EML 6488 Midway Quarry

PEPR Compliance Report 2024/2025

September 2025

Acknowledgements

Acknowledgements go to all of the staff across the Carrapateena Operations for their contributions to the overall report and for undertaking all activities in a safe and effective manner. We also acknowledge the Kokatha People for their ongoing support and assistance provided.

Document control

CA-0000-ENV-REP-1051

Version	Description	Author	Approval	Date
1	PEPR Compliance Report 2024/25	Luke Boehm Environment Specialist Trent Anderson Environment Specialist Joshua Allen Superintendent Environment Operations	Sally Durandt Manager Asset Environment Approvals & Sustainability	26/09/2025

Executive summary

BHP Carrapateena submits this Program for Environment Protection and Rehabilitation (PEPR) Mining Compliance Report for the period July 2024 to June 2025 inclusive (Compliance Report); as required by the *Mining Act 1971* (SA) and associated regulations and conditions of the Midway Quarry Extractive Minerals Lease (EML 6488). This Compliance Report demonstrates compliance with the EML conditions described in the tenement document and the Environmental Outcomes and Outcome Measurement Criteria (OMC) committed to in the PEPR. This Compliance Report has been completed in general accordance with the Determination Terms of Reference 009 (TOR009) – Mining Compliance Reports.

EML 6488 was granted on 13 July 2018 following submission of the Mining Proposal in February 2018. MPEPR2019/029 was approved in accordance with Section 70C(5) of the *Mining Act 1971* (SA) on 23 July 2020. A Program Notification outlining proposed changes to the Midway Quarry pit design and material stockpile locations was submitted on 30 October 2020 and approved without requiring amendments to the approved PEPR on 26 November 2020. BHP Carrapateena notified the Government of South Australia's Department for Energy and Mining of the commencement of mining on 7 January 2021.

The Carrapateena operation has been developed and operated by OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd, wholly owned by OZ Minerals Limited. On 2 May 2023 BHP Group Limited completed the acquisition of OZ Minerals Limited. The Carrapateena site has been integrated into the BHP Copper South Australia (SA) asset, also incorporating BHP's Prominent Hill mine, Olympic Dam mine and Oak Dam exploration site. Copper SA forms part of BHP's Australian business portfolio, which also includes Western Australia Iron Ore, Western Australia Nickel, Coal, Mt Arthur Coal and Operations Services.

This Compliance Report covers activities at the Midway Quarry between July 2024 to June 2025. During the period, no extractive materials were mined, and no non-compliances were recorded against the OMCs or Leading Indicators nominated within the approved PEPR, and no non-compliances to lease conditions were recorded.

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1 Introduction

BHP Carrapateena submits this Program for Environment Protection and Rehabilitation (PEPR) Mining Compliance Report for the period 1 July 2024 to 30 June 2025 inclusive (Compliance Report); as required by the *Mining Act 1971* (SA) and associated regulations and conditions of the Midway Quarry Extractive Minerals Lease (EML 6488). This Compliance Report demonstrates compliance with the EML conditions described in the tenement document and the Environmental Outcomes and Outcome Measurement Criteria (OMC) committed to in the PEPR MPEPR2019/029 (OZ Minerals 2019). Proponent details are provided in Table 1.1

Table 1.1 | Proponent details

Operation name	Midway Quarry	PEPR number	PEPR MPEPR2019/029
		PEPR approval date	Date approved: 23 July 2020
Lease holder	OZ Minerals Carrapateena Pty Ltd (42%) and OZM Carrapateena Pty Ltd (58%)		
Operator	BHP		
Lease approval date	13 July 2018		
Tenements	EML 6488		
Approval document	PEPR		
Ministerial determination	The Compliance Report has been completed in general accordance with the Determination Terms of Reference 009 (TOR 009) Mining Compliance Reports (DEM 2020) and associated Mineral Regulatory Guideline (MG3) (DEM 2021)		
Site contact	Vinod Perera, General Manager, Carrapateena		
	Email	vinod.perera@bhp.com	
Site location details	Located approximately 160 km north of Port Augusta, in close proximity to the Carrapateena Arm on the western boundary of Lake Torrens. Nearby townships include Woomera (approximately 65 km west) and Roxby Downs (approximately 90 km north-west). Refer to Figure 1.1.		
Reporting period	1 July 2024 to 30 June 2025		
Date of compliance report preparation	September 2025		

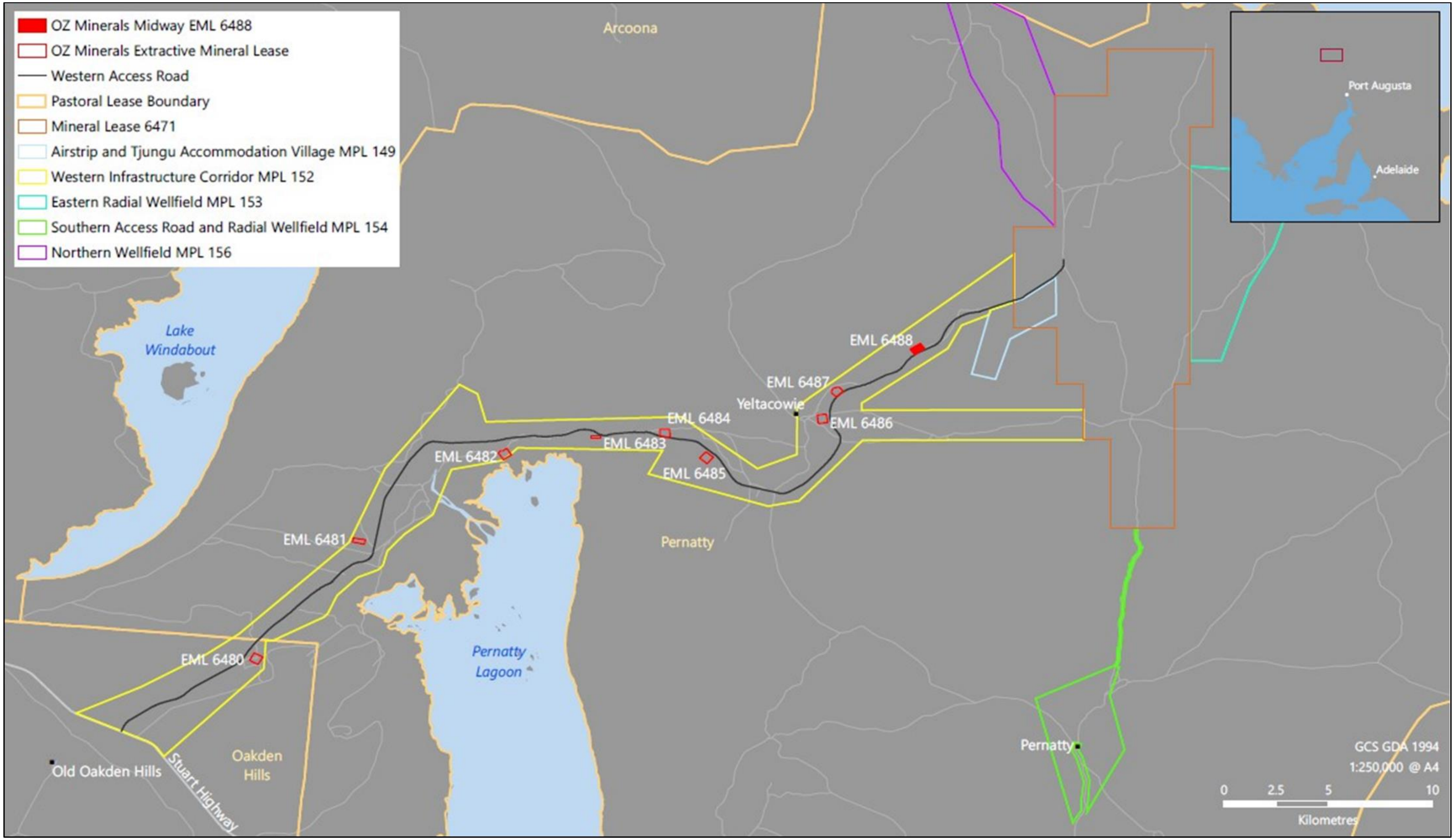

Figure 1.1 | Location of EML 6488 Midway Quarry

2 Declaration of accuracy

<table>
<tr><th colspan="4">Person responsible for the preparation of the Compliance Report</th></tr>
<tr><td colspan="4">This document has been prepared to fulfil the requirement under sub-regulation 77(3)(b) of Mining Regulations 2020 (SA) for the tenement listed herein. The information contained in this report is to the best of my knowledge a true and accurate record of the mining activities and compliance status for the reporting period.</td></tr>
<tr><th>Name</th><th>Position or Agent</th><th>Signature</th><th>Date</th></tr>
<tr><td>Anna Wiley</td><td>Asset President Copper South Australia</td><td></td><td>26/09/2025</td></tr>
<tr><th colspan="4">Company/Agent</th></tr>
<tr><td colspan="4">Report prepared by tenement holder</td></tr>
<tr><th colspan="4">Summary of steps undertaken to review the compliance report to ensure report accuracy</th></tr>
<tr><td colspan="4">This report has been prepared by the Carrapateena Environment Team.</td></tr>
</table>

3 Public liability insurance

Details of the public liability insurance for the Midway Quarry are provided in Table 3.1. A copy of the cover note for the public liability insurance and/or a copy of the policy of insurance for BHP is included in Appendix A.

Table 3.1 | Public liability insurance details

Certificate of currency general liability	
Principal insured	BHP Group Limited and all subsidiaries' companies and all/or related and/or affiliated and/or controlled, managed, administered and associated companies or corporation and/or related joint ventures and/or partnerships and other entities.
Start date	1 July 2024
Finish date	30 June 2025
Limits of liability	US$25,000,000
Company/Agent	
Report prepared by tenement holder	
Summary of steps undertaken to review the compliance to ensure report accuracy	
This report has been prepared by the Carrapateena Environment Team.	

4 Tenements

A summary of the existing tenement for the Midway Quarry is provided in Table 4.1. The location of the tenement is shown on Figure 1.1.

Table 4.1 | Tenement summary

Tenement	Tenement number	Tenement grant date	Tenement expiry date	Status of currency
Midway Quarry (Extractive Minerals Lease)	EML 6488	13 July 2018	2 January 2039	Current

5 Other approvals, licences, permits, waivers, native title and agreements

A summary list and the current status of approvals required to authorise the mining operations and that are relevant to the achievement of Environmental Outcomes and objectives within the approved PEPR (OZ Minerals 2019), and/or compliance with the tenement conditions, are presented in Table 5.1

Table 5.1 | Other approvals, licences, permits, waivers, native title and agreements

Approval document	Regulatory authority or other	Supporting document	Relevant outcome or tenement condition	Status of currency
Native Title Mining Agreement (NTMA) between OZ Minerals Carrapateena Pty Ltd and Kokatha Aboriginal Corporation	Kokatha Aboriginal Corporation	CA-CRL-LET-1003 NTMA (Confidential)	Outcome 6 (Tenement Condition 7) – The Tenement Holder must, during construction and operation, ensure that there is no disturbance to Aboriginal or European heritage sites, objects or remains unless prior approval under the relevant legislation is obtained	Active for the life of the Midway Quarry
Pernatty Pastoral Access and Compensation Agreement	Billa Kalina Pastoral Pty Ltd, Colin and Jillian Greenfield	CA-APR-AGR-1033 (Confidential)	NA	Active for the life of the Midway Quarry

6 Ore reserves and mineral resources

6.1 Ore reserves and estimated mine life

A statement of the estimated mine life is presented in Table 6.1.

Table 6.1 | Estimated mine life

Estimated mine life (years)	Seven (7)
Notes	Extractive mining in the Midway Quarry is estimated to continue through to 2028 with material to be used for construction activities associated with the Carrapateena expansion. Areas of the quarry no longer required will be progressively rehabilitated as the opportunity arises.

6.2 Exploration activities

No exploration activities are currently being undertaken nor proposed within the EML.

7 Compliance with environmental outcomes

Compliance for the Reporting Period is summarised in Section 7.1 to Section 7.14. No non-compliances were recorded against the OMCs or Leading Indicators (LIs) nominated within the approved PEPR (OZ Minerals 2019), and no non-compliances to lease conditions were recorded during the reporting period.

7.1 Blasting

Table 7.1 | Blasting compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must, during construction and operation, ensure that there are no public health and/or nuisance impacts from air blast, vibrations or flyrock caused by blasting.				
Tenement Condition	Sixth Schedule, Condition 1: The Tenement Holder must, during construction and operation, ensure that there are no public health and/or nuisance impacts from air blast, vibrations or fly rock caused by blasting				
Outcome Measurement Criteria	Records from the Mine Logbook demonstrate that all blast-related complaints received were acknowledged within 48 hours and resolved with the complainant within 7 days (or other time as approved by the Mining Regulator) to the satisfaction of the Mining Regulator. If complaints are not resolved to the satisfaction of the Mining Regulator blast monitoring is to occur at locations, and using methods as agreed with the Mining Regulator to demonstrate that: • air blast and vibrations levels meet limits in the Australian Standards (AS 2187.2) • there are no incidents of fly rock leaving the tenement boundary				
Outcome Measurement Criteria summary	No blasting occurred at Midway Quarry during the reporting period.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	Controls implemented included imposing blast exclusion zones, undertaking blasting activities in accordance with AS 2187.2 and visual inspections for fly rock on the perimeter of the tenement following blasting have been effective and no public health impacts have been reported.				
Supporting report reference	Midway Quarry Management Plan (CA-5410-PRM-PLN-1012) Midway Quarry Blast Design (CA-5410-CIV-REP-1029)				

7.2 Public safety (construction and operation)

Table 7.2 | Public safety (construction and operations) compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must, during construction and operation, ensure that unauthorised entry to the Land does not result in public injuries and or deaths that could have been reasonably prevented.				
Tenement Condition	Sixth Schedule, Condition 2: The Tenement Holder must, during construction and operation, ensure that there are no public injuries and or deaths resulting from unauthorised entry to the site that could have been reasonably prevented				
Outcome Measurement Criteria	Investigation and review of incident report records triggered as a result of an incident associated with unauthorised entry to infrastructure locations demonstrates that the incident could not have been reasonably prevented and that any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or other authorised officer).				
Outcome Measurement Criteria summary	No occurrences of unauthorised access by members of the public were recorded during the reporting period.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	The following controls were implemented: • Access to the EML 6488 managed through perimeter fencing and gates. • Signs established at access points and limited to authorised personnel only. • Access to the Western Access Road (WAR) limited during construction with exclusion controls imposed including restriction and hazard signs at each end point. • EML 6488 and WAR is sign-posted making the public aware of hazards associated with the construction areas. • Temporary fencing installed as appropriate. • These controls have been effective at mitigating the risks associated with this aspect.				
Supporting report reference	N/A				

7.3 Public safety (post-completion)

Table 7.3 | Public safety (post-completion) compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must demonstrate that post completion, the risks to the health and safety of the public so far as it may be affected by mining-related activities are as low as reasonably practicable.				
Tenement Condition	Sixth Schedule, Condition 3: The Tenement Holder must ensure that no public injuries or deaths occur as a result of the final landform post-mine completion				
Outcome Measurement Criteria	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer) prior to application of lease surrender demonstrates that all infrastructure is removed or left in-situ as agreed with stakeholders, in a manner that risks to the health and safety of the public so far as it may be affected by mining-related activities are as low as reasonably practicable.				
Outcome Measurement Criteria summary	Extractive mining in the Midway Quarry is estimated to continue through to 2028 with material likely used for the Carrapateena expansion. Rehabilitation of areas no longer required commenced in 2022 and progressive rehabilitation will continue where practicable. As a result the OMC is not yet achieved.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	The following rehabilitation works, and controls that have been completed to date: • Surface mining infrastructure including offices, workshop and batch plant have been decommissioned and removed. • Stockpiles are being reduced to support progressive rehabilitation near EML boundaries. • Western/eastern stockpile areas have had topsoil pushed back over and contour ripped to manage surface water runoff. • Ramp bund has been constructed to limit inflow and topography surveyed to ensure low points and subsequent pooling is controlled. • Landscape Function Analysis (LFA) site installed on eastern hardstand in August 2022 and monitored in 2023. These controls have been effective at mitigating the risks associated with this aspect. Batter profiling to be deferred until the bottom flitches of the borrow pit are completed. Following final rehabilitation work all slopes are battered to at least a 1:3 ratio (18 degrees) and all stockpiles are to be removed as per the PEPR (OZ Minerals 2019).				
Supporting report reference	Midway Quarry Management Plan (CA-5410-PRM-PLN-1012)				

7.4 Noise and air quality

Table 7.4 | Noise and air quality compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must, during construction and operation, ensure that there are no public nuisance impacts from dust and noise generated by mining operations or mining-related traffic.				
Tenement Condition	Sixth Schedule, Condition 5: The Tenement Holder must, during construction and operation, ensure that there are no nuisance impacts to local residents from dust generated by mining operations. Sixth Schedule, Condition 12: The Tenement Holder must, during construction and operation, ensure that there are no public nuisance impacts from noise emanating from the Land.				
Outcome Measurement Criteria	Audit of stakeholder engagement records undertaken quarterly demonstrates that all traffic-related dust and noise concerns associated with access roads are responded to in accordance with the Local Area Agreement – Operating Protocols[1] within 24 hours upon notification and any corrective actions are closed out within 14 days or as agreed with the Director of Mines (or other authorised officer). If the complaint is not resolved to the satisfaction of the Director of Mines (or other authorised officer), monitoring may be required at the receptor to confirm compliance with the Environment Protection (Noise) Policy 2007.				
Outcome Measurement Criteria summary	An audit of stakeholder engagement records in Borealis shows that no traffic-related or noise concerns were formally raised.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	Dust suppression was applied on unsealed roads and surfaces and speed limit restrictions were imposed as controls. These controls have been effective at mitigating risks associated with this aspect.				
Supporting report reference	N/A				

[1]See PEPR Table 5.2 for description of Local Area Agreement – Operating Protocols (OZ Minerals 2019)

7.5 Surface water

Table 7.5 | Surface water compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must during construction, operation and post Completion ensure no adverse impact to surface water quality and water dependent ecosystems, on or off the Land, as a result of contamination and sedimentation caused by mining operations or mining-related activities.				
Tenement Condition	Sixth Schedule, Condition 6: The Tenement Holder must, during construction and operation, ensure that no water contaminated as a result of mining operations leaves the Land.				
Outcome Measurement Criteria	Audit of surface water management infrastructure undertaken after rainfall events that create surface water flows demonstrates surface water management infrastructure have performed in accordance with the design and corrective actions closed out within 14 days.				
Outcome Measurement Criteria summary	A combination of drone imagery captured by BHP Carrapateena personnel and on-ground inspections were utilised to access the integrity of surface water infrastructure. The Midway Quarry was inspected during the annual surface water infrastructure inspection in September 2024 and no erosion or sedimentation was observed.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	The following controls were implemented during the reporting period: • Bund wall/s were constructed to divert runoff into the working pit. • Stockpiles were positioned to limit interaction with surface water. • Tenement perimeter bunded was constructed at potential discharge points to minimise surface water and sediment runoff into surrounding areas. • Separation of overland surface water flows originating from undisturbed areas of the EML from the surface water run-off that has interacted with stockpiles and borrow pit. • Chemicals and hydrocarbons were stored in accordance with SA Environment Protection Authority (EPA) guidelines. • Equipment maintenance was undertaken to prevent accidental spillages. • Rehabilitation procedures and inspection program were followed. These controls have been effective at mitigating the risks associated with this aspect.				
Supporting report reference	N/A				

7.6 Heritage

Table 7.6 | Heritage compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must during construction, operation and post Completion, ensure that there is no damage, disturbance or interference to Aboriginal heritage sites, objects or remains unless it is authorised under the relevant legislation.				
Tenement Condition	Sixth Schedule, Condition 7: The Tenement Holder must, during construction and operation, ensure that there is no disturbance to Aboriginal or European heritage sites, objects or remains unless prior approval under the relevant legislation is obtained				
Outcome Measurement Criteria	• Annual audit of BHP's internal land use permits (LUP) demonstrate that infrastructure locations are within approved work areas, cultural heritage survey report conditions and have authorisation in accordance with the Aboriginal Heritage Act 1988 (SA) prior to any ground disturbance occurring. • Annual audit of cultural heritage survey records demonstrate that upon discovery of new Aboriginal heritage sites, objects or remains at infrastructure locations were treated in accordance with the Cultural Heritage Management Plan2 until authorisation under the *Aboriginal Heritage Act 1988* (SA) was obtained.				
Outcome Measurement Criteria summary	All land disturbance is spatially audited against LUP boundaries using survey data, drone and satellite imagery in ArcGIS to ensure works remained within approved work areas, cultural heritage survey report conditions and have authorisation in accordance with the *Aboriginal Heritage Act 1988* (SA).				
Leading Indicator Criteria	Monthly inspection (ground survey, drone flyover or suitable alternative method) of a selected infrastructure location during construction demonstrates land clearing has not been undertaken outside of areas defined in the associated LUP[1].				
Leading Indicator summary	Disturbance was reconciled to design as reported within the CY24 MPEPR 2024/009 Annual Compliance Report.				
Effectiveness of existing controls	All land disturbance is spatially audited against LUP boundaries using survey data, drone and satellite imagery in ArcGIS to ensure works were completed within approved work areas, cultural heritage survey report conditions and have authorisation in accordance with the *Aboriginal Heritage Act 1988* (SA).				
Supporting report reference	Land Disturbance Procedure (CA-ENV-PRO-1008) Cultural Heritage Management Plan (000647)				

1. BHP maintains a Land Disturbancah e Procedure (CA-ENV-PRO-1008) which requires application and approval of a Land Use Permit (000965) in BHP's Global Land Use Permit System prior to undertaking any land disturbance.
2. BHP maintains a Cultural Heritage Management Plan (000647) to ensure that BHP employees and contractors respect local cultural heritage and protect sites of historical, cultural and religious significance or potential significance.

7.7 Traffic

Table 7.7 | Traffic compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must during construction and operation, ensure that there are no traffic accidents involving members of the public and mine related traffic that could have been reasonably prevented by the Tenement Holder.				
Tenement Condition	Sixth Schedule, Condition 8: The Tenement Holder must, during construction and operation, ensure that there are no traffic accidents involving the public at mine access points that could have been reasonably prevented by the Tenement Holder				
Outcome Measurement Criteria	Investigation and corrective actions triggered as a result of an accident associated with mine related traffic demonstrates that the incident could not have been reasonably prevented and that any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or authorised officer).				
Outcome Measurement Criteria summary	No traffic accidents involving members of the public or Midway operators were recorded during the reporting period.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	The following controls have been implemented to date: • Operators made aware of risk surrounding vehicle interaction within site inductions, toolbox meetings and targeted critical risk verifications. • Road signs displayed at mine entry and exit points, warning the public of the dangers of large trucks entering and exiting the tenement. • Traffic Management Plans and speed limits are implemented. • Area-specific and site inductions and training are conducted. No traffic incidents involving members of the public were reported.				
Supporting report reference	N/A				

7.8 Weeds and pests

Table 7.8 | Weeds and pests compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement holder must during construction and operation ensure no introduction of new species of Weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals), nor sustained increase in abundance of existing weed or pest species in the Land as a result of mining operations or mining-related activities.				
Tenement Condition	Sixth Schedule, Condition 9: The Tenement Holder must, during construction and operation, ensure that there is no introduction of new species of Weeds or Pests (including feral animals), nor increase in abundance of existing Weed or Pest species in the Land.				
Outcome Measurement Criteria	• Annual flora and fauna surveys undertaken by independent and suitably qualified ecologists at flora (including weeds) and fauna monitoring locations demonstrates no introduction of new species of weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals) as a result of mining-related activities when compared to previously recorded weed species and introduced fauna. • Annual flora and fauna surveys undertaken by independent and suitably qualified ecologists at flora (including weeds) and fauna monitoring locations demonstrated no increase in the abundance of existing weeds or pest species in the land compared to previous survey records as a result of mining-related activities.				
Outcome Measurement Criteria summary	Annual 2024 Carrapateena Fauna and Flora Survey (CA-0000-ENV-REP-1047) (Appendix B). Ongoing monitoring of LFA site on the rehabilitated western hardstand area.				
Leading Indicator Criteria	• Monthly inspection (including photographic evidence) of a selected infrastructure location identifies weeds listed in the Weed Red Alert List and triggers a review of the effectiveness of management strategies. • Quarterly audit of records maintained at the site by all contractors demonstrates that all incoming vehicle, plant and equipment have been subject to weed hygiene procedures.				
Leading Indicator summary	Weed inspections were routinely completed as inspection criteria within the LUP Health Check Inspection and General Environmental Inspection. Audit of weed hygiene certificates pertaining to mobile plant mobilised to site for the WAR Project demonstrate compliance.				
Effectiveness of existing controls	In 2024, no new species of weeds declared or listed under relevant legislation (*Landscape South Australia Act 2019* (SA)), or plant pathogens were recorded at flora survey sites, within weed transects or opportunistically.				
Supporting report reference	2024 Carrapateena Flora and Fauna Survey (CA-0000-ENV-REP-1047) (Appendix B)				

7.9 Soil

Table 7.9 | Soil compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant

Environmental Outcome	• The Tenement Holder must, ensure that:
	  ○ There is no contamination of land and soils either on or off the Land as a result of mining operations or mining-related activities; and
	  ○ No contamination of land and soils either on or off the Land post Completion occurs as a result of mining operations or mining-related activities.
	• Before Completion, the Tenement Holder must satisfy the Director of Mines (or other authorised officer) that where practicable, the pre-Tenement land use of the Land can be recommenced post Completion.
	• The Tenement Holder must ensure that the Land is progressively and finally rehabilitated to support the future land use.				

Tenement Condition	Sixth Schedule, Condition 10: The Tenement Holder must, during construction and operation, ensure that the existing (pre-mining) soil quality and quantity is maintained.				
Outcome Measurement Criteria	• Annual inspection records of soil stockpiles show all stockpiles to have no signs of erosion (formation of rills, gullies or other evidence of soil loss). • Audit of rehabilitation activities at infrastructure locations and waste disposal records prior to application of lease surrender demonstrates that commercial and/or industrial wastes have been disposed of to an EPA licenced facility.				
Outcome Measurement Criteria summary	Topsoil was removed and stockpiled within the footprint of the tenement. The southern topsoil was covered with extractive materials due to constraints on capacity. Further works to be undertaken to verify the suitability of topsoil as a growth medium on internal pit batters given its erosive classification.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	Controls have been effective in preventing contamination of land or soils.				
Supporting report reference	N/A				

7.10 Waste

Table 7.10 | Waste compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must ensure that all commercial or industrial waste is disposed of in an EPA licensed facility.				
Tenement Condition	Sixth Schedule, Condition 11: The Tenement Holder must, during construction and operation, ensure that all commercial or industrial waste is disposed of in accordance with relevant legislation.				
Outcome Measurement Criteria	Audit of rehabilitation activities at infrastructure locations and waste disposal records prior to application of lease surrender demonstrates that all commercial or industrial waste (including contaminated soil) within the tenement was disposed of to an EPA-licenced facility.				
Outcome Measurement Criteria summary	No activity was undertaken on the EML during the reporting period, therefore no waste was generated.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	Controls are considered effective with all waste types disposed of in accordance with EPA Guidelines.				
Supporting report reference	N/A				

7.11 Groundwater

Table 7.11 | Groundwater compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must, during construction and operation, ensure that there is no adverse impact to groundwater caused by mining operations to existing users and water dependent ecosystems.				
Tenement Condition	Sixth Schedule, Condition 13: The Tenement Holder must, during construction and operation, ensure that there is no adverse impact to ground water caused by mining operations to existing users and water dependent ecosystems Sixth Schedule, Condition 14: The Tenement Holder is required to address the following matters for the purposes of Regulation 65(2)(c) of the Regulations in relation to the Sixth Schedule Groundwater outcome: 14.1 Ensure that no mining is undertaken with 2 metres of the highest seasonal groundwater table level. Sixth Schedule, Condition 15: The Tenement Holder is required to address the following matters for the purposes of Regulation 65(2)(d) of the Regulations in relation to the Sixth Schedule Groundwater outcome: 15.1 Collect appropriate baseline data to be used as part of the measurement criteria to ensure the criteria can measure the separation between the pit floor and the highest seasonal groundwater table level				
Outcome Measurement Criteria	Mine depth measurement taken at the completion of each stage will demonstrate that mining has occurred to the depth stated in section 3.4 and no mining is undertaken within 2 m of the estimated highest seasonal groundwater level. Further groundwater testing, undertaken at or prior to the pit floor reaching 27 m, shows no groundwater to at least 32 m				
Outcome Measurement Criteria summary	At the end of the reporting period and cessation of extractive recovery, the Midway quarry floor resides at 179 mRL (18 m depth from the pre-mining surface).				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	N/A				
Supporting report reference	N/A				

7.12 Post-mining land use

Table 7.12 | Post-mining land use compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	• Before Completion, the Tenement Holder must satisfy the Director of Mines (or other authorised officer) that where practicable, the pre-Tenement land use of the Land can be recommenced post Completion. • The Tenement Holder must ensure that the Land is progressively and finally rehabilitated to support the future land use.				
Tenement Condition	Sixth Schedule, Condition 16: The Tenement Holder must ensure that all disturbed land is progressively rehabilitated to achieve the agreed post mining land use Sixth Schedule, Condition 4: The Tenement Holder must ensure that all rehabilitation blends in with the surrounding landscape with no impact to external visual amenity				
Outcome Measurement Criteria	• Audit undertaken prior to application of lease surrender against any relevant third-party liability legal transfer agreements and Government agreements demonstrates that all infrastructure have been removed, unless otherwise agreed with Government or signed legal documentation to transfer ongoing liability of the infrastructure to third parties is provided prior to the relinquishment of the tenement(s) • Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer) prior to application of lease surrender verifies that representative sites in rehabilitated areas at infrastructure locations have achieved or by trends may be confidently predicted to reach and pass sustainability thresholds as defined by Landscape Function Analysis (LFA) in order for the land to be returned to pastoral use (pre-mining) through the review of LFA monitoring results in order for the land to be returned to pastoral use (pre-mining)				
Outcome Measurement Criteria summary	Midway Quarry is within an operational phase, this is a completion criteria and as such, is not relevant.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	Areas of the tenement no longer required have been progressively rehabilitated, including the western flank where offices and associated surface infrastructure were positioned. Final rehabilitation of Midway Quarry has not been completed with further extractive material to be won. BHP Carrapateena anticipates that rehabilitation works will be completed post-2028, following construction of expansion infrastructure.				
Supporting report reference	N/A				

7.13 Protection of third-party property

Table 7.13 | Protection of third-party property compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must during construction, operation and post Completion ensure there are no impacts to third-party land use or property on or off the Land as a result of mining operations or mining-related activities other than those agreed between the Tenement Holder and the affected user or determined by an appropriate court as evidenced in its order(s) (and the Tenement Holder must provide the Director of Mines (or other authorised officer) with a copy of the order(s), which shall be placed on the Mining Register).				
Tenement Condition	Sixth Schedule, Condition 17: The Tenement Holder must, during construction and operation, ensure no unauthorised damage (including that caused by fire) to adjacent public or private property and infrastructure. Sixth Schedule, Condition 19: The Tenement Holder must, during construction and operation ensure no adverse impacts to adjacent land use.				
Outcome Measurement Criteria	Audit of stakeholder engagement records undertaken quarterly demonstrates that concerns associated with agricultural productivity of Pernatty Pastoral Lease or adjacent pastoral leases as a result of EML activities are responded to in accordance with the Local Area Agreement – Operating Protocol[1] within 24 hours and any corrective actions are closed out within 14 days or as agreed with the Director of Mines (or other authorised officer).				
Outcome Measurement Criteria summary	An audit of stakeholder engagement records in Borealis shows that no concerns were formally raised.				
Leading Indicator Criteria	N/A				
Leading Indicator summary	N/A				
Effectiveness of existing controls	No impacts to third-party land use or property have been observed and controls are considered effective.				
Supporting report reference	N/A				

1. See PEPR Table 5.2 for description of Local Area Agreement – Operating Protocols (OZ Minerals 2019)

7.14 Native vegetation (clearance and unplanned disturbance)

Table 7.14 | Native vegetation (clearance and unplanned disturbance) compliance summary

Operation	Midway Quarry	Tenement	EML 6488	Compliance status	Compliant
Environmental Outcome	The Tenement Holder must during construction, operation and post Completion ensure that there is no loss of abundance and/or diversity of native vegetation on or off the Land unless a significant environmental benefit has been approved in accordance with the relevant legislation.				
Tenement Condition	Sixth Schedule, Condition 18: The Tenement Holder must, during construction, operation and post-mine completion, ensure that there is no loss of abundance or diversity of native vegetation on or off the Land through; 18.1 Clearance, 18.2 Dust/contaminant deposition, 18.3 Fire, 18.4 Other damage, unless prior approval under the relevant legislation is obtained.				
Outcome Measurement Criteria	Annual audit (reconciliation) of land disturbance register for infrastructure locations demonstrates native vegetation clearance does not exceed the significant environmental benefit approved under the *Native Vegetation Act 1991* (SA) and plains mouse habitat clearance does not exceed that approved under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth)				
Outcome Measurement Criteria summary	Total disturbance does not exceed the amount approved in Native Vegetation Management Plans.				
Leading Indicator Criteria	Monthly inspection (ground survey, drone flyover or suitable alternative method) of a selected infrastructure location during construction demonstrates land clearing has not been undertaken outside of areas defined in the associated land disturbance permit				
Leading Indicator summary	All land disturbance is spatially audited against LUP boundaries using survey data, drone and satellite imagery in ArcGIS to ensure works were completed within approved work areas, cultural heritage survey report conditions and have authorisation in accordance with the *Aboriginal Heritage Act 1988* (SA). No fringing impacts to flora from dust were verified via capture of ortho-imagery following cessation of mining activity. No incidents of fire or damage recorded during the reporting period.				
Effectiveness of existing controls	N/A				
Supporting report reference	N/A				

8 Compliance with non-outcome-based tenement conditions

Table 8.1 provides details of the compliance status of any tenement conditions of the EML that do not relate to an Environmental Outcome in the approved PEPR (OZ Minerals 2019). Evidence to support the statement of compliance is provided.

Table 8.1 | Compliance with non-outcome-based tenement conditions

Tenement condition number	Tenement condition	Compliance status	Evidence
Details of Grant of a Mining Tenement			
1	On 13 July 2018, pursuant to Part 6 of the Act, the Minister made a statutory grant of an Extractive Minerals Lease (the Mining Tenement) described in this Tenement Document.	Not applicable	Tenement document Extractive Minerals Lease EML 6488 (Midway) (CA-APR-AGR-1027)
2	The Mining Tenement is granted:		
2.1	To OZM Carrapateena Pty Ltd (ACN 007 756 443) and OZ Minerals Carrapateena Pty Ltd (ACN 149 626 255)		
2.2	For the purpose of recovering the Mineral(s) described in the First Schedule of this Tenement Document	Compliant	Recovery of extractive materials consistent with the mining operations described in the Mining Lease Proposal (OZ Minerals 2017)
3	The Mining Tenement is numbered EML6488		
4	The Mining Tenement is		
4.1	Subject to the Terms and Conditions prescribed by the Act and Regulations and specified in this Tenement Document	Compliant	Operation of the Midway Quarry consistent with the Terms and Conditions prescribed by the Act and Regulations
4.1	Subject to the Additional Terms and Conditions specified in the First and Second Schedules (respectively) of this Tenement Document	Compliant	Activities undertaken on EML 6488 consistent with State and Commonwealth legislation and regulations
5	The Mining Tenement is granted over an area of 14.99 hectares and is located in the Pernatty area, approximately 56 km east-southeast of Woomera	Compliant	Changes to the Mining Tenement area adjusted in accordance with State policies and regulations. Eastern Stockpile Extension Program Notification approved by South Australian Department for Energy and Mining (DEM) on 7 May 2021 (CA-ENV-LET-1000)
6	The location of the Mining Tenement is more specifically defined in the map and coordinates specified in the Third Schedule of this Tenement Document	Compliant	Changes to the Mining Tenement area adjusted in accordance with State policies and regulations. Eastern Stockpile Extension Program Notification approved by DEM on 7 May 2021 (CA-ENV-LET-1000)
7	The Mining Tenement is granted for the term of Twenty (20) years, One Hundred and Seventy Four (174) days. The term of the Mining Tenement commenced on 13 July 2018, and, unless it is earlier renewed, surrendered or cancelled, the Mining Tenement will cease on 2 January 2039	Compliant	Extraction operations commenced on the 7 January 2021 (CA-ENV-LET-1010).
8	The Tenement Holder shall pay, by way of rental, such sums as may be prescribed and in accordance with section 40 of the Act and regulation 42 of the Regulations	Not applicable	
9	The Minister may, at any time, require the Tenement Holder to pay to any person an amount of compensation stipulated by the Minister, to which that person is, in the opinion of the Minister, entitled in consequence of mining operations in pursuance of the rights granted and the obligations imposed by the grant of the Mining Tenement	Not applicable	
10	Pursuant to subsection 41(1) of the Act, the Minister may suspend or cancel the Mining Tenement if the Tenement Holder contravenes or fails to comply with a term or condition of this Tenement Document or a provision of the Act (which includes the Regulations).	Not applicable	
11	Pursuant to subsection 41(2) of the Act, the Minister may stipulate in the tenement document a process for suspension or cancellation that must be followed before the powers in subsection 41(1) may be exercised	Not applicable	
12	The process for suspension of the Mining Tenement shall be as stipulated in the Fourth Schedule of this Tenement Document	Not applicable	
13	The process for cancellation of the Mining Tenement shall be as stipulated in the Fifth Schedule of this Tenement Document	Not applicable	
14	The Sixth Schedule of this Tenement Document sets out outcomes contemplated in regulation 65(2) of the Regulations that the Tenement Holder is required to address in any program submitted in accordance with Part 10A of the Act	Compliant	PEPR MPEPR2019/029 (OZ Minerals 2019) Midway Quarry Management Plan (CA-5410-PRM-PLN- 1012)
15	All of the restatements in this portion of this Tenement Document are included for guidance only and do not replace the substantive provisions of the Act or the Regulations	Compliant	
16	If any restatement is inconsistent with the substantive provisions of the Act or the Regulations, the restatement will be invalid and the substantive provision of the Act or the Regulations will prevail and the Tenement Holder is required to comply with the substantive provision of the Act or the Regulations	Compliant	
17	The Tenement Holder is still required to comply with any provision of the Act or Regulations that is not restated in this Tenement Document	Compliant	

Tenement condition number	Tenement condition	Compliance status	Evidence
18	The grant of the Mining Tenement confers an exclusive right upon the Tenement Holder including officers, employee(s), contractor(s) or duly authorised agent(s) of the Tenement Holder, to conduct mining operations on the Land, for the Mineral(s), subject to the provisions of the Act and the Regulations, and the terms and conditions of this Tenement Document	Compliant	
19	The grant of the Mining Tenement authorises the Tenement Holder, including officers, employee(s), contractor(s) or duly authorised agent(s) of the Tenement Holder, to sell, or dispose of, the Mineral(s) recovered in the course of mining operations conducted in pursuance of the grant or to utilise any such mineral(s) for any commercial or industrial purpose, subject to the payment of royalty	Compliant	Extractive materials used for construction of the Western Access Road, specifically sub-base, base coarse, rip-rap and cement-stablished fill.
20	The grant of the Mining Tenement does not confer any right on the Tenement Holder		
20.1	To use the Land for any purpose other than the authorised mining operations	Not applicable	
20.2	To confer any rights on any other person in relation to the Mining Tenement	Not applicable	
21	The Tenement Holder must not carry out mining operations unless there is an approved program for environment protection and rehabilitation (an Approved PEPR)	Compliant	DEM approved PEPR MPEPR2019/029 (OZ Minerals 2019)
22	A Proposed PEPR will only be approved when it complies with the requirements of Part 10A of the Act and the Regulations	Compliant	
23	To comply with Part 10A of the Act, the Proposed PEPR must		
23.1	Contain the information specified in section 70B(2) of the Act and regulation 65(2),(5),(6) of the Regulations and determinations made by the Minister under regulation 65(7) of the Regulations (if any)	Compliant	
23.2	Comply with any applicable conditions specified in this Tenement Document (if any)	Compliant	
23.3	Address any relevant environmental outcomes listed in the Sixth Schedule of this Tenement Document	Compliant	
24	In accordance with regulation 65(10) of the Regulations, the Tenement Holder must submit to the Department of the Premier and Cabinet (DPC) for ministerial approval a Proposed PEPR that fully complies with the Act and Regulations within twelve (12) months after the grant of the Mining Tenement unless the Tenement Holder has been granted an extension of time for such submission	Compliant	DEM approved PEPR MPEPR2019/029 (OZ Minerals 2019)
25	In accordance with regulation 35 of the Regulations, unless otherwise determined or agreed by the Minister, the Tenement Holder must:		
25.1	Commence mining operations in accordance with the Approved PEPR within twelve (12) months after its approval	Compliant	Mining operations associated with EML 6488 commenced on the 7 January 2021 (CA-ENV-LET-1010).
25.2	Thereafter continue mining operations in accordance with the requirements of the program in the Approved PEPR	Compliant	Operation of the Midway Quarry consistent with requirements outlined in the PEPR (MPEPR2019/029) (OZ Minerals 2019)
26	In addition to obligations about the conduct of mining operations and rehabilitation, the Act and Regulations impose other obligations on the Tenement Holder including obligations to:		
26.1	Comply with Part 3 of the Act (royalties)	Compliant	
26.2	Comply with the applicable provisions of Part 9 of the Act (entry onto land and use of declared equipment)	Compliant	
26.3	Comply with the applicable provisions of Part 9B of the Act (native title)	Compliant	NTMA – Confidential (CA-CRL-LET-1003) Cultural Heritage Management Plan (CA-CRL-PLN-1016)
26.4	Comply with the provisions of section 76 of the Act (mining returns) to the extent relevant to an extractive minerals lease	Compliant	
26.5	Comply with section 77 of the Act (records and geological samples) and regulation 84 of the Regulations	Compliant	
26.6	Comply, as necessary, with section 83 of the Act (ministerial consent for dealings in relation to the Tenement) and regulations 44 and 70 of the Regulations	Compliant	
26.7	Comply, insofar as applicable to an extractive minerals lease, with regulation 86 of the Regulations (compliance reports)	Compliant	
26.8	Comply with the requirement in regulation 43 of the Regulations to maintain all posts, boundary indicator markers and notices in the positions required by the Regulations as applicable	Compliant	
26.9	Permit the pastoral lessee (if any) of the Land to have free access and use at all times for domestic purposes, and for the purposes of watering stock from any surface water on the land which shall not have been provided or stored by artificial means by the Tenement Holder	Compliant	Pernatty Pastoral Access and Compensation Agreement – Confidential (CA-APR-AGR-1033)
27	In accordance with section 9 of the Act, the grant of the Mining Tenement does not authorise prospecting, exploring or mining upon any exempt land unless or until the benefit of the exemption is waived under section 9AA	Compliant	
28	In accordance with section 62 of the Act, the Minister may by written notice require the Tenement Holder to pay a bond in such sum and subject to		

Tenement condition number	Tenement condition	Compliance status	Evidence
	such terms and conditions as ensure, in the opinion of the Minister, that the following will be satisfied		
28.1	Any civil or statutory liability likely to be incurred by the Tenement Holder in the course of carrying out mining operations	Not relevant	
28.2	The present and future obligations of the Tenement Holder in relation to the rehabilitation of land disturbed by mining operations	Not relevant	
29	The Tenement Holder shall pay all fees imposed by the Act and Regulations from time to time	Not relevant	
30	This Mineral Tenement shall be renewed in accordance with the Act	Not relevant	
31	The Tenement Holder may apply to surrender the Mining Tenement during its term in accordance with the Act and the Regulations	Not relevant	Midway Quarry remains in care and maintenance.
32	The Mining Tenement is subject to the forfeiture provision of the Act being sections 70 and 85	Not relevant	
33	Notices under the Act will be served in accordance with regulation 106 of the Regulations	Not relevant	
34	Section 15A of the Act requires the Mining Registrar to keep a register of, amongst other things, mining tenements. Upon payment of the prescribed fee, the public may inspect the Mining Register	Compliant	
35	As defined by section 6 of the Act “mining operations” means:		
35.1	Operations carried out in the course of prospecting, exploring or mining for minerals; or	Not relevant	
35.2	Without limiting paragraph 35.1, any operations by which minerals are recovered from any place or situation, including by recovering minerals from the sea or a natural water supply; or	Not relevant	
35.3	On-site operations undertaken to make minerals recovered from the site a commercially viable product, other operations involving such minerals, or other operations involving minerals brought on to the site of a mine for processing; or	Not relevant	
35.4	Operations for the rehabilitation of land on account of the impact of any operations under a preceding paragraph; or	Not relevant	
35.5	Operations that are directly related to any operations under a preceding paragraph; but does not include:	Not relevant	
35.6	An investigation or survey under section 15 of the Act; or	Not relevant	
35.7	Fossicking; or	Not relevant	
35.8	The surface removal of loose rock material disturbed by agricultural operations.	Not relevant	
36	This definition applies to operations that occur during all phases of the mine’s life	Not relevant	
37	The Tenement Holder must comply with regulation 98(1)(c) and 98(2).	Compliant	
37.1	If the Tenement Holder is a natural person, he or she is required to notify the Mining Registrar of a declaration of bankruptcy within fourteen (14) days of the declaration	Not relevant	
37.2	If the Tenement Holder is a company, it is required to notify the Mining Registrar of its being placed under official management, or in liquidation or receivership within fourteen (14) days of any of those events	Not relevant	
38	The Tenement Holder must comply with regulation 90, which concerns public liability insurance	Not relevant	
First Schedule Additional Terms			
1	Mining operations authorised by the grant of the Mining Tenement must:		
1.1	Only be for the recovery of extractive minerals including, but not limited to Dolomite, Limestone, Quartzite, Sandstone, Sand, Shale and Siltstone; and	Compliant	
1.2	Be consistent with the mining operations described in the mining lease proposal document Midway dated 7 February 2018	Compliant	
Second Schedule Additional Conditions			
1	The Tenement Holder agrees to the Approved PEPR and reportable incident reports, submitted in accordance with the Regulations, being made available for public inspection	Compliant	
2	The Tenement Holder must comply with all State and Commonwealth legislation and regulations applicable to the activities undertaken pursuant to this Mining Tenement	Compliant	
Sixth Schedule Environmental Outcomes			
Refer Chapter 7 of this Compliance Report			

9 Rectification of non-compliances

9.1 Reporting period

Where instances of non-compliance have occurred during the reporting period, corrective actions and/or rectification has been applied as described in Table 9.1.

9.2 Previous reporting periods

No non-compliances under Regulation 79 of the Mining Regulations 2020 have previously been reported in compliance reports.

Table 9.1 | Rectification of non-compliances

Date of the incident	Date the incident was reported	What environmental outcome/objective or tenement condition was breached?	Cause of the non-compliance	Actions taken or yet to be taken to rectify the non-compliance and to prevent the recurrence of any such non-compliance
NA	NA	NA	NA	NA

10 Disturbance and rehabilitation activities

The EML 6488 operations necessitated the clearance of approximately 26.7 hectares (ha) of native vegetation, the clearance of which is regulated by the *Native Vegetation Act 1991* (SA) (NV Act) and the Native Vegetation Regulations 2003. An NV Act-compliant significant environmental benefit (SEB) offset provision was described as a component of the greater Carrapateena Mineral Lease PEPR (OZ Minerals 2020). Land disturbance associated with the EMLs, including Midway, are incorporated into the SEB provision assuming, as a worst case, that all land within the EML was disturbed and subsequently rehabilitated.

The Midway Quarry is in care and maintenance and no further rehabilitation occurred during the reporting period. Batters remain at mined angle, with 12 m of pit floor remaining unmined for future use for the potential Carrapateena expansion (subject to further approvals). BHP Carrapateena will reprofile quarry batters to 18 degrees following completion of extractives activity by 2028.

Table 10.1 provides a summary of the disturbance and rehabilitation activities completed to date and Figure 10.1 and Figure 10.2 show the disturbance and rehabilitation that has occurred to date.

Table 10.1 | Disturbance and rehabilitation activities

Area where disturbance and rehabilitation activity occurred (ha)	Description of rehabilitation works carried out to date (ha)	Amount of land disturbed during the reporting period (ha)	Estimated amount of land to be rehabilitated in the next reporting period (ha)	Total amount of land where rehabilitation works are completed (ha)
26.7	6.7	0.0	0.0	6.7

Strategies implemented to avoid or minimise disturbance:
Land Disturbance Permitting process ensures that work areas are safely minimised and already disturbed land is used for new works as much as reasonably possible. For temporary works the stripping of topsoil is avoided. Land disturbance areas are surveyed and barricaded to avoid any disturbance outside of the allowed area.
Summary of any potential improvements learned from previous rehabilitation activities:
Rehabilitation trials under Mineral Lease 6471 have indicated that deep contour ripping and seeding local groundcovers and shrubs is necessary to achieve successful rehabilitation. As the operation is in its early stages, further techniques will be trialed to enhance rehabilitation success (applying woody debris and watering during critical dry periods).

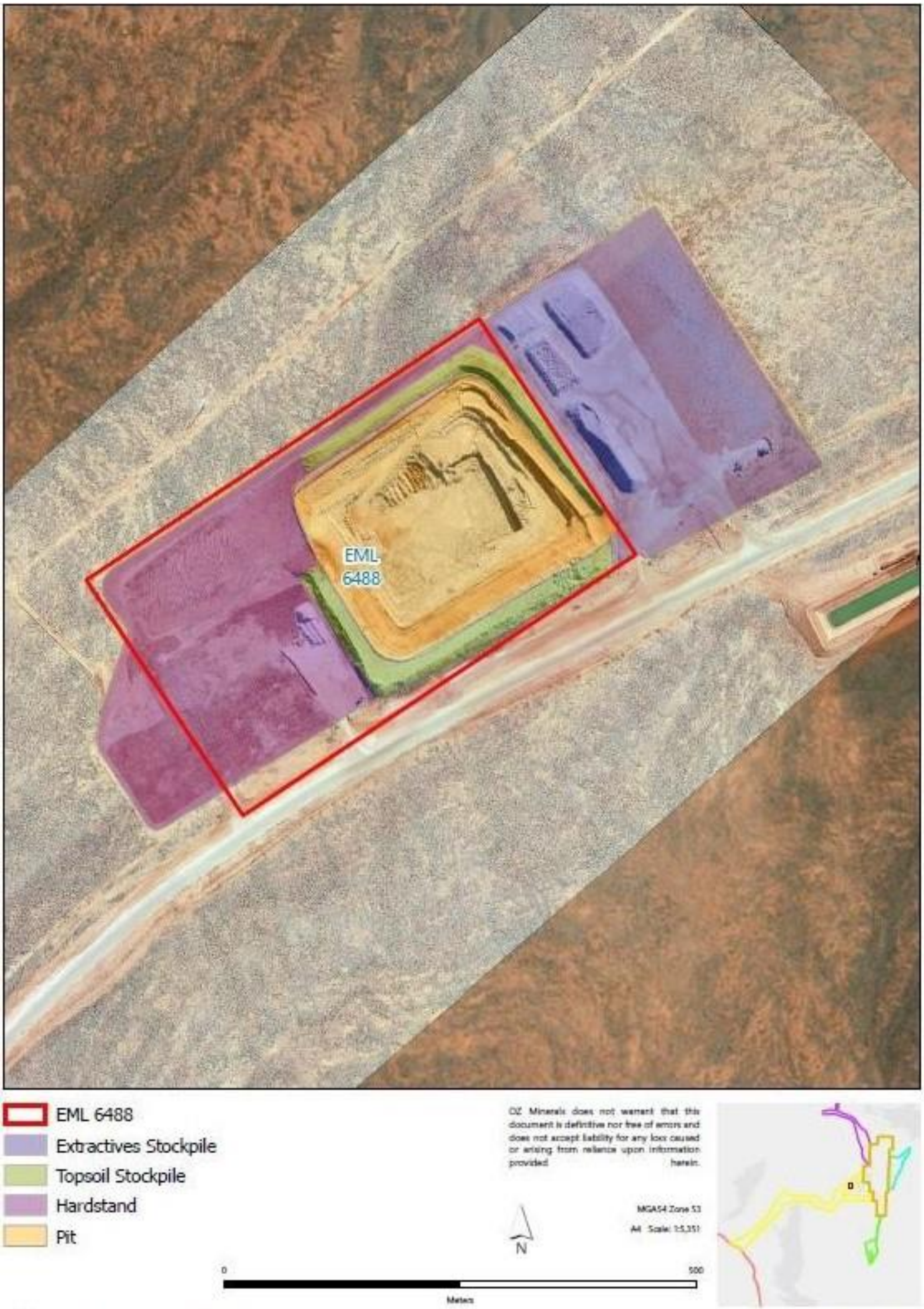

Figure 10.1 | Land disturbed and quarry layout

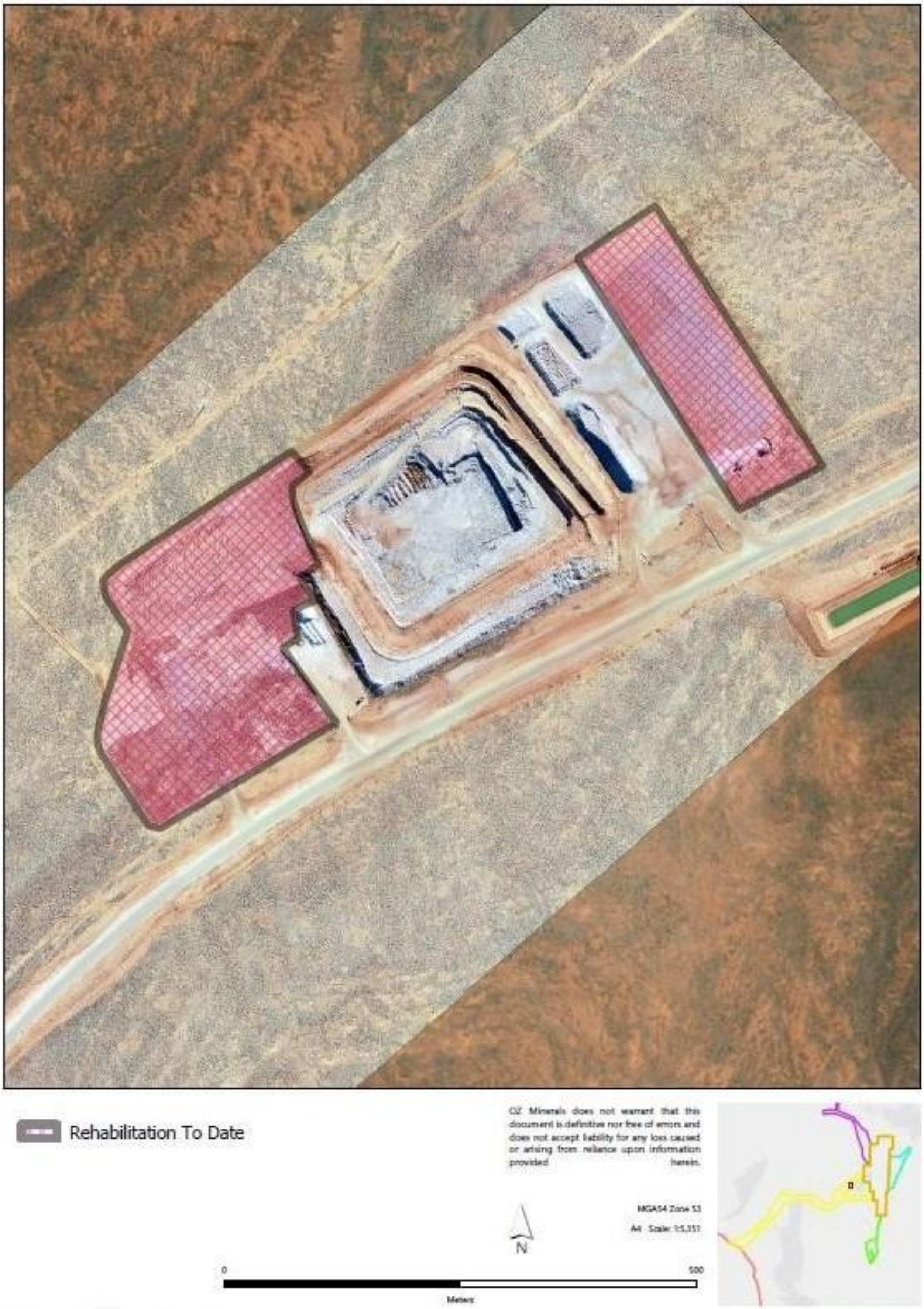

Figure 10.2 | Rehabilitation to date

11 Reconciliation of native vegetation clearance

Reconciliation of native vegetation clearance is described in Table 11.1.

Table 11.1 | Summary of native vegetation clearance since commencement of the Midway Quarry

Lease	Approval	Approved maximum clearance (ha)	Total amount cleared in the reporting period (ha)	Total amount cleared to date (ha)	Estimated amount to be cleared in the next reporting period (ha)
EML 6488	MPEPR2019/029	26.7	0	26.7	0

12 *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)

Table 12.1 | EPBC Act reporting

Condition number	Condition	Compliance status	Evidence demonstrating compliance with condition
1	To manage the impacts of the action on the environment, the person taking the action must implement the conditions of the SA approval.	Compliant	The Compliance Report (BHP 2025a) associated with the granting of the Carrapateena Tenements under the *Mining Act 1971* (SA) was submitted to DEM on 28 March 2025 indicating compliance with the conditions of the state approval. The Compliance Report will be publicly available on the DEM website at: DEM Carrapateena Project and on the BHP website.
2	The person taking the action must not impact more than 1,740 hectares of Plains Rat habitat within the disturbance footprint.	Compliant	Total disturbance since the commencement of the referred action is 1,546.4 ha, including 280.8 ha of Plains Rat (Plains Mouse) habitat, as shown in Figure 5.1 of the Carrapateena Operation EPBC Compliance Report 2024 (BHP 2025b), replicated here as Figure 12.2.
3	Prior to commencement of the action, to compensate for residual impacts to the Plains Rat, the person taking the action must acquire an offset property which must contain: a. a population of the Plains Rat b. no less than 1,740 hectares of Plains Rat habitat c. habitat quality equal to that of the Plains Rat habitat within the disturbance footprint.	Compliant	Following on from an 'Agreement to Underlease' (CA-APR-AGR-1037) with the Pastoral Lessee of South Gap Pastoral Station two offset areas, BHP has established two individual Underlease Agreements, one for each offset area. This secures a total of 3,251 ha of suitable Plains Mouse habitat under Northern Offset Underlease Agreement for 1,882 ha and Southern Offset Underlease Agreement for 1,369 ha (CA-APR-LET-1178). The Underlease Agreements have a 10-year expiry term, with successive Agreements to be established to total the required duration as per the approval conditions. The offset areas consist of Arcoona Tablelands habitat that is similar in quality and structure to the land disturbed at Carrapateena and are considered to represent equally viable Plains Mouse habitat. Historical observations of Plains Mouse have been recorded nearby the northern offset, and within the same stretch of continuous tablelands habitat connecting disturbed Plains Mouse habitat at Carrapateena, to the offset areas on South Gap Station.
4	The person taking the action must maintain or improve the habitat quality of the existing Plains Rat habitat at the acquired offset property for the life of this approval.	Compliant	BHP Carrapateena has developed an Environmental Offset Management Plan (CA-0000-ENV-PLN-1004) (the Plan) which aims to: • establish baseline conditions, including the distribution and condition of Plains Mouse habitat, the presence and distribution of target species, and the identification and prioritisation of local threats • define the potential presence, distribution and abundance of other target species within the offset (i.e. Thick-billed Grasswren and Night Parrot) • manage total predation pressure (fox, cat, wild dog/dingo) • enhance the condition of habitat for the benefit of Plains Mouse, through the management of total grazing pressure (i.e. stock exclusion) and invasive weeds • improve knowledge of local target species populations including an understanding of how they respond to management locally. The Plan presents fourteen (14) individual objectives grouped under eleven (11) management strategies to address EPBC Act offset liability, and associated legislative and policy obligations, for the first ten (10)-year period of management.
5	Within 2 years from commencement of the action, the person taking the action must change the tenure of the offset property for conservation purposes using an appropriate legal mechanism for long term protection.	Compliant	Underlease agreements signed, executed and back-dated from to 21 April 2020 (2 years from the commencement of the action) for the Northern Offset Area and the Southern Offset Area. The areas have been officially registered with the Lands Titles Office: two registrations, as associated with each offset area. The Agreements to Underlease clearly define that the areas are to be and set aside for environmental offset purposes. The change in land use will apply for 10 years, after which the change in land use will need to be renewed (Permission granted by the Commonwealth to manage as rolling terms to achieve the total required tenure).
6	Prior to the commencement of the action, the person taking the action must engage a suitably qualified expert to undertake a Night Parrot survey within the development envelope. The Night Parrot survey must be undertaken in' accordance with the EPBC Act Night Parrot survey guidelines. Within three months of the Night Parrot survey being completed, the person taking the action must provide the Department with the Night Parrot survey results.	Compliant	BHP Carrapateena completed a targeted Threatened Species Survey for Night Parrot in March 2018 (CA-ENV-REP-1040). There were no Night Parrots or evidence of Night Parrots detected during the survey. The results of the survey were forwarded to the Commonwealth regulator in April 2018 (DOE: CA-APR-EML-1077). Night Parrot has not been reconfirmed as locally extinct within South Australia.

