



R E P O R T

HUNTER VALLEY OPERATIONS

Life of Mine Fine Reject Management Strategy

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EXECUTIVE SUMMARY

This document presents a Life of Mine Fine Reject Management Strategy for Hunter Valley Operations (HVO) to satisfy Schedule 4 condition 28A of DA 450-10-2003. In this report “Life of Mine” refers to the maximum approved development consent at HVO, which is the South Project Approval 06_0261. All approved Tailings Storage Facilities (TSFs) at HVO operate under the North Project Approval 450-10-2003.

The study is based on a production schedule commencing at July 2018 and continuing to March 2030. The total planned production of washed coal is estimated to be approximately 194 Mt (CPP output) over the study period. Fine rejects (tailings) are produced from two plants, namely the Hunter Valley Coal Preparation Plant (HVCPP) and the Howick Coal Preparation Plant (HCPP). The planned tailings production is estimated to be approximately 17.83 Mt over the study period.

HVO’s current tailings disposal strategy satisfies the predicted HVO tailings storage requirements to March 2030 by utilising existing (constructed) TSFs Dam 6, North Void and Cumnock Void (via agreement with Glencore), approved Carrington In-Pit (CIP) under the Modification 6 consent approval and proposed West Pit TSF.

HVO are transitioning to a tailings disposal strategy that utilises secondary (or Pipe Head) flocculation. This deposition strategy is currently employed for North Void and Cumnock TSFs. The strategy will be expanded to Dam 6 TSF in 2019, and CIP TSF from commencement of deposition.

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1 INTRODUCTION

This report presents an update of a previous study undertaken by ATC Williams Pty Ltd (ATCW), document ref. 101041R96 Rev 1 dated December 2015 [Ref 1], into the management of fine rejects at Hunter Valley Operations (HVO) for the period 2015 to 2030 inclusive. March 2030 is the expiry date of the development consents held by HVO South Project Approval 06_0261. ATCW notes that HVO North's consent Modification 6 (MOD 6) now allows for the use of the existing Carrington Pit (Carrington In-Pit (CIP) Tailings Storage Facility (TSF) to be filled with fine rejects.

This update is based on HVO's decision to flocculate the tailings to be deposited at the site's existing and future TSFs. The proposed flocculation is to commence from the end of 2018 onwards.

HVO is located approximately 24 kilometres (km) north-west of Singleton, New South Wales (NSW). The mining and processing activities at HVO are geographically divided by the Hunter River into HVO North and HVO South. While HVO is managed as one operation, HVO North and HVO South each have separate planning approvals.

It is noted that HVO is jointly owned by Yancoal Australia and Glencore Coal Pty Ltd.

This report was prepared for submission to the NSW Department of Planning & Environment (DPE), to satisfy Schedule 4 condition 28A of DA 450-10-2003, which states:

The Applicant shall prepare and implement a life of mine fine reject management strategy to the satisfaction of the Director-General. The strategy must:

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| (a) <i>be prepared in consultation with DRE and NOW, and submitted to the Director-General for approval by 30 June 2015.</i> | Initial consultation occurred with DRE on 7/4/2015 and NOW on 31/3/2015. Document was simultaneously sent to the DP&E, DRE and NOW for subsequent review. DRE and DP&E provided further comments which have been addressed in this revised document. No further comments were provided by NOW. |
| (b) <i>describe potential locations and design options for the emplacement of fine reject on site.</i> | Addressed in Section 3 and Figure 2 . |
| (c) <i>assess any material short term and long term impacts on surface and groundwater resources associated with each option.</i> | Addressed in summary in Appendix A and in more detail in existing or subsequent consents, EISs and individual operating and maintenance manuals for tailings storage facilities. |

- | | |
|---|--|
| <p>(d) <i>describe the measures that would be implemented to avoid, minimise, manage and monitor any adverse impacts of the fine reject emplacements over time.</i></p> | <p>Addressed in summary in Appendix A and in more detail in existing or subsequent operating and maintenance manuals for tailings storage facilities.</p> |
| <p>(e) <i>describe how the fine reject emplacements would be rehabilitated and describe potential options for future land uses.</i></p> | <p>Addressed in Section 5, Appendix A and existing or subsequent MOPs. The MOP is required to be consistent with the approved EIS and Final Landform and Landuse Plans included in the HVO North Project Approval as Appendix 6 and 7.</p> |
| <p>(f) <i>be integrated with the Rehabilitation Management Plan and Agricultural Land Reinstatement Management Plan for the mine.</i></p> | <p>The information in the fine reject management strategy is consistent with the Rehabilitation Management Plans (MOPs) and the Agricultural Land Reinstatement Management Plans for HVO South and HVO North.</p> <p>These documents describe the status of the tailings storage facilities and how the rehabilitation of the active facilities will be undertaken.</p> <p>These documents are required to be consistent with the approved EIS and will be utilised in the development of the site closure management plan that is to be reviewed and approved prior to closure.</p> |

