Planning Services
Resource Assessments
Contact: Colin Phillips
Phone: (02) 9274 6483

Greg Dressler
Quarry Manager
Karuah East Quarry Pty Ltd
PO Box 23
Karuah, NSW, 2324

01/06/2020

Dear Mr Dressler

Karuah East Quarry Project (MP09_0175)
Landscape and Rehabilitation Management Plan

I refer to the Landscape and Rehabilitation Management Plan which was submitted in accordance with Condition 32 of Schedule 3 of the approval for the Karuah East Quarry Project (MP09_0175).

The Department has carefully reviewed the document and is satisfied that it addresses the requirements of condition 32 of Schedule 3 of the planning approval.

Accordingly, the Planning Secretary has approved the *Landscape and Rehabilitation Management Plan* (Revision 4, dated 2 March 2020). Please ensure that the approved plan is placed on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Colin Phillips on 02 9274 6483.

Yours sincerely

Matthew Sprott
Director
Resource Assessments (Coal & Quarries)
as nominee of the Planning Secretary

KARUAH EAST MANAGEMENT PLANS

Landscape and Rehabilitation Management Plan

Prepared for:

Karuah East Quarry Pty Ltd
PO Box 284
THORNTON NSW 2322

SLR Ref: 630.11235-R01
Version No: -v1.0
March 2020

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Karuah East Quarry Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
Revision 4	2 March 2020	Joel Fleming (Karuah East)	Chris Jones (SLR)	Chris Jones
Revision 3 (Response to Hunter Quarries Review)	7 February 2020	Sam McDonald (SLR)	Chris Jones (SLR)	Chris Jones
Revision 2 (Response to DPIE Comments)	July 2019	Sam McDonald (SLR)	Chris Jones (SLR)	Chris Jones
Revision 2	4 June 2019	Sam McDonald (SLR)	Chris Jones (SLR)	Greg Dressler

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Karuah East Quarry Pty Ltd (Karuah East) to prepare a *Landscape and Rehabilitation Management Plan* (this plan) to satisfy the requirements of the Project Approval (PA 09_0175) granted on 17 June 2014 for the Karuah East Quarry Project (the Project). Ecological consultants, Kleinfelder have completed sections relating to landscape and biodiversity management including **Sections 4.3, 5.1, 6** and **12**.

The *Landscape and Rehabilitation Management Plan* has been prepared with reference to the following documents:

- *Environmental Assessment Report – Proposed Karuah East Hard Rock Quarry* prepared by ADW Johnson Pty Ltd dated 31 January 2013 (hereafter referred to as the EA);
- *Preferred Project Report – Proposed Karuah East Quarry* prepared by ADW Johnson Pty Ltd dated 30 July 2013 (hereafter referred to as the PPR);
- *Proposed Karuah East Quarry Project, Pacify Highway, Karuah – Life of Project, Quarry Closure and Rehabilitation Plan* prepared by SLR dated November 2012;
- Karuah East Quarry Environmental Assessment Section 57W Application (MOD 1) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area prepared by ADW Johnson Pty Ltd dated January 2018) (hereafter referred to as MOD 1);
- Karuah East Quarry Environmental Assessment Section 57W Application (MOD 2) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area prepared by ADW Johnson Pty Ltd dated August 2018) (hereafter referred to as MOD 2);
- Karuah East Quarry Response to Submissions Section 75W Application (MOD 1) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area prepared by ADW Johnson Pty Ltd dated March 2018 (hereafter referred to as MOD 1 RTS);
- Karuah East Quarry Response to Submissions Section 75W Application (MOD 2) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area prepared by ADW Johnson Pty Ltd dated October 2018 (hereafter referred to as MOD 2 RTS);
- *Terrestrial Ecology Survey and Assessment Report – Karuah East Quarry* prepared by RPS Australia East Pty Ltd dated July 2013;
- *Biodiversity Offset Strategy – Karuah East Quarry* prepared by Eco Logical Australia Pty Ltd dated July 2013;
- *EPBC Act Assessment Report – Karuah East Quarry – EPBC 2014/7282* prepared by Eco Logical Australia Pty Ltd dated October 2014;
- *Biodiversity Offset Area Management Plan – Karuah East Quarry* prepared by Kleinfelder Australia dated July 2018;
- *Humane pest animal control: Codes of Practice*. Department of Primary Industries (2014). (Website: http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests);
- EPBC Act Approval 2014/7282;
- Project Approval 09_0175;
- Project Approval 09_0175 MOD1;
- Project Approval 09_0175 MOD2; and

- Environment Protection Licence (EPL) 20611.

1.1 Definitions

The following terms are referred to throughout this plan to describe particular geographic areas:

- Project Approval Area (or Project Area) – refers to the entirety of Lots 12 and 13 DP 1024564, and the road extension within Lots 16 and 17 DP 1024564 (see **Figure 1**);
- Project Disturbance Area – refers to the areas within the Project Approval Area that will be directly impacted by the project, including part Lots 12 and 13 DP 1024564 (see **Figure 1**); and
- Biodiversity Offset Area – refers to the areas of vegetation to be retained on part Lot 13 DP 1024564, and the entirety of Lot 14 DP 1024564 and Lot 5 DP 838128 which adjoin the eastern boundary of the Project Disturbance Area (see *Biodiversity Offset Area Management Plan* for further details (Kleinfelder, 2015).

1.2 Consultation for this Management Plan

A copy of the *Landscape and Rehabilitation Management Plan* was provided to Mid - Coast Council and the Office of Environment and Heritage (OEH) for comment on 15 September 2015. The OEH responded to Karuah East in a letter dated 23 September 2015, but they did not have any comments relating to the *Landscape and Rehabilitation Management Plan* with all comments relating to the management of the offset area and *Tetratheca juncea*. A copy of the OEH response letter is attached as **Appendix A1**.

Mathew Bell from Mid - Coast Council provided comments to Karuah East on 1 October 2015 regarding the *Landscape and Rehabilitation Management Plan*. The response is outlined in **Table 1** below:

Table 1 Comments from Mid – Coast Council

Comment from Mid-Coast Council	Response from Karuah East
We are satisfied that the LRMP is suitably adequate and deals with the key issues associated with pre-clearing, clearing, weed and pest management and progressive and final rehabilitation. These are all significant site issues. *We are particularly satisfied that critical site resources such as hollow logs, hollow limbs, mulch from clearing, topsoil, etc, from approved clearing areas are proposed to be utilised as habitat furniture and site stabilisation and rehabilitation.*	Karuah East will report on the implementation of the management plan in the Annual Review.
The LRMP does not deal with how the final rehabilitated landform would be secured (that is, that the restoration achieved would be consolidated in the long-term). Perhaps a s88B instrument or Conservation Agreement is required to ensure that the progressive and closure rehabilitation outcomes are secured.	Further details regarding conservation agreements and post quarrying management will be outlined in future updates to the Landscape and Rehabilitation Management Plan.

Comment from Mid-Coast Council	Response from Karuah East
Further, there is no calculation of the quantum of a conservation bond to ensure that the rehabilitation is achieved in the event that the current or future registered proprietor fails to deliver on the outcomes. An adequate conservation bond is imperative to ensuring a suitable outcome. We understand that there is a separate process for the determination of this bond.	The Karuah East rehabilitation bond (Schedule 3 Condition 34) is required to be submitted to the DPIE within six months of approval of this Plan. Initial calculations have been completed and the bond will be sent to the DPIE prior to this timeframe.
Obviously, the Plan is only as good as its implementation. We would appreciate being provided copies of any implementation reports for progressive landscaping and rehabilitation of this landform.	Karuah East will report on the implementation of the management plan in the Annual Review.

A full copy of this response from Mid - Coast Council is attached as **Appendix A2**.

The *Landscape and Rehabilitation Management Plan* was submitted to the DPIE for review on 16 October 2015. The Plan has been updated to incorporate all comments received. The DPIE's review is attached as **Appendix A3**.

No further consultation was completed for the November 2017 update (See **Section 1.3** for details).

MOD 1

The CCC Consultative Committee was briefed on Mod 1 during meetings on the 14 August 2017 and the 4 December 2017.

The DPIE were consulted on a range of matters associated with MOD 1 following lodgement on 12 July 2017. For further details on matters discussed refer to Table 1 in MOD 1 EA (ADW, 2018).

The MOD 1 Response to Submissions (ADW, 2018a) addressed feedback from the following agencies:

- Office of Environment and Heritage;
- Environment Protection Authority;
- NSW Department of Industry (Resources and Energy);
- NSW Department of Industry (Water); and
- Port Stephens Council.

MOD 2

The CCC Consultative Committee was briefed on Mod 2 during meetings on the 5 March 2018 and the 3 September 2018.

The DPIE were consulted on a range of matters associated with MOD 2 following lodgement on 28 February 2018. For further details on matters discussed refer to Table 1 in the MOD 2 EA (ADW, 2018).

The MOD 2 Response to Submissions (ADW, 2018b) addressed feedback from the following agencies:

- Office of Environment and Heritage;

- Environment Protection Authority;
- NSW Department of Planning and Environment (Resources & Geoscience);
- NSW Roads and Maritime Services; and
- Port Stephens Council.

1.3 Management Plan History

A history of the management plan reviews is outlined below in **Table 2**:

Table 2 Management Plan History

Document Status	Date	Comment
Revision 4	March 2020	This document was updated to include estimates of topsoil and subsoil available at Karuah East for transportation to Karuah Quarry for rehabilitation.
Revision 3	January 2020	This document was updated with details on transporting overburden and soil material to Karuah Quarry for use in assisting with the Karuah Quarry Final Landform.
Revision 2	July 2019	The document has also been updated to include responses to the May 2019 DPIE revisions which included: amending the definition of 'extractive industries', addition of wording around commitments to fulfilling rehabilitation of the final void to the satisfaction of the Planning secretary and updating dates throughout the document.
	May 2019	This document has been updated to include Modification 2 (MOD 2) Environmental Assessment (ADW August 2018) and MOD 2 RTS (ADW October 2018) information. Update to site figures to illustrate minor changes to layout.

Document Status	Date	Comment
Revision 1	October 2018 – January 2019	Document updated based on the requirement of the Independent Environmental Audit (EMM 2017). Updates included: Review of status of Karuah East – construction almost complete with air quality monitoring system operating; and Update to site figures to illustrate minor changes to layout. The document has also been updated to include some details from Modification 1 (MOD 1) Environmental Assessment (ADW January 2018) and MOD 1 RTS (ADW March 2018).
Revision 0	12 November 2015	Document prepared and submitted to the DPIE.

2 Statutory Requirement and Guidelines for Rehabilitation and Landscape Management

2.1 Project Approval Requirements

Requirements of the *Landscape and Rehabilitation Management Plan* are provided in Schedule 3, Condition 32, and Schedule 5, Condition 3 of PA 09_0175 (see **Table 3**).

Table 3 Project Approval (PA 09_0175) Requirements

<table>
<tr><th>Condition</th><th>Requirement</th><th>Relevant Section</th></tr>
<tr><td colspan="3">Schedule 3 – Environmental Performance Conditions</td></tr>
<tr><td>Schedule 3
Condition 30

Rehabilitation Objectives</td><td>The proponent must rehabilitate the site to the satisfaction of the Planning Secretary. This rehabilitation must:
a) Be generally consistent with the rehabilitation strategy as described in the EA and shown conceptually in Figure 1 in Appendix 5; and
b) Comply with the objectives in Table 11.
Table 11: Rehabilitation Objectives
<table><tr><th>Feature</th><th>Objective</th></tr><tr><td>Site (as a whole)</td><td>Safe, stable & non-polluting.</td></tr><tr><td>Surface Infrastructure</td><td>To be decommissioned and removed, unless the Secretary agrees otherwise.</td></tr><tr><td>Quarry Wall Benches</td><td>Landscaped and revegetated utilising native tree and understorey species, ensuring that the tree canopy is restored and integrated with the surrounding tree canopy.</td></tr><tr><td>Quarry Pit Floor</td><td>Landscaped and revegetated with wetland vegetation.</td></tr><tr><td>Other land affected by the project</td><td>Restore ecosystem function, including maintaining or establishing self-sustaining eco-systems comprised of:
• native endemic species; and
• a landform consistent with the surrounding environment.</td></tr><tr><td>Community</td><td>Ensure public safety.
Minimise the adverse socio-economic effects associated with quarry closure.</td></tr></table></td><td>Section 5.</td></tr>
<tr><td>Schedule 3
Condition 31
Progressive Rehabilitation</td><td>The Proponent must:
(a) rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance;
(b) take all reasonable and feasible measures to minimise the total area of the site exposed at any time; and
(c) implement interim rehabilitation strategies where areas prone to dust generation cannot yet be permanently rehabilitated.</td><td>Section 9.2.</td></tr>
<tr><td rowspan="3">Schedule 3
Condition 32

Landscape and Rehabilitation Management Plan</td><td>Within 6 months of the date of approval of Modification 1, the Proponent must prepare and implement a Landscape and Rehabilitation Management Plan for the project to the satisfaction of the Planning Secretary. This Plan would relate to the area of the quarry and all perimeter lands. This plan must:
(a) be prepared by a suitably qualified expert whose appointment has been approved by the Planning Secretary;</td><td>Letter from DPIE approving SLR and Kleinfelder on 22/7/2015.</td></tr>
<tr><td>(b) be prepared in consultation with OEH and Council, and submitted to the Planning Secretary for approval prior to the commencement of construction activities;</td><td>Section 1.2.</td></tr>
<tr><td>(c) describe how the implementation of the Tetratheca juncea Translocation Program would be integrated with the overall rehabilitation of the site;</td><td>Section 6.2.5.</td></tr>
</table>

Condition	Requirement	Relevant Section
		Also see Tetratheca juncea Translocation Plan.
	(d) describe the short, medium and long-term measures that would be implemented to: • manage remnant vegetation and habitat of the site; and • ensure compliance with the rehabilitation objectives and progressive rehabilitation obligations of this approval.	**Section 5.** **Section 6-9.**
	(e) include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, including triggers for any remedial action;	**Section 13.** **Section 15**
	(f) include a detailed description of the measures that would be implemented over the next 3 years (to be updated for each 3 year period following initial preparation of the plan), including the procedures to be implemented for: • Ensuring compliance with the rehabilitation objectives and progressive rehabilitation obligations of this approval; • Enhancing the quality of remnant vegetation and fauna habitat; • Restoring native endemic vegetation and fauna habitat within the rehabilitation area, including details of the target revegetation communities of the rehabilitated landform; • Coordinating the relocation of native fauna to protected habitats associated with pre-clearing fauna surveys; • Maximising the salvage of environmental resources within the approved disturbance area – including tree hollows, vegetative and soil resources - For beneficial reuse in the enhancement of the rehabilitation area; • Collecting and propagating seed; • Ensuring minimal environmental consequences for threatened species, populations and habitats; • Minimising the impacts on native fauna on site, including the details and implementation of appropriate pre-clearance surveys; • Minimising the impacts on fauna movement between undisturbed areas of the site and nearby vegetation (including potential fauna crossings); • Controlling weeds and feral pests; • Controlling erosion • Controlling access and providing for management trails; and • Bushfire management and implementation of ecologically appropriate bushfire intervals.	**Section 6 -9**

