austral bricks®

ABN: 52 000 005 550

Rehabilitation Management Plan

for the

Marulan Shale Quarry

RWCorkery&co

August 2022

ACKNOWLEDGEMENT

R.W. Corkery & Co. acknowledge and pay our respects to the Traditional Custodians of the lands comprising NSW and Australia on which our projects are located. We appreciate the knowledge, advice and involvement of the Elders and extended Aboriginal community that contribute to our Projects and extend our respect to all Aboriginal and Torres Strait Islander peoples.

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Prepared for:

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Ref No. 537/46 August 2022

RWCorkery&co

Summary Table

Name of Mine		Marulan Shale Quarry		
RMP Commencement Date		2 July 2022		
Mineral Authorities		PLL1293	**Expiry Date**	16 October 2041
		ML786		16 October 2042
		ML866		16 October 2042
Name of Leaseholder		The Austral Brick Company Pty Limited		
Version	**Author**	**Purpose**	**Approved by**	**Date of Submission**
1	RWC	New Document	Peter Young-Whitford	August 2022

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PLANS

LIST OF ACRONYMS

AHD	Australian Height Datum
DA	Development Application
EPA	Environmental Protection Authority
EPL	Environment Protection Licence
ML	Mining Lease
NSW	New South Wales
PLL	Private Lands Lease
RCE	Rehabilitation Cost Estimate
RMP	Rehabilitation Management Plan
RWC	R.W. Corkery & Co. Pty Limited
SoEE	Statement of Environmental Effects
SWMP	Soil and Water Management Plan
V:H	Vertical : Horizontal

1. INTRODUCTION TO MINING PROJECT

This *Rehabilitation Management Plan* (RMP) for the Marulan Shale Quarry (the "Quarry") has been compiled by R.W. Corkery & Co. Pty. Limited (RWC) in conjunction with The Austral Brick Company Pty Limited (Austral Bricks). The Quarry is located adjacent to the Hume Highway, approximately 10km to the west of Marulan NSW (the "Quarry Site" (see **Figure 1**). The Quarry Site operates under Private Lands Lease (PLL)1293, Mining Lease (ML)786 and ML866.

This RMP has been prepared in accordance with the following documents and guidelines.

- *Form and Way: Rehabilitation Management Plan for Large Mines (July 2021).*
- *Form and Way: Rehabilitation Objectives, Rehabilitation Completion Criteria and Final Landform and Rehabilitation Plan for Large Mines (July 2021).*
- *Guideline 1: Rehabilitation Risk Assessment (July 2021)*
- *Guideline 2: Rehabilitation Records (July 2021)*
- *Guideline 3: Rehabilitation Controls (July 2021)*
- *Guideline 5: Rehabilitation Objectives and Rehabilitation Completion Criteria (July 2021)*

1.1 HISTORY OF OPERATIONS

1.1.1 Extraction Operations

1.1.1.1 Historical Operations

Extraction of clay and shale for brickmaking from the Quarry Site has occurred since the 1960's. The Quarry Site was originally developed and operated by Gulson Pty Limited prior to Austral Bricks assuming control of the Quarry in the mid-1990's.

During this period, extraction occurred at three locations, as shown in **Table 1** and **Figure 2**.

Table 1
Historical Extraction Areas

Extraction Area	Mineral Authority (1995)[1]	Area (1995)[1]
Eastern Extraction Area	PLL1293	2.6ha
Southern Extraction Area	ML866	0.44ha
Western Extraction Area	PLL1293	0.35ha
Note 1: Approval for the current Quarry Site was granted in 1996 following formal assessment		

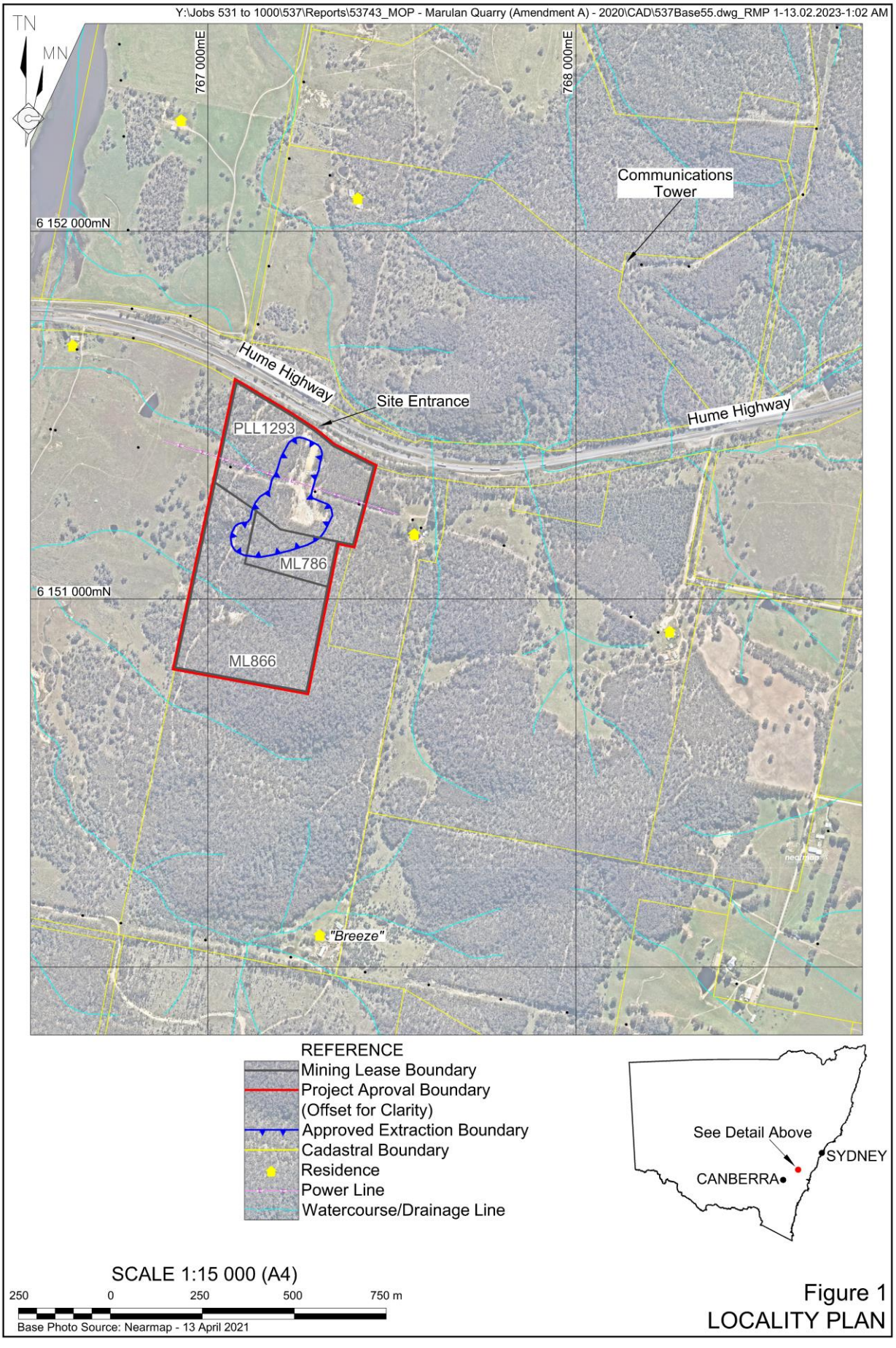


Figure 1
LOCALITY PLAN

1.1.1.2 Currently Approved Operations

Approval for the current Quarry was formalised in 1996 with the issuing of Development Consent DA2921 by (then) Mulwaree Shire Council. DA2921 permits the continuation of extraction of clay/shale from the Eastern Extraction Area, and the extension of the Eastern Extraction Area into ML786 and ML866. Further information on the current approvals for the Quarry Site are provided in Section 1.3.

Extraction of shale occurs on a as needed and campaign basis, with all extraction, load and haul operations undertaken by external contractors under the guidance of Austral Bricks personnel. Extraction campaigns generally consist of the following.

- When required, clearing of vegetation using a bulldozer or similar, with the blade positioned just above the surface. Vegetation is stockpiled adjacent to the extraction area or directly placed onto areas undergoing rehabilitation.
- When required, stripping and stockpiling of soil adjacent to the extraction area. Alternatively, stripped soil may be used immediately for progressive rehabilitation. The soil stockpiles are permitted to revegetate naturally.
- Excavation and stockpiling of white-firing shale using a bulldozer equipped with rippers and/or an excavator.
- Loading and transportation of white-firing shale to Austral Bricks Brick Plants in daylight hours in dry weather using an excavator or front-end loader and road-registered trucks.

1.1.2 Layout

The current layout of the Quarry Site is shown on **Figure 2**. The principal components of the Quarry Site include the following.

- Eastern Extraction Area – consisting of the approved extraction area of the Quarry Site.
- Water Management Infrastructure – namely the Sedimentation Basin and other minor drains and diversion structures.
- Property Access Road – the main access point for the Quarry Site and the "Breeze" property, located at the southern extent of Lot 2 DP829547 (see **Figure 1**). The Property Access Road joins the Hume Highway via an uncontrolled intersection.
- Rehabilitation Areas – including the area previously rehabilitated within the Eastern Extraction Area, as well as the Western and Southern Extraction Areas.

In addition, the Quarry Site is traversed by electrical and telecommunications infrastructure, namely a power line and associated asset protection zone as well as a Telstra underground cable.

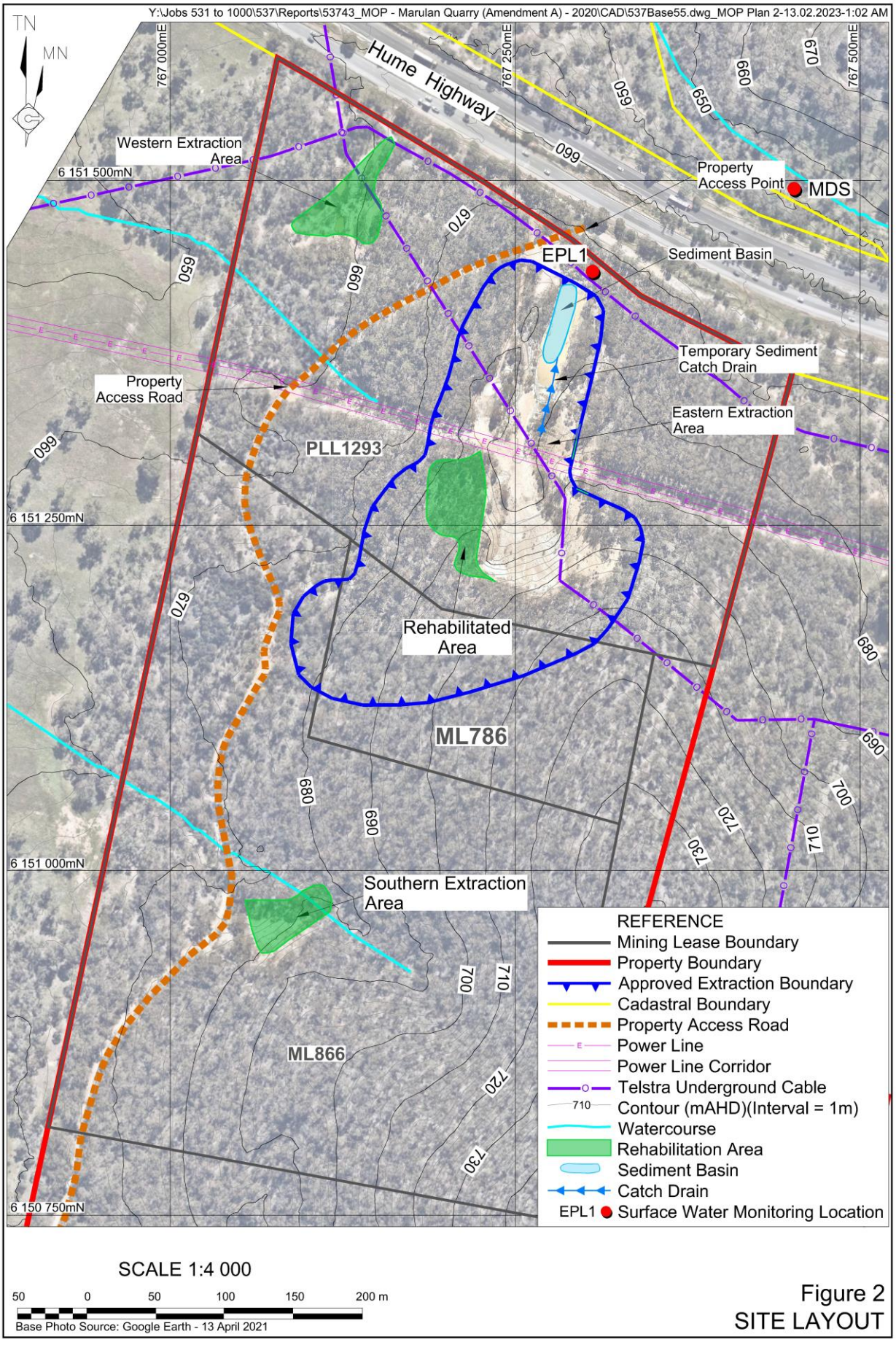


Figure 2
SITE LAYOUT

1.2 CURRENT DEVELOPMENT CONSENTS, LEASES AND LICENCES

Table 2 provides a summary of the relevant consents, authorisations and licences held by the Company for the Quarry. **Plan 1** displays the relevant mineral authorisation boundaries.

Table 2
Current Consents, Authorisations and Licences

Approval/Lease/Licence	Issue Date	Expiry Date	Details / Comments
Development Approval			
DA2921	31 January 1996	-	Development consent granted by (then) Mulwaree Shire Council.
Mineral Authorisations1			
ML866	20 Aug 1980	16 Oct 2042	Granted for Brick Clay and Structural Clay. The current lease area covers 12.76ha.
ML786	17 Oct 1979	16 Oct 2042	Granted for Brick Clay and Structural Clay. The current lease area covers 2.96ha.
PLL1293	18 May 1972	16 Oct 2041	Granted for Structural Clay. The current lease area covers 10.88ha.
Other Approvals and Licences			
EPL 21312	9 October 2019	Renewed Annually 9 October	Issued by the NSW Environment Protection Authority (EPA). Current licence version dated 9/10/2019.
Note 1: See Plan 1			

1.3 LAND OWNERSHIP AND LAND USE

1.3.1 Land Ownership

Figure 3 and **Table 3** presents the land ownership within and in the vicinity of the Quarry Site. In summary, the Quarry Site is privately owned by a third party, with ongoing access for shale extraction purposes permitted under a royalty arrangement between Austral Bricks and the landowner. In the vicinity of the Quarry Site, land is generally a mix of freehold and Crown land, as well as land owned by the State of NSW for the Hume Highway.

Table 3
Land Ownership Schedule

Lot	Deposited Plan	Tenure	Owner	Leases
Quarry Site				
2	829547	Freehold	Privately Owned – leased and occupied by The Austral Brick Company Pty Limited	PLL1293, ML786, ML866
Land Adjacent to the Quarry Site				
1	829547	Freehold	Privately Owned	N/A
3	253743	Freehold	Privately Owned	N/A
A	385235	Freehold	Privately Owned	N/A
5	730901	Freehold	Privately Owned	N/A
274	750029	Freehold	Privately Owned	N/A
5	657521	Freehold	Privately Owned	N/A
3	1194646	Freehold	Privately Owned	N/A
14	1095572	Freehold	Privately Owned	N/A
1	238289	Crown Land	The State of NSW	N/A

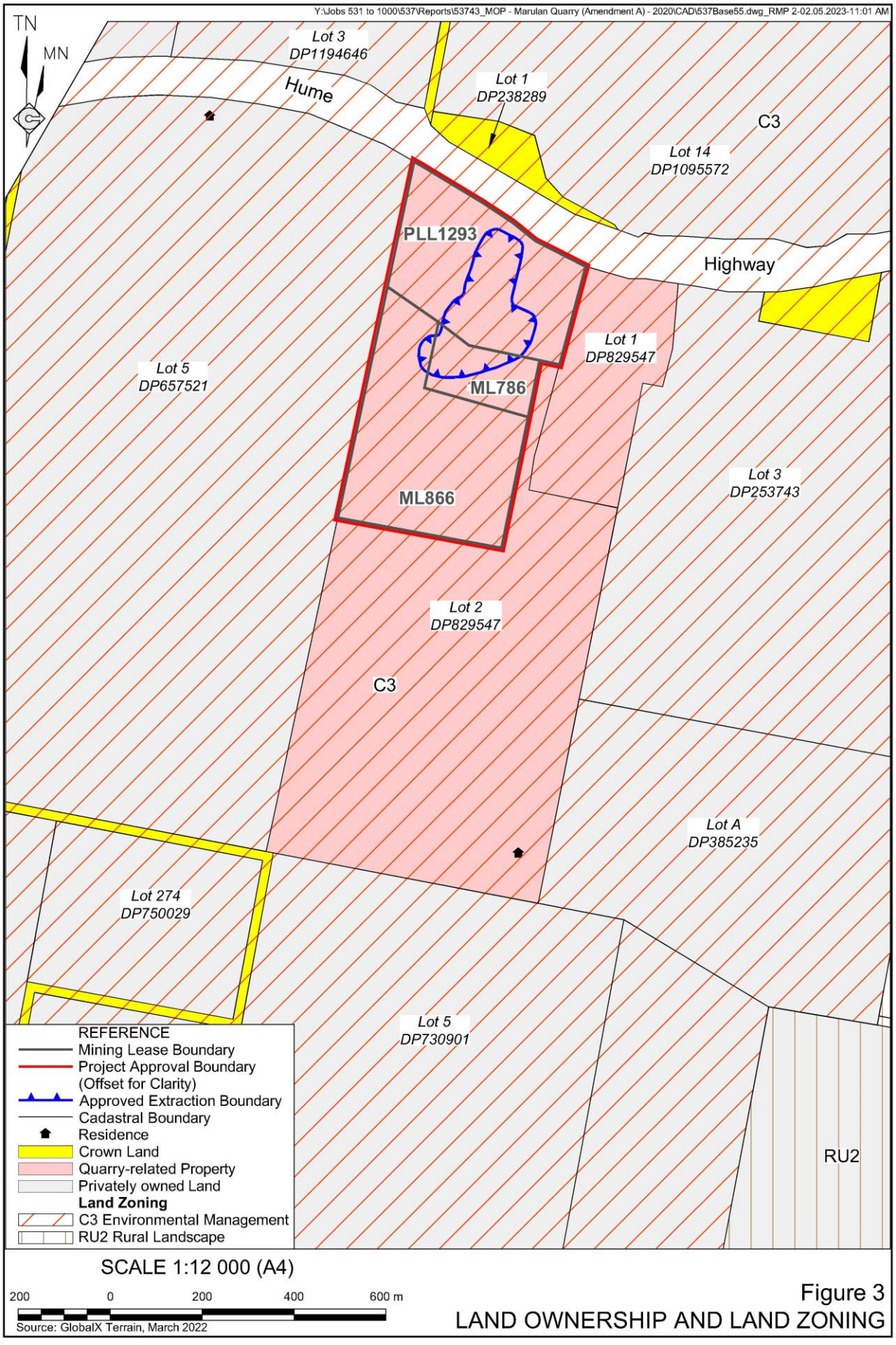


Figure 3
LAND OWNERSHIP AND LAND ZONING

1.3.2 Land Use

Figure 3 presents land zoning under the *Goulburn Mulwaree Local Environmental Plan 2009*. The Quarry Site is located on and is surrounded by land identified as C3 Environmental Management, with land zoned RU2 Rural Landscape located to the southeast of the Quarry Site.

Figure 4 presents the NSW State mapping of land uses within and in the vicinity of the Quarry Site. Mapped land uses in the vicinity of the Quarry Site include but are not limited to:

- agricultural production and rural residential;
- nature conservation; and
- transportation, namely the Hume Highway.

Figure 5 presents the NSW State Vegetation Type Mapping of the distribution of Plant Community Types within and in the vicinity of the Quarry Site. Further information on the existing vegetation types of the Quarry Site is provide in Section 6.2.1.

The approved final land use for the Quarry Site is general nature conservation with retention of infrastructure to support post-quarrying land uses within and in the vicinity of the Quarry Site. Further information is presented in Section 2.

There are currently no Stewardship Agreements, Conservation Agreements or other similar agreements applicable to the Quarry Site.

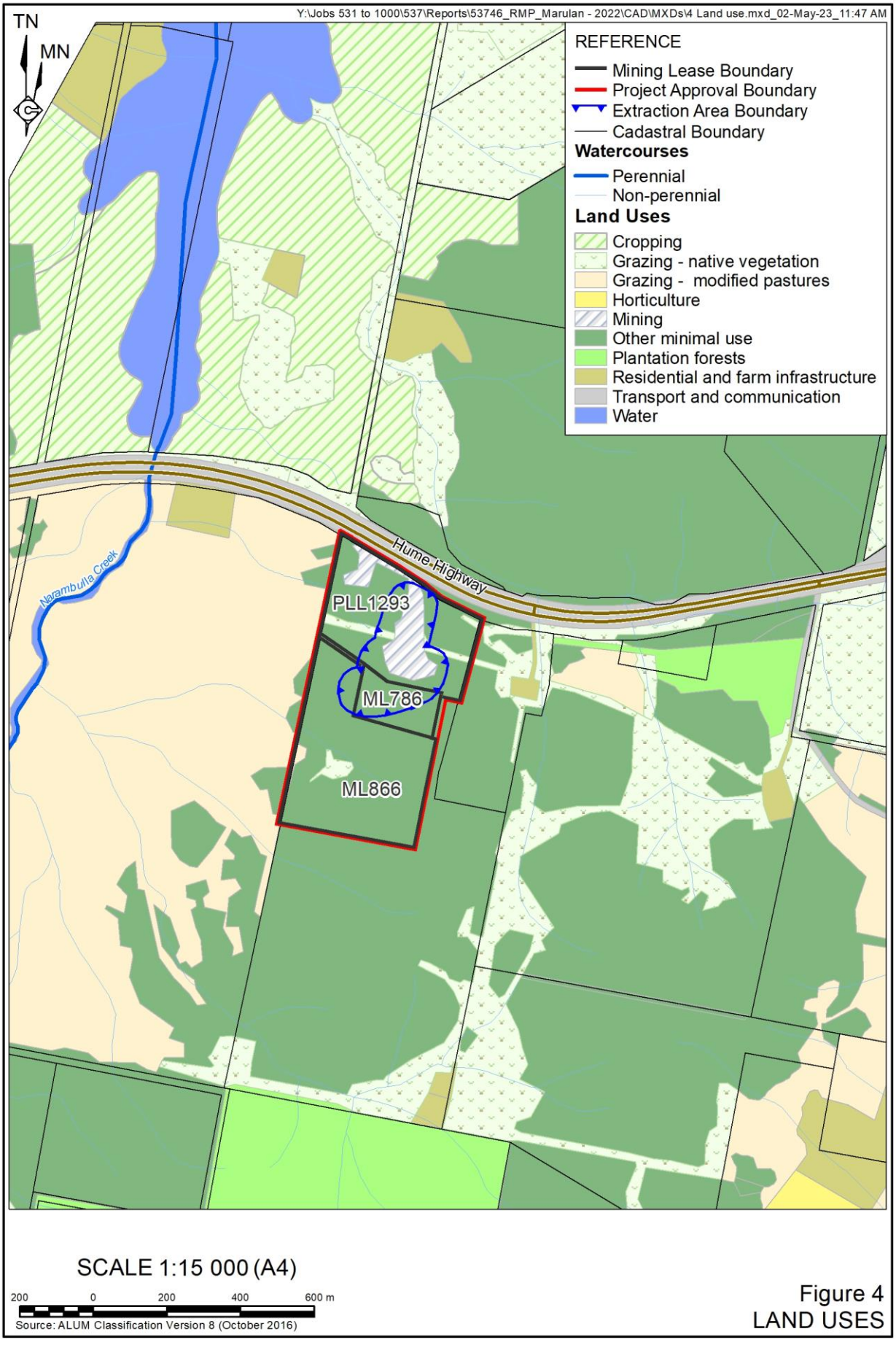


Figure 4
LAND USES

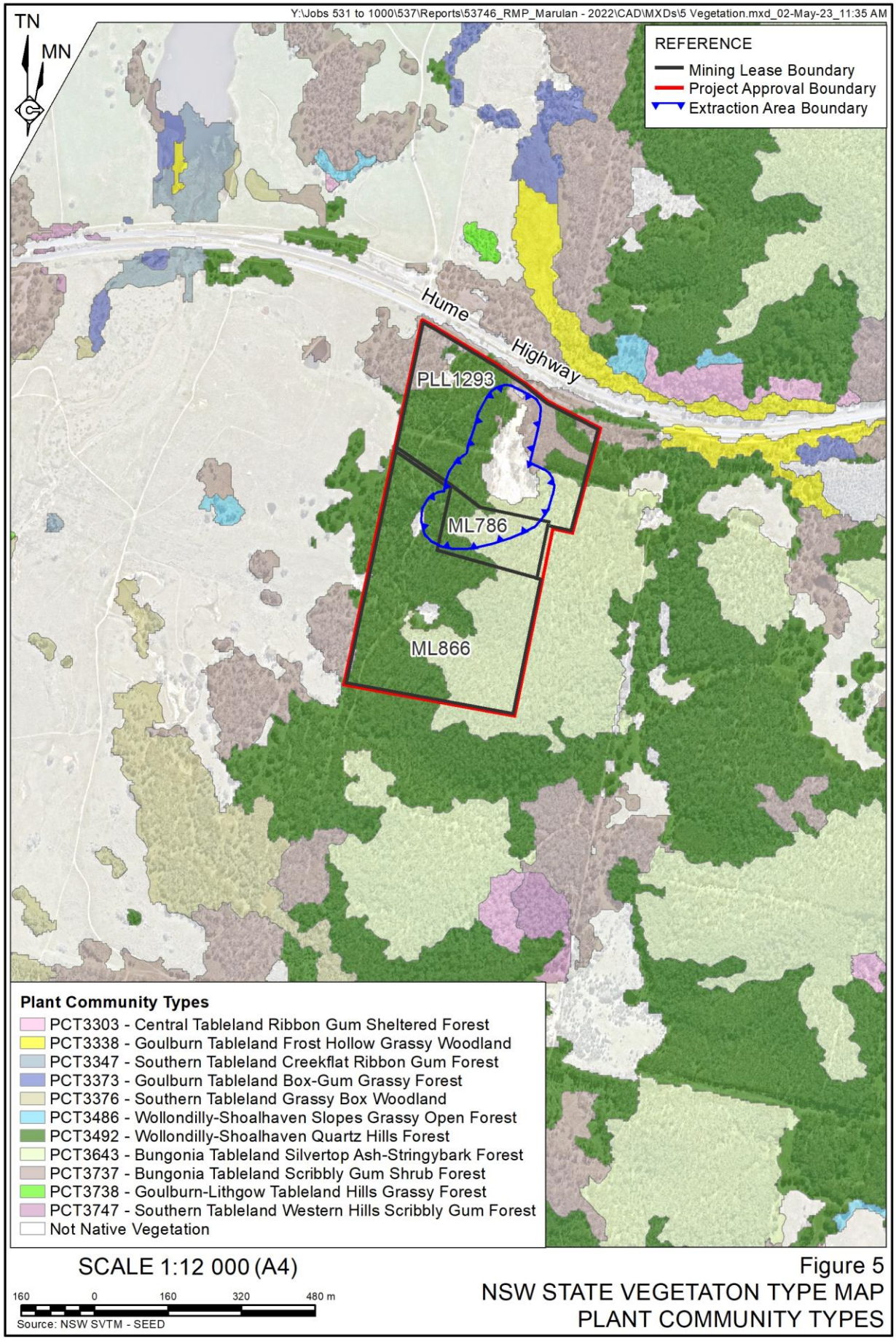


Figure 5
NSW STATE VEGETATON TYPE MAP
PLANT COMMUNITY TYPES

2. FINAL LAND USE

2.1 REGULATORY REQUIREMENTS FOR REHABILITATION

Table 3 lists the regulatory requirements relating to rehabilitation of the Quarry Site and post-extraction land uses.

