August 29, 2016

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

Mine Haul Road
Drainage Improvement Project
Phase 1 Construction
As-Built Report

Submitted to:
Baffinland Iron Mines Corporation
2275 Upper Middle Road East, Suite 300
Oakville, ON Canada
L6H 0C3

REPORT

Report Number: 1649295 (DOC008)

Distribution:

1 electronic copy - Baffinland Iron Mines Corporation
1 hardcopy- Golder Associates Ltd.

Golder Associates

Executive Summary

Golder Associates Ltd. (Golder) was retained by Baffinland Iron Mines Corporation (Baffinland) to provide engineering design and offsite technical support for the Phase 1 (pre-freshet 2016) construction activities related to the Mine Haul Road Drainage Improvement Project. Construction drawings and specifications were included in the design report summarizing the Mine Haul Road Drainage Improvement Project prepared for Baffinland by Golder (2016a). A key recognition for the overall project was that a phased approached for construction was required as it was not feasible to construct the entire works in a single period.

The Phase 1 scope of work included installation of seven twin culverts and inspection of the existing ditch and improving the ditch (as required) to meet the design requirements of cross-sectional area and erosion protection. It was recognized at the time of the design that the scope of work for Phase 1 construction may not be carried in completion due to weather constraints. Incomplete work (or partially completed) in Phase 1 was to be deferred to Phase 2 construction.

Phase 1 construction was carried out between April 25, 2016 and May 15, 2016. Baffinland and OPC North provided construction management and contract administration for the duration of the work. Nuna Logistics Ltd. was the main contractor responsible for the completion of the scope of work, quality control, and surveying. Hatch Ltd. provided quality assurance and Golder provided offsite engineering support during this period.

Six twin culverts and one single culvert were installed and the existing ditch was protected with rip along the mine haul road. The culvert trench was excavated by drilling and blasting due to the frozen ground conditions. The existing ditches were cleared of snow and inspected. Due to the time constraints and weather conditions the existing ditches were not modified. The existing ditches were observed to have little to no erosion protection. Rip rap was added along the length of the ditch, and in steep sections geotextile was placed prior to rip rap.

The following modifications were made to the design during construction:

- The culverts layout points were adjusted to fit the encountered field conditions.
- Only one culvert was installed at the CV2 culvert crossing location.
- Culverts inlet basins were configured to fit encountered field conditions.
- Downstream outflow pads were constructed without excavation to create a toe depression.
- The existing ditch was not modified to achieve the design dimensions.
- Ditch 7 and Ramps 1, 2, and 3 ditches were not constructed.
- An additional culvert (CV8) was installed in the magazine access road.

These modifications were made to accommodate field conditions and timing constraints. The modifications were made in discussion with Golder and are considered to have no material effect on the completed work relative to the design. Alterations and maintenance may be required in the future to accommodate these modifications.

The outstanding items from Phase 1 construction plus the additional requirements in Phase 2 construction are provided below:

- A post-construction inspection by a member of Golder's engineering team is to be carried out.
- Sections of the ditch should be modified to meet the design requirements if performance and/or observations indicate such.
- Ongoing inspection and maintenance of the rip rap is to be carried out as the rip rap rock sizes used in the ditch and culvert inlet basins and outflow pads are insufficient for the design storm as described in the design report (Golder 2016a).
- Develop and implement an inspection and maintenance program as per the design (Golder 2016a).
- Connect the downstream outflow pad to a stream/ flow path with sufficient protection to convey the design storm as per the design (Golder 2016a).
- Implement improvements to the mine haul road to reduce sediment loading (Golder 2016b).

The Phase 1 construction campaign was completed in substantial compliance with the design intent based on Golder's review of the information provided by Baffinland. Field changes that were made to suit the field conditions encountered.

The Reader is instructed to read the entire report, including appendices. Particular attention is to be paid to the *Study Limitations* section following the report text.

Table of Contents

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Baffinland Iron Mines Corporation (Baffinland) to provide engineering design and offsite technical support for the Phase 1 (pre-freshet 2016) construction activities related to the Mine Haul Road Drainage Improvement Project.

Baffinland owns and operates the Mary River Project, an open pit iron ore mine located on northern Baffin Island, in the Nunavut Territory at a latitude of 71°19' north and a longitude of 79°12' west. Operations comprise the blasting and excavation of ore and waste rock. Waste rock is managed in stockpiles. Ore is hauled from the open pit via the mine haul road to the crushing area. Following crushing, the ore is loaded onto trucks and hauled to the port facility for shipment to processing facilities. There are no processing facilities on-site.

Golder completed a site visit in February 2016 and carried out an options assessment for improving the water management system with Baffinland. Baffinland developed a Mine Haul Road Drainage Improvement Project which included modifications to the road side ditch and to the road culvert crossings in addition to the placement of additional mine haul road embankment fill as the preferred option. Golder prepared a design report summarizing the Mine Haul Road Drainage Improvement Project, including construction drawings and specifications (Golder 2016a). A key recognition for the overall project was that a phased approached for construction was required as it was not feasible to construct the entire works in a single period. Phase 1 construction was carried out between April 25, 2016 and May 15, 2016. This report summarizes the construction activities that took place as part of the Phase 1 construction campaign for the Mine Haul Road Drainage Improvement Project. Golder provided offsite engineering support during the Phase 1 construction.

The report is organized as follows:

- The original scope of work is described in Section 2;
- The division of responsibilities for the construction campaign is provided in Section 3;
- A summary of the as-built information provided by Baffinland for inclusion in this report is provided in Section 4;
- The modifications and scope revisions are provided in Section 5;
- The construction activities are described in Section 6;
- The construction quality control and quality assurance are described in Section 7; and
- The path forward is described in Section 8.

The Reader is instructed to read the entire report, including appendices. Particular attention is to be paid to the *Study Limitations* section following the report text.

2.0 PHASE 1 SCOPE OF WORK

Phase 1 construction of the mine haul road drainage improvement project was to be carried out prior to the 2016 spring freshet. The phase 1 scope of work included the following:

- Installation of seven twin culverts, including the construction of the culvert inlet basin and downstream outflow pad.
- Inspection of the existing ditch and improving the ditch (as required) to meet the design requirements of cross-sectional area and erosion protection.

It was recognized at the time of the design that the scope of work for Phase 1 construction may not be carried to completion due to weather constraints. Incomplete work (or partially completed) in Phase 1 was to be deferred to Phase 2 construction. Additionally, the drainage swale from approximately station 103+750 to 105+250 (if required) and the sediment traps (if required) within the ditch along the mine haul road would be carried out in Phase 2 construction if determined to be required based on conditions encountered in the field.

Golder is to perform a post-freshet 2016 inspection of the Phase 1 construction. As of the date of this report, this inspection had yet to be carried out but is expected to be scheduled.

3.0 DIVISION OF RESPONSIBILITIES

The division of responsibilities for the parties involved were as follows:

Baffinland

Role: Owner
Responsibilities: Construction management, contract administration

OPC North

Role: Owner's Representative
Responsibilities: Construction management, contract administration

Nuna Logistics Ltd.

Role: Contractor
Responsibilities: Completion of the scope of work, construction quality control, layout, and as-built surveying

Hatch Ltd.

Role: Owner's Representative (assisting OPC North)
Responsibilities: Quality assurance

Golder

Role: Designer and engineering support
Responsibilities: Technical support on an as requested basis, preparation of as-built report and drawings.

4.0 AS-BUILT INFORMATION PROVIDED BY BAFFINLAND

The following information was provided by Baffinland for inclusion in the as-built report:

- As-built surveys of the constructed culverts and ditch. These files were used to produce as-built drawings in Appendix A and a copy of the raw files is provided in Appendix B.

- Quality control and quality assurance construction checklists and photographs (Appendix C)

No material grain size analyses on the construction materials were carried out. No survey data of the trench backfill grades or downstream outflow pads were provided. Because the existing haul road survey data used in the design did not match the encountered field conditions, some additional survey data of the road shoulders was collected during construction and is presented in the as-built drawings.

5.0 MODIFICATIONS AND SCOPE REVISIONS

Modifications to the design provided in the construction drawings and specifications were required to accommodate field conditions that were encountered as construction progressed. The project scope of work was occasionally revised for similar reasons. The following modifications were made:

- The culverts layout points were adjusted to fit the encountered field conditions. The base mapping contour data used in the design did not match the encountered field conditions and as such the layout points of the culverts, culvert inlet basins and downstream outflow pads were adjusted. The culvert crossing locations were moved slightly to the best fit the existing conditions while maintaining the design requirements.
- Only 1 culvert was installed at the CV2 culvert crossing location. The required flow capacity is provided by this single culvert but the redundancy of twin culverts is not provided.
- Culverts inlet basins were configured to fit encountered field conditions. The width, depth, and side slopes varies at each inlet location and differs from the design configuration. A minimum depth of 0.6 m below the below the culvert to the base of the inlet basin was not obtained at some crossing locations. The inlet basins that were constructed smaller and with steeper side slopes than design requirements will still function as required however increased maintenance will be required. Where a minimum depth of 0.6 m was not achieved, there is a higher risk of sediment transportation downstream.
- Downstream outflow pads were constructed without excavation to create a toe depression. Instead of excavating the downstream slope, geotextile and rip rap were placed on the existing slope. The purpose of the toe depression was to dissipate energy to avoid erosion of the downstream slope. Improvements to the downstream outflow pad may be required.
- The existing ditch was not modified to achieve the design dimensions. Due to the timing of the construction period and the onset of the 2016 freshet, alterations to the ditch configuration were postponed. The existing ditch varies in depth, width and side slopes throughout the length. The existing ditch was protected with rip rap and due to the varying configuration the thickness of the rip rap varies throughout the length. Sections of the ditch may be required to be modified to meet the minimum design requirements.
- Ditch 7 and Ramps 1, 2, and 3 ditches were not constructed. Due to the timing of construction and the onset of the freshet these ditches were not constructed. These ditches should be constructed in the Phase 2 campaign.
- An additional culvert (CV8) was installed in the magazine access road. This culvert was not part of the design.

These modifications were made to accommodate field conditions and timing constraints. The modifications were made in discussion with Golder and are considered to have no material effect on the completed work relative to the design.

Alterations and maintenance may be required in the future to accommodate these modifications. Refer to a Section 8.0 for the path forward.

6.0 DISCUSSION ON CONSTRUCTION ACTIVITIES

Six twin culverts and 1 single culvert were installed and the existing ditch was protected with rip rap (Material Type 19) along the mine haul road between April 25, 2016 and May 15, 2016. Best efforts were made to remove the snow and ice from the construction areas and backfill material. Based on the encountered field conditions the culverts locations were adjusted to best fit the existing topography. The culvert trench was excavated by drilling and blasting due to the frozen ground conditions. Each culvert crossing, except for culvert CV2, was excavated and backfilled in two sections (left and right side of the haul road) to allow for haul traffic during construction. Bedding (Material Type 5) was placed and shaped by excavator bucket. Compaction of the trench backfill material (Material Types 5 and 8) was completed by a minimum of 5 passes with a walk behind plate tamper. The culvert inlet basins were drilled and blasted and lined with geotextile with the exception of culvert CV2 (through ramp 1) where geotextile was not used. Rip rap was placed within the culvert inlet basin and along the downstream outflow pad.

The existing ditches were cleared of snow and inspected. Due to the time constraints and weather conditions the existing ditches were not modified. The existing ditches were observed to have little to no erosion protection. Rip rap (Material Type 19) was added along the length of the ditch, and in steep sections geotextile was placed prior to rip rap.

7.0 CONSTRUCTION QUALITY CONTROL AND ASSURANCE

Construction quality control was provided by the Contractor. Quality assurance was provided by the Owner's Representative. No material testing was completed on the material types. Material was visually observed to meet specifications.

Inspection checklists were completed as record of the works being carried out as per the requirements of the specifications and are provided in Appendix C along with a photograph log of each culvert crossing and the ditch.

8.0 PATH FORWARD

The summary of the outstanding items from Phase 1 construction plus the additional requirements in Phase 2 construction are provided below:

- A post-construction inspection by a member of Golder's engineering team is to be carried out. The requirements of constructing the drainage swale between stations 103+750 to 105+250 as well as locations

of sediment traps will be identified. It is expected that this inspection will be scheduled during 2016 prior to the onset of snowfall conditions.

- Sections of the ditch should be modified to meet the design requirements if performance and/or observations indicate such.
- The rip rap rock sizes used in the ditch and culvert inlet basins and outflow pads are insufficient for the design storm as described in the design report (Golder 2016). Rip rap in the specification was provided as it was the only size of material available at the time of construction however based on the design calculations sections of the ditch will require upgrading of the erosion protection. As per the design, ongoing inspection and maintenance of the rip rap is to be carried out.
- Develop and implement an inspection and maintenance program as per the design (Golder 2016a).
- Connect the downstream outflow pad to a stream/ flow path with sufficient protection to convey the design storm as per the design (Golder 2016a).
- Implement improvements to the mine haul road to reduce sediment loading (Golder 2016b).

9.0 CLOSING

The Phase 1 construction campaign was completed in substantial compliance with the design intent based on Golder's review of the information provided by Baffinland. Field changes that were made to suit the field conditions encountered have been described in Section 5. A path forward has been described in Section 8.

We trust this report provides the information you presently require. Should you have any comments or questions, please contact the undersigned.

Report Signature Page

GOLDER ASSOCIATES LTD.

REGISTERED PROFESSIONAL ENGINEER
P.M. BEDELL
LICENSEE
29/8/2016
NWT/NU

Michelle Tyldesley, PEng (ON)
Geotechnical Engineer

Paul M. Bedell, MESc, PEng
Principal, Senior Geotechnical Engineer

MJT/PMB/jl

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 29/8/2016
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

https://capws.golder.com/sites/1414686haulroadwatermanagement/phases and tasks/7000 as-built/final report/1649295 dft rpt as-built report baffinland mhr drainage improvements phase 1.docx

References

Golder (Golder Associates Ltd.). 2016a. Mine Haul Road Drainage Improvement Project Detailed Design Report-Draft. Prepared for Baffinland Iron Mine Corporation. Mississauga ON: Golder Associate Ltd. Golder Doc. No. No. 1649295. 4 May 2016.

