BLUESTONE MINES TASMANIA JOINT VENTURE PTY LTD

Permanent Non-Acid Forming Aggregate Storage Facility

Renison Operations

26th October 2020

Final

Notice of Intent

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ABBREVIATIONS

ASF	Aggregate Storage Facility
BMTJV	Bluestone Mines Tasmania Joint Venture
CCL	Compacted Clay Liner
COVA	COVA Thinking Pty Ltd
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMPCA	*Environmental Management and Pollution Control Act* 1994
EPA	Environmental Protection Authority
EPBC	*Environment Protection and Biodiversity Conservation Act* 1999
EPN	Environment Protection Notice
FMEA	Failure Modes and Effects Analysis
H	Horizontal
HDPE	High Density Polyethylene liner
HMS	Heavy Media Separation
LUPAA	*Land Use and Planning Approval Act* 1993
NAF	Non-Acid Forming
NMD	Neutral Metalliferous Drainage
NOI	Notice of Intent
PAF	Potential Acid Forming
SO_4	Sulphate
T	Tonnes
TSF	Tailings Storage Facility
UC	Uncertain
UG	Underground
V	Vertical

1. INTRODUCTION

1.1 The Proponent

The Proponent, Bluestone Mines Tasmania Joint Venture Pty. Ltd. (BMTJV) operates as a joint venture between Metals X Ltd and YT Parksong Australia Holding Pty Ltd. In summary, BMTJV:

- Acquired the Renison Tin Mine in 2004;
- Completed refurbishment works before recommencing operations in 2008;
- Operates the Renison Tin Mine in accordance with the requirements of Environment Protection Notice (EPN 7092/2); and
- Has an approved Mine Closure Plan for the Renison Tin Mine operation, which includes provision of financial assurance for use in the event of closure.

The person lodging the application and key contact person for this Proposal is:

Mark Recklies
General Manager
Bluestone Mines Tasmania Joint Venture Pty Ltd
PO Box 20
Zeehan TAS 7469

ABN: 35 141 265 974
Phone: +61 3 6473 2618

It is stated herein that the body of persons that manage BMTJV operations at the Renison Tin Mine site and person lodging on behalf of BMTJV:

- have not contravened obligations under the *Environmental Management and Pollution Control Act* (EMPCA) 1994 and *Land Use and Planning Approvals Act* (LUPAA) 1993 (e.g. failing to comply with environmental conditions or restrictions imposed under the Acts or subordinate regulations and permits issued under these Acts); and
- have they been convicted of an offence against *EMPCA*, or other Tasmanian regulation that relates to protection of the environment.

1.2 Name and Objective of the Proposed Project

The project is known as the 'Permanent Non-Acid Forming (NAF) Aggregate Storage Facility (ASF)'.

In brief, the proposal outlined in this Notice of Intent (NOI) is to obtain approval for:

- a change in operation of the existing ASF located at Renison Tin Mine from a trial to a permanent NAF surface storage facility;
- adoption of an alternative filling program and progressive covering to closure design which will minimise water and oxygen ingress, minimise neutral metalliferous drainage (NMD), improve water quality of seepage from the ASF and improve control of stormwater runoff within the ASF footprint; and

- continued operation of the permanent ASF in accordance with an updated Environmental Management (and Progressive Closure) Plan or Environmental Impact Statement (as deemed appropriate by the EPA).

The total cost of continuing to operate the permanent ASF with progressive filling and covering design is estimated to be $1,560,000.

1.3 Location of Proposed Project

The Renison Tin Mine is situated within consolidated mining lease 12M/95, 136 kilometres (km) south of Burnie and approximately 16 km north-east of the township of Zeehan on the West Coast of Tasmania.

The existing clay-lined trial ASF is situated immediately adjacent to the Renison Tin Mine processing plant. The footprint used for the trial ASF will continue for the permanent facility (i.e. there will be no change in size).

2. OVERVIEW OF THE TRIAL ORE SORTER AND ASF

2.1 BMTJV Strategic Plan

BMTJV's original operation returned all waste rock from the processing plant to underground (UG) for disposal, with some NAF material going to tailings storage facilities (TSFs) as necessary.

Since BMTJV has implemented its strategic plan to increase its underground mine production by 190,000 Tonnes (T) of additional ore up to a maximum of 1,500,000T per annum, this waste rock disposal method is no longer viable operationally or financially.

2.2 EPA Approved Ore Sorter and Trial ASF

To support BMTJV's strategic plan, approval for the installation of a new crushing and sorting facility (hereafter referred to as the 'ore-sorter') was sought from the Environment Protection Authority Tasmania (EPA) in 2017 and approval was granted.

Since that time, the ore sorter has been operated under the requirements of the existing EPN 7092/2 for the Renison Process Plant operation.

In addition, the EPA issued EPN 9937/1 in 2018 which applies to the trial of a temporary surface waste rock storage facility on the Renison site. The trial facility aimed to improve waste rock management. The improved measures included:

- Pre-concentration of Process Plant (mill) feed via the removal of barren, waste rock;
- Segregation of the waste rock generated into NAF and potentially acid-forming (PAF) aggregate;
- Temporary stockpiling of NAF material on the surface within a dedicated, lined facility (constructed within a surface void adjacent to the Renison Process Plant); and
- Return of PAF material to UG for disposal.

2.3 Overview of the Completed Trials

The ore sorter equipment and adjacent trial ASF were established and operated effectively during the trial period (July 2018 to August 2019), as well as the interim period (August 2019 to the present date).

The ore sorter was, and continues to be, operated in accordance with the *Ore Sorter Environmental Management Plan* (BMTJV, 2017).

The trial ASF was and continues to be operated in the interim in accordance with the Environmental Management Plan: Non-Acid Forming Aggregate Storage Facility (BMTJV, 2017). The trial ASF:

- Was developed within an existing void adjacent to the Renison Process Plant;
- Was constructed with a compacted clay liner (CCL), surface water run-off diversion channels and seepage drainage system, which discharges into the existing Crusher Dam water management facility; and
- Currently contains approximately 130,000 T of NAF aggregate, generated during the trial period.

2.4 Trial Findings and Potential Issues of Concern

The ore sorter trial ascertained that the equipment was able to consistently sort NAF and PAF materials into separate waste material streams, with an acceptable built-in safety margin. BMTJV is looking at ways to fine-tune the ore sorter parameters which may allow for improved sorting which could also result in a reduction in the potential for NMD and metal mass loads in trial ASF seepage.

Water quality for the trial ASF seepage collected from the stockpiled NAF material has been identified as being unlikely to be acidic in nature and to have potential for NMD generation.

Based on ASF trial findings, further improved cover and water management measures should be implemented to reduce the volume of stockpiled NAF material exposed to rain in order to minimise the potential generation of NMD if the trial ASF continues to be operated.

If this method of surface storage is deemed to be unacceptable for managing NAF material in the longer term, further capacity for waste rock disposal will be required UG, within the D-Dam TSF, and/or at an alternative surface disposal facility.

The backfilling of large quantities of waste rock from the surface to UG for disposal (as was the practice prior to the trial) is:

- Less financially viable due to excessive haulage distances associated with extension of the mine into deeper levels;
- Limited by a general lack of suitable voids, as all current voids are being filled on a continuous basis with development material, which is in most instances PAF; and
- Still likely to require a surface disposal facility near the end of mine life, as extracted rock will not be able to be accommodated UG.

3. DESCRIPTION OF THE EXISTING ENVIRONMENT / TRIAL ASF

3.1 Original Site Conditions and Existing Trial ASF Footprint

The existing footprint of the trial (and interim) ASF is shown with a white line in Figure 1. It is situated close to the Renison Process Plant operational area and ore sorter, with the head of ASF constrained on the upstream side by the Upper Crusher Dam and the ASF toe on the downstream end (northern end) by the Lower Crusher Dam.

Figure 1: ASF footprint (white line) and proximity to existing operational areas (LISTMap, 2020)

The trial ASF has been designed to lie within an existing void formerly occupied by the Waste Rock Holding Point, Heavy Media Separation (HMS) Scats and Federal Tailings stockpile. These legacy waste materials were excavated and relocated to D-Dam during 2017 and early 2018 as part of improved environmental management of the site the redevelopment of the void for use as the CCL lined Trial ASF.

Following cartage of legacy PAF HMS Scats and Federal Slimes Dam Tailings to D-Dam in 2017/18, the void created was surveyed by BMTJV in March 2018 and was calculated to provide a maximum volume of approximately 627,000m^3. The resulting void has capacity for approximately five (5) years of Ore Sorter production within the trial ASF (i.e. to 2023).

3.2 Key Physical Features of the Existing Trial ASF

In brief, the key physical features of the existing trial ASF design are shown in Figure 2 (GHD, 2018) and summarized below:

- Constructed within an existing void with a lining on the base and side walls comprising 300mm of compacted low permeability clay material (with a push tube test permeability of less than 2.4×10^{-10}m/sec);
- Constructed with perimeter diversion coarse rock drains on the eastern and western sides of the facility to hydraulically separate and minimise the amount of rainfall run-on, legacy seepage and groundwater from entering the ASF; and
- Constructed with a drainage system within the base of the ASF to collect seepage and allow drainage from a pipe at the toe of the ASF for discharge into the nearby Lower Crusher Dam;
- Commencement of filling in the base of the ASF using vehicular dumping methods (end tipping of NAF from the ore sorter in a north-easterly direction is to commence once a base covering has been established to protect the CCL).

For further description of construction, filling and operation of the trial ASF refer to Tables 1 and 2.

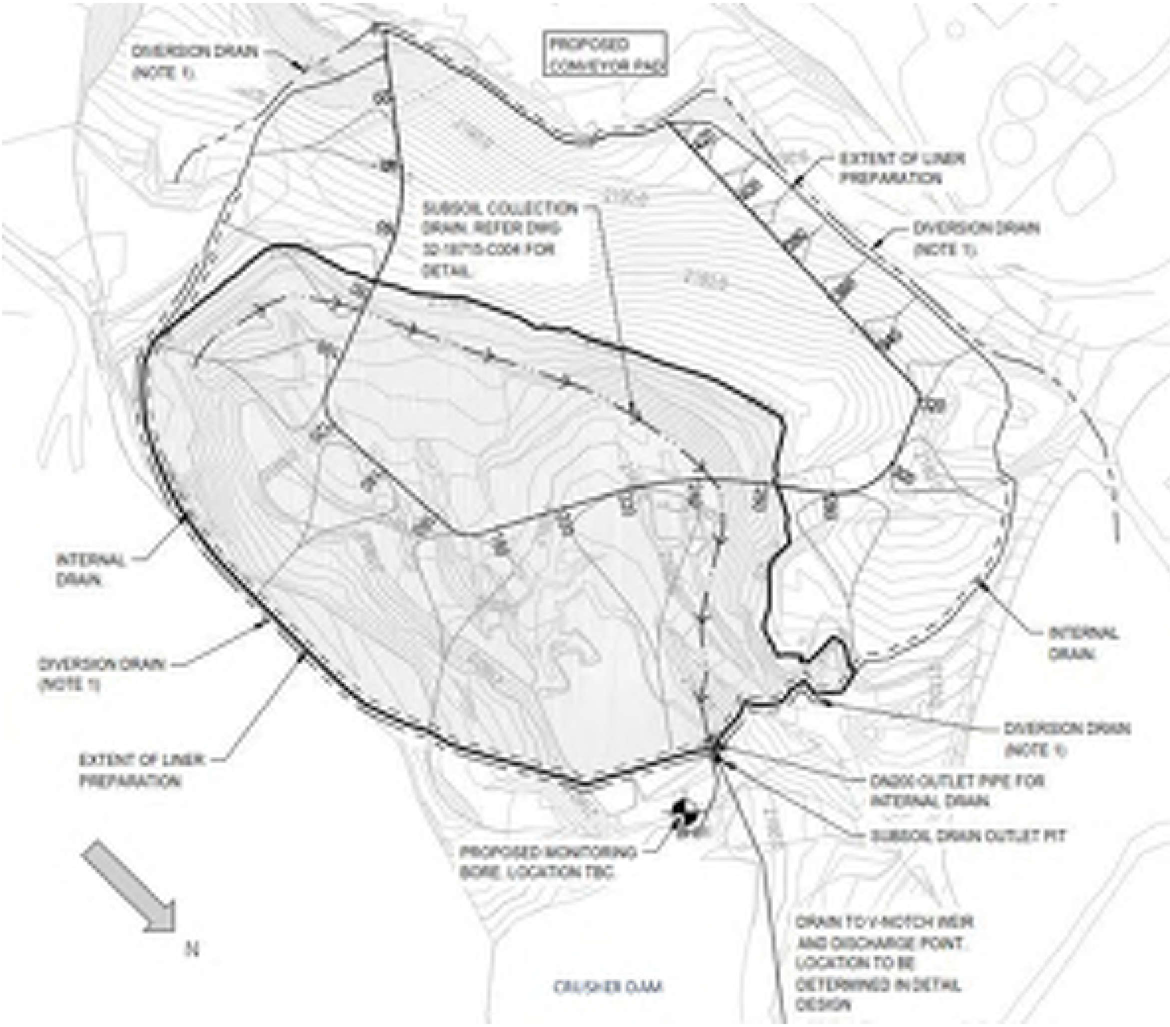


Figure 2: Design features and arrangement of the Trial ASF (GHD, 2018)

3.3 Trial ASF Construction and Filling to Date

Figures 3 to 5 provide a pictorial description of the ASF construction works completed to date.

Figure 3: Trial ASF basal CCL works completed (July, 2018)
(Crusher Dam is visible at the toe of the Trial ASF in the background)

Figure 4: Commencement of NAF stockpiling operations (August, 2018)

Figure 5: Extension of the basal CCL on the eastern side and filling progress (August 2019)

4. OVERVIEW OF THE PROPOSED PERMANENT ASF

4.1 Objective of the New Permanent ASF Conceptual Design

The main objective of the conceptual design for the permanent ASF is to address concerns regarding NMD generation impacting seepage water quality and presenting an unacceptable environmental risk to the receiving environment during the trial ASF (and interim) operational period.

This objective will be achieved through implementation of management measures in the design to mitigate potential environmental impacts during the operational, closure and post closure phases of the permanent ASF, including:

- Development of proposed closure objectives to drive design and allow for clear assessment and evaluation of the performance of the permanent ASF;
- Development of progressive construction, covering and a rehabilitation method which is staged to limit the volume of NAF aggregate exposed to rainfall at any one time and resultant mobilisation of contaminants;
- Design of a conceptual cover system for progressive placement in stages to limit net percolation (NP) and manage the risk of NMD impacted seepage (reducing NP to <10% rainfall);
- Design of a final landform shape (and surface water management system) with batter profiles and surface materials that resist erosion and support vegetation establishment;
- Design the closed landform to have:
    - an improved visual amenity; and
    - not require ongoing maintenance and expenditure above that normally required for an area of similar land use.
- Expansion of existing monitoring programs to enable collection of usable data to valid design, trigger adaptive management plans and action response plans (as necessary), with ultimately to demonstrate achievement of closure objectives and criteria during covering through to post closure phase (Okane, 2020c).

4.2 Operations That Will Continue Predominantly Unchanged

NAF waste rock material has continued to be stored within the ASF beyond the original trial period, with the implementation of the same accepted management measures.

The transition of the facility from a trial to a permanent operation is not expected to result in any notable operational changes. The following existing trial operational practices and features will continue unchanged:

- Current production level of 1,500,000 T (as approved under EPN 7092/2);
- Operating hours;

- Infrastructure or services on site;
- Existing ASF footprint (there will be no increase in area);
- Existing CCL in the base and on the walls of the ASF (there are no extensions needed);
- Locations of existing surface water and groundwater monitoring points;
- Surface and groundwater monitoring programs;
- Generation of dust or noise emissions associated with ASF operation;
- Operational batter slope (based on the angle of the NAF materials angle of repose) of 1 vertical (V) to 3 horizontal (H);
- Maintenance of 2% fall from the crest of final surface batters back to the Process Plant ground level;
- Vehicular movements within, to, or from site;
- Staffing arrangements; and
- Usage of infrastructure or services in local towns.

4.3 Changes to Existing Operations and New Operations

The main change associated with making the operation permanent will be the **implementation of an alternative (staged) progressive filling, covering and rehabilitation program**.

The methods for the alternative program have been designed to address the findings of a Failure Modes and Effects Analysis (FMEA) for continued operation of the ASF (Okane, 2020a) for improvement of both operational and environmental management of the ASF.

Table 1 compares the existing filling plan under the trial (and interim continued operational period) ASF to that proposed for implementation when operating as the proposed permanent ASF.

The current life of mine plan indicates a ten (10) year life of the trial ASF based on ore reserves, this projects out to a 15-year plan (i.e. to 2035) for the permanent ASF when indicated and inferred resource conversion is taken into account.

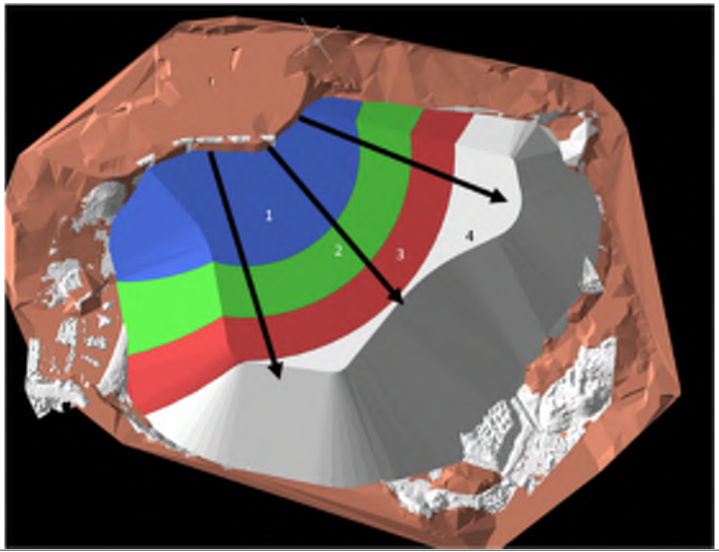
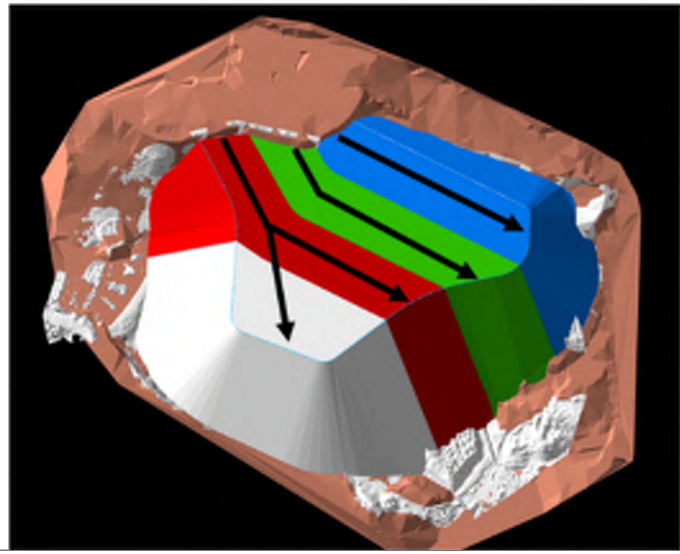
5. COMPARISON OF THE TRIAL AND PROPOSED PERMANENT ASF

This section presents the trial and proposed permanent operational information in tabular form to allow direct comparison and easier identification of design, operational and environmental management changes.

