port Granby, Ontario	Project coordinator for the Port Granby Project EA Study Report, including planning, project management and writing activities. Aided in developing EA reports, including the Basis for EA, malfunctions and accidents scenarios, and writing and compiling the EA Study Report sections. Project management tasks include tracking budgets and handling monthly invoicing and progress reports. Also assisted with the alternative means evaluation process and the preparation of the Feasible Concepts Report and Qualified Concept Report for the Engineering Sub-consultant.

Best Theratronics - Radioactive Waste Storage Facility
Kanata, Ontario, Canada

Technical advisor for the environmental assessment of Best Theratronics Ltd. Class 1B nuclear license application to the CNSC under the NSCA to expand and operate its facility and store radioactive waste material. The project was a "designated project" under CEAA 2012.

Nuclear Waste Management Organization
Toronto, Ontario

Assisted in preparing the risks, benefits and costs assessment of the alternative approaches for the long-term management of used nuclear fuel in Canada. Responsibilities included coordinating the completion of the environmental, worker and public safety assessments, integrating the report sections and quality control.

PROJECT EXPERIENCE – MINING/OTHER

Cliffs Natural Resources
Northern Ontario, Canada

Project manager with responsibility for implementing studies for the coordinated EA pursuant to federal and provincial Individual EA requirements to facilitate development of Cliffs Natural Resources Chromite Project. The EA included extensive engagement and consultation with Indigenous communities, the general public, and many federal/provincial regulatory agencies.

CBM St. Marys Cement
Bowmanville, Ontario, Canada

Project manager for the development of a permitting and environmental assessment roadmap/strategy and EA for a proposed underground quarry below the bottom of Lake Ontario. The assessment must meet the MNDM Class EA process, as well as federal, provincial and local permit requirements.

KGHM International
Sudbury, Ontario, Canada

EA lead for the construction of a 4.9 MW of temporary diesel power supply during construction for the completion of an Environmental Screening under the Electricity Projects Regulation.

TransCanada, Vaughan Mainline Expansion/Kings North Connection
Vaughan, Ontario, Canada

Project director for the environmental services (EA, permitting, construction monitoring, hearing support) in support of two new 11 km natural gas pipelines in the City of Vaughan. The projects required s.58 authorizations from the NEB.

PROJECT EXPERIENCE – WASTE

Waste Services Inc.
Navan, Ontario

Contributor to the preparation of the Terms of Reference (ToR), for the environmental assessment of the proposed expansion of the Navan Landfill. Involvement included public and agency consultation and desktop environmental component studies, and drafting of the ToR.

City of Toronto
Toronto, Ontario

Participated in the preparation of Phase I and Phase II site assessments for ten former landfills in the City of Toronto. Tasks included reviewing historic documents, City of Toronto records, aerial photos and monitoring records to form a conclusion as to the presence and limits of fill of the former landfills, and potential hazard associated with them. Phase II studies included field investigations and the collection of soil and water samples to confirm the extent of the landfills.

PROJECT EXPERIENCE – OTHER

Canadian Environmental Assessment Agency
Ottawa, Ontario

Technical manager for the completion of a draft compendium of examples of assessments of alternative means, cumulative effects and significance of adverse effects. These hypothetical examples are written to meet the pending draft technical guidance documents and are to be used as examples of good practices for meeting the requirements of the Canadian Environmental Assessment Act, 2012.

Foreign Affairs and International Trade
International

Project manager for the completion of a screening level environmental assessment under the Canadian Environmental Assessment Act. The assessment was conducted for Foreign Affairs and International Affairs Canada (DFAIT) for planned upgrades at a Canadian embassy location abroad.

Ontario Realty Corporation/General Chemical
Brigden, Ontario

Project coordinator for an ORC Category C Class Environmental Assessment for the granting of an easement for a proposed brine pipeline near Brigden, Ontario. The Class EA included a comprehensive consultation program involving mailings, open houses and agency consultation. Responsibilities included writing, reviewing and compiling an Environmental Study Report, Consultation Plan and other supporting documents. Was also responsible for facilitating and preparing for Open House events.

Ontario Realty Corporation
Various Locations, Ontario

Project coordinator for sixteen ORC Category B Class Environmental Assessments for the transfer of ownership between government agencies of sixteen agricultural research properties in Ontario. Responsibilities included coordinating the collection of existing environmental conditions information, contacting affected parties for all sixteen sites and preparing the Consultation and Documentation Reports.

PROFESSIONAL AFFILIATIONS

Professional Engineers of Ontario

Resumé CARLA G. EVANS

Education

M.Sc. (Remote Sensing and GIS) Geography, The University of Western Ontario, London, 2005

H.B.A. Geography, The University of Western Ontario, London, 2002

Certifications

Digital Global Certified Reseller, July 2015

Golder Associates Ltd – Mississauga

Employment History

Golder Associates Ltd. – Mississauga, Ontario
GGH GIS Team Lead (2018 to Present)

Responsible for a team of approximately 10 employees within the GGH GIS and information management development team. Supports, mentors and coaches' staff with respect to their career growth and professional development.

Golder Associates Ltd. – Mississauga, Ontario
GIS Analyst (1999 to Present)

Primary duties include data acquisition, compiling, processing, data interpretation, and managing spatial and remote sensing data. Additional duties include data conversions, spatial analysis, the development and management of environmental databases, and digital map creation.

The University of Western Ontario – London, Ontario
Teaching Assistance, Department of Geography (2003 to 2004)

Responsible for being knowledgeable in the subject matter of the undergraduate courses assigned to teach; the preparation of tutorials and lab materials, marking and exam assistance. Courses taught included Introduction to Geographic Information Systems, Introduction to Remote Sensing, Advance Remote Sensing, Introduction to Urban and Regional Planning, Land Use Planning, and Geography: An Introduction to Systems.

SELECTED PROJECT EXPERIENCE

Region of Waterloo eWRAS EQuIS Implementation
Ontario, Canada

Support the Region of Waterloo implementation of the eWRAS EQuIS database. Tasks included were assist in the configuration and implementation of EDGE, develop widgets to support end-users, historical geochemical data compilation and leverage out-of-the-box reporting tools. Golder also provided general support and trouble-shooting exercises for the Region.

NPS20 Pipeline Routing Study
Toronto, Ontario, Canada

Ontario Information management lead for the NPS20 Pipeline Routing Study (Pipeline routing corridor analysis using GoldSET). Enbridge proposed replacing 4.5km of an existing natural gas pipeline in Toronto, Ontario. Responsibilities included procuring data, reviewing data and analysis, attending presentation meetings and reviewing documents and maps for a desktop corridor routing study to evaluate two Enbridge produced corridors, as well as determining other potentially feasible corridor options for the proposed pipeline using a methodology and suite of tolls known collectively as GoldSET.

MNRF Drought Emergency Management in Ontario (Advisory Report on Hazard identification and Risk Assessment and Monitoring and Early Warning Systems for Drought Ontario, Canada	IM lead. Supported the drought advisory study and developed a methodology for undertaking drought Hazard Identification and Risk Assessment mapping on a provincial scale. Performed a Data Gap Analysis based on other drought management systems. Acquired, Compiled, and interpreted relevant provincial datasets from various sources for input into Golder's multi-criteria tool, GoldSet. This process combined feedback from ministry stakeholders and spatial data sets to create a drought risk map. Provided a path forward to further advance the drought risk mapping in Ontario and recommendations.
USG Oakfield Mine Subsidence Project New York, USA	Responsibilities included data acquisition, data migration, LiDAR DEM reconciling and merging, differential analysis and mapping needs, to support identifying potential areas for monitoring of subsidence for an underground mine in New York.
East-West Tie Transmission Line Project Ontario, Canada	IM support for Constraints Analysis and Environmental Impact and Social Assessment for proposed 400 km transmission line in Northern Ontario. Provides and co-manages the IM component for a multi-disciplinary team. Coordinates data requests, budget, data acquisitions, analysis (watershed delineation, noise contour modelling, aerial interpretation and constraints analysis) and mapping.
TransCanada Pipeline Limited, Vaughan Mainline Expansion Project Ontario, Canada	IM task leader for Constraints Analysis and Environmental Impact and Social Assessment for proposed 11.7 km pipeline in Southern Ontario. Provides and manages the IM component for a multi-disciplinary team. Coordinates data requests, budget, data acquisitions, analysis (watershed delineation, noise contour modelling, aerial interpretation and constraints analysis) and mapping.
Coastal Risk Assessment, Barbados Barbados, Barbados	IM task lead. Developed and implemented field data collection methods for the entire shoreline assessment. Supports data acquisition, data migration, LiDAR DEM and Bathymetry data reconciling and merging, analysis and mapping needs. Preparing 1:5000 map sheets to depict field data collected for use in Coastal Risk Assessment, developing risk assessment maps, and mapping setbacks and coastal risk zones and recommendations.
TransCanada Pipeline Limited, Parkway West Project Ontario, Canada	IM task leader for Constraints Analysis and Environmental Impact and Social Assessment for proposed 250 m pipeline in Southern Ontario. Provides and manages the IM component for a multi-disciplinary team. Coordinates data requests, budget, data acquisitions, analysis (watershed delineation, noise contour modelling, aerial interpretation and constraints analysis) and mapping.
TransCanada Pipeline Limited, King's North Connection Project Ontario, Canada	IM task leader for Constraints Analysis and Environmental Impact and Social Assessment for proposed 12.5 km pipeline in Southern Ontario. Provides and manages the IM component for a multi-disciplinary team. Coordinates data requests, budget, data acquisitions, analysis (watershed delineation, noise contour modelling, aerial interpretation and constraints analysis) and mapping.

TransCanada Pipeline Limited, Eastern Mainline Project Ontario, Canada	IM task leader for Constraints Analysis and Environmental Impact and Social Assessment for proposed 365 km pipeline in Southern Ontario. Provides and manages the IM component for a multi-disciplinary team. Coordinates data requests, budget, data acquisitions, analysis (watershed delineation, noise contour modelling, aerial interpretation and constraints analysis) and mapping.
Cliffs Chromite Project Ontario, Canada	Developed mapping for environmental and social issues, scoping, baseline studies, impact assessment and management plans. Work included acquisition of base data, processing and acquiring of IKONOS, Quickbird and LiDAR imagery, site selection, generating maps for all field work programs, developing a geodatabase of all data pertaining to the project, 3D visualization, analyse data collected from baseline to assess impacts of project, and reporting. GIS and Remote Sensing Lead for the Environmental Impact Assessment.
Hammond Reef Gold Project Atikokan, Ontario, Canada	IM task leader. Developed mapping for environmental and social issues, scoping, baseline studies, impact assessment and management plans. Work included acquisition of base data, Airphoto Imagery processing and acquisition, site selection, generating maps for all field work programs, developing a geodatabase of all data pertaining to the project, 3D visualization, analyse data collected from baseline to assess impacts of project, and reporting and working very closely with the client. GIS and Remote Sensing Lead for the Environmental Impact Assessment for the Mine and Transportation and Transmission Line.
Golder GIPMS/GIDIE/IDMS Global	Responsible for overseeing and managing the development of the Golder GIPMS (Golder Integrated Project Management Solution) and GIDIE (Golder Integrated Data Interpretation and Evaluation). Also acts as project manager to other GIDIE projects.
NWMO Various Sites in Ontario Ontario, Canada	Gathered and consolidated geoscientific data from a wide range of government and private sources and assembled geophysical and surficial data from subconsultant partners. Complied and created various layers into spatial maps to assist in the analysis and to aid in the selection of potential general siting areas. Worked closely with the NWMO on the compilation and delivery of the GIS data and metadata to be managed in Geosoft NWMO DAP Metadata software, a spatially searchable GIS system. The information management, database development and spatial mapping support enabled the quick integration and analysis of a multitude of geospatial datasets in a timely and cost-effective way. Assisted in 2015-2016 mobile field collection setup and deployment, using ArcGIS Online and ArcGIS Collector Application.

Resumé MICHELE FERNETTI

Golder Associates S.r.l. – Torino

Education

Ph.D. Biomonitoring methods and environmental quality ("GIS assessment of Operational Geographic Units based on small-scale environmental quality indicators") Ecology, University of Trieste, TRIESTE,Italy, 2003

Natural Sciences Ecology, University of Trieste, TRIESTE,Italy, 1991

Languages

English – Fluent

Italian – Fluent

Senior GIS analyst

Michele is a senior geographic information system (GIS) analyst and information management specialist with almost 20 years of working experience. The main expertise of Michele relates to Environmental Spatial data Management and Analysis. He worked as a GIS, remote sensing and data analysis specialist in several international research projects for environmental assessment and natural resources conservation for the University of Trieste and UNIDO International Centre for Science and High Technology.
Since 2007, Michele works as a consultant for the Italian information management team of Golder Associates and collaborates in the development and support of GIS applied in SEA and EIA projects. Since 2010, Michele is the lead developer of the GoldSET Spatial module.

Employment History

UNIDO –United Nations Industrial Development Organization – Vienna-Jerusalem-Hebron
International GIS consultant (2013 fino a 2013)

Technical advisor for UNIDO in support of the information management of the census survey data of Palestinian Stone and Marble Industry - PSMC center in Hebron, West Bank

UNIDO –United Nations Industrial Development Organization – Trieste
GIS National Consultant (2011 fino a 2011)

GIS Consutant and tutor - Training program at Internationa Center for Science and High Technology (UNIDO)

UNIDO –United Nations Industrial Development Organization – Trieste
International GIS and IM consultant (1997 fino a 2001)

GIS design and Internet mapping applications for the implementation of a real-time transportation system, "Ship Information And Management System (SIAMS)", European Union project

University of Trieste – Trieste
Technical manager (1999 fino ad oggi)

Technical Manager of the Laboratory of Geomatics and Geographic Information Systems at - Department of Mathematics and GeoSciences - University of Trieste

University of Trieste – Trieste
Contracted researcher (1993 fino a 2007)

Michele worked as a GIS, remote sensing, and data analysis specialist in several international research projects for environmental assessment and natural resources conservation. Michele is co-author in several scientific papers published in national and international scientific journals.

University of Trieste – Trieste
Contracted professor (1997 fino a 1999)

Contracted professor of Thematic mapping and automated cartography

Golder Associates – Turin
Senior GIS analyst (2007 fino ad oggi)

Since 2007, Michele works as a consultant for the Italian information management and ESIA teams of Golder Associates, collaborating in the development and support of GIS and Information management applied to SEA and EIA projects.

Resumé MOISE COULOMBE-PONTBRIAND

Golder Associates Ltd. – Calgary

Education

B.Sc. Physical Geography, University of Sherbrooke, Sherbrooke, 1999

M.Sc. Physical Geography, McGill University, Montreal, 2002

Certifications

ESRI Certified ArcGIS Desktop Associate 10, 2011

Languages

English – Fluent

French – Fluent

Information Management Component Lead

Mr. Moise Coulombe-Pontbriand has a M.Sc. in Physical Geography and 13 years experience in environmental planning and management of geographic information. As an Information Management Component Lead in the Information Management Division, Geospatial Services Group, Moise's responsibilities include leading the Information Management of multi-disciplinary energy projects and managing data activities based on best practices. Moise brings significant experience in GIS for wind power projects, linear developments, constraint mapping and environmental alignment sheets.

PROJECT EXPERIENCE – PIPELINES

TransCanada PipeLines Limited Smoky River Lateral Loop Western Alberta, Canada	Information Management for environmental planning and provincial and federal environmental applications, including an Environmental and Socio-economic Assessment (ESA) as part of a National Energy Board application, for the 28 km long pipeline.
TransCanada PipeLines Limited Moosa Crossover Project Oil Sands Region of Alberta, Canada	Information Management Lead for environmental planning and provincial and federal environmental applications, including an Environmental and Socio-economic Assessment (ESA) as part of a National Energy Board application, for the 5 km long 20" pipeline.
TransCanada PipeLines Limited Projects Oil Sands Region of Alberta, Canada	Information Management Lead and/or Reviewer for federal and provincial environmental impact assessments and environmental applications of four pipeline projects in the oil sands region of Alberta: Moosa Crossover, Wolverine River Lateral Loop, Leming Lake Sales Lateral Loop and Saddle Lake Lateral Loop. Conducted and directed GIS analysis to support various aspects of the project in a multi-disciplinary context: field support, mapping and standards, spatial analysis and cumulative impact assessments.
TransCanada PipeLines Limited Wolverine River Lateral Loop (Carmon Creek Section) Project Alberta, Canada	Information Management Reviewer for environmental planning and provincial and federal environmental applications, including an Environmental and Socio-economic Assessment (ESA) as part of a National Energy Board Section 52 application, for the 61 km long 20" natural gas pipeline.

TransCanada PipeLines Limited Simonette Lateral Loop Pipeline Project Northwest Alberta, Canada	Information Management Lead for environmental planning and provincial and federal environmental applications, including an Environmental and Socio-economic Assessment (ESA) as part of a National Energy Board Section 58 application, for the 22.4 km long 24 " natural gas pipeline and the Simonette East Receipt Meter Station.
TransCanada PipeLines Limited Towerbirch Expansion Pipeline Project Northwest Alberta, Northeast BC, Canada	Information Management Senior Reviewer for environmental planning and provincial and federal environmental applications, including an Environmental and Socio-economic Assessment (ESA) as part of a National Energy Board Section 52 application, for the 110 km long 36" natural gas pipeline and the three meter stations.
TransCanada PipeLines Limited South Kirby Expansion Project Oil Sands Region of Alberta, Canada	Information Management Lead and Reviewer for environmental planning and provincial and federal environmental applications, including an Environmental and Socio-economic Assessment (ESA) as part of a National Energy Board Section 52 application, for the 42 km long 16" and 24" natural gas pipeline.
Talisman Energy Pipeline Projects Alberta, Canada	Environmental Project Planner for multiple AER-regulated Talisman Energy pipeline projects in the Upper Foothills of Alberta. The area was characterized by major topographic constraints, key wildlife protection objectives, sensitive watercourse crossings and land stability issues. Responsibilities included leading the route selection process in collaboration with the Client, conducting environmental constraint analysis and generating environmental alignment sheets from a GIS. Responsibilities also included conducting field reconnaissance and fish and fish habitat assessment of proposed watercourse crossings for each projects, as well as obtaining environmental applications: environmental field reports, Code of Practice notifications, DFO notifications, Navigable Waters Protection application, caribou protection plans and environmental protection plans. Notable projects include the Talisman Energy Foothills Ram, Interconnect, Muskeg River, Hinton, and Narraway pipeline projects. Tracking of issues, commitments and corridor selection justification was key to delivering the projects within schedule.
Talisman Energy Interconnect Pipeline Project Northwest Alberta, Alberta	Environmental Project Coordinator for a 33 km long AER-regulated pipeline project. Responsibilities included recording the route selection process, conducting environmental constraint analysis and generating environmental alignment sheets from GIS. Recorded corridor selection justification. The project was located near Grande Cache.
Talisman Energy Foothills Ram Pipeline Project Central West Alberta, Alberta	Environmental Project Coordinator for the planning of a 25 km long AER-regulated pipeline project in the Upper Foothills near Rocky Mountain House. Responsibilities included recording the route selection process, conducting environmental constraint analysis and generating environmental alignment sheets from GIS. The project was characterized by major topographic constraints, grizzly bear habitat protection objectives, and land stability issues. Led route analysis activities in collaboration with client representatives. The project was completed within schedule due to the optimization of the route selection process through field and desktop GIS analysis.

Talisman Energy Muskeg River Pipeline Project Northwest Alberta, Alberta	Environmental Project Coordination for the planning of a 22 km long AER-regulated pipeline project in the Upper Foothills near Grande Cache. Responsibilities included recording the route selection process, conducting environmental constraint analysis and generating environmental alignment sheets from GIS.
Talisman Energy Hinton Pipeline Project Central West Alberta, Alberta	Environmental Project Coordinator for the planning of a 32 km long AER-regulated pipeline project within Hinton-Edson area. Responsibilities included recording the route selection process, conducting environmental constraint analysis and generating environmental alignment sheets from a GIS. The project was situated near an urbanized centre and involved the management of many restrictive notations. Tracking of issues and commitments was the key to completing the project within schedule.
Talisman Energy Narraway Pipeline Project Northwest Alberta, Alberta	Environmental Project Coordination for the planning of a 9 km long NEB-regulated inter-provincial pipeline project near Grande Prairie. Responsibilities included recording the route selection process, preparing a screening environmental impact assessment, conducting environmental constraint analysis and generating environmental alignment sheets from a GIS.
Keyera Energy Fort Saskatchewan Pipeline Project Central Alberta	Environmental Planner for a 20 km AER-regulated pipeline projects. Responsibilities included the identification of environmental constraints, completion of C&R applications, as well as federal and provincial watercourse crossing applications/notifications. Directed cartographic needs and prepared environmental alignment sheets. Was also responsible to support field work and track project costs.
Keyera Energy Rimbey Pipeline Project Central Alberta, Canada	Environmental Planner for a 50 km AER-regulated pipeline project. Responsibilities included the identification of environmental constraints, completion of C&R applications, as well as federal and provincial watercourse crossing applications/notifications. Directed cartographic needs and prepared environmental alignment sheets. Was also responsible to support field work and track project costs.
Pembinca AOSPL Interconnection Project Northeast Alberta, Canada	Information Management Lead for the AER-regulated Pembina AOSPL Interconnection Project. Responsibilities included providing support for field mapping, EFR, Code of Practice notification and environmental alignment sheets.
Alberta Product Pipeline Ltd. Route Option Selection and Evaluation of Risk Factor Alberta, Canada	Information management and GIS consultant for the evaluation of two proposed Alberta Product Pipeline route options. The approach utilized multi-criteria analysis to evaluate the indicators and compare the route options. Responsibilities included supporting the identification and mapping of routing indicators and risk factors as well as the reviewed figures and summaries.
ATCO Pipelines Southeast Canmore Pipeline Project Southwest Alberta, Canada	Information Management Reviewer for environmental planning and provincial applications for a 20 km long AER-regulated pipeline project.

ATCO Pipelines West Calgary Connector Pipeline Project
Southwest Alberta, Canada

Information Management Reviewer for environmental planning and provincial applications for a 6 km long AER-regulated pipeline project.

PROJECT EXPERIENCE – WATER RESOURCES

Various Municipalities Waterline Projects
Alberta, Canada

Environmental Planner for three regional water line projects in southern Alberta. Responsibilities included the identification of environmental constraints, completion of C&R applications, as well as federal and provincial watercourse crossing applications/notifications. Directed cartographic needs and prepared environmental alignment sheets. Responsible for field work support and project costs tracking.

Resumé SEAN KURASH

Education

B.Sc. Geomatics Engineering, University of Calgary, Calgary, 2009

Bachelor of Engineering Program Engineering, Mount Royal College, Calgary, 2005

Golder Associates Ltd. – Calgary

GIS Analyst

Sean Kurash has a B.Sc. in Geomatics Engineering from the University of Calgary. He was a survey assistant in oil and gas and legal surveys from 2003 turning full time in 2009. Sean joined Golder as a GIS Analyst in the Information Management (IM) Division, GeoSpatial Services Group in October 2010. He is the manager of the Calgary IM Division Spatial Data Warehouse (SDW). He is the Information Management GIS contact for the Water Resources team and has worked on a various flood inundation projects. Sean has also utilized GoldSET Spatial for transmission line and pipeline corridor routing as well as facility and well siting projects. He is also responsible for mapping, data manipulation, and calculations for a variety of disciplines including aquatics, archaeology, vegetation, soils, and wildlife as part of various transmission, mining, and oil and gas projects. Sean is the IM component lead on a few wind power project constraints mapping and environmental evaluations. Sean prepares supplemental data field crew see in Collector and supports them with their post-field QA/QC and edits of field collected data. He is also the IM component lead of various pipeline geohazard projects. Sean often uses FME to automate data management, translation and summary tasks.

Employment History

Golder Associates Ltd. – Calgary
GIS Analyst (2010 to Present)

Coordinates tasks with project manager and disciplines and oversees figure creation and data summaries for projects. Responsible for managing and manipulating project data and automating data summaries. Manages the Regions Spatial Data Warehouse (SDW). Supports field crew with Collector, a field data collection tool, pre and post field.

Tronnes Surveys – Calgary
Survey Assistant (2006 to 2010)

Summer student, turned full-time. Conducted field surveys using Total Station and GPS equipment for topographical surveys and layout for subdivisions, building and road construction. Responsible for performing Real Property Reports (RPRs). Use of 3D Laser Scanner for as-built surveys.

Usher Canada Ltd. – Calgary
Survey Assistant (2003 to 2005)

Summer student. Conducted field surveys using Total Station and GPS equipment for topographical surveys and layout for pipelines and well sites. Responsible for as-built and layout surveys for the Long Lake Project.

SELECTED RELEVANT PROJECT EXPERIENCE

TC Energy/NGTL Pipeline Geohazard Projects
Alberta, Canada

IM component lead/GIS technician for Geohazards on various NGTL Pipelines and major river crossings. Works with geologists to provide information, data and resources needed to derive the geohazards. Responsible for GIS Geohazard and pipeline data management and measure summaries adhering to TransCanada standards using ArcGIS model builder and FME. Also responsible for overseeing figure requests.

Nexen Aurora LNG Pipeline Routing
British Columbia, Canada

GIS Analyst for Nexen's proposed Aurora pipeline project to determine the most suitable routing corridors for a 500 km long pipeline from northeast BC to tidewater, and connecting through gas processing facilities. Developed 89 different routing criteria and prepare these criteria in GIS format for input into GoldSET Spatial. Sensitivity analysis was performed resulting in over 50,000 km of potential pipeline corridors. Performed in depth analysis of these resulting in key corridor options which were optimal considering engineering, economic, regulatory, environmental and social considerations.

Chevron Duvernay Development Compressor Station and Pipeline Network Footprint Optimization Project
Alberta, Canada

GIS Technician for siting gathering stations, determining the optimal number of gathering stations and routing pipeline network connecting wells to gathering stations. Indicator processing for inputs to both siting and routing GoldSET Spatial suitability surfaces used for siting and routing. Water pipelines were also routed from surface and groundwater sources.

Long Lake Oil Sands Project
Alberta, Canada

Construction Surveyor for an oil excavation plant southeast of Fort McMurray while working for Usher Canada Ltd. who have since merged with MMM. Responsible for as-built and layout surveys.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1, Page 10

Preamble:

"All required land easements, permits and necessary agreements will be coordinated with the following:

- Ontario Energy Board
- Ontario Ministry of Environment, Conservation and Parks (MECP)
- Ontario Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), formerly Ministry of Tourism, Culture and Sport (MTCS)
- Ontario Ministry of Transportation (MTO)
- Hydro One Networks Inc.
- City of Toronto
- Toronto and Region Conservation Authority (TRCA)"

Question**:**

Considering that the OEB does not issue permits or own land on which Enbridge is seeking easement, why is the OEB included in the list?

Response:

The OEB is responsible for granting Leave to Construct of hydrocarbon lines under section 91 of the Ontario Energy Board Act, 1998. Pursuant to the Act, the OEB approves the form of easement(s).

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1, Attachment 1, Environmental Report (Placeholder)

Question**:**

a) When was the Environmental Report completed?

b) Please explain why the Environmental Report was not filed with the original application.

c) When and how was the Environmental be filed?

Response:

a) The Environmental Report was completed in March 2020.

b) The Environmental Report was filed with the original application. A link to the report was provided under Exhibit C, Tab 1, Schedule1, Attachment 1

c) Please refer to response b). The Environmental Report can also be found on the Company's website through the following link: https://www.enbridgegas.com/NPS20_C2B_ER

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit D, Tab 1, Schedule 1, Page 2

Question**:**

Has the City of Toronto agreed to the 1 m depth of cover?

Response:

Final drawings for the Project have not yet been completed. Enbridge Gas has not yet had discussions with the City of Toronto regarding the final running line and depth of the pipeline to be constructed.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit D, Tab 1, Schedule 1, Page 3

Question**:**

What will Enbridge Gas do if it does not obtain all of the required permits and approvals by April 2021?

Response:

Depending on the nature of the outstanding approval, the commencement of Project construction could be delayed (it should be noted that the expected construction commencement date is June 2021).

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit D, Tab 1, Schedule 1, Page 5, Table 3

Question**:**

Please provide the supporting information for each item in Table 3. Also refer to Exhibit I.EP.25 for indirect overheads details.

Response:

Item No.	Description	Cost
1.0	**Material Costs**	**$3,486,320**
	Pipe Fittings	$680,000.00
	Pipe & Coating	$2,616,320.00
	Valves	$160,000.00
	Consumables	$ 30,000.00
2.0	**Labour Costs**	**$71,820,730**
	Pipeline Installation	$68,700,000.00
	Tie-In Services	$100,000.00
	Nitrogen Rentals	$20,730.00
	Site Restoration & Backfilling	$2,000,000
	Contaminated Soil Disposal	$1,000,000
3.0	**External Permitting, Land**	**$1,055,700**
	Title Searches	$13,000.00
	Permits	$42,700.00

	Yard Rental (if required)	$1,000,000.00
4.0	**Outside Services**	**$5,199,780**
	Design, Drafting & Engineering	$1,320,600.00
	Legal & Insurance	$70,000.00
	Site Inspection/Monitoring/Testing	$3,696,680.00
	Flagging	$112,500.00
5.0	**Direct Overheads**	**$950,975**
	Expenses	$34,975.00
	Project Management	$365,000.00
	Company Crews	$350,000.00
	Other Internal Resources	$198,000.00
	Office / Safety Supplies & Equipment	$2,500.00
	Site-Specific Training	$500.00
6.0	**Contingency Costs**	**$24,754,051**
7.0	**Project Cost**	**$107,267,556**
8.0	**Indirect Overheads**	**$24,073,159**
9.0	**IDC**	**$1,707,176**
10.0	**Total Project Costs**	**$133,047,891**

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit D, Tab 1, Page 5

Preamble:

"The cost estimates set out above include a 30% contingency applied to all direct capital costs to reflect the preliminary design stage of this Project."

Question**:**

a) Please explain the reason Enbridge is applying for approval of a 30% contingency for this project when it used a 15% contingency in the EB-2019-0172 Windsor Pipeline Replacement Project.

b) Please confirm that the 30% contingency is applied to all direct capital costs including materials, labour, external permitting, land, outside services, and direct overheads.

c) Please explain why materials, labour, external permitting, land, outside services, and direct overheads would all have the same risk that would justify using the same 30% contingency.

Response:

a) The contingency amounts applied to the Project differ from the contingency amounts used in the Windsor Pipeline Replacement Project due to the risk profile of the Project. The Project is to be constructed in an urban setting in the downtown core of a major city. These construction characteristics and risks associated with the heavily congested buried infrastructure in the city, are very different from the risks associated with building infrastructure in a mostly rural setting.

b) Confirmed.

c) Given the project maturity, and the fact that risks often impact more than one cost category at once, the 30% contingency applied to all categories is appropriate.

Enbridge Gas recognizes the fact that some risks for certain categories may be higher and some risks for other categories may be lower. The application of a global contingency percentage takes this into account.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit D, Tab 1, Page 5

Question**:**

a) Please provide a breakdown of the $24,073,159 Indirect Overheads estimate including a list of costs of Enbridge departments that Enbridge is proposing to allocate to the project and capitalize.

b) Please confirm that the $24,073,159 would be expensed if the OEB does not approve this project.

c) Please confirm that allocated costs of $24,073,159 are not incremental costs and should not be included in Enbridge's upcoming application for Incremental Capital Module funding of this project.

Response:

a) The indirect overheads of $24,073,159 are comprised of Department Labour Charge (DLC) allocations and HR Burdens. A revised indirect overhead capitalization methodology was implemented in 2020 as part of EGI integration activities. The EGD rate zone has eliminated the previous category of Administrative and General (A&G) overheads and has replaced this with HR Burdens. HR Burdens are allocated to direct company labour costs on capital projects. The DLC allocation represents the indirect overheads from support functions across the EGI organization. Table 1 represents the breakdown of HR Burdens and DLC allocations.

Table 1

Overhead Category	**Cost**
HR Burdens	$1,335,291
DLC Allocation	$22,737,868
Total	**$24,073,159**

Table 2 represents the breakdown of DLC allocations by department.

Table 2

Function	Allocation %	Indirect Overhead Cost ($ M)
Engineering	17%	3.9
Operations	30%	6.8
Regulatory	4%	0.9
IT	4%	0.9
Finance	2%	0.5
Human Resources & Benefits	19%	4.3
Real Estate and Workplace Services	7%	1.6
Supply Chain	1%	0.2
Central Function Allocated Costs	14%	3.2
Other	2%	0.4
Total	**100%**	**$22.7**

b) The indirect overheads would still be incurred if the Project as proposed did not proceed. In this case these indirect overhead costs would be re-allocated to other projects.

c) Not confirmed. The OEB has indicated that indirect overheads are included in the calculation of rate base and should be included in the assessment of the costs included in ICM; EB-2019-0194 Decision and Order, May 14, 2020, page 9.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Energy Probe (EP)

INTERROGATORY

Reference:

Exhibit E, Tab 1, Schedule 1, Page 2

Question**:**

a) If the City of Toronto or any of the other entities listed refuses to issue permits necessary for construction is Enbridge planning to file application(s) under Section 101 of the OEB Act with the OEB for authorization to proceed with construction without permits as it did in the EB-2020-0160 proceeding? Please explain your answer.

b) If the OEB issues a Leave to Construct order to Enbridge in this proceeding will Enbridge make a commitment that it will not start construction until it has received all permits or the OEB has made such permits unnecessary by order or orders authorizing construction under Section 101 of the OEB Act?

Response:

a) Enbridge Gas anticipates that the City of Toronto and other permitting authorities will issue the required permits if the OEB grants leave to construct the Project. If a permitting authority declines to issue a permit in that circumstance, Enbridge Gas will have to consider what additional steps could be taken. It is premature to indicate at this time what those steps might be.

b) Enbridge Gas will not start construction until it has received all necessary permissions relevant to the construction being undertaken.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Federation of Rental-housing Providers in Ontario (FRPO)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Pages 2-11

Preamble:

In the above reference, EGI describes the condition of the subject pipeline. We would like to understand better, assessment done, mitigation that was applied and choices made to limit the assessment.

Question**:**

Given the integrity concerns created, when EGI was doing the integrity digs in 2016-2018, was any corrosion mitigation applied such as anodes to improve the corrosion resistance of the pipe, at least, on an interim basis?

a) If yes, please describe the approach and the additional investment applied.

b) If not, please explain why no investment was made to reduce the congoing corrosion to delay the need for further

Response:

a) and b) Additional corrosion mitigation was employed during the integrity digs, although not per the specific example noted above. Additional anodes were not employed at these locations because the piping is protected by an impressed current system rather than galvanic anodes. In general, Enbridge Gas does not mix galvanic protection with impressed current protection. As such, local anodes were not employed at these locations. However, the coating was inspected and repaired to ensure effective corrosion control. In addition, the backfill at the site was replaced with a clean sand backfill. Finally, where feasible, test stations with coupons were installed at these locations to enhance the understanding of the cathodic protection on the piping. Please see Exhibit I.EP.10 b).

ENBRIDGE GAS INC.
Answer to Interrogatory from
Federation of Rental-housing Providers in Ontario (FRPO)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Pages 2-11

Preamble:

EGI evidence states: "*Based on the observations described above, and in consideration of the additional costs that would be incurred, Enbridge Gas made the decision to not conduct an ILI of the remaining 2.6 km of the C2B segment.*"

Question**:**

Please provide the actual cost to conduct ILI inspections for the first 1.9 km of the project.

a) Please provide the estimated cost to conduct ILI for the remaining 2.6 km of the project.

b) Please provide the analysis, report and/or recommendation that led EGI to estimate the condition of the remaining 2.6 km.

Response:

a) The actual cost of the 2016 ILI inspection was $322,396. The actual cost of the 2018 ILI was $517,585. Enbridge Gas estimates the cost to conduct an ILI for the remaining 2.6km of the Cherry to Bathurst segment would be approximately $1 million if conducted in 2020.

b) Please refer to Exhibit I.EP.6.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Federation of Rental-housing Providers in Ontario (FRPO)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Pages 2-11

Preamble:

EGI evidence states: "*Based on the observations described above, and in consideration of the additional costs that would be incurred, Enbridge Gas made the decision to not conduct an ILI of the remaining 2.6 km of the C2B segment.*"

Question**:**

Please provide the output from PiMSlider model including any glossary which assists with interpretation.

Response:

Please refer to the Excel file associated with this response for the output from PiMSlider. There is no associated glossary document.

OUTPUT FROM PiMSlider MODEL

Placeholder: The Attachment (Excel) has been filed separately

ENBRIDGE GAS INC.
Answer to Interrogatory from
Federation of Rental-housing Providers in Ontario (FRPO)

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, Pages 9-10 and
Section 101, EB-2019-0172, Exhibit B, Tab 1, Schedule 1, Pages 3-4

We would like to understand better EGI's policy on depth of cover. In the instant proceeding, EGI states that while the CSA Z662 has a minimum cover of 0.6m, EGI's minimum depth is 0.9m. However, in Section 101 application for the Windsor Line replacement, EGI states that it initially proposed 0.75 km.

Question**:**

Please reconcile this seeming contradiction in two current proposed projects.

a) Please provide the company's policy on depths as it pertains to new installations and existing installations

b) For table 4, please provide how many instances and lengths are between 0.75 m and 0.9 m.

c) In the last 5 years, how many HP Steel lines has EGI installed at the minimum depth of 0.75m?
    i) Please provide the individual projects, the pipe size and the lengths.

Response:

a) The difference in minimum depth of cover requirements is due to differences in the Construction and Maintenance (C&M) Manuals as between legacy Enbridge Gas Distribution and legacy Union Gas. The C&M Manual for legacy Enbridge Gas Distribution stipulates a minimum depth of cover of 0.9m for a natural gas main installed in a right of way. The C&M Manual for legacy Union Gas stipulates a minimum depth of cover of 0.75m for a natural gas main installed in the untraveled portion of a right of way. For the legacy EGD C&M Manual, deviations from minimum depth of cover require approval from the Engineering Department. These may include:

- Underground structures or subsurface features prevent minimum cover. For such instances, additional protection from external loads must be installed (i.e. a ditch slab).
- Operation of pipelines at less than 30% SMYS located in private right-of-way, where the potential for external damage is low.

In no case must the depth of cover be less than 0.6 m (2 ft.).

b) This question pertains to the legacy Union Gas C&M Manual and is not pertinent to this application for leave to construct.

c) Please see the response to b) above.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Metrolinx

INTERROGATORY

Reference:

Exhibit B, Tab 1, Schedule 1, page 30

Preamble:

Timing

With leave of the Board, Enbridge Gas expects to commence construction of the Project in Q2 of 2021. In order to meet Project timelines, Enbridge Gas respectfully requests the approval of this Application as soon as possible and not later than February 2021.

Question**:**

Please provide Metrolinx with a copy of the proposed project schedule for review and comments.

Response:

Please refer to Exhibit I.Toronto.9.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Metrolinx

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1, page 6

Preamble:

Enbridge Gas selected the PR based on public consultation, environmental and socio-economic concerns, and technical and constructability requirements. Stakeholder engagement played an important role in the process of identifying the routes assessed in the ER. The PR is sited in existing, previously disturbed municipal road ROW, which greatly reduces potential adverse effects to the surrounding environment. The location of the PR and ARs can be found in Figure 5 of the ER which is reproduced below for ease of reference. Table 3 shows the final routes (the PR and ARs) for the Project and the names of the final routes.

Question**:**

Please provide Metrolinx with a schedule containing the proposed project plans for review.

Response:

Please see Exhibit I.Toronto.5.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Metrolinx

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1, page 10

Preamble:

All required land easements, permits and necessary agreements will be coordinated with the following:

- Ontario Energy Board
- Ontario Ministry of Environment, Conservation and Parks (MECP)
- Ontario Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), formerly Ministry of Tourism, Culture and Sport (MTCS)
- Ontario Ministry of Transportation (MTO)
- Hydro One Networks Inc.
- City of Toronto
- Toronto and Region Conservation Authority (TRCA)

Question**:**

a) Please provide Metrolinx with a schedule of Enbridge's plans for submissions of the traffic impact analysis.

b) Please advise if Enbridge has any agreements with the City of Toronto pertaining to road closures or road occupancy in respect of the project.

c) Please advise if Enbridge has submitted any applications to the city of Toronto for road closure or road occupancy permits. If Enbridge has not yet submitted applications for such permits, please provide Metrolinx with a schedule detailing Enbridge's current plan for submission of road closure and road occupancy permit applications.

Response:

a) Please see Exhibit I.Toronto.22 a).

b) Please see Exhibit I.Toronto.22 a)

c) Please see Exhibit I.Toronto.22.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. A, T2, Sch.1]

Question**:**

a) Please confirm that Enbridge does not require approval from the OEB to abandon the existing NPS 20 pipeline.

b) Please specify what approvals (if any) Enbridge is seeking from the Board in this proceeding related to the abandonment of the existing NPS 20 pipeline.

c) If the OEB provides Leave to Construct approval as requested in this application, does Enbridge expect to defend and justify the new NPS 20 project costs when it requests inclusion in Rates (i.e. during an Enbridge Rate Case) or does Enbridge consider an OEB approval in this proceeding pre-approval of those costs for rate purposes?

d) Please confirm if the abandonment of the existing NPS 20 pipelines is considered part of this Leave to Construct application. Please provide application references as appropriate.

Response:

a) Confirmed.

b) Please see the response to a) above.

c) Enbridge Gas expects to apply for ICM treatment of the Project in the 2022 rates application. Approval of the immediate application by the OEB will establish the need for the Project and confirm a reasonable cost estimate for the Project. Those findings will be relevant when the Company seeks cost recovery through the ICM. All capital expenditures may be subject to a prudence review at the time of re-basing.

d) The abandonment of the existing NPS 20 pipeline is part of the overall Project and costs. Please refer to Exhibit F, Tab 1, Schedule 1, Attachment 1, Page 2.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

OEB Staff Interrogatory #7

[Ex. A, T2, Sch.1, Page 10] - "An Environmental Protection Plan (EPP) will be developed for the Project."

OEB Staff provided a list of Draft Conditions of Approval for Enbridge to comment on. One of those was the following condition:

"Enbridge Gas shall implement all the recommendations of the Environmental Report filed in the proceeding, and all the recommendations and directives identified by the Ontario Pipeline Coordinating Committee review"

Question**:**

a) Due to the environmental and socio-economic impact of large diameter construction in an urban congested area, please confirm that Enbridge would support the following condition of approval (or if not, please explain why):

   Enbridge shall retain or assign a qualified Environmental Inspector for the duration of the project, including construction and restoration.

b) Please confirm that the reference to Ontario Pipeline Coordinating Committee in the proposed condition above includes all permitting and approval authorities per the OEB's Environmental Guidelines for Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario.

Response:

a) Enbridge Gas does not believe that this condition is required. As explained at Exhibit C, Tab 1, Schedule 1, Page 11:

> A qualified Environmental Inspector or suitable representative will be available to assist the Project Manager in ensuring that mitigation measures identified in the EPP as well as permitting requirements and any associated conditions of approval in the Board Decision are adhered to and that commitments made to the public, landowners and agencies are honoured. The Environmental Inspector and Project Manager will

also ensure that any unforeseen environmental circumstances that arise before, during and after construction are appropriately addressed.

b) Confirmed.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. A, T2, Sch.1]

“The route and location for the Project were selected by an independent environmental consultant (Dillon Consulting Ltd.)”

Question**:**

Please provide a copy of the engagement letter and/or executed contract outlining the scope of work for Dillion Consulting Inc.

Response:

Please see the attachment to this response which sets out the scope of work that Enbridge Gas set out in the request for proposal that lead to Dillion’s engagement.

Service Requisition

Requested by:	Kelsey Mills	Date:	September 3, 2109
Business Unit:	Enbridge Gas Inc.		
Stakeholders:	Melany Afara		
Director:			
Vice-President			
Approvals			
Preferred Vendors:			
Is sourcing of new vendors required?	(Yes / **No**)		

Background:

I would like to request a proposal for a potential Environmental Assessment required on a pipeline replacement project that is subject to Leave-to-Construct requirements under the Ontario Energy Board.

Enbridge Gas Distribution Inc. (Enbridge) is proposing to replace approximately 4.5 kilometers (km) of existing high pressure (HP) Nominal Pipeline Size 20-inch (NPS20) steel natural gas pipeline located along Lake Shore Boulevard from Cherry Street to Remembrance Drive in Toronto, Ontario with an anticipated in-service date of 2022 (the Project).

The area is highly urbanized with many stakeholders and is difficult to pre-screen for potential routes, Enbridge has therefore retained Golder to perform a desktop corridor routing study to determine potentially feasible corridor options for the proposed pipeline through their Goldset methodology. The potentially feasible corridors will be explored further through detailed engineering studies and regulatory processes including the LTC and Environmental Assessment.

The Environmental assessment will need to review and incorporate the results of the Golder report.

The Project must satisfy the Ontario Energy Board's (OEB) Environmental Guidelines for the Location, Construction and Operation for Hydrocarbon Pipelines and Facilities in Ontario, 7th ed. 2016 and the Canadian Environmental Assessment Act (CEAA) (if applicable) and other federal approval requirements (i.e., Indigenous and Northern Affairs Canada).

The Project has 5 routes currently being considered:

See Figure 1 in Appendix A.

Objectives:

As part of the NPS 20 Cherry to Bathurst Project, a Leave-To-Construct (LTC) application must be submitted to the Ontario Energy Board (OEB).

In support of the Project, Enbridge Gas Inc. (EGI) is seeking the services of an environmental consultant to perform an environmental, cumulative effects and stage I archaeology assessment of the proposed work, as well as, prepare an Environmental Report documenting all findings and recommended mitigation measures.

The report will become part of the evidence to be filed with the OEB. Enbridge will file a Leave to Construct application for this pipeline with the OEB.

A review and incorporation of the Golder desktop corridor routing study will be required as part of the environmental assessment.

Scope of Services:

See Appendix A.

Deliverables:

Environmental Report

The Environmental Report must satisfy the Ontario Energy Board's (OEB) Environmental Guidelines for the Location, Construction and Operation for Hydrocarbon Pipelines and Facilities in Ontario, 7th ed. 2016 and the Canadian Environmental Assessment Act (CEAA) (if applicable) and other federal approval requirements (i.e., Indigenous and Northern Affairs Canada).

Full-Term Contract Value, $:

Contract Term (i.e. 2 Years, 3 years, 5 years?)

Insurance Requirements (i.e. CGL $2M or $5M, Auto, Non-Auto, etc.)

Will a Third Party Risk Assessment be required? (Cybersecurity, Enbridge Network access, Cloud if there is IT component required by RFx)

No

Project Timeline / Schedule (if applicable)

Task #	Task Description	Completion Date
1	Duty to Consult Letter submission to MOENDM	TBD
2	Project Kick-Off Meeting	TBD
3	MOENDM Delegation Letter Received by Enbridge (estimate)	TBD
4	Public Open House	TBD
5	Submission of Draft Report to Enbridge	TBD
6	Final Report	TBD
7	LTC Filing with OEB	TBD
8	OEB Decision	TBD
9	Project Construction	TBD
10	Project Completion	2022

RFQ Timeline / Schedule

Item	Ideal Date
Issuance of RFQ	September 5, 2020
Deadline of Intent to Respond	September 17, 2020
Query Submission Deadline	
Pre-Proposal Meeting (if required)	
Site Visits (if required/Construction Projects	
Proposal Submission Deadline	September 20, 2019
Proposal Review and Clarification / Interview Meeting (if required)	

Special conditions / Applicable Documents/ Regulations (if applicable):

Submission to this RFQ must include the following:

1. A detailed outline of the proposed study approach indicating all tasks to be undertaken (i.e. route generation, background research, site visits, route evaluation, consultation program, first nation consultation program, impact assessment, mitigation/monitoring, Stage I Archaeology Assessment, etc.) and assumptions used in the work plan.
2. A communication strategy for the project which includes public, agency and Indigenous consultation (i.e. stakeholder list, consultation log, etc.).
3. The work schedule for all tasks and final report preparation. Included in this, should be the assumptions used for the number of meetings required between Enbridge and the selected Recipient. The Recipient should assume that the kick-off meeting scheduled for the week of October 7, 2019 would take place at Enbridge's office at 500 Consumers Rd Office. The consultant will prepare environmental material for the update meeting. Any variations from the proposed schedule should be identified in the proposal, including a rationale for doing so. Also include the cost for bi-weekly update meetings up until the ER is finalized.
4. Estimates for all maps and the types of maps proposed to be used for displaying the environmental information. The Recipient should also indicate the scales of the maps that are intended to be used.
5. Organizing, and providing suitable visual and handout materials for community information meetings. This cost should also include an estimated cost for the use of a meeting hall, preparing mail drops, preparing the newspaper advertisements (please include 2 newspaper advertisements per open house), questionnaires, storyboards (15 panels), nametags and the names of the proposed newspapers in which the adverts will be placed. Light snacks and refreshments (coffee and timbits) should be included in the cost for open house attendees as well as a light meal (sandwiches) for the Enbridge/consultant representatives.
6. Estimated costs associated with the preparation of the draft and final copy of the report in Adobe Acrobat or Microsoft Word format. The draft reports shall be in a format that is easy to review and edit (i.e., track changes). The final report must be in a format suitable for immediate distribution to agencies. The consultant should also include any assumptions used in reviewing the draft report.
    - One copy of the report, including all graphics, should be provided in a format suitable for copying and printing.
    - Costs shall include 11 printed copies of a final report including all maps. Seven of these copies must be redacted while 4 copies must be un-redacted. Printed reports shall be mailed to Enbridge's office at 500 Consumers Rd, North York, ON M2J 1P8.
    - Electronic copies must include 1 secured version (both redacted and un-redacted), and one unsecured version (redacted only).
7. Cost table, including estimated fees and disbursements per task.
8. A table providing the people involved in the project, their title, rate as per the Consultant Agreement and their percent involved in the project. Also, their qualifications should be provided. The use of any sub-consultants, if required should also be specified. If similar project experience is listed, please indicate the function of current proposed project team members during those projects, if any.

9. A schedule of per diem professional fees for attendance at additional meetings and for testifying at the OEB, if required.
10. Map(s) to show existing, proposed and potential routes to be included as part of the Environmental Report.
11. Assumptions.
12. Any recommended additions to the Scope with reasoning as to why they are being recommended.

Regulations:

- Ontario Energy Board's (OEB) Environmental Guidelines for the Location, Construction and Operation for Hydrocarbon Pipelines and Facilities in Ontario, 7th ed. 2016
- The Canadian Environmental Assessment Act (CEAA) (if applicable)
- Other federal or provincial approval requirements (i.e., Indigenous and Northern Affairs Canada)

Location/Geography of where services will be required by Area (i.e. Area 10, etc)

See Appendix A.

APPENDIX A – SCOPE OF SERVICES

NPS 20 Cherry to Bathurst PIPELINE PROJECT

1. INTRODUCTION

Enbridge Gas Distribution Inc. (Enbridge) is proposing to replace approximately 4.5 kilometers (km) of existing high pressure (HP) Nominal Pipeline Size 20-inch (NPS20) steel natural gas pipeline located along Lake Shore Boulevard from Cherry Street to Remembrance Drive in Toronto, Ontario with an anticipated in-service date of 2022 (the Project).

The area is highly urbanized with many stakeholders and is difficult to pre-screen for potential routes, Enbridge has therefore retained Golder to perform a desktop corridor routing study to determine potentially feasible corridor options for the proposed pipeline through their Goldset methodology. The potentially feasible corridors will be explored further through detailed engineering studies and regulatory processes including the LTC and Environmental Assessment.

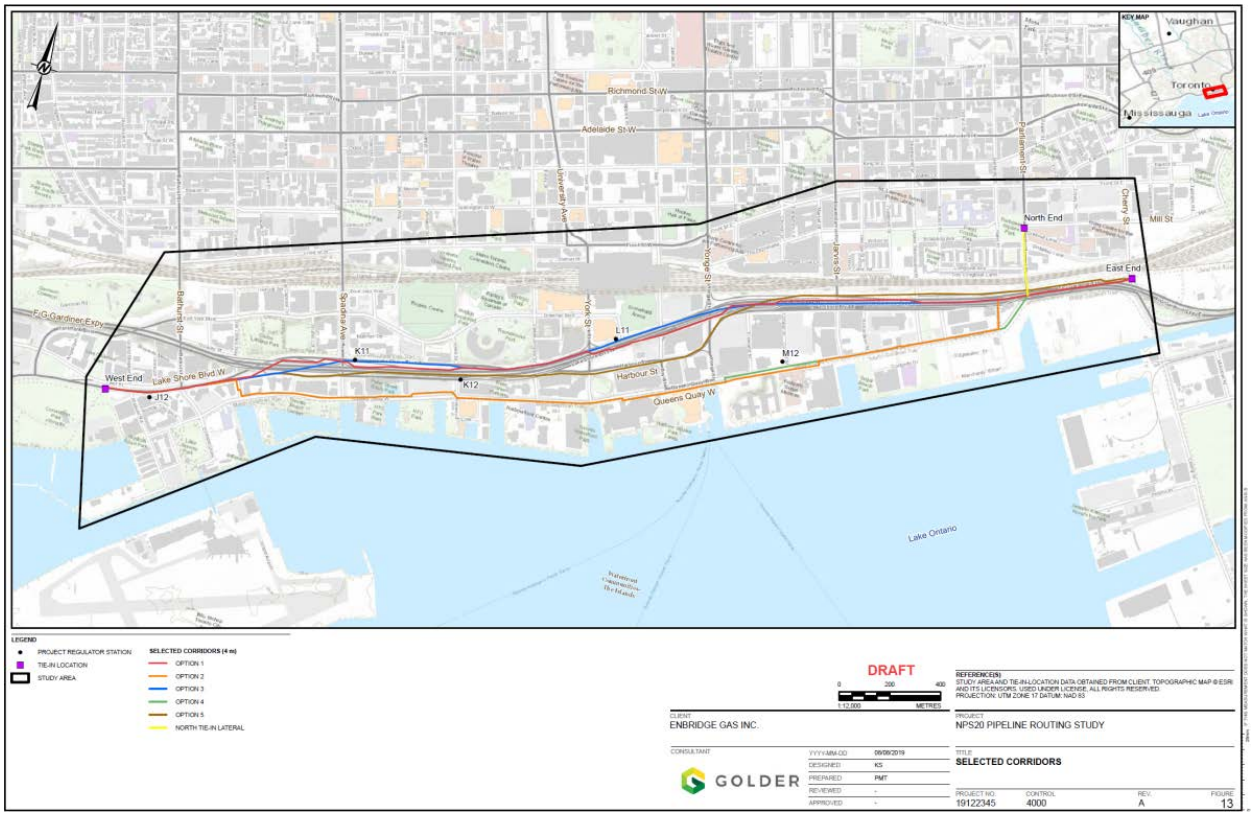
The Environmental assessment will need to review and incorporate the results of the Golder report.

An integrated public consultation program will also be required throughout the period of this study. This program should include affected government agencies, Indigenous groups (as identified from the Duty to Consult Process [to be completed by Enbridge]), interest groups,

landowners and other interested parties. The proposal should include a description of the consultant's public consultation program.

The Project timeline is indicated below:

Task #	Task Description	Completion Date
1	Duty to Consult Letter submission to MOENDM	TBD
2	Project Kick-Off Meeting	TBD
3	MOENDM Delegation Letter Received by Enbridge (estimate)	TBD
4	Public Open House	TBD
5	Submission of Draft Report to Enbridge	TBD
6	Final Report	TBD
7	LTC Filing with OEB	TBD
8	OEB Decision	TBD
9	Project Construction	TBD
10	Project Completion	2022



SELECTION OF THE PREFERRED PIPELINE

Phase I - Selection of Pipeline Route Alternatives

The consultant will complete an environmental inventory of the selected study area. This will include desktop studies, site visits, and personal contact with local, provincial, and federal government agencies as well as Indigenous communities.

As part of this study, the selected consultant will be required to ensure that the local environmental interest groups, directly and indirectly affected landowners and the public and private sector are notified and kept informed about the project and the Study findings. The contact list and a comment tracking table should be documented in the Environmental Report.

Based on the environmental information collected, together with the technical requirements for construction, the consultant will be expected to define a study area for the proposed pipeline and potential routes.

See Section 3 below regarding specific requirements for consultation and engagement during the project.

Phase II - Environmental Considerations of Preferred Route

As part of this study, the selected consultant will be expected to develop criteria by which to evaluate the proposed routes. The criteria will be based on the information received from the government agencies, Indigenous communities, stakeholders and from the environmental data compiled. Applying this criterion, the consultant will be expected to select the Preferred Route. This evaluation must be objective, replicable and defendable.

It is expected that the consultant will extract relevant environmental information including, but not limited to:

- geological resources (including depth to bedrock)
- soil resources
- wetlands (in accordance with the current Policy Statement)
- surface and groundwater conditions
- aquatic resources
- heritage resources (Built Heritage and Archaeological)
- seismic activity (if applicable)
- vegetation
- wildlife habitat (including vulnerable, threatened and endangered species)
- waste management areas (open and closed)
- social and cultural features, including identifying which route has the most working space
- cumulative effects

Other relevant environmental information on mineral resources, land uses, recreational areas, and municipal zoning may also be required. Indigenous traditional land use and knowledge must also be incorporated, and mitigation measures must be developed to protect these resources, as required.

Having selected the Preferred Route, the consultant will be expected to focus on refining and collecting further environmental and socio-economic information in more detail along the Preferred Route and developing mitigation and monitoring (if applicable) plans for this route.

It is expected that this detailed environmental information will be transposed to appropriate maps (i.e. figures, tables, alignment sheets, etc.) to be included in the Environmental Report and will also provide the basis for predicting the environmental impacts of the Preferred Route. The consultant will also be expected to provide advice on suitable mitigation measures to manage those impacts during construction and operation of the pipeline. Mitigation measures and suggested remediation should comply with accepted industry practice and Enbridge's Construction Specifications. Should the Preferred Route cross any environmentally sensitive areas, more detailed site-specific maps will be required to indicate the proposed site specific mitigative measures.

It is expected that a second open house will not be required, but if one is required, based on consultation then consultant's responsibilities will be the same as described for the first public meeting.

3. CONSULTATION, ENGAGEMENT AND OPEN HOUSE

Stakeholder Consultation

Enbridge shall be notified of all meetings, contacts with provincial, regional and local government representatives, Indigenous groups, interest groups, associations and other knowledgeable individuals that the Consultant may use in completing the required work. This may be achieved by providing Enbridge with a list of agencies to be contacted at the beginning of the study.

The Consultant shall maintain an updated contact list of names, titles, addresses, email addresses and phone numbers of all individuals and agencies contacts, the method of contact as well as the subject matter discussed. An annotated list shall be submitted to Enbridge with the draft and final versions of the Environmental Report.

Enbridge will consult with the Ministry of Energy, Northern Development and Mines (as required) in order to obtain a list of Indigenous communities to include in the consultation program.

In order to aid in the collection of stakeholder comments, a project specific email should be developed. This email shall be active until substantial construction is completed in 2022. The consultation logging shall include documenting comments from all stakeholders up until the OEB approves the Leave to Construct application, which is approximately 2020, and then shall include consultation logging for all Indigenous consultation up until substantial construction is completed.

The consultant will be responsible for responding and/or coordinating responses as well as documenting all inquiries and responses from the project specific email. To aid in this

responsibility, an FAQ and Key Information document will be provided to the consultant prior to the open houses and admail/advertisements.

Indigenous Engagement

Enbridge's own Indigenous Engagement Advisor will complete the Indigenous consultation, but it is expected that the consultant will support in this engagement, which could include preparing notice of commencement letters, project details, logging consultation, attendance at meetings, preparation of meeting agendas, documentation of meeting minutes, etc.

At this time, it isn't expected that meetings will be required with Indigenous communities, however, if meetings were to be required, consultant support will be required. A per meeting rate (including the preparation of materials) should be included in the RFQ response.

Open House

The first public information session should be held to seek public input and preferences for the alternate routes identified. It should be clear to the public participants how the information gathered at this meeting is to be used and how the environmentally preferred route for the pipeline will be selected in principle. So that all potential stakeholders in the proposed pipeline are made aware of the meeting, a mail drop for residents within the study area is required. The consultant will be expected to make all arrangements for these meetings including preparation of any newspaper advertisements, visual displays, questionnaires, name tags, etc. Costs associated with the placement of newspaper ads will be the responsibility of the consultant as well as the arrangement for placement of these ads. Snacks and refreshments for the project team and open house attendees shall also be included within the Proposal.

4. STAGE I ARCHAEOLOGY ASSESSMENT AND CULTURAL HERITAGE CHECKLIST

The Stage 1 Archaeology Assessment ("Stage I AA") will include a background review of the entire study area on surficial geology, post-glacial landscape evolution, historical and present land uses and will also review available data from the Ministry of Heritage, Sport, Tourism, and Cultural Industries (MHSTCI). Based on the results of the Stage I AA, recommendations will be made for a Stage II Archaeology Assessment. All aspects of the Stage I AA will meet requirements set out by the MHSTCI.

Time and budget must be included in order to incorporate comments from EGI, Indigenous communities (prior to MHSTCI submission) and the MHSTCI (after submission, if required).

A Cultural Heritage Checklist (Criteria for evaluating Potential for Built Heritage and Cultural Heritage Landscapes: A checklist for the non-specialist) should be completed to determine whether the project could affect known or potential cultural heritage resources. Recommendations should be given as to whether a Cultural Heritage Assessment Report ("CHAR") is required, based on the findings from the Cultural Heritage Checklist.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. A, T2, Sch.1]

"The Project consists of the installation of approximately 4.5 km of NPS 20 HP ST natural gas pipeline from the intersection of Cherry Street and Lake Shore Boulevard where it will tie-in to an existing natural gas pipeline. From there it travels west along Lake Shore Boulevard (and parts of Harbour Street) to Remembrance Drive (west of Bathurst Street) where it will tie-in to an existing natural gas pipeline. The Project also requires the construction of a tie-in lateral (the North Tie-In Lateral) which commences at the intersection of Mill Street and Parliament Street. At that intersection the North Tie-in Lateral will tie-in to an existing natural gas pipeline. From there the North Tie-in Lateral travels approximately 260 m south along Parliament Street to Lake Shore Boulevard where it will tie-in to the facilities to be constructed along Lake Shore Boulevard".

Question**:**

Please confirm the scope outlined above represents the "Project" and that the term "Project" and "LCEP" facilities are interchangeable. If not, please explain.

Response:

Confirmed. The description above represents the "Project". Enbridge Gas would note that the reference to "LCEP" facilities in Exhibit A, Tab 2, Schedule 1, Paragraph 13 i) should read Project.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. B, T1, Sch.1]

Question**:**

a) Please explain how the section of NPS 20 pipeline that Enbridge proposes to replace ranks against other projects identified with integrity issues. Please provide a table showing the ranking.

b) Please describe the process used to decide which of the project on the list above move forward for replacement and who makes that decision.

c) Has Enbridge completed an Integrated Planning assessment or screening for this project? If yes, please provide a copy.

Response:

a) Enbridge Gas follows its Asset Management process as outlined in the Asset Management Plan and does not specifically rank each project. See response to b) below.

b) As described in the Company's Asset Management Plan, reliability engineering is used to understand the health of assets. Based on projected life cycles, consequences of failure, tacit knowledge, and asset data, risk is quantified. Renewal projects are planned to reduce this risk to the lowest practicable level. All risk assessments are based on risk models and methodology using Enbridge Gas's Value-Based Asset Management Model and the Risk Management Framework. Portfolio optimization is performed as part of the Asset Management Process to establish the timing of projects for the Asset Plan. Section 4.1.5 of Enbridge Gas's latest Asset Management Plan (filed in EB-2020-0181) describes the decision making process.

c) Please see Exhibit B, Tab 1, Schedule 1, Paragraph 40.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. B, T1, Sch.1]

"Table 11 provides a summary of the results of the cost comparison analysis. The total cost of the Project is much lower than the cost of the Repair Option. While the net present value of the Repair Option is modestly lower than that of the Project, the cost of the Repair Option is a conservative estimate. It does not take into account any of the secondary impacts identified in Table 10 above such as economic impacts to residents and local businesses."

Question**:**

a) Please explain why Enbridge did not include economic estimates of all costs to make an apples-to-apples NPV comparison in Table 11.

b) Repairing localized issues (including on traffic and businesses) would have localized impacts rather than larger impacts due to constructing over a larger area. Please explain why that was not included as a benefit if the Repair Option in Table 10.

c) It appears that the decision above was based on Enbridge employee or executive judgement rather than pure economic (NPV) analysis. Please confirm this is correct or if not correct please explain how the conclusion was reached to go with the more costly option (per table 11).

Response:

a) Table 11 presents direct project capital costs for NPV comparison. This is consistent with the discounted cash flow methodology as described through E.B.O. 188, the methodology used by Enbridge Gas to compare the costs of the repair and replace options. The financial assessment of both the repair and replacement options used direct capital costs.

b) Over time, there may be no more disruption from Pipeline installation than Integrity Digs. Pipeline installation can deliberately be planned to avoid congested areas, whereas digs on the existing pipeline could be anywhere along the existing pipeline length, including in disruptive areas (middle of an intersection, roadway, close

proximity to Gardiner columns, etc.).

c) Please see Exhibit I.EP.2.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

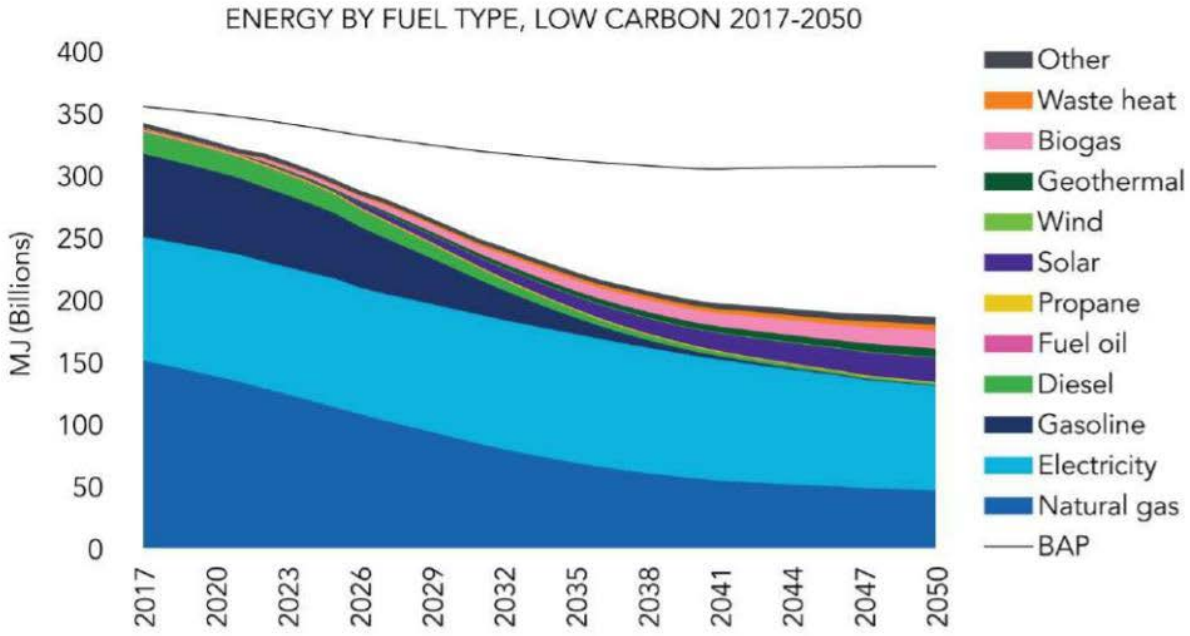
INTERROGATORY

Reference:

[Ex. B, T1, Sch.1]

"The scenarios presented above are premised on existing customers. As discussed below, Enbridge Gas expects that the downtown core will continue to experience growth over the coming years. Should the C2B segment remain in place in its current condition and be isolated in the future due to a defect or damage, then more customers and gas users could experience a service interruption than those presented in the scenarios above."

Figure 33. Energy by fuel, Low Carbon 2017-2050. TransformTO: Climate Action for a Healthy, Equitable, Prosperous Toronto.



Question:

a) The City of Toronto forecasts a significant decrease for natural gas use over the life of the proposed pipeline. Please reconcile that with Enbridge's projection and explain if a smaller pipeline or reduced pressure would be more cost-effective to

meet declining natural gas demand.

Response:

Please refer to Exhibit I.ED.3.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. C, T1, Sch. 1]

Question**:**

a) Please confirm which Enbridge policy, manual or other guidance material indicate that Enbridge will comply with the OEB's Environmental Guidelines for Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario and provide the relevant excepts from each document.

b) Please confirm that all requirements within the OEB's Environmental Guidelines for Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario have been followed or outline which requirements Enbridge has not followed.

c) Please provide a list of all regulatory approvals and permits Enbridge must secure in order to decommission the existing NPS 20 transmission pipeline.

d) Please confirm that Enbridge has secured approval from the City of Toronto to abandon the existing pipeline in place and please provide a copy of the correspondence from the City of Toronto indicating such approval.

e) If approval for abandonment in place of the existing NPS 20 pipeline has not already been secured, please provide an estimate of what additional costs could be incurred if the existing pipeline abandonment approval requires removal of the pipeline rather than abandonment in place.

Response:

a) As a regulated utility, it is Enbridge's Gas's understanding that the OEB expects it to comply with the Guidelines where required. The Guidelines apply to all hydrocarbon lines that fall under the OEB's jurisdiction under section 90 of the OEB Act.

b) Enbridge Gas will comply with all requirements of the Guideline. Enbridge Gas will also comply with all conditions of approval included the OEB's leave to construct decision.

c) Please refer to Exhibit I.Staff.2 a). Enbridge Gas may require permits from the City of Toronto, for example road cut permits to allow for sectionalizing of the abandoned pipeline.

d) Enbridge Gas does not require approval from the City of Toronto to abandon the pipeline in place.

e) The standard procedure at Enbridge Gas is to abandon pipelines in place. Removal of the existing NPS 20 would be cost prohibitive and would include having to excavate large portions of the existing pipeline including every fitting or bend. These are sometimes in hard-to-reach locations such as near the Gardiner columns, or in the middle of the roadway or intersections. Several utilities have been constructed around the NPS 20 over the years and would have to be daylighted to ensure no damage is made to them during the removal process. Contaminated soil would have to be disposed of. At a high-level, Enbridge Gas estimates that complete removal of the 4.5 km segment would cost as much as $100 million.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. C, T1, Sch. 1]

Question**:**

a) Will the proposed abandonment of the existing pipeline require significant work in accordance with Enbridge's construction and maintenance manual, including sectionalizing abandoned pipe every 450m and grouting road crossings to prevent settlement from above. If not correct, please explain.

b) Please provide which areas of the Environmental Report and mitigation plans cover the impacts and mitigation plan related to abandonment of the existing pipeline.

c) Has Enbridge assessed impacts to businesses and financial support during construction disruption for the project?

d) Please provide a copy of all materials shared with businesses along the proposed route.

e) It is not unexpected to encounter areas of contaminated soil in downtown Toronto. Please explain what Enbridge has done to investigate that potential along the proposed route and what funding the proposed project budget includes for such an eventuality.

Response:

a) Correct, the existing pipeline will be abandoned in accordance with Enbridge's Construction and Maintenance manual. Please see Exhibit I.ED.10.

b) The abandonment of the existing pipeline was not assessed as part of the Environmental Report.

c) The construction plans and schedules will be developed during the detailed engineering phase and Enbridge will continue to consult with the city, local residents

and businesses adjacent to the proposed Project route, to let them know when the construction will take place and who to contact if there are any concerns. The construction plan will incorporate details and mitigation measures to ensure minimal impacts to the businesses in the area.

d) Please refer to 'Section 3.0 Stakeholder Consultation Program' in the Environmental Report Filed in this application.

e) Enbridge Gas assumed most of the ground along the proposed route is contaminated. Costs related to ground contamination are included in Total Project Costs. Please see Exhibit I.EP.23.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. C, T1, Sch. 1]

Question**:**

a) Please provide a list of all OPCC organizations and permitting authorities where Enbridge has not yet received a letter confirming approval or that there are no residual issues with the proposed project.

b) If Enbridge has not received a letter from an OPCC organization or permitting authorities, does Enbridge make the assumption that silence is consent? If not, please explain how Enbridge intends to seek confirmation from all outstanding OPCC organizations and permitting authorities.

Response:

a) Please refer to the Exhibit I.Staff.4 a) for an updated consultation table. As indicated at Exhibit D, Tab 1, Schedule 1, Table 2 Enbridge Gas Expects to receive all permit approvals by April 2021.

b) The Guidelines recommend that the 42-day OPCC review period take place before an application is made to the OEB, to allow for a review of the ER and resolution of any concerns prior to the start of the hearing. The applicant must advise all affected parties in writing that those parties can provide comments on the ER to the applicant. Copies of any letters received, should be sent to the OPCC Chair. After the review of the ER is complete, the Chair of the OPCC will advise the applicant in writing of any issues which remain outstanding, following the review of the ER by OPCC representatives. Enbridge Gas is not mandated to follow up once the 42-day review period has finished. The OPCC's position on a project's environmental impacts does not preclude any intervenor, or OEB staff, from raising environmental concerns at the hearing.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. C, T1, Sch. 1, Attachment 1]

Question**:**

a) Does the proposed route intersect any dedicated bicycle lanes? If so, what mitigation is proposed to protect the safety of cyclists.

b) Did Enbridge conduct or leverage traffic study data for each route option? If so, please provide the traffic count information.

c) Construction in this congested downtown area will have spillover impacts on other roads due to traffic delays. Please describe how Enbridge has assessed those impacts and what mitigation it proposes.

d) The Environmental Report completed by Dillon indicates that all permits and approvals should be acquired prior to starting construction. Does Enbridge agree to this recommendation?

e) Please provide the following:
   • Water source for hydrostatic testing
   • Volume of water that will be required
   • Discharge location following hydrostatic testing
   • What permits and approval will be required

Response:

a) The proposed route does intersect with dedicated bicycle lanes at several intersections. The safety of cyclists will be incorporated into the traffic control plan for the Project. Specifically, Enbridge Gas will develop its traffic control plan in accordance with the Ontario Traffic Manual Book 7 – Temporary Conditions, which includes consideration of cyclist safety.

b) Enbridge Gas did not conduct or leverage traffic study data for each route option. An appropriate traffic control plan will be developed for the Project in accordance with

the Ontario Traffic Manual Book 7 – Temporary Conditions. Also, please refer to Exhibit I.Toronto.22.

c) Please refer to the response to b. above.

d) Yes. However, depending on the nature of the outstanding approval commencing construction of part of the Project may be possible.

e) Refer to EB-2020-0136 Exhibit D, Tab 1, Schedule 1. The NPS 20 HP ST pipeline will be pressure tested using a pneumatic test. No hydrostatic testing is required.

ENBRIDGE GAS INC.
Answer to Interrogatory from
Pollution Probe (PP)

INTERROGATORY

Reference:

[Ex. C, T1, Sch. 1, Attachment 2] –

The Golder Report includes an assumption that the Public is willing to tolerate construction in congested areas as they recognize the importance of replacing aging infrastructure.

Question**:**

a) Please provide the reference source of this assumption and a copy of supporting materials (e.g. public survey).

b) Does this assumption also apply to businesses along the proposed route? If so, please provide a copy of the materials (e.g. survey responses) supporting this assumption.

c) Has Enbridge identified what other road or utility projects will be occurring during the proposed construction window for this pipeline and the cumulative impacts due to these projects? If so, please provide a list and the proposed mitigation plan.

d) Please confirm that there are 27 direct service connections on the existing pipeline that the proposed project replaces. If not, please provide the accurate number. If yes, please explain why these customers are attached to the high-pressure transmission pipeline rather than a local distribution pipeline.

e) Please indicate if cycling lanes or number of businesses were used in analyzing and selecting the Preferred Route. If yes, please provide the reference. If not, why not.

Response:

a) Golder's assumption was made to facilitate the desktop review of potential alternatives using the 'Goldset' Method. Without this assumption, all routes would be infeasible.

   Dillon Consulting Ltd. was retained to evaluate the routes from an environmental and socio-economic perspective while also ensuring comprehensive consultation on the proposed routes was completed as part of the evaluation. Please refer to the

Environmental Report filed with this application to review the summary and recommendations of the study.

b) Refer to response a) above. Also please refer to Section 3.0 Stakeholder Consultation Program in the Environmental Report for the types of outreach and materials used in the consultation program.

c) Please refer to Section 7.0 Table 11 of the Cumulative Effects Assessment in the Environmental Report to view the list of projects that were assessed as part of the cumulative effects assessment. Enbridge Gas is committed to ongoing consultation with stakeholders and identifying projects that may not have been available to be assessed during the Environmental Report.

d) Confirmed, there are 27 direct service connections on the existing pipeline. These customers were connected to the high pressure system as there was no option to connect to a local distribution pipeline at the time of service installation.

e) Please refer to Section 2.0 Study Process and Section 5.0 Physical, Natural and Socio-Economic Environment Setting in the Environmental Report filed with this application. Enbridge Gas has not opted for a route along Queens Quay, where there are many cycling routes and businesses.

ENBRIDGE GAS INC.
Answer to Interrogatory from
OEB Staff (STAFF)

INTERROGATORY

Reference:

Exhibit A, Tab 2, Schedule 1, page 2
Exhibit B, Tab 1, Schedule 1, pages 1 to 3, 17, 25

Preamble:

Enbridge Gas Inc. (Enbridge Gas) requests leave to construct (LTC) approximately 4.3 kilometers of NPS 20 high pressure (HP) steel (ST) pipeline on Lake Shore Boulevard from Cherry Street to Bathurst Street, and 230 metres of NPS 20 pipeline on Parliament Street from Mill Street to Lakeshore Boulevard East in the City of Toronto (Project).

The Project is a like-for-like replacement project due to integrity issues with the Kipling Oshawa Loop (KOL), which the existing pipelines are a part of. Enbridge Gas's Asset Management Plan identified the KOL as having all the risks of vintage steel mains installed during and before the 1970s. The pipeline to be replaced by the Project was built in 1954 and is the first segment of the KOL to be investigated in detail; investigations are ongoing to identify other segments of the KOL requiring remediation or replacement.

Enbridge Gas stated that inline inspections were made using a robotic crawler tool were performed on approximately 1.9 km of the 4.5 km section of pipeline proposed to be replaced by the Project. The application is silent on whether the part or all of the KOL has ever been inline inspected using tools other than the robotic crawler (e.g., "smart pig").

Enbridge Gas expects that downtown Toronto will continue to grow and is aware of 55 developments in the immediate area of the Project that are either scheduled for occupancy in 2020 or 2021, and under construction or in the development process.

Enbridge Gas ran several scenarios that the KOL has either experienced in the past or to simulate a major supply disruption to determine if the Project segment could be downsized to lower the overall cost of the Project, examining the performance of the KOL in each scenario. Enbridge Gas stated the KOL system is designed such that it maintains a minimum pressure of 100 psig for the inlet pressure for all downstream district stations. Enbridge Gas stated that if pressures are not maintained, supply interruptions to customer will occur. The scenarios did not take into account customer

growth.

Question**:**

a) Please confirm that the 230 metre section to be constructed on Parliament Street is also a replacement of existing pipeline, and that the existing pipeline is also to be abandoned.

b) Please confirm that no ancillary facilities or stations are required to be constructed for this Project.

c) Have other sections or the entire length of the KOL ever been inline inspected? If not, please explain why not? If so, please explain and include in the response a description of the tools used and a summary of the findings.

d) Has Enbridge Gas taken into account the expected growth in the area in its pipeline design for the Project? Does Enbridge Gas expect to return to the Project area in the near future to replace the proposed pipeline with a larger diameter pipeline to accommodate the expected growth? If so, please explain why Enbridge Gas could not include a growth forecast with this application and propose a larger diameter pipeline to prevent having to return to the area for construction in the near-term.

e) Enbridge Gas stated that pressures were required to be maintained at 100 psig or greater along the KOL to prevent supply interruptions to customers, including hospitals and industrial customers west of the downtown core. In the scenario provided by Enbridge Gas where there was no feed from the West Mall Feeder Station, the inlet pressure at the West Mall Tie-In is expected to be 98 psig, even with an NPS 20 pipeline. Please explain why Enbridge Gas has not proposed a larger pipeline and/or higher operating pressures to maintain the minimum 100 psig and prevent a supply disruption in this scenario presented by Enbridge Gas. Also, please explain how Enbridge Gas intends to deal with the supply disruption.

f) Please indicate when Enbridge Gas anticipates having to replace the KOL given the condition of the Project segment and the likelihood that the rest of the KOL is currently in the same condition. Does Enbridge Gas intend to file an omnibus LTC application for the other sections of the KOL that will need to be replaced? Please provide the cost estimate for replacing the rest of the KOL anticipated by Enbridge Gas. Will Enbridge Gas include the KOL replacements in its Integrated Resource Planning?

Response:

a) Confirmed.

b) No ancillary facilities or stations are required to be constructed for this project. There are five existing district stations that will require inlet piping alterations to facilitate tying into the new Project.

c) Please see Exhibit I.ED.1 and Exhibit I.Toronto.17.

d) Please refer to Exhibit I.Toronto.16.

e) The purpose of this scenario was to determine if a smaller pipeline, a NPS 16, would be feasible and provide the same amount of reliability and flexibility as a NPS 20 pipeline. Enbridge Gas is confident that a NPS 20 pipeline will provide appropriate reliable and flexible service. In the event of a supply disruption as shown in this particular scenario, Enbridge Gas has the operational ability to manage this scenario with an NPS 20 pipeline.

   Enbridge Gas would follow its emergency response procedures, which would include monitoring pressures at the tail-ends of the system to have real-time data input to identify areas with potential supply shortfalls. Remedial efforts to rectify the supply shortfalls could include active manipulation of the existing pressure regulating stations feeding downstream networks, or the potential sourcing of compressed natural gas from internal supply or from external vendors, depending on the situation and availability of supply. The purpose of this comparison was to show the existing NPS 20 system is already at the supply threshold if an incident were to occur disrupting the feed from West Mall Feeder Station, which clearly shows the NPS 16 option was not a feasible solution.

f) Please see Exhibit I.Toronto.17 a).

   Recognizing that reviewing IRPAs for every forecasted infrastructure project would be extremely time intensive, binary screening criteria to determine if IRP analysis is warranted have been proposed by Enbridge Gas as part of its evidence in EB-2020-0091. Enbridge Gas notes that where a facility project is designed to meet a safety or reliability need, which may include replacement of short pipeline segments for integrity purposes, the project would not be a suitable candidate for IRP.

ENBRIDGE GAS INC.
Answer to Interrogatory from
OEB Staff (STAFF)

INTERROGATORY

Reference:

Exhibit F, Tab 1, Schedule 1, Attachment 1, page 2

Preamble:

Enbridge Gas expects to abandon approximately 4.5 km of the existing NPS 20 HP steel natural gas main along the same route.