Table 4
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Approvals, Leases, Licences					
Development Consent 2921	1	The recommendations and findings in the *Environmental Study* and Rehabilitation Plan prepared by Morse McVey and Associates dated June 1995 be implemented, and that Council be provided with an annual report highlighting the activities carried out with respect to the plan over the proceeding twelve months. This report should be provided to Council by 31 January each year.	Quarry site and surrounds	During operation and rehabilitation	6.2.1.1
	2	A weed management plan is to be developed and implemented in conjunction with the rehabilitation of the site, to prevent weed infestations of natural revegetated areas.	Quarry Site	During operation and rehabilitation	6.2.1
Private Lands Lease 1293, Mining Leases 786 and 866	4	**Must prevent or minimise harm to the environment** (1) The holder of a mining lease must take all reasonable measures to prevent, or if that is not reasonably practicable, to minimise, harm to the environment caused by activities under the mining lease. (2) In this clause – ***harm*** to the environment has the same meaning as in the *Protection of the Environment Operations Act 1997*.	Quarry Site	During operation and rehabilitation	Noted
	5	**Rehabilitation to occur as soon as reasonably practicable after disturbance** The holder of a mining lease must rehabilitate land and water in the mining area that is disturbed by mining activities under the mining lease as soon as reasonably practicable after the disturbance occurs.	Quarry Site	During operation and rehabilitation	Noted
	6	**Rehabilitation must achieve final land use** (1) The holder of a mining lease must ensure that rehabilitation of the mining area achieves the final land use for the mining area. (2) The holder of a mining lease must ensure any planning approval has been obtained that is necessary to enable the holder to comply with subclause (1). (3) The holder of the mining lease must identify and record any reasonably foreseeable hazard that presents a risk to the holder's ability to comply with subclause (1) **Note –** clause 7 requires a rehabilitation risk assessment to be conducted whenever a hazard is identified under this subclause.	Quarry Site	During operation and rehabilitation	2.2, 3

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Approvals, Leases, Licences (Cont'd)					
Private Lands Lease 1293, Mining Leases 786 and 866 (Cont'd)	6 (Cont'd)	(4) In this clause – ***final land use*** for the mining area means the final landform and final land uses to be achieved for the mining area – (a) as set out in the rehabilitation objectives statement and rehabilitation completion criteria statement, and (b) for a large mine – as spatially depicted in the final landform and rehabilitation plan, and (c) if the final land use for the mining area is required by a condition of development consent for activities under the mining lease – as stated in the condition. ***planning approval*** means – (a) a development consent within the meaning of the *Environmental Planning and Assessment Act 1979*, or an approval under that Act, Division 5.1.			
	7	**Rehabilitation risk assessment** (1) The holder of a mining lease must conduct a risk assessment (a ***rehabilitation risk assessment***) that – (a) identifies, assesses and evaluates the risks that need to be addressed to achieve the following in relation to the mining lease – (i) the rehabilitation objectives, (ii) the rehabilitation completion criteria, (iii) for large mines – the final land use as spatially depicted in the final landform and rehabilitation plan, and (b) identifies the measures that need to be implemented to eliminate, minimise or mitigate the risks. (2) The holder of the mining lease must implement the measures identified. (3) The holder of a mining lease must conduct a rehabilitation risk assessment – (a) for a large mine – before preparing a rehabilitation management plan, and (b) for a small mine – before preparing the rehabilitation outcome documents for the mine, and (c) whenever a hazard is identified under clause 6(3) – as soon as reasonably practicable after it is identified, and whenever given a written direction to do so by the Secretary.	Quarry Site	During operation and rehabilitation	3

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Approvals, Leases, Licences (Cont'd)					
Private Lands Lease 1293, Mining Leases 786 and 866 (Cont'd)	9	**General requirements for documents** A document required to be prepared under this Division must— (a) be in a form approved by the Secretary, and **Note—** The approved forms are available on the Department's website. (b) include any matter required to be included by the form, and (c) if required to be given to the Secretary—be given in a way approved by the Secretary.	Quarry Site	During operation and rehabilitation	This document
	10	**Rehabilitation management plans for large mines** (1) The holder of a mining lease relating to a large mine must prepare a plan (a rehabilitation management plan) for the mining lease that includes the following— (a) a description of how the holder proposes to manage all aspects of the rehabilitation of the mining area, (b) a description of the steps and actions the holder proposes to take to comply with the conditions of the mining lease that relate to rehabilitation, (c) a summary of rehabilitation risk assessments conducted by the holder, (d) the risk control measures identified in the rehabilitation risk assessments, (e) the rehabilitation outcome documents for the mining lease, (f) a statement of the performance outcomes for the matters addressed by the rehabilitation outcome documents and the ways in which those outcomes are to be measured and monitored. (2) If a rehabilitation outcome document has not been approved by the Secretary, the holder of the mining lease must include a proposed version of the document. (3) A rehabilitation management plan is not required to be given to the Secretary for approval. (4) The holder of the mining lease— (a) must implement the matters set out in the rehabilitation management plan, and (b) if the forward program specifies timeframes for the implementation of the matters—must implement the matters within those timeframes.	Quarry Site	During operation and rehabilitation	This document

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Approvals, Leases, Licences (Cont'd)					
Private Lands Lease 1293, Mining Leases 786 and 866 (Cont'd)	11	**Amendment of rehabilitation management plans** The holder of a mining lease must amend the rehabilitation management plan for the mining lease as follows— (a) to substitute the proposed version of a rehabilitation outcome document with the version approved by the Secretary—within 30 days after the document is approved, (b) as a consequence of an amendment made under clause 14 to a rehabilitation outcome document—within 30 days after the amendment is made, (c) to reflect any changes to the risk control measures in the prepared plan that are identified in a rehabilitation risk assessment—as soon as practicable after the rehabilitation risk assessment is conducted, (d) whenever given a written direction to do so by the Secretary—in accordance with the direction.	Quarry Site	During operation and rehabilitation	11
	12	**Rehabilitation outcome documents** (1) The holder of a mining lease must prepare the following documents (***the rehabilitation outcome documents***) for the mining lease and give them to the Secretary for approval— (a) the ***rehabilitation objectives statement***, which sets out the rehabilitation objectives required to achieve the final land use for the mining area, (b) the ***rehabilitation completion criteria statement***, which sets out criteria, the completion of which will demonstrate the achievement of the rehabilitation objectives, (c) for a large mine, the ***final landform and rehabilitation plan***, showing a spatial depiction of the final land use. (2) If the final land use for the mining area is required by a condition of development consent for activities under the mining lease, the holder of the mining lease must ensure the rehabilitation outcome documents are consistent with that condition.	Quarry Site	During operation and rehabilitation	4, 5

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Approvals, Leases, Licences (Cont'd)					
Private Lands Lease 1293, Mining Leases 786 and 866 (Cont'd)	13	**Forward program and annual rehabilitation report** (1) The holder of a mining lease must prepare a program (a ***forward program***) for the mining lease that includes the following— (a) a schedule of mining activities for the mining area for the next 3 years, (b) a summary of the spatial progression of rehabilitation through its various phases for the next 3 years, (c) a requirement that the rehabilitation of land and water disturbed by mining activities under the mining lease must occur as soon as reasonably practicable after the disturbance occurs. (2) The holder of a mining lease must prepare a report (an ***annual rehabilitation report***) for the mining lease that includes— (a) a description of the rehabilitation undertaken over the annual reporting period, (b) a report demonstrating the progress made through the phases of rehabilitation provided for in the forward program applying to the reporting period, (c) a report demonstrating progress made towards the achievement of the following— (i) the objectives set out in the rehabilitation objectives statement, (ii) the criteria set out in the rehabilitation completion criteria statement, (iii) for large mines—the final land use as spatially depicted in the final landform and rehabilitation plan. (3) If a rehabilitation outcome document has not been approved by the Secretary, the holder of the mining lease must rely on a proposed version of the document. (4) The holder of the mining lease must give the forward program and annual rehabilitation report to the Secretary. (5) In this clause— ***annual reporting period*** means each period of 12 months commencing on— (a) the date on which the mining lease is granted, or (b) if the Secretary approves another date in relation to the mining lease— the other date	Quarry Site	During operation and rehabilitation	8.3

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Approvals, Leases, Licences (Cont'd)					
Private Lands Lease 1293, Mining Leases 786 and 866 (Cont'd)	14	**Amendment of rehabilitation outcome documents and forward program** (1) This clause applies to— (a) a rehabilitation outcome document if it has been approved by the Secretary, and (b) a forward program if it has been given to the Secretary. (2) The holder of a mining lease must not amend a document to which this clause applies that relates to the mining lease unless— (a) the Secretary gives the holder a written direction to do so, or (b) the Secretary, on written application by the holder, gives a written approval of the amendment. (3) The holder of the mining lease must amend the document in accordance with the Secretary's direction or approval. (4) Nothing in this clause prevents the holder of a mining lease preparing a draft amendment for submission to the Secretary for approval.	Quarry Site	During operation and rehabilitation	8.3
	15	**Times at which documents must be prepared and given** (1) The holder of a mining lease must do the following before the end of the initial period— (a) prepare a rehabilitation management plan, and (b) prepare rehabilitation outcome documents and give them, other than the rehabilitation completion criteria statement, to the Secretary for approval, and (c) prepare a forward program and give it to the Secretary. (2) The holder of the mining lease must prepare a forward program and annual rehabilitation report and give them to the Secretary before— (a) 60 days after the last day of each annual reporting period, commencing with the annual reporting period in which the forward program was given to Secretary under subclause (1)(c), or (b) a later date approved by the Secretary. (3) A rehabilitation completion criteria statement relating to completion of rehabilitation during a period covered by a forward program must be given to the Secretary for approval when the forward program is required to be given to the Secretary.	Quarry Site	During operation and rehabilitation	Noted

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Private Lands Lease 1293, Mining Leases 786 and 866 (Cont'd)	15 (Cont'd)	(4) The holder of the mining lease must prepare updated rehabilitation outcome documents for the mining lease and give them to the Secretary for approval before— (a) 60 days after a development consent is modified following an application referred to in clause 20(1)(b), or (b) a later date approved by the Secretary. (5) A rehabilitation completion criteria statement is not required to be given to the Secretary under subclause (4) unless a rehabilitation completion criteria statement has already been given to the Secretary under subclause (3). (6) The Secretary may, by written notice, direct the holder of a mining lease to prepare, or give to the Secretary, a document required to be prepared under this Division at a time other than that specified in this clause. (7) The holder of the mining lease must comply with the direction. (8) In this clause— initial period means the period commencing when the mining lease is granted and ending— (a) 30 days, or other period approved by the Secretary, after this Division first applies to the mining lease, or (b) if this Division applies to the mining lease because of an increase in the required security deposit— (i) when the surface of the mining area is disturbed by activities under the mining lease, or at a later date approved by the Secretary.			
	16	**Certain documents to be publicly available** (1) This clause applies to the following documents— (a) a rehabilitation management plan, (b) a forward program, (c) an annual rehabilitation report. (2) The holder of a mining lease must make a document to which this clause applies publicly available by— (a) publishing it on its website in a prominent position, or (b) if the holder does not have a website— providing a copy of it to a person— (i) on the written request of a person, and (ii) without charge, and (iii) within 14 days after the request is received.	Quarry Site	During operation and rehabilitation	Noted

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Private Lands Lease 1293, Mining Leases 786 and 866 (Cont'd)	16 (Cont'd)	(3) If a document is published on the website of the holder of the mining lease, the holder must ensure that it is published— (a) for a rehabilitation management plan—within 14 days after it is prepared or amended, or (b) for a forward program or an annual rehabilitation report—within 14 days after it is given to the Secretary or amended, Personal information within the meaning of the *Privacy and Personal Information Protection Act 1998* is not required to be included in a document made available to a person under this clause.			
	17	**Records demonstrating compliance** The holder of a mining lease must create and maintain records of all actions taken that demonstrate compliance with each of the conditions set out in this Part. **Note—** The Act, sections 163D and 163E provide for the form in which records must be kept and the period for which they must be retained.	Quarry Site	During operation and rehabilitation	This document
	18	**Report on non-compliance** (1) The holder of a mining lease must provide the Minister with a written report detailing any non-compliance with— (a) a condition of the mining lease, or Note— The Act, section 364A contains provisions relating to the use and disclosure of information provided under this condition. (b) a requirement of the Act or this Regulation relating to activities under the mining lease. (2) The holder of the mining lease must provide the report within 7 days after becoming aware of the non-compliance. (3) The holder of the mining lease must ensure the report— (a) identifies the condition of the mining lease, or the requirement of the Act or this Regulation, to which the non-compliance relates, and (b) describes the non-compliance and specifies the date or dates on which, or the period during which, the non-compliance occurred, and (c) describes the causes or likely causes of the non-compliance, and (d) describes the action that has been taken, or will be taken, to mitigate the effects, and to prevent any recurrence, of the non-compliance.	Quarry Site	During operation and rehabilitation	Noted

Table 4 (Cont'd)
Regulatory Requirements for Rehabilitation

Document	Condition No.	Requirement	Area	Timing	RMP Section
Legislation					
Mining Act 1992	Division 3	Under these sections the Minister can direct a company to rehabilitate their land, or, should the company not comply with this direction, rehabilitate the land at the Ministers expense and recover the cost from the company.	Quarry Site	During rehabilitation	Noted

2.2 FINAL LAND USE OPTIONS ASSESSMENT

Statement of Environmental Effects (1995)

A general final land use options assessment was presented as part of Section 3.3.1 of the *Statement of Environmental Effects* (Fox, 1995). It should be noted that Fox (1995) addressed only the rehabilitation of the disturbance associated with the Eastern Extraction Area and associated infrastructure, and not the Western or Southern Extraction Areas. In summary, consideration of the permissible uses of the (then) Land Use Zone 1(a) General Rural Zone identified a broad range of potential end uses. These included the following.

- Agriculture – grazing, etc.
- Location of a dwelling house (subject to compliance and approval by Goulburn Mulwaree Council (Council)).
- Any other site-specific uses permissible within the zoning of the land, subject to Council approval.

Rather than identify any specific final land use, emphasis was places on ensuring that the final landform and site characteristics are such that they provide the potential for alternative possible end land uses. The (then) proposed final land aimed to:

> "*recreate a hillside appearance for the embankment which is to be revegetated to provide a rehabilitated state sympathetic with the surrounding topography and vegetation cover."*

Figure 6 presents the approved final land use plan for the Eastern Extraction Area, presented as Figure 8 of Fox (1995). In summary, the approved final landform and land use consist of a profiled landform with mixed vegetation cover. The Sedimentation Basin is to be retained as part of the final landform to provide water storage for post-quarrying land uses.

Mining Operations Plan (2020)

The final *Amended Mining Operations Plan for the Marulan Shale Quarry – PLL1293, ML786 and ML866* (MOP[1]) addressed the rehabilitation of all quarrying-related disturbance within the Quarry Site, including the historic (i.e. pre-dating DA2921) disturbance within the Western and Southern Extraction Areas.

Figure 7 presents the final land use as defined by the MOP. In summary, the Final Land Use Domains (referred to previously as Secondary Domains) included:

- Rehabilitation Areas consisting of grassland and woodland; and
- Water Management Area.

The Property Access Road would be retained to support final land use, and the central asset protection zone associated with the power line traversing the Quarry Site would not be impacted by the final landform and land use.

[1] As of 2 July 2022, the MOP has been superseded by this Plan.

Figure 6
APPROVED FINAL QUARRY PLAN

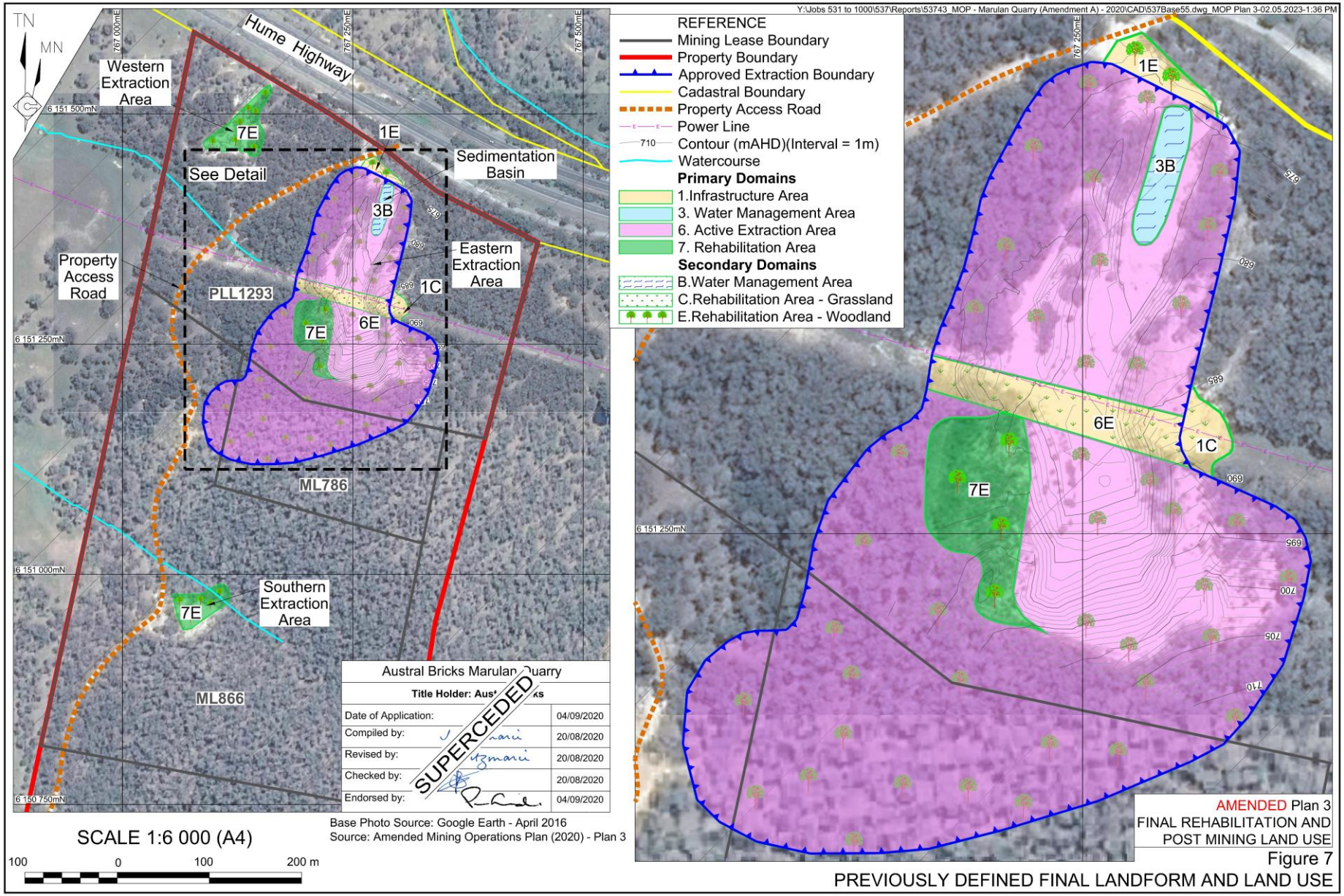


Figure 7
PREVIOUSLY DEFINED FINAL LANDFORM AND LAND USE

2.3 FINAL LAND USE STATEMENT

The Final Land Use for the Quarry Site is consistent with DA2921 and previously identified final land uses and includes the following.

- Native Ecosystem Areas – revegetated areas containing flora species assemblages and ecosystem characteristics for grassland and woodland areas consistent with the surrounding vegetation.
- Water Storage Areas – includes retained water storage dam.

Final land use and rehabilitation plans for the Quarry Site are presented in Section 5.

2.4 FINAL LAND USE AND MINING DOMAINS

The *Form and Way: Rehabilitation Management Plan for Large Mines (July 2021)* defines a domain as follows.

> *"An area (or areas) of the land that has been disturbed by mining and has a specific operational use (mining domain) or specific final land use (final land use domain). Land within a domain typically has similar geochemical and/or geophysical characteristics and therefore requires specific rehabilitation activities to achieve the associated final land use."*

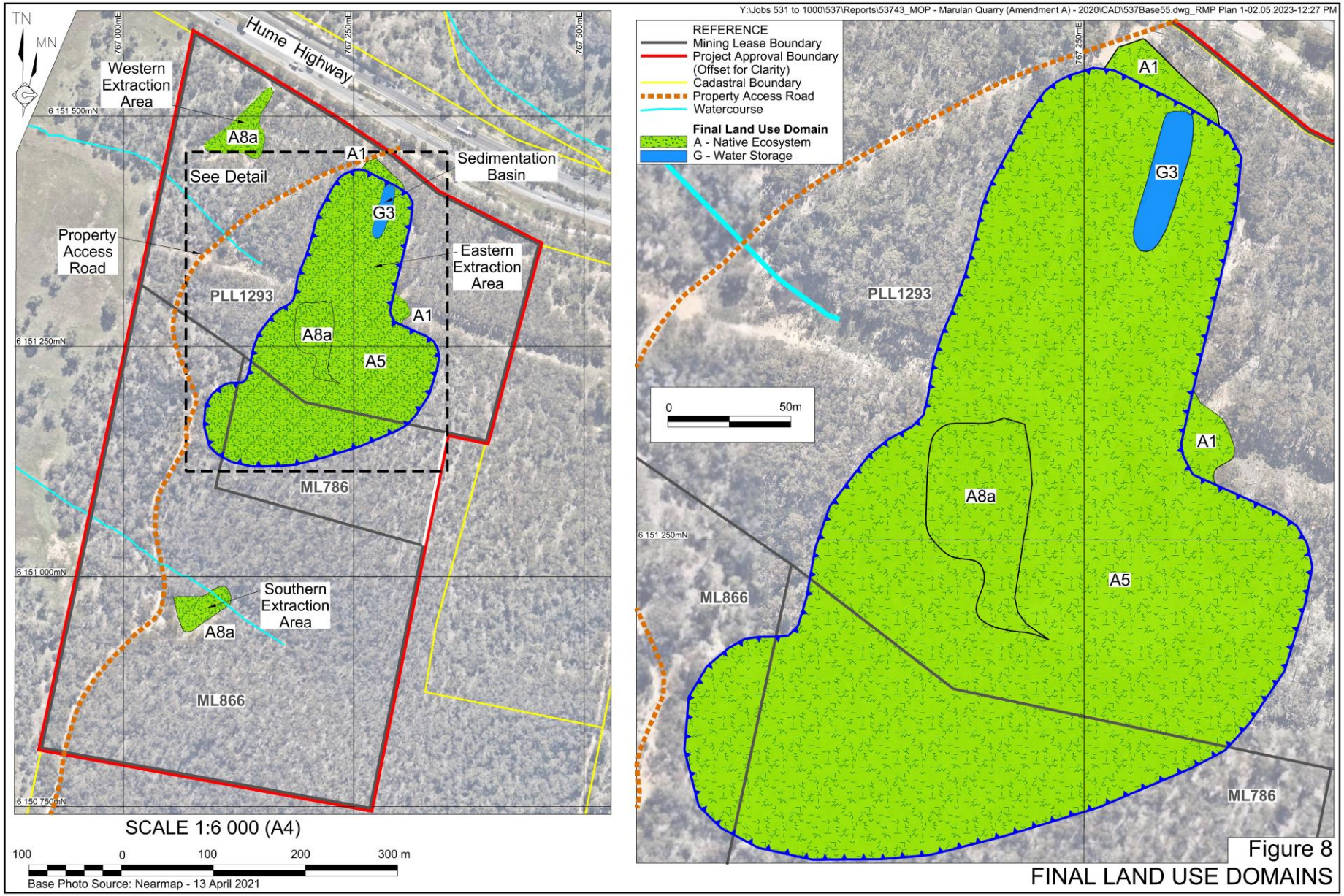
The following sub-sections summarise the Final Land Use and Mining Domains consistent with the domain descriptions and identifications provided for within the Guideline *Mine Rehabilitation Portal* (July 2021).

