

MTW / HVO
Lemington Underground Mine
Water Storage Project

Warkworth Mine

SUBMISSIONS REPORT



TABLE OF CONTENTS

1 INTRODUCTION 1

 1.1 OVERVIEW OF THE MODIFICATION 3

2 ANALYSIS OF SUBMISSIONS 6

3 ACTIONS TAKEN SINCE EXHIBITION 7

4 RESPONSES TO SUBMISSIONS 8

 4.1 DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT – WATER 8

 4.2 BIODIVERSITY AND CONSERVATION DIVISION 11

 4.3 NSW ENVIRONMENT PROTECTION AUTHORITY 12

 4.4 NSW RESOURCES REGULATOR..... 14

 4.5 NSW DIVISION OF MINING, EXPLORATION AND GEOSCIENCE 14

 4.6 WATERNSW 14

 4.7 SINGLETON COUNCIL 14

5 PROJECT EVALUATION..... 15

6 REFERENCES 16

LIST OF FIGURES

- Figure 1 Regional Location
- Figure 2 Project General Arrangement

LIST OF TABLES

- Table 1 Summary Comparison of Approved and Modified Project
- Table 2 Additional Groundwater Quality Analysis to be Undertaken

LIST OF ATTACHMENTS

- Attachment 1 Potential for Pillar Failure at Lemington Underground Mine due to Repeated Wetting and Drying of Underground Workings

1 INTRODUCTION

Mount Thorley Warkworth (MTW) Operations and Hunter Valley Operations (HVO) are neighbouring open cut coal mining operations situated in the Sydney Basin within the Singleton Local Government Area (LGA), in the Hunter Valley region of New South Wales (NSW) (Figure 1).

MTW comprises the Mount Thorley Operation (MTO) and Warkworth Mine. MTW is majority owned and operated by subsidiaries of Yancoal Australia Ltd (Yancoal). While MTW is managed as one operation, MTO and Warkworth Mine each have separate planning approvals. MTO is approved and operates under State Significant Development (SSD) Consent SSD-6465. Warkworth Mine is approved and operates under State Significant Development Consent SSD-6464.

HVO is a joint venture between subsidiaries of Yancoal and Glencore. HV Operations Pty Ltd is the appointed manager of the joint venture and operator of HVO. While HVO is managed as one operation, HVO North and HVO South each have separate planning approvals. HVO North operates under Development Consent DA 450-10-2003 and HVO South operates under Project Approval 06_0261.

Up until 2017, both MTW and HVO were majority owned and operated by Coal & Allied Operations Pty Limited (Coal & Allied) (Rio Tinto). As a result of this common ownership, various management functions (including water management) were integrated between the two mining complexes.

MTW and HVO have identified an opportunity to use the Lemington Underground void as an additional water storage to improve water management across both sites. Modification applications to both Development Consent SSD-6464 (Warkworth Mine) and Project Approval 06_0261 (HVO South) were lodged under section 4.55(1A) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to enable the transfer and storage of water into the existing Lemington Underground Mine void for later extraction and reuse.

Warkworth Mining Limited (WML) is also seeking to modify the Warkworth Development Consent SSD-6464 to allow for the construction of a new Ultra Class Truck Workshop adjacent to the existing workshop at the Warkworth Mine.

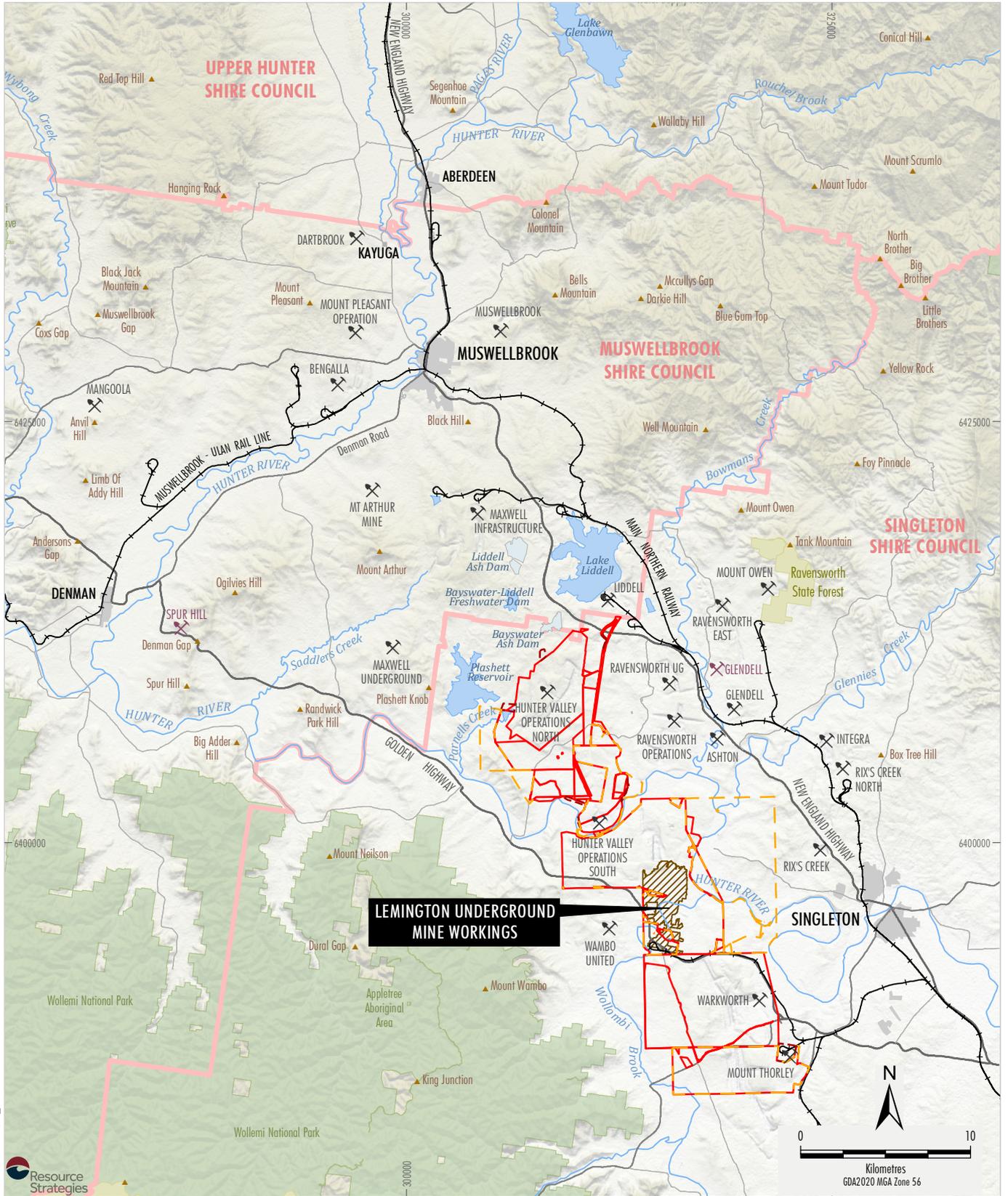
Both Modification Reports were placed on public exhibition by the Department of Planning, Industry and Environment (DPIE) from 5 October 2021 to 18 October 2021. During and following the exhibition period, a total of eight submissions on the Warkworth Modification (Mod 2) were received from the public, NSW government agencies and Singleton Council.

