DESIGN REPORT FOR CULVERT #15
MELIADINE PROJECT, NUNAVUT

PRESENTED TO
Agnico Eagle Mines Ltd.

JULY 2018
ISSUED FOR USE
TETRA TECH PROJECT NUMBER: 28920
AGNICO EAGLE DOCUMENT NUMBER: 6515-E-132-005-132-REP-018

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APPENDICES

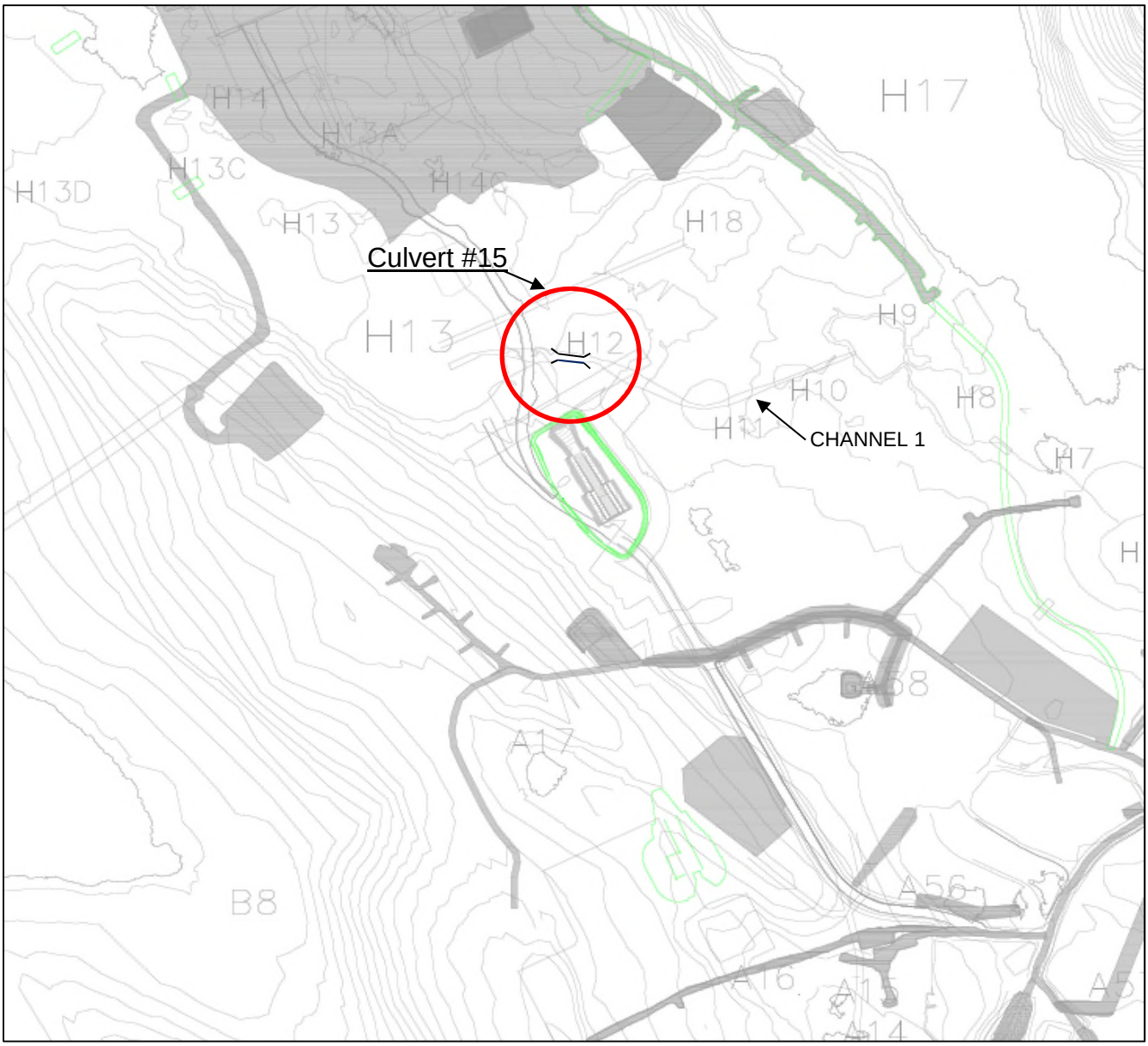
1.0 INTRODUCTION

1.1 Site Location and Access

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Project (the Project), a gold mine located approximately 25 km north of Rankin Inlet, and 80 km southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. The project 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).

