DESIGN REPORT FOR CULVERT #6 AND #21 MELIADINE MINE, NUNAVUT

PRESENTED TO
Agnico Eagle Mines Ltd.

APRIL 2020
ISSUED FOR USE
TETRA TECH PROJECT NUMBER: 28920
AGNICO EAGLE DOCUMENT NUMBER: 6526-695-230-REP-001

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APPENDICES

1.0 INTRODUCTION

1.1 Site Location and Access

Agnico Eagle Mines Limited (Agnico Eagle) is operating the Meliadine gold mine (the Mine), located approximately 25 km north of Rankin Inlet, and 80 km southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine site is located on the peninsula between the East, South, and West basins of Meliadine Lake (63°01'23.8"N, 92°13'6.42"W). The area is accessible from the all-weather gravel road linking the Meliadine mine site with Rankin Inlet. A general location plan of the project is shown in Figure 1 (Appendix A).

1.2 Existing and Future Site Facilities

The current mine plan focuses on the development of the Tiriganiaq gold deposit which will be mined using both conventional open-pit and underground mining operations. Current or proposed mining facilities to support this development include a plant site and accommodations, tailings storage facility and water management infrastructures.

Several infrastructures such as water retention dikes, berms, culverts, channels, collection ponds, pumping stations, fresh water intake and water treatment plants are required to manage water during pre-production, operation, and interim mine closure.

Facilities that have been constructed for the operation of the Meliadine mine include a process plant, power plant, maintenance facilities, tank farms for fuel storage, water treatment plant, sewage treatment plant, accommodations, and kitchen facilities for 520 people.

The Nunavut Water Board (NWB) has issued Type “A” Water License No. 2AM-MEL1631 (Water license “A”) to Agnico Eagle Mines Limited (Agnico Eagle) for the Meliadine Gold Project site authorizing the use of water and the disposal of waste required by mining and milling and associated uses.

1.3 Scope of Work

Agnico Eagle retained the services of Tetra Tech to carry out the planning and design works associated with the Water and Environment and the Civil Works components of the Project. As part of the scope of work, Agnico Eagle asked Tetra Tech to:

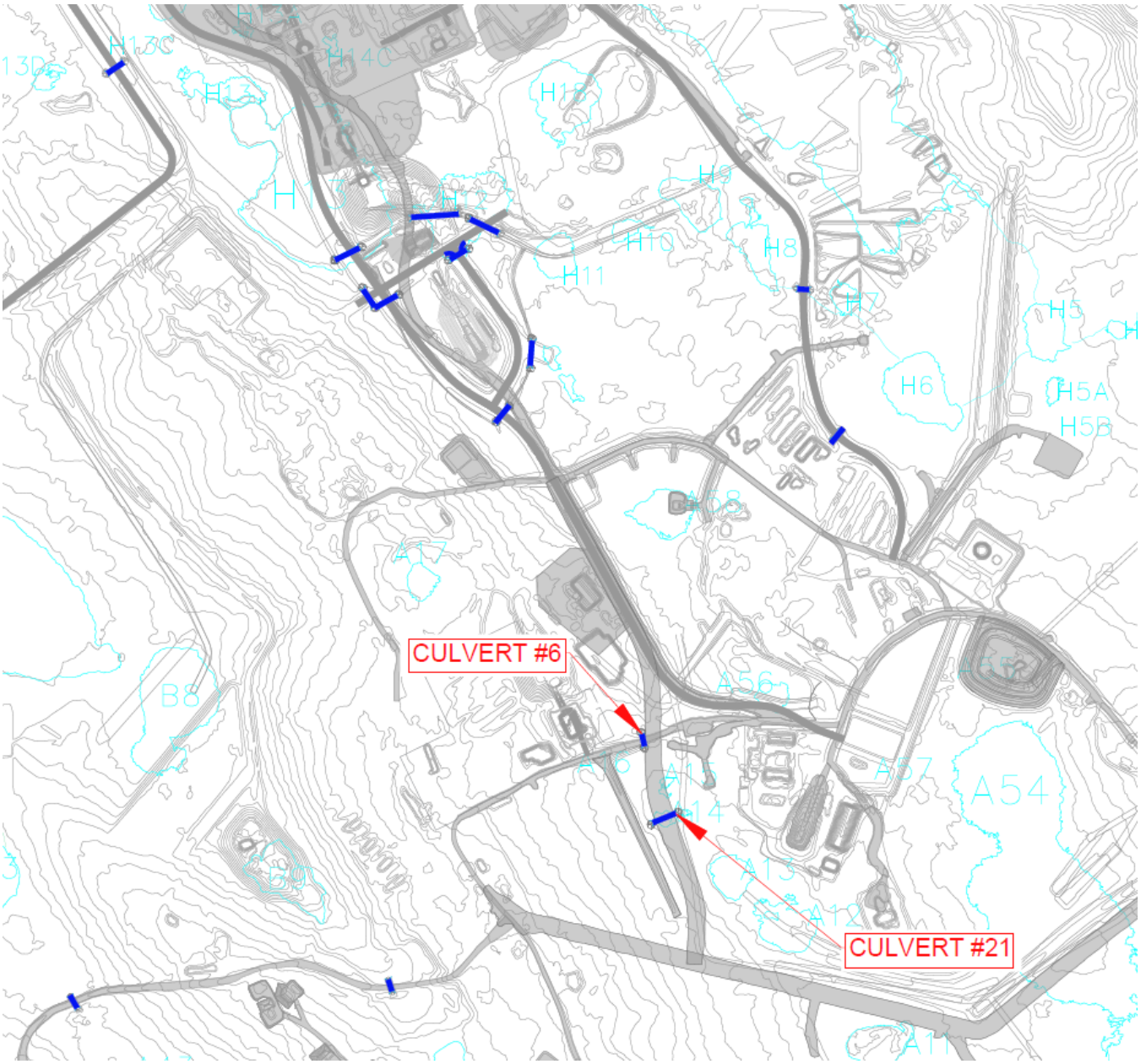
- Conduct a detailed design for the haul roads, service roads, and temporary roads as part of the civil work construction schedule including the crossing culverts;
- Produce construction drawings and specification for the roads and culverts;
- Prepare a design report of the culverts.

