ANNUAL REVIEW FOR THE KARUAH EAST HARD ROCK QUARRY, KARUAH, NSW

Review Period: 1 January, 2016 – 31 December 2016

Prepared by Karuah East Quarry Pty Ltd and SLR Consulting

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ABBREVIATIONS

CCC	Community Consultative Committee
DA	Development Application
DDG	Dust Deposition Gauge
DP&E	NSW Department of Planning and Environment
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EPL	Environment Protection Licence
Ha	Hectare
km	Kilometre
L	Litre
LDP	Licenced Discharge Point
OEH	Office of Environment and Heritage
POEO Act	Protection of the Environment Operations Act 1997
NPWS	NSW National Parks and Wildlife Service, now part of OEH
RFS	NSW Rural Fire Service
SLR	SLR Consulting Australia Pty Ltd
SWMP	Site Water Management Plan
tpa	tonnes per annum

i PURPOSE OF THE REPORT

Karuah East Quarry Pty Ltd (Karuah East Quarry) has prepared this report which fulfils the Annual Review requirement of the Project Approval PA 09_0175 (Schedule 5, Condition 4).

This Annual Review covers the reporting period from the **1 January 2016** to **31 December 2016**.

This report provides specific detail on the project including a summary of environmental monitoring data and environmental performance during the reporting period. All environmental data in full can be supplied at request.

Name of Operation	Karuah East Quarry Pty Ltd
Name of Operator	Karuah East Quarry Pty Ltd
Development Consent / Project Approval #	PA 09_0175
Name of holder of Development Consent / Project Approval	Karuah East Quarry Pty Ltd
Mining Lease #	None
Water Licences	None
Annual Review start date	1 January 2016
Annual Review end date	31 December 2016

I, Gerard Bowen, certify that this audit report is a true and accurate record of the compliance status of Karuah East Hardrock Quarry for the period 1 January 2016 to 31 December 2016 and that I am authorised to make this statement on behalf of Karuah East Quarry Pty Ltd.

Note.

The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.

The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).

Name of authorised reporting officer	Gerard Bowen
Title of authorised reporting officer	Quarry Manager
Signature of authorised reporting officer	G Bowen
Date 29/3/17.	

1.0 STATEMENT OF COMPLIANCE

Tables 1 and **2** outline the compliance status of the quarry operations at the end of the 2016 reporting period in accordance with relevant approval conditions.

Table 1 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Project Approval (PA 09_0175)	NO
Environment Protection Licence (No. 20611)	YES

Table 2 Non-Compliance

Relevant Approval	**Condition #**	**Condition Description (Summary)**	**Compliance Status**	**Site Comment**	**Where Addressed in Annual Review**
PA 09_0175	S3 Condition 3	Total Suspended Particulates Monitoring	Non - compliance relating to no sample being taken	Power failure at TSP HVAS resulted in missed data on 26 September 2016. The circuit breaker for the HVAS has been replaced to reduce the chance of a power failure occurring.	Covered in this table and **Section 6.8**.
EPL 20611	Nil	Nil	Compliant		

2.0 INTRODUCTION

This Annual Review covers the reporting period from the **1 January 2016** to **31 December 2016** for the Karuah East Quarry.

2.1 Project Overview

Karuah East Quarry is located on Lots 12 and 13 (DP 1024564) off the Pacific Highway, approximately three kilometres north of Karuah, NSW.

The approved development 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.. Removal of overburden is not included in the proposed annual extraction rate of 1.5 million tonnes of andesite;
- 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 truckloads per day (at maximum production);
- Implementation of erosion and sediment and water management control works to ensure no loss of sediment, minimise dust generation and control discharges from the site to ensure that all discharges are within acceptable volumetric and water quality criteria;
- Roadworks to secure access to the site including upgrade and extension of Blue Rock Lane, realignment of Andesite Road and Blue Rock Lane intersection, and adjust road markings at Branch Lane and Andesite Road intersection;
- Employment of up to 28 onsite staff;
- Construction of a new haul road and access through adjoining Roads and Maritime Services (RMS) land;
- Staged clearing;
- Drilling and blasting activities;
- Loading and hauling of extracted material;
- Crushing and screening of extracted material;
- Stockpiling of material onsite; and
- Location of plant on Lot 13 comprised of office buildings, workshops, parking areas, crushing plant, wash plant, weigh bridge and product storage areas.

Operations have not yet commenced, however there a large amount of construction occurred during the Annual Review reporting period, which is outlined in **Section 4.1** and **Section 4.2**.

Figure 1 presents the Karuah East Quarry site plan and layout. **Figure 2** outlines the water management system.

N

LANE

BRANCH

4
D.P.838128

5
D.P.838128

10
D.P.1032636

PROPOSED
QUARRY (14.4 Ha)

201
D.P.1042537

13
D.P.1024564

1
D.P.1032636

(S)

EXISTING
VEGETATION TO BE
RETAINED

EXISTING
DAMS

CRUSHING
PLANT

EXISTING HOUSE
& SHED

11
D.P.1024564

14
D.P.1024564

12
D.P.1024564

EXISTING
VEGETATION TO BE
RETAINED

ENTRANCE ROAD

MAIN OFFICE &
CARPARK

2
D.P.1032636

202
D.P.1042537

21
D.P.1024341

26
D.P.1024341

27 D.P.1024341

1 D.P.719493

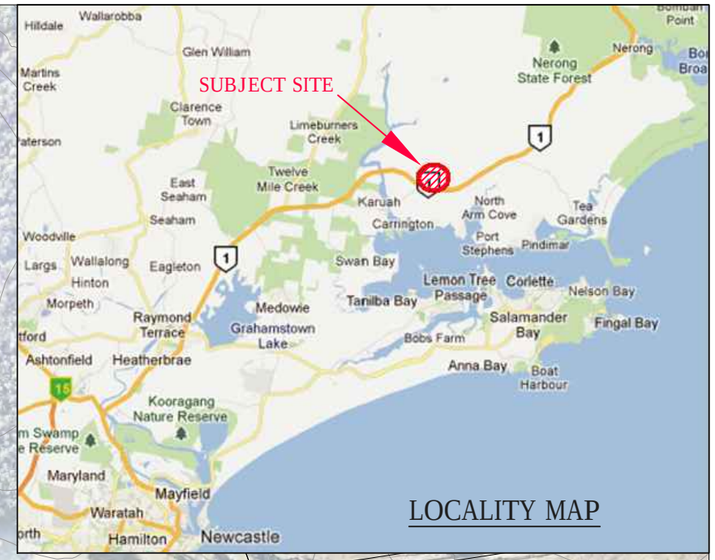
PACIFIC

16 D.P.1024564

HIGHWAY

17 D.P.1024564

18 D.P.1024564



0m 50 100 200 400

Bar Scale 1: 8000 (A3)

(R) RIGHT OF CARRIAGEWAY 10 WIDE (DP.838128)
(S) EASEMENT FOR OVERHEAD POWER RETICULATION 10 WIDE (DP.838128)

NOTE:
Data within this drawing was provided by ADW Johnson 2015 for use in SLR report. Some edits to original ADW drawing have been made by SLR for clarity.
Background aerial photograph sourced from NearMap

LEGEND

- PUBLIC ROAD ACCESS (THE BRANCH LANE)
- EXISTING QUARRY ACCESS (ANDERSITE ROAD)
- EXISTING ACCESS ROAD (BLUE ROCK LANE)
- PROPOSED ACCESS ROAD (BLUE ROCK LANE) EXTENSION
- PROPOSED PRIVATE ACCESS WITHIN LOT 12
- PROJECT APPROVAL AREA
- ADJACENT LOT BOUNDARIES
- PROPOSED DISTURBANCE AREA

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SLR

Karuah East Quarry - Site and Locality Plan

FIGURE 1

Powerline Easement
SW1
Haul Road
13
D.P.1024564
Quarry Extraction Area
In-pit Sump
Sediment Fence
Bund
Proposed LDP1
Existing Farm Dams to be Upgraded
Dam 1
Crushing Plant
Existing House & Shed
Bund
SW2
1
12
SW4
D.P.1024564
2
3
Existing farm dam
SW3
Proposed LDP3
Dam 3
TRUCK PARKING
Proposed LDP2
ENTRANCE ROAD
ENTRANCE ROAD
MAIN OFFICE & CARPARK
Dam 2
WB OFFICE & 2x WEIGHBRIDGES

LEGEND

- Culvert
- Lot boundary
- Proposed dam
- Existing Farm Dam
- Existing Drainage line
- Riparian corridor
- Drop structure
- Clean Water Diversion drain
- Dirty Water Diversion drain

Catchment Areas

- Quarry extraction area (Stage 5)
- Dam 1
- Dam 2
- Dam 3

SW3 ⊗ Proposed Surface Water monitoring points.

N
W E
S

0 50 100 150 200m

V:\633.10196\Figures\CAD\Current\Fg3_HQP05-008_SWPlan_130710_MS.dwg
To be printed A3

Proposed Surface Water Management Plan

FIGURE 2

A3E/Landscape, 10/07/2013 5:01:46 PM, MarinSkoljarev

3.0 APPROVALS

Karuah East Quarry is required to hold relevant approvals for the quarrying operations. These approvals are detailed in **Table 3.**

Table 3 Current Consents and Licences

Instrument	Date of Issue	Date of Expiration	Comments
Environment Protection Licence (No. 20611)	26 August 2015	-	The EPL is a requirement of *the Protection of the Environment Operations Act* (POEO Act) *1997*
Project Approval (PA 09_0175)	17 June 2014	31 December 2034	This is the main statutory document for the site
Federal Approval (EPBC 2014/7278)	20 March 2015	30 March 2045	Federal approval relating to the *Environment Protection Biodiversity Conservation* (EPBC) *Act 1999*

Karuah East Quarry has an Environment Protection Licence (EPL 20611) which covers all activities at Karuah East Quarry. **Table 4** outlines the licensing limits for production and material handling.

Table 4 EPL Fee-Based Activity

EPL Fee-Based Activity	Current Scale (tpa)
Crushing, Grinding or Separating	> 500,000 t – 2,000,000 t processed
Land-based extractive activity	> 500,000 t – 2,000,000 t obtained

3.1 Management Plans

The site operates under a series of approved environmental management plans, including:

- *Environmental Management Strategy;*
- *Air Quality and Greenhouse Gas Management Plan;*
- *Biodiversity Offset Area Management Plan;*
- *Blast Management Plan;*
- *Heritage Management Plan;*
- *Landscape and Rehabilitation Management Plan;*
- *Noise Management Plan;*
- *Traffic Management Plan;*
- *Water Management Plan;* and
- *Tetratheca juncea Translocation Program.*

3.2 Consent Conditions for Reporting in the Annual Review

The preparation of an Annual Review is required by Schedule 5, Condition 4 of PA 09_0175. This Annual review has been prepared in accordance with the Department of Planning and Environment's (DP&E) *Annual Review Guidelines* (2015).

Table 5 details the requirements of Condition 4 of Schedule 5 of PA 09_0175 and the respective section(s) in this document where these consent conditions are addressed.

Table 5 Checklist for Annual Review Reporting

Condition Number	Condition Requirement for Annual Review	Document Section
Schedule 5, Condition 4(a)	*By the end of March each year, the Proponent shall review the environmental performance of the project to the satisfaction of the Secretary. This review must:* *(a) describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;*	This document. First Annual Review
Schedule 5, Condition 4(b)	*(b) include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against:* • *the relevant statutory requirements, limits or performance measures/criteria;* • *the monitoring results of previous years; and* • *the relevant predictions in the EA;*	Section 6
Schedule 5, Condition 4(c)	*identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;*	Section 11
Schedule 5, Condition 4 d)	*identify any trends in the monitoring data over the life of the project;*	No trends yet as less than one year of data
Schedule 5, Condition 4(e)	*identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and*	Section 6
Schedule 5, Condition 4(f)	*describe the measures that would be implemented over the current calendar year to improve the environmental performance of the project.*	Section 12

3.3 Government Agencies Feedback

This is the first Annual Review for the Karuah East Quarry since construction commenced, therefore no feedback has been received.

4.0 OPERATIONS SUMMARY

The following section briefly describes the general operation and environmental performance of Karuah East Quarry during this 2016 reporting period.

4.1 Land Preparation

During the reporting period there was a large amount of land preparation undertaken to meet the requirements of the construction program. This included approximately 21.4 hectares of land which was cleared in accordance with the requirements of PA 09_0175, Federal Approval and key environmental management plans, including the *Landscape and Rehabilitation Management Plan* (LRMP). Pre clearance ecological work was completed and is detailed in **Section 6.5** and **Appendix 7**.

Photo 1 - Barrier tape and pink flagging tape is used to define the boundaries during the clearing process

Photo 2 – Current Cleared Quarry Footprint

4.2 Construction Activities

There was a large amount of construction and clearing associated with the Karuah East Quarry Project, including:

- The initial clearing of approved disturbance area which commenced on 27 April 2016. All relevant approvals were in place prior to commencing clearing;
- Pre clearance surveys and vegetation clearing supervision was completed by ecologists;
- The first stage of clearing of the approved disturbance area was completed on 21 November 2016. Vegetation still remains in the upper parts of the extraction area and will be cleared in future years as the Quarry progresses;
- Internal earthworks commenced on 11 August 2016. Daracon were contracted to undertake earthworks. Internal earthworks are close to being completed and include:
  - Internal haul road between plant to Weighbridge;
  - Internal access road has been excavated (final capping is still required);
  - Topsoil has been stripped from extraction area and stockpiled at site;
  - Product stockpile area has been levelled;
  - Ground is being cut and filled to allow for the construction of plant and site buildings; and
  - Dams 1, 2 and 3 were completed in October 2016 which includes additional water management around the area of Dam 2.
- Drilling and blasting has commenced. The first blast for the Karuah East Quarry was conducted on 14 December 2016. Blasting has been used for excavating the area for the new crushing plant. The material from this blasting is crushed and utilised on site; and
- Clearing of the Blue Rock Close extension only commenced in January 2017 and will be reported on in the 2017 Annual Review.

Photo 3 - Dam 1 looking west towards haul road

Photo 4 - Dam 3 - Spillway can be seen on the right

Photo 5 - Internal access road looking east

4.3 Quarry Operations

No quarrying operations were undertaken during the Annual Review reporting period. An update to quarrying operations will be provided in future Annual Reviews. There has been no material produced and hauled offsite during the reporting period. Some material has been processed through a portable crusher which was required as part of the construction phase to assist with stabilisation of the main infrastructure area.

Operations will likely commence in mid to late 2017, but are dependent on the completion of construction activities.

4.4 Operating Hours

In accordance with Schedule 2, Condition 7 of the PA 09_0175, Karuah East Quarry will operate during the following hours (see **Table 6**):

Table 6 Approved 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)$L_{Aeq(15minute)}$ 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.

During the Annual Review reporting period only the construction and maintenance hours were applicable to the site.

4.5 Operating Equipment

During the 2016 reporting period the following equipment were utilised for the construction of the Karuah East Quarry:

- Excavator x 4;
- Bulldozer x 2
- Mobile crusher (screening and crushing equipment);
- Front end loader;
- 13,000 L water tanker;
- Onsite Haul trucks x 2; and
- Road Grader.

4.6 Next Reporting Period

Table 7 outlines forecast operations for the next reporting period.

Table 7 Forecast Operations for Next Reporting Period

Aspect	Forecast for Next Reporting Period
Pit Expansion Areas	The footprint for the next Annual Review reporting period has been cleared.
Infrastructure Development / Upgrades	The Quarry Plant will be established during the 2017 reporting period.
Mining Fleet Upgrades	There will be a requirement for additional mining fleet to be purchased prior to the operations phase commencing.

5.0 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

This is the first Annual Review for the Karuah East Quarry, therefore no actions were taken.

6.0 ENVIRONMENTAL PERFORMANCE

6.1 Meteorological Monitoring

Schedule 3, Condition 17 of PA 09_0175 requires:

> *For the life of the project, the Proponent shall ensure that there is a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.*

A new meteorological station was installed to replace the long term monitoring station at the existing Karuah Quarry (adjacent to Karuah East Quarry) in August 2016. It should be noted that although the meteorological data has been presented for the full year, construction activities associated with Karuah East Quarry commenced in April 2016.

Table 8 presents a summary of the meteorological data collected by the meteorological station during the Annual Review reporting period.

Table 8 Annual Review Meteorological Data

Month	Temp (C^o)[1]			Rainfall[2]			Wind[1]
	Average (C^o)	Min Temp (C^o)	Max Temp (C^o)	Total (mm)	Max Daily (mm)	No rain days > 1 mm	Max Wind Gust (km/h)
Jan-16	22.8	13.2	41.4	422.4	225.0	12	49.9
Feb-16	22.7	13.6	33.8	32.4	11.0	5	33.8
Mar-16	22.5	11.5	33.6	40.8	13.6	9	30.6
Apr-16	19.5	10.6	35.1	150.8	110.8	6	51.5
May-16	16.5	1.7	28.5	11.2	6.0	3	38.6
Jun-16	13.3	0.8	22.5	156.9	91.4	9	51.5
Jul-16	12.5	-0.6	26.4	52.6	17.6	8	53.1
Aug-16	12.9	3.7	25.5	55.8	10.4	11	38.6
Sep-16	16.0	5.3	25.9	54.8	12.0	11	72.2
Oct-16	17.6	5.3	33.9	84.4	25.2	8	53.3
Nov-16	21.1	8.8	37.2	59.4	24.2	5	61.5
Dec-16	24.2	13.4	40.8	88.2	37.4	6	47.3

Note: 1. The Temperature and Wind data for January – August 2016 sourced from Karuah Quarry's meteorological station. Temperature and Wind data for September – December 2016 sourced from Karuah East Quarry's new meteorological station.

2. Rainfall data for January – August 2016 sourced from Williamtown, Bureau of Meteorology. Rainfall data for September – December 2016 sourced from Karuah East Quarry's new meteorological station.

The most extreme rainfall events occurred prior to construction commencing, with heavy rain occurring in January 2016. Heavy rainfall events also occurred during June 2016. Low rainfall occurred in May 2016 and August to December 2016 which assisted with construction activities.

6.2 Noise

6.2.1 EIS / Preferred Project Report Predictions

Construction

All predicted construction noise levels (stage 1 of quarry lifecycle) were below project specific noise criteria (SLR, 2012).

Operations

As part of the *Noise and Blasting Impact Assessment (SLR, 2012),* noise levels are predicted based on the three stages of the quarry lifecycle. All predicted levels were below the project specific noise criteria.

6.2.2 Approved Criteria

Approved noise criteria from PA 09_0175 are outlined in **Table 9** and are based on the *Interim Construction Noise Guidelines* (ICNG) (EPA, 2009).

Construction

Table 9 ICNG Construction Noise Management Levels

Time of Day	Management Level	How to apply
Recommended standard hours : Monday to Friday 7:00am to 6:00pm Saturday 8:00am to 1:00pm No work on Sundays or public holidays	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,(15mins)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly affected noise level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise levels of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

In accordance with the ICNG, **Table 10** presents the adopted construction noise goals for the project.

Table 10 Project Specific Construction Noise Goals (dBA $L_{Aeq(15minute)}$)

Location	Adopted RBL[1]	Noise Management Level (dBA $L_{Aeq(15minute)}$)	
		Noise Affected	Highly Noise Affected
Any approved Residence on Lot 11 DP 1024564[2]	44	54	75
A to E	44	54	
F	44	54	
G	34	44	

Note 1 – Adopted RBL as outlined in Noise Management Plan.
Note 2 – At present there is no approved residence on Lot 11.

Operational

Operational noise criteria are outlined in Schedule 3, Condition 3 of PA 09_0175 and state:

> *The Proponent shall ensure that the operational noise generated by the project does not exceed the criteria in* **Table 11.**

Table 11 Operational Noise Criteria (dBA $L_{Aeq(15minute)}$)

Location	*Criteria (day)*
Residence on Lot 11 DP 1024564	*43*
A	*40*
B	*37*
G	*38*
All other residences	*35*

The noise criteria in **Table 11** do not apply if the Proponent has an agreement with the relevant landowner to generate higher noise levels.

EPL Condition L4

The noise limits set out in Condition L4.1 of the EPL 20611 are reproduced in **Table 12** are generally consistent with the criteria detailed in PA 09_0175.

Table 12 EPL Noise Limits (dBA $L_{Aeq(15minute)}$)

Location	Noise Limit dBA - Day $L_{Aeq(15minute)}$
Residence A on Lot 100 DP 785172	40
Residence B on Lot 3 DP 785172	37
Residence G on Lot 1 DP 1032636	38
Any other residence or sensitive receiver not subject to a private negotiated agreement	35
Any approved residence on Lot 11 DP 1024564	43

Operational Noise Limits on Lot 11

It is noted that the noise limits detailed in EPL 20611 for Lot 11 are for *"any approved residence on Lot 11 DP 1024564"*. Currently, there is not an approved residence on Lot 1, therefore it is considered that the noise limits do not currently apply at this location.

As outlined in Section 1.1 of the *Noise Management Plan*, the DP&E agree that criteria only applies to 'Residence on Lot 11' if there is a Council approved residence within Lot 11. At this point in time, there is not a Council approved residence on Lot 11. Karuah East Quarry is committed to undertaking noise monitoring to determine compliance at 'approved residences' only. Should a residence be approved by Council on Lot 11, the *Noise Management Plan* will be updated to include noise monitoring at this location.

It should also be noted that operational criteria was not applicable during the Annual Review reporting period as the site was in the construction phase.

6.2.3 Key Environmental Performance or Management Issues

In accordance with PA 09_0175, both attended and unattended noise monitoring has been conducted at the nearest residential receivers to the quarry during the 2016 reporting period.

A summary of the results are provided in **Tables 13** to **16** below, with full copies of the noise monitoring reports appended to this Annual Review (see **Appendix 4**).

May Construction Noise Monitoring

Table 13 Operator Attended Noise Survey Results (May 2016)

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels LAmax – dBA
	LAmax	LA1	LA10	LA90	LAeq	
Location F Day 29/05/2016 13:59 pm W = 1m/s NW Temp = 25.6°C	73	61	49	43	50	Local road traffic 71 to 73 dBA Pacific Highway 47 to 52 dBA Frogs 48 dBA Dog Barking 48 to 50 dBA Birds 40 dBA Insect 38 dBA Hunter Quarry 34 dBA Karuah East Project not audible
Location G Day 29/05/2016 14:26 pm W = 1m/s NW Temp = 25.6°C	56	49	41	35	39	Chainsaw (not project related) 40dBA Insects 36 to 40 dBA Aircraft 42 dBA Birds 52 to 56 dBA Distant Road Traffic Noise 35 dBA Karuah East Project not audible

Table 14 Compliance Noise Assessment – Construction (May 2016)

Location	Estimated $L_{Aeq(15minute)}$ Contribution	Consent Conditions $L_{Aeq(15minute)}$	Compliance
Location F	<33[1]	44	Yes
Location G	<25[1]	34	Yes

Note 1: Karuah East construction activities remained inaudible during operator attended noise measurement suggesting that any contribution would be at least 10 dB below the overall LA90 noise level presented in **Table 4**.

Results presented in **Table 13 and 14** indicate that compliance with the relevant consent conditions was achieved at all noise monitoring locations for May 2016 monitoring.

Karuah East Quarry construction activities were found to be inaudible and therefore noise contributions from the quarry were found to be within the relevant consent condition criteria at all monitoring locations.

September 2016 Construction Noise Monitoring

Table 15 Operator Attended Noise Survey Results (September 2016)

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels L_{Amax} – dBA
	L_{Amax}	LA1	LA10	LA90	L_{Aeq}	
Location F Day 6/09/2016 9:05 am W = 1 m/s NW Temp = 13°C	74	55	50	43	49	Local road traffic 74 dBA Pacific Highway 45 to 55 dBA Frogs/Insects 35 to 37 dBA Birds 50 to 54 dBA Aeroplane 49 to 56 dBA Karuah East Project Construction not audible
Location G Day 6/09/2016 9:30 am W = 1 m/s N Temp = 16°C	60	51	44	33	40	Pacific Highway 32 to 38 dBA Frogs/Insects 30 to 36 dBA Birds 47 to 60 dBA Aeroplane 52 dBA Karuah East Project Construction not audible

Table 16 Compliance Noise Assessment – Construction (September 2016)

Location	Estimated $L_{Aeq(15minute)}$ Contribution	Consent Conditions $L_{Aeq(15minute)}$	Compliance
Location F	<33[1]	54	Yes
Location G	<23[1]	44	Yes

Note 1: Karuah East construction activities remained inaudible during operator attended noise measurement suggesting that any contribution would be at least 10 dB below the overall LA90 noise level presented in **Table 4**.

Results presented in **Table 15** and **16** indicate that compliance with relevant consent conditions were achieved at all noise monitoring locations for construction during the September 2016 monitoring event.

Karuah East Quarry construction activities were found to be inaudible and therefore noise contributions from the quarry were found to be within the relevant consent condition criteria at all monitoring locations.

6.2.4 Management Measures

The following objectives and management measures apply to noise management at Karuah East Quarry during the Annual Review reporting period:

The following best practice noise control measures shall be implemented:

- Adherence to operating hours;
- Noise monitoring will be undertaken on site and within the community;
- Keep plant and equipment well maintained;
- Regular inspection and maintenance of equipment to ensure it is in good working order and operating at the lowest feasible noise level;
- Equipment is not to be operated until it is maintained or repaired;
- Regular training for staff and contractors (i.e. toolbox talks) for the use of equipment in ways to minimise noise;
- Operate mobile plant in a quiet, efficient manner;
- Switching off vehicles and plant when not in use;
- A speed limit of 40 km/hour will be applied and enforced for all construction related vehicles onsite;
- Incorporate clear signage at the site including relevant contact numbers for community enquiries; and
- Prompt response to any community concerns.

6.2.5 Proposed Improvements to Management Measures

Noise monitoring indicates that the noise levels emitted by the site were below the requirements in the PA 09_0175 criteria during the construction phase at Karuah East Quarry. Noise monitoring will continue to be completed during the 2017 Annual Review period and will include both construction and operational scenarios.

Additional noise mitigation measures will be put in place once the site is operational. This includes the enclosure of screens and crushers.

6.3 Blasting

6.3.1 EIS Predictions

The Noise Impact Assessment (NIA) (SLR, 2012) prepared as part of the EIS, developed blasting site laws for Karuah East Quarry based on blast monitoring results from the existing Karuah Quarry. The site laws were utilised to determine limiting factors to blast design for the site in order to achieve the criteria described in **Section 6.3.2**. Based on the predicted blast results the blast emission criteria are predicted to be met without imposing any significant constraints on blast design throughout the life of the quarry.

6.3.2 Approved Criteria

Blasting criteria for the site are provided in Schedule 3, Condition 8 of PA 09_0175 and are summarised in **Table 17.**

Table 17 Project Approval Blasting Criteria

Location	Airblast overpressure (dB(Lin Peak))	Ground Vibration (mm/s)	Allowable Exceedance
Any residence on privately-owned land, or any public infrastructure	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months

Conditions L5.3 to 5.6 of EPL 20166 detail the blast limits for the project. The blast limits contained in the EPL are consistent with those presented in PA 09_0175.

6.3.3 Key Environmental Performance or Management Issues

There was only one blast during the reporting period relevant for construction activities at Karuah East Quarry. The results are outlined below:

Table 18 Blast Results 2016

Date and time	Overpressure and vibration	Monitor 1 (Front Gate)	Monitor 2 (Nearest Residence)
14/12/2016 13:47	Overpressure dB(L)	106.9	101.8
	Vibration (mm/s)	0.97	0.33

During the 2016 Annual Review reporting period:

- No blasts exceeded 120 dBL;
- No blast exceeded 115 dBL at the nearest residential dwelling or privately owned land; and
- All blasts were within the vibration criteria.

Blast monitoring locations are shown in **Appendix 3**.

6.3.4 Management Measures

Section 6 of the *Blast Management Plan* outlines the proposed blasting controls on site. In summary these include:

- Considerations of explosive loading, initiation sequence and firing;
- Use of experienced blast contractors;
- Monitoring of meteorological conditions prior to blasting; and
- Notifying landowners (at their request) and occupiers of blast events.

Additionally, all blasting activities at Karuah East Quarry are monitored by a licensed blasting contractor.

6.3.5 Proposed Improvements to Management Measures

Karuah East Quarry will continue to monitor all blasts at Receptor B as per the approved *Blast Management Plan*. Blast design and management will be completed in accordance with the approved *Blast Management Plan*. There will be a large increase in blasting activities during 2017 to finalise construction and commence operations.

6.4 Air Quality

6.4.1 EIS Predictions

The revised Air Quality Impact Assessment (AQIA) (updated for the Preferred Project Report) indicates that Karuah East Quarry may operate without significant impact on the surrounding environment. In particular, the updated AQIA has confirmed that potential cumulative impacts of Karuah East Quarry and existing Karuah Quarry are well below acceptable criteria levels and will not impose adverse impacts. Overall, it has been demonstrated that the AQIA for Karuah East Quarry is acceptable in terms of air quality considerations for both the construction and operational phases.

6.4.2 Approved Criteria

AQIA criteria relevant to the Project are provided in Schedule 3, Condition 13 and Tables 3 to 5 of PA 09_0175 and have been reproduced in **Table 19**, **Table 20**, and **Table 21**. The criteria are prescribed by the NSW Environment Protection Authority (EPA) in their document, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2005)* (Approved Methods).

All reasonable and feasible avoidance and mitigation measures are to be employed so that particulate matter emissions generated by the project do not exceed the criteria in **Table 19** to **Table 21** at any residence on privately owned land.

Table 19 Long-term impact assessment criteria for particulate matter

Pollutant	Averaging Period	[d] Criterion
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m^3

Table 20 Short-term impact assessment criteria for particulate matter

Pollutant	Averaging Period	[d] Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m^3

Table 21 Long-term impact assessment criteria for deposited dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c] Deposited dust	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month

Notes to **Table 19** to **Table 21** above:

a. Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to all other sources).

b. Incremental impacts (i.e. incremental increase in concentrations due to the project on its own).

c. Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003 Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter - Deposited Matter - Gravimetric Method.

d. Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the Director-General in consultation with EPA.

No specific limit conditions are specified for air quality emissions in EPL 2166.

6.4.3 Key Environmental Performance or Management Issues

The principle source of air pollution at the quarry is in the form of airborne dust, which arises from activities such as construction, quarrying, vehicle movements and crushing. **Table 22** outlines depositional dust monitoring results during 2016. Construction activities (vegetation clearance) first commenced at Karuah East Quarry on 27 April 2016. Monitoring prior to this date was completed to satisfy Project Approval requirements for the adjacent Karuah Quarry and allows a comparison of dust levels between pre Karuah East Quarry construction and during Karuah East Quarry construction.

Depositional Dust

Depositional dust results are outlined within **Table 22**. There is a comparison between pre – construction and during construction.

Table 22 Depositional Dust Monitoring Summary (g/m^2/month)

Date	DDG 1	DDG 2	DDG 3	DDG 4	DDG 5	Comment
Pre - Construction						
08/01/2016 to 08/02/2016	1.4	0.9	0.8	1.2	Not Established (NE)	No activity – Karuah East Quarry
08/02/2016 to 03/03/2016	4.0	0.7	0.6	0.9	NE	No activity – Karuah East Quarry
03/03/2016 to 04/04/2016	3.1	0.3	1.0	2.0	NE	No activity – Karuah East Quarry
Annual Average (Jan to March 2016)	2.8	0.6	0.8	1.4	NE	
Minimum (Jan to March 2016)	1.4	0.3	0.6	0.9	NE	
Maximum (Jan to March 2016)	4.0	0.9	1.0	2.0	NE	
Construction Phase						
04/04/2016 to 06/05/2016	1.5	1.1	0.4	3.2	NE	Construction commenced (clearance of vegetation) on 27 April 2016
06/05/2016 to 03/06/2016	1.0	0.9	0.7	0.4	NE	Construction activities
03/06/2016 to 04/07/2016	0.4	1.6	0.5	0.3	NE	Construction activities
04/07/2016 to 01/08/2016	1.4	0.7	0.3	0.5	NE	Construction activities
01/08/2016 to 31/08/2016	2.7	3.0	0.8	0.7	NE	Construction activities
31/08/2016 to 28/09/2016	2.1	1.6	0.8	0.8	0.9	Construction activities
28/09/2016 to 26/10/2016	0.8	0.6	0.8	0.5	0.7	Construction activities
26/10/2016 to 23/11/2016	0.7	1.0	1.3	2.3	1.9	Construction activities
23/11/2016 to 21/12/2016	1.3	0.5	0.9	1.0	4.2	Construction activities
21/12/2016 to 18/01/2017	0.4	0.8	0.7	2.5	3.1	Construction activities
Annual Average (April to December 2016)	1.2	1.2	0.7	1.2	2.2	
Minimum (April to December 2016)	0.4	0.5	0.3	0.3	0.7	
Maximum (April to December 2016)	2.7	3.0	1.3	3.2	4.2	

There is no comparison of long term data as this is the first year of dust monitoring required for Karuah East Quarry. All dust gauges were below the annual average for Karuah East Quarry based on the construction period (April – December 2016). When there is a comparison between the average depositional dust levels from pre-construction (January 2016 – March 2016) to during construction (April 2016 – December 2016), the following has been determined:

- DDG1 – Higher average at DDG1 prior to commencement of Karuah East Quarry construction;
- DDG2 – Increase in dust levels at DDG2 since construction of Karuah East Quarry commenced, however still within annual criteria;
- DDG3 – Little change between pre-construction and during construction dust levels at DDG3;
- DDG4 – Higher average at DDG4 prior to commencement of construction at Karuah East Quarry; and
- DDG5 – Only established once construction had commenced.

High Volume Air Sampler

Table 23 outlines the High Volume Air Sampler (HVAS) results during the 2016 reporting period. It should be noted that monitoring first commenced in April 2016.

Table 23 High Volume Air Sampler Results (µg/m³)

Date	TSP (µg/m³)	PM10 (µg/m³)	Comments
29/04/2016	23	18	
05/05/2016	20	18	
11/05/2016	17	8	
17/05/2016	25	19	
23/05/2016	35	20	
29/05/2016	11	5	
04/06/2016	9	8	
10/06/2016	11	4	
16/06/2016	10	8	
22/06/2016	11	4	
28/06/2016	11	6	
04/07/2016	20	5	
10/07/2016	10	6	
16/07/2016	10	8	
22/07/2016	14	7	
28/07/2016	9	5	
03/08/2016	27	14	
09/08/2016	11	6	
15/08/2016	18	12	
21/08/2016	10	5	
27/08/2016	9	4	
02/09/2016	11	7	
08/09/2016	15	8	
14/09/2016	11	6	
20/09/2016	16	9	
26/09/2016	Breakdown	Breakdown	Power failure
02/10/2016	18	7	
08/10/2016	35	21	

Date	TSP (µg/m³)	PM10 (µg/m³)	Comments
14/10/2016	12	8	
20/10/2016	19	11	
24/10/2016	21	12	Catch up sample for 26/9/2016
26/10/2016	21	12	
01/11/2016	19	9	
07/11/2016	74	50	Bushfires in vicinity
13/11/2016	27	14	
19/11/2016	40	24	
25/11/2016	28	13	
01/12/2016	25	12	
07/12/2016	16	14	
13/12/2016	41	21	
19/12/2016	41	23	
25/12/2016	19	13	
31/12/2016	34	22	
Year to date Average	20.5	12.0	
Year to date minimum	9	4	
Year to date maximum	74	50	
[1]24hr Max Criteria	**N/A**	**50**	
[1]Annual Average Criteria	**90**	**30**	

Notes:

- [1]= Maximum criteria as specified in PA 09_0175
- Results for dust monitoring have been below the criterion for all parameters.
- The high volume air samplers failed to start on the 26 September 2016 due to an electrical fault.

HVAS Total Suspended Particulates (TSP) and Particulate Matter less than 10 microns (PM_{10}) was below the relevant criteria since the commencement of monitoring in April 2016. There was one elevated level for PM_{10} on the 7 November 2016 which occurred as a result of bushfires within the vicinity of Karuah East Quarry.

6.4.4 Management Measures

The following best practice air quality control measures will also be implemented during the construction and operational phases of the quarry:

- Disturb only the minimum area necessary for onsite activities;
- Exposed areas are rehabilitated as soon as practicable with inert material and vegetation;
- Perform regular inspections of weather conditions to identify conditions which would be unfavourable in terms of dust levels at nearest sensitive locations blowing in the direction of sensitive receptors and implement remedial measures where required;
- All trafficable areas and vehicle manoeuvring areas in or on the premises will be maintained in a condition that will minimise the emission of dust to the air, or emission from the premises of wind-blown or traffic generated dust;
- Trucks entering and leaving the premises that are carrying loads of dust generating materials will have their loads covered at all times, except during loading and unloading; and
- All plant and equipment to be installed at the site to be maintained and operated in a proper and efficient condition, in accordance with manufacturer's instructions and POEO Act and Regulation.

6.4.5 Proposed Improvements to Management Measures

The Karuah East Quarry will continue to monitor air quality in accordance with the conditions of PA 09_0175 and will also review measures for improving dust management on site. Air quality monitoring during this reporting period showed air quality and dust levels are compliant with PA 09_0175 criteria. Additional controls will need to be implemented once the site is operational, as there will be additional dust sources to the construction phase.

6.5 Biodiversity

6.5.1 EIS Predictions

Major design amendments were undertaken in an effort to substantially decrease potential flora and fauna impacts associated with the Karuah East Quarry. This has resulted in a significant reduction in potential direct impacts on two state and federally listed threatened flora species - *Tetratheca juncea* and *Grevillea parviflora ssp parviflora*.

No Endangered Ecological Communities or Critically Endangered Ecological Communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) and EPBC Act were recorded.

6.5.2 Approved Criteria

There are no specific criteria associated with biodiversity management for the Karuah East Quarry. Activities are completed in accordance with the Preferred Project Report, Federal Approval, *Biodiversity Offset Area Management Plan* and *LRMP*.

6.5.3 Key Environmental Performance or Management Issues

Biodiversity Offset Area and Lot 12

The Biodiversity Offset Area (BOA) for the Karuah East Quarry is a 131.49ha consolidated land parcel comprised of three lots:

- Lot 13 DP 1024564 (part);
- Lot 14 DP 1024564; and
- Lot 5 DP 838128.

Ecological monitoring for the Karuah East Quarry was completed by Kleinfelder in October 2015 and October 2016. A copy of the 2016 Ecological Monitoring Report is attached as **Appendix 5**.

A total of 18 vegetation monitoring sites were established and surveyed within the BOA and Lot 12 in October 2015. These permanent monitoring sites were surveyed in October 2016 using the same methods as the baseline survey (see **Appendix 5**). A series of criteria have been developed as part of the overall ecological monitoring program, including:

- Fencing, gates and signage;
- Access tracks;
- Erosion, sedimentation and soil management;
- Existing dwellings;
- Revegetation and regeneration;
- Habitat augmentation;
- Threatened flora translocation;
- Weed control;
- Vertebrate pest management; and
- Fire management.

The results from the 2016 monitoring indicate that the vegetation and fauna habitats within the Karuah East Quarry BOA and Lot 12 are in high condition and remain relatively unchanged since the 2015 baseline survey. Additionally, no significant changes were recorded within the threatened flora populations sampled at the monitoring sites, and these populations were assessed as being in healthy condition.

Pre-Clearance Assessment

Kleinfelder were engaged by Karuah East Quarry to undertake pre-clearing surveys and supervise the clearing of native vegetation for the site in 2016. The letter dated 3 February 2017 summarised the pre-clearance assessments undertaken during the Annual Review reporting period.

Pre-clearing surveys for habitat features and major weed infestations were undertaken in March and April 2016. Pre-clearing surveys targeting Koalas were also undertaken by Kleinfelder each morning prior to supervising the clearing works. Additional pre-clearing fauna surveys involving Elliot trapping, diurnal searches and nocturnal surveys (spotlighting and stag watching) were also undertaken in late May and June 2016, in accordance with the LRMP.

Vegetation clearing for the Karuah East Quarry commenced in April 2016 and the majority of the approved disturbance footprint was cleared between April and June 2016, with some clearing also occurring in July and November 2016 (total of approximately 21.4 ha). For the purposes of this report, the vegetation clearing completed to date within the project area is referred to as Stage 1. The remaining vegetation within the northern part of the project area (approximately 10.2 ha) is unlikely to be cleared for some time as the areas cleared to date contain andesite resources that will take at least several years to extract. The extent of the Stage 1 clearing area, and the extent of the project disturbance area and adjoining Karuah East Quarry BOA are shown in **Figure 2** and **3**. A total of 63 confirmed habitat trees (comprising 48 hollow-bearing trees and 15 dead stags) were felled during the Stage 1 clearing supervision. These 63 habitat trees contained a total of 202 hollows.

A total of 54 native animals comprised of 15 species were safely captured and relocated during the clearing operations. Only three fauna deaths occurred during the clearing operations. None of the species captured or observed during pre-clearing surveys or clearing supervision are listed as threatened under the TSC Act or EPBC Act.

A full copy of the pre-clearance assessment is attached as **Appendix 7**.

Figure 3 Current Clearing within the Karuah East Quarry Project Area (Kleinfelder 2017)

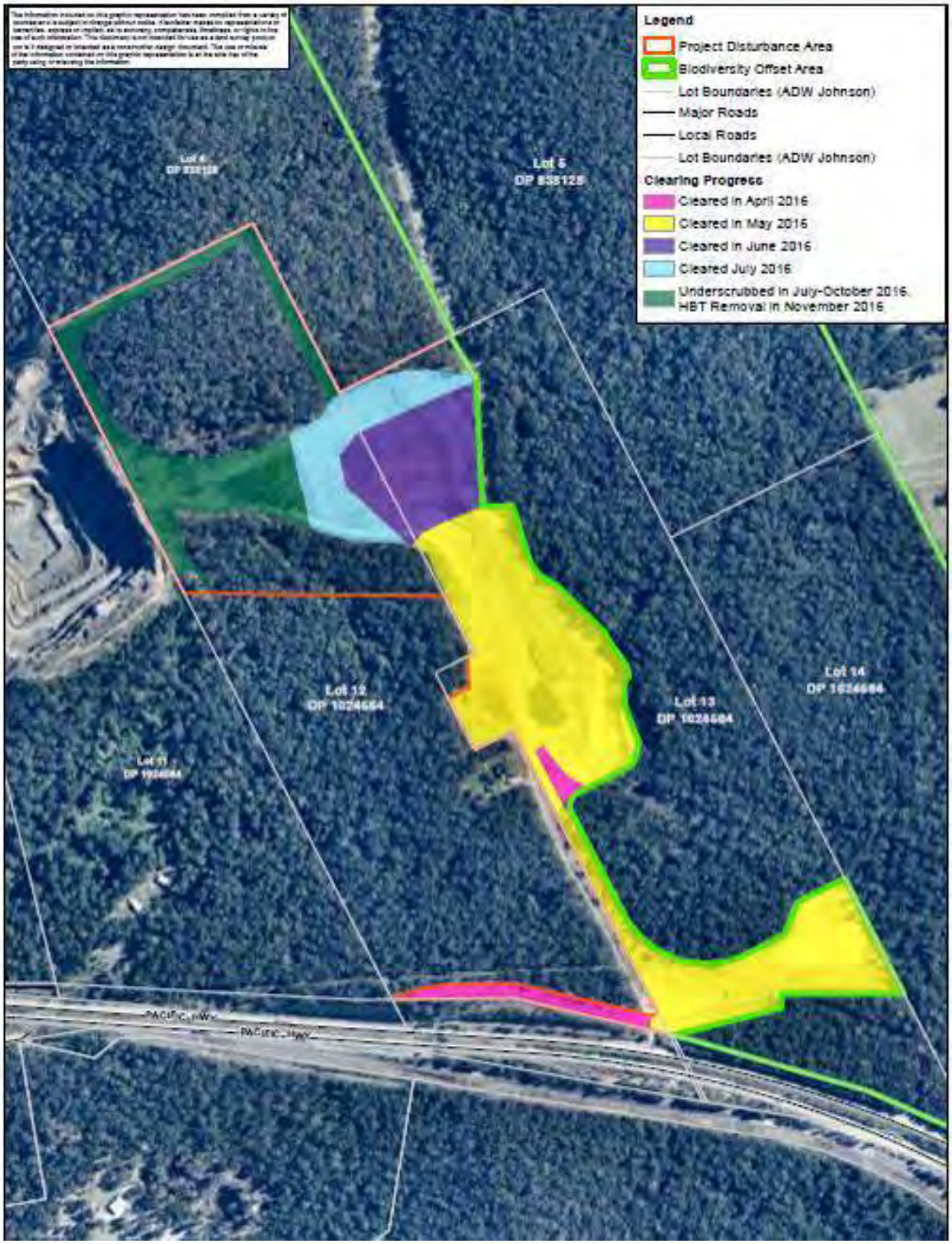
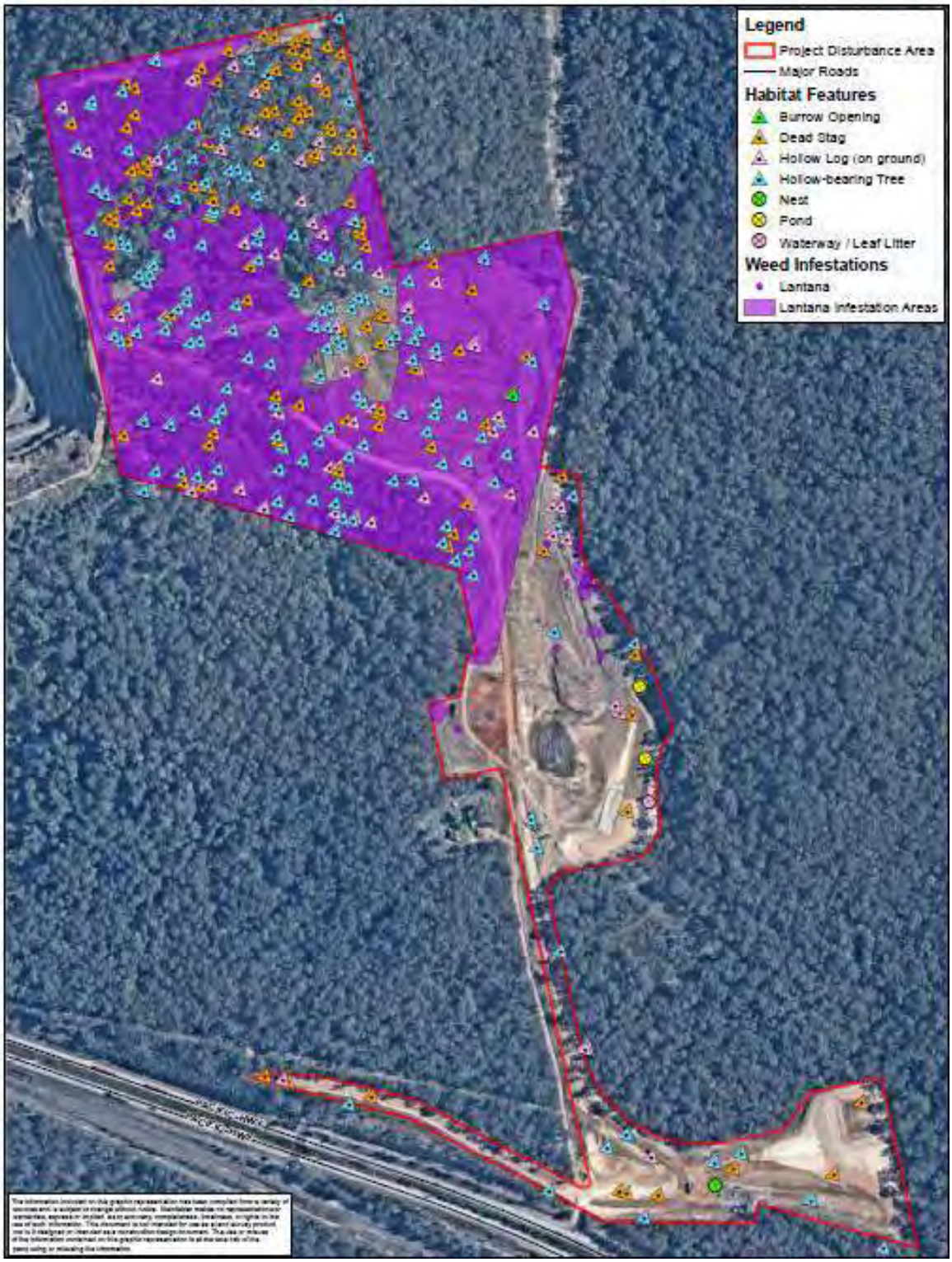


Figure 4 Habitat Features and Major Weed Infestations (Kleinfelder 2017)



***Tetratheca juncea* Translocation**

Monitoring of the *Tetratheca juncea (T.juncea)* translocation has been completed by Firebird (2016).

In accordance with the Translocation Plan for *Tetratheca junce* (*T.juncea*) (Firebird ecoSultants, 2015), monitoring of *T.juncea* was undertaken by Firebird ecoSultants (2016) to satisfy the requirements of the Project Approval PA 09_0175 for the Karuah East Quarry.

The site was originally surveyed and found that the approved impact area had 243 clumps of *T.juncea*. However, at the time of translocation (May 2016) 367 individuals were recorded. Translocation of the *T.juncea* located within the impact area to the offset area will assist in protecting the genetic diversity of the population.

The 367 *T.juncea* individuals were translocated into prepared areas within the offset area which covered between 2,500m^2 and 3,000m^2. The offset area was selected to ensure that an appropriate vegetation community and aspect would replicate the source environment as much as practicable.

The collection method entailed digging within the offset before collecting a translocation section form the impact area and placing the section into the hole within the offset. Site preparation included the removal of threatening processes that may impact upon the success of plant survival. These include weed control, protection from herbivory and management of fire risks. An irrigation system was installed to ensure moisture levels remain adequate for plant survival.

