DONALDSONCOAL

Part of the Yancoal Australia Group

ABN: 87 073 088 945

Annual Review

Donaldson Coal Mine

1 November 2021 – 31 October 2022

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DONALDSON COAL

PTY LTD

ABN: 87 073 088 945

Annual Review

for the

Donaldson Coal Mine

1 November 2021 – 31 October 2022

Compiled for:

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Ref No. 737/28a

January 2023

DONALDSONCOAL
Part of the Yancoal Australia Group

Title Block

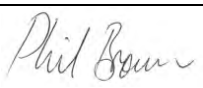
Name of Operation	Donaldson Coal Mine
Name of Operator	Donaldson Coal Pty Ltd
Development consent / project approval #	DA 98/01173 and 118/698/22
Name of holder of development consent / project approval	Donaldson Coal Pty Ltd
Mining Lease #	ML 1461
Name of holder of mining lease	Donaldson Coal Pty Ltd
Water licence #	20WA218980, 20WA211590 and WAL41522
Name of holder of water licence	Donaldson Coal Pty Ltd
RMP start date	02/07/2022
RMP end date	Not Applicable
Annual Review start date	01/11/2021
Annual Review end date	31/10/2022

I, Phillip Brown, certify that, to the best of my knowledge this report is a true and accurate record of the compliance status of the Donaldson Coal Mine for the period 01 November 2021 to 31 October 2022 and that I am authorised to make this statement of behalf of DONALDSON COAL PTY LTD.

Note.

a) 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.

b) 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); Section 307A, 307B and 307C (false or misleading application/information/documents – maximum penalty 2 years imprisonment or $22,000, or both).

Name of authorised reporting officer	Phillip Brown
Title of authorised reporting officer	Environment and Community Relations Superintendent
Signature of authorised reporting officer	
Date	31 January 2023

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APPENDICES

FIGURES

TABLES

1. STATEMENT OF COMPLIANCE

The compliance status of relevant approvals was reviewed for the reporting period (see **Appendix 3**) and is summarised in **Table 1.1**. There were no non-compliances during the reporting period.

Table 1.1
Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	Yes / No
Development Consent (combined DA 98/01173 and DA 118/698/22)	Yes
Mining Lease 1461	Yes

2. INTRODUCTION

2.1 OVERVIEW OF OPERATIONS

The Donaldson Coal Mine ("the mine") was an open cut coal mining operation located ~23km from the Port of Newcastle, north of John Renshaw Drive and west of Weakleys Drive (**Figure 2.1**). The mining lease is contained within the Cessnock and Maitland Local Government Areas. A locality plan and aerial photograph showing the location of the mine in a regional context is attached as **Appendix 1** of this report.

The mine commenced operation on 25 January 2001, following approval by the (then) Minister of Urban Affairs and Planning in 1999.

The first load of coal was railed from the mine on 26 March 2001. Up to 31 October 2013, approximately 13 002 548 tonnes of coal had been produced and exported from the site for either domestic (i.e. Hunter Valley power stations) or international use (via the Port of Newcastle).

Mining operations at the mine were completed in April 2013. Progressive rehabilitation activities were undertaken throughout the operation of the mine and a final rehabilitation project commenced in May 2013. This involved removal of roads, excavation of contaminated material, decommissioning of the fuel storage area, buildings and other surface infrastructure, reshaping surfaces to the final landform, topsoil spreading, drainage line construction and seeding with local tree and shrub species. The rehabilitation works at the mine were completed in March 2014 and, to date, remain in care and maintenance with ongoing monitoring.

2.2 SCOPE AND FORMAT

This Annual Review for the Donaldson Coal Mine has been compiled by R.W. Corkery & Co. Pty. Limited on behalf of Donaldson Coal Pty Ltd ("Donaldson"). Donaldson Coal Pty Ltd is a fully owned subsidiary of Yancoal Australia Limited.

This is the seventh Annual Review submitted for the mine, following 13 Annual Environmental Management Reports, and is applicable for the period 1 November 2021 to 31 October 2022 ("the reporting period").

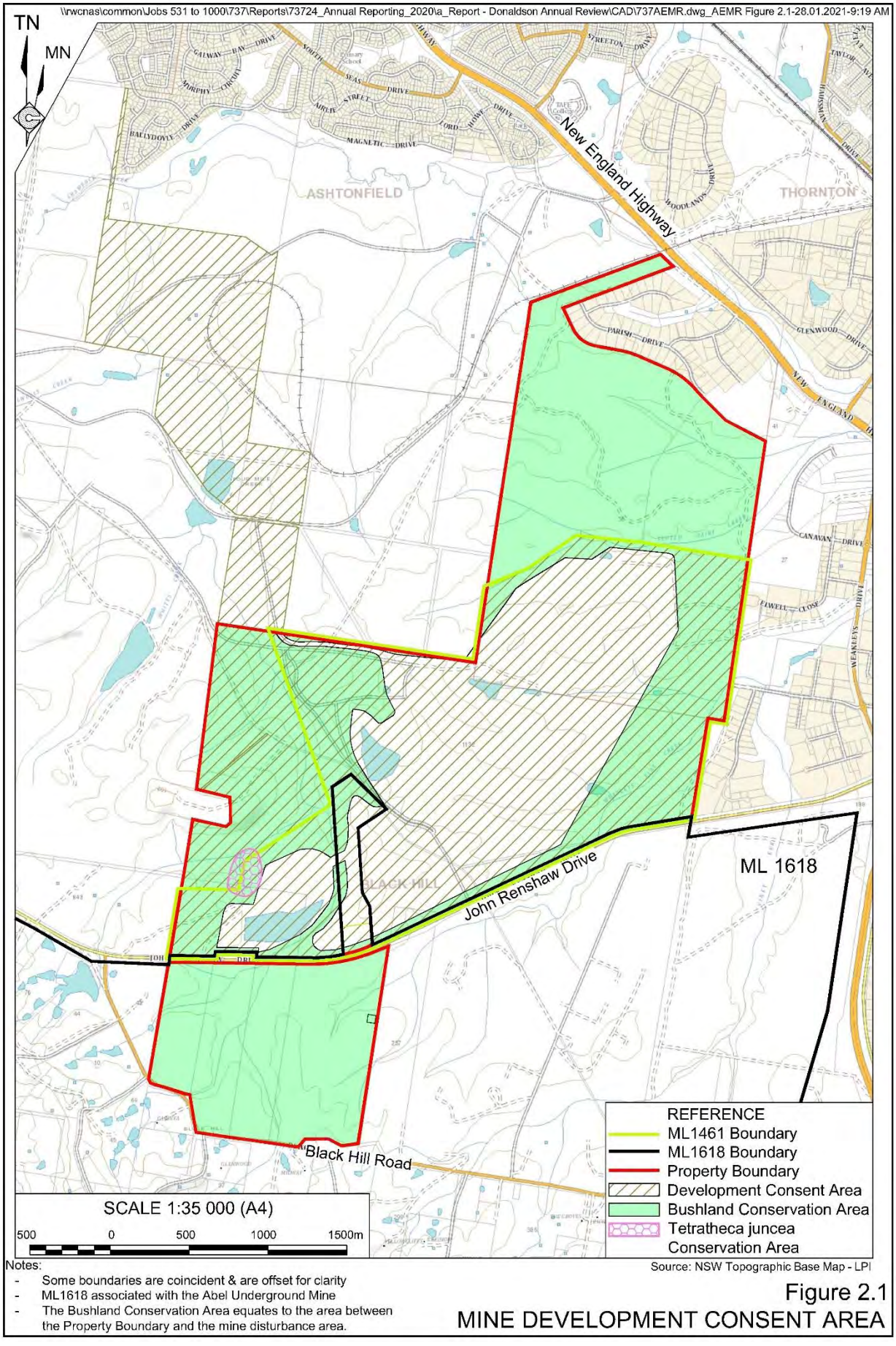
This Annual Review generally follows the format and content requirements identified in the NSW Government's *Annual Review Guideline* dated October 2015.

2.3 KEY PERSONNEL CONTACT DETAILS

Donaldson owns the mining operation and is the holder of Mining Lease (ML) 1461. Donaldson is also the mining operator. **Table 2.1** outlines the site personnel responsible for the various aspects of the operation during the reporting period.

Table 2.1
Site Personnel

Position	Site Personnel
Operations Manager, Donaldson Coal Mine	Mr William Farnworth
Environment and Community Relations Superintendent, Donaldson Coal Mine	Mr Phillip Brown



Notes:
- Some boundaries are coincident & are offset for clarity
- ML1618 associated with the Abel Underground Mine
- The Bushland Conservation Area equates to the area between the Property Boundary and the mine disturbance area.

Figure 2.1
MINE DEVELOPMENT CONSENT AREA

Table 2.2 outlines the contacts for the Donaldson Coal Operations Manager, Mr William Farnworth, and the Environment and Community Relations Superintendent, Mr Phillip Brown.

Table 2.2
Contact Details

Physical Address:	Donaldson Coal Mine 1132 John Renshaw Drive BLACK HILL NSW 2322
Postal Address:	PO Box 2216 GREEHILLS NSW 2323
Community Hotline (24hrs):	1800 111 271
Phone:	(02) 4993 7356 (William Farnworth) (02) 6570 9219 (Phillip Brown)
Fax:	(02) 4015 1159
e-mail:	donaldson@doncoal.com.au
Website:	www.doncoal.com.au

A 24-hour Environmental Hotline (Tel: 1800 111 271) is maintained by Donaldson. Details of calls are recorded by the Environment & Community Relations Superintendent for further actioning, if required.

3. APPROVALS

Table 3.1 provides a current list of statutory instruments in effect, including the date of grant of all leases, subleases, consents, approvals and licenses. It also includes information relating to the current Rehabilitation Management Plan (RMP).

Table 3.1
Donaldson Coal Mine – Approvals, Leases and Licences

Approval/Lease/ Licence	Issue / Approval Date	Expiry Date	Details / Comments
Mining Lease (No. 1461)	21/12/1999	20/12/2020 Renewal Sought	Granted by the (then) Minister for Mineral Resources. Incorporates a surface area of 515.6ha (following excision of the Abel Surface Infrastructure Area from the lease in 2008). A renewal application for ML 1461 was lodged 27 November 2019. Standard conditions were implemented for the mining lease on 17 October 2022 in accordance with the *Mining Regulation 2016* amendments.
Rehabilitation Management Plan	01/08/2022	Not Applicable	• In accordance with the Operational Rehabilitation Reform a Rehabilitation Management Plan was prepared and finalised on 1 August 2022. The Rehabilitation Objectives and Final Landform Plan remain with the Resources Regulator for approval.
Development Consent (combined DA 98/01173 and 118/698/22)	14/10/1999	-	• Modified on 26 September 2005 and 24 June 2011. • Consent for mining operations lapsed on 31 December 2013. • Certain conditions of the consent will continue to operate after the consent for mining operations has lapsed.
Environment Protection Licence (No. 12856)	09/07/2008	Not Applicable	• Anniversary date 09 July. • Current licence version dated 1 October 2021. • Combined licence for the Donaldson Coal Mine and Abel Underground Coal Mine.
Water Supply Works Approval 20WA218980	01/07/2016	30/06/2029	Bore Licence 20BL168123 was issued to cover groundwater extraction as a result of the active mining area. Following commencement of the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016* in July 2016 20BL168123 was converted to a water supply works approval and water access licence with an allocation of 300ML/year.
Water Access Licence (WAL) 41522	01/07/2016	Continuing	
Water Supply Works Approval 20WA211590	01/08/09	31/07/32	Issued for the works associated with the open cut mining pits as located within the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.*

4. OPERATIONS SUMMARY

4.1 MINING OPERATIONS

Coal mining activities ceased in April 2013 and all mining equipment was removed from site. No coal mining was undertaken during the reporting period or is planned during the next reporting period (see **Table 4.1**).

Table 4.1
Production Summary

Material	Approved limit (specify source)	Previous reporting period (actual)	This reporting period (actual)	Next reporting period (forecast)
Waste Rock / Overburden	No longer applicable	0	0	0
ROM Coal / Ore		0	0	0
Coarse Reject		0	0	0
Fine Reject (Tailings)		0	0	0
Saleable Product		0	0	0

4.2 OTHER OPERATIONS DURING THE REPORTING PERIOD

During the reporting period no exploration, land preparation or construction activities were undertaken. Additionally, no coal processing or transportation activities were undertaken within ML 1461 during the reporting period.

Environmental monitoring activities continued throughout the reporting period including surface water, groundwater, flora and fauna and rehabilitation monitoring. Results of this monitoring are summarised in Sections 6 and 7.

Rehabilitation activities were completed in March 2014 with no further rehabilitation work occurring during the reporting period.

A Rehabilitation Management Plan (RMP) and Forward Program were prepared during the reporting period in accordance with the Operational Rehabilitation Reforms and amendments to the *Mining Regulation 2016*.

The *Sediment Dam Investigation* report was also finalised in June 2022 and submitted as part of the RMP during the reporting period. The recommendations within this report are further discussed in Section 7.2.

4.3 NEXT REPORTING PERIOD

The activities proposed for 2022/2023 will principally involve continued monitoring and, if required, maintenance activities in accordance with the approved management plans and RMP. The following provides a summary of the planned activities.

Exploration

Donaldson currently does not intend to undertake any drilling within ML 1461 during the 2022/2023 reporting period.

Mining

No further mining will be undertaken.

Rehabilitation

All rehabilitation works have previously been completed. Any rehabilitation works during the 2022/2023 reporting period will relate to ongoing maintenance, principally erosion and sediment control, weed management and vegetation establishment, as required. Planning activities will also be undertaken including preparation of an implementation program for the recommendations arising from the *Sediment Dam Investigation* report and commencement of a rehabilitation materials balance report as discussed in the RMP.

Monitoring

The following monitoring will be undertaken during the next reporting period.

- Surface water – ongoing surface water quality monitoring in accordance with the site Water Management Plan. Monitoring will be undertaken by CBased Environmental.
- Groundwater – ongoing groundwater level and quality monitoring will be undertaken by CBased Environmental.
- Flora and Fauna – Kleinfelder Australia Pty Ltd will continue to undertake annual flora and fauna surveys and reporting.
- Rehabilitation – Kleinfelder Australia Pty Ltd and Global Soil Systems Pty Limited will continue to undertake rehabilitation monitoring and reporting.

Community Consultation and Liaison

The 24-hour environmental hotline will be maintained and a register retained of any complaints received.

5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2020/2021 Annual Review was submitted to the Department of Planning and Environment (DPE) compliance unit and the Resources Regulator on 28 January 2022. Feedback from the DPE compliance unit was received on 27 May 2022 confirming the Annual Review was considered to generally satisfy the requirements of DA 98/01173 and DA 118/698/22 and the Department's *Annual Review Guideline* (October 2015).

No feedback was received from the Resources Regulator in relation to the Annual Review.

In addition to feedback on the Annual Review, correspondence from DPE on 16 December 2022 outlined additional reporting content for future Annual Reviews. This additional reporting content is required for all coal mines and includes reporting on the following.

1. Biodiversity offsets – reporting on the long-term security arrangements for biodiversity offsets including information on the type of long-term security arrangements that have been/are to be implemented. – *Refer to Section 6.6.*

2. Greenhouse gas – reporting on the greenhouse gases for the reporting period and comparison of actual emissions against the predictions in the environmental assessment. Reporting of all reasonable and feasible steps undertaken during the reporting period to improve energy efficiency and reduce greenhouse gas emissions. – *Refer to Section 6.5*.

6. ENVIRONMENTAL PERFORMANCE

6.1 SUMMARY OF ENVIRONMENTAL PERFORMANCE

A summary of environmental performance for the principal environmental aspects is provided in **Table 6.1**. Further detail regarding specific environmental aspects is also provided in the following subsections.

Table 6.1
Environmental Performance

Aspect	Approval criteria / EIS prediction	Performance during the reporting period	Trend/key management implications	Implemented/ proposed management actions
Noise and Vibration	DA Condition 15 – approved noise limits range from 35dB(A) to 50dB(A).	No mining or earthmoving activities occurred and rehabilitation has been completed.	No community noise complaints were received for the mine during the reporting period. Implies management measures are currently adequate.	No noise monitoring undertaken. No additional management action required.
Blasting	DA Condition 24 – Overpressure 115dB(A) and max 120dB(A) -Vibration 5mm/s and max 10mm/s	No blasts undertaken.	No specific management implications given no blasts undertaken.	No specific management actions required.
Air Quality	DA Condition 37 – Annual Average TSP 90ug/m^3 and deposited dust 4g/m^2/month.	No mining or earthmoving activities occurred and rehabilitation has been completed. No exceedances recorded.	No community air quality complaints were received for the mine during the reporting period. Implies management measures are currently adequate.	No additional management action required.
Biodiversity	DA Condition 70 – Provision of compensatory habitat.	There have been no significant negative impacts on biodiversity within the Donaldson Bushland Conservation Area over the last 20 years. Whilst a slight recovery was recorded in 2020 following drought breaking rain, *Tetratheca juncea* numbers continued to show an overall decline since commencement of monitoring.	Trend has been an increase in biomass which has now plateaued. Overall fauna diversity consistent, however, decrease in birds with an interior habitat speciality since 2012 (possibly due to large-scale clearing associated with adjacent industrial estate in 2012). Continued maturation of mine rehabilitation areas may reverse this trend. Continued increase in ground species density appears to be the probable cause for the decline in the *Tetratheca juncea* population. A hazard reduction burn within the TJCA is recommended by ecologist. Renewal of clump flagging (for identification) is also recommended.	Continued monitoring of flora and fauna trends and further hazard reduction burns, particularly within the TJCA.
Heritage	DA Condition 81-86 – Aboriginal Heritage Conservation Area and Management Plan	No heritage items identified or disturbed during the reporting period. No complaints or other management issues.	No heritage complaints were received and no heritage-related issues were identified during the reporting period. Implies no specific management actions were necessary.	No additional management action required.

6.2 METEOROLOGICAL MONITORING

An on-site automated weather station continued to be operated during the reporting period, recording rain, wind speed and direction. **Figure 6.1** presents the monthly wind roses for the reporting period whilst **Table 6.2** provides the monthly rainfall data.

Table 6.2
Monthly Rainfall

Average Monthly Rainfall (mm)													
Period	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
2000	61.0	32.0	279.0	146.0	45.0	24.0	27.0	31.0	33.0	47.0	106.0	32.0	863.0
2001	46.0	169.0	193.0	114.0	244.0	3.4	63.0	22.0	12.0	31.0	91.0	38.0	1026.4
2002	48.0	281.0	184.0	66.4	62.1	30.0	30.0	21.0	17.4	18.8	56.2	149.2	964.1
2003	6.0	90.0	22.2	77.0	135.0	13.2	43.0	27.4	0.0	63.2	137.6	39.0	653.6
2004	86.0	176.6	80.0	33.6	17.4	9.4	15.4	43.1	61.2	136.0	77.4	69.8	805.9
2005	64.4	95.8	127.8	57.4	61.8*	56.8	7.2	0.8	37.0	84.0	22.8	9.6	625.4
2006	29.8	47.4	63.6	4.6	7.8	43.8	42.6	49.2	162.4	25.4	37.8	35.6	550.0
2007	13.4	88.0	102.0	86.0	60.0	301.0	17.0	79.6	19.8	17.2	163.8	49.5	997.3
2008	153.4	154.3	46.0	237.6	2.2	122.9	30.0	28.5	195.3	62.2	73.3	62.6	1168.3
2009	11.3	97.7	136.5	157.2	125.7	75.7	32.1	1.8	29.2	59.8	51.4	62.0	840.4
2010	0.0	52.1	83.9	37.1	89.4	112.8	65.3	38.5	26.4	80.6	171.1	39.9*	797.1
2011	26.0	34.5	65.6	137.9	98.8	152.0	129.0	49.0	103.0	100.0	171.9	75.9	1143.6
2012	96.1	207.0	137.6	114.7	11.8	172.3	53.8	26.6	18.7	5.7	21.8	1.2	867.3
2013	1.0	100.0	64.2	65.8	59.8	63.8	71.8	9.6	21.8	27.0	261.8	2.6	1094.0
2014	15.6	108.3	112.8	99.3	44.3	31.4	24.6	104.0	42.4	55.0	38.4	133.4	809.5
2015	167.0	48.0	73.3	412.0	89.4	44.6	17.9	30.6	56.8	59.0	69.8	103.8	1172.2
2016	430.8	26.0	78.0	31.8	13.4	113.0	44.2	74.2	60.0	43.8	44.5	41.8	1001.5
2017	66.9	71.7	150.4	94.5	12.7	128.5	3.2	6.0	12.6	77.7	66.8	41.6	624.2
2018	6.6	120.0	191.4	52.8	7.0	107.4	4.2	21.4	55.4	109.0	92.2	65.0	832.4
2019	17.2	32.8	158.0	27.0	19.4	97.4	26.0	66.6	69.4	22.0	28.2	0.0	564.0
2020	55.2	214.8	106.3	52	45.4	80.2	166.6	41	35.6	146.6	53.0	118.4	1115.1
2021	89.4	101.8	234.8	48.6	31.4	72.0	20.6	20.6	31.0	67.4	**198.6**	**55.4**	971.6
2022	**78.8**	**102.2**	**271.4**	**107.4**	**86.2**	**12.6**	**304.8**	**43**	**111.2**	**97.2**	**-**	**-**	-
Minimum	0.0	26.0	22.2	4.6	2.2	3.4	3.2	0.8	0.0	5.7	21.8	0.0	550.0
Average	68.3	106.6	128.8	98.3	59.5	81.2	53.9	36.3	52.7	62.4	92.5	56.5	885.8
Maximum	430.8	281.0	279.0	412.0	244.0	301.0	304.8	104.0	195.3	146.6	261.8	149.2	1172.2
Note: Results relevant to this reporting period are in **bold**.													

During the reporting period, winds dominated from the south-eastern quadrant during summer and early autumn (between December 2021 and March 2022) and from the north-western quadrant during autumn, winter and early spring (between April 2022 and September 2022). Winds dominated from both the south-eastern and north-western quadrants during periods of transition between cooler and warmer periods (i.e. November 2021, April 2022 and October 2022).

Total rainfall during the reporting period was 1468.8mm, which is 583mm more than the average rainfall recorded to date. Rainfall recorded for March 2021 (271.4mm) was 142.6mm greater than the long-term average for March since commencement of monitoring in 2000.

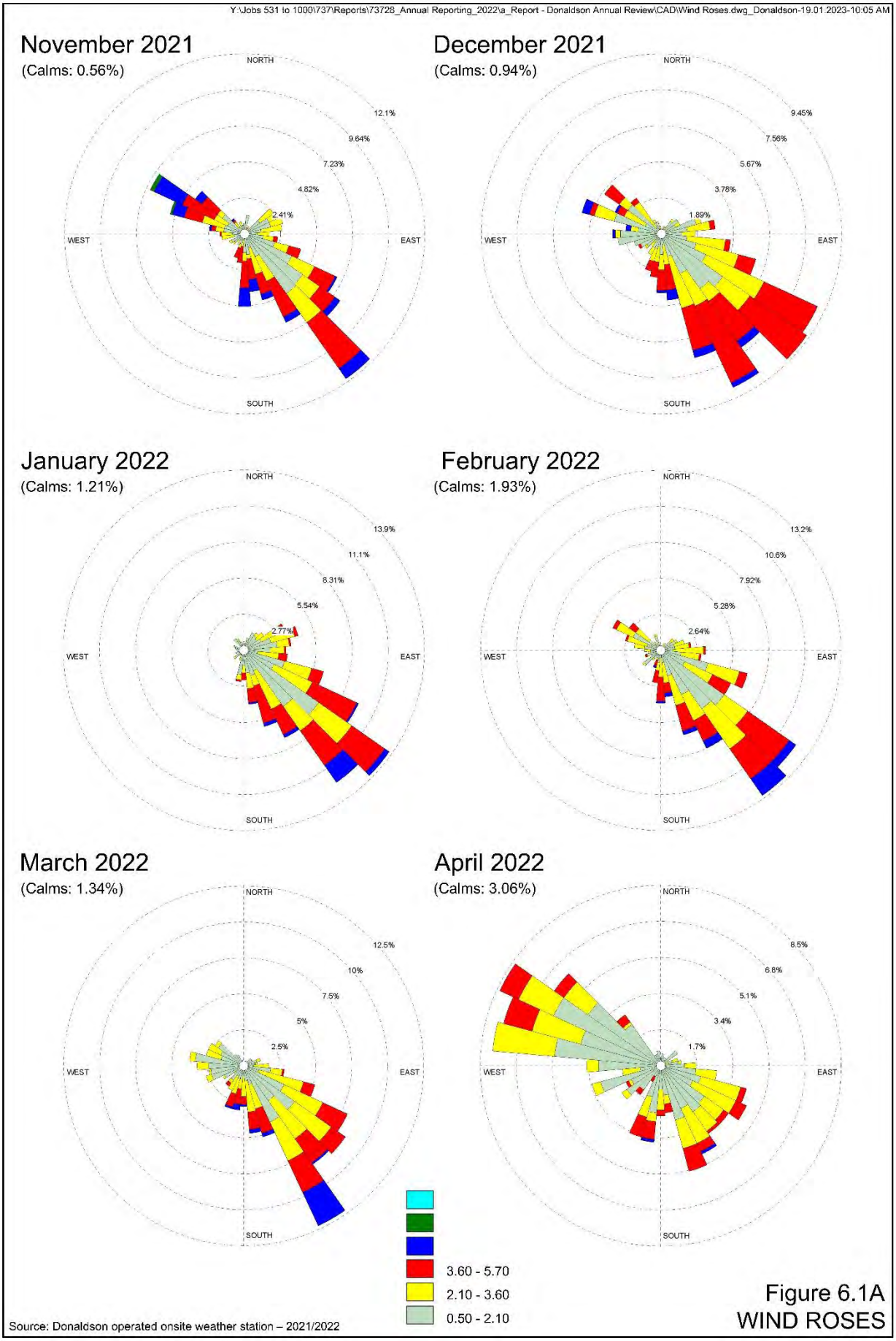


Figure 6.1A
WIND ROSES

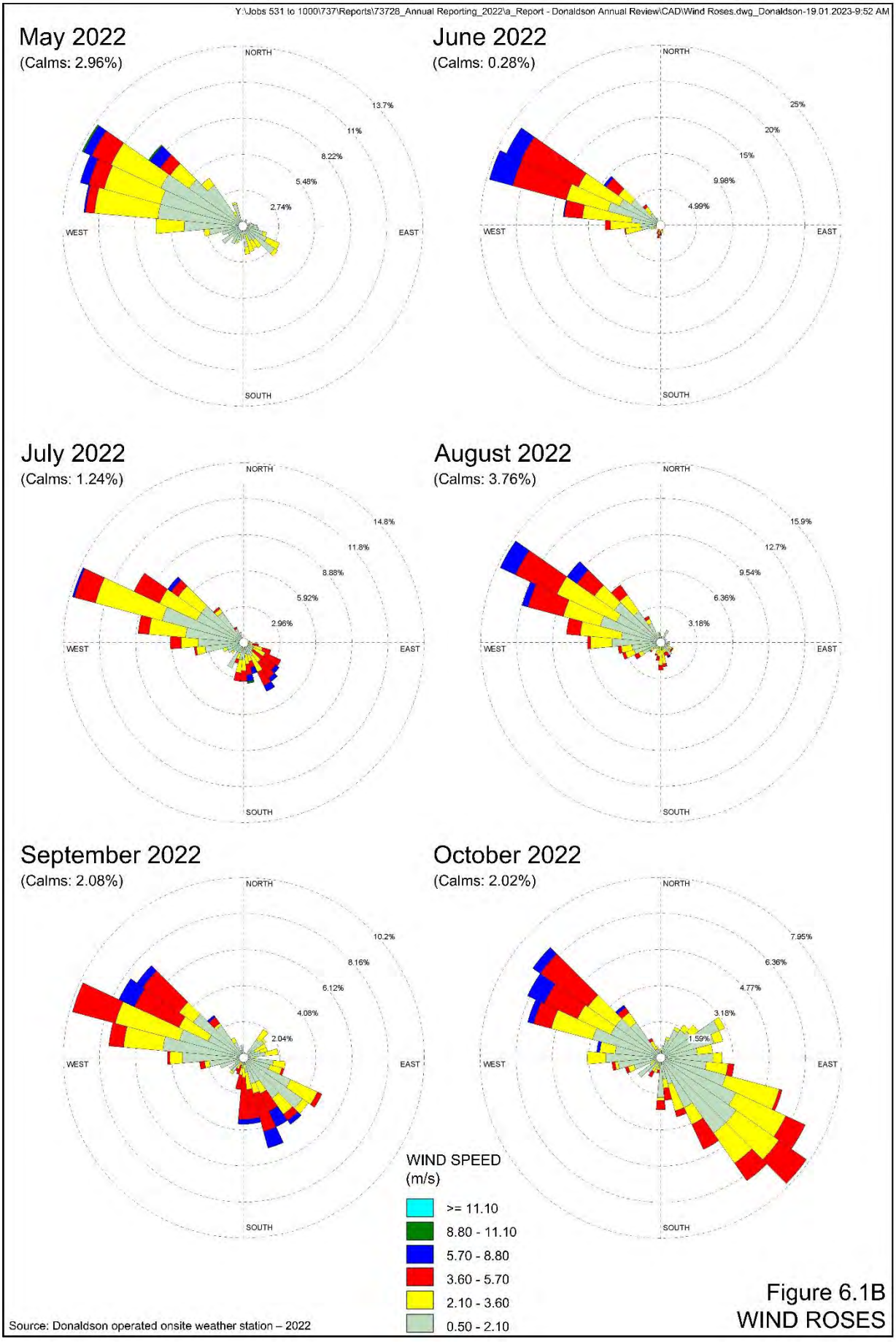


Figure 6.1B
WIND ROSES

6.3 NOISE

As mining ceased in April 2013, no noise monitoring was undertaken for the Donaldson Open Cut Coal Mine during the reporting period. Based on the absence of activities and community complaints, no specific noise management measures were required and no further improvements are currently considered necessary. No further monitoring is currently proposed.

6.4 BLASTING

No blasting was undertaken during the reporting period.

6.5 AIR QUALITY

Environmental Management

The Donaldson Air Quality and Greenhouse Gas Management Plan (Donaldson Coal Pty Ltd, 2019) reflects the reduced air quality monitoring requirements during the care and maintenance period of the mine in accordance with recommendations made in the 2019 Independent Environmental Audit for the Abel Underground Mine[1].

It is noted that, as part of the consolidation of EPL 11080 with EPL 12856, the requirement to monitor deposited dust and total suspended particulates (TSP) was removed. The date of consolidation (and corresponding reduction in monitoring requirements) occurred on 01 October 2021 with data continuing to be collected until December 2021, i.e. the first 2 months of this reporting period. Whilst not required to be monitored, this information is presented for completeness.

During the reporting period, the following dust monitoring equipment was decommissioned.

- Nine Depositional Dust Gauges measuring insoluble solids.
- Two HVAS measuring PM_{10}.
- One High Volume Air Sampler (HVAS) measuring TSP.

In accordance with EPL 12856, air quality monitoring data will now only be collected and reported for the continuous E-Sampler monitor measuring PM_{10} located at Black Hill. The locations of dust monitoring equipment, including both active equipment and equipment that has now been decommissioned, are outlined in **Appendix 1**.

As there were no operational activities during the reporting period and the majority of the site has been rehabilitated, no specific air quality management measures were required throughout the reporting period.

Environmental Performance

Donaldson operated the following dust monitoring equipment during the reporting period.

- One continuous E-Sampler monitor measuring PM_{10} (entire period).
- Nine Depositional Dust Gauges measuring insoluble solids (November and December 2021).
- Two HVAS measuring PM_{10} (November and December 2021).
- One High Volume Air Sampler (HVAS) measuring TSP (November and December 2021).

The locations of dust monitoring equipment are outlined in **Appendix 1** and the results of monitoring presented as follows. It is noted that measurements taken at any of these locations will include all background air pollution relevant to those locations, as well as any contribution occurring from the mine.

Depositional Dust Gauges

A summary of the deposited dust results for the reporting period is presented in **Table 6.3**. Results were generally obtained with acceptable levels of contamination from other sources such as insects, bird droppings and vegetation. No further samples will be collected as the nine gauges have been decommissioned.

Table 6.3
Depositional Dust Monitoring Results November 2021 to Decommissioning in December 2021

Sample Site	Maximum Insoluble Solids (g/m^2/month)	Minimum Insoluble Solids (g/m^2/month)	Annual Average Insoluble Solids (g/m^2/month)
DG1	1.0	0.7	0.9
DG2	1.4	0.8	1.1
DG3	1.3	0.5	0.9
DG4	0.8	0.4	0.6
DG7	0.9	0.7	0.8
DG8	1.8	0.4	1.1
DG9	1.5	0.3	0.9
DG11	1.3	0.7	1.0
DG12	1.2	0.7	1.0
Average	**1.2**	**0.6**	**0.9**

During the reporting period, all gauges were in compliance with the Air Quality and Greenhouse Gas Management Plan's targeted air quality goals, with annual average insoluble solid results for each gauge substantially below the Annual Average criteria of $4g/m^2$/month. Given that all mining and earthmoving activities have been completed at the Donaldson Coal Mine, results are indicative of the background environment inclusive of other local or regional sources. **Figure 6.2** shows the historical rolling annual averages for each depositional dust gauge. Results are generally consistent with the trends and ranges previously recorded.

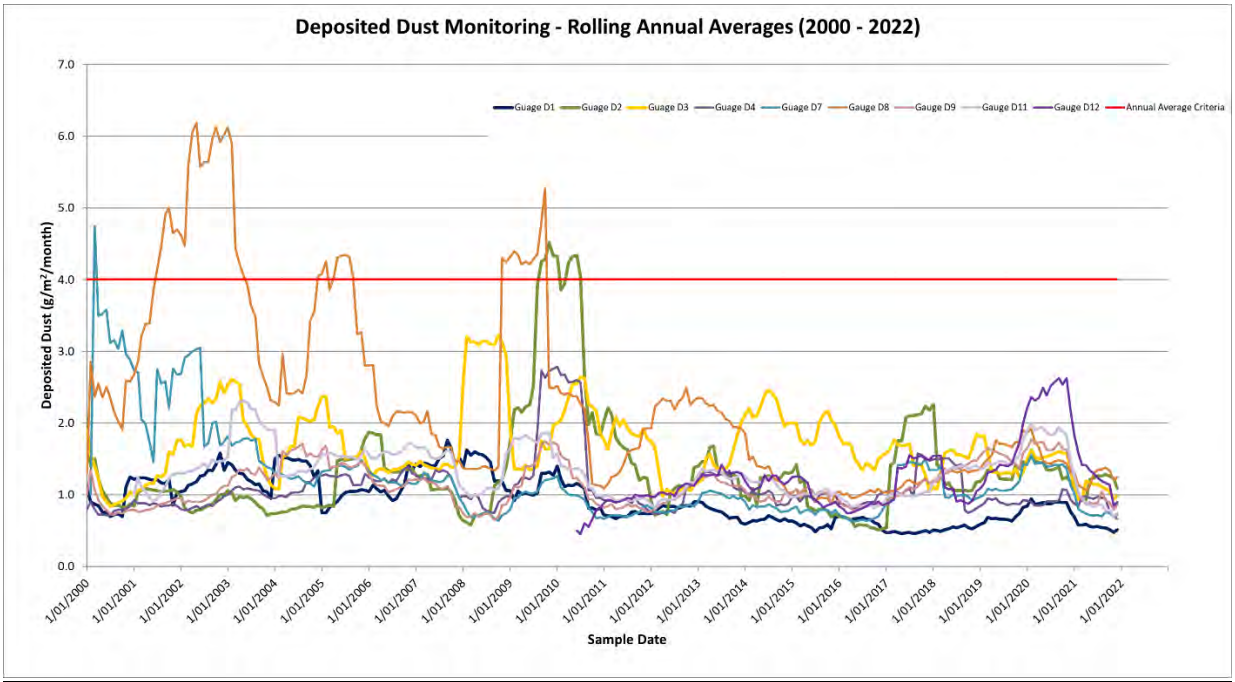


Figure 6.2 Deposited Dust Monitoring 2000 to Decommissioning in December 2021

High Volume Air Samplers

This section outlines the results of the HVASs located at Black Hill Public School and the Beresfield Golf Course. Two sets of measurements have been performed during the reporting period, PM_{10} (particulate matter of diameter less than 10µm) and TSP (total suspended particulate matter). **Table 6.4** displays the data capture rate for the three high volume air sampler units during the period.

Table 6.4
High Volume Air Sampler Data Capture Rate

Monitoring Location	Data Capture Rate (%)
Black Hill Public School (PM_{10})	100
Black Hill Public School (TSP)	100
Beresfield Golf Course (PM_{10})	100

PM_{10}

Table 6.5 provides a summary of the PM_{10} monitoring results for the reporting period whilst **Figure 6.3** displays the monitoring results since commencement of monitoring.

Table 6.5
HVAS Monitoring Results – PM_{10} (November 2021 to Decommissioning in December 2021)

Sample Site	No Samples Required	No samples collected and analysed	Maximum PM_{10} Value (µg/m³)	Minimum PM_{10} Value (µg/m³)	Average PM_{10} Value (µg/m³)
Black Hill Public School	0	10	20.0	6.9	11.8
Beresfield Golf Course	0	10	25.3	6.5	15.1

No exceedances of the *National Environment Protection Measures* (NEPM) 24hr maximum PM_{10} goal (50µg/m^3) were recorded at either the Black Hill Public School or Beresfield Golf Course monitoring locations during the reporting period.

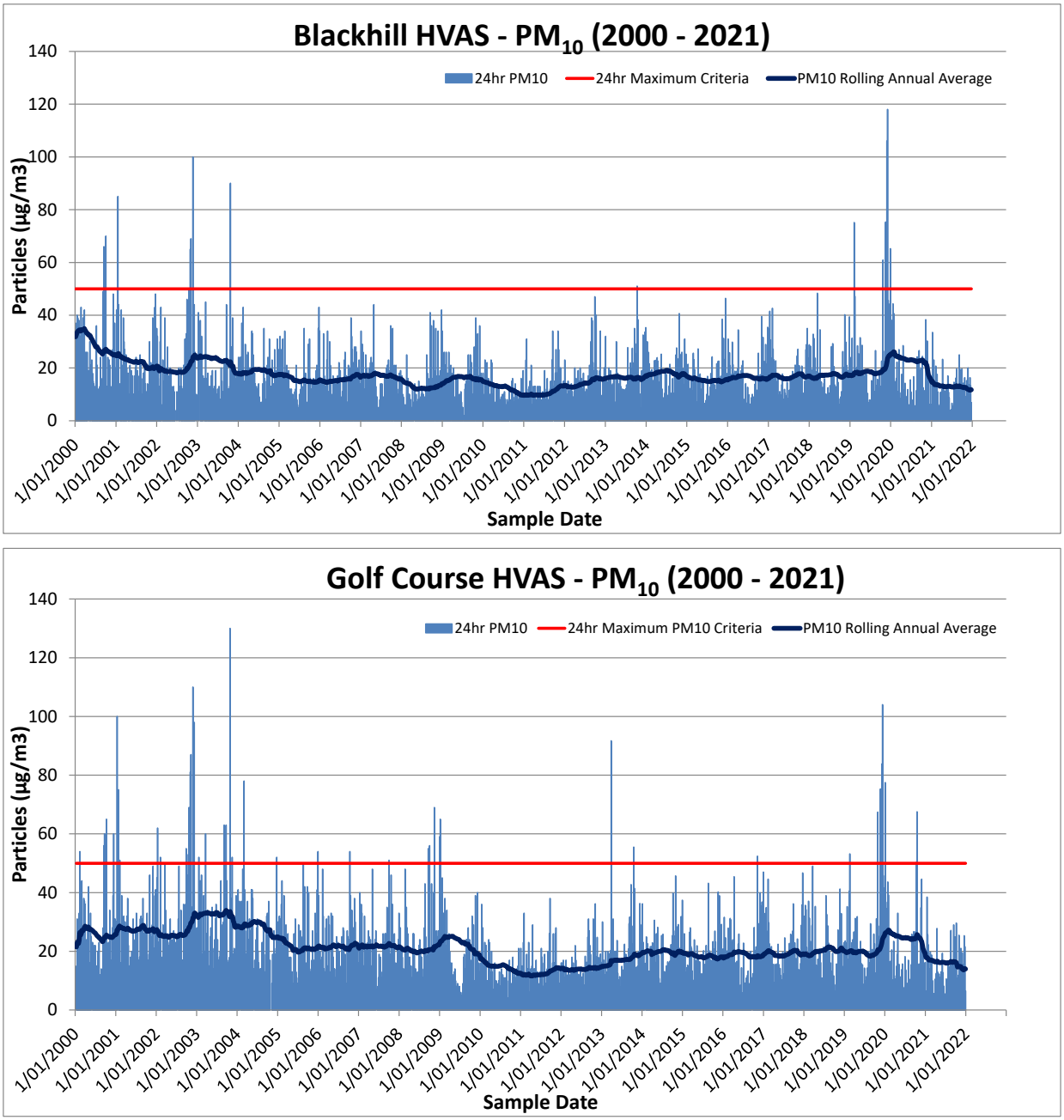


Figure 6.3 HVAS Results – PM_{10} (2000 to 2021)

Excepting an annual trend of lower 24-hour average PM_{10} during the winter months and higher 24-hour averages during the summer months, no long-term trends have been apparent during the course of monitoring. Similarly, rolling annual average PM_{10} levels have remained relatively consistent since 2005 excluding the 2019/2020 bushfires which resulted in sharp increase in the rolling average PM_{10} across both sites.

Total Suspended Particles

TSP results for the reporting period are displayed in **Table 6.6** with the results since the commencement of monitoring shown in **Figure 6.4**.

Table 6.6
HVAS Results – TSP (November 2021 to Decommissioning in December 2021)

Sample Site	No Samples Required	No samples collected and analysed	Maximum TSP Value (µg/m3)	Minimum TSP Value (µg/m3)	Annual Average TSP Value (µg/m3)
Black Hill Public School	0	10	27.0	11.6	19.3

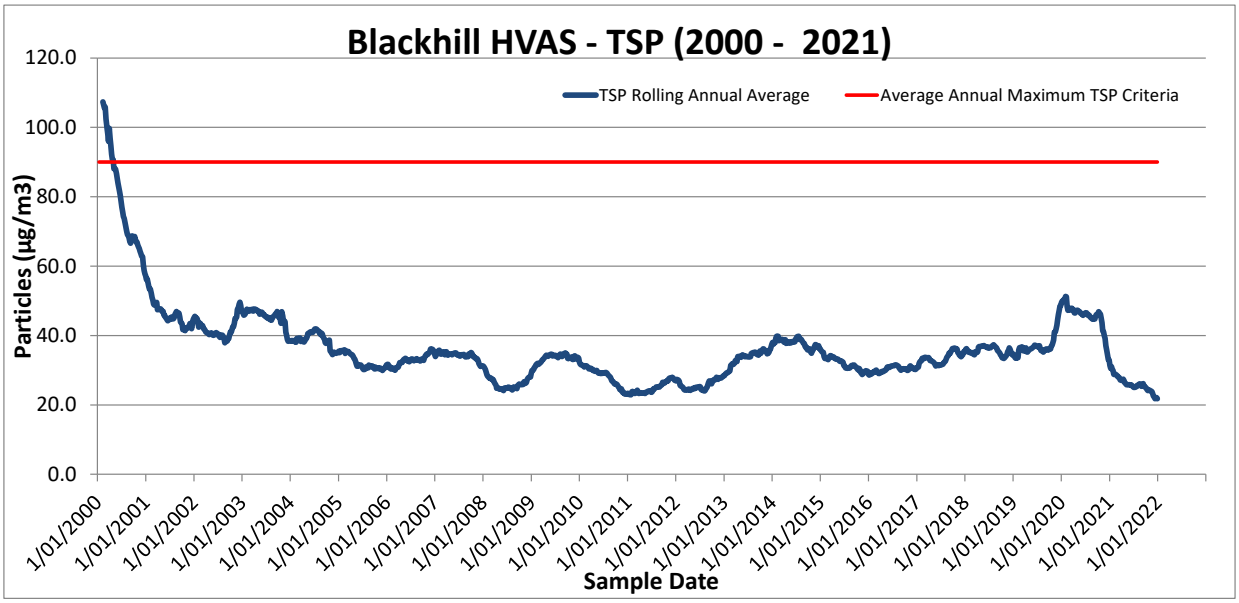


Figure 6.4 HVAS Results – Annual Average TSP (2000 to 2021)

The annual average TSP result at Black Hill Public School during the reporting period (to December 2021) was 19.3µg/m^3, well below the annual average criteria of 90µg/m^3. While there are no specified criteria for a 24-hr TSP maximum in the development consents or Environment Protection License, the maximum TSP of 27.0µg/m^3 results is well below the US EPA short term good air quality criteria of 260µg/m^3.

The ratio of the average PM_{10} to TSP during the reporting period was approximately 61%, which is generally consistent with the previous reporting period (49%). No long-term trends are evident within the TSP data.

In summary, when reviewing the results in light of there being no mine-related dust producing activities since March 2014, this indicates that between 2005 and 2014 Donaldson's operational activities had a low contribution to both PM_{10} and TSP. This is consistent with the previous environmental assessments which predicted no exceedance of air quality goals as a result of the operations.

Continuous Monitor

Donaldson operated one continuous E-Sampler air quality monitor at Black Hill Public School during the reporting period. **Table 6.7** and **Figure 6.5** summarise the continuous monitoring data since installation of the current E-Sampler unit. The measurement of PM_{10} by optical methods (such as by DustTrak and E-Sampler monitors) is known to be particularly sensitive to rainfall or high humidity events. Monthly inspections of the E-Sampler monitor and regular servicing of the instrument assist with reducing occasions when the measurements become unstable or drift from sensible values.

Table 6.7
E-Sampler Results – PM_{10} (November 2021 to October 2022)

Site	Data Collection	Days Sampled	Highest 24-hour average PM_{10} ($\mu g/m^3$)	Annual average PM_{10} ($\mu g/m^3$)	Lowest 24-hour average PM_{10} ($\mu g/m^3$)
Black Hill Public School	Continuous	352	25.0	0.6	7.0
Note: Data in this table is for the annual reporting period 1 November 2021 to 31 October 2022.					

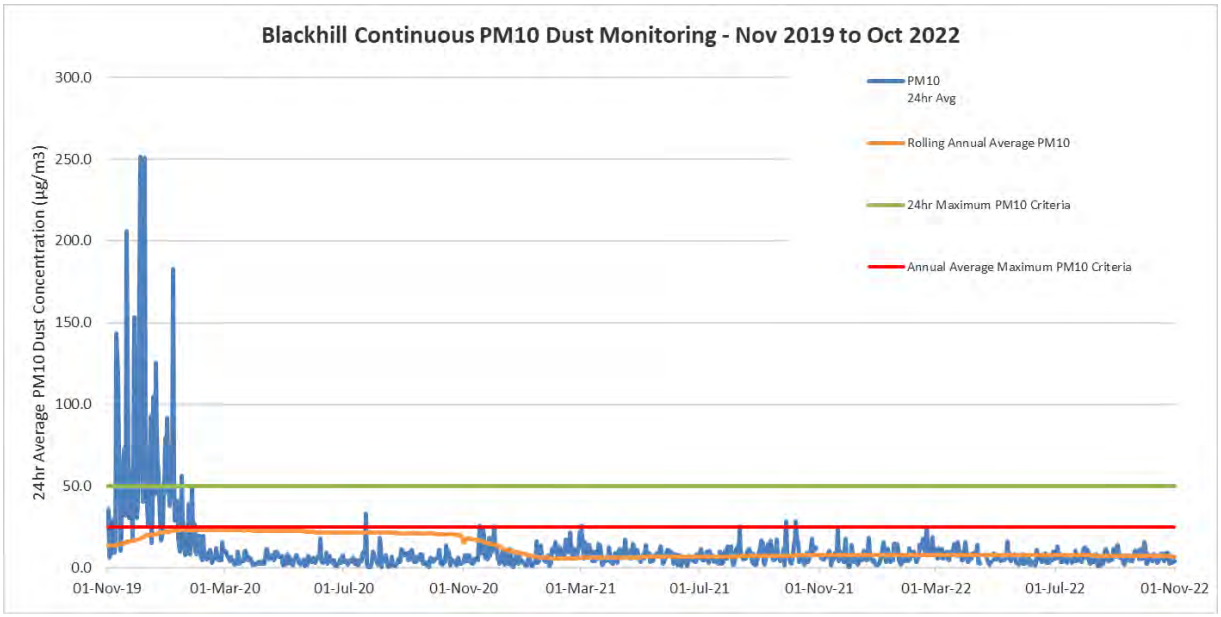


Figure 6.5 Results of Continuous PM_{10} Monitoring

Samples were successfully collected on 352 days of the sampling period of which there were 16 days in which there was partial data capture. In total 8,322.5hrs of data was captured out of 8,760hrs of possible data capture, equating to a 95.01% capture rate, in line with EPA's minimum capture requirements for continuous monitoring. Data loss during the period principally resulted from power outages with some data loss also occurring during maintenance activity. Notwithstanding this, the level of data capture is high and suitably characterises the air quality during the reporting period.

The average annual PM_{10} result of 7.0$\mu g/m^3$ from the continuous monitoring is similar to the 11.8$\mu g/m^3$ obtained from the PM_{10} HVAS at the Black Hill Public School.

No exceedances of the annual average criteria of 25$\mu g/m^3$ were recorded during the reporting period.

Greenhouse Gases

As the Donaldson Coal Mine has ceased operations, the principal activities undertaken include monitoring and inspections. As such, specific greenhouse gas emission monitoring/calculations are not undertaken nor proposed. Beyond maintenance of vehicles, no specific management measures were implemented or feasible during the reporting period.

It is noted that the Environmental Impact Statement for the mine was prepared in 1998 prior to current greenhouse gas assessment and reporting requirements.

Reportable Incidents

No reportable air quality incidents were recorded during the 2021/2022 Annual Review reporting period.

Further Improvements

No improvements relating to air pollution are planned or considered necessary. During the reporting period, existing depositional dust gauges and the HVAS were decommissioned to reflect revised monitoring requirements in accordance with the approved 2019 Air Quality and Greenhouse Gas Management Plan and consolidated EPL 12856.

6.6 BIODIVERSITY

During the reporting period, biodiversity values have principally been managed through the ongoing implementation of the flora and fauna monitoring program. These management measures are outlined in detail within the 'Flora and Fauna Management Plan' (dated June 2019) prepared for the mine. Full copies of the monitoring reports are provided as **Appendices 4** and **5**.

Management of biodiversity over the life of the mine has also been achieved through the implementation of the Bushland Conservation Area (BCA) in accordance with Conditions 70 to 74A of DA98/01173 and 118/698/22.

In accordance with the approved *Bushland Conservation Area Management Plan* and Condition 72, the BCA will continue to be actively managed until 2036.

6.6.1 Flora

Environmental Management

Flora monitoring has been conducted through several flora surveys throughout the reporting period. Surveys have been conducted in the Bushland Conservation Area (BCA), rehabilitation areas, and on *Tetratheca juncea*. Management and monitoring of flora within rehabilitation areas is discussed in Section 8.2.

Bushland Conservation Area

Annual flora quadrat monitoring has been conducted in the BCA since 2001. In 2021, nine 20m x 20m quadrats were monitored for species richness, density, floristic composition and biomass parameters. Quadrat monitoring occurs in late spring to early summer each year and aims to monitor the influence of mining activities on flora around the mine site.

Tetratheca Juncea

There was one species of threatened flora identified during the preparation of the 1998 Environmental Impact Statement (EIS), namely *Tetratheca juncea* (Black-eyed Susan). As a result, a Tetratheca Juncea Management Plan was developed (Gunninah, 2000a) and a survey and identification report (Gunninah, 2000b) was completed, which located the boundaries of the population and defined the limit of the conservation precinct. Subsequent works during 2001 and 2002 extended the boundary and up to an additional two hundred (200) plants were found during routine monitoring and vegetation characterisation.

In addition, approximately four hundred (400) plants were discovered during routine pre-clearing surveys and monitoring episodes. A large proportion of these plants fell outside of the active mine area, adding further conservation significance to the area(s) identified and managed by Donaldson as the Tetratheca Juncea Conservation Area (TJCA) (see **Figure 2.1**).

In addition to the creation of the TJCA, the following additional control measures have previously been employed.

- The protection of 650ha of bushland around the mine to conserve habitat.
- Ongoing mapping and management protocols.
- Pre-clearing surveys by a qualified biologist prior to any clearing activities.

In 2005, a design was also developed for the experimental translocation of *Tetratheca Juncea* from the planned mine disturbance area. The experimental design for the translocation was based on a study being conducted in the Gwandalan area (Ecobiological, 2005). The ongoing monitoring of the translocated plants focused upon collecting data and information about the circumstances under which the plants are growing. Each plant and each recipient site was photographed following translocation and every twelve months for 5 years. The plants were monitored and watered on a weekly basis for 6 weeks post planting to help ensure maximum initial survival and inspected twice per year for the 5 year period.

Environmental Performance

Bushland Conservation Area

The following summary of environmental performance has been extracted and compiled from Kleinfelder (2022a). A full copy of this report, including survey methodology, data and statistical analysis, is presented in **Appendix 4**.

The 2022 flora survey results show that the floristic composition of the monitoring sites is similar to the previous year, with an overall increase in plant species richness and structural components since the baseline survey in 2001. An overall increase in plant species richness and cover of groundcover species compared to 2019 was observed, likely indicative of the early stages of recovery from drought conditions experienced during 2018 and 2019. To date, a total of 305 flora species have been recorded across all survey events with 188 flora species identified during the 2021 survey. This represents a decrease of eight species compared to 2020, and an increase of 54 species since the 2001 baseline survey. Since commencement of monitoring the cumulative number of species steadily increased until 2009 and has since levelled and stabilised. This is consistent with expected ecological processes, weather patterns, and other variables.

Despite minor year-to-year fluctuations, all biomass variables examined (i.e. basal area, height, foliage projective cover (FPC), and stand volume) have also shown substantial increases over the last 20 years since the baseline survey in 2001. The regression analyses also confirmed that the relationship between time and increases in FPC and stand volume were highly significant indicating that the community biomass has increased substantially over time. Notwithstanding the significant increase since 2001, peaking during 2012 and 2013, the FPC and stand volume parameters appear to have stabilised at levels slightly lower than the peak. The protection of the Bushland Conservation Area from a history of logging, clearing, frequent fire, firewood collection and rubbish dumping has likely contributed to the significant increase in biomass at all monitored sites since 2001.

Overall, the recorded trends are indicative of a dynamic plant community with high recruitment from the seed pool, normally an indicator of a healthy, regenerating native plant community. Overall, Kleinfelder conclude that there have been no significant negative impacts on floristic diversity within the Donaldson Bushland Conservation Area over the last 20 years.

Tetratheca Juncea

A baseline report was completed in January 2003 by Barker Harle. This report describes the implementation of the Tetratheca Juncea Management Plan and includes baseline information for use in subsequent reports. Subsequent monitoring and reporting is undertaken on an annual basis.

The 2022 annual monitoring was completed by Kleinfelder (see **Appendix 5**). Kleinfelder (2022b) reported that the monitoring data has shown a declining population between 2005 and 2014, with a small recovery, followed by a continued decline. The probable cause for the continuing reduction was a measured increase in the density of ground species outcompeting *Tetratheca juncea*. The monitoring indicates that the *Tetratheca juncea* population would benefit from a fire which would both reduce the current level of competition and provide more nesting areas for tunnelling native bee pollinators.

Notwithstanding the overall decline, Kleinfelder note that there is a core of clumps that have survived over all, or for the majority of, the 16 year monitoring period potentially representing a permanent population. In addition, drought breaking rainfall in 2020 may have resulted in the recovery of 14 clumps since the 2019 survey, however, even after exceptional rainfall, the 2021 survey show a declining population with low flowering.

The monitoring also indicates that clump flagging had deteriorated to the point where it is difficult to identify clumps. Kleinfelder recommend that a certified surveyor is engaged to locate the original clump coordinates for further monitoring to continue.

Reportable Incidents

During the 2021/2022 Annual Review period unauthorised clearing of ~0.31ha within the Bushland Conservation area by an adjoining landowner was reported to DPE as an incident. This incident is further detailed in Section 11.

Further Improvements

Excluding ongoing weed monitoring and control, including targeting of *L. camara*, there are no proposed improvements to the management of flora in the BCA or TJCA in the next reporting period.

In response to recommendations from Kleinfelder, applications were submitted to the NSW Rural Fire Service (RFS) for 'hazard reduction burns' in several areas including the TJCA in order to improve the *Tetratheca juncea* habitat. Hazard reduction burns have undertaken in the northern part of the BCA, but not within the TJCA, by the RFS in October 2020 and September 2021 (**Figure 8.1**). Renewal of flagging for clumps of *Tetratheca juncea* will be reviewed during the next reporting period as recommended by Kleinfelder.

6.6.2 Fauna

Environmental Management

Several species of threatened fauna were identified during the 1998 EIS and supplementary reports, including both the areas proposed for mining and the immediate environs. They include the following.

- Powerful Owl
- Masked Owl
- Barking Owl
- Sooty Owl
- Varied Sittella
- Yellow-bellied Sheathtail Bat
- Eastern Bent-wing Bat
- Eastern Freetail Bat
- Eastern Cave Bat
- Greater Broad-nose Bat
- Little Bent-winged Bat
- Southern Myotis
- Little Lorikeet
- Squirrel Glide
- Eastern False Pipistrelle

To ensure a high level of conservation for the threatened fauna species found on the site, the following measures have been taken.

- The protection of 650ha of bushland around the mine to conserve habitat.
- Ongoing survey and management protocols.
- Routine annual quadrant monitoring.
- Wild dog and fox baiting programs, including a program undertaken by Enright Land Management between October and November 2021 in consultation with surrounding landholders (see also Section 9).
- Placement of nest boxes in the Bushland Conversation Area to replace nesting sites destroyed by clearing.
- Ongoing and progressive rehabilitation of disturbed areas.

The following fauna monitoring activities were undertaken during the 2021/2022 reporting period.

- Terrestrial and arboreal mammal trapping
- Microbat trapping
- Microbat call detection
- Owl call playback

- Spotlighting
- Bird surveys
- Nest box monitoring

These monitoring activities were carried out during summer and winter surveys, as well as during recolonisation surveys of rehabilitated areas at the mine. Kleinfelder (2022a) reported that a total of 45 nest boxes were available for fauna use during the reporting period, an increase of 15 from the previous reporting period.

Environmental Performance

The following summary of environmental performance has been extracted and compiled from Kleinfelder (2022a). A full copy of this report, including survey methodology, data and statistical analysis, is presented in **Appendix 4**.

A total of 180 fauna species have been recorded since monitoring began in 2001. The 2021 survey detected a total of 77 fauna species consisting of 49 bird, three arboreal and five terrestrial mammal, 15 bat, three amphibian and two reptile species. Seven of the bat species and two of the bird species are listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016*. The total number of fauna species recorded in 2022 is six below the yearly average of 83 but remains within the range of previous surveys with no significant change in species richness.

Similarity analysis of faunal assemblages for all years indicates a similarity of 60% although the results for 2021 was significantly different with the results for the all fauna assemblages in the previous monitoring events. This may be attributed to seasonal variability with the 2021 surveys occurring over a longer period, extending into early April 2022. Further analysis of assemblage similarity for various faunal groups revealed the following.

- Arboreal Mammals
  - The three arboreal mammals recorded in the 2021 survey is below the long-term average of 4.29 species.
  - Species assemblages for all years show a minimum similarity of 40% with two different groupings showing 100% similarity.
  - Variation can likely be attributed to sporadic detections of highly mobile or less common species.
- Terrestrial Mammals
  - The five terrestrial mammals recorded in the 2021 survey is slightly above the long-term average of 4.6 species.
  - Species assemblages for all years show a minimum similarity of 40%, with several clusters of years showing similarities ≥80%.
  - One introduced pest species was detected during the 2020/2021 survey; the Black Rat (*Rattus rattus*).

- Bats
  - The 15 bat species recorded in the 2021 survey is comparable to the long-term average of 15.1 species and is somewhat lower than the 2020 survey which recorded 32 species.
  - Species assemblages for all years show a minimum similarity of at least 60%, with three clusters of years showing similarities ≥80%. There is no clear pattern in the variation in the species assemblages over time.
- Birds
  - The 49 bird species recorded in the 2021 survey is generally comparable to the long-term average of 54.6 species. Overall the number of bird species recorded each year has remained relatively constant.
  - Bird assemblages from 2016 remained the most dissimilar compared to other years with all other years being at least 74% similar.
  - Further breakdown based on habitat preferences undertaken in 2016 indicates that birds with generalist habitat preference have remained consistent, however, there was an overall increase in generalist species and decrease in specialist species from 2012 (with mining having ceased in April 2013). However, compared to the 2013 to 2016 results, there was an increase in interior (specialist) and generalist species, and a decline in edge/open (specialist) species for the 2017 to 2020 period. This analysis will be repeated in 2024 to determine whether the identified trends have continued.
  - It is possible that changes in disturbance from mining have resulted in specialist bird species to move in or out of the area. However, it is possible that the change is a result of the large-scale clearing that occurred in the neighbouring industrial precinct in 2012. The creation of more edge habitat along nearly the entire eastern edge of the Bushland Conservation Area as a result of the industrial precinct may have made the habitat less suitable for interior specialists. Kleinfelder (2022a) notes that observed changes in species composition cannot be explained by any single factor but could be linked to many factors including natural fluctuations either locally or regionally.

Nest box monitoring undertaken by Kleinfelder within the BCA shows that fauna utilisation increased from the year of installation (2005) to 2012 and then decreased. A decrease in fauna utilisation following the 2012 monitoring event is likely to be due to weather damage, which makes the nest boxes less habitable. The replacement of damaged boxes occurred in winter 2018 and 2021 which has reduced the downward trend of utilisation due to uninhabitable boxes. Kleinfelder (2022a) notes that next box age and condition significantly affect utilisation rates with a 50% occupancy taking up to 4 years and peak occupancy being reached after 8 years. Therefore, it is expected that nest boxes installed in 2018 and 2021 will become more suitable over the coming years as arboreal fauna become more habituated.

Reportable Incidents

No reportable fauna related incidents were recorded during the 2021/2022 reporting period.

Further Improvements

Improvements during the next reporting period will include ongoing assessment of the effectiveness of the installed nest boxes and completion of repairs or replacement as necessary. General fauna survey within the Bushland Conservation Area will also continue together with statistical analysis of trends. There are no other proposed improvements to the management of fauna in the next reporting period.

6.7 HERITAGE

The following section outlines the commitment made by Donaldson for the protection of cultural and natural heritage of the area. A copy of a plan along with a summary table showing the known Aboriginal cultural heritage sites is attached as Appendix 2 of this report.

Thirty-one (31) sites of Aboriginal Cultural Heritage were previously identified on property owned by Donaldson. However, none of these sites were impacted by general management activities undertaken during the 2021/2022 Annual Review period.

There are no European heritage sites within the development consent or mining lease areas for the mine.

Archaeological Studies

The mine has been the subject of four archaeological studies since 1998. During each study the principal aims were to:

- consult and involve the Aboriginal Community at every stage of the investigation and to provide continuous opportunities for the Aboriginal Community through the Mindaribba Local Aboriginal Land Council (MLALC) to participate in the interpretation and decision making process;
- identify and record by field survey the material evidence of Aboriginal cultural heritage or locations of potential evidence with the land owned by Donaldson;
- assess the archaeological significance and understand the Aboriginal significance of material evidence of Aboriginal cultural heritage of the study area; and
- assess the impacts of the mine on Aboriginal Cultural Heritage.

No further archaeological studies have been required since the cessation of mining operations.

Management

In accordance with Conditions 84, 85 and 86 of the Development Consent, Donaldson has prepared an Aboriginal Sites Management Plan for the mine. Separate plans were produced for each year of operation at the mine. This provided a better opportunity to address specific issues for each year as well as an opportunity to review and address the management of Aboriginal Sites both inside the mine impact area and within associated bushland areas surrounding the mine.

The following control measures have been employed at the mine in order to ensure that reasonable duty of care is taken to ensure sites of Aboriginal cultural significance are not knowingly disturbed or destroyed.

- An Aboriginal Sites Management Plan was developed and implemented for the mine in consultation with the MLALC and other registered Aboriginal parties, where relevant.
- The MLALC is actively involved in the management of Aboriginal Sites at Donaldson.
- Representatives of the Lands Council were invited on site to monitor clearing and topsoil stripping activities during development and operation of the mine.

Performance

Donaldson and MLALC enjoy a good working relationship and to date there have been no complaints or incidents recorded in relation to the management of sites of Aboriginal cultural heritage.

Reportable Incidents and Further Improvements

No reportable heritage related incidents were recorded during the 2021/2022 reporting period and no further improvements are currently considered necessary.

7. WATER MANAGEMENT

7.1 WATER BUDGET

The mine area is primarily free draining with runoff from rehabilitated areas now returning to local catchments. With the exception of the localised Big Kahuna Dam catchment, all rehabilitated areas to the east of the site access road are now clean water catchments and drain off site. The Big Kahuna Dam continues to be used as an operational water storage for the Abel Underground Mine. Water from the Abel underground, Square Pit and West Pit are pumped to the Big Kahuna for storage.

During the reporting period the Abel underground mine transferred a total of 242ML into the Donaldson's Big Kahuna Dam. Runoff from the Abel surface facilities and water stored within the Square Pit and West Pit were also transferred to the Big Kahuna Dam as required. A total of 491ML of water was transferred from the Big Kahuna Dam to the Bloomfield mine site to be stored and used for operational purposes. There was no water discharged from the mine's licenced discharge point into Four Mile Creek. However, there was some minor discharge of water from a broken poly pipe transferring water from Donaldson Coal Mine to Bloomfield Coal Mine on 22/01/2022. This is further discussed in Section 7.2.

There was no water used or imported to the mine for rehabilitation or other purposes during the reporting period. **Table 7.1** summarises the status of water storage at the beginning and end of the reporting period.

Table 7.1
Water Stored at Donaldson

	Volumes Held (ML)		
	Start of Period	**End of Period**	**Storage Capacity**
Big Kahuna	270	361.25	400
Discharge to Creek	0	0	0
Contaminated Water	N/A	N/A	N/A

This data assumes that water in the West and Square Pits are managed and used by the Abel Underground Coal Mine. Water take is reported as part of the Annual Review for the Abel Underground Coal Mine

7.2 SURFACE WATER

Environmental Management

The Water Management Plan (Donaldson Coal Pty Ltd, 2019) details the measures employed by Donaldson to ensure protection of surface water on and around the mine site. Surface water monitoring has been ongoing since June 2000. A plan showing the location of the water monitoring sites is provided in **Appendix 1**. Routine sampling and analysis is undertaken at six (6) permanent surface water stream monitoring locations, when in flow. Opportunistic samples are also taken from various other locations around the mine area as required (sediment dams and mine water storage dams).

The surface stream water monitoring sites include:

- Four Mile Creek Upstream (FMCU) (EM1);
- Four Mile Creek Downstream (FMCD) (EM2);
- Scotch Dairy Creek Upstream (SDCU) (EM3);
- Scotch Dairy Creek Downstream (SDCD) (EM4);
- Weakleys Flat Creek Downstream (WFCD) (EM5); and
- Weakleys Flat Creek Upstream (WFCU) (EM6).

Samples collected from the six existing stream sites are analysed for Electrical Conductivity (EC), pH, Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and Sulfates (SO_4), on a monthly basis. A full suite analysis is also carried out on a quarterly basis and includes analysis for EC, pH, TDS, TSS, SO_4, Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Fluoride (Fl), Arsenic (As), Aluminium (Al), Barium (Ba), Cadmium (Cd), Cobalt (Co), Copper (Cu), Chromium (Cr), Iron (Fe), Manganese (Mn), Lead (Pb), Zinc (Zn), Total Alkalinity as $CaCO_3$, Turbidity, Nitrates and Phosphates (total).

In addition to the physical and chemical water quality work, biological monitoring (macroinvertebrates) was undertaken between 2000 and 2019 as previously required under the Water Management Plan. The program consisted of:

- a pre-mining baseline survey;
- a construction survey; and
- twice yearly operational surveys.

In accordance with the revised Water Management Plan, biological monitoring ceased following the September 2019 monitoring survey as rehabilitation and rehabilitation establishment is now considered to have been completed at the mine. Results of previous monitoring is presented in the respective Annual Reviews and AEMRs.

In addition to ongoing water quality monitoring, the following control measures are employed at the mine to ensure an appropriate level of protection to surface water on and around the mine site.

- Minimal disturbance and progressive rehabilitation (noting operational activities have now ceased).
- Source separation in order to separate water of differing quality.
- Collection and containment of mine water for dust suppression at the Abel Underground Mine surface facilities and/or transfer to the Bloomfield Colliery for operational use, as required.

In addition to these measures, inspections of drainage channels and structures were undertaken throughout the reporting period. The outcomes of the site investigation by SLR to assess the sediment generating potential of the site and the conveyance channels was also completed with *Sediment Dam Investigation* report finalised in June 2022. The recommendations of this report are summarised under ‘Further Improvements’.

Environmental Performance

Chemical and Physical Monitoring

A summary of three key parameters, required by EPL 12856, for the reporting period as well as the pre-mining baseline is included in **Table 7.2**. Monitoring results for pH and EC since the year 2000 are also presented graphically in **Figure 7.1** to assist in identifying trends.

pH

During the reporting period monthly pH values have been variable with a number of pH values recorded below the ANZECC Guideline criteria for freshwater 95% level protection (pH 6.5). The lowest pH of 5.20 was recorded at the WFCD site in May 2022 where water flow was recorded as 'slow'. The average pH for WFCD (pH 6.37) was also below the ANZECC Guideline but similar to the lower pre-mining level of pH 6.40. Samples collected at WFCD during the reporting period were consistent with those of the previous reporting period and loosely mirror the pH trends at the WFCU site (see **Figure 7.1**). As noted during previous reporting periods, lower pH values appear to be correlated to periods of low flow within the creeks and could be the result of acidification from the surrounding soils which naturally have a pH in the order of 4.5 to 4.8 (GSS, 2015).

The results for FMCU and FMCD were consistent with pre-mining levels and similar to the long-term mean. It is noted that there remained little divergence of the pH between the FMCU and FMCD locations during the reporting period, continuing the trend identified during the previous reporting period. Previous divergence of pH values is thought to be the result of leakage from the Stoney Pinch Reservoir (now Black Hill Reservoir) above the FMCD sample point. As repair works have been completed on the reservoir these effects have become less prominent and more readily reflect rainfall conditions that result in overflows from the reservoir.

The average pH for SDCU (pH 6.00) and SDCD (pH 6.06) was below the ANZECC Guideline but are generally consistent with the long-term average and within the pre-mining range.

Electrical Conductivity

During the reporting period, the average electrical conductivity (EC) values at all monitoring locations remained below the long-term averages with the exception of SDCU and SDCD which were slightly higher than the long-term average but remain within relevant ANZECC criteria.

Average EC values were also generally consistent with pre-mining levels except for SDCU, and FMCD which recorded average values slightly higher than those recorded pre-mining. Whilst exceeding pre-mining levels, the average EC at FMCD remained lower than upstream and the trends in upstream and downstream results generally consistent. At SDCU, whilst the average EC during the period was slightly greater than pre-mining levels it remained well below the long-term trend.

Monthly values at the remaining sites were generally consistent with range of pre-mining levels with only minor variations either above or below pre-mining levels.

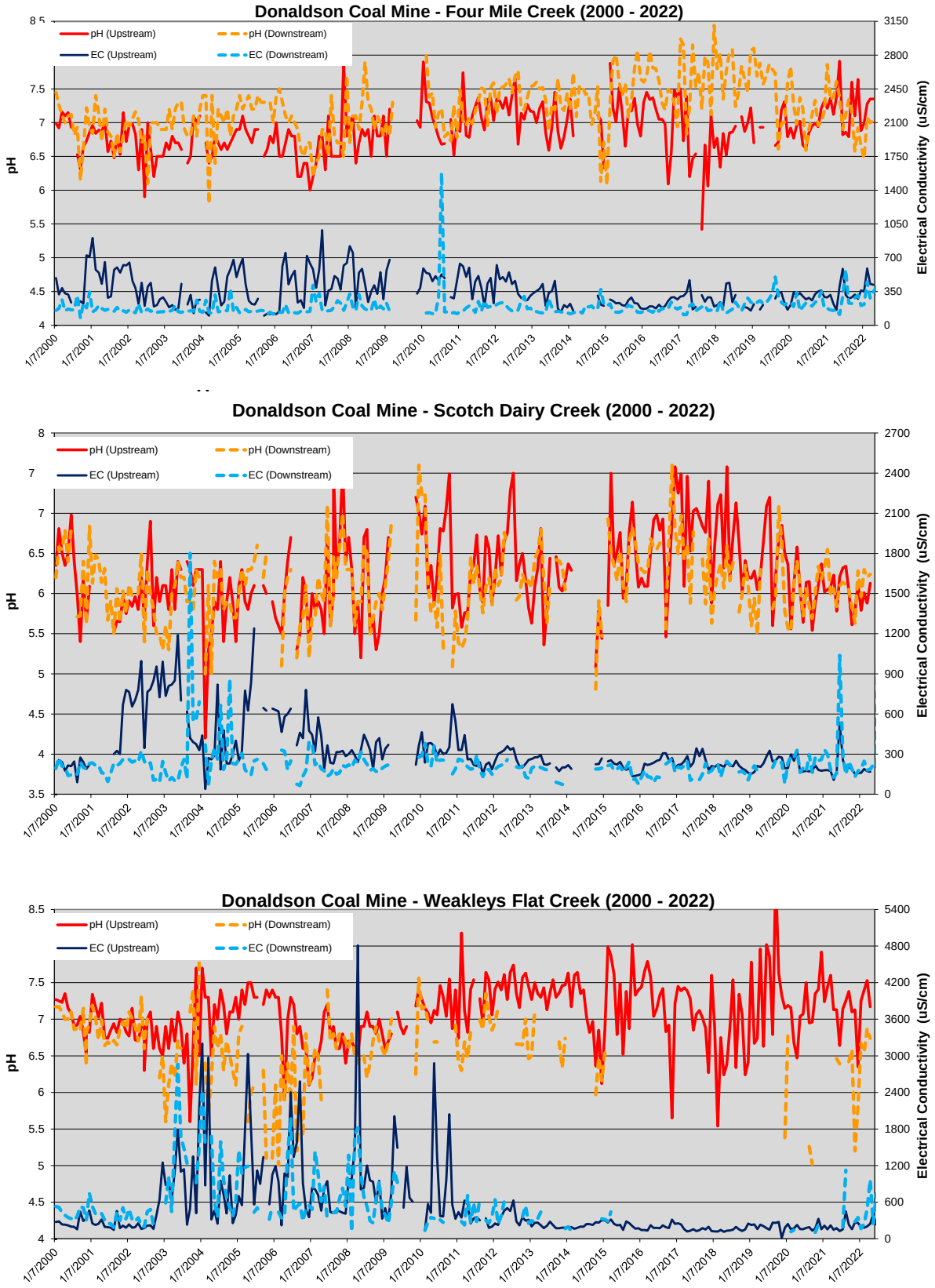


Figure 7.1 Surface Water Monitoring – 2000 to 2022

Table 7.2
Summary of Surface Water Quality Monitoring Results – 2021/2022

Sample Site	Pre-mining	2021		2022										*Mean 2021 / 2022*	*Long-term Mean*
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct		
Rainfall (mm)															
-	-	198.6	55.4	78.8	102.2	271.4	107.4	86.2	12.6	304.8	43.0	111.2	97.2	-	-
pH															
FMCU	*6.70 - 7.44*	**7.91**	6.82	6.86	6.79	**7.60**	7.10	**7.64**	6.88	6.99	7.28	7.35	7.35	7.22	6.89
FMCD	*6.40 - 7.73*	6.90	7.12	7.34	7.18	6.58	6.92	6.66	6.47	7.08	7.00	7.02	7.01	6.94	7.22
SDCU	*5.90 - 6.81*	**5.78**	6.21	6.32	6.34	6.03	**5.61**	**5.78**	6.13	**5.79**	6.01	**5.88**	6.13	6.00	6.23
SDCD	*5.80 - 6.80*	5.84	6.10	6.14	6.11	6.04	5.83	**5.63**	6.28	5.96	6.30	6.20	6.24	6.06	6.11
WFCU	*6.60 - 7.49*	7.13	6.64	7.14	7.25	7.38	7.10	7.13	**6.35**	7.25	7.40	**7.53**	7.17	7.12	7.08
WFCD	*6.40 - 7.28*	6.46	**6.39**	Dry	Dry	6.42	6.58	**5.20**	**5.81**	6.67	6.55	6.87	6.74	6.37	6.56
Electrical Conductivity (µS/cm)															
FMCU	*265 – 522*	403.0	**585.0**	315.0	276.0	290.6	319.0	274.2	361.4	350.6	**589.9**	429.0	420.1	384.5	356.5
FMCD	*120 - 265*	**299.5**	**577.0**	229.5	225.5	**285.4**	**313.0**	204.6	215.6	**451.0**	**282.1**	**347.7**	**391.6**	**318.5**	192.7
SDCU	*71 - 200*	170.8	**535.0**	**257.7**	178.1	**205.3**	185.6	151.7	157.2	160.6	189.2	172.0	167.9	**210.9**	**336.2**
SDCD	*145 - 270*	159.6	**1038.0**	**293.0**	148.8	244.5	188.7	**132.0**	173.4	192.2	247.1	180.2	186.8	265.4	220.8
WFCU	*200 - 310*	**154.7**	**449.0**	230.8	**155.3**	267.8	259.8	**194.6**	**180.1**	202.5	242.9	**410.0**	231.8	248.3	**502.7**
WFCD	*230 - 546*	**194.4**	**1124.0**	Dry	Dry	280.9	347.0	**165.0**	246.5	495.4	**964.6**	250.8	**729.3**	479.8	**589.6**
Total Suspended Solids (mg/L)															
FMCU	*32 - 180*	**12**	**14**	**9**	**17**	**14**	**17**	**16**	**<5**	**22**	**<5**	**18**	**<5**	**12**	**23**
FMCD	*2 - 32*	7	8	8	<5	5	<5	19	<5	16	8	8	<5	18	30
SDCU	*9 – 47*	**<5**	**6**	47	35	11	**<5**	11	**5**	**7**	18	14	**5**	28	**135**
SDCD	*12 - 1283*	16	24	92	41	18	**6**	43	20	**7**	126	12	**5**	66	91
WFCU	*1 – 3*	**<5**	**5**	**<5**	**<5**	**<5**	**<5**	**10**	**<5**	**12**	**10**	**22**	**<5**	**18**	**25**
WFCD	*3 - 17*	**33**	**33**	Dry	Dry	12	6	11	13	15	**41**	**21**	**<5**	14	**52**

Bold values exceed pre-mining levels. Red values exceed ANZECC Guideline criteria for lowland rivers (pH 6.5 to 8.0, and EC 125µS/cm to 2,200µS/cm).
FMCU = Four Mile Creek Upstream, FMCD = Four Mile Creek Downstream, SDCU = Scotch Dairy Creek Upstream, SDCD = Scotch Dairy Creek Downstream,
WFCU = Weakly's Flat Creek Upstream, WFCD = Weakly's Flat Creek Downstream.

Since monitoring commenced in July 2000, at the Four Mile Creek and Scotch Dairy Creek sites, with a few exceptions, the EC at the downstream sites has been consistently lower or similar to the upstream sites with no obvious trends evident (see **Figure 7.1**). However, since 2020 the EC at SDCD was regularly slightly higher than that of SDCU. This appears to be a function of reduced EC upstream at SDCU rather than an increase in EC at SDCD.

Previous monitoring results also show that, between 2003 and 2010, both the upstream and downstream EC levels within Weakleys Creek varied to a substantially greater extent than the Four Mile and Scotch Dairy Creek sites. However, since 2011, EC levels in Weakleys Creek have remained relatively consistent. Samples for the reporting period maintain this trend.

Overall, the available results suggest that the mine has had a negligible impact on the EC of surface waters in the surrounding area.

Total Suspended Solids

During the reporting period, TSS values at monitoring locations were generally low and similar to the respective pre-mining levels, except for SDCD and WFCU which both recorded averages above the pre-mining levels. Two exceedances of the TSS criteria of 50mg/L were recorded at one of the six monitoring locations during the reporting period. The highest values recorded were for SDCD during August (460mg/L) and January (92mg/L); however, these values are significantly below the maximum pre-mining level for this location (1,283mg/L). High TSS levels are not considered to reflect mine-related impacts as no mining operations or mine-related disturbance or discharge occurred during the reporting period.