Condition	Requirement	Relevant Section
	(g) include a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;	**Section 12.**
	(h) identify the potential risks to successful implementation of the Tetratheca juncea Translocation Program and rehabilitation of the site, and include a description of the contingency measures that would be implemented to mitigate these risks;	**Section 6.2.5.** Also see Tetratheca juncea Translocation Plan. See Appendix 4 for Contingency Plan.
	(i) include details as to how the rehabilitated land would be permanently conserved and managed as part of the broader Biodiversity Offset Area approved in these conditions	**Section 6.5** Also see Biodiversity Offset Area Management Plan.
	(j) include details of who would be responsible for monitoring, reviewing, and implementing the plan; and	**Section 17.**
	(k) include details as to the timing of actions set-out in plan The Proponent must implement the plan as approved by the Secretary.	**Section 16.**
Schedule 3 Condition 34 Conservation & Rehabilitation Bond	The Proponent must lodge a Conservation and Rehabilitation Bond with the DPIE within 6 months of the approval of the Landscape and Rehabilitation Management Plan, to ensure that the Biodiversity Offset Strategy and the rehabilitation of the site is implemented in accordance with the performance and completion criteria set out in the Landscape and Rehabilitation Management Plan. The sum of the bond must be determined by: (a) Calculating the cost of implementing the Biodiversity Offset Strategy over the next 3 years; (b) Calculating the cost of rehabilitation disturbed areas of the site, taking into account the likely surface disturbance over the next 3 years of quarrying operations; and (c) Employing a suitably qualified quantity surveyor or other expert to verify the calculated costs, to the satisfaction of the Planning Secretary. Notes: • If capital and other expenditure required by the Landscape and Rehabilitation Management Plan is largely complete, the Planning Secretary may waive the requirement for the lodgment of a bond in respect of the remaining expenditure. • If the Biodiversity Offset Strategy and rehabilitation of the site area are completed to the satisfaction of the Planning Secretary, then the Secretary will release the bond. If the Biodiversity Offset Strategy and rehabilitation of the site are not completed to the satisfaction of the Secretary, then the Planning Secretary will call in all or part of the bond, and arrange for the completion of the relevant site works.	Bond is outlined in **Section 13.**

Condition	Requirement	Relevant Section
	The component of the bond relating to the implementation of the Biodiversity Offset Strategy will be waived, if a separate arrangement is entered between the Proponent and OEH which satisfactorily replaces that component, to the satisfaction of the Planning Secretary.	
Schedule 5 – Environmental Management, Reporting and Auditing		
Management Plan Requirements		
3	The Proponent must ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include:	Whole of document
3(a)	Detailed baseline data	**Section 4.**
3(b)	A description of: • The relevant statutory requirements (including any relevant approval, licence or lease conditions); • Any relevant limits or performance measures/criteria; and • The specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	**Section 2.**
3(c)	A description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	**Section 2.**
3(d)	A program to monitor and report on the: • Impacts and environmental performance of the project; and • Effectiveness of any management measures (see (c) above);	**Section 12.**
3(e)	A contingency plan to manage any unpredicted impacts and their consequences;	**Section 15.**
3(f)	A program to investigate and implement ways to improve the environmental performance of the project over time;	**Section 12.3.**
3(g)	A protocol for managing and reporting any: • Incidents; • Complaints; • Non-compliances with statutory requirements; and • Exceedances of the impact assessment criteria and/or performance criteria; and	**Section 12.4** See EMS.
3(h)	A protocol for periodic review of the plan.	**Section 18.**

2.2 Details of MOD 1

ADW Johnson prepared the Environmental Assessment Section 75W Application (MOD 1) to amend Part 3A Project Approval 09_0175 for a Minor Increase to Approved Disturbance Area. This has been known as MOD 1.

The modification was minor in nature and included a nominal expansion to the approved area of disturbance (31.63 hectares) by an additional 2,500m$^{2.}$ This was an increase of less than 1% of the original Project Approval Area. Figures have been updated in all management plans outlining the MOD 1 extension area.

Key environmental aspects were assessed by SLR as part of the specialist report for MOD 1. The additional disturbance area will be utilised for vehicle manoeuvring and will likely reduce internal vehicle movements. An ecological assessment was completed by Kleinfelder as part of MOD 1. There will be no change to clearing practices or general land management within the extension area. At closure this area will be rehabilitated consistent with the rest of the Karuah East site.

MOD 1 was approved by the DPIE in April 2018.

2.3 Details of MOD 2

ADW Johnson prepared an Environmental Assessment Section 75W Application (MOD 2) to amend Part 3A Project Approval 09_0175 for a Minor Increase to Approved Disturbance Area. This has been known as MOD 2.

The modification was minor in nature which amended the Project Approval to expand the area of disturbance of the Karuah East Quarry by 1.133ha. Following detailed design and commencement of operations, it has been identified that the proposed minor extension will allow for increased operational efficiency, improved operational safety and improved environmental management, particularly relevant to surface water management. The MOD 2 area is heavily disturbed and is devoid of any significant vegetation. The area subject to MOD 2 contains a dwelling, an access road to the dwelling and a redundant electricity easement.

Key environmental aspects were assessed by SLR as part of the specialist report for MOD 2. As the extension is only minor, there are no predicted additional dust impacts at Karuah East during the operational phase. There will be no increase to the approved production limit, hence vehicle movements (and associated dust) will be within the maximum predicted as part of the original EA process.

MOD 2 was approved by the DPIE on 19 December 2018.

2.4 Environment Protection Licence Requirements

The Environment Protection Authority (EPA) regulates the operations conducted at the Project site through an Environment Protection Licence (EPL 20611) issued under the *Protection of the Environment Operations Act 1997 (POEO Act).* There are no specific EPL conditions relating to landscape or rehabilitation management.

2.5 Statement of Commitments

Section 11 of the Statement of Commitments refers to quarry closure and rehabilitation and Section 4 of the Statement of Commitments refers to biodiversity and conservation offsets. These aspects have been covered under this plan.

2.6 Key Legislation

2.6.1 Environmental Planning and Assessment Act 1979

The development assessment and approval system for NSW is outlined in Parts 4 and 5 of the *Environmental Planning and Assessment Act 1979 (EP&A Act).* Objectives of the EP&A Act include:

"(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection, provision and co-ordination of communication and utility services,

(iv) the provision of land for public purposes,

(v) the provision and co-ordination of community services and facilities, and

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecological sustainable development ..."

This Plan has been prepared with consideration of the *EP&A Act.*

2.6.2 Protection of the Environment Operations Act 1979

The objectives of the POEO Act are outlined below:

a. to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development,

b. to provide increased opportunities for public involvement and participation in environment protection,

c. to ensure that the community has access to relevant and meaningful information about pollution,

d. to reduce risks to human health and prevent the degradation of the environment by the use of mechanisms that promote the following:

(i) pollution prevention and cleaner production,

(ii) the reduction to harmless levels of the discharge of substances likely to cause harm to the environment,

(iia) the elimination of harmful wastes,

(iii) the reduction in the use of materials and the re-use, recovery or recycling of materials,

(iv) the making of progressive environmental improvements, including the reduction of pollution at source,

(v) the monitoring and reporting of environmental quality on a regular basis,

e. to rationalise, simplify and strengthen the regulatory framework for environment protection,

f. to improve the efficiency of administration of the environment protection legislation,

g. to assist in the achievement of the objectives of the Waste Avoidance and Resource Recovery Act 2001.

2.6.3 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) applies to mining and quarrying related activities. The definition of an "extractive industry" obtained from the Mining SEPP is outlined below:

Extractive industry means the winning or removal of extractive materials (otherwise than from a mine) by methods such as excavating, dredging, or quarrying, including the storing, stockpiling or processing of extractive materials by methods such as recycling, washing, crushing, sawing or separating.

3 Project Description

3.1 Overview

Hunter Quarries currently extract hard andesite material from the existing quarry operation on adjoining lands. Approval was granted for this designated development on the adjoining land (Lot 21 DP 1024341, Lot 11 DP 1024564 and Lot 12 DP 1024564) by the Minister as State Significant Development on 3 June 2005 (DA265/10/2004).

The existing Karuah Quarry currently operates under Development Consent (DA 265/2004) and is approved to extract up to 500,000 tonnes per annum (tpa) of 'andesite' basalt material suitable for use as road base, construction aggregate and concrete batching, among various other applications.

Following exploratory works adjacent to the existing approved quarry, additional resource has been identified to the east on land owned by the Proponent (Project site). On 17 June 2014, the approval (09_0175) was granted by the Planning Assessment Commission on behalf of the Minister for Planning and Environment for the extraction of this additional resource through the development of Karuah East, a stand-alone operation to the existing quarry. Federal Approval (EPBC 2014/7282) was granted for Karuah East under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act 1999) on 20 March 2015.

3.2 Karuah East Project Site

The Project site is located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah NSW.

The approved Project includes the following key elements:

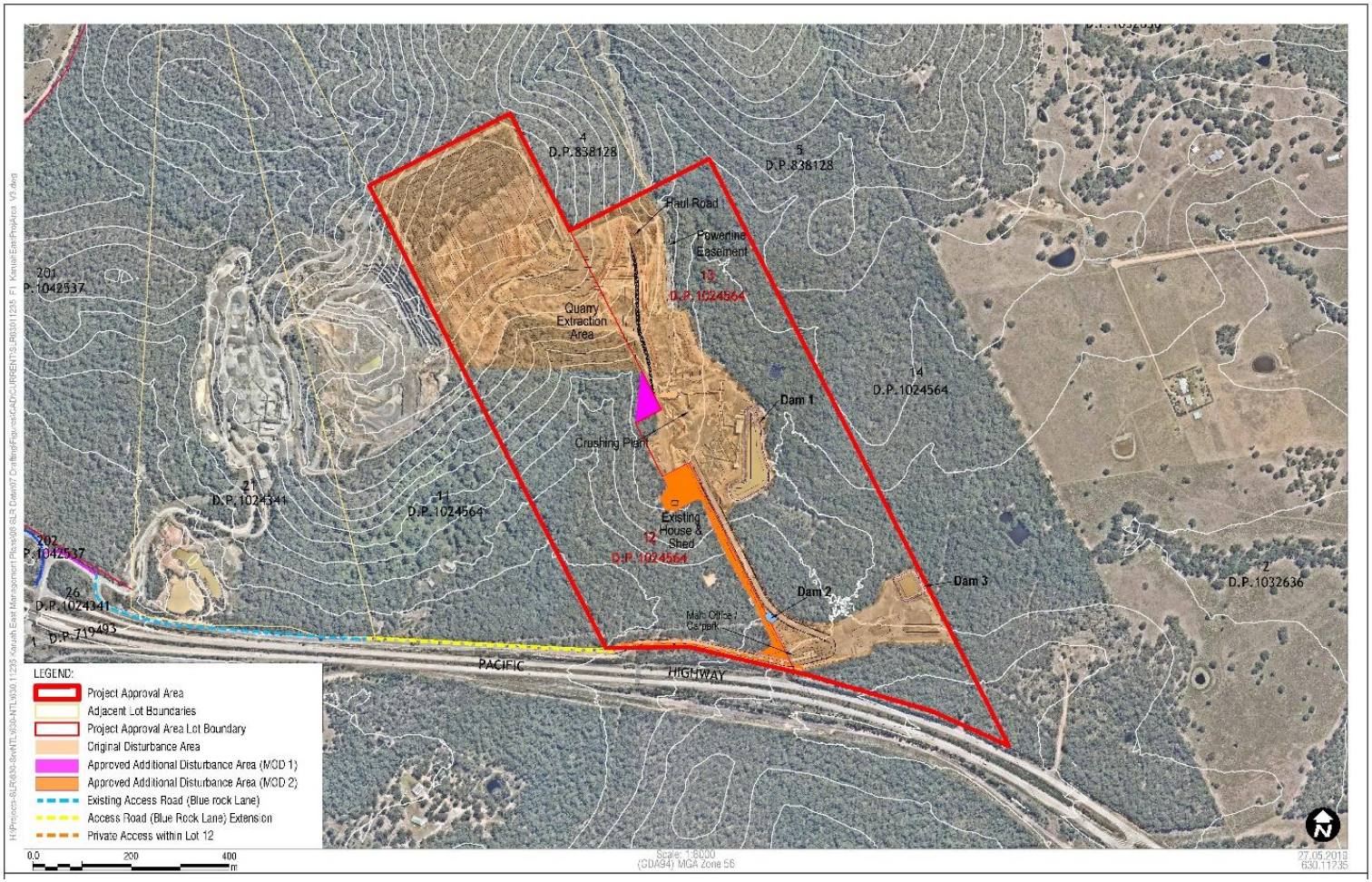
- Staged extraction of approximately 29 million tonnes of "andesite" over a 20 year timeframe;
- Extraction of up to 1.5 million tonnes of andesite material per year;
- Removal and stockpiling of an estimated 380,000 m^3 of overburden (approximately 750,000 tonnes) from the quarry extraction area in accordance with the Rehabilitation Plan prepared for the project. Removal of overburden is not included in the proposed extraction rate of 1.5 million tonnes of andesite annually;
- Haulage of up to 1.5 million tonnes of andesite per year from the site to market by 25 to 30 tonne haul trucks via the Pacific Highway;
- Up to 216 truck loads per day (at maximum production);
- Implementation of water management and erosion and sediment control works to ensure no loss of sediment, dust minimisation and to control discharges from the site to ensure that all discharges are within acceptable volumetric and water quality criteria;
- Employment of 28 on-site staff;
- Construction of new haul road and access through adjoining RMS land;
- Roadworks to secure access to the site including upgrade and extension of Blue Rock Lane, realignment of Andesite Drive and Blue Rock Lane intersection and adjust road markings at Branch Lane & Andesite Road intersection;
- Staged clearing;

- Expansion of approved disturbance area (MOD 1 and 2);
- Drilling and blasting activities;
- Loading and hauling of extracted material;
- Crushing and screening of extracted material;
- Stockpiling of material on-site; and
- Location of plant on Lot 13 comprised of office buildings, workshops, parking areas, crushing plant, wash plant, weigh bridge and product storage areas.

Figure 1 presents the Project site plan and layout.

It should be noted that this Plan does not cover any offsets associated with Karuah East, with these being covered under a separate management plan (Schedule 3 Condition 33 – *Biodiversity Offset Area Management Plan*).

Figure 1 Karuah East Quarry Site Plan (MOD 2 Extension Area in Orange) (SLR 2019)



3.3 Operating Hours

In accordance with Schedule 2, Condition 7 of PA 09_0175, Karuah East will operate during the following hours:

Table 4 Operating Hours

Activity	Operating Hours
Quarrying Operations	7.00 am to 6.00 pm, Monday to Friday; and 7.00 am to 1.00 pm, Saturdays. No quarrying operations on Sundays or Public Holidays
Construction activities	7.00 am to 6.00 pm, Monday to Friday; and 8.00 am to 1.00 pm, Saturdays. Unless noise from the activities does not exceed 35 dB(A)LAeq(15minute) at any privately-owned residence.
Maintenance activities	24 hours a day, 7 days per week, providing maintenance activities are inaudible at any privately-owned residence.

Note: This condition does not apply in the event of a direction from police or other relevant authority for safety or emergency reasons regarding works which may need to be undertaken to avoid loss of life, property loss and/or to prevent environmental harm.

4 Existing Environment

4.1 Land Use

Pre Quarrying Land Use

A description of the relevant land capability classes is provided in **Table 5**.

Table 5 Pre-Quarrying Rural Land Capability Classes

Land Class	Pre-Quarrying	
	ha	%
Class IV	13.2	44
Class VII	16.4	56
Total	**29.6**	**100**

Class IV Land

Class IV land consists of Soil Type 1 and 2 (Brown Chromosol and Red Dermosol) and covers an area of 13.2 ha. This classification indicates that the land is suitable for grazing with only occasional cultivation and is the best class of grazing land. The majority of Class IV land occurs within the proposed infrastructure area.

Class VII Land

Class VII land consists of Soil Type 3 (Leptic Tenosol) and covers an area of 16.4 ha. This land is considered unsuitable for rural production and is best protected by green timber to control erosion. The majority of Class VII land occurs within the proposed quarry extraction area. Constraints associated with these soil types include its slope, heavy subsoil clay content, shallow topsoil depth and susceptibility to erosion.

4.2 Soil

GSS Environmental (GSSE) completed an assessment of soils as part of the Soil Survey and Land Resource Assessment for the Environmental Assessment in July 2011.