Culvert #15 is in the Meliadine Site area, more specifically underneath the ramp access to the Crusher, in the Channel 1 path. See Figure 2 for Culvert #15 location.

Figure 2: Culvert # 15 location



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 are planned to be constructed for the operation of the future 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 2018 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 #15, in addition to construction drawings and specifications of those infrastructures.

2.0 DESIGN

2.1 Culvert Design Basis and Water Management Strategy

The overall objective of the water management strategy of this project 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 on 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 x13 mm and a minimum thickness of 2.8 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 ramp access to the Crusher, a minimum of 850 mm granular fill cover should be placed on top of the Culvert #15 to allow 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 culvert are presented in drawings 65-417-230-224_R2 and 65-417-230-203_R3 provided in Appendix B.

The Table 1 below presents the characteristics of the proposed culvert:

Table 1 : Culvert #15 specifications

Item	Culvert #15
Location	Crusher ramp access
Number of pipes in culvert	4
Length of each culvert (m)	50
Diameter of each culvert (mm)	1 200
Min. Granular fill cover over culvert (m)	0,85
Corrugation profile of each culvert (mm)	68 x 13
Thickness of each culvert (mm)	2,8

According to the proposed configuration, the inverts of the pipes are indicated in Table 2.

Table 2 : Culvert #15 characteristics

Number of pipes and Diameter	S (%)	Highest pipe		Lowest pipe		Length of each pipe (m)
		Invert Upstream (m)	Invert Downstream (m)	Invert Upstream (m)	Invert Downstream (m)	
4 Ø 1200 mm	0,46	66,15	65,93	65,85	65,62	50

2.1.3 Figures and Drawings

Figure 1 in Appendix A presents a general site layout plan, while Figure 2 in section 1 of this report shows the location of Culvert #15. Drawing 65-417-230-224 and 65-417-230-203 provided in Appendix B presents the construction plan view and details for Culvert #15.

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

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.
O/A TETRA TECH
Signature
Date 2018·07·16
PERMIT NUMBER: P 1029
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
J.M.I.F. ALARIE
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2018/07/16

