Appendix 26.
Tailings Storage Facility Scoping Study

Tailings Storage Facility Scoping Study

Fountain Head Gold Project, Northern Territory

PNX Metals Ltd

Rev C
24 May 2021

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Report

Title:	Tailings Storage Facility (TSF) Scoping Study
File:	P19-05-PR-04
Author(s):	Mitch Hanger; Joshua Blake
Client:	PNX Metals Ltd
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Synopsis:	This document presents the Scoping Study design of the Tailings Storage Facility at the Fountain Head Gold Project

Revision

Date	Revision	Purpose	Author
21 MAY 2021	REV A	ISSUE FOR REVIEW AND COMMENT	MH; JB
22 MAY 2021	REV B	ISSUE FOR REVIEW AND COMMENT	MH; JB
24 MAY 2021	REV C	ISSUE FOR REVIEW AND COMMENT	MH; JB
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21 MAY 2021	REV A	MH	PNX METALS LTD	1. PDF
22 MAY 2021	REV B	MH	PNX METALS LTD	1. PDF
24 MAY 2021	REV C	MH	PNX METALS LTD	1. PDF
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Appendix A: Preliminary Design Drawing

Terminology and Abbreviations

The following terminology and abbreviations have been used in this document:

AEP	Annual exceedance probability
ANCOLD	Australian National Committee on Large Dams
BOM	Bureau of Meteorology
DITT	Department of Industry, Tourism and Trade (NT)
DMIRS	Department of Mines, Industry Regulation and Safety (WA)
DR	Design Report
DWERS	Department of Water and Environmental Regulation (WA)
GPS	Global Positioning System
GSI	Geotechnical Site Investigation
LOM	Life of mine
IFD	Intensity frequency duration
IPTSF	In-Pit Tailings Storage Facility
IWL	Integrated Waste Landform
m/a	Metres per annum
m^3/d	Cubic meters per day
Mm^3	Million cubic meters
Mt	Million tonnes
Mt/a	Million tons per annum
NAF	Non-acid forming
OM	Operating Manual
PAF	Potentially Acid Forming
RL	Reduced level
t/a	Tonnes per annum
t/d	Tonnes per day
t/m^3	Tonnes per cubic metre
SMDD	Standard maximum dry density
TSF	Tailings Storage Facility
TSM	Tailings storage management

1. TSF Proposal Summary

Resource Engineering Consultants Pty Ltd (REC) has been engaged to prepare this Engineering Feasibility Study (EFS) level design of the Tailings Storage Facility (TSF) at the PNX Metals Ltd (PNX) Fountain Head Gold Project (Project) to support the overall project Feasibility Study into the technical and commercial viability of the Project.

1.1 Scope of Works

The EFS scope of works is based on the proposal and comprises:

- Feasibility Study level Embankment Design;
- Sizing based on data provided by PNX and others;
- Preparation of an EFS Design Report; and
- Preparation of EFS Drawings (preliminary design drawings).

1.2 Guidelines and Information Supplied

The following information has been provided by PNX for reference:

- PNX CAD files, detailing the project site ground surface topographic contours, planned alignment and tenement boundaries;
- PNX presentation slides illustrating the proposed IWL concept, and tailings and waste storage requirements;
- Geochemical Characterisation of Fountain Head CIL Tailings, by Environmental Geochemistry International, dated 16 March 2021;
- Prefeasibility Study - Hayes Creek Project, Tailings Storage Facility, IPTSF Concept Hayes Creek Project, by Land & Marine Geological Services Pty Ltd, dated 2 June 2017;

The following publicly available information has also been referenced:

- Bureau of Meteorology (BoM) website (http://www.bom.gov.au/jsp/ncc/climate_averages/evaporation/index.jsp?period=an#maps).

2. TSF Design Criteria

2.1 Introduction

REC was engaged by PNX to prepare the design of the IWL for the Project. As part of the EFS level design of the IWL, the PNX mine production schedule has been used to volumetrically stage the design the facility.

2.2 Production Parameters

The IWL design for the project is based on a 4-year operational life. The Project ore processing route is CIL and tailings will be filter pressed to form a tailings paste with a moisture content of approximately 10 – 15 % before being transported to the IWL for dry stacking via heavy earthmoving machinery. The project waste and tailings production schedule are presented in Table 1.

Table 1: Production Schedule

Material	Year 0	Year 1	Year 2	Year 3	Year 4	Total
Waste (Mt)	0	5.39	6.05	5.43	0.88	17.75
Cumulative Waste (Mt)	0	5.39	11.44	16.87	17.75	-
Tailings (Mt)	0	0.68	0.73	0.75	0.56	2.72
Cumulative Tailings (Mt)	0	0.68	1.42	2.17	2.72	-

2.3 Storage Capacity

At an assumed average dry density of 2.1 t/m^3 for the IWL tailings following completion of the filter pressing process route, the IWL provides 1.37 Mm^3 of storage capacity for 2.87 Mt of tailings across 4 operational stages. This exceeds the required 1.30 Mm^3 of tailings storage capacity for 2.72 Mt over 4 years. The IWL design stage capacities are presented in Table 2.