In accordance with Part D of the Water License “A”, this report summarizes the site conditions, design basis, and considerations of Culvert #6 and #21 in addition to construction drawings and specifications of those infrastructures.

1.4 Culvert Locations

At its Meliadine site, Agnico Eagle is extending an existing haul road to reach Tiri 01 and Tiri 02 open pits. As a result of the haul road extension, 2 culverts will be required to properly manage the water within this internal area of the overall site. Culvert #6 is located to the west of the haul road extension on the access road to the Tiriganiaq esker, while Culvert #21 is located on the haul road extension. See Figure 2 for culvert locations.

Figure 2: Culverts #6 and #21 locations



2.0 DESIGN

2.1 Culvert Design Basis and Water Management Strategy

The overall objective of the water management strategy of this mine is to develop a practical and feasible site wide water management plan to minimize the potential negative impacts of mining development on the surrounding environment including habitats for fish and wildlife, and to facilitate mine operation and long-term closure and reclamation of the mine site. To attain this objective, culverts are used to control and divert runoff underneath the roads and allow discharge flows to channels.

2.1.1 Erosion Control

Rip rap will be installed around the culvert inlet and outlet areas to control erosion. For an example of a rip rap section, see attached the typical culvert cross-section presented in Appendix B.

During the installation of the culverts, if required, straw logs will be used in the work area to prevent total suspended solids from reaching downstream water bodies.

2.1.2 Culvert Specifications

Standard galvanized, corrugated steel pipe culvert with a profile of 68 x 13 mm and a minimum thickness of 2.0 mm for pipe diameters ≤ 700 mm and 2.8 mm for pipe diameters > 700 mm is proposed. The culvert will be in service for up to 15 years. It is understood that the haul trucks to be used at the project site will be CAT AD60 for underground trucks and Komatsu HD465 model or equivalent for open pit trucks.

For the Tiriganiaq access road, a minimum of 825 mm granular fill cover shall be placed on top of the Culvert #6 highest pipe. For the haul road extension, a minimum of 850 mm granular fill cover shall be placed on top of the Culvert #21 highest pipe to allow for heavy traffic access. The backfill around the culvert will be granular fill 50mm MINUS, or an approved equivalent, and shall be placed in lifts not greater than 0.3 m thick and compacted to a minimum of 95% of Standard Proctor Maximum Dry Density (ASTM D698).

The location and details of the proposed culverts are presented in drawings 65-417-230-229 and 65-417-230-203 provided in Appendix B. The Table 1 below presents the characteristics of the proposed culverts:

Table 1 : Culvert #6 and #21 specifications

Item	Culvert #6	Culvert #21
Number of Pipes and Diameter	2 Ø 900 mm	2 Ø 1000 mm
Slope Gradient (%)	4.46	0.56
Invert Upstream (m)	69.90	67.69
Invert Downstream (m)	68.74	67.51
Length of Each Pipe (m)	26	32
Corrugation profile of each culvert (mm)	68 x 13	68 x 13
Thickness of each culvert (mm)	2.8	2.8
Estimated Peak flow (m^3/s)	0.685	0.748
Culvert Flow Capacity (m^3/s)	4.142	1.944

2.1.3 Figures and Drawings

Figure 1 in Appendix A presents the location of the mine site.
Figure 2 in section 1.1 presents the proposed culverts location.

