BRUNSWICK WEST TAILINGS STORAGE FACILITY CLOSURE PLAN

ADVERTISED PLAN

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1. Introduction

1.1. Location

The Costerfield Operations are located in Central Victoria, approximately 50 km east of the City of Greater Bendigo, on Mining Licences MIN4644 and MIN5567. The licences are held by Mandalay Resources Costerfield Operations Pty Ltd (MRCO), a wholly owned subsidiary of Mandalay Resources Australia Pty Ltd (Mandalay).

Costerfield Operations comprise of the underground Augusta, Cuffley, Brunswick and Youle gold and antimony mines, and associated infrastructure including the Brunswick Processing Plant, the Brunswick and Bombay Tailings Storage Facilities (TSFs) and the Splitters Creek Evaporation Facility. The mining and processing activities are located within MIN4644, while the evaporation facility at Splitters Creek is within MIN5567.

The Brunswick West Tailing Storage Facility (TSF) and Return Water Pond (RWP) is located at 200 Bradleys Lane, Costerfield, Victoria. Figure 1 shows the 'Property Boundary' in which the TSF and RWP will be located and Appendix A contains information on the TSF.

Figure 1. Brunswick West TSF 'Property Boundary'

1.2. Scope

This Closure Plan covers the closure and rehabilitation activities associated with the Brunswick West TSF within MIN4644 (only).

The primary objective for the Brunswick West TSF Closure Plan is to design and construct an engineered cover system utilising available on-site materials to ensure secure long term tailings containment. Once constructed, the covered tailings impoundment will require minimal and ideally no on-going supervision. The proposed TSF final landform would comprise the following;

- Long-term stable embankments with minimum 4H:1V outer slopes to limit erosion and allow revegetation;
- A tailings surface capping system of minimum 500mm thickness, consisting largely of excavated waste rock from the underground mine;

- Revegetation of the landform as pasture for livestock.

This closure strategy will remain flexible and will be amended as the TSF evolves, new rehabilitation techniques are developed and environmental investigations progress.

2. Closure Obligations and Commitments

MRCO has identified the legal requirements as well as commitments relevant to the rehabilitation of the Brunswick West TSF.

2.1. Relevant Legislation and Guidelines

The primary legislative instruments that regulate the operation of a mine in Victoria are the Mineral Resources (Sustainable Development) Act 1990 (MRSD Act) and the Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019 (MRSD (MI) Regulations). Both the MRSD Act and the Regulations include requirements for rehabilitation.

Earth Resources Regulation (ERR) has published a Guideline for Mining and Prospecting Projects that provides guidance on the Preparation of Rehabilitation Plans (February 2020, Version 1.0).

Australian National Committee on Large Dams (ANCOLD 2019) – Guidelines on Tailings Dams provides current engineering best practice guidance including closure.

2.2. Commitments

The final rehabilitation of the land and infrastructure on the Brunswick West TSF site will be in accordance with requirements set out in the Brunswick West TSF Work Plan Variation (WPV) that has been submitted to ERR for statutory endorsement.

Commitments made by MRCO within the Brunswick West TSF WPV are considered binding commitments. Some of these commitments are preliminary in nature and will be subject to refinement as further information becomes available and technical investigations continue through the commissioning and operational phases of the TSF. This is the case for some commitments relating to TSF closure, where closure strategies will continually be assessed and refined as more information becomes available in the lead up to closure.

3. Stakeholder Engagement

3.1. Stakeholder Engagement

MRCO will continue to update and refine the Community Engagement Plan which provides structure and processes for keeping communities, government and other stakeholders informed of the operations updates and milestones. The ongoing program of engagement will include:

- Consultation with the land holder will be maintained by MRCO throughout the life of the TSF.
- Maintaining good relationships with landholders, local business and industry, Traditional Owners and government (at all levels).
- Identifying new stakeholders and re-analysing levels of interest and impact regularly to maintain a good understanding of stakeholder needs and concern.
- Keeping stakeholders up to date with relevant information in a timely manner and addressing concerns as they arise.
- Monitoring and responding to issues raised through the stakeholder engagement process and incorporating feedback into the TSF closure planning process and future revisions of this Closure Plan, where possible.

As part of the TSF closure planning, the engagement strategy will also comprise of consultation with key stakeholders in relation to aspects such as:

- Agreement on the nominated post-closure land uses;
- Nominated TSF closure strategies;
- TSF closure objectives and completion criteria;
- Socio-economic aspects associated with eventual transitioning from operational to closure and post-closure phases; and
- Potential retention of TSF infrastructure or services for the use by post-closure land users (e.g. RWP, roads, piping).

4. Baseline Data and Analysis

This chapter summarises key environmental data, informed by related specialist studies, that has influenced the closure objectives and completion criteria. Data from ongoing studies during TSF construction and operations will be used to refine the closure outcomes and completion criteria as closure planning advances.

4.1. Land Use

The Brunswick West TSF 'Property Boundary' is shown in Figure 1. The site is located approximately 500 m north-west of the Brunswick Processing Plant within a farm paddock which has been used for sheep grazing. The site is roughly triangular in shape, and is confined by Crown Land to the east, MRCO infrastructure and additional farmland to the south, and Bradleys Lane to the west.

4.2. Climate

The local climate of the Costerfield region is considered 'semi-arid'. The climate is generally characterised by cool and wet winters, whilst the summer is often hot and dry. Details of the climate are provided in Section 4.1 of the Detailed Design Report (ATCW, 2023).

4.3. Land Systems

The site has a ridge at approximately 194.0 m (AHD) in the centre of the paddock running in a south-easterly direction, from which the natural ground slopes to the north, east and south at a natural grade of up to 5%. The site currently contains two farm water dams at the east and south, the latter of which is situated within a natural drainage channel. Details of land systems, including soils, geology and topography are provided in Sections 4.2 and 4.3 of the Detailed Design Report (ATCW, 2023).

4.4. Surface Water

There are a number of ephemeral creeks in the vicinity of the Brunswick West TSF, including Wappentake Creek and its tributaries. A series of clean water diversion drains will be constructed around the toe of the embankment. These drains will divert rainfall runoff from the upstream catchment around the TSF without causing excessive scour and/or erosion and will be connected to the existing diversion drain network around the Brunswick site. Details of the clean water diversion drains are provided in Section 13.5 of the Detailed Design Report (ATCW, 2023).

4.5. Groundwater

The regional hydrogeology of the area encompassing the Costerfield Gold Mine consist of a Shallow Alluvial Aquifer (SAA) and a Regional Basement Aquifer (RBA). The RBA occurs under the entire area of MIN4644 and the SAA is a minor aquifer situated along the confines of the modern-day water course valleys and is mostly dry.