Question**:**

a) Please confirm that the TSSA abandonment guidelines and the applicable current edition of CSA code Z662 will be followed for all pipeline abandonment in place.

b) Please comment on any aspects of the pipeline replacement that could adversely impact existing customers.

c) Please describe the measures that Enbridge Gas will have in place for the maintenance of customer supply and to ensure quality and reliability of service is met during the replacement/upgrade of these services.

d) Please provide a schedule of details regarding the decommissioning of the existing pipeline.

Response:

a) Confirmed.

b) and c) The Project will install a new pipeline that will be commissioned prior to abandonment of the existing pipeline. This will ensure uninterrupted service to existing customers. If live service tie-overs for the 27 existing customers fed directly off the existing main cannot occur, Enbridge Gas will contact the impacted customer(s) directly to coordinate the service relay to minimize disruption of service.

d) Abandonment will be completed at the same time as reinstatement, in October 2022.

ENBRIDGE GAS INC.
Answer to Interrogatory from
OEB Staff (STAFF)

INTERROGATORY

Reference:

Exhibit C, Tab 1, Schedule 1, page 2

Preamble:

A copy of the Environmental Report (ER) has been submitted to the Ontario Pipeline Coordinating Committee (OPCC), local municipalities, government agencies, interest groups, affected third party utilities and Indigenous communities. The City of Toronto and the Toronto and Region Conservation Authority (TRCA) have not provided comments on the ER.

Enbridge Gas retained a licensed Archaeologist to complete an Archaeological Assessment for the Project. The Archaeological Assessment Report was submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) on June 4, 2020.

Question**:**

a) Please file an update of the comments (in tabular format) that Enbridge Gas received as part of the OPCC review and in any public consultation. Please include the dates of communication, the issues and concerns identified by the parties, as well as Enbridge Gas's responses and actions to address these issues and concerns.

b) Has Enbridge Gas received a letter from the MHSTCI accepting the Archaeological Assessment Report submitted to the ministry into the Ontario Public Register of Archaeological Reports? If so, please provide a copy of the letter. If not, please indicate when Enbridge Gas anticipates a response from the MHSTCI.

Response:

a) Please see Attachment 1 for the updated OPCC consultation log as well as any comments that were received post finalization of the Environmental Report.

b) Enbridge Gas has not received an acceptance letter from the MHSTCI as of the date of this filing. Enbridge Gas does not know when the MHSTCI will issue a letter of acceptance. However, when received, Enbridge Gas will provide the acceptance letter to the Board.

DILLON CONSULTING

ENBRIDGE GAS INC.

NPS 20 Replacement Cherry to Bathurst

Stakeholder Consultation Logs – Post-ER Correspondence

Ontario Pipeline Coordinating Committee (OPCC) Correspondence

(Note: this table includes all OPCC correspondence that occurred after the Environmental Report was finalized for review [March 10, 2020]. Records of OPCC correspondence are included as attachments.)

Line Item	Date of Consultation	Name of Agency and/or Contact	Description of Consultation Activity	Date of Response	Response and Issue Resolution (if applicable)	Attachment No.
1.1	April 13, 2020	Ontario Energy Board Contact: Zora Crnojacki	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
2.1	April 13, 2020	Toronto and Region Conservation Authority (TRCA) Contact: Zack Carlan	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
2.2	June 23, 2020	TRCA Contact: Nathan Jenkins	TRCA representative provided a comment response letter to Enbridge related to the Environmental Report for the Project.	October 15, 2020	Enbridge representative apologized to TRCA representative for the delay and provided a letter in response to TRCA's June 23 letter.	2
3.1	April 13, 2020	Technical Standards and Safety Authority (TSSA) Contact: Kourosh Manouchehri	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	April 27, 2020	TSSA representative responded, stating that an "Application for Review of Pipeline Project" needed to be filled out and submitted to the TSSA as part of the OPCC review process.	3
3.2	April 28, 2020	TSSA Contact: Kourosh Manouchehri	Enbridge representative sent completed Application to TSSA representative.	N/A	N/A	3
3.3	April 30, 2020	TSSA Contact: Myrtle daFonseca	TSSA representative emailed Enbridge representative indicating that the "Application for Review of Pipeline Project" submitted on April 28th had been processed and assigned a file number. TSSA representative stated that the file had been assigned to Kourosh Manouchehri and to contact him directly with any questions.	N/A	N/A	4
3.4	May 15, 2020	TSSA Contact: Kourosh Manouchehri	TSSA representative emailed Enbridge representative and stated they had reviewed the Environmental Report and have no comments. TSSA representative noted the anticipated construction start date of spring 2021 and stated they would audit the Project site during construction. TSSA representative requested that Enbridge provide a more detailed construction schedule, when available.	May 15, 2020	Enbridge representative thanked TSSA representative.	5
4.1	April 13, 2020	Ontario Ministry of Agriculture, Food and Rural Affairs Contact: Arthur Churchyard	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
5.1	April 13, 2020	Ministry of Municipal Affairs and Housing (MMAH), Western Municipal Services Office Contact: Scott Oliver	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
6.1	April 13, 2020	MMAH Contact: Ross Lashbrook	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
7.1	April 13, 2020	MMAH, Eastern Municipal Services Office Contact: Michael Elms	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1

Line Item	Date of Consultation	Name of Agency and/or Contact	Description of Consultation Activity	Date of Response	Response and Issue Resolution (if applicable)	Attachment No.
8.1	April 13, 2020	MMAH, Northern Municipal Services Office Contact: Bridget Schulte-Hostedde	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
9.1	April 13, 2020	Infrastructure Ontario Contact: Patrick Grace	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
10.1	April 13, 2020	Ontario Ministry of Energy, Northern Development and Mines Contact: Shannon McCabe	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
11.1	April 13, 2020	Ministry of Environment, Conservation, and Parks (MECP) Eastern Regional Office Contact: Ruth Orwin	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
12.1	April 13, 2020	MECP Southwestern Regional Office Contact: Crystal LaFrance	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
13.1	April 13, 2020	MECP Northern Regional Office Contact: Kathy McDonald	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
14.1	April 13, 2020	MECP Eastern Regional Office Contact: Natalie Stacey	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
15.1	April 13, 2020	MECP Central Regional Office Contact: Paul Martin	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
16.1	April 13, 2020	Ministry of Heritage, Sport, Tourism, and Culture Industries (MHSTCI) Contact: Laura Hatcher	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
17.1	April 13, 2020	Ministry of Transportation (MTO) Contact: Tony DiFabio	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1
18.1	April 13, 2020	Ministry of Natural Resources and Forestry (MNRF) Contact: Sally Renwick	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A	1

Agency Correspondence

(Note: this table includes all agency correspondence that occurred after the Environmental Report was finalized for OPCC review [March 10, 2020])

Line Item	Date of Consultation	Name of Agency and/or Contact	Description of Consultation Activity	Date of Response	Response and Issue Resolution (if applicable)
PROVINCIAL AGENCIES					
1.1	March 18, 2020	Metrolinx Contact: Kowsiya Vijayaratnam	Dillon representative sent meeting minutes for the March 6th meeting and requested that Metrolinx representative distribute internally to Metrolinx attendees.	March 18, 2020	Metrolinx representative acknowledged receipt of the email and indicated they would circulate the meeting minutes accordingly.
1.2	March 23, 2020	Metrolinx Contact: Kowsiya Vijayaratnam	Enbridge representative sent a GIS file of the Project routes.	N/A	N/A
2.1	April 13, 2020	MECP – Source Protection Programs Branch	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A
MUNICIPAL AGENCIES					
3.1	April 13, 2020	City of Toronto – City Planning Contact: Matthew Davis	Enbridge representative sent link to the Environmental Report on the Project website and requested feedback no later than May 25, 2020.	N/A	N/A
4.1	July 23, 2020	City of Toronto - Major Capital Infrastructure Coordination Contact: Doodnauth Sharma	City representative emailed Enbridge representative to check on the status of the Environment Report. City representative asked whether a preferred route had been identified and if the Project timeline had changed.	July 27, 2020	Enbridge representative stated that the Project Manager was currently away on vacation and that they would look into finding someone else who could respond to the City's questions.
4.2	September 2, 2020	City of Toronto - Major Capital Infrastructure Coordination Contact: Doodnauth Sharma	City representative followed up on their July email asking for a status update on the Project.	September 3, 2020	Enbridge representative apologized for the not getting back to the City representative and stated that the Project Manager would respond.
4.3	September 11, 2020	City of Toronto - Major Capital Infrastructure Coordination Contact: Doodnauth Sharma	Enbridge representative apologized for the delay in responding and provided an update on the Environmental Report, preferred route, and Project schedule.	N/A	N/A

Interest Group Correspondence

(Note: this table includes all interest group correspondence that occurred after the Environmental Report was finalized for OPCC review [March 10, 2020])

Line Item	Date of Consultation	Name of Group and/or Contact	Description of Consultation Activity	Date of Response	Response and Issue Resolution (if applicable)
1.1	March 16, 2020	York Quay Neighbourhood Association (YQNA) Contact: Carolyn Johnson	YQNA representative requested an update on the status of the Environmental Report/Leave-to-Construct Application.	March 16, 2020	Dillon representative provided update on status of the Environmental Report and Leave-to-Construct Application and provided a link to the Project website.
1.2	March 16, 2020	YQNA Contact: Carolyn Johnson	YQNA representative thanked Dillon representative for the update.	N/A	N/A
1.3	May 8, 2020	YQNA Contact: Ulla Colgrass	YQNA representative emailed Enbridge representative inquiring where to find the information on the Project website with regard to the decision for the preferred routing on Lake Shore Boulevard. YQNA representative stated they were interested in the details and timing of the Project and noted that the YQNA appreciated the decision to use Lake Shore boulevard instead of Queens Quay.	May 12, 2020	Enbridge representative thanked YQNA representative for the email and provided directions on how to navigate to the Environmental Report on the Project website. Enbridge representative noted that information on Project timing is also available on the Project website under the “Project Information” tab.
2.1	April 28, 2020	St. Lawrence Market Neighbourhood Business Improvement Area (BIA) Contact: Mark van Elsberg	BIA representative emailed Enbridge representative with questions about the scope of another Enbridge project in the same area as the NPS 20 Cherry to Bathurst Project.	April 28, 2020	Enbridge representative responded and clarified that there are two Enbridge projects in the same area and provided the notices for both. Enbridge representative also provided a link to the Project website and indicated that the preferred route along Lake Shore Boulevard had been chosen for the NPS 20 Cherry to Bathurst Project.
2.2	April 29, 2020	St. Lawrence Market Neighbourhood BIA Contact: Mark van Elsberg	BIA representative thanked Enbridge representative for the clarification and inquired whether Enbridge would be available to discuss the decision for the preferred Project routing, as well as the timing of proposed construction on Parliament Street.	May 11, 2020	Enbridge representative described how to access the Environmental Reports for the two NPS 20 projects from their “About Us” website and explained the rationale for the preferred route chosen for the other NPS 20 project. Enbridge representative provided the anticipated construction timing for both projects.
3.1	April 8, 2020	Waterfront Toronto	Conference call meeting between Enbridge and Waterfront Toronto representatives.	N/A	N/A
3.2	April 16, 2020	Waterfront Toronto Contacts: Halija Mazlomyar and Tom Davidson	Enbridge representative sent a letter to Waterfront Toronto representatives as a follow-up to the April 8 conference call meeting.	April 16, 2020	Waterfront Toronto representative thanked Enbridge representative for the letter and asked when the selection of the preferred route would be made public.
3.3	April 17, 2020	Waterfront Toronto Contact: Tom Davidson	Enbridge representative responded that the route was now public and provided a link to the Environmental Report.	April 17, 2020	Waterfront Toronto representative thanked Enbridge representative and stated they were having trouble navigating to the Project webpage and requested a link to the Project page rather than the Environmental Report PDF.
3.4	April 17, 2020	Waterfront Toronto Contact: Tom Davidson	Enbridge representative sent a link to the Enbridge “About Us” website and indicated how to navigate to the Project-specific content and explained where to find information on the preferred route in the Environmental Report.	N/A	N/A

Line Item	Date of Consultation	Name of Group and/or Contact	Description of Consultation Activity	Date of Response	Response and Issue Resolution (if applicable)
4.1	April 23, 2020	Cycle Toronto Contact: Tamara Nahal	Group representative sent a letter from the Group's executive director in response to the proposed Project routing on Queens Quay and requested an update on the status/progress of the Project in light of the novel coronavirus (COVID-19) situation.	April 29, 2020	Enbridge representative responded that the Environmental Report for the Project is currently with the OPCC for review and indicated that Lake Shore Boulevard had been chosen as the preferred route. Enbridge representative provided a link to the Project website. Enbridge representative stated that construction was not anticipated to begin until late spring 2021 and that Enbridge would be monitoring the latest guidance from public health authorities.
4.2	May 1, 2020	Cycle Toronto Contact: Tamara Nahal	Group representative thanked Enbridge representative for the information and link to the Project website and indicated they had found the Environmental Report. Group representative asked if there would be further opportunities for providing feedback.	May 7, 2020	Enbridge representative responded that once the Environmental Report is submitted to the Ontario Energy Board (OEB), interested parties will have the opportunity to participate in the review process and provided a link to the OEB website for further information.
4.3	May 11, 2020	Cycle Toronto Contact: Tamara Nahal	Group representative thanked Enbridge representative for the additional information and further inquired about the timelines for OPCC review and OEB submission.	May 11, 2020	Enbridge representative responded that the OPCC has a 42-day review period, which will end on May 25, 2020, and then Enbridge is planning on filing the Leave-to-Construct Application with the OEB in late May/early June. Enbridge representative directed Group representative to the Project website for more information on timelines and Project details.
5.1	May 1, 2020	Smith + Andersen (Engineering Firm) Contact: Erich Hoyle	Company representative emailed Project inbox requesting more information on the Project as they had just become aware of it and noted they are currently working on the design of a new building at the corner of Bay Street and Lake Shore Boulevard that may be affected by the proposed Project's construction.	May 11, 2020	Enbridge representative thanked Company representative for their email and explained that the Environmental Report was currently being reviewed by the OPCC and provided a link to the report on the Project website. Enbridge representative indicated that they are anticipating filing the Leave-to-Construct Application with the OEB this summer and that construction may begin in spring/summer 2021. Enbridge representative stated they would review the address of the Company's proposed development in relation to the Project's scope and would be in contact regarding any potential construction impacts.
5.2	May 11, 2020	Smith + Andersen (Engineering Firm) Contact: Erich Hoyle	Company representative thanked Enbridge representative for the information and provided the specific address of their proposed development. Company representative asked that Enbridge be in touch if they need any other information from the Company.	N/A	N/A
6.1	June 17, 2020	Oxford Properties Group Contact: Otto Wramhed	Company representative sent an email noting their company is responsible for the development site at 30 Bay Street and were wondering if a decision had been made regarding the Project route. Company representative noted that construction on their site is anticipated to begin in 2021 and primary access to the site is planned to be via Lakeshore Boulevard and, as such, they are interested in knowing how the Project will impact their development plans.	N/A	N/A
6.2	July 6, 2020	Oxford Properties Group Contact: Otto Wramhed	Company representative followed up on their June email requesting that someone get back to them with a Project update.	N/A	N/A

Public Correspondence

(Note: this table includes all public correspondence that occurred after the close of the public comment period on February 22, 2020, which was not included in the Environmental Report that was submitted for OPCC review)

Line Item	Date of Consultation	Name of Contact	Description of Consultation Activity	Date of Response	Response and Issue Resolution (if applicable)
1.1	February 23, 2020	Resident	A resident noted opposition to the Queens Quay route.	February 24, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
2.1	February 23, 2020	Resident	A resident noted opposition to the Queens Quay route.	February 24, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
3.1	February 24, 2020	Resident	A resident requested more information on the Project.	February 24, 2020	Dillon representative provided information and link to the Project website.
3.2	February 24, 2020	Resident	Resident thanked Dillon representative.	N/A	N/A
4.1	February 24, 2020	Resident	A resident noted opposition to the Queens Quay route.	February 24, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
5.1	February 24, 2020	Resident	A resident noted opposition to the Queens Quay route.	February 24, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
6.1	February 25, 2020	Resident	A resident noted opposition to the Queens Quay route.	February 25, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
7.1	February 26, 2020	Resident	A resident noted opposition to the Queens Quay route.	February 27, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
8.1	February 26, 2020	Resident	A resident noted opposition to the Queens Quay route.	February 27, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
9.1	February 27, 2020	Resident	A resident noted opposition to the Queens Quay route.	March 2, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
10.1	February 27, 2020	Resident	A resident noted opposition to the Queens Quay route.	March 2, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
11.1	March 1, 2020	Resident	A resident noted opposition to the Queens Quay route.	March 2, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
12.1	March 3, 2020	Resident	A resident noted opposition to the Queens Quay route.	March 3, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
13.1	March 3, 2020	Resident	A resident requested the January 23rd Open House materials and to be added to the Project contact list. Resident asked if the deadline to provide comments had passed.	March 4, 2020	Dillon representative responded to the resident's questions and provided a link to the Project website and attached a copy of the Open House storyboard panels.
14.1	March 4, 2020	Resident	A resident noted opposition to the Queens Quay route.	March 4, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
14.2	March 4, 2020	Resident	Resident responded to Dillon representative, restating their strong opposition to the Queens Quay route.	N/A	N/A
15.1	March 5, 2020	Resident	A resident noted opposition to the Harbour Street and Lakeshore Boulevard routes.	March 5, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Harbour Street and Lakeshore Boulevard routes.
16.1	March 5, 2020	Resident	A resident noted opposition to the Harbour Street and Lakeshore Boulevard routes.	March 6, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Harbour Street and Lakeshore Boulevard routes.
17.1	March 6, 2020	Resident	A resident noted opposition to the Queens Quay route.	March 6, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
18.1	March 6, 2020	Resident	A resident noted opposition to the Queens Quay route.	March 6, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Queens Quay route.
19.1	April 4, 2020	Resident	A resident noted opposition to the Harbour Street and Lakeshore Boulevard routes.	May 5, 2020	Dillon representative acknowledged the resident's concerns and opposition to the Harbour Street and Lakeshore Boulevard routes.

Line Item	Date of Consultation	Name of Contact	Description of Consultation Activity	Date of Response	Response and Issue Resolution (if applicable)
20.1	April 18, 2020	Resident	A resident asked about the status of the Project and the Project regulator, and indicated that they had not received the Project notice until after the Open House. Resident noted opposition to the Queens Quay route and a preference for the Lake Shore Boulevard route.	May 5, 2020	Dillon representative responded to the resident's questions and acknowledged the resident's concerns and opposition to the Queens Quay route.
21.1	May 7, 2020	Resident	A resident noted opposition to the Queens Quay route and indicated preference for the Harbour Street route.	May 8, 2020	Dillon representative thanked the resident for their email and noted that the Lake Shore Boulevard route had been chosen as the preferred route and directed the resident to the Project website to view the Environmental Report.
22.1	July 13, 2020	Resident	A resident noted opposition to the Queens Quay route and provided suggested alternatives.	July 14, 2020	Dillon representative thanked the resident for their email and noted that the Lake Shore Boulevard route had been chosen as the preferred route and directed the resident to the Project website to view the Environmental Report.

Attachments

OPCC Correspondence

Attachment 1

DILLON CONSULTING

Replacement, NPS 20 <nps20replacement@dillon.ca>

NPS 20 Cherry to Bathurst Replacement Pipeline Project - Environmental Report - OPCC Review

Stephanie Allman <Stephanie.Allman@enbridge.com> Mon, Apr 13, 2020 at 10:09 AM
To: Zora Crnojacki <Zora.Crnojacki@oeb.ca>, "arthur.churchyard@ontario.ca" <arthur.churchyard@ontario.ca>, "Laura.e.hatcher@ontario.ca" <Laura.e.hatcher@ontario.ca>, "tony.difabio@ontario.ca" <tony.difabio@ontario.ca>, "sally.renwick@ontario.ca" <sally.renwick@ontario.ca>, "ross.lashbrok@ontario.ca" <ross.lashbrok@ontario.ca>, Kourosh Manouchehri <KManouchehri@tssa.org>, "scott.oliver@ontario.ca" <scott.oliver@ontario.ca>, "michael.elms@ontario.ca" <michael.elms@ontario.ca>, "bridget.schulte-hostedde@ontario.ca" <bridget.schulte-hostedde@ontario.ca>, "shannonmccabe@ontario.ca" <shannonmccabe@ontario.ca>, "kathy.mcdonald@ontario.ca" <kathy.mcdonald@ontario.ca>, "ruth.orwin@ontario.ca" <ruth.orwin@ontario.ca>, "crystal.lafrance@ontario.ca" <crystal.lafrance@ontario.ca>, "Natalie.Stacey@ontario.ca" <Natalie.Stacey@ontario.ca>, "Paul.Martin@ontario.ca" <Paul.Martin@ontario.ca>, "Patrick.Grace@infrastructureontario.ca" <Patrick.Grace@infrastructureontario.ca>, "sourceprotectionscreening@ontario.ca" <sourceprotectionscreening@ontario.ca>, "Matthew.Davis@toronto.ca" <Matthew.Davis@toronto.ca>, "zack.carlan@trca.on.ca" <zack.carlan@trca.on.ca>
Cc: Joel Denomy <Joel.Denomy@enbridge.com>, Kelsey Mills <Kelsey.Mills@enbridge.com>, "NPS20Replacement@dillon.ca" <NPS20Replacement@dillon.ca>

Good morning -

Enbridge Gas Inc. (Enbridge Gas) is seeking to construct a natural gas pipeline in order to replace a portion of an existing natural gas pipeline in the City of Toronto, Ontario. The Ontario Energy Board's *Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario 7th Edition 2016* (Guidelines) recommend that a project proponent provide a copy of the environmental report (ER) for a project to the Ontario Pipeline Coordinating Committee for review and comment. In the link below please find a copy of the ER for the NPS 20 Cherry to Bathurst Replacement Pipeline Project (Project). Pursuant to the Guidelines please provide any comments on the ER for the Project by no later than Friday May 25, 2020.

https://www.enbridgegas.com/NPS20Cherry-Bathurst

Comments should be directed to:

Kelsey Mills

Advisor, Environment

Enbridge Gas Inc.

101 Honda Boulevard

Markham, Ontario

L6C 0M6

Cell: 416-454-9539

Email: NPS20Replacement@dillon.ca

Attachment 2

DILLON CONSULTING

Replacement, NPS 20 <nps20replacement@dillon.ca>

TRCA CFN 63062 - Response to Enbridge Final Environmental Report - Proposed 20in Replacement Bathurst to Cherry

Nathan Jenkins <Nathan.Jenkins@trca.ca> Tue, Jun 23, 2020 at 2:53 PM
To: "Kelsey.Mills@enbridge.com" <Kelsey.Mills@enbridge.com>
Cc: Chuck Reaney <Chuck.Reaney@enbridge.com>, "NPS20Replacement@dillon.ca" <NPS20Replacement@dillon.ca>, Michael Noble <Michael.Noble@toronto.ca>, Ken Dion <kdion@waterfrontoronto.ca>, Beth Williston <Beth.Williston@trca.ca>, Renee Afoom-Boateng <Renee.Afoom-Boateng@trca.ca>, Sharon Lingertat <Sharon.Lingertat@trca.ca>, Brandon Hester <Brandon.Hester@trca.ca>, Jennifer Stephens <Jennifer.Stephens@trca.ca>, Deanna Cheriton <Deanna.Cheriton@trca.ca>

Hi Kelsey,

Please find the attached TRCA comment response letter related to Enbridge's final Environmental Report for the Proposed 20in Replacement Bathurst to Cherry, CFN 63062.

Please feel free to contact me with any question you may have after you reading it.

Thank you,

Nathan Jenkins, H.B.Sc. (Env), M.Pl., RPP
Planner I
Infrastructure Planning and Permits | Development and Engineering Services

T: (416) 661-6600 ext. 5508
E: nathan.jenkins@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

CFN 63062_20in Replacement Bathurst to Cherry Environmental Report Response_June 23-20.pdf
232K

Attachment 2

Toronto and Region Conservation Authority

June 23, 2020

CFN 63062
XREF: 59825

BY E-MAIL ONLY (Kelsey.Mills@enbridge.com)

Ms. Kelsey Mills
Environmental Advisor
Enbridge Gas Inc.
3rd Floor, 101 Honda Boulevard
Markham, ON
L6C 0M6

Dear Ms. Mills:

Re: Response to Final Environmental Report (ER)
Enbridge Gas Proposed 20in Replacement Bathurst to Cherry
In Accordance with the Ontario Energy Board's Environmental Guidelines for the Construction of Hydrocarbon Pipelines and Facilities in Ontario
Don River Watershed; City of Toronto – Toronto and East York

Toronto and Region Conservation Authority (TRCA) staff TRCA staff were circulated a formal Notice of Project Commencement for this EA on January 13, 2020; and obtained email confirmation of the final Environmental Report (ER) for the above noted project from Enbridge on April 13, 2020. As a recognized commenting agency under the Ontario Environmental Assessment Act, TRCA has interests in this project.

PROJECT OVERVIEW

Staff understand that this study, completed under the Ontario Energy Board's (OEB) Guidelines for the Construction of Hydrocarbon Pipelines and Facilities in Ontario, has examined options for replacing an approximately 4.2 kilometer segment of Nominal Pipe Size (NPS) 20-inch natural gas pipeline located along the City of Toronto waterfront. There does not appear to be a description of the preferred alignment in the final ER. Therefore, TRCA staff's approximate description of the preferred route (based on the route shown in Figure 5 of the final ER) is as follows: the approximately 4.2 kilometer route starts on the westbound lanes of Lake Shore Boulevard immediately west of Remembrance Drive, travels east along Lake Shore Boulevard to Parliament Street where it appears to diverge into two separate routes. The first route travels north on parliament ending at Mill Street, while the second route continues along Lake Shore Boulevard to Cherry Street.

This 20 inch Lake Shore pipeline has been identified by Enbridge Gas Inc. as being a vintage steel pipeline originally installed in 1954 with recent integrity monitoring indicating the pipeline requires replacement due to its age and condition. Enbridge Gas Inc. has determined that replacing the pipeline is the best option for maintaining safe and reliable natural gas service to this densely populated area of downtown Toronto.

PROJECT REVIEW

TRCA staff have completed their review and while staff has no objection in principle to the preferred alternative, detailed comments are provided in **Appendix A**.

It is TRCA staffs understanding that a portion of this proposed pipeline was assessed and described under the Enbridge Gas 20 Inch Lower Don Natural Gas Pipeline Replacement (XREF CFN 59825). TRCA staff require further clarification at the detail design stage whether the preferred route along Parliament Street, immediately north of the Gardener Expressway to Mill Street, will be permitted in association with this EA or as described in TRCA CFN 59825.

Permits under Ontario Regulation 166/06 will be required for work in TRCA regulated areas and any outstanding items from this correspondence may need to be addressed at that stage. Recommendations regarding environmental protections (i.e. erosion and sediment controls) can be provided upon submission of detail design plans.

RESUBMISSION REQUIREMENTS

As noted in the ER, permits in accordance with Ontario Regulation 166/06 are required from TRCA prior to project construction.

Please submit the detailed design drawings, together with the appropriate reports and documents. The TRCA Complete Submission Checklist for Infrastructure Projects is available on our website (https://trca.ca/app/uploads/2016/01/TRCA-PRE-CONSULTATION-CHECKLIST.pdf), and should be used as a guide to your permit submission. The permit application form, together with additional submission checklist and guidelines are also available on our website should be used as appropriate to inform the development of your application. These can be found under the Planning and Permitting, Environmental Assessment section of the TRCA website at: http://www.trca.on.ca/planning-services-permits/environmental-assessment.dot#check.

Please include a digital copy of all submitted material. Materials must be submitted in PDF format, with drawings pre-scaled to print on 11”x17” pages. Materials may be submitted via e-mail (if less than 25 MB), or through file transfer protocol (FTP) sites (if posted for a minimum of two weeks).

REVIEW FEES

Please be advised that this application is not subject to an application review fee as per the TRCA and Enbridge Gas Inc Service Agreement. Staff will charge all time worked on this project to the appropriate CFN, as noted in this letter.

Should you have any questions, please contact me at extension 5508 or at Nathan.jenkins@trca.ca.

Regards,

Nathan Jenkins

Nathan Jenkins, H.B.Sc (Env), M.Pl., RPP
Planner I, Infrastructure Planning and Permits
Development and Engineering Services

Attached: Appendix A: TRCA Comments

BY E-MAIL

cc: Applicant: Kelsey Mills (Kelsey.Mills@enbridge.com)
Chuck Reaney, Land Services, (chuck.reaney@enbridge.com)
Consultant: NPS20Replacement@dillon.ca

City of Toronto: Michael Noble, Project Manager, Waterfront Secretariat
Waterfront Toronto: Ken Dion, Project Director - Port Lands
TRCA: Beth Williston, Associate Director, Infrastructure Planning and Permits
Renee Afoom-Boateng, Senior Planner, Infrastructure Planning and Permits
Sharon Lingertat, Senior Planner, Infrastructure Planning and Permits
Brandon Hester, Senior Property Agent
Jennifer Stevens, Coordinator, Source Water Protection
Deanna Cheriton, Conservation Lands & Trails

APPENDIX A: TRCA COMMENTS AND PROPONENT RESPONSES

ITEM	TRCA COMMENTS (June 23, 2020)	PROPONENT/CONSULTANT RESPONSE (PLEASE INSERT DATE)
General		
1.	The precise route path for preferred alternative and potential pipeline options are not adequately described in the final ER. TRCA staff have reviewed according to the routes as visually presented in Figure 5. Please clarify if this is accurate and provide a description of the preferred alternative alignment.	
2.	Please advise if this project is being coordinated in conjunction with the City of Toronto's active Lake Shore Boulevard and Cherry Street Reconstruction work as this may impact the preferred alignment.	
3.	Please advise if any new stations or permanent structures, beyond the proposed pipelines, are required to be installed within the subject area in order to facilitate this project. Additionally, please advise what infrastructure the proposed pipeline ties into at the east and west limits of the study area.	
4.	TRCA staff encourage the Enbridge team to contact TRCA during detail design stages to ensure that the design has adequately considered impacts to, and caused by, the floodplain. Additionally, TRCA recommend locating all equipment staging, stockpiling and temporary facilities outside of the Regulatory floodplain; which appears to be minor in this study area. Staff can provide updated floodplain mapping if required by Enbridge.	
5.	Please be advised that the preferred route appears to fall within the Intake Protection Zone (IPZ), Highly Vulnerable Aquifers (HVA), vulnerable areas under the Credit Valley - Toronto and Region - Central Lake Ontario Source Protection Plan (CTC SPP). TRCA supports the legislated protection of municipal drinking water sources through the Clean Water Act and acts as a technical advisor to municipalities in their role for implementing some aspects of the CTC SPP. For more information please visit http://www.ctcswp.ca/.	
6.	Erosion and sediment control (ESC) measures should be implemented to mitigate erosion and sediment processes during construction. At the detailed design stage, please provide comprehensive ESC plans as part of associated applications. The ESC plan should be consistent with the Erosion and Sediment Control Guideline for Urban Construction (December 2006).	

Attachment 2

DILLON CONSULTING

Replacement, NPS 20 <nps20replacement@dillon.ca>

TRCA CFN 63062 - Response to Enbridge Final Environmental Report - Proposed 20in Replacement Bathurst to Cherry

Kelsey Mills <Kelsey.Mills@enbridge.com> Thu, Oct 15, 2020 at 11:55 AM
To: Nathan Jenkins <Nathan.Jenkins@trca.ca>
Cc: Chuck Reaney <Chuck.Reaney@enbridge.com>, "NPS20Replacement@dillon.ca" <NPS20Replacement@dillon.ca>, Michael Noble <Michael.Noble@toronto.ca>, Ken Dion <kdion@waterfrontoronto.ca>, Beth Williston <Beth.Williston@trca.ca>, Renee Afoom-Boateng <Renee.Afoom-Boateng@trca.ca>, Sharon Lingertat <Sharon.Lingertat@trca.ca>, Brandon Hester <Brandon.Hester@trca.ca>, Jennifer Stephens <Jennifer.Stephens@trca.ca>, Deanna Cheriton <Deanna.Cheriton@trca.ca>, Mark Cairns <Mark.Cairns@enbridge.com>, Aron Murdoch <Aron.Murdoch@enbridge.com>, Byron Madrid <Byron.Madrid@enbridge.com>

Hi Nathan,

Hope you are doing well.

We apologize for the delay but please find a response to your letter attached.

If you have any questions or concerns please feel free to reach out to myself.

Thank you,

Kelsey Mills

—
TEL: 905-927-3145 I CELL: 416-454-9539

From: Nathan Jenkins <Nathan.Jenkins@trca.ca>
Sent: Tuesday, June 23, 2020 2:54 PM
To: Kelsey Mills <Kelsey.Mills@enbridge.com>
Cc: Chuck Reaney <Chuck.Reaney@enbridge.com>; NPS20Replacement@dillon.ca; Michael Noble <Michael.Noble@toronto.ca>; Ken Dion <kdion@waterfrontoronto.ca>; Beth Williston <Beth.Williston@trca.ca>; Renee Afoom-Boateng <Renee.Afoom-Boateng@trca.ca>; Sharon Lingertat <Sharon.Lingertat@trca.ca>; Brandon Hester <Brandon.Hester@trca.ca>; Jennifer Stephens <Jennifer.Stephens@trca.ca>; Deanna Cheriton <Deanna.Cheriton@trca.ca>
Subject: [External] TRCA CFN 63062 - Response to Enbridge Final Environmental Report - Proposed 20in Replacement Bathurst to Cherry

Hi Kelsey,

Please find the attached TRCA comment response letter related to Enbridge's final Environmental Report for the Proposed 20in Replacement Bathurst to Cherry, CFN 63062.

Please feel free to contact me with any question you may have after you reading it.

Thank you,

Nathan Jenkins, H.B.Sc. (Env), M.Pl., RPP
Planner I
Infrastructure Planning and Permits | Development and Engineering Services

T: (416) 661-6600 ext. 5508
E: nathan.jenkins@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

EGI_Response to TRCA_NPS 20 C2B_15OCT2020.pdf
70K

Attachment 2

Enbridge
500 Consumers Road
North York, Ontario M2J 1P8
Canada

October 15, 2020

Nathan Jenkins, H.B.Sc (Env), M.Pl., RPP
Planner I, Infrastructure Planning and Permits
Development and Engineering Services
101 Exchange Avenue, Vaughan, ON L4K 5R6
T: 416.661.6600 Ext 5508

Dear Mr. Jenkins,

Thank you for your letter dated June 23, 2020 in response to the Environmental Report for the Enbridge Gas NPS 20 Replacement Cherry to Bathurst (the 'Project').

Enbridge Gas understands that the TRCA has no objection in principle to the preffered alternative route. Permits in accordance with Ontario Regulation 166/06 will be applied for as part of detailed planning. Please see responses to detailed comments provided by TRCA as Appendix A below.

Sincerely,

Kelsey Mills
Environmental Advisor
Environment, Lands and Permitting
Enbridge Gas Inc.
101 Honda Blvd
Markham, ON L6C 0M6

Attachment 2

Enbridge
500 Consumers Road
North York, Ontario M2J 1P8
Canada

Appendix A:

Item	TRCA Comments (June 23, 2020)	Proponent/Consultation Response (October 13, 2020)
1.	The precise route path for preferred alternative and potential pipeline options are not adequately described in the final ER. TRCA staff have reviewed according to the routes as visually presented in Figure 5. Please clarify if this is accurate and provide a description of the preferred alternative alignment.	a) Figure 5 represents the proposed routes that were brought forth for assessment based on consultation that was undertaken as part of the Environmental Assessment. b) The Preferred Route for the Project (Option B) commences at the intersection of Cherry Street and Lake Shore Boulevard where it will tie-in to an existing Nominal Pipe Size (NPS) 20 High Pressure (HP) Steel (ST) natural gas pipeline. From there it travels west along Lake Shore Boulevard (and parts of Harbour Street) to Remembrance Drive (west of Bathurst Street) where it will tie-in to an existing NPS 20 HP ST natural gas pipeline on Lakeshore Boulevard. c) The North Tie-In Lateral commences at the intersection of Mill Street and Parliament Street where it will tie-in to an existing NPS 20 HP ST natural gas pipeline on Parliament Street. From there it travels south along Parliament Street to Lake Shore Boulevard where it will tie-in to the PR
2.	Please advise if this project is being coordinated in conjunction with the City of Toronto's active Lake Shore Boulevard and Cherry Street Reconstruction work as this may impact the preferred alignment.	a) Enbridge is in consultation with the City of Toronto regarding this project and projects planned in the area.
3.	Please advise if any new stations or permanent structures, beyond the proposed pipelines, are required to be installed within the subject area in order to facilitate this project. Additionally, please advise what infrastructure the proposed pipeline ties into at the east and west limits of the study area.	a) No new stations are proposed as part of this project. Enbridge will be reconnecting the replaced pipeline to the existing stations b) The proposed pipeline will tie into existing infrastructure at the east and west end of the study area.
4.	TRCA staff encourage the Enbridge team to contact TRCA during detail design stages to ensure that the	Noted

	design has adequately considered impacts to, and caused by, the floodplain. Additionally, TRCA recommend locating all equipment staging, stockpiling and temporary facilities outside of the Regulatory floodplain; which appears to be minor in this study area. Staff can provide updated floodplain mapping if required by Enbridge.	
5.	Please be advised that the preferred route appears to fall within the Intake Protection Zone (IPZ), Highly Vulnerable Aquifers (HVA), vulnerable areas under the Credit Valley - Toronto and Region - Central Lake Ontario Source Protection Plan (CTC SPP). TRCA supports the legislated protection of municipal drinking water sources through the Clean Water Act and acts as a technical advisor to municipalities in their role for implementing some aspects of the CTC SPP. For more information please visit http://www.ctcswp.ca/.	Noted
6.	Erosion and sediment control (ESC) measures should be implemented to mitigate erosion and sediment processes during construction. At the detailed design stage, please provide comprehensive ESC plans as part of associated applications. The ESC plan should be consistent with the Erosion and Sediment Control Guideline for Urban Construction (December 2006).	Noted

Attachment 3

DILLON CONSULTING

Replacement, NPS 20 <nps20replacement@dillon.ca>

NPS 20 Cherry to Bathurst Replacement Pipeline Project - Environmental Report - OPCC Review

Melany Afara <Melany.Afara@enbridge.com> Tue, Apr 28, 2020 at 9:50 AM
To: Joel Denomy <Joel.Denomy@enbridge.com>, Stephanie Allman <Stephanie.Allman@enbridge.com>, Kelsey Mills <Kelsey.Mills@enbridge.com>
Cc: "Replacement, NPS 20" <nps20replacement@dillon.ca>

Good Morning,

Attached is the form filled in for Cherry to Bathurst. I filled in the sections similarly to the Georgian Sands project. I do not remember this process for the NPS 30 – so who typically sends this back to TSSA?

Thank you,

Melany Afara, P. ENG
Sr. Advisor Capital Development

Capital Development

ENBRIDGE
TEL: 905-704-3791| CELL: 437-991-7872|
3401 Schmon Parkway, Thorold, ON, L2V 4Y6

enbridge.com
Safety. Integrity. Respect.

From: Joel Denomy <Joel.Denomy@enbridge.com>
Sent: Monday, April 27, 2020 8:42 AM
To: Stephanie Allman <Stephanie.Allman@enbridge.com>; Kelsey Mills <Kelsey.Mills@enbridge.com>; Melany Afara <Melany.Afara@enbridge.com>
Subject: RE: NPS 20 Cherry to Bathurst Replacement Pipeline Project - Environmental Report - OPCC Review

Thanks Steph,

Melany see below.

Joel

From: Stephanie Allman <Stephanie.Allman@enbridge.com>
Sent: Monday, April 27, 2020 8:40 AM
To: Kelsey Mills <Kelsey.Mills@enbridge.com>
Cc: Joel Denomy <Joel.Denomy@enbridge.com>
Subject: NPS 20 Cherry to Bathurst Replacement Pipeline Project - Environmental Report - OPCC Review

Please see the email below from, Kourosh.

From: Kourosh Manouchehri <KManouchehri@tssa.org>
Sent: Monday, April 27, 2020 8:37 AM
To: Stephanie Allman <Stephanie.Allman@enbridge.com>
Subject: [External] RE: NPS 20 Cherry to Bathurst Replacement Pipeline Project - Environmental Report - OPCC Review

Attachment 3

Hi Stephanie,

Thank you for the provided information about this project. An application needs to be filled and submitted for the review of this project by TSSA as part of Ontario Pipeline Coordinating Committee. Please fill Application for Review of Pipeline Project and send it to the email address provided on the form.

If you have any question, please contact me.

Regards,

Kourosh Manouchehri, P.Eng., PMP | Engineer

Fuels Safety

345 Carlingview Drive

Toronto, Ontario M9W 6N9

Tel: +1-416-734-3539 | | Fax: +1-416-231-7525 | E-Mail: kmanouchehri@tssa.org

www.tssa.org

From: Stephanie Allman <Stephanie.Allman@enbridge.com>
Sent: April 13, 2020 10:09
To: Zora Crnojacki <Zora.Crnojacki@oeb.ca>; arthur.churchyard@ontario.ca; Laura.e.hatcher@ontario.ca; tony.difabio@ontario.ca; sally.renwick@ontario.ca; ross.lashbrok@ontario.ca; Kourosh Manouchehri <KManouchehri@tssa.org>; scott.oliver@ontario.ca; michael.elms@ontario.ca; bridget.schulte-hostedde@ontario.ca; shannonmccabe@ontario.ca; kathy.mcdonald@ontario.ca; ruth.orwin@ontario.ca; crystal.lafrance@ontario.ca; Natalie.Stacey@ontario.ca; Paul.Martin@ontario.ca; Patrick.Grace@infrastructureontario.ca; sourceprotectionscreening@ontario.ca; Matthew.Davis@toronto.ca; zack.carlan@trca.on.ca
Cc: Joel Denomy <Joel.Denomy@enbridge.com>; Kelsey Mills <Kelsey.Mills@enbridge.com>; NPS20Replacement@dillon.ca
Subject: NPS 20 Cherry to Bathurst Replacement Pipeline Project - Environmental Report - OPCC Review

Good morning -

Enbridge Gas Inc. (Enbridge Gas) is seeking to construct a natural gas pipeline in order to replace a portion of an existing natural gas pipeline in the City of Toronto, Ontario. The Ontario Energy Board's *Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario 7th Edition 2016* (Guidelines) recommend that a project proponent provide a copy of the environmental report (ER) for a project to the Ontario Pipeline Coordinating Committee for review and comment. In the link below please find a copy of the ER for the NPS 20 Cherry to Bathurst Replacement Pipeline Project (Project). Pursuant to the Guidelines please provide any comments on the ER for the Project by no later than Friday May 25, 2020.

https://www.enbridgegas.com/NPS20Cherry-Bathurst

Comments should be directed to:

Kelsey Mills

Advisor, Environment

Enbridge Gas Inc.

101 Honda Boulevard

Markham, Ontario

Attachment 3

L6C 0M6

Cell: 416-454-9539

Email: NPS20Replacement@dillon.ca

Application-for-review-of-Pipeline-Project---FS-09563-07.18.pdf
231K

Attachment 3

Technical Standards and Safety Authority
345 Carling view Drive
Toronto, Ontario M9W 6N9
Fax: 416.231.4078
Customer Service: 1.877.682.8772
Email: fssubmissions@tssa.org
www.tssa.org

Clear Form | Print Form

Application for Review of Pipeline Project

Technical Standards and Safety Act
Fuels Safety Regulations

Please submit completed application and supporting documentation by mail, fax, or email (in pdf format).

For Office Use Only

Project Name or Title: : NPS 20 Cherry to Bathurst Replacement Pipeline Project

Required Documentation (eligible PDFs are acceptable)

- [x] Design and piping specifications related to the project
- [ ] Calculation of High consequence area
- [x] Project time-line related to design and construction (approximate dates are acceptable)
- [x] Length of pipeline project: 4.5 KM Diameter of Pipe: NPS 20
- [x] Pipe Material and its Standard CSA Z245.1-18 Steel
- [x] Pipe wall thickness 12.7 mm
- [ ] Stress level on pipe wall based on the design pressure; S/SMYS ____ %
- [x] Maximum Operating Pressure: 1200 kPa
- [ ] TSSA Transmission or Distribution license number: ____

A. APPLICANT

Company Name: Enbridge Gas Inc.		Corporation No.:
Street Name / 911 Number/Address, if applicable: 500 Consumers Rd		
Unit/Suite:	PO Box:	
City/Town: North York	Province: Ontario	Postal Code: M2J1P8
Telephone No.:	Fax No.:	Cell No.: 437-991-7872
Email: melany.afara@enbridge.com		
Print Name of Contact Person: Melany Afara		

B. LOCATION ADDRESS: Start and end location of the pipeline project (if applicable)

Lake Shore Boulevard from approximately Cherry Street to Bathurst Street and a section on Parliament Street from Mill Street to Lake Shore Boulevard East.

C. TECHNICAL CONTACT

Same as: [x] A [ ] D

(Company should communicate regarding engineering and inspection approval on behalf of the owner.)

Company Name:			
Street Name / 911 Number/Address, if applicable:			
Unit/Suite:	PO Box:		
City/Town:	Province:	Postal Code:	
Telephone No.:	Fax No.:	Cell No.:	
Email:			
Print Name of Contact Person:			

Note: It is illegal to use an appliance, equipment, or work for its intended purpose unless it is approved.
Please note that this approval may be revoked or suspended if the relevant review and inspection fees are not paid in full.

Attachment 3

Technical Standards and Safety Authority
345 Carling View Drive
Toronto, Ontario M9W 6N9
Fax: 416.231.4078
Customer Service: 1.877.682.8772
Email: fssubmissions@tssa.org
www.tssa.org

Application for Review of Pipeline Project

Technical Standards and Safety Act
Fuels Safety Regulations

Location Address:

D. INVOICEE
(Company responsible for fees invoiced for approval including engineering and inspection fees.)

Company Name: Enbridge		
Street Name/911 Number/Address, if applicable: 500 Consumers Rd		
Unit/Suite:	PO Box:	
City/Town: North York	Province: Ontario	Postal Code: M2J1P8
Telephone No:	Fax No:	Cell No: 437-991-7872
Email: Melany.afara@enbridge.com		
Print Name of Contact Person: Melany Afara	Signature of Contact Person: M. Afara	

FEES FOR ENGINEERING REVIEW AND INSPECTION

Check box to request type of service.

☒ **Regular Service:** 20-30 working days for engineering and inspection services.
Standard Fee: $169.50 (13% HST included) per hour for engineering review and inspection services.

☐ **Rush Engineering Service Only:** 5 to 10 working days.
Fee: 2 x Standard fee for engineering review.

☐ **Rush Engineering and Inspection Services:** 5 to 10 working days for each service.
Fee: 2 x Standard fee for engineering review and inspection services.

Legal Disclaimer - The owner agrees to indemnify and hold harmless the Technical Standards and Safety Authority, its employees, agents, successors and assigns from any and all damages, actions, suits, claims or loss arising from the granting of this variance. In the event of claims made against TSSA arising from the granting of this variance, the owner accepts, on demand, to defend such actions on behalf of TSSA and to assume any costs, legal or otherwise, for the defense or settlement of such claims. Failure to comply with any of the terms and conditions of the variance voids the variance.

Deposit Payment Method

Deposit of $593.25 (13% HST included) must accompany each application. Invoice will only be issued for the amount billed over and above the deposit. HST Registration No.: 891131369

Purchase Order No. _____ Purchase Order number will be reflected on invoices and TSSA will not enter into any purchasing agreements.

☐ Cheque or money order enclosed. Please make payable to: Technical Standards and Safety Authority

☒ Charge my credit card: ☐ VISA ☒ MASTERCARD

Card No. 5 5 6 9 2 1 0 0 0 0 5 8 5 7 1 8

Expiry Date: Month 05 / Year 21

Name of Card Holder: Melany Afara (First Name / Last Name) Telephone No. _____

Signature of Card Holder X _____ Date _____ (dd-mmm-yyyy)

Payment Receipts can be requested by calling our Customer Contact Centre at 1.877.682.8772 only after the payment has been processed.

Attachment 4

DILLON CONSULTING

Replacement, NPS 20 <nps20replacement@dillon.ca>

Your Application for Review of Pipeline Project on Lakeshore Blvd from approximately Cherry St to Bathurst St and a Section on Parliament St

Myrtle daFonseca <mdafonseca@tssa.org> Thu, Apr 30, 2020 at 12:10 PM
To: "MELANY.AFARA@ENBRIDGE.COM" <MELANY.AFARA@enbridge.com>, "nps20replacement@dillon.ca" <nps20replacement@dillon.ca>, "Kelsey.Mills@enbridge.com" <Kelsey.Mills@enbridge.com>
Cc: Kourosh Manouchehri <KManouchehri@tssa.org>

Good Morning,

We have processed your application for Review of Pipeline Project on Lakeshore Blvd from approximately Cherry St to Bathurst St and a Section on Parliament St, from Mill St to Lakeshore Blvd East – our file SR#2839438.

This file has been assigned to Kourosh Manouchehri for review. Please contact via email Kourosh at kmanouchehri@tssa.org, if you have additional questions.

Thanks

Myrtle daFonseca | Administrative Assistant

Fuels Safety

345 Carlingview Drive

Toronto, Ontario M9W 6N9

Tel: +1-416-734-3346 | Fax: +1-416-231-7525 | E-Mail: mdafonseca@tssa.org

www.tssa.org

Attachment 5

DILLON CONSULTING

Replacement, NPS 20 <nps20replacement@dillon.ca>

Your Application for Review of Pipeline Project on Lakeshore Blvd from approximately Cherry St to Bathurst St and a Section on Parliament St

Melany Afara <Melany.Afara@enbridge.com> Fri, May 15, 2020 at 1:59 PM
To: Kourosh Manouchehri <KManouchehri@tssa.org>
Cc: "nps20replacement@dillon.ca" <nps20replacement@dillon.ca>, Kelsey Mills <Kelsey.Mills@enbridge.com>

Thank you Kourosh. Have a nice long weekend.

From: Kourosh Manouchehri <KManouchehri@tssa.org>
Sent: Friday, May 15, 2020 1:44 PM
To: Melany Afara <Melany.Afara@enbridge.com>
Cc: nps20replacement@dillon.ca; Kelsey Mills <Kelsey.Mills@enbridge.com>
Subject: [External] RE: Your Application for Review of Pipeline Project on Lakeshore Blvd from approximately Cherry St to Bathurst St and a Section on Parliament St

EXTERNAL: PLEASE PROCEED WITH CAUTION.
This e-mail has originated from outside of the organization. Do not respond, click on links or open attachments unless you recognize the sender or know the content is safe.

Hi Melany,

I reviewed the environmental report related to this project and don't have any comment at this point of time. According to the schedule posted in the website, potential construction start date will be spring 2021. TSSA will visit construction site as part of auditing this project. Please let me know when more accurate schedule is available.

If you have any question, please contact me.

Regards,

Kourosh Manouchehri, P.Eng., PMP | Engineer

Fuels Safety

345 Carlingview Drive

Toronto, Ontario M9W 6N9

Tel: +1-416-734-3539 | | Fax: +1-416-231-7525 | E-Mail: kmanouchehri@tssa.org

www.tssa.org

From: Myrtle daFonseca <mdafonseca@tssa.org>
Sent: April 30, 2020 12:11
To: MELANY.AFARA@ENBRIDGE.COM; nps20replacement@dillon.ca; Kelsey.Mills@enbridge.com
Cc: Kourosh Manouchehri <KManouchehri@tssa.org>
Subject: Your Application for Review of Pipeline Project on Lakeshore Blvd from approximately Cherry St to Bathurst St and a Section on Parliament St

Good Morning,

Attachment 5

We have processed your application for Review of Pipeline Project on Lakeshore Blvd from approximately Cherry St to Bathurst St and a Section of Parliament St, from Mill St to Lakeshore Blvd East – our file SR#2839438.

This file has been assigned to Kourosh Manouchehri for review. Please contact via email Kourosh at kmanouchehri@tssa.org, if you have additional questions.

Thanks

Myrtle daFonseca | Administrative Assistant

Fuels Safety

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www.tssa.org

ENBRIDGE GAS INC.
Answer to Interrogatory from
OEB Staff (STAFF)

INTERROGATORY

Reference:

Exhibit F, Tab 1, Schedule 1

Preamble:

The Indigenous Consultation Report (ICR) in the application lists consultation activities until May 27, 2020. Enbridge Gas provided the ICR to the Ministry of Energy, Northern Development and Mines (MENDM) on July 31, 2020.

Question**:**

a) Please file any comments received from any Indigenous groups regarding the Project since May 27, 2020.

b) Please update the evidence with any correspondence between the MENDM and Enbridge Gas after July 31, 2020, regarding the MENDM's review of Enbridge Gas's consultation activities.

c) Please indicate when Enbridge Gas expects to receive from the MENDM a letter indicating whether or not Enbridge Gas has adequately discharged the procedural aspects of the Crown's Duty to Consult.

Response:

a) No supplementary consultation activities occurred following the leave to construct submission. There were no requests for additional information or concerns identified by Indigenous communities and there were no additional comments received from Indigenous groups regarding the Project since May 27, 2020.

b) and c) There was no correspondence between MENDM and Enbridge Gas after July 31, 2020 regarding Enbridge Gas's consultation activities other than the MENDM providing a sufficiency letter regarding Enbridge Gas's Indigenous consultation activities for the Project. This letter was received by Enbridge Gas on October 14, 2020 and is set out in the attachment to this response. In that letter the MENDM indicates that it "…is of the opinion that the procedural aspects of consultation

undertaken by Enbridge Gas Distribution Inc. to date for the purposes of the Ontario Energy Board's Leave to Construct approval process for the Cherry to Bathurst NPS 20 Pipeline Replacement Project is satisfactory.".

Ministry of Energy, Northern Development and Mines

77 Grenville Street
6th Floor
Toronto ON M7A 2C1

Ministère de l'Énergie, du Développement du Nord et des Mines

77, rue Grenville
6e étage
Toronto ON M7A 2C1

Ontario

October 14, 2020

VIA EMAIL

Joel Denomy
CFA Technical Manager, Regulatory Applications
Enbridge Gas Inc.
109 Commissioners Road West
London, Ontario, N6A 4P1

Re: Consultation Sufficiency Opinion for the Cherry to Bathurst NPS 20 Pipeline Replacement Project

Dear Joel Denomy,

The Ontario Ministry of Energy, Northern Development and Mines (ENDM) has completed its review of Enbridge Gas Distribution Inc. Indigenous consultation report for the Cherry to Bathurst NPS 20 Pipeline Replacement Project. This letter is to notify you that it is our understanding that there are no outstanding concerns from Indigenous communities that are known to ENDM at this time. As a result, the ministry has no concerns with the sufficiency of the consultation to date. ENDM is of the opinion that the procedural aspects of consultation undertaken by Enbridge Gas Distribution Inc. to date for the purposes of the Ontario Energy Board's Leave to Construct approval process for the Cherry to Bathurst NPS 20 Pipeline Replacement Project is satisfactory.

If you have any questions about this letter or require any additional information, please contact Jonathon Wilkinson, Senior Advisor at (705) 313-3658 or jonathon.wilkinson@ontario.ca.

It is expected that by Enbridge Gas Distribution Inc. will continue to engage with communities throughout the life of the Cherry to Bathurst NPS 20 Pipeline Replacement Project, and that Enbridge Gas Distribution Inc. will notify ENDM should any additional rights-based concerns or issues arise.

Sincerely,

Dan Delaquis
A/Manager
Indigenous Energy Policy

c: Ontario Energy Board
Ontario Pipeline Coordinating Committee

ENBRIDGE GAS INC.
Answer to Interrogatory from
OEB Staff (STAFF)

INTERROGATORY

Reference:

Exhibit E, Tab 1, Schedule 1, page 1-4
Exhibit E, Tab 1, Schedule 1, Attachment 1

Preamble:

Enbridge Gas stated that the Preferred Route (R) for the Project may require a bylaw or easement where municipal road allowances are not dedicated, as well as approval from Hydro One Networks Inc. for an easement crossing. Enbridge Gas will be required to obtain road occupancy permits from the City of Toronto.
Enbridge Gas will require temporary land use (TLU) rights to complete the Project. Enbridge Gas will therefore require the OEB's approval of the form of easement agreement that it has offered or will offer to the affected landowners.

Question**:**

a) Please provide an update on the current status and prospect of negotiations with landowners of properties where easements/easement crossings and TLU rights are needed, including any concerns that have been expressed by landowners with respect to the proposed Project. Please indicate the number of TLU rights that are required.

b) Please confirm whether the form of temporary land use agreement filed as part of the application has been previously approved by the OEB. If so, please provide the OEB case number and project name in which this form of easement agreement was last used.

c) Please provide an update of Table 1, including any other permits and approvals that are required to complete the construction of the Project, and a description of the purpose or need for each permit and the status of each permit/approval application. Please provide dates for when Enbridge Gas expects to receive any outstanding permits/approvals required, and what impact and delays in receiving these might have on the Project schedule.

d) Please discuss any concerns that Enbridge Gas has with respect to obtaining any of the required land rights and/or permits for the Project.

Response:

a) The Project will be constructed completely within the Road Allowances, there are no temporary land use requirements. Please see Exhibit I.Toronto.8 a). Agreements for temporary working rights will be negotiated if required.

b) The form of temporary land use agreement filed as part of this application was previously approved by the Board in the EB-2018-0108 proceeding.

c) Please see the table below for an updated version of Table 1 with anticipated timelines. Depending on the nature of the outstanding approval, the commencement of Project construction could be delayed (it should be noted that the expected construction commencement date is June 2021).

Table 1: Permits & Agreements Required

AUTHORITY	PURPOSE	PROPOSED TIMING FOR APPROVALS
Toronto & Region Conservation Authority 101 Exchange Ave, Vaughan, ON L4K 5R6 Attn: Nathan Jenkins	Permit for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses, as required	Anticipated required date of May 5, 2021
City of Toronto Toronto and East York District 433 Eastern Ave, Building B, 1st Floor Toronto, Ontario M4M 1B7	Noise Exemption Permit	Anticipated required date of January 27, 2021
City of Toronto Transportation Services – ROW Management North York Civic Centre 5100 Yonge Street, 4th Floor Toronto, Ontario	Street Occupation Permit Cut Permit Application for Installation of Serviceswithin the City of Toronto Streets.	Parliament St: Road Occupancy Permit – Anticipated required date of August 12, 2021

M2N 5V7 Attn: Antonio Longo, Supervisor, Utility Review (utilrev@toronto.ca)	Follow PUCC process and contact required utilities.	Road Cut Permit – Anticipated required date of August 12, 2021 Lake Shore Blvd Road Occupancy Permit – Anticipated required date of August 12, 2021 Road Cut Permit – Anticipated required date of August 12, 2021
City of Toronto Toronto Water Environmental Monitoring & Protection 30 Dee Avenue Toronto, Ontario M9N 1S9	Sewer Discharge Permit(s)/Agreement(s) are required as per Chapter 681 of the City of Toronto Municipal Code if discharging private water into the City's sewer system	Anticipated required date of February 10, 2021
City of Toronto Scarborough Civic Centre, 5th Floor 150 Scarborough Drive Toronto, ON M1P 4N7 Attn: Craig Wilson (craig.wilson@toronto.ca)	Permit to remove or injure trees as per Chapter 813 of the City of Toronto Municipal Code	Anticipated required date of January 27, 2021
Ministry of Heritage, Sport, Tourism and Culture Industries 401 Bay St, Toronto, Ontario M7A 0A7 Attn: Dan Minkin	Archaeological clearance under the Ontario Heritage Act (OHA), Review of Built Heritage and Cultural Landscape under the OHA.	

Ontario Ministry of the Environment, Conservation and Parks Environmental Approvals Branch 135 St. Clair Avenue West Toronto, ON M4V 1P5	Environmental Activity and Sector Registry (EASR) registration if dewatering of more than 50,000 litres (L) per day but less than 400,000 L per day is required. Permit to Take Water if water taking is greater than 400,000L per day.	Anticipated required date of February 10, 2021
Ontario Ministry of the Environment, Conservation and Parks Species at Risk Branch 50 Bloomington Rd Aurora, ON L4G 0L8	Letter of advice, project registration and/or a permit under the Endangered Species Act, 2007 (ESA) for work within, or adjacent to, Species At Risk habitat.	
Environment and Climate Change Canada 867 Lakeshore Road Burlington, ON L7S 1A1	Nest sweeps to be conducted at a maximum of 7 days prior to vegetation removal during the bird nesting season, (e.g. April 1 to August 31), as per the *Migratory Birds Convention Act*	
Metrolinx	Rail Crossing (pipe within the ROW but going under the Parliament Street Rail Bridge) Hydro One Infrastructure on Bridgeway as well.	Anticipated required date of June 30, 2021
Hydro One	Rail Crossing (pipe within the ROW but going under the Parliament Street Rail Bridge) Hydro One Infrastructure on Bridgeway as well.	Anticipated required date of February 10, 2021

d) Currently Enbridge Gas does not have any concerns with respect to obtaining any of the required land rights and/or permits for the Project. As indicated in the response to a) above Enbridge Gas will be using its own Station B facility for storage and does not anticipate a requirement for temporary land use.

ENBRIDGE GAS INC.
Answer to Interrogatory from
OEB Staff (STAFF)

INTERROGATORY

Reference:

Exhibit A, Tab 2, Schedule 1

Preamble:

The OEB Act permits the OEB, when making an order, to "impose such conditions as it considers proper."[1]

Question**:**

OEB staff has prepared the following draft Conditions of Approval. If Enbridge Gas does not agree to any of the draft conditions of approval noted below, please identify the specific conditions that Enbridge Gas disagrees with and explain why. For conditions in respect of which Enbridge Gas would like to recommend changes, please provide the proposed changes and an explanation of the changes.

Enbridge Gas Inc.
NPS 20 Replacement Cherry to Bathurst Project (EB-2020-0136)
OEB Act Section 90 Leave to Construct

DRAFT CONDITIONS OF APPROVAL

1. Enbridge Gas Inc. (Enbridge Gas) shall construct the facilities and restore the land in accordance with the OEB's Decision and Order in EB-2020-0136 and these Conditions of Approval.
2. (a) Authorization for leave to construct shall terminate 12 months after the decision is issued, unless construction has commenced prior to that date.

   (b) Enbridge Gas shall give the OEB notice in writing:

   i. of the commencement of construction, at least ten days prior to the date construction commences;

[1] OEB Act, s. 23

ii. of the planned in-service date, at least ten days prior to the date the facilities go into service;

iii. of the date on which construction was completed, no later than 10 days following the completion of construction; and

iv. of the in-service date, no later than 10 days after the facilities go into service.

3. Enbridge Gas shall implement all the recommendations of the Environmental Report filed in the proceeding, and all the recommendations and directives identified by the Ontario Pipeline Coordinating Committee review.

4. Enbridge Gas shall advise the OEB of any proposed change to OEB-approved construction or restoration procedures. Except in an emergency, Enbridge shall not make any such change without prior notice to and written approval of the OEB. In the event of an emergency, the OEB shall be informed immediately after the fact.

5. Enbridge Gas shall file, in the proceeding where the actual capital costs of the project are proposed to be included in rate base, a Post Construction Financial Report, which shall indicate the actual capital costs of the project and shall provide an explanation for any significant variances from the cost estimates filed in this proceeding.

6. Both during and after construction, Enbridge Gas shall monitor the impacts of construction, and shall file with the OEB one paper copy and one electronic (searchable PDF) version of each of the following reports:
    a) A post construction report, within three months of the in-service date, which shall:
        i. provide a certification, by a senior executive of the company, of Enbridge Gas' adherence to Condition 1;
        ii. describe any impacts and outstanding concerns identified during construction;
        iii. describe the actions taken or planned to be taken to prevent or mitigate any identified impacts of construction;
        iv. include a log of all complaints received by Enbridge Gas, including the date/time the complaint was received, a description of the complaint, any actions taken to address the complaint, the rationale for taking such actions; and
        v. provide a certification, by a senior executive of the company, that the company has obtained all other approvals, permits, licenses, and certificates required to construct, operate and maintain the proposed project.

b) A final monitoring report, no later than fifteen months after the in-service date, or, where the deadline falls between December 1 and May 31, the following June 1, which shall:
   i. provide a certification, by a senior executive of the company, of Enbridge Gas' adherence to Condition 3;
   ii. describe the condition of any rehabilitated land;
   iii. describe the effectiveness of any actions taken to prevent or mitigate any identified impacts of construction;
   iv. include the results of analyses and monitoring programs and any recommendations arising therefrom; and
   v. include a log of all complaints received by Enbridge Gas, including the date/time the complaint was received; a description of the complaint; any actions taken to address the complaint; and the rationale for taking such actions.

7. Enbridge Gas shall designate one of its employees as project manager who will be responsible for the fulfillment of these conditions, and shall provide the employee's name and contact information to the OEB and to all the appropriate landowners, and shall clearly post the project manager's contact information in a prominent place at the construction site.

Response:

Enbridge Gas agrees to all draft Conditions of Approval, with the exception of 2a). Enbridge Gas would request that authorization for leave to construct terminate after 18 months after the decision is issued rather than 12 months. This is consistent with the Conditions of Approval for the Don River replacement Project (EB-2018-0108), a recent project completed in Toronto.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence, 2020-07-31, Exhibit B, Tab 1, Schedule 1, Page 2 of 30

Application and Evidence, 2020-07-31, Exhibit C, Tab 1, Schedule 1, Attachment 2, Page 32 of 106 (page 86 of PDF)

Preamble:

Enbridge states that "[t]he potential consequences of a failure are amplified as the C2B segment is located in a high consequence area including characteristics such as wall-to-wall concrete, a densely populated downtown core with residential, commercial and critical customers, the Gardiner Expressway, utility congested road allowance, and close proximity to railway/public transportation."

Enbridge's routing study did not consider or fully map the support columns under the Gardiner Expressway (the "Gardiner"). It states that:

…it is recommended that further survey work be completed to map the locations and extents of the [Gardiner] support columns. Once this data has been obtained, it could be included in the Base Case model with the columns as exclusion area (or high constraint) plus a buffered setback to further gauge the feasibility of constructing a pipeline in this road allowance.

This is a very dense urban area with third party projects continuing to be proposed within the Study Area. The results of this Study are from information known at this time. Other corridor options or changes to existing routes could be made in the future by combining individual nodes and segments once more detailed information and new development information, including regulatory, stakeholder and/or public feedback, is available.

There are extensive Toronto infrastructure projects along the Project's preferred route, with complex construction phasing, coordination, and staging.

Question**:**

How will Enbridge avoid conflict between its Project and planned Toronto works on the Project route, including:

a. the Gardiner Expressway ("Gardiner") rehabilitation, inclusive of the proposed location of new bents from the Gardiner East Environmental Assessment;
b. the Cherry Street watermain replacement;
c. the Yonge Street watermain replacement;
d. the Yonge Street sanitary sewer replacement;
e. the Lower Jarvis watermain replacement;
f. the Cooper Street sewer rehabilitation;
g. roadworks, including along Lakeshore Avenue East;
h. watermain replacement on Bathurst Street, and;
i. bikeway construction on Dan Leckie Way.

Response:

a-i) Enbridge Gas is aware of the Gardiner rehabilitation work, as well as other work taking place along the Preferred Route, and is committed to working with the City of Toronto to address any conflicts that arise. Enbridge Gas will avoid conflict between its Project and planned Toronto works on the Project route through coordination meetings with the City of Toronto and by progressing the Project through the Toronto Public Utilities Coordinating Committee (TPUCC) processes currently in place.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

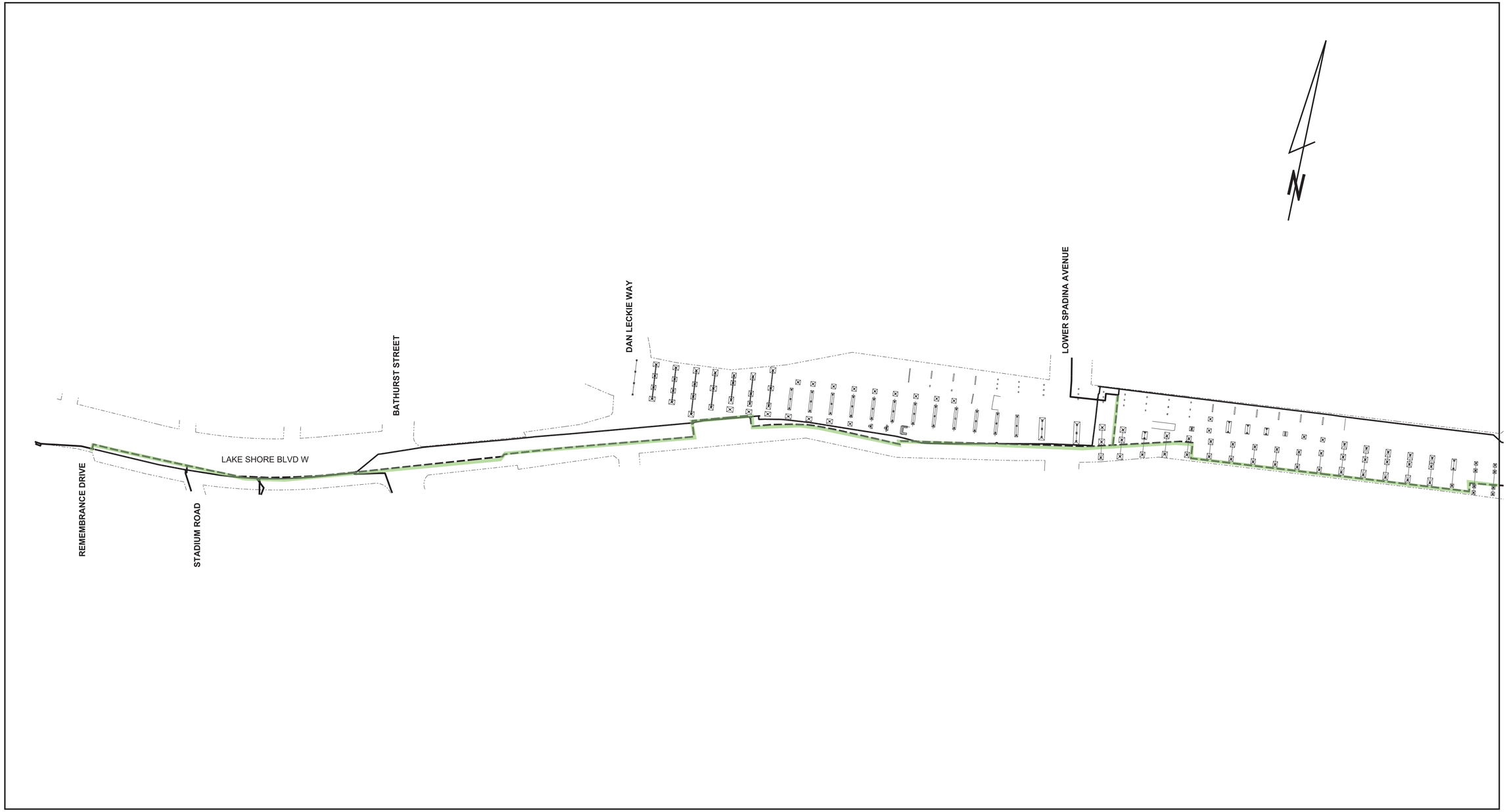
Question**:**

Has Enbridge mapped the location of its proposed pipeline relative to the Gardiner footings? If so, please provide this mapping. If not, when will Enbridge complete this mapping, and will it provide this mapping to Toronto when it is available?

Response:

Enbridge Gas has hired a consultant to map out the columns and footings relating to the Gardiner Expressway. Enbridge Gas has also obtained copies of the original as-laids of each column and footing giving Enbridge Gas a better understanding of the size of each column/footing as well as the construction methodology (general arrangement, piling, footing reinforcement details etc.) of each so that this information could be incorporated into Enbridge Gas's design for the Project.

Please refer to the attached for a map.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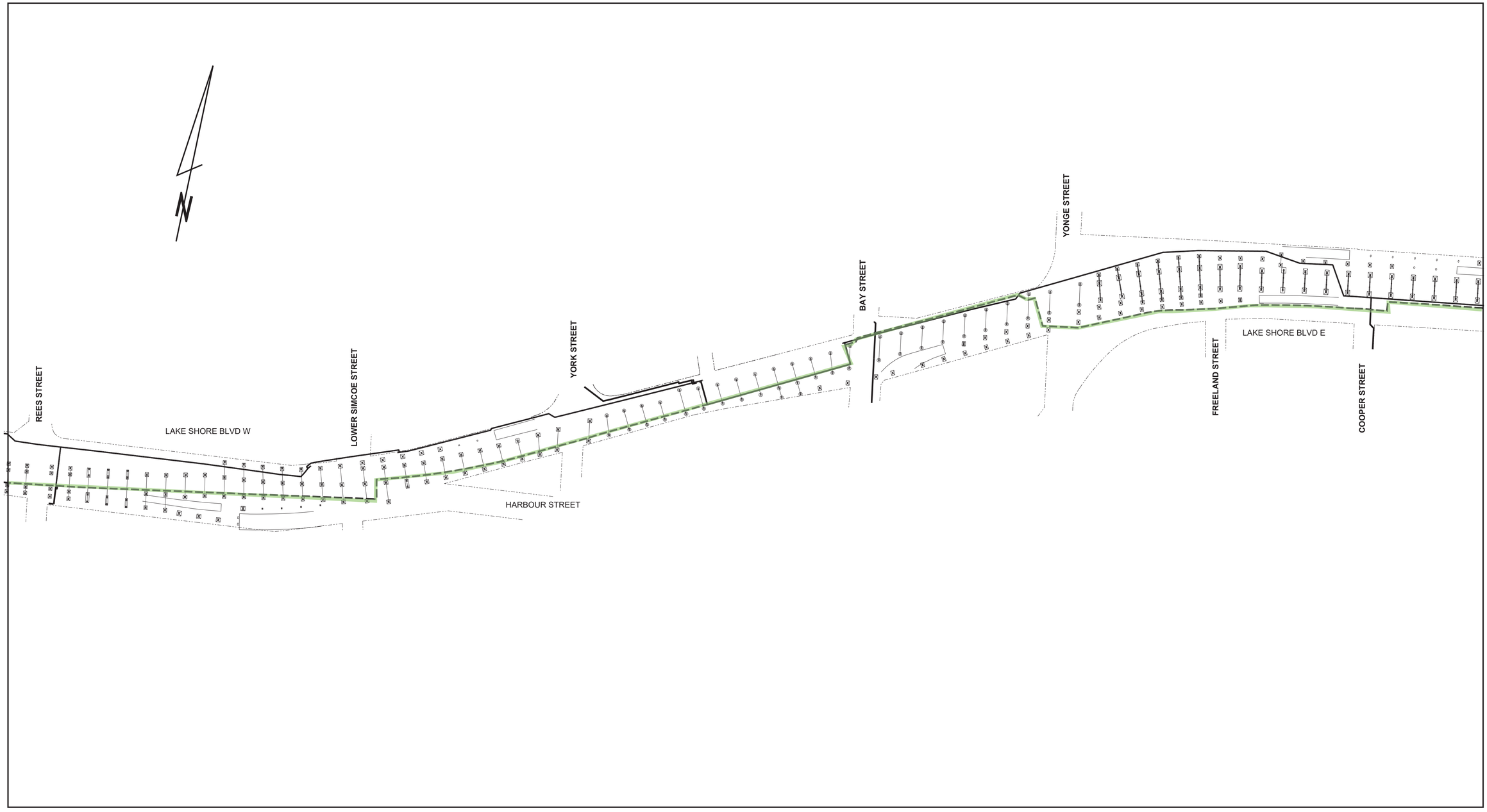
LAKE SHORE BLVD W
REMEMBRANCE DRIVE
STADIUM ROAD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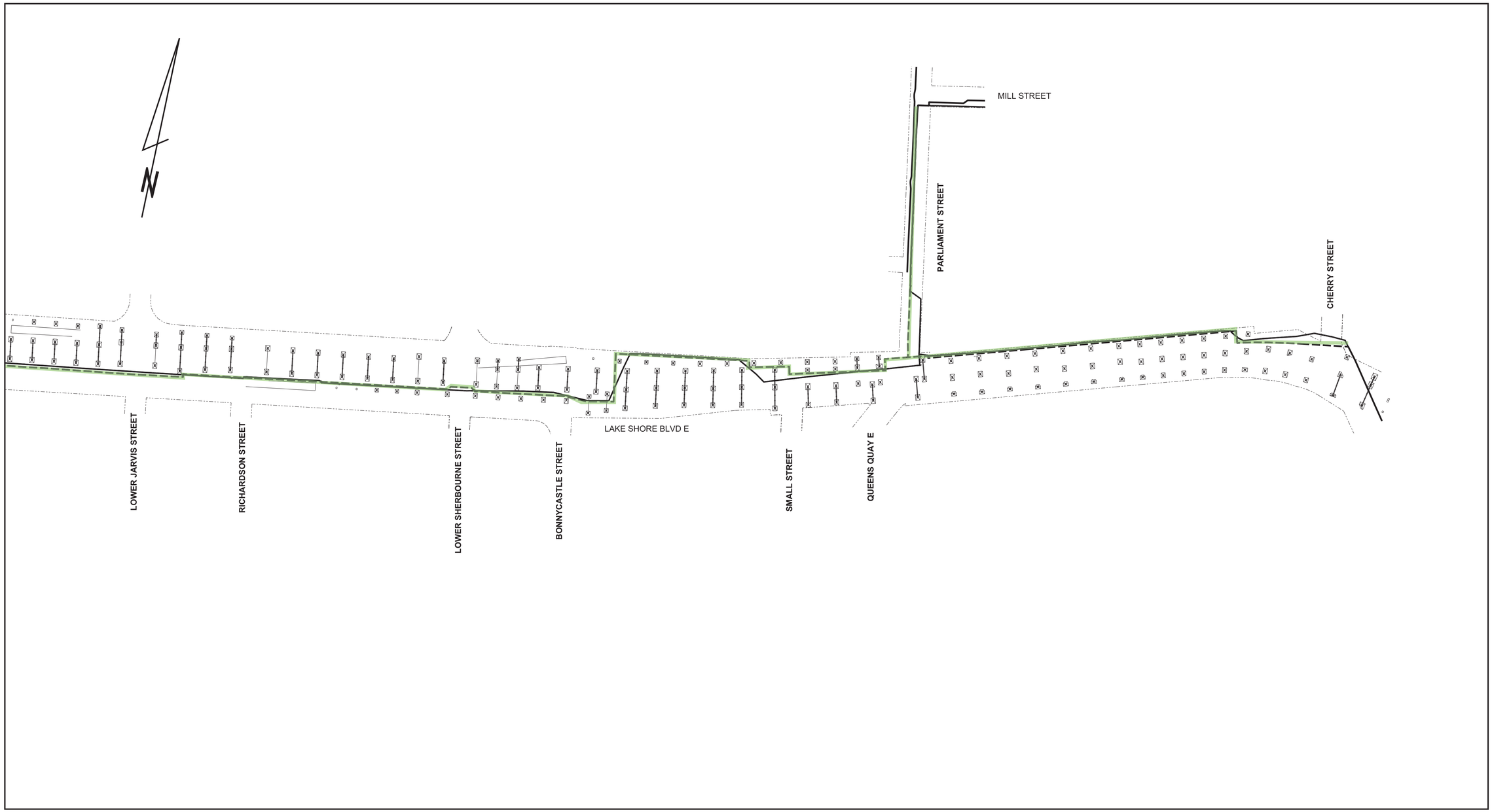
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BONNYCASTLE STREET
SMALL STREET
QUEENS QUAY E

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

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Application and Evidence, 2020-07-31, Exhibit C, Tab 1, Schedule 1, Attachment 2, Page 32 of 106 (page 86 of PDF)

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Enbridge's routing study did not consider or fully map the support columns under the Gardiner Expressway (the "Gardiner"). It states that:

…it is recommended that further survey work be completed to map the locations and extents of the [Gardiner] support columns. Once this data has been obtained, it could be included in the Base Case model with the columns as exclusion area (or high constraint) plus a buffered setback to further gauge the feasibility of constructing a pipeline in this road allowance.

This is a very dense urban area with third party projects continuing to be proposed within the Study Area. The results of this Study are from information known at this time. Other corridor options or changes to existing routes could be made in the future by combining individual nodes and segments once more detailed information and new development information, including regulatory, stakeholder and/or public feedback, is available.

There are extensive Toronto infrastructure projects along the Project's preferred route, with complex construction phasing, coordination, and staging.

Question**:**

How will Enbridge ensure that the structural integrity of the Gardiner Expressway is not compromised by its Project?

Response:

Enbridge Gas has hired an engineering consulting firm to complete a desktop study in order to provide geotechnical information for the Project's alignment. The consultant will verify the desktop information by drilling boreholes at major intersections where trenchless crossings are most likely to take place. At the completion of the study, the consultant will produce a final report for Enbridge Gas that reviews the ground conditions and foundation details of the Gardiner Expressway and will provide impact assessment statements to allow the City of Toronto to start its review process for the Project.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Please provide alignment sheets for the Project, showing the depth of cover, any proposed valves or chambers, etc. If alignment sheets have not yet been prepared, please:

a. confirm when they will be prepared, and provide them to Toronto at that date, and;

b. provide the most accurate and detailed information Enbridge has available on the Project alignment, including the location and depth of any valves or chambers.