BMTJV intend to construct and operate the permanent ASF as outlined in the conceptual design supplement report and drawings in Appendix A (Okane, 2020c).

5.1 Comparison of Filling Plans

Table 1: Filling plan comparison during trial and permanent ASF operations.
(Tipping zones are represented by different numbers and different colours)

	TRIAL (AND INTERIM) ASF	PROPOSED PERMANENT ASF
		
Documents Describing Filling Operations:	• EPN 9937/1; and • Updated *EMP: NAF ASF* (BMTJV, 2018).	• Updated *EMP: NAF ASF* (BMTJV, 2018); and • *Renison Operations ASF Supplementary Conceptual Design Report* (Okane, 2020c)
Initial Base Filling Operations:	• Vehicular trucking, tipping and spreading of NAF material to build a suitable base to provide a protective layer over the CCL (This is the current stage of filling, Figure 5).	• The base of the ASF will continue to be filled via vehicular trucking, tipping and spreading of NAF material.

	TRIAL (AND INTERIM) ASF	PROPOSED PERMANENT ASF
ASF Void Filling Method	• Following construction of a base, the trial ASF will be filled by end tipping from the existing land surface height at the Process Plant, progressing in a north easterly direction towards the Lower Crusher Dam. • Areas filled to full height will be progressively benched down slope as one large advancing tipping face forming the toe of the ASF (i.e. from Zone 1 at Process Plant land surface level down to Zone 4 adjacent to the Lower Crusher Dam).	• In brief, the same filling methodology will be adopted as outlined for the trial, but in a different filling direction. • Following construction of a base, filling will occur using end tipping of NAF material from the Process Plant conveyor pad on the eastern side of the ASF and/or truck dumping and spreading within the ASF void. • Filling will progress in fingers running parallel to the existing road, with progressive benching as strips are filled to full height, with staging of filled areas (Appendix A).
Fall of Benched Surfaces	• Areas being filled will maintain a top land surface with a 2% fall from the crest of the batters back towards the Process Plant to direct surface water flows to perimeter drains (i.e. away from the exposed face on the toe of the ASF).	• Same as for the trial (Refer to drawings in Appendix A). • Construction of a new perimeter drain at the toe of the ASF to the north to improve surface water management.
Operational Batter Slope	• Establish and maintain operational batter slope of 1 V to 1.3 H will be established (This is based on the estimated angle of repose and NAF material friction angles resulting from end tipping).	• Same as for the trial ASF.
Final Landform Height and Surface	• As shown in the conceptual filling plan above to the final landform height of 2,196 m crest as outline in the updated *EMP: ASF* (BMTJV, 2018).	• Same height as for the trial, with the final landform redrawn to represent the permanent ASF conceptual filling plan (Refer to drawings in Appendix A).
Final Toe Slope	• The toe of the final bench (Zone 4) will be recontoured (dozed) from the operational slope of 1.3 V to 1 H, down to 1 V to 2 H. • The recontoured slope of the toe is to improve stability at closure such that it has a factor of safety greater than 1.5.	• Same final toe slope as committed to for the trial ASF. • Constructed as shown in drawings in Appendix A).

5.2 Comparison of Operations

Further to the filling plan changes described in Table 1, Table 2 provides descriptions of the existing operations under the trial (and interim period) to allow for comparison with the alternative operational program proposed for the permanent ASF.

Table 2: Operational comparison of the trial and proposed permanent ASF.

	EXISTING TRIAL ASF	PROPOSED PERMANENT ASF
Planning	The trial ASF is approved for operation in accordance with: • EPN 9937/1; and • Updated Draft Environmental Management Plan: NAF ASF report (BMTJV, 2018).	Seek permission to operate the ASF as a permanent basis through the preparation and submission of a document to describe the: • Change in operation as part of the assessment process (defined by the EPA) such as an updated EMP or EIS; and • Alternative progressive filling, covering, rehabilitation and closure plan for the permanent ASF.
Ore Sorting	• Ore sorting is undertaken as outlined in the updated Draft EMP: NAF ASF report (BMTJV, 2018).	• Prepare and implement improved ore sorting to provide greater NAF sorting quality assurance and control to: - ensure the amount of PAF waste material being misclassified and placed within the ASF is within acceptable limits; and - facilitate spot checking of material classified as NAF. • Undertake further trials (as discussed in Section 7.1.4) to refine levels for triggering material separation by minerals. (Note: These changes will not substantially alter the nature of material to be managed in the ASF from a contaminant perspective).
Compacted Clay Liner	• The trial ASF has a CCL in place within the base and on the side walls to full height.	• There will be no change to the CCL. • Maintain the integrity of the existing CCL.

	EXISTING TRIAL ASF	PROPOSED PERMANENT ASF
Material Delivery and Vehicular Access	• A combination of end tipping of material off the crest at the Renison Process Plant (Mill) and truck dumping of material within the ASF is adopted. • The vehicular access into ASF is on northern side of the void.	• Continue to use the existing material delivery system and access point while completing the filling of the base. • Establish a conveyor pad adjacent to the ASF for end tipping from Process Plant level. • Maintain a central vehicular access between completed benched levels as the ASF is progressively filled.
Surface Water Management	• Surface water from surrounding areas is diverted around the ASF. • All water from rainfall collected within the ASF sheds towards the discharge point at the lowest point in the north east.	• Construction of a new perimeter stormwater diversion drain on the northern side to improve control (shown in drawings in Appendix A). • As outlined in Table 1, provision of a 2% fall of land surfaces on benches towards the Process Plant. • Establish drainage systems on benched areas to: - Divert surface water away from the exposed material on the working face; - Direct collected surface water towards perimeter drains to the west north west; and - Maintain suitably dry operating conditions for tipping and spreading operations on benches.
Rainwater Ingress and NMD Generation	• The surface of all NAF material stored within the ASF is exposed to rainfall, so uncontrolled water ingress is possible. • Percolation of water through the stockpile results in uncontrolled NMD generation and potential contamination of seepage water as there are no limits to oxidation (coarse aggregate/high advection).	• Provision of progressive cover layers on filled benches to: - reduce the area of exposed stockpile materials, - minimize net percolation (NP) of ingress water, erosion, oxygen ingress, NMD generation; and - ultimately, the volume of surface water contaminated by NMD within the ASF.

	EXISTING TRIAL ASF	PROPOSED PERMANENT ASF
Progressive Covering and Erosion Controls	• No progressive or interim cover and erosion controls were committed to for the trial ASF (i.e. uncontrolled ingress of rainwater into the stockpile).	• Provision of progressive cover over the plateau (bench surface) and outer embankment face on four staged strips (filled to final height) to encapsulate NAF materials. Note: The inner embankment face of the ASF will remain exposed to allow for recontouring to create a suitable final slope for closure. • Construct cover layers using CCL or bituminous material on benches which meet required regulatory and statutory requirements. Constructed as shown in drawings provided in Appendix A. • Develop and adopt quality assurance criteria to allow sign-off of cover layer placement to show regulatory requirements have been met, soil media placed, and revegetation completed using approved species mix.
Final Cover	• Only a final cover layer was to be provided over the entire ASF upon filling to completion (i.e. one cover at end of life only). • No final sign-off criteria have been developed or agreed on.	• Recontour (doze) the remaining exposed inner embankment profiles of the ASF toe material to 1 V to 2 H final slope necessary for safe closure. • Provide a coarse drainage layer and growth medium on the exposed recontoured toe to form a final cover over the entire ASF upon completion of the four filling campaigns for establishment of vegetation. • Provide a course armouring to protect key surface water management structures and final steep embankment face at closure to achieve an acceptable level of erosional performance (in the low to very low range). • Obtain approval for closure of the ASF facility once rehabilitation and monitoring demonstrate satisfactory closure.

Operational Monitoring Programs	• Fortnightly compliance monitoring of flow and sampling for analysis of ASF seepage water quality at the ASF discharge as it releases to the Lower Crusher Dam; • Testing of Lower Crusher Dam discharge water samples for a suite of metals and other water quality parameters in accordance with EPN 7092/2; and • Quarterly monitoring of dedicated downstream groundwater bores to record the groundwater level and water quality changes.	• Continue ASF discharge and GW compliance monitoring. • Develop and implement operational monitoring programs for: - NAF aggregate production and placement rates (production reports); - ASF construction progress (survey); - ongoing geochemical analysis of NAF aggregate (QA/QC program); and - geotechnical stability (health and safety).
Closure and Post Closure Monitoring Programs	• No closure or post closure monitoring programs were developed for the trial ASF.	• Develop and implement closure and post closure monitoring programs for: - cover system placement; - erosion; and - ecology.

5.3 Comparison of Contaminant Storage and Mobilisation

The intention of the progressive rehabilitation approach is to reduce the mobilisation of contaminants (measured as SO_4), restrict O_2 ingress and therefore oxidation rates to some degree.

Table 3 provides a summary of the implications and benefits of the trial and proposed permanent ASF in terms of stored and mobilized sulfate (SO_4) (Okane, 2020 b,c).

Table 3: Comparison of stored and mobilised SO_4

	EXISTING TRIAL (AND INTERIM) ASF	PROPOSED PERMANENT ASF
Percentage SO_4 Mobilisation	• 100% mobilisation of stored sulfate (SO_4) (i.e. stored = released over time).	• Mobilisation per stage will be reduced by 70% once the cover system has been installed on that stage. • Mobilisation reduces to 10% once cover system on the adjacent stage is installed (based on assumption that the cover has net percolation of <5% rainfall). • Covering percentage of total ASF per the filling stages shown in Table 1: - 20% of existing trial NAF aggregate covered during stage 1; - 50% during stage 2; - 80% during stage 3; and - 100% during stage 4. • The overall mobilisation will be reduced to 30% of stored load once covered.
Maximum stored SO_4	• 4,914 tonnes	• 5,386 tonnes *
Mobilised SO_4	• 4,914 tonnes	• 2,417 tonnes **
Relative Stored SO_4	Stored=Mobilised	• 10%
Relative mobilised SO_4	-	• Approximately 50%
Remaining stored SO_4	• 0 tonnes	• 2,969 tonnes

* It is noted that the initial stored SO_4 in the permanent ASF is slightly higher than in the current trial ASF (base case), this is due to the alternative construction (progressive covering) methodology presented in Table 1 and conceptual design drawings provided in appendix A.

** The amount of mobilised SO_4 calculated for the proposed permanent ASF is less the amount already mobilised from NAF material stockpiled in the trial ASF to date.

6. KEY ENVIRONMENTAL, ECONOMIC AND SOCIAL ISSUES

6.1 Overview of the Physical Environment

As outlined in Section 3.1, the physical environment of the existing trial ASF footprint has:

- Been highly modified, as it was previously used as a mine waste disposal area;
- Been redeveloped as a clay lined trial ASF (after removal and disposal of stockpiled mine waste material from within the footprint);
- Been constructed with an internal seepage water collection system which currently discharges to Crusher Dam;
- Perimeter drains for the diversion of (potentially acid mine drainage contaminated) surface run-off from surrounding areas to Crusher Dam;
- A safety berm at the top of the ASF adjacent to the temporary waste rock stockpile area;
- A haulage road into the base of the ASF for truck access to tip NAF material;
- Partial placement of a layer of NAF material across the base to protect the CCL; and
- A small localised area of regenerated vegetation on the eastern side of the ASF in an area of legacy mine waste.

6.2 Ecological and Heritage Management

Due to the highly modified nature of the footprint area delineated for the existing trial ASF waste stockpile area, no ecological (flora and fauna), or heritage investigations were considered necessary prior to the commencement of construction in 2018.

The change in operation to a permanent facility will not result in a change in footprint, so no additional ecological or heritage investigations will be required.

6.3 Water Quality Management

The existing trial ASF water management measures will continue unchanged when operated as a permanent facility and include:

- Diversion of surface run-off from surrounding areas to minimise stormwater run-on into the ASF;
- Collection of seepage water within the ASF; and
- Sampling and monitoring of seepage water at the ASF discharge point.

The following management measures will be addressed by the proposed alternative filling and progressive closure and rehabilitation plan, which will be detailed in an updated EMP or environmental impact statement (EIS) document as deemed appropriate by the EPA.

These measures will be aimed at improving the water quality from the ASF through:

- Improved management of surface water generated from incidental rainfall within the ASF footprint;
- Investigations into ore sorter adjustments to alter waste rock segregation which may result in decreased metal mass loadings in ASF seepage as the stockpile increases in volume; and
- Minimisation of stockpiled NAF material exposed to rain ingress to reduce the potential for generation of NMD.

It is considered that the proposed filling and capping design program will result in improved water quality seepage and runoff compared to the trial and interim ASF.

6.4 Other Potential Environmental Management Issues

ASF operations have the potential to generate localised noise and dust emissions. However there have been no complaints or incidents requiring investigation during the trial period, as such, there is low potential to cause nuisance off site when the ASF is operated on a permanent basis.

On site vehicular movements will be varied during the permanent operation of the ASF (and potentially reduced) when tipping operations are changed to involve alternative NAF material tipping as outlined in the design provided in Table 1 and in greater detail in Appendix A (Okane, 2020c).

No further disturbance of the visual environment is proposed as part of the permanent ASF operation. Progressive closure and rehabilitation of downslope levels will result in improved visual amenity.

6.5 Economic and Social Issues

The change in operation from a trial to a permanent ASF is not expected to have any notable influence on the local economy, nor social impacts on the two nearby local communities of Rosebery and Zeehan, as it will not result in any changes to staff, nor off site transport.

The change to permanent operation of the ASF for stockpiling NAF material has potential to have a longer-term indirect impact in savings to BMTJV through:

- Reduced haulage of material for UG disposal; and
- Longer duration for filling the D-Dam as it will not need to be utilised for disposal of NAF material (i.e. delayed investment in the development of a new TSF).

BMTJV will be able to reinvest these savings in the Renison Tin Mine operation.

6.6 Stakeholder Consultation

Other than liaison with the EPA, no specific stakeholder consultation has been undertaken to date regarding the trial and proposed permanent ASF.

The change in operation should have little or no impact off-site, with no significant stakeholder concerns expected.

In operating the Renison Tin Mine, BMTJV maintains a list of identified Stakeholders that will be informed of the change from trial to permanent operation of the facility during the approval process.

Further to this, it is noteworthy that there have been no complaints recorded in relation to operation of the trial ASF.

7. SURVEYS AND STUDIES

7.1.1 Completed Trials and Geochemical Testing

Trials and geochemical testing of the performance of the ore sorter have now been completed. The trial ran for 12 months from July 2018, during this time, 89,972T of NAF aggregate was temporarily stored on the surface with 10,575T of PAF and Uncertain (UC) aggregate segregated and disposed of UG.

Static and kinetic geochemical testing conducted as part of the ore sorter trial confirmed that the sorting process is effective in producing a NAF aggregate with inherently conservative geochemical factors of safety.

Water quality results for seepage discharge from the ASF since commencement of the trial to the present have ascertained that seepage is unlikely to be acidic but show that NMD is being generated due to the sulphate and metals present in the stockpiled aggregate. NMD generation is currently occurring as a result of the ASF stockpile being open for rain infiltration.

Upon review of the results, the EPA expressed concerns regarding the current exposure of the accumulated above-ground ASF stockpile to water infiltration and its potential for NMD generation.

The conceptual design for the permanent ASF presented in this NOI has been developed based on the objective to mitigate water infiltration and minimise potential NMD generation. Assessment of the adequacy of the mitigation measures in the design and environmental management commitments will be outlined in detail within the environment document submitted to the EPA as part of the assessment process for approval of the change in operation from a trial to permanent ASF.

7.1.2 ASF Conceptual Design FMEA Report

The FMEA has been prepared for the existing trial ASF to:

- Critically assess environmental aspects of the design; and
- Further develop mitigation and control measures to adequately manage potential environmental risks associated with operating the ASF on a permanent basis (Okane 2020a).

The report provided:

- outcomes in relation to closure performance objectives, cover system design, landform design, construction methodology, CCL integrity, pore-water pressure conditions, quality assurance and control, revegetation and baseline monitoring; and
- Suggested design enhancements for inclusion in a conceptual design for the permanent ASF (Okane 2020a).

7.1.3 ASF Progressive Rehabilitation Evaluation

Based on the findings of the FMEA report, progressive rehabilitation conceptual design options were modelled and evaluated to enable comparison and selection of a preferred option for this NOI (Okane 2020b).

7.1.4 Proposed Trials and Investigations

BMTJV will investigate:

- The ability for further adjustment of ore sorter parameters to potentially decrease NMD and metal mass loads in ASF seepage; and
- NAF stockpile encapsulation options (e.g. clay, bituminous and high-density polyethylene liners).

8. PROPOSED TIMETABLE FOR PROJECT

Since the use of the trial ASF is ongoing during the approval process, the proposed change to a permanent operation will commence immediately upon approval being granted.

Rehabilitation of each filled level of the permanent ASF will be undertaken within three (3) months of completion to a suitable landform for cover and substrate media placed for revegetation.

It is predicted that all levels of the permanent ASF will be filled and a final landform over the entire facility established for closure by the end of 2035.

Should approval not be granted, BMTJV will discuss and agree with EPA on suitable management arrangements for the existing ASF materials.

9. LEGISLATIVE APPROVAL OVERVIEW FOR THE PERMANENT ASF

9.1 Existing Approvals and Regulatory Conditions for the Site

The existing Level 2 BMTJV mining and mineral processing activity is operated in accordance with conditions outlined in the activity's EPN 7092/2 and temporary ASF storage EPN 9937/1.