The following construction drawings are presented in Appendix B and present the details for the culverts' construction:

- 65-417-230-229: Haul Road Extension – Plan and profile – 0+00 to 0+729
- 65-417-230-203: Typical section for haul road and culverts

3.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Agnico Eagle Mines Ltd. and their agents. Tetra Tech does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Agnico Eagle Mines Ltd., or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech's Services Agreement.

4.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech

2020-04-22

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.
O/A TETRA TECH
Signature Josée Alarie, ing.
Date 20/04/22
PERMIT NUMBER: P 1029
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
J.M.I.F. ALARIE
LICENSEE
Josée Alarie, ing.
NT/NU
20/04/22

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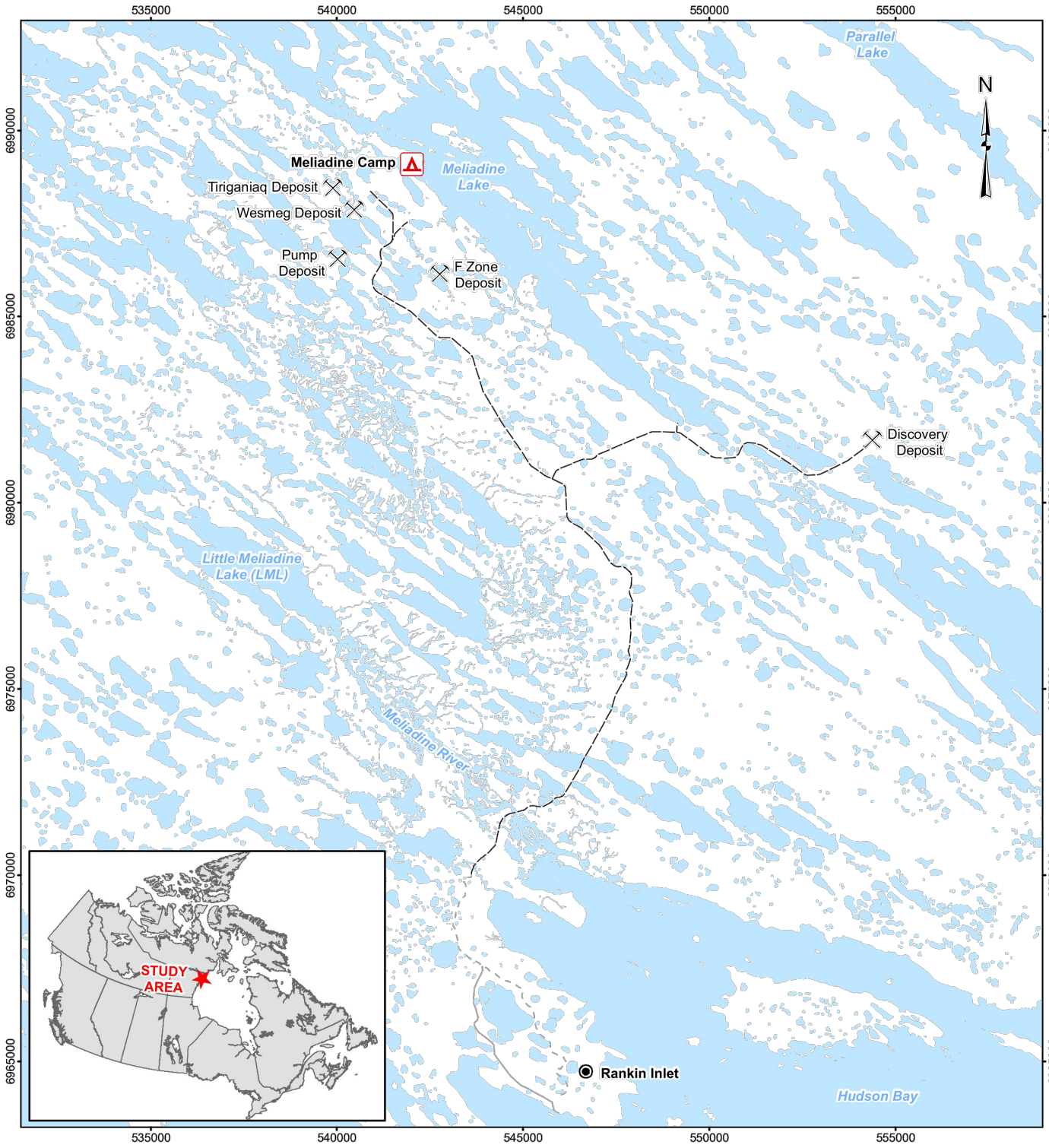
APPENDIX A