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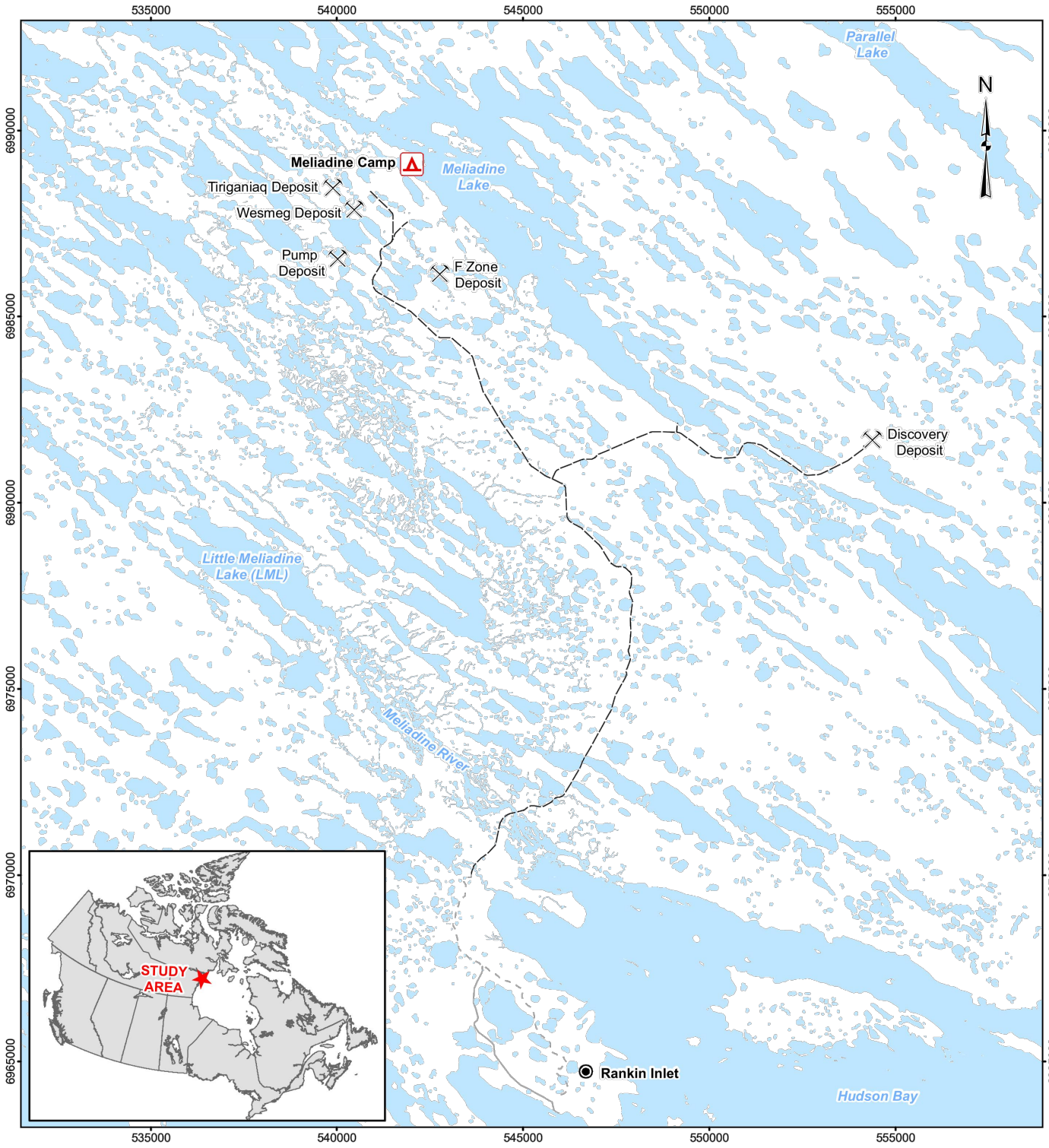
2018·07·16

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

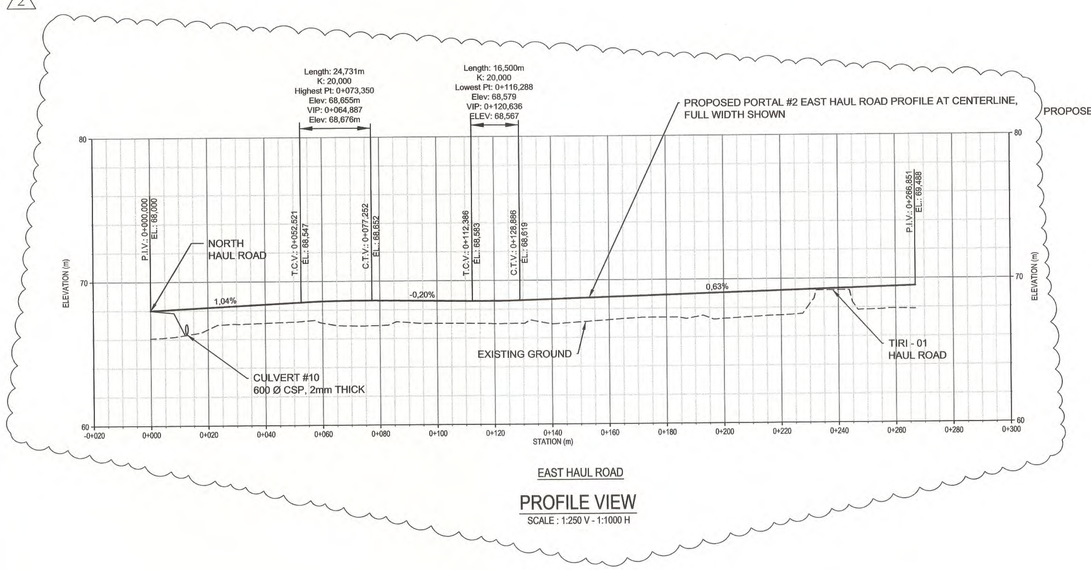
P:\28920\DOC-PROJ\60\60CCL\Infrastructures Josée Alarie\Design Criteria\Culverts\Design Report for culverts 7, 8, 10, 12, 13, 14\Figure 1\Figure 1.dwg FILE NO. .DWG