The soil landscapes within the Project Area have been mapped by the Land & Water Conservation incorporating the Soil Conservation Service of NSW at the scale of 1:100,000 by Matthei (1995). The soil landscape units described by these publications are “areas of land that have recognisable and specific topographies and soils that can be presented on maps and described by concise statements”. The soil landscape units that occur within the Project Area are as follows:

- North Arm Cove unit is the most common and is present extensively throughout the eastern and central areas of the Project Area;
- Gan Gan unit occurs in the north western area of the Project Area;
- Gan Gan variant A occurs small pocket in the project site north-west, and;
- Nungra unit small pockets in the Project Sites southern area.

The North Arm Cove soil landscape occurs as undulating to rolling rises on Nerong Volcanics in the Karuah Mountains and Medowie Lowlands, east of the Karuah River. Local relief up to 50m and slope gradient of <15%. Common soil occurrences of this landscape include a weakly structured light sandy clay loam, bleached hardsetting sandy clay loam and mottled blocky clay. Limitations include high erosion hazard and seasonal waterlogging on lower slopes.

The Gan Gan soil landscape occurs on the steep hills of the Nerong Volcanics on the Karuah Mountains. Slope gradients >25%, local relief 100-200m, elevation 60 – 260m. Common soil occurrences of this landscape include a stony brownish black weakly pedal sandy loam, bleached stony hardsetting light sandy clay loam, and whole coloured light clay.

Gan Gan variant A is found on lower footslopes and includes imperfectly drained soils that have sharp boundaries between soil materials and a depth of >200cm. Limitations include mass movement associated with steep slopes, shallow soils with rock outcrops and an extreme water erosion hazard.

The Nungra soil landscape occurs on widespread gently inclined footslopes and drainage plains of the Medowie Lowlands and Karuah Mountains physiographic regions. Slope gradient <3%, local relief <10m and elevation to 40m. Common soil occurrences include a greyish yellow brown weakly pedal silty clay loam, bleached hardsetting silty clay loam, greyish yellow brown mottled silty clay. Limitations include localised salinity, water erosion hazard, high run on, seasonal water logging and flood hazards.

4.3 Biodiversity

RPS Australia Pty Ltd (2013) conducted an Ecological Assessment of the proposed Karuah East Quarry Project Approval Area and adjoining lands (including Lots 12, 13 and 14 DP1024564) as part of the Environmental Assessment. Additional ecological surveys were also conducted by Eco Logical Australia (ELA) across Lots 12-14 and Lot 5 DP 838128 (**Figure 2**) to inform the preparation of the Biodiversity Offset Strategy (ELA 2013) and EPBC Act Assessment Report (ELA 2014). The following sections provide a summary of the biodiversity values identified within the Project Disturbance Area, and outline the potential biodiversity impacts of the development to be mitigated by measures detailed in this plan.

4.3.1 Vegetation

A total of three native vegetation communities were recorded and mapped within the Project Disturbance Area (RPS 2013). ELA (2013) identified and mapped five biometric vegetation types in the Biodiversity Offset Area, with this being managed under the *Biodiversity Offset Area Management Plan*. The area (ha) of each vegetation community recorded in the Project Disturbance Area is provided in **Table 6**. A summary of the structure and floristics of each vegetation type is also provided in **Table 6**. The distribution of these vegetation communities is shown in **Figure 2**. None of the vegetation types recorded in the Project Disturbance Area is listed as threatened ecological communities under the NSW *Threatened Species Conservation Act* (TSC Act) 1995 or the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999.

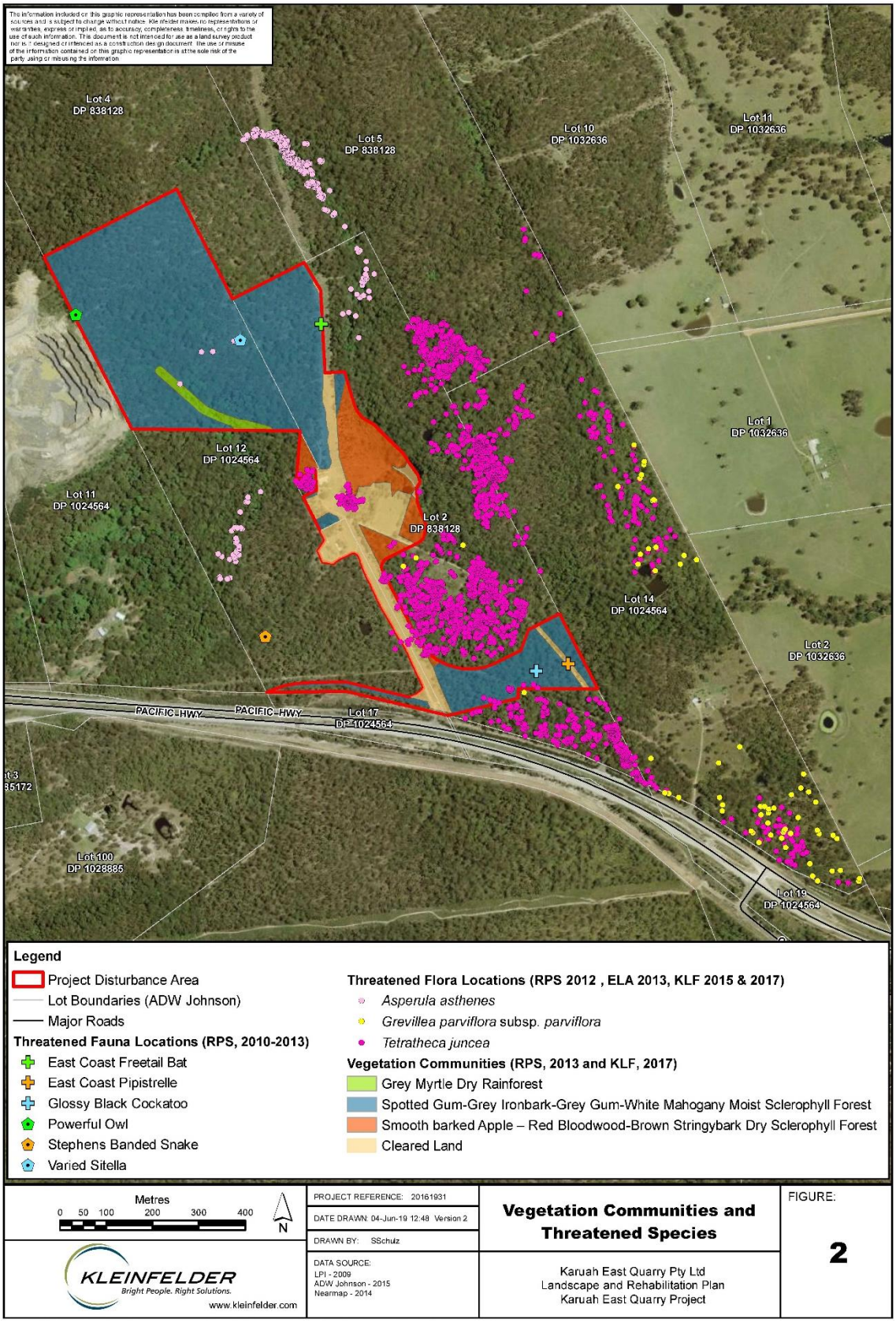
The construction and development of Karuah East Quarry and associated infrastructure would directly impact 33.02 ha of land. Of this, 28.09 ha consists of native vegetation. The biodiversity offset area, which is to be managed under the *Biodiversity Offset Area Management Plan* (Kleinfelder 2018), would protect and enhance at total of 131.44 ha of native vegetation.

Table 6 Vegetation communities within the Project Description Area

Vegetation Community (RPS 2013)	Description (ELA 2013; RPS 2013)	Project Disturbance Area (ha)
Spotted Gum-Grey Ironbark-Grey Gum-White Mahogany Moist Sclerophyll Forest	Remnant open forest, with a distinct sub-canopy and an understorey, scattered shrubs and predominantly native perennial grasses and forbs. **Dominant species** Canopy: *Corymbia maculata* (Spotted Gum), *Eucalyptus paniculata* subsp. *paniculata* (Grey Ironbark), *Eucalyptus propinqua* (Small-fruited Grey Gum) and *Eucalyptus acmenoide*s (White Mahogany). Midstorey: Allocasuarina torulosa (Forest Oak). Groundcover: Imperata cylindrica (Blady Grass) and *Themeda australis* (Kangaroo Grass).	20.38

Vegetation Community (RPS 2013)	Description (ELA 2013; RPS 2013)	Project Disturbance Area (ha)
Smooth barked Apple – Red Bloodwood-Brown Stringybark Dry Sclerophyll Forest	Remnant open forest vegetation with a sparse sub-canopy. A distinct but variable shrub layer was present, sometimes moderately dense. The groundcover layer was generally dominated by native grass species. **Dominant species** Canopy: Angophora costata (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus piperita* (Sydney Peppermint). Midstorey: *Allocasuarina littoralis* (Black She-oak). Groundcover: *Imperata cylindrica* (Blady Grass), *Entolasia stricta* (Wiry Panic) and *Themeda australis* (Kangaroo Grass).	7.56
Grey Myrtle Dry Rainforest	Remnant closed forest with a dense canopy layer and emergents. Contains a sparse shrub layer and groundcover is predominately comprised of ferns, grasses and forbs. **Dominant species** Canopy: *Diospyros australis* (Black Plum), *Cryptocarya microneura* (Murrogun) and *Backhousia myrtifolia* (Grey Myrtle). Midstorey: *Ficus coronata* (Sandpaper Fig) and *Eupomatia laurina* (Bolwarra). Groundcover: *Imperata cylindrica* (Blady Grass) and *Themeda australis* (Kangaroo Grass).	0.40
Cleared land	Highly disturbed, non-native community was recorded in the central portion of the subject site within an existing powerline easement, along vehicle access tracks and a small section of Yalimbah Creek. The community generally comprised a mosaic of exotic grasses and shrubs, 'garden plantings' and bare ground. Some scattered native trees and shrubs occur.	4.68
	Total	33.02

Figure 2 Vegetation Types and Threatened Species Records



4.3.2 Threatened and Migratory Species

A total of three threatened flora species listed as Vulnerable under both the *BC Act* and *EPBC Act* were recorded during surveys of the study area: *Tetratheca juncea* (Black-eyed Susan), *Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes* (Trailing Woodruff). A summary of the population sizes and habitats in which these species occur within the Project Disturbance Area and adjoining lands is provided in **Table 7**. The locations of these threatened flora species are provided in **Figure 2**.

A total of nine threatened fauna species listed as Vulnerable under the BC Act were recorded during surveys of the study area in association with the 2018 Biodiversity Offset Area Monitoring (Kleinfelder 2019): Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Little Bent-winged Bat (Miniopterus australis), Eastern Bent-winged Bat (Miniopterus orianae oceanensis), Eastern Coastal Free-tailed Bat (Mormopterus norfolkensis), Southern Myotis (Myotis macropus), Eastern Cave Bat (Vespadelus troughtoni) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*). The Biodiversity Offset Area Monitoring Report (Kleinfelder 2019) recorded the Rufous Fantail (Rhipidura rufifrons) a migratory species listed under the EPBC Act 1999. The locations of threatened fauna records within the Project Area are shown in **Figure 2**. An additional 15 threatened fauna species and four EPBC-listed migratory species were considered to potentially occur in the Project Area.

The ecological assessments concluded that the project is unlikely to have a significant impact on the above-mentioned threatened and migratory species provided appropriate mitigation measures are implemented.

Table 7 Threatened Flora Species recorded in the Project Disturbance Area and Adjoining Lands

Species	Habitat	Population Size
Tetratheca juncea	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin. Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	7,163 clumps across project area. Of these, 256 clumps occur in the project disturbance area, and 6,907 occur in the offset area.
Grevillea parviflora subsp. parviflora	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin. Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	At least 100 stems within the offset area. No stems occur within the project disturbance area.
Asperula asthenes	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	60 individuals occurred within the project disturbance area. 399 individuals occur in the biodiversity offset area, and 200+ individuals occur on Lot 12 outside the project disturbance area.

4.3.3 Fauna Habitat

The majority of the Project Area consists of remnant native vegetation providing habitat for a range of fauna species. Key fauna habitat features present include multiple vegetation strata, hollow-bearing trees, flowering trees, fallen logs and timber, bush rock, and leaf litter; these resources offer sheltering, foraging, nesting and roosting habitat to a variety of fauna occurring within the locality.

The project would directly impact 28.34 ha (disturbance area, including MOD 2) of forested habitat. The biodiversity offset area would protect and enhance at total of 131.44 ha of forested fauna habitat (see *Biodiversity Offset Area Management Plan*, Kleinfelder (2018).

4.3.4 Indirect Impacts

In addition to the direct impacts described in the previous sections, the project also has the potential to have the following indirect impacts on retained and adjacent vegetation, threatened flora species and fauna habitats:

- Habitat fragmentation;
- Erosion and sedimentation;
- Use of herbicides/pesticides;
- Hydrocarbon/chemical spills;
- Dust impacts;
- Weed invasion (see **Section 4.3.5**) and edge effects;
- Inadvertent disturbance of vegetation; and
- Rubbish dumping and increased human activity.

These indirect impacts will be prevented and/or mitigated through implementation of the management actions detailed in this plan.

4.3.5 Weeds

A total of twenty-four exotic species have been recorded within the site during the baseline surveys and subsequent annual monitoring of the BOA. Three of these species have specific control orders within the Mid-Coast Council control area under the *Biosecurity Act 2016* (**Table 8**). Lantana is also listed as a Weed of National Significance (WoNS).

Table 8 Exotic species recorded in the study area during baseline surveys and annual monitoring

Scientific Name	Common Name	Mid-Coast Council Control Area (Biosecurity Act 2016).
Ageratina riparia	Creeping Crofton Weed	-
Anagallis arvensis	Scarlet Pimpernel	-
Andropogon virginicus	Whisky Grass	-
Asparagus aethiopicus	Ground Asparagus	Prohibition on dealings
Axonopus fissifolius	Narrow-leafed Carpet Grass	-
Bidens pilosa	Cobblers Pegs	-

Scientific Name	Common Name	Mid-Coast Council Control Area (Biosecurity Act 2016).
Briza maxima	Quaking Grass	-
Chloris gayana	Rhodes Grass	-
Hypochaeris radicata	Catsear	-
Lantana camara	Lantana	Prohibition on dealings
Lolium perenne	Perennial Ryegrass	-
Melinis repens	Red Natal Grass	-
Paspalum dilatatum	Paspalum	-
Paspalum mandiocanum	Broadleaf Paspalum	-
Pennisetum clandestinum	Kikuyu	-
Plantago lanceolata	Lamb's Tongues	-
Senecio madagascariensis	Fireweed	Prohibition on dealings
Senna pendula var. glabrata	Cassia	-
Setaria sphacelata	South African Pigeon Grass	-
Solanum nigrum	Black-berry Nightshade	-
Stellaria media	Common Chickweed	-
Trifolium repens	White Clover	-
Tradescantia fluminensis	Wandering Jew	
Verbena bonariensis	Purpletop	-
Vulpia myuros	Rat's Tail Fescue	-

4.4 Baseline Rehabilitation Data

Annual rehabilitation inspections commenced at the adjacent Karuah Quarry in 2014. These rehabilitation areas will continue to be inspected/monitored and will be used as analogue rehabilitation sites in the future for Karuah East.

5 Rehabilitation Management Objectives

5.1 Landscape Management Objectives

- Protect and enhance the quality of remnant vegetation and fauna habitat to be retained within the Project Area;
- Maximise the salvage of environmental resources within the approved disturbance area for beneficial reuse in the enhancement of the rehabilitation area;
- Minimise impacts on native fauna on site;
- Ensure minimal environmental consequences for threatened species and their habitats; and
- Minimise impacts on fauna movement between undisturbed areas of the site and nearby vegetation.