Condition number	Condition	Compliance status	Evidence demonstrating compliance with condition
7	Should the Night Parrot or evidence of the Night Parrot be recorded during the survey, the person taking the action must submit for the Minister's approval, a Night Parrot Management Plan that must include: a. Details of the Night Parrot survey results, including the methodology, timing and area surveyed. b. An assessment of the impacts to the Night Parrot that will result from the action. Management actions that will avoid, minimise and/or offset both the immediate and long-term impacts of the action on the Night Parrot. d. Monitoring and reporting requirements that demonstrate the management actions are effectively being implemented and achieve the intended results. This should include the frequency, intensity and duration of monitoring. The person taking the action must not commence the action prior to the Minister approving the Night Parrot Management Plan. The approved Night Parrot Management Plan must be implemented.	Not Applicable	The targeted survey (CA-ENV-REP-1040) did not find evidence of the Night Parrot in the Operation area. Night Parrot has not been reconfirmed as locally extinct within South Australia.
8	Prior to the commencement of the action, the person taking the action must engage a suitably qualified expert to undertake a *Frankenia plicata* survey within the development envelope. The *Frankenia plicata* survey must be undertaken in accordance with contemporary survey methods. Within three months of the *Frankenia plicata* survey being completed, the person taking the action must provide the Department with the *Frankenia plicata* survey results.	Compliant	BHP Carrapateena completed a targeted Threatened Species Survey for *Frankenia plicata* in March 2018 (CA-ENV-REP-1040). *Frankenia plicata* was not detected during the survey. The results of the survey were forwarded to the Commonwealth regulator in April 2018 (CA-APR-EML-1077). Follow-up work by the engaged consultant uncovered the incorrect classification of locally collected *Frankenia* samples lodged with the South Australian Herbarium. Consultation with the SA Herbarium coupled with extensive survey work within the Carrapateena tenements and more broadly within the region has failed to detect this species, which is more likely to occur much further north of the Operation.
9	Should the *Frankenia plicata* be recorded during the survey, the person taking the action must submit for the Minister's approval, a *Frankenia plicata* Management Plan that must include: a. Details of the *Frankenia plicata* survey results, including the methodology, timing and area surveyed. b. An assessment of the impacts to the *Frankenia plicata* that will result from the action. c. Management actions that will avoid, minimise and/or offset both the immediate and long-term impacts of the action on the *Frankenia plicata*. d. Monitoring and reporting requirements that demonstrate the management actions are effectively being implemented and achieve the intended results. This should include the frequency, intensity and duration of monitoring. The person taking the action must not commence the action prior to the Minister approving the *Frankenia plicata* Management Plan. The *approved Frankenia plicata* Management Plan must be implemented.	Not Applicable	The targeted survey (CA-ENV-REP-1040) did not find evidence of *Frankenia plicata* in the Operation area. Follow-up work by the engaged consultant uncovered the incorrect classification of locally collected *Frankenia* samples lodged with the South Australian Herbarium.
10	Within 3 months following the change of tenure referred to in condition 5) the person taking the action must provide the Department with written evidence that the offset property has been secured for conservation purposes using an appropriate legal mechanism.	Compliant	Written evidence provided to the Commonwealth regulator via letter dated 16 December 2020 (CA-APR-LET-1178).
11	Within 30 days after the commencement of the action, the person taking the action must advise the Department in writing of the actual date of commencement.	Compliant	OZ Minerals advised the Commonwealth regulator of the commencement of the action on 21 April 2018 (CA-ENV-LET-1001).
12	The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.	Compliant	BHP Carrapateena maintains an Environmental Management System that includes electronic data management systems for document control (Aconex), obligations management and land access (LandFolio) and consultation/correspondence (Borealis). Data collected during Carrapateena monitoring is recorded on the site environmental data management system (MonitorPro) or within ArcGIS. Data collected for the environmental offsets on South Gap station are collected, managed and reported on by a third party engaged to manage the offset (Nature Foundation) with select information captured back into the Carrapateena systems.
13	Within 30 days after completion of the action, the person taking the action must advise the Department in writing of the actual date of completion and provide a map clearly defining the date, location and actual impact within the Disturbance footprint of the action and be accompanied with a shape file.	Not Applicable	BHP Carrapateena is currently undertaking the action.
14	The approval holder must prepare a compliance report for each 12-month period following the date of commencement of the action, or as otherwise agreed to in writing by the Minister. The approval holder must: a. publish each compliance report on the website within 60 business days following the relevant 12-month period; b. notify the Department by email that a compliance report has been published on the website within five business days of the date of publication; c. keep all compliance reports publicly available on the website until this approval expires; d. exclude or redact sensitive ecological data from compliance reports published on the website; and	Compliant	The EPBC 2017/7895 Compliance Report (BHP 2025b) is posted annually in April to the BHP website where copies of previous Compliance Reports can also be located.

Condition number	Condition	Compliance status	Evidence demonstrating compliance with condition
	e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication. NOTE: The first compliance report may report a period less than 12 months so that it and subsequent compliance reports align with the similar requirement under state approval.		
15	Upon the direction of the Minister, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	Not Applicable	BHP Carrapateena has not been directed by the Minister to commission an independent audit of compliance with the conditions of approval associated with EPBC 2017/7895.
16	If, at any time after 5 years from the date of this approval, the person taking the action has not commenced the action, then the person taking the action must not commence the action without the written agreement of the Minister.	Not Applicable	OZ Minerals commenced the action in late March 2018, as communicated to the Commonwealth regulator in April 2018 (CA-ENV-LET-1001).
17	The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify: a. the condition which is or may be in breach; and b. a short description of the incident and/or non-compliance.	Compliant	There were no non-compliances with the EPBC 2017/7895 conditions of approval, nor non-compliances with commitments described in any plans required therein during the reporting period. There were no incidents associated with the action during the reporting period that caused, or had the potential to cause, significant impacts to matters of national environmental significance (MNES).
18	The approval holder must provide to the Department details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 30 days after becoming aware of the incident or non-compliance, specifying: a. Any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future; b. the potential impacts of the incident or non-compliance; and c. the method and timing of any remedial action that will be undertaken by the approval holder.	Compliant	There were no non-compliances with the EPBC 2017/7895 conditions of approval, nor non-compliances with commitments described in any plans required therein during the reporting period. There were no incidents associated with the action during the reporting period that caused, or had the potential to cause, significant impacts to MNES.

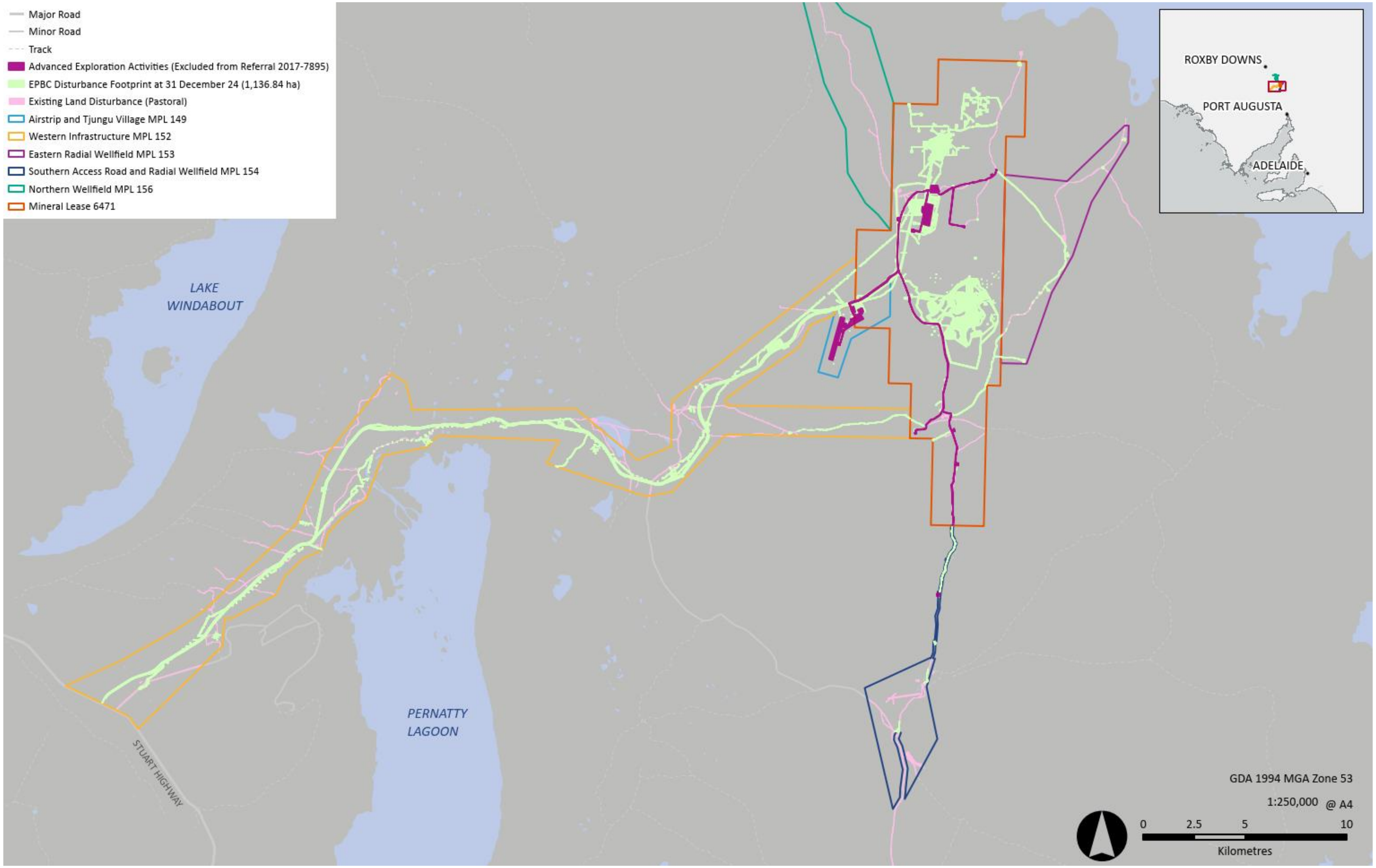

Figure 12.1 | EPBC disturbance footprint (December 2024)

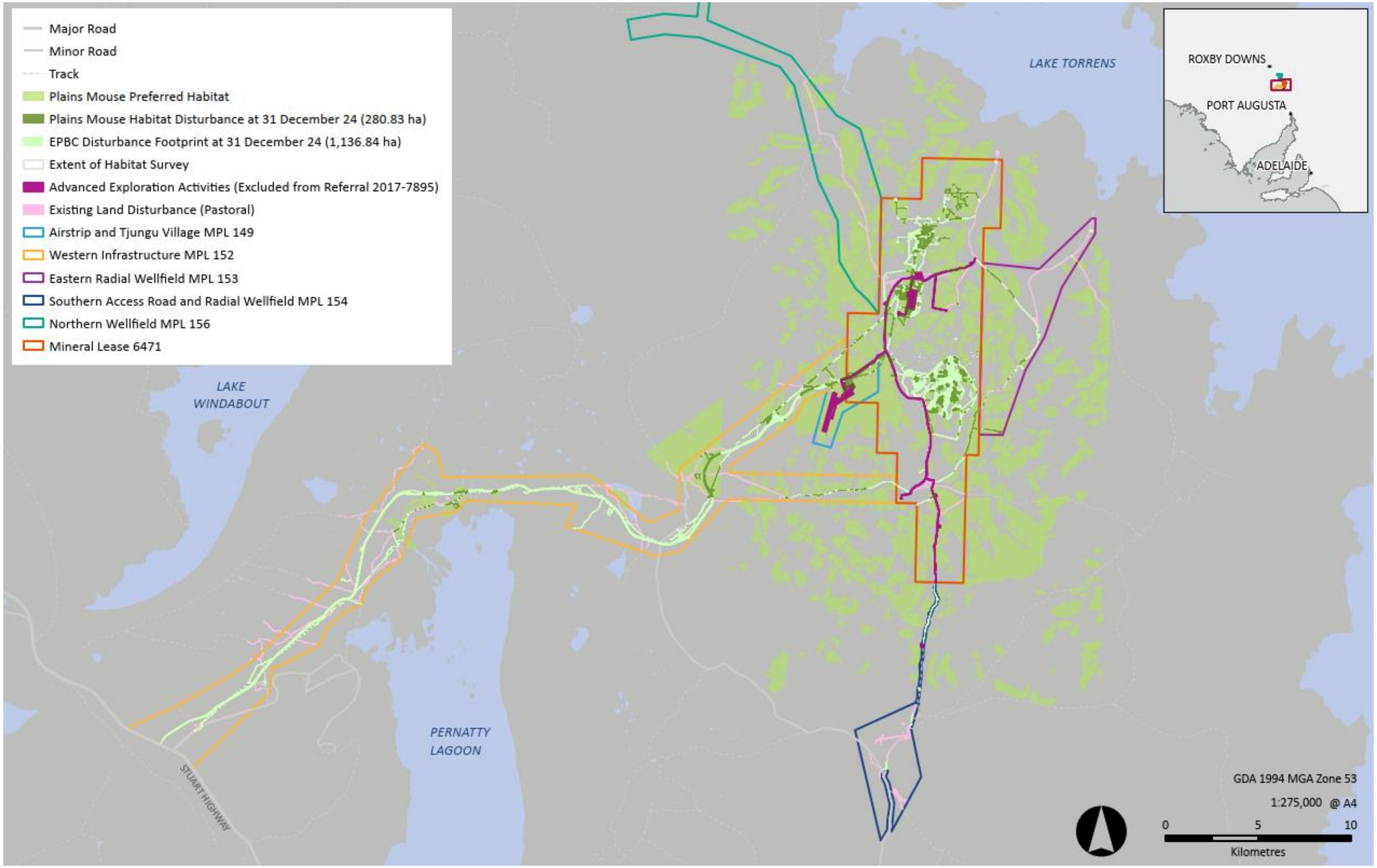

Figure 12.2 | Plains Mouse (*Pseudomys australis*) habitat disturbance (December 2024)

13 Exempt land

There is no exempt land in the vicinity of EML 6488. Relevant waivers are contained within and as part of the Pernatty Land Access and Compensation Agreement for the entirety of Pernatty station.

14 Complaints

No complaints regarding EML 6488 operations were received throughout the reporting period.

15 Changes to authorised operations and emerging environmental hazards

Table 15.1 provides a summary of any change(s) to authorised operations submitted as a review of a PEPR or submitted as a change notification, in accordance with the terms of reference for change in operations application, any PEPR approvals and any changes to the tenement terms and conditions approved for the reporting period.

Table 15.1 | Changes to authorised operations

Description of change to existing mining operation	Significance level (1 to 4)	Date submitted to DEM	Date endorsed by DEM	Current status at the end of the reporting period
Program Notification: Pit Design, Material Stockpiles and Heavy Vehicle Go-Line on Extractive Minerals Lease (EML) 6488 – Midway Quarry, and Miscellaneous Purposes Licence (MPL) 152	4	30 October 2020	26 November 2020 (CA-ENV- LET-1020)	PEPR2017/029 approved for EML 6488
Program Notification – Midway Quarry Temporary Batch Plant	3	21 January 2021	4 February 2021 (CA-ENV- LET-1022)	PEPR2017/029
Program Notification – Eastern Stockpile Extension	3	20 April 2021	7 May 2021 (CA-ENV- LET-1000)	PEPR2017/029

16 Technical reports

Table 16.1 provides a summary list of all technical data, studies and reports generated during the reporting period that support the achievement of tenement conditions and environmental outcomes and objectives in the approved PEPR (OZ Minerals 2019).

Table 16.1 | Technical reports

Report Title	Author(s)
Appendix B 2024 Carrapateena Flora and Fauna Survey	Lathwida Environmental

17 Abbreviations and units of measure

17.1 Definition of acronyms

Acronym	Expansion
AS	Australian Standard
DEM	Government of South Australia's Department for Energy and Mining
EML	Extractive Minerals Lease
EPA	Government of South Australia's Environment Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
LUP	land use permit
LFA	Landscape Function Analysis
LI	Leading Indicator
MPL	Miscellaneous Purposes Licence
MNES	matters of national environmental significance
NTMA	Native Title Mining Agreement
OMC	Outcome Measurement Criteria
PEPR	Program for Environment Protection and Rehabilitation
SEB	significant environmental benefit
TOR 009	Terms of Reference 009
WAR	Western Access Road

17.2 Units of Measure

Abbreviation	Expansion of Unit
$	Australian dollars(s)
US$	United States dollar(s)
%	percent
ha	hectare
km	kilometre
m	metre
mRL	metres reduced level

18 References

BHP (2025a) *Carrapateena Operation PEPR Compliance Report 2024*. *Mineral Lease, MPL 149 Airstrip, Workers' Accommodation Village, Access Road and Ancillary Infrastructure, MPL 152 Western Infrastructure Corridor, MPL 153 Eastern Radial Wellfield, MPL 154 Southern Access Road and Radial Wellfield, MPL 156 Northern Wellfield.* Dated 28 March 2025. BHP, South Australia, Adelaide.

BHP (2025b) *Carrapateena Operation EPBC Compliance Report 2024*. Dated 28 March 2025. BHP, South Australia, Adelaide.

DEM (Department for Energy and Mining) (2020) *Determination Terms of Reference 009 (TOR 009) Mining Compliance Reports*. Notice under Regulation 77 of the Mining Regulations 2020. Dated 11 December 2020. Government of South Australia's Department for Energy and Mining, South Australia, Adelaide.

DEM (Department for Energy and Mining) (2021) *Preparing a mining compliance report*. Mineral Regulatory Guidelines MG3, Mineral Resources Division. Dated August 2021. Government of South Australia's Department for Energy and Mining, South Australia. Adelaide.

OZ Minerals (2017) *Carrapateena Project Mining Lease Proposal and Miscellaneous Purposes Licence Management Plans*. May 2017. OZ Minerals, South Australia, Adelaide.

OZ Minerals (2019) *Carrapateena Project Midway Program for Environment Protection and Rehabilitation for Extractive Minerals Lease 6488*. December 2019. MPEPR2019/029. 30 December 2019. OZ Minerals, South Australia, Adelaide.

OZ Minerals (2020) *Carrapateena Project Program for Environment Protection and Rehabilitation. ML 6471 Mineral Lease, MPL 149 Airstrip, Workers' Accommodation Village, Access Road and Ancillary Infrastructure, MPL 152 Western Infrastructure Corridor, MPL 153 Eastern Radial Wellfield, MPL 154 Southern Access Road and Radial Wellfield, MPL 156 Northern Wellfield.* February 2020. MPEPR2019/026. OZ Minerals, South Australia, Adelaide.

Appendices

Appendix A Public liability insurance

A copy of the cover note for the public liability insurance and/or a copy of the policy of insurance is attached on the following page.

Stein Insurance Company Limited

PO Box 230
Heritage Hall
Le Marchant Street
St Peter Port
Guernsey GY1 4JH
Telephone +44 (0) 1481 737100
Fax +44 (0) 1481 729046

26 June 2025

To Whom It May Concern

Certificate of Placement – Public & Products Liability

This certificate is issued as a matter of information only and confers no rights upon the holder. It does not amend, extend or alter the coverage afforded by the policy/policies listed. It is issued as a summary only of the cover provided and is current only at the date of issue. For full particulars reference should be made to the current policy wording.

Named Insured: BHP Group Limited and all subsidiary companies and all related and/or affiliated and/or controlled, managed, administered and associated companies or corporations (now existing or hereinafter acquired, formed or incorporated) and/or related joint ventures and/or partnerships and other entities named or described herein for their respective rights and interests.

Insurer(s): Stein Insurance Co. – a Captive Insurance Company and wholly owned subsidiary of BHP Group Ltd currently rated A- by Standard & Poor's

Policy Number: PL/0001/25

Period of Insurance: 1st July 2025 to 30th June 2026, both days inclusive, local standard time at the location of the property, operations or activities insured.

Interest Insured: The Insurers will indemnify the Insured up to the Limit of Liability stated in the Schedule for all amounts which the Insured shall become legally liable to pay by way of compensation (including claimants' costs and expenses) for and/or arising out of Personal Injury (including death) and/or Property Damage occurring during the Period of Insurance in connection with the Business of the Insured and/or the Insured's Products and/or Completed Operations

STEIN INSURANCE COMPANY LIMITED

	Including the Insured's Liability arising out of the ownership, possession or use by or on behalf of the Insured of any Automobile excluding claims which are the subject of statutory or similar legislation controlling the use of Automobiles for which the Insured is compelled to effect insurance
Situation and/or Premises:	Anywhere in the world but the Insurers shall not be liable to pay any claim or indemnity hereunder to the extent that payment of such would expose the Insurers to any sanction, prohibition or restriction under any United Nations resolutions or any trade or economic sanctions, laws or regulations of any applicable jurisdiction.
Limit of Liability:	US$20,000,000 any one occurrence in respect of Public Liability US$20,000,000 any one occurrence and in the annual aggregate in respect of Products Liability US$20,000,000 any one occurrence and in the annual aggregate in respect of Medical Malpractice US$20,000,000 any one occurrence and in the annual aggregate in respect of Professional Indemnity
Notice of Occurrence:	The Insured shall promptly furnish the Insurers with all information available respecting any Claim, and the Insurers shall have the right to appoint adjusters, assessors or surveyors and to control all negotiations, adjustments and settlements in connection with such Claim, subject always to the terms and conditions of the policy wording.

All other terms and conditions as per the full policy wording.

Signed for and on behalf of
Stein Insurance Company
J. Stewart - Manager

Appendix B 2024 Carrapateena Flora and Fauna Survey

BHP

Carrapateena Operations

Flora and Fauna Survey 2024

BHP

LATHWIDA ENVIRONMENTAL

March 2025

Revision 0

Document status

Revision	Doc Type	Reviewed By	Approved By	Date Issued
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B	Draft for client review	RF	ZMB	10/02/2025
0	Final	ZMB	ZMB	11/03/2025

Project details

Client	BHP – Carrapateena
Project	BHP Carrapateena Ecology Support
Project Number	LE24009
Report Subject	Flora and Fauna Survey 2024
Project Manager	Zeta Bull
Project Director	Nick Bull
Authors	Zeta Bull, Sonia Croft
File Reference	LE24009 Carra Ecology Report_Rev 0

Suggested citation

Lathwida (Lathwida Environmental Pty Ltd) (2025) *Carrapateena Operations Flora and Fauna Survey 2024*. Revision 0. March 2025. Report prepared for BHP.

Disclaimer

This report has been prepared on behalf of, and for the exclusive use of Lathwida Environmental Pty Ltd (Lathwida) and Lathwida's client BHP, and is subject to, and issued in accordance with, the provisions of the contract between BHP and Lathwida.

Lathwida accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

This report should be read in full, and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Lathwida for use of any part of this report in any other context.

The sole purpose of this report and the associated services performed by Lathwida is to document the 2024 Ecological Assessment for the survey area. This document and associated data will support the development of primary approval documentation required for the Carrapateena Mine site in South Australia. The report is based on the results of an annual flora and fauna survey for BHP. The scope of services, as described in this report, was developed with BHP.

In preparing this report, Lathwida has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Lathwida has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Lathwida collected and reviewed data and information available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Lathwida has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

Note on currency

Where possible, information contained in this Document is up to date as at March 2025. This was not possible for supporting appendices, and information based on those appendices, which were prepared by third parties (as discussed in the second paragraph in the Disclaimer above) prior to the Document being finalised.

Copyright

Executive summary

Carrapateena is a copper-gold mining operation located in South Australia approximately 160 km north of the regional centre of Port Augusta. BHP (previously OZ Minerals) have an approved Program for Environment Protection and Rehabilitation (PEPR) for the Carrapateena Mineral Lease (ML 6471), and associated Miscellaneous Purposes (MPLs) 149, 152, 153, 154 and 156, which satisfies section 70B of the Mining Act 1971 (SA) (Mining Act) (BHP 2024). Under the Mining Act Part 10A, a compliant program must be in force before carrying out operations as defined in the PEPR.

BHP engaged Lathwida Environmental (Lathwida) to conduct the annual flora and fauna survey to demonstrate approval conditions and outcomes as per the PEPR ML 6471 and associated MPLs. The relevant approval conditions focus on flora and fauna survey to monitor the following: plant diversity and abundance, plant health, evidence of new weed species that are declared under legislation, increases in abundance of existing (non-declared) weed species and evidence of pathogens or feral animals as a result of the mine operation or mine related activities. In addition, approval conditions require BHP to report records of fauna species with a National Conservation Rating (e.g. relevant species to Carrapateena listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)); Plains Mouse (*Pseudomys australis*), Night Parrot (*Pezoporus occidentalis*) and Thick-billed Grasswren (*Amytornis modestus indulkanna*). The PEPR outlines specific Outcome Measurement Criteria (OMC) which BHP are required to report against.

This report provides the outcomes of the spring 2024 survey, which builds upon the previous ecological compliance monitoring surveys undertaken since the commencement of construction in autumn 2018. The majority of surveys were conducted in spring (from September 2018), however an autumn survey was also conducted in 2023, given the change in rainfall in the preceding years. The intention of the 2023 autumn survey was to detect a different suite of flora and fauna and to provide an additional opportunity to capture the EPBC listed Plains Mouse. In 2024, Carrapateena rainfall was below average and fluctuated, with only two larger events in March (over 20 mm) and July (40mm), hence a spring survey was conducted rather than autumn.

Flora survey methods undertaken here are generally consistent with methods that have been used at the Carrapateena for baseline studies undertaken prior to construction (2012-2017), with minor modifications to align data collection with the outcomes and mine approval conditions. Flora methods include Jessup transects, Rangeland Assessment Methodology (RAM), canopy cover assessments and weed transects. These methods provide a combination of data that informs current native and exotic (weed) plant diversity and abundance, whilst canopy cover data provides an indication of tree health (and stress) within a creekline downstream of the Tailings Dam. Results are compared to baseline survey data where applicable data is available. Landscape Functional Analysis (LFA) was conducted at four sites (two established 2020, two established in 2022) that have begun rehabilitation. LFA uses field assessment of physical, chemical and biological processes to determine the degree to which the land system is self-sustaining, and in particular, assesses the capture or loss of resources from the system. The results of the spring 2024 LFA were compared with 2019 - 2023 results and baseline data from corresponding representative 'analogue' sites. One site no longer requires monitoring (Tjungu), one only requires one method of monitoring given the plant density is high, and one site should be rehabilitated again, given shallow ripping is very slow to rehabilitate and one transect has been compromised. In future additional LFA sites and new analogue sites could be established immediately adjacent the LFA Sites, once infrastructure locations are final, and the rehabilitation is evident.

Fauna survey methods followed a modified version of the biological survey methods (as per Owens 2000), with a focus on pitfall trapping to address the lease area condition relating to small mammal and reptile diversity, including the EPBC listed as Vulnerable Plains Mouse (*Pseudomys australis*). A single trap line was installed at eight established fauna sites, and bird surveys were undertaken at 20 sites, aligning with vegetation survey sites. One un-baited camera trap was also installed at each trap line site, and Song Meters were deployed at 10 sites to record bird calls and at three sites to record microbat calls. Opportunistic observation / capture of all vertebrate species across the site was also recorded to provide information about overall species diversity at Carrapateena, which is comparable with previous surveys.

Despite below average rainfall for the year prior to the survey, an above average winter rainfall event in July and reduced grazing impacts has resulted in an abundance of short-lived flora species and sustained the four main long-lived flora species at Carrapateena and high numbers of reptiles which have less reliance on sustained rainfall. However, lack of sustained rainfall earlier in the year, and suitable food resources (e.g. grass seeds), has likely influenced the overall fauna records at the site, i.e. lower rodent diversity and captures and continued lack of detection of EPBC listed Plains Mouse,

ES1 Flora results

The conditions of the PEPR require native vegetation condition surveys that assess native plant species abundance and diversity. In 2024, total species diversity recorded across all flora sites (141 native species) was the equal highest recorded during compliance monitoring, due to a very high diversity of short-lived species being recorded. During construction monitoring, variation in total species diversity within the mining lease has largely been due to variation in diversity of short-lived species that germinate in response to rainfall events, such as the well above average rainfall received in July 2024. Grazing impact continued to be low in 2024, following widespread destocking across the mining lease, which also likely influenced short-lived species diversity and widespread increased abundance of palatable species (e.g. Bladder Saltbush, Bush Minuria and Plains Lantern Bush). The population abundance of the five most abundant and/or widespread long-lived perennials declined during 2018 to 2020, but have all increased since 2021 (Bladder Saltbush, Samphire, Sea-heath, Bush Minuria, Plains Lantern Bush). The declines and increases in long lived perennial species are attributed to yearly and long-term rainfall totals rather than mining impacts (e.g. the 50% increases in Plains Lantern Bush and Cunningham's Daisy abundance in 2022 and/or 2023 were particularly striking). Similar to 2023, in 2024 the mean total species diversity for impact sites and for control sites was not significantly different, were within the baseline range, and comparable with mean total species diversities recorded in 2018 (early compliance). Based on the above, mining activities are not considered to be impacting either short-lived or long-lived species diversity at the mineral lease. Hence, results suggest there are no impacts on native flora species diversity and abundance from mining activities, satisfying Schedule 6 Conditions of the PEPR and OMCs SWRF1, AQ2.

Impacts in Eliza Creek have the potential to occur as a result of reduced surface water flows, reduced groundwater flows and / or groundwater contamination attributed to tailings seepage from the Tailings Storage Facility (TSF), or flood water released through activation of the decant dam spillway in a 1 in 100-year 72 AEP rain event. Since 2018, there has been no distinct trend in species diversity for any of the Eliza Creek sites, with both small increases and decreases occurring yearly at each site. There are also no distinct differences in species diversity between sites. There is no clear pattern emerging in species diversity data relating to the time since the TSF establishment and the distance from the TSF. Ten of the most abundant long-lived woody perennials recorded at the Eliza Creek Jessup transects were separately analysed. All 10 species have shown yearly fluctuations, but no downward population trends at any of the Eliza Creek sites since 2018, with the exception of Dead Finish at Site 10. The slight downward trend of Dead Finish may be attributable to fluctuating numbers between surveys and difficulty in separating dense clusters of spiky plants into individuals. Regardless, the Eliza Creek Jessup transects have shown an increase in total perennial species abundance. Canopy cover assessments have also shown positive tree health for the sites downstream of the TSF. Western Myall trees have shown an increase in foliage and recruitment and River Red Gums have regained canopy losses, but there was still no recruitment of Red Gums recorded along transects. Lack of recruitment from River Red Gums along the transects (located furthest from the TSF) are likely reflective of lower than average rainfall. No impact from mining activities is considered evident (based on diversity, abundance and canopy cover assessments) at the formal Eliza Creek sites. The results of the formal monitoring sites results would suggest there are no impacts on Eliza Creek vegetation arising from the TSF and associated mining activities, satisfying Sixth Schedule Condition 2 of the PEPR and OMC SWRF1, TSF6. However, downstream of the TSF there has been a seepage incident at the Decant Dam, resulting in the death of Western Myall trees and understorey shrubs upstream of Site 17. This is currently considered non-compliant until the extent of impact is finalised, and Significant Environmental Benefit (SEB) offset is accounted for. A follow up survey in spring 2024 has been undertaken to finalise the SEB offset requirement under the Native Vegetation Act 1991 (refer Separate memo).

Weed species were surveyed at existing flora sites; at designated weed transects, and at opportune locations throughout the lease area, including the camps and dams. Most weeds recorded were annual herbs or grasses. Most annual weed records were from dams or drainage lines, areas naturally susceptible to weed invasion, and from the dune habitats, and their presence is unrelated to mining activities. There were no new weeds recorded in 2024 and no overall increase in abundance or extent of weeds declared under legislation. Although not declared, Wards Weed was recorded along the Western Access Road for the first time, however was previously recorded along the SAR (2021). This introduction may be due to mine related activities. It is recommended that this small population be located in winter when it is actively growing and eradicated.

Ongoing control of Tobacco Bush at Dawson Dam and South Eliza Dam is recommended. Fluctuations in density reflect seasonal rainfall patterns rather than mining impacts. No new species of declared weeds were recorded during spring 2024, indicating compliance with the Schedule 6 Condition 6, Schedule 2 Condition 28, and OMC WP1 and WP2.

No EPBC listed or NPW Act listed flora species were recorded during the 2024 survey.

ES2 LFA results

The current status and trends at four rehabilitation sites (Aerodrome laydown, Ventia laydown, Midway Quarry and Tjungu) were again measured by Landscape Function analysis (LFA), using the Established Method and Point Centre Quarter (PCQ) method for all sites. The LFA and PCQ show a positive trend in the number and area of plants per hectare (ha) at all four rehabilitation sites. Plant colonisation across sites is currently dominated by short-lived perennial species (*Sclerolaena* spp.) although several longer-lived perennials were also recorded and some distant from the transects. The short-lived species are an important colonising component of the naturally occurring vegetation in the stony tableland habitat, and all plants improve soil stability and function. As plants (patches) establish and increase in size, the potential for resource capture and nutrient cycling improves leading to ongoing increased potential for recruitment of native species. Developed patches also provide cover and habitat opportunities for native fauna species and reduce soil loss and erosion.

Although LFA monitoring is in its early stages, there are evident differences between application of different rehabilitation techniques which may be affecting recruitment. These include deeper contour ripping and application of rocky surface strew at the Aerodrome, Midway Quarry and Tjungu sites compared with shallow contour ripping at the Ventia site. The addition of hand seeding has also likely accelerated establishment of plants at the Tjungu site, although only a few species from the seed mix were recorded, regardless this site no longer requires monitoring. The absence of resource trapping patches (troughs) at the Ventia site is likely to substantially limit the speed with which the site rehabilitates, plus one transect was decommissioned in 2024 given it had been compromised by vehicle tracks. However, additional intervention or restoration activities of the remaining sites may further enhance site rehabilitation for all sites, including applying native woody debris (e.g. old Myall fence posts, fallen branches), planting local groundcovers and low shrubs, and providing supplementary watering during critical periods of plant establishment. Ongoing monitoring will assist in informing trends and the benefit of additional intervention such as deeper or repeat ripping and seeding.

Currently, LFA data is compared with data from a series of 'analogue sites' which were collected prior to construction at the site. Whilst this analogue data is considered broadly representative of the vegetation communities around the mine lease, and therefore a useful indicator of rehabilitation success, a more precise reference would be to establish LFA sites adjoining each rehabilitation site.

Overall, OMC LUP4 is considered to be in-progress / compliant.

ES3 Fauna results

The 2024 spring fauna survey identified a total of 107 vertebrate species from the eight survey sites and opportunistically across the study area. Capture rates for small mammals and reptiles were within baseline and compliance ranges. Reptile and bird diversity, and total species diversity across the whole of Carrapateena was however within or above the range of diversity that has been recorded during baseline surveys, meaning construction and early operational activities do not appear to have resulted in a loss of abundance or diversity. Compared to recent years, increased reptile captures and the highest diversity recorded were most likely influenced by the warmer temperatures (e.g. a day of 36 and 40 degrees, respectively), however there were also thunderstorms and extreme wind events. Bird diversity was within baseline and compliance range, with waterbird presence increased as a result of water present in dams and a temporary water source at South Eliza. Mammal captures were within baseline and compliance ranges, but diversity was slightly lower for rodents and no planigales were detected. However, these mammal types were generally captured in smaller numbers in previous surveys and respond to rainfall (or lack of). Higher total fauna capture rates were also likely associated with presence of short-lived flora species, a winter rainfall event and the warmer daily temperatures during the survey. The common species were captured in numbers within baseline ranges (e.g. Stripe-faced Dunnart, Fat-tailed Dunnart, Saltbush Ctenotus, Earless Dragons). Similar to the other compliance monitoring surveys, the reduced survey effort (reduced trap lines) compared with baseline surveys did not appear to influence capture rates per site. This trapping effort appears sufficient to capture information that is required for the mine conditions and PEPR outcomes, which focus on habitat quality and species presence or absence (diversity) rather than abundance, as well as comparison between control and impact sites. Diversity of species and families was comparable to baseline data, and birds and reptiles showed evidence of breeding (e.g. plumage, multi-sex groupings and presence of juveniles), suggesting that mining related construction activities are not negatively impacting fauna at Carrapateena. Small mammal capture numbers were again skewed towards Stripe-faced Dunnarts, aligning with baseline and compliance trends, with the exception of 2022 when Fat-tailed Dunnarts were captured in higher numbers. This may suggest conditions were more favourable for Stripe-faced Dunnarts compared to Fat-tailed Dunnarts at the time of the survey. In addition, microbats were surveyed using Song Meter acoustic device at three opportunistic sites and five species were detected, three of these had not been recorded since baseline.

The approval conditions of the PEPR (Schedule 2 Condition 28) require that any records of three EPBC Act listed as threatened species (Night Parrot *Pezoporus occidentalis*, Thick-billed Grasswren *Amytornis modestus*, and Plains Mouse *Pseudomys australis*) are documented and provided to the Biological Databases of South Australia (BDBSA), if they are recorded during ecological surveys at Carrapateena, or opportunistically during regular site activities. None of these EPBC listed threatened were detected during the 2024 survey. One EPBC listed as threatened and migratory was detected (Sharp-tailed Sandpiper) and one EPBC listed as migratory species (Common Sandpiper) was detected throughout the spring 2024 survey; both detected in small numbers at South Eliza Dam. Both species have previously been detected at Carrapateena at dams or effluent irrigation areas with run off.

During the spring 2024 survey, there were fauna species detected that had not previously recorded within the lease during baseline and compliance monitoring (Pelican, Red-necked Avocet, Rufous Songlark) and others that had not been detected since baseline (Southern Four-toed Slider, Australian Pratincole, Inland Forest Bat, Inland Free-tailed Bat and Lesser Long-eared Bat). Gould's Wattled Bat was also detected, considered as likely present in 2023, but calls could only be verified to Genus level that year. Carrapateena occurs within or on the edge of the known range of these species and there are historic BDBSA records for these species within the broader region (i.e. > 50km from the study area).

Less invasive fauna detection methods such as Song Meters and cameras have again proved useful to complement bird and fauna survey effort, particularly in the arid zone, where local climate can affect species presence during a survey.

Overall, OMC WP1, WP2, EPBC1, EPBC2, EPBC3 are considered to be compliant.

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1 Introduction

1.1 Operation background

Carrapateena is a copper-gold mine, now owned and operated by BHP Group Limited (BHP), and which located in South Australia on the eastern margin of the Gawler Craton, approximately 160 km north of the regional centre of Port Augusta (Figure 1.1). Construction on Carrapateena was completed by OZ Minerals in late 2019 – early 2020, and is now in a steady state of operation. The Carrapateena operation is an underground copper gold mine using a sub-level cave mining method. Onsite there is the Tjati and materials handling declines, process plant, ancillary infrastructure, Tailings Storage Facility (TSF), Tjungu village and Aerodrome. An exploration village that was temporary is also likely to be retained and updated given expansions that are in progress. OZ Minerals was purchased by BHP in 2023 and all former OZ Minerals assets are now part of BHP.

BHP have an approved Program for Environment Protection and Rehabilitation (PEPR) for the Carrapateena Mineral Lease (ML 6471), which satisfies section 70B of the Mining Act 1971 (SA) (Mining Act). Under Part 10A of the Mining Act, a compliance program must be in force before carrying out operations as defined in the PEPR. OZ Minerals was granted ML 6471 on 3 January 2018. The PEPR was updated in June 2024. In addition to the ML, the Carrapateena PEPR also includes the following Miscellaneous Purposes Licence (MPLs) for infrastructure associated with the mine:

- Airstrip, Workers' Accommodation Village, Access Road and Ancillary Infrastructure (MPL 149), granted 5 July 2017
- Western Infrastructure Corridor (MPL 152), granted 3 January 2018
- Eastern Radial Wellfield (MPL 153), granted 3 January 2018
- Southern Access Road and Radial Wellfield (MPL 154), granted 3 January 2018
- Northern Wellfield (MPL 156), granted 11 December 2018.

Jacobs were previously engaged to conduct construction and operational ecological monitoring surveys in autumn and spring of 2018, spring 2019, spring 2020, spring 2021, spring 2022, and autumn 2023 in order to meet approval conditions outlined in the PEPR ML 6471. This report represents the findings from the eighth compliance monitoring survey; undertaken in spring 2024 by Lathwida Environmental (Lathwida). The approval conditions focus on:

- Surveying native plant species to ensure there is no decline in diversity and abundance as a result of mining activities,
- Monitoring of plant health to demonstrate there are no detrimental impacts on plants as a result of mining activities (e.g. including impacts from raised dust levels, contaminants and/or declines in surface water flow),
- Monitoring to demonstrate that no new weed species declared under legislation have been introduced to Carrapateena, and no increase in abundance of existing (non-declared) weed species, pathogens or feral animals has occurred as a result of mining activities,

- Surveying common native fauna to ensure there is no loss in diversity or abundance, as a result of as a result of mining activities (e.g. from direct impacts, impacts to habitat, weeds and pests),
- Surveying native fauna species to ensure there is no decline in diversity and abundance of NPW Act or EPBC Act listed fauna as a result of mining activities, and
- Reporting of any records of EPBC Act listed fauna species, including migratory species, with specific objectives for several EPBC listed species (discussed below).

Figure 1.1: Project Location
Carrapateena Flora and Fauna Survey

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1.1.1 Relevant conditions of approval

As stated in the initial compliance monitoring report, which occurred during construction (Carrapateena Ecology autumn 2018 survey, Jacobs 2018a), the approval conditions of the PEPR for ML 6471 and associated MPLs define a number of conditions relating to fauna and flora values that occur within the lease areas, which are summarised in Table 1.1 below. The PEPR, updated in 2024, also outlines the monitoring program including Outcome Measurement Criteria (OMC), Leading Indicators and Strategies to demonstrate compliance with the defined and agreed Outcomes, which are summarised in Table 1.2.

Table 1.1: Mineral Lease 6471 and associated MPLs fauna and flora conditions relevant to annual monitoring

Schedule and Conditions Reference no.	Condition Environmental Outcome / OMC ID
Schedule 2 Condition 28.2 to 28.4 (ML 6741, MPL 152 to 154)	To ensure the protection of Matters of National Environmental Significance, the Tenement Holder must: 28.1 (refer Schedule 6) 28.2. Provide data from any future sightings and records of the Thick-billed Grasswren to the Biological Databases of South Australia (BDBSA) to enable effective monitoring and record keeping, as per the Recovery Plan Actions; 28.3. Provide data from any future sightings and records of the Night Parrot to the Night Parrot Recovery Team; and 28.4. Provide data from any future sightings and records of the Plains Mouse to the BDBSA to enable effective monitoring and record keeping, as per the Recovery Plan Actions. OMC ID EPBC1, EPBC2, EPBC3
Schedule 6 Condition 6 and 28.1 (ML 6471) Condition 3 (MPL 156) Condition 6 (MPL 152 to 154) Conditon10 (MPL149)	The Tenement holder must during construction and operation ensure no introduction of new species of Weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals), nor sustained increase in abundance of existing weed or pest species in the Land as a result of mining operations or mining related activities. 28.1. Develop, implement and maintain appropriate management actions to ensure the control of feral animal populations, including cats and foxes. OMC ID WP1, WP2
Schedule 6 Condition 17 (ML 6471)	The Tenement Holder must during construction, operation and post Completion ensure no adverse impact to surface water quality and water dependent ecosystems (excluding surface water in the mine subsidence zone), on or off the Land, as a result of contamination and sedimentation caused by mining operations or mining-related activities. OMC SWRF1, TSF6
Schedule 6 Condition 7, 6, 4 (MPL 6471, MPL 149, 152 to 154, 156)	The Tenement Holder must during construction and operation ensure no impacts to agricultural productivity for third-party land users on or off the Land as a result of mining-related activities other than those agreed between the Tenement Holder and the affected user or determined by an appropriate court as evidenced in its order(s) (and the Tenement Holder must provide the Director of Mines (or other authorised officer) with a copy of the order(s), which shall be placed on the Mining Register). OMC LUP4
Schedule 6 Condition 14 (ML 6471)	The Tenement Holder must during construction, operation and post Completion ensure no adverse change to the air quality environment as a result of particulate emissions and/or dust generated by mining operations or mining related activities. OMC AQ2

Table 1.2: Outcomes, Outcome Measurement Criteria (OMC) / Leading Indicator / Strategies

Outcome Measurement Criteria (OMC) Code	Relevant Environmental Outcomes	OMC / Leading Indicator / Strategy	Achievement Values
SWRF1	The Tenement Holder must during construction, operation and post Completion ensure no adverse impact to surface water quality and water dependent ecosystems (excluding surface water in the mine subsidence zone), on or off the Land, as a result of contamination and sedimentation caused by mining operations or mining-related activities.	Annual surveys undertaken by an independent and suitably qualified expert demonstrates no adverse impact on the diversity and abundance of native vegetation and water dependent ecosystems at Eliza Creek monitoring attributed to reduced surface water flows caused by mining operations when compared to baseline conditions	No adverse impact on the diversity and abundance of native vegetation and water dependant ecosystems attributed to reduced surface water flows caused by mining operations when compared to baseline conditions (Appendix C5 of PEPR - Ecological Baseline BHP 2024) unless a significant environmental benefit has been approved in accordance with the relevant legislation Linked to Native Vegetation Outcome (Schedule 6 Condition 11)
TSF6		Annual surveys undertaken by an independent and suitably qualified expert demonstrates no adverse impact on the diversity and abundance of native vegetation and water dependent ecosystems at Eliza Creek monitoring sites attributed to tailings seepage when compared to baseline conditions (Appendix C5 Ecological Baseline of PEPR BHP 2024) and surveys for new sites undertaken prior to commencement Stage 1 Tailings commissioning)	No adverse impact on the diversity and abundance of native vegetation and water dependant ecosystems attributed to tailings seepage when compared to baseline conditions (Appendix C5 of PEPR - Ecological Baseline BHP 2024) unless a significant environmental benefit has been approved in accordance with the relevant legislation. Linked to Native Vegetation Outcome (Schedule 6 Condition 11).
WP1	The tenement holder must during construction and operation ensure no introduction of new species of weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals), nor sustained increase in abundance of existing weed or pest species in the Land as a result of mining activities mining operations or mining-related activities.	Annual flora and fauna surveys undertaken by suitably qualified ecologists at flora, fauna and weeds monitoring locations demonstrates no introduction of new species of weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals) as a result of mining related activities when compared to previously recorded weed species and introduced fauna	No introduction of: • new species of weeds declared or listed under relevant legislation • plant pathogens, pests (including feral animals) when compared to previously recorded weed species and introduced fauna.
WP2		Annual flora and fauna surveys undertaken by independent and suitably qualified ecologists at flora, fauna and weed monitoring locations demonstrates no increase in the abundance of existing weeds or pest species in the land compared to previous survey records as a result of mining related activities	No increase in the abundance of existing weeds or pest species in the land compared to previous survey records.

Outcome Measurement Criteria (OMC) Code	Relevant Environmental Outcomes	OMC / Leading Indicator / Strategy	Achievement Values
AQ2	The Tenement Holder must during construction, operation and post Completion ensure no adverse change to the air quality environment as a result of particulate emissions and/or dust generated by mining operations or mining-related activities.	Annual surveys undertaken by a suitably qualified and experienced expert demonstrates no adverse impact on the diversity and abundance of native vegetation at monitoring sites (Figure 2.1) directly attributed to dust deposition from mining operations or mining related activities when compared to baseline native vegetation conditions	No adverse impact on the diversity and abundance of native vegetation at monitoring sites directly attributed to dust deposition from mining operations or mining related activities when compared to baseline native vegetation conditions (Appendix C5 Ecological Baseline of BHP 2024)
EPBC1	Provide data from any future sightings and records of the Thick-billed Grasswren to the Biological Databases of South Australia (BDBSA) to enable effective monitoring and record keeping, as per the Recovery Plan Actions.	Future records of the Thick-billed Grasswren are to be provided to the BDBSA to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites or opportunistic sighting (Figure 2.1, Figure 2.2, Figure 2.3)	Records of the Thick-billed Grasswren provided to the BDBSA if observed. Linked to MNES Condition (Schedule 2 Condition 28.2).
EPBC2	Provide data from any future sightings and records of the Plains Mouse to the BDBSA to enable effective monitoring and record keeping, as per the Recovery Plan Actions	Future records of the Plains Mouse are to be provided to the BDBSA to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites or opportunistic sighting (Figure 2.1, Figure 2.2, Figure 2.3)	Records of the Plains Mouse, provided to the BDBSA if observed. Linked to MNES Condition (Schedule 2 Condition 28.4).
EPBC3	Provide data from any future sightings and records of the Night Parrot to the Night Parrot Recovery Team	Future records of the Night Parrot are provided to the Night Parrot Recovery Team to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites or opportunistic sighting (Figure 2.1, Figure 2.2, Figure 2.3)	Records of the Night Parrot provided to the Night Parrot Recovery Team if observed. Linked to MNES Condition (Schedule 2 Condition 28.3)
LUP4	The Tenement Holder must ensure that the Land is progressively and finally rehabilitated to support the future land use.	Rehabilitation trials shall be undertaken at infrastructure locations no longer required Figure 2.6 and ongoing (annual) assessment at LFA monitoring sites are assessed annually demonstrating development of trends and annual improvement of rehabilitation through LFA methodology. Should the data indicate rehabilitation not trending towards sustainability root-cause investigations will be undertaken and rectification methods be identified and implemented	Rehabilitation has achieved, or is likely to achieve, a landscape function equivalent to that of adjacent analogue LFA sites

Note WP3 includes monthly weed inspections, this is not part of the scope of this report.

1.2 History of monitoring at Carrapateena

The history of baseline ecological monitoring at Carrapateena was summarised in the Carrapateena Ecology autumn 2018 survey report (Jacobs 2018a), which represented the first of the compliance monitoring reports following commencement of construction. Briefly, baseline flora and fauna surveys were undertaken by EBS Ecology within and surrounding the Carrapateena Mineral Lease (ML 6471), biannually between autumn 2012 and spring 2016 / 2017 (references provided in Jacobs 2018). The surveys covered a range of seasonal and yearly climatic conditions and therefore collectively provide a robust baseline data set describing the fauna and flora values present at the site, against which impacts from the Carrapateena construction and operation can be compared.

A summary of baseline ecological monitoring (2012 to 2017, EBS Ecology 2017b) is provided in previous monitoring reports (Jacobs 2018a, 2018b; 2019, 2020, 2021, 2022, 2023d). The autumn and spring 2018, and spring 2019 to 2023 surveys (conducted by Jacobs) are considered to represent the commencement of, and ongoing construction and operational compliance monitoring associated with the mining operation approved under ML 6471. It is noted that whilst baseline surveys were conducted in 2017, some raw data (primarily floristic data) was not available for comparison against the compliance monitoring data.

1.3 Climate at Carrapateena

The nearest weather station to Carrapateena Mine that provides detailed temperature and rainfall data is the Woomera Aerodrome (station number 16001, Commonwealth of Australia Bureau of Meteorology (BoM) 2023a), approximately 70 km to west of the operational area. Long term climatic statistics are available for this site (1949 to current) providing an insight into the region's climatic trends. The mine is located in an arid environment, with a hot, dry climate, and average rainfall of approximately 180 mm per year (BoM 2024a). Long-term mean monthly rainfall shows no distinct seasonal variation, whereas mean monthly temperature maximums vary from the mid to low 30s in the summer months to below 20 degrees Celsius in the winter months (Figure 1.2).

In the 12 months preceding the spring 2024 survey, the Woomera region recorded below average yearly rainfall, despite July and December receiving around 14 mm and 40 mm more rain than mean long term totals respectively (Figure 1.3, Figure 1.4, and Figure 1.5). This shortfall can be explained by six months of the year receiving at least 10 mm rain less than the mean monthly long-term totals (Figure 1.3). All remaining months during this period received within 5 mm of the mean monthly long-term totals. Further detail about specific trends in rainfall at Carrapateena are discussed in Section 3.1.

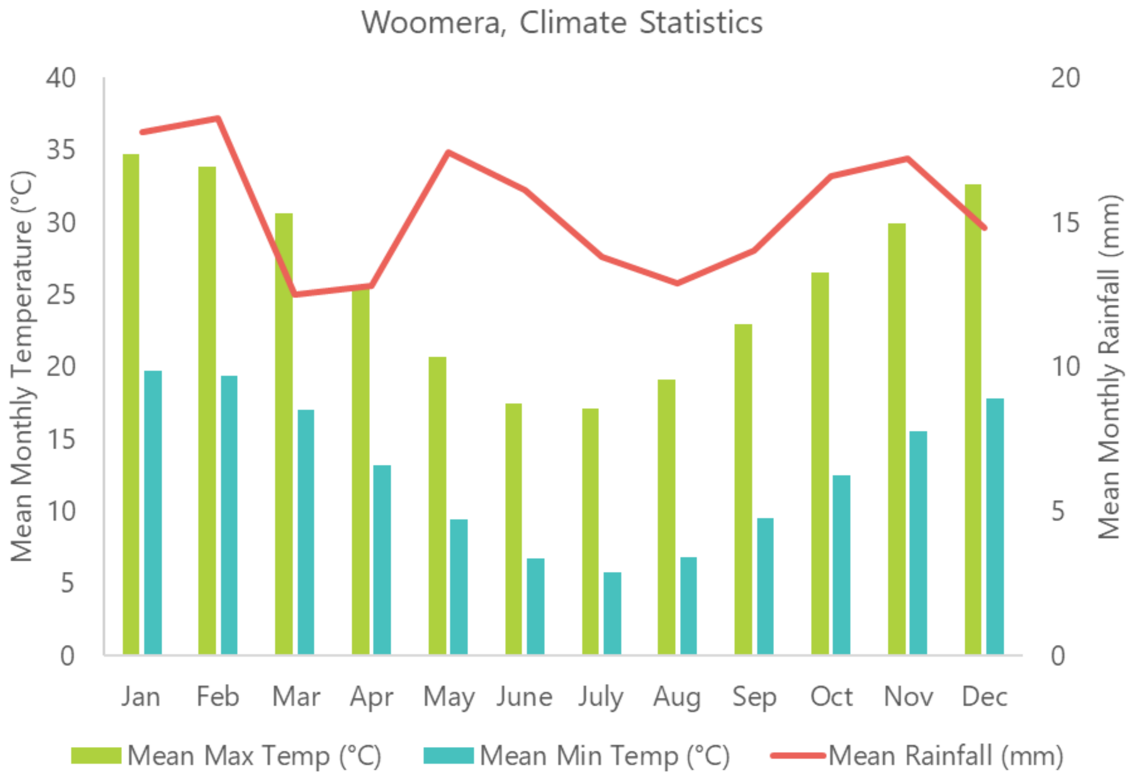

Figure 1.2: Long-term climate averages (1949-2024) for regional weather station nearest to Carrapateena, Woomera Aerodrome

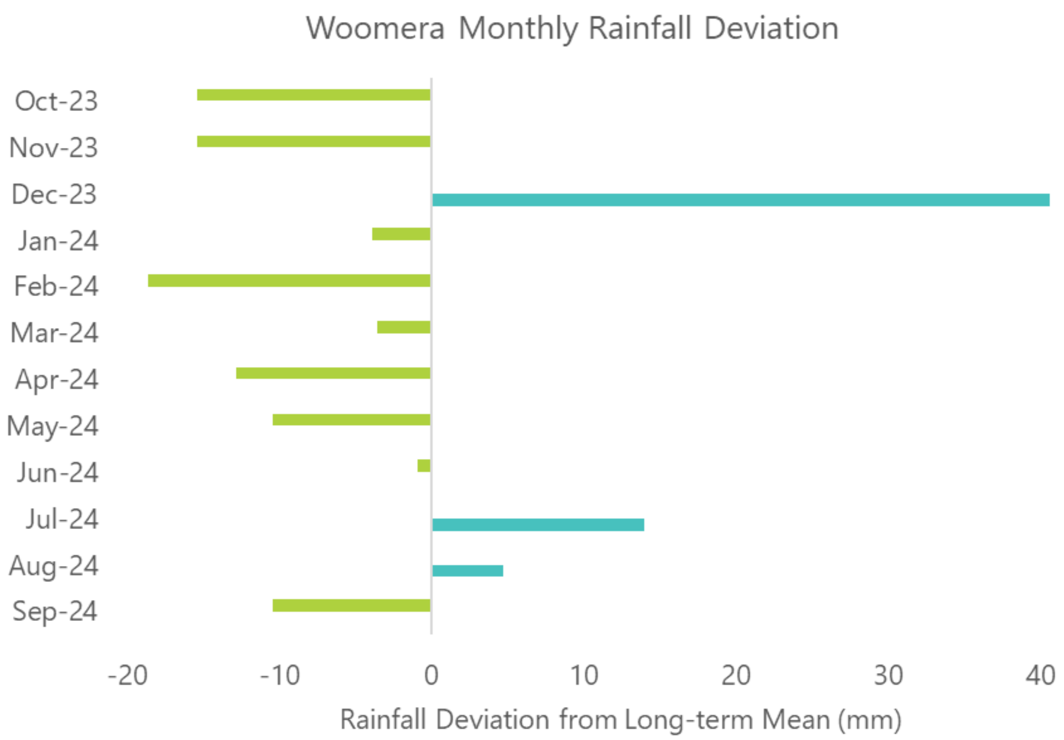

Figure 1.3: Rainfall deviations between year preceding survey and long-term averages (1949-2024) for regional weather station nearest to site, Woomera Aerodrome

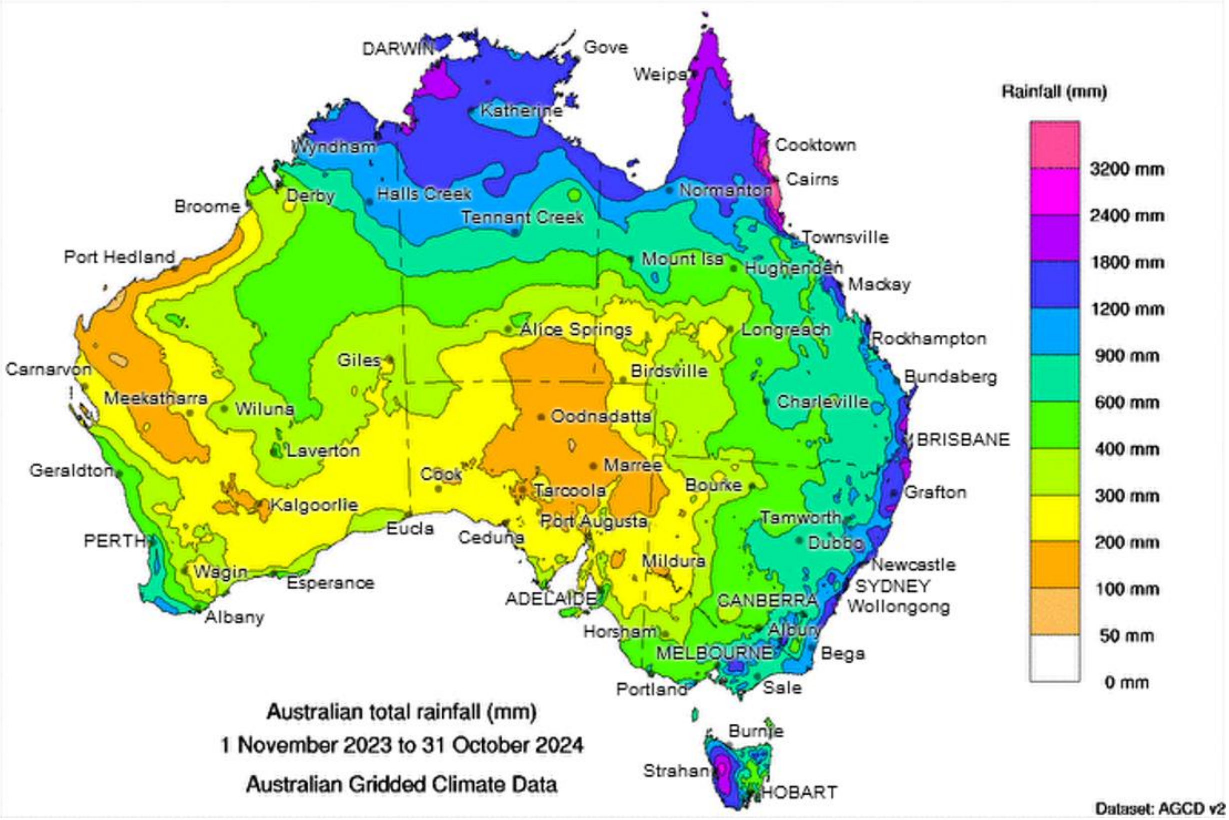

Figure 1.4: Total rainfall across Australia, 12 months preceding the spring 2024 survey (BoM 2024b)

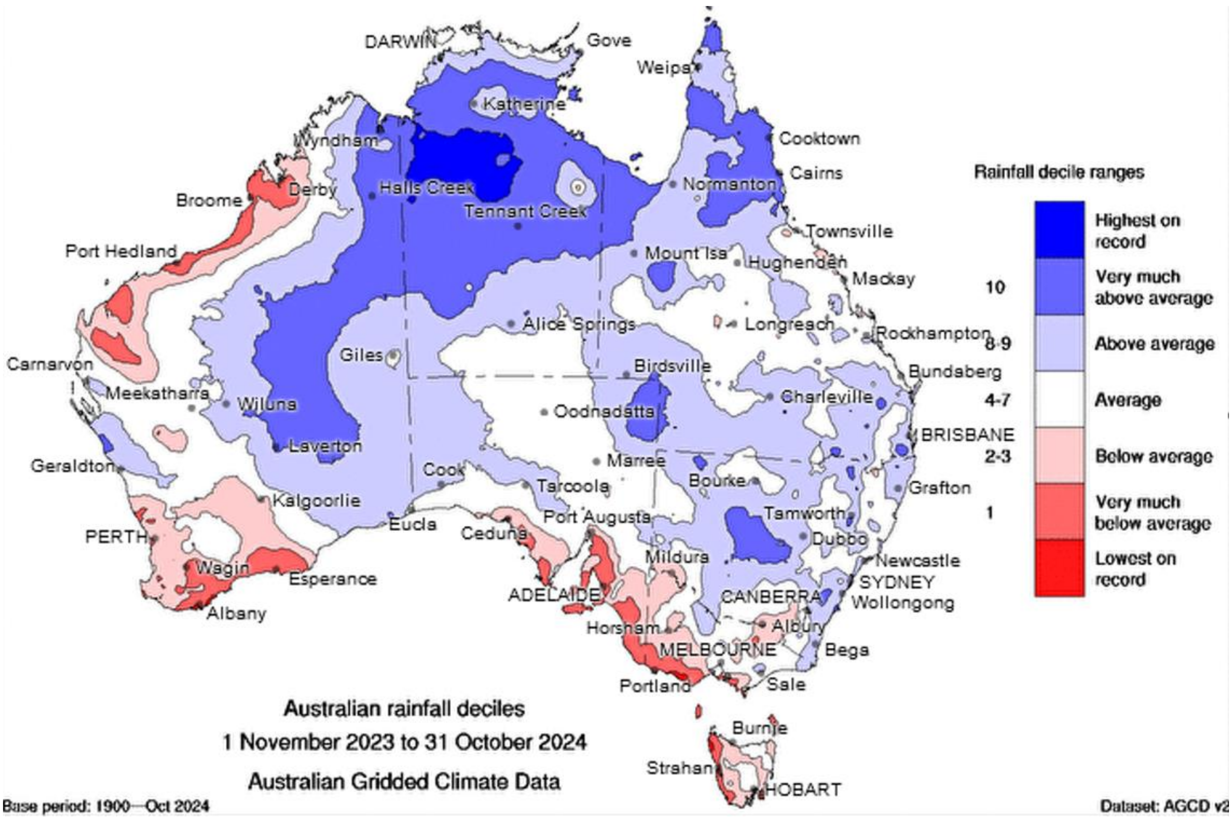

Figure 1.5: Rainfall deciles across Australia, 12 months preceding the spring 2024 survey (BoM 2024b)

2 Methods

2.1 Survey details

Lathwida undertook the spring flora and fauna surveys at Carrapateena between 14 and 23 October 2024. The survey team included the following suitably qualified personnel:

- Principal Ecologist Dr Zeta Bull undertook trap installation, morning and afternoon trap checks, bird survey, mammal and reptile identification lead, flora survey assistant, trap removal.
- Senior Associate Ecologist Greg Smith undertook trap installation, morning and afternoon trap checks, mammal and reptile identification, bird survey, flora survey, trap removal and Song Meter deployment and analysis. Greg specifically surveyed 'men only' cultural sites;
- Senior Ecologist Dr Sonia Croft undertook trap installation, morning and afternoon trap checks, flora surveys, bird survey, trap removal;
- Undergraduate Ecologist Andy Delvaux provided survey assistance and undertook trap installation, assisted with morning and afternoon trap checks, assisted with flora survey, mammal and reptile identification, bird survey and trap removal. Andy assisted with survey of the 'men only' cultural sites.

