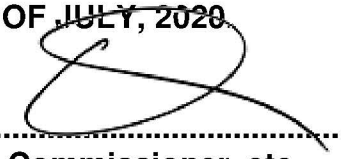
THIS IS EXHIBIT "S"

REFERRED TO IN THE AFFIDAVIT OF

JANE MUSTAC

SWORN BEFORE ME THIS 24TH DAY

OF JULY, 2020.



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ENBRIDGE PIPELINE VEHICLE LOADING ANALYSIS STRESS REPORT

WINDSOR TO PORT ALMA PIPELINE REPLACEMENT ESSEX AND KENT COUNTIES, ONTARIO

Prepared for:
Enbridge Gas Inc.
50 Keil Dr, Chatham, Ontario

VEHICLE LOADING ANALYSIS AND STRESS REPORT

Windsor To Port Alma Pipeline Replacement, Essex And Kent Counties, Ontario

Project No.: SYS197128-4 Wood Project No. 244569

Prepared for:
Enbridge Gas Inc.
50 Keil Dr, Chatham, Ontario
Attention: Ms. Olivia Curti

Prepared by:
Wood Canada Limited
Calgary Alberta

May 19, 2020

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1.0 INTRODUCTION

Wood Canada Limited ("Wood") has been retained by Enbridge Gas Inc. ("Enbridge") to carry out a stress analysis related to vehicle loading on a new high pressure NPS 6 steel pipeline to be installed by Enbridge.

The overall project consists of the construction of approximately 60 kilometres (km) of pipeline between the Town of Tecumseh in Essex County and the Town of Port Alma in Chatham-Kent County, Ontario. The existing pipeline to be replaced by the NPS 6 pipeline is understood to be an NPS 10 steel pipeline with mechanical connections and numerous aerial crossings.

Site and Project Description

The site is located within Essex and Chatham-Kent Counties, Ontario. Land use in the area of the site is primarily agricultural and rural residential.

The proposed alignment for the replacement pipeline is in a generally east-west orientation and traverses relatively flat, mainly rural lands adjacent to Essex County Road 46 and Lakeshore Road 309 in Essex, and Goodreau Line in Chatham-Kent County. The pipelines proposed alignment is located within the county road allowance.

The proposed alignment begins at a new proposed station on County Road 46, east of Concession Road 8 and continues easterly following the alignment of County Road 46 for about 30 km through a rural/residential setting to Rochester Townline. It then continues east on Lakeshore Road 309 for about 13 km to the Essex County border. The alignment crosses an inactive rail corridor on County Road 46, approximately 5 km west of Rochester Townline.

Crossing into Chatham-Kent, the proposed alignment follows the west side of the Highway 77 (Wheatly Road) ROW and extends about 13 km east on the north side of Goodreau Road to the south side of Simpson Line. The new pipeline alignment then travels easterly to County Road 14 and then south on the west side of the ROW to the existing station in Port Alma where it crosses County Road 14.

2.0 SCOPE OF THE ANALYSIS

There is a concern about the stress of the pipeline in its proposed location as it is likely to be exposed to vehicle loading including, but not limited to super loads, particularly on County Road 46 in the County of Essex as the pipeline's proposed alignment is within approximately 2m of road edge in some locations. The following analysis provides the results of a load assessment on this new pipeline under vehicle loading conditions to meet Enbridge's design and operating requirements and those of CSA Z662-15 and to determine the maximum allowable axle load that can be accepted by the pipeline. The analysis considers the hoop stress due to internal pressure and those imposed on it by the soil and vehicle loading.

A geotechnical report was previously completed for the project and the results discussed in the report titled "Geotechnical Investigation and Design Report, Windsor to Port Alma Pipeline Replacement, Essex and Kent Counties, Ontario", report number SYS197128-1.

3.0 PIPELINE TECHNICAL DATA

The design and operating characteristics for the new pipeline are:

- Design and stress analysis to be as per the requirements of Clause 12, of CSA Z662-15;
- During vehicle loading pipeline shall operate at less than 85% specified minimum yield strength (SMYS);
- Pipe properties: NPS 6 (168.3 mm), 4.8mm, Gr 359, Cat I, CSA Z245.1-18;
- Maximum Operating Temperature: 20C degree;
- Design/Maximum Operating Pressure: 3450 kPa;
- Minimum Installation Temperature: 0C degree; and
- Contents: Sweet Natural Gas.