9.2 Environmental Assessment and Approval Processes

Preliminary discussions indicate that the assessment and approval process for the proposed permanent ASF will necessitate one of the three tiers of regulators, as outlined (and shaded) in Table 4. Referral to the Commonwealth under the *Environmental Pollution and Biodiversity Control* (EPBC) Act 1999 will not be required.

A single application for approval will be made under Section 27 of the *EMPCA* via submission of this NOI to the EPA.

9.3 Applicable Environmental Legislation, Standards and Guidelines

Details of applicable State environmental and planning legislation, guidelines, standards and policies that BMTJV will commit to meeting for the proposed development, will be outlined in environmental documentation to be submitted as part of the assessment and approval process.

9.4 Suggested Documentation for Environmental Approvals

It is proposed that the recently submitted Draft update of the *Environmental Management Plan: Non-Acid Forming Aggregate Storage Facility* report (BMTJV, 2019) be updated, or an environmental approval document be developed as prescribed by the EPA. The document would include:

- Potential impacts of the proposed change of operation from existing trial to permanent ASF;
- Updated operational information relating to the proposed alternative progressive filling, covering and closure plan;
- Description of improved operational and environmental management measures (where needed);
- A summary of commitments (such as undertaking additional trials and investigations in the event that ASF seepage discharge water quality monitoring results indicate that the risk of potential environmental impact of operating the ASF is still an issue of concern); and
- An indicative implementation plan.

Table 4: Approval Process-Related Legislation and Application to the Proposed Permanent ASF

GOVERNMENT	MAIN APPROVAL PROCESS-RELATED LEGISLATION	APPLICATION
Commonwealth	*Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act)	No referral of the proposed development to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act* 1999 will be required (refer to Section 8.2).
Local	*Land Use Planning and Approvals Act* 1993 (LUPAA) *West Coast Interim Planning Scheme* (PS) 2013	The current temporary ASF is a permitted use within the current zoning (29.0 *Environmental Management*) and is situated within an area with a *Bushfire Prone Area* overlay. BMTJV have sought preliminary advice from the West Coast Council (WCC) to ascertain if a permit for the proposed change in operation will be required under LUPAA and/or the *West Coast Interim Planning Scheme* 2013. In response, the Planning and Regulatory Services Co-Ordinator at West Coast Council advised BMTJV that: *"Council have reviewed the proposal in conjunction with the supplied previous approvals. Based on the information it is not apparent that there is any significant change to the use of the mine that would require a Development Application. It is noted that there is no associated buildings or development apart from the covering of stockpiled materials and rehabilitation. While a change in ground level would normally require a Development Application, extractive industry uses are exempt from any such requirements under the Change in Ground Level Code.* *Please be advised that a Development Application is not required for the proposed permanent non-acid forming aggregate storage facility"* (WCC email dated 5th March 2020).
State	*Environmental Management and Pollution Control Act* 1994 (EMPCA) *Mineral Resources Development Act 1995* *Forest Practices Act* 1985 *Crown Land Act* 1976 *Water Management Act* 1999 *Nature Conservation Act* 2002	The proposed change in operation is situated within the existing trial ASF footprint which is: • Within the Renison Tin Mine Mining Lease (ML 12M/1995) under *Mineral Resources Development Act* 1995; • Listed as *Renison Bell Regional Reserve* under the *Nature Conservation Act 2002*; • Recorded as Crown Land; and • To be associated with the existing Renison Tin Mining activity under the current EPN 7092/2, with new license issued to replace EPN 9937/1. The EPA have advised that the proposed permanent operation the ASF is defined as a Level 2 Activity (Waste Depot) under Schedule 2 of EMPCA by the EPA Board (Section 27). Submission of this Notice of Intent (NOI) will formally commence the approval process for the change, with the assessment wholly undertaken wholly by EPA. The assessment and (if approved) resultant EPN issued by the EPA Board will be based on information provided in a document as part of the assessment process such as an updated EMP (which includes Progressive Closure Rehabilitation) or EIS.

10. REFERENCES

BMTJV, 2017 — *Ore Sorter Project Environmental Management Plan. Renison Operations. Revision A for EPA Comment. August 2017.*

BMTJV, 2018 — Environmental Management Plan: Non-Acid Forming Aggregate Storage Facility. Renison Operations. Revision B, Final. April 2018.

GHD, 2018 — Renison Aggregate Storage Facility (ASF) Concept Design Report. June 2018.

Okane 2020a — Renison ASF Conceptual Design FMEA Report. Prepared for Bluestone Mines Tasmania Joint Venture Pty Ltd. Prepared by Okane Consultants Pty Ltd. Dated 9 June 2020.

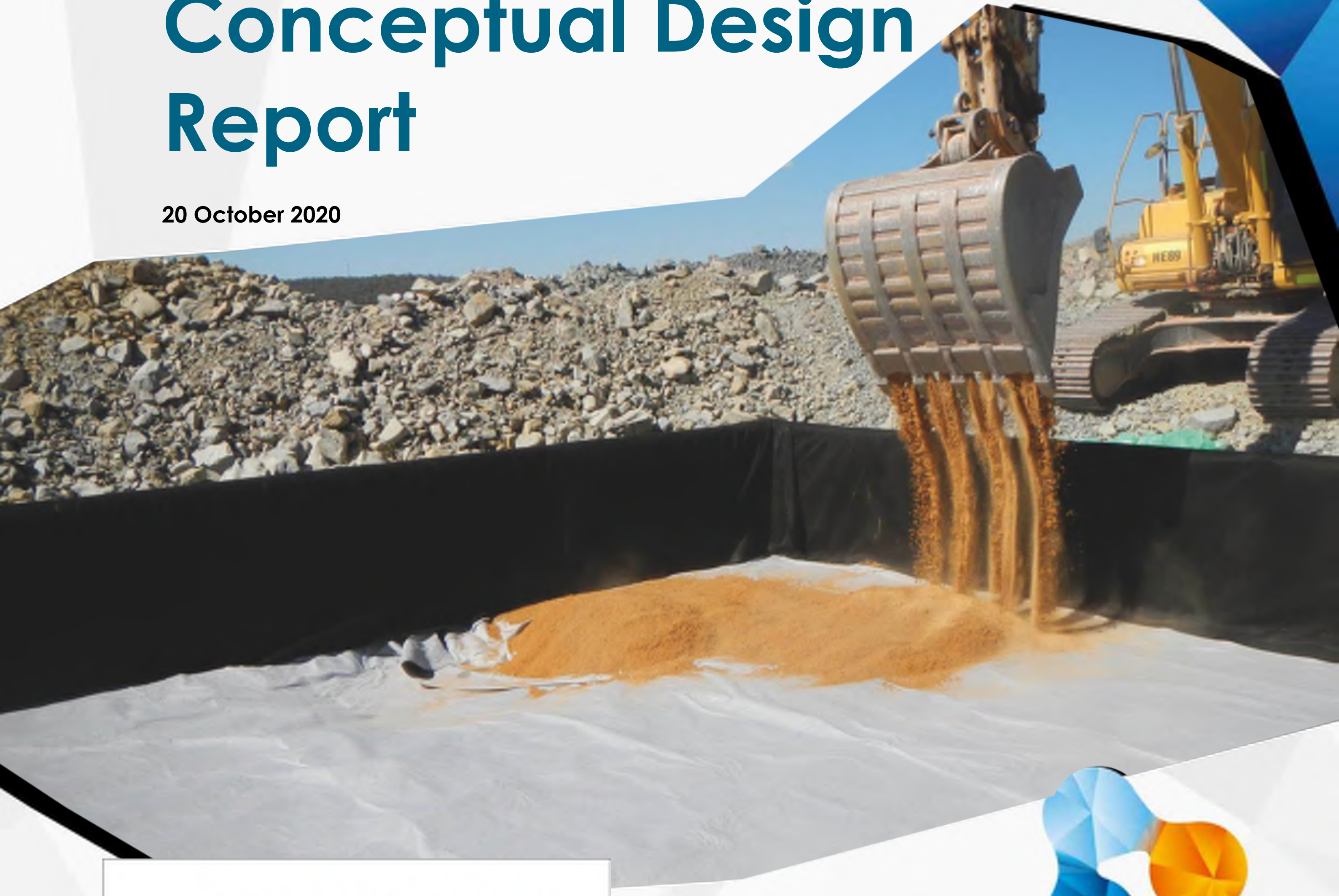
Okane, 2020b — Renison ASF Progressive Rehabilitation Evaluation (B-1116-011-04) Presentation. Prepared for Bluestone Mines Tasmania Joint Venture Pty Ltd. Prepared by Okane Consultants Pty Ltd. Dated September 2020.

Okane 2020c — Renison Operations ASF Supplementary Conceptual Design Report. Prepared for Bluestone Mines Tasmania Joint Venture Pty Ltd. Prepared by Okane Consultants Pty Ltd. Dated 20 October 2020.

APPENDIX A: Renison Operations ASF Supplementary Conceptual Design Report (Okane, 20 October 2020)

Renison Operations ASF Supplementary Conceptual Design Report

20 October 2020



Integrated Mine Waste Management
and Closure Services
Specialists in Geochemistry and
Unsaturated Zone Hydrology

Renison Operations ASF
Supplementary Conceptual Design Report

1116-011-02

October 2020

Prepared for:

Bluestone Mines Tasmania Joint Venture Pty Ltd
Murchison Highway
Zeehan, Tasmania 7469

Prepared by:

Okane Consultants Pty Ltd

202 Petrie Terrace
Brisbane QLD 4000
Australia

Telephone: (07) 3367 8063
Facsimile: (07) 3367 8052
Web: www.okc-sk.com

Rev. #	Rev. Date	Author	Reviewer	PM Sign-off
C	10 Sept. 2020	JJ / AO	DC / IT	AO
0	19 Oct 2020	AO	KL	AO

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EXECUTIVE SUMMARY

Okane Consultants (Okane) were engaged by Bluestone Mines Tasmania Joint Venture Pty Ltd (BMTJV) to assist with the conceptual design of the proposed permanent aggregate storage facility (ASF) at the Renison Operations (Renison). Following the successful completion of a trial crushing and sorting program, using plant known as an ore-sorter, BMTJV are seeking approval for a change in operation for the ASF from a temporary to a permanent facility and to allow the ongoing above ground storage of the non-acid forming (NAF) material generated by the ore-sorter.

Initial geochemical studies determined that whilst the NAF aggregate to be stored at the ASF was classified as NAF, it has potential to generate neutral metalliferous drainage (NMD) and may lead to long-term environmental impacts without appropriate consideration and control.

In order to assist BMTJV obtain regulatory approval for the ASF, Okane conducted a Failure Mode and Effects Analysis (FMEA) on the existing Concept Design (GHD, 2018) and identified several design enhancements that can be incorporated into the existing Concept Design to improve environmental performance, including the generation and discharge of NMD, during the operational, closure and post-closure phases of the ASF.

This Supplementary Conceptual Design Report has been prepared to support the BMTJV Permanent Non-acid Forming Aggregate Storage Facility Notice of Intent (BMTJV, 2020a) and provides additional ASF conceptual design detail including:

- Proposing five ASF specific closure objectives;
- Proposing a progressive rehabilitation and staged construction methodology whereby the final ASF cover system is progressively installed and would be anticipated to result in approximately 50% less mobilisation of contaminants of concern during the operational phase;
- A conceptual 'barrier' type cover system design;
- A conceptual final landform design which incorporates a surface water management system that will effectively segregate ASF impacted runoff and seepage from non-impacted runoff and seepage; and
- Baseline, operational and closure monitoring programs.

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1 INTRODUCTION

Okane Consultants (Okane) were engaged by Bluestone Mines Tasmania Joint Venture Pty Ltd (BMTJV) to assist with the conceptual design of the proposed permanent aggregate storage facility (ASF) at the Renison Operations (Renison). BMTJV completed a crushing and sorting facility trial program, referred to as the ore-sorter, between July 2018 and August 2019. To support the trial, approval was obtained for the temporary storage of non-acid forming (NAF) classified waste rock (aggregate) from the ore-sorter on a clay liner constructed within an existing surface void adjacent to the mineral processing plant and ore-sorter. Following the successful completion of the trial program, BMTJV are seeking approval for a change in operation for the ASF from a temporary to a permanent facility.

1.1 Project Objectives and Scope

The objective of the Renison Operations ASF Supplementary Conceptual Design Report is to demonstrate how potential environmental impacts, primarily related to the generation and discharge of neutral metalliferous drainage (NMD), will be managed during the operational, closure and post-closure phases of the ASF. This objective has been achieved by completing the following tasks:

- Proposing closure objectives to drive design and allow for the clear assessment and evaluation of performance for the ASF;
- Developing a progressive rehabilitation and staged construction methodology that will limit the volume of NAF aggregate exposed to rainfall at any one time and therefore reduce the mobilisation of stored contaminants;
- Designing a conceptual cover system to limit net percolation (NP) and manage the risk of NMD impacted seepage resulting in unacceptable environmental risk;
- Designing a final landform and surface water management system with batter profiles and surface materials that will resist erosion and support vegetation establishment; and
- Developing monitoring programs that will gather usable data and will allow validation of the design, trigger adaptive management plans or trigger action response plans (TARPs) when necessary, and will demonstrate closure objectives and criteria are being achieved, and will continue to be achieved, through the post-closure phase.

Following receipt of Environment Protection Authority (EPA) project specific guidelines for the preparation of the Development Proposal and Environmental Management Plan, detailed design will be undertaken to address the requirements outlined in project specific conditions and relevant Codes, Australian Standards, etc. Detailed design works will progress designs to a level that will allow construction to commence and is anticipated to incorporate:

- Cover system modelling and design refinement, based on the geotechnical / geochemical properties of available materials;
- Erosion assessments and embankment profile refinement, based on the geotechnical / geochemical properties of available materials and the final cover system design;
- Engineering reviews to ensure appropriate factors of safety have been achieved and design assumptions have been tested against final designs;
- Optimised staged construction and progressive rehabilitation plans for execution;
- Development of final quality assurance and quality control (QA/QC) documentation and procedures; and
- Development of a final detailed revegetation plan including species lists, planting methodology and any soil enhancements or amelioration required.

1.2 Report Organization

For convenient reference, this report has been subdivided into the following sections:

- Section 2 – Background;
- Section 3 – Conceptual ASF Closure Objectives;
- Section 4 – Progressive Rehabilitation;
- Section 5 – Conceptual Cover System Design;
- Section 6 – Conceptual Landform Design;
- Section 7 - ASF Monitoring Programs;
- Section 8 – Detailed Design; and
- Section 9 – References.

2 BACKGROUND

Renison is an underground tin mine located 45 km north of Queenstown and 8 km west of Rosebery in western Tasmania (Figure 2.1). The mine site is south of Lake Pieman and surrounded by the Lake Pieman Forest Reserve. The main operational areas are situated between the Argent and Ring Rivers which are the receiving waters for the ASF catchment (BMTJV, 2017). The project resides on mining lease ML12M/1995 and lies in the Renison Bell Regional Reserve (BMTJV, 2020a).

Figure 2.1: Location of Renison Operations.

Google Earth, 2020

Renison is an underground mine applying up-hole benching and open stope mining methods. Metals X (2020) state the measured, indicated and inferred resource for Renison is 18.54 Mt at 1.54% tin. Renison produce a tin concentrate which is transported to the Port of Burnie by train for shipping.

Figure 2.2: Renison site layout with indicative ASF footprint in blue.

Google Earth, 2020

2.1 Environment and Surrounds

Renison is situated in a relatively low lying area between mountainous regions at an approximate elevation of 200 m Australian Height Datum (AHD). The mine site contains a range of fauna habitats including wet eucalypt forest, rainforest, scrub and riparian habitat (EPA Tasmania, 2015). Multiple fauna species and one native vegetation community listed in accordance with the Tasmanian *Threatened Species Protection Act 1995* and the Nature Conservation Act 2002, respectively, have been identified and are considered present onsite according to a surveys completed between 2008 and 2013 (EPA Tasmania, 2015). The receiving waters for Renison is Lake Pieman, either directly or via the Argent River to the west or the Ring River to the East of the site.

Runoff from the ASF will report to the Lower Crusher Dam, located directly north-east of the ASF. Water can be released from the Lower Crusher Dam via the approved discharge point to the Ring River. Seepage from the ASF is discharged via an internal drain to the Lower Crusher Dam. Seepage can be collected at this point for sampling, or, whilst sludge removal is occurring in the Lower Crusher Dam, seepage can be returned to the process plant and redirected to D-Dam (BMTJV, 2020a & 2020b).

2.2 Ore-sorter and ASF Trial

BMTJV completed a trial program in 2018 for the crushing and sorting of 100 kt of material through a facility known as the ore-sorter (BMTJV, 2020a). The ore-sorter acts as a pre-concentrator of the mill feed by removing barren material prior to the grinding process, the goal being to increase grade and decrease processing costs (Figure 2.3). Material is crushed into 18-50 mm particles and then fed through the ore-sorter conveyer system. Using x-ray transmission (XRT) the ore-sorter can separate ore and waste based on atomic density (BMTJV, 2020b). The ore-sorter then uses ejection by air jets to sort the material accordingly.

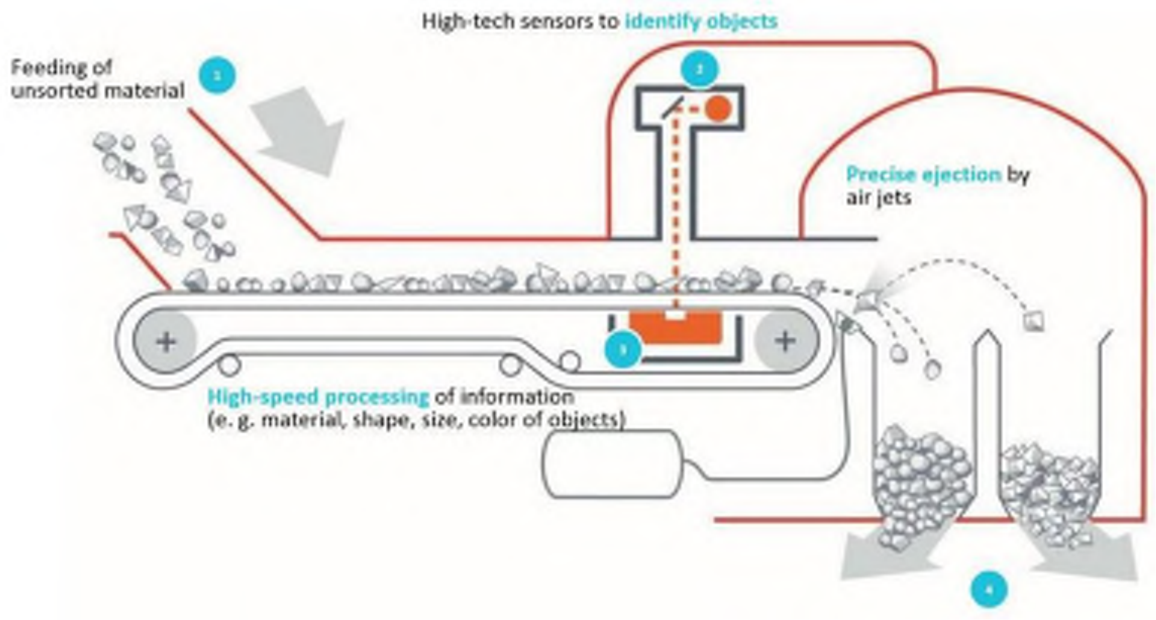

Figure 2.3: Simplified ore-sorter schematic.