BHP Environmental personnel Josh Allen, Nicholas Kruger, Bob Starkey, Trent Anderson and Jennifer Kerr assisted with various logistics associated with the survey.

2.2 Permitting

Undertaking ecological research and handling/trapping of animals in South Australia can only legally be undertaken with relevant permits and licences in place. Relevant permits and licences were obtained prior to field survey commencement. All works were undertaken in accordance with permit and licence conditions; details as below.

- Permit to Undertake Scientific Research:
  - Permit # A27482-1, valid from 11/10/2024 to 10/10/2025
- Wildlife Ethics Committee Permit:
  - Application number Bull_26/2023 statewide fauna with semi-pitfalls, approval period 31/08/2023 to 01/09/2026
- Permit to Undertake Scientific Research for State-wide Vegetation Surveys:
  - Permit # U27347-2-16, valid 17/10/2024 to 16/10/2025
- Licence for 'teaching, research or experimentation involving animals':
  - Licence # 414, expires 25/8/2025

- Licence to 'possess and administer Prescription Drug[1]:
  - Licence # 2023-87672, expires 12/09/2026.

2.3 Spring 2024 Sites

The objective of the survey monitoring program is to demonstrate compliance against the conditions of the Mineral Lease and the approved outcomes during the mine construction, operations and rehabilitation. Table 2.1 below includes a summary of previous monitoring sites against the compliance survey sites and an explanation for any changes. Table 2.2 provides a summary of specific spring 2024 survey site details. Refer spring 2019 report (Jacobs 2020a) for further details. The locations of the spring 2024 survey sites are provided on Figure 2.1 for flora and canopy cover, Figure 2.2 for fauna sites, Figure 2.3 for weed transects, and Figure 2.6 for LFA, as part of the operational monitoring.

[1] A condition of Scientific Research Permits is that 'best practice' for biological survey work is undertaken, including vouchering of specimens of interest for the South Australian Museum (SAM). This condition is included on permits as a means of maximising value obtained from survey work across the State, to enable taxonomic specialists the chance to verify field identification, and to encourage survey records to be included in the Biological Database of South Australia for broader knowledge. As such, the project team liaised with the SAM prior to undertaking the survey to ascertain whether the Museum had particular interest in the region being surveyed. In this case, the curator of mammals and curator of reptiles requested voucher specimens and liver tissue samples be collected for target species. Pentobarbitone sodium is used to euthanize specimens, however, was not required on this survey as no animals were euthanized.

Table 2.1: Sites surveyed in spring 2024, compared with baseline survey sites

Baseline Survey Sites (2012-2017)	Compliance sites	Construction / Operational (Compliance) Monitoring Survey Sites (spring 2024)
Flora		
Jessup transects (x 16 sites) (Flora Site 1 to Flora Site 16)	Jessup sites (x 18)	Jessup sites (as per baseline Flora Site 1 to Flora Site 16), plus additional Jessup sites at Eliza Creek Flora Sites 17 to 20. *Note in spring 2019, Site 8 and 14 were permanently removed from the program given proximity to stock impact areas, interfering with assessment of mining impacts. Refer Jacobs Spring 2019 for additional detail (Jacobs 2020a). **Jessup sites not undertaken at site 21, 22 sand dune habitat as per Section 2.4
Flora sites (x 16 sites) (Flora Site 1 to 16)	Rangeland (x 20)	Flora Site 1 to 16), Eliza Creek sites (Sites 17 to 20) and dune habitat sites (Sites 21 and 22), excludes Site 8 and 14. Baseline and Compliance surveys recorded all plant species and cover/abundance within a 1 ha area. For Compliance surveys Rangeland Assessment Method (RAM) (NVC 2024) was also undertaken (assessing grazing impact and life stages present for long-lived plant species).
Flora cover sites (x 33 sites) (CFL01 to CFL33)	NA	Baseline surveys only, not continued. Survey sites covered 10 m x 5 m area, deemed too small to capture meaningful change in this habitat type.
Canopy cover (x 11 transects). 7 Eliza Creek transects, 4 Yeltacowie Creek transects (CCC01 to CCC11)	8 sites (Eliza Creek)	Baseline Yeltacowie Creek and Eliza Creek canopy cover sites (CCC01 to CCC11, EBS 2017) were not assessed as per 2018-2023. Eliza Creek canopy cover transects (sites17AB, 18AB, 19AB and 20AB), were surveyed in spring (2018 to 2022, 2024) and in autumn (2018, 2019, 2023).
Weed Monitoring (x 4 transects) (CWM01 to CWM04)	10 weed transects	Baseline weed transects (CWM01 to CWM04), CWM06, CWM07 (established in 2018) and CWM05 (established in 2022). Northern Wellfield MPL 156, transects NWM01, NWM02 and NWM03 were assessed. Opportunistic observations of declared weed species or species listed under legislation are also recorded (e.g. dams, villages and effluent irrigation areas, spill areas).
Fauna		
Reptiles and mammals (x 8 sites) Fauna Sites 1 – 6, 15, 16)	8 sites	Semi-permanent pitfall trap line sites as per baseline surveys (Fauna Site 1 to 6, Fauna Site 15 to 16). As per 2018 to 2023, only one pitfall line was opened at each site and only 6 pits per line. No Elliott traps were deployed as per baseline (2015-2017), and compliance / operation (2018 to 2023). This methodology will be continually reviewed based on an analysis of compliance monitoring trapping data for small rodents (e.g. Plains Mouse). Camera traps have also been used (1 per line) since 2021.
Bats	NA	As per 2018 to 2023. Common microbat audible to humans (Dennis Mathews, pers. com.) assessed during spotlighting. No bats likely to be present at the site have a conservation rating. In 2024 Song Meters were deployed to detect birds and microbats at Site 7, 10 and South Eliza Dam.
Bird Sites (x 16 sites - Fauna Site 1 – 16), opportunistic surveys at water points	20-22 sites, opportunistic at water points / irrigation areas	Bird surveys at 14 of the baseline sites (e.g. Fauna Site 1 to 6, 15 and 16, Flora site 7, 9, 10, 11,12,13) and 6 compliance sites (17,18,19, 20, 21, 22). Opportunistic surveys were also undertaken at water points (e.g. farm dams), camps to capture diversity across the site as per baseline surveys. Survey of water points also enables opportunistic observations of seasonal of migratory shorebirds. Song meters were deployed to detect bird species by call at all fauna sites (except site 3 adjacent admin), South Eliza Dam, Eliza Creek Site 10, and Flora site 7 (Bosworth Creek). The dam was full of water, the creeks were dry.
Landscape Functional Analysis (LFA)		
Landscape Functional Analysis (CEF01 to CEF07)	4 sites, each with 2 transects	Four Landscape Functional Analysis sites (LFAAL1, LFAVOL2, LFAQUA3, LFATJU4), each with two transects labelled A and B (e.g. LFAAL1A, LFAAL1B) were assessed. In October 2024, Site LFAVOL2 Transect A was discontinued, due to 50% of the transect being graded and used as a temporary laydown area for widening of the adjoining road. No vegetation was present on the remainder of the transect.

Refer to Jacobs Spring 2019 report for additional detail (Jacobs 2020a).

Table 2.2: Summary of survey sites, codes and coordinates

Survey Techniques at Site	Site Code	Start / End	Easting	Northing
Weed Transect	CWM01	Start	737108	6517520
		End	736871	6516550
	CWM02	Start	737842	6530179
		End	738177	6529435
	CWM03	Start	733610	6535627
		End	732611	6535266
	CWM04	Start	735912	6540184
		End	736548	6540963
	CWM05	Start	700638	6518508
		End	701466	6519078
	CWM06	Start	717686	6529628
		End	718673	6529505
	CWM07	Start	743694	6539567
		End	743410	6540518
	NWM01	Start	726014	6554920
		End	726937	6554923
	NWM02	Start	726955	6569623
		End	725963	6569751
	NWM03	Start	720606	6580675
		End	720551	6581674
RAM, Jessup, Fauna Trapping, Birds	Flora / Fauna 1	Start	731707	6550590
	Flora / Fauna 2	Start	734223	6545185
	Flora / Fauna 3	Start	736001	6540156
	Flora / Fauna 4	Start	736251	6534615
	Flora / Fauna 5	Start	729131	6532955
	Flora / Fauna 6	Start	739690	6531181
	Flora / Fauna 15	Start	737123	6538106
	Flora / Fauna 16	Start	732472	6535805
RAM, Jessup, Birds	Flora / Fauna 7	Start	732755	6548730
	Flora / Fauna 9	Start	746788	6544253
	Flora / Fauna 10	Start	740538	6541973
	Flora / Fauna 11	Start	734655	6536360
	Flora / Fauna 12	Start	740402	6532837
	Flora / Fauna 13	Start	745093	6528963
RAM, Jessup, Birds, Canopy Cover	Flora / Fauna 17, CC17A	Start	739269	6536920
	Flora / Fauna 18, CC18A	Start	739350	6537556
	Flora / Fauna 19, CC19A	Start	739621	6539504
	Flora / Fauna 20, CC20A	Start	739950	6541083
Canopy Cover	CC17B	Start	739265	6536929
	CC18B	Start	739345	6537556
	CC19B	Start	739676	6539434
	CC20B	Start	739959	6541060
RAM, Birds	Flora / Fauna 21	Start[1]	722657	6531233
	Flora / Fauna 22	Start[1]	718006	6529448
Landscape Function Analysis	LFA Site 1 Aerodrome Laydown (Aerodrome)	Start	733020	6534295
		End	733063	6534316
		Start	733052	6534277
		End	733068	6534319
	LFA Site 2 Ventia (Office) Laydown (Ventia)[2]	Start	736103	6540338
		End	736103	6540391
	LFA Site 3 Midway Quarry Laydown (Midway Quarry)	Start	729264	6533139
		End	729291	6533097
		Start	729307	6533163
		End	729335	6533123
	LFA Site 4 Tjungu to WAR	Start	734595	6536191
		End	734631	6536219
		Start	734631	6536219
		End	734673	6536252

[1]Refer Jacobs (2019) for further detail; [2]Transect A Start Easting 736070 Northing 6540392, End Easting 736069 Northing 6540392 discontinued in 2024 due to transect being 50% graded and used as temporary laydown area for widening of the adjoining road. The remainder of the transect contained no plants.

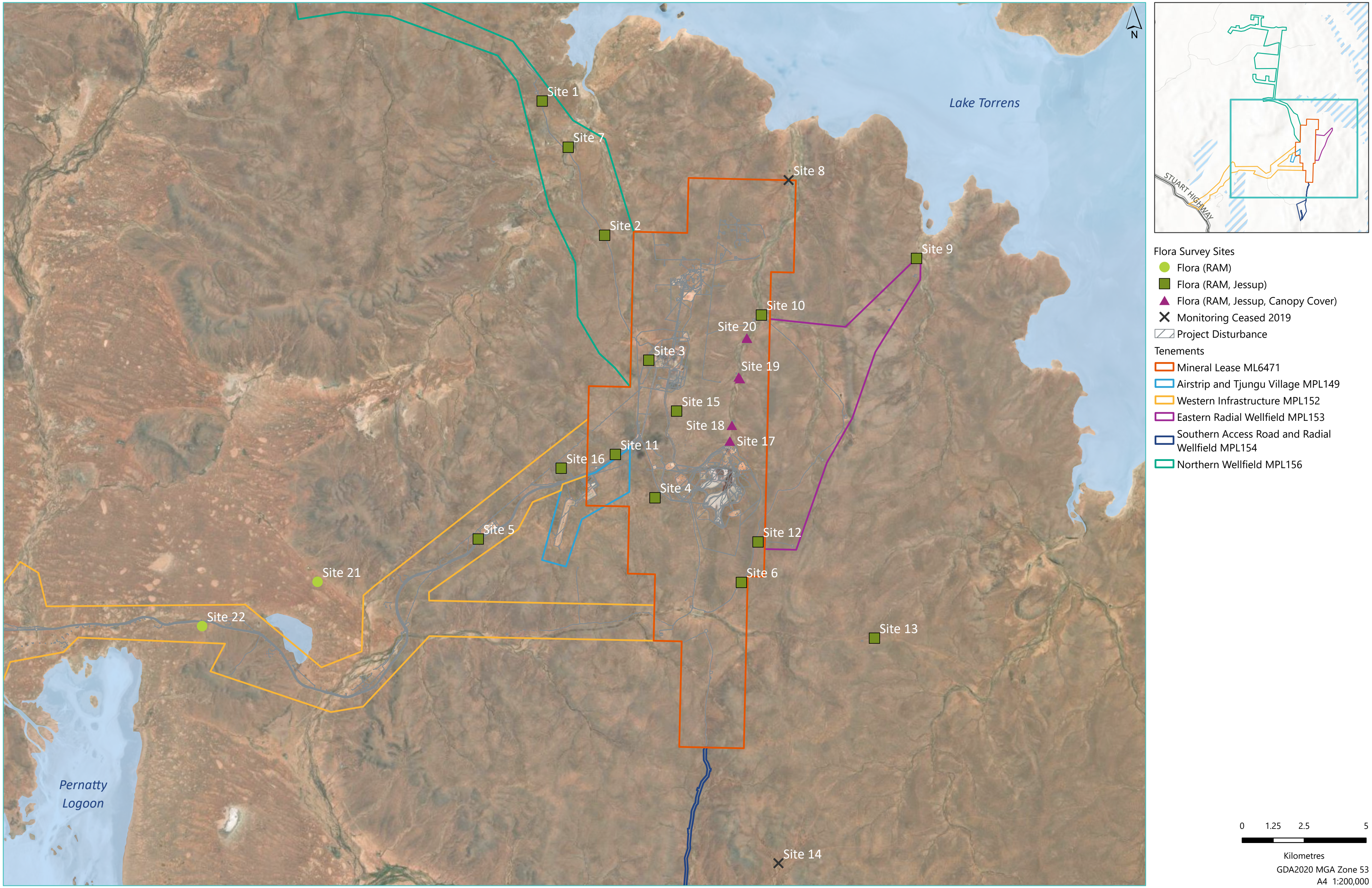

Figure 2.1: Location of Flora Sites
Carrapateena Flora and Fauna Survey

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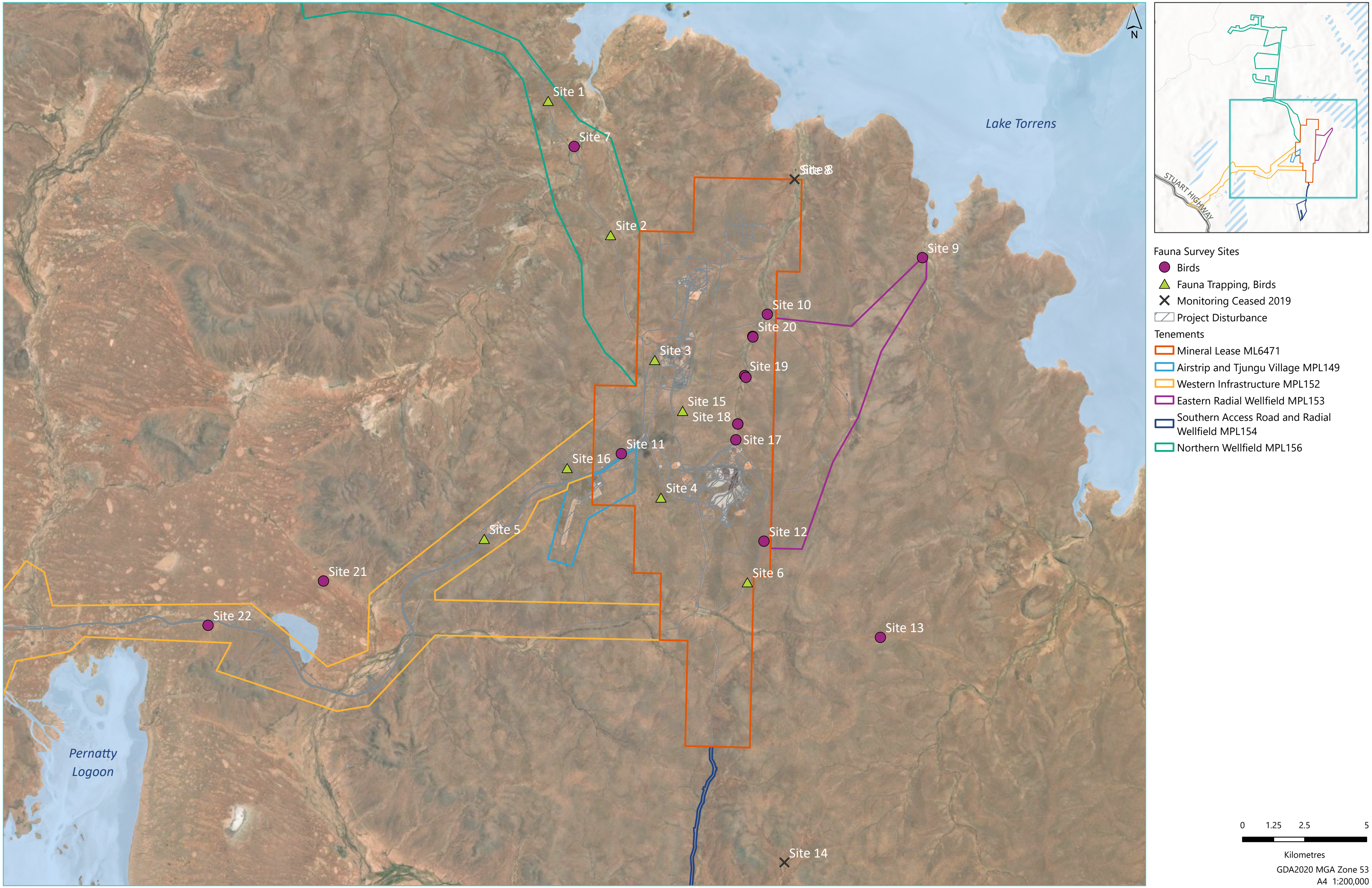

Figure 2.2: Location of Fauna Sites
Carrapateena Flora and Fauna Survey

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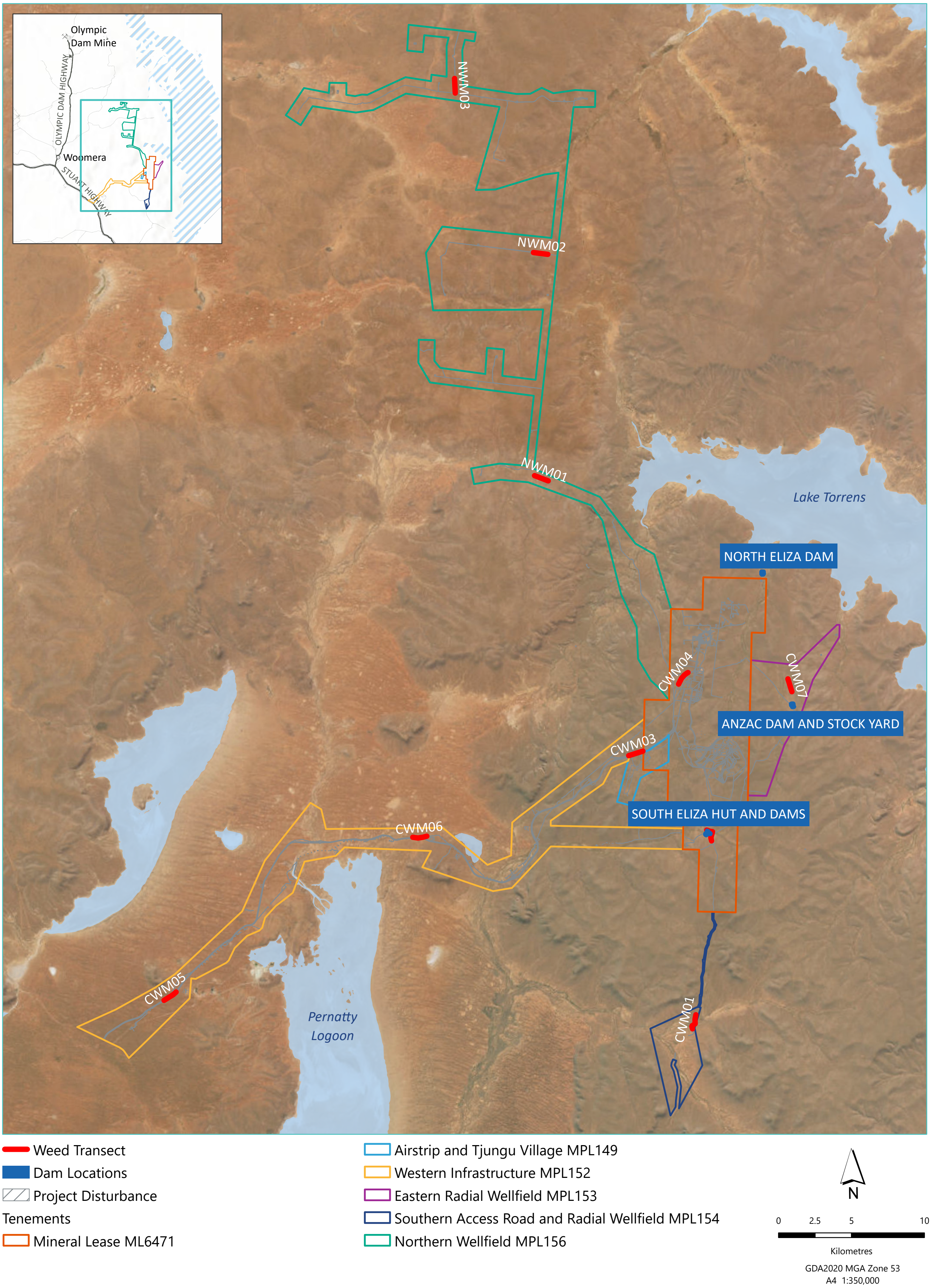

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Figure 2.3: Location of Weed transects Carrapateena Flora and Fauna Survey

2.3.1 Nomenclature

Survey site naming conventions remain as per previous spring surveys (Jacobs 2019a, 2020a, 2021, 2022, 2023a). It is noted that throughout this report, a simplified version of site names is often used e.g. Site 1, whereas CAR001 is the code used for data permit (refer Section 2.7) and the Carrapateena database.

2.3.2 Designation of control sites and impact sites

Survey sites are assigned to be either a control site (no detectable impact from mining considered likely) or an impact site (impacts on flora and/or fauna from mining activities considered possible). All sites on Eliza Creek, downstream of the tailings dam, were considered to be possible impact sites, due to potential changes in groundwater and / or surface water impacting vegetation, and the analysis of potential impacts here will be a comparison of results over time, and with distance from the Tailings Storage Facility (TSF) embankment.

For other sites, impacts on flora and / or fauna were considered to be most likely due to increased dust, noise and / or increased vehicle presence, and for sites near the airstrip, also aerial collision of birds with aircraft. For non-Eliza Creek sites, there were considered to be potential impacts from mining activities if the site was < 2 km from infrastructure. Distances > 2 km were considered unlikely to be impacted by possible raised dust (e.g. based on air quality modelling), noise and / or increased vehicle presence, and as such, sites located > 2 km from infrastructure (including roads) were designated as control sites for future comparison.

The initial designation in 2018 assumed the Western Access Road (WAR) would be a major thoroughfare, complete at the time of the 2022 and 2023 surveys, the Midway Quarry adjacent site 5 and the WAR (but is being progressively rehabilitated) and site 22 (sand dune site) is also adjacent the WAR. Site 6 located 1.5 km off the Southern Access Road (1.5 km from South Eliza Dam), but 2.4 km from the south-eastern edge of the TSF has been swapped to a control site in 2024 due to the Southern Access Road no longer being widely used, and being hydrogeologically distant and over 2 km from the TSF. Compliance monitoring to date has shown that sites 1.5 km from roads have not been impacted by mining activities and no change in flora of fauna is expected due to the lower vehicle activity on the SAR. Similarly, Site 4 is < 300 m from the Southern Access Road and former gatehouse, but also remains 1.5 km from the TSF. Again, compliance monitoring to date has demonstrated no impact from mining activities on flora and fauna at this site and no changes are anticipated in future, due to reduced vehicle use of the SAR. Hence this site has also been swapped to a control site.

A site summary, including distance from infrastructure and designation as control or impact, is provided in Table 2.3 below. Control sites were Sites 1, 2, 7, 9, 13 and 21, from 2012 to 2023, but also included Site 4 and 6 in 2024, given the reduction in potential impact, as a result of the reduced use of the SAR. Impact sites for the 2024 survey were sites 3, 5, 10, 11, 12, 15, 16, 17,18, 19, 20 and 22 (Site 4 and 6 were swapped to Control in 2024). Site locations relevant to infrastructure, including roads are provided in Figure 2.4 and Figure 2.5 below. It is noted that degree of impact varies and all sites are close to roads or tracks, but some have lower levels of traffic (e.g. Site 12). Regardless data is assessed for trends and if trends emerge further analysis is undertaken where necessary.

Rehabilitation sites (LFA sites) were assessed in 2024 as at the Aerodrome Laydown (LFA Site 1 / Aerodrome), Ventia Laydown (LFA Site 2 / Ventia), Midway Quarry Laydown (LFA Site 3 / Midway Quarry) and Tjungu to WAR Laydown (LFA Site 4 / Tjungu), with two transects at each site, noting only one transect was assessed at the Ventia site in 2024 (refer Table 2.3, Figure 2.6 and Section 2.5 for further information).

Weeds have been recorded at standard flora sites, designated weed transects, targeted sites (dams and villages), and opportunistically. Details of weed transect relative locations and habitat are provided in Table 2.4.

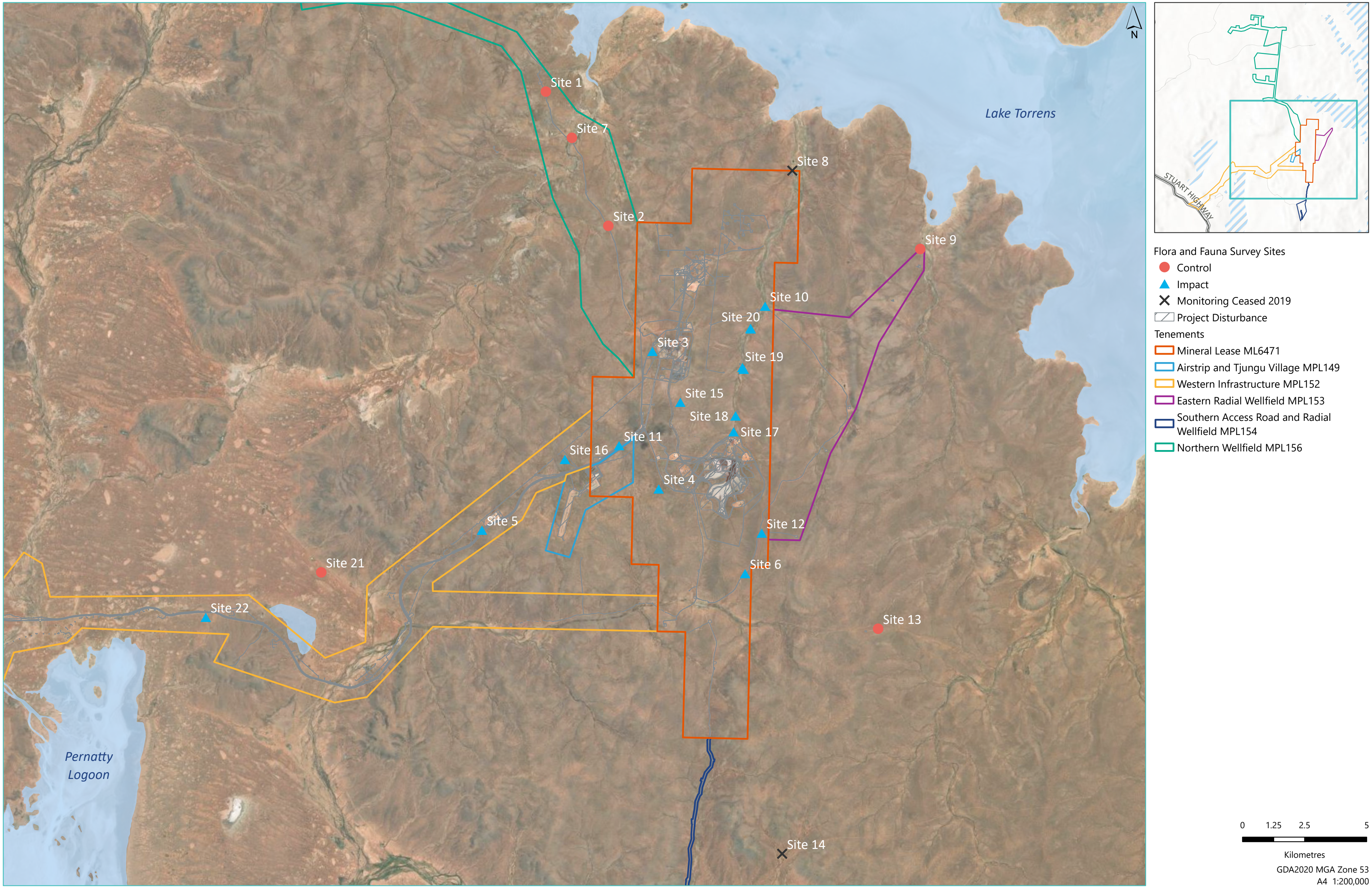

Figure 2.4: Carrapateena Control and Impact Sites (Baseline to 2023 Original Treatment)
Carrapateena Flora and Fauna Survey

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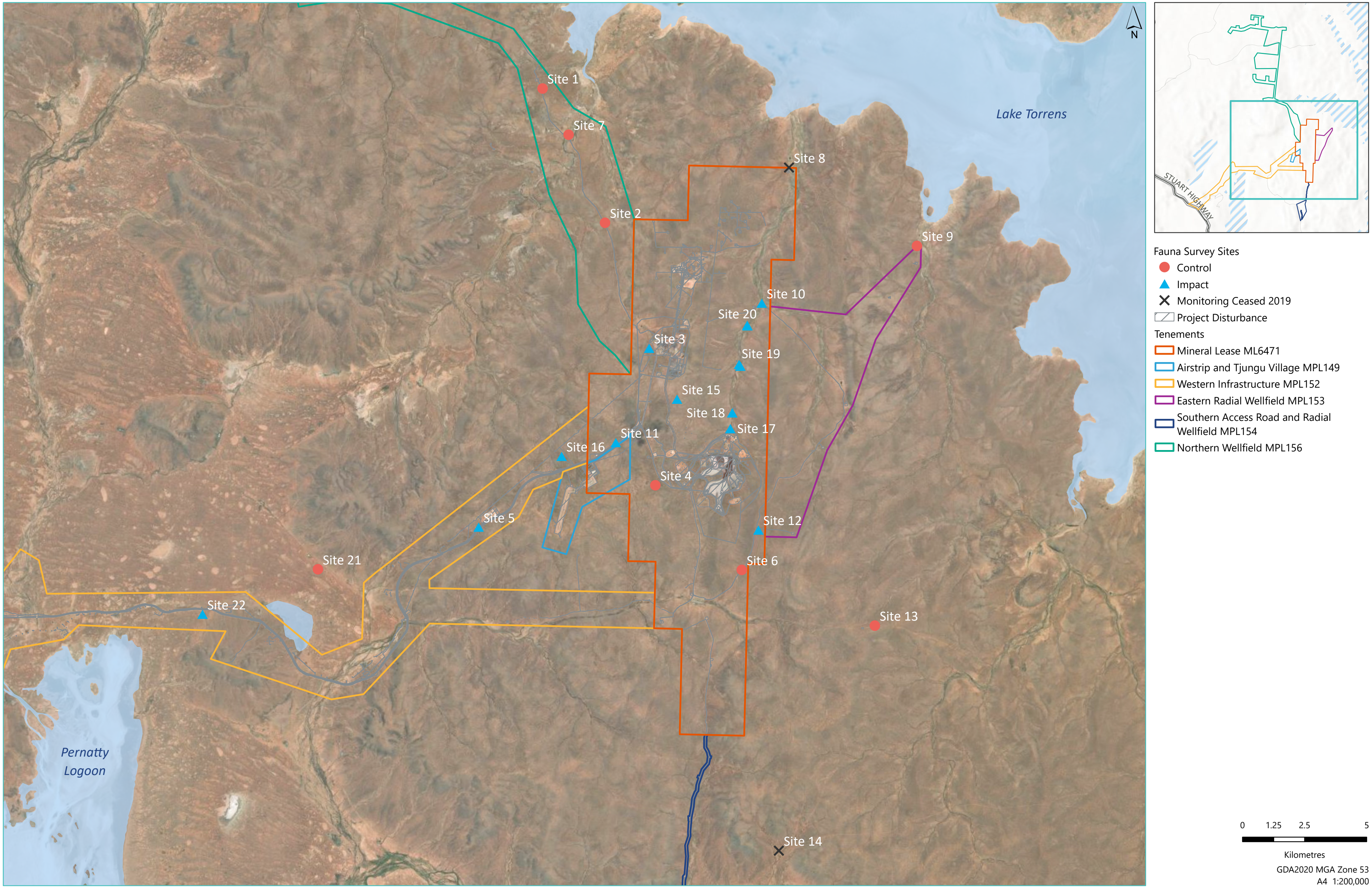

Figure 2.5: Carrapateena Control and Impact Sites (2024 Updated Treatment)
Carrapateena Flora and Fauna Survey

LATHWIDA

Table 2.3: Summary of survey sites, and designation as control or impact

Site	Vegetation Association	Landform	Distance from Infrastructure	Site Type
Flora / Fauna Site 1 (CAR001)	Bladder Saltbush (*Atriplex vesicaria*) Low Open Shrubland	Stony Tableland with shallow drains	7 km from Drill pad, and outside lease area, adjacent northern wellfield road (Khamzin)	Control
Flora / Fauna Site 2 (CAR002)	Bladder Saltbush Low Very Open Shrubland	Stony Tableland	Approximately 2 km west of Drill Pad, adjacent northern wellfield road (Khamzin). Depending on future traffic volume these sites may need to be considered impact in the future.	Control
Flora / Fauna Site 3 (CAR003)	Bladder Saltbush / Samphire (*Tecticornia medullosa*) Low Open Shrubland		Southern Access Road, adjoining western edge of Processing Plant and approximately 2 km SW of Expo Village.	Impact
Flora / Fauna Site 4 (CAR004)	Bladder Saltbush +/– Samphire Low Open Shrubland		Approximately 1.5 km west of tailings dam. Approximately 300 m from Southern Access Road. With the completion of the WAR, the SAR now receives very little vehicle use. Further it is hydrogeologically disconnected from the TSF. Hence, in 2024, Site 4 was changed from being an Impact site to a Control site.	Control
Flora / Fauna Site 5 (CAR005)			Western Access Road. Site begins about 40 m from WAR. Site is at least 3.5 km from airstrip	Impact
Flora / Fauna Site 6 (CAR006)	Bladder Saltbush Low Open Shrubland		1.5 km east of South Eliza Dam / SAR. 2.4 km from south-eastern edge of tailings dam. With the completion of the WAR the SAR now receives very little vehicle use. Further it is hydrogeologically disconnected from the TSF. Hence, in 2024, Site 6 was changed from being an Impact site to a control site.	Control
Flora / Bird Site 7 (CAR007)			100 m west of Hilson Creek and 3 km south of Lake Torrens. 5 km north-west of Drill Pad	Control
Flora / Bird Site 9 (CAR009)	Western Myall (*Acacia papyrocarpa**) Tall Open Shrubland on minor drainage line over Bladder Saltbush Low Open Shrubland	Minor drainage line (150m west of junction with Tadpole Creek) / adjoining stony plain. Approximately 1.5 km from Lake Torrens.	12 km north-east of tailings dam. 600 m from Radial Pipeline.	Control
Flora / Bird Site 10 (CAR010)	Northern River Red Gum (*Eucalyptus camaldulensis* ssp. *arida*) Low Open Woodland	Eliza Creek, junction with major tributary. 8 km south of Lake Torrens.	Approximately 5.5 km downstream of tailings dam	Impact
Flora /, Bird Site 11 (CAR011)	Bladder Saltbush Low Open Shrubland fringed by Western Myall	Stony Tableland and Minor Drainage Line	Approximately 1.5 km from Southern Access Road junction. 200 m west of lay down area, and 40 m from Western Access Road. 2 km northeast of Tjungu Accommodation Village.	Impact
Flora /, Bird Site 12 (CAR012)	Bladder Saltbush) Low Open Shrubland	Stony Tableland	Approximately 0.8 km east of the Tailing Dam's mid-eastern boundary	Impact
Flora / Bird Site 13 (CAR013)	Bladder Saltbush +/- Samphire Low Open Shrubland		Adjoining minor vehicle track, approximately 15 km SE of mining village. Approximately 6 km SE of Tailings Dam and 6 km from Radial Pipeline.	Control
Flora / Fauna Site 15 (CAR015)	Bladder Saltbush Low Open Shrubland		Approximately 1.5 – 2 km south of processing plant and 650 m from Explosives Magazine.	Impact
Flora /, Fauna Site 16 (CAR016)			Approximately 1 km north west of Tjungu Accommodation Village and airstrip and 500 m north of Western Access Road.	Impact
Flora / Bird Site 17 (CAR017)	Western Myall Low Open Woodland)	Major Drainage Line / Eliza Creek	230 m north of the Tailings Storage Facility Decant Dam Embankment	Impact
Flora / Bird Site 18 (CAR018)			870 m north of the Tailings Storage Facility Decant Dam Embankment	Impact
Flora / Bird Site 19 (CAR019)	Northern River Red Gum* Low Open Woodland		3 km north of northern bank of tailings dam on Eliza Creek. 730 m from Injection Well.	Impact
Flora / Bird Site 20 (CAR020)			5 km north of northern bank of tailings dam on Eliza Creek and 470 m from Injection Pipeline.	Impact
Flora / Bird Site 21 (CAR021)	Umbrella Bush (*Acacia ligulata*) Tall Shrubland	Sand Dune	>2 km from WAR	Control[1]
Flora / Bird Site 22 (CAR022)	Umbrella Bush shrubland over Sandhill Cane-grass (*Zygochloa paradoxa*) Hummock Grassland		150 m from Western Access Road	Impact

Site	Vegetation Association	Landform	Distance from Infrastructure	Site Type
LFA Aerodrome Laydown (LFAAL1A-B)	Formerly Bladder Saltbush Low Open shrubland	Stony Plain	10 m from airport road, 100 m from airport	Impact
LFA Ventia Laydown (LFAVOL2A-B)	Formerly Bladder Saltbush / Samphire Low Open Shrubland	Stony Tableland	5 m from road, 100 m from processing plant	Impact
LFA Midway Quarry Laydown (LFAQUA3A-B)			Western Access Road (40 m in), west of Mid-way Quarry	Impact
LFA Tjungu to WAR Laydown (LFATJU4A-B)	Formerly Bladder Saltbush (Low Open Shrubland		Western Access Road, approximately 1.5 km from Southern Access Road junction.	Impact

*Refer Appendix B for explanation of taxonomy; [1]Refer Jacobs (2019) for additional detail about change of site location

Table 2.4: Weed Transects location and habitat

Transect	Road	Habitat
CWM01	Southern Access Road (SAR)	Gibber stony tableland is dominant, but the transect also includes creeks and culverts
CWM02		
CWM03	Western Access Road (WAR)	Gibber stony tableland
CWM04	Access Road west of Administration and Processing area	Gibber stony tableland, includes "Ventia" LFA site
CWM05	Western end of WAR	Mulga (*Acacia aneura*) woodland on sandy loam
CWM06	WAR	Gibber stony tableland, dunes and minor creek
CWM07	Minor road, north-east of Anzac Dam	Gibber stony tableland
NWM01	Northern Wellfields Road	
NWM02		
NWM03		Drainage Line

2.4 Techniques to address OMC

Table 2.5 summarises the survey techniques used in spring 2024 to assess each OMC. More detailed descriptions of each method (Jessup, RAM, Photopoints, Canopy Cover, Weeds) are provided in the 2018 -2022 reports (Jacobs 2018a, 2019a, 2019b, 2020a, 2021a, 2022a, 2023a).

At each Flora site where a RAM (NVC 2024) was undertaken, it was within a 1 ha area. For the stony tableland sites (1 – 7, 9, 11–13, 15 and 16) this was a survey of 100 m x 100 m plot, 50 m either side of the line joining the start and end of the Jessup transect. For the Eliza Creek sites (Flora Site 10, Flora sites 17 – 20) the one-hectare survey was confined to vegetation considered to be under the influence of the creek landform and water regime.

As per spring 2019 – 2023 surveys, Jessup surveys were not undertaken at Site 21 and 22 (sand dunes), given the sand dune sites were not marked in the field (due to potential heritage values). The RAM survey area at Sites 21 and 22 is an area centred on the site coordinate, with a 55 m radius (namely a circular area of approximately 1 ha).

As per 2021 to 2023 reporting, Canopy Cover results include data from spring 2018 onwards, given alterations in transect alignment from initial establishment in autumn 2018. For Canopy Cover sites, densitometer results are provided for individual transects at each site, as well as mean data results for the two transects at a site. Canopy Cover intactness is calculated as the extent of the individual tree's live canopy at the time of the survey compared to the potential extent of the canopy for a fully healthy tree.

Weed transect refinements were required at some locations in spring 2024. Due to realignments and substantial widening of the WAR since the initial weed transects were established, survey point locations along the transect have varied. In 2024, new coordinates were recorded for the start, 250 m, 500 m, 750 m and end (1000 m) locations. The distances (250 m, 500 m, 750 m and 1000 m) represent the distance in a straight line from the start of the transect and not necessarily the distance along the road (some transects have bends/curves). For the SAR and WAR roads, two photographs are taken on both sides of the road, photo bearings being parallel with the road (i.e. four photos at each survey location). The area surveyed is a semicircle on either side of the road with a radius of 50 m beginning from the carriageway (the surveyed area includes the road shoulder/verge). For weed transects on the Northern Wellfield Road and narrow tracks (CWM04 and CWMO7), the area surveyed is a circle with a 50 m radius from centre of road.

Table 2.5: Survey techniques used in spring 2024 to address Outcome Measurement Criteria

OMC Code	Outcome Measurement Criteria (OMC)	Technique / data collection strategy to determine if obligations are being met
SWRF1	Annual surveys undertaken by an independent and suitably qualified expert demonstrates no adverse impact on the diversity and abundance of native vegetation and water dependent ecosystems at Eliza Creek monitoring (Figure 9.2, Figure 9.3 of the PEPR) attributed to reduced surface water flows caused by mining operations when compared to baseline conditions (Appendix C6 Ecological Baseline and surveys for new sites undertaken prior to commencement Stage 1 Tailings commissioning).	RAM survey x five sites on Eliza Creek (0.23 km, 0.87 km, 3 km, 5 km and 5.5 km) at increasing distance (downstream) from the northern bank the TSF dam. Results assist with distinguishing grazing impacts from other causes of defoliation / plant damage, provides inventory of species present and detection of any loss of diversity. Abundance data allows detection of changes in native and introduced species, with repeat monitoring. Jessup (DENR 2011) and Canopy Cover transects at the same location as RAM sites. One Jessup transects at each of the five sites. Provides information on population structure of long-lived perennials, including recruitment. Eight canopy Cover sites (2 parallel transects at each of the five sites) to assess possible impacts on tree health due to potential higher watertable, reduced surface water flows and / or tailings seepage. Comparing the total number of GRS densitometer foliage records along a transect over time provides an indication of changes in total canopy volume. Canopy data recorded from 100 points at each location. One transect representing instream habitat and one representing bank habitat. In summary, Jessup, Rangeland Assessment and Canopy Cover Assessment provides detailed information on plant species diversity, abundance and health at each site: vegetation structural layers, population data for woody perennials (number of adults and number of juveniles), and grazing impacts on woody perennials, plus notes on existing disturbance agents at each site.
TSF6	Annual surveys undertaken by an independent and suitably qualified expert demonstrates no adverse impact on the diversity and abundance of native vegetation and water dependent ecosystems at Eliza Creek monitoring sites (Figure 9.2, Figure 9.3 of the PEPR) attributed to tailings seepage when compared to baseline conditions (Appendix C6 Ecological Baseline and surveys for new sites undertaken prior to commencement Stage 1 Tailings commissioning).	
WP1	Annual flora and fauna surveys undertaken by suitably qualified and experienced ecologists at flora (including weeds) and fauna monitoring locations (Figure 9.2, Figure 9.3 and 9.4 of the PEPR) demonstrates no introduction of new species of weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals) as a result of mining related activities when compared to previously recorded weed species and introduced fauna.	The four Weed Transects surveyed during baseline from 2013 to 2016 re-surveyed (CMW01-CMW04). Namely, for each weed transect, the abundance and cover of all weeds recorded at 5 locations (250 m intervals, 50 m radius) along a 1000 m transect). Additional weed transects established along the WAR (CMW05, CWM06) and near Anzac Dam (CWM07) to monitor potential impacts along the WAR and the eastern wellfield. Additional weed transects established along Northern Wellfields Road to monitor potential impacts from dust due to mine vehicle traffic (NWM01, NWM02 and NWM03). Opportunistic records of all weed species made whilst moving around the whole mine site in general. Weed location, habitat, and weed population size and extent recorded. In addition, active searches of areas with a high potential for weed establishment also undertaken (e.g. dams, spill areas, and effluent irrigation areas adjacent the Exploration Village and the Tjungu Village).
WP2	Annual flora and fauna surveys undertaken by independent and suitably qualified ecologists at flora (including weeds) and fauna monitoring locations (Figure 9.2, Figure 9.3 and 9.4 of the PEPR) demonstrates no increase in the abundance of existing weeds or pest species in the land compared to previous survey records as a result of mining related activities	
AQ2	Annual surveys undertaken by a suitably qualified and experienced expert demonstrates no adverse impact on the diversity and abundance of native vegetation at monitoring sites (Figure 9.3 Flora of the PEPR) directly attributed to dust deposition from mining operations or mining related activities when compared to baseline native vegetation conditions (Appendix C5 Ecological Baseline of the PEPR).	Jessup Transects x 14 sites, RAM x 14 sites with the addition of collecting species cover and abundance information using both the Crown Separation Ratio scale. Jessup and RAM at the same location. Undertaken at the existing 14 of the 16 baseline flora site locations to enable comparison. Additional sites along the WAR within dune habitat that was not covered by the existing baseline data (namely, sites 21 and 22, RAM only).
EPBC1	Future records of Thick-billed Grasswren are to be provided to the Biological Database of South Australia BDBSA to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites ((Figure 9.2, Figure 9.3 and 9.4 of the PEPR))	Bird surveys conducted at 14 of the 16 baseline bird monitoring sites, as well as at the 4 Eliza Creek flora sites and the 2 WAR dune sites. Opportunistic records of Thick-billed Grasswren to be recorded. All records of Thick-billed Grasswren will be forwarded to Department for Environment and Water (DEW) as part of the Permit reporting requirements, which will then be uploaded into the BDBSA.
EPBC2	Future records of Plains Mouse are to be provided to the Biological Database of South Australia BDSA to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites (Figure 9.2, Figure 9.3 and 9.4 of the PEPR)	Fauna surveys conducted at each of the eight baseline sites as per autumn 2017. Pitfall traps and un-baited cameras used to detect any Plains Mouse captures in spring 2024, aligning with the later years of the baseline surveys.
EPBC3	Future records of Night Parrot are provided to the Night Parrot Recovery Team to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites (Figure 9.2, Figure 9.3 and 9.4 of the PEPR)	Bird surveys are undertaken as part of annual survey. (none detected to date during compliance monitoring).
LUP4	Rehabilitation trials shall be undertaken at infrastructure locations no longer required and ongoing assessment at LFA monitoring at sites (Figure 9.3; CEF1-7 of the PEPR) are assessed annually demonstrating development of trends and annual improvement of rehabilitation through LFA methodology. Should the data indicate rehabilitation not trending towards sustainability root-cause investigations will be undertaken and rectification methods be identified and implemented	Following site rehabilitation, LFA is being undertaken within rehabilitation zones, and comparable data from these sites is being compared with baseline data, and future more relevant control sites will be established. Four LFA sites established.

Refer Appendix C for additional detail about species classification and long-lived and short-lived, flora taxonomy and identification.

2.5 Landscape function

2.5.1 LFA sites

To meet the requirements of Outcome Measurement Criteria (OMC) LUP4 in the PEPR (Table 1.2), Landscape Function Analysis (LFA) monitoring was conducted at four sites in October 2024. LFA measures various processes that contribute to the formation of self-sustaining ecosystems and can be used to monitor revegetation post-impact (Tongway & Hindley 2005). The data collected during the October 2024 survey represents the sixth year of data collection for the two sites established in 2019 and third year for the two sites established in 2022.

Initially, two rehabilitation areas were selected by BHP for LFA assessment prior to the 2019 survey: a laydown area adjacent to the operational Carrapateena airport (referred to as the Aerodrome Site in this report) and a second laydown area adjacent to the Carrapateena Mine Processing Plant (referred to as the Ventia Site in this report). Prior to the Spring 2019 survey, the rehabilitation sites were contour ripped to create troughs ('patches') for nutrients and water to accumulate and facilitate regeneration and revegetation; Aerodrome – June 2018, Ventia Laydown August-September 2019. The objective of subsequent LFA surveys (2019 to present) was to measure the success of returning the sites to sustainable pre-impact levels of landscape function. The two sites established in spring 2022 are both on the WAR, one adjacent the Midway Quarry that was used for WAR construction and one near the Tjungu Village (opposite Flora Site 11).

The Midway Quarry site is situated west of the WAR on a northwest facing gentle slope with two transects (3A and 3B) installed in a northwest facing direction (perpendicular to the WAR) with Site 3A slightly southwest of and parallel to transect 3B. The Tjungu village site is situated on the south-eastern side of the WAR on a north-east facing moderate slope which extends down to a minor drainage line. Both sites were deeply ripped prior to the 2022 survey. The Tjungu site was hand seeded three months prior to the September 2022 survey, whilst the Midway Quarry site was not seeded, trialling natural recruitment / regeneration. The surface at both sites comprises large flat broken rock in deeply ripped contours, more irregular at the Midway Quarry site.

For the initial surveys of all sites, the LFA Bank and Trough assessment method was undertaken for the new sites as they comprised only non-vegetated rip lines (refer Jacobs 2023h). By the second or third survey, the ripped troughs had levelled out and sufficient vegetation had established to convert to the Established method, whereby patches comprised plants and inter-patches comprised soil/rocks. The rehabilitation of the four areas has been monitored using two complementary methods: the LFA, following the established method, supplemented by the Point-centred Quarter (PCQ) method during the early phase of colonisation and succession (Tongway and Hindley 2005). Jacobs (2023h) provides a summary of the methodologies applied and reasoning for the change. Table 2.6 provides a summary of where the different approaches have been applied to date. For LFA transect coordinates and location refer Table 2.2 above and Figure 2.6.

Section 2.5.2 and 2.5.3 below provides a summary of the methodologies applied and reasoning for the change. Table 2.6 provides a summary of where the different approaches have been applied to date.

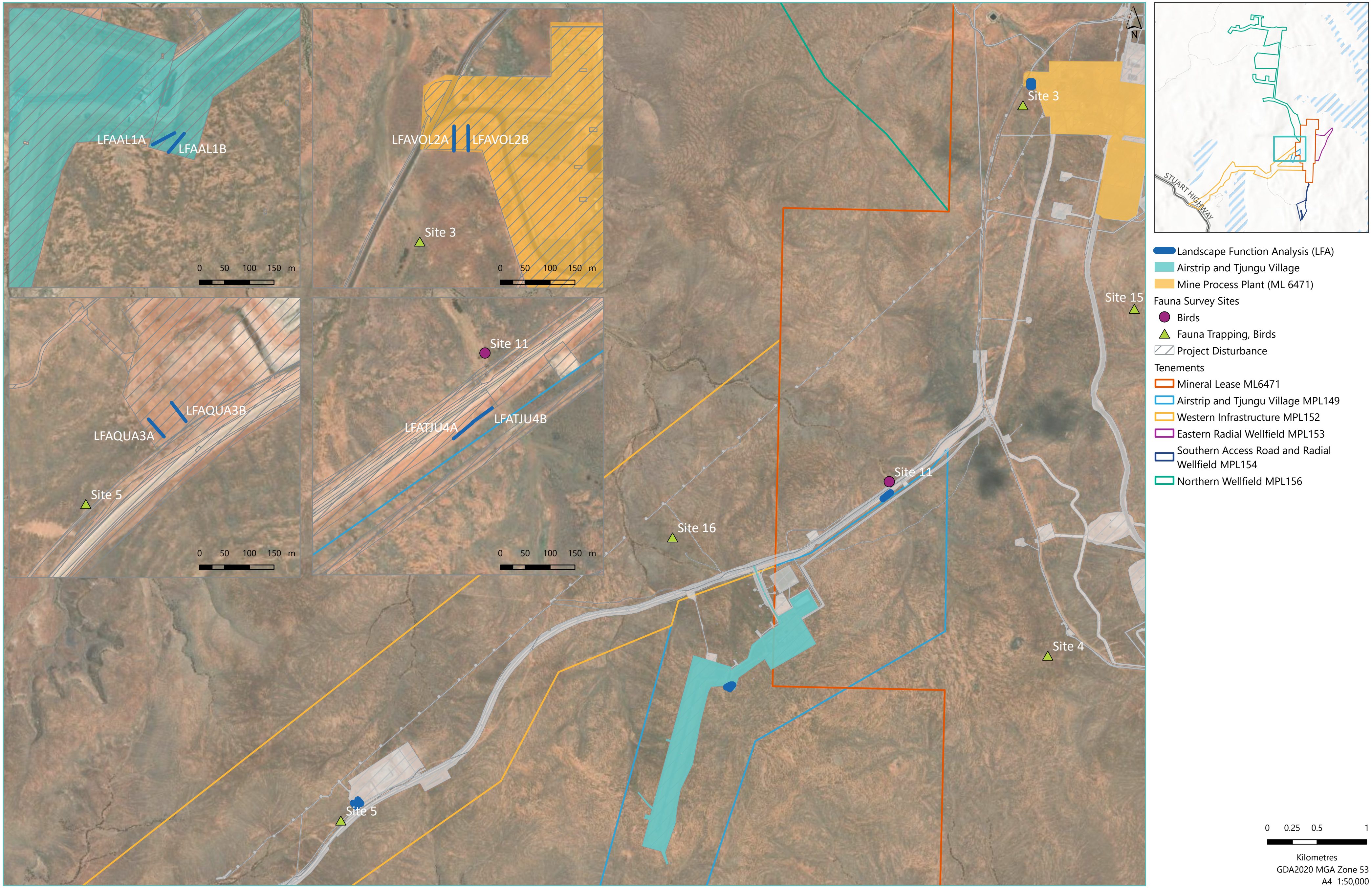

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Figure 2.6: LFA Sites, Aerodrome Laydown (LFAAL), Ventia Laydown (LFAVOL), Midway Quarry (LFAQUA), Tjungu (LFATJU)
Carrapateena Flora and Fauna Survey

2.5.2 The LFA established method

The methodology used during compliance monitoring for the LFA 'Established Method' is as described in Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE) (2013). At each site, two fixed transects have been established, 50 m in length (Table 2.2). Directly beneath the transect line, the zones that occur are classified as a patch (represented by a plant/s with overlapping canopies or other resource-accumulator such as litter or logs), or interpatch (e.g. rocky surface, or bare ground). All short-lived and long-lived perennial species have been included as patches. Short-lived perennials, particularly *Sclerolaena* species, comprise a large proportion of the groundcover in the LFA site natural habitat.

2.5.3 Supplementary vegetation sampling using the Point-centred Quarter (PCQ) Method

Rehabilitation in semi-arid Australia is expected to be slow. In the early phase, plants may colonise in low abundance, or a clumped pattern, making it difficult to representatively sample using a fixed transect (Tongway and Hindley 2004). To supplement the LFA Established Method, the PCQ Method was used.

The fixed transects were dived into regular intervals: 10 m, 20 m, 30 m, 40 m and 50 m. At each point, the nearest long-lived perennial or biennial plant up to 10 m away was located within each of four quadrants. No data was recorded for a quarter where there were no perennial or biennial plants within 10 m of the sample point that had not already been sampled for a prior quadrant (Tongway and Hindley 2005).

For each transect the mean distance between plants, and plant density per 100 m^2 were derived from the PCQ data. It is anticipated that the mean distance between plants would decrease (as more plants become established), while the plant density would increase. A summary of the different methods of data collection that have been applied for LFA at the Carrapateena site is presented below in Table 2.6.

Table 2.6: Summary of methods used to date for Landscape Function Analysis at Carrapateena

Survey	Sites	LFA Bank & Trough Method	LFA Established Method	LFA Soil Surface Assessment (SSA)	Point-centred Quarter (PCQ) method
2013 /2014 Baseline (EBS)	6 analogue sites	Nil	All 6 sites	X	Nil
September 2019 (Jacobs) (newly ripped soil)	2 sites with 2 transects each	1A, 1B, 2A, 2B		1A, 1B, 2A, 2B	Nil
September 2020 survey (Jacobs)		2A	1A, 1B, 2B	1A, 1B, 2A, 2B	1A, 1B, 2A, 2B
September 2021 (Jacobs)		Nil	1A, 1B, 2A, 2B	1A, 1B, 2A, 2B	1A, 1B, 2A, 2B
September 2022 (Jacobs)	4 sites with 2 transects each	3A, 3B, 4A, 4B	1A, 1B, 2A, 2B	1A, 1B, 2A, 2B	1A, 1B, 2A, 2B
May 2023 (Jacobs)		Nil	1A, 1B, 2A, 2B 3A, 3B, 4A, 4B	1A, 1B, 2A, 2B 3A, 3B, 4A, 4B	1A, 1B, 2A, 2B 3A, 3B, 4A, 4B
October 2024 (Lathwida)	3 sites with 2 transects each, 1 site with one transect	Nil	1A, 1B, 2B, 3A, 3B, 4A, 4B	1A, 1B, 2B, 3A, 3B, 4A, 4B	1A, 1B, 2B, 3A, 3B, 4A, 4B

2.6 Fauna survey method

2.6.1 Fauna trapping

As per 2018-2023 monitoring, fauna trapping was undertaken at eight sites, with groups of four sites monitored over two consecutive trapping periods. Each site was monitored for four days and four nights between 14 and 23 October 2024. Two sites were opened on 14 October, and two sites were opened on the 15 October which were closed on 18 and 19 October respectively, and a second round of sites was opened on 18 October and closed on 22 October. All equipment and flagging tape was removed from each site at the end of each survey, except for semi-permanent pits which remained in-situ with lids re-established, and screwed in with 'hex' screws to prevent animals entering the pits post monitoring. Trench lines for drift fencing between pit traps were backfilled.

The configuration at each site was as follows:

- A single pitfall line was opened from one of four semi-permanent baseline pit lines that are established at the eight fauna site (i.e. Sites 1-6, 15, 16), noting Site 5 only has three semi-permanent pit lines remaining, one being removed in 2019 due to a number pits with decreased integrity / holes in bases.
- Six pitfall traps were opened at each site, as required by the SA Vertebrate Survey Guidelines (Owens 2000).
- Each drift fence line, was approximately 80 m x 0.3 m, dug into the ground approximately 5-10 cm depth. Lines running across semi-permanent pitfall traps, 10 m apart (fence extending approximately 5 m either side of the first and last pitfall trap).
- The semi-permanent pitfall traps were 240 mm diameter (standard PVC 225 / 250 mm pipe - internal diameter 240mm) and 600 mm deep with a mesh base to allow water drainage were used to target small to medium sized mammals and reptiles.
- Two funnel trap pairs were placed evenly along each line.
- Two camera traps were established facing each trap line at open locations, with minimal vegetation to avoid accidental triggers (as per 2021).
- No Elliott traps, cage traps, HARP traps or ANABAT recorders were used.
- One Song Meter was established at a suitable location away from the trapping line, with the exception of Site 3 which is immediately adjacent the noisy processing plant. A Song Meter was established at Dawson Dam which is 0.5 km from Site 3.
- Refer spring 2019 report (Jacobs 2020a) for additional details.

2.6.2 Bird/bat detection

As per previous monitoring (2018 to 2023), bird surveys were undertaken at least once at each of the 20 survey sites (Flora sites 1 to 7, 9 to 13, 15 to 16, plus sites 17, 18, 19, 20, 21 and 22), for 30 minutes at each site within 2 hours of dawn. If weather conditions or timing were not considered optimal, repeat surveys were undertaken. Bird data was also collected opportunistically during multiple visits to the fauna trapping sites and when driving between sites, during flora surveys, at four dams, camps and at the two effluent irrigation areas.

In addition, in 2024 Song Meters were deployed at all fauna trapping sites, one dam and one creek site, in order to detect additional species that were not detected during the day or nocturnal / crepuscular species. Song meters were deployed for a minimum of 24 hours at each site. Desktop analysis was undertaken post field to determine whether any additional species were present. Such analysis involves ecologists reviewing images and calls of bird calls and bat calls and verifying species against recognised images.

Six Autonomous Recording Units (ARUs), of the Song Meter Mini Bat model (Wildlife Acoustics, 2022), were fitted with an acoustic stub microphone to enable recording of vocal bird species in the audible frequency range. They were deployed within areas of habitat considered suitable for detection of birds approximately 100-200m from fauna trapping lines. ARUs were configured to record in the acoustic mode: for one hour either side of both sunset and sunrise. In this configuration, for every 24 hours of deployment, each ARU captured 14 hours of acoustic recordings (birds) and 4 hour of ultrasonic records (bats).

Each ARU was affixed to a stake or other stable object using cable ties. All cable ties were clipped short to avoid the potential for whistling interference in high winds. This model of ARU is synchronised with the GPS reading from the user's smartphone to correctly set sunrise and sunset times. The location of each deployment was also marked using a GPS unit (IPAD).

