

CONSTRUCTION SUMMARY (AS-BUILT) REPORT FOR CULVERTS #6 AND #21 MELIADINE MINE, NUNAVUT



PRESENTED TO
Agnico Eagle Mines Ltd.

SEPTEMBER 2020
ISSUED FOR USE
TETRA TECH PROJECT NUMBER: 28920
AGNICO EAGLE DOCUMENT NUMBER: 6526-695-230-REP-003

EXECUTIVE SUMMARY

Tetra Tech was retained by Agnico Eagle Mines Limited (Agnico Eagle) to conduct a detailed design of the civil works and the water management infrastructures at the Meliadine Gold Mine, Nunavut. As a part of this mandate, Tetra Tech designed the Culverts #6 and #21. Tetra Tech previously prepared the design report for these water management infrastructures (Agnico Eagle N° 6526-695-230-REP-001).

Agnico Eagle requested Tetra Tech to complete on their behalf the following as-built construction summary report. It should be noted that Tetra Tech was not involved, nor was on site, during the construction activities for these water management infrastructures. Accordingly, all the construction, quality assurance, and commissioning activities associated with the aforementioned infrastructure was managed by Agnico Eagle and their subcontractors. As such, Tetra Tech has presented the construction data as supplied by Agnico Eagle and therefore Tetra Tech cannot accept any responsibility for the accuracy of any of the data supplied.

The construction for the aforementioned culverts was conducted between June 9th and June 16th, 2020.

This report summarizes the construction as-built information for Culvert #6 and #21 for the Meliadine Gold Mine.

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	SUMMARY OF THE CONSTRUCTION	2
2.1	Culvert Locations	2
2.2	Construction Schedule.....	3
2.3	Culvert Characteristics.....	3
2.4	Drawings and Photographs	4
3.0	DOCUMENTATION ON FIELD DECISIONS THAT DEVIATED FROM ORIGINAL DESIGN.....	4
3.1	Culverts #6 and #21	4
4.0	CONSTRUCTION MONITORING.....	5
5.0	LIMITATIONS OF REPORT	5
6.0	CLOSURE.....	6

APPENDICES

Appendix A	As-built drawings
Appendix B	Survey drawings
Appendix C	Photographs
Appendix D	Construction Summary Report of Culverts #6 and #21
Appendix E	Particle Size Summary - 50 mm minus granular material

1.0 INTRODUCTION

Agnico Eagle Mines Limited (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 Meliadine Mine, a gold mine located approximately 25 km north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut.

Tetra Tech previously prepared the design report for Culverts #6 and #21. 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 design and construction summary reports of the culverts.

As required by the Water Licence A (No. 2AM-MEL1631), this report summarizes the construction work of those water management infrastructures. Included in this report is:

- A summary of the characteristics of Culverts #6 and #21.
- Documentation on field decisions that deviate from original plans.
- As-built drawings.
- Survey drawings.
- Photographs.
- Construction Summary Report of Culverts #6 and #21.
- Particle Size Summary for 50 mm minus granular material from Run of Mine (ROM) sources.

2.2 Construction Schedule

The construction work for Culvert #6 and #21 was completed according to the following milestones, shown in Table 2.1 below:

Table 2.1: Culverts #6 and #21 Milestone Dates

Item	Date of Completion
Culvert #21 Start	June 9 th , 2020
Culvert #21 Completion	June 11 th , 2020
Culvert #6 Start	June 15 th , 2020
Culvert #6 Completion	June 16 th , 2020

2.3 Culvert Characteristics

The characteristics of Culverts #6 and #21 and as-built in-place quantities are presented in Tables 2.2 and 2.3 respectively.