BMTJV, 2020

Once the waste is separated from the ore, it is reprocessed through the ore-sorter to sort non-acid forming (NAF) and potentially acid forming (PAF) material using an electromagnetic (EM) sensor. The EM sensor detects electromagnetically conductive materials (e.g. iron, manganese, copper and nickel) and then separates the waste stream into NAF and PAF. PAF material will be stored in underground mine workings and NAF material will be stored in the proposed ASF.

The ASF footprint (Figure 2.2) exists within an area formerly used for the storage of heavy media separation (HMS) scats and federal tailings known as the Waste Rock Holding Pad (WRHP). These wastes were excavated and relocated to D-Dam during 2017 and early 2018 (BMTJV, 2020a). The final void created provides storage for approximately 627,000 m^3 of NAF aggregate (Figure 2.4).

GHD were engaged by BMTJV to provide engineering design services for the ASF and associated compacted clay liner (CCL). Construction of the CCL over the base and side walls on the ASF footprint commenced in March 2018 (Figure 2.5). The CCL was constructed in two lifts and at the time of construction was determined to have a permeability less than 2.4 x 10^{-10} m/s (BMTJV, 2020a). A seepage collection system was installed above the CCL and drains towards the lower crusher dam. Perimeter drains comprising of coarse rock were installed around the ASF to prevent rainfall runon from external catchments impacting the facility. A subsoil drain was installed below the CCL to divert legacy seepage and groundwater around the ASF. Construction of the CCL was completed in July 2018. Placement of NAF aggregate from the ore-sorter trial program commenced in August 2018 (Figure 2.6) and continued through to 2019 (Figure 2.7).

Figure 2.4: Final void prior to construction of ASF – March, 2018.

BMTJV, 2020

Figure 2.5: ASF CCL prior to stockpiling - July, 2018.

BMTJV, 2020

Figure 2.6: NAF aggregate material spread over CCL – August, 2018.

BMTJV, 2020

Figure 2.7: Stockpiling of NAF material – August, 2019.

BMTJV, 2020

2.3 Permanent ASF Details

The existing ASF Concept Design (GHD, 2018) allows for 627,000 m^3 of dump space. Based on current NAF Aggregate extraction rates, ASF storage will be exhausted by 2035 (Table 2.1).

Table 2.1: Ore-sorter NAF Aggregate Production Schedule

Financial Year	Ore-sorter NAF production (m^3)	Cumulative NAF Production (m^3)
Existing Material (Trial)	10,831	10,831
2020	10,368	21,199
2021	41,472	62,671
2022	41,472	104,143
2023	41,472	145,615
2024	41,472	187,087
2025	41,472	228,559
2026	41,472	270,031
2027	41,472	311,503
2028	41,472	352,975
2029	41,472	394,447
2030	41,472	435,919
2031	41,472	477,391
2032	41,472	518,863
2033	41,472	560,335
2034	41,472	601,807
2035	25,193	627,000

The existing concept design for the ASF (Figure 2.8) prescribes NAF aggregate material is end-tipped from the crest, adjacent to the ore-sorting facility in a north-easterly direction. Operational batters are designed to be 1 V:1.3 H based on angle of repose with the ASF surface to maintaining a 2% fall from the crest of the batter back to the processing plant (GHD, 2018). At closure, the existing concept design recommends the final batter angle be re-profiled to 1 V:2 H (GHD, 2018). The final level of the ASF aligns with the current hardstand level of the Renison processing plant (RL 2,196 m). The existing concept design call for an outer encapsulation zone to minimise air ingress be constructed once storage space has been exhausted (GHD, 2018).

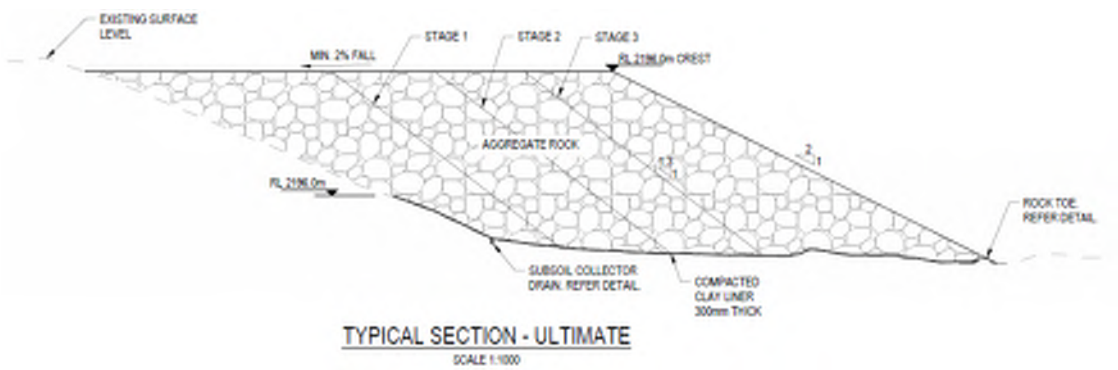

Figure 2.8: GHD ASF conceptual design.

GHD, 2018

2.4 Conceptual Levels of Performance

The term Net Percolation (NP) is used throughout this report and is presented schematically in Figure 2.9. Rainfall (R) will either be intercepted by vegetation, runoff (RO), or infiltrate into the surface. A portion of the water that infiltrates will be stored in the 'active zone' (ΔS) and subsequently exfiltrate back to the surface and evaporate or be removed by transpiration (ET). Infiltration can also move laterally downslope within and below the active zone (referred to as interflow). A percentage of the infiltrating water will migrate beyond the active zone as a result of gravity overcoming the influence of atmospheric forcing (i.e. evaporation) and result in NP to the underlying material, in this case, the ASF aggregate material.

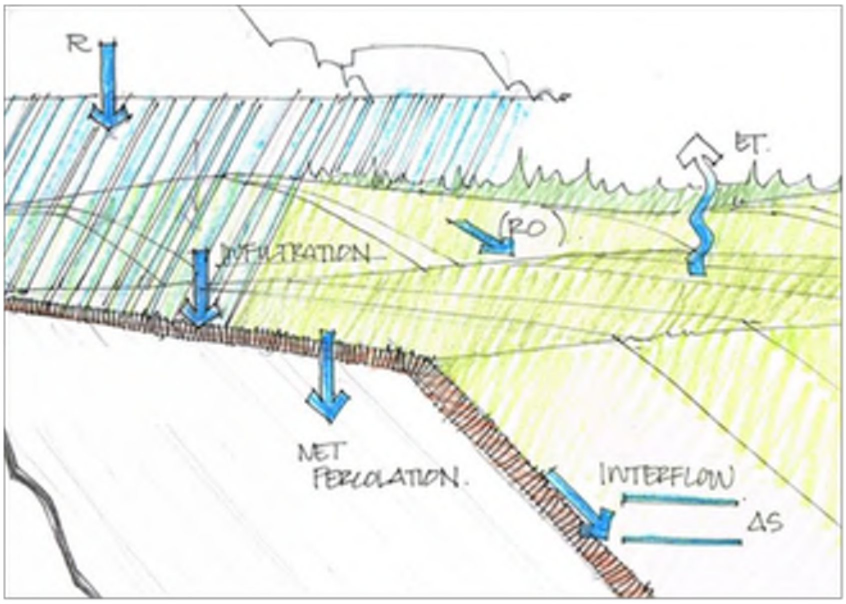

Figure 2.9: Schematic of hydrologic processes that influence cover systems for WRDs.

INAP, 2017

As stated in Section 2.1, Renison is classified as a Cfb climate, or temperate with warm summers and no dry season, according to the Köppen-Geiger classification system. Based on this classification system and guidance provided by the Global Cover System Design – Technical Guidance Document (INAP, 2017), the range of expected cover system performance for Renison can be presented conceptually in terms of the following, and is summarised in Figure 2.10:

- "Very High" NP is greater than 50% R;
- "High" NP is between 20% R and 50% R;
- "Moderate" NP is between 10% R and 20% R;
- "Low" NP is between 5% R and 10% R; and
- "Very Low" NP is less than 5% R.

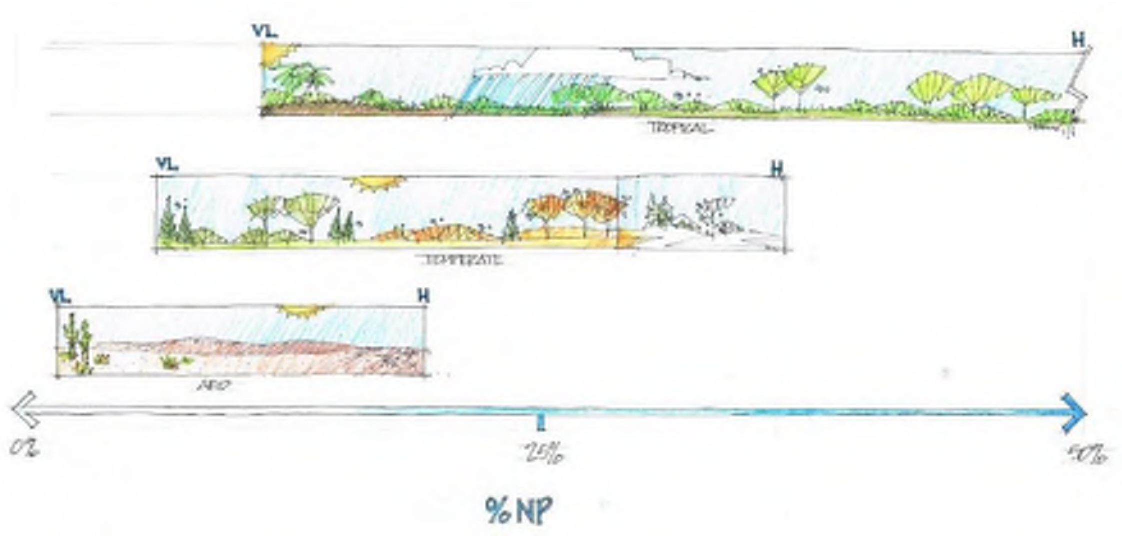

Figure 2.10: Qualitative NP rates for different climatic classifications.

INAP, 2017

NP rates and resultant %R can be higher or lower for any given year. For example, a high rainfall year (or, more specifically, a number of successive wetter than average climate years) may result in a high NP rate for the year, even for a site classified, on average, as having a very low NP rate. Therefore, occasional exceedances of the target NP are not necessarily an indication of cover system 'failure'.

Oxygen control is dependent on oxygen diffusion and the saturation extent of the cover system material/s. As with NP, achievable oxygen ingress rates vary depending on climate, as shown in Figure 2.11. However, the continuum for controlling oxygen is not as widespread as with NP. There is an exponential relationship between oxygen diffusion and the degree of saturation of porous media, as well as that for air permeability. As such INAP determine that controlling oxygen in terms of cover system performance can generally be thought of as either "Very Low" or "High to Very High". To classify the performance continuum for a particular climate type, management of water resources for internal cover system processes is critical.

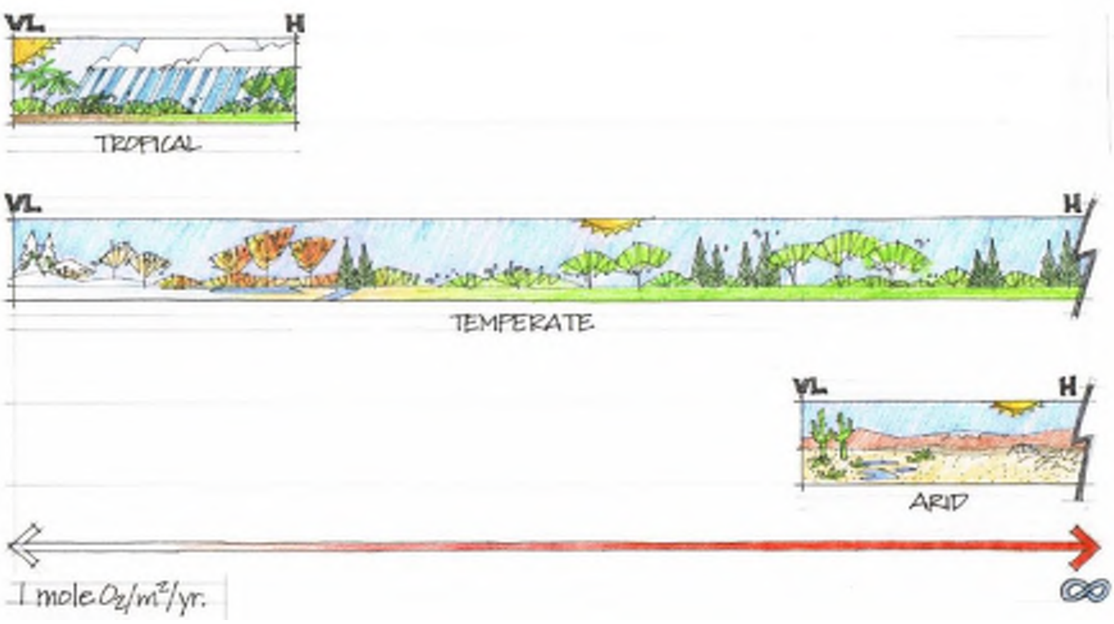

Figure 2.11: Qualitative oxygen ingress rates for different climatic classifications.

INAP, 2017

Erosion rates from natural and rehabilitated landforms vary greatly based on factors such as (but not limited to) climatic setting, surface materials, landform configuration, and surface management practices. For temperate climates such as Renison, a wide range of performance is possible (Figure 2.12) thus it is important to strike a balance between surface materials, surface cover and erosive forces. The high rainfall provides good opportunity for vegetation establishment, often required to overcome frequent erosive forces generated by rainfall-runoff.

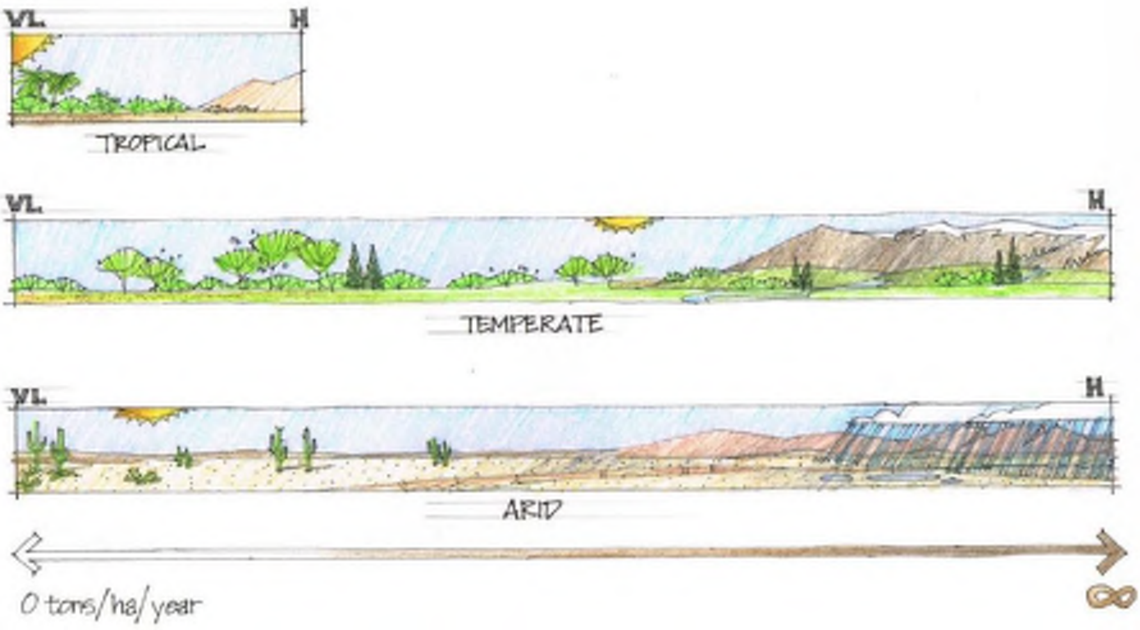

Figure 2.12: Qualitative erosion rates for different climatic classifications.

INAP, 2017

Average erosion rates are typically measured in tonnes per hectare per year (t/ha/y) and are commonly used to benchmark erosion performance. Providing the values on a per unit basis rather than a total volume allows comparison of erosion rates from site to site with varying landform or watershed sizes. Okane has developed provisional erosion classifications for benchmarking erosion performance of various mine landforms (Table 2.2). This framework has been developed based on average denudation rates and related environmental impacts (e.g. cover system deterioration) resulting from different rates of erosion.

Table 2.2: Erosion Risk Classification

Erosion Risk Classification	Average Erosion Rate (t/ha/yr.)	Average Denudation Rate* (mm/y)	Erosion Risk Classification
Very Low	< 1	<0.05	Negligible impact on surfaces. Landform erosionally stable.
Low	1 to 10	0.05 – 0.5	Minor impact to landform surfaces / cover system performance. Landform conducive to vegetation establishment and trending to an inherently erosionally-stable surface.
Moderate	10 to 25	1.5– 1.3	Landform generally stable with limited adverse effect on overall cover system / landform surface performance. Some rilling and gully development. Certain areas potentially requiring minor remedial earthworks repairs in the to prevent worsening.
High	25 to 50	1.3 – 2.6	Material losses from the cover system are significant resulting in adverse performance and surfaces trending towards instability. Likely to require revegetation strategies and active management strategies to mitigate erosion issues.
Very High	> 50	> 2.6	Substantial materials loss from the cover system. Substantial earthworks and revegetation strategies required for remediation.