Golder (Golder Associates Ltd.). 2016b. Mine Haul Road Drainage Improvement, Mary River Project. Prepared for Baffinland Iron Mine Corporation. Mississauga ON: Golder Associates Ltd. Golder Doc. No. 1649295. 6 April 2016.

Study Limitations

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APPENDIX A

As-Built Drawings

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET	2
002	GENERAL ARRANGEMENT PLAN	2
003	PLAN AND PROFILE STA 103+500 TO 104+080	2
004	PLAN AND PROFILE STA 104+080 TO 104+660	2
005	PLAN AND PROFILE STA 104+660 TO 105+250	2
006	PLAN AND PROFILE STA 105+250 TO 105+860	2
007	PLAN AND PROFILE STA 105+860 TO 106+460	2
008	PLAN AND PROFILE STA 106+460 TO 107+030	2
009	PLAN AND PROFILE STA 107+030 TO 107 + 620	2
010	PLAN AND PROFILE STA 107+620 TO 108+200	2
011	PLAN AND PROFILE STA 108+200 TO 108+770	2
012	PLAN AND PROFILE STA 108+770 TO 109+350	2
013	PLAN AND PROFILE STA 109+350 TO 109+821	2
014	PIPE CROSSING TYPICAL DETAILS AND CULVERT SCHEDULE	2
015	DITCHES AND SEDIMENT TRAPS TYPICAL DETAILS	2
016	CUT SLOPES EROSION PROTECTION DETAILS	2
017	DITCH SETOUT POINTS	2

KEY PLAN
NOT TO SCALE

SPECIFICATION		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1649295-S	MINE HAUL ROAD DRAINAGE IMPROVEMENTS	0

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature Original Signed
Date
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

ORIGINAL SIGNED AND SEALED

CLIENT
Baffinland

CONSULTANT
Golder Associates

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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
TITLE SHEET

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	1 of 17	001

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
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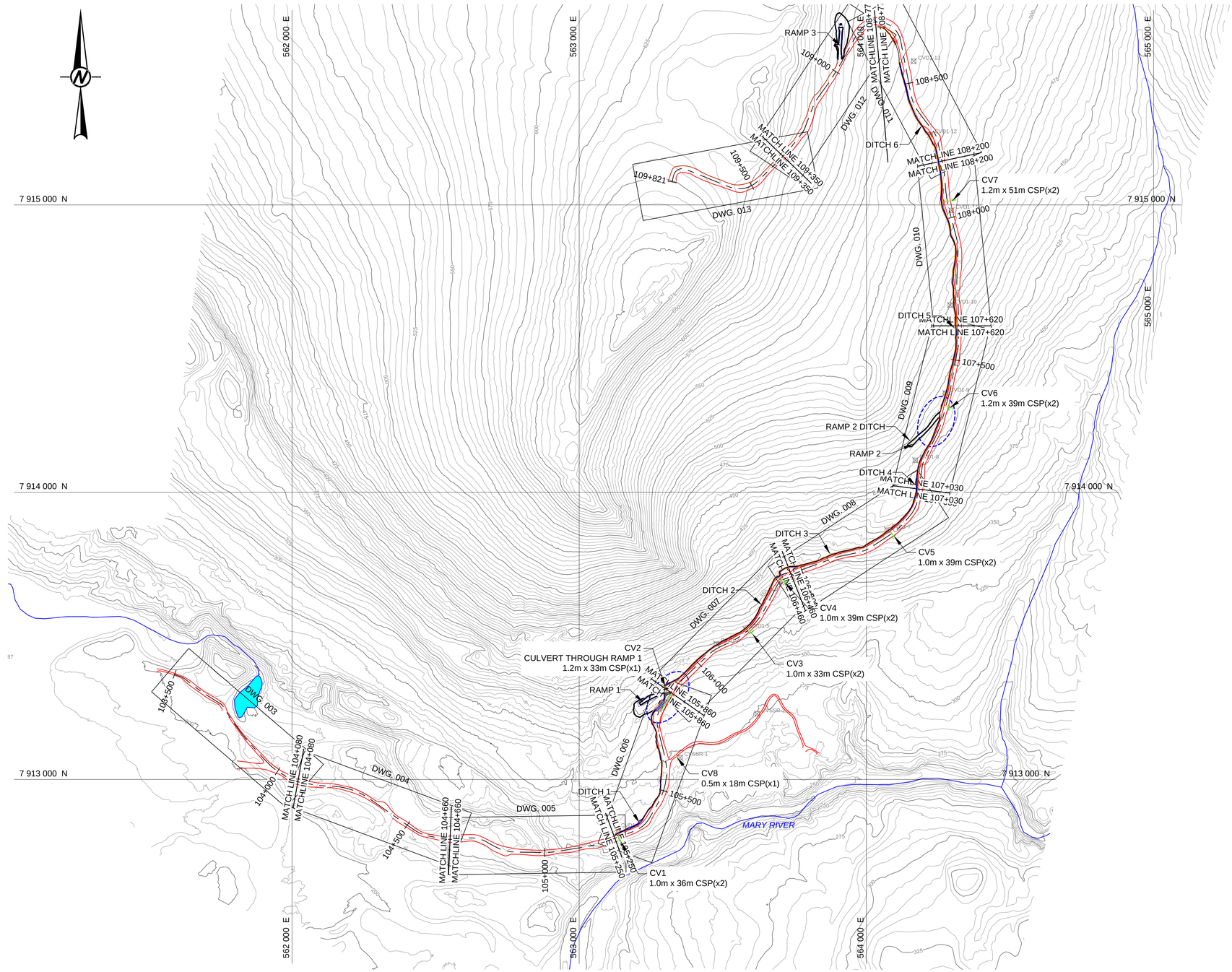

LEGEND

- AS-BUILT CULVERT (KNIGHT PIESOLD, 2008)
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- EXISTING ROAD
- BASE MAPPING CONTOUR
- WATERCOURSE
- CV3 — PIPE CROSSING
- DITCH

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17.
3. CONTOUR INTERVAL IS 1 m WITH EXISTING TOPOGRAPHY.
4. AS-BUILT DRAWINGS SHOW PHASE 1 CONSTRUCTION.
5. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE AS-BUILT REPORT.
6. THE POTENTIAL SEDIMENT TRAPS WERE NOT CONSTRUCTED IN THIS CONSTRUCTION PHASE.
7. THE POTENTIAL DRAINAGE SWALE WAS NOT CONSTRUCTED IN THIS CONSTRUCTION PHASE.
8. THE EXISTING MINE HAUL ROAD CENTRELINE IS SHOWN FOR REFERENCE PURPOSES ONLY. THE EXISTING MINE ROAD WAS NOT SURVEYED IN COMPLETION IN PHASE 1 CONSTRUCTION AND THAT SHOWN HAS BEEN IDENTIFIED IN THE FIELD AS NOT ACCURATE.
9. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
10. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

0 250 500
1:7,500 METRES

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1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
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STAMP/SEAL
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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
GENERAL ARRANGEMENT PLAN

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	2 of 17	002

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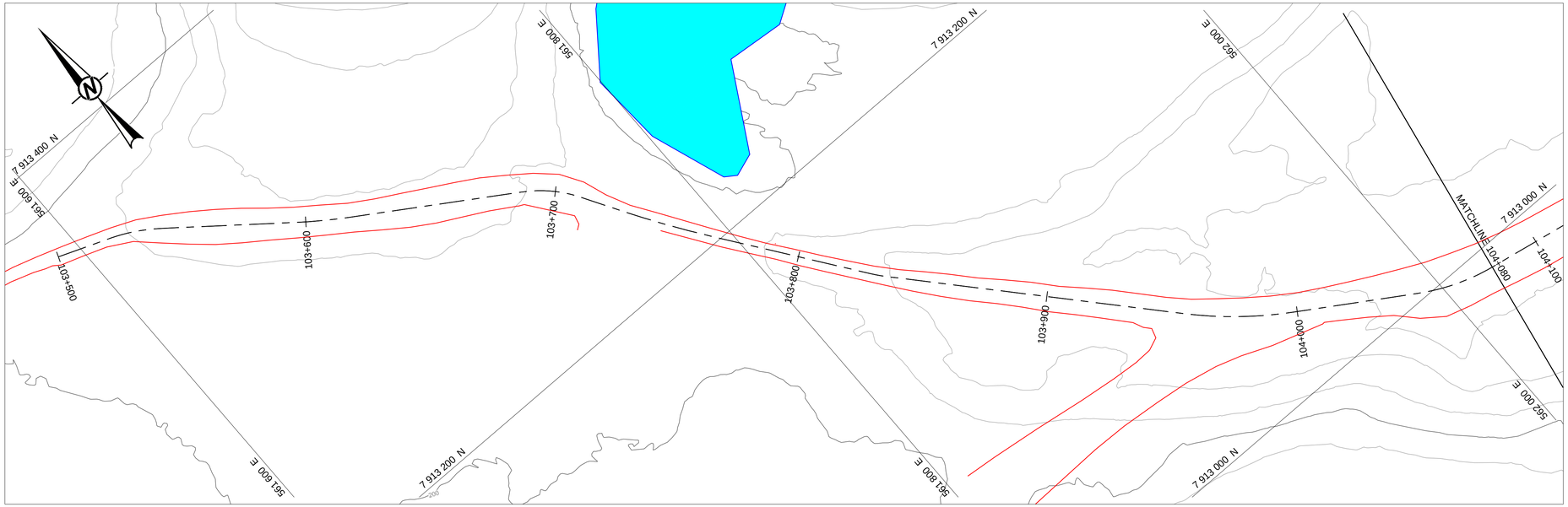
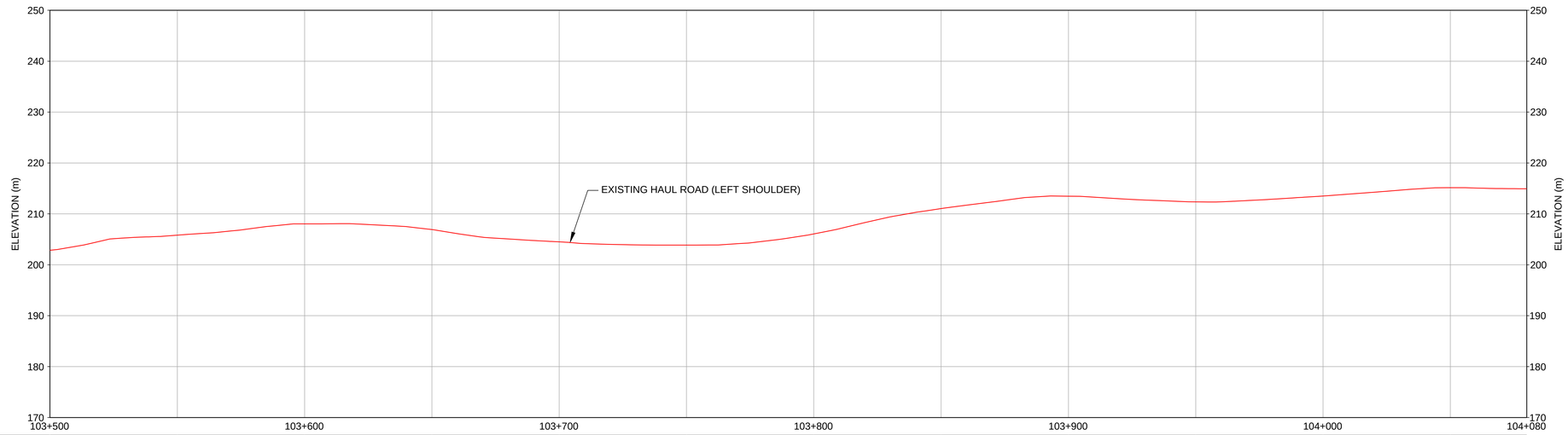


PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	202.86	205.83	208.04	206.93	204.52	203.87	206.06	211.05	213.48	212.36	213.51	215.15	214.93

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- CV3 — PIPE CROSSING

NOTES

1. THE POTENTIAL DRAINAGE SWALE WAS NOT CONSTRUCTED.
2. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
3. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
4. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
PLAN AND PROFILE STA 103+500 TO 104+080