APPENDIX B

Drawings – Proposed Culvert Location & Details

NO. DESSIN DRAWING NO. 65-417-230-224_R2_RECOVER

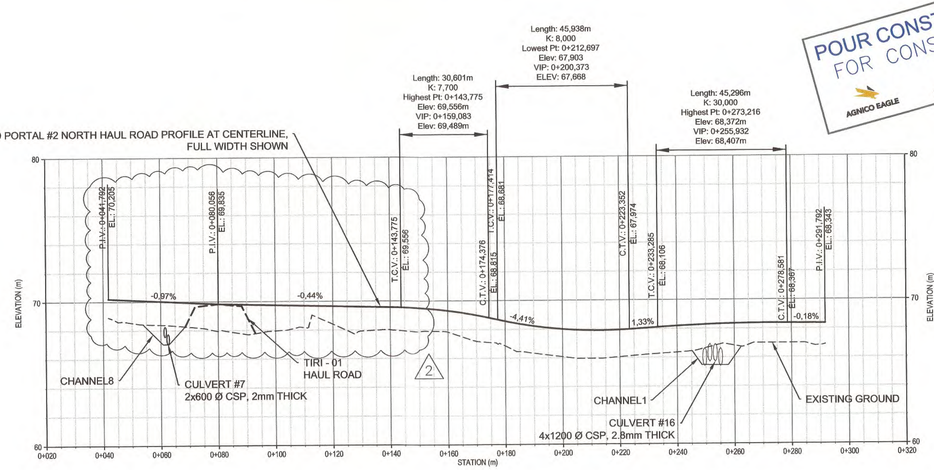
FORMAT ARCHD



EAST HAUL ROAD

PROFILE VIEW

SCALE : 1:250 V - 1:1000 H

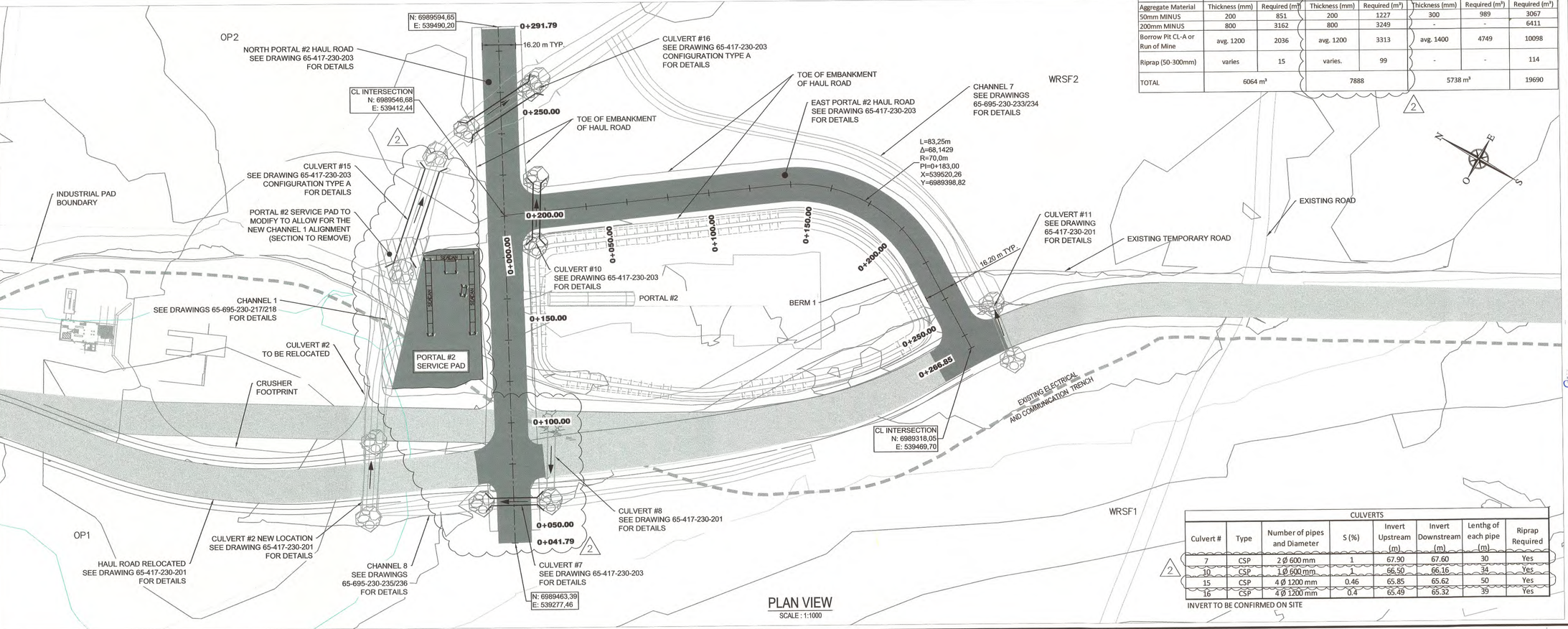


NORTH HAUL ROAD

PROFILE VIEW

SCALE : 1:250 V - 1:1000 H

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2018-07-10



PLAN VIEW

SCALE : 1:1000

QUANTITY CONSTRUCTION CHART*

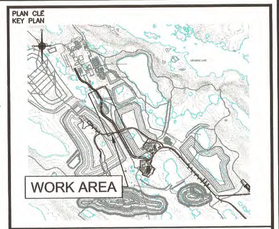
* THEORETICAL MEASURES (IN SITU)

	EAST HAUL ROAD (L: 250m)		NORTH HAUL ROAD (L:244m)		PORTAL #2 SERVICE PAD (50m x 65m)		OVERALL
Aggregate Material	Thickness (mm)	Required (m³)	Thickness (mm)	Required (m³)	Thickness (mm)	Required (m³)	Required (m³)
50mm MINUS	200	851	200	1227	300	989	3067
200mm MINUS	800	3162	800	3249	-	-	6411
Borrow Pit CL-A or Run of Mine	avg. 1200	2036	avg. 1200	3313	avg. 1400	4749	10098
Riprap (50-300mm)	varies	15	varies.	99	-	-	114
TOTAL	6064 m³		7888		5738 m³		19690

CULVERTS

Culvert #	Type	Number of pipes and Diameter	S (%)	Invert Upstream (m)	Invert Downstream (m)	Lenthg of each pipe (m)	Riprap Required
7	CSP	2 Ø 600 mm	1	67.90	67.60	30	Yes
10	CSP	1 Ø 600 mm	1	66.50	66.16	34	Yes
15	CSP	4 Ø 1200 mm	0.46	65.85	65.62	50	Yes
16	CSP	4 Ø 1200 mm	0.4	65.49	65.32	39	Yes