Figure 1 – Site Location



LEGEND

- Camp
- Proposed Mine Site
- All-weather Access Road (AWAR)
- Road - New
- Road - Existing
- Watercourse
- Waterbody

AGNICO EAGLE – MELIADINE DIVISION

AGNICO EAGLE

TETRA TECH

AGNICO EAGLE – MELIADINE DIVISION

GENERAL PROJECT LOCATION PLAN

No. PROJET PROJECT No.		DATE	2017-05-04
DESSINÉ PAR DRAWN BY	M. SENNADJ		FEUILLE/SHT 1 / 1
APPROUVÉ PAR APPROVED BY	R. PANAZAN		
NO. DESSIN DRAWING NO.	FIGURE 1		REVISION A

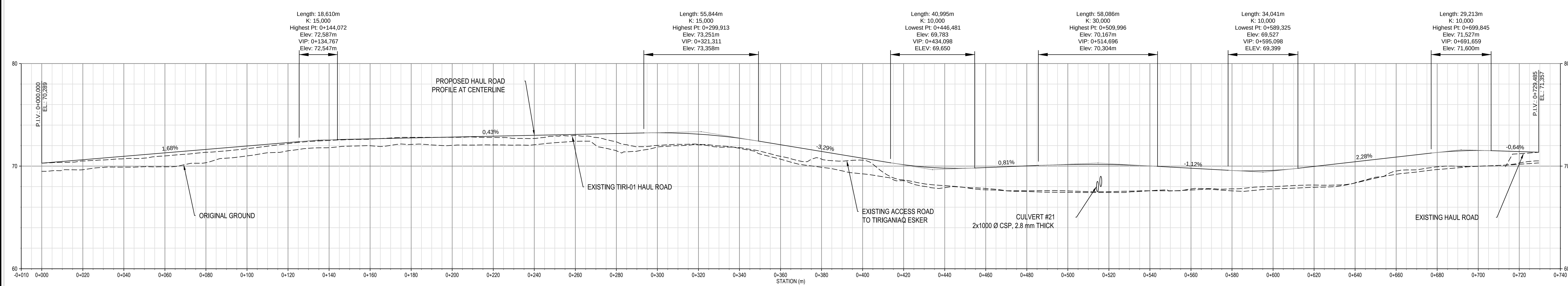
P:\28920\DOC-PROJ\60\60CCL\Infrastructures Josée Alarie\Design Criteria\Culverts\Design Report for culverts 7, 8, 10, 12, 13, 14\Figure 1\Figure 1.dwg FILE NO. .DWG