HVO North operates under Development Consent No. DA 450_10_2003, which is due to expire in June 2025. HVO South operates under Project Approval No. 06_0261, which is due to expire in March 2030. This study considers tailings production until March 2030.

In development of the strategy, ATCW undertook a study to evaluate the storage requirements for the fine rejects (tailings) planned to be generated from the Hunter Valley Coal Processing Plant (HVCCP) and Howick Coal Processing Plant (HCPP) to the LOM. The intent was to identify the most practical and efficient means of utilising the existing and proposed future TSFs in both HVO North and HVO South.

This study includes the following:

- Development of a tailings disposal strategy using the planned production schedule, and
- Calculation of the tailings storage capacity for all TSFs.

2 BACKGROUND

2.1 Current Mining Plan

HVO North currently undertakes mining in West Pit and Carrington Pit. HVO South currently undertakes mining in Cheshunt and Riverview Pit. HVO is divided by the Hunter River and is serviced by one integrated fleet of equipment and personnel. Equipment and personnel are dispatched to each of the mining areas as required.

Run-of-mine (ROM) coal contains overburden and interburden material from above and below the target coal seams. The coal washing process in the CPP processes the ROM coal to generate reject material. Two forms of reject material are produced; coarse and fine. The coarse material is hauled to active emplacement areas, whilst the fine reject material is pumped as a slurry from the CPP to fine reject emplacement facilities. HVO North has two CPP's, the HVO CPP (HVCPP) and Howick CPP (HCPP).

Table 2.1 outlines rehabilitated and current approved TSFs.

TABLE 2.1
SUMMARY OF CURRENTLY APPROVED HVO NORTH TSFs

Site	Status	Tailings source	Start	Finish	Estimated Rehabilitation Timeframe	Estimated Capping Volume kbcm, and (Source)
Lemington 1 TSF Cell A	Rehabilitated					
Lemington 1 TSF Cell B	Rehabilitated					
Lemington 2 TSF	Rehabilitated					
Lemington 3 TSF	Rehabilitated					
Lemington 4 TSF Cell A	Rehabilitated					
Lemington 4 TSF Cell B	Rehabilitated					
Lemington 5 TSF	Rehabilitated					
Howick TSF	Rehabilitated					
Eastern TSF	Rehabilitated					
Western TSF Cell A	Rehabilitated					
Western TSF Cell B	Rehabilitated					
South East TSF	Inactive Capping commenced in 2017		Nov 2002	Jun 2004	2017-2020	541 (Mine spoil adjacent to TSF)
Central TSF	Inactive Capping scheduled 2021		2001	Mar 2009	Est. 2021-2022	467 (Carrington out of pit dump)
Bob's Dump TSF	Inactive	HCPP	2001	Dec 2012	Est. 2021-2022	910 (Mitchell and Wilton Pits)
Dam 6 TSF (Stage 2)	Active	HCPP	Jan 2013	Aug 2025	Est. 2033-2034	(Mitchell and Wilton Pits, stockpiled)
North Void TSF	Active	HVCPP	Jan 2004	Feb 2019	Est. 2028-2031	3946 (Carrington out of pit dump)
Cumnock Void TSF	Active	HCPP	Oct 2015	Aug 2025	Glencore's responsibility	
Carrington In-Pit	Active	HVCPP	Mar 2019	Mar 2030	Est. 2038-2040	3709 (Carrington out of pit dump)
West Pit	Future	HCPP & HVCPP	Sept 2025	Beyond 2030	2038-2040	TBC

2.2 Tailings Production Schedule

The planned production schedule was advised by HVO on 12 September 2018. The study is based on a tailings production schedule commencing at July 2018 and continuing to 2030. The schedule reflects the production from the HVCPP and the HCPP.