On 19 October 2021, DPIE requested that Yancoal prepare and submit a Submissions Report for the Modification. Accordingly, this Submissions Report has been prepared to address comments raised in submissions on the Warkworth Mine Modification Report. This Submissions Report has been prepared in consideration of the *State Significant Development Guidelines – Preparing a Submissions Report* (DPIE, 2021a).

A separate Submissions Report has been prepared for the HVO South Modification Report submissions.

This Submissions Report is structured as follows:

- Section 1** Provides an introduction and overview of the approved and modified projects.
- Section 2** Provides an analysis of the submissions received during the public exhibition period.
- Section 3** Summarises the actions taken since exhibition of the Modification Report, including additional engagement activities and further refinements and assessment of the Modification.
- Section 4** Provides responses to aspects raised in submissions and provides information requested.
- Section 5** Provides an updated evaluation of the Modification.
- Section 6** Lists the documents referenced in the Submissions Report.



YAN-21-38-Subm Report_2024



Source: NSW Spatial Services (2021)



- LEGEND**
- Mining Operation
 - Proposed Mining Operations (Application Lodged)
 - Exploration Licence Boundary (EL, AUTH, AL)
 - Mining and Coal Lease Boundary (CCL, CL, CML, ML, MPL)
 - Mining Lease Application Area (MLA)
 - Railway
 - Local Government Area
 - State Forest
 - National Parks and Wildlife Estate

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**LEMINGTON UNDERGROUND MINE
 WATER STORAGE PROJECT**

Regional Location

Figure 1

1.1 OVERVIEW OF THE MODIFICATION

To provide greater flexibility in site water management, MTW and HVO are seeking to augment their existing approved water management infrastructure to enable the transfer and storage of water into the existing Lemington Underground Mine void for later extraction and reuse at MTW and HVO.

The Modification would include (Figure 2):

- construction of bores and associated infrastructure (e.g. pumps and power supplies) at three transfer sites to access the Lemington Underground Mine void;
- use of the bores at these three transfer sites and existing LUG Bore to transfer water from MTW into and out of the former Lemington Underground Mine void;
- development of supporting infrastructure (e.g. pipelines and powerlines); and
- construction of a new Ultra Class Truck Workshop adjacent to the existing workshop.

The proposed Modification would provide the following benefits:

- Enable more water to be stored on-site for later reuse, increasing water supply security and supplementing external water supplies such as the Hunter River.
- Reduce the reliance on off-site discharges to the Hunter River during periods of higher rainfall as there would be greater storage capacity on-site.
- Reduce operational disruption associated with storage of surplus water in active mining areas, thereby facilitating efficient recovery of approved resources.
- Avoid the loss of water through evaporation that occurs in open water storages.

A comparison of the key components of the approved and modified Warkworth Mine is provided in Table 1.