2.4.1 Final Land Use Domains

Table 5 defines the final land use domains for the Quarry Site as presented in **Figure 8**.

Table 5
Final Land Use Domains

Final Land Use Domain	Domain ID[1]	Domain Description
Native Ecosystem Area	A	Includes areas to be revegetated to form native grassland and woodland ecosystems and includes the following areas. • The Eastern Extraction Area. • The previously rehabilitated Southern Extraction Area. • The previously rehabilitated Western Extraction Area.
Water Storage	G	Includes the sedimentation basin within the Eastern Extraction Area retained as a clean water storage.
Note 1: See **Figure 8**		


TN
MN
Hume Highway
Western Extraction Area
Sedimentation Basin
See Detail
Property Access Road
Eastern Extraction Area
Southern Extraction Area
PLL1293
ML786
ML866
A1
A8a
A5
G3
767 000mE
767 250mE
767 500mE
6 151 500mN
6 151 250mN
6 151 000mN
6 150 750mN
SCALE 1:6 000 (A4)
100 0 100 200 300 m
Base Photo Source: Nearmap - 13 April 2021
Y:\Jobs 531 to 1000\537\Reports\53743_MOP - Marulan Quarry (Amendment A) - 2020\CAD\537Base55.dwg_RMP Plan 1-02.05.2023-12:27 PM
REFERENCE
Mining Lease Boundary
Project Approval Boundary
(Offset for Clarity)
Cadastral Boundary
Property Access Road
Watercourse
Final Land Use Domain
A - Native Ecosystem
G - Water Storage
0 50m
Figure 8
FINAL LAND USE DOMAINS

2.4.2 Mining Domains

Table 6 defines the mining domains for the Quarry Site as presented in **Figure 9**.

Table 6
Mining Domains

Mining Domain	Domain ID[1]	Domain Description
Infrastructure Area	1	Includes the access into the Eastern Extraction Area and disturbance associated with the power line asset protection zone traversing the Quarry Site.
Water Management Area	3	Includes the Sedimentation Basin in the northern section of the Eastern Extraction Area.
Active Mining Area	5	Includes all areas within the Eastern Extraction Area, including soil stockpiles.
Other (Rehabilitation Area)	8a	This domain includes areas which have previously been extracted, backfilled with overburden, shaped and revegetated, including the central portion of the Eastern Extraction Area and both the Western and Southern Extraction Areas.
Note 1: See **Figure 9**		

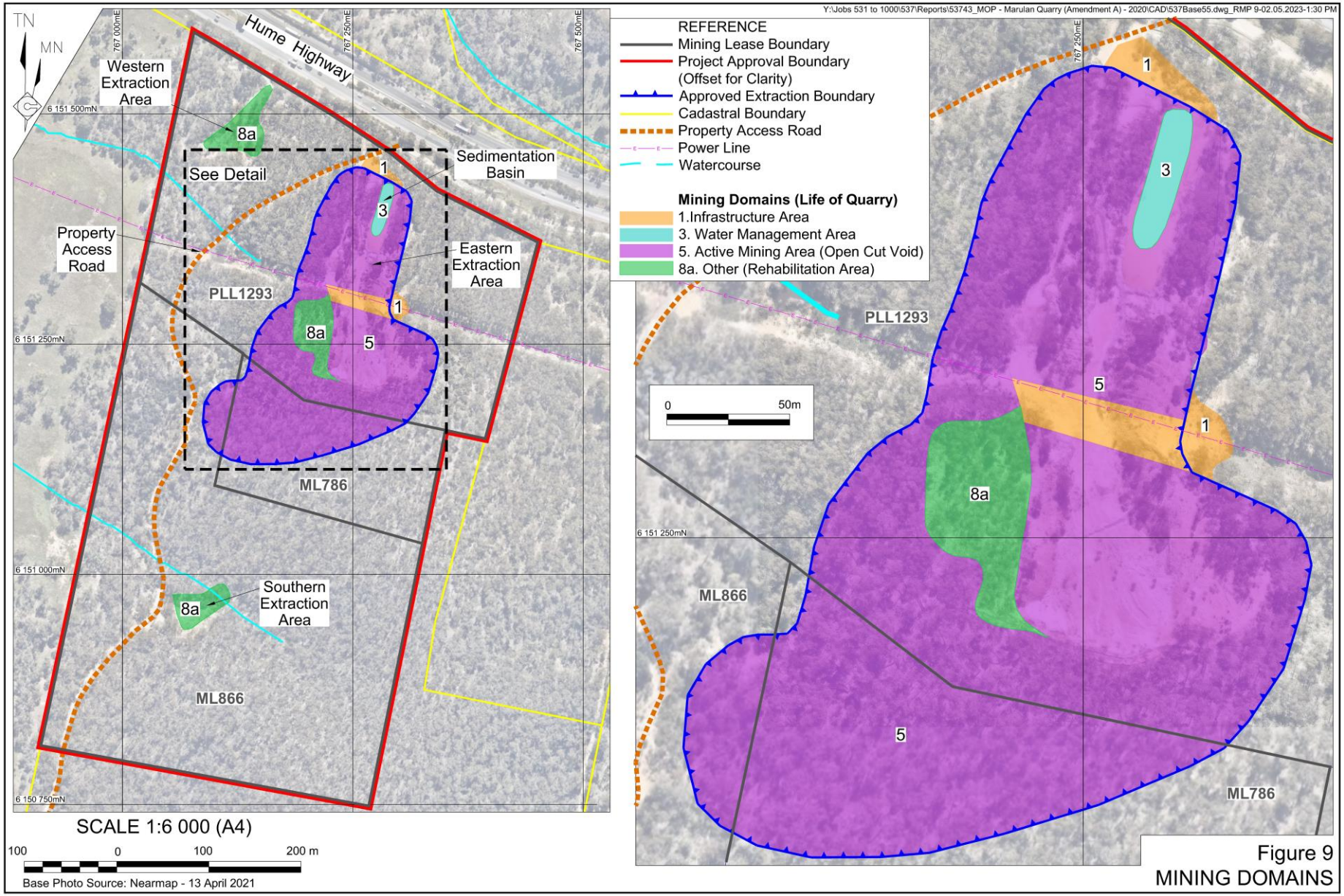


Figure 9
MINING DOMAINS

3. REHABILITATION RISK ASSESSMENT

The following risk assessment was undertaken generally in accordance with *Australian Standards HB 203:2006, AS/NZS 4360:2004 and AS/NZS ISO 31000:2018 Risk Management – Principles & Guidelines.*

Risks to achieving the rehabilitation objectives and rehabilitation completion criteria outlined in Section 4, as well as the final landform outlined in Section 5, were identified and assessed jointly by Austral Bricks and R.W. Corkery & Co. Pty Limited during the preparation of this Plan. Site-specific threats to rehabilitation were assessed based on observations of site-specific conditions and threats to rehabilitation in collaboration with Austral Bricks. This risk assessment was completed with consideration of existing controls as well as those risk controls outlined in this plan.

For each identified risk to rehabilitation, potential adverse outcomes were identified and allocated a risk rating based on the potential consequences and likelihood of occurrence. **Tables 7**, **8** and **9** present the consequence, likelihood and risk rating used during this analysis. Where risks were determined to be unacceptable, namely those risks classified as "Moderate" or above, a summary table has been developed and is presented below in **Table 10**.

Table 7
Qualitative Consequence Rating

Level	Descriptor	Description
1	Negligible	No detrimental impact on the final land use is measurable or envisaged.
2	Minor	An event which could have temporary and minor effects on the suitability of the final land use.
3	Moderate	An event which would create substantial temporary or minor permanent damage to the suitability of the final land use.
4	Major	An event which could have a substantial and permanent consequence to the suitability of the final land use.
5	Severe	A major event which could cause severe damage to the suitability of the final land use with actual or potential loss of credibility with key stakeholders, environmental liability, regulatory intervention, national publicity/complaints, or could close the operation prematurely.
Note: Rating modified after AS ISO 31000:2018 Risk Management – Guidelines		

Table 8
Qualitative Likelihood Rating

Level	Descriptor	Description
A	Certain	Is an ongoing occurrence or will occur under all conditions.
B	Almost Certain	Is expected to occur in most circumstances.
C	Likely	Will probably occur in most circumstances.
D	Possible	Will probably occur under favourable circumstances.
E	Unlikely	May occur, but only under favourable circumstances.
F	Rare	Not expected to occur, unless subject to exceptional circumstances.
G	Very Rare	Theoretically possible but not expected to occur.
Source: Rating modified after HB 89:2012 – Figure B7		

Table 9
Qualitative Risk Rating

Likelihood	Consequences				
	1 Negligible	**2 Minor**	**3 Moderate**	**4 Major**	**5 Severe**
A Certain	M	H	H	VH	VH
B Almost Certain	M	M	H	VH	VH
C Likely	M	M	H	H	VH
D Possible	L	M	M	H	H
E Unlikely	L	L	M	M	H
F Rare	L	L	L	M	M
G Very Rare	L	L	L	L	M
Risk Rating: L = Low, M = Moderate, H = High and VH = Very High					
Source: Modified after HB 89:2012 – Figure B8					

Table 10
Rehabilitation Risk Assessment

Rehabilitation Phase	Risk	Risk Control	Final Land Use Domain / Risk Ranking		Where Addressed in RMP
			Domain A: Native Ecosystem	Domain G: Water Storage (Excluding final void)	
General	Insufficient skills and experience of rehabilitation personnel.	Extensive experience of management team. Development and implementation of Integrated Management Plan documentation, including inductions, toolbox talks and Contractor Permit to Work, safety contacts and workplace inspections. Engagement of specialists consultants to address specific issues if and when required.	L (F3)	L (F3)	7, 10
	Lack of clearly defined responsibilities.	Responsibilities as defined in the *Rehabilitation Management Plan* and Safety, Health and Environment Management System, Implementation of *Integrated Management Plan* documentation, including inductions, toolbox talks and Contractor Permit to Work.	L (G3)	L (G3)	7
	Insufficient funding for or prioritisation of rehabilitation activities.	Rehabilitation cost estimate and maintenance of security bond.	L (F3)	L (F3)	7, 10
Active Mining Phase of Rehabilitation	Inappropriate biological resource (e.g. subsoil, topsoil, vegetative material, seedbank, rocks, habitat resources) through clearing, salvage, and handling practices.	Stockpiling of growth medium in location not subject to run-on water or vehicle access. Spraying of weeds on an as needed basis. *Signposting of growth medium stockpile (when present).*	L (F3)	NA	6.2.1.1, 6.2.1.11, 9.2
	Limited pre-existing biological resources for use (e.g. topsoil, woody debris).	Strip all available soil / growth medium resources and either immediately place on shaped landform or stockpile in accordance with Rehabilitation Management Plan. *Maintain a growth medium register.* *Record growth medium stockpile locations on map (when present).*	M (D3)	NA	6.2.1.1, 9.2
	Adverse meteorological conditions during salvage of biological resources.	Review of meteorological forecast prior to vegetation clearing and soil stripping and avoidance of salvage activities during high rainfall. Review site conditions prior to commencement of vegetation clearing and soil stripping.	L(F3)	NA	6.2.1.1, 6.2.5, 8.2
	Adverse geochemical/chemical composition of materials such as overburden, processing wastes, topsoils and subsoils.	Allowance for application of gypsum and fertiliser in rehabilitation cost estimate. *Testing of growth medium following spreading but prior to application of seed to confirm rates of gypsum, fertiliser and/or other soil ameliorants required.*	L(F3)	NA	6.2.1.1, 6.2.1.6, 6.2.1.8, 9.2.
	Handling and containment of geochemical and geotechnically unsuitable process residue and reject materials.	No geochemically or geotechnically unsuitable process residues or reject materials generated or present.	NA	NA	-
	Adverse surface and/or groundwater quality and quantity.	Erosion and sediment control structures. Storage of all hydrocarbons and chemicals in accordance with AS1940:2017 – The storage and handling of flammable and combustible liquids. (Note: no permanent storages present on site) Management of discharge water quality, including use of flocculants / coagulants as required.	L (F3)	L (F3)	6.2.1.5, 6.2.6, 10
Decommissioning Phase of Rehabilitation	Impacts on heritage items.	There are currently no known heritage items on site *Unexpected finds protocol in the event that a heritage item is discovered.*	L (G4)	L (G4)	6.2.1.13, 9.2
	Hazards associated with retained infrastructure.	Inspection of roads and sediment pond following periods of intense rainfall to ensure trafficability / stability.	L (F3)	L (F3)	6.2.2.3, 9.2.5
	Contamination resulting from associated activities (e.g. storage and use of hydrocarbons/chemicals, drilling fluid, spillage of dirty water, brine, sewage).	Storage of all hydrocarbons and chemicals in accordance with AS1940:2017 – The storage and handling of flammable and combustible liquids. (Note: no permanent storages present on site) *Visual contamination inspection and report prior to relinquishment.*	L (G4)	L (G4)	6.2.2.4, 6.2.2.5
	Material and waste products from the demolition process retained on the final landform.	No demolition works applicable. Removal of all equipment and any associated spares / wastes in accordance with established protocols.	L (F2)	NA	6.2.2.2, 9.2.5
	Groundwater accumulation in former underground workings (e.g. potential for fill and spill or impacts on regional ground water users.	No underground workings present.	NA	NA	-
	Exposure or access to underground workings.	No underground workings present.	NA	NA	-
	Habitation of structures and/or underground workings by native fauna (e.g. bats).	No underground workings present.	NA	NA	-

Table 10 (Cont'd)
Rehabilitation Risk Assessment

Rehabilitation Phase	Risk	Risk Control	Final Land Use Domain / Risk Ranking		Where Addressed in RMP
			Domain A: Native Ecosystem	Domain G: Water Storage (Excluding final void)	
Landform Establishment Phase of Rehabilitation	Unstable landform due to erosion and/or mass movement issues associated with inappropriate design and/or quality assurance during landform construction.	Establishment of safe and stable final extraction faces up to 1:3 V:H during mining operations. *Reduce dam wall spillway invert to reduce volume stored.* *Visual inspection and report of slope and dam wall stability prior to relinquishment.*	L (F3)	L(F3)	6.2.3.4
	Exposure or release of geochemical and/or geotechnically adverse material associated with containment design and construction, including capping/cover system.	No capping or containment systems present or required.	NA	NA	-
	Lack of availability of suitable materials for encapsulation or capping of adverse materials.	No capping or containment systems present or required.	NA	NA	-
	Borehole or gas well seals failure.	No boreholes or gas wells present.	NA	NA	-
	Final landform unsuitable for final land use (e.g. large rocks present affecting cultivation, unsuitable surface cover and landform settlement).	*Shaping and ripping of final batters and extraction floor to provide suitable grades and surface substrate for application of growth medium.* *Visual inspection prior to application of growth medium.*	L(F3)	L(F3)	6.2.3, 8
	Retained final landform is not free-draining / results unintended ponding of water.	*Shaping of batters and extraction floor to provide suitable grades directing surface water flows to the retained water storage and/or suitably stabilised outlet.*	L(E2)	NA	6.2.3.1, 6.2.3.2
	Uncontrolled public access to highwalls	No highwalls will be retained with all slopes 1:3 V:H or less.	NA	NA	-
Growth Medium Development Phase of Rehabilitation	Inappropriate physical and structural properties of growth medium.	*Shaping and ripping of batters and extraction floor to provide suitable grades and surface substrate for application of growth medium.* *Light ripping of growth medium across contours to key in to substrate, reduce surface runoff velocities, and retain seed (when spread).* Allowance for application of gypsum in rehabilitation cost estimate. *Testing of growth medium following spreading but prior to application of seed to confirm rates of gypsum and/or other soil ameliorants required.* *Restriction of vehicular access following spreading of soil material.*	L(F3)	NA	6.2.1.1, 6.2.1.6, 6.2.1.11, 6.2.4, 8, 9.2
	Subsoil and topsoil deficit for rehabilitation activities.	Strip all available soil / growth medium resources and either immediately place on shaped landform or stockpile in accordance with Rehabilitation Management Plan. *If required, suitable source of additional soil material to be identified, including the need for importation of growth medium or soil conditioners to increase volume of on-site growth medium.*	M(D3)	NA	
	Substrate inadequate to support revegetation or agricultural land capability (e.g. lack of organic matter, nutrient deficiency, lack of soil biota, adverse soil chemical properties, exposed hostile geochemical materials, and any other factors impeding the effective rooting depth).	Allowance for application of gypsum and fertiliser in rehabilitation cost estimate. *Testing of growth medium following spreading but prior to application of seed to confirm rates of gypsum, fertiliser and/or other soil ameliorants required.*	M(E3)	NA	
Ecosystem and Land Use Establishment Phase of Rehabilitation	Lack of availability and quality of target seed resources, including genetic integrity.	*Source and purchase of appropriate native seed mix for ground stabilisation and ecosystem establishment suitably in advance of planned rehabilitation activities.*	L (F3)	NA	6.2.5, 8
	Poor seed viability or seed dormancy.	*Source and purchase of appropriate native seed mix for ground stabilisation and ecosystem establishment suitably in advance of planned rehabilitation activities.*	L (F3)	NA	8
	Seed predation.	*Use of appropriate sowing and seeding techniques.* *Selection of seed mix appropriate to the season / current weather conditions so that germination occurs as soon as practicable following sowing.*	L (F3)	NA	8
	Damage to seed through revegetation process.	*Use of appropriate sowing and seeding techniques.*	L (F3)	NA	8, 9
	Poor quality tubestock.	*Purchase of suitable tube stock grown from locally collected seed and sourced from reputable supplier..*	L (G3)	NA	8, 9

Table 10 (Cont'd)
Rehabilitation Risk Assessment

Rehabilitation Phase	Risk	Risk Control	Final Land Use Domain / Risk Ranking		Where Addressed in RMP
			Domain A: Native Ecosystem	Domain G: Water Storage (Excluding final void)	
Ecosystem and Land Use Establishment Phase of Rehabilitation (Cont'd)	Weed infestation associated with both introduction and control (or lack thereof).	Implement weed inspection and control program. Implement equipment delivery protocol to ensure equipment does not import weeds.	L (F2)	NA	6.2.1.11, 6.2.5, 8
	Adopting inappropriate or inadequate rehabilitation techniques, including equipment fleet.	Extensive experience of management team. *Engagement of experienced contractors.* *Rehabilitation personnel induction and training.*	L (F3)	NA	9, 10
	Inappropriate revegetation species mix for targeted final land use.	*Consult with suitably experienced expert to confirm suitable seed mix that compliments the existing / retained native vegetation community.* *Source seed mix from reputable supplier.*	L (F3)	NA	6.2.5, 8, 9
	Adverse weather and climatic influences (e.g. drought; intense rainfall events; bushfire and climate change).	*Review long-term weather forecast prior to purchase of seed mix.* *Consult with suitably experienced expert to confirm suitability of seed mix for seasonal conditions.* *If required, utilisation of stored water for irrigation of revegetation areas to achieve effective root establishment.*	M (E3)	NA	6.2.5
	Lack of infrastructure to support intended final land use (e.g., bunding or fences).	No specific infrastructure required to support final land use.	NA	NA	-
Ecosystem and Land Use Development Phase of Rehabilitation	Hazards associated with retained infrastructure.	No infrastructure to be retained that represents a hazard.	NA	NA	-
	Adverse weather and climatic influences (e.g. drought; intense rainfall events; bushfire and climate change).	Review long-term weather forecast. *If existing seed mix is inappropriate for current weather conditions, consult with suitably experienced expert to confirm alternative species and/or cover crop or mulch for temporary stabilisation.*	L (F3)	NA	6.2.6
	Substrate inadequate to support revegetation or agricultural land capacity.	*If inadequate groundcover / projected foliage cover achieved, consult with suitably experienced expert to confirm appropriateness of species selection or need for additional soil amelioration requirements (gypsum, fertiliser, organic matter).*	L (F3)	NA	6.2.1.1, 6.2.1.11, 9.2
	Post-closure water quality and quantity issues.	*Ensure adequate projected foliage cover to limit erosion / silt entrainment.* *Ensure water management structures remain stable and functional.*	L (F3)	L (F3)	6.2.3.1, 6.2.6.2, 9.2
	Damage to rehabilitation (e.g. fauna, domestic stock, vandalism, vehicular interactions, bushfire).	Maintain existing property fencing. *Creation of barrier to vehicular entry to the rehabilitation areas.* *Rehabilitation monitoring program.*	L (F3)	NA	6.2.2.1, 6.2.5, 6.2.6.1, 9.2
	Re-disturbance of established rehabilitation areas.	*Appropriate rehabilitation planning / scheduling.* *Creation of barrier to vehicular entry to rehabilitation areas.*	L (F3)	L (F3)	8, 6.2.2.1
	Insufficient establishment of target species and limited species diversity.	*Rehabilitation monitoring program.* *Supplementary sowing of additional species seed mix (if required to maintain adequate projected foliage cover or species diversity).* *If required, suitably qualified ecologist or revegetation expert engaged to assess reasons for failure of appropriate species to emerge and recommend actions to ensure that the final vegetation community is suitably complimentary to the surrounding remnant vegetation community.*	L (F3)	NA	6.2.6, 8
	Erosion and failure of landform, drainage and water management/storage structures.	*Visual inspection program.* *If required, suitably qualified expert engaged to recommend erosion and sediment control measures.*	L (F3)	L (F3)	6.2.6
	Lack of infrastructure to support intended final land use (e.g. bunding, fences).	No specific infrastructure required to support final land use.	NA	NA	-
	Lack of resources for rehabilitation maintenance.	Rehabilitation cost estimate and maintenance of security bond. Rehabilitation planning / scheduling.	L(G3)	L(G3)	6.2.6, 10
Other Risks (Non-Phase Specific)	Redirection of creek and river flows.	No watercourses present in extraction areas.	NA	NA	-
	Subsidence cracking.	No underground mining undertaken.	NA	NA	-
	Interconnective cracking with underground workings	No underground mining undertaken / no historic underground workings present.	NA	NA	-

4. REHABILITATION OBJECTIVES AND REHABILITATION COMPLETION CRITERIA

4.1 REHABILITATION OBJECTIVES AND REHABILITATION COMPLETION CRITERIA

Table 11 presents the objectives and rehabilitation completion criteria and the methods used to validate the criteria for the Quarry Site.

Table 11
Proposed Rehabilitation Objectives and Rehabilitation Completion Criteria – Marulan Quarry

Final Land Use Domain	Mining Domain	Spatial Reference	Rehabilitation Objective	Indicator	Rehabilitation Completion Criteria	Validation Method
Native Ecosystem	Infrastructure Area, Active Mining Area (Open Cut Void), Other-Rehabilitation Area	A1, A5, A8a	***Decommissioning Phase***			
			All infrastructure not suitable for a lawful final land use will be removed.	All infrastructure not suitable for lawful final land use will be removed.	Infrastructure not required for final land use removed.	Single occurrence relinquishment inspection and report, including photographs, following decommissioning.
				Removal of the mobile plant.	Mobile plant is removed from site.	
			Domains safe and free from contaminated and hazardous materials.	Contaminated land identified and remediated.	Contaminated land assessment indicates contamination acceptable for final land use.	Single occurrence visual contamination assessment and report prepared by a suitably qualified person.
			Landform Establishment Phase			
			Safe, free-draining, stable and non-polluting landform established.	Landform slopes consistent with final landform plan.	Maximum slopes of 1:3 (V:H)	Final survey plans. Relinquishment inspection and report, including photographs.
				Free draining landform.	Mapping confirms that the final landform is free draining / drains to retained water storage structures. No visible pooling water.	
				Presence of erosion / sedimentation controls.	No visible evidence of mass movement or active erosion.	
				Landform is non-polluting.	All runoff reports to retained water storage dam (Domain G3).	
			Growth Medium Development Phase			
			Establish soil / growth medium suitable for establishment of proposed vegetation communities.	Appropriate depth of growth medium.	Minimum soil depth of 100mm over all areas stripped of soil. OR Soil conditioner and mulch (particles <16mm and thickness 20mm to max 40mm / 200m^3 per ha).	Single occurrence testing using small ‘test pits’ (5 per ha) and report, including photographs, following final placement/shaping of growth medium.
				Presence of surface compaction	Compacted areas are deep ripped cross slope.	Single occurrence inspection and photographs of ripped areas following completion of ripping.