In October 2016, Monitoring of the *T. juncea* individuals was undertaken in accordance with the Translocation Plan for *T. juncea* (Firebird, 2015). Monitoring involved the following:

- Flower Counts;
- Observe general plant health;
- Identify all plants within each Section; and
- Photo points.

Out of the 367 individuals translocated, 319 survived and were showing signs of regrowth and/or in flower (see **Photo 6**).

Photo 6 - *T. juncea* Flowering and Regrowth

This presents a survival rate of 86% for the first year of monitoring. A further four (4) years of monitoring will be able to show more certainty of the success of translocation of *T. juncea*. Please see **Appendix 8** for the full report.

6.5.4 Management Measures

A large number of management strategies are proposed within the BOA based on the key aspects listed in **Section 6.5.3**. These are outlined in Section 3 of the BOA Management Plan (Kleinfelder 2015).

A large number of management strategies relating to land management and rehabilitation are outlined within the LRMP, including:

- Inductions;
- Controlling access to the site;
- Weed and feral animal management;
- Pre-clearing protocol;
- Salvaging of key resources during clearing (including removal of habitat trees);
- Fauna displacement and relocation; and
- Seed collection and propagation.

Photo 6 – Salvaged Hollow Logs

6.5.5 Proposed Improvements to Management Measures

The Karuah East Quarry will continue to implement the BOA Management Plan and LRMP during 2017, including:

- Completion of fence installation – site boundary and fencing within the BOA;
- Nest box installation; and
- Weed control and vertebrate pest management within the BOA.

6.6 Heritage (Aboriginal and Non-Aboriginal)

6.6.1 EIS Predictions

An Aboriginal Heritage Impact Assessment was completed as part of the EIS specialist report prepared by RPS (2012). A search of the Aboriginal Heritage Information Management System (AHIMS) database revealed no listed sites inside the project area and the pedestrian survey revealed no Aboriginal cultural heritage items. No evidence of Aboriginal cultural heritage was found during the survey and no impacts were predicted.

6.6.2 Approved Criteria

There are no specific Project Approval criteria associated with heritage relating to the project. Heritage is managed in accordance with the approved *Heritage Management Plan* (RPS, 2015).

The process for managing any unexpected heritage items is outlined in **Section 6.6.4**.

6.6.3 Key Environmental Performance or Management Issues

There were no issues relating to Aboriginal cultural heritage during the reporting period.

6.6.4 Management Measures

The process for managing unexpected Aboriginal objects/items is outlined in the *Heritage Management Plan* (RPS, 2015).

Should unexpected Aboriginal objects/features be encountered, work must stop immediately and the area cordoned off with a high visibility barrier. The Quarry Manager is to then contact a heritage consultant and Registered Aboriginal Parties (RAPs). The heritage consultant, in consultation with the RAPs, is to conduct a field survey to assess the Aboriginal objects/features identified. The heritage consultant, in consultation with the RAPs, will then recommend appropriate mitigation measures.

The Quarry Manager is to implement the mitigation measures that are recommended by the heritage consultant and agreed to by the RAPs and in accordance with the Office of Environment and Heritage regulations. If additional visual inspection and salvage is recommended, the Quarry Manager is to arrange for the heritage consultant and RAPs to undertake those works.

Provided that these heritage contingency protocols have been followed, works within the project area may proceed.

6.6.5 Proposed Improvements to Management Measures

There are no further proposed management responses other than those outlined in the *Heritage Management Plan (RPS, 2015).*

6.7 General Waste Management

6.7.1 Environmental Management

Once operational, Karuah East Quarry will use a licensed contractor for waste removal at the site. There has been minimal waste generated as part of the construction process, as activities have generally included clearing and earth works.

There has been no plant or infrastructure established at the site yet which will generate waste. As construction activities increase and the site becomes operational, there will be additional waste generated from the operations.

Typical waste generation at the quarry once operational will consist of non-hazardous and general wastes, as well as oily wastes. The general and non-hazardous wastes will be placed in a skip bin and removed from site.

Oily water which accumulates in the workshop sump within a bunded area will be removed by a contractor when the sump is full. Additionally, scrap steel and tyres will be separated and stockpiled until there is a sufficient quantity for removal by a licensed contractor for recycling.

6.7.2 Environmental Performance

Total waste volumes will be reported in the 2017 Annual Review.

6.7.3 Proposed Improvements to Management Measures

The Karuah East Quarry will implement a waste management strategy similar to the adjacent Karuah Quarry.

6.8 Summary of Environmental Performance

Table 24 provides a summary of the environmental performance at the site for the reporting period.

Table 24 Environmental Performance

Aspect	Approval Criteria/EIS Prediction	Performance During the Operating Period	Trend/Key Management Implications	Implemented / Proposed Management Actions
Noise	See Section 6.2.1	Compliant	Within criteria	Continued monitoring
Blasting	See Section 6.3.1	Compliant	Within criteria	Continued monitoring
Air Quality	See Section 6.4.1	Non - Compliant (relating to power failure on HVAS)	Within criteria	Continued monitoring
Biodiversity	See Section 6.5.1	Compliant	Within criteria	Continued monitoring
Heritage	See Section 6.6.1	Compliant	Within criteria	Continued monitoring
Waste	No predictions	Compliant	Minimal change over successive years	Continued monitoring

TSP, PM10 and DDG were all within criteria. The HVAS TSP & PM10 was not recorded on 26/9/2016 due to power failure. The circuit breaker for the HVAS was tripping frequently since around September 2016. Through further investigations, we found it was not related to a fault with either one of the HVAS. An electrician replaced circuit breaker with a new one on 2 March 2017.

7.0 WATER MANAGEMENT

7.1 Summary of Water Management at Site

7.1.1 Environmental Management

Surface water at Karuah East Quarry is managed in accordance with the *Water Management Plan (WMP).* The primary objective of water management is to remain compliant with EPL 20166 and ensure there is no uncontrolled discharge of water from the site and that the quality of water leaving the site meets the appropriate standards. This objective is intrinsic to erosion and sedimentation designs and controls for the quarry. As such, the following specific objectives of this WMP will be established as part of the construction and operational phases:

- Conducting best practice land clearing procedures for all proposed disturbance areas;
- Implementation of erosion and sediment controls during construction and operation at per the Blue Book and WMP;
- Separating undisturbed runoff from disturbed runoff where possible to minimise and isolate the amount of disturbed or dirty water runoff;
- Directing sediment-laden runoff into designated sediment control dams;
- Diverting clean runoff from areas upstream of the operation into natural depressions and creeks;
- Allowing sediments to settle in sediment control dams so that the water can be re-used for onsite dust suppression, thereby maintaining dam capacities for subsequent rainfall events;
- Maintaining sediment control structures to ensure that the designed capacities are maintained for optimum settling of sediments; and
- Implementing an effective revegetation and maintenance program for the site.

The WMP is attached as **Appendix 3**.

Water Storage and Use

The Karuah East Quarry has three sediment dams, including:

- Dam 1 - Catchment (crushing plant and product stockpiles);
- Dam 2 - Catchment (product stockpiles and office infrastructure area)
- Dam 3 - Catchment (product stockpiles area).

7.1.2 Proposed Improvements to Management Measures

As the site is still in construction phase, additional water management works are required prior to the commencement of the operational phase. In early 2017, additional water management including levelling of surrounding land will be undertaken in the area around Dam 2. There is also a requirement to finalise drainage lines around the site. The proposed water management, once the site is fully operational, is shown in **Figure 2**.

7.2 EIS/Preferred Project Report Predictions

Surface water was assessed for the Karuah East Quarry EIS and then updated for the Preferred Project Report (2013).

The only direct disturbance to occur to the local drainage system will be in the upper reaches of the northern most drainage line in Lot 12. The length of the channel which will be disturbed as a result of excavation is located in the upper reaches of the catchment with no clearly defined bed or banks. Therefore, the impact on the wider catchment as a result of disturbance to the upper reaches of this drainage line is not anticipated to be significant.

With regards to offsite discharges, a water balance model has been developed to predict the frequency and volume of discharges from the project. The water balance predicts that uncontrolled discharges will be minimal, averaging only one discharge day per year in Stage 2 (which represents approximately half of the total disturbance area) and two days in Stage 5 (at full disturbance).

7.3 Surface Water Monitoring Results

7.3.1 Approved Criteria

Discharge criteria for the Karuah East Quarry is provided in Condition L2.4 of EPL 20166 and outlined in **Table 25**.

Table 25 Surface Water Criteria

Pollutant	Units of Measure	50 Percentile Concentration Limit	90 Percentile Concentration Limit	3DGM Concentration Limit	100 Percentile Concentration Limit
Oil and Grease	Milligrams per litre	-	-	-	5 and/or none visible
pH	pH	-	-	-	6.5 - 8.5
Total Suspended Solids	Milligrams per litre	-	-	-	5

7.3.2 Monitoring Results

The WMP outlines a series of parameters which are to be monitored monthly. A full list of monitoring results is outlined in **Appendix 6**. As this is the first year of monitoring undertaken, it is difficult to determine trends as several sites have only had one or two sampling events. Trends will be assessed in the 2017 Annual Review. **Table 26** outlines the average surface water quality results for key parameters.

Table 26 Average Surface Water Quality Results for Key Parameters

Monitoring Location	pH	TSS (mg/L)	EC (µS/cm)	Oil and Grease (mg/L)	Number of Samples	Comment
Dam 1	5.8	147.8	227.6	<5.0	5.0	Monitoring commenced in July 2016 following construction. Dry in September.
Dam 2	5.0	95.5	539.5	<5.0	2.0	Monitoring commenced in November 2016 following construction.
Dam 3	4.9	31.5	182.5	19.5	2.0	Monitoring commenced in November 2016 following construction. Oil and grease sample was higher in November 2016 (34mg/L) monitoring event. There may have been some historical contamination at the site that was collected from an old access trail.
SW1 - Bulga Creek (drainage line)	5.6	<5.0	204.0	9.0	1.0	This sample was taken in January 2016 (pre - construction). No other flows. Dry during other samples.
SW2 - Bulga Creek(drainage line)	5.5	6.0	177.8	<5.0	4.0	One sample pre – construction and three samples when flowing during the period.

SW3 - Yalimbah Creek(drainage line)	5.4	6.0	104.0	<5.0	1.0	This sample was taken in January 2016 (pre - construction). No other flows. Dry during other samples.
SW4 – Yalimbah Creek(drainage line)	5.7	13.0	201.0	<5.0	1.0	This sample was taken in January 2016 (pre - construction). No other flows. Dry during other samples.

As outlined above, due to minimal available data it not yet possible to determine trends in data. The data however does indicate that there is a higher TSS level at the dams compared to the surrounding water courses. There also appears to be higher levels of EC in some dams compared to SW1-4. pH in dams is also slightly lower than SW1-4, with all monitoring locations being slightly acidic.

SW2 is the only drainage line which regularly has water during sampling events.

7.4 Groundwater Monitoring Results

Sampling of groundwater monitoring locations occurred on 30 March 2016 and 3 October 2016. A summary of key parameters are outlined in the table below. As this is the first year of monitoring, it is difficult to determine trends. Results have been compared against data sampled from 2010 (pre-Karuah East Quarry). Trends will be able to be assessed in the 2017 Annual Review.

Table 27 Average Groundwater Quality Results for Key Parameters

Monitoring Location	pH	TDS (mg/L)	EC (µS/cm)	Number of Samples
Pre Karuah East (Average results from 2010 data)				
BH 205	7.2	665	Not sampled	2
BH207	7.4	1540	Not sampled	1
BH303	6.3	600	Not sampled	1
Average Results 2016				
BH 205	7.3	1182	2015	2
BH 207	6.9	1578	2780	2
BH 208	6.4	2000	3010	2
BH303	6.4	889	1555	2

Results indicate the pH level is generally neutral, ranging from an average of 6.4 to 7.3 at monitoring locations during 2016. This is within the range of the 2010 data. TDS results for 2016 are variable, with generally higher TDS levels compared to 2010 results. EC was not sampled during 2010 monitoring, therefore data from 2016 cannot be compared against pre-Karuah East Quarry levels.

7.5 Water Take

There is no Water Take at the Karuah East Quarry, with the site having no groundwater extraction licences.

7.6 Discharges

Water Discharge Events

There were no discharge events at Karuah East Quarry during the reporting period. Clearance first commenced in April 2016, with dams constructed following clearance and land preparation. There have been no offsite discharges from dams during 2016.

7.7 Salinity Trading Scheme Credit Use

Not applicable to Karuah East Quarry.

7.8 Compensatory Water to Other Users

Not applicable to Karuah East Quarry.

8.0 REHABILITATION

There have been limited opportunities to establish rehabilitation at the quarry site as the site has been in a construction phase. Future rehabilitation activities will be undertaken in accordance with the approved LRMP.

8.1 Rehabilitation Performance During Reporting Period

A summary of rehabilitation at Karuah East Quarry is outlined in **Table 28**.

Table 28 Summary of Rehabilitation Performance During Reporting Period

Guideline Requirement	Site Comment
Extent of the operations and rehabilitation at completion of the reporting period	No Rehabilitation with construction still ongoing.
Agreed post- rehabilitation land use	No Rehabilitation as the project only commenced construction in April 2016. Final landuse is outlined within the LRMP. The vegetation at closure will be native woodland consistent with the surrounding bushland.
Key rehabilitation performance indicators	No Rehabilitation.
Renovation or removal of buildings	No Rehabilitation.
Any other Rehabilitation Taken including: • Exploration activities; • Infrastructure; • Shafts; • Adits • Dams; and • The installation or maintenance of fences, bunds and any other works.	No Rehabilitation.
Any rehabilitation areas which have received formal sign off from Department of Resources and Energy (DRE)	No Rehabilitation.
Variations to activities undertaken to those proposed (including why there were variations and whether DRE was notified)	No Rehabilitation.
Outcomes of trials, research projects and other initiatives	No Rehabilitation.
Key issues that may affect successful rehabilitation	No Rehabilitation.

Table 29 Disturbance and Rehabilitation Status

Quarry Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
Total Quarry Footprint (including access road in)	0	21.4 ha	21.4 ha
Total Active Disturbance	0	21.4 ha	21.4 ha
Land Being Prepared for Rehabilitation	0	0	0
Land Under Active Rehabilitation	0	0	0
Completed Rehabilitation	0	0	0

8.2 Actions for the next Reporting Period

The DP&E (2015) *Annual Review Guidelines* requires an outline of the rehabilitation actions proposed during the next reporting period. These actions are detailed in **Table 30**.

Table 30 Actions for the Next Reporting Period

Action	Site Comment
Describe the steps to be undertaken to progress agreement during next reporting period, where final rehabilitation outcomes have not yet been agreed between stakeholders.	There is no planned additional rehabilitation at the site in the next annual rehabilitation period. There may be some stabilisation, however this has not been classified as 'final rehabilitation'.
Outline proposed rehabilitation trials, research projects and other initiatives to be undertaken during next reporting period.	There are no additional rehabilitation trials during the next Annual Review period.
Summary of rehabilitation activities proposed for next report period.	There are no additional rehabilitation trials during the next Annual Review period.

9.0 COMMUNITY

9.1 Community Engagement Activities

A Community Consultative Committee (CCC) was formed for the Karuah East Quarry in accordance with Schedule 5, Condition 6 of PA 09_0175, which states:

> *The Proponent shall establish and operate a Community Consultative Committee (CCC) for the project. The CCC must:*
>
> *(a) be established and operated in general accordance with the Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects (Department of Planning, 2007, or its latest version); and*
>
> *(b) be established prior to the commencement of construction activities, to the satisfaction of the Secretary.*

Meetings were held on the following dates:

- 10 May 2016;
- 8 August 2016; and
- 14 November 2016.

The CCC comprises of an independent chair, three community members, two company representatives and two environmental consultants. Other attendees include a representative from the Great Lakes Council. Meeting minutes are found on the website:

http://hunterquarries.com.au/wp-content/uploads/2016/12/Karuah-East-Quarry-CCC-Draft-Minutes-141116.pdf.

Key aspects discussed include:

- Site inspection (completed for two of the three meetings);
- Current construction – work completed in past three months;
- Proposed construction – work proposed for the next three months; and
- Environmental management performance and summary of monitoring results.

9.2 Community Contributions

The Karuah East Quarry feels strongly about supporting the local community and has a history of community contributions. Community contributions are being made through Hunter Quarries Pty Limited through the Karuah Quarry.

9.3 Complaints

There was 1 complaint received regarding Karuah East Quarry during this Annual Review reporting period. Karuah East Quarry continues to routinely notify all surrounding residents prior to blasting.

Complaint received via third party. The Roads and Maritime Service (RMS) received complaint from an RMS contractor regarding mud that had been dragged onto the Pacific Highway from the Karuah East Quarry construction site on Friday 14 October 2016. The initial complaint was received by Daracon, who are contracted by Karuah East. Upon investigation, it was discovered that material had been spread along the highway from light vehicles exiting the quarry site. Due to heavy rain on the 13 and 14 October, the KEQ site had become muddy and as result, light vehicles that exited the worksite dragged material onto the highway. Karuah East and Daracon took the following action:

- An emergency response was actioned with RMS. Traffic control was put into place and one lane was closed;
- Mud was cleaned from the highway by contactors. Highway was cleaned by 12:30pm, 17 October 2016; and
- The internal access track was capped with aggregate on 19 October 2016. A grid was installed near the exit of Lot 13 to act as a wheel cleaner for vehicles exiting site.

If a complaint is received, it is logged and investigated by the Quarry Manager. Feedback is then provided to the complainant and government agencies, as required. This process forms a part of the Karuah East Environmental Management Strategy (EMS).

A telephone number has been established for the purpose of receiving complaints and enquiries from the community and this number is available on the Karuah East Quarry website (www.hunterquarries.com.au) and is provided on a sign at the entrance to the quarry. The community can contact the quarry on (02) 4997 5966 as well as through the Karuah East Quarry website.

10.0 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit is required for at Karuah East Quarry in accordance with Schedule 5 Condition 9 of PA 09_0175. This is to be completed ”within 12 months of the commencement of development on the site, and every 3 years thereafter”. The first Independent Environmental Audit is scheduled for May 2017 and Karuah East Quarry has sent out scopes to potential auditors. An update will be provided in the 2017 Annual Review along with a response to the Audit Action plan.

11.0 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

11.1 Summary of Incidents

There were no incidents during the reporting period.

11.2 Summary of Exceedances

There were no monitoring exceedances during the reporting period. There was a non – compliance relating to the power outage at the HVAS monitor with this outlined within Section 6.8.

12.0 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Table 31 outlines the proposed actions in the next Annual Review.

Table 31 Proposed Actions in the Next Annual Review

Proposed Action	Timeline	Management Plan Requires Revision
Complete the Independent Environmental Audit	May 2017	Possibly
Complete construction activities and commence operations	On-going	Possibly
Continue environmental monitoring in accordance with management plans and approval requirements	On-going	Possibly
Continue CCC and community support	On-going	No
Continue to update the website with monitoring data and key environment and community information	On-going	No

13.0 REFERENCES

The following documents and reports have been used to assist in writing the quarry's Annual Review:

Management Plans

- *Air Quality and Greenhouse Gas Management Plan (SLR 2015);*
- *Biodiversity Offset Area Management Plan (Kleinfelder 2015);*
- *Blast Management Plan (SLR 2015);*
- *Environmental Management Strategy (SLR 2015);*
- *Heritage Management Plan (RPS 2015);*
- *Landscape and Rehabilitation Management Plan (Kleinfelder and SLR 2015);*
- *Noise Management Plan (SLR 2015);*
- *Tetratheca juncea Translocation Program (Firebird 2015);*
- *Traffic Management Plan (Streetwise 2015);* and
- *Water Management Plan (SLRE 2015).*

Statutory Documents

- *Environmental Assessment Report – Proposed Karuah East Quarry (ADW Johnson 2013);*
- *Environment Protection Licence (No. 20611);*
- *Preferred Project Report - Proposed Karuah East Quarry (ADW Johnson July 2013);*
- *Project Approval (PA 09_0175); and*
- *Federal Approval (EPBC 2014/7278).*

APPENDIX 1 – Project Approval and Federal Approval

Project Approval

Section 75J of the *Environmental Planning and Assessment Act 1979*

As delegate of the Minister for Planning and Environment, the Planning Assessment Commission approves the project application referred to in Schedule 1, subject to the conditions in Schedules 2 to 5.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

Alan Coutts
Member of the Commission

David Johnson
Member of the Commission

Sydney 17 June 2014

SCHEDULE 1

Application Number:	09_0175
Proponent:	Karuah East Quarry Pty Limited
Approval Authority:	Minister for Planning and Environment
Land:	Lot 12 DP 1024564 Lot 13 DP 1024564 Lot 202 DP 1042537 Lot 26 DP 1024341 Lot 27 DP 1024341 Lot 16 DP 1024564 Lot 17 DP 1024564
Project:	Karuah East Quarry Project

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DEFINITIONS

Annual review	The review required under condition 4 of Schedule 5
BCA	Building Code of Australia
Biodiversity offset strategy	The conservation and enhancement strategy described in the EA, and depicted conceptually in the figure in Appendix 4
CCC	Community Consultative Committee
Conditions of this approval	Conditions contained in Schedules 1 to 5 inclusive
Council	Great Lakes Council
CPI	Australian Bureau of Statistics Consumer Price Index
Day	The period from 7.00 am to 6.00 pm Monday to Friday, and from 7.00 am to 1.00 pm on Saturday
DRE	Division of Resources and Energy within the Department of Trade and Investment, Regional Services and Infrastructure
EA	Environmental Assessment titled *Environmental Assessment Report, Proposed Karuah East Hard Rock Quarry*, prepared by ADW Johnson Pty Limited and dated 31 January 2013, including the response to submissions prepared by ADW Johnson Pty Limited and dated 31 May 2013 and the Preferred Project Report titled *Preferred Project Report Proposed Karuah East Quarry*, prepared by ADW Johnson Pty Limited and dated 30 July 2013
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPL	Environment Protection Licence under the *POEO Act*
Extraction Area	Extraction Area shown in Figure 1 in Appendix 1
Feasible	Feasible relates to engineering considerations and what is practical to build
Incident	A set of circumstances that: • causes or threatens to cause material harm to the environment; and/or • breaches or exceeds the limits or performance measures/criteria in this approval
km	Kilometre
Land	As defined in the EP&A Act, except where used in the noise and air quality conditions in schedules 3 and 4 of this approval where it is defined to mean the whole of a lot, or contiguous lots, owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Material harm to the environment	Actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial
Minister	Minister for Planning and Environment, or delegate
NOW	NSW Office of Water
OEH	Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations Act 1997*
Privately-owned land	Land that is not owned by a public agency or the Proponent (or its subsidiary)
Project	The development as described in the EA
Proponent	Karuah East Quarry Pty Limited, or its successors in title, or any other person who seeks to carry out the project
Quarrying operations	Includes the removal of overburden and extraction, processing, handling, storage and transportation of quarry products on the site
Quarry products	Extractive material which extracted from and transported from the site
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Rehabilitation	The treatment or management of land disturbed by the project for the purpose of establishing an appropriately revegetated, safe, stable and non-polluting environment
RMS	Roads and Maritime Services

Secretary	Secretary of Planning and Environment, or nominee
Statement of commitments	The Proponent's commitments in Appendix 6
Site	The land listed under "Land" in schedule 1

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT

1. In addition to meeting the specific performance criteria established under this approval, the Proponent shall implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation, or rehabilitation of the project.

TERMS OF APPROVAL

2. The Proponent shall carry out the project generally in accordance with the:
   (a) EA;
   (b) statement of commitments; and
   (c) conditions of this approval.

   Notes:
   - *The general layout of the project is shown in Appendix 1.*
   - *The statement of commitments is reproduced in Appendix 6.*

3. If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this approval shall prevail to the extent of any inconsistency.

4. The Proponent shall comply with any reasonable requirement/s of the Secretary arising from the Department's assessment of:
   (a) any reports, strategies, plans, programs, reviews, audits or correspondence that are submitted in accordance with this approval; and
   (b) the implementation of any actions or measures contained in these documents.

LIMITS ON APPROVAL

Quarrying Operations

5. The Proponent may carry out quarrying operations on the site until 31 December 2034.

   Note: Under this approval, the Proponent is required to rehabilitate the site and carry out additional undertakings to the satisfaction of the Secretary. Consequently, this approval will continue to apply in all other respects other than the right to conduct quarrying operations until the rehabilitation of the site and those undertakings have been carried out to a satisfactory standard.

Production Limit

6. The Proponent shall not extract, process and transport more than 1.5 million tonnes of quarry products from the site in any calendar year.

Hours of Operation

7. The Proponent shall comply with the operating hours in Table 1.

Table 1: 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 these activities does not exceed 35dB(A) $L_{Aeq(15\ min)}$ 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.

STRUCTURAL ADEQUACY

8. The Proponent shall ensure that any new buildings and structures, and any alterations, or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

Notes:

- *Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for proposed building works.*
- *Part 8 of the EP&A Regulation* sets out the requirements for the certification of the project.

DEMOLITION

9. The Proponent shall ensure that all demolition work on site is carried out in accordance with *AS 2601-2001: The Demolition of Structures*, or its latest version.

PROTECTION OF PUBLIC INFRASTRUCTURE

10. The Proponent shall:
    (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the project; and
    (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the project.

DEVELOPER CONTRIBUTIONS

11. The Proponent shall pay Council, in accordance with Council's *Great Lakes Wide Development Contributions Plan (November 2007) – Amended*:
    (a) a one-off Headquarters Building contribution of $1.00 per $1,000.00 of capital value of the project*;* and
    (b) annual road maintenance contributions of $.037 per tonne per km, for every tonne of quarry products transported from the site on local roads in accordance with Council's *Great Lakes Wide Development Contributions Plan (November 2007) – Amended.* Each payment must be:
        (i) paid to Council at the end of each calendar year;
        (ii) based on weighbridge records of the quantity of quarry products transported from the site; and
        (iii) increased annually over the life of the project in accordance with the CPI.

Note: If the parties are not able to agree on any aspect of the road maintenance contributions, either party may refer the matter to the Secretary for resolution.

OPERATION OF PLANT AND EQUIPMENT

12. The Proponent shall ensure that all plant and equipment used at the site is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient manner.

STAGED SUBMISSION OF ANY STRATEGY, PLAN OR PROGRAM

13. With the approval of the Secretary, the Proponent may submit any strategy, plan or program required by this approval on a progressive basis.

Notes:

- *While any strategy, plan or program may be submitted on a progressive basis, the Proponent will need to ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times; and*
- *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*

PRODUCTION DATA

14. The Proponent shall:
    (a) provide annual quarry production data to DRE using the standard form for that purpose; and
    (b) report this data in the Annual Review (see condition 4 of Schedule 5).

SCHEDULE 3
ENVIRONMENTAL PERFORMANCE CONDITIONS

IDENTIFICATION OF APPROVED LIMITS OF EXTRACTION

1. The Proponent shall, prior to carrying out quarrying operations on the site:
   (a) engage a registered surveyor to mark out the boundaries of the approved limits of extraction within the Extraction Area; and
   (b) submit a survey plan of the extraction boundaries,
   to the satisfaction of the Secretary.

2. The Proponent shall ensure that the extraction boundaries are clearly marked at all times while quarrying operations are being carried out, in a manner that allows the limits of extraction to be clearly identified.

NOISE

Operational Noise Criteria

3. The Proponent shall ensure that the operational noise generated by the project does not exceed the criteria in Table 2.

Table 2: Operational noise criteria (dB(A) $L_{Aeq(15\ min)}$)

Location	***Criteria (day)***
Residence on Lot 11 DP 1024564	43
A	40
B	37
G	38
All other residences	35

Notes:
- *Receiver locations are shown in Appendix 2.*
- *Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.*
- *Appendix 4 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.*

However, the noise criteria in Table 2 do not apply if the Proponent has an agreement with the relevant landowner to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of the agreement.

Road Traffic Noise Criteria

4. The Proponent shall take all reasonable and feasible measures to ensure that the traffic noise generated by the project does not cause additional exceedances of the criteria in Table 3 at any residence on privately-owned land.

Table 3: Road traffic noise criteria (dB(A) $L_{Aeq(period)}$)

Road	***Criteria (day)***
Pacific Highway	60
Local roads	55

Cumulative Noise Criteria

5. The Proponent shall implement all reasonable and feasible measures to ensure that the noise generated by the project combined with the noise generated by adjacent quarrying operations does not cause any exceedances of the criteria in Table 4.

Table 4: Cumulative noise criteria (dB(A) $L_{Aeq(period)}$)

Location	***Criteria (day)***
F	50
G	50
All other privately-owned residences, except the residence on Lot 11	55

Notes:

- *Receiver locations are shown in Appendix 2.*
- *The structure used as a residence on Lot 11 is excluded from Table 4 because the other major contributor to cumulative noise totals is quarrying operations conducted on this Lot, under agreement with the Lot owner.*
- *Cumulative noise is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.*
- *Appendix 4 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.*

Operating Conditions

6. The Proponent shall:
   (a) implement best management practice, to minimise the construction, operational and traffic noise of the project;
   (b) minimise the noise impacts of the project during meteorological conditions when the noise limits in this approval do not apply; and
   (c) regularly assess noise monitoring data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this approval;
   (d) apply and enforce a speed limit of 40 km/hour for all project-related vehicles on site;
   (e) ensure that project-related trucks slowing to use the intersection of Branch Lane and Andesite Road do not use engine or compression braking systems,

   to the satisfaction of the Secretary.

Noise Management Plan

7. The Proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be prepared by a suitably qualified expert whose appointment has been approved by the Secretary;
   (b) be prepared in consultation with EPA, and submitted to the Secretary for approval prior to the commencement of construction activities;
   (c) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this approval;
   (d) describe the proposed noise management system in detail; and
   (e) include a monitoring program that:
      - uses attended and unattended monitoring to evaluate the compliance of the project against the noise criteria in this approval;
      - evaluates and reports on:
        - the effectiveness of the on-site noise management system; and
        - compliance against the noise operating conditions; and
      - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

BLASTING

Blasting Criteria

8. The Proponent shall ensure that blasting on the site does not cause exceedances of the criteria in Table 5.

Table 5: Blasting criteria

Location	***Airblast overpressure (dB(Lin Peak))***	***Ground vibration (mm/s)***	***Allowable exceedance***
Any residence on privately-owned land, or any public infrastructure	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months

However, these criteria do not apply if the Proponent has a written agreement with the relevant landowner or infrastructure provider/owner, and the Proponent has advised the Department in writing of the terms of this agreement.

Blasting Hours

9. The Proponent shall ensure that blasting on site is only carried out during the hours in Table 6.

Table 6: Blasting hours

Day	***Blasting hours***
Monday – Friday	9.00 am to 4.00 pm
Saturdays, Sundays and Public Holidays	No blasting

Blasting Frequency

10. The Proponent shall not carry out more than 2 blasts a week on the site, unless an additional blast is required following a blast misfire.

Note: A blast may involve a number of explosions within a short period, typically less than two minutes.

Operating Conditions

11. The Proponent shall:
    (a) implement best blast management practice to:
        - protect the safety of people and livestock in the surrounding area;
        - protect public or private infrastructure/property in the surrounding area from any damage; and
        - minimise the dust and fume emissions of any blast;
    (b) schedule blasts to avoid the blasting schedule of any nearby quarrying operation;
    (c) operate a suitable system to enable the public to get up-to-date information on the proposed blasting schedule on the site, and
    (d) not undertake blasting within 500 metres of:
        (i) any public road without the approval of the relevant road authority; or
        (ii) any land outside the site not owned by the Proponent, unless:
            - the Proponent has a written agreement with the relevant landowner to allow blasting to be carried out closer to the land, and the Proponent has advised the Department in writing of the terms of this agreement, or
            - the Proponent has:
                – demonstrated to the satisfaction of the Secretary that the blasting can be carried out closer to the land without compromising the safety of the people or livestock on the land, or damaging the buildings and/or structures on the land; and
                – updated the Blast Management Plan to include the specific measures that would be implemented while blasting is being carried out within 500 metres of the land,

    to the satisfaction of the Secretary.

Blast Management Plan

12. The Proponent shall prepare and implement a Blast Management Plan for the project to the satisfaction of the Secretary. This plan must:
    (a) be prepared by a suitably qualified expert whose appointment has been approved by the Secretary;
    (b) be prepared in consultation with Council and EPA, and submitted to the Secretary for approval prior to the commencement of construction activities;
    (c) describe the measures that would be implemented to ensure:
        - best management practice is being employed; and
        - compliance with the relevant conditions of this approval;
    (d) include a road closure protocol if blasting occurs within 500 metres of a public road;
    (e) include a specific blast fume management protocol, to demonstrate how emissions will be minimised including risk management strategies if blast fumes are generated; and
    (f) include a monitoring program for evaluating the performance of the project including:
        - compliance with the applicable criteria; and
        - minimising fume emissions from the site.

AIR QUALITY

Air Quality Criteria

13. The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not exceed the criteria in Tables 7 to 9 at any residence on privately-owned land.

Table 7: Long-term impact assessment criteria for particulate matter

Pollutant	***Averaging period***	***[d] Criterion***
Total suspended particulates (TSP)	Annual	[a] 90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m^3

Table 8: Short-term impact assessment criteria for particulate matter

Pollutant	***Averaging period***	***[d] Criterion***
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m^3

Table 9: Long-term Impact Assessment Criteria for Deposited Dust

Pollutant	***Averaging period***	***Maximum increase in deposited dust level***	***Maximum total deposited dust level***
[c] Deposited dust	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month

Notes to Tables 7-9:

- [a] Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources);
- [b] Incremental impact (ie incremental increase in concentrations due to the project on its own);
- [c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.
- [d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal *activities or any other activity agreed by the Secretary in consultation with EPA.*

Greenhouse Gas Emissions

14. The Proponent shall implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site.

Operating Conditions

15. The Proponent shall:
    (a) implement best management practice to minimise dust emissions by the project;
    (b) regularly assess air quality monitoring data and relocate, modify, and/or stop operations on site as may be required to ensure compliance with the air quality criteria in this approval;
    (c) minimise the air quality impacts of the project during adverse meteorological conditions and extraordinary events (see note d under Tables 7-9); and
    (d) minimise surface disturbance of the site, other than as permitted under this approval.

Air Quality Management Plan

16. The Proponent shall prepare and implement an Air Quality Management Plan for the project to the satisfaction of the Secretary. This plan must:
    (a) be prepared by a suitably qualified expert whose appointment has been approved by the Secretary;
    (b) be prepared in consultation with Council and EPA, and submitted for approval to the Secretary prior to the commencement of construction activities;
    (c) describe the measures that would be implemented to ensure:
        - compliance with the relevant air quality conditions of this approval;
        - best management practice is employed; and
        - the air quality impacts of the project are minimised during adverse meteorological conditions and extraordinary events;
    (d) describe the proposed air quality management system; and
    (e) include a monitoring program that:
        - is capable of evaluating the performance of the project;
        - includes a protocol for determining any exceedances of the relevant conditions of approval;
        - effectively supports the air quality management system; and
        - evaluates and reports on the adequacy of the air quality management system.

METEOROLOGICAL MONITORING

17. For the life of the project, the Proponent shall ensure that there is a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline.

SOIL & WATER

Note: The Proponent is required to obtain the necessary water licences for the project under the Water Act 1912 and/or the Water Management Act 2000.

Water Supply

18. The Proponent shall ensure it has sufficient water during all stages of the project, and if necessary, adjust the scale of quarrying operations on site to match its available supply.

Surface Water Discharges

19. The Proponent shall comply with the discharge limits in any EPL, or with Section 120 of the POEO Act.

Effluent Management

20. The Proponent shall:
    (a) not irrigate, discharge or dispose of sewage or bathroom effluent from the site; and
    (b) operate and maintain a suitable effluent storage facility,
    to the satisfaction of Council and EPA.

Water Management Plan

21. The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with the EPA and NOW by suitably qualified and experienced person/s whose appointment has been approved by the Secretary;
    (b) be submitted to the Secretary for approval prior to the commencement of construction activities;
    (c) include:
        (i) a Site Water Balance that includes details of:
            - sources and security of water supply, including contingency planning;
            - water use on site; and
            - measures that would be implemented to minimise use of clean water and maximise recycling of dirty water on the site;
        (ii) a Surface Water Management Plan, that includes:
            - baseline data on surface water flows and quality in the watercourses that could be affected by the project;
            - a detailed description of the surface water management system on the site, including the design objectives and performance criteria for the:
                - clean water diversions;
                - erosion and sediment controls;
                - water storages (including Maximum Harvestable Rights requirements); and
                - control of water pollution from areas of the site that have been rehabilitated;
            - surface water impact assessment criteria, to be developed following analysis of baseline data, including trigger levels for investigating any potentially adverse surface water quality impacts;
            - a program to monitor:
                - any surface water discharges;
                - the effectiveness of the water management system;
                - surface water flows and quality in local watercourses; and
                - ecosystem health of local watercourses; and
            - an assessment of appropriate options to improve storage and retention times in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom);
        (iii) a Groundwater Monitoring Program that includes:
            - baseline data of groundwater levels surrounding the site;
            - groundwater impact assessment criteria, to be developed following analysis of baseline data, including trigger levels for investigating any potentially adverse groundwater impacts; and
            - a program to monitor and/or validate the impacts of the project on groundwater resources; and
        (iv) a Surface and Ground Water Response Plan that describes the measures and/or procedures that would be implemented to:
            - respond to any exceedances of the surface water impact assessment criteria and groundwater impact assessment criteria; and
            - mitigate and/or offset any adverse impacts on surface water and groundwater resources located within and adjacent to the site.

TRANSPORT

Roadworks

22. The Proponent shall, at its own cost, complete the following roadworks shown conceptually in Figure 2 of Appendix 1, prior to transporting quarry products from the site:
    (a) extending Blue Rock Close, with tar seal and appropriate pavement, road markings and advance warning signage, to the satisfaction of Council and RMS;
    (b) realigning and upgrading the Blue Rock Close/Andersite Road intersection with appropriate road markings, pavement thickening and advance warning signage, to the satisfaction of Council;

(c) upgrading the Branch Lane/Andersite Road intersection with appropriate road markings and advance warning signage, to the satisfaction of Council;
(d) constructing the site access road on Lots 12 and 13 DP 1024564 with appropriate pavement and advance warning signage, to the satisfaction of Council; and
(e) installing a wheel-wash facility on the site.

Monitoring of Product Transport

23. The Proponent shall:
(a) keep accurate records of:
- the amount of quarry products transported from the site (per calendar month and year); and
- the number of laden truck movements from the site (per hour, day, week, calendar month and year); and

(b) publish these records on its website quarterly.

Parking

24. The Proponent shall provide sufficient parking on-site for all project-related traffic, in accordance with Council's parking codes, to the satisfaction of the Secretary.

Operating Conditions

25. The Proponent shall ensure that all project-related heavy vehicles:
(a) enter and exit the site in a forward direction; and
(b) exit the site with loads covered.

Transport Management Plan

26. The Proponent shall prepare and implement a Transport Management Plan for the project to the satisfaction of the Secretary. This plan must:
(a) be prepared by a suitably qualified traffic consultant whose appointment has been approved by the Secretary;
(b) be prepared in consultation with RMS and Council, and submitted to the Secretary for approval prior to the commencement of construction activities;
(c) include a Driver Code of Conduct;
(d) describe the measures that would be implemented to ensure:
- compliance with the relevant conditions of this approval;
- that drivers of project-related heavy vehicles are aware of potential safety issues along the haulage routes; and
- that drivers of project-related heavy vehicles comply with the Driver Code of Conduct; and

(e) include a program to monitor the effectiveness of these measures.

LANDSCAPE

***Tetratheca Juncea* Translocation**

27. The Proponent shall develop and implement a translocation program for *Tetratheca juncea* to the satisfaction of the Secretary. This program must:
(a) be prepared in consultation with OEH, by a suitably qualified and experienced ecologist whose appointment has been approved by the Secretary;
(b) be submitted to the Secretary for approval prior to the commencement of construction activities that involve clearing of or potential harm to *Tetratheca juncea*;
(c) include measures for the translocation of all *Tetratheca juncea* stems in the area of disturbance to nearby areas with similar physical and biological habitat features;
(d) include a monitoring program to study the *Tetratheca juncea* stems before and after translocation;
(e) include short and long-term goals and performance criteria to measure the effectiveness of the program; and
(f) provide for the transfer of information obtained as a result of implementing the program to OEH and P&I.

Biodiversity Offset Strategy

28. The Proponent shall, prior to the commencement of vegetation clearing activities, finalise and implement the Biodiversity Offset Strategy, as described in the EA, summarised in Table 10 and shown conceptually in Figure 1 of Appendix 4, in consultation with OEH and Council, and to the satisfaction of the Secretary.

Table 10: Biodiversity Offset Strategy

Area	***Offset Type***	***Minimum Size (ha)***
Offset Area	Existing vegetation to be managed and enhanced	129.32 ha

Note: The Biodiversity Offset Strategy shall direct that the land proposed as the Biodiversity Offset shall be free of any dwelling-houses and associated sheds, bushfire asset protection zones and other related utilities or structures so as to preserve the integrity and function of that offset area. The Biodiversity Offset Strategy shall also provide details of the revegetation of any parts of the offset area that are cleared of native vegetation or are in an otherwise substantially modified state, other than required management trails and boundary fencing buffer distances.

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Long Term Security of Offsets

29. The Proponent shall, within 12 months of the finalisation of the Biodiversity Offset Strategy, make suitable arrangements to provide appropriate long-term security for the offset area, in consultation with OEH and Council, and to the satisfaction of the Secretary.

Note: In order of preference, mechanisms to provide appropriate long term security to the land within the Biodiversity Offset Strategy include transfer to the National Park Estate, Biobanking Agreement, Voluntary Conservation Agreement, or restrictive covenant on land titles.

Rehabilitation Objectives

30. The Proponent shall rehabilitate the site to the satisfaction of the 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

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 comprised 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.

Progressive Rehabilitation

31. The Proponent shall:
(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.

Landscape and Rehabilitation Management Plan

32. The Proponent shall prepare and implement a Landscape and Rehabilitation Management Plan for the project to the satisfaction of the 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 Secretary;
b. be prepared in consultation with OEH and Council, and submitted to the Secretary for approval prior to the commencement of construction activities;
c. describe how the implementation of the Tetratheca juncea Translocation Program would be integrated with the overall rehabilitation of the site;
d. describe the short, medium and long-term measures that would be implemented to:
    - manage remnant vegetation and habitat on the site; and
    - ensure compliance with the rehabilitation objectives and progressive rehabilitation obligations of this approval.
e. include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, including triggers for any remedial action;
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.
g. include a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;
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;
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;
j. include details of who would be responsible for monitoring, reviewing, and implementing the plan; and

k. include details as to the timing of actions set-out in the plan

Biodiversity Offset Area Management Plan

33. The Proponent shall prepare and implement a Biodiversity Offset Area Management Plan for the project to the satisfaction of the Secretary. This Plan would relate to the area of the Biodiversity Offset Area required in these Conditions. This plan must:

a. be prepared by a suitably qualified expert whose appointment has been approved by the Secretary;
b. be prepared in consultation with OEH and Council, and submitted to the Secretary within 12-months of the approval of the Biodiversity Offset Strategy required in these conditions;
c. describe how the implementation of the Tetratheca juncea Translocation Program would be integrated with the Biodiversity Offset Area management;
d. describe the short, medium and long-term measures that would be implemented to manage remnant vegetation and habitat on the Biodiversity Offset Area;
e. include detailed performance and completion criteria for evaluating the performance of the conservation, restoration and management of the Biodiversity Offset Area, including triggers for any remedial action;
f. providing for the transfer of environmental resources from the approved disturbance area - including tree hollows, vegetative and soil resources - for beneficial reuse in the enhancement of the Biodiversity Offset Area;
g. providing for the incorporation of the final rehabilitated landform into the Biodiversity Offset Area and its management;
h. 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:
    - enhancing the quality of remnant vegetation and fauna habitat;
    - restoring native endemic vegetation and fauna habitat within the parts of the Biodiversity Offset Area that are cleared or modified, including details of the target revegetation communities of the restored landform;
    - coordinating the relocation of native fauna to protected habitats associated with pre-clearing fauna surveys;
    - collecting and propagating seed;
    - maximising the protection and restoration of threatened species, populations and habitats in the Biodiversity Offset Area;
    - maximising fauna movement between the Biodiversity Offset Area and adjacent habitats;
    - controlling weeds and feral pests;
    - controlling erosion;
    - controlling access and providing for management trails; and
    - bushfire management and implementation of ecologically appropriate bushfire intervals.
i. include a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;
j. identify the potential risks to successful implementation of the Biodiversity Offset program, and include a description of the contingency measures that would be implemented to mitigate these risks;
k. include details of who would be responsible for monitoring, reviewing, and implementing the plan;
l. include details of the indicative costs of management actions; and
m. include details as to the timing of actions set-out in the plan

Conservation & Rehabilitation Bond

34. The Proponent shall lodge a Conservation and Rehabilitation Bond with P&I 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 shall be determined by:
    (a) calculating the cost of implementing the Biodiversity Offset Strategy over the next 3 years;

(b) calculating the cost of rehabilitating 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 Secretary.

Notes:

- *If capital and other expenditure required by the Landscape and Rehabilitation Management Plan is largely complete, the Secretary may waive the requirement for the lodgement 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 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 Secretary will call in all or part of the bond, and arrange for the completion of the relevant works.*
- *The component of the bond relating to the implementation of the Biodiversity Offset Strategy may be waived, if a separate arrangement is entered into between the Proponent and OEH which satisfactorily replaces that component,to the satisfaction of the Secretary.*

35. Within 3 months of each Independent Environmental Audit (see condition 9 of schedule 5), the Proponent shall review, and if necessary revise, the sum of the Conservation and Rehabilitation Bond to the satisfaction of the Secretary. This review must:
    (a) consider the performance of the implementation of the Biodiversity Offset Strategy and rehabilitation of the site to date;
    (b) consider the effects of inflation; and
    (c) calculate the cost of implementing the Biodiversity Offset Strategy and rehabilitating the disturbed areas of the site (taking into account the likely surface disturbance over the next 3 years of quarrying operations); and

HERITAGE

Heritage Management Plan

36. The Proponent shall prepare and implement a Heritage Management Plan for the project to the satisfaction of the Secretary. This plan must:
    (a) be prepared by a suitably qualified expert whose appointment has been approved by the Secretary;
    (b) be prepared in consultation with the local Aboriginal community and OEH, and submitted to the Secretary for approval prior to the commencement of construction activities;
    (c) describe the measures that would be implemented to:
        - monitor initial surface disturbance on site for Aboriginal cultural heritage sites or objects;
        - manage the discovery of Aboriginal cultural heritage sites, objects or human remains on site; and
        - ensure ongoing consultation with Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage values on site.

VISUAL

37. The Proponent shall:
    (a) ensure that clearing vegetation from any visually prominent ridgeline is undertaken in a progressive manner, to provide for a maximum of 6 months of future quarrying operations; and
    (b) mitigate the visual impact of the project through the progressive and early rehabilitation of the upper quarry benches in accordance with the objectives in Table 11,

    to the satisfaction of the Secretary.

Advertising Signage

38. The Proponent shall not erect or display any advertising structure or sign on the site without the written approval of the Secretary.

    Note: This condition does not apply to business identification, traffic management, and/or safety or environmental signs.

EMEGENCY AND HAZARDS MANAGEMENT

Dangerous Goods and Hazardous Materials

39. The Proponent shall ensure that the storage, handling, and transport of dangerous goods and hazardous materials is conducted in accordance with the relevant *Australian Standards*, particularly AS1940 and AS1596, and the *Dangerous Goods Code*.

Safety

40. The Proponent shall secure the site to ensure public safety at all times, to the satisfaction of the Secretary.

Bushfire Management

41. The Proponent shall:
    (a) ensure that the project is suitably equipped to respond to any fires on site; and
    (b) assist the Rural Fire Service and emergency services as much as possible if there is a fire in the surrounding area.

WASTE

42. The Proponent shall:
    (a) minimise the waste generated by the project; and
    (b) ensure that the waste generated by the project is appropriately stored, handled, and disposed of,

    to the satisfaction of the Secretary.

SCHEDULE 4
ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. As soon as practicable after obtaining monitoring results showing an:
   (a) exceedance of any relevant criteria in Schedule 3, the Proponent shall notify affected landowners in writing of the exceedance, and provide regular monitoring results to each affected landowner until the project is again complying with the relevant criteria; and
   (b) an exceedance of the relevant air quality criteria in Schedule 3, the proponent shall send a copy of the NSW Health fact sheet entitled *"Mine Dust and You"* (as may be updated from time to time) to the affected landowners and/or existing tenants of the land.

INDEPENDENT REVIEW

2. If an owner of privately-owned land considers the project to be exceeding the relevant criteria in schedule 3, then the landowner may ask the Secretary in writing for an independent review of the impacts of the project on its land.

   If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision the Proponent shall:
   (a) commission a suitably qualified, experienced and independent expert, whose appointment has been approved by the Secretary, to:
      - consult with the landowner to determine its concerns;
      - conduct monitoring to determine whether the project is complying with the relevant criteria in Schedule 3; and
      - if the project is not complying with these criteria, then identify the measures that could be implemented to ensure compliance with the relevant criteria; and
   (b) give the Secretary and landowner a copy of the independent review.

3. If the independent review determines that the project is complying with the relevant criteria in Schedule 3, then the Proponent may discontinue the independent review with the approval of the Secretary.

   If the independent review determines that the project is not complying with the relevant criteria in Schedule 3, then the Proponent shall:
   (a) implement all reasonable and feasible mitigation measures, in consultation with the landowner and appointed independent expert, and conduct further monitoring until the project complies with the relevant criteria; or
   (b) secure a written agreement with the landowner to allow exceedances of the relevant criteria,
   to the satisfaction of the Secretary.