Details of groundwater, including the regional hydrogeological setting, local baseline groundwater quality, hydrological modelling results, and aquifer performance predictions are provided in the Brunswick West Tailings Storage Facility Groundwater Assessment (WSP, 2023).

4.6. Geochemistry

Geochemical assessments of the tailings and waste rock have indicated that the tailings are unlikely to be acid producing and are classified as Non-Acid Forming (NAF).

Multi-element assessments have been undertaken on tailings and waste rock samples and are presented in Table 1 (multi-element solids) and Table 2 (multi-element water extracts).

Table 1. Multi-Element Concentration of Tailings and Waste Rock Samples.

				(mg/kg) unless otherwise stated					
		Sample Number		Tailings Slurry 1	Tailings Slurry 2	Tailings Slurry 3	Tailings Slurry 4	Waste Rock 1	Waste Rock 2
		Sample Name / Description ---->		Tailings	Tailings	Tailings	Tailings	Rock	Rock
Parameters	Detection Limit	ANZECC[1] Environmental Investigation Level	NEPC[2] Health-Based Investigation Level						
	(mg/kg) unless otherwise stated								
Minor Elements									
As	5	20	200	272	267	294	282	9	9
Cu	5	60	2,000	10	8	9	9	24	20
Fe	50	-	-	39500	37400	39700	41800	27100	25600
Pb	5	300	600	385	502	510	450	23	7
Sb	5	2[3]	-	1150	1680	1770	1940	11	<5
Zn	5	200	14,000	37	32	32	33	77	52

Notes:

< indicates less than the analytical detection limit. Shaded cells indicate values which exceed selected ANZECC or NEPC guideline values.

1. ANZECC and NHMRC, Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites. Australian and New Zealand Environment Conservation Council and the National Health and Medical Research Council: Canberra, ACT (1992).
2. National Environmental Protection Council (NEPC). National Environmental Protection (Assessment of Site Contamination) Measure (NEPM). Guideline on Investigation Levels for Soil and Groundwater (1999). HIL(E): parks, recreational open spaces and playing fields.
3. ACMER, A Guide to the Application of the ANZECC/ARMCANZ Water Quality Guidelines in the Minerals Industry. Interim Sediment Quality Guidelines Australian Centre for Mining Environmental Research (2003)

Table 2. Multi-Element Concentration of Tailings and Waste Rock Samples Water Extracts

		Sample No.	Tailings Slurry 1	Tailings Slurry 2	Tailings Slurry 3	Tailings Slurry 4	Waste Rock 1	Waste Rock 2
		Material Type -->	Tailings	Tailings	Tailings	Tailings	Rock	Rock
Parameters	Detection Limit	ANZECC[1]/NEPC[2] Guidelines						
Minor Elements	(mg/L)							
As	0.01	0.5	0.03	0.04	0.03	0.02	<0.01	0.01
Cu	0.01	0.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fe	0.05	1 [3]	<0.05	<0.05	<0.05	<0.05	0.24	0.19
Pb	0.01	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sb	0.01	0.03 [4]	5.12	6.51	6.94	5.84	0.32	0.50
Zn	0.01	20	0.24	0.18	0.16	0.09	0.04	0.03

Notes:

< Indicates concentration less than the detection limit. Shaded cells indicate values which exceed selected ANZECC/NEPC guideline values.

1. ANZECC and ARMCANZ, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water.
2. National Environmental Protection Council (NEPC). National Environmental Protection (Assessment of Site Contamination) Measure (NEPM). Guideline on Investigation Levels for Soil and Groundwater (1999). Groundwater Investigation Levels (Livestock drinking water)
3. No livestock drinking water guidelines exist for iron therefore NEPC irrigation water quality guideline criteria have been used.
4. No livestock drinking water guidelines exist for antimony therefore NEPC fresh water quality guideline criteria have been used.

The results of tailing multi-element solids testing indicate that the tailing material has some total metal concentrations within the relevant ANZECC and NEPC guideline criteria for sediments. The main exceptions are arsenic, which has exceeded both ANZECC and NEPC criteria for sediments and antimony and lead which have exceeded ANZECC criteria for sediments. These metals need further investigation as part of the final closure design for the Brunswick West TSF.

The results of the waste rock multi-element solids testing indicates that the waste rock has total metal concentrations within the relevant ANZECC and NEPC guideline criteria for sediments. The only exception is antimony which exceeds ANZECC criteria for sediments.

The results of the tailings and waste rock multi-element water extract testing indicates that in general soluble metal composition of the water extracts from tailings and water rock are generally within the criteria limits for livestock drinking water with the exception of antimony. Soluble antimony for the tailings and waste rock was found to exceed the guideline for freshwater aquatic ecosystems.

Elevated antimony concentrations in waste rock material may inhibit effective long-term closure of the TSF. Baseline sediment surveys are to be conducted to determine the natural background level of antimony in sediment. This will aid in assessing if local vegetation communities will be affected by elevated antimony levels in sediment during

closure activities. Alternatively, closure trials may be conducted to determine if antimony concentrations in waste rock will affect long term plant growth.

4.7. Radioactivity

The regional geology at the Costerfield mine site comprises recent to Holocene age fluvial and colluvial deposits, typically comprising of gravel, sand and silt, overlying Silurian age Costerfield Siltstone, typically comprising thinly bedded siltstone, with minor sandstone and conglomerate. None of these host rocks present a radiation risk and thus the risk of radiation from the tailings is non-existent.

4.8. Biodiversity

Details of biodiversity, including flora and fauna associated with the project, vegetation communities, fauna habitat types and the presence of threatened species are provided in Native Vegetation Removal Report (Central Highland Environmental Consultancy, 2023).

5. Closure Risk Assessment

5.1. Risk Assessment Methodology

The risks associated with closure, rehabilitation and post mining land use were examined as part of a high-level risk assessment undertaken during the design phase of the TSF, refer to Appendix B.

This risk register is a non-exhaustive list and is to be continually updated throughout the various stages of the facility.

5.2. Knowledge Gaps, Trials and Investigations

The risk assessment and closure planning process identified a number of knowledge gaps that will be addressed through the initiation of technical investigations and rehabilitation trials.

A number of these trials and investigations are to be carried out during the operational life of the TSF. The results of these trials will be used to inform the final landform design and rehabilitation proposals. Table 3 summarises the currently envisaged program. This is to be reviewed and updated during the TSF operational phase.