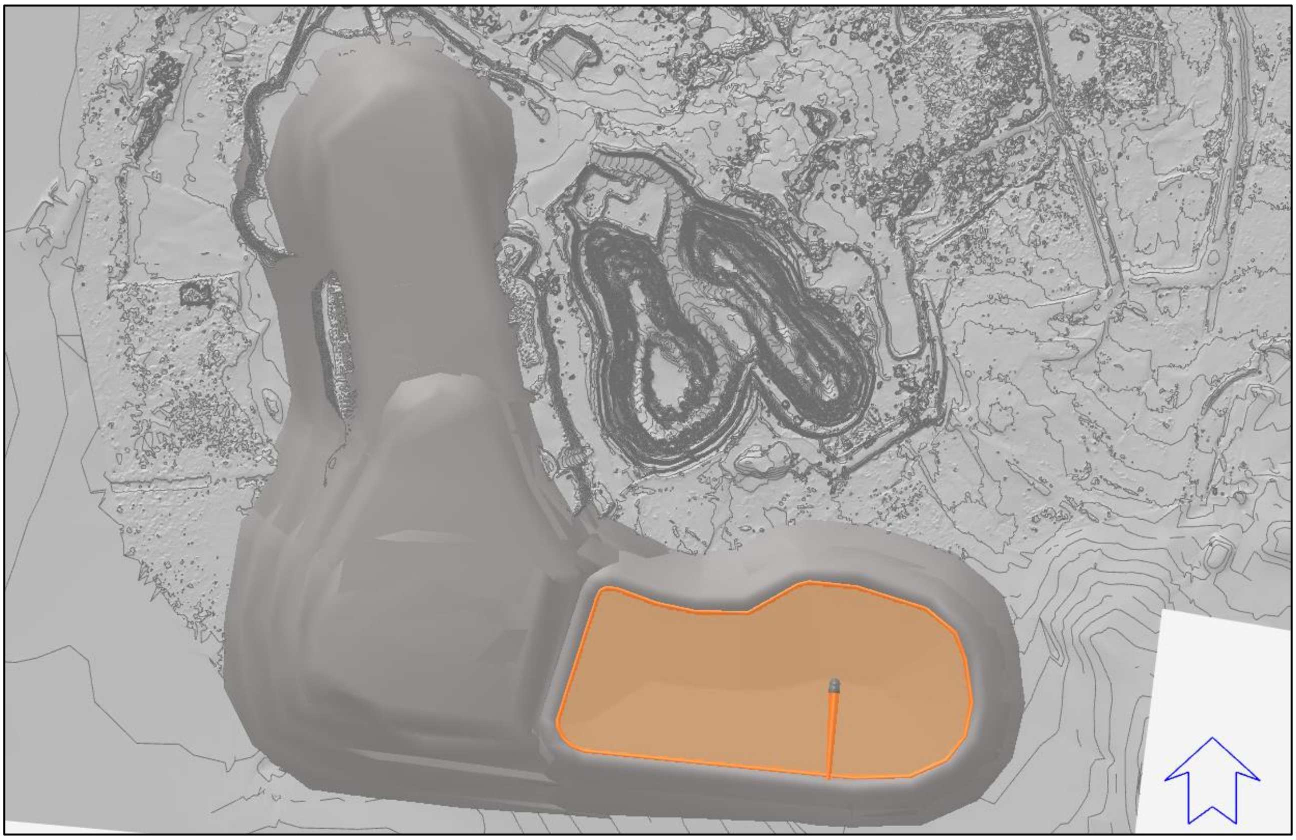
Table 2: Design Capacities

Material	Stage 1	Stage 2	Stage 3	Stage 4	Total
Embankment Crest Height (m)	113.5	118.0	122.0	125.0	22.5
Assumed Dry Density (t/m^3)	2.1	2.1	2.1	2.1	
Storage Capacity (Mt)	0.69	0.77	0.76	0.65	2.87
Cumulative Tailings (Mt)	0.69	1.46	2.22	2.87	-
Tailings Storage Capacity (Mm^3)	0.33	0.37	0.36	0.31	1.37
Tailings Cumulative Capacity (Mm^3)	0.33	0.70	1.06	1.37	-
Storage Life (years)	1.0	1.0	1.0	1.0	4.0
Life (Years)	1.0	2.0	3.0	4.0	-
Constructed Tailings Beach Slope (%)	2.75	2.50	2.50	2.25	-
Maximum Waste Crest Height (m)	118.0	125.0	135.0	135.0	40.0
Waste Capacity (Mt)	6.25	6.07	5.48	0.96	18.75
Cumulative Waste Capacity (Mt)	6.25	12.32	17.79	18.75	-
Waste Capacity (Mm^3)	2.30	2.25	2.03	0.36	6.94
Cumulative Waste Capacity (Mm^3)	2.30	4.56	6.59	6.94	-

2.4 Tenure and Site Conditions

The Project is situated approximately 170 km by road south east of the city of Darwin and can be accessed from Stuart Highway. The proposed Year 4 IWL configuration is shown in plan on Figure 1.

Figure 1: IWL Layout



2.5 Climate and Design Rainfall

Data from the Bureau of Meteorology (BoM) weather station nearest to the site has been used to evaluate the climate of the project area. Presented in Table 3 are the long-term temperature (1968-2020) for Douglas River (BoM Site 014901) and rainfall data (1957-2020) for Hayes Creek (BoM Site 014073), located approximately 53 km south east and 14 km south east of the site respectively. Evaporation data for the site was interpreted from the BoM Evaporation maps and are noted to be 'Class A evaporation pan' values.

Table 3: Climate Data – Fountain Head Gold Project Area

Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mean Max. Temp.*	°C	33.7	33.5	34.0	34.7	33.3	31.4	31.9	33.6	36.8	37.9	36.9	35.1	-
Mean Min. Temp.*	°C	23.9	23.7	23.2	20.5	16.7	13.7	12.9	14.0	18.5	22.3	23.6	23.8	-
Mean Rainfall**	mm	290.6	254.4	191.3	65.1	8.2	0.5	1.8	0.9	6.7	39.8	114.6	196.6	1176.2
Highest Rainfall**	mm	676.6	543.0	587.5	486.2	112.2	9.0	34.4	20.0	40.6	262.4	248.2	517.5	1737.1
Evap. BoM Interp.***	mm	150	125	150	150	175	162.5	175	200	200	200	250	175	2000
* 1968-2020 (BoM Site 014901); ** 1957-2020 (BoM Site 014073); *** BOM 1975-2005														

Design rainfall depths (mm) for the project site obtained from the BoM 2016 Rainfall IFD (Intensity Frequency Duration) Data System are shown on Table 4. The design storm storage requirement under DMP (2015) and ANCOLD (2012) guidelines is for a 1:100 year 72-hour duration rainfall event (highlighted) in Table 4. The DMP and ANCOLD design storm storage requirements are discussed further in Section 3.2 & 3.3 respectively.

Table 4: Rare Design Rainfall Depths

	Annual Exceedance Probability (1 in x)				
Event Duration	1 in 100	1 in 200	1 in 500	1 in 1000	1 in 2000
24-hour	287	332	395	447	505
48-hour	382	435	513	577	646
72-hour	439	495	576	641	710
96-hour	475	531	612	676	742
120-hour	495	552	632	694	759
144-hour	504	563	641	702	768
168-hour	507	567	644	703	771

2.6 Geology

The Fountain Head group tenements is located within the Pine Creek Geosyncline formation, which is a tightly folded sequence of fine to coarse grained clastic basinal sediments of Lower Proterozoic age. Over time the sequence has transformed through metamorphic processes into greenschist facies, with an intrusion of late syn-orogenic to post orogenic granitoids. A range of economic minerals are now hosted across structurally permissive sites due to these intrusions and their resulting thermal contact metamorphic and metasomatic effects.

Fountain Head is located within units of the Mount Bonnie Formation, which is the uppermost division of the South Alligator Group. Alternative lithologies of siltstone, mudstone and greywacke comprise this group, which have been metamorphosed into greenschist facies.

2.7 Tailings

2.7.1 Geochemical Testing

Preliminary geochemical test results indicate that total Sulphur is not expected to exceed 1.37 % (average of 0.52 % across 5 samples). The tailings samples acid forming results indicate that the tailings have acid forming potentials ranging from acid consuming to acid forming. Leaching characteristics of the fresh tailings, even in the absence of oxidation, were indicated to potentially produce leachates containing elevated arsenic concentrations on contact with water.

Given that some tailings are Potentially Acid Forming (PAF) and elevated arsenic concentrations are expected in leachate, it is proposed that seepage is controlled by means of a basal liner and underdrainage system. The basal liner is proposed to comprise borrow material won local to or within the footprint of the IWL. The maximum permeability of the compacted basal liner is expected to be 5.0 E^{-9} m/s. On this basis, seepage control by means of a basal liner and underdrainage system is deemed adequate for the overall environmental control for the IWL and the EFS level design.

2.7.2 Implications for Tailings Management

In the absence of low permeability oxide tailings with which to line the base of the IWL during commissioning and early operation, the base (floor) of the IWL will need to include a low permeability basal liner to reduce seepage.

The installation of an underdrainage system within the IWL is likely to assist in the consolidation of the placed and compacted tailings and will allow excess water to be removed from the facility. It is envisaged that excess water removed from the IWL through the underdrainage system will be routed to sumps located to the north of the facility. Underdrainage water collected in these sumps will be pumped back to the Plant or Evaporation Pond.

