ATTACHMENT 10

WATER MANAGEMENT PLANS

10.1 Mine Site Water Management Plan
10.2 Milne Port Water Management Plan
10.3 Mine Site Crusher Pad Drawings

ATTACHMENT 10.1

MINE SITE WATER MANAGEMENT PLAN

Mine Surface Water Management Plan

					Stanger, Daniel	
11-09-2018	0	Issued for Use	F Hugo	A Grobbelaar	D Stanger	T Atiba
Date	Rev.	Status	Prepared By	Checked By	Approved By	Approved By
			HATCH			Client

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List of Appendices

1. Introduction

This document describes the various earthworks and infrastructure features that are planned to be constructed as part of the Expansion Project and how storm water is managed as a result of the new features. This document covers the design of all surface water infrastructure required to satisfy the approved Civil Design Philosophy for the Mary River Mine Site.

Storm water management and drainage systems were applied in various locations across the site to ensure that surface water runoff will have limited interference with infrastructure at the mine infrastructure site.

Care was taken to ensure that where possible, the existing watersheds and streams remained in their original state. This was done through the use of berms, ditches, swales and culverts.

For more detail refer to the Issued for Construction (IFC) drawings for the relevant areas. For a list of the related IFC drawings see Appendix A.

The overall layout for the Mine Site Storm Water Drainage Plan can be seen in Appendix B.

2. References

2.1 General

2.1.1 All applicable federal, territorial (Nunavut) and local laws and regulations apply, in particular the following apply:

- OHSA Occupational Health and Safety Act
- CSA Canadian Standards Association
- MHSA Mine Health and Safety Act (Nunavut – S.N.W.T. 1994)
- OHSR Occupational Health and Safety Regulations
- NBCC National Building Code of Canada (2010)
- ASTM American Society for Testing and Materials
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2.2 Reference Documents

Reference is made to the contents of the following documents, articulated during the previous phases of the project and the current phase:

- H353004-00000-200-210-0001: Civil Design Philosophy
- H337697-0000-10-122-0001: Storm Water Management and Drainage System Design

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- H353004-40000-200-210-0001: 2018 Water Management Report.

3. Overview

This document is divided into different areas of interest. The areas are grouped as follows:

- 800 Person Camp – Storm water management in and around the new 800-person camp
- Haul Road & Stormwater Diversion Berms 1 and 2 – These diversion berms divert water away from the crusher pad and haul road
- Mine Crusher Pad – Runoff from the crusher pad into swales and culverts draining towards the new Mine settling pond
- Mine Settling Pond – A new settling pond designed for runoff from the new crusher pad
- New Mine workshop pad and access road – Storm water management for the workshop pad and access road to the pad
- New Mine Fuel Tank Farm – Storm water management in and around the new fuel tank terrace and berms created for containment of spillage
- Mine Culvert 3A, 3B and 4 – These culverts are designed to manage storm water runoff from an existing stream underneath the new Tote Road diversion and proposed rail alignment and associated service road
- Kohler Gen Sets – Storm water management at the pad where new generator sets will be located
- Tote Road Diversion – Storm water management along the Tote Road Diversion and new airport access required as a result of the rail construction
- Rail Service & Access road – Stormwater management for the service road along the rail line providing access to the 800 person camp and the treated effluent discharge point

The layout of the various drainage areas described above is depicted in Figure 3-1 below.

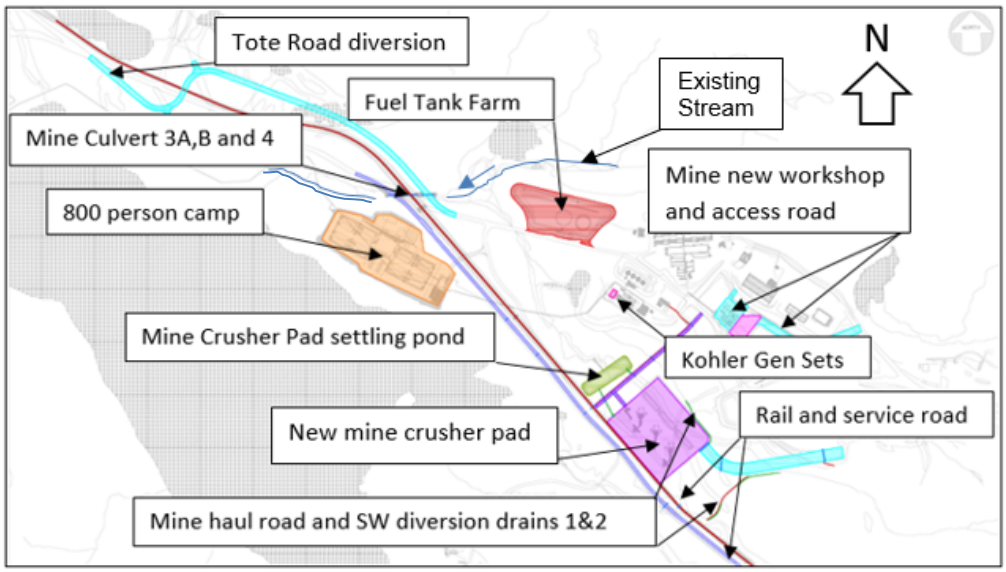

Figure 3-1: Mine Site Drainage Areas

4. 800-Person Camp Area Drainage

This section describes the drainage for the terrace created for the new 800 person camp.

The 800-person camp is constructed on top of a purpose-built pad. This camp pad includes a parking area for vehicles & personnel transport as well as a raised platform for delivery of food and other consumables to the kitchen area.

The camp pad is designed with a gradient to direct storm water from the perimeter areas of the pad to the sides of the pad. On top of the camp pad, additional level pads were constructed for the accommodation, kitchen and other facilities (wastewater treatment plant, waste disposal and electrical plant, etc.).

Storm water runoff from the level pads underlying these units (8 accommodation wings and common core with kitchen/dining area) is nominal and any run off is managed through troughs on the pad. Note that The accommodation wings are raised above the pad level and no water can enter the buildings.

Storm water runoff from the larger underlying camp pad is through overland sheet flow off the pad. No storm water is concentrated through swales, culverts or canals.

Figure 4-1 shows the 800-person camp site drainage.

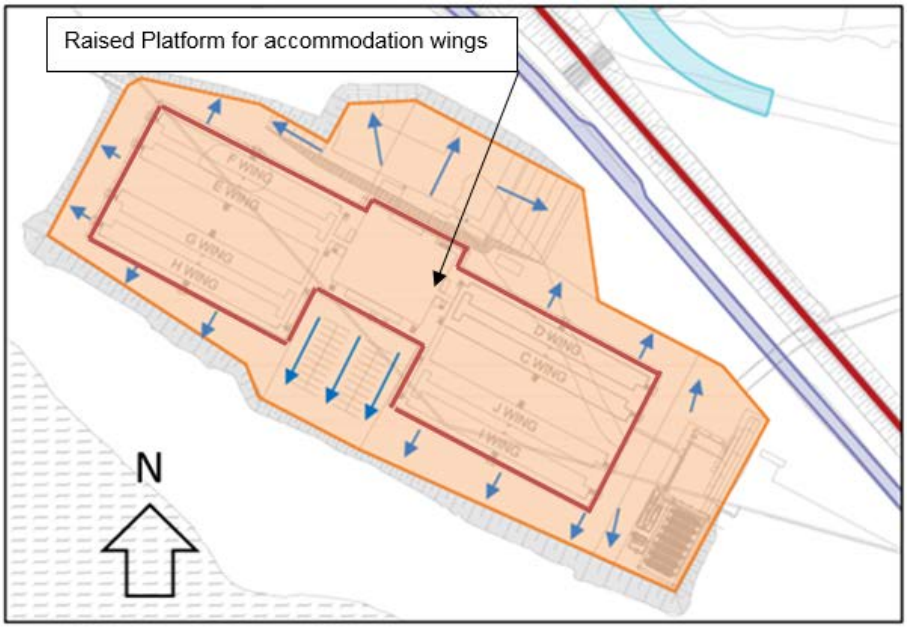

Figure 4-1: 800 Person Camp Site Drainage

5. Haul Road and Storm Water Diversion Berms 1 and 2

A new haul road is to be constructed to access the new crusher pad and on-loading platform for the rail wagons.

The haul road and storm water diversion berms 1 & 2 are indicated on Figure 5-1.

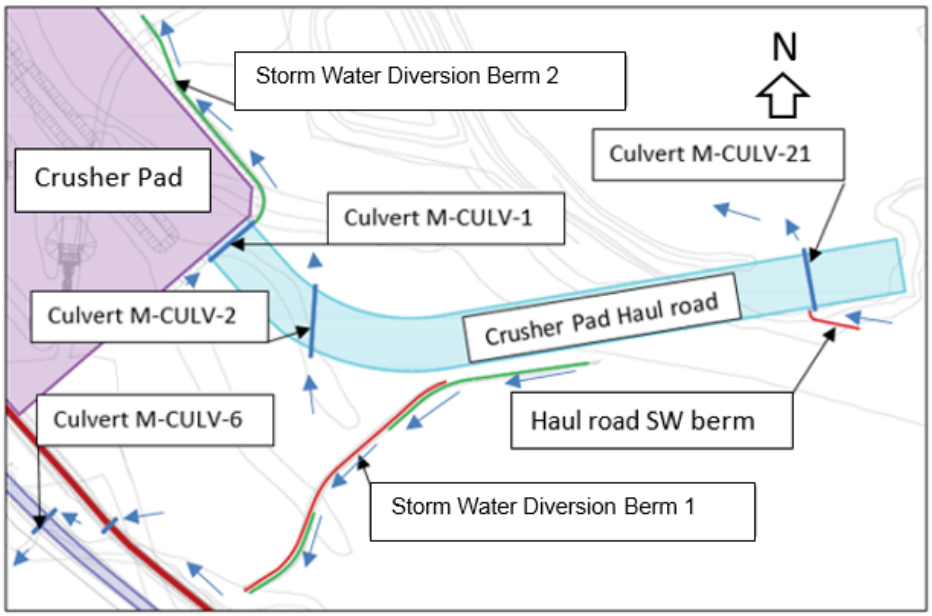

Figure 5-1: Mine Crusher Pad Haul Road And Diversion Berms 1 & 2

The haul road is graded in one direction ensuring sheet flow runoff from the road towards the downstream slope of the surrounding ground level. Openings in the safety berms adjacent to the road allows water to escape to the natural environment.

Two storm water diversions (SWD 1 & 2) and a haul road storm water berm are designed to divert storm water away from the crusher and on loading platform and direct it to natural drainage ditches / culverts in the vicinity (M-CULV-1, 2 and 21).

Storm Water Diversion 1 (SWD-1) – The diversion is located to the south of the haul road. Storm water accumulates against the toe of the haul road fill and runs towards the crusher pad. At a point close to the pad, a diversion ditch is created, directing the flow to the south to a low point where it joins a natural stream. This stream eventually crosses the rail and adjacent service road through a 1 200 mm diameter CSP culvert (M-CULV-6) where it subsequently drains into the surrounding environment. This SWD-1 diversion has the following dimensions:

- Minimum vertical depth of 800mm
- Side slopes at 1V:2H
- Bottom Width - 0.5m
- Flow (1:100) - 1.52 m^3/s
- Velocity - 1.35 m/s

Rip rap will be provided for the first section of the diversion since the hydraulic analysis showed that the velocity will be greater than 1.5 m/s when no rip rap is present.

Storm Water Diversion 2 (SWD-2) – This diversion caters for storm water accumulating at the low point where the haul roads enters the crusher pad. The accumulated water from a small catchment to the south of the haul road is conveyed underneath the haul road through a 600mm diameter CSP culvert (M-CULV-1). From the exit of the culvert the storm water is conveyed in a ditch and directed to an existing stream adjacent to the crusher pad.

The diversion has the following dimensions and detail:

- Side slopes at 1V:2H
- Bottom Width - 0.5m
- Flow (1:100) - 0.67 m^3/s
- Velocity - 1.08 m/s
- No rip rap will be required for this diversion.

6. Mine Crusher Pad Drainage

The crusher pad drainage area is depicted is Figure 6-1 below.

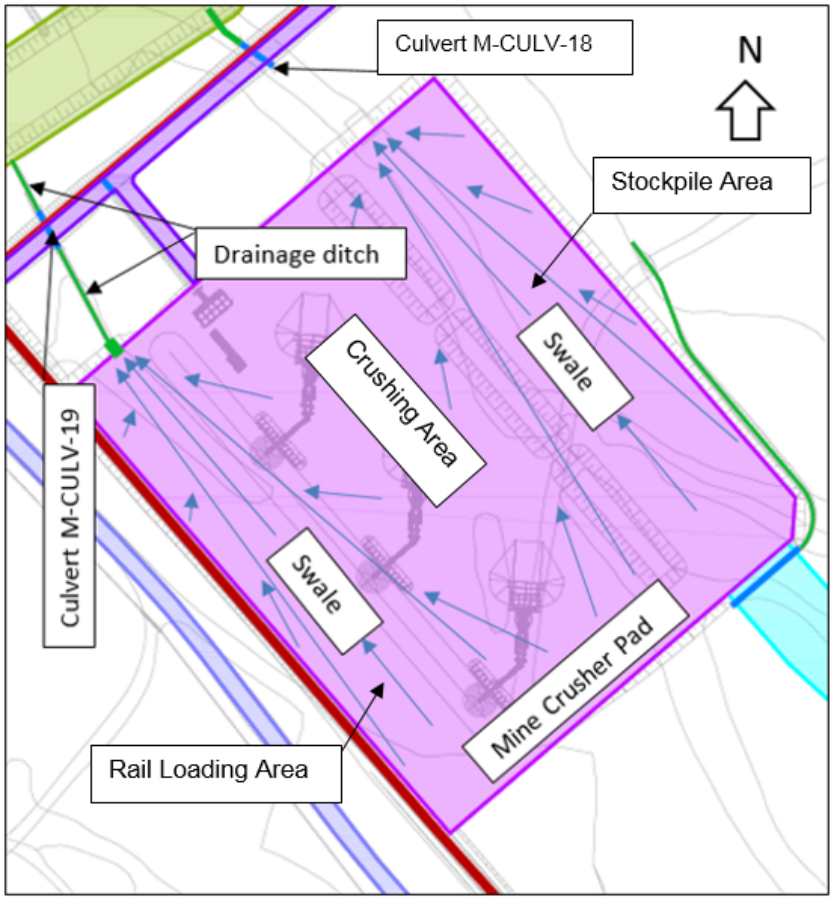

Figure 6-1: Mine Crusher Pad Drainage Area

The crusher pad consist of three distinct areas:

- Stockpiling area
- Crushing area
- Rail wagon on-loading area.

The crusher pad is elevated from the surrounding natural ground to prevent any storm water discharging onto the pad, either through sheet flow or concentrated flow. The runoff from the pad may be impacted by high levels of total suspended solids and therefore needs to be contained and tested before release.

Storm water runoff is directed towards a settling pond (See section 7) in two separate swales on top of the pad. The pad is graded to form the swales.

The swale on the north side of the pad discharges to the natural environment and ends up at a low point where it continues flowing to the settling pond via a culvert (M-CULV-18) and eventually into the setting pond via a channel (Eastern). At the discharge point from the pad, erosion protection is provided on the pad embankment in the form of rip-rap. The drainage channel (Eastern) has the following properties:

- Bottom Width - 0.1m
- Side Slopes - 1V:1.5H
- Flow - 0.10 m^3/s
- Velocity - 0.78 m/s

The pad swale to the south discharges in a similar manner as the one to the north except that it continues flow in a drainage ditch and then passes underneath the utility berm and road through a 600mm diameter CSP culvert (M-CULV- 19) before finally discharging into the settling pond. The drainage channel (Western) was designed with the following properties:

- Bottom Width - 0.1m
- Side Slopes - 1V:1.5H
- Flow - 0.10 m^3/s
- Velocity - 0.57 m/s

7. Mine Crusher Pad Settling Pond

An overall layout of the settling pond area can be seen in Figure 7-1 below.

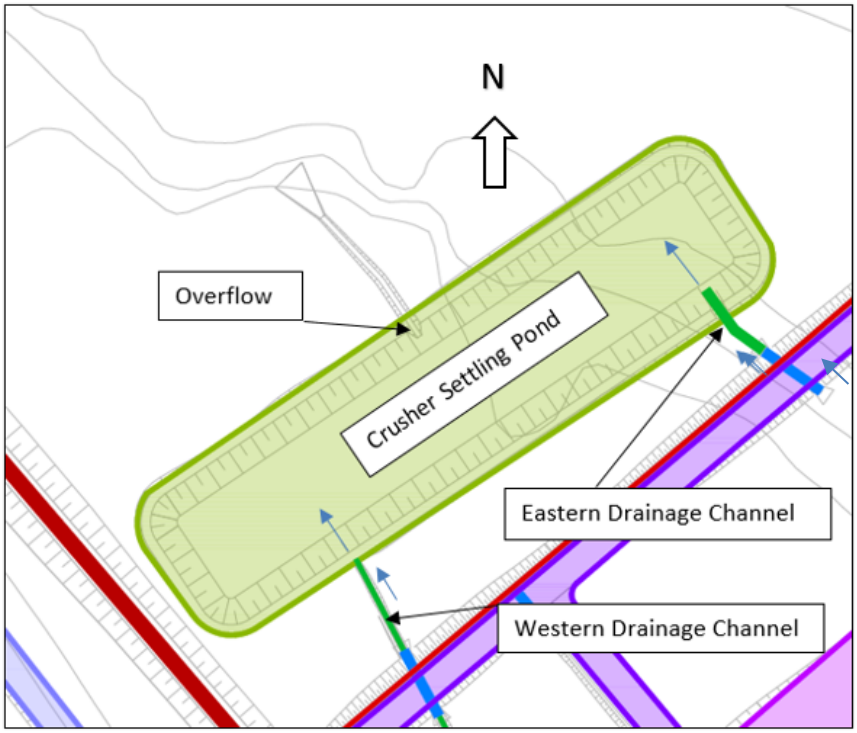

Figure 7-1: Crusher Pad Settling Pond

The inflow to the pond is from the Mine Crusher Pad Eastern and Western drainage channels which capture the runoff from the pad. The pond has an emergency overflow that flows into the natural environment and is designed in accordance with the Civil Design Philosophy. At the bottom of the overflow, rip rap is provided to dissipate the energy and prevent erosion.

The following values were applied in sizing the pond:

- Catchment area - 47 435 m2
- Runoff Coefficient - 0.9
- Rainfall (1:10 year 24 hour) - 40.8 mm

Based on these parameters it was determined that the required pond capacity is 1 742 m^3.

The overflow is designed to safely discharge the 1:200 year return period rainfall event. The result of the design and analysis are as follows:

- Bottom Width - 0.5 m
- Depth - 0.3 m
- Flow - 0.20 m3/s

8. New Mine Workshop Pad and Access Road

8.1 Truck Workshop Terrace

The truck workshop terrace layout is indicated below in Figure 8-1.

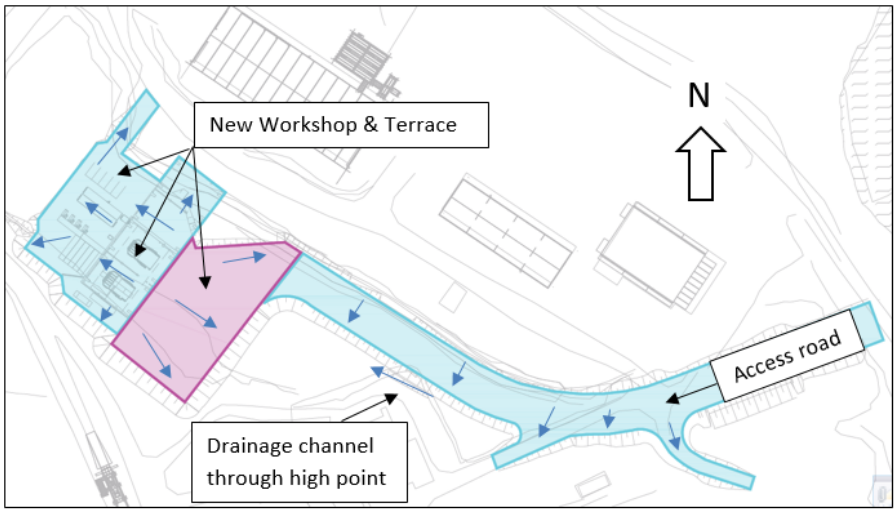

Figure 8-1: Mine New Workshop and Access Road Drainage

The new workshop terrace is graded to slope towards the outside of the terrace away from the footprint of the workshop building. The workshop footprint area is level to accommodate the floor and general structure. The parking area to the northwest is also

graded from the centre of the terrace toward the outside to accommodate overland flow. Once storm water flows off the terrace, it follows the natural drainage path.

8.2 Workshop Access Road Drainage

The access road to the new workshops is singularly graded to one side to allow natural drainage off the road surface. Safety berms on the access road have openings every 25m to allow for storm water to exit the access road surface.

A high point at the toe end of the fill to the access road has been cut to allow flow to continue past this high point. This side drain has a bottom width of 0.6m and side slopes of 1V:2H.

9. Mine New Fuel Tank Farm

Figure 9-1 indicates the Mine new fuel tank farm drainage.

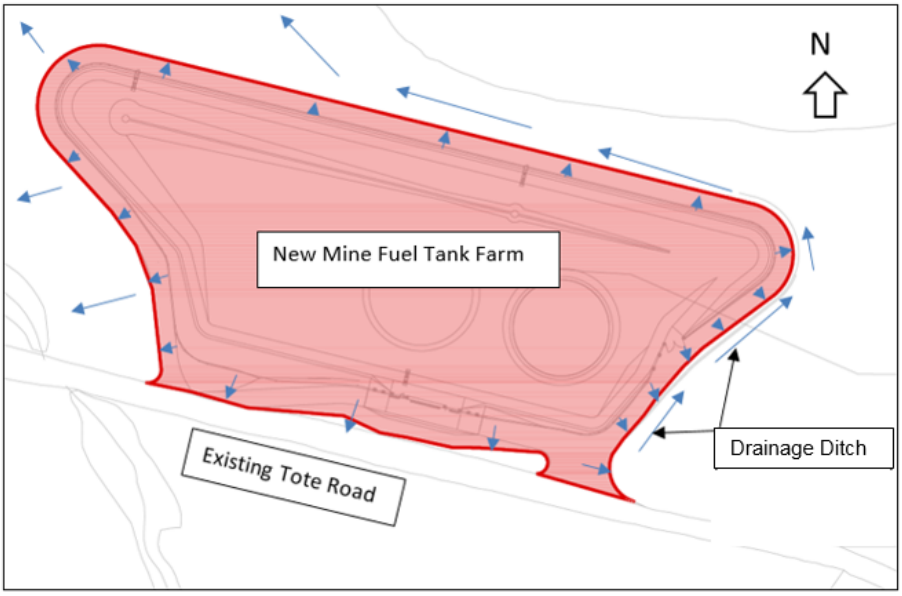

Figure 9-1: New Fuel Tank Farm Drainage

The tank farm consists of perimeter dykes and berms to ensure containment of any possible spillage. The containment dyke creates capacity for fuel spill storage of the largest tank volume plus 10% of the remaining tank/s volume. The design is in accordance with all relevant legislation and regulations governing the tank farm construction and design.

All precipitation collected inside the fuel tank farm is contained and tested before being discharged. If required, the water is treated to remove contaminants and then discharged. The road around the perimeter of the tank farm provides access for maintenance and emergency vehicles. Storm water drains to the outside of the road, off the terrace and into the natural environment.

On the south eastern side, a localised ditch is created to divert local rainfall towards the north (falling onto the access & service roads). This ditch is graded to convey the water to the north and into the existing natural drainage ditch.

10. Mine Culvert 3A, 3B and 4

The culvert M-CULV3-A, 3-B and 4 is to be constructed in phases. Culverts 3-A and -4 are to be constructed first as part of the Tote Road diversion (M-CULV-4) and the new airport access road and 800 personnel camp (M-CULV3-A). Culvert 3B will be constructed later, during construction of the rail embankment.

The culvert layout is depicted in Figure 10-1.

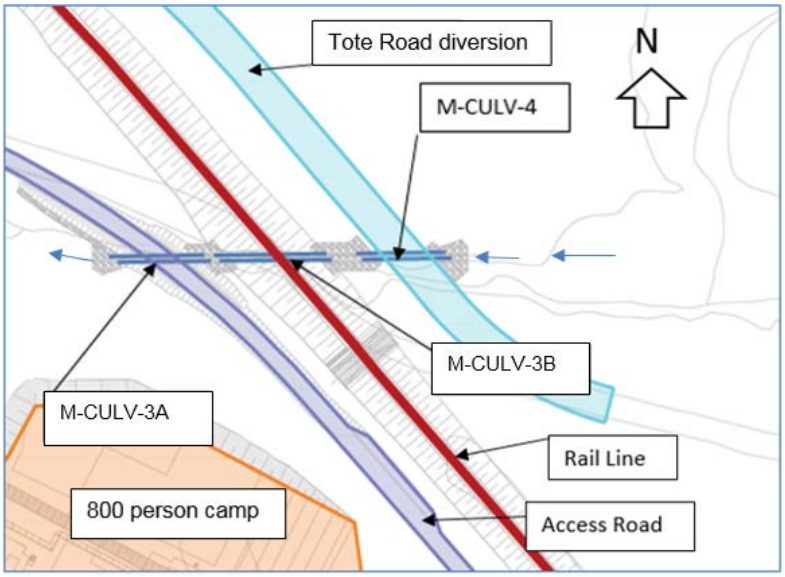

Figure 10-1: Mine Culvert 3A, 3B and 4

Each culvert has an inlet and outlet with rip rap to protect the embankment and its surrounds against scouring.

The culverts consists of 2 x 1.5 m diameter CSP barrels. Details of these culverts are shown on drawing No. H353004-10000-228-272-0004-0001.

The hydraulic calculations indicated the following:

- The upstream catchment area of the culvert is 3.7 ha
- Based on the 1:100 year return period flood, the computed headwater elevation at the culvert inlet is 180.139 m. This elevation is lower than the top of the tote road and the rail line, with an allowance of 300 mm freeboard.
- Calculated maximum velocity is equal to 1.83 m/s and as a result, rip rap will be placed at the inlet and outlet of the culverts to protect against erosion.

11. Kohler Gen Sets

Additional electrical generation sets are required for the mine expansion program. These Gen Sets are located on a existing terrace that will be expanded. The terrace is graded to allow sheet flow off the terrace where it then flows into the natural environment, , as shown on Figure 11-1.

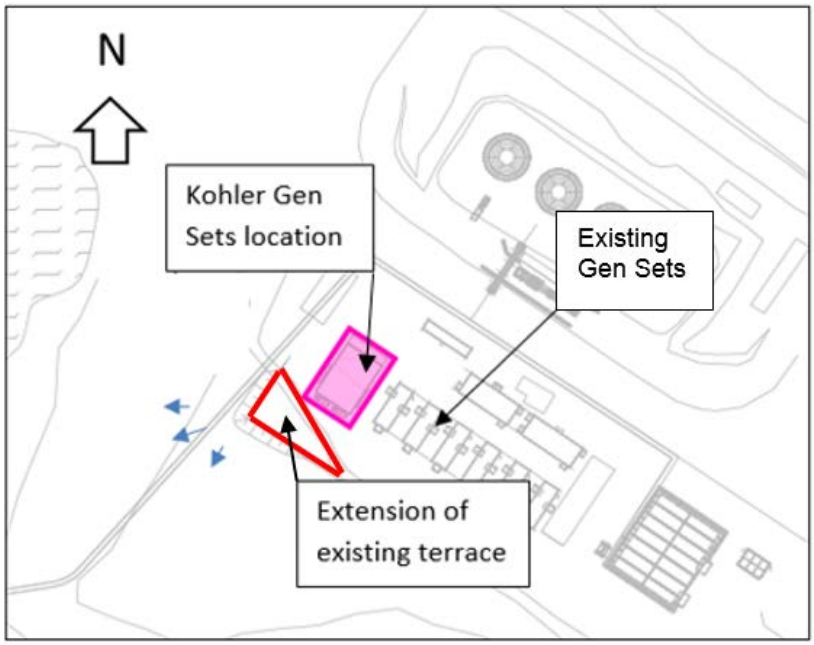

Figure 11-1: Kohler Gen Set Drainage

12. Tote Road Diversion

Drainage of the Tote Road diversion is based on surface runoff from the graded road. The drainage is from either side of the centre line to the sides of the road, and then onto the natural environment.

See Figure 12-1 below for the layout of the Tote Road diversion.

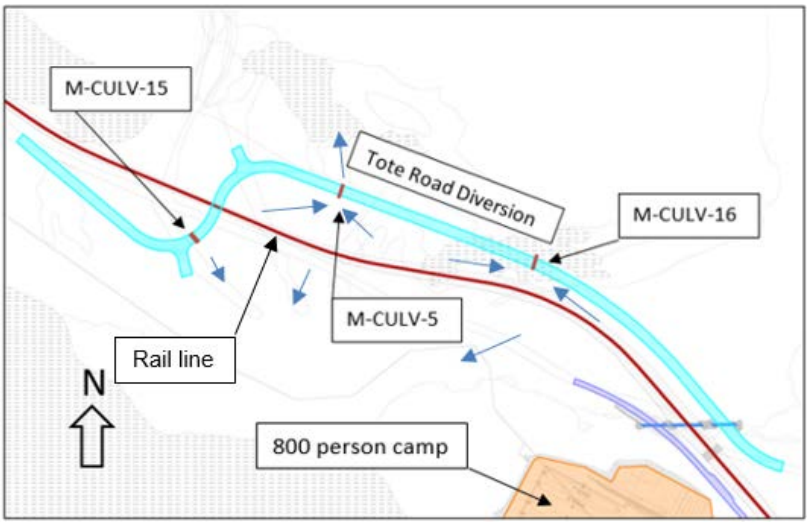

Figure 12-1: Tote Road Diversion Drainage

Apart from culverts M-CULV-3A, 3B & 4 described in Section 10, three additional culverts provide drainage at low points along the Tote Road diversion. These culverts are:

- M-CULV-5 - 1 x 600mm diameter CSP barrel

- M-CULV-15 - 1 x 600mm diameter CSP barrel
- M-CULV-16 - 1 x 600mm diameter CSP barrel.

None of the flow velocities through these culverts exceeds 1.5m/s and thus no erosion protection is required.

13. Rail Service and Access Road

The rail service and access road to the 800 personnel camp also serves as access to the treated effluent discharge point. The discharge point is located at the southern terminus of the road. This road follows the alignment of the rail embankment in a southeasterly direction. Storm water runoff from the catchment area between the rail line and the access road is directed to culverts at low points along the road. The location of these culverts are shown on Figure 13-1 and Figure 13-2.The design details for these culverts are:

- M-CULV-7 - 1 x 600mm diameter CSP barrel - no erosion protection required
- M-CULV-8 - 1 x 600mm diameter CSP barrel - no erosion protection required
- M-CULV-10 - 1 x 600mm diameter CSP barrel- no erosion protection required
- M-CULV-11 - 1 x 600mm diameter CSP barrel- no erosion protection required
- M-CULV-12 - 1 x 600mm diameter CSP barrel- requires erosion protection
- M-CULV-13 - 1 x 600mm diameter CSP barrel- requires erosion protection.