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Secretary. This strategy must:
   (a) be submitted to the Secretary for approval prior to the commencement of construction activities;
   (b) provide the strategic framework for environmental management of the project;
   (c) identify the statutory approvals that apply to the project;
   (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
   (e) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
      - receive, handle, respond to, and record complaints;
      - resolve any disputes that may arise during the course of the project;
      - respond to any non-compliance; and
      - respond to emergencies; and
   (f) include:
      - copies of any strategies, plans and programs approved under the conditions of this approval; and
      - a clear plan depicting all the monitoring required to be carried out under the conditions of this approval.

Adaptive Management

2. The Proponent shall assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 3. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation.

   Where any exceedance of these criteria and/or performance measures has occurred, the Proponent shall, at the earliest opportunity:
   (a) take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur;
   (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
   (c) implement remediation measures as directed by the Secretary;
   to the satisfaction of the Secretary.

Management Plan Requirements

3. The Proponent shall ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include:
   (a) detailed baseline data;
   (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;
   (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
   (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);

(e) a contingency plan to manage any unpredicted impacts and their consequences;

(f) a program to investigate and implement ways to improve the environmental performance of the project over time;

(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

(h) a protocol for periodic review of the plan.

Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.

Annual Review

4. By the end of March each year, the Proponent shall review the environmental performance of the project to the satisfaction of the Secretary. This review must:
   (a) describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;
   (b) include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against:
   - the relevant statutory requirements, limits or performance measures/criteria;
   - the monitoring results of previous years; and
   - the relevant predictions in the EA;

   (c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
   (d) identify any trends in the monitoring data over the life of the project;
   (e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
   (f) describe the measures that would be implemented over the current calendar year to improve the environmental performance of the project.

Revision of Strategies, Plans and Programs

5. Within 3 months of:
   (a) the submission of an annual review under Condition 4 above;
   (b) the submission of an incident report under Condition 7 below;
   (c) the submission of an audit report under Condition 9 below; or
   (d) any modification to the conditions of this approval, (unless the conditions require otherwise),

   the Proponent shall review the strategies, plans, and programs required under this approval, to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted for the approval of the Secretary.

   Note: The purpose of this condition is to ensure that strategies, plans and programs are regularly updated to incorporate any measures recommended to improve environmental performance of the project.

Community Consultative Committee

6. The Proponent shall establish and operate a Community Consultative Committee (CCC) for the project. The CCC must:
   (a) be established and operated in general accordance with the *Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects* (Department of Planning, 2007, or its latest version); and
   (b) be established prior to the commencement of construction activities,to the satisfaction of the Secretary.

   Notes:
   - *The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Proponent complies with this approval.*
   - *In accordance with the guideline, the Committee should comprise an independent chair and appropriate representation from the Proponent, Council, recognised environmental groups and the local community.*

REPORTING

Incident Reporting

7. The Proponent shall immediately notify the Secretary and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. For any other incident associated with the project, the Proponent shall notify the Secretary and any other relevant agencies as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Secretary any relevant agencies with a detailed report on the incident, and such further reports as may be requested.

Regular Reporting

8. The Proponent shall regularly report on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval.

INDEPENDENT ENVIRONMENTAL AUDIT

9. Within 12 months of the commencement of development on the site, and every 3 years thereafter, unless the Secretary directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
   (a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;
   (b) include consultation with the relevant agencies;
   (c) assess the environmental performance of the project and whether it is complying with the relevant requirements in this approval and any relevant EPL and/or Water Licence (including any assessment, plan or program required under these approvals);
   (d) review the adequacy of any approved strategy, plan or program required under the these approvals; and
   (e) recommend measures or actions to improve the environmental performance of the project, and/or any assessment, plan or program required under these approvals.

   Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Secretary.

10. Within 3 months of commissioning this audit, or as otherwise agreed by the Secretary, the Proponent shall submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report.

ACCESS TO INFORMATION

11. The Proponent shall:
   (a) make the following information publicly available on its website:
      - the EA;
      - any statutory approvals for the project;
      - approved strategies, plans and/ programs;
      - a summary of the monitoring results of the project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval;
      - a complaints register, updated quarterly;
      - minutes of CCC meetings;
      - annual reviews;
      - any independent environmental audit, and the Proponent's response to the recommendations in any audit; and
      - any other matter required by the Secretary; and

   (a) keep this information up-to-date, to the satisfaction of the Secretary.

APPENDIX 1
PROJECT LAYOUT

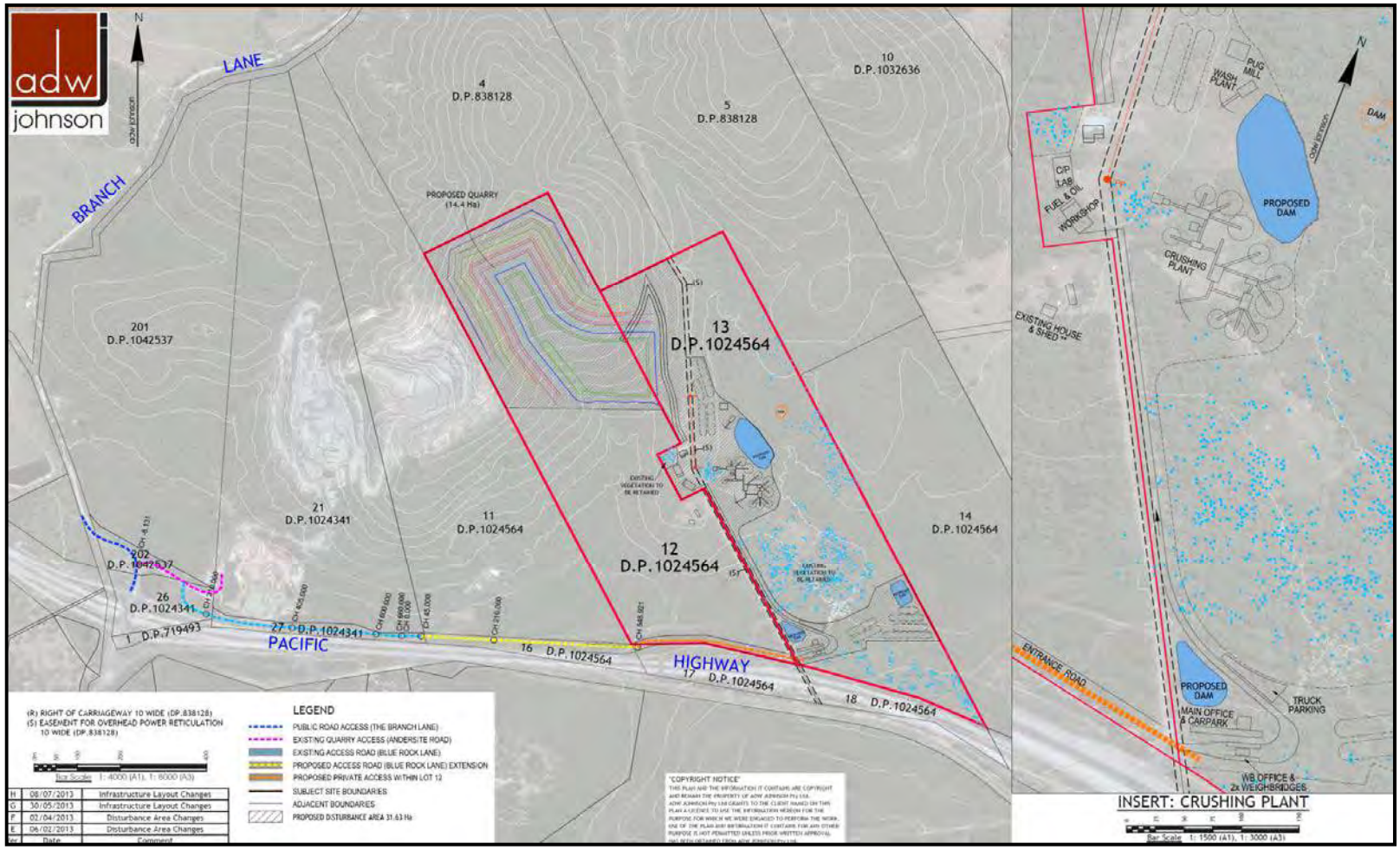


***Figure 1**: Project Layout*

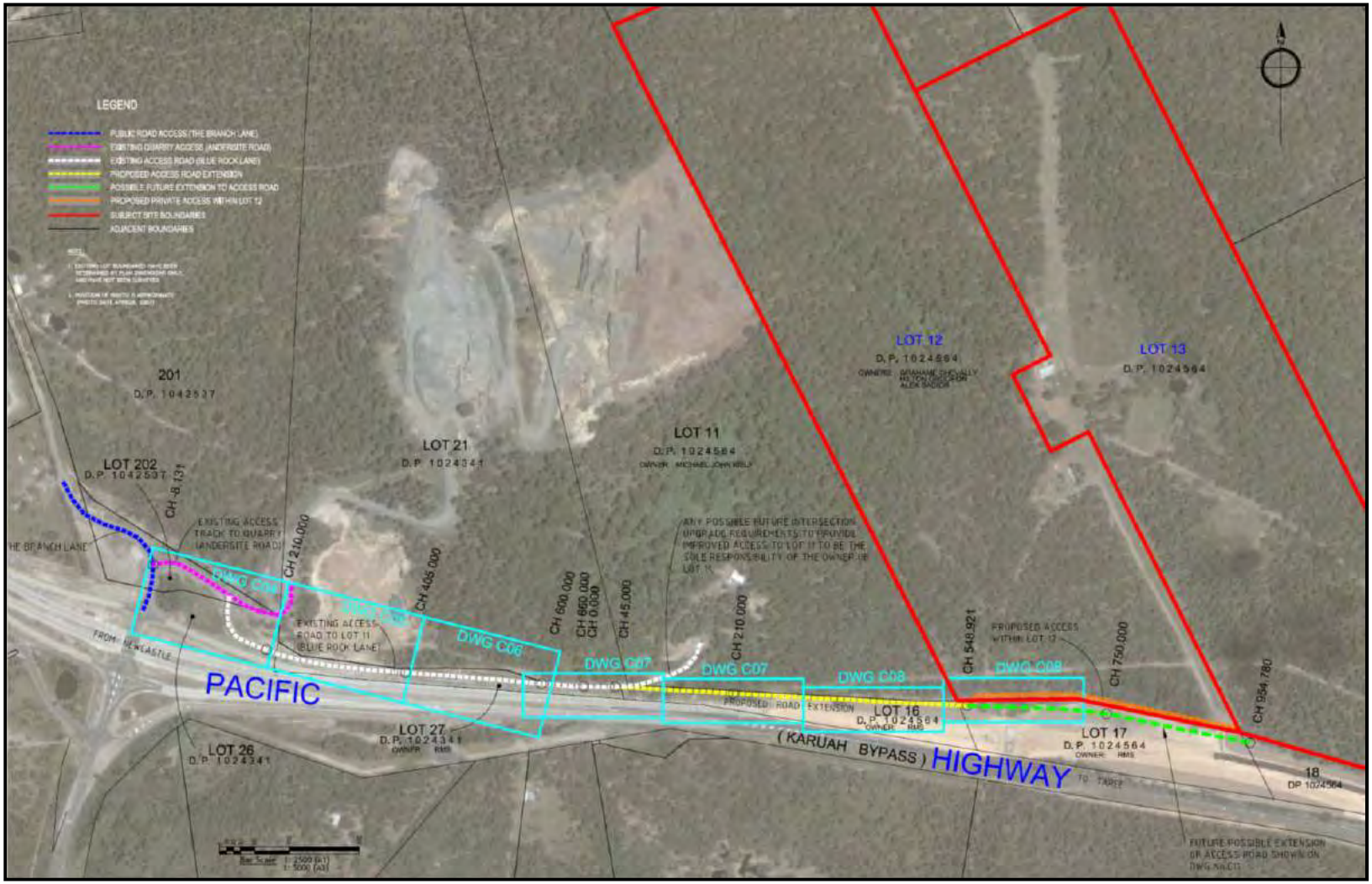


Figure 2: *Proposed roadworks*

APPENDIX 2
NOISE RECEIVER LOCATIONS

Figure 1: Closest residences

APPENDIX 3
NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in Tables 2 and 4 are to apply under all meteorological conditions except the following:
   (a) during periods of rain or hail; or
   (b) wind speeds greater than 3 m/s measured at 10 m above ground level.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station in the vicinity of the site.

Compliance Monitoring

3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

4. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
   (a) monitoring locations for the collection of representative noise data;
   (b) meteorological conditions during which collection of noise data is not appropriate;
   (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

APPENDIX 4
CONCEPTUAL BIODIVERSITY OFFSET AREA

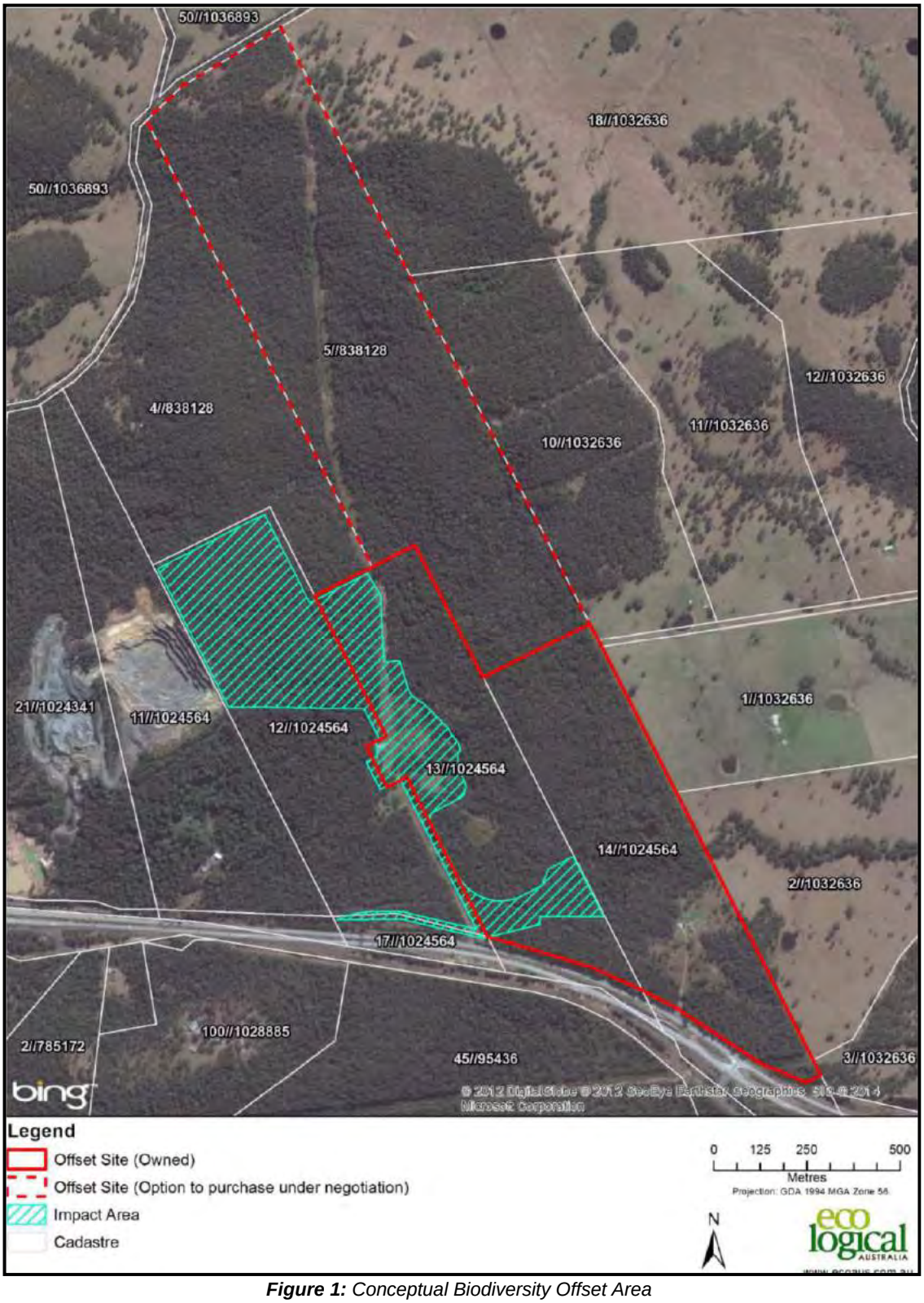


Figure 1: *Conceptual Biodiversity Offset Area*

APPENDIX 5
REHABILITATION STRATEGY

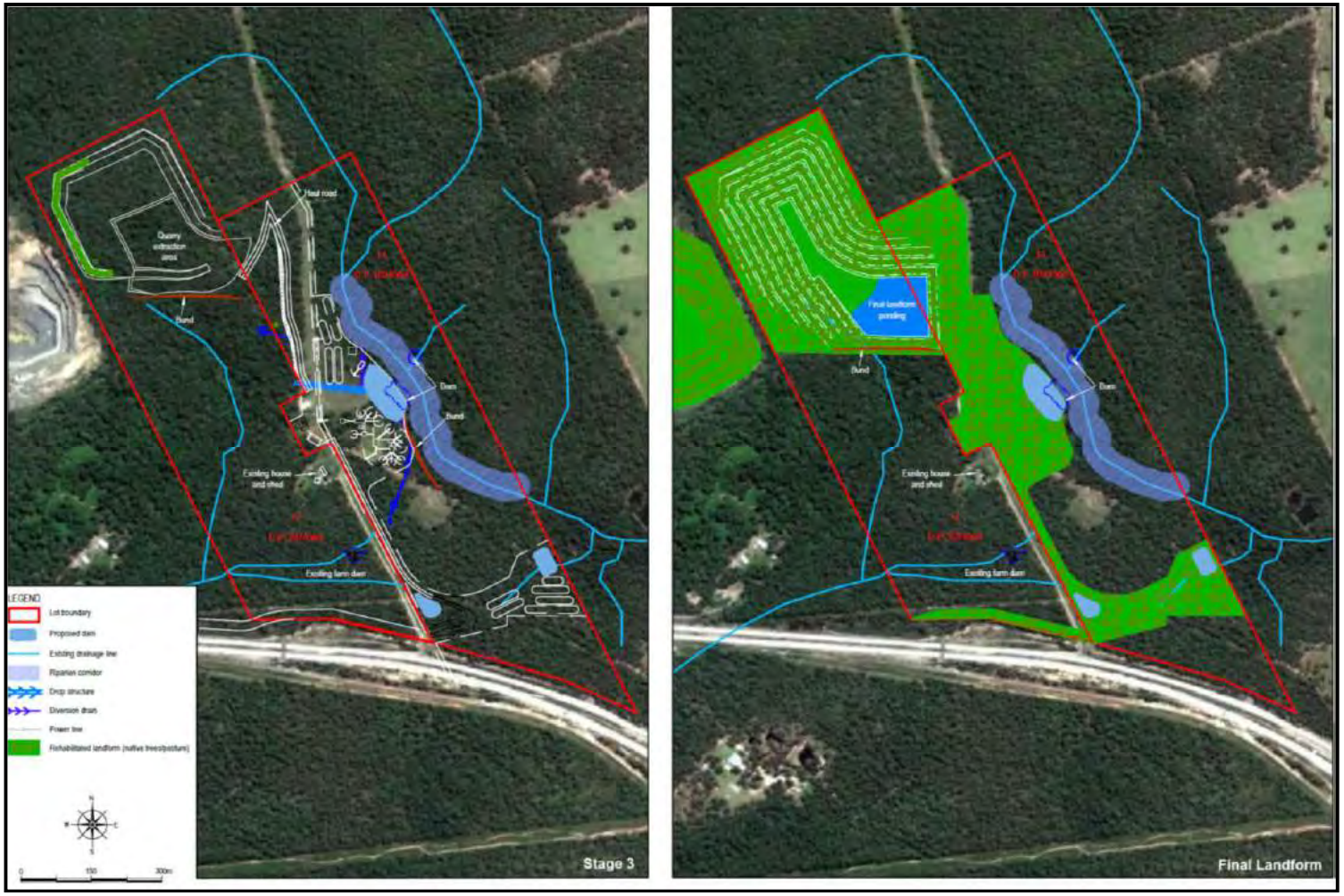


Figure 1: *Conceptual Rehabilitated Landform*

Australian Government
Department of the Environment

Approval

Karuah East Quarry, Pacific Highway, 3 km from Karuah, NSW (EPBC 2014/7282)

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

Person to whom the approval is granted	Karuah East Quarry Pty Ltd
Proponent's ACN	141 505 035
Proposed action	To develop a hard rock (andesite) quarry and associated infrastructure in the Lower North Coast, Pacific Highway, 3 km north of Karuah, NSW

Approval decision

Controlling Provision	Decision
Listed threatened species and communities (sections 18 & 18A)	Approved

Conditions of approval

This approval is subject to the conditions specified below.

Expiry date of approval

This approval has effect until 30 March 2045.

Decision-maker

name and position	Tim Wyndham Acting Assistant Secretary South-Eastern Australia Environment Assessments Branch
signature	
Date of decision	20.3.15

Conditions attached to the approval

Proposed project area

1. The person taking the action must not impact on any **Black-eyed Susan** or **Trailing Woodruff** outside the **project area** identified at **Appendix A.**

2. The person taking the action must not impact on any habitat for the **Koala** outside the **project area** identified at **Appendix B**.

Mitigation

3. Prior to the **commencement of construction**, the person taking the action must install fencing around the perimeter of the **project area** and identify signed **no-go areas**. Fencing and **no-go areas** must be maintained for the life of the action.

4. Prior to the **commencement of construction** and for the life of the action, all on-site personnel must be inducted on environmental sensitivities in the area, including the risk of **Koala** vehicle strike. Induction material is to be prepared by a **suitably qualified ecologist.**

5. Should injury to Koalas occur, advice from a **wildlife expert** 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.

6. Within 48 hours before the clearing of vegetation, pre-clearance surveys must be undertaken by a **suitably qualified ecologist** to ensure the absence of the **Koala** in the **project area**. If any **Koalas** are found to be present, **salvage and translocation** must be undertaken by a **suitably qualified ecologist**.

Offsets

7. The person taking the action must comply with the offset conditions set out in the **NSW Project Approval.**

8. Prior to the **commencement of construction**, to compensate for the impact to the **Trailing Woodruff** and habitat for the **Koala**, the person taking the action must secure suitable offset sites consistent with the **Karuah East Quarry EPBC Act Assessment Report.** In the case that offsets for the **Trailing Woodruff** or habitat for the **Koala** consistent with those set out in the **Karuah East Quarry EPBC Act Assessment Report** cannot be secured, alternative offset sites must be secured, consistent with the **EPBC Act Offsets Policy.**

9. Prior to the **commencement of construction**, the person taking the action must provide the **Minister** with a Biodiversity Area Offset Management Plan for approval. The Biodiversity Area Offset Management Plan must be consistent with the **NSW Project Approval** and include:

    a) **survey information** identifying the number of **Trailing Woodruff** present across all proposed offset sites; and

    b) details on the management and monitoring of the **Trailing Woodruff**, and corrective actions and **contingency plans** to be implemented where the re-establishment of the **Trailing Woodruff** fails to meet targets specified in the **Karuah East Quarry EPBC Act Assessment Report**.

    The approved Biodiversity Area Offset Management Plan must be implemented.

Administrative

10. Within 30 days after the **commencement of construction**, the person taking the action must advise the **Department** in writing of the actual date of **commencement of construction**.

11. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the management plan, and make it available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.

12. Within three months of every 12 month anniversary of the **commencement of construction**, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval over the previous 12 months, including implementation of any management plan, as specified in the conditions. Documentary evidence providing proof of the date of publication must be provided to the Department at the same time as the compliance report is published. The compliance reports must remain on the website for 12 months from the date of publishing. Potential or actual contraventions of the conditions of the approval must be reported to the **Department** in writing within 2 business days of the person taking the action becoming aware of the potential or actual contravention. All contraventions must also be included in the compliance reports.

13. Upon the direction of the **Minister**, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The independent auditor must be approved by the **Minister** prior to the commencement of the audit. Audit criteria must be agreed to by the **Minister** and the audit report must address the criteria to the satisfaction of the **Minister**.

14. If the person taking the action wishes to carry out any activity otherwise than in accordance with the management plan as specified in the conditions, the person taking the action must submit to the Department for the **Minister**'s written approval a revised version of that management plan. The varied activity shall not commence until the **Minister** has approved the varied management plan in writing. If the **Minister** approves the revised management plan, that management plan must be implemented in place of the management plan originally.

15. If the **Minister** believes that it is necessary or convenient for the better protection of listed threatened species and ecological communities to do so, the **Minister** may request that the person taking the action make specified revisions to the management plan specified in the conditions and submit the revised management plan for the **Minister's** written approval. The person taking the action must comply with any such request. The revised approved management plan must be implemented. Unless the **Minister** has approved the revised management plan then the person taking the action must continue to implement the management plan originally approved, as specified in the conditions.

16. If, at any time after 5 years from the date of this approval, the person taking the action has not **substantially commenced** the action, then the person taking the action must not **substantially commence** the action without the written agreement of the **Minister**.

17. Unless otherwise agreed to in writing by the **Minister**, the person taking the action must publish all management plans referred to in these conditions of approval on their website. Each management plan must be published on the website within 1 month of being approved. The person taking the action must notify the **Department** within 5 business days of publishing the management plan on their website and the management plan must remain on the website for the period this approval has effect.

Definitions:

Black-eyed Susan is the EPBC listed threatened species *Tetratheca juncea.*

Commencement of construction is the date that preparatory works are first undertaken, including but not limited to clearing of vegetation, the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for infrastructure or earthworks. This does not include investigative activities such as accessing the site for surveying or planning purposes.

Contingency plans include compensatory measures such as additional direct offsets which would be required to meet the EPBC Act Offsets Policy.

Department means the Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999.*

EPBC Act Offsets Policy means the Australian Government policy document titled: *EPBC Act environmental offsets policy Department of the Environment, 2013 Policy guiding the use of offsets under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*

Karuah East Quarry EPBC Act Assessment Report means the report prepared by Eco Logical Australia, October 2014.

Koala is the EPBC listed threatened species *Phascolarctos cinereus.*

Minister means the Australian Government Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* and includes a delegate of the Minister.

No-go areas means areas adjacent to the **project area** containing habitat for EPBC listed threatened species, to be excluded from construction, vehicles, personnel and equipment.

NSW Project Approval means Project Approval number 09_0175, granted under section 75J of the *Environmental Planning and Assessment Act 1979* by the Minister for Planning to Karuah East Quarry Pty Ltd and dated 17 June 2014.

Project area means the Karuah East Hard Rock Quarry identified by the red line at Appendix A and Appendix B.

Salvage and translocation means the relocation of animals or plants from an area adversely affected by development to an area reserved or protected from ongoing impacts.

Substantially commence/d means the installation of any permanent infrastructure associated with the action excluding signage and fences.

Suitably qualified ecologist means an ecologist with relevant tertiary qualifications and at least 2 years of experience in koala surveying and salvage and translocation.

Survey information is data gathered by a **suitably qualified ecologist**.

Trailing Woodruff is the EPBC listed threatened species *Asperula asthenes.*

Wildlife expert means a practicing expert (such as a veterinarian) with qualifications in caring for injured wildlife and access to adequate equipment to provide appropriate care.

Appendix A – locations of the Black-eyed Susan and Trailing Woodruff in the **project area** and surrounding properties.

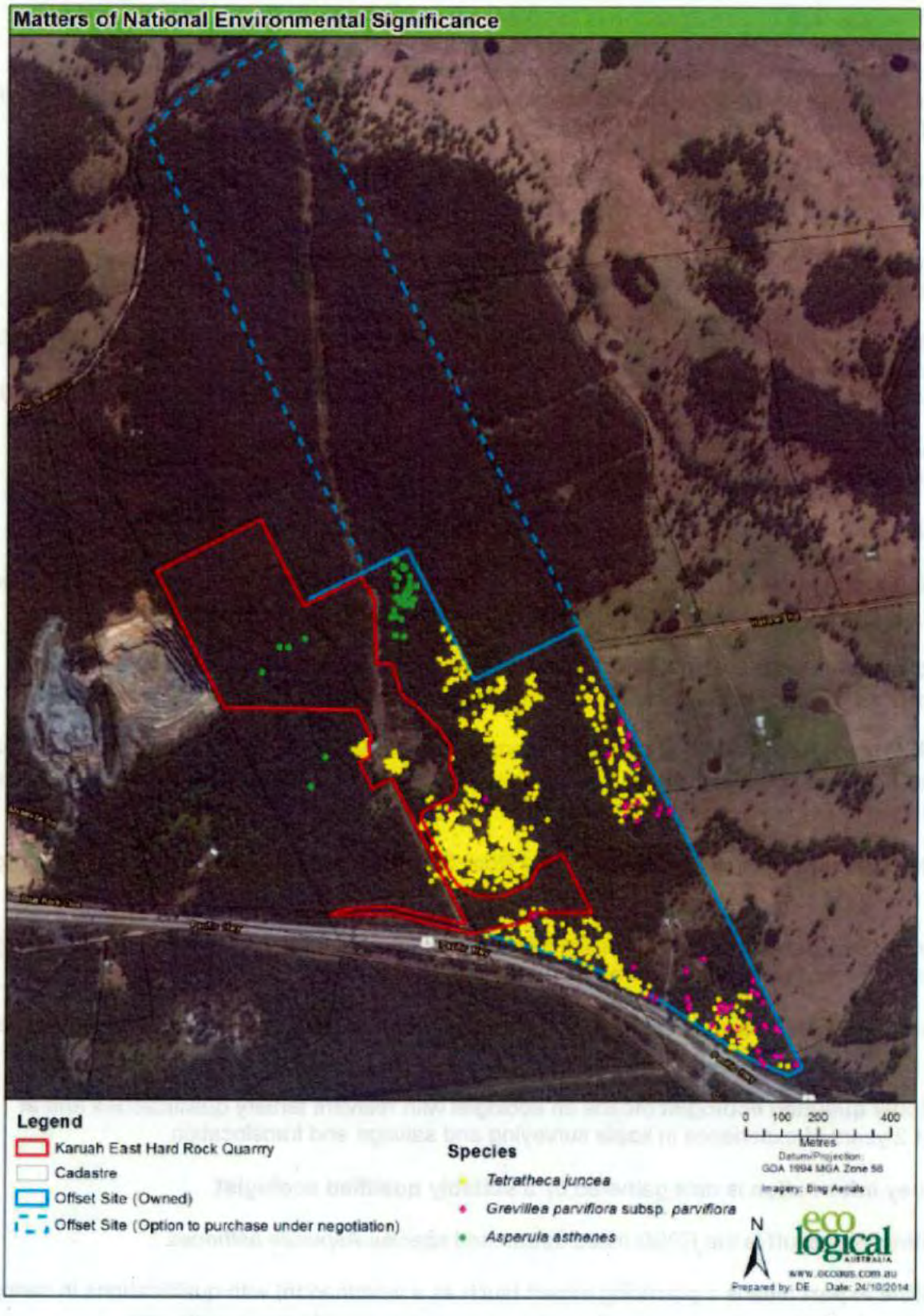


Figure 11 Threatened species recorded within the offset site

Appendix B – location of Koala habitat in the **project area** and surrounding properties

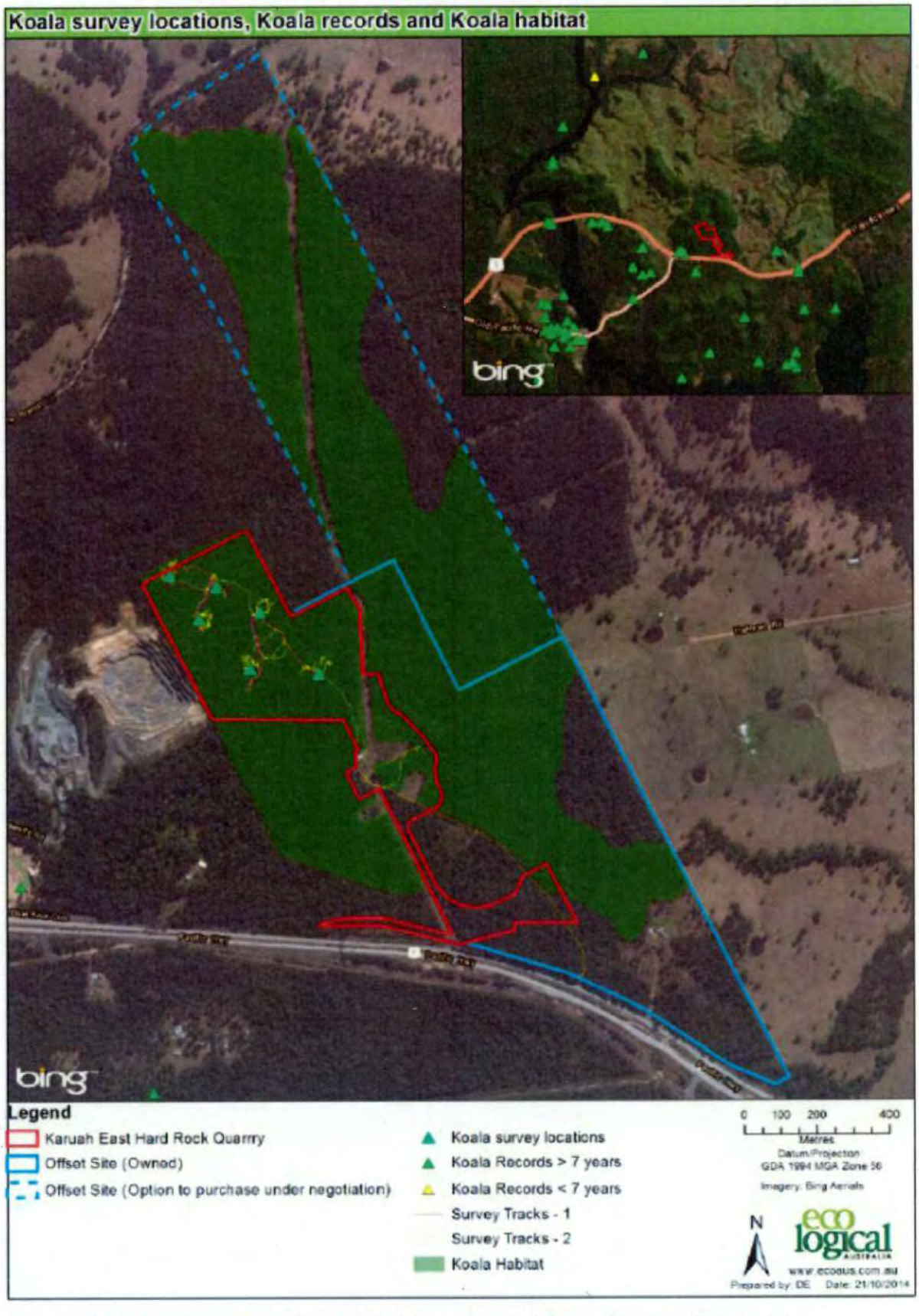
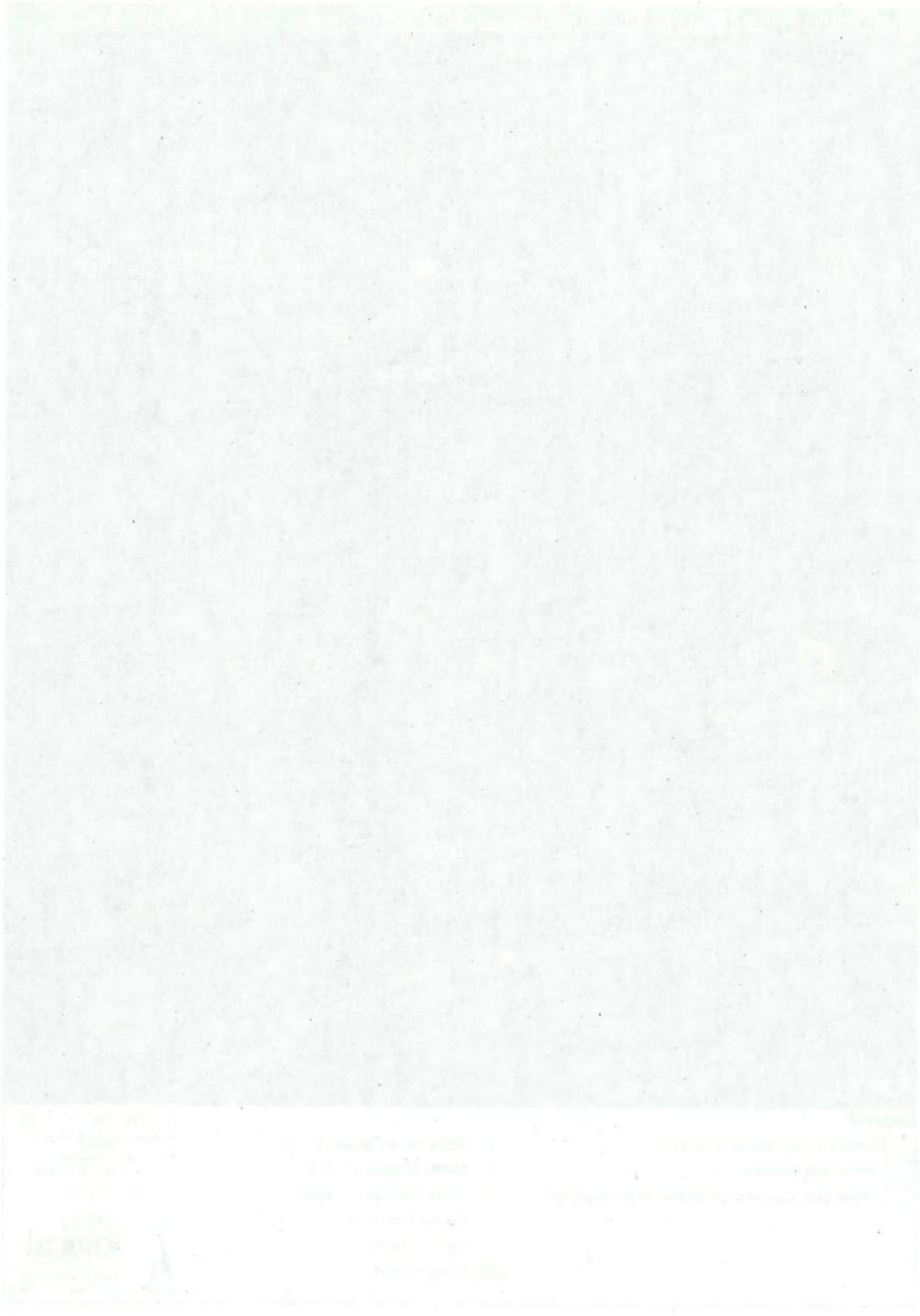


Figure 9 Koala habitat within both the quarry impact area and the adjacent offset areas



APPENDIX 2 – Environment Protection Licence

Environment Protection Licence

Licence - 20611

Licence Details	
Number:	20611
Anniversary Date:	26-August

Licensee
KARUAH EAST QUARRY PTY LIMITED
PO BOX 3284
THORNTON NSW 2322

Premises
KARUAH EAST QUARRY
PACIFIC HIGHWAY
KARUAH NSW 2324

Scheduled Activity
Crushing, grinding or separating
Extractive activities

Fee Based Activity	Scale
Crushing, grinding or separating	> 500000-2000000 T annual processing capacity
Land-based extractive activity	> 500000-2000000 T annual capacity to extract, process or store

Region
North - Hunter
Ground Floor, NSW Govt Offices, 117 Bull Street NEWCASTLE WEST NSW 2302
Phone: (02) 4908 6800
Fax: (02) 4908 6810
PO Box 488G NEWCASTLE
NSW 2300

Environment Protection Licence

Licence - 20611

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Environment Protection Licence

Licence - 20611

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

Licence - 20611

The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

KARUAH EAST QUARRY PTY LIMITED
PO BOX 3284
THORNTON NSW 2322

subject to the conditions which follow.

Environment Protection Licence

Licence - 20611

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled development work listed below at the premises listed in A2:
Works necessary to commence quarry operations (eg stormwater controls, development of roads).

A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Crushing, grinding or separating	Crushing, grinding or separating	> 500000 - 2000000 T annual processing capacity
Extractive activities	Land-based extractive activity	> 500000 - 2000000 T annual capacity to extract, process or store

A1.3 Notwithstanding the condition above, the scale of the land-based extractive activity and / or scale of crushing, grinding and separating authorised under this licence must not exceed 1.5 million tonnes of quarry products per annum, being the amount equivalent to the extraction limit approved by the project approval MP09_0175 granted under the *Environmental Planning and Assessment Act 1979* for the premises specified in A2.

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
KARUAH EAST QUARRY
PACIFIC HIGHWAY
KARUAH
NSW 2324
LOT 26 DP 1024341, LOT 27 DP 1024341, LOT 12 DP 1024564, LOT 13 DP 1024564, LOT 16 DP 1024564, LOT 17 DP 1024564, LOT 202 DP 1042537

A3 Information supplied to the EPA

A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air

EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
4	Air emissions monitoring		Adjacent to Residence C at 5760 Pacific Highway, Karuah, referred to as DDG1 on Figure 2 "Sensitive Receivers & Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558.
5	Air emissions monitoring		Adjacent to Residence B at 5770 Pacific Hwy, Karuah, referred to as DDG2 on Figure 2 titled "Sensitive Receivers & Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558
6	Air emissions monitoring		Located Lot 24 DP 1024341 Pacific Karuah, referred to as DDG3 on Figure 2 titled "Sensitive Receivers and Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558.
7	Air emissions monitoring		Located at 21 Halloran Road, North Arm Cove, referred to as DDG4 on Figure 2 titled "Sensitive Receivers and Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558.
8	Air emission monitoring		Located on Lot21 DP1024341 Pacific Hwy, Karuah, referred to as DDG5 on Fig 2 "Karuah East Quarry - Sensitive Receivers & Air Quality Monitoring Locations" attached to licence variation application received 16/12/16. Located within EPA document DOC16/58114

Environment Protection Licence

Licence - 20611

9	Air emission monitoring	Residence B located at Lot 3 DP 785172, Karuah, referred to as "B" HVAS on Fig 2 "Karuah East Quarry - Sensitive Receivers & Air Quality Monitoring Locations" in licence variation application received 16/12/16. Located within EPA document DOC16/581149

P1.2 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

P1.3 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to waters	Discharge to waters	The discharge point from Dam 1 as shown on the plan titled "Proposed Surface Water Management Plan - Figure 3", which is filed as part of EPA document DOC15/253402.
2	Discharge to waters	Discharge to waters	The discharge point from Dam 2 as shown on as shown on the plan titled "Proposed Surface Water Management Plan - Figure 3", which is filed as part of EPA document DOC15/253402.
3	Discharge to waters	Discharge to waters	The discharge from Dam 3 as shown on the plan titled "Proposed Surface Water Management Plan - Figure 3", which is filed as part of EPA document DOC15/253402.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise

EPA identification no.	Type of monitoring point	Location description
11	Air blast overpressure & ground vibration peak particle velocity monitoring	Blast Monitor located adjacent to Residence B as identified in 'Figure 1 - Appendix 2 - Noise Receiver Locations' located in EPA document DOC15/253402.

3 Limit Conditions

Environment Protection Licence

Licence - 20611

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L2.4 Water and/or Land Concentration Limits

POINT 1,2,3

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	milligrams per litre				5 and/or none visibl
pH	pH				6.5 - 8.5
Total suspended solids	milligrams per litre				40

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.

L3.2 This condition only applies to the storage, treatment, processing, reprocessing or disposal of waste at the premises if those activities require an environment protection licence.

L4 Noise limits

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L4.1 Noise generated at the premises must not exceed the noise limits in the table below. The locations referred to in the table below are indicated in Table 3 and Figure 10 of the document entitled Environmental Assessment Report - Proposed Karuah East Quarry (ADW Johnson Pty Limited 2013) which has been filed on EPA file LIC08/1088-03.

Location	Noise Limit dB(A)
	Day LAeq (15 minute)
Residence A on Lot 100 DP 785172	40
Residence B on Lot 3 DP 785172	37
Residence G on Lot 1 DP 1032636	38
Any other residence or sensitive receiver not subject to a private negotiated agreement	35
Any approved residence on Lot 11 DP 1024564	43

L4.2 For the purpose of the table above, Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays.

L4.3 The noise limits set out in this licence apply under all meteorological conditions except for the following:
a) Wind speed greater than 3 metres/second at 10 metres above ground level; or
b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
c) Stability category G temperature inversion conditions.

L4.4 **Determining Compliance**

To determine compliance:
a) with the Leq(15 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located:
i) approximately on the property boundary, where any dwelling is situated 30 metres or less from the property boundary closest to the premises; or
ii) within 30 metres of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable
iii) within approximately 50 metres of the boundary of a National Park or a Nature Reserve.
b) with the LA1(1 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located within 1 metre of a dwelling façade.
c) with the noise limits in the Noise Limits table, the noise measurement equipment must be located:
i) at the most affected point at a location where there is no dwelling at the location; or
ii) at the most affected point within an area at a location prescribed by part (a) or part (b) of this condition.

Note: A non-compliance of the Noise Limits table will still occur where noise generated from the premises in excess of the appropriate limit is measured:
i) at a location other than an area prescribed in part (a) and part (b); and/or
ii) at a point other than the most affected point at a location.

L4.5 For the purposes of determining the noise generated at the premises the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

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L5 Blasting

L5.1 Blasting in or on the premises must only be carried out between 0900 hours and 1600 hours, Monday to Friday. No blasting is permitted Saturdays, Sundays or public holidays. Blasting outside of the hours specified in this condition can only take place with the written approval of the EPA.

L5.2 Blasting is not permitted simultaneously with adjacent quarry(s).

L5.3 The airblast overpressure level from blasting operations in or on the premises must not exceed:
115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period
at monitoring point 11 detailed in Condition P1.4.

L5.4 The airblast overpressure level from blasting operations in or on the premises must not exceed:
120 dB (Lin Peak) at any time at monitoring point 11 detailed in Condition P1.4.

L5.5 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed 5 mm/second for more than 5% of the total number of blasts during each reporting period at monitoring point 11 detailed in Condition P1.4.

L5.6 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed 10 mm/second at any time at monitoring point 11 detailed in Condition P1.4.

L5.7 Error margins associated with any monitoring equipment used to measure airblast overpressure or peak particle velocity are not to be taken into account in determing whether or not the limit has been exceeded.

L5.8 The airblast overpressure and ground vibration levels in the conditions above do not apply at noise sensitive locations that are owned by the licensee or subject to a private agreement, relating to airblast overpressure and ground vibration levels, between the licensee and land owner.

L5.9 Offensive blast fume must not be emitted from the premises.

Definition:

Offensive blast fume means post-blast gases from the detonation of explosives at the premises that by reason of their nature, duration, character or quality, or the time at which they are emitted, or any other circumstances:
1. *are harmful to (or likely to be harmful to) a person that is outside the premises from which it is emitted, or*
2. *interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.*

L6 Hours of operation

L6.1 All construction work at the premises must be conducted between 7am to 6pm Monday to Friday and between 8am to 1pm Saturdays and at no time on Sundays and public holidays. This condition does not apply in the event of a direction from police or other relevant authority for safety or emergency reasons.

Note: 'safety or emergency reasons' refers to emergency works which may need to be undertaken to avoid loss of life, property loss and/or prevent environmental harm.

L6.2 Construction may occur outside these hours provided the noise (LAeq 15min) from these activities does not exceed 35 dBA at any privately owned residence.

L6.3 All quarrying operations, including extraction, processing and loadings / transport must be conducted between 7am to 6pm Monday to Friday and 7am to 1pm Saturdays and at no time on Sundays and public holidays.

Maintenance activities may occur 24 hours per day, 7 days per week, provided these activities are inaudible at any privately owned residence.

L7 Potentially offensive odour

L7.1 No condition of this licence identifies a potentially offensive odour for the purposes of Section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 All areas in or on the premises must be maintained in a condition that prevents or minimises the emission of dust to the air.

O3.2 Any activity carried out in or on the premises must be carried out by such practical means as to prevent dust or minimise the emission of dust to the air.

O3.3 Any plant operated in or on the premises must be operated by such practical means to prevent or minimise dust or other air pollutants.

O3.4 All trafficable areas and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the emmession of dust to the air, or emmission from the premises of wind-blown or traffic generated dust.

O3.5 The licensee must ensure it has sufficient water during all stages of the quarry, and if necessary adjust the scale of quarrying operations on the premises to match its available supply.

O3.6 Trucks entering and leaving the premises that are carrying loads of dust generating materials must have their loads covered at all times, except during loading and unloading.

O4 Emergency response

O4.1 The licensee must maintain, and implement as necessary, a current Pollution Incident Response Management Plan (PIRMP) for the premises. The licensee must keep the incident response plan on the premises at all times. The incident response plan must document systems and procedures to deal with all types of incidents (e.g. spills, explosions or fire) that may occur at the premises or that may be associated with activities that occur at the premises and which are likely to cause harm to the environment.

The PIRMP must be tested at least annually or following a pollution incident.

The licensee must develop the Pollution Incident Response Management Plan in accordance with the requirements in Part 5.7A of the Protection of the Environment Operations (POEO) Act 1997 and POEO regulations.

O5 Processes and management

O5.1 All tanks and storage areas for drums containing material that has potential to cause environmental harm must be bunded or have an alternative spill containment system in-place.

The bunding and/or spill containment systems must be properly designed, engineered, and constructed to be suitable for the material types and quantities stored therein in accordance with all appropriate standards, including Australian Standards (AS)1940 and AS1596.

O5.2 Bunds must:
a) have walls and floors constructed of impervious materials;
b) be of sufficient capacity to contain 110% of the volume of the tank (or 110% volume of the largest tank where a group of tanks are installed);
c) have floors graded to a collection sump; and
d) not have a drain valve incorporated in the bund structure,

or be constructed and operated in a manner that achieves the same environmental outcome.