Reportable Incidents and Further Improvements

During the 2021/2022 reporting period, there was one reportable incident in regards to a leak in the pipeline pumping water from Big Kahuna Dam to the Bloomfield Colliery. This incident was reported to the relevant authorities including details of the incident. This incident is further detailed in Section 11.

In relation to further improvements, the *Sediment Dam Investigation* report finalised by SLR in June 2022 included a range of recommendations relating to: updated water quality criteria for the sediment dams; remediation works for erosion; liaising with TransGrid in relation to erosion in the easement; and confirmation of harvestable rights for retained structures. A program for implementation of these recommendations will be prepared during the next reporting period and status of implementation updated during future Annual Reviews.

7.3 GROUNDWATER

Environmental Management

The Water Management Plan (Donaldson Coal Pty Ltd, 2019) details the measures employed by Donaldson to ensure protection of groundwater on and around the mine site.

Groundwater monitoring has been ongoing since June 2000. There are six (6) current monitoring sites, the locations of which are provided in **Appendix 1**.

The groundwater piezometers are monitored to determine impacts on both Standing Water Levels (SWL) and groundwater quality. A regional site, REG DPZ1, is also included in the monitoring program and is located in Avalon Estate approximately 1.2km north of the mine.

Samples collected from the six bores are analysed for EC, pH, TDS, TSS and Sulfates (SO_4), on a monthly basis. A full suite analysis is also carried out on a quarterly basis and includes analysis for EC, pH, TDS, TSS, Sulfates (SO_4), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Fluoride (Fl), Arsenic (As), Aluminium (Al), Barium (Ba), Cadmium (Cd), Cobalt (Co), Copper (Cu), Chromium (Cr), Iron (Fe), Manganese (Mn), Lead (Pb), Zinc (Zn), Total Alkalinity as $CaCO_3$ and Turbidity.

The standing water level of each of the monitoring bores is measured each month, as metres below ground level.

Environmental Performance

Monthly water monitoring results were routinely reviewed to determine whether there were any changes as a result of activities at the mine.

A summary of the three key parameters required by the EPL (Standing Water Level, pH and EC) for the 2021/2022 reporting period, along with the pre-mining baseline, is included in **Table 7.3**. Monitoring results since commencement of monitoring are also presented graphically in **Figure 7.2**.

Standing Water Levels

REGDPZ-1: Regional control bore located in strata well below the Donaldson Seams. Shows groundwater level trends that generally reflect long-term rainfall patterns, declining gradually from 2000 to 2005 (a period of below average rainfall); rising gradually from 2007 to 2013 (a period of slightly above average rainfall) before plateauing between 2013 and 2016; and declining gradually since 2016, reflecting regional drought conditions. Since 2020 groundwater levels have been gradually rising reflecting high levels of rainfall received throughout 2020 to 2022.

DPZ3: Located in the open cut area and screened in coal measures below Donaldson Seam. An unexplained rise in water level was recorded from 2004 to 2010 followed by a decline which was a response to mining from the Donaldson Open Cut. Between 2015 and 2018 the SWL remained relatively stable and slightly higher than pre-mining levels. A slight decrease occurred in 2019 followed by a consistent increase during 2020 to 2022 likely in response to increased rainfall during this period.

DPZ6: Showed drawdown during latter stages of the Donaldson Open Cut and then more pronounced drawdown once development of the Abel Underground South Mains started in April 2008. A partial recovery was subsequently evident during 2013 to 2016, most likely due to recovery within in the completed Donaldson Open Cut. Levels during the reporting period have remained relatively stable, although a sharp increase in groundwater levels is observed from July 2022 following the substantial 304.8mm of rainfall received in that month.

DPZ8: Screened in Donaldson and Big Ben Seams. Responded to mining in the Donaldson Open Cut in 2007 and then slight post-mining recovery. The water level has remained steady since 2014.

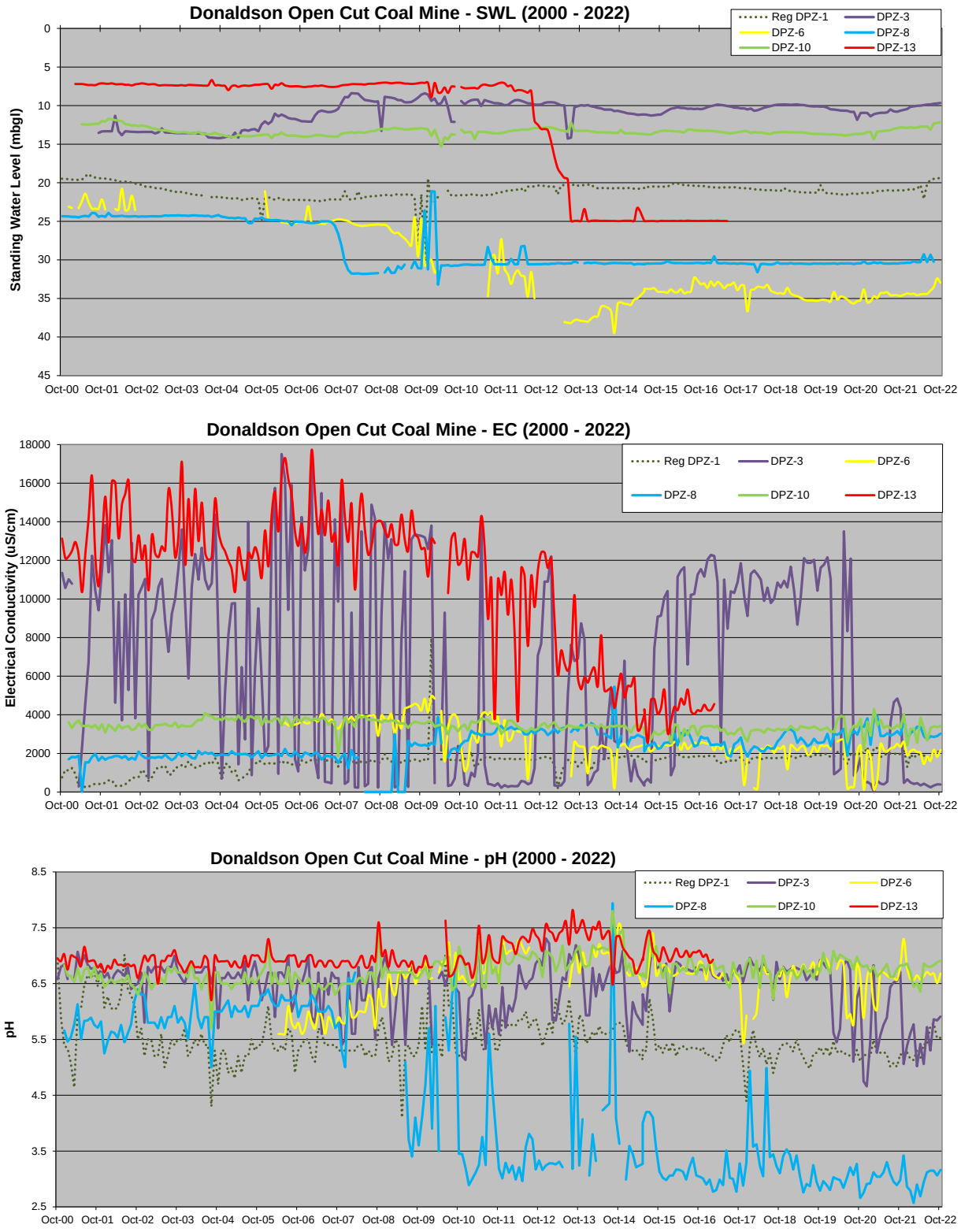


Figure 7.2 Groundwater Monitoring – 2000 to 2022

Table 7.3
Summary of Groundwater Monitoring Results – 2021/2022

Sample Site	Pre-mining	Site Average[1]	2021		2022									
			Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Rainfall (mm)														
-	-	-	198.6	55.4	78.8	102.2	271.4	107.4	86.2	12.6	304.8	43.0	111.2	97.2
Standing Water Level (m below natural ground surface)														
REG DPZ-1	N/A	21.10	20.98	20.9	20.87	20.84	20.77	20.29	22.09	20.17	19.61	19.49	19.5	19.31
DPZ3	12.05 - 11.51	10.89	10.03	10	9.93	9.86	9.84	9.75	9.72	9.65	9.59	9.36	9.11	8.94
DPZ6	N/A	30.94	34.52	34.36	34.42	34.39	34.58	34.47	34.42	34.41	33.99	33.53	32.42	32.96
DPZ8	24.35	28.42	30.47	30.41	30.41	30.38	30.37	30.2	30.3	30.29	29.27	30.29	29.33	30.24
DPZ10	12.4	13.38	12.86	12.73	12.72	12.68	13.11	12.31	12.24	12.16	11.91	11.73	11.6	11.43
DPZ13	7.01 - 7.25	12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pH														
REG DPZ-1	N/A	5.48	5.19	5.27	5.15	5.13	5.3	5.16	5.42	5.4	5.74	5.79	5.52	5.53
DPZ3	5.99 - 6.96	6.45	5.06	5.38	5.61	5.77	5.02	5.42	5.06	5.72	5.3	5.86	5.84	5.91
DPZ6	N/A	6.55	7.3	6.8	6.59	6.56	6.65	6.57	6.63	6.71	6.66	6.68	6.51	6.68
DPZ8	5.46 - 5.66	4.43	3.42	2.86	2.79	2.57	2.9	2.69	2.94	3.12	3.15	3.15	3.06	3.16
DPZ10	6.48 - 6.97	6.73	6.83	6.86	6.71	6.44	6.51	6.35	6.86	6.81	6.8	6.83	6.88	6.91
DPZ13	6.67 - 7.22	7.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Electrical Conductivity (µS/cm)														
REG DPZ-1	N/A	1558	2250	1283	1945	1759	1980	1927	1886	1743	1744	2092	2169	1935
DPZ3	10200 - 11350	6685	475	652	491	419	460.8	337	428.4	331	244.7	335.7	393.8	388.4
DPZ6	N/A	2713	2602	1921	2122	2194	2067	2035	1452	1838	1614	2197	1820	2170
DPZ8	1690 - 1820	2448	3800	2690	3060	3170	3380	3370	2890	2730	2890	2850	2900	3020
DPZ10	3670	3436	4030	2410	3270	3280	2547	3860	3280	2662	3310	3400	3360	3420
DPZ13	12200 - 13750	5 838	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

1. Since monitoring commenced at that site. N/A = Not Accessible

DPZ10: Screened in the Beresfield Seam and shows modest open cut mining effect from 2001 to 2006, then modest recovery, and more recent response to Abel Underground mining from 2011. The SWL has remained relatively stable since 2011, with a slight increase shown over the reporting period, likely in response to increased rainfall compared to the previous reporting period.

DPZ13: Screened in Donaldson Seam overburden, and showed no response to open cut mining, but clear response to Abel Underground mining from early 2012. Groundwater level has remained consistent since 2013. Access has not been available to DPZ13 since April 2017 due to ongoing restricted access to the landholding. As a result, DPZ13 will no longer form part of the monitoring network.

Groundwater Quality

Salinity (EC and TDS) varies over a wide range from bore to bore, but within each bore, salinity generally is quite stable over time. Some of the monitored bores have reported occasional outliers of significantly lower salinity and corresponding reduction in pH which are likely due to ingress of rainwater temporarily lowering the salinity in the bore. This occurred during the reporting period for both DPZ3 with elevated EC levels recorded during July to October 2021, corresponding with low rainfall, followed by a sudden decrease following rain events in November 2022 with EC levels since remaining stable.

A downward trend in EC is observed at bores DPZ6 and DPZ13, starting in 2010 or 2011, which could be due to enhanced recharge following drawdowns in the coal measures as a result of open cut mining. The downward trend has levelled out from the start of 2015.

Conversely, a rise in EC was observed at DPZ8, starting in 2008 or 2009, which is almost certainly related to open cut mining. However, the EC in DPZ8 has not continued rising, having stabilised at about 500µS/cm to 1 000µS/cm higher than pre-2008.

Apart from the EC rise in DPZ8 in 2008, the monitoring has not indicated any rising trend in salinity in any bore, apart from the regional control bore REGDPZ1, which is unrelated to any mining activity, and is thought to be a result of increased urbanisation.

Likewise, although there are some pH variations from bore to bore, the monitoring has generally reported consistent pH values at individual bores over the past 4 to 5 years. In the past, both DPZ3 and DPZ8 show changes in pH that are probably related to mining or associated activities.

The pH values reported from DPZ3 were generally in the range 6.5 to 7.0 until around 2006, when the pH started to be more erratic, and more frequent lower pH values than previously, possibly indicating slightly more acidic conditions. Since around May 2006, pH values at DPZ3 have been generally in the range 5.2 to 7.2. During the reporting period, pH levels within DPZ3 continued ranged between 5.02 and 5.91. DPZ6 shows a similar pattern on fluctuation over the reporting period, however the variations were to a lesser degree and ranged from 6.51 to 7.30 during the reporting period. The period of pH variability reflects the period of EC variability and is expected to be similarly related in ingress of rainwater.

The pH values reported from DPZ8 were generally in the range 5.0 to 6.5 until late 2007, when the pH started to be more erratic, and generally much lower than previously, indicating more acidic conditions. Water levels in DPZ8 dropped sharply in September 2007, at the same time that EC noticeably increased and pH started to be erratic and eventually fell to a much lower

level. Since February 2009, pH values at DPZ8 have been generally in the range 3.0 to 4.0 albeit with a number of higher outlier values, but significantly lower than the pre-mining levels. This is most likely due to the open cut exposing sulphides or other acid-forming minerals present in the coal seams or interburden strata to oxidation, leading to the reduction in pH at the time that mining reached the vicinity of this bore. This is an expected outcome given the nature of the geology, of which some strata are known to be net acid producing, and the predicted drawdown resulting from mining operations.

Reportable Incidents and Further Improvements

No reportable groundwater incidents were recorded during the 2021/2022 reporting period and no future improvements to groundwater management are currently planned.

8. REHABILITATION

8.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

Assorted infrastructure was removed from site as part of the final rehabilitation activities during the 2013/14 reporting period. This included the removal of fuel storage tanks, traffic control boom gates and a number of bitumen and dirt roads. No additional infrastructure was removed during the current reporting period. As at the end of the reporting, the mine-related infrastructure remaining within ML 1461 included the following.

- Administration office.
- Workshop.
- Core shed.
- Selected access roads.

These infrastructures are not proposed to be removed during the near term until their potential utilisation for future land uses is determined (discussed below).

Rehabilitation works previously completed, as outlined in the *Mine Closure Plan for Donaldson Open Cut*, include the following.

- Excavation of waste rock and contaminated material to the West Pit.
- Reshaping of the land surface to as near as possible to natural topography.
- Spreading of topsoil on reshaped surfaces.
- Spreading of a seed mix of local tree and shrub species, as well as fast growing, sterile groundcovers which grow rapidly to provide erosion control, of the remaining 27.7ha of rehabilitated area.

The post rehabilitation land uses for Donaldson include conservation area, open spaces and light industrial area. The rehabilitated open cut area is completely vegetated with native shrubs and trees. These areas will be conserved and managed similar to the adjacent Bushland Conservation Area. Subject to future approval, the areas around the former open cut maintenance workshop and administration building may be used as a light industrial area.

The West Pit and Square Pit have been made safe and left for use by the Abel Underground Mine which will be responsible for ongoing management. No specific management was required during the reporting period.

No further areas remain to be rehabilitated as part of the Donaldson Coal Mine operation and no additional rehabilitation works were undertaken during the 2021/2022 reporting period.

Figure 8.1 shows the final landform and current revegetation status. A summary of the total area of rehabilitation is provided in **Table 8.1.**

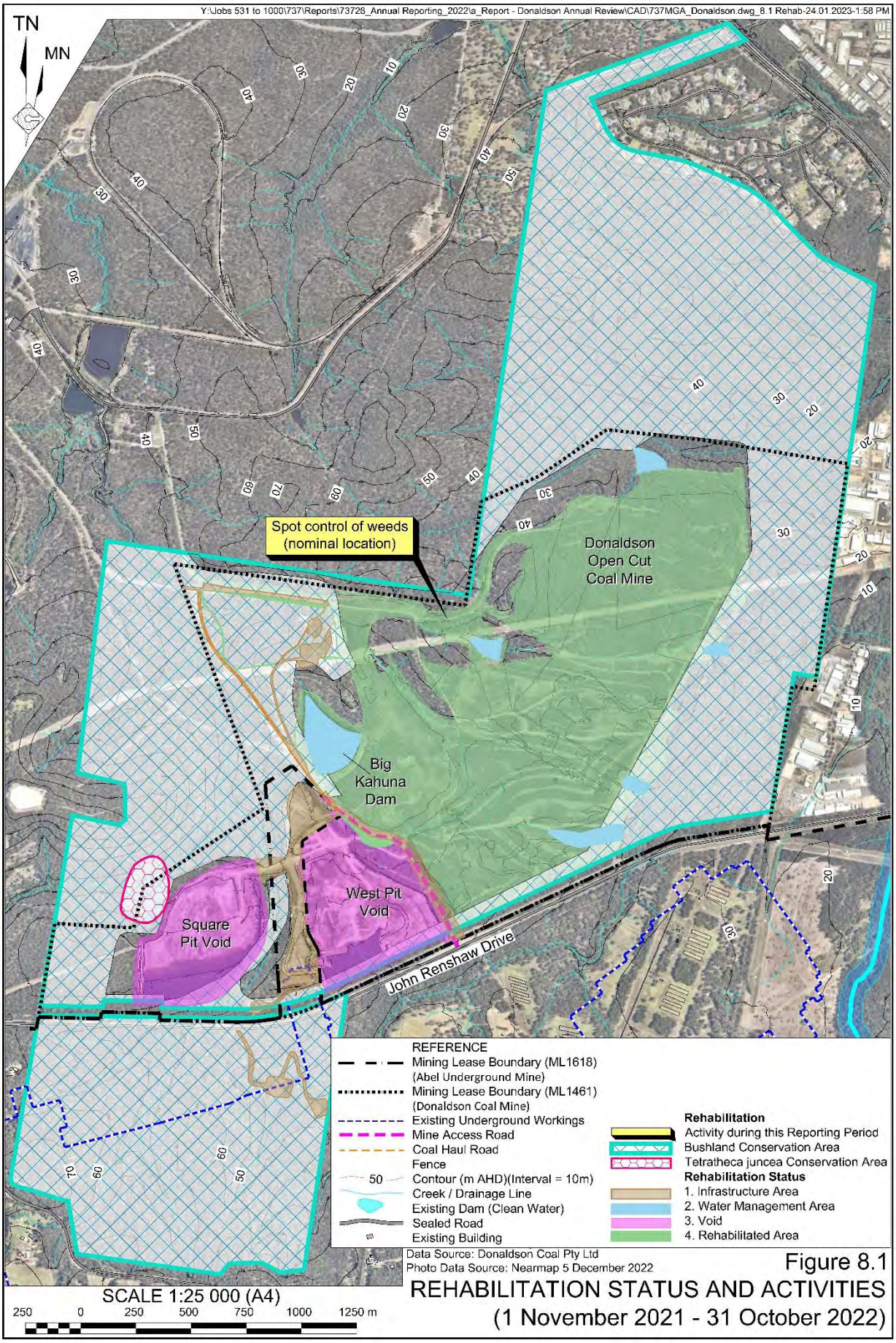


Figure 8.1
REHABILITATION STATUS AND ACTIVITIES
(1 November 2021 - 31 October 2022)

Table 8.1
Rehabilitation Summary (Cumulative)

Mine Area Type	Previous Reporting Period (Actual) Year 18 (ha)	This Reporting Period (Actual) Year 19 (ha)	Next Reporting Period (Forecast) Year 20 (ha)
Total mine footprint	308	308	308
Total active disturbance	78[1]	78[1]	78[1]
Land being prepared for rehabilitation	0	0	0
Land under active rehabilitation	230	230	230
Completed rehabilitation	0	0	0

Notes: 1. Includes 60ha for the Square Pit and West Pit and 18ha for other retained infrastructure. These areas are used to support the operation of the Abel Underground Mine.

As noted in **Table 8.1**, the 'active disturbance' area for the Donaldson Coal Mine includes the Square Pit (27ha) and West Pit (33ha). The areas encompassing these pits will be subject to closure and rehabilitation in accordance with the respective Rehabilitation Management Plans and *Abel Underground Mine and Donaldson Open Cut Mine – Closure Strategy for the West and Square Pits* with final closure scenarios to be confirmed depending on the closure or resumption of mining operations at the Abel Underground Mine (currently under care and maintenance). The rehabilitation security for these areas will continue to be held against Mining Lease 1461.

8.2 REHABILITATION MONITORING

Assessment of rehabilitation performance (fauna and habitat) was conducted by Kleinfelder in March 2022 (see **Appendix 6**). Rehabilitation performance (flora) monitoring is scheduled on a 2-yearly basis and was last undertaken by Global Soil Systems in September 2019. However, the monitoring scheduled to be undertaken during September 2021 was delayed due to restrictions from the Covid-19 pandemic and was instead undertaken in December 2022 by Wedgetail Project Consulting, i.e. beyond the current reporting period. The updated flora and soil monitoring will be reported as part of the next Annual Review.

The monitoring undertaken aims to determine the effectiveness of the rehabilitation program in re-establishing pre-mining / natural biodiversity levels and to determine the habitat requirements of recolonising fauna. Surveys are undertaken within a total of four monitoring plots, including one control plot, and four nesting box plots. Monitoring commenced in 2008.

The monitoring undertaken by Global Soil Systems includes one control plot in the remnant bushland (Plot 1) and nine monitoring plots in the rehabilitated areas of the mine (Plots 2 to 10). The plots have been established for between 7 and 18 years.

The results of these assessments are compared with the completion criteria adopted by Donaldson. These criteria cover soil quality, vegetation, growth rates, species diversity and stem densities. A summary of the results of the January 2022 fauna and habitat monitoring and previous 2019 flora and soil monitoring compared to the completion criteria is provided in **Table 8.2**.

Table 8.2
Status of Monitoring Against Completion Criteria

Feature	Completion Criteria	Current Status
General	Stable landform	All monitoring plots were observed to be 'stable' with no signs of significant erosion.
	Effective drainage	The rehabilitated areas are effectively draining with no evidence of pooling water.
	Resilience to drought episodes in rehabilitated area.	Decreasing canopy cover and increasing leaf litter indicate some drought stress.
Flora	Re-establishment of a dense and diverse mixture of local native understory and overstorey vegetation species, specifically four (4) overstorey and four (4) understorey species in each monitoring plot.	Plot 1 (control) = 11 understory and 5 overstorey species. Plots 2 to 10 = 4 to 13 understorey and 4 to 19 overstorey species.
	Limited presence of weeds	Increasing evidence of weeds (*Lantana camara, Cortaderia selloana, Senecio madagascariensis* and annual weeds) noted in Plots 2, 5, 7, 8, 9 and 10.
	Tree/shrub densities of 3 000 stems/ha after 5 years and 1 000 stems/ha after 15 years.	Plot 1 (control) = 6 600. Plots 2 to 10 range from 2 400 to 11 100.
	Evidence of natural regeneration in at least four species.	Natural recruitment was observed in most plots and evidence of flowering and seed production in some eucalypts and acacias.
Fauna	Reinvasion of rehabilitated area by native fauna.	The similarity of fauna diversity between the rehabilitation quadrats and the analogue site has increased from 20% similarity in 2011 to between 60% and 80% for two quadrats and approximately 40% to 60% for the remaining quadrat in 2021. This represents the highest value recorded for this quadrat (Q4) and is expected to be less as the survey design does not incorporate Anabat deployment. Overall, the 2021 monitoring recorded the greatest species diversity. These results show that the rehabilitation areas are trending towards the remnant forest analogue site conditions, with some year-to-year variation.
Soil Loss	Minimal erosion and soil movement, specifically soil loss from less than 40t/ha/year	Soil loss per annum for Plots 2 to 10 (ranged between 210 and 40 tonnes/ha) was generally lower than the analogue plot (175 tonnes/ha).
Soil Quality	Soil pH to be no lower than 10% of analogue plot pH after 5 years.	Plot 1 (analogue) – pH 5.3 Plots 2 to 10 – pH 5.1 to 5.6
	Conductivity of replaced soil to be below 900uS/cm after 5 years	EC for all plots ranged from 29 to 81µS/cm.
	Surface layer to be free of any hazardous material to a depth of at least 1m.	There has been no evidence of hazardous material following deep ripping.
	Runoff water conductivity to be less than 1 000µS/cm after 5 years.	Internal monitoring of the retained on-site sediment dams confirms ECs generally ranging between 118µS/cm and 175µS/cm.
	Soil nitrogen and phosphorous levels to be within 20% of levels in analogue site after 5 years.	The phosphorous levels within all rehabilitation plots remained lower than the analogue site. Phosphorous levels at both the analogue and rehabilitation plots decreased to levels previously recorded in 2015 (following a spike in 2017 – potentially due to sampling technique). All plots had nitrogen levels similar to or above the analogue plot value.
Pollution	Soil should not be a source of pollutants. Quality of water leaving the site to be in accordance with EPL requirements.	No non-compliance with EPL surface water quality requirements have been recorded with no discharges required. Internal due diligence monitoring within the on-site sediment dams confirms that all measured ECs and the majority of total suspended solid results during the reporting period would be compliant with discharge criteria. The pH of the dams are slightly acidic but generally consistent with surrounding water courses.
Source: GSS (2019), Kleinfelder (2022), Donaldson Coal.		

It is noted that updated rehabilitation objectives and completion criteria have been proposed as part of the Rehabilitation Management Plan finalised in August 2022. These objectives and criteria remain subject to approval by the Resources Regulator with rehabilitation to reviewed against these during future reporting periods.

To date, the monitoring has found that several of the rehabilitated areas have already met the completion criteria and that all rehabilitated areas assessed are on track to meet the required completion criteria.

8.3 ACTIONS FOR THE NEXT REPORTING PERIOD

8.3.1 Rehabilitation

The primary activity planned to occur in the next reporting period is monitoring as outlined in the RMP for the mine. Additional mine closure planning, including commencement of a rehabilitation materials balance report, will be undertaken.

8.3.2 Monitoring

Rehabilitation monitoring required to be undertaken at the mine under the development consent and other regulatory documents will continue to be carried out in the 2022/2023 reporting period.

9. COMMUNITY

No complaints, matters of concern, or environmental queries were raised with Donaldson during the 2021/2022 reporting period.

In accordance with the conditions of the mine's development consent, Donaldson established a community consultative committee for the mine. The last committee meeting was held on 7 August 2013. No meetings were held during the reporting period and further meetings are currently deemed unnecessary.

No other specific community engagement activities relating to the mine were undertaken during the reporting period.

Given that coal mining activities ceased in April 2013 and rehabilitation was completed by March 2014, there has been negligible social impact to the community throughout the reporting period. As a result, during the reporting period Donaldson did not:

- provide community donations;
- need to conduct mitigation works to address any community impacts; or
- undertake any mine-related property acquisitions.

However, continued community benefits have occurred as a result of the utilisation of locally based employees for completion of maintenance activities within the rehabilitated areas. Additionally, contractors who are engaged to conduct routine and non-routine land management works are also sourced locally.

10. INDEPENDENT AUDIT

The last and final independent environmental audit of the mine was undertaken in March 2015 following the completion of mining in 2013 and rehabilitation in 2014. The audit found a high degree of compliance and identified the conditions of the development consent which were considered to remain active following the completion of mining. These remaining conditions have been treated as 'recommendations' and the status of these conditions is outlined within the 2014/2015 AEMR and further updated in **Table 10.1**.

Table 10.1
2015 Independent Audit Recommendations and Status Update

Page 1 of 2

Cond No.	Development Consent Condition	Comment	Update
63(xiv)	**Biological Monitoring** The Applicant shall prepare and implement a detailed monitoring program for groundwater and surface water (xiv) monitoring of macro-invertebrates and vegetation in accordance with protocols developed for the Hunter SIGNAL biological assessment criteria, with an assessment of inflows to the wetlands.	The biological monitoring will continue in accordance with Development Consent condition 63(xiv) "for a period of at least five years after the completion of mining, or other such period as determined by the Director- General."	Monitoring has been undertaken for period of at least 5 years from completion of mining (i.e. until April 2018). Annual monitoring ceased at the end of the 2019 reporting period in accordance with the approved updated Water Management Plan. **Status: Complete**
69	**Tetratheca juncea Management Plan** The Plan shall be consistent with the Flora and Fauna Management Plan and include measures for fire management.	The ongoing control measures employed at the Donaldson Coal Mine site ensure a high level of conservation for the *Tetratheca juncea*.	The *Tetratheca juncea* area is contained within the Bushland Conservation Area (BCA). Refer to comment below.
72(ii) & (iii)	**Bushland Conservation Area Management** (ii) retain management and ownership of the land for a minimum of 36 years from the commencement of construction, unless other arrangements are agreed in accordance with Condition 73; and (iii) prepare and implement a Management Plan for that area in consultation with OEH and to the satisfaction of the Director-General, during the period in which the Applicant is responsible for management.	Donaldson Coal Pty Ltd will retain management and ownership of the land for a minimum of 36 years from the commencement of construction, unless other arrangements are agreed in accordance with Development Consent condition 73.	The BCA is currently being managed in accordance with the BCA Management Plan and will be maintained for the period as per Condition 73 (i.e. until January 2037 or as agreed).

Table 10.1 (Cont'd)
2015 Independent Audit Recommendations and Status Update

Cond No.	Development Consent Condition	Comment	Update
78	**Rehabilitation** The Flora and Fauna Management Plan shall also include a Rehabilitation Plan that details the measures to be undertaken to progressively rehabilitate disturbed areas of the mine to replicate the original vegetation cover that existed before mining occurred. The Applicant shall be responsible for the management and monitoring of the rehabilitated mine site until such time as the Director-General agrees that restoration has been successful.	The Rehabilitation Plan is included in the Mining Operations Plans (MOP) and amendments for the Donaldson Coal Mine. The current MOP is for May 2014 to May 2021. Recommendation: As the reporting on the Mining Operations Plan is required under the Mining Lease, the rehabilitation progress and monitoring will be reported to the DRE and it is recommended that approval be sought from DPE to submit this MOP report to DPE to satisfy this condition.	Currently the Annual Reviews are provided to both Resources Regulator and the DPE compliance team and will continue to be provided.
114	**ANNUAL ENVIRONMENTAL MANAGEMENT REPORT** The Applicant shall prepare and submit an Annual Environmental Management Report (AEMR) throughout the life of the mine to the satisfaction of the Director-General. The AEMR shall review the performance of the mine against the Environmental Management Strategy and the Conditions of this Consent, and other licences and approvals relating to the mine.	The preparation of the Annual Environmental Management Report for the Donaldson Coal Mine will be required unless an exemption is obtained from the Director-General/Secretary of DPE. *Recommendation:* It should be considered that reporting on the rehabilitation progress, the biological monitoring and bushland conservation area could be achieved by submitting the expert consultant reports and placing the reports on the Donaldson Coal website.	Donaldson is continuing to prepare the full Annual Review, however, this recommendation will be further considered in future reporting periods.

Email correspondence from the (then) Department of Planning dated 31 October 2018 confirms that, given the completion of mining in 2013 and the previous independent audit in 2015, no further independent audits are required unless otherwise directed by the Secretary (see **Appendix 7**).

11. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

During the reporting period there were no:

- non-compliances;
- reportable exceedances; or
- official cautions, warning letters, penalty notices or prosecution proceedings.

During the reporting period there were two reportable incidents which are summarised as follows with full copies of the incident reports provided as **Appendix 8**.

The first incident related to water leaking from a poly pipe on 21 January 2022 and was reported to EPA, DPE and Resources Regulator on 21 January 2022 in accordance with the site's Pollution Incident Response Management Plan (PIRMP). The water within the poly pipe was being transferred from the Big Kahuna Dam to the Bloomfield Colliery in accordance with the Abel consent MP05_0136 and the pipeline runs adjacent to the Hunter Water Main Trunk Line. Inspections are undertaken at least daily whilst transfers are occurring. The cause of the leak was from an uncontrolled fire which melted a small hole in the poly pipe resulting in water leaking to Four Mile Creek. On the basis of the estimated maximum volume of water discharge and water quality monitoring undertaken in response to the leak and additional water quality monitoring data, it was concluded that no material environmental harm occurred.

It is noted that, whilst the transfer of water is approved through the Abel consent MP05_0136, as the incident occurred within the Donaldson Coal Mine site boundary, the incident has been recorded against the Donaldson Coal Mine. The PIRMP implemented for the response and reporting has been prepared as a joint PIRMP covering both the Donaldson Coal Mine and Abel Underground Coal Mine.

The second incident related to unauthorised clearing of ~0.31ha within the Bushland Conservation area by an adjoining landowner. DPE was notified on 6 May 2022 with a follow up incident report on 18 May 2022. The vegetation clearing occurred without the consent or knowledge of Donaldson Coal and included clearing of vegetation and importation of fill materials by a neighbour. Notwithstanding this clearing, the required 2:1 ration of bushland to mine impact area has been maintained.

The EPA was also notified of the incident and has commenced investigations and issued a clean-up notice to the neighbouring landowner. Donaldson Coal will continue to undertake inspections and review aerial photography to review any potential future unauthorised activities.

12. ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Activities planned to be completed during the next reporting period are outlined in Sections 4.3 and 8.3 and planned improvements in environmental management practices are outlined in Sections 6 and 7. In summary, the key activities planned for the next reporting period are as follows.

- Continued environmental monitoring.
- Continued weed control within the BCA and rehabilitation areas.
- Preparation of a program to implement measures recommended in the *Sediment Dam Investigations* report by SLR and potential commencement of works.
- Commencement of the rehabilitation materials balance report.

Appendices

Appendix 1

Site Locality Plan and Monitoring Locations

(Total No. of pages including blank pages = 6)

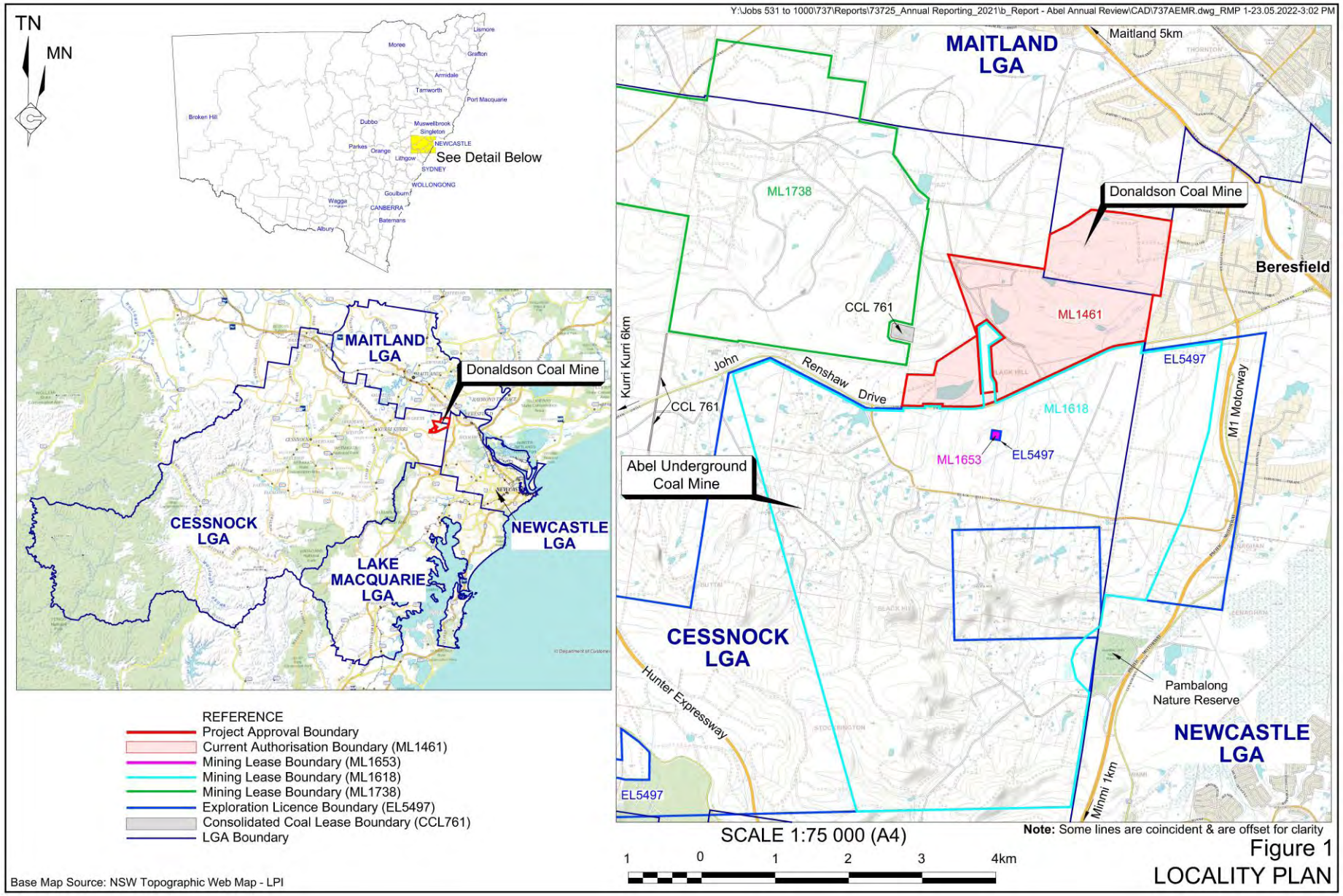


Figure 1
LOCALITY PLAN

DONALDSONCOAL
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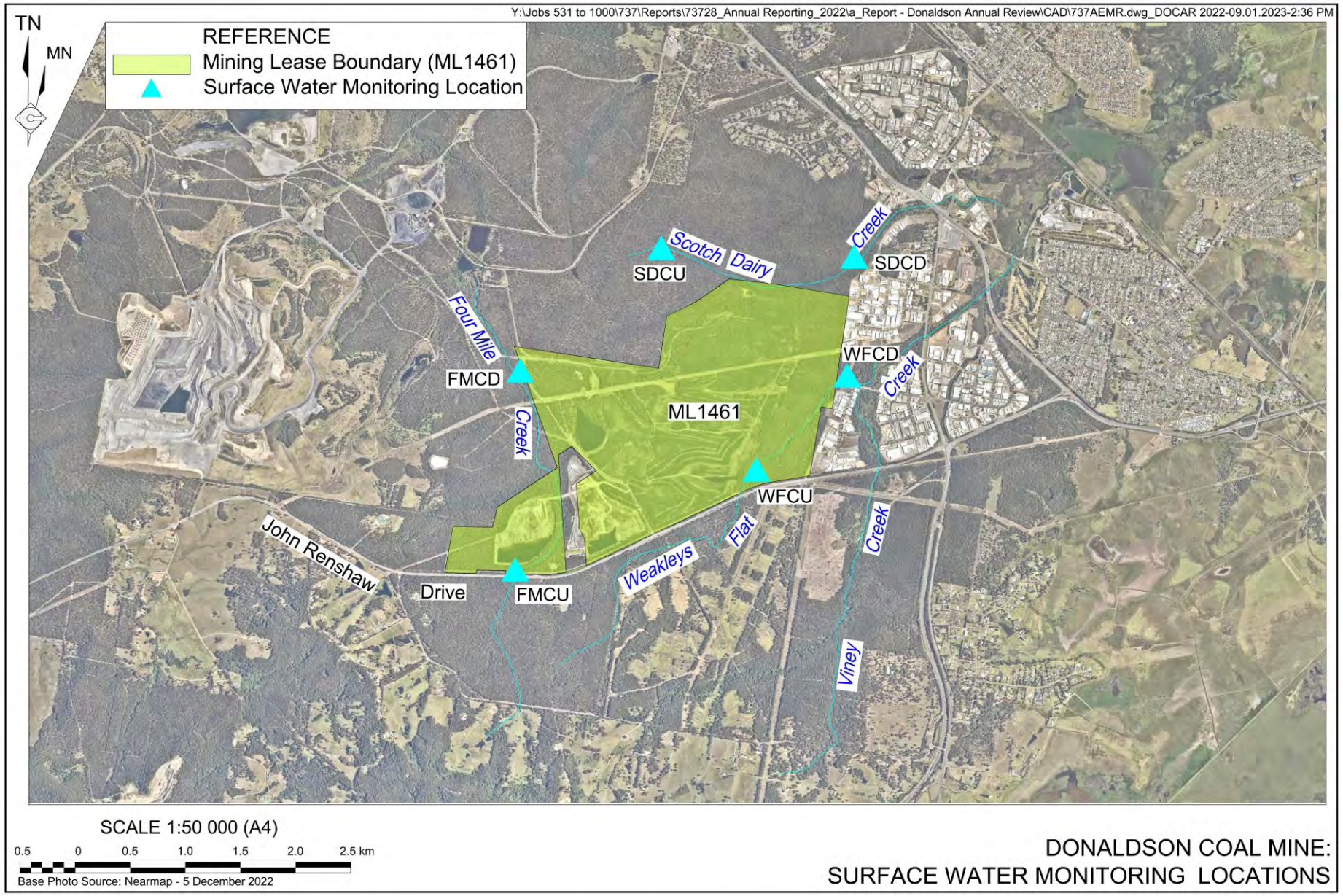
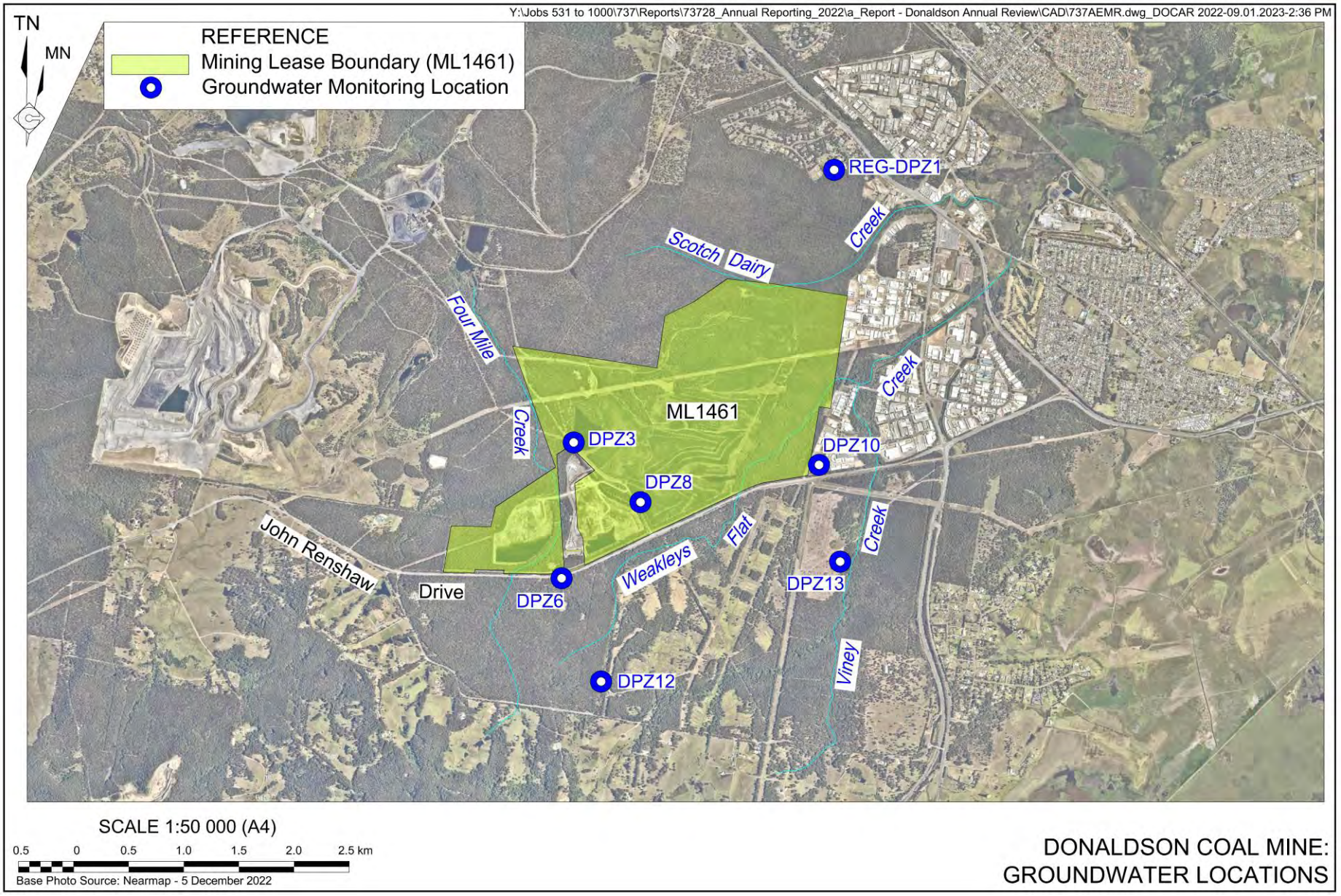
Y:\Jobs 531 to 1000\737\Reports\73725_Annual Reporting_2021\a_Report - Donaldson Annual Review\CAD\737AEMR.dwg_DOCAR 2021-11.01.2022-2:42 PM
TN
MN
ML1461
John Renshaw
Drive
SCALE 1:35 000 (A4)
500 0 500 1000 1500m
Base Photo Source: Nearmap - 15 December 2021
DONALDSON COAL MINE:
REGIONAL CONTEXT



DONALDSONCOAL
Part of the Yancoal Australia Group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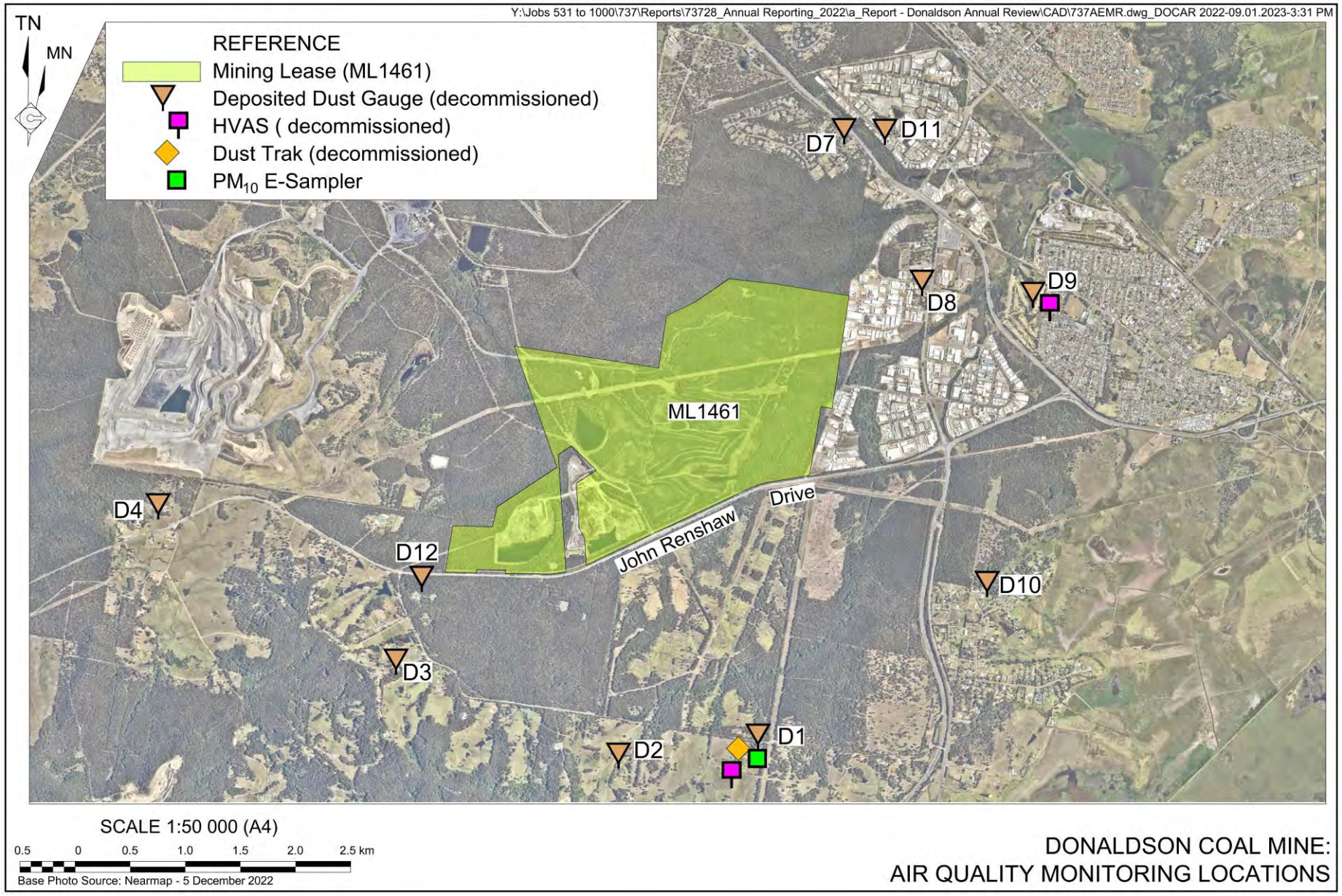
TN
MN
REFERENCE
Mining Lease Boundary (ML1461)
Groundwater Monitoring Location
REG-DPZ1
Scotch Dairy Creek
Four Mile Creek
ML1461
DPZ3
DPZ10
DPZ8
John Renshaw Drive
DPZ6
Weakleys Flat Creek
DPZ13
DPZ12
Viney Creek
SCALE 1:50 000 (A4)
0.5 0 0.5 1.0 1.5 2.0 2.5 km
Base Photo Source: Nearmap - 5 December 2022
DONALDSON COAL MINE:
GROUNDWATER LOCATIONS



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Appendix 2

Description and Location of Known Aboriginal Sites

(Total No. of pages including blank pages = 3)

Site Name	Recorder	Location	Description	Comments
Bushland Conversation Area				
FMC3	Effenberger (1997)	368300E 6368900N Bank of Four Mile Creek	Artefact scatter (5 artefacts), one axe grinding groove	
FMC4	Effenberger (1997)	368250E 6368650N Lower slope above Four Mile Creek	Artefact scatter (2 artefacts)	
FMC5	Effenberger (1997)	368500E 6368700N Lower slope above Four Mile Creek	Artefact scatter (2 artefacts)	
FMC6	Effenberger (1997)	368400E 6366100N Upper slope above Four Mile Creek	Artefact scatter (4 artefacts)	
FMC7	Effenberger (1997)	367600E 6366500N Crest between Four Mile Creek and a major tributary	Artefact scatter (3 artefacts)	
FMC8	Effenberger (1997)	367600E 6366850N Upper slope above tributary of Four Mile Creek	Scarred tree	
WFC1	Effenberger (1997)	371200E 6369200N Lower slope above Weakleys Flat Creek	Artefact scatter (3 artefacts)	
ISF3	Umwelt (1998)	368750E 6367650N Lower slope above Four Mile Creek	Isolated find	
ISF4	Umwelt (2001)	370550E 6368625N Mid slope above Weakleys Flat Creek	Isolated find	
Four Mile Creek 1 (38-4-139)	Brayshaw (1985)	368130E 6367020N Bank of Four Mile Creek	Artefact scatter (19 artefacts)	
Four Mile Creek 2 (38-4-140)	Brayshaw (1985)	367820E 6366880N Terrace of Four Mile Creek	Artefact scatter (10 artefacts)	
CA1	Umwelt (2001)	370658E 6368051N Mid slope, south of Weakleys Flat Creek	Isolated find	
CA2	Umwelt (2001)	371132E 6369039N Lower slope, north west of Weakleys Flat Creek	Artefact scatter (2 artefacts)	
CA3	Umwelt (2001)	370985E 6370511N Lower slope above a tributary of Scotch Dairy Creek	Isolated find	
CA4	Umwelt (2001)	369568E 6370040N Mid slope above Scotch Dairy Creek	Isolated find	
CA5	Umwelt (2001)	368391E 6366747N Mid slope, east of Four Mile Creek	Isolated find	
CA6	Umwelt (2001)	368229E 6366592N Lower slope above a tributary of Four Mile Creek	Isolated find	

Site Name	Recorder	Location	Description	Comments
CA7	Umwelt (2001)	367617E 6366456N Mid slope above Four Mile Creek	Isolated find	
CA8	Umwelt (2001)	370746E 6369747N Lower slope, south of Scotch Dairy Creek	Isolated find	
DMS2	Umwelt (2002)	370966E 6368184N Mid slope, south of Weakleys Flat Creek	Artefact scatter (2 artefacts)	
DMS4	Umwelt (2002)	368649E 6368181N Mid slope, east of Four Mile Creek	Isolated find	
DMS5	Umwelt (2002)	370665E 6368177N Mid slope, south of Weakleys Flat Creek	Isolated find	
DMS6	Umwelt (2002)	370809E 6369721N Mid slope, south of Scotch Dairy Creek	Scarred tree	
Mine Impact Area				
ISF1	(Effenberger 1997)	370500E 6369100N Lower slope above small tributary of Weakleys Flat Creek	Isolated find	Consent to Destroy granted (2002)
ISF2	(Effenberger 1997)	369800E 6368950N Lower slope above tributary of Weakleys Flat Creek	Isolated find	Consent to Destroy granted (2002)
ISF5	Umwelt (2001)	370275E 6368626N Mid slope above Weakleys Flat Creek	Isolated find	Application being prepared for consent to remove
ISF6	Umwelt (2001)	370305E 6368600N Mid slope above Weakleys Flat Creek	Isolated find	Application being prepared for consent to remove
Ironbark 2 (38-4-339)	Ruig (1993)	369190E 6367890N Upper slope above tributary of Weakleys Flat Creek	Isolated find	
DMS1	Umwelt (2002)	369734E 6369122N	Isolated find	Consent to Destroy granted (2002)
DMS3	Umwelt (2002)	369090E 6367962N Mid slope above Four Mile Creek	Isolated find	

Appendix 3

Compliance Review

(Total No. of pages including blank pages = 41)

Table A3.1
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
OPERATION OF DEVELOPMENT			
1	(1) Applicant shall carry out the development generally in accordance with the: • Development application DA 8/01173, dated 13 February 1998, lodged with Maitland City Council and DA 118/698/22 dated 19 February 1998, lodged with Cessnock City Council and the accompanying *Environmental Impact Statement* (EIS) dated 10 February 1998, and prepared by PPK Environment and Infrastructure, as modified by reports in Schedule 4; • Submissions to the Commission of Inquiry by the applicant; • Statement of Environmental Effects titled Modification to the approved mining area at the Donaldson Open Cut Cola Mine, Beresfield, dated 10 November 2004, and prepared by GSS Environmental; • modification application DA 98/01173 & DA 118/698/22 MOD 2 and supporting information, prepared by Donaldson Coal Pty Limited and dated 16 December 2010 and 25 March 2011; and Conditions of this consent. (2) If there is any inconsistency between the above, 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. (3) Unless otherwise specifically stated, the conditions of consent do not apply to lot 131 DP 234203 (owned by Steggles Limited at the date of this consent), provided the Deed of Agreement between Steggles Limited and the Applicant is in effect.	YES	The Donaldson Coal project has been developed generally in accordance with the specified documents, with the mine pits and rehabilitation conducted in accordance with the *Mining Operations Plan (Amendment)* approved by the Resources Regulator.
2	Except as expressly provided by the *Statement of Environmental Effects*, dated 10 November 2004, the development shall be restricted as follows: (i) the mine plan in the EIS shall be reduced such that no mining shall be undertaken in any area identified in accordance with these Conditions as a Conservation Area. This includes the Tetratheca Juncea Conservation Area (Condition 68); and (ii) the Applicant shall not clear any land or erect any structures within any Conservation Area without obtaining any further development approval from the Director-General.	YES	The mining area is delineated on the mine plans with the Conservation Area that surrounds the disturbed area of the mine managed for the protection of the vegetation and habitat value. The relocation of the 11kV power line required clearing a small area of the Bushland Conservation Area on the western end of the site and rehabilitation of the existing power line easement. The clearing and rehabilitation of these areas and the adjustment to the boundaries of the Bushland Conservation Area were approved by DoP in Nov 2006. It is noted that the illegal clearing within the BCA reported as an incident in 2022 was not undertaken by or authorised by the Company. Therefore compliance is considered to have been maintained.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

<table>
<tr><th>Cond. No.</th><th>Minister's Conditions of Consent (MCoA)</th><th>Compliance</th><th>Comments/Notes</th></tr>
<tr><td colspan="4">OPERATION OF DEVELOPMENT (Cont'd)</td></tr>
<tr><td>3</td><td>(1) Subject to (2) the approved hours of operation are as follows:
<table><tr><th>Works</th><th>Period</th><th>Hours</th></tr><tr><td>Construction, including construction of any bunds</td><td>Monday to Friday</td><td>7am to 6pm</td></tr><tr><td></td><td>Saturday</td><td>8 am to 1pm</td></tr><tr><td>Mining operations, including mining, haulage of waste to dumps and coal processing</td><td>Monday to Friday</td><td>24 hours per day</td></tr><tr><td></td><td>Saturday, Sunday</td><td>7am to 6pm</td></tr><tr><td>Road transportation and stockpiling of coal</td><td>7 days per week</td><td>24 hours per day</td></tr><tr><td>Rail loading of coal</td><td>7 days per week</td><td>7am to 10pm</td></tr><tr><td>Maintenance of mobile and fixed plant</td><td>7 days per week</td><td>24 hours per day</td></tr><tr><td>Blasting, not involving closure of John Renshaw Drive</td><td>Monday to Saturday</td><td>7am to 5pm</td></tr><tr><td>Blasting, involving closure of John Renshaw Drive</td><td>Monday to Saturday</td><td>10am to 2pm</td></tr></table>Table 1: Approved Hours of Operation
Notes: Restrictions on Public Holidays are the same as Sundays.</td><td>YES</td><td>No construction or mining activities occurred during the reporting period.</td></tr>
<tr><td></td><td>(2) The Applicant shall submit a report to the Director-General's satisfaction demonstrating that the noise limits in Condition 15 can be met while rail loading of coal is occurring during the period from 6pm to 10pm. If that report does not demonstrate that the noise limits can be met to the Director-General's satisfaction, then the hours of operation for rail loading of coal shall be restricted to 7am to 6pm.</td><td>YES</td><td>Report previously submitted.</td></tr>
<tr><td>4</td><td>The Applicant shall comply with any order of the Director-General to cease activities causing serious or irreversible environmental concerns, until those concerns have been addressed to the satisfaction of the Director-General.</td><td>Not Activated</td><td>No order issued to date.</td></tr>
<tr><td colspan="4">COMMENCEMENT AND DURATION</td></tr>
<tr><td>5</td><td>(1) To ensure the employment benefits of this development are realised without delay, the Applicant shall commence mining within two years of the date of this Consent. This does not remove the obligation of the Applicant to comply with any other requirement listed in the Conditions of this Consent.
(2) To minimise potential delays to development on adjoining lands, consent for mining operations shall lapse on 31 December 2013.
Note: Under this consent, the Applicant is required to rehabilitate the site and perform additional undertakings to the satisfaction of the Director-General and DRE. Consequently this approval will continue to apply in all other respects other than the right to conduct mining operations until the site has been properly rehabilitated.</td><td>YES</td><td>Mining commenced on 25 January 2001 (i.e. within 2 years of granting of the Consent) therefore this condition was complied with.
Extension of time approved by Department of Planning.

The Donaldson Open Cut Coal Mine operations ceased in April 2013.</td></tr>
<tr><td>6</td><td>The Applicant shall notify the Director-General and the Councils in writing of the dates of commencement of:
(i) construction works,
(ii) mining, and
(iii) coal processing operations,
14 days prior to the commencement of such works.</td><td>YES</td><td>Donaldson Coal provided written Notification to the Director-General and Councils prior to commencement of construction works, mining and coal processing operations.</td></tr>
<tr><td>7</td><td>No construction or mining shall commence until:
(i) the relevant compliance reports in Condition 121 have been completed to the satisfaction of the Director-General; and
(ii) the Applicant provides evidence to the Director-General of an agreement with the adjoining Bloomfield mine for the use of rail loading infrastructure.</td><td>YES</td><td>Compliance Reports for construction and mining were prepared and submitted to DUAP prior to commencement of the activities on the site in 2001.</td></tr>
</table>

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
ENVIRONMENTAL OFFICER			
8	The Applicant shall employ an Environmental Officer, whose qualifications are suitable to the Director-General, throughout the life of the mine. The Environmental Officer shall: (i) be responsible for the preparation of the *Environmental Management Strategy* (Conditions 10-13) and environmental management plans; (ii) be responsible for considering and advising on matters specified in the Conditions of this Consent and compliance with such matters; (iii) be responsible for receiving and responding to complaints in accordance with Condition 113; (iv) facilitate an induction and training program for all persons involved with construction activities, mining and environmental management activities; and (v) have the authority and independence to require reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts and failing the effectiveness of such steps, to stop work immediately if an adverse impact on the environment is likely to occur.	YES	Phillip Brown was employed as Environmental Manager in May 2003 and Planning NSW was notified on 7 April 2003 as required by MCoA 8.
9	The Applicant shall notify the Director-General, OEH, NOW, DRE, Councils and the Community Consultative Committee (Conditions 107-110) of the name and contact details of the Environmental Officer upon appointment and upon any changes to that appointment.	YES	The Director-General, EPA, DLWC, DMR, NPWS, Councils and the Community Consultative Committee were notified 30 May 2003 by letter of the appointment of Phillip Brown.
ENVIRONMENTAL MANAGEMENT STRATEGY			
10	The Applicant shall prepare an *Environmental Management Strategy* (the Strategy) for the development, providing a strategic context for environmental management. All environmental management plans required by the Conditions of this Consent shall be consistent with the Strategy. The Strategy shall be prepared in consultation with the relevant authorities and the Community Consultative Committee and to the satisfaction of the Director-General, prior to commencement of construction.	YES	The *Environmental Management Strategy* was prepared in May 2000 for the Donaldson Mine for construction of the mine and mining operations. Revision of the EMS occurred to integrate the requirements of the Donaldson Mine and the mining contractor to provide a single EMS for the project occurred in 2002. Review and revision of the EMS has occurred as management plans for the Donaldson Coal operations are revised and an integrated *Environmental Management Strategy* to include the Tasman and Abel Coal projects was approved by DoP on 26 February 2008. The current version of the EMS was updated August 2018 and approved by DPE on 31 August 2018.
11	The Strategy shall cover the area of mining, the haul road and rail loading facility, and the Conservation Areas. The Strategy shall include: (i) statutory and other obligations which the Applicant is required to fulfil during construction and mining, including all approvals and consultations and agreements required from authorities and other stakeholders, and key legislation and policies;	YES	The *Environmental Management Strategy* prepared for the Abel and Donaldson Mine includes sections addressing each of the requirements of MCoA 11.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
ENVIRONMENTAL MANAGEMENT STRATEGY (Cont'd)			
11 Cont'd	(ii) definition of the role, responsibility, authority, accountability and reporting of personnel relevant to environmental management including the Environmental Officer; (iii) overall environmental management objectives and performance outcomes, during construction, mining and decommissioning of the mine for each of the key environmental elements for which management plans are required under this Consent; (iv) overall ecological and community objectives and a strategy for restoration and management including habitat areas, creeklines and drainage channels, within the context of those objectives; (v) identification of cumulative environmental impacts and procedures for dealing with these at each stage of the development; (vi) overall objectives and strategies for minimising the impacts of the development on economic productivity; (vii) steps to be taken to ensure that all approvals, plans, and procedures are being complied with; (viii) processes for conflict resolution in relation to the environmental management of the project; and (ix) documentation of the results of consultations undertaken in the development of the Strategy.		
12	The Applicant shall make copies of the *Environmental Management Strategy* available to Councils, OEH, NOW, DRE and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	Copies of the *Environmental Management Strategy* and revisions prepared for Donaldson Coal projects have been made available.
ENVIRONMENTAL MONITORING AND REVIEWING			
13	(1) Except as provided in (2), the Applicant shall provide six-monthly monitoring reports on all environmental monitoring required under this Consent for the first three years of the project and for any further period as may be determined necessary by the Director-General. The reports shall contain interpretations of the monitoring data, and summarise exceedances and action taken. The Applicant shall make copies of the monitoring reports available to the Director-General, NOW, OEH, DRE, Councils and the Community Consultative Committee. (2) Noise monitoring reports shall be provided six-monthly for the life of the mine, unless the Director-General, on the advice of the independent noise expert (Condition 48) requires more frequent reports.	YES	Monitoring Reports including all noise, blasting, air quality, surface and groundwater, indigenous heritage, flora and fauna, employment statistics, community consultation and complaints, were prepared six monthly and provided to the relevant authorities listed in MCoA 13 (1) between 2001 and 2004. DIPNR approved the reporting of monitoring an annual basis on 1 April 2004. All monitoring data and reporting has occurred in the AEMR's / Annual Reviews since 2004.
14	All sampling strategies and protocols undertaken as part of any monitoring program shall include a quality assurance/quality control plan and shall require approval from the relevant regulatory agencies to ensure the effectiveness and quality of the monitoring program. Only accredited laboratories shall be used for laboratory analysis.	YES	Quality assurance/Quality Control information and data is included in the laboratory reports from the NATA registered laboratory, with the monitoring data. All sampling and analysis has been conducted by NATA or AS/NZS ISO 17025 registered laboratories, as from 23 May 2002.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

<table>
<tr><th>Cond. No.</th><th>Minister's Conditions of Consent (MCoA)</th><th>Compliance</th><th>Comments/Notes</th></tr>
<tr><td colspan="4">NOISE AND VIBRATION</td></tr>
<tr><td colspan="4">Noise Limits</td></tr>
<tr><td>15</td><td>Except as may be expressly provided by a OEH licence under the Protection of the Environment Operations Act 1997, or unless subject to a negotiated agreement in accordance with Condition 23, the Applicant shall ensure that the noise emission from construction or mining operations, when measured or computed at the boundary of any dwelling not owned by the Applicant (or within 30 metres of the dwelling, if the boundary is more than 30 metres from the dwelling), shall not exceed the following limits:
<table><tr><td colspan="3">Location LA10(15 minute) noise limits (dB(A))</td></tr><tr><td></td><td>Daytime</td><td>Night-time</td></tr><tr><td>Beresfield (residential)</td><td>45</td><td>35</td></tr><tr><td>Steggles Poultry Farm</td><td>50</td><td>40</td></tr><tr><td>Ebenezer Park</td><td>46</td><td>41</td></tr><tr><td>Black Hill Area</td><td>40</td><td>38</td></tr><tr><td>Buchanan/Louth Pk</td><td>38</td><td>36</td></tr><tr><td>Ashtonfield Area</td><td>41</td><td>35</td></tr><tr><td>Thornton Area</td><td>48</td><td>40</td></tr></table>Table 2: Noise Limits

Note: Daytime is 7am to 10pm Monday – Saturday, and 8am to 10pm Sundays and Public Holidays. Night-time is 10pm to 7am Monday – Saturday, and 10pm to 8am Sundays and Public Holidays.

The noise limits apply for prevailing meteorological conditions (winds up to 3 m/s), except under conditions of temperature inversions.</td><td>YES</td><td>Given that mining operations have ceased, no noise monitoring was undertaken during the reporting period. Previous Quarterly Noise Surveys generally identified that noise levels contributed by Donaldson Mine operations do not exceed noise emission goals for any of the periods. In the absence of operations, complaints and previous monitoring results, compliance is considered likely.</td></tr>
<tr><td colspan="4">Noise Management</td></tr>
<tr><td>16</td><td>Prior to 31 October 2005, the Applicant shall prepare a Noise Monitoring Program for the development in consultation with OEH, and to the satisfaction of the Director-General, which includes a noise monitoring protocol for evaluating compliance with the criteria in condition 15.</td><td>YES</td><td>The Mine Noise Monitoring Plan was forwarded to DoP and DEC in Oct 2005 and a final revised copy submitted on 27 Dec 2005 for approval. The Plan was approved by DoP on 22 Jan 2007. An updated Noise Management Plan was approved by the (then) DPE in June 2019 and covers both the Abel and Donaldson mines.</td></tr>
<tr><td>17</td><td colspan="3">Deleted in Notice of Modification 26 August 2005</td></tr>
<tr><td>18</td><td colspan="3">Deleted in Notice of Modification 26 August 2005</td></tr>
<tr><td>19</td><td colspan="3">Deleted in Notice of Modification 26 August 2005</td></tr>
<tr><td>20</td><td>In the event that a landowner or occupier considers that noise or vibration from the project at their property is in excess of the relevant criteria set out in this Consent, the Applicant shall, upon receipt of a written request and at its own expense immediately undertake direct discussion with the landowners or occupiers affected to determine their concerns. Independent investigations of the noise complaints shall be carried out if the matter is not resolved within six weeks, in accordance with Conditions 48-53</td><td>Not activated</td><td>No request for acquisition by any landowners due to noise or vibration impact had been initiated.</td></tr>
</table>