5.2 Rehabilitation Management Objectives

Schedule 3 Condition 30 of PA 09_0175 outlines the rehabilitation objectives for Karuah East Quarry. These are listed in **Table 9** below:

Table 9 Rehabilitation Objectives from the Project Approval

Feature	Objective
Site (as a whole)	Safe, stable & non-polluting
Surface Infrastructure	To be decommissioned and removed, unless the secretary agrees otherwise
Quarry Wall Benches	Landscaped and revegetated utilising native tree and understorey species, ensuring that the tree canopy is restored and integrated with the surrounding tree canopy.
Quarry Pit Floor	Landscaped and revegetated with wetland vegetation
Other land affected by the project	Restore ecosystem function, including maintaining or establishing self-sustaining eco-systems compromised of: • Native endemic species; and • A landform consistent with the surrounding environment
Community	Ensure public safety Minimise the adverse socio-economic effects associated with quarry closure

Other key landscape and rehabilitation objectives include:

- Minimise the environmental impact of the operation during the development and operational phases, ensuring that protection of water quality and erosion control works are key priorities, and to ensure progressive rehabilitation is completed as soon as possible;
- Ensuring operations do not have a negative impact on remnant vegetation. This includes only disturbing within the approved footprint and managing weeds and feral animals in the adjacent remnant areas;
- Ensure that site drainage and sedimentation structures remain stable and functional;

- Ensure that vegetative matter and topsoil is made available for the site rehabilitation as required;
- Undertake rehabilitation in a manner consistent with that of the existing adjacent quarry;
- Guarantee that the resource is extracted and the site rehabilitated in a manner that will ensure the quality of surface runoff at all times;
- Produce a final landform that is geotechnically stable that blends aesthetically into the surrounding landforms, yet as far as possible does not limit possible future land uses; and
- Minimise visual impact of the operation during the operational phase as well as post-quarrying.

6 Landscape and Biodiversity Management

Note: the landscape and biodiversity management program provided in the following section only applies to the Karuah East Quarry and all perimeters lands (referred to as the Project Area) as specified in Schedule 3 Condition 32 of PA 09_0175. A separate *Biodiversity Offset Area Management Plan* (BOAMP) has also been prepared as required under Schedule 3 Condition 33 of the Project Approval which applies to the Biodiversity Offset Area adjoining the eastern side of the Project Area. Section 6 has been prepared by Kleinfelder.

6.1 General Management Measures

6.1.1 Inductions

All persons must undergo a site specific induction before entering the site. Induction material relating to landscape and biodiversity management to be delivered as part of all site inductions will be prepared by a suitably qualified ecologist, and will generally include the following:

- All staff and contractors entering the site will be made aware of environmentally sensitive habitat and surrounding vegetation at the site, including threatened species;
- All site personnel will be made aware of vegetation clearing limits, signed 'no-go areas' and their purpose (i.e. protection of vegetation, fauna habitat and threatened species), and that access to any areas outside the project disturbance area is restricted to authorised persons only;
- All clearing contractors will be informed of clearing protocols outlined in this plan, including those relating hollow-bearing tree removal, resource salvage, and threatened species protection;
- Staff and contractors will be made aware of the possibility of encountering Koalas during work activities. All staff and contractors will be made aware of the identified Koala habitat within and adjacent to the project area, the locations of potential koala movement on the site, and the potential risk of Koala vehicle strike. This will be achieved through the site induction;
- Staff and contractors will be made aware of noxious weeds present on the site and procedures to reduce weed spread will be detailed; and
- Domestic fauna (i.e. dogs) will be prohibited from entering the subject site with staff or contractors.

6.1.2 Controlling Site Access

- Only authorised personnel are allowed to enter the site. All contractors must undergo a site induction prior to entering/working on the site;
- Road access into Karuah East Quarry is via the internal access road that adjoins Blue Rock Close on the southern end of Lot 12; and
- Unauthorised access outside the project disturbance areas will be prevented through installing permanent fencing around the perimeter of the project disturbance area and locked gates (or similar) at all access points. Any vegetation to be retained within the project disturbance area will be delineated and protected through installation of temporary fencing (see **Section 6.2.1** for further details on fencing). Monitoring and maintenance of boundary fencing and gates will occur during regular inspections of the site (monitoring program, **Section 12**).

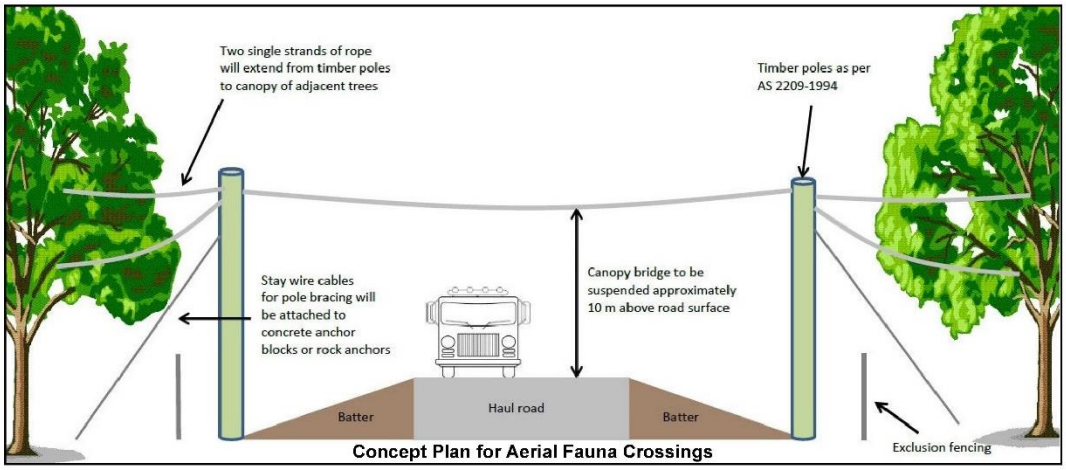
6.2 Pre-Clearing Survey Protocol

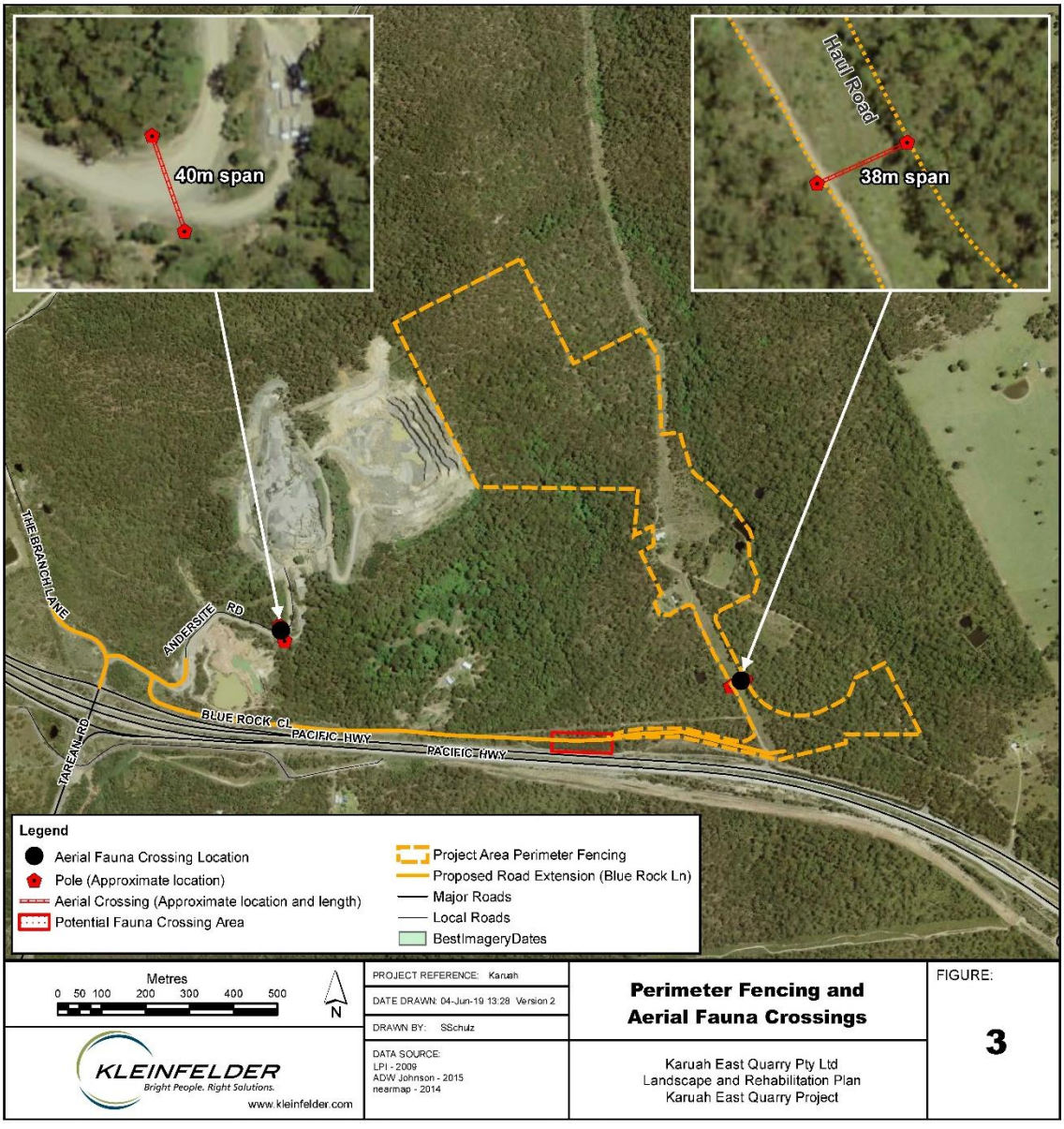
Clearing of the project disturbance area will be conducted in stages (i.e. separated by more than one week). The following protocols must be undertaken for each stage/planned clearing area.

6.2.1 Protection of Vegetation and Threatened Flora

- Permanent chain wire metal exclusion fencing has been installed around the entire perimeter of the quarry footprint. The permanent perimeter fencing will be installed to the following specifications:
    - The fencing would be constructed from chain wire metal fencing. The top of the fence will not have sharp edges to avoid injury to wildlife (e.g. gliders).
    - 'No-Go Area' (or similar) signs will be installed approximately every 100m along the perimeter fencing such that they are visible to staff and contractors working onsite;
    - The fencing has incorporated two 'drop-out' ramps (two on either side of the fencing at the aerial fauna crossing location along the new haul road). These ramps will deter animals from entering the site but will allow any trapped fauna to self-relocate from the project disturbance area; and
    - The perimeter fencing layout is shown in **Figure 3**.
- All machinery and vehicles are to be clean on entry of the site (i.e. free of soil, seeds or plant material) to reduce the potential for introduction or spread of noxious weeds and fungal pathogens.

Figure 3 Perimeter Fencing and Aerial Fauna Crossings





6.2.2 Fauna

- Approximately one week prior to any vegetation clearing, a survey of habitat trees will be conducted in the planned clearing area by a suitably qualified ecologist;
- Habitat trees (containing hollows or nests) will be clearly marked using flagging tape or spray paint. The location of each habitat tree will also be recorded using a hand-held GPS, and a map showing these will be produced for each planned cleared area and provided to the supervising ecologist and clearing contractor; and
- The fencing is designed to not allow fauna into the Project Area, including fauna that lives on the ground and in trees.

Targeted Surveys for Koalas

- Within 48 hours prior to vegetation clearing, pre-clearing surveys must be undertaken by a suitably qualified ecologist to ensure the absence of Koalas within each planned clearing area. Any trees identified as containing Koalas will be clearly marked to indicate occupation so that this can be communicated to the tree felling operator and ecologist supervising their removal; and
- If any Koalas are found to be present within a planned clearing area during the pre-clearing surveys, the relevant steps detailed in **Section 6.3.2** must be followed.

6.2.3 Weeds

- During pre-clearing surveys, areas of major weed infestation (including noxious species listed in **Section 4.3.5**) will be delineated with flagging tape to allow for separate stockpiling of this soil and vegetative material. This will reduce the spread and establishment of weed infestations in rehabilitated areas post construction.

6.2.4 Additional Pre-clearing Surveys

Where possible, vegetation clearing will be timed to avoid the following breeding periods for hollow-dependent fauna:

- October – February (microbats); and
- June – August (large forest owls; microbats in torpor).

If clearing is to occur within these periods the following additional pre-clearing surveys will be undertaken for each planned clearing area, in addition those detailed in **Section 6.2.2**:

- Within one week prior to vegetation clearing, searches for signs of threatened fauna species will be undertaken, including (but not limited to) searches for signs of roosting or nesting threatened raptors and forest owl species (e.g. Powerful Owl and Masked Owl) such as whitewash and owl pellets (regurgitated hair and bone);
- Within one week prior to vegetation clearing, stag watching and spotlighting of habitat trees will be conducted over a two night period to determine whether any of the hollows are in use by fauna. In particular, these surveys will be undertaken to identify potential microchiropteran bat roost trees;

- If the above surveys identify any nesting or potentially roosting threatened species within the planned clearing area during their respective breeding period, no clearing will be undertaken within 50 m of the occupied tree(s) until the nest/roost sites are vacated or until after the breeding season is completed. Monitoring would be required to determine if fledglings or juveniles have vacated the nests or hollows through stag watching and/or physical inspection of the nests/ hollows;
- Within one week prior to vegetation clearing, Elliot trapping will be undertaken over a four night period, targeting the Brush-tailed Phascogale (*Phascogale tapoatafa*) and Squirrel Glider (*Petaurus norfolcensis*). Any fauna captured during the pre-clearing trapping will be relocated to a suitable location within the biodiversity offset area. The following trapping effort will be conducted:
    - For staged clearing, a trapping effort of eight arboreal Elliot trap nights per hectare and 16 terrestrial Elliot trap nights per hectare shall be applied to each planned clearing area.
- Any trees identified as containing fauna (including threatened species) during the pre-clearing surveys will be clearly marked to indicate occupation so that this can be communicated to the clearing contractor and supervising ecologist.

As of April 2019, most of the area has been cleared except for approximately 6 hectares in the extraction area and within the MOD 1 and MOD 2 disturbance boundary. However, there will be some additional staged clearing in coming years as extraction and production increases.

6.2.5 Tetratheca juncea Translocation

- A *Tetratheca juncea* Translocation Program (TjTP) has been prepared for the project. All *Tetratheca juncea* clumps within the disturbance footprint will be translocated to the recipient site(s) within the biodiversity offset area prior to the commencement of clearing (see TjTP and BOAMP for further details).

6.3 Vegetation Clearing Protocol

6.3.1 Clearing Protocol and Salvage of Resources

- A fully qualified and experienced ecologist will supervise the felling of habitat trees that were identified during the pre-clearing surveys (**Section 6.2.2**). Refer to **Section 6.3.3** below for habitat tree removal protocol;
- Prior to commencing of vegetation clearing, an allocated vet will be notified of the possibility of receiving injured animals;
- Clearing will be undertaken predominantly by bulldozer and excavator and will be conducted in conjunction with topsoil removal;
- Vegetation will be cleared in a way that maintains habitat linkages and allows fauna living in or near the clearing site to move safely from the site to adjacent areas without additional human intervention:
    - Clearing will occur towards connecting vegetation;
    - The direction of clearing will ensure that fauna are directed away from threats such as roads and developed or disturbed areas (e.g. existing quarry to the west); and
    - Sequential clearing will not create an ‘island’ of habitat that is isolated from adjoining habitat by roads or cleared and disturbed areas.
- Ideally, no clearing will occur during the early evening or at night (i.e. when most fauna species are active and likely to be on the move and are more vulnerable to injury);

- Trees shall be felled away from retained vegetation towards cleared areas;
- Where possible, the vegetation to be cleared will be mulched on site with the exception of hollows, logs and large limbs that will be salvaged and incorporated into the rehabilitation or offset areas as fauna habitat;
- Native seed or plant material suitable for brush matting will be collected prior to or during clearing of the project disturbance area, stored, and spread over rehabilitation areas and/or utilised within the offset areas requiring revegetation (see BOAMP for further details);
- Hollow logs and other large organic debris cleared from the project disturbance area will be stockpiled and either spread on rehabilitated areas immediately after re-distribution of topsoil, or reinstated within the adjacent offset area. Logs and large debris will only be salvaged and redistributed into the adjoining offset area where the transfer process will have minimal disturbance to the recipient area (i.e. placed along the project disturbance area/offset area boundary, and where there are no threatened flora species present in the recipient area);
- Hollows will be salvaged from felled habitat trees by cutting at least 100 mm beyond the deepest point of the hollow and then stored in a dry safe place, or transported directly to the offset areas for installation; and
- Procedures for salvage and stockpiling of topsoil (including the native soil seedbank) are detailed in **Section 9.3**.