* Assuming density of 1.9 t/m^3.

Erosion is normally controlled by (1) increased vegetation establishment and/or (2) coarser surfaces. Providing coarser surface materials can increase permeability and reduce cover system effectiveness, therefore improving vegetation coverage is normally more effective in temperate climates. Within a Cfb climate vegetation establishment is not normally considered a constraint, providing an opportunity to achieve long term performance objectives with respect to erosion.

2.5 Summary of FMEA Outcomes

Okane completed an FMEA workshop on 14 May 2020 in order to identify risks associated with the operation and closure of the ASF for the current conceptual design. The following question was considered:

"Can BMTJV obtain regulator approval for Renison's ASF by demonstrating the permanent facility can be operated and closed without posing an unacceptable environmental risk?"

During the workshop, multiple failure modes were identified and assessed. Several reoccurring themes became apparent and related to:

- Performance objectives;
- Cover system design;
- Landform design;
- Construction methodology;
- CCL integrity;
- Pore-water pressure conditions;
- QA/QC process and procedures;
- Revegetation; and
- Baseline monitoring.

Based on these themes and Okane's understanding of the ASF Concept Design (GHD, 2018), a number of design enhancements were identified to reduce potential environmental risk posed by the design. Several enhancements were not considered appropriate for a conceptual level design and therefore will be addressed during detailed design. The following enhancements were considered appropriate for a conceptual level design and have been incorporated into the existing Concept Design to support the NoI application:

1) Define and clarify closure objectives for the ASF.
2) Develop a conceptual cover system design.
3) Review, and where necessary, refine the final landform design.
4) Develop an alternative construction methodology that will integrate a progressive rehabilitation approach.
5) Develop a baseline monitoring program.

The following design enhancements are proposed to be developed during the detailed design phase when project specific conditions have been defined:

1) Final cover system and detailed landform design.

2) Construction/progressive rehabilitation methodology detailed design.

3) Detailed engineering reviews of key design assumptions against final designs to ensure they remain valid.

4) Develop QA/QC processes and procedures for ASF and cover system construction.

5) Develop a revegetation program.

6) Detailed operations and closure monitoring program.

3 CONCEPTUAL ASF CLOSURE OBJECTIVES

The purpose of developing conceptual ASF closure objectives are to set out long-term goals for closure outcomes (DFAT, 2016). Closure objectives for the ASF must align with, and work towards achieving the outcomes of, the wider Renison closure objectives.

As defined in the Renison Mine Closure Plan (BMTJV, 2017) the overall site closure strategy for Renison is to:

"carry out actions that will result in the development of a self-sustaining and stable ecosystem (not pristine wilderness), while having due regard for public safety and the cultural heritage aspects of the site. With this in mind the mine closure plan aims to ensure that acidic and metalliferous drainage does not further compromise the ecological values within the Pieman River catchment."

The four general closure objectives for Renison are (BMTJV, 2017):

1) To make the site safe;
2) To minimise environmental impact;
3) To preserve remnant resources for future generations; and
4) To reduce the need for long-term monitoring and maintenance by stabilising the site.

The existing Concept Design (GHD, 2018) included the following high-level mine waste storage facility, or domain level, closure objectives:

1) Long term stabilisation of physical, chemical ecological and social conditions of the facility to minimise ongoing degradation; and
2) The closed facility should not require ongoing maintenance and expenditure other than that normally required for a similar land use.

Proposed ASF conceptual closure objectives have been developed with consideration for the above site-wide and domain-specific closure objectives and were used to guide the design enhancements proposed in this Supplementary Conceptual Design Report. The proposed ASF conceptual closure objectives are:

1) Limit the release of NMD impacted seepage from the ASF on the Lower Crusher Dam by reducing NP to a low level (<10% R);
2) Limit erosion of the cover system surface in the long term to a low level (<10 t/ha/yr);
3) Provide a cover system capable of establishing and maintaining targeted vegetation;

4) The closed landform must result in a net improvement to the visual amenity of the area when compared to immediately prior to construction of the ASF; and

5) The closed landform should not require ongoing maintenance and expenditure above that normally required for an area with a similar land use

The proposed conceptual ASF closure objectives have been developed with reference to relevant environmental legislation and regulation, site specific approval conditions, existing site closure objectives and currently accepted best practice environmental management. Final ASF closure objectives, performance criteria and indicators for demonstrating the landform is meeting the objectives and achieving the desired closure outcomes will be developed during detailed design to ensure project specific conditions are adequately considered.

4 PROGRESSIVE REHABILITAION

Accumulation and release of NMD impacted seepage from the ASF Concept Design (GHD, 2018) was identified as an environmental risk and is considered inconsistent with objectives set out in the *Environmental Management Pollution Control Act* 1994 and the *State Policy on Water Quality Management* 1997 (EPA Tasmania, 2019). A progressive approach to the rehabilitation of the ASF has been proposed to minimise this risk and improve the likelihood of achieving the ASF closure objectives described in Section 3.

A progressive rehabilitation approach for the ASF has been adopted for the primary purpose of minimising NMD impacted seepage presenting an unacceptable environmental risk to the receiving environment during the operational phase. However, as highlighted by the Australian Government's Leading Practice Handbooks for Sustainable Mining (DFAT, 2016b), several additional benefits are likely to be realised by progressively rehabilitating the ASF, including:

- Reducing the overall footprint of unrehabilitated areas at Renison;
- An ability to utilise existing operational resources to complete rehabilitation activities;
- Building rehabilitation knowledge for application at other areas of the site as they become available for rehabilitation;
- Demonstrating BMTJV's commitment to the successful rehabilitation and the eventual closure of Renison;
- Potential to reduce closure costs later in the operation's life; and
- Potential for relinquishment or certification of the rehabilitated ASF earlier in Renison's post-closure phase.

The key ASF conceptual closure objectives expected to benefit from the adoption of a progressive rehabilitation approach are:

- Limiting the release of NMD impacted seepage from the ASF on the Lower Crusher Dam by reducing NP;
- An immediate improvement to the visual amenity of the area when compared to immediately prior to construction of the ASF; and
- Earlier establishment of rehabilitated areas and demonstration that ongoing maintenance and expenditure, above that normally required for an area with a similar land use, will not be required.

The major constraints to adopting progressive rehabilitation for the ASF include:

- The relatively small ASF footprint is difficult to progressively rehabilitate without ongoing operational activities impacting rehabilitated areas; and
- Separation of non-NMD impacted surface water (collecting on established rehabilitated areas) from NMD impacted and/or sediment laden surface waters from operational, or recently constructed and not yet established, rehabilitated areas.

4.1 Progressive Rehabilitation Approach and Construction Methodology

The construction methodology proposed for the existing ASF Concept Design (GHD, 2018) involves initially placing NAF aggregate by conveyor and dozing, to mitigate the potential for failure of the inclined section of basal liner, before further developing the ASF by end-tipping from the Mill in a north-easterly direction. Embankment profiles would be dozed down to final landform grades once ASF storage has been exhausted.

The proposed progressive rehabilitation approach will involve constructing the ASF in end-tipped, finger-like stages rather than a single advancing tip face (Figure 4.1). Following the completion of each stage, the final cover system will be constructed and will limit rainfall infiltration into the aggregate and therefore reduce mobilisation of contaminants of concern. The final cover system will be progressively installed over the plateau and outer embankments of each stage as they are constructed, leaving only the inner embankment face exposed until which time as the next stage extends out and across the previous face or, in the case of the final stage, the full cover system is completed. Shaping of outer embankments would occur at the end of each stage and prior to cover system installation. Surface water runoff from rehabilitated areas will be segregated from operational areas and shed to the west / northwest into the ASF perimeter drains.

High-level analysis indicates this progressive rehabilitation approach could reduce the mobilisation of contaminants of concern by approximately 50% when compared to modelling undertaken for the existing Concept Design. The key mechanism for the reduction in mobilised contaminants of concern is to minimise the surface area of NAF aggregate exposed to rainfall at any one time and therefore the volume of NP available to infiltrate the ASF and mobilise contaminants. As progressive rehabilitation involves installing the final cover system at the completion of each stage, NP in covered areas would be reduced to within a performance range of <10% annual rainfall in order to achieve the proposed conceptual ASF closure objectives.

It is acknowledged this approach will also restrict O_2 ingress, and therefore oxidation rates, to some degree. However, owing to the uniformly coarse properties of the NAF aggregate, the degree of restriction is likely to be limited. A reduction in O_2 ingress, however small, was not considered in the high-level analysis and any improvement achieved would be an additional benefit to that gained through a reduced NP rate. Consideration was given to strategic waste placement techniques, such as paddock dumping and compaction, however, once again, due to the generally uniform and coarse texture of the NAF aggregate, the benefits that would be realised by adopting these techniques were considered unlikely to be material (GHD, 2018).

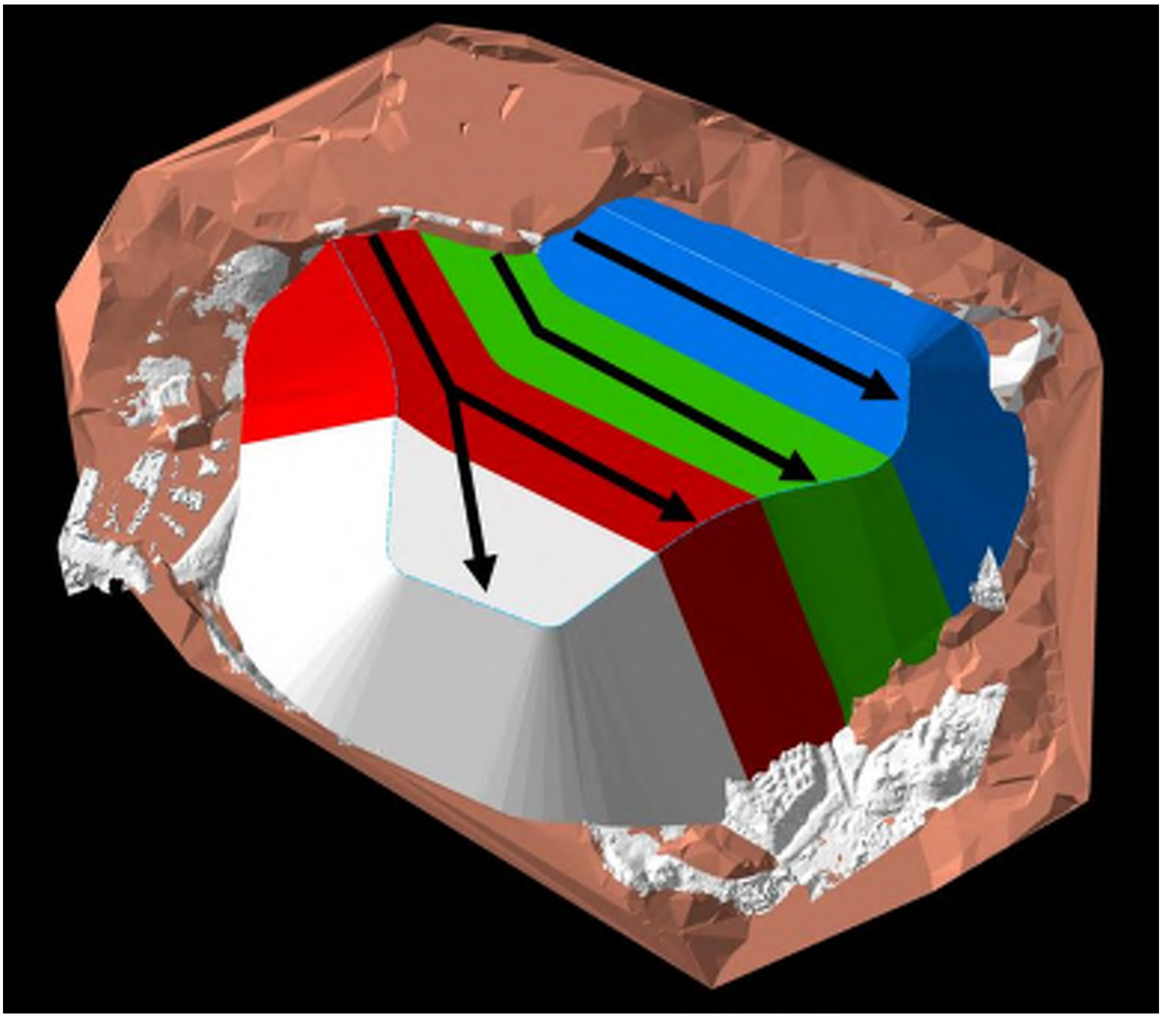

Figure 4.1: Conceptual construction methodology using end-tipped 'fingers'

5 CONCEPTUAL COVER SYSTEM DESIGN

The purpose of a cover system is to aid in the reclamation of surface mine waste storage facilities to provide a stable, reliable and sustainable engineered interface between the receiving environment and the mine waste (INAP, 2017). It supports agreed-upon land uses while minimising degradation of the surrounding environment.

The conceptual closure design for the existing Concept Design (GHD, 2018) prescribes construction of an outer encapsulation zone at closure. This section expands upon this design element and provides greater detail for the proposed conceptual cover system for the ASF. As described in Section 4, it is proposed this outer encapsulation zone, or cover system, be constructed progressively to minimise mobilisation of contaminants during both the operational and closure phases.

Cover system design requires analysis of all site attributes that can constrain design alternatives and limit performance. Four key site attributes that constrain design alternatives include climate, hydrogeological setting, materials and vegetation (Figure 5.1). A well designed cover system will be critical for achieving the proposed ASF closure objectives.

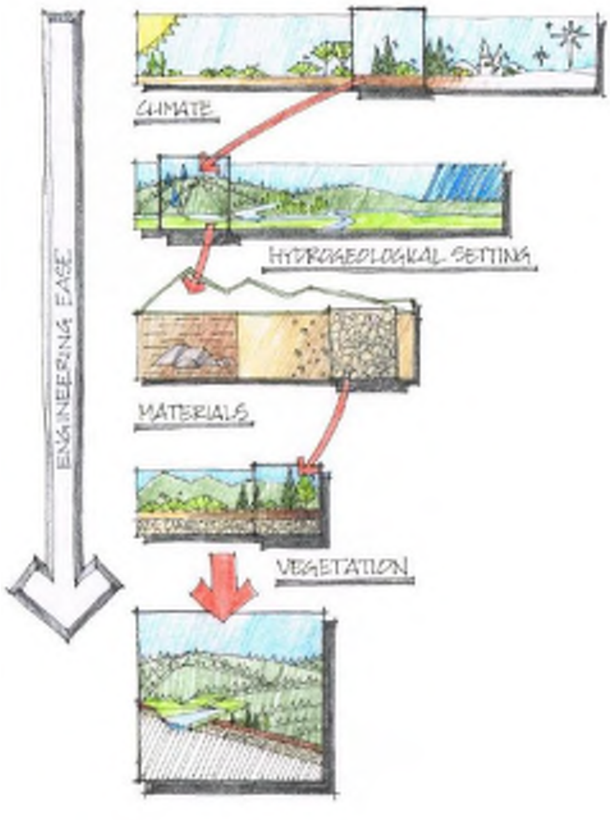

Figure 5.1: Cover system design framework displaying four filters.

INAP, 2017.

5.1 Climate

Renison is classified as a temperate region with warm summers and no dry season (Cfb) using the Köppen-Geiger climate classification system. Rainfall in the region typically occurs throughout the year with a mean annual rainfall of approximately 2,234 mm. Based on 109 years of recorded data, higher rainfall tends to occur from April to October (~222 mm per month) and lower rainfall from November to March (~133 mm per month) (BOM, Renison Bell station 097021, 2020). Mean monthly maximum and minimum temperature data has been obtained from Rosebery HEC substation number 097073 (BOM, 2020) for the years 1996 to 2020. The lowest monthly mean minimum temperature is 3°C (July) and the highest monthly mean maximum temperature is 23°C (February). Summary climate data for the Renison area is presented in Figure 5.2.

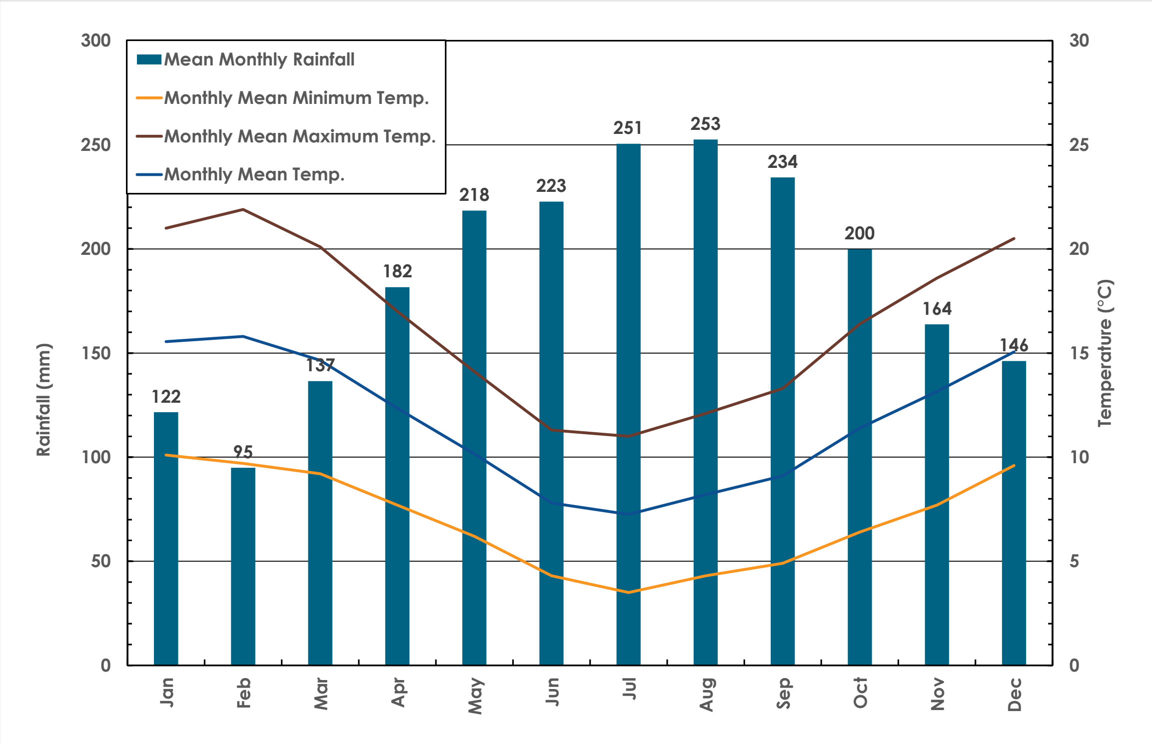

Figure 5.2: Average monthly rainfall (Renison Bell station 097021) and temperature (Rosebery HEC substation 097073).