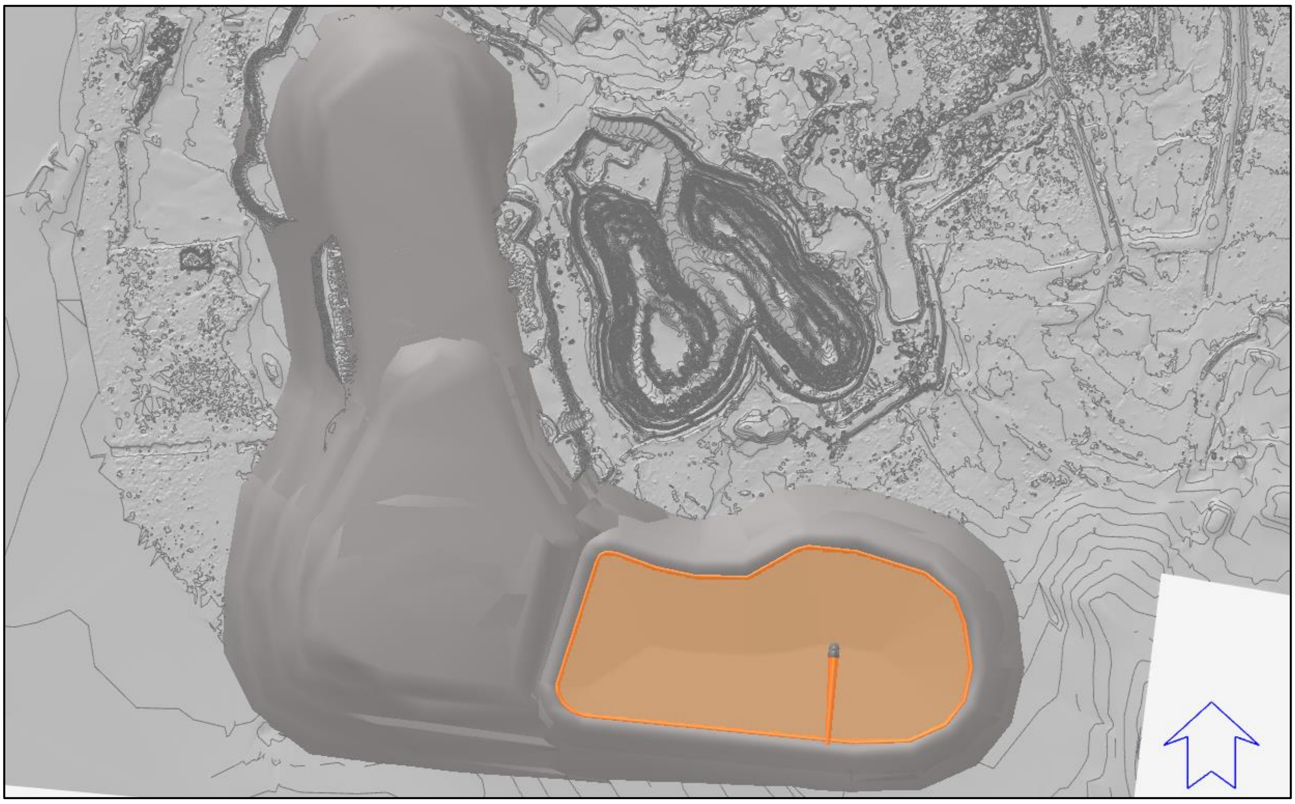
3. TSF Design

3.1 General

The objectives of the design of the IWL is to optimise tailings storage capacity, maximise tailings density, remove water from the facility, reduce seepage and minimising the environmental and societal impact. The IWL is proposed to be constructed using downstream construction methodology. The downstream embankments are proposed to be placed and traffic compacted progressively using mine waste produced as part of mining operations. The upstream face of the embankments is proposed to be constructed using low permeability materials sourced from nearby areas. The floor of the IWL is proposed to be lined with a compacted clay basal liner. The remainder of the mine waste produced as part of mining operations is proposed to form an adjacent Waste Dump.

The proposed Stage 4 IWL configuration relative to the site is shown in Figure 2. The design drawings are included in Appendix J.

Figure 2: IWL General Arrangement (Plan)



The conceptual design for the IWL utilises the details discussed in Sections 4 and 5 and the guiding principles in the following documents:

- Government of Western Australia Department of Mines and Petroleum (DMP): "*Guide to Departmental requirements for the management and closure of tailings storage facilities (TSFs)"*, 2015a;
- Government of Western Australia Department of Mines and Petroleum (DMP) Code of Practice (CoP): *"Tailings Storage Facilities in Western Australia"*, 2013;
- Australian National Committee on Large Dams (ANCOLD): "*Guidelines on the Consequence Categories for Dams*", 2012; and
- Australian National Committee on Large Dams (ANCOLD): "*Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure*", 2019.

3.2 DMIRS Classification

In the absence of guidelines on TSF design and operation by the Northern Territories Department of Industry, Tourism and Trade (DITT), the Western Australian DMP CoP in addition to ANCOLD guidelines have been used to classify the facility.

3.2.1 Hazard Rating and Category

The IWL has been assessed in accordance with the DMP CoP (DMP 2013, Table 1), as being assigned a 'Medium' hazard rating, as demonstrated in Table 5. In accordance with the DMP Code of Practice (DMP 2013, Table 2), the proposed IWL is classified as a "Category 1" facility as the IWL has a hazard rating of 'Medium' and the embankment will be greater than 15 m in height, as demonstrated in Table 6.

Table 5: DMP CoP Hazard Rating System

Type of Impact or Damage	Hazard Rating	Extent or Severity of Impact or Damage
Loss of human life or personal injury	Medium	For the proposed location of the IWL the potential population at risk (ANCOLD terminology) is >1 - 10.
Adverse human health due to direct physical impact or contamination of the environment	Medium	The potential for human exposure is limited, and temporary adverse health effects are possible.
Loss of assets due to direct physical impact or contamination of the environment	Medium	Livestock are grazed just outside the PNX tenement boundaries, approximately 200 m – 300 m from IWL. Hence, there is potential for loss of livestock from failure. The impact to stock water supply downstream is acknowledged but considered to be minimal.
	Medium	There is mining infrastructure or other mining assets immediately downstream of the IWL. Temporary loss is acknowledged though repairs can be made.
	Medium	Loss of IWL storage capacity is possible. The IWL Stage 4 embankments will be constructed of placed mine waste to a minimum crest width of 25 m.
Damage to items of environmental, heritage or historical value due to direct physical impact or contamination of the environment	Medium	The Project is not in close proximity to areas of significant environmental value, although temporary damage to the natural environment is possible.
	Medium	Temporary adverse effects on flora and fauna are possible.
	Low	Limited or no potential for damage of items of heritage or historical value.

Table 6: DMP CoP Category Rating System

Maximum Embankment or Structure Height (m)	Hazard Rating		
	High	Medium	Low
> 15.0	Category 1	Category 1	Category 1
5.0 - 15.0	Category 1	Category 2	Category 2
< 5.0	Category 1	Category 2	Category 3

3.3 ANCOLD Consequence Category

3.3.1 General

There are two Consequence Categories that need to be assessed as part of Tailings Dam design. These are the Dam Failure Consequence Category and the Environmental Spill Consequence Category. These are used to determine various design and operational requirements including design of spillways and for flood storage requirements.

3.3.2 Dam Failure Severity Level

In accordance with ANCOLD (2012) Guidelines there are seven (7) damage type categories that need to be assessed in order to determine the severity level/impact (Minor, Medium, Major and Catastrophic) of a potential facility failure or spill. In accordance with the Dam Severity Level impact assessment (ANCOLD 2012, Table 1), the proposed IWL is classified as a 'Medium' severity level as detailed in Table 7.

Table 7: ANCOLD Dam Severity Level Rating System

Damage Type	Severity Level	Severity Level Impact
Infrastructure	Medium	$10M - $100M production losses and repair costs
Business Importance	Medium	Significant impacts to operations
Public Health	Medium	No persons affected
Social Dislocation	Minor	No persons affected
Impact Area	Medium	Based on preliminary dam break assessment
Impact Duration	Medium	Less than 5 years
Impact on Natural Environment	Medium	Subject to confirmation by others

3.3.3 Dam Failure Population at Risk

The population at risk (PAR) is defined as all people who would be directly exposed to floodwaters assuming they took no action to evacuate.

No homes, businesses, recreational areas are located downstream of the IWL. However, an existing open pit (inactive) is located downstream of the embankment, and operational personnel may be present in low lying areas downstream of the embankment. Based on this, the PAR for the IWL is considered to be greater than 1 but less than 10 (ANCOLD PAR category of >1 to 10).

3.3.4 Dam Failure Consequence Category

The dam failure consequence category is adapted from the severity level assessment of damage and loss, combined the Population at Risk (PAR).

Based on a dam failure severity level of 'Medium' and a PAR >1 to 10, the ANCOLD guidelines recommend the adoption of a 'High C' Dam Failure Consequence Category rating for purpose of the IWL design.

3.3.5 Environmental Spill Consequence Category

The Environmental Spill Consequence Category is assessed by considering the effect of spilling dam water to the downstream environment (typically through the dam spillway during a flood event). The aerial extent of the spill impact will be significantly smaller than the area which would be affected in the event of dam failure. The effect of spilling water to the environment from the IWL is primarily driven by the geochemistry of the tailings solids and supernatant; see Section 2.5.5.

As the IWL contains dry stacked tailings, no free water resulting from tailings deposition will be stored on the facility. Consequently, any water stored on the dam will be directly related to rainfall. As such, water spilled from the dam under extreme rainfall events will consist only of rainfall and will hence be significantly diluted, and further diluted again given the downstream environment of the dam is also likely to be flooded. Therefore, the severity of impact on the natural environmental from environmental spills from the IWL would be 'Minor'.

The PAR assigned to a dam spill is >1 to 10. The combined Dam Spill Consequence Category is assessed as 'High C' at this stage of the design.

3.3.6 ANCOLD Design Criteria

The recommended design criteria for a 'High C' consequence category facility have been adopted for the design of the IWL and are presented in Table 8 below.

Table 8: IWL ANCOLD Design Criteria

Parameter	Value
Design Storm Event	1:100-year AEP, 72-hour event
Additional Freeboard (Stormwater)	0.5 m
Operating Basis Earthquake (OBE)	1:475-year up to 1:1,000-year AEP
Safety Evaluation Earthquake (SEE)	1:2,000-year AEP

3.4 Minimum Freeboard

Freeboard has been assessed according to the DMP (2015) guidelines, and comprises three distinct elements, namely: operational freeboard, beach freeboard and total freeboard. These elements are graphically illustrated in Figure 3, and are summarised in Table 9, where:

- Operational freeboard is the height difference between the tailings beach and the embankment crest;
- Beach freeboard is the level difference between the tailings beach and the decant water level plus allowance for the 1 in 100-year average recurrence interval (ARI), 72-hour rainfall event, and;
- Total freeboard is the sum of the operational freeboard and beach freeboard plus allowance for the 1 in 100-year average recurrence interval (ARI), 72-hour rainfall event.