Table 11 (Cont'd)
Proposed Rehabilitation Objectives and Rehabilitation Completion Criteria – Marulan Quarry

Final Land Use Domain	Mining Domain	Spatial Reference	Rehabilitation Objective	Indicator	Rehabilitation Completion Criteria	Validation Method
Native Ecosystem (Cont'd)	Infrastructure Area, Active Mining Area (Open Cut Void), Other-Rehabilitation Area (Cont'd)	A1, A5, A8a (Cont'd)	***Ecosystem Establishment Phase***			
			Establishment of vegetation communities with a similar species composition to the surrounding native woodland.	The rehabilitated area does not constitute and erosion hazard.	Total projected foliage cover is greater than 70% cover OR equivalent to analogue sites not disturbed by Quarry activities.	Establish a minimum of one monitoring point per 5ha of rehabilitation and two analogue sites. Monitoring to be completed by suitably trained / qualified person and a report prepared summarising performance of the rehabilitation against the completion criteria / analogue monitoring point annually for a minimum of 5 years.
				Weeds are not competing or impacting on rehabilitated area.	Revegetation monitoring confirms that, after 2 years from planting, the non-native / non-target species (weeds) represent less than 20% of projected foliage cover OR equivalent to surrounding vegetation not disturbed by Quarry activities.	
				Grazing not adversely impacting on ecosystem development.	Domestic grazing animals are excluded from the rehabilitation area. Feral animal control programs implemented if required.	
			Ecosystem Development Phase			
			Self-sustaining vegetation communities with a similar species composition to the surrounding native woodland.	Vegetation is self-sustaining.	Monitoring confirms: - evidence of new growth of target species; - evidence of successive generations of target species; and - no further active weed control required (beyond that considered necessary at analogue sites).	Establish a minimum of one monitoring point per 5ha of rehabilitation and two analogue sites. Monitoring to be completed by suitably trained / qualified person and a report prepared summarising performance of the rehabilitation against the completion criteria / analogue monitoring points.
			Rehabilitation Completion / Relinquishment Phase			
			Relinquish lease and return of the security lodged.	Demonstrated compliance with all performance indicators.	Demonstrated compliance with all completion criteria.	Single occurrence relinquishment report prepared by a suitably qualified or experienced person(s) prior to relinquishment.

Table 11 (Cont'd)
Proposed Rehabilitation Objectives and Rehabilitation Completion Criteria – Marulan Quarry

Final Land Use Domain	Mining Domain	Spatial Reference	Rehabilitation Objective	Indicator	Rehabilitation Completion Criteria	Validation Method
Water Storage	Water Management Area	G3	***Decommissioning Phase***			
			All infrastructure not suitable for a lawful final land use will be removed.	All infrastructure not suitable for lawful final land use will be removed.	Infrastructure not required for final land use removed.	Single occurrence relinquishment inspection and report, including photographs, following decommissioning.
			Domains safe and free from contaminated and hazardous materials.	Contaminated land identified and remediated.	Contaminated land assessment indicates contamination acceptable for final land use.	Single occurrence visual contamination assessment and report prepared by a suitably qualified person.
			Landform Establishment, Growth Medium Development, Ecosystem Establishment and Development Phase			
			Structures suitable for providing long-term clean water storage.	Dam structures are stable and contain a suitably stable spill way for overflow of water to surrounding drainage lines.	Dam wall and spillway do not show signs of active erosion and are assessed to be stable.	Relinquishment inspection and report, including photographs.
			Domain is non-polluting.	Water quality monitoring results show the domain is non-polluting.	Water quality of discharges meets EPL criteria or the objective of Section 120 of the *Protection of the Environment Operations Act 1997*.	Water quality testing undertaken until water quality monitoring demonstrates compliance.
			Rehabilitation Completion / Relinquishment Phase			
			Relinquish lease and return of the security lodged.	Demonstrated compliance with all performance indicators.	Demonstrated compliance with all completion criteria.	Single occurrence relinquishment report prepared by a suitably qualified or experienced person(s) prior to relinquishment.

4.2 REHABILITATION Objectives and Rehabilitation Completion Criteria – Stakeholder Consultation

Table 12 presents a summary of consultation undertaken with relevant stakeholders with regards to the rehabilitation objectives, rehabilitation completion criteria, final land uses and landforms presented in this Plan. This table will be updated with each revision to this Plan to include details of further consultation with relevant and interested stakeholders.

Table 12
Consultation Undertaken

Stakeholder	Consultation Activities
Pejar Local Aboriginal Land Council (LALC)	• Form of Consultation: Letter (email transmission). • Date: 11 July 2022. • Matters Subject to Consultation: Rehabilitation Objectives and Rehabilitation Completion Criteria, and Final Land Use Domain Plans. • Outcomes: – Pejar LALC responded on 11 July 2022. – Response: Pejar LALC requested clarifications regarding any proposed increases to areas of disturbance within the Quarry Site. RWC replied the same day, confirming that no additional disturbance was proposed. No further communications were received.
Goulburn Mulwaree Council	• Form of Consultation: Letter (email transmission). • Date: 11 July 2022. • Matters Subject to Consultation: Rehabilitation Objectives and Rehabilitation Completion Criteria, and Final Land Use Domain Plans. • Outcomes: – Council responded on 11 July 2022. – Response: Acknowledgement of receipt only.
Mining, Exploration and Geoscience (MEG)	• Form of Consultation: Letter (email transmission). • Date: 11 July 2022. • Matters Subject to Consultation: Rehabilitation Objectives and Rehabilitation Completion Criteria, and Final Land Use Domain Plans. • Outcomes: No response received by 3 August 2022.
Environmental Protection Authority (EPA)	• Form of Consultation: Letter (email transmission). • Date: 11 July 2022. • Matters Subject to Consultation: Rehabilitation Objectives and Rehabilitation Completion Criteria, and Final Land Use Domain Plans. • Outcomes: – The EPA responded on 26 May 2022 – Response: The EPA has reviewed the documents and have no specific comments to make.
Resources Regulator	• Form of Consultation: Letter (email transmission). • Date: 11 July 2022. • Matters Subject to Consultation: Rehabilitation Objectives and Rehabilitation Completion Criteria, and Final Land Use Domain Plans. • Outcomes: – The Resources Regulator responded on 3 August 2022. – Response: The Resources Regulator will review, assess and determine the rehabilitation objectives statement and rehabilitation completion criteria once submitted for approval.
Landholders: Gary Breeze	• Form of Consultation: Letter (email transmission). • Date: 11 July 2022. • Matters Subject to Consultation: Rehabilitation Objectives and Rehabilitation Completion Criteria, and Final Land Use Domain Plans. • Outcomes: No response received by 3 August 2022.

5. FINAL LANDFORM AND REHABILITATION PLAN

5.1 FINAL LANDFORM AND REHABILITATION PLAN – ELECTRONIC COPY

Plan 1 presents the final landform features for the Quarry and **Plan 2** presents the final landform contours for the Quarry.

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TN
MN

Hume Highway

767 000mE
767 250mE
767 500mE

6 151 500mN
6 151 250mN
6 151 000mN
6 150 750mN

Western Extraction Area
Sedimentation Basin
Eastern Extraction Area
Southern Extraction Area
Property Access Road
See Detail

A8a
A1
G3
A5
PLL1293
ML786
ML866

REFERENCE
Mining Lease Boundary
Project Approval Boundary (Offset for Clarity)
Final Land Use Domain
A - Native Ecosystem
G - Water Storage

Final Land Use Domain	Mine Domain	Ref	Area (ha)
Native Ecosystem	Infrastructure Area	A1	0.1
Native Ecosystem	Active Mining Area (Open Cut Void)	A5	4.3
Native Ecosystem	Other (Rehabilitation Area)	A8a	0.7
Water Storage		G3	0.07

0 50m

SCALE 1:4 000 (A3)

50 0 50 100 150 200 m

Base Photo Source: Nearmap - 13 April 2021

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 1 Final Landform Features
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	4 August 2022
Data Theme Submission ID Numbers	3112,3113,3114,3115,3116,3117 3118,3119

Plan 1
FINAL LANDFORM FEATURES

RWCorkery&co

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TN
MN

Hume Highway

Western Extraction Area

See Detail

Dam

Property Access Road

Eastern Extraction Area

PLL1293

ML786

ML786

Southern Extraction Area

ML866

767 000mE
767 250mE
767 500mE
6 151 500mN
6 151 250mN
6 151 000mN
6 150 750mN

SCALE 1:4 000 (A3)

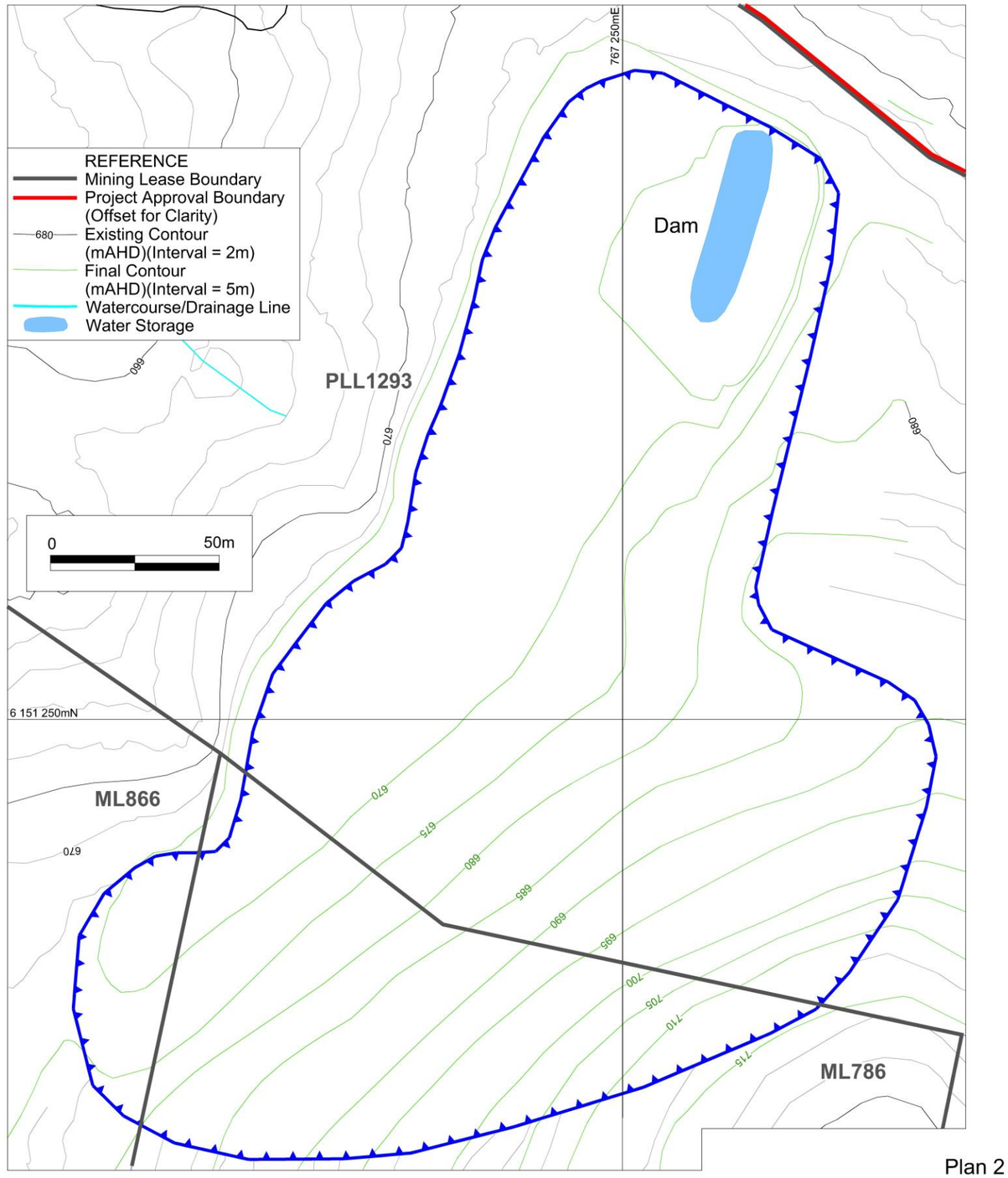
50 0 50 100 150 200 m

Base Contour Source: DFSI - December 2013

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 2 Final Landform Contours
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	4 August 2022
Data Theme Submission ID Numbers	3112,3113,3114,3115,3116,3117 3118,3119

REFERENCE
Mining Lease Boundary
Project Approval Boundary (Offset for Clarity)
680 Existing Contour (mAHD)(Interval = 2m)
Final Contour (mAHD)(Interval = 5m)
Watercourse/Drainage Line
Water Storage

0 50m



Plan 2
FINAL LANDFORM CONTOURS

6. REHABILITATION IMPLEMENTATION

6.1 LIFE OF MINE REHABILITATION SCHEDULE

Based on the limited scale of extraction operations at the Quarry Site it is unknown when extraction operations are anticipated to be completed.

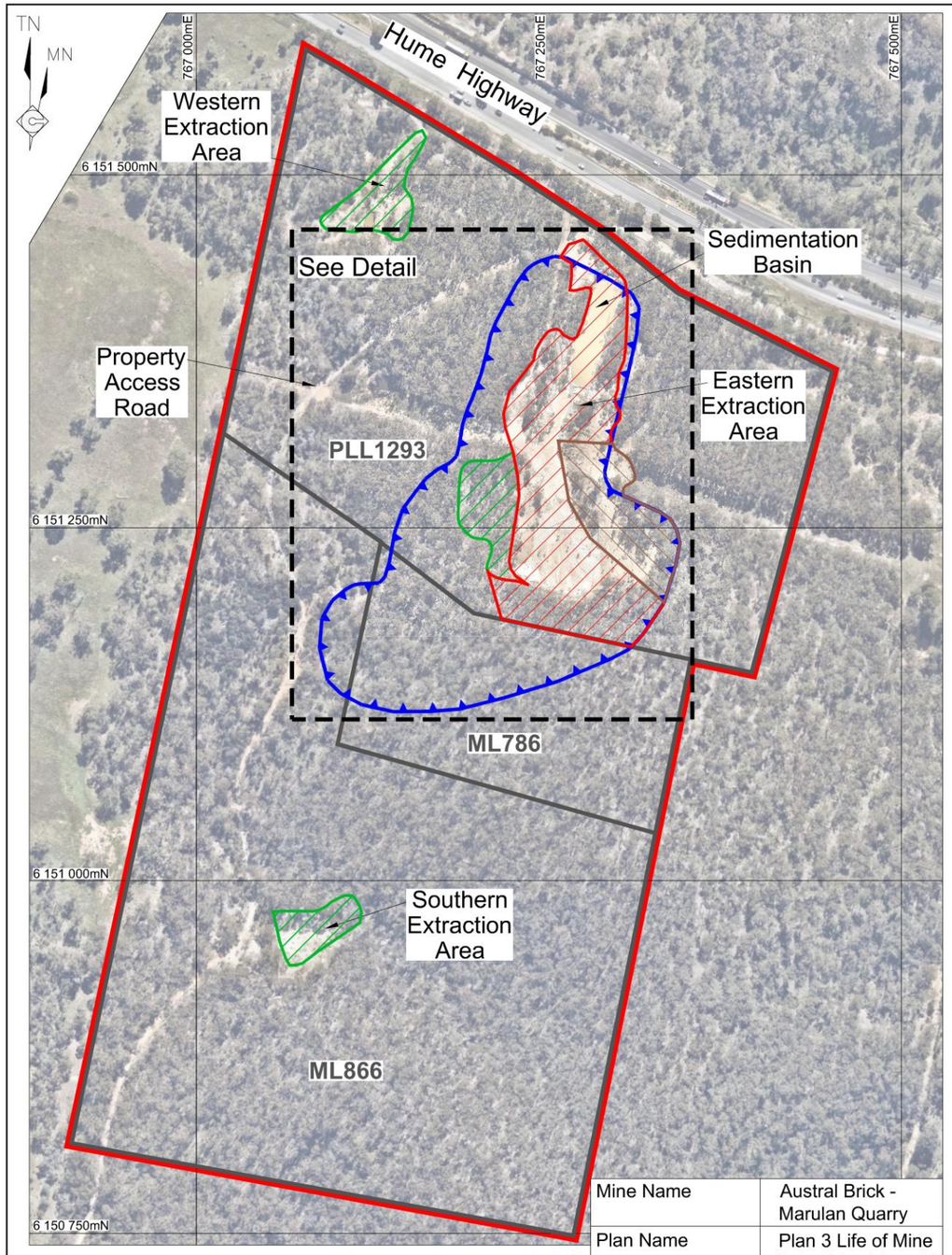
Prior to cessation of extraction operations, rehabilitation will only be undertaken in areas which are no longer required for operational purposes. As the extent of disturbance at the Quarry is largely confined to operational areas required to support ongoing extraction activities as well as storage areas for rehabilitation materials (i.e. topsoil stockpiles), opportunities for progressive rehabilitation prior to the completion of extraction operations are limited.

Figure 9 depicts the current extent of disturbance at the Quarry (i.e. the Mining Domains). **Plans 3** to **8** present the indicative rehabilitation schedule for the Quarry by depicting those areas which would be rehabilitated during each 5-yearly increment between the commencement of this plan and Quarry closure. Based on current production rates at the Quarry and the known extent of shale resources, extraction operations at the Quarry are not anticipated to be completed for >100 years. However, for the purposes of rehabilitation planning, a nominal completion date of 2057 has been specified.

It is noted that this schedule is applicable only until the completion of the Ecosystem and Land Use Establishment phase of rehabilitation operations within all Mining Domains (see Section 6.2). Approximate timings for the Ecosystem and Land Use Development phase of rehabilitation have not yet been defined as this phase will principally involve the monitoring and maintenance of completed rehabilitation works until completion criteria identified in Section 4.1 have been achieved.

In addition, due to the significant volumes of remaining resource (i.e. >100 years), and the infrequent undertaking of extraction campaigns, the stages of Quarry Site development and rehabilitation shown on **Plans 3** to **9** are highly indicative, and show a general staging of operations that may occur over a significantly greater period of time.

Notwithstanding the above and in summary, as extraction progresses towards the south and southwest, completed extraction areas that are no longer required for stockpiling or operations will be progressively rehabilitated as required. Following the cessation of extraction operations, all other Mining Domains would be subject to the decommissioning, landform establishment, growth medium development and ecosystem and land use establishment rehabilitation phases as outlined in Section 6.2. It is unknown when it is anticipated that the rehabilitation of all Mining Domains and the successful establishment of all Final Land Use Domains (up to the Ecosystem and Land Use Establishment phase, as a minimum) will be completed.



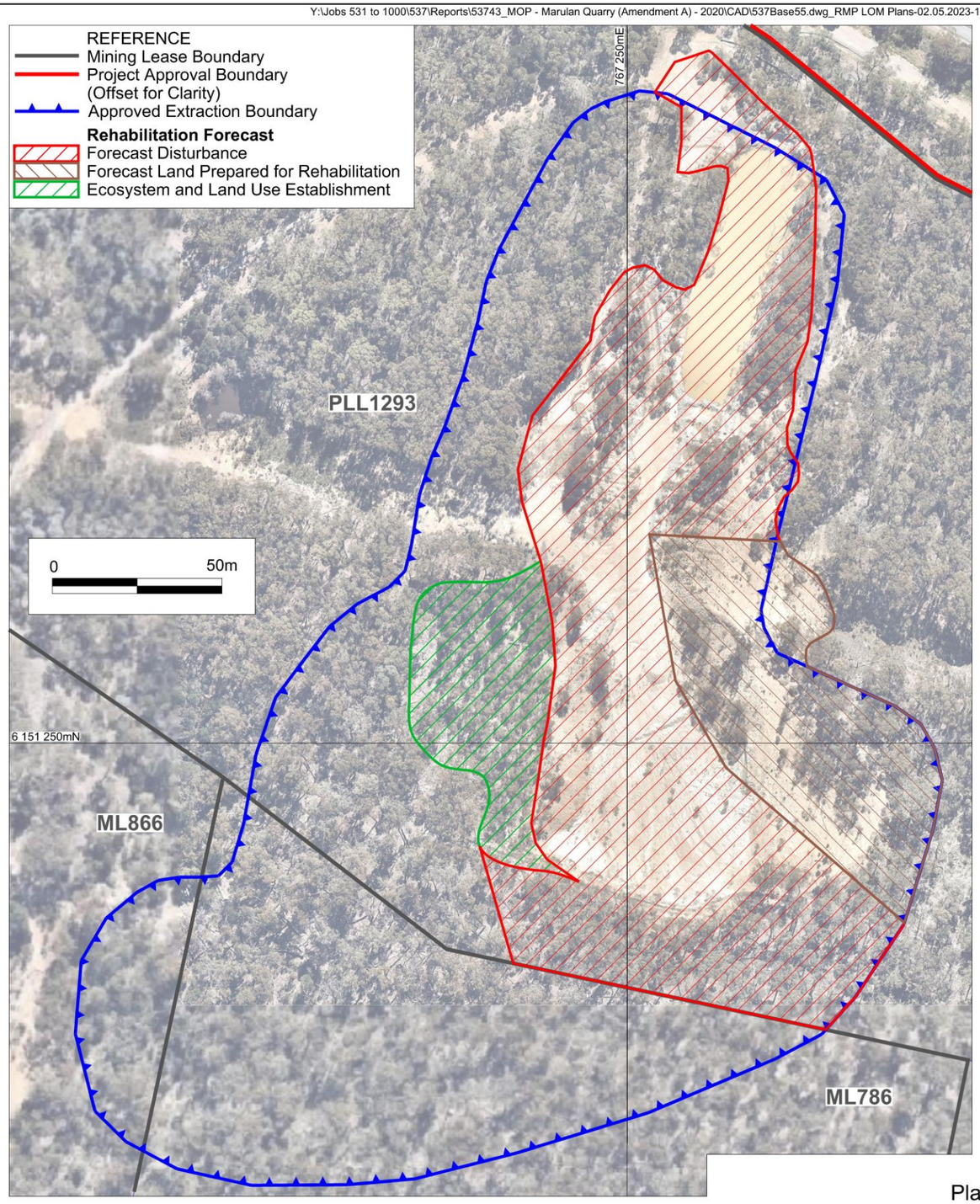
SCALE 1:4 000 (A3)

50 0 50 100 150 200 m

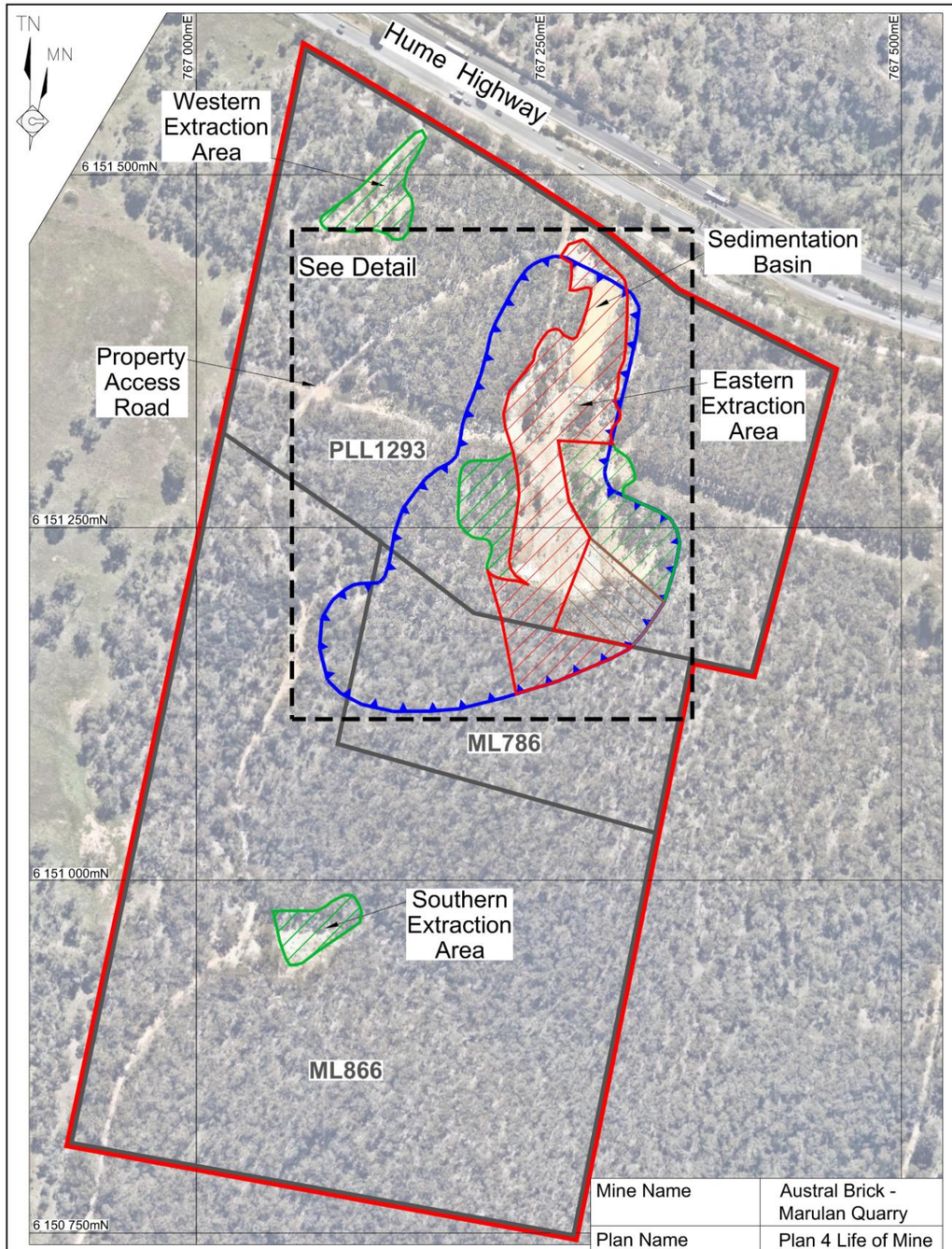
Base Photo Source: Nearmap - 13 April 2021