BOM, 2020

The Global Acid Rock Drainage Guide (Gard Guide) (INAP, 2009), indicates the cover system that best fits with the site's climate utilises a "barrier" for controlling the ingress of atmospheric water, and in some cases, atmospheric oxygen (Figure 5.3). Cover systems which utilise a barrier incorporate one or more layers to reduce as-built (field) saturated hydraulic conductivity to 1 x 10^{-9} m/s or lower. Barrier type cover systems include systems which incorporate compacted clay layers, compacted sand bentonite layers and geosynthetic layers.

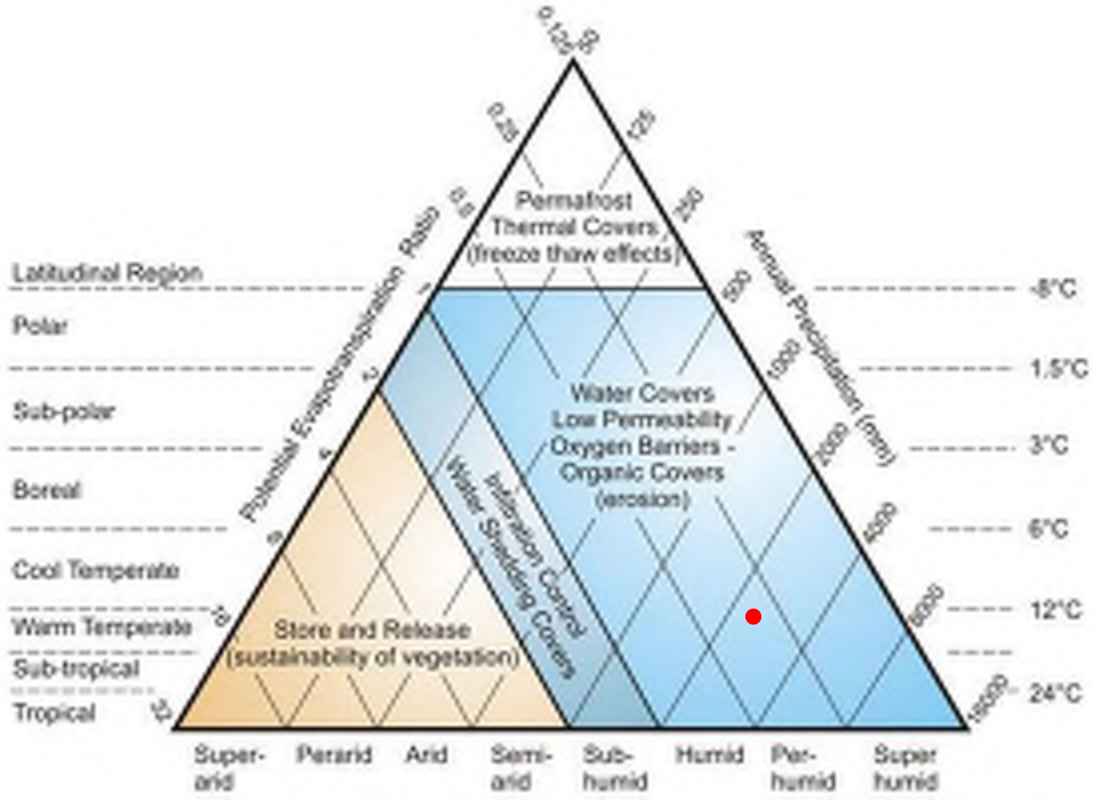

Figure 5.3: Cover systems and climate types. Red dot indicates approximate performance for Renison.

INAP, 2009.

5.2 Hydrogeological Setting

The regional hydrogeological setting focuses on several physical processes, including recharge, discharge rates, locations, volumes and rates of water movement, in addition to water flow pathways. The hydrogeological setting constrains the residence time and flux of water movement and while it can be altered, this requires substantial effort and expense, as such it is more advantageous to understand the hydrogeological setting prior to design and construction of any cover system design (INAP, 2017). The geological setting and landform geometry affect geotechnical stability and influences the overall NP mechanisms and rates.

Construction of the CCL prior to development of the ASF is intended to isolate the ASF from the surrounding hydrogeological setting. An interim as constructed report by GHD (2019) states the permeability of the as constructed CCL is acceptable to perform the required design function. Isolating the ASF both reduces potential for seepage generated within the ASF to enter the local groundwater system and for poor quality groundwater from legacy areas in and around the Mill from interacting with the ASF. Sub-soil collection drains constructed below the CCL will collect groundwater seepage from legacy areas and discharge via an outlet pipe to the Lower Crusher Dam.

The key focus of a cover system for the ASF will be to manage rainfall, and the resulting surface water runoff, that falls directly on the ASF. Perimeter drains will be constructed to limit surface water from external catchments running on to the ASF cover system.

5.3 Materials

The behaviour of a cover system is largely influenced by the physical properties, including the PSD, permeability and water holding properties of the materials used in construction. The materials likely required for constructing a barrier type cover system on the ASF will include:

- A low permeability layer, such as a CCL or geosynthetic;
- A coarse drainage layer to convey infiltration off the landform as interflow;
- A growth medium capable of supporting the targeted vegetation; and
- Coarse armouring to protect key water management structures and minimise erosion in areas with a high erosion potential, such as embankments.

5.4 Vegetation

The climate at Renison is considered conducive to vegetation growth and, with an appropriate growth medium, vegetation coverage can be used as a tool to manage erosion potential in the longer term (Figure 5.4). However, appropriate landform design remains critical, particularly whilst vegetation establishes. Vegetation establishment and growth should not be relied on in the short term to manage erosion potential. In order to achieve the site wide closure strategy, revegetation of the final landform will be required.

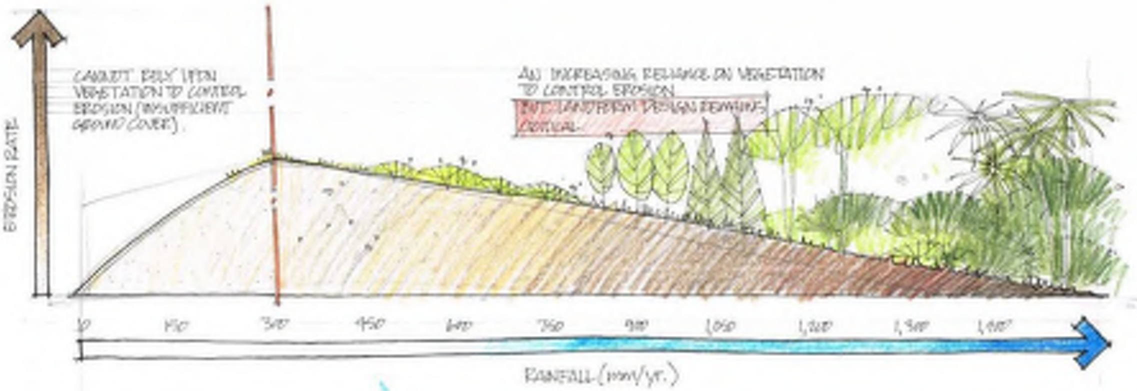

Figure 5.4: Continuum of erosion potential in the context of a climate-vegetation relationship.

INAP, 2017.

5.5 Conceptual Cover System Design

The key ASF conceptual closure objectives for cover system design are:

- Limit the release of NMD impacted seepage from the ASF on the Lower Crusher Dam by reducing NP to a low level (<10% R);
- Limit erosion of the cover system surface to a low level (<10 t/ha/yr);
- Provide a cover system capable of establishing and maintaining targeted vegetation;

The major constraints to a conceptual cover system design for the ASF include:

- A cover system design that can be implemented progressively as the ASF is constructed;
- Maximising storage space while maintaining landform embankment profiles that will meet ASF closure objectives and allow for construction of a barrier layer cover system;
- Availability of suitable cover system construction materials; and
- Managing surface water runoff both during progressive cover system construction and on the final landform.

In order to meet the proposed conceptual ASF closure objectives, and considering the four cover system design filters and design constraints discussed above, the proposed conceptual cover system design for the ASF is a barrier type cover system with the following properties (Figure 5.5):

- Growth medium. A layer of material suitable for supporting vegetation growth and resisting erosion.
- Interflow drainage layer. A layer of benign, coarse material with a hydraulic conductivity high enough to prevent positive pore water pressures developing above the barrier layer. The drainage layer allows water that has infiltrated down through the growth medium layer to be conveyed off the landform as interflow and prevents ponded water accumulating above the barrier layer.
- Low permeability barrier layer. A bituminous geomembrane (BGM) would be considered a suitable material for this purpose, however the conceptual embankment profiles are towards the upper limit for acceptable surface friction and will require detailed analysis to determine if embankment grades should be reduced. NP through a cover system using a geomembrane as a barrier element can still occur through diffusion, although the transmission rates are typically very low. In general, the hydraulic conductivity corresponding to water diffusion is in the order of 10^{-14} to

10^{-13} m/s for a BGM, depending on the thickness of the product (Breul et al., 2004). As a result, NP is primarily attributed to leakage through holes in the BGM. In the cover system profile, this leakage can only be triggered when positive pore water pressures (i.e. ponding of water) develop on top of the BGM in proximity to a hole.

Figure 5.5: Conceptual Cover System Design for Renison ASF incorporating a geosynthetic barrier layer.

6 CONCEPTUAL LANDFORM DESIGN

Landform design is a fundamental consideration for any mine waste storage facility and is critical for the success of an overlying cover system. Cover system failure can often be traced back to poor surface water management and/or landform instability (MEND, 2007). Landform and cover system design should be an integrated process. A failure in one of these elements will ultimately increase the risk of failure in the other (INAP, 2017) A site's climate, geology, soils, local hydrogeological setting, topography, constructability and final land use should all be considered when designing a final landform design (INAP, 2017). In addition, landform design is central to achieving the Renison site wide and domain closure objectives to make the site safe, reduce the need for long term monitoring and maintenance and to provide long term physical stabilisation.

The following four key control mechanisms can be manipulated during landform design to manage surface instability:

- Material texture;
- Slope length;
- Slope angle; and
- Vegetation cover.

Figure 6.1 provides a matrix type visualisation as to how these mechanisms contribute to surface instability and where one mechanism can offset the impacts of another.

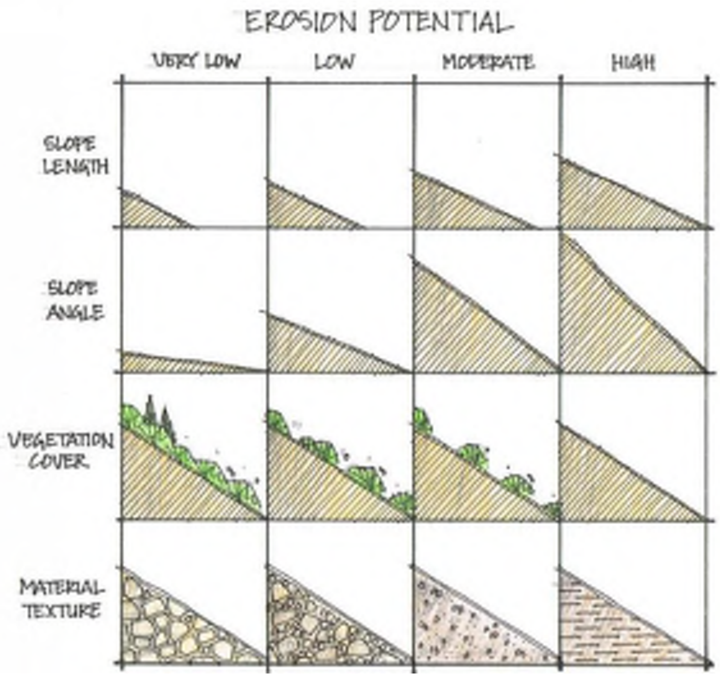

Figure 6.1: Surface stability control mechanisms.

INAP, 2017.

6.1 Conceptual Landform Design

The key ASF conceptual closure objectives for landform design are:

- Limit erosion of the cover system surface to a low level (<10 t/ha/yr); and
- The closed landform should not require ongoing maintenance and expenditure above that normally required for an area with a similar land use.

The major constraints to a conceptual ASF landform design include:

- A high rainfall climate;
- A limited ASF footprint dictated by existing hard barriers being the Mill and supporting embankment to the west and the Lower Crusher Dam to the east;
- Maximising dump space while maintaining landform embankment profiles that will meet ASF closure objectives;
- Conceptual cover system design (reduced friction angle for cover materials placed above a geomembrane as opposed to directly on the NAF aggregate);
- Upstream catchments reporting past the ASF and into the Lower Crusher Dam; and
- Availability of suitable outer cover system materials with low erosion potential.

To meet the proposed conceptual ASF closure objectives, and considering the four key control mechanisms and design constraints discussed above, the proposed conceptual final landform design for the ASF can be described as:

- Embankment cover materials will be a coarse, competent rock armour capable of resisting erosion and achieving the ASF closure objectives. The constraints placed on the ASF footprint entail embankment cover material selection will likely be the most effective erosion control mechanism available to meet the erosion focused ASF closure objectives.
- Final landform embankment gradients will be limited to 1V:2H. Operational tip heads are expected to be angle of repose, or approximately 1V:1.3H. Dozing of final embankments will be required to achieve the final landform embankment design. Shallower embankment gradients will be considered if cover materials with suitable erosion resistance are not available in sufficient quantities. Should the final cover system include a geomembrane as the barrier layer, consideration will need to be given to maximum allowable friction angles. The current conceptual embankment gradients are towards the upper limit of commonly acceptable friction angle for a BGM. However, a shallower embankment gradient will increase slope length and therefore increase embankment catchment area. Simply flattening out the embankment may not necessarily result in an improvement to erosion performance.

- Maximum final landform slope lengths will be limited to 90 m (36 m vertically) unless a reduction in embankment gradients forces slope length to increase and results in a net improvement to erosion performance. Consideration will be given to the introduction of slope breaks such as benches and/or contours berms should slope lengths need to be extended. However, the introduction of benches and contour berms will require additional surface water management control measures be implemented to avoid overtopping and breakthrough failures. In a high volume, but low-intensity, rainfall environment like Renison, and dependant on the erosion potential of the cover material placed on embankments, sedimentation of shallow gradient benches and contour berms could significantly increase overtopping and breakthrough risk.

- The plateau of the landform will have a catchment area of approximately 4 ha. At its widest point, the distance from the ASF crest and the Mill embankment will be approximately 140 m. The plateau will be graded back towards the Mill at approximately 2% to direct surface water into perimeter diversion drains and away from the ASF.

- A revegetation program will be developed in the detailed design phase for implementation during rehabilitation works. The revegetation program will need to consider specifics of the landform and cover system designs and target appropriate species for both the plateau area and embankments.

6.2 Conceptual Surface Water Management Design

The guiding principles for the conceptual surface water management design are to:

- Prevent runon from outside catchments entering the ASF footprint;
- Avoid shedding runoff down steep slopes in concentrated flows; and
- Where shedding runoff from steep slopes cannot be avoided, reduce catchment areas as far as possible and shed water down the most efficient path/s.

Surface waters from surrounding catchments will be directed to a series of perimeter diversion drains conveying run off from external catchments around the ASF and into the Lower Crusher Dam. Clean surface water runoff and interflow from the upper plateau section of the ASF cover system will be directed towards the west and report to the same perimeter diversion drains used to convey runoff from external catchments. Clean surface water runoff and interflow from the embankment cover system will report to the toe of the embankment and into the Lower Crusher Dam.

During operations and the early post closure period, ASF seepage discharged from the seepage outlet pipe will report to the Lower Crusher Dam. When monitoring data from the collection point indicates ASF seepage quality (contaminant load) is consistent, and will not lead to water quality criteria exceedances at receiving environment compliance monitoring locations, seepage will be redirected to the receiving environment or will be diverted to the Lower Crusher Dam to assist with managing water quality in this storage.

7 ASF MONITORING PROGRAMS

Monitoring ASF performance will be essential for identifying when corrective actions are needed and for determining if performance criteria, and therefore closure objectives, for the ASF are being achieved. Water quality, stability (both erosional and geotechnical) and ecological monitoring will be required to demonstrate ASF closure objectives will be achieved. The following section outlines the baseline, operational and closure monitoring programs proposed for the ASF.

7.1 Baseline Monitoring Program

A baseline monitoring program will establish baseline conditions for both operational and closure monitoring programs and will assist the development and refinement of achievable and measurable closure objectives and performance criteria (DFAT, 2016). Baseline monitoring is currently underway and should continue until which time as construction of the permanent ASF commences. The proposed baseline monitoring program is summarised in Table 7.1.

7.1.1 ASF Seepage

Monitoring of ASF seepage commenced in July 2018 when NAF aggregate from the ore-sorter trial program was first placed within the ASF footprint (BMTJV, 2020b). Monitoring consists of temperature, pH, conductivity, discharge (L/s), acidity, alkalinity, SO_4, Fe, Mn, Al, As, Cd, Co, Cu, Fe, Hg, Ni, Pb, Zn. Water quality samples and flow rate measurements are collected from the ASF seepage collection and monitoring point. Monitoring of NAF aggregate placed during the trial period presents an opportunity to understanding the potential baseline rates of NMD generation that could have emanated from an ASF without progressive rehabilitation or final cover system controls in place and to demonstrate the improvements gained by implementing these controls. Monitoring of flows will assist in understanding the hydrology of the ASF, including predicting drawdown rates and durations.

Monitoring of ASF seepage is proposed to be undertaken on a fortnightly basis but is subject to flow conditions at the time. Opportunistic sampling should be considered during times of sporadic flow.

7.1.2 Subsoil Collector Drain Monitoring

Subsoil collection drains have been installed below the compacted clay basal liner to intercept and convey legacy seepage from the surrounding areas. Outlet pipes have been installed at the downstream ends to discharge legacy seepage from the subsoil collector drains to the Lower Crusher Dam. The intent of the basal liner is to create hydraulic separation between the ASF and the underlying materials. Baseline monitoring and development of a water quality signature for legacy seepage will assist with evaluating the performance of the basal liner, and conversely, performance of ASF and its associated controls. Due to the presence of legacy impacts, development of a baseline dataset will be critical to understanding basal liner performance.