PROJECT NO.	PHASE	REV.		DRAWING
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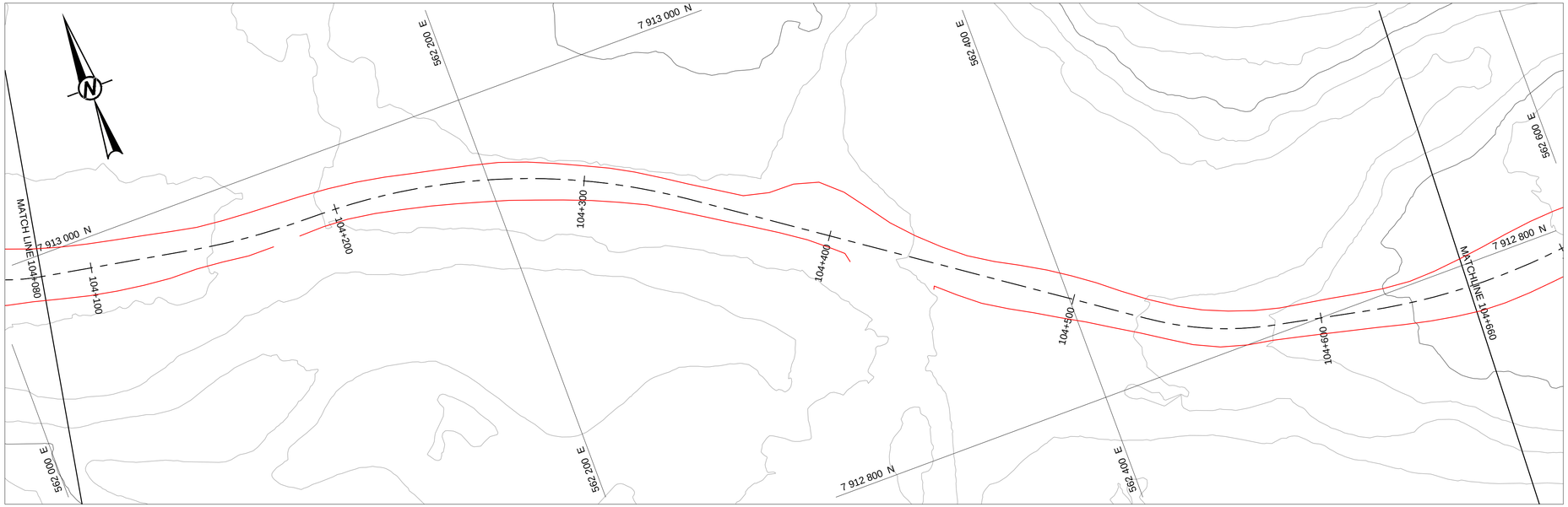
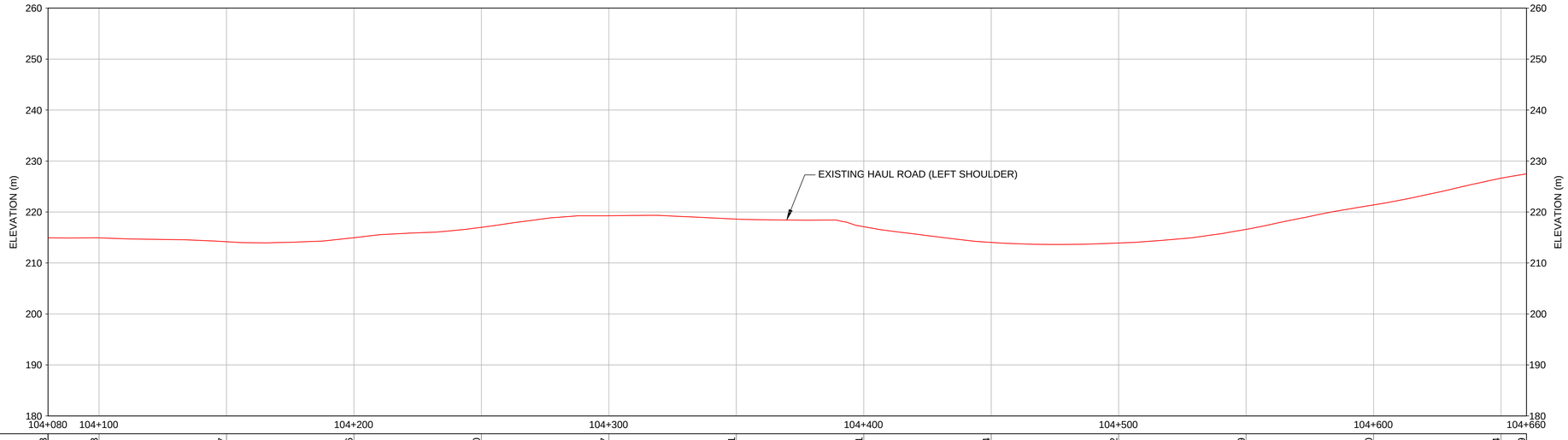


PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	214.93	214.93	214.17	214.96	217.00	219.27	218.61	217.11	214.04	213.92	216.59	221.40	226.64	227.49

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- CV3 — PIPE CROSSING

NOTES

1. THE POTENTIAL DRAINAGE SWALE WAS NOT CONSTRUCTED.
2. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
3. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
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0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

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Date
PERMIT NUMBER: P 049
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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

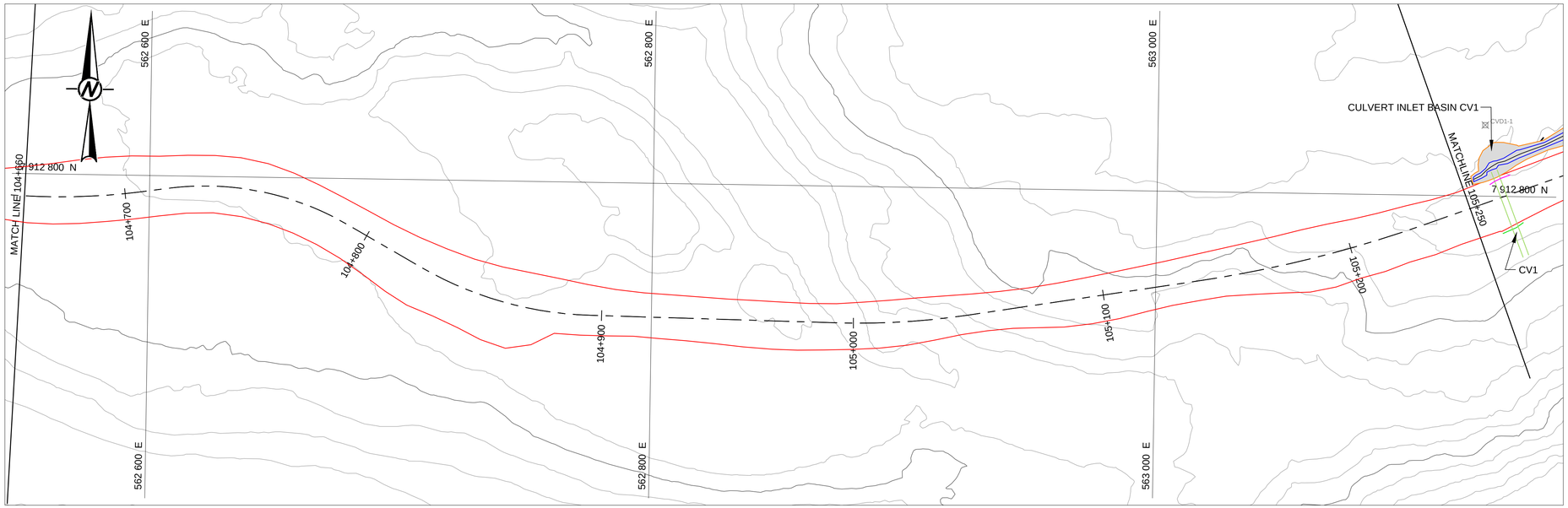
TITLE
PLAN AND PROFILE STA 104+080 TO 104+660

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	4 of 17	004

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\GAL\Mississauga\SIM\Clients\Baffinland_Iron_Mines_Corp\Baffin_Island\09_PRO\11649295-40_PROD\0001_Water_Mgmt\ | File Name: 1649295-0001-CM-0004.dwg



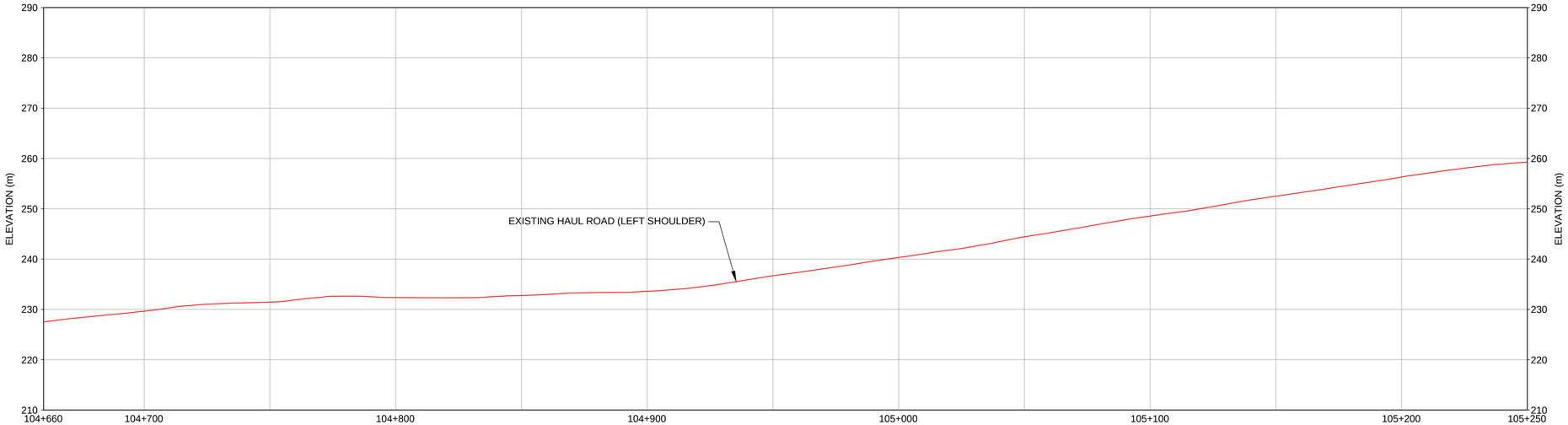
PLAN VIEW
SCALE 1:1,000

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

1. THE POTENTIAL DRAINAGE SWALE WAS NOT CONSTRUCTED.
2. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
3. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
4. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	227.49	229.64	231.46	232.36	232.77	233.60	236.70	240.32	244.42	248.56	252.50	256.31	259.29

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

PERMIT TO PRACTICE
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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

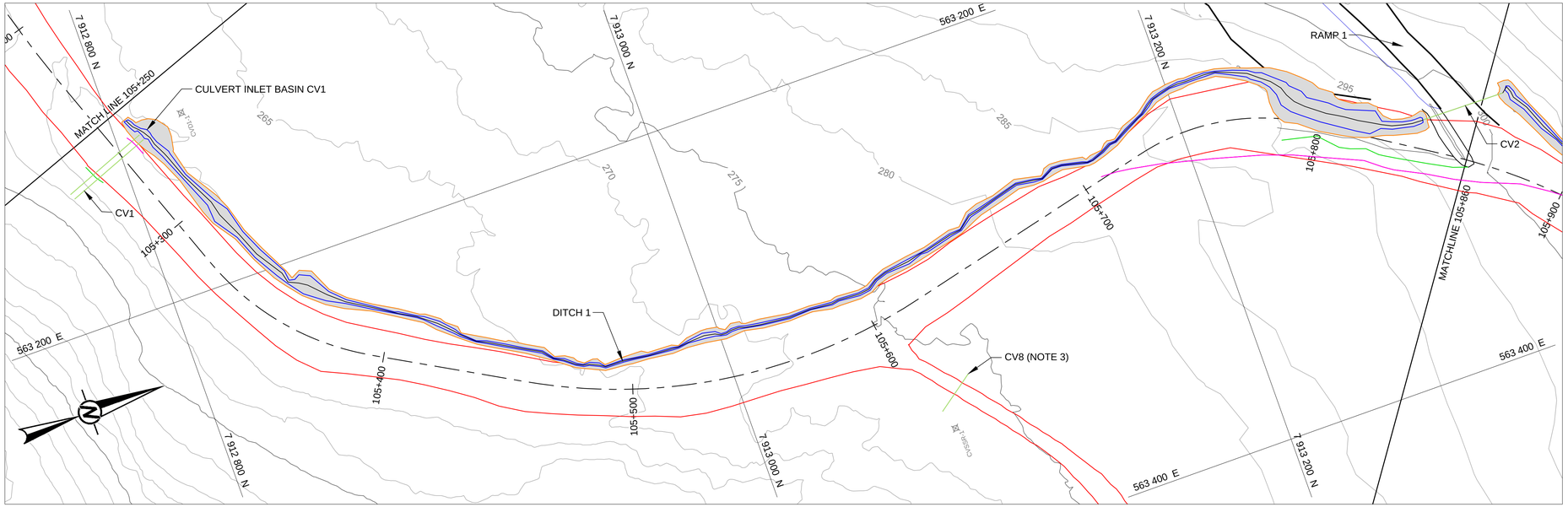
TITLE
PLAN AND PROFILE STA 104+660 TO 105+250

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	5 of 17	005

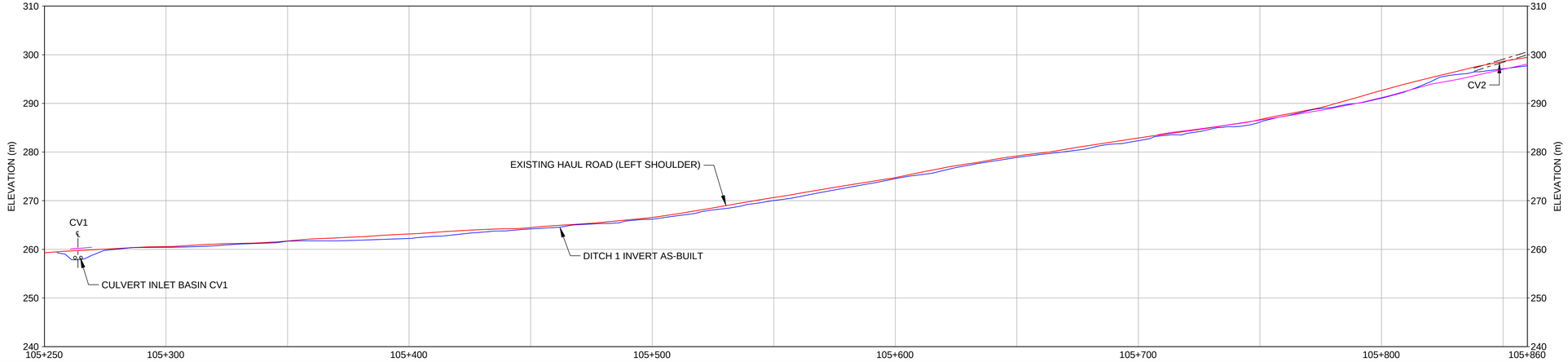
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\GAL\Mississauga\SIM\Clients\Baffinland_Iron_Mines_Corp\Baffin_Island\09_PROJ\1649295\40_PROD\0001_Water_Mgmt\ | File Name: 1649295-0001-CM-0005.dwg



PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	259.49	259.68	259.82	260.57	261.71	263.17	264.48	266.55	270.64	274.75	279.19	282.88	286.68	292.65	298.64	299.46
DITCH INVERT AS-BUILT ELEVATION	259.33	257.88	258.03	260.42	261.69	262.23	264.19	266.17	270.04	274.54	278.88	282.34	286.15	291.07	297.11	297.73

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

1. DITCH AND PIPE CROSSING LAYOUT WAS ADJUSTED IN THE FIELD BASED ON THE ENCOUNTERED CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. AS-BUILT POINTS FOR THE PIPE CROSSING ARE PROVIDED ON DWG. 014.
3. AN ADDITIONAL CULVERT (CV8) WAS INSTALLED IN THE MAG. ROAD.
4. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
5. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
6. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

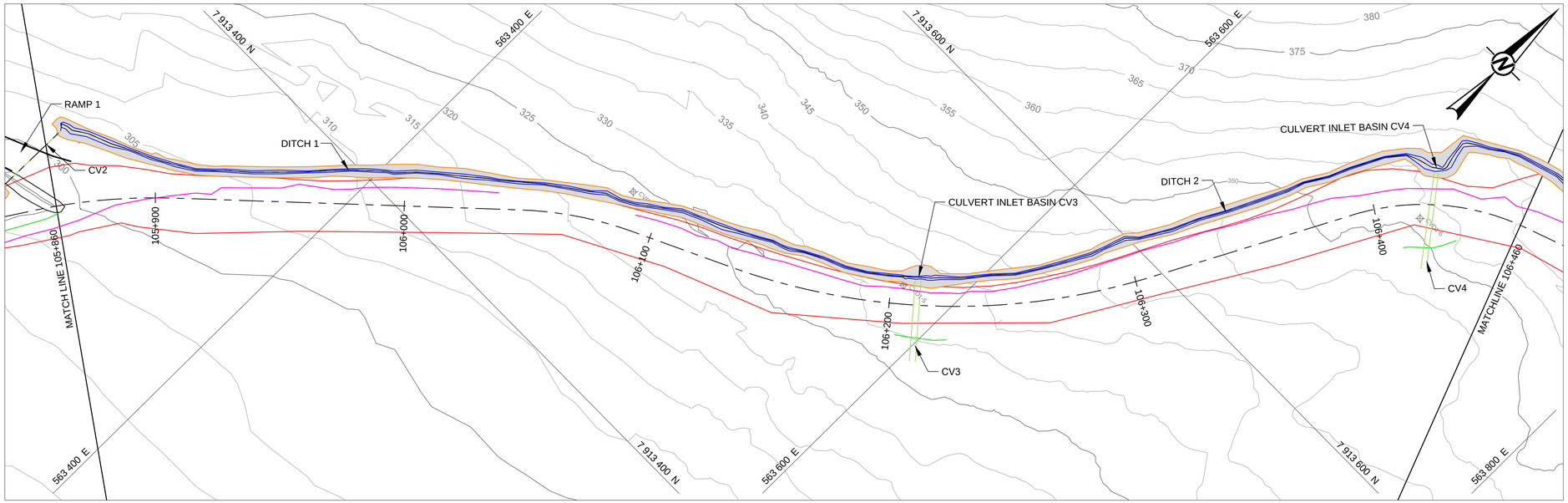
TITLE
PLAN AND PROFILE STA 105+250 TO 105+860

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	6 of 17	006

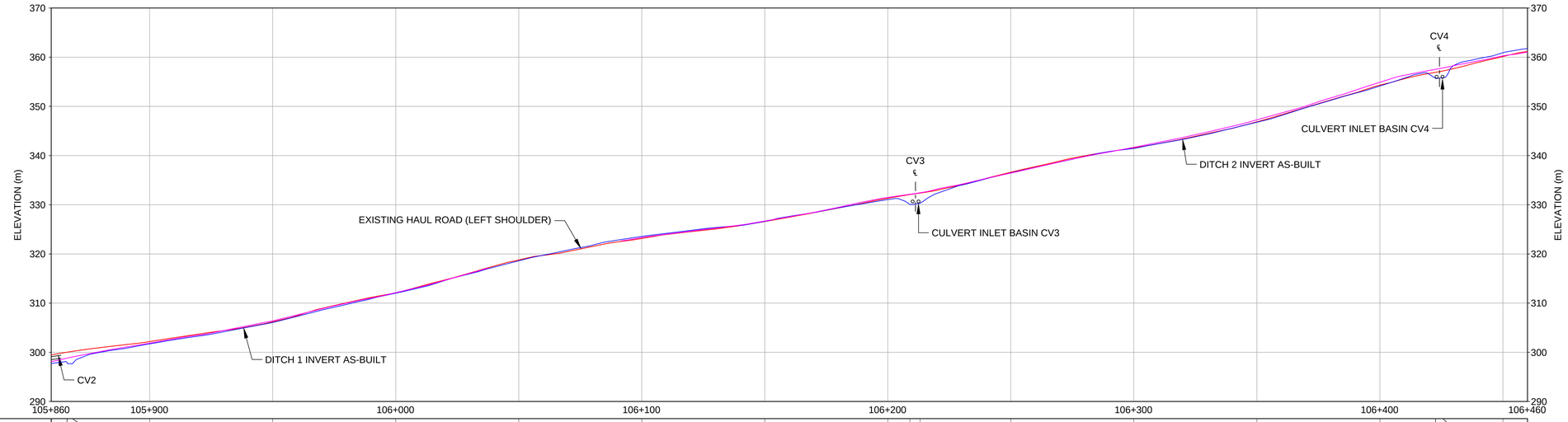
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

25 mm

Path: \\golder.gds\GAL\Mississauga\SIM\Clients\Baffinland_Iron_Mines_Corp\Baffin_Island\09_PROJ\1649295\40_PROD\0001_Water_Mgmt\ | File Name: 1649295-0001-CM-0006.dwg



PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	299.46	300.01	300.18	302.19	306.19	312.08	318.78	323.15	326.59	331.33	332.08	332.38	336.62	341.58	346.85	354.33	356.93	357.19	360.14	361.18
DITCH INVERT AS-BUILT ELEVATION	297.73	297.91	297.69	301.71	306.05	312.01	318.60	323.57	326.62	331.06	330.07	330.29	336.49	341.46	346.77	354.15	355.70	355.84	360.91	361.77

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

1. DITCH AND PIPE CROSSING LAYOUT WAS ADJUSTED BASED ON ENCOUNTERED FIELD CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. AS-BUILT POINTS FOR THE PIPE CROSSING ARE PROVIDED ON DWG. 014.
3. RAMP 1 DITCH WAS NOT CONSTRUCTED.
4. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
5. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
6. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

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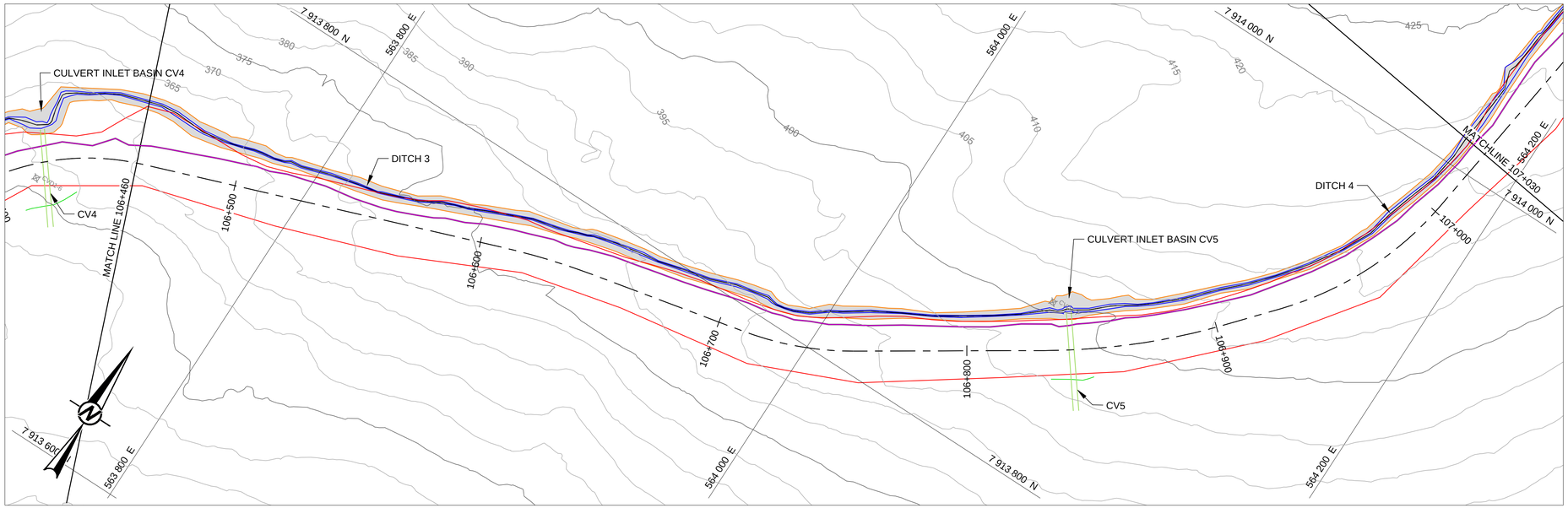
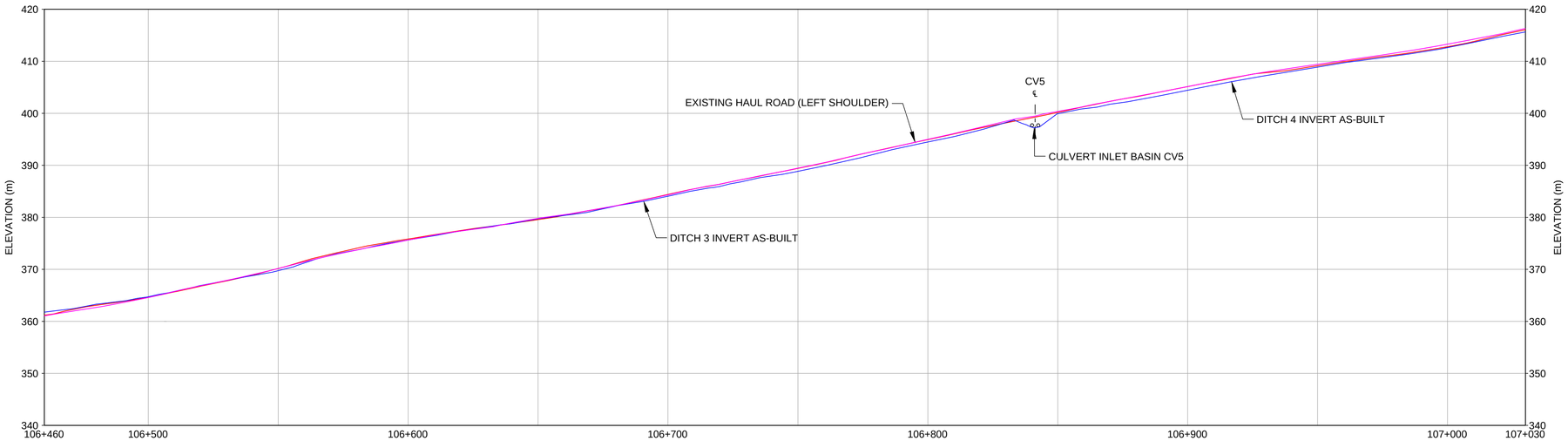
PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
PLAN AND PROFILE STA 105+860 TO 106+460

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	7 of 17	007



PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	361.18	364.59	370.16	375.84	379.57	384.40	389.42	394.94	398.43	399.24	399.45	400.17	405.13	409.15	412.81	416.06
DITCH INVERT AS-BUILT ELEVATION	361.77	364.72	369.75	375.64	379.74	384.06	388.84	394.48	398.62	397.20	397.40	399.91	404.44	408.89	412.63	415.65

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

1. DITCH AND PIPE CROSSING LAYOUT WAS ADJUSTED BASED ON ENCOUNTERED FIELD CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. AS-BUILT POINTS FOR THE PIPE CROSSING ARE PROVIDED ON DWG. 014.
3. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
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0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

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PROJECT
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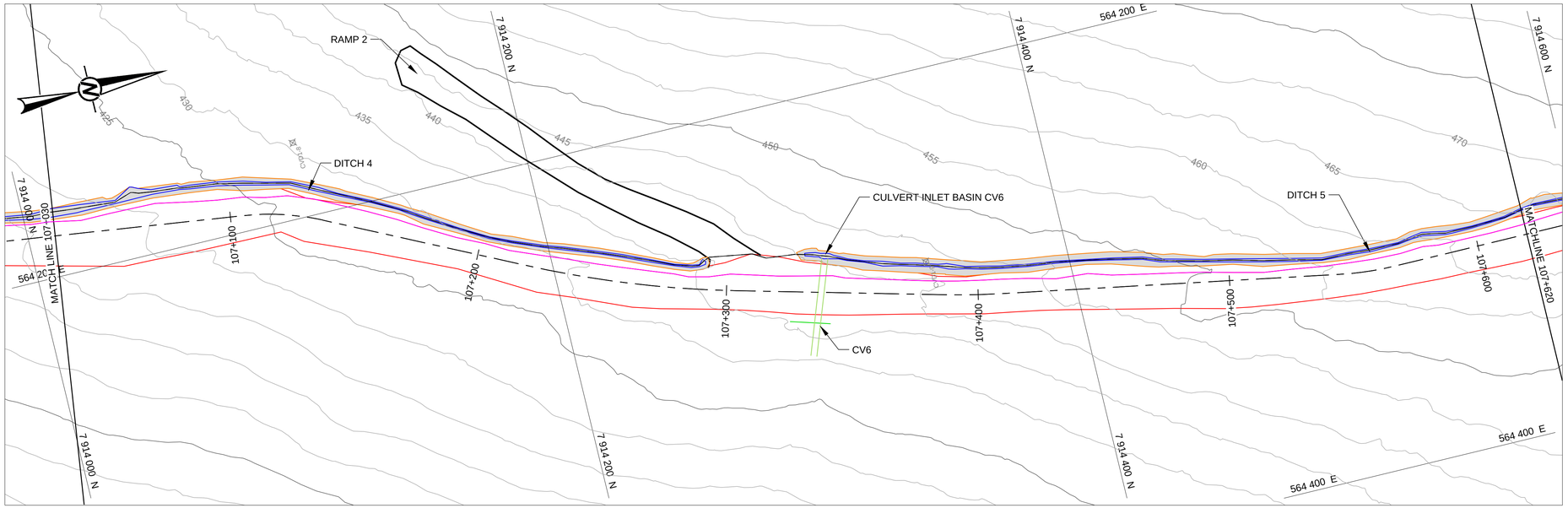
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