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 3 Life of Mine Schedule - Year 10
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	25 July 2022

Y:\Jobs 531 to 1000\537\Reports\53743_MOP - Marulan Quarry (Amendment A) - 2020\CAD\537Base55.dwg_RMP LOM Plans-02.05.2023-1:55 PM



Plan 3
LIFE OF MINE SCHEDULE - YEAR 10



SCALE 1:4 000 (A3)

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Base Photo Source: Nearmap - 13 April 2021

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 4 Life of Mine Schedule - Year 15
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	25 July 2022

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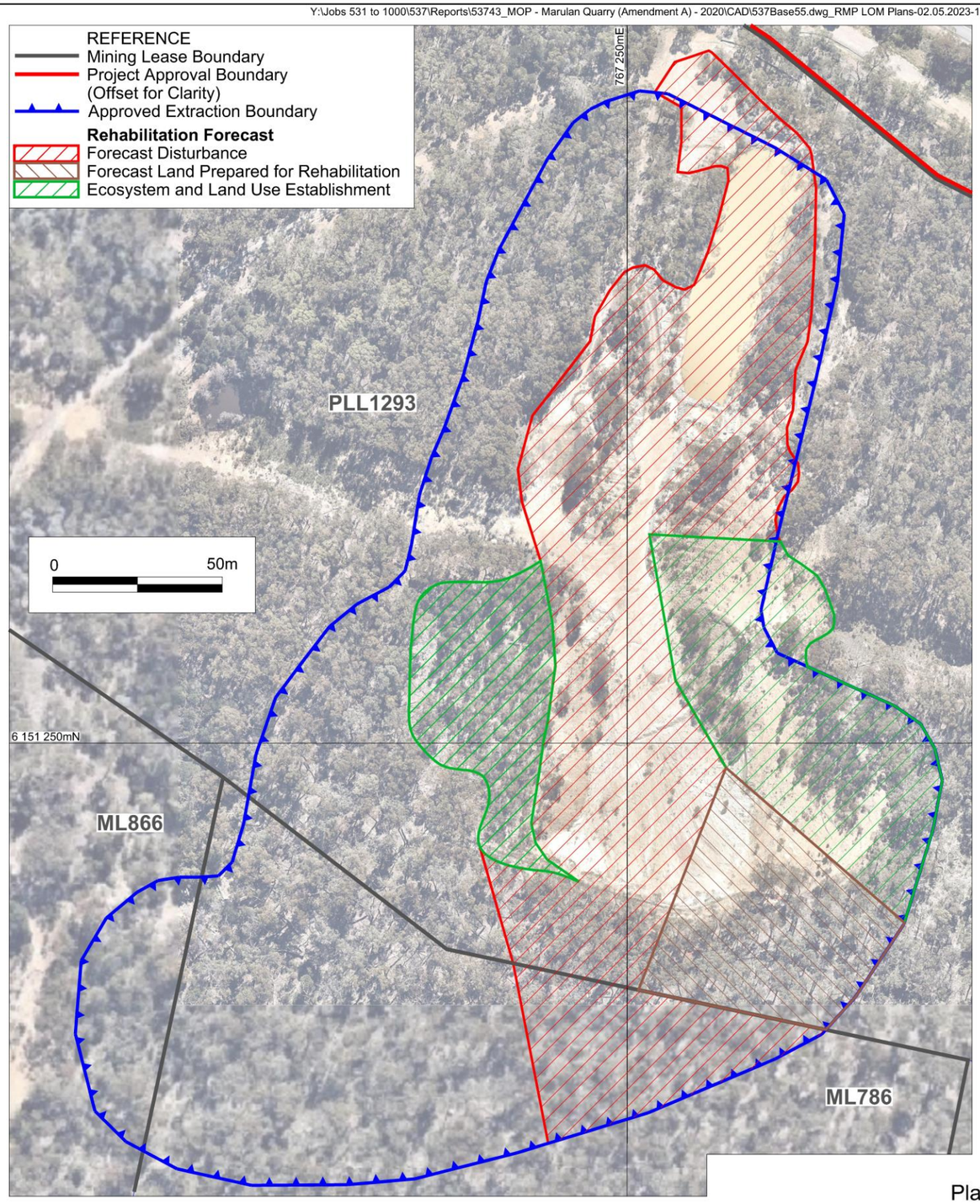
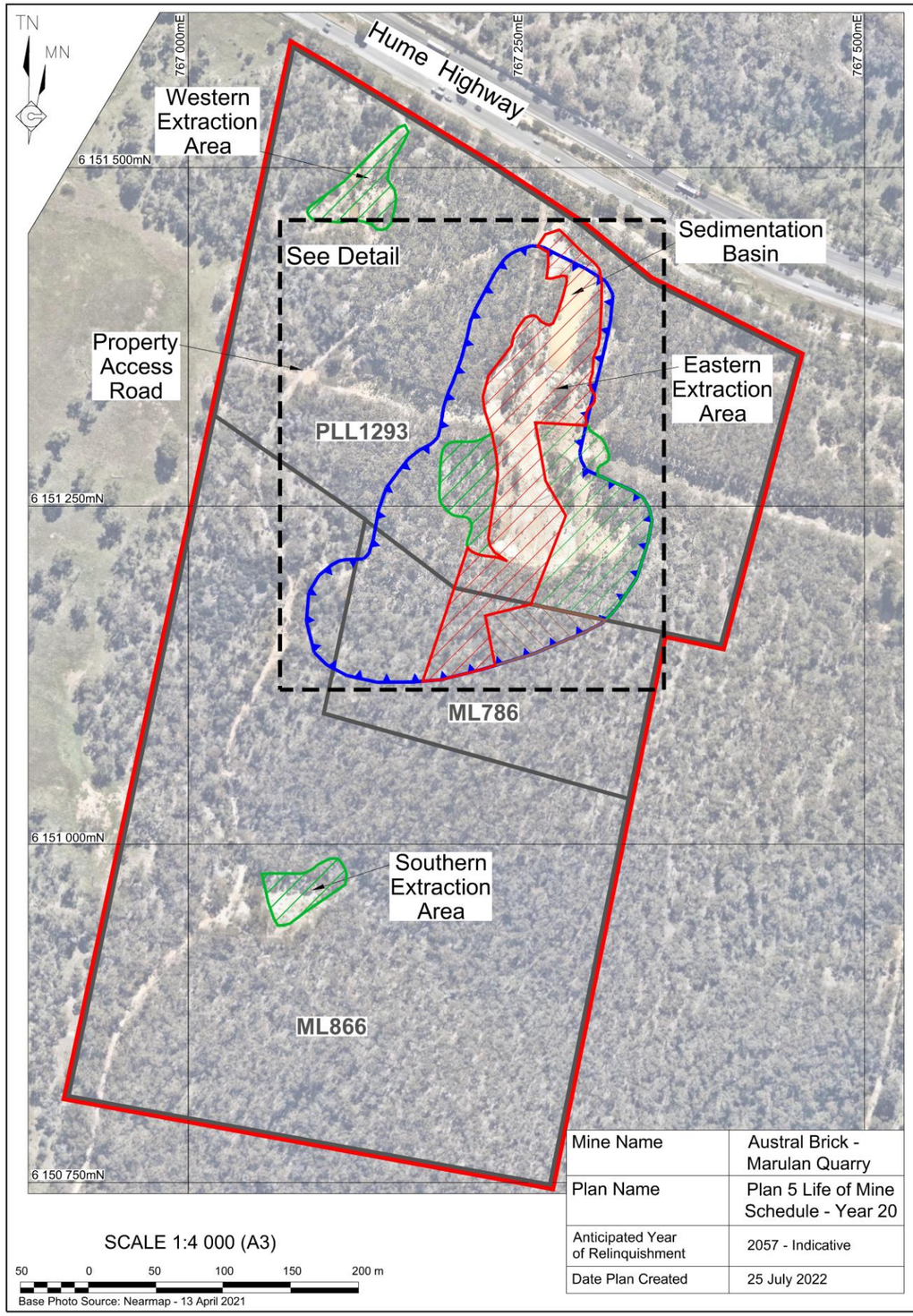


Plan 4
LIFE OF MINE SCHEDULE - YEAR 15



SCALE 1:4 000 (A3)

50 0 50 100 150 200 m

Base Photo Source: Nearmap - 13 April 2021

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 5 Life of Mine Schedule - Year 20
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	25 July 2022

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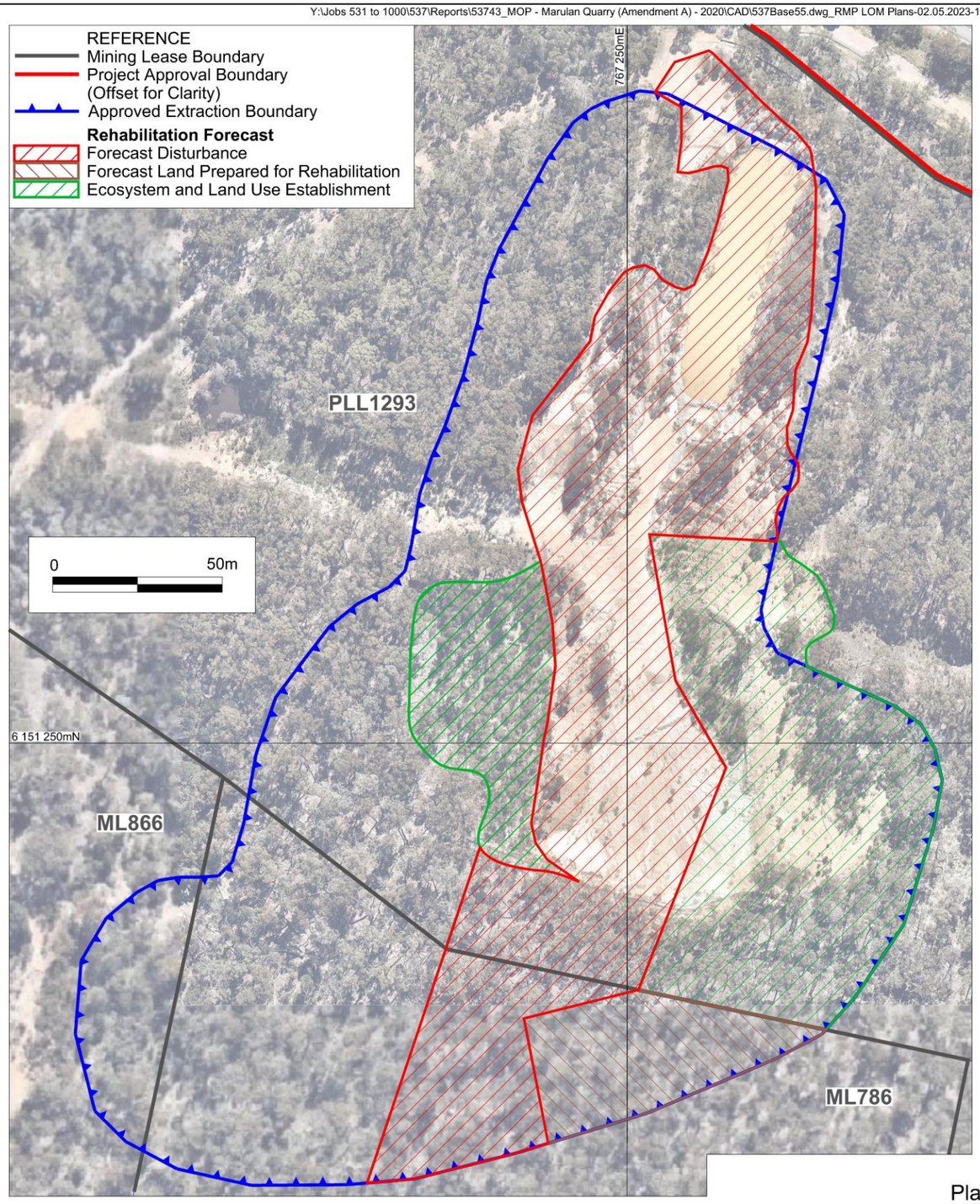
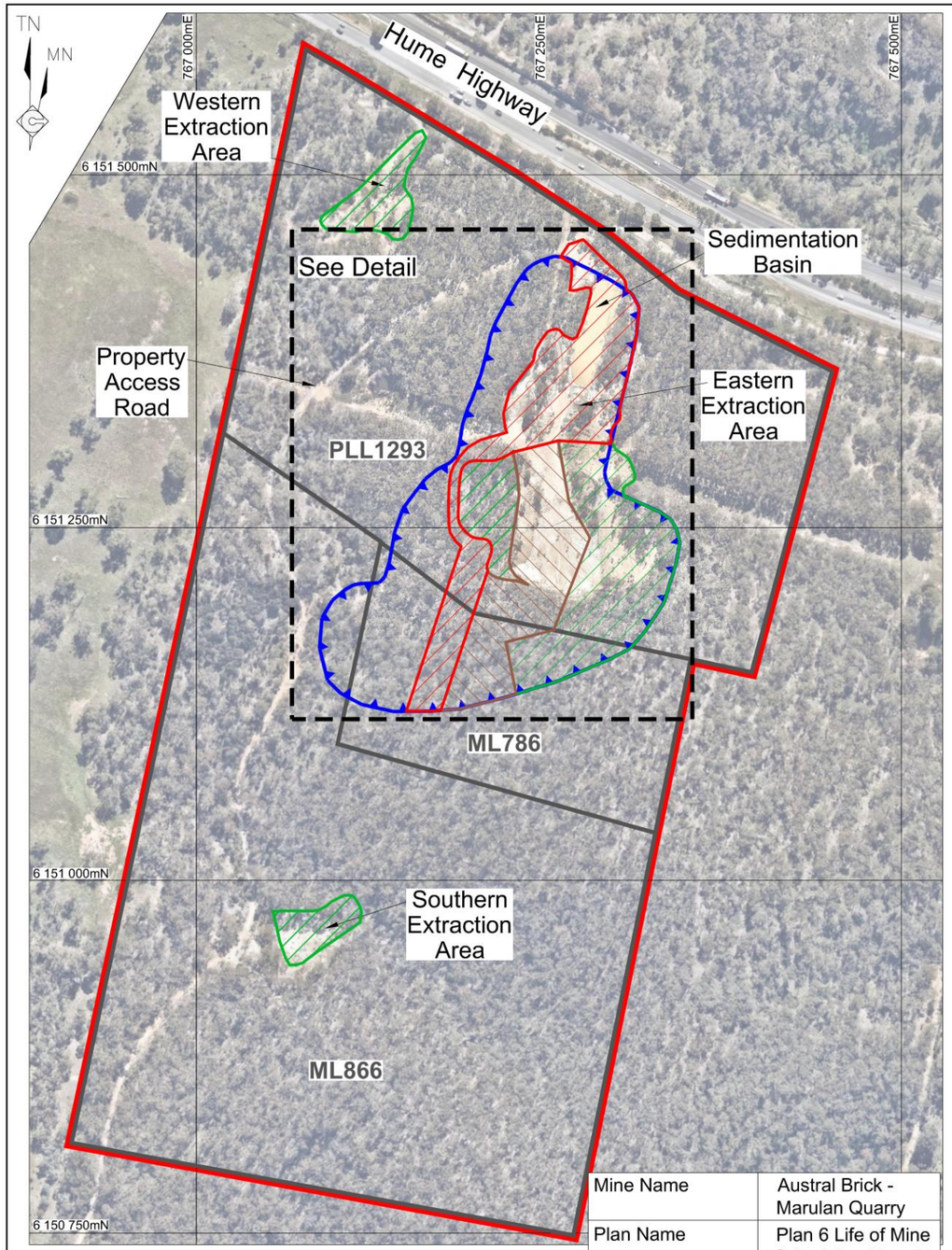


Plan 5
LIFE OF MINE SCHEDULE - YEAR 20



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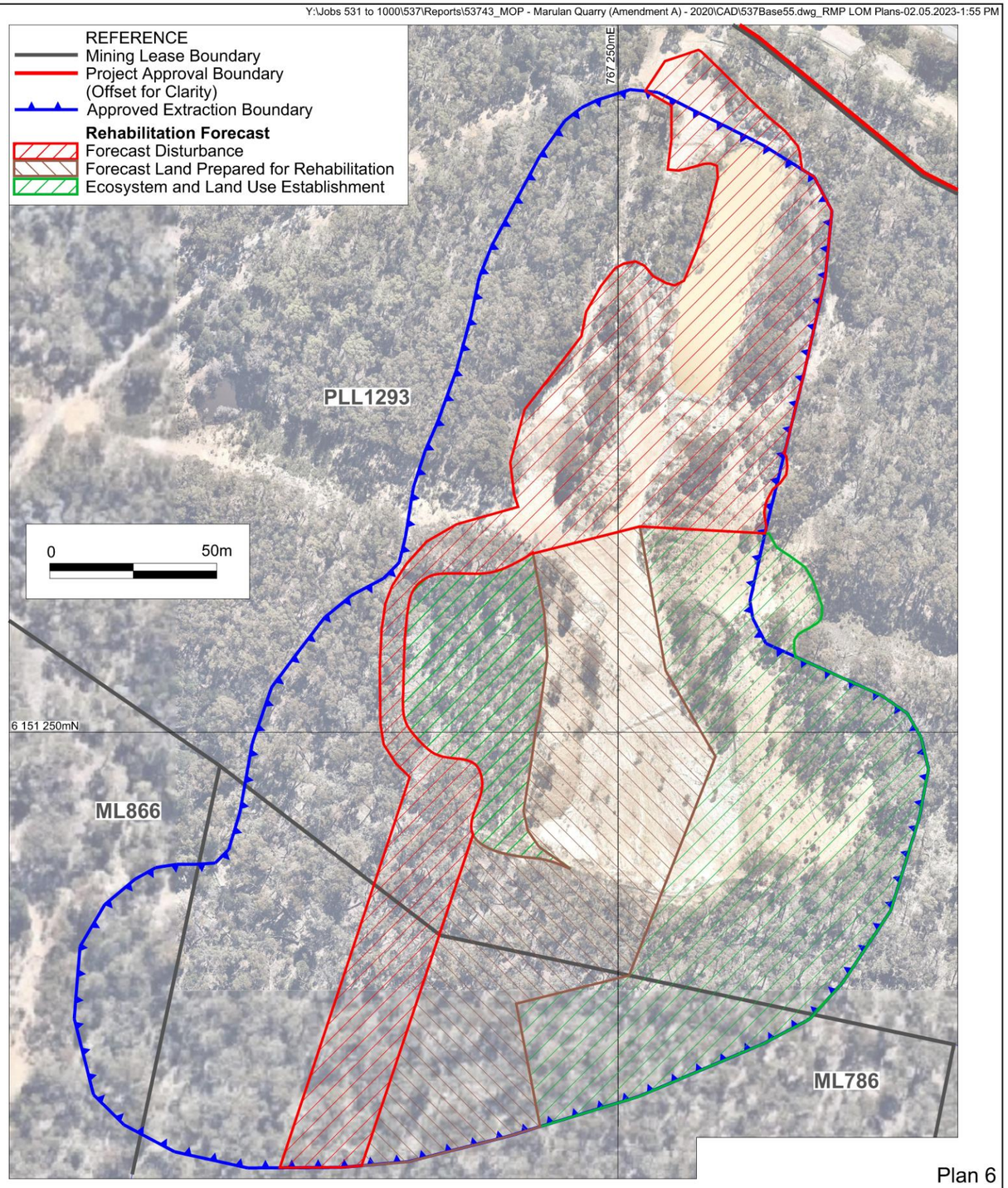
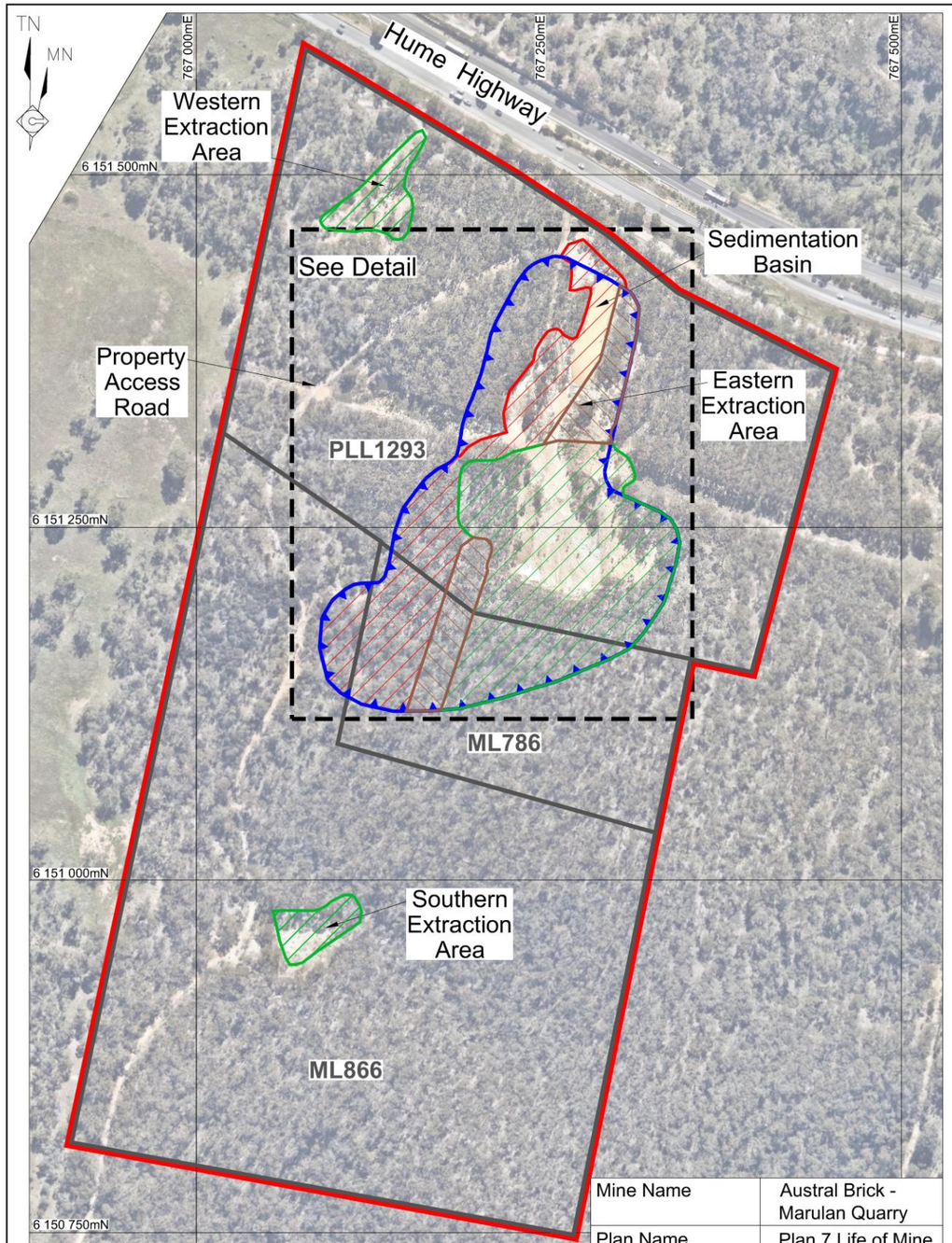
Base Photo Source: Nearmap - 13 April 2021

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 6 Life of Mine Schedule - Year 25
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	25 July 2022



Plan 6
LIFE OF MINE SCHEDULE - YEAR 25



SCALE 1:4 000 (A3)