6.3.2 Protection of Threatened Fauna

The Project Area contains and/or adjoins known or potential habitat for a number of threatened fauna species as detailed in **Section 4.3.2**. The following measures will be implemented to minimise impacts to these species during vegetation clearing:

- During pre-clearing surveys, active searches for Koalas will be conducted and any trees containing Koalas will be marked (as described in **Section 6.2.2**). If prior to clearing commencing the Koala(s) have not self-relocated from the planned clearing area the following procedure will be followed:
    - A 30 m exclusion zone around occupied trees will be maintained during clearing. To encourage self-relocation all other surrounding vegetation, apart from that within 30 m of the occupied tree, will be cleared. No vegetation will be felled onto the occupied tree and vegetation links to adjacent retained vegetation will be maintained;
    - The occupied tree (and vegetation within the 30 m exclusion zone) will be left standing for a minimum of two nights to encourage self-relocation to vegetation outside the project disturbance area;
    - If after this period the Koala(s) have not self-relocated, they may be retrieved from the tree by a suitably qualified ecologist prior to felling and relocated to a safe location within the adjacent biodiversity offset area. If it is not considered safe or practical to retrieve the Koala(s) from the tree, the occupied tree will be left standing until self-relocation occurs; and
    - Should injury to Koalas occur during clearing, advice from a wildlife expert (e.g. veterinarian) must be sought and action taken in accordance with that advice. Records of any Koala injury within the project area must be documented and maintained (**Section 6.3.6**).
- As stated in **Section 6.2.4**, where possible vegetation clearing will be timed to avoid breeding periods for hollow-dependent fauna (October-February and June-August); and

- The habitat tree removal protocol (**Section 6.3.3**) will serve to mitigate impacts on other threatened fauna species (Microchiropteran bats, birds, and arboreal mammals) that may potentially occur within the project disturbance area.

6.3.3 Habitat Tree Removal Protocol

- Hollow-bearing trees identified during the pre-clearing surveys (**Section 6.2.2**) will be left standing for two nights after the surrounding vegetation has been cleared to encourage any native fauna species utilising the habitat hollows to self-relocate;
- The felling of all habitat trees will be attended by a suitably qualified and experienced ecologist in order to ensure the safety of any fauna found to be in the hollows;
- On all occasions, trees having potential habitat hollows or nests will be 'soft felled' by an experienced machine operator. The recommended soft felling procedure is as follows:
    - The hollow-bearing tree is given several moderate nudges with an excavator to give a warning to any occupying native fauna;
    - The hollow-bearing tree is then carefully watched and any native fauna present is given an opportunity to self-relocate before the tree is felled;
    - The hollow-bearing tree is soft felled with the rate of the trees fall controlled by the machinery operator to minimise impact; and
    - All hollows will be inspected for native fauna species and if any are found, the animal will be relocated at an appropriate time of day (i.e. dusk for nocturnal species). If the animal is injured, it will be taken to a local veterinarian (see **Section 6.3.4**).
- The number of hollows present within each habitat tree will be counted and recorded once the tree has been felled. Unless the hollows are salvaged and erected within the offset area (as described in **Section 6.3.1**), a nest box will be installed for each hollow lost (1:1 ratio) within the offset areas in accordance with the Nest Box Installation and Monitoring Protocol detailed in the BOAMP (Kleinfelder 2018).

6.3.4 Fauna Displacement and Relocation Protocol

Displacement of fauna will occur as part of the clearing process. The following protocol will be followed to ensure minimal impacts to native fauna during clearing:

- Any fauna fleeing the clearing area will be directed to a safe area outside the project disturbance area, or captured and relocated if necessary;
- All fauna are to be handled in such a way as to prevent injury to the animal or the handler;
- Once the animal has been safely captured, it will be relocated or caged in a hessian bag or box and released at an appropriate time of day;
- All fauna that are captured during the clearing operations that are uninjured will be relocated to a safe and appropriate location within the adjacent biodiversity offset area on the same day as capture;
- Any microbats or other nocturnal species captured during the tree removal process will be held in cotton or hessian bags and released at dusk;
- If any animal is injured during the vegetation clearing works, a veterinarian will be contacted immediately for professional advice on the best course of action; and

- If any native animal is injured during other construction or operational processes while an ecologist, environmental representative or animal handler is not present, they must be contacted immediately. The procedure and relevant contacts for wildlife injuries will be communicated to all staff during the site induction.

6.3.5 Weed Management

- All noxious or environmental weed infestations will be delineated with flagging tape during the pre-clearing surveys (**Section 6.2.3**). All topsoil and vegetative material (excluding large trees and logs that can be salvaged) from within these delineated areas shall be either:
    - Immediately transported offsite and disposed of to a licenced landfill facility; or
    - Processed and stockpiled separately onsite. Separate stockpiling and storage will aim to prevent contamination and subsequent spread of weed propagules in topsoil or mulch to be used in rehabilitation areas within the project disturbance area and/or areas requiring revegetation in the biodiversity offset area. These separate stockpiles must be clearly signed as 'weed contaminated' to avoid mixing of clean and weed contaminated materials.
- Stockpiled topsoil, mulch and other vegetative material will be routinely inspected for weed regrowth during the construction and operation phases. Any weed outbreaks will be treated through manual and/or chemical control methods (see **Section 6.4.3** for further details).

6.3.6 Reporting

The following records will be maintained by the supervising ecologist(s) for each planned clearing area:

- Methods and results of pre-clearing surveys, including fauna surveys, habitat tree marking, and weed mapping;
- Dates and person hours spent undertaking clearing supervision;
- Area of vegetation cleared each day;
- Number of hollow-bearing trees, including number and size class of hollows removed each day;
- Number/quantity of hollows, logs or other habitat features salvaged for reuse;
- Number, species and release location of any fauna that required relocating;
- Any fauna injuries or deaths; and
- All other incidental fauna observations during clearing.

A Vegetation Clearing Completion Report containing all data/ records specified above will be prepared and submitted to OEH within one month following completion of vegetation clearing.

6.4 Construction and Post-Construction Management

6.4.1 Aerial Fauna Crossing Installation

Two aerial fauna crossings are to be installed during 2020. The majority of the haul road was constructed in 2017, however the design of the haul road was changed as part of MOD 2 which has delayed the installation of the aerial fauna crossings. Key details of the crossings are outlined below:

1. The western aerial fauna crossing is to be located at the existing quarry haul road approximately 250 metres north east from the existing quarry site office; and
2. The eastern aerial fauna crossing is proposed on Lot 13 along the north-south running access road.

The approximate locations and conceptual design of the aerial fauna crossings are shown on **Figure 3**. The crossings will be established as follows:

- The aerial fauna crossings must be supplied and installed by a suitably qualified contractor;
- The crossings will generally be consistent with the specifications of aerial crossings constructed as part of the Pacific Highway upgrade by the NSW Roads and Maritime Services (e.g. Karuah bypass) and will consist of the following:
    - The canopy bridges will consist of a flat rope ladder crossing design that will be suspended approximately 10 m above the road pavement across the entire width of the haul roads;
    - The crossings will be connected to two poles placed on opposite sides of the roads. The poles will be in accordance with AS2209-1994 (Timber – Poles for Overhead Lines) and consist of treated grade timber. Concrete anchor blocks or rock anchors (depending on subsurface conditions) will be installed to brace the poles; steel cable wire will be attached to the top of each pole and connected to the anchors located behind each pole. Anchors for the pole bracing may need to be located outside the project disturbance area boundary; should this be required, these works must be supervised be a suitably qualified ecologist to ensure no impacts to native vegetation or threatened species occur;
    - The western canopy bridge will be approximately 40m in length and the eastern canopy bridge will be approximately 38 m in length (depending on final haul road design). Both canopy bridges will be 50 cm wide;
    - The rope netting will consist of lattice-work configuration constructed from 20 mm external ropes with 12 mm silver rope weaved through; and
    - Two strands of 25 mm silver rope will be installed from each pole to the canopy of adjacent trees to facilitate access by arboreal mammals.

6.4.2 Seed Collection and Propagation

As progressive rehabilitation will be undertaken over the life of the quarry, native seed will also need to be collected progressively for revegetation works. It is proposed that seed will be collected from the adjoining biodiversity offset area to ensure local provenance of species used in rehabilitation. Seed collection and propagation will be undertaken through the following protocol:

- Revegetation methods and native species selected for the rehabilitation areas are detailed in **Section 9.5**;
- All seed collection must be undertaken by a suitably qualified and experienced bush regenerator or ecologist;
- Seed collection and storage will be undertaken in consideration of the relevant Florabank guidelines and codes of practice (available at https://www.florabank.org.au/);
- Seed collection will be undertaken in accordance with the following general principles:
    - Only the minimum quantity of seed or plant material required for rehabilitation will be collected;

- A maximum of 20% of fruit and 10% of plant material will be collected from any one plant (i.e. larger seed quantities will be obtained by collecting from more plants);
- No collection of seed or plant material from threatened flora species listed under the TSC Act or EPBC Act, or schedule 13 protected native plants under the *National Parks and Wildlife Act 1974* will be undertaken unless the appropriate permits or licences have been secured; and
- Records of all seed collection activities within the offset area, including dates, locations, species collected, and quantity of plant material/seed/fruit, will be maintained.

Where seed cannot be propagated from the adjoining offset area or only a small area of rehabilitation is required, a seed mix containing locally endemic species will be purchased from a local seed supplier.

6.4.3 Weed and Pest Control

Weed and pest management will be undertaken within the Project Area to minimise habitat degradation, encourage growth of native species, and protect native fauna within retained vegetation and rehabilitation areas in the project area through the following process:

- Inspections of the Project Area and adjoining vegetation will be undertaken during monitoring (**Section 12**) to identify weeds and evidence of pest species, focusing on rehabilitation areas and retained vegetation;
- The locations and specific methods for weed and pest management will be directed by monitoring inspections (i.e. recommendations from monitoring reports);
- Weed control will generally be undertaken using a combination of manual removal and targeted chemical application using an appropriate herbicide. Chemical methods will only be used for larger weed outbreaks and/or where there is negligible risk for indirect impacts on native vegetation;
- Any vertebrate pest control will be conducted in accordance with *Humane Pest Animal Control: Codes of Practice* (DPI 2014);
- If pest control is required it would generally involve a routine (six monthly) baiting program. Other control methods such as shooting or trapping can also be used if deemed necessary or appropriate with advice from OEH or the Local Land Service;
- Weeds will be monitored within areas of remnant vegetation within the Project Approval. Weed management programs will focus on disturbed areas, areas of rehabilitation and areas adjacent to the Project Approval area (remnant areas); and
- All weed and pest control works will be undertaken by a suitably qualified contractor.

6.4.4 Additional Measures for Threatened Species and Fauna Protection

- Ensure vehicle and equipment parking areas and stockpile areas are identified and sited to avoid areas containing ecological value;
- A maximum speed limit of 40 km/hr will be signposted and adhered to in the vicinity of potential fauna crossing areas (**Figure 3**);
- Should any trenches be created during the construction phase (e.g. installation of underground services), minimise the length of time that trenches remain open to avoid fauna becoming trapped. Monitor open sections of trenches daily or as required for trapped animals, such as small ground-dwelling mammals. If required ramps will be incorporated into open sections of trench to allow animals that have fallen into the trench to make their way out;

- The Construction Environmental Management Plan (CEMP) will include management strategies to mitigate work-site lighting, dust suppression and noise associated with the construction phase of the project that could impact on native flora and fauna;
- Potential impacts from erosion and sedimentation associated with clearing and disturbance of the project disturbance area will be mitigated through implementation of measures detailed in **Section 9.4**; and
- Weed control will generally be undertaken using a combination of manual removal and targeted chemical application using an appropriate herbicide (e.g. glyphosate).

6.4.5 Bushfire Management

- A separation distance of at least 10 m will be maintained between stockpiles of combustible material (e.g. mulch) and remnant vegetation;
- An emergency action plan will be prepared prior to quarry operations and include procedures to be followed in the event of a bushfire;
- All earth moving machinery will be fitted with spark arresting mufflers and haul trucks will have serviceable exhaust systems to prevent accidental ignition of vegetation;
- The project disturbance area will be equipped with firefighting measures to assist in the management of any fires on site. All machinery, trucks and vehicles on site will be equipped with fire extinguishers;
- As the project disturbance area will be entirely or mostly cleared of native vegetation no ecological burning is considered necessary; and
- Any ecological burning undertaken within the adjoining offset area must be planned and approved in conjunction with the quarry operations (see BOAMP for further details). At this point none is planned, however any burning would be completed in conjunction with the Rural Fire Service.

6.5 Rehabilitation and Offset Area Management

Any rehabilitation undertaken at the Karuah East Quarry will be managed in accordance with the biodiversity offset areas associated with the project. Species found within the offset areas will be used in the rehabilitation mix for Karuah East. The goal of final rehabilitation will be to create a fauna corridor between rehabilitation and offset areas.

Once rehabilitation is established the rehabilitation and offset areas will be managed concurrently for land management (including pest and weed management).

A Biodiversity Offset Area Management Plan has been prepared by Kleinfelder (2018).

7 Decommissioning and Demolition

7.1 Investigation of the Site and Structures

Prior to closure, Karuah East shall undertake an investigation into the types of structures at the site. This investigation will include:

- The type, location and extent of underground services such as conduits, cables and pipe work;
- The location, type and extent of overhead services and structures such as power cables, the plant, light poles and pipe work, etc;
- The location and condition of all tanks and vessels (with emphasis on remaining combustible materials and methods required for their removal);
- The presence of contaminated and hazardous materials and the classification and disposal of these materials;
- The general condition of adjacent structures; and
- Any infrastructure to remain (including roads and tracks) following decommissioning.

7.2 Removal of Site Infrastructure and Services

Opportunities for the sale and/or re-use of assets and recycling of scrap steel will be maximised at closure.

Concrete footings and pads will be broken up to at least 0.5 m below the surface and removed. Options for the re-use of this material (for example, crushed and used for road and track stabilisation) will be investigated as the operation approaches closure. If re-use or recycling opportunities aren't available or viable, all "non-contaminated" waste material will be disposed of at a suitable location on-site or taken off-site to an approved waste management facility. Once operations have ceased, all buildings and infrastructure will be removed from the hardstand.

7.3 Contamination and Hazardous Materials

Prior to final closure, a preliminary investigation into potential sources of contamination including additional Phase 1 sampling and analysis will be undertaken. This will be used to determine whether a detailed assessment (for example, Phase 2 sampling and analysis) will be conducted to quantify the amount of any contaminated material that may require remediation.

All identified sources of contamination will be remediated during the operational phase of the site. In some cases, this may not be possible and in these circumstances the remediation will be undertaken following closure and during the decommissioning phase.

8 Minimising Socio-economic effects

A social impact assessment will be prepared as part of a detailed quarry closure plan at least three years prior to the planned closure date. Some issues that will be included within this assessment include the following:

- A detailed assessment of Karuah East's contributions and expenditure within the community and local area; the location of staff residences; and local businesses and suppliers that are likely to be affected. The purpose of the assessment is to determine how dependent the local community is upon the operations of Karuah East;
- The level of dependence of the employees upon the local community and infrastructure, for example, whether their children attend local schools;
- The proportion of sales by local businesses and suppliers that is from Karuah East;
- Potential impacts on local services, such as schools and health facilities, as a result of quarry closure and possible relocation of staff;
- The views of the community and stakeholders on the closure options; and
- Identification of potential industries that will see future growth and thus, provide possible employment for staff upon closure.