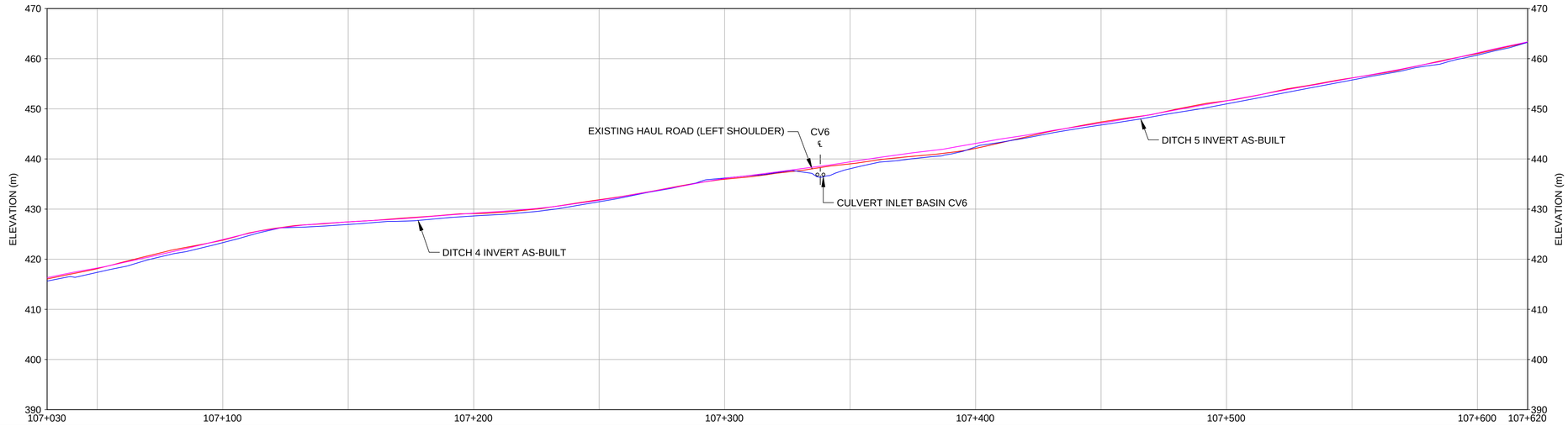
TITLE
PLAN AND PROFILE STA 106+460 TO 107+030

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	8 of 17	008

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm





PLAN VIEW
SCALE 1:1,000

LEGEND

— — —	ORIGINAL GROUND SURFACE (2008)
—	EXISTING ROAD SHOULDER
▨	DITCH
108+000 —	ROAD CENTRELINE AND STATIONING (APPROXIMATE)
☒ CVD1-8	AS-BUILT CULVERT LOCATION (2008)
=	PIPE CROSSING
—	SURVEY EXISTING ROAD SHOULDER
—	TOE BERM

NOTES

1. DITCH AND PIPE CROSSING LAYOUT WAS ADJUSTED BASED ON ENCOUNTERED FIELD CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. AS-BUILT POINTS FOR THE PIPE CROSSING ARE PROVIDED ON DWG. 014.
3. RAMP 2 DITCH WAS NOT CONSTRUCTED.
4. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
5. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
6. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	416.06	418.12	423.80	427.45	429.10	431.86	435.96	437.54	438.29	438.59	439.02	442.13	447.38	451.61	456.16	461.01	463.25
DITCH INVERT AS-BUILT ELEVATION	415.65	417.38	423.31	426.94	428.63	431.47	436.18	437.67	436.34	436.70	438.06	442.41	446.77	450.97	455.74	460.72	463.21

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
PLAN AND PROFILE STA 107+030 TO 107 + 620

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	9 of 17	009

Path: \\golder.gds\GAL\Mississauga\SIM\Clients\Baffinland_Iron_Mines_Corp\Baffin_Island\99_PROJ\1649295\40_PROD\0001_Water_Mgmt\ | File Name: 1649295-0001-CM-0009.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm
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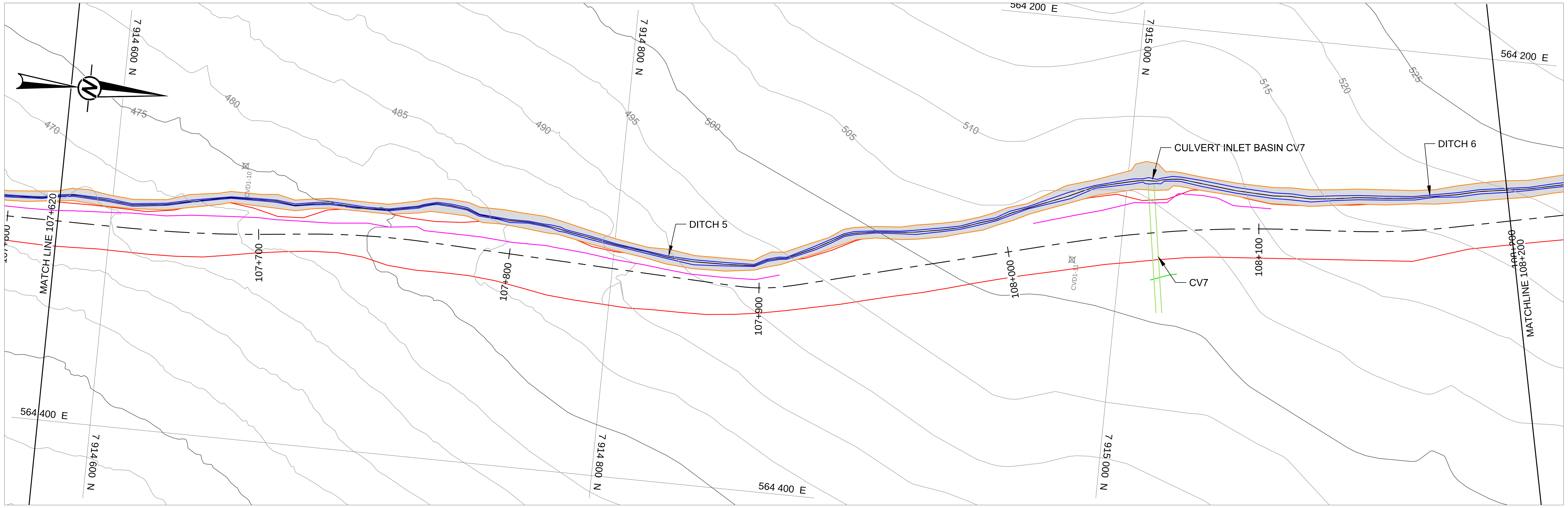

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

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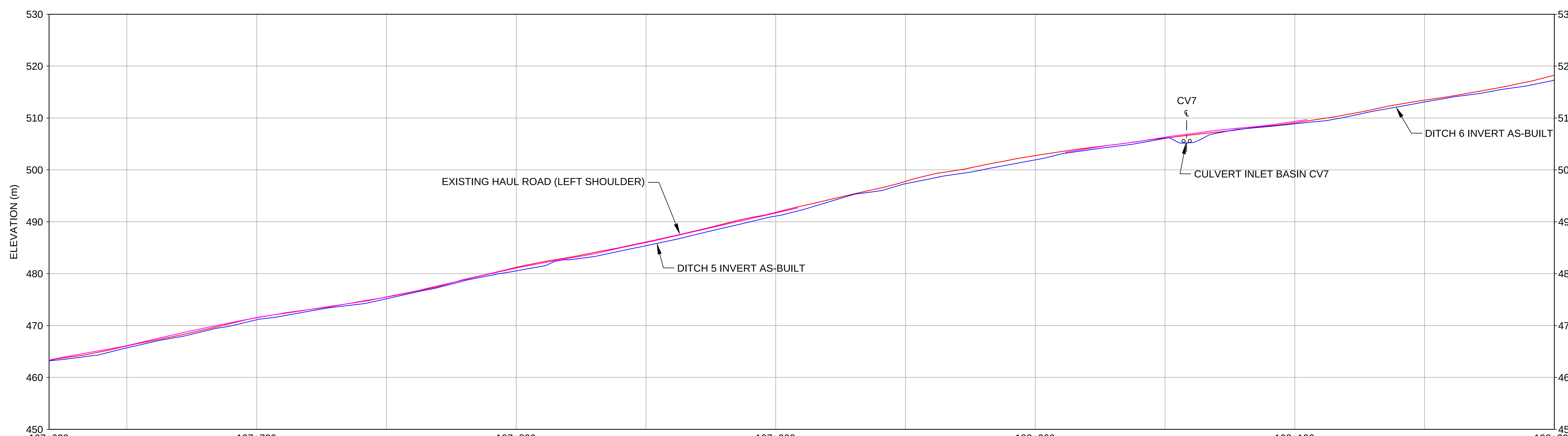
PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	463.25	466.06	471.50	475.48	481.23	486.10	491.81	497.78	502.75	506.13	506.47	506.79	507.13	509.09	513.44	518.24
DITCH INVERT AS-BUILT ELEVATION	463.21	465.69	471.12	475.16	480.53	485.39	491.09	497.34	501.93	506.07	505.16	505.28	506.76	508.88	513.09	517.30

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
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0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

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NT/NU Association of Professional Engineers and Geoscientists

ORIGINAL SIGNED AND SEALED

STAMP/SEAL

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Baffinland

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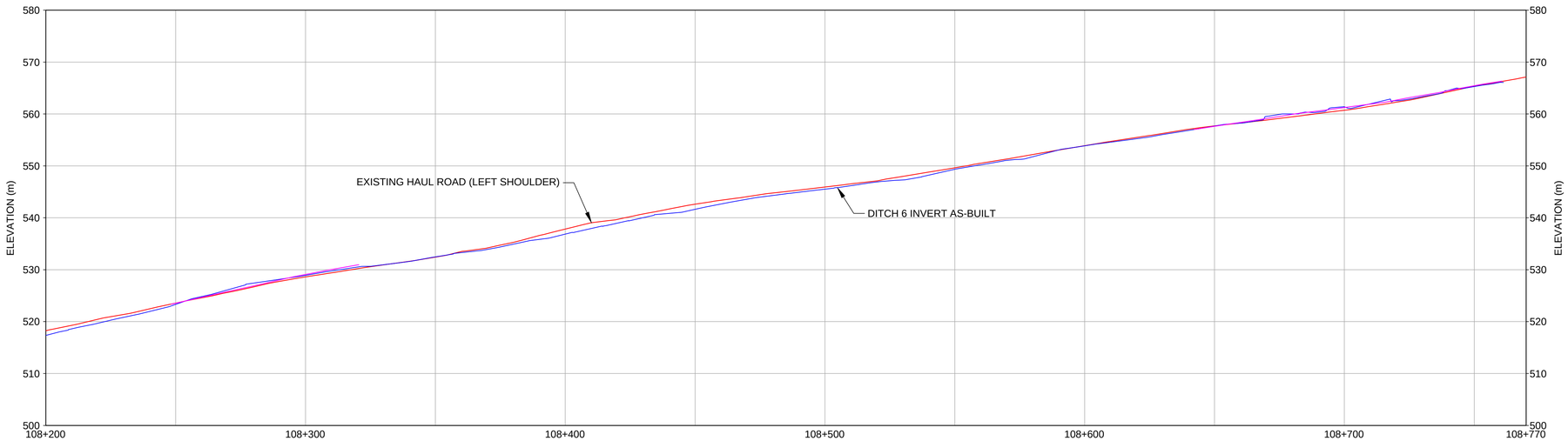
PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
PLAN AND PROFILE STA 107+620 TO 108+200

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	10 of 17	010

PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD LEFT SHOULDER ELEVATION	518.24	523.57	528.62	532.43	537.83	542.63	545.93	549.64	553.90	557.71	560.72	565.32	566.35
DITCH INVERT AS-BUILT ELEVATION	517.34	523.32	528.91	532.48	536.86	541.64	545.51	549.36	553.86	557.68	561.39	565.28	566.09

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

1. DITCH AND PIPE CROSSING LAYOUT WAS ADJUSTED BASED ON ENCOUNTERED FIELD CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. AS-BUILT POINTS FOR THE PIPE CROSSING ARE PROVIDED ON DWG. 014.
3. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
4. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
5. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

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CANADA
[+1] (905) 567 6100
www.golder.com