Figure 3: Freeboard Definition (DMP, 2015)

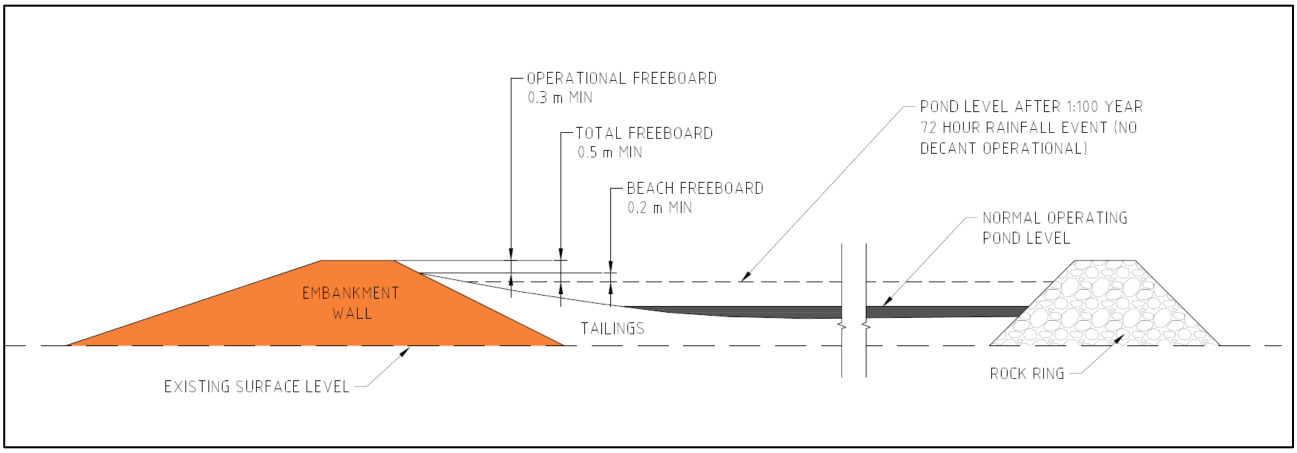


Table 9: DMIRS Freeboard Requirements

Parameter	Value
Operational Freeboard	0.3 m
Beach Freeboard	0.2 m
Total Freeboard (minimum)	0.5 m

3.4.1 Recommended Freeboard

Based on the DMIRS Classification and ANCOLD Consequence Category assessment, the total freeboard (to maximum operating pond level) adopted for the purpose of the design is presented below in Table 10. The maximum operating pond level, normal operating pong level, design storm event volume and freeboard levels for Stage 6 are presented in Section 3.5.6.

Table 10: Recommended Freeboard

Parameter	Value
Operational Freeboard (DMIRS minimum)	0.3 m
Beach Freeboard (DMIRS minimum)	0.2 m
Additional Stormwater Freeboard (ANCOLD ‘High C’)	0.5 m
Total Freeboard (minimum to max. operating pond)	1.0 m

3.5 Design Concept

The IWL is proposed to be constructed using downstream construction methodology. The downstream embankments are proposed to be placed and traffic compacted progressively using mine waste produced as part of mining operations. The upstream face of the embankments is proposed to be constructed using low permeability materials sourced from nearby areas. The floor of the IWL is proposed to be lined with a compacted clay basal liner. The remainder of the mine waste produced as part of mining operations is proposed to be placed around the downstream zone to form an IWL.

At each Stage, filter pressed tailings will be dumped within the facility and compacted to form a graded slope from the embankments towards the centre of the facility. The tailings will be required to be placed at specific slopes, depending on the stage of operation and varying between 2.25 % and 2.75 %, to ensure sufficient stormwater storage is provided across the IWL.

A decant facility will be located in the centre of the facility, with the purpose of capturing and removing incidental rainfall accumulated across the tailings surface.

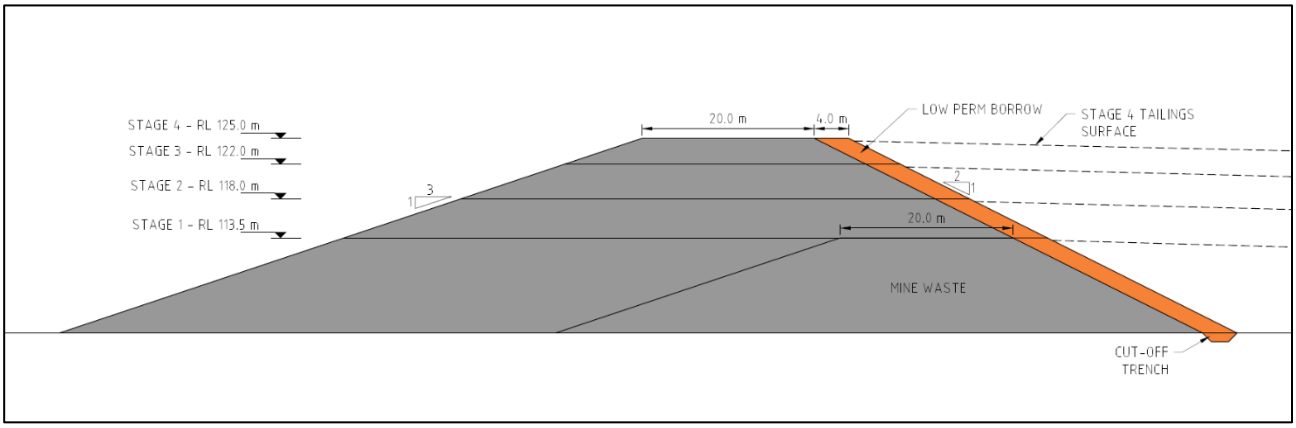
3.6 Drainage Design

The IWL is designed such that tailings will be dumped within the facility with a graded slope from the embankments towards a centrally located decant. This will facilitate any incidental rainfall forming a decant pond located away from the embankment, reducing the potential for phreatic conditions (pore pressures) from developing beneath and with the main embankment.

3.7 Embankment Geometry

The proposed future IWL embankment raises (Stage 1 to Stage 4) are proposed to be constructed using mine waste. These perimeter embankments will be constructed progressively as waste is produced and hauled to the IWL. The upstream batter of each raise will be compacted to form a low permeability face comprising clayey borrow material won from a nearby location. The proposed IWL final configuration is shown in section in Figure 4. Note that the design geometry is based on the known volumes of mine waste at the time of the preparation of this document.

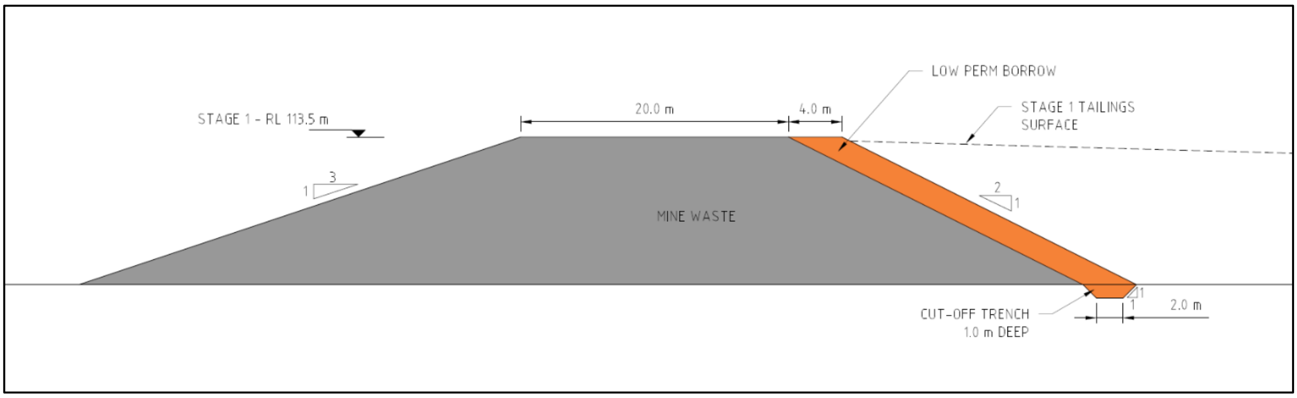
Figure 4: IWL Configuration (Section)



3.8 Cut-Off Trench

A cut-off trench is proposed as part of the construction of the IWL embankment. The trench aims to intercept lateral seepage through and beneath the embankment. The configuration of the trench relative to the embankment is shown in Figure 5.