APPENDIX B

Drawings – Proposed Culvert Location & Details

NO. DESSIN
DRAWING NO. 65-417-230-200TO202_R1_229_R0

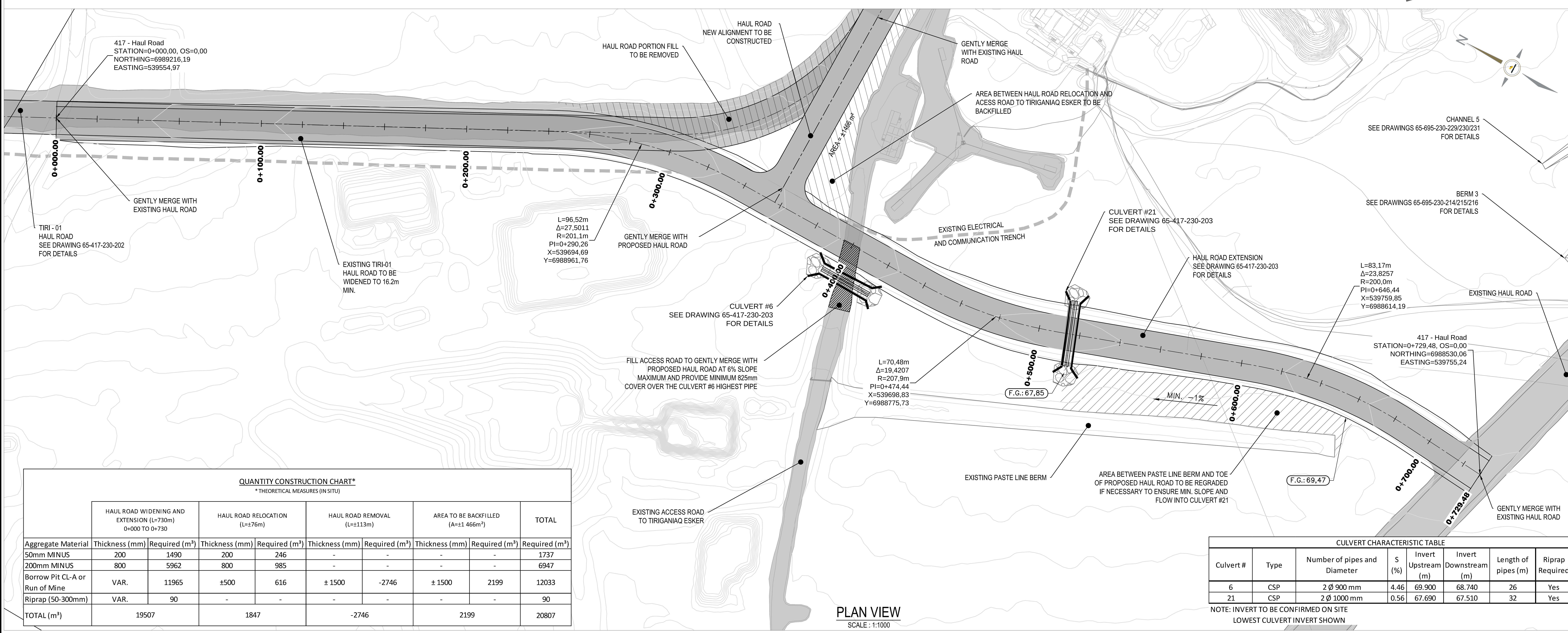
FORMAT ARCHD



PROFILE VIEW

SCALE : 1:250 V - 1:1000 H

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2020-04-21



QUANTITY CONSTRUCTION CHART*
* THEORETICAL MEASURES (IN SITU)

	HAUL ROAD WIDENING AND EXTENSION (L=730m) 0+000 TO 0+730		HAUL ROAD RELOCATION (L=±76m)		HAUL ROAD REMOVAL (L=±113m)		AREA TO BE BACKFILLED (A=±1 466m²)		TOTAL
Aggregate Material	Thickness (mm)	Required (m³)	Thickness (mm)	Required (m³)	Thickness (mm)	Required (m³)	Thickness (mm)	Required (m³)	Required (m³)
50mm MINUS	200	1490	200	246	-	-	-	-	1737
200mm MINUS	800	5962	800	985	-	-	-	-	6947
Borrow Pit CL-A or Run of Mine	VAR.	11965	±500	616	± 1500	-2746	± 1500	2199	12033
Riprap (50-300mm)	VAR.	90	-	-	-	-	-	-	90
TOTAL (m³)	19507		1847		-2746		2199		20807

PLAN VIEW

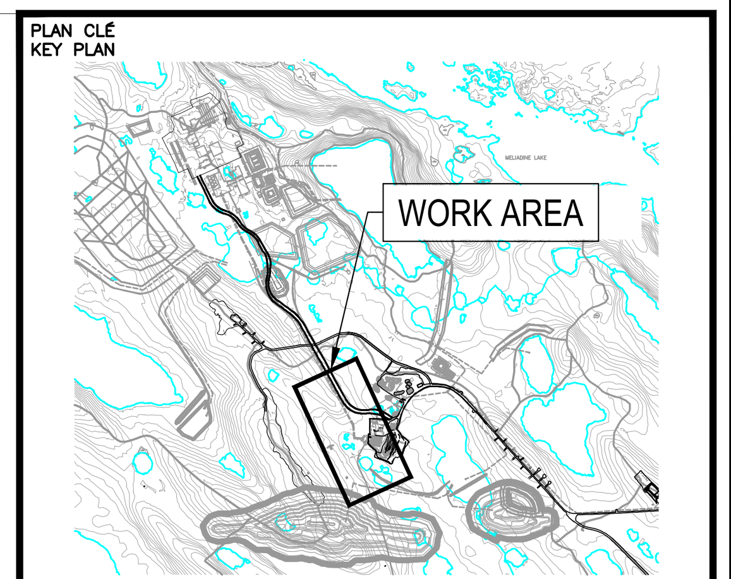
SCALE : 1:1000

CULVERT CHARACTERISTIC TABLE

Culvert #	Type	Number of pipes and Diameter	S (%)	Invert Upstream (m)	Invert Downstream (m)	Length of pipes (m)	Riprap Required
6	CSP	2 Ø 900 mm	4.46	69.900	68.740	26	Yes
21	CSP	2 Ø 1000 mm	0.56	67.690	67.510	32	Yes

NOTE: INVERT TO BE CONFIRMED ON SITE
LOWEST CULVERT INVERT SHOWN

PLAN CLÉ
KEY PLAN



TETRA TECH

NOTES GÉNÉRALES / GENERAL NOTES

GENERAL NOTES:

1. EXISTING GROUND DTM PROVIDED BY AEM.
2. ALL UNITS ARE IN METERS.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY, SECURITY AND SLOPES OF ALL EXCAVATIONS/ BACKFILL AND SHALL ABIDE BY ALL RELEVANT STANDARDS AND REGULATIONS. THE STABILITY, DEWATERING AND MAINTENANCE OF ALL EXCAVATIONS SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
4. GRANULAR MATERIAL SHALL BE PLACED IN LIFTS NOT EXCEEDING 300mm AND COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY. BORROW PIT OR RUN OF MINE MATERIAL SHALL BE PLACED IN LIFTS NOT EXCEEDING 500mm AND COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY. MOISTURE CONDITIONING MAY BE REQUIRED PRIOR TO COMPACTION.
5. CULVERTS ARE PROVIDED BY AEM. CULVERTS WILL BE GALVANIZED CORRUGATED PIPES WITH A PROFILE OF 68x13mm.
6. THE MINIMUM BACKFILL COVER INDICATED IN THE TABLE BELOW SHALL BE RESPECTED AT ALL TIMES.

CULVERT DIAMETER (mm)	GAUGE (mm)	PROFILE (mm)	MIN. COVER (mm)
600	2	68x13	750
700	2	68x13	800
800	2.8	68x13	825
900	2.8	68x13	825
1000	2.8	68x13	850
1200	2.8	68x13	850

7. THE INSTALLATION OF THE CULVERTS SHALL CONFORM TO THE MANUFACTURER`S INSTRUCTIONS.
8. THE MAXIMUM ALLOWABLE SLOPE FOR CULVERTS IS 6%. INSTALL RIPRAP TO FILL THE GAP BETWEEN THE BOTTOM OF THE PIPE AND THE EXISTING GROUND IF REQUIRED.

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
CHANNEL 5 PLAN AND PROFILE	65-695-230-229/230/231
BERM 3 PLAN AND PROFILE	65-695-230-214/215/216
TIRI-01 HAUL ROAD PLAN AND PROFILE	65-417-230-202
ROAD AND CULVERT DETAIL	65-417-230-203
GENERAL ARRANGEMENT	65-000-210-200

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
0	2020-04-21	ISSUED FOR CONSTRUCTION	C.M.	J.A.	
C	2020-04-17	ISSUED FOR COMMENTS	C.M.	J.A.	
B	2020-04-15	ISSUED FOR COMMENTS	C.M.	J.A.	
A	2020-02-07	ISSUED FOR COMMENTS	C.M.	J.A.	

REVISIONS

REGISTERED PROFESSIONAL ENGINEER
J.M.I.F. ALARIE
LICENSEE
NT/NU
20/04/21

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.
D/A TETRA TECH
Signature Josée Alarie, ing.
Date 20/04/21
PERMIT NUMBER: P 1029
NT/NU Association of Professional Engineers and Geoscientists

TITRE / TITLE

AGNICO EAGLE – DIVISION
417 – HAUL ROAD – INDUSTRIAL SITE TO TIRIGANIAK
230 – GENERAL EARTH WORKS
HAUL ROAD EXTENSION
PLAN / PROFILE
0+000 TO 0+729

DESSINÉ PAR / DRAWN BY	CHRISTOPHER MORIN	DATE	2020-02-05
VERIFIÉ PAR / CHECKED BY	JOSEE ALARIE		2020-02-05
APPROUVÉ PAR / APPROVED BY	JOSEE ALARIE		2020-02-05
ÉCHELLE / SCALE	AS SHOWN	DATE	2020-02-05