O5.3 All refuelling must be undertaken in a dedicated refuelling area. The refuelling area must be a hardstand and suitably bunded in accordance with EPA bunding guidance.

O5.4 The licensee must, before undertaking any earthmoving or vegetation removal works, implement erosion and sediment control measures to prevent pollution of waters in accordance with Soils and Construction: Managing Urban Stormwater 2004 (Landcom, 2004).

O5.5 Stormwater from all areas of the premises which has the potential to mobilise sediments and other material must be controlled and diverted through the appropriate erosion and sediment control and/or pollution control measures/structures, so as not to cause, permit or allow water pollution to occur.

O5.6 The in-pit sump must be sized at all times to prevent a discharge to waters in the event of pump failure.

O6 Waste management

O6.1 The licensee must not irrigate, discharge or dispose of sewage effluent, on the premises.

O6.2 The licensee must operate and maintain a wastewater collection and storage tank/s to enable the pump out and offsite disposal of any sewage effluent.

O6.3 The licensee must ensure that sewage effluent collected at the premises is pumped out and disposed of in a lawful manner.

O7 Other operating conditions

Noise and Blast Management

O7.1 All acoustic bunds necessary to achieve compliance with the noise limits specified in this licence must be constructed prior to the commencement of quarrying activities and be maintained thrughout the operational life of the premises to the height and location described in the Noise Management Plan.

Bitumin Pre-coat Plant

O7.2 The licensee must not have a bitumin pre-coat plant on the site. Project Approval MP09_0175 did not assess or approve such a plant.

5 Monitoring and Recording Conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:

a) in a legible form, or in a form that can readily be reduced to a legible form;
b) kept for at least 4 years after the monitoring or event to which they relate took place; and
c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
a) the date(s) on which the sample was taken;
b) the time(s) at which the sample was collected;
c) the point at which the sample was taken; and
d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 4,5,6,7,8

Pollutant	Units of measure	Frequency	Sampling Method
Particulates - Deposited Matter	grams per square metre per month	Monthly	AM-19

POINT 9

Pollutant	Units of measure	Frequency	Sampling Method
PM10	micrograms per cubic metre	Every 6 days	AM-18
Total suspended particles	micrograms per cubic metre	Every 6 days	AM-15

M2.3 Water and/ or Land Monitoring Requirements

POINT 1,2,3

Pollutant	Units of measure	Frequency	Sampling Method
Oil and Grease	milligrams per litre	Special Frequency 1	Visual Inspection
pH	pH	Special Frequency 1	Grab sample
Total suspended solids	milligrams per litre	Special Frequency 1	Grab sample
Turbidity	nephelometric turbidity units	Special Frequency 1	Grab sample

Note: For the purposes of the table above 'Special Frequency 1' means:
(a) within 12 hours prior to any controlled discharge; and
(b) daily during a controlled discharge; or
(c) daily during any uncontrolled discharge.

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Weather monitoring

M4.1 Prior to the commencement of operation of the development, the Proponent must establish a permanent meterological station complying with the Approved Methods for Sampling and Analysis and the Australian Standard AS2923 - 1987, at the facility. The meterological station must monitor the following parameters:

Parameter	Units of measure	Averaging period	Frequency	Sampling Method
Rainfall	mm/hr	1 hour	Continuous	AM-4
Sigma Theta @ 10m	degrees	1 hour	Continuous	AM-2
Siting	-	-	-	AM-1
Temperature @ 10m	Kelvin	1 hour	Continuous	AM-4
Temperature @ 2m	Kelvin	1 hour	Continuous	Am-4
Total Solar Radiation @ 10m	W/m2	1 hour	Continuous	AM-4

Wind direction @ 10m	degrees	1 hour	Continuous	AM-2
Wind speed @ 10m	m/s	1 hour	Continuous	AM-2

Note: Sampling methods as identified in the table above refer to those outlined in NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in NSW.

M4.2 The location of the site chosen for the station and details of equipment, measurement and maintenance / service procedures and scedules to be installed and maintained must be submitted to the EPA and approved in writing by the EPA before any sampling or analysis is carried out.

M4.3 The meterological monitoring station must be calibrated at least once every 12 months. The EPA is to be provided with data on request in a Microsoft Office software compatible format.

M5 Recording of pollution complaints

M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M5.2 The record must include details of the following:
a) the date and time of the complaint;
b) the method by which the complaint was made;
c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
d) the nature of the complaint;
e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
f) if no action was taken by the licensee, the reasons why no action was taken.

M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M6.3 The preceding two conditions do not apply until 1 month after the date of the issue of this licence.

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M7 Blasting

M7.1 To determine complaince with Blast Limit conditions of this licence:
a) Airblast overpressure and ground vibration levels must be measured and electronically recorded for monitoring point 11 for the parameters specified in Column 1 of the table below; and
b) The licensee must use the units of measure, sampling method, and sample at the frequency specified opposite in the other columns.

Parameter	Units of Measure	Frequency	Sampling Method
Airblast Overpressure	Decibels (Linear Peak	All blasts	Australian Standard AS 2187.2-2006
Ground Vibration Peak Particle Velocity	millimetres/second	All blasts	Australian Standard AS 2187.2-2006

M8 Noise monitoring

M8.1 To assess compliance with the noise limits for this premises attended noise monitoring must be undertaken in accordance with all noise conditions and:
a) at each one of the locations listed in the noise limits table of this licence;
b) occur annually each reporting period at the time of year generally associated with maximum noise transmission (ie generally winter conditions);
c) occur during each day period as defined in the NSW Industrial Noise Policy.

Note: the frequency of this noise monitoring may be varied at the discretion of the EPA.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
1. a Statement of Compliance,
2. a Monitoring and Complaints Summary,
3. a Statement of Compliance - Licence Conditions,
4. a Statement of Compliance - Load based Fee,
5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,
6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and
7. a Statement of Compliance - Environmental Management Systems and Practices.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect *EPA* or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R2 Notification of environmental harm

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written

report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

Reporting blasting limit exceedance

R4.1 The licensee must report any exceedance of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedance becomes known to the licensee or to one of the licensee's employees or agents.

Annual Blast Monitoring Report

R4.2 The licensee must supply a Blast Monitoring Report with the EPA licence Annual Return, which must include the following information relating to each blast carried out within the premises during the respective reporting period:
a) the date and time of the blast;
b) the location of the blast on the premises;
c) the blast monitoring results at each blast monitoring station;
d) an explanation for any missing blast monitoring results.

Noise Monitoring Report

R4.3 A noise compliance assessment report must be submitted to the EPA within 30 days of the completion of the annual monitoring. The assessment must be prepared by a suitably qualified and experienced acoustical consultant and include:
a) an assessment of compliance with noise limits presented in this licence; and
b) an outline of any management actions taken within the monitoring period to address any exceedances

of the limits contained in this licence.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder describe d at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste

Mr Peter Jamieson

Environment Protection Authority

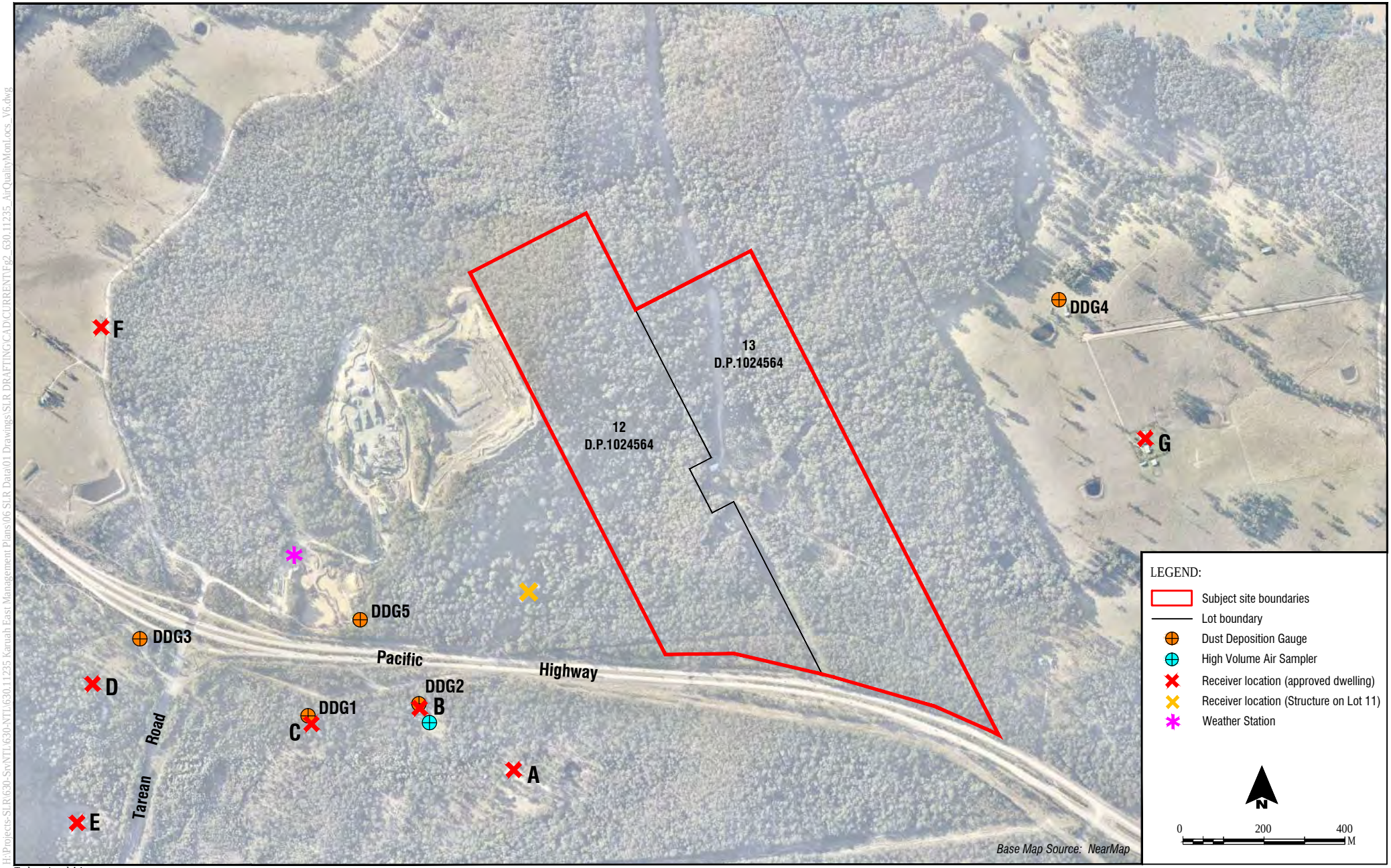
(By Delegation)

Date of this edition: 26-August-2015

End Notes

2	Licence varied by notice 1533596 issued on 21-Sep-2015
3	Licence varied by notice 1547416 issued on 06-Dec-2016

APPENDIX 3 – Key Figures/Plans



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Karuah East Quarry - Sensitive Receivers and Air Quality Monitoring Locations

FIGURE 1

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Karuah East Quarry - Sensitive Receivers and Blasting Monitoring Locations

FIGURE 2

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Karuah East Quarry - Sensitive Receivers and Monitoring Locations

FIGURE 3

Powerline Easement
SW1
Haul Road
13
D.P.1024564
Quarry Extraction Area
In-pit Sump
Sediment Fence
Bund
Proposed LDP1
Existing Farm Dams to be Upgraded
Dam 1
Crushing Plant
Existing House & Shed
Bund
SW2
1
12
SW4
D.P.1024564
2
3
Existing farm dam
SW3
Proposed LDP3
Dam 3
TRUCK PARKING
Proposed LDP2
ENTRANCE ROAD
ENTRANCE ROAD
MAIN OFFICE & CARPARK
Dam 2
WB OFFICE & 2x WEIGHBRIDGES

LEGEND

- Culvert
- Lot boundary
- Proposed dam
- Existing Farm Dam
- Existing Drainage line
- Riparian corridor
- Drop structure
- Clean Water Diversion drain
- Dirty Water Diversion drain

Catchment Areas

- Quarry extraction area (Stage 5)
- Dam 1
- Dam 2
- Dam 3

SW3 ⊗ Proposed Surface Water monitoring points.

N
W E
S

0 50 100 150 200m

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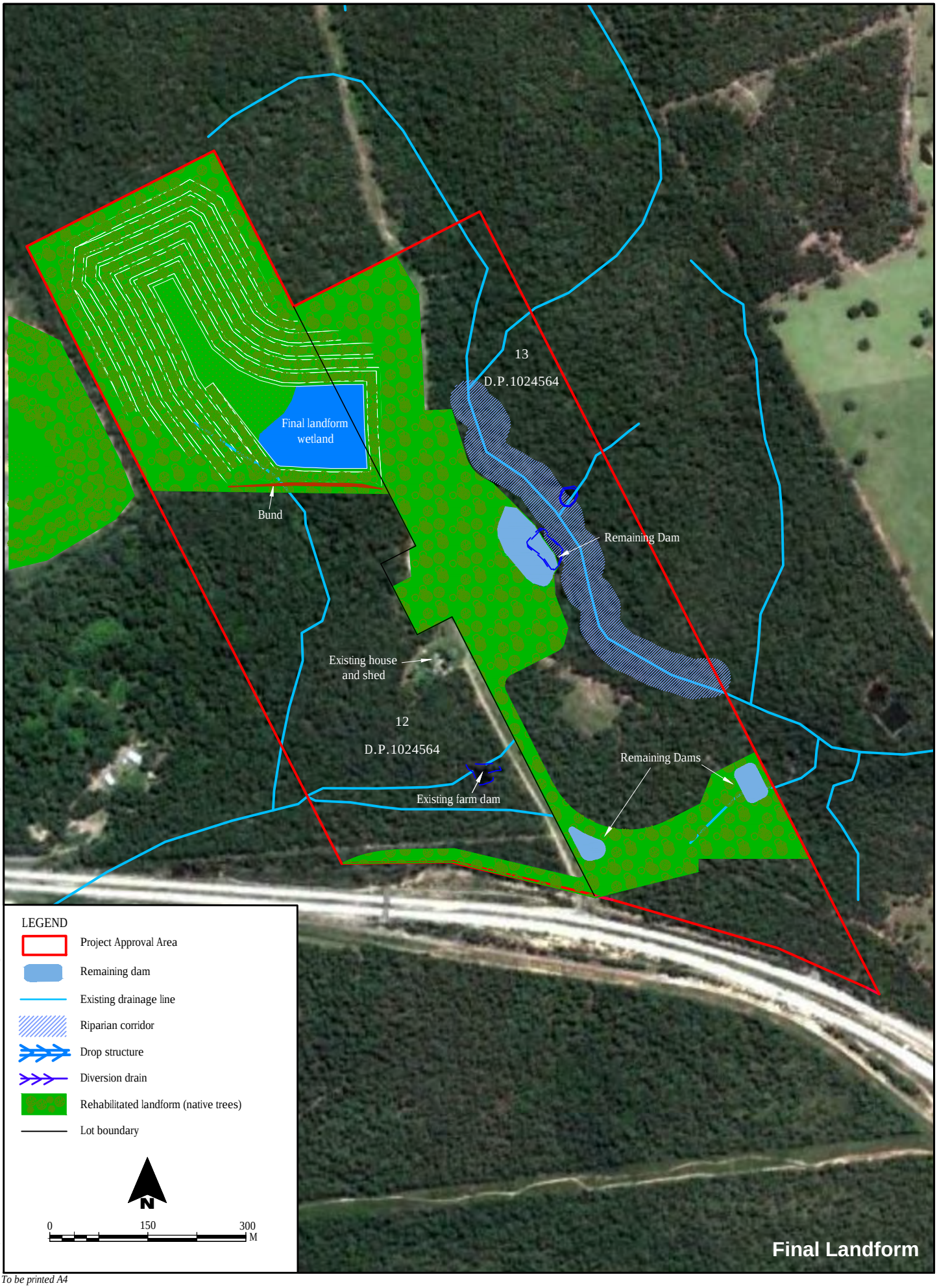
Proposed Surface Water Management Plan

FIGURE 4

A3E/Landscape, 10/07/2013 5:01:46 PM, MarinSkoljarev



H:\Projects-SLR\630-SrvNTL\630-NTL\630.11235 Kartuah East Management Plans\06 SLR Data\01 Drawings\SLR DRAFTING\CAD\CURRENT\Fg6_630.11235_Stage rehab_V1.dwg

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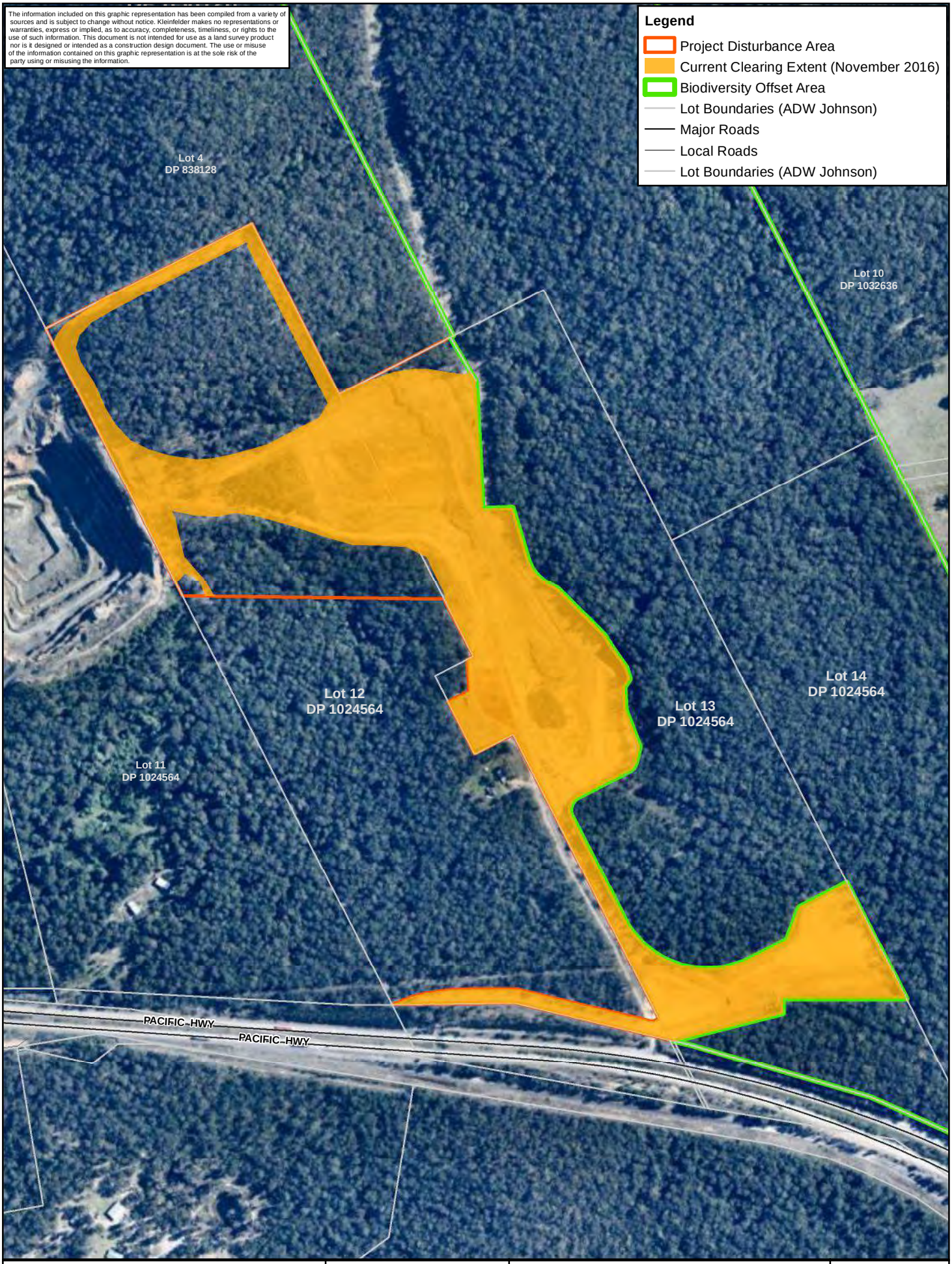
SLR

Indicative Progressive and Final Rehabilitation

FIGURE 5



Metres
0 25 50 100 150 200 250

N

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PROJECT REFERENCE: 20172280

DATE DRAWN: 24/11/2016 16:20 Version 1

DRAWN BY: gjoyce

DATA SOURCE:
LPI - 2015
ADW Johnson - 2015
nearmap - 2016

Current Extent of Clearing within the Karuah East Quarry Project Area

Karuah East Quarry Pty Ltd
2016 Annual Monitoring Report
Karuah East Quarry Project

FIGURE:

6

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APPENDIX 4– Noise Monitoring Reports

Construction Noise Compliance Monitoring

Karuah East Project

April 2016

Report Number 630.11672

20 March 2017

Karuah East Quarry Pty Ltd

Andersite Road

Karuah, NSW 2324

Version: v1.0

Construction Noise Compliance Monitoring

Karuah East Project

April 2016

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
630.11672	V1.0	20 March 2017	Tristan Robertson	Nathan Archer	Martin Davenport

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Appendix A Acoustic Terminology

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Karuah East Quarry Pty Ltd to conduct construction noise compliance monitoring for the Karuah East Project located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah NSW (Development Site).

The objective of the construction noise compliance monitoring was to measure impacts of noise from the Development Site and to provide in-principle recommendations with regard to management strategies and mitigation measures, where necessary, with the aim of achieving the project specific noise criteria.

The construction noise compliance monitoring has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the NSW EPA Interim Construction Noise Guideline (ICNG) and Karuah East Quarry Noise Management Plan (NMP) *630.11235-R1 Karuah East Quarry Project Noise Management Plan* dated October 2015.

1.1 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 SENSITIVE RECEPTORS

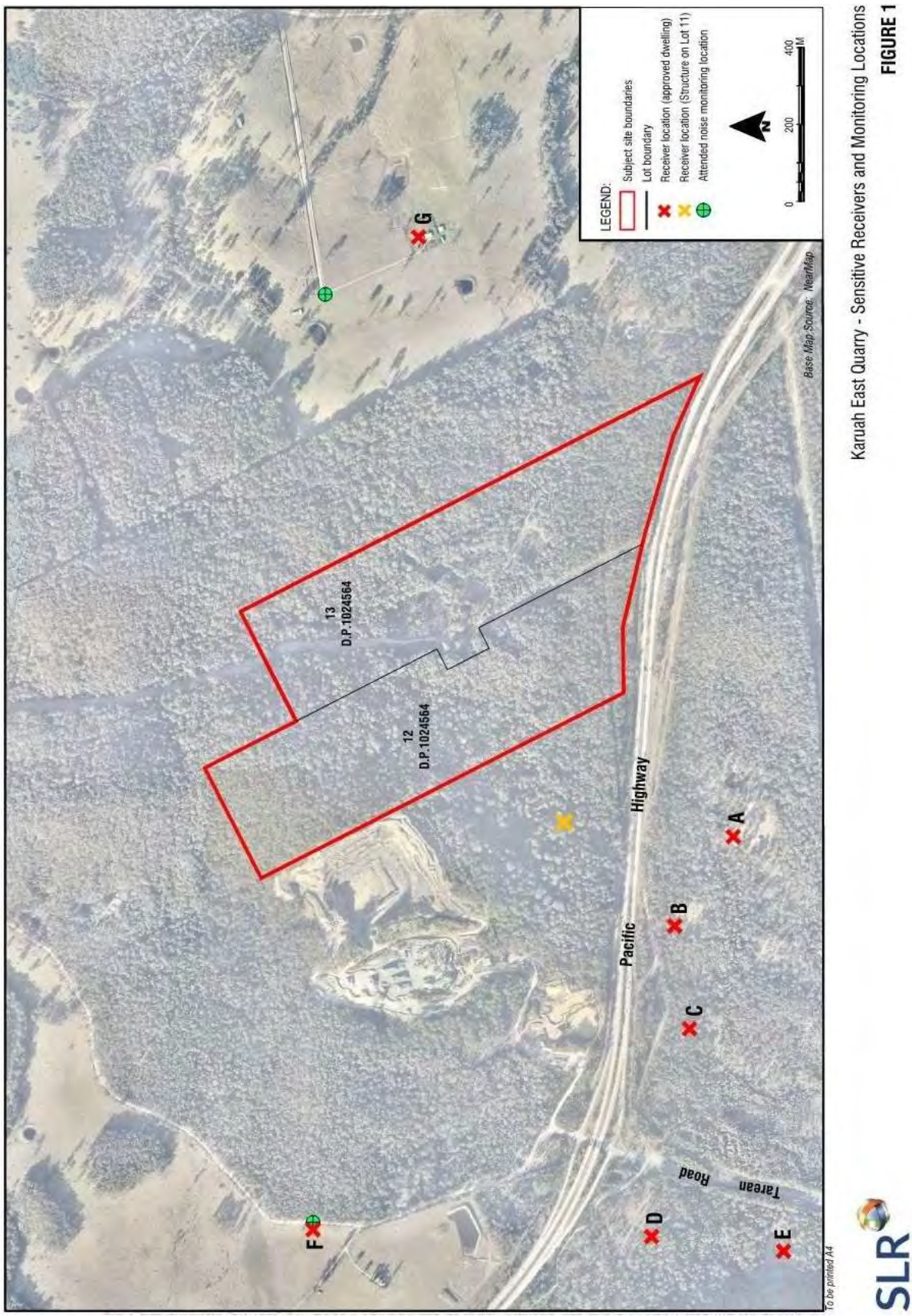
The Karuah East Quarry NMP identified the closest sensitive receptors to the Development Site. These locations are listed in **Table 1** and shown in **Figure 1**.

Table 1 Sensitive Receptor Locations Used in this Assessment

Receiver ID	Details
Existing Approved Dwellings	
A	Lot 100 DP 785172
B	Lot 3 DP 785172
C	Lot 2 DP 785172
D	Lot 22 DP 1024341
E	Lot 250 DP 1092111
F	Lot 50 DP 1036893
G	Lot 1 DP 1032636
Other Structures	
Lot 11[1]	Lot 11 DP1024564

Note 1 - No currently approved residential dwelling exists on Lot 11.

Figure 1 Sensitive Receptor Locations – Development Site



3 CONSTRUCTION COMPLIANCE NOISE CRITERIA

In accordance with the NMP, **Table 2** presents the adopted construction noise goals for the Development Site.

Table 2 Project Specific Construction Noise Goals (dBA $L_{Aeq(15minute)}$)

Location	Adopted RBL	Noise Management Level (dBA $L_{Aeq(15minute)}$)	
		Noise Affected	Highly Noise Affected
Any approved Residence on Lot 11 DP 1024564[1]	44	54	75
A to E	44	54	
F	44	54	
G	34	44	

Note 1 – At present there is no approved residence on Lot 11.

4 CONSTRUCTION COMPLIANCE NOISE ASSESSMENT

4.1 General Methodology

A compliance noise survey was conducted to characterise and quantify the noise emissions from the Development Site. In accordance with the NMP, noise monitoring was undertaken at two locations, Location F and Location G (refer to **Figure 1**) considered representative of the nearest potentially-affected noise-sensitive receivers to the Development Site.

The construction compliance noise monitoring consisted of operator attended noise surveys.

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672 2004 "*Electroacoustics - Sound Level Meters*" (parts 1 and 2) and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

4.2 Operator Attended Noise Compliance Monitoring

Operator attended noise measurements were conducted during the day period on Friday 29 April 2016 at the noise monitoring location F and Location G. Details of the monitoring location are provided in **Table 3** and shown in **Figure 1**.

Table 3 Ambient Noise Monitoring Locations

Sound level meter Type/ Serial No.	Location	Location (m, UTM)	
		Easting	Northing
SVAN 957 S/N 27522	Location F – Eastern Boundary of property	405644	6389785
	Location G – North western boundary of property	408055	6389753

Each operator attended noise survey was 15 minutes in duration.

The results of the operator attended noise measurements are given in **Table 4**. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, and any other industrial operations.

The tables provide the following information:

- Monitoring location.
- Date and start time.
- Wind velocity (m/s) and temperature (ºC) at the measurement location.
- Typical maximum (L_{Amax}) and contributed noise levels.

Table 4 Operator Attended Noise Survey Results

Date/Start Time Weather	**Primary Noise Descriptor (dBA re 20 µPa)**					**Description of Noise Emission and Typical Maximum Levels LAmax – dBA**
	LAmax	**LA1**	**LA10**	**LA90**	**LAeq**	
Location F Day 29/05/2016 13:59 pm W = 1m/s NW Temp = 25.6°C	73	61	49	43	50	Local road traffic 71 to 73 dBA Pacific Highway 47 to 52 dBA Frogs 48 dBA Dog Barking 48 to 50 dBA Birds 40 dBA Insect 38 dBA Hunter Quarry 34 dBA Karuah East Project not audible
Location G Day 29/05/2016 14:26 pm W = 1m/s NW Temp = 25.6°C	56	49	41	35	39	Chainsaw (not project related) 40dBA Insects 36 to 40 dBA Aircraft 42 dBA Birds 52 to 56 dBA Distant Road Traffic Noise 35 dBA Karuah East Project not audible

4.3 Compliance Assessment and Discussion of results

Results of the construction compliance assessment are given in **Table 5**.

Table 5 Compliance Noise Assessment – Construction

Location	**Estimated LAeq(15minute) Contribution**	**Consent Conditions LAeq(15minute)**	**Compliance**
Location F	<33[1]	44	Yes
Location G	<25[1]	34	Yes

Note 1: Karuah East construction activities remained inaudible during operator attended noise measurement suggesting that any contribution would be at least 10 dB below the overall LA90 noise level presented in **Table 4**.

Results presented in **Table 5** indicate that compliance with the relevant consent conditions was achieved at all compliance assessment noise monitoring locations.

5 CONCLUSION

SLR Consulting Australia Pty Ltd (SLR) has undertaken construction noise compliance monitoring for the Karuah East Project located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah NSW (Development Site).

The objective of the construction noise compliance monitoring was to measure impacts of noise from the Development Site and to provide recommendations with regard to management strategies and mitigation measures, where necessary, with the aim of achieving the project specific noise criteria.

Operator Attended Construction Compliance Noise Monitoring

The operator attended noise compliance measurements were conducted during the daytime period on Friday 29 April 2016 at monitoring location F and Location G representing the worst affected receptor locations.

Karuah East construction activities were found to be inaudible and therefore noise contributions from the Development Site were found to be within the relevant consent conditions at all monitoring locations.

6 REFERENCES

- 630.11235-R1 Karuah East Quarry Project Noise Management Plan, SLR Consulting Australia Pty Ltd, October 2015.
- AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3, Australian Standard, 1997.
- AS IEC 61672.1—2004 & Electroacoustics - Sound level meters, Part 1: Specifications, Standards Australia, 2004.

Acoustic Terminology

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-5 Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quiet
20	Unoccupied recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(Z) or dB.

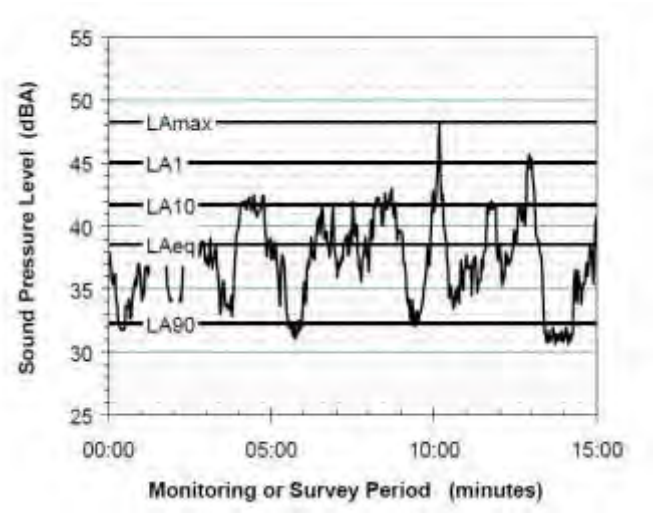
3 Sound Power Level

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 1E-12 W.
The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

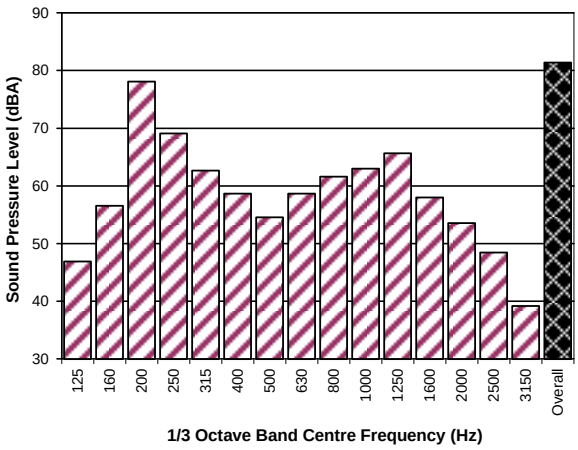
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

10 Over-Pressure

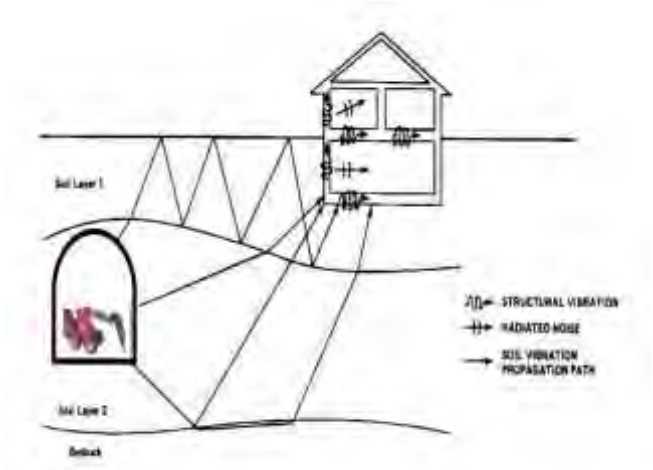
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "regenerated noise", "structure-borne noise", or sometimes "ground-borne noise". Regenerated noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term "regenerated noise" is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This "secondary" noise may be referred to as regenerated noise.

Construction Noise Compliance Monitoring

Karuah East Project

September 2016

Report Number 630.11672

20 March 2017

Karuah East Quarry Pty Ltd

Andersite Road

Karuah, NSW 2324

Version: v1.0

Construction Noise Compliance Monitoring

Karuah East Project

September 2016

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4.2 Operator Attended Noise Compliance Monitoring 7
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APPENDICES

Appendix A Acoustic Terminology

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Karuah East Quarry Pty Ltd to conduct construction noise compliance monitoring for the Karuah East Project located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah, New South Wales (NSW) (the Development Site).

The objective of the construction noise compliance monitoring was to measure impacts of noise from the Development Site and to provide in-principle recommendations with regard to management strategies and mitigation measures, where necessary, with the aim of achieving the project specific noise criteria.

The construction noise compliance monitoring has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the NSW EPA Interim Construction Noise Guideline (ICNG) and Karuah East Quarry Noise Management Plan (NMP) *630.11235-R1 Karuah East Quarry Project Noise Management Plan* dated October 2015.

1.1 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 SENSITIVE RECEPTORS

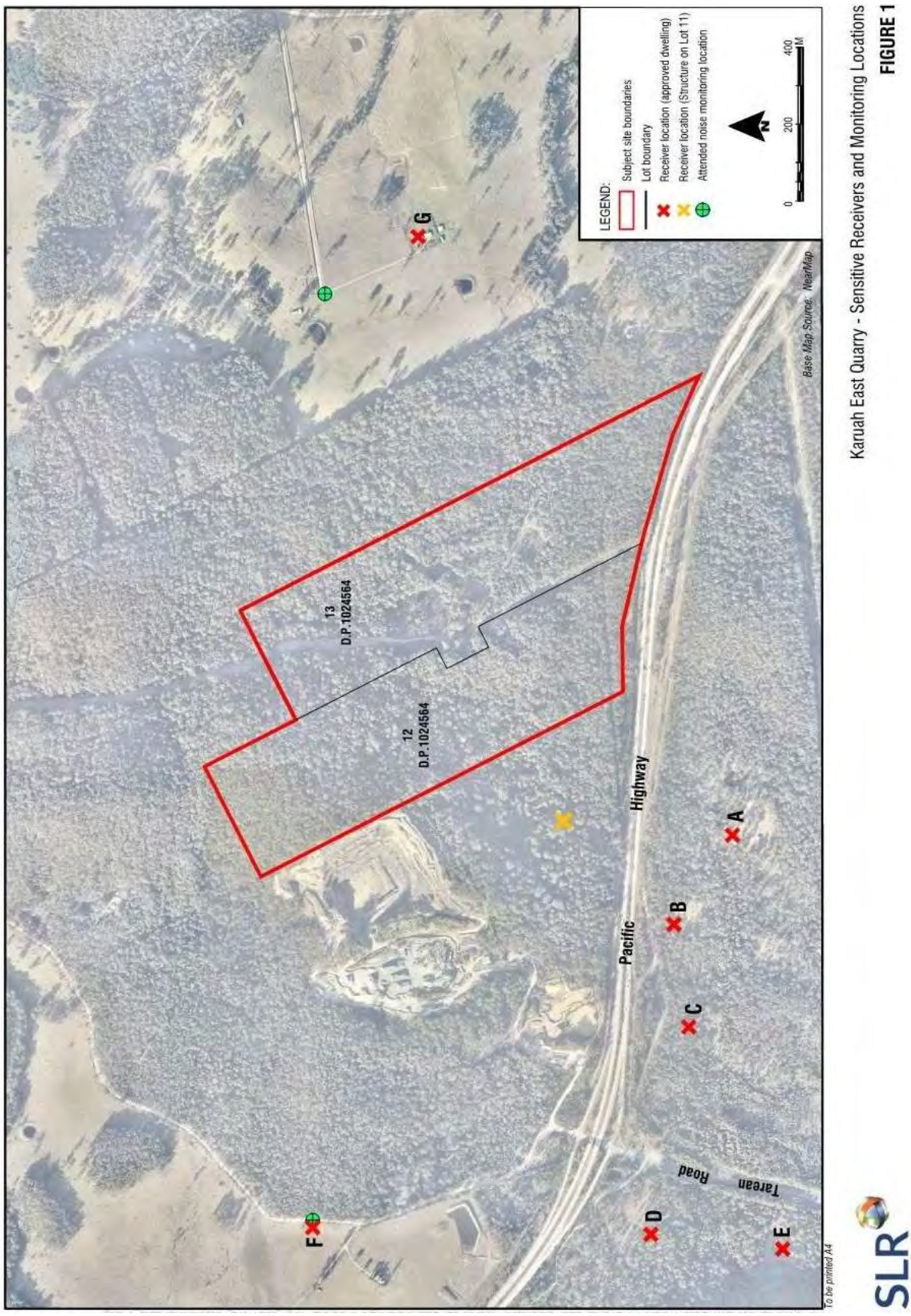
The Karuah East Quarry NMP identified the closest sensitive receptors to the Development Site. These locations are listed in **Table 1** and shown in **Figure 1**.

Table 1 Sensitive Receptor Locations Used in this Assessment

Receiver ID	Details
Existing Approved Dwellings	
A	Lot 100 DP 785172
B	Lot 3 DP 785172
C	Lot 2 DP 785172
D	Lot 22 DP 1024341
E	Lot 250 DP 1092111
F	Lot 50 DP 1036893
G	Lot 1 DP 1032636
Other Structures	
Lot 11[1]	Lot 11 DP1024564

Note 1 - No currently approved residential dwelling exists on Lot 11.

Figure 1 Sensitive Receptor Locations – Development Site



3 CONSTRUCTION COMPLIANCE NOISE CRITERIA

In accordance with the NMP, **Table 2** presents the adopted construction noise goals for the Development Site.

Table 2 Project Specific Construction Noise Goals

Location	Adopted Rating Background Level (RBL)	Noise Management Level (dBA $L_{Aeq(15minute)}$)	
		Noise Affected	Highly Noise Affected
Any approved Residence on Lot 11 DP 1024564[1]	44	54	75
A to E	44	54	
F	44	54	
G	34	44	

Note 1 – At present there is no approved residence on Lot 11.

4 CONSTRUCTION COMPLIANCE NOISE ASSESSMENT

4.1 General Methodology

A compliance noise survey was conducted to characterise and quantify the noise emissions from the Development Site. In accordance with the NMP, noise monitoring was undertaken at two locations, Location F and Location G (refer to **Figure 1**) considered representative of the nearest potentially-affected noise-sensitive receivers to the Development Site.

The construction compliance noise monitoring consisted of operator attended noise surveys.

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672 2004 "*Electroacoustics - Sound Level Meters*" (parts 1 and 2) and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

4.2 Operator Attended Noise Compliance Monitoring

Operator attended noise measurements were conducted during the day period on Tuesday 6 September 2016 at the noise monitoring locations F and G. Details of the monitoring location are provided in **Table 3** and shown in **Figure 1**.

Table 3 Ambient Noise Monitoring Locations

Sound level meter Type/ Serial No.	Location	Location (m, UTM)	
		Easting	Northing
Bruel and Kjaer Type 2270 S/N 3003729	Location F – Eastern Boundary of property	405644	6389785
	Location G – North western boundary of property	408055	6389753

Each operator attended noise survey was 15 minutes in duration.

The results of the operator attended noise measurements are given in **Table 4**. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, and any other industrial operations.

The tables provide the following information:

- Monitoring location.
- Date and start time.
- Wind velocity (m/s) and temperature (ºC) at the measurement location.
- Typical maximum (L_{Amax}) and contributed noise levels.

Table 4 Operator Attended Noise Survey Results

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels LAmax – dBA
	LAmax	LA1	LA10	LA90	LAeq	
Location F Day 6/09/2016 9:05 am W = 1 m/s NW Temp = 13°C	74	55	50	43	49	Local road traffic 74 dBA Pacific Highway 45 to 55 dBA Frogs/Insects 35 to 37 dBA Birds 50 to 54 dBA Aeroplane 49 to 56 dBA Karuah East Project Construction not audible
Location G Day 6/09/2016 9:30 am W = 1 m/s N Temp = 16°C	60	51	44	33	40	Pacific Highway 32 to 38 dBA Frogs/Insects 30 to 36 dBA Birds 47 to 60 dBA Aeroplane 52 dBA Karuah East Project Construction not audible

4.3 Compliance Assessment and Discussion of Results

Results of the construction compliance assessment are given in

Table 5.

Table 5 Compliance Noise Assessment – Construction

Location	Estimated LAeq(15minute) Contribution	Consent Conditions LAeq(15minute)	Compliance
Location F	<33[1]	54	Yes
Location G	<23[1]	44	Yes

Note 1: Karuah East construction activities remained inaudible during operator attended noise measurement suggesting that any contribution would be at least 10 dB below the overall LA90 noise level presented in **Table 4**.

Results presented in

Table 5 indicate that compliance with the relevant consent conditions was achieved at all compliance assessment noise monitoring locations.

5 CONCLUSION

SLR Consulting Australia Pty Ltd (SLR) has undertaken construction noise compliance monitoring for the Karuah East Project located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah NSW (Development Site).

The objective of the construction noise compliance monitoring was to measure impacts of noise from the Development Site and to provide recommendations with regard to management strategies and mitigation measures, where necessary, with the aim of achieving the project specific noise criteria.

Operator Attended Construction Compliance Noise Monitoring

The operator attended noise compliance measurements were conducted during the daytime period on Tuesday 6 September 2016 at monitoring location F and location G representing the worst affected receptor locations.

Karuah East construction activities were found to be inaudible and therefore noise contributions from the Development Site were found to be within the relevant consent conditions at all monitoring locations.

6 REFERENCES

- 630.11235-R1 Karuah East Quarry Project Noise Management Plan, SLR Consulting Australia Pty Ltd, October 2015.
- AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3, Australian Standard, 1997.
- AS IEC 61672.1—2004 & Electroacoustics - Sound level meters, Part 1: Specifications, Standards Australia, 2004.

Acoustic Terminology

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-5 Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quiet
20	Unoccupied recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(Z) or dB.

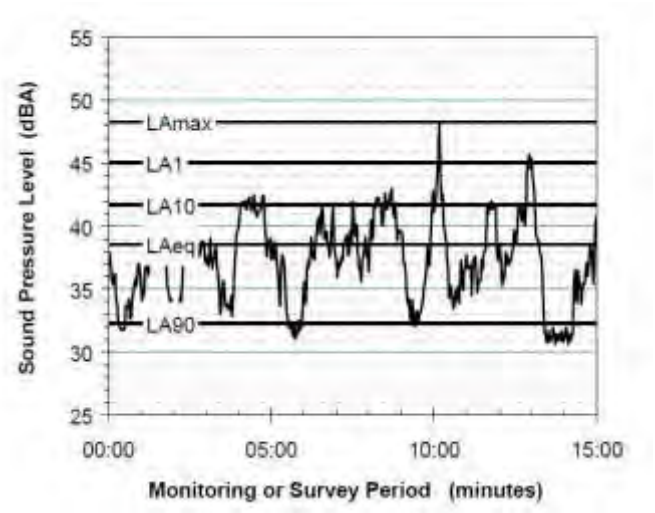
3 Sound Power Level

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 1E-12 W.
The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

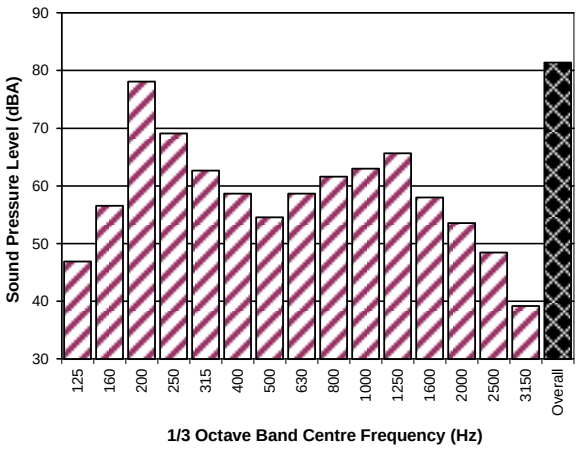
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

10 Over-Pressure

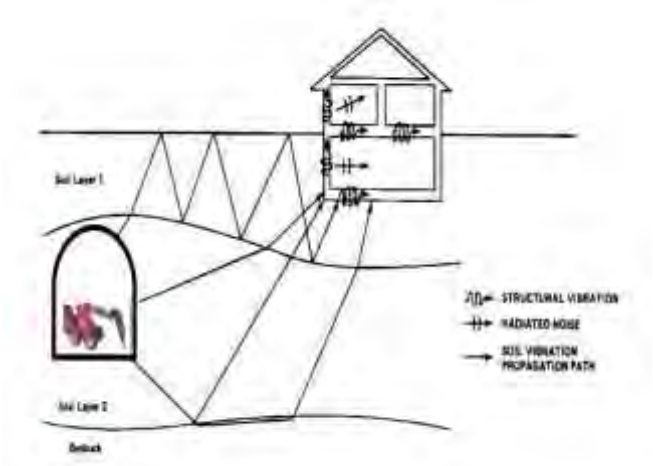
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "regenerated noise", "structure-borne noise", or sometimes "ground-borne noise". Regenerated noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term "regenerated noise" is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This "secondary" noise may be referred to as regenerated noise.

APPENDIX 5 – Ecological Monitoring Report

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2016 Annual Monitoring Report

Karuah East Quarry Biodiversity Offset Area and Lot 12

Karuah East Quarry Pty Ltd

November 2016

2016 Annual Monitoring Report

Karuah East Quarry Biodiversity Offset Area and Lot 12

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Prepared for:

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1. INTRODUCTION

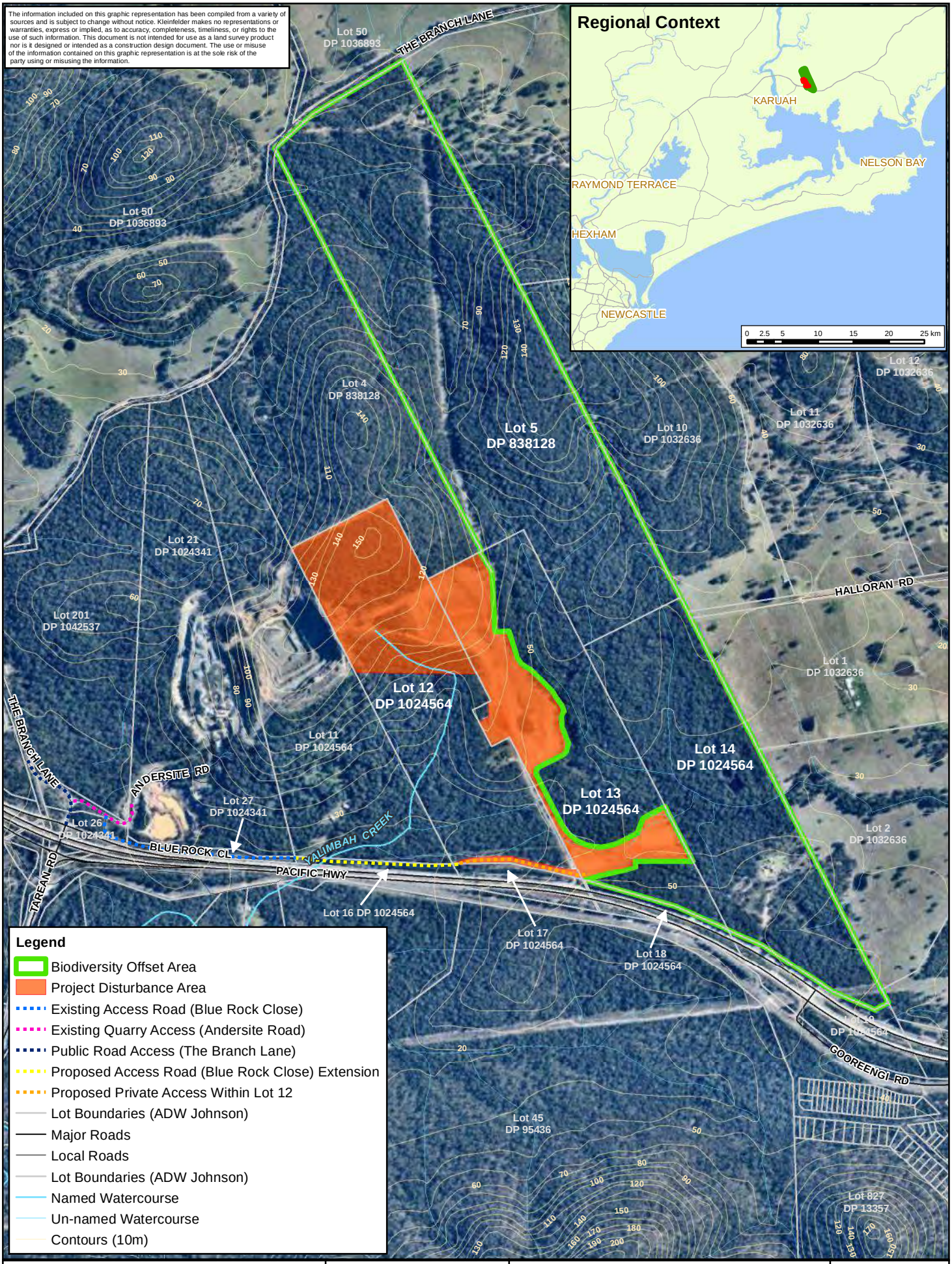
1.1 BACKGROUND

The Karuah East Quarry (KEQ) Project was subject to an assessment under part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The project was approved by the Planning Assessment Commission on 17 June 2014 subject to conditions set out in Schedules 2 to 5 of the Project Approval (09_0175). A referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the project was also lodged with the Department of the Environment (DotE) on 29 July 2014 (EPBC 2014/7282). On 25 August 2014 the project was determined as a Controlled Action under the EPBC Act requiring further assessment subject to the controlling provision 'listed threatened species and communities'. The action was approved by DotE on 20 March 2015 subject to 17 conditions of approval.