Table 3. Pre-Closure Trials and Investigations

Topic	Information Gap/Uncertainity	Description
Pasture trials	Optimum pasture planting mixes for rapid establishment under local climatic and soil conditions on post closure landform	Trials of soil covers and pasture recuitment. To occur on Bombay TSF or Brunswick TSF 2-3 years prior to closure. Assess topsoil and improvement opportunities in CY2023.
Progressive rehabilitation trials	Optimum cover design for maximum stability and pasture establishment success	Field trials of soil profile, erosion and pasture recruitment. To occur on Bombay TSF or Brunswick TSF 2-3 years prior to closure.
Rehabilitaion and closure materials	Availability of suitable cover material for closure	Cover materials resource assessment including further detailed geotechnical, geochemical and erodibility studies to locate and characterise sufficient quanitites of closure materials. This is to include assesment of requirements for trials and progressive closure. To occur 2-3 years prior to closure. Investigate whether Geotubes can aid closure by using tailings to form part of the final landform shape. To commence in CY2023.
Tailings	Opportunities for material reuse as part of the circular economy	Investigate tailings granulo chemical and mineralogical analysis as well as any decontamination requirements. To commence in CY2023.
TSF cover and rehabilitation	Stable covering for TSF	Trials of cap designs and pasture establishment. To occur on Bombay or Brunswick TSF 2-3 years prior to closure.
Geochemical studies	Annual sampling and NAPP/NAG testing of tailings and waste rock	Kinetic leach testing of waste rock and tailings to be performed 2 years pre-closure. Annual NAF/PAF analysis of tailings and waste rock. Annual tailings entrained water geochemistry.
Groundwater	Impact on groundwater levels and chemistry	Ongoing monitoring of groundwater levels and chemistry. Review against groundwater model predictions via annual reviews. Preliminary data on actual groundwater levels is not expected until 2 years post closure.
Tailings shear strength	Suitability of tailings to support initial layers of capping material over tailings and of the landform itself	Expected to be readily achievable within 2- 3 years of cessation of deposition. Shear strength testing would therefore be expected to be conducted in these 2-3 years after deposition, generally during dry weather to allow for access to the entire facility.
Soils assessment	Erodibility of topsoil	Soil assessment to be undertaken at anytime during operation of TSF. Data will be required to fed into landform design.
Climate	Weather Extremes	Future forecasting of weather patterns is to be integrated into the design of TSF closure design to ensure the consequences of extreme environmental conditions on the safety, stability and sustainability of the final TSF landform is appropriately assessed.
Consolidation modelling	Rate of tailings consolidation	2D consolidation models to be developed for Bombay and Brunswick TSFs prior to their closure, then refined for Brunswick West TSF. Modelling inputs will include vane shear strength testings as well as Cone Penetration Testing. Study to be completed at least 6 months prior to end of deposition. Determine ultimate tailings retained water content and incorporate into post-clsoure tailings water balance. A review of the performance of the BGM against long term seepage will be considered as part of the consolidation modelling.

6. Post-Closure Land Use

6.1. Preliminary Post Closure Land Use and Target Ecosystems

The proposed preliminary post-closure land use for the TSF and RWP is to return the land to pasture grazing land for livestock.

The target eco-system will be to optimise the pasture vegetation to secure slope stability, prevent erosion and preserve the integrity of the cover system. Management of the level of grazing permitted will also need to be established to minimise the erosion of the cover system.

Post-closure land use(s) will be finalised following discussion with stakeholders, e.g., the landowner, regarding potential land use opportunities post closure and, in particular, whether any of the infrastructure can be used for other land uses.

The target ecosystem will evolve with post-closure rehabilitation planning and the results of re-vegetation trials.

7. Closure Objectives and Completion Criteria

7.1. Closure Objectives

The principle aims of the closure and rehabilitation of the TSF are to:

1. Securely store the tailings for an indefinite period, and prevent them becoming a hazard to public health and safety, or the environment;
2. Make the closed TSF inherently stable and resistant to degradation;
3. Design the closed TSF for the long term, with minimum requirement for long term maintenance and upkeep;
4. Return the land, as close is reasonably practical, to its pre-disturbance land use; and
5. Make the site suitable for future land owner likely uses for the site.

With these principle aims in mind, the following TSF closure objectives have been identified:

1. Legal compliance - to meet all legal obligations and commitments;
2. Meet stakeholder expectations - to meet stakeholder expectations for the closed site;

3. Public safety - to provide a closed site with no unacceptable safety risks or hazards to people and animals;
4. Long-term stability - to achieve physical, chemical and biological stability of rehabilitated areas; and
5. Minimise impacts to groundwater or surface waters so that the nominated post-closure land uses are not affected.

7.2. Completion Criteria

Completion criteria have been developed to ensure they are specific to an environmental aspect and are measurable and attainable, refer to Table 4. Quantitative criteria have been prioritised, although where quantitative criteria are not suitable, qualitative criteria have been developed. Completion criteria will continue to be refined as the closure design process progresses.

Table 4. Closure Objectives and Completion Criteria

Objective	Criteria	Measurement
Compliance		
Project meets all conditions and commitments to rehabilitation and closure	Register of compliance is prepared and updated annually with no records of non-compliances	Audit of compliance
Stakeholder Expectations		
Post-closure land use is agreed with stakeholders	Closure design employs agreed landforms and land uses	Stakeholder engagement records
Post-closure land use corresponds to that agreed with stakeholders	Final rehabilitated land use conforms to that agreed with stakeholders	As built plans and stakeholder engagement records
Safety		
Risks of impacts to human health, livestock and ecoystems from closure activities are reduced to an acceptable level	All slopes are stable	Geotechnical stability assessment
	All facilities and equipment are safely decommisioned, demolished and removed unless they are to remain for an agreed future use	Final site inspection by regulator
Tailings is securely contained to prevent impacts on human health and ecology	TSF and RWP has been managed appropriately	Dam Safety annual inspections
	Design and peformance of capping systems approved by regulators	Written approval of tailings storage design from regulator
	As-built cover/containment system conform to approved designs	Inspection and audit of rehabilitation works during and after construction As-built drawings

