



January 25, 2013

Mr. Leonard Avery, P.Eng.

Heritage Gas

200-238 Brownlow Avenue
Dartmouth, NS B3B 1Y2

Dear Mr. Avery,

**Re: Geotechnical Investigation, Phase 1 – New Glasgow Pipeline
Pictou County, Nova Scotia**

This is our report on the geotechnical investigation conducted for Phase 1 (Boreholes 3 to 7) for the proposed Natural Gas Pipeline in Pictou County, Nova Scotia.

The subsurface conditions in the boreholes consisted of rootmat over compact to dense sandy silt till then bedrock (mudstone). Bedrock was encountered at each borehole with the exception of Borehole 3. The presence of bedrock at most borehole locations will complicate the proposed directional drilling.

Table A: Summary of Findings

Borehole	Thickness of Rootmat/Topsoil (m)	Thickness of Till (m)	Bedrock Depth (m)	Groundwater Depth* (m)
BH 3	0.2	>13.8	>13.8	groundwater not encountered
BH 4	0.2	6.3	6.5	encountered at 0.6 m
BH 5	0.1	1.8	1.9	groundwater not encountered
BH 6	0.2	8.6	8.8	encountered at 4.3 m
BH 7	0.3	2.9	3.2	encountered at 3.0 m

* encountered at the time of drilling. Actual groundwater depth may vary.

Please contact us if you require additional information.

Thank you,

Glenn Graham, P.Eng.
Geotechnical Engineer
ggraham@conquest-eng.com
Project No. 533-001

TABLE OF CONTENTS

	<i>page</i>
1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION AND GEOLOGY	1
3.0 SUBSURFACE CONDITIONS	2
5.0 CLOSURE	3

TABLES

Table A: Summary of Findings	2
------------------------------------	---

APPENDICES

APPENDIX A:	BOREHOLE RECORDS 3 TO 7
	FIGURE 1: GRAIN SIZE DISTRIBUTION
	SOIL RESISTIVITY – CERTIFICATE OF ANALYSIS
	DRAWING NO. 1 – BOREHOLE LOCATIONS

1.0 INTRODUCTION

We have conducted Phase 1 of the Geotechnical Investigation for the proposed natural gas pipeline in Pictou County, NS at the request Heritage Gas. The purpose of this investigation was to evaluate the subsurface conditions on the site, and to provide a factual report of our findings.

2.0 SITE DESCRIPTION AND GEOLOGY

Boreholes 3 and 4 are located at the crossing of Highway #4 in Alma, NS. Borehole 5 is located along the power transmission line right of way on top of MacDonald Hill. Boreholes 6 and 7 are located at the crossing for Middle River. Figure A shows an aerial view of Boreholes 3 to 5. Figure B shows an aerial view of Boreholes 6 and 7.

The borehole locations along the power transmission line right of way are predominantly cleared with some overgrown brush (alders) present. The borehole locations along Middle River were predominantly wooded. Access to the sites was through private properties. Bedrock was exposed in the locations for BH5 and BH7.

The principal soil type is sandy silt till over bedrock (mudstone) which is part of the Middle River Formation.



Figure A: Borehole locations



Figure B: Borehole locations

3.0 SUBSURFACE CONDITIONS

The field program consisted of five boreholes (BH3 to BH7) completed on January 7 to January 9, 2013. The borehole locations are shown in Figure A and Figure B (Figure 1 in the appendix is a complete location plan).

The boreholes were drilled using a track mounted drill rig. Representative samples were taken during the field work and the conditions at the boreholes were logged in detail. The soil and groundwater conditions encountered at the site are described in detail on the appended Borehole Records and summarized in the following paragraphs and Table A.

The subsurface conditions in the boreholes consisted of rootmat over compact to dense sandy silt till then bedrock (mudstone). Bedrock was encountered at each borehole with the exception of Borehole 3. Groundwater was encountered in Boreholes 4, 5, and 6 at the time of drilling. Table A below lists the depths for each layer encountered.