Karuah East will use the results of this assessment to investigate whether there is potential to minimise the impacts of quarry closure upon employees and the local community.

9 Rehabilitation management

9.1 Landform Design and Planning

Thorough site preparation will be undertaken to ensure rapid establishment and growth of seedlings. All areas proposed for seeding will be deep ripped to an approximate depth of 400 – 500mm.

Where ripping on slopes is required, the ripping will be undertaken around the contour of the land at right angles to water flow. Benches will be deep ripped to actively promote infiltration of water which will enhance soil moisture requirements for direct tree seeding and minimise surface runoff to underlying benches and the pit floor dirty water control system. Revegetation will also visually screen disturbed areas and will re-establish habitat for native fauna. The topography of the final landform will consist of a large number of stepped benches formed in an amphitheatre configuration, each with a revegetated bench (refer to **Figure 4**).

The area currently supports an open eucalyptus woodland forest. The broad rehabilitation objective for the post-quarry landform is to establish a similar land use on the disturbed areas, with the exception of the final void.

The void will be some approximately 3 hectares in area. Until such time that extraction has ceased, rehabilitation will occur around the perimeter of the pit only along the benches, and will not involve the pit floor. The primary purpose of rehabilitation during the operational phase is to mitigate any visual impacts.

Figure 4 Example of bench rehabilitation

An integrated and coordinated rehabilitation approach will be undertaken to ensure consistency with regards to rehabilitation of the Karuah East Quarry and the existing adjacent Karuah Quarry. The selection of species and timing of rehabilitation will be coordinated such that revegetation works will provide habitat value over a wider geographical area inclusive of both quarry sites.

The Rehabilitation Management Plan for the existing Karuah Quarry notes that the area surrounding the quarry consists of native forest vegetation, and proposes to re-establish a similar cover to the majority of the post-quarrying landform. The revegetation program of this quarry will therefore involve the re-establishment of native forest/shrub/ground cover on the stabilised benched areas of the quarry. This same approach will be applied to revegetation of the post-quarrying landform at Karuah East. In addition, given that the adjacent quarry is in close proximity to Karuah East, and consistent species will be used across both sites in re-establishing native forest vegetation across the area.

9.2 Progressive Rehabilitation

Disturbed areas which are not available for final rehabilitation will be temporarily rehabilitated. Additional erosion control measures such as the application of hydromulch will be considered, particularly in drainage lines and areas of temporary rehabilitation. Sugar cane (or other) mulch as slurry provides cover for the soil to improve pasture growth and/or modifying the soil surface to control erosion. The mulch also has the effect of protecting the soil surface against raindrop impact, improving the micro-environment for seed, reducing evaporation losses and assisting in the control of surface erosion caused by overland water flow.

Where benches are not required for future operations (ie access or quarrying) then Karuah East will rehabilitate the benches. Disturbed areas which are no longer required for operational purposes will be progressively rehabilitated.

Opportunities for the use of potential soil ameliorants to accelerate the revegetation process will also be considered

9.3 Soil and Vegetation Management

Topsoil stripping within the disturbed area will be undertaken when the soil is in a slightly moist condition to reducing damage to soil structure. Where possible stripped material will be placed directly onto the disturbed areas and spread immediately if excavation sequences, equipment scheduling and weather conditions permit.

A maximum stockpile height of 3m will be maintained to preserve viability and reduce soil deterioration. Stockpiles will be protected with sediment fencing and planted with a sterile cover crop (annual species) to ensure stabilisation. Surface drainage in the vicinity of the stockpiles will be configured so as to direct any runoff around the stockpile.

Where the stockpile is not wholly contained within the "closed loop" water management system, temporary sediment control measures such as sand bags and silt fences will be used to prevent sediment from leaving the disturbed areas.

Topsoil will be re-spread in the reverse sequence to its removal, so that the organic layer, containing any seed or vegetation, is returned to the surface. Topsoil will be spread to a minimum depth of 50mm on 3:1 or steeper slopes and to a minimum depth of 150mm on flatter slopes. Re-spread topsoil will be levelled to achieve an even surface, avoiding a compacted or an over-smooth finish.

When topsoil is to be used for rehabilitation programs, soil testing will be undertaken to determine the quality of the soil for rehabilitation. The results will be used to determine specific ameliorant techniques that will be applied to the soil material in order for rehabilitation to be sustainable. Ameliorants may include gypsum, lime, fertiliser and biosolids. The use of soil ameliorants is designed to balance pH, prevent surface crusting, increase moisture and organic content, and buffer surface temperatures to improve germination.

9.3.1 Export of Soil

Additional soil material and overburden is required at Karuah Quarry for final rehabilitation. This material will be imported from Karuah East Quarry to assist the landform shaping and rehabilitation of the Eastern highwall face. Calculations of topsoil and subsoil available and required for rehabilitation at Karuah East Quarry have demonstrated there will be adequate volumes to rehabilitate Karuah East Quarry and also provide material and soil to Karuah Quarry for rehabilitation. The material and soil will be transported via truck through the top gate using internal roads and side casted from the top of the Karuah Quarry onto the eastern benches below. By using internal roads to move material from Karuah East Quarry to Karuah Quarry, Hunter Quarries will ensure public roads are not impacted by additional traffic.

Geospatial analysis of the Karuah Quarry rehabilitation and final landform has given approximate values of material required for the desired outcome. It is considered that 23,000 tonnes of material spread along the benches from the highwall toe to the second bench will allow for revegetation of the berms and for long term stability. A breakdown of available material at Karuah East Quarry is provided in the subsequent sections.

9.3.1.1 Topsoil – Amount calculated from Karuah East Quarry Environmental Assessment 2013

Table 10 details the quantity of topsoil available at Karuah East Quarry which incorporates all disturbed areas within the project area. Note calculations included in **Table 10** were made during the Karuah East Quarry Environmental Assessment 2013 and actual values may vary. Estimated available topsoil volumes detail the surplus available at Karuah East Quarry.

Table 10 Estimated Topsoil Balance

Topsoil	Volume (m^3)
Amount of topsoil available to be stripped	25,800
Amount of topsoil required for rehabilitation at closure	19,650

9.3.1.2 Subsoil - Amount calculated from Karuah East Quarry Environmental Assessment 2013

Table 11 details the quantity of subsoil available (as an intermediate layer for rehabilitation) at Karuah East Quarry which incorporates all disturbed areas within the project area. Note calculations included in **Table 11** were made during the Karuah East Quarry Environmental Assessment 2013 and actual values may vary. Estimated available subsoil volumes detail the surplus available at Karuah East Quarry.

Table 11 Estimated Subsoil Balance

Subsoil	Volume (m^3)
Amount of subsoil available to be stripped	131,400
Amount of subsoil required for rehabilitation works at closure	39,300

9.4 Water Management and Erosion and Sediment Controls for Rehabilitation Areas

The following principles will be used for erosion and sediment control on site throughout the operation and during rehabilitation:

- Erosion and sediment controls as per the *Water Management Plan*;
- Key erosion and sediment and sediment controls at site in rehabilitation areas include:
    - Drainage channels;
    - Contour banks;
    - Sediment basins; and
    - Sediment fencing.

Rehabilitated activities will be undertaken within the dirty water catchment, with water draining from rehabilitated areas to sediment dams onsite.

9.5 Species Selection

Section 6.4.2 outlines the potential for seed collection and propagation from the biodiversity offset area. Where seed cannot be propagated from the adjoining offset area or only a small area of rehabilitation is required, a seed mix containing locally endemic species will be purchased from a local seed supplier.

Direct seeding (via broadcasting) is preferred over tube stock planting as it enables a far greater success rate, limits the need for ongoing maintenance (e.g. watering) and is the most effective method in achieving a successful rehabilitation outcome. Notwithstanding this, tube stock will be utilised in landscape planting around the site if required. Not all native trees and shrubs are suited to direct seeding due to their innate germination requirements, therefore, it will be required to supplement with some tubestock to increase biodiversity.

Native Trees and Shrubs

Native open woodland currently occurs over most of the Project Approval Area. It is proposed to re-establish a similar cover to the majority of the post-quarrying landform (excluding the void). Native vegetation will largely be established using direct seeding and from the seed store within re-spread topsoil. Supplementary native pasture and/or tubestock seeding will be undertaken where specific species combinations are required.

Final rehabilitation of the site will be undertaken once extraction is complete. As the extraction progresses through the resource, 15 m wide benches will be left every 15 m of depth to provide a horizontal platform on which native flora species will be established.

A mixture of native trees and shrubs endemic to the area will be sown onto the majority of the reshaped and benched pit areas following topdressing and site preparation. This tree and shrub seed will complement natural regeneration from seed contained within the soil seed bank. The seed mix used for revegetation of the disturbed quarry area will include many of the major tree and shrub species shown in **Table 12** below. This species list is consistent with the recommended species for rehabilitation presented in the Rehabilitation Management Plan for the existing adjacent quarry.

Table 12 Recommended Species Mix for Quarry Rehabilitation

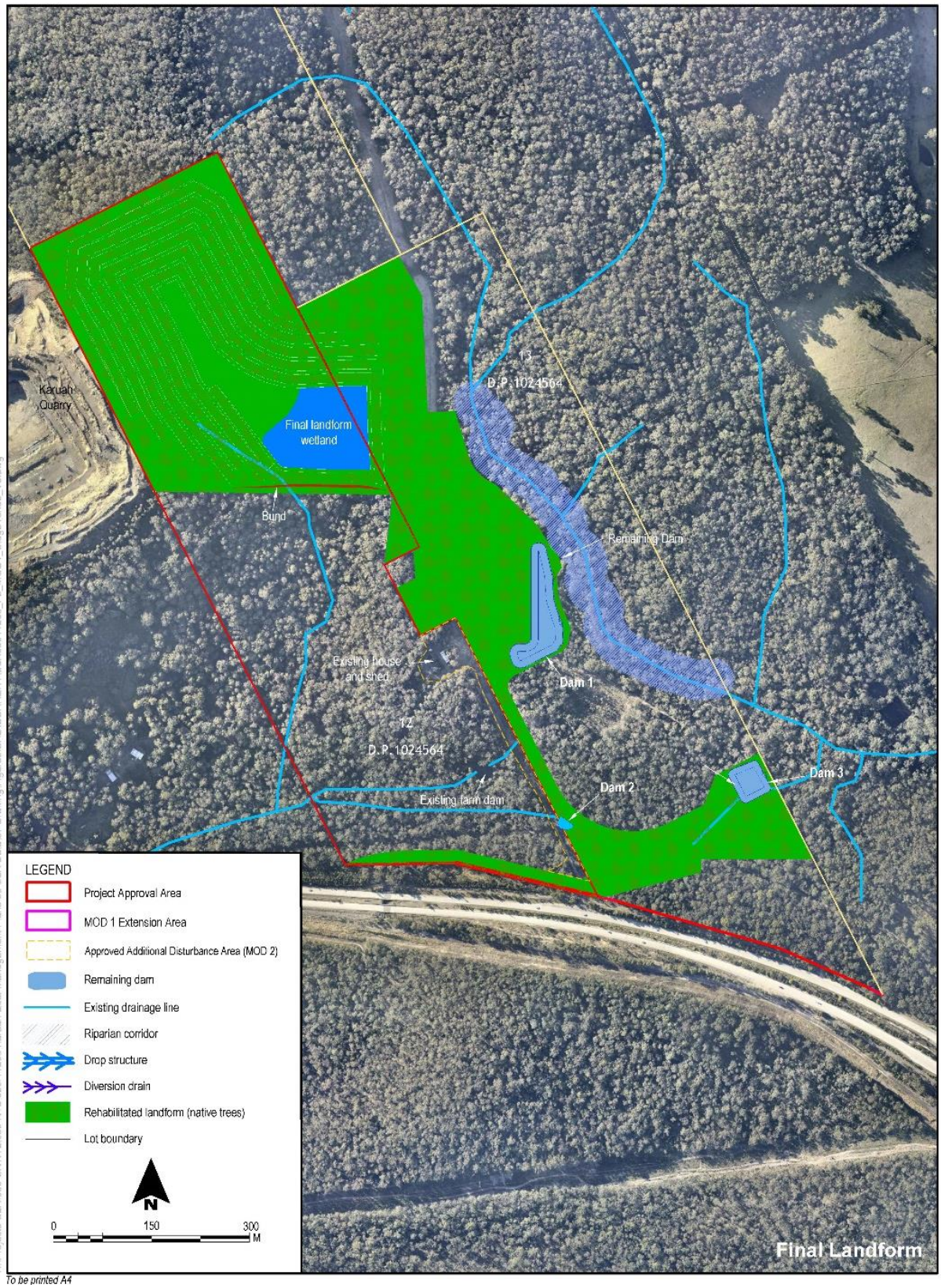
Genus	Species	Seeding Rate (kg/ha)
Acacia	*Falcate*	0.4
	Longifolia	0.6
	Terminalis	0.4
	Irrorata	0.3
	Decurrens	0.4
Eucalyptus	*Globoidea*	0.4
	Resinifera	0.2
	Paniculata	0.4
	Tereticornis	0.6
	punctata/propinqua	0.5
	Moluccana	0.5
	Crebra	0.3
Angophora	*Costata*	0.1
Allocasuria	*Torulosa*	0.1
Croymbia	*Macultata*	0.8
	Gummifera	0.3

Genus	Species	Seeding Rate (kg/ha)
	Total	**6.3**

The seed will be sourced from reputable seed supply agents or collected and propagated as per **Section 6.4.2.** Some native species have difficult dormancy mechanisms that need to be broken before germination can occur. Native seed for revegetation of the quarry will be appropriately pre-treated in order to break dormancy restrictions. Subject to sufficient follow up rain, high initial tree densities can be expected. These high densities will quickly help stabilise and screen the site and will result in healthy mature tree stands over time. It is intended to create, over time, a mosaic of variable native species and plant densities representative of that currently occurring in the area. Growth rates of between 1 and 2 metres per year can be initially expected for many of the more dominant trees and shrubs.

The correct treatment and application of seed in the appropriate ratios is important in controlling emerging weeds and in allowing the tree stand to develop in a positive direction. The native tree and shrub seed mix will be sown at a total combined rate of approximately 6.3 kg/ha. Seed will be broadcast evenly onto topdressed areas. Care will be taken to ensure it will not be buried. Seeding will be conducted in late spring, summer and early autumn giving superior results due to higher ground temperatures

Figure 5 Final Rehabilitation



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10 Rehabilitation and Closure by Domains

These domains have been based on construction being completed, with the site at full operational capacity.

10.1 Domain 1 – Undisturbed Woodland

A large section of the Project Approval area will continue to be managed as remnant woodland when the site is fully operational. Operations at the site will be managed to ensure the remnant woodland is not impacted. Exclusion fencing will be established to reduce access to remnant vegetation.

10.2 Domain 2 - Haul Road and Site Access Road

The site access road is the main route, where rock is hauled from the stockpile area to offsite for sale. This is an extension of the existing Blue Rock Lane. A haul road will be constructed from the intersection of the site access road to the top of the pit. Other smaller access roads will also be constructed around the quarry.

It is envisaged that the site access road and main haul road will remain post closure as they will be used for firefighting access. Rehabilitation will be completed to smaller access roads and the batters of the main haul road and site access road.

10.3 Domain 3 - Plant Area and Stockpiles

The plant and stockpile area will be constructed prior to the commencement of operations. At closure this area will not be required for post quarrying. All product in the stockpile area will be hauled offsite for sale. The plant area will be decommissioned and removed from site at closure. Plant and machinery will likely be sold at closure.

Once all plant and stockpiles have been removed, the area will be shaped and rehabilitated with a woodland seed mix (See **Section 9.5**).

10.4 Domain 4 - Quarry Pit and Emplacement Areas

Areas around the quarry pit (including overburden) will be shaped, topsoiled and rehabilitated using a woodland seed mix. A section of the quarry pit will remain as the final void. The potential options for the management of the final void are listed below:

1. Water storage;
2. Wetlands or wildlife habitat;
3. Recreation;
4. Aquaculture;
5. Waste facility; and
6. Backfilling the void and woodland rehabilitation.