The assumptions and data used for the stress analysis are:

- The stress analysis to be provided as if pipeline was under the travelled portion of the road with minimum cover should the road expand over the pipeline in the future;
- Legal loads used were per API RP 1102, Steel Pipeline Crossing Railroads and Highways;
- The pipeline will be driven over by superloads that may be too large to stay in their lane, i.e. the tire load could be directly over the pipeline.

- The assumed cover depth was 100 cm to the top of the pipe;
- It is assumed that the pipeline is in a Class 3 location (with location factor 0.625);
- Required data and soil characteristics for computer simulations were retrieved from the geotechnical report.

4.0 SOFTWARE USED FOR ANALYSIS AND TECHNICAL ASSUMPTIONS

The stresses of the pipeline with the live load applied were analyzed in accordance with CSA Z662-2015 and 2019. Table 1 lists the analyzed cases. Software Caesar II (Version 9.00.00.5900) was used in this analysis.

Table 1: Load Cases for Analysis

Case	Combination	Category	Description	Allowable
L1	W+T1+P1	Operation	Operation case in maximum T and MOP	SMYS
L2	W+T2+P1	Operation	Operation case in minimum T and MOP	SMYS
L3	W+T1+P1+U1	Operation	Operation case in maximum T and MOP with live load	SMYS
L4	W+P1	Sustain	Weight and pressure	0.5 x SMYS
L5	W+P1+U1	Occasional	Stress due to sustained load and vehicle load	0.5 x SMYS
L6	L1-L4	Expansion	Thermal stress ranges from installation T to maximum T	0.72 x SMYS
L7	L2-L4	Expansion	Thermal stress ranges from installation T to minimum T	0.72 x SMYS
* if pipe is buried and axial stress is compressive				

Where the load abbreviations in the table are defined as follows:

W: Dead weight
P1: MOP
T1: Maximum Operation Temperature
T2: Minimum Soil Temperature
U1: Vehicle Load

The following assumptions were made:

- The localized stresses in the pipe and the pipe ovality are evaluated in accordance with ASCE ALA Guidelines for the Design of Buried Steel Pipe (July 2001).
- The welds are checked in accordance with API RP 1102 for Steel Pipelines Crossing Railways and Highways.
- The detailed results for the critical wheel loads are in Appendix A, B and C.

5.0 LIVE LOADS

The maximum single axle load for design recommended by API RP 1102, Steel Pipeline Crossing Railroads and Highways, is 24kips (106.8kN or 10886kg) and the maximum tandem axial load for design is 40kips (177.9kN or 18144kg). These values are both higher than the single axle load (9100kg) and the tandem axial load (17000kg) as specified on the Federal-Provincial-Territorial Memorandum of Understanding on Interprovincial Weights and Dimensions in Canada. Therefore, API RP1102 recommended loads were selected for the evaluation.

6.0 RESULTS

The evaluation considers the cyclic stresses in the welds, through-wall bending stresses, critical bending, ovality of pipe, as well as the code stresses per CSA Z662 (2015 and 2019).

With the API recommended load limits, the following table summarizes the evaluation results. The highest stress level is 51% of the CSA Z662 allowable limit in operation case.

Axle Load		Cyclic Circumferential Stress Ratio	Through Bending Stress Ratio	Critical Ring Buckling Ratio	Ovality	Max CSA Z662 Stress Ratio
Single, kg	Tandem, kg					
10886	18144	42%	26.2%	3.4%	0.21%	51.0%

The design meets the requirement for superloads provided that the load per axle does not exceeded the Highway Legal Axle Load allowance.

7.0 CLOSURE

The limitations of this report, as discussed in the Report Limitations, in Appendix D following the text of this report, constitute an integral part of the report. Appendix E provides Wood's generalized approach to the utility design near roadways, including the selection of invert elevations, addressing utility conflicts and provisions for future expansion of the roadway.

We trust this report is complete within the terms of our reference. However, should there be any questions or if any point requires further clarification kindly contact our office at your convenience.