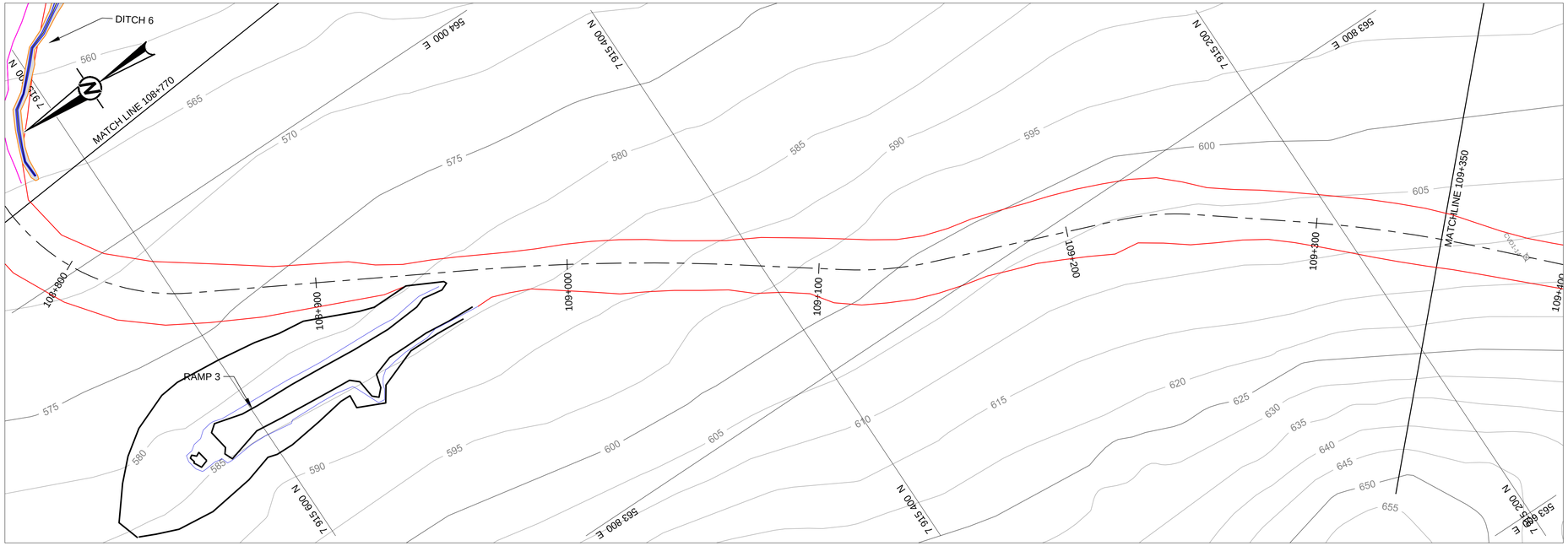
PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
PLAN AND PROFILE STA 108+200 TO 108+770

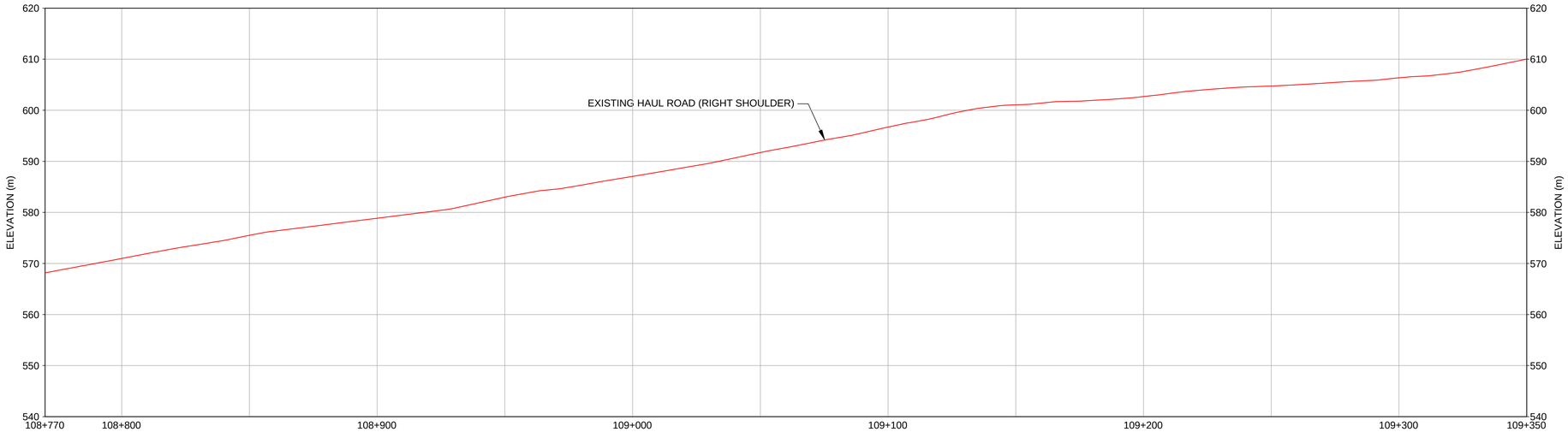
PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	11 of 17	011

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
0 25 mm

Path: \\golder.gds\GAL\Mississauga\SIM\Clients\Baffinland_Iron_Mines_Corp\Baffin_Island\99_PROJ\1649295-40_PROD\0001_Water_Mgmt\ | File Name: 1649295-0001-CM-0011.dwg



PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD RIGHT SHOULDER ELEVATION	568.17	570.98	575.52	578.86	582.99	587.05	591.72	596.70	601.07	602.69	604.75	606.37	610.02

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

1. DITCH 7 WAS NOT CONSTRUCTED.
2. RAMP 3 DITCH WAS NOT CONSTRUCTED.
3. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
4. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
5. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

0 20 40
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0 50 100
1:1,000 METRES

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PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
PLAN AND PROFILE STA 108+770 TO 109+350

PROJECT NO.	PHASE	REV.	DRAWING
1649295	7000	2	012

12 of 17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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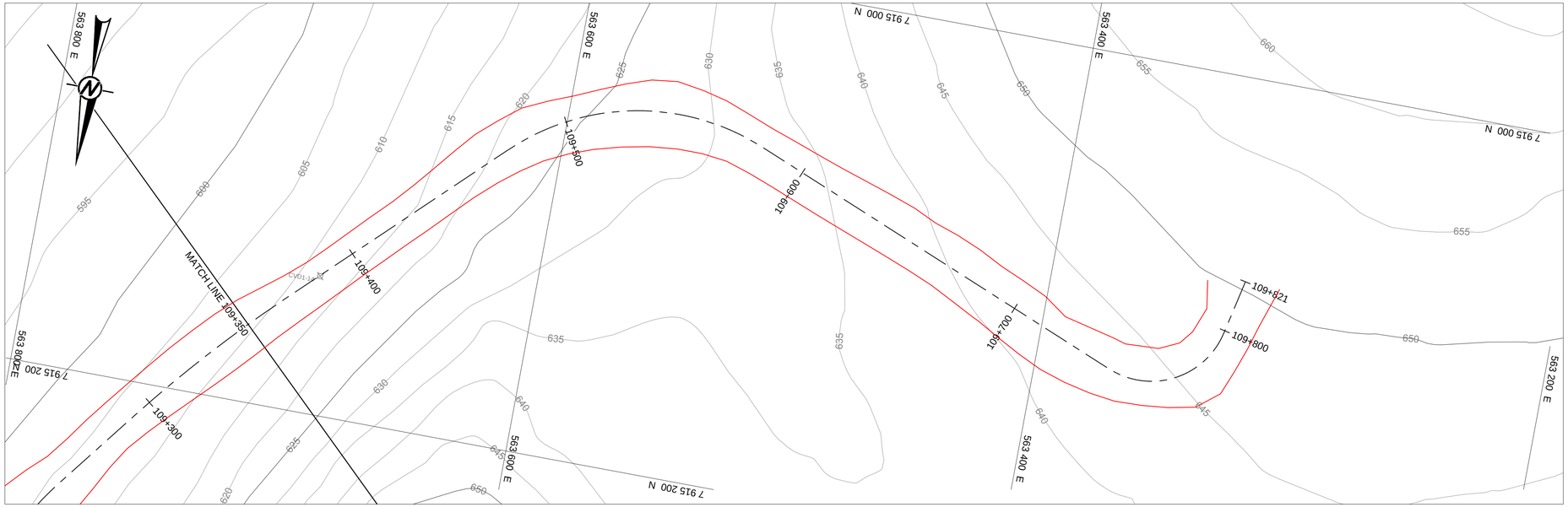
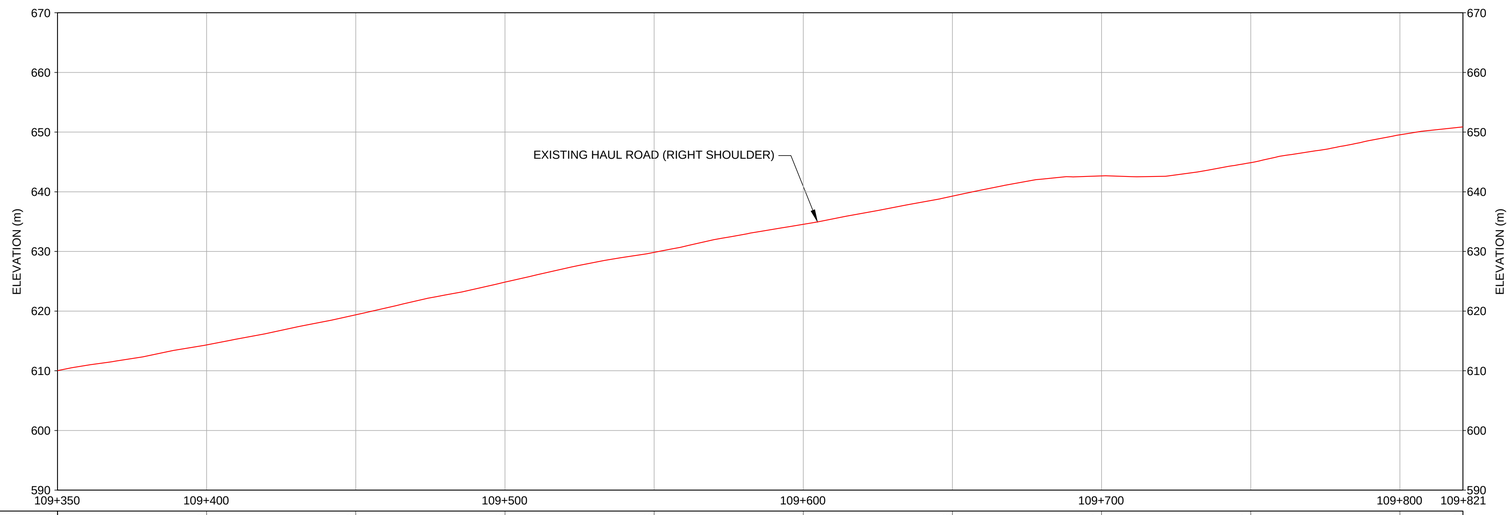


PLAN VIEW
SCALE 1:1,000



EXISTING HAUL ROAD RIGHT SHOULDER ELEVATION	610.02	614.33	619.38	624.86	629.85	634.54	639.26	642.67	644.87	649.54	650.88

PROFILE VIEW
H SCALE 1:1,000
V SCALE 1:500

LEGEND

- ORIGINAL GROUND SURFACE (2008)
- EXISTING ROAD SHOULDER
- DITCH
- 108+000 — ROAD CENTRELINE AND STATIONING (APPROXIMATE)
- CVD1-8 — AS-BUILT CULVERT LOCATION (2008)
- PIPE CROSSING
- SURVEY EXISTING ROAD SHOULDER
- TOE BERM

NOTES

1. DITCH 7 WAS NOT CONSTRUCTED.
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3. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
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0 20 40
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0 50 100
1:1,000 METRES

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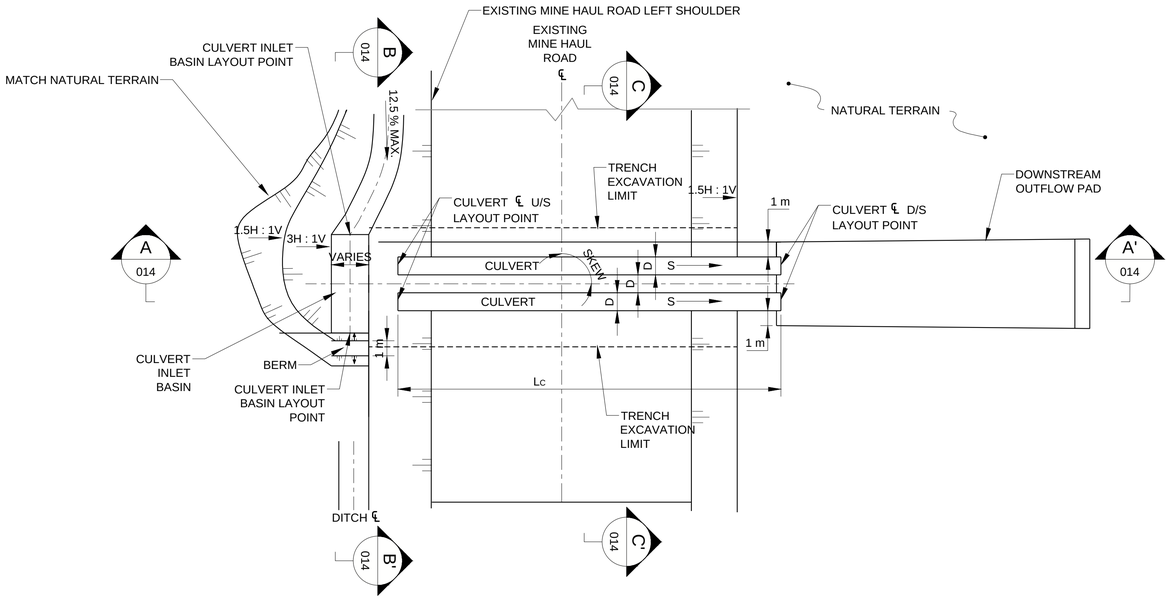
PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

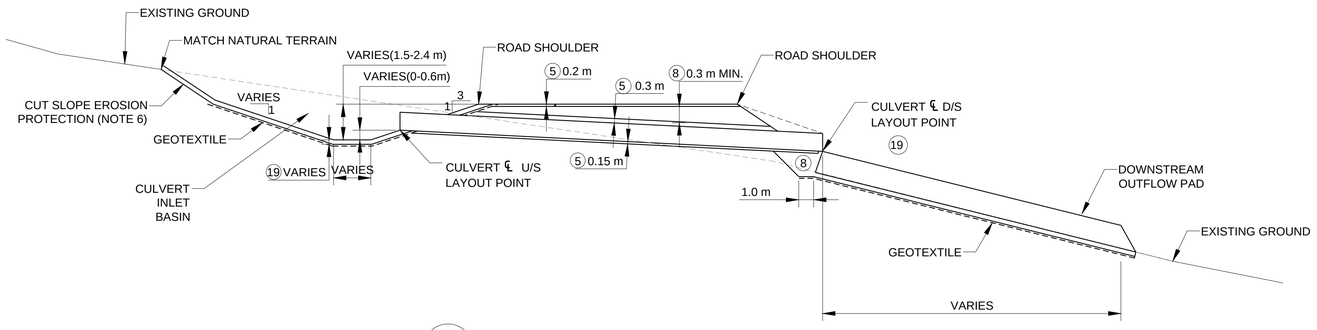
TITLE
PLAN AND PROFILE STA 109+350 TO 109+821