There are positives and negatives of all these final void options. At this stage it is likely that the final land use of the pit/void would be to return the site to a wetland.

The Australian Coal Association Research Program (ACARP, 2000) report titled *Final Void Water Quality Enhancement* outlines the use of final voids as wetlands. One successful example of the rehabilitation of mine sites using wetlands at Capel in Western Australia.

- The benefits of a final void being used as a wetland or wildlife habitat includes:
- Potential enhancement of water quality (if required);
- Potential increase in habitat and a subsequent increase in local biodiversity values;
- Enhancement of environmental and community values;
- Potential location of long term environmental studies; and
- This has been completed successfully at other mines sites in Australia and internationally.

Currently this is the proposed final land use for the void. If this is chosen as a preferred option, a Plan will be developed by a specialist outlining the proposed layout of the wetland and outlining key requirements for management and maintenance. The site will be rehabilitated to the satisfaction of the DPIE Secretary and the Closure Plan will require approval from the DPIE Secretary. No work associated with rehabilitation in the area around the final void will commence until the Closure Plan has been signed off by the DPIE Secretary. **Section 11** of this Plan provides further detail regarding void management.

10.5 Domain 5 - Water Management

There will be three sediment dams constructed when the site is fully operational.

Sediment dams that are to remain after lease surrender will be reviewed and if necessary reshaped prior to quarry decommissioning. This will provide safe access for native fauna and to satisfy public safety requirements. Sediment will be removed from dams during operations and at closure to increase the storage capacity of dams. The smaller Dam 2 and 3 are likely to be filled with sediment over the years, following closure of the site and the discontinuing of dam maintenance.

11 Final Void Design and Management

A section of the quarry pit to remain at closure as a final void. As previously outlined, at this stage it is likely that the final land use of the pit/void would be to turn the area into a wetland, which is consistent with the proposed final land use of the void at the existing Karuah Quarry. Key design and management of the final void is outlined in this section.

11.1 Void Water Quality

Water will only be permitted to accumulate in the void if it maintains a quality that does not compromise its intended final use or surrounding groundwater systems. The aim is to provide a biologically viable water resource for the surrounding environment. The following aspects need to be considered with respect to managing final void water quality:

- Concentration of elements resulting from the quarrying of material;
- Control of surface flow into the void; and
- Rainfall and evaporation.

Post closure a water monitoring program will need to remain in place to closely monitor any changes to chemistry within the void.

11.2 Void Slope Stability

To ensure the safety of the final void, the surrounding final slopes will be left in a condition where the risk of slope failure is minimised. This may require the benches to be battered back from the vertical to enable a stable overall slope angle.

The following will need to be considered when assessing the geotechnical stability of highwalls:

- Long term final void water levels;
- Height and inclination of slope and number and spacing of intermediate benches;
- Shear strength of the highwall soils and rocks;
- Density and orientation of fractures, faults, bedding planes, and any other discontinuities, and the strength along them; and
- The effects of the external factors, such as surface runoff.

Prior to closure, investigations will be undertaken to confirm the criteria above.

11.3 Safety

At quarry closure, one of the main priorities for the void will be to render it safe in terms of access by humans, livestock and wildlife. The following will be considered at the time of closure to ensure that the void is left in a safe manner. These include:

- Instability of the high wall can induce failures or mass movement. All high walls are to be left geo-technically stable;

- A barrier at a safe distance from the perimeter of the void to prevent human access will be constructed.
- Suitable signs, clearly stating the risk to public safety and prohibiting public access will be erected at 50 m intervals outside the safety fence;
- Surface runoff from land surrounding the void will be diverted from entering the void so as to prevent the instability of the walls; and
- Shrub and/or tree planting along the outside edge of the bund wall will be implemented where practicable to lessen the visual impact of the wall, and will be in accordance with the agreed post-quarrying rehabilitation criteria and land use.

12 Monitoring Program and Reporting

Section 12.1 of this Management Plan has been prepared by Kleinfelder.

12.1 Ecological Monitoring

The following key parameters will require monitoring within the Project Area to inform ongoing maintenance works:

- Weed regrowth and outbreaks;
- Vegetation protection measures, including perimeter fencing and erosion/sediment controls;
- Indirect impacts of the development on adjoining vegetation and threatened flora;
- Measures to facilitate fauna movement across the site (i.e. aerial fauna crossings); and
- Rehabilitation (**Section 12.2**).

12.1.1 Weeds

Target weed species will be mapped on an annual basis within the Project Disturbance Area and adjoining vegetation on Lots 12 and 13 (within 50 m of the project disturbance area boundary). Additionally, weed mapping along Yalimbah Creek will also be undertaken as part of the ecological monitoring program. This monitoring will assess the effectiveness of ongoing weed control works and whether the target weeds species are being eradicated and controlled at an appropriate rate. In addition, these monitoring events will identify any new significant weed species present on the site and recommend appropriate management procedures for these species.

Baseline weed mapping was undertaken prior to the commencement of the major clearing program in 2016.

12.1.2 Vegetation Protection Measures

Erosion and sediment control structures, perimeter fencing and any temporary fencing installed within the project disturbance area to protect retained vegetation will be inspected as part of annual ecological monitoring. These inspections will ensure vegetation protection measures are effective and comply with relevant management plans. Any necessary repairs or modifications will be detailed in the monitoring report.

12.1.3 Vegetation Condition and Threatened Flora Monitoring

Potential indirect impacts from the project (e.g. dust, stormwater run-off, weed invasion) may adversely affect the condition of retained and/or adjoining native vegetation (including threatened flora populations). A total of 13 monitoring points have been established (with a capped star picket) within 50 m of the project disturbance area in the retained vegetation on Lots 12 and 13. An additional five monitoring points have also been established along Yalimbah Creek (Lot 12).

A qualitative assessment of vegetation condition and photo monitoring is undertaken at each monitoring point (18 monitoring points in total) at each survey event. At each monitoring point, the following data is collected and compared to the previous survey event:

- Vegetation type and structure, including dominant species in each stratum;

- General health of vegetation, including evidence of foliage die-off;
- Weed species and abundance; and
- Any management issues or indirect impacts from the project disturbance area.

At nine of the 18 monitoring points, threatened flora species monitoring was also conducted. At these sites, all threatened flora individuals within 10 m of the monitoring point were recorded. The bearing and distance of each clump / individual from the star picket recorded during the baseline survey was used to accurately re-locate known individuals in the survey area. The bearing (degrees) for each clump was measured using a Suunto compass and the distance was determined using a tape measure attached to the star picket. Additionally, each clump / individual was permanently marked with a steel peg (positioned 20 cm to the south of each clump / individual to avoid damaging plants); a metal tag was attached to each peg which provides a unique ID number.

Baseline monitoring of the 18 monitoring locations was undertaken in October 2015, and annual monitoring has continued at the same time each year.

12.1.4 Aerial Fauna Crossings

A 12-month monitoring program of the two aerial fauna crossings will be undertaken using remote motion sensing cameras mounted on each pole (four cameras in total) once the crossings have been installed. Data will be collected from the cameras periodically, and the results will be presented in the annual monitoring report (**Section 12.1.7**). The monitoring will be used to evaluate the effectiveness of the crossings and to inform any modifications or improvements to the crossings.

12.1.5 Maintenance

Following completion of annual ecological monitoring, maintenance will be undertaken as directed in the monitoring reports. These reports will include information on the location, timing, species and preferred methods for weed management, and whether any repairs to vegetation protection measures are required (e.g. perimeter fencing). Maintenance would generally be undertaken on an annual basis unless otherwise specified in the monitoring reports or other management plans (e.g. BOAMP), and would generally entail:

- Control of weed regrowth and outbreaks;
- Maintaining and repairing fencing; and
- Maintaining and repairing erosion/sediment control structures.

12.1.6 Performance Criteria

Performance criteria are provided in **Table 13 t**o measure the effectiveness of the ecological monitoring and maintenance program. Specific criteria are provided for each of the key monitoring parameters. Where performance criteria are not achieved, potential causes will be investigated; corrective actions required to achieve the criteria and/or justification why criteria have not been achieved must then be provided as part of annual reporting (**Section 12.1.7**).

Table 13 Performance Criteria for the ecological monitoring program

Parameter	Monitoring Method	Performance Criteria
Weed regrowth and outbreaks	Weed mapping; Qualitative assessment (monitoring points); and Photo monitoring.	Weed abundance equal to or less than baseline levels; and Any new noxious or environmental weed species recorded (as compared to the baseline) are eradicated within 12 months.
Vegetation protection	Inspection of fencing and erosion control structures; Qualitative assessment (monitoring points); and Photo monitoring.	No breaks in permanent or temporary fencing; No erosion or sedimentation outside the project disturbance area; and No evidence of human disturbance, unauthorised access or vegetation management outside of project disturbance area.
Vegetation condition	Qualitative assessment (monitoring points); and Photo monitoring.	No major changes in vegetation health or condition.
Threatened flora	Tetratheca juncea and Asperula asthenes population monitoring (at monitoring points).	Less than 10% decline in Tetratheca juncea and Asperula asthenes population sizes (at monitoring sites) within five years; and No significant decline in population health within five years.

12.1.7 Reporting

The findings of the ecological monitoring and subsequent recommended management actions will be documented through the preparation of annual reports. These reports will provide the basis for and guide future management and monitoring of the site.

The monitoring report will include:

- Results of the assessments, including comparison to baseline data and performance criteria;
- Weed mapping, including locations and extent of any new weed infestations;
- Effectiveness of any maintenance works conducted since the previous monitoring events;
- Recommendations and management actions required to address any management issues identified within the site; and
- A summary of ecological monitoring and performance will be provided in the Annual Review.

12.2 Rehabilitation Monitoring

Rehabilitation monitoring was outlined in the specialist *Quarry Closure and Rehabilitation Plan* prepared by GSSE (2012) for the Environmental Assessment.

Regular monitoring of the revegetated areas will be required to demonstrate that the objectives of the rehabilitation strategy are being achieved and that a sustainable, stable landform has been provided. **Table 12** presents the monitoring program, including the specific aspects and elements to be monitored and frequencies for those various aspects. It should be noted that only 'final rehabilitation' will be monitored with temporary rehabilitation inspected for stabilisation.

Monitoring will be conducted periodically by independent, suitably skilled and qualified persons at locations which will be representative of the range of conditions on the rehabilitating areas. Annual rehabilitation monitoring will be conducted to assess trends and monitoring program effectiveness. The outcome of these reviews will be included in the Annual Review.

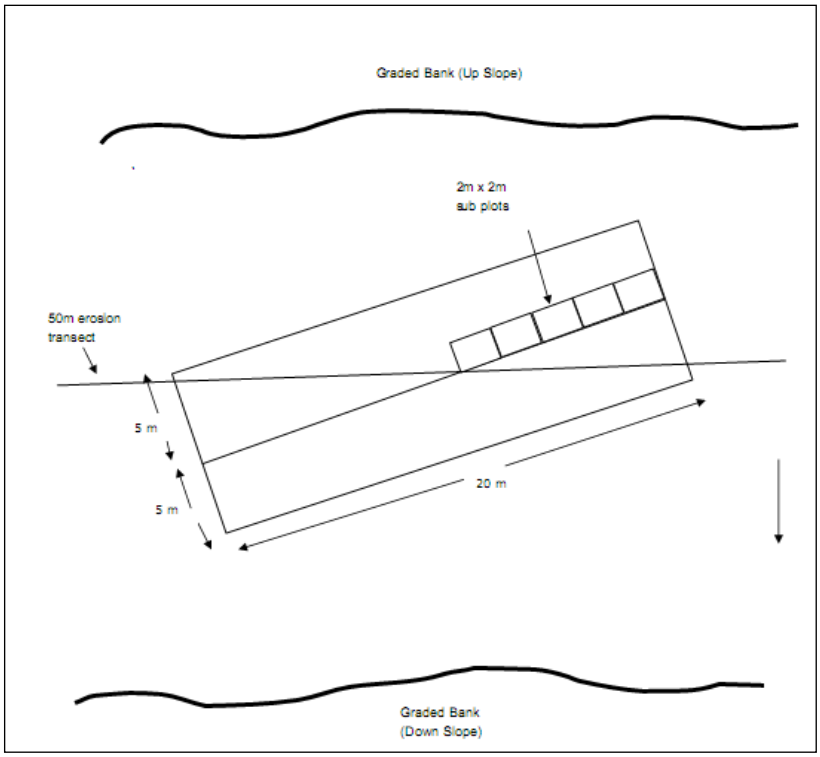
In addition to the rehabilitated areas, at least two reference sites will be monitored to allow a comparison of the development and success of the rehabilitation against a control. Reference sites indicate the condition of surrounding un-disturbed areas.

In developing the rehabilitation monitoring program, the following aspects will be taken into consideration.

- Sites will be monitored 12 months after establishment and then every 2 years.
- A standard monitoring plot design for areas rehabilitated with trees includes:
    - 2 m x 2 m quadrates – these will provide some estimate of statistical variance, so that if required, statistical analyses can be undertaken to objectively compare different rehabilitation treatments and changes over time;
    - a 20 m x 10 m plot overlying the 2 m quadrats and located 5 m either side of the centerline, for ease of monitoring; and
    - a 50 m erosion monitoring transect on contour, running through the centre of the plot.

Figure 6 shows the monitoring plot design that is to be adopted for the monitoring an area revegetated with trees.

Figure 6 Typical Monitoring Plot Design – Woodland



The purpose of the monitoring during operation is so rehabilitation methods can be improved as additional knowledge develops from the monitoring data collected through these programs.

More specifically, monitoring of the key elements in **Table 14** will be undertaken.

Table 14 Proposed Rehabilitation Monitoring Program

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
Ecosystems Establishment		
General Description	• Describe the vegetation in general terms, e.g. mixed eucalypt woodland with grass understorey and scattered shrubs, dense Acacia scrub, etc.	12 months after establishment of final rehabilitation and then every 2 years
2m x 2m quadrats	• Count the number of plants of all species, excluding grass • Measure live vegetation cover for understorey and grasses (separately) using a line intercept method	12 months after establishment of final rehabilitation and then every 2 years

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
	• Record details of ground cover (litter, logs, rocks etc.)	
20m x 10m plots	• Count, by species, all trees >1.6m tall. • Tag and measure DBH of trees >1.6m tall, to a maximum of 10 for any one species. • Record canopy cover over the whole 20m centreline when trees are tall enough • Subjectively describe tree health, by species if relevant, noting signs of drought stress, nutrient deficiencies, disease and severe insect attack. Where health problems are noted, record the percentage of unhealthy trees. • Record any new plant species not present in the smaller plots, including any problem and declared noxious weeds • Take five surface soil samples (e.g. at approx. 5m intervals along the centreline) and bulk these for analyses of: pH, EC, chloride and sulfate; exchangeable Ca/Mg/K/Na; cation exchange capacity; particle size analysis and R1 dispersion index; 15 bar and field capacity moisture content; organic carbon; total and nitrate nitrogen; total and extractable phosphorus; Cu, Mn and Zn.	12 months after establishment of final rehabilitation and then every 2 years

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
50m transect	• Along the 50m erosion monitoring transect, record the location, number and dimension of all gullies >30cm wide and/or 30cm deep. • Erosion pins will be established in plots located in newer rehabilitation to record sheet erosion if present	12 months after establishment of final rehabilitation and then every 2 years
Rehabilitation in general	• When traversing between monitoring plots, note the presence of species of interest not previously recorded (e.g. key functional or structural species, protected species, noxious weeds), as well as obvious problems including any extensive bare areas (e.g. those greater than 0.1ha). • Observations such as this can provide useful, broad scale information on rehabilitation success and problems.	12 months after establishment of final rehabilitation and then every 2 years
Photographic record	• For each 20m x 10m plot, a photograph will be taken at each end of the plot, along the centreline looking in.	12 months after establishment of final rehabilitation and then every 2 years
Habitat	• General observations relating to the availability and variety of food sources (e.g. flowering/fruiting trees, presence of invertebrates etc). • Availability and variety of shelter (e.g. depth of leaf litter, presence of logs, hollows etc). • Presence/absence of free water in the rehabilitated areas	12 months after establishment of final rehabilitation and then every 2 years

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
Fauna	• General observations of vertebrate species (including species of conservation significance). • Detailed fauna surveys including presence and approximate abundance and distribution of vertebrate species (focussing on species of conservation significance).	After final rehabilitation is three years old undertake monitoring in every 2 years after establishment in both Autumn and Spring
Weeds and pests	• Species identity. • Weed spraying and pest management.	Quarterly during the first two years of final rehabilitation and biennially after that. Inspections will be opportunistic after significant rainfall events.
Geotechnical Stability		
	• Assessment of the stability of batters and also looking at surface settlements (sink holes). In particular where these features could impact on the performance of any surface water management system. • Surface integrity of landform cover/capping (measurement of extent of integrity failure). • Presence / absence of landform slumping.	Annually for final rehabilitation
Surface and Groundwater		
	• Groundwater quality and depth. • Efficiency of landform surface water drainage systems (integrity of banks and drains) • Water quality including pH, EC and total suspended solids of water in water storages, and pits, sedimentation dams.	Quarterly or following rainfall events Monitoring of receiving waters during a rainfall event which results in runoff

12.3 Reporting and Improvement of Environmental Performance

Rehabilitation and land management performance will be outlined in Annual Review document. The Annual Review will include details of any rehabilitation and land management completed as well as any results of rehabilitation and ecological monitoring. Rehabilitation and land management performance will be assessed through the review of rehabilitation and ecological monitoring results and through environmental inspections. Proposed changes/improvements to the rehabilitation and land management program are outlined in the Annual Review.