Grainsize analysis of one sample from Borehole 4 showed 25% gravel, 20% sand, and 55% fines. One sample from Borehole 6 showed 12% gravel, 27% sand, and 51% fines. Moisture content analysis from Borehole 4 ranged from 11.6% to 16.7%, with an average of 14.2%. Moisture content analysis from Borehole 6 ranged from 6.3 % to 17.8%, with an average of 12.9%.

Compressive strength analysis of the bedrock for two samples from Borehole 6 was 1.89 MPa, and 3.98 MPa.

Laboratory analysis for electrical resistivity of two samples showed 6670 Ω ·cm, and 7690 Ω ·cm.

Table A: Summary of Findings

Borehole	Thickness of Rootmat/Topsoil (m)	Thickness of Till (m)	Bedrock Depth (m)	Groundwater Depth* (m)
BH 3	0.2	>13.8	>13.8	groundwater not encountered
BH 4	0.2	6.3	6.5	encountered at 0.6 m
BH 5	0.1	1.8	1.9	groundwater not encountered
BH 6	0.2	8.6	8.8	encountered at 4.3 m
BH 7	0.3	2.9	3.2	encountered at 3.0 m

* encountered at the time of drilling. Actual groundwater depth may vary.

5.0 CLOSURE

If there are changes to the proposed work we require that we be notified to allow for review of our recommendations.

A field investigation is a limited sampling of a site. Some variation between sampling locations should be expected. If the conditions encountered are significantly different than described in this report, we request that we be notified immediately.

This report was completed for the sole benefit of Heritage Gas. Any other person or entity may not rely on this report without the express written consent of Conquest Engineering Ltd. This report was written by Glenn Graham, P.Eng. and reviewed by Bruce MacNeil, P.Eng.