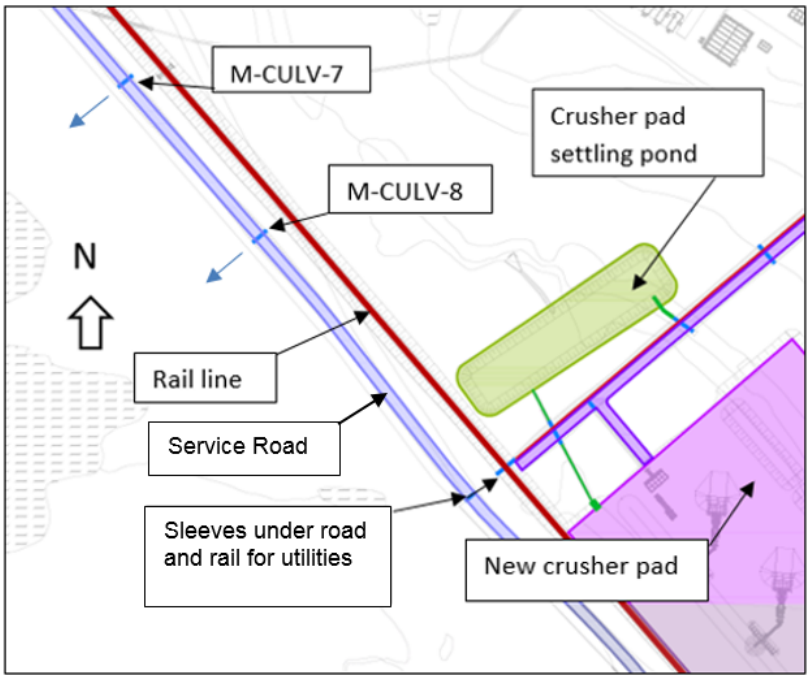

Figure 13-1: Rail Service & Access Road - Cross Drainage Culverts

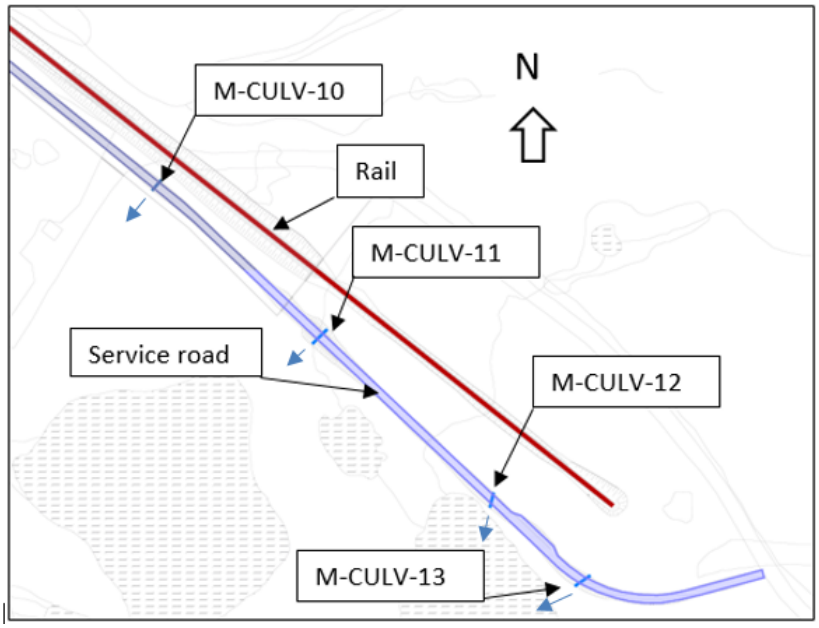

Figure 13-2: Rail Service & Access Road – Cross Drainage Culverts

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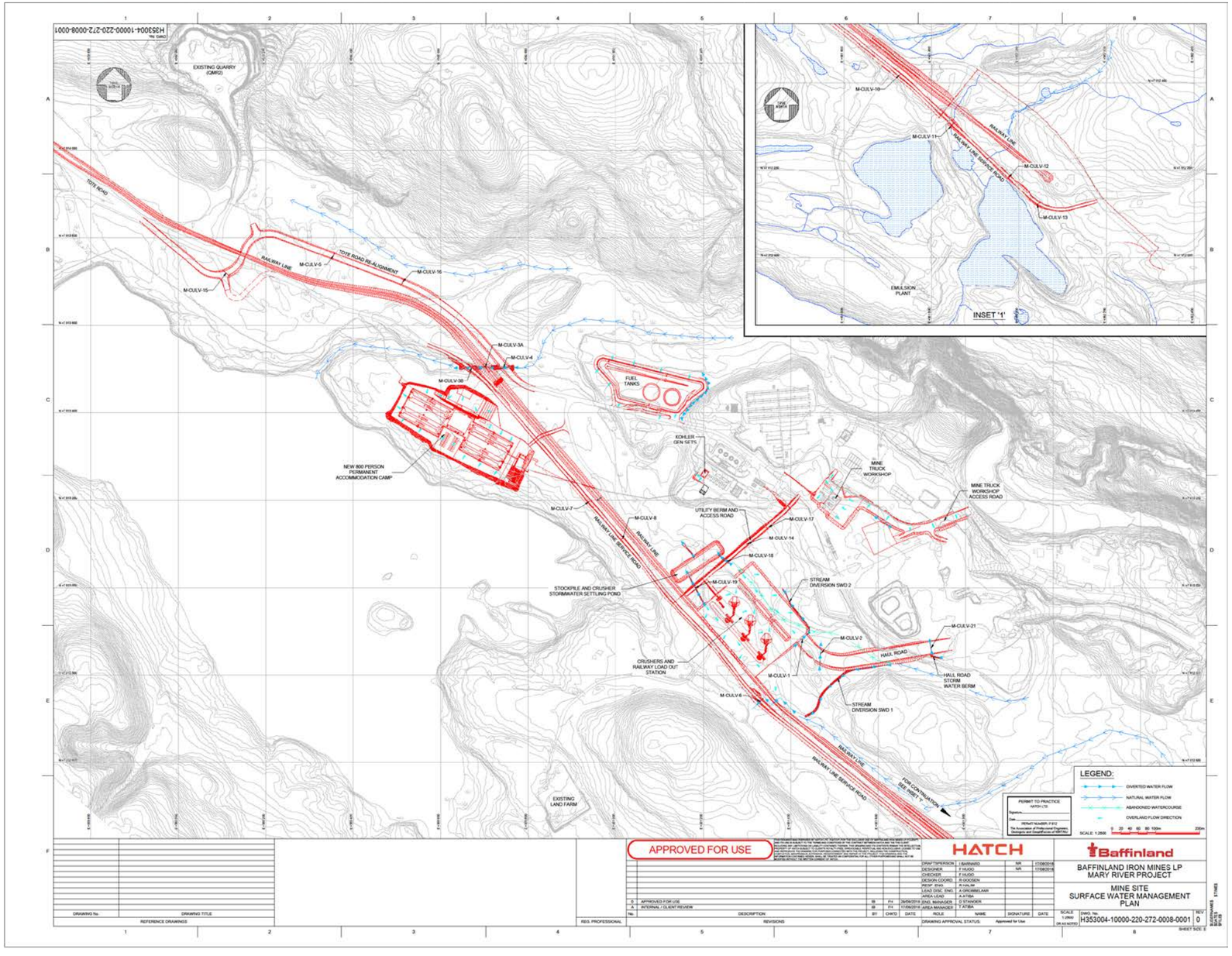
Appendix A
IFC Drainage Drawing List

Drainage Drawings	
H353004-10000-228-272-0001-0001	Mine Site - 800 Person Camp Pad - Drainage Plan
H353004-10000-228-272-0005-0001	Mary River Expansion Project - Mine Site - Crusher Pad - Drainage Plan
H353004-10000-228-273-0001-0001	Mary River Expansion Project - Mine Site - Rail Loadout Terrace- Polluted Water Dam - Cross Section & Details
H353004-10000-228-272-0006-0001	Mary River Expansion Project - Mine Site - Rail Loadout Terrace- Polluted Water Dam - Layout Drawing
H353004-10000-228-272-0004-0001	Mine Site - Service Road Culvert Detail
H353004-10000-221-273-0001-0001	Mine Site – Mine Truck Workshop pad – Earthworks cross sections
H353004-10000-221-271-0009-0001	Mine Site – Mine Truck Workshop pad – Access Road plan & profile

Other	
H353004-00000-200-210-0001	Civil Design Philosophy
H353004-10000-220-272-0008-0001	Mary River Project - Mine Site - 2018 Surface Water - Management Plan

Typical	
H353004-00000-221-294-0001-0001	Site Wide - Standard Drawing - Typical Culvert Details
H353004-00000-221-294-0002-0001	Site Wide - Standard Drawing - Earthworks & Drainage Details
H353004-00000-221-294-0003-0001	Site Wide - Standard Drawing - Earthworks & Drainage Details
H353004-00000-221-294-0004-0001	Site Wide - Standard Drawing - Earthworks & Drainage Details
H353004-00000-221-294-0005-0001	Site Wide - Standard Drawing - Earthworks & Drainage Details
H353004-00000-221-294-0006-0001	Site Wide - Standard Drawing - Earthworks & Drainage Details
H353004-00000-221-294-0007-0001	Site Wide - Standard Drawing - Road Signage Placement Details
H353004-00000-221-294-0008-0001	Site Wide - Standard Drawing - Typical Pad, Ditch & Berm Sections
H353004-00000-221-294-0009-0001	Site Wide - Standard Drawing - Typical Internal Road Sections
H353004-00000-221-294-0010-0001	Site Wide - Standard Drawing - Typical Internal Road Sections

Appendix B
Drawing H353004-10000-220-272-0008-0001 – Surface Water Management Plan – Mine Site



ATTACHMENT 10.2

MILNE PORT WATER MANAGEMENT PLAN

Mary River Expansion Project

Port Surface Water Management Plan

			p.p.		Stanger, Daniel Digitally signed by Stanger, Daniel DN: cn=Stanger, Daniel Date: 2018.09.17 15:03:01 -04'00'	
2018-09-13	0	Approved for Use	A Grobbelaar	R Goosen	D Stanger	T Atiba
Date	**Rev.**		**Prepared By**	**Checked By**	**Approved By**	**Approved By Client**

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Storm water management and drainage systems were applied in various locations across the site to ensure that surface water runoff will have limited interference with infrastructure at the port.

Care was taken to ensure that where possible, the existing watersheds and streams remained in their original state. This was done through the use of berms, ditches, swales and culverts.

For more detail refer to the Issued for Construction (IFC) drawings for the relevant areas. For a list of the related IFC drawings see Appendix A.

The overall layout for the Port storm water Drainage Plan can be seen in Appendix B.

2. References

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3. Overview

This document is divided into different areas of interest. The areas are grouped as follows:

- Rail Dumper drainage area that consists of the rail yard, dumper and storm water diversions berms / canals / ditches in the area.
- Ore Processing drainage area which will include the feed stockpile pad as well as the crushing and screening pad. This area will also include for laydowns that are constructed next to the areas and storm water diversions required as a result.
- Stockpile No.1 drainage area that will include the extension of the existing Stockpile and the upgrade/modifications to the existing settling pond No.1 as well as No.2 and associated storm water infrastructure.
- Stockpile No.2 drainage area that will include the stockpiles, stacker reclaimer berm, maintenance area, eastern berm and the western berm.
- Roads drainage areas will be grouped together. These include various access roads, existing road modifications and larger bypasses.

- Balance of Work drainage areas. All other areas not covered in the above mentioned shall be referred to as the balance of work and will include a number of laydown areas, accommodation camp pad and some storm water diversions.

The layout of the various drainage areas above is depicted in Figure 3-1 below.

General principles applied to the drainage management plan are as follows:

- All hydraulics designs where done using software from Bentley “Flow Master” or “HEC-Ras” by the USA Army Engineering Core.
- Where velocities in channels or ditches are above 1.5m/s, erosion protection is provided through placement of rip rap (Stone pitching).
- Erosion protection is provided at all concentrated discharge points i.e., culvert / channel / ditches exits into the environment. The protection is in the form of rip rap.
- Culverts are Corrugated Steel Pipes (CSP) unless otherwise stated.

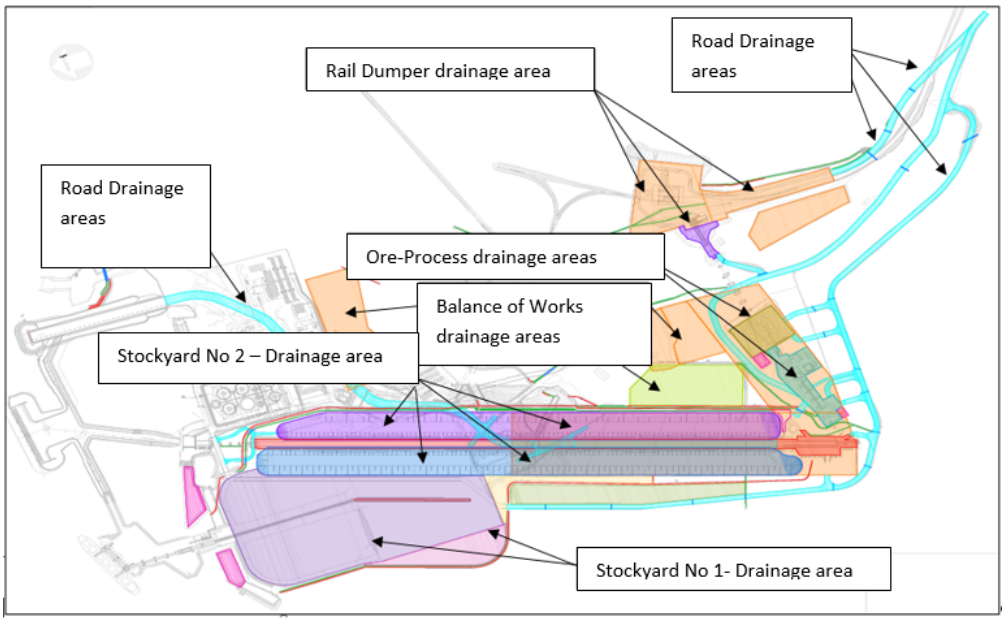


Figure 3-1: Port Drainage Areas

4. Rail Dumper Area Drainage

This section describes the drainage for the Rail Yard, Dumper and cut-off drains P-SWD-5 and P-SWD-6.

4.1 Rail Yard

The rail yard is to be constructed close to where the existing quarry (Q1) is located. Due to the grading requirements for the railway, the majority of the rail yard terrace is flat. Where possible, the terrace is graded away from the facilities to facilitate natural overland drainage. It is then collected in a cut-off ditch and diverted towards storm water diversion P-SWD-5.

Figure 4-1 shows the rail yard drainage.

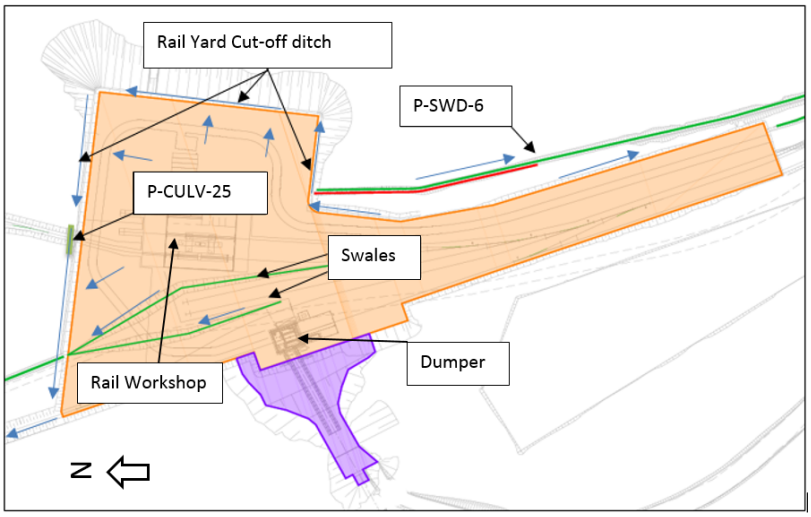


Figure 4-1: Rail Yard Drainage Plan

The rail yard terrace cut-off ditch was designed and analysed with the following results:

- Bottom Width - 1m
- Side Slopes - 1V:1.5H
- Flow - 1.621 m^3/s
- Velocity - 1.43 m/s (no rip rap required).

The rail yard cut-off ditch crosses the future railway formation with a 1200mm diameter culvert (see P-CULV-25 in Figure 4.1) with widenings and rip rap upstream and downstream. This will be constructed when the railway line is constructed.

As shown in Figure 4-1, the rail yard has two swales in between the rails to facilitate drainage in the area. The swales discharge towards the north and into P-SWD-5.

Where storm water flow velocities are modelled above 1.5m/s, adequate rip rap protection against erosion is provided as per drawing titled “Site Wide – Standard Drawing – Earthworks & Drainage Details” No. H353004-00000-221-294-0006-0001.

Two nominal 600mm diameter culverts are designed beneath the southern end of the rail yard to drain water that accumulates between the rail terrace and P-SWD-6.

4.2 Rail Car Dumper

The drainage for the rail car dumper is shown by the flow direction arrows in Figure 4-2.

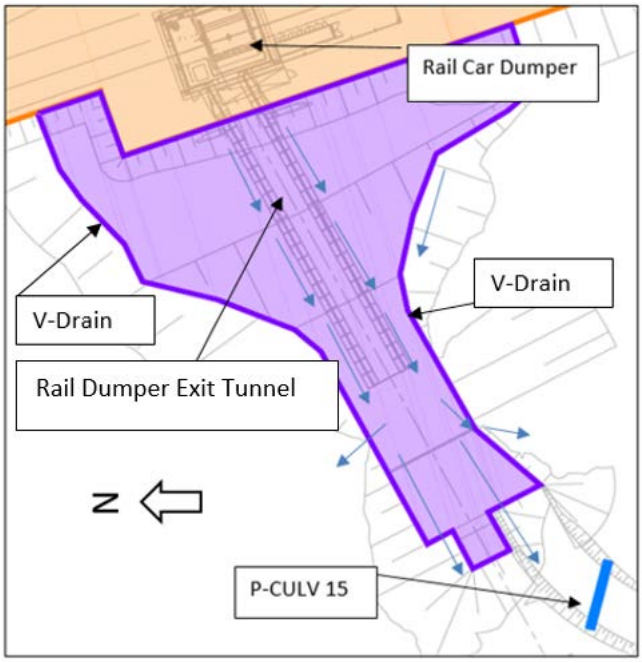


Figure 4-2: Rail Car Dumper Drainage Plan

The design ensures that water drains away from the dumper and the dumper exit tunnel. General drainage is based on overland flow with the various dumper areas graded to facilitate this. Vee-Drains are provided at the interface between the excavation/backfill slope interface.

Due to the steep slopes of the backfill, there are high flow velocities expected and rip rap is placed where water concentrates. This is to protect against scouring.

The results of the analysis are as follows:

- V-Drain with side slopes of 1V:3.52H and 1V:3.13H for the left and right sides of the dumper tunnel backfill.
- Flow - 0.008 m^3/s
- Velocity - 1.05 m/s

4.3 P-SWD-6

Storm water diversion No.6 will initially extend inside the rail yard area. When the rail yard is constructed the portion of the diversion overlapping the rail yard will be demolished. The diversion collects runoff from the rail yard but will primarily serve as a cut-off for water flowing from the catchment area to the east and diverting it towards the south. Figure 4-3 shows the diversion.

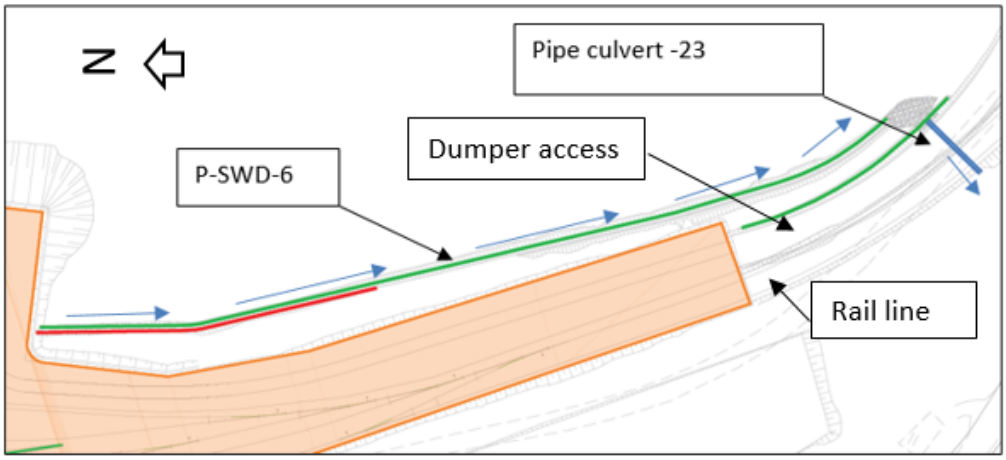


Figure 4-3: P-SWD-6

The ditch will daylight at the downstream end where it passes through P-CULV-23, underneath the Rail Yard Access Road. This road and its drainage is described in Section 8.1.

The diversion was modelled and analysed as a combination of berm and channel taking into account the surrounding existing ground. The results were as follows:

- Berm Height Required = 1 m
- Channel bottom width = 0.5 m
- Maximum Velocity = 1.28 m/s

Based on the results rip rap will only be provided at the discharge point.

4.4 P-SWD-5

Storm water diversion No.5 is planned for construction in 2018 and will extend inside the Rail Yard area. When the rail yard is constructed the portion of the diversion overlapping the rail yard will be demolished. The diversion will collect runoff from the rail yard but will primarily serve as a cut-off for water flowing from the catchment area to the east and diverting it towards the north. Figure 4-4 shows the diversion.

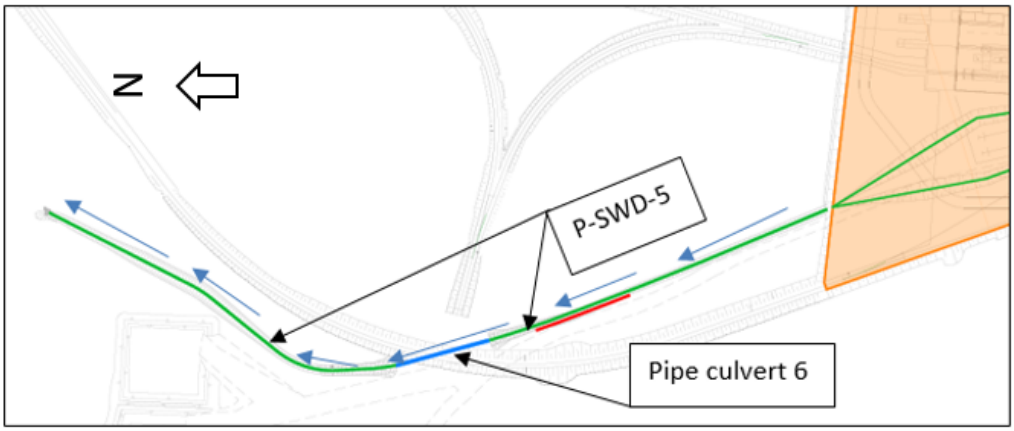


Figure 4-4: P-SWD-5

When the railway line is constructed it will require construction of a new culvert (P-CULV-6) to allow water to pass underneath the railway formation. The culvert is designed as a 1200mm diameter CSP with rip rap placed on the upstream and downstream side. The channel will also be widened at the culvert to allow space for the placing of pipes.

The diversion was modelled and analysed as a combination of berm and channel taking into account the surrounding existing ground. The results are as follows:

- Berm Height Required = 1 m
- Channel bottom width = 0.5 m
- Maximum Velocity = 1.40 m/s

Based on the results no rip rap, will be required in the channel except at the culvert as mentioned above and at the discharge point.

5. Ore Processing Area Drainage

5.1 Crushing Feed Stockpile

The crushing feed stockpile will be used to store ore before it is crushed and screened. In accordance with the civil design philosophy, runoff from this area needs to be contained in a settling pond and discharged once the water quality criteria has been met. The pad and pond is indicated in Figure 5-1.

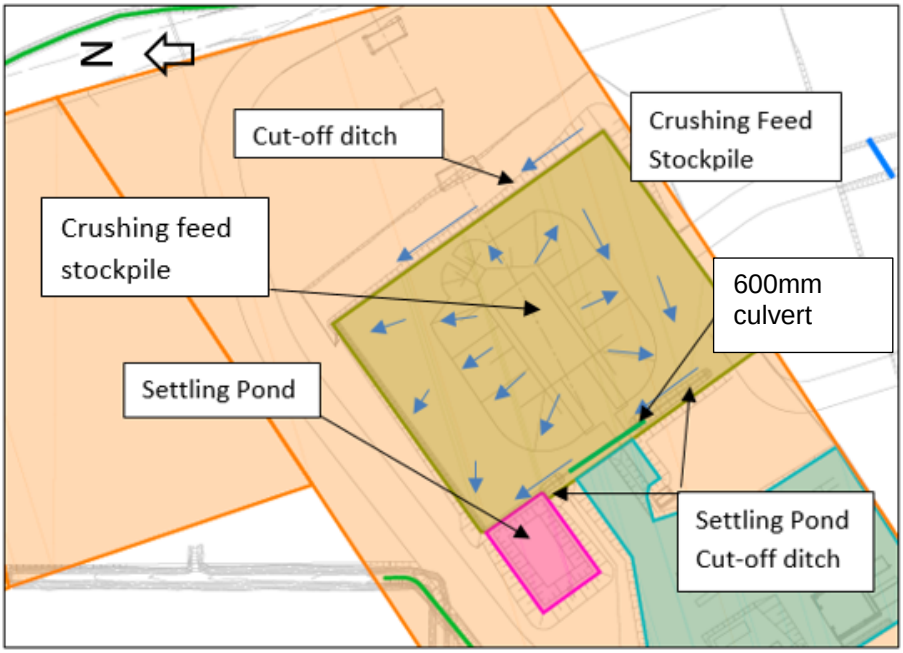


Figure 5-1: Crushing Feed Stockpile Pad Drainage Plan

5.1.1 Crushing Feed Stockpile Pad

The pad mainly drains through overland sheet flow and into a ditch on the western side and down a berm on the northern side. The ditch has one culvert crossing to allow access to the pad from the crushing and screening pad. The details of the ditch are as follows:

- Bottom Width - 0.5m
- Side Slopes - 1V:1.5H
- Flow (1:200) - 0.064 m^3/s
- Velocity - 0.95 m/s

The culvert is constructed as a 600mm diameter CSP.

On the eastern side of the pad a cut-off ditch is constructed to separate clean water from potential sediment impacted runoff on the pad. The ditch will flow in 2 directions (to the north and to the west) around the pad and daylight onto laydown LP5 and LP6 respectively. The channel was designed and analysed with the following results:

- Bottom Width - 0.5m
- Side Slopes - 1V:1.5H
- Flow - 0.035 m^3/s
- Velocity - 0.52 m/s

5.1.2 Crushing Feed Stockpile Settling Pond

The main inflow to the pond is from the settling pond drainage ditch. The pond has an emergency overflow that flows onto laydown LP5 and is designed in accordance with the Civil design philosophy.

The following values were applied in sizing the pond:

- Catchment area - 14 389 m^2
- Runoff Coefficient - 0.9
- Rainfall (1:10 year 24 hour) - 40.8mm

With the above it was determined that the required pond capacity is 528 m^3.

The spillway is designed to safely discharge the 1:200 year return period rainfall event. The result of the design and analysis are as follows:

- Bottom Width - 0.5m
- Depth - 0.15m
- Flow - 0.064 m^3/s

5.2 Crushing and Screening Pad

Storm water runoff as a result of precipitation on the crushing and screening pad is dealt with as sheet flow. This flow is depicted in Figure 5-2.

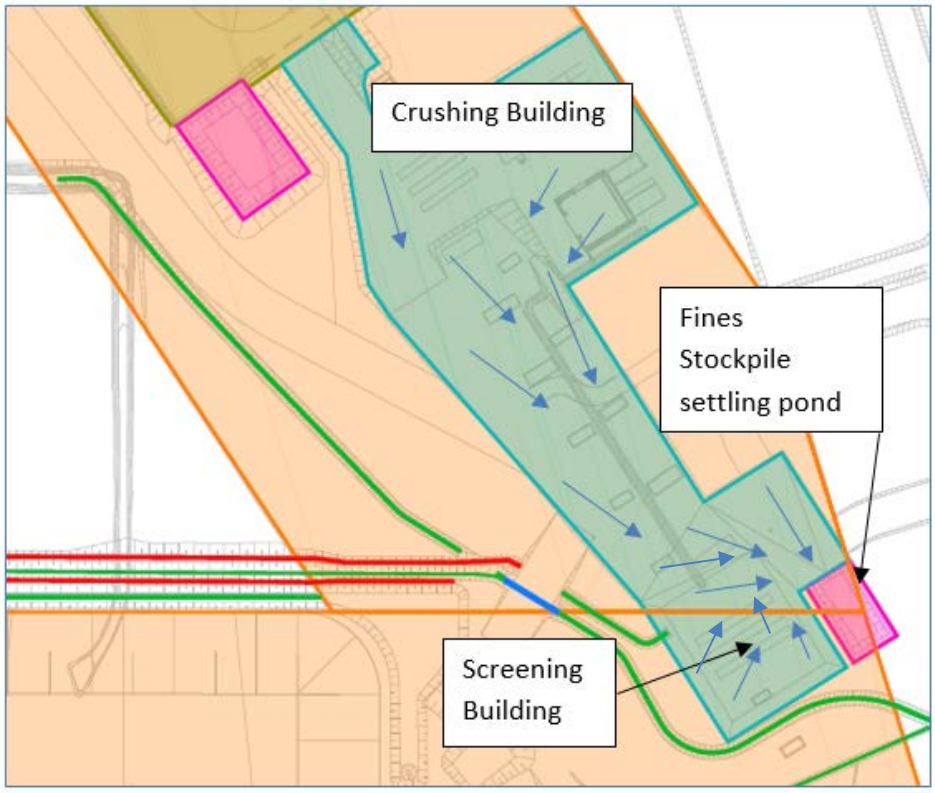


Figure 5-2: Crushing and Screening Pad Drainage Plan

Where utility berms are constructed, nominal 600mm diameter culverts are installed to ensure no ponding of water and promote free flow through the area.

The fines stockpile is situated next to the screening building. Runoff from the fines stockpile must be captured in a settling pond. The pond calculation results are as follows:

- Catchment area - 1 577 m^2
- Runoff Coefficient - 0.9
- Rainfall (1:10 year 24 hour) - 40.8mm

With the above it is determined that the required pond capacity must be 58 m^3.

The spillway is designed to safely discharge the 1:200 year return period rainfall. The result of the design and analysis are as follows:

- Bottom Width - 0.5m
- Depth - 0.15m
- Flow - 0.007 m^3/s

6. Stockpile No.1 Drainage

Stockpile No.1 is to be extended to allow for fines product stockpiling. (Stockpile No.2 will occupy a portion of the footprint area of the existing Stockpile No.1). Due to the need to maintain the area for the stockpile No.1 while Stockpile No.2 is developed, the Stockpile No.1 extension area is required.

The drainage of the new Stockpile No.1 extension area (Measuring 26 300m^2) is linked to the existing Stockpile No.1 drainage area, conveying storm water to settlement pond No.1/1A. The stockpile area is graded through nominal fill and cut to facilitate this drainage. The overland flow is then intercepted by storm water drain P-SWD-4 (berm) which, at the downstream end, links up with the existing drainage system. Figure 6-1 shows the layout.

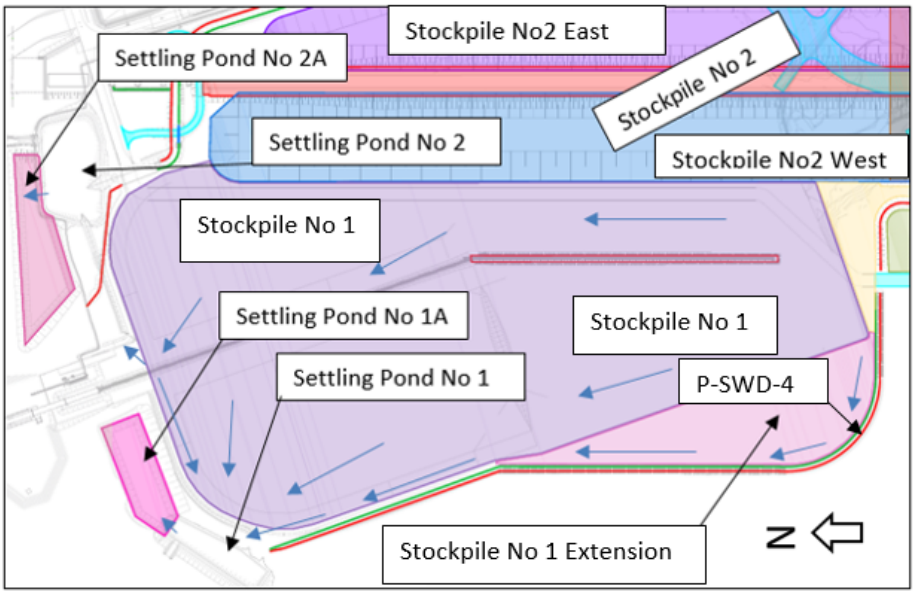


Figure 6-1: Stockpile No.1 Extension with Settling Pond No.1 and No.1A

The catchment area for Settling Pond No.1 will increase due to the following reasons:

- Stockpile No.1 extension (see Section 6) increases the catchment area
- South Western part of Stockpile No.2 drains towards this pond.

Due to the increase in catchment area, the existing pond is calculated to be under capacity for the new development. A second compartment is designed to linked with Settling Pond No.1 which will be referred to as Settling Pond No.1A.

This ensures that there is enough storage capacity as per the requirement specified in the civil design philosophy.

The two compartments are interlinked with a spillway. The existing emergency spillway of Pond No.1 is retained. The existing spillway is adequate in terms of the design philosophy requirements.

Figure 6-2 shows both the existing Pond No.1 and the additional 1A compartment.