Figure 5: Cut-off Trench Configuration



3.9 Liner Details

Based on nearby investigations at the WSD, the floor of the IWL and foundation of the embankments is expected to comprise a 1.5 m – 3.0 m thick layer of clayey materials overlying Phyllite bedrock. This is expected to provide a low-permeability floor for the IWL. An underdrainage system has been incorporated into the concept design. In the absence of low permeability oxide tailings with which to line the base of the IWL, the base (floor) of the IWL will need to include a clay liner to reduce seepage. The installation of an underdrainage system within the IWL is likely to assist in the consolidation of the tailings and removal of excess water from the facility.

3.10 Underdrainage System

An underdrainage system has been incorporated into the concept design. In the absence of low permeability oxide tailings with which to line the base of the IWL, the base (floor) of the IWL will need to include a clay liner to reduce seepage. The installation of an underdrainage system within the IWL is likely to assist in the consolidation of the tailings and will allow excess water to be removed from the facility.

It is envisaged that excess water removed from the IWL through the underdrainage system will be routed to sumps located to the north of the facility. Underdrainage water collected in these sumps will be pumped back to the Plant or Evaporation Pond.

It is recommended that an underdrainage system is installed as detailed on the drawings attached to this design report. The proposed underdrainage system layout is presented below in relation to the Stage 1 embankment configuration.

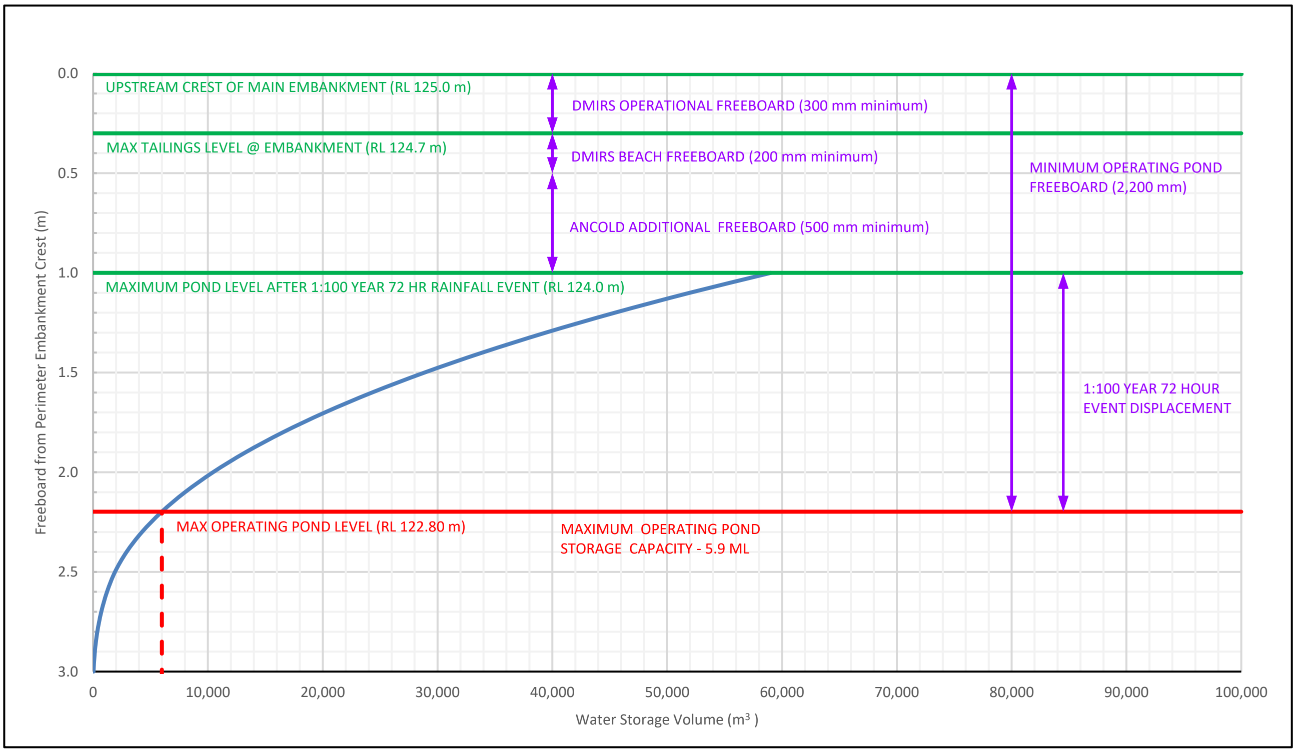
Figure 6: Underdrainage System Layout

3.11 Water Management

Assessment of freeboard has been conducted taking into consideration the *ANCOLD Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure (ANCOLD, 2012)* and the Code of Practice (CoP): Tailings Storage Facilities in Western Australia (DMP, 2013). The proposed IWL does not receive rainfall runoff from an upstream catchment. It is assumed that only the low permeability face and tailings surface contributes to the IWL catchment.

The IWL freeboard was assessed as shown on Figure 7 (top-down approach); the figure shows that based on a maximum operating pond level of RL 122.8 m, there is sufficient freeboard to contain a 1:100 AEP 72-hour storm event whilst maintaining 1.0 m of freeboard to the crest. The storm water storage capacity is dependent upon the actual beach slope constructed during tailings placement and the volume estimate for the IWL is based on a 2.25 % beach slope at Stage 4.

Figure 7: IWL Freeboard Assessment



These freeboard requirements are only applicable at the end of the operation of the facility (i.e. dam full tailings). During the operational life of the IWL the risk of overtopping is significantly reduced as the incidental rainfall is contained within the IWL and should not be allowed to pond on the tailings surface. Removal of stormwater is managed by designing the decant pumps to extract not only the volume of water required for the target dry density, but also the volume of water expected from the 1:100 AEP 72-hour storm event.

It should be noted that the maximum pond level (RL 122.8 m) could be a combination of small storm events prior to a 1:100 AEP 72-hour storm event; i.e. the maximum pond level at a dam full (tailings) scenario should not be viewed as a maximum operating level under normal circumstances. The freeboard assessment should be revisited prior to reaching dam full of tailings to assess if the above Stage 4 beach slope has been constructed.

3.12 Water Balance

A preliminary Water Balance was prepared using an excel spreadsheet for the IWL. The spreadsheet calculates an estimation of the inflows and outflows from the IWL and determines the balance after plant water requirements have been met. Water shortfall or water in excess of requirements is indicated on a monthly and annual basis.

Due to the operation of the IWL as a dry stack tailings facility, water inflows consist solely of incidental rainfall. Water outflows consist of retention of water within tailings and seepage, however these are negligible compared to the rainfall inflows.

The following information was used for the water balance:

- Average monthly rainfall figures for Douglas River (BOM Station 014073) adjacent to the site (recording period: 1957 to 2020).

The following assumptions were made for the water balance:

- Runoff co-efficient of 1.0 for the surface of the tailings;
- Runoff co-efficient of 0.0 for the upstream catchment (permeable mine waste);
- The maximum tailings surface area of the IWL, 12.1 ha, was used in this water balance.

Based on the above information the following preliminary water balance was produced:

Table 11: Water Balance

Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Rainfall*	mm	290.6	254.4	191.3	65.1	8.2	0.5	1.8	0.9	6.7	39.8	114.6	196.6
Rainfall Inflow	m^3	35,163	30,782	23,147	7,877	992	61	218	109	811	4,816	13,867	23,789
Rainfall Inflow	tph	47	46	31	11	1	0	0	0	1	6	19	32
* 1968-2020 (BoM Site 014901)													

It is recommended that the water recovery system (decant pumps and piping) has a minimum capacity of not less than 50 m^3/hr for the project, to ensure adequate water removal, particularly during high rainfall periods.