Table 2.2: Culvert #6 and #21 As-built Characteristics

Item	Culvert #6	Culvert #21
Number of Pipes and Diameter	2 ø 1000 mm	2 ø 1000 mm
Slope Gradient (%)	2.00 / 2.05	0.62 / 0.83
Invert Upstream (m)	70.559 / 70.063	67.380 / 67.932
Invert Downstream (m)	69.958 / 69.449	67.173 / 67.682
Length of Each Pipe (m)	30.00 / 29.90	33.32 / 30.04
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)	3.700	2.220

Table 2.3: Culvert #6 and #21 As-built Material Quantities

Material Quantities		
Item	Culvert #6	Culvert #21
Granular Fill 0-50 mm (m ³)	8	17
Esker Sand	11	-
Rip rap Fill Volume (m ³)	45	45

2.4 Drawings and Photographs

As-built drawings are presented in Appendix A.

Survey drawings conducted during and after the construction of the Culverts #6 and #21 can be found in Appendix B.

Photographs of Culvert #6 and #21 during construction are shown in Appendix C.

3.0 DOCUMENTATION ON FIELD DECISIONS THAT DEVIATED FROM ORIGINAL DESIGN

This section documents variations from original design which were approved by the designer and/or the field engineer on site. The changes listed herein do not affect the original water management strategy. The structures designed intent were not compromised with any of the changes to the original design.

A construction summary was prepared for Culverts #6 and #21 by the Agnico Eagle construction team. This summary is available in Appendix D.

3.1 Culverts #6 and #21

The following Table 3.1 presents the changes between the design and the as-built for the culverts.

Table 3.1: Culvert #6 and #21 Design vs. As-built Characteristics

Culverts	Design					As-built				
	Number of Pipes and Diameter (mm)	Slope (%)	Length of Each Pipe (m)	Estimated Peak flow (m ³ /s)	Culvert Flow Capacity (m ³ /s)	Number of Pipes and Diameter (mm)	Slope (%)	Length of Each Pipe (m)	Estimated Peak flow (m ³ /s)	Culvert Flow Capacity (m ³ /s)
#6	2 x 900	4.46	26	0.685	4.142	2 x 1 000	2.03	30	0.685	3.700
#21	2 x 1 000	0.56	32	0.748	1.944	2 x 1 000	0.73	30	0.748	2.220

The culverts are different from the original design on the following points:

- Culvert #6 location was moved 40 meters towards the west to better suit with the on-site natural lower point.
- Culvert #21 location was moved 10 meters towards the north to better suit with the on-site natural lower point.
- Culvert #6 was changed from 2 x 900 mm to 2 x 1000 mm culverts due to a shortage of smaller diameter pipes on site.
- The lengths and slope gradients for both culverts were field fitted to match the natural ground slope.
- Esker sand was used in place of 50 mm minus as bedding for Culvert #6.

In all cases, the as-built culvert flow capacity is greater than the estimated peak flow, which is compliant with the designed intent.

4.0 CONSTRUCTION MONITORING

The construction monitoring was managed by Agnico Eagle. The performance of the culverts should be monitored frequently, particularly during freshet flows. Monitoring should include inspection of the culverts to note any signs of instability and also any culvert jacking or ice-plugging.

5.0 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. Tetra Tech accepts no responsibility for losses, claims, expenses or damages, if any, suffered by a third party as a result of any decisions made or actions based on this report. Use of this report is subject to the terms and conditions stated in Tetra Tech's Services Agreement.

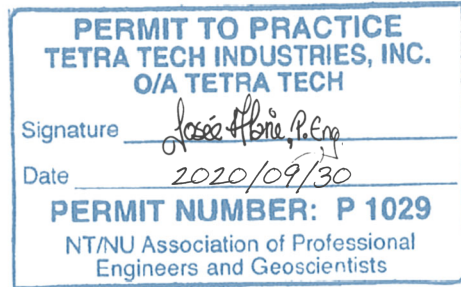
While it is believed that the information contained herein is reliable under the conditions and subject to the limitations set forth in the report, this report is based on information not within the control of Tetra Tech, nor has said information been verified by Tetra Tech, and Tetra Tech therefore cannot and does not guarantee its sufficiency and accuracy. The comments in the report reflect Tetra Tech's best judgment in light of the information available to it at the time of preparation.