NO. DESSIN / DRAWING NO. 65-417-230-229

NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6515 / 28920	0	1 / 1

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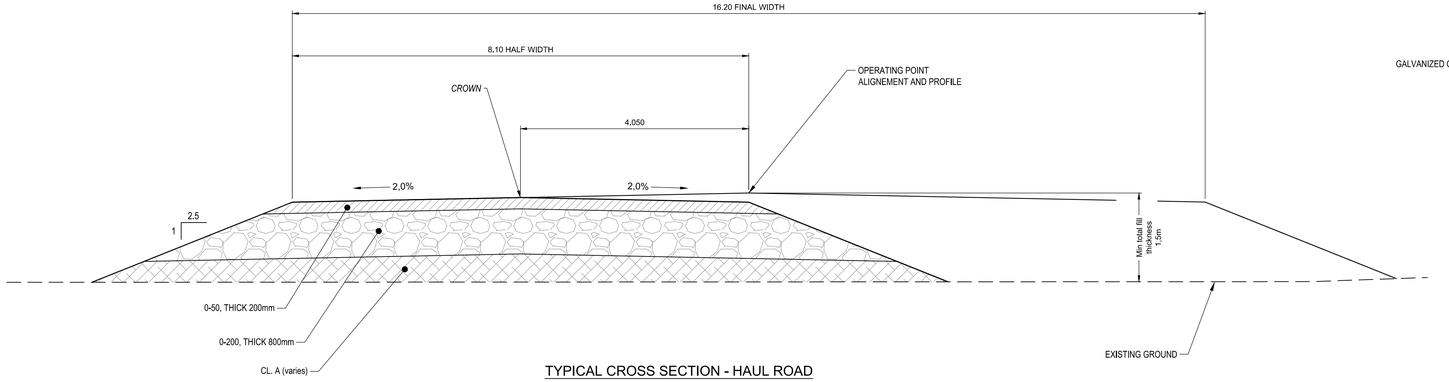
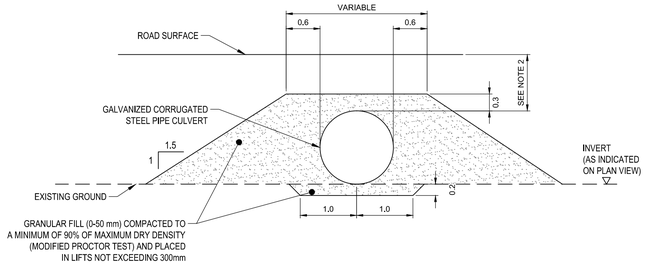


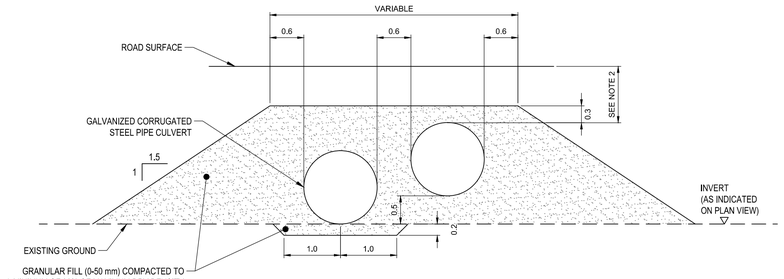
TYPICAL CROSS SECTION - HAUL ROAD

SCALE 1:100



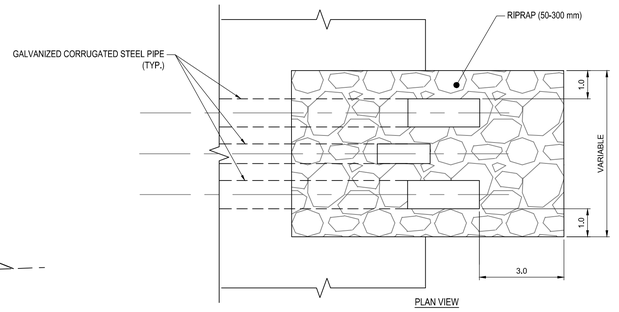
TYPICAL CULVERT DETAIL - CONFIGURATION WITH 1 CULVERT

SCALE 1:50

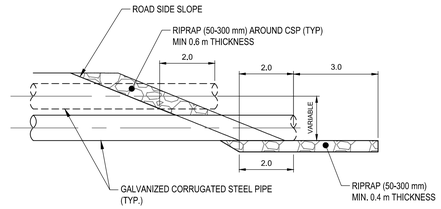


TYPICAL CULVERT DETAIL - CONFIGURATION WITH 2 CULVERTS

SCALE 1:50



PLAN VIEW



CROSS SECTION

TYPICAL DETAIL - CULVERT RIPRAP FOR BOTH INLET AND OUTLET

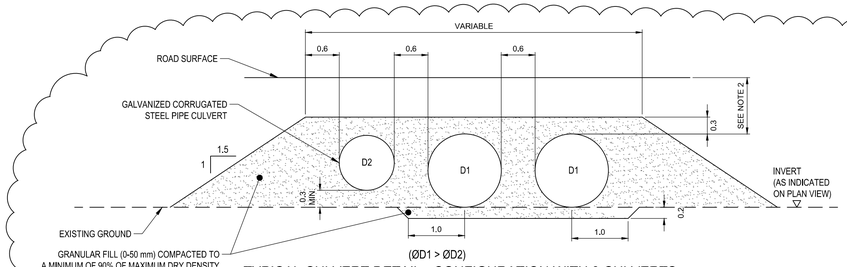
SCALE = N.T.S

Notes:

1. Culverts are provided by AEM. Culverts will be Galvanized Corrugated Pipes, with a profile of 68x13 mm.
2. At any time, the minimum backfill cover indicated in the table below shall be respected.