Response:

a. Enbridge Gas currently has a preliminary design prepared that indicates the horizontal alignment for the Project. Enbridge Gas anticipates having the depth of the pipeline incorporated into the design drawings by December 2020. Enbridge Gas will provide the design drawings to the City of Toronto once the depths are incorporated.

b. This information will be sent to the City of Toronto (Doodnauth Sharma and Easton Gordon) shortly.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

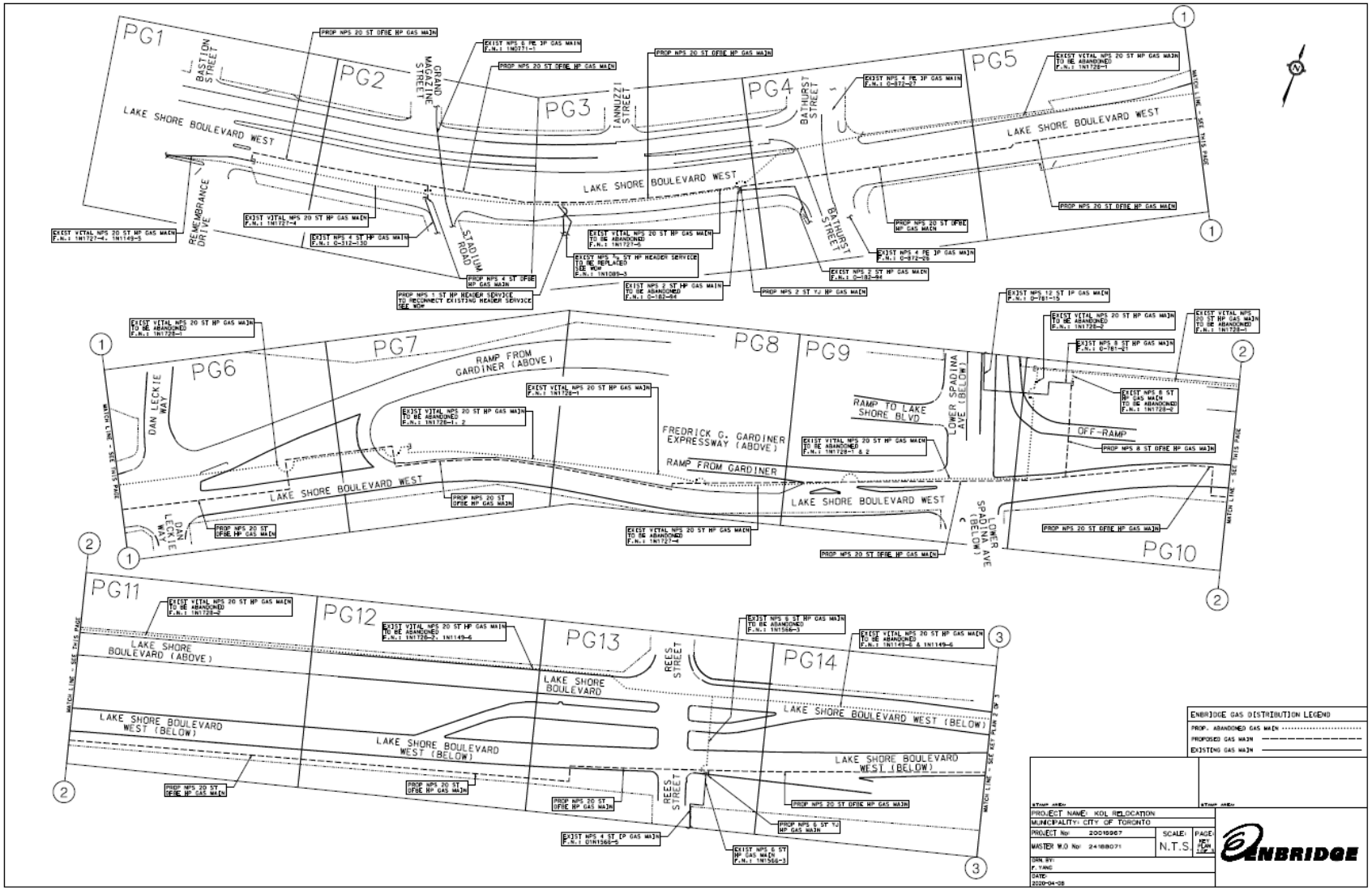
INTERROGATORY

Question**:**

Please provide the most detailed available map of the Project route.

Response:

Please see the map below. Full scale .pdf versions of these maps can be provided to interested parties upon request.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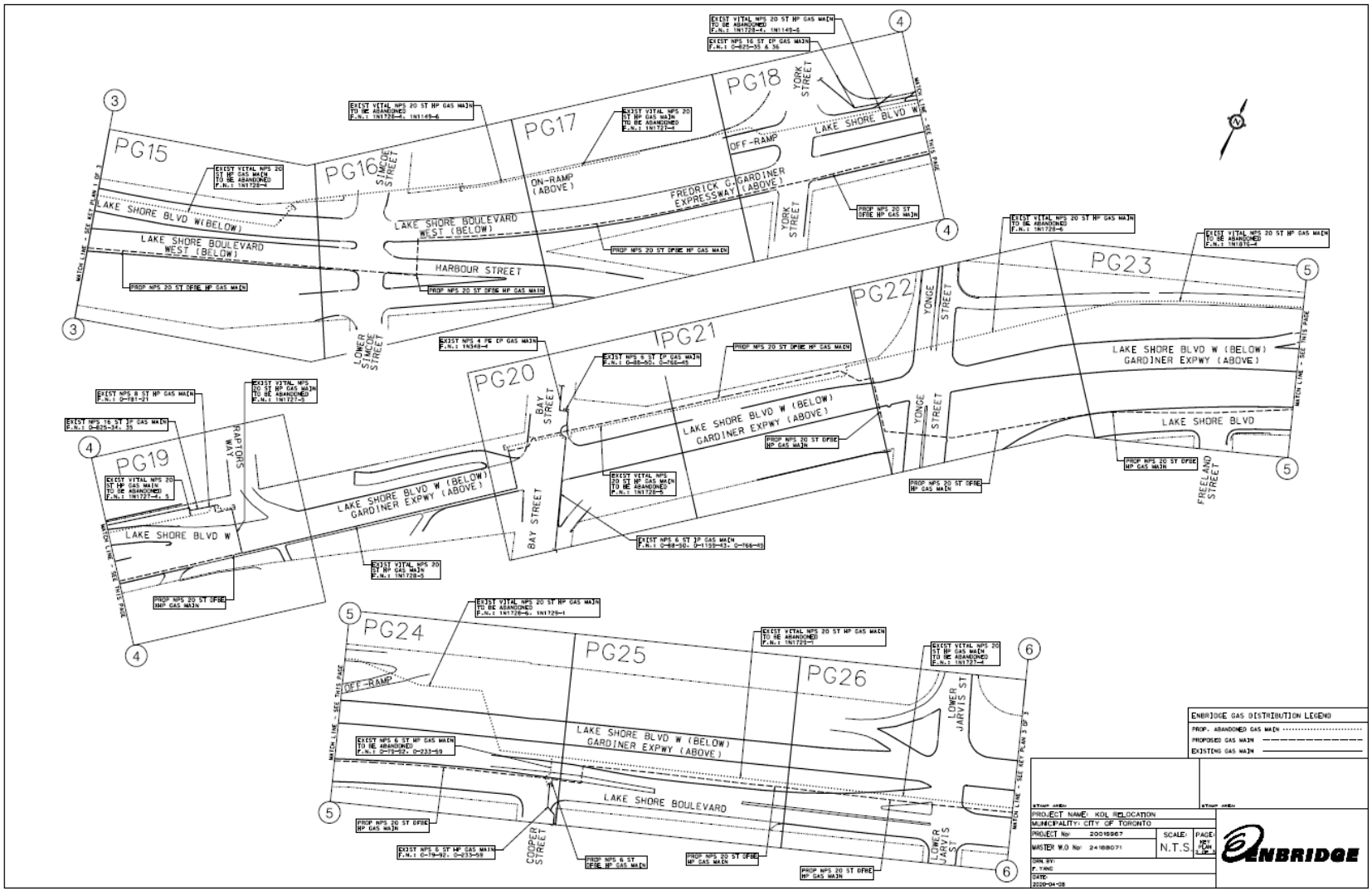
LAKE SHORE BOULEVARD WEST
LAKE SHORE BOULEVARD (ABOVE)
LAKE SHORE BOULEVARD WEST (BELOW)
BASTION STREET
GRAND MAGAZINE STREET
ANNUZZI STREET
BATHURST STREET
REMEMBRANCE DRIVE
STADIUM ROAD
DAN LECKIE WAY
RAMP FROM GARDINER (ABOVE)
FREDRICK G. GARDINER EXPRESSWAY (ABOVE)
RAMP FROM GARDINER
RAMP TO LAKE SHORE BLVD
OFF-RAMP
LOWER SPADINA AVE (BELOW)
REES STREET
ENBRIDGE GAS DISTRIBUTION LEGEND
PROP. ABANDONED GAS MAIN
PROPOSED GAS MAIN
EXISTING GAS MAIN
PROJECT NAME: KOL RELOCATION
MUNICIPALITY: CITY OF TORONTO
PROJECT No: 20016967
MASTER W.O No: 24188071
SCALE: N.T.S.
DRN. BY: F.YANG
DATE: 2020-04-08
ENBRIDGE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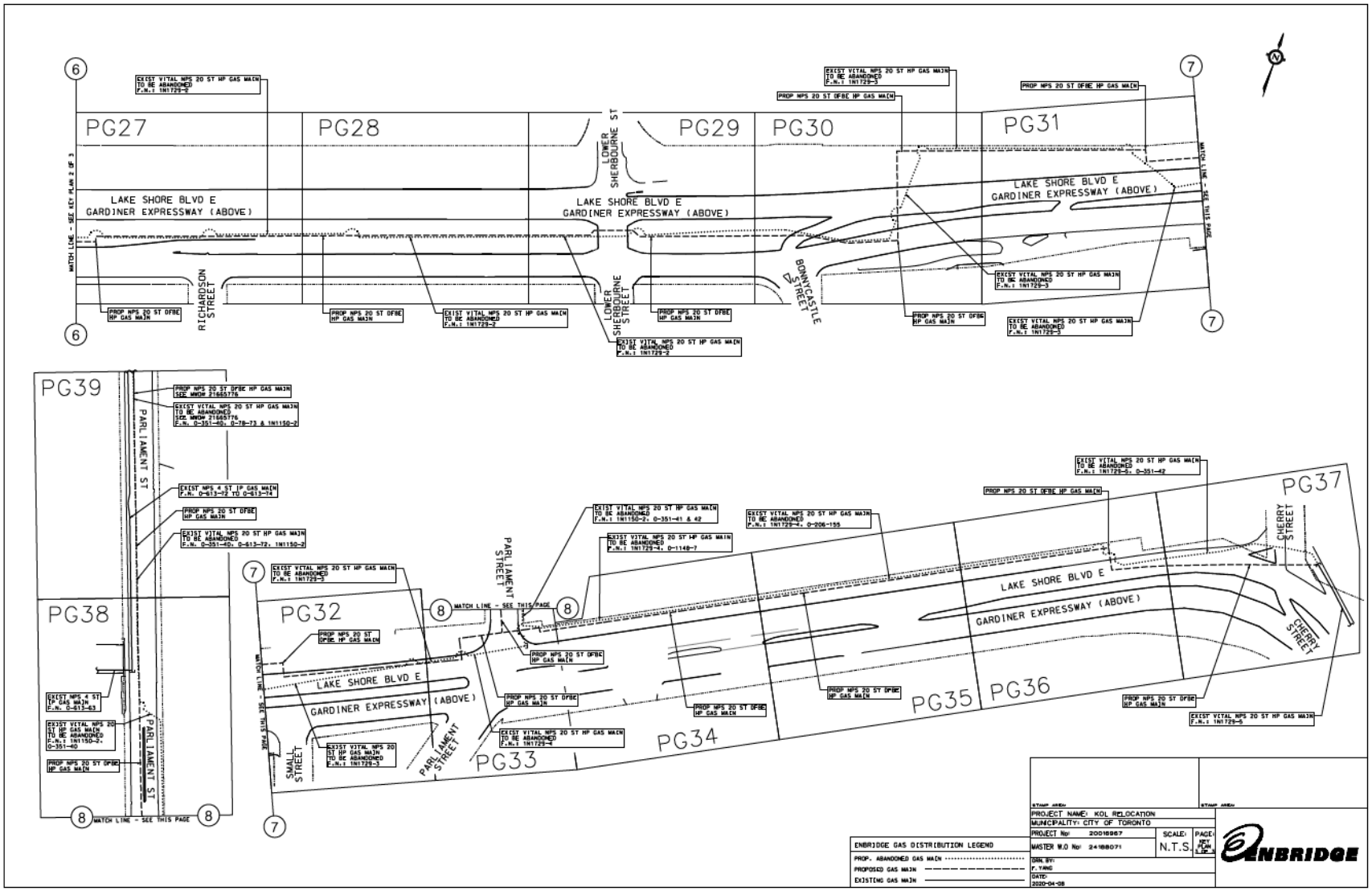
LAKE SHORE BOULEVARD WEST (BELOW)
HARBOUR STREET
FREDRICK G. GARDINER EXPRESSWAY (ABOVE)
ON-RAMP (ABOVE)
OFF-RAMP
LAKE SHORE BLVD W (BELOW) GARDINER EXPWY (ABOVE)
LAKE SHORE BLVD
LAKE SHORE BOULEVARD
SIMCOE STREET
LOWER SIMCOE STREET
YORK STREET
BAY STREET
YONGE STREET
RAPTORS WAY
FREELAND STREET
COOPER STREET
LOWER JARVIS ST
ENBRIDGE GAS DISTRIBUTION LEGEND
PROP. ABANDONED GAS MAIN
PROPOSED GAS MAIN
EXISTING GAS MAIN
PROJECT NAME: KOL RELOCATION
MUNICIPALITY: CITY OF TORONTO
PROJECT No: 2001997
MASTER W.O No: 24188071
SCALE: N.T.S
DRN. BY: F. YANG
DATE: 2020-04-28
ENBRIDGE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PARLIAMENT ST
SMALL STREET
CHERRY STREET
MATCH LINE - SEE KEY PLAN 2 OF 3
MATCH LINE - SEE THIS PAGE
ENBRIDGE GAS DISTRIBUTION LEGEND
PROP. ABANDONED GAS MAIN
PROPOSED GAS MAIN
EXISTING GAS MAIN
PROJECT NAME: KOL RELOCATION
MUNICIPALITY: CITY OF TORONTO
PROJECT No: 20019967
MASTER W.O No: 2418807
SCALE: N.T.S.
DRN. BY: F.YANG
DATE: 2020-04-08
ENBRIDGE

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence, 2020-07-31, Exhibit B, Tab 1, Schedule 1, Page 2 of 30

Application and Evidence, 2020-07-31, Exhibit C, Tab 1, Schedule 1, Attachment 2, Page 32 of 106 (page 86 of PDF)

Preamble:

Enbridge states that "[t]he potential consequences of a failure are amplified as the C2B segment is located in a high consequence area including characteristics such as wall-to-wall concrete, a densely populated downtown core with residential, commercial and critical customers, the Gardiner Expressway, utility congested road allowance, and close proximity to railway/public transportation."

Enbridge's routing study did not consider or fully map the support columns under the Gardiner Expressway (the "Gardiner"). It states that:

…it is recommended that further survey work be completed to map the locations and extents of the [Gardiner] support columns. Once this data has been obtained, it could be included in the Base Case model with the columns as exclusion area (or high constraint) plus a buffered setback to further gauge the feasibility of constructing a pipeline in this road allowance.

This is a very dense urban area with third party projects continuing to be proposed within the Study Area. The results of this Study are from information known at this time. Other corridor options or changes to existing routes could be made in the future by combining individual nodes and segments once more detailed information and new development information, including regulatory, stakeholder and/or public feedback, is available.

There are extensive Toronto infrastructure projects along the Project's preferred route, with complex construction phasing, coordination, and staging.

Question**:**

Please confirm that Enbridge will, if requested by Toronto, provide as-built plans of its Project to Toronto.

Response:

Confirmed. Enbridge Gas will provide as-built plans of this Project to the City of Toronto when requested.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Will Enbridge pay for any relocation that may be required of its proposed new pipeline or the decommissioned pipeline, where one or both conflict with currently-planned Toronto capital projects?

Response:

Enbridge Gas will endeavor to avoid any future conflicts with its proposed new pipeline by engaging with the City of Toronto during the Project's design stages. Refer to Exhibit I.Toronto.1. If a conflict is identified at a later date, the expense of the relocation project will be cost shared with the City of Toronto pursuant to the *Public Service Works and Highways Act* and/or other relevant frameworks.

If a future conflict arises with the decommissioned pipeline, it will be the responsibility of the requesting party to remove the portion of the decommissioned pipeline in conflict, as is standard practice.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Enbridge Gas Inc. NPS 20 Replacement Cherry to Bathurst Environmental Report (the "Environmental Report"), page 22

Preamble:

The Environmental Report states that "lands located approximately 30 m on each side of the road right-of-way…can be used to site temporary facilities".

Question**:**

Please:

a. provide a map of the actual Project footprint, including all temporary facilities;

b. advise if the Project footprint will occupy any areas outside of the Lakeshore and Parliament road allowances;

c. advise if the Project footprint will occupy any parks. If so, please confirm the dates that Enbridge proposes to occupy them, and;

d. confirm how Enbridge intends to avoid interference with parks and damage to trees from its Project.

Response:

a. The Project footprint from a construction standpoint is completely within the Road Allowances, there are no temporary facilities being looked at outside of Enbridge Gas's Station B compound at 405 Eastern Avenue. Station B will be utilized by Enbridge Gas to store materials for the Project. For detailed Project maps please see Exhibit I.Toronto.5.

b. The Project footprint from a construction standpoint will be within the road allowances on Lakeshore Boulevard and Parliament Street. The lands 30m on either side of the road allowance noted in the Environmental Report was referring to the lands studied during the field work to produce the Environmental Report.

c. Current plans for the Project do not contemplate the occupation of any parks. In the event that a park does need to be occupied, Enbridge Gas will consult with the City of Toronto for further direction.

d. Enbridge Gas does not anticipate any interference with parks with the current running line for the Project. If damage to any tree is necessary, Enbridge Gas will hire a certified Arborist to produce an Arborist Report and will submit an application for a Permit to Injure or Remove Trees (per the City of Toronto Tree Protection By-law).

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit D, Tab 1, Schedule 1, page 4 of 5

Preamble:

Enbridge states that "Project construction is expected to take approximately 16 months. Construction of the Project is expected to commence in June 2021. The Project is expected to be in service by August 2022 and Project construction is expected to be completed by September 2022".

Toronto is concerned about the potential for disruption caused by a 16-month construction period.

Question**:**

Please:

a. provide a detailed construction timeline;

b. confirm why Enbridge anticipates a 16 month construction period, and;

c. confirm if there are any periods for which Enbridge cannot perform construction activities, e.g. winter, and if so confirm why work cannot be performed.

Response:

a) Contractor Procurement has not been completed yet, thus a detailed construction timeline is not available at this time. Enbridge Gas estimated the construction duration based on past projects and constraints specific to the preferred route. Included in the construction time estimate are timelines required for mobilization, installation, testing, conditioning, tie-ins, energization, abandonment, and restoration.

b) Please refer to the response to a) above.

c) External constraints (weather, events, etc.) that may prevent construction for a day at a time

were factored in the construction timelines. The construction timeline does not assume demobilization during winter.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit D, Tab 1, Schedule 1, page 4 of 5

Preamble:

Enbridge states that "Project construction is expected to take approximately 16 months. Construction of the Project is expected to commence in June 2021. The Project is expected to be in service by August 2022 and Project construction is expected to be completed by September 2022".

Toronto is concerned about the potential for disruption caused by a 16-month construction period.

Question**:**

Please:

a. confirm the method and timing of restoration, for roads and any other construction areas;

b. specify the timing and sequence of restoration relative to other Project construction activities,

c. specify how restoration activities are affected by weather conditions, e.g. winter weather, and;

d. confirm that Enbridge will permanently restore its construction zone immediately after completing its underground work, in order to minimize disruption to traffic.

Response:

a) Enbridge Gas will perform temporary restoration throughout the Project duration as pipe is being installed.

   Enbridge Gas will retain the services of a specialized contractor to perform permanent restoration of hard surface areas at the end of the Project and is planning

to complete restoration by October 2022. Refer to Exhibit D-1-1 Table 2.

b) Refer to a) above.

c) Enbridge Gas typically ensures that permanent restoration occurs outside of the winter months. However, should a temporary restoration require repairs or maintenance, Enbridge Gas will complete that work promptly.

d) Not confirmed. Enbridge Gas will complete temporary restoration throughout the Project and then complete permanent restoration after the installation is complete.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 1-2 of 30

Preamble:

Enbridge states that "[t]he segment of pipeline to be replaced is part of the NPS 20 HP ST natural gas main known as the Kipling Oshawa Loop (KOL)."

Enbridge states that "mains installed in the 1970s and prior thereto, have demonstrated declining health compared to steel mains installed after the 1970s". Enbridge further states that the Kipling Oshawa Loop is a vintage steel main.

Question**:**

Please:

a. provide a map of the complete Kipling Oshawa Loop;

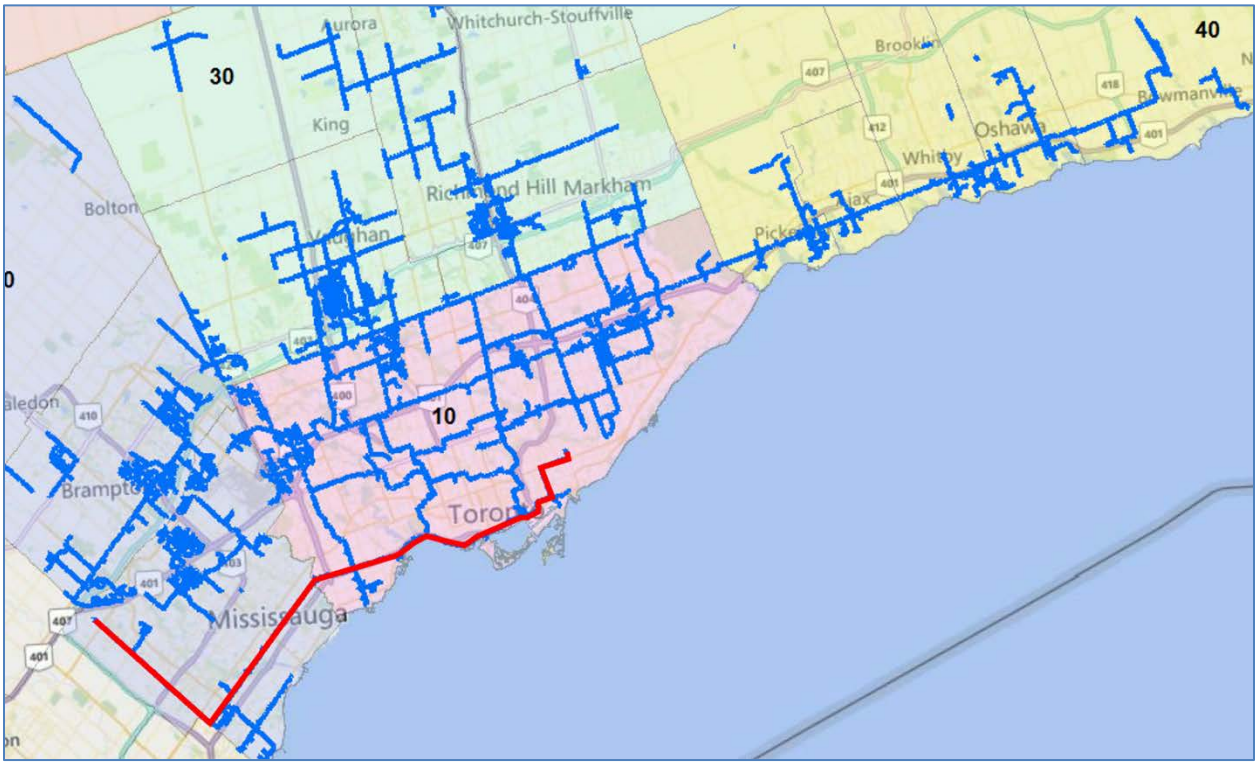
b. confirm which pipeline segments the Project will tie into;

c. confirm the age of the existing Cherry to Bathurst pipeline segment, and;

d. confirm the age of the remaining sections of the Kipling Oshawa Loop, including the dates that any sections were replaced and their length.

Response:

a. The KOL is a pipeline system that has expanded and connected with multiple other networks over many decades. The map below shows the KOL HP system as it exists today. The map also highlights, in red, the NPS 20 pipeline (a part of the KOL) that Enbridge Gas has identified as having integrity concerns.



b. The segments this Project will tie into are as follows:

- Eastern Tie In – Intersection of Cherry St and Lake Shore Blvd, tying into the existing NPS20 pipeline approximately 3m south of the southernmost existing NPS20 45° elbow
- Northern Tie In – Intersection of Parliament St and Mill St, tying into the existing NPS12 (reduced) approximately 1m north of the south street line of Mill St.
- Western Tie In - Intersection of Lake Shore Blvd W and Remembrance Dr, tying into the existing NPS20 pipeline approximately 5m east of the existing NPS20 45º elbow

c. The age of the Cherry to Bathurst NPS20 pipeline segment is as follows:

Length (m)	Year Installed
3365.4	1954
384	1960
417.6	1962
193.5	1996
100.4	1997

d. Dates installed, pipeline size and lengths of the KOL provided in the table below.

	Pipe Size												
Year Installed	1	2	3	4	6	8	12	10	16	20	24	30	Grand Total
1954							315.9	16.4		8382.6			8714.9
1955		22.3		2673.4	168.4	3533.6	23210.4			14979.2			44587.3
1956		2018.8		3027.5	3123.1	735.9	30773.1		289.6	3			39971
1957		71.5		1258.9	2661	3321.4	10822.7			2249.3			20384.8
1958		213.4		213.2	133.1	1900.4	16510.8			9633.5			28604.4
1959		955.6		777.2	211.4	2160.7	7897.1		7712.4				19714.4
1960	51.5	128.4		376.5	877.5	708.2	8125.1		2612.7	384			13263.9
1961		989.4		2457.5	1298.8	1405.9	11309.9		955.4				18416.9
1962		50.6		2532.4	465.6	5956.6	19329.7		8572.3	417.6			37324.8
1963	176	1672.3		8630.3	103.2	2305.7	12784.5		1255.4				26927.4
1964	868.3	2170.8		3914.5	2504.5	3999.4	8672.4						22129.9
1965	367.7	4207.1		5901.3	1160	3718.4	1791.5						17146
1966	159.7	1429.7		4664.6	2880.2	172.5	12395.6			2167.6			23869.9
1967	1898	2693.9		5288.3	1538.2	1563	12846.8		15.2				25843.4
1968	2112.3	1610.9		6064	1705.1	3288	8408.4		160				23348.7
1969	3383.7	3141.2	402.8	3889.6	3276.2	33.5	6058.7			858.2			21043.9
1970	2647.8	2356.3		835.3	131.1	1005	3374.1		57.9				10407.5
1971	1465.7	2222.7		2302.9	3019.8	1360.7	5801.5		1759.5	1375.7			19308.5
1972	2738.3	1988.2		7238.3	5101.3	972.4	3040			217.3		4.6	21300.4
1973	4199.2	2386.5	294	8291.8	4033.7	2336.2	2023.5		645.7				24210.6
1974	2534.3	1736.9		1547.3	1451.2	3126.7	1451.5		55				11902.9
1975	1488.2	2054.2		2720	1473.1	4172	2549						14456.5
1976	1327	816.1	294.1	2342		1122.7	2070.4			935.4			8907.7
1977	1467.7	1217.9	181	3779.6	310.5	1658.8	427.3						9042.8
1978	1689.8	690		7694.7	881.7	2094.2	1613.7						14664.1
1979	1650.8	924.5		1462.4	1886.3	676.9	3977.9			1022.3			11601.1
1980	2027.2	2126.9		3687.3	1057.8	265	7378.2						16542.4
1981	605.7	1312.9		3654.7	4134.4	155.7	699.9		21.7				10585
1982	1398.9	3601.6		2133.8	2117.6	3594.5	2042.4	3					14891.8
1983	853.6	975.8		2502.3	358.8		2257.1						6947.6
1984	1138.4	2881.3		5529.9	1583.6	581.6	398.6						12113.4
1985	2493.9	2716.7		4984.9	3889	2974	4518.9		250.6		115.9		21943.9
1986	3123.6	2687.5		2865.9	594.6	495	136						9902.6
1987	2770.2	6776.7		7511.6	634.9	648.6	2543		53	351.7			21289.7
1988	5476.7	7880.7		7020.8	5162.3	2449.5	4046.8						32036.8
1989	4060.9	2407.4		4703	1113.9	1811.7	452.5		117.7				14667.1
1990	536.9	1588.1		3867.8	3175.3	3728.3	1428.5		1180.1				15505
1991	1360.2	1244.7		605.4	6.6	2540	9378.9		91.1	16	4111.9		19354.8
1992	685.6	776.6		2908	2337	3.4	1790.1				911.5	12560.9	21973.1
1993	641.6	614.7		406.1	1057.5	407.1	99.4		567.6		920.9		4714.9
1994	912	2281.3		3023.6	2634.2	3933.8	1770.1						14555
1995	1192.8	999.4		2586.6	2385.6	4986.9	719.9						12871.2
1996	909.3	2123.8		7230.6	3688.1	474.3	683.6			362.5			15472.2
1997	813.6	1794.7		1930.3	5985.9	13505	3430.5			100.4			27560.4
1998	298	1630.3		5573.9	3752	715.6	752.6		5.7	10			12738.1
1999	908.2	3656.6		4151.4	2688.3	4955.1	4036.5						20396.1
2000	831.1	1539.3		7855.3	3163.3	2879.9	3468.5			53.7			19791.1
2001	909	1684.7		2197.7	4562.3	3923.8	1719.2			9.6			15006.3
2002	557.2	2385.3		3474.5	5191	2693.5	4073.8		795.1				19170.4
2003	1682.5	3382.3		4538	1890.2	1161.9	121.2			1683.5		10.8	14470.4
2004	1252.8	1230.6		591.9	2184.8	802.3	1171.2						7233.6
2005	1299.1	1859.9		2896.8	685.3	1858.1	2510.2		32				11141.4
2006	758.1	1054.3		358.1	8.5	2792.8	1897.7		90.6				6960.1
2007	928.2	1868.1		8562.2	1003	17	221.5		3	143			12746
2008	662.4	1854.3		1364.9	1056.3	591.8	939.1			2763.5			9232.3
2009	389.3	1044.8		3928.7	62.8		523.1						5948.7
2010	77	859.6		1367.1	51	841.3	1421.9						4617.9
2011	508.5	815		1522	2100.5	224.8	2218.9						7389.7
2012	324.7	680.4		2356.3	826.1	393.2	1069.8		3.1	431.6			6085.2
2013	806.4	1141.2		995.1	3608.6	5669	2333.2						14553.5
2014	78.5	371.5		857.3	168.9	1349.2	1235						4060.4
2015	167.4	132.9		2481.5	1253	15.4	1880.8			5.7			5936.7
2016	337.2	891.4		1385.4	676.1	3723.4	979.7			6.7			7999.9
2017	89.4	1496.7		706.1	4121.2	1718.3	2790.3						10922
2018	94.3	365.7		3460	1224.1	2675.3	539.2						8358.6
2019	168.9	963.8		1034.8			353.6		2.9				2524
2020						1.2							1.2
Unknown	14.9	66.1		89	1647.7	2515.7	4193.8			123.1			8650.3
Grand Total	**74370.2**	**113534.8**	**1171.9**	**218784.1**	**124237.1**	**137401.8**	**301806.7**	**19.4**	**27305.3**	**48686.7**	**6060.2**	**12576.3**	**1065954.5**

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 5-6 of 30

Preamble:

Enbridge advises that its 2016 inline inspection from Cherry to Parliament Street found two areas that required integrity digs. These integrity digs were done in 2017. The inspection also found several anomalies which would likely require remediation or replacement. A 2018 inline inspection also found numerous anomalies which would likely require remediation or replacement.

Question**:**

Please provide the 2016 and 2018 inline inspection reports and/or results, as well as any other documents on the condition of the Kipling to Oshawa pipeline and the need for it to be replaced.

Response:

Attachment 1 to this response sets out the 2016 ILI report. Attachment 2 to this response sets out the 2018 ILI report. Please see Exhibit I.EP.2 and Exhibit I.EP.3 for further documentation.

pipetel TECHNOLOGIES INC.

Enbridge Gas Distribution

109.LAK.20-10 NPS 20inch Lakeshore - Parliament KOL
Toronto, ON

MFL/LDS/Video Pipeline Inspection
Inspection Date: September 27, 2016

Final Data Analysis Report:
Version1 Issue Date: November 29, 2016
Version2 Issue Date: December 23, 2016

Supplementary
PRIM file(Profile2.3/Feb2017) Issue Date: February 24, 2017

Version Control

Version No.	Date	File Name	Description	Prepared by	Approved by
1	November 29, 2016	EGD105 NPS20KOL FinalReport.pdf	Initial release.	Anita Eisakhani	Francis Gracias
2	December 23, 2016	EGD105 NPS20KOL FinalReport.pdf	Client Change: Requested.Wall thickness changed from 7.3mm to 7.92mm Dec 1, 2016. Re-analysis required. Prelim report invalidated. Report / spreadsheet errors. corrections to header and unit conversions. <u>NEW PRIM DELIVERABLE</u> New EnbridgeProfile2.0 rcvd Dec16, 2016.. PRIM updates according to Enbridge Profile2.0. Changes/corrections to Enbridge Profile2.0. New Enbridge Profile2.3 rcvd 02/06/2017. PRIM updates according to Enbridge. Clarifications rcvd 02/17/2017. PRIM update sent 02/24/2017.	Anita Eisakhani	Francis Gracias

Contents

1 Inspection Summary

General information about the inspected pipeline is summarized below. The summary table contains pipeline information received from Enbridge Gas Distribution as well as inspection information generated by Pipetel Technologies.

Pipeline Information	
Pipeline Name:	NPS 20inch KOL
Pipeline Location:	Toronto, ON
Product:	Natural gas
Pipeline Construction Year:	1962
Nominal Pipe Size (NPS):	20 inch
Pipe Outer Diameter (OD):	20 inch
Nominal Pipe Wall Thickness (WT):	7.92 mm (wall thickness provided Dec 1, 2016)
Pipe Grade:	290 MPa
Maximum Allowable Operating Pressure (MOP):	1207 kPa
Flow Direction During Inspection:	East to West

10

Inspection Analysis Information	
Inspection Date:	September 27, 2016
Inspection Robot:	Explorer 20/26
Inspection Type(s):	Magnetic flux leakage (MFL) for metal loss. Laser Deformation Sensor (LDS) for dents. Visual (video camera) for general pipeline condition.
Inspected Pipeline Length:	404.7 m
Inspection Upstream Limit:	Limit A
Inspection Downstream Limit:	Limit B
MFL Data Coverage:	97.4 %
LDS Data Coverage:	98.3 %
Cluster Rules:	6T x 6T
Metal loss Reporting Threshold:	≥ 10%
Dent Reporting Threshold:	≥ 1%

2 Inspection Findings Summary

Critical Findings Metal Loss Indications	
Depth ≥ 70% WT:	1
FPR ≤ 1.1:	0
Total:	**1**
Dents	
Depth ≥ 10% OD:	0
Dent with indication of metal loss or cracking:	0
Total:	0

Clusters and Non-Interacting Metal Loss Indications with Depth ≤ 70% WT	
Depth < 20% WT:	195
20% ≤ Depth < 40% WT:	88
40%≤ Depth < 60% WT:	18
60% ≤ Depth < 70% WT:	2
Total:	303
Dents with Depth ≤10% OD	
6% ≤ Depth < 10% OD:	0
Depth < 6% OD:	0
Total:	0

Other Features	
Close Metal Objects:	2
Manufacturing Related:	8
Long Seam Weld indications:	2
Girth Weld indications:	1
Debris location :	1
Total:	**14**

Pipe Joints and Pipe Segments	
Girth Welds:	43
Pipe Segments:	**44**

Installations	
Valve:	0
Tap:	6
Tee:	0
Fitting:	1
Casing:	1
CP/ETS:	0
Off-Take:	0
Sleeve:	2
Support:	0
Stopple:	1
Repair:	0
Reducer:	0
Other:	0
Total:	**11**

3 Reporting Specifications

For reporting convenience, following assumptions are made in this report:

- **The upstream data limit was used as the zero (0) position and all feature locations are given relative to this stated reference site**
- **Positions downstream of the reference are reported as positive (+) and positions upstream of the reference are reported as negative (-)**
- **Flow direction was assumed to be from East to West**
- **O'clock positions are reported looking downstream along the pipeline. The 6:00 position is taken in the direction of gravity, toward the bottom of the pipeline**

Features, welds, and pipe sections are assigned unique identification codes (abbreviated to ID codes). All ID codes consist of a letter prefix followed by a three (3) digit number. The prefixes represent:

A	Metal Loss Indication
C	Cluster
D	Dent
I	Installation
O	Other feature
P	Pipe segment
W	Pipe joint

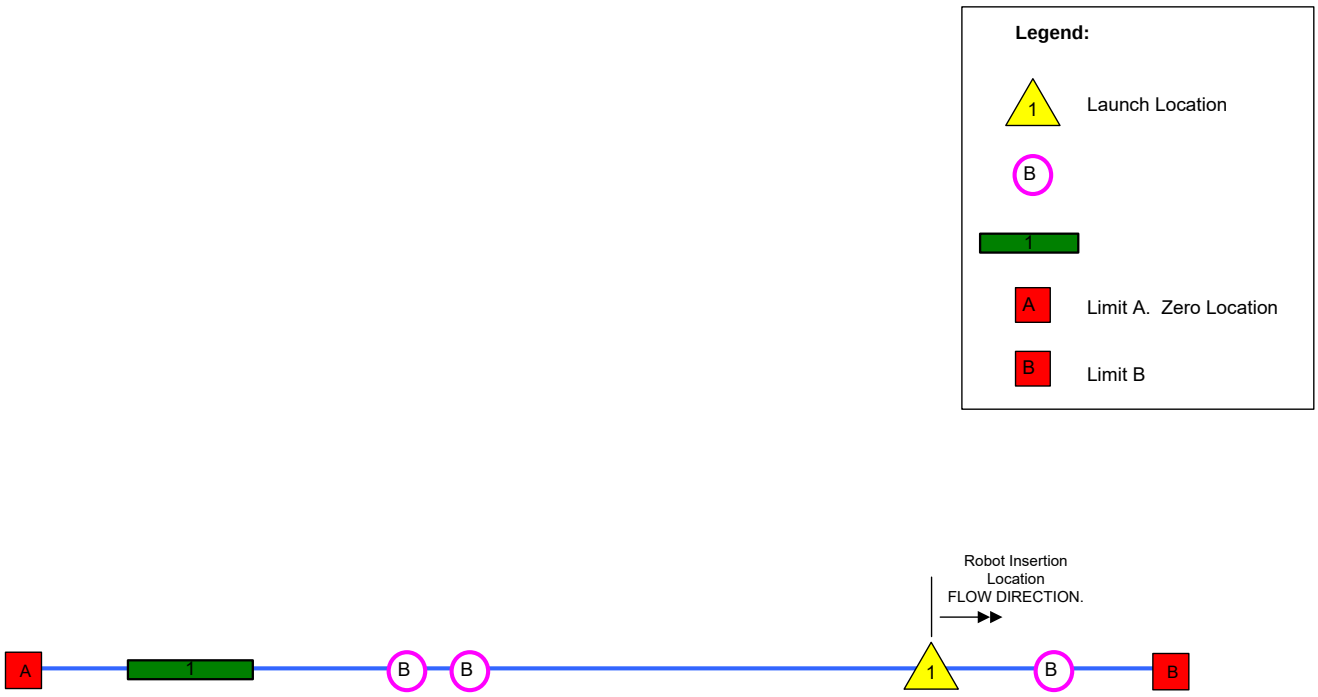
ID codes take the form:

Pipe joint:	W(3 digit number)	example: W044
Metal Loss Indication:	A(3 digit number)	example: A003

ID codes increase sequentially downstream within each prefix group. For example, metal loss indication A003 occurs downstream than metal loss indication A002 is four (4) pipe segments further downstream than pipe segment P044.

4 Inspection Schematic

A schematic of the NPS 20inch KOL pipeline indicating launch sites, the zero reference position and other features are shown in the figure. The extremes of the inspection were Limit A and Limit B, which represent the inspection start and end points, respectively.



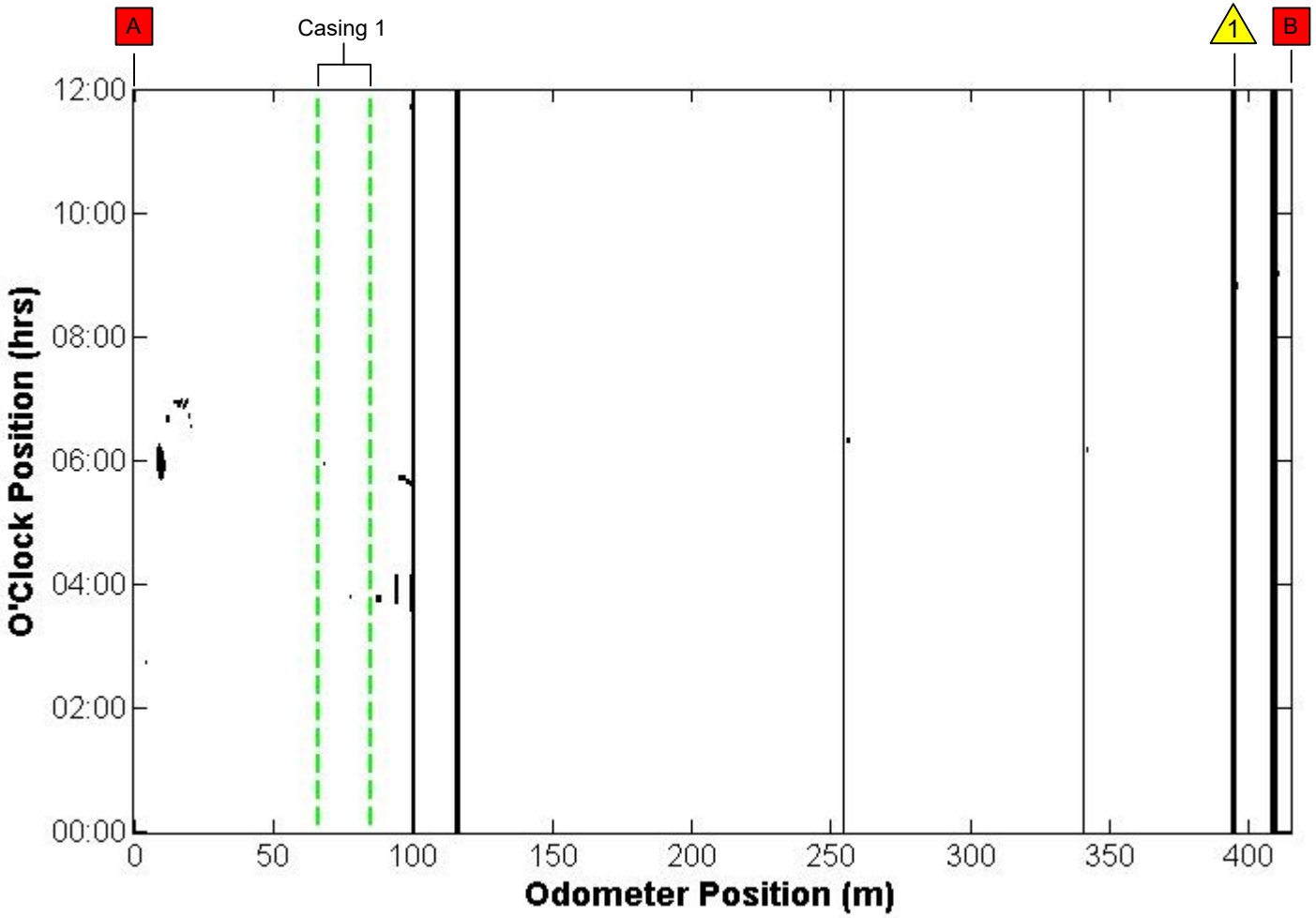
5 MFL Pipeline Data Coverage

Min. Upstream Odometer Distance (m)	Max. Downstream Odometer Distance (m)	Inspected Pipeline Length (m)	Accepted Metal Loss Data (m)	Pipeline Data Coverage (%)	Missing Data at Elbows & Features (%)	Missing Data from Sensor Issues (%)
0	414.9	414.9	404.7	97.4%	2.5%	0.1%

Explorer 20/26 inspected a pipeline length of **414.9 m**., from **0 m**. to **414.9 m.**, and collected **404.7 m.** of MFL data from the pipeline. The amount of MFL data was less than the odometer distance travelled by the robot because the MFL sensors on Explorer 20/26 are deactivated to traverse elbows and large features in the pipeline, resulting in absent MFL data before and after each elbow and large feature in the pipeline.

5.1 MFL Pipeline Data Coverage Map

A map of pipeline data coverage for the NPS20KOL inspection is shown in the figure. White indicates MFL data. Black bands of missing data occur around features in the pipeline such as elbows, launch sites, or sensor shutdown locations.



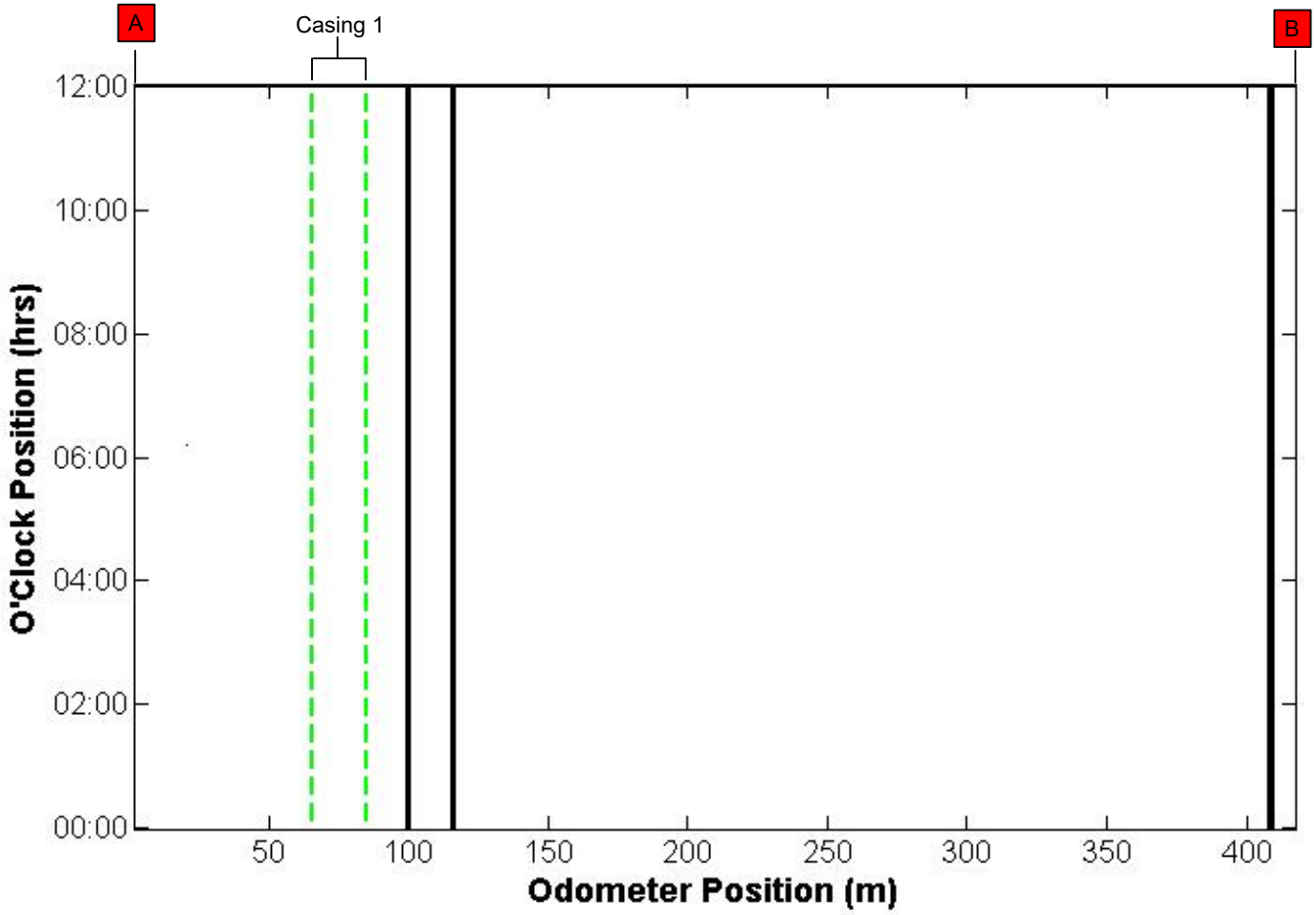
6 LDS Pipeline Data Coverage

Min. Upstream Odometer Distance (m)	Max. Downstream Odometer Distance (m)	Inspected Pipeline Length (m)	Accepted LDS Data (m)	Pipeline Data Coverage (%)	Missing Data at Elbows & Features (%)	Missing Data from Sensor Issues (%)
2.4	417.3	414.9	407.9	98.3%	1.7%	0.0%

Explorer 20/26 inspected a pipeline length of **414.9 m.**, from **2.4 m** to **417.3 m.**, and collected **407.9 m.** of LDS data from the pipeline. The amount of LDS data was less than the odometer distance travelled by the robot because the LDS on Explorer 20/26 does not collect useable data around elbows and large features in the pipeline, resulting in absent data before and after each elbow and large feature in the pipeline.

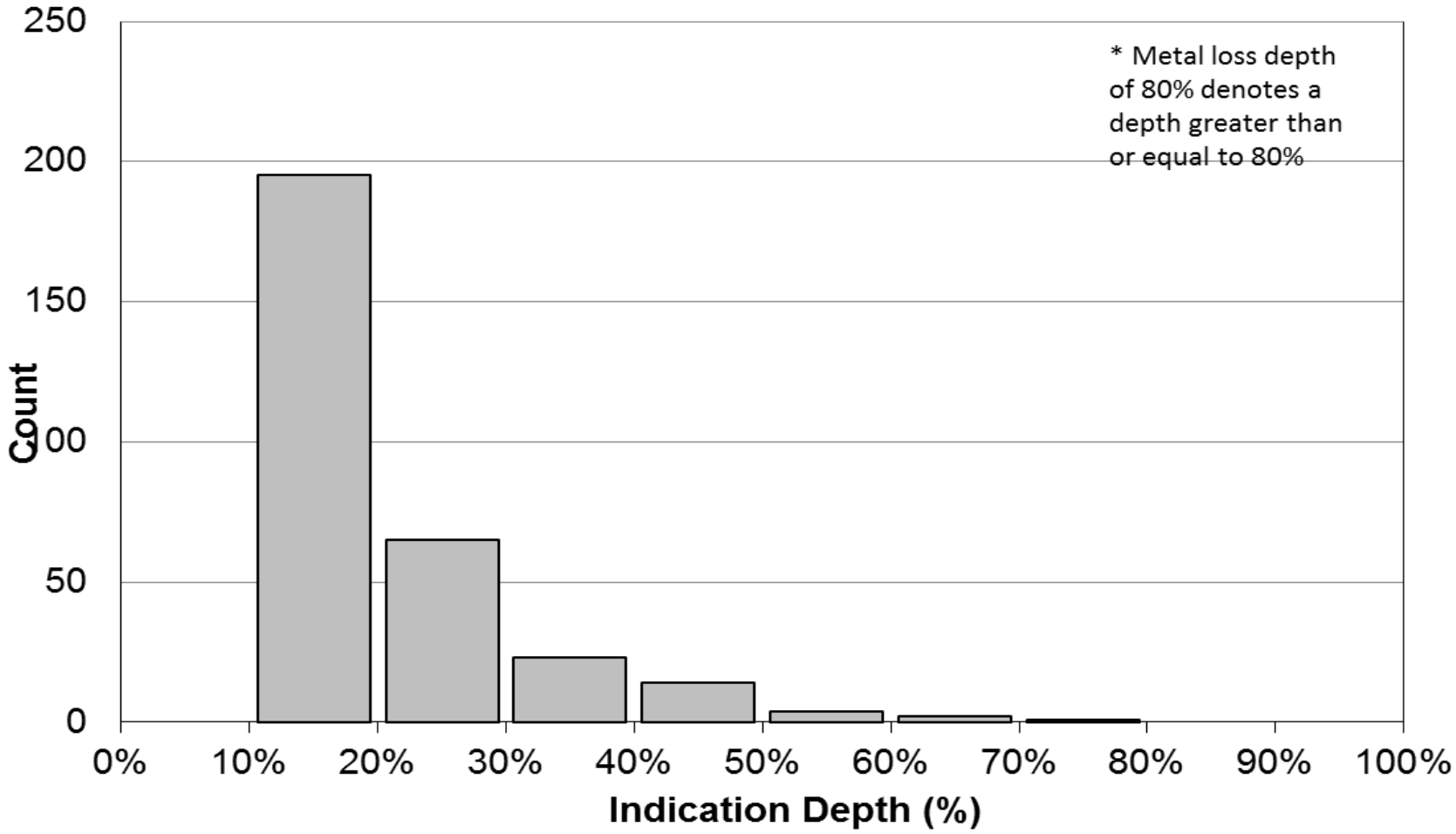
6.1 LDS Pipeline Data Coverage Map

A map of pipeline data coverage for the NPS 20inch KOL inspection is shown in the figure. White indicates LDS data, while black indicates missing LDS data regions. Black bands of missing data occur around features in the pipeline such as elbows, launch sites, or sensor shutdown locations.



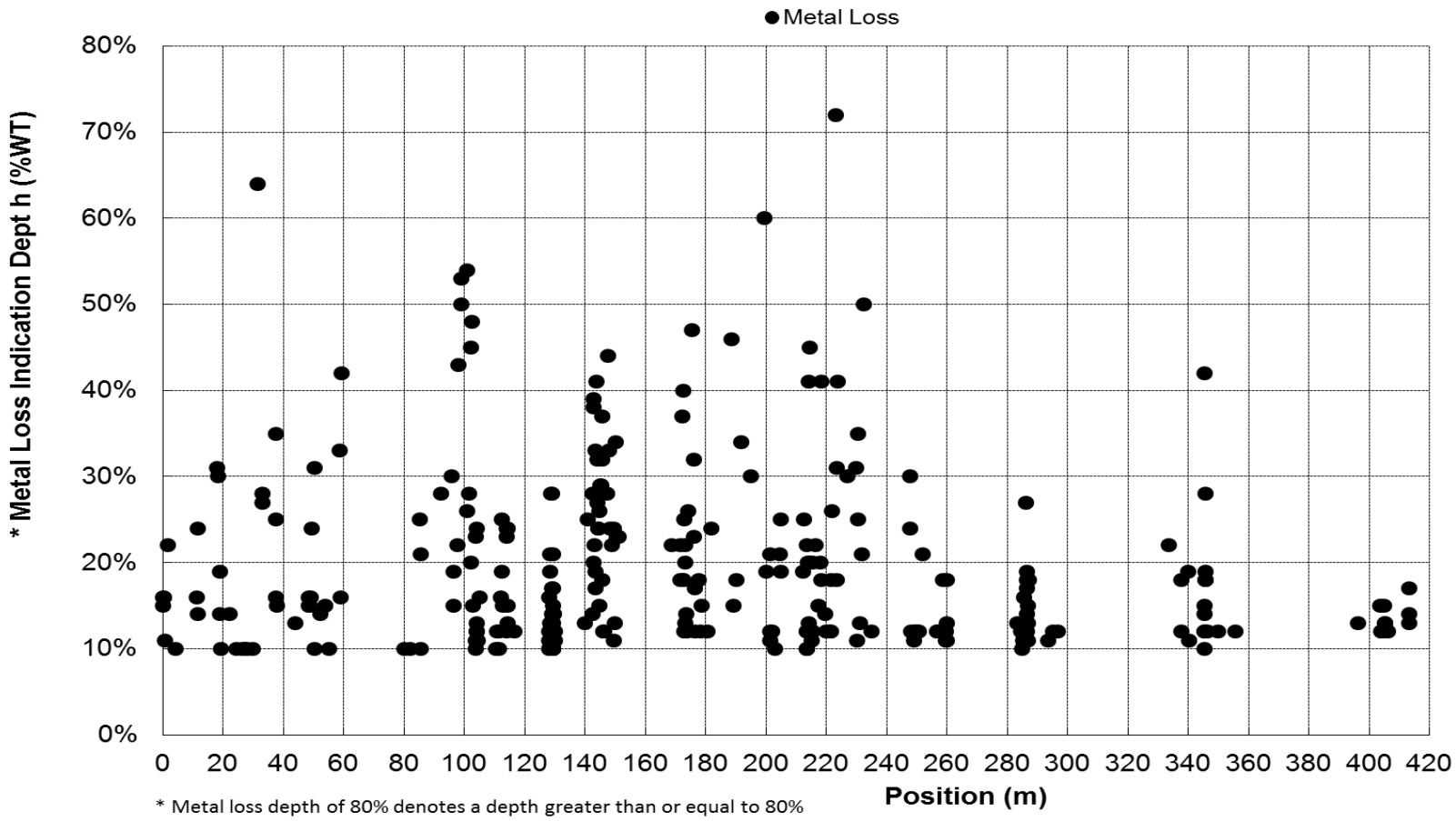
7 Inspection Findings

7.1 Clusters and Non-Interacting Metal Loss Indication Percent Depth Distribution Histogram



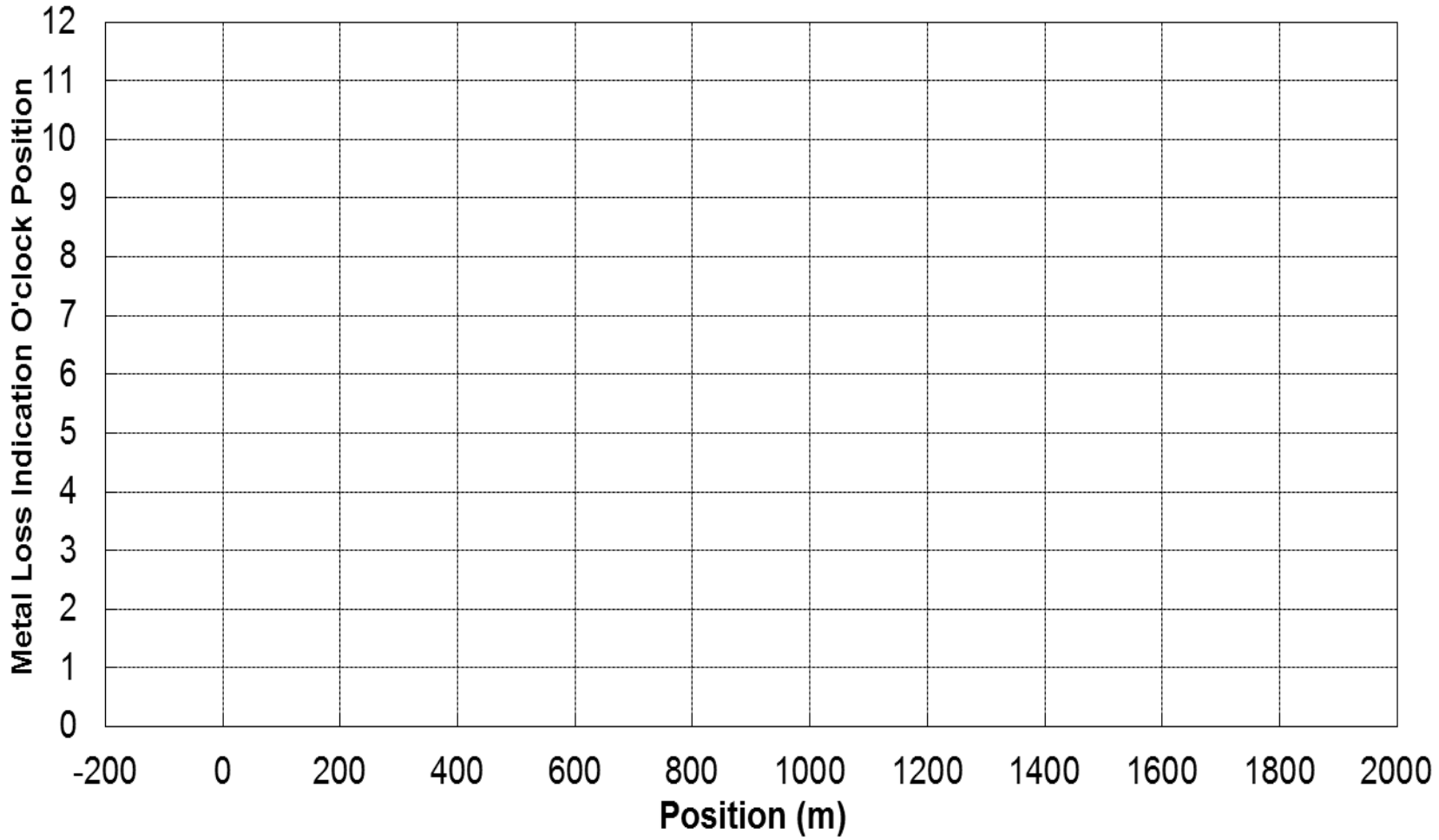
7.2 Clusters and Non-Interacting Metal Loss Indication Percent Depth Distribution

7.2.1 External Metal loss



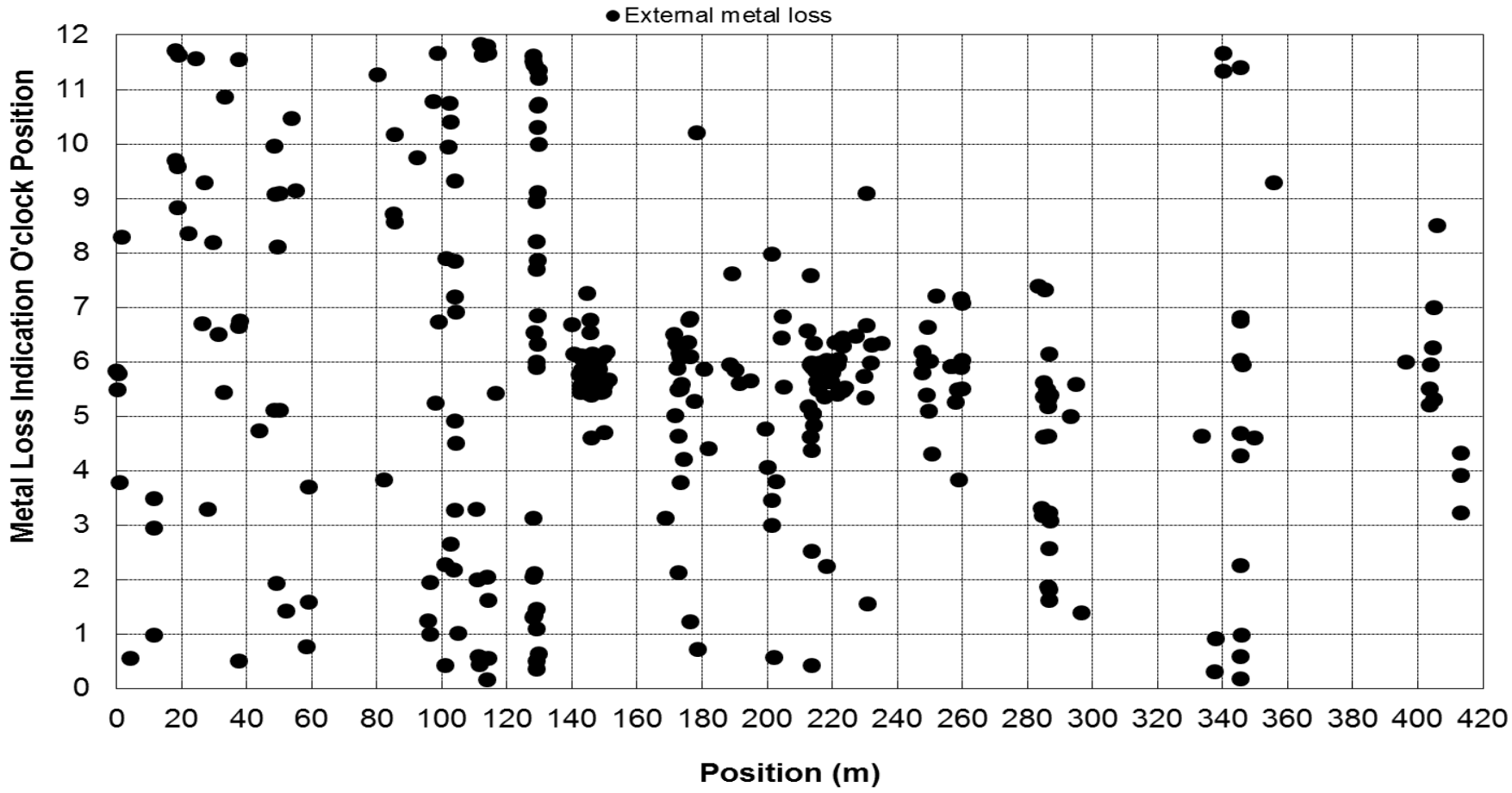
7.2.2 Internal Metal loss

There was no internal metal loss reported. This figure was intentionally left empty.



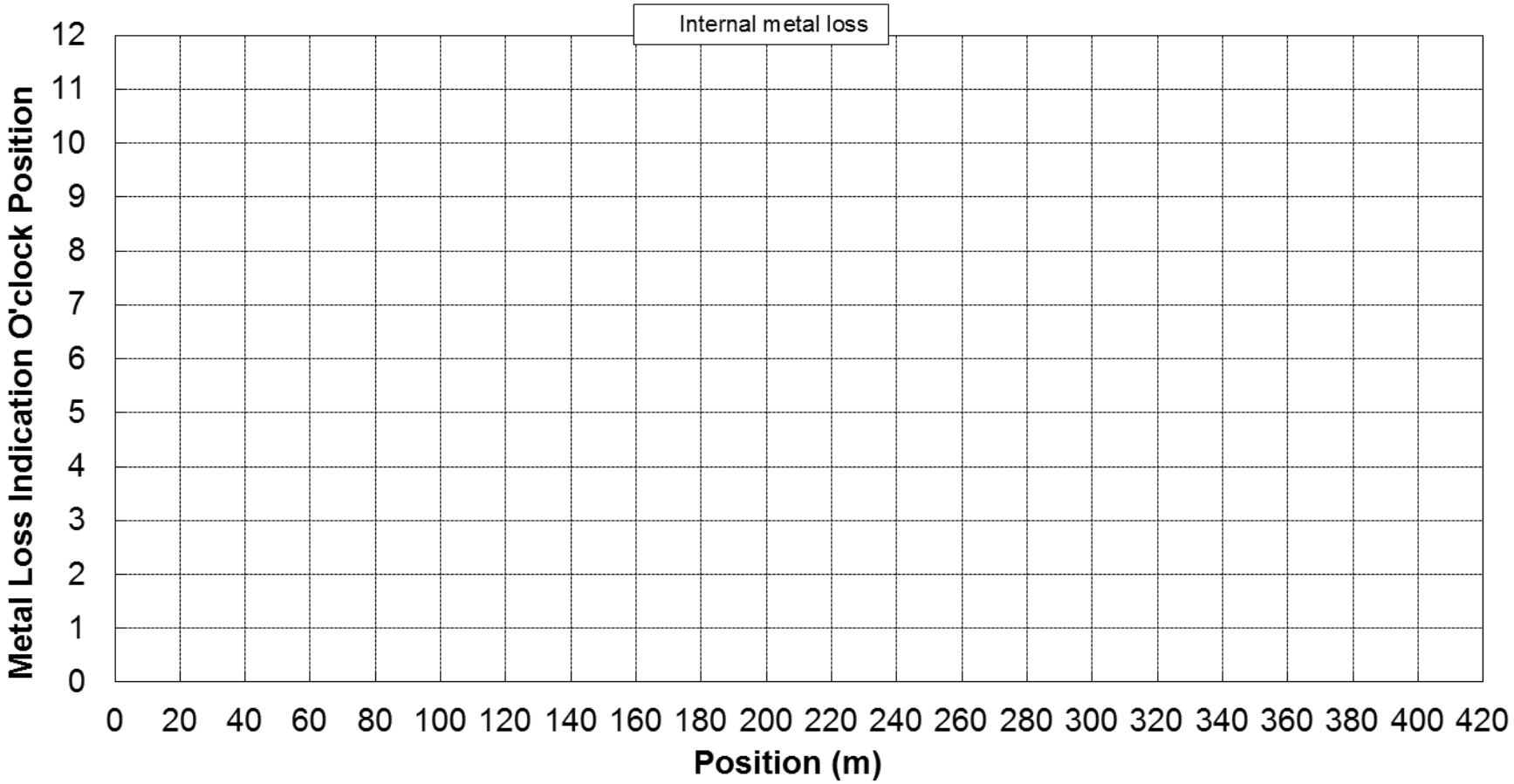
7.3 Clusters and Non-Interacting Metal Loss Indication O'clock Position

7.3.1 External Metal Loss

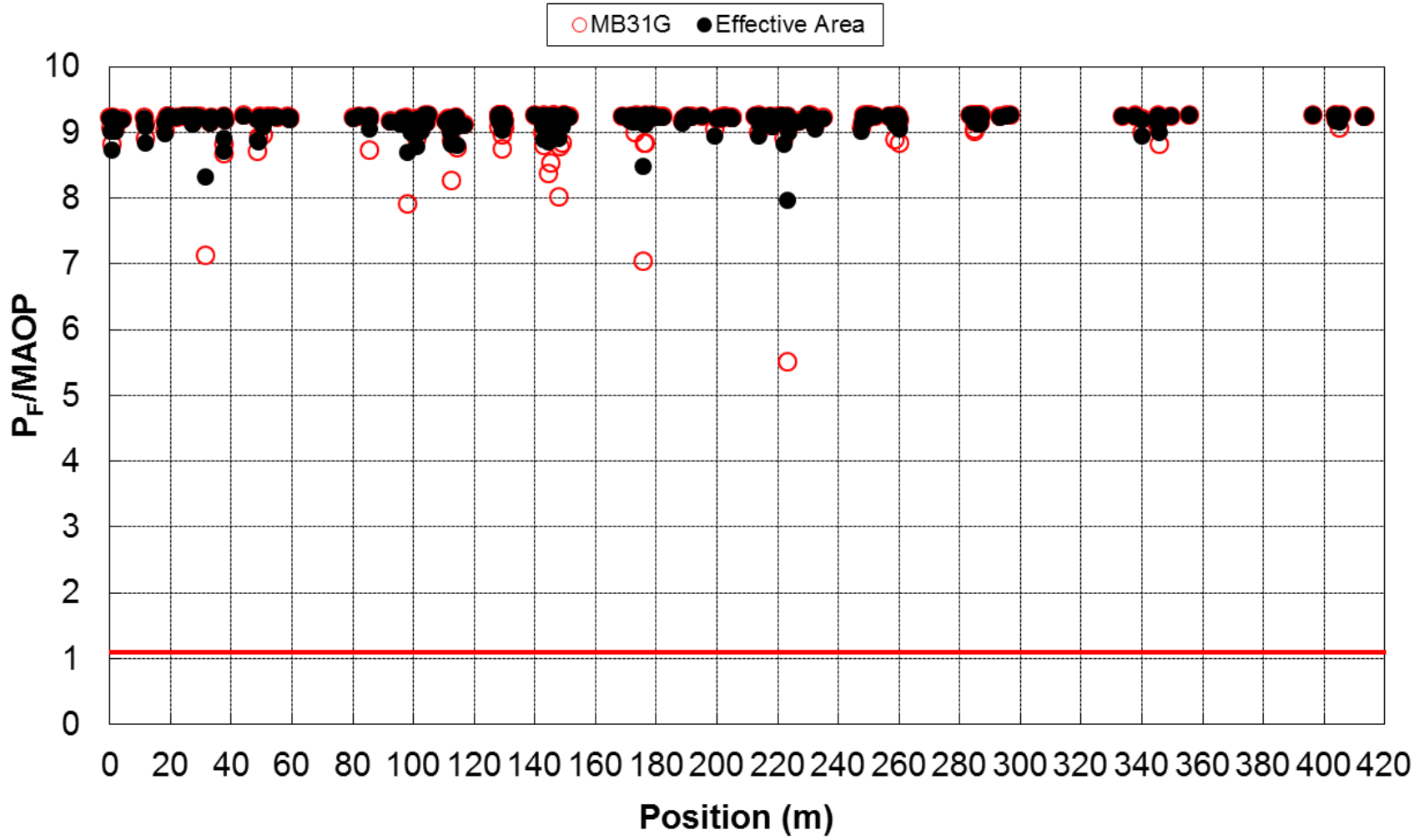


7.3.2 Internal Metal Loss

There was no internal metal loss reported. This figure was intentionally left empty.

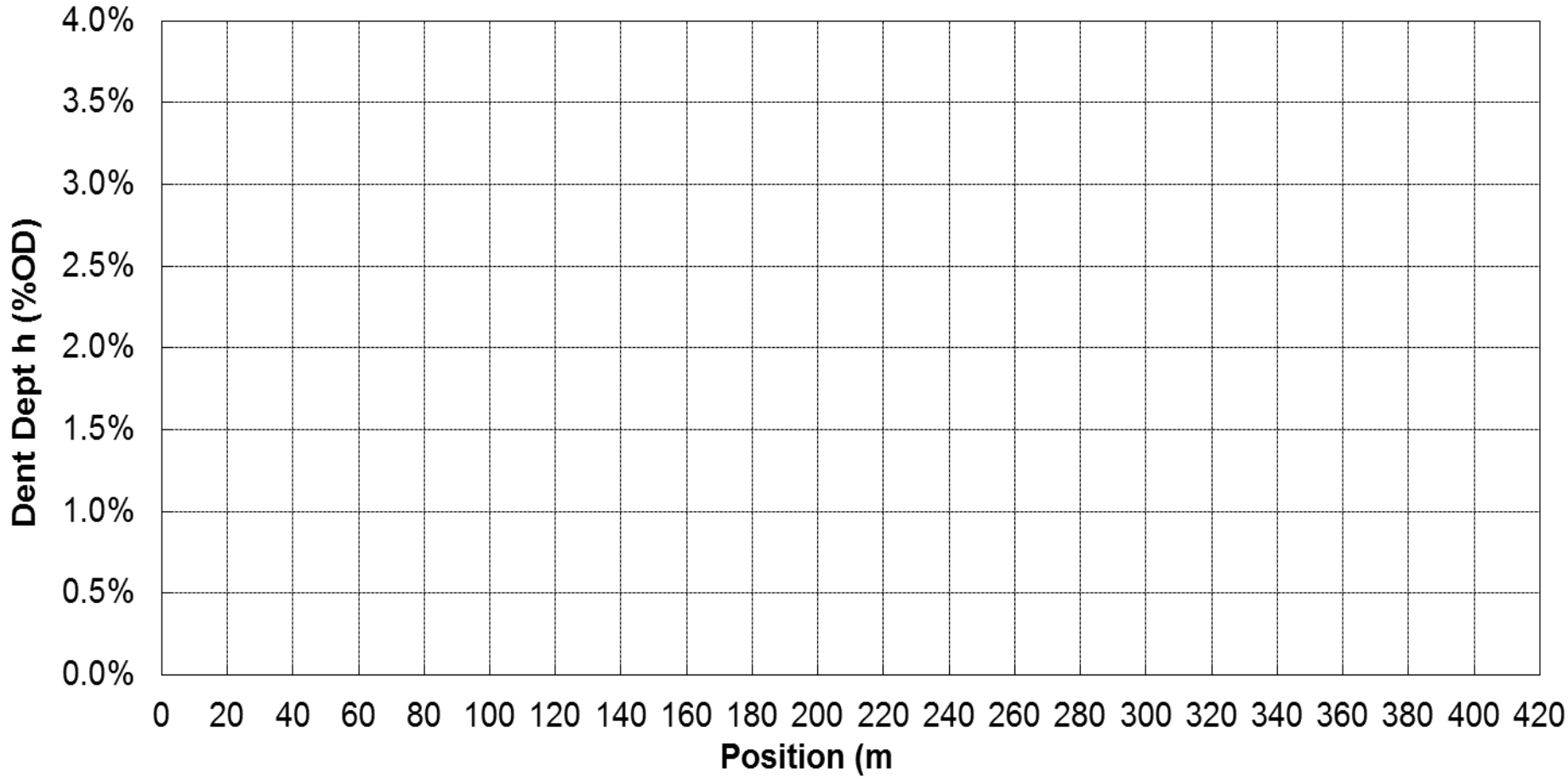


7.4 Clusters and Non-Interacting Metal Loss Indication Metal Loss Indication Failure Pressure Ratio



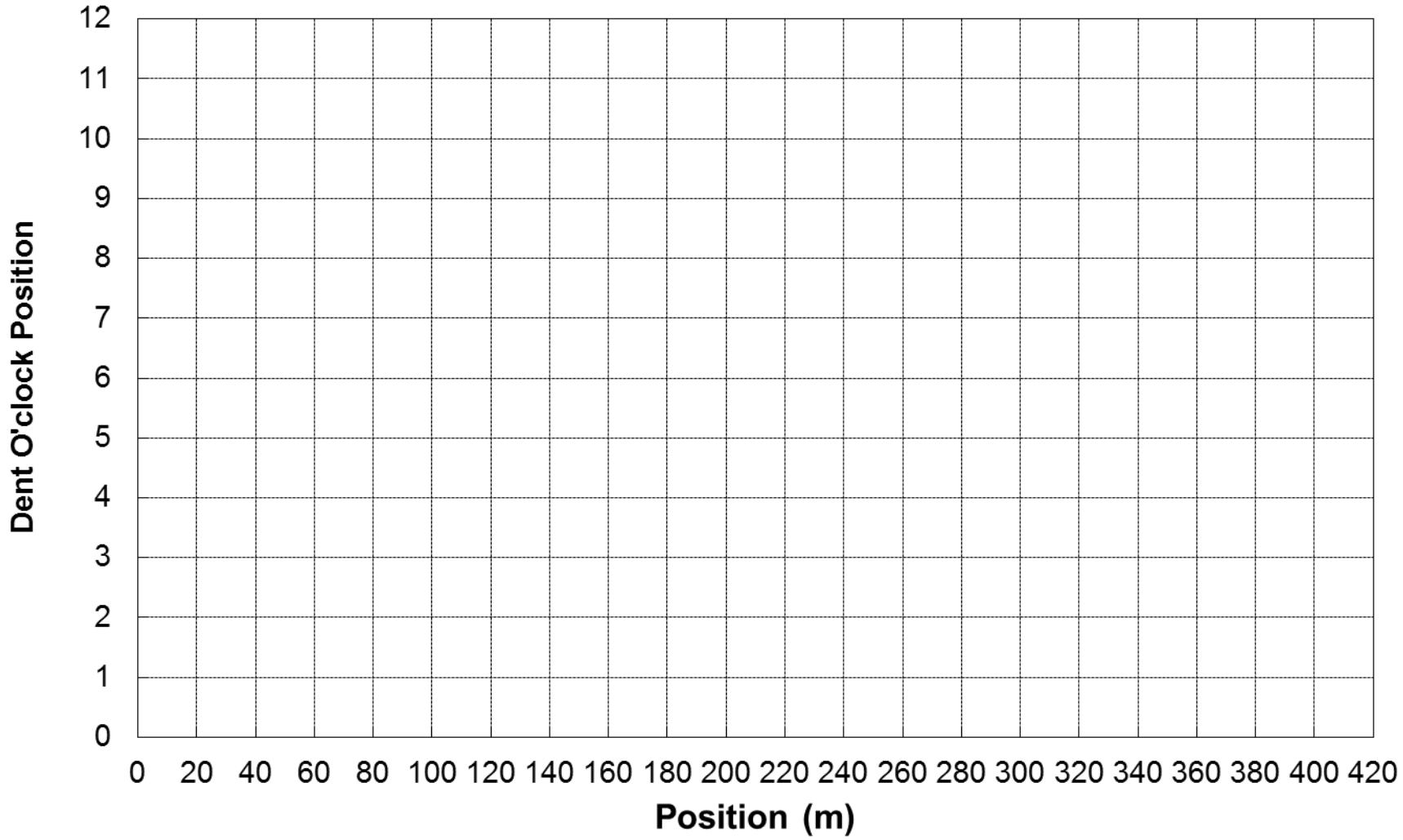
7.5 Dent Depth Distribution

There were no dents reported. This figure was intentionally left empty.

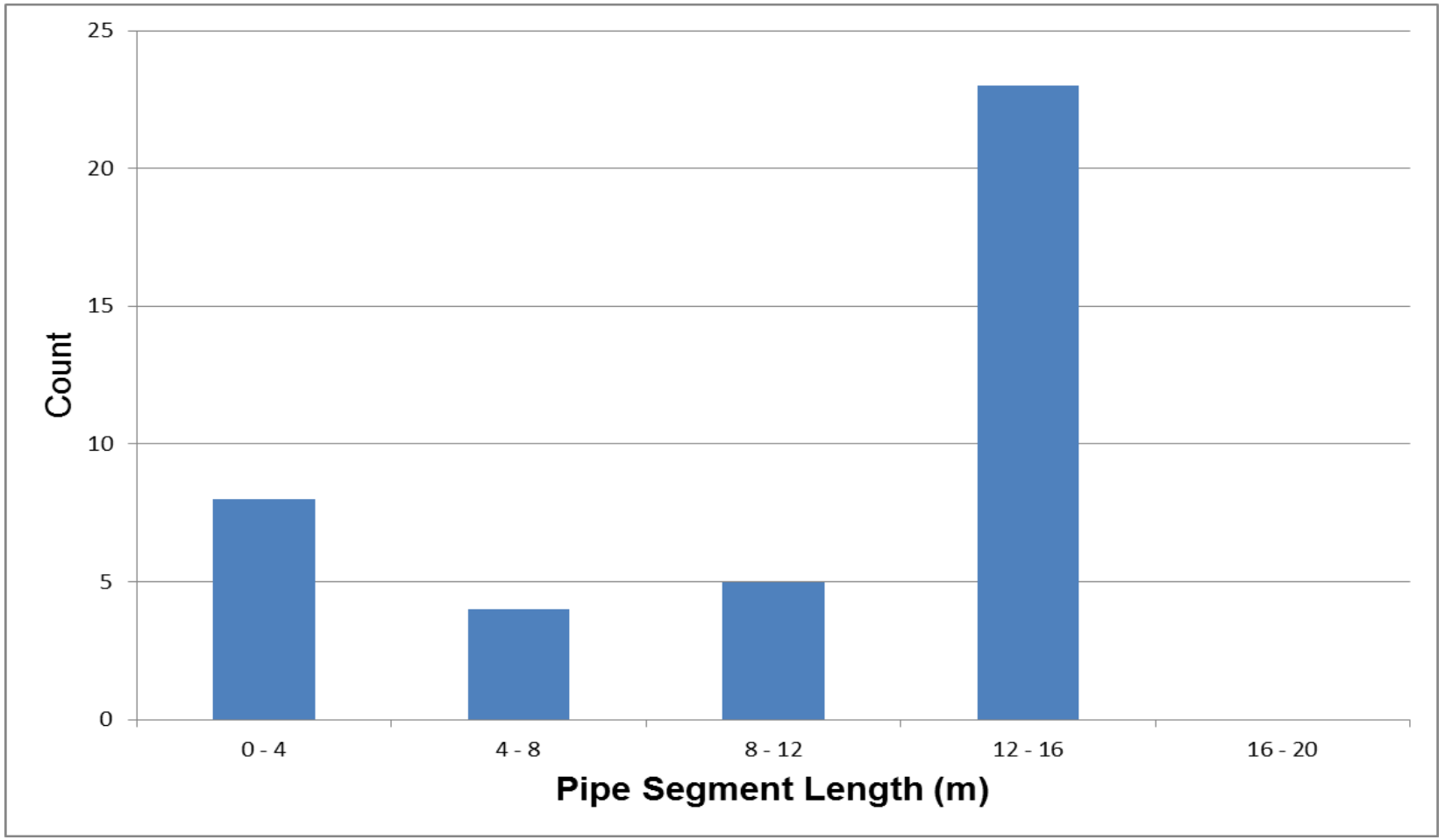


7.6 Dent O'clock Position

There were no dents reported. This figure was intentionally left empty.