Sincerely,

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

Prepared By:

Wojciech Bujak, M.Eng. P.Eng.
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Reviewed by:

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Geotechnical Engineer

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Principal Geotechnical Engineer

APPENDIX A

CAESAR II STRESS SUMMARY

CAESAR II 2017 Ver.9.00.00.5900, (Build 160721) Date: MAY 13, 2020 Time: 9:26
Job:: BH-16-TYPE1 SOILB
Licensed To:: SPLM: Edit company name in <system>\company.txt

Table of Contents

LISTING OF STATIC LOAD CASES FOR THIS ANALYSIS 2
Stress Summary : Multiple 3

CAESAR II 2017 Ver.9.00.00.5900, (Build 160721) Date: MAY 13, 2020 Time: 9:26
Job:: BH-16-TYPE1 SOILB
Licensed To:: SPLM: Edit company name in <system>\company.txt

LISTING OF STATIC LOAD CASES FOR THIS ANALYSIS

1 (OPE) W+T1+P1
2 (OPE) W+T2+P1
3 (OPE) W+T1+P1+U1
4 (SUS) W+P1
5 (OCC) W+P1+U1
6 (EXP) L6=L1-L4
7 (EXP) L7=L2-L4

CAESAR II 2017 Ver.9.00.00.5900, (Build 160721) Date: MAY 13, 2020 Time: 9:26
Job:: BH-16-TYPE1 SOILB
Licensed To:: SPLM: Edit company name in <system>\company.txt

STRESS SUMMARY REPORT: Highest Stresses Mini Statement
Various Load Cases

LOAD CASE DEFINITION KEY

CASE 1 (OPE) W+T1+P1
CASE 2 (OPE) W+T2+P1
CASE 3 (OPE) W+T1+P1+U1
CASE 4 (SUS) W+P1
CASE 5 (OCC) W+P1+U1
CASE 6 (EXP) L6=L1-L4
CASE 7 (EXP) L7=L2-L4

Piping Code: Z662 = CANADIAN Z662 -2015, June 2015

CODE STRESS CHECK PASSED : LOADCASE 1 (OPE) W+T1+P1

Highest Stresses: (KPa)	LOADCASE 1 (OPE) W+T1+P1			
Ratio (%):	46.9	@Node	818	
OPE Stress:	168197.2	Allowable Stress:		359000.0
Axial Stress:	100149.6	@Node	533	
Bending Stress:	0.0	@Node	11	
Torsion Stress:	0.0	@Node	11	
Hoop Stress:	57023.8	@Node	11	
Max Stress Intensity:	158949.0	@Node	590	

CODE STRESS CHECK PASSED : LOADCASE 2 (OPE) W+T2+P1

Highest Stresses: (KPa)	LOADCASE 2 (OPE) W+T2+P1			
Ratio (%):	17.2	@Node	46	
OPE Stress:	61701.8	Allowable Stress:		359000.0
Axial Stress:	23580.7	@Node	2999	
Bending Stress:	0.0	@Node	11	
Torsion Stress:	0.0	@Node	11	
Hoop Stress:	57023.8	@Node	11	
Max Stress Intensity:	62249.5	@Node	11	

CODE STRESS CHECK PASSED : LOADCASE 3 (OPE) W+T1+P1+U1

Highest Stresses: (KPa)	LOADCASE 3 (OPE) W+T1+P1+U1			
Ratio (%):	51.0	@Node	894	
OPE Stress:	183209.5	Allowable Stress:		359000.0
Axial Stress:	100149.6	@Node	533	
Bending Stress:	15012.4	@Node	894	
Torsion Stress:	0.0	@Node	11	
Hoop Stress:	57023.8	@Node	11	
Max Stress Intensity:	173105.0	@Node	894	

CODE STRESS CHECK PASSED : LOADCASE 4 (SUS) W+P1

Highest Stresses: (KPa)	LOADCASE 4 (SUS) W+P1			
Ratio (%):	15.9	@Node	11	
Code Stress:	28511.9	Allowable Stress:		179500.0
Axial Stress:	27674.7	@Node	11	