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Noise Acquisition			
21	If noise monitoring or independent noise investigations indicate that noise from construction or operation of the mine at the boundary of a dwelling, or within 30 metres of the dwelling where the boundary is more than 30 metres from the dwelling, is in excess of the noise limits set out in this Consent under adverse weather conditions and if appropriate noise control measures cannot be achieved on the mine site, the landowner may request the Applicant in writing to acquire the whole of the property or such part of the property requested by the landowner where subdivision is approved. Note: Adverse weather conditions means the presence of winds up to 3 metres per second, and/or temperature inversions of up to 4 degrees Celsius per 100 metres.	Not activated	As above.
22	Any such request shall be referred to the Director-General for determination in consultation with the independent expert. If the Director-General determines acquisition is necessary, the Applicant shall acquire the property in accordance with Conditions 54-55.	Not activated	As above.
Negotiated Agreements			
23	If monitoring or independent investigations indicate that noise or dust from the mine is in excess of the criteria set out in this Consent and the affected landowner does not wish to be acquired, the Applicant shall, if requested by the affected landowner, enter into a negotiated agreement. Where a negotiated agreement is required, the Applicant shall, within the time period specified by the Director-General: (i) appoint an independent facilitator, approved by the Director-General; (ii) negotiate a package of benefits for the landowner, which may include undertaking noise reduction measures on the property or at the dwelling(s) or compensation; (iii) pay all reasonable costs of the process; and (iv) report to the Director-General and the OEH on the agreement reached.	Not activated	No requirement has arisen for a negotiated agreement with any land owners.
BLASTING			
Blasting Criteria			
24	The Applicant shall ensure that the airblast over pressure level from blasting at the development does not exceed the criteria in Table 3, and the ground vibration level does not exceed the criteria in Table 4, at any residence on privately-owned land or noise sensitive location as defined in the EPA's Industrial Noise Policy. Airblast overpressure (db(Lin Peak) — Allowable exceedance 115 — 5% of total number of blasts in a 12 month period 120 — 0% *Table 3: Airblast Overpressure Impact Assessment Criteria*	YES	No blasting occurred during the reporting period.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
BLASTING (Cont'd)			
Blasting Criteria (Cont'd)			
24 Cont'd	Peak Particle Velocity mm/s | Allowable exceedance 5 | 5% of total number of blasts in a 12 month period 10 | 0% *Table 4: Ground Vibration Impact Assessment Criteria*		
Blasting Design and Management			
25e	(1) The Applicant shall not blast within 500 metres of an occupied residence.	YES	No blasting occurred during the reporting period.
	(2) The Applicant shall not blast within 500 metres of private lands unless there is a written agreement between the Applicant and the landowner/occupier(s) to the satisfaction of the Director-General that guarantees the safety of persons who might use those lands.	YES	No blasting occurred during the reporting period.
	(3) The Applicant shall not blast within 500 metres of public lands unless public access to those areas is prevented at times of blasting.	YES	No blasting occurred during the reporting period.
	(4) The Applicant shall not blast within 500 metres of a public road unless the road is closed with the prior written agreement of the Regional Traffic Committee (or in the absence of the Regional Traffic Committee, the Director-General). A copy of any such agreement shall be supplied to the Director-General within 14 days of the agreement. If determined necessary by the Regional Traffic Committee, the Applicant shall prepare a Traffic Study to identify upgrading of the surrounding road system commensurate with the additional traffic volumes. The Study shall be prepared in consultation with Councils and the RTA, and to the satisfaction of the Regional Traffic Committee. All recommended traffic management measures and road infrastructure upgrading are to be undertaken at the Applicant's expense prior to any closure of John Renshaw Drive. If the study identifies the need for acquisition to enable the works to be undertaken, acquisition shall occur in accordance with the acquisition procedures established under this Consent.	YES	No blasting occurred during the reporting period.
	(5) The 500 metre distance may be reduced by the Director-General if a risk analysis undertaken by the Applicant to the Director-General's requirements indicates a lesser distance provides an appropriate level of safety.	Not activated	The 500m setback distance was not requested to be reduced.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
BLASTING (Cont'd)			
Blasting Design and Management (Cont'd)			
26	The Applicant shall prepare and implement a *Blast Management Plan* in consultation with DRE and Councils, prior to the commencement of blasting (including trial blasting). The Applicant shall make copies of the *Blast Management Plan* available to the independent noise expert (Condition 48), OEH, /DRE, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	*Blast Management Plan* was developed for the Donaldson Mine in consultation with the DMR and Maitland City Council, Cessnock City Council, and Newcastle City Council, prior to the commencement of blasting at the Donaldson Mine and copies of the Plan were distributed to the relevant authorities and the CCC. The *Blast Management Plan* was revised in 2007 and approved by the (then) DoP.
27	The *Blast Management Plan* shall: (i) provide details of any proposed trial blasting;	YES	The *Blast Management Plan 2001* addresses Trial Blasting in Section 6.2.
	(ii) identify a monitoring program, including locations and justification for selection of locations such as the Steggles Black Hill poultry operations and areas of old underground mine workings;	YES	The *Blast Management Plan 2007* Section 6 addressed the Monitoring Program for the specified areas.
	(iii) detail measures to ensure that air blast overpressure and vibration monitoring and control is generally carried out in accordance with the recommendations of Australian Standard AS-2187-1993 (or its latest version) and in terms of ANZECC Guidelines;	YES	The *Blast Management Plan 2007* addresses Monitoring Procedures, in Section 4 and 6. The monthly *Blast Monitoring and Assessment Reports* by Hunter Acoustics addressed the quality control and monitored the data collection and recording.
	(iv) detail methods to measure weather data as soon as practicable prior to blasting and from that data predict whether noise levels are likely to be increased above the levels expected under prevailing meteorological conditions;	YES	The *Blast Management Plan 2007* addresses Meteorological Data Collection in Section 5.1. The meteorological station located at the Donaldson Mine provides continuous records of the prevailing weather conditions and this data was available immediately prior to blasting.
	(v) detail measures to be taken to minimise disruptions from blasting, including any road closures agreed in accordance with Condition 25, and management of impacts on local traffic and pedestrian movements;	YES	The *Blast Management Plan 2007* addresses minimisation of disruptions caused by blasting in Section 5.2.
	(vi) specify procedures for ensuring that the occurrence of concurrent blasts with the adjoining coal mine operators is avoided; and	YES	The *Blast Management Plan 2007* addresses timing of blasts in Section 5.1.
	(vii) identify procedures for notifying landowners/occupiers within 2 km of the site of the general blasting program and for notifying landowners or occupiers within 500m of blasting events (or any reduced area approved by the Director-General under Condition 25(5)) prior to blasting occurring.	YES	The *Blast Management Plan 2007* addresses notification of blasting events to land owners in Section 5.3.
28	The Applicant shall not blast if weather conditions indicate that air blast overpressure levels are likely to be exceeded at residences not owned by the Applicant.	Not Applicable	No blasting occurred during the reporting period.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
29	The Applicant shall report on blasting practices (including any trial blasting), weather data and the results of blast emissions monitoring in the six-monthly environmental monitoring reports and in the AEMR.	Not Applicable	No blasting occurred during the reporting period.
30	The Applicant shall revise the *Blast Management Plan* as necessary and provide an updated Plan five years after commencement of mining to the Director-General, the independent noise expert, OEH, DRE, Councils and the Community Consultative Committee.	YES	The *Blast Management Plan* was revised and submitted to the DoP on 16 July 2007. Approval from DoP was received on 17 July 2007.
Blasting Impacts			
31	Prior to the commencement of blasting, the Applicant shall undertake baseline structural surveys of all buildings and structures within 1.5 kilometres of blasting locations, unless it can be demonstrated to the satisfaction of the Director-General in consultation with DRE that surveys of certain properties are unnecessary because blasting damage is unlikely to occur to those properties. In conducting these structural surveys, the Applicant shall ensure that: (i) the surveys are carried out by a technically qualified person, as agreed in consultation with the Director-General and relevant landowners; and (ii) a copy of any inspection report (including video or photographs, if requested), certified by the person who undertook the inspection, is supplied to the relevant property owner within 14 days of receipt of same.	YES	Two consultants - Burke Engineering Services and Geoff Craig & Associates, were offered to building owners for the structural survey reports in 2000. All the required surveys of residences had been conducted when blasting commenced at the mine site, except for buildings on the Steggles property (as per a commercial agreement with Steggles). The survey of ABAKK House at the western end of the property was carried out later when the Donaldson Mine operations progressed to the west. Donaldson Coal corresponded with ABAKK Pty Ltd in 2007 in relation to three dwellings and infrastructure that would be within 1 500m of the area of blasting at the Donaldson Mine and arranged for structural inspections. A copy of the structural survey reports were provided to the property owners for each residence/structure.
32	In the event that a landowner or occupier considers that blast emissions from the development may have affected the material condition of their property, the landowner may make a written request to the Director-General for an independent dilapidation assessment. If the Director-General, in consultation with the DRE, is satisfied that an independent investigation is required, the Applicant shall ensure: (i) the survey is carried out by a technically qualified person, as agreed in consultation with the Director-General and the relevant landowners or occupiers; and (ii) a copy of any inspection report (including video or photographs, if requested), certified by the person who undertook the inspection, is supplied to the relevant property owner within 14 days of receipt of same.	Not activated	No requests for structural surveys have been received during this reporting period.
33	Where a dilapidation assessment concludes that structural damage has occurred as a result of blast emissions, the Applicant shall undertake immediate preventative and/or remedial measures at its expense.	YES	No dilapidation assessments have been requested during this reporting period.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Newcastle Herald's Printing Facilities at Holmwood Business Park			
34	Prior to commencement of mining, the Applicant shall: (i) conduct ambient vibration monitoring adjacent to (on the floor) and if required, on the most vibration-sensitive component of the printing facilities in order to establish both the levels of ambient vibration generated by the operation of the Printing Facility itself and that of any other nearby vibration sources; (ii) provide a detailed report on the monitoring procedures and the monitoring results and findings to the Newcastle Herald upon completion of the survey; (iii) meet with Herald representatives to discuss the results of the survey and determine whether the initially agreed limit of 0.3 mm/s is appropriate; and (iv) design initial blasting for compliance with a peak particle velocity vibration criterion of 0.3 mm/s adjacent to or on the Printing Facility, unless a more appropriate limit is mutually agreed.	YES	Blast Vibration Assessment was conducted for the Newcastle Fairfax Printing facility in 2001. The report results established the ambient vibration levels at the site. Discussions with Fairfax in 2001 resulted in an agreement that the vibration criteria be 3 mm/s ppv. Correspondence in relation to the 3mm/s ppv was received by Donaldson and DUAP advised of the change on 18 December 2001.
35	The Applicant shall monitor the impacts of blasting on the Printing Facility throughout the life of the mine, at a mutually agreed location in or adjacent to the Printing Facility during every blast. The Applicant shall provide results of the monitoring to the Newcastle Herald and provide a summary in the AEMR.	Not Applicable	No blasting occurred during the reporting period.
Hunter Water Corporation Pipelines			
36	The Applicant shall ensure that blasting is undertaken in a manner that protects the Hunter Water Corporation's pipeline to the satisfaction of the Hunter Water Corporation.	YES	Consultation with HWC resulted in agreement of a peak particle velocity of 100mm/sec at the pipeline. Vibration monitoring has previously been conducted for each blast at monitors located along the pipeline corridor. No blasting occurred during the reporting period.
AIR QUALITY			
Air Quality Criteria			
37	The Applicant shall take all practical steps to manage the mine's operations so that the ambient air quality goals for total suspended particles (TSP) of 90ug/m^3 (annual average) and the dust deposition goal of 4gm/m^2 (annual average) are not exceeded as a result of the development when monitored at any monitoring location specified in the *Air Quality Management Plan*.	YES	The air quality results reported for the Donaldson Mine are compliant with the criteria in MCoA 37. The dust deposition criteria of 4gm/m^2 and the TSP goal of 90ug/m^3 have not been exceeded during this reporting period. The *Air Quality Management Plan* approved in 2019 no longer requires ongoing deposited dust or TSP monitoring.
Air Quality Management			
38	The Applicant shall prepare and implement an *Air Quality Management Plan*, containing strategies to manage the mine's contribution to dust deposition, TSP, PM10 and PM2.5 to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the *Air Quality Management Plan* available to the independent expert (Condition 48), OEH, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The *Air Quality Management Plan* for the Donaldson Mine was finalised in November 2000 and presented to the CCC on 13 November 2000.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Air Quality Management (Cont'd)			
38 Cont'd			The *Air Quality Management Plan* was reviewed in 2007 by Holmes Air Services and no revision was required. A revised plan was prepared 3 June 2019 for care and maintenance and approved by the (then) DPE 4 June 2019. A copy is provided on the Company website and the CCC was notified of the revised plan.
39	The *Air Quality Management Plan* shall: (i) identify potential sources of dust deposition, TSP and fine particulates (PM10 and PM2.5) and specify appropriate monitoring intervals and locations. The purpose of the monitoring is to evaluate, assess and report on these emissions and the ambient impacts with the objective of understanding the mine's contribution to levels of dust deposition, TSP and fine particulates in ambient air around the mine site;	YES	The 2019 *Air Quality Management Plan* addresses potential sources of dust emissions and presents an appropriate monitoring program in Section 8. The monitoring program was implemented and the results of the dust deposition, TSP and PM_{10} recording are presented in Section 6 of the Annual Review.
	(ii) provide the mine's monitoring plan having regard to local meteorology and the relevant Australian Standards, identifying the methodologies to be used, including justification for monitoring intervals, weather conditions, seasonal variations, selecting locations, periods and times of measurements;	YES	The 2019 *Air Quality Management Plan* addresses the monitoring plan in Section 8.
	(iii) provide the design of any modelling or other studies, including the means for determining the contribution to dust deposition, TSP and fine particulates from the development;	YES	The 2019 *Air Quality Management Plan* addresses modelling and other studies in Section 10.
	(iv) provide details of dust suppression measures for all sources of dust from the development (including the haul road and the rail loading site);	YES	The 2019 *Air Quality Management Plan* addresses dust suppression measures in Section 7.2.
	(v) provide details of actions to ameliorate impacts if they exceed the relevant criteria; and	YES	The 2019 *Air Quality Management Plan* addresses amelioration and mitigation measures for dust control in Section 10.3.
	(vi) provide the design of the reactive management system intended to reduce the day-to-day impacts of dust and fine particulates due to the mine's operation.	YES	The 2019 *Air Quality Management Plan* addresses dust management procedures in Sections 7.2 and 10.3.
40	The Applicant shall ensure the prompt and effective rehabilitation of all disturbed areas as soon as practicable to minimise the generation of dust.	YES	Rehabilitation progressively occurred on disturbed land at the Donaldson Mine overburden and backfill areas to minimise generation of wind blown dust, with revegetation established using local indigenous species.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Air Quality Management (Cont'd)			
41	The Applicant shall cease offending work at such times when the hourly average wind speed exceeds 5 metres per second and the operations are resulting in visible dust emissions blowing in a direction so as to cross onto public roads or lands not owned by the Applicant.	YES	The meteorological station installed at the Donaldson Mine site (and relocated to the Abel mine area in 2017) provides continuous reading of wind speed. Results are available instantly on computer. Wind speed above 5 m/s triggers a response to stop work at the mine site until wind conditions return to below 5 metres/sec. No earthmoving activities occurred during the reporting period.
42	The Applicant shall revise the *Air Quality Management Plan* as necessary and provide an updated Plan five years after commencement of mining and to the Director-General, independent air quality expert (Condition 48), OEH, Councils and the Community Consultative Committee.	YES	The *Air Quality Management Plan* and monitoring program was reviewed by Holmes Air Services in 2007 and it was concluded that the plan was adequate and did not require to be updated. A further review was undertaken in 2019 and the plan updated to reflect care and maintenance.
Air Quality Monitoring			
43	The Applicant shall install, maintain and continuously operate a meteorological station in accordance with the relevant Australian Standards and to the satisfaction of the OEH. The meteorological station shall be installed within six weeks of the date of this consent and remain for the life of the mine. The Applicant shall analyse and report the meteorological data on a monthly basis to adequately characterise the site, and shall use the data collected by the wind monitoring and recording station to determine when and how the mine operation is to be modified in accordance with the *Air Quality Management Plan* and the Conditions of this Consent.	YES	A meteorological station installed at the Donaldson Mine site since December 2000 and was relocated to the Abel mine area in 2017. Meteorological data is collected continuously and analysed monthly.
44	The Applicant shall install, maintain and operate dust deposition gauges in accordance with the relevant Australian Standards and to the satisfaction of the OEH. The dust deposition gauges shall be installed and operational within six weeks of the date of this consent and the Applicant shall determine the dust deposition rate in grams/m2/month in each calendar month so that any increases in dust deposition rates can be presented in the AEMR.	YES	Nine (9) dust deposition gauges were previously installed on the Donaldson Mine site, in accordance with Australian Standards. Approval from the (then) DPE was granted on 4 June 2019 for the decommissioning of deposited dust monitoring in accordance with the revised *Air Quality Management Plan* (2019). EPL 11080 has now also been surrendered and monitoring requirements of the combined EPL 12856 reflect updated air quality monitoring requirements.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Air Quality Monitoring (Cont'd)			
45	(1) The Applicant shall install, maintain and operate an air quality monitoring network in accordance with the relevant Australian Standards and to the satisfaction of the OEH. The network shall be installed and operational within six weeks of the date of this consent and in each calendar year the Applicant shall determine the concentrations of TSP in g/m3 (annual average) and fine particulates (PM10 and PM2.5) in g/m3 (24 hour average and annual average) so that the contribution of the mine to regional ambient air quality can be presented in the AEMR. (2) The Applicant shall also participate in (and if appropriate contribute reasonable funds to) regional air quality studies conducted by or on behalf of the OEH or the Director-General.	YES	See MCoA 44 above. All air quality meteorological data is stored on the air quality database at the Donaldson Mine site. High Volume Air Samplers (HVAS) were previously installed at Bartter Enterprise site and Beresford Golf Course for collection of TSP and PM_{10}. The revised *Air Quality Management Plan*, approved by the (then) DPE on 4 June 2019, replaces the previously installed HVAS and Dustrak monitors with a PM_{10} E-Sampler. Only continuous data from the E-Sampler will be collected and reported in future Annual Reviews. No approach has been made to Donaldson Mine in relation to regional air quality studies during this reporting period.
Air Quality Acquisition			
46	If dust monitoring or independent dust investigations indicate that dust from operation of the mine at a dwelling is in excess of the criteria set out in this Consent and if appropriate dust control measures cannot be achieved on the mine site, the landowner may request the Applicant in writing to acquire the whole of the property or such part of the property requested by the landowner where subdivision is approved.	Not activated.	No such requests received.
47	Any such request shall be referred to the Director-General for determination. If the Director-General determines acquisition is necessary, the Applicant shall acquire the property in accordance with Conditions 54-55.	Not activated.	No such requests received.
INDEPENDENT MONITORING OF NOISE, VIBRATION OR DUST			
48	The Applicant shall bear the reasonable costs of the appointment by the Director-General of an independent noise and air quality expert(s) and/or mediator to assist in the implementation of the Conditions of this Consent. The independent expert(s) shall: (i) receive and advise the Director-General on the Noise, Blast and Air Quality Management Plans; (ii) receive and advise the Director-General on noise and dust monitoring results; (iii) be responsible for, or supervise, the independent investigation of complaints; and (iv) advise the Director-General on the need for acquisition due to noise, vibration or dust. The independent expert(s) shall report directly to the Director-General and provide such advice as agreed by the Director-General to the Applicant and the landowner or occupier.	Not activated	No independent experts have been required to be appointed.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
INDEPENDENT MONITORING OF NOISE, VIBRATION OR DUST (Cont'd)			
49	In the event that a landowner or occupier considers that noise, vibration and/or dust from the project at their property is in excess of the relevant criteria set out in this Consent the landowner may make a written request to the Applicant for an investigation. If the Director-General, on the advice of the independent expert, is satisfied that an investigation is required, the independent expert shall ensure that: (i) direct discussions are undertaken with the landowners or occupiers affected to determine their concerns and to plan and implement an investigation to quantify the impact and determine the sources of the effect; (ii) independent investigations are conducted to quantify the impact and determine the source of the effect; and (iii) a report is submitted to the Director-General, the Applicant and the landowner or occupier.	Not activated	No such requests received.
50	If exceedances are identified, within six weeks or as otherwise directed by the Director-General, the Applicant shall modify the mining activity which may be causing the impacts and/or enter into a negotiated agreement (Condition 23) with the affected landowner.	Not activated	As above.
51	The Applicant shall bear the cost of the independent investigations and make available plans, programs and other information necessary for the independent expert(s) to form an appreciation of the past, present and future works and their effects on noise, vibration and/or dust emissions.	Not activated	As above.
52	Investigations shall be carried out in accordance with a documented Plan. The Plan shall be designed and implemented to measure and/or compute (with appropriate calibration by measurement) the relevant noise, vibration and/or dust levels at the complainant's residence/property boundary emitted by the development.	Not activated	As above.
53	Further independent investigations shall cease if the Director-General, in consultation with the independent expert, is satisfied that the relevant approval levels are not being exceeded and are unlikely to be exceeded in the future.	Not activated	As above.
ACQUISITION PROCEDURE			
54	Upon determination of the Director-General in relation to the purchase of a property in accordance with any Conditions of this Consent, the Applicant shall negotiate and purchase the whole of the property (unless the request specifically requests acquisition of only part of the property and subdivision has already been approved) within six months of receipt of notification from the Director-General. The Applicant shall pay the landowners an acquisition price resulting from proper consideration of: (i) a sum not less than the current market value of the owner's interest in the land, whosoever is the occupier, having regard to:	Not activated	As above.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
ACQUISITION PROCEDURE (Cont'd)			
54 Cont'd	(a) the existing use and permissible use of the land in accordance with the applicable planning instruments at the date of the written request; (b) the presence of improvements on the land and/or any Council approved building or structure which although substantially commenced at the date of the request is completed subsequent to that date; and (c) as if the land was unaffected by the development proposal. (ii) the owner's reasonable compensation for disturbance allowance and relocation within the Lower Hunter Region; (iii) the owner's reasonable costs for obtaining legal advice and expert witnesses for the purposes of determining the acquisition price for the land and the terms upon which it is to be acquired; and (iv) the purchase price determined by reference to points (i), (ii) and (iii) shall be reduced by the amount of any compensation awarded to a landowner pursuant to the *Mining Act, 1992* or other legislation providing for compensation in relation to coal mining but limited to compensation for dwellings, structures and other fixed improvements on the land, unless otherwise determined by the Director-General in consultation with the DRE.		
55	Notwithstanding any other Condition of this Consent, the Applicant may, upon request of the landowner, acquire any property affected by the project during the course of this Consent on terms agreed to between the Applicant and the landowner.	Not activated	As above.
INDEPENDENT VALUATION			
56	In the event that the Applicant and the landowner cannot agree within three months upon the acquisition price of the land and/or the terms upon which it is to be acquired under the terms of this Consent, then either party may refer the matter to the Director-General who shall request an independent valuation to determine the acquisition price. The independent valuer shall consider any submissions from the landowner and the Applicant in determining the acquisition price.	Not activated	As above.
57	If the independent valuer requires guidance on any contentious legal, planning or other issues, the independent valuer shall refer the matter to the Director-General, who, if satisfied that there is a need for a qualified panel, shall arrange for the constitution of the panel. The panel shall consist of: (i) the appointed independent valuer; (ii) the Director-General; and/or (iii) the President of the Law Society of NSW or nominee. The qualified panel shall, on the advice of the valuer, determine the issue referred to it and advise the valuer.	Not activated	As above.
58	The Applicant shall bear the costs of any independent valuation or survey assessment requested by the Director-General.	Not activated	As above.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
INDEPENDENT VALUATION (Cont'd)			
59	The Applicant shall, within 14 days of receipt of a valuation by the independent valuer, offer in writing to acquire the relevant land at a price not less than the said valuation.	Not activated	As above.
WATER			
Water Management			
60	The Applicant shall prepare and implement a *Water Management Plan* in consultation with NOW, Councils, OEH and the Hunter Catchment Management Trust, and to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the *Water Management Plan* available to the OEH, NOW, DRE, Councils, the Hunter Catchment Management Trust and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The *Water Management Plan 2000* was developed in consultation with the EPA, DLWC, Councils, Hunter Catchment Management Trust and to the satisfaction of the Director-General, prior to the commencement of construction. The *Water Management Plan* was reviewed in 2005 and a revision of the Plan occurred in 2008. The Water Management plan was again revised in 2019.
61	The *Water Management Plan* shall include but not be limited to: (i) management of the impacts of the development on the quality and quantity of surface and groundwater, including water in dirty water dams and clean water diversion dams;	YES	(i) The *Water Management Plan* addresses the management of impacts of the development on the quality and quantity of surface and ground water in Sections 3 and 5.
	(ii) stormwater and general surface runoff diversion to ensure separate effective management of clean and dirty water;		(ii) The *Water Management Plan* addresses the management of impacts of the development on the quality and quantity of surface and ground water in Sections 3, 4 and 5.
	(iii) stormwater management facilities designed to at least a 1:10 year storm design criteria;		(iii) The *Water Management Plan* addresses the stormwater management issues, in Sections 3 and 5.
	(iv) identification of any possible adverse effects on water supply sources (both surface and groundwater) of landowners or occupiers from the development, and implementation of mitigation measures as necessary;		(iv) The *Water Management Plan* addresses possible adverse effects of the development on water supply sources, in Sections 3 and 5.
	(v) identification of the fresh quality groundwater zones within the DA area and appropriate protection strategies;		(v) The *Water Management Plan* addresses the quality of groundwater zones within the DA area, in Sections 4 and 5.
	(vi) management of the impacts of the development on the quality and quantity of groundwater within 2 kilometres of the boundary of the DA area, with particular attention to mobilisation of salts and contingency plans for managing any adverse impacts;		(vi) The *Water Management Plan* addresses the management of impacts on the quality and quantity of groundwater within 2km of the DA area, in Sections 4 and 5.
	(vii) management of the impacts of the development on the quality and quantity of surface water discharged, including scheduling of mining operations to minimise the area excised from the catchment draining to Woodberry Swamp at any one time;		(vii) The *Water Management Plan* addresses the management of impacts on the quality and quantity of surface water discharged from the Donaldson Mine site, in Sections 3 and 5.
	(viii) identification of a defined buffer zone between the mine pit and Four Mile Creek and measures to minimise the risk of blast-induced fractures in the buffer zone to prevent saline seepage from the rehabilitated landform toward Four Mile Creek in the post-mining period;		(viii) The *Water Management Plan* addresses the buffer zone and protection Four Mile Creek in Sections 3 and 5.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Water Management (Cont'd)			
61 Cont'd	(ix) procedures for the maintenance of drainage systems and water management structures; and	YES	(ix) The *Water Management Plan* addresses the procedures for maintenance of drainage systems and water management structures in Sections 3 and 5.
	(x) development of a strategy for the decommissioning of water management structures, including dirty water dams and clean water diversion dams, and long term management of the final void.		(x) The *Water Management Plan* addresses the strategy for decommissioning of the water management structures in Sections 3, 4 and 5.
62	The Applicant shall revise the *Water Management Plan* as necessary and provide an updated Plan five years after commencement of mining to the Director-General, OEH, NOW, DRE, Councils, the Hunter Catchment Management Trust and the Community Consultative Committee.	YES	The *Water Management Plan* was reviewed in 2005 and Tasman Mine requirements included. The Plan was further revised in 2008 to include the Abel Mine water management and again revised in 2019 to cover the care and maintenance period for the Abel Underground Mine.
Water Monitoring			
63	The Applicant shall prepare and implement a detailed monitoring program for groundwater and surface water in consultation with DP&I, OEH, DRE, and the Hunter-Central Rivers Catchment Management Authority, throughout the life of the mine and for a period of at least 5 years after the completion of mining, or other such period as determined by the D_G. The results of the monitoring shall be included in the AEMR (Conditions 114-116). The monitoring program shall contain: (i) details of proposed monitoring sites, frequency and parameters to be tested; (ii) pre-mining baseline data;	YES	(i) *Water Management Plan* section 3.6 and 4.2. (ii) *Water Management Plan* section 3.6 and 4.1. (iii) *Water Management Plan* section 3.6. (iv) Biological monitoring in the three creeks using SIGNAL and AUSRIVAS assessment criteria was undertaken between 2000 and 2019. Biological monitoring ceased in 2019 in accordance with the revised *Water Management Plan* (2019). (v) Macro-invertebrate surveys included bank and bed stability. (vi) Continuous metering of water transfer volumes between the Donaldson and Bloomfield operations occurs. (vii) Whilst four (4) monitoring bores were previously destroyed as part of the mining operations, a review of the groundwater monitoring network by Dundon Consulting Pty Ltd concluded that the existing network is adequate with no changes considered necessary. It is noted that the mine has ceased operations for ~10years – as such, the requirements of this condition have been met and are no longer applicable.
	(iii) monitoring of surface water quality to detect any changes in ambient water quality between the mine site and the wetlands; (iv) monitoring of macroinvertebrates and vegetation in accordance with the protocols developed by the Hunter SIGNAL biological assessment criteria, with an assessment of inflows to the wetlands; (v) monitoring of stream bank and bed stability; (vi) monitoring of the volume and quality of water transfer between the Donaldson and Bloomfield operations; and (vii) a program for replacement of any monitoring bores destroyed by the development.		
64	Prior to 31 October 2005, the Applicant shall revise, and then implement any necessary changes in the monitoring program for groundwater and surface water to the satisfaction of the Director-General.	YES	The *Water Management Plan* was revised in 2005 under the Notification of Modification condition with comments received from DLWC and DoP and response from Peter Dundon & Associates.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Water Supply			
65	On request of a landowner whose water supply from licensed bore holes or springs has been determined by NOW at any time to have been affected by the project, the Applicant shall replace lost water supply with water of an equivalent quality and quantity to meet the landowner's requirements, to the satisfaction of NOW.	Not activated	No such request received.
EROSION AND SEDIMENT CONTROL			
66	The Applicant shall prepare and implement an *Erosion & Sediment Control Plan* for the development (including the haul road and the relocation of utilities and services) to the satisfaction of NOW and submit the Plan to the OEH as part of applications for a licence under the Protection of the *Environment Operations Act*. The Plan shall be prepared prior to the commencement of work in the relevant areas. The Applicant shall make copies of all Erosion & Sediment Control Plan(s) available to Director-General, Councils and the Community Consultative Committee within 14 days of approval.	YES	*Erosion and Sediment Control Plan* was submitted to the EPA on 4 May 2000 as part of the application for Environment Protection Licence No. 11080. A review of the *Erosion and Sediment Control Management Plan* was conducted in 2005 following the DPI-MR inspection in May 2005, and the Plan revised.
67	The Erosion and Sediment Control Plan(s) shall include consideration and management of erosion and sedimentation of watercourses and water bodies, including Woodberry Swamp.	YES	The *Erosion and Sediment Control Plan* addresses the management of erosion and sedimentation of watercourses and water-bodies on the Donaldson Mine site, in Sections 4. Control of erosion and monitoring of water quality of watercourses and water bodies on the mine site and to the boundaries of the Donaldson property, results in management of impact from the mine on downstream habitats (e.g. Woodberry Swamp). Monitoring also previously included assessment of bank and bed stability as part of the macroinvertebrate survey reports.
FLORA AND FAUNA			
Tetratheca Juncea Conservation Area			
68	Prior to the commencement of construction, the Applicant shall: (i) undertake a survey of potential Tetratheca Juncea habitat in the southwest portion of the site. The survey shall: (a) be undertaken by a suitably qualified botanist, with the assistance of a suitably qualified surveyor, both approved by the Director-General; (b) re-examine the outcomes of previous surveys; (c) be undertaken between the months of August and December (inclusive); (d) record the location of Tetratheca Juncea clumps on the ground using suitable tags and by using either theodolite and electronic measuring equipment or differential GPS;	YES	(i) Figures 1 and 4 of the *Tetratheca Juncea Management Plan* show the Southwest Conservation Area. (a) a T. Juncea survey of the Conservation Area was undertaken by Gunninah Environmental Consultants and the aerial survey of the area was conducted by a qualified surveyor. (b) The results of previous T. Juncea surveys were assessed and collated with the current data for the preparation of the maps and T. Juncea Management Plan. (d) T. Juncea clumps have been located using GPS and surveyed onto the site maps in the T.Juncea Management Plan.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
FLORA AND FAUNA (Cont'd)			
Tetratheca Juncea Conservation Area (Cont'd)			
68 Cont'd	(e) investigate the occurrence of any native sonicating bee habitat within 500 metres of the Tetratheca Juncea population; and (ii) establish a Conservation Area for the Tetratheca Juncea based on the findings of the survey. The Conservation Area shall include a 50 metre buffer. The boundaries of the Conservation Area shall be surveyed and marked by a suitably qualified surveyor, with the assistance of a botanist, using either a theodolite and electronic measuring equipment or differential GPS. No clearing, construction or mining shall commence until the boundary of the Conservation Area has been approved by the Director-General.	YES	e) Bee habitat is discussed in Section 5.2.2 of the T. Juncea Management Plan. (ii) The southwest Conservation Area has been established with a 50 metre buffer to the closest area that may become part of the mine operations (see Figure 1 from the *Flora and Fauna Management Plan*). The area is pegged but not fenced.
69	The Applicant shall prepare a Management Plan for the Tetratheca Juncea Conservation Area in consultation with OEH and to the satisfaction of the Director-General, prior to commencement of construction. The Plan shall be consistent with the *Flora and Fauna Management Plan* (Conditions 76-79); and include measures for fire management. The Applicant shall clearly mark the boundary of the Conservation Area and make provision for signage which specify that no dumping, clearing or other works are permitted in the Conservation Area. Such signage shall be replaced as required. The Applicant shall make copies of the *Tetratheca Juncea Management Plan* available to OEH, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	NPWS provided correspondence advising they were satisfied with the T Juncea Management Plan in November 2000. The property boundary of the Conservation Area is fenced along John Renshaw Drive and the T.Juncea areas are pegged but not fenced or signed. (The presence of a fence or signage around the specific areas of T.Juncea would highlight their location and result in unwanted attention and possibly vandalism to the area). The current status of the Conservation Area indicates that there is no intrusion of work areas or other disturbance to the T.Juncea locations. A biologist monitors the T.Juncea areas to keep records of the status of growth and flowering.
70	Within six months of this Consent, or as otherwise agreed by the Director-General, the Applicant shall identify a bushland area(s) in the region that will adequately compensate for the impact of the mine on biodiversity, provide compensatory habitat and be managed for the primary purposes of conservation. The area shall be identified in consultation with OEH and Councils and be to the satisfaction of the Director-General. Identification of the bushland area(s) shall include: (i) a detailed assessment of the current characteristics and ecological values of existing ecosystems affected by the mine, including the habitat of threatened species identified in the EIS as possibly occurring in the area and the Spotted Gum Ironbark community; (ii) identification of conservation objectives to be achieved by the establishment of the bushland area(s), with reference to the *Regional Biodiversity Strategy* and the principles of Ecologically Sustainable Development;	YES	(i) A detailed assessment of the current flora and fauna and habitat values of the mine site was conducted by Barker Harle in 2001. (ii) The *Bushland Area Management Plan* was prepared and submitted to the Director-General in 2005 for approval. The Plan included identification of conservation objectives. (iii) NPWS provided Donaldson Mine with a number of compensatory bushland areas to consider in 2001. Donaldson assessed inclusion of land around the mining lease, and have established the Conservation Area for bushland protection, within the mine lease area.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Tetratheca Juncea Conservation Area (Cont'd)			
70 Cont'd	(iii) consideration of alternative locations within the region, including, but not limited to, the land proposed as compensatory area in the EIS (i.e. land adjoining the mine site); (iv) a detailed assessment of appropriate boundaries, size and shape of the bushland area(s), in relation to the characteristics, values and objectives; (v) consideration of appropriate management options necessary to protect the conservation values; and (vi) consideration of opportunities to incorporate cultural heritage conservation into the bushland area(s).		
BUSHLAND AREA			
71	In identifying the bushland area(s), the following broad criteria shall be applied: (i) a ratio of 2:1 in terms of compensatory area to the area to be directly impacted by mining and associated infrastructure; (ii) the vegetation communities and habitat values of the bushland area(s) are to be broadly representative of the area which will be subject to mining and contain a similar suite of fauna species; (iii) the location of the bushland area(s) will aim to consolidate existing reserves in the lower Hunter Area; and (iv) reserve design criteria, including edge-to-area ratio, size and connectivity shall be taken into account.	YES	(i) The Donaldson owned property around the mine area has been retained as a buffer and compensatory conservation area. (ii) The compensatory area of bushland is adjacent to and surrounds the mining area and is representative of the vegetation communities and habitat present on the disturbed areas. (iii) The compensatory area around the Donaldson Mine is contiguous with the Ironbark-Spotted Gum vegetative corridors in the Maitland area.
72	Upon approval of the identified bushland area(s) by the Director-General, the Applicant shall: (i) secure care, control and management of the bushland area(s) prior to the commencement of mining; (ii) retain management and ownership of the land for a minimum of 36 years from the commencement of construction, unless other arrangements are agreed in accordance with Condition 73; and (iii) prepare and implement a Management Plan for that area in consultation with OEH and to the satisfaction of the Director-General, during the period in which the Applicant is responsible for management. The Management Plan shall be consistent with the *Flora and Fauna Management Plan* (Conditions 76-79) and consider the integration of cultural conservation objectives and management. The Applicant shall make copies of the Management Plan available to OEH and the Community Consultative Committee within 14 days of approval by the Director-General. For the purposes of the Conditions of this Consent, the bushland area(s) approved by the Director-General shall be known as the Bushland Conservation Area until the completion of the period referred to in Condition 72(ii) and any Conditions relating to Conservation Areas shall apply to that area during that period. The Management Plan referred to in Condition 72(iii) shall be referred to as the Bushland Conservation Area Management Plan.	YES	(i) The bushland area around the mine operations is owned by Donaldson Mine and managed as part of the overall land management strategies. (ii) See above. Management will continue until 2036. (iii) The *Bushland Conservation Area Management Plan* was developed in consultation with the NWPS and the Plan submitted to the Director-General on 31 October 2005. (Refer to MCoA 74).

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
BUSHLAND AREA (Cont'd)			
73	The Applicant shall undertake negotiations with the OEH and Councils to reach agreement on the long term tenure and management status of the Bushland Conservation Area. These negotiations must commence within six months of commencement of construction.	YES	Donaldson Coal provided information on the management of the proposed bushland conservation area to NPWS in May 2001 and undertook consultation and negotiations with the authorities. A Draft Plan of Management for the Bushland Conservation Area was presented to the D-G in February 2005 and the Plan revised and submitted to the D-G in October 2005. Studies by DEC during 2006 in preparation for the *Draft Lower Hunter Conservation Plan* (LHCP), which was to be released together with the final LHRS, identified parts of the Donaldson land for conservation reserve and bio-banking investment (NAPS Map). The identified conservation land does not align exactly with the Donaldson Bushland Conservation Area. Donaldson, along with other Lower Hunter major landowners, was formally requested by DEC to consider dedication of lands for conservation in the reserve system prior to announcement of the final LHRS and Draft LHCP. Donaldson presented a formal proposal to DEC in late 2006, and discussions with B&CD are continuing for a major portion of the Donaldson land to be dedicated as conservation reserve or nominated as Bio-banking investment area. The likely outcome of the intensive investigations described above is that some 400-500 hectares of the Donaldson land may be placed in permanent conservation (via either the reserve system or bio-banking) and the remainder of the land will be zoned consistent with the final LHRS.
74	Prior to 31 October 2005, the Applicant shall revise the *Bushland Conservation Area Management Plan* to compensate for the extension of the disturbance area in the vicinity of Weakleys Flat Creek, to the satisfaction of the Director-General, and provide an updated Plan to the OEH, Councils and the Community Consultative Committee.	YES	The *Bushland Conservation Area Management Plan* was prepared and revised following consultation with the NPWS/OEH.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
BUSHLAND AREA (Cont'd)			
74A	By 30 September 2011, the Applicant shall revise the *Bushland Conservation Area Management Plan* to the satisfaction of the Director-General. The revised plan must: (i) be prepared in consultation with OEH; and (ii) include the 3 hectares of land removed from the approved mining area, as detailed in the letter from Donaldson Coal Pty Limited to the Minister for Planning dated 25 March 2011.	Yes	The *Bushland Conservation Area Management Plan* was prepared, submitted to OEH 22 September 2011 and revised following consultation with the NPWS/OEH. The map of the bushland conservation area was updated to compensate for the extension of the disturbance area in the vicinity of Weakleys Flat Creek.
Flora and Fauna Management			
75	The Applicant shall bear the reasonable costs of the appointment by the Director-General of an independent flora and fauna expert(s) to assist in the implementation of the Conditions of this Consent. The independent expert(s) shall: (i) be selected in consultation with the applicant; (ii) assess and advise the Director-General on the Applicant's proposed Conservation Areas and Management Plans for those areas; (iii) assess and advise the Director-General on the Applicant's proposed bushland area(s); (iv) assess and advise the Director-General on the Applicant's proposed Flora and Fauna Management and the Rehabilitation Plan; and (v) assess and advise the Director-General on the Applicant's monitoring of flora and fauna management and rehabilitation.	Planning NSW - condition of approval	Robert Payne was commissioned as an independent flora and fauna expert by Director-General to assess and advise on the flora and fauna management for the Donaldson Mine proposed conservation areas and flora and fauna management plans.
76	The Applicant shall prepare and implement a *Flora and Fauna Management Plan* for the mine site (in addition to the management plans for specific Conservation Areas), in consultation with NOW, OEH and Councils, and to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the *Flora and Fauna Management Plan* available to NOW, OEH, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The *Flora and Fauna Management Plan* was prepared and approved by DUAP in December 2000. The *Flora and Fauna Management Plan* was implemented for the Donaldson Mine site and the Plan reviewed in 2007 and 2019. The flora and fauna monitoring programs have been conducted and results summarised in the AEMR's / Annual Reviews.
77	The *Flora and Fauna Management Plan* shall include but not be limited to: (i) additional surveys to more precisely identify the distribution of known and potential nest and roost trees for owl species. The surveys shall: (a) be undertaken by a person experienced in the identification of owl nest and roost trees, approved by the Director-General; and (b) record the location of known and potential nest and roost trees on the ground by marking the tree and by using either theodolite and electronic measuring equipment or differential GPS; (c) a vegetation map delineating major vegetation communities, topographic features and the location of threatened species habitats, including potential and known owl nest and roost trees;	YES	(i)(a) Additional surveys of owl habitat were conducted by Rod Kavanagh on the Donaldson Mine site during Sept - Oct 2000. (ii) Figure 4-1 and 4-3 in the *Flora and Fauna Management Plan* present vegetation communities and locations of threatened species habitats on the Donaldson Mine site.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Flora and Fauna Management (Cont'd)			
77 Cont'd	(ii) details of measures to manage the impacts of the development, including: (a) restoration of degraded areas; (b) management of invasive weeds and feral animals; (c) establish an appropriate hazard reduction regime in keeping with the ecological values of the area; (d) revegetation and provision of compensatory areas of equivalent ecological and habitat value where necessary; and (e) strategies to provide increased security for existing habitats and communities; iii) details of measures to manage the impacts of environmental management on flora and fauna, including the impact of erosion and sediment control measures and hazard reduction burning; (v) priorities for action and a timetable for all works outlined in the Plan; and (vi) a program to monitor flora and fauna impacts on undisturbed portions of the mining lease area and downstream environments (such as the Woodberry Swamp). The program shall extend for the life of the mine and for a period thereafter as approved by the Director-General, and include: (a) justification for monitoring intervals and locations; (b) monitoring of the presence and persistence of native flora and fauna species over time, particularly threatened species; and (c) monitoring the effectiveness of management measures.	YES	(iii)(a) Degraded area restoration procedures are presented in the *Rehabilitation Plan* Dec 2000 section 4.3.7. (iii)(b) Weed management and feral animal control are presented in the *Rehabilitation Plan* sections 5.2 and 5.3. (iii)(c) Hazard reduction addressed in the *Rehabilitation Plan* Section 5.4, and the *Bushfire Management Plan*. (iii)(d) See comments on MCoA 71 to 74. (iii)(e) Protection strategies for existing habitats and communities include pre-clearing surveys of all areas to be disturbed, fenced perimeter of the mine lease area, and the *Flora and Fauna Management Plan* Section 4. (v) The priorities for action in relation to protection of flora and fauna are outlined in Section 7 of the 2019 *Flora and Fauna Management Plan.* (vi) Section 5 of the 2019 *Flora and Fauna Management Plan* describes the proposed monitoring programs.
78	The Flora and Fauna Management Plan shall also include a Rehabilitation Plan that details the measures to be undertaken to progressively rehabilitate disturbed areas of the mine to replicate the original vegetation cover that existed before mining occurred. The Applicant shall be responsible for the management and monitoring of the rehabilitated mine site until such time as the Director-General agrees that restoration has been successful.	YES	The *Rehabilitation Management Plan* was updated in 2019 and is presented as Appendix 1 in the 2019 Flora and Fauna Management Plan and as a separate document on the Company website.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Flora and Fauna Management (Cont'd)			
78A	By 31 October 2011, the Applicant shall revise the *Rehabilitation Plan* to the satisfaction of the Director-General. The revised plan must: (i) be prepared in consultation with DRE; (ii) include: • the rehabilitation objectives for the site; • a strategic description of how the rehabilitation of the site would be integrated with surrounding land uses; • a general description of the short and long term measures that would be implemented to rehabilitate the site, including; – managing remnant vegetation and habitat on site; – minimising impacts on fauna; – minimising visual impacts; – conserving and reusing topsoil; – controlling weeds, feral pests, and access; and – managing bushfires; • detailed performance and completion criteria for the rehabilitation of the site; • a detailed description of how the performance of the rehabilitation works would be monitored over time to achieve the stated objectives and against the relevant performance and completion criteria; and • details of who is responsible for monitoring, reviewing and implementing the plan.	Yes	The *Rehabilitation Plan* is also addressed as part of the current MOP (period ending 1 May 2021) for the Donaldson Mine and was prepared in consultation with the (then) DRE and includes: • Section 5.2 Domain Rehabilitation Objectives; • Section 5 *Rehabilitation Planning and Management* provides a strategic description of integration of the rehabilitation of the site with surrounding land uses; • Section 7 *Rehabilitation Implementation* describes the short and long term measures to be implemented to rehabilitate the site; • performance and completion criteria for rehabilitation; • Section 8 *Rehabilitation Monitoring* addresses monitoring performance of the rehabilitation works over time to achieve stated objectives and against performance and completion criteria; and • responsibilities for monitoring, reviewing and implementing the plan. Further review and update of the *Rehabilitation Plan* will be undertaken as part of the preparation of the new *Rehabilitation Management Plan* in accordance with the Resources Regulator's Operational Rehabilitation Reform.
79	The Applicant shall revise the *Flora and Fauna Management Plan* as necessary and provide an updated Plan five years after commencement of mining to the Director-General, OEH, Councils and the Community Consultative Committee.	YES	The *Flora and Fauna Management Plan* was reviewed by Ecobiological in March 2007 and a *Revised Flora and Fauna Management Plan* submitted to DoP on 17 July 2007. DoP approved the revised Plan on 25 July 2007. A further revision to reflect care and maintenance was prepared on 3 June 2019 and approved by the (then) DPE 4 June 2019.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Flora and Fauna Management (Cont'd)			
80	The Applicant shall participate in (and if appropriate, contribute such reasonable funds as determined by the Director-General in consultation with OEH) research into the Powerful Owl and Masked Owl habitat requirements in the region, and the habitat requirements and lifecycle of *Tetratheca Juncea.*	YES	Donaldson Mine supported projects by the University of Newcastle with financial and technical help for: Deborah Landenberger - 2 year Honours project 'Defining the Niche of T. Juncea'; and Adam Blundell with Rod Kavanagh during 2002-2003 for 'Comparing Ecology of Powerful Owl in Disturbed and Undisturbed Environments'. Both these projects have been completed.
HERITAGE			
Heritage Statutory Requirements			
81	Prior to commencement of construction, the Applicant shall: (i) comply with the statutory requirements of OEH in relation to works affecting Aboriginal sites; and (ii) undertake a targeted archaeological survey of the slopes component within the mining impact area in cooperation with the Aboriginal community. Any Aboriginal sites located will be recorded, the significance of the sites assessed, and management strategies for the sites identified.	YES	Management of the Aboriginal heritage sites occurs in accordance with the *Aboriginal Sites Management Plan* and the status of management is reported in the respective AEMR / Annual Review.
82	If, during the course of construction, the Applicant becomes aware of any heritage or archaeological material, all work likely to affect the material shall cease immediately and the relevant authorities consulted about an appropriate course of action prior to recommencement of work. The relevant authorities may include OEH, the Heritage Office, and the Local Aboriginal Land Councils. Any necessary permits or consents shall be obtained and complied with prior to recommencement of work.	YES	Section 90 Consents to Destroy under the *National Parks and Wildlife Act 1979*, were obtained for Aboriginal artefact areas DMS1 on 22 April 2000 and ISF1 and ISF2 on 3 May 2000. No further Section 90 Consents have been required since that time.
Aboriginal Heritage Management			
83	Prior to commencement of construction, the Applicant shall establish an Aboriginal Conservation Area along Four Mile Creek and tributaries in accordance with a plan approved by the Director-General. The plan shall include: (i) identification of an appropriate boundary and the basis on which the boundary has been selected; (ii) a map at a scale of 1:1 000 or larger which clearly delineates the Conservation Area boundary and specific features; and (iii) documentation of consultations with OEH and Aboriginal community groups in relation to the definition of the Conservation Area.	YES	(i) A 50 metre buffer along Four Mile Creek as an Aboriginal Conservation Area (ACA) has been established by Donaldson Coal. The ACA boundary is shown in Figure 2.3 of the *Aboriginal Sites Management Plan*. ii) Maps of the Four Mile Creek Conservation Area and other Conservation Areas (1:1 000 scale) have been prepared by Donaldson Coal for the Donaldson Mine area. (iii) Consultation with the Mindaribba Aboriginal Local Land Council was held during the preparation of the *Aboriginal Sites Management Plan*. NPWS consultation and correspondence was available on file.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
Aboriginal Heritage Management (Cont'd)			
84	The Applicant shall prepare and implement an *Aboriginal Sites Management Plan* in consultation with the Aboriginal community, Councils and OEH, and to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the *Aboriginal Sites Management Plan* available to the Director-General, Aboriginal community, Councils and the Community Consultative Committee within 14 days of approval by OEH.	YES	An *Aboriginal Sites Management Plan* was prepared prior to commencement of mining operations in 2000, with Supplementary Plans prepared for Years 2 to 5 of the operations. The *Aboriginal Sites Management Plan* has been submitted to the relevant authorities within 14 days of approval by the NPWS. The *Aboriginal Sites Management Plan* has not required revision since 2005.
85	The Management Plan shall include, but not be limited to: (i) documentation of consultation with the relevant Aboriginal community groups to identify any outstanding concerns they may have with the project and a clear statement about how these concerns will be addressed, including any action to be taken; (ii) identification of conservation objectives for the site as a whole and for the Conservation Area specifically; (iii) a program to monitor the impacts of the development on the Conservation Area, including justification for monitoring locations and intervals; (iv) strategies to achieve conservation objectives, including an access policy; (v) the provision of fencing to permit faunal movement and the removal of fencing within six months of completion of mining; (vi) further investigations; and (vii) long term management requirements upon completion of mining.	YES	(i) Consultation with the Mindaribba Aboriginal Local Land Council is addressed in the Plan with relevant correspondence attached in Appendix 1 of the Plan. (ii) Conservation objectives are addressed in Section 1.3 of the *Aboriginal Sites Management Plan*. (iii) Monitoring of the Conservation Area is outlined in Section 2.1 and 3 of the *Aboriginal Sites Management Plan*. The location of the monitoring datum points are illustrated in Figure 2.4 of the Plan. (iv) Strategies to achieve the conservation objectives are outlined in Section 2 of the *Aboriginal Sites Management Plan*. (v) The boundary of the Mining lease area and the Donaldson owned land is fenced. (vi) The mining lease area was re-surveyed for Year 2 to 5 of the mining operations. Ongoing monitoring and surveys will occur prior to disturbance of any new areas required for mining.
86	The Applicant shall revise the *Aboriginal Sites Management Plan* as necessary and provide an updated Plan five years after commencement of mining to the Director-General, OEH, Councils and the Community Consultative Committee.	YES	The *Aboriginal Sites Management Plan* was subjected to annual review until 2005 and amendments to the Plan made by Umwelt as required. The Plan has not required revision since 2005.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
WASTE			
87	The Applicant shall prepare and implement a *Waste Management Plan* in consultation with OEH, DRE and the Hunter Waste Planning and Management Board, and to the satisfaction of the Director-General, prior to commencement of construction. The Applicant shall make copies of the *Waste Management Plan* available to Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The *Waste Management Plan* was prepared prior to commencement of construction of the mine. The Plan was submitted to DUAP and approved on 10 October 2000. Copies of the *Waste Management Plan* were distributed to the Councils and the CCC, within 14 days of approval by the Director-General.
88	The *Waste Management Plan* shall include, but not be limited to the management of the mine site to prevent dumping of waste; and the management and treatment of Potentially Acid Forming waste.	YES	Management of waste streams including overburden, coarse rejects material and fine reject material is included in Section 7 of the *Waste Management Plan*. The management and treatment of potential acid forming (PAF) material is addressed in the geotechnical report and there is ongoing assessment of PAF material to ensure application of best practice management options.
89	The Applicant shall meet the requirements of Councils, OEH and Hunter Water Corporation with respect to water and sewer.	YES	Potable water for use on the mine site is supplied from the Hunter Water Corporation. There is no discharge to sewer from the site operations. All ablutions are connected to onsite biocycle systems.
VISUAL AMENITY			
Landscaping			
90	The Applicant shall provide a minimum of 50 metres of landscaping between the outer edge of the bund wall and the edge of John Renshaw Drive. The 50 metres may include landscaping within the road verge if agreed by Cessnock Council.	YES	The *Landscape Management Plan* has been implemented with revegetation of the 50m strip along the power-line easement between John Renshaw Drive and the earthen bund on the edge of the high-wall of the open cut. The *Landscape Management Plan* was reviewed and revised in March 2008 by GSS Environmental. The 2008 *Landscape Management Plan* is an integrated plan for all the Donaldson Coal projects (i.e. the Donaldson Mine, Tasman Mine and Abel Mine).
91	The Applicant shall, within three months of the date of this Consent, or within such further period as Councils may require, submit for the Councils' approval a detailed Landscaping Plan covering all land within the proposed mining area (including the haul road and transmission line easements) and road reserve along the frontage to John Renshaw Drive. The Applicant shall engage a suitably qualified person to assist in the landscaping plan.	YES	

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
VISUAL AMENITY (Cont'd)			
Landscaping (Cont'd)			
92	The Landscaping Plan shall be consistent with the *Environmental Management Strategy* and include: (i) provision for the establishment of trees and shrubs and the construction of mounding or bunding along the planned highwall and any other areas identified as necessary by the Councils for the maintenance of satisfactory visual amenity and the re-establishment of flora and fauna habitats and corridors; (ii) appropriate erosion control and sediment control practices for earthworks associated with the landscaping; (iii) details of the visual appearance of all buildings, structures, facilities or works (including paint colours and specifications). Buildings and structures shall be designed and constructed so as to present a neat and orderly appearance and to blend as far as possible with the surrounding landscape; and (iv) details, specifications and staged work programs to be undertaken, including a maintenance program of all landscape works, building materials and cladding.	YES	The *Landscape Management Plan 2000* addresses the establishment of trees and shrubs for visual amenity and re-establishment of flora and fauna corridors in Section 4.3. The *Landscape Management Plan 2000* addresses erosion and sediment control in Section 4.3 and refers to the Erosion and Sediment Management Plan. The *Landscape Management Plan 2000* addresses the visual appearance of buildings, structures, facilities and works in Section 4.0. The *Landscape Management Plan 2000* addresses the staged work programs for maintenance program of all landscape works, building materials and cladding in Section 4.2
93	The Applicant shall implement the approved Plan in accordance with Councils' requirements and make copies available to the Community Consultative Committee within 14 days of approval by Councils.	YES	Copies of the *Landscape Management Plan 2000* were provided to the CCC following approval by the Councils 9 March 2000. The revised *Landscape Management Plan* was submitted to the CCC in 2008.
94	The Applicant shall plant screening vegetation on properties at higher elevation and with views across the mine site in the Black Hill area if requested in writing by the landowner, within three months of that request. The species, density and location of the plantings shall be determined in consultation with the landowner.	Not activated	No such requests received.
95	The Applicant shall lodge a landscaping bond with Cessnock Council, to a maximum of $10,000 at any one time, for landscaping during the life of mine. This bond does not affect rehabilitation works covered by the *Mining Act*.	No Longer Applicable	Landscaping bond of $10,000 was lodged with the Cessnock City Council on 19 April 2007.This bond was previously refunded due to the satisfactory completion of the works.
Lighting			
96	The Applicant shall screen or direct all onsite lighting and vehicle lights away from residences and roadways to the satisfaction of Councils. All screening to be completed prior to commissioning of the coal preparation plant and associated facilities.	YES	Lighting from site activities has not given rise to complaints. No lighting is used on high points at night and no light scatter occurs to roadways or residential areas from the Donaldson Mine operations.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
HAZARDS, RISKS AND SAFETY			
97	The Applicant shall: (i) provide adequate fire protection works on site. This shall include one fully equipped fire fighting unit on standby and hazard reduction works at a time determined by the relevant Council, with particular attention to boundaries of adjoining land holdings;	YES	(i) Meetings have been held between Donaldson Mine and the Cessnock City Council / Thornton Fire Rural Fire Brigade/ Benwerrin Rural Fire Brigade in relation to access to the mine site in case of fire.
	(ii) submit an annual report on fire management activities to the local Bush Fire Management Committee; and	YES	(ii) A *Bushfire Management Plan* for the areas owned by Donaldson Coal was prepared in 2004 and submitted to the Rural Fire Service for review. Following a site inspection the RFS provided comments and the Plan was updated and finalised. A report on controlled burn-off at the Donaldson site was forwarded to the RFS for inclusion in the Bush Fire Management Committee folder in Oct 2005. Hazard burning is conducted on the Donaldson Mine site and reported to the Bushfire Management Committee by the RFS. Mechanical works along the southern and eastern sections of the Avalon Estate at Thornton is also carried out annually by Donaldson and reported to RFS. An inspection of the Donaldson Mine site with the RFS is conducted at least annually.
	(iii) ensure that all dangerous goods and materials stored on site are stored in accordance with the relevant Australian standards.	YES	Fuels and lubricants are no longer stored within the Donaldson Open Cut Coal Mine area.
UTILITIES AND SERVICES			
98	The Applicant shall consult with affected service authorities and make arrangements satisfactory to those authorities for the protection or relocation of utilities and services (such as transmission lines and pipelines) at the Applicant's expense, prior to any existing utilities or services being affected by mining activity. Relocation of utilities and services shall be conducted in accordance with the relevant Management Plans and the Erosion and Sediment Control Plan(s).	YES	The Energy Australia 11kV power-line was relocated along an easement adjacent to the John Renshaw Drive boundary of the mine lease, in 2002. Part of the Hunter Water Corporation water pipeline was relocated for the progression of the Donaldson Mine, in accordance with the MOP. Telstra lines off the new intersection on John Renshaw Drive were relocated in 2006.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
99	Prior to commencement of construction, or as otherwise agreed by the Councils, the Applicant shall design, construct and seal the private haul road and access road to the satisfaction of the Councils, and with consideration of the impact on the fragmentation of fauna habitat and fauna movement.	YES	The internal haul road was constructed from Donaldson Mine to Bloomfield CPP and Coal Loader in 2001. Cessnock City Council advised it did not require to approve the road construction as it was an internal haul road. The *Flora and Fauna Management Plan* included pre-clearing protocol, road design and general measures covering erosion and sediment control, removal of weeds and rubbish, and incident reporting that were applied to the construction of the road.
100	No coal shall be hauled on public roads.	YES	No coal is transported on public roads.
TRANSPORT AND ACCESS			
101	The Applicant shall carry out intersection improvements as determined necessary by the Regional Traffic Committee as a result of the development and by such times as directed by the Regional Traffic Committee.	YES	A Development Application was submitted to the Cessnock City Council for the John Renshaw Drive intersection in November 2001. The Hunter Regional Traffic Committee considered the DA and recommended a number of changes, and the plan was amended and re-submitted to the Council. The Council re-exhibited the DA and granted consent in July 2003. The intersection from John Renshaw Drive to the Donaldson Mine access road was completed in accordance with the consent.
102	If closure of John Renshaw Drive is agreed by the Regional Traffic Committee under Condition 25(4), the Applicant shall: (i) pay $20,000 to Cessnock City Council to upgrade the alignment and surface of the unsealed western end of Black Hill Road; (ii) provide a water cart and apply water to the unsealed western end of Black Hill Road to the requirements of Cessnock City Council prior to each closure of John Renshaw Drive for blasting; and (iii) prepare a *Traffic Management Plan* for the approval of the RTA in relating to the closure of John Renshaw Drive during blasting.	YES	The $20,000 contribution was provided to the Cessnock City Council in November 2004 for the upgrade of the western end of Black Hill Road. The improvements to Black Hill Road were completed by Cessnock City Council. The improvement of the Black Hill Road intersection with a John Renshaw Drive turning lane, was constructed during 2010 as part of the Abel Underground approval. Donaldson received a Road Occupancy Licence for the closure of John Renshaw Drive during blasting.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
INITIAL COAL WASHING (Cont'd)			
103	The Applicant shall provide for signalling of the Bloomfield rail loop to the satisfaction of Freight Corp prior to the commencement of mining.	YES	Freightcorp correspondence provided options for implementation of safe working procedures for the rail loop to satisfy MCoA 103. Bloomfield upgraded the rail system alarm signals on the Entry road to the mines, from the old key system. The management of trains on the loop has been upgraded with implementation of safe work practices.
INITIAL COAL WASHING			
104	Upon commencement of coal extraction, the Applicant shall initially make use of the coal preparation plant (CPP) at the adjoining Bloomfield coal mine for up to two years from commencement of mining or such other period as approved by the Director-General. This will allow the Applicant to: (i) trial the washing of Donaldson coal to assist in the determination of its washing characteristics; and (ii) commence the earliest possible coal extraction at Donaldson, and hence hasten project completion.	YES	Approval for the ongoing use of the Bloomfield CPP is now in place under the Abel Mine consent with an extended agreement between Bloomfield Coal and Donaldson Coal.
105	The haulage route for raw coal from the Donaldson pit to the Bloomfield CPP shall be the same as that proposed for haulage of product coal from the proposed Donaldson CPP to the existing Bloomfield rail loading facility up to the point of intersection with the Bloomfield Mine access road, and thence westward along the Bloomfield Mine access road to the CPP, unless otherwise agreed to with the owners of Bloomfield. However, any variation to the route shall be considered to determine whether a modification to this Consent is required to enable the variation.	YES	Donaldson Coal constructed an internal sealed haul road to transport ROM coal to the Bloomfield CPP, the road alignment crossing Four Mile Creek.
106	The Applicant shall notify the Director-General within eighteen months of the commencement of mining as to the results of the Bloomfield washery trials.	YES	See comment on MCoA 104.
COMMUNITY INVOLVEMENT			
Community Consultative Committee			
107	The Applicant shall establish a Community Consultative Committee which shall be chaired by an independent chairperson approved by the Director-General. Selection of representatives shall be agreed by the Director-General and include (unless otherwise agreed by the Director-General) two representatives from the Applicant (including the Environmental Officer), four community representatives (including a representative of the local Aboriginal Community) and representatives of the local Councils. Representatives from relevant government agencies (including DUAP) may be invited to attend meetings of the Committee as required.	YES	The CCC was established on 30 May 2000 and meetings have been held regularly during operations. As the mine has ceased operations and been rehabilitated, no further meetings are currently planned.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
COMMUNITY INVOLVEMENT (Cont'd)			
Community Consultative Committee (Cont'd)			
108	The Committee may make comments and recommendations about the implementation of the development. The Applicant shall ensure that the Committee has access to the necessary plans and/or studies for such purposes. The Applicant shall consider the recommendations and comments of the Committee and provide a response to the Committee and the Director-General.	YES	Management Plans have previously been provided to the CCC for comment and information. Discussion of management plans occurred at the CCC meetings.
109	The Applicant shall, at its own expense: (i) provide appropriate facilities for meetings of the Committee;	YES	CCC Meetings were previously held at Donaldson Mine offices. Donaldson arranged and provided the required material and administrative backup for the meetings.
	(ii) nominate a representative to attend all meetings of the Committee;	YES	Donaldson Coal nominated representative to attend all meetings is the Environmental Manager-Phillip Brown.
	(iii) ensure that the first meeting is held prior to commencement of construction, that meetings are held at least every six months for the first 24 months from the date of the mining lease and at least annually thereafter;	YES	The first meeting of the CCC was held on 30 May 2000 prior to commencement of construction and subsequent meetings were held on a regular basis. The meetings were arranged by the Independent Chairperson as required.
	(iv) provide to the Committee regular information on the progress of the work and monitoring results;	YES	Reports on project status, monitoring results and AEMR's/Annual Reviews and complaints are provided to the CCC and published on the Company website.
	(v) promptly provide to the Committee such other information as the Chairperson of the Committee may reasonably request concerning the environmental performance of the development; and	YES	Material is provided to the CCC as and when requested as detailed in the CCC Minutes.
	(vi) provide reasonable access for site inspections by the Committee.	YES	Site inspections by members of the CCC to view the mine and rehabilitation areas, following CCC Meetings.
110	The Applicant shall establish a trust fund to be managed by the Chairperson of the Committee to facilitate functioning of the Committee, and pay $2,000 per annum to the fund for the duration of mining operations. The payment shall be indexed according to the Consumer Price Index (CPI) at the time of payment. The first payment shall be made by the date of the first Committee meeting.	YES	A trust fund for the functioning of the CCC was established in May 2000 and has been managed by the Independent Chairperson. Donaldson Coal provides all the requirements for the CCC Meetings with any additional funding reported to be provided upon request by the Chairperson.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
COMMUNITY INVOLVEMENT (Cont'd)			
Community Information			
111	The Applicant shall, in consultation with Councils, ensure that the local community is kept informed of the progress of the project, including prior notice of: (i) the nature of works proposed for the forthcoming period; (ii) hours of construction; (iii) a 24 hour contact telephone number; (iv) any traffic disruptions and controls; (v) proposed blasting program, and any changes to the program; (vi) work required outside the normal working hours; (vii) individuals' rights under the Conditions of this Consent (such as the rights for acquisition or independent monitoring) and mechanisms proposed to be used to safeguard the community and individual properties against adverse impacts from the development.	YES	Since June 2003, community information has been made available on the Donaldson website.
112	By 30 September 2011, the Applicant shall: (i) make copies of the following publicly available on its website: • all relevant statutory approvals for the development; • all approved strategies, plans and programs required under the conditions of this consent; • monitoring results, reported in accordance with the specifications in any approved plans or programs required under the conditions of this consent or any other approval; • a complaints register, which is to be updated on a monthly basis; • minutes of CCC meetings; • the Annual Environmental Management Reports required under condition 114; • any independent environmental audit of the development, and the Applicant's response to the recommendations in any audit; • any other matter required by the Director-General; and (ii) keep this information up-to-date, to the satisfaction of the Director-General.	YES	Donaldson website has been established and information on the CCC, monitoring and company status and activities is available on the site, including Minutes of the CCC Meetings, AEMR's / Annual Reviews and any project Newsletters.
Complaints			
113	(1) The Applicant shall record details of all complaints received and ensure that a response is provided to the complainant within 24 hours. (2) If the Applicant's response does not address the complaint to the satisfaction of the complainant within six weeks, the Applicant shall refer the matter to an independent mediator (approved by the Director-General) and bear the costs of such mediation. The Applicant shall immediately carry out such works as agreed through the mediation process. (3) The Applicant shall make available a 3 monthly report on complaints to the Community Consultative Committee and to relevant government agencies and the Councils upon request; and include a summary in the AEMR. The report shall include the complaints that have been resolved with or without mediation.	YES	(1) The Complaints Register is on a database held at the Donaldson Mine office and maintained by the Environment Manager. (2) This requirement of the condition had not been activated at the time of the audit. (3) A Complaints Report was prepared and presented to the CCC at each meeting. A summary of complaints/actions/status is presented in the AEMR's / Annual Reviews.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
ANNUAL ENVIRONMENTAL MANAGEMENT REPORT			
114	The Applicant shall prepare and submit an Annual Environmental Management Report (AEMR) throughout the life of the mine to the satisfaction of the Director-General. The AEMR shall review the performance of the mine against the *Environmental Management Strategy* and the Conditions of this Consent, and other licences and approvals relating to the mine. To enable ready comparison with the EIS's predictions, diagrams and tables, the report shall include, but not be limited to, the following matters:	YES	The AEMR's / Annual Review have been prepared in accordance with the relevant guidelines and submitted to the DPE and Resources Regulator.
	(i) an annual compliance audit of the performance of the project against Conditions of this Consent and statutory approvals; (ii) a review of the effectiveness of the environmental management of the mine in terms of OEH, NOW, DRE, and the Councils' requirements and provide an explanation of any variance; (iii) results of all environmental monitoring required under this Consent or other approvals, including interpretations and discussion by a suitably qualified person; (iv) identification of trends in monitoring results over the life of the mine; (v) a comparison of the actual impacts with predictions made in the EIS and supporting documents; (vi) a review of the social impact of the mine, including mitigation works and acquisition; (vii) a listing of any variations obtained to approvals applicable to the subject area during the previous year; (viii) the outcome of the water budget for the year, the quantity of water used from water storages and details of discharge of any water from the site; (ix) rehabilitation report; and (x) environmental management targets and strategies for the next year, taking into account identified trends in monitoring results.	YES	(i) Compliance Audit conducted by Donaldson Mine in August 2001. Compliance with the conditions of consent is commented on in each AEMR / Annual Review. (ii) Commented on throughout the Annual Review. (iii) Environmental monitoring data included in the Annual Review in the relevant sections. (iv) Trends in monitoring data are presented under each specific heading in Sections 6 & 7 of the Annual Review. (v) Comparison with the EIS predictions for the development are provided in each AEMR / Annual Review taking account of the approved MOP. (vi) No acquisition requests have been made to the time of this audit. Mitigation measures are part of the normal mine operation. (vii) Approval status is summarised in Section 3 of the Annual Review viii) Water management is reported in Section 7 of the Annual Review. (ix) Rehabilitation progress is reported in Section 8 of the Annual Review. (x) Targets and strategies for the next 12 months are reported in Section 12 of the Annual Review.
115	In preparing the AEMR, the Applicant shall: (i) consult with the Director-General during preparation of each report for any additional requirements; (ii) comply with any requirements of the Director-General or other relevant government agency and with any guidelines current at the time of reporting; and (iii) ensure that the first report is completed and submitted within 12 months of this Consent, or at a date determined by the Director-General in consultation with the DRE and the OEH.	YES	Actions / requirements raised by DPE and Resources Regulator from previous Annual Review have been summarised and addressed within this Annual Review (Section 5).

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
ANNUAL ENVIRONMENTAL MANAGEMENT REPORT (Cont'd)			
116	The Applicant shall ensure that copies of each AEMR are submitted at the same time to DP&I, OEH, NOW, Councils and the Community Consultative Committee, and made available for public information at Councils within 14 days of submission to these authorities.	YES	Copies of the previous AEMR's / Annual Reviews prepared for the Donaldson Mine have been submitted to the authorities following receipt of acceptance of the document by the (then) DII (or DPI-MR) and the Director-General. The AEMR's / Annual Reviews are made publicly available on the Company website.
INDEPENDENT ENVIRONMENTAL AUDIT			
117	At 3 yearly intervals after the commencement of mining and at the completion of mining, unless the Director-General directs otherwise, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the development.	YES	An Independent Environmental Audit was conducted in March 2015 by Trevor Brown & Associates to fulfil the requirements of MCoA 117. The (then) DPE confirmed via email on 31 October 2018 that no further audits are required unless otherwise directed by the Secretary.
	This audit must: (i) be conducted by a suitably qualified, experienced and independent person whose appointment has been endorsed by the Director-General; (ii) be consistent *with ISO 19011:2002 – Guideline for Quality and/or Environmental Systems Auditing*, or equivalent updated versions of these guidelines; (iii) assess the environmental performance of the development, and its effects on the surrounding environment; (iv) assess whether the development is complying with the relevant standards, performance measures and statutory requirements; (v) review the adequacy of the Applicant's *Environmental Management Strategy* and *Environmental Monitoring Program*; (vi) and if necessary, recommend measures or actions to improve the environmental performance of the development, and/or the environmental management and monitoring systems.	YES	The March 2015 audit was conducted by Trevor Brown of Trevor Brown & Associates Applied Environmental Management Consultants. The conduct of the 2015 audit was consistent with the requirements of ISO 19011. The environmental performance of the development was reviewed and comments are provided in Section 4 of the audit report. The development demonstrated a high degree of compliance with the standards, performance measures and statutory requirements relevant to the development (v) Comment on the *Environmental Management Strategy* and *Environmental Monitoring Program* are provided in Sections 4.1 and 4.2 of the audit report
118	The audit shall: (i) assess compliance with the requirements of this Consent, licences and approvals; (ii) review the effectiveness of the environmental management of the mine, and any mitigation works; (iii) be carried out at the Applicant's expense; and (iv) be conducted by a duly qualified independent person or team approved by the Director-General in consultation with the Councils.	YES	An Independent Environmental Audit was conducted in March 2015 by Trevor Brown & Associates to fulfil the requirements of MCoA 117 and 118.
119	The Director-General may, after assessing compliance in accordance with this Consent and after considering any submission made by the OEH,NOW, DRE, the Councils or the Community Consultative Committee on the report, notify the Applicant of any reasonable requirements for compliance with this Consent. The Applicant shall comply with those requirements within such time as the Director-General may require.	Noted	

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
COMPLIANCE			
120	The Applicant shall comply with all requirements of the Director-General in respect of the implementation of any measures arising from the Conditions of this Consent. The Applicant shall bring to the attention of the Director-General any matter that may require further investigation and the issuing of instructions from the Director-General. The Applicant shall ensure that these instructions are implemented to the satisfaction of the Director-General within such time that the Director-General may specify. If necessary, the Director-General may order the Applicant to cease work until non-compliance has been addressed to her satisfaction.	Noted	
121	The Applicant shall submit for the approval of the Director-General compliance reports concerning the implementation of Conditions of this Consent as applicable: (i) before the commencement of construction works; and (ii) before the commencement of mining.	YES	Compliance Reports were prepared and submitted to DUAP for construction of the Donaldson Mine on 20 October 2000, and a Compliance Report was submitted to DUAP prior to commencement of mining works on 17 January 2001.
Y2K COMPLIANCE			
122	One month prior to the commencement of operation of any automated system, included embedded systems used for operation, pollution control, monitoring and safety (including fire safety), the Applicant shall provide the Director-General with a report confirming that the system(s) has been tested in accordance with the most recent edition of BSI/DISC PD2000-1 to confirm continuous time and date functionality of that system.	YES	The Donaldson Mine commenced after 1 January 2000. Systems installed and operated for the Donaldson Mine are Y2K compliant.
DISPUTE RESOLUTION			
123	In the event that the Applicant and an individual, the Councils or a Government agency, other than DP&I, cannot agree on the specification or requirements applicable under this Consent, the matter shall be referred by either party to the Director-General or if not resolved within six months, to the Minister for Planning and Infrastructure, whose determination of the disagreement shall be final and binding on the parties.	Noted	The development consent was accepted by the parties and construction and commencement of mining occurred after 1 January 2000.

Table A3.1 (Cont'd)
Donaldson Development Approval – Compliance Review

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
OTHER ISSUES			
124	The Applicant shall participate in (including a financial contribution if appropriate, to a maximum of $10,000) the preparation of a revised Planning Strategy for the Thornton-Beresfield area. Any such financial contribution shall be paid as directed by the Director-General and any amounts not expended in the review upon completion of mining shall be refunded to the Applicant.	Not activated	The Thornton-Beresford Area has been incorporated into the Lower Hunter Area and a Planning Strategy as an employment generating area with a transport internodal hub proposed for the area. Donaldson has participated in meetings associated with the Thornton-Killingworth study, *Lower Hunter Regional Strategy* and *Lower Hunter Conservation Plan*. Donaldson also made some financial contributions including analysis and participation in the planning of a Newcastle rail by-pass line through the Stony Pinch site. The *Lower Hunter Regional Strategy and Conservation Plan* is not yet finalised, but Donaldson Coal continues to be involved in discussions with the authorities on the Strategy and Plan.
125	The Applicant shall provide reasonable funding to Councils for independent counselling services for any landowner within 1.5 kilometres of the mining lease area who may request support on stress-related matters resulting from the development.	Not Activated	No requests have been made for the activation of this condition.
126	Within six months of the date of this Consent and in each AEMR thereafter, the Applicant shall report to the Director-General on the number of personnel employed by the mine in construction, mining and environmental management during that reporting period. The report shall compare the employment figures with those predicted in the EIS.	YES	As the mine is now on care and maintenance there are a total of eight full-time equivalent positions on site.

Table A3.2
Mining Lease 1461 – Compliance Review

Cond. No.	Requirement	Compliance	Comments/Notes
GENERAL CONDITIONS			
1	Notice to Landholders (a) Within 90 days from the date of grant or renewal of this mining lease, the lease holder must give each landholder notice in writing: (i) that this mining lease has been granted or renewed; and (ii) whether the lease includes the surface. The notice must include a plan identifying the lease area and each landholder and individual land parcel within the lease area. (b) If there are ten or more landholders to which notice must be given, the lease holder will be taken to have complied with condition 1(a) if a notice complying with condition 1(a) is published in a newspaper circulating in the region where the lease area is situated	Not Yet Applicable	The 2019 renewal application has not yet been processed.
2	Security The lease holder is required to provide and maintain a security deposit to secure funding for the fulfilment of obligations under the mining lease, including obligations under the mining lease that may arise in the future. The amount of the security deposit to be provided has been assessed at $3,576,000.	Yes	The required security deposit has been established. A revised RCE was submitted as part of Rehabilitation Management Plan in July 2022. Awaiting DRNSW response.
3	Cooperation Agreement The lease holder must make every reasonable attempt, and be able to demonstrate its attempts to the satisfaction of the Secretary, to enter into a cooperation agreement with the holder(s) of any overlapping authorisations issued under the Mining Act 1992 and petroleum titles issued under the Petroleum (Onshore) Act 1991. The cooperation agreement should address but not be limited to: • access arrangements • operational interaction procedures • dispute resolution • information exchange • well location • timing of drilling • potential resource extraction conflicts; and • rehabilitation issues.	Not Applicable	There are currently no overlapping authorisations with other Companies.
4	Assessable Prospecting Operations (a) The lease holder must not carry out any assessable prospecting operation on land over which this lease has been granted unless: (i) it is carried out in accordance with any necessary development consent; or (ii) if development consent is not required, the prior written approval of the Minister has been obtained. (b) The Minister may require the lease holder to provide such information as required to assist the Minister to consider an application for approval. (c) An approval granted by the Minister under this condition may be granted subject to terms. (d) The lease holder must comply with the approval granted to the holder under this condition.	Yes	No assessable prospecting operations occurred during the reporting period.

Table A3.2 (Cont'd)
Mining Lease 1461 – Compliance Review

Cond. No.	Requirement	Compliance	Comments/Notes
SPECIAL CONDITIONS			
5	Aboriginal Place or Relic The lease holder shall not knowingly destroy, deface or damage any aboriginal place or relic within the subject area except in accordance with an authority issued under the National Parks and Wildlife Act, 1974, and shall take every precaution in drilling, excavating or disturbing the land against any such destruction, defacement or damage.	Yes	No Aboriginal places or relics were disturbed during the reporting period.
6	Dams Safety – Mining Leases (a) The lease holder must not mine within any part of the lease area which is within the notification area of the Stoney Pinch Reservoir Dam without the prior written approval of the Minister and subject to any conditions the Minister may stipulate. (b) Where the lease holder desires to mine within the notification area, the lease holder must: (i) at least twelve (12) months before mining is to commence or such lesser time as the Minister may permit, notify the Minister of the desire to do so. A plan of the mining system to be implemented must accompany the notice; and (ii) provide such information as the Minister may direct. (c) The Minister must not, except in the circumstances set out in sub-paragraph (ii), grant approval unless sub-paragraph (i) of this paragraph has been complied with. (i) This sub-paragraph is complied with if: (a) Dams Safety NSW as constituted by section 6 of the Dams Safety Act 2015 and the owner of the dam have been notified in writing of the desire to mine referred to in paragraph (b). (b) the notifications referred to in clause (a) are accompanied by a description or plan of the area to be mined. (c) the Secretary has complied with any reasonable request made by Dams Safety NSW or the owner of the dam for further information in connection with the mining proposal. (d) Dams Safety NSW has made its recommendations concerning the mining proposal or has informed the Minister in writing that it does not propose to make any such recommendations; and (e) where Dams Safety NSW has made recommendations the approval is in terms that are: - in accordance with those recommendations; or - where the Minister does not accept those recommendations or any of them - in accordance with a determination under sub-paragraph (ii) of this paragraph.	Yes	No mining activities occurred during the reporting period.

Table A3.2 (Cont'd)
Mining Lease 1461 – Compliance Review

Cond. No.	Requirement	Compliance	Comments/Notes
SPECIAL CONDITIONS			
6 cont'd	(ii) Where the Minister does not accept the recommendations of Dams Safety NSW or where Dams Safety NSW has failed to make any recommendations and has not informed the Minister in writing that it does not propose to make any recommendations, the approval shall be in terms that are, in relation to matters dealing with the safety of the dam: - as determined by agreement between the Minister and the Minister administering the Dams Safety Act 2015; or - in the event of failure to reach such agreement - as determined by the Premier. (d) The Minister, on notice from Dams Safety NSW, may at any time or times: (i) cancel any approval given where a notice pursuant to section 19 of the Dams Safety Act 2015 is given. (ii) suspend for a period of time, alter, omit from or add to any approval given or conditions imposed.		
EXPLORATION REPORTING			
Note:	Exploration Reports (Geological and Geophysical) The lease holder must lodge reports in accordance with the requirements in section 163C of the Mining Act 1992 and clauses 59, 60 and 61 of the Mining Regulation 2016 as well as any further requirements issued by the Secretary under clause 62 of the Mining Regulation. Guidelines for the structure, content and data format requirements for reports are set out in the Exploration Reporting: A guide for reporting on exploration and prospecting in New South Wales.	Yes	The 2022 exploration report was lodged 16/06/22 (as part of an approved group report) .

Appendix 4

2021 Annual Flora and Fauna Monitoring

prepared by

Kleinfelder Australia Pty Ltd

(Total No. of pages including blank pages = 112)

2021 Annual Flora and Fauna Monitoring

Donaldson Open-Cut Coal Mine, Beresfield, NSW

20222040

27 March 2022

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2021 Annual Flora and Fauna Monitoring

Donaldson Open-Cut Coal Mine, Beresfield, NSW

Kleinfelder Project: 20222040

Kleinfelder Document: NCA22R135642

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James Baldry	Emily Fittell	David Martin

EXECUTIVE SUMMARY

Findings of the 2021 annual quadrat monitoring survey are presented in this document in accordance with Section 5.1 Monitoring Program of the Donaldson Coal Flora and Fauna Management Plan. Data collected biannually since 2001 have been analysed in order to investigate trends in the flora and fauna species composition over time. The 2021 flora survey results show that floristic diversity and cover of ground cover species has increased since 2020 across most quadrats. This is likely indicative of recovery following the end of drought conditions including below average rainfall and higher mean maximum temperature recorded in 2019.

An overall increase in plant species richness and structural components has been recorded since the baseline survey in 2001. This trend is indicative of a dynamic plant community with high recruitment from the seed pool, normally an indicator of a healthy, regenerating native plant community. While the species composition recorded in each quadrat has changed slightly over the entire survey period, the number of species identified within each quadrat has remained relatively consistent over time.

All biomass variables examined (i.e. basal area, height, foliage projective cover (FPC) and stand volume), have shown consistent increases since the baseline survey. The regression analyses confirmed that the relationship between time and increases to stand volume were highly significant indicating that the community biomass has increased substantially across time with no significant year-to-year variation. The regression analyses of FPC show a slight downward trend although the cover has significantly increased since the baseline surveys. This now includes Quadrat 6 which was impacted by Myrtle rust (*Puccinia psidii*) in previous years but has now recovered to a higher FPC than the baseline.

The 2021 survey detected a total of 77 fauna species consisting of 49 bird, three (3) arboreal and five (5) terrestrial mammal, 15 bat, three (3) amphibian and two (2) reptile species. Seven (7) bat species and two (2) bird species detected are listed as vulnerable under the New South Wales *Biodiversity Conservation Act 2016*. The 2021 fauna assemblage exhibits a lower species richness than the average of all monitoring events. Additionally, the assemblage was determined to be significantly different to those of previous years. This may be attributed to seasonal variability as the surveys occurred over a longer period in 2021, extending into early April 2022.

Nest box surveys in 2021 (Winter and Summer average) saw 37% nest box usage (Winter) and 29% usage (Summer) with many boxes showing signs of use (both actual animals present and evidence of usage). Nest box utilisation remained constant in Winter compared to previous years. The drop in utilisation in the Summer surveys is likely directly attributed to the replacement of several damaged boxes, that are yet to be colonised. Utilisation peaked in 2012 and gradually declined until it stabilised in 2018. This reduction may be attributed to the replacement of nest boxes over time as they deteriorated. Newly installed nest boxes often experience low utilisation immediately, and for sometimes years, following installation. It is expected that the usage rate will increase in coming years as fauna become acclimatised to the new boxes.

Overall results conclude that there has been minimal impact to floristic and fauna diversity within the Donaldson Bushland Conservation Area over the last 20 years. Fluctuations in biodiversity across all quadrats have been observed which are consistent with natural ecosystem functioning, weather patterns and the changing nature of the adjoining habitat, resulting from past mining activities and neighbouring development.

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1 INTRODUCTION

Yancoal Australia Ltd operated the Donaldson Coal Open Cut Mine (Donaldson Coal) from 2001 until 2013, when operations ceased due to the exhaustion of resources. Donaldson Coal is located on a mining lease near Beresfield in the Lower Hunter Valley, New South Wales (NSW) (**Figure 1**). As part of the Conditions of Consent, a Flora and Fauna Management Plan (F&FMP) was prepared prior to the commencement of operations (Gunninah 2000) with subsequent revisions made by ecobiological in 2007.

The F&FMP prescribes the approach and the frequency of monitoring of the remnant bushland surrounding the mine disturbance area, referred to hereafter as the Bushland Conservation Area (BCA). Regular monitoring activities are conducted at nine permanently established 20 x 20 metre (m) quadrats positioned across the mining lease (**Figure 1**). A Baseline Report (Barker Harle 2001) was prepared at the commencement of mining activities and each year since, to monitor the impact of mining activities on flora and fauna at the mine.

This report provides a comparison of flora and fauna species richness and composition, as well as several specific vegetation parameters over time to determine potential impacts of mining activities at Donaldson Coal on flora and fauna in the BCA. Statistical analyses were conducted to detect significant patterns in any data set that was deemed comprehensive enough to pick up significant trends or changes overtime. Due to the adaptive nature of the monitoring program, including changes to methodologies and to the intensity of survey effort over time, not all data sets were considered to be comprehensive, only relevant data was analysed and discussed.

1.1 COMPLIANCE WITH THE F&FMP

The nine permanent quadrats were established in accordance with Section 5.1 Monitoring Program in the F&FMP. One of the permanent quadrats was to be established downstream of the mine in Woodbury Swamp, however this location was not situated within Donaldson Coal's mining lease. In consultation with the Donaldson Environmental Officer (EO) it was decided not to establish this quadrat. In 2003 Quadrat 9 was established in an area of bushland of similar type to that originally found over the pit area.

The monitoring program was conditioned to include a quarterly assessment of:

- Condition and type of vegetation and fauna habitat;
- Flora and fauna species list and the Braun-Blanquet cover scale of each plant species within a quadrat; and
- Proximity of the quadrat to the mine site and other areas having the potential to affect the quality of the vegetation.

The Baseline Report (Barker Harle 2001), prepared to fulfil part of the requirements of Section 5.0 of the F&FMP, provides a detailed discussion of the program requirements. During initial discussions with the Donaldson EO it was decided that the program requirements could be met by a very detailed annual assessment and a quarterly general inspection of each quadrat for any significant change. In 2004, Winter fauna monitoring methods were changed from trapping to artificial nestbox inspection. The change was implemented as a result of poor trapping results and the high risk of mortality to captured animals from cold exposure.

Reporting requirements outlined in Section 6.1 of the F&FMP include the following:

- Pre-clearing Verification Reports and Clearing Verification Reports prepared for bushland to be cleared as mining and associated activities require.

Both the Pre-clearing Verification Reports and the Clearing Verification reports were prepared.

- Monitoring reports which are provided biannually and summarise all monitoring activities carried out in the preceding six months and brief monitoring reports to be provided following each monitoring event.

In order to meet Condition 13(1) of the Conditions of Consent a six-monthly environmental monitoring report should be provided to the stakeholders. A six-monthly fauna report was provided.

1.2 AIMS AND OBJECTIVES

The aim of the monitoring program is to assess the diversity and abundance of flora and fauna species at a temporal and spatial scale across the BCA.

The long-term objectives of the program include:

- Monitor flora and fauna present on the BCA on an annual basis through targeted surveys;
- Document and report annually on the flora and fauna present on the BCA;
- Document and report changes in species diversity and floristic composition of flora on the site;
- Document and report changes in stand volume and biomass parameters;
- Provide recommendations that will assist in the management of flora and fauna species;
- Make recommendations that will contribute to minimising mine disturbance on the remnant vegetation around the mine site; and
- Determine the temporal impacts of mining operations on the ecological attributes of the BCA.