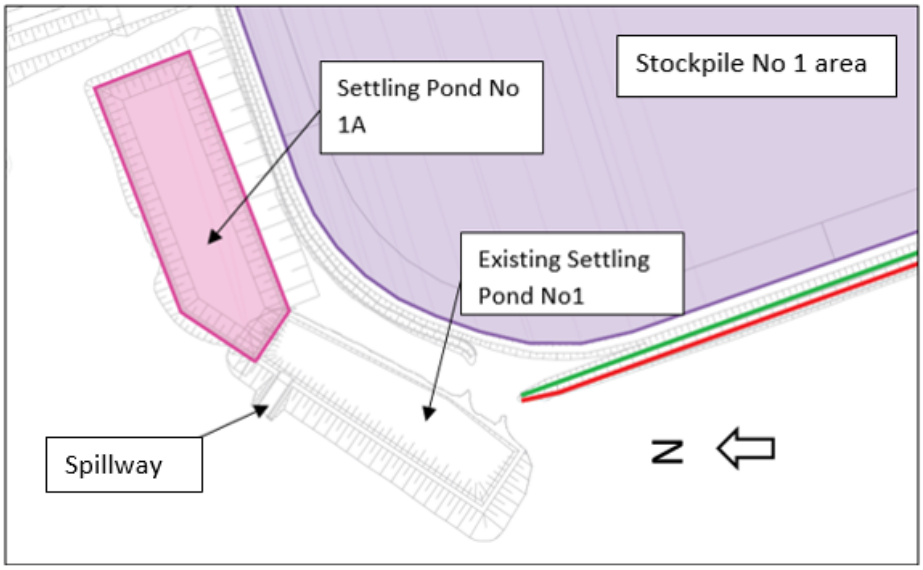


Figure 6-2: Settling Pond 1 and 1A

The pond extension calculation results can be seen below:

- Catchment area - 183 441 m^2
- Runoff Coefficient - 0.9
- Rainfall (1:10 year 24 hour) - 40.8mm

Using the calculations above the total required pond capacity required is 6,750 m^3. From as-built information it was determined that the available storage in the existing pond is 2,600 m^3. Settling pond No.1A is therefore to be constructed to provide additional storage capacity of 4,150 m^3.

6.1 Settling Pond No.2 and No.2A

The catchment area for Settling Pond No.2 will increase due to the construction of the new Stockpile No.2. A portion of the Stockpile No.2 will drain to the existing Pond No.2. Due to the increase in the catchment area for Pond No.2, the settling pond will not have sufficient capacity to contain the run-off.

A new compartment will be constructed to provide sufficient storage capacity. The existing pond crest and spillway need to be lifted to increase storage capacity.

The emergency spillway is re-designed at a higher elevation with the same cross-sectional profile which then provides sufficient capacity to discharge the 1:200 year return period flow. Figure 6-3 shows the proposed modifications.

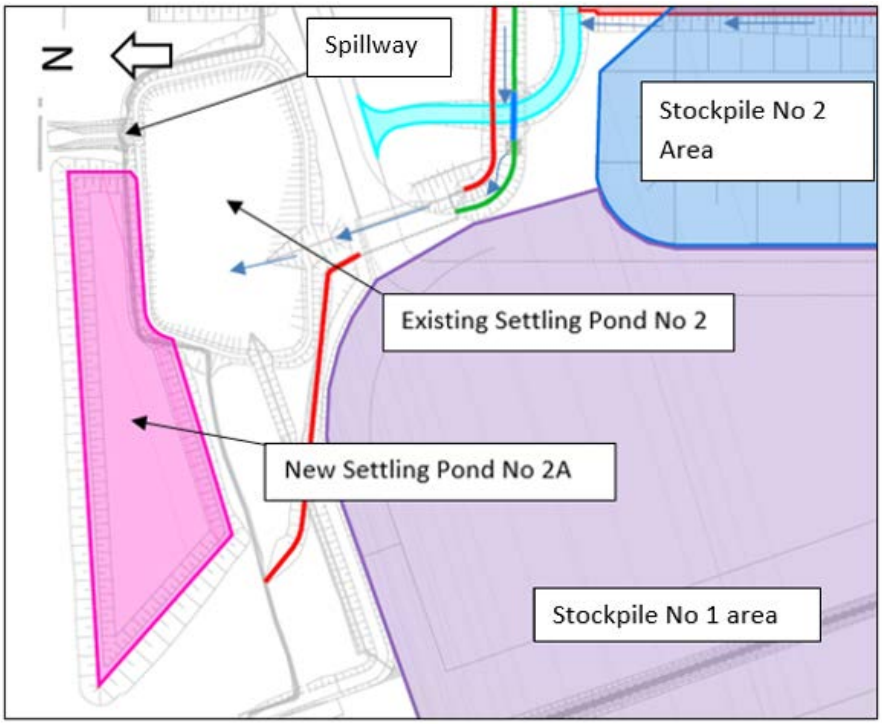


Figure 6-3: Settling Pond 2 and 2A

The results of the calculations associated with the pond extension can be seen below:

- Catchment area - 147 759 m^2
- Runoff Coefficient - 0.9
- Rainfall (1:10 year 24 hour) - 40.8mm

Using the calculations above the total required pond capacity must be 5,430 m^3. The combination of Settling Pond No.2 and No.2A will be constructed to ensure that this volume is achieved.

6.2 Northern Utility Berm

Due to the construction of Settling Pond No.2A, Ship Loader No.1 power cables will have to be relocated. A utility berm will be constructed between the existing road and Settling Pond 2. The berm crosses an existing drainage ditch that discharge water into Settling Pond 2.
A culvert (P-CULV-28) will be constructed as a 600mm CSP. No rip rap is required since the velocity is calculated below 1.5m/s for the design return period of 1:25 years. See Figure 6-4 for the utility berm and culvert.

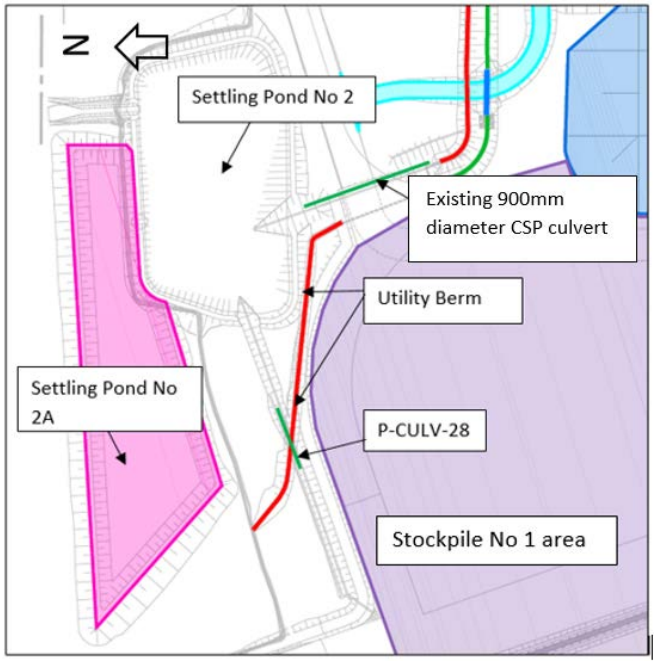


Figure 6-4: Northern Utility Berm Drainage

7. Stockpile No. 2 Drainage Area

Stockpile No.2 area consists of the following:

- Stockpile No.2 East
- Stockpile No.2 West
- Stacker reclaimer Berm
  - Northern Section
    - Access Roads
  - Middle Section
  - Southern Section
    - Maintenance Area / Storm Lock Position
    - Storm Lock Cradle
    - Berm Surroundings

The above will be discussed in the following sections. An overall layout of the area can be seen in Figure 7-1.

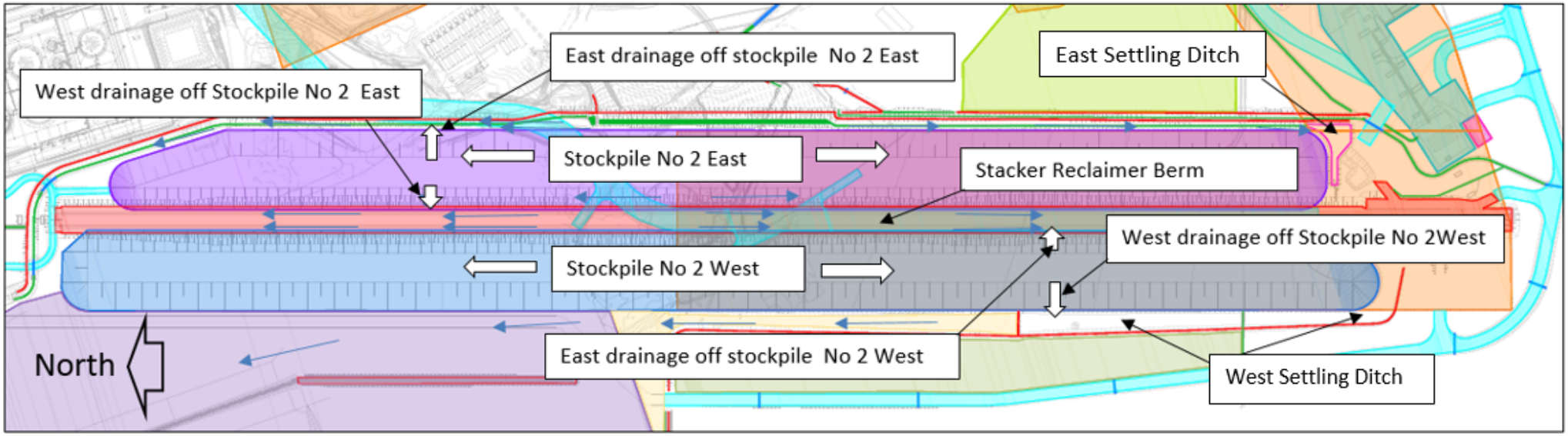


Figure 7-1: Stockpile No.2 Drainage Plan

7.1 Stockpile No.2 East

Runoff from the stockpile draining towards the outside of the stockpile is collected in the Eastern Berm. (The eastern berm drainage is discussed in more detail in Section 7.4.)

Stockpile runoff draining inwards to the stacker reclaimer berm is collected in a precast 900mm x 900mm concrete drain on top of the berm. The drain will be constructed with no gradient due to limitations of the stacker reclaimer rail. The accumulated run-off flows in both north and south directions through hydraulic head build up inside the 900mm x 900mm drain. At the end points it discharges off the berm where the following occurs:

- In the south direction, water is conveyed in a swale towards a settling ditch along the Eastern Berm where it is retained (Similar to the settling ponds described previously).
- In the north direction, discharge is onto the stockpile area itself which is graded to drain into Settling Pond No.2.

7.2 Stockpile No.2 West

Runoff from the stockpile draining to the outside of the stockpile will be contained by the Western Berm. Due to limitations on natural ground gradient there are 2 ways in which the runoff will be managed:

- On the southern end water will be contained inside the western berm enclosed area which forms a containment / settling pond (see Section 7.5.1)
- On the northern end, water is conveyed towards the north and eventually ends up in Settling Pond No.1 /1A or No.2/2A - pending gradients. (see Section 7.5.2).

Runoff draining inside the stockpile to the stacker reclaimer berm is managed similar to Section 7.1 in the 900mm x 900mm drainage channel. Storm water finding its way to the southern end will be retained through surrounding berms (forming the West Settling Ditch – See Figure 7-1) until after suspended solids testing. Channel flow to the north will drain to the settling ponds to the north and is facilitated through construction of berms and specific located culverts draining into the Settling Ponds No.1/1A and No.2/2A.

7.3 Stacker Reclaimer Berm Southern Section

The southern end of the stacker reclaimer berm will include a maintenance area (incorporating the storm lockdown position). Figure 7-2 shows the southern section in more detail.

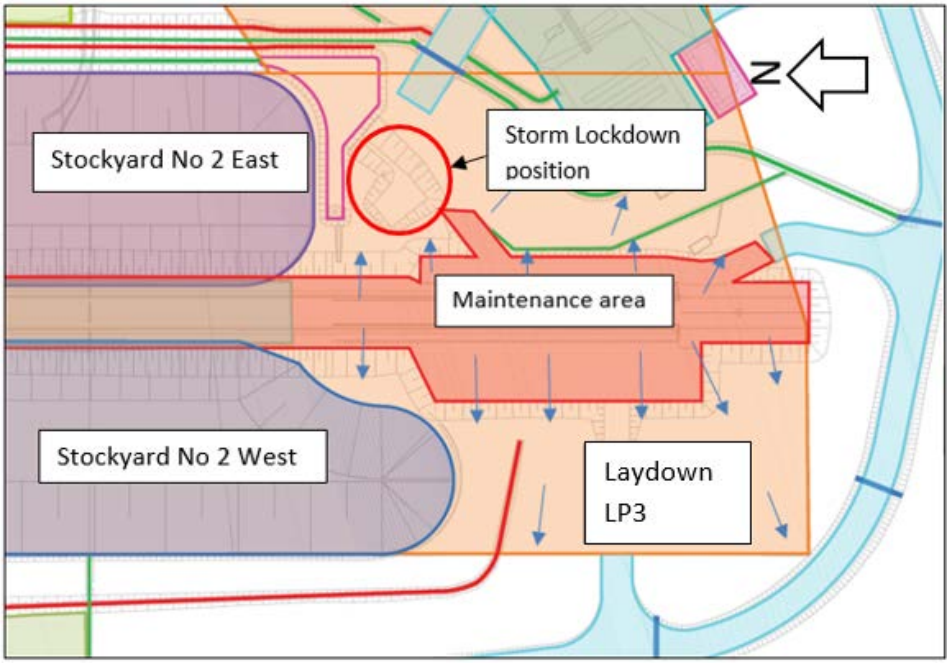


Figure 7-2: Stacker Reclaimer Berm Southern Section Drainage Plan

Storm water runoff from this area will be facilitated through natural run-off from the maintenance area onto the surrounding LP3 lower level ground. From here it is either directed to a swale or culvert and onto the natural environment.

The surrounding area will flow on Laydown LP3 as described in the 2018 Water Management Plan, H353004-40000-200-210-0001, and be diverted through the use of swales and ditches.

7.4 Stockpile No.2 Eastern Berm

The eastern berm has multiple functions as summarized below:

- Due to the natural low point along the eastern section of stockpile No 2, clean water runoff will have accumulated against the eastern berm. The berm serves to prevent clean water from entering the stockpile area by ponding against the berm
- Allow for overflow of the clean water towards the south when accumulating in access of the berm height during extreme events.
- Prevent potential sediment impacted runoff from Stockpile No.2 from enter the natural surroundings
- Settling out suspended solids from runoff generated inside the stockpile area
- Conveying water north toward the existing Settling Pond No.2
- Used for utilities such as electricity and fibre optic cable routing.

7.4.1 *Eastern Clear Water Pond*

The clear water pond will be used to temporarily store runoff which will be pumped out or discharged into the overflow channel. The berm will be lined with a geomembrane to prevent water from the clear water pond entering the stockpile area. Figure 7-3 shows the extents of the pond.

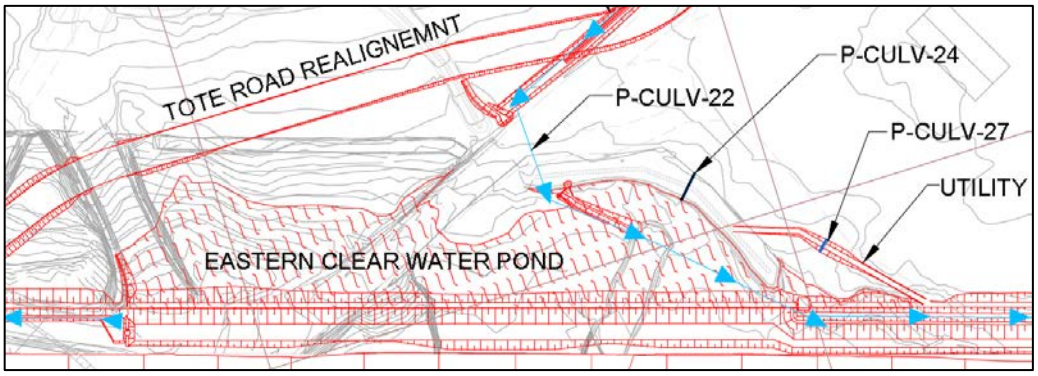


Figure 7-3: Eastern Clear Water Pond

The extent of the pond is dictated by the overflow level of the pond and care was taken to ensure that no infrastructure such as road or cables will be inundated.

7.4.2 *Eastern Berm – Clear Water Overflow Channel*

Although the Eastern Clear Water pond must be operated as empty during the rainy season by means of pumping, it may not always be empty when a large storm event occurs. It is therefore necessary to have an emergency overflow. This overflow channel can be seen in Figure 7-4.

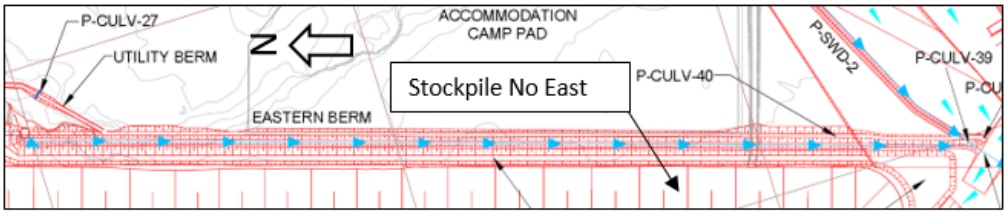


Figure 7-4: Eastern Berm – Clear Water Overflow Channel

The overflow channel has been designed as a trapezoidal channel to convey the 1:100 year flood event and is built on top of the eastern berm. The water will flow south and connect with P-SWD-2 (see Section 9.7). South of the Accommodation Camp Pad a 600mm diameter culvert (P-CULV-40) will be installed through the berm to allow water to enter the channel. The area will also be locally shaped to ensure that there is no ponding of water against this portion of the berm/channel. The calculation results for the overflow channel are as follows:

- Bottom Width - 0.5m
- Side Slopes - 1V:1.5H

- Flow - 1.144 m^3/s
- Normal Flow Depth - 0.727m
- Velocity - 0.99 m/s

7.4.3 Eastern Berm – Settling Ditch

As part of the containment of runoff from the stockpile area, a settling pond in the form of an elongated ditch is designed and is constructed on the south eastern end of the stockpile area as can be seen in Figure 7-5.

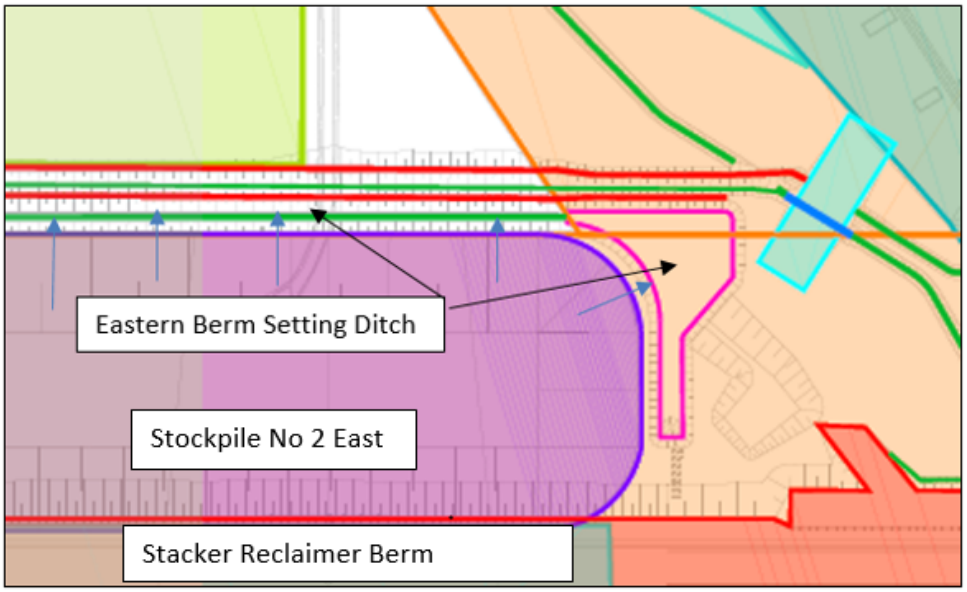


Figure 7-5: Eastern Berm – Settling Ditch

The settling ditch must be able to contain the runoff volume from the 1:10 year 24-hour storm event. The ditch will have a sump at the southern end that will be used to empty the ditch by means of pumping as soon as the necessary criteria is achieved for discharge as per the Environmental Design Criteria. An emergency overflow is designed to the north that will discharge into the northern section in an extreme event. This overflow was designed for the 1:200 peak flood. The calculations are as follows:

- Catchment area - 83 766 m^2
- Runoff Coefficient - 0.9
- Rainfall (1:10 year 24 hour) - 40.8mm

With the above it was determined that the required pond capacity is 3 075 m^3.

The spillway is designed for the 1:200 year return period. The spillway design result is as follows:

- Bottom Width - 1.5m
- Depth - 0.2m
- Flow - 0.346 m^3/s

7.4.4 Eastern Berm – Northern Section

The northern section of the eastern berm is a combination of ditch and berm conveying water towards the existing Settling Pond 2. Figure 7-6 shows this section.

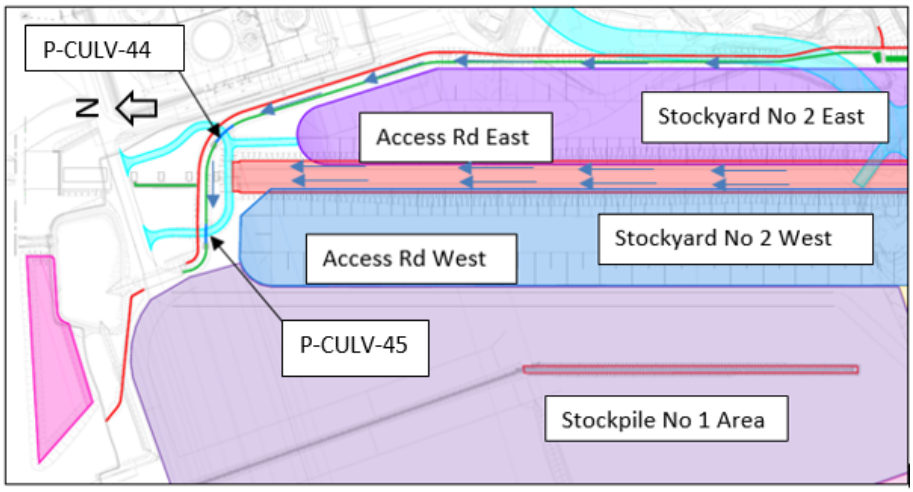


Figure 7-6: Eastern Berm – Northern Section

The ditch will cross two access roads where culverts will be used to allow for safe passage of the flow. The culverts and the ditch were designed to cope with the 1:100 year flood. The ditch will link up with the existing drainage system, from where it will pass underneath an existing culvert and into settling pond 2 (see Section 6.1).

The results from the design and analysis of the ditch is reflected below:

- Bottom Width - 1m
- Side Slopes - 1V:2H
- Flow - 0.772 m^3/s
- Max Normal Flow Depth (0.2% fall) - 0.486m
- Max Velocity (1.6% fall) - 1.22 m/s

Based on the above there is no need for rip rap except for the culverts (see Section 8.5).

7.5 Western Berm

The western berm will be constructed to perform the following functions:

- Prevent runoff from Stockpile No 2 from entering the natural surroundings
- Settling out suspended solids from runoff generated inside the Stockpile No.2 West area for the southern section of the berm
- Convey runoff towards Stockpile No.1 west for the northern section of the berm.

Figure 7-7 shows the overall layout of the Western Berm.

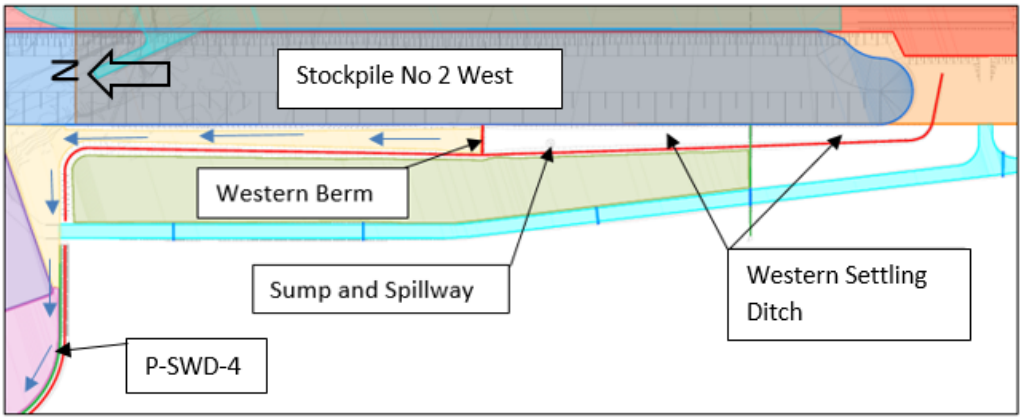


Figure 7-7: Western Berm Drainage Plan

7.5.1 Western Berm Settling Ditch

As part of the environmental requirement to contain runoff from the stockpile area and due to a lack of gradient to drain storm water naturally, a settling pond in the form of an elongated ditch is designed and will be constructed on the south western end of the stockpile.

The settling ditch is designed to contain the runoff volume from the 1:10 year 24-hour storm event. The ditch has a sump that is centrally placed and will be used to empty the ditch as soon as the necessary Environmental criteria for discharge has been achieved. An emergency overflow channel will be constructed in the same location as the sump that allows spillway water into the natural environment. This overflow is designed for the 1:200 peak flood. Calculation results are reflected below:

- Catchment area - 47 435 m^2
- Runoff Coefficient - 0.9
- Rainfall (1:10 year 24 hour) - 40.8mm

With the above calculations the required pond capacity is 1 742 m^3.

The spillway is designed to safely discharge the 1:200 year return period. The result of the spillway design indicates the following geometry:

- Bottom Width - 0.5m
- Depth - 0.3m
- Flow - 0.196 m^3/s

7.5.2 Western Berm – Northern Section

The northern section of the western berm conveys water towards Stockpile No.1. The drainage system of Stockpile No.1 is discussed in Section 6.

7.6 Drive Station

The yard conveyor drive station is situated at the northern end of Stockpile No 2. This area is designed to allow for sheet flow runoff to drain off the pad and into the ocean. A 20m wide road connects the existing area with the proposed ship loader causeway. This road does not require any drainage culverts as there are no stream / drainage crossings. Figure 7-8 shows the area.

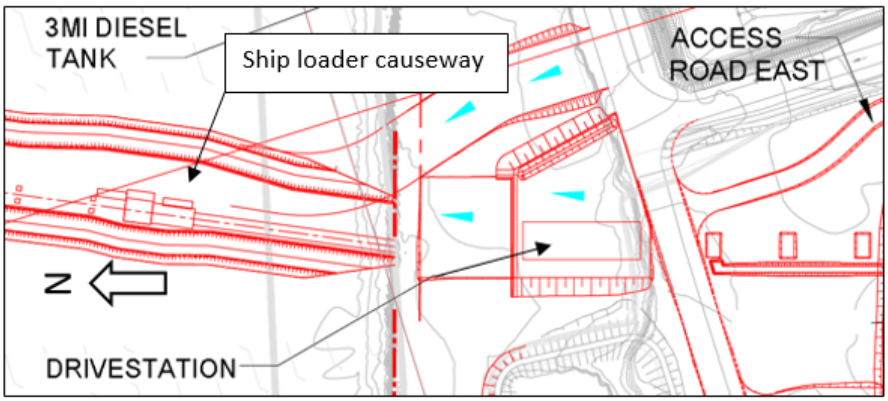


Figure 7-8: Drive Station

8. Road Drainage Areas

8.1 Rail Yard Access Road

The rail yard access road will be constructed to facilitate the delivery of the dumper module and will be utilised for future access to the rail yard. The road is designed with 3 drainage culverts:

- P-CULV-23 – 2 x 900mm Diameter CSP
  - This culvert crosses both the rail yard access road as well as the future rail formation. The culvert will initially be constructed underneath the road and will be extended when the railway is constructed.
- P-CULV-48 - 600mm Diameter CSP
- P-CULV-47 - 600mm Diameter CSP

The Rail Yard Access Road is shown in Figure 8-1.

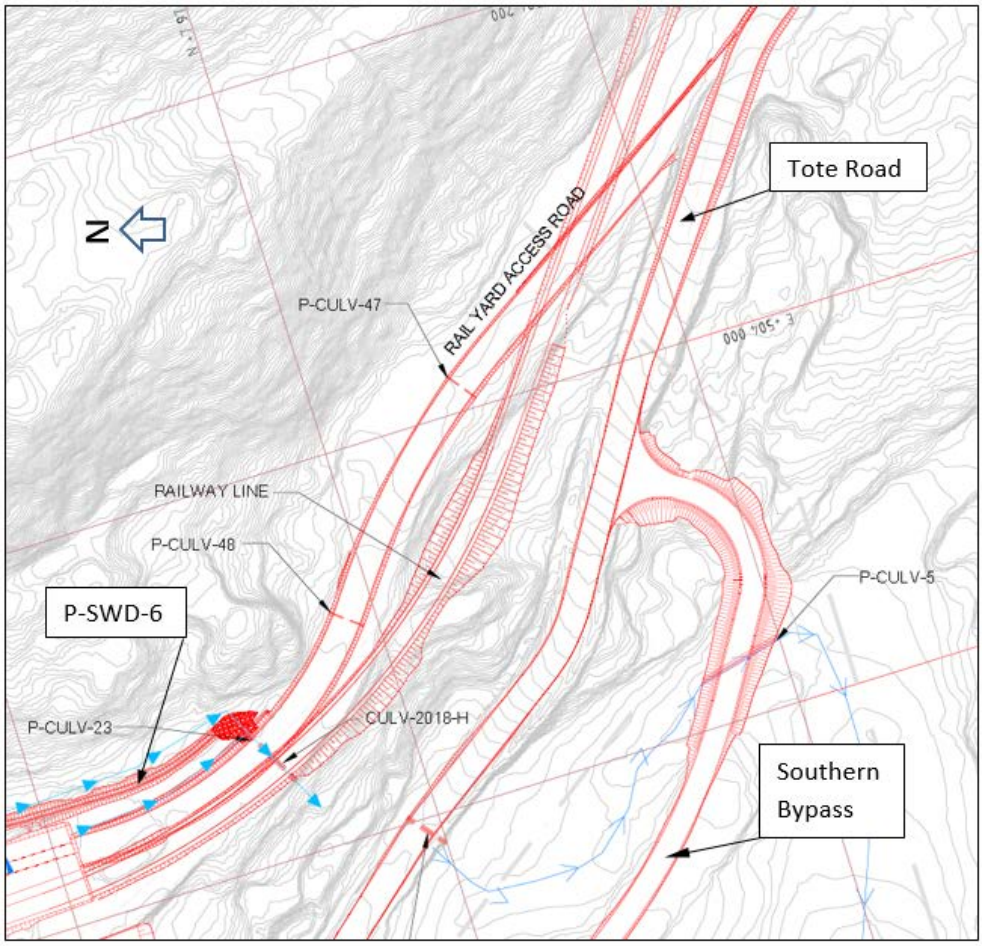


Figure 8-1: Rail Yard Access Road Drainage

8.2 Tote Road Drainage

This section discusses the drainage of the Tote Road and is covered in 3 Sections.

8.2.1 Tote Road Upgrade

At the southern end of the port the Tote Road requires upgrading to allow for the transportation of the dumper module and indexer building module. Figure 8-2 shows the area of consideration.