CAESAR II 2017 Ver.9.00.00.5900, (Build 160721) Date: MAY 13, 2020 Time: 9:26
Job:: BH-16-TYPE1 SOILB
Licensed To:: SPLM: Edit company name in <system>\company.txt

STRESS SUMMARY REPORT: Highest Stresses Mini Statement
Various Load Cases

Bending Stress:	0.0	@Node	11
Torsion Stress:	0.0	@Node	11
Hoop Stress:	57023.8	@Node	11
Max Stress Intensity:	62249.5	@Node	11

CODE STRESS CHECK PASSED : LOADCASE 5 (OCC) W+P1+U1

Highest Stresses: (KPa)	LOADCASE 5 (OCC) W+P1+U1		
Ratio (%):	24.2	@Node	894
Code Stress:	43524.3	Allowable Stress:	179500.0
Axial Stress:	27674.7	@Node	11
Bending Stress:	15012.4	@Node	894
Torsion Stress:	0.0	@Node	11
Hoop Stress:	57023.8	@Node	11
Max Stress Intensity:	62249.5	@Node	11

CODE STRESS CHECK PASSED : LOADCASE 6 (EXP) L6=L1-L4

Highest Stresses: (KPa)	LOADCASE 6 (EXP) L6=L1-L4		
Ratio (%):	0.0	@Node	11
Code Stress:	0.0	Allowable Stress:	258480.0
Axial Stress:	127824.3	@Node	495
Bending Stress:	0.0	@Node	11
Torsion Stress:	0.0	@Node	11
Hoop Stress:	0.0	@Node	11
Max Stress Intensity:	127824.3	@Node	495

CODE STRESS CHECK PASSED : LOADCASE 7 (EXP) L7=L2-L4

Highest Stresses: (KPa)	LOADCASE 7 (EXP) L7=L2-L4		
Ratio (%):	0.0	@Node	11
Code Stress:	0.0	Allowable Stress:	258480.0
Axial Stress:	21328.9	@Node	39
Bending Stress:	0.0	@Node	11
Torsion Stress:	0.0	@Node	11
Hoop Stress:	0.0	@Node	11
Max Stress Intensity:	21328.9	@Node	39

APPENDIX B

VEHICLE LIVE LOAD CALCULATION

Design For Buried Steel Pipeline (Non Pressurized)					
Pipe Ovalization Stress Calculation for Concentrated Load					
				Rev	A
				Date	13-May-20
Item description	**Symbol**	**input values**	**Unit**	**Reference**	
Pipe Characteristic					
Yield Strength of Pipe Material	Sy=	359000	kPa		
Pipe outside diameter	D=	6.625	in =	168.3	mm
Pipe radius	R=	3.3125	in		
Pipe wall thickness	t_w=	0.189	in =	4.800	mm
Deflection lag factor	D_l=	1.5		ALA, 4.2.1	
Bedding constant	K=	0.1		ALA, 4.2.1	
Modulus of elasticity of pipe	E=	29000000	psi		
	H/D=	5.94			
Safety Factor	FS	2.5		ALA, Sect. 4.2.4	
Site Characteristic					
Burried depth	H=	3.28	ft=	1.000	m
Modulus of soil recation	E'=	500	psi	API 1102, Table A-1	
Soil unit weight	Y=	127.32	lb/ft^3	see soil charract assumptn	
Water table height above pipe	h_w=	0.00	in		
Water buoyancy factor	R_w=	1		ALA, 4.2.4	
Loads on Pipe					
earth pressure on the pipe					
P_v=Y*H (static load)	P_v=	2.90	psi=	20.00	kPa
unit earth load on pipe	FL=	230.61	lb/ft=	343	kg/m
Concentrated surface load	=	12000	lb=	5443	kgf
applied live pressure on pipe					
Impactor Factor	F'=	1.00		ALA, Table 4.1-2	
offset distance	d=	0.00	ft		
P_p=F'*(3*Ps)/((2*PI*H^2)*(1+(d/H)^2)^2.5)	P_p=	3.70	psi=	25.49	kPa
Uniform Load on Pipe	U=	4289	N/m=	437	kg/m
Total applied pressure on pipe					
B' coefficient of elastic support					
B'=1 / (1+4*EXP(-0.065*H*12/D)	B'=	0.269			
moment inertia of pipe					
I= (t_w)^3/12	I=	0.000562	in^3		
Critical ring buckling pressure					
P_c= 1/FS*SQRT(32*R_w*B'*E'*E*I/D^3)	Pc=	196.51	psi=	1355	kPa
Total applied pressure on pipe					
P=P_v + P_p (due to total compressive load)	P=	6.60	psi=	45	kPa
		Pass		ALA, Appendix A	
Ovality of the pipe					
Δy/D = D_1*K*P/((E*I)/R^3) + 0.061*E')		0.21%	<	3.00%	
		Pass		API 1102	
Through- wall bending stress					
σ= 4*E*(Δy/D)*(t_w/D)	**σ=**	6833	psi		Sy/2
		47111	kPa	<	179500
		Pass		ALA, Appendix A	