2.6.2.1 Acoustic analysis

ARUs recorded all data to Secure Digital (SD) cards. The data was then transferred to a laptop computer and backed-up to internal servers. All bird recordings were processed using Kaleidoscope Software for visual and acoustic assessment. Analyses for these deployments followed the procedure of analysing recordings for the presence of any fauna species by first detection using a combination of listening through in real time and high-speed visual spectrogram scanning. All audible taxa were noted in the order in which they appear in recordings. A total of 434 hours of recording were collected from 10 sites between 18-22 October 2024.

Bat data that was analysed included at total of 539 WAV format bat detector sound files from three recording sites over 8 recording nights (nights of 16 – 21 October 2024); Site 7, Site 10 (Eliza Creek) and South Eliza Dam).

The ultrasonic recordings provided were recorded in WAV sound format from Wildlife Acoustics Song Meter Mini Bat bat detectors. All sound files were inspected in Anabat Insight version 2.1.3 software and Adobe Audition version 23.1 (Specialised Zoological 2025, provided in Appendix F).

Species identifications were made based on measurements of characteristic frequency and observation of pulse shape, and with reference to information in Armstrong et al. (2021b, cited in Specialised Zoological 2025). Nomenclature follows Jackson and Groves (2015, cited in Specialised Zoological 2025). Distribution information for all bat species considered here was checked against the BatMap resource hosted by the Australasian Bat Society, Inc (https://www.ausbats.org.au/batmap.html) (Milne et al. 2023, cited in Specialised Zoological 2025).

2.6.3 Active reptile, track and scat search

Given the warmer conditions of the spring 2024 survey and the high number of reptile captures at fauna trapping sites, active reptile searches were not undertaken. Additional reptile species were also detected as part of opportunistic observations throughout the survey, and via camera trapping.

2.6.4 Spotlighting

As per previous monitoring (2018 - 2023), nocturnal searches were conducted at a subset of sites that were easier to safely access at night (e.g. Site 10 - Eliza Creek). Survey involved spotlighting with head-torches (LED), active searching and listening for nocturnal vertebrate species including Night Parrot and a bat species that are audible to the human ear (e.g. White-striped Free-tail Bat). Searches were undertaken for a minimum of 30 minutes at Site 10 and 20 minutes at the next drainage line by 4 observers / spotters. Noting the Camera Traps (one per site), and Song Meters were also collecting nocturnal images / acoustic data for four / one trap nights (respectively) at each of the eight fauna sites (Sites 1-4, 15, 16) and Site 10 Eliza Creek.

2.6.5 Opportunistic observations

Opportunistic observations make up an important component of a fauna survey and constitute any observations made while travelling around the Operations area, targeted searches at likely locations for fauna (e.g. dams), or between the survey sites. Any animals identified opportunistically, either via direct observation or by evidence, were recorded on fauna and flora data sheets with location and any useful notes. These species were added to site species lists if identified at a survey site, or to a general survey species list if from the broader Operations area (if not attributed to a particular habitat type).

Location details for the key opportunistic observation locations are provided in Table 2.7 and on Figure 2.3.

Table 2.7: Key opportunistic survey site locations at Carrapateena

Location	Easting	Northing
Exploration Camp	737500	6541120
Exploration Village Effluent Irrigation Area (EV EIA)	733550	6535200
Anzac Dam	743880	6539300
Tjungu Village EIA (TV EIA)	733700	6535306
Dawson Dam	735690	6541028
North Eliza Dam	741682	6547790
South Eliza Dam	737960	6529976
Yeltacowie Homestead	724430	6530245

*MGA zone 53. GDA1994

2.6.6 Identification

It is noted that some species have undergone taxonomic revision since earlier reports; where possible the common name follows the nomenclature of the Biological Databases of Australia flora and fauna taxonomy (DEW

The following reference material and taxonomic keys were used for species identification and classification:

Reptiles and Amphibians

- A Complete Guide to Reptiles of Australia 2nd edition (Wilson and Swan 2008)
- Reptiles and Amphibians of Australia (Cogger 2014)
- Key to the Geckos of South Australia (Hutchinson and Williams 2024a)
- Key to the Skinks of South Australia (Hutchinson and Williams 2024b)
- Key to the Snakes of South Australia (Hutchinson and Williams 2024c)
- Key to the Dragons of South Australia (Hutchinson and Williams 2024d)
- Key to the Goannas of South Australia (Hutchinson and Williams 2024e)
- Checklist of the Reptile and Frogs of South Australia (Hutchinson and Williams 2024f).

Birds

- The Field Guide to the Birds of Australia, 9th edition (Pizzey et al. 2012)
- Field Guide to the Birds of Australia, 8th edition (Simpson and Day 2010)
- eGuide to Birds of Australia, application (Morcombe 2011-2019, Version 1.6.2)
- The Australian Bird Guide. (Menkhorst et al. 2019)
- Annotated List of the Birds of South Australia (Horton et al. 2020)

- The compact Australian Bird Guide (Davies et al. 2022).

Mammals

- A Field Guide to the Mammals of Australia (Menkhorst and Knight 2004)
- Mammals of Australia (Strahan 1995)
- Tracks, Scats and Other Traces (Triggs 2004)
- Key to Dasyuridae of SA (Kemper and Stokes 2020)
- Key to Muridae of South Australia (Kemper and Stokes 2021)
- Australian Bats (Churchill 2008).

Plants

- PlantNET - NSW FloraOnline (2024)
- Plants of Western New South Wales (Cunningham et al. 1992)
- Field guide to the plants of outback South Australia (Kutsche et al. 2023).
- South Australian Seed Conservation Centre (2024)
- The Australasian Virtual Herbarium (AVH) (2024)
- Atlas of Living Australia (ALA) (2024).

2.6.7 Vouchering

No vouchering of fauna species was required, as all species captured had been sufficiently vouchered previously.

Flora vouchering was undertaken as per permits (2.2).

2.6.8 Fauna survey limitations

The limitations associated with this fauna survey, consistent with most fauna surveys, are as follows:

- The results of the fauna surveys are only a 'snapshot' in time and cannot describe seasonal variation or migrations on their own.
- Scats could not always be correctly attributed to species, however where they could be confidently identified, they provide an accurate indication of the presence and habitat preferences of certain species (Triggs 2004).
- Detection of nocturnal species by spotlighting potentially does not detect all of the animals present and is affected by environmental factors (Wayne et al. 2005).
- Read & Moseby (2001) concluded that environmental factors affected the capture rates of small reptiles. Unfortunately, planning logistics for fauna surveys around specific environmental conditions is very difficult. Planning to survey when weather conditions are generally favourable (as was done here) allows the best chance of favourable conditions during a survey and species

identification. It is noted that daily conditions were considered favourable for reptiles during this survey.

- Conditions for birds were suitable as the survey was undertaken in mid spring, however there were extreme windy and above average warm days (e.g. two days 36-40 degrees). Bird detection was also enhanced at each individual site with Song Meter deployment, and opportunistic observations from across the broader Operation area (e.g. dams, tracks, camps, creeks). Given many Song Meter files were wind affected, each site was analysed for one 24-hour period and at least two mornings.
- Similar to recent surveys, for camera traps, facing the camera towards open areas, without vegetation, or roads in the field of view are noted to produce less false triggers.

3 Results

3.1 Climate during and preceding survey

3.1.1 Rainfall preceding survey

Average yearly rainfall totals for the region are approximately 180 mm (BOM 2024b). The mean monthly rainfall totals are relatively consistent over the year, with a slight decrease generally observed during the late autumn and late winter months. In the years 2021, 2022, and 2023, annual rainfall at Woomera weather station totalled 155 mm, 381.4 mm and 173.2 mm respectively; 2022 being well above the long-term annual mean rainfall.

In the 12 months preceding the survey (01 October 2023 to 30 September 2024), the Carrapateena weather station recorded 157 mm of rain, 15% below the regional yearly average, due to mostly below average rainfall totals between January and June. This annual rainfall deficit was reported despite the two months, December and July, recording almost 40% of the total rainfall for this period. For all but July, monthly rainfall totals at Carrapateena and Woomera differed by less than 10 mm.

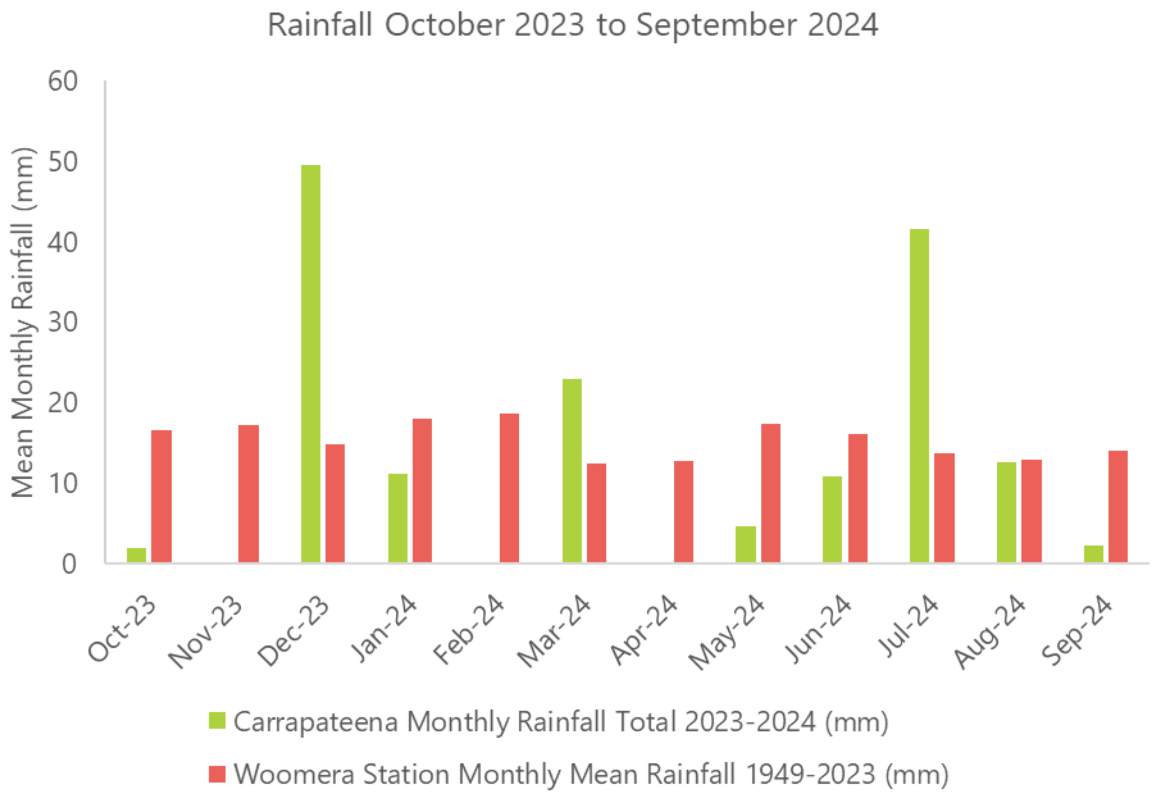

Figure 3.1: Rainfall 12 months preceding the spring 2024 survey at Carrapateena (OZ unit – Vaisala WXT520) and regional long-term averages (1949-2024) at regional weather station nearest to site, Woomera Aerodrome

3.1.2 Weather during survey

The weather conditions during the survey are summarised in Table 3.1 below, presenting data from the on-site weather station located near the Tailings Storage Facility (a Vaisala WXT520). Conditions (including overnight temperatures) were warm to hot, with the maximum daily temperatures ranging between 23.3°C to 40.5°C, and an average of 30.8°C for the survey period. These temperatures are higher than the average regional long-term maximum daily temperatures for October of 26.5°C (Woomera Aerodrome, BoM 2024a).

Minimum overnight temperatures were relatively mild and ranged from 11.2°C to 21.7°C, with an average of 17.6°C, notably higher than the long-term mean minimum temperature of 12.5°C for October (Woomera Aerodrome, BOM 2024a).

During the spring survey, average winds were light to moderate breezes each day, with average speeds ranging between 11.3 and 23.6 km/h. There was also a thunderstorm event, and strong winds on 17 October, with very few captures the following morning, as would be expected. These conditions are considered generally optimal for bird surveys and Song Meter deployment; excluding excessively windy periods. Overall conditions were considered generally suitable for fauna survey, and the warmer days likely increased reptile activity.

Table 3.1: Field survey weather (Carrapateena All Weather Data Spring 2022)

Observation	14-Oct	15-Oct	16-Oct	17-Oct	18-Oct	19-Oct	20-Oct	21-Oct	22-Oct	23-Oct	24 Oct
Min temp (°C)	20.89	21.66	20.77	20.17	15.21	11.24	15.24	20.56	19.68	15.59	12.35
Max temp (°C)	32.27	31.09	36.85	40.47	24.78	26.85	28.71	32.82	34.21	27.52	23.28
Mean wind (km/h)	15.20	17.00	21.40	22.00	23.60	17.70	14.00	11.30	15.90	18.90	21.00
Rainfall total (mm)	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.2 Flora

3.2.1 Plant diversity

A general floristic description of each site is provided in the Carrapateena Ecology Survey – Autumn 2018 report (Jacobs 2018a). Representative photographs of each site during the spring 2024 survey are provided in Appendix A.

3.2.1.1 Total species diversity: compliance monitoring period

In spring 2024, a cumulative total of 141 native flora taxa was recorded at the one-hectare RAM sites across the Carrapateena Operation area (Flora Sites 1-7, 9 – 13,15 – 22). This was the equal highest diversity recorded during the compliance monitoring period, that began in autumn 2018 (Table 3.2). During compliance monitoring, the total plant species diversity recorded at the flora sites has ranged from 111 species in spring 2018 to 141 species in both 2023 and 2024.

Since 2018, the variation in total species diversity has been almost entirely due to variations in short-lived species diversity (ranging from 52 to 83 species recorded), with long-lived perennial species diversity remaining within the narrow range of 58 – 62 species (Table 3.2). Pre-construction comparisons of total species diversity across the Carrapateena Operation area are not possible, as Sites 17 – 22 were established in 2018. A list of all species recorded in spring 2024, their frequency and their long-lived status is contained in Appendix B. A list of all species at each site, their abundance and grazing impact is contained in Appendix B2.

Table 3.2: Total species diversity recorded at RAM sites during compliance monitoring period (construction and operation)

Life Span	2018	2018	2019	2020	2021	2022	2023	2024	2018 – 2024 range	2018 – 2023 Mean, St Dev
	Autumn	Spring	Spring	Spring	Spring	Spring	Autumn	Spring		
Long-lived[2]	58	59	61	59	62	60	58	60	58 – 62	60 (±1.4)
Short -lived	58	52	75	80	57	74	83[1]	81	52 – 83	70 (±12.4)
Totals	116	111	136	139	119	134	141	141	111 – 141	130 (±12.3)

[1] amended from 2023 report to remove duplicate records; [2] Long-lived woody perennials and long-lived grasses; rounded to nearest whole number

3.2.1.2 Total species diversity at control/impact sites: baseline and compliance monitoring period comparison

Flora sites 1-7, 9-13 and 15-16 were surveyed in all years both during pre-construction (baseline) and during the construction/operational phase (compliance monitoring period). Hence these sites are suitable to compare species diversity during these phases. Species diversity at all individual sites in 2024 was within the baseline range for each site. In 2024, total native plant diversity at six sites was the highest recorded during compliance monitoring (Table 3.3). During both baseline and the compliance monitoring period, there has been a wide range in total plant diversity within all sites, however the remaining eight sites were still within the compliance monitoring range (Table 3.3). The following sections show that the range in total native plant diversity is largely due to variations in short-lived plant diversity.

In 2024, the mean total species diversity for control and impact sites was 28.3 and 28.6, respectively, and not significantly different (t test, t = 0.9). The 2024 mean diversities for impact and control sites were at the upper end of the range for compliance monitoring (Table 3.3).

For analyses up to 2023, the Baseline Control Mean was 29.1 and the Baseline Impact Mean was 26.6 (Figure 3.2). For analyses from 2024, when Sites 4 and 6 were changed to control sites, the Baseline Control Mean was 27.2 and the Baseline Impact Mean was 28.1 (Figure 3.3). This again demonstrates that the 2024 results were well within the baseline range.

Table 3.3: Total native plant species diversity, baseline versus compliance monitoring period

Type	Baseline (2012-2016) and Compliance Total Diversity to (2018-2023)									
	RAM Site[1]	Baseline Min	Baseline Max	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn
Control	1	18	40	24	17	23	18	25	27	31
	2	9	35	14	15	21	21	14	19	21
	7	20	46	30	24	30	17	32	33	25
	9	21	42	21	18	30	34	31	34	40
	13	10	34	14	22	30	20	18	19	27
	Means	**15.6**	**39.4**	**20.6**	**19.2**	**26.8**	**22.0**	**24.0**	**26.4**	**28.8**
Impact	3	16	41	23	22	29	21	17	25	34
	4	15	38	14	25	19	17	23	25	26
	5	13	41	21	14	25	19	17	23	25
	6	15	38	15	28	23	16	18	21	24
	10	26	56	22	15	28	23	16	18	21
	11	18	49	32	25	37	28	26	31	37
	12	9	32	17	14	29	22	16	25	30
	15	10	36	18	16	31	23	16	19	21
	16	10	36	17	16	27	15	17	16	24
	Means	**14.7**	**40.8**	**22.2**	**19.7**	**30.1**	**23.7**	**20.9**	**24.6**	**29.8**

Updated Treatment Baseline and Compliance 2024				
Type	RAM Site	Baseline Min	Baseline Max	2024 Spring
Control	1	18	40	24
	2	9	35	28
	4	15	38	25
	6	15	38	21
	7	20	46	35
	9	21	42	**41**
	13	10	34	24
	Means	**15.4**	**39**	28.3
Impact	3	16	41	37
	5	13	41	26
	10	26	56	24
	11	18	49	24
	12	9	32	36
	15	10	36	33
	16	10	36	20
	Means	**14.6**	**41.6**	**28.6**

[1] Rangeland sites, as per previous reporting. Note: Comparable data for 2017 not available.

[2] In 2024, Sites 4 and Site 6 were transferred from impact to control sites due to the Southern Access Road no longer being in general use for mining activities, and there being no hydrogeological connection to the Tailings Storage Facility. The baseline mean (and min/max) values therefore change at 2024 as a result of these changes.

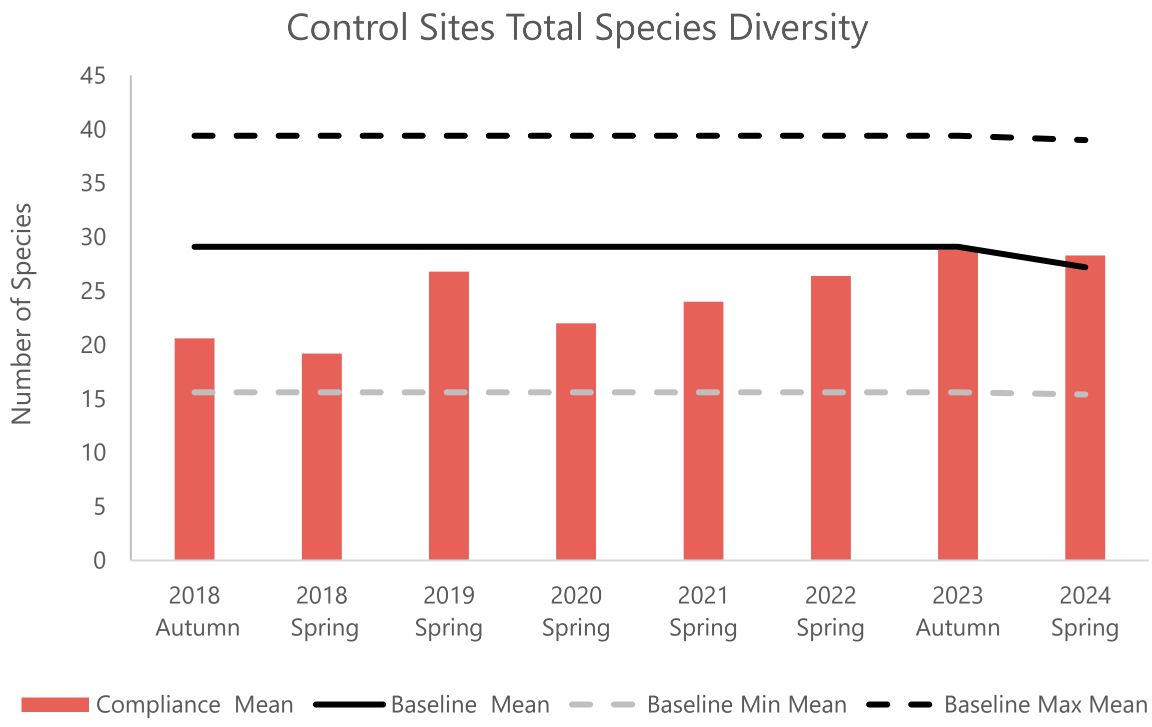

Figure 3.2: Mean total flora species diversity (long-lived and short-lived species) at control sites during compliance monitoring (compared to baseline mean, min, max, changed in 2024)

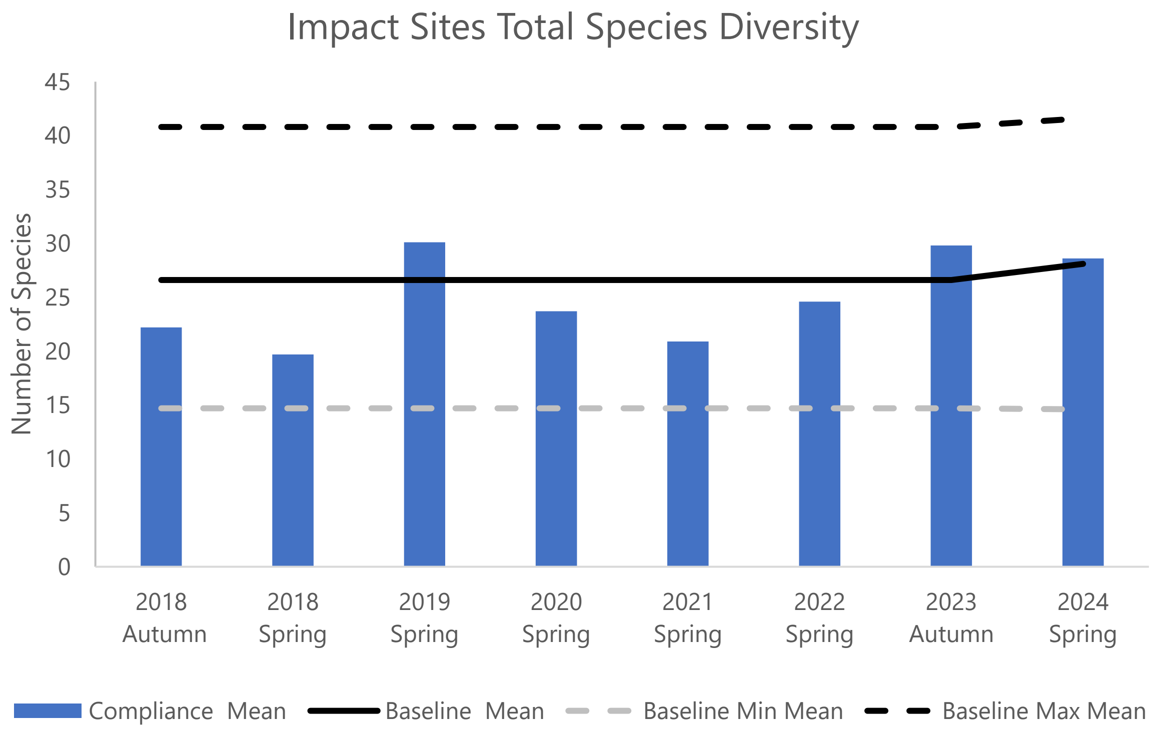

Figure 3.3: Mean total flora species diversity (long-lived and short-lived species) at impact sites during compliance monitoring (compared to baseline mean, min, max, changed in 2024)

3.2.1.3 Long-lived species diversity: baseline and compliance monitoring period comparison

Table 3.4 and Figure 3.4 show the range in long-lived native species diversity at sites surveyed in common during baseline (autumn 2012 to 2016) and during the compliance monitoring period (autumn 2018 to spring 2024). Mean diversity of long-lived species during spring 2024 exceeded the baseline means for both control and impact sites. For analyses up to 2023, the Baseline Control Mean was 11.5 and Baseline Impact Mean was 9.7 (Figure 3.4). For analyses from 2024 (Site 4 and 6 as control Sites), the Baseline Control Mean was 9.9 and the Baseline Impact Mean was 10.9 (Figure 3.5). The 2024 mean diversity of long-lived plant species for control sites was the highest recorded during compliance monitoring to date (2018 – 2024) and was at the upper end of the range for impact sites.

Control and impact sites have recorded similar directional changes in perennial species diversity during compliance monitoring. Namely, both control and impact sites recorded increases in mean perennial diversity in 2018, 2019, 2021 and 2022, and a decrease in mean perennial species diversity in 2020.

At individual impact and control sites, perennial species diversity has been very consistent between surveys, for all sites except impact Site 12 and control Sites 1 and 2. The latter have fluctuated between survey periods but show no obvious trends. Variations at these sites occurred prior to 2022, and are thought likely to be due to variation between observers in interpreting survey boundaries, rather than actual changes in perennial diversity.

Table 3.4: Long-lived perennial native species diversity, baseline versus compliance monitoring period

Type	Baseline (2012-2016) and Compliance Long-lived Diversity to (2018-2023)									
	RAM Site[1]	Baseline Min	Baseline Max	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn
Control	1	10	14	12	10	13	7	15	12	11
	2	4	8	4	7	9	6	3	7	7
	7	11	19	16	17	20	10	16	19	11
	9	13	21	15	14	19	16	18	16	19
	13	4	8	4	6	6	6	6	8	8
	Means	**8.4**	**14**	**10.2**	**10.8**	**13.4**	**9**	**11.6**	**12.4**	**11.2**
Impact	3	5	10	9	10	10	7	8	9	10
	4	5	10	7	7	8	7	7	8	7
	5	8	14	10	10	11	8	9	11	10
	6	4	8	7	6	7	7	6	6	6
	10	17	29	22	26	26	21	27	25	24
	11	11	16	18	16	17	14	15	17	19
	12	3	7	4	8	8	6	4	10	9
	15	6	10	6	7	8	10	7	7	6
	16	6	10	6	7	7	5	5	7	9
	Means	**7.2**	**127**	**9.9**	**10.8**	**11.3**	**9.4**	**9.8**	**11.1**	**11.1**

Updated Treatment Baseline and Compliance 2024				
Type	RAM Site	Baseline Min	Baseline Max	2024 Spring
Control	1	10	14	11
	2	4	8	7
	4	5	10	9
	6	4	8	9
	7	11	19	18
	9	13	21	19
	13	4	8	10
	Means	**7.3**	**12.6**	**11.9**
Impact	3	5	10	11
	5	8	14	9
	10	17	29	23
	11	11	16	18
	12	3	7	7
	15	6	10	8
	16	6	10	9
	Means	**8**	**13.7**	**12.1**

*In 2024, Sites 4 and 6 were transferred from impact to control sites due to the Southern Access Road no longer being in general use for mining activities, and there being no hydrogeological connection to the Tailings Storage Facility. The baseline mean (and min/max) values therefore change at 2024 as a result of these changes.

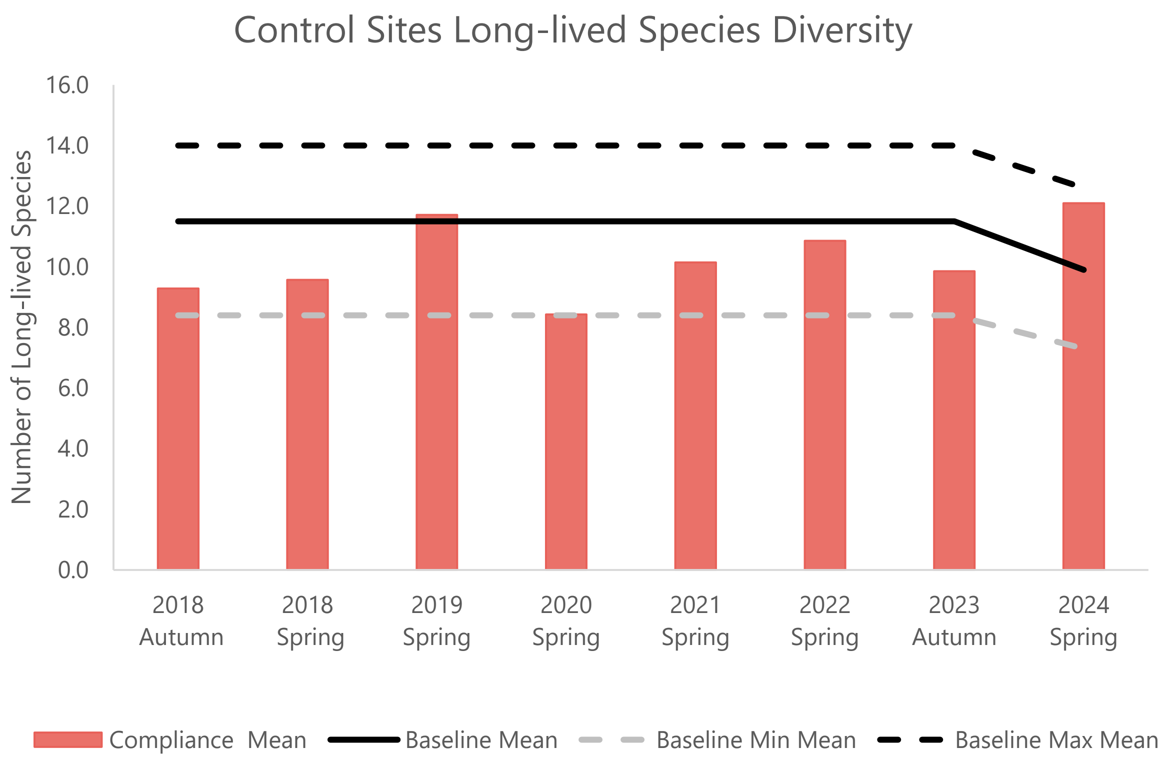

Figure 3.4: Mean diversity of long-lived flora species at control sites during compliance monitoring (compared with baseline mean, min, max, changed in 2024)

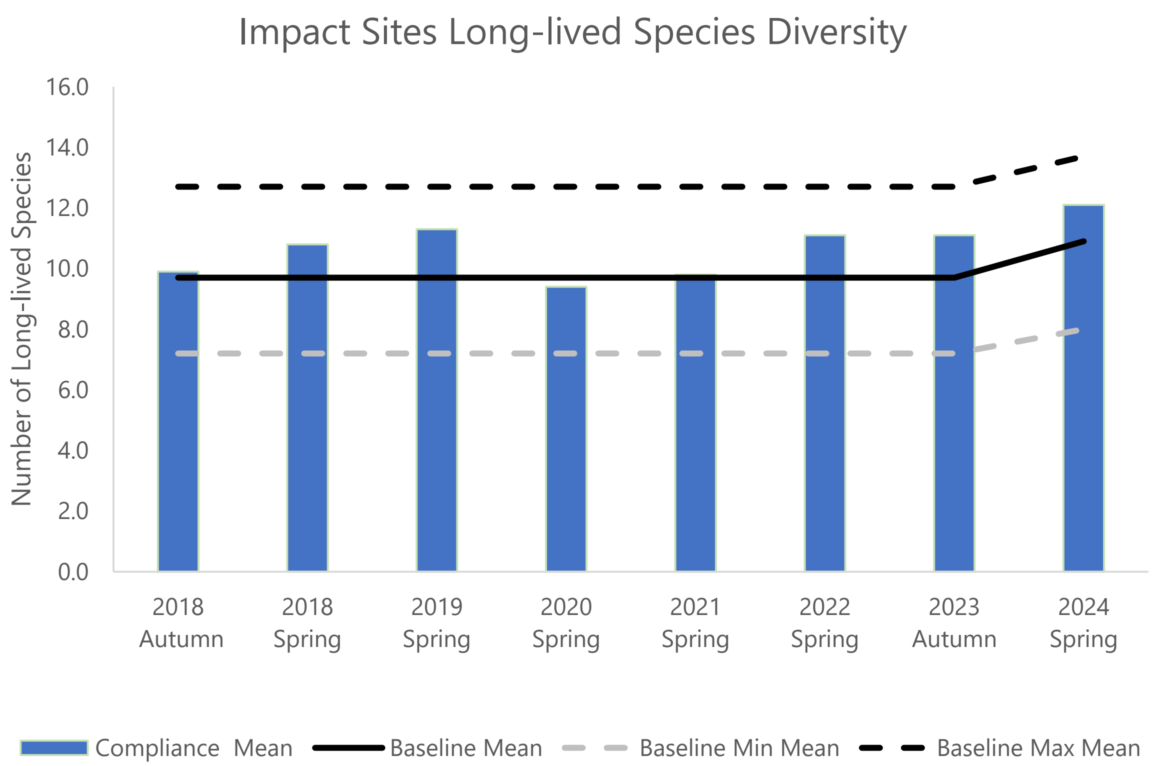

Figure 3.5: Mean diversity of long-lived flora species at impact sites during compliance monitoring (compared with baseline mean, min, max, changed in 2024)

3.2.1.4 Short-lived species diversity: baseline and compliance monitoring period comparison

During compliance monitoring, the mean short-lived species diversity for both control and impact sites has fluctuated yearly, largely in response to fluctuations in rainfall patterns. In 2024, the mean short-lived species diversities for control sites (17.0 species) and for impact sites (16.3 species) were the second highest and third highest, respectively recorded during compliance monitoring, and at the upper end of the range for baseline monitoring. The tallies for all individual sites were also within the baseline ranges (Table 3.5). Three control sites and two impact sties recorded the highest short-lived species diversity tallies for the compliance/operational period. For analyses up to 2023 (Site 4 and 6 as Impact), the Baseline Control Mean was 16.4 and the Baseline Impact mean was 18.2 (Figure 3.6). For analyses in 2024 (Site 4 and 6 as Control) the Baseline Control Mean was 16.9 and Baseline Impact Mean was 18.2 (Figure 3.6). These results also well within the baselines ranges, regardless of site allocation to control of impact (for Site 4 and 6).

Table 3.5: Total diversity of short-lived native species, baseline versus compliance monitoring period

Type	Baseline (2012-2016) and Compliance Short-lived Diversity to (2018-2023)									
	RAM Site[1]	Baseline Min	Baseline Max	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn
Control	1	6	28	12	7	10	11	10	15	20
	2	4	31	10	8	12	15	11	12	14
	7	8	28	14	7	10	7	16	14	14
	9	2	25	6	4	11	18	13	18	21
	13	5	27	10	14	24	14	12	11	19
	Means	**5.0**	**27.8**	**10.4**	**8.0**	**13.4**	**13.0**	**12.4**	**14.0**	**17.6**
Impact	3	10	35	14	12	19	14	9	16	24
	4	8	29	14	7	17	12	10	15	18
	5	4	32	12	10	14	12	9	10	16
	6	11	24	15	9	21	16	10	12	15
	10	8	28	6	9	14	21	18	18	26
	11	7	33	14	9	20	14	11	14	18
	12	6	25	13	6	21	16	12	13	21
	15	4	29	12	9	23	13	9	12	15
	16	4	30	11	9	20	10	12	9	15
	Means	**6.9**	**29.4**	**12.3**	**8.9**	**18.8**	**14.2**	**11.1**	**13.2**	**18.7**

Updated Treatment Baseline and Compliance 2024				
Type	RAM Site	Baseline Min	Baseline Max	2024 Spring
Control	1	6	28	13
	2	4	31	21
	4	8	29	17
	6	11	24	15
	7	8	28	17
	9	**2**	**25**	**22**
	13	5	27	14
	Means	6.3	27.4	17.0
Impact	3	10	35	26
	5	4	32	15
	10	8	28	13
	11	7	33	15
	12	6	25	13
	15	4	29	17
	16	4	30	15
	Means	**6.1**	**30.3**	**16.3**

*In 2024, Sites 4 and Site 6 were transferred from impact to control sites due to the Southern Access Road no longer being in general use for mining activities, and there being no hydrogeological connection to the Tailings Storage Facility. The baseline mean (and min/max) values therefore change at 2024 as a result of these changes.

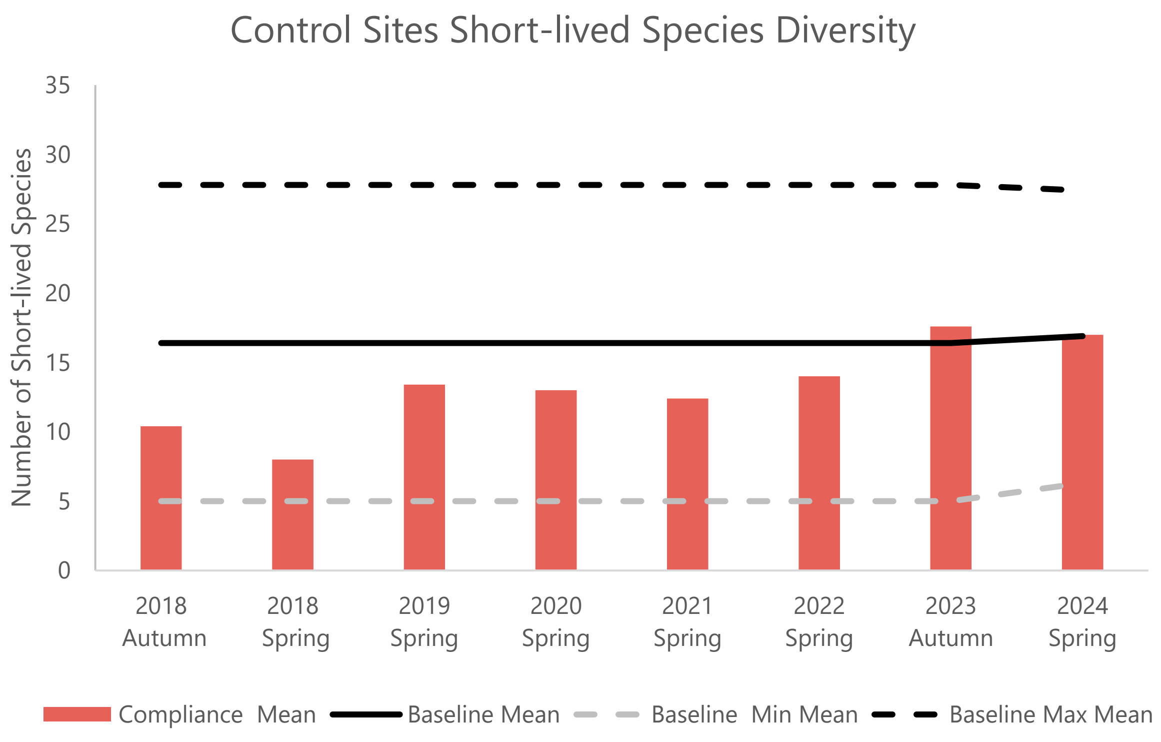

Figure 3.6: Mean diversity of short-lived flora species at control sites during compliance monitoring (compared with baseline mean, min, max, changed in 2024)

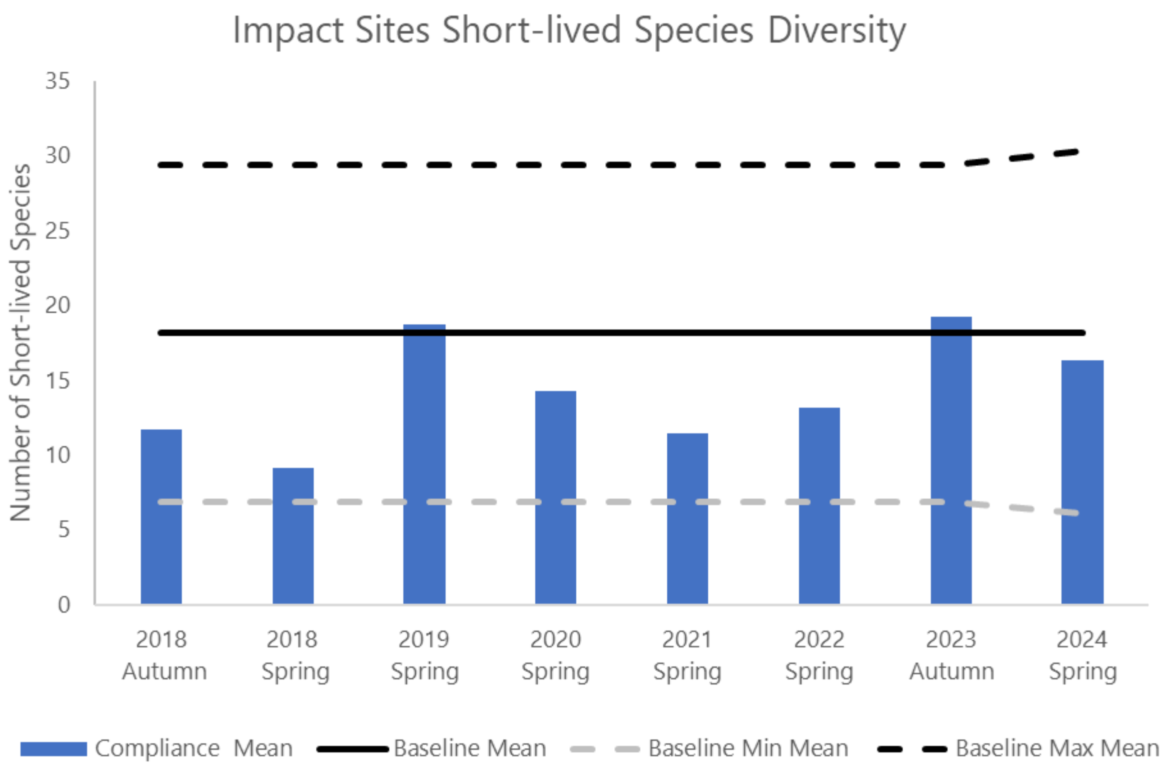

Figure 3.7: Mean diversity of short-lived flora species at impact sites during compliance monitoring (compared with baseline mean, min, max, changed in 2024)

3.2.1.5 Comparison of long-lived species diversity by habitat type and site

Four distinct habitats were recognised at the Flora Rangeland sites: Eliza Creek (major drainage line) sites, sand dune sites, gibber sites with no drainage line, and gibber sites with a drainage line. Trends in perennial species diversity were compared between sites of similar habitat. This was done to:

1. Determine the magnitude of inherent variation between sites of similar habitats, regardless of potential impact from mining, and
2. Detect potential changes in plant diversity associated with a particular habitat, regardless of distance from mining infrastructure; namely to detect possible stressors (mining related or otherwise), impacting species diversity in specific habitats.

Potential increasing or decreasing trends for individual sites were also assessed. This was done to detect possible trends at a site level, that were otherwise being masked at a control group or impact group level.

Long-lived species diversity at Eliza Creek sites

The Eliza Creek Sites 17, 18, 19 and 20 were established in autumn 2018, specifically to monitor the potential impacts of the tailings dam embankment on downstream vegetation. In addition, flora Site 10, established in 2012, is located on Eliza Creek, approximately 5 km downstream from the Tailings Storage Facility (TSF) and is therefore also a potential impact site from the TSF. The TSF construction began in 2018 and TSF commenced operations during February 2020. As such, the 2018 and 2019 survey data represent the best 'baseline' data available for Eliza Creek survey sites 17-20, noting that natural spatial and temporal variations in species diversity are present and due to inter alia: slight habitat differences (width and depth of channel); seasonal and yearly rainfall variations; and slight variations in area surveyed at each site for each survey.

Since 2018, there has been no distinct trend in species diversity for any of the Eliza Creek sites, with mean diversity since 2020 (namely, TSF operational) being similar to 2018 and 2019 tallies (Table 3.6 and Figure 3.8). Mean species diversity for each site post construction has either been greater than construction (2018 and 2019) means or within 5% of construction mean diversities. In addition to similar baseline and operational mean diversities, the range in species diversity recorded at individual sites has also been similar for construction and operational phases (Table 3.6). Mean perennial diversity between sites during operational monitoring has also been very similar, varying from a mean of 22 species at Sites 17 and 18 to 24 species at Sites 19 and 10.

In summary there is no clear pattern emerging in species diversity data relating to the time since TSF establishment and the distance from the TSF (Sites 17 being the closest and Site 10 being the furthest away). Site 17 is approximately 200 m downstream from the TSF and as at October 2024 had experienced no species loss, or evident decline in populations of any species.

Table 3.6: Long-lived perennial plant species diversity at Eliza Creek sites during compliance monitoring (all sites considered potential impact sites)

RAM Site[1]	Construction Long-lived Species Diversity			Operation Long-lived Species Diversity						
	Min	Max	2018-2019 Mean	2020	2021	2022	2023	2024	2020-2024 Range	2020-2024 Mean
17	19	24	21	18	20	27	24	22	18 - 27	22
18	22	25	23	21	20	23	21	24	20 - 24	22
19	16	19	18	23	24	25	24	23	23 - 25	24
20	21	26	24	20	21	23	25	25	20 - 25	23
10	22	26	25	21	27	25	24	23	21 - 27	24

[1] Flora sites (One hectare Rangeland) displayed by increasing distance from TSF, where flora Site 17 = CAR017, 18 = CAR018 and so on.

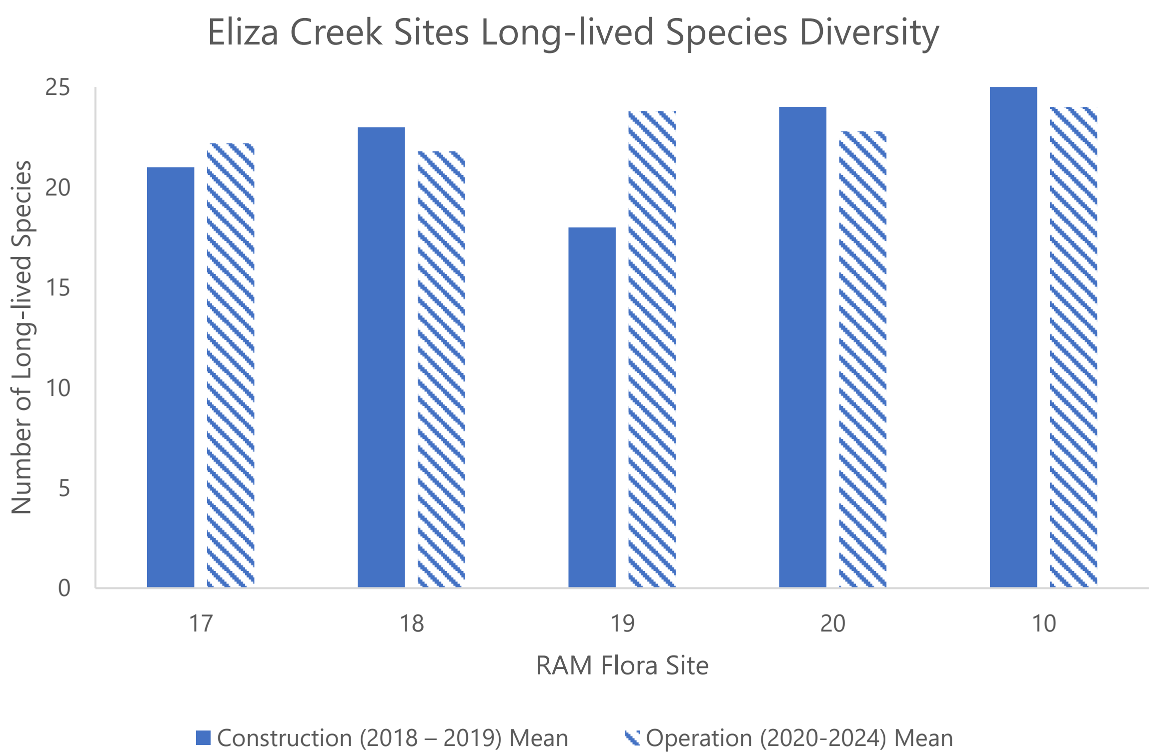

Figure 3.8: Mean native long-lived species diversity at Eliza Creek Rangeland Flora Sites (TSF construction (2018 and 2019) and operation (2020 – 2024)

Long-lived species diversity at sand dune habitat

Flora Sites 21 and 22 were established in May 2018 on sand dunes, a previously un-monitored habitat within the Carrapateena Operation area, but the control Site 21 was relocated in spring 2018 given proximity to proposed infrastructure. For both sites, perennial species diversity has fluctuated yearly (Table 3.7) without any clear trend emerging in either long-term increases or declines.

The sand dune sites are not defined on the ground. A central point is designated by an easting and northing coordinate and the site is surveyed by walking within an area defined by a 55 m radius from the central coordinate (namely an area equivalent to a 10 000 m^2 RAM site). Several species are present as isolated individuals only. Due to the undulating nature of the dunes and the absence of on-ground survey markers, it is possible that some perennial species of low abundance, are present but not detected during some surveys.

Table 3.7: Long-lived perennial plant species diversity at sand dune habitats during compliance monitoring

RAM Site	Site Type	Compliance Monitoring Long-lived Species Diversity						
		2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
21	Control	10	8	7	9	8	12	11
22	Impact	7	8	10	5	5	7	9

Long-lived species diversity at gibber habitats with no drainage line

Gibber habitat sites that contained no drainage line were control Sites 2, 4, 6 and 13, and Impact Sites 3, 5, 12,15 and 16. There has been no obvious trend in long-lived species diversity at any individual site (Table 3.8). Mean diversity at all sites during compliance monitoring has remained within the baseline range, and been similar to baseline diversity (Table 3.9).

Post-construction long-lived species diversity has fluctuated slightly at all sites with no consistent trend evident at any site, regardless of whether designated a control or potential impact site (based on distance from mining infrastructure). Of the gibber (non-drainage line) sites, site 3 recorded the highest perennial species diversity in both 2023 and 2024, noting that this site is closest to major mining infrastructure.

Table 3.8: Long-lived perennial plant species diversity at gibber sites (with no drainage lines) during compliance monitoring

RAM Site	Compliance Monitoring Long-lived Species Diversity Totals							
	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
2	4	7	9	6	3	7	7	7
3	9	10	10	7	8	8	10	11
4	7	7	8	7	7	9	7	9
5	10	10	11	8	9	8	10	9
6	7	6	7	7	6	11	6	9
13	4	6	6	6	6	10	8	10

RAM Site	Compliance Monitoring Long-lived Species Diversity Totals							
	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
12	4	8	8	6	4	6	9	7
15	6	7	8	10	7	7	6	8
16	6	7	7	5	5	7	9	9

*Sites 4 and 6 were changed from potential impact sites to control sites in 2024 due to operational changes around 2024.

Table 3.9: Long-lived plant perennial plant species diversity at gibber sites (with no drainage lines), means and ranges

RAM Site	Baseline Diversity (2012-2016)			Compliance Diversity (2018-2024)		
	Min	Max	Mean	Min	Max	Mean
2	4	8	5.3	4	9	6.3
3	5	10	7.3	7	10	9.1
4	5	10	7.6	7	9	7.6
5	8	14	9.7	8	11	9.4
6	4	8	6.3	6	11	7.4
13	4	8	6.6	4	10	7.0
12	3	7	4.7	4	9	6.5
15	6	10	7.9	6	10	7.4
16	6	10	6.7	5	9	6.9

The baseline mean (and min/max) values change at 2024 in the graph below as a result of changes in allocation of control and impact sites due to operational changes around 2024. Site 4 and Site 6 were designated as impact sites up until 2023 due to the proximity of the Southern Access Road. With the SAR no longer widely used for mine-related activities, and the absence of hydrological connectivity to the TSF, these sites have been re-designated as control sites.

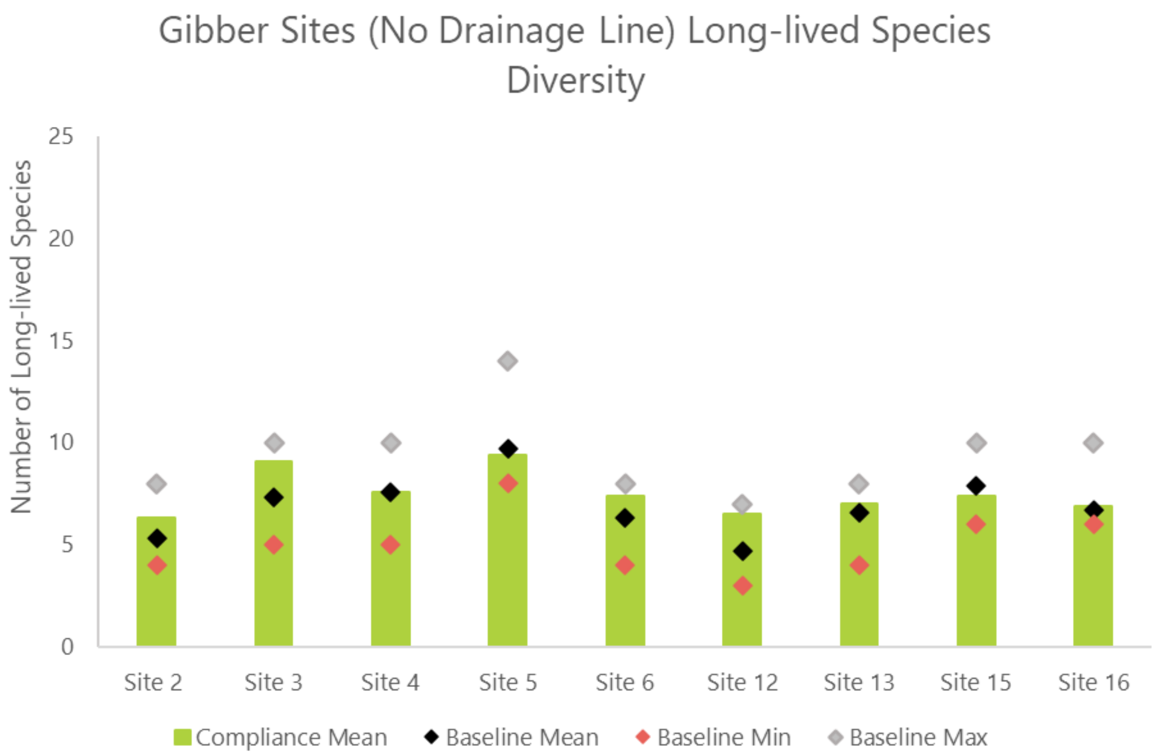

Figure 3.9: Mean species diversity of long-lived species at gibber sites (no minor drainage line in site)
*Sites 4 and 6 changed from potential impact sites to control sites in 2024, due to operational infrastructure changes.

Long-lived species diversity at gibber habitats that include a minor drainage Line

Gibber sites that contained a drainage line were Control Sites 1, 7 and 9, and Impact Site 11. Since 2018, there has been no obvious trend in long-lived species diversity at these sites (Table 8). During both baseline and post-construction/ operational monitoring, diversity has fluctuated quite widely at Control Sites 1 and 7, and to a lesser extent at Sites 9 and 11, but overall has shown no clear trends at these sites (Table 3.10). Variations in long-lived species diversity at these sites is thought to be largely due to slight variations in area surveyed at each survey: the presence of multiple habitats decreasing the ability to replicate survey areas precisely. Mean diversity at all sites during compliance monitoring has remained within the baseline range (Table 3.11 and Figure 3.10).

Table 3.10: Long-lived perennial plant species diversity at gibber sites with a minor drainage line during compliance monitoring

RAM Site	Compliance Monitoring Long-lived Species Diversity Totals							
	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
1	12	10	13	7	15	12	11	11
7	16	17	20	10	16	19	11	18
9	15	14	19	16	18	16	19	19
11	18	16	17	14	15	17	19	18

Table 3.11: Long-lived perennial plant species diversity at gibber sites with a minor drainage line; baseline and compliance monitoring means and ranges

RAM Site	Baseline Diversity (2012-2016)			Compliance Diversity (2018-2024)		
	Min	Max	Mean	Min	Max	Mean
1	10	14	12.2	7	15	11.4
7	11	19	15.4	10	20	15.9
9	13	20	18.0	14	19	17.0
11	11	16	14.4	14	19	16.8

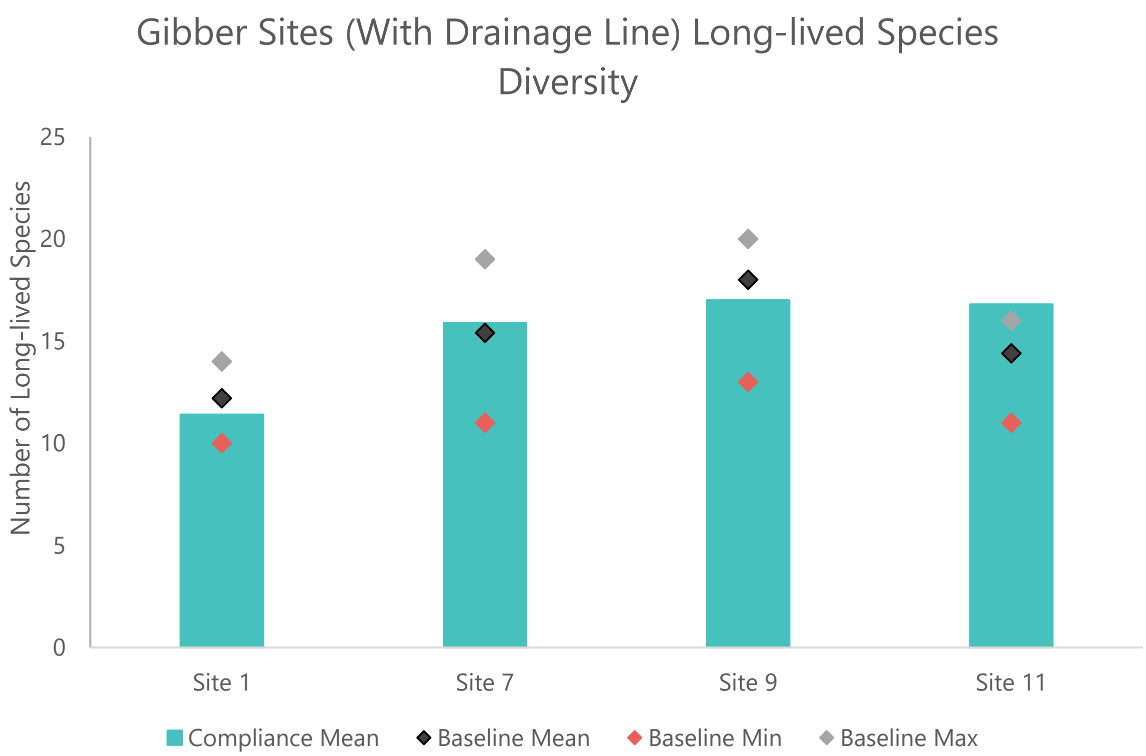

Figure 3.10: Mean long-lived species diversity at gibber sites that include a minor drainage line

3.2.2 Jessup transects – population structure of long-lived woody perennials

During compliance monitoring, Jessup transects were conducted at all 13 gibber habitat flora sites (Sites 1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 13, 15 and 16) and at the five Eliza Creek flora sites (Sites 10, 17, 18, 19, 20). Appendix D1 contains all species data recorded for Jessup transects in 2024. Baseline Jessup site data is available for comparison for the 13 gibber sites for 2013 to 2025 surveys (Sites 15 and 16 were not surveyed in 2012).

3.2.2.1 Gibber habitat Jessup transects

Jessup data (Appendix D) shows the total number of adults and juveniles of long-lived woody perennials for the flora sites, recorded in spring 2024. Jessup transects conducted in gibber habitat during both the baseline and compliance periods were Sites 1 to 7, 9 to 13, 15 and 16.

For the gibber habitat Jessup sites three species have been chosen for a detailed comparison of baseline and compliance population levels: the two dominant species, *Atriplex vesicaria* and *Tecticornia* species, which are present at all gibber sites, and a third species, *Frankenia serpyllifolia*, which was also present at most sites.

- Bladder Saltbush (*Atriplex vesicaria*): Dominates the Jessup transects, scoring approximately eight times more individuals (adults and juveniles combined) than the next most abundant species.
- Samphire (*Tecticornia medullosa*): Widespread and abundant at most gibber sites, sometimes co-dominant with Bladder Saltbush.
- Sea-heath (*Frankenia serpyllifolia*): Chosen for analysis because it is widespread at gibber sites and the next most abundant species recorded in Jessup gibber sites, following Bladder Saltbush and Samphire species. Its relative unpalatability eliminates grazing impact as a cause of potential decline. Hence causes of potential changes in abundance can be narrowed down to climate and/or mining impact.

Further interrogation of the presence of these three species at control and impact sites, is provided below.

Bladder Saltbush

Bladder Saltbush is a long-lived woody perennial, and the dominant plant species at the gibber habitat Jessup transects (Sites 1 to 7, 9 to 13, 15 and 16). In this habitat due to the semi-saline soils, Bladder Saltbush is only moderately palatable.

During both baseline and compliance monitoring, the combined total population of Bladder Saltbush from all gibber sites has varied widely. Since compliance monitoring began in autumn 2018, the total number of adult and juvenile Bladder Saltbush from all gibber sites has ranged from 2,175 individuals in spring 2020 to 3,455 individuals in spring 2018. The total abundance recorded in 2024 was 3,146 individuals and near the upper end of the range recorded since 2018.

During compliance monitoring the greatest fluctuations in yearly population sizes occurred in control sites with large declines in 2020 and 2021, before steadily increasing in 2022, 2023 and 2024 (Figure 3.11). The fluctuations reflect changes in juvenile numbers, but also defoliation of shrubs during years of well below average rainfall. In 2024 the 374 juveniles recorded was the highest since construction monitoring began. At control sites, the mean number of Bladder Saltbush (adult and juvenile combined) in 2020, 2021, 2022 and 2023 were all below the baseline range but in 2024 had recovered to be once more just within the baseline range (Figure 3.12).

At impact sites the mean number of Bladder Saltbush plants has fluctuated less than at control sites, and during all compliance monitoring surveys remained within the baseline range for all but the 2020 survey (Figure 3.13).