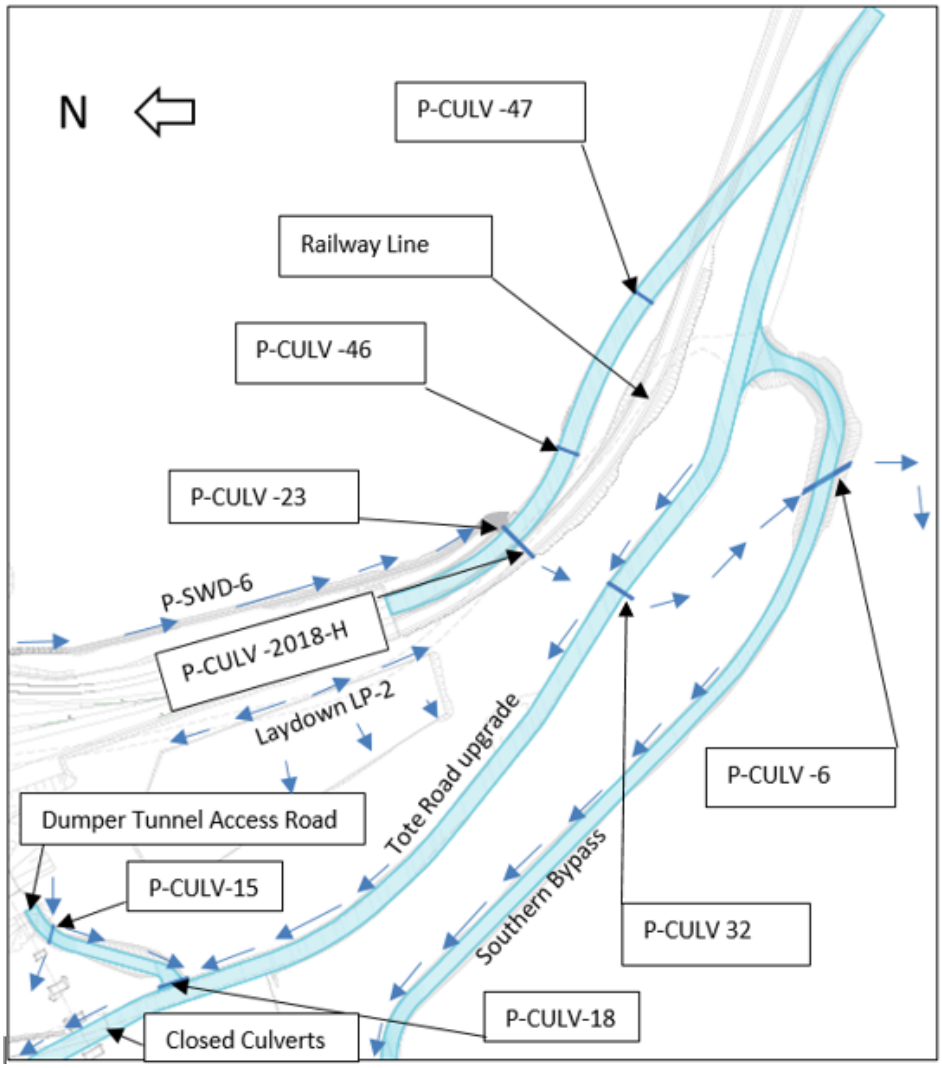


Figure 8-2: Tote Road Upgrade Drainage Plan

For this section, two existing culverts indicated in Figure 8-2 will be closed off to direct runoff away from construction activities. Water must flow to the north where it is collected in the Tote Road ditch.

This drainage section requires an additional culvert. Culvert P-CULV-32 allows safe passage of surface runoff water that primarily comes from P-SWD-6. Flow is discharged through this culvert. The culvert will be constructed out of 2x900mm diameter CSP with rip rap on both ends.

8.2.2 Tote Road Drainage Ditch

The existing Tote Road has a drainage ditch on the eastern side of the road. This ditch directs water to the north. The drainage ditch requires upgrading due to the additional catchment area enforced by the culvert closures. Figure 8-3 shows the ditch location and culverts.

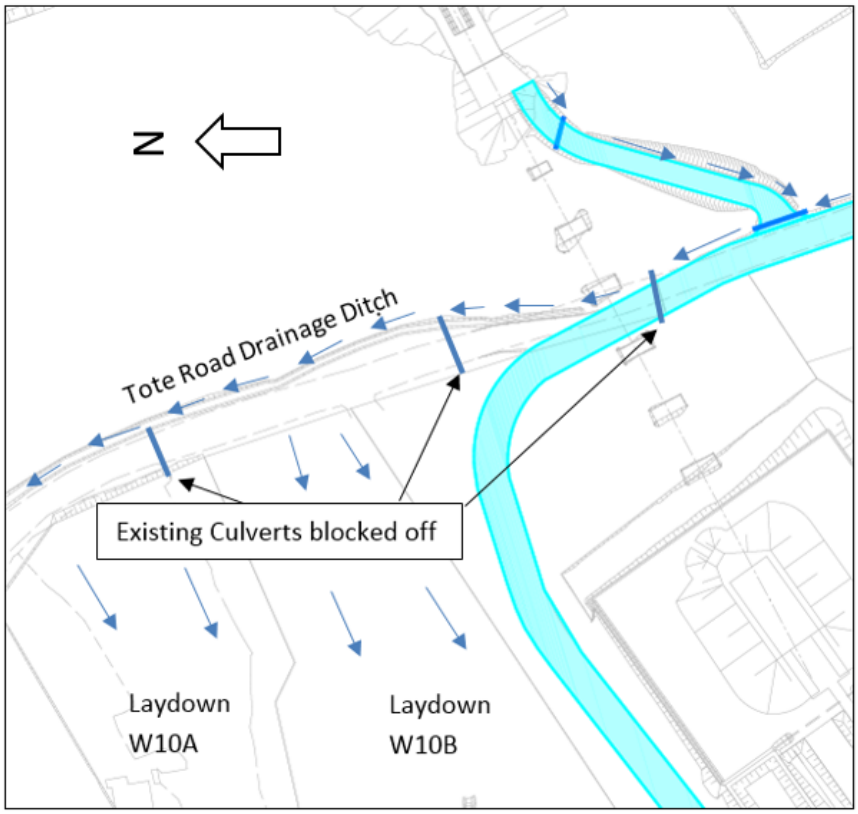


Figure 8-3: Tote Road Drainage Ditch

The ditch was sized and analysed. The results from the analyses are reflected below:

- Bottom Width = 2 m
- Side Slopes = 1V:2H
- Discharge (1:100) = 0.87 m^3/s
- Velocity = 1.82 m/s

Rip rap is provided to protect against erosion since the velocity exceeds 1.5 m/s.

In the first construction phase planned for 2018, the water is unobstructed up to the point where it needs to cross the Tote Road to the west at Culvert P-CULV-22. This culvert is designed to allow water to pass underneath the existing Tote Road into a ditch that will link up with an existing drainage ditch. The culvert will be constructed as 2x600mm diameter CSP pipes. 4 shows more detail for this area.

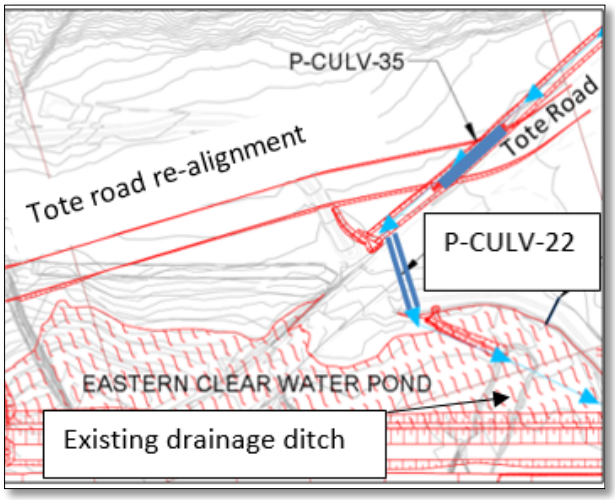


Figure 8-4: P-CUVL-22

In future, a Tote Road realignment is required which requires a crossing of the Tote Road drainage ditch – this is further discussed in Section 8.2.3 below.

8.2.3 Tote Road Realignment

The Tote Road realignment will be constructed to allow vehicles to travel around the proposed Stockpile No.2. The drainage of this road requires two culverts:

- P-CULV-35 - 2x600mm diameter CSP
  - Culvert to be placed inside the Tote Road drainage ditch (see section 8.2.2)
- P-CULV-9 - 600mm diameter CSP

Figure 8-5 shows this section.

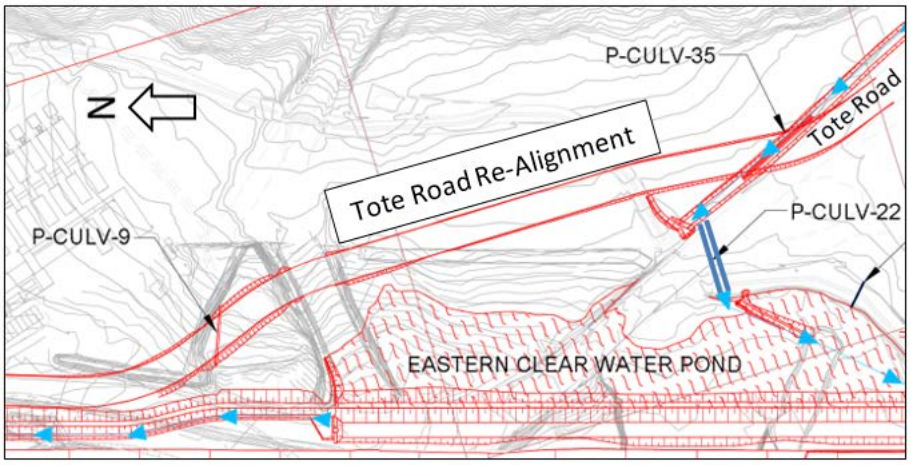


Figure 8-5: Tote Road Realignment Drainage Plan

8.3 Dumper Tunnel Access Road

This road connects the Tote Road to the dumper exit tunnel. Figure 8-6 shows the road.

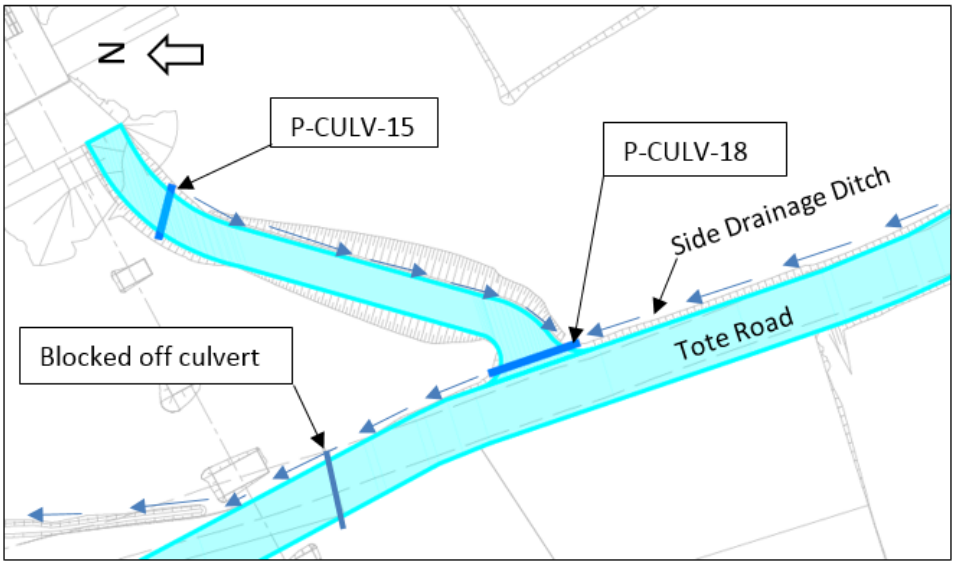


Figure 8-6: Dumper Tunnel Access Road Drainage Plan

The road will be constructed with the following storm water infrastructure:

- Side ditch to prevent water flowing over the road from the upstream catchment. The results from the design and analyses for this ditch are as follows:
  - Bottom Width - 0.5m
  - Side Slopes - 1V:1.5H
  - Depth - 0.4m
  - Flow - 0.05 m^3/s
  - Velocity - 1.45 m/s
- P-CULV-18 - 600mm diameter CSP
  - Culvert that will be constructed to allow flow from the Tote Road side ditch to drain underneath the dumper tunnel access road
- P-CULV-15 - 600mm diameter CSP
  - Culvert at low point to allow water to pass underneath the road.

8.4 Western Bypass Road

The Western Bypass will allow for vehicle access around the western and the northern side of Stockpile No.2.

Figure 8-7 shows the Western Bypass Road.

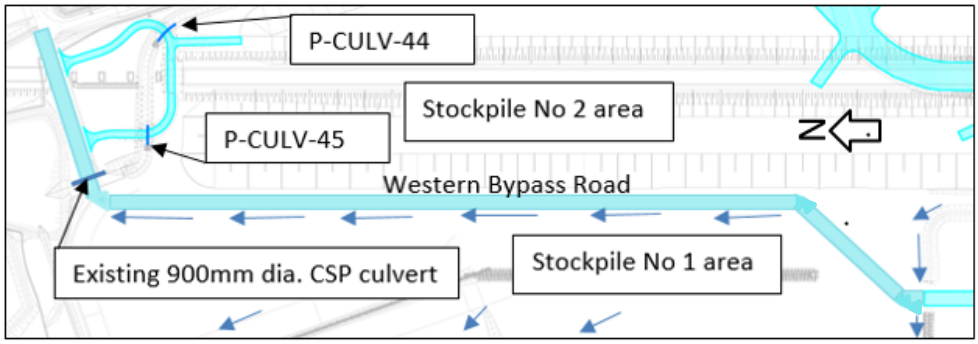


Figure 8-7: Western Bypass Drainage Plan

The road will only be demarcated route where it is routed through the existing stockpile area as no road layerworks required on the stockpile area. Drainage will be as per the stockpile drainage plan.

In the north, the road will be lowered to allow vehicles to pass underneath the stockpile conveyor gantry. The road section is sloped in one direction to allow water run off when it exits a cut.

The demarcated road area on top of the Stockpile No.1 terrace also crosses an existing culvert that discharges into the existing Settling Pond No.2. From survey information it was determined that the culvert is a 950mm diameter CSP. The survey information was used to confirm that there is sufficient capacity in this culvert.

Two access roads are connected to the Western Bypass road that will allow vehicle access to the stacker reclaimer berm from the north.

The drainage for these roads will be discussed in Section 8.5.

8.5 Northern Access Roads

Two roads, access road east & access road west, will be constructed to allow for vehicle access to the northern section of the stacker reclaimer berm. These roads can be seen in in Figure 8-8.

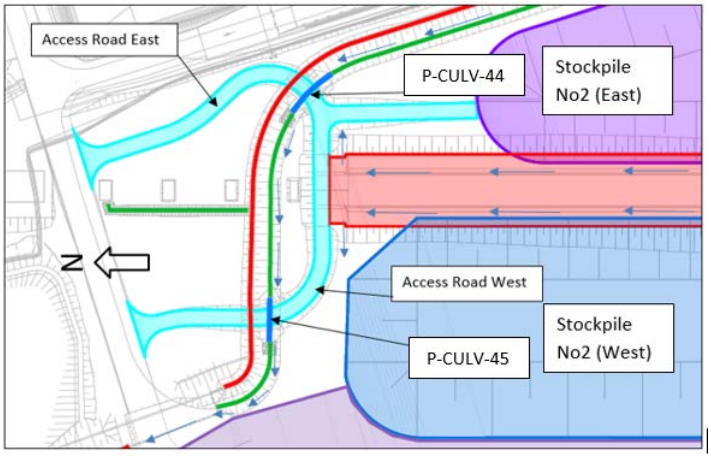


Figure 8-8: Northern Access Roads

The roads will be constructed across the Eastern berm as described in section 7.4.4.

The culvert details are as follows:

- P-CULV-44 - 900mm diameter CSP
- P-CULV-45 - 900mm diameter CSP

8.6 Southern Bypass Road

The main function of the Southern Bypass is to connect the Tote Road with Stockpile No.1. The road will also have roads branching off to provide access to the following areas:

- Stockpile No.2
  - Access Rd - 6
  - Access Rd - 7
- Fines Stockpile at the fines crusher
  - Access Rd - 1
  - Access Rd - 2
- Crushing and screening pad
  - Access Rd - 3
- Crushing Feed Stockpile
  - Access Rd - 4
  - Access Rd - 5

The road can be seen in Figure 8-9.

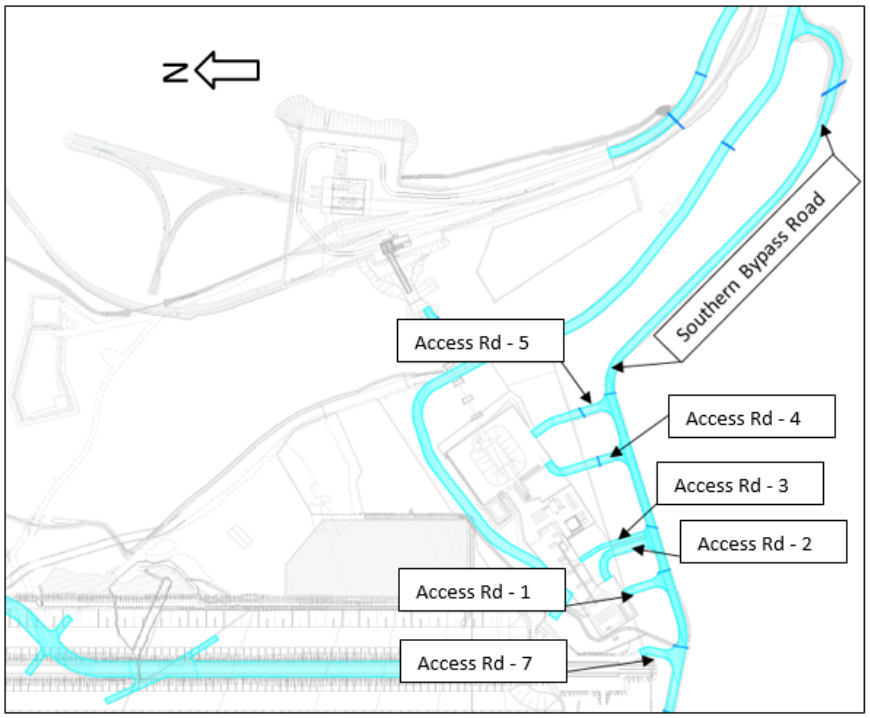


Figure 8-9: Southern Bypass Drainage Plan (i)

The following drainage culverts will be constructed at locations indicated in Figure 8-10, Figure 8-11 and Figure 8-12.

- P-CULV-34 - 600mm Diameter CSP
- P-CULV-1 - 600mm Diameter CSP
- P-CULV-2 - 600mm Diameter CSP
- P-CULV-43 - 600mm Diameter CSP
  - Culvert will be constructed inside Laydown LP3 daylight ditch as per the 2018 Surface Water Management Plan
- P-CULV-19 - 600mm Diameter CSP
- P-CULV-3 - 600mm Diameter CSP

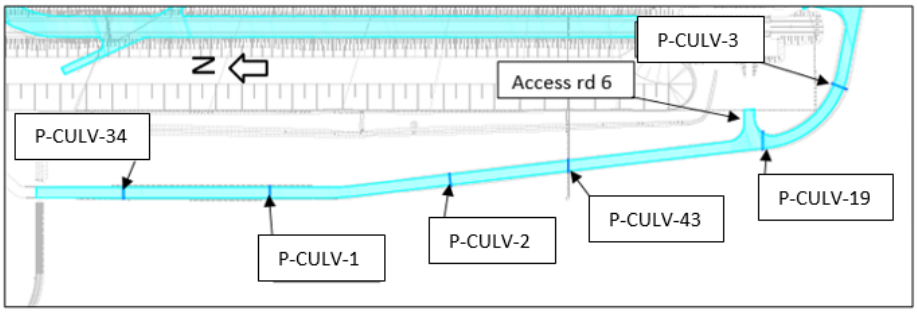


Figure 8-10: Southern Bypass Drainage Plan (ii)

- P-CULV-38 - 1200mm Diameter CSP
  - Culvert will discharge flow from P-SWD-2 (See Section 9.7)
- P-CULV-21 - 600mm Diameter CSP
- P-CULV-20 - 900mm Diameter CSP
- P-CULV-7 - 900mm Diameter CSP
- P-CULV-33 - 900mm Diameter CSP
- P-CULV-4 - 600mm Diameter CSP

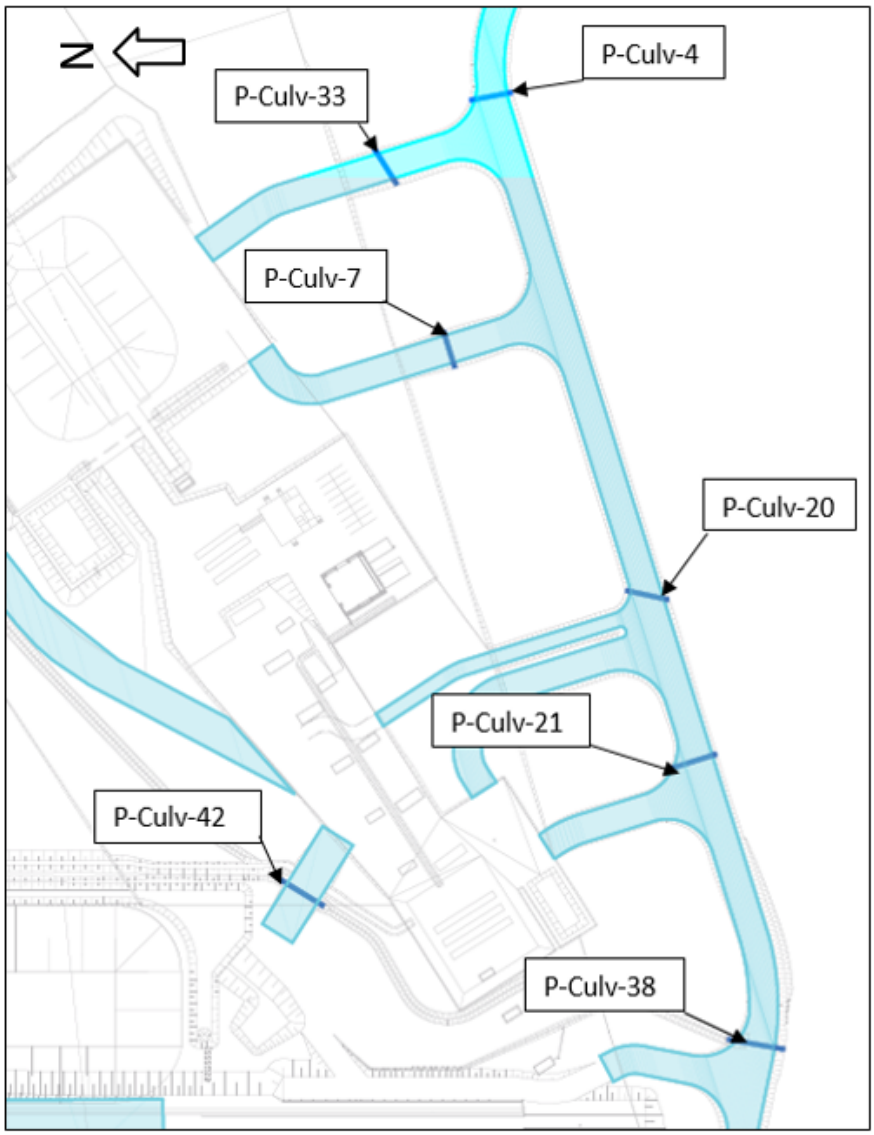


Figure 8-11: Southern Bypass Drainage Plan (iii)

- P-CULV-5 - 2 x 1200mm Diameter
  - Culvert will discharge flow from the east that was diverted through P-SWD-6 and underneath the Tote Road through P-CULV-32.

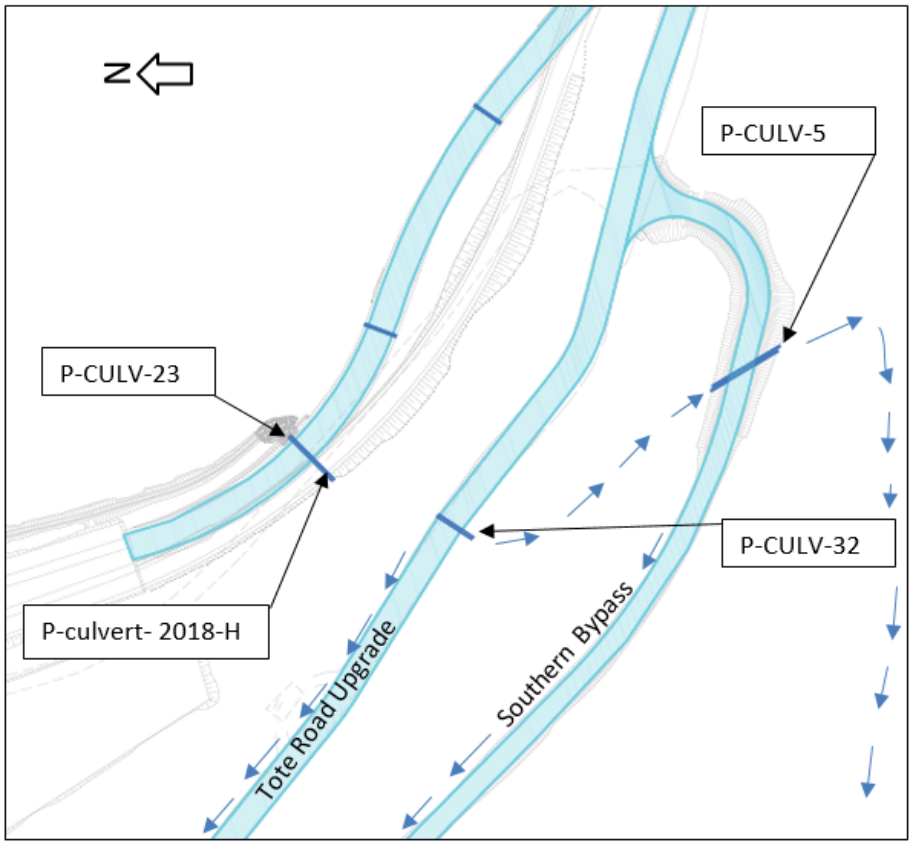


Figure 8-12: Southern Bypass Drainage Plan (iv)

For more detail on the culverts refer to the relevant road Issued for Construction (IFC) drawings.

The Southern Bypass also has one roadside ditch to allow drainage of a low-lying area from east to west toward P-CULV-38. The ditch can be seen in Figure 8-13.

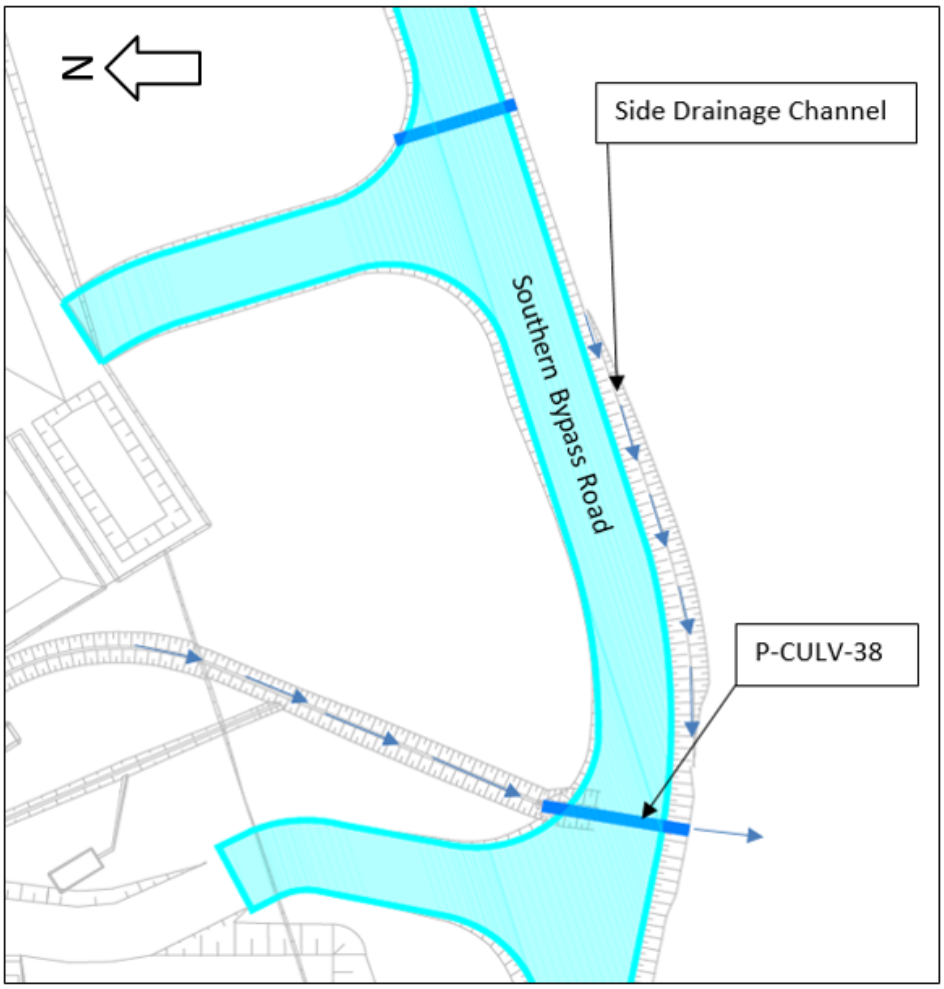


Figure 8-13: Southern Bypass Road Side Drainage Channel

9. Balance of Work Drainage

9.1 Storm Water Diversion - P-SWD-3

Storm water diversion number 3 will be constructed to divert water away from Laydown LP2 situated to the south of the existing Port Site Camp. Both the diversion and the laydown area are planned to be constructed in 2018. Figure 9-1 indicates the diversion.

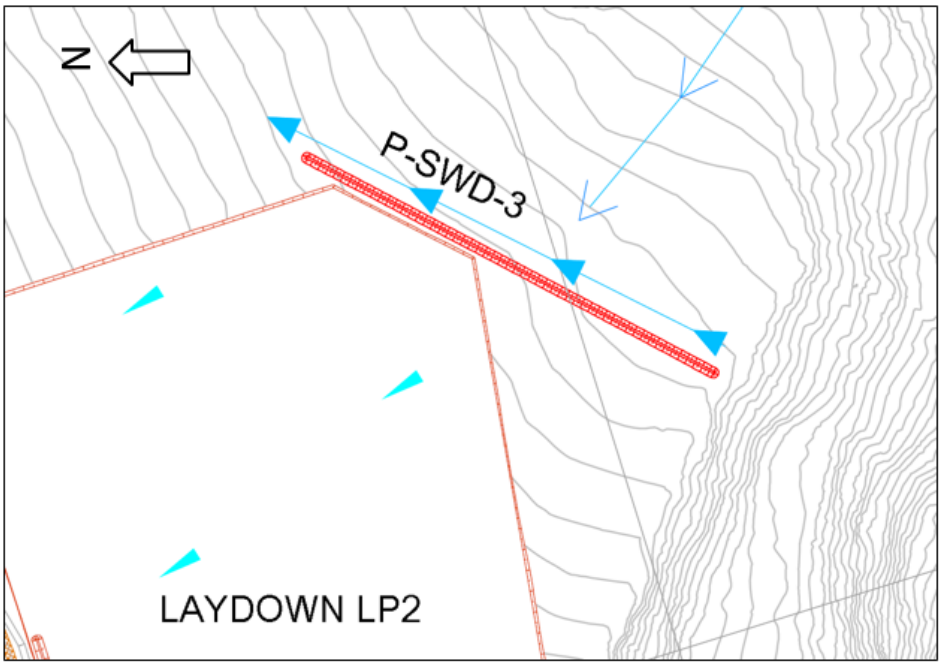


Figure 9-1: P-SWD-3

The diversion will be constructed as a berm collecting water from the catchment area to the south and primarily from P-SWD-5. When exiting the berm, the water will flow naturally towards the north joining the natural stream east of the Port Site Camp (PSC).

The diversion was modelled and analysed as a berm taking into account the surrounding natural ground. The results were as follows:

- Berm Height Required = 0.6 m
- Maximum Velocity = 1.49 m/s

9.2 Laydown LP2 Drainage

Laydown LP2 will be constructed south of the existing Port Site Camp. This area will be used for laydown of equipment and construction plant as well as to serve as the location of relocated buildings as indicated in Figure 9-2.

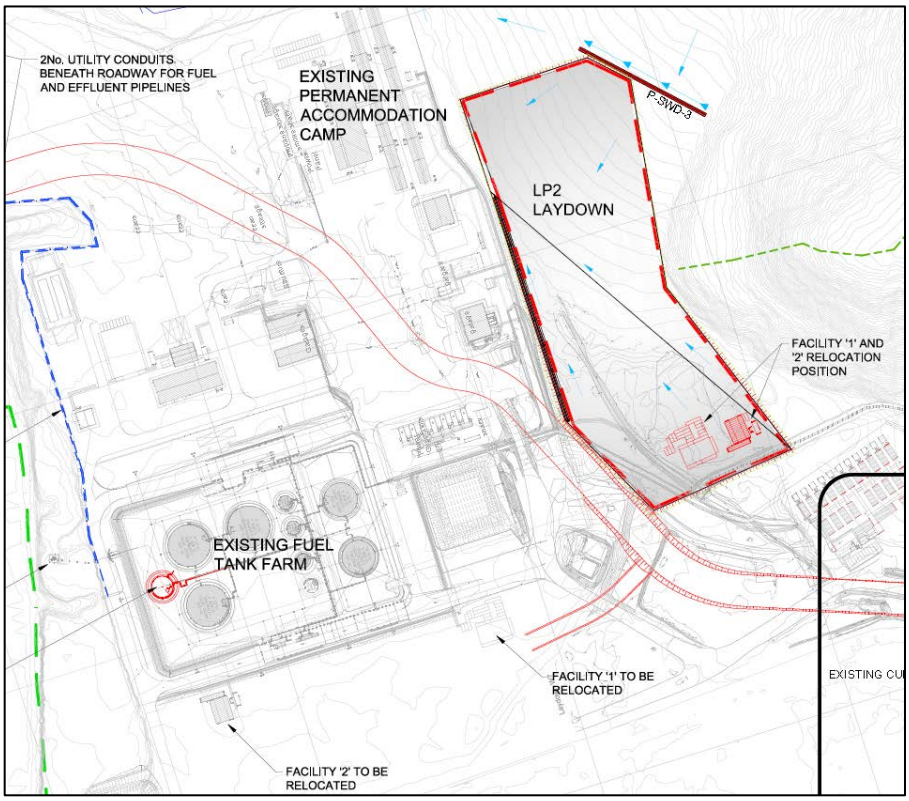


Figure 9-2: Laydown LP2 Location

Figure 9-3 shows the proposed LP2 laydown area in more detail.