APPENDIX C

FATIQUE FAILURE ON GIRTH WELDS

Project	
Enbridge Windsor NPS6 Gas Line Replacement	
Location	Date
Lakeshore	5/4/2020

TECHNICAL TOOLBOXES

API 1102 - Gas Pipeline Crossing Highway

PIPE AND OPERATIONAL DATA:

Operating Pressure [MPa]	3.45
Location Class:	3
Operating Temperature [°C]	38
Pipe Outside Diameter [mm]	168.30
Pipe Wall Thickness [mm]	4.800
Pipe Grade: X52	
Specified Minimum Yield Stress	359
Design Factor	0.50
Longitudinal Joint Factor	1.000
Temperature Derating Factor	1.000
Pipe Class: API 5L Seamless	
Young's Modulus for Steel	207,000
Poisson's Ratio for Steel	0.3
Coefficient of Thermal Expansion [per°C]	0.0000117

SITE AND INSTALLATION DATA:

Soil Type:	Soft to medium clays and silts with high plasticities
E' - Modulus of Soil Reaction [MPa]	1.4
Er - Resilient Modulus [MPa]	34.5
Average Unit Weight of Soil [kN/m³]	20.0
Pipe Depth [m]	1.00
Bored Diameter [mm]	168.30
InstallationTemperature [°C]	-20.0
Design Wheel Load from Single Axle [kN]	53.38
Design Wheel Load from Tandem Axles [kN]	44.48

Pavement Type: None

Impact Factor Method: ASCE - Highway

Safety Factor Applied: API 1102 Procedure

RESULTS

Hoop Stress [MPa]	60.4
Allowable Hoop Stress [MPa]	179.5
Stiffness Factor for Earth Load Circumferential Stress	1,638
Burial Factor for Earth Load Circumferential Stress	1.17
Excavation Factor for Earth Load Circumferential Stress	0.83
Circumferential Stress from Earth Load [MPa]	5.3
Impact Factor	1.50
Highway Stiffness Factor for Cyclic Circumferential	14.10
Highway Geometry Factor for Cyclic Circumferential	1.47
Cyclic Circumferential Stress [MPa]	17.1
Highway Stiffness Factor for Cyclic Longitudinal Stress	12.20
Highway Geometry Factor for Cyclic Longitudinal Stress	1.45
Cyclic Longitudinal Stress [MPa]	14.6

Maximum Circumferential Stress [MPa]	81.2
Maximum Longitudinal Stress [MPa]	-106.6
Maximum Radial Stress [MPa]	-3.4
Total Effective Stress [MPa]	162.9
Allowable Effective Stress [MPa]	179.5

Stress [MPa]	Calculated	Allowable	PASS/FAIL
Hoop	60.4	179.5	PASS
Effective	162.9	179.5	PASS
Girth Welds	17.1	41.4	PASS
Long. Welds	14.6	72.4	PASS

Notes:

Reference: API RP 1102 "Steel Pipelines Crossing Railroads and Highways"

Prepared By Leo Yang	Approved By	Revision: 13.0.1

APPENDIX D

LIMITATIONS

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Limitations to Geotechnical Reports