Objective	Criteria	Measurement
Physical Stablity of Rehabilitated Areas		
Final landform is safe and stable	Landform designs to provide long-term geotechnical stability and safety are approved by regulators	Written approval of landform designs by regulator Audit of designs and specifcations
	As built landforms conform to approved designs	Inspection and audit of rehabilitation works during and after construction As-built drawings
	Landform height, gradient and slope length are designed to minimise erosion	Erosion modelling Drainage design Audit of approved design and specifications
Chemical Stablity of Rehabilitated Areas		
Surface material properties will not inhibit the development of target ecosystem	Landform designs include a suitable surface cover	Audit of approved designs and specifications
	Chemical properties of soil do not limit establishment of revegetation	Revegetation monitoring and assessment Chemical soil testing
	Rehabiltated ecosystem can retain water and nutrients	Rehabilitaton monitoring and assessment
Containment of tailings prevents release of contaminants such that there is no deleterious effect on local land uses	Dust composition around TSF site reflects background levels	Dust quality and composition monitoring
Biological Stablity of Rehabilitated Areas		
Rehabiltiated ecosystem achieves target ecosystem	Self-sustaining pasture cover is successfully re-established	Rehabilitation monitoring and assessment
	Weed populations do not restrict establishment of pasture cover	Weed surveys

Objective	Criteria	Measurement
Groundwater and Surface Water		
Water quality leaving site is generally consistent with pre-TSF quality	Sediment deposition downstream of the site is consistent with baseline conditions Groundwater down gradient of the site is consistent with baseline conditons	Sediment sampling Groundwater sampling
	Levels of dissolved contaminants is consistent with local background levels	Surface water quality monitoring
The site does not require continuing active mangement	No additional site surface water management required	Sediment sampling Monitoring of diversion channel condition
	Post groundwater quality is to be consistent with baseline conditions	Groundwater monitoring
	No additional land management	Site inspection and audit of monitoring and management records to determine land management requirements

8. Closure Implementation

8.1. Closure Vision

The overall objective of the Closure Plan is to achieve a post-mining land use that is safe, stable, self-sustaining and non-polluting. The closed Brunswick West TSF and RWP will have a similar land use as to pre-construction, providing pasture and grazing land for livestock.

The tailings capping and rehabilitation system will serve the following purposes:

- Provide a stable surface and embankments, such that it is protected from ongoing erosion and is environmentally and geotechnical stable for > 1000 years;
- Limit rainfall infiltration into the tailings to prevent contaminated outflow of water from the facility by providing a capping surface graded towards the outer embankments (minimum 5%);
- Allow for successful revegetation with pasture vegetation, utilising topsoil stripped during the TSF construction phase;
- Limit salt rise from the tailings to the topsoil surface (capillary break) to allow successful colonisation of pasture vegetation; and
- Allow for minimal and ideally no ongoing supervision.

8.2. Closure Schedule

Formation of the closure landform is generally undertaken to ensure long term stability of the TSF, and to minimise surface erosion that can occur without the regular maintenance a TSF would experience during operation.

Table 5 provides an indicative timeline of the phases of closure and rehabilitation planning, implementation and monitoring.

The program is provisional and may be subject to change resulting from a wide range of potential factors. The program is to be reviewed and updated regularly during the life of the TSF.

Table 5. Closure Schedule.

Phase	Timetable	Summary of Activities	Closure Plan	Closure & Rehab Designs	Closure Costs
Approvals	Pre- Operation	Initial Closure Planning and Design	Preliminary Closure Plan (this plan) Initial stakeholder engagement and post-closure land use assessment	Closure concept	
Operation	2nd year of operation to LOM	Detailed Closure Planning and Design	First Draft detailed Closure Plan Stakeholder agreed post-closure land uses First Draft detailed Care and Maintenance Plan	Outline closure design	Prepare robust closure costs esimate in the 2nd year of operation
	Current LOM	Vegetation and cover trials	Annual review of Closure Plan including Risk Assessment Trials, investigations and monitoring	Iterations to designs with new innovations in closure design, emerging data and amendments to mining plans and activities	Annual review of costs in response to updated designs
Pre Closure	6 months pre-closure	Develop tender documents and procure contractors for closure activities Pre closure surveys	Final detailed Closure Plan	Finalised closure design	Finalised costs
Decommissioning and Closure	2 years post closure	Capping/covering of TSF Removal of RWP Creation of closure landform Decommissioin decant infranstructure and associated piping	Full implementation of Closure Plan Annual review of Closure Plan Audit of closure completion	Audit of design implementation	
Rehabilitation	5 years post closure	Soil conditioning Weed control			
Post-closure	10 years post-closure	Weed control Monitoring and maintenance of reabilitation areas			

8.3. Closure Assumptions

In the development of this Closure Plan, the following assumptions have been made:

1. The conditions at the end of filling will be as modelled in the Design Report (ATCW, 2023), such that a minimum of 500mm freeboard is maintained between the embankment crest and tailings head of beach, and the tailings surface will develop the beach slopes (1.5% for 50m, 0.6% runout) adopted for the design;
2. The tailings will be dewatered with the removal of as much water as is practical using the existing pumping system;
3. The tailings surface will form a desiccated crust capable of supporting tracked construction plant, permitting the relatively straight forward placement of a cover over the tailings using suitable site sourced materials, generally requiring a minimum of 15 kPa in the upper 3 – 5m of tailings deposit to support light weight earthmoving equipment.
4. The tailings will continue to remain as inert and Non-Acid Forming (NAF) tailings so that a relatively straight forward self-shedding cover to contain and isolate the tailings is adequate.

It should be noted that as part of the Bombay TSF raise 4 design, in-situ strength testing was undertaken on the tailings less than 1 year after deposition ceased. Shear vane and CPTu traces found a minimum shear strength of around 8-10 kPa in the upper few metres of the deposit, with the tailings surface readily trafficable by foot. Given no material change is expected in the tailings properties and similar deposition methodology will be used, it is expected that the Brunswick West TSF tailings will have formed a suitable strength crust within 2-3 years after ceasing deposition.

As part of the Brunswick West TSF design, the embankment downstream batter slopes will be constructed to 4:1 (H:V) slopes, covered with a minimum of 300mm of topsoil and seeded with pasture grasses to promote vegetation growth. The primary intention of this has been to address the visual amenity of the site that will come with construction of a ~15 metre high TSF and removal of previously planted trees along the Brunswick site perimeter, as well as to reduce the amount of topsoil required to be stockpiled. Further, construction of 4:1 closure batter slopes have been chosen as a typical closure slope for an embankment of this height (up to 15m). Construction of the embankment batters to their closure profile will also minimise the closure works required at the end of life of the facility.

8.4. RWP Decommissioning

Once the Brunswick West TSF, as well as the Bombay TSF and Brunswick TSFs have been capped and closed, the external RWP will no longer be required to provide contingency storage for the TSF, and the RWP can be removed.