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	13 of 17	013

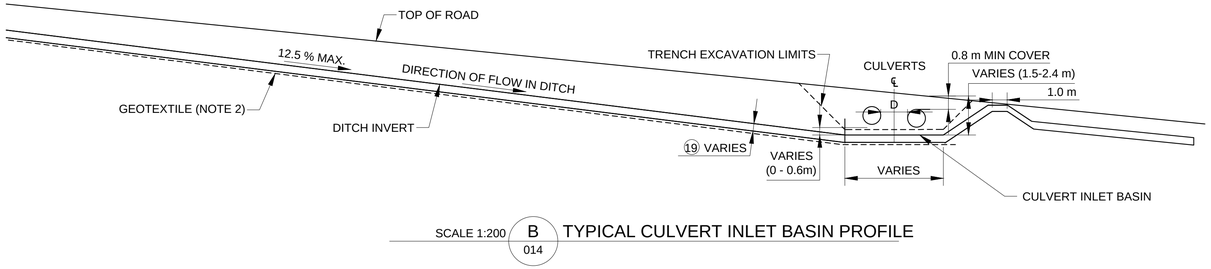


TYPICAL PIPE CROSSING PLAN VIEW

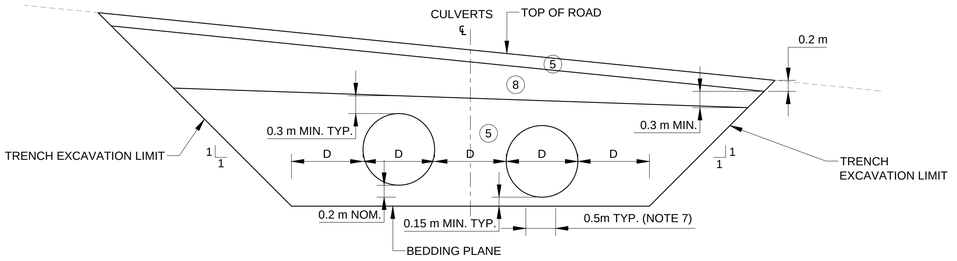
SCALE 1:200



SCALE 1:200 A 014 TYPICAL PIPE CROSSING PROFILE



SCALE 1:200 B 014 TYPICAL CULVERT INLET BASIN PROFILE



SCALE 1:50 C 014 TYPICAL PIPE CROSSING SECTION

LEGEND

5	SCREENED MATERIAL
8	JAW RUN
19	EROSION PROTECTION (NOTE 9)

NOTES

1. PIPE CROSSING LAYOUT WAS ADJUSTED BASED ON ENCOUNTERED FIELD CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. GEOTEXTILE WAS PLACED IN ALL INLET BASINS AND OUTFLOW PADS EXCEPT AT CV2.
3. THE INLET BASINS WERE NOT CONSTRUCTED TO DESIGN DIMENSIONS DUE TO THE FROZEN GROUND CONDITIONS.
4. NO SURVEY INFORMATION WAS PROVIDED FOR THE DOWNSTREAM OUTFLOW PADS.
5. NO SURVEY INFORMATION WAS PROVIDED FOR THE BACKFILL LAYERS. LAYER THICKNESS WAS OBSERVED BY THE OWNER'S REPRESENTATIVE IN THE FIELD.
6. CULVERT SKEW WAS ADJUSTED BY THE OWNER'S REPRESENTATIVE BASED ON ENCOUNTERED FIELD CONDITIONS.
7. BEDDING WAS SHAPED TO RECEIVE THE PIPE.
8. IT IS RECOMMENDED THAT EROSION PROTECTION OF THE DOWNSTREAM OUTFLOW PAD BE EXTENDED TO A WATER BODY CAPABLE OF CONVEYING THE CONCENTRATED FLOW TO PREVENT EROSION OF THE NATURAL SOILS.
9. THE EROSION PROTECTION ROCK SIZE IS SMALLER THAN REQUIRED FOR THE SELECTED 1:10 YEAR DESIGN FLOW. THIS IN IN RECOGNITION OF THE AVAILABLE MATERIAL AND AT THE OWNER'S REQUEST. RIPRAP BLOCKS COULD MOBILIZE EVEN DURING FREQUENT FLOOD EVENTS, WHICH MIGHT IMPACT SIGNIFICANTLY THE OPERATION OF THE DRAINAGE SYSTEM. REGULAR MAINTENANCE WILL BE REQUIRED. FUTURE IMPROVEMENTS (I.E. REPLACEMENT OF EROSION PROTECTION WITH MATERIAL WITH LARGER ROCK SIZES, PLACEMENT OF GABION MATS) ARE RECOMMENDED.
10. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
11. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
12. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

CULVERT SCHEDULE

CULVERT ID	FISH BEARING (Y/N)	NUMBER OF PIPES	DIAMETER, D (mm)	LENGTH L_c, (m)	TYPE	CULVERT CL LAYOUT AT UPSTREAM			CULVERT CL LAYOUT AT DOWNSTREAM			SLOPE, S (%)	SKEW (°)
						NORTHING	EASTING	U/S INV. ELEV. (m)	NORTHING	EASTING	D/S INV. ELEV. (m)		
CV1	N	2	1000	36.0	CSP	7912810.6	563134.8	258.47	7912776.9	563147.9	256.62	5%	90
						7912809.7	563132.5	258.26	7912775.9	563145.7	256.43	5%	
CV2	N	1	1200	33.0	CSP	7913325.4	563298.6	298.12	7913292.0	563298.1	296.46	5%	-
CV3	N	2	1000	33.0	CSP	7913529.4	563583.7	330.34	7913503.1	563603.7	328.48	6%	88
						7913527.8	563582.0	330.11	7913504.6	563605.5	328.68	4%	
CV4	N	2	1000	39.0	CSP	7913707.4	563699.0	356.04	7913675.4	563721.5	353.80	6%	96
						7913706.3	563697.8	355.78	7913676.7	563723.2	353.96	5%	
CV5	N	2	1000	39.0	CSP	7913867.3	564079.1	397.64	7913837.5	564104.3	395.86	5%	97
						7913868.5	564080.5	397.79	7913836.2	564102.5	395.66	5%	
CV6	N	2	1200	39.0	CSP	7914306.9	564264.9	436.40	7914291.3	564300.7	434.30	5%	97
						7914304.6	564264.0	436.20	7914293.5	564301.6	434.50	4%	
CV7	N	2	1200	51.0	CSP	7915008.2	564263.1	504.96	7915018.7	564313.2	502.65	5%	92
						7915010.5	564262.8	505.12	7915016.5	564313.4	502.41	5%	
CV8	N	2	500	18.0	CSP	7913087.9	563332.5	274.52	7913073.2	563343.2	273.50	6%	-

0 2 4
1:50 METRES

0 10 20
1:200 METRES

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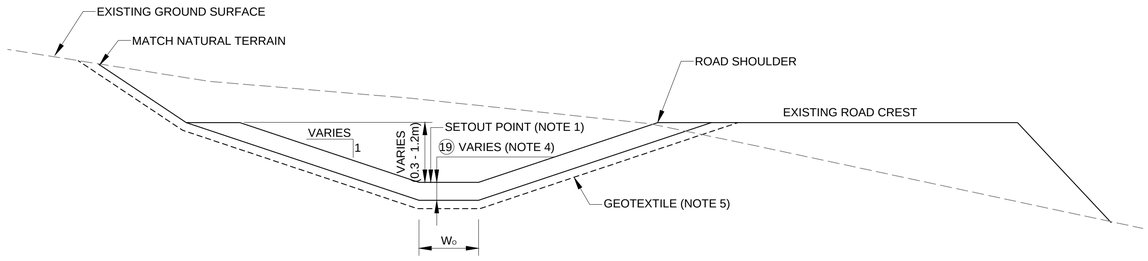
PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

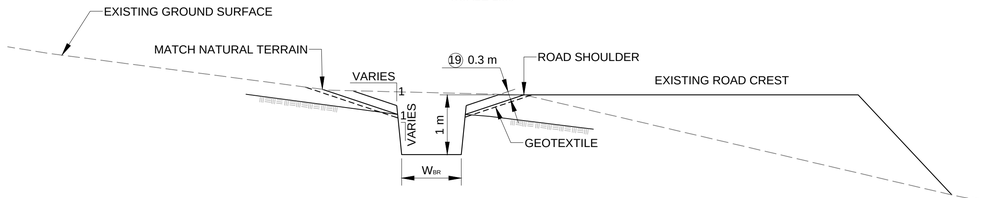
TITLE
PIPE CROSSING TYPICAL DETAILS AND CULVERT SCHEDULE

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	14 of 17	014



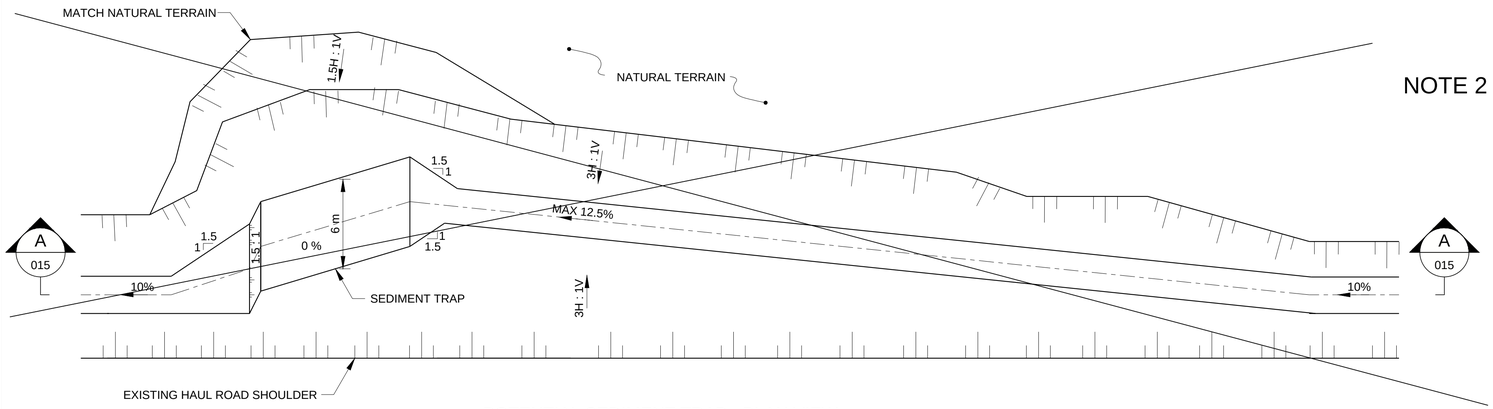
TYPICAL DITCH CROSS-SECTION (OVERBURDEN)

SCALE 1:50



TYPICAL DITCH CROSS-SECTION (ROCK CUT)

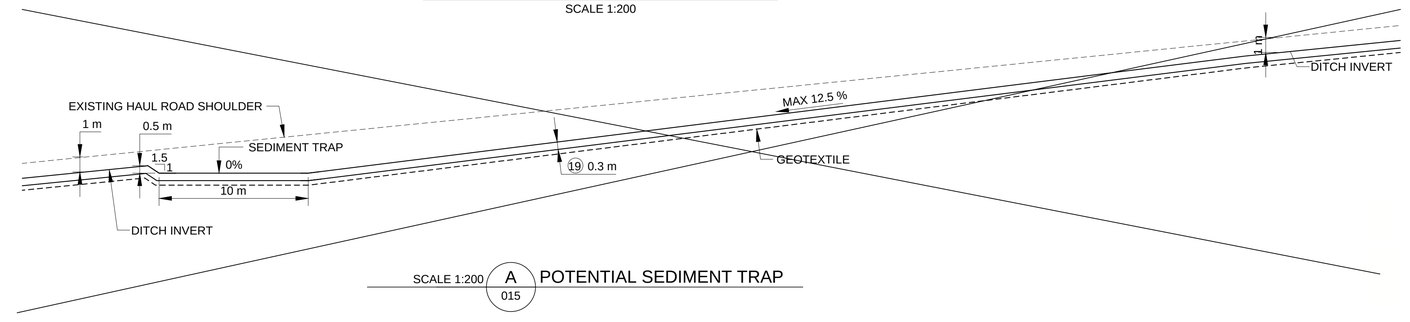
SCALE 1:50



POTENTIAL SEDIMENT TRAP - PLAN VIEW

SCALE 1:200

NOTE 2



SCALE 1:200 A 015 POTENTIAL SEDIMENT TRAP

NOTE 2

LEGEND

19 EROSION PROTECTION (NOTE 8)

NOTES

1. DITCH LAYOUT WAS ADJUSTED BASED ON ENCOUNTERED FIELD CONDITIONS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. THE POTENTIAL SEDIMENT TRAPS WERE NOT CONSTRUCTED IN THIS CONSTRUCTION PHASE.
3. THE POTENTIAL DRAINAGE SWALE WAS NOT CONSTRUCTED IN THIS CONSTRUCTION PHASE.
4. THE CONFIGURATION AND THE EROSION PROTECTION THICKNESS VARIED FROM DESIGN FOR THE DITCH DUE TO THE ENCOUNTERED FIELD CONDITIONS.
5. GEOTEXTILE WAS PLACED IN STEEP SECTIONS OF THE DITCH.
6. RANGE OF BASE WIDTH BASED ON AS-BUILT CROSS-SECTIONS SPACED AT 50 m.
7. DITCH 7, RAMP 1 DITCH, RAMP 2 DITCH AND RAMP 3 DITCH WERE NOT CONSTRUCTED IN THIS CONSTRUCTION PHASE.
8. THE EROSION PROTECTION ROCK SIZE IS SMALLER THAN REQUIRED FOR THE SELECTED 1:10 YEAR DESIGN FLOW. THIS IN IN RECOGNITION OF THE AVAILABLE MATERIAL AND AT THE OWNER'S REQUEST. RIPRAP BLOCKS COULD MOBILIZE EVEN DURING FREQUENT FLOOD EVENTS, WHICH MIGHT IMPACT SIGNIFICANTLY THE OPERATION OF THE DRAINAGE SYSTEM. REGULAR MAINTENANCE WILL BE REQUIRED. FUTURE IMPROVEMENTS (I.E. REPLACEMENT OF EROSION PROTECTION WITH MATERIAL WITH LARGER ROCK SIZES, PLACEMENT OF GABION MATS) ARE RECOMMENDED.
9. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
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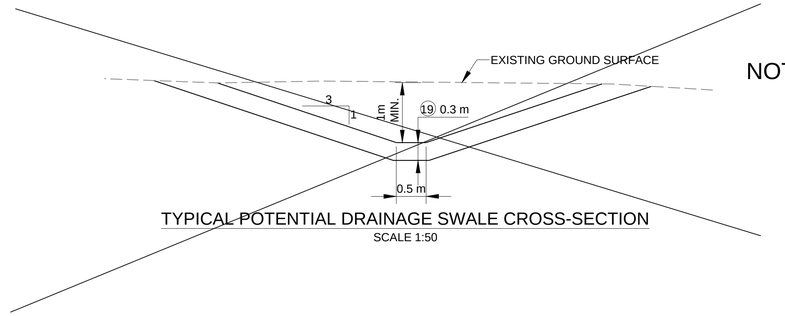