1. The work performed in the preparation of this report and the conclusions presented herein are subject to the following:
   a) The contract between Wood and the Client, including any subsequent written amendment or Change Order dully signed by the parties (hereinafter together referred as the "Contract");
   b) Any and all time, budgetary, access and/or site disturbance, risk management preferences, constraints or restrictions as described in the contract, in this report, or in any subsequent communication sent by Wood to the Client in connection to the Contract; and
   c) The limitations stated herein.
2. **Standard of care:** Wood has prepared this report in a manner consistent with the level of skill and are ordinarily exercised by reputable members of Wood's profession, practicing in the same or similar locality at the time of performance, and subject to the time limits and physical constraints applicable to the scope of work, and terms and conditions for this assignment. No other warranty, guaranty, or representation, expressed or implied, is made or intended in this report, or in any other communication (oral or written) related to this project. The same are specifically disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.
3. **Limited locations:** The information contained in this report is restricted to the site and structures evaluated by Wood and to the topics specifically discussed in it, and is not applicable to any other aspects, areas or locations.
4. **Information utilized:** The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth in this report.
5. **Accuracy of information:** No attempt has been made to verify the accuracy of any information provided by the Client or third parties, except as specifically stated in this report (hereinafter "Supplied Data"). Wood cannot be held responsible for any loss or damage, of either contractual or extra-contractual nature, resulting from conclusions that are based upon reliance on the Supplied Data.
6. **Report interpretation:** This report must be read and interpreted in its entirety, as some sections could be inaccurately interpreted when taken individually or out-of-context. The contents of this report are based upon the conditions known and information provided as of the date of preparation. The text of the final version of this report supersedes any other previous versions produced by Wood.
7. **No legal representations:** Wood makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.
8. **Decrease in property value:** Wood shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.
9. **No third party reliance:** This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or Contract. Any use or reproduction which any third party makes of the report, in whole or in part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this document, or any information contained in this document, for use or consideration by any third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on this report or anything set out therein. including without limitation, any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.
10. **Assumptions**: Where design recommendations are given in this report, they apply only if the project contemplated by the Client is constructed substantially in accordance with the details stated in this report. It is the sole responsibility of the Client to provide to Wood changes made in the project, including but not limited to, details in the design, conditions, engineering or construction that could in any manner whatsoever impact the validity of the recommendations made in the report. Wood shall be entitled to additional compensation from Client to review and assess the effect of such changes to the project.
11. **Time dependence**: If the project contemplated by the Client is not undertaken within a period of 18 months following the submission of this report, or within the time frame understood by Wood to be contemplated by the Client at the commencement of Wood's assignment, and/or, if any changes are made, for example, to the elevation, design or nature of any development on the site, its size and configuration, the location of any development on the site and its orientation, the use of the site, performance criteria and the location of any physical infrastructure, the conclusions and recommendations presented herein should not be considered valid unless the impact of the said changes is evaluated by Wood, and the conclusions of the report are amended or are validated in writing accordingly.

    Advancements in the practice of geotechnical engineering, engineering geology and hydrogeology and changes in applicable regulations, standards, codes or criteria could impact the contents of the report, in which case, a supplementary report may be required. The requirements for such a review remain the sole responsibility of the Client or their agents.

    Wood will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.
12. **Limitations of visual inspections:** Where conclusions and recommendations are given based on a visual inspection conducted by Wood, they relate only to the natural or man-made structures, slopes, etc. inspected at the time the site visit was performed. These

conclusions cannot and are not extended to include those portions of the site or structures, which were not reasonably available, in Wood's opinion, for direct observation.

13. **Limitations of site investigations**: Site exploration identifies specific subsurface conditions only at those points from which samples have been taken and only at the time of the site investigation. Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions.

    The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite this investigation, conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

    Final sub-surface/bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports.

    Bedrock, soil properties and groundwater conditions can be significantly altered by environmental remediation and/or construction activities such as the use of heavy equipment or machinery, excavation, blasting, pile-driving or draining or other activities conducted either directly on site or on adjacent terrain. These properties can also be indirectly affected by exposure to unfavorable natural events or weather conditions, including freezing, drought, precipitation and snowmelt.

    During construction, excavation is frequently undertaken which exposes the actual subsurface and groundwater conditions between and beyond the test locations, which may differ from those encountered at the test locations. It is recommended practice that Wood be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered at the test locations, that construction work has no negative impact on the geotechnical aspects of the design, to adjust recommendations in accordance with conditions as additional site information is gained and to deal quickly with geotechnical considerations if they arise.