The RWP would be decommissioned by removing stored water and re-grading the embankments to ensure water cannot be stored and provide a more natural landform. This would consist of the following activities:

1. Removal of the HDPE liner, pipelines and pumps.
2. Removal of Zone S material and Geotextile from emergency spillway and clean water diversion drains surrounding the RWP.
3. Demolish the external RWP embankments.
4. The excavations of the external RWP impoundment and clean water diversion drains surrounding the RWP will be backfilled to 0.5m below previous natural surface level.
5. Backfilling will utilise Zone 1B material won demolishing the RWP embankments, and remaining Zone 1B material will be used for TSF closure.
6. Replacement of 0.5m of topsoil over the previous external RWP and toe drains area to match the previous topography of the area.

8.5. TSF Decommissioning

This section presents the conceptual TSF closure plan. Details regarding the staging and construction of closure will be subject to detailed assessment and design.

The stages of decommissioning the TSF are expected to be as follows:

1. Re-profiling of the final tailings surface and embankment batters to prevent ponding and facilitate surface runoff. This will likely require a final campaign of targeted tailings deposition to infill any significant depressions and to move the decant pond towards the southwestern embankment where the spillway can discharge to the Return Water Pond. In addition, "mud farming" or "tailings improvement" may be required in advance of closure to provide a higher strength surface for the cover system.
2. Construction of a cover over the TSF.

3. Constructing drainage channels at locations of concentrated flow to collect clean rainwater that falls within the TSF and discharge it to the environment without erosion of the TSF.
4. Revegetating the surface of the cover with pasture grasses to stabilise the cover surface and assisting in the removal of water stored within the cover.

Cover trials for the TSF will likely be a requirement in lead up to any closure to optimise the design and thickness of the cover required. This could include trialling of synthetic liners to help reduce the requirement for clay and benign rock material, and further reduce net percolation.

As tailings will be deposited sub-aqueously, progressive rehabilitation of the tailings surface will not be possible, further investigations, trials and design will be prepared when closure of the TSF is imminent.

The current cover design for the upper surface of the TSF is conceptual only and will be refined as further information becomes available from current and future technical investigations. The concept is to provide a cover comprising an earth fill water shedding system, utilising various on-site materials, including excavated waste rock from the underground mine and topsoil stripped and stockpiled during the construction stage.

The conceptual closure landform will have the following attributes:

1. A domed (convex), self-shedding cover with a 5% grade.
2. The cover layers will comprise a low permeability earthfill material , overlain by inert (i.e. non-acid generating) earthfill and weathered rockfill, and a final layer of topsoil to support revegetation.
3. The low permeability earthfill material will be placed directly over the tailings surface and will be:
   a. A minimum thickness of 0.5m at the perimeter embankment, and increase in thickness over the tailing surface towards the centre of the TSF to form a minimum 5% grade from the centre of the TSF towards the perimeter embankment,
   b. The earthfill material will connect to the Zone 1B subgrade and BGM liner around the entire perimeter of the TSF to fully encapsulate the tailings,

c. The increasing thickness of the earthfill material towards the centre of the TSF is designed to support a revegetated surface without vegetation intercepting the tailings below.

4. The earthfill and weathered rockfill will be placed over the low permeability earthfill material to a minimum thickness of 0.5m and matching the underlying 5% grade of the landform.
5. The topsoil material will be placed over the earthfill and weathered rockfill to a nominal thickness of 300mm to match the topsoil thickness on the batter slopes.
6. The decant structure will be decommissioned by removal of the pumping infrastructure and grouting the decant pipelines.
7. The emergency spillway will be retained as a drainage structure outlet, with a longitudinal drain to be formed through the centre of the landform to aid in the control of surface runoff.

The TSF closure concept plan cover system layout and sections are presented in Appendix C and D respectively.

Formation of the initial cap to support the closure landform is dependent on achieving sufficient shear strength (generally a minimum of 15 kPa) in the upper 3 – 5m of tailings deposit. It is expected that the Brunswick West TSF tailings will have formed a suitable strength crust within 2-3 years after ceasing deposition to support the placement of the initial cap.

Refinement of the conceptual design will be based on the continuation of further investigations into aspects such as:

- Chemical properties of the tailings materials (e.g. ARD or neutral mine drainage potential, salinity) to determine the extent of potentially problematic materials and the associated risk of leaching to the environment.
- Tailings physical and chemical properties to assist in understanding the drying and consolidation processes once deposition has ceased.
- Physical and chemical properties of the available cover materials.
- Sensitivity of the receiving environment, baseline groundwater levels and quality.
- Cover modelling and seepage modelling to understand the performance of various cover design alternatives.

- Stakeholder engagement in relation to post-closure land uses, closure objectives and completion criteria.

8.6. Performance of BGM Liner

At the completion of deposition (prior to construction of the landform), the BGM liner will be mostly covered with deposited tailings, with only the remaining upper portion at the embankment crest expected to remain exposed. Once covered with tailings, degradation of the BGM liner can only come from the tailings solids itself, which are not expected to react and chemically degrade the BGM liner and the BGM liner is expected to retain its serviceability in the long term.

The exposed BGM liner above the tailings will not experience significant degradation over the life of the facility. The hydraulic performance of the liner is expected to be maintained for the containment of surface water during the initial closure stage to prevent seepage during this low maintenance phase of the facility.

Post closure (i.e., once the self-shedding landform has been constructed), the long-term seepage losses, and potential for embankment internal erosion, from the facility will largely be dependent on the release of water retained in the tailings from long term consolidation. This consolidation will be driven by the self-weight of the tailings themselves plus the additional overburden weight of the closure landform. As the tailings are expected to experience a significant degree of consolidation during operation, the long-term release of water is expected to be relatively slow and not cause seepage issues against the BGM liner.

8.7. Closure Cover Stability

The stability of the closure system will be assessed to verify the long-term stability of the system with considerations for long term phreatic surfaces that may generate once pumping ceases, reduced material strength parameters of the outer exposed material due to ongoing weathering, and considerations for the Maximum Credible Earthquake.

The 4:1 batter slopes and single stage construction (i.e., no construction over tailings) of the Brunswick West TSF has presented with significant factors of safety against instability. The TSF has a long term static Factor of Safety (FoS) of 3.0, and a Post Seismic FoS of 2.1. These assessments considered zero tailings strength and a very high phreatic surface through the embankment as a result of liner failure and pooling of rainfall runoff from extreme storm events.