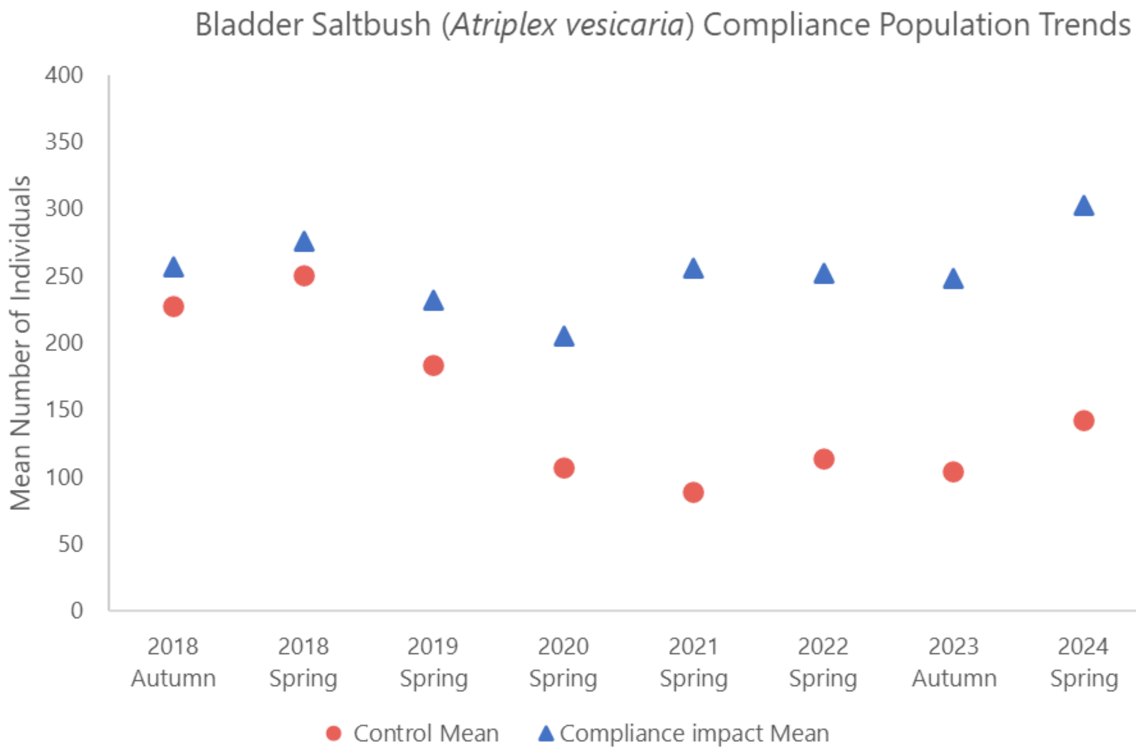

Figure 3.11: Population trends in Bladder Saltbush during compliance monitoring at control and impact sites

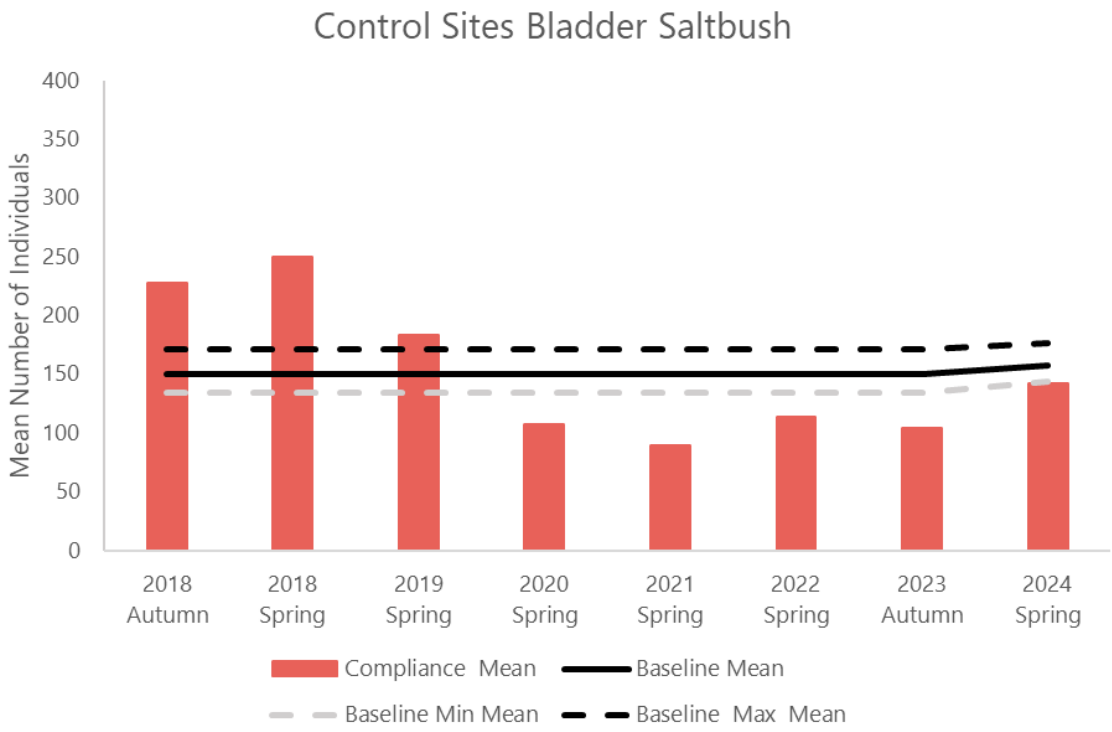

Figure 3.12: Mean abundance of Bladder Saltbush (adults and juveniles combined) at Jessup control sites, baseline versus compliance monitoring.

Note, baseline mean populations are for 2013 – 2015, given some sites not surveyed in 2012 and no data available for 2016 or 2017.

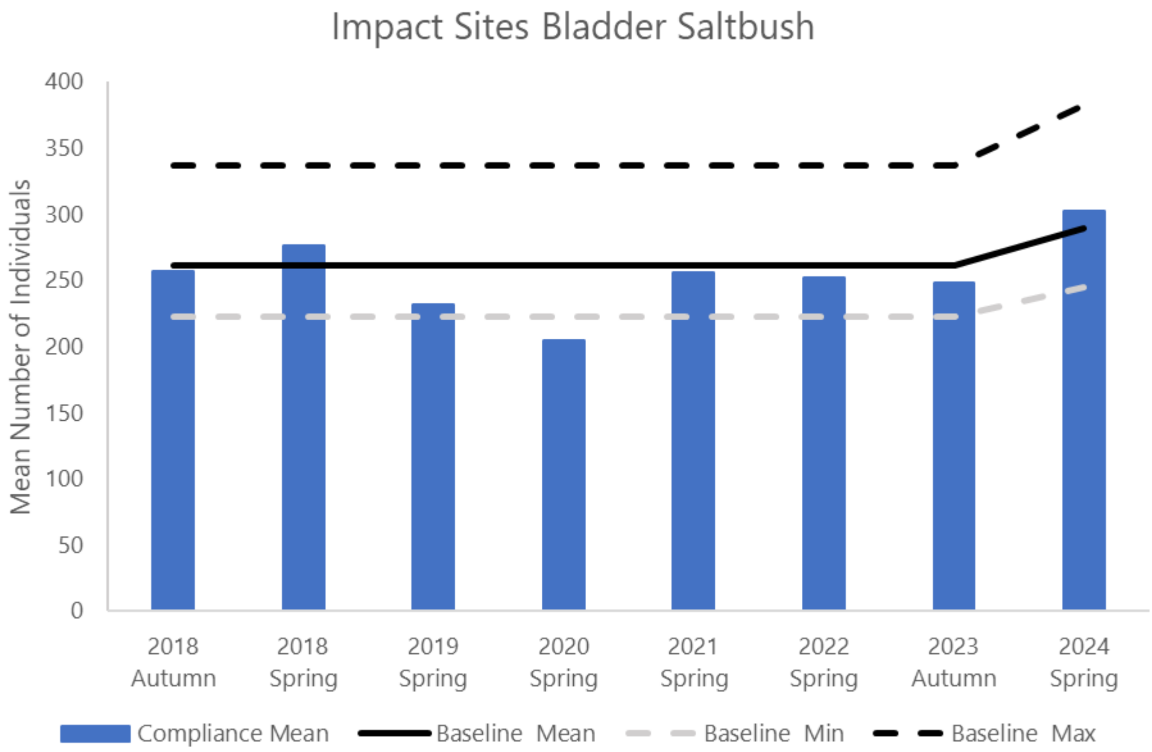

Figure 3.13: Mean abundance of Bladder Saltbush (adults and juveniles combined) at Jessup impact sites, baseline (2013-2015) vs compliance monitoring (autumn 2018 to spring 2024).

Note not all sites surveyed in 2012, and no data available for 2016 or 2017.

Samphire

All Samphire species were analysed collectively. The most widespread Samphire species at the Jessup sites is *Tecticornia medullosa*, with *T. pergranulata* and *T. tenuis* being associated with floodout areas of drainage lines. Samphire species were present at all 13 gibber Jessup sites.

As with all the long-lived woody perennials analysed since 2018, the abundance of Samphire was lowest in 2020/2021 and then increased in 2022, 2023 and 2024 (Figure 3.14). The 2024 combined tally of 400 adult and juvenile Samphire species, from 13 Jessup transects were the highest recorded during the compliance / construction period. Since 2018, the mean number of Samphire individuals at control sites has been within, or exceeded, the baseline range except in 2021 (Figure 3.15). The mean number of Samphire at impact sites was slightly below the baseline range in 2020, 2021 and 2022. In 2023 and 2024, the mean number of individuals at impact sites returned to being within the baseline range (Figure 3.16). It is noted for both impact and control, some sites were not surveyed in 2012, and there was no data available for 2016 or 2017.

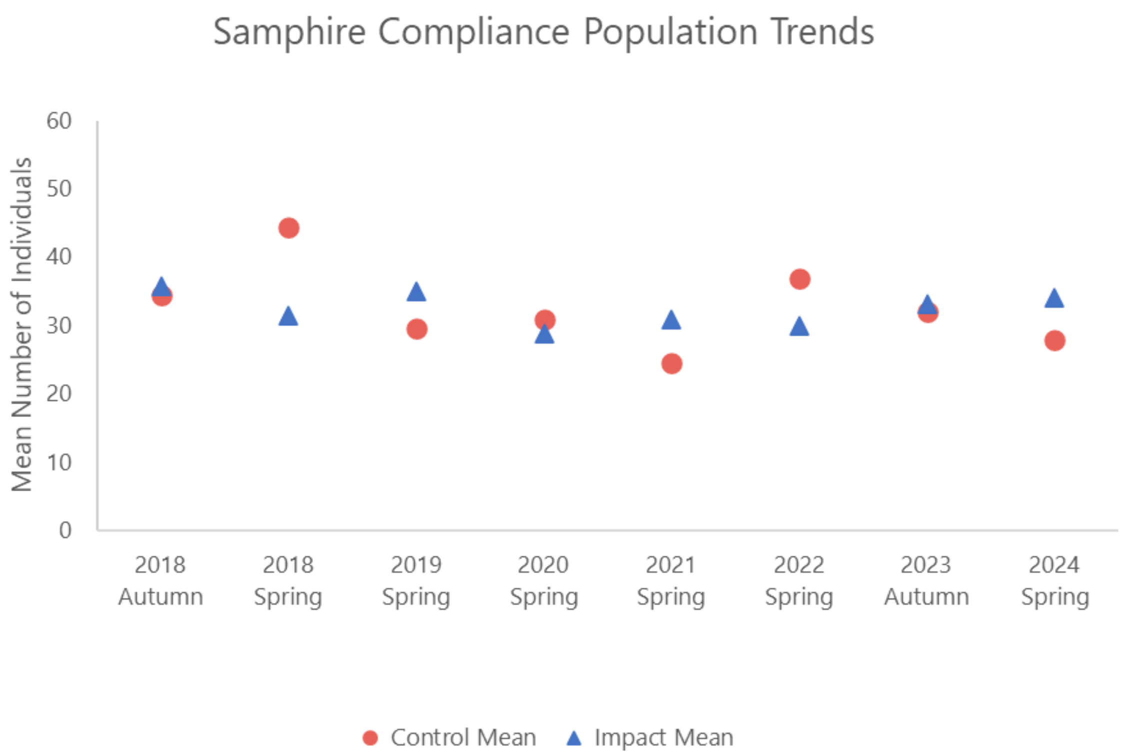

Figure 3.14: Population trends in Samphire during compliance period, control and impact sites

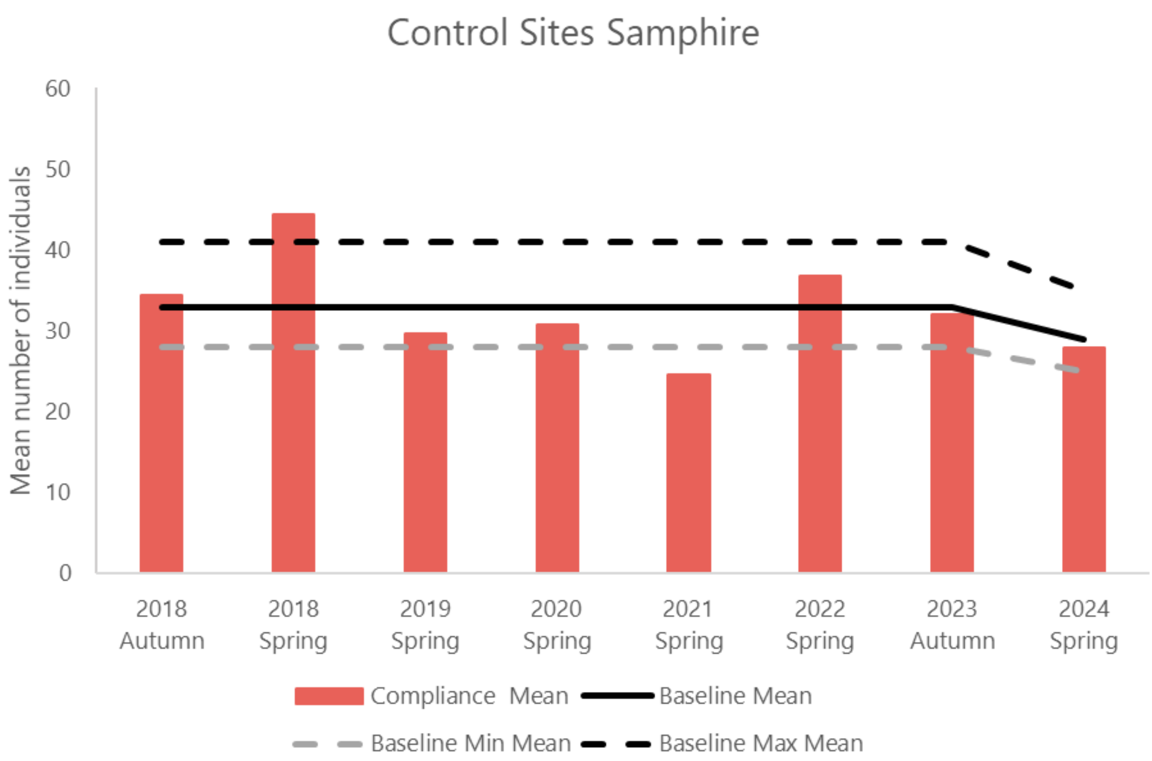

Figure 3.15: Mean number of Samphire at Jessup control sites, baseline (2013-2015) vs compliance monitoring (autumn 2018 to spring 2024).

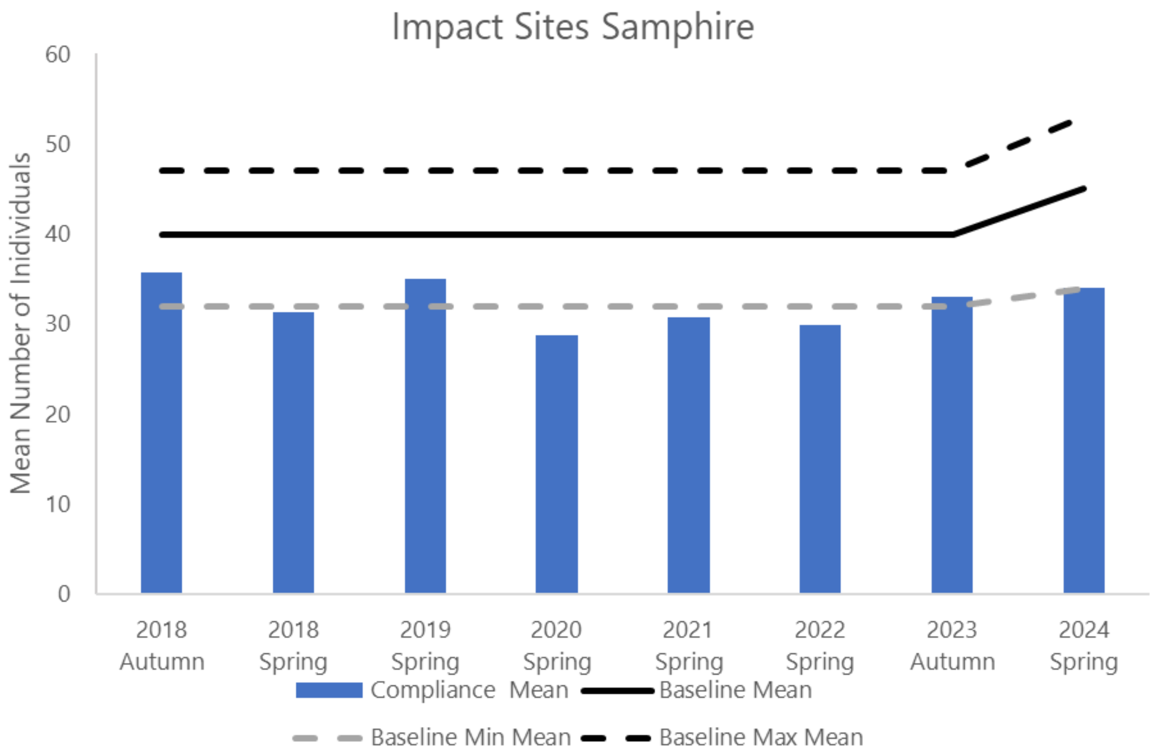

Figure 3.16: Mean number of Samphire at Jessup impact sites, baseline (2013-2015) vs compliance monitoring (autumn 2018 to autumn 2024).

Sea-heath

Sea-heath is also widespread in the gibber habitat, recorded from 12 of the 13 gibber Jesup sites. This species is tolerant of saline habitats and largely unpalatable. As with other long-lived woody perennials, abundance at Jessup transects has fluctuated during both baseline and compliance monitoring. The lowest Sea-heath totals for both control and impact sites were recorded in 2020 and 2021 (Figure 3.17). In 2024, 146 adults and 2 juveniles were recorded from 11 sites. This compares with 169 adults and no juveniles recorded from 10 Jessup transects in 2023 (Jacobs 2023h). In both 2023 and 2024, approximately 45% of all Sea-heath plants were recorded at Jessup transect Site 5. It is noted that Sites 4 and 6 changed from potential impact to control sites in 2024 due to infrastructure changes.

At control sites, the mean number of Sea-heath has been within, or exceeded, the baseline range for all survey periods except spring 2021 (Figure 3.18). At impact sites, the mean number of Sea-heath has remained within the baseline range during all compliance phase surveys (Figure 3.19). For all sites except Sites 1, 7 and 12, the compliance mean abundance has exceeded the baseline mean abundance (Table 3.12).

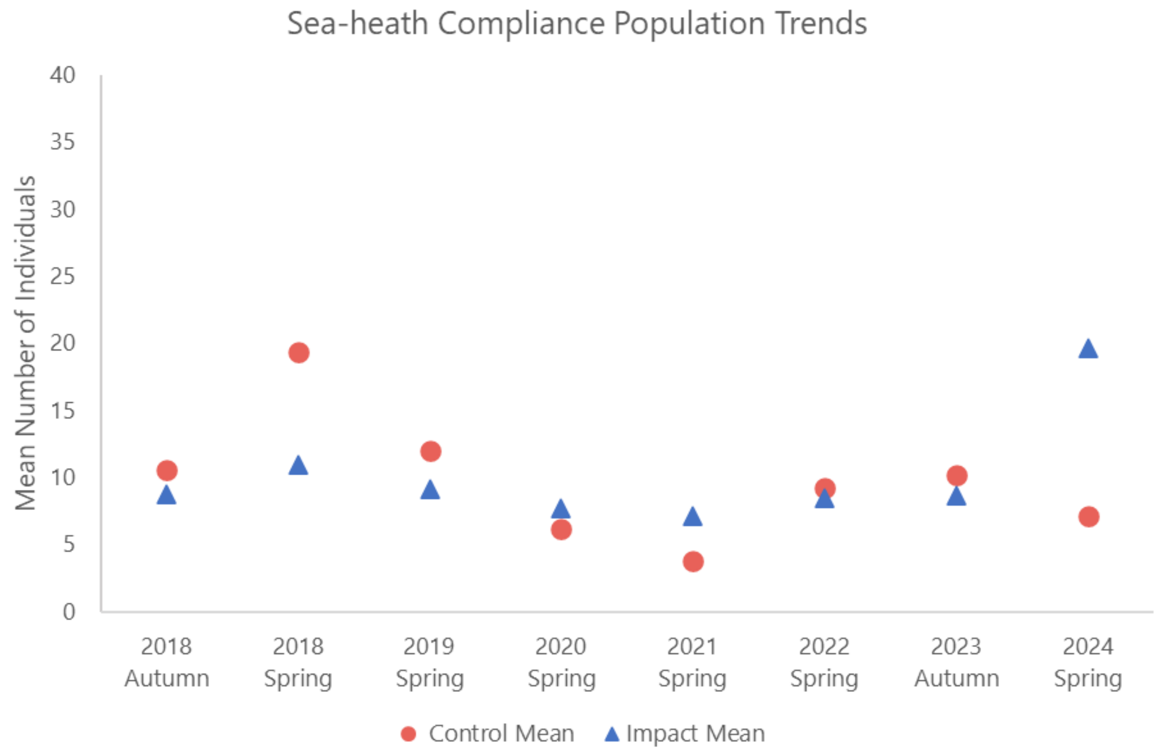

Figure 3.17: Population trends in Sea-heath during compliance period, control and impact sites

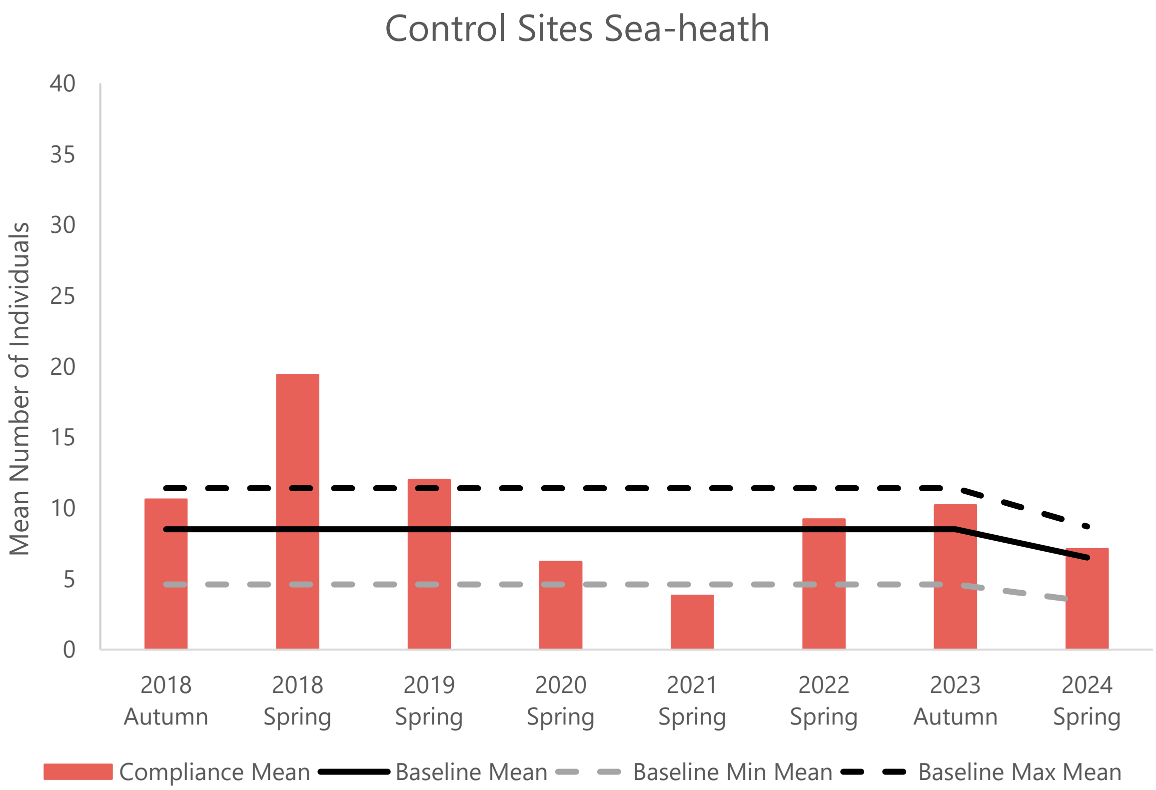

Figure 3.18: Mean number of Sea-heath at Jessup control sites, baseline (2013-2015) vs compliance monitoring (autumn 2018 to spring 2024).

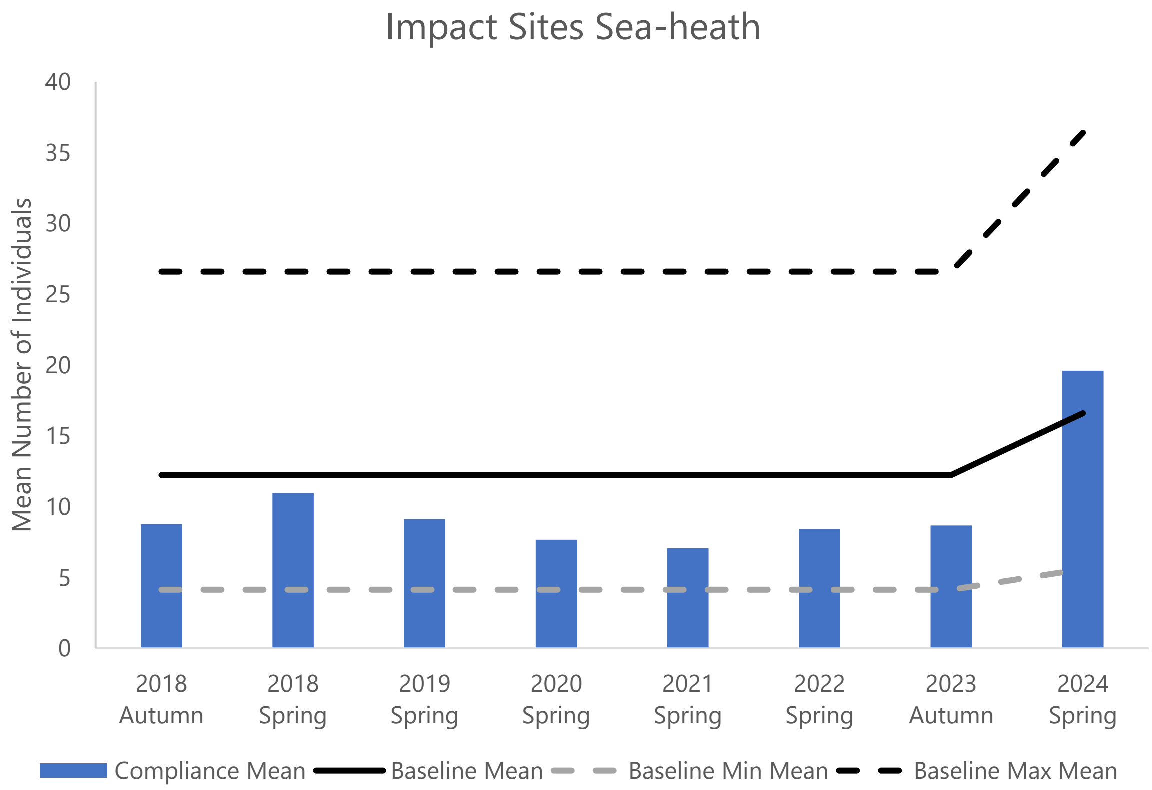

Figure 3.19: Mean number of Sea-heath at Jessup control sites, baseline (2013-2015) vs compliance monitoring (autumn 2018 to spring 2024).

Table 3.12: Sea-heath abundance (adults and juveniles) at individual sites, baseline (2013 – 2015) and compliance (2018 – 2024)

Jessup Site	Baseline Mean	Baseline Min	Baseline Max	Compliance Mean	Compliance Min	Compliance Max
1	8	4	14	1	0	4
2	1	0	2	1	0	5
3	22	9	39	26	9	45
4	1	0	3	2	0	12
5	54	9	135	77	14	116
6	1	0	2	2	0	5
7	17	11	20	11	3	21
9	3	0	5	13	2	28
11	2	1	3	10	0	65
12	2	1	3	1	0	2
13	14	6	27	23	1	58
15	4	0	21	6	4	8

Bush Minuria (*Minuria cunninghammii*) and Plains Lantern Bush (*Abutilon halophilum*)

Previous compliance reporting has compared the abundance of Bush Minuria and Plains Lantern Bush with baseline data. As with other Jessup data comparisons, baseline data available for Jessup transects is limited to a relatively short period (2013 – 2015) which did not reflect a wide range in rainfall extremes. Given there are high inherent spatial and temporal variability in the density of these two species, and the relatively small abundances at most Jessup sites, a comparison of compliance abundance levels with baseline abundance levels is somewhat spurious.

However, because Bush Minuria is relatively widespread at the gibber sites and is one of the larger long lived perennials present, abundance in 2024 at Jessup sites was briefly compared to baseline data. Bush Minuria is a long-lived shrub that is highly palatable in the Carrapateena region. Previous compliance reporting has shown that the abundance of Bush Minuria at Jessup sites has varied widely both between surveys and also within survey sites. This was attributed to both variation in yearly rainfall totals and also grazing impact.

The 2024 data, however, shows that the current population of Bush Minuria exceeds the baseline populations for both control and impact sites, and the extent of occurrence has also increased. The mean abundance at baseline control and impact sites (based on 2024 infrastructure) was 5 individuals and 4 individuals, respectively (with means ranging from 3.2 to 7 individuals per site at control sites, and from 1.2 to 8.8 individuals per site at impact sites). In 2024 the mean abundance at control and impact sites was 12.5 individuals and 6.8 individuals, respectively. During baseline surveys (2013 to 2015), Bush Minuria was recorded at 8 sites. During the 2024 survey, Bush Minuria was surveyed at 11 Jessup sites.

3.2.2.2 Jessup transects Eliza Creek Sites

To assess potential impacts on vegetation downstream of the Tailings Storage Facility (TSF), four sites were established in autumn 2018 progressively downstream from the TSF embankment within Eliza Creek. In addition, Site 10 was established in 2012 during baseline surveys, and is located downstream from site 20 (furthest from the TSF). At each site, the survey methods included a Jessup transect, which is a count of all adult and juvenile woody long-lived perennial species. Since 2018, all sites have recorded a net increase in the total number of long-lived woody perennials (Figure 3.20). Sites 17, 19 and 20 have recorded approximately 50% increase since 2018 and Sites 10 and 18 have recorded an increase of approximately 25%.

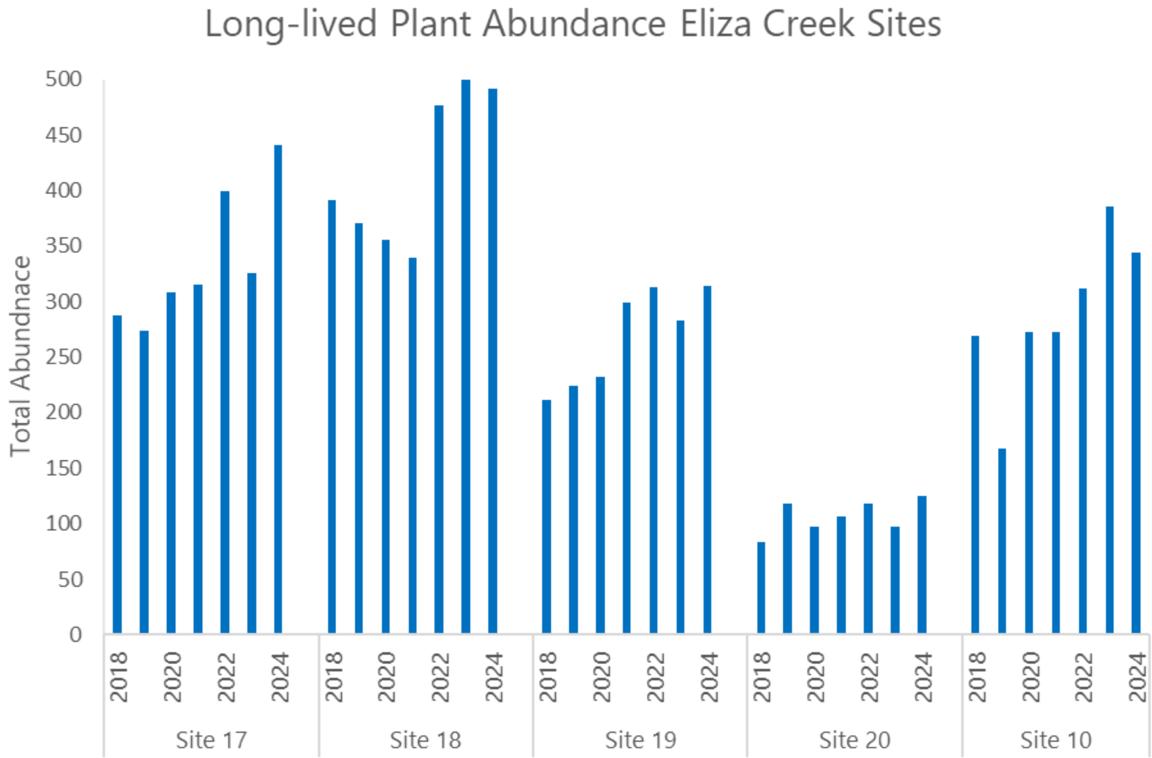

Figure 3.20: Combined abundance of all species recorded at Eliza Creek Jessup survey sites (adults and juveniles included)

3.2.2.3 Abundance of select long-lived perennials at Eliza Creek sites

To further analyse population trends in long-lived species at the Eliza Creek transects, the total number of individuals recorded for the most widespread and/or abundant long-lived species are presented in Figure 3.21 to Figure 3.30. Appendix D2 presents the data in tabular form.

Dead Finish *(Acacia tetragonophylla)*

The results show all species populations have either remained stable of recorded an upward trend since 2018. The only exception is a downward trend for Dead Finish at Site 10, which is the furthest site from the TSF.

At the Jessup sites, Dead Finish is most abundant at Site 10, with abundance ranging from 22 individuals in 2019 to 43 individuals in 2020 (Figure 3.21). Dead Finish occurs in dense clusters at Site 10, and fluctuating numbers may reflect differences in distinguishing individual plants between survey periods. At the Jessup transects upstream from Site 10 (closer to the TSF), populations of Dead Finish have remained stable since 2018. Noting Dead Finish does not occur in the Jessup transect for Site 17.

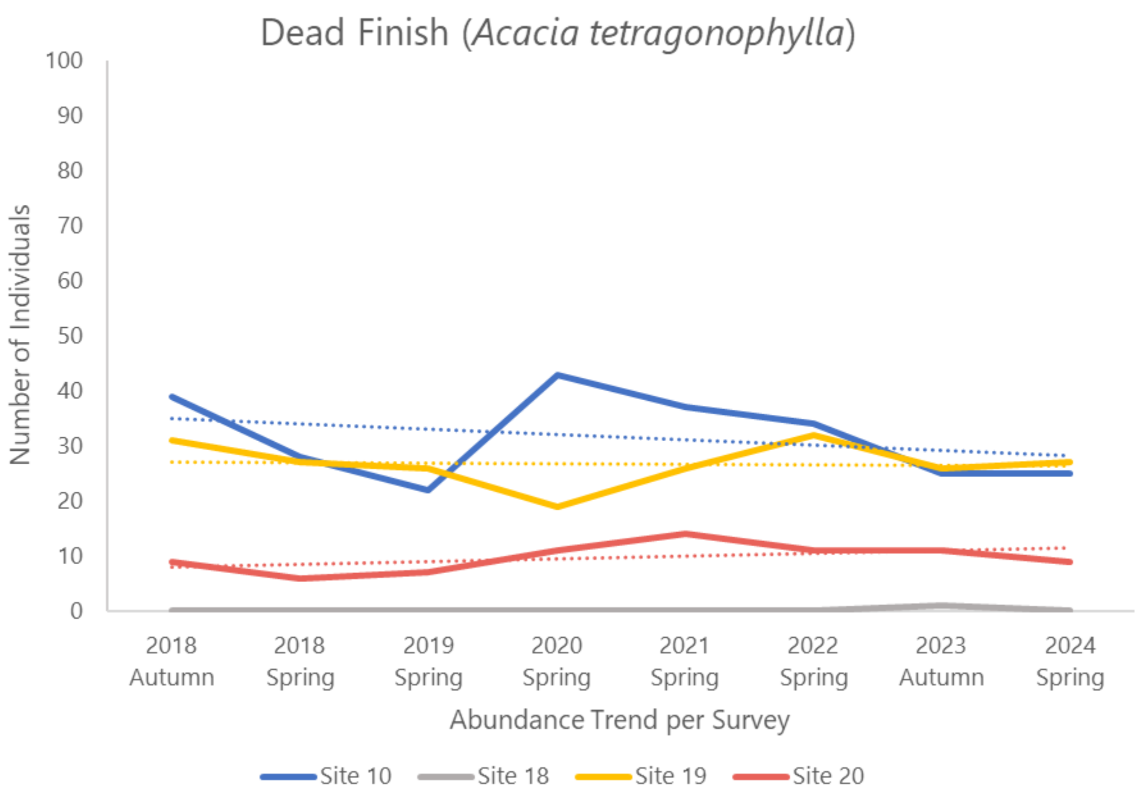

Figure 3.21: Abundance of Dead Finish (adult and juveniles) recorded along Eliza Creek Jessup transects (2018-2024)

Western Myall *(Acacia papyrocarpa*)

Western Myall abundance has fluctuated widely at Site 18, largely due to fluctuations in seedling abundance (with some seedlings germinating but not surviving beyond a year). Regeneration of Western Myall has been widespread, and particularly at Site 17 where nine juveniles were recorded in 2024 (Figure 3.22). There is no notable decline in abundance of Western Myall which could be attributed to the TSF operation.

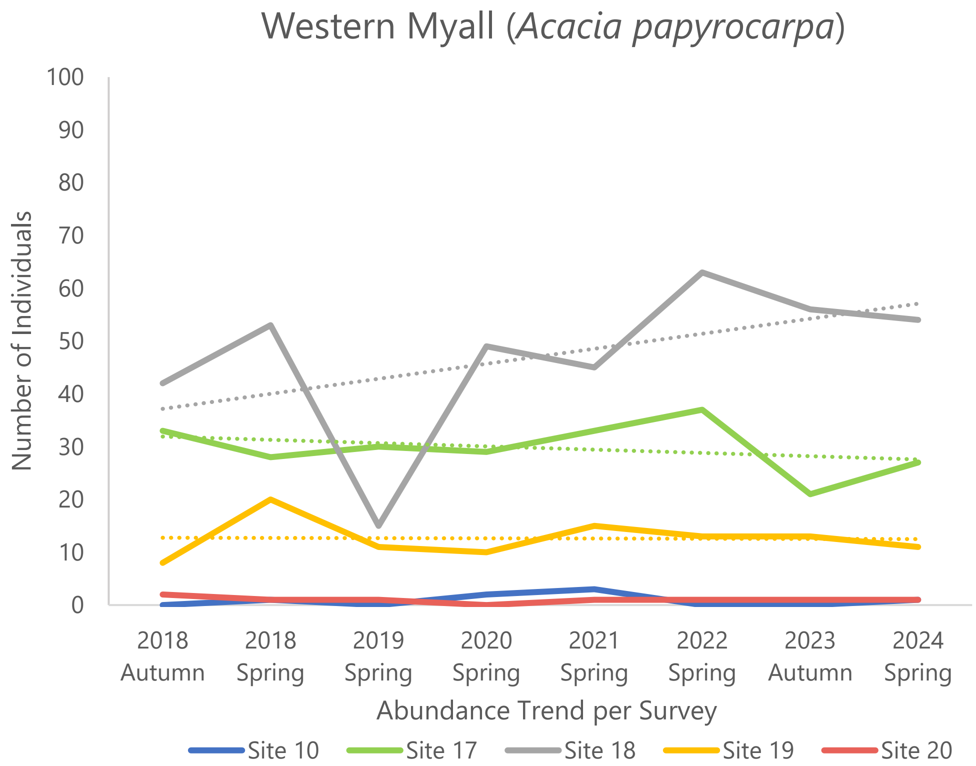

Figure 3.22: Abundance of Western Myall (adult and juveniles) recorded along Eliza Creek Jessup transects (2018-2024)

Lobed-leaf Hopbush *(Dodonaea lobulata)*

Lobed-leaf Hopbush abundance has remained stable at Sites 10, 17, 18 and 20. At Site 19, population levels at the Jessup site have fluctuated but show no distinct long-term trends (Figure 3.23). In 2024, one juvenile was recorded, with the remaining 188 individuals being adults. There is no notable decline in abundance of Lobed-leaf Hopbush which could be attributed to the TSF operation.

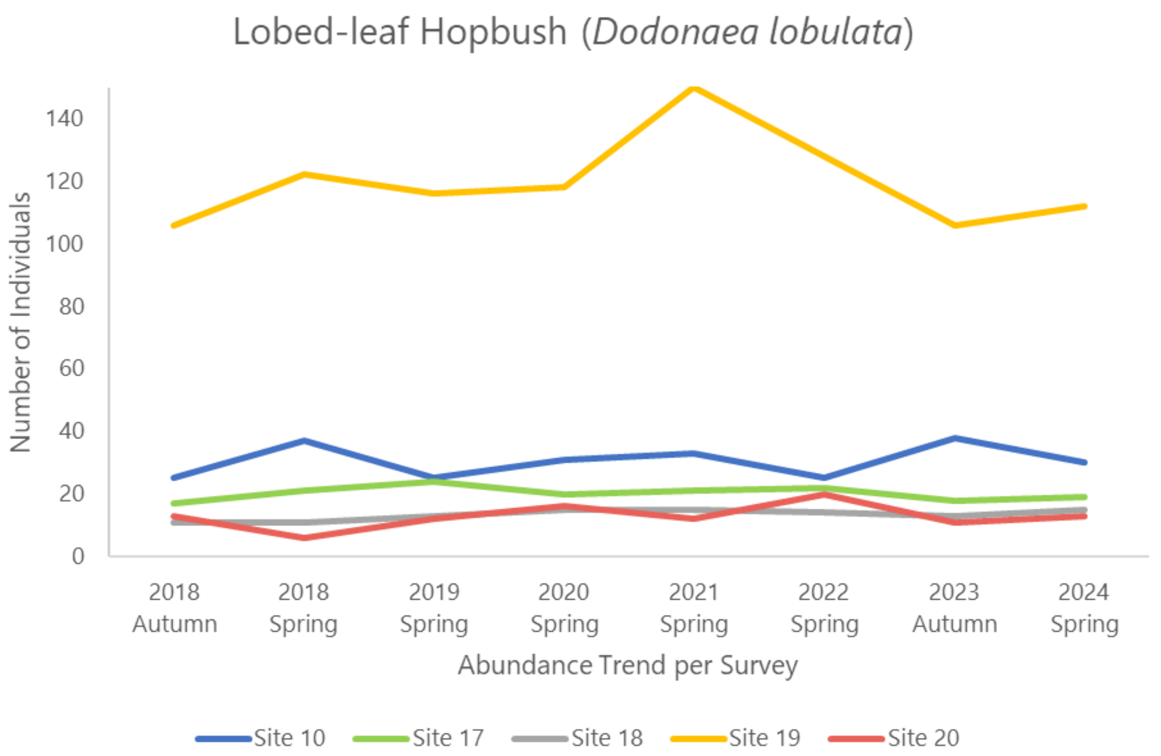

Figure 3.23: Abundance of Lobed-leaf Hopbush (adult and juveniles) recorded along Eliza Creek Jessup transects (2018-2024)

Lignum *(Duma florulenta)*

Lignum is sparsely present at Sites 10 and 19, and more abundant at Site 21, but populations have remained stable at all sites (Figure 3.24). There is no notable decline in abundance of Lignum which could be attributed to the TSF operation.

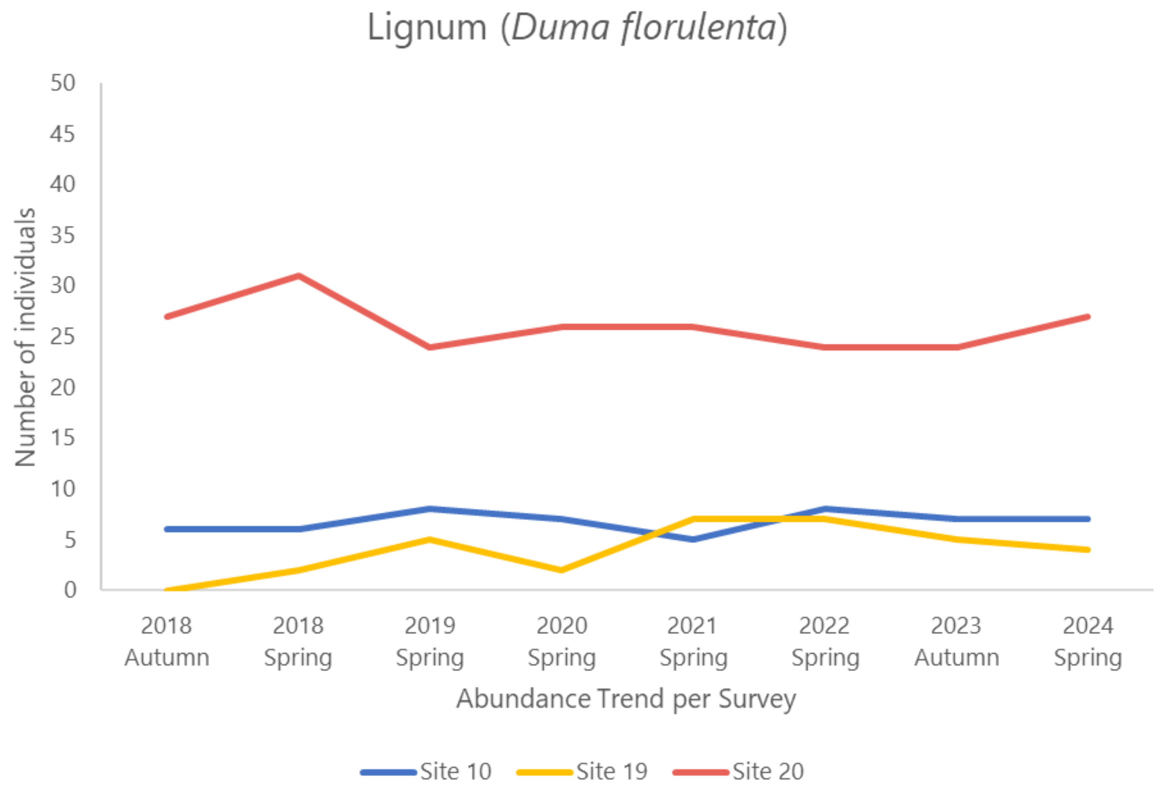

Figure 3.24: Abundance of Lignum recorded along Eliza Creek Jessup transects (2018-2024)

Crimson Emubush *(Eremophila latrobei)*

Crimson Emubush is sparsely present at Sites 10, 17 and 20, but has remained stable at these sites. At Jessup Site 18, the population has increased from 3 plants in 2018 to 9 plants in 2024 (Figure 3.25). There is no notable decline in abundance of Crimson Emubush which could be attributed to the TSF operation.

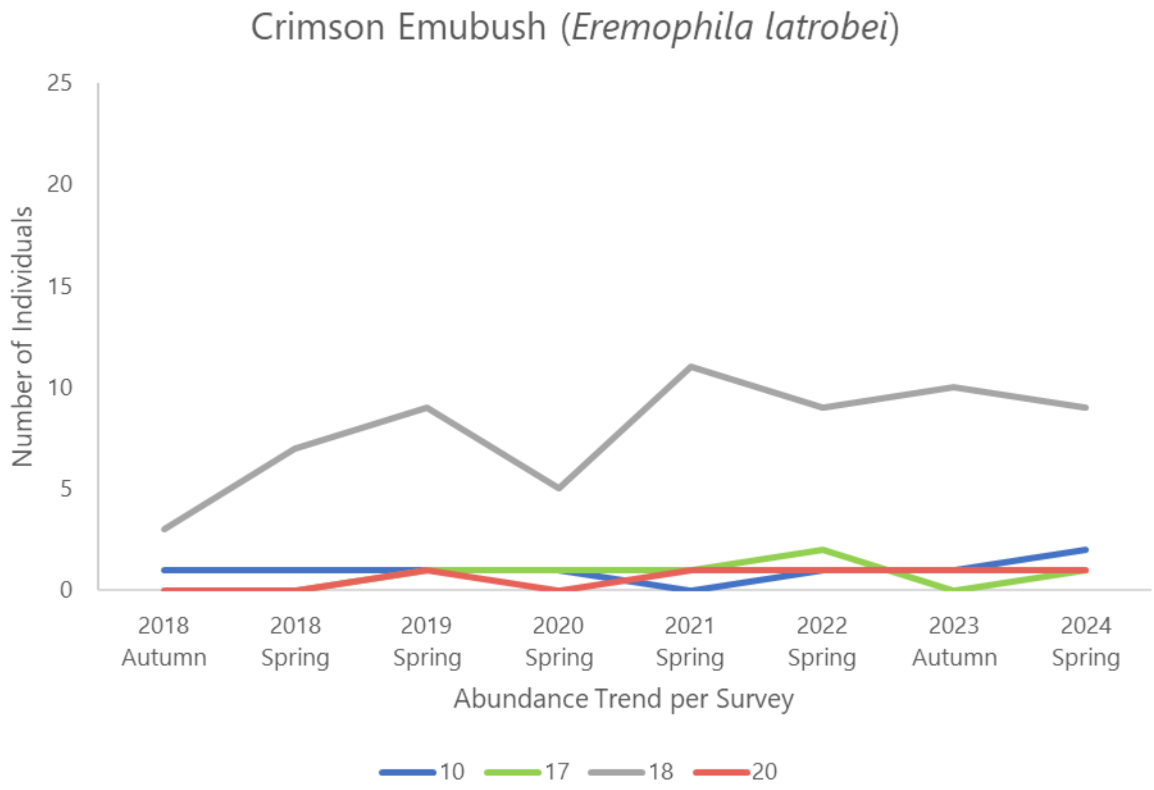

Figure 3.25: Abundance of Crimson Emubush (adult and juveniles) recorded along Eliza Creek Jessup transects (2018-2024)

Spongy-fruit *Bluebush (Maireana spongiocarpa)*

Spongy-fruit Bluebush is highly palatable but the populations as Sites 17 and 18 have increased since 2018 (Figure 3.26). Note data for species was not collected in autumn 2018. There is no notable decline in abundance of Spongy-fruit Bluebush which could be attributed to the TSF operation.

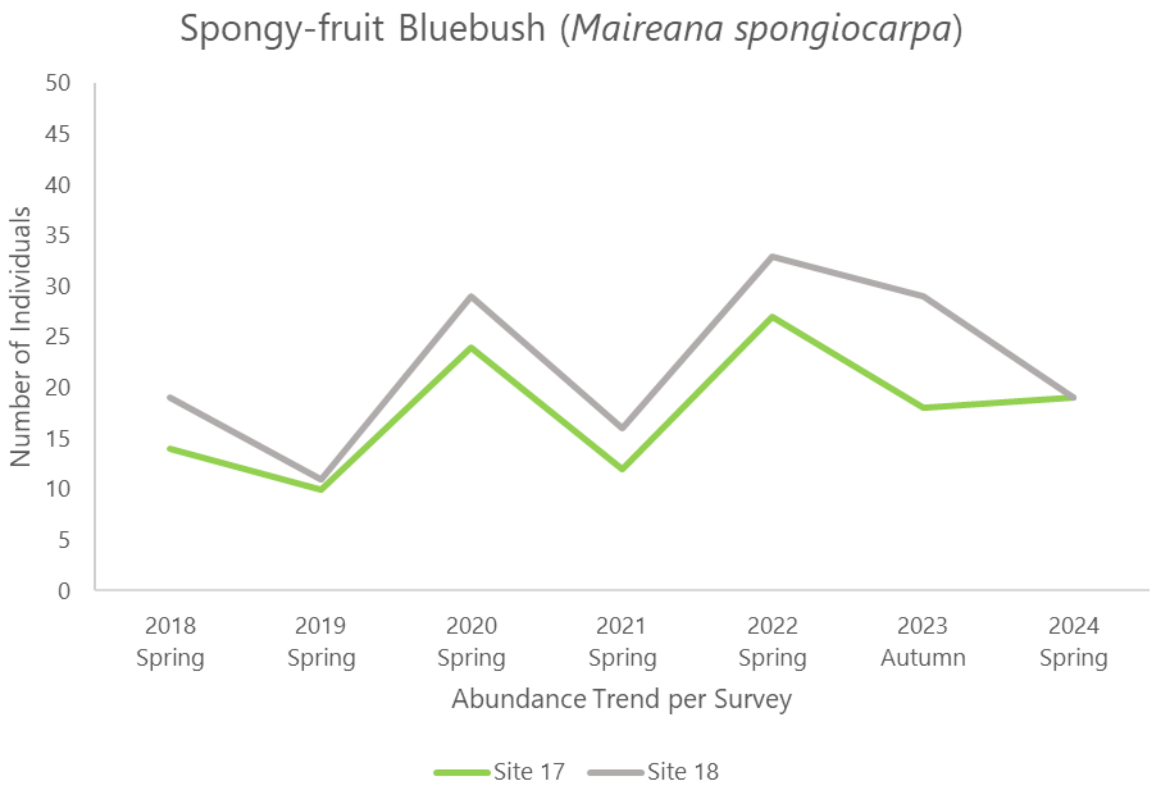

Figure 3.26: Abundance of Spongy-fruit Bluebush (adult and juveniles) recorded along Eliza Creek Jessup transects (2018-2024)

Native Myrtle *(Myoporum montanum)*

In 2024, 75 adults and juveniles of Native Myrtle were recorded from Eliza Creek Jessup sites, the highest recorded since 2018 (Figure 3.27). Of these, 33 individuals were juveniles, likely accounting for at least part of the increased abundance in 2024. In 2023, only five Native Myrtle were recorded from Site 10, whereas 7 adults and 7 juveniles were recorded from Site 10 in 2024. There is no notable decline in abundance of Native Myrtle which could be attributed to the TSF operation.

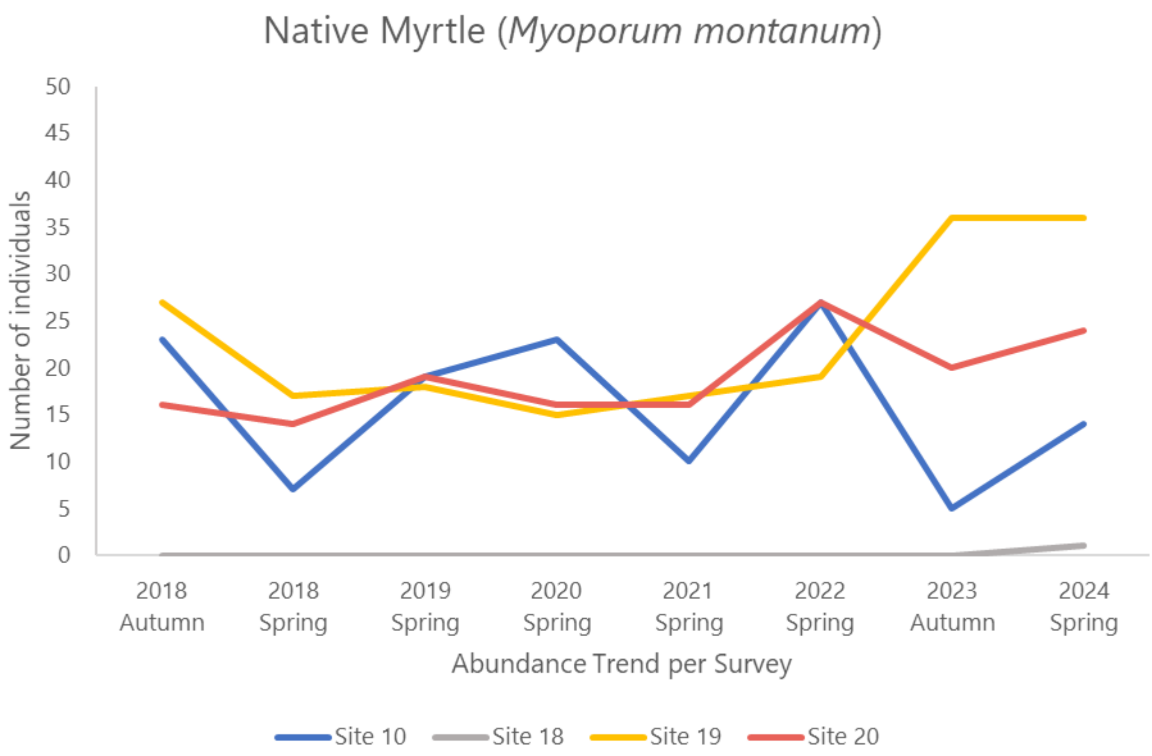

Figure 3.27: Abundance of Native Myrtle (adult and juvenile) recorded along Eliza Creek Jessup transects (2018-2024)

Silver Mulla Mulla *(Ptilotus obovatus)*

Silver Mulla Mulla has increased at each survey site, and especially at Site 10 and 17 where the species has at least doubled in abundance since 2018 (Figure 3.28).

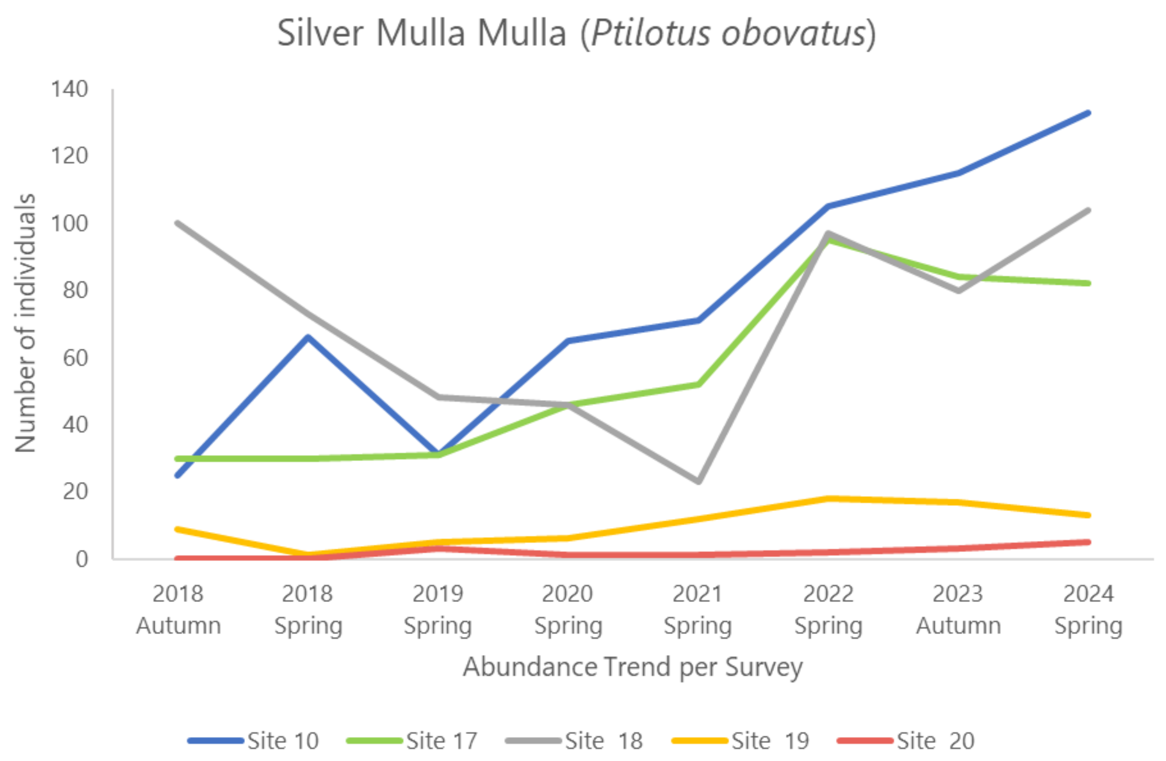

Figure 3.28: Abundance of Silver Mulla Mulla (adult and juveniles) recorded along Eliza Creek Jessup transects (2018-2024)

Spiny Fanflower *(Scaevola spinescens)*

Spiny Fanflower has steadily increased at Sites 10 and 19, and remained stable at Site 17, Site 18 and Site 20 (Figure 3.29).

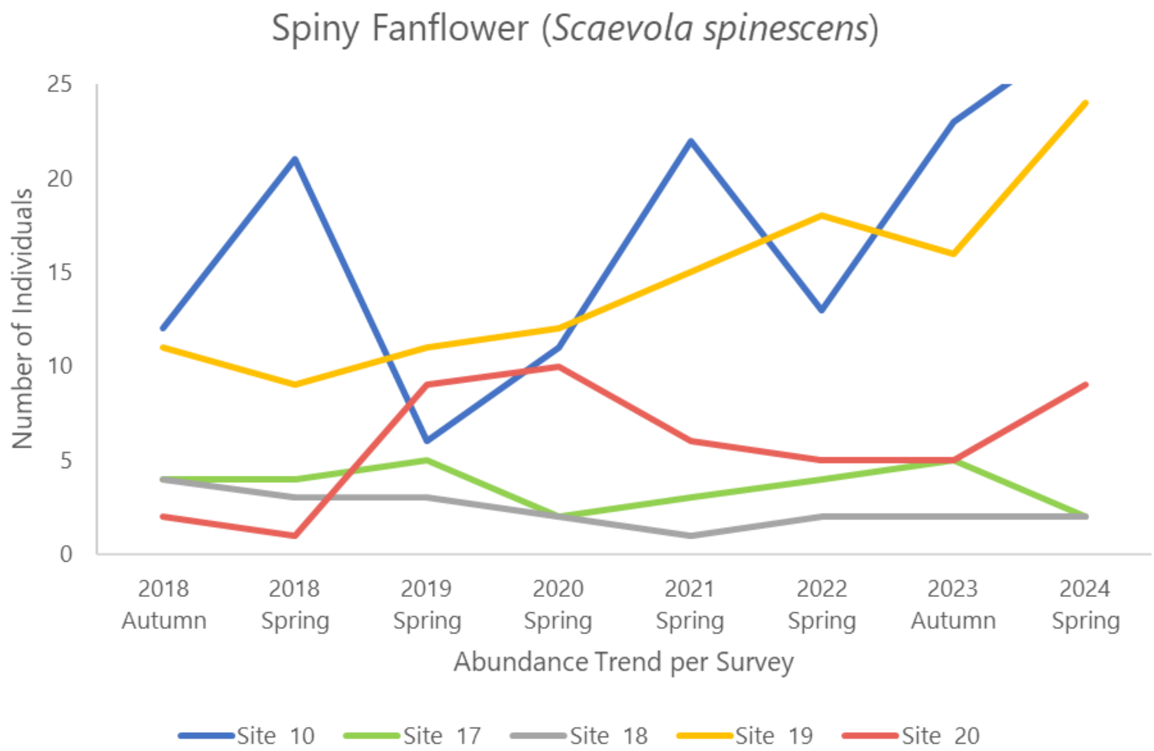

Figure 3.29: Abundance of Spiny Fanflower (adult and juveniles) recorded at Eliza Creek Jessup transects (2018-2024)

Senna sp.