Average planned tailings production rates adopted for this Strategy schedule are summarised in **Table 2.2** below.

TABLE 2.2
AVERAGE TAILINGS PRODUCTION RATES (Mtpa)

Coal preparation plant	July - Dec 2018	2019	2020+	Total to March 2030
Hunter Valley Coal Preparation Plant	0.57	1.24	1.24	14.83
Howick Coal Preparation Plant	0.12	0.25	0.25	3.00
Total	0.67	1.49	1.49	17.83

The planned tailings production for the study period (mid-2018 to 2030) is 17.83 Mt, at an average annual combined (for both plants) production rate of 1.49 Mt.

2.3 Tailings Properties

ATCW undertook a study in 2014 to assess the geotechnical characteristics of representative tailings samples in a laboratory. The results from the study are used as a basis for the study, but are not detailed herein. For reference, the results of this testing are documented in the following report:

ATC Williams, "Rio Tinto Coal Australia, Hunter Valley Operations (HVO), Factual Report on Tailings Testing", Ref 101041R89 Rev 1, September 2014. [Ref 2]

2.4 Status of Tailings Storage Facilities at HVO

A site overview illustrating the location of each of the existing and proposed future TSFs is presented in **Illustration 1** (located on the next page). Details of current approved TSFs for HVO North are listed in **Table 2.1**. Approved HVO South facilities are not detailed as they are not proposed for inclusion as part of this strategy. Existing and proposed future TSFs forming part of the Updated Fine Reject Management Strategy are detailed in **Appendix A**.