Use of this Document acknowledges acceptance of the foregoing conditions.

6.0 CLOSURE

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

Respectfully submitted,
Tetra Tech



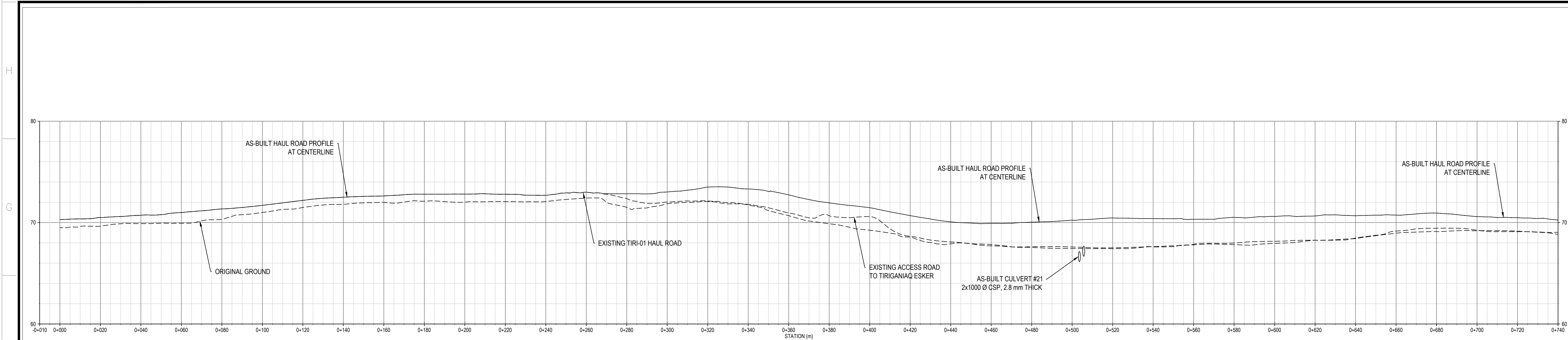
Prepared by: 
Christopher Morin, P. Eng.
Direct Line: 438-469-3503
Christopher.Morin@tetrattech.com

Reviewed by: 
Josée Alarie, P. Eng.
Direct Line: 438-469-3370
Josee.Alarie@tetrattech.com