    Interpretations and recommendations presented herein may not be valid if an adequate level of review or inspection by Wood is not provided during construction.

14. **Factors that may affect construction methods, costs and scheduling**: The performance of rock and soil materials during construction is greatly influenced by the means and methods of construction. Where comments are made relating to possible methods of construction, construction costs, construction techniques, sequencing, equipment or scheduling, they are intended only for the guidance of the project design professionals, and those responsible for construction monitoring. The number of test holes may not be sufficient to determine the local underground conditions between test locations that may affect construction costs, construction techniques, sequencing, equipment, scheduling, operational planning, etc.

    Any contractors bidding on or undertaking the works should draw their own conclusions as to how the subsurface and groundwater conditions may affect their work, based on their own investigations and interpretations of the factual soil data, groundwater observations, and other factual information.

15. **Groundwater and Dewatering**: Wood will accept no responsibility for the effects of drainage and/or dewatering measures if Wood has not been specifically consulted and involved in the design and monitoring of the drainage and/or dewatering system.

16. **Environmental and Hazardous Materials Aspects**: Unless otherwise stated, the information contained in this report in no way reflects on the environmental aspects of this project, since this aspect is beyond the Scope of Work and the Contract. Unless expressly included in the Scope of Work, this report specifically excludes the identification or interpretation of environmental conditions such as contamination, hazardous materials, wild life conditions, rare plants or archeology conditions that may affect use or design at the site. This report specifically excludes the investigation, detection, prevention or assessment of conditions that can contribute to moisture, mould or other microbial contaminant growth and/or other moisture related deterioration, such as corrosion, decay, rot in buildings or their surroundings. Any statements in this report or on the boring logs regarding odours, colours, and unusual or suspicious items or conditions are strictly for informational purposes.

17. **Sample Disposal**: Wood will dispose of all uncontaminated soil and rock samples after 30 days following the release of the final geotechnical report. Should the Client request that the samples be retained for a longer time, the Client will be billed for such storage at an agreed upon rate. Contaminated samples of soil, rock or groundwater are the property of the Client, and the Client will be responsible for the proper disposal of these samples, unless previously arranged for with Wood or a third party.

Wood Environment & Infrastructure Solutions,

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APPENDIX E

APPLICATION OF TAC GUIDELINES FOR UNDERGROUND UTILITY INSTALLATIONS CROSSING HIGHWAY RIGHTS-OF-WAY

Memo

To: Scott Walker
Manager Engineering Pipeline Design
Enbridge

From: David Sinke, P.Eng.
Principal Transportation Engineer

Date: May 19, 2020

File:

cc: Ty Garde
Principal Foundation Engineer
Wood

Re: **Application of TAC Guidelines for Underground Utility Installations Crossing Highway Rights-of-way**

Further to your inquiry, we have reviewed with our transportation design team the applicability of the above referenced standard to our municipal clients based on our experience since publication of the standard in March 2013. In particular, you inquired about the applicability of the depth of bury standards in Figure 4 and Table 1.

In our experience, municipalities we have dealt with have not, to date, referenced the above standards. For new or replacement plant installations, municipalities have deferred to the utility company's standard depth of bury. The exception to this practice has been at a location of an actual or anticipated future conflict, where addition depth of bury has been required.

Further, it is often the case that the bury depth of utilities constructed within the undeveloped portion of a road allowance will *increase* following the placement of the pavement structure (granular subbase, base and asphalt) associated with road widening, which can result in an increased bury depth of 500 mm or more, depending on the road profile, drainage and pavement design. Consequently, a depth of bury of 1.0 m within a pre-existing road right of way could be expected to result in a depth of bury in the order of 1.5 m or more following widening of the roadway.

Our involvement has been in consulting with multiple utility companies in the course of planning road widening and relocation. Our services within the Regions of Halton, Peel, and Niagara, and the Cities of Hamilton and Brantford, for example, have included review and approval of utility relocation plans on behalf of these municipalities.

We trust that this information has been helpful.

DS/ds

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