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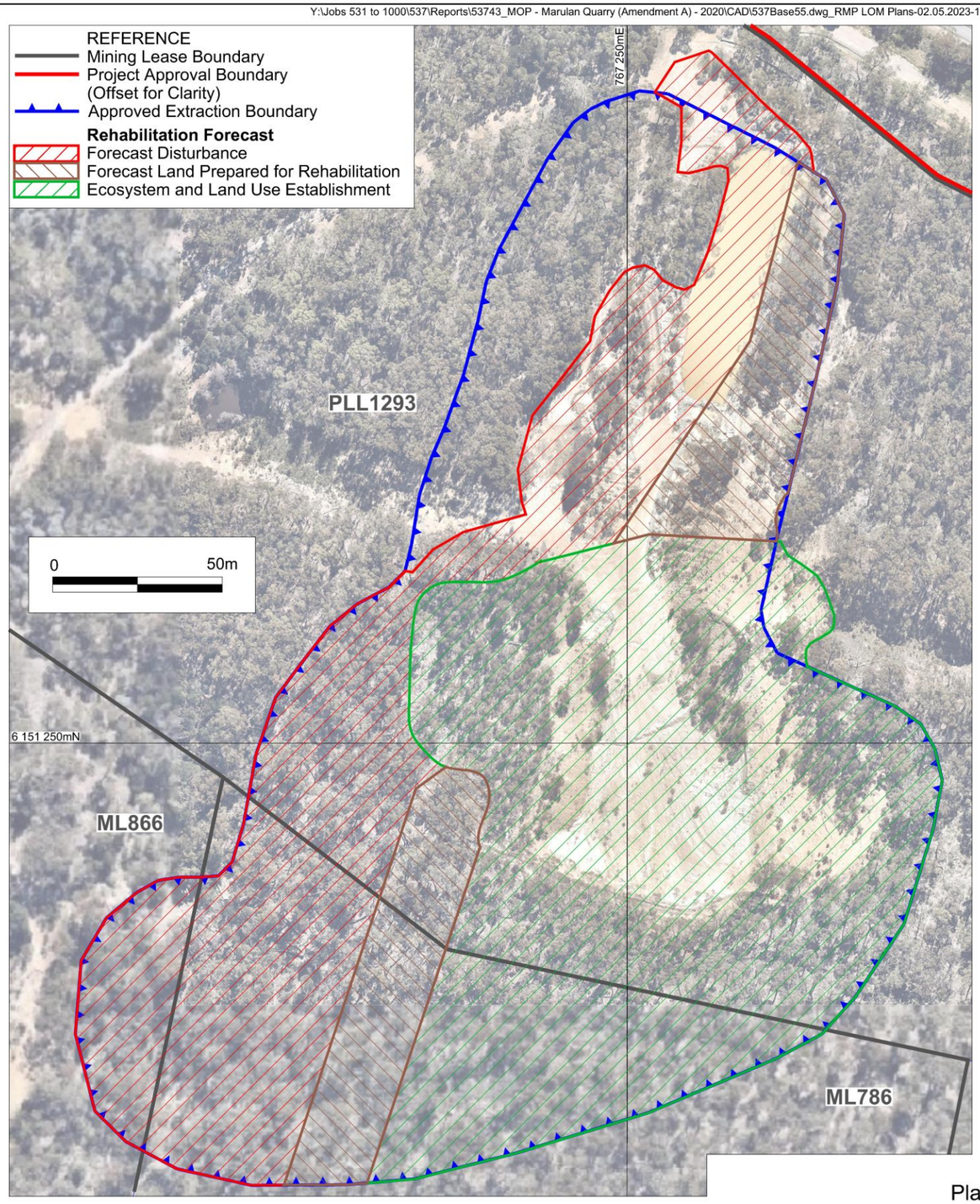
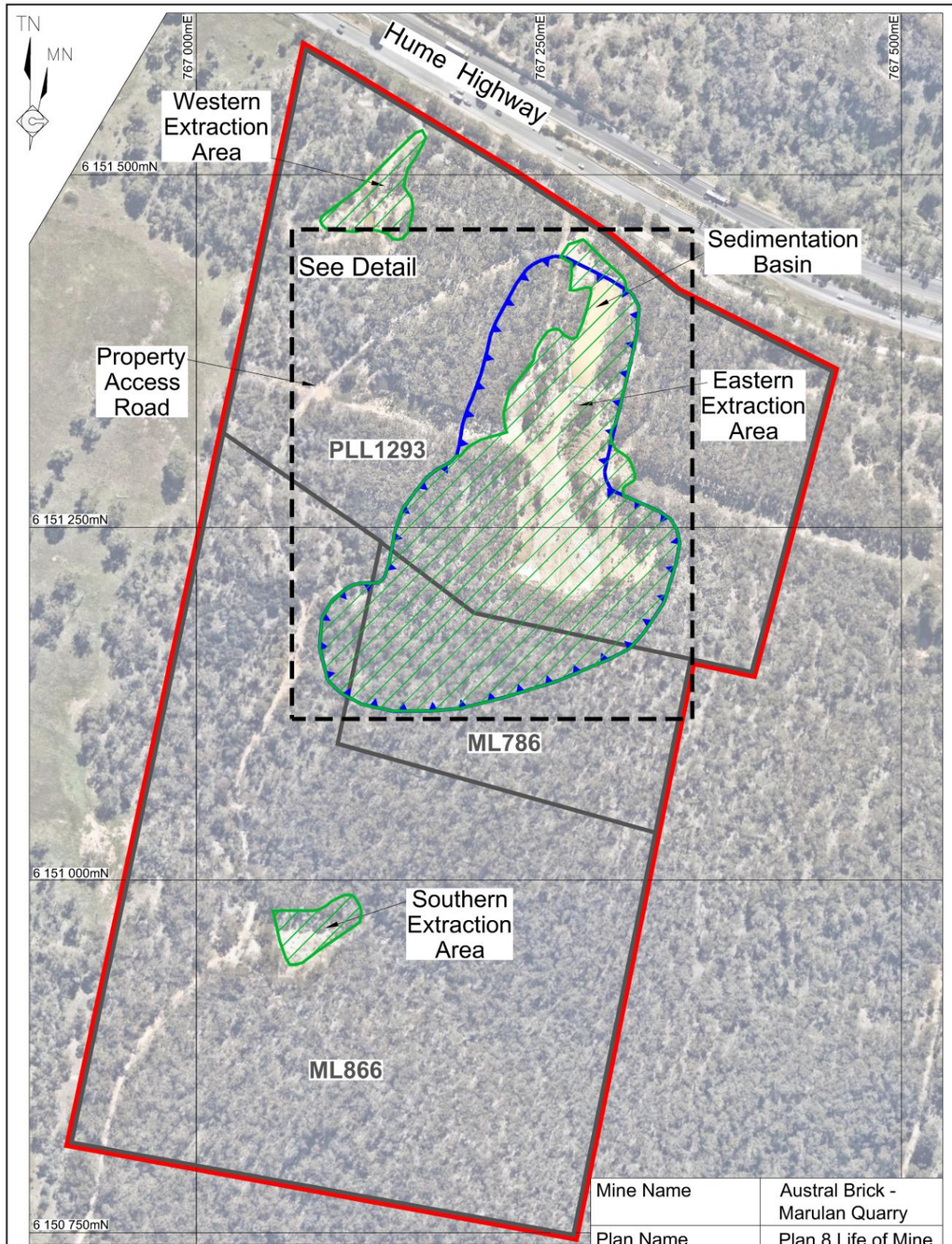
Base Photo Source: Nearmap - 13 April 2021

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 7 Life of Mine Schedule - Year 30
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	25 July 2022



Plan 7
LIFE OF MINE SCHEDULE - YEAR 30

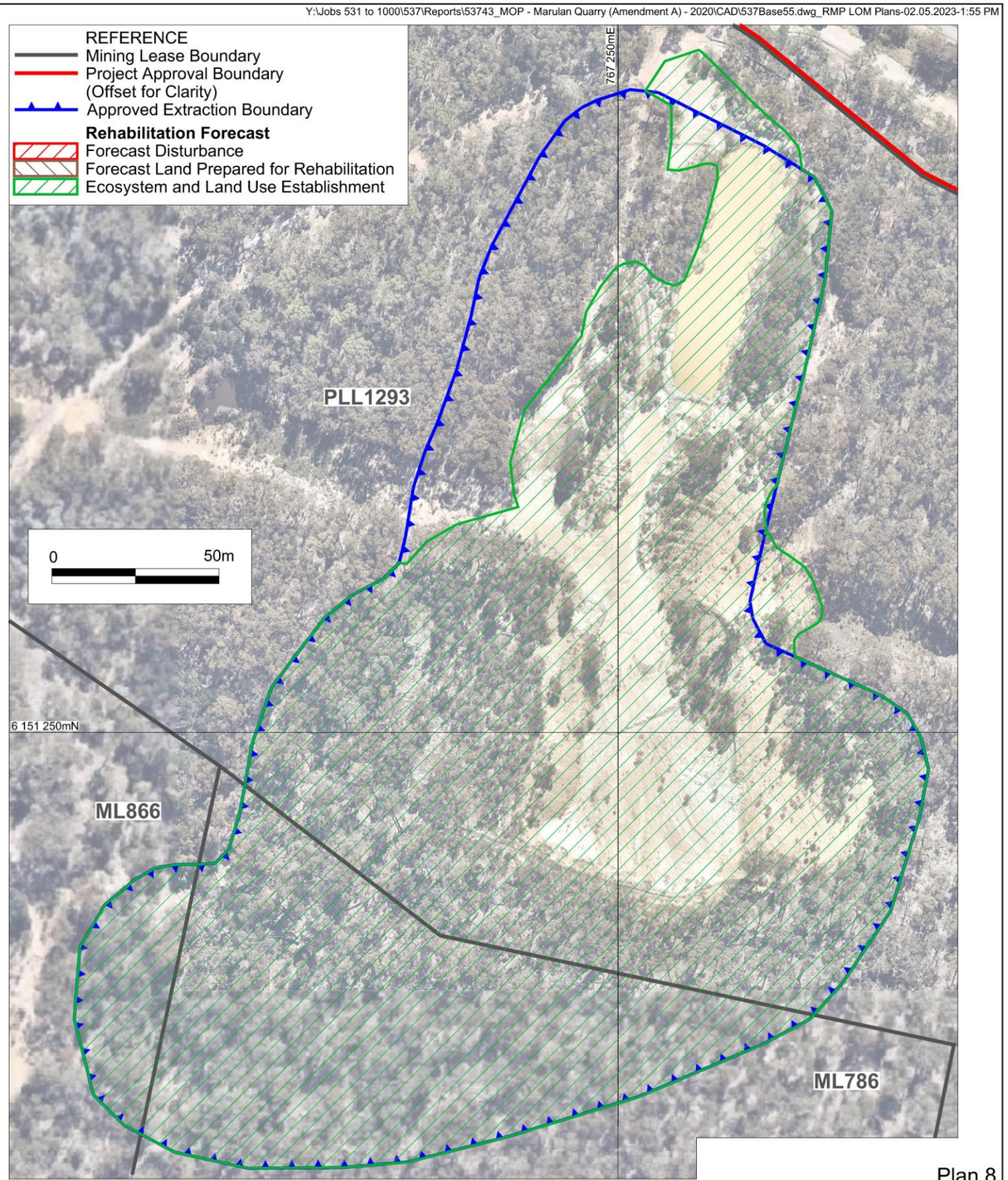


SCALE 1:4 000 (A3)

50 0 50 100 150 200 m

Base Photo Source: Nearmap - 13 April 2021

Mine Name	Austral Brick - Marulan Quarry
Plan Name	Plan 8 Life of Mine Schedule - Year 35
Anticipated Year of Relinquishment	2057 - Indicative
Date Plan Created	25 July 2022



Plan 8
LIFE OF MINE SCHEDULE - YEAR 35

6.2 PHASES OF REHABILITATION AND GENERAL METHODOLOGIES

6.2.1 Active Mining Phase

6.2.1.1 Soils and Materials

Existing Environment

An assessment of the in-situ soils of the Quarry Site, including commentary on their suitability for rehabilitation, was prepared by Morse McVey & Associates in 1995. The following presents a summary of the findings and recommendations of *Environmental Study for Lot 2, PM 1 (D.P. 253743) Hume Highway, Marulan*, hereafter referred to as McVey (1995a).

The Quarry Site was identified by McVey (1995a) as being located on the Lickinghole Soil Landscape[2]. Three distinct soil units were identified as occurring within the Quarry Site, as follows.

- Fine sandy loam – located within the top 25cm to 40cm of topsoil with a grey to greyish-brown, stony texture
- Greyish-brown to red clay loam – 20cm to 40cm of subsoil
- Reddish-brown clay loam – over 20cm of subsoil

Soils within these layers were found to have a moderate erodibility reading with K-factors ranging from 0.024 to 0.040. **Table 13** presents a summary of the results of McVey (1995a).

Table 13
Soil Assessment Results

Factor[1]	**Summary of Results**
pH	Very strongly to moderately acid soils (4.9 to 5.7).
Electrical Conductivity	Very low, unlikely to affect ground cover (0.02 to 0.08 decisiemens per metre).
Cation Exchange Capacity	Very low (4.5 for topsoils) to moderate (21.6 for lower slope subsoil), indicating nutrient deficiencies within the sandy topsoil, and reduced leaching in the higher clay content subsoils.
Particle Size Analysis	Moderate erodibility.
Organic Carbon	Extremely low to low (0.08% to 1.04%).
Dispersion Percentage	8% for lower slope subsoil and 42% for stockpiled overburden.
Emerson Aggregate Test	Class 3(1) for in situ soils, Class 2(1) for stockpiled overburden and Class 5 for lower slope subsoils (indicative of aggregated materials)
Unified Soil Classification System	Class CL for in situ material, and CL-CII for lower slope
Note 1: More information on the methodology and application of the factors assessed is provided in Sections 5 and 6 of McVey (1995a) Source: McVey (1995a) after Section 6	

[2] The Soil Landscapes of the Goulburn 1:250,000 Sheet maps the Quarry Site as being primarily located on the Blakney Creek Soil Landscape, with the Lickinghole Soil Landscape mapped to the south-eastern area of the Quarry Site.

Controls

An assessment of the potential implications of the results of the soil assessment for rehabilitation was presented in:

- *Environmental Study for Lot 2, PM 1 (D.P. 253743) Hume Highway, Marulan* (McVey, 1995a); and
- *Commentary for a Rehabilitation Plan for Lot 2, PM 1 (D.P. 253743) Hume Highway, Marulan* (McVey, 1995b).

The following presents a summary of the general recommendations of McVey (1995b).

- Topsoils should be stripped, stockpiled and stabilised.
- Stabilisation of remaining stockpiled soils following the completion of an extraction campaign should occur no later than 30 days post extraction.
- Ecosystem and land use establishment should occur as soon as possible following landform establishment and growth medium development.
- Restrict access to rehabilitated areas as far as practicable.
- Permanent rehabilitation species selection should be undertaken using locally native species.
- As soil pH is commensurate with surrounding soils, the application of lime is not recommended.
- Fertiliser application will be required.

In accordance with the above recommendations, topsoil is salvaged and stockpiled for use in rehabilitation. Where available, stripped topsoils are placed within areas to be rehabilitated either immediately, or as soon as practicable, to minimise stockpiling times. It should be noted that prior to Austral Bricks' involvement at the Quarry Site, topsoil salvage and stockpiling practices are not known.

During campaigns, when required, stripping and stockpiling of soil will be undertaken adjacent to the extraction area, where it will be signposted when present. Alternatively, stripped soil may be used immediately for progressive rehabilitation. The soil stockpiles are permitted to revegetate naturally. Where progressive rehabilitation is not possible, the soil is stockpiled and stabilised to prevent degradation of the soil resource and sedimentation. Temporary stabilisation and soil stockpile management includes the following practices.

- Minimise, as far as practicable, the operation of machinery on stockpiles to minimise compaction.
- Ensure that stockpiles have a maximum height of 2m and a maximum slope of 1:3 (V:H).
- Leave the surface of the stockpile with an even but roughened surface to assist in erosion control and seed germination and emergence.
- Permit natural revegetation on stockpiles.
- Spraying of noxious weeds on an as needed basis.

It is noted that part of the material salvaged by Austral Bricks through the development of the Eastern Extraction Area has been used as part of the rehabilitation of the Western and Southern Extraction Area due to the lack of stockpiled resources from historical operations (i.e. pre-Austral Bricks' tenure of the Quarry Site).

In general, the naturally low fertility, moderate erodibility and the low availability of topsoils for use in rehabilitation is considered a moderate risk to rehabilitation of the Quarry Site. Managing the existing risk levels will involve careful management of the remaining available topsoils within the Quarry Site.

Current volumes of stockpiled topsoil within the Quarry Site are unknown. Based on the current area of disturbance (approximately 1.69ha) and a minimum depth of 100mm, approximately 1,690m^3 of topsoil material would be required for rehabilitation. In consideration of the above, a materials balance and *Growth Medium Register* will be developed by Austral Bricks to identify potential soil material resource deficit for rehabilitation.

6.2.1.2 Flora

Existing Environment

A qualitative assessment of the flora of the Quarry Site is presented as part of Fox (1995). In summary, the surrounding vegetated areas were described as predominantly comprising of an open forest Eucalypt community. Lower slopes were dominated by *Eucalyptus melliodora* (yellow box), and variable understory species including *Acacia sp.*, *Persoonia sp.*, and *Xanthorrhoea sp.* in more open areas. Upper slope areas were dominated by rough barked Eucalyptus species with a sparse to non-existent understory.

Assessments of existing rehabilitation efforts, including observations of vegetation of the Quarry Site, have been undertaken periodically over the life of the Quarry by Anne Clements & Associates Pty Ltd. Assessment outcomes are presented in the following documents.

- *Rehabilitation Plan for Existing Eastern Quarry and Assessment of Rehabilitation of Former Western Quarry* (Anne Clements & Associates Pty Ltd (Clements), 2008).
- *Assessment of Rehabilitation Requirements: Austral Bricks Quarry, Hume Highway, Marulan* (Clements, 2003).

Clements (2008) states that the surrounding undisturbed Eucalypt woodland on the adjoining slopes on the extraction areas was used as the benchmark for the (then) planned rehabilitation works. **Table 14** presents the woodland community species identified as occurring within the Quarry Site by Clements (2008 and 2003).

Observations of previous rehabilitation areas identified the occurrence of the native daisy *Helichrysum leucopsideum* on relatively steep slopes of little to no cover. Unidentified native vegetation was also observed on the edges of disturbed areas, with wetland plant species observed within the shallows water management/storage infrastructure. Woodland species were observed colonising stockpiled soil material.

In summary, none of plant species listed in **Table 14** are classed as threatened or endangered under State or Commonwealth legislation, and no endangered ecological communities or threatened flora species have been identified as occurring within the Quarry Site.

Table 14
Observed Woodland Community Species

Species Name	Common Name
Canopy	
Eucalyptus sieberi	Silvertop ash
E. rossii	Inland scribbly gum
Shrubs	
Acacia parramattensis	Sydney green gattle
A. terminalis subsp. aurea	Sunshine wattle
Allocasuarina littoralis	Black she-oak
Cassinia arcuata	Sifton bush
Davesia ulicifolia subsp. ulicifolia	Gorse bitter-pea
Olearia viscidula	Sticky gaisy-bush
Persoonia linearis	Narrow-leaf geebung
Understory Species	
Aristida ramosa var. ramosa	Wiregrass
Austrostipa mollis	Soft speargrass
Bossiaea buxifolia	Malted bossiaea
Dianella revoluta	Blue flax-lily
Entolasia stricta	Wiry panic
Goodenia hederacea	Ivy goodenia
Lepidosperma laterale	Variable sword edge
Pomax umbellata	Pomax
Source: Clements (2008)	

Controls

In light of the above, and in consideration of the relatively minor areas to be cleared for each extraction campaign, risk to rehabilitation pertaining to specific plant communities or species are considered to be low. Consequently, no species-specific flora rehabilitation objectives for threatened ecological communities or flora species have been established and no specific risk controls are required.

Management measures include progressive revegetation of disturbed areas including placement of cleared vegetation directly onto areas undergoing rehabilitation or adjacent to the active extraction area. Furthermore, weed management will be conducted to reduce competition with native species.

6.2.1.3 Fauna

No formal fauna assessments have been undertaken within the Quarry Site as no significant impacts are anticipated. This is due to the extent of disturbance, the relatively limited extent of the area of vegetation to be removed, the locational context of the Quarry Site near to the Hume highway and the clearing associated with the power line easement.

Therefore, no endangered ecological communities, threatened fauna species or populations have been identified within the Quarry Site. Consequently, no species-specific fauna rehabilitation objectives have been established and no specific risk controls are required.

Pest management and control measures to be implemented as part of rehabilitation at the Quarry Site are provided in Sections 6.2.5 and 6.2.6.

6.2.1.4 Rock / Overburden Emplacement

Overburden is salvaged during extraction campaigns and either placed directly as backfill within completed extraction areas or stockpiled within existing disturbance areas for use in final landform shaping. This may include material stockpiled and placed within the Western and Southern Extraction Areas associated with historic activities.

In general, there are no specific locations for the placement of overburden, however it is noted that the slopes of the approved final landform for the Eastern Extraction Area (**Plan 2**) may require backfilling in addition to final shaping.

Notwithstanding, a materials deficit is not anticipated with respect to material required for final landform shaping. Subsequently, no specific actions are required.

6.2.1.5 Waste Management

The principal production waste to be generated during the active mining phase is overburden material which will be managed as discussed in Section 6.2.1.4. Equipment maintenance will be undertaken off site between campaigns. However, should any equipment repair or maintenance be required during a campaign, all wastes generated will be removed by the contractor for off-site disposal and/or recycling.

Non-production waste management

As no permanent plant or personnel are located at the Quarry Site, general waste management is undertaken as part external contractor operations during extraction campaigns. In general, waste material generated on site may include:

- light waste from daily contractor activity; and
- waste generated from maintenance activities, such as repair/replacement of fencing, signage and other infrastructure.

Regular servicing of vehicles and machinery is not permitted to be undertaken within the Quarry Site unless under emergency circumstances. As such, no related wastes are regularly generated on sited.

In consideration of the above, all wastes generated within the Quarry Site are able to be removed from site either daily, or at the cessation of extraction and or maintenance operations. Therefore, waste management is not considered to present a risk to rehabilitation.

It should be noted that due to the proximity of the Hume Highway, waste material from highway users does enter the Quarry Site.

6.2.1.6 Geology and Geochemistry

Existing Environment

The Quarry is hosted by the Silurian-aged Covan Creek Formation, a thin to very thick-bedded medium grained sandstone with interbedded, laminated, pale-grey to buff siltstone and mudstone. The Quarry is hosted within one of the interbedded fine-grained units. The depositional environment is interpreted to be shallow marine, with common bioturbation and biological activity noted. The slope gradients at the site range from 5% to 50%, although the majority of the slopes surrounding the quarry are between 15% and 40%. Rock outcrops occur at the site and ranges from 2% to 20% of the ground surface, with greater outcrops generally occurring towards the crests.

Controls

The geological and geochemical properties of the clay/shale resource within the Quarry Site is considered by Austral Bricks to be well understood. No environmental or geochemical constraints from the properties of the material are known to occur and therefore no risk to rehabilitation from the use of overburden are expected to occur.

6.2.1.7 Material Prone to Spontaneous Combustion

As no material within the Quarry Site is prone to spontaneous combustion, no specific risks to rehabilitation associated with spontaneous combustion have been considered.

6.2.1.8 Material Prone to Generating Acid Mine Drainage

The Quarry Site does not contain any geological material that is acid forming or potentially acid forming, nor material of any other geochemical issue or concern. Therefore, geochemical risks to rehabilitation has not been considered further.

6.2.1.9 Ore Beneficiation Waste Management (reject and tailings disposal)

As no processing of ore is undertaken with the Quarry Site, no process residues or tailings will be produced and associated wastes have therefore not been considered further.

6.2.1.10 Erosion and Sediment Control

Existing Environment

An assessment of the general erosion risk of the Quarry Site was undertaken as part of Fox (1995) and is presented as McVey (1995a and 1995b). Soil characterisation testing (see Section 6.2.1.1) identified the following general implications for soil and water management measures for the Quarry Site.

- Low Organic Carbon levels indicate very poor to moderate structural condition and stability, due to limited leaf litter and the inherent properties of the loose, sandy nature of the in situ topsoils.

- Dispersion percentages for subsoils within the Eastern Extraction Area exceed 10% and are therefore 'significant'.
- Emerson Aggregate Test Classes varied across the Quarry Site, however stockpiled overburden was identified as being suitable for use in water storage structures (and is the material used for the Sediment Dam).

Table 15 presents a summary of the key risks relating to soil and water management within the Quarry Site, as identified by McVey (1995b).

Table 15
Erosion Constraints and Opportunities

Constraint/Opportunity	Value
Rainfall Erosivity	Low (*R*=1380)
Soil Erodibility	Moderate (*K*=0.024-0.040)
Calculated Soil Loss	450t/ha/year
Soil Loss Class	Class 2
Slope Gradients	Mostly 15-35%
Soil Texture Group	Mostly *Type F* (32-64%)
Percent Dispersibility (whole subsoil)	Significant (14-42%)
Runoff Coefficient	High (0.9)
Source: Modified after Table 1 of McVey (1995b)	

Controls

Erosion and sedimentation within the Quarry Site is generally managed in accordance with McVey (1995b). All contractors operating within the Quarry Site are made aware of their responsibilities in regard to management of potential impacts from erosion and sedimentation.

The location of existing water management infrastructure within the Quarry Site is presented on **Figure 2**. In summary, the disturbed area within the Eastern Extraction Area is internally draining, with surface runoff captured within the Sedimentation Basin. Management of suspended sediments within the Sedimentation Basin is undertaken through the use of flocculants/coagulants as required prior to discharge from the licensed discharge location (see **Figure 2**). Clean water diversion drains are located around the southern extent of the active extraction face of the Eastern Extraction Area to minimise the total catchment area as far as practicable. Existing site fencing and access controls limit the potential for disturbance of surfaces and rehabilitation areas through inadvertent or unlawful access by stock or the public.

Due to the poor to moderate structural condition and stability of the soils, surface water controls such as diversion banks and catch drains will be installed and maintained. These will have a 3:1 gradient or less as per the SWMP.

Temporary erosion and sediment controls may also implemented as required within the Quarry Site during extraction campaigns, or in response to observed elevated erosion/sedimentation. Temporary controls may include:

- stabilisation of soil stockpiles;
- placement of cut vegetation across slopes to slow surface water flows;

- installation of silt fencing;
- installation of high-visibility fencing around rehabilitation areas in close proximity to potential disturbance areas (e.g., areas where vehicles may operate).

All temporary erosion and sediment controls are maintained until all earthwork activities are completed and management measures are no longer required (i.e. due to reduced risk).

6.2.1.11 Ongoing Management of Biological Resources for Use in Rehabilitation

Management of in situ Seedbank

Management of stockpiled material, including implications of stockpile ages and seed viability, is described in Section 6.2.1.1.

Due to the significant periods of time between extraction campaigns, topsoil and overburden may be stockpiled for extended periods of time. Consequently, viability of seed material salvaged with the soil material is likely to be relatively reduced. Notwithstanding, the growth of native vegetation on stockpiled material is permitted to occur. In addition, with regular weed inspections and controls, the existing stockpiling measures are considered suitable for the retention and support of in situ seed banks.

Required Topsoil Depths

No specific minimum topsoil depth has been identified for rehabilitation within the Quarry Site. Observations of in situ soil profiles identified a variable depth of topsoils between approximately 250mm and 400mm.