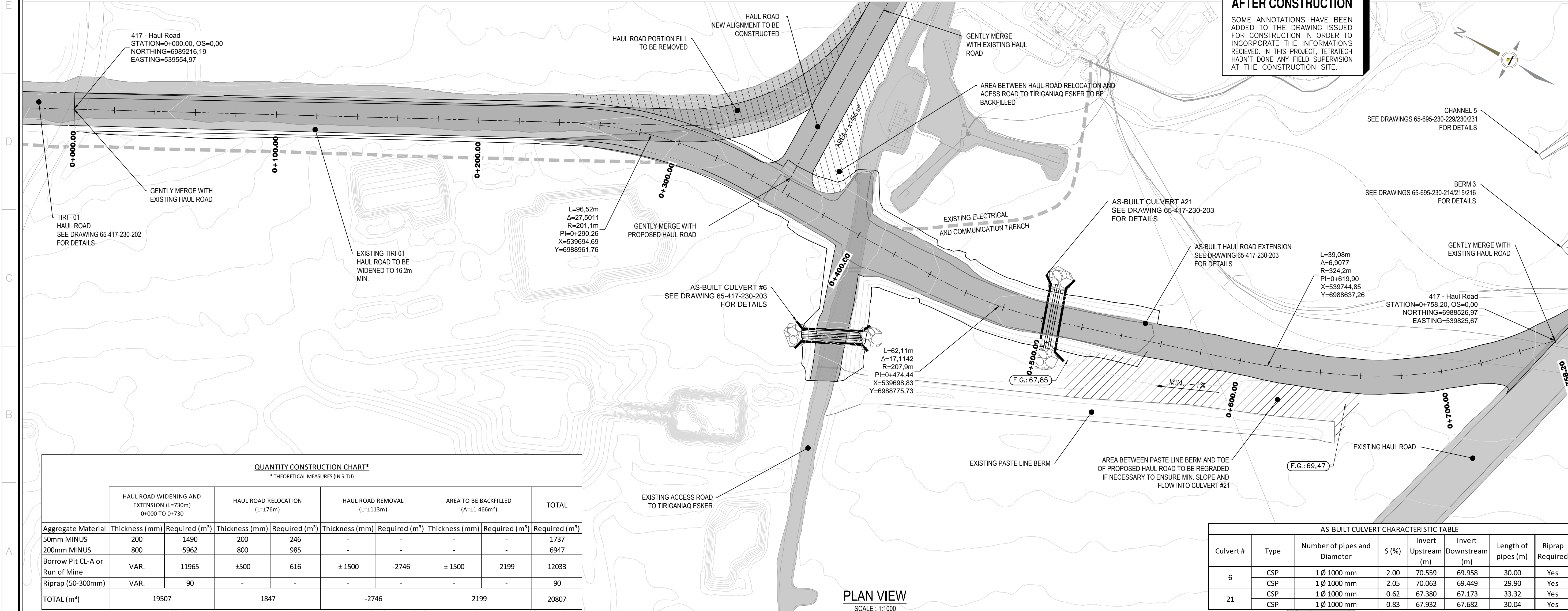


APPENDIX A

As-built drawings



PROFILE VIEW
SCALE : 1:250 V - 1:1000 H

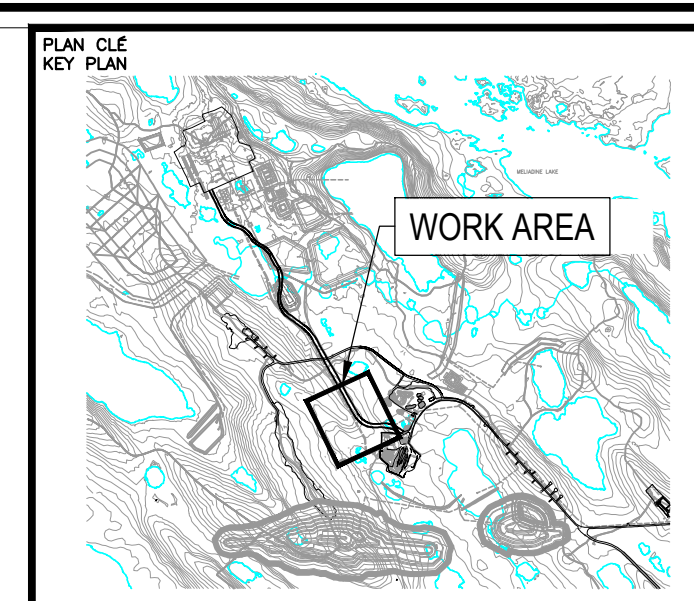


PLAN VIEW
SCALE : 1:1000

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

AS-BUILT 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	1 Ø 1000 mm	2.00	70.559	69.958	30.00	Yes
	CSP	1 Ø 1000 mm	2.05	70.063	69.449	29.90	Yes
21	CSP	1 Ø 1000 mm	0.62	67.380	67.173	33.32	Yes
	CSP	1 Ø 1000 mm	0.83	67.932	67.682	30.04	Yes



NOTES GÉNÉRALES / GENERAL NOTES

- GENERAL NOTES:
- EXISTING GROUND DTM PROVIDED BY AEM.
 - ALL UNITS ARE IN METERS.
 - 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.
 - 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 CONDITIONINGS MAY BE REQUIRED PRIOR TO COMPACTION.
 - CULVERTS ARE PROVIDED BY AEM. CULVERTS WILL BE GALVANIZED CORRUGATED PIPES WITH A PROFILE OF 68x13mm.
 - THE MINIMUM BACKFILL COVER INDICATED IN THE TABLE BELOW SHALL BE RESPECTED AT ALL TIMES.
 - THE INSTALLATION OF THE CULVERTS SHALL CONFORM TO THE MANUFACTURER'S INSTRUCTIONS.
 - 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.