Condition 33 of the NSW Project Approval and Condition 9 of the EPBC Act approval require the implementation of a Biodiversity Offset Area Management Plan (BOAMP) for the KEQ biodiversity offset area (BOA), which is a 138.22 ha consolidated land parcel adjoining the western boundary of the project disturbance area (**Figure 1**). The BOAMP was prepared by Kleinfelder (2015) and subsequently approved by the NSW Department of Planning and Environment (DP&E) on 14 December 2015, and approved by the DotE on 16 March 2016.

Baseline ecological surveys and monitoring were undertaken in October 2015 prior to commencement of clearing and construction as required under Section 3 of the BOAMP. The baseline monitoring surveys involved the establishment of 13 permanent monitoring sites within the Karuah East BOA in accordance with the BOAMP. An additional five permanent monitoring sites were also established on the adjoining Lot 12 DP 1024564 as per Sections 3.2 and 4.1 of the Statement of Commitments in accordance with Section 11.1.3 of the Landscape and Rehabilitation Management Plan (L&RMP) (SLR 2015). In addition to establishing the permanent monitoring sites, the surveys also involved baseline assessment of fencing, access tracks, erosion, weeds and vertebrate pests in accordance with Section 3 of the BOAMP. The baseline ecological surveys and monitoring report (Kleinfelder 2016) was submitted as an addendum to the BOAMP in January 2016 (available from http://hunterquarries.com.au/karuah-east-documents/).

The first year of annual monitoring of the BOA and Lot 12 was undertaken in October 2016. This report provides the results of the 2016 monitoring including analysis of monitoring data to evaluate changes in vegetation condition and threatened flora populations in the BOA. This report also provides a summary of management actions completed within the BOA to date, and recommendations for implementation of management actions in the remainder of Year 1 and Year 2 of the BOAMP implementation to ensure compliance with relevant performance criteria.



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Karuah East Quarry and Biodiversity Offset Area

Karuah East Quarry Pty Ltd
2016 Annual Monitoring Report
Karuah East Quarry Project

FIGURE:
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1.2 SCOPE

Section 3 of the BOAMP details the annual monitoring requirements for the Karuah East BOA. Additionally, Section 12.1 of the L&RMP details the ecological monitoring requirements for the Karuah East Quarry project area, adjoining vegetation within 50 m of the project area boundary on Lots 12 and 13, and along Yalimbah Creek (Lot 12). A summary of the Karuah East annual ecological monitoring requirements are provided in **Table 1**. It is noted that not all monitoring activities listed in **Table 1** are required for the 2016 monitoring (refer to the timing / frequency).

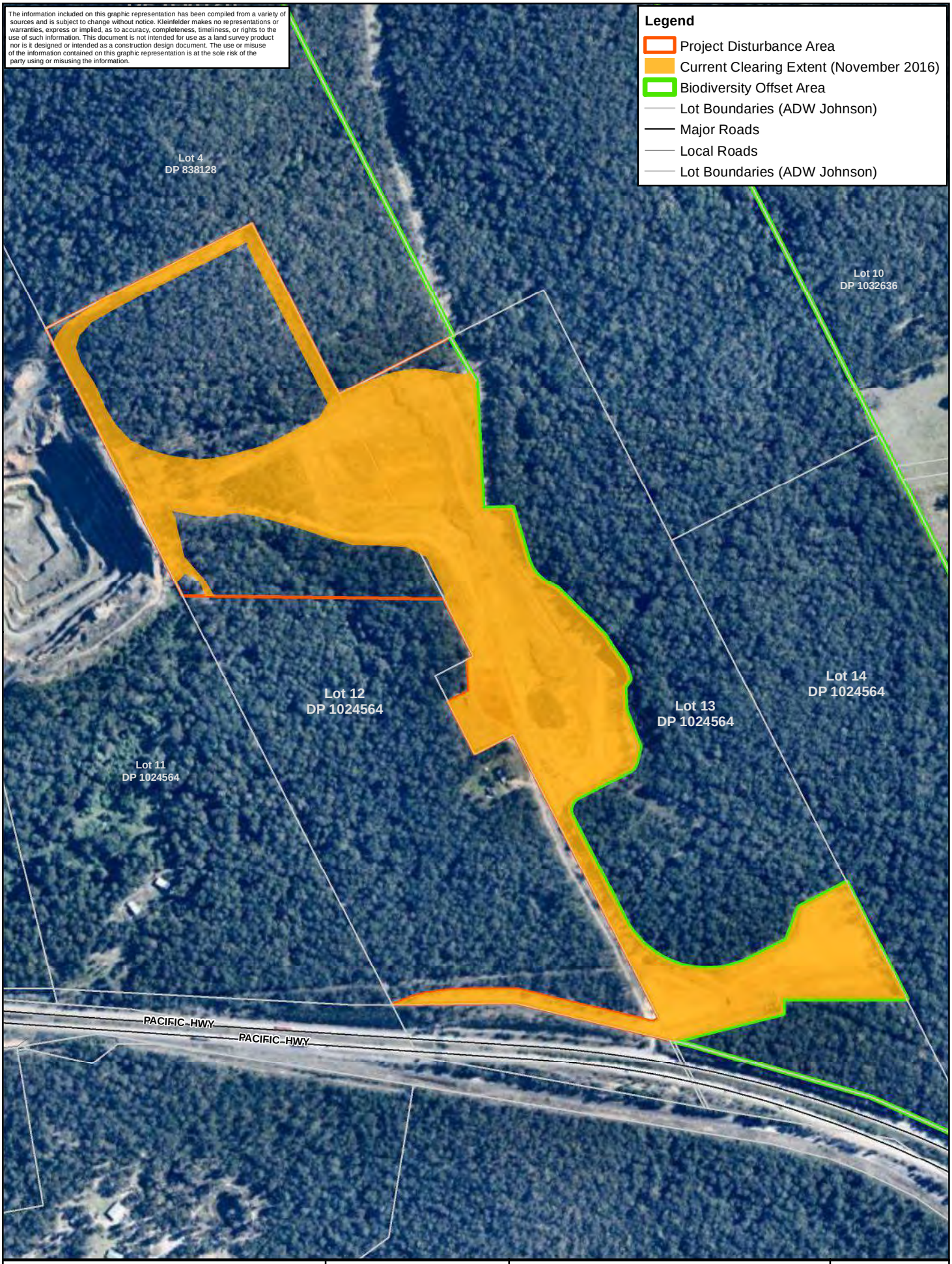
Table 1: Summary of annual monitoring requirements for Karuah East Quarry BOA and Lot 12

Monitoring Requirements	BOAMP / L&RMP Section(s)	Timing / Frequency	Completed in 2016?
Vegetation and Threatened Flora Monitoring • The 18 permanent monitoring sites established in the BOA and Lot 12 during the baseline are to be surveyed annually in accordance with Section 3.13 of the BOAMP and Section 12.1.3 of the L&RMP. • Monitoring is to be undertaken during spring to coincide with the flowering times of threatened flora species in the BOA.	Section 3.13 of BOAMP Section 12.1.3 of L&RMP	Annually for LOQ	Yes
Fencing • Inspections of boundary fencing will be undertaken as part of annual monitoring to identify maintenance requirements and record fencing activities undertaken in previous year. • The effectiveness of fencing in excluding stock and unauthorised activities (e.g. rubbish dumping) will also be evaluated during annual monitoring and any additional controls will be identified if required.	Section 3.2 of BOAMP Section 12.1.2 of L&RMP	Annually for life of quarry (LOQ)	Yes
Tracks • Inspections of retained and redundant access tracks will be undertaken as part of annual monitoring to identify maintenance requirements and record maintenance activities undertaken in previous year.	Section 3.3 of BOAMP	Annually for LOQ	Yes
Erosion • Inspections of erosion sites will be undertaken as part of annual monitoring to identify maintenance requirements and record maintenance activities undertaken in previous year. • Erosion and sediment control structures installed within the project disturbance area to protect retained vegetation will be inspected as part of annual ecological monitoring.	Section 3.4 of BOAMP Section 12.1.2 of L&RMP	Annually for LOQ	Yes
Existing Dwellings • Inspections of the dwellings, access tracks, and asset protection zones (APZs) will be undertaken as part of annual monitoring to identify maintenance requirements. These inspections will focus on fencing, weeds, and unauthorised access / disturbance.	Section 3.5 of BOAMP	Annually for LOQ	Yes
Habitat Augmentation and Nest Boxes • Nest boxes will be inspected and maintained (or replaced) every two years following installation.	Section 3.8 of BOAMP	Every two years following installation for LOQ	N/A – nest box monitoring will be required in 2018

Monitoring Requirements	BOAMP / L&RMP Section(s)	Timing / Frequency	Completed in 2016?
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. • Weed mapping for the BOA will be undertaken every two years and compared to the previous mapping to assess changes in the extent and density of target weeds. Monitoring results will be used to develop a control strategy for the following two years, identifying target locations and timing for primary and follow-up control.	Section 12.1.1 of L&RMP Section 3.10 of BOAMP	Annually (KEQ, 50 m buffer and Yalimbah Creek) Every 2 years from baseline survey for LOQ (BOA)	Yes (KEQ, 50 m buffer and Yalimbah Creek) BOA weed mapping not required until 2017
Vertebrate Pest Assessment • Monitoring of vertebrate pests will be undertaken using the same methods, locations and effort as the baseline assessment unless otherwise recommended in the annual monitoring reports. This will enable results to be accurately compared to the baseline assessment.	Section 3.11	Every 2 years from baseline survey for LOQ (BOA)	N/A – required in 2017
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.	Section 12.1.4 of L&RMP	12 months from installation of the crossings	N/A – quarry haul road not yet constructed
Threatened Flora Translocation – refer to *Tetratheca juncea Translocation Management Plan* (TjMP; Firebird 2015).	Refer to TjMP	Refer to TjMP	Yes – refer to Tj Translocation Monitoring Report (Firebird 2016)

1.3 KARUAH EAST QUARRY PROGRESS

The Karuah East Quarry (KEQ) Project was under construction at the time of monitoring (October 2016). Vegetation clearing commenced in April 2016 and the majority of the KEQ project area was primarily cleared between April and June 2016, with some clearing also occurring in November 2016. Clearing completed to date represents completion of the first stage of clearing for the project. Major earthworks have also commenced including construction of the haul road, detention basins, and other infrastructure areas. The current extent of clearing within the KEQ project area is shown in **Figure 2**. The remaining vegetation within the northern part of the project area is unlikely to be cleared for some time as the areas cleared to date contain andesite resources that will take at least several years to extract.



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Current Extent of Clearing within the Karuah East Quarry Project Area

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2016 Annual Monitoring Report
Karuah East Quarry Project

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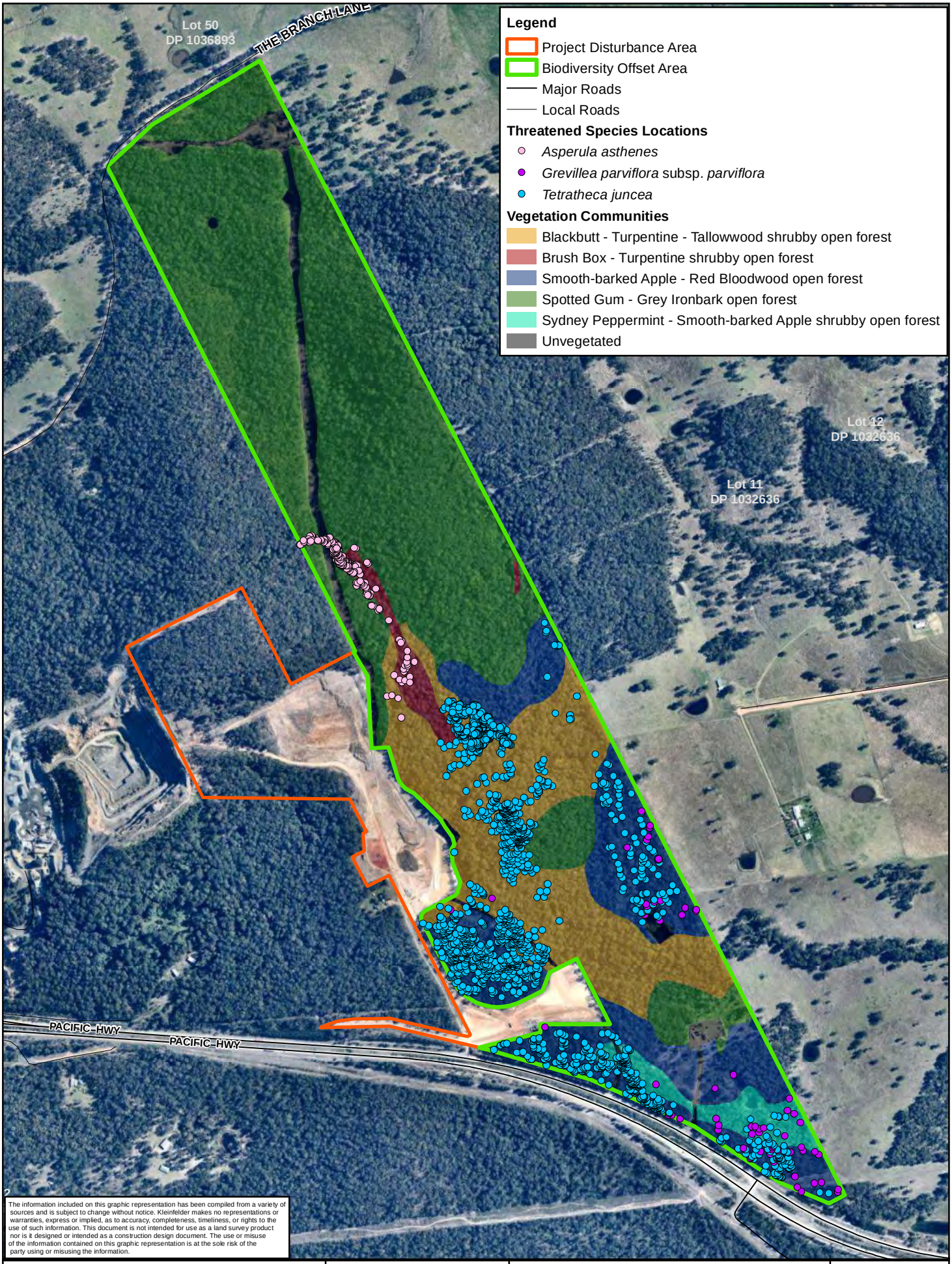
1.4 BIODIVERSITY VALUES

Section 2.3 of the BOAMP provides a detailed description of the biodiversity values identified in the Karuah East BOA during previous assessments (RPS Australia Pty Ltd 2013; Eco Logical Australia (ELA) 2013, 2014). Additional baseline ecological surveys were also undertaken within the BOA in October 2016 (Kleinfelder 2016). A summary of the key biodiversity values present (or previously recorded) within the site are provided in **Table 2**. The locations of threatened flora species and the distribution of vegetation communities across the BOA are shown in **Figure 3**.

Table 2: Key biodiversity values recorded within the Karuah East BOA

Biodiversity Values		Area (ha) / No. of individuals
Vegetation Communities	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin.	69.98
	Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	3.96
	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin.	26.58
	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast.	28.30
	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast.	2.62
Threatened Flora Species	*^*Tetratheca juncea* (Black-eyed Susan)	6,907
	*^*Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)	100
	*^*Asperula asthenes* (Trailing Woodruff)	399
Threatened and Migratory Fauna Species	*Eastern Falsistrelle (*Falsistrellus tasmaniensis*)	-
	*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*)	-
	*Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	-
	*Varied Sittella (*Daphoenositta chrysoptera*)	-
	*Powerful Owl (*Ninox strenua*)	-
	+Rufous Fantail (*Rhipidura rufifrons*)	

** = listed as Vulnerable under the TSC Act 1995*
^ = listed as Vulnerable under the EPBC Act 1999
+ = listed as Migratory under the EPBC Act 1999



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Vegetation Types and Threatened Flora Locations

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2. METHODS

2.1 VEGETATION AND THREATENED FLORA MONITORING

Thirteen vegetation monitoring sites were established and surveyed within the BOA in October 2015 as per Section 3.1.3 of the BOAMP. An additional five vegetation monitoring sites were also established and surveyed within 50 m of the project disturbance area and along Yalimbah Creek on Lot 12 DP 1024564 as per Section 11.1.3 of the L&RMP. The location of each monitoring site was recorded with a handheld GPS (Trimble™ Juno 5S unit) and permanently marked with a capped star picket. As such, a total of 18 vegetation monitoring sites were established and surveyed within the BOA and Lot 12 in October 2015. These permanent monitoring sites were surveyed in October 2016 using the same methods as the baseline survey which are described in the following subsections.

Vegetation Monitoring

A qualitative assessment of vegetation condition and photo monitoring was undertaken at each of the 18 monitoring points, involving collection of the following data:

- Vegetation type and structure, including dominant species and estimated percentage foliage cover of each stratum (within 20 m radius of monitoring point);
- General health and condition of vegetation, including evidence of foliage die-off;
- Weed species and abundance; and
- Any management issues or indirect impacts from the project area or adjoining lands.

Additionally, four photographs (north, south, east and west) were taken at each of the monitoring points. The locations of the vegetation monitoring points are shown on **Figure 4**.

Threatened Flora Monitoring

Monitoring of threatened flora species was also undertaken at nine of the monitoring sites as per the BOAMP and L&RMP. 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.

Tetratheca juncea individuals or ‘clumps’ were delineated and counted in accordance with the standardised method described by Payne *et al*. (2002), in which individual clumps occurring

30 cm or more apart are considered separate, individual plants. A 30 cm separation distance between *Grevillea parviflora* subsp. *parviflora* stems was also used to identify separate individuals. *Asperula asthenes* were delineated based on the methodology used by ELA (2014) during previous targeted surveys to ensure a consistent approach for population surveys and monitoring across the BOA. Based on this method, stems (or groups of stems) of *Asperula asthenes* occurring 40 cm or more apart are considered separate individuals.

For each individual identified in the survey area, the following information was recorded:

- Clump number;
- Distance and bearing of the clump to the centre star-picket;
- The size of the clump (cm) (for *Asperula asthenes* and *Tetratheca juncea*) or number of stems (for *Grevillea parviflora* subsp. *parviflora*);
- Presence or absence of flowers (for *Asperula asthenes* and *Grevillea parviflora* subsp. *parviflora*). The number of flowers and fruit on *Tetratheca juncea* plants were recorded to enable monitoring of reproductive output of this species; and
- Notes on general health of the plant, including any die-back or disease.

Following assessment of all previously recorded individuals, an additional survey of the area was performed at each site to identify any new individuals. For all new individuals identified within the survey area, the above listed information was collected. A summary of the vegetation and threatened flora monitoring sites within the BOA and Lot 12 is provided in **Table 3**.

Table 3: Summary of vegetation and threatened flora monitoring sites

Monitoring Point	Site	Threatened Flora Species Monitored
1	BOA – Lot 5	-
2	BOA – Lot 5	-
3	BOA – Lot 5	*Asperula asthenes*
4	BOA – Lot 13	*Asperula asthenes*
5	BOA – Lot 14	-
6	BOA – Lot 13	-
7	BOA – Lot 13	*Tetratheca juncea*
8	BOA – Lot 13	*Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora*
9	BOA – Lot 13	-
10	BOA – Lot 14	-
11	BOA – Lot 14	*Grevillea parviflora* subsp. *parviflora*
12	BOA – Lot 14	*Grevillea parviflora* subsp. *parviflora*
13	BOA – Lot 14	-
14	Lot 12	-
15	Lot 12	*Tetratheca juncea*
16	Lot 12	-
17	Lot 12	*Asperula asthenes*
18	Lot 12	*Asperula asthenes*

2.2 SITE WALKOVER AND INSPECTION

Inspection of key management features was undertaken across the BOA and Lot 12 (within 50 m of the project area and along Yalimbah Creek) in October 2016 in accordance with Section 3 of the BOAMP. The following features were inspected and assessed:

- Internal and external fencing;
- Access tracks and gates;
- Areas of active erosion and sedimentation;
- Areas surrounding the two existing dwellings within the BOA;
- Redistribution of habitat resources salvaged during clearing for the KEQ Project;
- Extent and density of noxious and environmental weeds within the project disturbance area, adjoining vegetation within 50 m of the disturbance area boundary on Lots 12 and 13, and along Yalimbah Creek (note: the baseline weed mapping for the BOA will be resurveyed in 2017; this report includes the 2015 baseline weed mapping for the BOA).

Weed Mapping

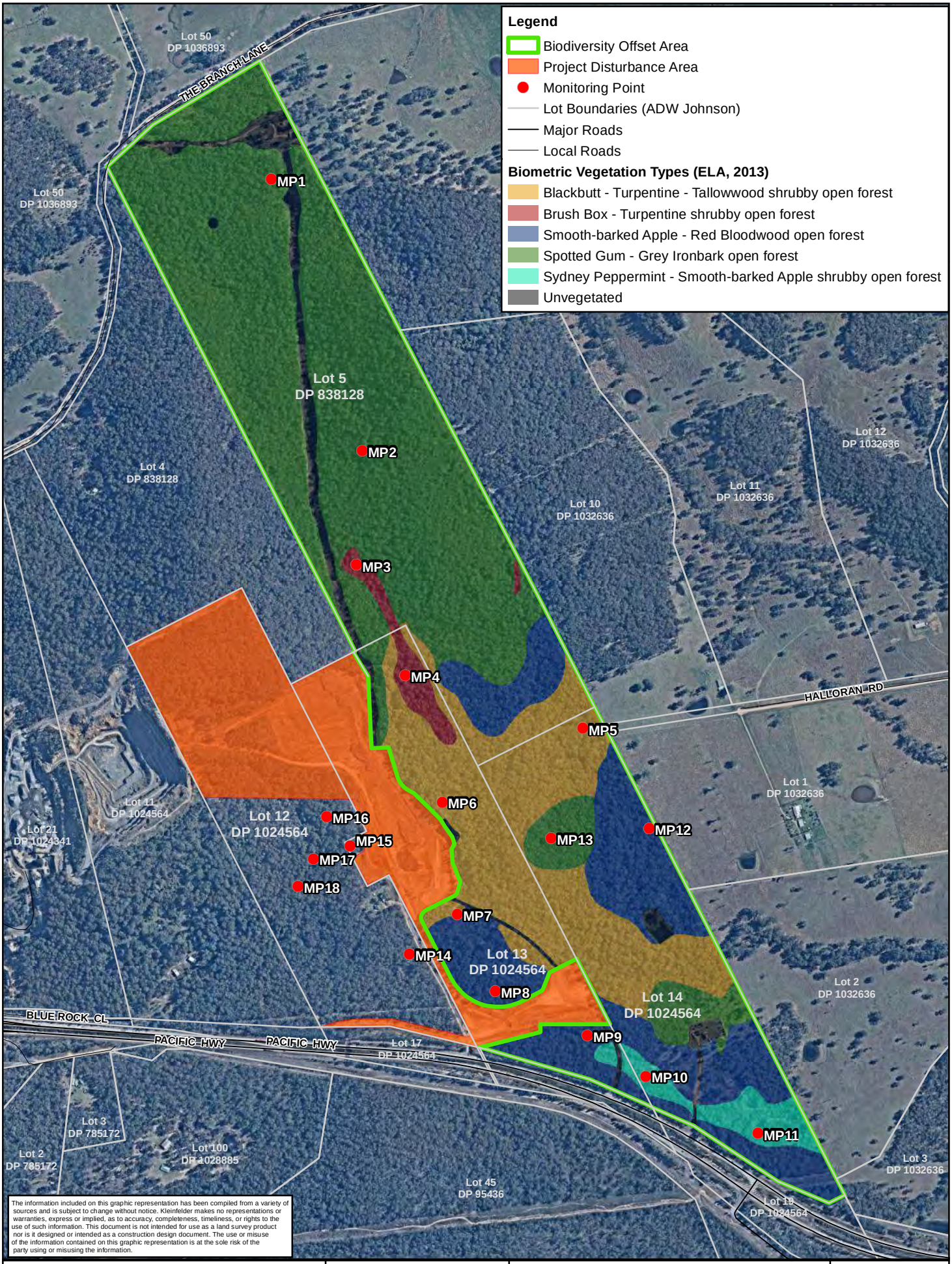
Weeds for which detailed mapping was undertaken (i.e. target weed species) are those:

- Listed under the *Noxious Weeds Act 1993* within the Great Lakes Council control area;
- Identified as a Weed of National Significance (WoNS); and / or
- Environmental weeds which represent major infestations and / or have the potential to adversely affect ecological values within the BOA.

The most widespread and abundant weed species across the site is *Lantana camara* (Lantana). Four categories were used during field surveys to map areas of different Lantana density based on the percentage foliage cover:

- Nil: no Lantana observed;
- Scattered: ≤20% Lantana cover;
- Moderate: 21-60% Lantana cover; and
- High: >60% Lantana cover.

Other target weed species occurring outside moderate to high Lantana areas were mapped separately (i.e. weeds which may not be identified and treated as part of Lantana control).



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DATA SOURCE:
LPI - 2015
ADW Johnson - 2015
nearmap - 2016

Vegetation and Threatened Flora Monitoring Locations

Karuah East Quarry Pty Ltd
2016 Annual Monitoring Report
Karuah East Quarry Project

FIGURE:
4

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3. RESULTS AND DISCUSSION

3.1 VEGETATION AND THREATENED FLORA MONITORING

The results of the vegetation and threatened flora monitoring within the BOA are summarised in **Table 4**. The threatened flora monitoring data and vegetation structure/cover data from the 2015 (baseline) and 2016 surveys is provided in **Appendix 1 and 2**, respectively. Photo monitoring points (north) taken at each of the sites in 2015 and 2016 are also provided in **Appendix 3**. Due to the large number of photos, only the photos taken from the northern direction at each monitoring site are presented in this report; the remaining photos from the south, east and west directions have been provided as separate files with the report.

Table 4: Summary of 2016 vegetation and threatened flora monitoring results

Monitoring site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP1	Spotted Gum – Grey Ironbark open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen logs / timber • Dense ground cover • Low rock cover • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP1.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP1.	N/A

Monitoring site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP2	Spotted Gum – Grey Ironbark open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen logs / timber • Moderate to dense ground cover • Rocky areas present • Hollow-bearing trees present • A minor reduction (5%) in estimated midstorey cover was recorded as a result of one *Allocasuarina torulosa* falling over within the survey area since the previous survey (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP2.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP2.	N/A
MP3	Brush Box – Turpentine shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High structural complexity of vegetation • High fallen timber • Ephemeral pools within stream • High weed invasion (Lantana) • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP3.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP3.	• A total of 17 *Asperula asthenes* individuals were recorded at MP3 in 2016 compared to 16 individuals recorded in 2015. Two individuals recorded at MP3 in 2015 were absent in 2016, but three new individuals were identified in 2016 within the survey area. • All *A. asthenes* plants at MP3 were observed to be in healthy condition.
MP4	Brush Box – Turpentine shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High structural complexity of vegetation • Dense ground cover • High fallen timber • Weed invasion (Lantana) • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP4.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP4.	• A total of 17 *Asperula asthenes* individuals were recorded at MP4 in 2016 compared to 15 individuals recorded in 2015, with two additional individuals recorded since the previous survey. • All *A. asthenes* plants at MP4 were observed to be in healthy condition.

Monitoring site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP5	Blackbutt – Turpentine – Tallowwood shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • Moderate fallen logs / timber • Dense ground cover • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP5.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP5.	N/A
MP6	Blackbutt – Turpentine – Tallowwood shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen logs / timber • Moderately dense ground cover • Standing pools within creek • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP6.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP6.	N/A
MP7	Smooth-barked Apple - Red Bloodwood open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • Regrowth vegetation to the north and east (previously cleared) • Low fallen timber • Dense ground cover • A minor reduction (10%) in estimated ground cover (other) was recorded within the survey area since the previous survey (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP7.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP7.	• A total of 15 *Tetratheca juncea* individuals were recorded at MP7 in 2016 compared to 14 individuals recorded in 2015, with one additional individual recorded since the previous survey. • All *T. juncea* plants at MP7 were observed to be in healthy condition.

Monitoring site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP8	Smooth-barked Apple - Red Bloodwood open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • Moderate fallen timber • Dense ground cover and midstorey • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP8.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Old track to north-east **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP8.	• A total of 10 *Tetratheca juncea* and 1 *Grevillea parviflora* subsp. *parviflora* individuals were recorded at MP8 in 2016. Two additional *T. juncea* clumps were recorded at MP8 since the previous survey in 2015, while the number of *G. parviflora* plants remained stable. • All *T. juncea* and *G. parviflora* plants at MP8 were observed to be in healthy condition.
MP9	Smooth-barked Apple - Red Bloodwood open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen timber • Dense ground cover and midstorey • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP9.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Old track to south **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP9.	N/A
MP10	Sydney Peppermint - Smooth-barked Apple shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen timber • Dense ground cover • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP10.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Several old dead stags present • Some canopy gaps (from past clearing/logging) **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP10.	N/A

Monitoring site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP11	Sydney Peppermint - Smooth-barked Apple shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • Low fallen timber • Dense ground cover • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP11.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP11.	• A total of 16 *Grevillea parviflora* subsp. *parviflora* individuals were recorded at MP11 in 2016. One individual recorded at MP11 in 2015 was absent in 2016, but one new individual was identified in 2016 within the survey area. The number of *G. parviflora* plants at MP11 has remained unchanged since 2015. • It was noted in 2015 that a number of *G. parviflora* at MP11 were dying-off / senescing. The health of these same individuals has declined (i.e. one individual) or remained the same. The remaining *G. parviflora* were observed to be in heathy condition in 2016, which is consistent with the 2015 observations.
MP12	Smooth-barked Apple – Red Bloodwood open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen timber • Dense ground cover • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP12.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Cleared grazing land 20 m to east adjacent to BOA with exotic grasses, but no weeds within BOA in this area. **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP12.	• A total of 8 *Grevillea parviflora* subsp. *parviflora* individuals were recorded at MP12 in 2016, compared to 7 individuals recorded in 2015. One additional individual was recorded at MP12 since the previous survey in 2015. • All *G. parviflora* plants at MP12 were observed to be in healthy condition.

Monitoring site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP13	Spotted Gum – Grey Ironbark open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen logs / timber • Dense ground cover • Moderate rock cover • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP13.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP13.	N/A
MP14	Smooth-barked Apple - Red Bloodwood open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • Low fallen/ timber • Dense ground cover • A minor increase (5%) in estimated cover of the canopy and shrub strata was recorded within the survey area since the previous survey (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP14.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Exotic grasses around dam to south **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP14.	N/A
MP15	Blackbutt - Turpentine - Tallowwood shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • Regrowth vegetation to the north and east (previously cleared) • High fallen timber • Dense ground cover and leaf litter • Rocky areas present • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP15.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Several trees and large limbs fallen (mostly likely during recent storm) **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP15.	• A total of 31 *Tetratheca juncea* individuals were recorded at MP15 in 2016 compared to 30 individuals recorded in 2015, with one additional individual recorded since the previous survey. • All *T. juncea* plants at MP15 were observed to be in healthy condition.

Monitoring site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP16	Spotted Gum – Grey Ironbark open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • Moderate fallen timber • Dense ground cover and leaf litter • Low rock cover • No changes in estimated foliage cover for each vegetation stratum (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP16.	• No evidence of erosion and sedimentation • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Several old dead stags present **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP16.	N/A
MP17	Brush Box - Turpentine shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen timber • Dense ground cover • Rocky areas along ephemeral creek • A minor increase (5%) in estimated exotic plant cover (i.e. Lantana) was recorded within the survey area since the previous survey (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP17.	• Very minor scouring along creek bank • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire • Several trees and large limbs fallen (noted in 2015) **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP17.	• A total of 11 *Asperula asthenes* individuals were recorded at MP17 in 2016. No individuals were absent and no new individuals were recorded since the 2015 survey. • All *A. asthenes* plants at MP17 were observed to be in healthy condition.
MP18	Brush Box - Turpentine shrubby open forest	• No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen timber • Dense ground cover • Rocky areas along ephemeral creek • A minor increase (5%) in estimated exotic plant cover (i.e. Lantana) was recorded within the survey area since the previous survey (**Appendix 1**) **Conclusion**: No significant or notable changes in vegetation and habitat condition since the previous baseline survey (2015) at MP18.	• Very minor scouring along creek bank • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust • No signs of recent fire **Conclusion**: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2015) at MP18.	• A total of 13 *Asperula asthenes* individuals were recorded at MP18 in 2016. No individuals were absent and no new individuals were recorded since the 2015 survey. • All *A. asthenes* plants at MP18 were observed to be in healthy condition

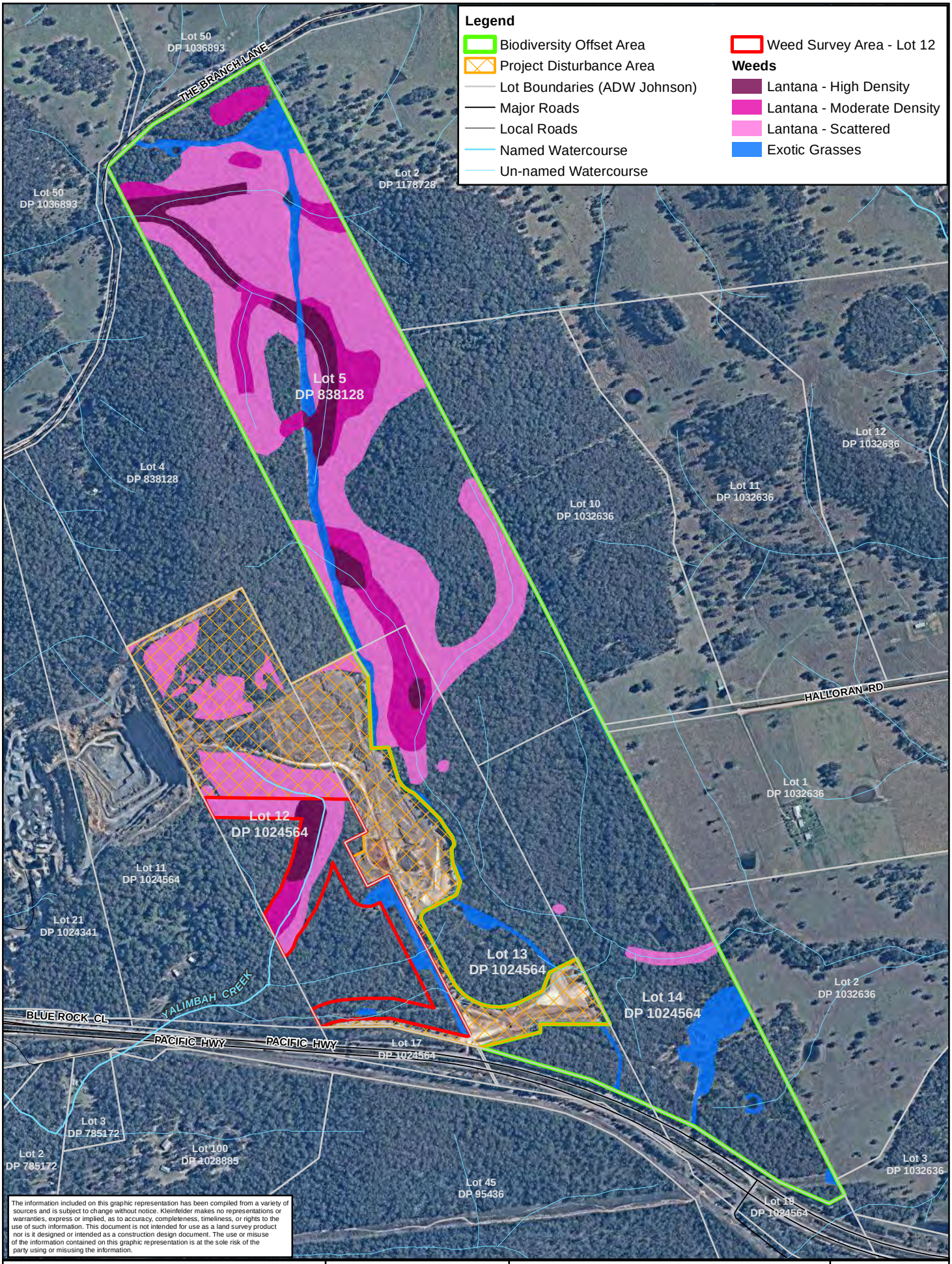
3.2 WEEDS

Figure 5 shows the distribution of weeds mapped across the BOA, within the project disturbance area, within 50 m of the project disturbance area, and along Yalimbah Creek on Lot 12. *Lantana camara* (Lantana) (Class 4 noxious weed within the Great Lakes LGA) is the most abundant weed species across the site, with the majority of infestations occurring on the northern part of the BOA. Dense infestations of Lantana were primarily observed along the drainage lines in Lot 5. Two other noxious weed species were also identified in the BOA: *Asparagus aethiopicus* (Ground Asparagus) and *Senecio madagascariensis* (Fireweed) are both listed as Class 4 noxious weeds within the Great Lakes LGA. *Ageratina riparia* (Creeping Crofton Weed) is also a listed noxious weed, but is not declared within the Great Lakes LGA (**Figure 5**). These three species only occur as small discrete patches in a few locations in the BOA.

Notable areas of exotic perennial grasses have also been mapped (**Figure 5**). The dominant exotic grass species in these areas include *Setaria sphacelata* (South African Pigeon Grass), *Andropogon virginicus* (Whisky Grass) and *Axonopus fissifolius* (Narrow-leafed Carpet Grass), as well as a variety of annual and perennial exotic herbs. The areas dominated by exotic grasses are primarily restricted to the powerline easement, around existing dwellings, tracks edges, and previously cleared regrowth areas on the southern part of Lot 14. While the dense areas of exotic grasses have been mapped, they are not considered target weed species at this stage as they represent a relatively low threat to the integrity of ecological values within the site. The exotic grasses occurring in the areas of native regrowth are also likely to be shaded out over time as the canopy and midstorey cover continue to regenerate. However, the distribution of exotic grasses will continue to be monitored, and any increases will be evaluated to determine if management is required.

It is recommended that Year 1 and 2 weed control works focus on the Lantana infestations in the south-west portion of Lot 5 and north-east part of Lot 13. Additionally, manual control of exotic grasses within 10 m of the *Asperula asthenes* individuals in the powerline easement on Lot 5 should also be undertaken. These weed control activities must be undertaken in spring in accordance with the procedures detailed in Section 3.10 of the BOAMP due to the presence of threatened flora (*Asperula asthenes*) in these areas.

A combined list of weed species from the surveys completed by ELA (2013) and Kleinfelder (2016) across the BOA is provided in **Appendix 4**.



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DATA SOURCE:
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Nearmap - 2015

Weed Mapping

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FIGURE:

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3.3 FENCING AND TRACKS

Figure 6 shows the layout of existing and required fencing, gates and tracks across the BOA. Boundary fencing is required around the entire KEQ project area, along the north-western boundary of the BOA, and a small section on the north-east boundary of the BOA. Additionally, there are a number of locations where the existing boundary fence of the BOA has been damaged by trees and requires repairing. Internal fencing is also required around the existing dwelling on Lot 5. It is noted that that this dwelling is not currently occupied. This internal fencing must be installed prior to this dwelling being occupied. All fencing works shall be undertaken in accordance with Section 3.2 of the BOAMP.

Several access tracks occur throughout the BOA. The majority of these tracks are important for facilitating access for management activities across the BOA, and as such it is recommended that these tracks be maintained. Several sections of tracks on the southern part of the BOA are not considered critical for ongoing management, and it is recommended that these tracks be rehabilitated with branches, hollow logs / sections and other organic debris salvaged from the KEQ disturbance area during vegetation clearing. Branches and organic material containing seeds / propagules shall only be used for rehabilitation in the BOA where the species are consistent with the vegetation community at the recipient location.

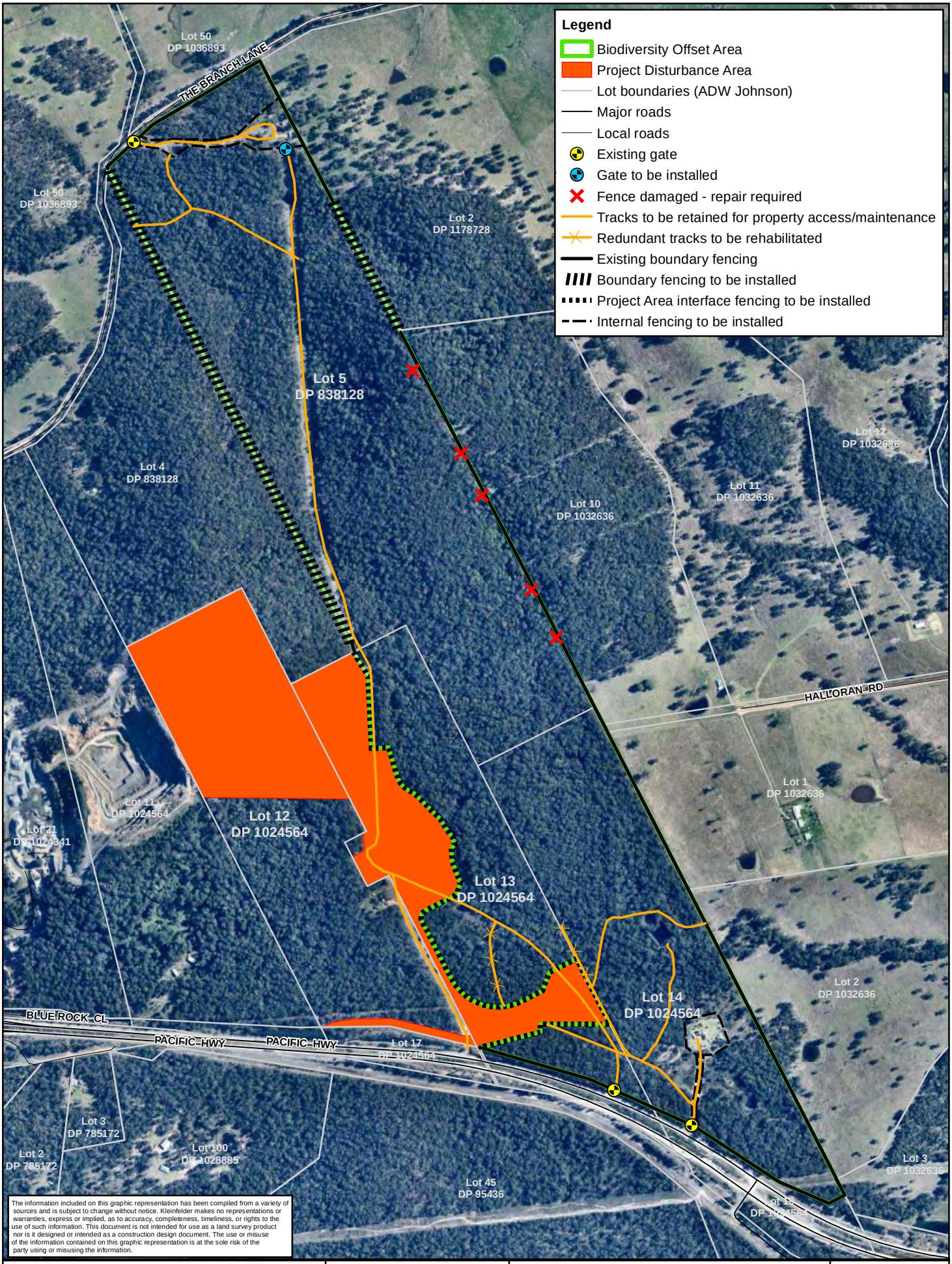
The existing tracks to be retained in the BOA were assessed as being in adequate condition for 4WD access during the 2016 surveys and no maintenance is recommended at this stage. However, it is noted that some initial repairs may be required for the tracks to be suitable for emergency fire-fighting vehicles. The need for initial repairs will be determined during development of the Fire Management Strategy as per Section 3.12 of the BOAMP.

3.4 EROSION

No areas of major active erosion were identified within the BOA during the 2016 monitoring. Minor scouring was observed in several locations along the drainage lines within Lot 5. However, this scouring is considered to be natural stream bank erosion as there was no evidence of unnatural disturbance in these areas, and overall the streams have relatively high ground vegetation cover and appear stable. There are also some areas of bare ground on the access tracks within the BOA; however, these areas also appeared to be stable and no substantial active erosion or sedimentation was observed in these areas.

Certain areas of the BOA (primarily the steep slopes on Lot 5) have the potential to develop erosion following Lantana control works. The need for erosion or soil stabilisation measures following initial treatment of moderate and high density Lantana areas on steep slopes will be assessed each maintenance / monitoring event.

Sediment fencing and bund walls/diversion drains were in place downslope of disturbed areas within the Karuah East Quarry project area at the time of the 2016 inspection.



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DATA SOURCE:
LPI - 2015
ADW Johnson - 2015
nearmap - 2016

Fences and Tracks

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FIGURE:
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3.5 HABITAT RESOURCES

Salvage and Redistribution of Habitat Resources

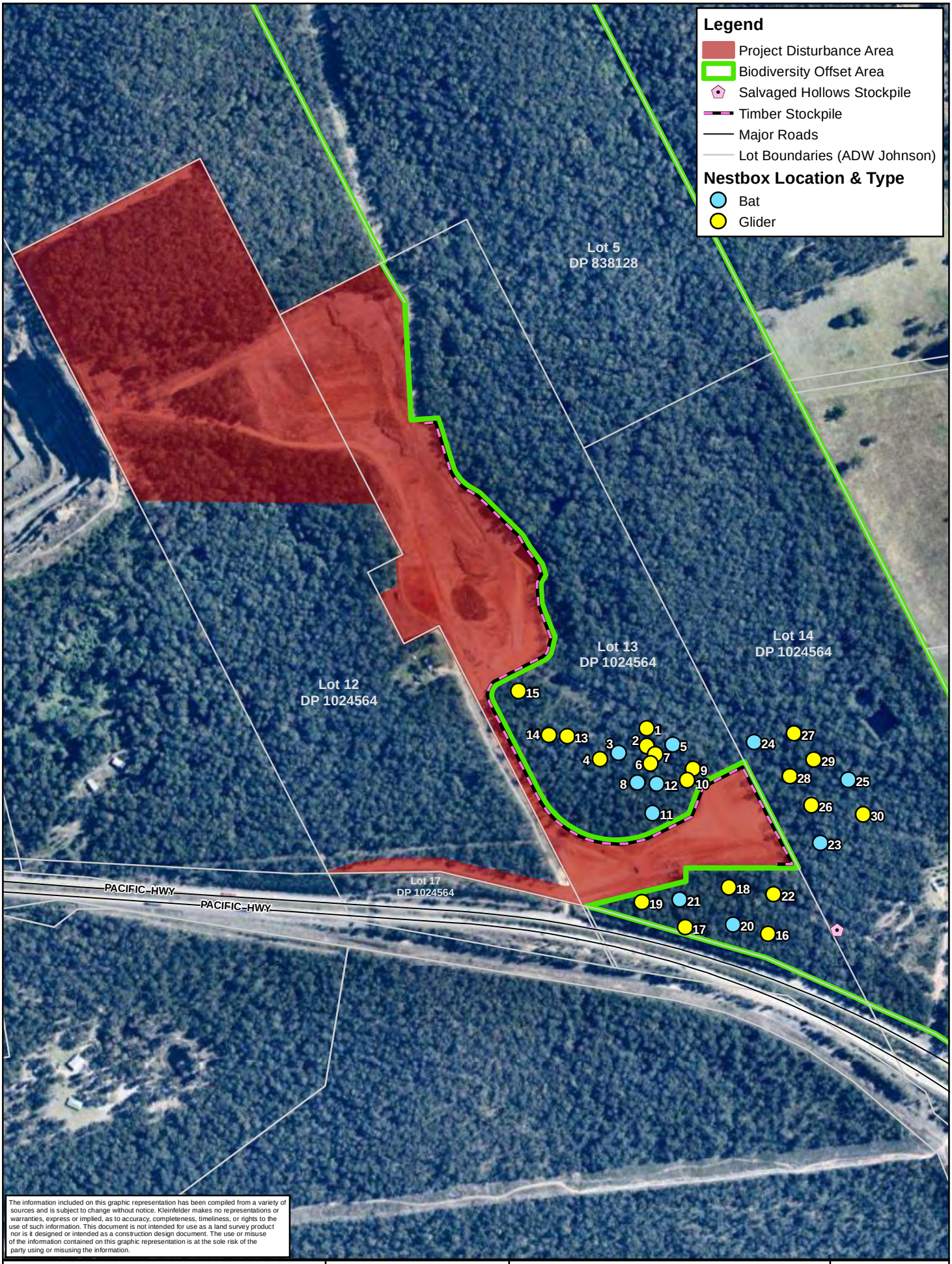
Section 6.3.1 of the L&RMP and Section 3.8 of the BOAMP detail the protocol and requirements for salvaging habitat resources (i.e. logs, hollows and other large organic debris) during the KEQ project, and redistributing into the rehabilitation or offset areas. Vegetation clearing undertaken in 2016 for the KEQ project has included the salvage of a large quantity of organic material (primarily large trees and logs). These resources are currently stockpiled on the boundaries of the KEQ project area (**Figure 7**), which will be respread across rehabilitation areas as the project progresses.