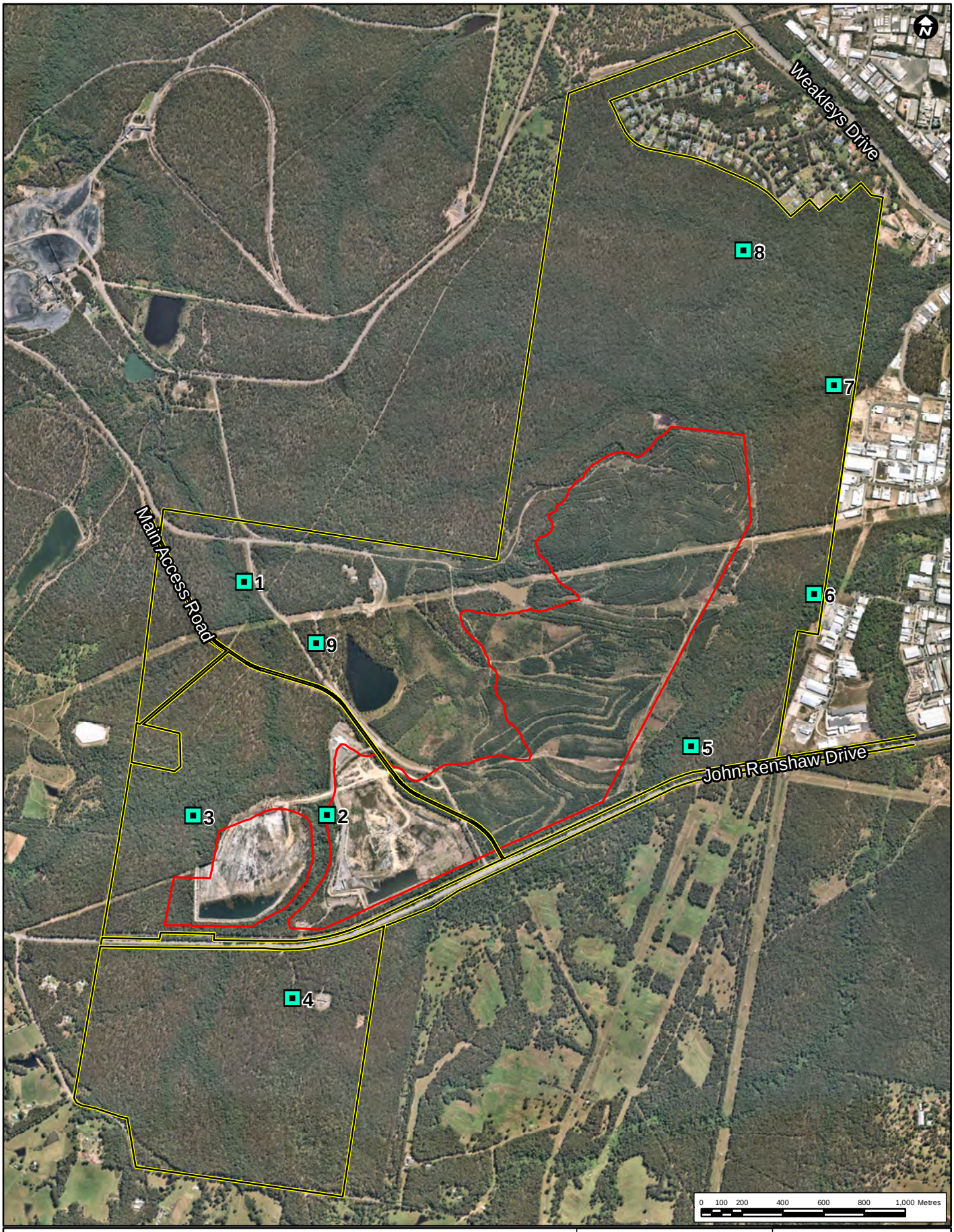

Figure 1: Extent of Donaldson Open Cut Mine and the Location of Nine Permanent Monitoring Quadrats

- Donaldson Coal Mine Disturbance (Pit) Area
- Subject Site
- Quadrat Locations

KLEINFELDER

Project Ref:	20222040
Plot Date:	2022/03/31 09:50
Revision:	001 (GJoyce)

Map Projection:
GDA 1994 MGA Zone 56

Data Sources:
Nearmap - 2022
Kleinfelder Ecobiological - 2013

Disclaimer:This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

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2 METHODOLOGY

Field surveys are conducted annually from late Spring to early Summer (October – December). Field survey methods are summarised below. More detailed information regarding survey methodologies are available in the Baseline Report (Barker Harle 2001). Nest boxes are inspected twice a year, once in Winter and again in late Spring/Summer.

2.1 FLORA SURVEY

Eight (8) permanent 20 m x 20 m (0.04 ha) monitoring quadrats (Quadrats 1-8) were established in 2001 across the Donaldson Coal property (**Figure 1**). An additional quadrat (Quadrat 9) was established in 2003. These quadrats are permanently marked with star pickets to allow precise replication of the measurement of floristic structure, content and biomass on an annual basis.

2.1.1 Vegetation Communities

The vegetation communities present within the BCA, as confirmed by ecobiological (2004), are presented in **Figure 2**. Each quadrat was classified according to its vegetation type (i.e. dominant association). Brief descriptions on the condition and structure of each vegetation community are provided in **Section 3.2.**

2.1.2 Floristic Identification and Nomenclature

Floristic identification and nomenclature was based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNET (http://plantnet.rbgsyd.nsw.gov.au). If a plant was unable to be identified using these references, a sample was sent to the National Herbarium, Royal Botanic Gardens, Sydney, NSW.

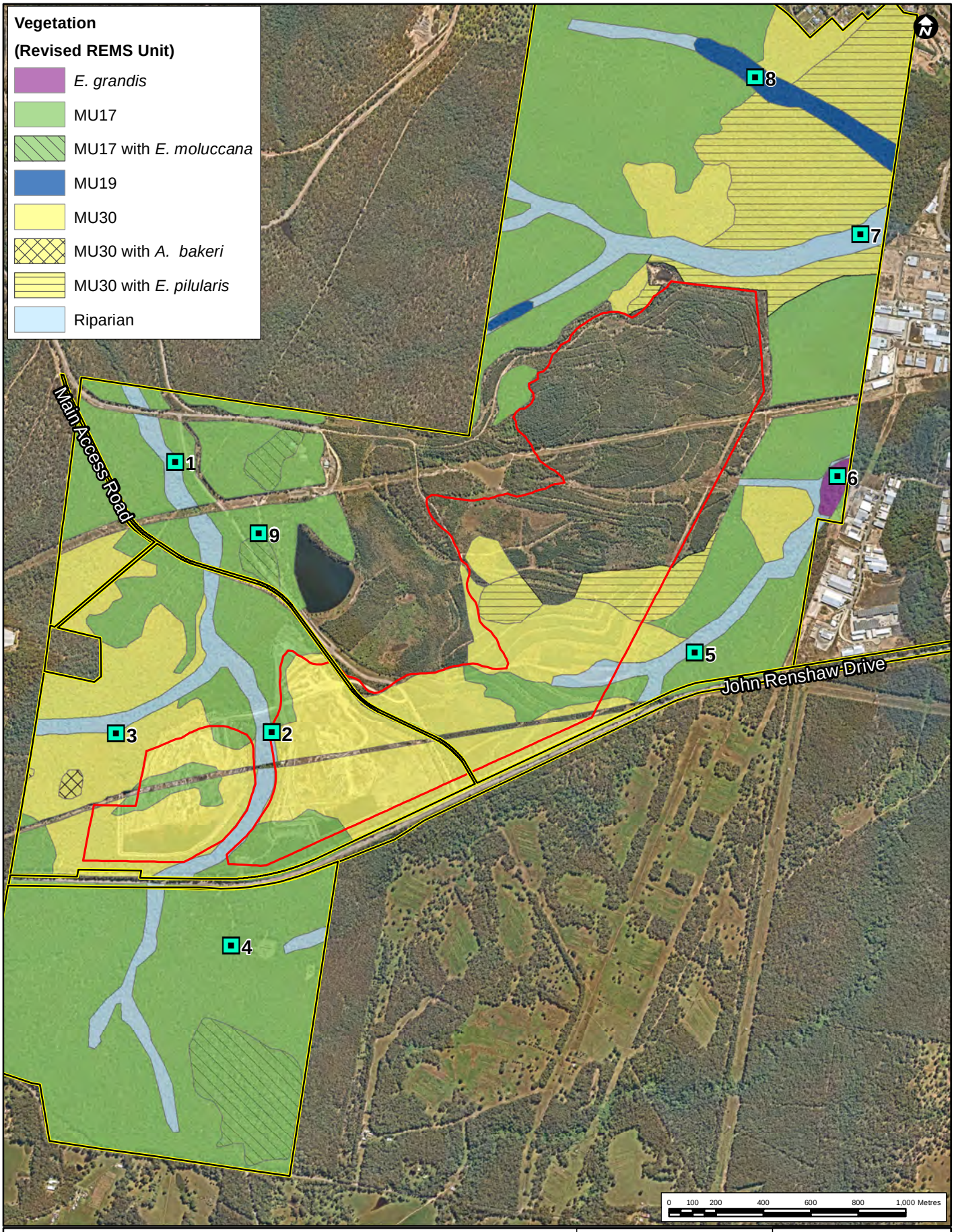

Figure 2: Vegetation Communities Surrounding Donaldson Coal Open Cut Mine

- Donaldson Coal Mine Disturbance (Pit) Area
- Subject Site
- Quadrat Locations

KLEINFELDER

Project Ref:	20222040
Plot Date:	2022/03/31 09:57
Revision:	001 (GJoyce)

Map Projection:
GDA 1994 MGA Zone 56

Data Sources:
Nearmap - 2022
Kleinfelder Ecobiological - 2014

Disclaimer:This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

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2.1.3 Biomass

2.1.3.1 Foliage Projective Cover

Foliage Projective Cover (FPC) is described as the horizontal spread of the foliage of all the vegetation covering any area and is a measure of the total photosynthetic respiratory surface over that area (Specht 1983; Specht & Specht 1999). A system for classifying structure of vegetation communities is detailed in Specht & Specht (1999). This method allows for precise and repeatable comparison of plant communities. An example of this classification technique can be found in Le Brocque & Buckney (1997).

FPC was measured in each quadrat. Methods used were adapted from Specht (1981) and Specht (1983). FPC was recorded for canopy species and for groups of species making up the shrub and ground cover. The spread of foliage was measured on a 1 x 1 m grid, set out with measuring tapes and recorded on grid paper. Vegetation layers included ground cover, shrubs (≤ 2 m), overstorey and emergent trees. **Plate 1** shows an example (Quadrat 5) of the grid layout with measuring tapes for each quadrat.

All vegetation covering the quadrat was recorded, including plants with overlapping foliage inside the quadrat and bases located outside. A vertical sighting device adapted from the cross-wire sighting device described by Winkworth and Goodall (1962) was used to determine the position of overhead foliage. The outline of each predominant species or group of species foliage was established by walking the foliage perimeter and at specific points recording the locations from the tape measures onto grid paper. These points were then joined to give polygons representing FPC.

2.1.3.2 Basal Area

The location of individual shrub and tree stems was recorded on grid paper to allow temporal comparisons. Trees taller than two metres had their girth measured at 1.4 m above the ground. The girth was used to assess the Diameter at Breast Height (DBH). Trees over two metres also had their height measured with a Haglöf digital hypsometer.

Basal area was determined for all trees over two metres tall. The total basal area and total basal area of each species in the quadrats was determined. The basal area was calculated using the below equation:

- Basal area $m^2 = a^2 \div 4\pi$, where girth (a) in metres is measured at 1.4 m high.

2.1.3.3 Total Stand Volume

Total stand volume was calculated from basal areas and tree heights. The below equation was used:

- Total stand volume $m^3/ha = (b \div 0.04\ ha) \times (c \div 3)$, where (b) is basal area in m^2 and (c) is tree height in m.

Research has shown that there is a relationship between the growth of one part of an organism and another part that is known as allometric (where a part is a constant exponential function of the whole). The relationship between the basal area of a tree and the height can be used to monitor the development of the trees within the quadrats over time.

Plate 1: Example of grid layout for collection of biomass measurements (Quadrat 5)

2.2 FAUNA SURVEY

Field surveys were conducted in accordance with the revised F&FMP (ecobiological 2007). Early surveys followed a methodology designed around the observation of fauna species within the 20 x 20 m quadrats. This method proved inadequate to accurately assess fauna species richness. The revised field survey methodologies are summarised below.

2.2.1 Terrestrial and Arboreal Mammal Trapping

Terrestrial and arboreal mammal trapping was undertaken at Quadrats 1, 2, 3, 4 and 9 on 8 –11 February 2022 and at Quadrats 5, 6, 7 and 8 on 1 – 4 February 2022. Trapping was conducted within a 300 m radius of each quadrat. Trapping effort spanned four nights. Terrestrial trapping involved employment of 20 Elliott A, three Elliott B and three cage traps set on the ground. Arboreal trapping involved employment of five Elliott B traps set approximately 2 m above the ground, mounted on the trunks of trees. all traps were checked each morning.

2.2.2 Microbat Trapping

Since 2004, one harp trap per quadrat has been used for four nights total trapping effort. These are used in addition to microbat call detection, as not all species can be identified by echolocation calls alone.

2.2.3 Microbat Call Detection

One Anabat™ Express bat detector (Titley Scientific, Lawnton, Qld) per quadrat was used to undertake passive monitoring of bats flying or foraging within each quadrat. Detectors were set up at dusk when bat activity is highest, and recording occurred for one hour on one night.

2.2.4 Owl Call Playback

Calls of four threatened owl species (Powerful Owl [*Ninox strenua*], Sooty Owl [*Tyto tenebricosa*], Masked Owl [*Tyto novaehollandiae*] and Barking Owl [*Ninox connivens*]) were broadcast by loudspeaker in the area of each quadrat after dusk. Each species' call was played for a 2 to 3 minute period followed by quiet listening for approximately 10 minutes.

2.2.5 Spotlighting

Spotlighting was undertaken from dusk for at least one-person hour (i.e. one observer for an hour or two observers for 30 minutes) in the area of each quadrat to detect the presence of nocturnal fauna species.

2.2.6 Bird Surveys

A 2 ha area centered on each quadrat was searched by one observer for 30 minutes and all birds detected were identified either visually with the aid of binoculars, or by call interpretation. Surveys were conducted in the early morning when bird activity is highest.

2.2.7 Nest Box Monitoring

Forty-five (45) nest boxes were originally installed in 2005. Nest boxes are inspected twice a year, once in Winter and again in late Spring/Summer. Evidence of usage is determined through either direct detection of animals at the time of the visit or indirect evidence such as recent chew marks, hair, or leaf nests.

2.3 Statistical Analysis

2.3.1 Flora

Data for FPC and stand volume (a derivative of basal area and tree height) for flora survey quadrats from 2001 to 2021 were analysed to determine whether the plant communities were increasing in biomass over time and undergoing succession towards a mature plant community structure (Specht & Specht 2002, pp 28-41). An increase in these parameters over time is taken as an indicator of plant community health and viability, in addition to other measures such as species diversity and richness. The analysis was undertaken using a linear regression model, with time as the explanatory variable. R2 values were also calculated to determine how well the fitted lines explained the data. The closer the R2 value is to 1, the higher confidence that the trend line fits the data.

Similarity indices were calculated for all pairs of quadrats in the baseline survey to determine the level of floristic similarity between the different plant communities surveyed across the quadrats. Similarity indices were also calculated for each quadrat between two different monitoring events (i.e. 2001 vs 2002), to determine changes in floristic composition at each quadrat over time. The index used was Sorensen's Similarity Index (Krebs, 1999, p. 377) computed as SI = 2a/ (2a + b + c) where a = the number of species present in both quadrats, b = the no. of species present in only one quadrat of a pair, and c = no. of species present in only the second quadrat of a pair. Quadrat pairs with a low index (minimum possible = 0; no species in common) share fewer species in common, and pairs with a higher index share more species in common (maximum possible = 1.00 where all species recorded in the pair of quadrats are present in both).

2.3.2 Fauna

Data on fauna species detected between 2001 and 2021 were analysed to determine changes in species richness and diversity over time. Non-metric Multidimensional Scaling (nMDS) and cluster analysis were undertaken to explore the relationship between fauna species assemblages detected in different sample years. The Primer-E software program was used with the Kulczynski Similarity Index for presence only data (Clarke and Gorley, 2006). This analysis produced scatterplots which depict, in 2-dimensional space, the similarity between species assemblages of different survey years. Associated dendrograms were also produced that graphically depict the relationship between sample years.

The strength of any clusters apparent in the scatterplot were tested by running a similarity profile routine (SIMPROF) over branches in the dendrogram. Solid black lines in the dendrogram indicate statistically significant differences between clusters at the 95% confidence level. Broken red lines link clusters that are not significantly different. The results of the SIMPROF analysis are shown in Appendix H.

Single factor Analysis of Variance (ANOVA) is used to determine if there was a significant difference between nest box usage in Summer and Winter with all years combined. Percentages were arcsine transformed before analysis. This analysis can only be carried out during years where the number of Nest Boxes is the same.

3 RESULTS

3.1 WEATHER

Monthly temperature and rainfall data from 2001-2021 are presented in **Table 1** and **Table 2**. Data was accessed from the Bureau of Meteorology weather station at Maitland Visitors Centre (BOM station ID 061388, 2016) up until July 2016, when this station closed. For the remainder of the monitoring period, data was collected from the Maitland Airport (BOM station ID 061428). Average monthly and annual figures are used to derive overall climatic trends.

Monthly average maximum temperatures for 2021 are lower than the average maximum temperatures for each month over the 20 years, excluding August and September. The annual rainfall recorded in 2021 was above the average of all the previous years combined (2001 – 2021). March recorded the highest monthly rainfall in 2021 (269 mm) and July recorded the lowest (13 mm).

Table 1: Monthly and annual average maximum temperatures for Maitland Visitors Centre (2001 – July 2016) and Maitland Airport (August 2016 onwards)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
2001	31.4	29.8	25.9	24.8	19.8	19.5	18.2	19.7	23.2	25.4	25.4	29.3	24.4
2002	30	27.1	27.2	24.8	20.6	18.6	18.8	20.6	24	28.3	29.6	28.9	24.9
2003	29.9	29.1	26.2	23.3	20.7	20	18.2	19.7	23.9	23.3	26.2	28.7	24.1
2004	31.5	31.5	26.8	25.5	21.9	19.7	18.5	20.4	23.3	24.8	27.4	28.2	25
2005	30.2	30	25.8	26	21.1	19	19	20.6	22	26.1	27.1	32.8	25
2006	31.6	31.4	28.2	25.7	21.3	18.1	18.2	20.3	23.7	26.2	28.5	28.2	25.1
2007	31.6	30.1	28.7	24.3	23.1	16.9	17.3	20.8	22.8	28.5	26.7	27.6	24.9
2008	28.5	26.1	27.1	22.7	21.4	19.1	17.8	18.3	23.2	25.4	25.4	29	23.7
2009	31.2	29.5	27.9	23.5	21.1	18.9	18.3	22.4	24.6	24.2	30	28.7	25
2010	31.4	30	28.1	25.8	21.4	18.3	17.7	18.5	22.6	23.8	26.2	28.5	24.4
2011	30.8	31.4	28.5	23.6	20.2	18.5	17.5	20.5	23.3	23.9	27.6	24.6	24.2
2012	28.2	27.1	26.4	23.9	21.3	18.1	17.6	20.3	24.4	25.8	27.7	29.2	24.2
2013	30.9	27.8	27.6	25.2	21.4	18.1	19.3	21.7	26.6	28.4	26.6	29.1	25.2
2014	30	28.1	27.9	25.1	22.8	19.1	18.5	19.1	22.8	27.8	29.8	-	24.6
2015	30	29	30	24	21	19	18	20	22	28	28	30	24.9
2016	29.3	30.7	30.3	26.9	24.1	18.8	17.2	19.4	21.8	24.7	29.6	31.6	25.4

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
2017	32.8	33.2	27.2	23.9	21.4	18	19.1	20.2	25.5	26.8	25.8	31.8	25.5
2018	33.3	31.4	28.5	26.5	21.7	17.4	19.6	20.0	22.3	24.1	27.3	31.3	25.3
2019	35.2	31.9	29.6	25.8	22.3	18.8	19.5	20.7	23.7	27.2	31.2	33.0	26.5
2020	32.7	29.3	26.0	25.0	20.0	18.6	17.8	18.8	23.0	25.6	29.4	27.4	24.4
2021	29.0	27.3	25.9	23.8	21.1	17.7	17.7	20.9	23.6	25.5	24.3	28.4	23.8
Mean	30.9	29.6	27.6	24.8	21.4	18.6	18.3	20.1	23.4	25.9	27.6	29.3	24.8

Source: Bureau of Meteorology. (-) indicates no temperature data available.

Table 2: Monthly and yearly rainfall (mm) totals and totals for Maitland Visitors Centre (2001 – July 2016) and Maitland Airport (August 2016 onwards)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average monthly	Annual total
2001	20	128	170	74	145	5	51	21	15	28	76	59	**66**	**792**
2002	26	247	103	61	44	29	25	13	25	10	51	106	**62**	**740**
2003	11	75	59	77	107	16	30	43	0	53	125	61	**55**	**657**
2004	90	166	74	38	20	10	28	31	49	172	71	89	**70**	**838**
2005	-	141	141	22	120	65	12	1	43	68	61	21	**63**	**695**
2006	28	55	106	31	12	58	65	50	157	6	-	45	**56**	**613**
2007	21	57	86	55	44	392	23	-	-	24	-	-	**88**	**702**
2008	-	170	35	213	4	121	38	19	178	83	97	70	**93**	**1028**
2009	8	234	50	164	70	62	23	2	26	66	33	58	**66**	**796**
2010	66	48	75	22	73	111	62	32	20	60	192	63	**69**	**824**
2011	37	38	48	140	92	160	87	57	76	105	142	157	**95**	**1139**
2012	84	174	102	79	12	125	45	14	22	7	46	45	**63**	**755**
2013	141	134	79	67	51	80	30	12	17	51	365	16	**87**	**1043**
2014	21	86	115	81	30	45	22	111	31	50	22	164	**65**	**778**
2015	155	41	35	358	80	42	15	38	57	44	102	135	**92**	**1102**
2016	405	35	26	26	7	114	7	-	71	48	44	95	**80**	**878**
2017	74	59	181	57	22	95	1	7	11	93	28	55	**57**	**683**
2018	10	103	182	35	6	78	1	15	49	108	78	43	**59**	**708**
2019	30	28	156	13	18	62	20	47	49	16	12	1	**38**	**452**
2020	38	204	118	28	44	55	107	24	34	87	32	156	**77**	**927**
2021	98	117	269	29	28	43	13	52	29	68	205	36	**82**	**986**
Mean	**72**	**111**	**105**	**80**	**49**	**84**	**34**	**31**	**48**	**59**	**94**	**74**	**71**	**816**

Source: Bureau of Meteorology. (–) Indicates no rainfall data available.

3.2 VEGETATION COMMUNITIES

Four vegetation communities have been mapped across the Donaldson Coal BCA (ecobiological 2004). Also present are some variants within each of these communities. Of note is the "riparian zone" as indicated in **Figure 2**. These areas should be regarded as being of a similar vegetation type to the surrounding vegetation, albeit with some floristic differences associated with minor gullies.

These vegetation communities are listed below:

- Tall Moist Forest with *E. grandis*;
- Riparian Moist Forest;
- Spotted Gum Communities;
- Spotted Gum with *E. moluccana*;
- Hunter Lowland Redgum Forest;
- Smooth-barked Apple Forest;
- Smooth-barked Apple Forest with *A. bakeri;*
- Smooth-barked Apple Forest with *E. pilularis.*

The Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) (NPWS 2000) mapping for the BCA maps large areas as the endangered Mapping Unit (MU) 17 – *Lower Hunter Spotted Gum Ironbark Forest*. Ground-truthing of the BCA by ecobiological (2004) confirmed the identity of this ecological community as most consistent with MU 16 – *Seaham Spotted Gum – Ironbark Forest*. The following account was given in the analysis by ecobiological (2004):

"The Spotted Gum data from Donaldson was compared with 126 other sites from the Central Coast and Hunter region using both cluster analysis (PATN) and non-metric Multi-Dimensional Scaling (nMDS). The analysis indicates that there are five probable Spotted Gum community types across the region, and that the Spotted Gum vegetation at Donaldson is more closely related to the Seaham Spotted Gum – Ironbark Forest than the Lower Hunter Spotted Gum – Ironbark Forest. From this analysis, it would appear that the Lower Hunter Spotted Gum – Ironbark Forest is restricted to the area immediately around Cessnock and that the Quorrobolong Valley vicinity marks the transition from Seaham Spotted Gum – Ironbark Forest to Coastal Foothills Spotted Gum – Ironbark Forest."

Some sites show distinct riparian characteristics which makes them very different from the surrounding vegetation (Quadrat 1 and Quadrat 2), referred to as "Riparian Moist Forest". The characteristics of this vegetation are summarised below (ecobiological 2004).

"A range of sites extending from Clarence Town to the Holgate Ranges near Gosford support a moist forest type which has been tentatively termed here Hunter Valley Moist Forest. However, NPWS (2000) do not map this community south of Quorrobolong Valley, but sites from Gosford and Wyong fall within this group. There may be some overlap with some of the other moist forest communities defined by NPWS (2000), but further clarification is beyond the scope of this report. Two riparian sites from within Donaldson Coal occur within this group."

Brief descriptions of the vegetation communities occurring at each quadrat and a summary of key vegetation parameters are provided in **Table 3**. Note that some vegetation layers have changed their cover considerably over the 20 years of monitoring and only 2021 data is provided in this table.

Table 3: Summary of vegetation communities occurring at Quadrats 1-9

Quadrat	Vegetation Community	Revised REMS Unit	Dominant Overstorey Species	Midstorey/Shrub Cover (%)	Ground cover (%)	Overall Condition
1	Riparian Moist Forest	-	*Backhousia myrtifolia* *Corymbia maculata* *Syncarpia glomulifera* *Angophora costata* *Eucalyptus umbra*	0%	5%	The vegetation at Quadrat 1 was identified as being in moderately good condition as a result of groundcover remaining low (5%). A total of 42 plant species were identified in 2021 which is one species less than that recorded in 2020. No weed species were identified or any other forms of land degradation (i.e. erosion). Some dieback was noted in select *Eucalyptus umbra* individuals.
2	Riparian Moist Forest	-	*Backhousia myrtifolia* *Corymbia maculata* *Eucalyptus acmenoides* *Glochidion ferdinandi* *Syncarpia glomulifera*	5%	70%	The vegetation at Quadrat 2 was identified as being in good condition in 2021, given the high percentage of ground cover species, consistent with 2020. This high percentage cover is likely due to an increase in rainfall. A total of 52 plant species were identified in 2021 which is a small decrease from the previous year (54 species). Species richness in 2021 still remains below that recorded between 2006 and 2018. The ground cover increased from 30% in 2019 to 70% in 2020. The shrub layer cover has remained the same as the 2020 survey. *Lantana camara* has occurred in low densities within the quadrat since the baseline surveys were conducted in 2001. The occurrence of this weed species has increased between the 2020 and 2021 monitoring events, likely due to favourable conditions e.g. high rainfall. Despite this, most the individuals are juvenile and occupy little space within the quadrat.
3	Smooth-barked Apple Forest	MU 30	*Angophora costata* *Eucalyptus fibrosa* *Eucalyptus umbra* *Melaleuca styphelioides* *Syncarpia glomulifera*	22%	25%	The vegetation at Quadrat 3 was identified as being in good condition. A total of 63 plant species were identified in 2021, an increase from the number recorded in 2020 (59 species). The ground layer cover has increased by 10% this year, when compared to 2020. The shrub layer canopy cover has declined substantially over the previous two years. A further reduction was recorded in 2021, however to a lesser degree (approximately 3%). *L. camara* continues to be present.

Quadrat	Vegetation Community	Revised REMS Unit	Dominant Overstorey Species	Midstorey/Shrub Cover (%)	Ground cover (%)	Overall Condition
4	Spotted Gum – Ironbark Forest	MU 17	*Corymbia maculata* *Eucalyptus acmenoides* *Eucalyptus fibrosa*	7%	80%	The vegetation at Quadrat 4 was identified as being in good condition. A total of 58 plant species were identified in 2021 an increase from the 54 species recorded in 2020. The ground layer cover increased to 80% in 2021 from a low of 35% in 2019. The shrub layer cover remained relatively stable at 7%. Three weed species were identified in low densities in 2021, *Vernonia cinerea var. cinerea*, *Hypochaeris radicata* (Catsear) and *Senecio madagascariensis* (Fireweed).
5	Spotted Gum – Ironbark Forest	MU 17	*Corymbia maculata* *Eucalyptus acmenoides* *Eucalyptus siderophloia* *Syncarpia glomulifera*	1%	80%	The vegetation at Quadrat 5 was identified as being in good condition. A total of 60 plant species were identified in 2021, which is an increase of four species compared to that recorded in 2020. The percentage ground cover has almost doubled between the 2020 and 2021 monitoring events, suggesting the vegetation is recovering from the dry conditions in 2019. The groundcover in 2021 is now comparable to that recorded in 2018 (75%). The shrub layer percentage cover remains stable in 2021 compared to 2020. A greater abundance of the exotic species, *Lantana camara* was present within the quadrat during the 2021 survey, likely in response to favourable conditions.

Quadrat	Vegetation Community	Revised REMS Unit	Dominant Overstorey Species	Midstorey/Shrub Cover (%)	Ground cover (%)	Overall Condition
6	Tall Moist Forest with *Eucalyptus grandis*	-	*Cryptocarya microneura* *Eucalyptus acmenoides* *Eucalyptus grandis* *Syncarpia glomulifera* *Melaleuca styphelioides* *Melicope micrococca*	2%	95%	The vegetation at Quadrat 6 was identified as being in moderately good condition. A total of 48 plant species were identified in 2021 which is an increase of four species compared from the 2020 monitoring event. The ground cover has recovered to the percentage of cover observed prior to the drought conditions of 2019 from 55% the previous year. The shrub cover result in 2021 (2%) is similar to that recorded in 2020. Three weed species were identified in the 2021 survey: *Tradescantia fluminensis, Solanum mauritianum* and *L. camara*. *T. fluminensis* remains the dominant ground cover species along with native grasses; *Oplismenus aemulus* and *Oplismenus imbecillis*. *L. camara* occurs along the edge of the quadrat along the creek line. Whilst targeted spraying of large stands of *L. camara* adjacent to Q6 was undertaken in the past, regrowth is now occurring in these areas and requires follow-up control for effective long-term management.
7	Smooth-barked Apple Forest with *Eucalyptus pilularis*	MU 30	*Angophora costata* *Eucalyptus pilularis,* *Glochidion ferdinandi* *Melaleuca linariifolia* *Eucalyptus acmenoides* *Allocasuarina torulosa*	29%	85%	The vegetation at Quadrat 7 was identified as being in good condition. A total of 48 plant species were identified in 2021, the same number as the previous monitoring event (2020). The ground cover increased from 80% (2020) to 85% (2021), likely indicating continued recovery from dry conditions experienced on site in 2019. The weed species *L. camara* has occurred within the site since 2001. An approximately 10% decrease in midstorey vegetation was observed in 2021, largely noted from a decline in the extent of *Notelaea venosa*. Targeted spraying of large stands of *L. camara* adjacent to Q7 was undertaken previously. The spraying has been effective within the quadrat although other large patches remain along the creek line.

Quadrat	Vegetation Community	Revised REMS Unit	Dominant Overstorey Species	Midstorey/Shrub Cover (%)	Ground cover (%)	Overall Condition
8	Hunter Lowland Redgum Forest	MU 19	*Corymbia maculata* *Eucalyptus punctata* *Eucalyptus siderophloia* *Eucalyptus tereticornis* *Melaleuca linariifolia* *Melaleuca styphelioides*	19%	85%	The vegetation at Quadrat 8 was identified as being in good condition. A total of 67 plant species were recorded in 2021 compared to 62 plant species identified in 2020, an increase of five species. The recorded ground cover increased from 80% in 2020 to 85% in 2021, maintaining the pre-drought returning to levels recorded in 2018. The shrub layer coverage slightly reduced this year compared to the 2019 survey, from 21% to 17%. One weed species, *L. camara* was recorded in 2020 and in previous survey. Targeted spraying of *L. camara* adjacent to Q8 was undertaken in previous years which appears to have been effective in controlling most of the large stands.
9	Spotted Gum – Ironbark Forest with *Eucalyptus moluccana*	MU 30	*Corymbia maculata* *Eucalyptus fibrosa* *Eucalyptus umbra* *Eucalyptus punctata* *Eucalyptus moluccana*	0%	95%	The vegetation at Quadrat 9 was identified as being in moderately good condition. A total of 70 plant species were identified in 2021, a similar number to that recorded in 2020 (71). The ground cover increased from 80% (2020) to 95% (2021), a greater cover than that recorded in 2018, prior to drought conditions. The shrub layer cover declined markedly from 4% (2020) to 0% (2021). This is largely attributed to the dieback of *Bursaria spinosa* within the quadrat. One weed species, *L. camara* was recorded in 2021, whilst this was a low cover (c.a. 1), this is the second year the weed species has been recorded within this site.

3.3 BIOMASS

3.3.1 Foliage Projective Cover

Each quadrat has shown an increase in FPC when compared to the baseline survey results. However, there has been a general decline in FPC since the highest levels were recorded in 2012/2013, with most quadrats recording a decrease in FPC between the years of 2015 to 2017 (

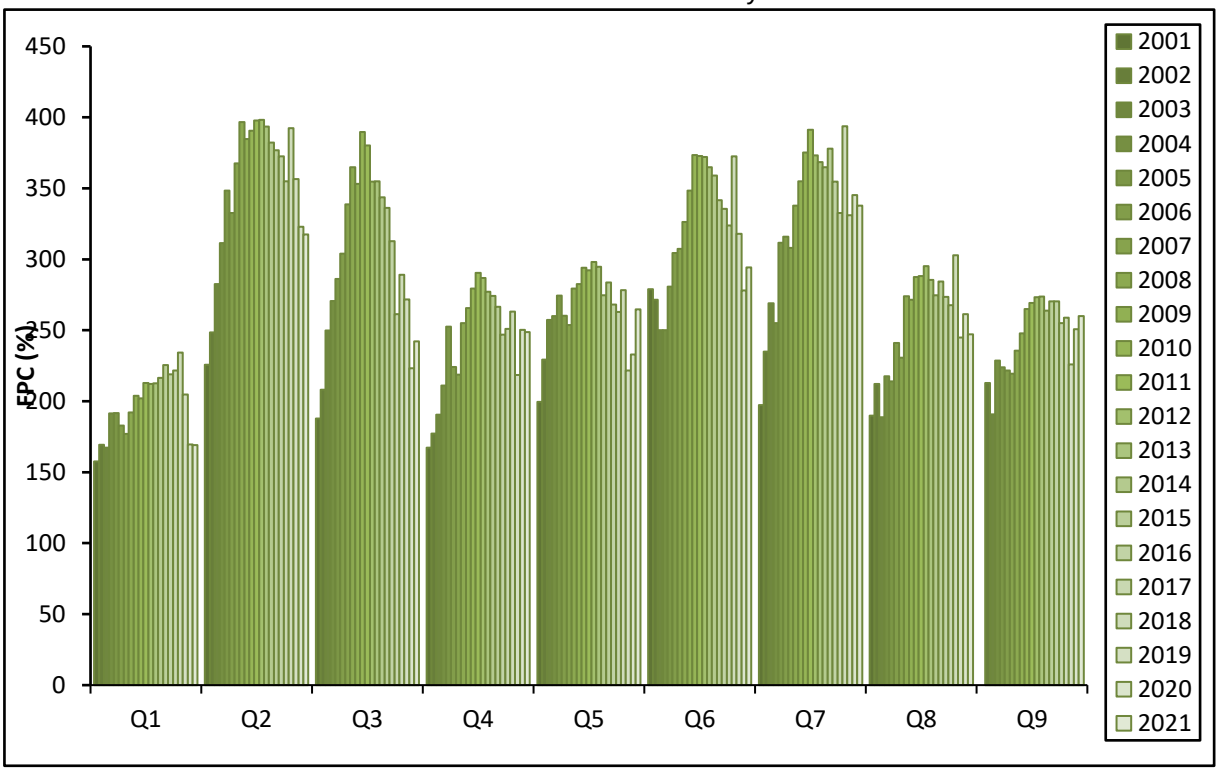


Figure 3**; Appendix A**). The 2021 FPC results are mixed, with five (5) quadrats recording a small decline (Quadrats 1, 2, 4, and 8) and others recording a small to substantial increase (Quadrats 3, 5, 6 and 9).

Fluctuations in FPC are likely to be a result of one or a combination of factors:

- Observer variation, where no noticeable canopy dieback or fallen limbs were observed;
- Dieback of canopy and shrub species;
- Wilting of midstorey species, decrease of ground cover and species diversity due to the impact of the drought, with recent increases indicating the early stages of recovery;
- The lack of fire or an inappropriate fire regime for the ecological community over time will decrease the density and diversity of species.

In 2014, *Rhodomyrtus psidioides* seedlings were recorded in Quadrat 6. Most of these seedlings were observed to be infected with a rust fungus (most likely Myrtle Rust). By 2016, the mature trees of this species had completely died, and only one small seedling was observed within the quadrat. No *R. psidioides* were recorded during the current survey (2021) in Quadrat 6 or in any of the additional quadrats. No evidence of Myrtle Rust was observed.

3.3.2 Basal Area

Basal area in 2021 has generally increased since baseline surveys (2001 for Quadrats 1-8; 2009 for Quadrat 9), with basal area increasing across most quadrats again in 2021 (with the exception of Quadrat 1 and Quadrat 3) (**Figure 4, Appendix B**).

A notable decrease in basal area was observed in Quadrat 1 following the death of a mature *Angophora costata* tree. A number of small trees, previously not recorded within quadrats, were added to the monitoring programme, effectively reducing the average tree girth in their respective sites.

A noticeable reduction in tree height between 2003 and 2004 may be attributable to the change in methodology associated with the use of the Hypsometer.

3.3.3 Total Stand Volume

Total stand volume (derived from height and basal area measurements) has increased by an average of 125.3 m^3/ha across the quadrats since the initial monitoring event in 2001 (2003 for Quadrat 9) (**Figure 6**). Most quadrats recorded an increase in total stand volume in 2019 compared to 2018. Quadrats 1, 3, 4, and 5 recorded small decreases in total stand volume between 2019 and 2020. In 2021, all the Quadrats recorded an increase in total stand volume, excluding Quadrat 1. The minor changes in total stand volume recorded in 2021 do not represent a significant change in forest condition, instead it is likely the result of changes in basal areas (as discussed in **Section 3.3.2**), along with the influence adding additional small trees to quadrats has on average height data.

The total stand volume has been presented in this report instead of the average stand volume which was used prior to 2012. The use of total stand volume allows for the recruitment and addition of new trees in the quadrats without lowering the values.

3.3.4 Biomass Trends

Despite minor year-to-year fluctuations in these vegetation parameters, an overall positive trend of growth has been observed for all quadrats from the baseline to the current survey. The protection of remnant bushland surrounding the pit area from a history of logging, clearing, frequent fire, firewood collection and rubbish dumping has likely contributed to the overall increase in biomass at all quadrats between the baseline survey and current survey year.

Vegetation parameters are presented graphically in

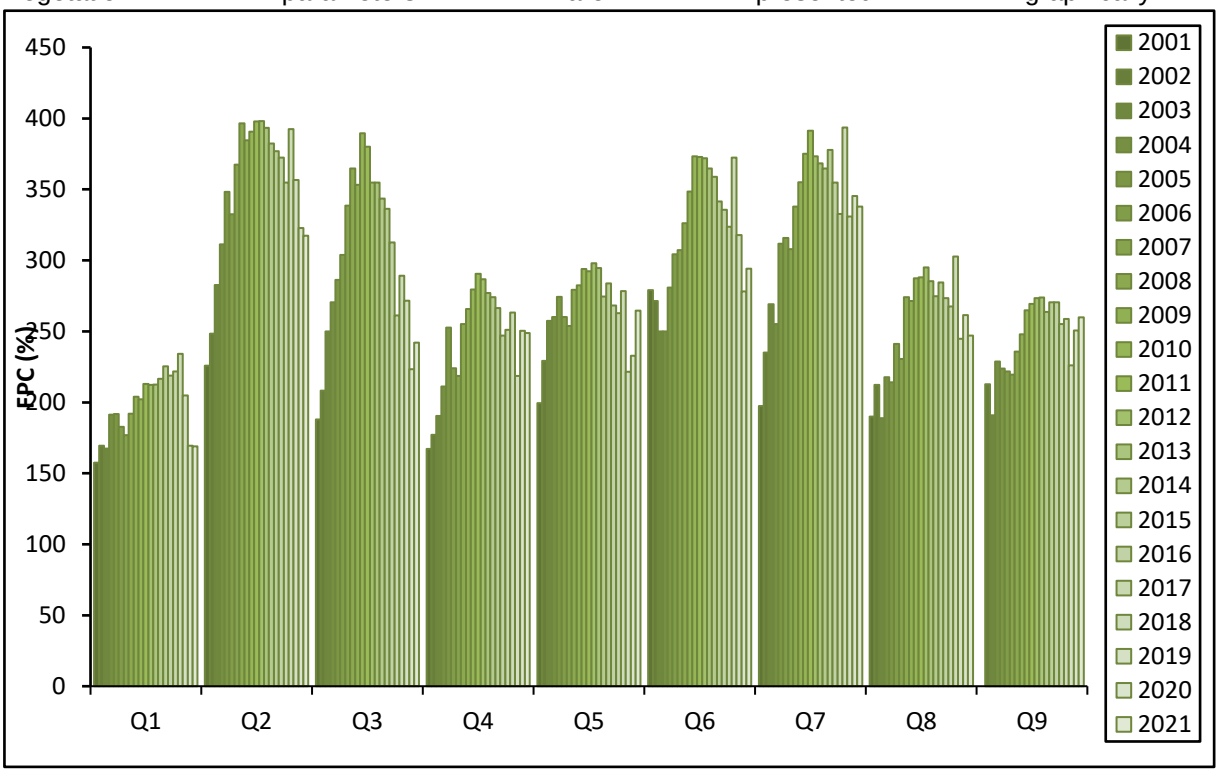


Figure 3 through to **Figure 6**. The raw data for tree height, foliage cover, basal area and stand volume recorded at each quadrat from the baseline (2001/2003) through to 2021, (see **Appendix A**, **Appendix B**, and **Appendix C**).

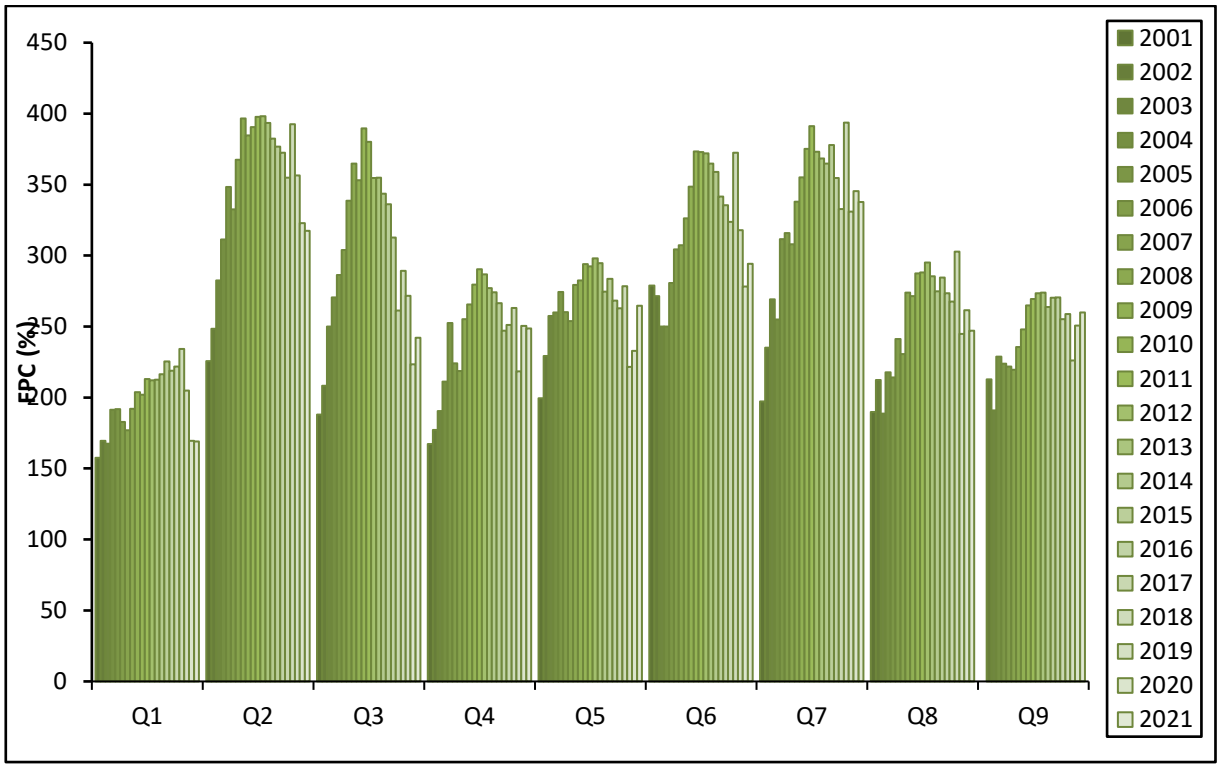


Figure 3: Total foliage projective cover for each quadrat between 2001 and 2021.

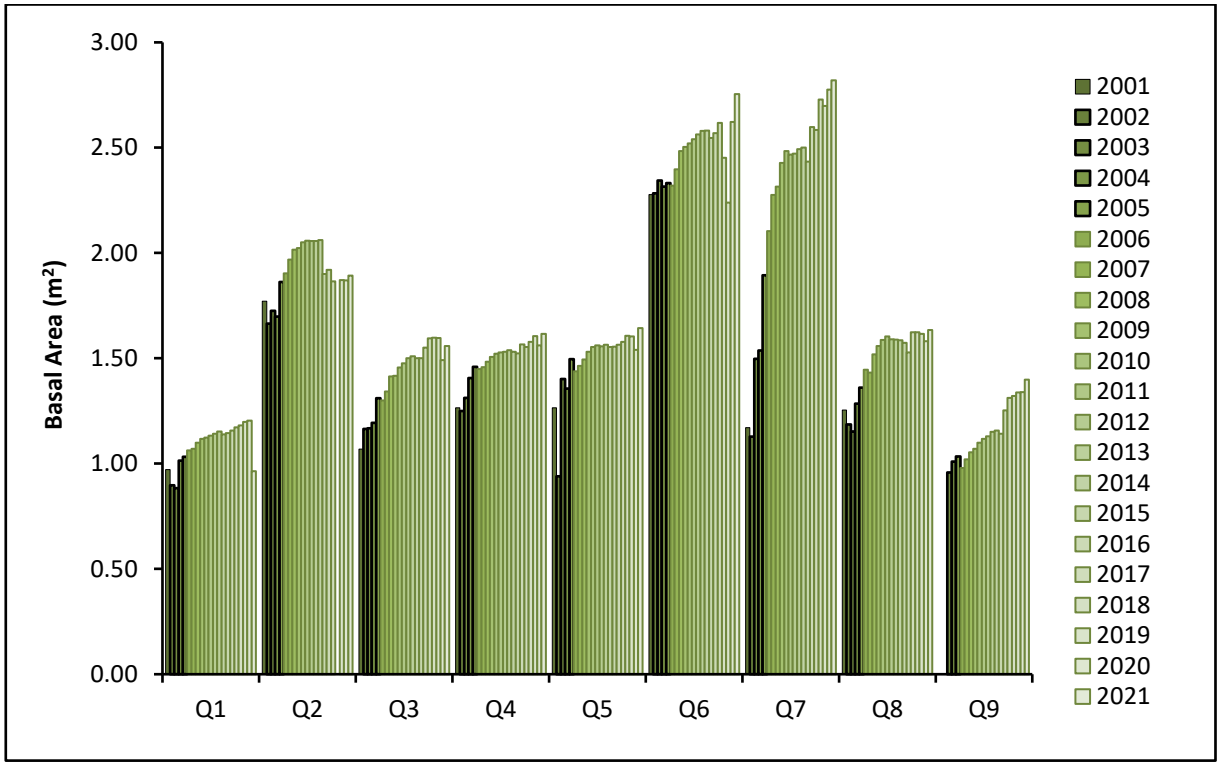


Figure 4: Basal area for each quadrat between 2001 and 2021.

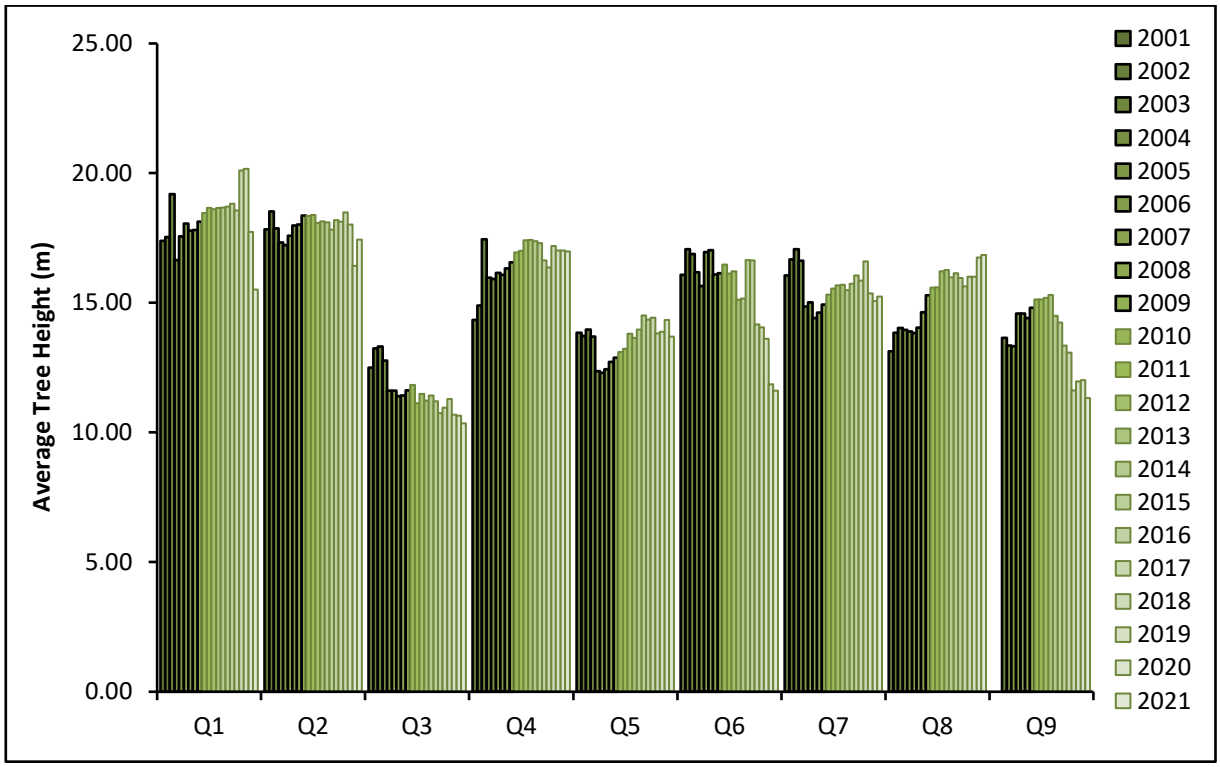


Figure 5: Average tree height for each quadrat between 2001 and 2021.

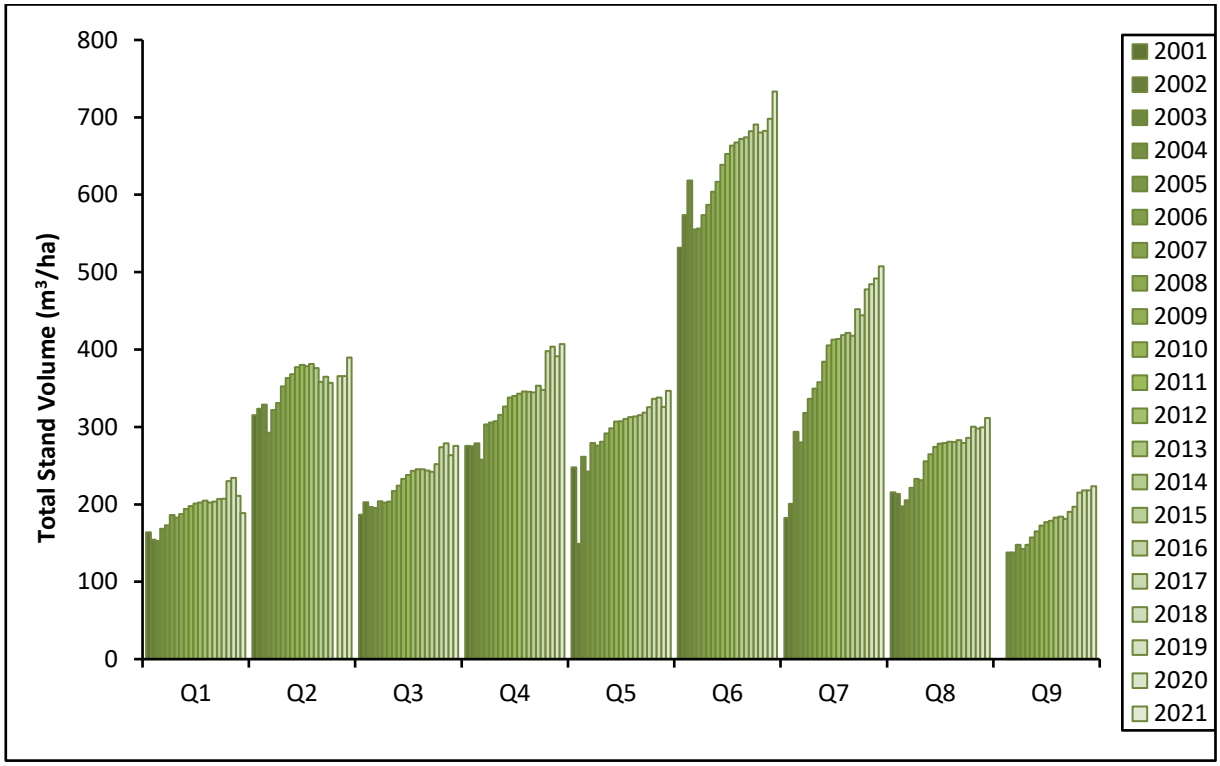


Figure 6: Total stand volume for each quadrat between 2001 and 2021.

Linear regression analysis was performed for all quadrat data to assess the relationship between biomass measurements (FPC and stand volume) and time. The analysis highlights variations in vegetation growth and development over time, which may be attributed to previous edge effects from mining activities (i.e. dust, weed invasion, changes in hydrology). The analysis indicates that FPC has significantly increased since baseline across all quadrats ($F_{1, 19}$ = 6.8; p= 0.017) although there has been an overall gradual decrease since 2011. The R^2 value has decreased from 0.35 (2020) to 0.26 (2021) which indicates that there has been a slight increase in the variation from previously modelled results (**Figure 7**).

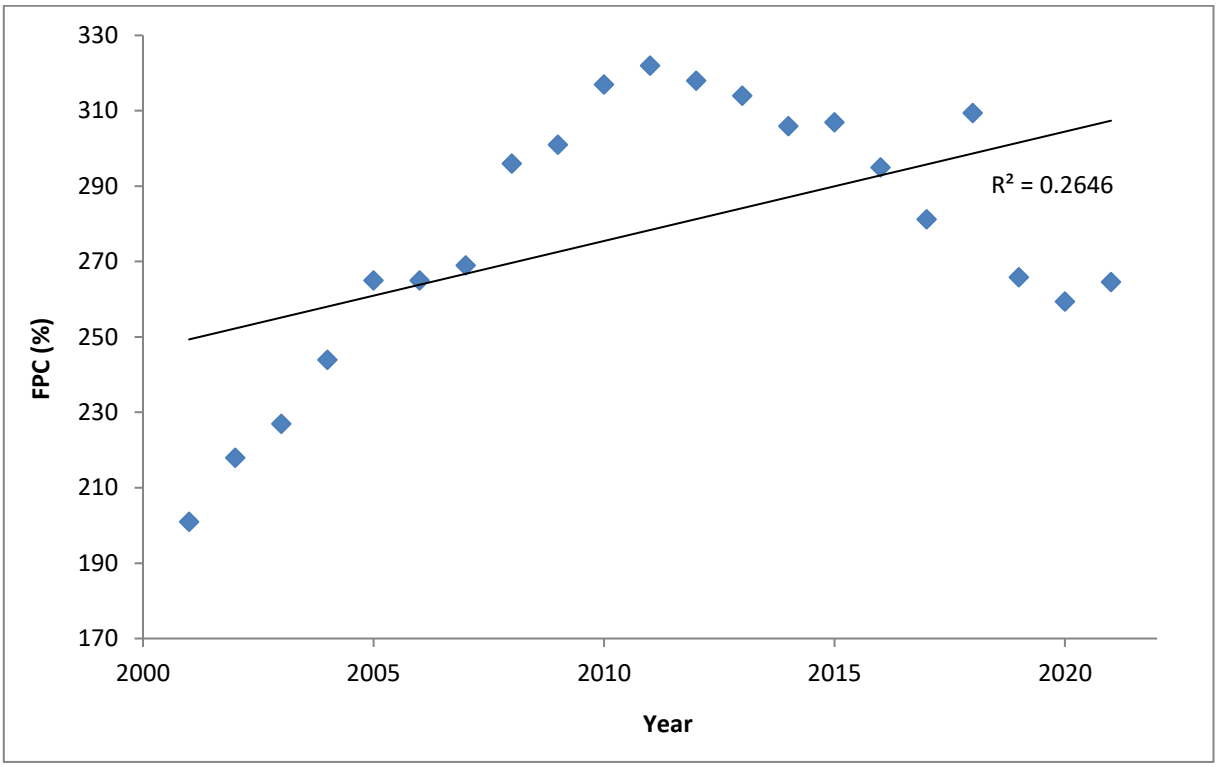


Figure 7: Total FPC (%) for combined quadrats across time (2001-2021). R-squared values from linear regression analysis displayed.

The linear regression analysis for stand volume indicates that this parameter has increased significantly over time across all quadrats ($F_{1, 19}$ = 215.3; p= <0.05). The R^2 value is high (>0.91), which indicates that there is little variation in stand volume from year-to-year among the quadrats (**Figure 8**). An overall progressive increase in stand volume since the baseline survey is evident. Some variation may be attributed to the maturation of trees to over 2 m and/or trees dying.

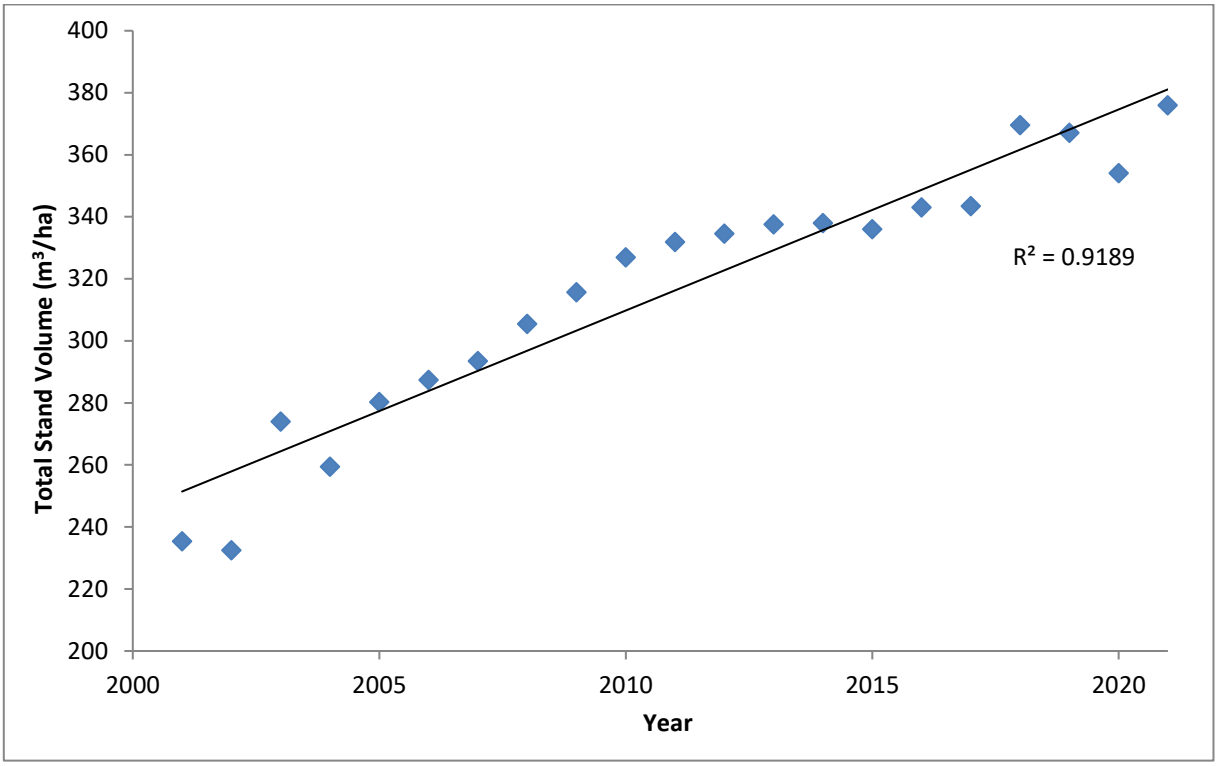


Figure 8: Total stand volume (m^3/ha) for combined quadrats across time (2001-2021). R-squared values from linear regression analysis displayed.

3.4 FLORISTICS

A total of 188 flora species were recorded in 2021, including nine (9) exotic and 175 native species. This represents a decrease of eight (8) species compared to 2020 (192 species), and an increase of 54 species since the 2001 baseline survey (134 species) (see **Appendix D**).

A total of 309 species have been recorded across all survey events since baseline surveys in 2001. **Figure 9** presents the cumulative number of species recorded since the baseline, illustrating a steady increase in species number until 2009 where numbers levelled off and stabilised through to 2019. In 2021, an additional four species were identified within the site.

The overall levelling of the species recorded over time can be explained by the species-time relationship (STR), which is similar to the pattern observed for species-area relationship (SAR), whereby the species richness of a given plant community being observed typically fits a power or exponential model. The potential number of plant species within a defined area (i.e. a quadrat) is expected to increase substantially over the short-term, and then plateau to an asymptotic maximum value as the time period increases (Specht and Specht 2002).

Ecological processes and variables which generally explain the observation of most plant species within the short-term include disturbance events, detectability (i.e. sporadic flowering time, dormancy), and variable climatic conditions such as rainfall. The expected decrease in the cumulative number of observed species richness over a longer time scale is less influenced by short-term variables and affected more by processes such as metapopulation dynamics and successional changes. For example, a reasonable proportion of many plant community assemblages consist of dormant/ephemeral species which are only detectable when conditions are suitable for germination, such as post-fire or high rainfall events. The majority of these species are likely to be

detected within the short-term (i.e. within 5 years). The floristic results of the quadrat surveys within the BCA are consistent with this fundamental ecological pattern.

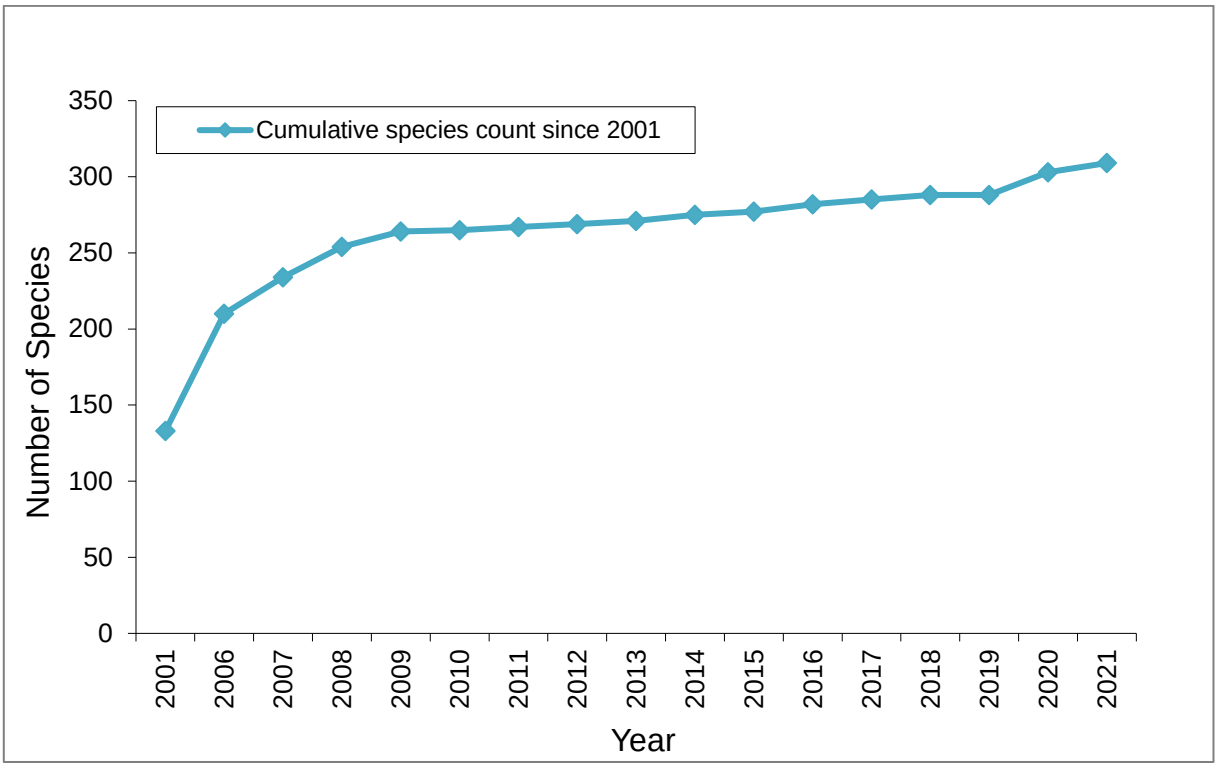


Figure 9: Cumulative species count since the baseline (2001) survey event.

Similarity indices were calculated for all pairs of quadrats in the baseline survey to determine how similar in species composition to each other the plant communities were in the quadrats surveyed. The similarity indices are shown in **Table 4**. Values from the baseline survey varied between 0.000 and 0.517 indicating a wide range in the degree of similarity between pairs of quadrats, from pairs with no shared species (Quadrat 6 and Quadrat 9), to pairs with many shared species (i.e. Quadrat 6 and Quadrat 2). This indicates that the nine quadrats sampled capture a wide degree of community and species diversity across the mining lease.

Table 4: Sorensen's Similarity Index for all pair-wise comparisons between quadrats 1-9 determined from the presence/absence data for all plant species recorded during the baseline flora survey

Similarity Index Matrix: Baseline Flora									
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**
Q1		0.290	0.427	0.281	0.222	0.207	0.328	0.273	0.310
Q2	0.290		0.160	0.063	0.222	0.517	0.149	0.182	0.103
Q3	0.427	0.160		0.234	0.241	0.113	0.425	0.278	0.423
Q4	0.281	0.063	0.234		0.255	0.033	0.261	0.324	0.367
Q5	0.222	0.222	0.241	0.255		0.146	0.160	0.163	0.195
Q6	0.207	0.517	0.113	0.033	0.146		0.063	0.032	0.000
Q7	0.328	0.149	0.425	0.261	0.160	0.063		0.254	0.222

Q8	0.273	0.182	0.278	0.324	0.163	0.032	0.254		0.419
Q9	0.310	0.103	0.423	0.367	0.195	0.000	0.222	0.419	
Mean	0.292	0.211	0.288	0.227	0.201	0.139	0.233	0.241	0.255
SD	0.068	0.142	0.124	0.119	0.041	0.167	0.112	0.116	0.153
Overall Mean	0.232								
SD	0.125								

Values from 0.3-0.4 highlighted green (moderate similarity); > 0.4 highlighted orange (high similarity).

A comparison of the similarity indices for Quadrats 1-9 between 2001 (2003 baseline for Q9), 2007 and 2015 (i.e. 7 and 15 year intervals), as well as the previous (2020) and current (2021) survey periods are presented in **Table 5**Table 5. This analysis was performed on interval data to examine the across-time trends in floristic changes for each quadrat. The analysis shows that generally the similarity of the quadrats has stabilised over time. The comparison between consecutive years shows moderate to high similarity between survey periods, with similarity indices of 0.78 to 0.89 recorded between 2020 and 2021. This represents that a smaller change in floristics occurred between 2020-2021 when compared to the previous period of between 2019 - 2020 (i.e. between 0.65 – 0.85 similarity for all quadrats between 2019 and 2030 surveys). This is likely due to continuing favourable climatic conditions throughout the two periods.

A review of similarity indices from baseline surveys through to 2021 suggests a change in floristics has occurred within the quadrats throughout the last 19 years indicative of a dynamic plant community responding to climatic conditions and ecological variables over time. Floristic similarities between baseline and the current assessment indicate that most quadrats have a species composition moderately similar to that in 2001 (2003 for Q9). The lowest similarity was recorded at Q5, likely due to the 14 additional species added to the quadrat since 2001.

Table 5: Sorensen's Similarity Index for Quadrats 1-9, comparing species composition from baseline (2001 for Q1-Q8; 2003 for Q9), 2007, and 2015, as well as the previous and current surveys. Values for quadrats may range between 0 (no species present at both survey periods) to 1.0 (all species present in both surveys).

		Baseline vs '07	2007 vs '15	Baseline vs '15	Baseline vs 2021	2020 vs '21
Q1	No. of sp. present only 1 year	32	22	34	41	19
	No. of sp. present in both years	22	33	20	16	33
	Similarity Index	0.579	0.75	0.541	0.438	0.776
Q2	No. of sp. present only 1 year	45	37	40	35	16
	No. of sp. present in both years	22	40	25	24	45
	Similarity Index	0.494	0.684	0.556	0.578	0.849

		Baseline vs ‘07	2007 vs ’15	Baseline vs ’15	Baseline vs 2021	2020 vs '21
Q3	No. of sp. present only 1 year	47	32	51	44	20
	No. of sp. present in both years	27	44	29	32	51
	Similarity Index	0.535	0.733	0.532	0.593	0.836
Q4	No. of sp. present only 1 year	44	28	52	51	14
	No. of sp. present in both years	19	37	17	20	49
	Similarity Index	0.463	0.725	0.395	0.440	0.875
Q5	No. of sp. present only 1 year	39	39	42	52	14
	No. of sp. present in both years	10	28	11	11	51
	Similarity Index	0.339	0.589	0.344	0.298	0.879
Q6	No. of sp. present only 1 year	36	30	40	39	12
	No. of sp. present in both years	17	33	20	18	39
	Similarity Index	0.486	0.688	0.500	0.480	0.867
Q7	No. of sp. present only 1 year	43	30	47	34	14
	No. of sp. present in both years	22	38	22	25	41
	Similarity Index	0.506	0.717	0.484	0.595	0.854
Q8	No. of sp. present only 1 year	40	42	46	56	17
	No. of sp. present in both years	23	33	23	23	56
	Similarity Index	0.535	0.611	0.500	0.451	0.868
Q9	No. of sp. present only 1 year	52	34	50	64	16
	No. of sp. present in both years	16	40	17	17	63
	Similarity Index	0.381	0.702	0.405	0.347	0.887

3.5 FAUNA

A total of 178 fauna species have been recorded since monitoring began in 2001, including 12 frog, 18 non-flying mammal, 27 bat, 112 bird and 13 reptile species. Fauna species recorded in 2021 totalled 77, consisting of 49 bird, 15 bat, five (5) terrestrial mammal, three (3) arboreal mammal, three (3) frog and two (2) reptile species (**Figure 10**). Seven (7) bat and two (2) bird species are listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act). The low numbers observed in 2002, 2003 and 2004 are due to the lack of bird surveys completed in those years.

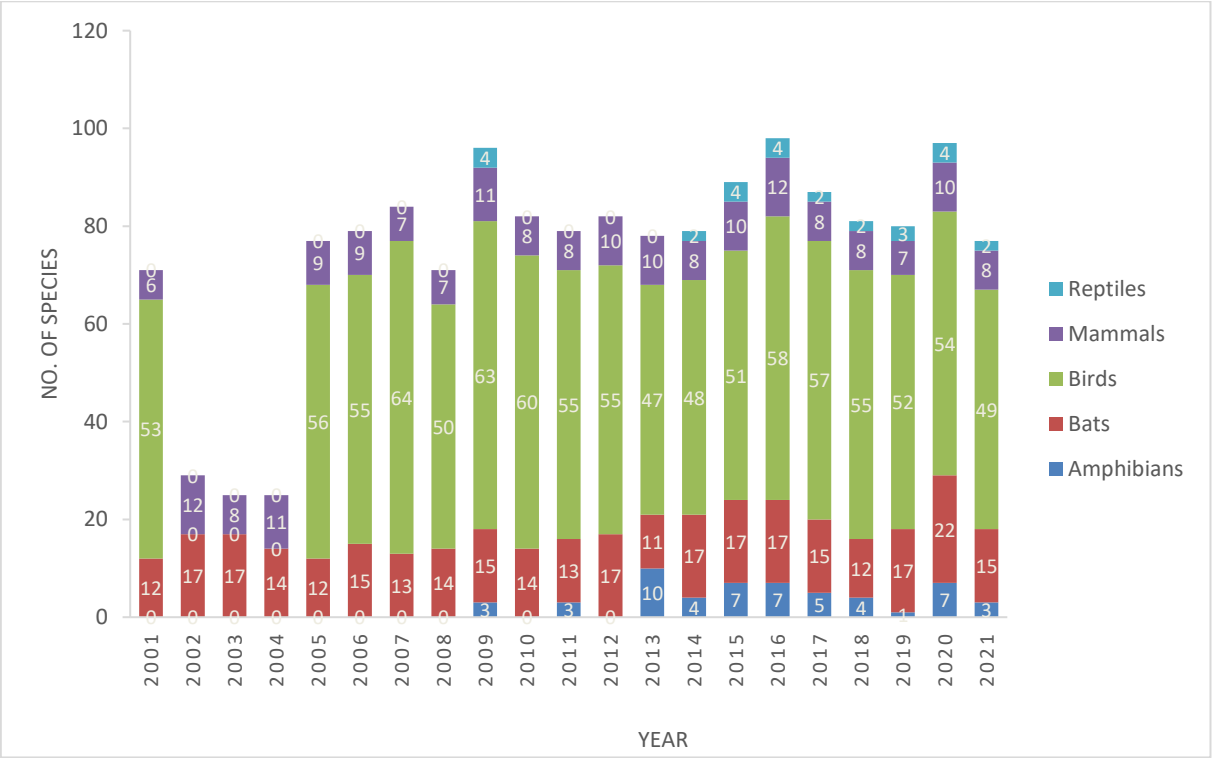


Figure 10: Total fauna species recorded across all years (2001 – 2021).

The nMDS analysis (**Figure 11**) illustrates the degree of similarity, across years, for the number of fauna species detected within each survey period. Two clusters of years containing 2007-2008 and 2010-2012 show 80% similarity (**Appendix H**) (indicated by the red dotted line) with all other years having between 60-80% similar fauna assemblages.

Fauna assemblages for all year's show at least 60% similarity. The SIMPROF test (**Appendix H**) showed that the greatest similarity of fauna assemblages exists between years 2010 and 2011. The most dissimilar assemblage to this year's results (2021) is 2001 with a similarity index of 0.59, suggesting the species assemblage has gradually changed since the baseline surveys were conducted. The assemblage identified in 2021 is significantly different to all fauna assemblages identified in previous monitoring events. The most notable difference between these monitoring periods is within the composition of observed bird species. This is discussed in greater detail in **Section 3.5.1.4.**

It should also be noted that a hazard reduction burn was undertaken within very northern portion of the BCA (within the vicinity of Quadrat 8). Specially, all ground vegetation was burnt ensuring that all large trees and the flora quadrat was avoided. The burn was undertaken following fauna surveys in 2020. The reduction burn has the potential to influence fauna occurrence in the coming years.

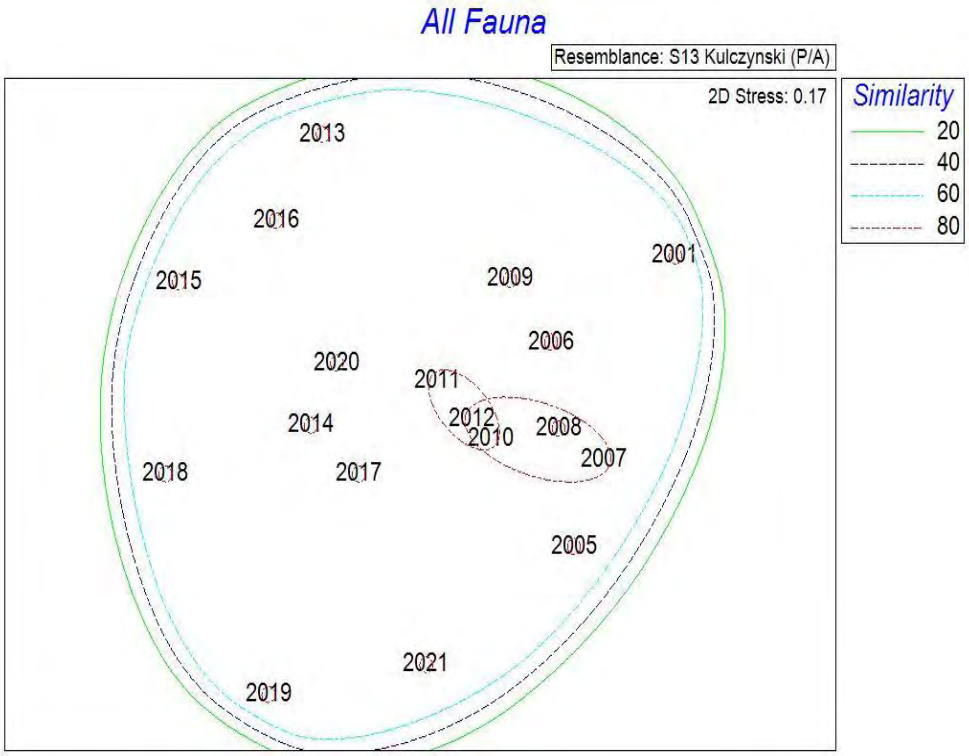


Figure 11: nMDS analysis of all fauna species detected in all quadrats 2001 – 2021 (excluding 2002 – 2004).

3.5.1 Mammals

A total of 23 mammal species were detected during the 2021 surveys, comprising 14 microbats, one (1) megabat, five (5) terrestrial species and three (3) arboreal species. This number is inclusive of six (6) BC Act listed bat species include: Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis)*, Eastern Coastal Free-tailed Bat (*Mormopterus norfolkensis*), Little Bent-winged Bat (*Miniopterus australis*), Southern Myotis (*Myotis macropus*), and the Grey-headed Flying-fox (*Pteropus poliocephalus*). The number of mammals detected during the current survey (23), is lower than the number identified in 2020 (32) (**Figure 12**).

During the 2021 surveys one introduced pest mammal species was detected, namely the Black Rat (*Rattus rattus*).

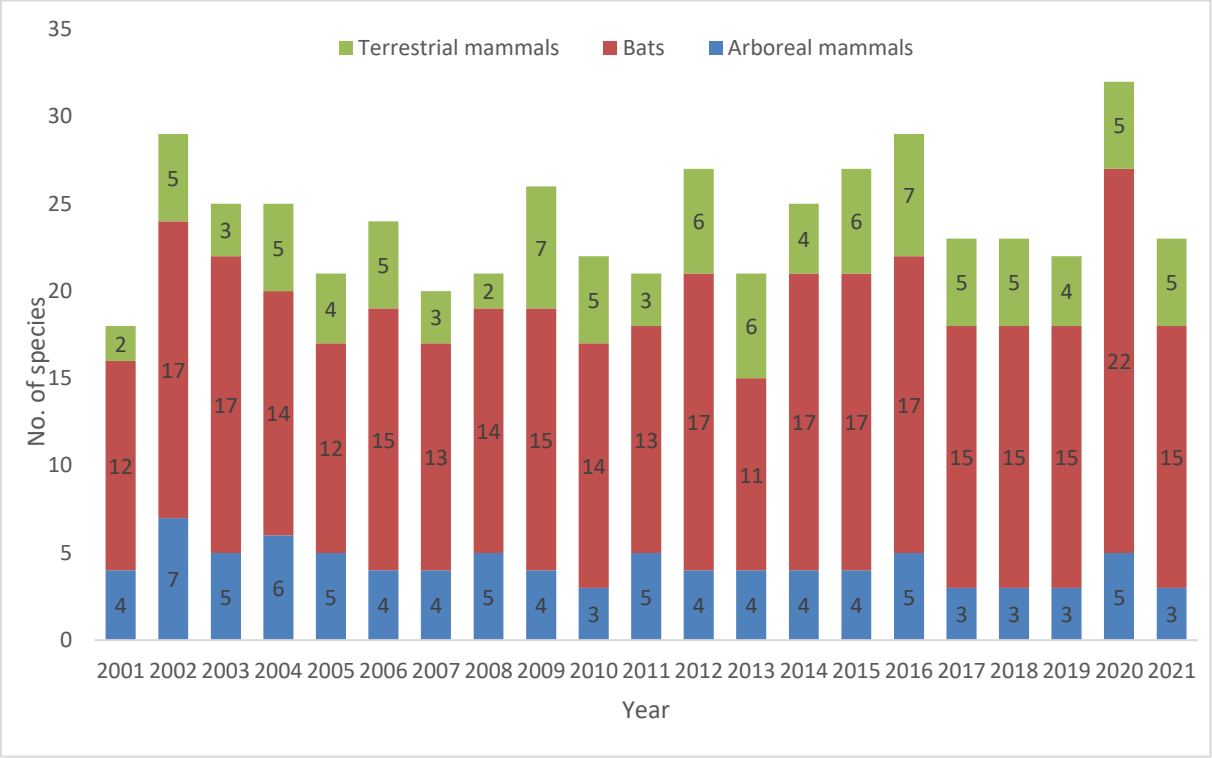


Figure 12: Total mammal species recorded at each survey event 2001 – 2021.