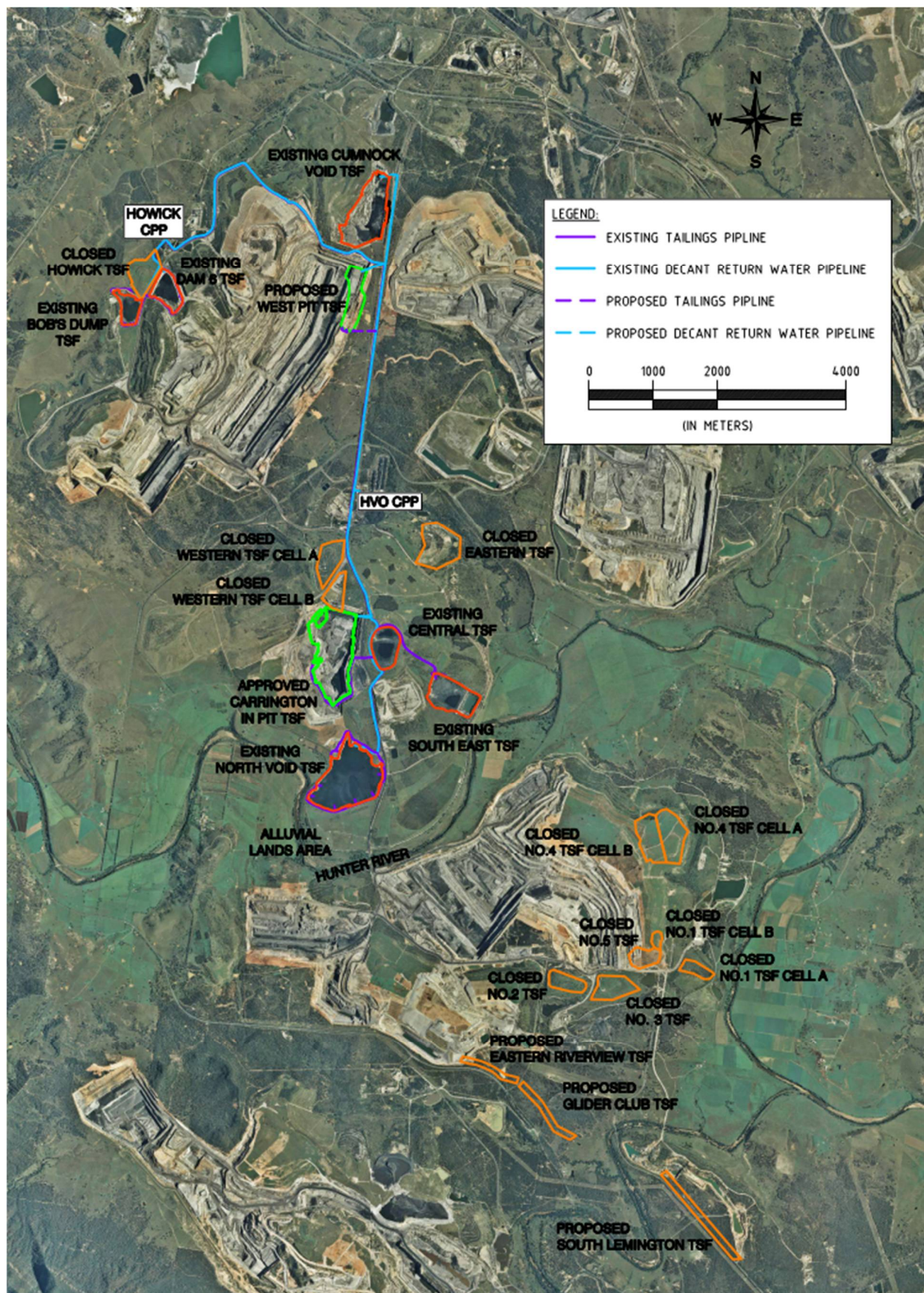


Illustration 1 - Site Overview

All HVO TSFs are owned and operated by HVO, with the exception of Cumnock Void TSF which is owned and operated by Glencore. HVO have a commercial Joint Tailings Facility Agreement (JTFA) in place that defines Glencore as the owners and operators of this facility, but for which HVO has access rights for a defined volumetric capacity for tailings storage.

The planned operating dates listed above for Cumnock Void TSF reflect planned access for tailings disposal by HVO, not the TSF whole of life operating timeframe. Under the JTFA, Glencore is responsible for the rehabilitation of the TSF. HVO is responsible for reimbursement to Glencore of costs associated with the rehabilitation of the TSF for the portion of the facility that is on HVO land.

HVO advised that Glencore has utilised the majority of its allocated void space of the Cumnock Void TSF and intend to return to the TSF sometime in the future. As part of the agreement with Glencore, HVO has an allocation of 2.0 Mm³ at the Cumnock Void TSF. While HVO have not deposited tailings at the Cumnock Void TSF in 2018, HVO has previously deposited tailings in the TSF and advised the total of tailings deposited to date is approximately 0.5 Mm³, leaving a remnant allowance of 1.50 Mm³ of void space.

3 TAILINGS DISPOSAL STRATEGY

3.1 Overview

HVO are proceeding with secondary flocculation across their current active TSFs, and proposed future TSFs located at HVO North.

HVO South currently has no active tailings storage facilities. All previously active facilities have been closed, capped and rehabilitated. Three proposed locations for the storage of tailings, discussed in the current HVO South EIS as shown in **Figure 1**, have been designated for the disposal of tailings generated by the (currently decommissioned) Lemington Coal Preparation Plant (LCPP), and are not large enough to cater for the addition of tailings produced at either HCPP or HVCPP in the North. The tailings production profiles used in the development of this strategy assume that all coal produced at both HVO North and HVO South operations is processed through the HVO North processing plants (HCPP & HVCPP). Changes to the Tailings Management Strategy will be required if the option to recommission the LCPP is implemented in the future.

Mine scheduling is a limiting factor in using tailings to backfill final voids in the South. Ideally, whilst HVO is still producing tailings, the operation would prefer to utilise existing voids for tailings storage, as this minimises the operation's footprint, reduces the size of the final open void and is more cost effective to the operation; but this can only be done after active mining has ceased within the pit.

As HVO North operations will be completed prior to HVO South operations, the voids remaining in the North (Carrington In-Pit and West Pit) will be suitable to backfill with tailings produced from the processing of coal from HVO South, pending approval. However, the currently proposed final voids in HVO South remain active mining areas until 2030 and will not be available for use as storage facilities.

In addition to the capacity constraints and scheduling, pumping tailings from HVCPP or HCPP to the approved HVO South facilities is not favoured due to both financial and environmental risks. This option is costly due to the pumping upgrades required to pump tailings the additional distance and spill containment upgrades to the Hunter Valley & Wollombi Brook Bridges.

The following sections describe the fine rejects management strategy that is based on HVO's decision to implement pipe head flocculation.

3.2 Fine Reject Management Strategy

The strategy utilises the existing TSFs Dam 6, North Void, Cumnock Void, Carrington In-Pit (CIP) and future West Pit (within a restricted area of West Pit that is yet to be mined) for tailings disposal.