In addition to this, a number of hollows and hollow log sections (total of 77) have been salvaged and are in the process of being prepared for redistribution into the BOA (**Plate 1**). The location of the hollow logs to be redistributed throughout the BOA is shown on **Figure 7**. The quantity and locations of hollows and other salvaged organic materials that are redistributed in the BOA will be recorded as part of future monitoring.

Plate 1: Hollow sections salvaged for redistribution into the BOA

Nest Boxes

A total of 30 nest boxes were installed within the BOA prior to commencement of vegetation clearing as per Section 3.8 of the BOAMP. The locations of these nest boxes are shown in **Figure 7**. As clearing for the first stage of the KEQ project has been completed as of November 2016, additional nest boxes will need to be installed to offset loss of hollows at a 1:1 ratio as per Section 3.8 of the BOAMP. A Clearing Completion Report is currently in preparation which will detail the number of nest boxes required for installation within the BOA.



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DATA SOURCE:
LPI - 2015
ADW Johnson - 2015
Nearmap - 2016

Habitat Resources and NestBox Locations

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FIGURE:
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4. PERFORMANCE CRITERIA EVALUATION

Table 5 details the management actions and associated BOAMP performance criteria relevant to Years 1-3 of the BOAMP implementation. This provides an evaluation of the current status of each relevant management action, and indicates if further works are required to complete the action (priority actions in **bold** text).

It is noted that the BOAMP was endorsed by all consent authorities (i.e. Council, NSW DP&E and Commonwealth DotE) as of March 2016. As such, all Year 1 management actions should be completed before March 2017 to ensure compliance with the relevant performance criteria.

Table 5: Current status of BOAMP performance criteria

Action	Performance Criteria (Years 1-3)	Current Status (2016)
FENCING, GATES AND SIGNAGE		
Fence mapping	Completed by end of year 1	Baseline fence mapping completed in October 2015.
Boundary fencing, gates and signage installation/repairs	Completed by end of year 1	**Installation and repair of boundary fencing, gates and signage required prior to March 2017.**
Redundant fencing removal	Completed by end of year 3	N/A – no redundant fencing identified during baseline fence mapping.
Fencing inspections	Completed annually	Annual inspection completed in October 2016.
Fencing maintenance	Boundary fencing in place and signage present by end of year 1	**Installation and repair of boundary fencing, gates and signage required prior to March 2017.**
ACCESS TRACKS		
Access track mapping and assessment	Completed by end of year 1	Baseline track mapping and assessment completed in October 2015.
Access track repairs	Completed by end of year 3 Track repair does not impact on ecological values and is restricted to defined limits	No track repair requirements identified. Access tracks assessed as being in suitable condition for 4WD access during the 2016 monitoring.
Redundant access track rehabilitation	Completed by end of year 3	Rehabilitation of redundant tracks identified in Section 3.3 of this report required prior to end of Year 3.
Access track inspections	Completed annually	Annual inspection completed in October 2016.
EROSION, SEDIMENTATION AND SOIL MANAGEMENT		
Erosion and sedimentation mapping	Completed by end of year 1	Baseline assessment completed in October 2015.
Erosion repair and management	Completed by end of year 3 Repair of erosion within BOA does not impact on ecological values	No erosion repair or management requirements identified during the 2016 monitoring. **The effectiveness of erosion and sediment control measures within the Karuah East Quarry project area such as silt fencing and diversion drains should be inspected and maintained regularly and after rain events.**
Erosion inspections	Completed annually	Annual inspection completed in October 2016.

Action	Performance Criteria (Years 1-3)	Current Status (2016)
EXISTING DWELLINGS		
Exclusion of existing dwellings from Conservation Agreement	Completed by end of year 1	Survey plan for Conservation Agreement was in preparation at the time this report was prepared. The survey plan will exclude the two existing dwellings.
Fencing and signage installation	Completed by end of year 1	**Installation of fencing, gates and signage required prior to March 2017.**
Inspections	Completed annually	Annual inspection completed in October 2016.
Maintenance and weed control	No noxious weeds present within excised areas. No unauthorised disturbance outside of excised areas in the BOA.	No noxious weeds identified in excised areas during 2016 monitoring. No authorised disturbance observed outside of excised areas in the BOA during 2016 monitoring.
REVEGETATION AND REGENERATION*		
Confirm extent of revegetation areas	Completed by end of year 1	Completed. No revegetation works were assessed as being required within the BOA during the 2015 or 2016 monitoring. The requirement for revegetation works within the BOA will be reassessed each year.
HABITAT AUGMENTATION		
Salvage and redistribution of habitat resources	Redistribution of salvaged resources by end of Year 3 Redistribution of salvaged resources does not impact on ecological values of BOA, including threatened flora	Salvage and redistribution of habitat resources in progress (refer to Section 3.5).
Nest box installation	30 nest boxes installed in BOA prior to commencement of clearing. Remaining nest boxes installed within three months following completion of clearing.	The 30 nest boxes were installed in the southern part of the BOA in April 2016 prior to commencement of clearing. **As clearing for the first stage of the KEQ project has been completed as of November 2016, additional nest boxes will need to be installed. A Clearing Completion Report is currently in preparation which will detail the number of nest boxes required for installation within the BOA. Installation of these additional nest boxes is required by the end of February 2017.**
Nest box monitoring and maintenance	Nest boxes inspected every two years. Repairs/maintenance implemented within 6 months of biennial inspection.	N/A – monitoring to be completed in 2018.
THREATENED FLORA TRANSLOCATION		
Tetratheca juncea translocation	Translocation completed by end of year 1 Maintenance and monitoring undertaken in accordance with the TjMP	Refer to Tj Translocation Monitoring Report (Firebird 2016).
WEED CONTROL		
Baseline weed mapping	Completed by end of year 1	Baseline assessment completed in October 2015 (Kleinfelder 2015).

Action	Performance Criteria (Years 1-3)	Current Status (2016)
Delineation of threatened flora prior to weed control works	No impacts on threatened flora populations within BOA from weed control activities.	N/A – no weed control works undertaken within BOA to date.
Weed control	20% reduction in extent or density (cover) of target weeds per year compared to baseline mapping by end of Year 3. Weed control activities do not impact on ecological values.	**It is recommended that weed control works are commenced as soon as possible to meet weed reduction targets prior to the end of Year 3.**
Weed monitoring	Completed biennially (every two years) (for BOA). Completed annually (KEQ, 50 m buffer and Yalimbah Creek).	Weed mapping revisited for KEQ project area, adjoining vegetation within 50 m of the project area boundary on Lots 12 and 13, and along Yalimbah Creek (Lot 12) in October 2016.
VERTEBRATE PEST MANAGEMENT		
Baseline vertebrate pest assessment	Completed by end of year 1	Baseline assessment completed in October 2015 (Kleinfelder 2015).
Vertebrate pest control	No non-target species affected by control works. Reduction in abundance of target species across BOA compared to baseline assessment.	**Vertebrate pest control required prior to March 2017.**
Monitoring	Completed biennially (every two years).	N/A – monitoring required in 2017.
FIRE MANAGEMENT		
Fire management strategy	Completed by end of year 1	**A fire management strategy is to be prepared for the BOA prior to March 2017.**
Bushfire mitigation	Bushfire mitigation measures in the L&RMP adhered to at all times	Refer to KEQ Annual Environmental Report.
ECOLOGICAL MONITORING		
Additional baseline surveys	Completed prior to clearing	Baseline surveys completed (refer to Kleinfelder 2016).
Vegetation and threatened flora monitoring	Baseline ecological monitoring undertaken prior to clearing in year 1. Less than 10% decline in *Tetratheca juncea, Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes* population sizes (at monitoring sites) compared to baseline assessment. No major changes in vegetation health or condition across BOA.	Baseline ecological monitoring completed (refer to Kleinfelder 2016). No reduction in threatened flora populations recorded at the monitoring sites in 2016. No major changes in vegetation health or condition were observed in the BOA in 2016.

*Criteria relating to revegetation within the project area is outlined in the Landscape and Rehabilitation Management Plan (L&RMP).

5. CONCLUSION

The results from the 2016 monitoring indicate that the vegetation and fauna habitats within the Karuah East Biodiversity Offset Area (BOA) and Lot 12 are in high condition and remain relatively unchanged since the baseline survey in 2015. Additionally, no significant changes were recorded within the threatened flora populations sampled at the monitoring sites, and these populations were assessed as being in healthy condition.

The majority of the management and monitoring actions required prior to the end of Year 1 (i.e. March 2017) have been completed or are in the process of being completed. The 2016 monitoring has identified several key management actions that are required prior to the end of Year 1, which have been highlighted in **Section 4** of this report. These include fence installation, nest box installation, weed control, and vertebrate pest management. These actions should be undertaken in accordance with the relevant sections of the BOAMP and this monitoring report.

6. REFERENCES

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APPENDIX 1. THREATENED FLORA MONITORING

Appendix 1.1 – Biodiversity Offset Area Monitoring Sites

Monitoring Point 3 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)		Flowers / Fruit Present (2016)	Comments
			2015	2016		
3A	160	140	30 x 25	70 x 40	Fl	-
3B	280	150	20 x 25	-	-	Not recorded in 2016
3C	160	120	40 x 30	40 x 30	-	-
3D	460	110	50 x 20	30 x 20	-	-
3E	500	110	55 x 30	30 x 30	-	-
3F	530	105	50 x 10	30 x 30	Fl	Clump consists of several small seedlings within 30 cm of each other
3G	590	115	25 x 35	25 x 40	-	-
3H	650	110	20 x 20	40 x 20	-	-
3I	690	130	40 x 25	30 x 20	Fl	-
3J	780	120	35 x 20	20 x 20	-	-
3K	850	120	30 x 30	30 x 30	Fl	-
3L	900	145	35 x 45	20 x 10	-	-
3M	680	260	40 x 35	40 x 35	Fl	-
3N	790	270	30 x 25	30 x 20	Fl	-
3O	990	300	55 x 25	-	-	Not recorded in 2016
3P	240	70	40 x 20	40 x 15	Fl	-
3Q	590	105	-	40 x 10	-	New individual recorded in 2016
3R	930	115	-	30 x 30	Fl	New individual recorded in 2016
3S	700	275	-	20 x 30	Fl	-

Monitoring Point 4 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)		Flowers / Fruit Present (2016)	Comments
			2015	2016		
4A	160	195	30 x 20	30 x 20	-	-
4B	620	215	55 x 20	45 x 25	-	-
4C	660	215	30 x 15	30 x 30	-	-
4D	630	220	20 x 20	20 x 20	-	-
4E	760	220	65 x 20	40 x 20	-	-
4F	810	210	70 x 45	70 x 40	-	-
4G	940	205	40 x 15	50 x 10	-	-
4H	740	205	50 x 30	50 x 30	Fl	-
4I	740	200	80 x 15	60 x 40	-	-
4J	110	325	80 x 30	60 x 30	-	-
4K	890	25	30 x 30	40 x 30	Fl	-
4L	920	20	55 x 35	50 x 25	-	Multiple stems within 40 cm
4M	210	105	115 x 30	90 x 40	-	-
4N	840	185	110 x 30	100 x 40	-	-
4O	590	80	40 x 25	50 x 50	Fl	-
4P	850	270	-	20 x 20	-	New individual recorded in 2016
4Q	680	355	-	20 x 30	Fl	New individual recorded in 2016

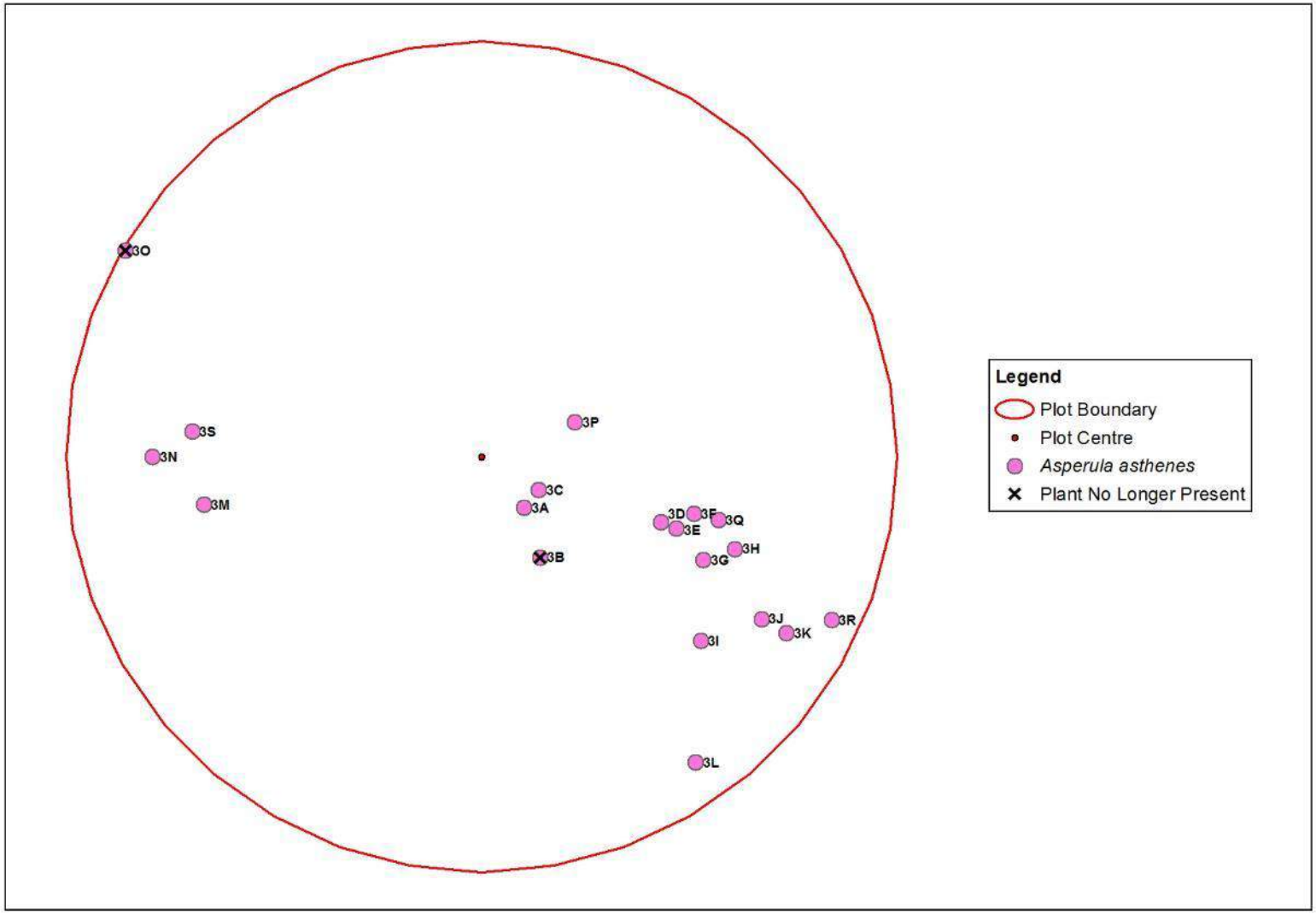

Figure 8: ***Asperula asthenes*** **locations – monitoring point 3**

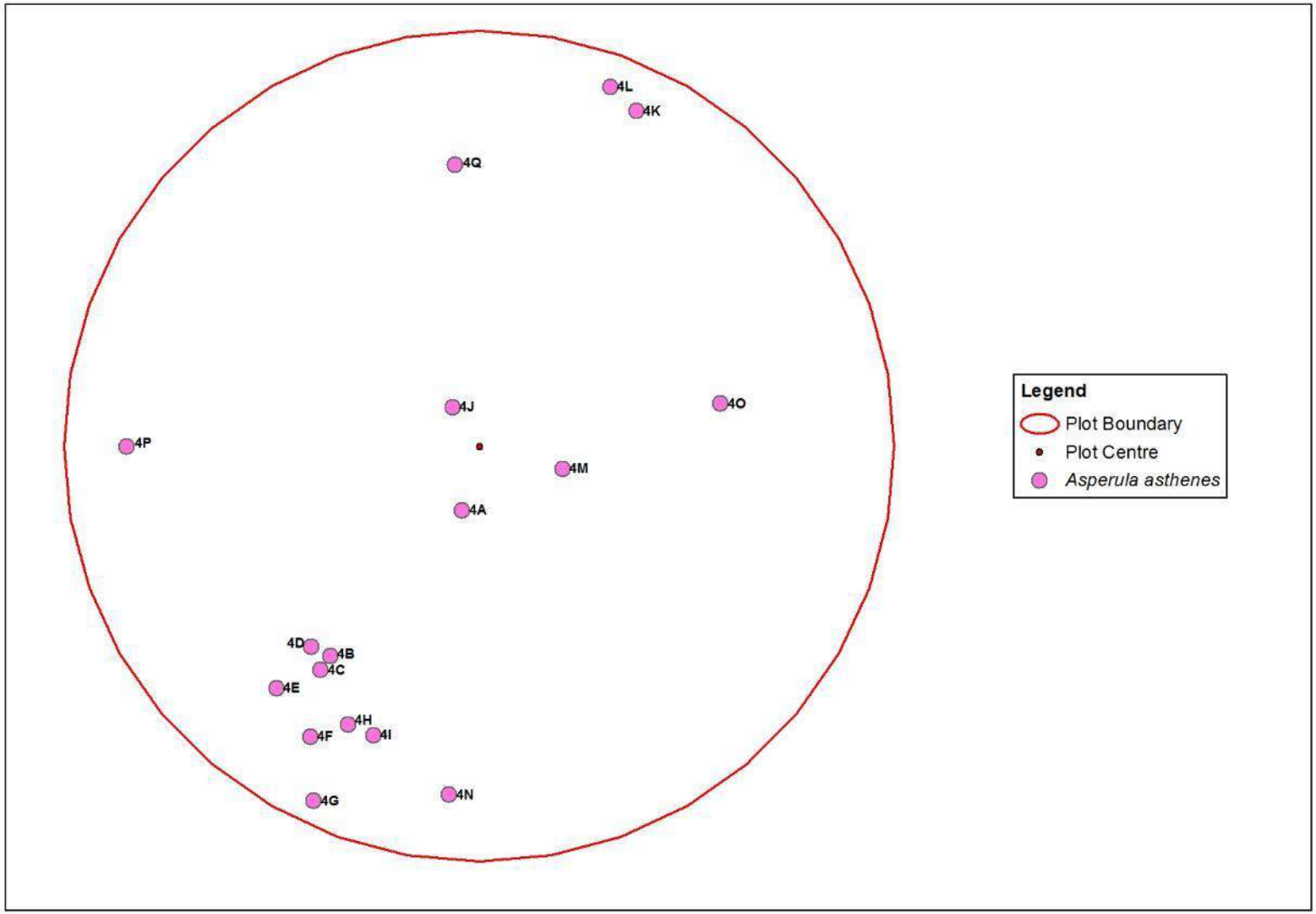

Figure 9: ***Asperula asthenes*** **locations – monitoring point 4**

Monitoring Point 7 - *Tetratheca juncea* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)		Flowers (2016)	Fruit (2016)	Comments
			2015	2016			
7A	440	160	70 x 40	60 x 40	18	12	-
7B	470	155	5 x 5	10 x 5	-	1	-
7C	500	155	35 x 15	40 x 15	7	3	-
7D	770	135	50 x 20	60 x 40	22	7	-
7E	730	95	60 x 50	90 x 40	37	18	-
7F	800	275	60 x 10	70 x 20	17	10	-
7G	780	270	40 x 40	40 x 40	4	2	-
7H	710	270	50 x 10	50 x 10	3	4	-
7I	510	265	30 x 10	30 x 10	2	1	-
7J	460	255	40 x 20	40 x 30	3	13	-
7K	420	260	70 x 45	80 x 40	26	15	-
7L	400	240	45 x 10	50 x 10	7	16	-
7M	570	205	110 x 70	110 x 70	64	17	-
7N	610	195	45 x 35	45 x 35	16	3	-
7O	310	240	-	20 x 20	3	0	New individual recorded in 2016

Monitoring Point 8 - *Tetratheca juncea* and *Grevillea parviflora* monitoring results

Number	Species	Distance (cm)	Bearing (degrees)	Clump Size (cm) / Maximum Stem Height		Flowers (2016)	Fruit (2016)	Comments
				2015	2016			
8A	*Tetratheca juncea*	210	235	110 x 70	110 x 80	22	9	-
8B	*Tetratheca juncea*	480	225	40 x 30	60 x 30	9	6	-
8C	*Tetratheca juncea*	560	225	120 x 110	120 x 100	9	5	-
8D	*Tetratheca juncea*	650	230	110 x 110	110 x 110	13	9	Multiple clumps within 30 cm
8E	*Tetratheca juncea*	750	230	65 x 30	65 x 30	5	2	-
8F	*Tetratheca juncea*	620	240	80 x 30	90 x 30	25	16	-
8G	*Tetratheca juncea*	710	240	100 x 50	100 x 50	27	18	-
8H	*Tetratheca juncea*	730	250	60 x 50	60 x 50	9	2	-
8I	*Grevillea parviflora* subsp. *parviflora*	310	280	30 cm	30cm	Fl		-
8J	*Tetratheca juncea*	390	285	50 x 10	50 x 10	4	0	New individual recorded in 2016
8K	*Tetratheca juncea*	400	195	60 x 20	60 x 20	11	9	New individual recorded in 2016

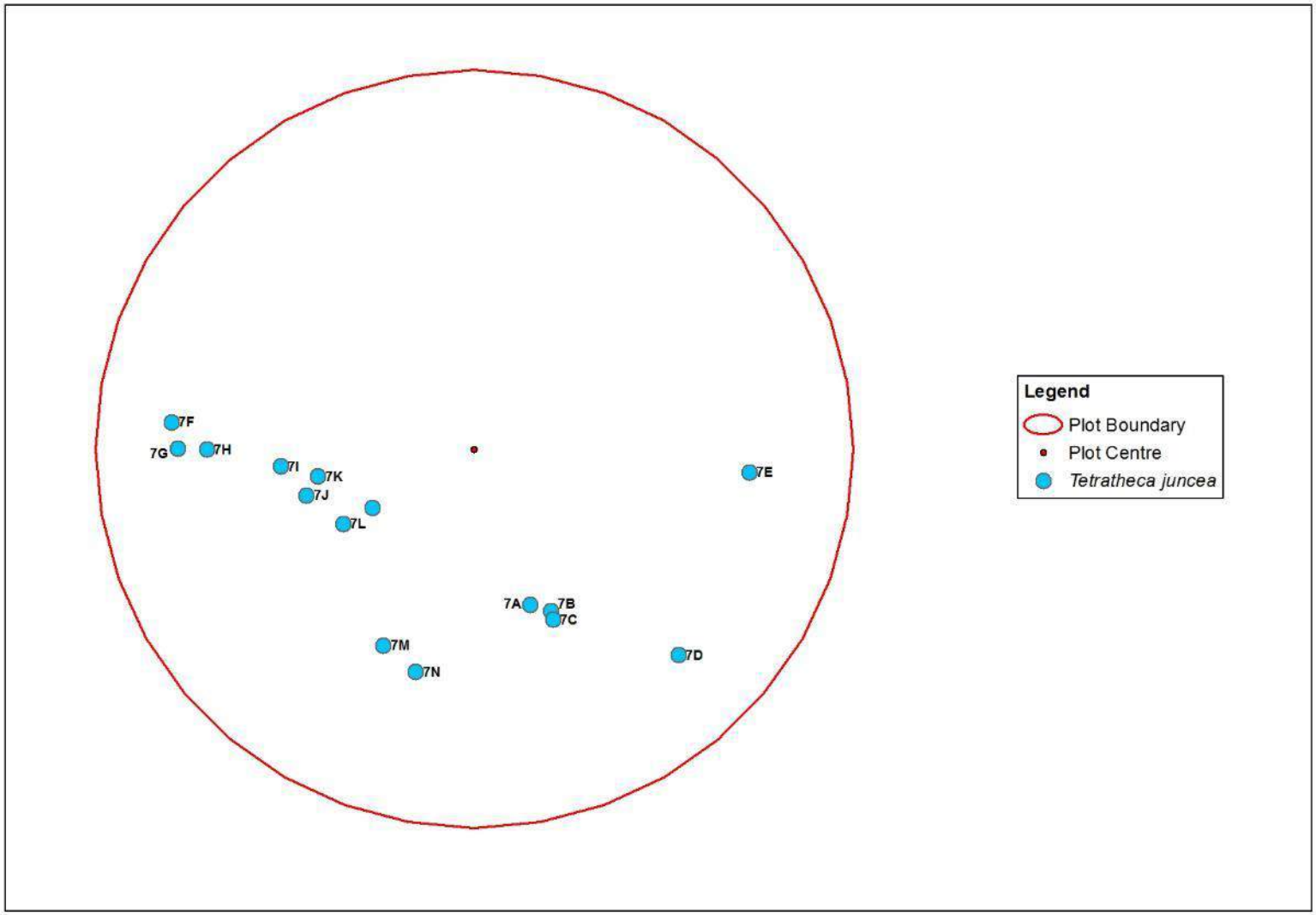

Figure 10: ***Tetratheca juncea*** **locations – monitoring point 7**

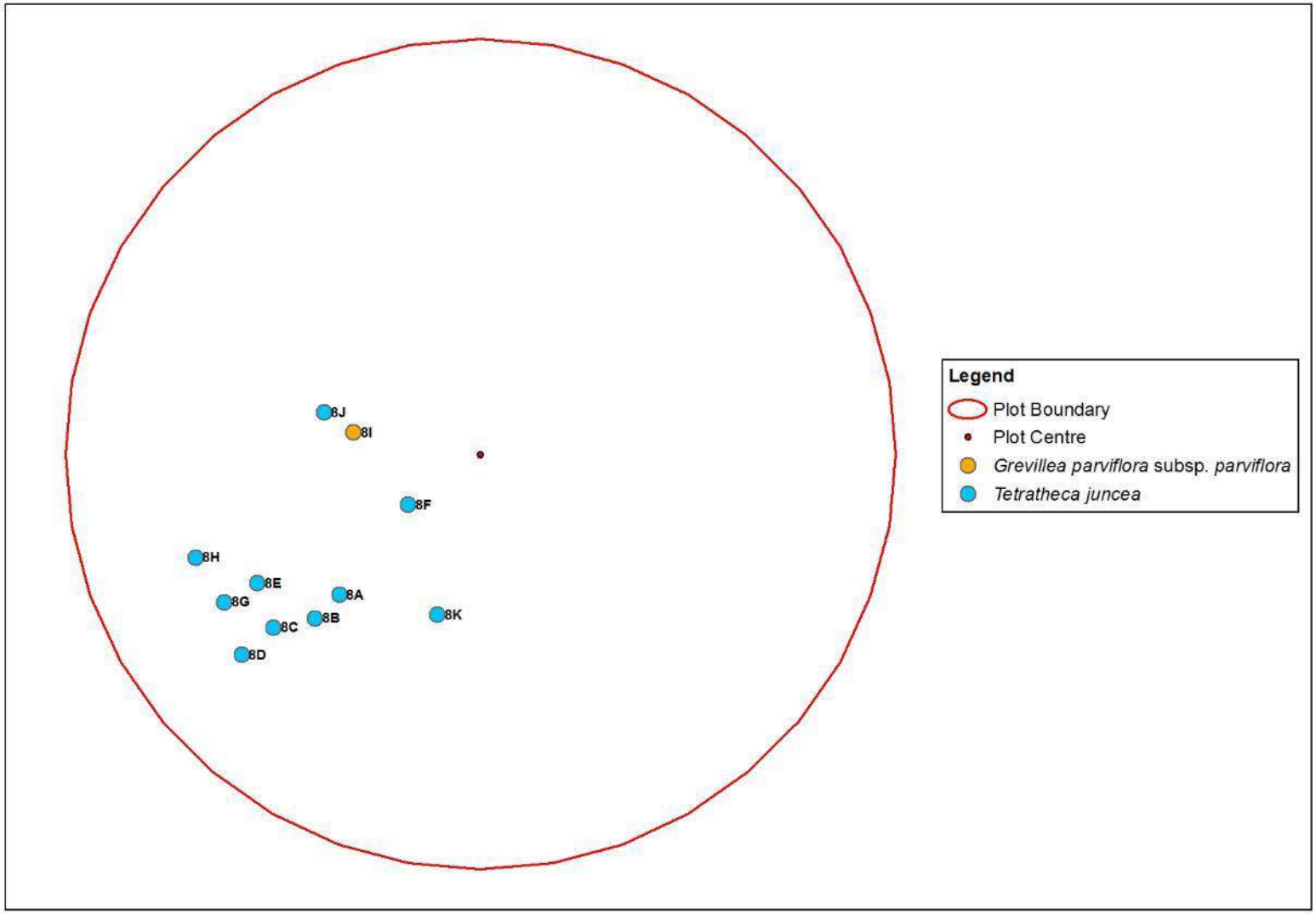

Figure 11: ***Tetratheca juncea*** **locations – monitoring point 8**

Monitoring Point 11 - *Grevillea parviflora* monitoring results

Number	Distance (cm)	Bearing (degrees)	Maximum Stem Height (cm)		Flowers / fruit (2016)	Comments
			2015	2016		
11A	560	165	90	90	Fl	-
11B	565	110	20	45	-	-
11C	610	105	55	-	-	Dead in 2016 – individual was noted to be in late stage of senescence in 2015
11D	650	105	100	65	Fl	Some die-off / senescence (noted in 2015)
11E	720	100	75	75	-	Some die-off / senescence (noted in 2015)
11F	770	100	20	10	-	High level of die-off / senescence (only a few leaves remaining) (noted in 2015)
11G	830	85	110	110	-	Some die-off / senescence (noted in 2015)
11H	900	100	60	60	Fl	-
11I	620	80	50	50	-	-
11J	460	70	45	35	-	-
11K	620	80	40	40	-	-
11L	610	75	45	55	-	-
11M	700	75	65	70	Fl & Fr	-
11N	540	80	35	40	-	1 branch died-off (noted in 2015)
11O	630	70	20	30	-	-
11P	490	80	45	70	-	-
11Q	430	80	-	20	-	New individual recorded in 2016

Monitoring Point 12 - *Grevillea parviflora* monitoring results

Number	Distance (cm)	Bearing (degrees)	Maximum Stem Height (cm)		Flowers / fruit (2016)	Comments
			2015	2016		
12A	430	40	80	80	Fl	-
12B	570	40	80	90	Fl & Fr	-
12C	580	35	65	70	Fl	-
12D	540	35	20	25	-	-
12E	710	35	25	30	Fl	Flattened by fallen branch (noted in 2015)
12F	660	30	25	25	Fl	Flattened by fallen branch (noted in 2015)
12G	550	25	50	50	Fl	-
12H	260	100	-	25	-	New individual recorded in 2016

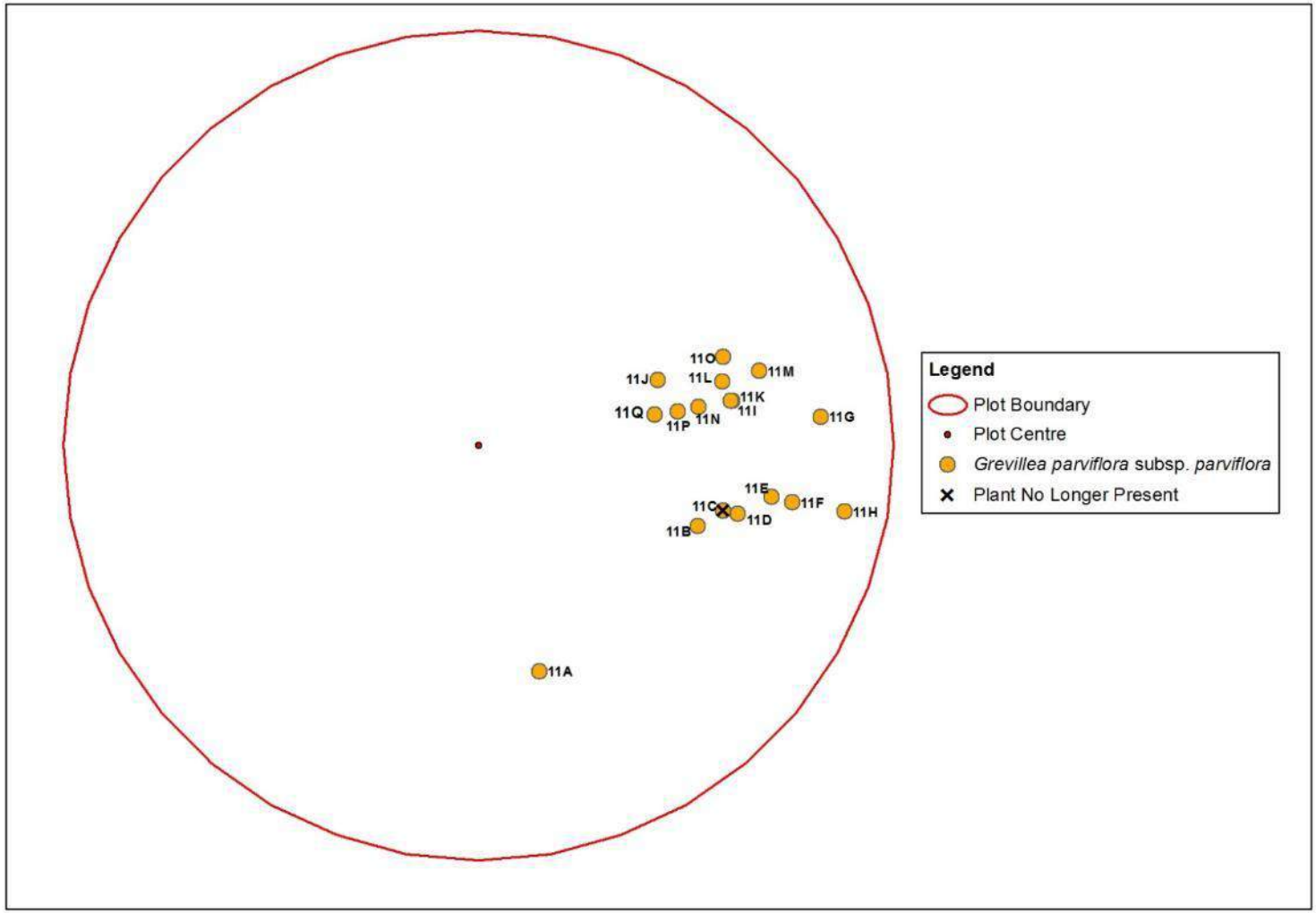

Figure 12: ***Grevillea parviflora*** **locations – monitoring point 11**

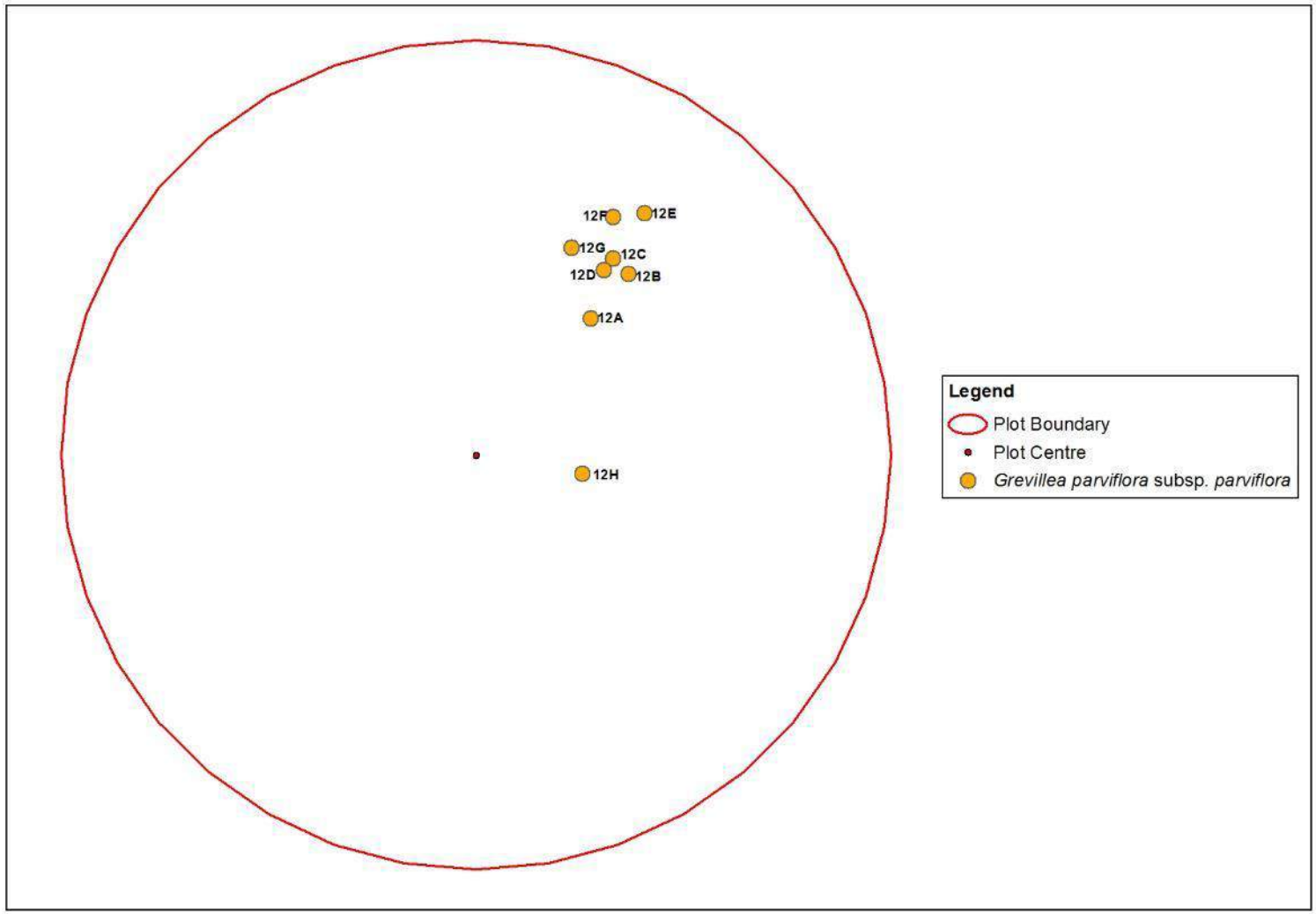

Figure 13: ***Grevillea parviflora*** **locations – monitoring point 12**

Appendix 1.2 – Lot 12 Monitoring Sites

Monitoring Point 15 - *Tetratheca juncea* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)		Flowers (2016)	Fruit (2016)	Comments
			2015	2016			
15A	420	80	20 x 10	30 x 10	0	0	-
15B	990	65	5 x 5	10 x 5	0	0	-
15C	1000	50	50 x 50	60 x 40	15	10	-
15D	870	45	40 x 40	40 x 40	2	5	-
15E	960	40	75 x 20	80 x 20	14	6	-
15F	780	45	30 x 15	40 x 15	2	0	-
15G	800	35	40 x 25	50 x 25	0	0	-
15H	790	10	5 x 5	10 x 5	0	0	-
15I	620	10	60 x 30	60 x 30	2	6	-
15J	730	0	20 x 30	40 x 20	2	5	-
15K	730	355	50 x 20	40 x 20	4	3	-
15L	480	0	30 x 10	30 x 10	2	4	-
15M	270	5	40 x 10	50 x 10	4	12	-
15N	300	355	40 x 10	40 x 10	2	0	-
15O	100	275	20 x 5	20 x 40	3	0	-
15P	770	270	60 x 20	50 x 30	3	2	-
15Q	510	260	60 x 50	70 x 50	21	15	-
15R	590	245	70 x 50	70 x 50	17	28	-
15S	910	195	20 x 10	20 x 10	0	0	-
15T	400	230	30 x 10	30 x 10	1	0	-
15U	870	190	10 x 10	30 x 10	1	2	-
15V	550	180	30 x 15	40 x 20	3	1	-
15W	670	175	5 x 5	10 x 5	0	0	-
15X	290	155	40 x 10	40 x 10	0	0	-
15Y	360	170	5 x 5	30 x 5	2	1	-
15Z	470	165	30 x 40	50 x 30	48	35	-
15AA	570	170	25 x 20	50 x 20	18	5	-
15AB	810	170	5 x 5	10 x 5	0	0	-
15AC	520	135	40 x 10	50 x 15	9	4	-
15AD	560	160	20 x 30	20 x 30	2	3	-
15AE	370	130	-	20 x 10	3	0	New individual recorded in 2016

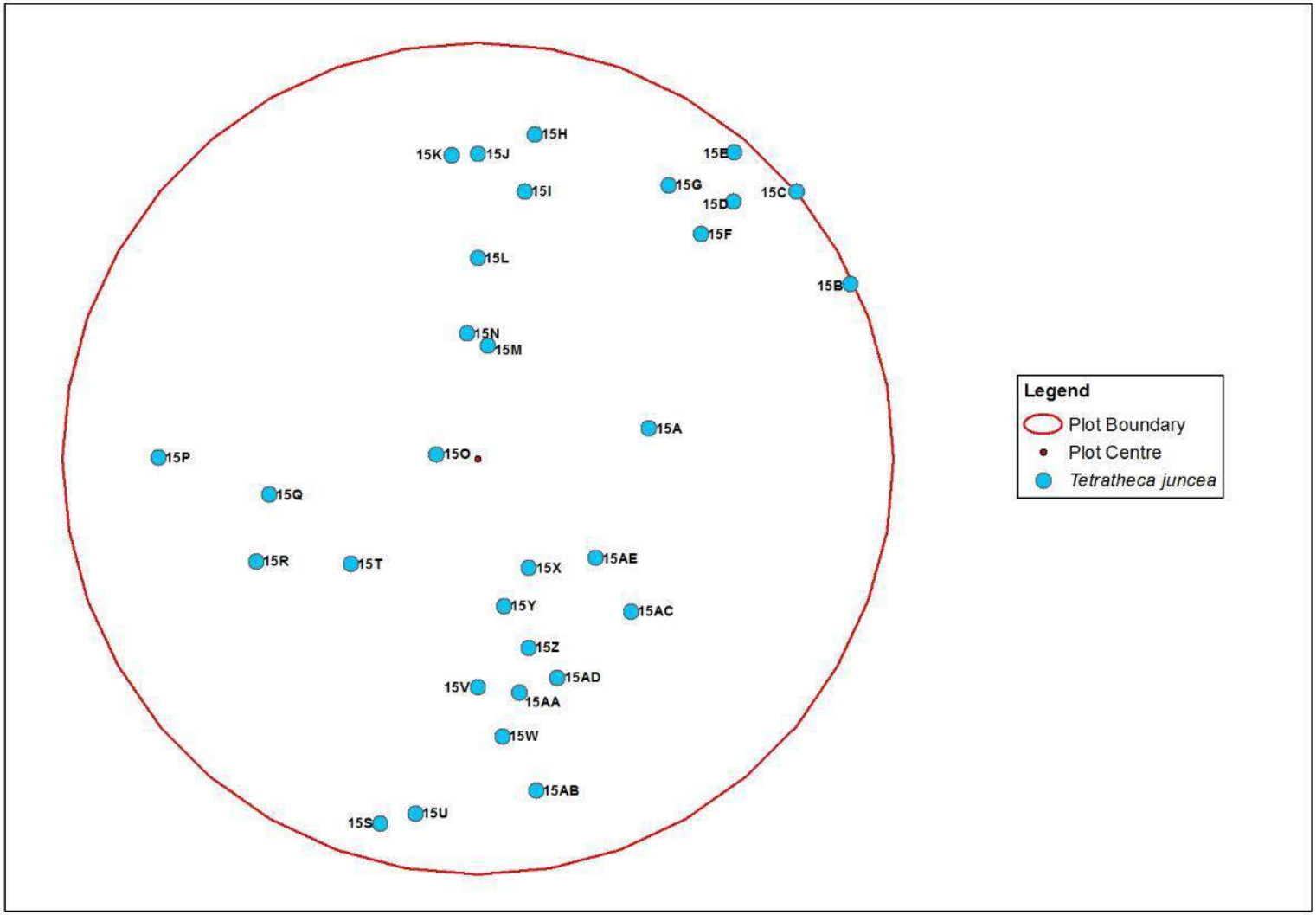

Figure 14: ***Tetratheca juncea*** **locations – monitoring point 15**

Monitoring Point 17 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)		Flowers / fruit present (2016)	Comments
			2015	2016		
17A	140	220	20 x 5	20 x 5	-	-
17B	270	235	35 x 15	20 x 10	Fl	-
17C	300	255	40 x 5	30 x 5	Fl	-
17D	340	250	5 x 5	10 x 5	-	-
17E	550	230	80 x 80	80 x 80	Fl & Fr	-
17F	640	225	20 x 25	20 x 25	Fl	-
17G	870	240	20 x 10	20 x 10	-	-
17H	760	265	90 x 35	90 x 35	Fl & Fr	-
17I	810	245	35 x 20	25 x 10	-	-
17J	840	245	40 x 60	40 x 50	Fl	-
17K	710	235	20 x 5	20 x 10	Fl	-

Monitoring point 18 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)		Flowers / fruit present	Comments
			2015	2016		
18A	610	220	40 x 30	40 x 30	Fl	-
18B	690	220	100 x 60	100 x 50	Fl & Fr	Multiple stems within 40 cm
18C	670	225	30 x 20	30 x 20	Fl	-
18D	880	215	20 x 40	20 x 40	-	-
18E	900	220	100 x 90	90 x 90	Fl	-
18F	760	225	70 x 80	70 x 90	Fl & Fr	-
18G	820	235	70 x 30	70 x 40	Fl	-
18H	890	265	5 x 10	20 x 10	Fl & Fr	-
18I	820	280	30 x 40	30 x 30	Fl	Multiple stems within 40 cm
18J	830	290	55 x 30	50 x 30	Fl	-
18K	960	235	50 x 10	40 x 15	Fl	Multiple stems within 40 cm
18L	780	215	10 x 10	20 x 20	Fl	-
18M	980	225	30 x 10	20 x 10	-	-