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

TETRA TECH

FINAL ISSUE
AFTER CONSTRUCTION

SOME ANNOTATIONS HAVE BEEN ADDED TO THE DRAWING ISSUED FOR CONSTRUCTION IN ORDER TO INCORPORATE THE INFORMATIONS RECEIVED. IN THIS PROJECT, TETRA TECH HADN'T DONE ANY FIELD SUPERVISION AT THE CONSTRUCTION SITE.

TEL QUE CONSTRUIT
AS BUILT

AGNICO EAGLE

DATE : 2020-09-29

L'INFORMATION QU'ON VOUS PRESENTE EST LA PROPRIÉTÉ DE AGNICO EAGLE. L'ÉTAT ET L'ÉTAT DES DROITS DE PROPRIÉTÉ SONT GARANTIS. AGNICO EAGLE S'OPPOSE À TOUTE REPRODUCTION NON AUTORISÉE DE CE DOCUMENT. AGNICO EAGLE S'OPPOSE À TOUTE REPRODUCTION NON AUTORISÉE DE CE DOCUMENT. AGNICO EAGLE S'OPPOSE À TOUTE REPRODUCTION NON AUTORISÉE DE CE DOCUMENT.

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS		
TITLE / TITRE	#	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	



REV.	DATE	DESCRIPTION	PAR/REV	APP.	CLIENT
2	2020-09-29	ISSUED AS-BUILT	C.M.	J.A.	
1	2020-09-18	ISSUED AS-BUILT	C.M.	J.A.	
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.	

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.
OIA TETRA TECH

Signature: *[Signature]*
Date: 2020-09-29

PERMIT NUMBER: P 1029
NTNU Association of Professional Engineers and Geoscientists

TITRE / TITLE	
AGNICO EAGLE - DIVISION 417 - HAUL ROAD - INDUSTRIAL SITE TO TIRIGANIAQ 230 - GENERAL EARTH WORKS HAUL ROAD EXTENSION PLAN / PROFILE 0+000 TO 0+729	

DESSINÉ PAR DRAWN BY	CHRISTOPHER MORIN	DATE 2020-02-05
VÉRIFIÉ PAR CHECKED BY	JOSEÉ ALARIE	2020-02-05
APPROUVÉ PAR APPROVED BY	JOSEÉ 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 / SH	
			2		1 / 1	