INVERT TO BE CONFIRMED ON SITE



TETRA TECH

NOTES GÉNÉRALES / GENERAL NOTES

NOTES:
1. EXISTING GROUND DTM PROVIDED BY AEM.
2. ALL UNITS ARE IN METERS.
3. GRANULAR MATERIAL SHALL BE PLACED IN LIFT NOT EXCEEDING 300mm AND COMPACTED AS INDICTED. BORROW PIT MATERIAL OR RUN OF MINE MATERIAL SHALL BE PLACED IN LIFTS NOT EXCEEDING 900mm AND COMPACTED TO A MIN. OF 95% OF MAXIMUM DRY DENSITY. MOISTURE CONDITIONING MAY BE REQUIRED PRIOR TO COMPACTION
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY SECURITY AND SLOPE OF ALL EXCAVATIONS, BACKFILL AND SHALL ABIDE BY ALL RELEVANT STANDARDS AND REGULATIONS. THE STABILITY, DEWATERING AND MAINTENANCE OF ALL EXCAVATIONS OR BACKFILL SHALL BE CONTRACTOR'S RESPONSIBILITY.
5. TYPICAL FILL SLOPE TO BE 1V:2.5H. FILL SLOPE TO BE CONFIRMED IN THE FILED BY GEOTECHNICAL ENGINEER.
6. THE LOCATION ELEVATION AND LENGTH OF CULVERT GROUP SHALL BE CONFIRMED ON SITE.
7. FOR SUMMER CONSTRUCTION GEOTEXTILE SHALL BE INSTALLED BETWEEN THE ORIGINAL GROUND AND THE GRANULAR MATERIAL WHEREVER THE ORIGINAL GROUND IS UNSTABLE TO SUPPORT FILL MATERIAL COMPACTION.
8. INVERTS OF THE LOWER CULVERT PIPES ARE INDICATED IN THE CULVERTS TABLE.

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
2	2018-07-10	ISSUED FOR CONSTRUCTION	C.M.	J.A.	
1	2017-09-15	ISSUED FOR CONSTRUCTION	C.M.	J.A.	
0	2017-07-28	ISSUED FOR CONSTRUCTION	C.M.	J.A.	
A	2017-06-09	ISSUED FOR COMMENTS	M.S.	J.A.	

REVISIONS

J.M.I.F. ALARIE LICENCE NT/NU 14014 2018-07-10

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.
O/A TETRA TECH
Signature
Date 2018-07-10
PERMIT NUMBER: P 1029
NT/NU Association of Professional Engineers and Geoscientists

TITRE / TITLE

AGNICO EAGLE – DIVISION
417 – HAUL ROAD – INDUSTRIAL SITE
230 – GENERAL EARTH WORKS
NORTH & EAST PORTAL#2 HAUL ROAD
PLAN / PROFILE

DESSINÉ PAR DRAWN BY	MOURAD SENNADJ	DATE 2017-06-09
VERIFIÉ PAR CHECKED BY	CHRISTOPHER MORIN	2017-06-09
APPROUVÉ PAR APPROVED BY	ALARIE JOSEE	2017-06-09
ÉCHELLE SCALE	AS SHOWN	DATE 2017-06-09
NO. DESSIN DRAWING NO.	65-417-230-224	
NO. PROJET PROJECT NO.	6515 / 28920	REVISION 2 / FEUILLE / SHT 1 / 1

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NO. DESSIN DRAWING NO. 65-417-230-203_R3