Although recording yearly fluctuations, at each site, there have been no obvious increasing or decreasing trends for Senna species. The 2018 and 2024 populations varied by no more than two individuals at any one site (Figure 3.30). There is no noticeable decline in Senna, which could be attributed to the TSF.

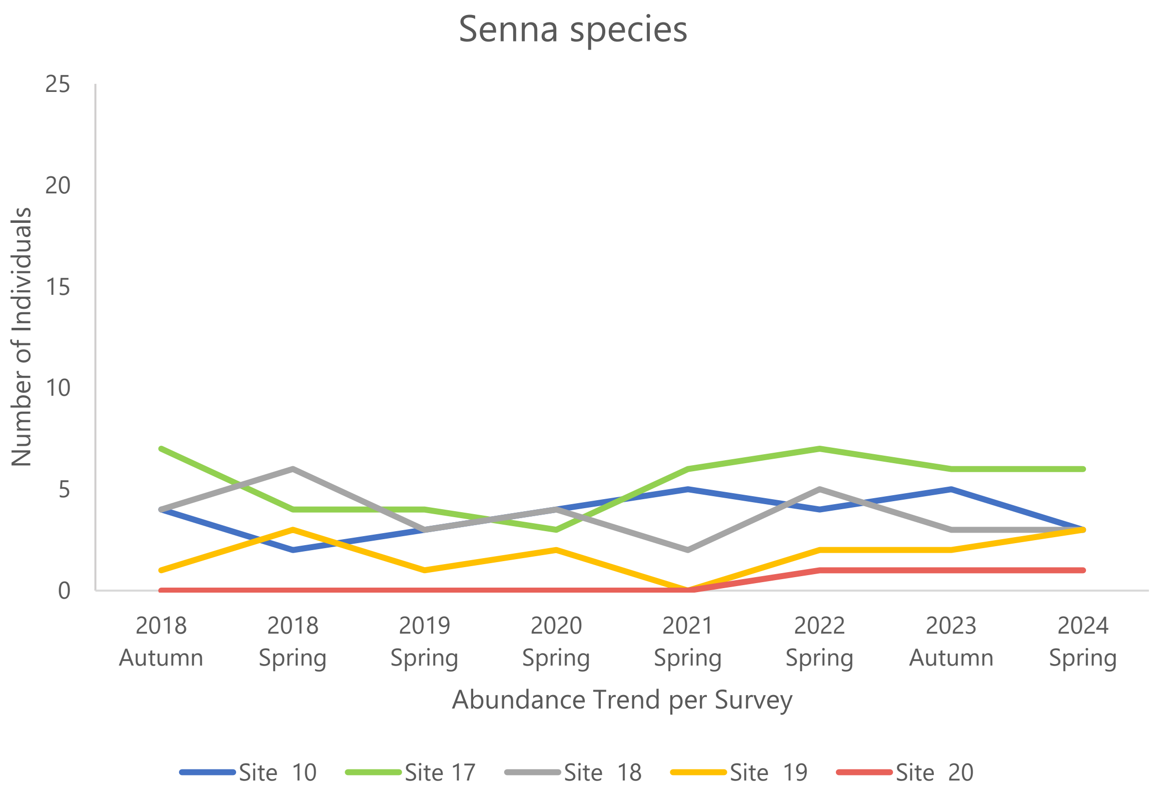

Figure 3.30: Abundance of Senna species (adult and juveniles) recorded along Eliza Creek Jessup transects (2018-2024)

3.2.3 Canopy cover tree health, Eliza Creek

In addition to Jessup transects, tree canopy cover was assessed at transects in the Eliza Creek sites to assess potential impacts on tree health due to seepage from the TSF or reduced water flows down the catchment as a result of the TSF. It is noted that Sites 17 and 18 are Western Myall sites and Sites 19 and 20 are River Red Gum dominant (refer Table 3.13 for approximate distance from TSF). No canopy cover sites were installed in Eliza Creek Site 10 because it was part of the original RAM / Jessup program and is furthest downstream, therefore least likely to demonstrate impacts from the TSF.

3.2.3.1 Canopy cover change

Table 3.13 summarises changes in canopy cover along each transect, since 2018, using two techniques: the densitometer, and visual estimates of individual canopy extent.

Table 3.13: Summary of canopy changes between 2018 to 2024

Transect, landscape position, trees in 2024	New Trees and Tree Death	Number of Foliage Intercepts	Net % Change in # of Foliage Intercepts	Tree Mean Canopy Extent	Net % Change in Mean Canopy Extent
17A, channel (270 m from TSF), WM: 12 live	New trees: 5 Deaths: 0	2018: 25 2024: 27	+8%	2018: 86% 2024: 86%	0
17B, bank (270 m from TSF), WM: 8 live	New trees: 1 Deaths: 0	2018: 17 2024: 16	-6%	2018: 90% 2024: 90%	0
18A, bank (930 m from TSF), WM: 17 live	New trees: 6 Deaths: 1	2018: 13 2024: 32	+146%	2018: 81% 2024: 80%	-1%
18B, channel (930 m from TSF), WM: 5 live	New trees: 1 Deaths: 1	2018: 7 2024: 7	0	2018: 42% 2024: 33%	-21%
19A, channel (3km from TSF), RG: 6 live WM: 8 live	RG New trees: 0 Deaths: 0 WM New trees: 6 Deaths: 0	RG 2018: 26 2024: 28	+8%	RG 2018: 59% 2024: 61%	+3%
19B, channel edge (3 km from TSF), RG: 5 live WM: 6 live, 0 dead	RG New trees: 1 Deaths: 1 WM New trees: 4 Deaths: 0	RG 2018: 16 2024: 12	-25%	RG 2018: 41% 2024: 47%	+15%
20A, channel edge (4.65 km from TSF), RG: 9 live WM: 1 live	RG New trees: 0 Deaths: 0 WM New trees: 0 Deaths: 0	RG 2018: 21 2024: 28	+33%	RG 2018: 39% 2024: 61%	+56%
20B, channel (4.65 km from TSF), RG: 4 live WM: nil	RG New trees: 0 Deaths: 0	RG 2018: 24 2024: 19	-21%	RG 2018: 51% 2024: 78%	+53%

[1]WM = Western Myall (*Acacia papyrocarpa/Acacia sp. Blyth Range*), RG = River Red Gum (*Eucalyptus camaldulensis subsp. arida*)

3.2.3.2 Live foliage estimates (densitometer data)

Comparing the total number of densitometer foliage records along a transect over time provides an indication of changes in total canopy cover along the transect. Potential changes in total canopy cover may be a combination of canopy expansion of individual trees (natural growth, improved canopy health), dieback; and/or recruitment of new trees.

Western Myall (Acacia papyrocarpa/ Acacia sp. Blyth Range)[2]

The total number of Western Myall foliage records for the two transects combined at each site has varied between survey periods, but Sites 17 (Western Myall), 18 (Western Myall) and 19 (River Red Gums and Western Myalls present) have trended strongly upwards (Figure 3.31). The increase in foliage records at each site is largely due to additional trees being recorded along each transect (refer below). At Site 20, there has been only one Western Myall tree intercepted at all recording periods, and the foliage records have been relatively constant. Figure 3.31 shows the sum of Western Myall foliage records for the two transects combined at each site. Figure 3.32 and Figure 3.33 show foliage records for individual transects at Site 17 and Site 18, respectively.

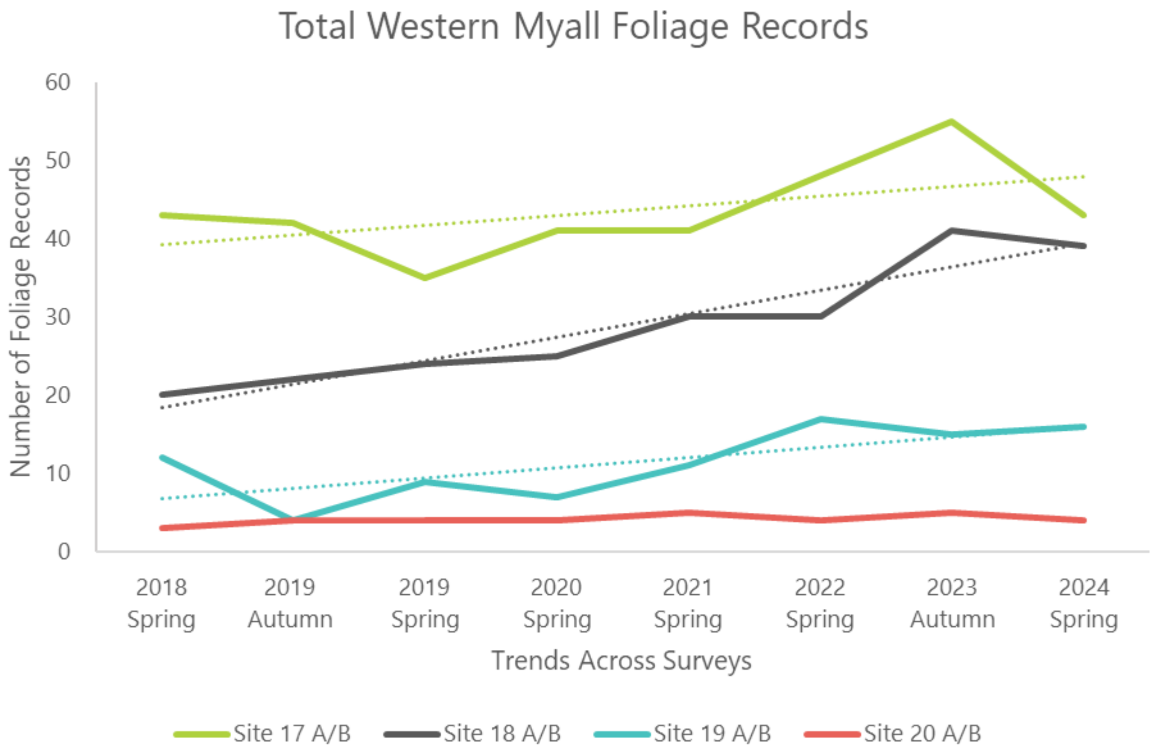

Figure 3.31: Total number of Western Myall foliage records 2018-2024 at each site

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[2] Note that the Western Myalls in the Carrapateena operational area may be *Acacia papyrocarpa* and/or the very similar Acacia sp. Blyth (formerly *Acacia affinity papyrocarpa*). Distinction requires fruiting pods which were absent during surveys

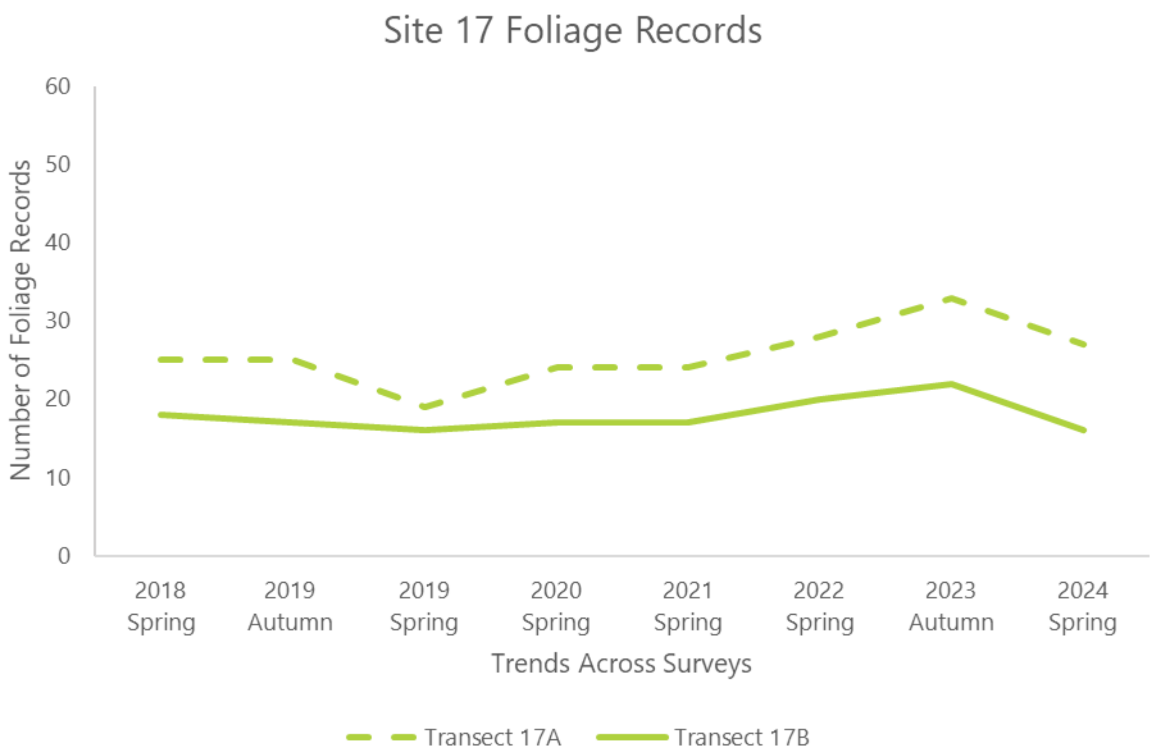

Figure 3.32: Number of Western Myall foliage hits along Site 17 transects (2018 to 2024)

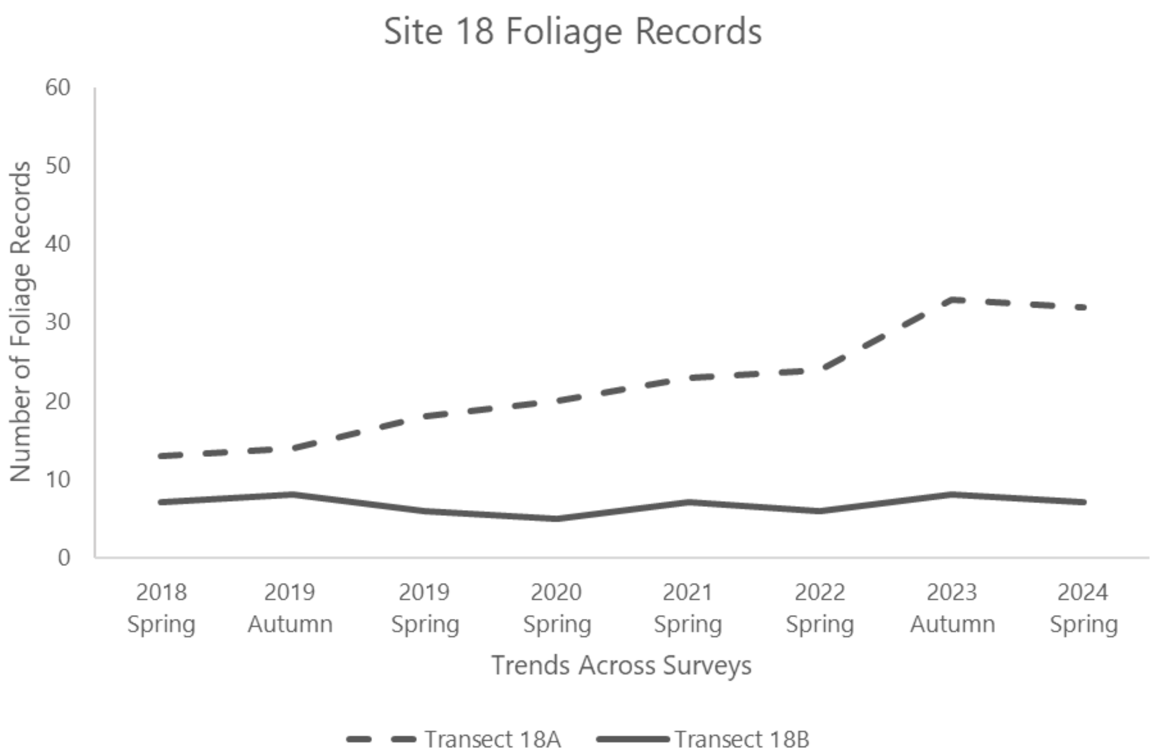

Figure 3.33: Number of Western Myall foliage hits along Site 18 transects (2018 to 2024)

Northern River Red Gum *(Eucalyptus camaldulensis* ssp. *arida)*

The number of foliage records for Sites 19 and 20 (for both transects combined at each site) has fluctuated, often quite markedly, between survey periods. However, there has been no trend apparent at Site 19 (nor for each individual transect at Site 19), and an upward trend in total foliage records at Site 20 (and also for each individual transect at Site 20). At Site 19, the total number of foliage records declined sharply during 2019 to 2021 before recovering between 2022 and 2024, to 2018 levels. Similarly, at Site 20, following declines in canopy foliage in 2019 and 2020, canopy foliage records recovered in 2021 to 2024 to 2018 levels.

Figure 3.33 shows the River Red Gum foliage records for the two transects combined at each site. Figure 3.35 and Figure 3.36 show River Red Gum foliage records for individual transects at Sites 19 and 20, respectively.

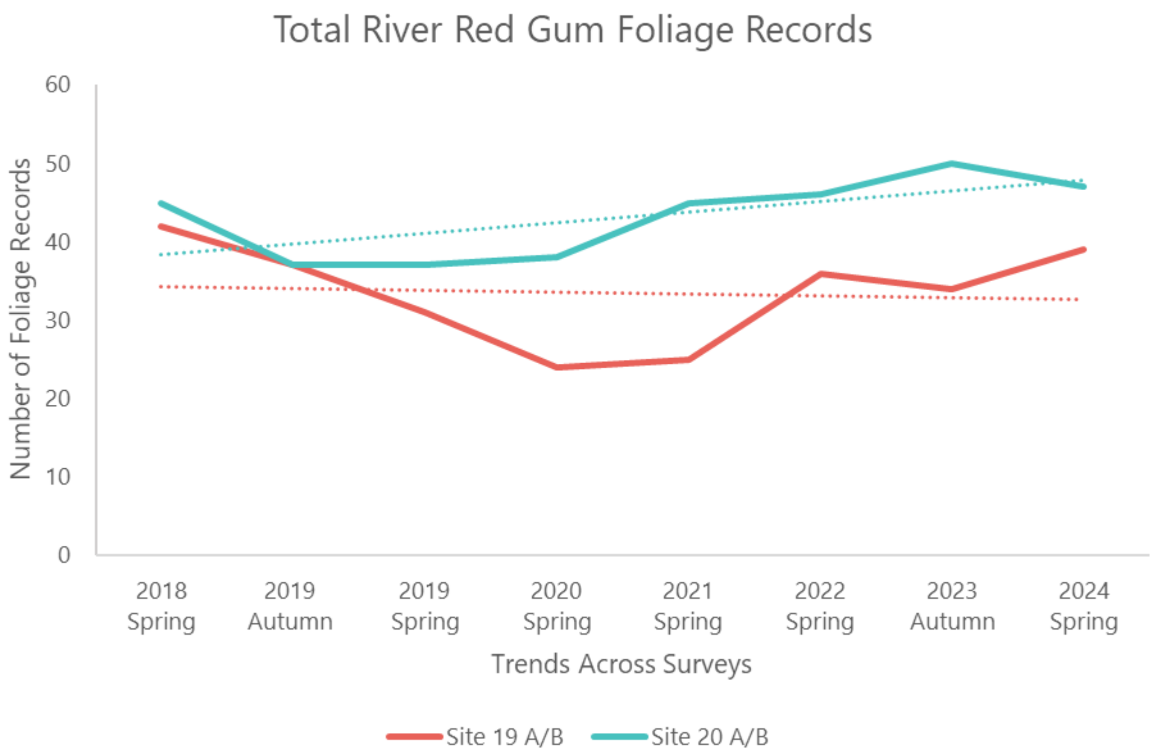

Figure 3.34: Total number of River Red Gum foliage hits for each site (autumn 2018 to spring 2024)

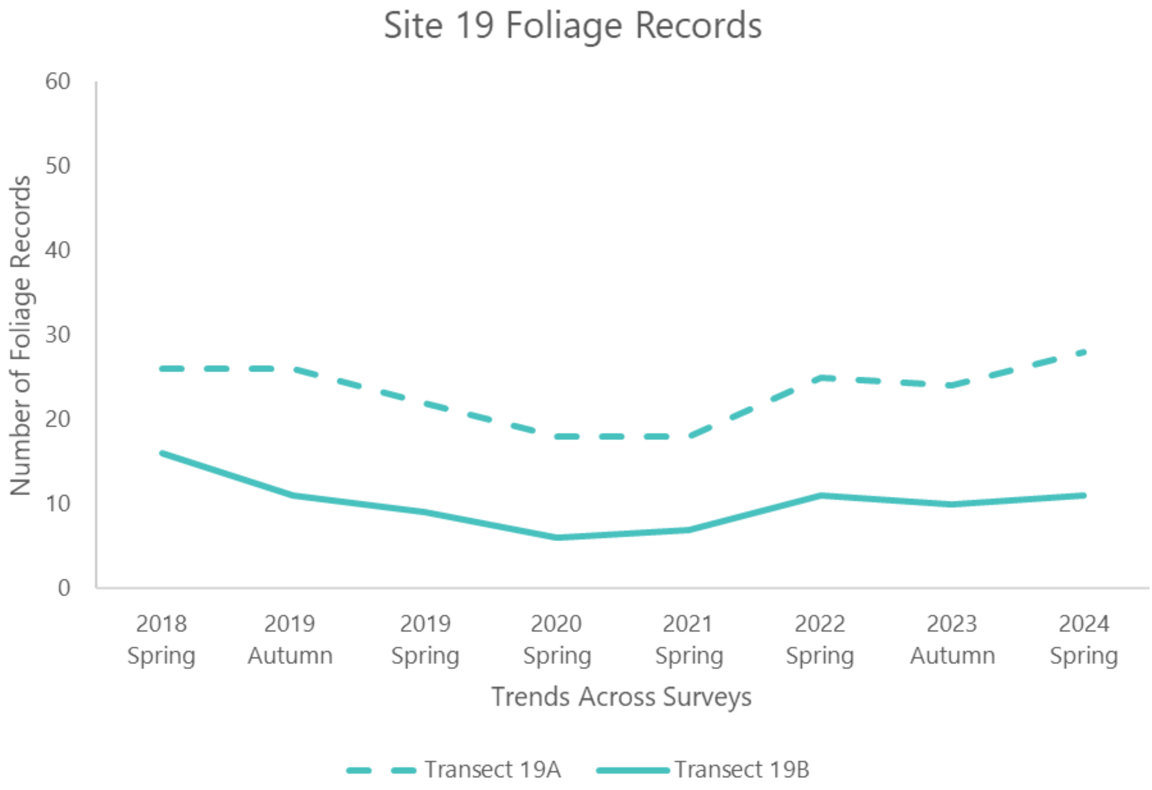

Figure 3.35: Number of River Red Gum foliage hits along Site 19 transects (2018 to 2024)

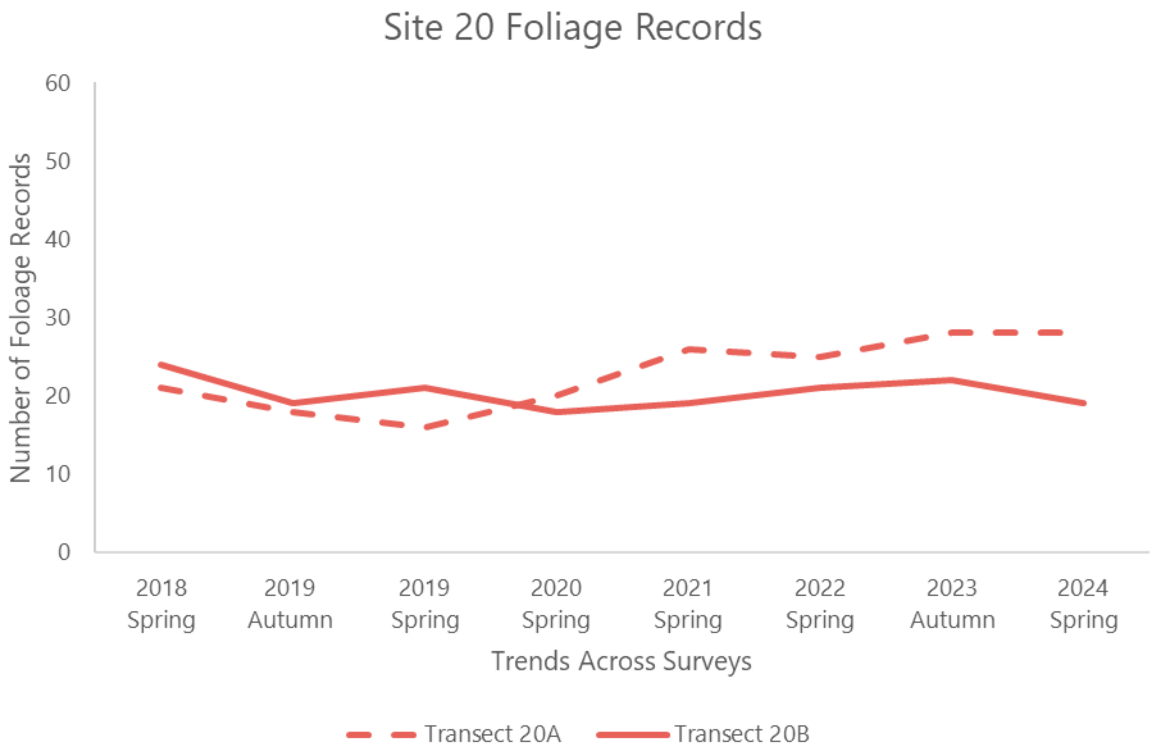

Figure 3.36: Number of River Red Gum foliage hits along Site 20 transects (2018 to 2024)

3.2.3.3 Tree death and new trees

Given the surveyed trees are individually numbered along each transect (initiated in 2019), it is possible to identify: individual tree death, canopy loss resulting in trees no longer being recorded along the alignment, and tree canopies that are intercepted along the alignment for the first time. New trees are recorded as a result of expansion of mature tree canopies onto the transect alignment and/or younger trees that newly meet the survey criteria for densitometer recordings (i.e. minimum plant height of 1 m and intercepting the transect).

Western Myall

In 2024, 4 new Western Myall trees were recorded along the transects (one at Site 17, two at Site 18 and one at Site 19). No tree deaths were recorded (Figure 3.37).

Since 2018, there have been two Western Myall tree deaths and 23 new Western Myall trees recorded along the combined transects. The two deaths both occurred at Site 18. These trees were estimated to have retained less than 10% of their canopy foliage prior to the operation of the TSF (see Jacobs 2020a report for full details). There have been no Western Myall deaths at Sites 17, 19 or 20. The great majority of new trees intercepted along transects have been juveniles that have increased in size, namely whose canopy had expanded to a sufficient degree to be intercepted along the alignment and/or whose height of canopy above the ground met the survey criteria (as above).

The number of existing, new and dead Western Myall trees recorded at each site (transects combined) is shown in Figure 3.37 and Appendix E, respectively, noting that Site 17 is the closest to the TSF.

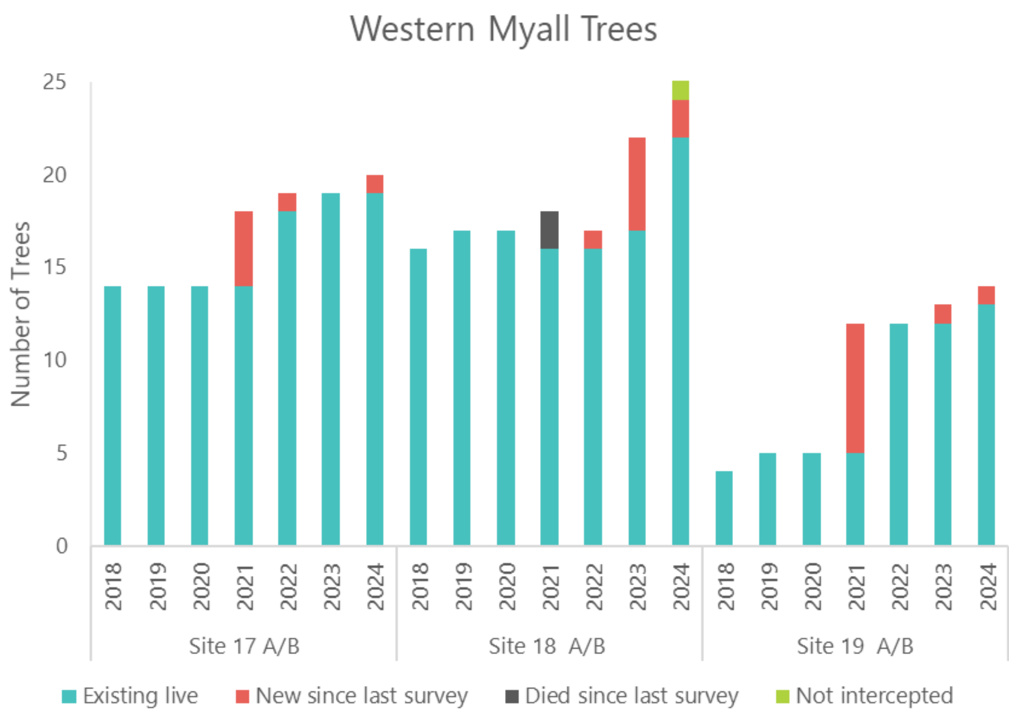

Figure 3.37: Change in Western Myall abundance (new = meets criteria, not intercepted = tree present but not intersecting transect yet)

Site 20 not shown, given only one Western Myall present at all survey periods.

River Red Gums

In 2024 one new Red Gum was recorded (Site 19) and there were no River Red Gum deaths. Since 2018, one River Red Gum has died (at Site 19) and one new tree has been intercepted along the transects (also at Site 19). The dead tree recorded in 2021 at Site 19 had a visually estimated canopy extent of approximately 50% in 2019 and 3% in 2020. Transect 19 is 3,000 m downstream of the TSF.

In 2020, loss of a large branch resulted in one tree not intercepting the transect at CC20. However, by 2022, this tree had regained canopy, resulting in it once again being intercepted along the transect, and recorded in 2022, 2023 and 2024. Figure 3.38 shows the number of live Red Gum trees, deaths and new trees for each survey period since 2018.

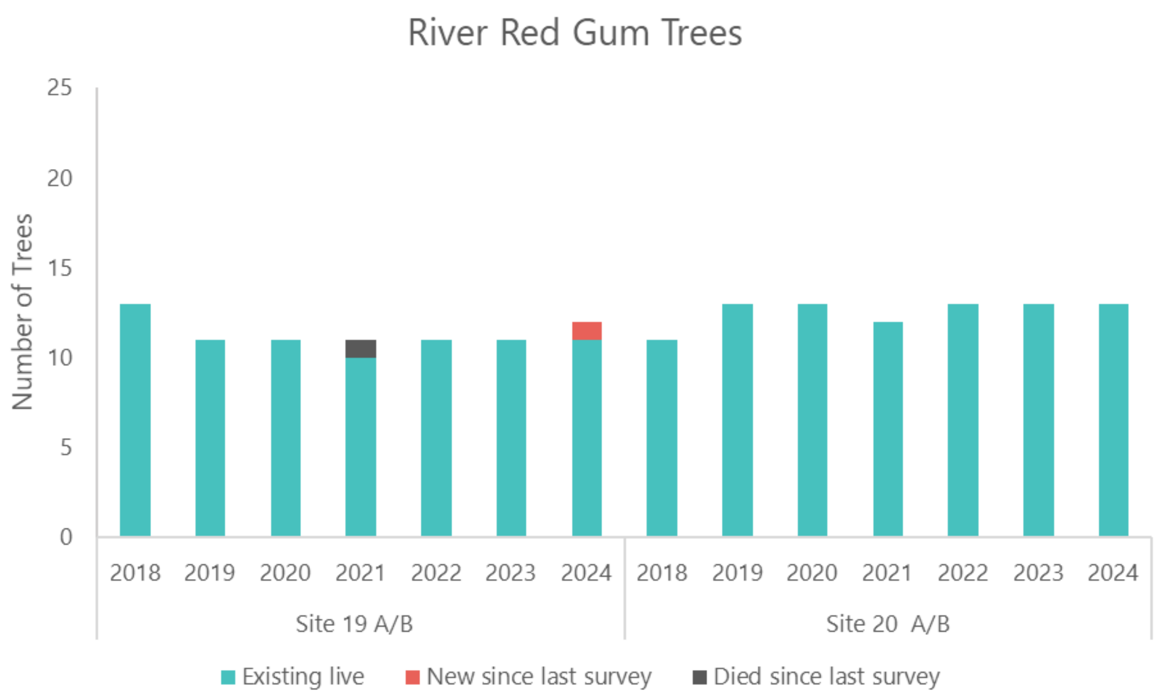

Figure 3.38: Change in River Red Gum abundance (new = met criteria, not intercepted = tree present, but not intersecting transect yet)

3.2.3.4 Visual estimates of canopy intactness

Visual estimates of canopy intactness for individual trees commenced in 2019 as an additional alternate means of estimating overall tree health. Results for all trees are shown in Appendix E. Mean canopy intactness for each transect is shown in Figure 3.39, Figure 3.40, and summarised in Table 3.14 and Table 3.15.

Western Myall

For all transects, there has been no obvious decline in canopy intactness (Figure 3.39). At all transects except 18B and 19B, the majority of Western Myall trees retain almost complete canopies, with canopy intactness estimated at close to 90% or higher (Figure 3.21 and Figure 3.39). This includes both transects at Site 17, which is closest to the TSF (approximately 250 to 350 m downstream).

Mean canopy intactness has remained between 68% and 86% at Transect 19B and has remained stable (from a relatively low base) at Transect 18B. Some variation between survey periods is likely due to observer variation (different observers are likely to differ slightly in their estimates of canopy extent).

Table 3.14: Visual estimates of canopy intactness for Western Myall trees

Transect	Mean % Canopy Intact[1] Western Myall Trees					
	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
17A	86	87	94	90	92	86
17B	90	92	93	91	97	90
18A	81		72	80	89	80
18B	42		18	28	35	33
19A	100	100	96	99	100	97
19B	69	68	75	77	86	79
20A	100	90	77	100	100	70

[1]Visual estimate of canopy extent compared with expected canopy extent for tree in optimum health. No Western Myall on transect 20B.

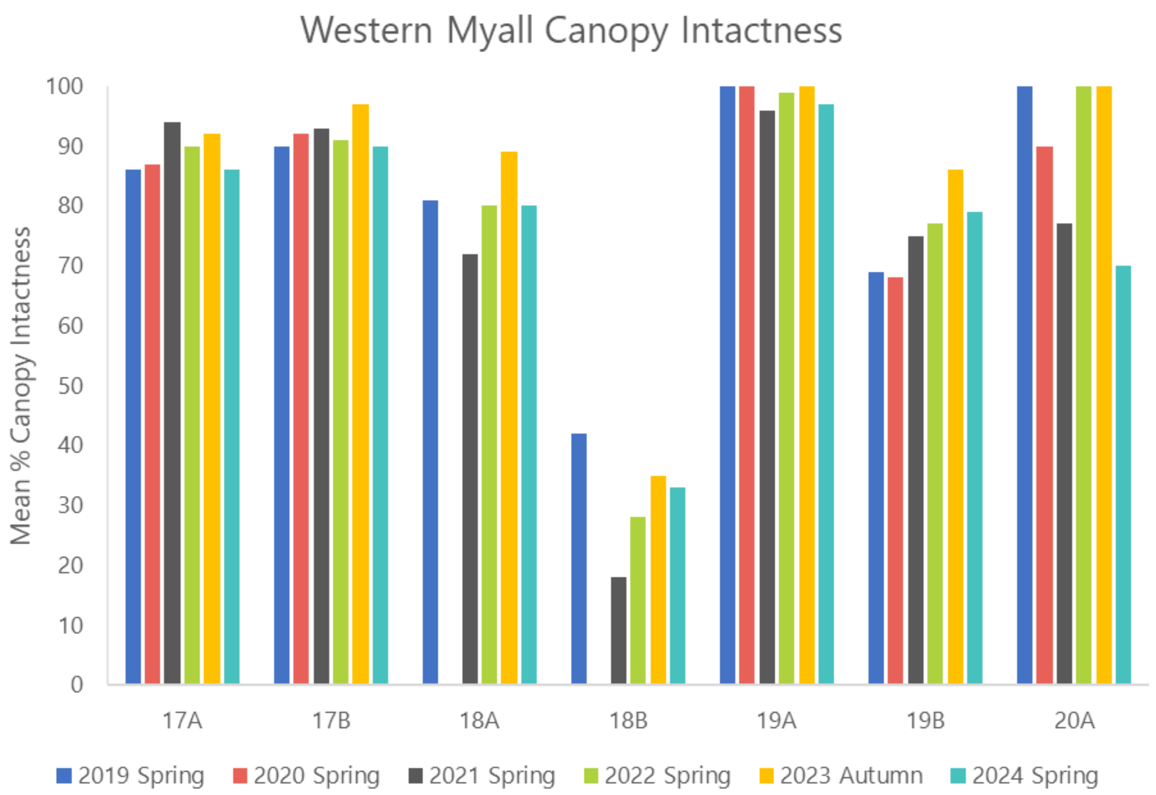

Figure 3.39: Visual estimates of mean canopy intactness for Western Myall trees (2019-2024)

[Canopy intactness not recorded in 2020 for transects 18A and 18B. In the above graph, 2019 values have been used for transects 19A and 18B transects].

River Red Gum

Canopy intactness for all the Red Gum transects fluctuated between survey periods, generally being relatively low until 2021, before 50% to 90% increases in canopy intactness in 2022 and 2023. In 2024, all transects recorded declines in mean canopy intactness of Red Gums but intactness levels were still mid-range for the recording period 2019 to 2024 (Table 3.15, Figure 3.40).

Table 3.15: Visual estimates of canopy intactness for River Red Gum trees

Transect	Mean % Canopy Intact[1] River Red Gum Trees					
	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
19A	70	63	60	72	87	61
19B	54	47	43	42	67	47
20A	49	40	47	80	91	61
20B	63	46	46	75	85	78

[1]Visual estimate of canopy extent compared with expected canopy extent for tree in optimum health

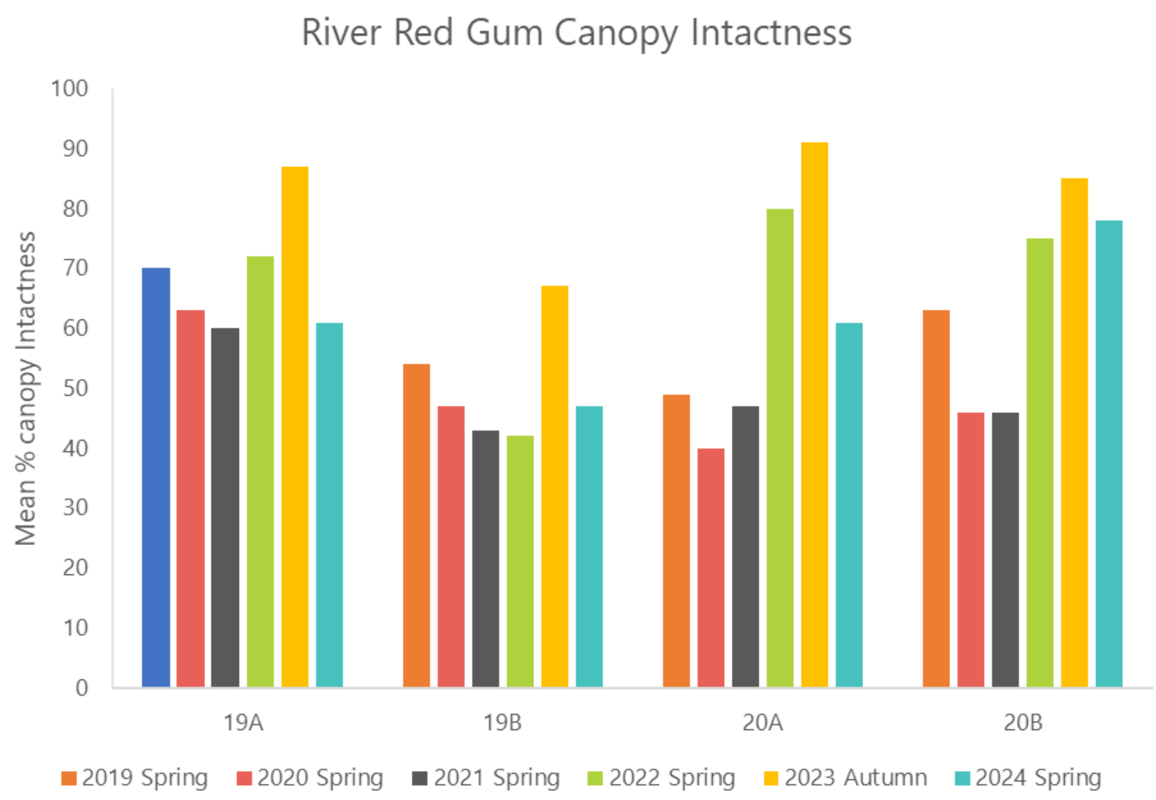

Figure 3.40: Visual estimates of canopy intactness for River Red Gum trees

3.2.4 Weed diversity and abundance

Weeds were surveyed at standard flora sites, designated weed transects, targeted sites (dams and villages), and opportunistically. All weed species recorded during baseline surveys (2012 to 2016) and compliance monitoring (2018 to 2024) are summarised in Appendix G1 and Appendix G2.

Although Dawson Dam, South Eliza Dam, North Eliza Dam and Anzac Dam are outside of existing mineral leases, weed species are documented at these locations to:

- Identify potential sources of new weed infestations into the mineral leases and/or
- Document potential spread of weeds from the mineral leases into dams.

3.2.4.1 New weed species

No new weed species were recorded during the 2024 spring survey.

3.2.4.2 Increase in abundance

Compared with surveys conducted between 2019 and 2023, Smooth Mustard (*Sisymbrium erysimoides*) had increased in abundance in October 2024, particularly on the sand dune flora Site 22. At this site, Smooth Mustard was recorded with a CSR density of 5 for over 50% of the survey area, and CSR 4 over the remainder of the survey area. Previous surveys have recorded the highest CSR cover rating of 4 at this site (and CSR of 2 in 2023). Site 22 is within 200 m of the WAR, hence a designated impact site. At the other dune flora Site, 21, no change in the density of Smooth Mustard was recorded between 2023 and 2024, remaining sparsely distributed but with localised patches of CSR 4. In 2024, Smooth Mustard was also of greater abundance at Dawson Dam and at weed transects CWM05 and CWM06 compared with previous levels. Conversely Smooth Mustard was not recorded in 2024 at RAM Sites 10, 12 and 17 (where it has been previously recorded during operational monitoring).

3.2.4.3 Species recorded at previously unreported locations

Six weed species were recorded in 2024 at previously unreported locations.

Wards Weed (Carrichtera annua)

Two plants were recorded on the northern shoulder of the WAR at the 500 m survey point of weed transect CWM05 (within 25 m of Easting 701080 Northing 6518800). Within the Carrapateena operational area, Wards Weed has only previously been recorded along the SAR; in 2021 an isolated patch was recorded along weed transect CWM01. Wards Weed has not subsequently been recorded along CWM01. The 2024 location of Wards Weed was near the western end of the WAR (approximately 5.5 km from the Stuart Highway), which was constructed/upgraded in 2022, specifically for vehicle access to the Carrapateena Mine site.

Maltese Thistle (Centaurea melitensis)

In 2024, Maltese thistle was recorded for the first time along weed transect CWM01; one plant was located at a culvert along the SAR (Easting 737045 Northing 6517110) and numerous plants were recorded where the Whitata Creek crosses the SAR. Maltese thistle has previously been recorded during baseline and compliance surveys in Eliza Creek and at Dawson Dam.

Mallow (Malva parviflora)

In 2024 a few plants were recorded at North Eliza Dam. This species has previously been recorded at South Eliza Dam, Anzac Dam and ephemeral watercourses along weed transects CWM01 and CWM02.

Smooth Mustard (Sisymbrium erysimoides)

Several plants were recorded at flora Site 20 (Eliza Creek) for the first time in 2024.

Scarlet Pimpernel (Lysimachia arvensis)

A few plants were recorded for the first time at North Eliza Dam. This species has previously been recorded from the Expo Village Effluent Irrigation Area and along weed transects CWM001 (culvert area) and CWM06 (ephemeral drainage line).

Trailing Verbena (Verbena supina)

One plant was recorded at North Eliza Dam for the first time. This species has previously been recorded at Anzac Dam.

Appendix G1 and Appendix G2 contain further details on weed records during baseline and compliance monitoring.

3.2.4.4 Weeds recorded at RAM sites (Control and Impact)

Only three species of weeds were recorded at Rangeland flora sites:

- Maltese Thistle (*Centaurea melitensis*) – small isolated clusters at Eliza Creek Site 20. This species was also recorded at Site 20 in 2020 and 2023.
- Smooth Mustard (*Sisymbrium erysimoides*) - recorded at both dune sites (21 and 22) scattered plants to locally common at Site 21 and widespread and abundant at Site 22. Smooth Mustard has been recorded every year since 2020 at Site 21 and every year since 2019 at Site 22. In 2024 a few plants were also recorded at Eliza Creek Site 20 (refer above).
- Sow Thistle (*Sonchus oleraceus*) – one or two plants were recorded at Eliza Creek Sites 18 and 19. Sow Thistle has been previously recorded as sparsely present at these sites.

These results are very similar to previous surveys during compliance (operational) monitoring (and noting that the dune sites and Eliza Creek sites were not surveyed during baseline monitoring). Maltese Thistle and Smooth Mustard have been consistently recorded at the Eliza Creek and dune sites, respectively, and at similar levels of abundance since 2018. Sow Thistle occurs infrequently and sporadically at RAM sites, and at very low levels of abundance.

3.2.4.5 Northern Wellfields lease area

Within the Northern Wellfield Lease area, operational monitoring sites are weed transects NWM01, NWM02, NWM03, and RAM Sites 1, 2 and 7. These were all surveyed in spring 2024 by Lathwida ecologists, and no weeds were recorded (similarly no weeds were recorded at these sites during annual surveys from 2020 to 2023).

3.2.4.6 Weeds of National Significance

Prickly Pear *(Opuntia species)*

The isolated population of Prickly Pear near the Yeltacowie homestead has been actively managed by poisoning with cochineal since 2021.

A cluster of *Opuntia* was first observed during operational monitoring in 2018 near the Yeltacowie homestead, occurring within an area of approximately 10 m x 10 m (Easting 724000 Northing 6530688 Zone 53). A few plants remain in this cluster, but it has not expanded since 2023.

Athel Pine *(Tamarix aphylla)*

Athel Pine has been recorded as clustered trees around Yeltacowie Homestead and the nearby dam. These trees are being actively controlled with numerous dead trees and/or cut trees. In 2024 it was noted that a few trees remain at the site.

3.2.4.7 Declared Weeds

In addition to being Weeds of National Significance, Prickly Pear and Athel Pine are also Declared species under the Landscape Act 2019. Athel Pine is declared for control within 100 m of a watercourse.

Bathurst Burr (Xanthium spinosum)

In 2024, Bathurst Burr was recorded within the operational area only at previously recorded locations: Dawson Dam, South Eliza Dam, and weed transects CWM01 (including Whittata Creek) and CWM02 both transects adjoining the Southern Access Road. No new populations, and no expansion of existing populations, were recorded.

The population of Bathurst Burr at Dawson Dam remains extensive, and similar to that recorded in 2021, 2022 and 2023. The 20 m wide drainage line adjoining the north-west and north-east aligned dam walls contains patches of densely spaced plants (possibly 1000’s of individuals) over approximately 150 m. The circular depression, approximately 30 m in diameter, and southeast of the dam wall also contained densely spaced plants when observed in October 2024. It is noted that Dawson Dam resides is excluded from ML6471, hence managed by the landholder and management and control is ongoing.

Bathurst Burr has been recorded since 2021 along and near Whittata Creek, which intercepts Weed Transect CWM011. In 2024, approximately 30 seedlings were present in a culvert 130 m north of where Whittata Creek crosses the Southern Access Road. A few seedlings were also recorded where the main channel crosses the Southern Access Road.

Bathurst Burr was recorded along weed transect CWM02 in 2021 and 2023 (approximately 10 plants recorded adjoining the Southern Access Road in the vicinity of South Eliza Creek). In 2024, isolated plants were recorded near a culvert crossing the SAR and near the waters' edge (overflow from the dam). In 2024 the South Eliza Dams were overflowing due to pumping in of waste treatment water. Bathurst Burr was recorded as sparsely present, in the drainage channel south of the main dam wall, and also sparse near the SAR.

3.2.4.8 Other weeds of high environmental threat

Tobacco Bush (**Nicotiana glauca**)

Although not a Declared Weed, an extensive population of Tobacco Bush persists at South Eliza Dam (in the drainage channels behind the dam). Due to is high rate of fruit and seed set, high viability of seeds and successful survival of seedlings, it forms dense stands and has the potential to increase still further in this location.

Couch (**Cynodon dactylon**)

Patches of couch grass were recorded on the banks / floodout area of Whittata Creek, which was surveyed as part of the weed transect CWM01. Couch was recorded as moderately dense patches within an area of approximately 30 m x 10 m, when surveying the 50 m radius of a designated survey point in the weed transect.

3.2.5 Assessment of grazing impacts

An indication of grazing impact at each site was obtained to enable potential mining and/or climate related impacts to be separated from baseline impacts due to grazing. Grazing was first reported on in 2018 when the operation survey area was still being widely grazed by domestic stock. Since 2018, the operation area has been largely destocked. However, ongoing grazing continues at some sites, including the dunes. Although total grazing pressure has been reduced since 2018, ongoing grazing occurs largely through kangaroos and feral animals.

The Rangeland Assessment Method (RAM) (NVC 2024a) provides a single index of grazing impact called the Site Vegetation Utilisation Score (hereafter referred to as the Site Utilisation Score) and is based on a combination of the proportion of a species' population that is grazed (either heavily or severely) and the palatability of that species, and whether juveniles are present. The lower the Site Utilisation Score, the heavier the grazing impact and/or lower regeneration levels. Heavy grazing that has modified the habit of a plant is referred to as Modified impact. Severe grazing results in removal of more than 50% of the leaves and twigs, and impairs the reproductive function of a plant; referred to as Over Utilised impact (Native Vegetation Council 2024). Site utilisation scores were lowest (indicating heaviest grazing) in 2018 and 2019 before increasing in 2020 – 2023 and decreasing slightly in 2024 (Figure 3.41). However, in 2024 Site Utilisation Scores were still well above those of 2018 and 2019. Noting that for 2018-2023 Sites 4 and 6 were classified as Impact sites and swapped to Control sites in 2024.

The heaviest grazing impact (lowest Site Utilisation Scores) was recorded at the sand dune flora sites, and for gibber Sites 2, 6 and 13 (Figure 3.42). Cattle dung was present at the sand dune sites and sheep dung was present at the gibber habitat Sites 6 and 13; a large flock of sheep observed at Site 6 during the survey (18 and 19 October). At Site 2 only seven long-lived perennials were recorded, of which two were heavily grazed grasses, strongly influencing the Site Utilisation Score.

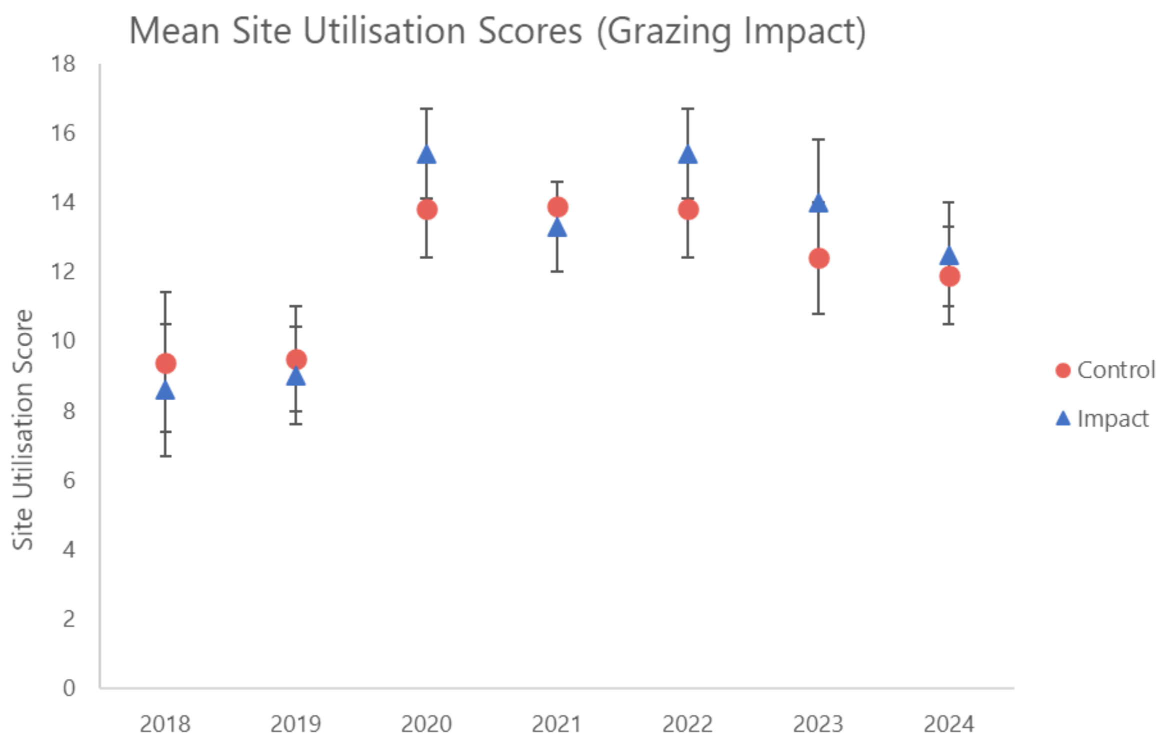

Figure 3.41: Mean site utilisation scores for control and impact sites during compliance monitoring, 2018-2024

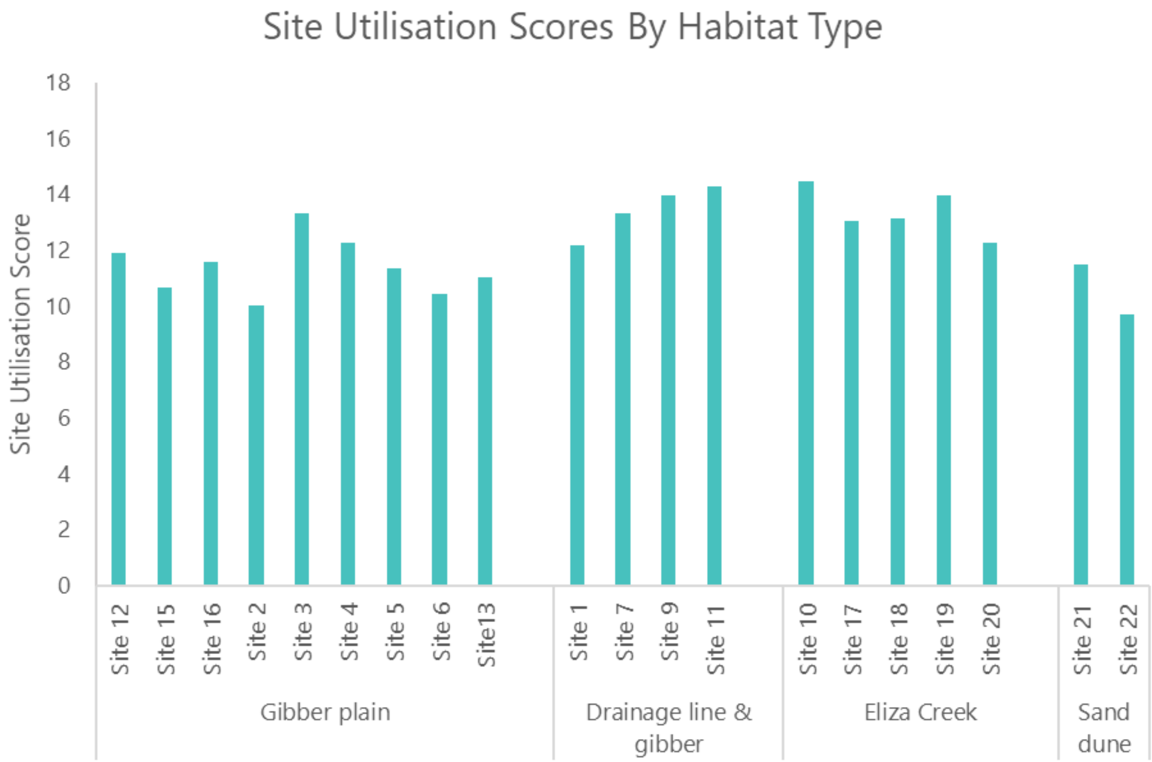

Figure 3.42: Mean site utilisation scores (grazing impact) for each site, grouped by habitat

Table 3.16 lists the species where over-utilised grazing impact was recorded at RAM sites. For the gibber habitat (stony tableland) and creek sites, heavy grazing of > 50% of the population was largely restricted to a relatively few highly palatable species e.g. Spongy-fruit Bluebush (*Maireana spongiocarpa*), Bush Minuria (*Minuria cunninghammii*), Kangaroo Grass (*Themeda triandra*), Bristly Love-grass (*Eragrostis setifolia*) and Twiggy Sida (*Sida intricata*). However, there has been no loss of these species at any site, nor decline in population recorded at Jessup transects and/or as indicated by Crown Separation Ratio estimates of abundance (refer Appendix B for 2024 CSR values). Where domestic stock grazing is absent, grazing of palatable shrubs was much reduced. For example, at Site 3 which adjoins the Processing Plant / car park and main administration areas, all shrubs of the highly palatable, Bush Minuria were ungrazed.

Several species were heavily grazed in the creeklines, but for the majority of species, < 50% of individuals were heavily grazed at a site. The exception was Opposite-leaved Emubush (*Eremophila oppositifolia*), where only a few individuals were present at each of two sites, but numbers were not declining.

At the dune sites, no species were recorded as being over-utilised. Although grazing was considered to have modified some species such as Horse Mulga (*Acacia ramulosa*), grazing had not removed more than 50% of the canopy/stems and the individual plant's regeneration potential was not impacted.

Table 3.16: Species with evidence of grazing impact

Scientific Name	Common Name	# flora sites where recorded	% of flora sites where > 50% of individuals were over-utilised	% of flora sites where any individuals were over-utilised
Astrebla pectinata	Barley Mitchell-grass	8	25	38
Atriplex vesicaria	Bladder Saltbush	16	0	19
Dodonaea lobulata	Lobed-leaf Hop-bush	5	0	20
Eragrostis australasica	Cane-grass	1	100	100
Eragrostis setifolia	Bristly Love-grass	13	23	54
Eremophila oppositifolia ssp. oppositifolia	Opposite-leaved Emubush	2	100	100
Eulalia aurea	Silky Brown-top	4	0	75
Maireana aphylla	Cotton-bush	11	0	9
Maireana appressa	Pale-fruit Bluebush	12	8	8
Maireana astrotricha	Low Bluebush	1	0	100
Maireana spongiocarpa	Spongy-fruit Bluebush	8	13	25
*Maireana turbinata/ Maireana georgei**	Top-fruit Bluebush/ Satiny Bluebush	3	33	67
Minuria cunninghamii	Bush Minuria	13	23	69
Sida intricata	Twiggy Sida	10	0	50

*Identification uncertain due to absence of fruit is some plants

3.2.5.1 Impact versus control site grazing impact

In 2020 and 2022, the mean Site Utilisation Scores for impact sites was significantly higher than for control sites. But for all other survey periods, there has been no significant difference between mean Site Utilisation Scores for impact and control sites (Table 3.17). Noting that Site 4 and 6 were designated as Impact sites from baseline to 2023 and swapped to Control sites in 2024.

Table 3.17: Site Utilisation Scores* (grazing intensity) for each flora site

Type	Landform	Site	2018	2019	2020	2021	2022	2023	2024
Control	Gibber Plain	2	7.3	8.2	15.8	14.6	15.8	14.79	9.9
	Gibber Plain	4							12.3
	Gibber Plain	6							10.25
	Gibber Plain	13	11.4	11.4	14	14.3	14	12.42	10.58
	Drainage Line & Gibber	1	10.5	9.6	12	12.7	12	11.45	12.89
	Drainage Line & Gibber	7	11.5	11	13.5	14.5	13.5	11.64	13.06
	Drainage Line & Gibber	9	8.3	8.1	12.5	14	12.5	13.66	13.97
	Sand Dune	21	7.2	8.4	14.9	13.4	14.9	10.3	11.5
Control		**Mean**	**9.4**	**9.5**	**13.8**	**13.9**	**13.8**	**12.4**	**11.9**
		St Dev	**2**	**1.5**	**1.4**	**0.7**	**1.4**	**1.6**	**1.4**
Impact	Gibber Plain	4	9.5	8.7	16.6	11.7	16.6	13.5	
	Gibber Plain	6	7.2	8.9	14.5	14.4	14.5	14	
	Eliza Creek	10	9.6	8.9	15.8	13.3	15.8	14.34	14.33
	Eliza Creek	17	8.7	9.3	16.7	10.8	16.7	14.45	13.15
	Eliza Creek	18	9.6	9.3	16.5	12.1	16.5	15.76	13.16
	Eliza Creek	19	12.8	12.6	16.8	13.9	16.8	14.19	13.96
	Eliza Creek	20	10.1	9.9	15.4	12.4	15.4	15.52	12.48
	Gibber	12	7.5	7.5	14.6	14	14.6	13.25	11.89
	Gibber	15	9.4	9.1	15	14	15	12.15	10.65
	Gibber	16	9.8	10.7	15.6	16	15.6	16.56	11.49
	Gibber Plain	3	5	7	17.6	14.1	17.6	15.9	13.34
	Gibber Plain	5	6.7	7.8	12.9	12.8	12.9	13.75	11.18
	Drainage Line & Gibber	11	7.3	8.2	13.6	13.7	13.6	12.49	14.11
	Sand Dune	22	7.8	7.7	14.6	12.9	14.6	9.5	9.72
Impact		**Mean**	**8.6**	**9.0**	**15.4**	**13.3**	**15.4**	**14.0**	**12.5**
		St Dev	**1.9**	**1.4**	**1.3**	**1.3**	**1.3**	**1.8**	**1.5**
		t-test p value[2]	**0.47**	**0.52**	**0.04**	**0.19**	**0.04**	**0.08**	**0.34**

[1] Based on the sum of all Utilisation Scores for individual species – which incorporates grazing intensity and presence of regeneration, scores rounded to one decimal point

[2] Two-tailed T-test assuming equal variances comparing control means and impact means. Values greater than 0.05 indicate not significantly different.