7.7 Pipe Segments Length Distribution



8 Feature Lists

Metal loss indications, dents, installations, and other features identified in the inspected pipeline are identified and described in the following tables. All features identified within the pipeline are referenced to the upstream pipe joint nearest to the feature (abbreviated as USRJ); all "USRJ to Feature" distances are feature positions as distances downstream from reference weld positions.

Metal loss indications that do not meet the minimum reporting dimensions may be listed. These metal loss indications are presented with the understanding that their reported dimensions do not adhere to the accuracy specifications listed in Appendix C. These metal loss indications are identified as Below Reporting Specifications (BRS) in this report.

Features located within the casing ROI are identified as “In ROI”.

8.1 All Clusters and Individual Metal Loss Indication List

Feature ID	Type	Cluster ID	Feature pos. (m)	O’clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A001	Indication		0.05	5:50	16%	20.3	53.3	7.9	E	in debris
A002	Indication		0.16	5:29	15%	50.8	78.7	7.9	E	in debris
A003	Indication		0.57	5:47	16%	88.9	81.3	7.9	E	in debris
A004	Indication		0.86	3:47	11%	22.9	17.8	7.9	E	
A005	Indication		1.76	8:17	22%	38.1	73.7	7.9	E	
A006	Indication		4.21	0:33	10%	33	55.9	7.9	E	
A007	Indication		11.39	2:57	16%	20.3	15.2	7.9	E	
A008	Indication		11.56	3:29	14%	43.2	68.6	7.9	E	

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A009	Indication		11.56	0:59	24%	50.8	94	7.9	E	
A010	Indication		18.02	11:43	31%	20.3	25.4	7.9	E	
A011	Indication		18.29	9:42	30%	33	27.9	7.9	E	
A012	Indication		18.87	8:50	14%	17.8	33	7.9	E	
A013	Indication		18.90	9:35	19%	15.2	10.2	7.9	E	
A014	Indication		19.16	11:38	10%	17.8	40.6	7.9	E	
A015	Indication		22.08	8:21	14%	20.3	35.6	7.9	E	
A016	Indication		24.31	11:34	10%	20.3	86.4	7.9	E	
A017	Indication		26.25	6:42	10%	20.3	48.3	7.9	E	in debris
A018	Indication		27.14	9:17	10%	48.3	17.8	7.9	E	
A019	Indication		28.01	3:17	10%	20.3	12.7	7.9	E	
A020	Indication		29.71	8:11	10%	22.9	25.4	7.9	E	
A021	Indication	C001	31.38	6:22	30%	17.8	17.8	7.9	E	in debris
C001	Cluster	C001	31.41	6:30	64%	71.1	53.3	7.9	E	
A022	Indication	C001	31.43	6:37	64%	25.4	22.9	7.9	E	in debris
A023	Indication		33.14	5:26	27%	22.9	20.3	7.9	E	in debris
A024	Indication		33.20	10:52	28%	12.7	15.2	7.9	E	
A025	Indication	C002	37.53	0:32	15%	30.5	30.5	7.9	E	
C002	Cluster	C002	37.55	0:30	25%	71.1	43.2	7.9	E	
A026	Indication		37.55	11:33	35%	43.2	40.6	7.9	E	
A027	Indication	C002	37.57	0:24	25%	20.3	15.2	7.9	E	
A028	Indication		37.60	6:39	16%	12.7	10.2	7.9	E	in debris
A029	Indication		37.79	6:45	15%	27.9	22.9	7.9	E	in debris
A030	Indication		44.03	4:44	13%	12.7	40.6	7.9	E	in debris
A031	Indication	C003	48.39	5:07	16%	53.3	78.7	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
C003	Cluster	C003	48.42	5:07	16%	109.2	83.8	7.9	E	in debris
A032	Indication	C003	48.47	5:07	13%	15.2	83.8	7.9	E	in debris
A033	Indication		48.48	9:58	15%	25.4	91.4	7.9	E	
A034	Indication		48.81	9:04	15%	73.7	78.7	7.9	E	
A035	Indication		49.06	1:56	16%	22.9	27.9	7.9	E	
A036	Indication		49.44	8:06	24%	12.7	17.8	7.9	E	
A037	Indication	C004	50.30	5:16	31%	10.2	30.5	7.9	E	in debris
C004	Cluster	C004	50.32	5:07	31%	38.1	71.1	7.9	E	in debris
A038	Indication		50.31	9:05	10%	35.6	48.3	7.9	E	
A039	Indication	C004	50.33	4:55	20%	15.2	15.2	7.9	E	in debris
A040	Indication		52.18	1:25	14%	17.8	81.3	7.9	E	
A041	Indication		53.78	10:28	15%	17.8	35.6	7.9	E	
A042	Indication		55.20	9:08	10%	25.4	48.3	7.9	E	
A043	Indication		58.51	0:46	33%	10.2	15.2	7.9	E	
A044	Indication		59.04	1:35	16%	17.8	12.7	7.9	E	
A045	Indication		59.18	3:42	42%	12.7	12.7	7.9	E	
A046	Indication		80.20	11:16	10%	27.9	66	7.9	E	
A047	Indication		82.09	3:50	10%	17.8	101.6	7.9	E	
A048	Indication		85.34	8:43	25%	17.8	33	7.9	E	
A049	Indication	C005	85.43	10:19	21%	17.8	10.2	7.9	E	
C005	Cluster	C005	85.46	10:10	21%	78.7	50.8	7.9	E	
A050	Indication	C005	85.49	10:01	16%	15.2	12.7	7.9	E	
A051	Indication		85.50	8:34	10%	20.3	27.9	7.9	E	
A052	Indication		92.29	9:45	28%	20.3	25.4	7.9	E	
A053	Indication		95.73	1:15	30%	22.9	35.6	7.9	E	

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A054	Indication		96.36	1:57	19%	20.3	12.7	7.9	E	
A055	Indication		96.40	1:00	15%	25.4	10.2	7.9	E	
A056	Indication		97.55	10:47	22%	17.8	12.7	7.9	E	
A057	Indication	C006	98.02	5:20	43%	17.8	10.2	7.9	E	in debris
C006	Cluster	C006	98.05	5:14	43%	81.3	35.6	7.9	E	in debris
A058	Indication	C006	98.08	5:14	25%	30.5	33	7.9	E	in debris
A059	Indication		98.81	11:40	53%	12.7	22.9	7.9	E	
A060	Indication		99.12	6:44	50%	20.3	27.9	7.9	E	in debris
A062	Indication	C007	100.95	0:00	35%	15.2	50.8	7.9	E	
A063	Indication		100.96	2:16	26%	17.8	22.9	7.9	E	
C007	Cluster	C007	100.95	0:25	54%	25.4	165.1	7.9	E	
A061	Indication	C007	100.95	0:49	54%	25.4	61	7.9	E	
A064	Indication		101.43	7:54	28%	17.8	38.1	7.9	E	in debris
A065	Indication		102.11	9:57	45%	17.8	22.9	7.9	E	
A066	Indication		102.27	10:45	20%	22.9	38.1	7.9	E	
A067	Indication		102.60	2:39	48%	20.3	38.1	7.9	E	
A068	Indication		102.70	10:24	15%	27.9	45.7	7.9	E	
A069	Indication		103.84	2:11	10%	17.8	35.6	7.9	E	
A070	Indication		103.88	7:11	11%	10.2	20.3	7.9	E	in debris
A071	Indication		103.90	7:51	23%	10.2	15.2	7.9	E	in debris
A072	Indication		103.95	9:19	24%	25.4	10.2	7.9	E	
A073	Indication		103.97	3:16	13%	22.9	20.3	7.9	E	
A074	Indication		104.05	4:55	12%	22.9	12.7	7.9	E	in debris
A075	Indication		104.23	4:30	12%	40.6	73.7	7.9	E	in debris
A076	Indication		104.28	6:55	11%	20.3	45.7	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A077	Indication		104.93	1:01	16%	10.2	10.2	7.9	E	
A078	Indication		110.64	3:17	10%	43.2	66	7.9	E	
A079	Indication		110.88	2:00	12%	38.1	25.4	7.9	E	
A080	Indication		111.37	0:35	10%	33	30.5	7.9	E	
A081	Indication		111.49	0:26	12%	43.2	10.2	7.9	E	
A082	Indication		112.01	11:50	16%	50.8	20.3	7.9	E	
A083	Indication	C008	112.23	1:00	15%	25.4	12.7	7.9	E	
C008	Cluster	C008	112.32	0:33	19%	205.7	132.1	7.9	E	
A084	Indication	C008	112.30	0:42	15%	25.4	20.3	7.9	E	
A085	Indication	C008	112.35	0:31	14%	17.8	33	7.9	E	
A086	Indication	C008	112.41	0:05	19%	22.9	10.2	7.9	E	
A087	Indication	C009	112.51	11:23	21%	30.5	17.8	7.9	E	
C009	Cluster	C009	112.52	11:39	25%	53.3	88.9	7.9	E	
A088	Indication	C009	112.53	11:56	25%	38.1	15.2	7.9	E	
A089	Indication		112.63	11:38	15%	22.9	20.3	7.9	E	
A090	Indication		113.96	0:10	12%	22.9	94	7.9	E	
A091	Indication		114.03	11:48	23%	15.2	22.9	7.9	E	
A092	Indication		114.07	2:03	24%	25.4	10.2	7.9	E	
A093	Indication		114.17	0:33	13%	40.6	35.6	7.9	E	
A094	Indication	C010	114.19	2:13	12%	35.6	40.6	7.9	E	
A095	Indication	C010	114.23	1:33	11%	38.1	50.8	7.9	E	
C010	Cluster	C010	114.23	1:37	15%	106.7	208.3	7.9	E	
A096	Indication	C010	114.26	0:54	15%	30.5	15.2	7.9	E	
A097	Indication		114.29	11:40	24%	30.5	58.4	7.9	E	
A098	Indication		116.54	5:25	12%	48.3	22.9	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A099	Indication		128.11	11:37	12%	17.8	27.9	7.9	E	
A100	Indication		128.20	2:03	10%	12.7	25.4	7.9	E	
A101	Indication		128.20	11:31	11%	27.9	10.2	7.9	E	
A102	Indication	C011	128.22	1:16	12%	12.7	22.9	7.9	E	
C011	Cluster	C011	128.24	1:18	16%	45.7	30.5	7.9	E	
A103	Indication	C011	128.26	1:23	16%	10.2	10.2	7.9	E	
A104	Indication		128.27	3:08	13%	12.7	10.2	7.9	E	
A105	Indication		128.34	11:27	10%	15.2	25.4	7.9	E	
A106	Indication		128.34	2:07	21%	25.4	53.3	7.9	E	
A107	Indication		128.49	1:20	19%	10.2	10.2	7.9	E	
A108	Indication		128.58	6:32	28%	10.2	10.2	7.9	E	in debris
A109	Indication		128.97	7:42	17%	22.9	50.8	7.9	E	in debris
A110	Indication		128.98	5:54	14%	17.8	83.8	7.9	E	in debris
A111	Indication		129.07	0:30	11%	17.8	17.8	7.9	E	
A112	Indication		129.07	1:27	12%	12.7	10.2	7.9	E	
A113	Indication		129.15	8:57	13%	50.8	10.2	7.9	E	
A114	Indication		129.17	8:12	10%	10.2	10.2	7.9	E	
A115	Indication		129.18	6:00	28%	15.2	10.2	7.9	E	in debris
A116	Indication		129.20	1:06	11%	20.3	17.8	7.9	E	
A117	Indication		129.27	0:21	12%	20.3	10.2	7.9	E	
A119	Indication	C013	129.28	6:36	12%	12.7	43.2	7.9	E	in debris
A118	Indication	C012	129.28	8:09	13%	17.8	48.3	7.9	E	
C012	Cluster	C012	129.31	7:52	13%	76.2	121.9	7.9	E	in debris
A120	Indication		129.29	9:06	10%	27.9	10.2	7.9	E	
A121	Indication	C013	129.32	6:22	17%	17.8	33	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A122	Indication		129.34	11:21	10%	15.2	10.2	7.9	E	
A123	Indication	C012	129.34	7:33	10%	20.3	35.6	7.9	E	in debris
C013	Cluster	C013	129.32	6:19	17%	96.5	116.8	7.9	E	in debris
A124	Indication	C013	129.36	6:06	13%	15.2	58.4	7.9	E	in debris
A125	Indication		129.39	6:51	10%	12.7	10.2	7.9	E	in debris
A126	Indication		129.40	10:18	21%	12.7	30.5	7.9	E	
A127	Indication	C014	129.51	10:45	15%	15.2	12.7	7.9	E	
C014	Cluster	C014	129.52	10:42	15%	43.2	25.4	7.9	E	
A128	Indication	C014	129.54	10:39	12%	15.2	12.7	7.9	E	
A129	Indication		129.66	10:00	14%	15.2	10.2	7.9	E	
A130	Indication		129.69	11:12	12%	17.8	40.6	7.9	E	
A131	Indication		129.80	11:21	12%	17.8	12.7	7.9	E	
A132	Indication	C015	129.88	10:45	11%	25.4	15.2	7.9	E	
C015	Cluster	C015	129.88	10:44	11%	40.6	20.3	7.9	E	
A134	Indication	C016	129.91	0:45	12%	12.7	10.2	7.9	E	
A133	Indication	C015	129.90	10:42	10%	17.8	10.2	7.9	E	
C016	Cluster	C016	129.94	0:38	12%	58.4	43.2	7.9	E	
A135	Indication	C016	129.96	0:30	10%	17.8	10.2	7.9	E	
A136	Indication		139.89	6:41	13%	10.2	10.2	7.9	E	in debris
A137	Indication		140.73	6:08	25%	10.2	12.7	7.9	E	in debris
A138	Indication	C017	142.39	5:51	21%	15.2	27.9	7.9	E	in debris
C017	Cluster	C017	142.40	5:46	28%	38.1	48.3	7.9	E	
A139	Indication	C017	142.41	5:38	28%	12.7	10.2	7.9	E	in debris
A140	Indication		142.53	5:26	14%	12.7	12.7	7.9	E	in debris
A141	Indication		142.67	5:33	38%	10.2	12.7	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A142	Indication		142.74	5:47	20%	10.2	10.2	7.9	E	in debris
A143	Indication		142.84	5:51	39%	30.5	58.4	7.9	E	in debris
A144	Indication	C018	143.04	5:56	15%	10.2	10.2	7.9	E	in debris
C018	Cluster	C018	143.07	6:07	22%	66	58.4	7.9	E	in debris
A145	Indication	C018	143.10	6:17	22%	10.2	10.2	7.9	E	in debris
A146	Indication		143.31	6:03	33%	25.4	15.2	7.9	E	in debris
A147	Indication		143.48	5:44	19%	17.8	10.2	7.9	E	in debris
A148	Indication		143.56	6:05	17%	12.7	10.2	7.9	E	in debris
A149	Indication		143.71	5:35	41%	10.2	12.7	7.9	E	in debris
A150	Indication		143.96	5:44	32%	10.2	10.2	7.9	E	in debris
A151	Indication		144.00	5:46	27%	25.4	30.5	7.9	E	in debris
A152	Indication	C019	144.44	5:33	24%	10.2	10.2	7.9	E	in debris
A153	Indication	C019	144.47	5:21	22%	20.3	17.8	7.9	E	in debris
C019	Cluster	C019	144.49	5:32	24%	111.8	66	7.9	E	
A154	Indication	C019	144.50	5:44	12%	10.2	10.2	7.9	E	in debris
A155	Indication		144.51	7:15	24%	27.9	30.5	7.9	E	in debris
A156	Indication	C019	144.54	5:33	15%	20.3	27.9	7.9	E	in debris
A157	Indication		144.66	5:38	26%	25.4	20.3	7.9	E	in debris
A158	Indication		144.82	6:00	15%	22.9	48.3	7.9	E	in debris
A159	Indication	C020	145.05	5:36	29%	15.2	12.7	7.9	E	in debris
C020	Cluster	C020	145.08	5:25	29%	73.7	58.4	7.9	E	in debris
A160	Indication	C020	145.11	5:19	11%	20.3	30.5	7.9	E	in debris
A161	Indication		145.32	5:45	29%	10.2	10.2	7.9	E	in debris
A162	Indication		145.55	6:32	32%	12.7	12.7	7.9	E	in debris
A163	Indication		145.64	6:46	37%	10.2	10.2	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A164	Indication		145.82	4:36	18%	17.8	22.9	7.9	E	in debris
A165	Indication		145.89	5:23	12%	12.7	15.2	7.9	E	in debris
A166	Indication		146.40	6:08	12%	12.7	27.9	7.9	E	in debris
A167	Indication		147.19	5:29	28%	12.7	10.2	7.9	E	in debris
A168	Indication	C021	147.71	5:31	25%	20.3	20.3	7.9	E	in debris
C021	Cluster	C021	147.74	5:38	44%	73.7	55.9	7.9	E	in debris
A169	Indication	C021	147.77	5:48	44%	10.2	10.2	7.9	E	in debris
A170	Indication		147.87	5:57	33%	12.7	10.2	7.9	E	in debris
A171	Indication	C022	148.14	5:53	24%	12.7	15.2	7.9	E	in debris
C022	Cluster	C022	148.16	5:52	24%	63.5	17.8	7.9	E	in debris
A172	Indication	C022	148.19	5:51	12%	10.2	10.2	7.9	E	in debris
A173	Indication	C023	148.93	5:31	12%	12.7	15.2	7.9	E	in debris
C023	Cluster	C023	148.95	5:26	22%	63.5	40.6	7.9	E	in debris
A174	Indication	C023	148.97	5:20	22%	17.8	17.8	7.9	E	in debris
A175	Indication		149.44	5:27	11%	10.2	10.2	7.9	E	in debris
A176	Indication		149.53	6:06	24%	12.7	20.3	7.9	E	in debris
A177	Indication		149.84	4:42	13%	10.2	15.2	7.9	E	in debris
A178	Indication		150.04	5:34	34%	10.2	10.2	7.9	E	in debris
A179	Indication		150.63	6:10	23%	12.7	35.6	7.9	E	in debris
A180	Indication		151.23	5:40	23%	12.7	12.7	7.9	E	in debris
A181	Indication		168.69	3:08	22%	10.2	22.9	7.9	E	
A182	Indication		171.45	6:30	22%	12.7	22.9	7.9	E	in debris
A183	Indication		171.62	5:01	18%	25.4	20.3	7.9	E	in debris
A184	Indication		172.21	6:20	37%	12.7	15.2	7.9	E	in debris
A185	Indication		172.41	5:53	40%	15.2	17.8	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A186	Indication		172.64	5:29	18%	12.7	12.7	7.9	E	in debris
A187	Indication		172.65	2:08	18%	12.7	17.8	7.9	E	
A188	Indication		172.82	4:38	25%	15.2	20.3	7.9	E	in debris
A189	Indication		172.83	6:17	12%	15.2	25.4	7.9	E	in debris
A190	Indication	C024	173.03	5:59	12%	12.7	12.7	7.9	E	in debris
C024	Cluster	C024	173.06	6:09	13%	71.1	53.3	7.9	E	in debris
A191	Indication	C024	173.08	6:15	13%	15.2	25.4	7.9	E	in debris
A192	Indication		173.23	6:05	20%	12.7	10.2	7.9	E	in debris
A193	Indication		173.26	3:47	12%	12.7	17.8	7.9	E	
A194	Indication		173.27	5:30	22%	17.8	25.4	7.9	E	in debris
A195	Indication		173.54	6:15	14%	20.3	22.9	7.9	E	in debris
A196	Indication		173.81	5:35	12%	17.8	25.4	7.9	E	in debris
A197	Indication		174.21	4:12	26%	12.7	22.9	7.9	E	in debris
A198	Indication	C025	175.50	6:38	45%	12.7	12.7	7.9	E	in debris
A199	Indication	C025	175.52	6:32	42%	15.2	10.2	7.9	E	in debris
A200	Indication	C025	175.56	6:20	46%	10.2	10.2	7.9	E	in debris
C025	Cluster	C025	175.56	6:21	47%	132.1	86.4	7.9	E	
A201	Indication	C025	175.61	6:05	47%	12.7	15.2	7.9	E	in debris
A202	Indication	C026	176.14	6:37	23%	12.7	20.3	7.9	E	in debris
C026	Cluster	C026	176.17	6:46	23%	61	58.4	7.9	E	
A203	Indication	C026	176.19	6:57	11%	10.2	10.2	7.9	E	in debris
A204	Indication		176.24	1:14	32%	15.2	27.9	7.9	E	
A205	Indication		176.28	6:48	12%	10.2	12.7	7.9	E	in debris
A206	Indication	C027	176.34	6:03	10%	10.2	10.2	7.9	E	in debris
C027	Cluster	C027	176.38	6:06	17%	78.7	27.9	7.9	E	

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A207	Indication	C027	176.41	6:05	17%	17.8	27.9	7.9	E	in debris
A208	Indication		177.69	5:16	18%	15.2	15.2	7.9	E	in debris
A209	Indication		178.35	10:12	12%	25.4	12.7	7.9	E	
A210	Indication		178.69	0:43	15%	10.2	10.2	7.9	E	
A211	Indication		180.64	5:52	12%	20.3	10.2	7.9	E	in debris
A212	Indication		181.94	4:24	24%	12.7	20.3	7.9	E	in debris
A213	Indication		188.61	5:57	46%	15.2	12.7	7.9	E	in debris
A214	Indication		189.10	7:37	15%	22.9	58.4	7.9	E	At Girth Weld in debris
A215	Indication		190.17	5:51	18%	12.7	15.2	7.9	E	in debris
A216	Indication		191.61	5:36	34%	10.2	12.7	7.9	E	in debris
A217	Indication		194.94	5:39	30%	10.2	12.7	7.9	E	in debris
A218	Indication		199.39	4:46	60%	17.8	22.9	7.9	E	in debris
A219	Indication		199.99	4:04	19%	20.3	17.8	7.9	E	in debris
A220	Indication		201.30	3:27	11%	27.9	30.5	7.9	E	
A221	Indication		201.30	7:59	12%	25.4	35.6	7.9	E	in debris
A222	Indication		201.46	3:00	21%	17.8	40.6	7.9	E	
A223	Indication		202.13	0:34	12%	20.3	17.8	7.9	E	
A224	Indication		202.84	3:48	10%	22.9	45.7	7.9	E	
A225	Indication		204.58	6:26	21%	15.2	17.8	7.9	E	in debris
A226	Indication		204.77	6:50	25%	15.2	22.9	7.9	E	in debris
A227	Indication		204.98	5:32	19%	17.8	12.7	7.9	E	in debris
A228	Indication		212.38	6:34	19%	12.7	17.8	7.9	E	in debris
A229	Indication		212.68	5:10	25%	10.2	10.2	7.9	E	in debris
A230	Indication		213.46	5:57	10%	17.8	30.5	7.9	E	in debris
A231	Indication		213.46	7:35	12%	25.4	15.2	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A232	Indication		213.48	4:37	10%	27.9	109.2	7.9	E	in debris
A233	Indication		213.55	5:59	22%	45.7	88.9	7.9	E	At Girth Weld in debris
A234	Indication		213.65	0:25	12%	12.7	10.2	7.9	E	
A235	Indication		213.68	4:22	12%	20.3	50.8	7.9	E	in debris
A236	Indication		213.69	2:31	20%	12.7	12.7	7.9	E	
A237	Indication		214.01	5:03	13%	22.9	48.3	7.9	E	in debris
A238	Indication		214.11	5:03	41%	17.8	15.2	7.9	E	in debris
A239	Indication		214.15	5:54	12%	15.2	48.3	7.9	E	in debris
A240	Indication		214.37	6:20	20%	12.7	17.8	7.9	E	in debris
A241	Indication		214.42	4:50	45%	15.2	17.8	7.9	E	in debris
A242	Indication		214.97	5:50	11%	35.6	45.7	7.9	E	in debris
A243	Indication		215.33	5:38	12%	22.9	55.9	7.9	E	in debris
A244	Indication		215.59	5:29	20%	17.8	30.5	7.9	E	in debris
A245	Indication		216.31	5:59	22%	17.8	15.2	7.9	E	in debris
A246	Indication		217.48	5:21	15%	15.2	10.2	7.9	E	in debris
A247	Indication		218.14	5:38	20%	15.2	10.2	7.9	E	in debris
A248	Indication		218.22	2:14	18%	38.1	27.9	7.9	E	
A249	Indication		218.26	6:02	41%	17.8	10.2	7.9	E	in debris
A250	Indication		219.74	5:38	14%	33	17.8	7.9	E	in debris
A251	Indication		220.06	5:48	12%	20.3	66	7.9	E	in debris
A252	Indication		221.07	6:21	12%	15.2	10.2	7.9	E	in debris
A253	Indication		221.48	5:57	18%	12.7	15.2	7.9	E	in debris
A254	Indication		221.59	5:24	12%	22.9	20.3	7.9	E	in debris
A255	Indication		221.94	6:03	26%	48.3	22.9	7.9	E	in debris
A256	Indication	C028	223.21	6:09	25%	33	40.6	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
C028	Cluster	C028	223.26	6:26	72%	116.8	149.9	7.9	E	
A257	Indication	C028	223.27	6:46	41%	30.5	61	7.9	E	At Girth Weld in debris
A258	Indication	C028	223.31	5:59	72%	15.2	27.9	7.9	E	At Girth Weld in debris
A259	Indication		223.40	5:28	18%	12.7	35.6	7.9	E	in debris
A260	Indication		223.41	6:17	31%	30.5	12.7	7.9	E	in debris
A261	Indication		223.78	5:31	41%	15.2	20.3	7.9	E	in debris
A262	Indication		227.07	6:28	30%	20.3	53.3	7.9	E	in debris
A263	Indication		229.79	5:44	31%	15.2	27.9	7.9	E	in debris
A264	Indication		230.22	5:20	11%	12.7	15.2	7.9	E	in debris
A265	Indication		230.37	6:40	35%	15.2	20.3	7.9	E	in debris
A266	Indication		230.56	9:05	25%	10.2	12.7	7.9	E	
A267	Indication		230.96	1:33	13%	12.7	30.5	7.9	E	
A268	Indication		231.81	5:59	21%	17.8	15.2	7.9	E	in debris
A269	Indication		232.33	6:18	50%	17.8	22.9	7.9	E	in debris
A270	Indication		235.09	6:20	12%	25.4	33	7.9	E	in debris
A271	Indication		247.62	5:48	30%	30.5	55.9	7.9	E	in debris
A272	Indication		247.83	6:10	24%	25.4	27.9	7.9	E	in debris
A273	Indication		248.24	6:00	12%	12.7	38.1	7.9	E	in debris
A274	Indication		248.88	5:23	11%	20.3	15.2	7.9	E	in debris
A275	Indication		249.41	6:38	12%	10.2	15.2	7.9	E	in debris
A276	Indication		249.69	5:06	12%	12.7	10.2	7.9	E	in debris
A277	Indication		250.00	6:01	12%	25.4	27.9	7.9	E	in debris
A278	Indication		250.54	4:18	12%	12.7	30.5	7.9	E	in debris
A279	Indication		251.94	7:12	21%	10.2	25.4	7.9	E	in debris
A280	Indication		256.68	5:55	12%	15.2	25.4	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A281	Indication		256.77	5:55	12%	15.2	15.2	7.9	E	in debris
A282	Indication		257.80	5:15	12%	20.3	17.8	7.9	E	in debris
A283	Indication	C029	258.62	5:22	12%	15.2	12.7	7.9	E	in debris
C029	Cluster	C029	258.65	5:29	18%	68.6	38.1	7.9	E	in debris
A284	Indication	C029	258.68	5:35	18%	12.7	10.2	7.9	E	in debris
A285	Indication		258.85	3:50	12%	15.2	20.3	7.9	E	
A286	Indication		259.52	5:54	12%	12.7	10.2	7.9	E	in debris
A287	Indication		259.76	7:09	11%	17.8	33	7.9	E	in debris
A288	Indication		259.92	6:02	13%	48.3	83.8	7.9	E	in debris
A289	Indication	C030	260.03	5:29	18%	17.8	22.9	7.9	E	in debris
C030	Cluster	C030	260.06	5:30	18%	76.2	25.4	7.9	E	in debris
A291	Indication	C030	260.08	5:32	12%	25.4	17.8	7.9	E	in debris
A290	Indication		260.08	7:05	11%	33	99.1	7.9	E	in debris
A292	Indication		283.38	7:23	13%	10.2	10.2	7.9	E	in debris
A293	Indication		284.51	3:18	12%	12.7	15.2	7.9	E	
A294	Indication	C031	284.80	3:06	11%	10.2	10.2	7.9	E	
C031	Cluster	C031	284.82	3:11	12%	40.6	30.5	7.9	E	
A295	Indication	C031	284.83	3:15	12%	12.7	10.2	7.9	E	
A296	Indication		284.88	5:21	10%	15.2	40.6	7.9	E	in debris
A297	Indication	C032	284.90	3:14	13%	12.7	17.8	7.9	E	
C032	Cluster	C032	284.92	3:13	13%	61	40.6	7.9	E	
A298	Indication	C032	284.95	3:13	13%	10.2	40.6	7.9	E	
A299	Indication	C033	284.98	4:34	12%	12.7	15.2	7.9	E	in debris
C033	Cluster	C033	285.01	4:37	12%	71.1	27.9	7.9	E	in debris
A300	Indication		285.04	5:37	11%	12.7	10.2	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A301	Indication	C033	285.04	4:40	10%	17.8	17.8	7.9	E	in debris
A302	Indication		285.38	7:19	16%	10.2	12.7	7.9	E	in debris
A303	Indication		286.15	5:29	27%	12.7	17.8	7.9	E	in debris
A304	Indication		286.22	5:10	11%	12.7	10.2	7.9	E	in debris
A305	Indication		286.32	4:38	12%	27.9	48.3	7.9	E	in debris
A306	Indication		286.36	1:52	18%	33	10.2	7.9	E	
A307	Indication		286.50	5:18	14%	10.2	30.5	7.9	E	in debris
A308	Indication		286.54	2:34	12%	15.2	15.2	7.9	E	
A310	Indication		286.59	1:37	19%	30.5	10.2	7.9	E	
A309	Indication		286.59	6:08	17%	15.2	40.6	7.9	E	in debris
A311	Indication		286.72	3:13	13%	12.7	10.2	7.9	E	
A312	Indication		286.80	1:49	11%	15.2	10.2	7.9	E	
A313	Indication		286.94	5:23	15%	12.7	27.9	7.9	E	in debris
A314	Indication		287.11	3:05	18%	10.2	12.7	7.9	E	
A315	Indication		293.40	5:00	11%	20.3	15.2	7.9	E	in debris
A316	Indication		294.98	5:35	12%	12.7	10.2	7.9	E	in debris
A317	Indication		296.72	1:23	12%	10.2	10.2	7.9	E	
A318	Indication		333.54	4:38	22%	10.2	15.2	7.9	E	in debris
A319	Indication		337.59	0:18	12%	12.7	10.2	7.9	E	
A320	Indication		337.78	0:55	18%	12.7	12.7	7.9	E	
A321	Indication		340.06	11:40	19%	50.8	63.5	7.9	E	
A322	Indication		340.19	11:20	11%	30.5	48.3	7.9	E	
A323	Indication		345.38	11:24	12%	40.6	38.1	7.9	E	
A324	Indication		345.39	4:41	10%	20.3	45.7	7.9	E	in debris
A325	Indication		345.43	6:02	14%	30.5	53.3	7.9	E	in debris

Feature ID	Type	Cluster ID	Feature pos. (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Wall Location	Comments
A326	Indication		345.44	6:45	42%	17.8	17.8	7.9	E	in debris
A327	Indication		345.45	2:15	12%	12.7	38.1	7.9	E	
A328	Indication		345.48	0:35	15%	12.7	10.2	7.9	E	
A329	Indication		345.55	0:11	28%	12.7	30.5	7.9	E	
A330	Indication	C034	345.56	6:53	12%	15.2	20.3	7.9	E	At Girth Weld in debris
C034	Cluster	C034	345.59	6:49	18%	78.7	38.1	7.9	E	in debris
A331	Indication	C034	345.61	6:49	18%	33	38.1	7.9	E	in debris
A333	Indication		345.65	0:59	18%	20.3	83.8	7.9	E	
A332	Indication		345.63	4:16	19%	20.3	10.2	7.9	E	in debris
A334	Indication		346.30	5:57	12%	25.4	10.2	7.9	E	in debris
A335	Indication		349.68	4:36	12%	17.8	43.2	7.9	E	in debris
A336	Indication		355.63	9:17	12%	10.2	35.6	7.9	E	
A337	Indication		396.21	6:00	13%	10.2	10.2	7.9	E	in debris
A338	Indication		403.68	5:30	15%	10.2	10.2	7.9	E	in debris
A339	Indication		403.76	5:12	12%	12.7	15.2	7.9	E	in debris
A340	Indication		404.11	5:57	12%	33	50.8	7.9	E	in debris
A341	Indication		404.74	6:15	15%	17.8	12.7	7.9	E	in debris
A342	Indication		405.03	5:18	13%	15.2	20.3	7.9	E	in debris
A343	Indication	C035	405.07	6:58	12%	15.2	17.8	7.9	E	in debris
A344	Indication	C035	405.11	7:04	13%	15.2	12.7	7.9	E	in debris
C035	Cluster	C035	405.09	7:00	13%	55.9	27.9	7.9	E	
A345	Indication		406.03	8:30	12%	10.2	10.2	7.9	E	
A346	Indication		413.16	4:19	13%	17.8	20.3	7.9	E	in debris
A347	Indication		413.29	3:55	14%	12.7	12.7	7.9	E	
A348	Indication		413.31	3:13	17%	12.7	10.2	7.9	E	

8.2 Clusters and Non-Interacting Metal Loss Indication FPR Breakdown

Metal loss indications were organized into four (4) categories based on their FPR. The categories defined were:

- Metal loss indications with FPR < 1.1
- Metal loss indications with 1.1 ≤ FPR < 1.39
- Metal loss indications with 1.39 ≤ FPR < 2.0
- Metal loss indications with 2.0 ≤ FPR < 3.3
- Metal loss indications with FPR ≥ 3.3

The failure pressure ratio (FPR) for all metal loss indications was computed according to ASME B31G-2009 using the modified[1] B31G (abbreviated to modified or MB31G) method. FPR is defined as FPR = P_F/MAOP, where P_F is the estimate failure pressure of the pipeline computed from ASME B31G-2009 and MAOP is the maximum allowable operating pressure of the pipeline specified by the client.

Metal loss indications are grouped in order of decreasing severity as follows:

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	C028	72%	116.8	7.9	290	1207	5.52	6659	7.97	9612
Pf/MAOP > 3.3	C025	47%	132.1	7.9	290	1207	7.04	8492	8.48	10234
Pf/MAOP > 3.3	C001	64%	71.1	7.9	290	1207	7.13	8608	8.32	10041
Pf/MAOP > 3.3	C006	43%	81.3	7.9	290	1207	7.92	9554	8.70	10492
Pf/MAOP > 3.3	C021	44%	73.7	7.9	290	1207	8.01	9669	8.91	10757
Pf/MAOP > 3.3	C008	19%	205.7	7.9	290	1207	8.27	9979	8.85	10684
Pf/MAOP > 3.3	C019	24%	111.8	7.9	290	1207	8.38	10113	8.86	10688
Pf/MAOP > 3.3	C020	29%	73.7	7.9	290	1207	8.54	10301	9.05	10919
Pf/MAOP > 3.3	C002	25%	71.1	7.9	290	1207	8.68	10477	8.91	10751

[1] ASME B31G-2009 paragraph 2.2(b)

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	C003	16%	109.2	7.9	290	1207	8.71	10515	8.88	10716
Pf/MAOP > 3.3	C005	21%	78.7	7.9	290	1207	8.73	10533	9.05	10923
Pf/MAOP > 3.3	C013	17%	96.5	7.9	290	1207	8.74	10547	9.04	10902
Pf/MAOP > 3.3	C010	15%	106.7	7.9	290	1207	8.76	10574	8.80	10616
Pf/MAOP > 3.3	C022	24%	63.5	7.9	290	1207	8.79	10601	9.12	11007
Pf/MAOP > 3.3	C018	22%	66.0	7.9	290	1207	8.81	10630	9.15	11040
Pf/MAOP > 3.3	A003	16%	88.9	7.9	290	1207	8.81	10636	8.72	10526
Pf/MAOP > 3.3	C034	18%	78.7	7.9	290	1207	8.82	10638	9.00	10861
Pf/MAOP > 3.3	A026	35%	43.2	7.9	290	1207	8.82	10648	8.71	10512
Pf/MAOP > 3.3	C023	22%	63.5	7.9	290	1207	8.83	10658	9.08	10959
Pf/MAOP > 3.3	C030	18%	76.2	7.9	290	1207	8.83	10659	9.05	10919
Pf/MAOP > 3.3	C026	23%	61.0	7.9	290	1207	8.83	10659	9.13	11014
Pf/MAOP > 3.3	C027	17%	78.7	7.9	290	1207	8.84	10672	9.12	11008
Pf/MAOP > 3.3	C009	25%	53.3	7.9	290	1207	8.87	10704	8.82	10640
Pf/MAOP > 3.3	C029	18%	68.6	7.9	290	1207	8.89	10723	9.13	11015
Pf/MAOP > 3.3	A255	26%	48.3	7.9	290	1207	8.91	10750	8.83	10652
Pf/MAOP > 3.3	A009	24%	50.8	7.9	290	1207	8.92	10759	8.84	10663
Pf/MAOP > 3.3	C007	54%	25.4	7.9	290	1207	8.92	10760	8.78	10591
Pf/MAOP > 3.3	A034	15%	73.7	7.9	290	1207	8.93	10773	8.86	10688
Pf/MAOP > 3.3	C004	31%	38.1	7.9	290	1207	8.96	10812	9.09	10972
Pf/MAOP > 3.3	C012	13%	76.2	7.9	290	1207	8.97	10818	9.12	11002
Pf/MAOP > 3.3	A143	39%	30.5	7.9	290	1207	8.98	10836	8.90	10736
Pf/MAOP > 3.3	C024	13%	71.1	7.9	290	1207	8.99	10848	9.15	11041
Pf/MAOP > 3.3	C017	28%	38.1	7.9	290	1207	9.00	10858	9.08	10955
Pf/MAOP > 3.3	A233	22%	45.7	7.9	290	1207	9.00	10859	8.94	10785
Pf/MAOP > 3.3	A321	19%	50.8	7.9	290	1207	9.00	10862	8.95	10796

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	C033	12%	71.1	7.9	290	1207	9.01	10876	9.16	11048
Pf/MAOP > 3.3	A011	30%	33.0	7.9	290	1207	9.04	10905	8.98	10834
Pf/MAOP > 3.3	C032	13%	61.0	7.9	290	1207	9.04	10911	9.18	11071
Pf/MAOP > 3.3	A218	60%	17.8	7.9	290	1207	9.05	10917	8.95	10803
Pf/MAOP > 3.3	A082	16%	50.8	7.9	290	1207	9.05	10920	9.00	10865
Pf/MAOP > 3.3	A260	31%	30.5	7.9	290	1207	9.06	10931	9.01	10866
Pf/MAOP > 3.3	A060	50%	20.3	7.9	290	1207	9.07	10938	8.99	10853
Pf/MAOP > 3.3	A002	15%	50.8	7.9	290	1207	9.07	10939	9.02	10887
Pf/MAOP > 3.3	A271	30%	30.5	7.9	290	1207	9.07	10942	9.02	10880
Pf/MAOP > 3.3	C035	13%	55.9	7.9	290	1207	9.07	10943	9.16	11048
Pf/MAOP > 3.3	A005	22%	38.1	7.9	290	1207	9.07	10943	9.02	10887
Pf/MAOP > 3.3	C016	12%	58.4	7.9	290	1207	9.07	10948	9.17	11066
Pf/MAOP > 3.3	A067	48%	20.3	7.9	290	1207	9.08	10955	9.01	10877
Pf/MAOP > 3.3	C011	16%	45.7	7.9	290	1207	9.08	10960	9.19	11087
Pf/MAOP > 3.3	A113	13%	50.8	7.9	290	1207	9.10	10975	9.06	10930
Pf/MAOP > 3.3	A146	33%	25.4	7.9	290	1207	9.10	10986	9.06	10935
Pf/MAOP > 3.3	A288	13%	48.3	7.9	290	1207	9.11	10991	9.07	10949
Pf/MAOP > 3.3	A269	50%	17.8	7.9	290	1207	9.11	10993	9.06	10927
Pf/MAOP > 3.3	A248	18%	38.1	7.9	290	1207	9.11	10994	9.08	10954
Pf/MAOP > 3.3	C014	15%	43.2	7.9	290	1207	9.11	10994	9.15	11043
Pf/MAOP > 3.3	A097	24%	30.5	7.9	290	1207	9.12	11002	9.08	10960
Pf/MAOP > 3.3	A098	12%	48.3	7.9	290	1207	9.12	11008	9.10	10975
Pf/MAOP > 3.3	A008	14%	43.2	7.9	290	1207	9.12	11009	9.09	10971
Pf/MAOP > 3.3	A065	45%	17.8	7.9	290	1207	9.14	11024	9.10	10974
Pf/MAOP > 3.3	A155	24%	27.9	7.9	290	1207	9.14	11029	9.11	10993
Pf/MAOP > 3.3	A151	27%	25.4	7.9	290	1207	9.14	11033	9.11	10997

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A306	18%	33.0	7.9	290	1207	9.15	11036	9.12	11005
Pf/MAOP > 3.3	A081	12%	43.2	7.9	290	1207	9.15	11037	9.12	11009
Pf/MAOP > 3.3	A093	13%	40.6	7.9	290	1207	9.15	11038	9.12	11007
Pf/MAOP > 3.3	A018	10%	48.3	7.9	290	1207	9.15	11040	9.13	11013
Pf/MAOP > 3.3	A157	26%	25.4	7.9	290	1207	9.15	11040	9.12	11006
Pf/MAOP > 3.3	A326	42%	17.8	7.9	290	1207	9.15	11041	9.11	10997
Pf/MAOP > 3.3	A053	30%	22.9	7.9	290	1207	9.15	11041	9.12	11004
Pf/MAOP > 3.3	A238	41%	17.8	7.9	290	1207	9.15	11046	9.12	11005
Pf/MAOP > 3.3	A249	41%	17.8	7.9	290	1207	9.15	11046	9.12	11005
Pf/MAOP > 3.3	A310	19%	30.5	7.9	290	1207	9.16	11047	9.13	11019
Pf/MAOP > 3.3	A075	12%	40.6	7.9	290	1207	9.16	11051	9.14	11026
Pf/MAOP > 3.3	C031	12%	40.6	7.9	290	1207	9.16	11051	9.20	11100
Pf/MAOP > 3.3	A323	12%	40.6	7.9	290	1207	9.16	11051	9.14	11026
Pf/MAOP > 3.3	A072	24%	25.4	7.9	290	1207	9.16	11054	9.14	11023
Pf/MAOP > 3.3	A092	24%	25.4	7.9	290	1207	9.16	11054	9.14	11023
Pf/MAOP > 3.3	A272	24%	25.4	7.9	290	1207	9.16	11054	9.14	11023
Pf/MAOP > 3.3	A023	27%	22.9	7.9	290	1207	9.17	11060	9.14	11031
Pf/MAOP > 3.3	A213	46%	15.2	7.9	290	1207	9.17	11061	9.13	11020
Pf/MAOP > 3.3	C015	11%	40.6	7.9	290	1207	9.17	11063	9.15	11044
Pf/MAOP > 3.3	A078	10%	43.2	7.9	290	1207	9.17	11064	9.15	11041
Pf/MAOP > 3.3	A079	12%	38.1	7.9	290	1207	9.17	11065	9.15	11043
Pf/MAOP > 3.3	A010	31%	20.3	7.9	290	1207	9.17	11065	9.14	11034
Pf/MAOP > 3.3	A241	45%	15.2	7.9	290	1207	9.17	11066	9.14	11028
Pf/MAOP > 3.3	A262	30%	20.3	7.9	290	1207	9.17	11070	9.15	11040
Pf/MAOP > 3.3	A250	14%	33.0	7.9	290	1207	9.18	11074	9.16	11050
Pf/MAOP > 3.3	A106	21%	25.4	7.9	290	1207	9.18	11074	9.16	11048

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A059	53%	12.7	7.9	290	1207	9.18	11074	9.14	11034
Pf/MAOP > 3.3	A052	28%	20.3	7.9	290	1207	9.18	11080	9.16	11055
Pf/MAOP > 3.3	A261	41%	15.2	7.9	290	1207	9.18	11082	9.16	11051
Pf/MAOP > 3.3	A185	40%	15.2	7.9	290	1207	9.19	11086	9.16	11056
Pf/MAOP > 3.3	A242	11%	35.6	7.9	290	1207	9.19	11088	9.17	11070
Pf/MAOP > 3.3	A325	14%	30.5	7.9	290	1207	9.19	11089	9.17	11068
Pf/MAOP > 3.3	A340	12%	33.0	7.9	290	1207	9.19	11091	9.18	11074
Pf/MAOP > 3.3	A183	18%	25.4	7.9	290	1207	9.19	11093	9.18	11073
Pf/MAOP > 3.3	A029	15%	27.9	7.9	290	1207	9.20	11096	9.18	11077
Pf/MAOP > 3.3	A068	15%	27.9	7.9	290	1207	9.20	11096	9.18	11077
Pf/MAOP > 3.3	A038	10%	35.6	7.9	290	1207	9.20	11098	9.18	11081
Pf/MAOP > 3.3	A066	20%	22.9	7.9	290	1207	9.20	11099	9.18	11081
Pf/MAOP > 3.3	A290	11%	33.0	7.9	290	1207	9.20	11100	9.19	11084
Pf/MAOP > 3.3	A265	35%	15.2	7.9	290	1207	9.20	11104	9.18	11082
Pf/MAOP > 3.3	A064	28%	17.8	7.9	290	1207	9.20	11104	9.19	11085
Pf/MAOP > 3.3	A006	10%	33.0	7.9	290	1207	9.21	11109	9.19	11094
Pf/MAOP > 3.3	A080	10%	33.0	7.9	290	1207	9.21	11109	9.19	11094
Pf/MAOP > 3.3	A045	42%	12.7	7.9	290	1207	9.21	11110	9.19	11087
Pf/MAOP > 3.3	A033	15%	25.4	7.9	290	1207	9.21	11111	9.19	11094
Pf/MAOP > 3.3	A055	15%	25.4	7.9	290	1207	9.21	11111	9.19	11094
Pf/MAOP > 3.3	A063	26%	17.8	7.9	290	1207	9.21	11112	9.19	11094
Pf/MAOP > 3.3	A322	11%	30.5	7.9	290	1207	9.21	11112	9.20	11098
Pf/MAOP > 3.3	A204	32%	15.2	7.9	290	1207	9.21	11113	9.19	11094
Pf/MAOP > 3.3	A109	17%	22.9	7.9	290	1207	9.21	11114	9.20	11099
Pf/MAOP > 3.3	A048	25%	17.8	7.9	290	1207	9.21	11115	9.20	11099
Pf/MAOP > 3.3	A305	12%	27.9	7.9	290	1207	9.21	11116	9.20	11103

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A263	31%	15.2	7.9	290	1207	9.21	11116	9.20	11098
Pf/MAOP > 3.3	A035	16%	22.9	7.9	290	1207	9.22	11119	9.20	11105
Pf/MAOP > 3.3	A054	19%	20.3	7.9	290	1207	9.22	11121	9.20	11107
Pf/MAOP > 3.3	A219	19%	20.3	7.9	290	1207	9.22	11121	9.20	11107
Pf/MAOP > 3.3	A332	19%	20.3	7.9	290	1207	9.22	11121	9.20	11107
Pf/MAOP > 3.3	A101	11%	27.9	7.9	290	1207	9.22	11122	9.21	11111
Pf/MAOP > 3.3	A220	11%	27.9	7.9	290	1207	9.22	11122	9.21	11111
Pf/MAOP > 3.3	A184	37%	12.7	7.9	290	1207	9.22	11123	9.20	11106
Pf/MAOP > 3.3	A089	15%	22.9	7.9	290	1207	9.22	11124	9.21	11111
Pf/MAOP > 3.3	A158	15%	22.9	7.9	290	1207	9.22	11124	9.21	11111
Pf/MAOP > 3.3	A214	15%	22.9	7.9	290	1207	9.22	11124	9.21	11111
Pf/MAOP > 3.3	A333	18%	20.3	7.9	290	1207	9.22	11125	9.21	11112
Pf/MAOP > 3.3	A115	28%	15.2	7.9	290	1207	9.22	11125	9.21	11111
Pf/MAOP > 3.3	A056	22%	17.8	7.9	290	1207	9.22	11126	9.21	11112
Pf/MAOP > 3.3	A194	22%	17.8	7.9	290	1207	9.22	11126	9.21	11112
Pf/MAOP > 3.3	A245	22%	17.8	7.9	290	1207	9.22	11126	9.21	11112
Pf/MAOP > 3.3	A209	12%	25.4	7.9	290	1207	9.22	11127	9.21	11117
Pf/MAOP > 3.3	A221	12%	25.4	7.9	290	1207	9.22	11127	9.21	11117
Pf/MAOP > 3.3	A231	12%	25.4	7.9	290	1207	9.22	11127	9.21	11117
Pf/MAOP > 3.3	A270	12%	25.4	7.9	290	1207	9.22	11127	9.21	11117
Pf/MAOP > 3.3	A277	12%	25.4	7.9	290	1207	9.22	11127	9.21	11117
Pf/MAOP > 3.3	A334	12%	25.4	7.9	290	1207	9.22	11127	9.21	11117
Pf/MAOP > 3.3	A046	10%	27.9	7.9	290	1207	9.22	11129	9.21	11118
Pf/MAOP > 3.3	A120	10%	27.9	7.9	290	1207	9.22	11129	9.21	11118
Pf/MAOP > 3.3	A232	10%	27.9	7.9	290	1207	9.22	11129	9.21	11118
Pf/MAOP > 3.3	A222	21%	17.8	7.9	290	1207	9.22	11129	9.21	11116

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A268	21%	17.8	7.9	290	1207	9.22	11129	9.21	11116
Pf/MAOP > 3.3	A244	20%	17.8	7.9	290	1207	9.23	11132	9.22	11121
Pf/MAOP > 3.3	A001	16%	20.3	7.9	290	1207	9.23	11133	9.22	11121
Pf/MAOP > 3.3	A007	16%	20.3	7.9	290	1207	9.23	11133	9.22	11121
Pf/MAOP > 3.3	A170	33%	12.7	7.9	290	1207	9.23	11133	9.21	11119
Pf/MAOP > 3.3	A073	13%	22.9	7.9	290	1207	9.23	11133	9.22	11122
Pf/MAOP > 3.3	A237	13%	22.9	7.9	290	1207	9.23	11133	9.22	11122
Pf/MAOP > 3.3	A188	25%	15.2	7.9	290	1207	9.23	11134	9.22	11121
Pf/MAOP > 3.3	A226	25%	15.2	7.9	290	1207	9.23	11134	9.22	11121
Pf/MAOP > 3.3	A162	32%	12.7	7.9	290	1207	9.23	11135	9.22	11122
Pf/MAOP > 3.3	A147	19%	17.8	7.9	290	1207	9.23	11136	9.22	11125
Pf/MAOP > 3.3	A227	19%	17.8	7.9	290	1207	9.23	11136	9.22	11125
Pf/MAOP > 3.3	A074	12%	22.9	7.9	290	1207	9.23	11138	9.22	11129
Pf/MAOP > 3.3	A090	12%	22.9	7.9	290	1207	9.23	11138	9.22	11129
Pf/MAOP > 3.3	A243	12%	22.9	7.9	290	1207	9.23	11138	9.22	11129
Pf/MAOP > 3.3	A254	12%	22.9	7.9	290	1207	9.23	11138	9.22	11129
Pf/MAOP > 3.3	A042	10%	25.4	7.9	290	1207	9.23	11138	9.22	11129
Pf/MAOP > 3.3	A164	18%	17.8	7.9	290	1207	9.23	11139	9.22	11129
Pf/MAOP > 3.3	A091	23%	15.2	7.9	290	1207	9.23	11139	9.22	11128
Pf/MAOP > 3.3	A149	41%	10.2	7.9	290	1207	9.23	11139	9.22	11125
Pf/MAOP > 3.3	A015	14%	20.3	7.9	290	1207	9.23	11140	9.22	11130
Pf/MAOP > 3.3	A195	14%	20.3	7.9	290	1207	9.23	11140	9.22	11130
Pf/MAOP > 3.3	A004	11%	22.9	7.9	290	1207	9.23	11142	9.23	11134
Pf/MAOP > 3.3	A024	28%	12.7	7.9	290	1207	9.24	11144	9.23	11133
Pf/MAOP > 3.3	A167	28%	12.7	7.9	290	1207	9.24	11144	9.23	11133
Pf/MAOP > 3.3	A329	28%	12.7	7.9	290	1207	9.24	11144	9.23	11133

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A225	21%	15.2	7.9	290	1207	9.24	11144	9.23	11134
Pf/MAOP > 3.3	A141	38%	10.2	7.9	290	1207	9.24	11144	9.23	11132
Pf/MAOP > 3.3	A044	16%	17.8	7.9	290	1207	9.24	11145	9.23	11136
Pf/MAOP > 3.3	A303	27%	12.7	7.9	290	1207	9.24	11145	9.23	11136
Pf/MAOP > 3.3	A163	37%	10.2	7.9	290	1207	9.24	11146	9.23	11135
Pf/MAOP > 3.3	A247	20%	15.2	7.9	290	1207	9.24	11146	9.23	11138
Pf/MAOP > 3.3	A020	10%	22.9	7.9	290	1207	9.24	11147	9.23	11139
Pf/MAOP > 3.3	A224	10%	22.9	7.9	290	1207	9.24	11147	9.23	11139
Pf/MAOP > 3.3	A197	26%	12.7	7.9	290	1207	9.24	11147	9.23	11138
Pf/MAOP > 3.3	A117	12%	20.3	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A211	12%	20.3	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A223	12%	20.3	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A235	12%	20.3	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A251	12%	20.3	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A282	12%	20.3	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A041	15%	17.8	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A341	15%	17.8	7.9	290	1207	9.24	11148	9.23	11140
Pf/MAOP > 3.3	A013	19%	15.2	7.9	290	1207	9.24	11149	9.23	11141
Pf/MAOP > 3.3	A178	34%	10.2	7.9	290	1207	9.24	11150	9.23	11141
Pf/MAOP > 3.3	A216	34%	10.2	7.9	290	1207	9.24	11150	9.23	11141
Pf/MAOP > 3.3	A012	14%	17.8	7.9	290	1207	9.24	11151	9.23	11143
Pf/MAOP > 3.3	A040	14%	17.8	7.9	290	1207	9.24	11151	9.23	11143
Pf/MAOP > 3.3	A110	14%	17.8	7.9	290	1207	9.24	11151	9.23	11143
Pf/MAOP > 3.3	A208	18%	15.2	7.9	290	1207	9.24	11151	9.24	11144
Pf/MAOP > 3.3	A076	11%	20.3	7.9	290	1207	9.24	11151	9.24	11145
Pf/MAOP > 3.3	A116	11%	20.3	7.9	290	1207	9.24	11151	9.24	11145

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A274	11%	20.3	7.9	290	1207	9.24	11151	9.24	11145
Pf/MAOP > 3.3	A315	11%	20.3	7.9	290	1207	9.24	11151	9.24	11145
Pf/MAOP > 3.3	A036	24%	12.7	7.9	290	1207	9.24	11151	9.23	11143
Pf/MAOP > 3.3	A176	24%	12.7	7.9	290	1207	9.24	11151	9.23	11143
Pf/MAOP > 3.3	A212	24%	12.7	7.9	290	1207	9.24	11151	9.23	11143
Pf/MAOP > 3.3	A043	33%	10.2	7.9	290	1207	9.24	11152	9.23	11143
Pf/MAOP > 3.3	A179	23%	12.7	7.9	290	1207	9.24	11153	9.24	11145
Pf/MAOP > 3.3	A180	23%	12.7	7.9	290	1207	9.24	11153	9.24	11145
Pf/MAOP > 3.3	A309	17%	15.2	7.9	290	1207	9.24	11153	9.24	11146
Pf/MAOP > 3.3	A150	32%	10.2	7.9	290	1207	9.24	11153	9.24	11145
Pf/MAOP > 3.3	A346	13%	17.8	7.9	290	1207	9.24	11154	9.24	11146
Pf/MAOP > 3.3	A016	10%	20.3	7.9	290	1207	9.24	11155	9.24	11149
Pf/MAOP > 3.3	A017	10%	20.3	7.9	290	1207	9.24	11155	9.24	11149
Pf/MAOP > 3.3	A019	10%	20.3	7.9	290	1207	9.24	11155	9.24	11149
Pf/MAOP > 3.3	A051	10%	20.3	7.9	290	1207	9.24	11155	9.24	11149
Pf/MAOP > 3.3	A324	10%	20.3	7.9	290	1207	9.24	11155	9.24	11149
Pf/MAOP > 3.3	A182	22%	12.7	7.9	290	1207	9.24	11155	9.24	11147
Pf/MAOP > 3.3	A217	30%	10.2	7.9	290	1207	9.25	11156	9.24	11148
Pf/MAOP > 3.3	A099	12%	17.8	7.9	290	1207	9.25	11156	9.24	11151
Pf/MAOP > 3.3	A130	12%	17.8	7.9	290	1207	9.25	11156	9.24	11151
Pf/MAOP > 3.3	A131	12%	17.8	7.9	290	1207	9.25	11156	9.24	11151
Pf/MAOP > 3.3	A196	12%	17.8	7.9	290	1207	9.25	11156	9.24	11151
Pf/MAOP > 3.3	A335	12%	17.8	7.9	290	1207	9.25	11156	9.24	11151
Pf/MAOP > 3.3	A126	21%	12.7	7.9	290	1207	9.25	11157	9.24	11150
Pf/MAOP > 3.3	A161	29%	10.2	7.9	290	1207	9.25	11157	9.24	11151
Pf/MAOP > 3.3	A246	15%	15.2	7.9	290	1207	9.25	11158	9.24	11152

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A192	20%	12.7	7.9	290	1207	9.25	11158	9.24	11152
Pf/MAOP > 3.3	A236	20%	12.7	7.9	290	1207	9.25	11158	9.24	11152
Pf/MAOP > 3.3	A240	20%	12.7	7.9	290	1207	9.25	11158	9.24	11152
Pf/MAOP > 3.3	A108	28%	10.2	7.9	290	1207	9.25	11159	9.24	11152
Pf/MAOP > 3.3	A111	11%	17.8	7.9	290	1207	9.25	11159	9.24	11154
Pf/MAOP > 3.3	A287	11%	17.8	7.9	290	1207	9.25	11159	9.24	11154
Pf/MAOP > 3.3	A129	14%	15.2	7.9	290	1207	9.25	11160	9.24	11154
Pf/MAOP > 3.3	A228	19%	12.7	7.9	290	1207	9.25	11160	9.24	11154
Pf/MAOP > 3.3	A186	18%	12.7	7.9	290	1207	9.25	11162	9.25	11156
Pf/MAOP > 3.3	A187	18%	12.7	7.9	290	1207	9.25	11162	9.25	11156
Pf/MAOP > 3.3	A215	18%	12.7	7.9	290	1207	9.25	11162	9.25	11156
Pf/MAOP > 3.3	A253	18%	12.7	7.9	290	1207	9.25	11162	9.25	11156
Pf/MAOP > 3.3	A259	18%	12.7	7.9	290	1207	9.25	11162	9.25	11156
Pf/MAOP > 3.3	A320	18%	12.7	7.9	290	1207	9.25	11162	9.25	11156
Pf/MAOP > 3.3	A014	10%	17.8	7.9	290	1207	9.25	11162	9.25	11157
Pf/MAOP > 3.3	A047	10%	17.8	7.9	290	1207	9.25	11162	9.25	11157
Pf/MAOP > 3.3	A069	10%	17.8	7.9	290	1207	9.25	11162	9.25	11157
Pf/MAOP > 3.3	A230	10%	17.8	7.9	290	1207	9.25	11162	9.25	11157
Pf/MAOP > 3.3	A342	13%	15.2	7.9	290	1207	9.25	11162	9.25	11157
Pf/MAOP > 3.3	A137	25%	10.2	7.9	290	1207	9.25	11163	9.25	11157
Pf/MAOP > 3.3	A229	25%	10.2	7.9	290	1207	9.25	11163	9.25	11157
Pf/MAOP > 3.3	A266	25%	10.2	7.9	290	1207	9.25	11163	9.25	11157
Pf/MAOP > 3.3	A148	17%	12.7	7.9	290	1207	9.25	11163	9.25	11158
Pf/MAOP > 3.3	A348	17%	12.7	7.9	290	1207	9.25	11163	9.25	11158
Pf/MAOP > 3.3	A189	12%	15.2	7.9	290	1207	9.25	11164	9.25	11160
Pf/MAOP > 3.3	A239	12%	15.2	7.9	290	1207	9.25	11164	9.25	11160

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A252	12%	15.2	7.9	290	1207	9.25	11164	9.25	11160
Pf/MAOP > 3.3	A280	12%	15.2	7.9	290	1207	9.25	11164	9.25	11160
Pf/MAOP > 3.3	A281	12%	15.2	7.9	290	1207	9.25	11164	9.25	11160
Pf/MAOP > 3.3	A285	12%	15.2	7.9	290	1207	9.25	11164	9.25	11160
Pf/MAOP > 3.3	A308	12%	15.2	7.9	290	1207	9.25	11164	9.25	11160
Pf/MAOP > 3.3	A028	16%	12.7	7.9	290	1207	9.25	11165	9.25	11160
Pf/MAOP > 3.3	A071	23%	10.2	7.9	290	1207	9.25	11165	9.25	11160
Pf/MAOP > 3.3	A181	22%	10.2	7.9	290	1207	9.25	11166	9.25	11161
Pf/MAOP > 3.3	A318	22%	10.2	7.9	290	1207	9.25	11166	9.25	11161
Pf/MAOP > 3.3	A312	11%	15.2	7.9	290	1207	9.25	11166	9.25	11162
Pf/MAOP > 3.3	A313	15%	12.7	7.9	290	1207	9.25	11166	9.25	11162
Pf/MAOP > 3.3	A328	15%	12.7	7.9	290	1207	9.25	11166	9.25	11162
Pf/MAOP > 3.3	A279	21%	10.2	7.9	290	1207	9.25	11167	9.25	11163
Pf/MAOP > 3.3	A140	14%	12.7	7.9	290	1207	9.26	11168	9.25	11164
Pf/MAOP > 3.3	A347	14%	12.7	7.9	290	1207	9.26	11168	9.25	11164
Pf/MAOP > 3.3	A105	10%	15.2	7.9	290	1207	9.26	11168	9.25	11165
Pf/MAOP > 3.3	A122	10%	15.2	7.9	290	1207	9.26	11168	9.25	11165
Pf/MAOP > 3.3	A296	10%	15.2	7.9	290	1207	9.26	11168	9.25	11165
Pf/MAOP > 3.3	A142	20%	10.2	7.9	290	1207	9.26	11168	9.25	11164
Pf/MAOP > 3.3	A030	13%	12.7	7.9	290	1207	9.26	11169	9.25	11166
Pf/MAOP > 3.3	A104	13%	12.7	7.9	290	1207	9.26	11169	9.25	11166
Pf/MAOP > 3.3	A267	13%	12.7	7.9	290	1207	9.26	11169	9.25	11166
Pf/MAOP > 3.3	A311	13%	12.7	7.9	290	1207	9.26	11169	9.25	11166
Pf/MAOP > 3.3	A107	19%	10.2	7.9	290	1207	9.26	11169	9.25	11166
Pf/MAOP > 3.3	A314	18%	10.2	7.9	290	1207	9.26	11170	9.25	11167
Pf/MAOP > 3.3	A112	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A165	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A166	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A193	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A234	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A273	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A276	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A278	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A286	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A293	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A316	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A319	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A327	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A339	12%	12.7	7.9	290	1207	9.26	11171	9.26	11168
Pf/MAOP > 3.3	A264	11%	12.7	7.9	290	1207	9.26	11172	9.26	11170
Pf/MAOP > 3.3	A300	11%	12.7	7.9	290	1207	9.26	11172	9.26	11170
Pf/MAOP > 3.3	A304	11%	12.7	7.9	290	1207	9.26	11172	9.26	11170
Pf/MAOP > 3.3	A077	16%	10.2	7.9	290	1207	9.26	11172	9.26	11170
Pf/MAOP > 3.3	A302	16%	10.2	7.9	290	1207	9.26	11172	9.26	11170
Pf/MAOP > 3.3	A210	15%	10.2	7.9	290	1207	9.26	11173	9.26	11171
Pf/MAOP > 3.3	A338	15%	10.2	7.9	290	1207	9.26	11173	9.26	11171
Pf/MAOP > 3.3	A100	10%	12.7	7.9	290	1207	9.26	11174	9.26	11171
Pf/MAOP > 3.3	A125	10%	12.7	7.9	290	1207	9.26	11174	9.26	11171
Pf/MAOP > 3.3	A307	14%	10.2	7.9	290	1207	9.26	11174	9.26	11172
Pf/MAOP > 3.3	A136	13%	10.2	7.9	290	1207	9.26	11175	9.26	11173
Pf/MAOP > 3.3	A177	13%	10.2	7.9	290	1207	9.26	11175	9.26	11173
Pf/MAOP > 3.3	A292	13%	10.2	7.9	290	1207	9.26	11175	9.26	11173

							Modified B31G		Effective Area	
PF/MAOP Category	ID Code	Depth (%)	Length (mm)	wt (mm)	Pipe grade (Mpa)	MAOP (KPa)	PF/MAOP	Failure Pressure (KPa)	PF/MAOP	Failure Pressure (Kpa)
Pf/MAOP > 3.3	A337	13%	10.2	7.9	290	1207	9.26	11175	9.26	11173
Pf/MAOP > 3.3	A205	12%	10.2	7.9	290	1207	9.26	11176	9.26	11174
Pf/MAOP > 3.3	A275	12%	10.2	7.9	290	1207	9.26	11176	9.26	11174
Pf/MAOP > 3.3	A317	12%	10.2	7.9	290	1207	9.26	11176	9.26	11174
Pf/MAOP > 3.3	A336	12%	10.2	7.9	290	1207	9.26	11176	9.26	11174
Pf/MAOP > 3.3	A345	12%	10.2	7.9	290	1207	9.26	11176	9.26	11174
Pf/MAOP > 3.3	A070	11%	10.2	7.9	290	1207	9.26	11177	9.26	11176
Pf/MAOP > 3.3	A175	11%	10.2	7.9	290	1207	9.26	11177	9.26	11176
Pf/MAOP > 3.3	A114	10%	10.2	7.9	290	1207	9.26	11178	9.26	11177

8.3 Dent List

No dents were identified in this inspection. The table below was left intentionally empty.

Feature ID	Feature Position (m)	O'Clock Position	Depth % O.D.	Length (mm)	Width (mm)	Wall thickness (mm)	Comments
-	-	-	-	-	-	-	-

8.4 Other Feature List

Feature ID	Feature Position (m)	O'Clock Position	Length (mm)	Width (mm)	Comments
O001	19.15	06:09	8,882.4	477.5	debris
O002	40.14	11:54	142.2	188.0	close metal object
O003	122.91	03:56	58.4	147.3	Manufacturing Related
O004	137.22	01:32	99.1	83.8	Close Metal Object
O005	223.32	05:44	27.9	109.2	Girth Weld Indication
O006	298.25	11:48	22.9	101.6	Manufacturing Related
O007	298.38	11:51	61.0	111.8	Manufacturing Related
O008	345.37	10:30	35.6	116.8	Long Seam Indication
O009	360.30	07:47	236.2	30.5	Manufacturing related
O010	370.94	03:07	17.8	68.6	Long Seam Indication
O011	409.98	11:56	165.1	139.7	Manufacturing Related
O012	410.23	11:56	106.7	142.2	Manufacturing Related
O013	410.31	11:58	144.8	165.1	Manufacturing Related
O014	410.46	11:58	154.9	157.5	Manufacturing Related

8.5 Installation List

Feature ID	Feature Position (m)	O'Clock Position	Length (mm)	Width (mm)	Comments
I001	30.10	5:17	15.2	1585.0	Start Sleeve.
I002	37.87	0:04	134.6	104.1	Attachment
I003	66.52	10:37	106.7	1569.7	Start Casing
I004	176.65	10:08	10.2	1590.0	Start of Sleeve. Metal Loss at Girth Weld.
I005	177.54	2:05	63.5	66.0	Tap
I006	254.87	2:40	94.0	124.5	Tap
I007	340.87	3:42	129.5	215.9	Tap
I008	392.26	0:01	78.7	66.0	Tap
I009	393.29	0:00	419.1	546.1	Stopple Launcher
I010	394.77	0:00	63.5	68.6	Tap
I011	411.09	0:04	66.0	50.8	Tap

*: Sleeves and Casings are indicated in this list at the start location.

8.6 Pipe Book

Feature ID	Feature Position (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (MPa)	Pipe Type	Pipe Length (m)	Comments
w001	0.00		7.9	290	SMLS	8.34	First Weld. Upstream
w002	8.35		7.9	290	SMLS	8.96	
w003	17.31		7.9	290	SMLS	6.77	
w004	24.08		7.9	290	SMLS	13.60	
w005	37.68		7.9	290	SMLS	10.59	
w006	48.26		7.9	290	SMLS	13.18	
w007	61.44		7.9	290	SMLS	12.97	
w008	74.41		7.9	290	SMLS	13.48	
w009	87.89		7.9	290	SMLS	12.12	
w010	100.01		7.9	290	Unknown	0.51	
w011	100.52		7.9	290	SMLS	3.00	
w012	103.52	0:06	7.9	290	DSAW	4.45	
w013	107.96	9:40	7.9	290	DSAW	7.07	
w014	115.04		7.9	290	Unknown	0.51	
w015	115.55	7:17	7.9	290	DSAW	12.30	
w016	127.85	9:56	7.9	290	DSAW	0.84	
w017	128.69	2:24	7.9	290	DSAW	11.74	
w018	140.43	10:09	7.9	290	DSAW	12.15	
w019	152.57	2:30	7.9	290	DSAW	12.20	
w020	164.77	0:41	7.9	290	DSAW	24.35	
w021	189.12	9:57	7.9	290	DSAW	12.25	
w022	201.38	1:27	7.9	290	DSAW	12.23	
w023	213.60	10:37	7.9	290	DSAW	9.70	
w024	223.30	2:20	7.9	290	DSAW	12.23	
w025	235.53	10:04	7.9	290	DSAW	12.23	

Feature ID	Feature Position (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (MPa)	Pipe Type	Pipe Length (m)	Comments
w026	247.76	3:04	7.9	290	DSAW	12.22	
w027	259.98	9:44	7.9	290	DSAW	12.20	
w028	272.18	2:49	7.9	290	DSAW	12.25	
w029	284.43	10:55	7.9	290	DSAW	12.20	
w030	296.63	2:35	7.9	290	DSAW	12.21	
w031	308.84	9:50	7.9	290	DSAW	12.21	
w032	321.05	2:37	7.9	290	DSAW	12.23	
w033	333.27	10:30	7.9	290	DSAW	12.26	
w034	345.53	3:48	7.9	290	DSAW	12.06	
w035	357.60	10:53	7.9	290	DSAW	12.19	
w036	369.79	3:26	7.9	290	DSAW	12.19	
w037	381.97	10:16	7.9	290	DSAW	24.52	
w038	406.50		7.9	290	Unknown	0.66	
w039	407.15		7.9	290	Unknown	1.15	
w040	408.30		7.9	290	Unknown	0.48	
w041	408.77	1:32	7.9	290	DSAW	3.92	
w042	412.70	2:51	7.9	290	DSAW	#VALUE!	Last Weld. Downstream

Appendix A: Attachments

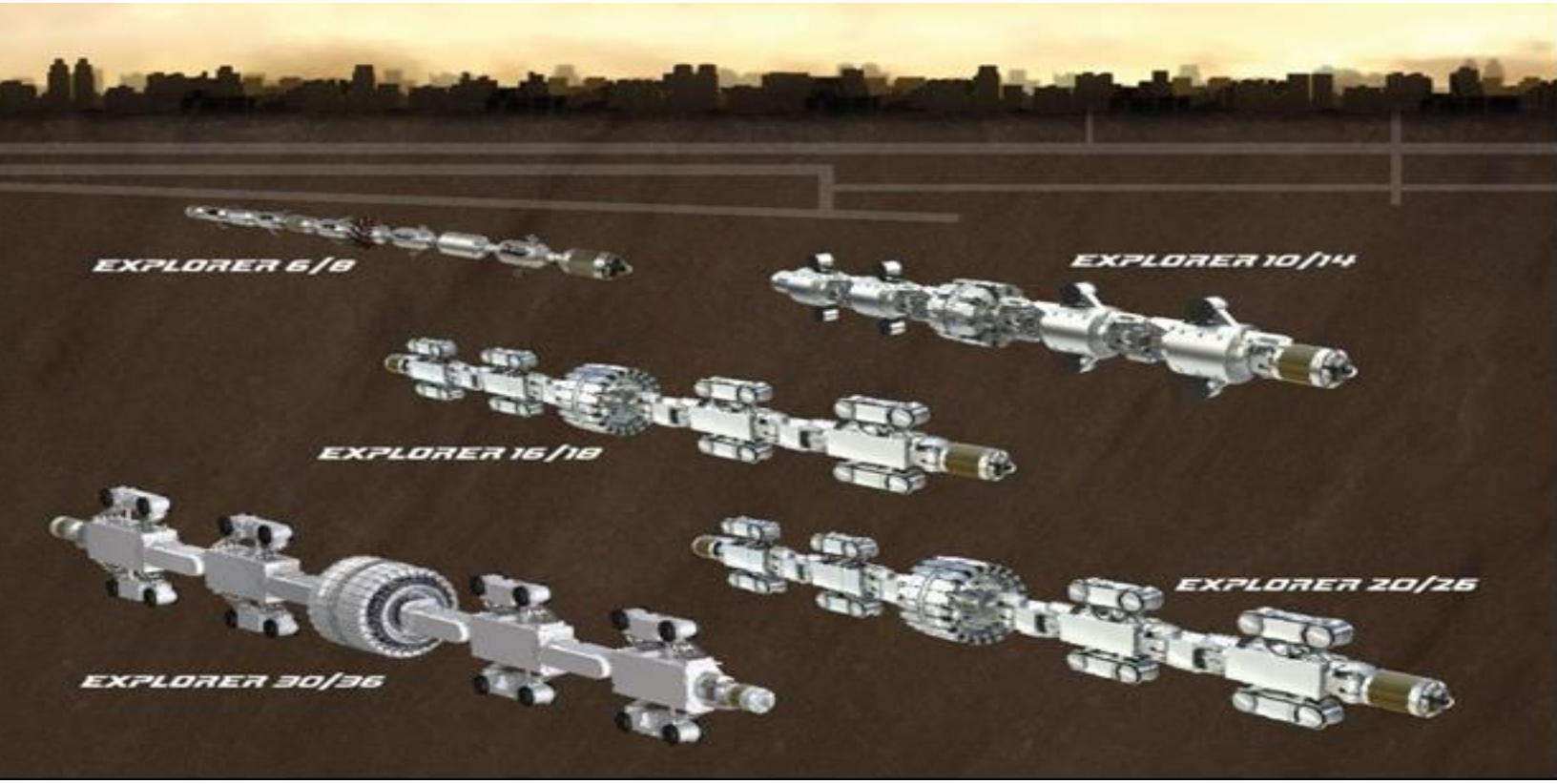
Following is the list of submitted data on an electronic storage to Enbridge Gas Distribution:

- .pdf format of this report
- .pdf format of preliminary report
- Datatel software for viewing data acquired from this pipeline
- A user guideline titled "Datatel User Guidelines.pdf"
- .pdf format inspection map
- .xls or .xlsx format pipe book
- .xls DigSheets

Appendix B: Pipetel Inspection Personnel

Role	Name
Crew Chief:	Greg Battagin
Field Electrical Engineers:	Bilal Sarwari, David Hutchinson, Scott Zeeman, Sheraz Ahmed, Henry Zhao, Michael Kobelak
Data Analyst:	Anita Eiskhani
General Manager:	Roderick Lee
Data Analyst Manager:	Francis Gracias
Solutions Manager:	Eduard Usurelu

Appendix C: The Inspection Robot Specifications



	Unit	Explorer 8	Explorer 10/14	Explorer 16/18	Explorer 20/26	Explorer 30/36
Pipe diameter	inch	8	10 12 14	16 18	20 22 24 26	30 32 34 36
Rated pressure	psi	750	750	750	750	750
Self-propelled inspection speed	ft/min	20	20	20	20	20
By pass	%	50	50	50	50	50
Bi-directional		Yes	Yes	Yes	Yes	Yes
Tetherless		Yes	Yes	Yes	Yes	Yes
Inline charging		Yes	Yes	Yes	Yes	Yes
Video		Yes	Yes	Yes	Yes	Yes
Metal loss sensor		MFL	MFL	MFL	MFL	MFL
Deformation sensor		LDS	LDS	LDS	LDS	LDS
Vertical segment		Yes	Yes	Yes	Yes	Yes
Back to back elbow		Yes	Yes	Yes	Yes	Yes
Mitered elbow		Yes	Yes	Yes	Yes	Yes
Plug valve		No	No	Yes	Yes	Yes
Valve (full port)		Yes	Yes	Yes	Yes	Yes
Tee (barred or unbarred)		Yes	Yes	Yes	Yes	Yes

Specifications of Metal Loss Sensors

General Metal Loss Sizing Specification	Nominal Pipe	Cased Pipe
Depth at POD = 90%	0.10t	0.20t
Depth accuracy (80% confidence)	± 0.10t	± 0.20t
Width accuracy (80% confidence)	± 0.75 inches ± 20 mm	± 1 inches ± 25 mm
Length accuracy (80% confidence)	± 0.5 inch ± 12 mm	± 0.75 inch ± 20 mm

- t = wall thickness
- Detection threshold and sizing accuracy in elbows are unspecified
- Detection threshold increases to 0.15t and depth sizing accuracy degrades to ±0.15t in seamless pipe
- Depth sizing accuracy degrades to ±0.20t near girth welds or in heat affected zones

Specifications of Deformation Sensors

Sizing Specification	Dent	Ovality
Depth at POD = 90%	1% of pipe nominal OD	1% of pipe nominal OD
Depth accuracy at 80% confidence	± 1% of pipe nominal OD	± 1% of pipe nominal OD
Width accuracy at 80% confidence	± 2 inches ± 50 mm	
Length accuracy at 80% confidence	± 1 inch ± 25 mm	

Appendix D: Definitions and Identification Codes

Antenna: A wireless antenna installed in the inspected pipeline for communication with Explorer 20/26.

ARS: Abbreviation for Above Reporting Specifications

BRS: Abbreviation for Below Reporting Specifications

Chips: Metal Shavings

Cluster: Multiple interacting indications. Two individual metal loss indications interact and shall be clustered when the axial spacing between metal loss indication edges is less than or equal to 6xT and the circumferential spacing is less than or equal to 6xT (where T is the pipe wall thickness)

Dent: Indentations of the pipe circular cross section caused by external forces.

ETS: Abbreviation for Electrolysis Test Station

Explorer 20/26: A pipeline inspection robot that features metal loss and video recording capabilities. May appear abbreviated to Explorer 20/26.

Feature: A signal that is of interest. Welds are not considered features.

Flange: An external ridge or rim for the attachment of site-installed pipe segments or installations.

Flanged joint: A pipeline joint consisting of two adjacent pipeline components with flanged ends.

FPR: Abbreviation for Failure Pressure Ratio

Girth Weld: A site-welded bond joining adjacent pipe sections.

Host Pipe: The pipe in which a specific feature is located.

ID Code: A unique identification code assigned to a feature, pipe, or weld.

Indication: A signal that is believed to be associated with a change in pipe wall thickness or mechanical damage to the pipeline. Indications are a subset of features.

Installation: A pipeline feature installed during the construction of the pipeline or as a modifications to the pipeline. Examples of installations are valves, tees, taps, casings, etc. Installations are a subset of features.

Isolation Fitting: A pipe joint specifically designed to electrically isolate, for the purpose of cathodic corrosion protection, two segments of a pipeline.

Launch: The process associated with the insertion of the robot into the pipe.

Launch Site: The location at which the robot is inserted into the inspected pipe. The launch site may be the same location as the receive site.

Launcher: Housing for Explorer 20/26 used to launch and receive the robot.

Mechanical Damage: Damage to the pipe surface caused by external forces such as gouges.

MFL Data: Data gathered with the metal loss sensor on Explorer.

MFL: Acronym for Magnetic Flux Leakage.

O'clock Position: The location at which the hour hand of a clock must point in order to point at the center of the object of interest.

Other feature: A feature that is not believed to be a metal loss indication or installation. Other features are a subset of features.

Objects: Items located in the pipeline

Pipe Joint: A connection between two pipe segments. Types of pipe joints include girth weld, flanged connection and isolation fitting.

Pipe Segment: A continuous length of pipe that is attached to the pipeline with welds or fittings.

RFEC: Acronym for Remote Field Eddy Current.

Robot: The mechanism used to inspect the pipeline, in this case the Explorer 20/26 inspection robot.

Receive: The process associated with the extraction of the robot from the pipe.