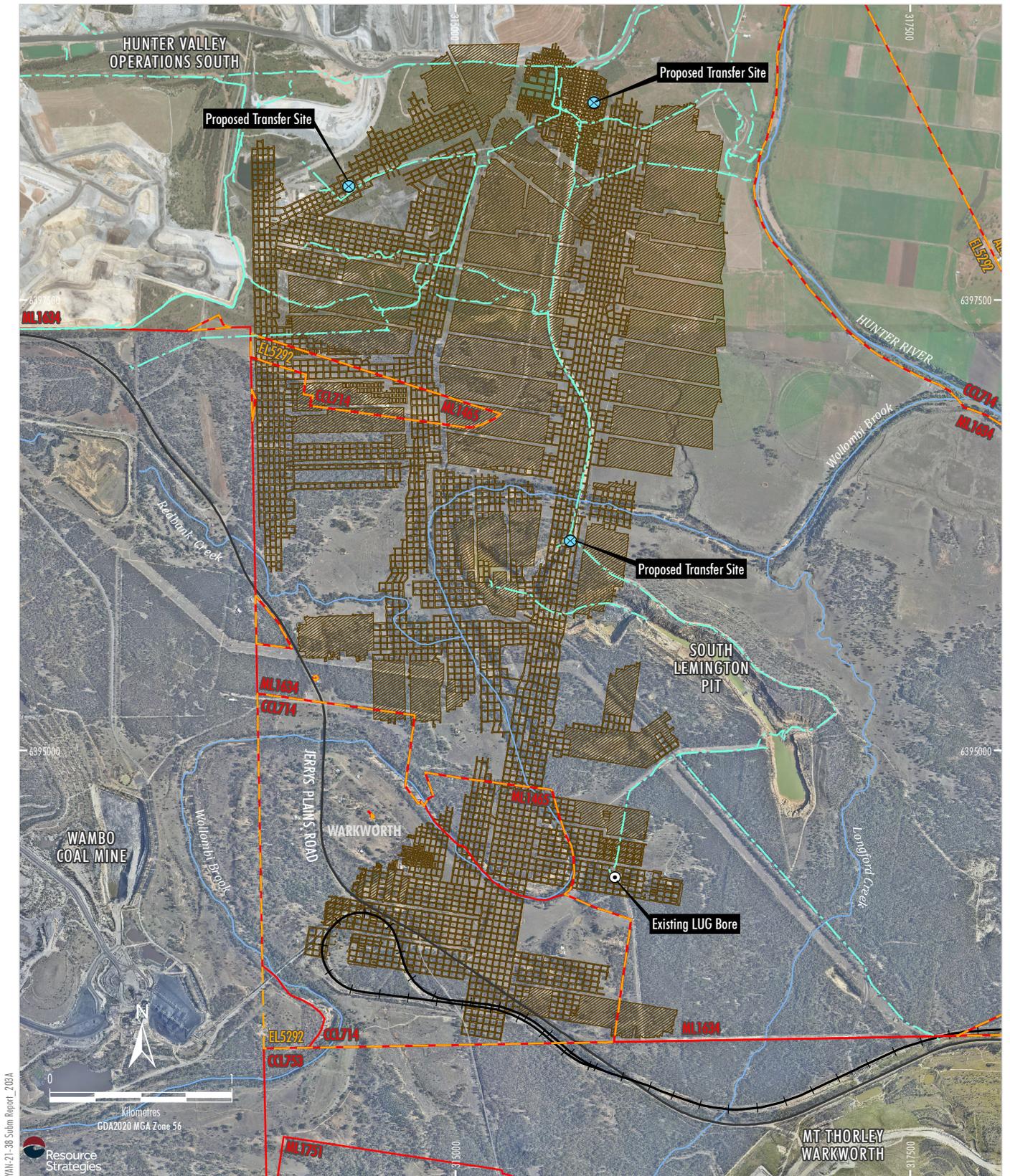
Table 1
Summary Comparison of Approved and Modified Project

Project Element	Warkworth Mine (SSD-6464)	
	Approved Project ¹	Modified Project
Approval period	21 years from commencement of development under Development Consent SSD-6464 (15 February 2016).	Unchanged.
Mining method	Open cut mining.	Unchanged.
ROM coal extraction rate	Extraction of up to 18 Mtpa of ROM coal.	Unchanged.
ROM coal transportation	ROM coal may be transported between Warkworth and MTO for processing at either Coal Processing Plant (CPP).	Unchanged.
ROM coal processing	Up to 13 Mtpa of ROM coal at Warkworth.	Unchanged.
Product coal transport	Product coal may be loaded out via the Mt Thorley Coal Loader or transported to the Redbank Power Station.	Unchanged.
Overburden emplacement	Disposal at in-pit and out-of-pit emplacements within MTW.	Unchanged.
Coarse rejects	Coarse reject produced at the Warkworth CPP is co-disposed within overburden emplacement areas within MTW.	Unchanged.

Table 1 (Continued)
Summary Comparison of Approved and Modified Project

Project Element	Warkworth Mine (SSD-6464)	
	Approved Project ¹	Modified Project
Tailings	Tailings produced at the Warkworth CPP is disposed at Tailings Storage Facilities within MTW.	Unchanged.
Water management	Integrated water management with MTO and HVO. Receipt of water extracted from the existing LUG Bore and from MTW water stored in HVO voids.	Construct additional bores (and associated infrastructure) at three transfer sites to facilitate transfer of water into the former Lemington Underground Mine void and/or extraction of water from the void. The indicative locations of the proposed transfer sites are shown on Figure 2.
Water transfers between mines	Permitted to receive water from, and transfer water to, MTO, HVO, Bulga Mine and Redbank Power Station (currently in care and maintenance).	Unchanged.
Infrastructure	Includes: workshops; vehicle washing facilities; bulk oil and fuel storages; water management infrastructure; coal bed methane gas wells and ancillary infrastructure; storage hoppers and crushers; coal stockpiles; CPP; erection pads; bathhouse; general stores; office building; and other facilities and incidental activities.	Construction and operation of an Ultra Class Truck Workshop, adjacent to the existing workshop facility.
Operating hours	Continuous operations, 24 hours per day, seven days per week.	Unchanged.
Employee numbers	Approximately 1,300 (combined numbers across MTW).	Unchanged.
Rehabilitation	Progressive rehabilitation. Final land use and final landform as described in a number of approval documents.	Unchanged.
Final void	One final void in the western pit.	Unchanged.
Schedule of Land	As per Appendix 1 of the Warkworth Development Consent.	Addition of land to Warkworth Mine Schedule of Lands covering the proposed water transfer infrastructure.