APPENDIX B

Survey Drawings

CULVERT #06

Start Invert: 70.559

Start Invert: 70.063

CSP dia:1000mm
L: 29.90m
Slope: 2.05%

Paste Plant
Service Road

CSP dia:1000mm
L: 30.00m
Slope: 2.00%

End Invert: 69.449

End Invert: 69.958



AGNICO

Date des travaux : 2020-06

Date d'envoi : 2020-07-07

Système de Coord.:
NAD83 UTM15

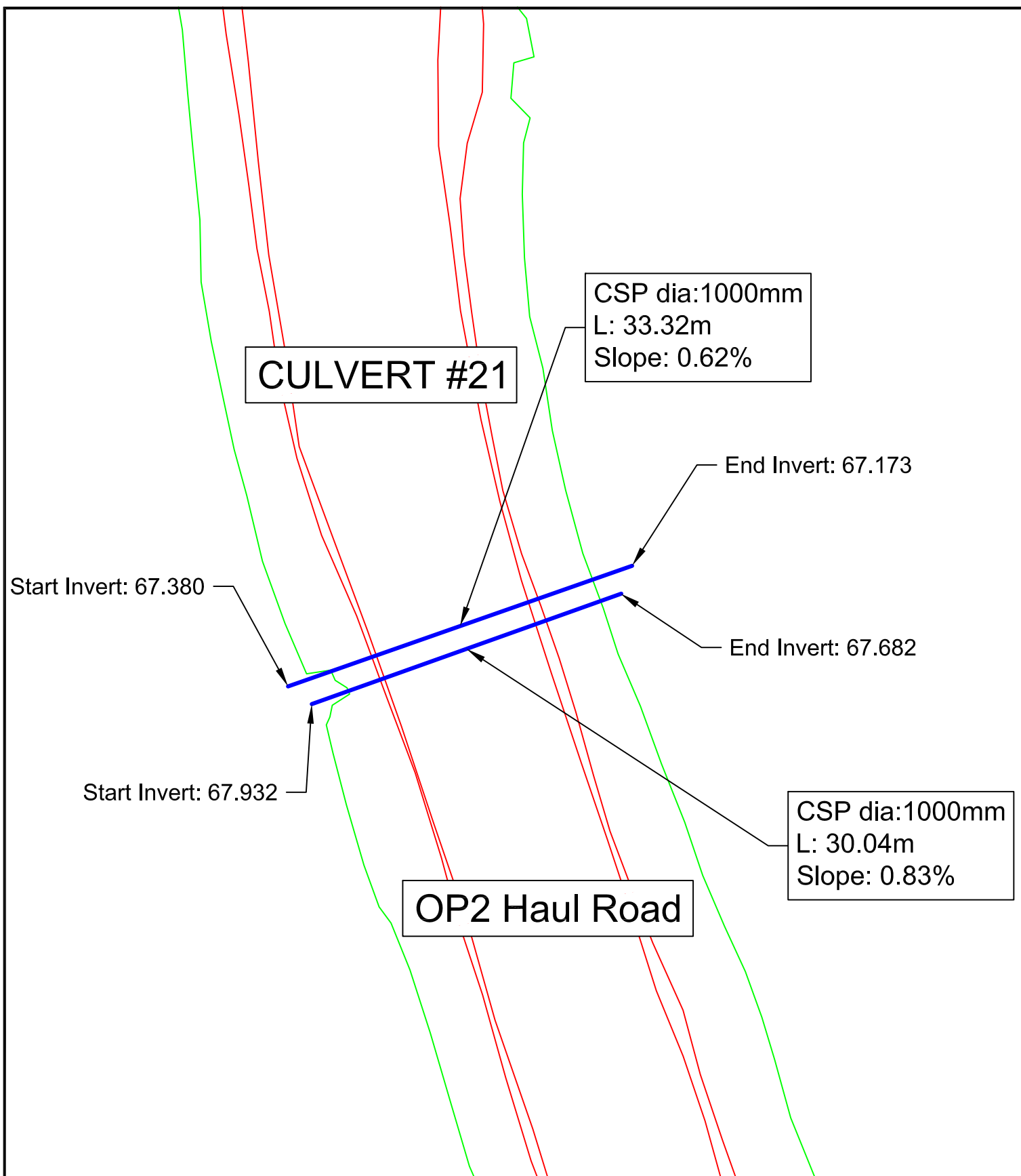
AB CULVERT #06

Dessine par:
JF Landreville

Echelle:
n. t. s.

No plan:
65-695-142-RO_ABD CULVERT 6 & 21 (OP2 Haul Road)

Approuve par:
Hamel Arp.



AGNICO

Système de Coord.:
NAD83 UTM15

Echelle:
n. t. s.

Date des travaux : *2020-06*

AB CULVERT #06

No plan:
65-695-142-RO_ABD CULVERT 6 & 21 (OP2 Haul Road)

Date d'envoi : *2020-07-07*

Dessine par:
JF Landreville

Approuve par:
Hamel Arp.