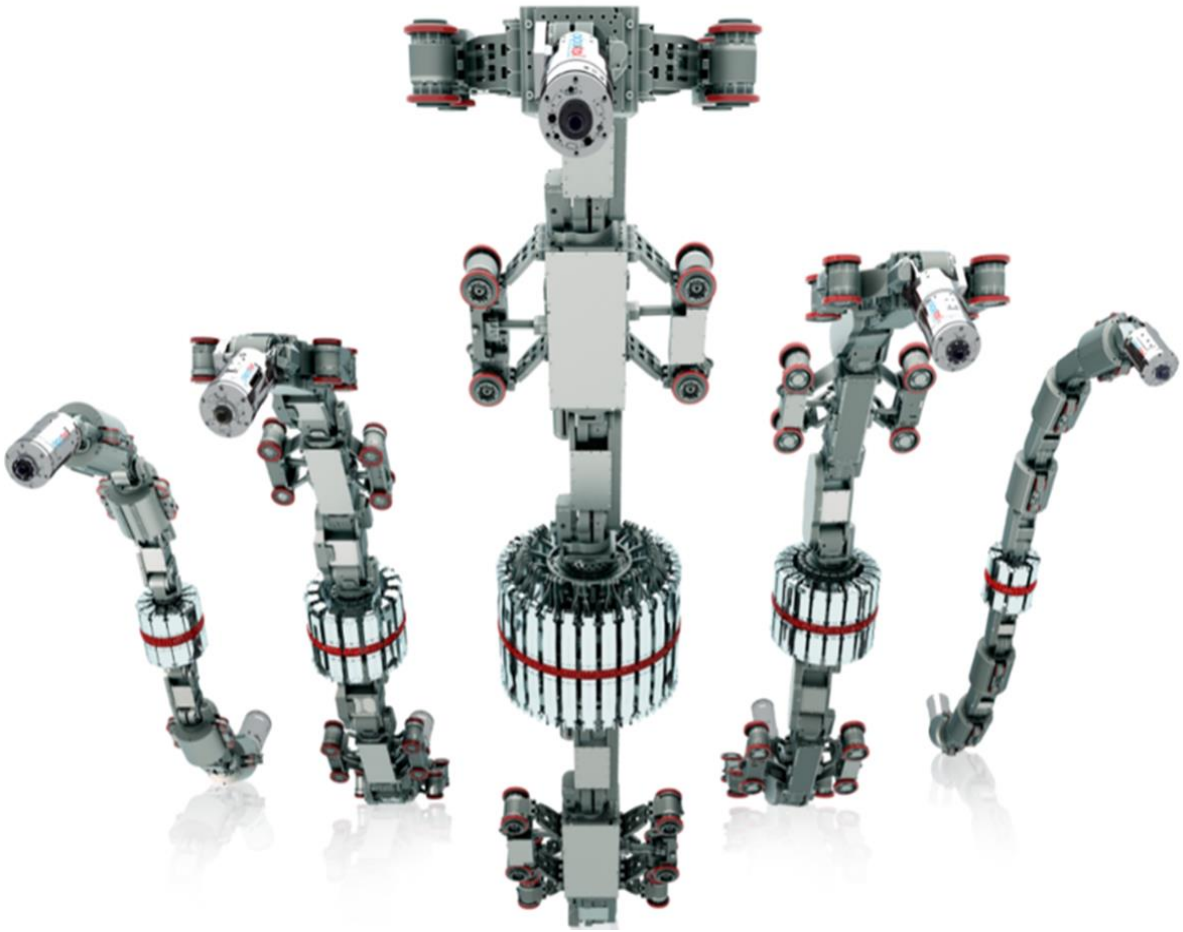
Receive Site: The location at which the robot is extracted from the inspected pipe. The receive site may be the same location as the launch site.

Video: Data gathered with the video capture system on the robot.

Data Analysis Final Inspection Report

Enbridge Gas Distribution Inc.

Pipeline Index: 111.LAK.20-10
Line Name: NPS 20 Lakeshore - Yonge
Upstream Data Limit: Data Limit A (Nearby Parliament St)
Downstream Data Limit: Data Limit B (Nearby Bay St)
Pipetel Project #: EGD119
Report Date: January 10, 2019. Version Issue# 2



Version Control

Version No.	Report Date	Description	Prepared by	Approved by
Issue# 1	January 4, 2019	Initial release	Brad Tang	Francis Gracias
Issue# 2	January 10, 2019	Attached Qualifications, QAQC forms and Preliminary report	Brad Tang	Francis Gracias

Contents

1 Executive Summary

On November 21, 2018, the Enbridge Gas Distribution Inc. NPS 20 Lakeshore - Yonge Line from Data Limit A (Nearby Parliament St) to Data Limit B (Nearby Bay St) was successfully inspected by the Pipetel Explorer Robot. The flow direction as provided by Enbridge Gas Distribution Inc. is East to West. The odometer position is increasing in the flow direction and the zero odometer position is set at the first identified weld.

Data coverage acceptance from Enbridge Gas Distribution Inc. was provided on November 22, 2018. The preliminary report was issued November 29, 2018. This final report provides tables and charts summarizing the comprehensive evaluation of the accepted inspection data and the validation pipe data (if provided).

2 Inspection Summary

General information about the inspected pipeline is summarized below. The summary table contains pipeline information received from Enbridge Gas Distribution Inc. as well as inspection information generated by Pipetel Technologies.

Pipeline Information	
Pipeline Name:	**NPS 20 Lakeshore - Yonge,** Data Limit A (Nearby Parliament St) to Data Limit B (Nearby Bay St)
Pipe Size (NPS):	20 in (508.0 mm)
Pipe Wall Thickness (WT):	0.312 in (7.92 mm)
Pipe Grade:	X42 (290 Mpa)
Maximum Allowable Operating Pressure (MAOP):	175 Psi
Flow Direction During Inspection:	East to West

Inspection Information	
Inspection Date:	November 19, 2018 - November 21, 2018
Inspection Robot:	Explorer X2026
Inspection Type(s):	Magnetic flux leakage (MFL) for metal loss. Laser Deformation Sensor (LDS) for dent detection. Visual (video camera) for general pipeline condition.
Inspection robot Magnetizer Calibration:	November 18, 2018
Inspection robot Axial Spatial Sampling:	1.27mm (0.050inch)
Inspected Pipeline Length:	1467.03 m
Inspection Upstream Limit:	Data Limit A (Nearby Parliament St)
Inspection Downstream Limit:	Data Limit B (Nearby Bay St)
MFL Data Coverage:	98.87%
LDS Data Coverage:	99.17%

3 Reporting Specifications

The following are criteria regarding reportable features and deliverables.

Reporting Criteria	
Metal Loss Cluster Rule:	6T x 6T
Metal loss Reporting Threshold 1:	>= 10% For ERW Pipe
Metal loss Reporting Threshold 2:	>= 15% For SMLS Pipe
Dent With Metal Loss Reporting Threshold:	Dent with any indicated metal loss or stress concentrators
Odometer Position of Metal Loss:	Center of feature
Odometer Position of non-metal loss features:	Center of feature
Apply Tool Tolerance to Metal Loss:	Depth and Length
Provide Effective Area Burst pressure Method:	Yes
Provide MB31G Burst Pressure Method:	Yes
Provide B31G Burst Pressure Method:	Yes
Identified Zero odometer Position:	The first identified weld
Flow direction (increasing odometer):	East to West

- **Positions downstream of the reference are reported as positive (+) and positions upstream of the reference are reported as negative (-)**
- **Flow direction was assumed to be from East to West.**
- **O'clock positions are reported looking downstream along the pipeline (i.e. looking downstream along the pipe, the 3:00 position will be on the right hand side of the pipe). The 12:00 position is at the top of the pipe.**

4 Inspection Findings Summary

Critical Findings Metal Loss Clusters or Non-Interacting Indications	
Depth ≥ 70% WT:	0
Eff. Area. P_F/MAOP≤ 1.1 and Depth < 70% WT:	0
Total:	**0**
Dents	
Dent with any indicated metal loss or stress concentrators :	**0**
Total:	**0**

Clusters and Non-interacting Metal Loss Indications	
Depth < 10% WT:	NA **
10% ≤ Depth < 20% WT:	287
20% ≤ Depth < 30% WT:	48
30% ≤ Depth < 40% WT:	42
40% ≤ Depth < 50% WT:	11
50% ≤ Depth < 60% WT:	3
60% ≤ Depth < 70% WT:	0
70% ≤ Depth < 80% WT:	0
80% ≤ Depth:	0 (note: a depth of 80% denotes a depth ≥ 80%)
Total:	**391**
Total Internal Metal Loss:	0
Total External Metal Loss:	**391**
Metal loss commented 'Manufacturing related':	0
Clusters and Non-interacting Metal Loss Indications P_F/100%SMYS (Effective Area)	
P_F/100%SMYS not provided. Metal loss depth≥ 80% :	0
P_F/100%SMYS ≤ 1.00:	0
P_F/100%SMYS > 1.00:	**391**
Clusters and Non-interacting Metal Loss Indications P_F*/100%SMYS (Effective Area with Tool Tolerance)	
Metal Loss Depth without tool tolerance added ≥ 80%:	(PF/100%SMYS not applicable. Not included below)
Metal Loss Depth with Tool tolerance added ≥ 80%:	(PF*/100%SMYS not applicable. Included below)
P_F/100%SMYS ≤ 1.00:	**1**
P_F/100%SMYS > 1.00:	**390**
Dents with Depth	
Depth ≥6% OD:	1
4%≤ Depth < 6% OD:	0
2%≤ Depth < 4% OD:	1
0.5%≤ Depth < 2% OD:	14
Depth < 0.5% OD:	NA **
Total:	16

*: Tool Tolerance applied (Depth and Length)
**: Below reporting threshold

Other Features	
Close Metal Object:	12
Circumferential fillet weld:	30
Start / End of run:	2
Liquid:	1
Manufacturing Related Indication:	36
Total:	**81**

Pipe Joints and Pipe Segments	
Girth Welds and pipe connections:	157
Pipe Segments:	158

Installations	
Valve:	0
Tap:	35
Spherical Tee:	1
Casing:	0
Support:	0
Stopple:	7 (including launcher stopple)
Flange:	0
Attachment:	5
Bend:	19
Offtake:	7
Total:	**74**

5 Inspection Schematic

A schematic of the NPS 20 Lakeshore - Yonge pipeline indicating the launch site, the zero reference position and other features are shown in the figure. The extremes of the inspection were Data Limit A (Nearby Parliament St) and Data Limit B (Nearby Bay St), which represent the inspection start and end points, respectively.

6 MFL Pipeline Data Coverage

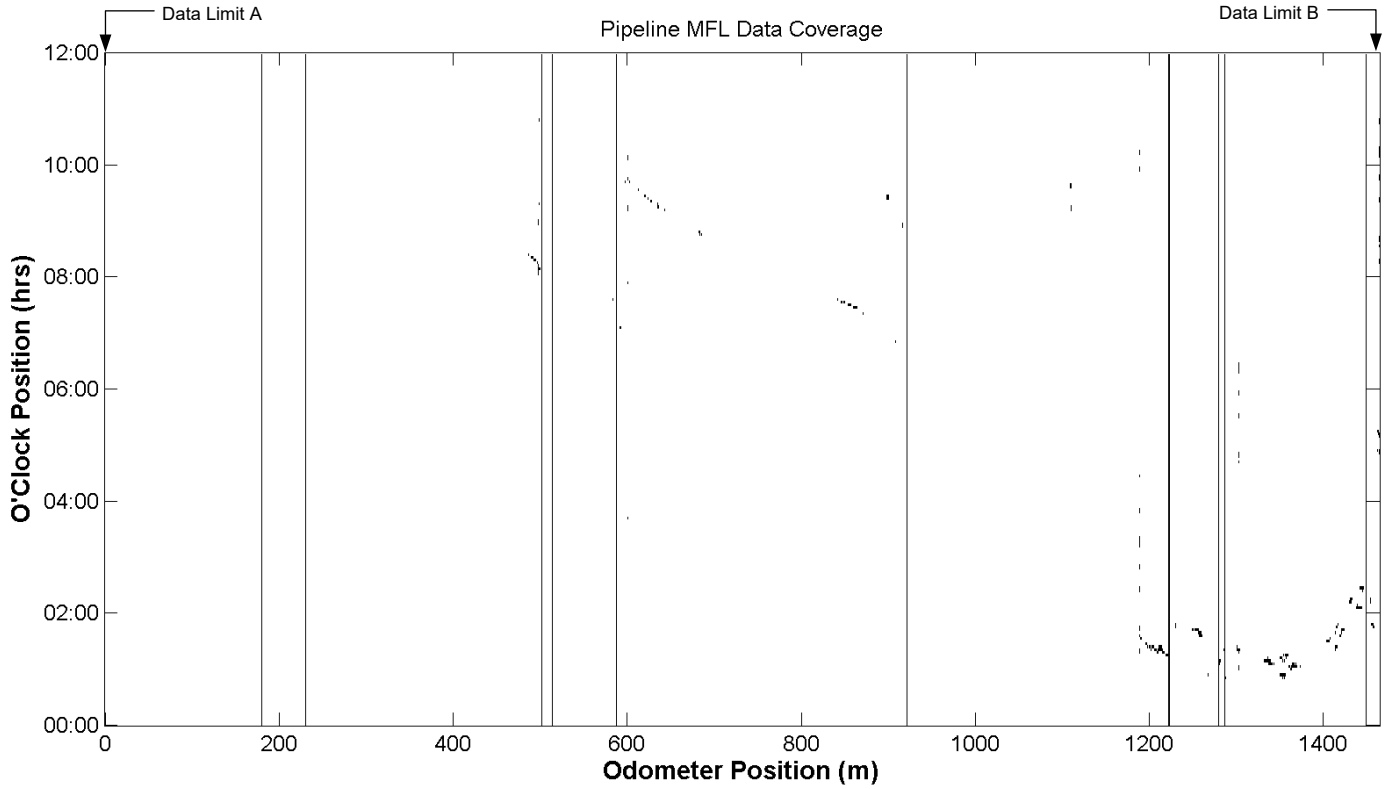
6.1 MFL Data Coverage Table

Min. Upstream Odometer Distance (m)	Max. Downstream Odometer Distance (m)	Inspected Pipeline Length (m)	Accepted MFL Data (m)	Pipeline Data Coverage (%)	Missing Data at Bends & Features (%)	Missing Data from Sensor Failure (%)
-1.68	1465.35	1467.03	1451.66	98.87	1.05	0.08

The Pipetel Explorer Robot inspected a pipeline length of 1467.03 m. from -1.68 m. to 1465.35 m. relative to the first identified weld, and collected 1451.66 m. of MFL data from the pipeline. The amount of MFL data was less than the odometer distance travelled by the robot because the MFL sensors are deactivated to traverse elbows and large features in the pipeline, resulting in absent MFL data before and after each elbow and large feature in the pipeline.

6.2 MFL Data Coverage Map

A map of pipeline data coverage for the NPS 20 Lakeshore - Yonge inspection is shown in the figure. White indicates MFL data. Black bands of missing data occur around features in the pipeline such as bends, launch sites, or sensor shutdown locations.



7 LDS Pipeline Data Coverage

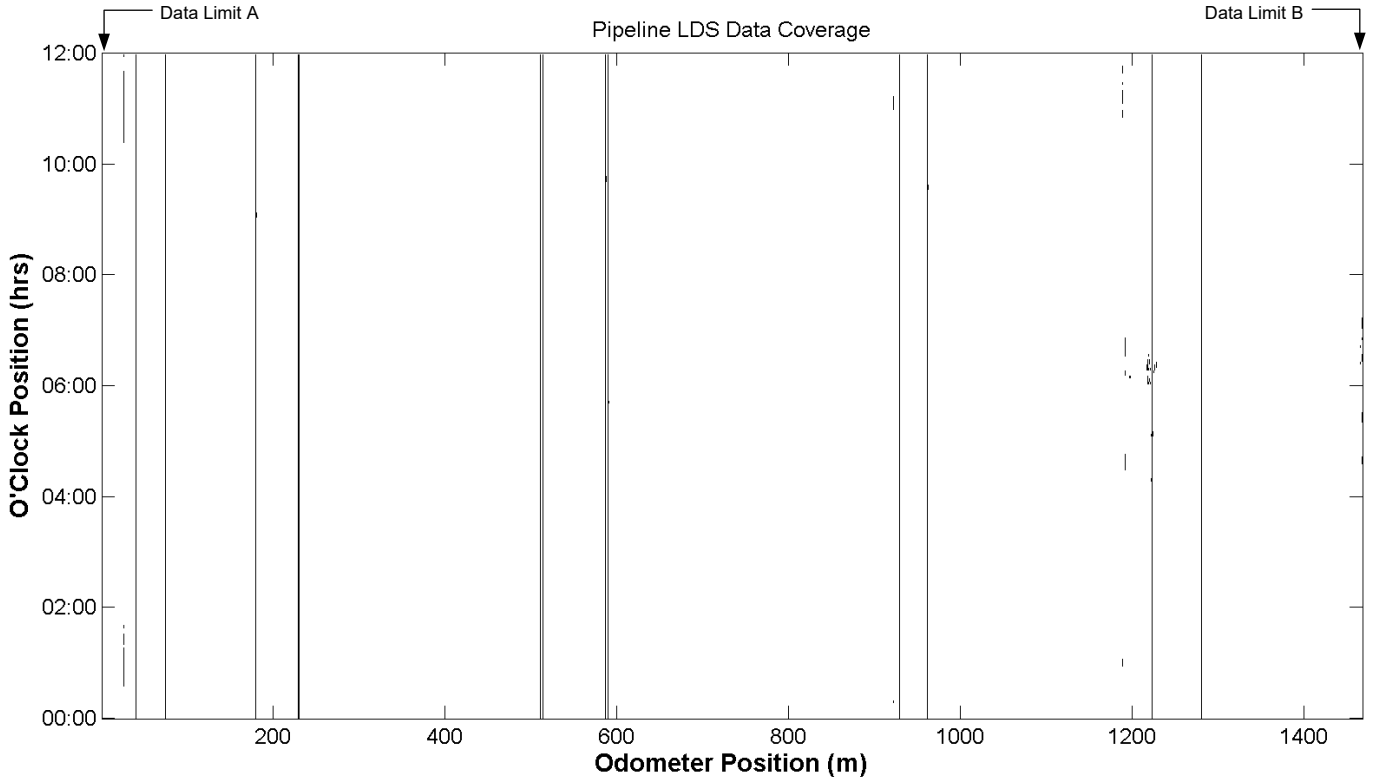
7.1 LDS Data Coverage Table

Min. Upstream Odometer Distance (m)	Max. Downstream Odometer Distance (m)	Inspected Pipeline Length (m)	Accepted LDS Data (m)	Pipeline Data Coverage (%)	Missing Data at Bends & Features (%)	Missing Data from Sensor Failure (%)
0.71	1467.76	1467.05	1455.24	99.17	0.81	0.02

The Pipetel Robot inspected a pipeline length of 1467.05 m. from 0.71 m. to 1467.76 m. relative to the first identified weld, and collected 1455.24 m**.** of LDS data from the pipeline. The amount of LDS data was less than the odometer distance travelled by the robot because the LDS sensors do not collect useable data around elbows and large features in the pipeline, resulting in absent data before and after each elbow and large feature in the pipeline.

7.2 LDS Data Coverage Map

A map of pipeline data coverage for the NPS 20 Lakeshore - Yonge inspection is shown in the figure. White indicates LDS data, while black indicates missing LDS data regions. Black bands of missing data occur around features in the pipeline such as bends, launch sites, or sensor shutdown locations.



8 Feature Listing (All reported features)

All reportable features identified in the inspection data are provided in the table below.

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
O001	--	Other Feature	-1.676	--	--			--	7.92	NA		Start of run
A001	--	Indication	-0.225	15%	--	20.3	53.3	03:58	7.92	External	circ groove	
A002	C001	Indication	-0.180	21%	--	25.4	27.9	06:29	7.92	External	general	
A003	C001	Indication	-0.176	32%	--	12.7	22.9	06:03	7.92	External	pitting	
C001	--	Cluster	-0.156	32%	--	76.2	83.8	06:17	7.92	External	general	
A004	C001	Indication	-0.122	19%	--	10.2	7.6	06:06	7.92	External	axial slot	
A005	--	Indication	-0.099	35%	--	12.7	15.2	04:40	7.92	External	pitting	
A006	--	Indication	-0.030	39%	--	15.2	25.4	05:05	7.92	External	pitting	At weld
A007	--	Indication	-0.015	38%	--	12.7	25.4	06:05	7.92	External	circ groove	At weld
W001		Weld	0.000	--	--			--	7.92	NA (weld)		The first detected weld from MFL
A008	--	Indication	0.126	20%	--	15.2	12.7	05:39	7.92	External	pitting	
A009	--	Indication	0.130	15%	--	10.2	10.2	06:06	7.92	External	pitting	
A010	--	Indication	0.191	34%	--	17.8	17.8	05:42	7.92	External	pitting	
A011	--	Indication	3.659	37%	--	27.9	27.9	10:39	7.92	External	general	
A012	--	Indication	5.894	15%	--	12.7	10.2	10:30	7.92	External	pitting	
A013	C002	Indication	6.830	15%	--	10.2	10.2	00:41	7.92	External	pitting	
C002	--	Cluster	6.856	15%	--	61.0	17.8	00:40	7.92	External	axial groove	
A014	C002	Indication	6.879	15%	--	12.7	15.2	00:40	7.92	External	pitting	
A015	--	Indication	7.384	15%	--	15.2	15.2	00:39	7.92	External	pitting	
A016	--	Indication	11.224	15%	--	12.7	10.2	04:38	7.92	External	pitting	
A017	--	Indication	13.550	16%	--	12.7	12.7	08:08	7.92	External	pitting	
A018	C003	Indication	13.636	15%	--	10.2	10.2	08:06	7.92	External	pitting	
C003	--	Cluster	13.668	16%	--	73.7	43.2	07:58	7.92	External	general	
A019	C003	Indication	13.699	16%	--	12.7	22.9	07:53	7.92	External	pitting	
W002		Weld	13.777	--	--			--	7.92	NA (weld)		
A020	C004	Indication	14.034	21%	--	12.7	12.7	07:16	7.92	External	pitting	
C004	--	Cluster	14.037	21%	--	20.3	101.6	06:57	7.92	External	circ groove	
A021	C004	Indication	14.042	16%	--	10.2	10.2	06:36	7.92	External	pitting	
A022	--	Indication	15.268	15%	--	12.7	15.2	02:05	7.92	External	pitting	
A023	--	Indication	19.086	25%	--	27.9	27.9	11:14	7.92	External	general	
A024	C005	Indication	22.318	21%	--	15.2	15.2	03:25	7.92	External	pitting	
C005	--	Cluster	22.323	21%	--	25.4	35.6	03:29	7.92	External	general	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A025	C005	Indication	22.329	15%	--	12.7	12.7	03:34	7.92	External	pitting	
I001	--	Installation	22.776	--	--	17.8	15.2	11:52	7.92	NA		Tap
A026	C006	Indication	22.979	15%	--	10.2	10.2	03:38	7.92	External	pitting	
C006	--	Cluster	22.987	16%	--	25.4	48.3	03:46	7.92	External	general	
A027	C006	Indication	22.993	16%	--	15.2	15.2	03:54	7.92	External	pitting	
A028	--	Indication	23.195	15%	--	12.7	10.2	07:11	7.92	External	pitting	
A029	--	Indication	23.219	15%	--	7.6	7.6	08:05	7.92	External	pinhole	
O002	--	Other Feature	23.281	--	--			--	7.92	NA		Circumferential fillet weld
I002	--	Installation	23.551	--	--	91.4	86.4	09:00	7.92	NA		Offtake
O003	--	Other Feature	23.841	--	--			--	7.92	NA		Circumferential fillet weld
A030	--	Indication	23.885	23%	--	15.2	15.2	07:25	7.92	External	pitting	
I003	--	Installation	24.542	--	--	68.6	73.7	11:57	7.92	NA		Tap
I004	--	Installation	25.490	--	--	30.5	25.4	00:10	7.92	NA		Tap
O004	--	Other Feature	26.152	--	--			--	7.92	NA		Circumferential fillet weld
I005	--	Installation	26.496	--	--	492.8	500.4	11:51	7.92	NA		Stopple with coupon
O005	--	Other Feature	27.003	--	--			--	7.92	NA		Circumferential fillet weld
W003		Weld	27.472	--	--			--	7.92	NA (weld)		
O006	--	Other Feature	29.034	--	--			--	7.92	NA		Circumferential fillet weld
I006	--	Installation	29.285	--	--	94.0	109.2	09:11	7.92	NA		Offtake
O007	--	Other Feature	29.575	--	--			--	7.92	NA		Circumferential fillet weld
I007	--	Installation	30.350	--	--	66.0	81.3	00:05	7.92	NA		Tap
I008	--	Installation	31.671	--	--	53.3	55.9	00:00	7.92	NA		Tap
A031	--	Indication	31.917	15%	--	15.2	15.2	04:33	7.92	External	pitting	
W004		Weld	35.342	--	--			--	7.92	NA (weld)		
A032	--	Indication	37.085	22%	--	12.7	27.9	02:27	7.92	External	circ groove	
A033	--	Indication	37.238	23%	--	15.2	15.2	00:14	7.92	External	pitting	
A034	--	Indication	37.482	15%	--	12.7	12.7	00:40	7.92	External	pitting	
A035	C007	Indication	37.497	10%	--	12.7	12.7	10:10	7.92	External	pitting	
A036	C007	Indication	37.541	13%	--	12.7	30.5	10:33	7.92	External	circ groove	
A037	C007	Indication	37.544	13%	--	15.2	27.9	09:33	7.92	External	pitting	
C007	--	Cluster	37.545	23%	--	106.7	190.5	09:57	7.92	External	general	
A038	C007	Indication	37.572	23%	--	12.7	15.2	09:18	7.92	External	pitting	
A039	C007	Indication	37.591	23%	--	15.2	33.0	09:57	7.92	External	circ groove	
A040	--	Indication	37.693	10%	--	10.2	10.2	00:24	7.92	External	pitting	
A041	--	Indication	37.735	14%	--	17.8	15.2	02:43	7.92	External	pitting	
A042	--	Indication	37.931	23%	--	10.2	12.7	00:24	7.92	External	pitting	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A043	--	Indication	39.673	25%	--	12.7	20.3	06:32	7.92	External	pitting	Interacting with long seam
A044	--	Indication	39.885	33%	--	12.7	27.9	06:34	7.92	External	circ groove	Interacting with long seam
W005		Weld	40.670	--	--			--	7.92	NA (weld)		Bend begin
I009	--	Installation	40.911	--	--			03:00	7.92	NA		Right bend center; 90+10.9
W006		Weld	41.225	--	--			--	7.92	NA (weld)		Bend end
A045	--	Indication	42.770	10%	--	12.7	22.9	05:39	7.92	External	pitting	
W007		Weld	44.804	--	--			--	7.92	NA (weld)		
A046	C008	Indication	46.383	40%	--	12.7	17.8	08:50	7.92	External	pitting	
C008	--	Cluster	46.386	57%	--	17.8	50.8	08:42	7.92	External	circ groove	
A047	C008	Indication	46.388	57%	--	15.2	27.9	08:38	7.92	External	pitting	
A048	C009	Indication	46.677	44%	--	17.8	27.9	09:02	7.92	External	pitting	
A049	C009	Indication	46.677	37%	--	12.7	15.2	08:51	7.92	External	pitting	
C009	--	Cluster	46.678	44%	--	17.8	68.6	09:03	7.92	External	circ groove	
A050	C009	Indication	46.679	32%	--	17.8	27.9	09:12	7.92	External	pitting	
A051	--	Indication	47.982	22%	--	12.7	12.7	02:13	7.92	External	pitting	
I010	--	Installation	47.984	--	--	55.9	76.2	00:01	7.92	NA		Tap
A052	--	Indication	48.009	42%	--	15.2	33.0	03:02	7.92	External	circ groove	
A053	--	Indication	48.028	15%	--	33.0	17.8	08:56	7.92	External	pitting	
A054	--	Indication	48.142	38%	--	12.7	27.9	03:20	7.92	External	circ groove	
A055	--	Indication	48.321	12%	--	15.2	15.2	10:00	7.92	External	pitting	
A056	--	Indication	48.859	10%	--	12.7	15.2	00:04	7.92	External	pitting	
A057	--	Indication	48.937	35%	--	15.2	25.4	08:59	7.92	External	pitting	
A058	--	Indication	49.763	24%	--	15.2	12.7	11:19	7.92	External	pitting	
A059	--	Indication	54.421	22%	--	12.7	15.2	00:47	7.92	External	pitting	
W008		Weld	54.906	--	--			--	7.92	NA (weld)		
I011	--	Installation	58.844	--	--	40.6	43.2	11:56	7.92	NA		Attachment with HAZ
O008	--	Other Feature	61.028	--	--	61.0	63.5	11:33	7.92	NA		Close metal object
W009		Weld	67.083	--	--			--	7.92	NA (weld)		
O009	--	Other Feature	71.223	--	--	241.3	53.3	11:45	7.92	NA		Manufacturing related
D001	--	Dent	72.552	--	0.5%	55.9	53.3	00:37	7.92	NA		
O010	--	Other Feature	74.088	--	--	421.6	81.3	11:34	7.92	NA		Manufacturing related
W010		Weld	74.787	--	--			--	7.92	NA (weld)		Bend begin
I012	--	Installation	75.055	--	--			09:00	7.92	NA		Left bend center; 89+84.6
W011		Weld	75.319	--	--			--	7.92	NA (weld)		Bend end
O011	--	Other Feature	79.890	--	--	53.3	61.0	06:16	7.92	NA		Close metal object
W012		Weld	87.581	--	--			--	7.92	NA (weld)		

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
D002	--	Dent	91.575	--	0.5%	91.4	73.7	09:22	7.92	NA		
A060	--	Indication	93.942	10%	--	12.7	10.2	09:10	7.92	External	pitting	
W013		Weld	99.670	--	--			--	7.92	NA (weld)		
A061	C010	Indication	106.219	10%	--	15.2	15.2	11:10	7.92	External	pitting	
A062	C010	Indication	106.287	10%	--	12.7	12.7	11:09	7.92	External	pitting	
A063	C010	Indication	106.349	10%	--	17.8	15.2	11:13	7.92	External	pitting	
A064	C010	Indication	106.385	10%	--	10.2	12.7	11:22	7.92	External	pitting	
C010	--	Cluster	106.415	11%	--	406.4	104.1	11:29	7.92	External	general	
A065	C010	Indication	106.446	11%	--	15.2	12.7	11:23	7.92	External	pitting	
A066	C010	Indication	106.484	10%	--	12.7	12.7	11:48	7.92	External	pitting	
A067	C010	Indication	106.565	10%	--	15.2	17.8	11:48	7.92	External	pitting	
A068	C010	Indication	106.611	10%	--	17.8	17.8	11:48	7.92	External	pitting	
O012	--	Other Feature	110.411	--	--	22.9	66.0	10:28	7.92	NA		Manufacturing related; On long seam
W014		Weld	111.722	--	--			--	7.92	NA (weld)		
W015		Weld	123.923	--	--			--	7.92	NA (weld)		
O013	--	Other Feature	128.517	--	--	22.9	38.1	11:56	7.92	NA		Close metal object
O014	--	Other Feature	128.764	--	--	17.8	38.1	11:54	7.92	NA		Close metal object
O015	--	Other Feature	131.708	--	--	48.3	53.3	10:55	7.92	NA		Close metal object
W016		Weld	136.131	--	--			--	7.92	NA (weld)		
W017		Weld	148.311	--	--			--	7.92	NA (weld)		
O016	--	Other Feature	157.185	--	--	27.9	119.4	00:51	7.92	NA		Manufacturing related
W018		Weld	160.519	--	--			--	7.92	NA (weld)		
O017	--	Other Feature	163.052	--	--	218.4	104.1	08:14	7.92	NA		Manufacturing related
O018	--	Other Feature	165.955	--	--	218.4	96.5	08:16	7.92	NA		Manufacturing related
O019	--	Other Feature	168.854	--	--	231.1	88.9	08:12	7.92	NA		Manufacturing related
O020	--	Other Feature	171.762	--	--	223.5	83.8	08:07	7.92	NA		Manufacturing related
W019		Weld	172.662	--	--			--	7.92	NA (weld)		
O021	--	Other Feature	174.270	--	--	264.2	264.2	02:05	7.92	NA		Manufacturing related
A069	--	Indication	174.511	12%	--	10.2	10.2	04:01	7.92	External	pitting	
W020		Weld	179.470	--	--			--	7.92	NA (weld)		Bend begin
I013	--	Installation	179.930	--	--			09:00	7.92	NA		Left bend center; 88+81.5
W021		Weld	180.441	--	--			--	7.92	NA (weld)		Bend end
O022	--	Other Feature	180.724	--	--	22.9	505.5	07:17	7.92	NA		Manufacturing related
O023	--	Other Feature	181.656	--	--	30.5	1038.9	06:53	7.92	NA		Manufacturing related
O024	--	Other Feature	182.570	--	--	25.4	889.0	06:18	7.92	NA		Manufacturing related
O025	--	Other Feature	183.476	--	--	22.9	952.5	06:39	7.92	NA		Manufacturing related

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
O026	--	Other Feature	184.379	--	--	25.4	368.3	06:56	7.92	NA		Manufacturing related
O027	--	Other Feature	185.293	--	--	17.8	266.7	08:07	7.92	NA		Manufacturing related
O028	--	Other Feature	186.185	--	--	22.9	652.8	06:13	7.92	NA		Manufacturing related
O029	--	Other Feature	187.097	--	--	22.9	866.1	06:33	7.92	NA		Manufacturing related
O030	--	Other Feature	188.007	--	--	25.4	513.1	06:23	7.92	NA		Manufacturing related
O031	--	Other Feature	188.905	--	--	25.4	640.1	06:59	7.92	NA		Manufacturing related
O032	--	Other Feature	189.796	--	--	17.8	823.0	06:37	7.92	NA		Manufacturing related
O033	--	Other Feature	190.691	--	--	22.9	795.0	06:13	7.92	NA		Manufacturing related
O034	--	Other Feature	191.611	--	--	22.9	408.9	08:53	7.92	NA		Manufacturing related
W022		Weld	192.687	--	--			--	7.92	NA (weld)		
D003	--	Dent	193.931	--	1.9%	114.3	99.1	11:49	7.92	NA		
A070	C011	Indication	195.005	15%	--	17.8	17.8	00:17	7.92	External	pitting	
A071	C011	Indication	195.080	10%	--	15.2	15.2	00:05	7.92	External	pitting	
A072	C011	Indication	195.168	10%	--	17.8	17.8	00:04	7.92	External	pitting	
A073	C011	Indication	195.233	10%	--	12.7	12.7	11:35	7.92	External	pitting	
A074	C011	Indication	195.321	10%	--	17.8	17.8	11:33	7.92	External	pitting	
C011	--	Cluster	195.331	15%	--	668.0	218.4	11:31	7.92	External	general	
A075	C011	Indication	195.376	14%	--	15.2	15.2	11:21	7.92	External	pitting	
A076	C011	Indication	195.413	10%	--	12.7	12.7	11:18	7.92	External	pitting	
A077	C011	Indication	195.458	10%	--	10.2	10.2	11:21	7.92	External	pitting	
A078	C011	Indication	195.538	10%	--	15.2	15.2	11:14	7.92	External	pitting	
A079	C011	Indication	195.561	10%	--	20.3	17.8	10:47	7.92	External	pitting	
A080	C011	Indication	195.644	15%	--	15.2	15.2	10:45	7.92	External	pitting	
A081	C011	Indication	195.654	11%	--	22.9	22.9	11:12	7.92	External	pitting	
D004	--	Dent	201.437	--	0.5%	106.7	94.0	03:18	7.92	NA		
D005	--	Dent	201.450	--	0.6%	124.5	114.3	08:23	7.92	NA		
D006	--	Dent	203.224	--	0.5%	40.6	61.0	11:32	7.92	NA		
W023		Weld	204.876	--	--			--	7.92	NA (weld)		
A082	--	Indication	206.916	34%	--	12.7	12.7	09:04	7.92	External	pitting	
A083	C012	Indication	207.248	10%	--	10.2	12.7	09:00	7.92	External	pitting	
C012	--	Cluster	207.281	15%	--	76.2	101.6	09:20	7.92	External	general	
A084	C012	Indication	207.283	15%	--	15.2	15.2	09:10	7.92	External	pitting	
A085	C012	Indication	207.310	11%	--	17.8	20.3	09:38	7.92	External	pitting	
A086	--	Indication	207.732	15%	--	15.2	15.2	08:42	7.92	External	pitting	
O035	--	Other Feature	207.991	--	--	22.9	25.4	01:31	7.92	NA		Manufacturing related; On long seam
A087	C013	Indication	208.161	21%	--	12.7	12.7	09:21	7.92	External	pitting	

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C013	--	Cluster	208.170	22%	--	30.5	53.3	09:12	7.92	External	general	
A088	C013	Indication	208.178	22%	--	15.2	30.5	09:06	7.92	External	circ groove	
W024		Weld	217.106	--	--			--	7.92	NA (weld)		
A089	--	Indication	223.217	10%	--	12.7	27.9	06:58	7.92	External	circ groove	
A090	C014	Indication	225.813	10%	--	22.9	27.9	02:41	7.92	External	pitting	
A091	C014	Indication	225.869	10%	--	7.6	10.2	02:47	7.92	External	circ slot	
A092	C014	Indication	225.947	10%	--	20.3	20.3	02:36	7.92	External	pitting	
A093	C014	Indication	226.036	10%	--	10.2	10.2	02:32	7.92	External	pitting	
C014	--	Cluster	226.064	20%	--	525.8	162.6	02:13	7.92	External	general	
A094	C014	Indication	226.085	10%	--	15.2	12.7	02:31	7.92	External	pitting	
A095	C014	Indication	226.138	10%	--	12.7	12.7	02:15	7.92	External	pitting	
A096	C014	Indication	226.192	10%	--	12.7	15.2	02:13	7.92	External	pitting	
A097	C014	Indication	226.241	10%	--	10.2	10.2	02:02	7.92	External	pitting	
A098	C014	Indication	226.315	20%	--	25.4	25.4	01:42	7.92	External	general	
A099	--	Indication	226.456	21%	--	15.2	15.2	00:19	7.92	External	pitting	
A100	--	Indication	226.549	10%	--	15.2	15.2	00:12	7.92	External	pitting	
A101	--	Indication	226.971	10%	--	12.7	12.7	10:37	7.92	External	pitting	
A102	C015	Indication	227.252	11%	--	15.2	17.8	03:13	7.92	External	pitting	
C015	--	Cluster	227.285	12%	--	81.3	109.2	02:52	7.92	External	general	
A103	C015	Indication	227.311	12%	--	27.9	27.9	02:34	7.92	External	general	
A104	--	Indication	228.314	11%	--	10.2	7.6	04:09	7.92	External	axial slot	
A105	--	Indication	228.960	10%	--	12.7	22.9	01:51	7.92	External	pitting	
W025		Weld	229.488	--	--			--	7.92	NA (weld)		Bend begin
I014	--	Installation	229.919	--	--			03:00	7.92	NA		Right bend center; 88+63.6
W026		Weld	230.457	--	--			--	7.92	NA (weld)		Bend end
A106	--	Indication	230.657	23%	--	12.7	43.2	03:07	7.92	External	circ groove	
A107	--	Indication	231.495	11%	--	15.2	12.7	00:20	7.92	External	pitting	
A108	--	Indication	234.384	10%	--	17.8	15.2	00:21	7.92	External	pitting	
A109	--	Indication	234.707	15%	--	12.7	15.2	03:11	7.92	External	pitting	
W027		Weld	242.714	--	--			--	7.92	NA (weld)		
A110	C016	Indication	243.430	10%	--	15.2	12.7	11:21	7.92	External	pitting	
C016	--	Cluster	243.449	10%	--	50.8	45.7	11:29	7.92	External	general	
A111	C016	Indication	243.464	10%	--	22.9	20.3	11:35	7.92	External	pitting	
A112	--	Indication	243.632	10%	--	12.7	12.7	11:37	7.92	External	pitting	
A113	--	Indication	243.850	10%	--	17.8	15.2	00:00	7.92	External	pitting	
A114	--	Indication	244.094	10%	--	12.7	12.7	00:00	7.92	External	pitting	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A115	C017	Indication	244.295	10%	--	12.7	15.2	00:22	7.92	External	pitting	
A116	C017	Indication	244.322	15%	--	15.2	12.7	00:28	7.92	External	pitting	
C017	--	Cluster	244.325	15%	--	73.7	27.9	00:25	7.92	External	general	
A117	C017	Indication	244.357	10%	--	10.2	7.6	00:28	7.92	External	axial slot	
O036	--	Other Feature	244.765	--	--	86.4	68.6	03:36	7.92	NA		Close metal object
A118	C018	Indication	246.761	10%	--	17.8	15.2	11:56	7.92	External	pitting	
A119	C018	Indication	246.779	10%	--	15.2	12.7	00:22	7.92	External	pitting	
C018	--	Cluster	246.802	10%	--	99.1	71.1	00:09	7.92	External	general	
A120	C018	Indication	246.846	10%	--	12.7	12.7	00:20	7.92	External	pitting	
A121	--	Indication	247.310	12%	--	17.8	17.8	00:23	7.92	External	pitting	
A122	C019	Indication	250.508	10%	--	12.7	12.7	00:58	7.92	External	pitting	
A123	C019	Indication	250.567	10%	--	20.3	20.3	01:08	7.92	External	pitting	
C019	--	Cluster	250.587	14%	--	170.2	94.0	00:51	7.92	External	general	
A124	C019	Indication	250.625	11%	--	12.7	12.7	00:45	7.92	External	pitting	
A125	C019	Indication	250.653	14%	--	15.2	15.2	00:33	7.92	External	pitting	
A126	C019	Indication	250.667	14%	--	12.7	10.2	01:09	7.92	External	pitting	
A127	--	Indication	250.765	14%	--	12.7	12.7	00:36	7.92	External	pitting	
A128	--	Indication	250.911	15%	--	17.8	27.9	00:40	7.92	External	pitting	
A129	--	Indication	251.633	10%	--	17.8	27.9	10:59	7.92	External	pitting	
A130	C020	Indication	252.833	13%	--	22.9	25.4	11:19	7.92	External	pitting	
A131	C020	Indication	252.847	12%	--	12.7	10.2	10:55	7.92	External	pitting	
A132	C020	Indication	252.886	10%	--	20.3	17.8	11:56	7.92	External	pitting	
A133	C020	Indication	252.953	10%	--	15.2	27.9	00:00	7.92	External	pitting	
C020	--	Cluster	252.960	20%	--	276.9	226.1	11:44	7.92	External	general	
A134	C020	Indication	252.977	10%	--	12.7	12.7	11:20	7.92	External	pitting	
A135	C020	Indication	253.017	10%	--	12.7	12.7	11:43	7.92	External	pitting	
A136	C020	Indication	253.076	18%	--	15.2	15.2	00:02	7.92	External	pitting	
A137	C020	Indication	253.092	20%	--	15.2	15.2	00:31	7.92	External	pitting	
A138	--	Indication	253.459	14%	--	17.8	27.9	00:05	7.92	External	pitting	
W028		Weld	254.991	--	--			--	7.92	NA (weld)		
I015	--	Installation	260.029	--	--	48.3	58.4	00:12	7.92	NA		Tap
A139	--	Indication	261.229	15%	--	10.2	10.2	11:55	7.92	External	pitting	
D007	--	Dent	262.859	--	0.5%	109.2	99.1	11:15	7.92	NA		
A140	--	Indication	266.822	10%	--	15.2	12.7	01:46	7.92	External	pitting	
A141	C021	Indication	267.001	10%	--	15.2	12.7	04:03	7.92	External	pitting	
C021	--	Cluster	267.005	10%	--	20.3	78.7	03:49	7.92	External	circ groove	

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A142	C021	Indication	267.009	10%	--	12.7	12.7	03:34	7.92	External	pitting	
A143	--	Indication	267.062	12%	--	12.7	10.2	02:23	7.92	External	pitting	At weld
A144	--	Indication	267.083	16%	--	12.7	12.7	03:45	7.92	External	pitting	At weld
W029		Weld	267.104	--	--			--	7.92	NA (weld)		
I016	--	Installation	276.550	--	--	83.8	88.9	00:00	7.92	NA		Tap
W030		Weld	277.861	--	--			--	7.92	NA (weld)		
W031		Weld	290.085	--	--			--	7.92	NA (weld)		
I017	--	Installation	295.103	--	--	45.7	58.4	00:00	7.92	NA		Tap
I018	--	Installation	296.097	--	--	43.2	61.0	00:01	7.92	NA		Tap
W032		Weld	297.992	--	--			--	7.92	NA (weld)		
I019	--	Installation	299.040	--	--	43.2	53.3	11:57	7.92	NA		Tap
O037	--	Other Feature	299.974	--	--			--	7.92	NA		Circumferential fillet weld
I020	--	Installation	300.358	--	--	497.8	487.7	11:45	7.92	NA		Stopple with coupon
O038	--	Other Feature	300.820	--	--			--	7.92	NA		Circumferential fillet weld
A145	C022	Indication	301.081	15%	--	10.2	10.2	04:59	7.92	External	pitting	
A146	C022	Indication	301.137	15%	--	10.2	12.7	04:40	7.92	External	pitting	
C022	--	Cluster	301.145	15%	--	139.7	53.3	04:50	7.92	External	general	
A147	C022	Indication	301.210	15%	--	10.2	12.7	04:42	7.92	External	pitting	
A148	--	Indication	301.478	15%	--	12.7	25.4	03:20	7.92	External	circ groove	
I021	--	Installation	302.153	--	--	71.1	78.7	00:00	7.92	NA		Attachment with HAZ
A149	--	Indication	302.259	15%	--	15.2	12.7	01:17	7.92	External	pitting	
I022	--	Installation	302.284	--	--	35.6	45.7	00:03	7.92	NA		Attachment with HAZ
A150	--	Indication	304.564	16%	--	15.2	15.2	02:43	7.92	External	pitting	
O039	--	Other Feature	306.810	--	--			--	7.92	NA		Circumferential fillet weld
I023	--	Installation	307.074	--	--	88.9	96.5	08:58	7.92	NA		Offtake
O040	--	Other Feature	307.355	--	--			--	7.92	NA		Circumferential fillet weld
A151	--	Indication	308.743	15%	--	12.7	12.7	02:33	7.92	External	pitting	
A152	--	Indication	309.528	16%	--	15.2	12.7	07:54	7.92	External	pitting	
A153	--	Indication	310.255	21%	--	12.7	12.7	01:42	7.92	External	pitting	
A154	C023	Indication	310.258	20%	--	15.2	15.2	00:07	7.92	External	pitting	
C023	--	Cluster	310.265	31%	--	27.9	104.1	11:46	7.92	External	general	
A155	C023	Indication	310.272	31%	--	12.7	22.9	11:28	7.92	External	pitting	
W033		Weld	311.051	--	--			--	7.92	NA (weld)		
I024	--	Installation	316.410	--	--	86.4	111.8	00:00	7.92	NA		Tap
A156	C024	Indication	318.717	15%	--	10.2	10.2	09:11	7.92	External	pitting	
C024	--	Cluster	318.738	32%	--	50.8	12.7	09:11	7.92	External	axial groove	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A157	C024	Indication	318.756	32%	--	15.2	12.7	09:11	7.92	External	pitting	
A158	--	Indication	320.209	15%	--	15.2	15.2	09:03	7.92	External	pitting	
O041	--	Other Feature	320.289	--	--	53.3	320.0	04:22	7.92	NA		Manufacturing related
A159	--	Indication	320.441	20%	--	17.8	15.2	01:59	7.92	External	pitting	
A160	C025	Indication	320.515	15%	--	7.6	7.6	02:00	7.92	External	pinhole	
C025	--	Cluster	320.542	21%	--	63.5	149.9	02:12	7.92	External	general	
A161	C025	Indication	320.548	15%	--	7.6	7.6	01:58	7.92	External	pinhole	
A162	C025	Indication	320.557	21%	--	15.2	12.7	02:43	7.92	External	pitting	
A163	C025	Indication	320.568	15%	--	10.2	10.2	01:41	7.92	External	pitting	
A164	--	Indication	320.959	15%	--	15.2	15.2	09:20	7.92	External	pitting	
O042	--	Other Feature	321.046	--	--	45.7	525.8	05:08	7.92	NA		Manufacturing related
A165	C026	Indication	324.380	45%	--	25.4	25.4	08:32	7.92	External	general	
C026	--	Cluster	324.405	45%	--	76.2	50.8	08:25	7.92	External	general	
A166	C026	Indication	324.435	15%	--	12.7	27.9	08:20	7.92	External	circ groove	
A167	--	Indication	324.514	15%	--	15.2	12.7	05:15	7.92	External	pitting	
W034		Weld	324.591	--	--			--	7.92	NA (weld)		
A168	--	Indication	325.231	16%	--	15.2	12.7	08:00	7.92	External	pitting	
A169	--	Indication	326.140	31%	--	17.8	17.8	07:04	7.92	External	pitting	
A170	--	Indication	327.390	32%	--	10.2	10.2	00:05	7.92	External	pitting	
A171	C027	Indication	327.394	15%	--	7.6	10.2	04:44	7.92	External	circ slot	
A172	C027	Indication	327.433	28%	--	12.7	20.3	04:33	7.92	External	pitting	
A173	C027	Indication	327.461	15%	--	7.6	7.6	04:50	7.92	External	pinhole	
A174	C027	Indication	327.490	20%	--	10.2	10.2	05:19	7.92	External	pitting	
A175	C027	Indication	327.513	22%	--	10.2	10.2	05:14	7.92	External	pitting	
A176	C027	Indication	327.533	15%	--	10.2	12.7	07:08	7.92	External	pitting	
A177	C027	Indication	327.555	20%	--	12.7	25.4	05:23	7.92	External	circ groove	
A178	C027	Indication	327.589	20%	--	12.7	15.2	07:01	7.92	External	pitting	
A179	--	Indication	327.602	15%	--	15.2	15.2	03:40	7.92	External	pitting	
C027	--	Cluster	327.603	33%	--	426.7	386.1	05:43	7.92	External	general	
A180	C027	Indication	327.605	15%	--	10.2	10.2	06:56	7.92	External	pitting	
A181	C027	Indication	327.610	29%	--	12.7	10.2	05:23	7.92	External	pitting	
A182	C027	Indication	327.621	15%	--	10.2	10.2	05:58	7.92	External	pitting	
A183	C027	Indication	327.648	15%	--	7.6	5.1	06:13	7.92	External	pinhole	
A184	C027	Indication	327.694	28%	--	12.7	22.9	07:03	7.92	External	pitting	
A185	C027	Indication	327.701	33%	--	10.2	10.2	06:26	7.92	External	pitting	
A186	C027	Indication	327.703	21%	--	7.6	7.6	05:16	7.92	External	pinhole	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A187	C027	Indication	327.723	30%	--	12.7	12.7	06:13	7.92	External	pitting	
A188	C027	Indication	327.735	15%	--	10.2	22.9	05:01	7.92	External	circ groove	
A189	C027	Indication	327.771	15%	--	10.2	10.2	05:32	7.92	External	pitting	
A190	C027	Indication	327.790	15%	--	15.2	12.7	04:18	7.92	External	pitting	
A191	C027	Indication	327.811	15%	--	10.2	12.7	04:44	7.92	External	pitting	
W035		Weld	328.237	--	--			--	7.92	NA (weld)		
A192	--	Indication	328.448	15%	--	15.2	12.7	07:43	7.92	External	pitting	
A193	--	Indication	332.114	16%	--	15.2	15.2	08:53	7.92	External	pitting	
A194	--	Indication	332.138	32%	--	12.7	12.7	10:49	7.92	External	pitting	
A195	--	Indication	333.575	15%	--	15.2	15.2	03:34	7.92	External	pitting	
A196	C028	Indication	333.820	15%	--	15.2	15.2	08:30	7.92	External	pitting	
C028	--	Cluster	333.844	16%	--	63.5	30.5	08:33	7.92	External	general	
A197	C028	Indication	333.868	16%	--	15.2	15.2	08:36	7.92	External	pitting	
W036		Weld	341.645	--	--			--	7.92	NA (weld)		
W037		Weld	353.673	--	--			--	7.92	NA (weld)		
A198	C029	Indication	367.040	15%	--	15.2	12.7	07:08	7.92	External	pitting	
C029	--	Cluster	367.062	16%	--	58.4	94.0	07:26	7.92	External	general	
A199	C029	Indication	367.084	16%	--	15.2	15.2	07:44	7.92	External	pitting	
A200	--	Indication	367.184	15%	--	10.2	10.2	07:56	7.92	External	pitting	
A201	--	Indication	367.260	15%	--	12.7	12.7	08:19	7.92	External	pitting	At weld
W038		Weld	367.303	--	--			--	7.92	NA (weld)		
A202	--	Indication	367.474	16%	--	15.2	17.8	09:25	7.92	External	pitting	
A203	--	Indication	367.489	15%	--	12.7	12.7	10:22	7.92	External	pitting	
A204	--	Indication	367.500	15%	--	17.8	15.2	08:08	7.92	External	pitting	
A205	--	Indication	369.177	30%	--	17.8	17.8	00:01	7.92	External	pitting	
A206	C030	Indication	369.477	15%	--	15.2	17.8	00:24	7.92	External	pitting	
A207	C030	Indication	369.503	15%	--	15.2	15.2	00:06	7.92	External	pitting	
A208	C030	Indication	369.523	15%	--	10.2	12.7	00:30	7.92	External	pitting	
A209	C030	Indication	369.552	15%	--	12.7	15.2	00:45	7.92	External	pitting	
A210	C030	Indication	369.568	15%	--	15.2	17.8	11:43	7.92	External	pitting	
C030	--	Cluster	369.587	23%	--	233.7	160.0	00:15	7.92	External	general	
A211	C030	Indication	369.596	15%	--	12.7	12.7	00:12	7.92	External	pitting	
A212	C030	Indication	369.611	15%	--	17.8	15.2	00:48	7.92	External	pitting	
A213	C030	Indication	369.641	15%	--	12.7	20.3	00:06	7.92	External	pitting	
A214	C030	Indication	369.695	23%	--	17.8	17.8	00:30	7.92	External	pitting	
A215	--	Indication	376.384	15%	--	15.2	17.8	00:36	7.92	External	pitting	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A216	--	Indication	377.569	39%	--	10.2	10.2	02:05	7.92	External	pitting	
A217	--	Indication	379.316	21%	--	12.7	15.2	01:03	7.92	External	pitting	
A218	C032	Indication	379.324	22%	--	12.7	30.5	10:50	7.92	External	circ groove	
A219	--	Indication	379.325	15%	--	10.2	12.7	01:51	7.92	External	pitting	
A220	C031	Indication	379.338	37%	--	15.2	30.5	08:25	7.92	External	circ groove	
C031	--	Cluster	379.352	37%	--	43.2	104.1	08:42	7.92	External	general	
C032	--	Cluster	379.354	22%	--	73.7	99.1	10:35	7.92	External	general	
A221	C031	Indication	379.369	15%	--	10.2	10.2	09:03	7.92	External	pitting	
A222	C032	Indication	379.383	15%	--	15.2	17.8	10:16	7.92	External	pitting	
W039		Weld	379.569	--	--			--	7.92	NA (weld)		
A223	C033	Indication	379.756	39%	--	10.2	17.8	10:25	7.92	External	pitting	
C033	--	Cluster	379.777	40%	--	53.3	355.6	09:40	7.92	External	general	
A224	C033	Indication	379.779	26%	--	15.2	27.9	09:13	7.92	External	pitting	
A225	C033	Indication	379.780	16%	--	10.2	10.2	10:57	7.92	External	pitting	
A226	C033	Indication	379.784	30%	--	15.2	25.4	09:49	7.92	External	pitting	
A227	C033	Indication	379.786	40%	--	15.2	17.8	10:15	7.92	External	pitting	
A228	C033	Indication	379.795	31%	--	15.2	27.9	08:26	7.92	External	pitting	
A229	C033	Indication	379.798	32%	--	10.2	20.3	10:50	7.92	External	circ groove	
A230	--	Indication	382.709	15%	--	10.2	10.2	07:12	7.92	External	pitting	
A231	--	Indication	383.674	35%	--	15.2	20.3	05:55	7.92	External	pitting	
A232	--	Indication	384.662	43%	--	12.7	20.3	07:00	7.92	External	pitting	
A233	C034	Indication	384.667	23%	--	10.2	10.2	07:37	7.92	External	pitting	
C034	--	Cluster	384.694	26%	--	63.5	30.5	07:42	7.92	External	general	
A234	C034	Indication	384.720	26%	--	10.2	10.2	07:46	7.92	External	pitting	
A235	--	Indication	384.808	25%	--	10.2	12.7	07:21	7.92	External	pitting	
A236	--	Indication	386.531	21%	--	15.2	15.2	02:30	7.92	External	pitting	
A237	--	Indication	389.217	15%	--	12.7	12.7	07:52	7.92	External	pitting	
A238	--	Indication	390.336	20%	--	15.2	15.2	07:40	7.92	External	pitting	
A239	--	Indication	391.116	15%	--	12.7	10.2	00:00	7.92	External	pitting	
A240	--	Indication	392.742	15%	--	12.7	25.4	07:12	7.92	External	circ groove	
A241	--	Indication	392.895	15%	--	15.2	15.2	06:45	7.92	External	pitting	
W040		Weld	392.993	--	--			--	7.92	NA (weld)		
A242	--	Indication	393.201	15%	--	20.3	66.0	05:34	7.92	External	circ groove	
A243	--	Indication	393.203	15%	--	12.7	22.9	04:06	7.92	External	pitting	
O043	--	Other Feature	394.439	--	--	63.5	83.8	01:52	7.92	NA		Close metal object
A244	--	Indication	396.442	15%	--	12.7	12.7	08:42	7.92	External	pitting	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
W041		Weld	405.893	--	--			--	7.92	NA (weld)		
A245	--	Indication	416.803	30%	--	10.2	10.2	06:15	7.92	External	pitting	At weld
W042		Weld	416.838	--	--			--	7.92	NA (weld)		
A246	--	Indication	416.891	18%	--	12.7	20.3	06:01	7.92	External	pitting	
A247	--	Indication	416.990	35%	--	15.2	27.9	06:45	7.92	External	pitting	
A248	C035	Indication	417.085	20%	--	15.2	40.6	05:05	7.92	External	circ groove	
A249	C035	Indication	417.085	34%	--	17.8	35.6	06:00	7.92	External	circ groove	
C035	--	Cluster	417.090	48%	--	27.9	304.8	06:05	7.92	External	general	
A250	C035	Indication	417.093	33%	--	15.2	30.5	07:07	7.92	External	circ groove	
A251	C035	Indication	417.095	48%	--	15.2	33.0	06:46	7.92	External	circ groove	
A252	--	Indication	418.284	15%	--	15.2	15.2	06:24	7.92	External	pitting	
A253	--	Indication	418.463	15%	--	10.2	12.7	04:19	7.92	External	pitting	
A254	--	Indication	420.867	15%	--	17.8	20.3	01:06	7.92	External	pitting	
W043		Weld	430.460	--	--			--	7.92	NA (weld)		
A255	--	Indication	432.601	15%	--	10.2	10.2	08:14	7.92	External	pitting	
W044		Weld	441.640	--	--			--	7.92	NA (weld)		
A256	--	Indication	443.612	15%	--	12.7	12.7	04:37	7.92	External	pitting	
A257	--	Indication	444.275	15%	--	15.2	17.8	09:53	7.92	External	pitting	
A258	--	Indication	444.439	15%	--	10.2	12.7	06:22	7.92	External	pitting	
A259	--	Indication	444.701	16%	--	12.7	12.7	05:37	7.92	External	pitting	
A260	--	Indication	445.181	15%	--	12.7	12.7	05:57	7.92	External	pitting	
A261	C036	Indication	446.292	15%	--	12.7	12.7	06:11	7.92	External	pitting	
C036	--	Cluster	446.312	47%	--	53.3	63.5	05:59	7.92	External	general	
A262	C036	Indication	446.331	47%	--	15.2	12.7	05:48	7.92	External	pitting	
A263	--	Indication	447.923	25%	--	17.8	20.3	04:45	7.92	External	pitting	
A264	C037	Indication	448.463	46%	--	12.7	15.2	06:22	7.92	External	pitting	
C037	--	Cluster	448.490	46%	--	66.0	27.9	06:19	7.92	External	general	
A265	C037	Indication	448.517	22%	--	12.7	12.7	06:15	7.92	External	pitting	
A266	--	Indication	448.608	41%	--	10.2	20.3	06:18	7.92	External	circ groove	
A267	--	Indication	448.613	27%	--	12.7	12.7	05:34	7.92	External	pitting	
A268	--	Indication	448.684	15%	--	10.2	12.7	05:42	7.92	External	pitting	
A269	--	Indication	448.726	26%	--	12.7	15.2	06:31	7.92	External	pitting	
A270	C038	Indication	453.848	30%	--	15.2	30.5	08:16	7.92	External	circ groove	
C038	--	Cluster	453.853	30%	--	22.9	127.0	07:54	7.92	External	circ groove	
A271	C038	Indication	453.857	21%	--	15.2	30.5	07:32	7.92	External	circ groove	
W045		Weld	454.052	--	--			--	7.92	NA (weld)		

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A272	C039	Indication	454.268	15%	--	12.7	12.7	07:34	7.92	External	pitting	
C039	--	Cluster	454.293	16%	--	63.5	78.7	07:44	7.92	External	general	
A273	C039	Indication	454.311	15%	--	12.7	25.4	07:33	7.92	External	circ groove	
A274	C039	Indication	454.317	16%	--	17.8	45.7	07:52	7.92	External	circ groove	
A275	--	Indication	463.913	22%	--	15.2	15.2	10:37	7.92	External	pitting	
A276	--	Indication	466.029	15%	--	10.2	12.7	05:26	7.92	External	pitting	
A277	--	Indication	466.112	15%	--	12.7	12.7	05:13	7.92	External	pitting	
A278	--	Indication	466.424	30%	--	15.2	15.2	05:23	7.92	External	pitting	
W046		Weld	466.628	--	--			--	7.92	NA (weld)		
I025	--	Installation	470.398	--	--	40.6	53.3	00:00	7.92	NA		Attachment with HAZ
W047		Weld	478.754	--	--			--	7.92	NA (weld)		
I026	--	Installation	483.048	--	--	40.6	50.8	00:00	7.92	NA		Tap; ILC for charging
I027	--	Installation	484.482	--	--	63.5	58.4	00:00	7.92	NA		Tap; ILC for antenna
O044	--	Other Feature	488.612	--	--	40.6	109.2	06:04	7.92	NA		Manufacturing related
W048		Weld	489.864	--	--			--	7.92	NA (weld)		
A279	--	Indication	492.374	15%	--	10.2	15.2	11:03	7.92	External	pitting	
A280	C040	Indication	493.015	15%	--	12.7	12.7	11:37	7.92	External	pitting	
A281	C040	Indication	493.015	15%	--	15.2	15.2	10:57	7.92	External	pitting	
C040	--	Cluster	493.015	15%	--	15.2	104.1	11:17	7.92	External	circ groove	
A282	--	Indication	493.132	15%	--	17.8	15.2	00:41	7.92	External	pitting	
A283	--	Indication	493.384	15%	--	17.8	15.2	02:32	7.92	External	pitting	
A284	--	Indication	494.230	15%	--	15.2	17.8	02:42	7.92	External	pitting	
A285	--	Indication	494.443	15%	--	12.7	15.2	09:19	7.92	External	pitting	
A286	--	Indication	494.727	15%	--	10.2	10.2	11:18	7.92	External	pitting	
A287	--	Indication	494.831	15%	--	12.7	25.4	03:15	7.92	External	circ groove	
A288	--	Indication	495.082	15%	--	17.8	17.8	09:47	7.92	External	pitting	
A289	--	Indication	495.341	15%	--	12.7	12.7	04:29	7.92	External	pitting	
A290	--	Indication	495.558	15%	--	12.7	12.7	02:38	7.92	External	pitting	
A291	C041	Indication	495.667	15%	--	15.2	15.2	00:17	7.92	External	pitting	
C041	--	Cluster	495.668	15%	--	17.8	86.4	00:33	7.92	External	circ groove	
A292	C041	Indication	495.669	15%	--	15.2	17.8	00:48	7.92	External	pitting	
A293	C042	Indication	495.693	15%	--	15.2	15.2	05:28	7.92	External	pitting	
C042	--	Cluster	495.699	15%	--	27.9	91.4	05:11	7.92	External	general	
A294	--	Indication	495.702	15%	--	15.2	15.2	03:47	7.92	External	pitting	
A295	C042	Indication	495.706	15%	--	12.7	25.4	04:56	7.92	External	circ groove	
A296	--	Indication	495.779	15%	--	15.2	15.2	04:00	7.92	External	pitting	

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A297	--	Indication	495.817	15%	--	17.8	17.8	04:46	7.92	External	pitting	
O045	--	Other Feature	498.150	--	--			--	7.92	NA		Circumferential fillet weld
I028	--	Installation	498.390	--	--	121.9	99.1	09:34	7.92	NA		Offtake
O046	--	Other Feature	498.626	--	--			--	7.92	NA		Circumferential fillet weld
A298	--	Indication	499.389	15%	--	15.2	15.2	11:27	7.92	External	pitting	
A299	--	Indication	500.146	15%	--	15.2	30.5	04:38	7.92	External	circ groove	
W049		Weld	500.389	--	--			--	7.92	NA (weld)		
O047	--	Other Feature	501.230	--	--			--	7.92	NA		Circumferential fillet weld
I029	--	Installation	501.686	--	--	487.7	525.8	00:00	7.92	NA		Stopple with coupon
O048	--	Other Feature	502.056	--	--			--	7.92	NA		Circumferential fillet weld
I030	--	Installation	502.603	--	--	43.2	40.6	00:01	7.92	NA		Tap
I031	--	Installation	503.277	--	--	91.4	99.1	11:57	7.92	NA		Tap
I032	--	Installation	504.462	--	--	45.7	61.0	11:57	7.92	NA		Tap
A300	--	Indication	506.369	15%	--	7.6	10.2	03:41	7.92	External	circ slot	
W050		Weld	508.982	--	--			--	7.92	NA (weld)		
O049	--	Other Feature	510.266	--	--	22.9	132.1	04:49	7.92	NA		Manufacturing related
W051		Weld	511.012	--	--			--	7.92	NA (weld)		Bend begin
I033	--	Installation	511.314	--	--			03:00	7.92	NA		Right bend center; 85+85.3
W052		Weld	511.652	--	--			--	7.92	NA (weld)		Bend end
W053		Weld	513.749	--	--			--	7.92	NA (weld)		Bend begin
I034	--	Installation	514.052	--	--			09:00	7.92	NA		Left bend center; 85+82.4
W054		Weld	514.387	--	--			--	7.92	NA (weld)		Bend end
A301	--	Indication	514.838	10%	--	15.2	15.2	05:09	7.92	External	pitting	
A302	--	Indication	514.859	10%	--	15.2	27.9	07:25	7.92	External	pitting	
W055		Weld	515.645	--	--			--	7.92	NA (weld)		
A303	--	Indication	515.925	10%	--	15.2	15.2	07:25	7.92	External	pitting	
A304	--	Indication	516.632	10%	--	10.2	10.2	07:28	7.92	External	pitting	
A305	C043	Indication	517.196	10%	--	10.2	7.6	10:47	7.92	External	axial slot	
C043	--	Cluster	517.210	14%	--	35.6	48.3	10:56	7.92	External	general	
A306	C043	Indication	517.223	14%	--	12.7	12.7	11:04	7.92	External	pitting	
A307	--	Indication	517.297	10%	--	17.8	30.5	11:06	7.92	External	pitting	
A308	--	Indication	517.843	14%	--	12.7	12.7	11:09	7.92	External	pitting	
W056		Weld	523.932	--	--			--	7.92	NA (weld)		
O050	--	Other Feature	535.411	--	--	27.9	35.6	06:44	7.92	NA		Manufacturing related; On long seam
A309	--	Indication	535.433	10%	--	10.2	7.6	04:40	7.92	External	axial slot	
W057		Weld	536.003	--	--			--	7.92	NA (weld)		

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A310	--	Indication	537.347	10%	--	7.6	7.6	07:31	7.92	External	pinhole	
A311	--	Indication	540.113	10%	--	12.7	10.2	11:51	7.92	External	pitting	
A312	--	Indication	540.167	10%	--	12.7	12.7	07:45	7.92	External	pitting	
A313	--	Indication	540.389	12%	--	12.7	10.2	02:59	7.92	External	pitting	
A314	C044	Indication	542.660	10%	--	15.2	15.2	01:44	7.92	External	pitting	
A315	C044	Indication	542.666	10%	--	17.8	17.8	02:14	7.92	External	pitting	
A316	C044	Indication	542.697	10%	--	15.2	15.2	02:31	7.92	External	pitting	
A317	C044	Indication	542.740	10%	--	12.7	12.7	02:39	7.92	External	pitting	
C044	--	Cluster	542.784	15%	--	264.2	142.2	02:09	7.92	External	general	
A318	C044	Indication	542.792	10%	--	12.7	12.7	02:17	7.92	External	pitting	
A319	C044	Indication	542.848	14%	--	15.2	12.7	02:32	7.92	External	pitting	
A320	C044	Indication	542.850	15%	--	15.2	12.7	01:50	7.92	External	pitting	
A321	C044	Indication	542.909	11%	--	12.7	12.7	01:40	7.92	External	pitting	
W058		Weld	546.713	--	--			--	7.92	NA (weld)		
W059		Weld	558.870	--	--			--	7.92	NA (weld)		
A322	--	Indication	559.714	11%	--	15.2	15.2	11:19	7.92	External	pitting	
A323	--	Indication	565.671	32%	--	12.7	12.7	04:02	7.92	External	pitting	
A324	C045	Indication	566.534	14%	--	15.2	12.7	05:55	7.92	External	pitting	Interacting with long seam
A325	C045	Indication	566.565	12%	--	17.8	17.8	05:29	7.92	External	pitting	Interacting with long seam
C045	--	Cluster	566.575	14%	--	96.5	180.3	05:17	7.92	External	general	Interacting with long seam
A326	C045	Indication	566.617	14%	--	15.2	15.2	04:40	7.92	External	pitting	
O051	--	Other Feature	570.003	--	--	53.3	68.6	06:19	7.92	NA		Close metal object
W060		Weld	571.050	--	--			--	7.92	NA (weld)		
W061		Weld	583.272	--	--			--	7.92	NA (weld)		
D008	--	Dent	583.741	--	0.8%	86.4	86.4	09:09	7.92	NA		
W062		Weld	585.191	--	--			--	7.92	NA (weld)		
W063		Weld	586.824	--	--			--	7.92	NA (weld)		Bend begin
I035	--	Installation	587.143	--	--			09:00	7.92	NA		Left bend center; 85+10.0
W064		Weld	587.509	--	--			--	7.92	NA (weld)		Bend end
W065		Weld	589.634	--	--			--	7.92	NA (weld)		Bend begin
I036	--	Installation	589.960	--	--			03:00	7.92	NA		Right bend center; 85+07.4
W066		Weld	590.296	--	--			--	7.92	NA (weld)		Bend end
W067		Weld	591.948	--	--			--	7.92	NA (weld)		
O052	--	Other Feature	592.591	--	--	27.9	238.8	06:20	7.92	NA		Manufacturing related
I037	--	Installation	594.418	--	--	40.6	61.0	00:01	7.92	NA		Tap
I038	--	Installation	595.441	--	--	94.0	99.1	00:00	7.92	NA		Tap

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I039	--	Installation	596.037	--	--	25.4	40.6	00:00	7.92	NA		Tap
A327	--	Indication	596.093	15%	--	15.2	15.2	03:37	7.92	External	pitting	
O053	--	Other Feature	596.593	--	--			--	7.92	NA		Circumferential fillet weld
I040	--	Installation	597.056	--	--	490.2	525.8	11:56	7.92	NA		Stopple with coupon
O054	--	Other Feature	597.494	--	--				7.92	NA		Circumferential fillet weld
O055	--	Other Feature	600.371	--	--			--	7.92	NA		Circumferential fillet weld
I041	--	Installation	600.608	--	--	101.6	119.4	08:58	7.92	NA		Offtake
O056	--	Other Feature	600.855	--	--			--	7.92	NA		Circumferential fillet weld
W068		Weld	602.002	--	--			--	7.92	NA (weld)		
I042	--	Installation	603.374	--	--	147.3	142.2	11:57	7.92	NA		Tap
A328	--	Indication	603.581	22%	--	15.2	15.2	11:24	7.92	External	pitting	
A329	--	Indication	608.568	15%	--	10.2	10.2	10:15	7.92	External	pitting	
A330	--	Indication	610.394	15%	--	12.7	12.7	02:19	7.92	External	pitting	
A331	--	Indication	610.637	15%	--	15.2	12.7	01:43	7.92	External	pitting	
A332	--	Indication	610.787	15%	--	15.2	15.2	02:17	7.92	External	pitting	
A333	--	Indication	612.622	15%	--	10.2	10.2	07:48	7.92	External	pitting	
A334	--	Indication	612.691	15%	--	10.2	10.2	08:15	7.92	External	pitting	
A335	--	Indication	612.823	15%	--	12.7	12.7	06:36	7.92	External	pitting	
A336	--	Indication	612.831	15%	--	12.7	12.7	08:14	7.92	External	pitting	
A337	--	Indication	612.984	16%	--	12.7	10.2	06:56	7.92	External	pitting	
A338	--	Indication	613.098	15%	--	15.2	15.2	02:59	7.92	External	pitting	
A339	--	Indication	613.174	15%	--	12.7	12.7	01:16	7.92	External	pitting	
A340	--	Indication	613.410	15%	--	10.2	10.2	02:00	7.92	External	pitting	
A341	--	Indication	613.475	15%	--	15.2	15.2	02:15	7.92	External	pitting	
W069		Weld	613.786	--	--			--	7.92	NA (weld)		
W070		Weld	625.170	--	--			--	7.92	NA (weld)		
W071		Weld	626.842	--	--			--	7.92	NA (weld)		
A342	--	Indication	640.197	23%	--	12.7	12.7	05:12	7.92	External	pitting	
A343	--	Indication	640.271	18%	--	15.2	27.9	05:46	7.92	External	pitting	At weld
W072		Weld	640.307	--	--			--	7.92	NA (weld)		
A344	C046	Indication	640.385	15%	--	7.6	7.6	05:00	7.92	External	pinhole	
A345	C046	Indication	640.398	15%	--	12.7	12.7	05:12	7.92	External	pitting	
C046	--	Cluster	640.410	38%	--	58.4	66.0	05:13	7.92	External	general	
A346	C046	Indication	640.432	38%	--	15.2	15.2	05:24	7.92	External	pitting	
A347	--	Indication	640.530	15%	--	10.2	12.7	05:11	7.92	External	pitting	
W073		Weld	653.449	--	--			--	7.92	NA (weld)		

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W074		Weld	666.481	--	--			--	7.92	NA (weld)		
A348	--	Indication	666.581	15%	--	10.2	10.2	06:23	7.92	External	pitting	
A349	C047	Indication	679.651	15%	--	15.2	17.8	06:22	7.92	External	pitting	
A350	C047	Indication	679.658	15%	--	15.2	25.4	06:02	7.92	External	pitting	
C047	--	Cluster	679.658	15%	--	30.5	165.1	05:49	7.92	External	general	
A351	C047	Indication	679.666	15%	--	15.2	15.2	05:15	7.92	External	pitting	
A352	--	Indication	679.701	15%	--	12.7	17.8	04:18	7.92	External	pitting	
W075		Weld	679.958	--	--			--	7.92	NA (weld)		
A353	--	Indication	692.956	15%	--	12.7	12.7	04:52	7.92	External	pitting	
W076		Weld	693.226	--	--			--	7.92	NA (weld)		
A354	--	Indication	700.189	15%	--	15.2	15.2	07:38	7.92	External	pitting	
A355	--	Indication	701.405	15%	--	17.8	43.2	06:53	7.92	External	circ groove	
A356	--	Indication	701.558	15%	--	12.7	22.9	07:16	7.92	External	pitting	
A357	--	Indication	702.292	15%	--	15.2	12.7	07:31	7.92	External	pitting	
A358	--	Indication	702.862	15%	--	12.7	30.5	06:40	7.92	External	circ groove	
A359	C048	Indication	703.150	15%	--	12.7	12.7	06:50	7.92	External	pitting	
C048	--	Cluster	703.154	15%	--	22.9	55.9	06:41	7.92	External	circ groove	
A360	C048	Indication	703.159	15%	--	15.2	15.2	06:32	7.92	External	pitting	
A361	C049	Indication	703.291	15%	--	12.7	12.7	06:52	7.92	External	pitting	
C049	--	Cluster	703.294	16%	--	17.8	66.0	06:40	7.92	External	circ groove	
A362	C049	Indication	703.295	16%	--	17.8	15.2	06:29	7.92	External	pitting	
A363	--	Indication	703.616	15%	--	17.8	15.2	06:43	7.92	External	pitting	
A364	C050	Indication	703.877	15%	--	10.2	10.2	06:31	7.92	External	pitting	
C050	--	Cluster	703.883	15%	--	22.9	43.2	06:39	7.92	External	pitting	
A365	C050	Indication	703.887	15%	--	12.7	12.7	06:46	7.92	External	pitting	
A366	--	Indication	704.651	18%	--	15.2	22.9	06:01	7.92	External	pitting	
A367	--	Indication	704.790	15%	--	12.7	15.2	07:23	7.92	External	pitting	
W077		Weld	704.901	--	--			--	7.92	NA (weld)		
A368	--	Indication	705.124	27%	--	15.2	22.9	04:23	7.92	External	pitting	
A369	--	Indication	709.937	15%	--	7.6	7.6	04:26	7.92	External	pinhole	
W078		Weld	717.991	--	--			--	7.92	NA (weld)		
D009	--	Dent	725.485	--	0.5%	63.5	61.0	11:03	7.92	NA		
W079		Weld	731.707	--	--			--	7.92	NA (weld)		
O057	--	Other Feature	732.782	--	--	185.4	248.9	01:30	7.92	NA		Manufacturing related
A370	C051	Indication	733.612	15%	--	20.3	20.3	01:24	7.92	External	pitting	
A371	C051	Indication	733.654	15%	--	17.8	12.7	00:51	7.92	External	pitting	

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A372	C051	Indication	733.658	15%	--	17.8	15.2	00:18	7.92	External	pitting	
C051	--	Cluster	733.669	19%	--	134.6	254.0	00:31	7.92	External	general	
A373	C051	Indication	733.703	15%	--	17.8	17.8	11:38	7.92	External	pitting	
A374	C051	Indication	733.730	19%	--	12.7	15.2	00:31	7.92	External	pitting	
A375	C052	Indication	734.260	30%	--	27.9	15.2	11:15	7.92	External	pitting	
A376	C052	Indication	734.268	15%	--	35.6	38.1	10:44	7.92	External	general	
C052	--	Cluster	734.271	33%	--	48.3	165.1	10:41	7.92	External	general	
A377	C052	Indication	734.275	33%	--	38.1	17.8	10:09	7.92	External	axial groove	
W080		Weld	745.374	--	--			--	7.92	NA (weld)		
W081		Weld	758.574	--	--			--	7.92	NA (weld)		
A378	C053	Indication	764.986	15%	--	10.2	20.3	00:47	7.92	External	circ groove	
A379	C053	Indication	764.988	16%	--	15.2	38.1	00:27	7.92	External	circ groove	
C053	--	Cluster	764.988	16%	--	15.2	73.7	00:35	7.92	External	circ groove	
W082		Weld	770.794	--	--			--	7.92	NA (weld)		
O058	--	Other Feature	772.006	--	--	33.0	27.9	09:35	7.92	NA		Manufacturing related
W083		Weld	783.204	--	--			--	7.92	NA (weld)		
A380	--	Indication	794.497	15%	--	15.2	15.2	10:11	7.92	External	pitting	
A381	--	Indication	796.570	15%	--	12.7	15.2	10:29	7.92	External	pitting	
W084		Weld	796.772	--	--			--	7.92	NA (weld)		
A382	--	Indication	803.253	15%	--	12.7	12.7	00:35	7.92	External	pitting	
A383	--	Indication	809.007	34%	--	12.7	12.7	06:37	7.92	External	pitting	
W085		Weld	809.112	--	--			--	7.92	NA (weld)		
A384	--	Indication	809.288	15%	--	12.7	12.7	08:33	7.92	External	pitting	
A385	--	Indication	811.718	15%	--	17.8	25.4	04:47	7.92	External	pitting	
A386	--	Indication	813.011	15%	--	12.7	12.7	07:09	7.92	External	pitting	
W086		Weld	822.490	--	--			--	7.92	NA (weld)		
A387	--	Indication	825.135	15%	--	10.2	7.6	08:07	7.92	External	axial slot	
A388	--	Indication	825.195	15%	--	12.7	12.7	08:13	7.92	External	pitting	
A389	--	Indication	825.278	15%	--	15.2	12.7	01:19	7.92	External	pitting	
A390	--	Indication	825.340	15%	--	10.2	25.4	08:22	7.92	External	circ groove	
I043	--	Installation	829.054	--	--	38.1	53.3	11:53	7.92	NA		Attachment with HAZ
W087		Weld	836.082	--	--			--	7.92	NA (weld)		
A391	--	Indication	841.457	32%	--	12.7	12.7	09:59	7.92	External	pitting	
A392	--	Indication	841.531	36%	--	10.2	10.2	07:55	7.92	External	pitting	
A393	--	Indication	844.409	15%	--	12.7	15.2	09:25	7.92	External	pitting	
A394	--	Indication	849.504	15%	--	12.7	27.9	05:06	7.92	External	circ groove	