¹ As per the consent granted on 26 November 2015.



YAN-21-38-Subm-Report_2024

Resource Strategies

- LEGEND**
- Exploration Licence Boundary (EL, AL)
 - Mining and Coal Lease Boundary (CCL, CL, ML)
 - Existing Lemington Underground Mine Workings
 - Existing Pipeline
 - Existing LUG Bore
 - X Indicative Location of Proposed Transfer Site

Source: HVO(2021); NSW Spatial Services (2021)
Aerial Imagery: MTW (2020); NSW Spatial Services (2020)



**LEMINGTON UNDERGROUND MINE
WATER STORAGE PROJECT**
Project General Arrangement

Figure 2

2 ANALYSIS OF SUBMISSIONS

A total of eight submissions on the Modification were received as follows:

- seven submissions in the form of comments were received from government agencies (including Singleton Council); and
- one objecting submission was received from a member of the public.

The objecting public submission pertained to potential impacts from coal mining generally and was not specific to the proposed Modification.

Submissions were received from the following government agencies:

- DPIE – Water;
- Biodiversity and Conservation Division (BCD) within DPIE;
- NSW Environment Protection Authority (EPA);
- NSW Resources Regulator (RR);
- NSW Division of Mining, Exploration and Geoscience (MEG) within the Department of Regional NSW;
- WaterNSW; and
- Singleton Council.

3 ACTIONS TAKEN SINCE EXHIBITION

Since exhibition of the Modification, MTW and HVO consulted with their respective Community Consultative Committees in mid-November 2021 and engaged a subsidence expert (SCT Operations Pty Ltd [SCT]) to address BCD's comment on pillar instability from repeated wetting and drying of underground workings. SCT's assessment is summarised in Section 4.2 and provided in Attachment 1.

No other actions have been taken or changes made to the Modification.

4 RESPONSES TO SUBMISSIONS

One objecting public submission pertained to potential impacts from coal mining generally and was not specific to the proposed Modification. Accordingly, no response to this submission is required.

Responses to submissions received from NSW government agencies and Singleton Council are provided in the sub-sections below.

4.1 DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT – WATER

Water Entitlement

Issue

DPIE – Water’s submission states that “...once water is put into the void it becomes groundwater as there are no return flows policy. Therefore, water taken from the void must be appropriately licenced...”. On this basis, DPIE – Water requested the provision of “... evidence that groundwater entitlements can be obtained to account for any water take from the Lemington Underground void”.

Response

Under the Modification, the Lemington Underground Mine void would be used as a temporary water storage, much like a surface water storage or open cut void is used to temporarily store water to support mining operations. Water would be transferred into the mine void from other site water storages as part of routine water management. This water would be derived from a variety of sources including the dewatering of mining areas, runoff from disturbed areas that is retained onsite as a pollution prevention measure and water extracted for operational purposes as supplementary make-up water from other water sources. The water stored within the void would be of generally poor quality with limited re-use opportunities other than for mining operational purposes.

The water as derived from various sources is licensed under the *Water Management Act 2000*. That water as licensed may then be used, or may be stored temporarily prior to use including in underground voids. We note that DPIE – Water state that “...once water is put into the void it becomes groundwater as there are no return flows policy”. ‘Groundwater’ is defined in the *NSW Aquifer Interference Policy* as “all water that occurs beneath the ground surface in the saturated zone. A groundwater system is any type of saturated geological formation that can yield anywhere from low to high volumes of water” Given this definition, water that is placed underground on a temporary basis is not groundwater as it does not ‘occur’ beneath the ground surface nor is that water yielded from those geological formations (and rather is derived from elsewhere and temporarily stored in the void prior to use). On that basis, the water being temporarily stored underground is also unlikely to be considered to be a water source that would be covered by the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*.

Further, the long-term average annual extraction limits in the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016* are calculated on the basis of an acceptable level of water take from each applicable water source captured by that plan. Any double counting of water take would be inconsistent with those extraction limits and would result in a distortion in the total water allocation given the same water would be accounted for twice.

Consequently, the water transferred into the mine void would already be accounted for under the *Water Management Act 2000* and therefore requiring this same water to be licensed upon transferring back to the sites following temporary storage in the mine void would be double counting under the current policy framework.

The ability to transfer and temporarily store water in the Lemington Underground Mine void has significant environmental and water management advantages, including:

- Evaporative losses that would occur for open surface water storages are avoided providing greater resource security and water management efficiency.
- Impacts associated with construction and operation of additional water storages are avoided, including potential biodiversity and competing land impacts associated with disturbance of additional land areas.

- The risk of uncontrolled water discharges from surface water storages is reduced.
- Extraction of additional water from the Hunter Regulated River Water Sources that would otherwise be required in the absence of sufficient on-site surface water storage capacity would be reduced.
- Water reuse opportunities for operational purposes is maximised.
- Water security at both HVO and MTW is improved (reducing reliance on other water sources).