Considering the nature of the soils within the Quarry Site, it is anticipated that the restricting factor for plant growth will be the selection of species adapted to local conditions, rather than depth of topsoils. Notwithstanding the above, a nominal depth of 100mm has been identified as the minimum depth of topsoil required for rehabilitation.

Propagation

Propagation of plant material, if required, is anticipated to be undertaken by external contractors, such as specialist nurseries and/or rehabilitation specialists. Translocation of significant specimens located within areas to be disturbed during rehabilitation (e.g. stockpiles) may be translocated where practicable. However, as this would only occur on a sporadic basis, reliance would not be made on translocation of individual specimens to achieve rehabilitation.

Habitat Features

In general, vegetation cleared during land preparation operations has been placed directly within undisturbed areas, or within areas undergoing long-term and/or temporary rehabilitation for use in soil stabilisation. Due to the minor amount of clearing undertaken at any given time, it is anticipated that handling of any plant material will be undertaken in a similar manner.

Apart from existing growth medium stockpiles and associated seedbanks, no specific biological resources have been salvaged and retained since the initial clearing of the Quarry footprint.

6.2.1.12 Mine Subsidence

No underground mining has occurred within the Quarry Site, and no significant backfilling operations have occurred. Therefore no subsidence or slumping management issues are anticipated to occur.

6.2.1.13 Management of Potential Cultural and Heritage Issues

No cultural or heritage sites have been identified within the Quarry Site. Therefore, no impacts to known heritage items or sites are anticipated to occur during rehabilitation. However, should any Aboriginal sites be found during operations, these will be notified in accordance with the unexpected finds procedure.

6.2.1.14 Exploration Activities

Exploration activities that may be undertaken within the Quarry during the active mining phase may include the following.

- Resource extensional drilling programs.
- Diamond drilling to define shale resources adjacent to operations.

Prior to commencement of any ground-disturbing exploration activities, all necessary approvals would be sought.

6.2.2 Decommissioning

6.2.2.1 Site Security

Existing site security measures will be maintained during decommissioning and active rehabilitation operations at the Quarry unless they are required to be modified for rehabilitation purposes. No public access to the Quarry Site is currently permitted, with the main site entry points secured by locked gates during and outside of operating hours. Exclusion of the public from the Quarry Site is currently provided via a combination of perimeter security fencing and stock-proof fencing.

Existing security fencing that is to be retained will be structurally assessed and repaired or replaced where necessary. Permanent safety bunds will be constructed around the top edge of batter walls to prevent inadvertent access to steep batter slopes and rehabilitated areas. Where safety bunds are already in place, these will be assessed and repaired as required or removed and replaced with waste rock safety bunds where existing safety bunds contain growth medium material required for rehabilitation.

6.2.2.2 Infrastructure to be Removed of Demolished

Table 16 presents a list of the site features to be decommissioned to achieve the final land use. No specific formal requirements exist for the decommissioning of built infrastructure at the Quarry Site. Notwithstanding, any infrastructure not required for the final land use will be subject to engineering assessments to identify potential risks associated with closure and decommissioning activities, where required.

Table 16
Assets in Quarry Site Domain to be Removed or Decommissioned

Mining Domain[1]	Assets	Decommissioning and Demolition Requirements
1 – Infrastructure Area	Roads: includes internal unsealed haul roads and access roads.	Access to the Extraction Areas and the Sediment Basin would be retained for future management or emergency uses. All remaining access tracks will be removed and rehabilitated.
3 – Water Management Area	Sediment Basin	The Sediment Basin would be retained as a permanent water storage.
5 – Active Extraction Area	Eastern Extraction Area	Final voids will be made safe, with perimeter safety bunds and security fencing constructed or retained where required to restrict human and fauna access.
Note 1: see **Figure 9**		

6.2.2.3 Buildings, Structures and Fixed Plant to be Retained

Site access, including the Property Access Road, will be retained to support continued access to surrounding residences. Access to the Sedimentation Basin will be retained to permit maintenance and emergency access, and to allow post-extraction use. As identified in Section 6.2.2.1, existing security infrastructure will also be retained.

Roads and access tracks to be retained will be subject to a relinquishment inspection by suitably qualified persons to identify potential risks and remedial actions required. Risks relating to the retention of roads/access tracks are considered to be low as the roads would only be required to support light vehicle access, and emergency access by larger vehicles would generally still be possible.

The Sedimentation Basin and all other Water Management Infrastructure to be retained will be subject to a relinquishment inspection by suitably qualified persons to confirm compliance with relevant design criteria. If required, the final capacity of the structure may be adjusted. Notwithstanding, retention of the Sedimentation Basin is not considered a significant risk to final land use.

Site fencing will be inspected prior to relinquishment to identify any significant remedial or maintenance requirements. Where required, fencing of final voids will be installed to current standards. The location and design of any final void fencing, including signage, will be undertaken in consultation with relevant Government agencies.

Infrastructure associated with services located within the Quarry Site is outside of the control of Austral Bricks and is maintained under agreements between the Landholder and the owners of service-related infrastructure. Notwithstanding the above, rehabilitation of the Quarry Site in the vicinity of the service infrastructure will be undertaken in consideration on potential land use conflicts i.e. woodland vegetation (e.g. large trees) would not be located in cleared asset protection areas.

6.2.2.4 Management of Carbonaceous / Contaminated Material

Extracted material from the Quarry does not contain high enough levels of carbonaceous material to be considered contaminated or contaminating material. The extracted is stockpiled and removed from the site within a reasonable timeframe minimising the possibility of contaminated material polluting the site and therefore, no permanent storages are present onsite. All hydrocarbons and chemicals are stored in accordance with AS1940:2017 – The storage and handling of flammable and combustible liquids. No known historical contamination events or contaminated material are located within the Quarry Site.

During rehabilitation, the only potential sources of carbonaceous and/or contaminated material would be from rehabilitation equipment. Management of potential risks from contamination will continue to be managed in accordance with the *Pollution Incident Response Management Plan*.

In consideration of the above, potential risks to rehabilitation relating to carbonaceous / contaminated material is considered to be low.

6.2.2.5 Hazardous Materials Management

No hazardous materials, including herbicides, pesticides, hydrocarbons and/or explosives are permanently stored within the Quarry Site. Where required, all hazardous material are brought to site on an as-needed basis and stored/used in accordance with all relevant safety standards.

No hazardous materials will be stored on-site during rehabilitation. In accordance with current practices, any hazardous material required during rehabilitation will be handled in accordance with all relevant guidelines and standards.

Regular visual inspections of operational environments during and following rehabilitation operations will be used to identify potential or actual risk from the use of hazardous materials within the Quarry Site for Quarry-related purposes.

No hazardous materials are proposed to be retained following the cessation of mining and rehabilitation operations. A hazardous materials audit of the Quarry Site will be conducted by a suitably qualified expert prior to the commencement of decommissioning activities to identify all potentially hazardous materials and any associated risks, including relevant handling and disposal practices.

6.2.2.6 Underground Infrastructure

No underground infrastructure is known to be located within or in the vicinity of the Quarry Site.

6.2.3 Landform Establishment

6.2.3.1 Water Management Infrastructure

The location of water management infrastructure to be retained, and the indicative location of water management infrastructure to be installed, is shown on **Plan 1**.

Where practicable, water management structures such as contour banks and drains will be constructed with longitudinal gradients which permit the transfer of water at non-erosive velocities (e.g. 1:3 (V:H)). Shaping of batters and extraction floor to provide suitable grades directing surface water flows to the retained water storage and/or suitably stabilised outlet.

Consequently, specialised rehabilitation treatments will generally not be required. However, an adequate projected foliage cover will be established to limit silt entrainment and erosion.

It is anticipated that the Sedimentation Basin will be retained after rehabilitation to manage suspended particulates and erosion at the site. These structures will be assessed to ensure that they are stable and functional before relinquishment.

6.2.3.2 Final Landform Construction: General Requirements

As shown on **Plan 1**, the majority of the Quarry Site will be progressively rehabilitated to achieve the appearance of vegetated natural landforms in the surrounding area. Areas which will remain unvegetated include the Sediment Basin which will be retained as a water storage area.

Following completion of rehabilitation operations, it is not expected that these areas will present any specific geotechnical or geochemical risks. Additionally, it is not expected that these areas will require specific erosion and sediment control measures following the establishment of vegetation.

Principle design elements of the final landform to address potential geotechnical and erosional issues include the following.

- Final landform shaping, including backfilling, to create a maximum slope of 1:3 (V:H) within areas disturbed by the Quarry and to direct surface water flows to water management infrastructure.
- Water management infrastructure, namely the Sedimentation Basin, contour banks, drains and diversion drains, to control and/or minimise erosion and sedimentation risk, as far as practicable.

The final landform, generally consisting of a sloped and vegetation landform, is considered to be commensurate with the surrounding landforms. Furthermore, in consideration of the approved final land use and existing rural setting, visual amenity is not considered to a significant risk for rehabilitation.

6.2.3.3 Final Landform Construction: Reject Emplacement Areas and Tailings Dams

Other than the use of overburden as backfill within completed extraction areas, no specific overburden emplacement areas are located within the Quarry Site. As such, no specific management measures regarding placement of overburden within the Quarry Site other than general erosion and sedimentation controls are considered necessary.

No processing is undertaken within the Quarry Site and therefore no tailings, fines or other processing residues are located within the Quarry Site.

6.2.3.4 Final Landform Construction: Final Voids, Highwalls and Low Walls

Key Design Features

The approved final landform as part of DA2921 assumes completed extraction of the entire Eastern Extraction Area . No specific design features are included as part of the approved final landform, other than the backfilled slopes commensurate with the surrounding landform. The completed extraction area will be orientated generally on a north to south axis, with a north-northwest facing sloped landform. Excluding the Sediment Basin, the elevation of the completed extraction area will be from approximately 675m AHD in the north to approximately 710m AHD in the southeast.

The nominated criteria for the maximum slope of the final landform of disturbed areas of the Quarry Site is 1:3 (V:H). Final shaping of minor areas of the existing extraction faces will be required to achieve a 1:3 slope.

Water Licencing

No water licencing will be required for the retention of the Sediment Basin as water storage within the final landform, as the maximum storage capacity of the Sediment Basin is within the maximum Harvestable Rights entitlement under the NSW *Water Management Act 2000* (WM Act).

The Quarry Site is located within the Coastal-draining Catchments Harvestable Rights Area as defined by the *Harvestable Rights (coastal-draining catchments) Order 2022*. Based on a total landholding of 76.2ha (Lot 2 DP829547), the combined maximum dam capacity of all harvestable rights dams is 5.72 million litres (ML).

6.2.3.5 Construction of Creek / River Diversion Works

No Quarry-related creek or river diversion works are known to be located within the Quarry Site.

6.2.4 Growth Medium Development

Potential risks to rehabilitation relating to growth medium are the availability of topsoil, and the naturally low fertility of the soils within and in the vicinity of the Quarry Site.

Based on the results of the materials balance (see Section 6.2.1.1), additional topsoil may be required to be sourced from off site for use in rehabilitation.

Soil characterisation testing will be undertaken for all soils, including available topsoil and overburden and any externally sourced material, to identify potential ameliorative requirements. Ameliorants may include fertilisers and/or the application of biomatter such as organic mulches.

Deep ripping of underlying substrate and minor ripping of applied growth medium may be undertaken to promote root and water penetration within areas to be rehabilitated. Ripping will be undertaken where practicable across the slope of the final landform.

Subsoils will consist of backfilled and/or shaped overburden to be placed using heavy equipment during landform establishment. Topsoil will be applied using load and haul or direct placement of material within rehabilitation areas and spread using machinery.

Weed control during growth medium development will consist of inspections and control of on-site weeds prior to and during placement of growth medium. This will include targeted surveys of stockpiled material. Where topsoil has been sourced from off site, targeted inspections of the material will be undertaken following placement to identify any weed material inadvertently imported. All vehicles and equipment used during rehabilitation will be inspected for weed material prior to commencement of operations.

Seasonal and local meteorological conditions will be monitored to identify conditions which may result in delaying vegetation establishment (e.g. drought conditions). Land preparation and growth medium spreading activities will only be undertaken where conditions are predicted to be favourable (i.e. average or above average annual rainfall) to the establishment of vegetation.

If vegetation establishment is delayed due to unfavourable meteorological conditions, additional management measures may be undertaken. This may include the application of a surface stabiliser, (e.g. polymer-based sprays) or supplementary watering using available water stored within the Sedimentation Basin.

No significant habitat resource stockpiles are present at the Quarry Site and no specific habitat augmentation will be required to meet the identified rehabilitation objectives.

6.2.5 Ecosystem and Land Use Establishment

The following subsections outline the considerations and anticipated methodologies required to establish the target vegetation associated with the approved final land use of the Quarry Site.

Target Plant Species

No specific Plant Community Type is proposed or required to be established within the Quarry Site. Condition 1 of DA2921 requires consideration of the findings of *Commentary for a Rehabilitation Plan for Lot 2, PM 1 (D.P. 253743) Hume Highway, Marulan* (McVey, 1995c) which identifies the species listed in **Table 17** for temporary rehabilitation of areas of concentrated flows. In regard to species selection for 'permanent' rehabilitation, McVey (1995c) states only that "*local seed merchants should be consulted to ensure the use of local native seed and mulch*". Furthermore, McVey (1995c) states that there is no need for consideration of salt-tolerant species due to the inherent soil characteristics of the Quarry Site.

Table 17
Previously Identified Species Selection and Treatment for Temporary Rehabilitation

Sowing season	Seed mix	Sowing Rate
Autumn/ Winter	Oats (Avena sativa)	40kg/ha
Spring/ Summer	Japanese millet (Echinochloa esculenta) Oats (A. sativa)	20kg/ha 20kg/ha
Source: Modified after Table 2 of McVey (1995c)		

Table 14 lists several species identified as occurring within the Quarry Site, including canopy, shrub, and understory species; Austral Bricks anticipates that plant species used in rehabilitation would include, but not be limited to, those species (see Section 6.2.1.2). Additional native species may be included depending on advice from revegetation specialists. In addition, several exotic species are known to occur within and in the vicinity of the Quarry Site. Exotic groundcover species may be used is suitable and required for temporary/rapid surface stabilisation.

Propagation Material Sourcing and Handling

Collection of propagation material, namely seeds, will generally be undertaken by revegetation specialist and may occur from local or regional (where relevant) sources to maintain and/or promote retention of genetic integrity as far as practicable. As no specific threatened or endangered species has been identified as occurring within the Quarry Site, no specific collection requirements are anticipated. Seeds will either be used for direct seeding, or for tubestock material.

Translocation of passively regenerated seedlings and other specimens from areas to be disturbed may also be undertaken as required. However, translocation would not be relied upon to achieve revegetation.

Revegetation Methodology

Revegetation will be undertaken using the following.

- Direct seeding.
- Tubestock.
- Hydromulching/hydroseeding.

Other Environmental Considerations

Monitoring of local and regional meteorological conditions will be undertaken leading up to, during, and following revegetation activities to identify risks and opportunities relating to climate. Vegetation establishment activities at the Quarry, including growth medium spreading and seeding operations, will occur only where favourable climatic conditions are expected to occur. If existing seed mix is inappropriate for current weather conditions, a suitably experienced expert will be consulted to confirm alternative species and/or cover crop or mulch for temporary stabilisation.

Areas recently revegetated may, if required, be watered regularly until an effective cover has been properly established and/or supplementary watering is no longer required. Further application of seed and fertiliser might be necessary later in areas of minor soil erosion and/or inadequate vegetation establishment.

Frequency of weed and pest monitoring and control operations may be increased prior to, during, and following revegetation operations to reduce as far as practicable competition from weed species and negative impacts of herbivory.

Where practicable, foot and vehicular traffic will be kept away from any such rehabilitated areas. Restriction of public access to the Quarry Site will continue to be maintained throughout revegetation. Where staged rehabilitation is to occur alongside or in close proximity to extraction operations, revegetated areas will be clearly delineated and identified to all persons on site to minimise inadvertent impacts as far as practicable.

6.2.6 Ecosystem and Land Use Development

The following subsections outline the considerations and anticipated methodologies required to develop the approved final land use of the Quarry Site.

6.2.6.1 Erosion, Drainage, and General Infrastructure

Regular inspections of Quarry Site infrastructure during the Ecosystem and Land Use Development phase will be an important control during a relatively increased risk stage for ecosystem development. Information on the anticipated erosion and sediment controls during rehabilitation is provided in Section 6.2.1.10. Information on security infrastructure is provided in Sections 6.2.2.1 and 6.2.2.3.

Erosion and sedimentation risk will be elevated until the target ground cover criteria are reached. During this period, regular inspections of all water management infrastructure will be undertaken to assess the performance of the existing controls, and identify potential remedial or additional actions, if required.

Inspections and maintenance of access tracks, and temporary and permanent fencing will be undertaken to enable safe and secure access to the Quarry Site during revegetation, monitoring and maintenance. Monitoring and maintenance of fences will also assist in protecting at-risk areas from damage from stock and vehicles, as far as practicable.

6.2.6.2 Weed and Pest Management and Monitoring

Several parameters associated with the presence of weeds and grazer impacts will be recorded as part of rehabilitation monitoring activities. The Annual Rehabilitation Report will include the following.

- An overview of any weed and pest management measures implemented at the Quarry Site during the reporting period.
- A list of weed species identified during rehabilitation monitoring and any other inspections completed at the Quarry Site.
- Details of any pests or evidence of grazer damage to revegetated areas identified during inspections, including a plan showing distribution within the Quarry Site, where appropriate.
- Recommendations for specific weed and pest management measures to be implemented during the subsequent 12-month period.

6.2.6.3 Environmental Management and Monitoring Program

Surface Water and Groundwater

Surface water monitoring will continue to be implemented based on the current monitoring program, as outlined in Section 6.2.1.10. Visual inspections of erosion and drainage control structures will be undertaken following significant rainfall events. If required, a suitably qualified expert will be engaged to recommend erosion and sediment control measures.

No monitoring of groundwater quality is currently undertaken or required at the Quarry Site.

Revegetation

Vegetation establishment activities at the Quarry, including growth medium spreading and seeding operations, will occur only where favourable climatic conditions are expected to occur. Consequently, prolonged drought periods may result in extended delays to these rehabilitation conditions. In the event that extended drought periods occur at the Quarry Site, rehabilitation schedules will be updated to prioritise other rehabilitation activities and opportunities to prepare additional areas for revegetation once favourable conditions return will be investigated.

The management measures will be implemented to monitor revegetation operations during the ecosystem development phase of rehabilitation will be consistent with those identified in **Table 10**, namely, establishment of one monitoring point per 5ha of rehabilitation and two analogue sites.

Results from rehabilitation monitoring will be used to assess the progress of revegetated areas towards target values based on analogue sites for each of the established vegetation community types (see Section 8.1).

The results of rehabilitation monitoring will also be compared against the triggers outlined in Section 10 and additional management actions implemented as required. These additional management actions may include, but would not be limited to:

- growth medium amelioration (e.g. fertiliser or organic matter application);
- reseeding of areas with seed of target species where species assemblages are not consistent with those of analogue sites; and
- engaging a suitably qualified expert to provide recommendations to improve rehabilitation outcomes.

Land Management and Infrastructure Maintenance

Site infrastructure including retained roads, security and stock-proof fencing, safety bunds and signage will be inspected on an annual basis. Additionally, infrastructure vulnerable to erosion (e.g. unsealed roads) will be inspected following significant rainfall events.

The results of infrastructure inspections as well as records of annual infrastructure maintenance activities and costs will be included as part of an Annual Rehabilitation Report.

6.3 REHABILITATION OF AREAS AFFECTED BY SUBSIDENCE

No subsidence has been identified as occurring within the Quarry Site. No underground mining is known to have occurred within or in the vicinity of the Quarry Site, and no significant backfilling operations have occurred which would have the potential for significant surface subsidence. As such, no subsidence-related management and maintenance programs are required.

7. REHABILITATION QUALITY ASSURANCE

The following section details the rehabilitation quality assurance process for the Quarry in accordance with *Guideline 3: Rehabilitation Controls (July 2021)*. The rehabilitation quality assurance checklist included in this section is intended to be used as an indicative guide for rehabilitation operation managers and practitioners responsible for the rehabilitation of the Quarry Site.

It is anticipated that rehabilitation operations within the Quarry Site will occur on a progressive basis as areas are no longer require for operational purposes. Consequently, it is noted that rehabilitation progress through the planned rehabilitation phases will not occur concurrently across all mining domains identified in **Figure 9**.

As part of the rehabilitation quality assurance process, relevant records and documentation will be recorded in a Rehabilitation Quality Assurance Register and reported as part of the Annual Rehabilitation Report. The Rehabilitation Quality Assurance Register will, as a minimum, include a compliance register used to assess the status of compliance with requirements under relevant development consents, leases and licences. The Rehabilitation Quality Assurance Register will be maintained, reviewed and refined by the Environment Superintendent to ensure that it is reflective of current rehabilitation progress, risk controls implemented at the Quarry Site and the outcomes of any updated rehabilitation risk assessments.

Table 18 outlines key responsibilities for Austral Bricks and Quarry personnel with regards to rehabilitation operations.

Table 18
Key Roles and Responsibilities

Role	Responsibility
Raw Materials and Mining Manager	• Comply with applicable laws, regulations, licences and approvals. • Ensure all contractors, sub-contractors and service personnel are appropriately qualified and/or licenced to undertake the required work. • Ensure that appropriate resources are available to site management and personnel to enable the implementation of this Plan.
Environment Manager / Site Supervisor	• Ensure that the Rehabilitation Quality Assurance register is maintained and up to date based on site activities. • Ensure that the workforce is aware of relevant development and rehabilitation risks and management and mitigation measures, including any additional corrective and/or preventative measures. • Ensure that the rehabilitation quality assurance process outlined in Section 7 is implemented as required. • Ensure that the documentation and recording of rehabilitation risk controls occurs within a suitable timeframe • Ensure that specialist contractors adhere to the guidelines and methodologies outlined in this RMP where required, or that the guidelines and methodologies in this Plan are updated to reflect those employed at the Quarry Site.
All Quarry Personnel	• Follow direction provided by the Environment Manager / Site Supervisor. • Notify the Environment Manager / Site Supervisor in the event that uncontrolled rehabilitation risks are identified at the Quarry.

8. REHABILITATION MONITORING PROGRAM

8.1 ANALOGUE SITE BASELINE MONITORING

No specific assessments or monitoring has been undertaken to define the proposed rehabilitation objectives and completion criteria for the Quarry Site.

Notwithstanding the above, information from existing assessments (see Section 6.2.1.2) and observations and experience from Austral Bricks personnel has been used to identify defining characteristics and benchmark values for each final land use domain.

As identified in Section 8.2, a minimum of two analogue sites are proposed to be established within the undisturbed vegetation of the Quarry Site to determine baseline values against which ecosystem establishment can be measured. It is anticipated that further refinement of the proposed rehabilitation completion criteria may be undertaken once analogue sites have been established.

8.2 REHABILITATION ESTABLISHMENT MONITORING

The rehabilitation monitoring program has been developed in consideration of the relatively low risks associated with rehabilitation of the Quarry Site.

Rehabilitation establishment monitoring will involve inspections of each progressive phase and will consist of the following.

- Photo monitoring of rehabilitated areas, including prior to seeding, immediately following seeding and one year after revegetation activities of the area is completed.
- Visual inspections and documentation following significant rainfall events (i.e. ≥25mm within 24 hours) to identify any signs of erosion and detail any follow up actions required (e.g. repairs, installation of additional erosion and sediment controls).
- Establishment of long-term monitoring sites within undisturbed areas (analogue sites) and rehabilitated areas. Ecological monitoring, such as Landscape Function Analysis and/or Ecosystem Function Analysis (or suitable equivalent) will be undertaken to monitor ecosystem development. Monitoring to be completed by suitably trained / qualified person and a report prepared summarising performance of the rehabilitation against the completion criteria / analogue monitoring points. The frequency of monitoring will be determined by a suitably qualified person, and may increase and/or decrease in response to perceived risk and/or rehabilitation performance.
- Recording of all monitoring and inspection events, including the results of monitoring and any follow up activities, in accordance with the Rehabilitation Quality Assurance Register.

These recommendations would be implemented as soon as reasonably practicable, and the above steps would be repeated until the nominated rehabilitation criteria have been achieved.

8.3 MEASURING PERFORMANCE AGAINST REHABILITATION OBJECTIVES AND REHABILITATION COMPLETION CRITERIA

Details of validation methods and indicators to be employed during monitoring to assess performance against the rehabilitation completion criteria for the Quarry Site are provided in Section 4.1.

Annual Rehabilitation Reports will form the foundation of long-term rehabilitation monitoring at the Quarry Site. As outlined in Section 8.2, assessment of rehabilitated areas will be undertaken throughout the rehabilitation stages and after significant rainfall events.

The establishment of analogue sites to inform rehabilitation completion criteria will begin once stages have commenced. Once monitoring has established suitable analogue sites and associated target values for key ecosystem characteristics within the identified vegetation community types, the target values will be recorded in this Plan.

The results of rehabilitation monitoring will be graphed and compared against target values to determine:

- the relative performance of rehabilitated areas compared to other sites within the Quarry Site;
- the rate of development towards target values, including a timeline for the achievement of target values and/or rehabilitation completion criteria; and
- whether additional controls, management measures or specialist assessments to identify issues and provide recommendations are required based on trigger values (see Section 10).

The Rehabilitation Quality Assurance Register will be used to record details of any additional management measures or risk controls implemented during the ecosystem development phase in response to the analysis of rehabilitation monitoring results.