Glenn Graham, P.Eng
Geotechnical Engineer
ggraham@conquest-eng.com



R. Bruce MacNeil, P.Eng
Senior Geotechnical Engineer
bmacneil@conquest-eng.com

APPENDIX A



BOREHOLE RECORD

Project Name: Proposed Natural Gas Pipeline - Phase 1

Project No.: 533-001

Client: Heritage Gas

Location: Pictou County, Nova Scotia

Water Level Date: Jan 8, 2012

Borehole No.: 4

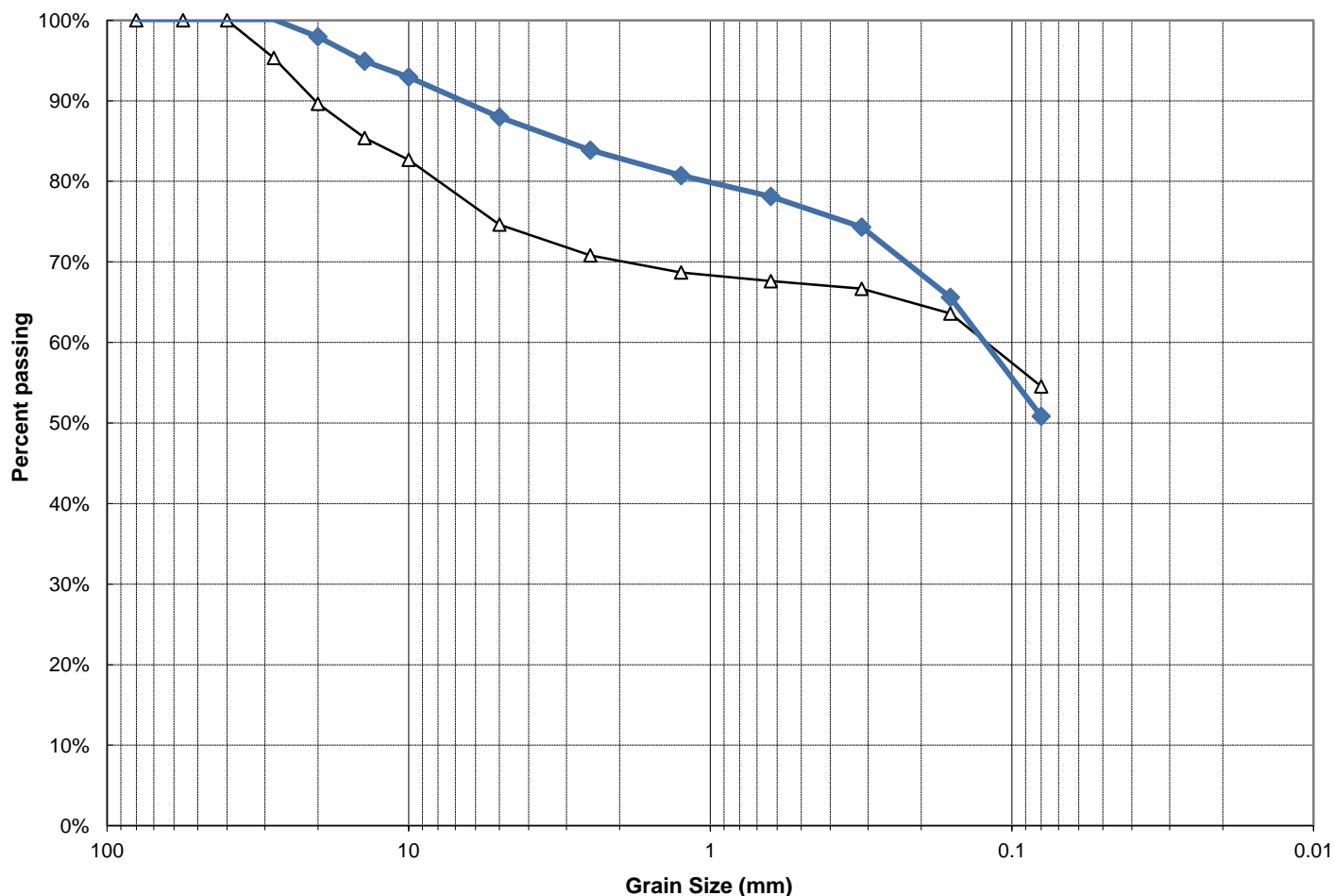
Page: 1 of 1

Date Drilled: Jan 8, 2013

Datum: Assumed

Depth (m)	Water Level (m)	Sample Type	Sample Number	Recovery (mm)	N Value or RQD %	Symbols	SOIL AND/OR ROCK DESCRIPTION	Elevation (m)	Moisture Content (%)					
									Wp	WL	5	15	25	35
									SPT (N)					
									5	15	25	35	45	
0	▼						ROOTMAT/TOPSOIL							
0.5							TILL: Compact to dense reddish brown sandy silt with gravel - trace cobbles							
2.0		SS	1	600	7									
3.5		SS	2	300	14									
5.0		SS	3	600	29									
6.5		SS	4	600	60-100mm									
7.0							BEDROCK: Mudstone							
8.0		SS		0	50-25mm									
9.0		SS		0	50-25mm									
10.0							END OF BOREHOLE groundwater at 0.6 m							

GRAIN SIZE DISTRIBUTION PLOT



GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

SAMPLE ID	DEPTH (m)	SYMBOL	CLASSIFICATION (<i>ASTM D2487 USCS</i>)	GRAVEL (%)	SAND (%)	FINES (%)
BH4, Sa3	-	—△—	Sandy SILT with gravel (ML)	25%	20%	55%
BH6, Sa4	-	—◆—	Sandy SILT with gravel (ML)	12%	37%	51%

Sample Type : Borehole Samples

Sample Location : Borehole BH4, and BH6

Comments : _____



Client : Heritage Gas
Project : Proposed Natural Gas Pipeline

Project No. : 533-001

Figure 1

Your P.O. #: 533-001
Your Project #: 533001
Site Location: DARTMOUTH BRIDGE TERMINAL
Your C.O.C. #: N/A

Attention: Glenn Graham

Conquest Engineering Ltd
348 Bluewater Road
Bedford, NS
CANADA B4B1J6

Report Date: 2013/01/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B310398

Received: 2013/01/22, 15:58

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Conductance - soil	2	2013/01/23	2013/01/24	ATL SOP 00006	Based on SM2510B