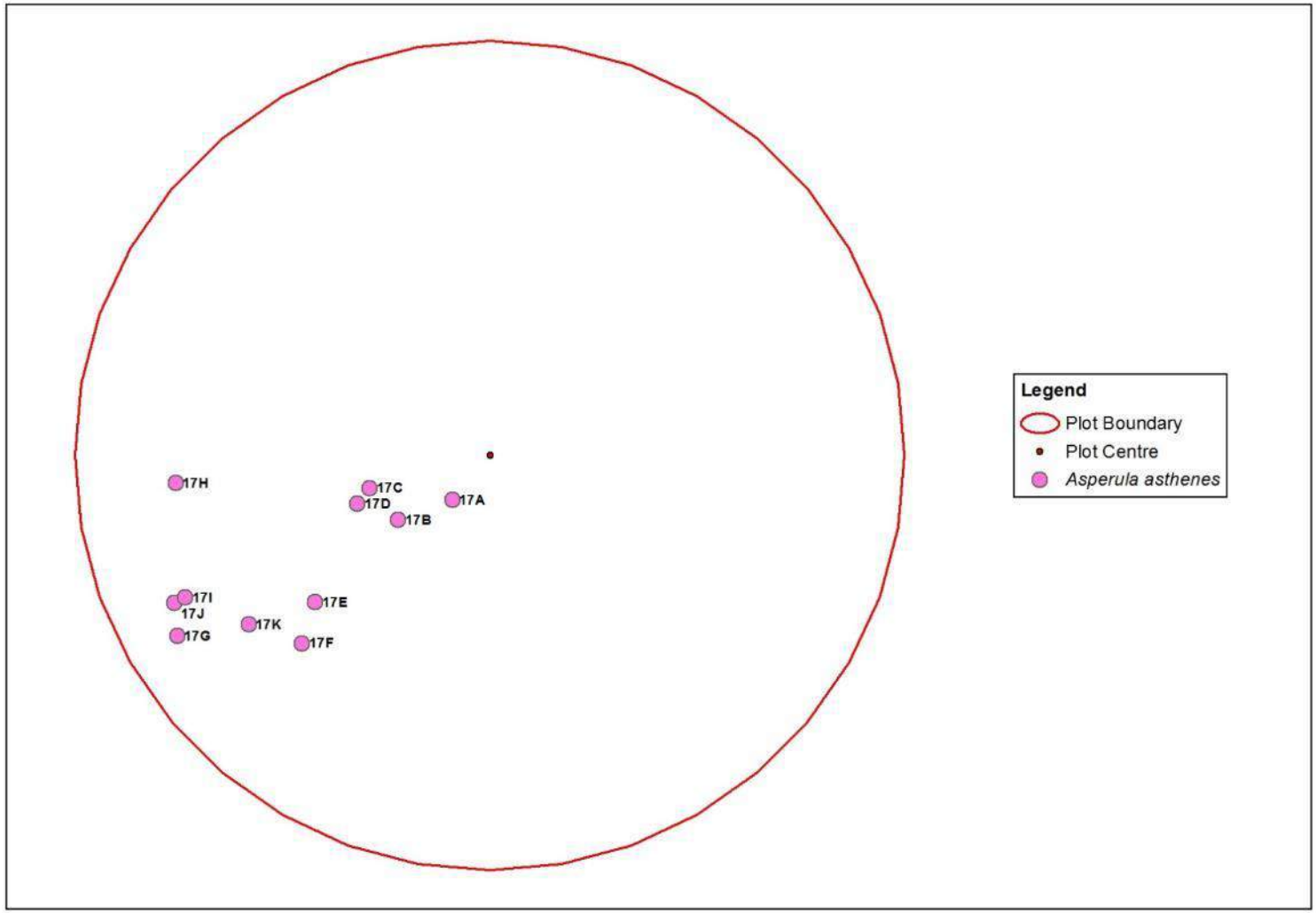

Figure 15: ***Asperula asthenes*** **locations – monitoring point 17**

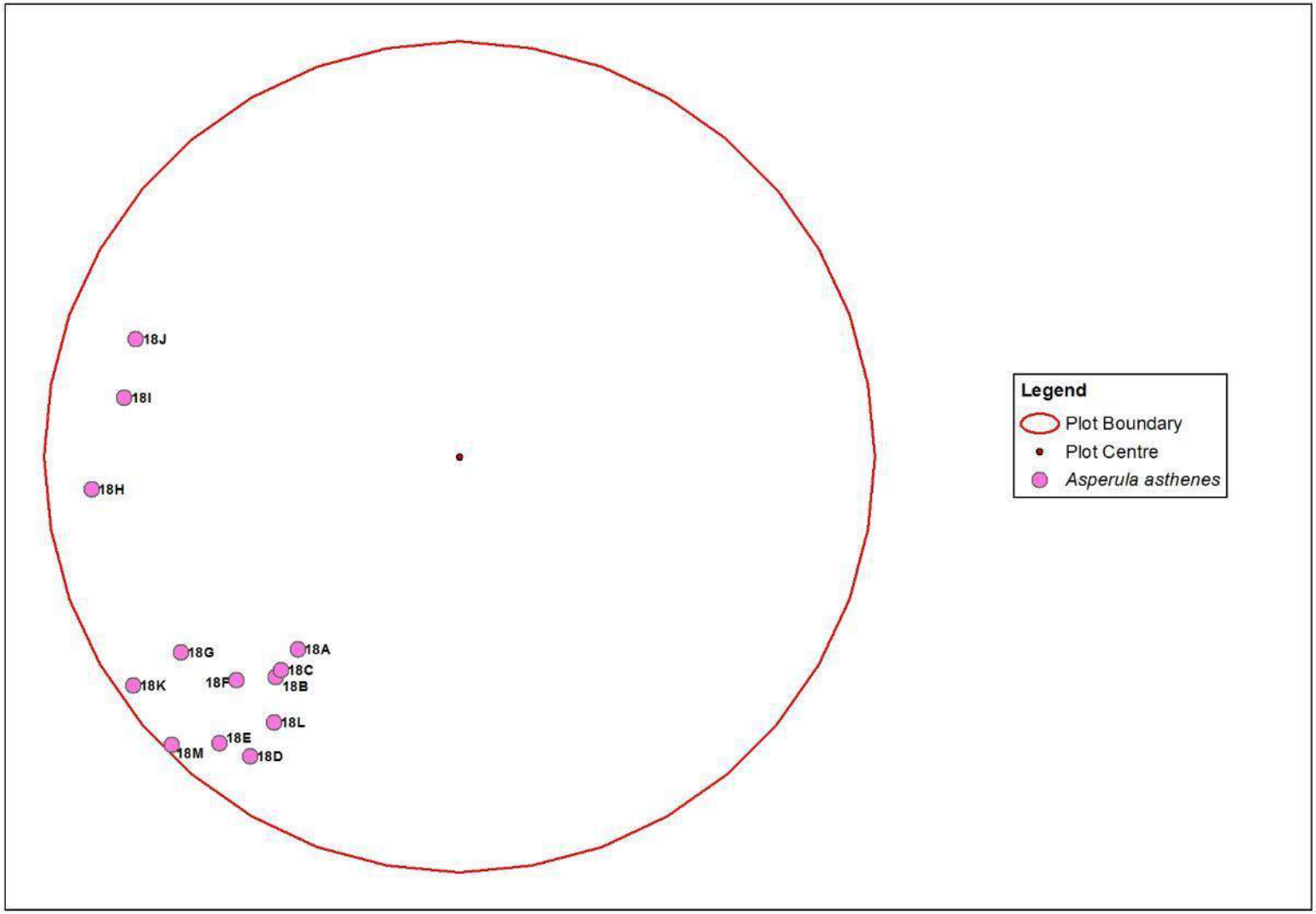

Figure 16: ***Asperula asthenes*** **locations – monitoring point 18**

APPENDIX 2. VEGETATION MONITORING DATA

Monitoring site	Dominant species in each stratum		Estimated % cover	
			2015	2016
MP1	Canopy	*Eucalyptus propinqua* (Small-fruited Grey Gum), *E. microcorys* (Tallowwood), *E. acmenoides* (White Mahogany) and *Corymbia maculata* (Spotted Gum)	50%	50%
	Midstorey	*Allocasuarina torulosa* (Forest Oak), *Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree) and *Breynia oblongifolia* (Coffee Bush)	40%	40%
	Shrub	*Leucopogon juniperinus* (Prickly Beard-heath) and *Hibbertia aspera* (Rough Guinea Flower)	5%	5%
	Ground (grass)	*Imperata cylindrica* (Blady Grass), *Oplismenus aemulus* (Australian Basket Grass) and *Poa labillardierei* (Tussock)	60%	60%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush), *Carex longebrachiata* and *Adiantum aethiopicum* (Common Maidenhair)	50%	50%
	Exotic	*Lantana camara* (Lantana)	30%	30%
MP2	Canopy	*Corymbia maculata* (Spotted Gum), *Eucalyptus microcorys* (Tallowwood), *E. canaliculata* (Grey Gum) and *E. paniculata* subsp. *paniculata* (Grey Ironbark)	40%	40%
	Midstorey	*Allocasuarina torulosa* (Forest Oak), *Bursaria spinosa* (Blackthorn) and *Exocarpos cupressiformis* (Cherry Ballart)	40%	35%
	Shrub	*Leucopogon juniperinus* (Prickly Beard-heath), *Pultenaea villosa* (Hairy Bush-pea) and *Acacia ulicifolia* (Prickly Moses)	5%	5%
	Ground (grass)	*Themeda triandra* (Kangaroo Grass) and *Poa labillardierei* (Tussock)	50%	50%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush), *Gonocarpus tetragynus* and *Eustrephus latifolius* (Wombat Berry)	20%	20%
	Exotic	*Lantana camara* (Lantana)	5%	5%
MP3	Canopy	*Lophostemon confertus* (Brush Box), *Syncarpia glomulifera* (Turpentine), *Eucalyptus propinqua* (Small-fruited Grey Gum) and *E. microcorys* (Tallowwood)	40%	40%
	Midstorey	*Melaleuca styphelioides* (Prickly-leaved Tea Tree), *Livistona australis* (Cabbage Palm), *Allocasuarina torulosa* (Forest Oak) and *Elaeocarpus obovatus* (Hard Quandong)	60%	60%
	Shrub	*Pittosporum multiflorum* (Orange Thorn), *Diospyros australis* (Black Plum) and *Lantana camara* (Lantana)	40%	40%
	Ground (grass)	*Oplismenus aemulus* (Australian Basket Grass)	<5%	<5%
	Ground (other)	*Doodia aspera* (Prickly Rasp Fern), *Carex longebrachiata, Adiantum hispidulum* (Rough Maidenhair Fern) and *Cissus antarctica* (Kangaroo Vine)	90%	90%
	Exotic	*Lantana camara* (Lantana)	50%	50%
MP4	Canopy	*Lophostemon confertus* (Brush Box), *Syncarpia glomulifera* (Turpentine), and *Eucalyptus propinqua* (Small-fruited Grey Gum)	30%	30%
	Midstorey	*Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree), *Melaleuca styphelioides* (Prickly-leaved Tea Tree), *Acmena smithii* (Lilly Pilly) and *Elaeocarpus obovatus* (Hard Quandong)	60%	60%
	Shrub	*Pittosporum multiflorum* (Orange Thorn)	5%	5%
	Ground (grass)	*Oplismenus aemulus* (Australian Basket Grass)	5%	5%
	Ground (other)	*Doodia aspera* (Prickly Rasp Fern), *Morinda jasminoides* (Sweet Morinda) and *Carex longebrachiata*	90%	90%
	Exotic	*Lantana camara* (Lantana) and *Asparagus aethiopicus* (Ground Asparagus)	35%	35%

Monitoring site	Dominant species in each stratum		Estimated % cover	
			2015	2016
MP5	Canopy	*Eucalyptus pilularis* (Blackbutt), *E. microcorys* (Tallowwood), *Angophora costata* (Smooth-barked Apple) and *E. globoidea* (White Stringybark)	40%	40%
	Midstorey	*Allocasuarina torulosa* (Forest Oak), *Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree), *Persoonia linearis* (Narrow-leaved Geebung) and *Melaleuca linariifolia* (Flax-leaved Paperbark)	60%	60%
	Shrub	*Leptospermum polygalifolium* (Tantoon), *Breynia oblongifolia* (Coffee Bush) and *Phyllanthus hirtellus* (Thyme Spurge)	5%	5%
	Ground (grass)	*Entolasia stricta* (Wiry Panic) and *Oplismenus imbecillis* (Creeping Beard Grass)	60%	60%
	Ground (other)	*Doryanthes excelsa* (Gymea Lily), *Pteridium esculentum* (Common Bracken) and *Lomandra longifolia* (Spiny-headed Mat-rush)	50%	50%
	Exotic	Nil	-	-
MP6	Canopy	*Eucalyptus microcorys* (Tallowwood), *E. propinqua* (Small-fruited Grey Gum), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus pilularis* (Blackbutt)	50%	50%
	Midstorey	*Callistemon salignus* (Willow Bottlebrush), *Melaleuca styphelioides* (Prickly-leaved Tea Tree), *Allocasuarina torulosa* (Forest Oak), *Acmena smithii* (Lilly Pilly) and *Zieria smithii* (Sandfly Zieria)	60%	60%
	Shrub	*Hibbertia aspera* (Rough Guinea Flower)	<5%	<5%
	Ground (grass)	*Imperata cylindrica* (Blady Grass), *Oplismenus imbecillis* (Creeping Beard Grass) and *Poa labillardierei* (Tussock)	20%	20%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush), *Doryanthes excelsa* (Gymea Lily), *Adiantum aethiopicum* (Common Maidenhair) and *Morinda jasminoides* (Sweet Morinda)	30%	30%
	Exotic	Nil	-	-
MP7	Canopy	*Angophora costata* (Smooth-barked Apple), *Eucalyptus eugenioides* (Thin-leaved Stringybark) and *Corymbia gummifera* (Red Bloodwood)	35%	35%
	Midstorey	*Allocasuarina littoralis* (Black She-oak), *Leptospermum polygalifolium* (Tantoon) and *Allocasuarina torulosa* (Forest Oak)	40%	40%
	Shrub	*Pultenaea euchila* (Orange Pultenaea)	5%	5%
	Ground (grass)	*Themeda triandra* (Kangaroo Grass) and *Entolasia stricta* (Wiry Panic)	50%	50%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush) and *Gahnia radula*	70%	60%
	Exotic	*Setaria sphacelata* (South African Pigeon Grass)	5%	5%
MP8	Canopy	*Angophora costata* (Smooth-barked Apple), *Eucalyptus eugenioides* (Thin-leaved Stringybark) and *Corymbia gummifera* (Red Bloodwood)	30%	30%
	Midstorey	*Allocasuarina littoralis* (Black She-oak), *Leptospermum polygalifolium* (Tantoon) and *Acacia longifolia* (Sydney Golden Wattle)	50%	50%
	Shrub	*Pultenaea paleacea* (Chaffy Bush-pea), *Pultenaea euchila* (Orange Pultenaea) and *Phyllanthus hirtellus* (Thyme Spurge)	20%	20%
	Ground (grass)	*Entolasia stricta* (Wiry Panic) and *Themeda triandra* (Kangaroo Grass)	50%	50%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush), *Ptilothrix deusta, Patersonia sericea* (Silky Purple-flag) and *Lomandra obliqua*	50%	50%
	Exotic	Nil	-	-

Monitoring site	Dominant species in each stratum		Estimated % cover	
			2015	2016
MP9	Canopy	*Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus microcorys* (Tallowwood) and *E. eugenioides* (Thin-leaved Stringybark)	40%	40%
	Midstorey	*Allocasuarina littoralis* (Black She-oak), *Dodonaea triquetra* (Large-leaf Hop-bush) and *Persoonia linearis* (Narrow-leaved Geebung)	50%	50%
	Shrub	*Leptospermum polygalifolium* (Tantoon), *Pultenaea euchila* (Orange Pultenaea) and *Logania albiflora*	10%	10%
	Ground (grass)	*Imperata cylindrica* (Blady Grass), *Entolasia stricta* (Wiry Panic) and *Themeda triandra* (Kangaroo Grass)	30%	30%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush), *Pteridium esculentum* (Common Bracken) and *Ptilothrix deusta*	60%	60%
	Exotic	Nil	-	-
MP10	Canopy	*Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus microcorys* (Tallowwood)	40%	40%
	Midstorey	*Allocasuarina littoralis* (Black She-oak), *Persoonia linearis* (Narrow-leaved Geebung) and *A. torulosa* (Forest Oak)	10%	10%
	Shrub	*Pultenaea euchila* (Orange Pultenaea), *Leptospermum polygalifolium* (Tantoon) and *Pultenaea paleacea* (Chaffy Bush-pea)	5%	5%
	Ground (grass)	*Entolasia stricta* (Wiry Panic), *Themeda triandra* (Kangaroo Grass) and *Imperata cylindrica* (Blady Grass)	40%	40%
	Ground (other)	*Gahnia radula, Doryanthes excelsa* (Gymea Lily), *Lomandra longifolia* (Spiny-headed Mat-rush) and *Ptilothrix deusta*	60%	60%
	Exotic	Nil	-	-
MP11	Canopy	*Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus capitellata* (Brown Stringybark)	35%	35%
	Midstorey	*Allocasuarina littoralis* (Black She-oak), *Glochidion ferdinandi* var. f*erdinandi* (Cheese Tree), *Leptospermum polygalifolium* (Tantoon) and *Banksia spinulosa* (Hairpin Banksia)	40%	40%
	Shrub	*Pultenaea paleacea* (Chaffy Bush-pea) and *Boronia pinnata*	5%	5%
	Ground (grass)	*Entolasia stricta* (Wiry Panic), *Imperata cylindrica* (Blady Grass) and *Themeda triandra* (Kangaroo Grass)	35%	35%
	Ground (other)	*Xanthorrhoea latifolia, Pteridium esculentum* (Common Bracken) and *Ptilothrix deusta*	60%	60%
	Exotic	Nil	-	-
MP12	Canopy	*Eucalyptus pilularis* (Blackbutt), *Angophora costata* (Smooth-barked Apple), *E. globoidea* (White Stringybark), *Corymbia gummifera* (Red Bloodwood), *E. microcorys* (Tallowwood) and *E. piperita* (Sydney Peppermint)	40%	40%
	Midstorey	*Leptospermum polygalifolium* (Tantoon), *Allocasuarina littoralis* (Black She-oak), *Glochidion ferdinandi* var. f*erdinandi* (Cheese Tree) and *Exocarpos cupressiformis* (Cherry Ballart)	30%	30%
	Shrub	*Pultenaea euchila* (Orange Pultenaea), *Boronia pinnata* and *Banksia spinulosa* (Hairpin Banksia)	10%	10%
	Ground (grass)	*Themeda triandra* (Kangaroo Grass), *Entolasia stricta* (Wiry Panic), and *Austrostipa* sp.	40%	40%
	Ground (other)	*Xanthorrhoea latifolia* and *Ptilothrix deusta*	40%	40%
	Exotic	Nil	-	-

Monitoring site	Dominant species in each stratum		Estimated % cover	
			2015	2016
MP13	Canopy	*Eucalyptus sparsifolia* (Narrow-leaved Stringybark), *Corymbia maculata* (Spotted Gum), *E. paniculata* (Grey Ironbark) and *E. microcorys* (Tallowwood)	40%	40%
	Midstorey	*Allocasuarina torulosa* (Forest Oak), *Syncarpia glomulifera* (Turpentine) and *Callistemon salignus* (Willow Bottlebrush)	40%	40%
	Shrub	*Hibbertia aspera* (Rough Guinea Flower) and *Pultenaea euchila* (Orange Pultenaea)	5%	5%
	Ground (grass)	*Imperata cylindrica* (Blady Grass), *Poa labillardierei* (Tussock), *Themeda triandra* (Kangaroo Grass) and *Oplismenus imbecillis* (Creeping Beard Grass)	60%	60%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush), *Doryanthes excelsa* (Gymea Lily), *Lepidosperma laterale* and *Patersonia sericea*	30%	30%
	Exotic	Nil	-	-
MP14	Canopy	*Angophora costata* (Smooth-barked Apple), *Eucalyptus eugenioides* (Thin-leaved Stringybark), *E. microcorys* (Tallowwood), and *E. paniculata* subsp. *paniculata* (Grey Ironbark)	35%	40%
	Midstorey	*Allocasuarina torulosa* (Forest Oak), *Callistemon salignus* (Willow Bottlebrush) and *Glochidion ferdinandi* (Cheese Tree)	25%	25%
	Shrub	*Leucopogon juniperinus* (Prickly Beard-heath), *Pultenaea villosa* (Hairy Bush-pea), *Leptospermum polygalifolium* (Tantoon) and *Hibbertia aspera* (Rough Guinea Flower)	10%	15%
	Ground (grass)	*Themeda triandra* (Kangaroo Grass), *Poa labillardierei* (Tussock) and *Entolasia stricta* (Wiry Panic)	80%	80%
	Ground (other)	*Lomandra longifolia* (Spiny-headed Mat-rush), *Doryanthes excelsa* (Gymea Lily) and *Brunoniella pumilio* (Dwarf Blue Trumpet)	30%	30%
	Exotic	*Setaria sphacelata* (South African Pigeon Grass)	5%	5%
MP15	Canopy	*Eucalyptus pilularis* (Blackbutt), *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood) and *E. microcorys* (Tallowwood)	45%	45%
	Midstorey	*Allocasuarina littoralis* (Black She-oak) and *Acacia irrorata* (Green Wattle)	20%	20%
	Shrub	*Hibbertia vestita* (Hairy Guinea Flower), *Breynia oblongifolia* (Coffee Bush) and *Phyllanthus gunnii* (Scrubby Spurge)	10%	10%
	Ground (grass)	*Themeda triandra* (Kangaroo Grass), *Entolasia stricta* (Wiry Panic) and *Imperata cylindrica* (Blady Grass)	30%	30%
	Ground (other)	*Doryanthes excelsa* (Gymea Lily), *Lomandra longifolia* (Spiny-headed Mat-rush), *Pteridium esculentum* (Common Bracken), *Lepidosperma laterale* and *Xanthorrhoea macronema*	60%	60%
	Exotic	*Lantana camara* (Lantana)	5%	5%
MP16	Canopy	*Eucalyptus pilularis* (Blackbutt), *E. propinqua* (Small-fruited Grey Gum), *E. microcorys* (Tallowwood) and *Angophora costata* (Smooth-barked Apple)	50%	50%
	Midstorey	*Allocasuarina torulosa* (Forest Oak), *Syncarpia glomulifera* (Turpentine) and *Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree)	30%	30%
	Shrub	*Leucopogon juniperinus* (Prickly Beard-heath) and *Acacia floribunda* (White Sally Wattle)	10%	10%
	Ground (grass)	*Poa labillardierei* (Tussock), *Imperata cylindrica* (Blady Grass), and *Oplismenus imbecillis* (Creeping Beard Grass)	50%	50%
	Ground (other)	*Carex appressa* (Tall Sedge), *Doodia aspera* (Prickly Rasp Fern), *Lomandra longifolia* (Spiny-headed Mat-rush) and *Calochlaena dubia* (Rainbow Fern)	30%	30%
	Exotic	*Lantana camara* (Lantana)	30%	30%

Monitoring site	Dominant species in each stratum		Estimated % cover	
			2015	2016
MP17	Canopy	*Eucalyptus pilularis* (Blackbutt), *E. microcorys* (Tallowwood), *Syncarpia glomulifera* (Turpentine), *E. acmenoides* (White Mahogany) and *E. propinqua* (Small-fruited Grey Gum)	40%	40%
	Midstorey	*Backhousia myrtifolia* (Grey Myrtle), *Lophostemon confertus* (Brush Box), *Livistona australis* (Cabbage Palm), *Acmena smithii* (Lilly Pilly) and *Allocasuarina torulosa* (Forest Oak)	50%	50%
	Shrub	*Wilkiea huegeliana* (Veiny Wilkiea), *Acacia maidenii* (Maiden's Wattle), *Eupomatia laurina* (Bolwarra) and *Pittosporum multiflorum* (Orange Thorn)	5%	5%
	Ground (grass)	*Poa labillardierei* (Tussock), *Themeda triandra* (Kangaroo Grass) and *Entolasia marginata* (Bordered Panic)	40%	40%
	Ground (other)	*Doodia aspera* (Prickly Rasp Fern), *Lomandra longifolia* (Spiny-headed Mat-rush) and *Gymnostachys anceps* (Settlers' Twine)	50%	50%
	Exotic	*Lantana camara* (Lantana)	10%	15%
MP18	Canopy	*Eucalyptus saligna* (Sydney Blue Gum), *E. microcorys* (Tallowwood), *Syncarpia glomulifera* (Turpentine), and *E. acmenoides* (White Mahogany)	45%	45%
	Midstorey	*Lophostemon confertus* (Brush Box), *Backhousia myrtifolia* (Grey Myrtle), *Cryptocarya glaucescens* (Jackwood), *Allocasuarina torulosa* (Forest Oak) and *Acacia irrorata* (Green Wattle)	25%	25%
	Shrub	*Acacia maidenii* (Maiden's Wattle) and *Denhamia silvestris* (Narrow-leaved Orangebark)	5%	5%
	Ground (grass)	*Poa labillardierei* (Tussock), *Imperata cylindrica* (Blady Grass), and *Oplismenus imbecillis* (Creeping Beard Grass)	50%	50%
	Ground (other)	*Doodia aspera* (Prickly Rasp Fern), *Lomandra longifolia* (Spiny-headed Mat-rush) and *Gymnostachys anceps* (Settlers' Twine)	50%	50%
	Exotic	*Lantana camara* (Lantana)	10%	15%

APPENDIX 3. PHOTO MONITORING POINTS

Appendix 3.1 – Biodiversity Offset Area Monitoring Sites

Monitoring Point 1 (MP1)

Monitoring point 1 (north) – 2015

Monitoring point 1 (north) - 2016

Monitoring Point 2 (MP2)

Monitoring point 2 (north) – 2015

Monitoring point 2 (north) – 2016

Monitoring Point 3 (MP3)

Monitoring point 3 (north) – 2015

Monitoring point 3 (north) – 2016

Monitoring Point 4 (MP4)

Monitoring point 4 (north) – 2015

Monitoring point 4 (north) – 2016

Monitoring Point 5 (MP5)

Monitoring point 5 (north) – 2015

Monitoring point 5 (north) – 2016

Monitoring Point 6 (MP6)

Monitoring point 6 (north) – 2015

Monitoring point 6 (north) – 2016

Monitoring Point 7 (MP7)

Monitoring point 7 (north) – 2015

Monitoring point 7 (north) – 2016

Monitoring Point 8 (MP8)

Monitoring point 8 (north) – 2015

Monitoring point 8 (north) – 2016

Monitoring Point 9 (MP9)

Monitoring point 9 (north) – 2015

Monitoring point 9 (north) – 2016

Monitoring Point 10 (MP10)

Monitoring point 10 (north) – 2015

Monitoring point 10 (north) – 2016

Monitoring Point 11 (MP11)

Monitoring point 11 (north) – 2015

Monitoring point 11 (north) – 2016

Monitoring Point 12 (MP12)

Monitoring point 12 (north) – 2015

Monitoring point 12 (north) – 2016

Monitoring Point 13 (MP13)

Monitoring point 13 (north) – 2015

Monitoring point 13 (north) – 2016

Appendix 1.2 – Lot 12 Monitoring Sites

Monitoring Point 14 (MP14)

Monitoring point 14 (north) – 2015

Monitoring point 14 (north) – 2016

Monitoring Point 15 (MP15)

Monitoring point 15 (north) – 2015

Monitoring point 15 (north) – 2016

Monitoring Point 16 (MP16)

Monitoring point 16 (north) – 2015

Monitoring point 16 (north) – 2016

Monitoring Point 17 (MP17)

Monitoring point 17 (north) – 2015

Monitoring point 17 (north) – 2016

Monitoring Point 18 (MP18)

Monitoring point 18 (north) – 2015

Monitoring point 18 (north) – 2016

APPENDIX 4. EXOTIC SPECIES RECORDED IN THE OFFSET AREA

Scientific Name	Common Name	Control Class (NW Act 1993) in Great Lakes Council control area
Ageratina riparia	Creeping Crofton Weed	-
Anagallis arvensis	Scarlet Pimpernel	-
Andropogon virginicus	Whisky Grass	-
Asparagus aethiopicus	Ground Asparagus	Class 4
Axonopus fissifolius	Narrow-leafed Carpet Grass	-
Bidens pilosa	Cobblers Pegs	-
Briza maxima	Quaking Grass	-
Chloris gayana	Rhodes Grass	-
Hypochaeris radicata	Catsear	-
Lantana camara	Lantana	Class 4
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	Class 4
Senna pendula var. glabrata	Cassia	-
Setaria sphacelata	South African Pigeon Grass	-
Solanum nigrum	Black-berry Nightshade	-
Stellaria media	Common Chickweed	-
Trifolium repens	White Clover	-
Verbena bonariensis	Purpletop	-
Vulpia myuros	Rat's Tail Fescue	-

APPENDIX 5. STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution
Aaron Mulcahy	BEnv Sc & Mgt MScStud (Botany) Accredited Biobanking Assessor (no.172)	Senior Ecologist	Field surveys and report writing
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation
Kristy Peters	BParkMgt (Hons)	Senior Ecologist	Report review
Shanti Mors	BSc (Hons)	Ecologist	Field surveys

APPENDIX 6 – Water Monitoring Data

Surface Water - Dam 1

	Criteria	Date					Min	Max	Average
		25 Jul 16	30 Aug 16	19 Oct 16	29 Nov 16	19 Dec 16			
pH (pH unit)	6.5 - 8.5	6.6	6.07	5.57	5.89	4.97	4.97	6.60	5.82
TSS (mg/L)	40	5	5	96	63	570	5	570	147.8
TDS (mg/L)	-	67	58	1150	1890	1595	58	1890	952
EC (µS/cm)	125-2200	107	74	317	305	335	74	335	227.6
Nitrogen (Nitrate) (mg/L)	0.35	0.01	0.01	0.01	0.02	0.26	0.01	0.26	0.06
Total Phosphorous (mg/L)	0.025	0.02	0.01	0.12	0.19	0.12	0.01	0.19	0.092
Ammonia (mg/L)	0.02	0.03	0.02	0.02	0.04	0.06	0.02	0.06	0.03
Oil and Grease (mg/L)	5	5	5	5	5	5	5	5	5
Calcium (mg/L)	-	0.3	3.4	0.7	1.1	1.5	0.3	3.4	1.4
Magnesium (mg/L)	-	1.7	4.5	4.5	7.1	8.5	1.7	8.5	5.3
Sodium (mg/L)	-	9	25	48	36	41	9	48	31.8
Potassium (mg/L)	-	1.7	2.3	1.8	2.3	3.3	1.7	3.3	2.3
Total Hardness (as $CaCO_3$)	-	8	27	20	32	39	8	39	25.2
Arsenic (mg/L)	0.024	0.0001	0.001	0.005	0.006	0.005	0.0001	0.006	0.003
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium (mg/L)	0.001	0.001	0.001	0.008	0.012	0.011	0.001	0.012	0.007
Copper (mg/L)	0.001	0.001	0.001	0.003	0.007	0.007	0.001	0.007	0.004
Nickel (mg/L)	0.011	0.001	0.001	0.001	0.002	0.003	0.001	0.003	0.002
Lead (mg/L)	0.003	0.001	0.001	0.001	0.021	0.017	0.001	0.021	0.008
Manganese (mg/L)	1.9	0.01	0.02	0.05	0.06	0.12	0.01	0.12	0.05
Vanadium (mg/L)	-	0.001	0.002	0.029	0.046	0.045	0.001	0.046	0.025
Zinc (mg/L)	0.021	0.072	0.048	0.077	0.034	0.048	0.034	0.077	0.056

Surface Water - Dam 2

	Criteria	Date		Min	Max	Average
		29 Nov 16	19 Dec 16			
pH (pH unit)	6.5 - 8.5	5.39	4.75	4.75	5.39	5.07
TSS (mg/L)	40	72	119	72	119	95.5
TDS (mg/L)	-	821	467	467	821	644
EC (µS/cm)	125-2200	520	559	520	559	539.5
Nitrogen (Nitrate) (mg/L)	0.35	0.01	0.21	0.01	0.21	0.11
Total Phosphorous (mg/L)	0.025	0.12	0.04	0.04	0.12	0.08
Ammonia (mg/L)	0.02	0.01	0.02	0.01	0.02	0.01
Oil and Grease (mg/L)	5	5	5	5	5	5
Calcium (mg/L)	-	0.6	0.5	0.5	0.6	0.6
Magnesium (mg/L)	-	4.6	3.9	3.9	4.6	4.3
Sodium (mg/L)	-	87	89	87	89	88
Potassium (mg/L)	-	2.3	2.2	2.2	2.3	2.3
Total Hardness (as $CaCO_3$)	-	21	17	17	21	19
Arsenic (mg/L)	0.024	0.004	0.003	0.003	0.004	0.004
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium (mg/L)	0.001	0.005	0.002	0.002	0.005	0.004
Copper (mg/L)	0.001	0.006	0.003	0.003	0.006	0.005
Nickel (mg/L)	0.011	0.002	0.001	0.001	0.002	0.002
Lead (mg/L)	0.003	0.011	0.006	0.006	0.011	0.009
Manganese (mg/L)	1.9	0.022	0.009	0.009	0.022	0.016
Vanadium (mg/L)	-	0.02	0.008	0.008	0.02	0.014
Zinc (mg/L)	0.021	0.034	0.072	0.034	0.072	0.053

Surface Water - Dam 3

	Criteria		Date	Min	Max	Average
		29 Nov 16	19 Dec 16			
pH (pH unit)	6.5 - 8.5	5.22	4.71	4.71	5.22	4.965
TSS (mg/L)	40	5	58	5	58	31.5
TDS (mg/L)	-	164	201	164	201	182.5
EC (µS/cm)	125-2200	260	284	260	284	272
Nitrogen (Nitrate) (mg/L)	0.35	0.01	0.01	0.01	0.01	0.01
Total Phosphorous (mg/L)	0.025	0.01	0.02	0.01	0.02	0.02
Ammonia (mg/L)	0.02	0.01	0.03	0.01	0.03	0.02
Oil and Grease (mg/L)	5	34	5	5	34	19.5
Calcium (mg/L)	-	0.3	0.3	0.3	0.3	0.3
Magnesium (mg/L)	-	1.3	1.7	1.3	1.7	1.5
Sodium (mg/L)	-	37	35	35	37	36
Potassium (mg/L)	-	0.5	1	0.5	1	0.8
Total Hardness (as $CaCO_3$)	-	6	8	6	8	7
Arsenic (mg/L)	0.024	0.001	0.001	0.001	0.001	0.001
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium (mg/L)	0.001	0.001	0.001	0.001	0.001	0.001
Copper (mg/L)	0.001	0.001	0.001	0.001	0.001	0.001
Nickel (mg/L)	0.011	0.001	0.001	0.001	0.001	0.001
Lead (mg/L)	0.003	0.001	0.001	0.001	0.001	0.001
Manganese (mg/L)	1.9	0.007	0.009	0.007	0.009	0.008
Vanadium (mg/L)	-	0.001	0.001	0.001	0.001	0.001
Zinc (mg/L)	0.021	0.005	0.005	0.005	0.005	0.005

Surface Water - SW1, SW3 and SW4

	Criteria	SW1	SW3	SW4
		19 Jan 2016	19 Jan 2016	19 Jan 2016
pH (pH unit)	6.5 - 8.5	5.6	5.4	5.7
TSS (mg/L)	40	5	6	13
TDS (mg/L)	-	230	332	219
EC (µS/cm)	125-2200	204	104	201
Nitrogen (Nitrate) (mg/L)	0.35	0.02	0.67	0.05
Total Phosphorous (mg/L)	0.025	0.06	0.01	0.05
Ammonia (mg/L)	0.02	0.01	0.01	0.01
Oil and Grease (mg/L)	5	9	5	5
Calcium (mg/L)	-	3	2	3
Magnesium (mg/L)	-	4	2	4
Sodium (mg/L)	-	29	17	29
Potassium (mg/L)	-	2	2	2
Total Hardness (as $CaCO_3$)	-	24	13	24
Arsenic (mg/L)	0.024	0.001	0.001	0.001
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0001
Chromium (mg/L)	0.001	0.004	0.005	0.002
Copper (mg/L)	0.001	0.003	0.01	0.003
Nickel (mg/L)	0.011	0.003	0.03	0.002
Lead (mg/L)	0.003	0.002	0.04	0.002
Manganese (mg/L)	1.9	0.082	0.056	0.065
Vanadium (mg/L)	-			
Zinc (mg/L)	0.021	0.014	0.015	0.011

Surface Water - SW2

	Criteria	Date				Min	Max	Average
		19 Jan 2016	25 Jul 16	30 Aug 16	19 Oct 16			
pH (pH unit)	6.5 - 8.5	4.66	5.97	5.7	5.84	4.66	5.97	5.543
TSS (mg/L)	40	5	7	5	7	5	7	6
TDS (mg/L)	-	224	191	134	160	134	224	177.25
EC (µS/cm)	125-2200	173	158	208	172	158	208	177.75
Nitrogen (Nitrate) (mg/L)	0.35	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Phosphorous (mg/L)	0.025	0.03	0.01	0.03	0.01	0.01	0.03	0.02
Ammonia (mg/L)	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Oil and Grease (mg/L)	5	5	5	5	5	5	5	5
Calcium (mg/L)	-	2	2.1	0.4	3	0.4	3	1.9
Magnesium (mg/L)	-	3	2.8	1.6	3.8	1.6	3.8	2.8
Sodium (mg/L)	-	28	18	9.3	19	9.3	28	18.6
Potassium (mg/L)	-	2	2	1.3	3.5	1.3	3.5	2.2
Total Hardness (as $CaCO_3$)	-	17	17	8	23	8	23	16.3
Arsenic (mg/L)	0.024	0.001	0.0001	0.001	0.001	0.000	0.001	0.001
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0001	0.0001	0.000	0.000	0.000
Chromium (mg/L)	0.001	0.9002	0.002	0.001	0.001	0.001	0.900	0.226
Copper (mg/L)	0.001	0.002	0.002	0.001	0.001	0.001	0.002	0.002
Nickel (mg/L)	0.011	0.002	0.001	0.001	0.001	0.001	0.002	0.001
Lead (mg/L)	0.003	0.001	0.002	0.001	0.001	0.001	0.002	0.001
Manganese (mg/L)	1.9	0.021	0.036	0.005	0.076	0.005	0.076	0.035
Vanadium (mg/L)	-		0.005	0.001	0.005	0.001	0.005	0.004
Zinc (mg/L)	0.021	0.009	0.012	0.033	0.048	0.009	0.048	0.026

Groundwater - BH 205 and BH 207

	BH 205					BH 207				
	Date		Min	Max	Average	Date		Min	Max	Average
	30 Mar 2016	3 Oct 2016				30 Mar 2016	3 Oct 2016			
Chloride (mg/L)	910	360	360	910	635	680	780	680	780	730
Conductivity (at 25Â°C) (µS/cm)	2230	1800	1800	2230	2015	2360	3200	2360	3200	2780
Nitrate & Nitrite (as N) (mg/L)	0.03	0.05	0.03	0.05	0.04	0.01	0.05	0.01	0.05	0.03
pH	6.95	7.7	7.0	7.7	7.3	6.4	7.4	6.4	7.4	6.9
Phosphate total (as P)	5.5	0.3	0.3	5.5	2.9	8.1	0.4	0.4	8.1	4.2
Sulphate (as S) (mg/L)	100	31	31	100	65.5	68	25	25	68	46.5
Total Dissolved Solids (mg/L)	1424	940	940	1424	1182	1456	1700	1456	1700	1578
Total Kjeldahl Nitrogen (as N) (mg/L)	49	1	1	49	25	6.8	0.2	0.2	6.8	3.5
Total Nitrogen (as N) (mg/L)	49	1	1	49	25	6.8	0.2	0.2	6.8	3.5
Calcium (mg/L)	71	62	62	71	66.5	31	32	31	32	31.5
Magnesium (mg/L)	40	31	31	40	35.5	38	48	38	48	43
Potassium (mg/L)	2.7	7.2	2.7	7.2	5	2	6.5	2	6.5	4.3
Sodium (mg/L)	350	220	220	350	285	460	490	460	490	475
Bicarbonate Alkalinity (as CaCO3)		360	360	360	360		220	220	220	220
Carbonate Alkalinity (as CaCO3)		10	10	10	10		10	10	10	10
Total Alkalinity (as CaCO3)	300	360	300	360	330	5	220	5	220	112.5
Benzene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
Ethylbenzene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
m&p-Xylenes (µg/L)	1	0.002	0.002	1	0.501	1	0.002	0.002	1	0.501

	BH 205					BH 207				
	Date		Min	Max	Average	Date		Min	Max	Average
	30 Mar 2016	3 Oct 2016				30 Mar 2016	3 Oct 2016			
o-Xylene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
Toluene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
Xylenes - Total (µg/L)	1.5	0.003	0.003	1.5	0.75	1.5	0.003	0.003	1.5	0.75
4-Bromofluorobenzene (surr)		102	102	102	102		81	81	81	81
TRH C10-36 (Total)		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1
TRH C10-C14 (µg/L)	50	0.05	0.05	50	25.03	50	0.05	0.05	50	25.03
TRH C15-C28 (µg/L)	530	0.1	0.1	530	265.1	200	0.1	0.1	200	100.1
TRH C29-C36 (µg/L)	200	0.1	0.1	200	100.05	200	0.1	0.1	200	100.05
TRH C6-C9 (µg/L)	40	0.02	0.02	40	20.01	40	0.02	0.02	40	20.01
Naphthalene	0.1	0.01	0.01	0.1	0.06	0.1	0.01	0.01	0.1	0.06
TRH >C10-C16		0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05
TRH >C10-C16 less Naphthalene (F2)		0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05
TRH >C16-C34		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1
TRH >C34-C40		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1
TRH C6-C10 less BTEX (F1)		0.02	0.02	0.02	0.02		0.02	0.02	0.02	0.02

Groundwater - BH 208 and BH 303

	BH 208					BH 303				
	Date		Min	Max	Average	Date		Min	Max	Average
	30 Mar 2016	3 Oct 2016				30 Mar 2016	3 Oct 2016			
Chloride (mg/L)	830	720	720	830	775	400	370	370	400	385
Conductivity (at 25Â°C) (µS/cm)	2720	3300	2720	3300	3010	1711	1400	1400	1711	1555.5
Nitrate & Nitrite (as N) (mg/L)	4	3.9	3.9	4	3.95	0.03	0.05	0.03	0.05	0.04
pH	6.33	6.4	6.33	6.4	6.37	6.08	6.7	6.08	6.7	6.39
Phosphate total (as P)	2.3	0.51	0.51	2.3	1.41	0.64	0.1	0.1	0.64	0.37
Sulphate (as S) (mg/L)	310	98	98	310	204	25	13	13	25	19
Total Dissolved Solids (mg/L)	-	2000	2000	2000	2000	1069	710	710	1069	889.5
Total Kjeldahl Nitrogen (as N) (mg/L)	6	1	1	6	3.5	8.5	0.2	0.2	8.5	4.4
Total Nitrogen (as N) (mg/L)	10	4.9	4.9	10	7.5	8.6	0.2	0.2	8.6	4.4
Calcium (mg/L)	45	42	42	45	43.5	21	13	13	21	17
Magnesium (mg/L)	44	58	44	58	51	21	21	21	21	21
Potassium (mg/L)	3.2	19	3.2	19	11.1	5.5	7.8	5.5	7.8	6.7
Sodium (mg/L)	590	510	510	590	550	270	200	200	270	235
Bicarbonate Alkalinity (as CaCO3)		77	77	77	77		120	120	120	120
Carbonate Alkalinity (as CaCO3)		10	10	10	10		10	10	10	10
Total Alkalinity (as $CaCO_3$)	64	77	64	77	70.5	100	120	100	120	110
Benzene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
Ethylbenzene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
m&p-Xylenes (µg/L)	1	0.002	0.002	1	0.501	1	0.002	0.002	1	0.501

	BH 208					BH 303				
	Date		Min	Max	Average	Date		Min	Max	Average
	30 Mar 2016	3 Oct 2016				30 Mar 2016	3 Oct 2016			
o-Xylene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
Toluene (µg/L)	0.5	0.001	0.001	0.5	0.25	0.5	0.001	0.001	0.5	0.25
Xylenes - Total (µg/L)	1.5	0.003	0.003	1.5	0.75	1.5	0.003	0.003	1.5	0.752
4-Bromofluorobenzene (surr)		91	91	91	91		100	100	100	100
TRH C10-36 (Total)		0.1	0.1	0.1	0.1		1	1	1	1
TRH C10-C14 (µg/L)	500	0.05	0.05	500	250.03	50	0.05	0.05	50	25.03
TRH C15-C28 (µg/L)	2000	0.1	0.1	2000	1000.1	1400	1	1	1400	700.5
TRH C29-C36 (µg/L)	2000	0.1	0.1	2000	1000.1	200	0.1	0.1	200	100.1
TRH C6-C9 (µg/L)	40	0.02	0.02	40	20.01	40	0.02	0.02	40	20.01
Naphthalene	1	0.01	0.01	1	0.51	0.1	0.01	0.01	0.1	0.06
TRH >C10-C16		0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05
TRH >C10-C16 less Naphthalene (F2)		0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05
TRH >C16-C34		0.1	0.1	0.1	0.1		1	1	1	1
TRH >C34-C40		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1
TRH C6-C10 less BTEX (F1)		0.02	0.02	0.02	0.02		0.02	0.02	0.02	0.02

APPENDIX 7 – Pre – Clearance Survey

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3 February 2017
Document No: NCA17R53678

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Delivered by email: Tim.Grugeon@hunterquarries.com.au

Subject: **Vegetation Clearing Completion Report for Stage 1 of the Karuah East Quarry Project**

Background and Scope

The Karuah East Quarry (KEQ) Project was subject to an assessment under part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The project was approved by the Planning Assessment Commission on 17 June 2014 subject to conditions set out in Schedules 2 to 5 of the Project Approval (09_0175). A referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the project was also lodged with the Department of the Environment (DotE) on 29 July 2014 (EPBC 2014/7282). On 25 August 2014 the project was determined as a Controlled Action under the EPBC Act requiring further assessment subject to the controlling provision 'listed threatened species and communities'. The action was approved by DotE on 20 March 2015 subject to 17 conditions of approval.

Condition 32 of the NSW Project Approval requires the preparation and implementation of a Landscape and Rehabilitation Management Plan (L&RMP) for the KEQ project area. This L&RMP was prepared by SLR (2015) with input from Kleinfelder, and subsequently approved by the NSW Department of Planning and Environment (DP&E) on 14 December 2015. The L&RMP details pre-clearing survey requirements and vegetation clearing protocol that must be implemented to minimise impacts on native fauna and adjacent vegetation, threatened species and fauna habitats during the clearing process. The L&RMP was also prepared to incorporate other mitigation measures specified in the Commonwealth conditions of approval (EPBC 2014/7282), including specific pre-clearing survey protocol for Koalas.

Kleinfelder were engaged by Karuah East Quarry Pty Ltd to undertake pre-clearing surveys and supervise the clearing of native vegetation for the Karuah East Quarry (KEQ) Project in 2016. This report has been prepared to detail the methods and results of the pre-clearing surveys and vegetation clearing supervision activities conducted to date in accordance with Section 6.3.6 of the L&RMP (SLR 2015).

Vegetation clearing for the KEQ Project commenced in April 2016 and the majority of the KEQ project area was cleared between April and June 2016, with some clearing also

occurring in July and November 2016 (total of approximately 21.4 ha). For the purposes of this report, the vegetation clearing completed to date within the project area is referred to as Stage 1. The remaining vegetation within the northern part of the project area (approximately 10.2 ha) is unlikely to be cleared for some time as the areas cleared to date contain andesite resources that will take at least several years to extract. The extent of the Stage 1 clearing area, and the extent of the project disturbance area and adjoining KEQ biodiversity offset area are shown in **Figure 1**.

Pre-clearing Surveys

Habitat Features and Weeds

Two Kleinfelder ecologists conducted systematic pre-clearing surveys across the KEQ project area on 29, 30 and 31 March and 1 and 4 April 2016 to identify habitat features for native fauna (hollow-bearing trees, dead stags and hollow ground logs) and areas of major weed infestation. These surveys were undertaken in accordance with Section 6.2.2 and 6.2.3 of the L&RMP.

The locations of all habitat features were recorded with a GPS unit, and all habitat features were identified with blue or orange flagging tape and marked with a 'H' using spray paint. The boundaries of major weed infestations (i.e. Lantana) were also recorded with a GPS unit and delineated with flagging tape.

A total of 160 potential hollow-bearing trees, 114 dead stags and 61 ground logs were identified during the pre-clearing surveys. The locations of the habitat features and major weed infestations identified during the pre-clearing surveys are shown on **Figure 2**.

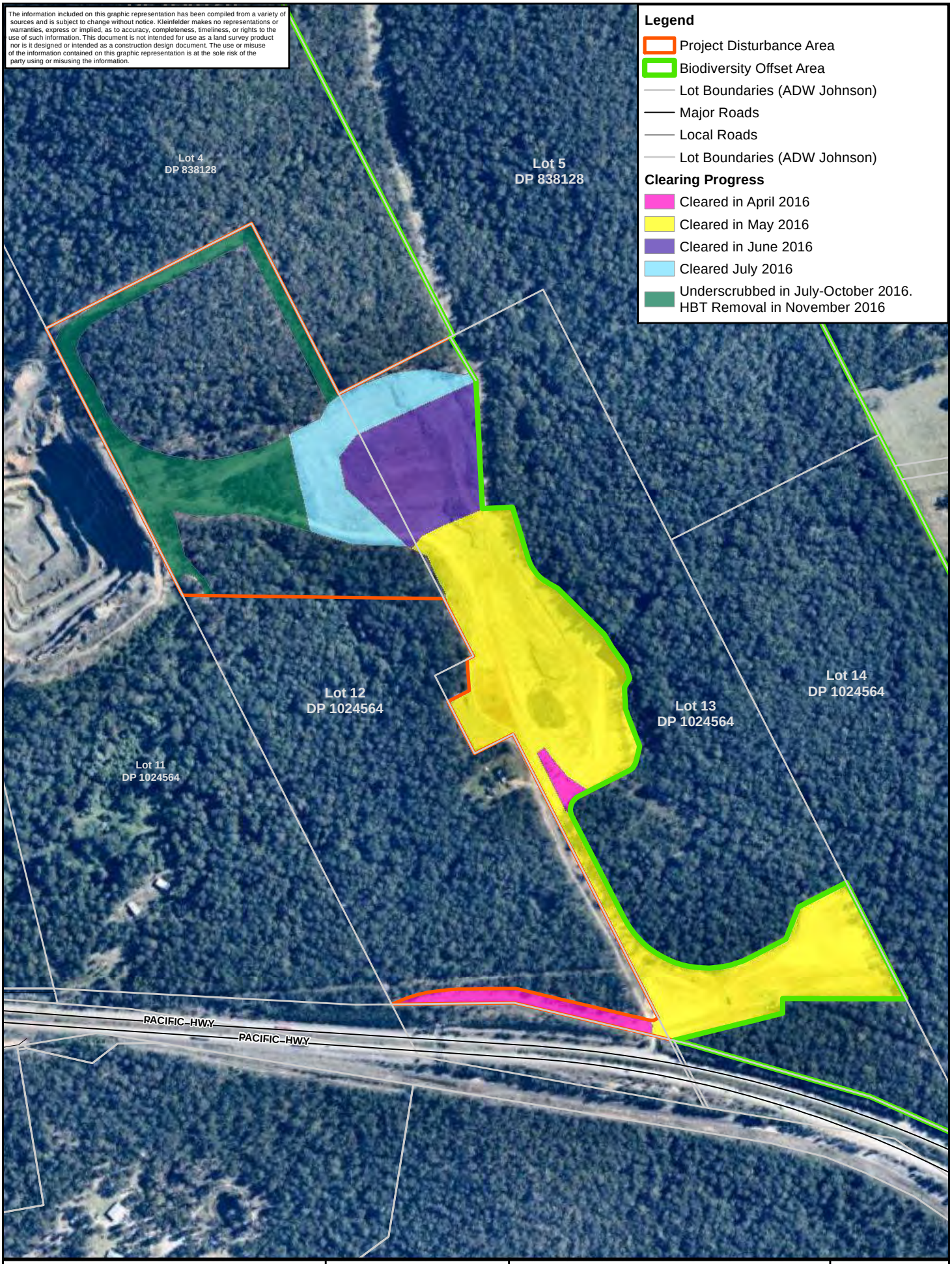
Pre-clearing Surveys for Koala

On the morning of each day Kleinfelder were engaged to undertake clearing supervision, a Kleinfelder ecologist conducted a pre-clearing survey of the planned clearing area to identify any Koalas that may be present. These surveys involved visual searches of the tree canopies, and inspecting the bases of trees for Koala scats. No Koalas were observed in the project disturbance area during pre-clearance surveys or during clearing supervision.