At closure, the embankment section will have an additional 1-3 m of earthfill and rockfill material providing driving weight. To allow for construction of the landform, the tailings will be required to have sufficient shear to support the overburden weight of the landform (typically a minimum of 15 kPa). The phreatic surface through the tailings and embankment is expected to be down to natural levels due to no deposition. Based on the above factors, it is considered that the long-term closure FoS for the embankments are likely to be in line, if not higher, than those estimated for the worst case operational scenario for the facility, and would meet the minimum FoS for long term stability.

8.8. Closure Materials Balance

Topsoil will be stockpiled during construction for use during construction as well as for final rehabilitation at closure. The embankments will be constructed to their final downstream closure batter slopes of 4:1 (H:V) and covered with topsoil.

Table 6 outlines the estimated volume of material required to complete rehabilitation. The volume of materials available is outlined in the MRCO Rehabilitation Plan.

Table 6. Closure Material Requirements

Closure Material	Volume
Earthfill	210,000 m^3
Rockfill	31,000 m^3
Topsoil	18,500 m^3

Flood protection bunds constructed to prevent inundation of the Brunswick Underground Portal will only be required while there exists a risk of a dam breach and the Brunswick Underground Portal is still used to provide underground access. These measures are temporary while the risks to personnel associated with the underground are present. Once this risk no longer exists, the bunds will be progressively decommissioned and demolished by excavation to supplement closure activities, such as formation of the TSF closure cap. These bunds will provide 8,500 m^3 of Zone 3B material.

9. Unexpected Mine Closure

If early closure of the facility is expected, the landform can be formed by partial deconstruction of the embankment to the tailings level, and reclamation of embankment materials for backfilling of the impoundment.

The following measures are to be in place to prepare for unexpected closure of mining operations:

- The TSF closure costs are to be updated to provide a detailed allocation of the decommissioning and rehabilitation costs, including a contingency. Any adjustment to the rehabilitation bond will be made based on the updated costs;
- A conceptual Care and Maintenance Plan will be developed. This will provide for making the site secure and safe as well as implementing an accelerated closure process based on the plans within this Closure Plan;
- The TSF has been designed to an appropriate ANCOLD risk category and adherence to relevant design standards for the provision of adequate storage capacity; and
- Sufficient freeboard allowance is to be maintained to prevent overflow from the TSF in high rainfall conditions.

In the case that unexpected or sudden closure is considered permanent, the closure and rehabilitation strategies proposed in the MRCO Rehabilitation Plan are likely to still remain applicable and will be implemented. The TSF capping strategy will be implemented (once confirmed through technical investigations and agreed with relevant stakeholders).

10. Monitoring and Maintenance

10.1. Operational Monitoring

Monitoring undertaken during operations will provide data to help refine the Closure Plan. Data gathered during the implementation of the Environment Management Plan is to be retained in a manner that allows easy access for closure design purposes.

Various trials and investigations undertaken to inform closure planning (Section 5.2) are to be monitored and results used to refine closure design and planning.

10.2. Post-Operational Monitoring and Maintenance

The post-closure phase is to include a program to monitor the effectiveness of rehabilitation and closure and the achievement of closure criteria (Section 7.2).

Post-closure monitoring is to include assessments of public safety, geotechnical stability, physical stability, chemical stability and revegetation success.

A preliminary monitoring program is outlined in Table 7. Further details of the monitoring location, frequency and parameters is to be included in future revisions of the Closure Plan.

For consistency and continuity many of the monitoring parameters and locations will be the same as during operation.

Following the end of operations, an agreed monitoring program is to be implemented, that will span the closure and rehabilitation phases. The program is to analyse performance and progress against the completion criteria.

The need for any ongoing monitoring is to be reassessed as required.

Table 7. Post-Closure Monitoring Program.

Discipline	Parameter	Approach	Frequency
Meterological Data	Rainfall, evaporation, wind and temperature	Maintain weather station post closure	Continuous
Surface Water	Surface water flows	Use existing surface water mointoring locations	During periods of flows
	Surface water quality in water courses	Use existing surface water mointoring locations	During periods of flows
Groundwater	Groundwater quality Physical and chemical parameters Groundwater site specific trigger values established for assessment purposes	Sampling groundwater monitorng bores Visual inspections of seepage	Six-monthly
	Groundwater levels	Groundwater monitoring bores	Six-monthly
Stability	Physical condition of embankments Erosion	Survey pins Drone surveys TSF inspections	Quarterly
Ecological	Revegetation Pasture establishment, cover and weeds	Ecological surveys and drone surveys	Annual
	Surface soil conditon assessment and erosion	Rehablitation monitoring and assessment	Annual

10.3. Post-Closure Monitoring and Maintenance

Access to the TSF post closure will be provided via the Brunswick site access road (i.e. 1091 Heathcote-Nagambie Road). The TSF will be fenced to incorporate it into the

Brunswick site and thus access to the TSF will be provided by the Brunswick access control system.

Where post closure monitoring identifies failure to meet completion criteria or predictive trends, the causes are to be investigated and where practicable, alternate remediation determined and implemented.

10.4. Post-Closure Reporting

Reports detailing the monitoring results are to be issued along with the relevant governing authorities. The reports and monitoring will be completed by suitably qualified individuals.

The completion criteria and monitoring program may change as research and development findings and monitoring trends emerge.

10.5. Rehabilitation Audit

Prior to relinquishment, a Rehabilitation Audit is to be completed to assess the achievement of the completion criteria. The results are to be provided to ERR for consideration as to whether the site can be relinquished.

11. Financial Provision for Closure

In accordance with the MRSD Act, MRCO will lodge an updated rehabilitation bond with ERR. The amount of the bond has been calculated using the applicable rates within the current version of the ERR bond calculator (ERR 2021a), released on 16 March 2021. The completed bond calculator for the TSF will be submitted separately from this Closure Plan.

The Brunswick West TSF will add $1.4M (not including Third Party Project Management & Contingencies) to the total estimated rehabilitation liability for MIN4644.

Liability calculations will be reviewed and updated at least annually so that adequate and accurate financial provisions can be made during the operational phase of the TSF and to prevent the MRCO, current or future land owners or the community from facing unexpected or unacceptable liability.

Key risks and knowledge gaps will continue to be addressed to improve the accuracy and certainty in relation to the closure strategies and the associated liability estimates. The accuracy of the liability estimate over time should continue to improve.

12. References

Central Highland Environmental Consultancy (2023), "Native Vegetation Removal Report (Intermediate Assessment Pathway), Assessment of native vegetation removal for the proposed construction of Brunswick West Tailing Storage Facility and Flood Protection Bunds to protect Brunswick Underground Portal", 1 March, Version 3.