Yancoal appreciates that there is no return flows policy, but in the absence of such policy, the Government should not discourage sustainable water management practices, such as this Modification, that align with the objectives of the *Water Management Act 2000*, the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016* and the NSW Water Strategy (DPIE, 2021b). Specifically, this Modification aligns with increasing resilience to changes in water availability which the NSW Government identified as a priority for 2021-2022 in the NSW Water Strategy (DPIE, 2021b).

Further, the licensing of the water to be temporarily stored in the Lemington Underground Mine void would also be inconsistent with the Objects (clause 3) of the *Water Management Act 2000* and the Objectives (clause 10) of the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*, namely:

3 Objects

- ...
- (c) *to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including—*
- ...
- (ii) *benefits to urban communities, agriculture, fisheries, industry and recreation, and*
- ...
- (e) *to provide for the orderly, efficient and equitable sharing of water from water sources,*
- ...
- (g) *to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,*
- (h) *to encourage best practice in the management and use of water.*

10 Objectives

- ...
- (d) *manage these groundwater sources to ensure equitable sharing between users, and*
- (e) *provide opportunities for enhanced market-based trading of access licences and water allocations within environmental and system constraints, and*
- ...
- (i) *adaptively manage these groundwater sources, and*
- ...

Requiring the double accounting of water is contrary to the free and equitable operation of a market-based water entitlement trade system which underpins the operation of the *Water Management Act 2000*.

Based on the above, Yancoal does not consider that the current *Water Management Act 2000* requires it to license water that is extracted from the water within the mine void that is transferred into the void for temporary storage where that water take (from its natural location) is the subject of a licence. Only water extracted over and above that transferred into the void would be licensed. The situation is similar to groundwater extracted during mining operations and subsequently stored in a surface water storage (e.g. a dam) and then that water is pumped from that surface water storage and used on site. Given the take of water is the subject of a licence, that water can then be moved around and temporarily stored on site without the need for a second access licence.

Issue

DPIE – Water requests that Yancoal provide details of the Water Access Licence (WAL) linked to the water take at the LUG Bore.

Response

WAL 39798 is assigned to the existing LUG Bore and is used to account for water extracted from the Lemington Underground Mine void under the current operating procedures (i.e. the mine void not being used as a temporary water storage). This licence is held by Coal & Allied Operations Pty Limited (a subsidiary of Yancoal) and Anotero Pty Ltd (a subsidiary of Glencore) as tenants in common and has been used to account for the extraction of water from the Lemington Underground Mine to date.

Works on Waterfront Land

Issue

DPIE – Water requests Yancoal provide the location of works (e.g. access tracks, powerlines and pipelines) to ensure they are in accordance with the NRAR Guidelines for Controlled Activities on Waterfront Land (NRAR, 2018).

Response

With the exception of two sections of new pipelines, all other surface infrastructure and activities required for the water transfer sites (i.e. including construction pads, bores, powerlines and access tracks) would not be located in areas considered to be waterfront land as defined by the *Guidelines for Controlled Activities on Waterfront Land* (NRAR, 2018).

The design and alignment of the new pipelines proposed by the Modification are in accordance with the *Guidelines for Controlled Activities on Waterfront Land* as:

- the number of stream crossings has been minimised; and
- the pipelines would be located within the corridor of existing access roads in the case of two first order stream crossings and would utilise an existing bridge crossing on the Wollombi Brook to avoid or minimise disturbance and harm to the riparian corridor/vegetated riparian zone.

There would be no new disturbance required to construct the pipelines over these streams.

Site Water Balance

Issue

DPIE – Water recommends Yancoal provide an updated site water balance including the groundwater take expected from storage within Lemington Underground Mine void.

Response

The MTW site water balance is reviewed annually in accordance with the MTW Water Management Plan and conditions of Development Consents SSD-6464 and SSD-6465. The MTW Water Management Plan including site water balance will be updated to include the Lemington Underground Mine void temporary water storage following approval of the Modification.

Maximum Fill Level

Issue

DPIE – Water recommends Yancoal set a maximum fill level at 30 mAHD, and/or a minimum 10 m buffer separation between the base of the alluvium and fill level, whichever gives the greater vertical separation. Final reference level can be revised after the additional drilling is completed.

Response

Yancoal acknowledges and accepts this recommendation.

Revised Water Management Plan

Issue

DPIE – Water recommends Yancoal revise the Water Management Plan to include a reporting process that:

- accounts for the inflows and outflows via the LUG bore; and
- informs on both water level recovery efficiency (inputs) and water level decay (extraction) so that 1:1 presumption of inflow/outflow can be reconciled.

Response

Yancoal acknowledges and accepts this recommendation.

Monitoring Points

Issue

DPIE – Water recommends Yancoal install additional monitoring points as proposed in the Modification Report.

Response

Yancoal acknowledges and accepts this recommendation.

4.2 BIODIVERSITY AND CONSERVATION DIVISION

Biodiversity Assessment Method

Issue

The BCD recommends that any impacts to biodiversity caused by the Modification are assessed by the Biodiversity Assessment Method and are offset in accordance with the Biodiversity Offsets Scheme, if the Biodiversity Offset Scheme is triggered.

Response

The proposed water management infrastructure for the Modification would be located on previously disturbed land primarily within the HVO Mining Complex.