Given the widespread destocking of Rangeland sites, grazing is not considered to be causing loss of abundance of species (compared to baseline levels). This is supported by Jessup results (refer Section 3.2.2) that indicated a widespread increased abundance of widespread palatable species (e.g. *Atriplex vesicaria,* including an increase in abundance of juveniles.

3.2.6 Landscape Function Analysis

The following provides a summary of changes in key parameters – plant density and diversity for Landscape Function Analysis transects. Each LFA site comprised 2 transects, each 50 m long. Photos taken at the start and end of each transect are contained in Appendix A.

3.2.6.1 Site 1: Aerodrome (LFAAL1)

Aerodrome transect 1A: LFA established method

Transect 1A comprised two zones, namely one patch type 'vegetation' and one interpatch 'rocky/ soil'. In 2024, Transect 1A continued to show increases in vegetative cover with an increase in the width of vegetation patches, and the continued emergence of long-lived plant species.

The proportion of transect occupied by patches in 2024 was very similar to 2023 but the width of patches increased by approximately 50%. Vegetation patches comprised 21% of the linear transect in 2022, 29% in 2023 and 30% in 2024 (the remainder being rocky inter patch). The mean patch width increased from 73 cm in 2022 to 135 cm in 2023 to 198 cm in 2024. The number of intercepted plants that were long-lived perennials had increased from 2 plants in 2022, 3 plants in 2023, to 7 plants in 2024. In 2024 long-lived perennial plants comprised 23% of all plants recorded along the transect. The long-lived plant species present in 2024 were: Samphire (*Tecticornia medullosa*) and Bladder Saltbush (*Atriplex vesicaria*), the dominant species in the adjoining non-cleared vegetation, as well as Plains Lantern Bush (*Abutilon halophilum*). The majority of vegetation patches were Salt Sclerolaena, (*Sclerolaena ventricosa*), a prominent component of the Bladder Saltbush community is this region. The first 15 m of the transect, however, remained devoid of vegetation (Plate 3.1). Species recorded along LFA linear transects are shown in Table 3.18.

Plate 3.1: Aerodrome transect 1A showing re-establishment of vegetation largely concentrated in the second half of the transect

Aerodrome transect 1A: PCQ method

Due to the high number of vegetation patches recorded along the transect, and notable changes being detected by the LFA method, the PCQ was no longer considered a necessary supplementary method to show yearly changes.

Aerodrome transect 1B: LFA established method

Transect 1B also comprised two zones, namely one patch type 'vegetation' and one interpatch 'rocky/ soil'. In 2024, there were continued increases in the percentage of the transect comprised of vegetation patches and the number of patches intercepted along the transect (Plate 3.2). The number of patches had increased from 7 patches in 2021 to 19 patches in 2024. Mean patch width was 117 cm in 2022, 47 cm in 2023 and 86 cm in 2024. Up to 2023, patches comprised only short-lived perennials (mainly *Sclerolaena* species and *Atriplex holocarpa*). However, in 2024, two long-lived perennial species were in patches that intercepted the transect in addition to nine short-lived perennial species (Table 3.18).

Aerodrome transect 1B: PCQ method

As with Transect 1A, due to the increased number of vegetation patches and notable changes being detected by the LFA method, the PCQ was no longer considered a necessary supplementary method to show yearly changes.

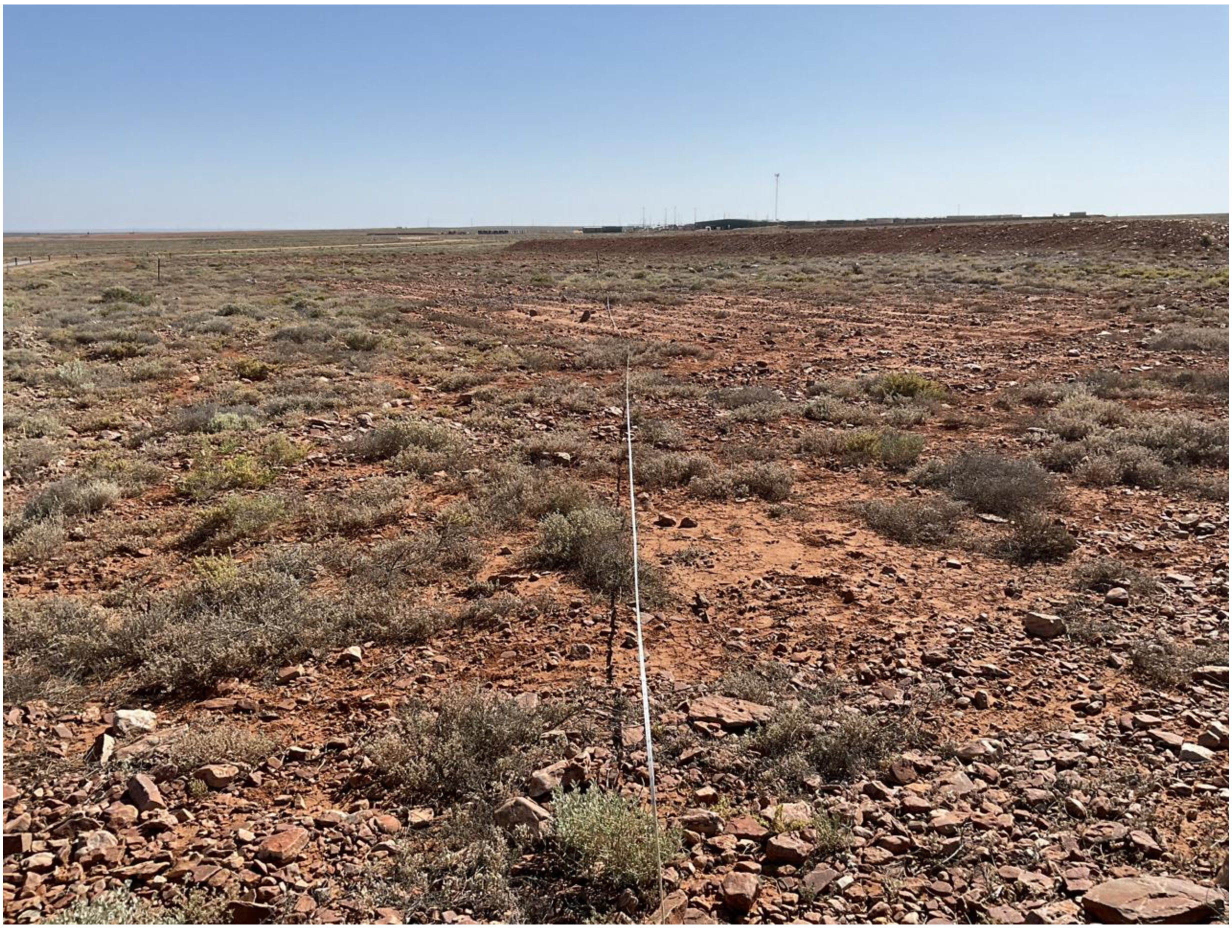

Plate 3.2: Aerodrome transect 1B. From 0 m at start, facing the end. Moderately dense vegetation covers much of the first half of the transect

3.2.6.2 Site 2: Ventia (LFAVOL2)

Ventia transect 2A

This transect was decommissioned in 2024 due to approximately half of the transect being recently graded and used as a temporary laydown area for construction/widening of the adjoining road (Plate 3.3). In October 2024, no plants were present along the entire transect alignment and less than 10 plants were present within 10 m of the alignment. In 2023, nine patches represented by only short-lived perennials, intercepted the transect, hence re-establishment of vegetation at this site had been sparse.

Plate 3.3: Ventia transect 2A. The majority of the transect has been recently graded and no vegetation remains along the alignment

Ventia transect 2B: LFA established method

Transect 2B comprised two zones, namely one patch type 'vegetation' and one interpatch 'rocky/ soil'. The number of vegetation patches increased from no patches in 2021 to 5 patches in 2023. However, in 2024 only one patch was intercepted along the transect – the short-lived species Pop Saltbush (*Atriplex holocarpa*) (Plate 3.4). The percentage of transect comprised of vegetation patches showed a corresponding decline from 1.3% of the linear transect in 2023 to just 0.8% in 2024.

Ventia transect 2B: PCQ method

In 2024, the PCQ recorded only short-lived perennials (no long-lived perennials), and in particular Pop Saltbush (*Atriplex holocarpa*). As with the LFA results the PCQ data also recorded a decline in plant density with the mean distance between plants increasing from 2.3 m in 2023 to 2.46 m in 2024. The 2024 density, however, was an increase on the 2020 and 2021 plant densities of 5.3 m and 5.2 m respectively. Similarly, the mean number of plants per m^2 showed a net increase since 2020 (0.03 to 0.16), but a slight decline between 2022 (0.18 plants per m^2).

In 2024 Pop Saltbush was the most common species recorded, representing a shift from previous years where the slightly longer-lived Salt Bindyi (*Sclerolaena ventricosa*) was dominant.

Plate 3.4: Ventia transect 2B: Only one vegetation patch was intercepted along the transect

3.2.6.3 Site 3: Midway Quarry (LFAQUA3)

Midway Quarry Transects 3A and 3B: LFA established method

Transects 3A and 3B are located adjacent each other on relatively flat deeply ripped ground and both comprised two zones, namely one patch type 'vegetation' and one interpatch 'rocky/ soil'.

In 2022, the sites were assessed using the LFA Bank and Trough Method whereby the trough created by ripping is equivalent to a patch (e.g. collects deposited materials and nutrients to encourage recruitment). The deep-ripped troughs comprised the majority of the transects in 2022 (72% for 3A and 60% for 3B). By 2023, however, the troughs had eroded and were no longer deep enough to be considered effective patches (Plate 3.5 and Plate 3.6), and both transects were assessed using the established LFA method. It is noted that a dense patch was also observed just off transect 3A (Plate 3.7).

Between 2023 and 2024, the LFA recorded an increase in both density and size of plant patches. Three patches were recorded along Transect A, compared with no patches in 2023. The 3 patches were all short-lived perennials and occupied 2% of the linear transect. In 2024, 8 patches were recorded comprising 4.4% of the linear transect, compared with 4 patches comprising 1.1% of the transect in 2023. Mean patch width also increased from 28 cm in 2023 to 43 cm in 2024.

Midway Quarry transects 3A and 3B: PCQ method

In 2022 the PCQ method was not conducted due to the transect and adjoining 10 m being devoid of plants. By May 2023, however, plants were recorded in most PCQ quadrats. The PCQ method was also conducted in 2024. Plant density increased between 2023 and 2024. Along transect A, the mean distance between plants decreased from 4.1 m in 2023 to 3.0 m in 2024 (mean number of plants increased from 0.06 plants per m2 to 0.11 plants per m^2). Transect B recorded an even greater increase in plant density. The mean distance between plants decreased from 2.9 m in 2023 to 1.4 m in 2024 (mean number of plants increased from 0.12 plants per m^2 to 0.51 plants per m^2).

Plate 3.5: Midway Quarry transect 3A from start (0 m) facing end. Most re-establishment of short-lived perennials has occurred near the start of the transect.

Plate 3.6: Midway quarry transect 3B, the contours have levelled out, now < 10 cm deep and plants have sparsely revegetated. Although still sparse, plant density is notably denser than in 2023

Plate 3.7: Dense patch of vegetation just off Midway Quarry transect 3A

3.2.6.4 Site 4: Tjungu to WAR (LFATJU4)

Tjungu transects 4A and 4B: LFA established method

Transects 4A and 4B are in one linear alignment sloping toward a minor drainage line. Due to the deep troughs and almost complete absence of plants, in 2022 the sites were assessed using the LFA Bank and Trough Method whereby the trough is equivalent to a patch (e.g. collects deposited materials and nutrients to encourage recruitment). In 2022, the troughs (patches) comprised 64% and 61% for transects 4A and 4B, respectively.

However, between spring 2022 and autumn 2023, there had been prolific plant establishment along both transects and were assessed using the established LFA method. Both transects comprised two zones, namely one patch type 'vegetation' and one interpatch 'rocky/ soil'.

Transects A and B comprised similar plant densities. In 2024, transect 4A rand 4B recorded 37 vegetation patches and 33 patches, respectively; both representing increases from 2023 when 26 patches and 28 patches were recorded. Vegetation patches comprised 23% of Transect 4A and 33% of Transect B, also representing an increase form 15% and 16% of Transects A and B in 2023. Mean patch width increased from 43 cm in 2023 to 78 cm in 2024 for Transect A, and from 42 cm to 70 cm for Transect B.

Long-lived perennial species comprised 24% of plant records recorded along Transect A, including eight records of Bladder Saltbush (*Atriplex vesicaria*), the dominant species of the reference vegetation type. Long-lived perennials comprised 22% of Transect B including 10 records of Bladder Saltbush.

Tjungu transects 4A and 4B: PCQ method

Due to the high number of vegetation patches recorded along the transects in 2023 and 2024, notable changes between survey periods were detected using the LFA method. Hence, in 2024 the PCQ was no longer considered a necessary supplementary method to show changes and was not conducted at the Tjungu to WAR site.

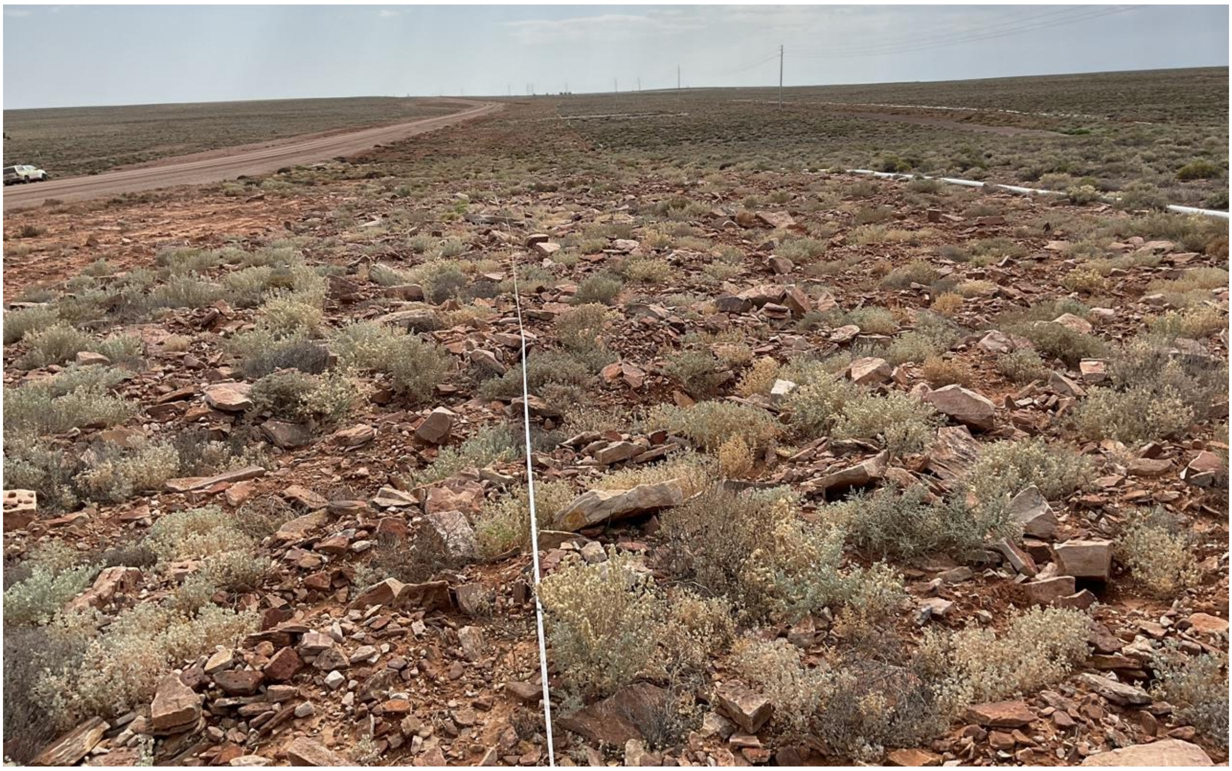

Plate 3.8: Tjungu transect 4A: From start at 0 m facing end. Large and abundant surface rock is present due to the deep ripping and vegetation is densely spaced

Plate 3.9: Transect 4A close up showing densely spaced vegetation in rip lines

Plate 3.10: Tjungu t transect 4B from start (0m). Densely spaced vegetation. Plant diversity comparable with adjoining non-cleared vegetation

Emergence of species used in hand-seeding at Tjungu LFA sites

Following deep-ripping of the area in 2022, the following species were hand-seeded at site LFATJU4 (Transect 4A and 4B) Pop Saltbush (*Atriplex holocarpa*), a Saltbush (*Atriplex lindleyi*), Lagoon Saltbush (*Atriplex suberecta*) Sandhill Saltbush (*Atriplex velutinella*), Bladder Saltbush (*Atriplex vesicaria*), Grey Bluebush (*Maireana appressa*), Fleshy Bluebush (*Maireana erioclada*), Black Bluebush (*Maireana pyramidata*), Nitrebush (*Nitraria billardierei*), Thorny Saltbush (*Rhagodia spinescens*), Desert Cassia (*Senna artemisioides*) and Shrubby Twinleaf (*Roepera aurantiacum*).

Of these species only Pop Saltbush and Bladder Saltbush were recorded during the LFA and/or PCQ surveys in 2023 and 2024. Species recorded along LFA linear transects are shown in Table 3.18.

Table 3.18: Species recorded along LFA transects 2024

Species	Number of patches species was recorded in along each transect						
	1A	1B	2B	3A	3B	4A	4B
Short-lived Perennials							
Atriplex holocarpa	1	1	1	2	8	26	14
Cullen cinereum		1					
Dissocarpus biflorus		6					
Dissocarpus paradoxus	1	1				1	
Enneapogon avenaceus		1					
Panicum decompositum		1					
Salsola australis						2	
Sclerolaena brachyptera		2					
Sclerolaena divaricata	2	3				1	3
Sclerolaena ventricosa	19	16		1		3	10
Sclerolanea intricata						1	9
Long-lived Perennials							
Tecticornia medullosa	3	2				1	
Atriplex vesicaria	3	3				8	10
Abutilon halophilum	1					1	
Maireana spongiocarpa						1	
Short-lived total number of patches	23	32	1	3	8	34	36
Short-lived patches as % of total	77	86	100	100	100	76	78
Long-lived total number of patches	7	5	0	0	0	11	10
Long-lived patches as % of total	23	14	0	0	0	24	22
Total number of patches	30	37	1	3	8	45	46

3.2.6.5 Indices of Rehabilitation Success

Results for 2019 when the Bank and Trough Method was used are detailed in Jacobs (2023h). As discussed above, the Bank and Trough method was used immediately following ripping of the sites and prior to plants re-establishing. In 2019, the sites were a combination of troughs and rock/soil inter-troughs with no plants present.

The following results compare data at the rehabilitation sites, surveyed using the LFA Established Method (2020 to present) with 'analogue' (reference) sites that were also surveyed using the LFA Established Method. Six analogue sites were surveyed prior to the compliance/operational period (by EBS Ecology). The LFA indices reviewed below are:

- Plant density, the mean number of plants per $10m^2$;
- The Landscape Organisation Index, which is the total length of patches/length of the transect. This is considered a key parameter as it encapsulates vegetation cover. Patch density (mean number of patches per $10m^2$) and total patch area are also presented below; and

- LFA Surface Soil Assessment, where the three indices derived from the Surface Soil Assessment are stability, infiltration and nutrients.

Plant density

Plant density at both the Tjungu and Aerodrome sites has exceeded the analogue mean since 2022 (Aerodrome site) and since 2023 (Tjungu site) (Figure 3.43). Plant density at the Aerodrome Site has increased only slightly since 2022. Plant density at the Tjungu site increased from no plants present in 2022 to well above the analogue mean in 2023 and further increasing almost 50% in 2024. At the Aerodrome site, most re-establishment to date occurred between 2021 and 2022, with a slight decline recorded in 2023. This reflects the majority of re-establishment to date comprises short-lived perennial species, and hence there will be year to year fluctuations, but with an expected long term trend of increasing plant matter. At the Midway Quarry Site 3, plant density has increased slowly since 2024 but remains sparse at just over 1 plant per $10m^2$ compared with the analogue mean of 3 plants per $10m^2$. At Ventia, only one transect was still active, and only one plant was present along the transect.

The Landscape Organisation Index for the Tjungu to WAR site and the Midway Quarry site have also increased since the sites were established. In 2024 the Landscape Organisation Index reached the analogue range of values (but still remains below the analogue mean (Figure 3.43). However, the Landscape Organisation Index remains very low for the Ventia site and the Aerodrome site.

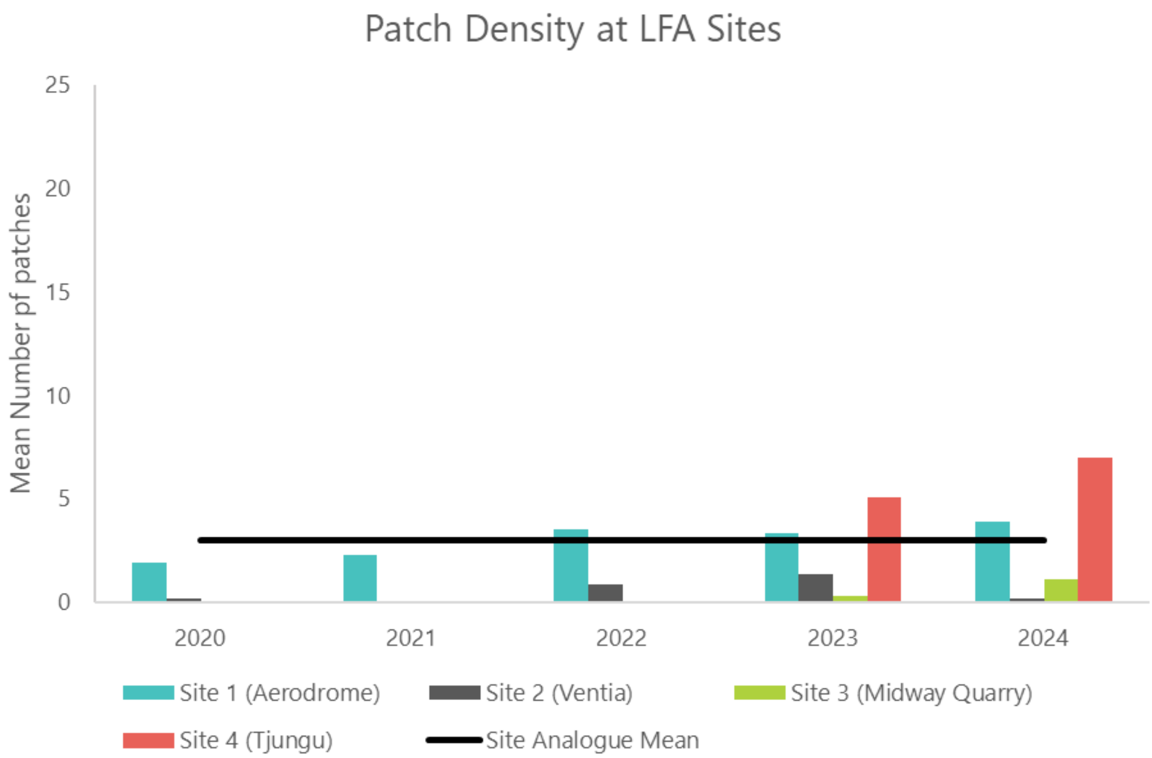

Figure 3.43: Plant density, mean number of patches (transect average for site) based on LFA Established Method 2020 to 2024.

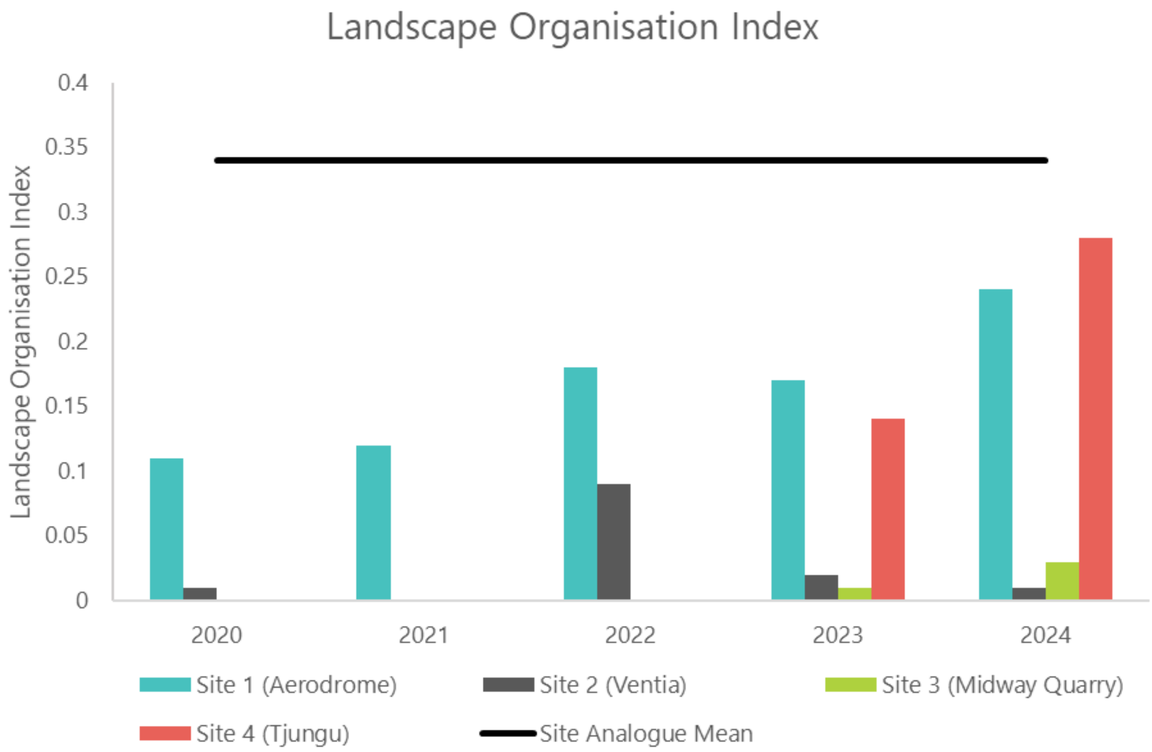

Figure 3.44: Mean Landscape Organisation Index (transect average for site) based on LFA Established Method 2020 to 2024.

Soil stability

Soil stability index is derived from the following parameters scored in the field: soil cover, litter cover, cryptogram cover, crust broken-ness, erosion, deposited materials, surface resistance to disturbance and slake test.

Soil stability scores decreased between 2023 and 2024, and were slightly below the analogue mean (Figure 3.45, Table 3.19). This is because for most sites, a cryptogram cover has not yet developed and materials are not obviously coming into the sites. Leaf litter is still largely confined to beneath the canopy of each plant.

Soil infiltration

The soil infiltration is derived from the following parameters scored in the field: vegetation cover, litter cover, surface roughness, surface resistance to disturbance, slake test and soil texture. For the Aerodrome Site LFAAL1 the soil infiltration has remained very similar since 2021, and very close to the analogue mean value (Figure 3.46). At the Ventia and Midway Quarry LFA Sites, the soil infiltration index has declined (Table 3.19). This is likely due to the evening out of troughs reducing soil roughness, while vegetation and litter cover remaining low. Soil infiltration values at Tjungu have fluctuated since 2022, but in 2024 were approaching the analogue mean value.

Nutrient cycling

The nutrient cycling index is derived from the following parameters scored in the field: vegetation cover, litter cover, cryptogram cover and surface roughness. The results show that the Aerodrome Site has scored close to the analogue mean since 2021, albeit slightly declining in 2023 and 2024 (Figure 5). Results for the other three LFA Sites remain below the analogue mean and have been variable between survey periods. Sites 2 (Ventia) and 3 (Midway Quarry) recorded the lowest nutrient cycling indices, reflecting that these sites have the lowest vegetation cover, litter cover, cryptogram cover and surface roughness.

Table 3.19: LFA Surface Soil Indices[1]

Year	Sites									
	Aerodrome		Ventia	Midway Quarry		Tjungu		Analogue		
	1A	1B	2B	3A	3B	4A	4B	Mean	Std Dev Upper	Std Dev Lower
Soil Stability										
2020	38	45	50					46	67	26
2021	46	43	43							
2022	45	45	45	40	41	36	37			
2023	42	39	41	47	47	45	46			
2024	41	38	38	38	37	36	41			
Soil Infiltration										
2020	19	18	16					29	43	15
2021	23	34	27							
2022	24	31	26	32	29	38	38			
2023	33	27	24	20	20	22	22			
2024	30	29	15	16	17	27	28			
Soil Nutrient Cycling										
2020	14	14	12					19	27	10
2021	18	19	16							
2022	20	26	15	14	14	17	16			
2023	26	16	9	9	9	15	15			
2024	20	17	9	12	12	15	16			

[1]Higher indices (percentages), reflect better landscape function

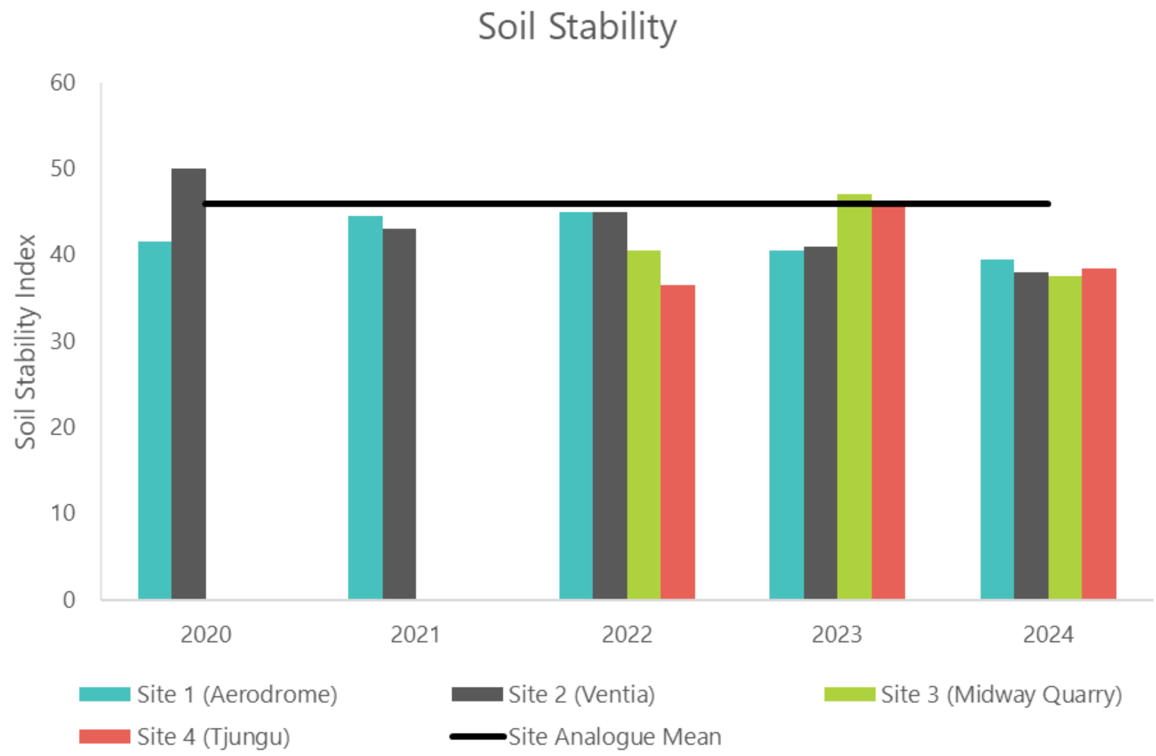

Figure 3.45: Mean soil stability index of transect based on combined patch and interpatch at LFA sites (2020 to 2024)

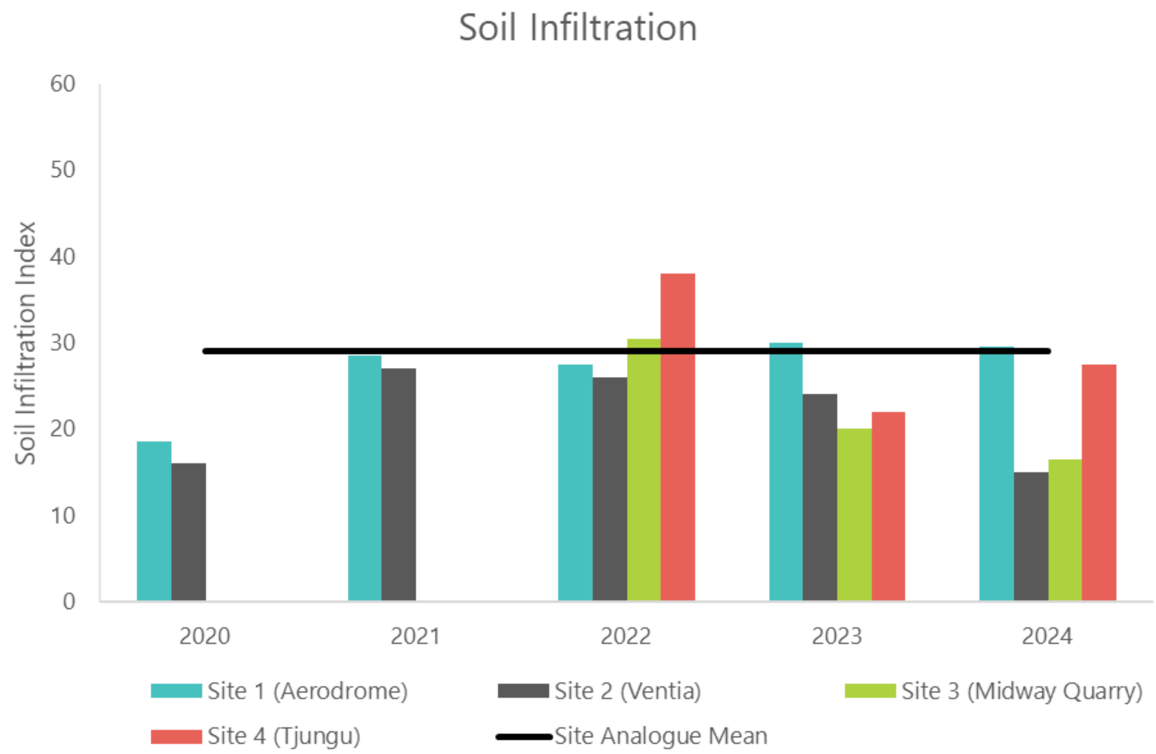

Figure 3.46: Mean soil infiltration index of transect based on SSA (combined patch and interpatch) at LFA sites (2020 to 2024)

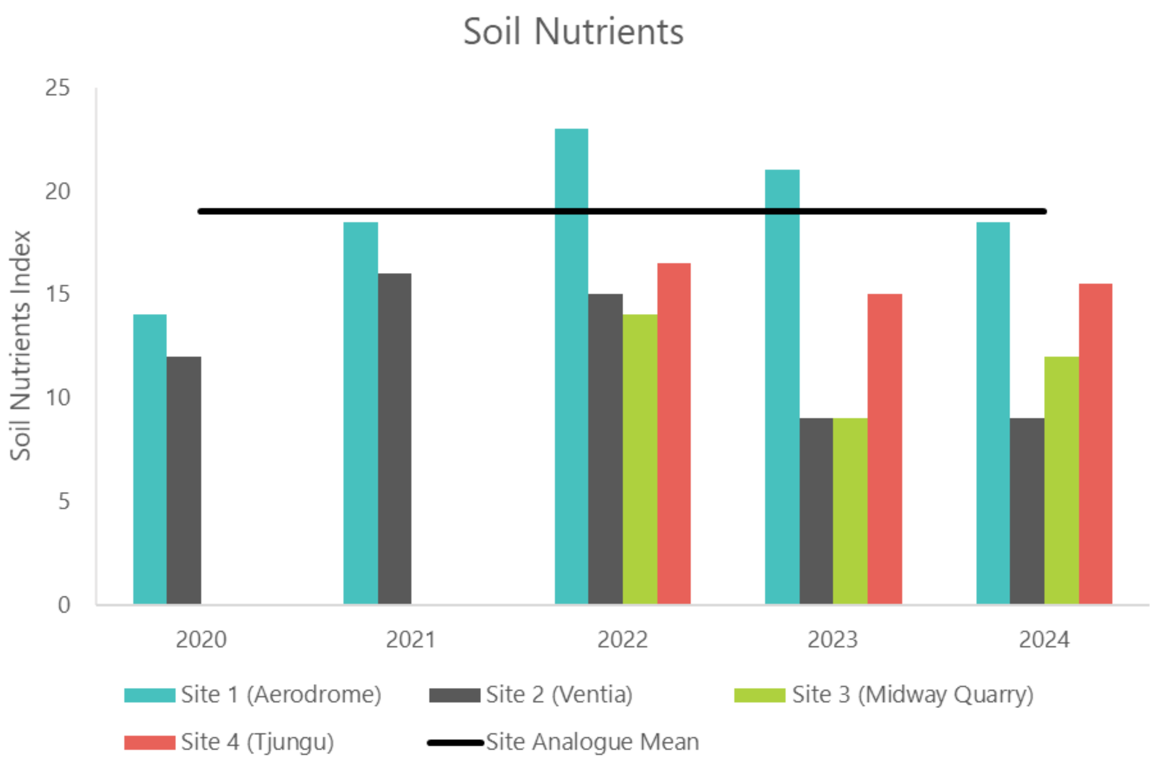

Figure 3.47: Mean nutrient cycling index of transect based on SSA (combined patch and interpatch) at LFA sites (2020 to 2024)

3.3 Fauna

3.3.1 Survey effort and capture rates

As per Section 2.6, fauna survey methods during compliance monitoring broadly followed the SA Vertebrate Survey guidelines (Owens 2000), with modifications aligning with the objectives of this survey, and based on recommendations from earlier surveys. The broadly accepted guidelines recommend a minimum of four trapping nights to ensure sufficient trapping effort for the purposes of documenting key faunal assemblages across a study area. A trapping line set up is shown in Plate 3.11.

Table 3.20 provides a summary of total trapping effort across the spring 2024 survey. Survey effort has been calculated by number of trapping nights (number of traps multiplied by the number of nights the traps were set for) and the total number of active surveys and searches. Active reptile searches / opportunistic observations and bird surveys were undertaken at all eight fauna sites, the four sites in Eliza creek, the dune Flora sites (21 and 22) and at opportunistic sites. Spotlighting was undertaken at sites 10 (creekline / drainage line); camera trapping and Song Meter deployment at fauna trapping sites also provided opportunity for capturing nocturnal activity.

Plate 3.11: Site 16 fauna trapping set up

Table 3.20: Fauna Survey Effort, Spring 2024

Location	# of Trap Nights		Total Trap Effort Per Site
	Funnel trap	Pit Trap	
Fauna Site 1	16	24	40
Fauna Site 2	16	24	40
Fauna Site 3	16	24	40
Fauna Site 4	16	24	40
Fauna Site 5	16	24	40
Fauna Site 6	16	24	40
Fauna Site 15	16	24	40
Fauna Site 16	26	24	40
Total	**128**	**192**	**320**

3.3.1.1 Capture rates

The spring survey returned a total of 577 observations, captures or evidence of fauna (excludes exact numbers for sheep, kangaroos, goats, rabbits and birds which were not counted). This included 344 detections / observations of birds, 73 of mammals and 160 of reptiles (excludes 64 Song Meter duplicate detections). Of the observations, 142 were pit or funnel trap captures. The highest capture rates were made in pitfall traps (93) and there were 49 captures in funnel traps. Capture rates for the number of pits and funnels deployed at each site are summarised in Table 3.21.

Total spring 2024 trapping capture rate for funnel and pit traps was calculated by dividing total captures by total trap effort (141/320 = 0.44). The total trapping capture rate was well above the 2018-2022 spring capture rates (~0.23) and the autumn 2023 capture rate (0.11). The 2024 total capture rate is well within the range reported during baseline surveys (0.14 to 0.97), where the lowest rates were recorded in autumn 2013 (0.14) and 2014 (0.13), and the highest rate was recorded in spring 2016 (0.97) (EBS 2017b). Capture rate numbers during the current survey are considered to be positive, particularly given the drier conditions preceding the survey. The diversity for small mammals was low, but within the range of baseline and previous construction monitoring surveys. Specific results per animal group and diversity results are presented further below.

As per above, both funnel and pit captures (142 in total) increased from the 2022 spring and 2023 autumn surveys, with only 10 recaptures (reptiles only) recorded. When reviewing trends across the control and impact site, as well as including captures and observations of additional species (opportunistic, spotlighting, bird surveys) there are no clear trends emerging between control and impact sites. It is noted that Impact Site 3 and new Control Site 4 had the highest overall fauna detection (39 and 38) and Control Site 1 and 2 had the lowest total species detection (19). Impact sites had variable numbers of bird species, varying levels of mammal / reptile captures and there are no clear trends when compared with spring 2022 and autumn 2023 results (Figure 3.48). Noting this comparison primarily relates to point of time comparison across the sites.

A summary of total fauna capture by site for the different survey methods (funnel, pitfall, opportunistic detection) is provided in Table 3.21, Table 3.22 and Table 3.23.

Table 3.21: Fauna (trapping only) capture rates per site, spring 2024

Site	Funnel Trap		Pit		Total Capture Rate	Total Capture Rate Comparison to Autumn 2023	Total Capture Rate Comparison to Spring 2022
	Captures	Capture Rates	Captures	Capture Rates			
Control							
Fauna Site 1	4	0.25	8	0.33	0.333	increase	Slight decrease
Fauna Site 2	7	0.44	6	0.25	0.325	increase	same
Fauna Site 4	9	0.56	18	0.75	0.675	increase	increase
Fauna Site 6	3	0.19	15	0.625	0.45	increase	increase
Impact							
Fauna Site 3	11	0.69	12	0.5	0.575	increase	increase
Fauna Site 5	6	0.375	10	0.42	0.4	increase	increase
Fauna Site 15	5	0.31	15	0.625	.5	increase	decrease
Fauna Site 16	4	0.25	9	0.375	0.325	increase	same

As per Section 2.3.2, Site 4 and Site 6 have been changed from Impact to Control sites.

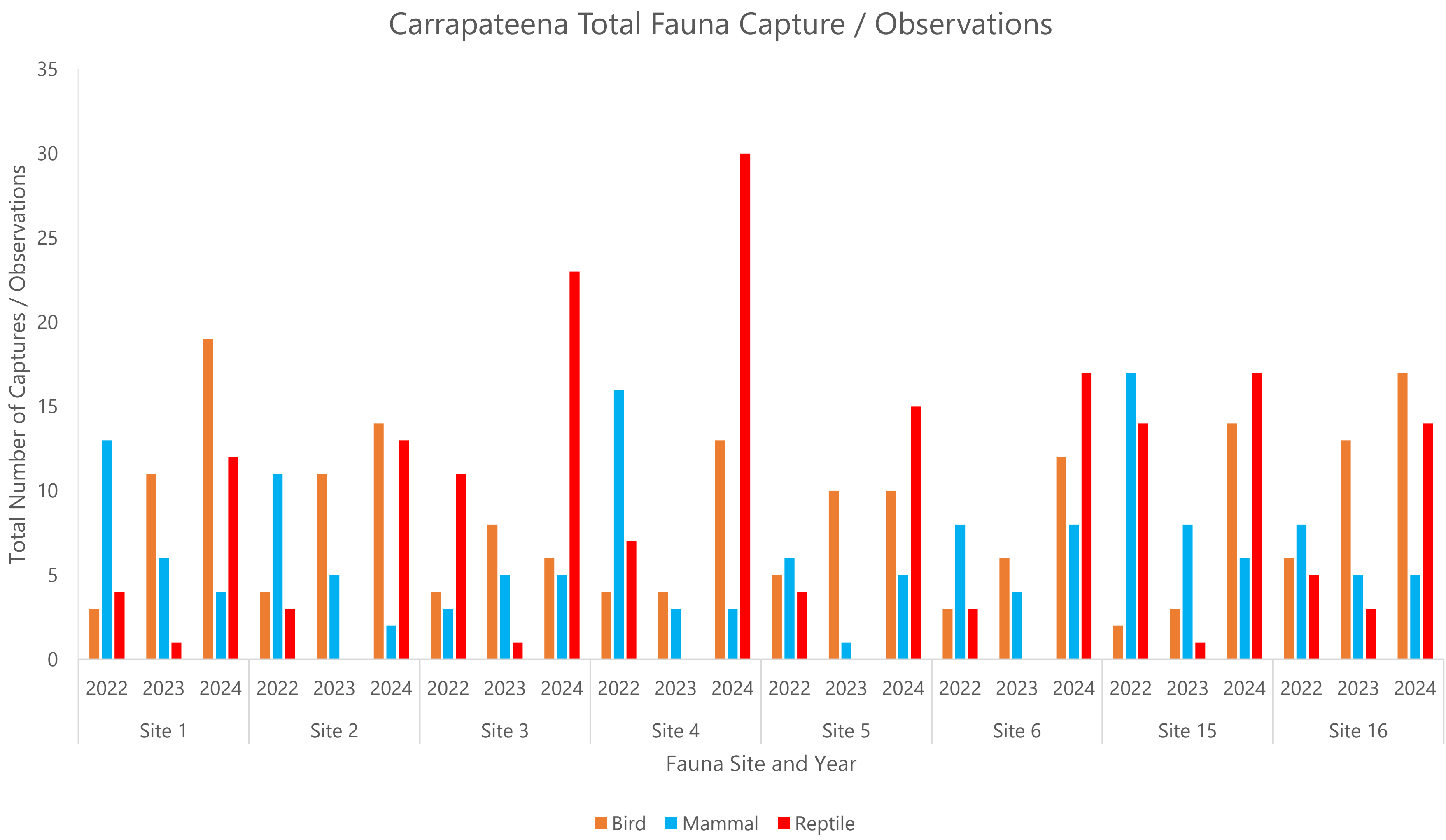

Figure 3.48: Total fauna capture/observation (bird are species only), spring 2022, autumn 2023 and spring 2024

3.3.2 Fauna diversity summary

During the 2024 spring fauna survey a total of 107 vertebrate species were detected from the 8 fauna survey sites, 20 bird survey sites and opportunistically within the study area. Of these 107 species, five species had not been observed / detected since the baseline surveys (2012-2017); Southern Four-toed Slider (*Lerista dorsalis*), Australian Pratincole *(Stiltia isabella*), Inland Forest Bat (*Vespadelus baverstocki*), Inland Free-tailed Bat (*Ozimops petersi*, previously only identified to genera *Mormopterus sp.*), and Lesser Long-eared Bat (*Nyclophilus geoffroyi*). Gould's Wattled Bat (*Chalinolobus gouldii*) was likely present in 2023, but calls could only be identified to genus rather than species level. In addition, three species which were detected during the current survey had not been detected at the site previously; Australian Pelican (*Pelecanus conspicillatus*), Rufous Songlark (*Cincloramphus mathewsi*), Red-necked Avocet (*Recurvirostra novaehollandiae*). The site occurs within the known range for these species (Menkhorst et al. 2019; Davies et al. 2022). The vertebrate species detected in the study area are summarised below:

- 74 bird species (53 at fauna sites and bird sites, 54 at opportunistic locations)
- 18 reptile species (13 fauna trapping captures, 15 camera trap / spotlighting / opportunistic observation)
- 15 mammal species (4 fauna trapping captures; 11 opportunistic including 3 exotic species, 5 microbat species) (excludes Sheep).

No NPW Act-listed as threatened species were detected, two EPBC listed were detected; Sharp-tailed Sandpiper (*Calidris acuminata*) listed as Threatened (Vulnerable) and Migratory, and Common Sandpiper (*Actitis hypoleucos*) listed as Migratory. Three Sharp-tailed Sandpipers and one Common Sandpiper were detected at the South Eliza Dams. This includes the original dam, overflow dam and temporary ponds that have developed following the release of surplus Class A treated wastewater from the Tjungu WWTP. This water source is temporary as the first use would be in the processing plant, only excess water is released to South Eliza Dam for livestock and wildlife. Previously Sharp-tailed Sandpipers and other waterbirds were detected in the WWTP irrigation areas, that are no longer active. Other shorebirds that were present included Banded Lapwing, Black-fronted Dotterel, Red-Kneed Dotterel, Black-winged Stilt and Red-necked Avocet. New records for the site included the Australian Pelican (one dead bird found at Site 4 over 2 km from the TSF), Rufous Songlark and Red-necked Avocet.

Introduced birds or mammals observed at the site included, House Sparrows (in similar numbers with previous years), live European Rabbits (observed at Site 15, North Eliza Dam, Site 21 and track / scats at five other locations) and Feral Cats (Site 21 tracks). There is still an active Rabbit Warren near Site 15, that requires ongoing management. Evidence of Feral Cats has decreased since the previous survey. Rock Doves (Feral Pigeon) were not detected.

The following sections provide detail on each faunal group identified, including summary tables of species.

Given the nature of fauna data from individual surveys, movement of species, the variations in weather conditions between surveys, variations in trapping effort (to baseline) and capture rates across surveys and sites, fauna data is reflective of high level trends over time only. Broadly, Figure 3.49 shows the total species diversity for mammals, birds, reptiles / frogs that were captured, recorded during dedicated bird surveys and recorded opportunistically across the Carrapateena site during spring baseline (2012 - 2017) surveys compared with data from the construction/operation period (2018 - 2024). Results indicate similar trends for some fauna types and increasing trends for other, with 2024 total diversity falling above the spring range reported from previous years, and snap shot autumn surveys from early baseline (2012), late baseline (2017) and early compliance monitoring (2017) (Figure 3.49). Similar to spring 2022 and autumn 2023 dams were full, plus South Eliza Dam had excess temporary ponds of Class A wastewater, where numerous waterbirds were present. There were increases in detection of bird species and families as a result of survey effort at these wetted areas, along with Song Meter detection.

Similar to previous years, there was evidence of breeding activity across the site. Given the arid environment, the breeding of many species is stimulated by climate conditions, hence breeding can occur throughout the year. The small mammals showed some evidence of breeding, however sample sizes were small for some species (e.g. Fat-tailed Dunnart, Sandy Inland Mouse). Stripe-faced Dunnarts were captured in higher numbers than Fat-tailed Dunnarts, as per previous surveys. Over 10 bird species were in breeding pairs / groups or had young present, which is a notable sign that species are persisting within the Operations area environment. Fauna with evidence of recent breeding included: multiple family groups of two fairywren species, numerous juvenile reptiles (Earless Dragon, Bynoes geckos, Four-toed Slider), various parrots in pairs or flocks or pairs (e.g. Mulga Parrots, Australian Ringneck, Blue Bonnets), pairs of Wedge-tailed Eagles and pregnant Stripe-faced Dunnart captured via camera trap (Plate 3.12).

No evidence of a significant reduction in species diversity was observed in spring 2024, with species numbers similar or greater than baseline and spring time compliance monitoring results, and with only the capture numbers of rodents reflective of the dry climate conditions preceding the survey (refer Section 3.1). House Mouse were captured in small numbers at Control Site 1 and Impact Site 16 during the survey (1 captured at each site). Survey for microbat species has not been undertaken every year, however with minimal survey effort in spring 2024 at three suitable sites (Flora Site 7, Flora Site 10 and South Eliza Dam), five microbat species were detected, three of these had not been detected since the baseline surveys.

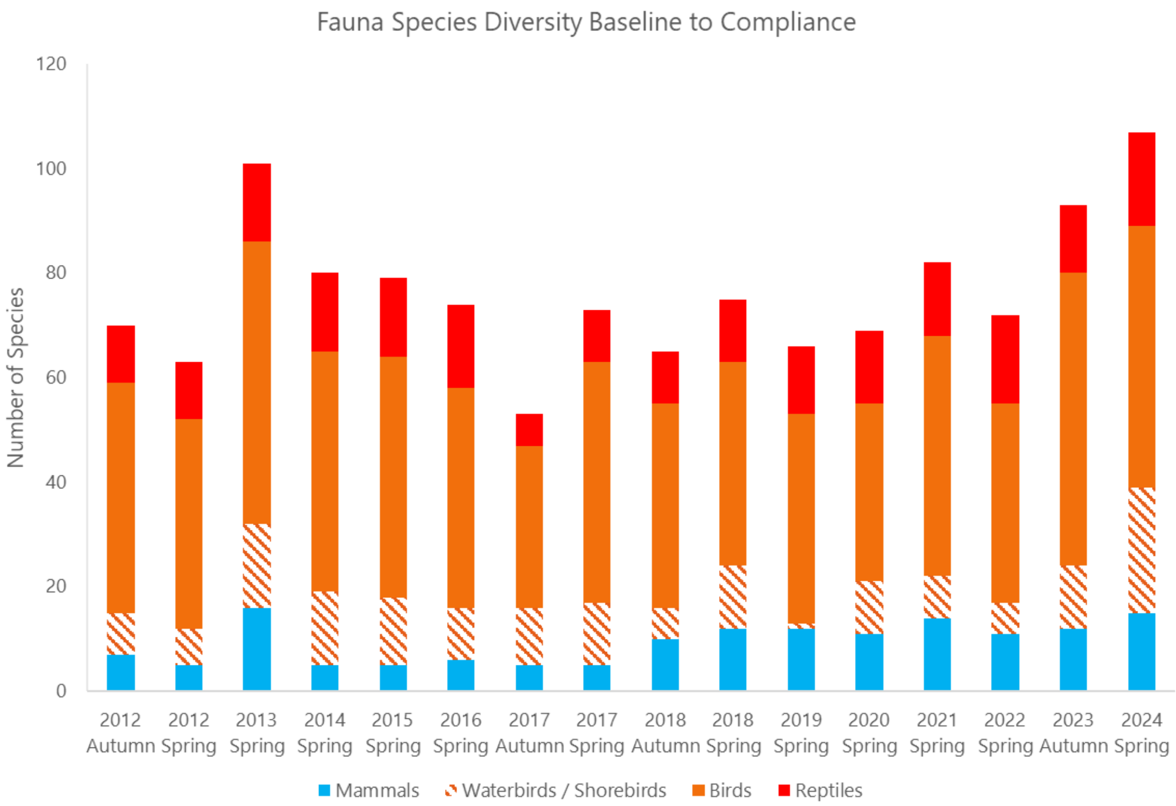

Figure 3.49: Vertebrate total species diversity, during baseline (2012-2017), and compliance monitoring (2018- spring 2024).

Plate 3.12: Pregnant Stripe-faced Dunnart captures via camera trap at Site 5

3.3.2.1 Bird diversity

A total of 74 bird species were detected during the spring 2024 survey across the Carrapateena site (see Appendix F). Of these species, 53 were recorded during dedicated bird surveys across 20 sites and the additional species were recorded opportunistically when driving along tracks, around camp, effluent irrigation areas, during weed surveys and at dams. At the time of the spring survey all of the dams had water including coffer dams, and waterbirds and resident shorebirds were present, similar to previous years when all the dams were full. Two EPBC listed Migratory species were detected, and one of these is also EPBC listed as threatened; Sharp-tailed Sandpiper (Vulnerable) and Common Sandpiper (both observed at the South Eliza Dams). No State listed species were recorded.

There were three new records for the site; Pelican (one dead bird at Site 4 near the TSF), Rufous Songlark (heard at the South Eliza Dam) and Red-necked Avocet (seen at the South Eliza Dam). Whilst the Red-necked Avocet has not been detected before, this endemic shorebird is known to occur in small numbers across the broader region, e.g. small numbers observed at the Roxby Downs Wastewater Treatment Plant (WWTP) and near Olympic Dam in a small dam in 2024 as part of other surveys (Z. Bull pers. comm.). The Pelican is likely an overfly species that died as a result of lack of suitable habitat at the site (i.e. deep water with fish).

Bird families were well represented, with birds from 37 different families observed (increased from 22 in spring 2022 and 34 in autumn 2023). Many families were only represented by one species (20 families) or by two species (9 families). Meliphagidae (honeyeaters and chats) were the most represented (7 species), with Anatidae (ducks) represented by 6 species, Charadriidae (shorebirds) by five species and Psittacidae (parrots) by four species.

The species detected at the most fauna sites during site targeted bird surveys were the Australian Raven (17 sites), followed by Australian Pipit (15 sites), Rufous Fieldwren (14 sites), Singing Honeyeater (14 sites), White-winged Fairywren (13 sites), Black-faced Woodswallow (13 sites) and the Australian Magpie, Galah and Zebra Finch (all with 10 sites).

Family groups of two different types of Fairywren (White-winged and Purple-backed (Variegated) were present at a number of sites. White-winged Fairywren groups (males and females) were commonly observed across the Carrapateena Operation area in Chenopod habitats close to Western Myall Creeklines (e.g. Impact Site 3 adjacent the admin). Other species also showed breeding plumage, had juveniles present, were in breeding groups or nesting (e.g. Australasian Grebes, Black Swans, Black-fronted Dotterel, Orange and Crimson Chats, Eurasian Coots, Hooded Robin, Inland Dotterel, Wedge-tailed Eagle). The South Eliza Dams provided temporary nesting site for a number of waterbird species.

The House Sparrow (*Passer domesticus*) was again observed around both site camps in 2024, as per previous years. Both males and females were present, in similar numbers than previously, numbers are not declining. No Rock Dove (feral pigeon) (*Columba livia*) were detected.

Plate 3.13: Sharp-tailed Sandpipers at South Eliza Dam

Comparison with baseline data – birds

Mean bird species diversity per bird site in spring 2024 was 13.17 (increased from 5.6 spring 2022, 9.65 2023), with total diversity per site ranging from 4 to 35 species. More species were generally observed in creekline sites (e.g. Site 7, Site 10), or sites with Western Myall Woodland nearby (i.e. sites with a tree canopy in addition to shrubland understorey, such as Site 1, Site 16). Mean diversity per site in spring 2024 was well above the mean diversity observed in 2018-2023 (5-9.65). Species diversity per bird site was also well above the range recorded for baseline surveys (e.g. ranging from 4.1 in 2016, to 7.9 in 2013). This is likely related to the optimal conditions to detect birds (fewer windy days, warmer temperature and presence of water in dams), as well as the use of Song Meters to complement bird surveys. Noting that the lowest number of species detected was at Site 18, where a Song Meter was not deployed (also not deployed at Site 17, 19 and 20) and conditions were less suitable on the day this site was visited (warm and windy).

Total spring (74) bird species diversity across the site was above the range of diversity reported during baseline surveys (e.g. species diversity ranged from 42 in autumn 2017 to 70 in spring 2013; EBS 2017), and well above compliance monitoring numbers observed to date (2018 autumn to spring (46-51), 2019 (45), 2020 (44), 2021 (54), 2022 (37), 2023 (68)). Total number of bird families (37) represented across the site was within the range recorded during baseline survey results (e.g. families recorded ranged from 29 in spring 2012 to 38 in spring 2014 (EBS 2017)), and was also above results from previous compliance monitoring to date (e.g. 2018 (28-26), 2019 (21), 2020 (26), 2021 (29), 2022 (22), 2023 (34)). Given the presence of water in all of the dams, the temporary excess Class A wastewater at South Eliza Dam, rainfall event in winter, and use of Song Meters to enhance survey effort, it is not unexpected that an increased diversity of species and families were detected. Although, noting only 10 additional species were detected via Song Meter. A variety of nomadic species were detected that had been rarely detected since baseline or early compliance monitoring (e.g. Rufous Fieldwren, Australian Pratincole). The variety of species and families of different types detected in 2024 and the ongoing evidence of numerous species breeding reflects stable conditions for an arid environment. In addition, the detection of Nationally listed shorebird species is a good indicator of stable conditions. Regardless, there is no evidence to suggest mining activities are impacting bird presence across the site.

Plate 3.14: Male Red-capped Robin near South Eliza Dam

Plate 3.15: South Eliza Dam, excess temporary water source

3.3.2.2 Reptile diversity

Eighteen reptile species from 160 detections were recorded across the sites during the spring 2024 survey (Table 3.22). During 2024, 73% of the records (116 out of 160) were through physical trapping, with the remainder detected opportunistically, including via spotlighting and via camera trap. In terms of diversity, 83% of species were detected opportunistically, and 72% of species were detected via pit / funnel captures (noting the overlap with some species detected through both pathways). The main species recorded in traps was the Salt-bush Ctenotus (*Ctenotus olympicus*) with the greatest numbers being detected at Site 4 (18) and Site 15 (15). The very high number of trap captures is likely due to the warmer temperatures during spring (refer Table 3.22).

Five common reptile families were well represented during the survey; including seven skink species, three dragon species and four gecko species. Juveniles of several species were detected during the survey (e.g. Earless Dragons, Bynoes Gecko, Salt-bush Ctenotus and Southern Four-toed Slider (Plate 3.16) indicating ongoing successful breeding activity across the site.

One species that has not been detected since baseline surveys (in 2016), the Southern Four-toed Slider (*Lerista dorsalis*), was detected at Site 6 through capture of a single juvenile individual. This species was detected during baseline surveys at Site 2, 3, 6, 15 and 16 (between 2012-2016), and detection of a juvenile individual during the current survey is a positive indication that the species persists in the area.

It is noted that in 2023 it was reported that the Eyrean Skink (*Ctenotus taeniatus*) was captured at Site 16, however there has been further taxonomic revision of this genus and the species was in fact the Short-legged Ctenotus (*Ctenotus strauchii*) (Mark Hutchinson pers. comm.) (refer Plate 3.17). This species was detected at Site 3 during 2024, previously detected in smaller numbers during baseline surveys and during previous compliance surveys in 2018, 2020 and 2023.

Also of note were detection of three snake species (Mulga Snake via camera trap (Plate 3.18), Curl Snake via funnel traps and Western Brown opportunistically in the Tjungu Village).