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W088		Weld	849.688	--	--			--	7.92	NA (weld)		
A395	--	Indication	854.500	15%	--	10.2	12.7	08:22	7.92	External	pitting	
A396	--	Indication	856.440	15%	--	15.2	15.2	10:34	7.92	External	pitting	
W089		Weld	862.711	--	--			--	7.92	NA (weld)		
A397	--	Indication	867.496	15%	--	12.7	30.5	00:10	7.92	External	circ groove	
A398	--	Indication	868.029	15%	--	12.7	27.9	10:38	7.92	External	circ groove	
A399	--	Indication	872.545	36%	--	10.2	25.4	05:24	7.92	External	circ groove	
W090		Weld	876.255	--	--			--	7.92	NA (weld)		
A400	--	Indication	887.997	15%	--	7.6	10.2	10:26	7.92	External	circ slot	
A401	--	Indication	888.092	15%	--	12.7	12.7	01:08	7.92	External	pitting	
W091		Weld	889.805	--	--			--	7.92	NA (weld)		
A402	--	Indication	892.637	15%	--	15.2	12.7	10:01	7.92	External	pitting	
A403	--	Indication	896.357	15%	--	15.2	30.5	01:54	7.92	External	circ groove	
D010	--	Dent	897.308	--	3.5%	101.6	86.4	00:09	7.92	NA		
A404	--	Indication	897.549	15%	--	15.2	17.8	11:32	7.92	External	pitting	
A405	--	Indication	897.689	15%	--	15.2	15.2	01:01	7.92	External	pitting	
A406	--	Indication	897.700	15%	--	17.8	15.2	00:09	7.92	External	pitting	
I044	--	Installation	900.927	--	--	114.3	106.7	09:01	7.92	NA		Tap
A407	--	Indication	901.564	15%	--	12.7	12.7	08:30	7.92	External	pitting	
W092		Weld	903.433	--	--			--	7.92	NA (weld)		
A408	--	Indication	910.732	15%	--	15.2	12.7	10:28	7.92	External	pitting	
A409	--	Indication	912.582	15%	--	17.8	17.8	10:27	7.92	External	pitting	
A410	--	Indication	914.162	15%	--	12.7	12.7	07:45	7.92	External	pitting	
A411	--	Indication	914.661	15%	--	10.2	10.2	05:36	7.92	External	pitting	
A412	--	Indication	914.751	15%	--	12.7	12.7	04:30	7.92	External	pitting	
A413	--	Indication	914.833	16%	--	15.2	25.4	07:30	7.92	External	pitting	
A414	--	Indication	914.835	15%	--	15.2	15.2	08:33	7.92	External	pitting	
A415	--	Indication	914.869	15%	--	7.6	20.3	06:49	7.92	External	circ slot	
A416	--	Indication	914.916	15%	--	12.7	25.4	07:30	7.92	External	circ groove	
W093		Weld	915.111	--	--			--	7.92	NA (weld)		
O059	--	Other Feature	916.556	--	--			--	7.92	NA		Circumferential fillet weld
I045	--	Installation	916.831	--	--	162.6	152.4	02:53	7.92	NA		Offtake
O060	--	Other Feature	917.163	--	--			--	7.92	NA		Circumferential fillet weld
A417	--	Indication	920.059	21%	--	30.5	27.9	10:48	7.92	External	general	
O061	--	Other Feature	921.390	--	--			--	7.92	NA		Circumferential fillet weld
I046	--	Installation	921.880	--	--	480.1	525.8	00:05	7.92	NA		Stopple with coupon

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
O062	--	Other Feature	922.293	--	--			--	7.92	NA		Circumferential fillet weld
I047	--	Installation	922.808	--	--	22.9	33.0	00:04	7.92	NA		Tap
I048	--	Installation	923.841	--	--	73.7	78.7	00:00	7.92	NA		Tap
I049	--	Installation	925.558	--	--	53.3	48.3	00:00	7.92	NA		Tap
W094		Weld	927.506	--	--			--	7.92	NA (weld)		
W095		Weld	928.848	--	--			--	7.92	NA (weld)		Bend begin
I050	--	Installation	929.303	--	--			03:00	7.92	NA		Right bend center; 81+71.8
W096		Weld	929.772	--	--			--	7.92	NA (weld)		Bend end
A418	--	Indication	930.131	10%	--	15.2	15.2	10:46	7.92	External	pitting	
W097		Weld	931.967	--	--			--	7.92	NA (weld)		
A419	--	Indication	933.458	10%	--	15.2	12.7	07:12	7.92	External	pitting	
D011	--	Dent	934.245	--	0.5%	63.5	61.0	05:18	7.92	NA		
A420	--	Indication	935.674	10%	--	10.2	10.2	07:25	7.92	External	pitting	
A421	--	Indication	942.341	10%	--	10.2	20.3	02:48	7.92	External	circ groove	
W098		Weld	942.571	--	--			--	7.92	NA (weld)		
A422	--	Indication	942.771	10%	--	7.6	15.2	02:46	7.92	External	circ slot	
A423	--	Indication	948.669	10%	--	12.7	12.7	01:12	7.92	External	pitting	
O063	--	Other Feature	950.940	--	--	383.5	147.3	00:04	7.92	NA		Manufacturing related
W099		Weld	954.707	--	--			--	7.92	NA (weld)		
W100		Weld	961.113	--	--			--	7.92	NA (weld)		Bend begin
I051	--	Installation	961.550	--	--			09:00	7.92	NA		Left bend center; 81+58.2
W101		Weld	962.072	--	--			--	7.92	NA (weld)		Bend end
A424	--	Indication	962.268	10%	--	12.7	15.2	00:20	7.92	External	pitting	
A425	--	Indication	962.663	10%	--	10.2	10.2	10:55	7.92	External	pitting	
A426	--	Indication	962.757	11%	--	12.7	12.7	01:25	7.92	External	pitting	
A427	--	Indication	963.196	10%	--	12.7	12.7	09:24	7.92	External	pitting	
A428	--	Indication	965.538	37%	--	27.9	27.9	11:12	7.92	External	general	
A429	--	Indication	965.691	10%	--	10.2	12.7	08:38	7.92	External	pitting	
A430	--	Indication	967.197	10%	--	12.7	12.7	10:01	7.92	External	pitting	
W102		Weld	971.217	--	--			--	7.92	NA (weld)		
A431	C054	Indication	971.473	23%	--	15.2	33.0	08:59	7.92	External	circ groove	
A432	C054	Indication	971.488	20%	--	12.7	22.9	09:27	7.92	External	pitting	Interacting with long seam
C054	--	Cluster	971.494	23%	--	55.9	139.7	09:00	7.92	External	general	Interacting with long seam
A433	C054	Indication	971.500	11%	--	12.7	12.7	08:32	7.92	External	pitting	
A434	C054	Indication	971.517	20%	--	10.2	10.2	08:52	7.92	External	pitting	
A435	C055	Indication	971.521	11%	--	12.7	10.2	11:13	7.92	External	pitting	

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A436	C055	Indication	971.543	15%	--	12.7	25.4	10:01	7.92	External	circ groove	
A437	C055	Indication	971.546	31%	--	17.8	33.0	10:34	7.92	External	pitting	
C055	--	Cluster	971.557	31%	--	83.8	177.8	10:35	7.92	External	general	
A438	C055	Indication	971.592	13%	--	15.2	17.8	11:00	7.92	External	pitting	
A439	C056	Indication	971.605	10%	--	12.7	12.7	08:50	7.92	External	pitting	
C056	--	Cluster	971.616	10%	--	33.0	71.1	09:03	7.92	External	general	
A440	C056	Indication	971.626	10%	--	15.2	15.2	09:15	7.92	External	pitting	
A441	C057	Indication	971.701	14%	--	12.7	15.2	08:15	7.92	External	pitting	
C057	--	Cluster	971.723	25%	--	55.9	185.4	08:50	7.92	External	general	Interacting with long seam
A442	C057	Indication	971.732	20%	--	15.2	15.2	08:12	7.92	External	pitting	
A443	C057	Indication	971.736	25%	--	12.7	27.9	09:01	7.92	External	circ groove	
A444	C057	Indication	971.737	20%	--	17.8	35.6	08:30	7.92	External	circ groove	
A445	C057	Indication	971.744	15%	--	15.2	35.6	09:23	7.92	External	circ groove	Interacting with long seam
A446	--	Indication	972.604	10%	--	10.2	12.7	05:57	7.92	External	pitting	
A447	C058	Indication	972.630	15%	--	17.8	17.8	00:06	7.92	External	pitting	
C058	--	Cluster	972.634	15%	--	25.4	40.6	00:11	7.92	External	general	
A448	C058	Indication	972.638	10%	--	15.2	17.8	00:17	7.92	External	pitting	
A449	--	Indication	972.754	10%	--	12.7	12.7	00:27	7.92	External	pitting	
W103		Weld	983.393	--	--			--	7.92	NA (weld)		
A450	C059	Indication	985.431	10%	--	12.7	12.7	09:56	7.92	External	pitting	
A451	C059	Indication	985.460	13%	--	12.7	12.7	10:29	7.92	External	pitting	
A452	C059	Indication	985.496	13%	--	15.2	15.2	11:05	7.92	External	pitting	
A453	C059	Indication	985.510	10%	--	15.2	15.2	09:47	7.92	External	pitting	
A454	C059	Indication	985.568	10%	--	15.2	15.2	10:29	7.92	External	pitting	
A455	C059	Indication	985.658	10%	--	17.8	17.8	09:42	7.92	External	pitting	
A456	C059	Indication	985.663	10%	--	12.7	15.2	10:29	7.92	External	pitting	
A457	C059	Indication	985.692	10%	--	20.3	17.8	11:43	7.92	External	pitting	
C059	--	Cluster	985.699	13%	--	548.6	370.8	11:01	7.92	External	general	
A458	C059	Indication	985.721	10%	--	17.8	15.2	10:42	7.92	External	pitting	
A459	C059	Indication	985.815	10%	--	15.2	15.2	10:37	7.92	External	pitting	
A460	C059	Indication	985.822	10%	--	22.9	25.4	11:24	7.92	External	pitting	
A461	C059	Indication	985.846	10%	--	12.7	17.8	00:05	7.92	External	pitting	
A462	C059	Indication	985.955	10%	--	12.7	10.2	10:51	7.92	External	pitting	
A463	C059	Indication	985.960	10%	--	15.2	15.2	00:21	7.92	External	pitting	
A464	C059	Indication	985.960	10%	--	27.9	25.4	11:49	7.92	External	general	
A465	C060	Indication	986.094	10%	--	15.2	15.2	11:39	7.92	External	pitting	

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A466	C060	Indication	986.095	10%	--	15.2	17.8	00:01	7.92	External	pitting	
A467	C060	Indication	986.114	10%	--	12.7	12.7	11:04	7.92	External	pitting	
A468	C060	Indication	986.118	10%	--	22.9	22.9	10:40	7.92	External	pitting	
C060	--	Cluster	986.142	10%	--	111.8	200.7	11:20	7.92	External	general	
A469	C060	Indication	986.186	10%	--	22.9	20.3	11:23	7.92	External	pitting	
A470	C060	Indication	986.188	10%	--	15.2	15.2	11:51	7.92	External	pitting	
A471	C061	Indication	990.070	10%	--	10.2	12.7	08:12	7.92	External	pitting	
A472	C061	Indication	990.099	13%	--	12.7	12.7	08:28	7.92	External	pitting	
C061	--	Cluster	990.109	13%	--	86.4	132.1	08:39	7.92	External	general	
A473	C061	Indication	990.139	10%	--	15.2	33.0	08:51	7.92	External	circ groove	
A474	C061	Indication	990.145	12%	--	15.2	15.2	09:05	7.92	External	pitting	
A475	--	Indication	992.544	10%	--	17.8	15.2	05:12	7.92	External	pitting	
A476	C062	Indication	993.146	10%	--	10.2	10.2	09:12	7.92	External	pitting	
A477	C062	Indication	993.199	10%	--	17.8	33.0	10:24	7.92	External	pitting	
A478	C062	Indication	993.221	10%	--	15.2	27.9	09:34	7.92	External	pitting	
A479	C062	Indication	993.223	15%	--	17.8	15.2	09:21	7.92	External	pitting	
A480	C062	Indication	993.250	10%	--	7.6	12.7	11:37	7.92	External	circ slot	
A481	C062	Indication	993.277	10%	--	12.7	20.3	10:46	7.92	External	pitting	
C062	--	Cluster	993.277	15%	--	271.8	485.1	10:47	7.92	External	general	
A482	C062	Indication	993.281	10%	--	10.2	10.2	09:00	7.92	External	pitting	
A483	C062	Indication	993.299	10%	--	12.7	17.8	11:53	7.92	External	pitting	
A484	C062	Indication	993.322	10%	--	15.2	15.2	09:12	7.92	External	pitting	
A485	C062	Indication	993.323	10%	--	17.8	17.8	00:33	7.92	External	pitting	
A486	C062	Indication	993.368	10%	--	12.7	15.2	10:10	7.92	External	pitting	
A487	C062	Indication	993.407	11%	--	15.2	27.9	00:25	7.92	External	pitting	
A488	--	Indication	994.773	10%	--	15.2	15.2	00:05	7.92	External	pitting	
W104		Weld	995.544	--	--			--	7.92	NA (weld)		Bend begin
I052	--	Installation	995.636	--	--			03:00	7.92	NA		Right bend center; 81+26.9
W105		Weld	995.746	--	--			--	7.92	NA (weld)		Bend end
A489	C063	Indication	999.623	11%	--	15.2	15.2	06:16	7.92	External	pitting	
A490	C063	Indication	999.679	10%	--	10.2	10.2	07:04	7.92	External	pitting	
A491	C063	Indication	999.679	10%	--	10.2	25.4	06:00	7.92	External	circ groove	
C063	--	Cluster	999.722	39%	--	213.4	320.0	05:55	7.92	External	general	
A492	C063	Indication	999.732	10%	--	10.2	10.2	06:29	7.92	External	pitting	
A493	C063	Indication	999.739	10%	--	7.6	7.6	06:02	7.92	External	pinhole	
A494	C063	Indication	999.747	20%	--	15.2	15.2	04:52	7.92	External	pitting	

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A495	C063	Indication	999.769	10%	--	7.6	10.2	05:46	7.92	External	circ slot	
A496	C063	Indication	999.770	10%	--	5.1	7.6	05:11	7.92	External	pinhole	
A497	C063	Indication	999.771	23%	--	10.2	10.2	07:00	7.92	External	pitting	
A498	C063	Indication	999.791	10%	--	10.2	12.7	05:58	7.92	External	pitting	
A499	C063	Indication	999.792	10%	--	10.2	10.2	06:16	7.92	External	pitting	
A500	C063	Indication	999.798	39%	--	10.2	17.8	04:47	7.92	External	pitting	
A501	C063	Indication	999.798	35%	--	10.2	17.8	06:49	7.92	External	pitting	
A502	C063	Indication	999.823	21%	--	12.7	12.7	05:23	7.92	External	pitting	
A503	C064	Indication	999.899	36%	--	10.2	10.2	05:01	7.92	External	pitting	
A504	--	Indication	999.911	23%	--	17.8	15.2	06:46	7.92	External	pitting	
C064	--	Cluster	999.922	39%	--	55.9	43.2	05:01	7.92	External	general	
A505	C064	Indication	999.925	14%	--	7.6	7.6	05:09	7.92	External	pinhole	
A506	C064	Indication	999.944	39%	--	12.7	20.3	04:55	7.92	External	pitting	
A507	--	Indication	1000.989	10%	--	12.7	10.2	05:56	7.92	External	pitting	
A508	--	Indication	1001.798	10%	--	12.7	12.7	11:08	7.92	External	pitting	
A509	--	Indication	1005.615	10%	--	10.2	10.2	08:07	7.92	External	pitting	
W106		Weld	1006.511	--	--			--	7.92	NA (weld)		
A510	--	Indication	1009.165	10%	--	7.6	10.2	07:03	7.92	External	circ slot	
A511	--	Indication	1013.810	10%	--	10.2	10.2	06:53	7.92	External	pitting	
W107		Weld	1018.671	--	--			--	7.92	NA (weld)		
O064	--	Other Feature	1025.231	--	--	66.0	81.3	05:58	7.92	NA		Close metal object
A512	--	Indication	1026.728	10%	--	12.7	12.7	05:00	7.92	External	pitting	
A513	--	Indication	1028.423	14%	--	10.2	10.2	05:36	7.92	External	pitting	
A514	--	Indication	1030.223	13%	--	7.6	7.6	05:14	7.92	External	pinhole	
A515	--	Indication	1030.225	10%	--	10.2	7.6	06:05	7.92	External	axial slot	
A516	--	Indication	1030.553	19%	--	10.2	12.7	05:50	7.92	External	pitting	
A517	--	Indication	1030.790	12%	--	10.2	10.2	06:11	7.92	External	pitting	
W108		Weld	1030.895	--	--			--	7.92	NA (weld)		Bend begin
I053	--	Installation	1030.981	--	--			09:00	7.92	NA		Left bend center; 80+94.8
W109		Weld	1031.074	--	--			--	7.92	NA (weld)		Bend end
W110		Weld	1043.329	--	--			--	7.92	NA (weld)		
A518	C065	Indication	1047.088	32%	--	15.2	20.3	06:28	7.92	External	pitting	
C065	--	Cluster	1047.114	32%	--	66.0	33.0	06:25	7.92	External	general	
A519	C065	Indication	1047.143	10%	--	10.2	10.2	06:19	7.92	External	pitting	
A520	C066	Indication	1047.243	21%	--	10.2	12.7	06:49	7.92	External	pitting	
A521	C066	Indication	1047.266	13%	--	7.6	7.6	06:35	7.92	External	pinhole	

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C066	--	Cluster	1047.295	32%	--	116.8	121.9	06:29	7.92	External	general	
A522	C066	Indication	1047.297	20%	--	10.2	10.2	06:50	7.92	External	pitting	
A523	C066	Indication	1047.311	21%	--	12.7	12.7	06:04	7.92	External	pitting	
A524	C066	Indication	1047.315	32%	--	10.2	10.2	06:25	7.92	External	pitting	
A525	C066	Indication	1047.332	16%	--	10.2	20.3	06:07	7.92	External	circ groove	
A526	C066	Indication	1047.347	27%	--	10.2	22.9	06:51	7.92	External	circ groove	
A527	C066	Indication	1047.349	29%	--	10.2	25.4	06:36	7.92	External	circ groove	
A528	--	Indication	1050.881	41%	--	15.2	20.3	04:57	7.92	External	pitting	
A529	C067	Indication	1054.689	11%	--	12.7	22.9	02:24	7.92	External	pitting	
C067	--	Cluster	1054.719	43%	--	73.7	160.0	02:54	7.92	External	general	
A530	C067	Indication	1054.732	15%	--	12.7	22.9	03:14	7.92	External	pitting	
A531	C067	Indication	1054.749	43%	--	15.2	15.2	03:28	7.92	External	pitting	
A532	C068	Indication	1054.957	15%	--	12.7	12.7	02:31	7.92	External	pitting	
A533	C068	Indication	1054.976	19%	--	12.7	12.7	03:09	7.92	External	pitting	
C068	--	Cluster	1054.982	19%	--	61.0	96.5	02:50	7.92	External	general	
A534	C068	Indication	1055.006	14%	--	15.2	12.7	02:56	7.92	External	pitting	
A535	--	Indication	1055.101	20%	--	17.8	15.2	02:32	7.92	External	pitting	
A536	--	Indication	1055.154	27%	--	15.2	25.4	03:05	7.92	External	pitting	
A537	--	Indication	1055.246	15%	--	12.7	12.7	02:31	7.92	External	pitting	
A538	--	Indication	1055.317	13%	--	15.2	27.9	03:10	7.92	External	pitting	
W111		Weld	1055.453	--	--			--	7.92	NA (weld)		
A539	--	Indication	1057.703	10%	--	10.2	12.7	06:17	7.92	External	pitting	
A540	--	Indication	1062.597	10%	--	10.2	27.9	05:17	7.92	External	circ groove	
W112		Weld	1067.662	--	--			--	7.92	NA (weld)		
A541	--	Indication	1072.704	10%	--	12.7	10.2	05:02	7.92	External	pitting	
W113		Weld	1079.864	--	--			--	7.92	NA (weld)		
D012	--	Dent	1083.153	--	0.5%	68.6	61.0	07:52	7.92	NA		
A542	--	Indication	1084.139	10%	--	10.2	12.7	06:56	7.92	External	pitting	
A543	C069	Indication	1084.214	10%	--	12.7	12.7	05:20	7.92	External	pitting	
C069	--	Cluster	1084.237	15%	--	58.4	17.8	05:21	7.92	External	axial groove	
A544	C069	Indication	1084.260	15%	--	12.7	12.7	05:22	7.92	External	pitting	
A545	--	Indication	1085.940	10%	--	12.7	10.2	06:29	7.92	External	pitting	
A546	--	Indication	1086.343	10%	--	7.6	10.2	05:47	7.92	External	circ slot	
A547	--	Indication	1088.445	11%	--	10.2	10.2	07:42	7.92	External	pitting	
A548	C070	Indication	1088.677	12%	--	10.2	10.2	06:08	7.92	External	pitting	
C070	--	Cluster	1088.709	25%	--	76.2	61.0	06:19	7.92	External	general	

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A549	--	Indication	1088.736	10%	--	10.2	10.2	05:25	7.92	External	pitting	
A550	C070	Indication	1088.739	24%	--	15.2	12.7	06:30	7.92	External	pitting	
A551	C070	Indication	1088.740	25%	--	15.2	15.2	06:12	7.92	External	pitting	
A552	--	Indication	1088.813	13%	--	12.7	12.7	07:39	7.92	External	pitting	
A553	--	Indication	1088.831	14%	--	10.2	10.2	05:30	7.92	External	pitting	
A554	C071	Indication	1088.913	10%	--	10.2	10.2	05:50	7.92	External	pitting	
C071	--	Cluster	1088.931	10%	--	45.7	25.4	05:47	7.92	External	general	
A555	C071	Indication	1088.948	10%	--	10.2	10.2	05:44	7.92	External	pitting	
A556	--	Indication	1089.305	10%	--	10.2	10.2	06:14	7.92	External	pitting	
A557	--	Indication	1089.605	10%	--	22.9	12.7	06:32	7.92	External	pitting	
A558	--	Indication	1089.754	12%	--	10.2	10.2	06:22	7.92	External	pitting	
W114		Weld	1090.797	--	--			--	7.92	NA (weld)		
A559	--	Indication	1091.191	14%	--	38.1	17.8	03:53	7.92	External	axial groove	
A560	--	Indication	1091.269	13%	--	12.7	12.7	05:38	7.92	External	pitting	
A561	C072	Indication	1091.367	13%	--	15.2	27.9	05:35	7.92	External	pitting	
A562	C072	Indication	1091.391	20%	--	15.2	12.7	06:17	7.92	External	pitting	
A563	--	Indication	1091.403	10%	--	30.5	17.8	02:41	7.92	External	pitting	
A564	C072	Indication	1091.422	10%	--	15.2	25.4	05:13	7.92	External	pitting	
C072	--	Cluster	1091.423	20%	--	127.0	160.0	05:44	7.92	External	general	
A565	C072	Indication	1091.428	10%	--	10.2	20.3	05:46	7.92	External	circ groove	
A566	C072	Indication	1091.479	12%	--	15.2	15.2	05:19	7.92	External	pitting	
A567	--	Indication	1091.837	36%	--	15.2	12.7	05:55	7.92	External	pitting	
A568	--	Indication	1092.731	15%	--	7.6	7.6	03:07	7.92	External	pinhole	
A569	--	Indication	1092.802	15%	--	17.8	25.4	04:53	7.92	External	pitting	
A570	--	Indication	1092.830	53%	--	15.2	25.4	06:52	7.92	External	pitting	
A571	--	Indication	1093.579	23%	--	12.7	12.7	07:44	7.92	External	pitting	
A572	--	Indication	1093.666	36%	--	15.2	25.4	07:34	7.92	External	pitting	
A573	--	Indication	1093.785	10%	--	10.2	7.6	06:49	7.92	External	axial slot	
A574	C073	Indication	1093.844	27%	--	12.7	12.7	07:55	7.92	External	pitting	
C073	--	Cluster	1093.871	27%	--	66.0	50.8	08:03	7.92	External	general	
A575	C073	Indication	1093.900	15%	--	7.6	7.6	08:12	7.92	External	pinhole	
A576	--	Indication	1094.140	10%	--	12.7	10.2	07:27	7.92	External	pitting	
A577	--	Indication	1094.296	15%	--	10.2	10.2	05:52	7.92	External	pitting	
A578	--	Indication	1097.210	12%	--	12.7	17.8	06:26	7.92	External	pitting	
A579	C074	Indication	1097.463	10%	--	12.7	12.7	04:19	7.92	External	pitting	
C074	--	Cluster	1097.491	10%	--	71.1	33.0	04:23	7.92	External	general	

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A580	C074	Indication	1097.519	10%	--	15.2	15.2	04:28	7.92	External	pitting	
A581	--	Indication	1097.590	12%	--	15.2	30.5	03:47	7.92	External	circ groove	
W115		Weld	1097.798	--	--			--	7.92	NA (weld)		Bend begin
I054	--	Installation	1097.837	--	--			09:00	7.92	NA		Left bend center; 80+27.1
W116		Weld	1097.884	--	--			--	7.92	NA (weld)		Bend end
A582	C075	Indication	1108.320	10%	--	15.2	15.2	02:42	7.92	External	pitting	
A583	C075	Indication	1108.331	10%	--	20.3	20.3	03:50	7.92	External	pitting	
A584	C075	Indication	1108.410	10%	--	15.2	15.2	03:17	7.92	External	pitting	
C075	--	Cluster	1108.412	10%	--	200.7	170.2	03:17	7.92	External	general	
A585	C075	Indication	1108.492	10%	--	12.7	15.2	03:45	7.92	External	pitting	
A586	C075	Indication	1108.505	10%	--	12.7	12.7	02:58	7.92	External	pitting	
W117		Weld	1110.223	--	--			--	7.92	NA (weld)		
D013	--	Dent	1110.258	--	9.5%	236.2	251.5	05:59	7.92	NA		Interacting with girth weld
A587	--	Indication	1112.483	13%	--	12.7	15.2	05:20	7.92	External	pitting	
A588	--	Indication	1116.878	10%	--	15.2	15.2	00:07	7.92	External	pitting	
A589	--	Indication	1116.928	10%	--	15.2	15.2	10:37	7.92	External	pitting	
A590	C076	Indication	1117.165	10%	--	12.7	15.2	10:52	7.92	External	pitting	
C076	--	Cluster	1117.193	10%	--	68.6	61.0	11:03	7.92	External	general	
A591	C076	Indication	1117.220	10%	--	15.2	15.2	11:14	7.92	External	pitting	
A592	C077	Indication	1117.496	10%	--	12.7	12.7	00:39	7.92	External	pitting	
C077	--	Cluster	1117.549	10%	--	119.4	66.0	00:28	7.92	External	general	
A593	C077	Indication	1117.560	10%	--	17.8	17.8	00:17	7.92	External	pitting	
A594	C077	Indication	1117.601	10%	--	12.7	12.7	00:24	7.92	External	pitting	
W118		Weld	1122.435	--	--			--	7.92	NA (weld)		
A595	--	Indication	1131.311	10%	--	15.2	15.2	04:25	7.92	External	pitting	
I055	--	Installation	1131.328	--	--	55.9	63.5	00:06	7.92	NA		Tap
W119		Weld	1134.570	--	--			--	7.92	NA (weld)		
A596	C078	Indication	1138.263	29%	--	12.7	12.7	07:38	7.92	External	pitting	Interacting with long seam
A597	C078	Indication	1138.284	20%	--	12.7	25.4	07:33	7.92	External	circ groove	Interacting with long seam
A598	C078	Indication	1138.294	29%	--	10.2	17.8	08:03	7.92	External	pitting	
A599	C078	Indication	1138.306	18%	--	7.6	10.2	07:44	7.92	External	circ slot	
A600	C078	Indication	1138.309	20%	--	10.2	10.2	07:29	7.92	External	pitting	Interacting with long seam
A601	C078	Indication	1138.331	14%	--	10.2	12.7	08:03	7.92	External	pitting	
A602	C078	Indication	1138.359	11%	--	7.6	7.6	07:12	7.92	External	pinhole	
C078	--	Cluster	1138.364	29%	--	215.9	149.9	07:44	7.92	External	general	Interacting with long seam
A603	C078	Indication	1138.369	13%	--	10.2	10.2	07:45	7.92	External	pitting	

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A604	C078	Indication	1138.383	10%	--	7.6	7.6	07:15	7.92	External	pinhole	
A605	C078	Indication	1138.401	28%	--	12.7	20.3	08:13	7.92	External	pitting	
A606	C078	Indication	1138.420	21%	--	12.7	25.4	07:32	7.92	External	circ groove	Interacting with long seam
A607	C078	Indication	1138.468	12%	--	7.6	7.6	07:54	7.92	External	pinhole	
A608	--	Indication	1138.654	12%	--	12.7	15.2	04:23	7.92	External	pitting	
A609	--	Indication	1140.313	30%	--	17.8	17.8	07:51	7.92	External	pitting	
A610	C079	Indication	1140.443	17%	--	15.2	40.6	07:12	7.92	External	circ groove	Interacting with long seam
A611	C079	Indication	1140.454	25%	--	12.7	12.7	06:12	7.92	External	pitting	
A612	C079	Indication	1140.490	11%	--	7.6	7.6	06:26	7.92	External	pinhole	
A613	C079	Indication	1140.495	11%	--	10.2	10.2	06:56	7.92	External	pitting	
A614	C079	Indication	1140.501	12%	--	10.2	10.2	07:06	7.92	External	pitting	
C079	--	Cluster	1140.510	35%	--	149.9	182.9	06:51	7.92	External	general	Interacting with long seam
A615	C079	Indication	1140.513	35%	--	10.2	10.2	06:59	7.92	External	pitting	
A616	C079	Indication	1140.516	21%	--	10.2	10.2	07:29	7.92	External	pitting	Interacting with long seam
A617	C079	Indication	1140.580	14%	--	12.7	10.2	07:30	7.92	External	pitting	Interacting with long seam
A618	C080	Indication	1140.919	13%	--	15.2	12.7	06:25	7.92	External	pitting	
A619	C080	Indication	1140.975	10%	--	10.2	12.7	06:37	7.92	External	pitting	
C080	--	Cluster	1141.023	21%	--	223.5	114.3	06:48	7.92	External	general	Interacting with long seam
A620	C080	Indication	1141.035	10%	--	12.7	10.2	06:38	7.92	External	pitting	
A621	C080	Indication	1141.061	21%	--	12.7	22.9	07:04	7.92	External	pitting	Interacting with long seam
A622	C080	Indication	1141.086	13%	--	10.2	10.2	07:11	7.92	External	pitting	Interacting with long seam
A623	C080	Indication	1141.129	11%	--	10.2	10.2	06:49	7.92	External	pitting	
A624	--	Indication	1142.696	13%	--	12.7	12.7	04:10	7.92	External	pitting	
A625	C081	Indication	1142.792	35%	--	12.7	22.9	04:02	7.92	External	pitting	
A626	C081	Indication	1142.802	21%	--	10.2	17.8	04:27	7.92	External	pitting	
A627	C081	Indication	1142.824	29%	--	10.2	20.3	04:16	7.92	External	circ groove	
A628	C081	Indication	1142.861	14%	--	12.7	12.7	05:11	7.92	External	pitting	
C081	--	Cluster	1142.864	35%	--	157.5	172.7	04:35	7.92	External	general	
A629	C081	Indication	1142.872	13%	--	5.1	7.6	04:49	7.92	External	pinhole	
A630	C081	Indication	1142.888	14%	--	7.6	7.6	04:55	7.92	External	pinhole	
A631	C081	Indication	1142.893	19%	--	7.6	7.6	04:24	7.92	External	pinhole	
A632	C081	Indication	1142.937	15%	--	12.7	22.9	04:32	7.92	External	pitting	
A633	C082	Indication	1143.007	13%	--	7.6	7.6	04:55	7.92	External	pinhole	
A634	C082	Indication	1143.017	25%	--	12.7	12.7	05:30	7.92	External	pitting	
A635	C082	Indication	1143.031	24%	--	12.7	12.7	04:30	7.92	External	pitting	
A636	C082	Indication	1143.039	21%	--	10.2	10.2	04:54	7.92	External	pitting	

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C082	--	Cluster	1143.081	55%	--	157.5	188.0	04:50	7.92	External	general	
A637	C082	Indication	1143.098	55%	--	12.7	35.6	04:53	7.92	External	circ groove	
A638	C082	Indication	1143.102	37%	--	17.8	33.0	04:34	7.92	External	pitting	
A639	C082	Indication	1143.155	11%	--	10.2	10.2	04:10	7.92	External	pitting	
A640	--	Indication	1145.630	13%	--	12.7	15.2	01:52	7.92	External	pitting	
W120		Weld	1145.936	--	--			--	7.92	NA (weld)		Bend begin
I056	--	Installation	1146.002	--	--			09:00	7.92	NA		Left bend center; 79+80.8
W121		Weld	1146.089	--	--			--	7.92	NA (weld)		Bend end
W122		Weld	1151.385	--	--			--	7.92	NA (weld)		
A641	--	Indication	1151.441	10%	--	10.2	7.6	05:04	7.92	External	axial slot	
A642	C083	Indication	1152.159	12%	--	7.6	10.2	05:48	7.92	External	circ slot	
A643	C083	Indication	1152.161	11%	--	7.6	7.6	06:09	7.92	External	pinhole	
C083	--	Cluster	1152.175	14%	--	40.6	55.9	05:58	7.92	External	general	
A644	C083	Indication	1152.189	14%	--	10.2	10.2	06:06	7.92	External	pitting	
A645	C083	Indication	1152.191	11%	--	7.6	7.6	05:48	7.92	External	pinhole	
A646	--	Indication	1155.504	10%	--	12.7	12.7	03:46	7.92	External	pitting	
W123		Weld	1163.574	--	--			--	7.92	NA (weld)		
A647	--	Indication	1166.094	10%	--	10.2	10.2	06:32	7.92	External	pitting	
A648	--	Indication	1171.065	11%	--	12.7	12.7	05:52	7.92	External	pitting	
A649	--	Indication	1171.139	15%	--	15.2	12.7	05:42	7.92	External	pitting	
A650	--	Indication	1171.377	10%	--	10.2	7.6	06:51	7.92	External	axial slot	
A651	--	Indication	1171.471	14%	--	10.2	10.2	06:39	7.92	External	pitting	
A652	--	Indication	1172.978	10%	--	10.2	7.6	04:48	7.92	External	axial slot	
W124		Weld	1175.770	--	--			--	7.92	NA (weld)		
A653	--	Indication	1177.108	11%	--	10.2	10.2	05:24	7.92	External	pitting	
A654	--	Indication	1178.924	10%	--	10.2	10.2	05:31	7.92	External	pitting	
I057	--	Installation	1187.414	--	--	48.3	43.2	00:00	7.92	NA		Tap
W125		Weld	1187.782	--	--			--	7.92	NA (weld)		
O065	--	Other Feature	1188.212	--	--			--	7.92	NA		Circumferential fillet weld
I058	--	Installation	1188.722	--	--	472.4	538.5	11:57	7.92	NA		Launcher stopple; Estimated 79+35.0
O066	--	Other Feature	1189.098	--	--			--	7.92	NA		Circumferential fillet weld
A655	--	Indication	1189.370	12%	--	12.7	12.7	06:24	7.92	External	pitting	
A656	C084	Indication	1189.828	10%	--	12.7	10.2	05:13	7.92	External	pitting	
A657	C084	Indication	1189.876	10%	--	7.6	10.2	04:55	7.92	External	circ slot	
C084	--	Cluster	1189.882	11%	--	119.4	53.3	05:03	7.92	External	general	
A658	C084	Indication	1189.936	11%	--	12.7	10.2	04:53	7.92	External	pitting	

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I059	--	Installation	1189.938	--	--	40.6	45.7	00:06	7.92	NA		Tap
A659	--	Indication	1190.036	11%	--	12.7	12.7	06:08	7.92	External	pitting	
W126		Weld	1199.935	--	--			--	7.92	NA (weld)		
A660	C085	Indication	1206.064	11%	--	12.7	12.7	04:56	7.92	External	pitting	
C085	--	Cluster	1206.089	11%	--	63.5	94.0	04:58	7.92	External	general	
A661	C085	Indication	1206.106	10%	--	7.6	10.2	04:39	7.92	External	circ slot	
A662	C085	Indication	1206.115	10%	--	10.2	10.2	05:17	7.92	External	pitting	
A663	C086	Indication	1206.221	10%	--	10.2	12.7	05:26	7.92	External	pitting	
A664	C086	Indication	1206.250	10%	--	15.2	15.2	04:55	7.92	External	pitting	
C086	--	Cluster	1206.290	10%	--	149.9	134.6	04:58	7.92	External	general	
A665	C086	Indication	1206.308	10%	--	10.2	10.2	05:02	7.92	External	pitting	
A666	C086	Indication	1206.352	10%	--	12.7	12.7	05:02	7.92	External	pitting	
A667	C086	Indication	1206.360	10%	--	7.6	10.2	04:29	7.92	External	circ slot	
A668	--	Indication	1209.447	12%	--	15.2	15.2	06:58	7.92	External	pitting	
W127		Weld	1212.129	--	--			--	7.92	NA (weld)		
A669	C087	Indication	1222.161	21%	--	15.2	15.2	05:20	7.92	External	pitting	
C087	--	Cluster	1222.161	22%	--	17.8	78.7	05:06	7.92	External	circ groove	
A670	C087	Indication	1222.163	22%	--	12.7	12.7	04:51	7.92	External	pitting	
W128		Weld	1222.210	--	--			--	7.92	NA (weld)		Bend begin
I060	--	Installation	1222.545	--	--			12:00	7.92	NA		Sag bend center; As per FN 0-169-17
W129		Weld	1222.919	--	--			--	7.92	NA (weld)		Bend end
W130		Weld	1223.211	--	--			--	7.92	NA (weld)		Bend begin
I061	--	Installation	1223.525	--	--			06:00	7.92	NA		Over bend center; As per FN 0-169-17
W131		Weld	1223.845	--	--			--	7.92	NA (weld)		Bend end
A671	--	Indication	1225.224	13%	--	12.7	12.7	10:47	7.92	External	pitting	
W132		Weld	1232.442	--	--			--	7.92	NA (weld)		
A672	--	Indication	1238.010	14%	--	15.2	15.2	06:05	7.92	External	pitting	
A673	--	Indication	1238.761	10%	--	15.2	15.2	06:22	7.92	External	pitting	
A674	--	Indication	1238.885	10%	--	12.7	12.7	05:21	7.92	External	pitting	
A675	--	Indication	1238.947	13%	--	15.2	12.7	06:20	7.92	External	pitting	
A676	--	Indication	1240.579	10%	--	12.7	10.2	05:25	7.92	External	pitting	
A677	--	Indication	1240.714	10%	--	10.2	10.2	06:00	7.92	External	pitting	
A678	--	Indication	1241.069	10%	--	12.7	12.7	06:17	7.92	External	pitting	
A679	--	Indication	1241.093	10%	--	10.2	10.2	05:43	7.92	External	pitting	
A680	--	Indication	1241.247	10%	--	12.7	22.9	06:37	7.92	External	pitting	
A681	--	Indication	1241.366	12%	--	15.2	12.7	06:25	7.92	External	pitting	

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A682	--	Indication	1243.585	10%	--	17.8	15.2	11:05	7.92	External	pitting	
W133		Weld	1244.581	--	--			--	7.92	NA (weld)		
A683	--	Indication	1252.000	34%	--	12.7	20.3	06:26	7.92	External	pitting	
W134		Weld	1256.598	--	--			--	7.92	NA (weld)		
A684	--	Indication	1257.939	10%	--	7.6	15.2	02:47	7.92	External	circ slot	
A685	C088	Indication	1264.790	10%	--	7.6	7.6	08:28	7.92	External	pinhole	
A686	C088	Indication	1264.811	10%	--	12.7	12.7	08:49	7.92	External	pitting	
C088	--	Cluster	1264.814	10%	--	55.9	68.6	08:36	7.92	External	general	
A687	C088	Indication	1264.836	10%	--	12.7	17.8	08:25	7.92	External	pitting	
W135		Weld	1268.560	--	--			--	7.92	NA (weld)		
I062	--	Installation	1276.393	--	--	55.9	50.8	00:13	7.92	NA		Tap
W136		Weld	1279.092	--	--			--	7.92	NA (weld)		
W137		Weld	1280.069	--	--			--	7.92	NA (weld)		Bend begin
I063	--	Installation	1280.390	--	--			09:00	7.92	NA		Left bend center; 78+46.3
W138		Weld	1280.719	--	--			--	7.92	NA (weld)		Bend end
O067	--	Other Feature	1284.267	--	--	106.7	213.4	10:56	7.92	NA		Manufacturing related
W139		Weld	1286.658	--	--			--	7.92	NA (weld)		Bend begin
I064	--	Installation	1287.028	--	--			03:00	7.92	NA		Right bend center; 78+40.5
W140		Weld	1287.468	--	--			--	7.92	NA (weld)		Bend end
O068	--	Other Feature	1288.350	--	--	101.6	99.1	10:14	7.92	NA		Close metal object
W141		Weld	1288.496	--	--			--	7.92	NA (weld)		
D014	--	Dent	1297.002	--	1.0%	53.3	53.3	11:26	7.92	NA		
W142		Weld	1298.708	--	--			--	7.92	NA (weld)		
I065	--	Installation	1299.904	--	--	50.8	50.8	00:02	7.92	NA		Tap
I066	--	Installation	1301.259	--	--	104.1	96.5	11:57	7.92	NA		Tap
I067	--	Installation	1302.299	--	--	68.6	55.9	00:01	7.92	NA		Tap
O069	--	Other Feature	1302.716	--	--			--	7.92	NA		Circumferential fillet weld
I068	--	Installation	1303.230	--	--	485.1	472.4	00:06	7.92	NA		Stopple with coupon
O070	--	Other Feature	1303.717	--	--			--	7.92	NA		Circumferential fillet weld
O071	--	Other Feature	1305.299	--	--			--	7.92	NA		Circumferential fillet weld
I069	--	Installation	1305.553	--	--	142.2	121.9	02:58	7.92	NA		Offtake
O072	--	Other Feature	1305.835	--	--			--	7.92	NA		Circumferential fillet weld
W143		Weld	1312.618	--	--			--	7.92	NA (weld)		
O073	--	Other Feature	1313.244	--	--	78.7	563.9	04:51	7.92	NA		Manufacturing related
A688	--	Indication	1320.723	15%	--	12.7	15.2	00:29	7.92	External	pitting	
W144		Weld	1321.246	--	--			--	7.92	NA (weld)		

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
I070	--	Installation	1333.987	--	--	55.9	43.2	11:51	7.92	NA		Tap
W145		Weld	1334.700	--	--			--	7.92	NA (weld)		
O074	--	Other Feature	1335.323	--	--	63.5	259.1	08:08	7.92	NA		Manufacturing related
O075	--	Other Feature	1335.339	--	--	55.9	193.0	03:51	7.92	NA		Manufacturing related
I071	--	Installation	1336.913	--	--	73.7	53.3	00:07	7.92	NA		Tap
A689	--	Indication	1342.900	15%	--	7.6	10.2	01:14	7.92	External	circ slot	
W146		Weld	1343.756	--	--			--	7.92	NA (weld)		
A690	--	Indication	1344.030	15%	--	15.2	71.1	10:06	7.92	External	circ groove	
A691	--	Indication	1349.293	15%	--	12.7	12.7	06:05	7.92	External	pitting	
A692	--	Indication	1356.009	15%	--	12.7	22.9	10:00	7.92	External	pitting	
W147		Weld	1356.292	--	--			--	7.92	NA (weld)		
W148		Weld	1369.144	--	--			--	7.92	NA (weld)		
W149		Weld	1382.402	--	--			--	7.92	NA (weld)		
A693	--	Indication	1385.824	15%	--	15.2	15.2	00:04	7.92	External	pitting	
W150		Weld	1395.979	--	--			--	7.92	NA (weld)		
A694	--	Indication	1403.081	15%	--	12.7	12.7	03:12	7.92	External	pitting	
A695	--	Indication	1403.780	15%	--	15.2	15.2	11:40	7.92	External	pitting	
D015	--	Dent	1405.773	--	1.5%	86.4	73.7	11:43	7.92	NA		
A696	--	Indication	1406.012	15%	--	20.3	20.3	11:22	7.92	External	pitting	
A697	--	Indication	1406.607	15%	--	12.7	20.3	10:43	7.92	External	pitting	
A698	--	Indication	1406.762	20%	--	17.8	20.3	10:58	7.92	External	pitting	
A699	--	Indication	1407.113	31%	--	30.5	15.2	00:12	7.92	External	axial groove	
A700	--	Indication	1408.175	18%	--	15.2	12.7	11:14	7.92	External	pitting	
A701	--	Indication	1408.258	22%	--	12.7	12.7	11:26	7.92	External	pitting	
A702	--	Indication	1408.301	21%	--	15.2	12.7	00:57	7.92	External	pitting	
W151		Weld	1408.772	--	--			--	7.92	NA (weld)		
A703	--	Indication	1408.904	16%	--	10.2	10.2	11:17	7.92	External	pitting	
A704	C089	Indication	1408.959	19%	--	20.3	22.9	05:34	7.92	External	pitting	
C089	--	Cluster	1408.969	19%	--	43.2	40.6	05:29	7.92	External	general	
A705	--	Indication	1408.979	21%	--	12.7	12.7	06:43	7.92	External	pitting	
A706	C089	Indication	1408.987	15%	--	7.6	7.6	05:22	7.92	External	pinhole	
A707	--	Indication	1409.025	15%	--	25.4	22.9	10:57	7.92	External	pitting	
A708	--	Indication	1409.276	17%	--	15.2	15.2	00:08	7.92	External	pitting	
A709	--	Indication	1409.556	15%	--	12.7	12.7	01:25	7.92	External	pitting	
A710	--	Indication	1409.686	18%	--	15.2	15.2	11:41	7.92	External	pitting	
D016	--	Dent	1411.311	--	0.9%	94.0	78.7	00:04	7.92	NA		

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A711	--	Indication	1412.195	15%	--	15.2	15.2	00:09	7.92	External	pitting	
A712	C090	Indication	1413.497	15%	--	12.7	10.2	10:28	7.92	External	pitting	
C090	--	Cluster	1413.522	17%	--	63.5	22.9	10:26	7.92	External	axial groove	
A713	C090	Indication	1413.545	17%	--	17.8	17.8	10:24	7.92	External	pitting	
A714	--	Indication	1416.432	15%	--	15.2	22.9	10:58	7.92	External	pitting	
W152		Weld	1422.440	--	--			--	7.92	NA (weld)		
A715	--	Indication	1422.659	15%	--	15.2	33.0	08:29	7.92	External	circ groove	
A716	C091	Indication	1429.415	15%	--	12.7	30.5	10:06	7.92	External	circ groove	
C091	--	Cluster	1429.463	15%	--	109.2	91.4	09:52	7.92	External	general	
A717	C091	Indication	1429.491	15%	--	17.8	33.0	09:59	7.92	External	pitting	
A718	C091	Indication	1429.513	15%	--	10.2	10.2	09:33	7.92	External	pitting	
A719	C092	Indication	1433.856	15%	--	17.8	25.4	00:46	7.92	External	pitting	
A720	C092	Indication	1433.884	15%	--	12.7	15.2	00:12	7.92	External	pitting	
C092	--	Cluster	1433.890	15%	--	83.8	167.6	00:14	7.92	External	general	
A721	C092	Indication	1433.925	15%	--	15.2	15.2	11:40	7.92	External	pitting	
A722	--	Indication	1434.284	15%	--	15.2	25.4	11:23	7.92	External	pitting	
A723	--	Indication	1434.896	15%	--	12.7	22.9	00:50	7.92	External	pitting	
A724	--	Indication	1434.987	15%	--	12.7	25.4	00:15	7.92	External	circ groove	
A725	--	Indication	1435.533	15%	--	15.2	15.2	11:06	7.92	External	pitting	
A726	--	Indication	1435.834	15%	--	12.7	12.7	05:06	7.92	External	pitting	
W153		Weld	1436.080	--	--			--	7.92	NA (weld)		
A727	--	Indication	1436.303	16%	--	15.2	30.5	09:09	7.92	External	circ groove	
A728	--	Indication	1441.222	15%	--	17.8	17.8	05:14	7.92	External	pitting	
A729	--	Indication	1444.550	15%	--	12.7	12.7	11:55	7.92	External	pitting	
W154		Weld	1449.724	--	--			--	7.92	NA (weld)		Bend begin
I072	--	Installation	1449.842	--	--			06:00	7.92	NA		Over bend center
W155		Weld	1449.966	--	--			--	7.92	NA (weld)		Bend end
O076	--	Other Feature	1450.418	--	--	20.3	33.0	00:20	7.92	NA		Close metal object
O077	--	Other Feature	1450.426	--	--	22.9	35.6	01:52	7.92	NA		Close metal object
A730	--	Indication	1451.740	16%	--	15.2	30.5	08:17	7.92	External	circ groove	
A731	C093	Indication	1451.740	15%	--	17.8	76.2	04:21	7.92	External	circ groove	
C093	--	Cluster	1451.747	16%	--	33.0	121.9	04:11	7.92	External	general	
A732	C093	Indication	1451.756	16%	--	15.2	30.5	03:50	7.92	External	circ groove	
A733	--	Indication	1452.498	15%	--	12.7	30.5	06:28	7.92	External	circ groove	
A734	--	Indication	1462.655	15%	--	12.7	15.2	06:40	7.92	External	pitting	
W156		Weld	1463.034	--	--			--	7.92	NA (weld)		

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Dimension Class	Comments
A735	--	Indication	1464.225	15%	--	17.8	17.8	11:26	7.92	External	pitting	
O078	--	Other Feature	1465.649	--	--	817.9	426.7	06:07	7.92	NA		Liquid; Video data only
O079	--	Other Feature	1465.742	--	--			--	7.92	NA		Circumferential fillet weld; Video data only
I073	--	Installation	1466.207	--	--	492.8	525.8	00:11	7.92	NA		Spherical tee; 76+64.3; Video data only
O080	--	Other Feature	1466.680	--	--			--	7.92	NA		Circumferential fillet weld; Video data only
I074	--	Installation	1467.457	--	--	30.5	33.0	00:00	7.92	NA		Tap; Video data only
W157		Weld	1467.741	--	--			--	7.92	NA (weld)		Video data only
O081	--	Other Feature	1467.761	--	--			--	7.92	NA		End of run; Welded cap; Video data only

9 Metal Loss Tables and Charts

9.1 Cluster and Non-Clustered Metal Loss Listing

Clusters and non-clustered individual Metal loss indications are listed below.
If no metal loss anomalies are reported, the table below is intentionally left empty.

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A001	Indication	-0.225	03:58	15%	20.3	53.3	7.92	290	External	
C001	Cluster	-0.156	06:17	32%	76.2	83.8	7.92	290	External	
A005	Indication	-0.099	04:40	35%	12.7	15.2	7.92	290	External	
A006	Indication	-0.030	05:05	39%	15.2	25.4	7.92	290	External	At weld
A007	Indication	-0.015	06:05	38%	12.7	25.4	7.92	290	External	At weld
A008	Indication	0.126	05:39	20%	15.2	12.7	7.92	290	External	
A009	Indication	0.130	06:06	15%	10.2	10.2	7.92	290	External	
A010	Indication	0.191	05:42	34%	17.8	17.8	7.92	290	External	
A011	Indication	3.659	10:39	37%	27.9	27.9	7.92	290	External	
A012	Indication	5.894	10:30	15%	12.7	10.2	7.92	290	External	
C002	Cluster	6.856	00:40	15%	61.0	17.8	7.92	290	External	
A015	Indication	7.384	00:39	15%	15.2	15.2	7.92	290	External	
A016	Indication	11.224	04:38	15%	12.7	10.2	7.92	290	External	
A017	Indication	13.550	08:08	16%	12.7	12.7	7.92	290	External	
C003	Cluster	13.668	07:58	16%	73.7	43.2	7.92	290	External	
C004	Cluster	14.037	06:57	21%	20.3	101.6	7.92	290	External	
A022	Indication	15.268	02:05	15%	12.7	15.2	7.92	290	External	
A023	Indication	19.086	11:14	25%	27.9	27.9	7.92	290	External	
C005	Cluster	22.323	03:29	21%	25.4	35.6	7.92	290	External	
C006	Cluster	22.987	03:46	16%	25.4	48.3	7.92	290	External	
A028	Indication	23.195	07:11	15%	12.7	10.2	7.92	290	External	
A029	Indication	23.219	08:05	15%	7.6	7.6	7.92	290	External	
A030	Indication	23.885	07:25	23%	15.2	15.2	7.92	290	External	
A031	Indication	31.917	04:33	15%	15.2	15.2	7.92	290	External	
A032	Indication	37.085	02:27	22%	12.7	27.9	7.92	290	External	
A033	Indication	37.238	00:14	23%	15.2	15.2	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A034	Indication	37.482	00:40	15%	12.7	12.7	7.92	290	External	
C007	Cluster	37.545	09:57	23%	106.7	190.5	7.92	290	External	
A040	Indication	37.693	00:24	10%	10.2	10.2	7.92	290	External	
A041	Indication	37.735	02:43	14%	17.8	15.2	7.92	290	External	
A042	Indication	37.931	00:24	23%	10.2	12.7	7.92	290	External	
A043	Indication	39.673	06:32	25%	12.7	20.3	7.92	290	External	Interacting with long seam
A044	Indication	39.885	06:34	33%	12.7	27.9	7.92	290	External	Interacting with long seam
A045	Indication	42.770	05:39	10%	12.7	22.9	7.92	290	External	
C008	Cluster	46.386	08:42	57%	17.8	50.8	7.92	290	External	
C009	Cluster	46.678	09:03	44%	17.8	68.6	7.92	290	External	
A051	Indication	47.982	02:13	22%	12.7	12.7	7.92	290	External	
A052	Indication	48.009	03:02	42%	15.2	33.0	7.92	290	External	
A053	Indication	48.028	08:56	15%	33.0	17.8	7.92	290	External	
A054	Indication	48.142	03:20	38%	12.7	27.9	7.92	290	External	
A055	Indication	48.321	10:00	12%	15.2	15.2	7.92	290	External	
A056	Indication	48.859	00:04	10%	12.7	15.2	7.92	290	External	
A057	Indication	48.937	08:59	35%	15.2	25.4	7.92	290	External	
A058	Indication	49.763	11:19	24%	15.2	12.7	7.92	290	External	
A059	Indication	54.421	00:47	22%	12.7	15.2	7.92	290	External	
A060	Indication	93.942	09:10	10%	12.7	10.2	7.92	290	External	
C010	Cluster	106.415	11:29	11%	406.4	104.1	7.92	290	External	
A069	Indication	174.511	04:01	12%	10.2	10.2	7.92	290	External	
C011	Cluster	195.331	11:31	15%	668.0	218.4	7.92	290	External	
A082	Indication	206.916	09:04	34%	12.7	12.7	7.92	290	External	
C012	Cluster	207.281	09:20	15%	76.2	101.6	7.92	290	External	
A086	Indication	207.732	08:42	15%	15.2	15.2	7.92	290	External	
C013	Cluster	208.170	09:12	22%	30.5	53.3	7.92	290	External	
A089	Indication	223.217	06:58	10%	12.7	27.9	7.92	290	External	
C014	Cluster	226.064	02:13	20%	525.8	162.6	7.92	290	External	
A099	Indication	226.456	00:19	21%	15.2	15.2	7.92	290	External	
A100	Indication	226.549	00:12	10%	15.2	15.2	7.92	290	External	
A101	Indication	226.971	10:37	10%	12.7	12.7	7.92	290	External	
C015	Cluster	227.285	02:52	12%	81.3	109.2	7.92	290	External	
A104	Indication	228.314	04:09	11%	10.2	7.6	7.92	290	External	
A105	Indication	228.960	01:51	10%	12.7	22.9	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A106	Indication	230.657	03:07	23%	12.7	43.2	7.92	290	External	
A107	Indication	231.495	00:20	11%	15.2	12.7	7.92	290	External	
A108	Indication	234.384	00:21	10%	17.8	15.2	7.92	290	External	
A109	Indication	234.707	03:11	15%	12.7	15.2	7.92	290	External	
C016	Cluster	243.449	11:29	10%	50.8	45.7	7.92	290	External	
A112	Indication	243.632	11:37	10%	12.7	12.7	7.92	290	External	
A113	Indication	243.850	00:00	10%	17.8	15.2	7.92	290	External	
A114	Indication	244.094	00:00	10%	12.7	12.7	7.92	290	External	
C017	Cluster	244.325	00:25	15%	73.7	27.9	7.92	290	External	
C018	Cluster	246.802	00:09	10%	99.1	71.1	7.92	290	External	
A121	Indication	247.310	00:23	12%	17.8	17.8	7.92	290	External	
C019	Cluster	250.587	00:51	14%	170.2	94.0	7.92	290	External	
A127	Indication	250.765	00:36	14%	12.7	12.7	7.92	290	External	
A128	Indication	250.911	00:40	15%	17.8	27.9	7.92	290	External	
A129	Indication	251.633	10:59	10%	17.8	27.9	7.92	290	External	
C020	Cluster	252.960	11:44	20%	276.9	226.1	7.92	290	External	
A138	Indication	253.459	00:05	14%	17.8	27.9	7.92	290	External	
A139	Indication	261.229	11:55	15%	10.2	10.2	7.92	290	External	
A140	Indication	266.822	01:46	10%	15.2	12.7	7.92	290	External	
C021	Cluster	267.005	03:49	10%	20.3	78.7	7.92	290	External	
A143	Indication	267.062	02:23	12%	12.7	10.2	7.92	290	External	At weld
A144	Indication	267.083	03:45	16%	12.7	12.7	7.92	290	External	At weld
C022	Cluster	301.145	04:50	15%	139.7	53.3	7.92	290	External	
A148	Indication	301.478	03:20	15%	12.7	25.4	7.92	290	External	
A149	Indication	302.259	01:17	15%	15.2	12.7	7.92	290	External	
A150	Indication	304.564	02:43	16%	15.2	15.2	7.92	290	External	
A151	Indication	308.743	02:33	15%	12.7	12.7	7.92	290	External	
A152	Indication	309.528	07:54	16%	15.2	12.7	7.92	290	External	
A153	Indication	310.255	01:42	21%	12.7	12.7	7.92	290	External	
C023	Cluster	310.265	11:46	31%	27.9	104.1	7.92	290	External	
C024	Cluster	318.738	09:11	32%	50.8	12.7	7.92	290	External	
A158	Indication	320.209	09:03	15%	15.2	15.2	7.92	290	External	
A159	Indication	320.441	01:59	20%	17.8	15.2	7.92	290	External	
C025	Cluster	320.542	02:12	21%	63.5	149.9	7.92	290	External	
A164	Indication	320.959	09:20	15%	15.2	15.2	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
C026	Cluster	324.405	08:25	45%	76.2	50.8	7.92	290	External	
A167	Indication	324.514	05:15	15%	15.2	12.7	7.92	290	External	
A168	Indication	325.231	08:00	16%	15.2	12.7	7.92	290	External	
A169	Indication	326.140	07:04	31%	17.8	17.8	7.92	290	External	
A170	Indication	327.390	00:05	32%	10.2	10.2	7.92	290	External	
A179	Indication	327.602	03:40	15%	15.2	15.2	7.92	290	External	
C027	Cluster	327.603	05:43	33%	426.7	386.1	7.92	290	External	
A192	Indication	328.448	07:43	15%	15.2	12.7	7.92	290	External	
A193	Indication	332.114	08:53	16%	15.2	15.2	7.92	290	External	
A194	Indication	332.138	10:49	32%	12.7	12.7	7.92	290	External	
A195	Indication	333.575	03:34	15%	15.2	15.2	7.92	290	External	
C028	Cluster	333.844	08:33	16%	63.5	30.5	7.92	290	External	
C029	Cluster	367.062	07:26	16%	58.4	94.0	7.92	290	External	
A200	Indication	367.184	07:56	15%	10.2	10.2	7.92	290	External	
A201	Indication	367.260	08:19	15%	12.7	12.7	7.92	290	External	At weld
A202	Indication	367.474	09:25	16%	15.2	17.8	7.92	290	External	
A203	Indication	367.489	10:22	15%	12.7	12.7	7.92	290	External	
A204	Indication	367.500	08:08	15%	17.8	15.2	7.92	290	External	
A205	Indication	369.177	00:01	30%	17.8	17.8	7.92	290	External	
C030	Cluster	369.587	00:15	23%	233.7	160.0	7.92	290	External	
A215	Indication	376.384	00:36	15%	15.2	17.8	7.92	290	External	
A216	Indication	377.569	02:05	39%	10.2	10.2	7.92	290	External	
A217	Indication	379.316	01:03	21%	12.7	15.2	7.92	290	External	
A219	Indication	379.325	01:51	15%	10.2	12.7	7.92	290	External	
C031	Cluster	379.352	08:42	37%	43.2	104.1	7.92	290	External	
C032	Cluster	379.354	10:35	22%	73.7	99.1	7.92	290	External	
C033	Cluster	379.777	09:40	40%	53.3	355.6	7.92	290	External	
A230	Indication	382.709	07:12	15%	10.2	10.2	7.92	290	External	
A231	Indication	383.674	05:55	35%	15.2	20.3	7.92	290	External	
A232	Indication	384.662	07:00	43%	12.7	20.3	7.92	290	External	
C034	Cluster	384.694	07:42	26%	63.5	30.5	7.92	290	External	
A235	Indication	384.808	07:21	25%	10.2	12.7	7.92	290	External	
A236	Indication	386.531	02:30	21%	15.2	15.2	7.92	290	External	
A237	Indication	389.217	07:52	15%	12.7	12.7	7.92	290	External	
A238	Indication	390.336	07:40	20%	15.2	15.2	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A239	Indication	391.116	00:00	15%	12.7	10.2	7.92	290	External	
A240	Indication	392.742	07:12	15%	12.7	25.4	7.92	290	External	
A241	Indication	392.895	06:45	15%	15.2	15.2	7.92	290	External	
A242	Indication	393.201	05:34	15%	20.3	66.0	7.92	290	External	
A243	Indication	393.203	04:06	15%	12.7	22.9	7.92	290	External	
A244	Indication	396.442	08:42	15%	12.7	12.7	7.92	290	External	
A245	Indication	416.803	06:15	30%	10.2	10.2	7.92	290	External	At weld
A246	Indication	416.891	06:01	18%	12.7	20.3	7.92	290	External	
A247	Indication	416.990	06:45	35%	15.2	27.9	7.92	290	External	
C035	Cluster	417.090	06:05	48%	27.9	304.8	7.92	290	External	
A252	Indication	418.284	06:24	15%	15.2	15.2	7.92	290	External	
A253	Indication	418.463	04:19	15%	10.2	12.7	7.92	290	External	
A254	Indication	420.867	01:06	15%	17.8	20.3	7.92	290	External	
A255	Indication	432.601	08:14	15%	10.2	10.2	7.92	290	External	
A256	Indication	443.612	04:37	15%	12.7	12.7	7.92	290	External	
A257	Indication	444.275	09:53	15%	15.2	17.8	7.92	290	External	
A258	Indication	444.439	06:22	15%	10.2	12.7	7.92	290	External	
A259	Indication	444.701	05:37	16%	12.7	12.7	7.92	290	External	
A260	Indication	445.181	05:57	15%	12.7	12.7	7.92	290	External	
C036	Cluster	446.312	05:59	47%	53.3	63.5	7.92	290	External	
A263	Indication	447.923	04:45	25%	17.8	20.3	7.92	290	External	
C037	Cluster	448.490	06:19	46%	66.0	27.9	7.92	290	External	
A266	Indication	448.608	06:18	41%	10.2	20.3	7.92	290	External	
A267	Indication	448.613	05:34	27%	12.7	12.7	7.92	290	External	
A268	Indication	448.684	05:42	15%	10.2	12.7	7.92	290	External	
A269	Indication	448.726	06:31	26%	12.7	15.2	7.92	290	External	
C038	Cluster	453.853	07:54	30%	22.9	127.0	7.92	290	External	
C039	Cluster	454.293	07:44	16%	63.5	78.7	7.92	290	External	
A275	Indication	463.913	10:37	22%	15.2	15.2	7.92	290	External	
A276	Indication	466.029	05:26	15%	10.2	12.7	7.92	290	External	
A277	Indication	466.112	05:13	15%	12.7	12.7	7.92	290	External	
A278	Indication	466.424	05:23	30%	15.2	15.2	7.92	290	External	
A279	Indication	492.374	11:03	15%	10.2	15.2	7.92	290	External	
C040	Cluster	493.015	11:17	15%	15.2	104.1	7.92	290	External	
A282	Indication	493.132	00:41	15%	17.8	15.2	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A283	Indication	493.384	02:32	15%	17.8	15.2	7.92	290	External	
A284	Indication	494.230	02:42	15%	15.2	17.8	7.92	290	External	
A285	Indication	494.443	09:19	15%	12.7	15.2	7.92	290	External	
A286	Indication	494.727	11:18	15%	10.2	10.2	7.92	290	External	
A287	Indication	494.831	03:15	15%	12.7	25.4	7.92	290	External	
A288	Indication	495.082	09:47	15%	17.8	17.8	7.92	290	External	
A289	Indication	495.341	04:29	15%	12.7	12.7	7.92	290	External	
A290	Indication	495.558	02:38	15%	12.7	12.7	7.92	290	External	
C041	Cluster	495.668	00:33	15%	17.8	86.4	7.92	290	External	
C042	Cluster	495.699	05:11	15%	27.9	91.4	7.92	290	External	
A294	Indication	495.702	03:47	15%	15.2	15.2	7.92	290	External	
A296	Indication	495.779	04:00	15%	15.2	15.2	7.92	290	External	
A297	Indication	495.817	04:46	15%	17.8	17.8	7.92	290	External	
A298	Indication	499.389	11:27	15%	15.2	15.2	7.92	290	External	
A299	Indication	500.146	04:38	15%	15.2	30.5	7.92	290	External	
A300	Indication	506.369	03:41	15%	7.6	10.2	7.92	290	External	
A301	Indication	514.838	05:09	10%	15.2	15.2	7.92	290	External	
A302	Indication	514.859	07:25	10%	15.2	27.9	7.92	290	External	
A303	Indication	515.925	07:25	10%	15.2	15.2	7.92	290	External	
A304	Indication	516.632	07:28	10%	10.2	10.2	7.92	290	External	
C043	Cluster	517.210	10:56	14%	35.6	48.3	7.92	290	External	
A307	Indication	517.297	11:06	10%	17.8	30.5	7.92	290	External	
A308	Indication	517.843	11:09	14%	12.7	12.7	7.92	290	External	
A309	Indication	535.433	04:40	10%	10.2	7.6	7.92	290	External	
A310	Indication	537.347	07:31	10%	7.6	7.6	7.92	290	External	
A311	Indication	540.113	11:51	10%	12.7	10.2	7.92	290	External	
A312	Indication	540.167	07:45	10%	12.7	12.7	7.92	290	External	
A313	Indication	540.389	02:59	12%	12.7	10.2	7.92	290	External	
C044	Cluster	542.784	02:09	15%	264.2	142.2	7.92	290	External	
A322	Indication	559.714	11:19	11%	15.2	15.2	7.92	290	External	
A323	Indication	565.671	04:02	32%	12.7	12.7	7.92	290	External	
C045	Cluster	566.575	05:17	14%	96.5	180.3	7.92	290	External	Interacting with long seam
A327	Indication	596.093	03:37	15%	15.2	15.2	7.92	290	External	
A328	Indication	603.581	11:24	22%	15.2	15.2	7.92	290	External	
A329	Indication	608.568	10:15	15%	10.2	10.2	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A330	Indication	610.394	02:19	15%	12.7	12.7	7.92	290	External	
A331	Indication	610.637	01:43	15%	15.2	12.7	7.92	290	External	
A332	Indication	610.787	02:17	15%	15.2	15.2	7.92	290	External	
A333	Indication	612.622	07:48	15%	10.2	10.2	7.92	290	External	
A334	Indication	612.691	08:15	15%	10.2	10.2	7.92	290	External	
A335	Indication	612.823	06:36	15%	12.7	12.7	7.92	290	External	
A336	Indication	612.831	08:14	15%	12.7	12.7	7.92	290	External	
A337	Indication	612.984	06:56	16%	12.7	10.2	7.92	290	External	
A338	Indication	613.098	02:59	15%	15.2	15.2	7.92	290	External	
A339	Indication	613.174	01:16	15%	12.7	12.7	7.92	290	External	
A340	Indication	613.410	02:00	15%	10.2	10.2	7.92	290	External	
A341	Indication	613.475	02:15	15%	15.2	15.2	7.92	290	External	
A342	Indication	640.197	05:12	23%	12.7	12.7	7.92	290	External	
A343	Indication	640.271	05:46	18%	15.2	27.9	7.92	290	External	At weld
C046	Cluster	640.410	05:13	38%	58.4	66.0	7.92	290	External	
A347	Indication	640.530	05:11	15%	10.2	12.7	7.92	290	External	
A348	Indication	666.581	06:23	15%	10.2	10.2	7.92	290	External	
C047	Cluster	679.658	05:49	15%	30.5	165.1	7.92	290	External	
A352	Indication	679.701	04:18	15%	12.7	17.8	7.92	290	External	
A353	Indication	692.956	04:52	15%	12.7	12.7	7.92	290	External	
A354	Indication	700.189	07:38	15%	15.2	15.2	7.92	290	External	
A355	Indication	701.405	06:53	15%	17.8	43.2	7.92	290	External	
A356	Indication	701.558	07:16	15%	12.7	22.9	7.92	290	External	
A357	Indication	702.292	07:31	15%	15.2	12.7	7.92	290	External	
A358	Indication	702.862	06:40	15%	12.7	30.5	7.92	290	External	
C048	Cluster	703.154	06:41	15%	22.9	55.9	7.92	290	External	
C049	Cluster	703.294	06:40	16%	17.8	66.0	7.92	290	External	
A363	Indication	703.616	06:43	15%	17.8	15.2	7.92	290	External	
C050	Cluster	703.883	06:39	15%	22.9	43.2	7.92	290	External	
A366	Indication	704.651	06:01	18%	15.2	22.9	7.92	290	External	
A367	Indication	704.790	07:23	15%	12.7	15.2	7.92	290	External	
A368	Indication	705.124	04:23	27%	15.2	22.9	7.92	290	External	
A369	Indication	709.937	04:26	15%	7.6	7.6	7.92	290	External	
C051	Cluster	733.669	00:31	19%	134.6	254.0	7.92	290	External	
C052	Cluster	734.271	10:41	33%	48.3	165.1	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
C053	Cluster	764.988	00:35	16%	15.2	73.7	7.92	290	External	
A380	Indication	794.497	10:11	15%	15.2	15.2	7.92	290	External	
A381	Indication	796.570	10:29	15%	12.7	15.2	7.92	290	External	
A382	Indication	803.253	00:35	15%	12.7	12.7	7.92	290	External	
A383	Indication	809.007	06:37	34%	12.7	12.7	7.92	290	External	
A384	Indication	809.288	08:33	15%	12.7	12.7	7.92	290	External	
A385	Indication	811.718	04:47	15%	17.8	25.4	7.92	290	External	
A386	Indication	813.011	07:09	15%	12.7	12.7	7.92	290	External	
A387	Indication	825.135	08:07	15%	10.2	7.6	7.92	290	External	
A388	Indication	825.195	08:13	15%	12.7	12.7	7.92	290	External	
A389	Indication	825.278	01:19	15%	15.2	12.7	7.92	290	External	
A390	Indication	825.340	08:22	15%	10.2	25.4	7.92	290	External	
A391	Indication	841.457	09:59	32%	12.7	12.7	7.92	290	External	
A392	Indication	841.531	07:55	36%	10.2	10.2	7.92	290	External	
A393	Indication	844.409	09:25	15%	12.7	15.2	7.92	290	External	
A394	Indication	849.504	05:06	15%	12.7	27.9	7.92	290	External	
A395	Indication	854.500	08:22	15%	10.2	12.7	7.92	290	External	
A396	Indication	856.440	10:34	15%	15.2	15.2	7.92	290	External	
A397	Indication	867.496	00:10	15%	12.7	30.5	7.92	290	External	
A398	Indication	868.029	10:38	15%	12.7	27.9	7.92	290	External	
A399	Indication	872.545	05:24	36%	10.2	25.4	7.92	290	External	
A400	Indication	887.997	10:26	15%	7.6	10.2	7.92	290	External	
A401	Indication	888.092	01:08	15%	12.7	12.7	7.92	290	External	
A402	Indication	892.637	10:01	15%	15.2	12.7	7.92	290	External	
A403	Indication	896.357	01:54	15%	15.2	30.5	7.92	290	External	
A404	Indication	897.549	11:32	15%	15.2	17.8	7.92	290	External	
A405	Indication	897.689	01:01	15%	15.2	15.2	7.92	290	External	
A406	Indication	897.700	00:09	15%	17.8	15.2	7.92	290	External	
A407	Indication	901.564	08:30	15%	12.7	12.7	7.92	290	External	
A408	Indication	910.732	10:28	15%	15.2	12.7	7.92	290	External	
A409	Indication	912.582	10:27	15%	17.8	17.8	7.92	290	External	
A410	Indication	914.162	07:45	15%	12.7	12.7	7.92	290	External	
A411	Indication	914.661	05:36	15%	10.2	10.2	7.92	290	External	
A412	Indication	914.751	04:30	15%	12.7	12.7	7.92	290	External	
A413	Indication	914.833	07:30	16%	15.2	25.4	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A414	Indication	914.835	08:33	15%	15.2	15.2	7.92	290	External	
A415	Indication	914.869	06:49	15%	7.6	20.3	7.92	290	External	
A416	Indication	914.916	07:30	15%	12.7	25.4	7.92	290	External	
A417	Indication	920.059	10:48	21%	30.5	27.9	7.92	290	External	
A418	Indication	930.131	10:46	10%	15.2	15.2	7.92	290	External	
A419	Indication	933.458	07:12	10%	15.2	12.7	7.92	290	External	
A420	Indication	935.674	07:25	10%	10.2	10.2	7.92	290	External	
A421	Indication	942.341	02:48	10%	10.2	20.3	7.92	290	External	
A422	Indication	942.771	02:46	10%	7.6	15.2	7.92	290	External	
A423	Indication	948.669	01:12	10%	12.7	12.7	7.92	290	External	
A424	Indication	962.268	00:20	10%	12.7	15.2	7.92	290	External	
A425	Indication	962.663	10:55	10%	10.2	10.2	7.92	290	External	
A426	Indication	962.757	01:25	11%	12.7	12.7	7.92	290	External	
A427	Indication	963.196	09:24	10%	12.7	12.7	7.92	290	External	
A428	Indication	965.538	11:12	37%	27.9	27.9	7.92	290	External	
A429	Indication	965.691	08:38	10%	10.2	12.7	7.92	290	External	
A430	Indication	967.197	10:01	10%	12.7	12.7	7.92	290	External	
C054	Cluster	971.494	09:00	23%	55.9	139.7	7.92	290	External	Interacting with long seam
C055	Cluster	971.557	10:35	31%	83.8	177.8	7.92	290	External	
C056	Cluster	971.616	09:03	10%	33.0	71.1	7.92	290	External	
C057	Cluster	971.723	08:50	25%	55.9	185.4	7.92	290	External	Interacting with long seam
A446	Indication	972.604	05:57	10%	10.2	12.7	7.92	290	External	
C058	Cluster	972.634	00:11	15%	25.4	40.6	7.92	290	External	
A449	Indication	972.754	00:27	10%	12.7	12.7	7.92	290	External	
C059	Cluster	985.699	11:01	13%	548.6	370.8	7.92	290	External	
C060	Cluster	986.142	11:20	10%	111.8	200.7	7.92	290	External	
C061	Cluster	990.109	08:39	13%	86.4	132.1	7.92	290	External	
A475	Indication	992.544	05:12	10%	17.8	15.2	7.92	290	External	
C062	Cluster	993.277	10:47	15%	271.8	485.1	7.92	290	External	
A488	Indication	994.773	00:05	10%	15.2	15.2	7.92	290	External	
C063	Cluster	999.722	05:55	39%	213.4	320.0	7.92	290	External	
A504	Indication	999.911	06:46	23%	17.8	15.2	7.92	290	External	
C064	Cluster	999.922	05:01	39%	55.9	43.2	7.92	290	External	
A507	Indication	1000.989	05:56	10%	12.7	10.2	7.92	290	External	
A508	Indication	1001.798	11:08	10%	12.7	12.7	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A509	Indication	1005.615	08:07	10%	10.2	10.2	7.92	290	External	
A510	Indication	1009.165	07:03	10%	7.6	10.2	7.92	290	External	
A511	Indication	1013.810	06:53	10%	10.2	10.2	7.92	290	External	
A512	Indication	1026.728	05:00	10%	12.7	12.7	7.92	290	External	
A513	Indication	1028.423	05:36	14%	10.2	10.2	7.92	290	External	
A514	Indication	1030.223	05:14	13%	7.6	7.6	7.92	290	External	
A515	Indication	1030.225	06:05	10%	10.2	7.6	7.92	290	External	
A516	Indication	1030.553	05:50	19%	10.2	12.7	7.92	290	External	
A517	Indication	1030.790	06:11	12%	10.2	10.2	7.92	290	External	
C065	Cluster	1047.114	06:25	32%	66.0	33.0	7.92	290	External	
C066	Cluster	1047.295	06:29	32%	116.8	121.9	7.92	290	External	
A528	Indication	1050.881	04:57	41%	15.2	20.3	7.92	290	External	
C067	Cluster	1054.719	02:54	43%	73.7	160.0	7.92	290	External	
C068	Cluster	1054.982	02:50	19%	61.0	96.5	7.92	290	External	
A535	Indication	1055.101	02:32	20%	17.8	15.2	7.92	290	External	
A536	Indication	1055.154	03:05	27%	15.2	25.4	7.92	290	External	
A537	Indication	1055.246	02:31	15%	12.7	12.7	7.92	290	External	
A538	Indication	1055.317	03:10	13%	15.2	27.9	7.92	290	External	
A539	Indication	1057.703	06:17	10%	10.2	12.7	7.92	290	External	
A540	Indication	1062.597	05:17	10%	10.2	27.9	7.92	290	External	
A541	Indication	1072.704	05:02	10%	12.7	10.2	7.92	290	External	
A542	Indication	1084.139	06:56	10%	10.2	12.7	7.92	290	External	
C069	Cluster	1084.237	05:21	15%	58.4	17.8	7.92	290	External	
A545	Indication	1085.940	06:29	10%	12.7	10.2	7.92	290	External	
A546	Indication	1086.343	05:47	10%	7.6	10.2	7.92	290	External	
A547	Indication	1088.445	07:42	11%	10.2	10.2	7.92	290	External	
C070	Cluster	1088.709	06:19	25%	76.2	61.0	7.92	290	External	
A549	Indication	1088.736	05:25	10%	10.2	10.2	7.92	290	External	
A552	Indication	1088.813	07:39	13%	12.7	12.7	7.92	290	External	
A553	Indication	1088.831	05:30	14%	10.2	10.2	7.92	290	External	
C071	Cluster	1088.931	05:47	10%	45.7	25.4	7.92	290	External	
A556	Indication	1089.305	06:14	10%	10.2	10.2	7.92	290	External	
A557	Indication	1089.605	06:32	10%	22.9	12.7	7.92	290	External	
A558	Indication	1089.754	06:22	12%	10.2	10.2	7.92	290	External	
A559	Indication	1091.191	03:53	14%	38.1	17.8	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A560	Indication	1091.269	05:38	13%	12.7	12.7	7.92	290	External	
A563	Indication	1091.403	02:41	10%	30.5	17.8	7.92	290	External	
C072	Cluster	1091.423	05:44	20%	127.0	160.0	7.92	290	External	
A567	Indication	1091.837	05:55	36%	15.2	12.7	7.92	290	External	
A568	Indication	1092.731	03:07	15%	7.6	7.6	7.92	290	External	
A569	Indication	1092.802	04:53	15%	17.8	25.4	7.92	290	External	
A570	Indication	1092.830	06:52	53%	15.2	25.4	7.92	290	External	
A571	Indication	1093.579	07:44	23%	12.7	12.7	7.92	290	External	
A572	Indication	1093.666	07:34	36%	15.2	25.4	7.92	290	External	
A573	Indication	1093.785	06:49	10%	10.2	7.6	7.92	290	External	
C073	Cluster	1093.871	08:03	27%	66.0	50.8	7.92	290	External	
A576	Indication	1094.140	07:27	10%	12.7	10.2	7.92	290	External	
A577	Indication	1094.296	05:52	15%	10.2	10.2	7.92	290	External	
A578	Indication	1097.210	06:26	12%	12.7	17.8	7.92	290	External	
C074	Cluster	1097.491	04:23	10%	71.1	33.0	7.92	290	External	
A581	Indication	1097.590	03:47	12%	15.2	30.5	7.92	290	External	
C075	Cluster	1108.412	03:17	10%	200.7	170.2	7.92	290	External	
A587	Indication	1112.483	05:20	13%	12.7	15.2	7.92	290	External	
A588	Indication	1116.878	00:07	10%	15.2	15.2	7.92	290	External	
A589	Indication	1116.928	10:37	10%	15.2	15.2	7.92	290	External	
C076	Cluster	1117.193	11:03	10%	68.6	61.0	7.92	290	External	
C077	Cluster	1117.549	00:28	10%	119.4	66.0	7.92	290	External	
A595	Indication	1131.311	04:25	10%	15.2	15.2	7.92	290	External	
C078	Cluster	1138.364	07:44	29%	215.9	149.9	7.92	290	External	Interacting with long seam
A608	Indication	1138.654	04:23	12%	12.7	15.2	7.92	290	External	
A609	Indication	1140.313	07:51	30%	17.8	17.8	7.92	290	External	
C079	Cluster	1140.510	06:51	35%	149.9	182.9	7.92	290	External	Interacting with long seam
C080	Cluster	1141.023	06:48	21%	223.5	114.3	7.92	290	External	Interacting with long seam
A624	Indication	1142.696	04:10	13%	12.7	12.7	7.92	290	External	
C081	Cluster	1142.864	04:35	35%	157.5	172.7	7.92	290	External	
C082	Cluster	1143.081	04:50	55%	157.5	188.0	7.92	290	External	
A640	Indication	1145.630	01:52	13%	12.7	15.2	7.92	290	External	
A641	Indication	1151.441	05:04	10%	10.2	7.6	7.92	290	External	
C083	Cluster	1152.175	05:58	14%	40.6	55.9	7.92	290	External	
A646	Indication	1155.504	03:46	10%	12.7	12.7	7.92	290	External	

Feature ID	Feature Type	Odometer (m)	O'clock Position	Depth (% wt)	Length (mm)	Width (mm)	WT (mm)	Pipe Grade (Mpa)	Pipe Wall Location	Comments
A647	Indication	1166.094	06:32	10%	10.2	10.2	7.92	290	External	
A648	Indication	1171.065	05:52	11%	12.7	12.7	7.92	290	External	
A649	Indication	1171.139	05:42	15%	15.2	12.7	7.92	290	External	
A650	Indication	1171.377	06:51	10%	10.2	7.6	7.92	290	External	
A651	Indication	1171.471	06:39	14%	10.2	10.2	7.92	290	External	
A652	Indication	1172.978	04:48	10%	10.2	7.6	7.92	290	External	
A653	Indication	1177.108	05:24	11%	10.2	10.2	7.92	290	External	
A654	Indication	1178.924	05:31	10%	10.2	10.2	7.92	290	External	
A655	Indication	1189.370	06:24	12%	12.7	12.7	7.92	290	External	
C084	Cluster	1189.882	05:03	11%	119.4	53.3	7.92	290	External	
A659	Indication	1190.036	06:08	11%	12.7	12.7	7.92	290	External	
C085	Cluster	1206.089	04:58	11%	63.5	94.0	7.92	290	External	
C086	Cluster	1206.290	04:58	10%	149.9	134.6	7.92	290	External	
A668	Indication	1209.447	06:58	12%	15.2	15.2	7.92	290	External	
C087	Cluster	1222.161	05:06	22%	17.8	78.7	7.92	290	External	

9.2 P_F/100%SMYS Break down: Cluster and Non-Interacting Metal Loss

Metal loss anomalies categories based on their P_F/100%SMYS. The categories defined were:

- P_F/100%SMYS Not Provided for Metal Loss Depth ≥ 80%
- Metal loss indications with RPR ≤ 1.00
- Metal loss indications with RPR > 1.00

The failure pressure ratio (P_F/100%SMYS) for all metal loss External Metal Loss is provided according to ASME B31G using the original[1] (abbreviated to B31G), modified[2] (abbreviated to modified or MB31G) B31G methods and Effective Area Calculation. P_F/100%SMYS is defined as P_F the estimate failure pressure of the pipeline computed from ASME B31G-2009 and MAOP the maximum allowable operating pressure of the pipeline specified by the client. As per client, when depth >=80%, failure pressure and pressure ratio is set to '-'.