Subsidence

Issue

The BCD recommends that Yancoal assess the subsidence risks associated with using the bord and pillar mining void to store water. The BCD states that *“The Lemington Underground Mine extends beneath the Hunter River, Redbank Creek and Wollombi Brook. Surface disturbance of the workings could impact these water courses, including changing the longitudinal stream profile gradient and streambed cracking.”* The BCD also notes that *“Surface disturbance from the subsidence of the old Lemington Underground Mine has the potential to expose the Hunter River, Redbank Creek and Wollombi Brook to an increased frequency of flooding or to flood risks that may not have existed previously.”*

Response

SCT has undertaken an assessment of potential pillar instability caused by wetting and drying cycles associated with pumping water into and out of the Lemington Underground Mine. This assessment is presented in Attachment 1.

SCT found that there is potential for rib pillar spalling to occur under the influence of wetting and drying cycles. For the vast majority of the Lemington Underground Mine area, rib pillar spalling would not materially affect long-term pillar stability.

SCT found that an approximately 20 hectare area of small split and quartered pillars in the northern part of the Lemington Underground Mine, on HVO-owned land, is likely to be exposed to wetting and drying if the water level cycles in the mine void above approximately 5 mAHD. However, as this area of pillars is not close to the Hunter River, Wollombi Brook or Redbank Creek, SCT concluded this mechanism is not expected to expose these water courses to direct subsidence or result in an increased frequency of flooding, or any other flood risks (Attachment 1). Accordingly, the Modification would not result in changes to the longitudinal stream profile gradient or streambed cracking on these water courses.

4.3 NSW ENVIRONMENT PROTECTION AUTHORITY

Groundwater Quality Analysis

Issue

The EPA recommends further analysis of groundwater quality in the former Lemington Underground Mine void following borehole completion to assess the accuracy of water quality modelling that was completed based on median result data obtained from the currently operational LUG Bore. The EPA recommends that the groundwater quality analysis be conducted in accordance with Table 2.

The results from this analysis will assist in determining appropriate surface water monitoring requirements and discharge limits at the MTW premises.

**Table 2
Additional Groundwater Quality Analysis to be Undertaken**

Parameter	Units
Physical	
pH	pH units
Electrical Conductivity	µS/cm
Total Dissolved Solids (calculated)	mg/L
Major Ions	
Sulfate as SO ₄ – Turbidimetric	mg/L
Chloride	mg/L
Fluoride	mg/L
Sodium	mg/L
Nutrients	
Ammonia as N	mg/L
Nitrate as N	mg/L
Total Phosphorus as P	mg/L
Total Metals	
Aluminium	mg/L
Arsenic	mg/L
Beryllium	mg/L
Barium	mg/L
Cadmium	mg/L
Chromium	mg/L
Cobalt	mg/L

Table 2 (Continued)
Additional Groundwater Quality Analysis to be Undertaken

Parameter	Units
Copper	mg/L
Lead	mg/L
Manganese	mg/L
Mercury	mg/L
Molybdenum	mg/L
Nickel	mg/L
Selenium	mg/L
Strontium	mg/L
Vanadium	mg/L
Zinc	mg/L
Boron	mg/L
Iron	mg/L

mg/L = milligrams per litre, $\mu\text{S}/\text{cm}$ = microSiemens per centimetre.

Response

An additional water sampling site (LUG_S001) was established as part of the preparation of the Groundwater Assessment (Appendix A of the Modification Report). LUG_S001 was located in the northern part of the workings, away from the existing LUG Bore, to verify that water quality chemistry is consistent across the workings. Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) (2021) concluded that the major ion chemistry in the LUG Bore and LUG_S001 are very similar which suggests that the LUG Bore data is likely to be representative of the water chemistry elsewhere in the workings.

Additional sampling for water quality analysis will be conducted from the existing LUG Bore and LUG_S001 as well as from the new transfer sites upon completion of the bores (where they are not dry). The sampling would be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales* (EPA, 2004) and would include an analysis of the analytes in Table 2. The additional sampling would be described in the revised Water Management Plan.

MTW (and HVO) would extract the water temporarily stored in the underground workings to supplement operational water supplies in preference to drawing water from the Hunter River. This would generally occur in times of water shortages. The extracted water would become mixed with other site water sources and generally be used for dust suppression and coal preparation.

MTW (and HVO) operates under the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002* (HRSTS) and all water required to be discharged from site would continue to be carried out under the existing HRSTS water discharge licence conditions. Importantly, the Modification does not require amending existing discharge (quantity and quality) licence limits.

Water Management Plan

Issue

The EPA recommends that an updated Water Management Plan be provided which identifies the water dams which will receive and send water to the Lemington Underground Mine workings and includes any surface water discharge points, as specified on the related Environmental Protection Licences (EPL) and delineated by the separate EPL boundaries.

Response

Yancoal acknowledges and accepts this recommendation.

4.4 NSW RESOURCES REGULATOR

The RR states the following in its submission:

The Resources Regulator has reviewed the request and based on the application and report, we have no specific comments regarding mine safety or mine rehabilitation matters.

Accordingly, no further response to the RR submission is required.

4.5 NSW DIVISION OF MINING, EXPLORATION AND GEOSCIENCE

MEG states the following in its submission:

MEG has reviewed the information supplied in relation to the abovementioned Projects and notes that there are no resource recovery or sterilisation concerns as a result of the Projects. MEG is supportive given the project benefits in terms of water security and reduction in required off-site discharges following significant rain events.

Accordingly, no further response to the MEG submission is required.