Remarks:

Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Mari Kenny, Project Manager
Email: MKenny@maxxam.ca
Phone# (902) 420-0203 Ext:291

=====
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Page 1 of 6

Maxxam Job #: B310398
 Report Date: 2013/01/24

Conquest Engineering Ltd
 Client Project #: 533001
 Site Location: DARTMOUTH BRIDGE TERMINAL
 Your P.O. #: 533-001
 Sampler Initials: GG

RESULTS OF ANALYSES OF SOIL

Maxxam ID		QH9965	QH9966		
Sampling Date		2013/01/22	2013/01/22		
COC Number		N/A	N/A		
	Units	BH3	BH7	RDL	QC Batch

Inorganics					
Conductivity	uS/cm	150	130	1.0	3103743

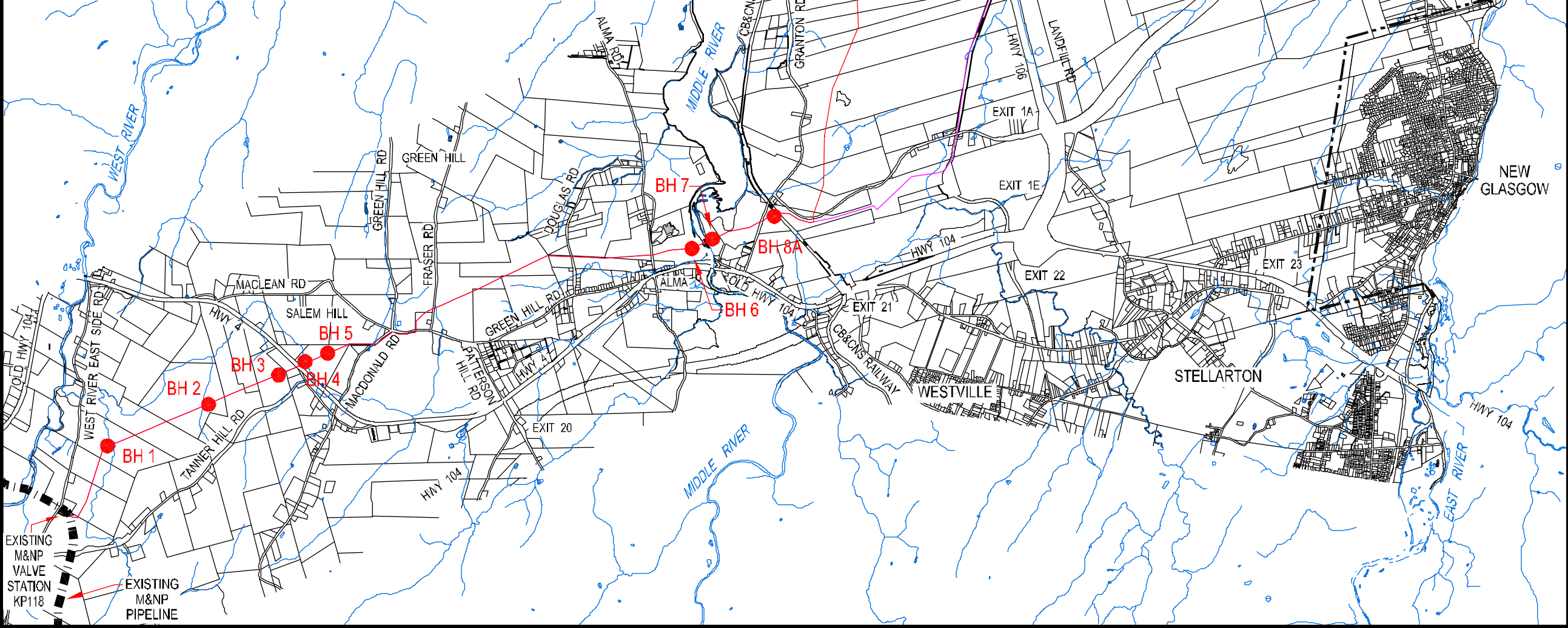
N/A = Not Applicable
 RDL = Reportable Detection Limit
 QC Batch = Quality Control Batch