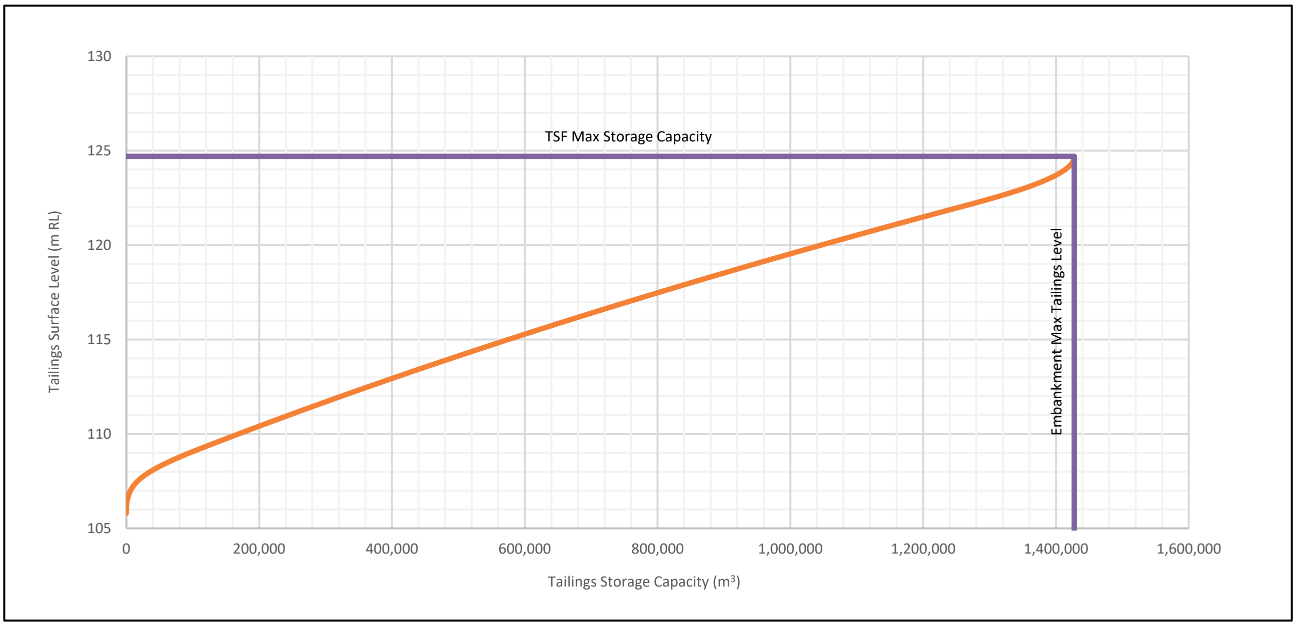
3.13 Tailings Placement

Tailings are expected to be delivered from the Plant at a production rate of 750,000 tonnes of solids per annum (tpa) for 4 years (base case production scenario). At times throughout the mine plan, the rate of tailings production may increase or decrease. The solids content (% solids) is expected to be between approximately 85 % and 90 %.

Filter pressed tailings will be dumped within the facility and traffic compacted to form a graded slope from the embankments towards the centre of the facility. The tailings will be required to be placed at specific slopes, depending on the stage of operation and varying between 2.25 % and 2.75 %, to ensure sufficient stormwater storage is provided across the IWL. The decant facility will be located in the centre of the facility, with the purpose of capturing any incidental rainfall captured across the tailings surface.

Development (filling) of the IWL is shown graphically on Figure 8 in terms of storage volume and tailings surface level.

Figure 8: IWL Tailings Storage Capacity Curve



4. Monitoring and Instrumentation

Groundwater monitoring bores are to be installed in the area downstream of the IWL to enable any deep-seated seepage beneath the perimeter embankment to be identified. In addition to monitoring for seepage from the IWL, a series of monitoring points, comprising Vibrating Wire Piezometers (VWP) will need to be installed at IWL to enable monitoring of the phreatic surface and of pore pressures within the embankment.

The VWPs are to be installed as part of the Stage 1 embankment construction and the proposed locations of the VWPs are presented in plan in Figure 9 and in section in Figure 10.

Figure 9: Embankment Instrumentation (Plan)

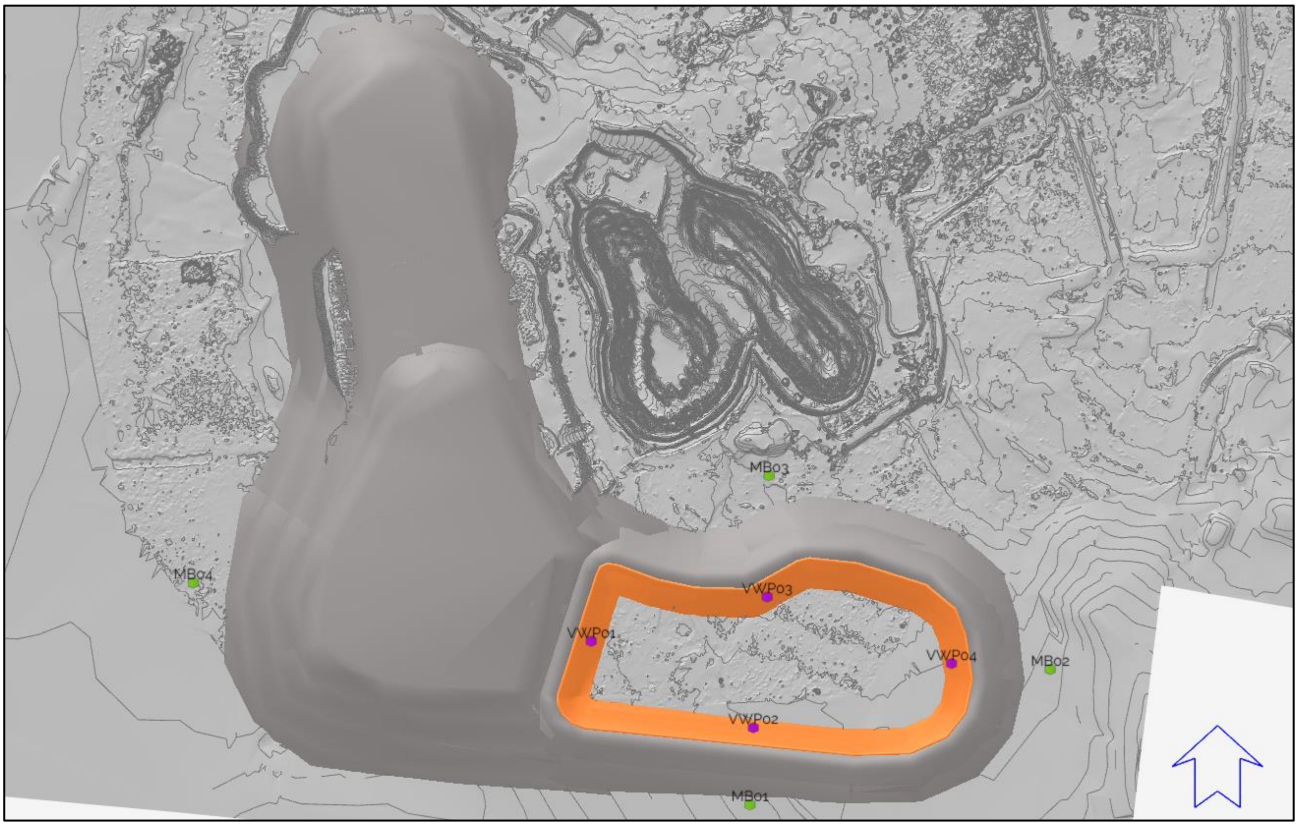
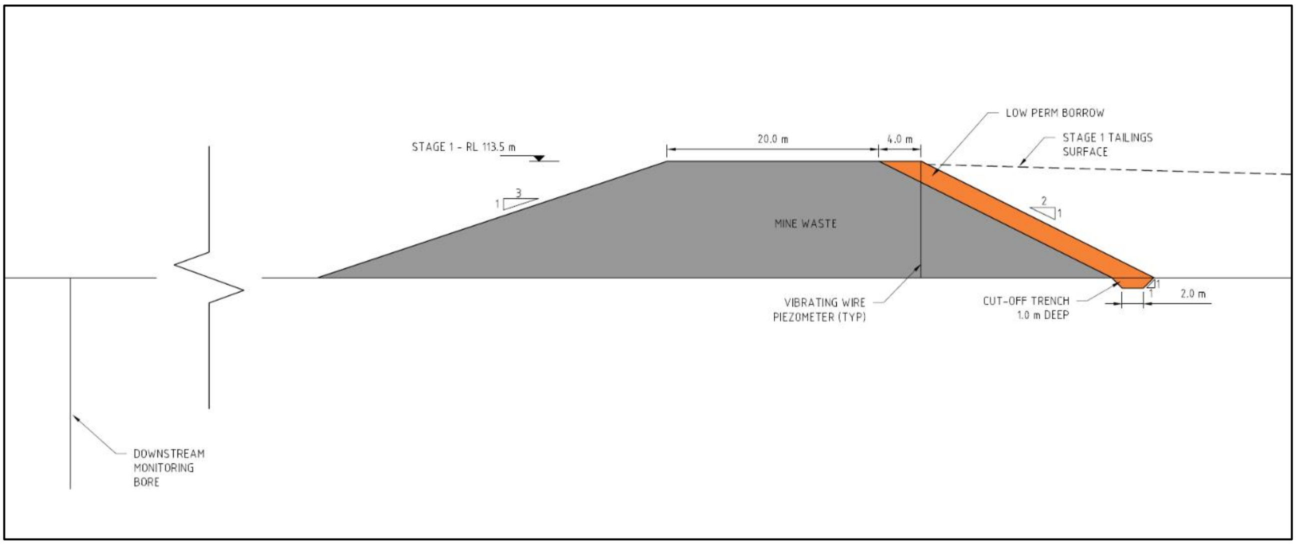