APPENDIX C

Photographs

2020-06-09
Culvert #6 Downstream



2020-06-09
Culvert #6 Upstream



2020-06-09
Culvert #21
Excavation through haul road



2020-06-11
Culvert #21
Coffer dam and bedding installation



2020-06-11
Culvert #21
Culvert installation



APPENDIX D

Construction Summary Report of Culverts #6 and #21

CONSTRUCTION SUMMARY – WATER MANAGEMENT OP2 HAUL ROAD

(CULVERT 6, CULVERT 21)

- Construction management and quality assurance performed by AEM Construction
- Contractor: Kiviliq Contractors Group
- All survey conducted by Hamel Arpentage

Culverts 6 and 21

- Dates and installation details of the culvert systems are provided in the following table:

Culvert System	Location	Date of Installation		Diameter (mm)	Length (m)	No. of Culverts	Avg. Slope (%)
		Start Date	End Date				
C6	Paste Plant Service Road	June 15, 2020	June 16, 2020	1000	30	2	2.03
C21	OP2 Haul Road	June 9, 2020	June 11, 2020	1000	30	2	0.73

1. Design Adjustments

- Larger diameter culverts were used for culvert system C6 due to on site material availability. The slope gradient was also reduced as a field fit with the terrain.
- Culvert system C21 was generally installed as per design.

2. Site Preparation

- Where required (C21), temporary cofferdams were constructed on the upstream prior to culvert installation.

3. Excavation

- Both culvert systems were installed through roadways and required excavation of the road material. This excavation was accomplished by free-digging with excavators or rock hammer.

4. Culvert Placement and Backfill

- 50 mm minus (C21) or esker sand (C6) bedding was placed under the culverts in controlled lifts and compacted.
- Culvert sections were lowered into place with an excavator and connected.
- Additional bedding material was then placed between and over the culverts in controlled lifts by the excavator, spread with rakes and compacted with hand tampers. All placement occurred to the satisfaction of AEM Construction.

5. Rip Rap Placement and Finishing

- Roadways were sloped prior to rip rap placement with an excavator. Rip rap (select 600 mm minus ROM) was then placed on the upstream and downstream of all culvert systems with an excavator and bucket tamped into place.
- Any temporary cofferdams were removed and remaining debris cleared.

Equipment Used for Construction:

- CAT 349 Excavator
- CAT 349 with rock hammer
- CAT 10t vibratory compactor
- 40 ton Haul Trucks
- WA-470 Loader
- Walk-behind plate tampers

QA/QC Summary:

- All earthworks material not subject to particle size analysis (culvert rip rap) was visually assessed as satisfactory for placement by AEM Construction.
- Granular material was placed according to the Technical Specifications for Civil Earthworks Revision 3 (6515-GNS-014, June 6, 2017). Compaction efforts of culvert bedding material occurred with small hand tampers and was conducted to the satisfaction of AEM Construction.
- Particle size analysis conducted on the 50 mm minus culvert bedding material (attached) indicate that the material generally falls within specification for 50 mm minus granular material (Technical Specifications for Civil Earthworks Rev 3 (6515-GNS-014, June 6, 2017)).