An Annual Rehabilitation Report and Forward Program will be prepared for the Quarry as required under the new standard mining lease conditions for rehabilitation. Austral Bricks proposes to submit an Annual Rehabilitation Report and Forward Program for the Quarry by 29 October of each year to cover the previous 12-month calendar year period. As part of the Annual Rehabilitation Report and Forward Program, Austral Bricks will validate and certify that the security deposit covers the estimated cost of rehabilitation liabilities each year.

9. REHABILITATION RESEARCH AND TRIALS

9.1 CURRENT REHABILITATION RESEARCH AND TRIALS

No rehabilitation research or formal rehabilitation trials are currently being undertaken within or surrounding the Quarry Site. The rehabilitation and revegetation activities to be undertaken are standard activities for which the required techniques are well understood by suitably qualified personnel. In addition, sufficient information from existing assessments is available to identify the key risks and opportunities for rehabilitation of the Quarry Site.

Notwithstanding the above, the performance of existing rehabilitation operations and revegetated areas within the Quarry Site (including rehabilitation conducted prior to involvement of the Company) has been considered during the preparation of this Plan.

9.2 FUTURE REHABILITATION RESEARCH AND TRIALS

No rehabilitation research or rehabilitation trials is expected or planned to be undertaken within or surrounding the Quarry.

Furthermore, no specific assessments are required to address factors such as contamination, hazardous material, or landform stability.

10. INTERVENTION AND ADAPTIVE MANAGEMENT

Table 19 presents the Trigger Action Response Plan for each of the rehabilitation threats and potential adverse outcomes identified in **Table 10** as having a risk rating of moderate or above.

The results of rehabilitation monitoring assessments, including the development of procedures to be implemented during rehabilitation operations, will be continually reviewed and reported in the Annual Rehabilitation Report for the Quarry. Where rehabilitation monitoring assessment outcomes suggest that rehabilitation methods outlined in this Plan may not support the realisation of rehabilitation completion criteria, this Plan will be updated to detail additional or alternative rehabilitation methods as required. Additionally, as required, this Plan will be updated to reflect specific management implications for individual areas of the Quarry Site and/or target values associated with rehabilitation completion criteria.

Table 19
Trigger Action Response Plan

Rehabilitant Risk	Potential Adverse Outcome	Trigger	Response
Active Mining Phase of Rehabilitation			
Limited pre-existing biological resources for use (e.g., topsoil, woody debris)	Insufficient resources available for rehabilitation limiting suitability of final land use.	Survey of stockpiled rehabilitation resources and/or growth medium register indicates a resource deficit within the Quarry Site.	Identify a suitable alternative source of additional growth medium, including any approvals necessary to acquire the resource.
			Commence investigations into measures that may be implemented to ameliorate other material to make them suitable for use as a growth medium.
Growth Medium Development Phase of Rehabilitation			
Subsoil and topsoil deficit for rehabilitation activities	Insufficient growth medium available for construction of sustainable final landform and land use.	Growth medium register indicates a deficit in material required for rehabilitation.	Identify an alternative source of additional suitable material, including the potential for amelioration of available unsuitable resources.
Substrate inadequate to support revegetation or agricultural land capability (e.g. lack of organic matter, nutrient deficiency, lack of soil biota, adverse soil chemical properties, exposed hostile geochemical materials, and any other factors impeding the effective rooting depth).	Inadequate growth medium thickness applied to final landform.	Test pitting following placement of growth medium material identifies placed thickness is not consistent with analogue site characteristics.	Spread additional growth medium material on the final landform
Ecosystem and Land Use Establishment Phase of Rehabilitation			
Adverse weather and climatic influences (e.g. drought; intense rainfall events; bushfire and climate change).	Delay to or failure of vegetation establishment	Long term and visual monitoring during and/or after adverse weather/climatic events identifies limited opportunities for progressive rehabilitation or negative effects on vegetation establishment	Review the rehabilitation schedule and update the forward schedule with revised rehabilitation timing estimates.
			If existing seed mix is inappropriate for current weather conditions, consult with suitably experienced expert to confirm alternative species and/or cover crop or mulch for temporary stabilisation.
			Identify any alternative areas which can be rehabilitated or activities which can be progressed during adverse weather conditions.

11. REVIEW AND IMPLEMENTATION

Table 20 presents the triggers for reviewing the Plan.

Table 20
Rehabilitation Management Plan Review Triggers

Trigger	Review
Request from the Resources Regulator or other relevant government agency to review the Plan.	As required by any notice
Modification of an existing development consent.	Within 3 months
Preparation of a revised Rehabilitation Risk Assessment.	Within 1 month
Submission of each Annual Rehabilitation Report and Forward Program.	Within 1 month
Completion of a rehabilitation trial.	Within 1 month
Review and re-development of any of the following. • *Flora and Fauna Management Plan* • *Soil and Water Management Plan*	Within 3 months
Receipt of a specialist consultant report prepared in response to a trigger outlined in Section 10.	Within 3 months
Consultation with relevant stakeholders with significant implications for the final land use and/or final landform.	Within 3 months
Consultation with relevant stakeholders with significant implications for rehabilitation objectives and/or rehabilitation completion criteria.	Within 3 months

The Raw Materials and Mining Manager is responsible for ensuring the implementation of this Plan, including reporting of non-compliances with the trigger values, and subsequent implementation of the relevant action plan. The Raw Materials and Mining Manager is also responsible for ensuring all employees are competent through training and awareness programs.

All employees of the Quarry are responsible for following the direction provided by the Raw Materials and Mining Manager and ensuring that operations are consistent with the plans and objectives detailed in this Plan.

In addition to reviews of this Plan as outlined in **Table 20**, a Rehabilitation Quality Assurance Register will be developed and regularly maintained to ensure that mining and rehabilitation activities at the Quarry Site are being conducted in accordance with this Plan. The Rehabilitation Quality Assurance Register will include the checklist presented as **Appendix 1** as well as a compliance register used to assess the status of compliance with requirements under relevant development consents, leases and licences. Additionally, the Rehabilitation Quality Assurance Register will include:

- records of any contaminated water or hazardous materials collected at the Quarry Site and disposed of off site;
- the latest map of weed distribution at the Quarry Site;
- the latest map of contamination at the Quarry Site; and
- details of any additional rehabilitation measures and/or risk controls implemented within individual subdomains during rehabilitation operations.

12. REFERENCES

Anne Clements & Associated Pty. Limited (2003). *Assessment of Rehabilitation Requirements: Austral Bricks Quarry, Hume Highway, Marulan*

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Morse McVey & Associates (McVey) (1995b). *Commentary for a Rehabilitation Plan for Lot 2, PM 1 (D.P. 253743) Hume Highway, Marulan*

Morse McVey & Associates (McVey) (1995c). *Commentary for a Rehabilitation Plan for Lot 2, PM 1 (D.P. 253743) Hume Highway, Marulan*

Appendix 1

Rehabilitation Risk Control Checklist

(Total No. of pages including blank pages = 13)

Table A
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Active Mining (Production)	
Soil and Materials Management	
Develop and maintain a materials and soils balance and database to include the following information: • volume of overburden, topsoil and subsoil stockpiled. • location, age and quality of stockpiles. • chronology of treatments (e.g. weed control, application of cover crop) undertaken on the stockpile. • volume of material, topsoil and subsoil required for application to current and future disturbance areas. • an estimate of the volume of suitable alternative material required to be imported onto site to supplement potential material, topsoil and subsoil deficits. • record data on the location of the stockpiled material including date stripped, source area, indicative volume, pre-strip plant community type. Information is to be stored using site-based GIS.	
Locate soil stockpiles away from traffic areas and at an appropriate distance from watercourses.	
Locate soil stockpiles on level or gently sloping areas to minimise the potential for erosion and soil loss.	
Limit soil stockpiles to less than two to three metres high and set out in windrows to maximise surface exposure and biological activity.	
Install appropriate erosion, dust and sediment controls around soil stockpiles to reduce the potential for soil loss.	
Appropriately sign-post soil stockpiles to identify the area and minimise the potential for unauthorised use or disturbance.	
Monitor and control weed growth on soil stockpiles.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Active Mining (Production) (Cont'd)	
Materials Handling	
Develop specific strategies (e.g. selective handling, management and placement) for materials management to address potential geochemical and geotechnical constraints for rehabilitation as follows: • adopt an appropriate geological model (typically block model for metalliferous mines) to determine source of problematic material. • continued identification and sampling/testing as required of overburden/interburden materials during operations to confirm the potential geochemical constraints across the deposit (e.g. spontaneous combustion). • continued sampling to ensure materials are understood (e.g. particle size distribution) and to identify potential changes in material properties. • development of a procedure/strategy for selective handling and management of materials.	
Seek specialist advice (as relevant) to develop effective mitigation strategies to minimise any potential interference to rehabilitation establishment or downstream pollution due to exposure of adverse geochemical material.	
Develop and maintain a register of any contaminated sites, waste landfill sites and bioremediation areas and where they are located.	
Environmental Monitoring	
Develop, maintain and document an environmental monitoring program that includes: • surface water • flora • land contamination • heritage	
Management of potential heritage issues	
Before demolition activities, undertake any necessary assessments to determine potential heritage approvals and or management measures that may be required (e.g. AHIP).	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Active Mining (Production) (Cont'd)	
Site Services	
Electricity services to any infrastructure scheduled for demolition will be removed before the start of building demolition works.	
Telecommunications, water supply and other services will also be disconnected and removed where practical.	
Where services are buried (e.g. pipelines, cables) and their retrieval may lead to further disturbance, the infrastructure may be left in situ (subject to any necessary approvals or agreements) if they don't pose constraints to the final land use. In this situation, the location of the services will be surveyed and marked on the site plan and a suitable caveat developed to provide that they are readily identifiable for future land holders.	
Buildings and Fixed Plant	
Before demolition, the infrastructure should be evaluated in terms of the presence of hazardous substances (e.g. asbestos, radiation devices and sources) and appropriate management strategies developed to protect employees, the public and minimise potential environmental harm. This includes the identification of the various waste streams and development of management strategies in accordance with the appropriate waste legislation.	
All buildings, fixed plant and other infrastructure that are not required as part of the final land use will be demolished and removed. Demolition will be carried out in accordance with the relevant Australian Standard.	
Remaining structures will be surveyed and recorded on a plan, with a suitable caveat developed to provide that they are readily identifiable for future land holders.	
Buildings and Fixed Plant to be Retained	
Where infrastructure is approved to remain as part of the final land use, a structural assessment should be prepared by a suitably qualified person to: • determine the structural integrity of the structure. • identify the associated short and long-term risks to public safety and the environment from the infrastructure remaining in situ, which should identify potential modes of failure. Based on assessment, identify and implement controls to address any potential residual risks and modes of failure.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Active Mining (Production) (Cont'd)	
Equipment Storage Areas, Hardstand Areas, Roadways, Sealed and Unsealed Roads and Car Parks	
Any redundant plant or equipment will either be sold for reuse, recycled (e.g. scrap metal) or disposed of at an authorised landfill facility.	
Removal of ore spillages and hazardous materials.	
Storage areas and hardstands will be assessed for potential contamination (e.g. hydrocarbons, salt accumulation) and remediation undertaken as required.	
Waste material (e.g. bitumen, concrete, ore) generated as part of the removal of car parks and hardstands is to be managed in accordance with relevant guidelines under the *Protection of the Environment Operations Act 1991*. The relevant guidelines can be found on the Environment Protection Authority's website. Where authorised to dispose of on the site, waste material must be buried at depth or suitably capped to ensure that it does not compromise the final land use.	
Management of Contaminated Material	
Any contaminated material should be managed in accordance with relevant guidelines under the *Contaminated Land Management Act 1997*. Records will need to be retained to validate that contamination has been remediated or managed effectively to meet the final land use rehabilitation objectives and rehabilitation completion criteria.	
Hazardous Materials Management	
All remaining hydrocarbons such as diesel and lubricants and other hazardous materials will be either used or discarded by an authorised waste contractor.	
Removal of any oily water treatment system, following the demolition of the workshop and associated facilities.	
Removal of sewage treatments systems and associated sewerage network.	
Storage tanks of hazardous materials will be removed and, depending on their condition, either sold or disposed at an authorised facility.	
Specific consideration should be given to managing asbestos materials, radiation devices, hydrocarbon as well as other contaminated substances/materials/soils in accordance with relevant guidelines that can be found on the Environment Protection Authority's website.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Active Mining (Production) (Cont'd)	
At the Completion of Exploration Activity	
Remove and lawfully dispose of all grid pegs, tags, sample bags, flagging tape, drill chips and other waste.	
Remove all drill core.	
Survey, seal and rehabilitate all boreholes.	
Remove and lawfully dispose of all plant and equipment (including surface pipelines) and imported fill material.	
Removal of concrete and footings.	
Undertake a visual contamination assessment where potential pollution generation activities have occurred (e.g. hazardous substance storage, saline water storage) to identify potential signs of contamination. Where contamination is present, develop and implement a contamination remediation program to ensure that the rehabilitation objectives and rehabilitation completion criteria for the intended post-exploration land use are met.	
Phase: Landform Establishment	
Emplacement Areas	
The geotechnical stability of the emplacement areas during construction must be understood and a strategy implemented to ensure: • location of emplacement areas are clearly defined. • emplacement dimensions (e.g. height – RL) are consistent with those approved by the development consent. • consideration is given to geotechnical stability during placement, including methods to promote compaction/consolidation during construction. • consideration is given to material selection and treatment (e.g. handling low strength or dispersive/sodic soils). • material handling field practices are in accordance with defined management practices – location, dump process, lift heights, compaction/consolidation treatment.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Landform Establishment (Cont'd)	
Emplacement Areas (Cont'd)	
The emplacement capping strategy should ensure that the capping material type, source and quantity has been identified and assessed as suitable for the final land use (e.g. does not become a source of contamination). Methods to quarantine adequate quantities of capping material should be specified and implemented.	
Landform Design/Shape	
The final landform design should build on the minimum requirements of the development consent and, wherever practicable, take into account the following: • a landform that is commensurate with surrounding natural landform and, where appropriate, incorporates geomorphic design principles. • appropriate use of landform design stability principles of reduced slope length and surface water management structures. • use of erosion models to optimise the landform design and to show where high-risk erosion areas are likely to occur (and to nominate how risk controls will be incorporated into the final landform design to appropriately treat these risks).	
• use of erosion modelling and/or hydrological projections to demonstrate the long-term competency of the capping of problematic material emplacement (e.g. acid mine drainage waste rock emplacements). • use of appropriate parameter model inputs – preferably field parameter data collected from the materials to be used in rehabilitation. • potential for settlement and how this will be accounted for in the design (especially differential settlement). • long-term stability of voids/pit walls and steep slopes, including determination of engineering treatments required for walls/ steep slopes.	
Develop specific strategies (e.g. selective handling and placement) for materials management to address potential geochemical constraints for rehabilitation (e.g. spontaneous combustion) based on sampling and testing of overburden/interburden materials used to construct the final landform.	
Develop specific strategies (e.g. selective handling and placement) to address any potential geotechnical issues associated with the final landform, including seepage pathways into groundwater and surface waters, for example saline seepage. Based on risk, these strategies may need to be developed in consideration of geotechnical studies.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Landform Establishment (Cont'd)	
Water Management Infrastructure	
Depending on the final land use, issues that should be addressed as part of the post-extraction water management system may include: • removal of excess sediment (e.g. saline sediment) from the surface dams for future use by the subsequent land owner or alternatively filling or removing the dams if they are no longer required. • the installation of appropriate sediment and erosion control measures. • water within final voids is appropriately licensed in perpetuity (e.g. under the *Water Management Act 2000*).	
Sediment material extracted from surface dams should be analysed to determine the potential for contamination and, if present, must be appropriately managed as identified above (refer to *Management of carbonaceous/contaminated material* above).	
Construction of Creek/Diversion Works	
Where practicable, similar characteristics and natural features as evident in upstream and downstream sections should be incorporated into the design of a creek or river that is to be constructed or re-established (e.g. pool and riffle sequences, low flow channels, high flow channels, log jams). This should be based on detailed geomorphological and hydraulic modelling to determine whether these key features can be adapted to the materials as well as water flows associated with creek restoration/re-establishment/ diversions works.	
Where engineering structures are required (e.g. drop structures, rock armoured banks, rock groins), they are to be designed and constructed in consideration of hydraulic assessments to ensure the long-term integrity and sustainability of the creek. These structures should also be designed to ensure that fish passage has not been compromised as part of the creek/river diversion works, and that fish passage is incorporated into the final landform (Policy and guidelines for fish habitat conservation and management, NSW Department of Primary Industries (Update 2013)).	
The final stabilisation and revegetation strategy associated with creek remediation/ rehabilitation works should be designed and implemented based on the outcomes of the above assessments as well as ecological assessments. Refer to Policy and guidelines for fish habitat conservation and management, NSW Department of Primary Industries, (Update 2013).	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Landform Establishment (Cont'd)	
As-Constructed Drawings	
Prepare 'as-constructed' drawings to verify that drainage and landform have been completed in accordance with design before 'growth medium development' phase.	
Phase: Growth Medium Development	
Before Commencing Rehabilitation (substrate preparation)	
Develop rehabilitation methodologies in consideration of site-specific constraints (e.g. topsoil and subsoil availability and quality, presence of contamination) required to achieve the approved, or if not yet approved, proposed rehabilitation objectives and rehabilitation completion criteria.	
Where revegetation is required, analyse representative samples to characterise the nature of the substrate (e.g. sodicity, acid-generating potential, particle size distribution, nutrient levels for planting) and determine any potential limitations to rehabilitation and sustainable plant growth. Immediately prior to application, collect and analyse samples of topsoil stockpiles to characterise material to determine any potential impacts to vegetation (e.g. sodicity, limited microbial activity, nutrients, organic matter).	
Use the results to determine specific amelioration techniques (e.g. addition of gypsum, lime, organic matter, fertiliser) that will be used to overcome potential limitations to landform stability, vegetation establishment and growth. Apply ameliorants (e.g. gypsum or lime) and organic material (e.g. mulch) based on the outcomes of the substrate characterisation analysis (as appropriate to address limitations in the revegetation substrate). Before revegetation activities, analyse the prepared substrate to determine whether amelioration measures have been successful.	
Implement suitable erosion control measures (e.g. catch drains, sediments dams, silt fences, mulches, cover crops) to minimise soil loss from areas undergoing rehabilitation.	
Preferentially schedule and undertake revegetation activities in or just before suitable seasonal conditions.	
Where permissible, should revegetation be delayed due to unsuitable seasonal conditions, undertake temporary stabilisation measures (e.g. sterile cover crops, erosion and sediment controls) to avoid erosion and further land degradation.	
Return topsoil and subsoil layers in sequential order, assuming suitability of material for the final land use.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Growth Medium Development (Cont'd)	
During Rehabilitation (general methodologies)	
Use appropriate earthmoving equipment to avoid compacting the rehabilitation substrate.	
Restore soil structure by scarifying or ripping (if soil compaction or erosion has occurred) in parallel with the contour. Apply soil ameliorants (where required) such as fertiliser to the substrate before the start of revegetation activities.	
Implement erosion and sediment controls in accordance with *Managing Urban Stormwater: Soils and Construction Volume 2E, Mines and Quarries* (DECC 2008b).	
Where direct seeding is planned, rip final surfaces parallel with the contour before the application of seed to provide for an adequate seed bed.	
Where access tracks are to be removed (e.g. not to be left as part of the final land use as defined by rehabilitation objectives and rehabilitation completion criteria), remove imported fill material (where used) and reprofile the disturbance area to the pre-existing landform.	
Topsoil shortages are to be supplemented with suitable alternatives such as biosolids, organic growth medium or another substitute, if required. However, the risk of introducing hazards to the establishment of the preferred plant community type (e.g. non-native species, elevated nutrient levels through the application of soil ameliorants) should be evaluated.	
Identify key habitat requirements for key fauna species.	
Use structures such as tree hollows, logs and other woody debris, rock material to augment the target habitat value of native rehabilitation (if appropriate, in consideration of bushfire risks).	
Phase: Ecosystem and Land Use Establishment	
During Rehabilitation (revegetation – native ecosystem)	
Native revegetation activities in rehabilitation areas should preferentially use local provenance seed for direct seeding or tube stock propagation.	
Use of seed orchards or onsite nurseries should be considered to ensure an appropriate stock is maintained for rehabilitation works.	
Consider techniques such as brush-matting where disturbed areas are situated directly adjacent to mature native ecosystems/area of clearing associated with mining that provide a good source of local seed, to stabilise the site while natural recruitment occurs.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Ecosystem and Land Use Establishment (Cont'd)	
During Rehabilitation (revegetation – native ecosystem) (Cont'd)	
Where adverse seasonal conditions (e.g. drought) or other factors affect the availability of local provenance seed and supplementary non-local provenance seed is required, seed stock should be purchased from reputable suppliers with quality control processes including seed viability testing. (It is good practice to record the name of the supplier and batch of seed being applied. Recording such details may assist in prevention/management of misidentified seeds).	
If revegetation is delayed due to unsuitable seasonal conditions, undertake temporary stabilisation measures (e.g. sterile cover crops, erosion and sediment controls) to avoid erosion and further land degradation.	
Undertake treatment of seed in terms to address issues such as seed dormancy and insect predation. Timing of treatment is to be aligned to timing of application with a focus on reducing the storage time of treated seed.	
Confirm the availability of seed and plant material and amend the seed mix or schedule of revegetation based on material supply.	
Spread seed as soon as possible following ripping/scarifying. If seeding is delayed following ripping/scarifying, undertake an assessment to determine whether further re-ripping/tilling is required before applying seed to ensure sufficient surface roughness (e.g. to break up any crusting that may have resulted from rainfall events).	
Develop a bushfire management plan (having regard to relevant ecological considerations and species fire tolerance) in consultation with NSW Rural Fire Service. Bushfire considerations should be factored into rehabilitation design (e.g. access tracks).	
Revegetation mix to capture species of all strata aligned to the plant community type. (If foundation species are being used, ensure that they do not compromise the attainment of the targeted plant community types).	
Use appropriate earthmoving equipment to avoid compacting the rehabilitation substrate.	
Weed/pathogen control on equipment for sensitive sites to prevent the spread of pathogens.	
Rehabilitation can include direct seeding and/or tube stock planting. Seed germination and seeding/seedling rate records are to be retained so that future rates can be assessed to ensure that target densities are achieved.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Ecosystem and Land Use Establishment (Cont'd)	
During Rehabilitation (revegetation – native ecosystem) (Cont'd)	
Maximise the number of target species (groundcover, mid-story and canopy) within the first round of revegetation activities to facilitate species richness. If the target plant community type requires a staged seeding approach to achieve the species mix, underrepresented species may be prioritised in subsequent revegetation rounds.	
Stock control fencing should be erected where required to protect ecological rehabilitation areas.	
Rehabilitation Establishment Inspections	
Conduct an initial establishment inspection no later than three months following the completion of each rehabilitation campaign to determine whether performance issues have occurred or are emerging, which have the potential to delay revegetation establishment.	
Conduct regular site inspections (e.g. at least quarterly) to assess soil conditions and erosion, drainage and sediment control structures, runoff water quality, revegetation germination rates, plant health and weed infestation, until vegetation has become well established and the site can be considered stable.	
Where possible, use drones or LiDAR to conduct additional inspections and analysis of developing rehabilitation.	
Record outcomes of inspections and implement any required intervention/adaptive management actions as soon as practicable after a monitoring program indicates that rehabilitation performance is unsatisfactory as part of the rehabilitation management and maintenance program.	
Rehabilitation Monitoring Programs	
Implement long-term rehabilitation monitoring program and evaluate trajectory of rehabilitation against achieving rehabilitation objectives and rehabilitation completion criteria.	
Broadly, the scope of the ecosystem rehabilitation monitoring program will be required to include indicators that measure site condition, vegetation composition and vegetation structure and ecosystem function. The range of indices should directly relate to the rehabilitation objectives and rehabilitation completion criteria identified for the specific ecological outcome.	
While the program should be designed to be comparable between monitoring periods, the program will also need to be flexible to enable incorporating evolving best practice in monitoring techniques.	
Include the monitoring and control of changes to surface and groundwater quality over time.	
The scope of the monitoring program should usually include photographic monitoring from fixed points.	

Table A (Cont'd)
Rehabilitation Risk Control Checklist

Rehabilitation Phase / Activity	Comment / Completion Date(s)
Phase: Ecosystem and Land Use Establishment (Cont'd)	
Rehabilitation Management and Maintenance Program	
Develop and implement a rehabilitation management and maintenance program based on the needs identified in the rehabilitation monitoring program. Examples of what this program may include are as follows: • weed and feral animal control. • erosion and drainage control works. • monitoring and control of changes to surface and groundwater quality over time. • reseeding/planting of failed rehabilitation areas (e.g. through lack of germination, high plant mortality rate). • repairing fence lines, access tracks and other general related land management activities. • regular site inspections to assess rehabilitation performance. The objective of this program is to facilitate rehabilitation progressing towards achieving the rehabilitation objectives and rehabilitation completion criteria in accordance with an approved progressive rehabilitation schedule (forward program).	
Phase: Ecosystem and Land Use Development (Management of Rehabilitated Lands)	
During Rehabilitation (revegetation – native ecosystem)	
Continue rehabilitation management and maintenance program (refer to Ecosystem Establishment Phase) until rehabilitation can be demonstrated to have achieved the approved rehabilitation objectives, rehabilitation completion criteria and (for large mines) the final landform and rehabilitation plan.	
Continue rehabilitation monitoring programs (refer to Ecosystem Establishment Phase) until rehabilitation can be demonstrated to have achieved the approved rehabilitation objectives, rehabilitation completion criteria and (for large mines) the final landform and rehabilitation plan.	
Actively manage rehabilitated lands to achieve the approved final land use(s).	