ATC Williams (2023), Mandalay Resources Costerfield Operations Costerfield Gold Mine, "Brunswick West Tailings Storage Facility Investigation and Design – Detailed Design Report", Reference 109014.15-R04-Rev 3, March 2023

ANCOLD (2019), "Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure", Australian National Committee on Large Dams, July 2019.

VIC ERR (2017), "Technical Guideline Design and Management of Tailings Storage Facilities", Victorian Government Department of Jobs, Precincts and Regions Earth Resources Regulation, April 2017.

WSP (2023), "Brunswick West Tailings Storage Facility Ground water Assessment", Reference PS134675-WSAP-MEL-MNG-REP-00003 - Rev A, March 2023.

Appendix A – Information on TSF

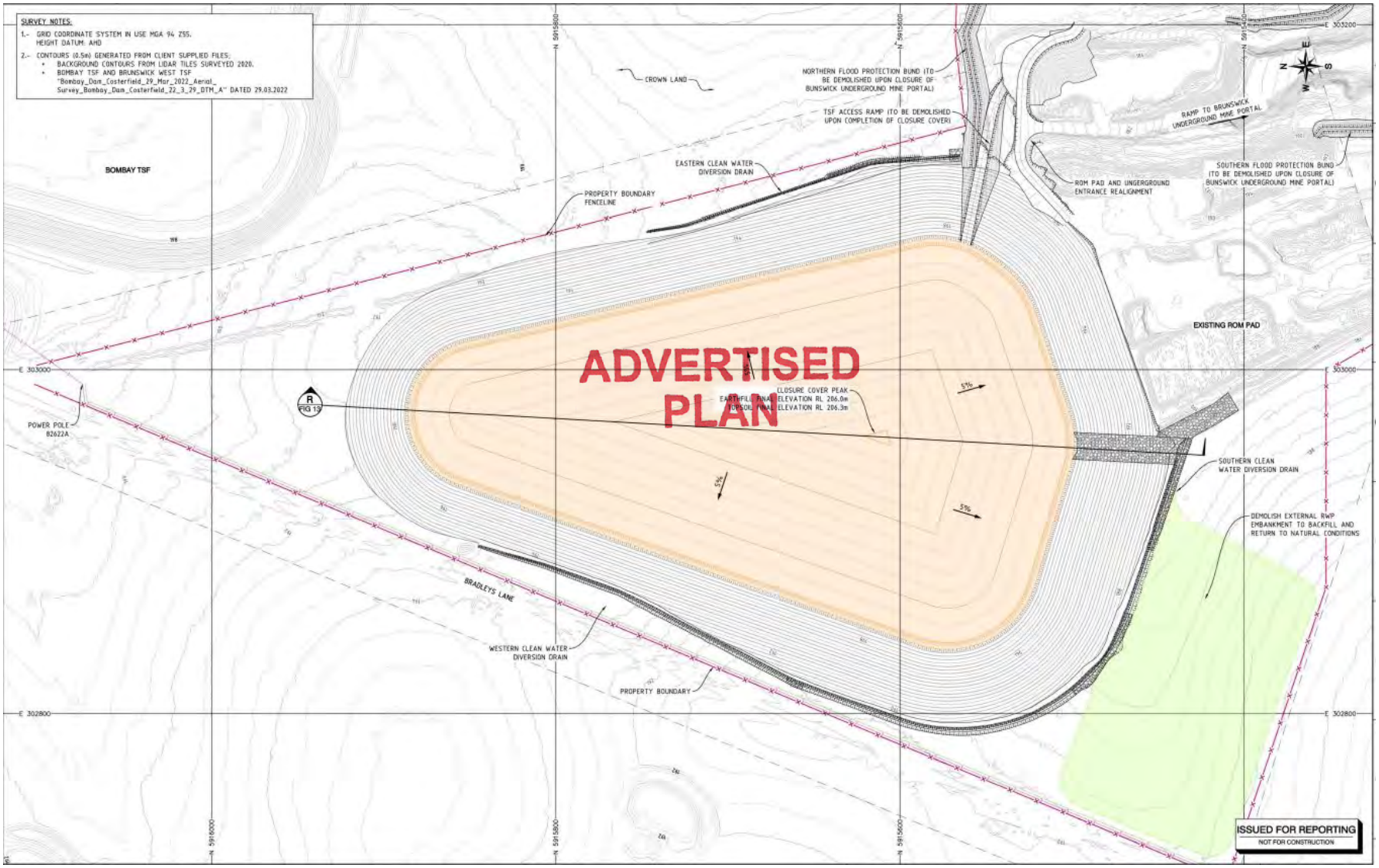
Section	Item	Description
General Information	Name of Dam	Brunswick West TSF
	Location (include road name)	200 Bradleys Lane, Costerfield VIC 3523
	Map Reference	VicRoads Ref 45 E8
	Period of Original Construction	Not yet constructed
	Water course	N/A
	Hazard Category (ANCOLD)	High B
	Population at Risk	25 people
Resevoir	Tailings Storage Capacity	584,000 m3
	Catchment Area	6.1 Ha (no waterway flows into TSF)
	Maximum Opertion Pond	14,000 m3
	Extreme Storm Storage Allowance	11,000m3
	Contingency Feeboard	0.3 m
	Contingency Volume	19,000m3
	Full Supply Level (Spillway Crest Level)	199.5 mAHD
	Full Supply Volume (Spillway Crest Level)	628,000 m3
Dam/Embankment	Type of Dam (material)	Earthfill with Synthetic Liner
	Embankment Height (max)	14.5m downstream slope, 20m upstream slope
	Embankment Length	980 m
	Embankment Crest Elevation	200 mAHD
	Upstream Slope of Embankment	2 Horizontal: 1 Vertical
	Downstream Slope of Embankment	4 Horizontal: 1 Vertical
	Embankment Crest Width	6m
Spillway/Outlet Works	Description of Spillway (material etc)	Concret cut-off with rock armoured outlet
	Location of Spillway	South section of embankment
	Full Supply Level (Spillway Crest Level)	199.5 mAHD
	Width of Spillway Crest	6m
	Existing Spillway Capacity	2.19 m3/s (Peak Outlflow) & 0.29m Peak Flood Height
	Dam Crest Flood	Probable Maximum Flood (PMF)
	Description of Outlet Works	Pump from decant structure to RWP
	Location	South-west embankment
	Capacity	0.015 m3/s
	Details of Operation	Operated by float controls