Monitoring of subsoil collector drain discharge should include the same parameters as monitoring for the ASF seepage and be undertaken on the same fortnightly frequency or opportunistically at times of sporadic flow.

7.1.3 Groundwater Monitoring

Two groundwater monitoring wells (GW16 and GW17) have been installed downstream of the ASF for the purpose of monitoring potential changes to the groundwater environment as a result of the ASF operation. The wells are located in close proximity to each other with GW16 screened at a depth of 31.8 m in the argillite bedrock and GW17 screened at a depth of 8.1 m in surficial sediments. These surficial sediments were thought to be a perched aquifer at the time, however, subsequent monitoring events have failed to identify water at this depth and indicate this is not the case (BMTJV, 2020b).

Monitoring should include the same parameters as monitored for ASF seepage and subsoil collector drains, with the exception of flow and the inclusion of standing water level (SWL). Similar to the subsoil collector drain discharge, groundwater in this area of the site is known to be impacted by previous works and developing a baseline dataset will be critical for detecting any cumulative impacts on groundwater from the operation of the ASF. Groundwater monitoring wells should be monitored on a quarterly basis.

7.1.4 Meteorological Monitoring

A weather station has been operating at Renison since September 2018. Parameters measured includes wind speed, wind direction, rainfall, radiation, temperature (wet and dry bulb), temperature (20 m above ground level), relative humidity and barometric pressure. Meteorological data will be integral to understanding the environmental context in which the ASF is located and how climatic conditions have, and will continue to, influence performance.

Table 7.1: ASF Baseline Monitoring Program

Type	Location	Parameters	Frequency
ASF Seepage	ASF Seepage Outlet Pipe	Temperature, pH, EC, flow, acidity, alkalinity, SO_4, Fe, Mn, Al, As, Cd, Co, Cu, Fe, Hg, Ni, Pb, Zn	Fortnightly
Legacy Seepage	Subsoil Collector Drain Outlet Pipes	Temperature, pH, EC, flow, acidity, alkalinity, SO_4, Fe, Mn, Al, As, Cd, Co, Cu, Fe, Hg, Ni, Pb, Zn	Fortnightly

Type	Location	Parameters	Frequency
Groundwater	GW16 & GW17	SWL, temperature, pH, EC, acidity, alkalinity, SO_4, Fe, Mn, Al, As, Cd, Co, Cu, Fe, Hg, Ni, Pb, Zn	Quarterly
Meteorological	Renison Operations	Wind speed & direction, rainfall, radiation, temperature, relative humidity & barometric pressure	Daily (min.)

Adapted from BMTJV, 2020b.

7.2 Conceptual Operational Monitoring Program

The operational monitoring program should be an extension of the baseline monitoring program and incorporate all the same parameters at the same frequencies. In addition, the operational monitoring program should also include mechanisms for collecting data relating to:

- NAF aggregate production and placement rates (production reports);
- ASF construction progress (survey);
- Ongoing geochemical analysis of NAF aggregate (QA/QC program); and
- Geotechnical stability (health and safety).

It is anticipated that additional data requirements for the operational monitoring program would be collected during the course of normal operations and do not represent an additional demand on site resources.

7.3 Conceptual Closure Monitoring Program

The closure monitoring program would come into effect at the completion of all major closure works, i.e. final cover system has been constructed and any revegetation works are completed. The closure monitoring program would include all the locations and parameters of the baseline monitoring program, with only the geotechnical stability monitoring continuing from the operational monitoring program.

The closure monitoring plan would also include provision for monitoring of the following additional elements:

- Cover system monitoring. A series of soil and water sensor stations monitoring conditions both above and below the cover system.

- Erosion monitoring. Both visual and high resolution digital survey methods would be employed to evaluate erosion rates and overall landform surface stability.
- Ecology monitoring. Various flora and fauna monitoring techniques would be employed to evaluate revegetation success.

As closure monitoring data accumulates and indicators trend toward the desired outcomes, it is anticipated the frequency of particular closure monitoring activities could be reduced until which time as relinquishment is achieved.

7.4 Adaptive Management

The Australian Government's Leading Practice Handbooks for Sustainable Mining (DFAT, 2016b) define adaptive management as:

"…an iterative process of decision-making in the face of uncertainty with the aim of reducing uncertainties using a risk-based approach. Trigger levels (upper and lower) are used to clearly identify levels at which management responses to unexpected or poor rehabilitation condition are needed. Management tools such as trigger action response plans (TARPs) can help to provide early warning signals that a trend towards unacceptable levels of risk is likely."

An adaptive management plan and supporting TARPs will be developed to define at what point action is to be taken in response to monitoring results from ASF monitoring programs. The adaptive management plan will be used not only for the early identification of trends with potential to result in undesirable outcomes, but to also identify when indictors are trending towards desirable outcomes and closure monitoring efforts can be reduced.

8 DETAILED DESIGN

As discussed in Section 2.5, several risks and associated design enhancements were identified during the FMEA that would be more effectively addressed during the detailed design phase once project specific guidelines have been defined. Detailed design is anticipated to incorporate:

- Cover system modelling and design refinement, based on the geotechnical / geochemical properties of available materials;
- Erosion assessments and embankment profile refinement, based on the geotechnical / geochemical properties of available materials and the final cover system design;
- Engineering reviews to ensure appropriate factors of safety have been achieved and design assumptions have been tested against final designs;
- Optimised staged construction and progressive rehabilitation plans for execution;
- Development of final quality assurance and quality control (QA/QC) documentation and procedures; and
- Development of a final detailed revegetation plan including species lists, planting methodology and timing and any soil enhancements or amelioration.

Detailed designs will form the basis for preparation of the Development Proposal and Environmental Management Plan.

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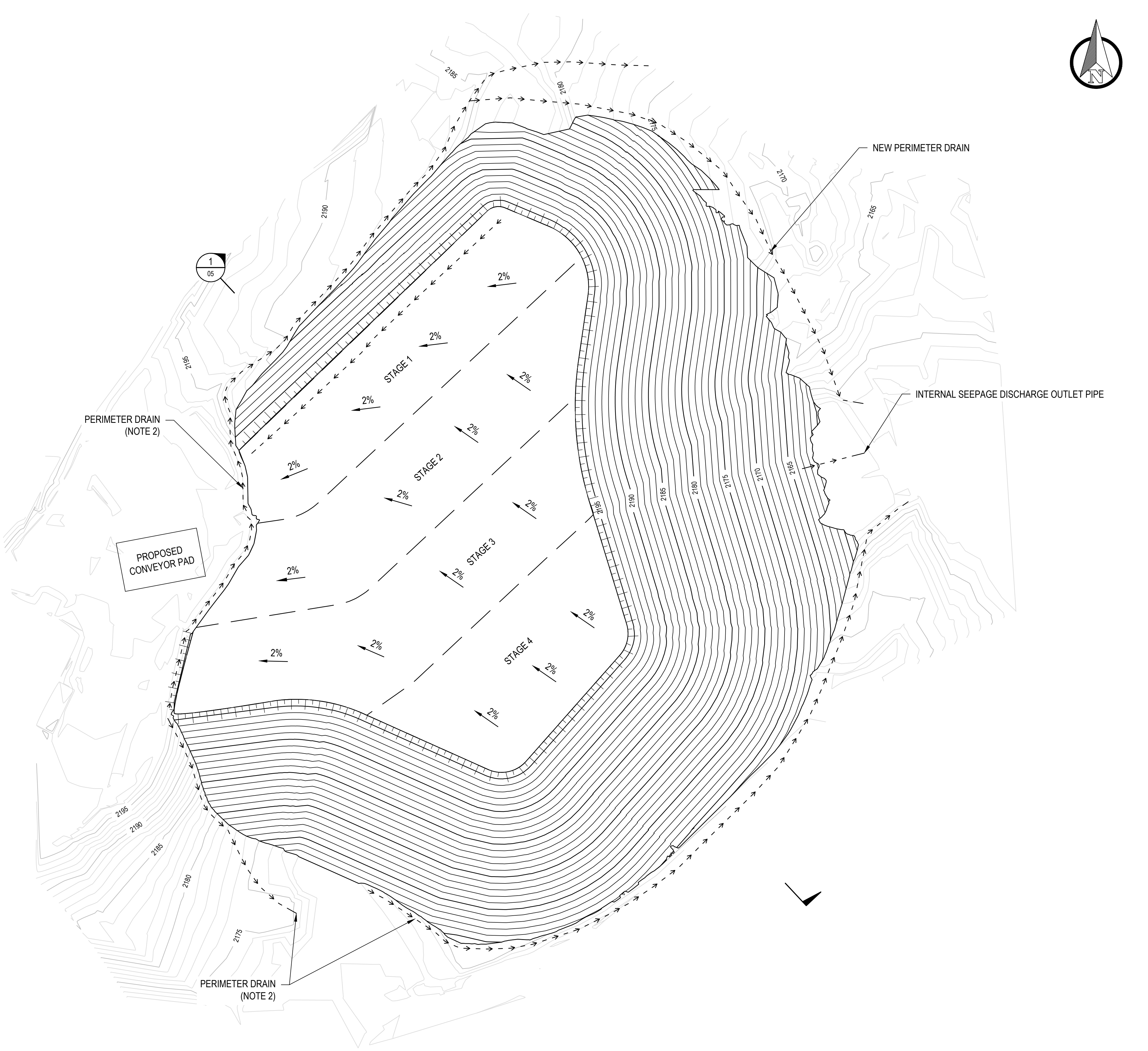
Appendix A

Conceptual Design Drawings



GENERAL ARRANGEMENT
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okane
Integrated Mine Waste Management and Closure Services
Specialists in Geochemistry and Unsaturated Zone Hydrology

PRELIMINARY
NOT FOR CONSTRUCTION

Legend/Notes

NOTE

1. ALL UNITS IN METRES U.N.O.
2. ALIGNMENT OF PERIMETER DIVERSION DRAINS TO BE DETERMINED ON SITE SUBJECT TO SITE CONDITIONS.
3. FINAL LANDFORM:
   3.1. 3D AREA = 39249m^2
   3.2. VOLUME = 629799m^3

LEGEND

EXISTING CONTOUR — 1100
DESIGN CONTOUR — 1100
SURFACE WATER DRAINS
CREST

10 0 10 20 30 40 50 60m
SCALE 1:1250

Revision	Description	Date
3		
2		
1		
0	ISSUED FOR FINAL REPORT	2020/10/20
A	ISSUED FOR CLIENT REVIEW	2020/09/15

Client/Project

BLUESTONE MINES TASMANIA JOINT VENTURE PTY LTD

BLUESTONE MINES TASMANIA
JOINT VENTURE PTY LTD
RENISON OPERATIONS ASF
CONCEPTUAL DESIGN

Drawn by
J. DAND

Designed by
OKANE CONSULTANTS

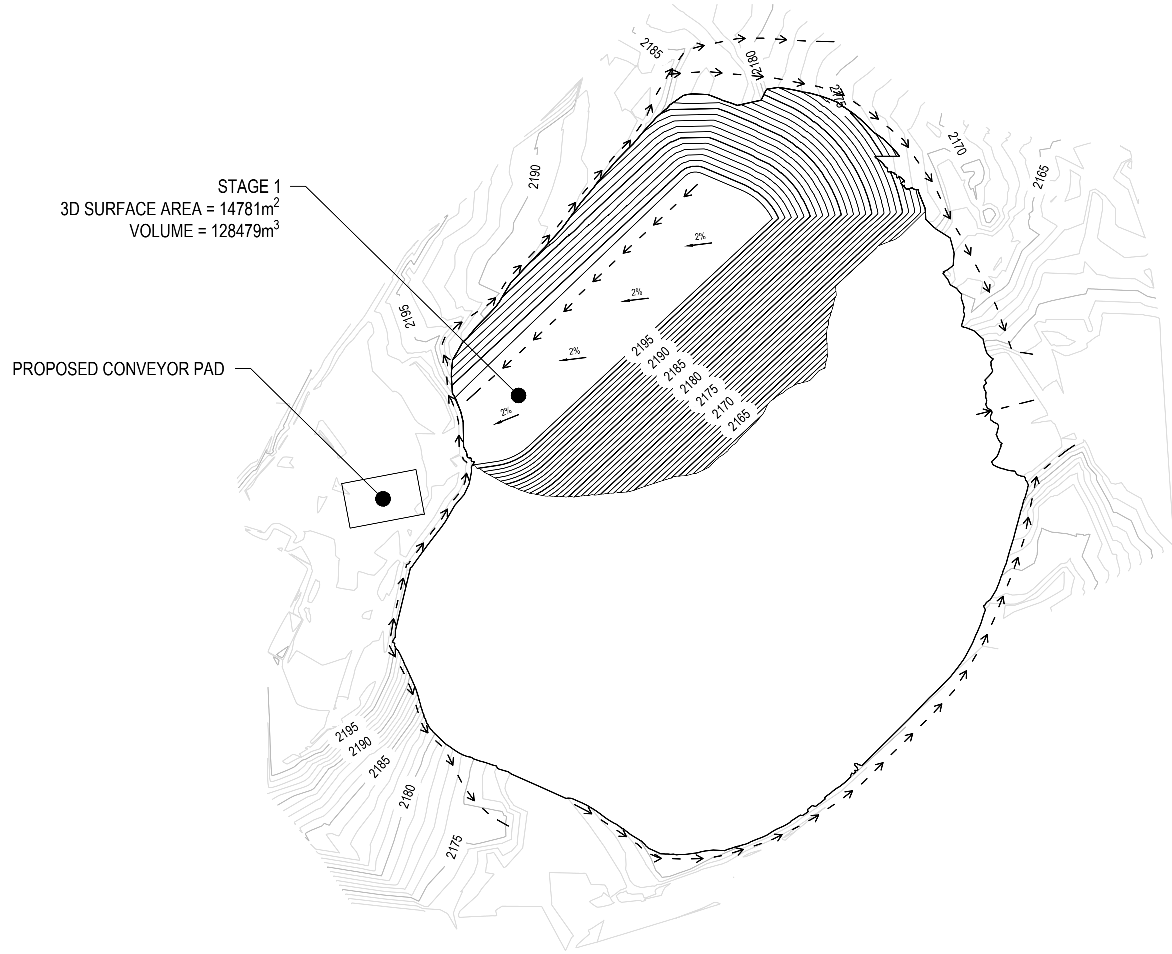
Approved by
A. OSBORN

Drawing title
GENERAL ARRANGEMENT AND CONCEPTUAL SURFACE WATER MANAGEMENT

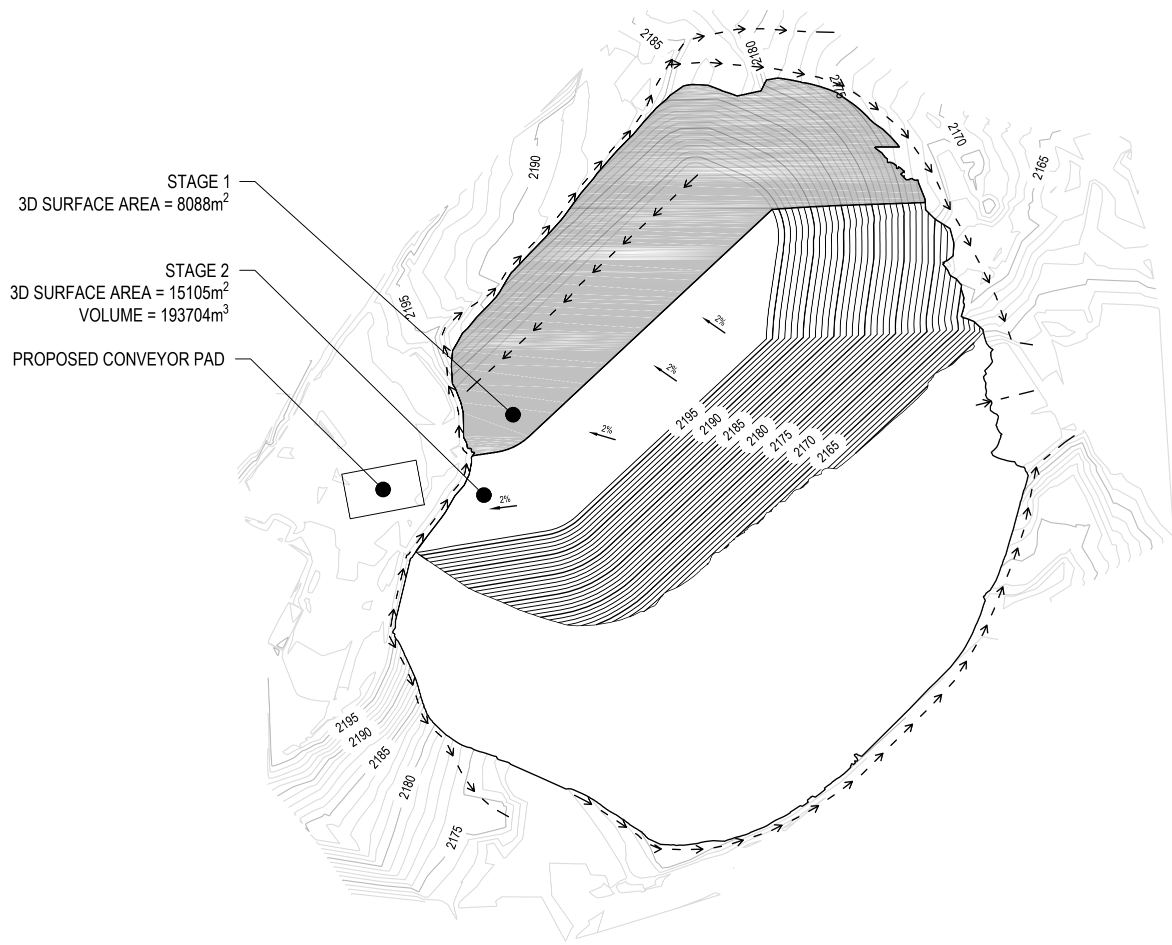
Project no.	Drawing no.	Sheet	Revision
1116-011	1116-011-01	A3	0

Last Saved:10/20/2020 10:11 AM

Cadfile Name:1116-011 Renison ASF Concept Design_Rev 0.dwg



STAGE 1
1:2500



STAGE 2
1:2500

Integrated Mine Waste Management and Closure Services
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PRELIMINARY
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Legend/Notes