If no metal loss anomalies are reported, the table below is intentionally left empty.
Metal loss anomalies are grouped in order of decreasing severity (Effective Area) as follows:

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
C027	33%	1207	0.74	6660	0.95	8556	1.14	10273	0.98	8887
C078	29%	1207	0.94	8536	1.02	9246	1.14	10315	1.05	9515
C082	55%	1207	0.82	7412	0.84	7584	1.14	10315	1.06	9584
C033	40%	1207	1.03	9273	1.14	10308	1.16	10480	1.05	9508
C052	33%	1207	1.05	9480	1.17	10604	1.16	10480	1.05	9467
C030	23%	1207	0.97	8805	1.07	9625	1.16	10494	1.02	9211
C066	32%	1207	0.97	8791	1.07	9632	1.16	10508	1.09	9804
C063	39%	1207	0.89	8012	0.94	8494	1.17	10542	1.09	9873
C081	35%	1207	0.93	8425	1.01	9101	1.17	10556	1.09	9804
C026	45%	1207	0.97	8763	1.06	9591	1.17	10570	1.07	9660
C079	35%	1207	0.94	8460	1.01	9149	1.18	10639	1.10	9908
C051	19%	1207	1.02	9225	1.13	10232	1.19	10708	1.07	9653

[1] ASME B31G-2009 paragraph 2.2(a)
[2] ASME B31G-2009 paragraph 2.2(b)

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
C007	23%	1207	1.02	9191	1.13	10197	1.19	10742	1.12	10108
C020	20%	1207	0.99	8908	1.08	9770	1.19	10742	1.09	9880
C062	15%	1207	1.02	9177	1.12	10142	1.19	10756	1.10	9942
C035	48%	1207	1.07	9639	1.19	10790	1.19	10770	1.09	9818
C064	39%	1207	1.02	9239	1.14	10266	1.19	10770	1.13	10246
C055	31%	1207	1.01	9087	1.11	10059	1.19	10783	1.13	10211
C067	43%	1207	0.98	8853	1.08	9722	1.19	10783	1.13	10239
C054	23%	1207	1.06	9556	1.19	10708	1.20	10797	1.14	10287
C001	32%	1207	1.01	9156	1.12	10156	1.20	10811	1.11	10018
C037	46%	1207	0.98	8880	1.08	9756	1.20	10811	1.11	10053
C059	13%	1207	0.96	8646	1.12	10149	1.20	10811	1.10	9942
A011	37%	1207	1.07	9708	1.21	10901	1.20	10818	1.11	9997
C072	20%	1207	1.02	9211	1.13	10225	1.20	10818	1.12	10163
C036	47%	1207	1.01	9115	1.12	10080	1.20	10839	1.12	10149
C046	38%	1207	1.02	9239	1.14	10266	1.20	10839	1.12	10128
A428	37%	1207	1.08	9729	1.21	10921	1.20	10852	1.13	10239
C011	15%	1207	0.93	8446	1.10	9942	1.20	10859	1.10	9963
C057	25%	1207	1.05	9522	1.18	10659	1.20	10859	1.15	10390
C019	14%	1207	1.03	9342	1.15	10390	1.20	10866	1.12	10135
C080	21%	1207	0.99	8929	1.08	9797	1.20	10873	1.11	10066
C014	20%	1207	0.88	7950	1.06	9584	1.20	10880	1.11	10053
C044	15%	1207	1.02	9184	1.12	10156	1.20	10887	1.11	10046
C008	57%	1207	1.08	9763	1.21	10949	1.21	10894	1.11	10046
C025	21%	1207	1.06	9542	1.18	10687	1.21	10914	1.13	10232
C045	14%	1207	1.06	9535	1.18	10666	1.21	10914	1.15	10356
C060	10%	1207	1.06	9618	1.19	10777	1.21	10921	1.14	10321
C068	19%	1207	1.06	9598	1.19	10756	1.21	10921	1.16	10466
C031	37%	1207	1.05	9480	1.17	10597	1.21	10928	1.14	10328
C010	11%	1207	0.98	8846	1.15	10349	1.21	10935	1.12	10087
C075	10%	1207	1.05	9487	1.17	10577	1.21	10942	1.13	10177
C065	32%	1207	1.02	9253	1.14	10287	1.21	10949	1.16	10494
C024	32%	1207	1.05	9460	1.17	10570	1.21	10956	1.15	10363
C032	22%	1207	1.04	9439	1.17	10542	1.21	10956	1.13	10246
C012	15%	1207	1.06	9598	1.19	10756	1.21	10963	1.16	10480
C015	12%	1207	1.07	9653	1.20	10825	1.21	10963	1.16	10473
C061	13%	1207	1.06	9604	1.19	10756	1.21	10963	1.16	10452

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
C070	25%	1207	1.03	9349	1.15	10418	1.21	10963	1.16	10487
C086	10%	1207	1.06	9549	1.18	10673	1.21	10963	1.14	10287
A023	25%	1207	1.08	9791	1.22	11011	1.21	10970	1.15	10397
C009	44%	1207	1.09	9804	1.22	11018	1.21	10976	1.15	10390
C039	16%	1207	1.07	9646	1.20	10818	1.21	10976	1.14	10335
C023	31%	1207	1.08	9763	1.21	10970	1.22	10983	1.15	10432
C022	15%	1207	1.04	9370	1.15	10425	1.22	10990	1.11	9984
C034	26%	1207	1.05	9446	1.17	10556	1.22	10990	1.15	10356
A570	53%	1207	1.09	9832	1.22	11045	1.22	10990	1.14	10266
C073	27%	1207	1.04	9384	1.16	10473	1.22	10990	1.17	10563
C018	10%	1207	1.07	9653	1.20	10811	1.22	10997	1.16	10452
C029	16%	1207	1.07	9666	1.20	10852	1.22	10997	1.15	10390
A417	21%	1207	1.09	9811	1.22	11032	1.22	10997	1.16	10494
C013	22%	1207	1.08	9797	1.22	11011	1.22	11004	1.18	10646
C028	16%	1207	1.07	9646	1.20	10818	1.22	11004	1.15	10377
C077	10%	1207	1.06	9604	1.19	10749	1.22	11004	1.15	10404
C017	15%	1207	1.06	9618	1.19	10783	1.22	11011	1.17	10563
C038	30%	1207	1.09	9811	1.22	11032	1.22	11025	1.16	10521
A559	14%	1207	1.09	9825	1.22	11052	1.22	11025	1.18	10680
C003	16%	1207	1.06	9584	1.19	10735	1.22	11032	1.15	10356
C002	15%	1207	1.07	9680	1.20	10859	1.22	11045	1.16	10466
A053	15%	1207	1.09	9839	1.22	11066	1.22	11045	1.19	10728
A528	41%	1207	1.09	9853	1.23	11080	1.22	11045	1.17	10563
C084	11%	1207	1.06	9570	1.18	10701	1.22	11045	1.16	10452
A010	34%	1207	1.09	9853	1.23	11080	1.22	11052	1.17	10535
A052	42%	1207	1.09	9860	1.23	11080	1.22	11052	1.17	10563
C016	10%	1207	1.09	9804	1.22	11025	1.22	11052	1.19	10708
C005	21%	1207	1.09	9839	1.22	11066	1.22	11059	1.18	10646
C047	15%	1207	1.09	9846	1.23	11080	1.22	11059	1.18	10639
A006	39%	1207	1.09	9860	1.23	11094	1.22	11066	1.16	10508
A247	35%	1207	1.09	9860	1.23	11094	1.22	11066	1.17	10556
A609	30%	1207	1.09	9860	1.23	11094	1.22	11066	1.19	10708
C085	11%	1207	1.08	9749	1.21	10949	1.22	11066	1.18	10680
C069	15%	1207	1.07	9694	1.20	10880	1.23	11073	1.19	10708
C074	10%	1207	1.08	9735	1.21	10935	1.23	11073	1.18	10659
C076	10%	1207	1.08	9742	1.21	10935	1.23	11073	1.18	10659

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A169	31%	1207	1.09	9873	1.23	11101	1.23	11080	1.18	10632
A205	30%	1207	1.09	9873	1.23	11101	1.23	11080	1.18	10639
A232	43%	1207	1.09	9873	1.23	11107	1.23	11080	1.16	10501
C006	16%	1207	1.09	9866	1.23	11101	1.23	11087	1.19	10721
A057	35%	1207	1.09	9873	1.23	11107	1.23	11087	1.19	10714
C042	15%	1207	1.09	9866	1.23	11101	1.23	11087	1.19	10714
A567	36%	1207	1.09	9873	1.23	11107	1.23	11087	1.19	10708
A572	36%	1207	1.09	9880	1.23	11107	1.23	11087	1.19	10708
A231	35%	1207	1.09	9880	1.23	11107	1.23	11094	1.18	10625
C083	14%	1207	1.09	9804	1.22	11025	1.23	11094	1.20	10811
A007	38%	1207	1.09	9887	1.23	11121	1.23	11101	1.18	10618
A054	38%	1207	1.09	9887	1.23	11121	1.23	11101	1.19	10721
A263	25%	1207	1.09	9880	1.23	11121	1.23	11101	1.19	10735
A563	10%	1207	1.09	9880	1.23	11114	1.23	11101	1.20	10845
A005	35%	1207	1.09	9887	1.23	11121	1.23	11107	1.18	10666
C004	21%	1207	1.09	9873	1.23	11114	1.23	11107	1.19	10763
A044	33%	1207	1.09	9887	1.23	11128	1.23	11107	1.19	10783
A082	34%	1207	1.09	9887	1.23	11128	1.23	11107	1.19	10777
A278	30%	1207	1.09	9887	1.23	11121	1.23	11107	1.19	10714
C043	14%	1207	1.09	9825	1.22	11052	1.23	11107	1.20	10859
C056	10%	1207	1.09	9873	1.23	11107	1.23	11107	1.20	10866
A504	23%	1207	1.09	9887	1.23	11121	1.23	11107	1.20	10845
A536	27%	1207	1.09	9887	1.23	11121	1.23	11107	1.20	10818
A323	32%	1207	1.10	9894	1.23	11128	1.23	11114	1.20	10797
C048	15%	1207	1.09	9887	1.23	11128	1.23	11114	1.20	10804
C050	15%	1207	1.09	9887	1.23	11128	1.23	11114	1.20	10804
A368	27%	1207	1.09	9887	1.23	11128	1.23	11114	1.19	10749
A391	32%	1207	1.10	9894	1.23	11128	1.23	11114	1.19	10721
C058	15%	1207	1.09	9880	1.23	11114	1.23	11114	1.20	10880
C071	10%	1207	1.09	9825	1.22	11052	1.23	11114	1.20	10839
A033	23%	1207	1.10	9894	1.23	11128	1.23	11121	1.20	10866
A216	39%	1207	1.10	9901	1.23	11135	1.23	11121	1.18	10687
A266	41%	1207	1.10	9901	1.23	11135	1.23	11121	1.18	10659
C087	22%	1207	8.20	9894	9.22	11135	9.22	11121	9.01	10873
C087	22%	1207	1.10	9894	1.23	11135	1.23	11121	1.20	10873
A058	24%	1207	1.10	9901	1.23	11142	1.23	11128	1.20	10887

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A159	20%	1207	1.10	9894	1.23	11135	1.23	11128	1.20	10825
A242	15%	1207	1.10	9894	1.23	11135	1.23	11128	1.20	10839
A269	26%	1207	1.10	9901	1.23	11142	1.23	11128	1.20	10804
A275	22%	1207	1.10	9901	1.23	11142	1.23	11128	1.20	10832
A328	22%	1207	1.10	9901	1.23	11142	1.23	11128	1.20	10825
C049	16%	1207	1.10	9901	1.23	11142	1.23	11128	1.20	10845
A383	34%	1207	1.10	9901	1.23	11135	1.23	11128	1.19	10735
A392	36%	1207	1.10	9901	1.23	11142	1.23	11128	1.19	10728
A535	20%	1207	1.10	9901	1.23	11135	1.23	11128	1.21	10901
A001	15%	1207	1.10	9901	1.23	11142	1.23	11135	1.20	10859
A030	23%	1207	1.10	9901	1.23	11142	1.23	11135	1.20	10832
A099	21%	1207	1.10	9901	1.23	11142	1.23	11135	1.21	10908
A194	32%	1207	1.10	9901	1.23	11142	1.23	11135	1.19	10783
A236	21%	1207	1.10	9901	1.23	11142	1.23	11135	1.20	10845
A238	20%	1207	1.10	9908	1.23	11149	1.23	11135	1.20	10866
A254	15%	1207	1.10	9908	1.23	11149	1.23	11135	1.20	10880
A399	36%	1207	1.10	9908	1.23	11142	1.23	11135	1.19	10742
A557	10%	1207	1.10	9901	1.23	11142	1.23	11135	1.21	10949
A008	20%	1207	1.10	9908	1.23	11149	1.23	11142	1.20	10880
A043	25%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10908
A059	22%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10935
A106	23%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10935
A128	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10956
A170	32%	1207	1.10	9908	1.23	11149	1.23	11142	1.20	10811
A193	16%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
A202	16%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
A204	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
A245	30%	1207	1.10	9908	1.23	11149	1.23	11142	1.20	10818
A267	27%	1207	1.10	9908	1.23	11149	1.23	11142	1.20	10832
A282	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10901
A283	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.20	10887
A288	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
C041	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
A297	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.20	10887
A355	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
A363	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A385	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
A406	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10894
A409	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10901
A569	15%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10949
A571	23%	1207	1.10	9908	1.23	11149	1.23	11142	1.21	10921
A031	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10921
A032	22%	1207	1.10	9908	1.23	11156	1.23	11149	1.21	10942
A041	14%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10976
A051	22%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10956
A138	14%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10976
C021	10%	1207	1.10	9908	1.23	11149	1.23	11149	1.21	10970
A150	16%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10928
A158	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10921
A164	15%	1207	1.10	9908	1.23	11156	1.23	11149	1.21	10908
A179	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10914
A192	15%	1207	1.10	9908	1.23	11156	1.23	11149	1.21	10908
A217	21%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10908
A257	15%	1207	1.10	9908	1.23	11156	1.23	11149	1.21	10908
A294	15%	1207	1.10	9908	1.23	11156	1.23	11149	1.21	10908
A299	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10914
A327	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10928
A331	15%	1207	1.10	9908	1.23	11156	1.23	11149	1.21	10908
A338	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10914
A342	23%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10901
A343	18%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10908
A366	18%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10908
C053	16%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10921
A380	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10921
A396	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10921
A403	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10921
A404	15%	1207	1.10	9908	1.23	11156	1.23	11149	1.21	10908
A405	15%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10914
A413	16%	1207	1.10	9915	1.23	11156	1.23	11149	1.21	10914
A015	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
A017	16%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10949
A022	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10956

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A042	23%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10963
A055	12%	1207	1.10	9915	1.24	11163	1.23	11156	1.22	11004
A086	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.22	10997
A108	10%	1207	1.10	9922	1.24	11163	1.23	11156	1.22	11011
A113	10%	1207	1.10	9915	1.23	11156	1.23	11156	1.22	10997
A121	12%	1207	1.10	9915	1.23	11156	1.23	11156	1.22	10997
A129	10%	1207	1.10	9915	1.24	11163	1.23	11156	1.22	11004
A148	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10956
A149	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A152	16%	1207	1.10	9915	1.23	11156	1.23	11156	1.21	10928
A153	21%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10921
A167	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
A168	16%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A195	15%	1207	1.10	9915	1.23	11156	1.23	11156	1.21	10928
A201	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10949
A203	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10956
A215	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A235	25%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10908
A241	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A246	18%	1207	1.10	9915	1.23	11156	1.23	11156	1.21	10921
A252	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
A259	16%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
C040	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
A284	15%	1207	1.10	9915	1.23	11156	1.23	11156	1.21	10928
A287	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10949
A296	15%	1207	1.10	9915	1.23	11156	1.23	11156	1.21	10928
A298	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A330	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10956
A332	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
A341	15%	1207	1.10	9915	1.23	11156	1.23	11156	1.21	10935
A352	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10949
A353	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10949
A354	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A357	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
A358	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10949
A367	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10949

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A389	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10942
A393	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10949
A398	15%	1207	1.10	9922	1.24	11163	1.23	11156	1.21	10949
A402	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A408	15%	1207	1.10	9915	1.23	11156	1.23	11156	1.21	10935
A414	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.21	10935
A475	10%	1207	1.10	9915	1.24	11163	1.23	11156	1.22	11011
A538	13%	1207	1.10	9922	1.24	11163	1.23	11156	1.22	11004
A581	12%	1207	1.10	9922	1.24	11163	1.23	11156	1.22	11011
A649	15%	1207	1.10	9915	1.24	11163	1.23	11156	1.22	10990
A012	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A016	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	10983
A028	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	10983
A034	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.22	11011
A100	10%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A107	11%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11032
A109	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.22	11011
A127	14%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A144	16%	1207	1.10	9922	1.24	11163	1.24	11163	1.22	11011
A151	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10956
A237	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10956
A239	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10976
A240	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	10983
A243	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	10983
A256	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10963
A260	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10963
A277	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	10983
A285	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10963
A289	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10963
A290	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A302	10%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11032
A307	10%	1207	1.10	9922	1.24	11163	1.24	11163	1.22	11018
A322	11%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A335	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10956
A336	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10956
A337	16%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10976

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A339	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10970
A356	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10976
A381	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A382	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A384	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A386	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A388	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A394	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10963
A397	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10963
A401	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	10983
A407	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10976
A410	15%	1207	1.10	9922	1.24	11163	1.24	11163	1.21	10963
A412	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A416	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.21	10970
A488	10%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A516	19%	1207	1.10	9922	1.24	11163	1.24	11163	1.22	10997
A537	15%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11018
A560	13%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A587	13%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A588	10%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11039
A595	10%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11032
A608	12%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11032
A624	13%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A640	13%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A668	12%	1207	1.10	9922	1.24	11170	1.24	11163	1.22	11025
A009	15%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11011
A045	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A056	10%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11045
A069	12%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A089	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11066
A101	10%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11052
A105	10%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11052
A112	10%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11052
A114	10%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11052
A139	15%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11045
A140	10%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11039

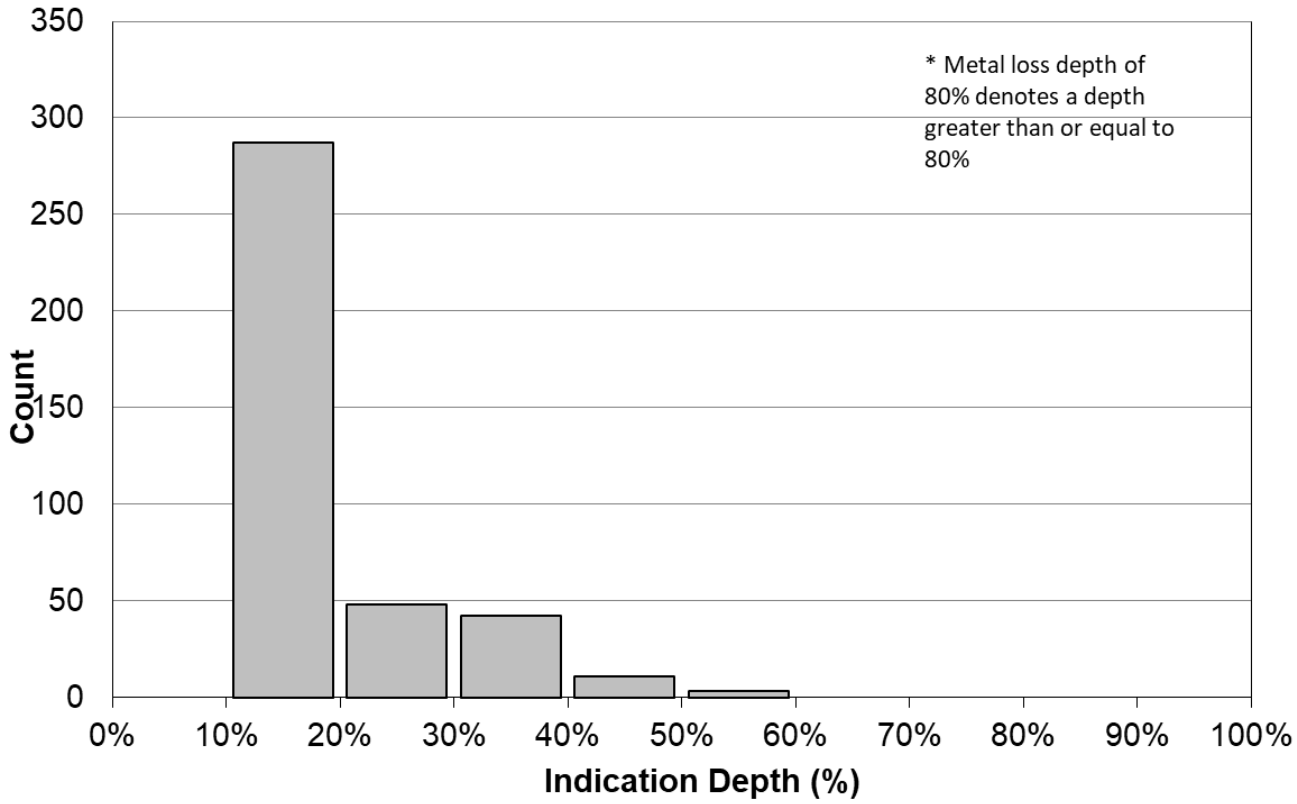
			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A143	12%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11045
A200	15%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11004
A219	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11004
A230	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10990
A244	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10983
A253	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10990
A255	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10997
A258	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10990
A268	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10997
A276	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10990
A279	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10990
A286	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10990
A301	10%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11045
A303	10%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11039
A308	14%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11032
A312	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A313	12%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11039
A329	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10997
A333	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10997
A334	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10990
A340	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10990
A347	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10990
A348	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10997
A390	15%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	10990
A395	15%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	10997
A411	15%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11004
A418	10%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11039
A419	10%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11045
A423	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A424	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11066
A426	11%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A427	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11066
A449	10%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11052
A508	10%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11052
A512	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A513	14%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11045

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A517	12%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A541	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A552	13%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11039
A553	14%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11052
A576	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A577	15%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11045
A578	12%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11039
A589	10%	1207	1.10	9922	1.24	11170	1.24	11170	1.22	11039
A646	10%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A648	11%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11045
A651	14%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11052
A655	12%	1207	1.10	9928	1.24	11170	1.24	11170	1.22	11045
A659	11%	1207	1.10	9928	1.24	11176	1.24	11170	1.22	11059
A029	15%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11025
A040	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A060	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11066
A104	11%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A300	15%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11025
A304	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11066
A309	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A311	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11066
A369	15%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11032
A387	15%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11025
A400	15%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11032
A415	15%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11039
A420	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A421	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A422	10%	1207	1.10	9935	1.24	11183	1.24	11176	1.23	11094
A425	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A429	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11066
A430	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11066
A446	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A507	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11066
A509	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A510	10%	1207	1.10	9935	1.24	11183	1.24	11176	1.23	11094
A511	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080

			B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
ID Code	Depth (%)	MAOP (Kpa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (KPa)	RPR	Failure Pressure (Kpa)	RPR*	Failure Pressure* (Kpa)
A514	13%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A515	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A539	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A540	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A542	10%	1207	1.10	9935	1.24	11176	1.24	11176	1.23	11087
A545	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.22	11066
A546	10%	1207	1.10	9935	1.24	11183	1.24	11176	1.23	11094
A547	11%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A549	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A556	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A558	12%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A568	15%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A573	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A641	10%	1207	1.10	9935	1.24	11176	1.24	11176	1.23	11087
A647	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A650	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11073
A652	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A653	11%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A654	10%	1207	1.10	9928	1.24	11176	1.24	11176	1.23	11080
A310	10%	1207	1.10	9935	1.24	11183	1.24	11183	1.23	11101

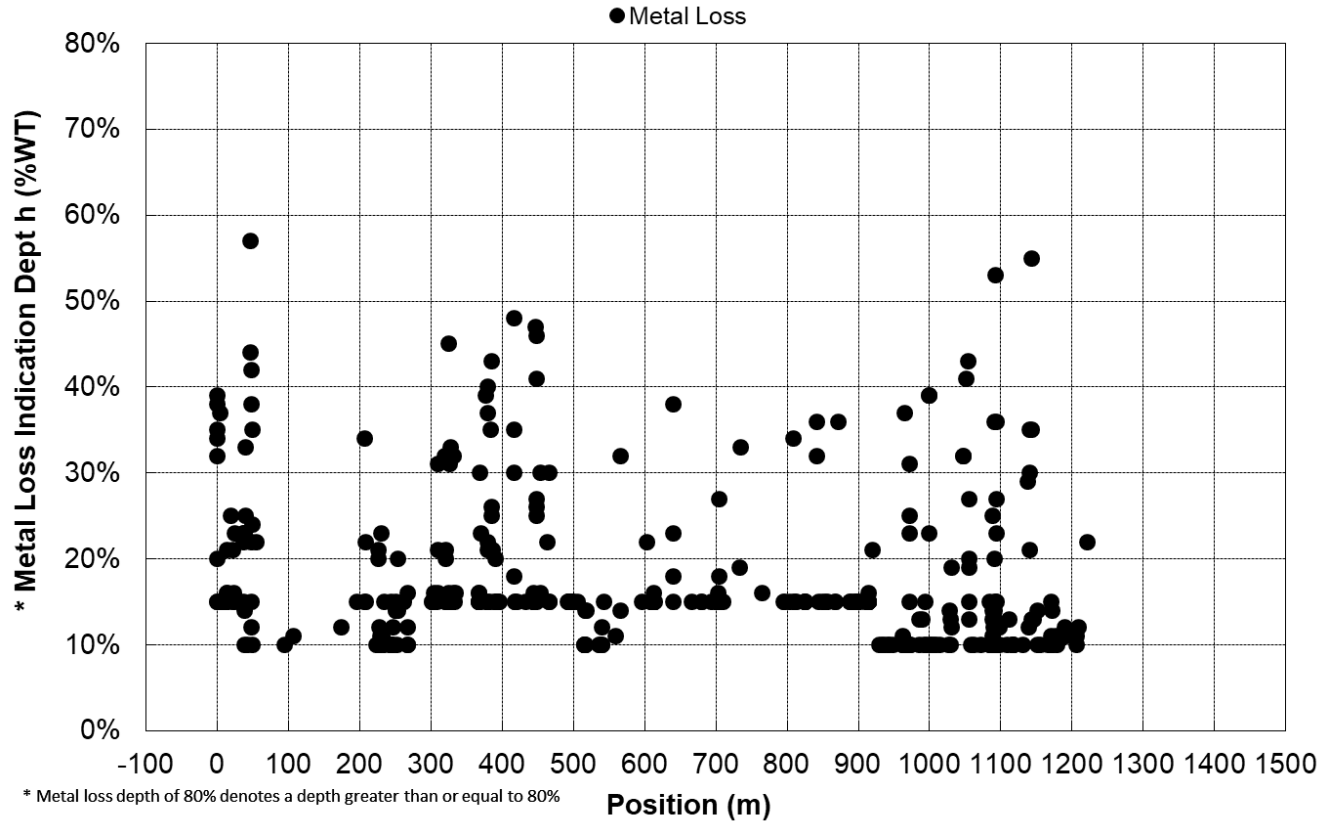
9.3 Cluster and Non-interacting Metal Loss Percent Depth Frequency Plot

If no metal loss anomalies are reported, the chart below is intentionally left empty.



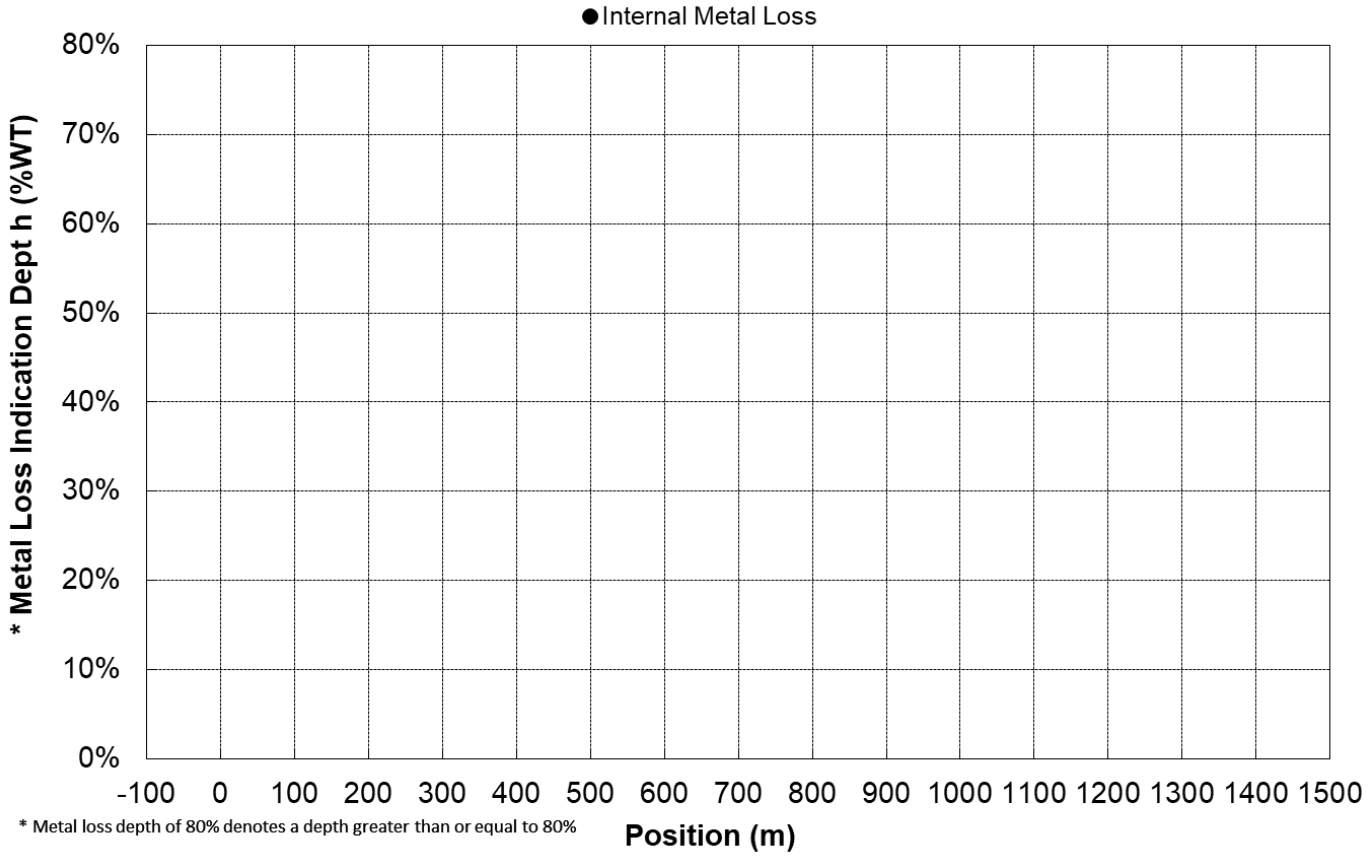
9.4 Cluster and Non-interacting Metal Loss Percent Depth Distribution

If no metal loss anomalies are reported, the chart below is intentionally left empty.



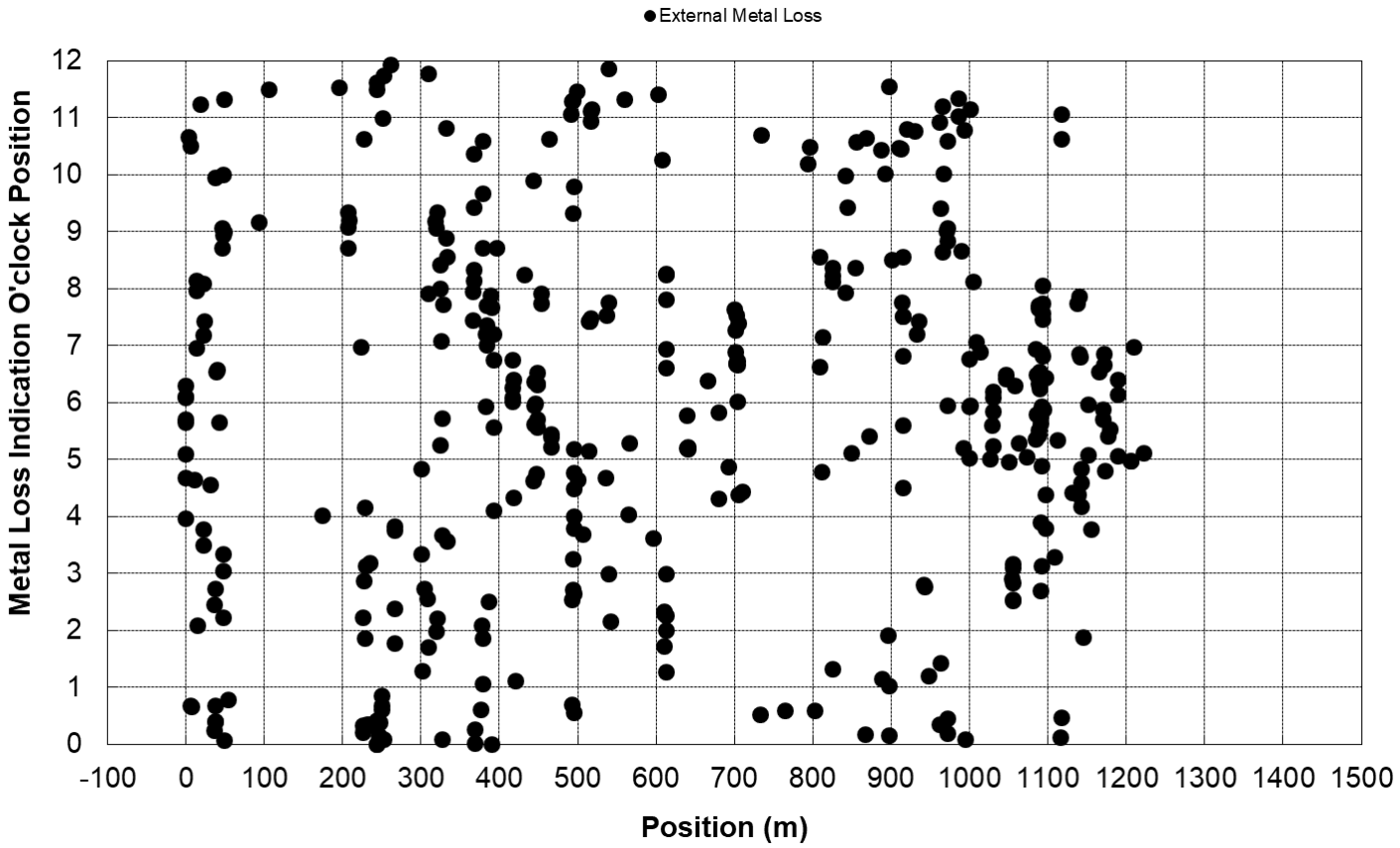
9.5 Internal Cluster and Non-interacting Metal Loss O'clock Position

If no internal metal loss anomalies are reported, the chart below is intentionally left empty.



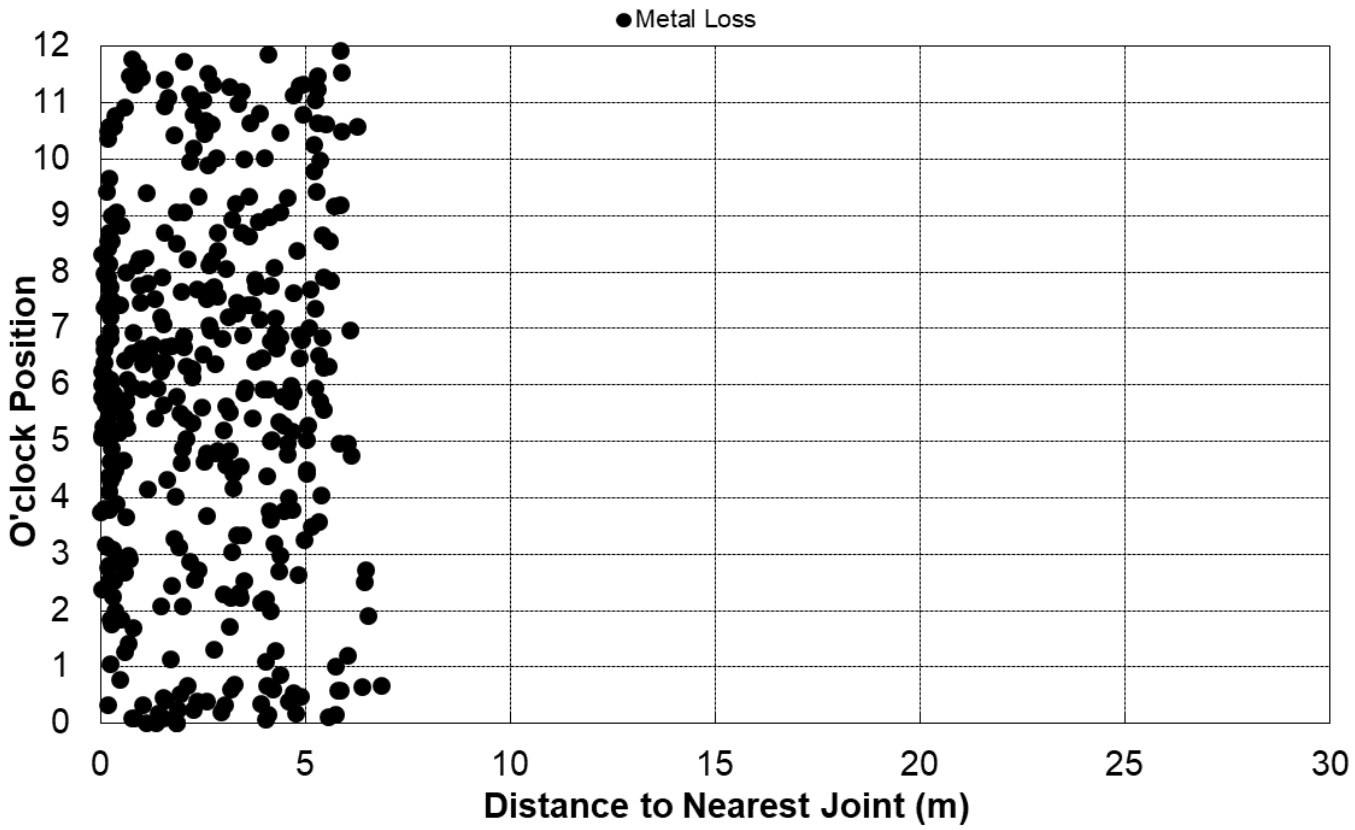
9.6 External Cluster and Non-interacting Metal Loss O'clock Position

If no external metal loss anomalies are reported, the chart below is intentionally left empty.



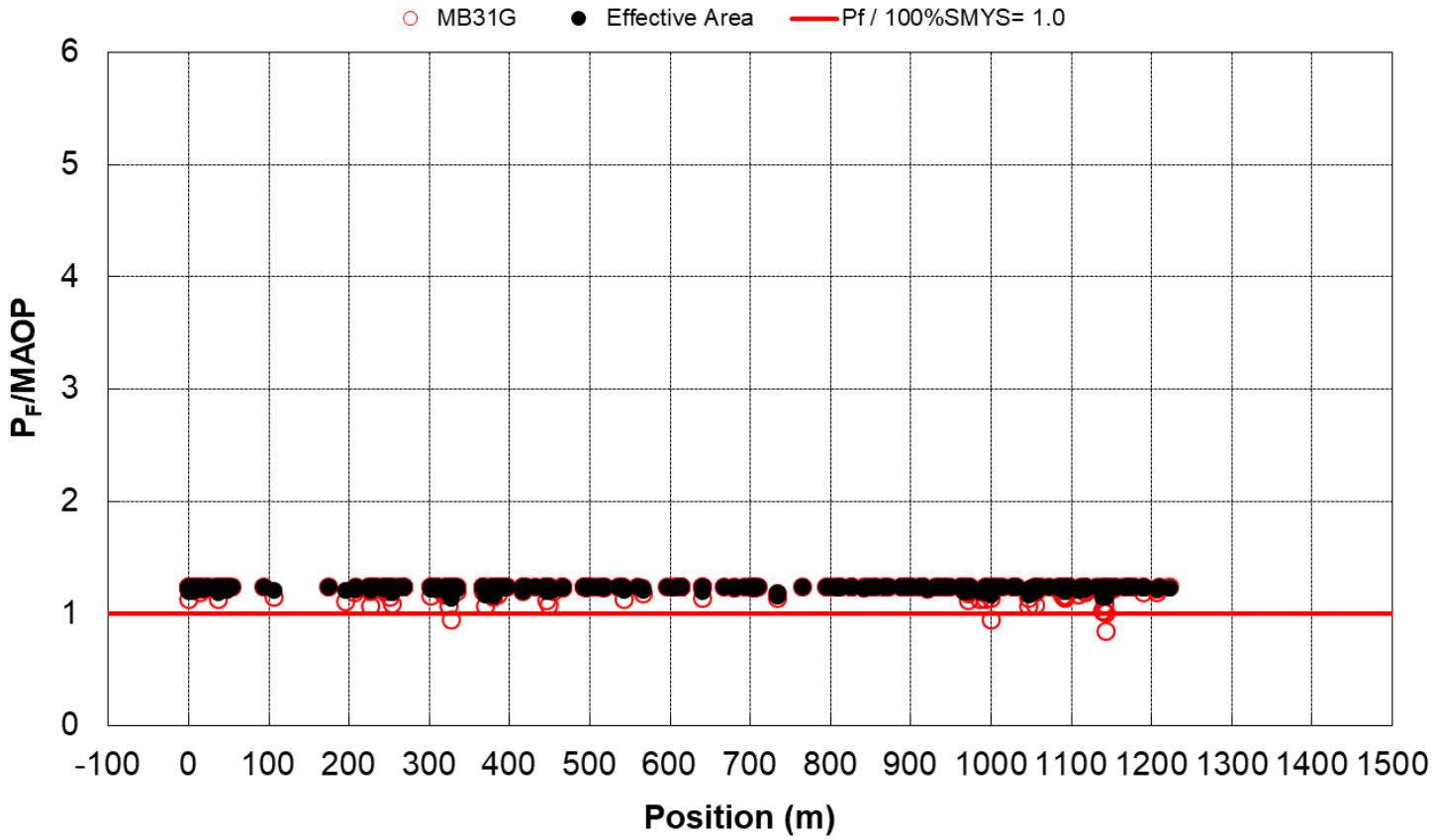
9.7 Cluster and Non-interacting Metal Loss Orientation at Nearest Girth Weld

If no metal loss anomalies are reported, the chart below is intentionally left empty.



9.8 Cluster and Non-interacting Metal Loss P_F/ 100%SMYS

If no metal loss anomalies are reported, the chart below is intentionally left empty.



10 Dents Tables and Charts

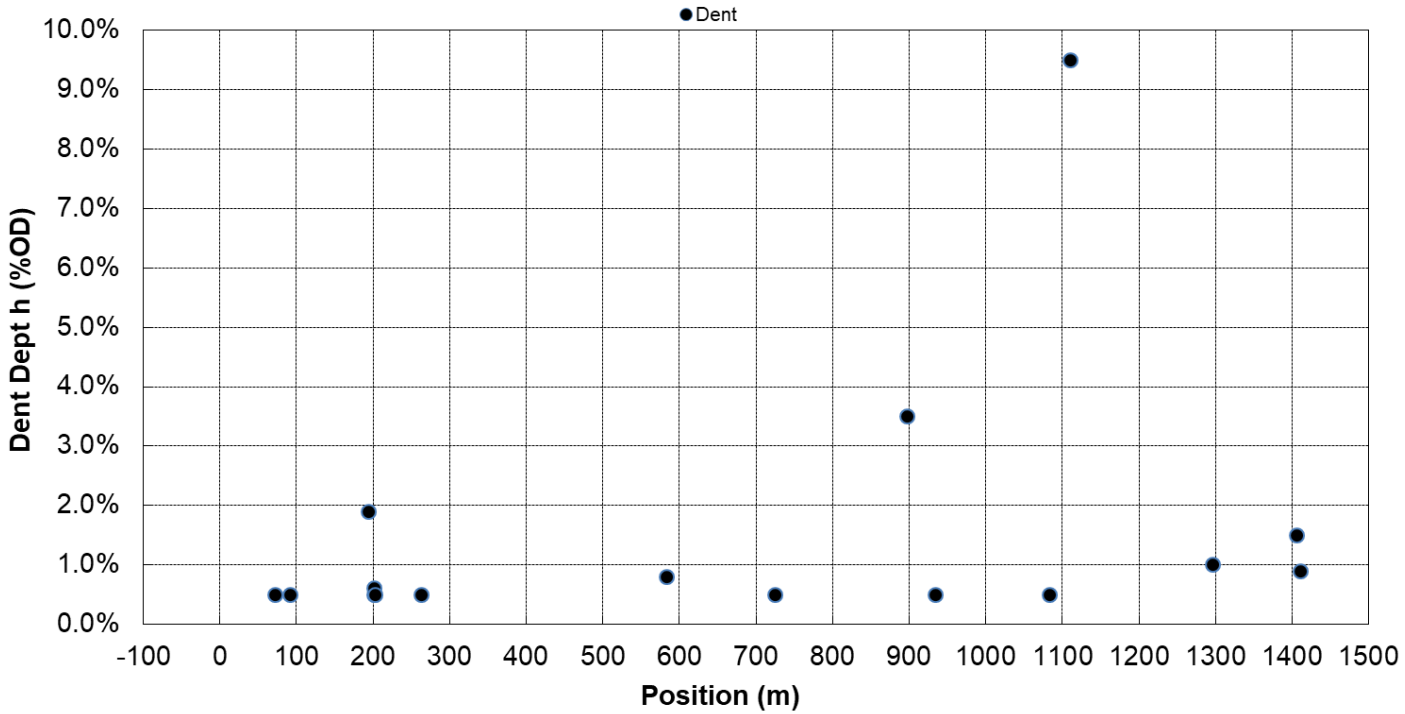
10.1 Dent Listing

All dents identified and reported in this inspection are provided in the listing below. If no dents are reported, the table below is intentionally left empty.

Feature ID	Odometer (m)	O'clock Position	Depth % O.D.	Length (mm)	Width (mm)	Wall thickness (mm)	Comments
D001	72.552	0:37	0.5%	55.9	53.3	7.92	
D002	91.575	9:22	0.5%	91.4	73.7	7.92	
D003	193.931	11:49	1.9%	114.3	99.1	7.92	
D004	201.437	3:18	0.5%	106.7	94.0	7.92	
D005	201.450	8:23	0.6%	124.5	114.3	7.92	
D006	203.224	11:32	0.5%	40.6	61.0	7.92	
D007	262.859	11:15	0.5%	109.2	99.1	7.92	
D008	583.741	9:09	0.8%	86.4	86.4	7.92	
D009	725.485	11:03	0.5%	63.5	61.0	7.92	
D010	897.308	0:09	3.5%	101.6	86.4	7.92	
D011	934.245	5:18	0.5%	63.5	61.0	7.92	
D012	1083.153	7:52	0.5%	68.6	61.0	7.92	
D013	1110.258	5:59	9.5%	236.2	251.5	7.92	Interacting with girth weld
D014	1297.002	11:26	1.0%	53.3	53.3	7.92	
D015	1405.773	11:43	1.5%	86.4	73.7	7.92	
D016	1411.311	0:04	0.9%	94.0	78.7	7.92	

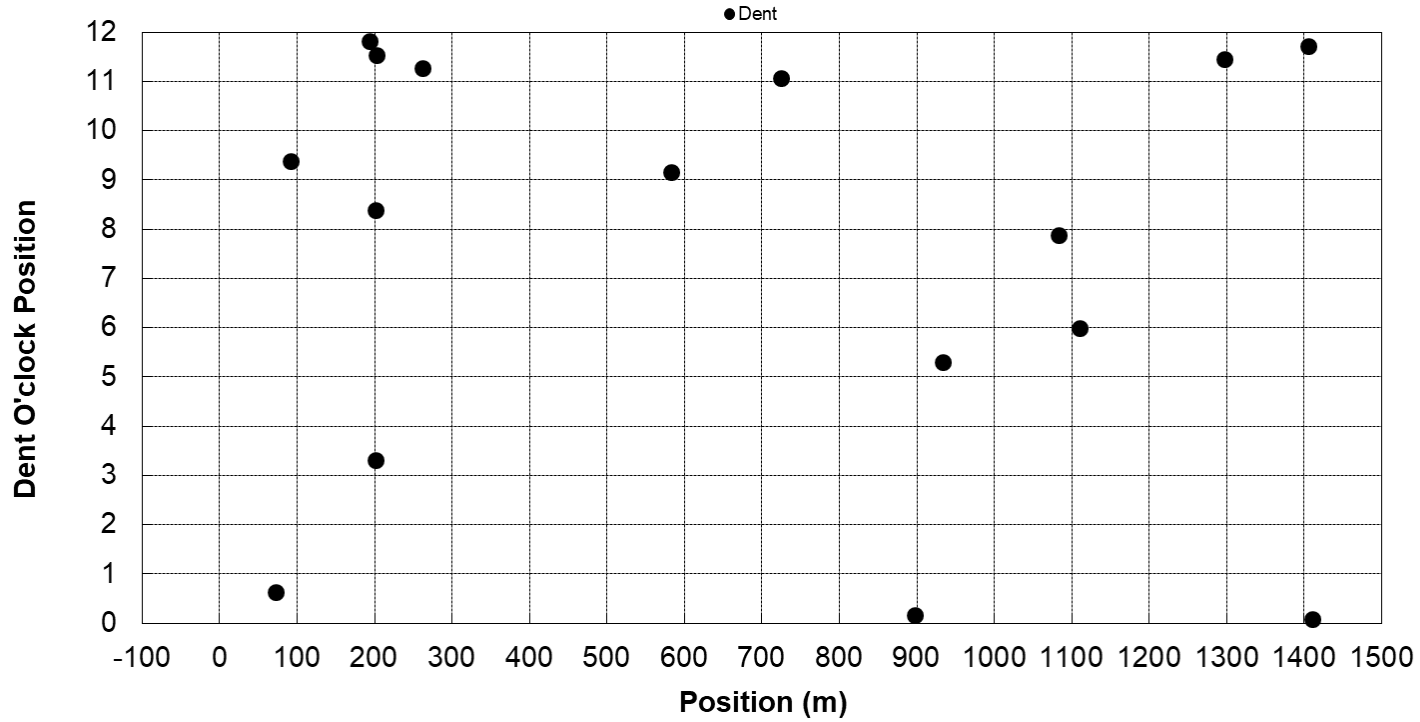
10.2 Dent Depth Distribution

If no dents are reported, the chart below is intentionally left empty.



10.3 Dent Circumferential Location Distribution

If no dents are reported, the chart below is intentionally left empty.



11 Other Features

All 'Other' type features identified and reported in this inspection are listed below. If no 'Other' type features are reported, the table below is intentionally left empty.

Feature ID	Odometer (m)	O'clock Position	Length (mm)	Width (mm)	Comments
O001	-1.676	--			Start of run
O002	23.281	--			Circumferential fillet weld
O003	23.841	--			Circumferential fillet weld
O004	26.152	--			Circumferential fillet weld
O005	27.003	--			Circumferential fillet weld
O006	29.034	--			Circumferential fillet weld
O007	29.575	--			Circumferential fillet weld
O008	61.028	11:33	61.0	63.5	Close metal object
O009	71.223	11:45	241.3	53.3	Manufacturing related
O010	74.088	11:34	421.6	81.3	Manufacturing related
O011	79.890	6:16	53.3	61.0	Close metal object
O012	110.411	10:28	22.9	66.0	Manufacturing related; On long seam
O013	128.517	11:56	22.9	38.1	Close metal object
O014	128.764	11:54	17.8	38.1	Close metal object
O015	131.708	10:55	48.3	53.3	Close metal object
O016	157.185	0:51	27.9	119.4	Manufacturing related
O017	163.052	8:14	218.4	104.1	Manufacturing related
O018	165.955	8:16	218.4	96.5	Manufacturing related
O019	168.854	8:12	231.1	88.9	Manufacturing related
O020	171.762	8:07	223.5	83.8	Manufacturing related
O021	174.270	2:05	264.2	264.2	Manufacturing related
O022	180.724	7:17	22.9	505.5	Manufacturing related

Feature ID	Odometer (m)	O'clock Position	Length (mm)	Width (mm)	Comments
O023	181.656	6:53	30.5	1038.9	Manufacturing related
O024	182.570	6:18	25.4	889.0	Manufacturing related
O025	183.476	6:39	22.9	952.5	Manufacturing related
O026	184.379	6:56	25.4	368.3	Manufacturing related
O027	185.293	8:07	17.8	266.7	Manufacturing related
O028	186.185	6:13	22.9	652.8	Manufacturing related
O029	187.097	6:33	22.9	866.1	Manufacturing related
O030	188.007	6:23	25.4	513.1	Manufacturing related
O031	188.905	6:59	25.4	640.1	Manufacturing related
O032	189.796	6:37	17.8	823.0	Manufacturing related
O033	190.691	6:13	22.9	795.0	Manufacturing related
O034	191.611	8:53	22.9	408.9	Manufacturing related
O035	207.991	1:31	22.9	25.4	Manufacturing related; On long seam
O036	244.765	3:36	86.4	68.6	Close metal object
O037	299.974	--			Circumferential fillet weld
O038	300.820	--			Circumferential fillet weld
O039	306.810	--			Circumferential fillet weld
O040	307.355	--			Circumferential fillet weld
O041	320.289	4:22	53.3	320.0	Manufacturing related
O042	321.046	5:08	45.7	525.8	Manufacturing related
O043	394.439	1:52	63.5	83.8	Close metal object
O044	488.612	6:04	40.6	109.2	Manufacturing related
O045	498.150	--			Circumferential fillet weld
O046	498.626	--			Circumferential fillet weld
O047	501.230	--			Circumferential fillet weld
O048	502.056	--			Circumferential fillet weld
O049	510.266	4:49	22.9	132.1	Manufacturing related

Feature ID	Odometer (m)	O'clock Position	Length (mm)	Width (mm)	Comments
O050	535.411	6:44	27.9	35.6	Manufacturing related; On long seam
O051	570.003	6:19	53.3	68.6	Close metal object
O052	592.591	6:20	27.9	238.8	Manufacturing related
O053	596.593	--			Circumferential fillet weld
O054	597.494				Circumferential fillet weld
O055	600.371	--			Circumferential fillet weld
O056	600.855	--			Circumferential fillet weld
O057	732.782	1:30	185.4	248.9	Manufacturing related
O058	772.006	9:35	33.0	27.9	Manufacturing related
O059	916.556	--			Circumferential fillet weld
O060	917.163	--			Circumferential fillet weld
O061	921.390	--			Circumferential fillet weld
O062	922.293	--			Circumferential fillet weld
O063	950.940	0:04	383.5	147.3	Manufacturing related
O064	1025.231	5:58	66.0	81.3	Close metal object
O065	1188.212	--			Circumferential fillet weld
O066	1189.098	--			Circumferential fillet weld
O067	1284.267	10:56	106.7	213.4	Manufacturing related
O068	1288.350	10:14	101.6	99.1	Close metal object
O069	1302.716	--			Circumferential fillet weld
O070	1303.717	--			Circumferential fillet weld
O071	1305.299	--			Circumferential fillet weld
O072	1305.835	--			Circumferential fillet weld
O073	1313.244	4:51	78.7	563.9	Manufacturing related
O074	1335.323	8:08	63.5	259.1	Manufacturing related
O075	1335.339	3:51	55.9	193.0	Manufacturing related
O076	1450.418	0:20	20.3	33.0	Close metal object

Feature ID	Odometer (m)	O'clock Position	Length (mm)	Width (mm)	Comments
O077	1450.426	1:52	22.9	35.6	Close metal object
O078	1465.649	6:07	817.9	426.7	Liquid; Video data only
O079	1465.742	--			Circumferential fillet weld; Video data only
O080	1466.680	--			Circumferential fillet weld; Video data only
O081	1467.761	--			End of run; Welded cap; Video data only

12 Installations

All installations identified and reported in this inspection are listed below. If no installations are reported, the table below is intentionally left empty.

Feature ID	Odometer (m)	O'clock Position	Length (mm)	Width (mm)	Comments
I001	22.776	11:52	17.8	15.2	Tap
I002	23.551	09:00	91.4	86.4	Offtake
I003	24.542	11:57	68.6	73.7	Tap
I004	25.490	00:10	30.5	25.4	Tap
I005	26.496	11:51	492.8	500.4	Stopple with coupon
I006	29.285	09:11	94.0	109.2	Offtake
I007	30.350	00:05	66.0	81.3	Tap
I008	31.671	00:00	53.3	55.9	Tap
I009	40.911	03:00			Right bend center; 90+10.9
I010	47.984	00:01	55.9	76.2	Tap
I011	58.844	11:56	40.6	43.2	Attachment with HAZ
I012	75.055	09:00			Left bend center; 89+84.6
I013	179.930	09:00			Left bend center; 88+81.5
I014	229.919	03:00			Right bend center; 88+63.6
I015	260.029	00:12	48.3	58.4	Tap
I016	276.550	00:00	83.8	88.9	Tap
I017	295.103	00:00	45.7	58.4	Tap
I018	296.097	00:01	43.2	61.0	Tap
I019	299.040	11:57	43.2	53.3	Tap
I020	300.358	11:45	497.8	487.7	Stopple with coupon
I021	302.153	00:00	71.1	78.7	Attachment with HAZ
I022	302.284	00:03	35.6	45.7	Attachment with HAZ

Feature ID	Odometer (m)	O'clock Position	Length (mm)	Width (mm)	Comments
I023	307.074	08:58	88.9	96.5	Offtake
I024	316.410	00:00	86.4	111.8	Tap
I025	470.398	00:00	40.6	53.3	Attachment with HAZ
I026	483.048	00:00	40.6	50.8	Tap; ILC for charging
I027	484.482	00:00	63.5	58.4	Tap; ILC for antenna
I028	498.390	09:34	121.9	99.1	Offtake
I029	501.686	00:00	487.7	525.8	Stopple with coupon
I030	502.603	00:01	43.2	40.6	Tap
I031	503.277	11:57	91.4	99.1	Tap
I032	504.462	11:57	45.7	61.0	Tap
I033	511.314	03:00			Right bend center; 85+85.3
I034	514.052	09:00			Left bend center; 85+82.4
I035	587.143	09:00			Left bend center; 85+10.0
I036	589.960	03:00			Right bend center; 85+07.4
I037	594.418	00:01	40.6	61.0	Tap
I038	595.441	00:00	94.0	99.1	Tap
I039	596.037	00:00	25.4	40.6	Tap
I040	597.056	11:56	490.2	525.8	Stopple with coupon
I041	600.608	08:58	101.6	119.4	Offtake
I042	603.374	11:57	147.3	142.2	Tap
I043	829.054	11:53	38.1	53.3	Attachment with HAZ
I044	900.927	09:01	114.3	106.7	Tap
I045	916.831	02:53	162.6	152.4	Offtake
I046	921.880	00:05	480.1	525.8	Stopple with coupon
I047	922.808	00:04	22.9	33.0	Tap
I048	923.841	00:00	73.7	78.7	Tap
I049	925.558	00:00	53.3	48.3	Tap

Feature ID	Odometer (m)	O'clock Position	Length (mm)	Width (mm)	Comments
I050	929.303	03:00			Right bend center; 81+71.8
I051	961.550	09:00			Left bend center; 81+58.2
I052	995.636	03:00			Right bend center; 81+26.9
I053	1030.981	09:00			Left bend center; 80+94.8
I054	1097.837	09:00			Left bend center; 80+27.1
I055	1131.328	00:06	55.9	63.5	Tap
I056	1146.002	09:00			Left bend center; 79+80.8
I057	1187.414	00:00	48.3	43.2	Tap
I058	1188.722	11:57	472.4	538.5	Launcher stopple; Estimated 79+35.0
I059	1189.938	00:06	40.6	45.7	Tap
I060	1222.545	12:00			Sag bend center; As per FN 0-169-17
I061	1223.525	06:00			Over bend center; As per FN 0-169-17
I062	1276.393	00:13	55.9	50.8	Tap
I063	1280.390	09:00			Left bend center; 78+46.3
I064	1287.028	03:00			Right bend center; 78+40.5
I065	1299.904	00:02	50.8	50.8	Tap
I066	1301.259	11:57	104.1	96.5	Tap
I067	1302.299	00:01	68.6	55.9	Tap
I068	1303.230	00:06	485.1	472.4	Stopple with coupon
I069	1305.553	02:58	142.2	121.9	Offtake
I070	1333.987	11:51	55.9	43.2	Tap
I071	1336.913	00:07	73.7	53.3	Tap
I072	1449.842	06:00			Over bend center
I073	1466.207	00:11	492.8	525.8	Spherical tee; 76+64.3; Video data only
I074	1467.457	00:00	30.5	33.0	Tap; Video data only

13 Pipe Book

13.1 Pipe Book Listing

All welds and pipe joints identified and reported in this inspection are listed below.

Feature ID	Odometer (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (Mpa)	Pipe Type	Pipe Length (m)	Comments
W001	0.000		7.92	290	SMLS	13.777	The first detected weld from MFL
W002	13.777		7.92	290	SMLS	13.695	
W003	27.472		7.92	290	SMLS	7.870	
W004	35.342	6:35	7.92	290	ERW	5.328	
W005	40.670		7.92	290	Bend	0.555	Bend begin
W006	41.225	4:45	7.92	290	ERW	3.580	Bend end
W007	44.804	1:40	7.92	290	ERW	10.102	
W008	54.906	1:05	7.92	290	ERW	12.177	
W009	67.083	8:25	7.92	290	ERW	7.704	
W010	74.787		7.92	290	Bend	0.532	Bend begin
W011	75.319	5:50	7.92	290	ERW	12.262	Bend end
W012	87.581	3:30	7.92	290	ERW	12.088	
W013	99.670	10:30	7.92	290	ERW	12.052	
W014	111.722	2:30	7.92	290	ERW	12.201	
W015	123.923	10:10	7.92	290	ERW	12.208	
W016	136.131	1:45	7.92	290	ERW	12.180	
W017	148.311	10:25	7.92	290	ERW	12.208	
W018	160.519	1:40	7.92	290	ERW	12.142	
W019	172.662	7:50	7.92	290	ERW	6.808	
W020	179.470		7.92	290	Bend	0.971	Bend begin
W021	180.441	12:15	7.92	290	ERW	12.246	Bend end
W022	192.687	4:40	7.92	290	ERW	12.189	

Feature ID	Odometer (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (Mpa)	Pipe Type	Pipe Length (m)	Comments
W023	204.876	1:30	7.92	290	ERW	12.230	
W024	217.106	9:15	7.92	290	ERW	12.383	
W025	229.488		7.92	290	Bend	0.969	Bend begin
W026	230.457	1:10	7.92	290	ERW	12.257	Bend end
W027	242.714	4:40	7.92	290	ERW	12.277	
W028	254.991	9:10	7.92	290	ERW	12.113	
W029	267.104	1:50	7.92	290	ERW	10.758	
W030	277.861	10:30	7.92	290	ERW	12.224	
W031	290.085		7.92	290	SMLS	7.907	
W032	297.992		7.92	290	SMLS	13.059	
W033	311.051		7.92	290	SMLS	13.540	
W034	324.591		7.92	290	SMLS	3.646	
W035	328.237		7.92	290	SMLS	13.407	
W036	341.645		7.92	290	SMLS	12.028	
W037	353.673		7.92	290	SMLS	13.631	
W038	367.303		7.92	290	SMLS	12.266	
W039	379.569		7.92	290	SMLS	13.424	
W040	392.993		7.92	290	SMLS	12.899	
W041	405.893		7.92	290	SMLS	10.946	
W042	416.838		7.92	290	SMLS	13.622	
W043	430.460		7.92	290	SMLS	11.180	
W044	441.640		7.92	290	SMLS	12.412	
W045	454.052		7.92	290	SMLS	12.576	
W046	466.628		7.92	290	SMLS	12.125	
W047	478.754		7.92	290	SMLS	11.111	
W048	489.864		7.92	290	SMLS	10.525	
W049	500.389		7.92	290	SMLS	8.593	

Feature ID	Odometer (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (Mpa)	Pipe Type	Pipe Length (m)	Comments
W050	508.982		7.92	290	ERW	2.031	
W051	511.012		7.92	290	Bend	0.640	Bend begin
W052	511.652		7.92	290	ERW	2.097	Bend end
W053	513.749		7.92	290	Bend	0.638	Bend begin
W054	514.387	9:30	7.92	290	ERW	1.258	Bend end
W055	515.645	3:15	7.92	290	ERW	8.287	
W056	523.932	6:40	7.92	290	ERW	12.071	
W057	536.003	1:10	7.92	290	ERW	10.710	
W058	546.713	6:15	7.92	290	ERW	12.157	
W059	558.870	5:40	7.92	290	ERW	12.180	
W060	571.050	1:35	7.92	290	ERW	12.221	
W061	583.272	6:50	7.92	290	ERW	1.920	
W062	585.191		7.92	290	ERW	1.633	
W063	586.824		7.92	290	Bend	0.685	Bend begin
W064	587.509	10:50	7.92	290	ERW	2.125	Bend end
W065	589.634		7.92	290	Bend	0.662	Bend begin
W066	590.296	8:30	7.92	290	ERW	1.651	Bend end
W067	591.948		7.92	290	SMLS	10.055	
W068	602.002		7.92	290	SMLS	11.784	
W069	613.786		7.92	290	SMLS	11.384	
W070	625.170		7.92	290	SMLS	1.672	
W071	626.842		7.92	290	SMLS	13.465	
W072	640.307		7.92	290	SMLS	13.142	
W073	653.449		7.92	290	SMLS	13.032	
W074	666.481		7.92	290	SMLS	13.477	
W075	679.958		7.92	290	SMLS	13.268	
W076	693.226		7.92	290	SMLS	11.675	

Feature ID	Odometer (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (Mpa)	Pipe Type	Pipe Length (m)	Comments
W077	704.901		7.92	290	SMLS	13.090	
W078	717.991		7.92	290	SMLS	13.717	
W079	731.707		7.92	290	SMLS	13.667	
W080	745.374		7.92	290	SMLS	13.200	
W081	758.574		7.92	290	SMLS	12.220	
W082	770.794		7.92	290	SMLS	12.410	
W083	783.204		7.92	290	SMLS	13.568	
W084	796.772		7.92	290	SMLS	12.340	
W085	809.112		7.92	290	SMLS	13.378	
W086	822.490		7.92	290	SMLS	13.593	
W087	836.082		7.92	290	SMLS	13.606	
W088	849.688		7.92	290	SMLS	13.023	
W089	862.711		7.92	290	SMLS	13.544	
W090	876.255		7.92	290	SMLS	13.550	
W091	889.805		7.92	290	SMLS	13.628	
W092	903.433		7.92	290	SMLS	11.679	
W093	915.111		7.92	290	SMLS	12.395	
W094	927.506	4:10	7.92	290	ERW	1.342	
W095	928.848		7.92	290	Bend	0.924	Bend begin
W096	929.772	4:00	7.92	290	ERW	2.194	Bend end
W097	931.967	4:00	7.92	290	ERW	10.605	
W098	942.571	10:50	7.92	290	ERW	12.136	
W099	954.707	12:05	7.92	290	ERW	6.406	
W100	961.113		7.92	290	Bend	0.958	Bend begin
W101	962.072	2:20	7.92	290	ERW	9.145	Bend end
W102	971.217	9:30	7.92	290	ERW	12.176	
W103	983.393	3:10	7.92	290	ERW	12.151	

Feature ID	Odometer (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (Mpa)	Pipe Type	Pipe Length (m)	Comments
W104	995.544		7.92	290	Bend	0.201	Bend begin
W105	995.746	10:45	7.92	290	ERW	10.765	Bend end
W106	1006.511	3:30	7.92	290	ERW	12.160	
W107	1018.671	10:45	7.92	290	ERW	12.225	
W108	1030.895		7.92	290	Bend	0.179	Bend begin
W109	1031.074	1:20	7.92	290	ERW	12.254	Bend end
W110	1043.329	9:40	7.92	290	ERW	12.124	
W111	1055.453	2:10	7.92	290	ERW	12.209	
W112	1067.662	9:55	7.92	290	ERW	12.202	
W113	1079.864	1:55	7.92	290	ERW	10.933	
W114	1090.797	9:15	7.92	290	ERW	7.001	
W115	1097.798		7.92	290	Bend	0.086	Bend begin
W116	1097.884	9:50	7.92	290	ERW	12.340	Bend end
W117	1110.223	2:10	7.92	290	ERW	12.212	
W118	1122.435	11:10	7.92	290	ERW	12.135	
W119	1134.570	7:30	7.92	290	ERW	11.366	
W120	1145.936		7.92	290	Bend	0.153	Bend begin
W121	1146.089	2:45	7.92	290	ERW	5.296	Bend end
W122	1151.385	9:30	7.92	290	ERW	12.190	
W123	1163.574	4:10	7.92	290	ERW	12.196	
W124	1175.770	9:15	7.92	290	ERW	12.012	
W125	1187.782	1:30	7.92	290	ERW	12.153	
W126	1199.935	10:30	7.92	290	ERW	12.194	
W127	1212.129	2:00	7.92	290	ERW	10.081	
W128	1222.210		7.92	290	Bend	0.709	Bend begin
W129	1222.919		7.92	290	ERW	0.292	Bend end
W130	1223.211		7.92	290	Bend	0.634	Bend begin

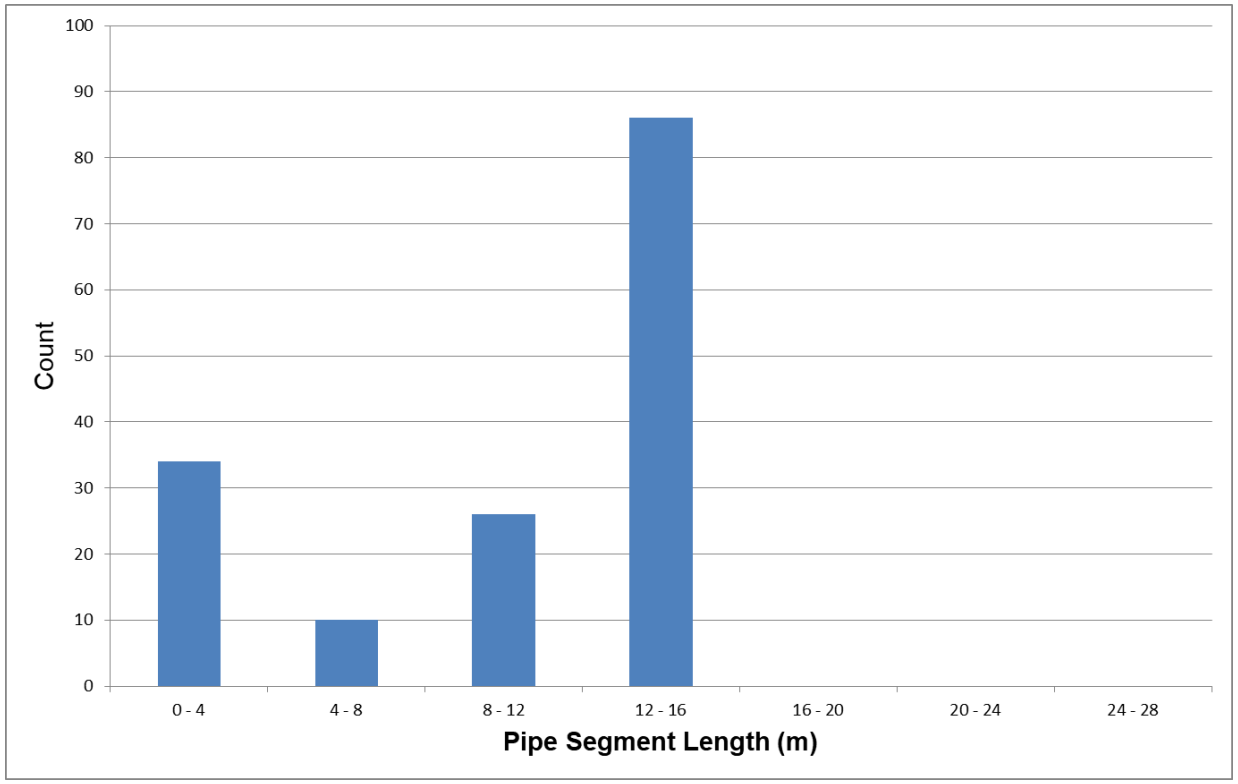
Feature ID	Odometer (m)	Seam Weld (O'clock)	Wall Thickness (mm)	Pipe Grade (Mpa)	Pipe Type	Pipe Length (m)	Comments
W131	1223.845	10:10	7.92	290	ERW	8.598	Bend end
W132	1232.442	8:25	7.92	290	ERW	12.139	
W133	1244.581	4:35	7.92	290	ERW	12.017	
W134	1256.598	11:00	7.92	290	ERW	11.962	
W135	1268.560	2:45	7.92	290	ERW	10.532	
W136	1279.092		7.92	290	ERW	0.977	
W137	1280.069		7.92	290	Bend	0.650	Bend begin
W138	1280.719	12:00	7.92	290	ERW	5.939	Bend end
W139	1286.658		7.92	290	Bend	0.810	Bend begin
W140	1287.468		7.92	290	ERW	1.028	Bend end
W141	1288.496		7.92	290	SMLS	10.213	
W142	1298.708		7.92	290	SMLS	13.909	
W143	1312.618		7.92	290	SMLS	8.629	
W144	1321.246		7.92	290	SMLS	13.454	
W145	1334.700		7.92	290	SMLS	9.056	
W146	1343.756		7.92	290	SMLS	12.536	
W147	1356.292		7.92	290	SMLS	12.852	
W148	1369.144		7.92	290	SMLS	13.258	
W149	1382.402		7.92	290	SMLS	13.577	
W150	1395.979		7.92	290	SMLS	12.793	
W151	1408.772		7.92	290	SMLS	13.668	
W152	1422.440		7.92	290	SMLS	13.640	
W153	1436.080		7.92	290	SMLS	13.643	
W154	1449.724		7.92	290	Bend	0.242	Bend begin
W155	1449.966		7.92	290	SMLS	13.067	Bend end
W156	1463.034		7.92	290	SMLS	4.708	
W157	1467.741		7.92	290	SMLS		Video data only

13.2 Pipe Type Listing

Feature ID	Odometer (m)	Segment (length) (m)	Pipe Type	Pipe Wall Thickness (mm)	Pipe Grade (Mpa)	MAOP (Kpa)	Pipe OD (mm)
W001	0.000	35.342	SMLS	7.92	290	1207	508
W004	35.342	5.328	ERW	7.92	290	1207	508
W005	40.670	0.555	Bend	7.92	290	1207	508
W006	41.225	33.562	ERW	7.92	290	1207	508
W010	74.787	0.532	Bend	7.92	290	1207	508
W011	75.319	104.151	ERW	7.92	290	1207	508
W020	179.470	0.971	Bend	7.92	290	1207	508
W021	180.441	49.048	ERW	7.92	290	1207	508
W025	229.488	0.969	Bend	7.92	290	1207	508
W026	230.457	59.628	ERW	7.92	290	1207	508
W031	290.085	218.896	SMLS	7.92	290	1207	508
W050	508.982	2.031	ERW	7.92	290	1207	508
W051	511.012	0.640	Bend	7.92	290	1207	508
W052	511.652	2.097	ERW	7.92	290	1207	508
W053	513.749	0.638	Bend	7.92	290	1207	508
W054	514.387	72.437	ERW	7.92	290	1207	508
W063	586.824	0.685	Bend	7.92	290	1207	508
W064	587.509	2.125	ERW	7.92	290	1207	508
W065	589.634	0.662	Bend	7.92	290	1207	508
W066	590.296	1.651	ERW	7.92	290	1207	508
W067	591.948	335.559	SMLS	7.92	290	1207	508
W094	927.506	1.342	ERW	7.92	290	1207	508
W095	928.848	0.924	Bend	7.92	290	1207	508
W096	929.772	31.341	ERW	7.92	290	1207	508
W100	961.113	0.958	Bend	7.92	290	1207	508
W101	962.072	33.473	ERW	7.92	290	1207	508
W104	995.544	0.201	Bend	7.92	290	1207	508
W105	995.746	35.150	ERW	7.92	290	1207	508
W108	1030.895	0.179	Bend	7.92	290	1207	508
W109	1031.074	66.723	ERW	7.92	290	1207	508
W115	1097.798	0.086	Bend	7.92	290	1207	508
W116	1097.884	48.053	ERW	7.92	290	1207	508

Feature ID	Odometer (m)	Segment (length) (m)	Pipe Type	Pipe Wall Thickness (mm)	Pipe Grade (Mpa)	MAOP (Kpa)	Pipe OD (mm)
W120	1145.936	0.153	Bend	7.92	290	1207	508
W121	1146.089	76.121	ERW	7.92	290	1207	508
W128	1222.210	0.709	Bend	7.92	290	1207	508
W129	1222.919	0.292	ERW	7.92	290	1207	508
W130	1223.211	0.634	Bend	7.92	290	1207	508
W131	1223.845	56.224	ERW	7.92	290	1207	508
W137	1280.069	0.650	Bend	7.92	290	1207	508
W138	1280.719	5.939	ERW	7.92	290	1207	508
W139	1286.658	0.810	Bend	7.92	290	1207	508
W140	1287.468	1.028	ERW	7.92	290	1207	508
W141	1288.496	161.228	SMLS	7.92	290	1207	508
W154	1449.724	0.242	Bend	7.92	290	1207	508
W155	1449.966	17.775	SMLS	7.92	290	1207	508

13.3 Pipe book Lengths Plot



14 Tie-in Locations (References and Above Ground Markers)

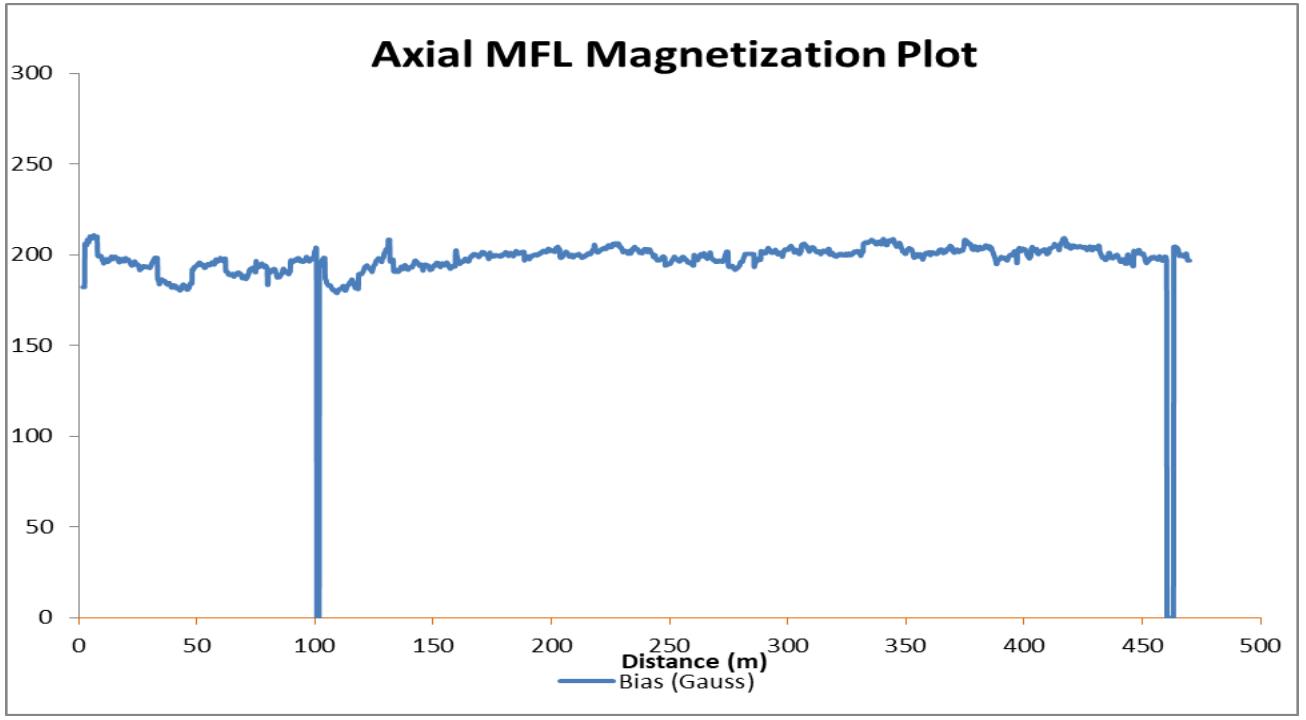
The following locations are identified in the data and are provided as references to locate reported features in the field. These tie-ins will be included in provided dig sheets.

If there are no tie-in locations, this table will intentionally be left empty.

Feature ID	Feature	Odometer (m)	Client Stationing (m)	Comments
I009	Installation	40.911	90+10.9	Right bend center; 90+10.9
I012	Installation	75.055	89+84.6	Left bend center; 89+84.6
I013	Installation	179.930	88+81.5	Left bend center; 88+81.5
I014	Installation	229.919	88+63.6	Right bend center; 88+63.6
I026	Installation	483.048	N/A	Tap; ILC for charging
I033	Installation	511.314	85+85.3	Right bend center; 85+85.3
I034	Installation	514.052	85+82.4	Left bend center; 85+82.4
I035	Installation	587.143	85+10.0	Left bend center; 85+10.0
I036	Installation	589.960	85+07.4	Right bend center; 85+07.4
I050	Installation	929.303	81+71.8	Right bend center; 81+71.8
I051	Installation	961.550	81+58.2	Left bend center; 81+58.2
I052	Installation	995.636	81+26.9	Right bend center; 81+26.9
I053	Installation	1030.981	80+94.8	Left bend center; 80+94.8
I054	Installation	1097.837	80+27.1	Left bend center; 80+27.1
I056	Installation	1146.002	79+80.8	Left bend center; 79+80.8
I058	Installation	1188.722	Estimated 79+35.0	Launcher stopple; Estimated 79+35.0
I060	Installation	1222.545	N/A	Sag bend center; As per FN 0-169-17
I061	Installation	1223.525	N/A	Over bend center; As per FN 0-169-17
I063	Installation	1280.390	78+46.3	Left bend center; 78+46.3
I064	Installation	1287.028	78+40.5	Right bend center; 78+40.5
I073	Installation	1466.207	76+64.3	Spherical tee; 76+64.3; Video data only

15 Magnetization Plot

The overall magnetic flux level measured along the inspection as measured by the axial MFL sensors are provided below.