TYPICAL POTENTIAL DRAINAGE SWALE CROSS-SECTION

SCALE 1:50

NOTE 3

DITCH DETAILS (NOTE 6)

DITCH ID	START STATION	END STATION	BASE WIDTH (m)
DITCH 1	105+277	106+209	0.5 - 4
DITCH 2	106+209	106+503	1.2 - 2.9
DITCH 3	106+503	106+836	1.7 - 2.0
DITCH 4	106+836	107+287	1.5 - 1.6
DITCH 5	107+339	108+035	1.0 - 1.5
DITCH 6	108+035	108+745	1.0 - 2.4
DITCH 7	NOT CONSTRUCTED		
RAMP 1 DITCH	NOT CONSTRUCTED		
RAMP 2 DITCH	NOT CONSTRUCTED		
RAMP 3 DITCH	NOT CONSTRUCTED		

0 2 4

1:50 METRES

0 10 20

1:200 METRES

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PROJECT

MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE

DITCHES AND SEDIMENT TRAPS TYPICAL DETAILS

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	15 of 17	015

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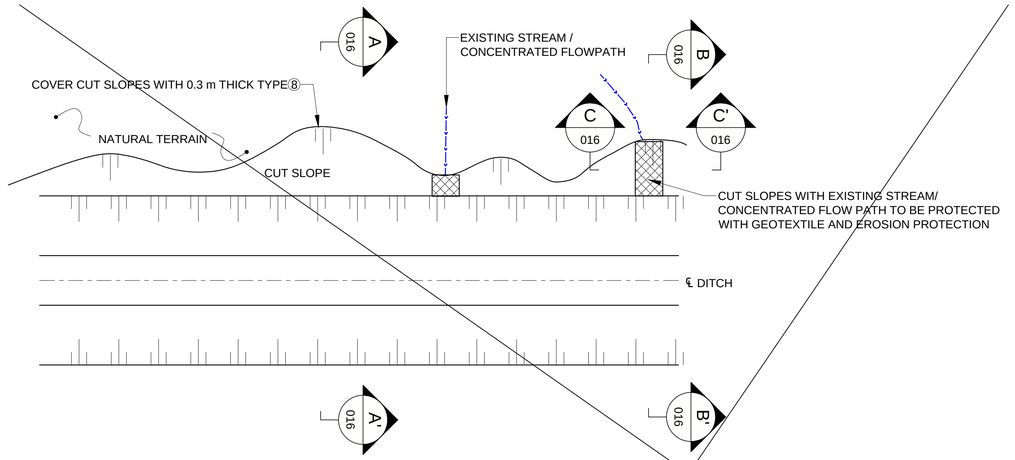
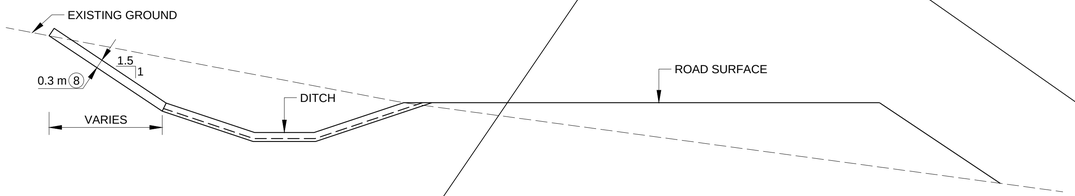
0 25 mm



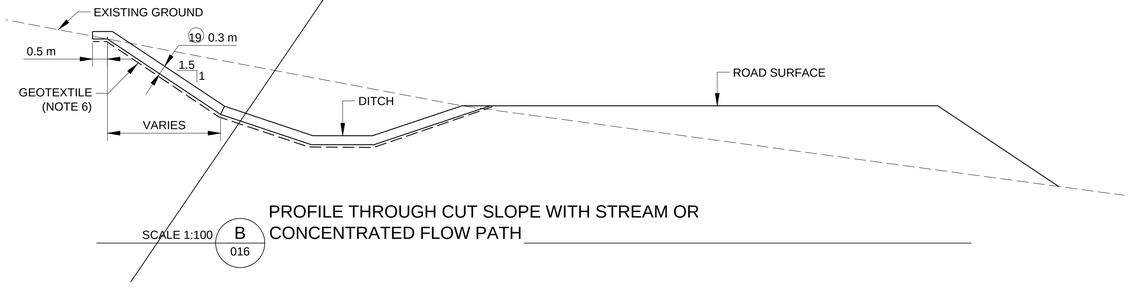
TYPICAL CUT SLOPE EROSION PROTECTION

SCALE 1:150

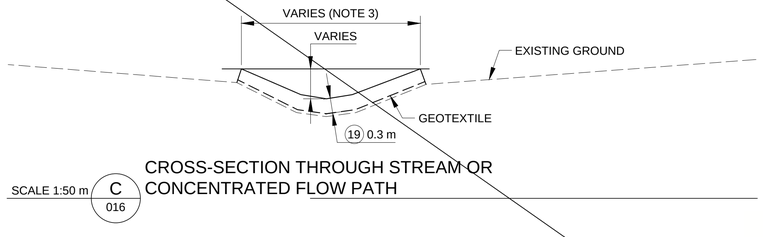
NOTE 1



SCALE 1:100 A 016 PROFILE THROUGH CUT SLOPE



SCALE 1:100 B 016 PROFILE THROUGH CUT SLOPE WITH STREAM OR CONCENTRATED FLOW PATH



SCALE 1:50 m C 016 CROSS-SECTION THROUGH STREAM OR CONCENTRATED FLOW PATH

NOTES

1. NO CUT SLOPE EROSION PROTECTION WAS PLACED DURING THIS CONSTRUCTION PHASE DUE TO THE ENCOUNTERED FIELD CONDITIONS (I.E. SLOPES COVERED IN SNOW AND ICE).
2. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
3. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
4. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

0 5 10
1:100 METRES

0 5 10
1:150 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
0	2016-04-01	ISSUED FOR CONSTRUCTION	FZG	MJT	MJT	PMB
A	2016-03-18	ISSUED FOR CLIENT REVIEW	FZG	MJT	MJT	PMB

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature Original Signed
Date
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

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CLIENT
Baffinland

CONSULTANT
Golder Associates

MISSISSAUGA OFFICE
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ONTARIO L5N 7K2
CANADA
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www.golder.com

PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
CUT SLOPES EROSION PROTECTION DETAILS

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	16 of 17	016

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

25 mm

DITCH 1 SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
D101	563159.30	7912821.98	259.50
D102	563204.45	7912843.25	260.56
D103	563236.73	7912880.71	262.22
D104	563261.75	7912923.98	263.59
D105	563278.26	7912970.38	266.03
D106	563283.04	7913020.15	270.44
D107	563282.87	7913070.04	275.18
D108	563271.78	7913118.70	279.12
D109	563263.65	7913167.84	282.95
D110	563254.28	7913215.67	286.43
D111	563272.85	7913260.92	291.65
D112	563298.12	7913303.84	297.73
D113	563329.77	7913341.21	300.79
D114	563367.19	7913374.26	304.60
D115	563402.66	7913409.42	310.61
D116	563439.07	7913443.57	317.07
D117	563480.67	7913471.16	321.48
D118	563524.68	7913494.80	324.79
D119	563570.17	7913521.20	329.94

DITCH 2 SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
D201	563597.31	7913553.99	332.58
D202	563625.10	7913595.55	338.89
D203	563652.41	7913637.40	345.24
D204	563671.17	7913683.66	352.46
D205	563708.48	7913715.37	357.48
D206	563721.21	7913732.91	360.25

DITCH 3 SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
D301	563819.64	7913761.47	369.56
D302	563865.23	7913781.56	375.04
D303	563913.77	7913793.26	378.62
D304	563962.17	7913805.61	383.41
D305	564007.80	7913824.22	389.10
D306	564050.60	7913849.90	394.62
D307	564062.68	7913858.07	396.25

DITCH 4 SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
D401	564098.38	7913890.78	399.55
D402	564121.54	7913910.21	403.32
D403	564144.44	7913933.35	407.22
D404	564165.26	7913978.58	411.32
D405	564171.78	7914027.56	416.69
D406	564176.17	7914077.27	422.27
D407	564194.10	7914123.46	426.09
D408	564216.02	7914168.25	427.87
D409	564236.84	7914213.63	430.18
D410	564245.75	7914238.45	432.26

DITCH 5 SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
D501	564273.70	7914339.24	439.45
D502	564282.88	7914387.91	443.93
D503	564291.43	7914437.06	448.24
D504	564303.85	7914485.48	452.95
D505	564308.80	7914535.13	457.53
D506	564308.93	7914585.13	462.79
D507	564304.29	7914634.47	467.86
D508	564301.94	7914683.17	472.50
D509	564301.41	7914732.89	477.09
D510	564302.42	7914782.51	482.29
D511	564306.87	7914831.97	487.71
D512	564299.01	7914880.97	494.09
D513	564283.68	7914928.20	499.55
D514	564270.02	7914973.57	503.48

DITCH 6 SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
D601	564256.79	7915025.35	505.64
D602	564258.21	7915037.44	507.18
D603	564261.57	7915057.86	508.48
D604	564259.09	7915086.58	511.08
D605	564250.66	7915135.85	515.59
D606	564239.68	7915184.63	521.02
D607	564228.43	7915233.25	526.72
D608	564197.28	7915271.06	531.02
D609	564169.99	7915311.41	535.53
D610	564146.96	7915355.79	540.35
D611	564135.84	7915403.81	543.98
D612	564123.99	7915452.19	547.01
D613	564118.39	7915500.76	551.36
D614	564107.24	7915549.46	555.47
D615	564078.23	7915589.10	559.42
D616	564047.05	7915617.12	563.98

DITCH 7 SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
D701	563869.69	7915455.23	587.81
D702	563842.62	7915413.31	592.77
D703	563811.22	7915375.05	597.62
D704	563793.99	7915328.41	600.67
D705	563773.77	7915282.79	602.65
D706	563751.19	7915239.08	604.27
D707	563718.98	7915201.12	606.23
D708	563684.90	7915164.54	610.73
D709	563650.25	7915128.50	615.35
D710	563614.18	7915093.95	620.83
D711	563568.47	7915075.02	627.21
D712	563552.39	7915073.34	628.87

NOTES

1. DITCH LAYOUT WAS ADJUSTED TO MATCH FIELD CONDITIONS AS SHOWN ON DWGS. 003 TO 013.
2. REFER TO DWG. 002 FOR ADDITIONAL NOTES.
3. AS-BUILT SURVEY DATA WAS PROVIDED ON MAY 30, 2016 BY NUNA LOGISTICS AND IS SHOWN AS PROVIDED UNLESS OTHERWISE INDICATED.
4. THE GEOTECHNICAL ENGINEER'S SEAL ON THIS DRAWING VERIFIES THAT THE AS-BUILT INFORMATION PROVIDED BY OTHERS AND REVIEWED, BUT NOT INSPECTED BY THE GEOTECHNICAL ENGINEER, HAS NO MATERIAL EFFECT ON THE DESIGN OF THE COMPLETED WORK.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2016-07-15	AS-BUILT - PHASE 1 CONSTRUCTION	FZG	MJT	MJT	PMB
1	2016-04-15	REVISED - MINE HAUL ROAD AS-BUILT	FZG	MJT	MJT	PMB
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www.golder.com

PROJECT
MARY RIVER PROJECT
MINE HAUL ROAD
DRAINAGE IMPROVEMENT PROJECT

TITLE
DITCH SETOUT POINTS

PROJECT NO.	PHASE	REV.		DRAWING
1649295	7000	2	17 of 17	017

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

25 mm

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Path: \\golder.gds\GAL\Mississauga\SIM\Clients\Baffinland_Iron_Mines_Corp\Baffin_Island\09_PROJ\1649295\40_PROD\0001_Water_Mgmt\ | File Name: 1649295-0001-CM-0017.dwg

APPENDIX B

As-Built Survey Files (Raw format) Provided by Baffinland

APPENDIX C

Site Checklists and Photographs Provided by Baffinland

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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