4.6 WATERNSW

WaterNSW states the following in its submission:

Please note that as the subject site is not located in close proximity to any WaterNSW land or assets, and as an SSD any flood works or licensing approvals will be assessed by others, WaterNSW has no comments or particular requirements.

Accordingly, no further response to the WaterNSW submission is required.

4.7 SINGLETON COUNCIL

The Singleton Council states the following in its submission:

We have been briefed by the applicant on these projects and Council does not have any comment in relation to the proposals.

Accordingly, no further response to the Singleton Council submission is required.

5 PROJECT EVALUATION

This Submissions Report provides responses to issues raised in submissions from government agencies and the Singleton Council during the exhibition period for the Modification Report. These responses do not change the scope of the Modification and therefore the justification previously provided in Section 7 of the Modification Report remains relevant.

In weighing up the main environmental impacts (costs and benefits) assessed and described in the Modification Report, as well as the submissions received during the public exhibition, the Modification is, on balance, considered to be in the public interest of the State of NSW.

6 REFERENCES

Australasian Groundwater and Environmental Consultants Pty Ltd (2021) *Lemington Underground Water Storage – Groundwater Assessment*.

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

Department of Planning, Industry and Environment (2021a) *State Significant Development Guidelines – Preparing a Submissions Report*.

Department of Planning, Industry and Environment (2021b) *NSW Water Strategy Implementation Plan 2021-2022*.

Department of Primary Industries – Water (2016) *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources – Background Document*.

Natural Resources Access Regulator (2018) *Guidelines for controlled activities on waterfront land – Riparian corridors*.

New South Wales Environment Protection Authority (2004) *Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales*.

Yancoal Australia Limited (2021) *MTW/HVO Lemington Underground Mine Water Storage Project Modification Report (Warkworth Mine)*.

ATTACHMENT 1

POTENTIAL FOR PILLAR FAILURE AT LEMINGTON UNDERGROUND MINE DUE TO REPEATED WETTING AND
DRYING OF UNDERGROUND WORKINGS



SCT Operations Pty Ltd

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3 December 2021

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MTW5390 Rev3

Dear Gary

POTENTIAL FOR PILLAR FAILURE AT LEMINGTON UNDERGROUND MINE DUE TO REPEATED WETTING AND DRYING OF UNDERGROUND WORKINGS

Lemington Underground Mine (LUM) is a non-operational underground coal mine located approximately 13 kilometres west of Singleton in the Hunter Valley of NSW. Hunter Valley Operations (HVO) and Mount Thorley Warkworth (MTW), two nearby opencut operations, are investigating the opportunity to use LUM as a water storage within their respective water management systems. MTW engaged SCT Operations Pty Ltd (SCT) to provide advice on the potential for pillar instability caused by wetting and drying cycles and the potential for any instability to impact on the surface watercourses. This letter report presents our assessment of this potential.

Our assessment indicates that there is potential for rib spalling to occur under the influence of wetting and drying cycles. For most of the LUM area, rib pillar spalling would not be expected to materially affect long-term pillar stability. The only area where there is potential for pillar stability and surface subsidence is on land owned by HVO. This area is remote from nearby watercourses. Wetting and drying of coal pillar ribs is not expected to expose the Hunter River, Redbank Creek and Wollombi Brook to direct subsidence, an increased frequency of flooding, or other flood risks.

On 20 October 2021 both HVO and MTW lodged separate development consent modification applications for the development of appropriate infrastructure to enable water to be transferred into and out of the LUM workings. In response to the modification applications, the Biodiversity and Conservation Division (BCD) of the Department of Planning, Industry and Environment (DPIE) identified the potential for wetting and drying cycles associated with pumping water into and out of this underground storage to cause instability of the coal pillars resulting in surface subsidence that could affect the nearby Hunter River and overlying Wollombi Brook and Redbank Creek.

Figure 1 shows the layout of LUM. Most of the LUM workings are in the Mt Arthur Seam where the overburden depth ranges from approximately 30 metres (m) in the north to approximately 270m in the south. There is also a small area of workings in a second seam in the northwest corner of the mine.