16 Client Validation Pipe Results

If client validation pipe defects are not provided, this section will intentionally be left empty.

Enbridge Gas Distribution Inc. provided a validation pipe for inspection and anomaly reporting. The following parameters are provided for the validation pipe:

Validation Pipe Information	
Pipe Outer Diameter (OD):	
Nominal Pipe Wall Thickness (WT):	
Pipe Seam Type:	
Pipe Grade:	
Specified Minimum Yield Strength (SMYS):	

All features identified in the validation pipe from the inspection data are provided in the table below.

Feature ID	Feature Type	Odometer	Length (mm)	Width (mm)	Depth (%WT)	Comments

17 Reporting QAQC

The following are Quality Assurance and Quality Control Checks:

Data Acceptance QAQC Check List complete ☒

Data Processing QAQC Check List complete ☒

Preliminary Report QAQC Check List complete ☒

Final Report QAQC Check List complete ☒

Validation Pipe Report QAQC Check List complete (if provided) ☐

QAQC: DATA ACCEPTANCE

Project #	EGD119
Client Name	Enbridge Gas Distribution Inc.
Pipeline Name	NPS 20 Lakeshore - Yonge
Data Analyst:	Brad Tang
QAQC Analyst 1:	Brad Tang
QAQC Analyst 2:	Francis Gracias
Date	1/10/2019

1ST CHECK	2ND CHECK	DATA ACCEPTANCE QAQC	
analyst 1	analyst 2		
DONE	DONE	DOCUMENTS	NOTES
Done		REVIEWED LOG FROM FIELD	Require flow direction and inspection direction / Contact Project Manager
Done		REVIEWED CONTRACT/SOW FOR THIS CLIENT	
Done		REVIEWED CLIENT DELIVERABLES DOCUMENTS/EMAILS	Or contact Analysis Manager to confirm
Done		REVIEWED PROJECT SUMMARY	Make sure cardinal directions correct (N E S W) in Google Earth
Done		REVIEWED PIPETEL QUESTIONNAIRE	
NA	DONE	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	
DONE	DONE	1. DATA PROCESSING	NOTES
Done		Review BBM chat to check if any data needs to be manually extracted from MBs	
Done		VERIFY MAGBAR DATA IS COMPLETE FOR PROCESSING OR ACCEPTABLE TO PROCESS.	
Done		VERIFY LDS DATA IS COMPLETE FOR PROCESSING	
Done		VERIFY ALL LOG FILES AVAILABLE.Review data acceptance package from field team for additional GUI logs if the GUI was restarted	
Done		Review the number of log incoming files. If there is more than one, verify that both files were parsed and that they were parsed in the correct order	
Done		OVERALL LENGTH OF LINE CORRELATES WITH CLIENT QUESTIONAIRE	
Done		VERIFY TIE-IN FEATURE BETWEEN SCANS. USE MFL OR LDS OR VIDEO DATA.	Compare with PFL if available
NA		REPORT MISSING TIE-IN FEATURE BETWEEN SCANS TO FIELD FOR CONFIRMATION.	Compare with PFL if available
NA		IDENTIFY DATA GAPS.Review both field notes and BBM chat to identify potential backwards movement that final processing may have removed	Must if only one scan
NA	DONE	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	
DONE	DONE	2. DATA COVERAGE	NOTES
Done		RECONCILE MAP SCHEMATIC WITH LOG AND PROJECT SUMMARY	
Done		CHECK 'START' AND 'END' ODO OF EACH SCAN CORRELATES WITH SCHEMATIC	
Done		Overall length of line correlates with field notes	
Done		VERIFY # CASINGS MATCH CASINGS IN PROJ SUMMARY.	
Done		VERIFY BENDS/FEATURES FROM PROJECT SUMMARY IN DATA and field notes	
Done		MFL COVERAGE test: CHECK info CORRELATES WITH DATA.	
NA		If dead sensors and/or MB and/or missing data exist, review coverage map to confirm it is reflected in the coverage map	
Done		LDS COVERAGE test: CHECK info CORRELATES WITH DATA.	
Done		Notify run acceptance result by email to all related people	
Done		CLARIFY ONE SCAN OR TWO FOR RUN ACCEPTANCE IN EMAIL SUBJECT LINE	
Done		COMMENT ANY MAGBAR / LDS DATA ISSUE (SAY, MAGBAR#107 IS UNVAILABLE) DURING RUN ACCEPTANCE	
Done		SAVE RUN ACCEPTANCE EMAIL AND DRIVE LOG ON R DRIVE IN CORRESPONDING FOLDER	
NA		Identify casing limits	
NA		Note all sensor failure points	
NA	DONE	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	

QAQC: DATA PROCESSING

Project #	EGD119
Client name	Enbridge Gas Distribution Inc.
Pipeline Name	NPS 20 Lakeshore - Yonge
Data Analyst:	Brad Tang
QAQC Analyst 1:	Brad Tang
QAQC Analyst 2:	Francis Gracias

1ST CHECK	2ND CHECK	DATA ACCEPTANCE QAQC	
analyst 1	analyst 2		
DONE	DONE	DOCUMENTS	NOTES
DONE		REVIEWED LOG FROM FIELD	Require flow direction and inspection direction / Contact Project Manager
DONE		REVIEWED CONTRACT/SOW FOR THIS CLIENT	
DONE		REVIEWED CLIENT DELIVERABLES DOCUMENTS/EMAILS	Or contact Analysis Manager to confirm
DONE		REVIEWED PROJECT SUMMARY	Make sure cardinal directions correct (N E S W) in Google Earth
DONE		REVIEWED PIPETEL QUESTIONNAIRE	
DONE		REVIEWED MFL COVERAGE	
DONE		REVIEWED LDS COVERAGE	
NA	DONE	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	
DONE	DONE	1. DATA PROCESSING	NOTES
NA		CHECK THAT LATE MAG BARS ARE PROCESSED (CHECK JARVIS)	
DONE		VERIFY ALL MFL, LDS, VIDEO DATA IS AVAILABLE FOR PROCESSING	
DONE		VERIFY LDS (FULL RES) DATA IS COMPLETE FOR PROCESSING	
DONE		Verify GUI and nose video files are uploaded	
DONE		Verify GUI and nose log files are uploaded	
NA		Review the number of log incoming files. If there is more than one, verify that both files were parsed and that they were parsed in the correct order	
DONE		If using log frame times from the nose, verify that both the rear and front frame times were used for processing	
DONE		OVERALL LENGTH OF LINE CORRELATES WITH CLIENT QUESTIONAIRE	
DONE		VERIFY TIE-IN FEATURE BETWEEN SCANS. USE MFL OR LDS OR VIDEO DATA.	Compare with PFL if available
NA		REPORT MISSING TIE-IN FEATURE BETWEEN SCANS TO FIELD FOR CONFIRMATION.	Compare with PFL if available
NA		IDENTIFY DATA GAPS.Review both field notes and BBM chat to identify potential backwards movement that final processing may have removed	Must if only one scan
DONE		CONFIRM FLOW DIRECTION	
DONE		VERIFY LOG-FRAME-TIMES DATA IS AVAILABLE FOR PROCESSING	
DONE		OVERALL LENGTH OF LINE CORRELATES WITH CLIENT QUESTIONAIRE	
NA	DONE	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	

QAQC: DATA ANALYSIS PRELIMINARY REPORT

Project #	EGD119
Client name	Enbridge Gas Distribution Inc.
Pipeline Name	NPS 20 Lakeshore - Yonge
Data Analyst:	Brad Tang
QAQC Analyst 1:	Brad Tang
QAQC Analyst 2:	Francis Gracias

1ST CHECK	2ND CHECK	PRELIMINARY REPORT QAQC	
analyst 1	analyst 2		
DONE	DONE	DOCUMENTS	NOTES
DONE	DONE	REVIEWED LOG FROM FIELD	Require flow direction and inspection direction / Contact Project Manager
DONE	DONE	REVIEWED CONTRACT/SOW FOR THIS CLIENT	
DONE	DONE	REVIEWED CLIENT DELIVERABLES DOCUMENTS/EMAILS	Or contact Analysis Manager to confirm
DONE	DONE	REVIEWED PROJECT SUMMARY	Make sure cardinal directions correct (N E S W) in Google Earth
DONE	DONE	REVIEWED PIPETEL QUESTIONNAIRE	
DONE	DONE	REVIEWED MFL COVERAGE	
DONE	DONE	REVIEWED LDS COVERAGE	
N/A	DONE	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	
DONE	DONE	4. PRELIMINARY ANALYSIS	NOTES
DONE	DONE	ENSURE WALL THICKNESS, PIPE GRADE AND MAOP CORRECT. OTHERWISE, CONTACT CLIENT.	Or contact Analysis Manager to confirm
DONE	DONE	REFER TO CONTRACT OR MGR FOR PRELIMINARY REPORT CRITERIA.	
DONE	DONE	Confirm that the property of the first weld selected in MFL conforms with the WT, pipe grade and MAOP specified by client	
DONE	DONE	Confirm that the correct sizing file has been checked off for the first weld property	
DONE	DONE	Confirm that LDS data has been calibrated	
DONE	DONE	FOR EACH SCAN, CHECK ORIENTATION OF FEATURES IN SAVE FILE AND DISPLAYED IN COLOUR MAP AND VIDEO IS THE SAME	
DONE	DONE	REVIEW MFL DATA AND BOX ALL METAL LOSS AND DENTS POTENTIALLY MEETING PRELIMINARY CRITERIA	
DONE	DONE	REVIEW LDS DATA AND BOX ALL ANOMALIES POTENTIALLY MEETING PRELIMINARY CRITERIA	
DONE	DONE	REVIEW VIDEO DATA AND BOX ALL FEATURES POTENTIALLY MEETING PRELIMINARY CRITERIA	
DONE	DONE	REPORT ALL DENTS>6% REPORTED IMMEDIATELY TO ANALYSIS MANAGER	
DONE	DONE	VERIFY ALL POTENTIAL DENTS IN VIDEO. CONSULT LOG BOOK FOR NOTES ON DENT OR DEBRIS AT LOCATION	
DONE	DONE	CHECK ML LENGTH, WIDTH AND AMPLITUDE ARE CORRECT WHEN INPUT FOR DEPTH SIZING.	
DONE	DONE	CHECK LDS CALIBRATION FILE IS UPDATED.	
DONE	DONE	CHECK DENT SIZING MAKES SENSE WITH VISUAL IN VIDEO DATA.	
N/A	N/A	SCAN MFL DATA FOR ANY MISSED FEATURES TO REPORT. ENSURE ALL REPORTED.	
N/A	N/A	SCAN LDS DATA FOR ANY MISSED FEATURES TO REPORT. ENSURE ALL REPORTED.	
N/A	N/A	SCAN VIDEO DATA FOR ANY MISSED FEATURES TO REPORT. ENSURE ALL REPORTED.	
DONE	DONE	CHECK SURFACE LOCATION OF ML USING ALL TECHNOLOGIES.	
DONE	DONE	SIZING: CHECK ALL ML >50% OR 40% ACCORDINGLY	
DONE	DONE	CHECK ALL ML AT WELD FOR WELD INDICTATIONS.	
N/A	N/A	ENSURE ALL PRELIM FEATURES AT WELD HAVE AN 'AT WELD' COMMENT.	
N/A	N/A	ENSURE ALL PRELIM FEATURES AT LS WELD HAVE AN 'AT LS WELD' COMMENT.	
DONE	DONE	IF section DOUBLE SCANNED, CHECK ALL ML> 50% OR 40% CONFIRMED IN BOTH SCANS	
DONE	DONE	IF section DOUBLE SCANNED, CHECK THAT THE SIZING OF ML> 50% OR 40% IS SIMILAR IN BOTH SCANS	
N/A	N/A	IF section DOUBLE SCANNED, CHECK ALL PRELIM DENTS CONFIRMED IN BOTH SCANS	
N/A	N/A	IF DOUBLE SCANNED, CHECK THAT THE SIZING OF PRELIM DENTS ARE SIMILAR BETWEEN SCANS	
N/A	N/A	IF section DOUBLE SCANNED, CHECK ALL DENTS W/ML CONFIRMED IN BOTH SCANS.	
N/A	N/A	IF NEEDED FOR COUPLING, SCAN VIDEO AND LDS DATA FOR GAPS	

50	N/A	N/A	IF NEEDED FOR COUPLINGS, CONFIRM GAP SIZES IN BOTH LDS DATA AND VIDEO DATA	
51	DONE	DONE	CLUSTERING: REVIEW ALL ML IS CLUSTERED AS PER CONTRACT	
52	N/A	N/A	GET 2ND OPINION ON ALL 'UNKNOWN' FEATURES FOR IDENTIFICATION.	
53	DONE	DONE	CHECK ORIENTATION OF KNOWN FEATURE IN EACH SCAN. CORRECT IF NEEDED.	
54	DONE	DONE	IDENTIFY DIFFERENCE OF ODO IN SCANS. DECIDE ON CORRECT ODO REFERENCES.	
55	DONE	DONE	Identify all potential reference points	
56	DONE	DONE	Ensure that the flow direction matches for all documents and scans	
57	DONE	DONE	Pay particular attention to the Pipe Seam Type, Pipe Grade, and MAOP fields. Cross check these fields with the Pipeline Questionnaire and clientName features lists. Cross check this information with the Client Spread Sheet (Pipeline Properties tab).	
58	N/A	N/A	If there are Critical Findings, ensure to inform Analysis Manager	
59	DONE	DONE	Cross check at least ten comment fields, ensuring that they match between the PRELIM Report and Datatel.	
60	DONE	DONE	Scan all data with Highlight All enabled. Ensure all welds and likely calls are selected	
61	**DONE**	**DONE**	5. PRELIMINARY REPORT	**NOTES**
62	DONE	DONE	HAVE FINAL PIPECONFIG FILE	
63	DONE	DONE	CHECK ALL REPORTABLE METAL LOSS,L,W,DEPTH AGREES WITH DATABASE	
64	DONE	DONE	CHECK ALL REPORTABLE DENTS,L,W,DEPTH AGREES WITH DATABASE	
65	N/A	N/A	CHECK ALL REPORTABLE DENTS WTH METAL LOSS,L,W,DEPTH AGREES WITH DATABASE	
66	DONE	DONE	CHECK HEADERS OF ALL TABLES	
67	DONE	DONE	CHECK HEADERS OF ALL CHARTS	
68	DONE	DONE	CHECK UNITS OF ALL DATA CORRELATE WITH UNITS IN HEADER.	
69	N/A	N/A	CHECK IMPERIAL/METRIC CONVERSIONS OF ALL VALUES.	
70	DONE	DONE	CHECK REPORT IS AS PER CONTRACT DOCUMENT.	
71	DONE	DONE	CHECK CLIENT NAME MATCHES QUESTIONAIRRE FOR ALL PAGES.	
72	DONE	DONE	CHECK HEADER AND FOOTER info corresponds with client provided info.	
73	DONE	DONE	CHECK INSPECTION SUMMARY INFO CORRELATES WITH REPORT	
74	DONE	DONE	ENSURE FLOW DIRECTIONS MATCH FOR ALL DOCS AND SCANS.	
75	DONE	DONE	CHECK ALL TALLIES ADD UP IN TABLES.	
76	DONE	DONE	Check terms used in report, schmatic and datatel are consistant	
77	DONE	DONE	Check pipeline info correlates with pipetel questionaire	
78	DONE	DONE	CHECK REPORT DATE IS CORRECT IN FOOTER AND FRONT PAGE.	
79	DONE	DONE	CHECK HEADER/FOOTER AT ALL PAGE ORIENTATION CHANGE FOR ERRORS.	
80	DONE	DONE	CHECK DOC TITLES MATCH TITLES REFERRED TO IN REPORT.	
81	DONE	DONE	CHECK DOC HAS CORRECT PAGE REFERENCES	
82	DONE	DONE	CHECK IF ANY DATA COVERAGE CHANGES AT THE PRELIM REPORT STAGE AND UPDATE IF NEEDED	
83	DONE	DONE	MAKE SURE PIPELINE NAME IN REPORT MATCHES PIPELINE QUESTIONNAIRE	
84	DONE	DONE	CONFIRM NUMBER OF 'INDICATIONS' IN TABLES MATCHES PRELIM REPORT.	
85	DONE	DONE	APPLICABLE CLUSTERING RULES ARE EXPLICITLY STATED IN REPORTING SPECS.	
86	DONE	DONE	PRESSURE CALC'S EXPLICITLY STATED IN 3. REPORTING SPECS.	
87	DONE	DONE	CHECK BENDS IN SCHEMATIC MAKE SENSE WITH PROJECT SUMMARY INFO	
88	DONE	DONE	SCHEMATIC: VERIFY '0' LOCATION IS CORRECT.	
89	DONE	DONE	SCHEMATIC: CHECK U/S AND D/S LIMITS, LABELS AGREE SECTION 1	

QAQC: DATA ANALYSIS FINAL REPORT

Project #	EGD119
Client Name	Enbridge Gas Distribution Inc.
Pipeline Name	NPS 20 Lakeshore - Yonge
Data Analyst:	Brad Tang
QAQC Analyst 1:	Brad Tang
QAQC Analyst 2:	Francis Gracias

1ST CHECK	2ND CHECK	FINAL REPORT QAQC	
analyst 1	analyst 2		
DONE	DONE	6. FINAL DATA ANALYSIS	NOTES
DONE	DONE	METAL LOSS REPORTING THRESHOLD IS 15% FOR SMLS PIPE, AND 10% FOR OTHER PIPE TYPES	
DONE	DONE	IF DOUBLE SCANNED, CHECK ALL ML CONFIRMED IN BOTH SCANS.	
DONE	DONE	IF DOUBLE SCANNED, CHECK ALL DENTS CONFIRMED IN BOTH SCANS.	
DONE	DONE	IF DOUBLE SCANNED, CHECK ALL DENTS W/ML CONFIRMED IN BOTH SCANS.	
DONE	DONE	IF DOUBLE SCANNED, CHECK ALL DENTS LOCATED BETWEEN 8 O'CLOCK AND 4 O'CLOCK TO IDENTIFY IF W/ML IN BOTH SCANS.	
DONE	DONE	IF DOUBLE SCANNED, CHECK ALL 'OTHER' TYPES CONFIRMED IN BOTH SCANS.	
N/A	N/A	IF DOUBLE SCANNED, CHECK ALL 'UNKKNOWN' TYPES CONFIRMED IN BOTH SCANS.	
DONE	DONE	FOR EACH SCAN, CHECK ORIENTATION OF FEATURES IN SAVE FILE AND DISPLAYED IN COLOUR MAP IS THE SAME	
DONE	DONE	VERIFY ALL POTENTIAL DENTS IN VIDEO. CONSULT LOG BOOK OR OPS FOR FURTHER CONFIRMATION.	
DONE	DONE	IF DOUBLE SCANNED, CHECK ALL POSSIBLE HAZ FEATURES IN BOTH SCANS	
N/A	N/A	FOR TOUCHING METAL OBJECT, CHECK IF IT CAUSES ID RESTRICTION IN BOTH SCANS	
N/A	N/A	NEED TO CONFIRM IF ANY REPAIR FEATURE IN SAVE FILE (FOR EXAMPLE, METAL SLEEVE, CLOCK SPRING, HALF SOLE, PATCH ...)	
DONE	DONE	MAKE SURE TO INSERT ALL FEATURES FROM CAMERA VIDEO IF NO MFL DATA (VALVE, TEE, TAP, BEND ...)	
DONE	DONE	Check that LDS data has been calibrated	
DONE	DONE	CHECK DENT SIZING MAKES SENSE WITH VISUAL IN VIDEO DATA.	
DONE	DONE	Check that the location of the dent in the video matches its orientation in the MFL and LDS data	
DONE	DONE	If double scanned, check that the dent sizing result is similar between scans	
N/A	N/A	IF NEEDED FOR COUPLING, SCAN VIDEO AND LDS DATA FOR GAPS	
N/A	N/A	IF NEEDED FOR COUPLINGS, CONFIRM GAP SIZES IN BOTH LDS DATA AND VIDEO DATA	
DONE	DONE	Enable "Highlight All" function and scan through MFL data for any missed welds and features to report. Ensure all reported.	
DONE	DONE	Enable "Highlight All" function and scan through LDS data for any missed features to report. Ensure all reported.	
DONE	DONE	Scan video data with particular attention in regions without either MFL or LDS data for possible missing welds and features	
DONE	DONE	CHECK SURFACE LOCATION OF ML USING ALL TECHNOLOGIES.	
DONE	DONE	Review the joint length column to check for unusually short and long segments to identifty missing or false weld selections	
DONE	DONE	CHECK IF CLUSTERING RULE SETTING IS CORRECT IN SCAN --> CLUSTERING RULE	
DONE	DONE	SIZING: CHECK ALL ML >50% or 40% ACCORDINGLY	
DONE	DONE	If double scanned, check that the ML sizing result is similar between scans	
DONE	DONE	SIZING: CHECK SIZING OF ALL ML	
DONE	DONE	CLUSTERING: REVIEW ALL ML IS CLUSTERED AS PER REG'S.	
DONE	DONE	CHECK ALL ML AT WELD FOR WELD INDICTATIONS.	
DONE	DONE	ENSURE ALL FEATURES AT WELD HAVE AN 'AT WELD' COMMENT.	
DONE	DONE	ENSURE ALL FEATURES AT LS WELD HAVE AN 'AT LS WELD' COMMENT.	
N/A	N/A	GET 2ND OPINION ON ALL 'UNKNOWN' FEATURES FOR IDENTIFICATION.	
N/A	N/A	ALL DENTS WITH METAL LOSS REPORTED IMMEDIATELY TO CLIENT.	
DONE	DONE	CHECK ALL REFERENCE POINTS AND TOGGLE ON / OFF IF NEEDED	
DONE	DONE	CHECK ORIENTATION OF KNOWN FEATURE IN EACH SCAN. CORRECT IF NEEDED.	
DONE	DONE	IDENTIFY DIFFERENCE OF ODO IN SCANS. DECIDE ON CORRECT ODO REFERENCES.	
DONE	DONE	Open the Final Features SAVE file, checking the start/stop positions for each scan. Do the maximum and minimum scan positons from the SAVE file agree with the Inspected Pipeline Length field in the Report?	
DONE	DONE	Ensure that the flow direction matches for all documents and scans	
DONE	DONE	Pay particular attention to the Pipe Seam Type, Pipe Grade, and MAOP fields. Cross check these fields with the Pipeline Questionnaire and clientName features lists. Cross check this information with the Client Spread Sheet (Pipeline Properties tab).	
N/A	N/A	If there are missed Critical Findings from preliminary report, ensure to inform Analysis Manager immediately	
DONE	DONE	Cross check at least ten comment fields, ensuring that they match between the Final Report and Datatel.	
DONE	DONE	Scan all data with Highlight All enabled. Ensure all welds and likely calls are selected	
N/A	N/A	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	
DONE	DONE	7. FINAL DATA REPORT	NOTES
DONE	DONE	HAVE FINAL PIPECONFIG FILE	
N/A	N/A	ROI (REGION OF INTEREST) IDENTIFIED ON SCHEMATIC	
N/A	N/A	ROI (REGION OF INTEREST) IDENTIFIED ON LDS AND MFL COVERAGE MAP AND TABLE.	
DONE	DONE	The Pipeline Data Coverage percentage should be equal to 100 minus the sum of the Missing Data at Bends and Features and Missing Data from Sensor Failure percentages.	
N/A	N/A	Cross check ROI length in the report with the length obtained in Datatel	
N/A	N/A	Cross check ROI limits, lengths, and coverage with the "Run Acceptance" file produced when the final coverages were estimated	
DONE	DONE	If there were sensor deactivations for large features, the difference between the Accepted Metal Loss Data and Inspected Pipeline Length divided by the Inspected Pipeline Length should equal the Missing Data at Bends and Features percentage	
DONE	DONE	Ensure that the Inspected Pipeline Length is the difference between the upstream and downstream limits.	
DONE	DONE	CHECK UNITS OF ALL DATA CORRELATE WITH UNITS IN HEADER.	
N/A	N/A	CHECK IMPERIAL/METRIC CONVERSIONS OF ALL VALUES.	
DONE	DONE	PRESSURE CALC'S EXPLICITLY STATED IN 3. REPORTING SPECS.	
N/A	N/A	Ensure all ROIs are indicated on positional plots, and located correctly.	
DONE	DONE	Ensure all positional plots have a common X-axis range, and coincides with inspection begin/end positions stated in the Inspection Summary (Section 2), MFL Pipeline Data Coverage (Section 6), LDS Pipeline Data Coverage (Section 7) and the Magnetization Plot (Section 14)	

71	DONE	DONE	If possible, quickly count the number of ML and dents in the graphs to check that all features have been plotted	
72	DONE	DONE	Randomly choose a few ML and dents from the SAVE file to confirm that the o'clock positions of these features have been represented correctly	
73	DONE	DONE	Review pressure calculations are correct.	
74	DONE	DONE	CHECK TOC TITLES MATCH TITLES REFERRED TO IN REPORT.	
75	DONE	DONE	CHECK TOC HAS CORRECT PAGE REFERENCES	
76	DONE	DONE	HAVE FINAL 'SAVE' FILE	
77	DONE	DONE	CONFIRM NUMBER OF 'INSTALLATIONS' IN TABLES MATCHES FINAL REPORT	
78	DONE	DONE	CONFIRM NUMBER OF 'OTHERS' IN TABLES MATCHES FINAL REPORT	
79	DONE	DONE	CONFIRM NUMBER OF 'UNKNOWNS' IN TABLES MATCHES FINAL REPORT	
80	DONE	DONE	CHECK TABLE OF CONTENTS IS UPDATED AND CORRECT.	
81	DONE	DONE	Ensure the counts on all histograms and graphs add up to the number of indications, dents and welds in Section 4	
82	DONE	DONE	If countable, ensure the number in each specified depth range agree with Section 4	
83	DONE	DONE	Review the x-axis odometer of the figures to confirm that it is representative of the inspection length	
84	DONE	DONE	For all plots in this section, ensure that the legend box is not covering data points. This can be done by checking the source graphics in the Analysis Spread Sheet (Special Figure tab). Move the position of the box to check this	
85	DONE	DONE	Indication numbering is complete with no omissions.	
86	DONE	DONE	Review Appendix B to check that the proper personnels are listed	
87	DONE	DONE	CHECK VERSION NUMBER OF THE REPORT	
88	DONE	DONE	CHECK REPORT DATE IS CORRECT IN FOOTER AND FRONT PAGE.	
89	DONE	DONE	APPLICABLE CLUSTERING RULES ARE EXPLICITLY STATED IN REPORTING SPECS.	
90	DONE	DONE	The severity table is sorted by increasing failure pressure.	
91	DONE	DONE	MFL COVERAGE: CHECK SECTION 1 MATCHES SECTION 5	
92	DONE	DONE	LDS COVERAGE: CHECK SECTION 1 MATCHES SECTION 5	
93	N/A	N/A	CHECK ALL PRELIMINARY REPORT FEATURES ARE ACCOUNTED.	
94	DONE	DONE	CHECK HEADERS OF ALL TABLES	
95	DONE	DONE	CHECK REPORT IS AS PER CONTRACT DOCUMENT.	
96	DONE	DONE	CHECK HEADERS OF ALL CHARTS	
97	DONE	DONE	CHECK BENDS IN SCHEMATIC MAKE SENSE WITH PROJECT SUMMARY INFO	
98	DONE	DONE	ANY UPDATES IN COVERAGE SHOULD BE STATED IN REPORT	
99	DONE	DONE	SCHEMATIC: VERIFY '0' LOCATION IS CORRECT.	
100	DONE	DONE	Verify that the same numbers used in the paragraph below the table are the same ones used in the table	
101	DONE	DONE	CHECK IF ANY DATA COVERAGE CHANGES AT THE FINAL REPORT STAGE AND UPDATE IF NEEDED	
102	DONE	DONE	CHECK ALL INFO FROM MFL COVERAGE MATCHES INFO IN SECTION 5	
103	DONE	DONE	CHECK ALL INFO FROM LDS COVERAGE MATCHES INFO IN SECTION 5	
104	DONE	DONE	CHECK CLIENT NAME MATCHES QUESTIONAIRRE FOR ALL PAGES.	
105	DONE	DONE	CHECK INSPECTION SUMMARY INFO CORRELATES WITH REPORT	
106	DONE	DONE	CHECK HEADER AND FOOTER info corresponds with client provided info.	
107	DONE	DONE	ENSURE FLOW DIRECTIONS MATCH FOR ALL DOCS AND SCANS.	
108	DONE	DONE	SCHEMATIC: CHECK U/S AND D/S LIMITS, LABELS AGREE SECTION 1	
109	N/A	N/A	CHECK IF ANY CHANGES FOR METAL LOSS & DENT SIZINGf from prelim REPORT AND EXPLAIN WHY	
110			CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	
111	**DONE**	**DONE**	**7A. ANALYSIS TABLES**	**NOTES**
112	DONE	DONE	REVIEW ANY DEPTHS BELOW REPORTING THRESHOLD.	
113	DONE	DONE	CHECK ALL COLUMNS OF ALL TABLES HAVE PROPER HEADING.	
114	DONE	DONE	CHECK UNITS OF ALL DATA CORRELATE WITH UNITS IN HEADER.	
115	N/A	N/A	CHECK IMPERIAL/METRIC CONVERSIONS OF ALL VALUES.	
116	DONE	DONE	CHECK TABLES AND CHARTS ARE AS PER CLIENT CONTRACT DOCUMENT.	
117	DONE	DONE	CHECK CLIENT NAME AND INFOR CORRELATES WITH PIPETEL QUESTIONAIRRE.	
118	DONE	DONE	CHECK REPORT DATE IS CORRECT IN FOOTER AND FRONT PAGE.	
119	DONE	DONE	CHECK HEADER/FOOTER AT ALL PAGE ORIENTATION CHANGE FOR ERRORS.	
120	DONE	DONE	Ensure that the latest version of the Analysis Spread Sheet was used to generate the Client Spread Sheet.	
121	DONE	DONE	CONFIRM NUMBER OF 'INDICATIONS' IN TABLES MATCHES 'SAVE' FILE.	
122	DONE	DONE	CONFIRM NUMBER OF 'CLUSTERS' IN TABLES MATCHES 'SAVE' FILE.	
123	DONE	DONE	CONFIRM NUMBER OF 'WELDS' IN TABLES MATCHES 'SAVE' FILE.	
124	DONE	DONE	CONFIRM NUMBER OF 'INSTALLATIONS' IN TABLES MATCHES 'SAVE' FILE.	
125	DONE	DONE	CONFIRM NUMBER OF 'OTHERS' IN TABLES MATCHES 'SAVE' FILE.	
126	N/A	N/A	CONFIRM NUMBER OF 'UNKNOWNS' IN TABLES MATCHES 'SAVE' FILE.	
127	DONE	DONE	Confirm the percentage depth breakdown of ML is correct in Section 4	
128	DONE	DONE	Confirm the Pf/MAOP category count is correct in Section 4	
129	DONE	DONE	Confirm the percentage depth breakdown of dents are correct in Section 4	
130	DONE	DONE	Confirm the breakdown of "Other Features" and "Installations" are correct in Section 4	
131	DONE	DONE	Confirm that the number of pipe segments is the number of girth welds + 1	
132			CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	
133	**DONE**	**DONE**	**7B. CLIENT TABLES SPREADSHEET**	**NOTES**
134	DONE	DONE	ENSURE INFORMATION CORRECT IN 'PIPELINE PROPERTIES' TAB	
135	DONE	DONE	CONFIRM FEATURE LIST TABLES MATCHES 'SAVE' FILE. MAKE SURE NO TYPOS FOR METAL LOSS & DENT DEPTH	
136	DONE	DONE	MAKE SURE DIGSHEET WORKS AND CHECK THE FIRST & LAST FEATURE, THE WORST METAL LOSS AND DENT IN DIGSHEET DISPLAY	
137	DONE	DONE	AFTER GAGC, REMOVE FORMULAS FOR HIDDEN TABS IN CLIENT TABLES SPREADSHEET	
138	N/A	N/A	CLARIFY ANY UNEXPECTED ISSUES/OBSTACLES	

Appendix A: Attachments

Following is the list of submitted data on an electronic storage to Enbridge Gas Distribution Inc.:

- .pdf format of this report
- .pdf format of preliminary report
- Datatel software for viewing data acquired from this pipeline
- A user guideline titled "Datatel User Guidelines.pdf"
- .xls or .xlsx format pipe book and Dig Sheet utility

Appendix B: Pipetel Inspection Personnel and Signature

Title	Name	Signature
Field Crew Lead:	Jason McKinnon	
Field Crew:	Konstantin Alimardanov	
Data Analyst:	Brad Tang	
QA/QC:	Francis Gracias	
Data Analysis Manager:	Francis Gracias	

pipetel TECHNOLOGIES

LEVEL III CERTIFICATE

Jason McKinnon

The above named individual has successfully completed the formal training and attained the required experience to be qualified as a Level III Member of Pipetel's Operations Team in providing robotic pipeline inspection services.

Certification Awarded:
April 26th, 2018

Paul Laursen, President

pipetel TECHNOLOGIES

LEVEL II CERTIFICATE

Konstantin Alimardanov

The above named individual has successfully completed the formal training and attained the required experience to be qualified as a Level II Member of Pipetel's Operations Team in providing robotic pipeline inspection services.

Certification Awarded:
April 13th, 2018

Paul Laursen, President

pipetel TECHNOLOGIES

LEVEL III CERTIFICATE

Brad Tang

Axial MFL and Geometry inspection data.

The above named individual has successfully completed requirements in accordance with API 1163 and ANSI/ASNT-PQ-2005(2010) for certification as Data Analyst Level III in Axial MFL and geometry inspection data.

Francis Gracias
Data Analysis Manager

Paul Laursen
President

pipetel TECHNOLOGIES

LEVEL III CERTIFICATE

Francis Gracias

Axial MFL and Geometry inspection data.

The above named individual has successfully completed requirements in accordance with API 1163 and ANSI/ASNT-PQ-2005(2010) for certification as Data Analyst Level III in Axial MFL and geometry inspection data.

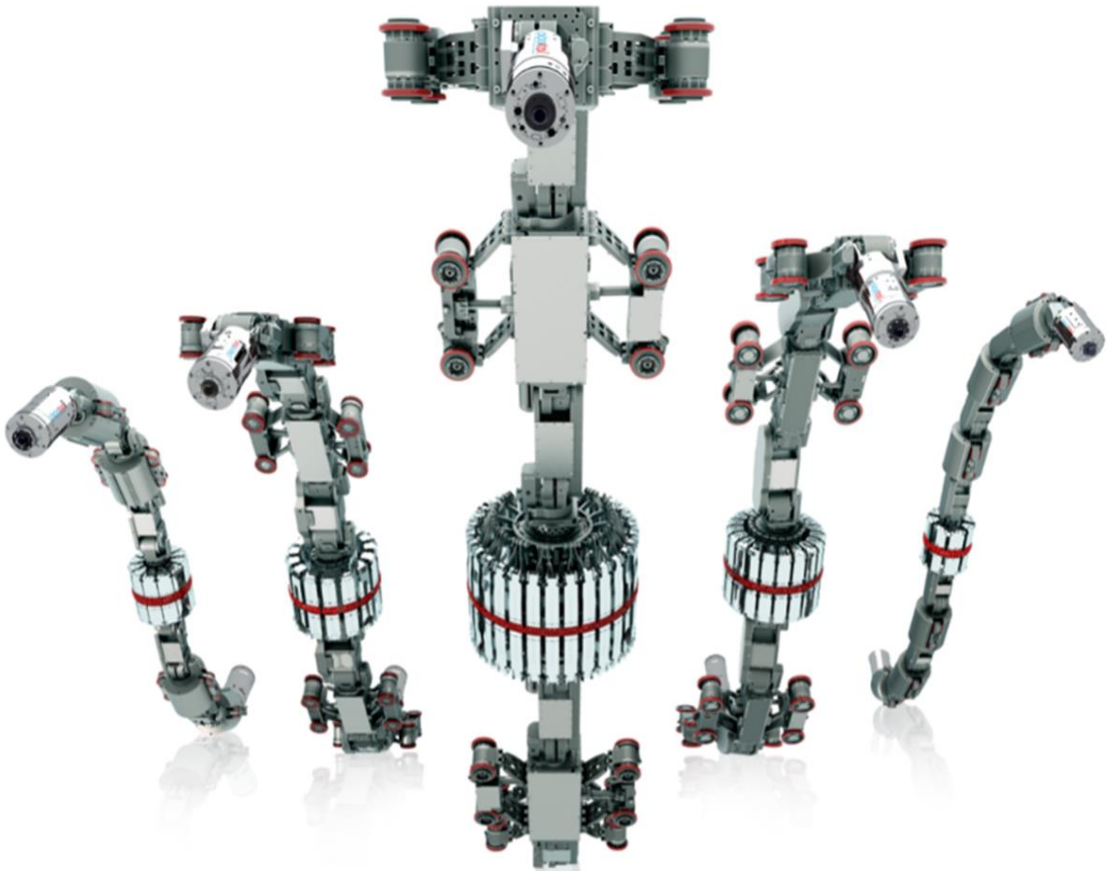
Rod Lee
General Manager

Paul Laursen
President

Appendix C: Data Analysis Preliminary Inspection Report

Enbridge Gas Distribution Inc.

Pipeline Index: 111.LAK.20-10
Line Name: NPS 20 Lakeshore - Yonge
Upstream Data Limit: Data Limit A (Nearby Parliament St)
Downstream Data Limit: Data Limit B (Nearby Bay St)
Pipetel Project #: EGD119
Report Date: January 10, 2019. Version 2



Version Control

Version No.	Report Date	File Name	Description	Prepared by	Approved by
Issue#1	November 29, 2018	NPS 20 Lakeshore-Yonge-MFL-20181129-PreliminaryReport	Initial release	Brad Tang	Francis Gracias

1 Executive Summary

On November 21, 2018, the Enbridge Gas Distribution Inc. NPS 20 Lakeshore - Yonge Line from Data Limit A (Nearby Parliament St) to Data Limit B (Nearby Bay St) was successfully inspected by the Pipetel Explorer Robot. The flow direction as provided by Enbridge Gas Distribution Inc. is East to West. The odometer position is increasing in the flow direction and the zero odometer position is set at the first identified weld.

Data coverage acceptance from Enbridge Gas Distribution Inc. was provided on November 22, 2018. This is the preliminary report summarizing features meeting preliminary reporting criteria from the evaluation of accepted inspection data.

2 Inspection Summary

General information about the inspected pipeline is summarized below. The summary table contains pipeline information received from Enbridge Gas Distribution Inc. as well as inspection information generated by Pipetel Technologies.

Pipeline Information	
Pipeline Name:	**NPS 20 Lakeshore - Yonge,** Data Limit A (Nearby Parliament St) to Data Limit B (Nearby Bay St)
Nominal Pipe Size (NPS):	20 inch (508 mm)
Pipe Wall Thickness (WT):	0.312 inch (7.92 mm)
Pipe Grade:	X42 (290 Mpa)
Maximum Allowable Operating Pressure (MAOP):	175 psi
Flow Direction During Inspection:	East to West

Inspection Information	
Inspection Date:	November 19, 2018 to November 21, 2018
Inspection Robot:	Explorer X2026
Inspection Type(s):	Magnetic flux leakage (MFL) for metal loss. Laser Deformation Sensor (LDS) for dent detection. Visual (video camera) for general pipeline condition.
Inspection robot Magnetizer Calibration:	November 18, 2018
Inspection robot Axial Spatial Sampling:	0.050 inch (1.27 mm)
Inspected Pipeline Length:	1467.03 m
Inspection Upstream Limit:	Data Limit A (Nearby Parliament St)
Inspection Downstream Limit:	Data Limit B (Nearby Bay St)

3 Preliminary Reporting Specifications

All features identified in this preliminary report have an ID preceded with a 'P'. The following are provided regarding reportable features and deliverables.

Preliminary Reporting Criteria	
Metal Loss Cluster Rule:	6T x 6T
Metal loss Preliminary Reporting Threshold:	>= 70%
Pf/MAOP Preliminary Report Threshold:	1.1 (Effective Area)
Dent With Metal Loss Preliminary Reporting Threshold:	Dent with any indicated metal loss or stress concentrators
Odometer Position of Metal Loss:	Center of feature
Odometer Position of non-metal loss features:	Center of feature
Apply Tool Tolerance to Metal Loss:	Depth and Length
Provide Effective Area Burst pressure Method:	Yes
Provide MB31G Burst Pressure Method:	Yes
Provide B31G Burst Pressure Method:	Yes
Pf/MAOP Preliminary Report Threshold:	1.1 (Effective Area)
Identified Zero odometer Position:	The first identified weld
Metal loss at weld : max signal separation distance:	1 inch (25.4 mm)

- **Positions downstream of the reference are reported as positive (+) and positions upstream of the reference are reported as negative (-)**
- **Flow direction was assumed to be from East to West.**
- **O'clock positions are reported looking downstream along the pipeline (i.e. looking downstream along the pipe, the 3:00 position will be on the right hand side of the pipe). The 12:00 position is at the top of the pipe.**

4 Data Quality Assessment

Client: Enbridge Gas Distribution
Pipeline Name: NPS 20 Lakeshore – Yonge (Stopple to ILC)
Inspection Type: Explorer 20/26
Pipetel Project No: EGD119
Inspection Date: 19-Nov-2018

MFL Run Acceptance Report

Odometer Distance Covered by Robot: 727.9 m
Distance Scanned with MFL System: 719.3 m
Missed MFL Data Around Features: 8.6 m

Total Pipeline Coverage from Inspection Start to Finish: 98.7%
Pipeline Coverage Lost Due to Sensor Failure: 0.1%
Pipeline Coverage Lost Due to Missed Data Around Features: 1.2%
Total Pipeline Coverage Lost: 1.3%

LDS Run Acceptance Report

Odometer Distance Covered by Robot: 728.0 m
Distance Scanned with LDS System : 719.4 m
Missed LDS Data Around Features: 8.6 m

Total Pipeline Coverage from Inspection Start to Finish: 98.8%
Pipeline Coverage Lost Due to Sensor Failure: 0.0%
Pipeline Coverage Lost Due to Missed Data Around Features: 1.2%
Total Pipeline Coverage Lost: 1.2%

MFL Run Acceptance Report

Client: Enbridge Gas Distribution
Pipeline Name: NPS 20 Lakeshore – Yonge (ILC to Eastern Limit)
Inspection Type: Explorer 20/26
Pipetel Project No: EGD119
Inspection Start Date: 19-Nov-2018
Inspection End Date: 20-Nov-2018

Odometer Distance Covered by Robot: 487.4 m
Distance Scanned with MFL System : 484.0 m
Missed MFL Data Around Features: 3.4 m

Total Pipeline Coverage from Inspection Start to Finish: 99.3%
Pipeline Coverage Lost Due to Sensor Failure: 0.0%
Pipeline Coverage Lost Due to Missed Data Around Features: 0.7%
Total Pipeline Coverage Lost: 0.7%

LDS Run Acceptance Report

Odometer Distance Covered by Robot: 487.4 m
Distance Scanned with LDS System: 484.0 m
Missed LDS Data Around Features: 3.4 m

Total Pipeline Coverage from Inspection Start to Finish: 99.3%
Pipeline Coverage Lost Due to Sensor Failure: 0.0%
Pipeline Coverage Lost Due to Missed Data Around Features: 0.7%
Total Pipeline Coverage Lost: 0.7%

MFL Run Acceptance Report

Client: Enbridge Gas Distribution
Pipeline Name: NPS 20 Lakeshore – Yonge (Stopple to Western Limit)
Inspection Type: Explorer 20/26
Pipetel Project No: EGD119
Inspection Date: 21-Nov-2018

Odometer Distance Covered by Robot: 276.4 m
Distance Scanned with MFL System : 273.4 m
Missed MFL Data Around Features: 3.0 m

Total Pipeline Coverage from Inspection Start to Finish: 98.6%
Pipeline Coverage Lost Due to Sensor Failure: 0.3%
Pipeline Coverage Lost Due to Missed Data Around Features: 1.1%
Total Pipeline Coverage Lost: 1.4%

LDS Run Acceptance Report

Odometer Distance Covered by Robot: 277.2 m
Distance Scanned with LDS System: 274.2 m
Missed LDS Data Around Features: 3.0 m

Total Pipeline Coverage from Inspection Start to Finish: 98.8%
Pipeline Coverage Lost Due to Sensor Failure: 0.1%
Pipeline Coverage Lost Due to Missed Data Around Features: 1.1%
Total Pipeline Coverage Lost: 1.2%

5 Reported Preliminary Features

5.1 Preliminary Features Summary

All features meeting preliminary reporting criteria are tallied in the table below.

Critical Findings Metal Loss Clusters and Non-Interacting Indications	
Depth ≥ 70% WT:	0
(Effective Area). PF/MAOP≤ 1.1 and Depth < 70% WT:	0
Total:	**0**
Dents	
As per client's request, dents with any indicated metal loss or stress concentrators(gouges, grooves, arc burns or cracks):	0
Total:	**0**

5.2 Preliminary Features Listing

All features meeting preliminary reporting criteria are included in the table below. The feature ID is preceded with 'P' to indicate that is identified in the preliminary report. These ID's will be re-assigned for the final report. When available, information limited to the 5 pipes upstream and downstream of a preliminary feature is provided for field location purposes. Above ground references are provided. Note that a reported metal loss depth of 80% indicates a predicted depth >= 80%.

If no features meet preliminary reporting criteria, the table below will intentionally be left empty.

Item No	Cluster ID	Feature Type	Odometer (m)	ML Depth (% wall loss)	Dent Depth (% O.D.)	Length (mm)	Width (mm)	Orient. (O'clock)	W.T. (mm)	Int/Ext	Comments

5.3 Metal Loss Pressure Ratio Listing

Metal loss anomalies categories based on their P_F/MAOP. The categories defined were:

- PF/MAOP Not Provided for Metal Loss Depth ≥ 80%
- Metal loss with PF/MAOP ≤ 1.1
- Metal loss with 1.1 < PF/MAOP ≤ 1.39
- Metal loss with 1.39 < PF/MAOP ≤ 2.0
- Metal loss with 2.0 < PF/MAOP ≤ 3.3
- Metal loss with PF/MAOP > 3.3

The failure pressure ratio (P_F/MAOP) for all metal loss Metal Loss is provided according to ASME B31G using the original (abbreviated to B31G), modified B31G methods (abbreviated to modified or MB31G) and Effective Area Calculation. P_F/MAOP is defined as P_F (the predicted failure pressure of the pipeline). Note that as all metal loss with depth >=80% are considered an 'Immediate', the failure pressure and pressure ratio that meets depth >=80% is set to '-'.

Metal loss anomalies are listed below in decreasing ratio as per Effective Area.

If no features meet preliminary reporting criteria, the table below will intentionally be left empty.

				B31G		Modified B31G		Effective Area		E.A. with Tool Tolerances	
PF/MAOP Category	ID Code	Depth (%)	MAOP (psi)	PF/MAOP	Failure Pressure (psi)	PF/MAOP	Failure Pressure (psi)	PF/MAOP	Failure Pressure (psi)	PF*/MAOP	Failure Pressure* (psi)

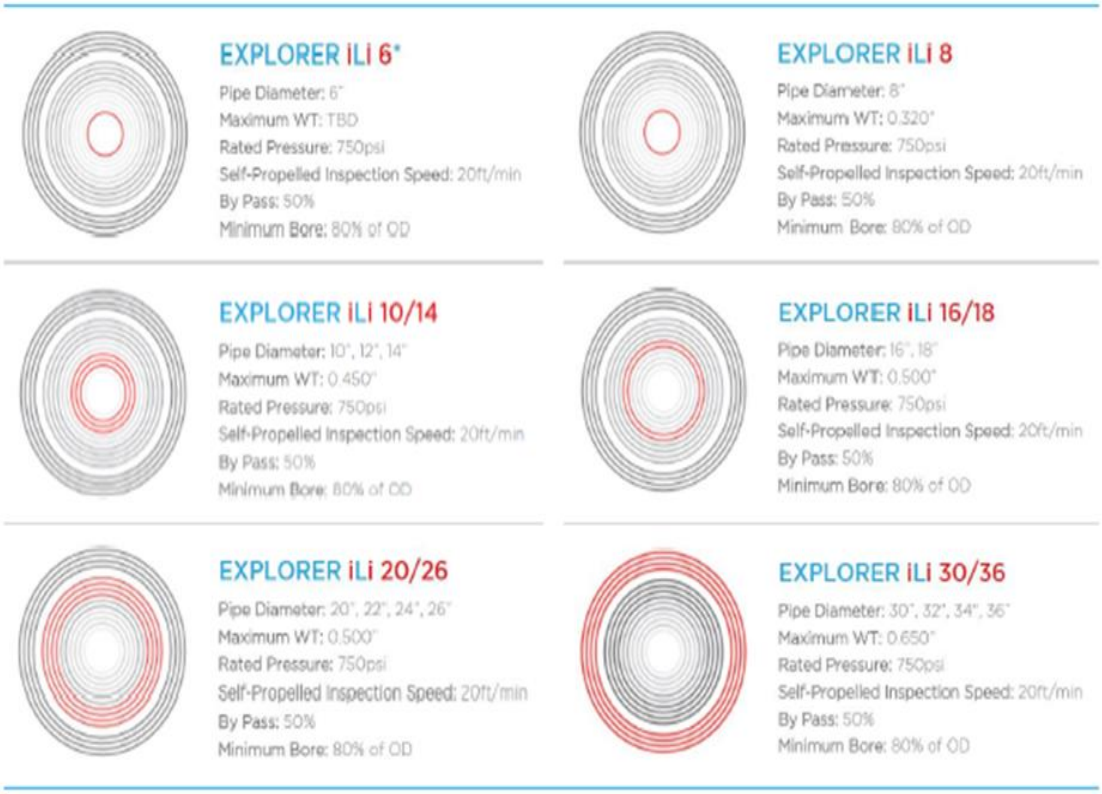
6 Tie-in Locations (References and AGM's)

Feature ID	Feature	Odometer (m)	Client Stationing (m)	Comments
PW001	Girth Weld	0.000		The first detected weld from MFL
PI022	Installation	1188.722		Launcher stopple

7 Dig Sheet and Feature Plot

A detailed dig sheet and a plot from the inspection data is provided for each reported preliminary feature.
If no features meet preliminary reporting criteria, this section will intentionally be left empty.

Appendix D: The Inspection Robot Specifications



EXPLORER iLi 6"
Pipe Diameter: 6"
Maximum WT: TBD
Rated Pressure: 750psi
Self-Propelled Inspection Speed: 20ft/min
By Pass: 50%
Minimum Bore: 80% of OD

EXPLORER iLi 8
Pipe Diameter: 8"
Maximum WT: 0.320"
Rated Pressure: 750psi
Self-Propelled Inspection Speed: 20ft/min
By Pass: 50%
Minimum Bore: 80% of OD

EXPLORER iLi 10/14
Pipe Diameter: 10", 12", 14"
Maximum WT: 0.450"
Rated Pressure: 750psi
Self-Propelled Inspection Speed: 20ft/min
By Pass: 50%
Minimum Bore: 80% of OD

EXPLORER iLi 16/18
Pipe Diameter: 16", 18"
Maximum WT: 0.500"
Rated Pressure: 750psi
Self-Propelled Inspection Speed: 20ft/min
By Pass: 50%
Minimum Bore: 80% of OD

EXPLORER iLi 20/26
Pipe Diameter: 20", 22", 24", 26"
Maximum WT: 0.500"
Rated Pressure: 750psi
Self-Propelled Inspection Speed: 20ft/min
By Pass: 50%
Minimum Bore: 80% of OD

EXPLORER iLi 30/36
Pipe Diameter: 30", 32", 34", 36"
Maximum WT: 0.650"
Rated Pressure: 750psi
Self-Propelled Inspection Speed: 20ft/min
By Pass: 50%
Minimum Bore: 80% of OD

Specifications of Metal Loss Sensors

General Metal Loss Sizing Specification	Nominal Pipe	Cased Pipe
Depth at POD = 90%	0.10t	0.20t
Depth accuracy (80% confidence)	± 0.10t	± 0.20t
Width accuracy (80% confidence)	± 0.75 inches ± 20 mm	± 1 inches ± 25 mm
Length accuracy (80% confidence)	± 0.5 inch ± 12 mm	± 0.75 inch ± 20 mm

- t = wall thickness
- Detection threshold and sizing accuracy in bends are unspecified
- Detection threshold increases to 0.15t and depth sizing accuracy degrades to ±0.15t in seamless pipe
- Depth sizing accuracy degrades to ±0.20t near girth welds or in heat affected zones

Specifications of Deformation Sensors

Sizing Specification	Dent
Depth at POD = 90%	1% of pipe nominal OD
Depth accuracy at 80% confidence	± 1% of pipe nominal OD
Width accuracy at 80% confidence	± 2 inches ± 50 mm
Length accuracy at 80% confidence	± 1 inch ± 25 mm

Explorer Robot Dimensions

Sizing Specification	Unit	Explorer 8	Explorer 10/14	Explorer 16/18	Explorer 20/26	Explorer 30/36
Length of Robot	feet	10	10	13	15	20
Length of Robot Carrier	feet	12	12	17	17	25
Weight of Robot	lbs	250	250	600	900	1,500
Weight of Robot Carrier	lbs	250	250	1,200	1,200	1,750

Appendix E: Definitions and Identification Codes

Cluster: Two individual metal loss interact and shall be clustered when the axial spacing between metal loss edges is less than or equal to a given threshold and the circumferential spacing is less than or equal to a given threshold. This interaction is known as a cluster and a cluster will treated as a single metal loss for burst pressure purposes.

Debris: Moveable object or fluid located in the pipeline. May interfere with magnetizer and/or sensor contact to pipe wall.

TBMS Above Ground Marker: Time based marker system used to correlate inspection data with reference locations provided by the client.

Sleeve: Full circumferential pipeline repair. Composite sleeve are not detected without metallic marking bands.

Patch: A localized attachment repair on the pipeline covering a large area but does not go around the full circumference..

Puddle Weld: A localized. Repair on the pipe addressing individual areas of concern.

Close Metal Object: A detected localized decrease in flux leakage in which the signal indicates a nearby metal object.

Touching Metal Object: A detected localized decrease in flux leakage in which the signal indicates a metal object in contact with the pipe.

Pipe Type: The manufacturing process for a pipe (i.e. ERW, Seamless, Spiral welded etc.).

Stopple: A hot tap. Generally used to launch the Pipetel Robot into a pipeline.

In-Line Charge (ILC): Device used during the operation of a Pipetel inspection to re-charge a robot for further inspection.

Over Bend: Inside of bend is at 6:00. The bend turns downward.

Sag Bend: Inside of bend is at 12:00. The bend turns upward.

Failure Pressure Ratio (FPR): Failure pressure / MAOP. MAOP provided by client.

Rupture Pressure Ratio (RPR): Failure stress /100%SMYS

Girth Weld:	A site-welded bond joining adjacent pipe sections.
HAZ	Heat Affected Zone.
Host Pipe:	The pipe in which a specific feature is located.
Internal / External location:	An anomaly observed in video is identified to be located as internal. Otherwise the anomaly may be considered external.
Installation:	A pipeline feature installed during the construction of the pipeline or as a modifications to the pipeline. Examples of installations are valves, tees, taps and casings.
Launch:	The process associated with the insertion of the robot into the pipe.
Manufacturing Related:	Anomaly created due to pipe processing or third party. May be located on surface or mid-wall of pipe.
MFL:	Acronym for Magnetic Flux Leakage.
O'clock Position:	The clock-wise circumferential location of a feature facing the downstream direction. Twelve o'clock is the top of the pipe.
Robot:	The mechanism used to inspect the pipeline
Receive:	The process associated with the extraction of the robot from the pipe.
Video:	Data gathered with the video capture system on the robot.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

If the existing pipeline were not replaced, and with reasonable maintenance activities, how long would Enbridge be able to safely and reliably operate it?

Response:

As indicated in the pre-filed evidence, Enbridge Gas does not believe that continual repair of the Cherry to Bathurst segment is a viable option. The majority of the Cherry to Bathurst segment was installed in 1954. While a pipeline can be repaired indefinitely, doing so for the Cherry to Bathurst segment would result in tiny segments being replaced over time until the pipeline is a patchwork of repair sleeves and joints. Every repair would have a different installation date/year to be monitored. From a socio-economic and environmental perspective this approach would be extremely costly and disruptive.

For the Cherry to Bathurst segment Enbridge Gas is forecasting a requirement of an integrity dig every 26 m for the next forty years. Enbridge Gas does not believe that this is an appropriate approach or a reasonable maintenance activity for this vital pipeline.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

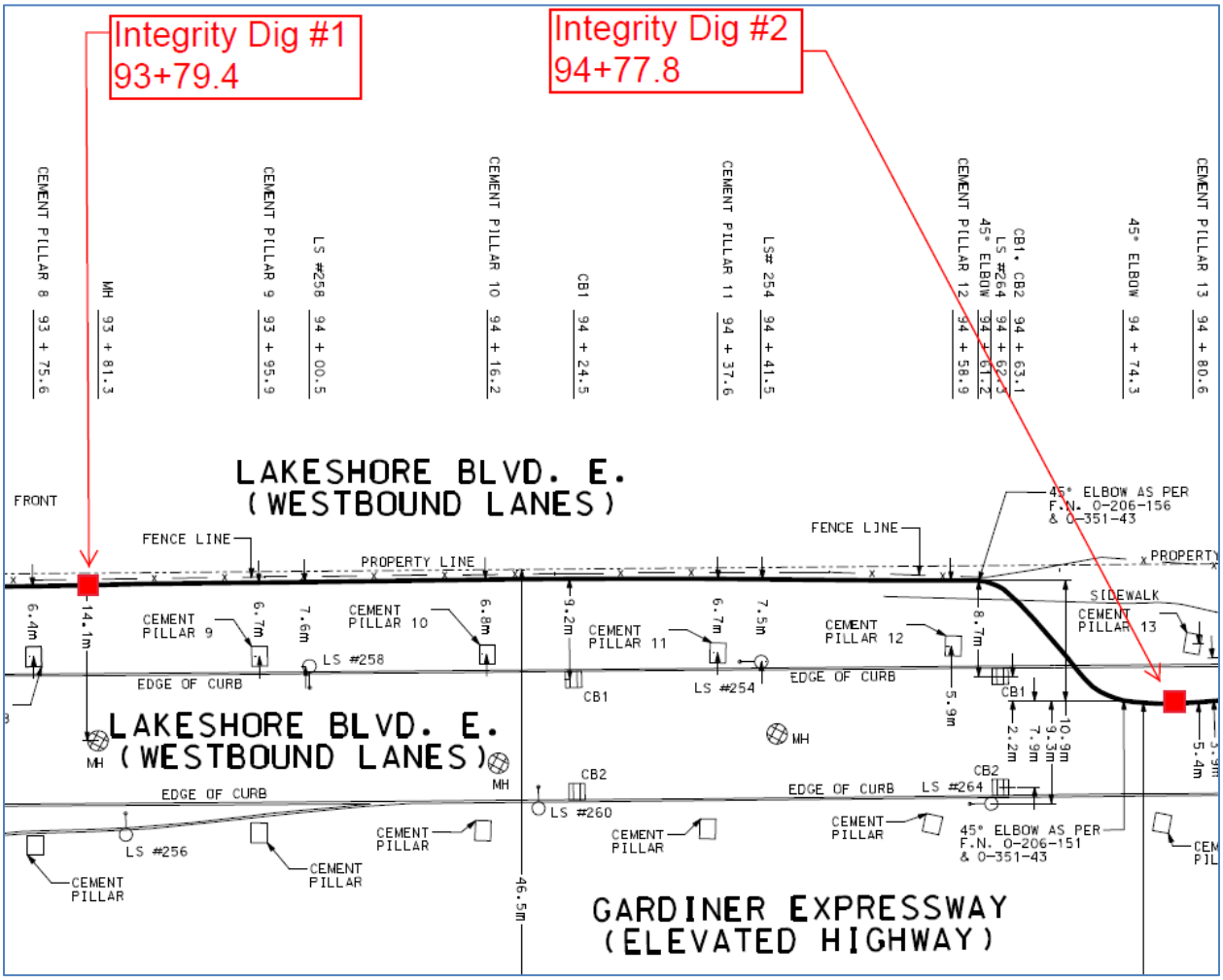
INTERROGATORY

Question**:**

Please provide a map indicating the location of the integrity digs and anomalies for the existing Cherry to Bathurst pipeline segment.

Response:

Below is a map indicating the two integrity dig locations. The reports from the ILIs in 2016 and 2018 are set out at Exhibit I.Toronto.12.


Integrity Dig #1
93+79.4
Integrity Dig #2
94+77.8
CEMENT PILLAR 8 93 + 75.6
MH 93 + 81.3
CEMENT PILLAR 9 93 + 95.9
LS #258 94 + 00.5
CEMENT PILLAR 10 94 + 16.2
CB1 94 + 24.5
CEMENT PILLAR 11 94 + 37.6
LS# 254 94 + 41.5
CEMENT PILLAR 12 94 + 58.9
45° ELBOW 94 + 61.2
CB1, CB2 LS #264 94 + 62.3
45° ELBOW 94 + 63.1
45° ELBOW 94 + 74.3
CEMENT PILLAR 13 94 + 80.6
LAKESHORE BLVD. E.
(WESTBOUND LANES)
FRONT
FENCE LINE
PROPERTY LINE
45° ELBOW AS PER F.N. 0-206-156 & 0-351-43
SIDEWALK
CEMENT PILLAR 9
CEMENT PILLAR 10
CEMENT PILLAR 11
CEMENT PILLAR 12
CEMENT PILLAR 13
EDGE OF CURB
LS #258
LS #254
LS #264
LS #260
LS #256
CB1
CB2
MH
CEMENT PILLAR
45° ELBOW AS PER F.N. 0-206-151 & 0-351-43
46.5m
GARDINER EXPRESSWAY
(ELEVATED HIGHWAY)

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 5-6 of 30

Preamble:

Enbridge advises that its 2016 inline inspection from Cherry to Parliament Street found two areas that required integrity digs. These integrity digs were done in 2017. The inspection also found several anomalies which would likely require remediation or replacement. A 2018 inline inspection also found numerous anomalies which would likely require remediation or replacement.

Question**:**

Please confirm whether:

a. the operation of the existing pipeline is approved by the Technical Standards and Safety Authority ("TSSA"), and whether;

b. Enbridge requires approval from the TSSA for the construction and operation of its Project, including the decommissioning of the existing pipeline.

Response:

a) Not confirmed. The TSSA has oversight over Enbridge Gas' design and operation of its gas distribution system but does not "approve" particular pipelines.

b) Not confirmed. Enbridge Gas is required by the TSSA to submit an Application for Review of a Pipeline Project when submitting an Environmental Report for the OPCC review process.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

How does Enbridge's Project account for future growth in demand for gas in the areas it serves, and will a further pipeline replacement be necessary to accommodate this growth?

Response:

Information about future growth is found at Exhibit B, Tab 1, Schedule 1, Paragraph 33. Enbridge Gas doesn’t anticipate having to replace or upsize this NPS20 pipeline to accommodate growth.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 5-6 of 30

Preamble:

Enbridge advises that its 2016 inline inspection from Cherry to Parliament Street found two areas that required integrity digs. These integrity digs were done in 2017. The inspection also found several anomalies which would likely require remediation or replacement. A 2018 inline inspection also found numerous anomalies which would likely require remediation or replacement.

Question**:**

Please confirm the following:

a. does Enbridge plan to do any maintenance or reconstruction activity on other segments of the Kipling Oshawa Loop;

b. if so, please describe the proposed works, including their scope, location, and anticipated dates;

c. if so, how will Enbridge coordinate this work with the Project work, and;

d. what further investigation, if any, is necessary to confirm the required maintenance or reconstruction work? Please break this down by location/pipeline segment.

Response:

a. The KOL is a vast network of multiple sized HP gas main that amounts to approximately 1065km's in length. Please see exhibit I.Toronto.11. On smaller pipelines there are maintenance programs in place typically relating to corrosion monitoring on steel gas mains. There are also unexpected relocation requirements due to the 3rd party developers or damages that come up which would cause Enbridge Gas to have to relocate components of the KOL pipelines. With regards specifically to the vintage NPS20 component of the KOL, Enbridge Gas anticipates using similar inline inspection practices for other sections of the pipeline but no

timelines for this work have currently been prepared. One other specific project being proposed on a different segment of the KOL pipeline is the NPS 20 Waterfront Relocation project recently filed with the OEB under Application EB-2020-0198.

b. There is no scope, location or anticipated dates for this type of work currently. For details on the NPS 20 Waterfront Relocation project please refer to the EB-2020-0198 application and evidence.

c. The additional anticipated inline inspection work specific to other sections of the NPS 20 portion of the KOL would likely occur after the Cherry to Bathurst NPS 20 replacement project is completed. With regards to the NPS 20 Waterfront Relocation project, this project will be coordinated with not only the C2B Replacement project but also with the required timelines for Waterfront Toronto and the City of Toronto. Even though these two projects involve the NPS 20 KOL pipeline, they are in two different locations and coordination of activities are not dependent between the two projects.

d. Similar to what has been done on the Cherry to Bathurst segment of the NPS20, inline investigations would be beneficial to examine other sections of the KOL NPS 20 pipeline to help ascertain the condition of the pipeline sections. These investigations measure wall thickness, and identifies anomalies such as metal loss, corrosion and dents in the pipeline. Based on this information Enbridge Gas would be able to pinpoint problem areas and establish remediation plans including repair or replace decisions. Enbridge Gas will not be able to perform inline inspections of the entire NPS 20 KOL segment as inline inspection tools cannot traverse the entire pipeline without significant modifications to the pipeline. Therefore, determination of the condition of the NPS 20 KOL segment will be made using representative segments of the pipeline that can accommodate inline inspection tools.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit C, Tab 1, Schedule 1, Attachment 2, pages 37-39 of 106 (pages 91-93 of PDF)

Preamble:

Enbridge advises that bridges and water crossings "may require additional engineering cost/complexity or mitigation".

Question**:**

Please:

a. confirm if Enbridge's proposed pipeline run along any bridges and/or have any water crossings;

b. if so, provide a map indicating their length and location, and;

c. if so, provide on request by Toronto complete, site-specific water crossing plans and specifications when they are available.

Response:

a. Enbridge Gas is not currently anticipating that its proposed Project will run along any bridges, nor any water crossings. Enbridge Gas does anticipate engineering costs and complexity relating to the following:
   i. Parliament Bridge crossing (within road allowance but with heavy rail on bridge above the road allowance)
   ii. Working in the proximity of the Gardiner support systems
   iii. A larger than normal Storm Sewer crossing approximately 90m east of Bathurst

b. Please refer to the response to a. above.

c. Acknowledged.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit D, Tab 1, Schedule 1, page 1 of 5

Preamble:

Enbridge advises that "[t]he method of construction will be a combination of open trench and trenchless technology".

Question**:**

Please:

a. provide a map indicating where trench or trenchless technology will be used to construct the Project, and;

b. confirm the rationale for the use of trenched or trenchless technology along the Project route.

Response:

a. Assessment of optimal construction methods is ongoing and will depend on the concurrent assessment of several inputs, including at the time of construction. Once the construction drawings identifying the proposed alignment and method of construction are available they will be circulated to the City and utilities for comments.

b. Trenchless technology will be used where necessary in order to enable efficient installation of the proposed pipeline with minimal disruption to existing infrastructure and the public. The difficulties with trenchless technology in aspects of this Project, specifically directional drilling the pipeline, is the low ceiling height of the Gardiner Expressway and the size and angle that the equipment (drilling equipment and side booms) would need to be at to facilitate Project construction.

   Open trench installation methods will be used on shorter length installations and on sections of the Project where trenchless installation isn’t feasible.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit C, Tab 1, Schedule 1, page 10 of 12

Preamble:

Enbridge indicates that it will prepare an Environmental Protection Plan for the Project.

Question**:**

Please:

a. provide the Project-specific Environmental Protection Plan if it has been completed;

b. if it has not been completed, confirm when it will be completed, and

c. if it has not been completed, consult with Toronto on its preparation and provide it on request to Toronto when it has been completed.

Response:

a. A project specific Environmental Protection Plan (EPP) has not been completed at this time.

b. The EPP will be developed prior to construction and will be finalized once all permit conditions have been received and can be incorporated into the EPP.

c. Enbridge Gas will consult with the City of Toronto on the development of mitigation measures as part of the permit application process, and will provide the EPP when completed.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 3 of 30

Preamble:

Enbridge indicates that the external environment of the existing pipeline includes contaminated soil.

Question**:**

Please provide Enbridge's Project-specific Contaminated Materials Management and Handling Plan. If it is not yet complete, please advise when it will be completed and confirm that Enbridge will provide it upon Toronto's request.

Response:

A project specific plan for management of suspect soils will be included as part of the Environmental Protection Plan. Please refer to Exhibit I.Toronto.20.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Environmental Report, page 81 (page 89 of PDF).

Preamble:

Enbridge's Environmental Report notes that "[t]he Project is located in downtown Toronto where traffic levels are high and there are various ongoing developments. Construction may cause traffic disruptions".

These traffic disruptions may be compounded by closure of the Gardiner during scheduled major revitalization works.

Question**:**

Please:

a. provide Enbridge's complete, Project-specific traffic management analyses plans;

b. specify Enbridge's proposed construction work hours, including whether these will include evenings and weekends;

c. specify how Enbridge will account for Gardiner closures during Project construction;

d. specify how Enbridge will minimize impacts on vehicle, pedestrian, cyclist, and transit traffic;

e. advise as to how Project design and construction will minimize impacts to Toronto transit facilities such as the Bathurst and Spadina streetcar tracks (e.g. use of trenchless construction), and;

f. confirm that Enbridge will consult with Toronto staff on its traffic management plans.

Response:

a. A project specific traffic management plan will be developed prior to construction in consultation with applicable regulatory authorities and following the requirements of

Construction Projects O. Reg. 213/91 found in Ontario OH&S Act & Regulations, and the Ontario Traffic Manual Book 7 Temporary Conditions (Field Edition).

b. The proposed standard construction hours are 07:30 to 17:30, five days a week. In some instances, work may have to be performed on weekends, such as when performing tie-in work.

c. Enbridge Gas will coordinate with the City of Toronto to account for the impacts of Gardiner closures.

d. The pipeline line location has been selected to avoid conflict with existing utilities and minimize traffic disruptions. Please see the response to a) and c) above.

e. Please see the response to d) above. Also please see Exhibit I.Toronto.19.

f. Confirmed.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Environmental Report, page 81 (page 89 of PDF).

Preamble:

Enbridge was granted leave to construct its Don River 30" Pipeline Project (EB-2018-0108) in the Ontario Energy Board's Decision and Order dated November 29, 2018. That pipeline travels through a central area of Toronto.

Question**:**

Are there any "lessons learned" from Enbridge's Don River project that it can apply to this Project, e.g. on avoiding or minimizing infrastructure conflicts, traffic management, or construction close to the Gardiner? If so, please describe them.

Response:

The means of construction and location of the NPS 30 Don River project are very different from the NPS 20 Cherry to Bathurst Replacement Project. The area chosen for the NPS 30 specifically avoided conflicts and used micro-tunneling as an alternative to HDD due to space constraints. The location had very little impact on traffic and was fixed throughout the project duration.

In terms of lessons learned, the NPS 20 Cherry to Bathurst Replacement Project resembles more closely other urban construction projects Enbridge Gas typically executes as part of its day-to-day operations, for example, the NPS 12 Bathurst Reinforcement project completed in 2019. Enbridge Gas endeavours to complete meaningful consultation with stakeholders early in any project to minimize construction impacts on the surrounding areas and infrastructure (e.g. traffic, etc.).

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit E, Tab 1, Schedule 1, page 1 of 4

Preamble:

Enbridge notes that the Preferred Route for the Project may require a bylaw or easement where municipal road allowances are not dedicated. It further notes that permanent easements are not required.

Question**:**

Please:

a. confirm that Enbridge is not seeking any easements from Toronto;

b. if Enbridge is seeking easements from Toronto, please provide a detailed map of their location, and;

c. if Enbridge is seeking easements from Toronto, advise if these are permanent or temporary easements.

Response:

a. Confirmed. Enbridge Gas is not seeking any easements from the City of Toronto; all work is being designed within the road allowance.

b. and c. Please see the response to a. above.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Environmental Report, pages 91, 93

Preamble:

Enbridge notes a potential effect of "[p]ipeline failure resulting in a leak of gas". It lists as a mitigation measure "implement applicable sections of Enbridge's internal protocols for safety, pre-emergency preparedness, and emergency response".

Enbridge states that mitigation measures can be found in its Construction and Maintenance Manual (2020).

Question**:**

Please:

a. provide Enbridge's Construction and Maintenance Manual;

b. provide Enbridge's emergency response plans for the construction and operation of the Project;

c. confirm if Enbridge will have an emergency response team available in the event of a pipeline emergency, and their response time (accounting for downtown traffic conditions);

d. advise if Enbridge will conduct emergency training exercises for the proposed pipeline. If so:
   i. please describe these exercises
   ii. will Enbridge share details of, and invite Toronto emergency staff to observe and participate in, these exercises;

e. confirm that Enbridge will maintain for Toronto emergency staff a 24 hours a day, 7 days a week contact line to enable immediate contact with Enbridge emergency management staff, should the need arise.

Response:

a) The Enbridge Gas Construction and Maintenance Manual is a very large and detailed document which is continually updated. The Company does not believe that the document is relevant to the relief requested in this proceeding.

b) Enbridge Gas has not yet completed its emergency response plan for the Project. The emergency response plan will be completed prior to the commencement of construction.

c) Enbridge Gas has an emergency response team available on-call 24/7 as part of regular operations. The nearest field office is located at Enbridge's Station B facility (405 Eastern Ave). This facility is located approximately 4.0km from the mid-point of construction. The Company aims to achieve a 45 minute response time.

d) Enbridge Gas provides Natural Gas Awareness Training to First Responders in its distribution area as part of its external outreach program. Enbridge Gas's Emergency Programs Office and Technical Training Department continually offer and deliver this awareness training and simulated exercises to Municipal Fire & Emergency Services departments. The First Responders can participate in training sessions at the Technology and Operations Centre's (TOC) Streetscape in Markham, Ontario. The Streetscape is the hallmark of the Technology and Operations Centre and was designed to provide the most comprehensive and realistic training facility for a natural gas utility in Canada. The Streetscape's distribution system can operate with compressed air to simulate natural gas, offering a flexible and safe environment for training. This allows participants to practice emergency procedures in a safe, realistic environment and see the tools and equipment Enbridge Gas uses when called to an emergency. This Natural Gas Awareness training can be coordinated and set up with the City First Responders.

e) Please see the response to c) above.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 13 of 30

Preamble:

Enbridge notes that "[a]ny pipeline defects or failures that could or do release gas into the atmosphere would most likely require a large emergency response and mitigation effort.

Question**:**

Does Enbridge anticipate relying on Toronto's emergency responders in the event of a pipeline leak, explosion, fire, or other emergency?

Response:

In the event of a pipeline leak, explosion, fire or other gas related emergency, it would be a collaborative response and effort to make the situation safe. Normal emergency response would include reliance on Toronto emergency responders.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 13 of 30

Preamble:

Enbridge notes that "[a]ny pipeline defects or failures that could or do release gas into the atmosphere would most likely require a large emergency response and mitigation effort.

Question**:**

Is Enbridge willing to provide, at its cost, emergency response training required for Toronto emergency staff to prepare for the construction and operation of the Project?

Response:

Enbridge Gas routinely engages in awareness and training activities with local fire departments as part of distribution operations. The Project does not add any complexity or challenge that does not already exist in the existing natural gas network.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit B, Tab 1, Schedule 1, page 13 of 30

Preamble:

Enbridge notes that "[a]ny pipeline defects or failures that could or do release gas into the atmosphere would most likely require a large emergency response and mitigation effort.

Question**:**

Please confirm that:

a. Enbridge will send, at its cost and on Toronto's request, a technical specialist to Toronto's emergency operations centre to assist in responding to a pipeline emergency, and;

b. if so, that Enbridge will pre-identify the technical specialist to Toronto, and update this information as it changes.

Response:

a. Enbridge Gas, if requested to do so, will send a technical specialist to Toronto's emergency operations centre to assist in responding to a pipeline emergency.

b. The technical specialists required for this role all take part in an uninterrupted on-call rotation that is constantly changing. In the event of an emergency, Enbridge Gas will identify the technical specialist to Toronto's emergency operations centre, and will provide an ongoing and updated schedule of technical specialists' shifts for the duration of the emergency.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Will Enbridge provide at its cost a communications staff person/public information officer, upon request by Toronto, to assist in public communications coordination in a pipeline emergency?

Response:

Enbridge Gas has an uninterrupted on-call rotation of Media Relation and Senior Advisor personnel that, in the event of a pipeline emergency, would assist in public communication coordination.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Is Enbridge agreeable to meeting annually with Toronto staff to review Toronto's emergency plans with a focus on Enbridge infrastructure and emergency management?

Response:

Yes.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Application and Evidence 2020-07-31, Exhibit E, Tab 1, Schedule 1, Attachment 1, Page 2 of 4

Preamble:

Enbridge's standard form of working area agreement provides for Enbridge maintaining comprehensive general public liability insurance, with the landowner as an additional insured. The agreement acknowledges the possibility of claims arising from Enbridge's operations.

Question**:**

Please confirm:

a) the name of the corporate entity(s) that will (1) own and (2) operate Enbridge's proposed pipeline, and;

b) if there are multiple corporate entities, their relationship to each other.

Response:

a) Enbridge Gas Inc.
b) Please see the response to a) above.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Please:

a. confirm what insurance coverage Enbridge has in place for the construction and operation of the Project, and the decommissioning of the existing pipeline, including the limits and deductibles for this coverage, and;

b. advise if Enbridge will add Toronto as an additional insured under this insurance.

Response:

a) Enbridge Gas arranges for Project-specific insurance coverage after leave to construct has been approved. Generally, for significant construction projects Enbridge Gas obtains and maintains project-specific insurance that starts with commencement of construction activities and ceases at final completion. Insurance coverage typically includes:

- Course of Construction - This coverage is intended to reimburse Enbridge Gas for risks of loss or damage to the Project under construction, including the Project itself, materials being incorporated into the Project, and materials while in transit to site. Overall limits represent the construction value of the project.
- Construction Liability – This coverage is intended to provide coverage for third party (non-Enbridge Gas) bodily injury and property damage for which Enbridge Gas is legally liable as a result of its construction activities. Overall limits may be between $10MM and $25MM.

Deductibles are typically determined at time of placement. Like all insurance policies, construction insurance policies may contain terms, conditions and exclusions that limit or restrict coverage available under the policy, and in some cases may contain sub-limits of coverage for identified risks, such as Natural Catastrophes.

The insurance coverage maintained by Enbridge for its operations is discussed in its Annual Report. The 2019 Annual Report, at page 50, indicates:

> Our operations are subject to many hazards inherent in our industry. Our assets may experience physical damage as a result of an accident or natural disaster. These hazards can also cause personal injury and loss of life, severe damage to and destruction of property and equipment, pollution or environmental damage, and suspension of operations. We maintain a comprehensive insurance program for us, our subsidiaries and certain of our affiliates to mitigate the financial impacts arising from these hazards. This program includes insurance coverage in types and amounts and with terms and conditions that are generally consistent with coverage customary for our industry, however insurance does not cover all events in all circumstances.

b) As with any construction project or operational request, adding a party as an Additional Insured is dependent on several factors including the existence of a contractual requirement, an appropriate indemnity obligation and insurer agreement.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Please detail the insurance arrangements, including types of insurance, limits, and deductibles, for Enbridge's contractors, subcontractors, and suppliers for the Project.

Response:

Enbridge Gas has not yet identified the contractor for the Project. The Company’s standard approach is to require suitable and adequate insurance coverage from its contractors.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Is there a risk that Enbridge will be unable to satisfy costs and claims associated with a pipeline emergency such as a fire or explosion?

Response:

Given its focus on safety and reliability, insurance coverage and its financial strength, Enbridge Gas believes that the noted risk is low. Enbridge Gas Inc.'s net planned liquidity, cash from operations, short-term borrowings, anticipated future access to debt capital markets and equity contributions from its parent Enbridge Inc., is expected to be sufficient to satisfy costs and claims associated with the unlikely event of a pipeline emergency.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Question**:**

Please confirm that Enbridge will comply with all Toronto bylaws and obtain all necessary approvals, permits, licences, and certificates required to construct, operate and maintain the Project.

Response:

Confirmed.

ENBRIDGE GAS INC.
Answer to Interrogatory from
City of Toronto (Toronto)

INTERROGATORY

Reference:

Environmental Report, Public Correspondence G-15, page 265 of PDF.

Preamble:

The Environmental Report states that "the existing pipeline will be decommissioned in place once the new pipeline is installed and active".

Question**:**

Please:

a) confirm what will happen to Enbridge's existing pipeline that the Project will replace;

b) advise if any portions of the existing pipeline will be reused for the new proposed pipeline;

c) advise if Enbridge retaining the option of reactivating the existing pipeline. If so, what approvals would be required for reactivation;

d) If the existing pipeline will remain in place, confirm what maintenance and/or monitoring of it Enbridge will perform, and;

e) provide the rationale for Enbridge's treatment of the existing pipeline.

Response:

a) Once the new pipeline is energized and has taken over the feed from the existing pipeline, the existing pipeline will be isolated, purged of any natural gas, then sealed at all open ends in accordance with Enbridge Gas’s Construction & Maintenance Manual, and abandoned in place.

b) There are two sections of the existing pipeline that Enbridge Gas is considering reusing as they are newer pipe. The portions include a 193.5m section west of Bay Street that was installed in 1996, and a 100.4m section crossing Lower Simcoe Street that was installed in 1997.

c) Enbridge Gas is not contemplating retaining the option of reactivation of the existing pipeline.

d) The existing pipeline will remain in place and treated as abandoned. The abandonment process ensures that continual monitoring of the abandoned pipeline is not required. Enbridge Gas will continue to address requests from 3rd party developers/constructors to confirm the abandoned pipeline is free of natural gas and water prior to any future removal.

e) Please see the response to a) above.