A list of all mammal species detected from 2001-2021 is provided in **Appendix E**. To investigate trends in species assemblages across the years, mammals were categorised for analysis into arboreal species, highly mobile flying species (Chiroptera or bats) and terrestrial species.

3.5.1.1 Arboreal Mammals

Three (3) species of arboreal mammal were detected during the 2021 fauna surveys (**Figure 12**). This is below the yearly average (4.29 species). The arboreal mammals detected included Sugar Glider (*Petaurus breviceps*) recorded during all survey periods except for 2001, as well as the Brown Antechinus (*Antechinus stuartii*), Common Brushtail Possum (*Trichosurus vulpecula*), which have been detected every year.

The nMDS analysis demonstrates that overall, the assemblages of arboreal mammal species have changed somewhat since 2001 (

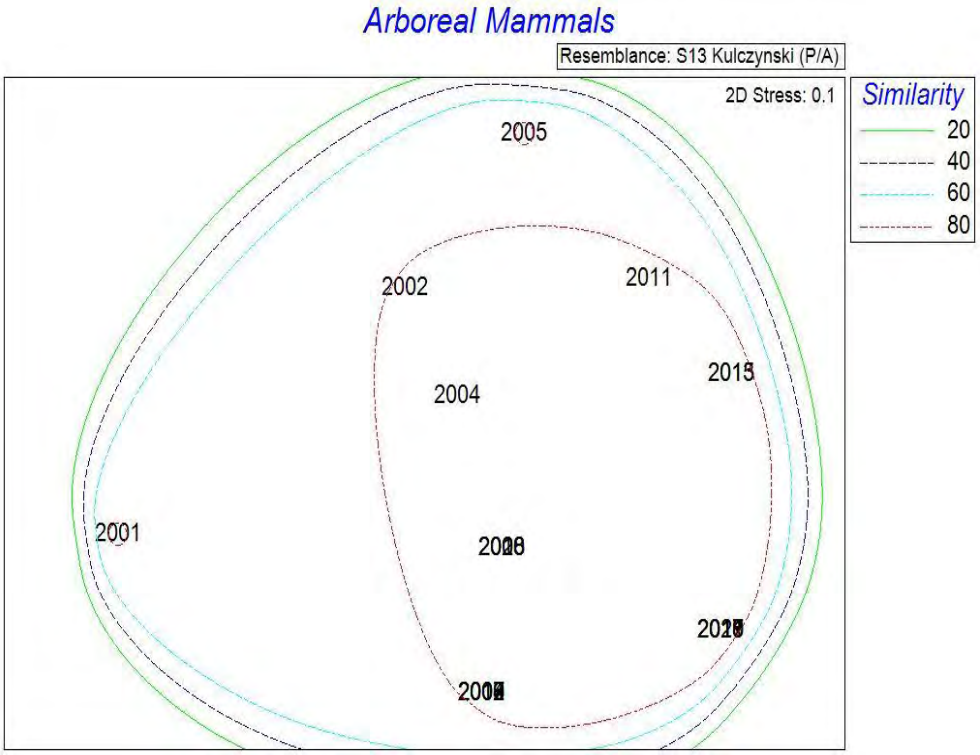


Figure 13). All years' show at least 40% similarity, with the least similar assemblage to this years (2021) being the baseline assemblage (2001). Recent monitoring events all show a highly similar assemblage to each other. The most similar years to this years assemblage include 2017 to 2019 with 100% similarity. Other highly similar groupings include 2003, 2016, 2008 and 2020, 2013 and 2015, 2010, 2017-2019, 2006, 2007, 2009, 2012, 2014, all of which have 100% similarity within each grouping. Variation of arboreal mammal assemblages, year to year, can be attributed to the sporadic detections of less common or highly mobile species such as the Greater Glider (*Petauroides volans*) and Squirrel Glider (*Petaurus norfolcensis*).

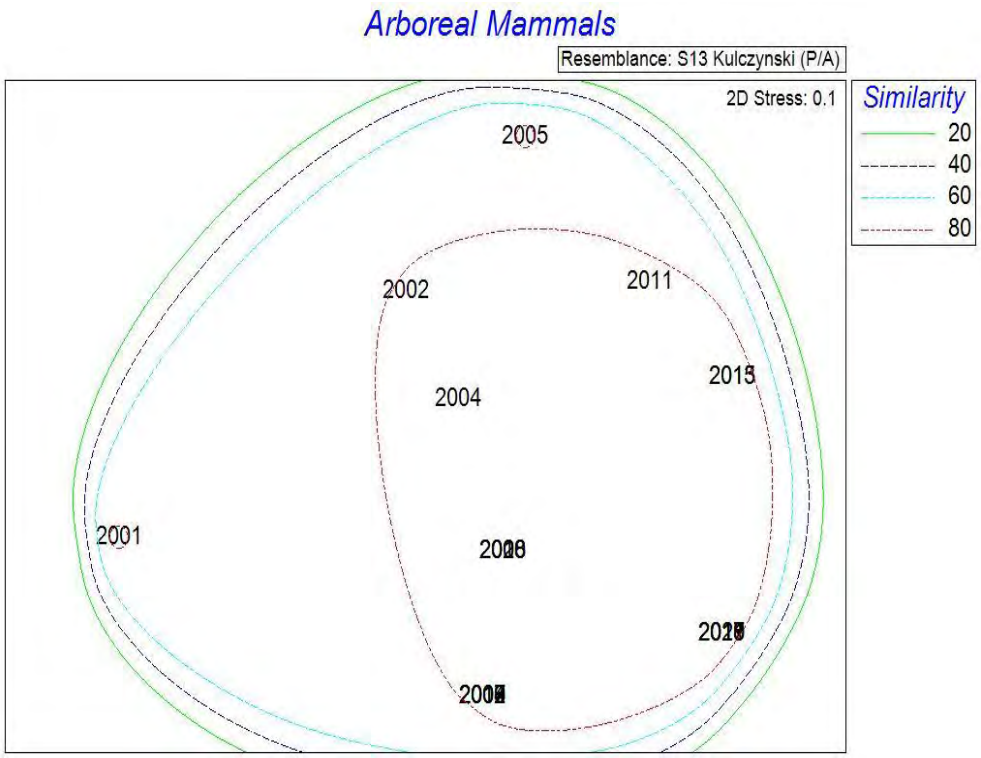


Figure 13: nMDS analysis of arboreal mammal species detected in all quadrats 2001 – 2021.

3.5.1.2 Terrestrial Mammals

The 2021 surveys recorded a total of five terrestrial mammal species (**Figure 12**) which is slightly above the average for all years (4.6 species). The terrestrial species comprised four native species; Bush Rat (*Rattus fuscipes*), Eastern Grey Kangaroo (*Macropus giganteus*), Swamp Wallaby (*Wallabia bicolor*) and the Long-nosed Bandicoot (*Perameles nasuta*) with one feral species detected in this year's surveys, the Black Rat (*Rattus rattus*). The nMDS analysis of terrestrial mammals (**Figure 14**) shows variation in species assemblages throughout the monitoring period with all years being at least 40% similar with several clusters of years being highly similar to each other (≥80%). The 2021 data being closely related to 2004 and 2017 with a similarity index of 100.

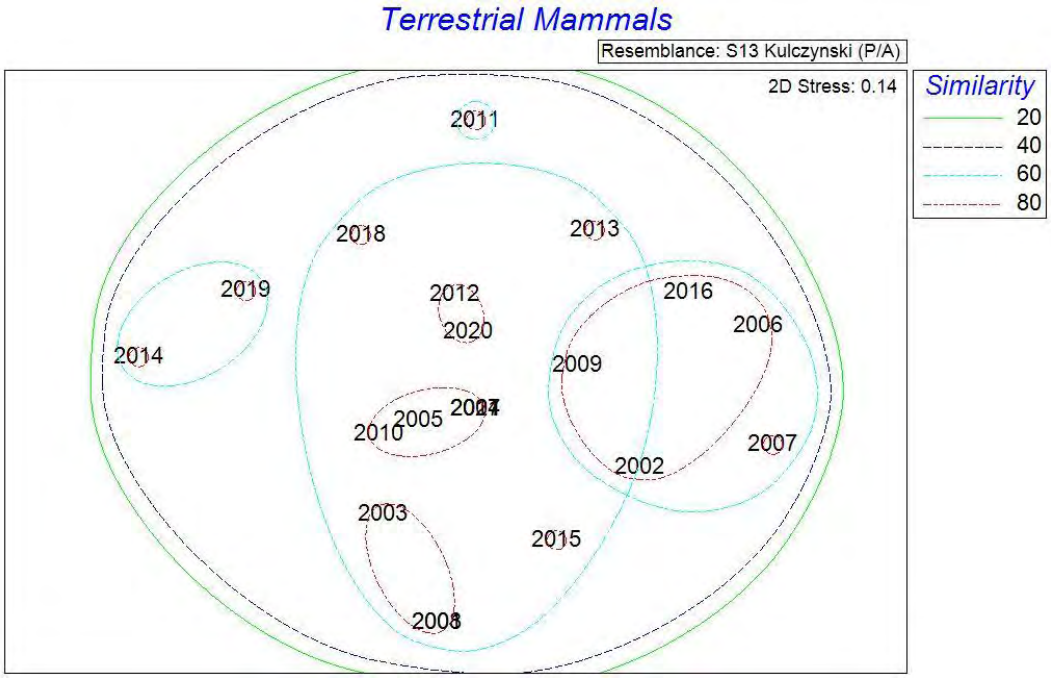


Figure 14: nMDS analysis of terrestrial mammal species detected in all quadrats 2001 – 2021.

3.5.1.3 Bats

A total of 15 species of bat were recorded across all nine quadrats during 2021 (**Figure 12**). This is comparable to the yearly average of 15.1 species despite being somewhat lower than last years surveys (32 species in 2020). Seven (7) of the 15 bat species recorded during the 2022 survey are listed as threatened under the BC Act including the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Eastern Coastal Free-tailed Bat (*Mormopterus norfolkensis*), Little Bentwing-bat (*Miniopterus australis*), Southern Myotis (*Myotis macropus*), and the Grey-headed Flying-fox (*Pteropus poliocephalus*). Bats account for 19% of all fauna species detected in the 2021 surveys.

The nMDS showed the bat assemblages of all years were at least 60% similar, with three clusters of years that were at least 80% similar (**Figure 15**). The 2021 results are most similar to the bat assemblage of 2008. There is no clear pattern in the variation in species assemblages over time.

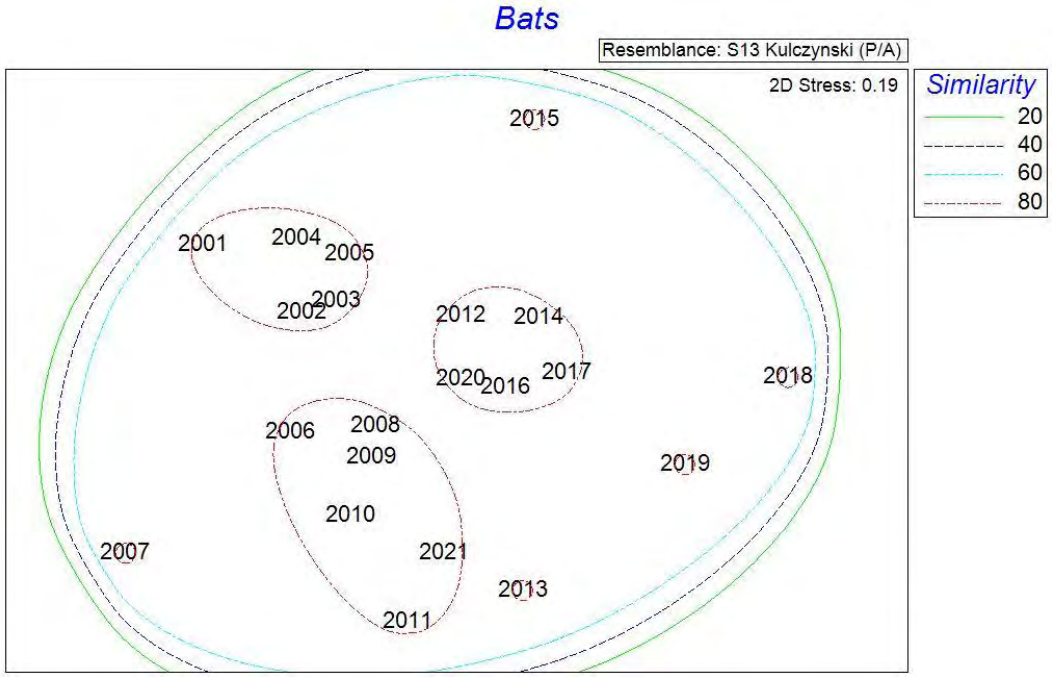


Figure 15: nMDS analysis of bat species detected in all quadrats 2001 – 2021

3.5.1.4 Birds

A total of 49 bird species were recorded across the nine quadrats during the 2021 surveys, which is comparable to the average of 54.6 species across all years (**Figure 10**). Overall, the number of bird species recorded each year has remained relatively constant with no marked increase or decrease. One (1) previously undetected species was observed in 2021 within Q8 – the Whistling Kite (*Haliastur sphenurus*). Two (2) species listed as Vulnerable under the BC Act were detected in 2021: the Little Lorikeet (*Glossopsitta pusilla*) at Q2, Q5, Q7 and the Powerful Owl (*Ninox strenua*) at Q8.

A total of 112 species have been recorded since monitoring began which belong to 41 families, of which the most common are Meliphagidae (Honeyeaters), Psittacidae (Parrots), Acanthizidae (Thornbills, Scrubwrens and Gerygones), Columbidae (Pigeons and Doves), Cuculidae (Cuckoos) and Artamidae (Woodswallows, Butcherbirds, Australian Magpies and Currawongs). A total of 20 families were only represented on site by one species, however, several of these families such as the Podargidae (Frogmouths), Coraciidae (Rollers), Oriolidae (Orioles and Figbird), Dicaeidae (Flowerpeckers) and Megapode (Mound Builders) have only 1 – 3 species present in Australia.

A total of seven threatened bird species have been recorded across the nine quadrats to date. Three of these species are large forest owls (Sooty Owl, Powerful Owl and Masked Owl) and four are woodland bird species (Glossy Black-Cockatoo, Little Lorikeet, Dusky Woodswallow and Varied Sittella).

The Sooty Owl has only been recorded within the BCA twice (2001 and 2016). The Masked Owl has been recorded between 2014 and 2018, as well as 2009 and 2010, but was not recorded in this survey period. The Powerful Owl has been recorded in all years except 2009, 2012, 2013, 2016. The Little Lorikeet and Varied Sittella have been recorded infrequently throughout the monitoring period. The Glossy Black-Cockatoo was recorded for the first time in 2016.

The total number of bird species recorded each year is displayed in **Figure 16**.

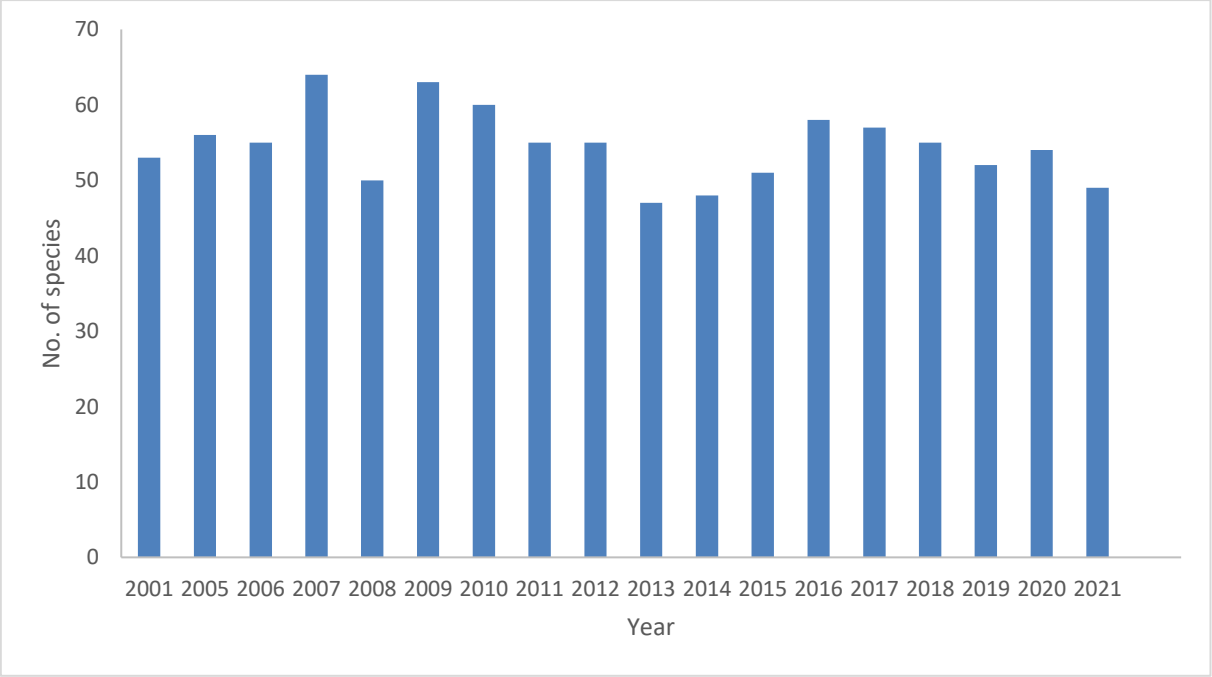


Figure 16: Total number of bird species recorded in all quadrats 2001 – 2021 (excluding 2002 - 2004).

Figure 17 shows the cumulative number of bird species recorded since the baseline survey event. The cumulative number of species has been increasing steadily every year since the baseline. The flattening of the species curves suggests that most species likely to occur at the site have now been recorded; however, a small number of new species continue to be recorded.

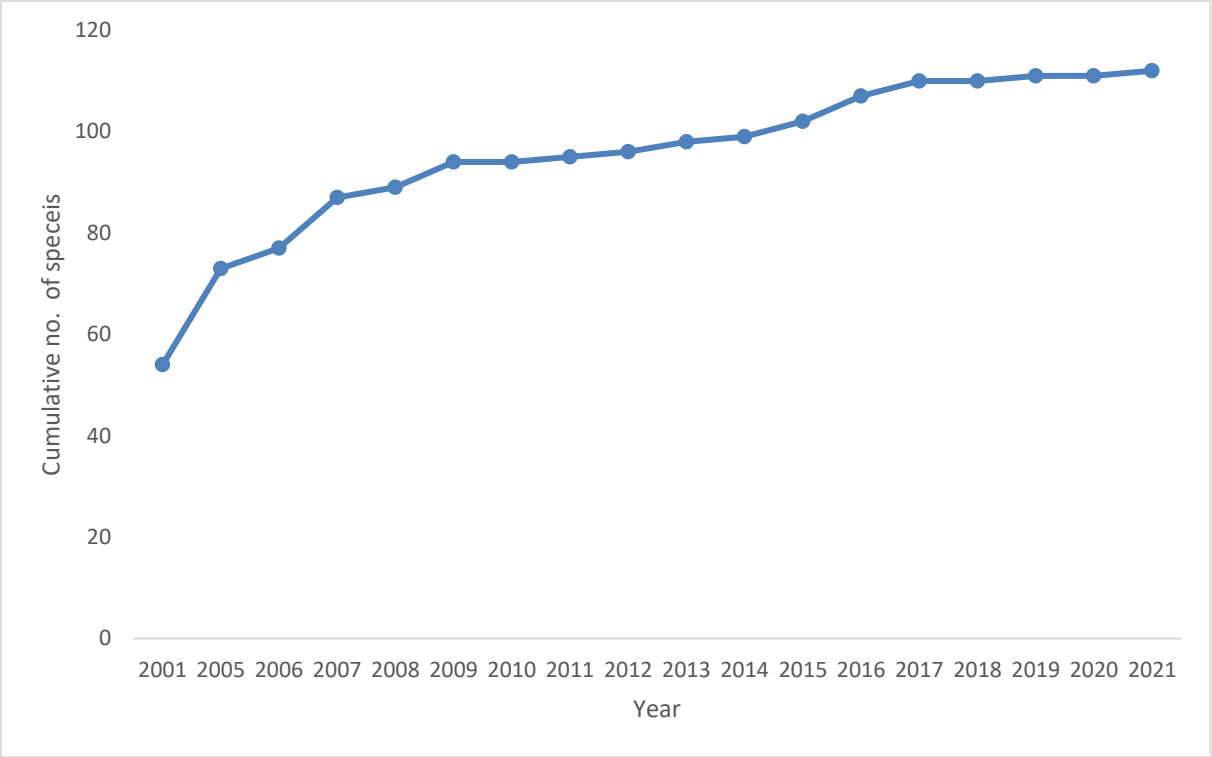


Figure 17: The cumulative bird species count since the baseline (2001) survey event.

Despite the total number of bird species recorded each year remaining relatively constant over time, the nMDS similarity analysis (**Figure 18**) showed a pattern of clustering of survey years similar to that observed for all fauna groups, suggesting that changes in bird assemblages may be responsible for the similarity results observed for all fauna (when vertebrate classes are grouped together due to the number of species within the bird group).

The SIMPROF cluster analysis (**Appendix H**), revealed that bird assemblage from 2016 is the most dissimilar statistically (95% confidence) compared to other years. With all other years being at least 74% similar with each other. To investigate this recent trend further, bird species were pooled (refer to 2016 annual report) based on general habitat preference (generalist, forest interior specialist, forest edge/open grassland preferred). Survey years were then pooled together to form the groups 2005 – 2008, 2008 – 2012 and 2013 – 2016 (the period since mining operations has ceased, **Figure 19**).

The analysis found that the average of the 2005-2008, 2009-2012 and 2013-2016 periods shows birds with generalist habitat preference have continued to be around 26-27 species per 4-year period with an increase to 30 species within the latest period of 2017-2020. In the period of 2013-2016 there was an average of 35 species (decrease of 12.5% from previous period) in the number of forest-interior specialists recorded increasing in the 2017-2020 period to 38 species (increase of 8%). Forest edge/open grassland species did increase by 20% (2009-2012 12 species to 15 species 2013-2016) since the cessation of mining operations in 2012 although decreasing by 26.6% to 11 species in the 2017-2020 period. This analysis will be undertaken again in 2024 (24 years of monitoring) to see whether this identified trend continues.

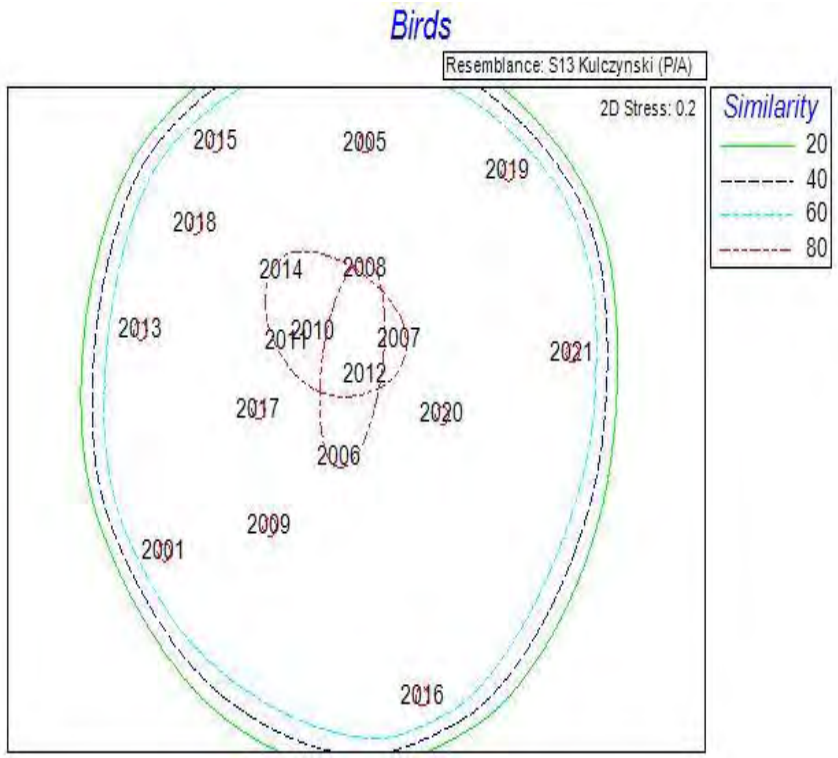


Figure 18: nMDS analysis of bird species detected in all quadrats 2001 – 2021 (excluding 2002 – 2004)

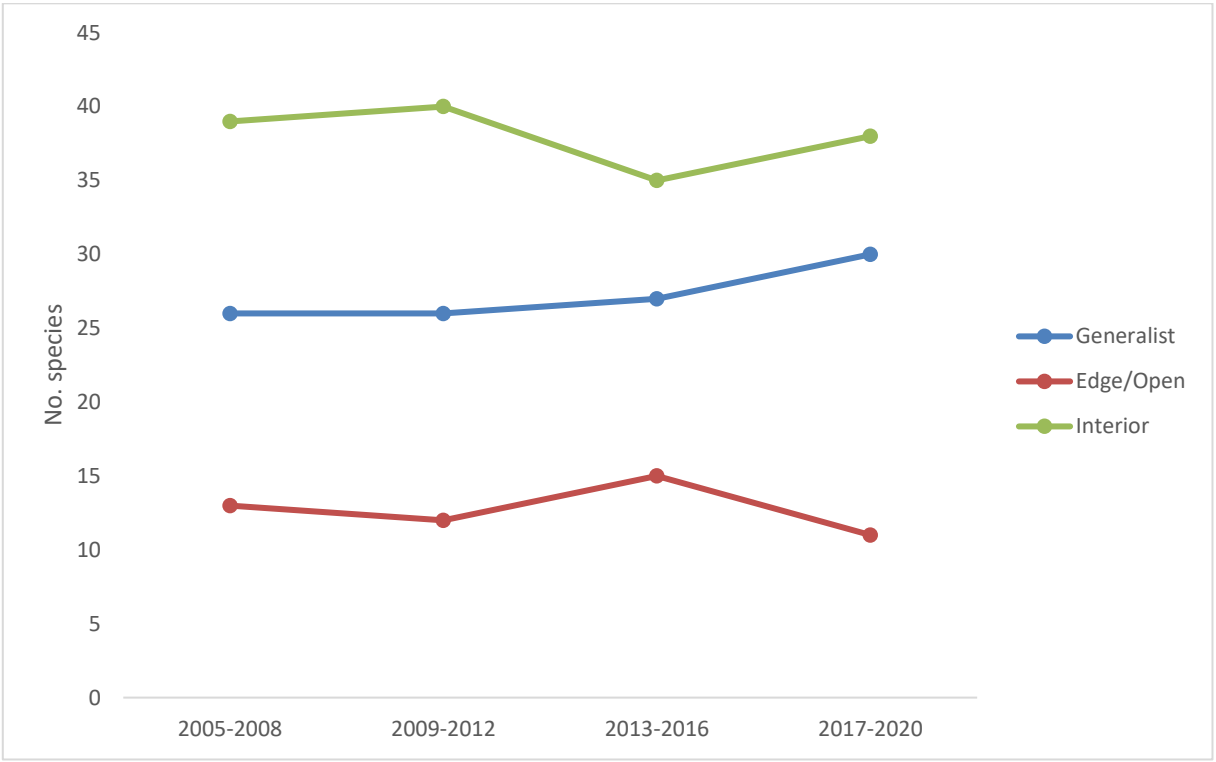


Figure 19: Number of birds per guild from 2005-2020.

3.5.2 Herpetofauna

Although herpetofauna monitoring is not officially part of the monitoring program, reptile and amphibian species were recorded opportunistically during survey events. No reptile or amphibian species were recorded prior to 2009, as such, herpetofauna was excluded from the statistical analyses comparing species assemblage similarity for those years.

Current survey identified three (3) amphibian species, the most common being the Red-Backed Toadlet (*Pseudophryne coriacea*) (**Figure 20**).

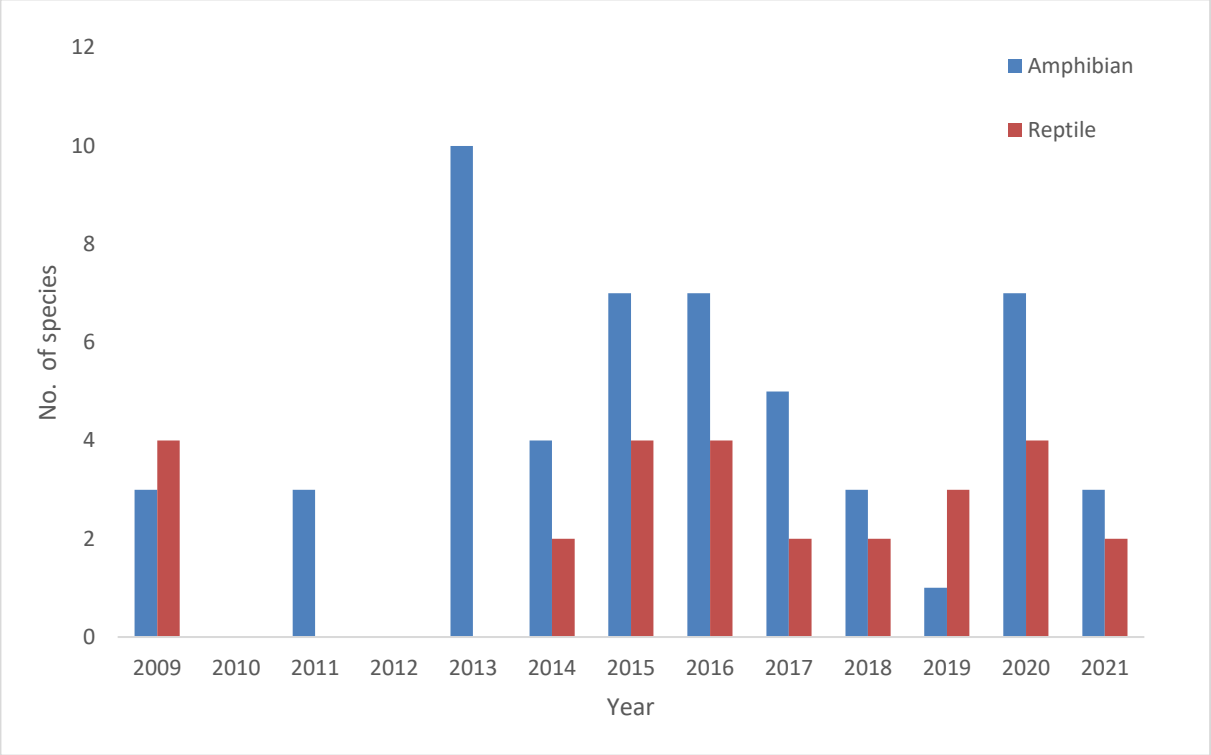


Figure 20: Number of amphibian and reptile species recorded within all quadrats over time.

3.5.3 Nest Box Monitoring

All 45 nest boxes were checked once during Winter and Summer in 2021 to determine occupancy rates. Initially, 45 nest boxes were installed across the nine quadrats in 2005, however, three (3) were removed in 2010 due to the construction of the western Square Pit. The three (3) nest boxes removed were replaced in May 2016 with new nest boxes at different locations within Quadrat 2. In total 15 nest boxes were replaced in 2016. After the 2018 Winter surveys, 15 nest boxes were replaced and three (3) repaired bringing the total available boxes back to 45. The 2021 Winter survey identified a further ten (10) boxes requiring replacement or repair due to their decreasing integrity. These boxes were tended to between the Winter and Summer monitoring events.

Total nest box utilisation in 2021 was 37% in Winter and 29% in Summer (**Figure 21**). A single factor ANOVA was not conducted for Summer and Winter 2021 due to the difference in the number of available boxes between seasons.

Nest box utilisation appeared to be plateauing with similar usage rates during the Winter surveys to last year **Figure 22**. Utilisation decreased by the Summer event following the replacing of several boxes. Three mammal species were confirmed to have used the nest boxes, Sugar Glider (*Petaurus breviceps*), Brown Antechinus (*Antechinus stuartii*) and Common Brushtail Possum (*Trichosurus vulpecula*).

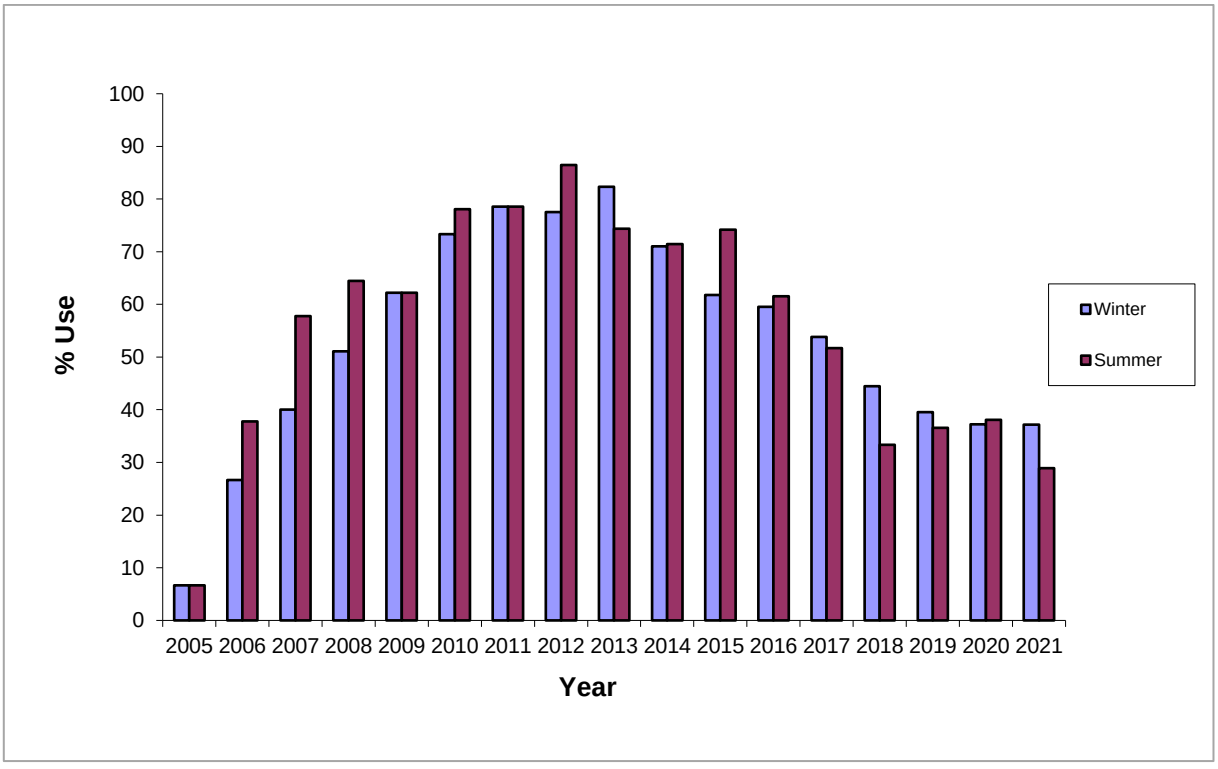


Figure 21: The proportion of nest boxes utilised in Winter and Summer between 2005 and 2021.

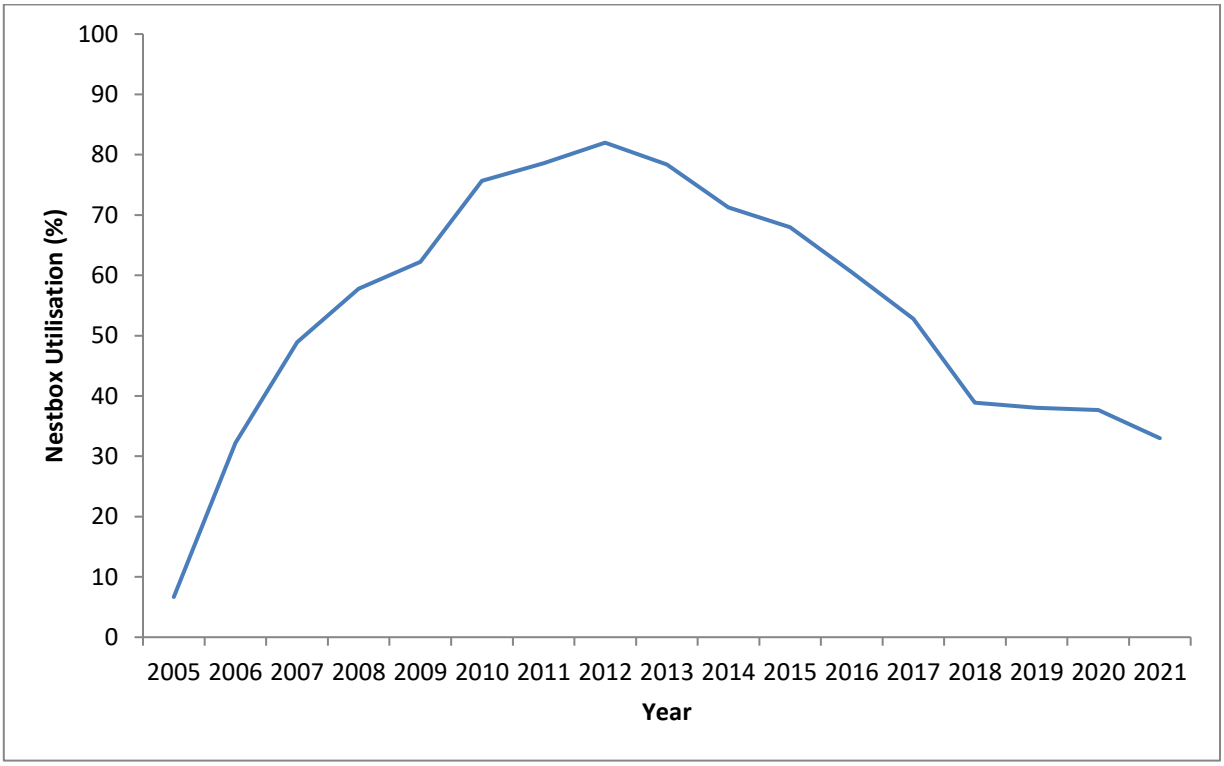


Figure 22 Nest box usage, Summer and Winter combined (2005 – 2021). Usage rates are calculated based on available boxes

Figure 23 shows the number of nest boxes available for use since installation in 2005. There was no decline in nest box availability from 2005 until 2010. Since then, nest box availability has fluctuated due to weather and termite damaged and the repair/instalment of new nest boxes. The number of available nest boxes reached 100% by the Summer monitoring event through the replacing of several deteriorating boxes.

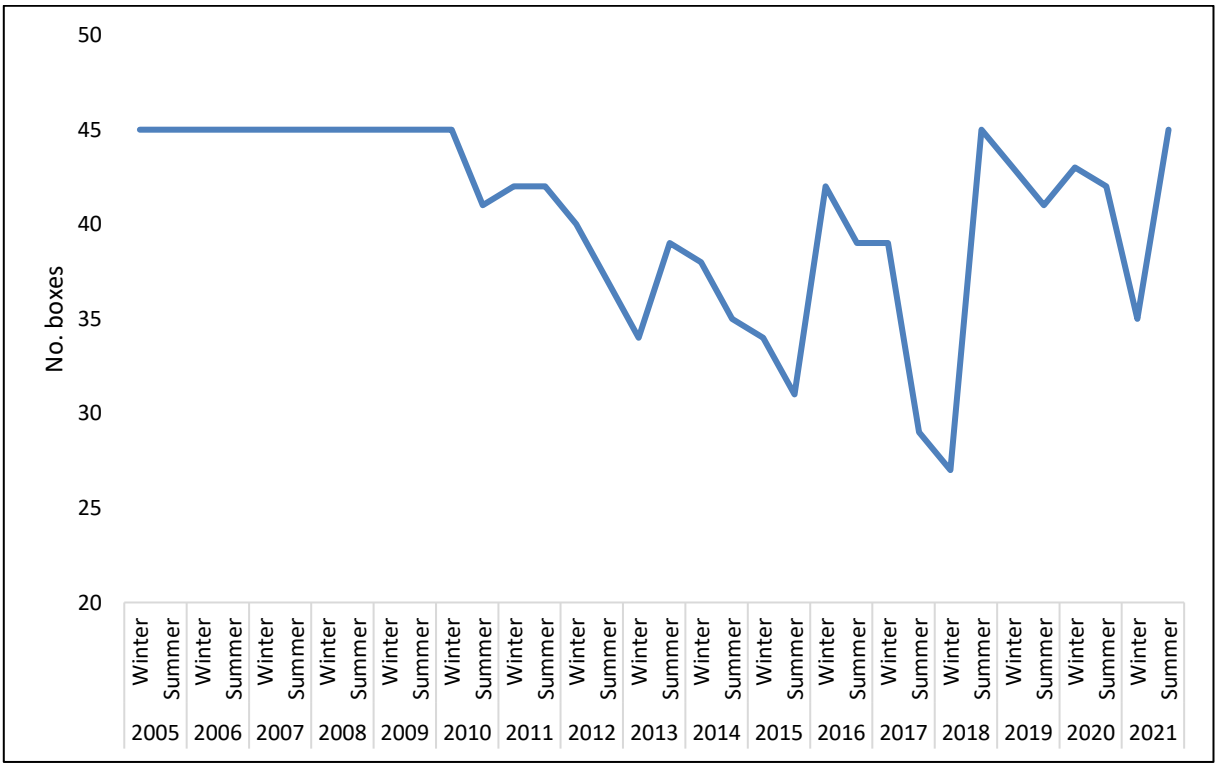


Figure 23: Number of available nest boxes over time (2005 - 2021).

4 DISCUSSION

4.1 VEGETATION

Plant species numbers have increased since 2001, as have all floristic structural components. This is indicative of a dynamic plant community with high recruitment from the seed pool, indicating a healthy plant community status. While the species composition recorded in each quadrat has changed over the survey period, the number of species identified within each quadrat has remained relatively consistent over time. The current survey results have revealed a moderate increase in species richness and cover since the 2019 survey, likely indicative of recovery from drought conditions experienced on site between 2018 and 2019.

Previous weed control has been effective in controlling *L. camara* and allowing the subsequent recruitment of native species, particularly in Quadrats 5 and Quadrat 7 where *L. camara* had noticeably declined. This species is growing in abundance, likely aided by favourable climatic conditions over the past two years and is now present in most of the quadrats. Follow-up weed control is critical to ensure the effective long-term management of these infestations and to limit regrowth. *L.* camara was identified as having a low but increasing cover (<5%) at Quadrats 2, 5, 6, 7 and 8. A lower abundance of Lantana occurs within Quadrats 3 and 9 as well as was Quadrat 4 where it was detected for the first time in 2021. Quadrat 6 has a persistently high exotic plant coverage, with an estimated cover of >75% in the ground layer (primarily *Tradescantia fluminensis*). Immediate control in Quadrat 6 is recommended to prevent further decline.

Given that total weed abundance has been relatively low within the BCA since 2001, it is difficult to identify changes in community condition based on weed abundance. Community condition has more likely been affected by the steady increases in biomass, resulting from the removal of weed species, fire management and tree removal, and a healthy native seedbank.

Regression analyses examining the change in FPC and stand volume for all quadrats over time demonstrate a steady increase in these parameters. Biomass results indicate minimal discernible adverse impact on vegetation growth and development from the surrounding mining operations. While an overall progressive increase in biomass parameters (FPC and stand volume) in the quadrats is supported by the data, the rate of increase has slowed with both parameters remaining relatively constant since the 2010 survey.

The FPC analysis in 2021 provides mixed results, albeit lower than the highest values recorded in 2012/2013 survey periods. Most quadrats have recorded an increase in FPC since 2019, indicating early stages of recovery post-drought conditions. Stand volume continues to broadly trend positively with some quadrats recording a slightly lower stand volume likely the result of the inclusion of a number of small trees which had reached the 2m threshold. Minimal regeneration of the canopy layer, a declining shrub layer and reduced ground cover is evident to various degrees at each quadrat – however results indicate early stages of recovery following the return of more favourable climatic conditions. The FPC of Quadrat 6, a quadrat previously impacted by Myrtle Rust, has recovered, now being higher than the baseline findings.

4.1.1 Myrtle Rust

In 2013 Quadrat 6 recorded a decrease in FPC resulting from the decline of *R. psidioides* species from Myrtle Rust fungus. In 2015, several of the seedlings were still present despite being infected, however the mature trees within and adjacent to Quadrat 6 were declining in health. By 2016, the mature trees had completely died off, and only one seedling was present. The species has been recorded absent from Quadrat 6 between the 2018-2021 surveys.

Myrtle rust is a plant disease caused by the exotic fungus *Puccinia Psidii*. It is a serious pathogen which affects plants belonging to the family Myrtaceae including Australian natives such as *Callistemon* spp., *Melaleuca* spp. and *Eucalyptus* spp. It was first detected in Australia in 2010 on the NSW Central Coast. Over 100 native plant species in NSW are known to be susceptible host species to the fungus, including several species present within the BCA; *Backhousia myrtifolia*, *Callistemon salignus*, *Eucalyptus pilularis*, *Melaleuca linariifolia* and *Syncarpia glomulifera*. While no other evidence of Myrtle Rust was observed within Quadrat 6, or other areas of the BCA, monitoring for evidence of the fungus will continue as part of future surveys.

4.2 FAUNA

Fauna species richness has remained stable. The current survey recorded 77 species, which is below the yearly average of 83 (excluding 2002-2004 where no bird surveys were conducted). Species recorded include 49 birds, which is also somewhat below the average throughout the monitoring program (54.6 species). Eight (8) non-flying mammals were recorded, slightly below the yearly average of 8.9 species. The species assemblages of arboreal mammals have been relatively constant throughout the monitoring period as Brown Antechinus, Sugar Glider and Common Brushtail Possum have been recorded every year.

The nMDS analysis of terrestrial mammals (**Figure 14**) indicates variation in species assemblages with no clear pattern. This may be attributed to the detectability of species, for example the Short-beaked Echidna (*Tachyglossus aculeatus*) was recorded in 2014 and 2019 only. This species is somewhat secretive and could easily go undetected despite its presence within the BCA.

Bat species assemblages have remained stable over the years, any variations do not fit a clear pattern. The ecology of most Australian bat species is poorly understood making interpretation difficult. The number of species detected each year has remained high which is a positive sign that bats are not in a decline. In 2018 and 2019 a difference is evident in the nMDS analysis from the rest of the other years, this is likely a result of the variation of species detected compared to earlier years. In 202 the nMDS analysis showed that the species assemblages had returned to more similar levels before the 2018 and 2019 periods. This has continued in 2021, with the most similar assemblage being 2008.

The cluster analysis identified a trend in the bird species assemblages. The assemblages recorded in the most recent years being most different from those recorded prior to 2013. To investigate the cause of the changing species assemblage, species were grouped according to general habitat preference (generalist, forest-interior specialist and forest edge specialist). With the addition of the 2017 - 2020 time period, trends indicate that the species with generalist habitat requirements have remained relatively stable since from 2005 to 2016 with an increase of three species. Species that prefer forest edges or open areas have decreased since the 2013-2016 period where previously they had increased. While interior specialist species appeared to be significantly decreasing at the end of the 2013-2016 period (Kleinfelder 2016), in the latest period there has been an increase in numbers. This latest four-year period shows that there are fluctuations within the edge/open and interior species throughout the years with generalist species slowly increasing each period.

Given that mining ceased in 2012 it is possible that changes in disturbance have led specialist species to move in or out of the area. Observed changes in species assemblages over the last four-years show that interior species have moved back into the area with edge/open area species moving out. The change in the bird species assemblage may fluctuate slowly occurring over time as a result of mining activities or due to large-scale vegetation clearing and development in the neighbouring industrial estate immediately to the east, which commenced in 2012 and is still ongoing.

The creation of more edge habitat along the eastern edge of the BCA may have made the habitat less suitable for some specialist species or detectability of these species may have been lower. It is most likely a combination of these two factors that has caused the changes observed in the 2021 analysis. The specialist species either the interior or edge that were recorded pre-2012 but not post-2012 may still be present within the BCA but might have experienced population decline, reducing their detectability. These increases and declines in species

assemblages cannot be explained by any single factor but could be linked to many factors such as the closing of the mine in 2012, clearing of habitat in 2012 on the eastern boundary, the introduction of noise generated by industry on the eastern boundary, natural fluctuations of species numbers, climatic conditions over each time period or detectability of some species within the BCA may all be factors.

With the cessation of the open-cut mine and the continued maturation of the adjacent rehabilitation area, these species may return or recover to previous population levels. This observed change in species composition may also be due to natural fluctuations either locally or regionally and not be related to mining activities.

The threatened Powerful Owl was detected during the 2021 surveys, despite having not been detected in 2020. Prior to 2020, it had been recorded for three consecutive years (2017-2019) within multiple locations (Quadrat 3, 6 and 8). Given that the species has been recorded for five consecutive years, this would suggest that there is a roosting location nearby. This was supported in 2015 when regurgitated pellets were found around the base of a tree where a Masked Owl was observed. The Sooty Owl has rarely been observed over the survey period with the last detection in 2001 (Quadrat 2) and in 2016 (Quadrat 3). The Masked Owl, however, has been more regularly detected with sightings in 2014, 2015, 2016, 2017 and 2018 but has not been sighted in the last three years.

The cluster analysis of the all fauna identified within the BCA determined that the 2021 assemblage was significantly different to previous years. Both the flora and fauna surveys were conducted over a longer period for the 2021 event, extending into early April 2022. Having a later survey period occurring into late autumn may have influenced the assemblage of fauna in the BCA, which could explain why it is significantly different from all previous years. Many generalist bird species that have been identified in the BCA throughout the monitoring program were absent in 2021, perhaps due to seasonality. The prolonged survey period may also have impacted the overall richness of fauna identified during the 2021 surveys. This may potentially account for the below average richness amongst most fauna classes.

4.3 NEST BOXES

The usage rate of nest boxes (percentage of available nest boxes showing signs of usage) by fauna increased in a linear fashion for the first five years following installation, after which, usage plateaued, followed by a decline. This pattern of nest box usage after five years of deployment has been observed in several other nest box monitoring programs in native forest (Kleinfelder 2015; Lindenmayer *et al*. 2009). For the first few years after installation, reasonable levels of nest box use were recorded. This was followed by high levels of nest box attrition after 8-10 years. These findings led to the suggestion of an ‘effective occupancy time’ of approximately five years for arboreal mammals. That is, the materials used in current nest box designs have a lifespan of only 8 – 10 years before they reach a point of decay where arboreal fauna no longer use them.

Another explanation for the rapid rise in nest box use, followed by a plateau and subsequent decrease could be due to the installation of new nest boxes as those installed in 2005 began to deteriorate as materials aged. Several nest box repair and replacement events have occurred since 2005 including the replacing of boxes in 2021. Although nest box utilisation is calculated based on the number of available nest boxes, this does not discount the fact that new nest boxes are not inhabited immediately and take time for fauna to take residence. Similar to the trends experienced for those nest boxes installed in 2005, it may take up to 3-4 years for new nest boxes to reach ~50% utilisation and about eight years for nest boxes to reach peak occupancy.

The current survey demonstrates a plateau after the decline of unusable nest boxes with levels similar to 2020 in Winter, prior to the removal of several damaged boxes. As outlined above, the utilisation drop in Summer is likely attributed to the replacement of these boxes and the delayed onset of utilisation. Given that previous trends indicate that nest box utilisation is often low for boxes less than 5 years old, it could be expected that future monitoring may show a considerable increase in utilisation (as a large number of boxes will now have been installed for 4-5 years). For the first time since 2018, the number of available boxes is at 100%. Ongoing maintenance (fixing broken lids and hinges and removal of undesirable species such as termites and wasps) and replacement of broken boxes is required to ensure the ongoing success of the nest box program within the Donaldson BCA.

5 CONCLUSION

The monitoring program indicates that the Donaldson Coal operations are causing minimal impact to biodiversity within the BCA. This conclusion is based on the summary of information provided below:

- All biomass variables examined (i.e. basal area, height, FPC and stand volume), have shown relatively consistent increases over the last 19 years since the baseline survey in 2001. The regression analyses also confirmed that the relationship between time and increases in stand volume were highly significant indicating that the community biomass has increased substantially across time with no significant year-to-year variation from 2001 to 2021. The rate of increase in both biomass parameters has slowed since 2010, with slight decreases in FPC at most quadrats since 2011. Analysis indicates that FPC may be stabilising at levels lower than the highest levels recorded during the 2012 and 2013 survey periods. Most quadrats have recorded an increase in FPC since 2020, however future surveys and analysis should reveal whether FPC is stabilising.
- Overall plant species numbers have increased since 2001 as have all floristic structural components which is indicative of a dynamic plant community with high recruitment from the seed pool, normally an indicator of healthy, regenerating plant community status. Results from the current survey indicate recovery in floristics and structural components following the return of more favourable climatic conditions and end of the drought.
- The total number of fauna species recorded during the monitoring surveys has remained relatively constant over the 20 years since monitoring began. There has been a general increase in the total number of species recorded since the cessation of mining in 2012.
- The number of mammal species recorded has remained constant. There has been some variation in the species assemblages over time, which is likely due to species detectability and their ecology.
- The number of bird species recorded each year for those with generalist habitat preferences remained relatively constant over the monitoring period. Between 2017 – 2021, the number of species that prefer the forest-interior have increased; the number of forest edge specialists have decreased. In recent years, there has been a shift in species assemblages with respect to birds with habitat specialisation. This trend will be investigated further in 2024 (year 24 of monitoring).
- Nest box monitoring shows that fauna utilisation increased from the year of installation (2005) to 2012 and then decreased. A decrease in fauna utilisation following the 2012 monitoring event is likely to be due to weather damage, which makes the nest boxes less habitable. The replacement of damaged boxes occurred in Winter 2018 which has reduced the downward trend of utilisation due uninhabitable boxes. It is expected that nest boxes installed in 2018 will become more suitable over the coming years as arboreal fauna become more habituated. Boxes replaced in 2021 have likely lead to a temporary reduction of utilisation, however this expected to increase as fauna colonise the new boxes.

6 RECOMENDATIONS

The following recommendations are considered necessary to maintain biodiversity values within the BCA:

- Monitoring should continue so that trends evident in the first 20 years may be better understood.
- Nest boxes should continue to be monitored biannually. Any deteriorating boxes identified in the future should be replaced.
- Extensive weed control should be carried out, targeting *L. camara* is recommended in areas with dense infestations. This should be conducted by a suitably qualified bush regenerator.
- The monitoring program indicates that the Donaldson Coal operations are causing minimal impact to biodiversity within the BCA; however, further monitoring will be required to assess accumulative impacts on biodiversity caused by other direct impacts and indirect pressures. This will elucidate the effects of confounding factors such as the impacts of residential development at the eastern edge of the BCA from 2012 and determine the influence of climate change and seasonal variation. Future years of monitoring should continue to analyse the diversity of specialist and generalist species separately and should focus on abundance trends of sensitive flora and fauna species, including threatened species.

7 REFERENCES

Barker Harle 2001, *Donaldson open-cut coal mine Beresfield, Quadrat monitoring program baseline report, September-October 2001*, Barker Harle Pty Limited Report to Donaldson Coal.

Clarke, KR and Gorley, RN 2006, Primer v6: User Manual/Tutorial. Primer-E, Plymouth.

Ecobiological 2004, *Donaldson Open-cut Coal Mine Beresfield, Annual Flora and Fauna Monitoring*, EcoBiological Survey & Assessment, Gateshead, NSW.ecobiological 2007, *Donaldson Open-cut Coal Mine Beresfield, Flora and Fauna Management Plan, Revision March 2007*, EcoBiological Survey & Assessment, Gateshead, NSW.

Gunninah 2000, *Donaldson Open-cut Mine Beresfield, Flora and Fauna Management Plan*, Gunninah Environmental Consultants, Crows Nest.

Harden, GJ (ed) 1992, *Flora of New South Wales Volume 3*, NSW University Press, Sydney.

Harden, GJ (ed) 1993, *Flora of New South Wales Volume 4,* NSW University Press, Sydney.

Harden, GJ (ed) 2000, *Flora of New South Wales Volume 1*, NSW University Press, Sydney.

Harden, GJ (ed) 2002 *Flora of New South Wales Volume 2,* NSW University Press, Sydney.

Krebs, CJ 1999, *Ecological Methodology,* Benjamin/Cummings, Menlo Park, CA.

Le Brocque, AF and Buckney, RT 1997, Multivariate Relationships between Floristic Composition and Stand Structure in Vegetation of Ku-ring-gai Chase National Park, New South Wales, *Australian Journal of Botany* **45**, pp 1033-1044.

Lindenmayer DB, Welsh A, Donnelly C, Crane M, Michael D, Macgregor C, McBurney L, Montague-Drake R and Gibbons P, 2009. Are nest boxes a viable alternative source of cavities for hollow-dependent animals? Long-term monitoring of nest box occupancy, pest use and attrition, *Biological Conservation*, 142: 33-42.

NSW NPWS 2000. *Vegetation Survey, Classification and Mapping Lower Hunter and Central Coast Region Version 1.2*, A project undertaken for The Lower Hunter and Central Coast Regional Environment Management Strategy CRA Unit Sydney Zone, NSW National Parks and Wildlife Service.

Specht, RL 1981, Foliage Projective Cover and Standing Biomass, In '*Vegetation Classification in Australia'* (Eds AN Gillison and DJ Anderson.) pp 10-21 (CSIRO-ANU Press, Canberra).

Specht, RL 1983, Foliage projective covers of overstorey and understorey strata of mature vegetation in Australia, *Australian Journal of Ecology* 8, pp 433-439.

Specht, RL & Specht, A 1999, *Australian Plant Communities, Dynamics of Structure, Growth and Biodiversity*, Oxford University Press.

Specht, RL & Specht, A 2002, *Australian Plant Communities, Dynamics of Structure, Growth and Biodiversity 2nd Edition*, Oxford University Press.

Winkworth, RE & Goodall, DW 1962 A Crosswire Sighting Tube for Point Quadrat Analyses, *Ecology* 43, pp 342-343.

APPENDIX A TOTAL FOLIAGE PROJECTION COVER 2001 (BASELINE) (2003 FOR Q9), 2007, 2015, 2016, 2017, 2018, 2019, 2020 AND 2021

Q1	2001	2007	2015	2016	2017	2018	2019	2020	2021
Ground cover	8.40%	10.20%	20.00%	20.00%	20.00%	20.00%	5.00%	5.00%	5.00%
Shrubs to 2m	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Overstorey	150.44%	166.72%	205.49%	198.86%	201.75%	214.21%	199.80%	164.45%	164.00%
Total FPC	**158.83%**	**176.92%**	**225.49%**	**218.86%**	**221.75%**	**234.21%**	**204.80%**	**169.45%**	**169.00%**
Q2	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	36.21%	70.00%	65.00%	60.00%	65.00%	55.00%	30.00%	70.00%	70.00%
Shrubs to 2m	7.96%	9.37%	10.31%	11.87%	8.08%	8.74%	9.45%	5.18%	4.95%
Overstorey	181.59%	288.10%	301.56%	300.65%	281.86%	328.71%	317.12%	247.70%	242.45%
Total FPC	**225.76%**	**367.48%**	**376.86%**	**372.52%**	**354.94%**	**392.45%**	**356.57%**	**322.88%**	**317.40%**
Q3	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	28.95%	60.00%	65.00%	65.00%	30.00%	30.00%	15.00%	15.00%	25.00%
Shrubs to 2m	33.65%	62.96%	61.81%	48.16%	42.92%	45.29%	35.43%	25.45%	21.53%
Overstorey	125.30%	215.67%	209.53%	199.57%	188.35%	213.86%	221.28%	182.85%	195.58%
Total FPC	**187.90%**	**338.62%**	**336.34%**	**312.73%**	**261.28%**	**289.15%**	**271.71%**	**223.30%**	**242.10%**
Q4	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	53.41%	40.00%	70.00%	70.00%	75.00%	75.00%	35.00%	75.00%	80.00%
Shrubs to 2m	0.00%	23.56%	37.69%	22.90%	18.29%	14.22%	8.77%	7.83%	7.00%
Overstorey	113.78%	155.08%	158.74%	154.09%	157.75%	173.97%	174.75%	167.55%	161.75%
Total FPC	**167.19%**	**218.63%**	**266.43%**	**246.99%**	**251.04%**	**263.20%**	**218.52%**	**250.38%**	**248.75%**
Q5	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	81.73%	80.00%	80.00%	80.00%	75.00%	75.00%	35.00%	45.00%	80.00%
Shrubs to 2m	10.00%	1.27%	1.64%	1.87%	1.14%	1.14%	1.12%	1.13%	1.03%

Overstorey	107.75%	172.51%	202.07%	186.35%	186.79%	202.22%	185.48%	186.78%	183.68%
Total FPC	**199.48%**	**253.78%**	**283.71%**	**268.22%**	**262.93%**	**278.36%**	**221.60%**	**232.90%**	**264.70%**
Q6	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	24.31%	80.00%	90.00%	90.00%	90.00%	90.00%	55.00%	55.00%	95.00%
Shrubs to 2m	49.54%	4.19%	3.64%	3.01%	4.26%	4.26%	4.79%	1.88%	1.85%
Overstorey	152.61%	225.19%	247.91%	242.57%	229.52%	278.17%	258.17%	221.23%	197.43%
Total FPC	**278.95%**	**309.38%**	**341.54%**	**335.58%**	**323.78%**	**372.43%**	**317.96%**	**278.10%**	**294.28%**
Q7	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	89.01%	80.00%	80.00%	80.00%	80.00%	85.00%	20.00%	80.00%	85.00%
Shrubs to 2m	20.27%	31.62%	39.29%	36.75%	37.54%	38.54%	38.54%	38.54%	28.90%
Overstorey	101.60%	196.31%	258.56%	238.00%	228.19%	270.12%	272.43%	226.80%	223.93%
Total FPC	**210.88%**	**307.93%**	**377.85%**	**354.75%**	**345.73%**	**393.66%**	**330.97%**	**345.34%**	**337.83%**
Q8	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	85.38%	50.00%	80.00%	80.00%	80.00%	80.00%	35.00%	80.00%	85.00%
Shrubs to 2m	11.00%	23.24%	25.90%	22.03%	20.13%	24.22%	21.40%	16.98%	19.13%
Overstorey	93.53%	157.44%	178.55%	171.43%	167.50%	198.53%	188.40%	164.48%	142.98%
Total FPC	**189.91%**	**230.67%**	**284.45%**	**273.46%**	**267.63%**	**302.74%**	**244.80%**	**261.45%**	**247.10%**
Q9	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Ground cover	87.56%	75.00%	85.00%	85.00%	80.00%	80.00%	50.00%	80.00%	95.00%
Shrubs to 2m	9.52%	14.43%	22.81%	24.19%	14.06%	12.85%	14.54%	3.60%	0.00%
Overstorey	93.75%	130.05%	162.61%	161.27%	161.05%	166.02%	161.46%	167.13%	165.00%
Total FPC	**190.83%**	**219.48%**	**270.42%**	**270.46%**	**255.11%**	**258.87%**	**226.00%**	**250.73%**	**260.00%**

APPENDIX B TOTAL TREE BASAL AREAS FROM 2001 (BASELINE) (2003 FOR Q9), 2007, 2015, 2016, 2017, 2018, 2019, 2020 AND 2021

Q1	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Angophora costata	0.241	24.80 %	0.258	24.09 %	0.254	22.15 %	0.252	21.78 %	0.252	21.50 %	0.252	21.35 %	0.252	21.35 %	0.254	21.47 %	0.000	0.00%
Corymbia maculata	0.293	30.13 %	0.313	29.29 %	0.337	29.46 %	0.337	29.14 %	0.343	29.26 %	0.345	29.24 %	0.350	29.67 %	0.353	29.92 %	0.344	35.71%
Eucalyptus resinifera	0.228	23.45 %	0.240	22.41 %	0.248	21.70 %	0.252	21.76 %	0.253	21.58 %	0.253	21.43 %	0.261	22.07 %	0.262	22.17 %	0.271	28.05%
Eucalyptus umbra	0.044	4.56%	0.050	4.70%	0.060	5.20%	0.059	5.08%	0.063	5.37%	0.064	5.46%	0.066	5.58%	0.069	5.83%	0.072	7.44%
Syncarpia glomulifera	0.166	17.07 %	0.209	19.51 %	0.246	21.49 %	0.257	22.24 %	0.261	22.29 %	0.266	22.52 %	0.269	22.81 %	0.266	22.54 %	0.278	28.80%
TOTAL BA (m³/ha)	**0.971**		**1.070**		**1.14**		**1.158**		**1.173**		**1.181**		**1.199**		**1.204**		**0.965**	

Q2	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Backhousia myrtifolia	0.349	19.71 %	0.362	18.37 %	0.165	8.66%	0.166	8.64%	0.168	9.01%	0.172	9.17%	0.186	9.92%	0.186	9.97%	0.115	6.06%
Corymbia maculata	0.287	16.18 %	0.342	17.39 %	0.380	20.00 %	0.389	20.24 %	0.387	20.76 %	0.390	20.82 %	0.387	20.69 %	0.385	20.58 %	0.415	21.94%
Cryptocarya microneura	0.064	3.64%	0.077	3.90%	0.088	4.62%	0.095	4.92%	0.096	5.16%	0.096	5.14%	0.096	5.14%	0.096	5.15%	0.089	4.72%
Eucalyptus acmenoides	0.467	26.37 %	0.531	26.96 %	0.597	31.40 %	0.626	32.58 %	0.624	33.43 %	0.624	33.32 %	0.609	32.52 %	0.612	32.72 %	0.681	35.97%
Eucalyptus siderophloia	0.038	2.15%	0.044	2.24%	0.047	2.48%	0.050	2.59%	0.048	2.59%	0.048	2.59%	0.050	2.65%	0.047	2.52%	0.048	2.56%
Glochidion ferdinandi	0.064	3.63%	0.076	3.85%	0.075	3.92%	0.077	4.01%	0.025	1.32%	0.025	1.31%	0.024	1.30%	0.025	1.32%	0.013	0.69%
Hymenosporum flavum	0.022	1.21%	0.028	1.43%	0.030	1.56%	0.030	1.57%	0.030	1.59%	0.030	1.58%	0.030	1.58%	0.030	1.58%	0.029	1.54%
Melaleuca styphelioides	0.387	21.85 %	0.398	20.20 %	0.410	21.57 %	0.375	19.54 %	0.374	20.06 %	0.374	19.99 %	0.374	19.98 %	0.372	19.90 %	0.376	19.86%
Melicope micrococca	0.013	0.74%	0.014	0.70%	0.012	0.64%	0.013	0.66%	0.013	0.68%	0.013	0.68%	0.012	0.65%	0.013	0.72%	0.013	0.71%
Syncarpia glomulifera	0.080	4.52%	0.097	4.95%	0.098	5.16%	0.101	5.25%	0.101	5.40%	0.101	5.39%	0.103	5.49%	0.104	5.54%	0.113	5.95%
TOTAL BA (m³/ha)	**1.772**		**1.968**		**1.90**		**1.920**		**1.866**		**1.872**		**1.871**		**1.870**		**1.893**	

Q1	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Q3	**2001**		**2007**		**2015**		**2016**		**2017**		**2018**		**2019**		**2020**		**2021**	
Acacia fimbriata	0.0069	0.65%	0.012	0.93%	0.00	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.002	0.05%	0.002	0.13%	0.002	0.11%
Acacia linifolia	0.0122	1.14%	0.000	0.00%	0.00	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%			0.000	0.00%	0.000	0.00%
Allocasuarina torulosa	0.0113	1.06%	0.031	2.27%	0.05	3.26%	0.044	2.81%	0.086	5.37%	0.038	1.35%	0.038	1.34%	0.037	3.17%	0.037	2.40%
Angophora costata	0.0690	6.45%	0.073	5.43%	0.08	5.22%	0.080	5.16%	0.081	5.08%	0.083	2.89%	0.082	2.86%	0.082	5.15%	0.087	5.55%
Callistemon salignus	0.0315	2.95%	0.054	3.98%	0.06	4.23%	0.067	4.33%	0.069	4.33%	0.069	2.42%	0.069	2.43%	0.068	5.77%	0.071	4.54%
Corymbia maculata													0.000	0.00%	0.000	0.00%	0.000	0.02%
Corymbia gummifera	0.0709	6.63%	0.084	6.24%	0.09	5.95%	0.095	6.16%	0.096	6.04%	0.100	3.50%	0.101	3.52%	0.101	8.56%	0.108	6.94%
Eucalyptus fibrosa	0.2443	22.86%	0.264	19.62%	0.30	19.97%	0.3026	19.51%	0.3073	19.26%	0.3088	10.81%	0.3120	10.91%	0.0032	0.27%	0.322	20.62%
Eucalyptus umbra	0.1288	12.05%	0.148	11.04%	0.17	11.62%	0.181	11.67%	0.185	11.59%	0.195	6.82%	0.199	6.98%	0.198	16.77%	0.208	13.33%
Melaleuca styphelioides	0.0237	2.22%	0.057	4.28%	0.05	3.19%	0.053	3.41%	0.051	3.20%	0.054	1.90%	0.053	1.85%	0.052	4.40%	0.057	3.66%
Syncarpia glomulifera	0.4702	44.00%	0.618	46.01%	0.68	45.65%	0.707	45.58%	0.699	43.79%	1.986	69.50%	0.720	25.20%	0.620	52.57%	0.651	41.73%
Glochidion ferdinandi			0.003	0.19%	0.01	0.92%	0.021	1.38%	0.021	1.34%	0.024	0.83%	0.020	0.71%	0.016	1.38%	0.017	1.11%
TOTAL BA (m³/ha)	**1.069**		**1.343**		**1.50**		**1.551**		**1.595**		**2.858**		**1.597**		**1.179**		**1.559**	
Q4	**2001**		**2007**		**2015**		**2016**		**2017**		**2018**		**2018**		**2020**		**2021**	
Corymbia maculata	0.110	8.72%	0.118	8.07%	0.12	8.11%	0.126	8.05%	0.125	8.04%	0.128	8.08%	0.128	8.11%	0.133	8.49%	0.140	8.63%
Eucalyptus acmenoides	0.341	26.94%	0.454	31.14%	0.47	30.89%	0.487	31.11%	0.468	30.13%	0.477	30.22%	0.485	30.75%	0.481	30.78%	0.483	29.92%

Q1	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Eucalyptus fibrosa	0.813	64.34 %	0.886	60.78 %	0.93	61.00 %	0.952	60.84 %	0.961	61.84 %	0.973	61.69 %	0.992	62.90 %	0.948	60.73 %	0.993	61.45%
TOTAL BA (m³/ha)	**1.264**		**1.458**		**1.52**		**1.565**		**1.554**		**1.578**		**1.605**		**1.562**		**1.616**	

Q5	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Corymbia maculata	0.167	13.22 %	0.212989	14.54 %	0.23	14.62 %	0.238	15.18 %	0.226	14.30 %	0.230	14.32 %	0.233	14.51 %	0.239	15.49 %	0.248	15.11%
Eucalyptus acmenoides	0.496	39.25 %	0.565672	38.63 %	0.61	39.02 %	0.611	39.08 %	0.620	39.26 %	0.621	38.67 %	0.614	38.24 %	0.601	39.06 %	0.644	39.21%
Eucalyptus siderophloia	0.423	33.44 %	0.478676	32.69 %	0.49	31.45 %	0.496	31.72 %	0.505	32.00 %	0.520	32.35 %	0.503	31.34 %	0.485	31.51 %	0.509	31.01%
Syncarpia glomulifera	0.178	14.08 %	0.207098	14.14 %	0.23	14.92 %	0.219	14.02 %	0.228	14.44 %	0.236	14.66 %	0.253	15.72 %	0.215	13.94 %	0.241	14.67%
TOTAL BA (m³/ha)	**1.264**		**1.464**		**1.55**		**1.564**		**1.578**		**1.606**		**1.603**		**1.540**		**1.643**	

Q6	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Allocasuarina torulosa	0.042	1.86%	0.045	1.89%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%			0.000	0.00%	0.000	0.000%
Backhousia myrtifolia	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.001	0.03%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.000%
Claoxylon australe	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.003	0.12%	0.004	0.14%	0.004	0.19%	0.001	0.02%	0.001	0.021%
Cryptocarya microneura	0.090	3.95%	0.116	4.83%	0.150	5.90%	0.158	6.14%	0.163	6.24%	0.168	6.83%	0.168	7.50%	0.230	8.76%	0.241	8.740%
Eucalyptus acmenoides	0.539	23.66 %	0.545	22.72 %	0.567	22.26 %	0.566	22.04 %	0.575	21.98 %	0.576	23.49 %	0.576	25.74 %	0.558	21.29 %	0.578	21.001 %
Eucalyptus grandis	0.933	40.98 %	1.061	44.25 %	1.140	44.79 %	1.158	45.05 %	1.179	45.02 %	1.187	48.41 %	1.012	45.20 %	1.200	45.77 %	1.268	46.045 %
Ficus fraseri	0.007	0.29%	0.010	0.40%	0.011	0.44%	0.012	0.47%	0.011	0.42%	0.011	0.46%	0.003	0.13%	0.000	0.00%	0.000	0.000%
Melaleuca styphelioides	0.018	0.79%	0.019	0.81%	0.020	0.78%	0.020	0.79%	0.022	0.85%	0.023	0.92%	0.022	0.98%	0.021	0.79%	0.024	0.888%
Melicope micrococca	0.038	1.66%	0.042	1.75%	0.050	1.96%	0.051	1.99%	0.055	2.10%	0.056	2.28%	0.056	2.50%	0.055	2.11%	0.060	2.182%
Rhodomyrtus psidioides	0.005	0.22%	0.006	0.25%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%			0.000	0.00%	0.000	0.000%

Q1	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Syncarpia glomulifera	0.606	26.59 %	0.554	23.10 %	0.606	23.81 %	0.603	23.45 %	0.607	23.17 %	0.426	17.37 %	0.381	17.03 %	0.556	21.19 %	0.573	20.812 %
Syzygium oleosum																	0.005	0.181%
Streblus brunonianus					0.002	0.06%	0.002	0.07%	0.002	0.07%	0.002	0.08%	0.016	0.72%	0.002	0.08%	0.004	0.130%
TOTAL BA (m³/ha)	**2.278**		**2.398**		**2.55**		**2.569**		**2.618**		**2.453**		**2.239**		**2.623**		**2.754**	
Q7	**2001**		**2007**		**2015**		**2016**		**2017**		**2018**		**2019**		**2020**		**2021**	
Allocasuarina torulosa	0.046	3.95%	0.053	2.33%	0.058	2.37%	0.058	2.22%	0.058	2.23%	0.061	2.25%	0.061	2.27%	0.060	2.18%	0.076	2.69%
Angophora costata	0.265	22.62 %	0.224	9.85%	0.233	9.57%	0.241	9.29%	0.286	11.06 %	0.289	10.59 %	0.289	10.69 %	0.239	8.61%	0.251 6	8.92%
Corymbia gummifera	0.295	25.21 %	0.712	31.29 %	0.707	29.05 %	0.707	27.21 %	0.638	24.67 %	0.704	25.80 %	0.704	26.08 %	0.703	25.31 %	0.734	26.03%
Eucalyptus acmenoides	0.057	4.83%	0.036	1.58%	0.044	1.80%	0.044	1.68%	0.042	1.61%	0.043	1.56%	0.043	1.58%	0.043	1.53%	0.047	1.67%
Eucalyptus pilularis	0.196	16.75 %	0.210	9.23%	0.233	9.56%	0.255	9.81%	0.246	9.54%	0.252	9.24%	0.255	9.45%	0.258	9.29%	0.255	9.04%
Eucalyptus paniculata	0.033	2.80%	0.037	1.64%	0.033	1.34%	0.033	1.25%	0.000	0.00%	0.000	0.00%	0.000	0.01%	0.000	0.01%	0.000	0.01%
Glochidion ferdinandi	0.028	2.42%	0.679	29.81 %	0.871	35.79 %	1.007	38.74 %	1.078	41.69 %	1.127	41.32 %	1.096	40.60 %	1.246	44.89 %	1.230	43.60%
Melaleuca linariifolia	0.200	17.10 %	0.242	10.64 %	0.160	6.56%	0.155	5.97%	0.136	5.25%	0.146	5.36%	0.146	5.39%	0.144	5.18%	0.140	4.96%
Notelaea longifolia	0.002	0.14%	0.022	0.95%	0.024	0.97%	0.025	0.94%	0.025	0.98%	0.028	1.03%	0.027	1.02%	0.000	0.01%	0.000	0.01%
Syncarpia glomulifera	0.049	4.17%	0.057	2.53%	0.066	2.71%	0.067	2.59%	0.070	2.69%	0.070	2.58%	0.071	2.63%	0.075	2.70%	0.078	2.77%
Clerodendrum tomentosum			0.004	0.15%	0.007	0.28%	0.007	0.28%	0.007	0.28%	0.008	0.29%	0.008	0.29%	0.008	0.29%	0.009	0.31%
TOTAL BA (m³/ha)	**1.171**		**2.277**		**2.43**		**2.598**		**2.585**		**2.729**		**2.699**		**2.775**		**2.820**	
Q8	**2001**		**2007**		**2015**		**2016**		**2017**		**2018**		**2019**		**2020**		**2021**	

Q1	2001		2007		2015		2016		2017		2018		2019		2020		2021	
Corymbia maculata	0.312	24.91 %	0.309	21.57 %	0.337	21.40 %	0.354	23.21 %	0.3450	21.24 %	0.3459	21.30 %	0.3437	21.27 %	0.3531	22.33 %	0.360	22.04%
Eucalyptus siderophloia	0.243	19.34 %	0.263	18.34 %	0.282	17.90 %	0.290	19.01 %	0.285	17.52 %	0.286	17.64 %	0.286	17.71 %	0.294	18.61 %	0.290	17.76%
Eucalyptus fibrosa	0.035	2.80%	0.042	2.96%	0.059	3.74%	0.061	3.99%	0.061	3.75%	0.062	3.80%	0.062	3.81%	0.070	4.45%	0.072	4.40%
Eucalyptus punctata	0.297	23.66 %	0.296	20.68 %	0.306	19.48 %	0.306	20.05 %	0.317	19.53 %	0.317	19.54 %	0.314	19.42 %	0.254	16.07 %	0.260	15.94%
Eucalyptus tereticornis	0.155	12.33 %	0.173	12.11 %	0.202	12.85 %	0.205	13.41 %	0.212	13.08 %	0.210	12.93 %	0.210	13.00 %	0.211	13.31 %	0.239	14.61%
Melaleuca linariifolia	0.152	12.09 %	0.242	16.89 %	0.275	17.47 %	0.195	12.79 %	0.286	17.62 %	0.285	17.52 %	0.282	17.48 %	0.266	16.82 %	0.275	16.86%
Melaleuca styphelioides	0.061	4.88%	0.107	7.45%	0.113	7.15%	0.115	7.54%	0.118	7.26%	0.118	7.27%	0.118	7.30%	0.133	8.42%	0.137	8.41%
TOTAL BA (m³/ha)	**1.254**		**1.432**		**1.57**		**1.527**		**1.624**		**1.624**		**1.616**		**1.581**		**1.634**	

Q9	2003		2007		2015		2016		2017		2018		2019		2020		2021	
Alphitonia excelsa													0.000	0.02%	0.000	0.02%	0.000	0.00%
Angophora costata	0.014	1.49%	0.018	1.72%	0.022	1.92%	0.023	1.82%	0.023	1.77%	0.000	0.00%						
Corymbia maculata	0.288	30.06 %	0.286	28.04 %	0.296	25.87 %	0.376	30.02 %	0.421	32.05 %	0.447	33.81 %	0.453	33.90 %	0.460	34.34 %	0.472	33.79%
Eucalyptus fibrosa	0.279	29.18 %	0.283	27.71 %	0.333	29.17 %	0.346	27.65 %	0.353	26.86 %	0.356	26.92 %	0.360	26.93 %	0.356	26.56 %	0.378	27.05%
Eucalyptus moluccana	0.043	4.52%	0.046	4.54%	0.052	4.56%	0.055	4.41%	0.056	4.24%	0.056	4.26%	0.057	4.29%	0.058	4.35%	0.061	4.33%
Eucalyptus punctata	0.060	6.27%	0.072	7.01%	0.084	7.33%	0.088	7.04%	0.091	6.96%	0.091	6.92%	0.092	6.87%	0.091	6.80%	0.097	6.92%
Eucalyptus umbra	0.273	28.48 %	0.316	30.97 %	0.356	31.14 %	0.364	29.06 %	0.369	28.12 %	0.371	28.09 %	0.374	27.99 %	0.374	27.92 %	0.390	27.91%
TOTAL BA (m³/ha)	**0.958**		**1.020**		**1.14**		**1.25**		**1.31**		**1.32**		**1.34**		**1.34**		**1.40**	