12.4 Complaints Handling and Incident Response

All complaints and environmental incidents relating to rehabilitation and flora and fauna will be managed in accordance with the Environmental Management Strategy.

13 Rehabilitation Success Criteria

Rehabilitation success criteria have been developed to provide long-term performance goals for rehabilitation activities. The rehabilitation success criteria presented in this section are considered conceptual, and will be developed further following consultation with the relevant stakeholders during the detailed mine closure planning stage. Criteria will be reviewed during the updates to this management plan and will take into account rehabilitation performance at the site. Criteria which were outlined in the *Quarry Closure and Rehabilitation Plan (GSSE, 2012)* that was prepared for the EA are outlined in **Table 15** below.

Table 15 Rehabilitation Success Criteria

Rehabilitation Element	Indicator	Criteria
Final Void		
Landform stability	Slope gradient	High wall faces exhibit long-term geotechnical stability and a geotechnical report has been completed. Competent rock high wall to have slope of <70° to the horizontal. Ramp walls not backfilled exhibit long-term geotechnical stability and a geotechnical report has been completed.
	Erosion control	Gully or tunnel erosion is less than 200mm.
	Erosion control	Average soil loss per annum per domain unit is <40 tonnes/ha/yr (sheet erosion). Erosion mitigation measures have been applied to ensure slope stability
	Surface Water Drainage	Use of contour banks and diversion drains to direct water into stable areas, sediment control basins or final void.
Water quality	Salinity (electrical conductivity)	Electrical conductivity of any void water may not exceed 900 µS/cm
Topdressing material (including topsoil and clay)	Salinity (electrical conductivity)	Soil salinity content is <0.6 dS/m.
	pH	Soil pH is between 5.5 and 8.5.
	Sodium content	Soil Exchange Sodium Percentage (ESP) is <15%.
	Nutrient cycling	Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a litter layer, mycorrhizae and/or other microsymbionts. Adequate macro and micro-nutrients are present.

Rehabilitation Element	Indicator	Criteria
Vegetation	Land use	Where in-pit spoil allows, area accomplishes and remains as a healthy working bushland ecosystem (although pasture grasses will be used as required).
	Surface cover	Minimum of 70% vegetative cover is present (or 50% if rocks, logs or other features of cover are present). No bare surfaces >20 m2 in area or >10 m along the benches.
	Species composition	Establishment of vegetation comprise a mixture grasses, shrubs / trees suitable for establishment on steeper slopes.
	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of native plant species.
	Sustainability	More than 75% of individual grasses and shrubs/trees are healthy when ranked healthy, sick or dead.
Safety	Risk Assessment	Risk assessment has been completed and risk mitigation measures have been implemented. Where risk mitigation measures include bunds, safety fences and warning signs, these have been erected generally in accordance with relevant guidelines and Australian Standards.
Quarry Plant/Industrial Areas/Stockpiling Areas		
Landform stability	Slope gradient	Areas have gradients of <2°.
	Erosion control	Erosion mitigation measures have been applied. Average soil loss per annum per domain unit is <40 tonnes/ha/yr (sheet erosion).
	Surface Water Drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		As for 1.

Rehabilitation Element	Indicator	Criteria
Topsoil		As for 1.
Vegetation	Land use	Buildings, water storage, roads (except those used by the public) and other infrastructure have been removed unless stakeholders have entered into formal written agreements for their retention. Areas are readily accessible and conducive to safe management activities. Predicted economics and /or benefits have been defined and agreed by the stakeholders.
	Surface cover	As for 1.
	Species composition	Subject to proposed land use, comprise a mixture of native trees, shrubs and grasses representative of regionally occurring native woodland.
	Resilience to disturbance	As for 1.
	Sustainability	More than 75% of individual grasses and trees / shrubs are healthy when ranked healthy, sick or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the ecosystem type, based on pre-quarry fauna lists and sighted within the three-year period preceding quarry closure. The number of vertebrate species does not show a decrease over a number of successive seasons prior to quarry closure.
	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different ecological processes.
	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of that ecosystem type are present, including: a variety of food plants; evidence of active use of habitat provided during rehabilitation such as nest boxes, and logs and signs of natural generation of shelter sources including leaf litter.

Rehabilitation Element	Indicator	Criteria
Safety	Risk Assessment	Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders.

14 Rehabilitation Bond Calculation

Schedule 3 Condition 34 of PA 09_0175 requires the preparation of the Conservation and Rehabilitation Bond for the Project, with this to be lodged to the DPIE within 6 months of approval of the *Landscape and Rehabilitation Management Plan.* This bond has been lodged.

15 Contingency Plan (Adaptive Management)

The table below refers to the Project Approval requirement (Schedule 5 Condition 3e) to prepare a contingency plan. Key triggers and response relating to rehabilitation are included in **Table 16** below.

Table 16 Rehabilitation Contingency Plan

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
Landform stability	Slope gradient	Trigger	Slopes <1:3 V:H.	Slopes >1:3 V:H, unless agreed by the Secretary.
		Response	No action.	Undertake a review of the landform design, including survey Undertake re-grading and revegetation of the area.
	Erosion control	Trigger	Minor gully or tunnel erosion present and/or minor rilling (rilling up to 200 mm).	Slumping and /or significant gully or tunnel erosion present and/or significant rilling.
		Response	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to install water management infrastructure to address erosion. Remediate.	Engage a specialist to assist with the management of erosion and sedimentation at the site and provide recommendations to remediate the erosion. Remediate within 48 hours Review, and update the *Erosion and Sediment Control Plan*.
	Free Draining Landforms	Trigger	Landforms exhibiting minor ponding.	Landforms exhibiting significant drainage issues.

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
		Response	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to address issues. Remediate as appropriate.	Undertake a review of the landform design, including survey. Undertake re-grading and re-vegetation of the area.
	Water Management Structures	Trigger	Water management structures in rehabilitation areas (sediment dams, channels, contour banks) minor erosion and/or scouring.	Water management structures in rehabilitation areas fail or display significant scouring / erosion.
		Response	An inspection of the site will be undertaken by a suitably trained person. Identify remedial actions such as amelioration, re-vegetation or alternative scour protection.	Engage specialist consultant to develop a site specific remediation plan and review water management structure design criteria.
Material Quality	Salinity	Trigger	Increasing salinity levels in material used in rehabilitation (overburden material).	Presence of salt scalds in rehabilitation.
		Response	Undertake material testing for EC and recommend further amelioration.	Engage a specialist consultant to develop a site specific management report to be implemented to remediate salinity scalds.
	Chemical characteristics	Trigger	Increasing trend in soil dispersivity.	Soil is moderately to highly dispersive.
		Response	Undertake testing to determine required amelioration and undertake amelioration as required.	Ameliorate dispersive spoils (for example with coarse gypsum). Re-vegetate.

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
	Stockpile Height	Trigger	Stockpile height greater than 2 metres (m) and not set out in windrows.	Stockpile height greater than 3 metres (m) and not set out in windrows.
		Response	Reshape topsoil stockpiles.	Reshape topsoil stockpiles.
	Soil pH in rehabilitation	Trigger	Soil pH <5.5 but >4.5 or >8.5 but <9.5.	Soil pH is <4.5 or > 9.5.
		Response	Engage a specialist to recommend appropriate measures to increase/reduce pH to within rehabilitation guidelines. Undertake consultants recommendations. Complete recommendations within 2 weeks.	Engage a specialist to recommend appropriate measures to increase/reduce pH to within rehabilitation guidelines. Undertake consultants recommendations. Complete recommendations within 1 week.
	Soil depth in rehabilitation	Trigger	Soil depth (topsoil and ameliorates) is less than 100mm in rehabilitation areas.	Soil depth (topsoil and ameliorates) in rehabilitation areas is less than 50mm in the rehabilitation areas.
		Response	Top dress with additional suitable topsoil resource and /or ameliorates.	Assess revegetation growth. Undertake a review of the topsoil balance to confirm sufficient material to meet minimum depth requirements. Investigate suitable topsoil resource substitutes (ameliorates). Additional topsoil will be required.

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
	Rehabilitation success	Trigger	<75% but >55%of shrubs and/or trees are healthy when ranked healthy, sick or dead during rehabilitation inspections in rehabilitation areas.	<55% of shrubs and/or trees are healthy when ranked healthy, sick or dead during rehabilitation inspections in rehabilitation areas.
		Response	Undertake a field survey to identify likely causes of vegetation sickness and/or death rates. Re-seed or re-plant tube stock in areas with high sickness or death rates. Review seeding and/or planting procedures.	Engage a suitably qualified specialist to investigate causes for vegetation sickness and death. Implement appropriate management actions.
	Weed Presence	Trigger	> 10% but <25% cover of undesirable species present in rehabilitation areas.	>25% cover of undesirable species present in rehabilitation areas.
		Response	Review and manage the presence of weeds. Engage weed management contractor. Implement agreed actions eg. Weed spraying and removal.	Engage weed management contractor to remove introduced weed species. Investigate management measures to reduce weeds including additional soil amelioration, establishment and retention of cover crops until weed presence is at acceptable levels. Implement recommendations as appropriate. Implement agreed actions eg. Weed spraying and removal.

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
	Temporary Rehabilitation	Trigger	<70% but >55% of vegetation cover is present on areas where hydromulching has been applied within 6 months.	<55% of vegetation cover is present on areas where hydromulching has been applied within 6 months.
		Response	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to address issues. Revegetate as appropriate. Review seed mix and application rates.	Engage a specialist consultant to develop a site specific plan to improve temporary rehabilitation success. Revegetate site as appropriate.
	Pest animal species presence	Trigger	Pest animal species presence and density increased in annual monitoring events.	Significant numbers of pest animals causing widespread damage to rehabilitation.
		Response	Consult with relevant government agencies (including OEH) to recommend and implement appropriate pest animal control campaign.	Consult with relevant government agencies (including OEH) to recommend and implement appropriate pest animal control campaign. Update to *Biodiversity Management Plan.*
Void Water Quality	Void Water Quality	Trigger	Electrical conductivity in the void water exceeds 600 µS/cm	Electrical conductivity in the void water exceeds 900 µS/cm
		Response	Additional water testing.	Additional water testing. Liaison with specialist to reduce EC levels.

16 Indicative Closure Timeframe

Rehabilitation work will be undertaken progressively as soon as reshaped, benched and topsoiled areas become available. Where possible seeding will be undertaken during spring where the best possible rehabilitation result can be expected.

As outlined earlier, minimal rehabilitation can be completed at the quarry until the operation ceases, as the current disturbed areas are required for safe and efficient operation. Most rehabilitation undertaken at the site during operations will be temporary rehabilitation for stabilisation. **Table 17** outlines the conceptual rehabilitation schedule. The site still has approval to operate until 31 December 2034.

This timeframe is assuming that once closure occurs, all infrastructure not required for the post closure land use will be removed, with rehabilitation of the site being undertaken in the first year of closure. Following rehabilitation, the site will be managed through a series of rehabilitation phases.

Specific timings for biodiversity management are set out in the *Biodiversity Offset Area Management Plan*.

Table 17 Proposed Rehabilitation and Closure Schedule

Years From Closure	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10
Closure Planning															
Stakeholder consultation regarding closure															
Agreed final Detailed Rehabilitation and Closure Plan															
Develop an infrastructure demolition plan															
Rehabilitation and Closure Activities															
Decommissioning															
Landform establishment															
Growth media establishment															
Ecosystem establishment															
Ecosystem development															
Relinquished Land															
Post Closure Activities															

Years From Closure	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10
Maintenance of Rehabilitated Areas															
Monitoring and Inspections															

17 Roles and Responsibilities

It is the responsibility of Quarry Manager for the implementation of the *Landscape and Rehabilitation Management Plan.* **Table 18** outlines the responsible positions and accountable tasks.

Table 18 Roles and Responsibilities

Position	Accountable Task
Quarry Manager and Environmental Officer	• Ensure all relevant personnel are aware of rehabilitation procedures. • Ensure all rehabilitation procedures are followed. • Ensure sufficient resources are available to meet rehabilitation criteria and schedule. • Coordinate progressive rehabilitation. • Provide advice and support for the Manager in relation to this Plan. • Ensure all rehabilitation is undertaken in accordance with the rehabilitation procedures presented in this Plan. • Review and analyse rehabilitation monitoring and advise on rehabilitation maintenance. • Conduct regular review of this Plan. • Advise on Best Management Practice mitigation techniques for the site.
Equipment Operators	• Ensure clearing remains within the area nominated by the Manager and identified on plans. • Vehicles to remain on established roads and tracks unless otherwise authorised. • Notify Quarry Manager of any disturbance in native vegetation or rehabilitated sites.

18 Periodic Review

The *Landscape and Rehabilitation Management Plan* must be reviewed and revised and/or updated, in accordance with Schedule 5 Condition 5 of PA 09_0175, within three months of any of the following:

- The submission of an annual review;
- The submission of an incident report;
- The submission of an audit; and
- Any modification to the conditions of the PA.

Review of the *Landscape and Rehabilitation Management Plan* will also take place if monitoring records indicate that it is warranted or in the event of any significant change to operations or air quality management procedures at the quarry.

The Karuah East management team will discuss and review the status of all management plans on an annual basis, but unless required all site environmental management plans will be reviewed and updated every three years.

Any modifications to the *Landscape and Rehabilitation Management Plan* will be undertaken in consultation with the:

- OEH;
- DPIE; and
- Mid-Coast Council.

19 References

Section 75W Application to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area (ADW Johnson 2017);

Environmental Assessment Report – Proposed Karuah East Quarry (ADW Johnson 2013);

Preferred Project Report - Proposed Karuah East Quarry (ADW Johnson 2013);

Noise and Blasting Impact Assessment – Karuah East Quarry Project, Pacific Highway, Karuah (SLR 2012);

Karuah East Quarry Environmental Assessment Section 57W Application (MOD 1) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area (ADW Johnson 2018a);

Section 75W Application (MOD 1) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area (ADW Johnson 2018b);

Response to Submissions Section 75W Application (MOD 1) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area (ADW Johnson 2018a); and

Response to Submissions Section 75W Application (MOD 2) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area (ADW Johnson 2018b).