Figure 10: Embankment Instrumentation (Section)



5. Closure and Rehabilitation

It is understood that a detailed Project Closure Plan will be developed by others. The proposed IWL and IPTSF has been developed with closure in mind, taking into consideration;

- The DMP's principal closure objectives for rehabilitated mines - Guidelines for Preparing Mine Closure Plans (DMP, 2015b);
    - (physically) safe to humans and animals,
    - (geo-technically) stable,
    - (geo-chemically) non-polluting/non-contaminating, and
    - capable of sustaining an agreed post-mining land use.
- The Environmental Protection Authority's (EPA) objective for Rehabilitation and Decommissioning to ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.

A low permeability cover will be required of be constructed over the IWL. This cover will consist of 0.5 m of compacted clay with an overlying 1.5 m of oxide waste rock, covered by 300 mm of topsoil. Oxide waste material will be stockpiled around the IWL embankments during operation, ready to be pushed out over the IWL at closure. This will provide long term containment and erosion protection of the tailings, as well as provide a suitable medium for re-establishment and sustenance of vegetation. The closure concept for the IWL utilises the closure surface to spill incidental rainfall.

The decant system may remain in place or on standby until the tailings surface cover has been installed; to provide an interim means of surface water removal. Further detail around decommissioning of the IWL should be coordinated with the project-wide decommissioning and closure plan.

A rehabilitation plan will be developed in conjunction with a site wide closure plan. Rehabilitation should involve respreading collected topsoil on top of the IWL tailings surface, following the placement of compacted clay and oxide waste rock. Excess topsoil should also be placed on the lower downstream batter surfaces where available. Topsoil surfaces may require ripping and seeding with native species in order to promote revegetation, and consequently blend the IWL into the natural landscape and promote evapotranspiration.

It's important that batter slopes function as erosion resistant water shedding structures. A thin layer of topsoil should be spread on the downstream batter surfaces mixed in between waste to promote revegetation. The outer slopes should have no berms, banks, moonscapes or rip lines as these pond water which inevitably result in piping failure or off-contour rip line breakout gullying.

6. Forward Works

6.1 Risk Based TSF Design

Prior to progressing the IWL through to Detailed Design (DD) level for regulatory approval, a risk assessment of the IWL design should be completed with information collected from the works detailed in the following sections.

6.2 Geotechnical Investigations and Material Testing

6.2.1 Geotechnical

A suitable Geotechnical Site Investigation (GSI) will be required across the footprint of the proposed IWL. The scope of the GSI should comprise the excavation of test pits across the base of the proposed IWL to identify the underlying lithology. The collection of bulk samples and laboratory testing will be required in order to understand the characteristics and shear strength of the underlying units.

As part of the GSI a search for potential borrow material sources and laboratory testing should be undertaken in order to identify local material suitable for the use in construction the low permeability face of the IWL.

In addition, sampling and characterisation should be undertaken on Mine Waste planned to be used to construct the downstream portions of the IWL.

6.2.2 Tailings

At the time of writing this report, preliminary representative primary tailings sample test results were not available for analysis. As part of future works, a suite of tailings testing will be required on samples representative of those to be placed within the IWL. A list of preliminary tailings testing is presented below:

- Particle Size Distribution (PSD) with hydrometer (AS 1289 3.6.3, 3.5.1 and 2.1.1).;
- Atterberg limits test (AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, and 3.4.1);
- Air-drying tests (not an Australian Standard Test); and
- Settling tests (undrained and drained) (not an Australian Standard Test).

The results of this tailings testwork should be used in future works to verify the suitability of the proposed design.

6.3 Seismicity Study

A desktop assessment of the IWL needs to be undertaken to confirm the seismicity characteristics of the site to ensure the IWL is designed to withstand the required earthquake loads over the operating life of the facility.

6.4 Detailed Design Works

Following the completion of the works detailed above, the detailed design works will need to be completed, which include the following:

- Preparation of the Design Report, which encompasses the basis of design and results from various analyses including seepage, stability, dam break etc., executed as part of the design works;
- Preparation of design drawings and materials take off;

- Preparation of an Operations Manual for the operation and management of the IWL;
- Preparation of instrumentation and monitoring details, to enable the performance of the IWTSF to be compared against the design criteria;
- Preparation of Closure and Rehabilitation details.

6.5 Construction

Following the completion of the detailed design works, the following construction planning works will need to be completed:

- Planning of mine waste and tailings placement for day-to-day operations;
- Identification of a suitable water source for the conditioning of construction materials;
- Construction of a borrow pit, within which material suitable for the use in construction of the low permeability face of the IWL can be excavated and conditioned;

7. References

1. ANCOLD 2012, Australian National Committee on Large Dams: Guidelines on the Consequence Categories for Dams
2. ANCOLD 2019, Australian National Committee on Large Dams: Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure
3. ANCOLD 2019, Australian National Committee on Large Dams: Guidelines for Dams and Appurtenant Structures for Earthquakes
4. BoM 2016/17, Bureau of Meteorology Website
5. DMP 2013, Code of Practice (CoP): Tailings Storage Facilities in Western Australia
6. DMP 2015, Guide to Departmental requirements for the management and closure of tailings storage facilities (TSFs)
7. DMP 2015, Guidelines for Preparing Mine Closure Plans
8. DMP 2015, Guide to the preparation of a design report for tailings storage facilities (TSFs)
9. Johns, C. A., 'Geotechnical Properties of Mine Tailings and Implication for Tailings Storage Facility Design' Proceedings of GEO2010, Calgary, Alberta.

8. Limitations

Resource Engineering Consultants Pty Ltd (REC) has prepared this geotechnical report for the Scoping Study level design of the Integrated Waste Landform (IWL) at the PNX Metals Ltd (PNX) Fountain Head Gold Project. This report is provided for the exclusive use of PNX and their consultants for this project only and for the purposes as described in the report. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of REC, does so entirely at its own risk and without recourse to REC for any loss or damage. In preparing this report REC has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after REC's field testing has been completed.

REC's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by REC in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. REC cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by REC. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of REC.

REC may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to REC.

Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Appendix A

Preliminary Design Drawings

NOTES:

1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. SURVEY PROVIDED BY CLIENT.
3. ALL CONSTRUCTION WORKS MUST BE EXECUTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EARTHWORKS SPECIFICATION

LEGEND:

- ZONE 1: ROLLER COMPACTED CLAYEY / 'LOW PERMEABILITY' EARTH FILL (300 mm LIFTS)
- ZONE 2: TRAFFIC COMPACTED MINE WASTE (500 mm LIFTS)
- ZONE 3: CLEAN COMPETENT ROCK FILL (50 mm - 300 mm) % FINES PASSING (0.075 mm) < 3%

REV	DATE	AMENDMENTS	DRG. NO.	REFERENCE DRAWING
A	24/05/2021	ISSUED FOR INTERNAL REVIEW		

REC. GEOTECHNICAL AND TAILINGS

CLIENT: PNX METALS

	BY	DATE	INITIAL
DRAWN :	J.BLAKE	24/05/21	
DESIGNED :	J.BLAKE	24/05/21	
CHECKED :	M.HANGER	24/05/21	
ORIGINATOR :			
COMPANY :			
APPROVED :			

TITLE
PNX METALS LTD
FOUNTAIN HEAD GOLD PROJECT
INTEGRATED WASTE LANDFORM
STAGE 1 PLAN

SCALE: 1:2,500

DRAWING No.: DRG-001

REV: A

A1 Border v1.4

NOTES:

1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. SURVEY PROVIDED BY CLIENT.
3. ALL CONSTRUCTION WORKS MUST BE EXECUTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EARTHWORKS SPECIFICATION

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- ZONE 2: TRAFFIC COMPACTED MINE WASTE (500 mm LIFTS)
- ZONE 3: CLEAN COMPETENT ROCK FILL (50 mm - 300 mm) % FINES PASSING (0.075 mm) < 3%

SCALE BAR 1:2,500

0 20 50 100 200

REV	DATE	AMENDMENTS	DRG. NO.	REFERENCE DRAWING
A	24/05/2021	ISSUED FOR INTERNAL REVIEW		

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REC. GEOTECHNICAL AND TAILINGS

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	BY	DATE	INITIAL
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DESIGNED :	J.BLAKE	24/05/21	
CHECKED :	M.HANGER	24/05/21	
ORIGINATOR :			
COMPANY :			
APPROVED :			

TITLE

PNX METALS LTD
FOUNTAIN HEAD GOLD PROJECT
INTEGRATED WASTE LANDFORM
STAGE 4 PLAN

SCALE 1:2,500

DRAWING No. DRG-002

REV A

A1 Border v1.4

LEGEND:

- ZONE 1: ROLLER COMPACTED CLAYEY / 'LOW PERMEABILITY' EARTH FILL (300 mm LIFTS)
- ZONE 2: TRAFFIC COMPACTED MINE WASTE (500 mm LIFTS)
- ZONE 3: CLEAN COMPETENT ROCK FILL (50 mm - 300 mm) % FINES PASSING (0.075 mm) < 3%

PRELIMINARY

NOTES:
1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. SURVEY PROVIDED BY CLIENT.
3. ALL CONSTRUCTION WORKS MUST BE EXECUTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EARTHWORKS SPECIFICATION

A - SECTION - PERIMETER EMBANKMENT
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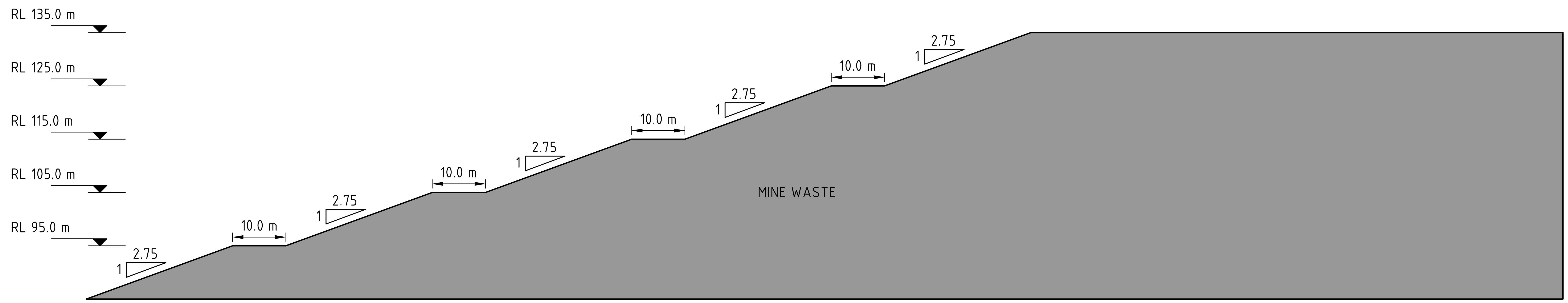
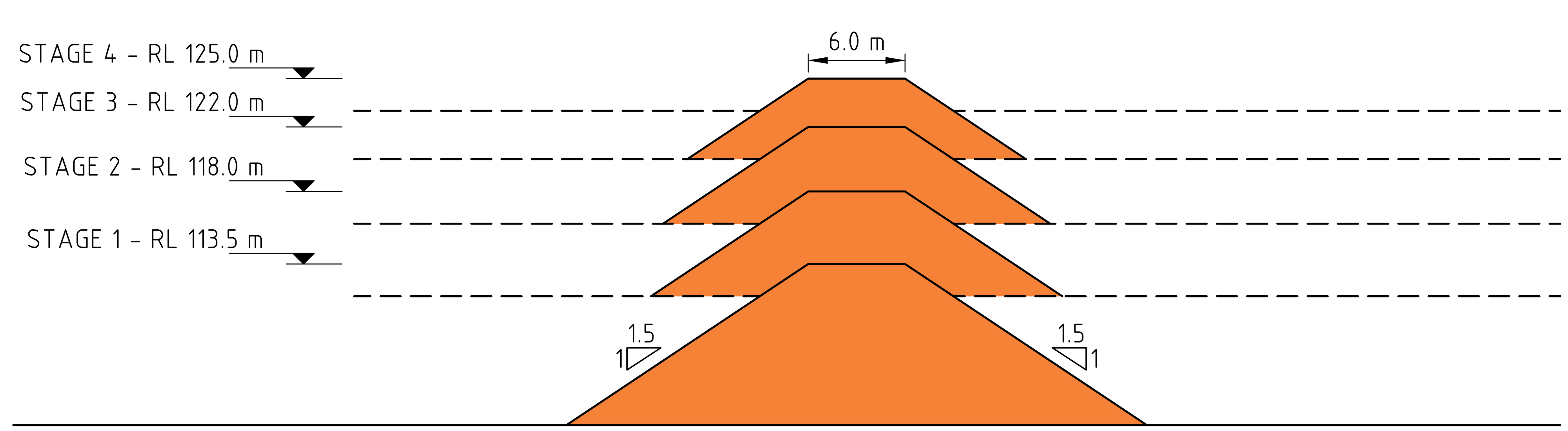
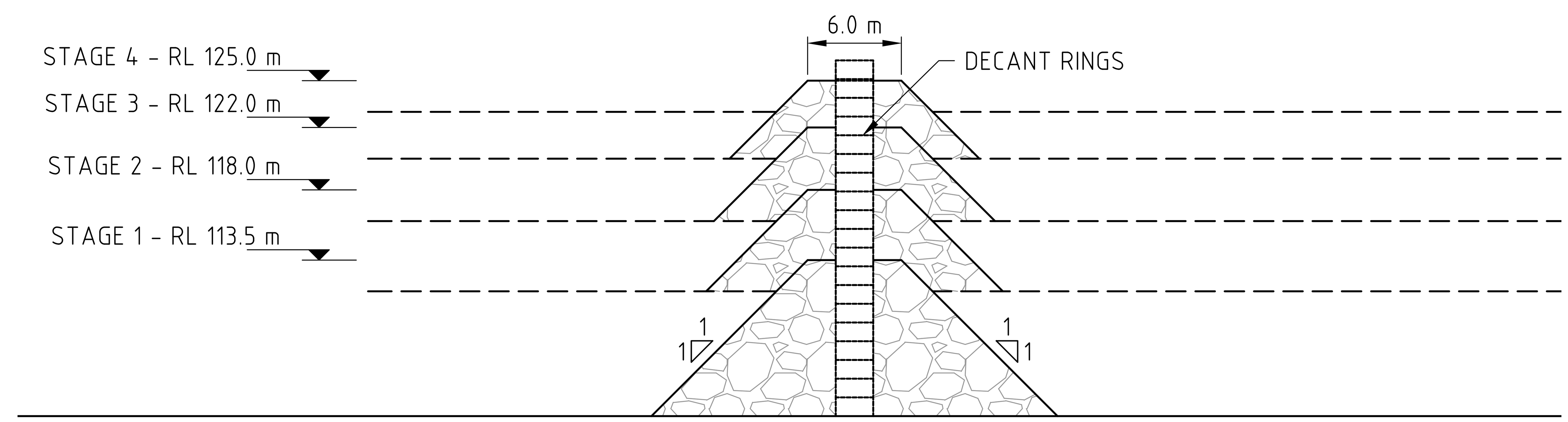


B - SECTION - WASTE DUMP
SCALE 1 : 500



C - SECTION - DECANT CAUSEWAY
SCALE 1 : 250



D - SECTION - DECANT SYSTEM
SCALE 1 : 250

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DRAWN :	J.BLAKE	24/05/21	
DESIGNED :	J.BLAKE	24/05/21	
CHECKED :	M.HANGER	24/05/21	
ORIGINATOR :			
COMPANY :			
APPROVED :			

TITLE
PNX METALS LTD
FOUNTAIN HEAD GOLD PROJECT
INTEGRATED WASTE LANDFORM
SECTIONS AND DETAILS

SCALE: -

DRAWING No. DRG-003

REV A

A1 Border v1.4