G:\CAD\11Region - NEW GLASGOW\2011 Projects\111101 New Glasgow Concept Preliminary Alignment\111101-264.dwg 10-DEC-2012 9:00am Terry

New Glasgow Steel Pipeline		Proposed Boreholes						December 10, 2012
Hole ID	Feature	Hole Location	Access via	Tree / Alder clearing	* Approx. Minimum Hole Depth (m)	Northing **	Easting **	
1	BH 1	Stream crossing	West side	Woods Rd off east side of "West River East Side Rd" to powerline access road	2.5m x 210m alders	14	5047632	4395693
2	BH 2	Stream crossing	East side	Woods Rd off north side of Tanner Hill Rd, up to powerline, then west on powerline access road	2.5m x 35m alders	15	5048074	4396729
3	BH 3	Hwy 4, Stream, Salem Hill	250m west of Hwy 4	Woods Rd off north side of Tanner Hill Rd, up to powerline, then east on powerline access road	2.5m x 30m alders	14	5048442	4397609
4	BH 4	Hwy 4, Stream, Salem Hill	50m east of Hwy 4	Driveway off east side of "Hwy 4" (under south wire of powerline)	None required	14	5048518	4397825
5	BH 5	Hwy 4, Stream, Salem Hill	320m east of Hwy 4 (Top of hill south side of powerline)	Farmers field access off west side of Macdonald Hill Rd	2.5m x 250m alders	20	5048629	4398077
6	BH 6	Middle River	West side of River	Civic 5077 driveway off north side Hwy 4, after white barn turn right, go 75m follow pink ribbon	2.5m x 50m alders, few small trees	22	5049779	4402041
7	BH 7	Middle River	East side of River	Daisy Lane off north side Hwy 4, left at cemetery, right onto driveway, go past mini home, stay right	2.5m x 40m alders	17	5049867	4402242
8	BH 8A	CB&CNS Railway	170m east of Granton Rd railway crossing	Possibly see if CB&CNS will allow to use tracked vehicle down beside railway tracks	2.5m x 140m alders, few small trees	4	5050157	4402966
9	BH 8C	Stream crossing	West side Hwy 106, north of pond	Woods Rd off west side Hwy 106	2.5m x 120m alders	18	5054071	4404939
10	BH 9	Stream crossing	West side Hwy 106, south side of Begg Brook	Woods Rd off west side Hwy 106, follow along tree line, turn in and follow flags	2.5m x 100m alders	23	5055610	4404431
11	BH 10	Hwy 106 & CB&CNS Railway crossings	West side Hwy 106, north side of CB&CNS Railway in grassy area	Off Hwy 106 on ramp, Exit 2	None required	7	5055847	4404400
12	BH 12	Abercrombie Rd & Begg Brook	South side of Abercrombie Rd, west side CB&CNS Railway, across from Northern Pulp truck entrance just inside tree line	South side of Abercrombie Rd, between Exit 2 off ramp and Railway crossing	5m x 10m	18	5056306	4404631

* NOTE : Approximate minimum borehole depth is given as an estimate of the variance in elevation between the ground surface at the borehole location and the low point of the feature that is being crossed added to the numbers as shown in section 6.1.1 of t

** NOTE : Northing and Easting refers to the 3deg MTM, ATS 77 projection.



LEGEND

- ▬ EXISTING M&NP STEEL PIPELINE
- BOREHOLE REQUIRED

NO.	ISSUED FOR REVIEW	12/12/10	TLM	
	REVISIONS	DATE	DWN	APP

Heritage Gas

AREA: NEW GLASGOW PICTOU CO., N.S.

PROJECT: NATURAL GAS DISTRIBUTION SYSTEM NEW GLASGOW PIPELINE

TITLE: PROPOSED BOREHOLES

DWG NO: 111101 - 264

FIGURE 1

DESIGN: T.L.M. DRAWN: T.L.M. SCALE: 1:50,000 0 500 1000m