Additional Pre-clearing Surveys – Fauna

Section 6.2.4 of the L&RMP specifies that additional pre-clearing fauna surveys must be conducted in each planned clearing area if vegetation clearing is undertaken between June to August, or October to February. These pre-clearing fauna surveys were undertaken at the end of May/ beginning of June 2016 within the remaining areas to be cleared. These additional surveys were not required during March, April and May 2016 clearing operations.

The pre-clearing fauna surveys were undertaken in accordance with Section 6.2.4 of the L&RMP. Details of the survey methods and results are provided in the following subsections.



Metres
0 25 50 100 150 200 250

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PROJECT REFERENCE: 20172280

DATE DRAWN: 2/02/2017 15:36 Version 1

DRAWN BY: gjoyce

DATA SOURCE:
LPI - 2015
ADW Johnson - 2015
nearmap - 2016

Current Extent of Clearing within the Karuah East Quarry Project Area (Stage 1)

Karuah East Quarry Pty Ltd
Vegetation Clearing Completion Report
Karuah East Quarry Project

FIGURE:
1

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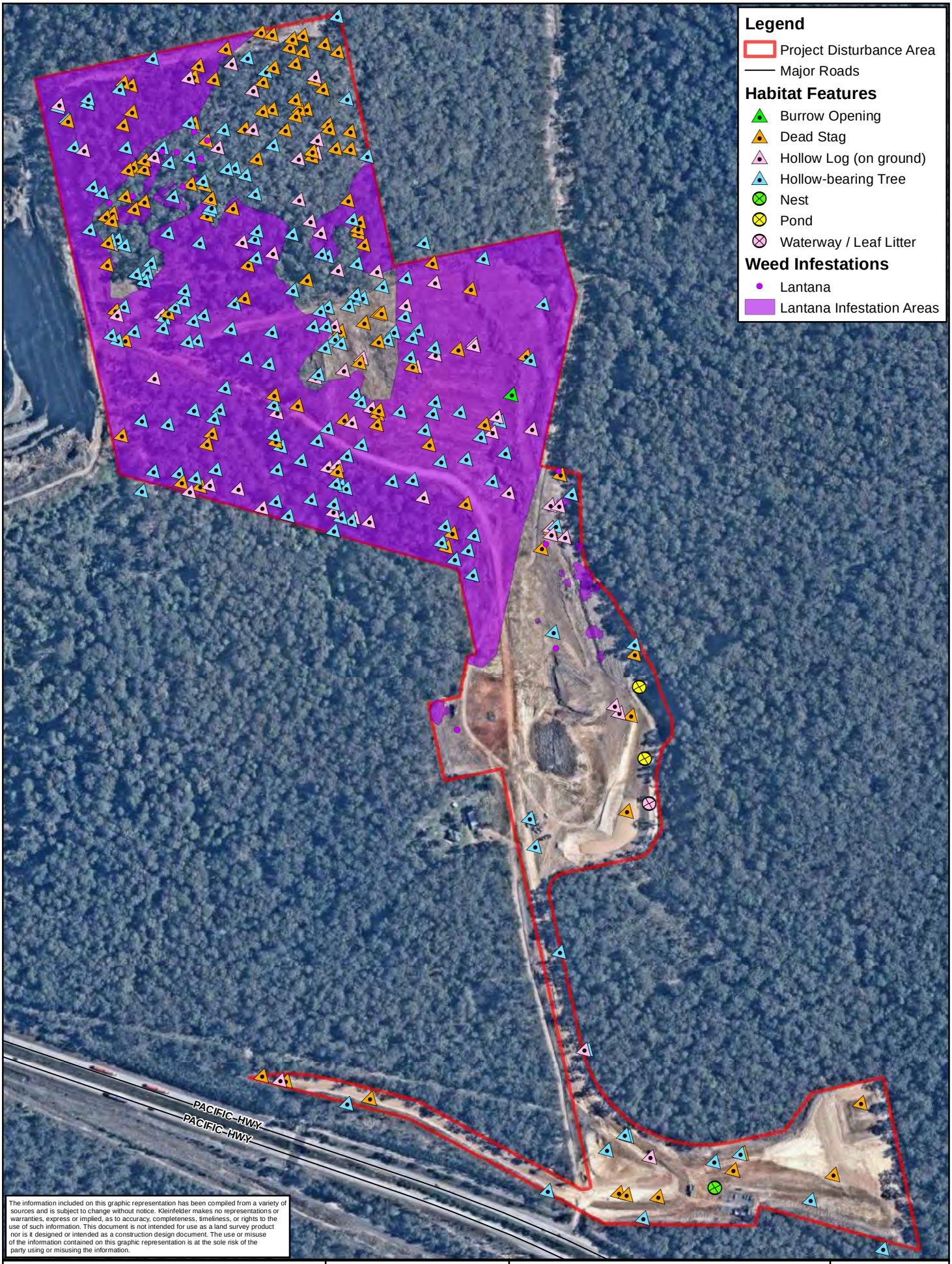

Metres
0 25 50 100 150 200 250

N

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PROJECT REFERENCE: 20164782
DATE DRAWN: 3/02/2017 11:04 Version 1
DRAWN BY: amulcahy

DATA SOURCE:
LPI - 2015
ADW Johnson - 2015
Nearmap - 2016

Pre-clearing Survey - Habitat Features and Major Weed Infestations

Karuah East Quarry Pty Ltd
Karuah East Pre-clearing Survey
Karuah East Quarry Project

FIGURE:
2

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Elliot Trapping

Two fauna trapping transects were established within the planned clearing area for four nights from 30 May to 3 June 2016. Each transect consisted of 16 terrestrial Elliott A traps and eight arboreal Elliott B traps, which were placed along each of the transects at regular intervals (total of 128 terrestrial Elliot trap nights and 64 arboreal Elliot trap nights across the two transects within the planned clearing area). All traps were baited using a mixture of peanut butter, honey, oats and vanilla essence. The locations of the fauna trapping transects are shown on **Figure 3**.

One native mammal species and one introduced mammal species were captured during the pre-clearance trapping: Brown Antechinus (*Antechinus stuartii*) and Black Rat (*Rattus rattus*), respectively. A total of nine Brown Antechinus were captured and relocated into the adjoining biodiversity offset area over the four nights (**Figure 3**). Additionally, one Black Rat was captured and humanely euthanised. No threatened fauna species were recorded during the trapping surveys.

Diurnal Fauna Searches

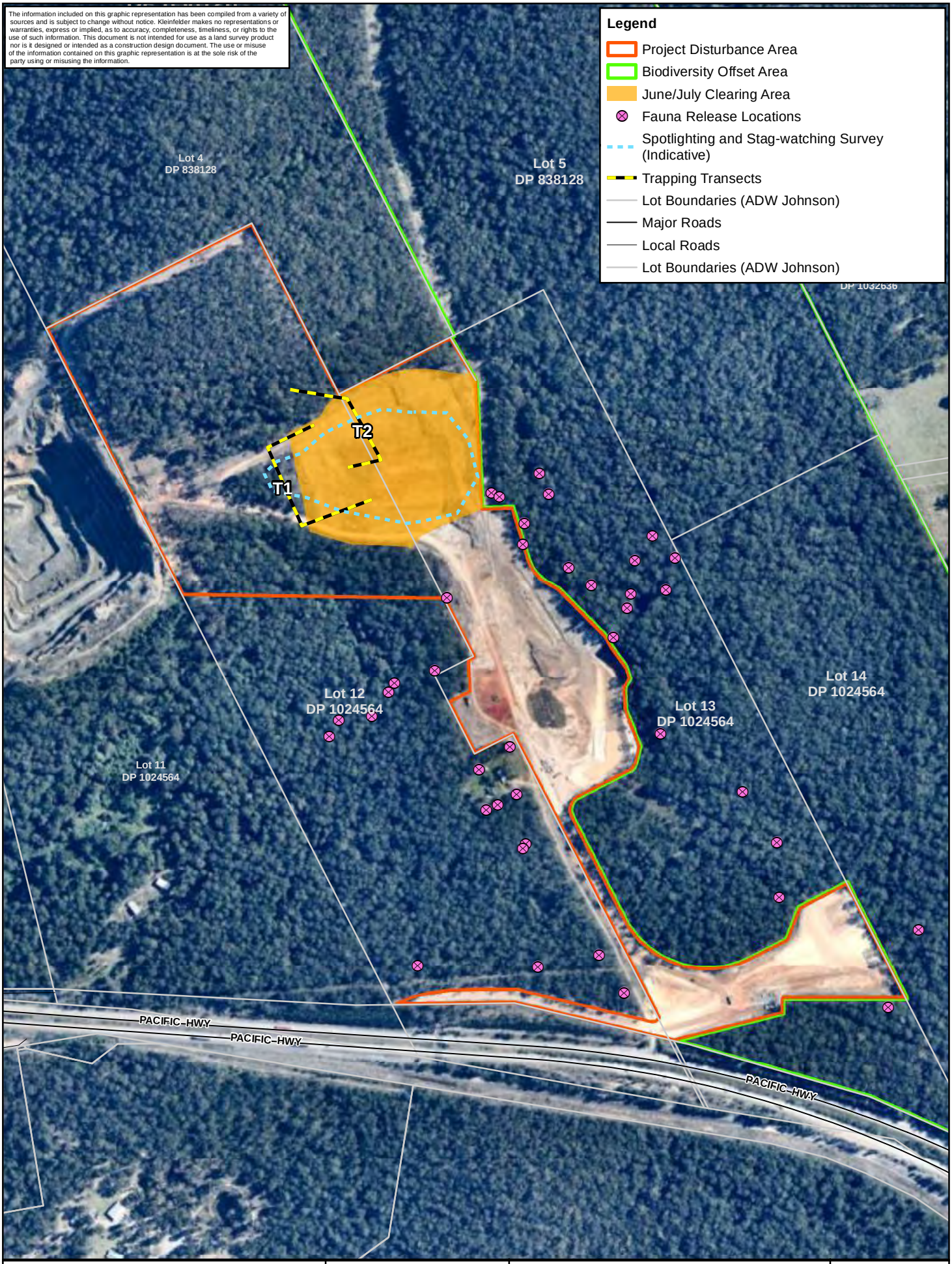
Diurnal searches for signs of threatened fauna species known from the locality were undertaken as part of daily pre-clearance surveys prior to commencement of clearing. These surveys primarily focused on searching for signs of roosting or nesting threatened raptors and forest owl species (e.g. Powerful Owl and Masked Owl) such as whitewash and owl pellets (regurgitated hair and bone).

No evidence of raptor or owl nesting or roosting sites were identified during the diurnal pre-clearance surveys. Additionally, no raptors or owls (or their nests) were recorded during the vegetation clearing supervision.

Spotlighting and Stag Watching

Spotlighting and stag watching were undertaken over a two night period (30 and 31 May 2016) within the planned clearing area to identify any hollow-bearing trees with occupying fauna. In particular, these surveys were undertaken to identify potential microchiropteran bat roost trees.

No microchiropteran bats or other native fauna were specifically recorded emerging from the habitat trees that were observed during stag-watching and spotlighting surveys. The locations of the spotlighting and stag-watching surveys are shown on **Figure 3**.



Metres
0 25 50 100 150 200 250

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nearmap - 2016

Pre-clearing Fauna Survey Locations and Fauna Release Locations

Karuah East Quarry Pty Ltd
Vegetation Clearing Completion Report
Karuah East Quarry Project

FIGURE:
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Vegetation Clearing Supervision

Summary of Clearing Supervision Activities

Qualified, trained and experienced Kleinfelder ecologists were present to supervise clearing within the KEQ project area for a total of 38 days between the 27 April 2016 and the 23 June 2016, and including one day on 18 July 2016 and one day on 21 November 2016. A summary of the clearing supervision activities undertaken during this period are provided in **Table 1**. A summary of the qualifications and experience of each supervising ecologist is also provided in **Appendix 1**.

Table 1: Summary of vegetation clearing supervision activities for Stage 1 of the KEQ Project

Dates	Supervising Ecologist	Clearing Activities Supervised
26-29 April 2016	Steve Williams	Under-scrubbing, tree removal, and habitat tree removal
2-6 May 2016	Mark Dean and Frederick Rainsford	Under-scrubbing, tree removal, and habitat tree removal
9-13 May 2016	Steve Williams and Frederick Rainsford	Under-scrubbing, tree removal, and habitat tree removal
16-20 May 2016	Steve Williams and Mark Dean	Under-scrubbing, tree removal, and habitat tree removal
23-27 May 2016	Steve Williams and Frederick Rainsford	Under-scrubbing, tree removal, and habitat tree removal
30 May – 3 June 2016	Steve Williams and Tim Buckley	Under-scrubbing, tree removal, and habitat tree removal
8-10 June 2016	Steve Williams	Under-scrubbing, tree removal, and habitat tree removal
14-15 June 2016	Steve Williams	Under-scrubbing, tree removal, and habitat tree removal
22-23 June 2016	Steve Williams	Under-scrubbing, tree removal, and habitat tree removal
18 July 2016	Frederick Rainsford	Habitat tree removal
21 November 2016	Steve Williams	Habitat tree removal

Vegetation Clearing Procedures

Section 6.3 of the L&RMP (SLR 2015) details the procedures that must be adhered to when undertaking clearing activities for the KEQ Project. Key responsibilities undertaken by the supervising ecologists included:

- Direct and advise the clearing contractor to ensure vegetation clearing and habitat tree removal was undertaken in accordance with Sections 6.3.1, 6.3.2 and 6.3.3 of the L&RMP, and in a manner that minimises potential harm or impacts to native fauna and adjacent vegetation/habitats;
- Ensuring all habitat trees were left standing for a minimum of two nights after the surrounding vegetation had been cleared prior to removal;
- Locate, rescue and relocate any fauna that may be impacted by the clearing operations in accordance with Section 6.3.4 of the L&RMP;
- Advise the clearing contractor to stockpile vegetative materials and soil infested with weeds (i.e. Lantana) separately; and

- Advise the clearing contractor of hollow-bearing trees and other habitat features that should be for salvaged for redistribution into the rehabilitation or offset areas.

Clearing of vegetation was undertaken at only one location at a time, and as such only one ecologist was engaged to supervise the vegetation clearing each day. Clearing works were generally undertaken between 7 am and 5 pm during daylight hours.

Hollow-bearing Tree Removal

Section 6.3.3 of the L&RMP (SLR 2015) details the procedures that must be adhered to when undertaking habitat tree removals for the KEQ Project. All hollow-bearing trees and dead stags were left standing for a minimum of two nights after the surrounding vegetation had been cleared.

Hollow-bearing trees were felled using an excavator which enabled the direct and speed of the tree felling to be controlled. Hollow-bearing trees were felled in accordance with the 'soft-felling' procedure as follows:

- Hollows of the marked habitat trees were located by the supervising ecologist;
- The supervising ecologist consulted the machine operator to discuss the direction of felling and potential safety issues;
- The hollow-bearing tree was given several nudges with the excavator to give a warning to any occupying native fauna;
- The hollow-bearing tree was then carefully watched and any native fauna present is given an opportunity to self-relocate before the tree is felled;
- The hollow-bearing tree was then soft felled with the rate of the trees' fall controlled by the machinery operator to minimise impact;
- Once the tree had been felled, all hollows were inspected by the supervising ecologist for native fauna species, and where found, the animal(s) were safely captured and relocated in accordance with Section 6.3.4 of the L&RMP.

A total of 63 confirmed habitat trees (comprising 48 hollow-bearing trees and 15 dead stags) were felled during the clearing supervision. It is noted that the number of potential habitat trees identified within the Stage 1 area during the pre-clearance surveys was higher than that observed during the clearing supervision. This is due to the conservative approach that was taken when the pre-clearance surveys were completed. A relatively high number of trees marked as potential habitat trees during the pre-clearance surveys were found to have termite infestation or branches that appeared to be hollow from the ground but on inspection did not have sufficient depth (i.e. < 10 cm deep) to provide suitable habitat for fauna.

Fauna Rescue and Relocation

A total of 54 native animals comprised of 15 species were safely captured and relocated during the clearing operations. None of the species captured or observed during clearing are listed as threatened under the NSW *Threatened Species Conservation Act 1995* (TSC Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

All captured fauna were released at an appropriate time of day/night (depending on the species' ecology) and were released into adjoining areas native vegetation that are subject to long-term conservation measures (i.e. KEQ biodiversity offset area and the conservation area on Lot 12 DP 1024564). The fauna release locations are shown on **Figure 3**.

Table 2: Summary of fauna rescued and relocated during clearing works

Date	Scientific Name	Common Name	Count	Source
27/04/2016	*Litoria peronii*	Peron's Tree Frog	1	Ground
29/04/2016	*Lampropholis delicata*	Delicate Skink	2	Hollow log and leaf litter
03/05/2016	*Lampropholis delicata*	Delicate Skink	3	Leaf litter
10/05/2016	*Lampropholis delicata*	Delicate Skink	1	Leaf litter
11/05/2016	*Petaurus breviceps*	Sugar Glider	2	Hollow-bearing tree
12/05/2016	*Lampropholis delicata*	Delicate Skink	1	Leaf litter
16/05/2016	*Lampropholis delicata*	Delicate Skink	1	Leaf litter
17/05/2016	*Petaurus breviceps*	Sugar Glider	1	Hollow-bearing tree
	Lampropholis delicata	Delicate Skink	2	Leaf litter
	Hemiaspis signata	Marsh Snake	1	Leaf litter/grass
18/05/2016	*Lampropholis delicata*	Delicate Skink	2	Leaf litter
	Litoria fallax	Eastern Dwarf Tree Frog	1	Grass
19/05/2016	*Varanus varius*	Lace Monitor	1	Hollow-bearing tree
20/05/2016	*Dendrelaphis punctulata*	Common Tree Snake	4	Hollow-bearing tree
23/05/2016	*Lampropholis delicata*	Delicate Skink	2	Leaf litter
25/05/2016	*Lampropholis delicata*	Delicate Skink	1	Leaf litter
26/05/2016	*Lampropholis delicata*	Delicate Skink	2	Leaf litter
	Amphibolurus muricatus	Jacky Lizard	1	Ground
30/05/2016	*Varanus varius*	Lace Monitor	1	Hollow-bearing Tree
01/06/2016	*Litoria peronii*	Peron's Tree Frog	1	Hollow-bearing Tree
03/06/2016	*Litoria peronii*	Peron's Tree Frog	1	Hollow-bearing Tree
14/06/2016	*Litoria peronii*	Peron's Tree Frog	1	Hollow-bearing Tree
	Antechinus stuartii	Brown Antechinus	5	Hollow-bearing Tree
	Morelia spilota	Diamond Python	1	Hollow-bearing Tree
	Nebulifera robusta	Robust Velvet Gecko	1	Hollow-bearing Tree
18/07/2016	*Litoria peronii*	Peron's Tree Frog	4	Hollow-bearing Tree
	-	Gecko	1	Hollow-bearing Tree
21/11/2016	*Litoria peronii*	Peron's Tree Frog	5	Hollow-bearing Tree
	Eulamprus tenuis	Bar-sided Skink	2	Hollow-bearing Tree
	Nebulifera robusta	Robust Velvet Gecko	1	Hollow-bearing Tree
	Trichosurus vulpecula	Common Brushtail possum	1	Hollow-bearing Tree (self-relocated)

Fauna Injuries and Mortalities

A total of three fauna deaths occurred during the Stage 1 clearing operations. **Table 2** provides details of the fauna deaths.

Table 3: Fauna injuries and mortalities

Date	Scientific Name	Common Name	Count	Source	Injury or Mortality	Details
26/05/2016	*Cacophis squamulosus*	Golden-crowned Snake	1	On ground in clearing zone	Mortality	Remains found after under-scrubbing
14/07/2016	*Varanus varius*	Lace Monitor	1	Felled tree hollow	Fatal injury	Found under felled habitat tree. No movement in hind limbs or tail due to spinal injury. Animal was humanely euthanised onsite due to the severity of the injury.
18/07/2016	*Morelia spilota*	Diamond Python	1	Felled tree hollow	Mortality	Found dead in felled habitat tree.

Nest Boxes

A total of 30 nest boxes were installed within the KEQ biodiversity offset area (BOA) prior to commencement of vegetation clearing as per Section 3.8 of the KEQ Biodiversity Offset Area Management Plan (BOAMP) (Kleinfelder 2015). Further details of this nest box installation is provided in the 2016 Annual Monitoring Report for the KEQ BOA (Kleinfelder 2016).

Section 6.3.3 of the L&RMP indicates:

> *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 of the L&RMP), a nest box will be installed for each hollow lost (1:1 ratio) within the offset area in accordance with the Nest Box Installation and Monitoring Protocol detailed in the BOAMP (Kleinfelder 2015).*

Within the 63 confirmed habitat trees that were felled during the Stage 1 clearing operations, a total 202 hollows were recorded. It is noted that KEQ have salvaged a total of 77 hollows and hollow sections during the clearing operations, and are in the process of preparing these for redistribution and installation within the BOA (see Section 3.5 of Kleinfelder [2016] for further details). Providing all of these 77 salvaged hollows are installed in the BOA (and accounting for the 30 nest boxes already installed), a total 95 additional nest boxes are required to be installed within the KEQ BOA for the Stage 1 clearing works.

As prescribed in the BOAMP, a range of nest box designs should be installed to compensate for the loss of hollows comprised of range of sizes. These nest boxes would provide suitable habitat for the suite of hollow-dependent fauna (including threatened species) known or likely to occur in the BOA.

Conclusion

Kleinfelder were engaged by Karuah East Quarry Pty Ltd to undertake pre-clearing surveys and supervise the clearing of native vegetation for the Karuah East Quarry (KEQ) Project in 2016.

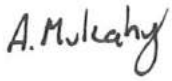
Pre-clearing surveys for habitat features and major weed infestations were undertaken in March/April 2016. Pre-clearing surveys targeting Koalas were also undertaken by Kleinfelder each morning prior to supervising the clearing works. Additional pre-clearing fauna surveys involving Elliot trapping, diurnal searches, and nocturnal surveys (spotlighting and stag-watching) were also undertaken in late May/ June 2016 in accordance with the L&RMP.

Vegetation clearing for the KEQ Project commenced in April 2016 and the majority of the KEQ project area was cleared between April and June 2016, with some clearing also occurring in July and November 2016. Approximately 21.4 ha of land within the KEQ project area was cleared during the Stage 1 works. A total of 63 confirmed habitat trees (comprising 48 hollow-bearing trees and 15 dead stags) were felled during the Stage 1 clearing supervision. These 63 habitat trees contained a total of 202 hollows.

A total of 54 native animals comprised of 15 species were safely captured and relocated during the clearing operations. Only three fauna deaths occurred during the clearing operations. None of the species captured or observed during pre-clearing surveys or clearing supervision are listed as threatened under the TSC Act or EPBC Act.

Should you have any queries please contact me on the contact details provided above.

Sincerely,



Aaron Mulcahy
Senior Ecologist
Kleinfelder Australia Pty Ltd

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Kleinfelder (2015). *Biodiversity Offset Area Management Plan: Karuah East Quarry Project*. Prepared for Karuah East Quarry Pty Ltd, January 2016.

Kleinfelder (2016). *2016 Annual Monitoring Report: Karuah East Quarry Biodiversity Offset Area and Lot 12.* Prepared for Karuah East Quarry Pty Ltd, November 2016.

SLR (2015). *Landscape and Rehabilitation Management Plan, Karuah East Quarry*. Prepared for Karuah East Quarry Pty Ltd, July 2015.

APPENDIX 1: STAFF QUALIFICATIONS

Name	Title	Qualifications and Experience	Contribution
Aaron Mulcahy	Senior Ecologist	• BEnvSc & Mgt • MScStud (Botany) • Respond to Wildlife Emergencies (AHCFAU301A) • Advanced Snake Handling Training (SSSafe)	Report writing and project management
Feach Moyle	Principal Ecologist	• BSc (Hons) • DipAppSc • Respond to Wildlife Emergencies (AHCFAU301A) • Advanced Snake Handling Training (SSSafe) • Over 20 years' experience conducting fauna surveys	Nocturnal surveys
Frederick Rainsford	Ecologist	• BEnvSc & Mgt (Hons) • GradCert Ornithology • Respond to Wildlife Emergencies (AHCFAU301A) • Advanced Snake Handling Training (SSSafe) • 3 years' experience undertaking clearing supervision	Pre-clearing surveys and clearing supervision
Luke Foster	Senior Ecologist	• BEnvSc & Mgt • MEnvMgt (Wildlife Ecology) • Respond to Wildlife Emergencies (AHCFAU301A) • Advanced Snake Handling Training (SSSafe) • 7 years' experience undertaking fauna surveys and clearing supervision	Pre-clearing surveys (trapping)
Mark Dean	Ecologist	• BEnvSc & Mgt • Respond to Wildlife Emergencies (AHCFAU301A) • Advanced Snake Handling Training (SSSafe) • 4 years' experience in animal handling and clearing supervision	Pre-clearing surveys and clearing supervision
Steve Williams	Ecologist	• BSc (Ecology) • Respond to Wildlife Emergencies (AHCFAU301A) • Advanced Snake Handling Training (SSSafe) • 6 years' experience in fauna surveys and clearing supervision	Pre-clearing surveys and clearing supervision
Tim Buckley	Ecologist	• BSc (Park and Wildlife Biology) • Respond to Wildlife Emergencies (AHCFAU301A) • Advanced Snake Handling Training (SSSafe) • 3 years' experience in animal handling and clearing supervision	Pre-clearing surveys (trapping and nocturnal surveys) and clearing supervision

APPENDIX 8 – *Tetratheca juncea* Monitoring

TETRATHECA JUNCEA MONITORING REPORT FOR THE KARUAH EAST QUARRY SITE (PROJECT APPROVAL 09-0175)

Prepared by:

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Site Details:	*Tetratheca juncea* Monitoring Report
Prepared by:	***Sarah Jones B.Env.Sc.,G.Dip.DBPA (Design in Bushfire Prone Areas)*** ***Firebird ecoSultants Pty Ltd*** **A**BN – 16 105 985 993 PO Box 354, Newcastle NSW 2300 M: 0414 465 990 Email: sarah@firebirdeco.com.au T: 02 4910 3939 Fax: 02 4929 2727
Prepared for:	Karuah East Quarry Pty Ltd
Reference No.	*Tetratheca juncea* Translocation - Karuah East
Document Status & Date:	February 2017 March 2017

ABBREVIATIONS

DA	*Development Application*
EPA Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GPS	*Global Positioning System*
OEH	*NSW Office of Environment and Heritage*
PA	*Project Approval*
PPR	*Preferred Project Plan*
RMS	*NSW Roads and Maritime Service*
TJMP	*Tetratheca juncea Management Plan*

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1 INTRODUCTION

Firebird ecoSultants has been engaged by Karuah East Pty Ltd to monitor the success of the translocation of the *Tetratheca juncea* in accordance with the Translocation Plan for *Tetratheca juncea* at Kaurah East Quarry prepared by Firebird ecoSultants (July 2015) to satisfy the requirements of the Project Approval (PA 09_0175) granted on 17 June 2014 for the Karuah East Quarry Project (Karuah East).

The new of the Karuah East Quarry Project required a translocation program to be implemented for threatened species *Tetratheca juncea*. The approved quarry expansion includes a biodiversity offset conservation area adjacent to the existing quarry. This area has been investigated during the approval process and found 6324 clumps of *Tetratheca juncea*. At the time of the original survey it was found that the approved impact area was found to have 243 clumps of *Tetratheca juncea.* However, at the time of translocation 367 individuals were recorded in the May 2016 surveys. It is acknowledged that translocation is not a mitigation measure and is considered as a supplementary action due to low certainty of success. However, in this instance, translocation is being proposed as an additional measure to gain a better biodiversity outcome. Translocation of the individuals to be impacted from within the impact area to the offset site will assist in protecting the genetic diversity of the population. Translocation has been successfully undertaken for *Tetratheca juncea* previously at other sites with a moderate survival rate of 27% after 5 years (Lake Macquarie City Council, 2013).

Alex Picton (Firebird, ecologist) and Nicolas Alexander (Firebird, ecologist) aided in the removal of 367 *T.juncea* individuals during their excavation from the impact site on the 11 May 2016 till the 23rd May 2016. The 367 individuals were translocated into pre-prepared areas within the proposed offset site now referred to as the Translocation Site within this report. An area of 2,500m^2 to 3,000m^2 has been identified in Lot 14 as the Translocation Site. Refer to Figure 3-3 showing location of Translocation Site. The Translocation Site has been selected to ensure that an appropriate vegetation community and aspect would be provided. The *Tetratheca juncea* removed from the impact area (being 367 clumps) were placed within this identified Translocation Site to ensure that translocation success is as high as possible, and replicates the source environment as much as practicable.

2 TRANSLOCATION PREPARATION

2.1 Marking Plants

Three hundred and sixty seven clumps of *Tetratheca juncea* were removed from the impact site that were translocated as part of the development approval. The collection method entailed digging within the Translocation Site before collecting a translocation section form the impact area and placing the section into the hole within the Translocation Site. Site preparation included the removal of threatening processes that may impact upon the success of plant survival. These include weed control, protection from herbivory and management of fire risks. An irrigation system was installed to ensure moisture levels remain adequate for plant survival.

Removal of the plants were undertaken in patches that included numerous clumps. Each of these patches are referred to as a translocation section with Rows A1-A30 and B1-B14 the number of individuals were recorded for each row. Refer to Table 2-1 for results of number of individuals plants in each row.

Table 2-1 Number of *T. juncea* translocated

Row	Count of Tetratheca juncea
A1	6
A2	5
A3	5
A4	4
A5	6
A6	8
A7	4
A8	7
A9	5
A10	5
A11	8
A12	7
A13	4
A14	6
A15	6
A16	6
A17	10
A18	11
A19	10
A20	10
A21	8
A22	9
A23	8

Row	Count of Tetratheca juncea
A24	8
A25	12
A26	16
A27	13
A28	11
A29	10
A30	11
B1	11
B2	9
B3	11
B4	7
B5	6
B6	11
B7	9
B8	10
B9	9
B10	11
B11	10
B12	9
B13	12
B14	3
Total	**367**

The following methods were employed for the translocation program:

- An excavator was used to dig the plants out of the ground in large scoops. This ensured the plant would be removed with large root balls and soil from the source area.
- The excavator operator would carefully slide the plants with the clump of soil from the excavator's bucket onto the bucket of a front end loader.
- Once the front end loader was filled with approximately 6 excavator scoops, the driver would carefully transport the plants to the translocation area. The plants and soil from source area were carefully slid from the loader bucket by a labourer into the prepared holes.
- The area was watered immediately. The translocation sections received follow up watering to ensure establishment.

3 MONITOING

Monitoring of the *T. juncea* individuals in accordance with the Translocation Plan for *T. juncea* (Firebird, 2015) was undertaken in October 2016. Monitoring involved the following:

- Flower Counts
- Observe general plant health
- Identify all plants within each Section
- Photo points

The results are displayed in Table 3-1 showed that of the 367 individuals translocated 319 had survived and were showing signs of regrowth &/ or in flower. This presents a survival rate of **86%**. Refer to Appendix A for results of number of flowers and general observation of the health of the plants translocated. Refer to Appendix B for Photos.

Table 3-1 Number of T.juncea plants recorded during the October 2016 survey

Row Number	No Translocated in May 2016	Monitoring Results October 2016	Flower Count
A1	6	6	Plant 1: 2 flowers, Plant 2: >30 Flowers, Plant 3 2 lots of buds, Plant 4: 3 flowers and buds about to flower, Plant 5: 2 flowers, Plant 6: 2 flowers
A2	5	0	None
A3	5	5	Plant 1 : 2 Floers Plants 2- 5 No flowers
A4	4	5	Plant 1: 4 Flowers and budding, Plant 2-5 No flowers but budding
A5	6	3	Plant 1 - NO flowers, Plant 2 - 3: 2 flowers
A6	8	8	Plants 1-8 Two flowers and budding
A7	4	4	Plants 1-4 No flowers
A8	7	9	Plant 1 - 2 flowers, Plant 2: 1 Flower, Plant 3: Regrowth, Plant 4: 4 flowers, Plant 5: 2 flowers, Plant 6: 20 Flowers, Plant 7: 10 Flowers, Plant 8: 5 flowers, Plant 9: 1 Flower
A9	5	5	Plant 1: 2 flowers, Plant 2: 3 flowers, Plant 3: No flowers, Plant 4: No fruiting, between but looks like re-sprouting, Plant 5: Two flowers
A10	5	3	Plant 1: Brown + re-sprouting green, Plant 2: 4 flowers, Plant 3: O/BR

Row Number	No Translocated in May 2016	Monitoring Results October 2016	Flower Count
A11	8	7	Plant 1: 8 Flowers, Plant 2=Fresh regrowth, Plant 3: O/BR, Plant 4Ö/BR, Plant 5: O/BR, Plant 6: Green regrowth, Plant 7: 3 flowers, Plant 8: Regrowth
A12	7	8	
A13	4	4	Plant 1: O/BR, Plant 2: > 40 Flowers, Plant 3: O/BR, Plant 4: O/BR
A14	6	6	Plant 1: regrowth, Plant 2: O/BR, Plant 3: regrowth, Plant 4: 1 flowers, Plant 5: O/BR, Plant 6: O/BR.
A15	6	6	Plant1: 12 Flowers and numerous buds, Plant 2: Regrowth, Plant 3: Regrowth, Plant 4: 1 Flower, Plant 5: 1 Plant 6: Regrowth 5 Flowers and numerous buds,
A16	6	4	Plant 1: Regrowth, Plant 2: 3 Flowers, Plant 3: Regrowth, Plant 4: > 20 Flowers, Plant 5: >12 Flowers, Plant 6: 3 flowers
A17	10	4	Plant 1: 1 flower, Plant 2: 5 Flowers, Plant 3: 1 Flower, Plant 4: Regrowth
A18	11	11	Plant 1: 1 Flower, Plant 2: 5 Flowers, Plant 3: 1 Flower, Plant 4: 3 lots of buds, Plant 5: 10 Flowers, Plant 6: 7 flowers, Plant 7: >20 Flowers, Plant 8 8 Flowers, Plant 9: 4 Flowers, Plant 10: 6 Flowers, Plant 11: 4 Flowers.
A19	10	8	Plant 1: 3 flowers, Plant 2: 20 Flowers, Plant 3: >30 Flowers, Plant 4: > 30 Flowers, Plant 6; 15 Flowers, Plant 7: 17 Flowers, Plant 8: 11 Flowers.
A20	10	9	Plant 1 : O/BR, Plant 2: Regrwoth, Plant 3: Regrowth, Plant 4: 4 Flowers, Plant 5: 1 Flowers, Plant 6: 10 Flowers, Plant 7: 8 Flowers, Plant 9: 16 Flowers.
A21	8	8	Plant 1: Green, Plant 2: Stem / dead. Plant 3: 1 Flower, Plant 4: Green, Plant 5: Green, Plant 6: Green, Plant 7: 2 Flowers, Plant 8: Green.
A22	9	8	Plant 1: 2 flowers, Plant 2: 20 Flowers, Plant 3: Green, Plant 4; Green, Plant 5: 2 Flowers, Plant 6- O/BR, Plant 7- Stem

Row Number	No Translocated in May 2016	Monitoring Results October 2016	Flower Count
A23	8	13	Plant 1: 3 Flowers, Plant 2: green, Plant 3: Green, Plant 4: 1 Flower, Plant 5: 2 Flowers, Plant 6- D PLant7: 4 flowers, Plant 8: 2 flowers, Plant 9. Green, Plant 10: 11 Flowers, Plant 11: 1 Flower, Plant 12: 1 Flower, Plant 13- Green
A24	8	7	Plant 1 : green, Plant 2: Green, Plant 3: 1 Flower, Plant 4: Green, Plant 5: Green, Plant 8: Green, Plant 7: 1 Flower
A25	12	6	Plant 1: 3 Flowers, Plant 2: 18 Floers, Plant 3: 8 Flowers, Plant 4 : Green, Plant 5: 15 Flowers
A26	16	18	Plant 1 - Green, Plant 2 Green, Plant3: Green, Plant 4: 2 flowers, Plant 5: Green, Plant 6: Green, Plant 7: Green, Plant 8: 10 Flowers, Plant 9: 10 Flowers, Plant 11 Green, Plant 12 Green, Plant 13: Green, Plant 14 5 flowers, Plant 16: 2 flowers, Plant 17: 1 Flower, Plant 18; 2 flowers
A27	13	7	Plant1: 14, Plant2: 0/BR, Plant3: 1, Plant4: 0/BR, Plant5: D, Plant6: 0, Plant7: 0/BR, 8: D
A28	11	2	Plant1: 0/BR, Plant2: 0/BR
A29	10	7	Plant1: 0/BR, Plant2: D, Plant3: 0/BR, Plant4: 0/BR, Plant5: 0/BR, Plant6: 2, Plant7: 0
A30	11	10	Plant 1: D, Plant2: 0/BR, Plant3: 0/BR, Plant4: 5, Plant 6: 0, Plant7: 0, lant7: 7, Plant9: 0/BR, Plant10: 0/BR
B1	11	12	Plant 1: 0/BR, Plant2: 0/BR, Plant3: 0/BR, Plant4: 3, Plant 5: 0/BR, Plant6: D, Plant 7: D, Plant 8: D, Plant 9: 0/BR, Plant 10: 1, Plant 11: 0/BR, Plant 12: 0/BR
B2	9	8	Plant1: 3, Plant2: 0/BR, Plant3: 0/BR, Plant4: 0/BR, Plant5: D, Plant6: D, Plant7: 0/BR, Plant8: 0/BR. PARTICULARLY LUSH REGROWTH IN THIS ROW
B3	11	9	Plant1: 4, Plant2: 0/BR, Plant3: D, Plant4: 0/BR, Plant5: 0/BR, Plant6: 0/BR, Plant7: 0/BR, Plant8: 0/BR, Plant9: 0/BR,

Row Number	No Translocated in May 2016	Monitoring Results October 2016	Flower Count
			Plant10: 0/BR. PARTICULARLY LUSH REGROWTH IN THIS ROW
B4	7	5	Plant1: 0/BR, Plant2: 0/BR, Plant3: D, Plant4: 1, Plant5: 0/BR
B5	6	6	Plant1: D, Plant2: D, Plant3: 0/BR, Plant4: 0/BR, Plant5: D, Plant6: D
B6	11	7	Plant1: 0/BR, Plant2: 1, Plant3: D, Plant4: D, Plant5: D, Plant6: D, Plant7: 0/BR
B7	9	8	Plant1: 0/BR, Plant2: 0/BR, Plant3: 0/BR, Plant4: 0/BR, Plant5: D, Plant6: D, Plant7: 0/BR, Plant8: 0/BR
B8	10	7	Plant1: D, Plant2: 0/BR, Plant3: 0/BR, Plant4: D, Plant5: 1, Plant6: D, Plant7: D
B9	9	6	Plant1: 2, Plant2: D, Plant3: 5, Plant4: D, Plant5: 3, Plant6: 0/BR
B10	11	11	Plant1: 1, Plant2: 0/BR, Plant3: 0/BR, Plant4: 0/BR, Plant5: 1, Plant6: 0/BR, Plant7: 1, Plant8: 0/BR, Plant9: 0/BR, Plant10: 10, Plant11: D
B11	10	10	Plant1: 0/BR, Plant2: 0/BR, Plant3: D, Plant4: 0/BR, Plant5: D, Plant6: 1, Plant7: 5, Plant8: 0/BR, Plant9: 0/BR, Plant10: D
B12	9	10	Plant1: 0/BR, Plant2: 0/BR, Plant3: D, Plant4: 0/BR, Plant5: D, Plant6: 1, Plant7: 5, Plant8: 0/BR, Plant9: 0/BR, Plant10: D
B13	12	10	Plant1: 0/BR, Plant2: 1, Plant3: 2, Plant4: 0/BR, Plant5: 0/BR, Plant6: D, Plant7: 6, Plant8: D, Plant9: 1, Plant 10: 0/BR
B14	3	9	Plant1: 0/BR, Plant2: 2, Plant3: 1, Plant4: 4, Plant5: 2, Plant6: 0/BR, Plant7: 0/BR, Plant8: 1, Plant9: 0/BR
Total	**367**	**319**	

0/BR = Plant has no flowers and is browned off however there is fresh regrowth

D = Dead

3.1 Conclusion

The monitoring of the *T. juncea* translocation has shown a survival rate of 86% for the first year of monitoring. However, a further four (4) years of monitoring will be able to show more certainty of the success of translocation of *T. juncea*.

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APPENDIX A MONITORING RESULTS

***juncea* Tr**

Row	Count	
A1	6	Plant 1: 2 flowers, Plant 2: >30 Flowers, Plant 3 2 lots of buds, Plant 4: 3 flowers and buds about to flower, Plant 5: 2 flowers, Plant 6: 2 flowers
A2	no	None
A3	5	Plant 1 : 2 Floers Plants 2- 5 No flowers
A4	5	Plant 1: 4 Flowers and budding, Plant 2-5 No flowers but budding
A5	3	Plant 1 - NO flowers, Plant 2 - 3: 2 flowers
A6	8	Plants 1-8 Two flowers and budding
A7	4	Plants 1-4 No flowers
A8	9	Plant 1 - 2 flowers, Plant 2: 1 Flower, Plant 3: Regrowth, Plant 4: 4 flowers, Plant 5: 2 flowers, Plant 6: 20 Flowers, Plant 7: 10 Flowers, Plant 8: 5 flowers, Plant 9: 1 Flower
A9	5	Plant 1: 2 flowers, Plant 2: 3 flowers, Plant 3: No flowers, Plant 4: No fruiting, between but looks like resprouting , Plant 5: Two flowers
A10	3	Plant 1: Brown + resprouting green, Plant 2: 4 flowers, Plant 3: O/BR
A11	7	Plant 1: 8 Flowers, Plant 2=Fresh regrowth, Plant 3: O/BR, Plant 4Ŏ/BR, Plant 5: O/BR, Plant 6: Green rerwoth, Plant 7: 3 flowers, Plant 8: Regrowth
A12	8	
A13	4	Plant 1: O/BR, Plant 2: > 40 Flowers, Plant 3: O/BR, Plant 4: O/BR
A14	6	Plant 1: regrowth, Plant 2: O/BR, Plant 3: regrowth, Plant 4: 1 flowers, Plant 5: O/BR, Plant 6: O/BR.
A15	6	Plant1: 12 Flowers and numerous buds, Plant 2: Regrwoth, Plant 3: Regrowth, Plant 4: 1 Flower, Plant 5: 1 Plant 6: Regrwoth 5 Flowers and numerous buds,
A16	4	Plant 1: Regrowth, Plant 2: 3 Flowers, Plant 3: Regrowth, Plant 4: > 20 Flowers, Plant 5: >12 Flowers, Plant 6: 3 flowers
A17	4	Plant 1: 1 flower, Plant 2: 5 Flowers, Plant 3: 1 Flower, Plant 4: Regrowth
A18	11	Plant 1: 1 Flower, Plant 2: 5 Flowers, Plant 3: 1 Flower, Plant 4: 3 lots of buds, Plant 5: 10 Flowers, Plant 6: 7 flowers, Plant 7: >20 Flowers, Plant 8 8 Flowers, Plant 9: 4 Flowers, Plant 10: 6 Flowers, Plant 11: 4 Flowers.
A19	8	Plant 1: 3 flowers, Plant 2: 20 Flowers, Plant 3: >30 Flowers, Plant 4: > 30 Floers, Plant 6; 15 Flowers, Plant 7: 17 Flowers, Plant 8: 11 Flowers.
A20	9	Plant 1 : O/BR, Plant 2: Regrwoth, Plant 3: Regrowth, Plant 4: 4 Flowers, Plant 5: 1 Flowers, Plant 6: 10 Flowers, Plant 7: 8 Flowers, Plant 9: 16 Flowers.
A21	8	Plant 1: Green, Plant 2: Stem / dead. Plant 3: 1 Flower, Plant 4: Green, Plant 5: Green, Plant 6: Green, Plant 7: 2 Flowers, Plant 8: Green.
A22	8	Plant 1: 2 flowers, Plant 2: 20 Flowers, Plant 3: Gren, Plant 4; Green, Plant 5: 2 Flowers, Plant 6- O/BR, Plant 7- Stem
A23	13	Plant 1: 3 Flowers, Plant 2: green, Plant 3: Green, Plant 4: 1 Flower, Plant 5: 2 Flowers, Plant 6- D PLant7: 4 flowers, Plant 8: 2 flowers, Plant 9. Green, Plant 10: 11 Flowers, Plant 11: 1 Flower, Plant 12: 1 Flower, Plant 13- Green
A24	7	Plant 1 : green, Plant 2: Green, Plant 3: 1 Flower, Plant 4: Green, Plant 5: Green, Plant 8: Green, Plant 7: 1 Flower
A25	6	Plant 1: 3 Flowers, Plant 2: 18 Floers, Plant 3: 8 Flowers, Plant 4 : Green, Plant 5: 15 Flowers
A26	18	Plant 1 - Green, Plant 2 Green, Plant3: Green, Plant 4: 2 flowers, Plant 5: Green, Plant 6: Green, Plant 7: Green, Plant 8: 10 Flowers, Plant 9: 10 Flowers, Plant 11 Green, Plant 12 Green, Plant 13: Green, Plant 14 5 flowers, Plant 16: 2 flowers, Plant 17: 1 Flower, PLant 18; 2 flowers
A27	7	Plant1: 14, Plant2: 0/BR, Plant3: 1, Plant4: 0/BR, Plant5: D, Plant6: 0, Plant7: 0/BR, 8: D
A28	2	Plant1: 0/BR, Plant2: 0/BR
A29	7	Plant1: 0/BR, Plant2: D, Plant3: 0/BR, Plant4: 0/BR, Plant5: 0/BR, Plant6: 2, Plant7: 0
A30	10	Plant 1: D, Plant2: 0/BR, Plant3: 0/BR, Plant4: 5, Plant 6: 0, Plant7: 0, lant7: 7, Plant9: 0/BR, Plant10: 0/BR
B1	12	Plant 1: 0/BR, Plant2: 0/BR, Plant3: 0/BR, Plant4: 3, Plant 5: 0/BR, Plant6: D, Plant 7: D, Plant 8: D, Plant 9: 0/BR, Plant 10: 1, Plant 11: 0/BR, Plant 12: 0/BR
B2	8	Plant1: 3, Plant2: 0/BR, Plant3: 0/BR, Plant4: 0/BR, Plant5: D, Plant6: D, Plant7: 0/BR, Plant8: 0/BR. PARTICULARLY LUSH REGROWTH IN THIS ROW
B3	9	Plant1: 4, Plant2: 0/BR, Plant3: D, Plant4: 0/BR, Plant5: 0/BR, Plant6: 0/BR, Plant7: 0/BR, Plant8: 0/BR, Plant9: 0/BR, Plant10: 0/BR. PARTICULARLY LUSH REGROWTH IN THIS ROW
B4	5	Plant1: 0/BR, Plant2: 0/BR, Plant3: D, Plant4: 1, Plant5: 0/BR
B5	6	Plant1: D, Plant2: D, Plant3: 0/BR, Plant4: 0/BR, Plant5: D, Plant6: D
B6	7	Plant1: 0/BR, Plant2: 1, Plant3: D, Plant4: D, Plant5: D, Plant6: D, Plant7: 0/BR
B7	8	Plant1: 0/BR, Plant2: 0/BR, Plant3: 0/BR, Plant4: 0/BR, Plant5: D, Plant6: D, Plant7: 0/BR, Plant8: 0/BR
B8	7	Plant1: D, Plant2: 0/BR, Plant3: 0/BR, Plant4: D, Plant5: 1, Plant6: D, Plant7: D
B9	6	Plant1: 2, Plant2: D, Plant3: 5, Plant4: D, Plant5: 3, Plant6: 0/BR
B10	11	Plant1: 1, Plant2: 0/BR, Plant3: 0/BR, Plant4: 0/BR, Plant5: 1, Plant6: 0/BR, Plant7: 1, Plant8: 0/BR, Plant9: 0/BR, Plant10: 10, Plant11: D
B11	10	Plant1: 0/BR, Plant2: 0/BR, Plant3: D, Plant4: 0/BR, Plant5: D, Plant6: 1, Plant7: 5, Plant8: 0/BR, Plant9: 0/BR, Plant10: D
B12	10	Plant1: 0/BR, Plant2: 0/BR, Plant3: D, Plant4: 0/BR, Plant5: D, Plant6: 1, Plant7: 5, Plant8: 0/BR, Plant9: 0/BR, Plant10: D
B13	10	Plant1: 0/BR, Plant2: 1, Plant3: 2, Plant4: 0/BR, Plant5: 0/BR, Plant6: D, Plant7: 6, Plant8: D, Plant9: 1, Plant 10: 0/BR
B14	9	Plant1: 0/BR, Plant2: 2, Plant3: 1, Plant4: 4, Plant5: 2, Plant6: 0/BR, Plant7: 0/BR, Plant8: 1, Plant9: 0/BR
Total	319	

0/BR = Plant has no flowers and is browned off;
D = Dead

APPENDIX B PHOTOS


48


AIS


A18


A19


A20


421


A22


A23


426