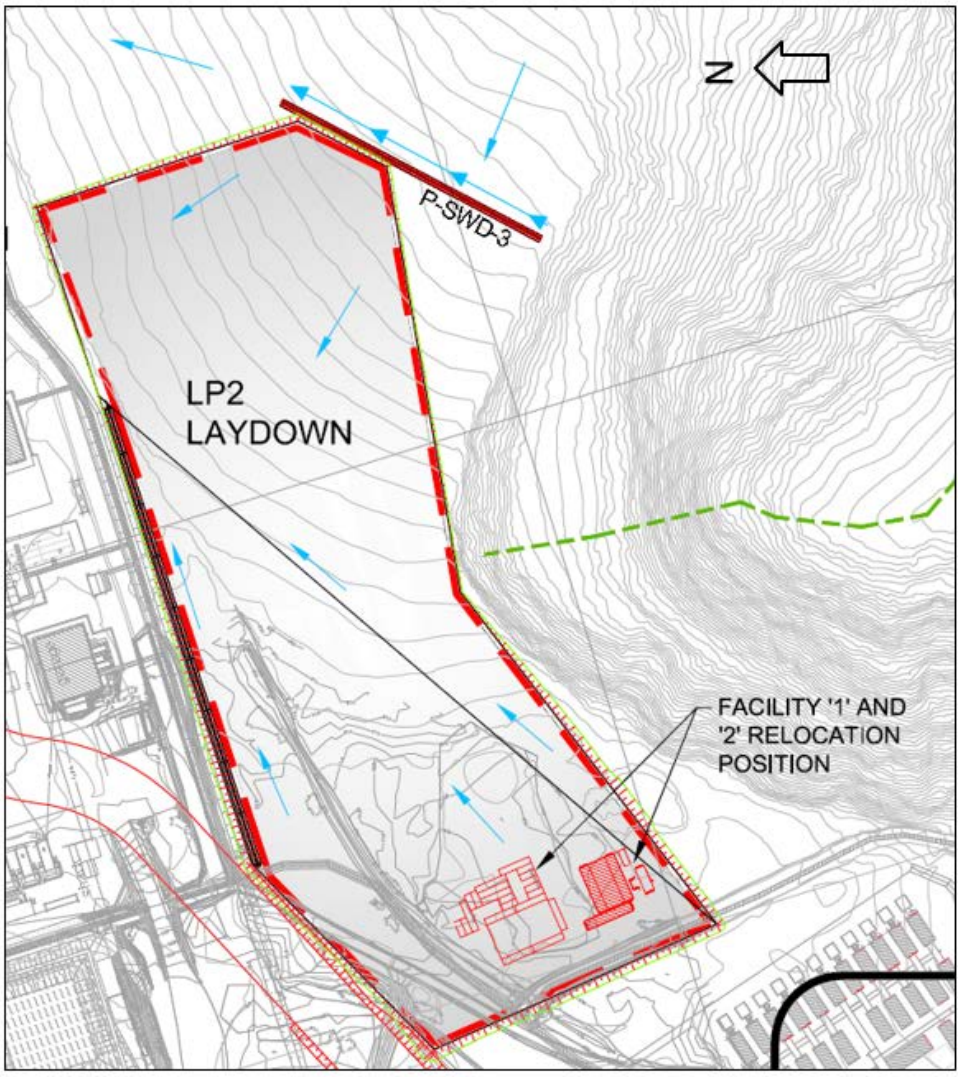


Figure 9-3: Laydown LP2 Drainage

The laydown area will be constructed with a swale sloping towards the northeast where it will discharge any storm water runoff into the existing drainage ditch. The discharge location was determined as the highest point in the existing drainage ditch to ensure water discharges to the east. A berm will be constructed on top of the laydown area to direct runoff to this point. This ditch discharges to the natural drainage path that will convey the water to the north.

9.3 Drainage in the Barge Offloading Dock Area - P-SWD-7

At the existing barge offloading dock, there is an existing culvert (referred to as Culv-Exg-B) that conveys runoff from the south and discharges it to the west. The storm water is directed towards the sea via a berm (P-SWD-7) after exiting the culvert. Refer to Figure 9-4.

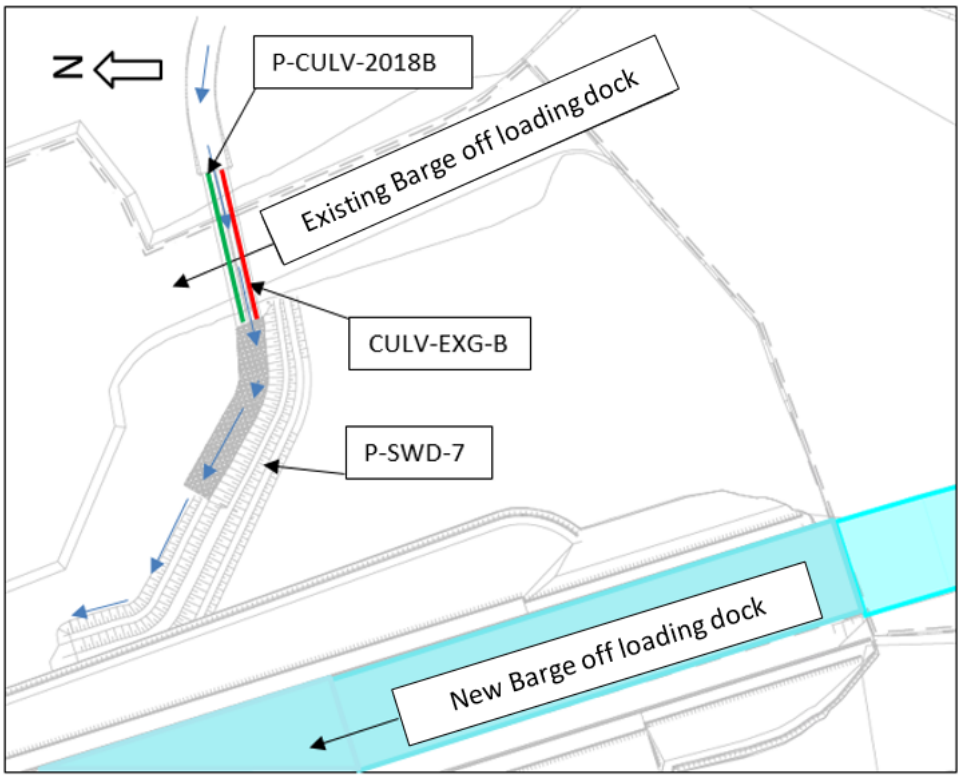


Figure 9-4: P-SWD-7

The existing culvert must be modified to ensure that no water for the 1:100 year flood event (See Civil Design Philosophy) will discharge towards the north which is not the natural discharge location for this stream. The berm P-SWD-7 is designed so that runoff will not interfere with the construction of the new barge offloading dock.

The existing culvert has two barrels of 1200mm diameter each. These are to be modified by lowering the inlet invert elevations and adding two additional 1200mm diameter barrels to the culvert at the same elevation.

- Based on the 1:100 year return period flood, the computed headwater elevation at the culvert's inlet is equal to 3.23 m. This is less than the maximum allowable elevation of 3.24m before a spill will occur to the north and into the sea.
- The calculated maximum velocity is equal to 1.83 m/s and as a result, rip rap will be placed at the inlet and outlet of the culverts to protect against erosion.

The diversion berm (P-SWD-7) is modelled and analysed taking into account the surrounding existing ground. The results are as follows:

- Berm Height Required = 1.2 m
- Maximum Velocity = 1.53 m/s

Based on the results, adequate rip rap shall be placed to protect against erosion.

9.4 Laydown W10A and W10B

Storm water runoff from laydown W10A and W10B will be directed to the west by constructing laydown levels that ensures adequate slope and flow. No swales will be constructed for the laydown area and all runoff will be considered as sheet flow. W10A and W10B are indicated on Figure 9-5.

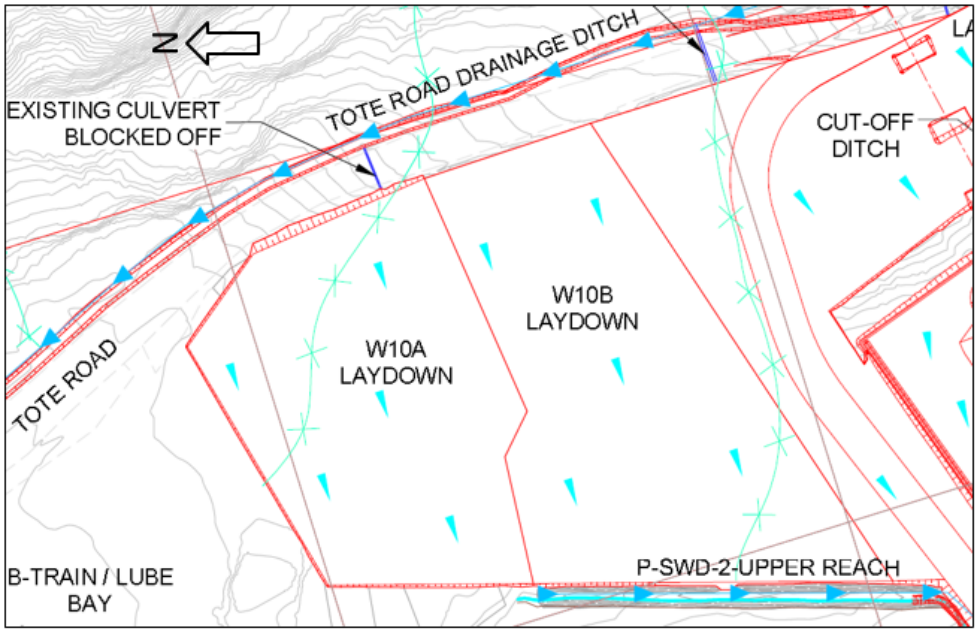


Figure 9-5: Laydown W10A and W10B Drainage Plan

Runoff from W10A will continue as sheet flow across the Accommodation Camp pad and runoff from W10B will flow into P-SWD-2-Upper Reach.

9.5 Laydown LP5

Laydown LP5 will drain towards the southwest through a combination of swales and sheet flow as per Figure 9-6.

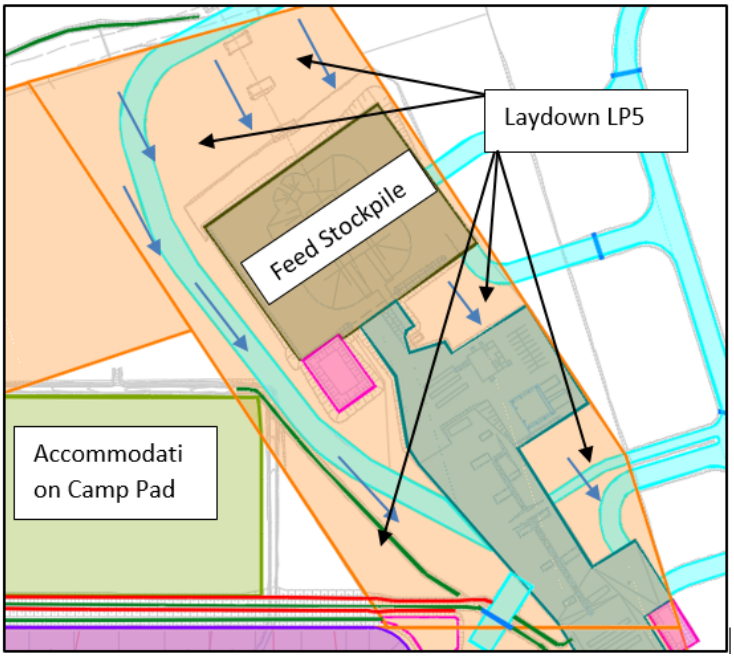


Figure 9-6: Laydown LP5 Drainage

9.6 Laydown LP6

This laydown area will drain towards the west as sheet flow. This is achieved through grading the laydown to ensure adequate slope. The LP6 laydown area will discharge into the natural environment as shown on Figure 9-7.

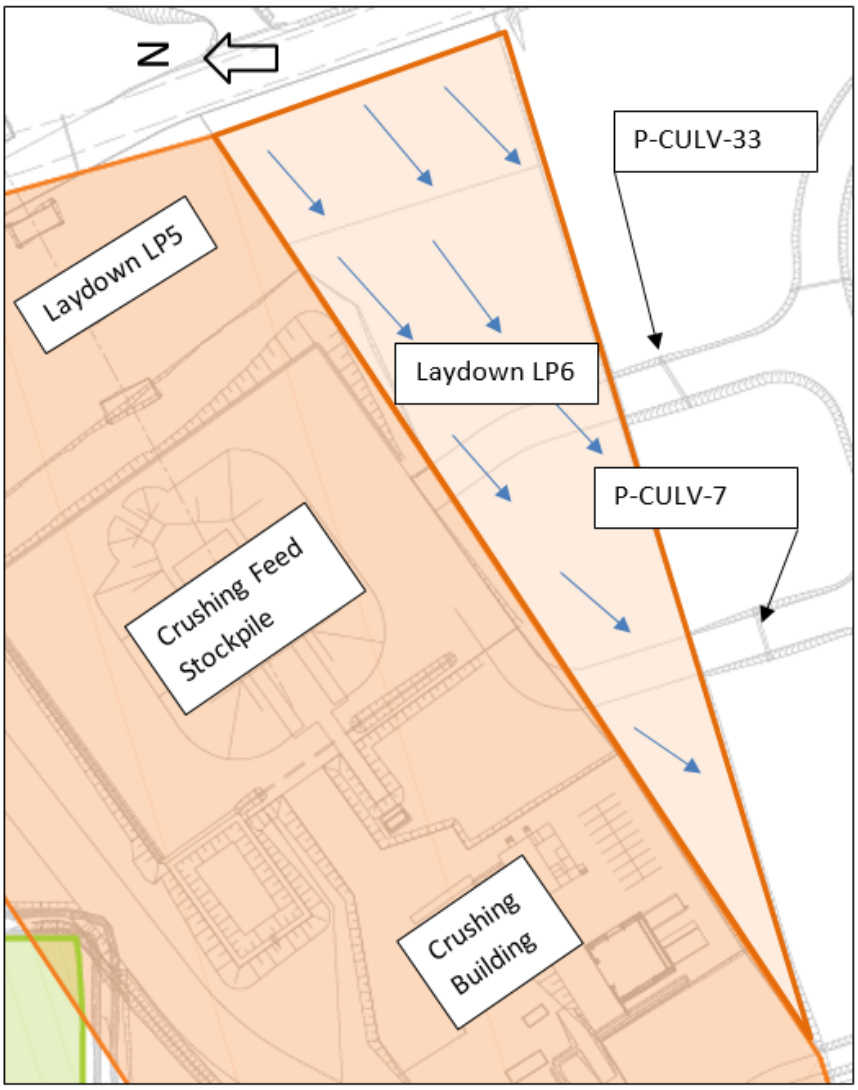


Figure 9-7: Laydown LP6 Drainage Plan

9.7 P-SWD-2

Storm water diversion No.2 consists of two sections:

- Upper Reach that was previously designed and constructed to facilitate drainage around the Accommodation Camp Pad.
- Lower reach that was designed to convey water to the south where it will discharge into the natural environment.

9.7.1 *P-SWD-2 – Upper Reach*

This section of the diversion was designed and constructed to convey flow from a large catchment area upstream of the existing Tote Road and discharge it on the western side of the construction accommodation camp pad. For the future phase, this section will link up with P-SWD-2 – Lower Reach which is described in Section 9.7.2.

9.7.2 *P-SWD-2 - Lower Reach*

This reach will be constructed to convey water from the P-SWD-2 – Upper Reach, upstream catchment area and the Eastern Berm – Clear Water Overflow Channel around the crushing and screening pad. The ditch will have several culvert crossings as follows:

- P-CULV-39 - 1200mm Diameter CSP
  - Crossing to allow for utilities crossing over the ditch, on top of a berm
- P-CULV-37 - 1200mm Diameter CSP
  - Crossing to allow access into the stockpile area for front end loader and maintenance vehicles
- P-CULV-38 - 1200mm Diameter CSP
  - Crossing at the Southern Bypass

Figure 9-8 shows the diversion.

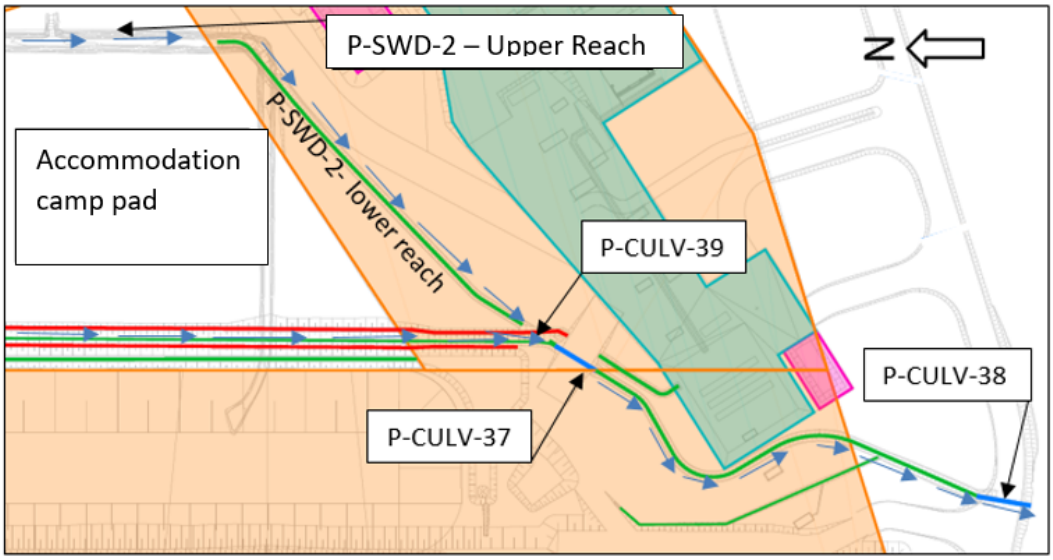


Figure 9-8: P-SWD-2

As part of the stacker reclaimer berm, a small trapezoidal ditch is designed to connect to this diversion.

The results of the design calculations for P-SWD-2 are as follows:

- Bottom Width - 0.5m
- Side Slopes - 1V:1.5H
- Flow - 2.348 m^3/s
- Max Normal Flow Depth - 0.995m
- Max Velocity - 1.18 m/s

Since this ditch drains a number of drainage areas; the above results are for the total drainage area when the highest flow is expected.

9.8 Laydown LP7

Figure 9-9 indicates the location of laydown LP7.

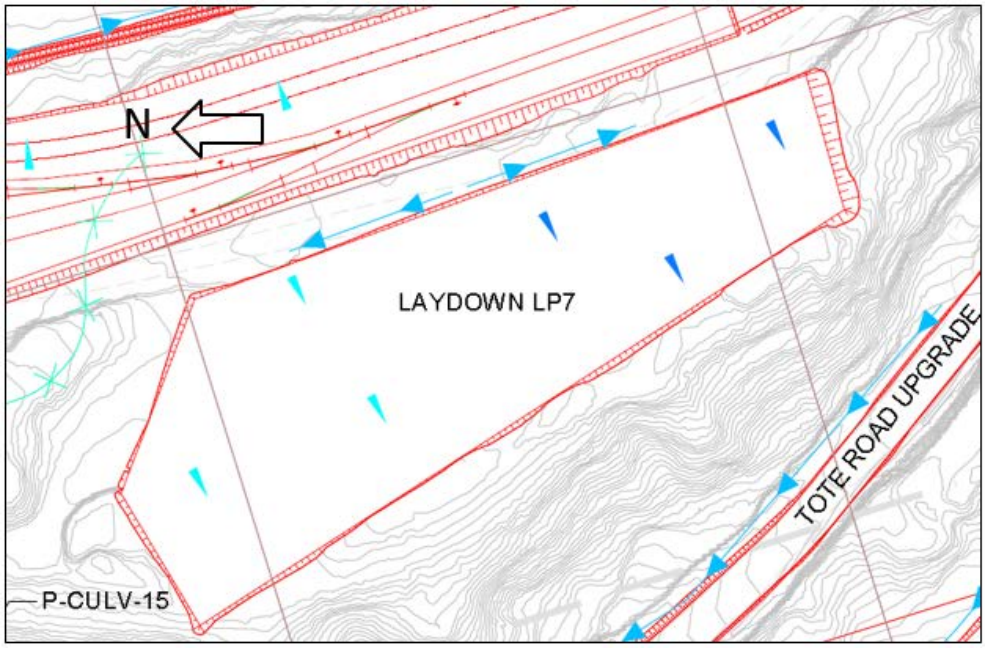


Figure 9-9: Laydown LP7 Drainage Plan

This laydown area will be drained as sheet flow to the west where it joins the Tote Road drainage and then diverts to the north.

9.9 Utility Berm – From Generation Station to South

Two drainage culverts will be provided beneath a utility berm. The details for the culverts are as follows:

- P-CULV-24 - 600mm Diameter
  - This culvert will be constructed beneath the existing utility berm located to the east of the eastern berm. No rip rap will be required.

- P-CULV-27 - 600mm Diameter
  - This culvert will be constructed beneath the new section of the utility berm. No rip rap will be required.

The area can be seen in Figure 9-10.

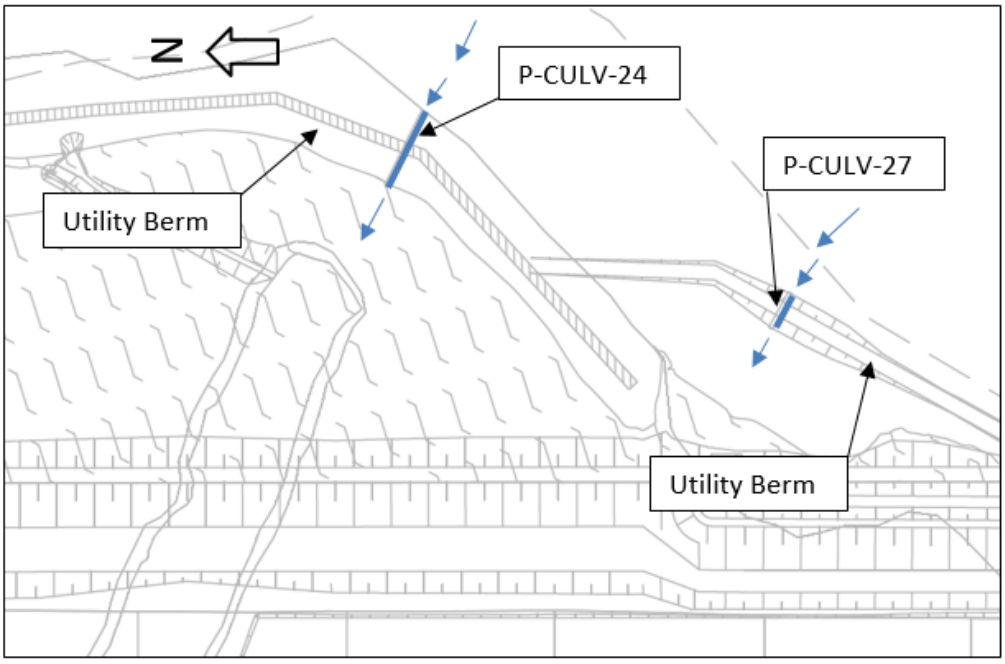


Figure 9-10: Utility Berm

9.10 Conveyor Bent Pads

Pads will be constructed along the conveyor alignment to support the conveyor bents located as per Figure 9-11. These platforms are in fill with a 1:200 fall across to facilitate drainage. Where they are in cut, daylight ditches will be constructed at 1:200 fall to ensure adequate drainage is achieved.

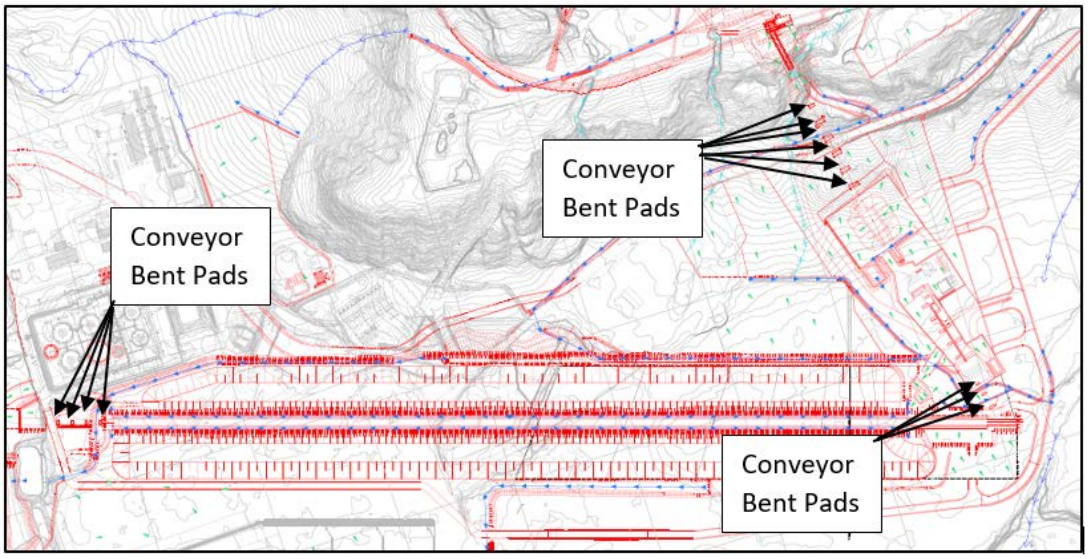


Figure 9-11: Conveyor Bent Pads

9.11 Accommodation Camp Pad

The Accommodation Camp Pad has been designed to allow for sheet flow across the pad. The catchment area only includes storm water runoff from the pad and flow from Laydown W10A. The pad drains toward the eastern berm and enters the clear water channel through P-CULV-40 as described in Section 7. Figure 9-12 shows the pad.

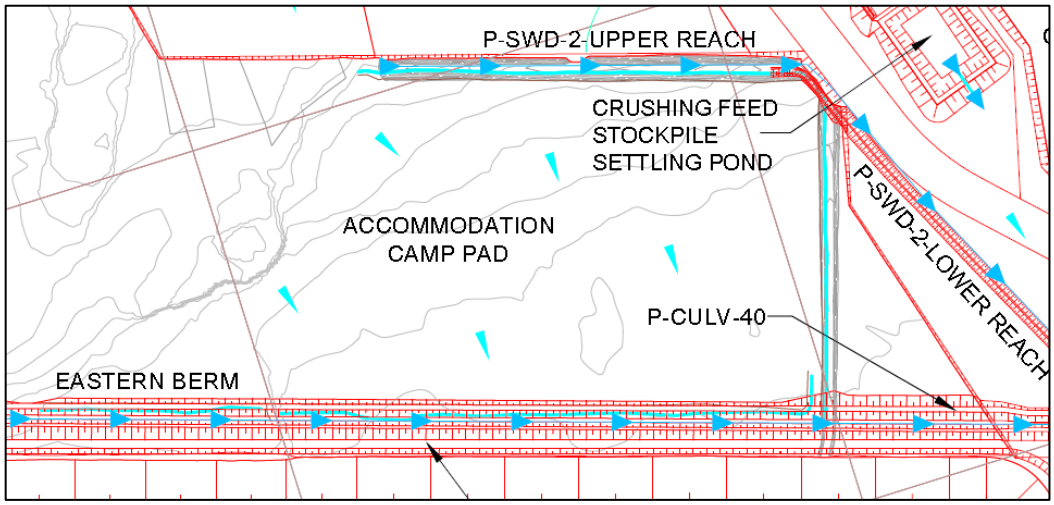


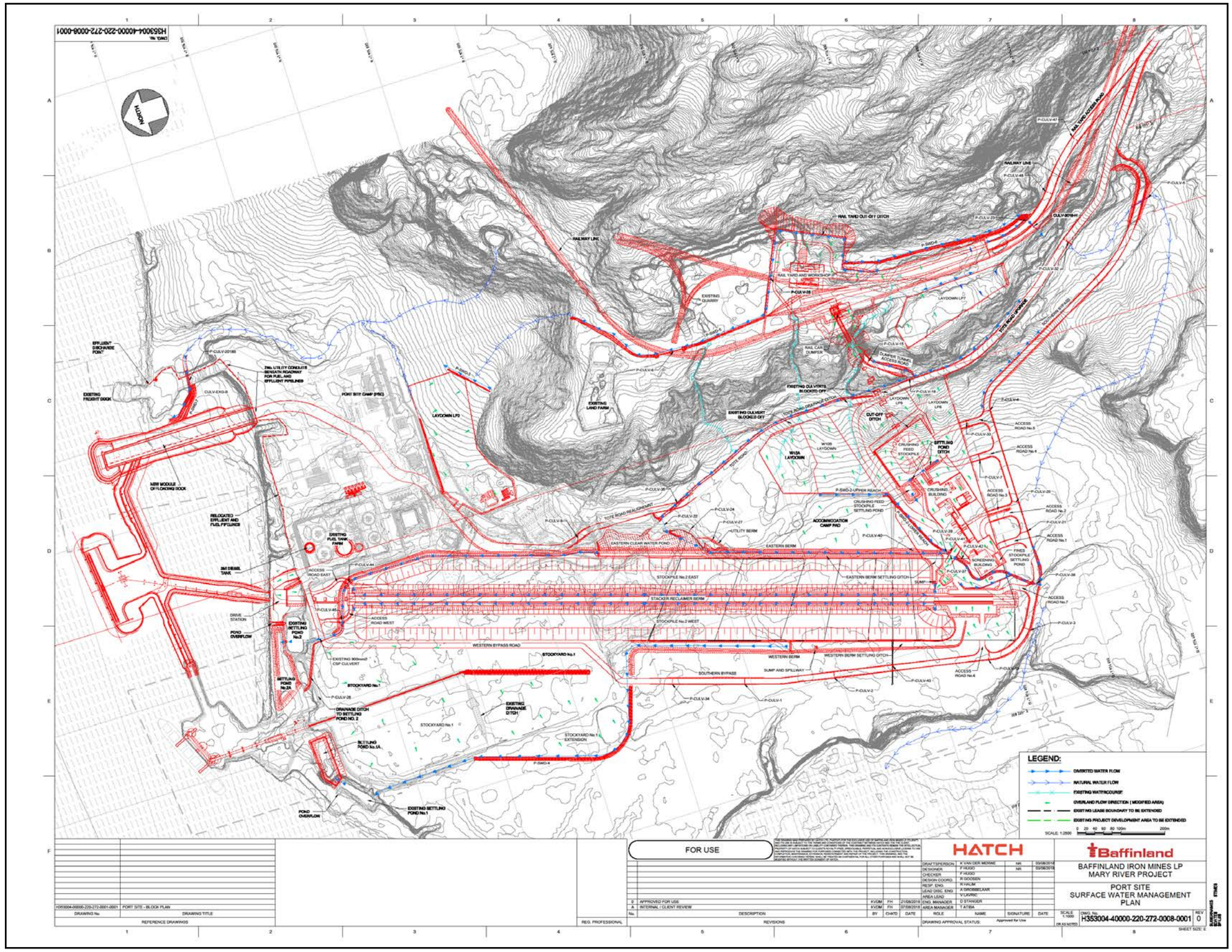
Figure 9-12: Accommodation Camp Pad Drainage

Appendix A
IFC Drainage Drawings List

Doc Number	Rev.	Doc Title	Status	Doc Type Code
H353004-00000-221-294-0002-0001	0	Site Wide - Standard Drawing - Earthworks & Drainage Details	Approved for Construction	294 - Standard Drawing
H353004-00000-221-294-0003-0001	0	Site Wide - Standard Drawing - Earthworks & Drainage Details	Approved for Construction	294 - Standard Drawing
H353004-00000-221-294-0004-0001	0	Site Wide - Standard Drawing - Earthworks & Drainage Details	Approved for Construction	294 - Standard Drawing
H353004-00000-221-294-0005-0001	0	Site Wide - Standard Drawing - Earthworks & Drainage Details	Approved for Construction	294 - Standard Drawing
H353004-00000-221-294-0006-0001	0	Site Wide - Standard Drawing - Earthworks & Drainage Details	Approved for Construction	294 - Standard Drawing
H353004-10000-221-272-0009-0001	0	MINE SITE - 2018 GENERATOR PAD EXPANSION - LAYOUT AND DRAINAGE DRAWING	Approved for Construction	272 - Layout Drawing
H353004-40000-221-272-0010-0001	0	PORT SITE - RAIL CAR DUMPER - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-223-271-0009-0001	0	PORT SITE - TOTE ROAD DRAINAGE UPGRADE - PLAN AND PROFILE SHEET 1 OF 3	Approved for Construction	271 - Plan / Profile
H353004-40000-228-271-0005-0001	0	PORT SITE - CONSTRUCTION PHASE - ACCESS ROADS DRAINAGE DETAILS	Approved for Construction	271 - Plan / Profile
H353004-40000-228-271-0007-0001	1	PORT SITE - STOCKYARD NO 1 - BERM (P-SWD-4) - DRAINAGE PLAN	Approved for Construction	271 - Plan / Profile
H353004-40000-228-272-0005-0001	0	PORT SITE - CRUSHING FEED STOCKPILE PAD - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0006-0001	0	PORT SITE - CRUSHING AND SCREENING PAD - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0009-0001	0	PORT SITE - LOCOMOTIVE WORKSHOP PAD - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing

Doc Number	Rev.	Doc Title	Status	Doc Type Code
H353004-40000-228-272-0011-0001	0	PORT SITE - LAYDOWN AREA LP2 - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0012-0001	0	PORT SITE - LAYDOWN AREA LP3 - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0013-0001	0	PORT SITE - LAYDOWN AREA LP7 - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0014-0001	0	PORT SITE - LAYDOWN AREA W10A - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0015-0001	0	PORT SITE - LAYDOWN AREA W10B - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0016-0001	0	PORT SITE - LAYDOWN AREA LP6 - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing
H353004-40000-228-272-0017-0001	0	PORT SITE - LAYDOWN AREA LP5 - DRAINAGE PLAN	Approved for Construction	272 - Layout Drawing

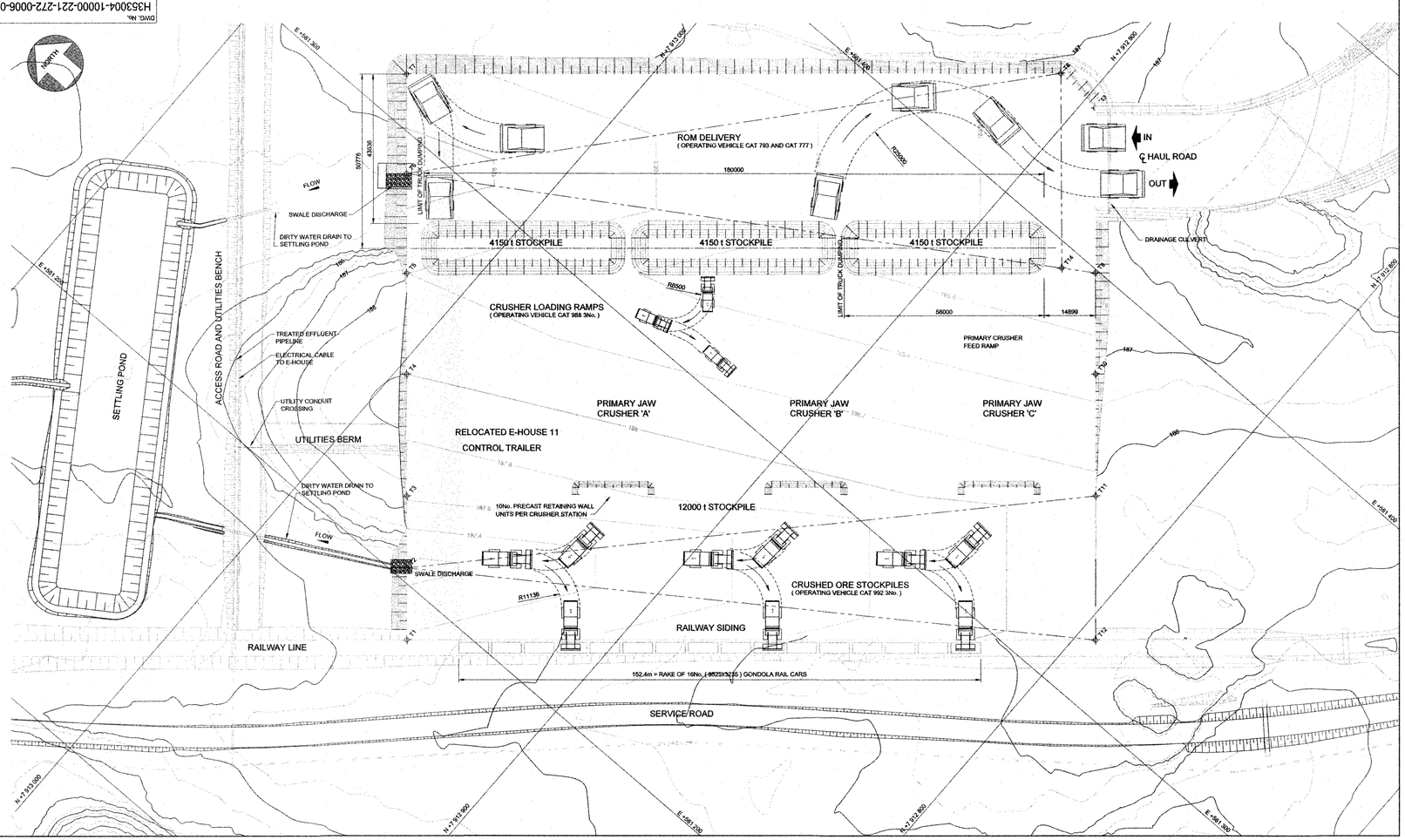
Appendix B
Drawing H353004-40000-220-272-0008-0001 - Surface Water Management Plan - Milne Port



ATTACHMENT 10.3

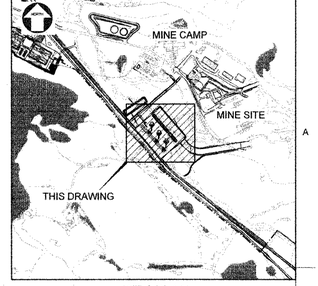
MINE SITE CRUSHER PAD DRAWINGS

DWG. No. H353004-10000-221-272-0006-0001



PLAN ON CRUSHER LOADING PAD

SCALE 1:500



KEY PLAN

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016)
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 0.5m.
4. ALL DIMENSIONS SHOWN ARE IN METERS, UNLESS OTHERWISE SPECIFIED.

LEGEND:

- 198 — CONTOUR
- EXISTING TREATED EFFLUENT
- NEW TREATED EFFLUENT
- ELECTRICAL CABLE

CRUSHER PAD SETTING OUT CO-ORDINATES

POINT	E	N	LEVEL
T1	561 187.603	7 912 946.397	187.630
T2	561 203.499	7 912 960.095	187.430
T3	561 219.407	7 912 973.804	187.630
T4	561 246.259	7 912 996.979	188.000
T5	561 268.645	7 913 016.237	187.630
T6	561 290.613	7 913 035.168	187.630
T7	561 312.582	7 913 054.100	187.630
T8	561 436.553	7 912 910.245	188.130
T9	561 399.145	7 912 864.606	188.130
T10	561 376.815	7 912 845.528	188.480
T11	561 349.940	7 912 822.334	188.130
T12	561 318.095	7 912 794.951	188.130
T13	561 435.506	7 912 896.141	188.130
T14	561 393.858	7 912 873.106	188.700

DRAWING No.	DRAWING TITLE
H353004-00000-221-294-0009-0001	STANDARD DRAWINGS - TYPICAL PAD, DITCH AND BERM SECTIONS
H353004-00000-221-294-0006-0001	STANDARD DRAWINGS - EARTHWORKS AND DRAINAGE DETAILS
H353004-10000-228-272-0005-0001	CRUSHER PAD - DRAINAGE PLAN
H353004-10000-221-273-0003-0001	CRUSHER PAD - PAD CROSS SECTIONS
H353004-10000-221-272-0007-0001	CRUSHER PAD - CRUSHER BARRIER SETTING OUT PLAN
H353004-00000-224-272-0027-0001	RAILWAY PLAN AND LONGITUDINAL SECTION CH106.900km TO CH109.610KM
H353004-41000-231-260-0002-0001	PRIMARY CRUSHER FEED RAMP - CONCRETE ARRANGEMENT AND DETAILS
H353004-19000-231-260-0001-0003	PRIMARY CRUSHER AREA - RETAINING WALL DETAILS
H353004-19000-231-260-0001-0001	PRIMARY JAW CRUSHER FOUNDATIONS - ARRANGEMENT AND DETAILS

REFERENCE DRAWINGS

REG. PROFESSIONAL

FOR CONSTRUCTION

No.	DESCRIPTION	BY	CHK'D	DATE
1	EDC NOTE REMOVED	JM	FH	02/08/2018
0	APPROVED FOR CONSTRUCTION	IHB	FH	13/04/2018

REVISIONS

HATCH

DRAFTSPERSON	I BARNARD	NR	01/08/2018
DESIGNER	I BARNARD	NR	01/08/2018
CHECKER	F HUGO		2018-08-03
DESIGN COORD.	R GOOSEN		2018-08-03
RESP. ENG.	R HALIM		2018-08-03
LEAD DISC. ENG.	A GROBBELAAR		2018-09-03
AREA LEAD	T ATIBA		
ENG. MANAGER	D STANIER		
AREA MANAGER	T ATIBA		2018-08-03
ROLE	NAME	SIGNATURE	DATE

DRAWING APPROVAL STATUS: Approved for Construction

PERMIT TO PRACTICE
HATCH LTD.
Signature _____
Date _____
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NU/YT/NU

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION PROJECT

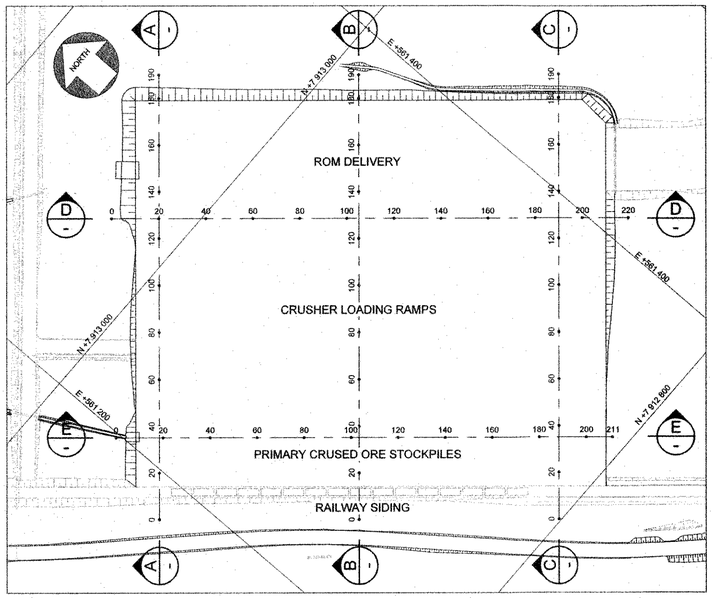
MINE SITE
CRUSHER PAD
LAYOUT PLAN

SCALE	DWG. No.	REV
1:500 OR AS NOTED	H353004-10000-221-272-0006-0001	1

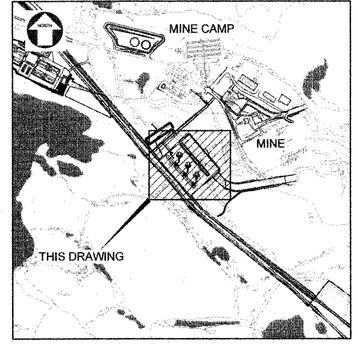
SHEET SIZE: E

SUSERNAMES
$LASTSAVEDBY
$TIMES
$FILES

DWG. No. H353004-10000-221-273-0003-0001



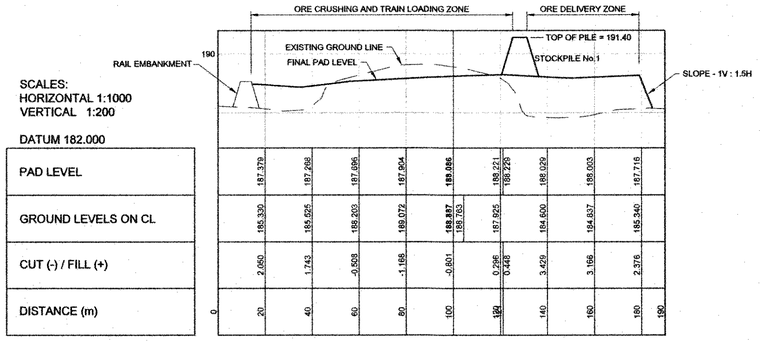
PLAN ON CRUSHER PAD
SCALE 1:1000



KEY PLAN

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016)
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 0.5m.
4. ALL DIMENSIONS SHOWN ARE IN METERS, UNLESS OTHERWISE SPECIFIED.

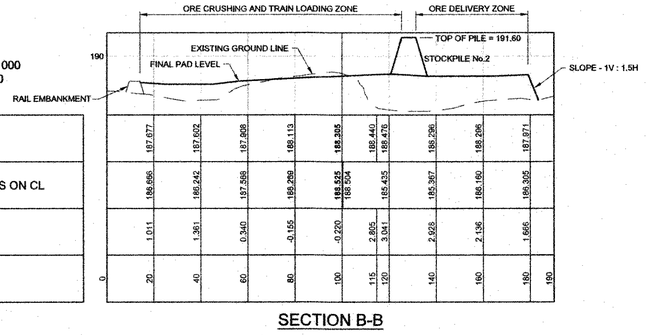


SCALES:
HORIZONTAL 1:1000
VERTICAL 1:200

DATUM 182.000

PAD LEVEL	187.379	187.268	187.096	187.804	188.086	189.221	189.229	188.029	188.003	187.718	
GROUND LEVELS ON CL	185.330	185.526	188.203	188.072	188.887	188.763	187.926	184.600	184.837	185.340	
CUT (-) / FILL (+)	2.050	1.743	-0.938	-1.168	-0.801	0.296	0.448	3.429	3.166	2.378	
DISTANCE (m)	0	20	40	60	80	100	104	120	140	160	180	190

SECTION A-A

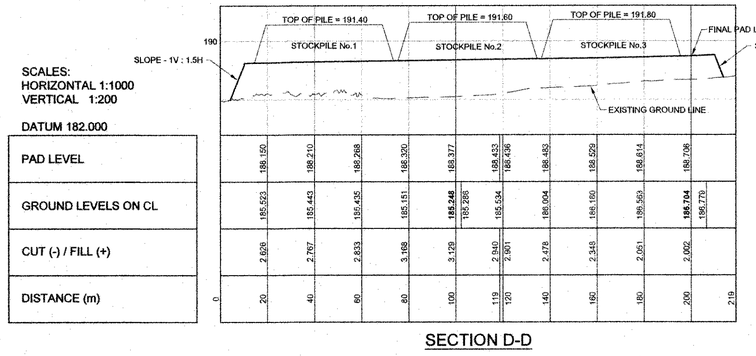


SCALES:
HORIZONTAL 1:1000
VERTICAL 1:200

DATUM 185.000

PAD LEVEL	187.677	187.602	187.268	188.113	188.385	188.440	188.476	188.286	188.286	187.971	
GROUND LEVELS ON CL	186.666	186.242	187.588	188.269	188.525	188.504	189.435	185.367	186.160	186.305	
CUT (-) / FILL (+)	1.011	1.361	0.340	-0.155	-0.220	2.805	3.041	2.928	2.136	1.666	
DISTANCE (m)	0	20	40	60	80	100	115	120	140	160	180	190

SECTION B-B

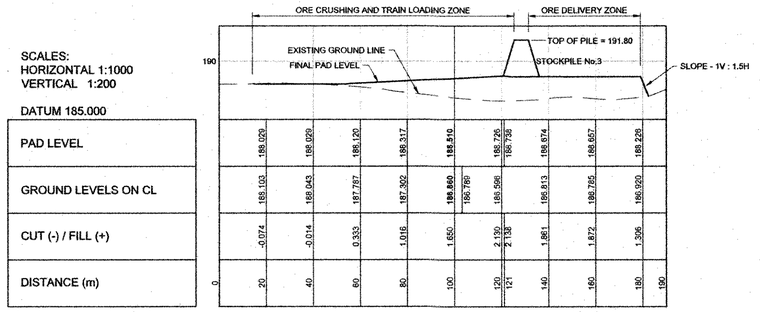


SCALES:
HORIZONTAL 1:1000
VERTICAL 1:200

DATUM 182.000

PAD LEVEL	188.150	188.210	188.268	188.320	188.377	188.433	188.436	188.483	188.559	188.614	188.706	
GROUND LEVELS ON CL	185.523	185.443	185.435	185.151	185.248	185.286	185.534	186.004	186.160	186.553	186.704	186.779
CUT (-) / FILL (+)	2.626	2.767	2.833	3.168	3.129	2.940	2.901	2.478	2.348	2.061	2.002	
DISTANCE (m)	0	20	40	60	80	100	119	120	140	160	180	200	219

SECTION D-D

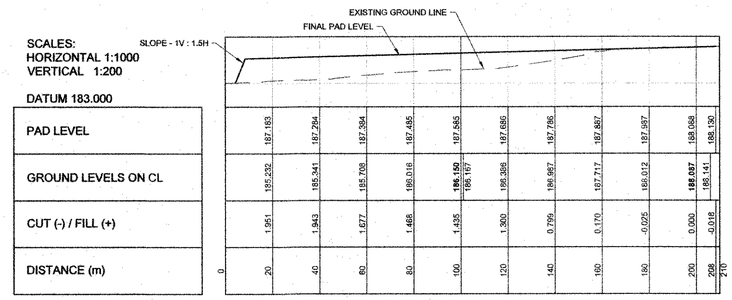


SCALES:
HORIZONTAL 1:1000
VERTICAL 1:200

DATUM 185.000

PAD LEVEL	188.029	188.029	188.120	188.317	188.510	188.726	188.738	188.674	188.657	188.229	
GROUND LEVELS ON CL	188.103	188.043	187.787	187.302	186.860	186.769	186.596	186.813	186.785	186.920	
CUT (-) / FILL (+)	-0.074	-0.014	0.333	1.016	1.650	2.130	2.138	1.861	1.872	1.306	
DISTANCE (m)	0	20	40	60	80	100	120	121	140	160	180	190

SECTION C-C



SCALES:
HORIZONTAL 1:1000
VERTICAL 1:200

DATUM 183.000

PAD LEVEL	187.183	187.294	187.384	187.485	187.585	187.686	187.786	187.887	187.987	188.068	188.130	
GROUND LEVELS ON CL	185.232	185.341	185.708	186.016	186.159	186.167	186.386	186.967	187.717	188.012	188.037	188.141
CUT (-) / FILL (+)	1.951	1.943	1.677	1.468	1.425	1.300	0.799	0.170	-0.025	0.000	-0.018	
DISTANCE (m)	0	20	40	60	80	100	120	140	160	180	200	208	210

SECTION E-E

PERMIT TO PRACTICE
HATCH LTD.
Signature
Date 2018-08-03
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

DRAWING No.	DRAWING TITLE
H353004-00000-221-294-0008-0001	STANDARD DRAWINGS - TYPICAL PAD, DITCH AND BERM SECTIONS
H353004-10000-221-272-0006-0001	CRUSHER PAD - LAYOUT PLAN
H353004-10000-231-260-0003-0001	PRIMARY CRUSHER STOCKPILE - RETAINING WALL DETAILS
H353004-10000-231-280-0002-0001	PRIMARY CRUSHER FFED RAMP - CONCRETE ARRANGEMENT AND DETAILS
H353004-10000-231-260-0001-0001	PRIMARY JAW CRUSHER - ARRANGEMENT AND DETAILS

REFERENCE DRAWINGS

REGISTERED PROFESSIONAL ENGINEER R. A. HALIM LICENSEE 2018-08-03 NWT/NU

REG. PROFESSIONAL

FOR CONSTRUCTION

No.	DESCRIPTION	BY	CHK'D	DATE
1	EDC NOTE REMOVED	JM	FH	02/08/2018
0	APPROVED FOR CONSTRUCTION	IHB	FH	13/04/2018

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	I BARNARD	NR	01/08/2018
DESIGNER	I BARNARD	NR	01/08/2018
CHECKER	F HUGO		2018-08-02
DESIGN COORD.	R GOOSEN		2018-08-03
RESP. ENG.	R HALIM		2018-08-03
LEAD DISC. ENG.	A GROBBELAAR		2018-08-03
AREA LEAD	T ATIBA		2018-08-03
ENG. MANAGER	D STANGER		
AREA MANAGER	T ATIBA		2018-08-03

DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION PROJECT

MINE SITE
CRUSHER PAD
PAD CROSS SECTIONS

SCALE 1:1000 OR AS NOTED

DWG. No. H353004-10000-221-273-0003-0001

REV 1

SHEET SIZE: E

USERNAMES
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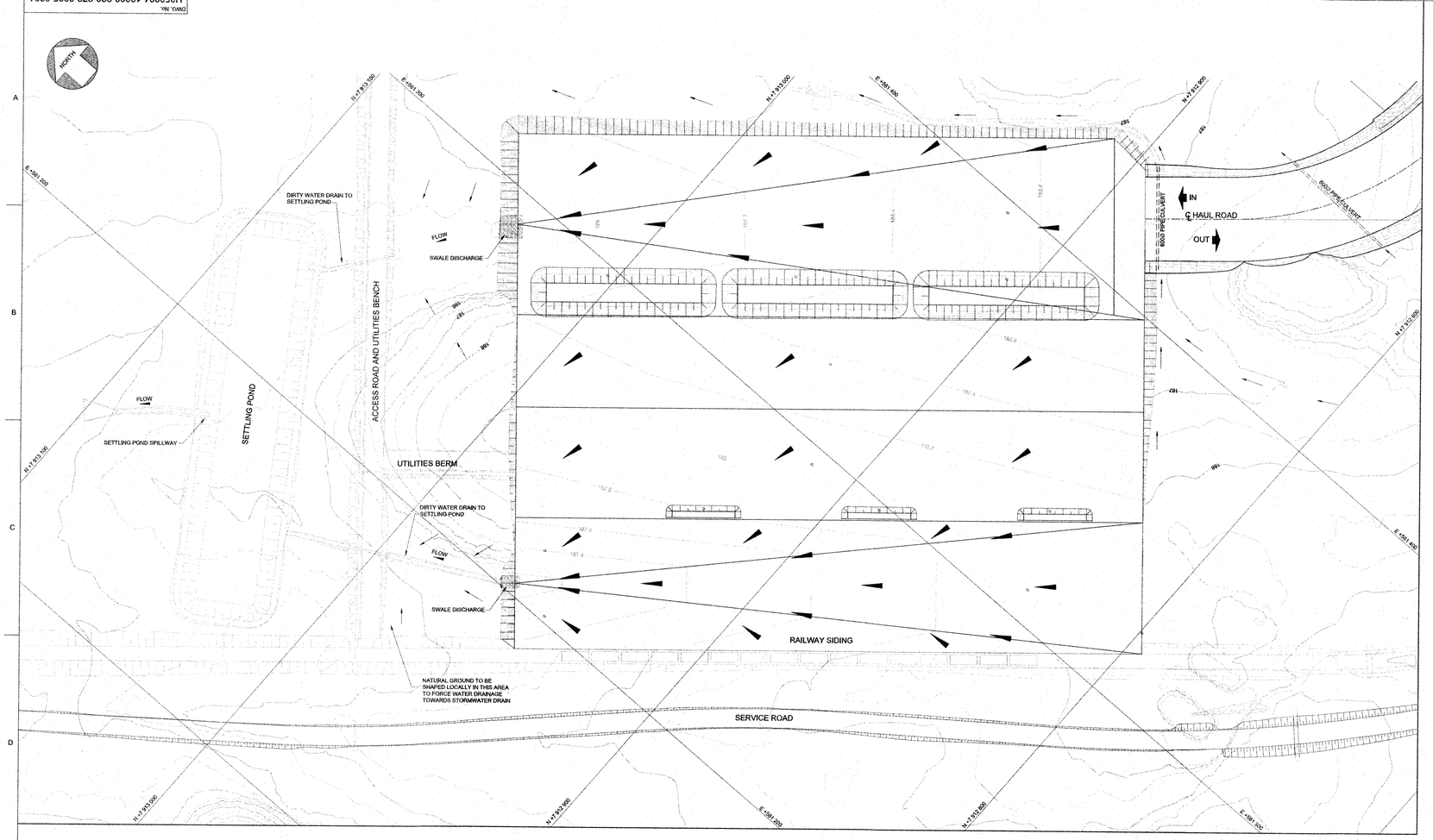
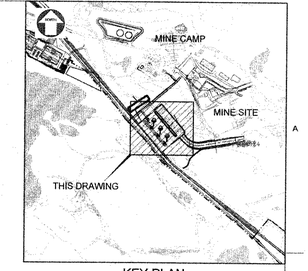
SDATES



PLAN ON CRUSHER PAD
SCALE 1:500



KEY PLAN

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016).
2. CO-ORDINATE GRID IS SHOWN IN UTM (NAD83), ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. THE CONTOUR INTERVAL IS 0.5m.
4. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
5. THE POND IS DESIGNED TO BE OPERATED EMPTY.
6. IT IS ASSUMED THAT ALL RUN OFF COLLECTED BY THE SETTLING POND IS NON-ACID GENERATING AND CAN BE DISCHARGED TO THE ENVIRONMENT ONCE THE REQUIREMENTS OF BIM ENVIRONMENTAL DESIGN CRITERIA HAS BEEN ACHIEVED. WATER TO BE DISCHARGED TO AN APPROVED POINT, IN ACCORDANCE WITH THE CLIENT'S (BIM) ENVIRONMENTAL REQUIREMENTS.
7. THE INSTALLATION OF THE GEOMEMBRANE (ENVIRO LINER 6050HD) IS TO BE IN STRICT ACCORDANCE WITH THE SPECIALIST PROVIDERS SPECIFICATIONS.

LEGEND:

- OFF PAD FLOW DIRECTION
- ON PAD FLOW DIRECTION

PERMIT TO PRACTICE
HATCH LTD.
Signature _____
Date _____
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

H353004-10000-228-272-0006-0001	CRUSHER PAD SETTLING POND - DETAILS
H353004-10000-228-272-0005-0001	CRUSHER PAD SETTLING POND - PLAN AND PROFILES
H353004-10000-221-273-0003-0001	CRUSHER PAD - PAD CROSS SECTIONS
H353004-10000-221-272-0006-0001	CRUSHER PAD - LAYOUT PLAN
DRAWING No.	DRAWING TITLE

REFERENCE DRAWINGS

REG. PROFESSIONAL

FOR CONSTRUCTION

No.	DESCRIPTION	BY	CHKD	DATE
1	EDC NOTE REMOVED	JM	FH	01/08/2018
0	APPROVED FOR CONSTRUCTION	IHB	FH	16/04/2018

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	I BARNARD	NR	01/08/2018
DESIGNER	S HALL	NR	01/08/2018
CHECKER	F HUGO		2018-08-03
DESIGN COORD.	R GOOSEN		2018-08-03
RESP. ENG.	R HAUM		2018-08-03
LEAD DISC. ENG.	A GROBBELAAR		2018-08-03
AREA LEAD	T ATTIBA		2018-08-03
ENG. MANAGER	D STANGER		2018-08-03
AREA MANAGER	T ATTIBA		2018-08-03

DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

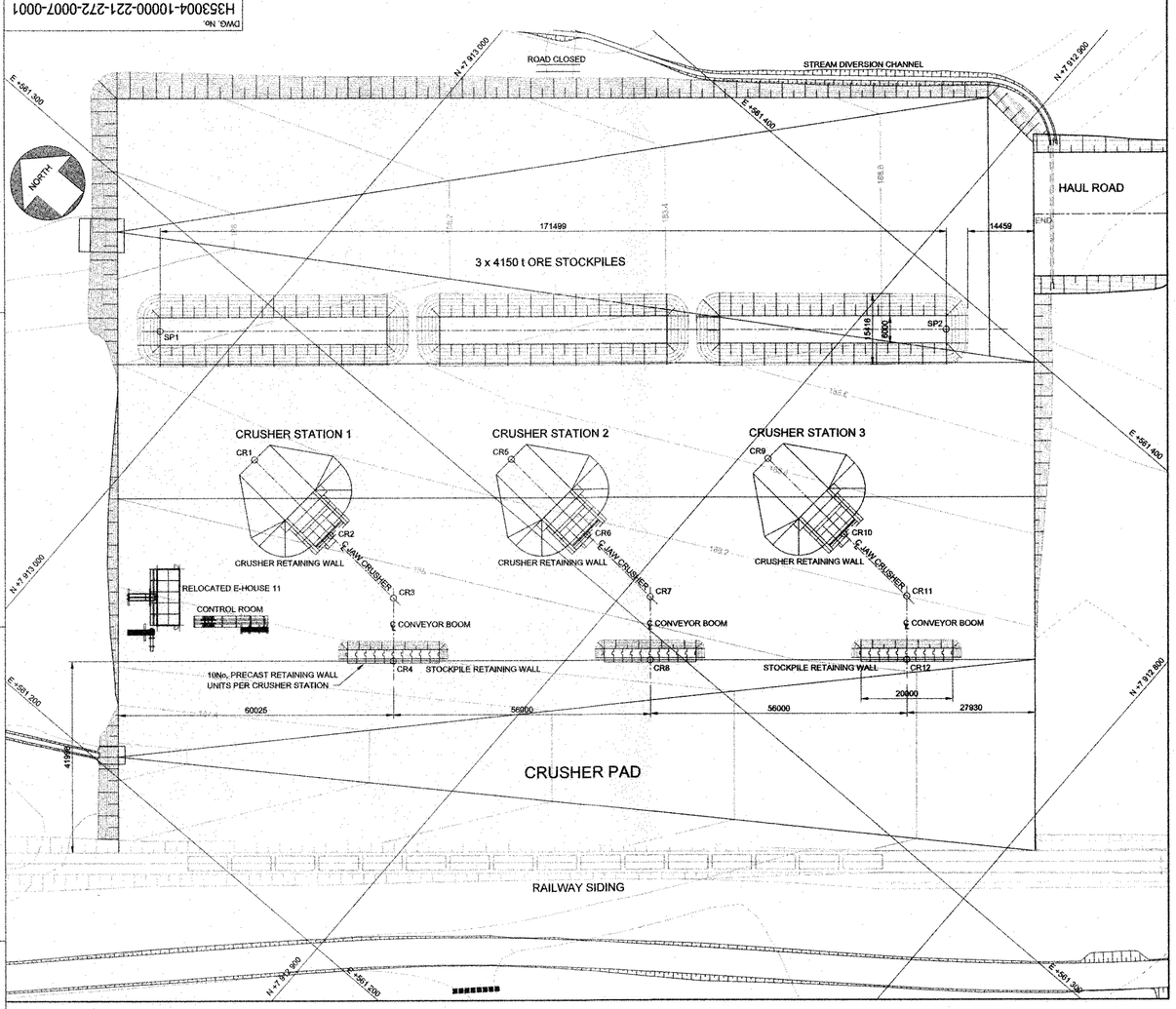
BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION PROJECT

MINE SITE
CRUSHER PAD
DRAINAGE PLAN

SCALE 1:500 OR AS NOTED
DWG. No. H353004-10000-228-272-0005-0001
REV 1
SHEET SIZE: E

STAGES
SCREENNAMES
STYLES
SHEETS

DWG. No. H353004-10000-221-272-0007-0001



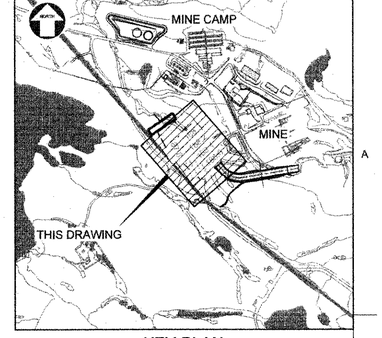
PLAN ON CRUSHER LOADING PAD

SCALE 1:500

SETTING OUT CO-ORDINATES		
POINT	E	N
ORE STOCKPILES		
SP1	561 280.150	7 913 013.946
SP2	561 392.157	7 912 884.075
CRUSHER STATIONS		
CR1	561 272.137	7 912 979.908
CR2	561 270.406	7 912 956.622
CR3	561 268.974	7 912 937.297
CR4	561 256.561	7 912 928.370
CR5	561 308.711	7 912 937.501
CR6	561 306.982	7 912 914.215
CR7	561 305.549	7 912 894.912
CR8	561 295.155	7 912 885.939
CR9	561 345.285	7 912 895.094
CR10	561 343.556	7 912 871.808
CR11	561 342.123	7 912 852.505
CR12	561 331.728	7 912 843.532

LEGEND:

195	CONTOUR
— — — —	TREATED EFFLUENT PIPELINE
TOC	TOP OF CONCRETE
FPL	FINAL PAD LEVEL



KEY PLAN

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016)
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 0.5m.
4. ALL DIMENSIONS SHOWN ARE IN METERS, UNLESS OTHERWISE SPECIFIED.