NOTE

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LEGEND

EXISTING CONTOUR 1100
DESIGN CONTOUR 1100
SURFACE WATER DRAINS

25 0 25 50 75 100 125m
SCALE 1:2500

Revision	Description	Date
3		
2		
1		
0	ISSUED FOR FINAL REPORT	2020/10/20
A	ISSUED FOR CLIENT REVIEW	2020/09/15

Client/Project

BLUESTONE MINES TASMANIA
JOINT VENTURE PTY LTD
RENISON OPERATIONS ASF
CONCEPTUAL DESIGN

Drawn by
J. DAND

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OKANE CONSULTANTS

Approved by
A. OSBORN

Drawing title

PROGRESSIVE REHABILITATION AND CONCEPTUAL STAGING PLAN STAGE 1 AND 2

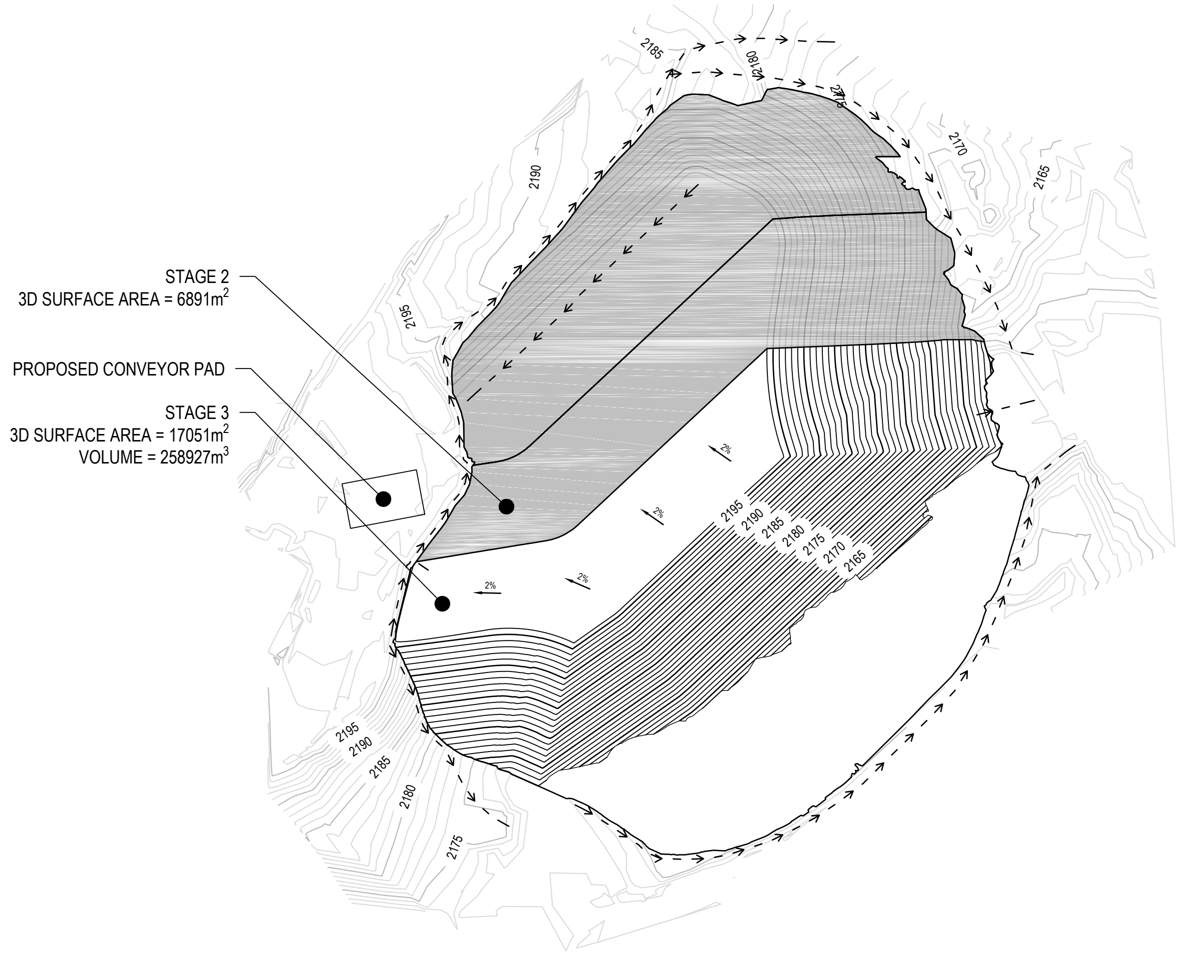
Project no.	Drawing no.	Sheet	Revision
1116-011	1116-011-02	A3	0

Last Saved:10/20/2020 10:11 AM

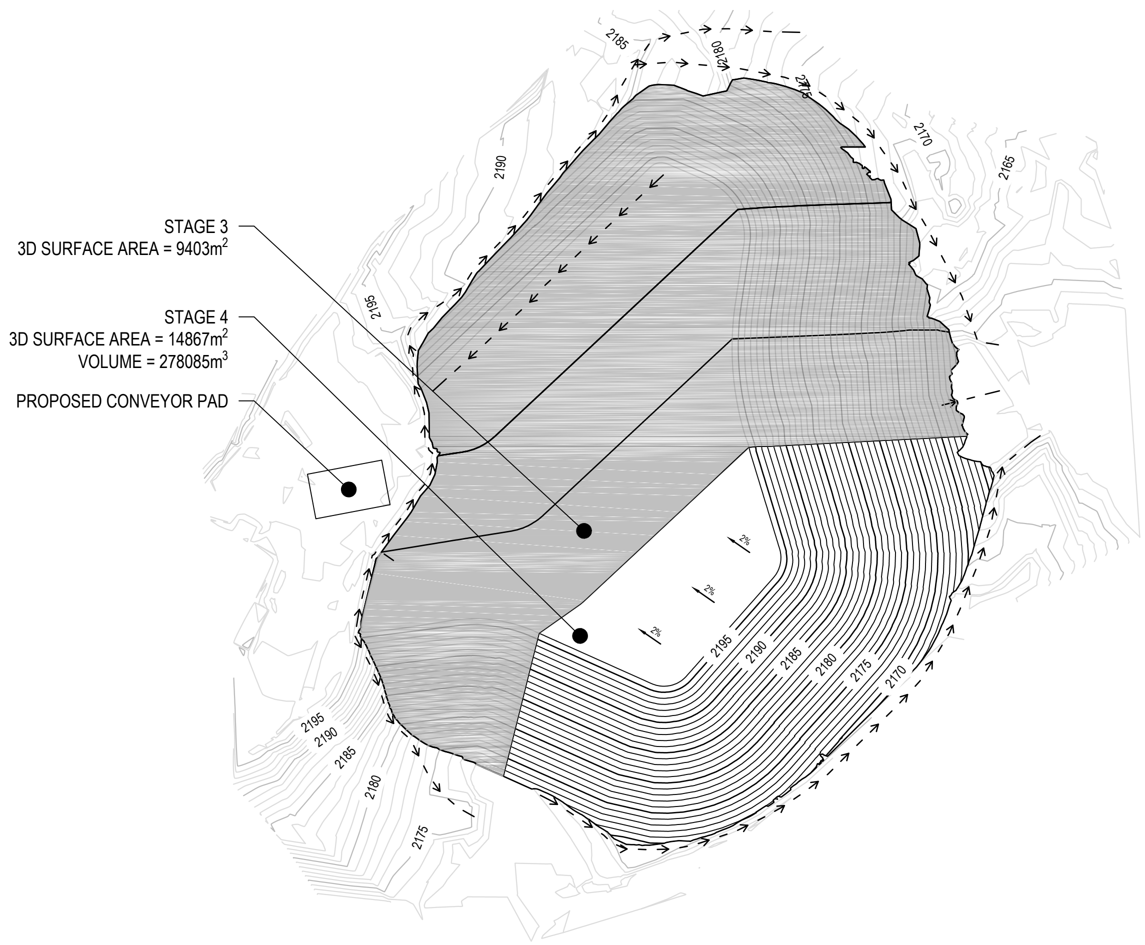
Cadfile Name:1116-011 Renison ASF Concept Design_Rev 0.dwg

Last Saved:10/20/2020 10:11 AM

Cadfile Name:1116-011 Renison ASF Concept Design_Rev 0.dwg



STAGE 3
1:2500



STAGE 4
1:2500

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Legend/Notes

NOTE

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2. ALIGNMENT OF PERIMETER DIVERSION DRAINS TO BE DETERMINED ON SITE SUBJECT TO SITE CONDITIONS.

LEGEND

EXISTING CONTOUR — 1100
DESIGN CONTOUR — 1100
SURFACE WATER DRAINS

25 0 25 50 75 100 125m
SCALE 1:2500

Revision	Description	Date
3		
2		
1		
0	ISSUED FOR FINAL REPORT	2020/10/20
A	ISSUED FOR CLIENT REVIEW	2020/09/015

Client/Project

BLUESTONE MINES TASMANIA JOINT VENTURE PTY LTD

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RENISON OPERATIONS ASF
CONCEPTUAL DESIGN

Drawn by
J. DAND

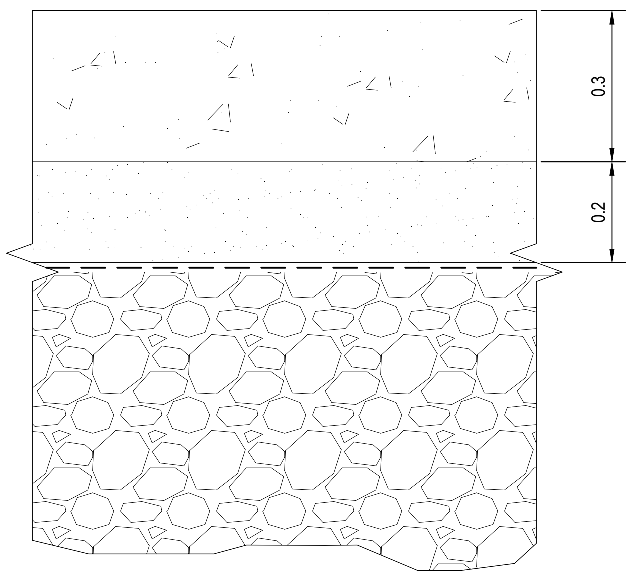
Designed by
OKANE CONSULTANTS

Approved by
A. OSBORN

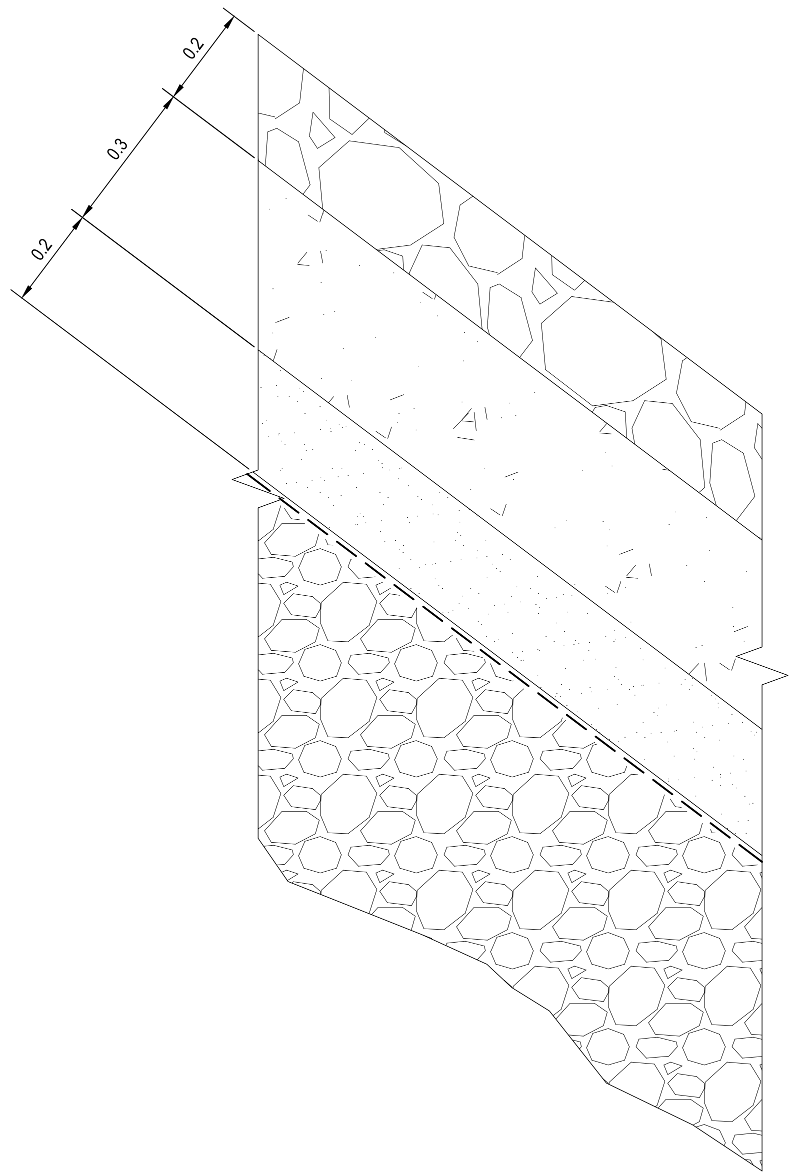
Drawing title

PROGRESSIVE REHABILITATION AND CONCEPTUAL STAGING PLAN STAGE 3 AND 4

Project no.	Drawing no.	Sheet	Revision
1116-011	1116-011-03	A3	0



TYPICAL PLATEAU COVER SYSTEM CROSS SECTION
1:15



TYPICAL EMBANKMENT COVER SYSTEM CROSS SECTION
1:15

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PRELIMINARY
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Legend/Notes

NOTE

1. ALL UNITS IN METRES U.N.O.

LEGEND

EXISTING CONTOUR 1100
DESIGN CONTOUR 1100
GEOSYNTHETIC LINER
COARSE ARMOUR
GROWTH MEDIUM
DRAINAGE LAYER
AGGREGATE

Revision	Description	Date
3		
2		
1		
0	ISSUED FOR FINAL REPORT	2020/10/20
A	ISSUED FOR CLIENT REVIEW	2020/09/15

Client/Project

BLUESTONE MINES TASMANIA JOINT VENTURE PTY LTD

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JOINT VENTURE PTY LTD
RENISON OPERATIONS ASF
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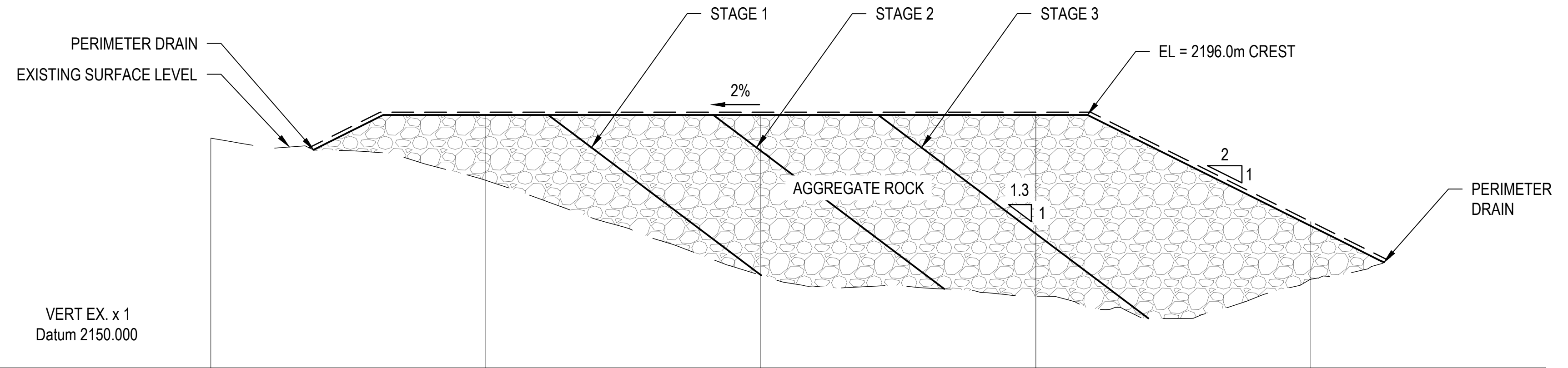
Drawing title
CONCEPTUAL COVER SYSTEM
TYPICAL CROSS SECTIONS

Project no.	Drawing no.	Sheet	Revision
1116-011	1116-011-04	A3	0

Last Saved:10/20/2020 10:11 AM

Cadfile Name:1116-011 Renison ASF Concept Design_Rev 0.dwg



COVER SYSTEM DESIGN SURFACE		2196.5	2196.5	2196.5	2176.57	2169.96	
ASF DESIGN SURFACE		2196.00	2196.00	2196.00	2175.79	2169.18	
EXISTING SURFACE	2191.78	2184.10	2166.83	2163.02	2166.10	2169.18	
DEPTH TO TOP OF ASF DESIGN SURFACE		11.90	29.17	32.98	9.69	0.00	
CHAINAGE	0.00	50.00	100.00	150.00	200.00	213.29	242.69

SECTION 1
1:1250

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LEGEND

EXISTING CONTOUR — 1100
DESIGN CONTOUR — 1100
GEOSYNTHETIC LINER

10 0 10 20 30 40 50 60m
SCALE 1:1250

Revision	Description	Date
3		
2		
1		
0	ISSUED FOR FINAL REPORT	2020/10/20
A	ISSUED FOR CLIENT REVIEW	2020/09/15

Client/Project

BLUESTONE MINES TASMANIA JOINT VENTURE PTY LTD
RENISON OPERATIONS ASF
CONCEPTUAL DESIGN

Drawn by: J. DAND

Designed by: OKANE CONSULTANTS

Approved by: A. OSBORN

Drawing title

CONCEPTUAL LANDFORM
TYPICAL CROSS SECTIONS

Project no.	Drawing no.	Sheet	Revision
1116-011	1116-011-05	A3	0

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Cadfile Name:1116-011 Renison ASF Concept Design_Rev 0.dwg

For further information contact:

Andrew Osborn
Senior Scientist
aosborn@okc-sk.com

Okane Consultants Pty Ltd

202 Petrie Terrace
Brisbane QLD 4000
Australia

Telephone: (07) 3367 8063
Facsimile: (07) 3367 8052
Web: www.okc-sk.com