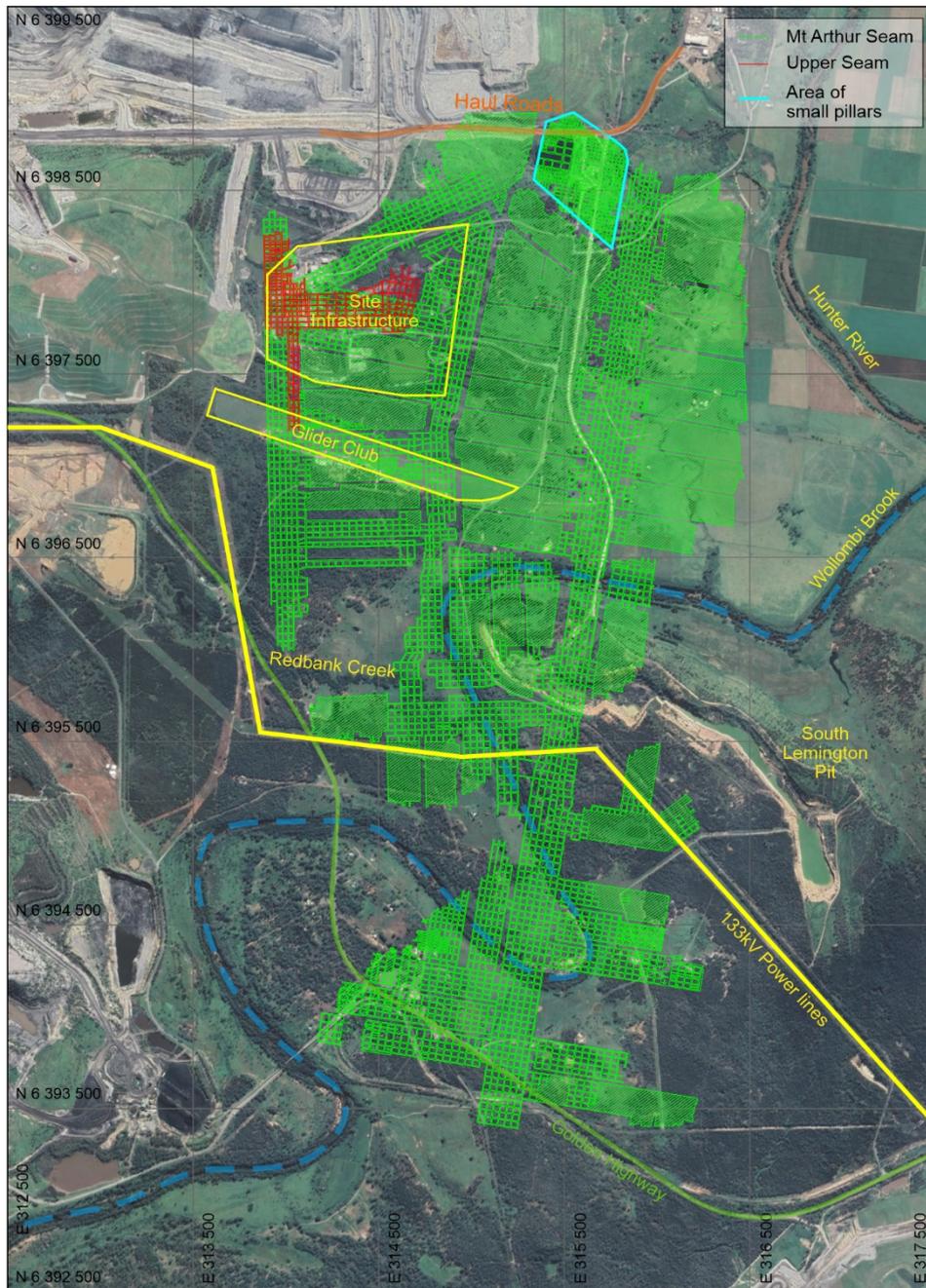


Figure 1: Plan of of Lemington Underground Mine and surface features in the vicinity.

The LUM workings comprise areas of main headings, split and quartered pillars, fully extracted panels and partial extraction panels. SCT undertook an assessment of pillar stability and potential for surface subsidence in SCT (2021). This assessment determined that all pillars in the mine were expected to remain stable based on the dimensions shown in the mine plan. However, no allowance was made in this previous assessment for wetting and drying cycles to cause deterioration of the pillar ribs.

With the proposed use of LUM as a water storage facility, there is potential for repeated wetting and drying cycles to cause a reduction in the size of pillars. A stable rib is expected to develop once the rib has fretted to a depth equal to about the height of the roadway. Fretting of the coal rib may also expose unsupported roof and lead to roof falls and potentially an increase in nominal pillar height, recognising that any increase in pillar height would be partly offset by the confinement provided by roof fall material.

Provided water velocities in the roadways remain less than the velocity necessary to cause erosion, there is not expected to be significant potential for erosion of coal. In this case, a stable rib is expected to be maintained once the fretted coal has reached its angle of repose.

Changes in stability resulting from a reduction in pillar size are expected to be greatest in small pillars. The stability of larger pillars is less susceptible to small changes in width.

An approximately 20ha area of small split and quartered pillars in the northern part of LUM, shown in Figure 1, is likely to be exposed to wetting and drying if the water level cycles in the underground mine cycles above about RL5m Australian Height Datum. The surface above this area, owned by HVO, would be vulnerable to sudden subsidence if pillar instability occurs. However, as this area is not close to the Hunter River, Wollombi Brook or Redbank Creek, there would be no potential for this subsidence to impact these watercourses.

Rib spalling in this area of small pillars is expected to become sufficient over time to reduce the nominal probability of failure to between 1 in 100 and 1 in 300. This probability of failure is not considered long-term stable and surface subsidence in this area could therefore be expected to develop at some stage. Pillar instability of any one of the numerous small pillars in this panel would be expected to lead to sudden subsidence of up to 1.5-2m across most of the panel. Two haul roads, various minor roads and road intersections, and a dam appear to be the main surface infrastructure currently located above this panel of small pillars. The land is owned by HVO.

Other areas of the LUM are not expected to be affected by pillar instability associated with rib fretting. Two other areas of split and quartered pillars are too small in extent to lead to significant surface subsidence should instability occur as a result of wetting and drying cycles. Larger standing pillars in main headings and deeper areas of the mine are sufficiently large that they would be expected to remain long term stable even if some rib fretting were to occur. Pillar extraction areas are unlikely to be significantly affected by repeated wetting and drying cycles.

If you have any queries or require further clarification of any of the issues raised, please don't hesitate to contact me directly.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Ken Mills', with a large, stylized flourish above the name.

Ken Mills
Principal Geotechnical Engineer

REFERENCES

SCT 2021 "Assessment of Subsidence Hazards and Likelihood from Lemington Underground Mine" SCT Report HVO5327, dated 9 August 2021.