CULVERT DIAMETER (mm)	GAUGE (mm)	PROFILE (mm)	Min COVER (mm) (required at any time)
600	2	68x13	750
700	2	68x13	800
800	2.8	68x13	825
900	2.8	68x13	825
1000	2.8	68x13	850
1200	2.8	68x13	850

3. The installation of the culverts shall be conform to the Manufacturer instructions.
4. The maximum allowable slope for culverts is 6%. Install RipRap to fill the gap between the pipe bottom and the existing ground if required.



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TYPICAL CULVERT DETAIL - CONFIGURATION WITH 3 CULVERTS

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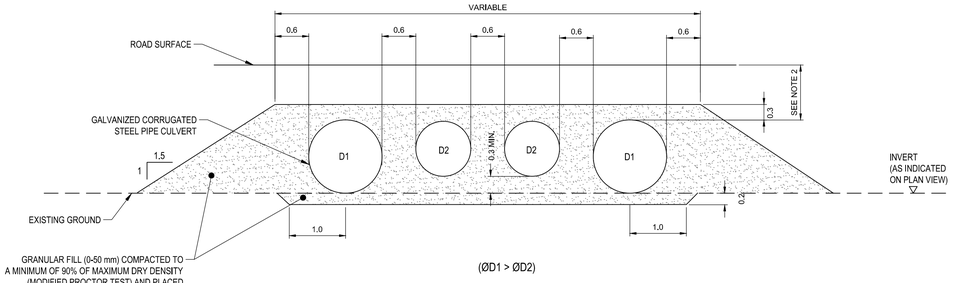

(ØD1 > ØD2)

CULVERT DETAIL - CONFIGURATION WITH 4 CULVERTS TYPE A

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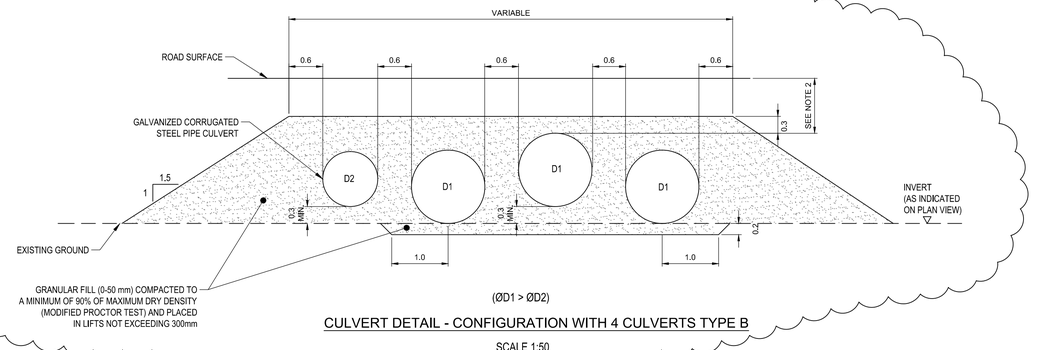

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CULVERT DETAIL - CONFIGURATION WITH 4 CULVERTS TYPE B

SCALE 1:50

PLAN CLÉ
KEY PLAN

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NOTES GÉNÉRALES / GENERAL NOTES

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-09-15

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
3	2017-09-14	ISSUED FOR CONSTRUCTION	M.M.	J.A.	
2	2017-07-28	ISSUED FOR CONSTRUCTION	S.M.	J.A.	
1	2017-02-28	0-50mm AGGREGATE MATERIAL AND CULVERT	M.L.P.	J.A.	
0	2015-10-07	ISSUED FOR CONSTRUCTION	A.B	J.A	
B	2015-09-20	REVISED LAYERS	P.H	J.A.	
A	2015-08-18	PRELIMINARY	P.H.	J.A.	

REVISIONS

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.
O/A TETRA TECH
Signature
Date 2017.09.15
PERMIT NUMBER: P 1029
NT/NU Association of Professional Engineers and Geoscientists
PROFESSIONAL ENGINEER J.M.F. ALARIE LICENSEE
2017-09-15

TITRE / TITLE

AGNICO-EAGLE - DIVISION
417 - HAUL ROAD - INDUSTRIAL SITE TO TIRIGANIAK
230-GENERAL EARTH WORKS
TYPICAL SECTION
HAUL ROAD

DESSINÉ PAR DRAWN BY	PATRICK HAMEL	DATE 2015-08-14
VÉRIFIÉ PAR CHECKED BY	SOLÈNE MOREAU	2015-08-18
APPROUVÉ PAR APPROVED BY	JOSÉE ALARIE	2015-08-18
ÉCHELLE SCALE	1:50	DATE 2015-08-14
NO. DESSIN DRAWING NO.	65-417-230-203	
NO. PROJET PROJECT NO.	6515/28920	REVISION 3 / FEUILLE / SHT

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