APPENDIX C MEAN TREE HEIGHTS FROM 2001 (BASELINE) (2003 FOR Q9), 2007, 2015, 2016, 2017, 2018, 2019, 2020 AND 2021

Q1	2001	2007	2015	2016	2017	2018	2019	2020	2021
Angophora costata	19.32	20	20.50	21.30	21.80	21.80	21.80	12.00	0.00
Corymbia maculata	20.04	21.18	21.93	21.58	21.35	22.60	22.60	22.60	22.57
Eucalyptus resinifera	18.55	19.27	19.97	20.00	19.53	22.63	22.73	20.97	21.07
Eucalyptus umbra	17.99	17.3	18.70	18.60	18.00	20.70	20.70	20.70	20.70
Syncarpia glomulifera	11.029	11.17	12.46	12.63	12.12	12.81	11.41	12.38	13.19
Average height (m)	**17.386**	**17.785**	**18.712**	**18.822**	**18.560**	**20.108**	**19.848**	**17.728**	**15.505**
Q2	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Backhousia myrtifolia	10.82	8.67	7.55	8.13	7.89	7.62	6.93	6.93	6.94
Corymbia maculata	29.68	29.00	30.25	30.50	31.20	33.25	33.45	33.45	33.45
Cryptocarya microneura	26.06	23.60	23.60	23.90	24.10	24.10	24.00	7.95	19.26
Eucalyptus acmenoides	30.25	30.15	30.70	30.80	30.70	31.30	31.35	31.35	31.45
Eucalyptus siderophloia	22.94	25.20	26.00	26.60	27.10	27.10	27.10	27.10	26.00
Glochidion ferdinandi	8.71	10.12	8.50	10.00	9.17	9.83	8.67	8.67	8.73
Hymenosporum flavum	17.27	18.00	18.70	19.00	18.40	19.00	19.00	19.00	19.00
Melaleuca styphelioides	9.83	12.35	9.70	9.73	9.83	10.57	7.53	7.53	7.40
Melicope micrococca	9.82	9.30	11.00	11.20	10.90	10.90	10.90	10.90	11.00
Syncarpia glomulifera	12.90	13.46	12.22	12.08	11.95	11.23	11.21	11.39	11.14
Average height (m)	**17.827**	**17.985**	**17.822**	**18.194**	**18.124**	**18.490**	**18.015**	**16.427**	**17.437**
Q3	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Acacia fimbriata	6.03	7.80	0.00	0.00	0.00	0.00	4.50	4.50	4.50
Acacia linifolia	7.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Allocasuarina torulosa	6.88	7.25	7.53	7.491	7.200	8.260	7.950	7.620	7.92

Q1	2001	2007	2015	2016	2017	2018	2019	2020	2021
Angophora costata	18.42	17.60	19.40	19.05	19.25	20.45	14.90	15.10	15.30
Callistemon salignus	8.63	10.30	8.45	8.05	7.75	6.97	7.22	7.22	7.25
Corymbia maculata							5.00	5.00	5.00
Corymbia gummifera	11.88	12.30	16.53	15.17	15.30	18.63	18.63	18.67	14.80
Eucalyptus fibrosa	35.93	26.50	28.80	26.20	29.20	29.20	30.40	30.40	30.40
Eucalyptus umbra	11.00	15.15	15.53	15.63	15.68	17.60	17.60	17.60	17.60
Melaleuca styphelioides	6.48	7.92	7.71	7.59	7.43	7.60	6.76	6.76	6.47
Syncarpia glomulifera	12.37	12.52	11.97	11.96	11.81	10.23	10.27	10.08	10.23
Glochidion ferdinandi		8.00	7.25	7.00	6.92	5.26	5.03	4.79	4.72
Average height (m)	**12.496**	**11.395**	**11.197**	**10.739**	**10.958**	**11.291**	**10.689**	**10.645**	**10.349**
Q4	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Corymbia maculata	12.27	14.50	15.39	15.54	15.17	15.20	15.40	15.26	15.46
Eucalyptus acmenoides	14.54	14.38	15.69	15.82	15.52	15.76	14.89	15.11	14.90
Eucalyptus fibrosa	16.21	19.34	20.81	18.53	18.39	20.60	20.75	20.68	20.58
Average height (m)	**14.339**	**16.075**	**17.298**	**16.630**	**16.358**	**17.188**	**17.014**	**17.015**	**16.978**
Q5	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Corymbia maculata	14.94	16.26	17.79	17.93	18.72	16.93	16.93	19.33	17.07
Eucalyptus acmenoides	14.14	13.61	18.08	16.89	16.94	16.49	16.48	16.48	16.36
Eucalyptus siderophloia	16.37	12.96	14.18	14.20	13.59	13.34	13.48	13.48	13.40
Syncarpia glomulifera	9.95	6.90	7.99	8.40	8.46	8.50	8.61	8.08	7.96
Average height (m)	**13.847**	**12.432**	**14.508**	**14.356**	**14.426**	**13.816**	**13.875**	**14.344**	**13.697**
Q6	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**

Q1	2001	2007	2015	2016	2017	2018	2019	2020	2021
Allocasuarina torulosa	16.18	18.00							
Backhousia myrtifolia					5.500	5.500	5.500		
Claoxylon australe					6.500	6.500	6.000	5.500	5.50
Cryptocarya microneura	11.70	12.15	13.43	13.13	11.69	12.26	11.28	10.22	10.25
Eucalyptus acmenoides	21.88	23.45	24.65	24.80	24.20	24.40	24.40	24.40	24.40
Eucalyptus grandis	36.16	37.37	41.63	41.47	41.67	42.33	42.33	42.33	42.33
Ficus fraseri	10.71	9.20	7.30	7.30	6.30	5.40	1.90		
Melaleuca styphelioides	10.22	10.35	9.60	9.60	9.35	9.75	9.75	9.75	9.75
Melicope micrococca	13.70	16.75	10.97	11.10	11.37	11.77	11.77	11.77	12.13
Rhodomyrtus psidioides	7.81	7.35							
Syncarpia glomulifera	16.35	18.67	19.13	19.30	18.93	16.52	16.18	19.40	19.40
Streblus brunonianus			6.50	6.40	6.10	6.10	7.00	7.00	7.00
Syzygium oleosum									8.50
Average height (m)	**16.077**	**17.031**	**16.651**	**16.636**	**14.161**	**14.052**	**13.611**	**11.851**	**11.605**

Q7	2001	2007	2015	2016	2017	2018	2019	2020	2021
Allocasuarina torulosa	12.53	13.15	14.45	14.25	14.00	14.95	14.95	15.00	15.25
Angophora costata	18.73	19.94	21.26	21.80	22.90	23.98	24.58	22.32	22.32
Corymbia gummifera	20.36	22.85	25.05	25.10	25.65	25.95	26.15	26.15	26.15
Eucalyptus acmenoides	11.55	9.33	11.57	12.77	12.33	13.07	12.67	12.67	12.70
Eucalyptus pilularis	29.23	28.10	30.50	30.70	30.70	30.70	31.70	31.80	31.80
Eucalyptus paniculata	17.16	17.10	18.00	18.00			4.90	4.80	4.80
Glochidion ferdinandi	8.63	9.48	10.81	11.13	10.65	10.44	10.06	11.71	10.97

Q1	2001	2007	2015	2016	2017	2018	2019	2020	2021
Melaleuca linariifolia	7.64	8.18	8.94	9.15	9.36	9.88	9.84	9.86	9.91
Notelaea longifolia		6.40	7.10	7.30	6.90	8.30	5.35	2.40	4.60
Syncarpia glomulifera	18.70	16.00	18.00	18.60	18.10	20.00	20.00	20.20	20.20
Clerodendrum tomentosum		8.00	7.35	7.75	8.00	8.75	8.75	8.80	8.90
Average height (m)	**16.057**	**14.411**	**15.730**	**16.050**	**15.859**	**16.601**	**15.358**	**15.065**	**15.236**
Q8	**2001**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Corymbia maculata	13.33	14.29	15.55	15.73	15.56	17.09	17.16	17.15	17.11
Eucalyptus siderophloia	11.33	12.43	11.69	11.36	11.18	11.02	11.18	11.17	11.68
Eucalyptus fibrosa	16.65	19.70	22.40	22.30	22.20	24.50	24.50	24.50	24.50
Eucalyptus punctata	19.44	19.85	23.40	22.30	22.17	19.97	20.50	25.60	25.60
Eucalyptus tereticornis	15.13	11.98	17.30	17.40	16.57	18.60	18.60	18.60	18.73
Melaleuca linariifolia	6.65	7.32	8.96	9.32	8.72	7.29	6.46	6.55	6.51
Melaleuca styphelioides	9.38	12.75	13.65	13.30	13.05	13.60	13.65	13.65	13.75
Average height (m)	**13.129**	**14.045**	**16.135**	**15.959**	**15.634**	**16.009**	**16.007**	**16.746**	**16.840**
Q9	**2003**	**2007**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Alphitonia excelsa							2.50	2.50	
Angophora costata	11.50	14.4	12.50	11.10	11.40	0.00			
Corymbia maculata	12.79	14.8	14.67	12.83	11.79	12.83	12.86	12.46	12.26
Eucalyptus fibrosa	16.09	15.65	14.66	12.30	12.26	12.23	12.39	12.40	11.74
Eucalyptus moluccana	12.53	10.83	10.20	10.33	10.33	9.45	9.45	9.48	8.55
Eucalyptus punctata	17.53	19.6	20.25	20.50	20.55	23.00	23.00	23.00	23.1
Eucalyptus umbra	11.47	12.24	13.14	13.00	12.14	12.25	11.64	12.26	12.30

Q1	2001	2007	2015	2016	2017	2018	2019	2020	2021
Average height (m)	**13.651**	**14.587**	**14.236**	**13.344**	**13.079**	**11.625**	**11.972**	**12.017**	**11.326**

APPENDIX D PLANT SPECIES RECORDED IN THE BASELINE (2001), 2019, 2020 AND 2021 SURVEY EVENTS

A represents the baseline (2001) survey

B represents the 2020 survey

C represents the 2021 survey

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Acanthaceae	*Brunoniella australis*	Blue Trumpet		1	1					2	2		2	2		1	1								1	1		2	2
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		1	1		2	2		2	2	+	1	2		2	2				+	2	2		2	2			
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair Fern	+			+	2	3	+	2	2					1	1		1	1	+	2	3	+	2	2			
Adiantaceae	*Adiantum formosum*	Giant Maidenhair Fern				+	3	3																					
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair Fern					2	2											1	1									
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Poison Rock Fern											1	1	+	2	2							+	1	1		2	2
Adiantaceae	*Pellaea falcata*	Sickle Fern					2	2																					
Anthericaceae	*Arthropodium milleflorum*	Pale Vanilla-lily											1				1											1	1
Anthericaceae	*Caesia parviflora* subsp. *parviflora*																												
Anthericaceae	*Thysanotus tuberosus* subsp. *tuberosus*	Common Fringe-lily																											
Anthericaceae	*Tricoryne simplex*																												
Aphanopetalaceae	*Aphanopetalum resinosum*	Gum Vine					1																						
Apiaceae	*Hydrocotyle peduncularis*																												
Apiaceae	*Hydrocotyle laxiflora*															2	2					2	2						
Apiaceae	*Centella asiatica*	Indian Pennywort																							2	2			
Apocynaceae	*Marsdenia flavescens*	Hairy Milk Vine																											
Apocynaceae	*Marsdenia rostrata*	Common Milk Vine		1	2														2	1									
Apocynaceae	*Marsdenia suaveolens*	Scented Marsdenia																											
Apocynaceae	*Parsonsia straminea*	Common Silkpod				+	1	1		1			1	1				+	1	1									
Apocynaceae	*Tylophora barbata*	Bearded Tylophora								1																			
Araceae	*Gymnostachys anceps*	Settlers Flax		1	1	+	2	2										+	1	1									
Araliaceae	*Polyscias sambucifolia* subsp. *sambucifolia*									1	1											1			1	1		2	2
Arecaceae	*Livistona australis*	Cabbage-tree Palm																											
Asteraceae	**Sonchus asper*	Prickly Sowthistle		2	2																							1	1
Asteraceae	**Facelis retusa*	Annual Trampweed																										1	
Asteraceae	**Ageratina adenophora*	Crofton Weed																		1									
Asteraceae	**Cirsium vulgare*	Spear Thistle																											
Asteraceae	**Conyza* sp.	Fleabane						1								1										1			2
Asteraceae	**Conyza canadensis*						1																						
Asteraceae	**Galinsoga parviflora*	Potato Weed																											
Asteraceae	**Gamochaeta calviceps*	Cudweed																							1				
Asteraceae	**Hypochaeris radicata*	Catsear										1	1		1	1									1	2		1	1
Asteraceae	**Senecio madagascariensis*	Fireweed											1												1				
Asteraceae	*Brachyscome multifida*																												
Asteraceae	*Cassinia* sp.																												1
Asteraceae	*Epaltes australis*	Spreading Nut-heads																											
Asteraceae	*Euchiton sphaericus*																											1	1
Asteraceae	*Lagenophora stipitata*	Blue Bottle-daisy							1	2		2	2		1	1						1		2	2		1	1
Asteraceae	*Olearia nernstii*	Daisy							+		2																		
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood																											
Asteraceae	*Senecio linearifolius*	Fireweed Groundsel																											
Asteraceae	*Sigesbeckia orientalis*	Indian Weed					1								1														
Asteraceae	*Vernonia cinerea* var. *cinerea*												1	1		1	1								2	1		1	
Asteraceae	*Vittadinia cuneata*	Fuzzweed																											
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine		2	2		2	2		1	1	+	2	2					2	2				+	2	2	+	2	2
Blechnaceae	*Blechnum minus*	Soft Water Fern				+																							
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern	+	1		+	3	3										+	2	3		1	1						
Blechnaceae	*Doodia australis*	Common Rasp Fern																+	2										

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell										+																1	
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak							+	3	3							+				1	2						
Celastraceae	*Maytenus silvestris*	Narrow-leaved Orangebark	+	1	1		1		+	1	1	+	2	2		1	1		1		+	1	1					1	1
Clusiaceae	*Hypericum gramineum*	Small St. John's Wort																											
Commelinaceae	**Tradescantia fluminensis*	Wandering Jew																	5	5									
Commelinaceae	*Aneilema acuminatum*						1	1																					
Commelinaceae	*Aneilema biflorum*					+																		+					
Commelinaceae	*Commelina cyanea*	Native Wandering Jew																+	2	1						2			
Convolvulaceae	*Dichondra repens*	Kidney Weed					2	1								2	2					2	1			2			
Convolvulaceae	*Polymeria calycina*											+				1	1				+	2	1	+	1	1	+		
Cyperaceae	**Cyperus eragrostis*																												
Cyperaceae	*Baumea articulata*	Jointed Twig-rush																											
Cyperaceae	*Baumea juncea*																								2	2			
Cyperaceae	*Carex appressa*	Tall Sedge										+	2	2											1	2			
Cyperaceae	*Carex longebrachiata*			1	2	+								1					1	1			1	+					
Cyperaceae	*Cyperus fulvus*	Sticky Sedge																											
Cyperaceae	*Cyperus polystachyos*																												
Cyperaceae	*Cyperus tetraphyllus*							1												1									
Cyperaceae	*Eleocharis cylindrostachys*																												
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge																											
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge					1	1		2	2											3	3						
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge							+												+								
Cyperaceae	*Isolepis inundata*																												
Cyperaceae	*Lepidosperma concavum*				1				+															+					
Cyperaceae	*Lepidosperma laterale*			1						2	2		2	2		1	2					1	1		1	1		2	2
Cyperaceae	*Machaerina rubiginosa*									1																			
Cyperaceae	*Ptilothrix deusta*									2	1																		
Cyperaceae	*Schoenus apogon*																												
Cyperaceae	*Schoenus lepidosperma* subsp. *pachylepis*																												
Cyperaceae	*Schoenus paludosus*																							+					
Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken							+	1	1										+	2	2	+	1	1			
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower											3	3								1				2			
Dilleniaceae	*Hibbertia empetrifolia* subsp. *empetrifolia*		+																										
Dilleniaceae	*Hibbertia obtusifolia*	Hoary guinea flower										+																	
Dilleniaceae	*Hibbertia pedunculata*																											1	
Dilleniaceae	*Hibbertia riparia*	Erect Guinea-flower																											
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower							+	2	2										+		1						
Dioscoreaceae	*Dioscorea transversa*	Native Yam	+			+	2	2								2	2	+	1	1			1						
Ebenaceae	*Diospyros australis*	Black Plum																											
Elaeocarpaceae	*Elaeocarpus* sp.																												
Elaeocarpaceae	*Tetratheca juncea*	Black-eyed Susan							+																				
Ericaceae - Styphelioideae	*Leucopogon juniperinus*	Prickly Beard-heath								1	1		1	2			1					1	1	+	2	2	+	2	2
Ericaceae - Styphelioideae	*Leucopogon lanceolatus*												1	1															
Ericaceae - Styphelioideae	*Lissanthe strigosa* subsp. *strigosa*	Peach Heath																											1
Ericaceae - Styphelioideae	*Styphelia triflora*	Pink Five-Corners		1																					1	1		2	2
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart		2	2																								
Euphorbiaceae	*Alchornea ilicifolia*	Dovewood																											
Euphorbiaceae	*Claoxylon australe*	Brittlewood																+	2	3									
Euphorbiaceae	*Croton verreauxii*	Green Native Cascarilla				+	3	3																					
Eupomatiaceae	*Eupomatia laurina*	Bolwarra																											

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Fabaceae - Faboideae	*Daviesia squarrosa*																												
Fabaceae - Faboideae	*Daviesia ulicifolia*	Gorse Bitter Pea																										1	1
Fabaceae - Faboideae	*Desmodium gunnii*	Slender Tick-trefoil								1			1	1															
Fabaceae - Faboideae	*Desmodium rhytidophyllum*											+									+				1	1			
Fabaceae - Faboideae	*Desmodium varians*	Slender Tick-trefoil																											
Fabaceae - Faboideae	*Dillwynia retorta*																											2	2
Fabaceae - Faboideae	*Glycine clandestina*									2	2		2	2														2	2
Fabaceae - Faboideae	*Glycine microphylla*	Small-leaf Glycine			1											1	1												
Fabaceae - Faboideae	*Glycine tabacina*			2	1											2	2					1	1		2	2		2	2
Fabaceae - Faboideae	*Gompholobium latifolium*	Golden Glory Pea							+																				
Fabaceae - Faboideae	*Hardenbergia violacea*	Purple Coral Pea									1	+	2	2										+		1		1	1
Fabaceae - Faboideae	*Indigofera australis*	Australian Indigo												1															
Fabaceae - Faboideae	*Kennedia rubicunda*	Dusky Coral Pea										+									+								
Fabaceae - Faboideae	*Pultenaea euchila*	Orange Pultenaea																										1	1
Fabaceae - Faboideae	*Pultenaea retusa*	Notched Bush-pea																											
Fabaceae - Faboideae	*Pultenaea spinosa*	Spiny Bush-pea										+	2	2															
Fabaceae - Faboideae	*Pultenaea villosa*	Hairy Bush-pea							+				1														+		
Fabaceae - Mimosoideae	*Acacia decurrens*	Black Wattle													+														
Fabaceae - Mimosoideae	*Acacia elongata*	Swamp Wattle																										2	2
Fabaceae - Mimosoideae	*Acacia falcata*																											1	1
Fabaceae - Mimosoideae	*Acacia fimbriata*	Fringed Wattle							+	1	1	+	3	3															
Fabaceae - Mimosoideae	*Acacia irrorata* subsp. *irrorata*	Green Wattle																											
Fabaceae - Mimosoideae	*Acacia linifolia*	White Wattle							+																		+		
Fabaceae - Mimosoideae	*Acacia myrtifolia*	Red-stemmed Wattle							+																			1	1
Fabaceae - Mimosoideae	*Acacia parvipinnula*	Silver-stemmed Wattle							+							1	1							+	2	2	+	1	1
Fabaceae - Mimosoideae	*Acacia sp.*						1																						
Gentianaceae	**Centaurium erythraea*	Common Centaury																											
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*	Forest Goodenia										+																	
Goodeniaceae	*Goodenia heterophylla* subsp. *heterophylla*									1																			
Goodeniaceae	*Goodenia rotundifolia*												2	2															
Haloragaceae	*Gonocarpus humilis*																							+					
Haloragaceae	*Gonocarpus teucrioides*	Raspwort											1	2											1	2		2	2
Hydrocharitaceae	*Ottelia ovalifolia* subsp. *ovalifolia*	Swamp Lily																											
Hypoxidaceae	*Hypoxis pratensis*	Golden-weather Grass															1												
Iridaceae	*Patersonia sericea*	Silky Purple-flag									1														1				
Juncaceae	**Juncus cognatus*																												
Juncaceae	*Juncus continuus*																												
Juncaceae	*Juncus planifolius*																												
Juncaceae	*Juncus subsecundus*																												
Juncaceae	*Juncus usitatus*																								1				
Juncaginaceae	*#Maundia triglochinoides*																												
Juncaginaceae	*Triglochin procera*																							+	1	1			
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum															1				+	2	2						
Lamiaceae	*Plectranthus parviflorus*																			1									
Lauraceae	**Cinnamomum camphora*	Camphor Laurel																						+					
Lauraceae	*Cassytha glabella*											+	2	2	+	1	2												
Lauraceae	*Cassytha pubescens*																											1	1
Lauraceae	*Cryptocarya microneura*	Murrogun	+	1	2	+	3	3										+	3	3									
Lindsaeaceae	*Lindsaea linearis*	Screw Fern																											
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern								2	2																		
Lobeliaceae	*Isotoma fluviatilis* subsp. *fluviatilis*	Swamp Isotome										+																	
Lobeliaceae	*Lobelia alata*											+																	

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	1				+	2	2	+	2	2	+	2	2			1		2	2	+	2	2	+	2	2
Loganiaceae	*Logania albiflora*																				+								
Loganiaceae	*Logania pusilla*																												
Lomandraceae	*Lomandra confertifolia* subsp. *rubinigosa*	Mat-rush		1						2			2	2															
Lomandraceae	*Lomandra cylindrica*	Needle Mat-Rush																											
Lomandraceae	*Lomandra filiformis* subsp. *coriacea*	Wattle Mat-rush										+	2	2		1	1							+	1	1	+	1	1
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush								2	2					1												2	2
Lomandraceae	*Lomandra glauca*	Pale Mat-rush						1																					
Lomandraceae	*Lomandra longifolia*	Spiny Mattrush	+	2	2	+		1	+	1	1				+	2	2				+	3	3			1	+	2	
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush								2	2		2	2											2	2		1	2
Loranthaceae	*Dendrophthoe vitellina*				1								1	1		1	1											1	1
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry					1	1		1	1		2	2		1	1					1	1		2	2			
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	+	1	2		2	2		1	1	+	2	2		2	2		1	1	+	1	2	+	1	1		1	2
Malvaceae	*Hibiscus heterophyllus* subsp. *heterophyllus*	Native Rosella	+	1	2														2	1									
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine					2													1	+	1	2						
Menispermaceae	*Stephania japonica* var. *discolor*	Snake Vine			1		1	2			2					1	1			1	+	2	2					1	1
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry				+												+											
Monimiaceae	*Palmeria scandens*	Anchor Vine																+											
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea					2	2											2	2									
Moraceae	*Ficus coronata*	Sandpaper Fig		1	1	+	2	2										+											
Moraceae	*Ficus fraseri*	Sandpaper Fig																	1	1									
Moraceae	*Streblus brunonianus*	Whalebone Tree																+	1	1									
Myrsinaceae	*Embelia australiana*																												
Myrsinaceae	*Myrsine variabilis*	Muttonwood	+	2	2			1	+	3	3					1	1		1	1	+	1	1						
Myrtaceae	*Acmena smithii*	Lilly Pilly																+											
Myrtaceae	*Angophora costata*	Smooth-barked Apple		3	3				+	3	3										+	4	3				+		
Myrtaceae	*Angophora leiocarpa*	Smooth-barked Apple	+																										
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	+	6	6	+	4	4										+	1	1									
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	+						+	3	3																		
Myrtaceae	*Corymbia gummifera*	Red Bloodwood							+	3	3										+		3						
Myrtaceae	*Corymbia maculata*	Spotted Gum	+	4	4	+	3	3			1	+	4	4	+	4	4							+	3	3	+	3	3
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany				+	4	4				+	3	3	+	5	5	+	3	3		1	1						
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark																											
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark							+	3	3	+	4	4											2	2	+	3	3
Myrtaceae	*Eucalyptus grandis*	Flooded Gum																+	4	4									
Myrtaceae	*Eucalyptus moluccana*	Grey Box																										2	2
Myrtaceae	*Eucalyptus paniculata* subsp. *paniculata*	Grey Ironbark																				1		+					
Myrtaceae	*Eucalyptus pilularis*	Blackbutt																			+	4	3						
Myrtaceae	*Eucalyptus punctata*	Grey Gum																	1	1				+	3	3	+	2	2
Myrtaceae	*Eucalyptus resinifera* subsp. *resinifera*	Red Mahogany	+	3	3																								
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum																+											
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark				+	3	3							+	4	4								3	3	+		
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum																						+	3	2			
Myrtaceae	*Eucalyptus umbra*	Broad-leaved White Mahogany	+	2	2				+	3	3											1	1				+	4	4
Myrtaceae	*Leptospermum polygalifolium* subsp. *polygalifolium*	Tantoon	+						+	2	2										+	1	1	+	3	3			
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark																			+	3	3	+	3	3			
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea tree				+	2	2	+	3	3							+	3	2	+			+	3	3			
Myrtaceae	*Rhodomyrtus psidioides*	Native Guava																+											
Myrtaceae	*Sannantha pluriflora*																												
Myrtaceae	*Sannantha similis*			2	2																								
Myrtaceae	*Syncarpia glomulifera*	Turpentine	+	4	4	+	3	3	+	5	5				+	4	4	+	4	4		2								
Myrtaceae	*Syzygium oleosum*	Blue Lilly Pilly																	1	1									

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Ochnaceae	**Ochna serrulata*	Mickey Mouse Plant																				1	1						
Oleaceae	*Notelaea longifolia* forma. *intermedia*	Large Mock-olive		1	2		2	2		1	1	+				1	1		2	2	+				1	2		2	2
Oleaceae	*Notelaea venosa*	Mock Olive											3	3				+				3	2						
Orchidaceae	*Acianthus fornicatus*	Pixie Caps							+																				
Orchidaceae	*Acianthus sp.*																									2			
Orchidaceae	*Caladenia catenata*	White Caladenia							+						+														
Orchidaceae	*Calochilus robertsonii*	Purplish Beard Orchid																										1	
Orchidaceae	*Chiloglottis trapeziformis*	Broad-lip Bird Orchid														1	1						1						
Orchidaceae	*Chiloglottis sp.*													1															
Orchidaceae	*Cymbidium suave*	Snake Orchid																											
Orchidaceae	*Epipogium roseum*	Drooping Orchid																											
Orchidaceae	*Plectorrhiza tridentata*	Tangle Orchid				+																							
Orchidaceae	*Pterostylis curta*	Blunt Greenhood													+														
Orchidaceae	*Pterostylis nutans*	Nodding Greenhood	+						+			+												+					
Orchidaceae	*Pterostylis sp.*										1																		
Oxalidaceae	*Oxalis exilis*												2												2				
Oxalidaceae	*Oxalis perennans*			1						1						1						2					2	2
Passifloraceae	*Passiflora aurantia*	Blunt-leaved Passionfruit					1																						
Phormiaceae	*Dianella caerulea* var. *caerulea*	Blue Flax-Lily	+				2	1	+		2	+	2	2	+	2	2				+	2	2		2	2		2	2
Phormiaceae	*Dianella longifolia* var. *longifolia*	Blueberry Lily		1								+																	
Phormiaceae	*Dianella revoluta* var. *revoluta*	Blue Flax-Lily											1																
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	+		2		1	1	+	1	1		1	2		1	2		1	1	+	2	2	+	3	3	+	3	3
Phyllanthaceae	*Glochidion ferdinandi* var. *ferdinandi*	Cheese Tree		1	1	+	3	2	+	3	3					2	2				+	4	4		1	1			1
Phyllanthaceae	*Phyllanthus gunnii*			1																									
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge							+	1	1																		
Phyllanthaceae	*Poranthera microphylla*															2	1								1	1		1	
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	+						+	1	2	+		1		2	2					1					+	2	2
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	Native Blackthorn	+									+	3	3										+	2	2	+	3	2
Pittosporaceae	*Hymenosporum flavum*	Native Frangipani				+	2	2																					
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn				+	1	1										+	2	2									
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum	+				1	2	+	1	1					1	1												
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell		1																									1
Poaceae	**Axonopus fissifolius*	Narrow-leafed Carpet Grass																											
Poaceae	*Anisopogon avenaceus*	Oat Speargrass																											
Poaceae	*Aristida vagans*	Threeawn Speargrass											1			1	1								2	2		3	3
Poaceae	*Austrostipa* sp.																												
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass											1	2														2	3
Poaceae	*Cynodon dactylon*	Couch																						+					
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass											2	2														1	1
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass																								1			
Poaceae	*Digitaria ramularis*																												
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Bushy Hedgehog-grass											2	2		2	2					1			2	2		2	2
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass										+												+					
Poaceae	**Ehrharta erecta*																												
Poaceae	*Entolasia marginata*	Bordered Panic				+													3	3		4	4	+	2	2			
Poaceae	*Entolasia stricta*	Wiry Panic		2	2		2	2		3	3		3	3		3	3					3	3		2	2		3	3
Poaceae	*Eragrostis brownii*	Brown's Lovegrass																											
Poaceae	*Imperata cylindrica*	Bladey Grass	+		1				+	2	2	+	3	3	+	2	3				+	1	1	+	3	3	+	3	3
Poaceae	*Lachnagrostis filiformis*																												
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Grass		1	2		2	2		2	2			1		2	2			1		1	1		3	2		1	2
Poaceae	*Oplismenus aemulus*			2												2	2		3	3	+				2	2			
Poaceae	*Oplismenus imbecillis*				3		3	3		2	2		2	2		3	3		4	4	+	4	4						

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Poaceae	*Ottochloa gracillima*		+																		+								
Poaceae	*Panicum simile*	Two-colour Panic												1											2	2		1	3
Poaceae	*Paspalidium distans*										1						1												
Poaceae	**Paspalum dilatatum*	Paspalum																								1			
Poaceae	*Poa affinis*																												
Poaceae	*Poa labillardierei var. labillardierei*	Tussock Grass									2		3	3											2	2		2	2
Poaceae	*Rytidosperma fulvum*											+	1	1													+	1	1
Poaceae	*Rytidosperma pallidum*	Silvertop Wallaby Grass											3	3														3	3
Poaceae	*Rytidosperma tenuius*																												
Poaceae	*Themeda australis*	Kangaroo Grass	+						+	1	2		3	3		1	1							+			+	4	4
Poaceae	*Urochloa piligera*	Hairy Armgrass																			+								
Polygonaceae	*Persicaria hydropiper*	Water Pepper		1	1																								
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn Fern					1	1																					
Proteaceae	*Grevillea montana*																											2	2
Proteaceae	*Lomatia silaifolia*	Crinkle Bush								1	1																		
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung							+	2	2					1	1								1	1			
Proteaceae	*Stenocarpus salignus*	Scrub Beefwood		1																									
Ranunculaceae	*Clematis glycinoides*	Headache Vine						1		1	2						1			2				+	1	1	+	1	1
Rhamnaceae	*Alphitonia excelsa*	Red Ash		1	1											1	1		1	1		1	1					1	1
Rhamnaceae	*Pomaderris sp.*																												1
Ripogonaceae	*Ripogonum album*	White Supplejack				+	3	3																					
Rosaceae	*Rubus parvifolius*	Native Rasberry																											
Rubiaceae	*Galium propinquum*	Maori Bedstraw											2	2											1	1		1	1
Rubiaceae	*Galium binifolium*															1													
Rubiaceae	*Morinda jasminoides*	Sweet Morinda	+		2	+	1	2			1							+	2	2									
Rubiaceae	*Opercularia aspera*	Coarse Stinkweed																			+						+		
Rubiaceae	*Opercularia diphylla*									1	2		2	1											1	1			1
Rubiaceae	*Pomax umbellata*	Pomax									1																	2	2
Rutaceae	*Acronychia oblongifolia*	White Aspen					1																		1				
Rutaceae	*Boronia polygalifolia*	Dwarf Boronia							+																	1	+	1	
Rutaceae	*Melicope micrococca*	Hairy-leaved Doughwood				+	2	2								1	1	+	3	2									
Rutaceae	*Zieria smithii*	Sandfly Zieria		2	2		1	2	+	3	3										+	1	1						
Sapindaceae	*Alectryon subcinereus*	Native Quince																											
Sapindaceae	*Dodonaea triquetra*	Hop Bush																			+						+		
Smilacaceae	*Smilax australis*	Lawyer Vine	+	1	2		2	2		1									1										
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsaparilla																		1									
Solanaceae	*Duboisia myoporoides*	Corkwood	+																		+	1	1						
Solanaceae	**Solanum nigrum*	Black-berry Nightshade					1																						
Solanaceae	*Solanum prinophyllum*	Forest Nightshade										+		1		1													
Solanaceae	*Solanum mauritianum*	Wild Tobacco Bush														1	1						1			1			
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia																											1
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger-plant																											
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower							+	1	1																		
Ulmaceae	*Trema tomentosa* var. *aspera*	Native Peach																											
Verbenaceae	**Lantana camara*	Lantana				+	1	2	+	1	1			1	+	1	1	+	2	2	+	2	2		2	2		1	1
Violaceae	*Hybanthus stellarioides*															1	1								1	1			
Violaceae	*Viola betonicifolia*	Native Violet															1												
Violaceae	*Viola hederacea*	Ivy-leaved Violet						2																+					
Vitaceae	*Cayratia clematidea*	Native Grape					1	1	+									+	1	1									
Vitaceae	*Cissus antarctica*	Water Vine				+	1	2									1		1	1									
Vitaceae	*Cissus hypoglauca*	Giant Water Vine			2	+													1	2									
Xanthorrhoeaceae	*Xanthorrhoea latifolia* subsp. *latifolia*	Grass Tree																											

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Xanthorrhoeaceae	*Xanthorrhoea macronema*	Grass Tree							+		1																+	2	2
Zamiaceae	*Macrozamia communis*	Burrawang	+	1	1				+	2	2	+															+		
Zamiaceae	*Macrozamia reducta*												1	2														2	2

* denotes an introduced species

# denotes a species listed on NSW *Biodiversity Conservation Act 2016*.

APPENDIX E MAMMAL SPECIES RECORDED 2001-2021

Species Name	Common Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Arboreal mammals																						
Acrobates pygmaeus	Feathertail Glider	+	+	+	+		+	+	+	+			+		+		+				+	
Antechinus stuartii	Brown Antechinus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Petauroides volans ^	Greater Glider	+	+			+																
Petaurus breviceps	Sugar Glider		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Petaurus norfolcensis #	Squirrel Glider		+		+	+						+										
Pseudocheirus peregrinus	Common Ringtail Possum		+	+	+				+			+		+		+	+				+	
Trichosurus vulpecula	Common Brushtail Possum	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Bats																						
Chalinolobus dwyeri #^	Large-eared Pied Bat							+								+						
Chalinolobus gouldii	Gould's Wattled Bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Chalinolobus morio	Chocolate Wattled Bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Falsistrellus tasmaniensis #	Eastern False Pipistrelle											+	+	+	+	+	+	+	+	+	+	+
Miniopterus australis #	Little Bent-winged Bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Miniopterus orianae oceanensis #	Large Bent-winged Bat		+	+	+	+	+		+	+	+	+	+		+	+	+	+			+	+
Mormopterus norfolkensis #	Eastern Coastal Free-tailed Bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+
Mormopterus ridei	Eastern Freetail-bat	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
Mormopterus spp. 4	Undescribed Freetail-bat																			+		

Species Name	Common Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Myotis macropus #	Southern Myotis	+	+	+	+	+			+	+	+	+	+	+	+	+	+	+		+	+	+
Nyctophilus geoffroyi	Lesser Long-eared Bat														+	+	+	+			+	
Nyctophilus gouldii	Gould's Long-eared Bat												+		+	+	+	+	+		+	
Nyctophilus sp.	Unidentified Long-eared Bat	+	+	+	+		+		+	+	+		+	+	+		+	+	+	+	+	+
Pteropus poliocephalus #	Grey-headed Flying-fox						+		+	+	+	+			+		+		+	+	+	+
Rhinolophus megaphyllus	Eastern Horseshoe Bat				+		+	+		+		+				+		+	+		+	+
Saccolaimus flaviventris #	Yellow-bellied Sheathtail Bat	+	+	+	+		+									+					+	
Scoteanax rueppellii #	Greater Broad-nosed Bat		+	+		+	+	+		+	+	+	+	+	+	+	+			+	+	
Scotorepens balstoni	Inland Broad-nosed Bat			+									+									
Scotorepens orion	Eastern Broad-nosed Bat	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+	+	+	+
Scotorepens sp.	Undescribed Broad-nosed Bat	+	+																			
Tadarida australis	White-striped Mastiff Bat	+	+	+	+	+	+	+	+	+			+		+	+	+	+		+	+	
Vespadelus darlingtoni	Large Forest Bat		+	+					+							+				+	+	+
Vespadelus pumilus	Eastern Forest Bat		+	+			+	+	+	+	+	+	+	+	+		+	+		+	+	+
Vespadelus regulus	Southern Forest Bat							+			+										+	
Vespadelus troughtoni #	Eastern Cave Bat		+	+	+	+							+		+		+				+	
Vespadelus vulturnus	Little Forest Bat	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+

Species Name	Common Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Terrestrial Mammals																						
Lepus europaeus *	Brown Hare		+				+	+		+						+	+					
Macropus giganteus	Eastern Grey Kangaroo		+		+	+	+	+		+	+	+	+	+			+	+	+	+	+	+
Macropus rufogriseus	Red-necked Wallaby						+			+		+	+	+			+				+	
Oryctolagus cuniculus *	European Rabbit												+	+	+	+			+			
Perameles nasuta	Long-nosed Bandicoot		+		+		+			+				+		+	+	+	+			+
Rattus fuscipes	Bush Rat	+	+	+	+	+			+	+	+	+	+		+	+		+	+	+	+	+
Rattus rattus *	Black Rat	+	+	+	+	+	+	+	+	+	+		+	+		+	+	+			+	+
Tachyglossus aculeatus	Short-beaked Echidna														+							
Thylogale thetis	Red-necked Pademelon?										+											
Vulpes vulpes *	Red Fox																+					
Wallabia bicolor	Swamp Wallaby			+	+	+				+	+		+	+	+	+	+	+	+		+	+
Arboreal mammals		4	7	5	6	5	4	4	5	4	3	5	4	4	4	4	5	3	3	2	5	3
Bats		12	17	17	14	12	15	13	14	15	14	13	16	12	17	17	17	15	12	15	22	15
Terrestrial mammals		2	5	3	5	4	5	3	2	7	5	3	6	6	4	6	7	5	5	2	5	5
Total mammals		18	29	25	25	21	24	20	21	26	22	21	26	22	24	27	29	23	20	19	32	23

APPENDIX F BIRD SPECIES RECORDED ACROSS ALL QUADRATS DURING 2001 & 2005-2021 SURVEYS

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Alectura lathami	Australian Brush-turkey														+					
Alisterus scapularis	Australian King-Parrot		+	+		+			+	+	+	+	+	+	+			+		
Cracticus tibicen	Australian Magpie		+		+	+	+	+	+	+	+		+	+	+	+			+	+
Aegotheles cristatus	Australian Owlet-nightjar		+	+		+		+					+	+	+		+			
Corvus coronoides	Australian Raven		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Chenonetta jubata	Australian Wood Duck				+							+	+							
Alcedo azurea	Azure Kingfisher														+					
Geopelia humeralis	Bar-shouldered Dove		+	+	+	+		+	+	+	+	+	+	+		+	+	+	+	
Zoothera lunulata	Bassian Thrush		+																	
Manorina melanophrys	Bell Miner			+	+	+	+	+	+	+	+	+	+	+	+				+	+
Coracina novaehollandiae	Black-faced Cuckoo-shrike		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Monarcha melanopsis	Black-faced Monarch		+		+	+	+	+	+	+	+		+		+	+	+	+	+	
Macropygia amboinensis	Brown Cuckoo-Dove		+		+			+	+	+		+	+	+	+	+	+		+	
Gerygone mouki	Brown Gerygone		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Accipiter fasciatus	Brown Goshawk		+																	
Acanthiza pusilla	Brown Thornbill			+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
Melithreptus brevirostris	Brown-headed Honeyeater		+		+			+	+	+		+			+	+			+	+
Cacomantis variolosus	Brush Cuckoo		+	+		+			+	+		+							+	
Acanthiza reguloides	Buff-rumped Thornbill			+	+															
Scythrops novaehollandiae	Channel-billed Cuckoo			+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	
Anas castanea	Chestnut Teal					+														
Coracina tenuirostris	Cicadabird		+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	
Accipiter cirrocephalus	Collared Sparrowhawk															+				
Phaps chalcoptera	Common Bronzewing			+															+	
Ocyphaps lophotes	Crested Pigeon				+															
Falcunculus frontatus	Crested Shrike-tit		+			+		+	+	+	+									
Platycercus elegans	Crimson Rosella							+		+	+									
Eurystomus orientalis	Dollarbird		+			+	+	+				+		+	+	+		+	+	

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Artamus cyanopterus	Dusky Woodswallow	V		+							+									
Eudynamys orientalis	Eastern Koel			+	+			+	+			+		+	+			+		
Platycercus eximius	Eastern Rosella		+	+	+	+	+	+	+	+	+				+	+	+	+		
Acanthorhynchus tenuirostris	Eastern Spinebill		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Psophodes olivaceus	Eastern Whipbird		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Eopsaltria australis	Eastern Yellow Robin		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cacomantis flabelliformis	Fan-tailed Cuckoo		+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+
Cacatua roseicapilla	Galah				+	+	+	+			+				+					
Calyptorhynchus lathami	Glossy Black-Cockatoo														+				+	
Pachycephala pectoralis	Golden Whistler		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cracticus torquatus	Grey Butcherbird		+	+	+	+	+	+	+	+	+				+	+		+	+	+
Rhipidura fuliginosa	Grey Fantail		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Accipiter novaehollandiae	Grey Goshawk			+	+			+							+					
Colluricincla harmonica	Grey Shrike-thrush		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo		+		+				+											
Microeca fascinans	Jacky Winter			+		+			+											
Dacelo novaeguineae	Laughing Kookaburra		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Myiagra rubecula	Leaden Flycatcher		+	+		+	+	+	+	+	+	+		+	+	+	+		+	+
Meliphaga lewinii	Lewin's Honeyeater		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cacatua sanguinea	Little Corella													+					+	+
Glossopsitta pusilla	Little Lorikeet	V		+		+									+			+	+	+
Grallina cyanoleuca	Magpie-lark					+		+			+							+	+	+
Vanellus miles	Masked Lapwing							+				+								+
Tyto novaehollandiae	Masked Owl	V						+	+				+	+	+	+	+			
Dicaeum hirundinaceum	Mistletoebird			+				+	+	+	+	+	+	+		+		+		+
Glossopsitta concinna	Musk Lorikeet										+								+	
Falco cenchroides	Nankeen Kestrel													+						
Phylidonyris novaehollandiae	New Holland Honeyeater														+	+		+	+	+

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Philemon corniculatus	Noisy Friarbird		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Manorina melanocephala	Noisy Miner					+	+		+		+				+				+	+
Oriolus sagittatus	Olive-backed Oriole		+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+
Aviceda subcristata	Pacific Baza											+			+					
Anas superciliosa	Pacific Black Duck					+								+						
Turnix varius	Painted Button-quail							+												
Geopelia striata	Peaceful Dove						+		+	+							+			
Falco peregrinus	Peregrine Falcon											+			+					+
Centropus phasianinus	Pheasant Coucal													+						
Cracticus nigrogularis	Pied Butcherbird			+	+	+	+		+	+	+	+		+		+	+	+		+
Strepera graculina	Pied Currawong		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Ninox strenua	Powerful Owl	V	+	+	+	+	+		+	+			+	+		+	+	+		+
Trichoglossus haematodus	Rainbow Lorikeet			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Anthochaera carunculata	Red Wattlebird															+	+			+

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Neochmia temporalis	Red-browed Finch		+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	+
Petroica rosea	Rose Robin			+	+	+		+	+		+					+	+			+
Rhipidura rufifrons	Rufous Fantail		+	+		+	+	+	+	+	+	+	+	+		+	+		+	
Pachycephala rufiventris	Rufous Whistler		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
Todiramphus sanctus	Sacred Kingfisher		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ptilonorhynchus violaceus	Satin Bowerbird									+						+	+	+		
Myiagra cyanoleuca	Satin Flycatcher		+					+												
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet						+											+	+	
Myzomela sanguinolenta	Scarlet Honeyeater		+	+	+	+		+	+	+	+	+	+	+	+	+	+		+	+
Chrysococcyx lucidus	Shining-Bronze Cuckoo			+			+		+	+						+	+			
Zosterops lateralis	Silvereye		+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+
Tyto tenebricosa	Sooty Owl	V	+												+					
Ninox novaeseelandiae	Southern Boobook		+					+								+	+			
Pardalotus punctatus	Spotted Pardalote		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cinclosoma punctatum	Spotted Quail-thrush		+		+	+	+	+	+		+									
Threskiornis spinicollis	Straw-necked Ibis					+														
Pardalotus striatus	Striated Pardalote			+	+	+	+											+		+
Acanthiza lineata	Striated Thornbill		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cacatua galerita	Sulphur-crested Cockatoo					+									+			+	+	+
Malurus cyaneus	Superb Fairy-wren		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Podargus strigoides	Tawny Frogmouth					+										+	+	+		
Lopholaimus antarcticus	Topknot Pigeon		+																	
Daphoenositta chrysoptera	Varied Sittella	V		+			+		+				+							
Malurus lamberti	Variegated Fairy-wren		+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+
Aquila audax	Wedge-tailed Eagle														+					
Hirundo neoxena	Welcome Swallow			+								+		+						
Haliastur sphenurus	Whistling Kite																			+
Sericornis frontalis	White-browed Scrubwren		+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Phylidonyris niger	White-cheeked Honeyeater												+					+		+
Lichenostomus leucotis	White-eared Honeyeater																	+		
Melithreptus lunatus	White-naped Honeyeater		+	+	+	+	+	+	+	+	+		+				+	+	+	+
Gerygone albogularis	White-throated Gerygone					+		+			+				+	+	+			
Hirundapus caudacutus	White-throated Needletail													+			+			
Eurostopodus mystacalis	White-throated Nightjar		+		+		+	+				+					+			
Cormobates leucophaeus	White-throated Treecreeper		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Corcorax melanorhamphos	White-winged Chough				+			+								+				
Rhipidura leucophrys	Willie Wagtail							+							+					
Leucosarcia picata	Wonga Pigeon					+		+	+	+	+		+	+	+	+	+	+	+	
Acanthiza nana	Yellow Thornbill			+	+	+			+		+		+	+	+		+	+	+	
Lichenostomus chrysops	Yellow-faced Honeyeater		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo					+		+									+			
Sericornis citreogularis	Yellow-throated Scrubwren															+	+			

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total			**53**	**56**	**55**	**64**	**50**	**63**	**60**	**53**	**55**	**47**	**48**	**51**	**58**	**57**	**55**	**52**	**54**	**49**

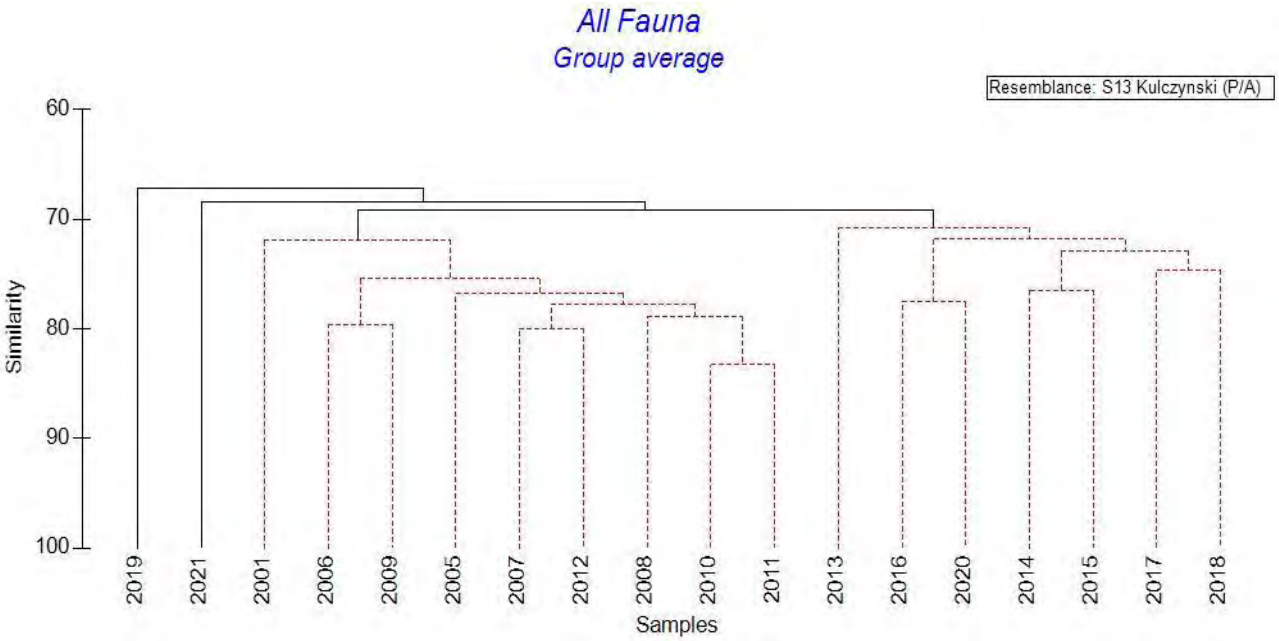
Status: V = Threatened (Vulnerable) under the *Biodiversity Conservation Act 2016* (NSW)

APPENDIX G AMPHIBIAN AND REPTILE SPECIES RECORDED ACROSS ALL QUADRATS 2009 - 2021

Scientific name	Common name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Adelotus brevis	Tusked Frog					+	+	+	+	+			+	
Crinia signifera	Common Toadlet			+		+	+	+	+	+			+	+
Limnodynastes peronii	Striped Marsh Frog			+		+		+	+				+	+
Limnodynastes tasmaniensis	Spotted Grass Frog					+					+		+	
Litoria fallax	Sedge Frog	+				+	+	+				+	+	
Litoria latopalmata	Broad-palmed Frog	+				+			+	+	+		+	
Litoria peronii	Emerald-spotted Tree Frog	+						+	+	+				
Litoria revelata	Revealed Frog					+								
Litoria tyleri	Tyler's Tree Frog					+		+	+					
Pseudophryne bibronii	Bibron's Toadlet					+								
Pseudophryne coriacea	Red-backed Toadlet			+		+	+	+	+		+		+	+
Uperoleia laevigata	Eastern Toadlet									+				
Total		**3**	**0**	**3**	**0**	**10**	**4**	**7**	**7**	**5**	**3**	**1**	**7**	**3**
Amphibolurus muricatus	Jacky Lizard	+												
Anilios nigrescens	Blackish Blind Snake												+	
Dendrelaphis punctulata	Green Tree Snake	+												
Demansia psammophis	Yellow-faced Whipsnake											+		
Furina diadema	Red-naped Snake	+												
Hemisphaeriodon gerrardii	Pink-tongued Skink							+						
Intellagama lesueurii	Eastern Water Dragon							+	+	+			+	+
Lampropholis delicata	Delicate Skink							+	+					
Morelia spilota spilota	Diamond Python						+							

Scientific name	Common name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Pogona barbarta	Eastern Bearded Dragon												+	
Pseudechis porphyriacus	Red-bellied Black Snake								+		+	+		
Pseudonaja textilis	Eastern Brown Snake							+						
Varanus varius	Lace Monitor	+					+		+	+	+	+	+	+
Total		**4**	**0**	**0**	**0**	**0**	**2**	**4**	**4**	**2**	**2**	**3**	**4**	**2**

APPENDIX H CLUSTER ANALYSIS DENDOGRAMS AND SIMPROF RESULTS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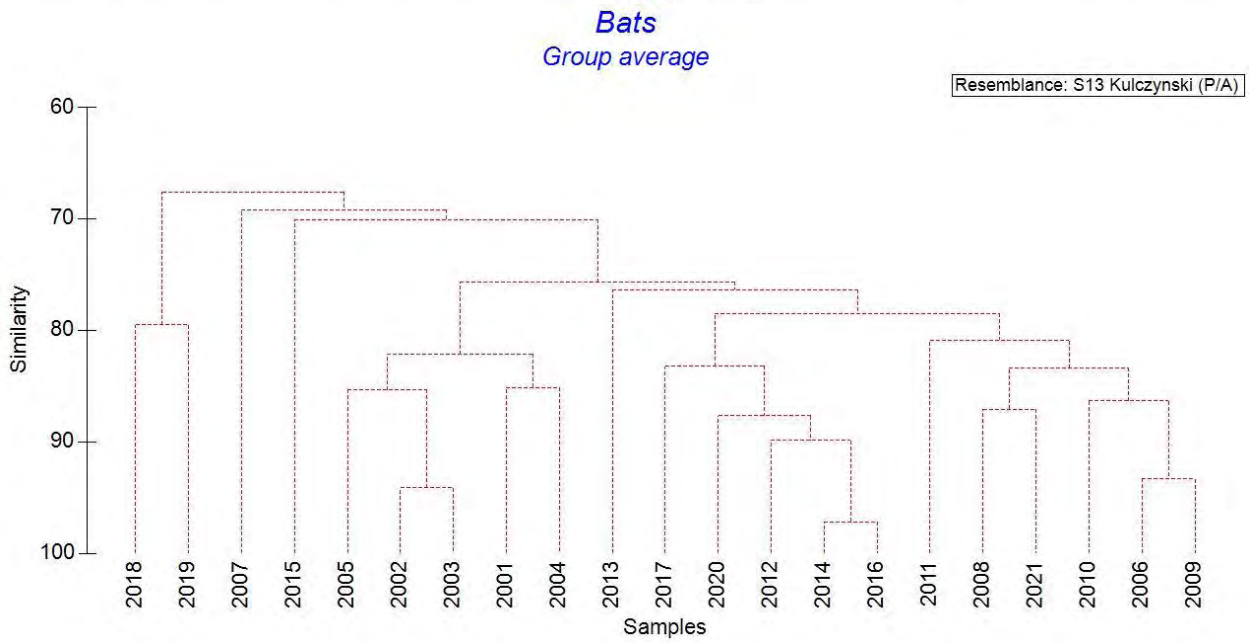
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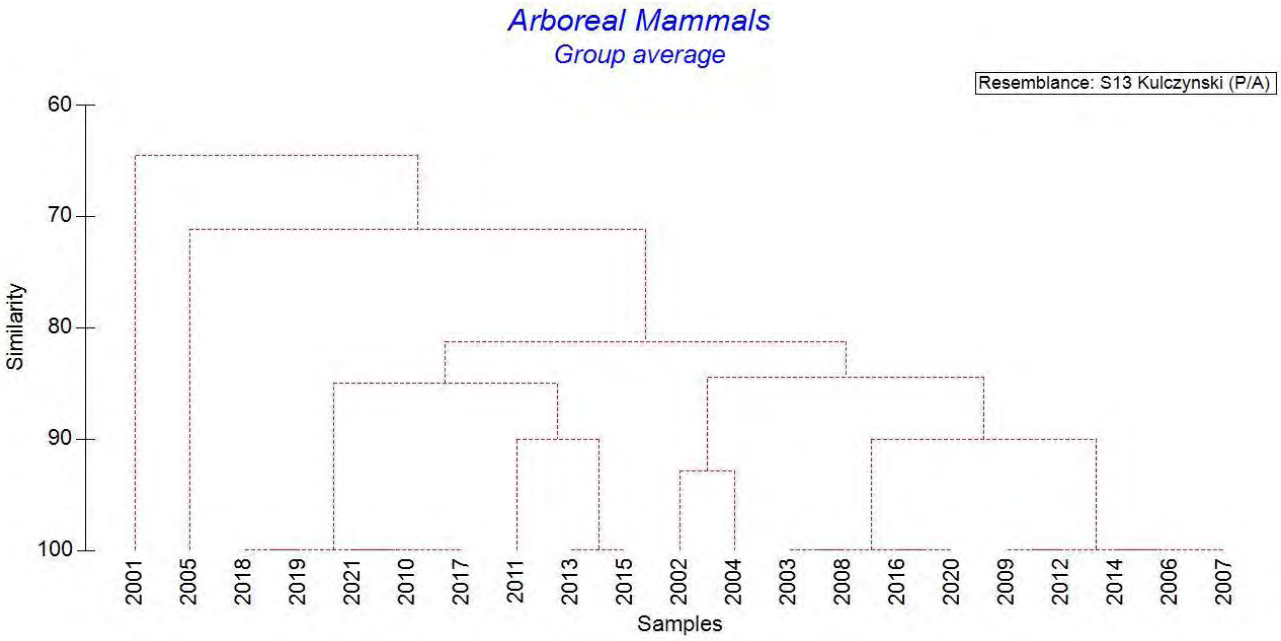
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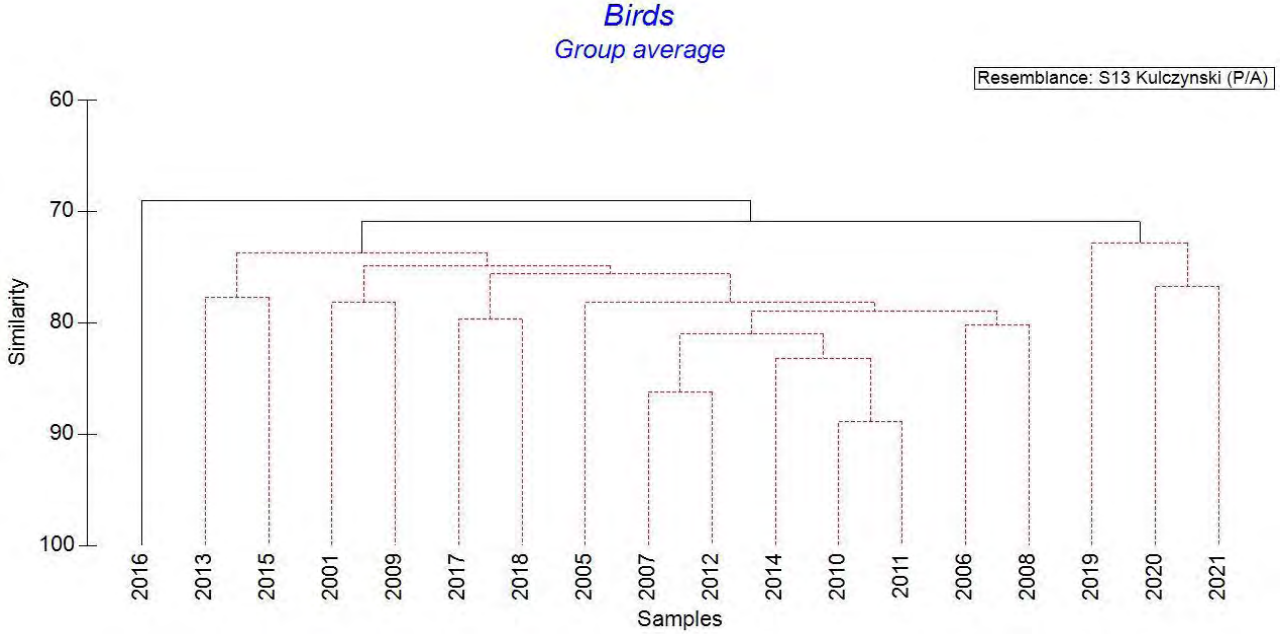
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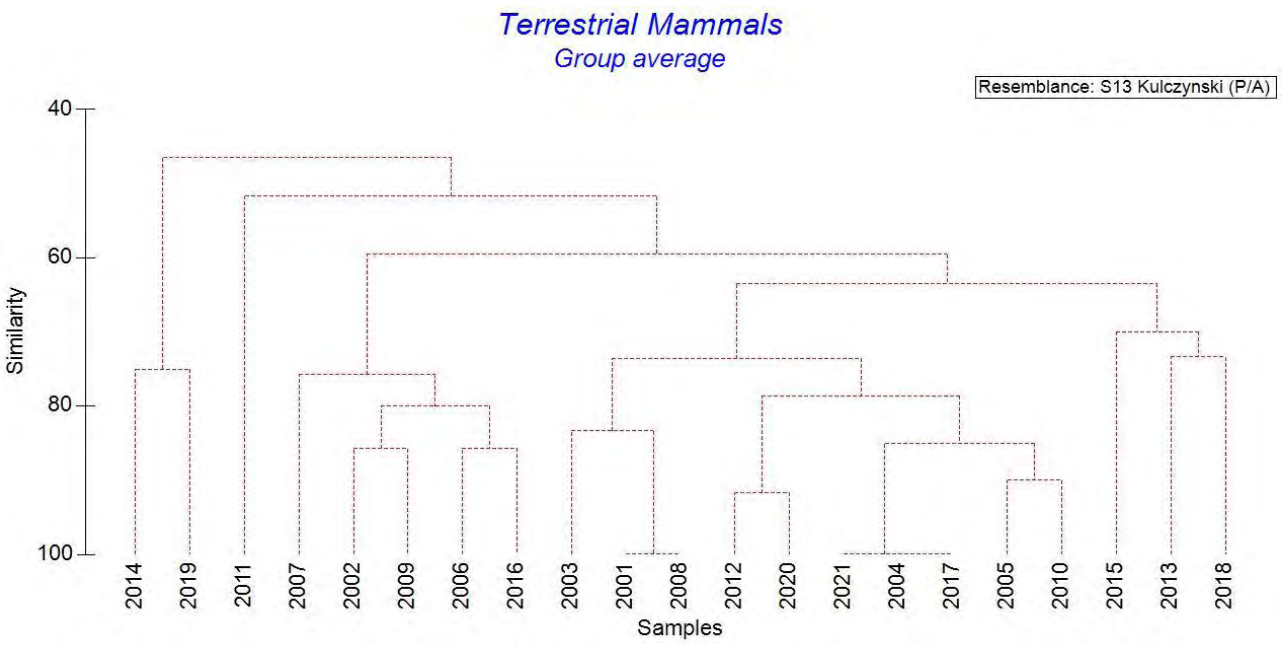
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APPENDIX I PHOTOS - FAUNA

Plate 2: Glossy Black-Cockatoos (*Calyptorhynchus lathami*), recorded in previous monitoring events

Plate 3: Sugar Glider nest in new nest box

Plate 4 Gould's Long-eared Bat (*Nyctophilus gouldii*), recorded in previous monitoring events

Plate 5 Southern Myotis (*Myotis macropus*)

Plate 6 Red-backed Toadlet (*Pseudophryne coriacea*)

APPENDIX J STAFF CONTRIBUTIONS AND QUALIFICATIONS

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

Name	Qualification	Title/Experience	Contribution
Ben Stewart	MMarSc&Mgt	Ecologist	Flora surveys
James Baldry	MBioCons	Ecologist	Flora surveys and report writing
David Martin	MSc	Ecologist (Botanist)	Flora surveys
Dan O'Brien	Phd	Senior Ecologist (Zoology)	Fauna surveys
Mark Dean	BEnvSc & Mgt	Ecologist (Zoology)	Fauna surveys
Emily Fittell	BSc (Hons)	Ecologist	Report review
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	Map preparation

Donaldson Nestbox Replacement and Install 2022

1132 John Renshaw Drive, Black Hill NSW 2322

20225858 - NCA22R138933

7 April 2022

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7 April 2022
20225858 - NCA22R138933

Donaldson Coal
Attention James Benson

Subject: Donaldson Nestbox Replacement and Install 2022
Donaldson Rehabilitation Area

1 INTRODUCTION

1.1 SCOPE

In 2011 the first nest box project was initiated within the rehabilitation areas involving the use of nest boxes as a method of promoting re-colonisation by arboreal and terrestrial fauna species. Four quadrats were established within rehabilitated vegetation of various ages (rehabilitated in 2003 and 2005) and 10 nest boxes were installed (six terrestrial, four arboreal) at each quadrat. Over the past 10 years, the nest boxes have deteriorated and now require replacement. Providing suitable nesting and refuge habitat for arboreal fauna will be necessary for the continued recolonisation of the rehabilitated areas as the trees within these areas typically will not develop hollows until 120 years of age.

Nest box monitoring identified a total of 40 nest boxes requiring replacement within the rehab area. A further six (6) nest boxes were identified as requiring replacement within the quadrats within the remnant bushland. A further five (5) nest boxes requiring repair were located within the remnant bushland within the nine (9) quadrat locations. Overall, these boxes are in reasonable condition, apart from the lid and hinges. These nest boxes require the replacement of the lids and hinges so that they continue to provide arboreal fauna with protection from the elements while also enabling ecologist to monitor their usage.

2 SITE WORKS

Two (2) Kleinfelder Ecologists (Mark Dean and James Baldry) installed a total of 40 nest boxes (All boxes) into the Donaldson Rehabilitation Area on the 04 April 2022. The Nest Boxes were installed at four (4) previously established monitoring quadrats and nine (9) monitoring quadrats within the remnant bushland areas of Donaldson Coal Mine. Of the 40 nest boxes, a total of 16 Glider Boxes were installed at a height of three (3) meters (m), and 24 nest boxes were installed at a height of 0.5m for small terrestrial fauna species within the Rehab area. The purpose of the nest box installation was to replace damaged nest boxes previously installed on poles within the rehab area. An additional six (6) nest boxes were replaced within the remnant bushland areas, and five (5) nest boxes were repaired with either a new lid or reattachment of old lid.

Please see below **Figure 1** showing Nestbox replacement locations and repairs of existing nest boxes and **Table 1** for locations and Box ID for Replaced/Repaired boxes within Donaldson Quadrats.

Table 1 Quadrat Nestbox Replacement and Repairs within the Bushland Areas

Quadrat	Box ID	Box Type/Repair
Q1	27	Glider
Q2	4	Repaired
Q4	37	Repaired
Q4	34	Repaired
Q6	12	Feathertail
Q6	38	Repaired
Q7	19	Possum
Q8	45	Antechinus
Q8	25	Antechinus
Q9	30	Feathertail
Q9	1	Repaired

3 CONCLUSION

A total of 40 nest boxes were replaced within the Donaldson Rehab and Remnant Areas, with repairs completed on a further six (6) nest boxes located within the remnant vegetation area. The location of these 46 nest boxes is illustrated in **Figure 1**. Spatial data of nest box locations will be provided upon submission of this letter.

If you require additional information or clarification, please contact the undersigned.

Sincerely,

Mark Dean

Ecologist (Zoologist)
Suite 3, 240-244 Pacific Highway
Charlestown, NSW 2290
m|: 0455 381 346
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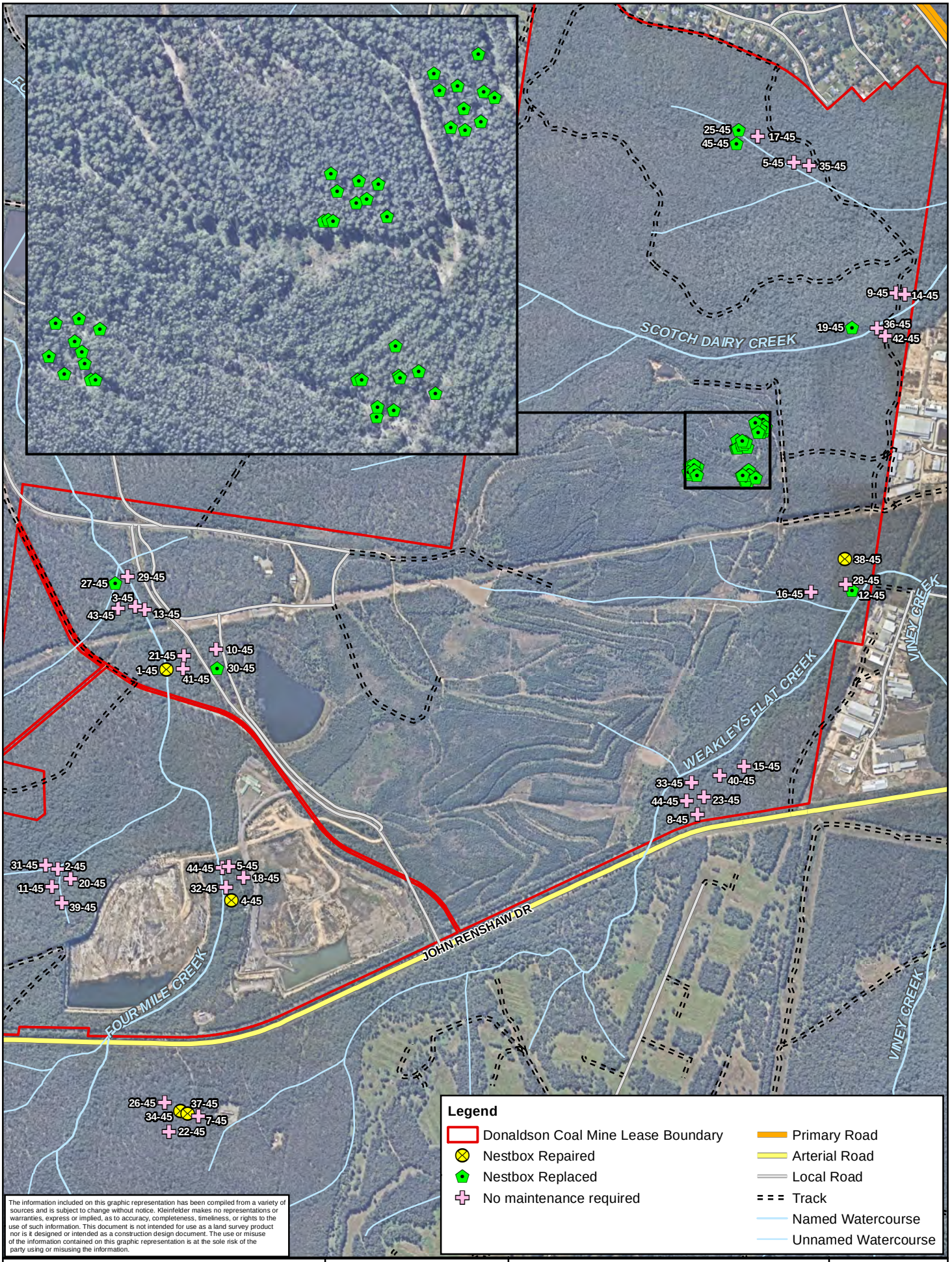
Kleinfelder Australia Pty Ltd



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PROJECT REFERENCE: 20225858
DATE DRAWN: 2022/04/11 12:41 Version 1
DRAWN BY: GJoyce
DATA SOURCE:
NSW DFSI - 2021
Nearmap - 2022

Nest Box Maintenance

Donaldson Coal
2022 Next Box Maintenance

FIGURE:
1

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ATTACHMENT 1 REPORT DETAILS

Staff Contributions

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

Table 3a Staff Contributions

Name	Qualification	Title/Experience	Contribution
Mark Dean	BEnvSc & Mgt	Ecologist (Zoologist)	Report Author.
David Martin	MSc	Ecologist (Botanist)	Report Review
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation

Scientific Licencing and Permits

Kleinfelder employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL100730, Expiry: 31 March 2023) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

ATTACHMENT 2 PHOTOS

Plate 1 Terrestrial Nestbox Rehab Quad

Plate 2 Arboreal Nestbox Rehab Quad

Plate 3 Nestbox Replacement Bushland Quadrats

Plate 4 Nestbox Replacement Bushland Quadrats

Appendix 5

Annual Survey of the *Tetratheca Juncea* Conservation Area 2021

prepared by

Kleinfelder Australia Pty Ltd

(Total No. of pages including blank pages = 20)

Annual Survey of the Tetratheca juncea Conservation Area 2021

Yancoal Donaldson Open-Cut

20222041

8 April 2022

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Annual Survey of the Tetratheca juncea Conservation Area 2021

Yancoal Donaldson Open-Cut

Kleinfelder Project: 20222041

Kleinfelder Document: NCA22R138938

Prepared for:

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Document Control:

Version	Description	Date
1.0	Final	8 April 2022
Prepared	Reviewed	Endorsed
Colin Driscoll	Emily Fittell	David Martin

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1. INTRODUCTION

1.1. BACKGROUND INFORMATION

The Yancoal Donaldson Open-Cut coal mine operated from 2001 to 2013 on a mining lease near Beresfield in the lower Hunter region, just west of Newcastle New South Wales (NSW).. During the initial flora and fauna investigations for the project, a substantial population of the threatened plant *Tetratheca juncea* was found to be present in about 6 hectares (ha) of land at the western edge of the lease. As part of meeting the Conditions of Consent for this mine, a conservation area was established to preserve these plants in a reserve. This area is known as the *Tetratheca juncea* Conservation Area (TjCA) and the management guidelines are documented in the *Tetratheca juncea* Conservation Area Management Plan (TjCMP) (Gunninah 2000). **Figure 1** shows the TjCA in the context of the overall mine and **Figure 2** shows the TjCA in detail.

The TjCMP details management and monitoring of the TjCA in relation to mining/post-mining operations, conservation area preservation and protection as well as biological and ecological data collection.

The TjCA has been monitored annually since the baseline report by Barker Harle (2003).

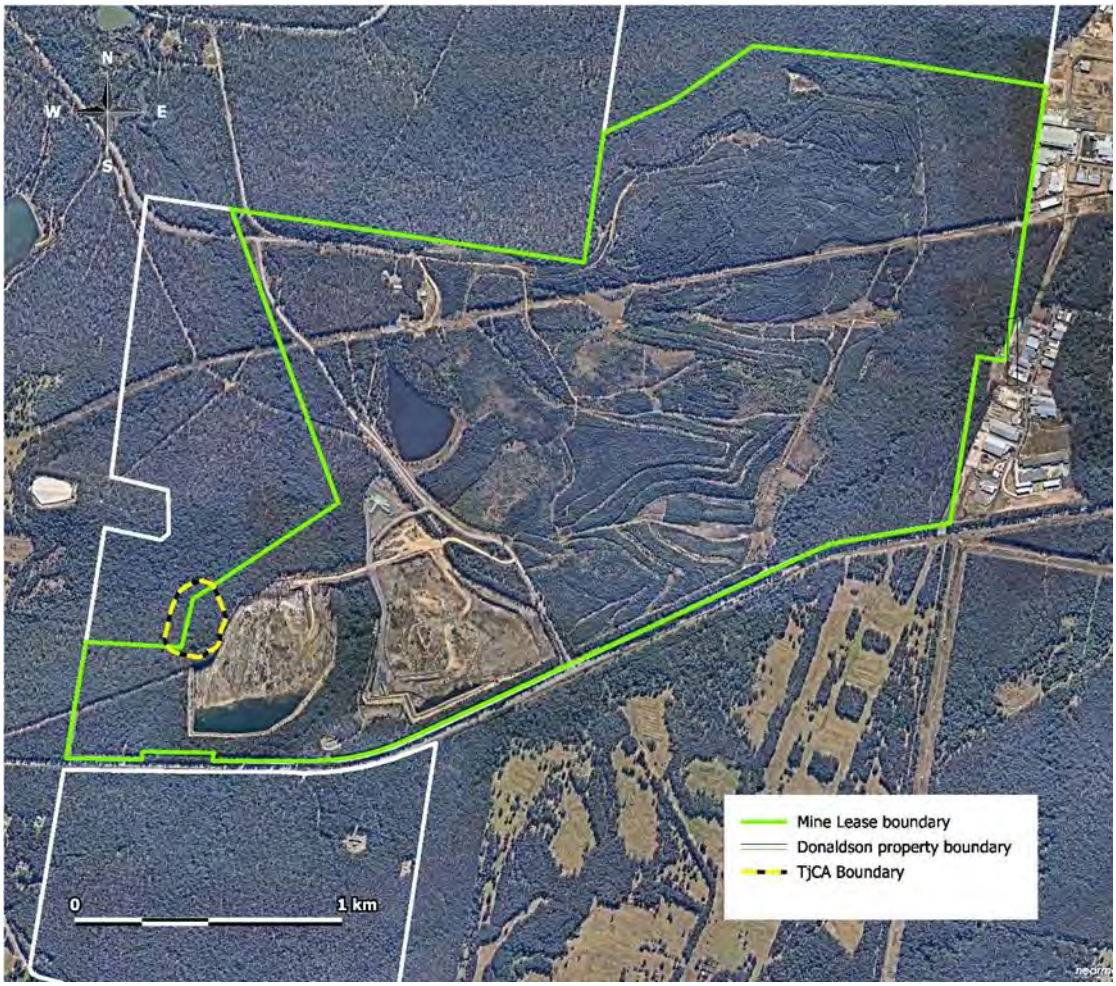

Figure 1: The *Tetratheca juncea* Conservation Area (TjCA) in the context of the overall mine (Image Nearmap August 2021).

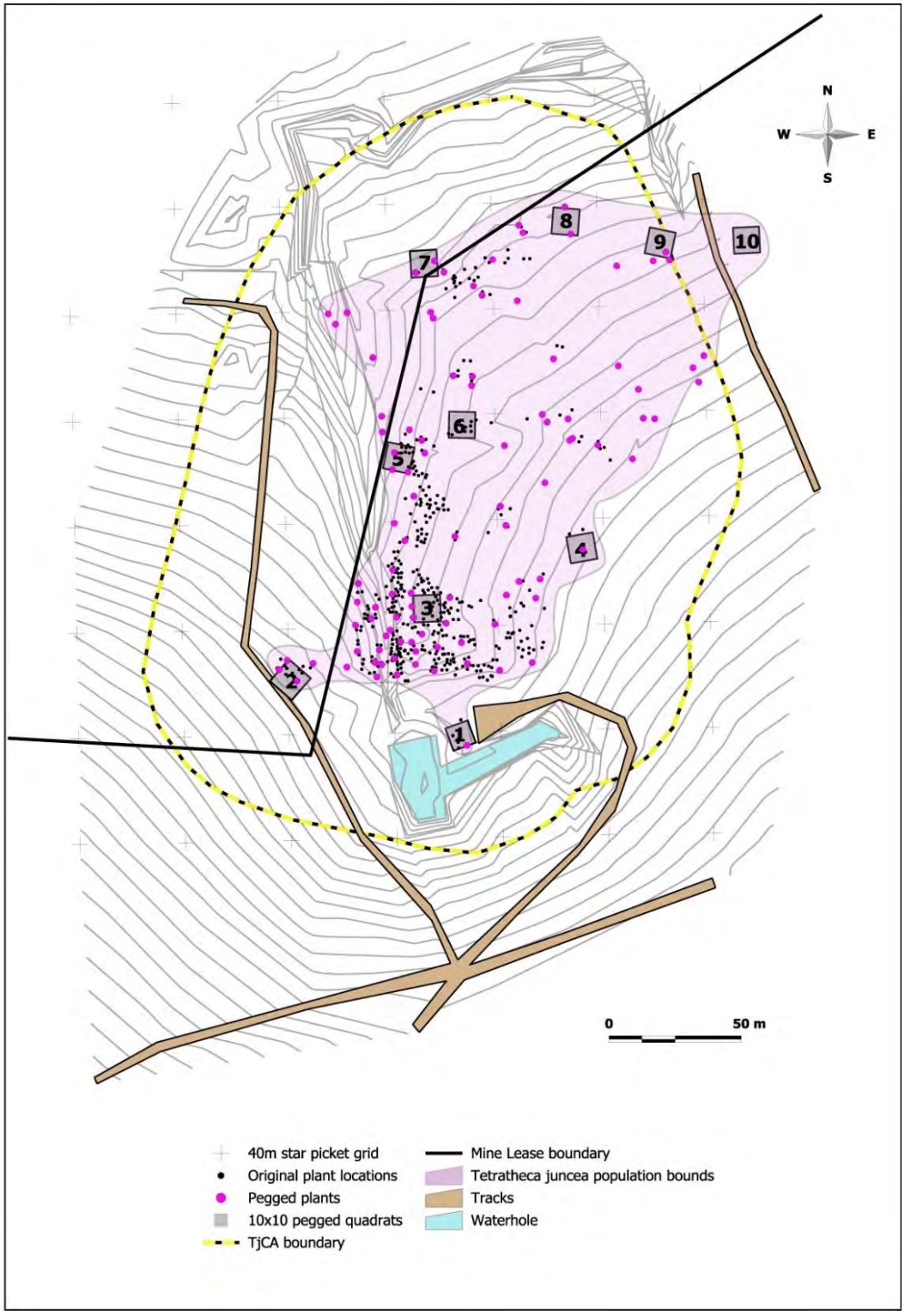

Figure 2: The *Tetratheca juncea* Conservation Area (TjCA) detail.