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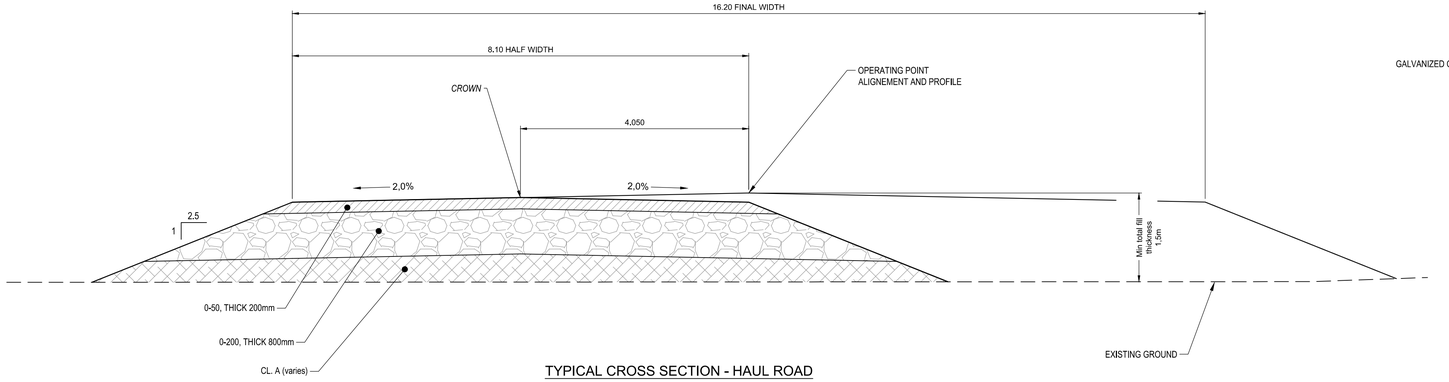
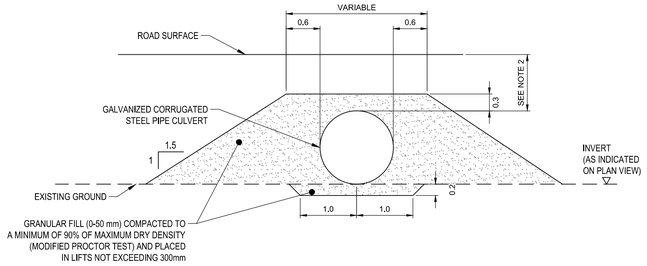


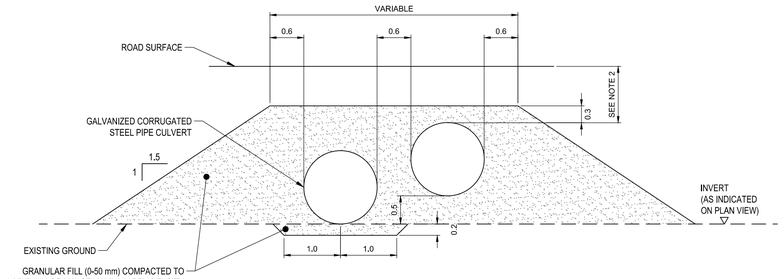
TYPICAL CROSS SECTION - HAUL ROAD

SCALE 1:100



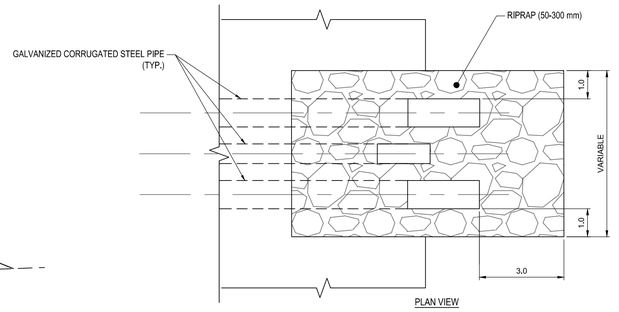
TYPICAL CULVERT DETAIL - CONFIGURATION WITH 1 CULVERT