The development of this strategy is based on a number of recent studies undertaken by ATCW for HVO. These studies include;

ATC Williams, "DRAFT Yancoal Australia, Hunter Valley Operations (HVO), North Void TSF Storage Optimisation Concept Study Report", Ref 101041.29R05, April 2018. [Ref 3]

ATC Williams, "Hunter Valley Operations (HVO), Carrington In-Pit TSF Capacity Review", Ref 101041.39-L001, 22 July 2018. [Ref 4]

For the development of the West Pit TSF, HVO advised the geometry and layout of the TSF is consistent with the previous study undertaken in [Ref 1]. However, as the previous study did not assess secondary flocculation of the tailings to be deposited at the TSF, this assessment was undertaken as part of this strategy update, with tailings properties assumed to be similar to those adopted for assessment of CIP TSF.

This proposed TSF filling strategy is presented in **Chart 1** below and in **Appendix B**.

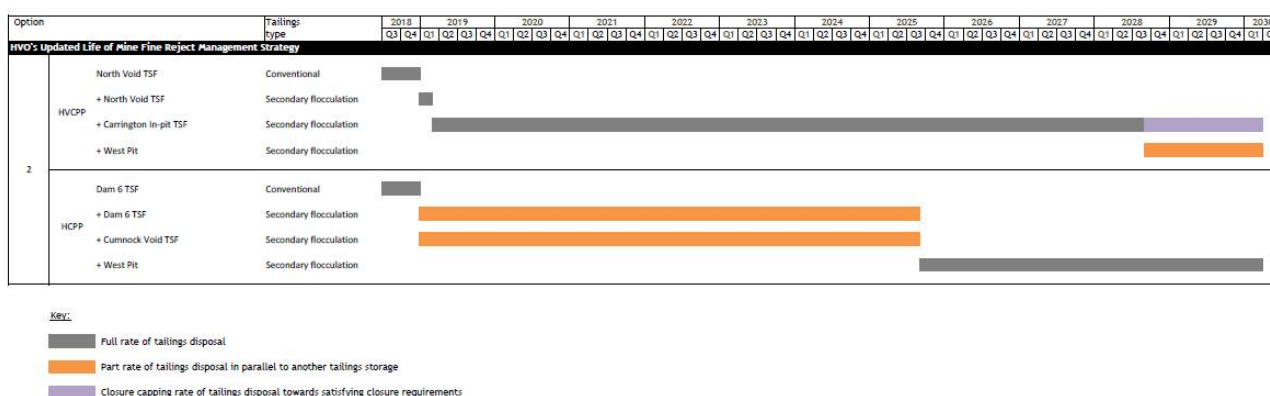


Chart 1 - Proposed Filling Strategy

The proposed filling strategy presented in **Figure 2** indicates that the existing TSF of North Void, Dam 6, CIP, Cumnock Void and including the proposed West Pit, have sufficient capacity to accommodate the tailings from both HVCPP and HCPP until 2030 and beyond that. The proposed filling strategy is based on the use of secondary flocculation of the tailings to be deposited in the TSF.

4 TAILINGS MINIMISATION AND ALTERNATE DISPOSAL METHODS

Detailed studies have been undertaken previously to identify opportunities to reduce the storage requirements for tailings by alternate treatment and disposal methods. It is a statutory requirement that all TSFs be capped and rehabilitated at completion of filling. Alternatives investigated include Belt Press Filters, Vacuum Filters and Chamber Presses, to reduce the volume of fine tailings by lowering the water content prior to disposal. The filter press methods create a tailings paste which has a moisture content low enough to enable co-disposal in overburden dumps, thereby removing the need for a separate tailings storage facility. These alternatives were not considered viable due to capital and operating costs. The age of the preparation plants at HVO and the cost required to retrofit these alternate disposal methods was central to the assessment of viability of these options.

Another project due for completion in 2018 is optimising the thickener control at HVCPP. This project aims to improve control over thickener underflow operation. One of the desired outcomes of this is that the average bulk density of the tailings slurry will increase from 1.1 t/m³ to 1.15 t/m³. The nett effect of this will be to reduce the volume of water that is transported to the TSFs, by up to 320 ML annually.