APPENDIX E

Particle Size Summary

50 mm minus Granular Material

50 mm Minus- ROM Meliadine

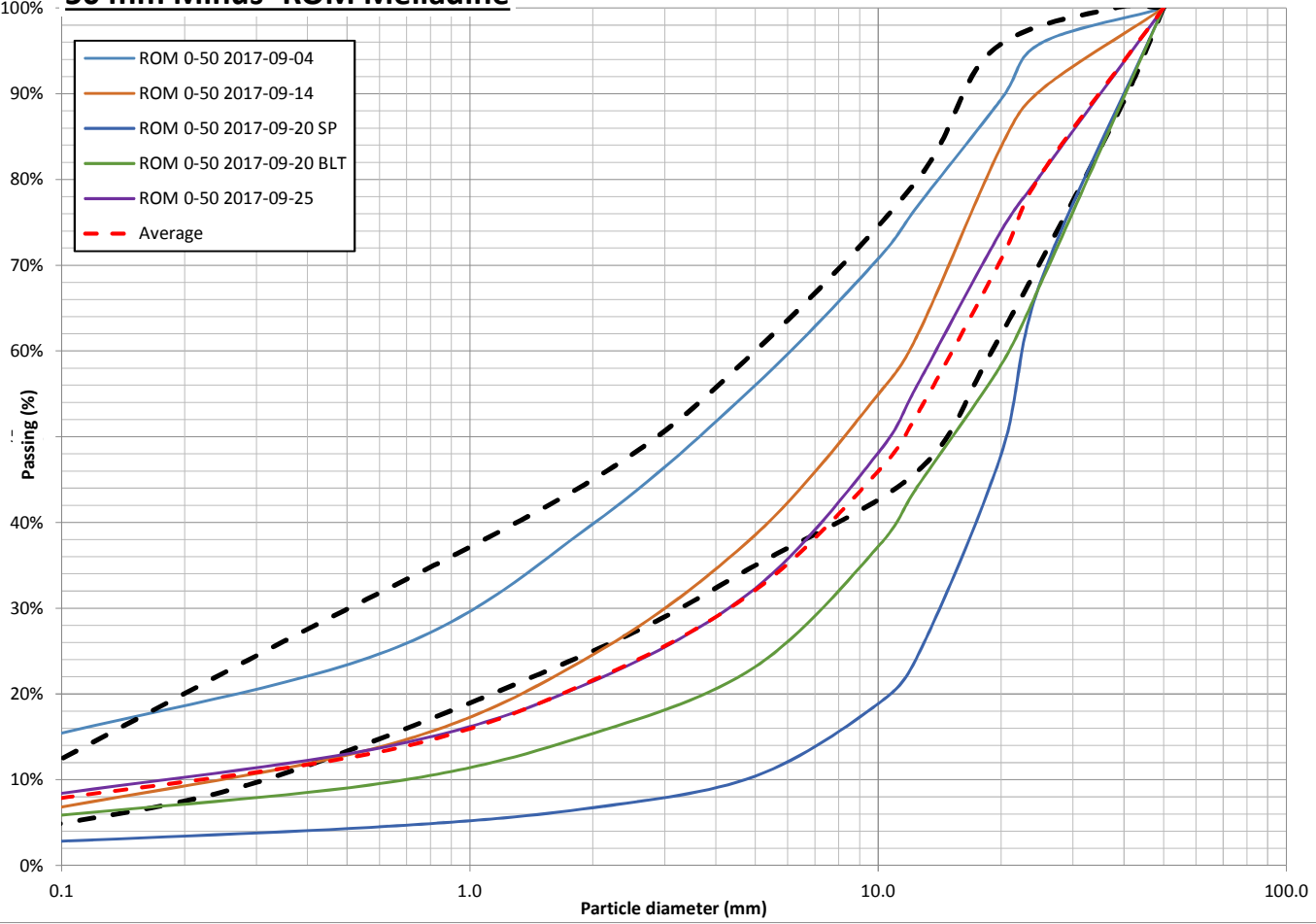


Table 1: Summary of Particle Size Analysis Results - 50 mm minus ROM Meliadine

No.	Sample ID	Sieve Size (mm)									Moisture Content
		50.00	25.00	20.00	12.50	10.00	5.00	2.00	0.63	0.08	
1	ROM 0-50 2017-09-04	100.0%	95.9%	89.4%	76.9%	70.8%	56.0%	39.8%	25.0%	14.3%	4.6%
2	ROM 0-50 2017-09-14	100.0%	90.4%	83.8%	61.9%	54.9%	38.6%	24.6%	14.1%	6.0%	5.1%
3	ROM 0-50 2017-09-20 SP	100.0%	68.1%	47.9%	24.4%	18.9%	10.4%	6.7%	4.6%	2.6%	1.0%
4	ROM 0-50 2017-09-20 BLT	100.0%	67.8%	58.4%	44.2%	37.2%	23.2%	15.4%	9.7%	5.4%	2.3%
5	ROM 0-50 2017-09-25	100.0%	80.5%	74.0%	56.1%	48.1%	32.3%	21.5%	13.9%	7.8%	2.5%
Average		100.0%	80.5%	70.7%	52.7%	46.0%	32.1%	21.6%	13.5%	7.2%	3.1%