Appendix B – Closure Risk Assessment

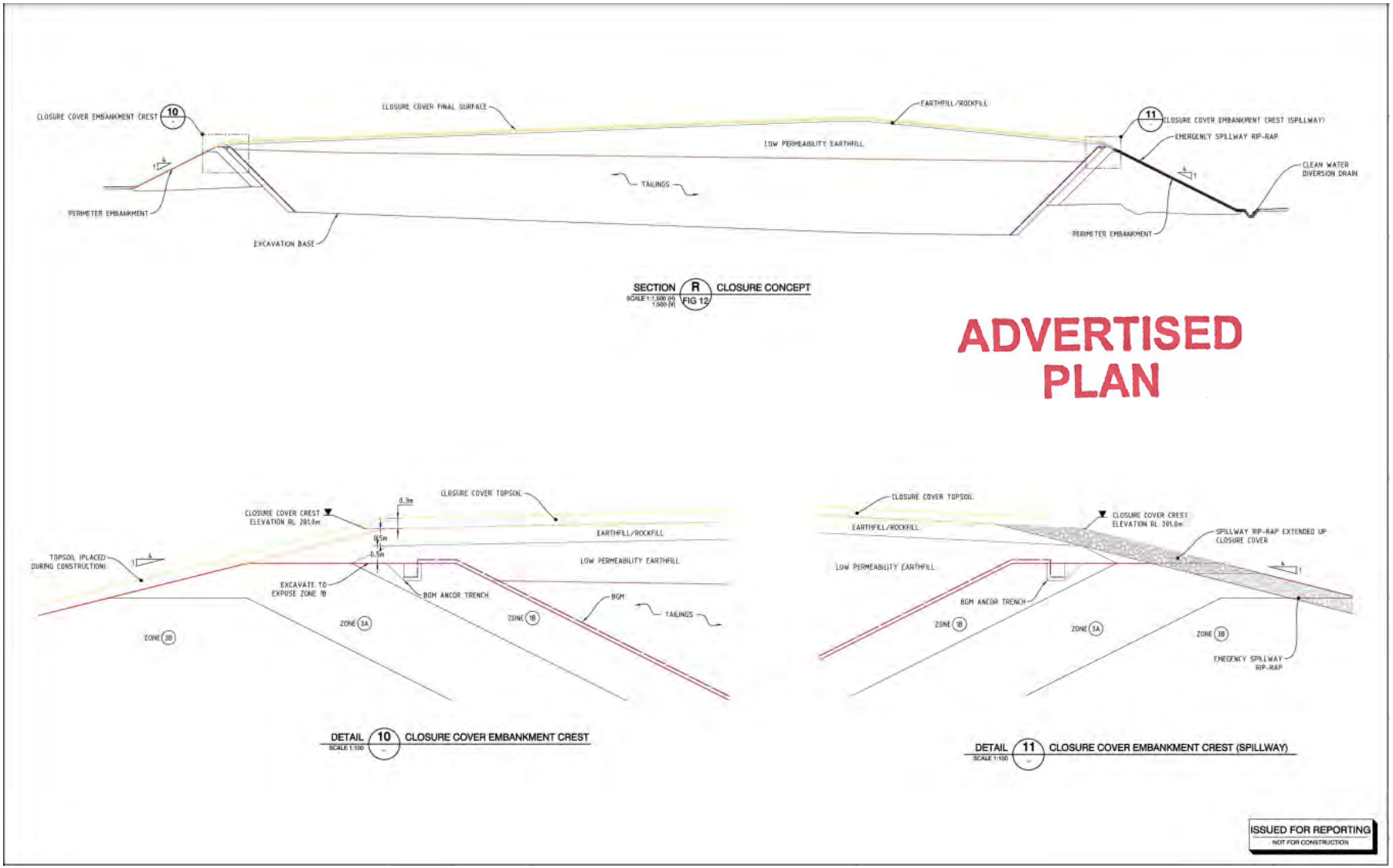
Client	Mandalay Resources Costerfield Operations
Site	Costerfield Gold Mine
Project	Brunswick West Tailings Storage Facility
Job No.	109014.15
Title	Design, Construction and Operation Risk Register
Prepared by	Alex Campbell (ATCW), Shannon Green (MRCO)
Date	31-Oct-2022

Reference	Phase	Identified Hazard or Risk	Hazard/Risk Event	Causes	Potential Impacts	Will this lead to catastrophic failure of the TSF?	Risk			Control Measures	Residual Risk		
							Likelihood	Consequence	Classification		Likelihood	Consequence	Classification
Clo1	Closure	Tailings left exposed on closure	Future dust loss/contaminated surface water runoff Unhabitable habitat for future land use	Poor execution of closure plan Poor landform design	Substantial impact to the environment	No	C	3	13	Closure plan includes a cover system and vegetation plan Closure plan to be reviewed prior to closure works commencing Sufficient thickness of inert soils allowed for tailings cover Survey to be undertaken of final tailings surface and top of capping layer to measure thickness of cover soils	E	3	6
Clo2		Root penetration through capping system	Penetration of cap by vegetation roots	Vegetation establishes on landform	Measurable but limited impact to the environment	No	D	2	5	Vegetation to be pasture Sheep grazing will remove any tree suckers Post closure monitoring to identify the establishment of any trees/shrubs and remove	E	2	3
Clo3		Suitability of cover soils	Unsuccessful revegetation	Cover soil not suitable Landform design inadequate	Substantial impact to the environment	No	D	2	5	Use of stockpiled topsoil from site Closure plan including cover system and vegetation plan to be refined as closure approaches Engage speciality consultant to aid closure planning process	E	2	3
Clo4		Unforeseen deterioration of liner	Failure of liner	Undocumented placement of contaminated material in TSF	Substantial impact to the environment	No	C	3	8	Annual surveillance of TSF by independent dam engineer Tailings Dam operating, maintenance and surveillance manual to be created and followed Closure plan to be reviewed prior to closure works commencing	E	3	6
Clo5		Future unsuitable land use proposed	Rehabilitation disturbed	Change in ownership	Measurable but limited impact to the environment	No	C	2	8	S173 agreement to set out future restrictions for future development of the land	E	2	3
Clo6		Erosion	Failure of terminal slopes	Landform design inadequate High rainfall event during rehabilitation establishment	Substantial impact to the environment	No	D	3	9	Slopes to be constructed to terminal slopes on initial construction to aid trials during operation of the facility	E	3	6

Appendix C – Closure Layout Plan Section



Appendix D – Closure Section and Details



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