SCALE 1:50

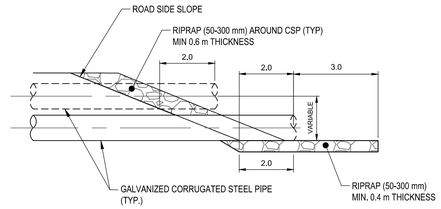


TYPICAL CULVERT DETAIL - CONFIGURATION WITH 2 CULVERTS

SCALE 1:50



PLAN VIEW



CROSS SECTION

TYPICAL DETAIL - CULVERT RIPRAP FOR BOTH INLET AND OUTLET

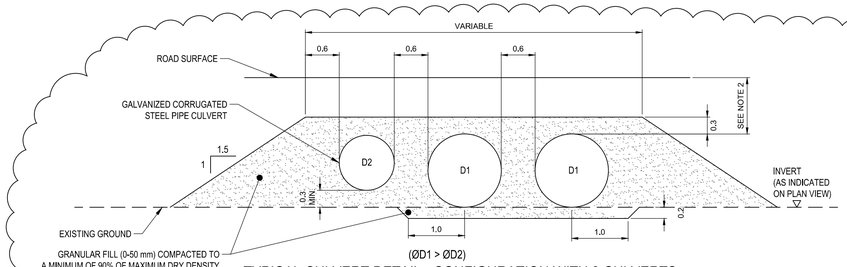
SCALE = N.T.S

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

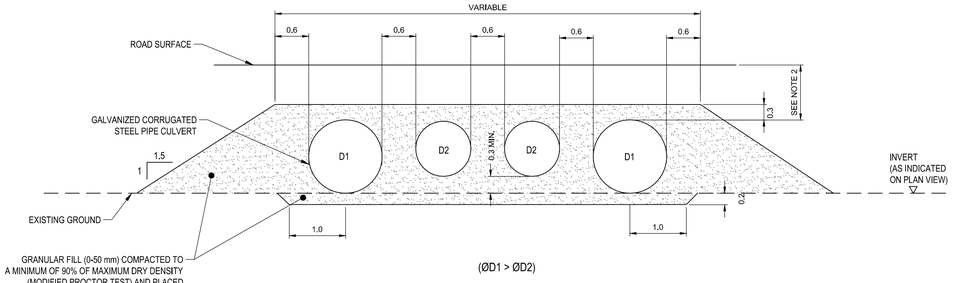
3. The installation of the culverts shall be conform to the Manufacturer instructions.
4. The maximum allowable slope for culverts is 6%. Install RipRap to fill the gap between the pipe bottom and the existing ground if required.



(ØD1 > ØD2)

TYPICAL CULVERT DETAIL - CONFIGURATION WITH 3 CULVERTS

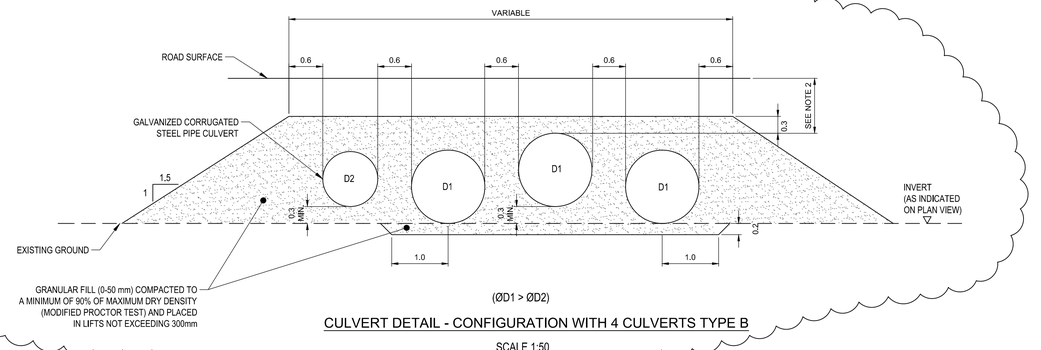
SCALE 1:50



(ØD1 > ØD2)

CULVERT DETAIL - CONFIGURATION WITH 4 CULVERTS TYPE A

SCALE 1:50



(ØD1 > ØD2)

CULVERT DETAIL - CONFIGURATION WITH 4 CULVERTS TYPE B

SCALE 1:50

PLAN CLÉ
KEY PLAN

TETRA TECH

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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