Work has also been ongoing to minimise the volume of tailings solids through the optimisation of the fine coal circuits at HVCPP and HCPP. HVO is also currently investigating ultrafine coal beneficiation as a means of improving recovery from HVCPP and HCPP. If proven viable, this initiative has the potential to significantly reduce the amount of tailings produced at HVO.

5 STORAGE CLOSURE AND REHABILITATION

It is a statutory requirement that all TSFs be capped and rehabilitated at completion of filling.

For HVO North's TSFs, the main elements of the closure and rehabilitation include:

1. Reducing tailings deposition rate (towards end of filling) to provide for development of a 5.0 m thick tailings crust to support closure activities, followed by
2. Placement of layers of capping fill materials, comprising typically mine overburden material, at a minimum of 2.0 m thick;
3. Revegetation;
4. Final land use for the TSFs are either grassland or woodland areas based on the approved Rehabilitation Management Plan (MOP).

Tailings deposition alone (with the addition of flocculant at the discharge point) is not capable of providing sufficient final density (and hence shear strength) to support placement of capping layers if the rate of filling remains high (i.e. typically above 1.0 m per year). Consequently it may become necessary to reduce the rate of placement of tailings over the top part of the deposit. Reducing the tailings deposition rate is proposed in the final stages of filling of all HVO TSFs where additional TSFs exist to operate parallel deposition schemes.

The method involves controlling the rate of rise during the final stages of filling so that significant desiccation occurs throughout the layer with a consequent increase in shear strength. Water is removed from the surface of the storage to enable the full surface to be exposed to evaporative drying. The intended effect is to develop a tailings crust with shear strengths high enough to support placement of layers of fill material with traditional earthmoving equipment which may include low ground pressure equipment.

It is emphasised that continued (sporadic) deposition of tailings may be required after completion of official filling, to fill consolidation voids and maintain a tailings surface with positive surface drainage. This will help to maintain a dry tailings surface and assist with evaporative drying, and hence shear strength development.

Placement of capping layers with mine spoil material can then be undertaken to develop a domed surface that allows for rainfall runoff and with a minimum cover of 2 m. Each facility will have a landform design engineered as per the approvals process for capping and closure of tailings storage facilities. This application is submitted to the Department for approval.

This cover material may then be re-vegetated in accordance with established rehabilitation practices published in the Mine Operations Plan for HVO.

Rehabilitation of the Cumnock Void TSF is under the responsibility of Glencore.

6 SUMMARY

This document presents the Life of Mine Fine Reject Management Strategy for Hunter Valley Operations.

The study has been based on the Life of Consent from the mid-2018 and continuing to the end of March 2030.

Both existing and approved future tailings storage facilities were assessed and concept general arrangements were prepared and presented in **Appendix A**.

The proposed sequence for tailings disposal is based upon the availability of each TSF at the time of emplacement, its location relative to the coal processing plants and the predicted storage capacity.

The opportunity for each TSF to undergo a reduced rate of tailings emplacement was also considered. To achieve this, additional TSFs will need to be brought online to operate in parallel.

HVO's current life of mine fine reject management strategy satisfies the predicted HVO tailings storage requirements to March 2030 by utilising existing TSFs Dam 6, North Void and Cumnock Void (via agreement with Glencore), approved TSF Carrington In-Pit, and proposed West Pit TSF.

HVO have identified that the life of mine fine reject management strategy would include the use of secondary flocculation of the tailings. This strategy utilises existing TSFs Dam 6, North Void, Cumnock Void, approved Carrington In-Pit and future West Pit (within a restricted area of West Pit) for tailings disposal.

To fulfil the requirements of a best practice Fine Reject Management Strategy, consideration was given to the life of mine plan by integrating TSFs in a practical schedule and ensuring that TSFs are cost effective, and minimise environmental risk and disturbance by filling open voids.

REFERENCES

- [1] ATC Williams, "Hunter Valley Operations, Life of Mine Fine Reject Management Strategy", Ref 101041R96 Rev1, December 2015.
- [2] ATC Williams, "Hunter Valley Operations, Factual Report on Tailings Testing", Ref 101041R89 Rev 1, September 2014.
- [3] ATC Williams, "Hunter Valley Operations, North Void TSF Storage Optimisation Concept Study Report", Ref 101041.29R05 Draft, April 2018.
- [4] ATC Williams. "Hunter Valley Operations (HVO), Carrington In-Pit TSF Capacity Review", Ref 101041.39-L001, 22 July 2018.