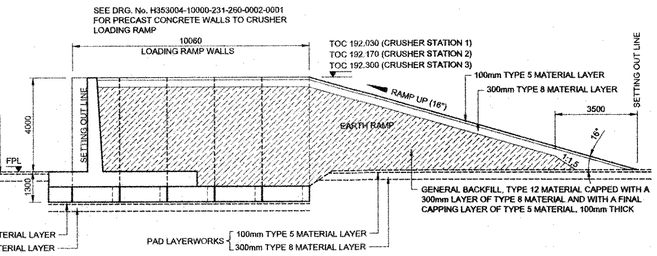
MATERIAL AND COMPACTION SPECIFICATION:

SUBGRADE PREPARATION:
THE SUBGRADE SHOULD SHOULD BE PROOF-ROLLED AND INSPECTED PRIOR TO PLACING FILL MATERIALS. THE IDENTIFIED SOFT AREAS SHALL BE FURTHER COMPACTED, OR IF NECESSARY, BE MITIGATED USING GRANULAR OR ROCK FILL. A QUALIFIED GEOTECHNICAL ENGINEER SHALL INSPECT AND APPROVE THE SUBGRADE.
THE ROCKFILL SHALL NOT BE PLACED IN WATER OR ON ICE. DEWATERING IS REQUIRED WHERE PONDING WATER IS ENCOUNTERED, OVER-EXCAVATION IS REQUIRED FOR GROUND ICE, IF ENCOUNTERED.
THE SUBGRADE ON THE GROUND SHALL BE LEFT AS IT IS NATURALLY BEFORE CONSTRUCTION AS MUCH AS POSSIBLE. THE OVER-EXCAVATION SHOULD BE MINIMIZED TO AVOID DISTURBANCE OF THE EXISTING PERMAFROST.

TYPE 5 (CRUSHER RUN 32mm MINUS MATERIAL) OR TYPE 3 (CRUSHER RUN 50mm MINUS):
THE MATERIAL MUST BE PLACED IN LIFTS NOT EXCEEDING 200mm AND SHALL BE COMPACTED BY MINIMUM 5 PASSES OF A MINIMUM 15 TON VIBRATORY ROLLER WITH VIBRATIONS IN THE RANGE OF 1200 TO 1500 vpm AND THE ROLLER SPEED OF ABOUT 2mph (3.2km/h). ALTERNATIVELY, THE COMPACTION SHOULD ACHIEVE A MINIMUM OF 100 PERCENT OF MAXIMUM DRY DENSITY AS DETERMINED BY TEST METHOD ASTM D698.

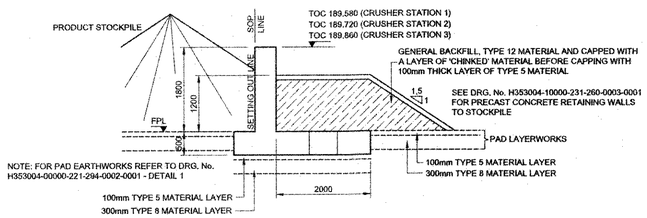
TYPE 8 (CRUSHER RUN 150mm MINUS):
THE ROCKFILL MUST BE PLACED IN LIFTS NOT EXCEEDING 500mm. THE PLACEMENT SHALL AVOID SEGREGATION AND NESTING OF COARSE PARTICLES. IT SHALL BE COMPACTED BY MINIMUM 5 PASSES OF A MINIMUM 15 TON VIBRATORY ROLLER WITH VIBRATIONS IN THE RANGE OF 1200 TO 1500 vpm AND THE ROLLER SPEED OF ABOUT 2mph (3.2km/h). EACH LIFT MUST BE "PROOF-ROLLED" PRIOR TO PLACING THE SUBSEQUENT LIFT.

TYPE 12 (RUN OF QUARRY):
THE ROCKFILL, IF USED, MUST BE PLACED IN LIFTS NOT EXCEEDING 1000mm. THE ROCKFILL SHALL BE COMPACTED BY MINIMUM 5 PASSES OF A MINIMUM 15 TON VIBRATORY ROLLER WITH VIBRATIONS IN THE RANGE OF 1200 TO 1500 vpm AND THE ROLLER SPEED OF ABOUT 2mph (3.2km/h). ALTERNATIVE COMPACTORS SUCH AS HEAVY LOADED RUBBER TIRED HAUL TRUCKS CAN ONLY BE USED AS PER A WRITTEN APPROVAL FROM THE ENGINEER.



TYPICAL ELEVATION ON CRUSHER LOADING RAMP

SCALE 1:100



TYPICAL ELEVATION ON STOCKPILE RETAINING WALL

SCALE 1:50

DRAWING No.	DRAWING TITLE
H353004-00000-221-294-0008-0001	STANDARD DRAWINGS - TYPICAL PAD, DITCH AND BERM SECTIONS
H353004-00000-221-294-0006-0001	STANDARD DRAWINGS - EARTHWORKS AND DRAINAGE DETAILS
H353004-10000-221-272-0006-0001	CRUSHER PAD - LAYOUT PLAN
H353004-41000-231-260-0002-0001	PRIMARY CRUSHER FEED RAMP - CONCRETE ARRANGEMENT AND DETAILS
H353004-19000-231-260-0001-0003	PRIMARY CRUSHER AREA - RETAINING WALL DETAILS
H353004-19000-231-260-0001-0001	PRIMARY JAW CRUSHER FOUNDATIONS - ARRANGEMENT AND DETAILS

REFERENCE DRAWINGS

PERMIT TO PRACTICE
HATCH LTD.
Signature
Date
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

REGISTERED PROFESSIONAL ENGINEER — R. A. HALIM — LICENSEE — 2019-08-03 — NWT/NU

REG. PROFESSIONAL

FOR CONSTRUCTION

No.	DESCRIPTION	BY	CHK'D	DATE
1	EDC NOTE REMOVED	JM	FH	02/08/2018
0	APPROVED FOR CONSTRUCTION	IHB	FH	13/04/2018

REVISIONS

HATCH

DRAFTSPERSON	I BARNARD	NR	01/08/2018
DESIGNER	I BARNARD	NR	01/08/2018
CHECKER	F HUGO		2018-08-03
DESIGN COORD.	R GOOSEN		2018-08-03
RESP. ENG.	R HALIM		2018-08-03
LEAD DISC. ENG.	A GROBBELAAR		2018-08-03
AREA LEAD	T ATIBA		
ENG. MANAGER	D STANGER		
AREA MANAGER	T ATIBA		2018-08-03

DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION PROJECT

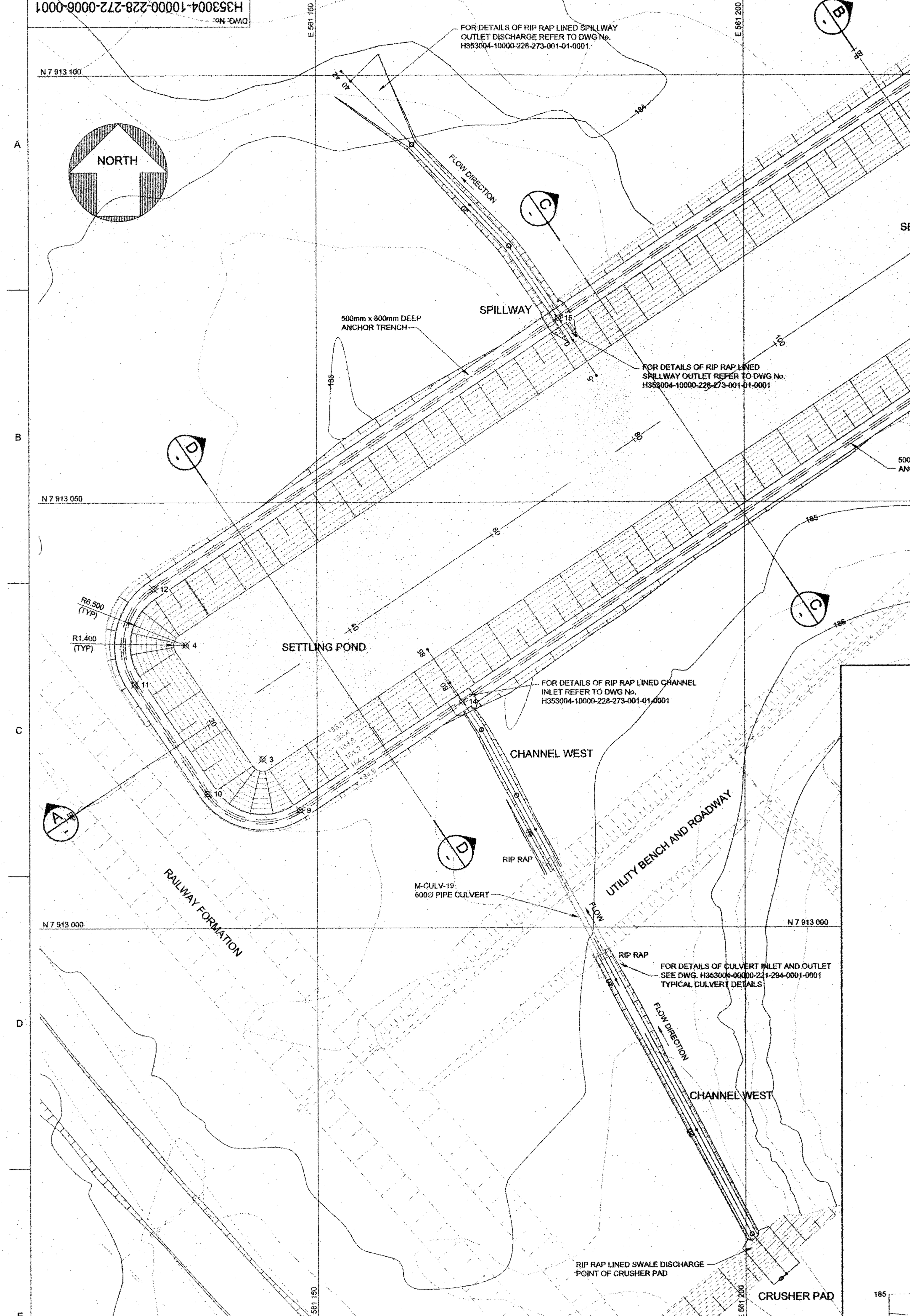
MINE SITE
CRUSHER PAD
CRUSHER RAMP & WALLS SETTING OUT

SCALE 1:500 OR AS NOTED | DWG. No. H353004-10000-221-272-0007-0001 | REV 1

SHEET SIZE: E

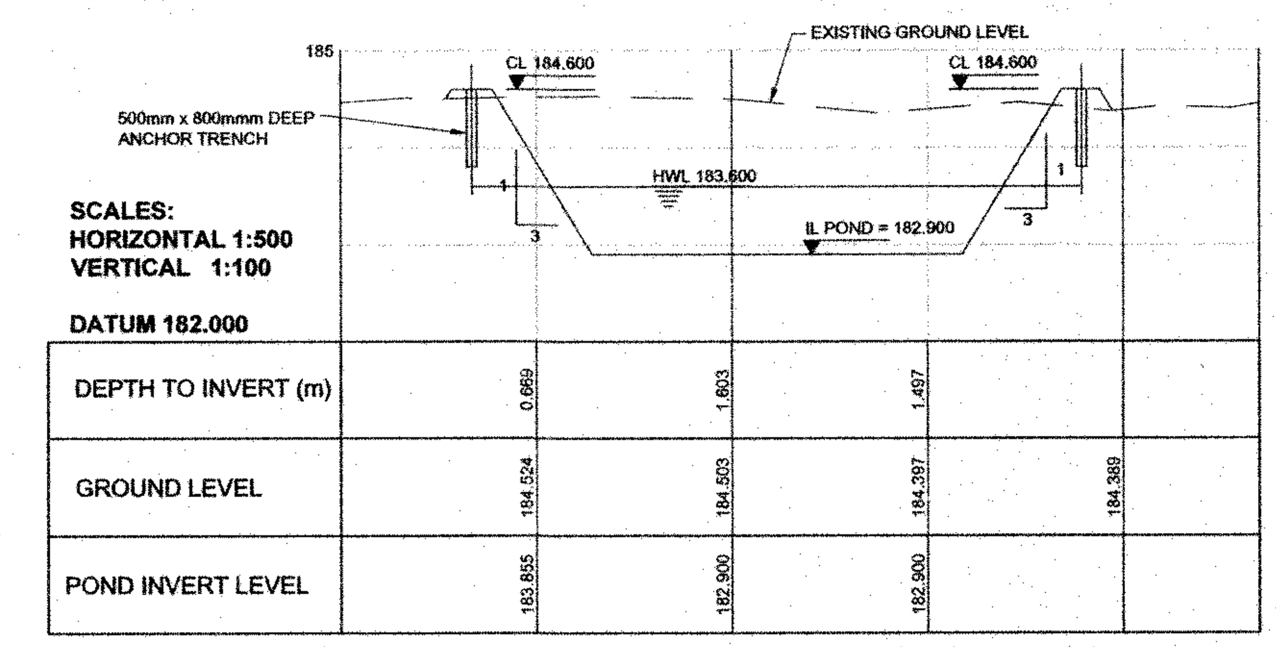
$USERNAMES
$FILES
$FILES
$TIMES

1 2 3 4 5 6 7 8

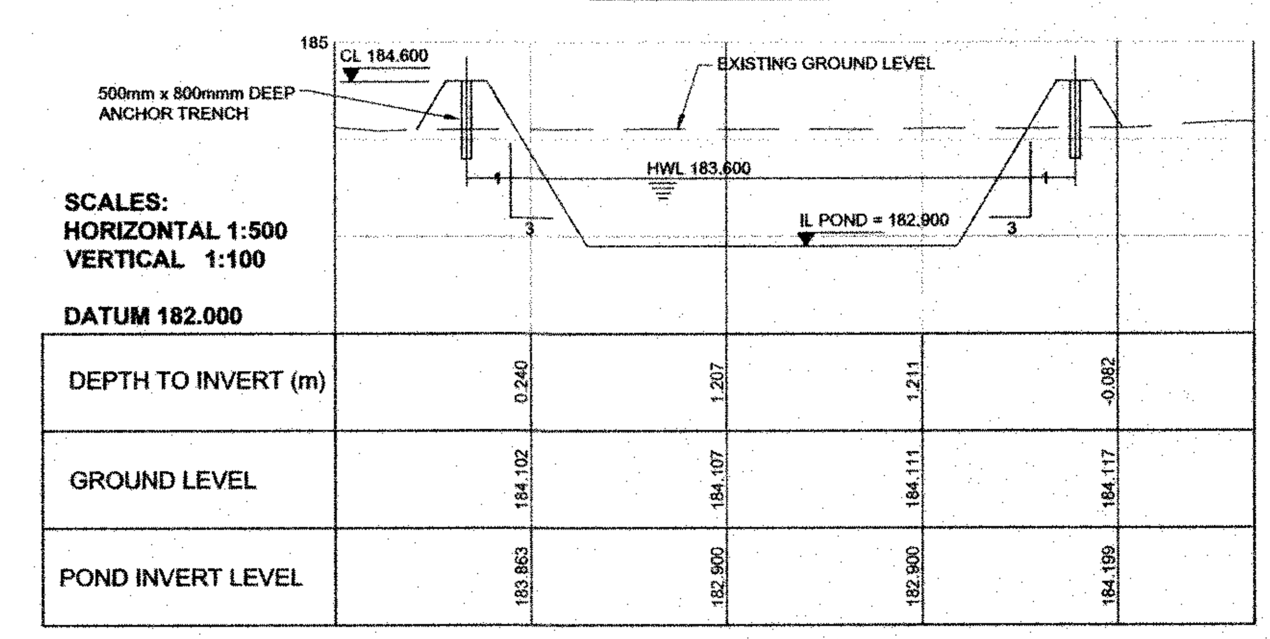


PLAN ON CRUSHER PAD SETTLING POND

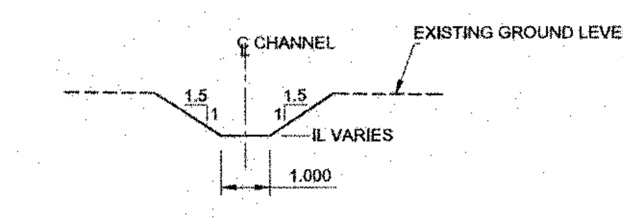
SCALE: 1:250



SECTION D - D



SECTION B - B



TYPICAL SECTION THROUGH CHANNEL WEST AND EAST

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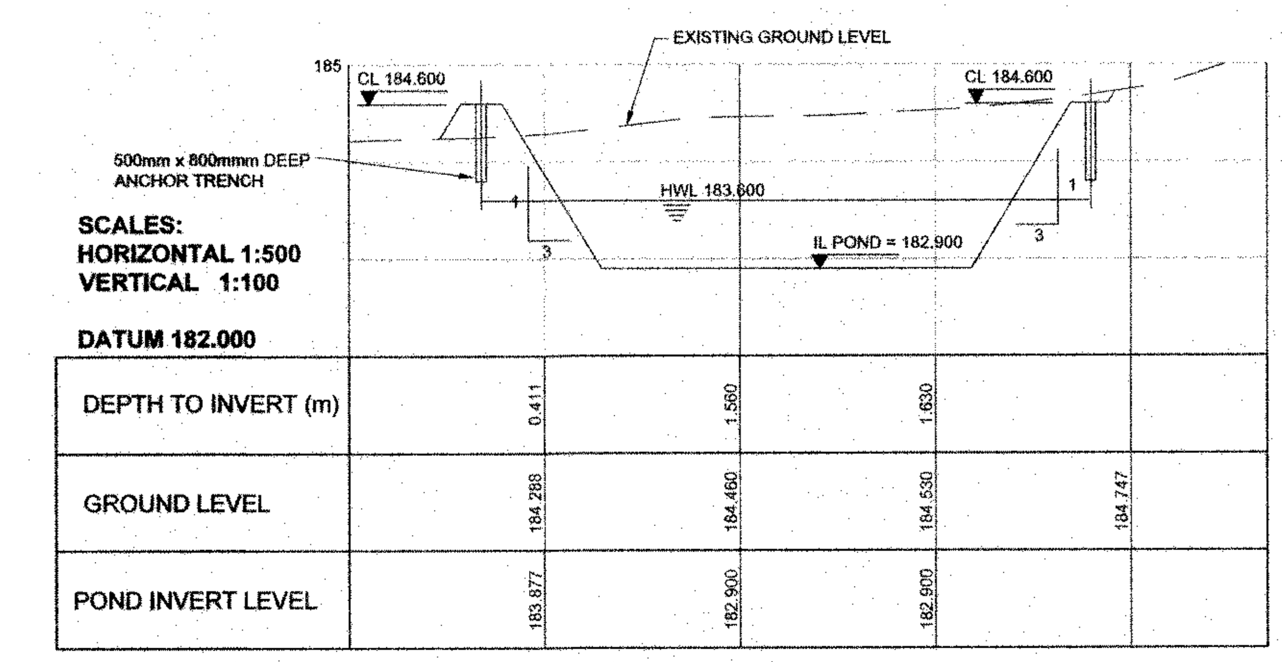
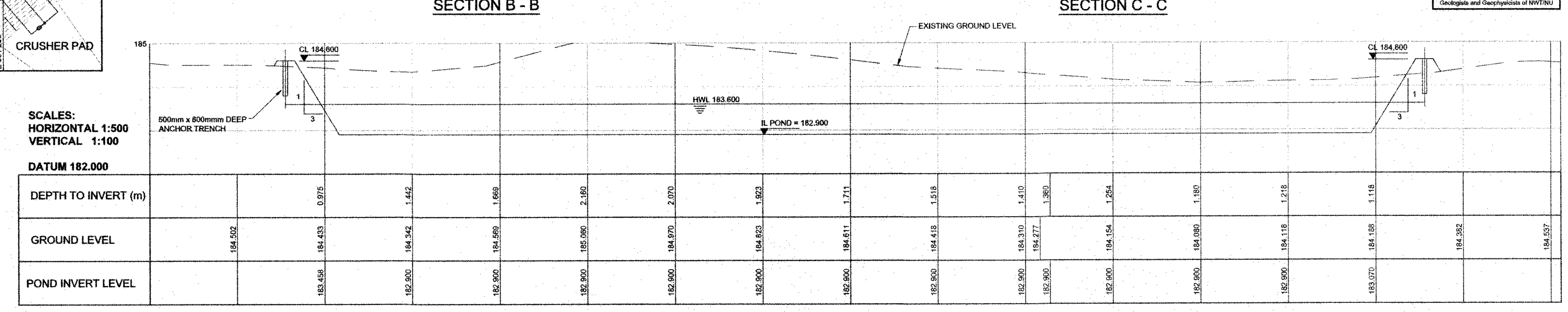


SECTION C - C



SECTION A - A

SETTLING POND SETTING OUT COORDINATES

POINT	E	N	LEVEL
1	561230.213	7913097.260	182.900
2	561239.178	7913083.871	182.900
3	561143.610	7913019.880	182.900
4	561134.636	7913033.269	182.900
5	561226.019	7913103.478	184.600
6	561236.445	7913101.432	184.600
7	561245.308	7913088.361	184.600
8	561243.330	7913077.625	184.600
9	561147.989	7913013.882	184.600
10	561137.161	7913015.850	184.600
11	561128.686	7913028.689	184.600
12	561130.894	7913039.869	184.600
13	561237.832	7913073.944	184.600
14	561167.005	7913026.623	184.600
15	561178.243	7913071.513	184.600

SETTING OUT DATA-SPILLWAY

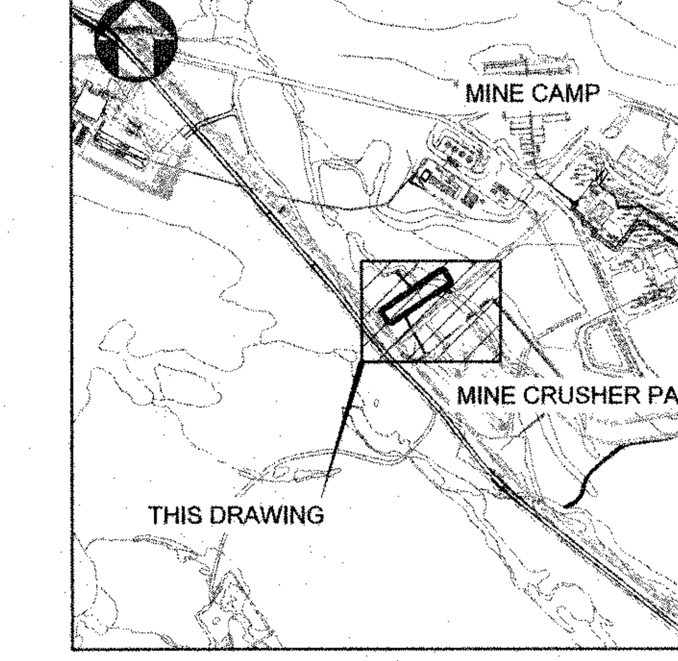
NAME	CH	E	N	DETAILS
START	-5.000	561182.769	7913064.760	L 17.081m
BCC PI ECC	12.081 14.583	561173.260 561172.562 561171.701	7913078.950 7913079.992 7913080.903	R 15.000m DA 9°33'20" TL 1.254m AL 2.502m
END	41.636	561153.009	7913100.460	L 11.818m

SETTING OUT DATA-CHANNEL WEST

NAME	CH	E	N	DETAILS
START	0.000	561204.752	7912959.261	L 6.177m
END	84.720	561162.912	7913032.733	L 11.353m

SETTING OUT DATA-CHANNEL EAST

NAME	CH	E	N	DETAILS
START	0.000	561257.379	7913058.273	L 20.012m
BCC PI ECC	20.012 22.707	561241.104 561239.997 561239.238	7913069.919 7913070.712 7913071.844	R 7.500m DA 20°35'30" TL 1.362m AL 2.695m



KEY PLAN

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016).
2. CO-ORDINATE GRID IS SHOWN IN UTM (NAD83), ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. THE CONTOUR INTERVAL IS 0.5m.
4. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
5. THE POND IS DESIGNED TO BE OPERATED EMPTY.
6. IT IS ASSUMED THAT ALL RUN OFF COLLECTED BY THE SETTLING POND IS NON-ACID GENERATING AND CAN BE DISCHARGED TO THE ENVIRONMENT ONCE THE REQUIREMENTS OF BIM ENVIRONMENTAL DESIGN CRITERIA HAS BEEN ACHIEVED. WATER TO BE DISCHARGED TO AN APPROVED POINT, IN ACCORDANCE WITH THE CLIENT'S (BIM) ENVIROMENTAL REQUIREMENTS.
7. THE INSTALLATION OF THE GEOMEMBRANE (ENVIRO LINER 6000HD) IS TO BE EXECUTED IN STRICT ACCORDANCE WITH THE VENDORS SPECIFICATIONS.

LEGEND:

CL	CREST LEVEL
IL	INVERT LEVEL
HWL	HIGH WATER LEVEL

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DRAWING No.	DRAWING TITLE
H353004-00000-221-294-0001-0001	STANDARD DRAWINGS - TYPICAL CULVERT DETAILS
H353004-10000-221-271-0001-0001	UTILITY BENCH AT CRUSHER PAD - PLAN AND PROFILE
H353004-00000-221-294-0008-0001	STANDARD DRAWINGS - TYPICAL PAD, DITCH AND BERM SECTIONS
H353004-00000-221-294-0002-0001	STANDARD DRAWINGS - EARTHWORKS AND DRAINAGE DETAILS
H353004-10000-221-272-0006-0001	CRUSHER PAD - LAYOUT PLAN
H353004-10000-228-273-0001-0001	CRUSHER PAD SETTLING POND - DETAILS

REFERENCE DRAWINGS

REGISTERED PROFESSIONAL ENGINEER — L1247 — R. A. HALIM — LICENSEE — 2018-08-03 — NWT/NU

REG. PROFESSIONAL

FOR CONSTRUCTION

No.	DESCRIPTION	BY	CHK'D	DATE
1	EDC NOTE REMOVED	JM	FH	02/08/2018
0	APPROVED FOR CONSTRUCTION	IHB	FH	01/06/2018

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	I BARNARD	NR	01/08/2018
DESIGNER	H HERBST	NR	01/08/2018
CHECKER	F HUGO		2018-08-03
DESIGN COORD.	R GOOSEN		2018-08-03
RESP. ENG.	R HALIM		2018-08-03
LEAD DISC. ENG.	A GROBBELAAR		2018-08-03
AREA LEAD	T ATIBA		
ENG. MANAGER	D STANGER		2018-08-03
AREA MANAGER	T ATIBA		2018-08-03

DRAWING APPROVAL STATUS: Approved for Construction

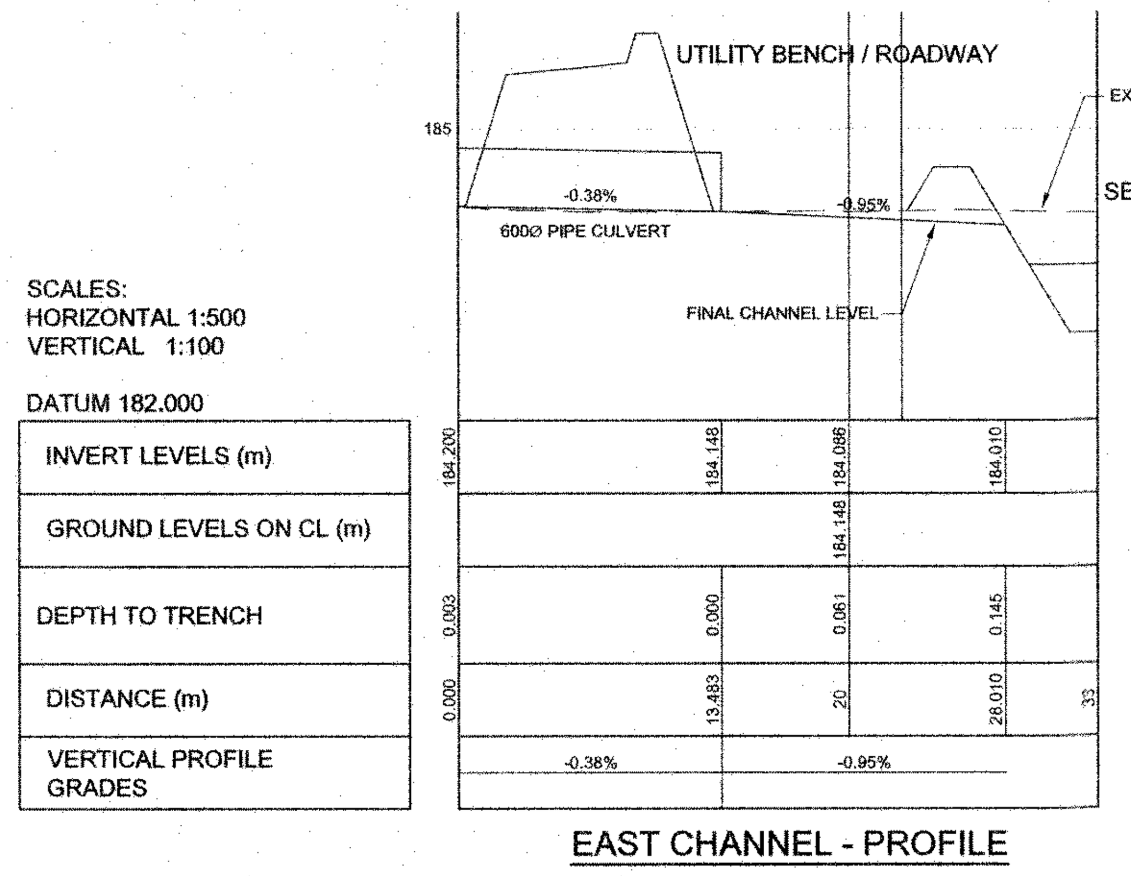
Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION PROJECT

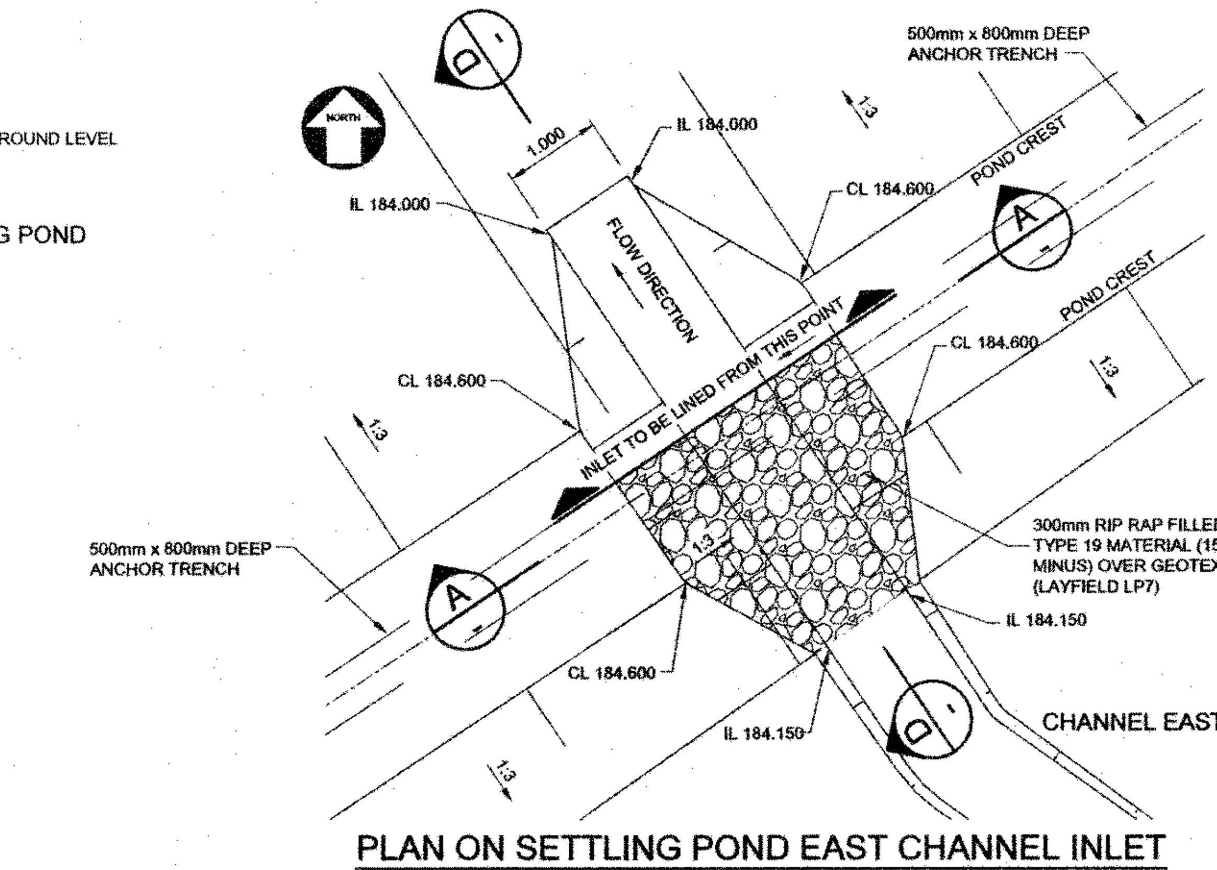
MINE SITE
CRUSHER PAD SETTLING POND
PLAN AND PROFILES