1.2. *TETRATHECA JUNCEA*

Tetratheca juncea Smith (Elaeocarpaceae, formerly Tremandraceae, Crayn *et al.* 2006) is a terrestrial herbaceous plant listed under both the NSW *Biodiversity Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as Vulnerable and has a ROTAP coding of 3Vca (Briggs and Leigh 1995). It is endemic to NSW with a coastal distribution from the Gosford/Wyong area in the south to Bulahdelah in the north (Gardner & Murray 1992, Payne 2000). The plant grows in disjunct populations throughout its range and there is no consensus about its growing requirements or preferred habitat. It can be found growing on Narrabeen sandstone-derived soil in open woodland amongst a low shrub understorey with grassy ground cover, on Nerong Volcanics derived soil or in coastal sand woodland and heath. Putting aside the limited geographical range of the plant and limited representation in reserves, the species rarity is probably, in part, due to the fact that the plant is virtually leafless and, outside of the flowering season, is very difficult to locate amongst the grasses with which it grows. The flowering period for *Tetratheca juncea* is generally reported as being from mid to late winter through to late summer (Gardner & Murray 1992). Driscoll (2013) confirmed that budding commenced shortly after the winter equinox with flowering peaking in September/October.

The flowers of *Tetratheca juncea* grow from nodes on the leafless stem and are generally solitary but occasionally in pairs with each flower facing downward, suspended on a peduncle approximately 10 millimetres (mm) in length (**Figure 3**).

Commonly there are four petals (can be 5 – 8) ranging in colour from mauve through pink to (rarely) white. There are eight dark mauve poricidal anthers attached by short stout filaments in four pairs surrounding the carpel with the stigma protruding beyond their length. The flowers of *Tetratheca juncea*, in common with other members of the *Tetratheca* genus produce no nectar that could serve as a pollinator attractor, and it would appear that pollen is the sole reward available to an insect such as a bee.

Figure 3: *Tetratheca juncea* flowers showing the grass-like stems.

The reproduction and propagation strategies of *Tetratheca juncea* are seed production and vegetative spread with stems sprouting from underground rhizomes. The species grows in a variety of forms, from single stems through multi-stemmed discrete clumps, to spreading patches covering several square metres. It has been assumed that clonal spread is a significant form of propagation for the species. However, recent genetic research (Jones 2011) has revealed that, even in a closely spaced population, the level of clonality was very low.

The growth form of the species makes counting individual 'plants' difficult and a standard method has been adopted that defines a clump as being a group of stems separated by >30 cm from the next group (Payne *et al.* 2002). Jones (2011) showed that genetically different individuals were growing <30 cm apart.

1.3. TjCA Population Size

The TjCA occupies an area of 4.8 ha and the population of *Tetratheca juncea* lies in about 2.2 ha of that area. In 2003, a population density estimate was carried out (Barker Harle 2003) and **Table 1.1** shows the results. The population was divided into individually identifiable plant clumps and clonal patches where individual clumps could not be distinguished.

Table 1.1: TjCA Population Size Estimate

Category	Estimate
Clumps	476
Patches	112
Average patch size	4.3 m^2
Combined patch area	453 m^2

m^2 = square metres

This method deviated from the method of Payne *et al.* (2002) by the inclusion of patch size. Driscoll & Bell (2008) developed a regression relationship between patch size and the number of clumps in a patch and while the authors note that the results are not necessarily transferable to other areas, this can be used as an indicator of the total clumps in the Donaldson TjCA. Using the regression, a patch of 4.3 m^2 would contain 6 clumps which would extrapolate to the equivalent of 672 clumps in patches with the total population being 1,171 clumps.

1.4. Monitoring

Monitoring has been conducted on 100 permanently pegged clumps which represent approximately 10% of the total population. On each annual monitoring occasion (**Table 1.2**), the 100 pegged clumps in the TjCA were inspected with the number of flowers and seed capsules being recorded for each plant clump along with the number of surviving clumps. The sum of flowers and seed capsules gives total flowers produced by the plant and total seed capsules divided by total flowers gives a rate of conversion that indicates pollinator activity. This index is commonly referred to as the fruit-flower ratio (FFR). As used here, FFR is primarily an index of pollinator activity up to the point at which data are collected. A true FFR would be determined by counting total flowers and total fruit produced across the entire flowering season.

Table 1.2: Dates of Annual Monitoring

Year	Survey	Year	Survey
2005	22/12/2005	2014	5/12/2014
2006	4/12/2006	2015	9/12/2015
2007	19/12/2007	2016	12/12/2016
2008	24/12/2018	2017	18/12/2017
2009	9/12/2009	2018	7/12/2018
2010	21/12/2010	2019	10/12/2019
2011	15/12/2011	2020	22/10/2020
2012	15/12/2012	2021	3/12/2021
2013	9/12/2013	-	-

2. RESULTS AND DISCUSSION

2.1. POLLINATOR ACTIVITY

The *Tetratheca juncea* flower has no nectar and is a pollen source only for native bees to use as food for their developing young. The consequence of this is that flower fertilisation and subsequent seed capsule development is likely to be pollinator limited. This means that the amount of seed produced is entirely dependent on the number of available pollinators. The species has in fact been shown to be pollinator limited (Gross *et al.* 2003). Combined with the fact that the flowers do not self-pollinate (even though the pollination system is self-compatible) the number of seed capsules produced on plants can be used as a direct indicator of pollinator activity (Driscoll 2003; Driscoll 2013).

These data have been collected since 2005 so there are now 17 years over which trends can be observed.

Figure 4 shows a plot of mean fruit per clump versus monitoring year which is characterised by high variance and wide error bars. While the trendline shows a slight increase in fruit per clump over time this is not significant (r2 = 0.008, F1,16 = 0.11, p = 0.740).

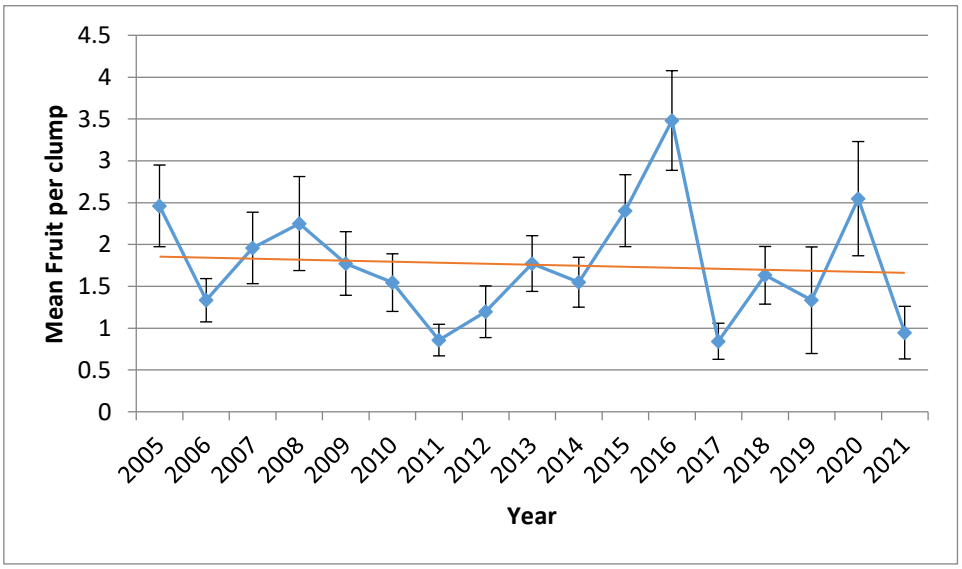

Figure 4: Mean fruit per clump from 2005 to 2021 (bars are ± 1 s.e.).

Figure 5 shows a plot of mean total flowers per clump over time indicating an overall increase to 2013 followed by a steady decline. A linear regression was significant (R2 = 0.24, F1,16 = 4.86, p = 0.044).

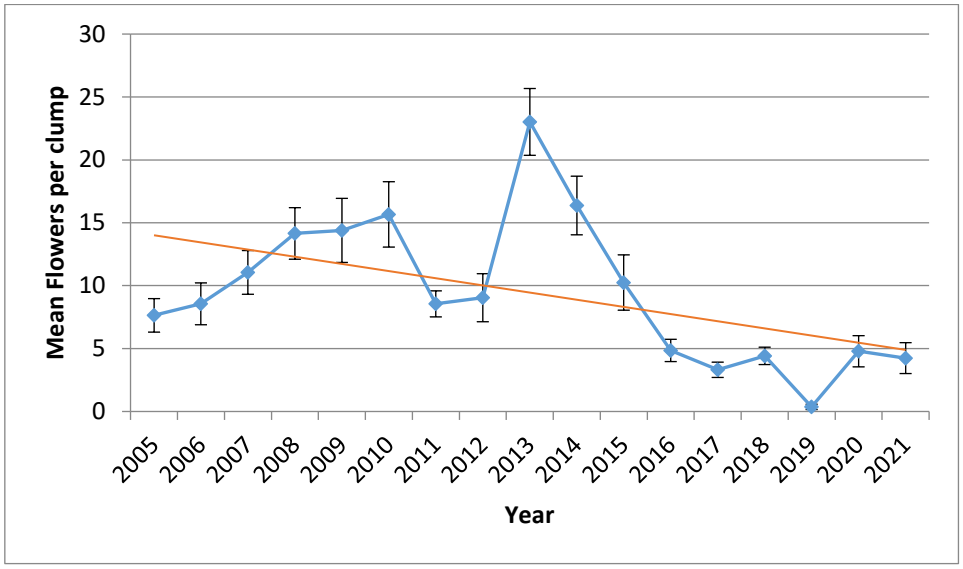

Figure 5: Mean total flowers per clump from 2005 to 2021 (bars are ± 1 s.e.).

Figure 6 shows the pattern of FFR values over the 17 years. While the trendline suggests an increase in FFR over time this is not significant (r2 = 0.104 F1,16 = 1.73, p = 0.208). The shape of this plot is difficult to explain other than to say that there are a number of potential factors influencing pollinator activity, particularly total available pollinators and pollen availability from all floral sources across the *Tetratheca juncea* population. Furthermore, as demonstrated in Driscoll (2013) FFR calculated in this manner is an indicative value rather than a true value.

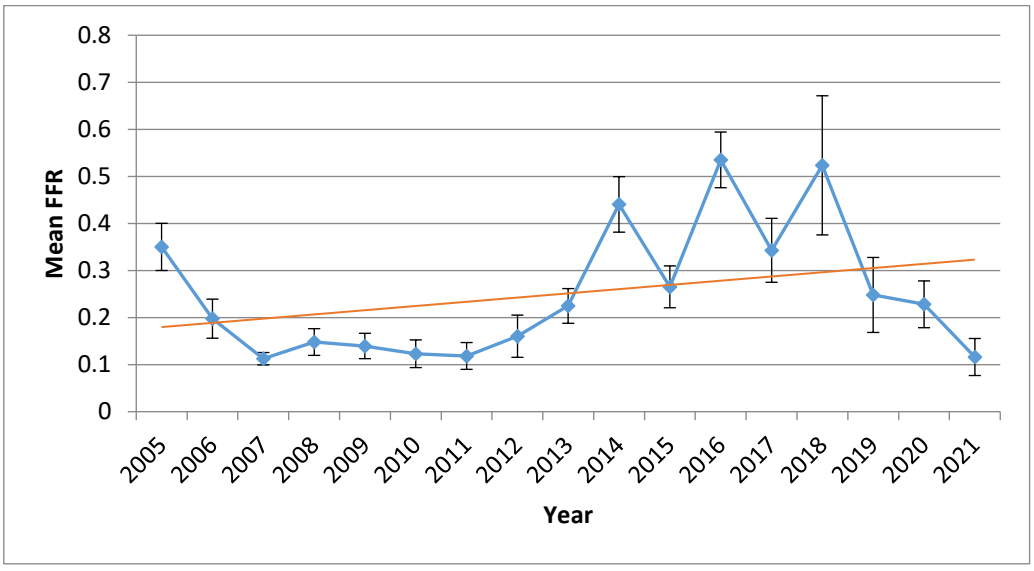

Figure 6: Mean fruit-flower ratio (FFR) 2005 – 2021 (bars are ± 1 s.e.).

Figure 7 shows a plot of mean flowers per clump against mean fruit per clump where it would be expected that if there were no shortage of pollinators, this would show an increased number of fruits with increased flower numbers. However, this was not the case (r2 = 0.003, F1,16 = 0.04, p = 0.838). This suggests that there are limited pollinator numbers and that numbers vary from year to year, for unexplained reasons.

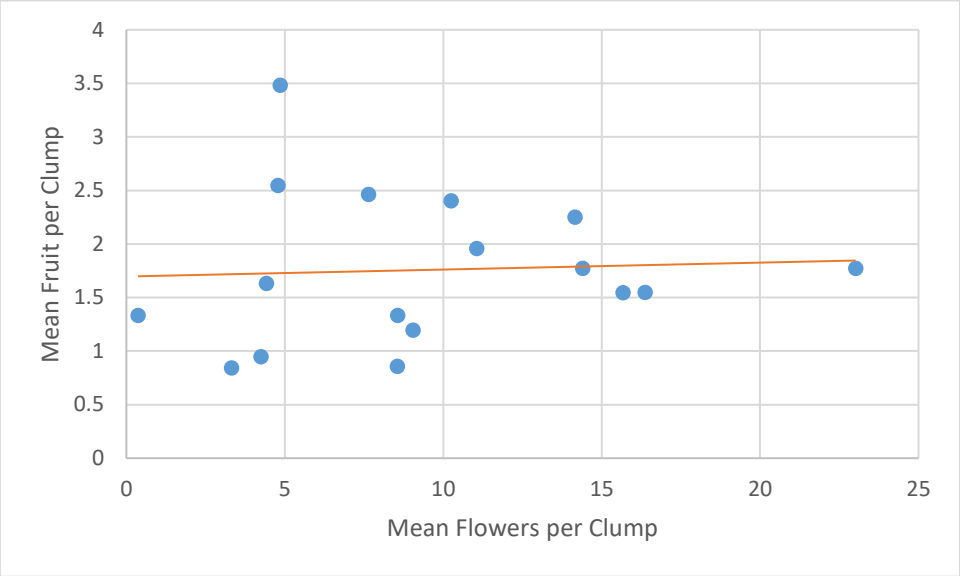

Figure 7: Mean fruit per clump versus mean flowers per clump.

2.2. POPULATION DYNAMICS

Each year the number of the 100 pegged clumps missing has been recorded and the summary results from 2004 to 2021 are shown in **Figure 8**. The trendline is significant (r2 = 0.87, F1,17 = 110.94, p < 0.001).

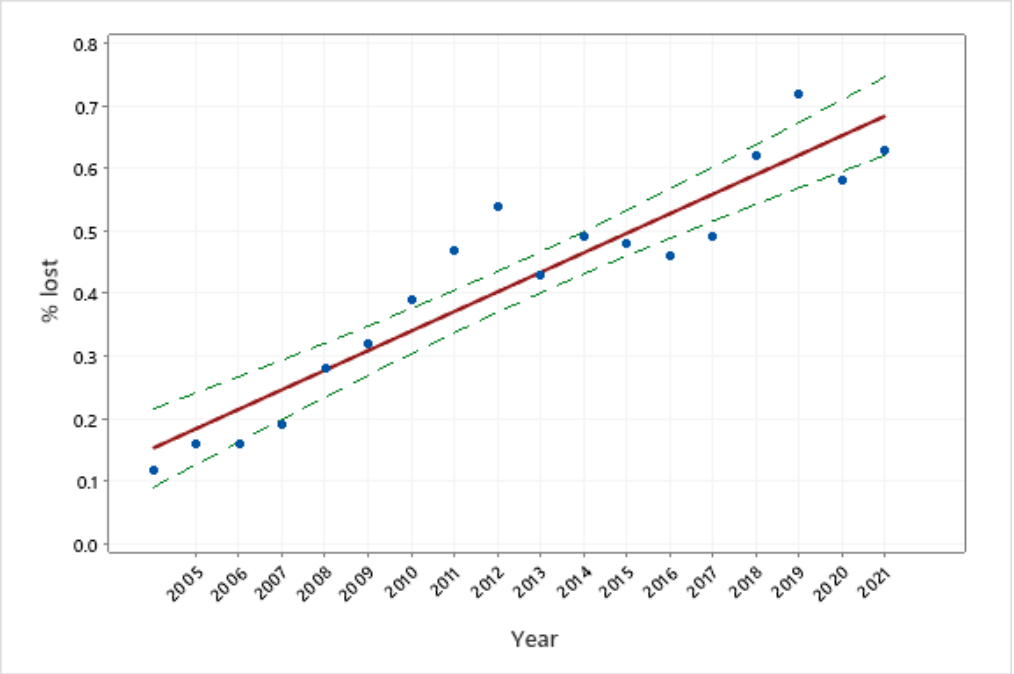

Figure 8: Percentage of the 100 clumps missing in each year.

Appendix A provides a graphical summary of the presence/absence of clumps over time.

Figure 9 shows a summary plot of the number of years that individual clumps have been recorded with 32% of clumps surviving 10 years or more. Only four clumps have been continually present.

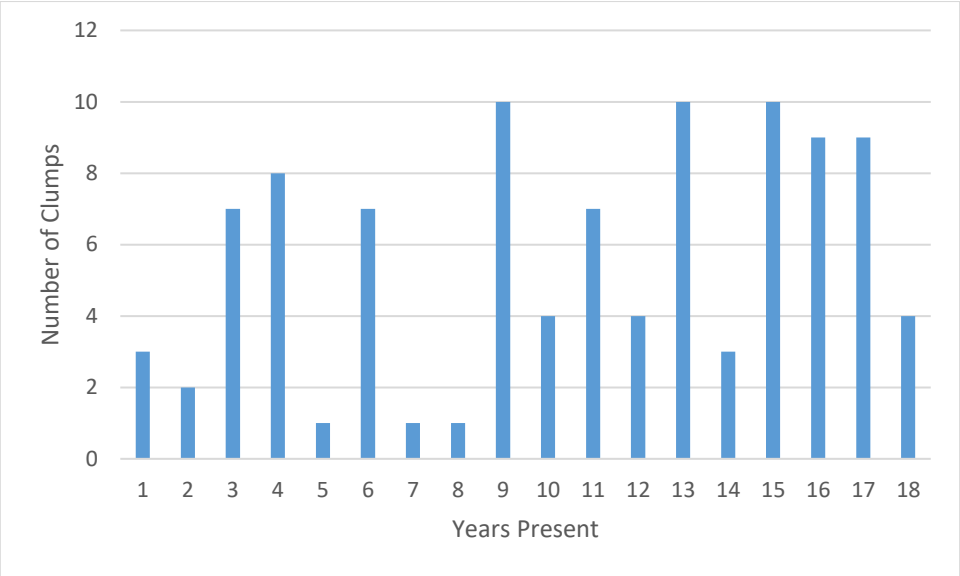

Figure 9: Clump survival times.

Kleinfelder (2012) suggested a probable cause for the continuing reduction in the population was a measured increase in the density of ground species out-competing *Tetratheca juncea* (**Figure 10**).

	
Xanthorrhoea latifolia and grasses	*Banksia spinulosa* and grasses
	
Rytidospermum pallidaum tussock grass	*Banksia spinulosa* and *Mirbelia rubifolia*

Figure 10: Examples of dense ground cover at location of lost clump (vertical arrows indicate the location of the original *Tetratheca juncea* clump).

3. DISCUSSION AND RECOMMENDATIONS

The monitoring data has shown a declining population since the start of monitoring up to 2014, with a small recovery followed by a continued decline. Evidence points to *Tetratheca juncea* being out-competed by other ground species. Overall, this report builds on previous reports in demonstrating that the TjCA population would benefit from a fire. This would both reduce the current level of competition and provide more nesting areas for tunnelling native bee pollinators.

There has been one published study by Norton (1994) and one unpublished study (Driscoll) looking at the response of *Tetratheca juncea* to fire. Both studies showed that plant clumps resprout following fire. Norton (1994) noted that fire temperature and duration of heating experienced by plant clumps had an effect on their ability to resprout. High temperatures are likely to burn deep into the rootstock which results in the plants being killed. Driscoll (unpub.) observed that even if the main rootstock was killed, the plant could resprout from secondary roots away from the original location. Bartier *et al*. (2001) studied germination of *Tetratheca juncea* seed and found that application of smoke water resulted in a significant increase in germination rate.

As has been recommended since the 2007 annual report, **it is again recommended that the TjCA be burned at an appropriate time**. An appropriate time would be no later than April in order to take advantage of viable seed and to allow for re-sprouting during warm weather.

However, despite the lack of burning this long-term monitoring program is providing invaluable data about the dynamics of a *Tetratheca juncea* population. There is a core of clumps that have survived over all, or the majority of, the monitoring period and these give a sense of permanency to the population.

A broad scale analysis has previously found that neither temperature nor rainfall influence the number of flowers per clump. However, it is possible that these factors do have an effect that is lost due to the regional weather data used. Had these data been collected from the population site itself there might have been a different result.

Large areas of eastern Australia were experiencing severe drought through 2018/2019. It is expected that this would have negatively impacted the Donaldson *Tetratheca juncea* population through reduced flowering and loss of monitored clumps that were not in a strong condition prior to the onset of the drought. Drought-breaking rainfall in 2020 appeared to have resulted in recovery of 14 clumps since 2019. However, even after exceptional rainfall the 2021 records show a declining population with low flowering.

Finally, it has become apparent that clump flagging has deteriorated to the point where there is some ambiguity about clump identification. If this monitoring is to be continued it is recommended that **a surveyor be engaged to locate the original clump coordinates** and clump flagging renewed.

4. COMPLIANCE WITH THE MONITORING REQUIREMENTS OF THE *TETRATHECA JUNCEA* MANAGEMENT PLAN

The TjCMP provides an outline of the changes in the TjCA that should be monitored and **Table 4.1** summarises the compliance with the TjCMP since the commencement of monitoring.

Table 4.1: Compliance with the TjCMP

Item	Compliance	Comment About Non-compliance
Demographic monitoring	Yes	-
Fire response monitoring	No	Ecological burns were recommended in the TjCMP. At that time there was no research that supports the idea that *Tetratheca juncea* requires fire for the long-term viability of the population. In consultation with the Donaldson Project Environmental Officer (PEO) it was determined that until further information was available, burns would not be conducted. Further information is now available and burning is **recommended**.
Changes in native competitors	Yes	-
6-monthly reporting	No	In consultation with the Donaldson PEO it was determined that annual reporting only would be required with periodic inspections and any significant incidents immediately reported.
Annual surveys conducted during flowering period	Yes	This report.

5. REFERENCES

Barker Harle (2003) Donaldson Open-cut Coalmine: *Tetratheca juncea* Conservation Area first annual report 2001-2003. A report prepared for Donaldson Coal.

Bartier, F.V., Gross, C.L., Mulligan, D.R., Bellairs, S.M. and Bowen, D. (2001) Understanding the Biology and Ecology of Vulnerable Plant Species – A Case Study With *Tetratheca juncea* Occurring Over Coal Leases, ACARP Project C8012. A report prepared for Australian Coal Research. June 2001.

Briggs, J.D. and J.H. Leigh (1996) *Rare or Threatened Australian Plants* - Revised Edition. Collingwood: CSIRO Publishing.

Crayn, D.M., Rossetto, M., and Maynard, D.J. (2006) Molecular phylogeny and dating reveals an oligomiocene radiation of dry-adapted shrubs (former Tremandraceae) from rainforest tree progenitors (Elaeocarpaceae) in Australia. *American Journal of Botany* 93(9): 1328–1342.

Driscoll, C. (2003) The pollination ecology of *Tetratheca juncea* Smith: finding the pollinators. *Cunninghamia* 8(1): 133-140.

Driscoll, C. (2013) The ecology of reproduction in a rare plant - *Tetratheca juncea.* PhD Thesis University of Newcastle. Faculty of Science & Information Technology, School of Environmental and Life Sciences. http://hdl.handle.net/1959.13/937469.

Driscoll, C. and Bell, S. (2008) *Survey for Tetratheca juncea (Elaeocarpaceae) for the Morisset Structure Plan, Lake Macquarie LGA*. A report prepared for Lake Macquarie City Council by Eastcoast Flora Survey.

Gardner, C. and Murra,y L. (1992) Tremandraceae. In: *Flora of New South Wales* Vol 3 (ed. G.J. Harden) pp. 74-78. UNSW Press.

Gross, C.L., Bartier, F.V. and Mulligan, D.R. (2003) Floral Structure, Breeding System and Fruit-set in the Threatened Sub-shrub *Tetratheca juncea* Smith (Tremandraceae) *Annals of Botany* 92: 771-777

Gunninah (2000) Donaldson Open-cut Coal Mine Beresfield *Tetratheca juncea* Management Plan. Gunninah Environmental Consultants Crows Nest.

Jones, A. (2011) A genetic investigation: multi-locus genotyping of *Tetratheca juncea* using microsatellite markers. University of Newcastle, unpublished honours thesis.

Norton, A.E. (1994) Field observations into *Tetratheca juncea*. Fire regeneration and its attribution within Lake Macquarie. Unpublished report, prepared for BHP Pty Ltd.

Kleinfelder (2012) Gloucester Coal Donaldson Opencut Annual Survey of the *Tetratheca juncea* Conservation Area 2013.

Payne, R.J. (2000). *Lake Macquarie Tetratheca juncea Conservation Management Plan Final Report November 2000*. A report prepared for Lake Macquarie City Council, NSW National Parks and Wildlife Service and BHP Pty Ltd.

Payne, R.J., Stevenson, D., and Wellington, R. (2002) *A standardised method for counting Black-eyed Susan populations.* Unpublished Report.

APPENDIX A GRAPHICAL REPRESENTATION OF THE SURVIVAL OF INDIVIDUAL CLUMPS OVER TIME

GRAPHICAL REPRESENTATION OF THE SURVIVAL OF INDIVIDUAL CLUMPS OVER TIME.

Green = clump present, Pink = clump absent

Clump	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
3	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
4	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
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6	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	1	1
7	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	0	0
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12	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1
13	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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24	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
25	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
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Clump	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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Clump	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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Appendix 6

2021 Rehabilitation Monitoring

prepared by

Kleinfelder Australia Pty Ltd

(Total No. of pages including blank pages = 53)

2021 Rehabilitation Monitoring

Donaldson Open Cut Mine
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20224817

21 March 2022

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2021 Rehabilitation Monitoring

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James Baldry	Emily Fittell	Dallas Milburn

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1 INTRODUCTION

1.1 BACKGROUND

The Donaldson Coal Open Cut Mine (Donaldson Mine), located in the vicinity of Beresfield in the Lower Hunter Valley of NSW, commenced operations in 2001. The current owner, Yancoal Australia Ltd ceased operation of the open cut mine in 2013 following exhaustion of the resource. The Donaldson Coal mining lease is shown in **Figure 1**.

1.2 SCOPE

Kleinfelder (formerly ecobiological) has been engaged since 2008 by Donaldson Coal to undertake annual fauna surveys of the revegetated areas of the Donaldson Coal mining lease. The aim of the survey is to provide information on the habitat requirements of recolonising fauna and to determine the effectiveness of the rehabilitation program in re-establishing pre-mining biodiversity levels. The surveys are carried out as part of the mining Conditions of Consent.

Stage one involved baseline fieldwork and the preparation of a baseline report (ecobiological 2008). A variation to the baseline study was approved by Donaldson Coal, adding an additional three quadrats and incorporating an additional quadrat to target an area of rehabilitation where no woody debris had been deliberately placed. The locations of quadrats are shown in **Figure 1**.

Through the process of adaptive management, nest box monitoring was introduced in 2011 to target the monitoring of specific species: Brown Antechinus (*Antechinus stuartii*) and Sugar Glider (*Petaurus breviceps*) in relation to rehabilitation age and structure. The implementation of the nest boxes and their monitoring has provided insight into the effectiveness of the rehabilitation program and nest boxes as artificial hollows within rehabilitated sites.

Fauna surveys have been conducted annually from 2008 to 2021 and nest box monitoring annually from 2011 to 2021. This report provides results for the 14th fauna and 11th nest box monitoring surveys conducted for the 2021 report. The data for this report was collected in January 2022.

1.3 DESCRIPTION OF THE PROPOSAL

Monitoring of the Donaldson Mine rehabilitation area aims to assess the level of successful re-colonisation by native terrestrial and arboreal species into differing aged sites. A key question being ‘Whether the introduction of woody debris and nest boxes has the ability to successfully facilitate fauna re-colonisation and therefore act as a management tool for current and future mine rehabilitation?’.

In an old growth forest, the development of a complex structure including ground cover and natural hollows is perpetual, consisting of tree growth, tree shed (branches and bark), hollow formation, tree death and ground material build up and decay. In areas that have been previously cleared and rehabilitated it takes long periods of time before the vegetation is old enough to start to produce the type of ground habitat and hollow structures required to support small terrestrial and arboreal mammals, reptiles, amphibians and invertebrates. By designing rehabilitation to include structural elements such as woody debris, rocks and artificial hollows, the time over which a rehabilitated area can be successfully re-colonised by fauna has the potential to be greatly reduced (Ireland *et al.* 1994; Carey and Johnson 1995; Loeb 1999; Butts and McComb 2000; MacNally *et al.* 2001; MacNally 2006; Lada *et al.* 2007).

Stage one of the program, involved preliminary surveys and trapping within the existing rehabilitated areas containing varying amounts of woody debris and in nearby native open forest vegetation as a control. Three (3) 40 x 40 metre (m) quadrats were used to monitor fauna species and their relocation into each of the differing aged sites. Additionally, the results from the two rehabilitated sites and the mature open forest area were compared to determine if there was a significant difference in species richness between areas containing varying amounts of woody debris.

The addition of a fourth quadrat in December 2008 was intended to enable comparison between the natural forested quadrat (Q1), two rehabilitation quadrats (Q2 and Q4) with varying manipulated woody debris levels and the fourth quadrat (Q3) where no woody debris had been deliberately placed. Annual monitoring allows variations in fauna species richness in conjunction with the changing vegetation structure of the rehabilitation area to be assessed. The results from all four quadrats are compared to determine what effect vegetation structure and woody debris levels have on fauna re-colonisation. This information will assist with future rehabilitation design aimed at successful faunal re-colonisation.

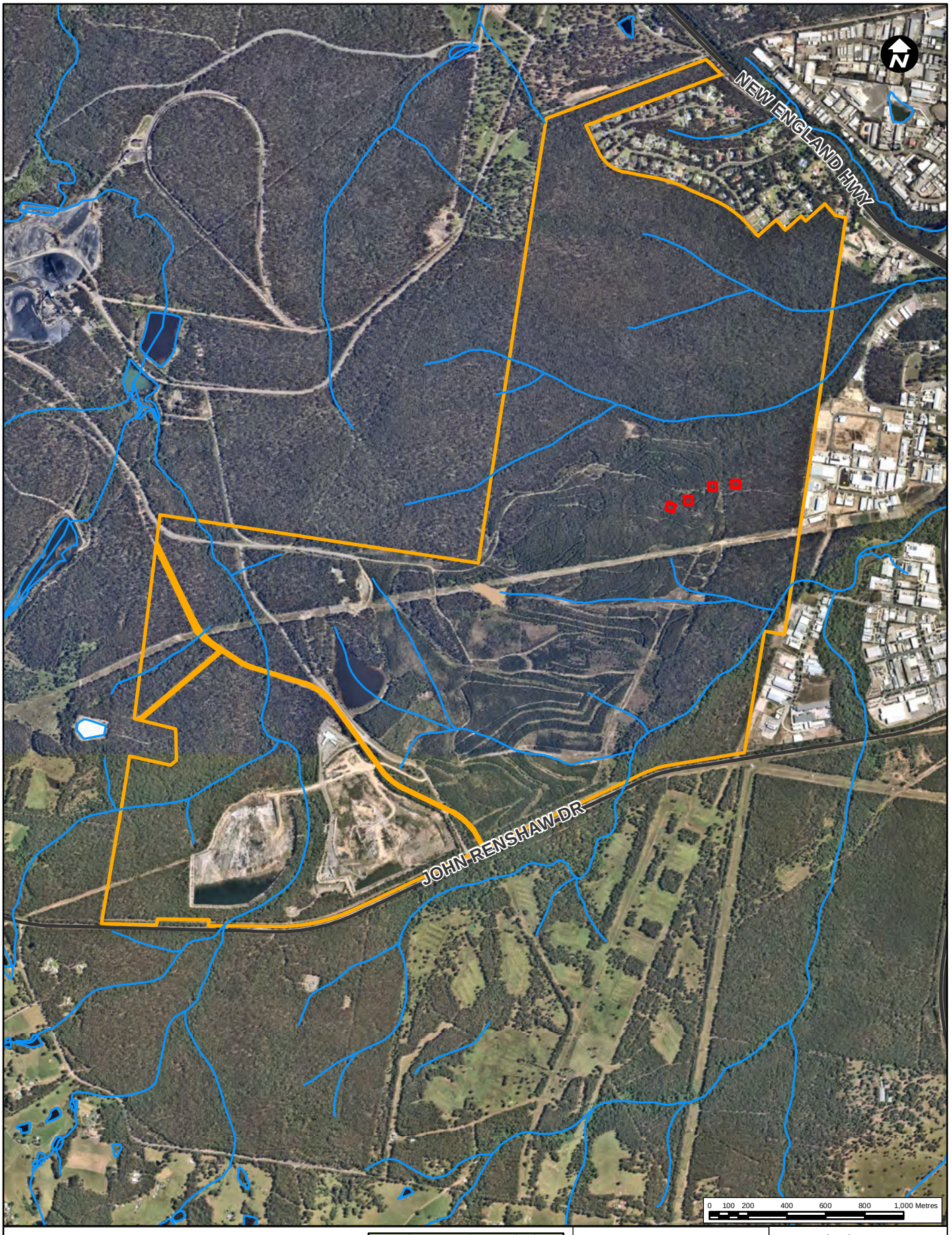
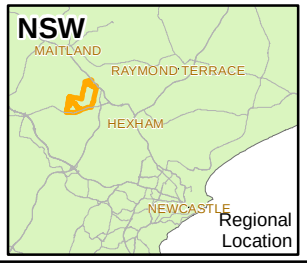


Figure 1: Locality Map & Quadrat Locations

Legend

- Donaldson Coal Mine Lease Boundary
- Study Area Quadrats
- Watercourse



KLEINFELDER

Project Ref:	20224187
Plot Date:	2022/03/11 09:21
Revision:	001 (GJoyce)

Map Projection:

GDA 1994 MGA Zone 56

Data Sources:

NSW DFSI - 2020
Nearmap - 2022

Disclaimer:This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

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2 METHODS

2.1 WOODY DEBRIS

Wood-load measurements from each original quadrat (Q1, Q2, and Q4) were undertaken in March 2008 by measuring all pieces of fallen timber with ≥8cm end diameters within the three 40 m x 40 m quadrats. The volume of each piece was calculated by treating pieces as cylinders and multiplying the length and mean diameter of each piece. Volumes were then converted into mass by using the mean density of 0.6 tonne/m3 (Mg) (Robinson 1997; MacNally and Horrocks 2007).

The woody debris survey has not been replicated since the 2008 survey as the overall monitoring report results rely on original measurements of mean density to derive a future rehabilitation design. Quadrat 2 (Q2) and Q4 were managed for woody debris while Q3 was not. Quadrat 1 (Q1) remains as mature forest adjoining the rehabilitation area.

The 2008 procedure was adapted from studies undertaken in the Riverina region of NSW (Robinson 1997) which looked at the density and current loads of woody debris. Woody debris of similar ages was measured, and volumes calculated. The findings from this research identified that irrespective of decay status, the volume of woody debris remained at a relatively constant 0.6 tonne/m3. This procedure was also undertaken for the additional quadrat (Q3) added in December 2008.

Re-colonisation results, in conjunction with initial woody debris levels provides information on the potential threshold required to facilitate successful re-colonisation by fauna species in terms of suitable habitat structure. Any new debris would be a result of natural decay and ecological process.

2.2 FAUNA

The assessment of fauna (including herpetofauna, Microchiropteran bats and Mammalia) was undertaken across the four, 40 x 40 m (1600 m²) quadrats (Q1 – Q4) between 17 and 21 January 2022. The quadrats were positioned within vegetation communities at different stages of rehabilitation (**Figure 2**):

- Quadrat 1 (Q1) is located in mature Spotted Gum – Ironbark open forest;
- Q2 is situated approximately 80 m west of the first quadrat in a rehabilitated area containing 18-year old vegetation.
- Q3 is within 16-year old rehabilitation and is located approximately 90 m to the southwest of Q2.
- Q4 is located 45 m to the southwest of Q3 also in a rehabilitated area containing 18-year old vegetation

T**able 1** depicts the total trap night count, and the location of trapping activities are shown in **Figure 3**.

Table 1: Trapping statistics for the four quadrats combined

Trap type	Traps	Nights	Trap nights
Elliott A	80	8	640
Type IV Funnel	24	8	192
Cage	8	8	64
Camera	4	5	20

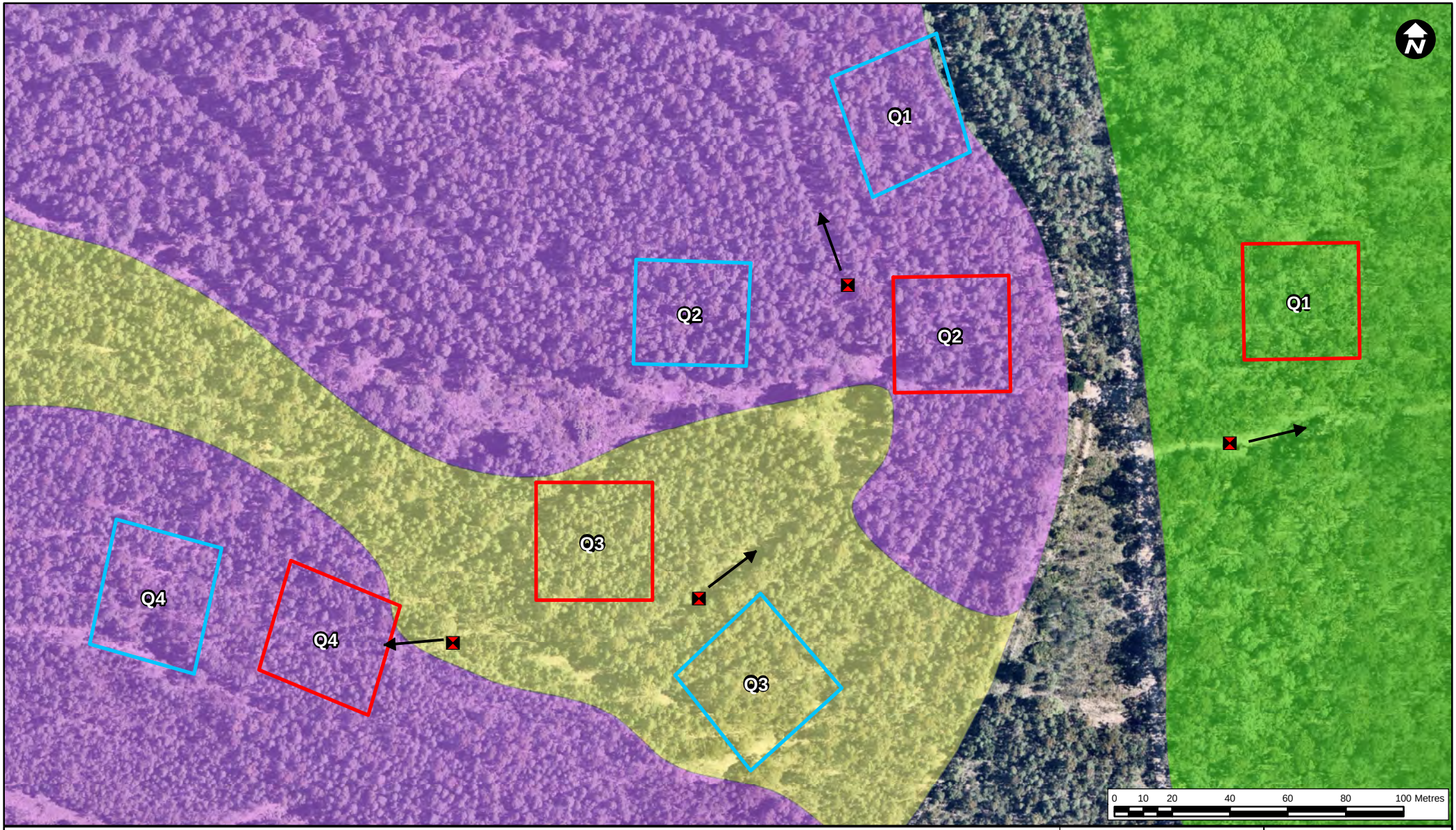

Figure 2: Survey Quadrats & Corresponding Age of Rehabilitation

Legend

- Study Area Quadrats
- Nestbox Quadrats
- Anabat Locations (and Directions)
- 2003 Rehab
- 2005 Rehab
- Spotted Gum - Ironbark Open Forest

KLEINFELDER

Project Ref:	20224187
Plot Date:	2022/03/11 11:10
Revision:	001 (GJoyce)

Map Projection:
GDA 1994 MGA Zone 56

Data Sources:
Kleinfelder - 2013
Nearmap - 2022

Disclaimer:This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

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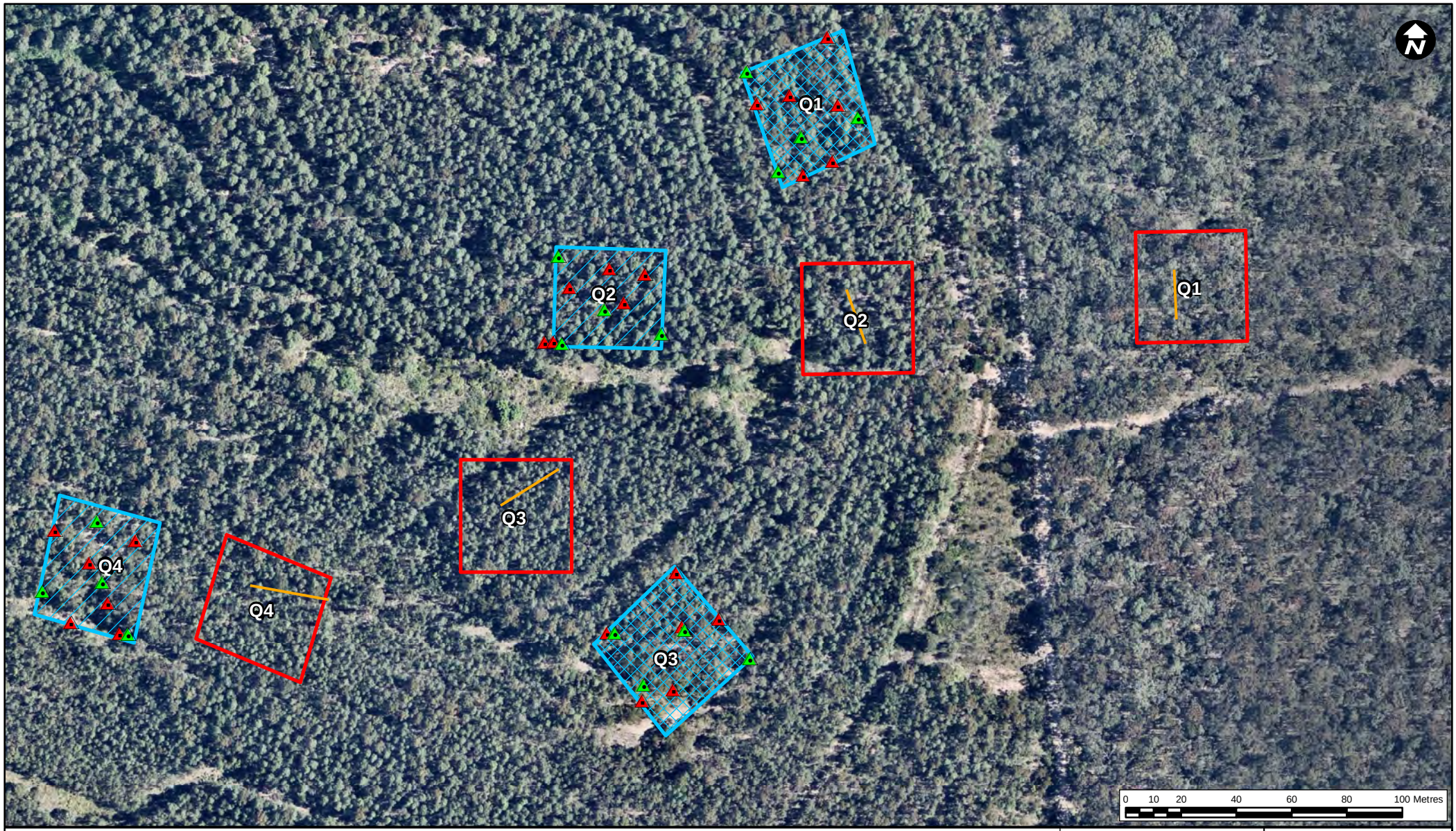

Figure 3: Nest Box and Fauna Quadrat Trapping Locations - Donaldson Coal Open Cut Mine

Legend

- Study Area Quadrats
- Reptile Run

Nestbox Quadrats

- High Fallen Timber
- Low Fallen Timber

Nestbox Location

- Arboreal box
- Terrestrial box

KLEINFELDER

Project Ref:	20224187
Plot Date:	2022/03/11 09:32
Revision:	001 (GJoyce)

Map Projection:
GDA 1994 MGA Zone 56

Data Sources:
Kleinfelder - 2013
Nearmap - 2022

Disclaimer:This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

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2.2.1 Terrestrial Mammals

Terrestrial mammals were surveyed between 17 – 21 January 2022. Eighty (80) Elliott A traps (20 per quadrat) were placed in an irregular grid pattern (4 x 5 traps). The 'best lie' method was used to avoid placing traps in open or exposed positions. Small mammals tend to avoid open spaces, preferring to go around the edge of a clearing rather than across it. Traps are generally more successful when placed against logs, under thick vegetation or along natural pathways through vegetation. Traps were baited with a mix of rolled oats, honey, peanut butter and treacle and set in position for eight consecutive nights and were checked each morning.

A Long-nosed Bandicoot (*Perameles nasuta*) was seen at Q3 during trap layout in December 2009. As a result, two cage traps were added to the trapping methodology for each quadrat to target larger terrestrial mammals. These traps were baited with the same mixture and set in position for eight consecutive nights and checked each morning. Additionally, remote camera sampling was utilised in 2022 for the first time in the monitoring program. This involved the installation of a single remote camera at a set location within each quadrat

2.2.2 Bats

Insectivorous Microchiropteran bat species were surveyed using Anabat recording units (Titley Scientific, Lawnton QLD). This method was introduced in 2011 and is now replicated annually. An Anabat was placed in the remnant vegetation (Q1), 18-year old rehab (Q2) and 16-year-old rehab (near Q3). The units were set out at 8 pm and recording continued through the night until 6 am for a total of 30 recording hours.

2.2.3 Birds

An area search within each quadrat was carried out on 21 January 2022 to survey for diurnal birds for a 20min period. Birds were identified either visually, with the aid of binoculars, or by call interpretation. Surveys were conducted in the morning when bird activity is at its peak (Bibby *et al.* 2000). Opportunistic sightings were also recorded and listed separately to actual survey results.

2.2.4 Herpetofauna

Six Type IV funnel traps were set along a 26 m run of drift fence in each quadrat between 17 – 21 December 2021. Trapping lines were left for eight consecutive nights and traps were checked daily.

Diurnal habitat searches for amphibians and reptiles were carried out within each quadrat during the January trapping period. Adult frogs encountered were identified by visual confirmation or their distinct advertisement calls. Suitable reptile habitat was inspected to detect any reptile species directly or indirectly through scats or other detectable traces. Suitable habitat included rock outcrops and crevices, fallen hollow logs and limbs, and burrows.

2.3 NEST BOXES

In 2011 an additional project was initiated within the rehabilitation areas involving the use of nest boxes as a method of promoting re-colonisation by arboreal and terrestrial species. Four quadrats located in similar rehabilitation age groups as the monitoring quadrats were selected and 10 nest boxes were erected (six terrestrial, four arboreal). The annual inspection was undertaken on 18 January 2022. The locations of the nest box plots and the existing fauna monitoring plots are provided in **Figure 3**. Photographs of the nest boxes design and current condition are provided in **Appendix B**.

2.4 STATISTICAL ANALYSIS

Data on fauna species detected between 2008 and 2021 were analysed to determine whether species richness or diversity differed between rehabilitation ages. Nine of the 11 sample periods were in summer and one in autumn (Baseline study in March 2008). The season in which surveys were conducted is known to have a significant influence on fauna diversity and abundance so data from March 2008 were excluded from analysis.

The relationship between two variables, species richness and sample year, was explored by linear regression. Regression statistics and charts were produced using Microsoft Excel. Non-metric Multidimensional Scaling (nMDS) and cluster analysis were also undertaken to explore the relationship between the fauna species assemblages detected in different rehabilitation age classes.

The Primer-E software program was used with the Kulczynski Similarity Index for presence only data (Clarke and Gorley 2006). This analysis produced scatterplots which graphically depicted, in 2-dimensional space, the similarity between species assemblages of different survey years. Associated dendrograms were also produced that graphically depict the relationship between sample years. The strength of any clusters apparent in the scatterplot was tested by running a similarity profile routine (SIMPROF) over branches in the dendrogram. Solid lines in the dendrogram indicate statistically significant clusters whereas dotted lines indicate clusters that are not statistically significant.

3 RESULTS

3.1 WEATHER CONDITIONS

The prevailing weather conditions throughout the trapping survey period (17 to 21 January 2022) were warm days to mild/warm nights. The total rainfall for the survey period was 35.4 mm, which predominantly fell on the 19-20 of January. During the trapping survey period the mean minimum temperature was 15.2^{o}C and the maximum temperature was 33.4^{o}C.

3.2 VEGETATION STRUCTURE

Flora monitoring does not form part of the program, however due to its relevance to fauna richness and re-colonisation, observations (**Plates 1 – 5**) regarding changes in floral diversity and structure are provided. Descriptions of all four quadrats are as follows:

- Q1 – located in an area of remnant vegetation and consists of mature Ironbark and Spotted Gum. Woody debris levels are low (7.26 tonne Ha^{-1}) (**Plate 1** and **Plate 2**).
- Q2 – located in the rehabilitation areas planted in 2003 which are dominated by a canopy of Eucalypt and Acacia species. Little ground cover is present and woody debris is high (57.36 tonne Ha^{-}) (**Plate 3** and **Plate 4**).
- Q3 – located in the rehabilitation areas planted in 2005 which are dominated by a canopy of Eucalypt and Acacia species medium shrub growth. No wood was placed in Q3 hence the low woody debris score (3.33 tonne Ha^{-1}) (**Plate 5** and **Plate 6**).
- Q4 – located in the rehabilitation areas planted in 2003. This area is dominated by a canopy of Eucalypt and Acacia species. This area has dense shrub growth and high woody debris levels (33.94 tonne Ha^{-1}) (**Plate 7** and **Plate 8**).

As expected, the overstorey vegetation of the rehabilitation quadrats is noticeably taller (~10-15 m) than in March 2008 (average 3 m). The Eucalypt species have continued to grow, but many of the Acacia species that were present in previous surveys have reached the end of their life cycle and are dead or dying. All quadrats are dominated by a canopy of Eucalypts which have formed dense thickets in some areas mainly in Q3 and Q4 with Q2 understorey being more open with less Acacia and shrub layers.

Smaller shrubs and ground species have continued to emerge, and native grasses are plentiful in some areas. Additional ground layer structure (leaf litter and woody debris) is also continuing to develop due to natural processes. Although overall floristic diversity is still relatively low, as the vegetation continues to age, it is likely that thinning of the canopy will facilitate greater species diversity within the understorey. This may take many years to occur.

Plate 1: Q1 – Understorey

Plate 2: Q1 Mid storey and Canopy

Plate 3: Q2 - Understorey

Plate 4: Q2 – Mid storey and Canopy

Plate 5: Q3 - Understorey

Plate 6: Q3 – Mid storey and Canopy

Plate 7: Q4 - Understorey

Plate 8: Q4 – Mid storey and Canopy

3.3 FAUNA

Fifty-three (53) fauna species were recorded during the 2021 survey (above the yearly average 38.4) (**Figure 4**). Additionally, four (4) previously undetected species were observed including: the Australasian Figbird (*Sphecotheres vieilloti*), Australian King Parrot (*Alisterus scapularis*), Bell Miner (*Manorina melanophrys*) as well as an BC Act listed species, the Powerful Owl (*Ninox strenua*). Photographs of native fauna species trapped and observed during the current survey are provided in **Appendix C**. A large increase in the number of species detected across all quadrats between years prior to, and years post 2011 is attributed to the inclusion of Anabat detection of Microchiropteran bat species in Q1, Q2, Q3 (2011 onwards) and Q4 (2021) (**Figure 5**).

The current survey results were comprised of one (1) arboreal and three (3) terrestrial mammals, 12 Microchiropteran bats, 32 bird species, four (4) reptiles and (1) amphibian species.

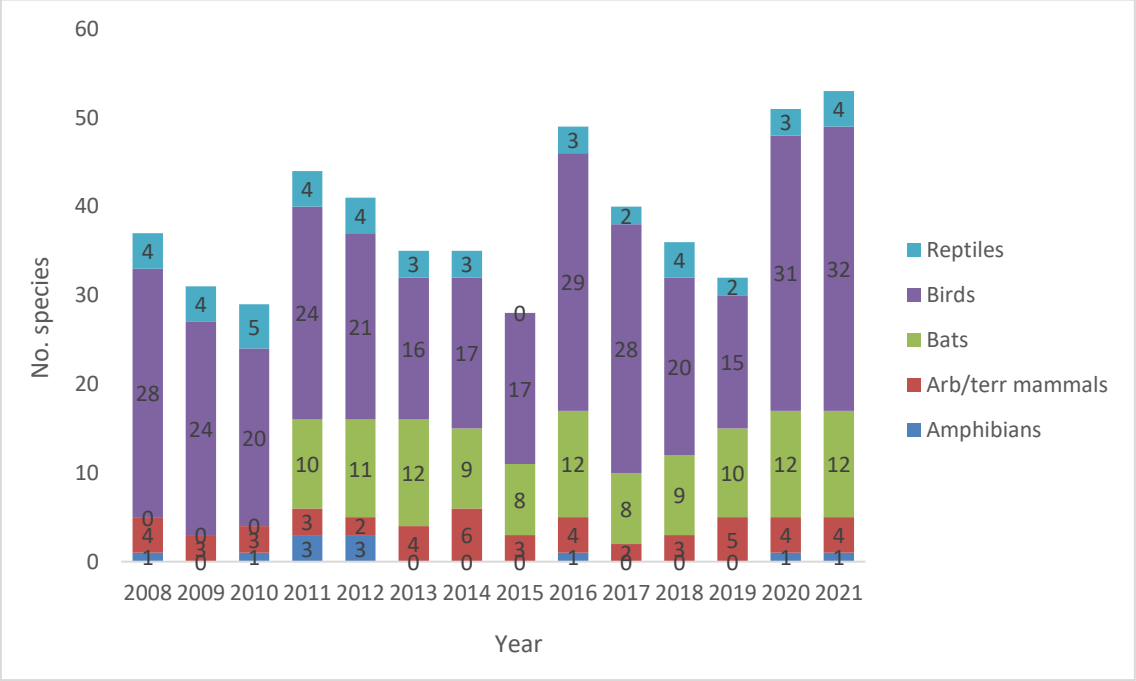


Figure 4: Number of fauna species per year from 2008 – 2011 (all quadrats combined)

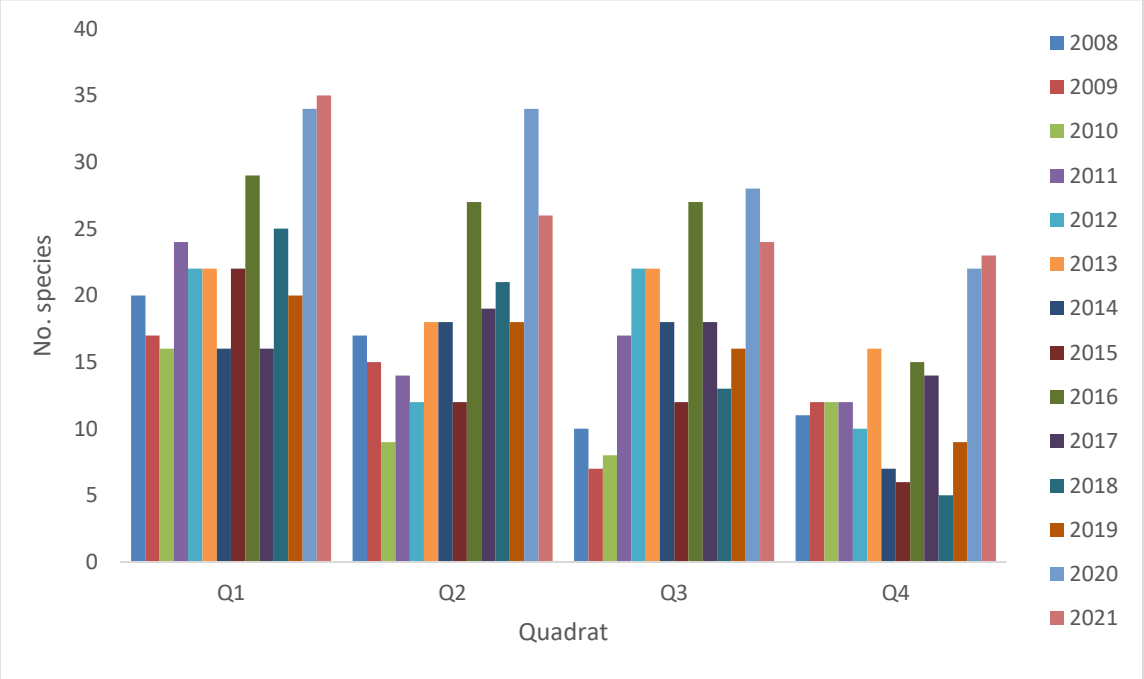


Figure 5: Number of fauna species per quadrat from 2008 - 2021

3.3.1 Arboreal and Terrestrial Mammals

One (1) arboreal and three (3) terrestrial mammal species were recorded during survey (**Figure 6**). The Common Brushtail Possum (*Trichosurus vulpecula*) and the Brown Antechinus (*Antechinus stuartii*) were detected in all quadrats. Additionally, the Swamp Wallaby (*Wallabia bicolor*), were recorded in Q1 and Q2, whilst the Long-nosed Bandicoot (*Perameles nasuta*) was exclusively recorded in Q1.

The level of recorded mammalian species richness has been most variable in Q1, ranging between one to four species. The Long-nosed Bandicoot (*Perameles nasuta*), a species that had not previously been recorded in this quadrat, was present in 2021. Mammal species detected in Q2 have increased in recent years with three species detected in 2019, 2020 and 2021. Mammalian species richness has remained relatively consistent within Q3, ranging between one – two species. Q4 displayed a similar range of species richness to Q3, ranging between one – two species year to year, until 2020 where four species were recorded. The level of species richness recorded in this quadrat in 2021 is similar to previous years (two species).

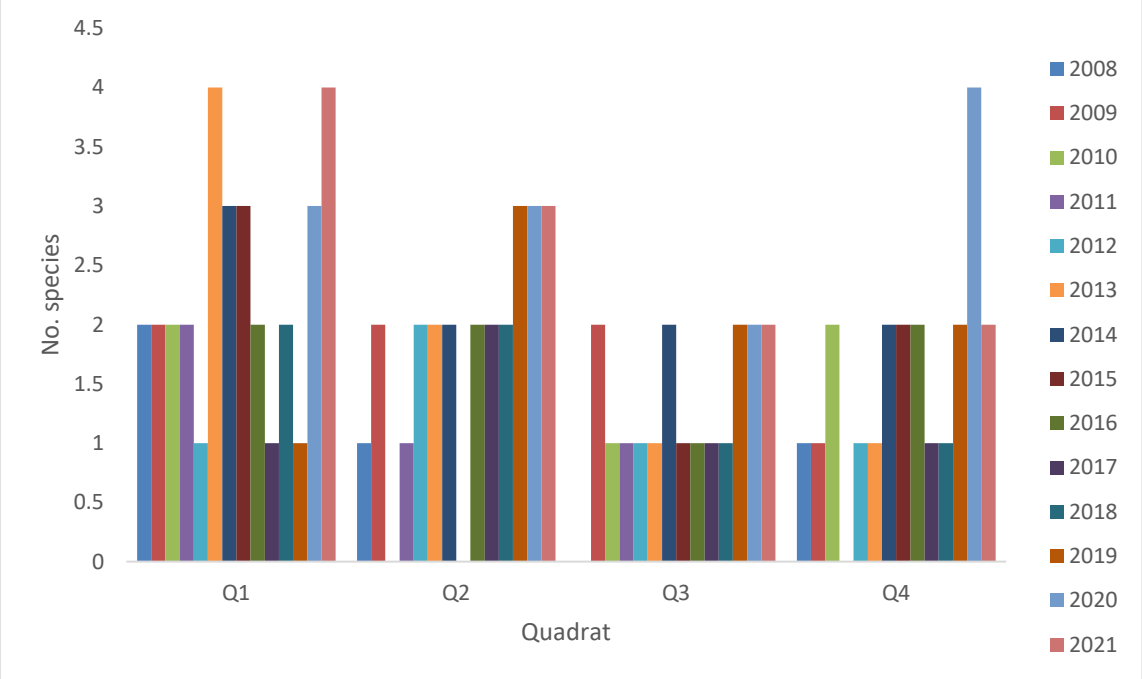


Figure 6: Number of arboreal and terrestrial mammal species per quadrat from 2008 – 2021.

The Brown Antechinus was not observed Q3 or Q4 during the early years of the monitoring program, however evidence of use by this species was recorded in 2013 in a nearby nest box quadrat. Usage of the rehabilitation area by the Brown Antechinus was confirmed in 2014 with the capture of a male animal in an Elliott A trap in Q4 over two consecutive mornings. The species has since been captured in Q4 from 2015 – 2021, excluding 2018. The first capture of a Brown Antechinus from Q3 was in 2017. Subsequent captures have now been recorded in 2019, 2020 and 2021, indicating that all ages of rehabilitation are now providing suitable habitat for this species.

3.3.2 Bats

A total of 12 bat species were recorded across the mature forest and rehabilitation areas in the January 2022 survey, four (4) of which, Little Bent-winged Bat (*Miniopterus australis*), Greater Broad-nosed bat (*Scoteanax rueppellii*), Eastern Cave Bat (*Vespadelus troughtoni*), and the Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) are listed as Vulnerable species under the NSW *Biodiversity Conservation Act 2016* (BC Act). Previously, only Q1, Q2 and Q3 had been surveyed for bats according to survey methodologies introduced in 2011. The same methodology was introduced in Q4 during the 2021 monitoring period, allowing for five (5) bat species to be recorded including the Vulnerable Little Bent-winged Bat. The number of bat species recorded per quadrat during current survey was above average for all Quadrat locations (**Figure 7**).

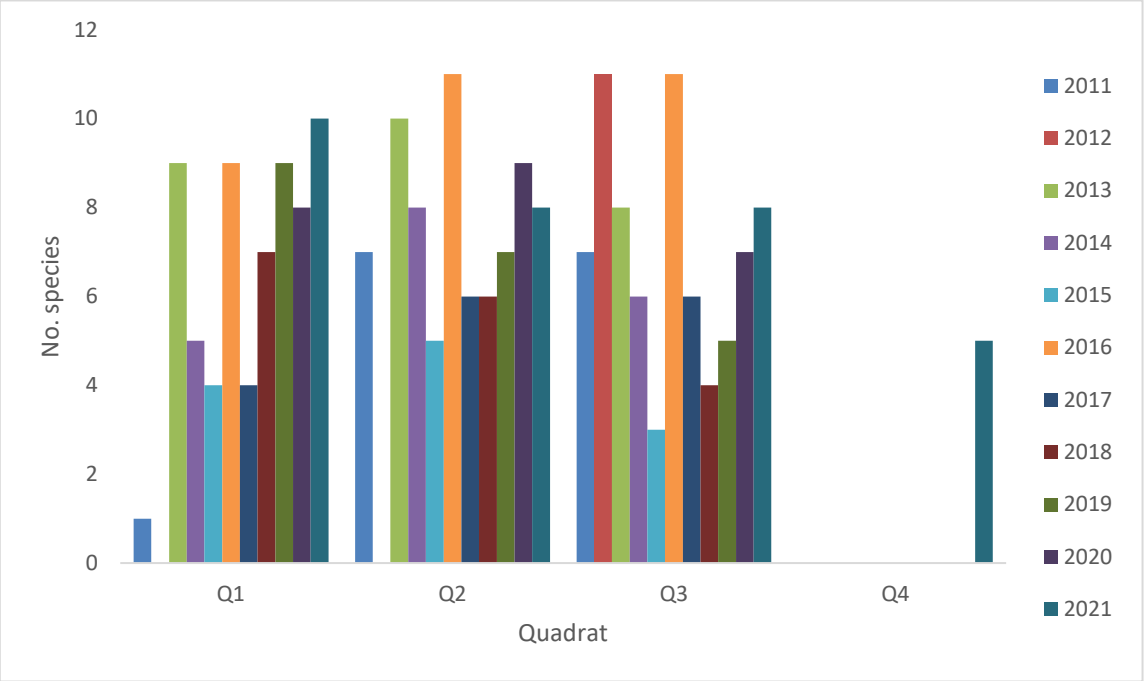


Figure 7: Number of bat species per quadrat from 2011-2021.

3.3.3 Birds

Thirty-two (32) bird species were recorded across all quadrats during the current survey (**Figure 8**). The result is well above the average of 22.9 species recorded across all quadrats between 2008 and 2021. In 2021, the number of bird species detected was above the yearly average for all quadrats and greater than the previous year's monitoring event (2020). The number of bird species recorded per quadrat each year is highly variable, with some survey years (2011, 2012, 2015 and 2018) recording considerably higher diversity in the mature forest (Q1) in comparison with the rehabilitation quadrats. In 2021, there was a higher diversity of birds detected within the remnant vegetation (Q1) than in the rehabilitated vegetation (Q2, Q3, and Q4).

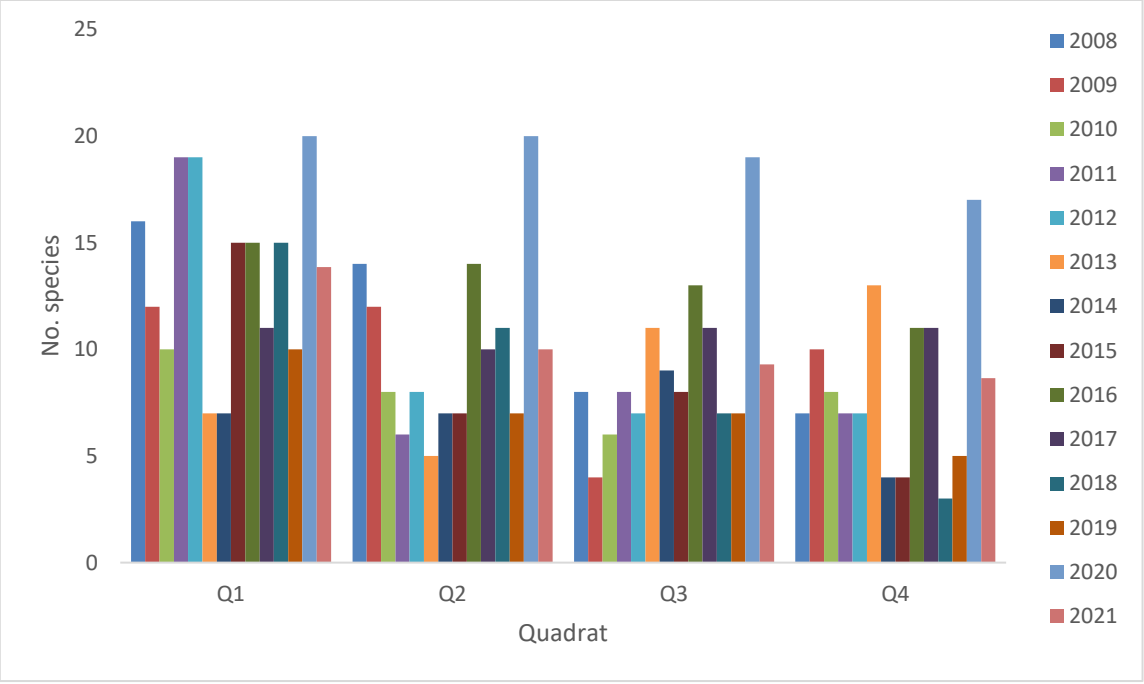


Figure 8: Number of bird species per quadrat from 2008-2021.

3.3.4 Reptiles

Four (4) reptile species were detected during current survey (**Figure 9**). One species, the Yellow-faced Whip Snake *(Demansia psammophis),* was opportunistically seen in Q1. The Garden Skink (*Lampropholis delicata*) has been recorded sporadically throughout the monitoring program and was once again detected in Q1 and Q2. The Southern Rainbow-skink (*Carlia tetradactyla*) was the only reptile species recorded within Q4 in 2021. The Lace Monitor (*Varanus varius*) was recorded in Q2 and Q3 for the first time, after only ever being recorded in Q1 in previous years.

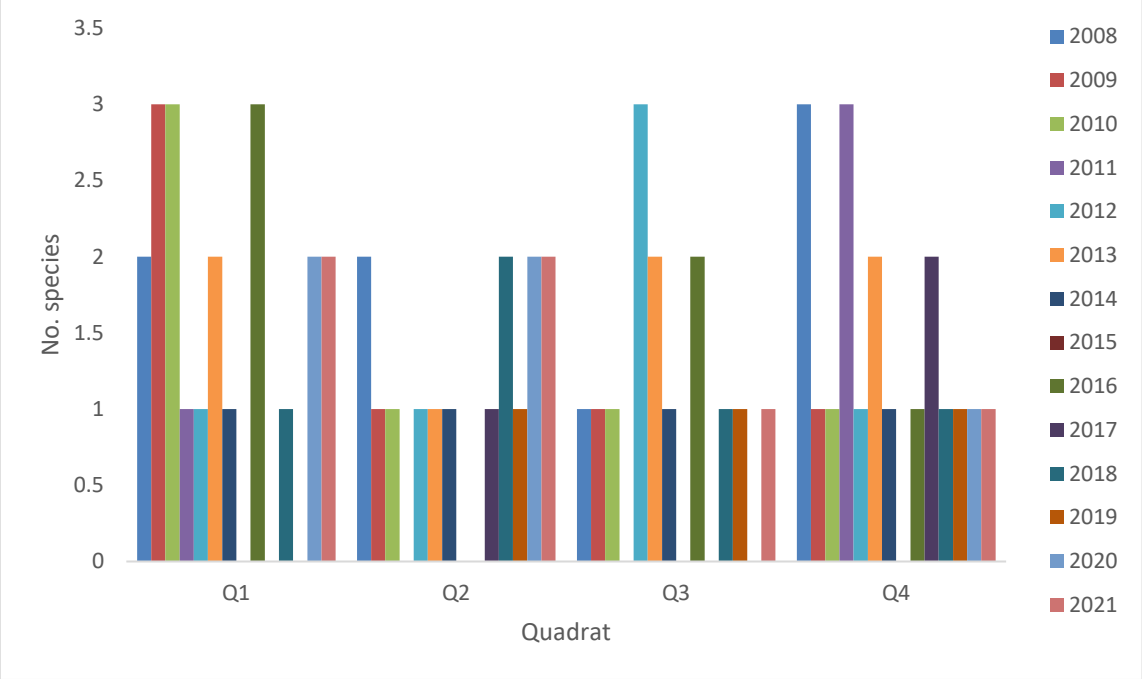


Figure 9: Number of reptile species per quadrat from 2008-2021.

3.4 FAUNA DIVERSITY PER QUADRAT

Three age classes of vegetation occur across the study area including remnant forest (**Plate 1-2**), rehabilitation planted in 2003 (**Plates 3-4 and 7-8**), and rehabilitation planted in 2005 (**Plate 5-6**). The location of all quadrats and corresponding rehabilitation age are shown in **Figure 2.** Non-metric Multidimensional Scaling (nMDS) analysis was used to investigate the relationship between the remnant vegetation and the rehabilitation vegetation based on the degree of similarity between fauna assemblages. The closer the data points are to each other, the more similar the fauna assemblages. Remnant refers to Q1, Rehab 1 and Rehab 3 refer to Q2 and Q4, respectively, which was planted in 2003; Rehab 2 refers to Q3 which was planted in 2005.

The nMDS analysis showed that in 2011, after four years of monitoring, all three rehabilitated quadrats (Q2, Q3, Q4) were at least 40% similar to each other with Rehab 1 and 2 being the most similar (greater than 60%) similar. The three rehabilitated areas, however, were marginally similar to the remnant forest in 2011, at only 20% similarity (**Figure 10**). After another four years, in 2015, all quadrats, including the remnant forest and rehabilitated areas, were greater than 40% similar. These findings show that over time the fauna assemblage in the rehabilitation areas is resembling the fauna species diversity of the remnant forest.

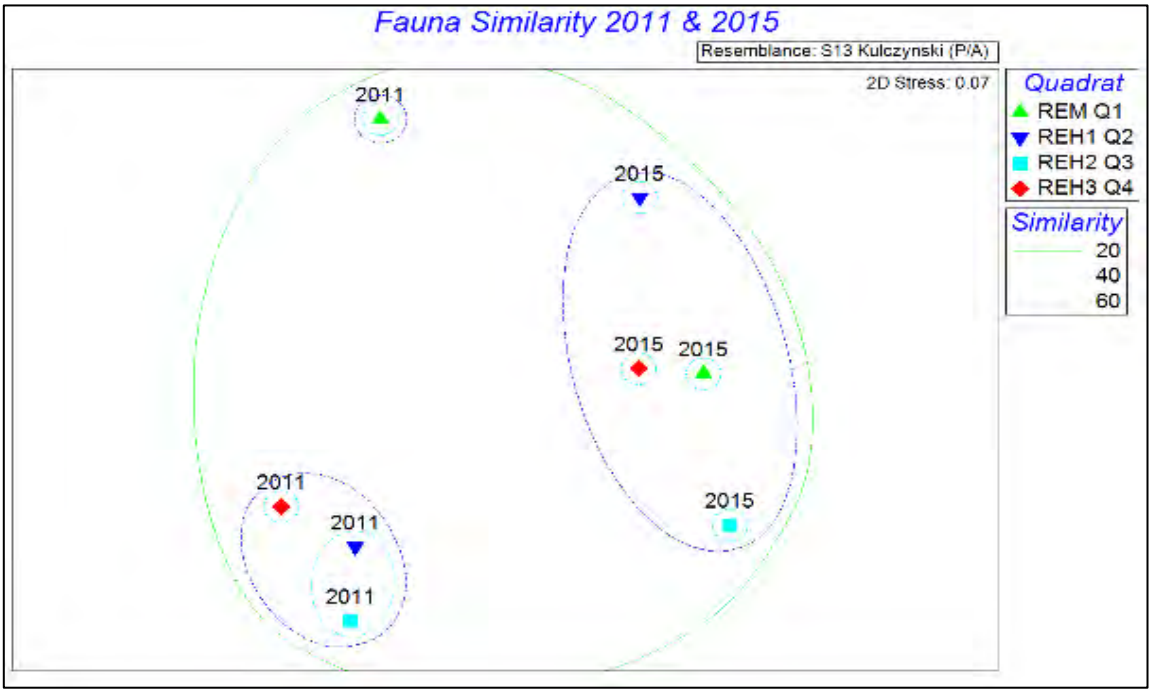


Figure 10: Non-metric Multidimensional Scaling analysis of all fauna per quad after 4 years (2011) and 8 years (2015). REM (Q1) = remnant vegetation; REH1 (Q2) = rehab planted in 2003; REH2 (Q3) = rehab planted in 2005; REH3 (Q4) = rehab planted 2003

Similarity measure analysis was also performed, comparing the fauna diversity of remnant and rehabilitated areas between 2016 – 2021 (**Figure 11**). In 2018, Q2 and Q3 were found to have a similarity index of 60%, with Q1 reducing in similarity to 40% in comparison to these other quadrats. In 2019, Q1 and Q2 had a similarity index of 60% increasing the index of Q1 from 40% in 2018. Both Q3 and Q4 having a 40% similarity in 2019 which is the first time Q4 has had a 40% similarity to Q1 since 2015 being 20% in the previous years. In 2020, Q1, Q2 and Q3 all have a similarity of between 60-80% with Q4 being high in the range of between 40-60%. Within the current monitoring period, Q2, Q3 and Q4 had a similarity between 60-80%, whilst the remnant vegetation (Q1) had a lower similarity, between 40-60%. This is the highest similarity rate that Q4 has had throughout the monitoring programme.

In the earlier years Q4 was found to have a similarity index of only 20% when compared with all other quadrats until 2019-2020, where the similarity index increased to between 40% and 60%. It was expected that the fauna diversity at Q4 would continue to have less similarity to all other quadrats as the survey design did not incorporate Anabat (microbat detector) deployment. Microbat species often contribute to approximately 30-40% of species richness over the last six years at quadrats 1, 2 and 3 where microbats are specifically surveyed (using Anabat detectors). The inclusion of bat surveying methodology may explain why the assemblage of Q4 experienced the highest similarity rate to the species assemblage of the other rehabilitation quadrats (Q2 and Q3) throughout the monitoring program.

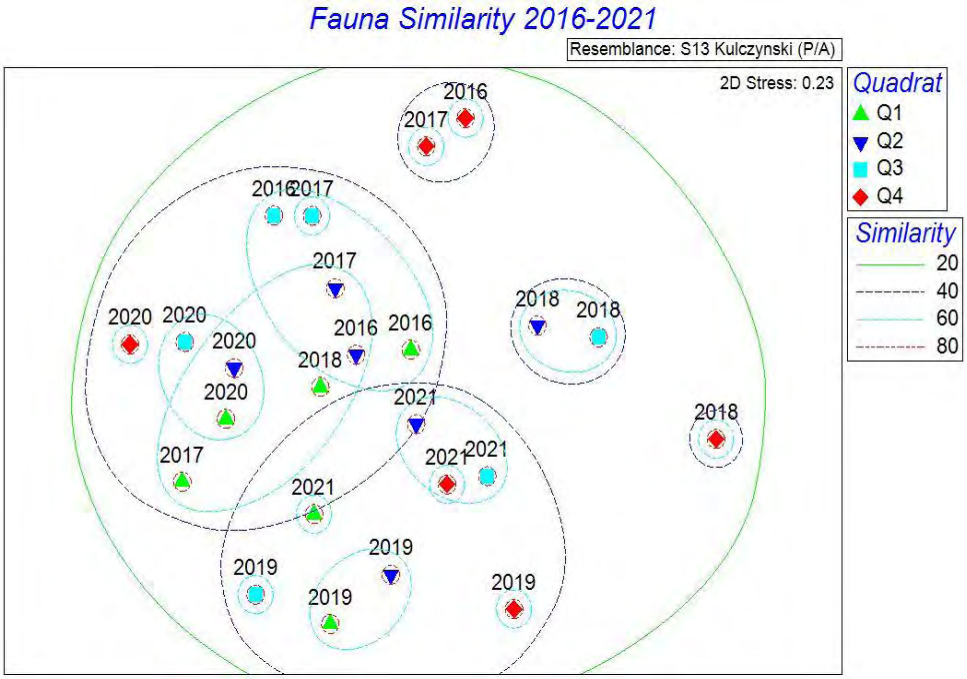


Figure 11: Non-metric Multidimensional Scaling analysis of all fauna per quad between years 2016-2021. REM (Q1) = remnant vegetation; REH1 (Q2) = rehab planted in 2003; REH2 (Q3) = rehab planted in 2005; REH3 (Q4) = rehab planted 2003.

3.5 Fauna Diversity vs Woody Debris

The results of the woody debris survey of each quadrat are presented in **Table 2** as background information. These data were collected in the preliminary survey (Q1, Q2 and Q4) and the first (Q3) monitoring event.

Table 2: Characteristics of woody debris between and within each quadrat

Quadrat No.	No. of pieces of woody debris per quadrat ≥8cm diameter	Average diameter of woody debris (cm)	Average length of woody debris (cm)	Total mass of woody debris in Tonne/Ha^{-1}
1 – mature forest stand	23	14.00	390.52	7.26
2 – now 18 year old rehab	39	14.79	128.74	57.36
3 – now 16 year old rehab	50	15.45	71.70	3.33
4 – now 18 year old rehab	91	13.75	103.92	33.94

Figure 12 demonstrates the relationship between the average number of terrestrial species recorded in each quadrat since monitoring began and the total mass of woody debris in each quadrat. The low R^2 (0.0054) value shows no effect regarding the amount of woody debris in each quadrat and the number of terrestrial species recorded.

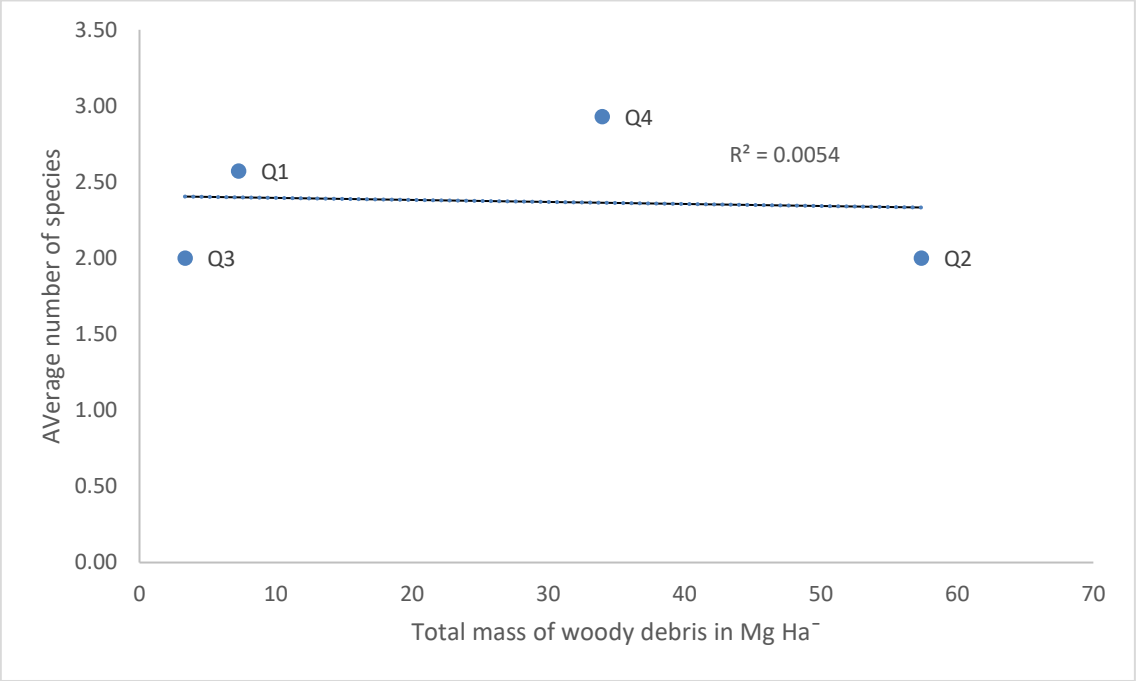


Figure 12: Average number of terrestrial species recorded each year, per quadrat and total mass of woody debris (T Ha^{-}).

Non-metric Multidimensional Scaling (nMDS) was used to determine whether the amount of woody debris influenced terrestrial fauna assemblage. **Figure 13** shows that all quadrats have a similarity index of at least 40-60%. A single cluster of Q3 and Q4 had a greater similarity (60-80%) than Q1 (remnant) and Q2. However, these clusters are not related to the amount of woody debris as the most similar quadrats, in terms of terrestrial fauna diversity, have significantly different amounts of woody debris.

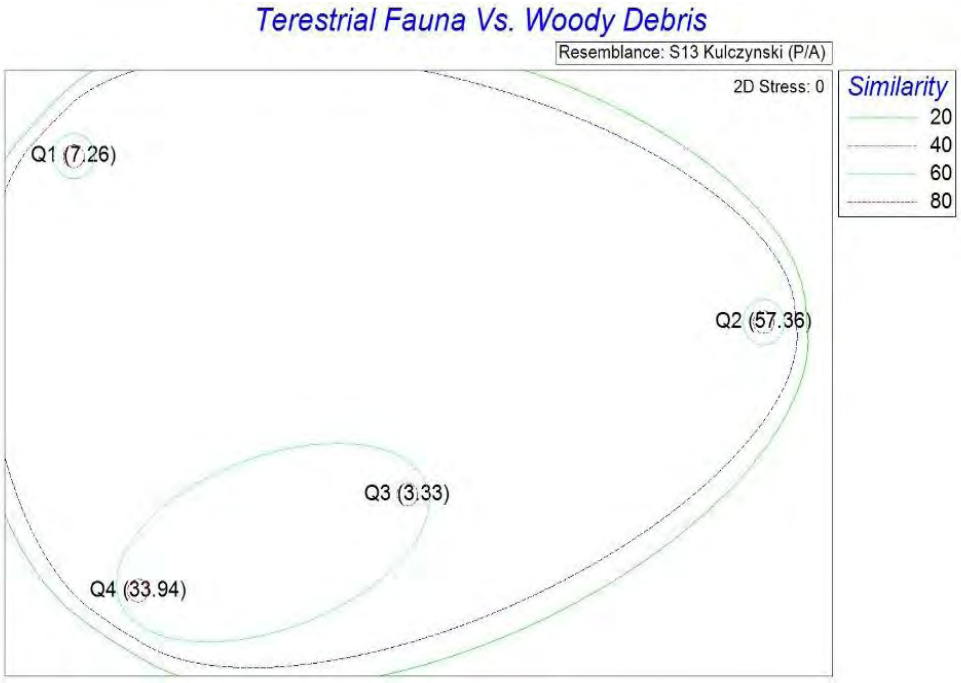


Figure 13: Non-metric Multidimensional Scaling analysis of number of terrestrial fauna species detected from 2008-2021 and its relationship to the amount of woody debris at each quadrat

3.6 NEST BOXES

Since monitoring began, all quadrats have shown evidence of activity in the form of individuals present, fresh leaf nests, scats, scratches and hairs. The most prevalent species has been the Sugar Glider. **Appendix D** contains photographs of the nest boxes and contents.

Nest box usage is recorded in four ways:

1. Actual use, animals sighted in the nest box (A);
2. Evidence of use which includes nests, scats and hair (E)
3. Unavailable (U) – the box is not habitable due to occupation by insects or from damage such as a missing lid or the box having fallen to the ground; and
4. No evidence (N).

In 2021, the total usage rate (A+E) for all usable nest boxes was 100% (7 out of 7 available boxes), equal to results from the previous 2 years (**Figure 14**). The total actual usage rate (A), where fauna are present within nest boxes, in 2021 was 43.9% (3 of 7 boxes).

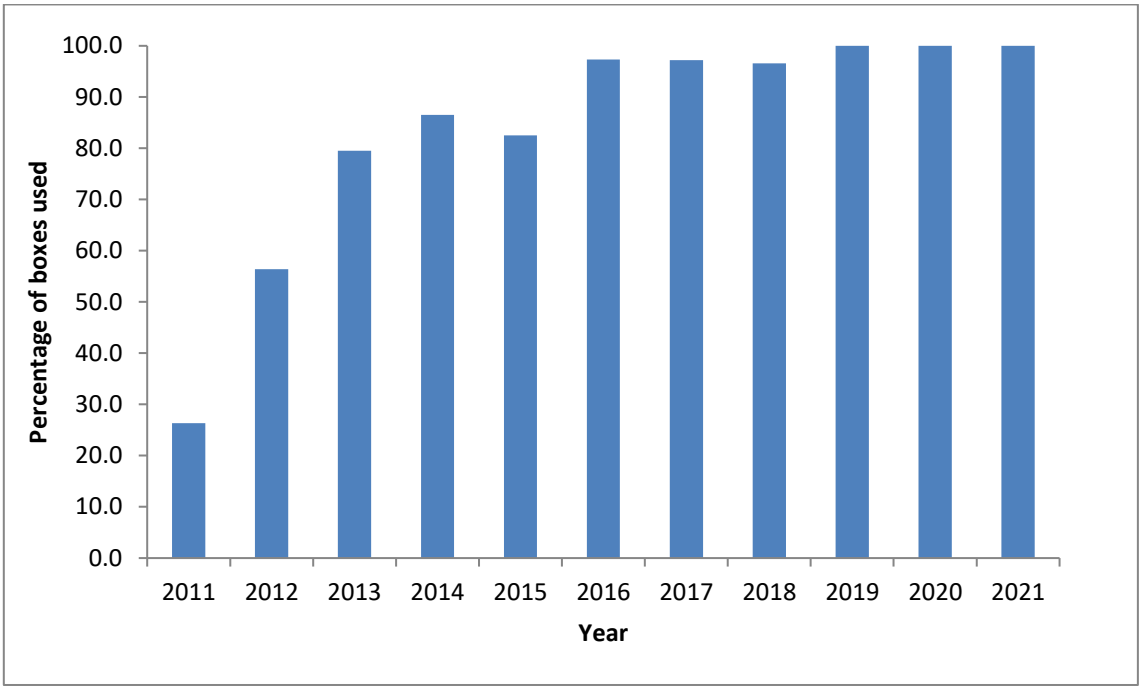


Figure 14: The percentage of total nest box (usable nest boxes only) usage (A+ E) for all quadrats 2011 – 2021.=

The percentage of boxes containing resident fauna (A) has remained steady over much of the monitoring period until 2019 and 2020 where there was an approximate 50% decrease over two years (**Figure 15**). In 2021, there has been a large increase in the percentage of boxes containing fauna, however there were substantially fewer boxes available during this time (7). Evidence of use (E) by fauna has increased every year until 2017 with a small decrease in 2018 with an increase in 2019 and 2020. In 2021, evidence of use decreased substantially. The number of available boxes showing no signs of fauna use has now reduced to zero indicating that a fauna species is inhabiting the rehabilitated areas.

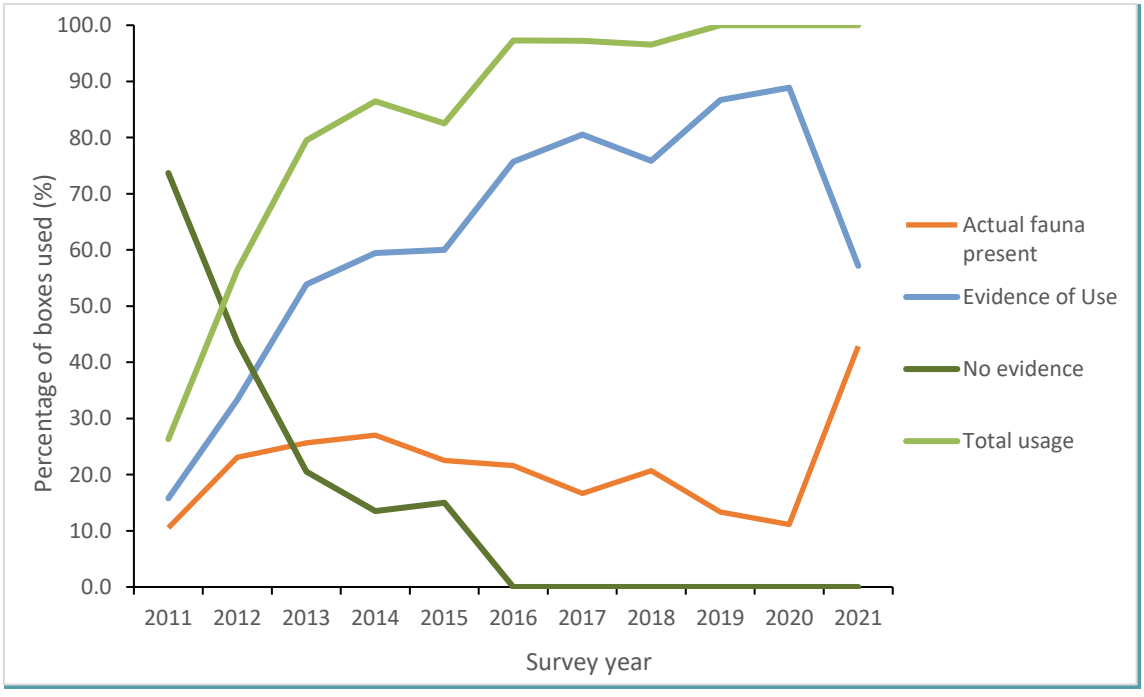


Figure 15: Percentage of available nest boxes used per usage category 2011 – 2021.

An analysis of Sugar Glider counts over time (2011 – 2021) (**Figure 16**) identified a steady increase from 2011 to 2015. The population has since declined; however, the rehabilitated quadrats still have a number of gliders present, suggesting breeding is occurring. The low numbers of sugar gliders in boxes may be attributed to the low number of available boxes as a result of weathering of materials and decay. Unavailable boxes now comprise 82.5% of all boxes, which reduces the overall chance of detecting sugar gliders which are still likely to be using the rehabilitated areas.

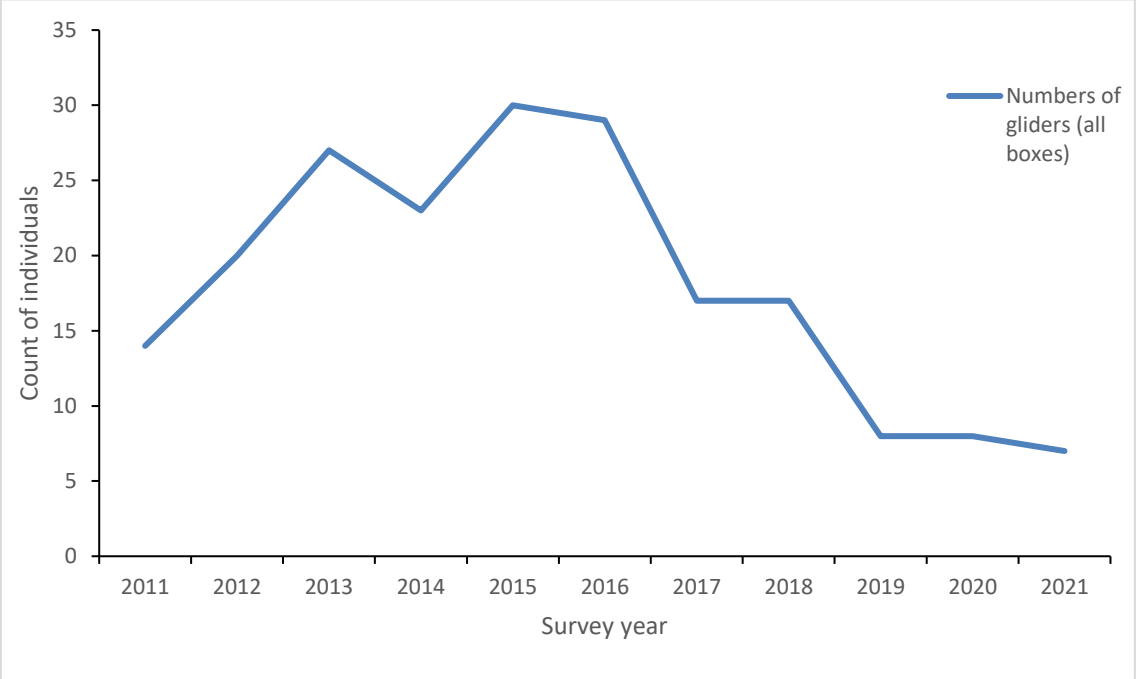


Figure 16: Number of Sugar Gliders (Petaurus breviceps) observed in boxes 2011 – 2021.

3.6.1 Arboreal nest boxes

Native fauna colonised the arboreal nest boxes soon after the installation, with fauna presence and evidence of use first being detected in 2011 (**Figure 17**). The overall utilisation of the boxes peaked in 2012 and remained stable until 2016. Since 2017, the overall number of utilised boxes has been declining. The rate of utilisation declined to its lowest rate in 2021 where five (5) boxes either had fauna present or evidence thereof. Nest box monitoring determined that 11 of the 16 arboreal nest boxes within the rehabilitation site (68.8%) were unavailable due to material decay or termite damage. The number of unavailable boxes has been increasing, and is likely responsible for the declining rate of detected fauna.

All the arboreal nest boxes have been used at some point by *Petaurus sp*. (identified by an actual animal or by the distinctive nest shape constructed by the *Petaurus* genus). In 2021, 60% (3 of 5) of the available arboreal boxes were occupied by Sugar Gliders with a total of seven (7) individuals recorded.

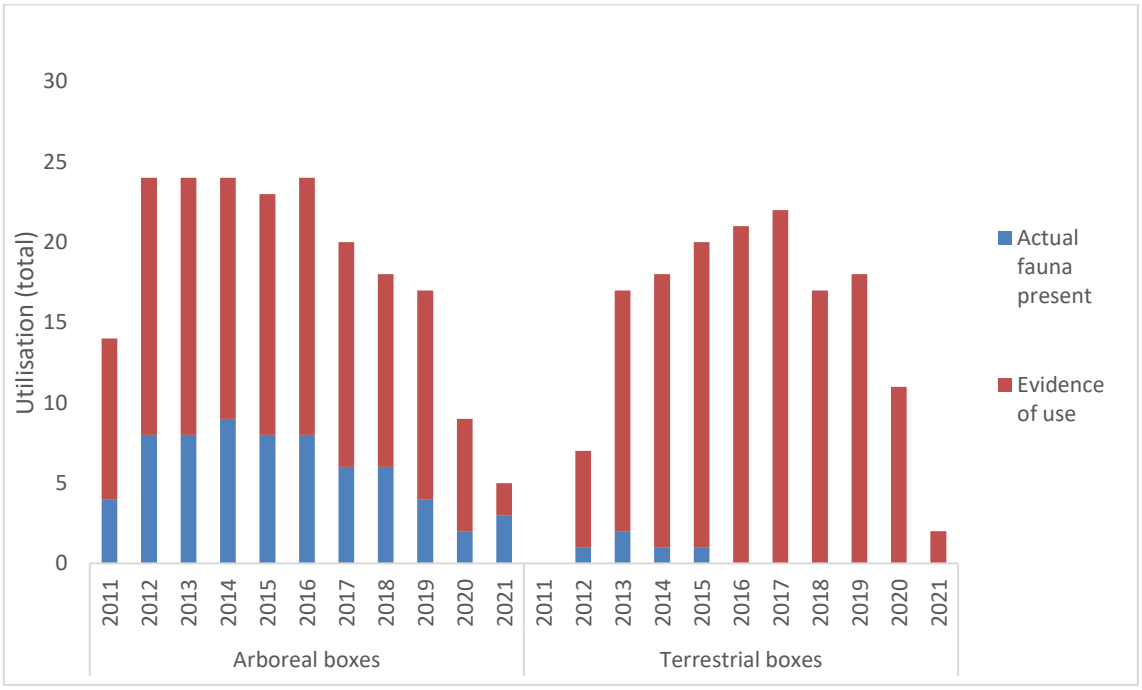


Figure 17: Evidence of use per nest box type 2011 – 2021 (usable nest boxes only).

3.6.2 Terrestrial nest boxes

The total usage of available terrestrial nest boxes has increased from zero usage (2011) (**Figure 17**) to 100% in 2016 – 2021 . In the 2021 monitoring period no boxes contained actual fauna, however, all available boxes contained some evidence of fauna use. Utilisation of terrestrial boxes by Sugar Gliders, evident by spherical shaped leaf nests was first detected in 2013. Despite the high utilisation, 21 out of the 24 nest boxes (87.5%) were unavailable to fauna due to decay or materials or termite infestation. This is a markedly higher number than the 13 unavailable boxes (54.2%) in 2020. As such, the utilisation of nest boxes is reflective of less than a quarter of the number that should be present.

3.6.3 Sugar Glider population

Sugar Gliders have been recorded within the rehabilitation area since the first nest box monitoring event in 2011. In 2021, seven (7) individual gliders were recorded using arboreal nest boxes only. Arboreal nest boxes have almost been at capacity for the years 2013 to 2016 through the number of actual Sugar Gliders observed in the available boxes. It is therefore expected that, given the lack of natural tree hollows in the rehabilitated areas, Sugar Gliders will begin to take up residence in the available terrestrial nest boxes. Consequently, lower numbers of antechinus use are being detected in nest boxes potentially due to colonisation by Sugar Gliders

The relationship between Brown Antechinus and Sugar Glider presence in terrestrial nest boxes is typically plotted and analysed each monitoring period. Given the large number of nest boxes that have become unavailable in 2021, this relationship is considered irrelevant for the current monitoring period and analysis has therefore been omitted from this report,

4 DISCUSSION

The rehabilitation area is showing positive signs of re-colonisation by a variety of fauna species. Over the course of the monitoring program, the total number of fauna species detected by the fauna surveys has remained reasonably constant (including the remnant quadrat), albeit fluctuating year to year (**Figure 4**). However, surveys in 2021 detected the greatest species diversity (across all quadrats) since monitoring commenced. This is potentially attributed to increased rainfall over the past 12-24 months allowing eastern Australia to emerge from a prolonged period of drought.

Bird, mammal and herpetofauna species counts have been variable throughout the 13-year survey period. For example, nine (9) new fauna species were recorded in 2012, two (2) new species in 2014, and five (5) new species in 2016. However, several species recorded in previous survey periods were not recorded in 2017, 2018 and 2019. In 2021, four (4) new species were recorded during the surveys. These changes are considered normal and are likely to continue as the vegetation structure matures addressing different species-specific requirements. In addition, the species detected during an annual survey period will depend largely on the weather conditions prior to, and during the survey period. Of note, as of 2017, the Brown Antechinus has been detected in all rehabilitation quadrats but was only detected within Q1 in the 2018 surveys. Whilst in the 2019 surveys the Brown Antechinus was detected in Q2, Q3 and Q4 but not within the remnant Q1 showing variability from year to year. In 2021 the Brown Antechinus was captured in all Quadrats. The variability in 2019 could be attributed to the severe drought conditions that were observed over the East coast of Australia and now with wetter conditions in 2021 species have returned to the rehab areas due to improved conditions.

4.1 FAUNA DIVERSITY PER REHAB AGE

Non-metric Multidirectional Scaling (nMDS) analysis and cluster analysis were used to compare the faunal assemblages of each quadrat at two points in time; 2011 (four years post-rehabilitation), and 2015 (eight years post-rehabilitation) after monitoring began. The following abbreviations were used in the analysis and are discussed in the following section: REM = Remnant; REH1 = Q2, 2003-planted rehabilitation; REH2 = Q3, 2005-planted rehabilitation and REH3 = Q4, 2003 planted-rehabilitation.

The original hypothesis was that over time, as the age and structural complexity of the rehabilitation increases, species diversity will be equivalent to the diversity observed in the remnant forest (Q1, REM). This was expected to take many decades, however as **Figure 10** and **Figure 11** shows, diversity in the two areas is already similar.

The 2011 faunal assemblages in the three quadrats in the rehabilitation area are clustered together and show 40-60% similarity but are only 20% similar to that of the remnant forest. However, after another four years, in 2015, all four quadrats are clustered together showing 40% similarity. In 2016, faunal assemblages of Q2 and Q3 were significantly more similar (60-80%) to the remnant quadrat than in 2015. When comparing 2018 with the previous two years (**Figure 11**) there is one large cluster showing a 40% similarity between Q1, Q2 and Q3 showing that these three areas are becoming similar to each other.

In 2021, the species diversity of the rehabilitated vegetation plots (Q2, Q3 and Q4) were found to be highly similar (60-80%). This differs from last years results in that Q4, is equally as similar to Q2 and Q3, whereas in 2020 it was 40-60% similar. This is likely attributed to the deployment of an Anabat within Q4 for the first time since the beginning of the monitoring program. Five (5) species of bat were detected in Q4 that were similar species to the other remnant plots. This year's results suggest that the absence of bat surveys within Q4 has likely been lowering its overall similarity to the other rehabilitated plots.

Additionally, the assemblage of Q4 was less similar to Q2 and Q3 than the previous year, decreasing from 60-80% in 2020 to 40-60% in 2021. Despite this decrease, the overall similarity between the remnant and rehabilitated quadrats remains high. The overall decrease in fauna similarity may be attributed to general variation in fauna utilisation year to year or the somewhat later onset of the monitoring period, instead being in late January 2022.

Overall, these findings show that the rehabilitation area is on a positive trajectory and is becoming more like the remnant forest whilst also experiencing phases where species richness fluctuates as seen in the 2021 data. It is

apparent that the original proposal - that species diversity in the rehabilitation sites will move closer to the species diversity of the remnant vegetation site - is supported by the monitoring data (with some year-to-year variation).

4.2 FAUNA DIVERSITY VS. WOODY DEBRIS

Several studies comparing mature forest and rehabilitated sites have found positive correlations between rock cover and woody debris with small mammal species richness and total reptile and amphibian captures. Most studies have found a positive correlation between habitat heterogeneity/diversity and species diversity (Tews *et al.* 2004*).* However, this may vary considerably depending on species specific requirements.

A comparison of the total number of terrestrial species recorded at each quadrat since monitoring began was made to determine if there is a positive correlation between this and the total mass of woody debris. As **Figure 12** shows there was no relationship between woody debris and number of species recorded (woody debris dependent species only). The nMDS analysis was then used to determine if the composition of all terrestrial species was affected by the amount of woody debris. The analysis, shown in **Figure 13**, highlights one cluster based on similarity of terrestrial species assemblages; Q3 and Q4, with Q1 and Q2 having a lower similarity.

The mass of woody debris throughout Q2 and Q4 is heavily skewed due to two large fallen logs which is suspected to make up the majority of debris for that area. These two separate logs are not likely to provide significant amounts of refuge for fauna. The presence of large fallen branches is also absent from the rehab areas with the bulk of woody debris being categorised as immature trees which have fallen over due to poor ground stability. These, also, do not provide much refuge for fauna as they often do not fall flat on the ground nor do they offer much cover underneath.

Originally it was expected that higher woody debris levels would result in greater species diversity. However, as the dataset has grown, it may be the case that woody debris levels may lead to greater abundance of a small number of species, not species diversity as a whole. As discussed previously, habitat structure and composition significantly affect the type and diversity of species present. For example, there is evidence that bird species diversity in forests is determined more by the physical structure of a plant community (i.e. how foliage is distributed vertically) than the diversity and amount of vegetation (MacArthur and MacArthur 1961). This suggests that physical structure may be more important in promoting faunal re-colonisation than the actual composition of plant species and is an important consideration for land rehabilitation practices.

Future monitoring may benefit from surveys to determine species diversity within each quadrat in addition to a classification of each quadrat based on the complexity of its vegetation structure. These results, in conjunction with species diversity may provide insight into what specific factors (e.g. woody debris, vegetation structure) aid in fauna re-colonisation.

It may be that woody debris does affect fauna diversity and abundance but not in a linear pattern and that the differences in total mass of debris between quadrats are not great enough to cause marked differences in fauna species assemblage. Rather than the amount of woody debris being the causal factor of terrestrial fauna species assemblage, it is possible that other factors, such as distance from the remnant forest or vegetation structure and complexity are also important in shaping terrestrial species assemblage.

Strong winds during a storm early in 2015 blew over many of the trees in the rehabilitation area, effectively increasing the total mass of woody debris in the area. Future monitoring could benefit through the recalculation of the mass of debris at each quadrat to determine if this change has had an impact on fauna diversity.

4.3 VEGETATION STRUCTURE

Overstorey vegetation within sections of Q3 and Q4 has increased in height, with height starting to plateau during the past three years of monitoring as the trees mature with no discernible increase in 2021 (~3 m in 2010, 4.5 m in 2011, 4.6 m in 2012, 5 m in 2013, 6 – 9 m in 2014, 7-10 m in 2015-2017 and 8-12m in 2018 - 2021). However, where trees are growing in proximity the canopy has become quite thick. This has resulted in some restricted growth and maturation of the trees in addition to preventing appropriate understorey growth and development. Other reasons for restricted growth could be too much competition or limited resources along with a drought period at the end of 2019. With wetter conditions over 2020 and 2021, the rehab has recovered its foliage cover. An assessment of the average tree height will be conducted in 2022.

Where the overstorey is not as dense or is absent (Q3 and Q4 compared to Q2), the understorey is more structurally and floristically diverse. These quadrats (Q3 and Q4) are comprised of tussock grasses, bare ground,

rock and pockets of leaf litter build-up below shrubs and juvenile trees. Improvements in understorey structure for Q3 and Q4 and shown with both quadrats containing Brown Antechinus and the Common Dunnart (*Sminthopsis murina*) found in Q4 during the 2020 monitoring event.

Poor regeneration of the shrub and ground layer could be due to the original high density of planting within Q2 of Eucalypt and Acacia species which have formed a thick canopy preventing enough light to support understorey plants. During the 2021 assessment of vegetation structure, it was noted that the Eucalypt species have continued to grow. All quadrats are dominated by a canopy of Eucalypt which have formed dense thickets in some areas. Natural processes will allow the canopy to thin and clear over time in all quadrats (Q2 will be of interest and this process has started to occur between 2019 - 2021). This will in turn support greater understorey growth and diversity.

As noted above, the storm event in 2015 has caused some thinning of Eucalypt trees across the rehabilitation sites. The impacts of this on ground and midstorey vegetation should be monitored in future survey events. During 2021 surveys, no healthy trees were observed to have fallen over, with observations of an increase in foliage cover of the canopy species following the drought period at the end of 2019.

The more complex ground cover and floristic diversity observed in Q3 and Q4 may be related to greater availability of light into those areas with less dense canopy. However, as observed throughout Q2, there are areas in Q3 and Q4 where the ground cover is poor due to Eucalypts forming a closed canopy limiting light reaching the understorey. The ground layer structure of the three Rehab quadrats is still relatively poor but is improving with grass cover and an increase in leaf litter observed in 2021. The paucity of ground cover has initially inhibited re-colonisation by small mammals due to a lack of shelter sites or habitat for their prey items. However, as the habitat matures, and the ground layer improves, native dasyurids such as the Brown Antechinus and native rodents such as the Bush Rat (*Rattus fuscipes*) are likely to increase in numbers which has occurred in 2021 with the Brown Antechinus seen in high numbers in all quadrats.

4.4 Terrestrial and Arboreal Animals

The numbers of Brown Antechinus observed in Q1 had remained relatively consistent since surveys began in 2008 except for 2012 and 2019 when no Brown Antechinus were captured. The species was originally absent from the rehabilitated vegetation (Q2, Q3 and Q4) until 2014 where the first capture of an individual Brown Antechinus was recorded at Q4. Since then, the species has been recorded most years in every quadrat. The numbers have fluctuated over time. The numbers recorded in 2016 and 2018, were lower than usual (two and three captures in comparison to the yearly average of six), however recovered in 2020 with nine captures of Brown Antechinus within Q1 alone. In 2021, record numbers of the Brown Antechinus were detected in all quadrats, the highest being 20 individuals in Q3. This may be attributed to favourable environmental conditions between 2020 and 2021 following the dry conditions in 2019. Additionally, surveys were conducted in late January (2022) instead of the usual period in mid-late December. Males of this species are short-lived, dying shortly after reaching sexual maturity and mating in late Winter. As such, the number of males may be lower in December than in late January where new immature males have become independent. Many males and female individuals were recorded in 2021.

Despite the increase in Brown Antechinus individuals potentially being attributed to seasonal variability, the species could act as an indicator species in determining the success of re-colonisation in the rehabilitated area. This is due to the sensitivity of this species to structural components such as understorey height and complexity, leaf litter and the abundance of logs. Previous observations of Brown Antechinus in Q2 are most likely due to its proximity to remnant vegetation. The nearby remnant vegetation has potentially aided in the re-colonisation of the rehabilitated area as species begin to forage in the new habitat. A similar trend was observed with the Common Brushtail Possum. This suggests that the rehabilitation area currently provides suitable foraging habitat for several species but may lack suitable nesting or breeding habitat for larger species.

The rate of nest box occupancy in the rehabilitation area supports these assumptions and highlights the importance of introducing habitat hollows into rehabilitation areas. In addition, the inconsistency in native terrestrial mammal observations in the rehabilitation area (Q2, Q3 and Q4) compared to the remnant habitat further suggests that the complexity of rehab vegetation does not match that of the remnant vegetation. Connectivity with remnant habitat is positive and will facilitate movement of native species into the rehabilitation area as suitable habitat becomes available.

Annual monitoring has shown slow improvements in the structure and complexity of the rehabilitation vegetation and further monitoring events will continue to provide insight into the relationship between the various vegetation/ground cover characteristics and fauna re-colonisation.

4.5 BATS

The recording of Microchiropteran bat species was added to the survey methodology in 2011 to determine whether bats are using the rehabilitation areas for foraging. In total, 12 species were detected in January 2021 including four threatened species; the Little Bent-winged Bat (*Miniopterus australis*), Greater Broad-nosed bat (*Scoteanax rueppellii*), Eastern Cave Bat (*Vespadelus troughtoni*), and the Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*).

The highest number of bat species recorded within an individual quadrat (11 species) was recorded in 2016. In 2021, numbers of bat species recorded were found to be above average across all quadrats excluding Q4 where bat survey methodology way employed for the first time in 2021, and an average is yet to be established. Similar species were identified in each quadrat suggesting that the same bat species are utilising the remnant and rehabilitated vegetation. The survey methodology created in 2011 for bats did not previously include Anabat detectors in Q4, however this methodology was incorporated in 2021. A similar assemblage of bats was found in Q4 to the quadrats,

Microbats are primarily insectivores, and are voracious feeders. Insects play important ecosystem roles by transporting pollen from one flower to another and thus achieving pollination. High pollination success is vital to the establishment of rehabilitated areas. It is encouraging to detect such a high number of microbat species not only from a fauna diversity perspective, but from an ecosystem perspective.

4.6 BIRDS

Species richness has varied slightly between each quadrat over the 11 years; however, Q1 has maintained the highest mean level of richness (**Figure 8**). This is not surprising as Q1 contains structurally diverse and complex habitat able to support different bird species and their habitat requirements. Several studies have confirmed this by showing that bird species richness was higher in complex revegetation compared to simple revegetation (Rossi 2003, Munro *et al.* 2007). Dynamic changes in species richness observed from year to year highlights the continual change in vegetation structure and complexity and can also be attributed to individual species' detectability and local climatic conditions.

The same total number of species were observed in 2020 and 2021 (31), although with varying assemblages. The bird diversity for 2020 – 2021 are the highest recorded throughout the monitoring program with many of the same species being found in all four quadrats. Several nectar feeding birds that have been detected in previous years at both remnant and rehab quadrats were observed in 2021 most likely due to the flowering nectar trees and continuing favourable conditions between 200-2021 compared within 2019 were we were in a drought. With the presence of nectar feeding birds the results have been above average. Other small to medium-sized insectivores were once again detected during the 2021 surveys within rehab quadrats including Superb Fairy-wren (*Malurus cyaneus*), Spotted Pardalote (*Pardalotus punctatus*), and Eastern Yellow Robin (*Eopsaltria australis*). The bird diversity for 2021 was the highest on record for all quadrats with many of the same species being found across all four quadrats.

The species recorded in the rehabilitation areas compared to the remnant area are characteristic of the vegetation structure present. Many bird species found in the rehabilitation areas prefer scrub type vegetation and are more commonly found in open and fringe areas while some species that prefer forest with larger trees were only detected within the remnant quadrat.

Another sign indicating progress of the rehabilitation area is the presence of the hemiparasitic plant, Mistletoe, and the consistent recording of Mistletoe birds. Mistletoes are considered a keystone resource in forests and woodlands throughout the world and the Mistletoe bird, a specialist feeder on mistletoe fruit, is a key dispersal agent. Mistletoes provide food in the form of nectar, fruit and leaves to many bird and mammal species. They also provide a key foraging substrate for insectivorous species, as well as nesting sites for many bird species. Several studies have found greater vertebrate species richness associated with higher mistletoe densities (Watson 2001).

4.7 HERPETOFAUNA

Herpetofauna results have remained reasonably constant across the monitoring program. However, as ground cover and understorey continue to develop it is expected that more amphibian and reptile species will recolonise the area. As stated previously, the lack of light penetrating the closed canopy of the rehabilitation sites may be inhibiting re-colonisation. A lack of suitable water bodies within the rehabilitation areas may also be a limiting factor restricting reptile and amphibian re-colonisation.

In 2021, the species richness of herpetofauna was higher than the overall average, excluding Q3 which was equal to the average.

4.8 NESTBOXES

Within the relatively new field of restoration ecology there is an assumption that successful rehabilitation of flora will facilitate fauna re-colonisation. However, natural tree hollows and remnant habitat required for successful re-colonisation can take hundreds of years to develop at a rehabilitation site.

To date, there have been very few studies which report successful fauna re-colonisation on mine sites and the effectiveness of artificial hollows/nest boxes within rehabilitation areas remains largely unknown. The information recorded from the 2021 nest box inspections is promising with 100% of all available arboreal and terrestrial nest boxes exhibiting actual use or evidence of use (equal to results from 2016, 2017, 2018 and 2019 and 2020; **Figure 14**).

Usage rates were appearing to plateau from 2013 to 2015 but have had a positive trend in the past five years of surveys (**Figure 15**). Arboreal nest boxes (**Figure 17**) reached a peak of 60% actual usage in 2014, but decreased to 28% in 2020. In 2021, this number has once again increased to 60%, however this is likely due to the large number of boxes that have become unavailable due to weathering and decay, particularly over the last year. As such, there are fewer boxes available to arboreal fauna, making the overall occupation of already occupied boxes seem higher than the previous year's results.

Similarly, in 2021 there was found to be large number of uninhabitable nest boxes (both the arboreal and terrestrial) which has potentially exaggerated the nest box usage rates. It is strongly recommended that all uninhabitable nest boxes within the rehab be replaced/fixed to enable accurate analysis of the nest box usage and fauna colonisation of the rehab.

Figure 16 plots Sugar Glider numbers over time (2011 – 2021) with the results showing a steady increase in individual glider numbers from 14 in 2011 to 29 in 2016, however there has been a steady decrease in glider numbers from 2017 onwards, with seven (7) individuals identified in 2021. The decrease in glider numbers is likely related to the large number of unavailable boxes that has been gradually increasing since 2017, resulting in fewer opportunities to record the species. Other potential factors include seasonal variability or the presence of a predator species foraging in the area

A Powerful Owl was observed roosting in a tree during the 2021 annual monitoring event within Q3. This species is known to prey on arboreal mammals such as gliders. It is evident that the structural complexity and floristic make-up of the rehabilitation area is at a point where it can provide sufficient food resources and cover from predators to support a population of gliders. The limited number of artificial arboreal hollows (tall nest boxes) in the rehabilitated areas have led to Sugar Gliders taking up residence in terrestrial nest boxes in previous survey periods. Nest boxes near to the ground are not typical nesting locations for Sugar Gliders as predation risks are higher. The target species for terrestrial nest boxes, Brown Antechinus, appears to be competing for nest boxes as some individual boxes were found to have both a Sugar Glider nest as well as Antechinus scats.

The increase in nest box use by Brown Antechinus each year since 2011 has been a positive sign for the re-colonisation of the rehabilitation area. However, with the 2015 and 2016 results showing increased competition from Sugar Gliders for available nest boxes, the data is beginning to show a decline in evidence of use by Brown Antechinus. Since the 2017 results there has been an increase in evidence of use by Brown Antechinus, with evidence of glider use decreasing. This trend could show fluctuations in the denning use between Sugar Gliders and the Brown Antechinus from year to year with 2020 swapping the trend again with Sugar Gliders being slightly more dominant than the Brown Antechinus. Nest-box maintenance is required for the majority of the boxes which

is likely impacting the trends that are being observed. Given that a large number of boxes became unavailable for fauna utilisation between 2020 and 2021, this relationship was not assessed or included in this year's monitoring report.

Overall, the trends emerging after eight years of nest box monitoring continue to be positive. The continued uptake and high utilisation of all nest box types is an indicator of the potential of rehabilitated areas to support local fauna species. The observed encroachment of gliders using terrestrial boxes for the last five years further demonstrates how vital hollow availability is to forest ecosystem restoration.

5 RECCOMENDATIONS

Overall, the rehabilitation area is showing positive signs of re-colonisation by a variety of fauna species. The original proposition was that over time, as the age and structural complexity of the rehabilitation increases, species diversity will gradually match the diversity observed in the remnant forest (Q1, REM). This process was expected to take many decades, however as discussed above, the process is already being confirmed by the data analysis.

It is recommended that:

- Monitoring continue so that trends observed in the first 12 years may be better understood over a greater timeline.
- Nest boxes should continue to be monitored annually and any repairs/replacements made as required. Current nest box usage does not accurately reflect the state of the rehab, as a large number of boxes (33 of 40) are uninhabitable due to weathering and insect damage. To ensure that rehab areas continue to provide nesting habitat for fauna and to be able to quantify this, it is recommended that unavailable boxes be replaced or repaired prior to the next monitoring event in 2022.
- Control of isolated individuals of the weed species *Lantana camara* in the vicinity of the quadrats be undertaken to ensure this species does not become more widespread within the rehabilitation; and
- Monitoring woody debris every 3 to 5 years would provide insight into the natural decay process within the rehabilitation area. This in turn can be correlated to the success of the rehabilitation in terms of observed species richness. Furthermore, this information will allow informed recommendations regarding the initial rehabilitation design and management of ongoing natural processes as the rehabilitation is compared to the natural forest.

6 REFERENCES

Bibby, C.J., Burgess, N.D. and Hill, D.A. (2000). Bird Census Techniques. Academic Press Limited, London.

Butts, S.R. and McComb, W. (2000). Associations of Forest-Floor Vertebrates with Coarse Woody Debris in Managed Forests of Western Oregon, The Journal of Wildlife Management, 64:1, 95-104.

Carey, A.B. and Johnson, M.L. (1995). Small mammals in Managed, Naturally Young, and Old-Growth Forests, Ecological Applications, 5:2, 336-352.

Clarke, K.R. and Gorley, R.N. (2006). *PRIMER v6: User Manual/Tutorial*. PRIMER-E, Plymouth.

Ecobiological (2008) Donaldson Rehabilitation Baseline Monitoring Report. Report prepared for Yancoal Australia Ltd.

Ireland, T.T., Wolters, G.L. and Schemnitz, S.D. (1994). Recolonization of Wildlife on a Coal Strip-mine in Northwestern New Mexico, The Southwestern Naturalist 39(1): 53-57.

Lada, H., Thomson, J.R., MacNally, R., Horrocks, G. and Taylor, A.C. (2007). Evaluating simultaneous impacts of three anthropogenic effects on a floodplain-dwelling marsupial *Antechinus flavipes*, Biological Conservation 134: 527-536.

Loeb, S.C. (1999). Responses of Small Mammals to Coarse Woody Debris in a Southeastern Pine Forest, Journal of Mammalogy, 80:2, 460-471.

MacArthur, R.H. and MacArthur, J.W. (1961). On bird species diversity, Ecology, 42, 594- 598.

MacNally, R. (2006). Longer-term response to experimental manipulation of fallen timber on forest floors of floodplain forest in south-eastern Australia, Forest Ecology and Management, 229: 155-160.

MacNally, R. and Horrocks, G. (2007). Inducing whole-assemblage change by experimental manipulation of habitat structure, Journal of Animal Ecology 76: 643-650.

MacNally, R., Parkinson, A., Horrocks, G., Conole, L. and Tzaros, C. (2001). Relationships between terrestrial vertebrate diversity, abundance and availability of coarse woody debris on south-eastern Australian floodplains, Biological Conservation, 99: 191-205.

Munro, N.T., Lindenmayer, D.B. and Fischer, J. (2007). Faunal response to revegetation in agricultural areas of Australia: A review, Ecological Society of Australia 8: 199-207.

Robinson , R. (1997). Dynamics of coarse woody debris in flood-plain forests: impacts of forest management and flood frequency. BSc (Hons) Thesis, Charles Sturt University.

Rossi S. (2003). Birds, mammals and their habitat in a variegated landscape in the western Strzelecki Ranges. Masters Thesis, School of Applied Sciences, Faculty of Science, Monash University, Melbourne, Vic.

Tews, J., Brose, U., Grimm, V., Tielborger, K., Wichmann, M.C., Schwager, M. and Jeltsch, F. (2004). Animal species diversity driven by habitat heterogeneity/diversity: the importance of keystone structures. Journal of Biogeography, 31, 79–92.

Watson, D.M. (2001). Mistletoe – a keystone resource in forests and woodlands worldwide. Annual Review of Ecological Systematics, 32: 219-249.

APPENDIX A FAUNA SPECIES RECORDED AT EACH QUADRAT PER YEAR

+ indicates presence
# Listed on NSW BC Act 2016
* Introduced species

Scientific Name	Common Name	Q1 (remnant)											Q2 (rehab)											Q3 (rehab)											Q4 (rehab)										
		'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21
Amphibians																																													
Limnodynastes peroni	Striped Marsh Frog																																												
Limnodynastes tasmaniensis	Spotted Marsh Frog																																												
Litoria latopalmata	Broad-palmed Frog			+																				+			+										+	+						
Pseudophryne bibronii	Bibron's Toadlet				+																																								
Pseudophryne coriacea	Red-backed Toadlet										+	+											+											+					+		+				+
Total		0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2	0	1	0	0	0	0	1
Birds																																													
Sphecotheres vieilloti	Australasian Figbird																																												+
Cracticus tibicen	Australian King Parrot																																	+											
Cracticus tibicen	Australian Magpie					+																										+	+			+							+		
Corvus coronoides	Australian Raven		+		+	+		+	+		+	+								+			+	+							+		+			+							+	
Geopelia humeralis	Bar-shouldered Dove				+		+						+	+							+											+					+			+	+			+	
Manorina melanophrys	Bell Miner											+																																	
Coracina novaehollandiae	Black-faced Cuckoo-shrike				+	+	+				+							+	+				+							+			+							+				
Elanus axillaris	Black-shouldered Kite																							+											+	+									
Gerygone mouki	Brown Gerygone																																												
Acanthiza pusilla	Brown Thornbill		+		+									+	+	+			+	+					+	+	+				+			+	+			+						
Melithreptus brevirostris	Brown-headed Honeyeater						+															+																							+
Cacomantis variolosus	Brush Cuckoo				+																								+																
Acanthiza reguloides	Buff-rumped Thornbill																																							+					
Scythrops novaehollandiae	Channel-billed Cuckoo					+			+		+							+				+										+						+	+			+	
Coracina tenuirostris	Cicadabird	+			+			+	+			+										+									+	+	+									+	
Phaps chalcoptera	Common Bronzewing																											+																
Eurystomus orientalis	Dollarbird																																											
Eudynamys orientalis	Eastern Koel	+	+			+							+					+	+			+																						
Platycercus eximius	Eastern Rosella										+																																	
Acanthorhynchus tenuirostris	Eastern Spinebill	+	+			+							+					+					+				+	+					+						+				
Eopsaltria australis	Eastern Yellow Robin		+				+	+	+		+	+		+	+	+		+			+	+	+						+		+	+	+	+							+	+	+
Cacomantis flabelliformis	Fan-tailed Cuckoo												+					+				+											+										
Calyptorhynchus lathami	Glossy Black Cockatoo									+																																			
Pachycephala pectoralis	Golden Whistler								+		+	+								+	+									+	+			+							+			+	
Cracticus torquatus	Grey Butcherbird	+					+	+		+	+	+	+							+			+									+											+	
Rhipidura fuliginosa	Grey Fantail	+	+	+			+		+	+		+								+		+									+	+		+						+		+	+			+
Colluricincla harmonica	Grey Shrike-thrush											+		+	+					+											+	+	+									+			
Dacelo novaeguineae	Laughing Kookaburra	+		+	+	+	+	+	+	+	+			+						+	+			+											+									+			+	
Myiagra rubecula	Leaden Flycatcher				+						+			+																							+									
Meliphaga lewinii	Lewin's Honeyeater								+																																				+	
Hieraaetus morphnoides	Little Eagle																																												
Glossopsitta concinna	Little Lorikeet										+																																		
Dicaeum hirundinaceum	Mistletoebird		+		+						+	+				+		+				+	+		+						+					+				+	+			+	+
Glossopsitta concinna	Musk Lorikeet																																												

+ indicates presence # Listed on NSW BC Act 2016 * Introduced species		Q1 (remnant)											Q2 (rehab)											Q3 (rehab)											Q4 (rehab)										
Scientific Name	Common Name	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21
Phylidonyris novaehollandiae	New Holland Honeyeater																												+																	
Philemon corniculatus	Noisy Friarbird	+	+		+			+	+		+	+	+				+		+	+		+	+						+				+							+					+
Oriolus sagittatus	Olive-backed Oriole	+		+	+			+	+		+	+								+						+																		
Turnix varia	Painted Button-quail													+										+	+	+	+									+									
Cracticus nigrogularis	Pied Butcherbird	+									+		+									+																					+	
Strepera graculina	Pied Currawong	+		+			+	+				+			+								+										+											
Ninox strenua	Powerful Owl																																	+											
Trichoglossus haematodus	Rainbow Lorikeet	+		+		+				+	+	+								+	+	+	+					+					+	+								+	+	+
Neochmia temporalis	Red-browed Finch													+													+			+							+						
Anthochaera carunculata	Red Wattlebird																																+											
Rhipidura rufifrons	Rufous Fantail																																											
Pachycephala rufiventris	Rufous Whistler	+		+	+	+							+	+	+	+				+	+			+		+	+	+			+			+		+	+	+	+	+	+	+	+		
Todiramphus sanctus	Sacred Kingfisher	+			+	+	+	+	+	+	+																																+		
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet									+		+																																
Myzomela sanguinolenta	Scarlet Honeyeater				+	+	+		+			+					+			+			+					+	+		+	+			+				+					+
Zosterops lateralis	Silvereye												+		+	+						+		+		+	+						+		+	+	+	+		+	+			+	
Pardalotus punctatus	Spotted Pardalote							+	+	+		+						+	+			+									+													+	
Acanthiza lineata	Striated Thornbill				+		+			+	+							+			+	+	+							+			+	+						+			+	
Malurus cyaneus	Superb Fairy-wren				+	+	+		+	+	+						+	+		+	+	+		+				+		+			+	+	+		+		+	+	+		+	+	+
Hirundo nigricans	Tree Martin																																		+										
Malurus lamberti	Variegated Fairy-wren		+	+										+										+												+	+								+
Hirundo neoxena	Welcome Swallow												+																						+										
Sericornis frontalis	White-browed Scrubwren	+			+		+						+	+				+		+		+		+					+	+					+		+							+
Melithreptus lunatus	White-naped Honeyeater	+											+																																
Hirundapus caudacutus	White-throated Needletail			+																																								
Eurostopodus mystacalis	White-throated Nightjar				+																																							
Cormobates leucophaeus	White-throated Treecreeper		+			+	+				+	+										+										+											
Corcorax melanorhamphos	White-winged Chough			+									+			+																												+
Rhipidura leucophrys	Willie Wagtail																																											
Acanthiza nana	Yellow Thornbill		+																																									+
Lichenostomus chrysops	Yellow-faced Honeyeater	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+		+	+			+	+	+	+	+	+		+	+			+	+	+	+	+	+		+	+
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo																																											
Total		16	12	10	19	14	15	11	15	10	20	18	14	12	8	6	7	14	10	11	7	19	11	8	4	6	8	8	13	11	7	7	19	13	7	9	8	7	4	11	11	3	5	17	14
Bats																																												
Austronomus australis	White-striped Mastiff Bat					+	+	+	+	+	+					+	+	+	+		+	+							+	+		+	+										
Chalinolobus gouldii	Gould's Wattled bat					+	+	+	+	+	+	+				+	+	+	+	+	+	+	+				+		+	+	+	+	+	+										+
Chalinolobus morio	Chocolate Wattled Bat						+		+	+		+						+	+	+								+	+	+	+												
Falsistrellus tasmaniensis	# Eastern False Pipistrelle						+		+									+		+									+		+												
Micronomus norfolkensis	# Eastern Coastal Free-tailed Bat											+					+	+									+	+	+	+			+										
Miniopterus australis	# Little Bent-wing Bat				+		+	+	+	+	+	+						+	+	+		+	+						+					+									+
Miniopterus orianae oceanensis	# Large Bent-winged Bat															+											+																

+ indicates presence # Listed on NSW BC Act 2016 * Introduced species		Q1 (remnant)											Q2 (rehab)											Q3 (rehab)											Q4 (rehab)										
Scientific Name	Common Name	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21	'08	'09	'10	'11	'15	'16	'17	'18	'19	'20	'21
Mormopterus ridei	Eastern Free-tailed Bat						+			+	+	+					+	+		+	+	+	+						+		+	+		+											
Myotis macropus	# Southern Myotis						+											+									+		+																
Nyctophilus sp.	Unidentified Long-eared Bat sp.					+				+		+				+				+	+	+	+					+					+	+											+
Rhinolophus megaphyllus	Eastern Horseshoe Bat						+															+	+						+															
Scoteanax rueppellii	# Greater Broad-nosed Bat										+	+					+				+	+										+												
Scotorepens orion	Eastern Broad- nosed bat							+	+	+	+	+				+		+			+	+	+				+						+	+											
Vespadelus darlingtoni	Large Forest Bat																																+												
Vespadelus pumilus	Eastern Forest Bat										+	+				+		+	+			+	+				+		+	+			+	+											+
Vespadelus troughtoni	Eastern Cave Bat									+											+		+											+											
Vespadelus vulturnus	Little Forest Bat					+	+		+	+	+	+				+		+	+				+				+		+	+		+		+											+
Total		0	0	0	1	4	9	4	7	9	8	10	0	0	0	7	5	11	6	6	7	9	9	0	0	0	7	3	11	6	4	5	7	8	0	0	0	0	0	0	0	0	0	0	5
Mammals																																														
Antechinus stuartii	Brown Antechinus	+	+	+	+	+	+	+	+		+	+		+				+	+		+	+	+							+		+	+	+					+	+	+		+	+	+
Macropus giganteus	Eastern Grey Kangaroo	+																																											
Macropus rufogriseus	Red- necked Wallaby																																												
Mus domesticus	*House Mouse																																												
Perameles nasuta	Long-nosed Bandicoot											+													+	+														+			+			
Petaurus breviceps	Sugar Glider																			+																									
Rattus fuscipes	Bush Rat												+			+												+																
Rattus rattus	*Black Rat					+								+											+					+	+									+	+			+	
Sminthopsis murina	Common Dunnart																																											+	
Trichosorus vulpecula	Common Brushtail Possum		+	+	+	+	+		+	+	+	+						+	+	+	+	+	+								+	+	+	+			+				+	+	+	+
Wallabia bicolor	Swamp Wallaby										+	+									+	+	+																					
Total		2	2	2	2	3	2	1	2	1	3	4	1	2	0	1	0	2	2	2	3	3	3	0	2	1	1	1	1	1	1	2	2	2	1	1	2	0	2	2	1	1	2	4	2
Reptiles																																													
Amphibolurus muricatus	Jacky Lizard	+	+	+			+						+	+	+									+					+						+			+						
Amphibolurus nobbi	Nobbi Dragon																																												
Carlia tetradactyla	Southern Rainbow Skink										+																													+		+	+	
Ctenotus robustus	Robust Striped Skink																								+										+	+	+							
Demansia psammophis	Yellow-faced Whip Snake						+					+										+		+			+					+						+			+		+		
Lampropholis delicata	Garden Skink		+	+	+		+				+	+								+	+	+	+	+					+		+								+	+				
Lampropholis guichenoti	Grass Skink		+										+																																	
Pogona barbata	Eastern Bearded Dragon								+																																				
Pseudonaja textilis	Eastern Brown Snake																																												
Varanus varius	Lace Monitor	+		+																			+											+										
Total		2	2	3	3	1	0	3	0	1	0	2	2	2	1	1	0	0	0	1	2	1	2	2	1	1	1	0	0	2	0	1	1	1	0	3	1	1	3	0	1	2	1	1	1
Yearly Totals		20	17	16	24	21	29	16	25	20	34	35	17	15	9	14	12	27	19	21	18	34	25	10	7	8	17	12	27	18	13	15	28	25	11	11	12	12	6	15	14	5	8	22	23

APPENDIX B TERRESTRIAL AND ARBOREAL NEST BOXES

Plate 9: Arboreal Nest Box

Plate 10: Terrestrial nest box

Plate 11: Damaged Terrestrial Nest box.

APPENDIX C NATIVE FAUNA PHOTOS

Plate 12: Sugar Glider (*Petaurus breviceps*)

Plate 13: Brown Antechinus (*Antechinus stuartii*)

Plate 14 Yellow-faced Whipsnake (*Demansia psammophis*)

Plate 15 Lace Monitor (*Varanus varius*)

APPENDIX D LICENSING

Kleinfelder employees involved in the current study are licensed or approved under the National Parks and Wildlife Act 1974 (License Number: SL100730, Expiry: 31 March 2022 and the Animal Research Act 1985 to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

APPENDIX E STAFF CONTRIBUTIONS

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

Name	Qualification	Title/Experience	Contribution
Mark Dean	B EnvSc&Mgt	Ecologist	Fauna surveys
James Baldry	MConsBio	Ecologist	Report author
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	Map preparation
Dr Daniel O'Brien	PhD B EnvSc&Mgt	Senior Ecologist	Fauna surveys/Report review

Appendix 7

Approval to Cease Independent Environmental Audits

(Total No. of pages including blank pages = 3)

From: Ann Hagerthy <Ann.Hagerthy@planning.nsw.gov.au>
Sent: Wednesday, 31 October 2018 3:02 PM
To: Phillip Brown
Cc: James Benson; Leah Cook
Subject: RE: Donaldson 2016/207 AR

Hi Phillip,

Thank you for your letter. The Department notes that Schedule 2, Condition 117 of DA 98/01173 and DA 118/698/22 states that Independent Environmental Audits (IEAs) are required at 3 yearly intervals and at the completion of mining, and notes that the consent for mining lapsed in 2013 with the last IEA completed in 2015. Please be advised that at this time the Department requires no future IEAs as required under Schedule 2, Condition 117 of DA 98/01173 and DA 118/698/22, unless otherwise directed by the Secretary.

Regards,

Ann Hagerthy, PMP
A/Team Leader
Compliance
Department of Planning & Environment | PO Box 3145 | Singleton NSW 2330
T 02 6575 3407 M 0428 976 540
E ann.hagerthy@planning.nsw.gov.au
compliance@planning.nsw.gov.au

From: Phillip Brown <Phillip.Brown@yancoal.com.au>
Sent: Thursday, 25 October 2018 2:02 PM
To: Ann Hagerthy <Ann.Hagerthy@planning.nsw.gov.au>
Cc: James Benson <James.Benson@yancoal.com.au>; Leah Cook <Leah.Cook@planning.nsw.gov.au>
Subject: RE: Donaldson 2016/207 AR

Hello Ann

Further to the email below, please find enclosed Donaldson's response.

Regards

Phillip Brown | ENVIRONMENT & COMMUNITY RELATIONS SUPERINTENDENT

Ashton Coal Operations Pty Ltd
SITE: Glennies Creek Road, Camberwell NSW 2330
POSTAL: PO Box 699 Singleton NSW 2330 Australia
PHONE: +61 2 6570 9219
MOBILE: 0439 909 952
EMAIL: Phillip.Brown@yancoal.com.au
WEBSITE: www.ashtoncoal.com.au

From: Ann Hagerthy [mailto:Ann.Hagerthy@planning.nsw.gov.au]
Sent: Wednesday, 10 October 2018 1:02 PM
To: Phillip Brown <Phillip.Brown@yancoal.com.au>
Cc: James Benson <James.Benson@yancoal.com.au>; Leah Cook <Leah.Cook@planning.nsw.gov.au>
Subject: RE: Donaldson 2016/207 AR

Hi Phillip,

Please find attached the Department's response letter to the 2016-2017 Annual Review. Please note that a revision is due 27 November 2018.

Regards,

Ann Hagerthy, PMP
Senior Compliance Officer (Wed, Thu, Fri)
Compliance
Department of Planning & Environment | PO Box 3145 | Singleton NSW 2330
T 02 6575 3407 M 0428 976 540
E ann.hagerthy@planning.nsw.gov.au
compliance@planning.nsw.gov.au

From: Phillip Brown <Phillip.Brown@yancoal.com.au>
Sent: Thursday, 25 January 2018 12:44 PM
To: Ann Hagerthy <Ann.Hagerthy@planning.nsw.gov.au>; DPE PSVC Compliance Mailbox <compliance@planning.nsw.gov.au>
Cc: James Benson <James.Benson@yancoal.com.au>
Subject: Donaldson 2016/207 AR

Hello Ann

Please find enclosed the 2016/2017 Annual Review for Donaldson Coal.

Thanks

Phillip Brown | ENVIRONMENT & COMMUNITY RELATIONS SUPERINTENDENT

Ashton Coal Operations Pty Ltd
SITE: Glennies Creek Road, Camberwell NSW 2330
POSTAL: PO Box 699 Singleton NSW 2330 Australia
PHONE: +61 2 6570 9219
MOBILE: 0439 909 952
EMAIL: Phillip.Brown@yancoal.com.au
WEBSITE: www.ashtoncoal.com.au

Appendix 8

Incident Reports

(Total No. of pages including blank pages = 10)

YANCOAL
兖煤澳大利亚有限公司

DONALDSONCOAL
Part of the Yancoal Australia Group

SITE: 1132 John Renshaw Drive Black Hill 2322
POSTAL: PO Box 2216 Greenhills 2323
PHONE: +61 2 4015 1100
WEBSITE: www.doncoal.com.au
ABN 87 073 088 945

28 January 2022

Mr Michael Howett
NSW Environment Protection Authority

By email: hunter.region@epa.nsw.gov.au

Dear Mr Howett,

Report Ref: 124983 / REF-NO-9147 Water Pipe Leak, Donaldson Coal Mine

Purpose

The purpose of this letter is to provide details to the best of our knowledge regarding the leaking of water from a damaged poly pipe which was identified on the 21 January 2022 at Donaldson Coal Mine. The event was reported in accordance with the Pollution Incident Response Management Plan (PIRMP) as per Part 5.7 of the *Protection of the Environment Operations Act 1997 (NSW)* to all relevant agencies. A locality plan showing the location of the leaking pipe in relation to the premises is provided in **Plan 1.** Donaldson Coal holds Environment Protection Licence No 12856 (EPL 12856) for the premises where the event occurred.

Background

Donaldson Coal Pty Ltd conduct water management activities in accordance with the Donaldson Water Management Plan (WMP). The Donaldson WMP is a requirement of Condition 16 of Schedule 4 of DA 05_0136 which allows for the transfer of water from the Donaldson Coal Mine to the Bloomfield Coal Mine *'The Proponent may transfer water between the site, the Donaldson Open-Cut Coal Mine and the Bloomfield Colliery, in accordance with the Water Management Plans for these operations.'*

On the day of the incident, Donaldson Coal was transferring mine water from the Big Kahuna Dam to the Bloomfield Colliery via a 225mm welded poly pipe.

The pipeline that transfers water from Donaldson to Bloomfield Colliery runs adjacent to the Hunter Water Main Trunk line with an access road along the majority of the pipeline. On days when Donaldson are transferring water to Bloomfield Coal, the pipeline is inspected at least daily. When water transfer pumping commences, the pipeline is inspected for leaks, and then again every 24hrs.

a) the cause, time and duration of the event;

An investigation of the incident identified the cause of the leak was from an uncontrolled fire, likely started by a lightning strike, causing a burning tree to fall onto the 225mm welded poly pipe. The burning tree melted a small hole in the poly pipe causing water to leak from the pipe.

Measurement with a thermal gun on 21/1/2022 at approximately 10:00am showed that some areas within the burnt ground were still hot and recorded temperatures up to 150 degrees. This indicates that the leak was recent.

The pipeline is inspected daily whilst water is being transferred. The last full inspection of the pipeline prior to the leak being detected, was conducted at approximately 10am on 20/1/2022. Later that day, at approximately 2.30pm, two contract surveyors drove in the vicinity of the leak area and did not see a leak. The leak was detected at approximately 6.40am on 21/1/2022.

The time that the burning tree fell onto the poly pipe causing the leak is unknown but is believed to be between approximately 2.30pm on 20/1/2022 and 6.40am on 21/1/2022 when the leak was detected. This is a maximum period of 16 hours that the leak could have been occurring.

It was evident from an inspection of the area that water had leaked from the pipeline and travelled down an access road approximately 170m and into Four Mile Creek at EPL 12856 discharge Point 19. Plan 1 provides an overview of the area.

b) the type, volume and concentration of every pollutant discharged as a result of the event;

The flow rate through the pipeline whilst pressurised by the diesel pump at the Big Kahuna Dam is approximately 0.35ML/hr.

Based on observations of the leak at 6.45am on 21/1/2022, a conservative estimate of 5% of pipeline flow leaked from the pipe. This would equate to approximately 0.0175ML/hr leaking from the pipe. Over the 16 hr period from the time the pipe was last observed, the loss of water from the pipe would be a maximum of 0.28ML (16hrs x 0.0175ML).

Water samples were collected in Four Mile Creek above and below the entry point of the leaked water as well as from the Big Kahuna Dam. The following table details the water results including the Bloomfield downstream monitoring result:

Site	Electrical Conductivity (µS/cm)	pH	Total Suspended Solids (mg/L)
WS1 (Four Mile Creek U/S of leak)	405	6.76	54
WS2 (Four Mile Creek D/S of Leak)	863	7.45	6
WS3 (Big Kahuna Dam)	2990	8.85	<5
Four Mile Creek (EPL Id 2)	5,160	7.9	6

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;

James Benson, Contract Environment Coordinator 1132 John Renshaw Drive, Black Hill NSW Mobile telephone 0407 921 461

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;

Adam Thompson, Surveyor, De Witt Consulting, 12 Nottage Hill Cl, Branxton, Mobile telephone 0426 668 411

Robert Galli, Surveyor, De Witt Consulting, 36 Peters Ave, Wallsend, 2287, Mobile telephone 0477 055 365

e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;

There were no complaints received as a result of the incident.

The Donaldson Pollution Incident Response Management Plan was triggered and relevant agencies notified.

The immediate action taken was to turn the pump off to depressurise the pipeline and stop the leak. This occurred at 6.47am 21/1/2022 and was undertaken by the Environmental Coordinator.

Water samples were taken in Four Mile Creek above and below the leaks as well as in the Big Kahuna Dam.

The section of pipe that was damaged has been replaced and tested.

f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and

The pipeline will be inspected before and after commencing transfer of water on a daily basis.

g) any other relevant matters.

At the time of the incident, and for the previous two days, Bloomfield Coal were discharging water under EPL 396 approximately 1600m downstream of where the leaked water entered Four Mile Creek. Plan 1 shows the location of the Bloomfield discharge location. Over a 3 day period Bloomfield Coal discharged 80ML in compliance with EPL 396.

Water quality results at the Bloomfield Discharge Location EPL ID 1 and Four Mile Creek downstream of Bloomfield Coal were;

DATE	DISCHARGE (EPL ID 1)			FOUR MILE CREEK (EPL ID 2)		
	pH	TOTAL SUSPENDED SOLIDS (mg/l)	SPECIFIC CONDUCTANCE (uS/cm)	pH	TOTAL SUSPENDED SOLIDS (mg/l)	SPECIFIC CONDUCTANCE (uS/cm)
19-Jan-22	8.2	6	5,790	7.6	14	2,210
20-Jan-22	8.1	5	5,720	7.9	7	5,240
21-Jan-22	8.2	7	5,100	7.9	6	5,160

Conclusion

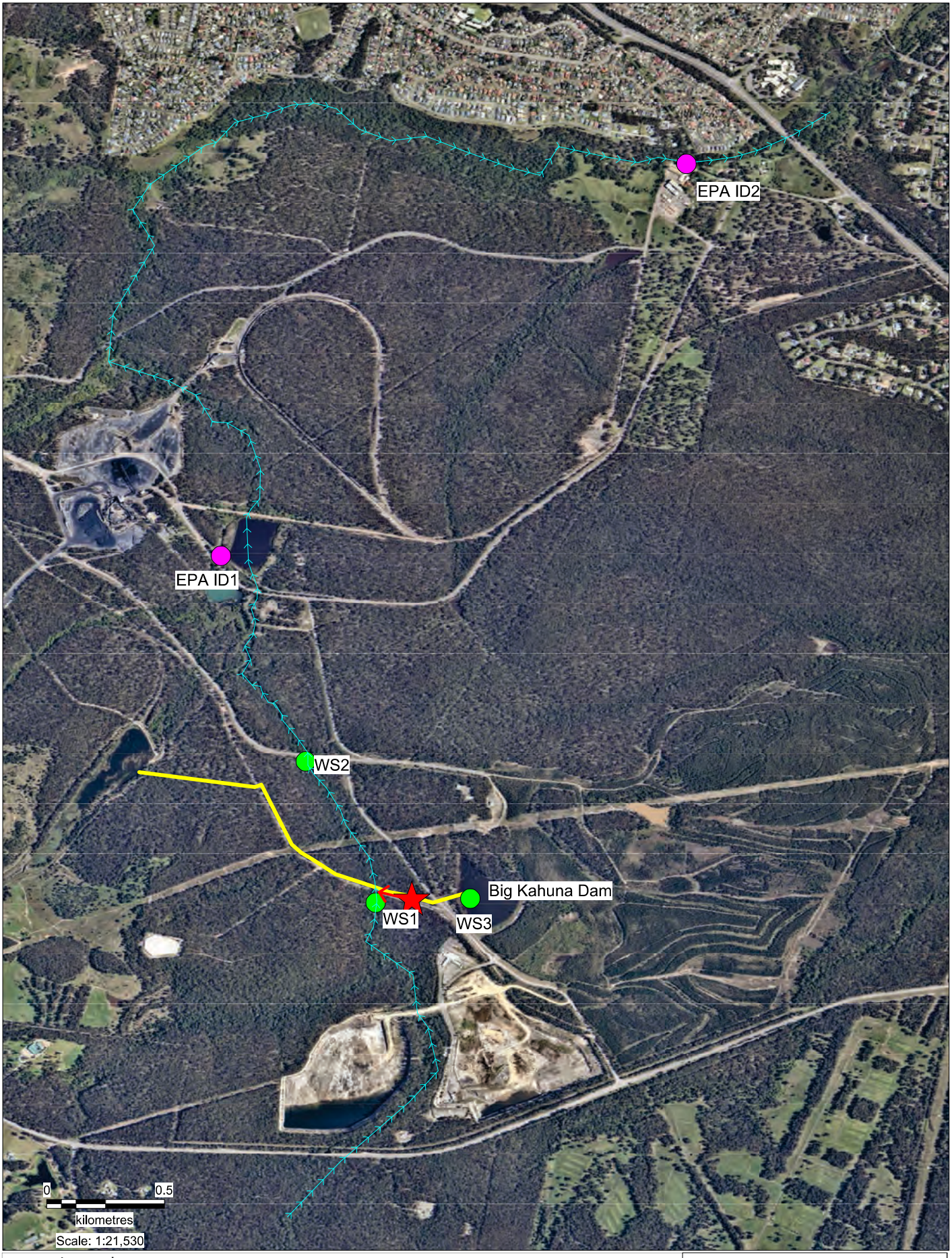
The leak from the Donaldson to Bloomfield pipeline occurred due to an unforeseen fire impacting the welded poly pipe. The leak was identified swiftly with the pump immediately shut down and the PIRMP activated. Whilst the volume of water which leaked from the pipe is unknown, it is estimated at up to 0.28ML. Approximately 1.6km downstream from this point, Bloomfield Colliery were discharging water up to 40Ml per day under EPL 396. The volume of water that leaked from the pipe and water quality is negligible compared to the licenced water discharged from Bloomfield Colliery. The water quality results detailed above in Four Mile Creek downstream of the leak support a conclusion that no material harm to the environment occurred as a result of the incident.

If you have any questions regarding this matter, please don't hesitate to contact the undersigned on 0439 909 952.

Yours sincerely

Phillip Brown

Environment & Community Relations Superintendent



Legend

- Big Kahuna Pipeline
- Leak Location
- Overland Flowpath
- Water Sampling Location
- Bloomfield Water Monitoring
- Four Mile Creek

Donaldson Coal
Water Pipeline Leak - 21/1/2022

N

Coordinate System; MGA94 Zone 56

Date; 28/1/2022

Produced By; JB

YANCOAL 兖煤澳大利亚有限公司

SITE: 1132 John Renshaw Drive Black Hill 2322
POSTAL: PO Box 2216 Greenhills 2323
PHONE: +61 2 4015 1100
WEBSITE: www.doncoal.com.au
ABN 87 073 088 945

18 May 2022

Ms Ann Hagerthy
Acting Team Leader Compliance
Energy, Industry & Compliance | Planning & Assessment
Department of Planning and Environment

By email: compliance@planning.nsw.gov.au

Dear Ms Hagerthy,

Illegal Clearing identified on Donaldson Coal Mine owned land

Purpose

The purpose of this letter is to advise, for information purposes only, the Department of the identification of illegal clearing within the Donaldson Bushland Conservation Area (BCA). The land that has been cleared is approximately 0.31ha in area and is located on the eastern side of Donaldson Coal land.

This clearing was not undertaken by Donaldson Coal.

A plan showing the location of the illegal clearing in relation to the premises is provided in **Plan 1** below**.**

Background

Donaldson Coal Pty Ltd (DCPL) holds Development Consents 98/01173 and 118/698/22 for the Donaldson Coal Mine. The Development Consents required the identification of a bushland area that would '*adequately compensate for the impact of the mine on biodiversity, provide compensatory habitat and be managed for the primary purpose of conservation*'. Such an area would be provided at a ratio of 2:1 in terms of *'compensatory area to the area to be directly impacted by mining and associated infrastructure'*.

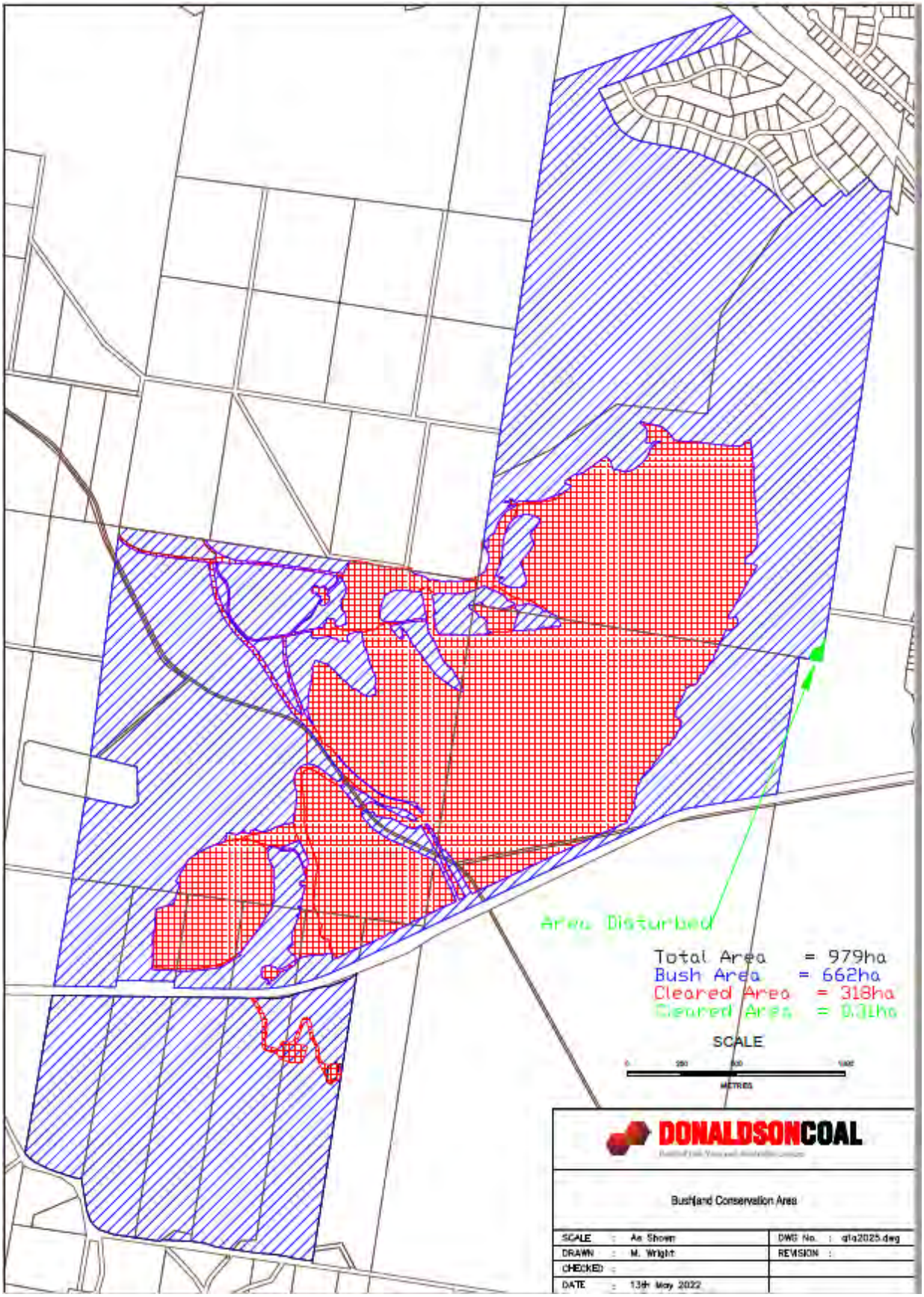
To meet this requirement, DCPL developed the Bushland Conservation Area Management Plan in 2005, which identified the BCA. The BCA is entirely on DCPL owned land that surrounds the Donaldson Coal Operations.

a) the cause, time and duration of the event;

A recent review of aerial photography over the Donaldson BCA identified a small portion of land, approximately 0.31ha, had been cleared without Donaldson's knowledge or consent. In discussion with the owner of the adjoining property, they confirmed that the land had been cleared by them for use with the transport business which is located on the adjacent property.

Plan 2 shows the area cleared in relation to the BCA.

A visual inspection of the area on 29/04/2022 by the DCPL Surveyor confirmed that DCPL land had been cleared of vegetation and that fill material had been imported to the site.



Plan 2. Donaldson Bushland Conservation Area

c) the name, address and business hours telephone number of employees or agents of DCPL, or a specified class of them, who witnessed the event;

Matthew Wright, Mine Surveyor, 1132 John Renshaw Drive, Black Hill NSW. Mobile telephone 0488 206 172.

d) the name, address and business hours telephone number of every other person (of whom DCPL is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;

Phillip Brown, Environment and Community Relations Superintendent, 1132 John Renshaw Drive, Black Hill NSW. Mobile telephone 0439 909 952

Anthony Mansell, Director AJM Transport AU/UK, 0421 622 452

e) action taken by DCPL in relation to the event, including any follow-up contact with any complainants;

Upon identification of the clearing from aerial photography, the Donaldson Mine Surveyor conducted a visual inspection of the area on 29/04/2022.

The NSW Environmental Protection Authority (EPA) was notified of the incident on 2/05/2022 due to the presence of what appears to be building waste that had been used as fill.

The Donaldson Environment and Community Relations Superintendent contacted the owner of the premises on the 3/05/2022 who confirmed that he had arranged for the clearing and fill.

f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and

DCPL have engaged a property surveyor to identify and peg the alignment of the property boundary and determine the amount of filling material deposited.

g) any other relevant matters.

The NSW EPA have inspected the site and are investigating the matter of both illegal clearing and the dumping of waste material and will coordinate the removal of the material with the owner of the transport company,

Conclusion

The unauthorized clearing of vegetation and depositing of material has occurred on an area of approximately 0.31 ha portion of DCPL land within the area identified as the Donaldson Bushland Conservation Area.

Despite this clearing, a review of the areas of land cleared by DCPL for the operation of the Donaldson Open Cut and the Abel Underground mine has confirmed that DCPL continues to maintain the required 2:1 ratio of bushland area to mine impacted area (refer to Plan 2 above) as required under Schedule 2 Condition 71 of the Donaldson Development Consent.

If you have any questions regarding this matter, please don't hesitate to contact the undersigned on 0439 909 952.

Yours sincerely

Phillip Brown

Environment & Community Relations Superintendent