SCALE 1:250 OR AS NOTED | DWG. No. H353004-10000-228-272-0006-0001 | REV 1

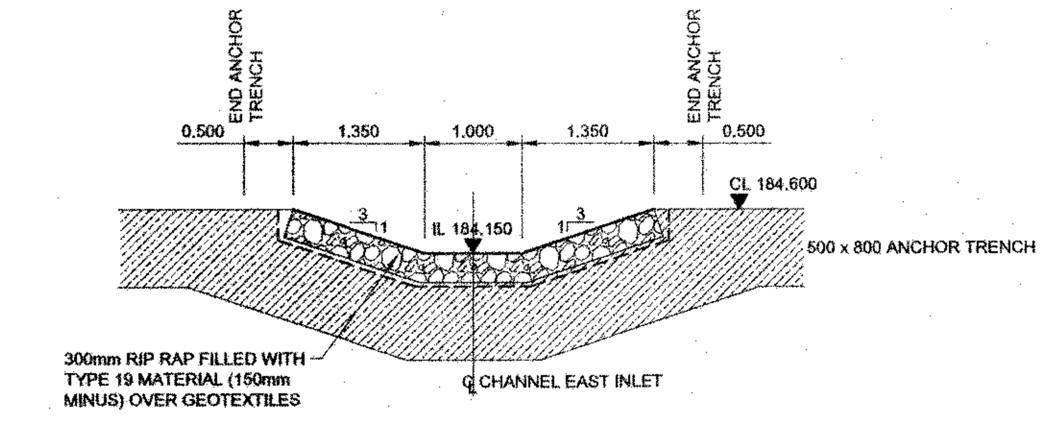
SHEET SIZE: E



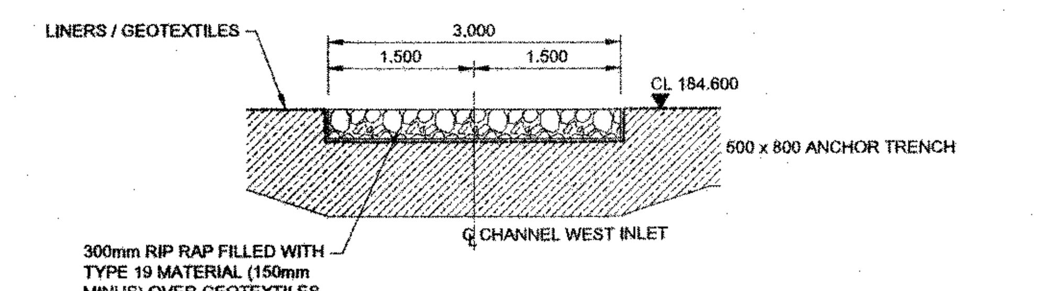
EAST CHANNEL - PROFILE



PLAN ON SETTLING POND EAST CHANNEL INLET
SCALE 1:50



SECTION A - A
SCALE 1:50



SECTION B - B
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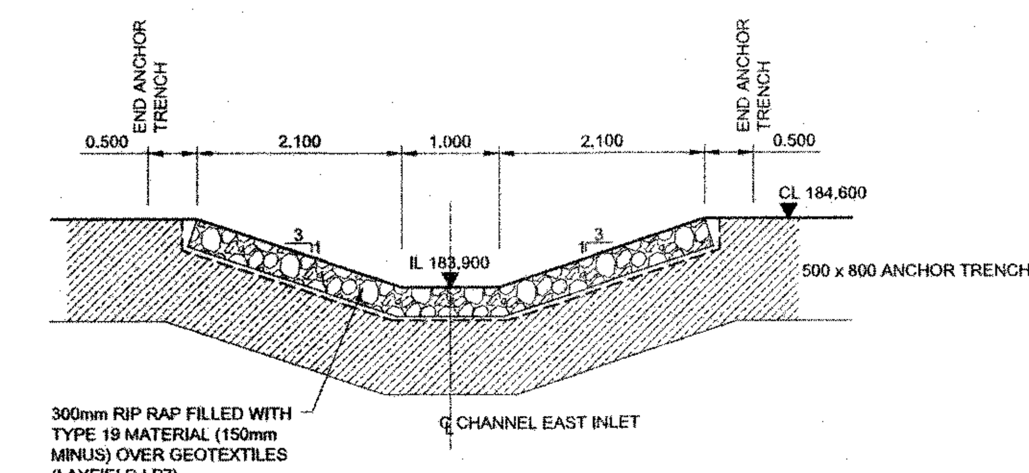

SECTION C - C
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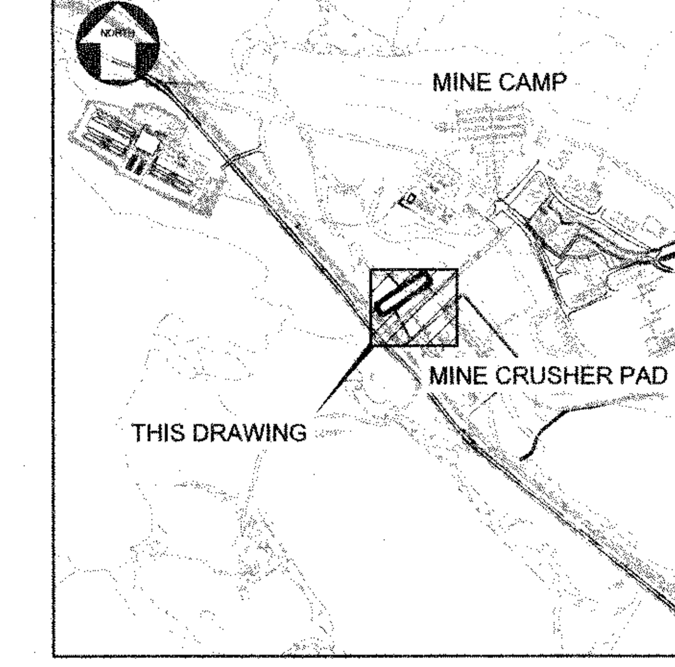

KEY PLAN

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016).
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3. CONTOURS ARE IN METERS. THE CONTOUR INTERVAL IS 0.5m.
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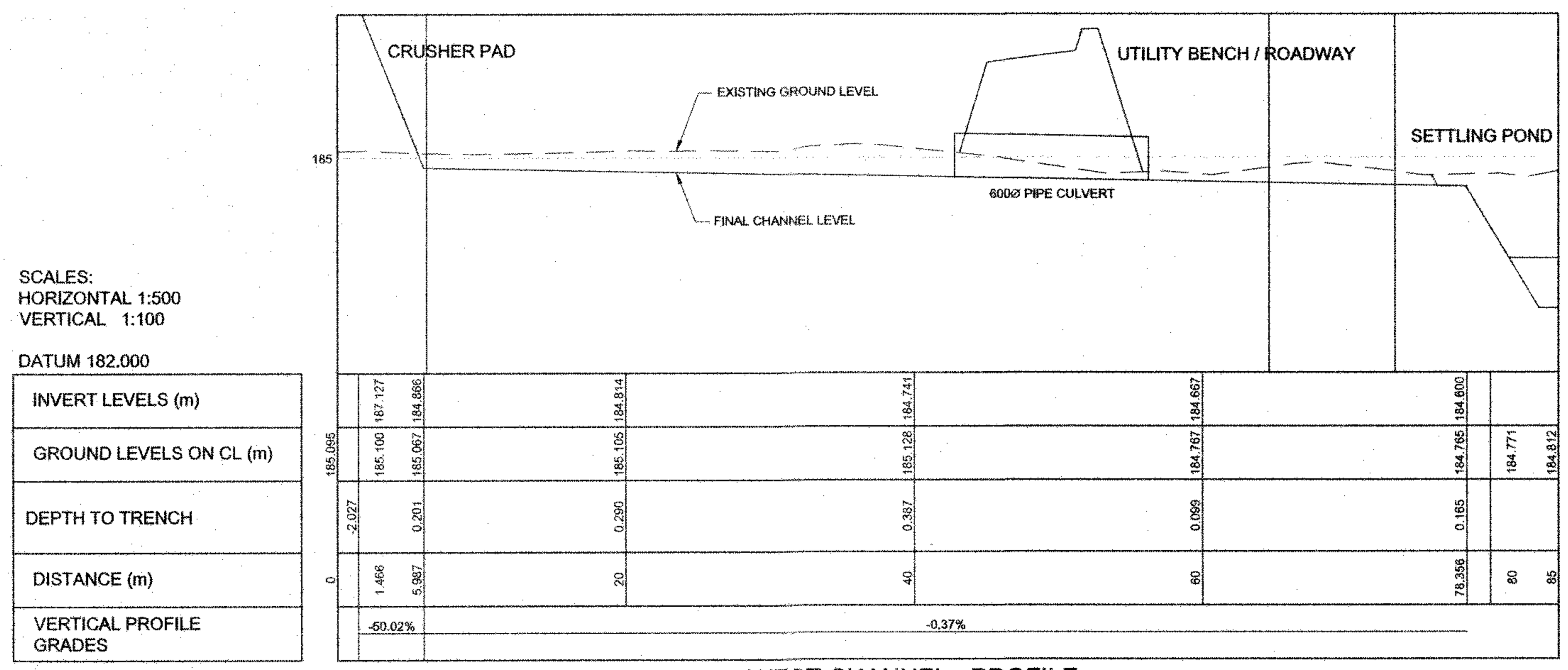
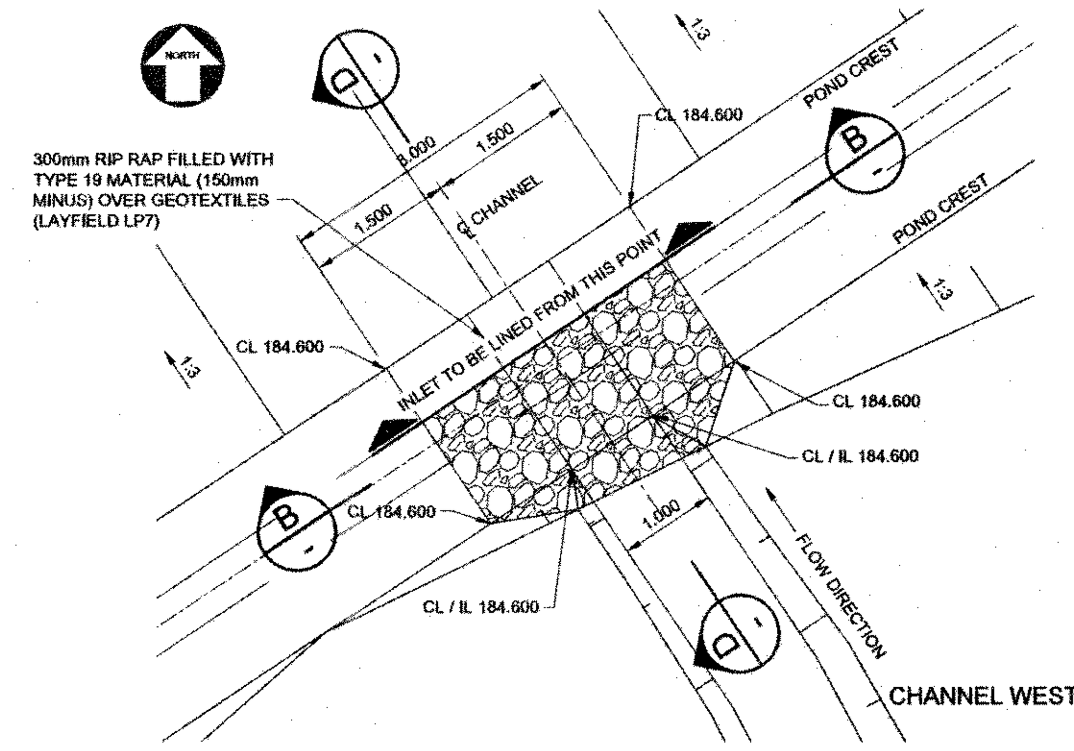
7. THE INSTALLATION OF THE GEOMEMBRANE (ENVIRO LINER 6000HD) IS TO BE IN STRICT ACCORDANCE WITH THE SPECIALIST PROVIDERS SPECIFICATIONS.

LEGEND:

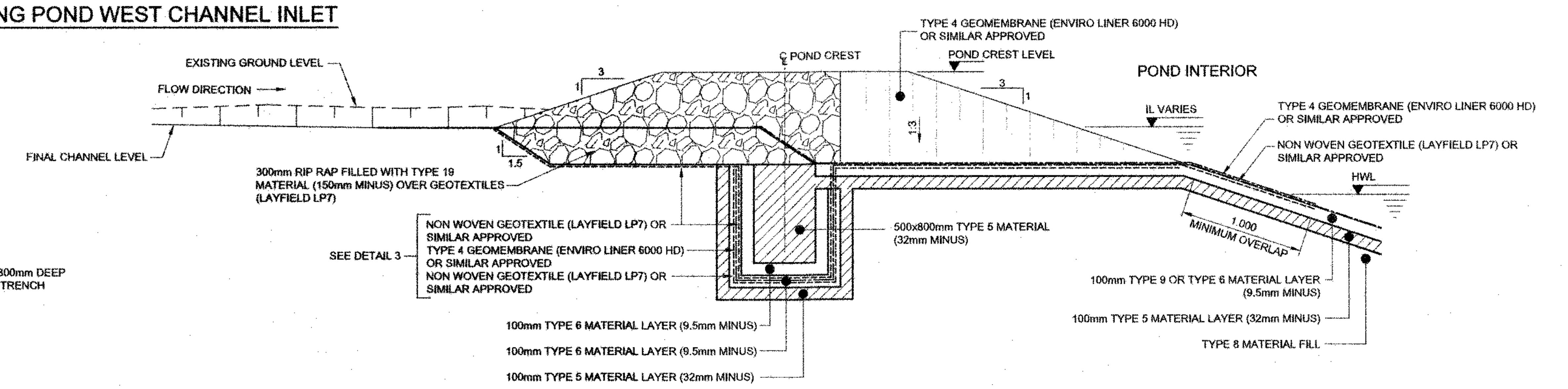
- CL — CREST LEVEL
- IL — INVERT LEVEL
- HWL — HIGH WATER LEVEL
- FBL — FREE BOARD LEVEL
- ——— - —— TYPE 4 GEO-MEMBRANE (ENVIRO LINER 6000 HD) OR SIMILAR APPROVED
- — — — — NON WOVEN GEO-TEXTILE (LAYFIELD LP7) OR SIMILAR APPROVED



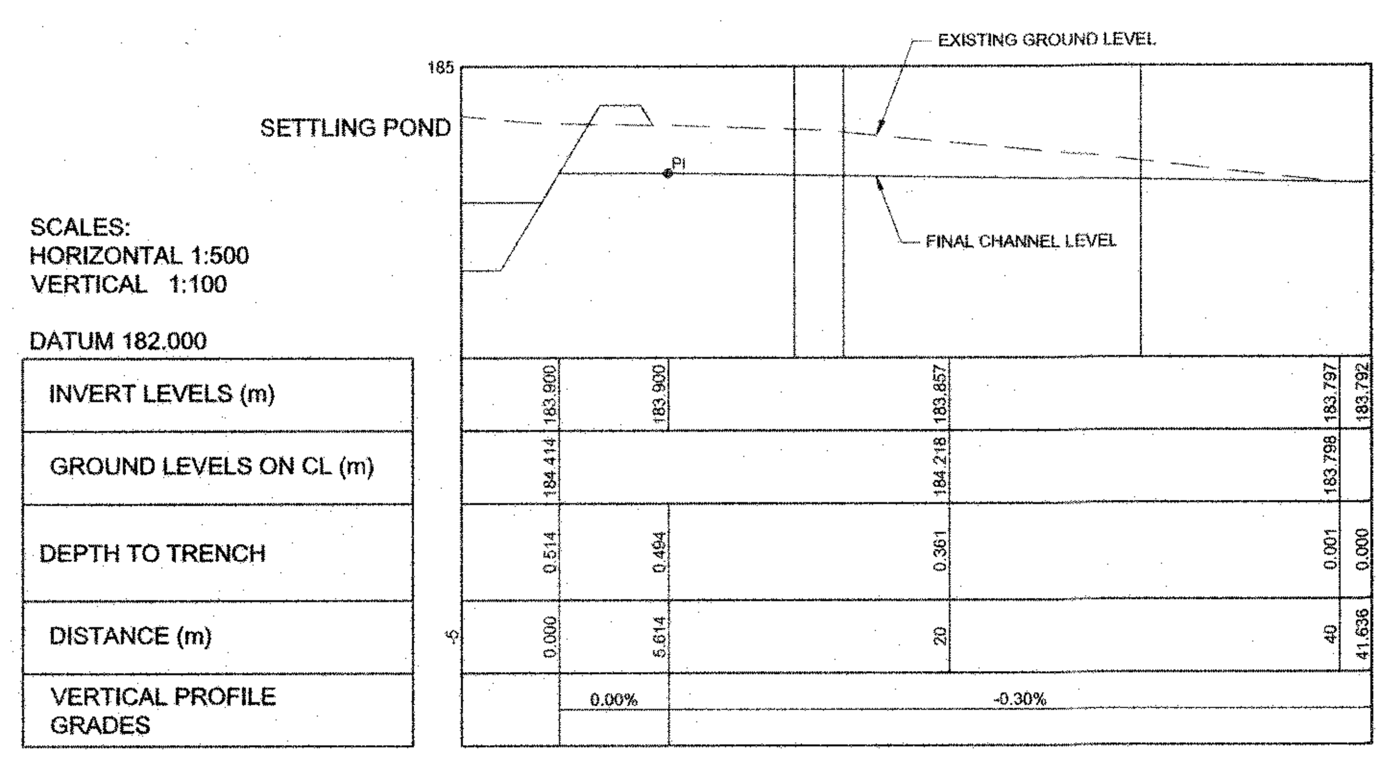
WEST CHANNEL - PROFILE



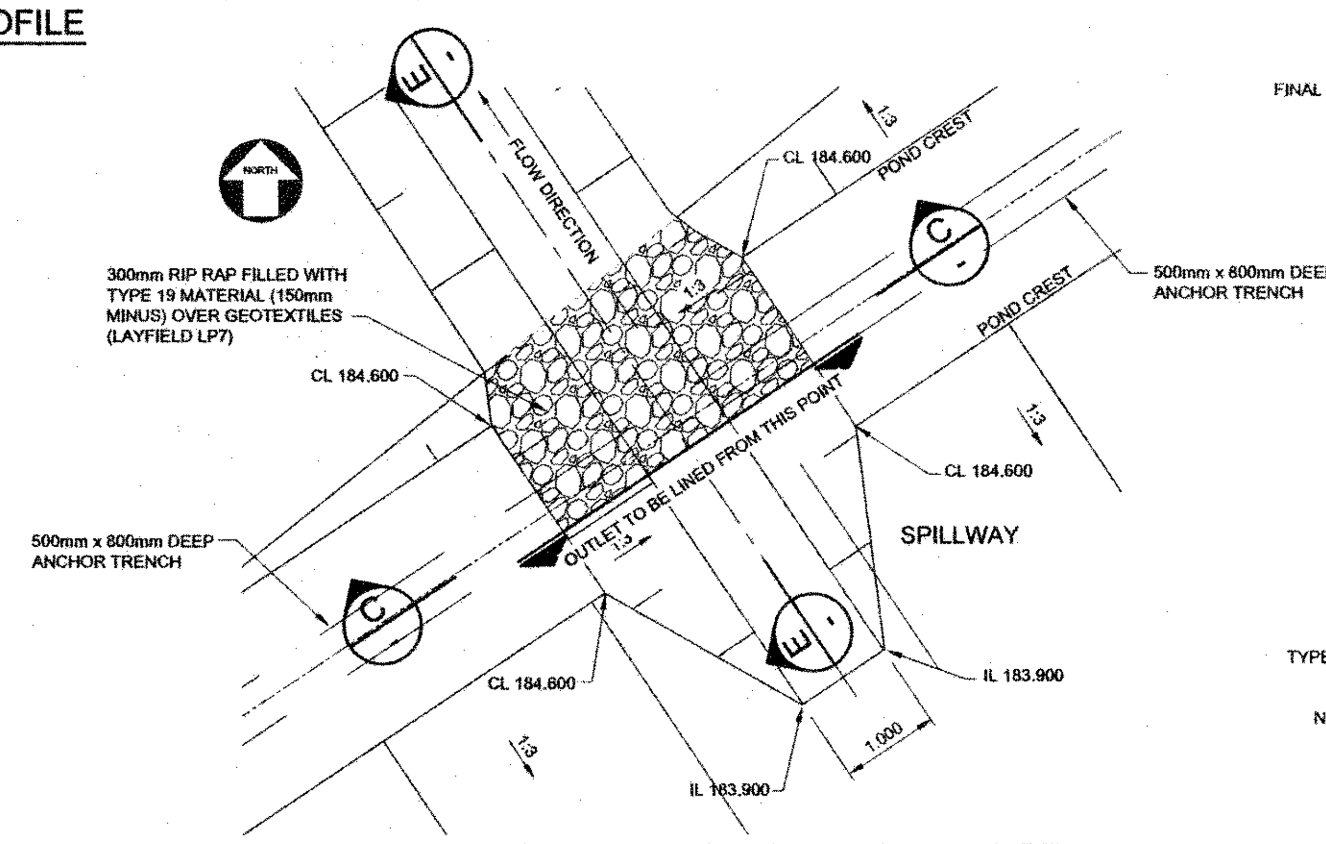
PLAN ON SETTLING POND WEST CHANNEL INLET
SCALE 1:50



SECTION D - D
SCALE 1:25



SPILLWAY OUTLET - PROFILE



PLAN ON SETTLING POND SPILLWAY OUTLET
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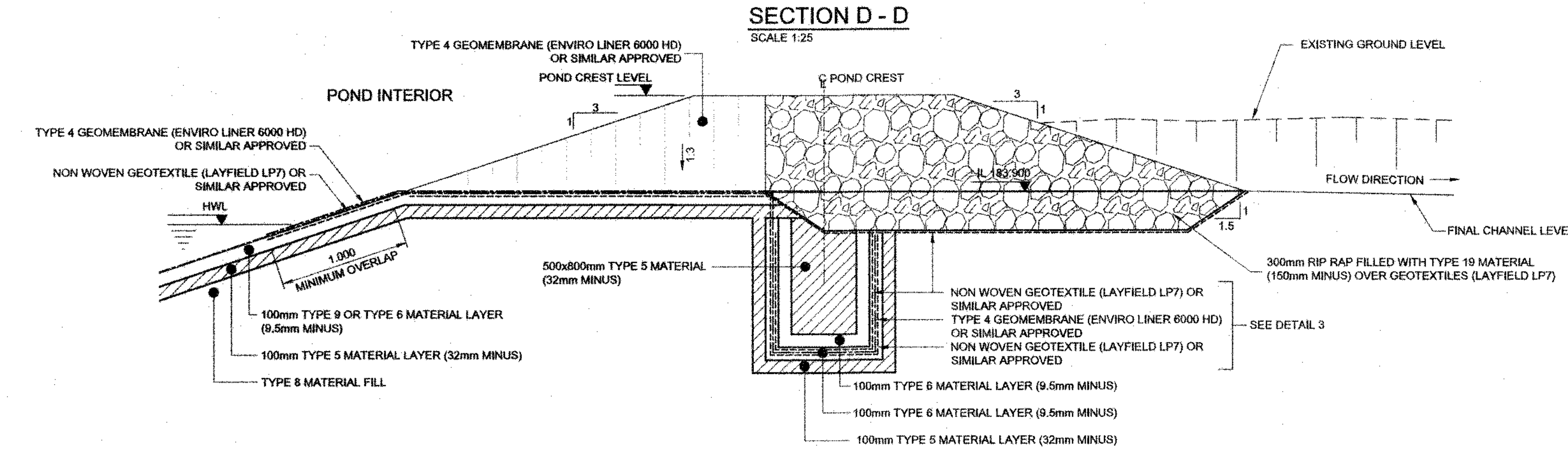
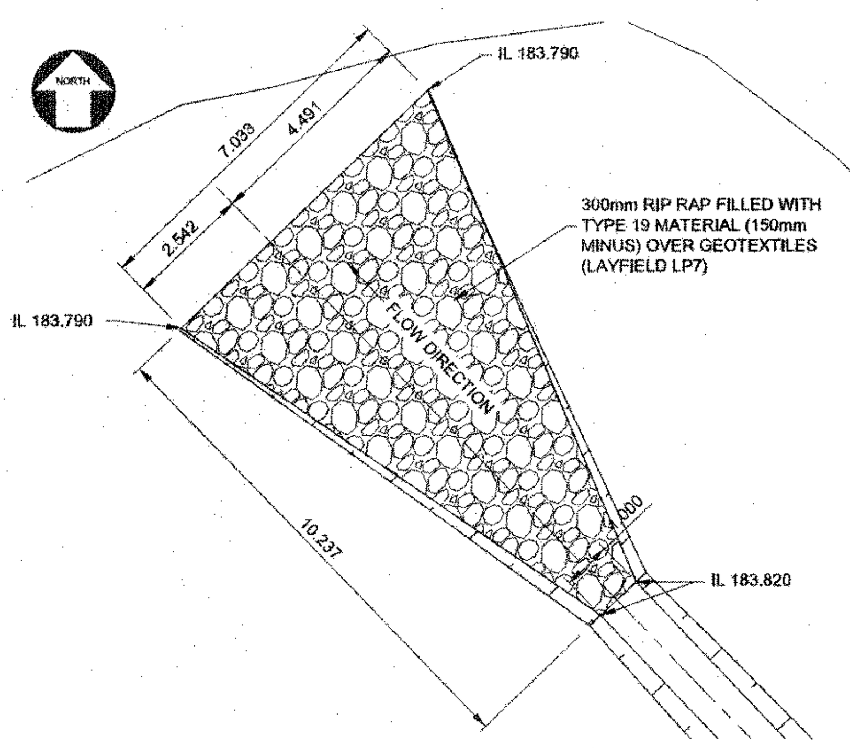
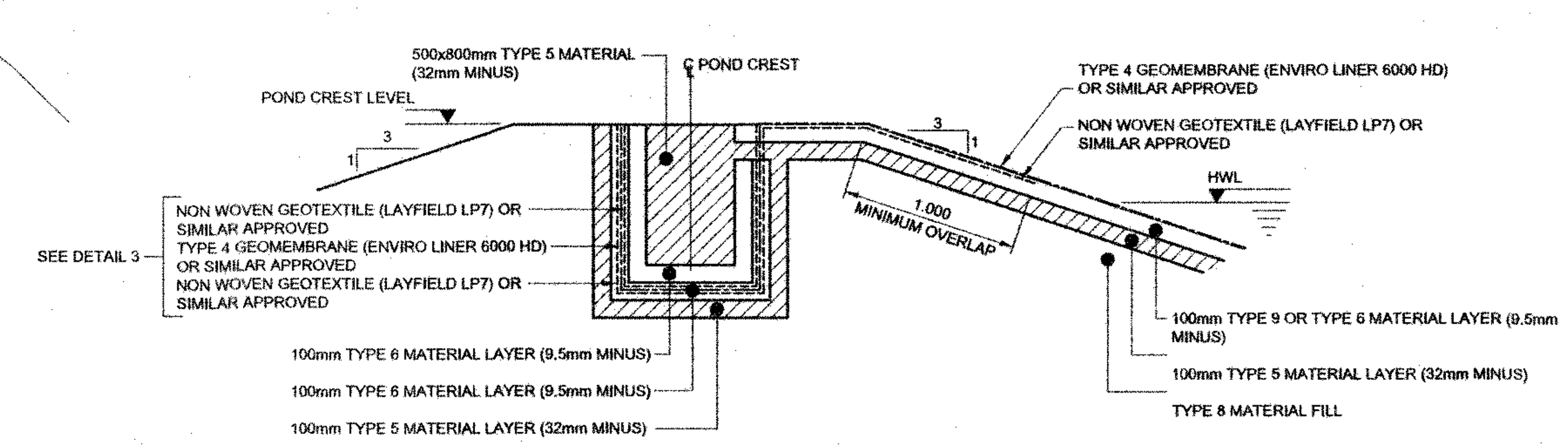


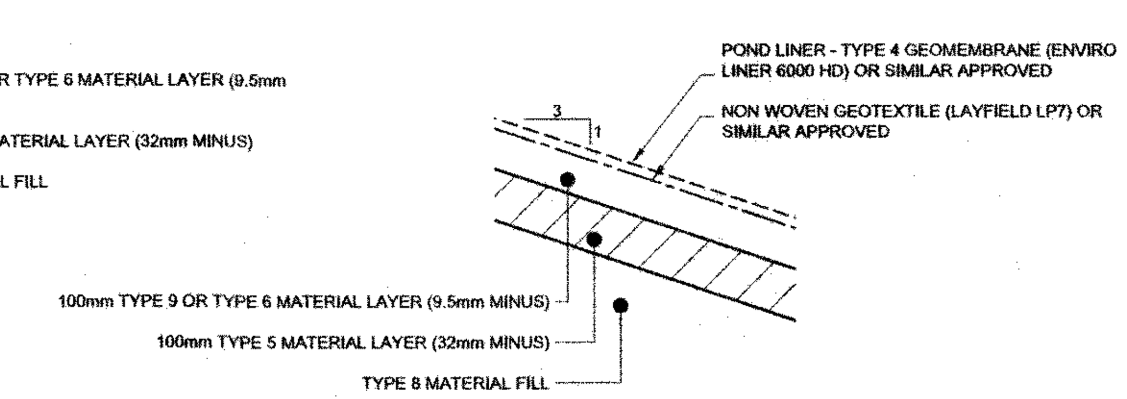
SECTION E - E
SCALE 1:25



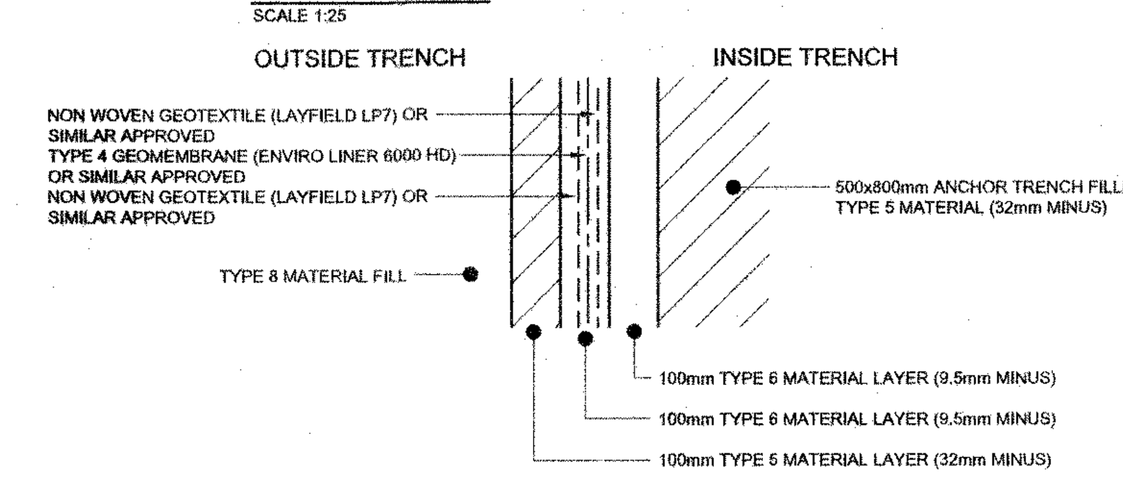
PLAN ON SPILLWAY OUTLET DISCHARGE
SCALE 1:100



DETAIL 1 - POND LINER ANCHOR TRENCH
SCALE 1:25



DETAIL 2 - POND LINER
SCALE 1:10



DETAIL 3 - TRENCH LINER
SCALE 1:10

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DRAWING No.	DRAWING TITLE
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H353004-10000-228-272-0006-0001	CRUSHER PAD SETTLING POND - PLAN AND PROFILES
H353004-10000-221-272-0006-0001	CRUSHER PAD - LAYOUT PLAN

REFERENCE DRAWINGS

FOR CONSTRUCTION

No.	DESCRIPTION	BY	CHK'D	DATE
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0	APPROVED FOR CONSTRUCTION	IHB	FH	01/06/2018

REVISIONS

REG. PROFESSIONAL — R.A. HALIM LICENSEE NWT/NU

HATCH

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DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

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MINE SITE
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DETAILS

SCALE 1:500 OR AS NOTED | DWG. No. H353004-10000-228-273-0001-0001 | REV 1

SHEET SIZE: E