Plate 3.16: Juvenile (indicated by red tail) *Lerista dorsalis* (Southern Four-toed Slider)

Plate 3.17: Short-legged Ctenotus (*Ctenotus strauchii*)

Table 3.22: Reptiles observed at Carrapateena in spring 2024

Family Name	Scientific Name	Common Name	Fauna Site								OP/SP/CT Total[1]	All Total
			1	2	3	4	5	6	15	16		
Agamidae	*Tympanocryptis sp.*	Earless Dragon	[1 CT]			[1 OP, 1CT]	[1CT]				[4]	4
Agamidae	*Tympanocryptis tetraporophora*	Eyrean Earless Dragon	1 (P), [2 OP]	1 (P)	2(P), 1(F), [1 OP]	2(P), [2 OP]	1(P)	2(P), [1OP]	2(P)		[6]	18
Agamidae	*Tympanocryptis intima*	Smooth-snouted Earless Dragon	1 (P), [1 OP]			[1 OP]				1(P)	1 LFA TJU, [3]	5
Agamidae	*Pogona vitticeps*	Central Bearded Dragon		[1 OP]							1 CWM03 [2]	2
Elapidae	*Pseudechis australis*	Mulga Snake								[1CT]	[1]	1
Elapidae	*Pseudonaja mengdeni*	Western Brown Snake									1 TJU Village [1]	1
Elapidae	*Suta suta*	Curl Snake	1 (F)	1 (F)				1(F)				3
Gekkonidae	*Diplodactylus tesselatus*	Tesselated Gecko	1 (F)	2 (P), 1 (F)		5(P)		[2CT]			[2]	11
Gekkonidae	*Gehyra versicolor*	Eastern Tree Dtella									5 SP [5]	5
Gekkonidae	*Heteronotia binoei*	Bynoe's Gecko	1 (P)				1(F)			1(P), 2(F)	1 SED [1]	6
Gekkonidae	*Underwoodisaurus milli*	Common Barking Gecko	1 (P)									1
Scincidae	*Ctenotus olympicus*	Saltbush Ctenotus	2 (F)	2(P), 4(F), [1 OP]	3(P), 9(F)	9(P), 9(F)	6(P), 5(F)	8(P),1(F), [1CT]	9(P), 5(F)	2(P), 1(F), [2OP,1CT]	1 LFA TJU [6]	82
Scincidae	*Ctenotus robustus*	Eastern Striped Skink								1(P)		1
Scincidae	*Ctenotus strauchii*	Short-legged Ctenotus			2(P), [2]						[2]	4
Scincidae	*Lerista dorsalis*	Southern Four-toed Slider						1(F)				1
Scincidae	*Menetia greyii*	Common Dwarf Skink					[1OP]			2(P)	[1]	3
Scincidae	*Morethia adelaidensis*	Adelaide Snake-eye			1(P), [1 CT]						1 at S17, S19, SED [4]	5
Scincidae	*Tiliqua rugosa*	Sleepy Lizard			1(F)						1 at S17, tracks at S21, S22, SED [4]	5
Varanidae	*Varanus gouldii*	Sand Goanna									Tracks at S21, S22 [2]	2
	Totals detected	160	12	13	23	30	15	17	17	14	44	
	Total species[1]	18	7	5	5	4	4	5	2	6	14	

[1] OP/SP/CT = opportunistic (OP) / spotlighting / camera trap (CT), [X] = totals; all others captured in pit (P) or Funnel (F); total excludes *Tympanocryptus sp.* as most likely *T. tetraporophora*, but unable to confirm from camera trap footage.

Comparison with baseline data – reptiles

Total reptile captures / observations for spring 2024 (160) was well above autumn 2023 (39) and spring 2022 (88), and within the range for baseline spring surveys (49 in 2016, 184 in 2014 and 117 in spring 2017 (EBS 2017, site fauna database), and well above previous spring compliance monitoring totals (ranging from 39 to 112).

Results in 2024 for total species diversity (18) were above the baseline monitoring range, which ranged between 10 to 16 species (EBS 2017), suggesting firstly that there is no notable impact from the reduction in trapping effort and the number of trap lines deployed since 2017 (i.e. only one trap line per site), and secondly, that there is no evidence from the data for impacts to reptile diversity across the sites as a result of mining activity. Warmer daytime and overnight temperatures, and a storm event during the 2024 survey likely contributed to the result, presenting optimal conditions for a range of species. Regardless, detection of juveniles and species not recorded since baseline, suggests mining is not impacting reptile fauna at the site.

Total reptile species diversity across the Carrapateena location in 2024 (18 species) was just above spring of 2022 (17 species), and above the range of the previous compliance monitoring spring surveys in 2018, 2019, 2020, 2021 (12, 13, 14, 14 species respectively) and above the range of total species diversity reported during all baseline surveys between 2012 – 2017 (which ranged between 10 to 16 species, EBS 2017). All families previously detected in baseline and compliance monitoring were represented, with the exception of the Pygopodidae; however only one individual has previously been recorded across the Carrapateena location during the 2013 baseline survey (EBS 2013a) whilst spotlighting (*Pygopus nigriceps*, Black-headed Scalyfoot). The Pernatty Knob-tailed Gecko (Carphodactylidae family) and Centralian Blind Snake (Typhlopidae family) remain undetected since 2014, but these species were only previously reported during spotlighting (presumably in dune habitats, which are not part of the compliance monitoring program).

Similar to autumn 2023 compliance monitoring, detection of species that have not been detected since baseline is always a positive for the monitoring program. In 2024 the species not detected since baseline was the Southern Four-toed Slider. This species was only detected at Site 6, now classed as a control Site.

Mean reptile species diversity per fauna site was 4.8 in spring 2024, ranging from 2 to 7 species (Table 3.22). This has increased from 2022 (3.13) and 2021 (2.13) and is just within the baseline range (4.8 in 2012 to 6.6 in 2014). It is noted that mean diversity was not calculated in 2023 due to low reptile captures and was not reported in the baseline report in 2017. These results are positive, and despite a drier season, local climatic effects appear to be favouring certain species with warmer temperatures and humidity during the survey.

Plate 3.18: Mulga Snake captured via camera trap at Site 16

3.3.2.3 Mammal diversity

Fifteen mammal species were detected across the Carrapateena site during the spring 2024 survey (refer Table 3.23), excluding Sheep. Four mammal species were captured via trapping; Fat-tailed Dunnart, Stripe-faced Dunnart, Sandy Inland Mouse and House Mouse (28 captures in total). Rodents were recorded in lower numbers (1 and 2 respectively). No Forrest's Mouse or Planigales were detected during the current survey. Other animals detected include pest or exotic fauna, three Kangaroo species and five species of microbats.

Similar to 2021 to 2023, the Stripe-faced Dunnart was the most abundant small mammal captured at all sites (19 in total), slightly above 2023 (16) and 2021 (18), but lower than 2022 when conditions were more optimal (46) (Jacobs 2019a, 2023d, 2023h). Both males and females were captured, and a range of age classes were present with some evidence of pouch activity. One female captured via camera trap appeared to be pregnant (Plate 3.12). Fat-tailed Dunnarts represented the next highest number of records, with only five animals detected via fauna trapping and one detected via camera trap (Plate 3.19).

The White-striped Free-tail Bat is the only bat in South Australia that is audible to the human ear. This larger micro bat was not heard during spotlighting in Eliza Creek (Site 10) and was not detected via Song Meter at that site, however the species was detected at South Eliza Dam via Song Meter. Four other microbat species were also detected via Song Meter; Gould's Wattled Bat, Lesser Long-eared Bat, Inland Forest Bat and Inland Free-tailed Bat. There were a total of 25 detections of microbats at the three locations (Site 7, Site 10 and South Eliza Dam) across four nights, the majority at South Eliza Dam. Three species were detected at Site 7, three at Site 10 and all five species were detected at South Eliza Dam (Specialised Zoological 2025).

Minimal evidence of pest fauna species was observed at the fauna trapping sites and as mentioned in Section 3.2.5 evidence of grazing was limited at flora sites. Goats were not observed during this survey, but a small group is known to occur across the broader Carrapateena site. Rabbit scats, diggings and live animal were detected opportunistically, and an active warren was recorded on the track to Site 15. Foxes have been recorded on the site previously (2012, 2013, 2015, den in Eliza Creek 2019, dead fox at Anzac Dam in 2019). Similar to 2023, foxes were not detected during 2024. Cats are known to occur at the site and have increased slightly in recent times, particularly around administration areas, and management of the species is ongoing. No cats were detected at the fauna sites, but tracks and scats were detected at Flora Site 21.

Grazing management has changed across the site, with less areas under grazing and more fencing delineating grazed areas; flocks of sheep were only observed / detected (Song Meter) at Site 6. As a result, kangaroos are also being managed more effectively across the site and there is likely less competition for resources. Red Kangaroos, Euros and one Western Grey Kangaroo were observed across the study area and were noted to be in excellent health. Euros were recorded in similar smaller numbers than previous years and similar numbers of Red Kangaroos.

Plate 3.19: Fat-tailed Dunnart detected by camera trap at Site 15

Plate 3.20: Native Mouse, likely Sandy Inland Mouse at Site 5

Plate 3.21: Prey of Sandy Inland Mouse, key resource when grass seed is unavailable

Table 3.23: Mammals recorded at Carrapateena during spring 2024 survey

Family Name	*Scientific Name*	Common Name	Site								OP [Total]1	Total[2]
			1	2	3	4	5	6	15	16		
Bovidae	*Ovis aries*	Sheep (Feral Sheep)						Flock				NA
Dasyuridae	*Sminthopsis crassicaudata*	Fat-tailed Dunnart	1			1	1		3			6
	Sminthopsis macroura	Stripe-faced Dunnart	2	2	4	1	2	5	1	2		19
Felidae	*Felis catus*	Cat (Feral Cat)									[S21[4]]	1
Leporidae	*Oryctolagus cuniculus*	Rabbit (European Rabbit)							Active Warren		[S17, S22, LFA QUA, SED][3]; 1 x S21, 2 x NED, 1 x S19 [8]	8
Macropodidae	*Macropus (Osphranter) robustus*	Euro								[2]	[2]	2
	Macropus (Osphranter) rufus	Red Kangaroo			[1]	[3]		[1]		[4]	S21, DD, S7 [11]	NA
	Macropus fuliginosus	Western Grey Kangaroo									S22 [1]	1
Muridae	*Mus musculus*	House Mouse	1							1		2
	Pseudomys sp.	Native Mouse[4]					[1 CT][3]				[1]	1
	Pseudomys hermannsburgensis	Sandy Inland Mouse					1					1
Vespertilionidae[5]	*Nyctophilus geoffroyi*	Lesser Long-eared Bat									3 x S7, 1 x S10, 3 x SED [7]	7
	Vespadelus baverstocki	Inland Forest Bat									3 xS7, 1 x S10, 4 x SED [7]	7
	Chalinolobus gouldii	Gould's Wattle Bat									1 x S10, 4 x SED [5]	5
Molossidae	*Austronomus australis*	White-stripe Free-tailed Bat									1 x SED [1]	1
	Ozimops petersi (Mormopterus planiceps)	Inland Free-tailed Bat									2 x S7, 3 x SED [5]	5
	Total Trap Captures		4	2	4	2	4	5	4	3		
	Total Species Detected		3	1	2	3	3/4	3	3	5		

[1]OP = Opportunistic, SED = South Eliza Dam, DED = North Eliza Dam, LFA QUA = Mid-way Quarry, DD = Dawson Dam; S21 = Site CAR021, S22 = Site CAR022, S11 = CAR011 etc.; [2]Not Accurate given kangaroos / sheep were not always counted; CT –recorded on Camera Trap. [3] fresh tracks and / scats. Excludes recaptures.[4] Rodent captured via camera cannot confirm *Pseudomys* to species level, but not Plains Mouse or *Leggadina*; [5]All microbats recorded on Song Meter, mice and dunnarts caught in pitfall trap unless otherwise mentioned as CT.

Comparison with baseline data – mammals

Small mammal species diversity from trapping effort alone during spring 2024 (4 small mammal species) was within the compliance monitoring range (3 – 5) and within the baseline range (4 – 6). Two House Mice were caught in traps in 2024, at Site 1 and Site 16. The Narrow-nosed Planigale was recorded in previous surveys in low numbers, but is an elusive species that is more active during warmer temperatures. This species was not detected in 2024 despite warm nights and a rainfall event. Forrest's Mouse were also previously detected in small numbers and were not detected in 2024. There were however five microbat species detected in 2024 opportunistically via acoustic methods at three sites with water and / or roosting habitat (e.g. Site 7 (men's site), Site 10 (Eliza Creek, dry at time of survey) and South Eliza Dam (water present).

In general, mammal species diversity did not differ notably from previous surveys. Red Kangaroos were present across the site, and similar to 2022/2023 remain in good health compared to previous years and were observed in moderate numbers (not counted). Evidence of feral goats was present (scats) and other feral animals still present in low numbers on par with baseline numbers. There were ongoing signs / evidence of rabbits and also live sightings at an established warren near Site 15, as well as North Eliza Dam and Site 19 (Plate 3.22).

Mean small mammal species diversity per fauna trapping site was 1.9, down from 2.4 in autumn 2023 and from 2.75 in spring 2022, but still ranging from 1 to 3 species per site, which is on par with previous compliance monitoring surveys (small mammal captures only) and within the baseline surveys results presented in EBS (2017). These results are considered satisfactory given the low number of small mammal captures for the autumn 2023 survey. There was very little difference between small mammal species diversity and captures across sites, with the highest diversity recorded at both control and impact sites (Site 1 and Site 5 both with 3 species). Captures ranged from 2-5 individuals, with four of the sites recording 4-5 captures (Site 1, 3, 6, 15).

Total diversity of mammals (15) observed or captured throughout the survey was above the range of mammal diversity reported during baseline surveys, which ranged from 4 to 6 (small mammals only), Figure 3.49). It is however noted that baseline surveys did not always report on presence of microbats, Kangaroos, Fox, Cow, Euro, Bat, Sheep, but occasionally recorded rabbit (e.g. spring 2014), hence it is difficult to compare data.

In terms of small mammal diversity and abundance, there were more Stripe-faced Dunnart captures (19) than Fat-tailed Dunnarts (6). This follows the trend observed during baseline and compliance monitoring (Table 3.24). Males and female dunnarts were recorded as present for both these species, some with evidence of brood patch, suggesting that at least one round of breeding may have occurred prior to the survey. Two small mammals that were not detected in 2024 include Forrest's Mouse (*Leggadina forresti*) and Planigale (Giles (*Planigale gilesi*) or Narrow-nosed (*P. tenuirostris*)). These small mammals have been detected in smaller numbers or not at all some years during baseline and compliance monitoring (Table 3.24), hence the lack of detection in 2024 is not cause for concern. Similarly, no Plains Mouse were detected, continuing the trend of no detections since the commencement of the compliance monitoring. Only two rodent species were detected, the Sandy Inland Mouse (one captured and one likely via camera) and the House Mouse, both in very low numbers. Low numbers of rodents in general is likely reflective of drier conditions in the preceding months before the survey, given rodents require sustained rainfall and associated resources to breed in larger numbers. The one rainfall event in July unlikely to sustain rodent numbers.

Microbat data collection and analysis were increased in 2024 (e.g. data collected at three sites, over several nights) and analysed using new methods (Specialised Zoological 2025). This resulted in detection of five microbat species in total, of which three had not been detected since the baseline monitoring (2007 and/or 2013); Lesser Long-eared, Inland Forest Bat and Inland Free-tailed (Figure 3.50). The Inland Free-tailed Bat was detected as a species in 2024, likely due to advances in acoustic analysis, previously only detected to genus level (*Mormopterus sp.*). Similarly, the Gould's Wattled Bat was detected to genus level in 2023.

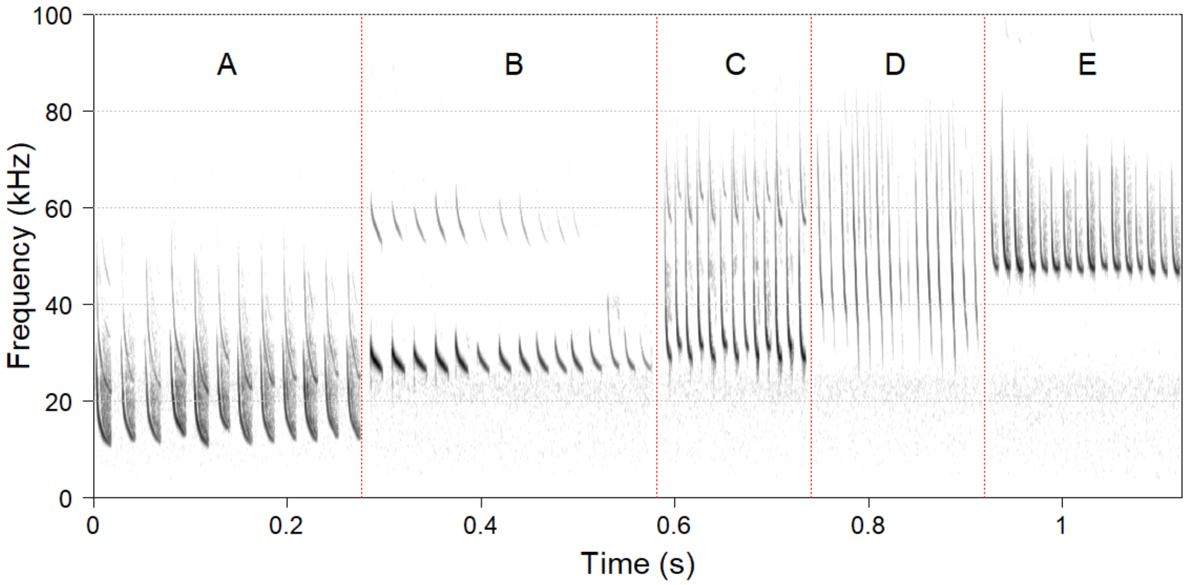

Figure 3.50: Representative echolocation call sequence portions of the species identified; (A) White-stripe Free-tailed Bat, (B) Inland Free-tailed Bat, (C) Gould's Wattled Bat; (D) Lesser Long-eared Bat, (E) Inland Forest Bat (time between pulses compressed).

Plate 3.22: Active rabbit warren at Site 15

Table 3.24: Summary of small mammal captures, baseline (2012-2017) versus compliance monitoring (2018-2024)

Family Name	*Scientific Name*	Common Name	Baseline (2012-2017)			Compliance (2018-2024)		
			Total[1]	Range per survey	Mean per survey	Total[1]	Range	Mean
Dasyuridae	*Sminthopsis crassicaudata*	Fat-tailed Dunnart	217	4-30	18	71	3-20	9
	Sminthopsis macroura	Stripe-faced Dunnart	610	8-95	51	124	3-47	16
	Planigale gilesi	Giles Planigale	56	0-10	<3	22	0-10	3
	Planigale tenuirostris	Narrow-nosed Planigale						
		Planigale sp.						
Muridae	*Leggadina forresti*	Forrest's Mouse	65	0-19	<7	23	0-8	3
	Pseudomys sp.	Native Mouse[5]	16	0-4	<2	4	0-2	<1
	Pseudomys hermannsburgensis	Sandy Inland Mouse						
	Pseudomys bolami	Bolam's Mouse						
	Pseudomys australis	Plains Mouse	37	0-20	3	0	0	0
	Mus musculus	House Mouse	11	0-10	<1	7	0-3	<1

Note: Numbers are rounded and do not account for recaptures as limited information is available for baseline data. [1]Number reflect totals, acknowledging that baseline totals include two surveys per year running two to four traplines per site and compliance surveys were reduced to one trapline per site and one survey per year from 2019 (two in 2018).

3.3.3 Control versus impact

Results from spring 2024 indicate that when combining total diversity of bird species observed, mammal species captured and reptile species captured / observed at fauna trapping sites, the mean species diversity is higher for impact sites than control sites using the original treatments (Table 3.25). However, when updating the treatments (Site 4 and 6 swapped to control Sites as explained in Section 2.3.2) the mean diversity is higher for control than impact. These results are summarised below in Table 3.25 and Table 3.26, respectively. A comparison of the mean total fauna diversity between control and impact sites (original treatment) using un-paired t-tests indicated no statistically significant difference (Control Mean +/- Standard Error (SE) = 32 +/- 3, Impact Mean +/- SE = 36.67 +/- 2.17, P = 0.3098). Similarly, comparison of means using the updated treatments, was also not statistically significant (Control Mean +/- Standard Error (SE) = 37 +/- 3.54, Impact Mean / SE = 34 +/- 1.41, P = 0.4608).

The mean number of total captures was higher at impact sites than control sites for the original treatment (Table 3.25) and the same for the updated treatment (Table 3.25). A comparison of mean total fauna captures (reptiles and mammals only) between control and impact sites using un-paired t-tests indicated no statistically significant difference for the original treatment, Control Mean +/- SE = 15.5 +/- 0.5, Impact Mean +/- SE = 24.5 +/- 2.17, P = 0.064; and for the updated treatment, Control Mean +/- SE = 22.25 +/- 4.23, Impact Mean +/- SE = 22.25 +/- 2.02, P = 1.0000.

These results indicated there are no differences in fauna species diversity or capture rates between impact and control sites with either of the treatment arrangements used (original or updated). This suggests there is no evidence that mining activity is impacting fauna diversity or trap capture rates. Whilst the differences for both diversity and captures were not statistically significant, the trends for the updated treatment suggest slightly higher at control Sites and aligns with the reallocation of treatment to Site 4 and 6. Similarly in the future there may be a need to reallocate control Site 1 and 2 to impact Sites, depending on influence of increased Khamsin Road traffic, Northern Wellfield activities. Regardless, overall diversity (birds, mammals and reptiles) and capture rates are within baseline ranges, and sites in closest proximity to the mine site (e.g. Site 3, 15 and 16) and camps provide good evidence that fauna impacts as a result of mining activity are not currently evident at Carrapateena.

Table 3.25: Comparison of fauna diversity and captures at control and impact sites (original treatment)

Site	Treatment	Diversity number of bird, reptile, small mammal captures / observed[1,2]	Average diversity at fauna sites by treatment type	Captures number of reptile, small mammal captures/ observed[1]	Average captures at fauna sites by treatment type
1	control	35	32	16	15.5
2	control	29		15	
3	impact	34	36.67	28	24.5
4	impact	46		33	
5	impact	30		20	
6	impact	38		25	
15	impact	36		22	
16	impact	36		19	

([1]Excludes kangaroos, goat, rabbit, [2]bird species only counted once)

Table 3.26: Comparison of fauna diversity and captures at control and impact sites (updated treatment)

Site	Treatment	Diversity number of bird, reptile, small mammal captures / observed[1,2]	Average diversity at fauna sites by treatment type	Captures number of reptile, small mammal captures/ observed[1]	Average captures at fauna sites by treatment type
1	control	35	37	16	22.25
2	control	29		15	
4	control	46		33	
6	control	38		25	
3	impact	34	34	28	22.25
5	impact	30		20	
15	impact	36		22	
16	impact	36		19	

([1]Excludes kangaroos, goat, rabbit, [2]bird species only counted once)

3.3.4 EPBC Act Protected Matters

The conditions of the PEPR require that records of three EPBC listed threatened species are reported if they a recorded during ecological surveys at site, namely Thick-bill Grasswren, Plains Mouse and Night Parrot. In addition, observations of the Migratory / Critically Endangered Curlew Sandpiper are to be noted as per EPBC referral commitments.

3.3.4.1 EPBC1 – Thick-billed Grasswren (Vulnerable)

No evidence of the Thick-billed Grasswren (TBGW) (*Amytornis modestus indulkanna*) (calls, direct observations) were observed during the 2024 survey, including bird surveys at 20 sites, or during opportunistic observations at dams and other likely habitat during the survey. As per 2023, Song Meters were deployed at all dedicated fauna sites, a pastoral dam (South Eliza Dam), Eliza Creek (Site 10) and a small patch of potentially suitable Thick-bill Grasswren habitat within the Carrapateena Wellfield Expansion area (Site 7). There was no evidence of the distinctive high pitch calls on the Sonogram outputs, only calls of White-winged Fairywrens and Purple-backed Fairywrens.

A total of 74 bird species were observed throughout the survey including other similar sized species, such as two species of Fairy-wren (White-winged, Purple-backed) and the Rufous Fieldwren.

Whilst captures for mammals were reduced, bird detection was increased due to both Song Meter detection and presence of water in dams.

3.3.4.2 EPBC2 – Plains Mouse (Vulnerable)

No evidence of Plains Mouse was recorded during pitfall and camera trapping at eight fauna sites during the spring 2024 survey, despite trapping effort within proximity to isolated patches of cracking clay habitat. However, it is noted that many gilgais did not show a large amount of activity, cracks and fauna runs into cracks. Native rodents were only captured on nocturnal cameras and in a pitfall trap at one site during the survey (Site 5). As per 2023, Plains Mice have also been detected in the region at the South Gap offset area (Nature Conservation 2025), and inside / outside the arid recovery area adjacent Olympic Dam, however in low numbers (i.e. only one at South Gap in 2024, Nature Conservation 2025). At South Gap it is considered the population has been undergoing a low, since mid-2022, and other small mammals have also been detected in low yet stable rates. The decline in detection in 2024, particularly given the survey effort (12 permanent camera sites, recording throughout the year) continues to suggest the population is currently declining (Nature Foundation 2025). The species was most recently caught at Carrapateena in 2017 (only 3 captured) prior to commencement of the compliance monitoring phase. Detection at South Gap in very low numbers, but not at Carrapateena us likely related to additional factors (reduced impacts from grazing and predators compared with Carrapateena). In addition, detection may also have been affected by the preceding climate conditions, reduced sustained rainfall that rodents require.

3.3.4.3 EPBC3 – Night Parrot Records (Endangered)

During the annual flora and fauna survey (spring 2024) at the Carrapateena Mine site, there was no evidence of Night Parrot (calls, direct observations or distinct feathers) at eight flora and fauna monitoring sites, 20 bird survey sites and a number of opportunistic observations at dams, during spotlighting. There was also no detection via Song Meter at the fauna sites or other opportunistic locations deployed (e.g. South Eliza Dam, Eliza Creek (Site 10, Site 7). A total of four parrot species were detected throughout the survey including four common parrot species (Eastern Blue Bonnet, Mulga Parrot, Australian Ringneck and Budgerigar).

No EPBC listed Parrots were detected during the spring 2024 survey.

3.3.4.4 Curlew Sandpiper (Critically Endangered)

The EPBC listed Critically Endangered and Migratory Curlew Sandpiper (*Calidris ferruginea*) is not covered by the PEPR conditions for Carrapateena, but is one of the four EPBC species that was considered in the Operation's EPBC referral. Whilst it was considered unlikely to occur at the site, there is potential the shorebird could visit water habitats at the site.

No evidence of Curlew Sandpiper (calls, direct observations) were detected during the 2024 spring survey, whilst undertaking bird surveys at 20 sites, or during opportunistic observations at dams or on Song Meter outputs. All dams contained water during the survey period and were quite full with little exposed mud areas. The South Eliza Dams had overflow and temporary wetland conditions, with large numbers of water bird species presence. A total of 74 bird species was observed throughout the survey; with two EPBC listed as Migratory shorebirds detected; Common Sandpiper and Sharp-tailed Sandpiper (also EPBC Vulnerable). A number of waterbird species and resident or endemic shorebirds were also recorded in water habitats; Banded Lapwing, Masked Lapwing, Black-fronted Dotterel, Red-kneed Dotterel, Red-necked Avocet, Inland Dotterel and Australian Pratincole).

3.3.5 Vouchers

For the spring survey no trap deaths occurred, hence no vouchers were provided as specimens to the SA Museum as required.

3.3.6 Pitfall line integrity

As mentioned earlier, the trapping effort at the site has been reduced over the years from four pit lines to one pit line per site being opened during each survey. The reduction in number of lines was undertaken to align the survey effort undertaken with the requirements of the PEPR (i.e. focus on species diversity and not focus on measures of abundance or a need for high capture rates). There has been some flexibility in the pits and lines opened during compliance monitoring to date, using only 6 of the 7 pits in a line, and potentially using different pit lines at a site over different surveys. Previously some of the pit lines contained pits that required maintenance or permanent removal as the integrity of the pit bases did not meet ethics standards. These holes were likely related to historical Planigale presence and potentially extraction of small skinks that had managed to get under the base liner. In 2019 it was recommended that a whole pitfall line be removed from Site 5 which was completed by site environmental staff. In 2019 it was also recommended that other lines either have existing semi-permanent pits reinstated or maintenance of pit bases be added to the site enviro maintenance program which was undertaken. Initially, site environmental staff have replaced metal mesh bases (previously attached with large rubber bands / gaffer tape prior to inserting pit tube into the hole) with a similar size plastic mesh that could be attached with hot glue / selastic. This was required given the effort to extract the pit tubes which are wedged into the clay holes. The upgraded bases worked well in 2021 and 2022, but some still required further maintenance given Planigales and House Mice ongoing capture and damage of pit bases. Following the 2023 survey, the site environmental team began replacing damaged pit bases with custom-made stainless steel bases with numerous holes (2-3 mm) drilled in, to reduce ongoing maintenance and improve pitfall trap integrity across the mine site. The new bases were easy to install and can be removed with narrow-nosed pliers and a rubber mallet.

As per above regarding pit maintenance, data on pitfall traps and lines that still require new bases is provided to the BHP environment team at the end of the survey and maintenance is undertaken in the cooler months. During the maintenance schedule the pit lids are also checked to ensure that they are secure and there are no gaps where animals (particularly very small skinks, geckos, juvenile mammals) can squeeze into cracks can get in and become trapped outside of the survey period. This is required six monthly as per the Wildlife Ethics Permit. The process for securing the lid involves: digging around the top of the pit, below the lip of the pit lid (e.g. ~10cm), then aligning pit lid, banging the lid down and inserting the tech screw through the lip of the UV stable lid and the UV stable pit liner. Prior to this process the pit is checked that it is free of any fauna, particularly if pits are left open for a short time for maintenance or pit bases. These steps are required because the mine site has been approved to close pits with a tech screw rather than filling the traps with non-perishable material (e.g. rocks, sand or sandbags) at the end of the survey, as is the protocol associated with the permit for this Operation and in the Wildlife Ethics Guideline (DEW 2023). Rocks are also placed on top of closed pits to reduce UV exposure to the lid. Ethics require photos of the closed pits, and GPS coordinates of all pits, are provided in the annual Wildlife Ethics Report (due 1 February each year - Lathwida prepares on behalf of BHP), for the Permit requirements.

4 Discussion

4.1 Summary of Spring 2024 results

4.1.1 Assessment of mining impacts

Potential impacts from mining activity on vegetation would be represented by a decline in the number of native species present; a decline in the abundance of individuals within a species; a decline in plant health (e.g. due to potential raised dust settling on plants, saline seepage from tailings dam and/or altered groundwater levels) and/or an increase in weed presence. The discussion below outlines why the 2024 survey results do not indicate impacts on vegetation from mining at Carrapateena.

4.1.2 Native flora species diversity (RAM sites)

Monitoring of perennial species diversity (number of species present) provides an indication of long-term trends in plant populations. Prior to operational monitoring, baseline monitoring was conducted between 2012 and 2017. This period included years of average, well above-average and well below-average rainfall, hence providing a wide range of data, against which compliance data can be compared.

At the Carrapateena operational area, long-lived species diversity is monitored at the scale of individual one-hectare sites, at a habitat scale (stoney tableland, dunes, drainage lines) and at a landscape scale (number of plant species present across the whole operational area). Long-lived plant diversity is relatively constant in undisturbed environments. In contrast, ephemeral diversity varies greatly in response to rainfall in arid rangelands. Long-term monitoring of short-lived plant diversity however is also important because short-lived plant species often comprise most plant species in arid rangelands (Davies et al. 2018). Long-term changes (10+ years) in short-lived species diversity may indicate possible irreversible changes such as due to climate change, loss of soil seed bank, grazing impacts.

4.1.2.1 Flora diversity across the whole Carrapateena operational area

In spring 2024, a cumulative total of 141 native flora taxa was recorded at the RAM flora sites across the Carrapateena Operation area. This was the equal highest diversity recorded during the any of the compliance monitoring surveys, which began in autumn 2018. The high species diversity was due to the high diversity of short-lived species: the total of 81 short-lived species in 2024 was the second highest recorded during the compliance monitoring to date, while the long-lived species diversity was within the range recorded during the previous compliance monitoring surveys. Long-lived plant diversity has been very stable, with yearly totals ranging from 58 to 62 since autumn 2018, and 60 species recorded in 2024. The very high number of short-lived species recorded in 2024 is likely to be the result of above-average rainfall received in June, July and August preceding the survey. For the stoney tableland flora sites, much of the short-lived species diversity is contained in the small gilgais (and as documented by Davies et. al. 2018), re-enforcing the importance of this micro-habitat. In 2024 the mean total species diversity for impact sites and for control sites was not significantly different (29 and 28 species, respectively), and within the baseline range. Given post-construction monitoring results have not shown clear trends emerging in long-lived or short-lived species diversity, and no significant difference between control and impact site mean diversity, it is considered that there has been no impact on perennial or short-lived species diversity from mining.

4.1.2.2 Flora diversity for individual habitats

Eliza Creek sites. Flora Site 10 was the only site on Eliza Creek to be established during the baseline survey period. To provide additional data against which to monitor potential impacts of the TSF dam embankment on downstream Eliza Creek habitats, flora Sites 17, 18, 19 and 20 were established in autumn 2018. Given the TSF became operational in 2020, the 2018 and 2019 surveys represent pre-construction species diversities. Since 2018, there has been no distinct trend in species diversity for any of the Eliza Creek sites, with mean diversity for 2020 to 2024 surveys (namely, TSF operational) being similar to 2018 and 2019 tallies.

Dune habitats. No dune habitat flora sites were included in baseline monitoring. Hence, flora Sites 21 and 22 were established to determine potential impacts from mining on sand dune habitat. Site 21 is considered a control site (> 2 km from mining infrastructure) and Site 22 a potential impact site as it adjoins the Western Access Road (< 2 km from mining infrastructure). Since 2018, no clear trend in long-lived species diversity has emerged at either site, hence species diversity in the dune habitat is not considered to have been impacted by mining activities.

Gibber (stony tableland habitat). As at spring 2024, there were also no trends emerging in species diversity at either control or impact sites in gibber (stony tableland) habitats, the dominant habitat within the mining lease.

4.1.2.3 Flora diversity for individual sites

At individual impact and control sites, perennial species diversity has been very consistent between surveys, for all sites except impact Site 12 and control sites 1 and 2. The latter have fluctuated between survey periods, but show no obvious trends. Variations at these sites occurred prior to 2022, and are thought likely to be due to variation between observers in interpreting survey boundaries, rather than actual changes in perennial diversity. Given that there have been no consistent trends in plant diversity for individual sites, it is considered that there has been no impact on mining at either the site level, habitat level or landscape level.

4.1.3 Long-lived woody perennial species diversity and abundance (Jessup transects)

To analyse potential mining impacts population trends (abundance) in long-lived woody plants, Jessup transects have been surveyed during baseline and construction monitoring. Since 2018, the population of the three most abundant and widespread shrubs have been analysed in detail, namely: Bladder Saltbush, Sea-heath and Samphire. Following declines in the abundance of all three species in 2019 and 2020/2021, the abundance of all three species across all sites, has increased or remained stable since 2021/2022. The widespread declines were associated with below average rainfall in 2017, 2018 and 2019, with the total rainfall in 2019 being 30% of the long-term mean, and with widespread dieback of shrubs noted during the 2019 and 2020 surveys. During prolonged drought, Bladder Saltbush drops its leaves and hence even if still present may have become less obvious in the Jessup transects. The increases in population abundance since 2021 have been associated with average or near-average long term rainfall totals. In 2024, the populations of the above four species either remained within the baseline range, or had recovered to once again be within the baseline range.

Bladder Saltbush is the dominant shrub and plant cover at all gibber sites and is slightly to moderately palatable in this environment. Bladder Saltbush has a lifespan of approximately 25 to 30 years and is recognised as an important species for ecosystem stability in rangelands of southern Australia (Walsh et. al. 2005). Widespread regeneration of Bladder Saltbush was recorded at the Jessup sites, in both 2023 and 2024, largely contributing to the recovery of Bladder Saltbush populations since 2020. In 2024 the number of juveniles recorded was the highest since construction monitoring began. Although many of the juveniles in 2024 were less than 10 cm tall, not woody and unlikely to survive an extended hot dry period, the survival of even a small percentage is likely to assist in there being a sustainable population. At control sites, the mean number of Bladder Saltbush (adult and juvenile combined) in 2020, 2021, 2022 and 2023 were all below the baseline range but in 2024 had recovered to be once more within the baseline range. Bladder Saltbush appears to germinate readily in cooler months, after good rains. The widespread regeneration in 2023 and 2024 correlates with average to near-average yearly rainfall totals. Since 2018 (compliance monitoring) the correlation of population size with rainfall and the greater recovery at impact sites (compared with control sites) indicates that rainfall totals rather than mining has influenced Bladder Saltbush populations.

As with Bladder Saltbush, the abundance of Samphire plants in Jessup sites declined in 2020/2021 following below average rainfall years. The population means for both impact and control sites returned to being within baseline ranges, in 2023 and 2024. As with Bladder Saltbush, the greater recovery at impact sites rather than control sites indicates that Samphire abundance has not been affected by mining related activities. During compliance monitoring, the population of Sea-heath recorded at Jessup transects also declined during the below average rainfall years of 2018 – 2020 but has increased since 2021 with increased yearly rainfall. During compliance monitoring the mean population of Sea-heath at impact sites has remained within the baseline range, while the mean population at control sites has been within the baseline range for all years except 2021. Samphire and Sea-heath are unpalatable species not grazed by stock, kangaroos or feral animals. Hence changes in abundance are potentially due to mining activities or climate changes. Impact sites, however, have either shown similar trends to control sites, or even increased population trends. Changes in abundance also show a strong correlation with rainfall totals - with increased populations recorded since 2021. Hence this suggests that changes in abundance in these species are related to climatic changes rather than impacts from mining. Plains Lantern Bush and Bladder Saltbush are moderately palatable and their increased abundance may be due to both increased rainfall and widespread destocking across the lease area.

In 2024, the Plains Lantern Bush population at Jessup transects was the highest recorded during both baseline and compliance surveys, and largely due to increases at impact sites. Juveniles were present indicating the recovery was due to increased rainfall stimulating germination and/or reduced grazing pressure (Plains Lantern Bush is moderately palatable).

Bush Minuria, although relatively resistant to dry periods, it is moderately palatable, and normally found in the protection of woody shrubs such as Bladder Saltbush. As with other long-lived shrubs recorded at the Jessup sites, Bush Minuria abundance declined (or remained at very low levels) in 2020 and 2021 but increased in 2023, by at least 200% at all sites, and recorded further increases in 2024. As with Plains Lantern Bush and Bladder Saltbush (also moderately palatable), the recovery of Bush Minuria coincided with increased rainfall and widespread destocking.

In summary, the population abundance of the five most abundant and/or widespread long-lived shrubs declined during 2018/2019 to 2020, but have all increased since 2021/2022. At control sites, the declines were either similar or greater than at impact sites. This indicates that the declines were due to factors other than mining impacts. The population fluctuations in the long-lived shrubs are attributed to fluctuations in yearly and longer- term rainfall totals rather than mining impacts. Exceptionally dry conditions in 2018 and 2019 are likely to have caused widespread dieback and decline of long-lived shrubs. Samphire and Sea-heath are non-palatable, removing grazing as a cause of the decline experienced in these species. Grazing impact has declined across all the study sites since 2018 (refer Section 3.2.5) which removed grazing as a possible cause of reduced abundance of the more palatable long-lived shrubs (Bladder Saltbush, Bush Minuria and Plains Lantern Bush). Widespread recovery of shrub health and increased germination since 2020/2021 has coincided with average or above-average yearly rainfall totals for the region.

To provide data against which to assess potential impacts on vegetation downstream of the TSF, four flora sites, which included Jessup transects, were established in autumn 2018, located progressively downstream from the TSF embankment within Eliza Creek. A fifth site was established during baseline surveys, located furthest from the TSF on Eliza Creek. At all sites, the total number of long-lived woody perennials present in the Jessup transect, has increased since 2018. Ten of the most abundant long-lived woody perennials recorded at the Eliza Creek Jessup transects were separately analysed. All 10 species have shown yearly fluctuations, but have either recorded no long-term change in abundance, or an increasing abundance trend. The only exception was Dead Finish which has recorded a downward trend at Site 10, since 2021. Dead Finish occurs in dense clusters at Site 10, and fluctuating numbers may reflect differences in distinguishing individual species between survey periods. At the Jessup transects upstream from Site 10 (namely, closer to the TSF than Site 10), populations of Dead Finish have remained stable since 2018.

Western Myall is the dominant tree at Jessup Sites 17 and 18. Western Myall abundance has fluctuated yearly at these sites, but without displaying a downward trend. The population fluctuations are largely due to fluctuations in seedling abundance (including some seedlings likely germinating, but not surviving beyond a year). Regeneration of Western Myall has been widespread. In 2024 most regeneration was recorded at the Jessup Site 17 where there were nine juveniles. This is notable as Site 17 is less than 300 m from the TSF and the adult and juvenile Western Myall trees remain healthy with regular recruitment and/or growth of trees.

The Eliza Creek Jessup transects have shown an increase in total perennial species abundance, as well as no decline in individual species abundance. Hence, no impact from mining activities is considered evident at the Eliza Creek flora sites.

4.1.4 Plant health

During the survey, there was no dust layer noted on plants. This aligns with findings of the Dust Impact study (Jacobs 2020b) which recorded no significant decline in plant health or vigour at distances greater than 10 m from roads. No new impact on plant health due to salinity was recorded.

In 2024, qualitative observations of Bladder Saltbush noted that dieback/ leaf loss was much reduced compared to 2020 levels, and that almost all shrubs were heavily in fruit, perhaps the most since compliance monitoring began (pers obs. S Croft who has conducted all surveys since 2018).

At the Eliza Creek flora sites, qualitative observations noted that the only species with reduced vigour were Green Emubush (*Eremophila serrulata*) and Crimson Emubush (*Eremophila latrobei*). These species displayed leaf yellowing in approximately 25% of the population. No species death was noted and there appeared to be no decline in abundance as indicated by Jessup data.

In summary, 2024 survey results indicate that there are no current detectable impacts from mining on flora, i.e. no long-term decline in the number of native species present; no long-term decline in abundance of any species, no differential decline between control and impact sites in the abundance of individuals within a species; and no decline in plant health (e.g. due to potential raised dust settling, saline seepage)..

4.1.5 Tree health (canopy cover)

The canopy health of the dominant tree species at Eliza Creek sites (17, 18, 19 and 20) has been assessed since 2018 using both a GRS densitometer and visual estimates of canopy intactness. Canopy cover was also assessed at transects in the Eliza Creek sites to assess potential impacts on tree health due to seepage from the TSF or reduced water flows down the catchment. Comparing the total number of densitometer foliage records along a transect over time provides an indication of changes in total canopy cover. Potential changes in total canopy cover may be a combination of canopy expansion of existing trees; recruitment of trees and/or canopy decline of existing trees. At each Eliza Creek site, there are two nearby parallel transects. Along each 100 m transect, readings were taken every metre, hence the number of readings showing canopy cover equates to the percent canopy cover along the transect. Additionally, visual estimates were made (with no tool) of the entire canopy of individual trees, to assess the extent of foliage compared to the potential extent of foliage expected of a tree in good health (after Souter et al 2009).

4.1.5.1 Western Myall trees

At sites 18, 19 and 20, the total number of Western Myall foliage records for each site has trended upwards since 2018. The increase in densitometer foliage records at each site is largely due to additional trees recorded along each transect. Visual estimates of tree canopy extent have remained stable for each site. For all transects combined there has been a net increase of 21 live Western Myall trees with a loss of two trees, but 23 new trees recorded since 2018. In 2024 four new Western Myall trees were recorded along the transects (one at Site 17, two at Site 18 and one at Site 19) and no deaths. The two Western Myall trees that have died since 2018 were trees with pre-existing very high levels of canopy loss prior to operation monitoring. In summary, since 2018, there has been an increase in Western Myall foliage recorded along the transects, and the very high levels of canopy intactness of existing trees has remained constant. These results indicate that there has been no decline in Western Myall tree health collectively for each site, and there has been strong recruitment and/or growth of juvenile trees. As at 2024, mining related activities (impacts from TSF) have not impacted Western Myall abundance or health along the Eliza Creek canopy cover transects.

4.1.5.2 River Red Gums

During the compliance monitoring (2018 to present), the canopy intactness levels of River Red Gums has varied considerably, both within individual trees, transects and between survey periods. However, the number of River Red Gum densitometer foliage records in 2024 was similar to the number of records in 2018. The records declined during and following the low rainfall years of 2018 and 2019/2020, followed by gradually increasing foliage trends. Well-below average rainfall was recorded in 2018 - 2020, followed by two years of average rainfall, but which included exceptional rainfall events in spring and summer.

Site 19 is 3 km from the TSF, and the first occurrence of River Red Gums downstream from the TSF. Site 20 is 4.6 km from the TSF. For both of these sites and transects, the number of foliage records have been relatively stable since 2022, and 2024 records are similar to those in 2018/2019. In 2024, the number of live River Red Gums present at Sites 19 and 20 was the same as in 2019.

Changes in the cover of River Red Gum canopies during operation monitoring is likely to reflect seasonal conditions, which in turn, will have varying impacts depending on unquantified variables such as age and size of tree (which will determine root depth and access to water). The impact of well above-average or well below-average rainfall on River Red Gums seems to be apparent within 12 months, with foliage shedding occurring in 2019 (low rainfall year) and increased foliage being recorded in 2021. Foliage records for transects at Site 19 and 20 in both 2023 and 2024 showed that River Red Gums had regained canopy losses in 2018-2020. However, there has been no recruitment of River Red Gums recorded along the transects.

To date, no potential impacts resulting from the construction and operation of the TSF to the dominant trees within Eliza Creek are evident.

4.1.6 Weed diversity and abundance

There were no new weeds recorded in 2024 and no overall increase in abundance or extent of weeds declared under legislation. Although not declared, Wards Weed was recorded along the Western Access Road for the first time. This introduction may be due to mine related activities. Further details are provided below.

4.1.6.1 Weed species Declared or listed under legislation (*Landscape South Australia Act 2019*)

Declared weed species recorded during compliance/operational surveys were Bathurst Burr (*Xanthium spinosum*), Athel Pine (*Tamarix aphylla*) and Prickly Pear (*Opuntia* species). These species have been recorded during all operational surveys. Athel Pine and Prickly Pear species are also considered to be Weeds of National Significance (WoNS).

To date during operational monitoring, Athel Pine has only been recorded as clustered trees around Yeltacowie Homestead and the nearby dam. These trees are being actively controlled with numerous dead trees and/or cut trees present in 2023 and 2024. In 2024 it was noted that a few trees remain at the site. The Carrapateena station falls within the Kingoonya group of the South Australian Arid Land landscape board. Land managers are required to control Athel Pine within 100 m of watercourses and waterholes (up to 3 Athel Pine at Carrapateena are within 100 m of a watercourse), but land managers are encouraged to monitor success of control and carry out follow up control of all trees, as necessary. It is recommended that existing control efforts be consolidated by lopping or otherwise killing remaining trees and trees that have resprouted.

Up until 2023, Prickly Pear was documented from only one location (near the Yeltacowie homestead) within the Carrapateena operational area. This small population has been actively managed during operational monitoring and the population has been reduced to several square meters. In 2024, however, BHP environmental staff have reported additional occurrences of Prickly Pear. These are recommended as high priority for control.

In 2024, Bathurst Burr was recorded within the operational area only at previously recorded locations: Dawsons Dam, South Eliza Dam, and weed transects CWM01 (including Whittata Creek) and CWM02 both transects adjoining the Southern Access Road. No new populations, and no expansion of existing populations, were recorded. Plants were again recorded in the overflow area of South Eliza Dam, but in 2024 this area contained surface water due to pumping of waste treatment water into South Eliza Dam. The extra water has created and enhanced habitat for numerous bird species, but conversely has the potential to increase the spread of weeds.

In South Australia, Bathurst Burr is Declared under the Landscape South Australia Act 2019. In the SA Arid Lands, control is not enforced but landholders are encouraged to manage infestations (Government of South Australia (2021). Weed transect CWM02 occurs within Mineral Lease 6172 and CWM01 falls within the Southern Access Road and Radial Wellfield MPL 154. It is recommended that BHP work with the station owner to manage infestations at Dawson Dam and South Eliza Dam.

4.1.6.2 Non-declared Weeds

New Weeds

No new species of weeds were recorded during the 2024 survey.

Increases in abundance and/or new locations of existing weeds

Six species were recorded at previously unreported locations. These species are either annuals or require moist habitats, and have been consistently and widely recorded during baseline and/or construction surveys. Annuals may persist in the soil seed bank and only germinate when conditions are favourable. Hence, some widespread annual weeds were recorded at new locations, and conversely some annual weeds were absent from previously recorded locations. Since monitoring began, there have been yearly fluctuations in the locations of annual herbs or grasses, including Smooth Mustard, Sow Thistle, Bitter Melon. These fluctuations reflect seasonal rainfall patterns rather than mining impacts. Their occurrence at any particular location is likely to vary from year to year and un-related to mining activities.

The annual species, Smooth Mustard was recorded in greater abundance at the designated impact flora site in dune habitat (Site 22), and at a flora site on Eliza Creek (Site 20) for the first time. Conversely, however, it was not recorded at several sites where previously recorded. Smooth Mustard is an annual species that has been consistently and widely recorded during baseline and construction surveys. Its occurrence at any particular location is likely to vary from year to year. Greater abundance of this weed at some locations is likely a reflection of rainfall received and also the time of survey, the October 2024 survey being approximately 4 months later than previous autumn surveys. Since operational monitoring began in 2018, the overall population of Smooth Mustard is not considered to have increased.

Two Wards Weed (*Carrichtera annua*) plants were recorded on the shoulder of the WAR approximately 5.5 km from the Stuart Highway. It has only previously been recorded within the Carrapateena operational area along the SAR as an isolated patch. This was in 2021 when the SAR was the main access to the mine site. The WAR was constructed/upgraded in 2022, specifically for vehicle access to the Carrapateena Mine site. Wards Weed therefore may have been introduced to the WAR as a result of mine-related activities. It is recommended that this small population be located in winter when it is actively growing and eradicated.

In 2024, Maltese thistle (*Centaurea melitensis*) was recorded for the first time along weed transect CWM01 adjoining the SAR. Maltese thistle has previously been recorded during baseline and compliance surveys in Eliza Creek and at Dawsons Dam. Its presence in 2024 in a SAR culvert and in Whittata Creek, is likely due to seeds being transported by water from the Whittata Creek complex, and not as a result of mine-related activities.

A few plants Mallow (*Malva parviflora*) were recorded at North Eliza Dam. This species has previously been recorded at South Eliza Dam, Anzac Dam and ephemeral watercourses along weed transects CWM01 and CWM02. Mallow is associated with high nutrient, moist soils and its presence at North Eliza Dam is likely due to the moist habitat, enhanced soil nutrients from stock grazing, and unrelated to mining activities. Scarlet Pimpernel (*Lysimackia arvenis*) was recorded for the first time at North Eliza Dam, but has previously been regularly recorded at the Expo Village Effluent Irrigation area and along weed transects CWM001 (culvert area) and CWM06 (ephemeral drainage line). Its presence is strongly linked to wet habitats and its occurrences other than at the Effluent areas is unrelated to mining. Weeds associated with the Effluent Irrigation area rely on this moist environment and are unlikely to spread beyond the irrigated area. Trailing Verbena (*Verbena supina*) was recorded at North Eliza Dam for the first time. This species has previously been recorded at Anzac Dam. Its presence is due to presence of surface water rather than mining related activities.

Non-declared weeds with potential to spread

Couch grass was recorded near the SAR, associated with Whittata Creek. Couch is present in the wider region associated with dams, watercourses and settlements, with the nearest public database records being Roxby Downs, Stuart Creek Homestead Dam, Curdimurka railway siding and watercourses at Witchelina and Flinders Ranges (ALA 2024). Although drought tolerant, Couch grass prefers moist locations, and colonises sites subject to disturb ace such as grazing. Its origin at Whittata Creek is unknown, but because the occurrence along Whittata Creek was approximately 35 m from the SAR, it seems unlikely to have been transported in by mining vehicles. Couch grass however has the potential to spread aggressively along the creek, by rhizomes and stolons, and sensitive environmental control is recommended.

4.1.7 Landscape Function Analysis

The spring 2024 survey was the sixth assessment of Landscape Function at two sites prepared for rehabilitation in 2019 (Aerodrome and Ventia sites), and the third assessment at two sites (Midway Quarry and Tjungu) prepared for rehabilitation in 2022. All sites were devoid of plants when initially prepared for rehabilitation and were on sites that would have formerly supported Bladder Saltbush +/- Samphire low shrubland on stony tableland. The Point-Centred Quarter (PCQ) method has been used to complement the LFA survey, to additionally record plant density and diversity in the early stages of rehabilitation when plant density along the LFA transect line is sparse. PCQ monitoring began in 2020 for the Aerodrome and Ventia sites, and in 2023 for the Midway Quarry and Tjungu sites.

For the LFA established method, successful rehabilitation has occurred when various plant cover and soil parameters that contribute to capturing nutrients in the landscape, are equal to those measured in reference (analogue) habitats. By 2023, the Tjungu LFA site had already exceeded plant densities recorded at analogue sites, despite only being established in 2022. In 2024 mean patch density at the Tjungu site increased still further to 7 patches per $10m^2$ (compared with the analogue mean of 3 patches per $10m^2$). In 2024, the Tjungu vegetation patches comprised between 23% and 33% of the linear transects. The species composition was also comparable with reference Bladder Saltbush communities. Ten native species were recorded including 4 long lived perennials, which in turn included several plants of Bladder Saltbush. Further, plant density was relatively even along the transects, there being no major gaps with no vegetation patches. The rehabilitation success of this site correlates with the deep ripping that occurred, not only providing deep trenches to capture water and seed, but also to create high volume surface rock cover that also assists in trapping nutrients. This site is considered to have been successfully and sustainable restored and further monitoring is not considered necessary.

Since 2022, the Aerodrome LFA site has also reached and slightly exceeded mean vegetation patch densities recorded for the reference (analogue) sites, the Aerodrome LFA recording 3 to 4 patches per $10m^2$. In 2024, 9 short-lived perennials and 3 long-lived plants were recorded at the Aerodrome LFA. The long-lived species were recorded along the LFA for the first time in 2024. Unlike the Tjungu site however, the Aerodrome transects each comprised extensive lengths of the transect where no vegetation patches were present. The relative success of rehabilitation at the Aerodrome correlates with the depth of trenches prepared and volume of surface rock – trench depth and surface rock volume were less than Tjungu LFA, but greater than Ventia and Quarry LFA sites.

The Midway Quarry site since its establishment in 2022 has recorded increases in plant density in 2023 and 2024, but the patch density of one plant per $10m^2$ is below the analogue mean of 3 patches per 10m2. Trench ripping at the midway Quarry site was relatively shallow and very little surface rock was present. Only two species were recorded along the transects, both short-lived perennials. This site should be continued to be monitored for rehabilitation success using both the LFA and at least in the short-term, the PCQ method.

The Ventia site trenches were very shallow and in 2024 only one patch comprising a short-lived biennial was recorded along one transect. The other transect at this site had been graded and was being used as a temporary laydown area for adjoining road construction. It is recommended that these sites be prepared again for rehabilitation with deep ripping.

Of the species that were hand-seed to prepare the Tjungu site, only two were recorded in 2024: Pop Saltbush (*Atriplex holocarpa*) and Bladder Saltbush. These species were also present at other rehabilitation sites. Although all of the hand-seed species have been recorded within the Carrapateena Operation survey area, in the rehabilitation habitat (stony tableland) the hand-seeded species most likely to naturally occur are: Pop Saltbush, Grey Bluebush (*Maireana appressa*), Bladder Saltbush and Shrubby Twinleaf (*Roepera aurantiacum*). Within the Operation survey area, the remaining hand-seeded species are more commonly associated with major creek lines, floodouts/clay depressions and/or dunes.

Soil properties

The LFA established method also reports on soil stability, infiltration and nutrients. Since the first LFA assessment at each site, the four rehabilitation sites have all recorded a soil stability index approaching the reference (analogue) mean. This is largely due to the heaver soil texture (high clay component) of the sites. However, the soil stability index declined slightly for all 4 sites in 2024, perhaps reflecting the flattening out of the trenches. Further improvement is expected however, as patch cover, litter cover, and deposited materials increase. For the soil infiltration index, in 2024, the indices recorded at the Aerodrome and Tjungu sites were approaching the analogue means. At the Ventia and Midway Quarry sites, the soil infiltration index has declined. This is likely due to the evening out of troughs reducing soil roughness, while vegetation and litter cover remaining low. Further improvement is still required at all sites to meet the analogue mean.

The nutrient index for each site has been highly variable between surveys, without showing a distinct trend. This index is heavily influenced by leaf litter which currently is highly patchy. The nutrient index the Aerodrome LFA has remained very close to the analogue mean, and at Tjungu is approaching the analogue mean, reflecting the high vegetative cover at these sites. At the Midway Quarry and Ventia sites, the nutrient index was approximately 50% of the analogue site means, reflecting the sparse vegetative cover at these sites.

In summary, soil stability for all sites are approximately 70% of analogue means, soil infiltration indices are similar to the analogue mean at Tjungu and Aerodrome LFAs (and 50% of the analogue mean at Ventia and Midway Quarry LFA sites), and soil nutrient indices range from 50% (Ventia site) to 90% (Aerodrome site) of the analogue mean. Given the soil indices are based on dependent variables, which have different trajectories (e.g. vegetation cover is likely to increase whereas surface roughness is likely to decrease), longer term data is likely needed to determine trends.

Given the variability of results, the establishment of plants and patches may be a more effective early measure of improvement, whilst the SSA may provide more value of long term function over future years of monitoring (provided there is no drastic loss of function observed during monitoring or anecdotally).

LFA summary and recommendations

At the Tjungu site, rehabilitation vegetation is considered to be compliant and complete, the plant density and floristic composition resembling analogue sites. Further monitoring is not considered necessary.

At the Aerodrome site rehabilitation is compliant, but still ongoing. Overall patch density resembles analogue sites, but because of the unevenness of plant cover, rehabilitation is not yet complete and further monitoring is recommended for at least one more year.

At the Midway Quarry site, rehabilitation is compliant as patch density has increased each survey period. However, patch density is still sparse and ongoing monitoring is recommended for several more years.

At the Venetia site, one transect had been substantially altered by mechanical grading and no plants were present. At the other site only one plant was present. It is unlikely to substantially improve further and site preparation should be re-done with deep ripping.

OMC LUP4 is considered to be in-progress / compliant at Tjungu, Aerodrome and Midway Quarry sites, but not at Ventia.

4.1.8 Fauna

4.1.8.1 Diversity and abundance

The 2024 spring fauna survey detected a total of 107 vertebrate species from the eight survey sites and opportunistically within the broader study area. Total species diversity (birds, mammals and reptiles) was generally within or above the range of baseline survey results. The capture rates for small mammals and reptiles combined (0.44) were above the previous spring compliance monitoring rates (~0.23, between 2018 and 2022) and within the range reported during baseline surveys (0.17 to 0.97). The high rate was largely attributable to the high number of reptile captures and warmer temperatures during the survey. The highest reptile diversity (above baseline and compliance) was also recorded for the 2024 survey, with 18 species detected (including the less common Eastern Striped Skink (*Ctenotus robustus*) captured again at Site 16 (Plate 4.1).

Whilst the site has previously experienced ongoing drought conditions and below average rainfall, above average rainfall events in summer of 2023 and winter of 2024, interspersed with periods of well below above average rainfall along with warmer temperatures during the spring survey likely influenced these results. Presence of water in all of the dams would have contributed to increased bird diversity, a winter rainfall event and presence of short-lived flora would have provided resources to the resident dunnart and reptiles species. For small mammals, rodent diversity and numbers were low and this is reflective of fluctuating rainfall throughout the preceding years. Regardless, there was evidence of all fauna breeding, in family groups or pairs, some small mammals had evidence of brood patches and one Stripe-faced Dunnart that appeared heavily pregnant was recorded via camera trap. In addition, a number of species were detected that were either a new record or species had not been detected since baseline / early compliance monitoring (e.g. juvenile Southern Four-toed Slider and several microbats). Overall, these results are positive and suggest that the reduced survey effort compared with baseline surveys has not influenced the capture rates or diversity, particularly for small mammals and reptiles. Hence the refinements to the trapping effort made during the course of the baseline survey work (2012 – 2017), and at the commencement of the compliance monitoring in 2018 to align with the requirements of the PEPR and mine lease conditions is sufficient. The presence of species that have not been recorded since the baseline monitoring and high bird and reptile diversity is also a positive sign for the overall condition of the Carrapateena site.

Mammals

In terms of small mammal diversity, several species were not detected in 2024, however these species have historically been recorded in lower numbers (Forest's Mouse, Planigales), and have not been recorded during all previous surveys. In addition, no Plains Mouse were detected. Similar to previous years, small mammals are likely influenced by preceding climate. It is well known that there are varying responses to climate and trapping response for small mammals in arid areas (Read 1988). For example, Pseudomys species have been shown to respond to significant weather events 3-10 months after the event, with the variability in response dependent on both pre-existing population abundance and resource availability (Dickman et. al., 1999, cited in EBS 2017).

Of the small mammal captures, Stripe-faced Dunnarts were represented in greater numbers than Fat-tailed Dunnarts, aligning with trends observed during baseline and compliance monitoring prior to 2024. Stripe-faced Dunnarts are more influenced by weather and habitat conditions and may have breaks or fewer litters. Stripe-faced Dunnarts also prefer habitats with greater plant diversity and healthier (denser) understorey (Animalia 2018, OEH 2020). Stripe-faced Dunnarts were present in several age classes and larger numbers, suggesting conditions were suitable for that species, whereas Fat-tailed Dunnarts were present in much lower numbers and may not have commenced breeding. Fat-tailed Dunnarts are known to continue to breed for to up 6 months without breaks once the breeding season commences, hence smaller numbers may suggest drier conditions earlier in the season may have limited the opportunity for a continuous breeding cycle. Similarly, dunnarts are known to use daily torpor to thrive in adverse environmental conditions and exploit resource poor environments and they are known to adjust the breeding period depending on climatic conditions. There is no evidence to suggest mining is impacting small mammal presence across the site.

While the survey effort used for detection of microbats has not been consistent across compliance monitoring and when compared with baseline monitoring, a number of species were detected during the baseline monitoring and it is considered good practice to occasionally monitor for these species to confirm ongoing existence at the site. During the 2024 survey five microbat species were detected at two Flora Sites and one Opportunistic Site. These sites were surveyed because they had suitable roosting or feeding habitat. Two of these species have been regularly detected at site (White-stripe Free-tailed Bat, audible to the human ear, and the Lesser Long-eared Bat). The other three species had not been detected since baseline surveys; Gould's Wattled Bat, Inland Forest Bat and Inland Free-tailed Bat.

Comparisons between mean species diversity and capture rates between control and impact sites showed slightly higher diversity and capture rates for impact sites for the original treatment, and slightly higher diversity for control site for the updated treatment. For the updated treatment, mean captures were the same for control and impact sites. Regardless, both treatments indicated no statistically significant differences for control and impact means for diversity and captures. As suggested in 2023, the updated treatment provides more statistical rigour having an equal number of control sites (4) compared with impacts sites (4) and aligns more with delineation of control and impacts sites (previously related to dust contour monitoring, distance to infrastructure) in relation to the operations phase, now that the WAR has been completed, and traffic along the SAR is greatly reduced. The findings for fauna also align with the flora results. Regardless, significant mining related impacts to common fauna are not evident from the 2024 data or when making comparisons to previous baseline and compliance data.

Birds

Splendid Fairywrens were not detected in bird surveys between 2019 to 2022, however they were detected in the sand dune habitats and nearby during the autumn 2023 survey. Similarly, they were also recorded during baseline surveys with higher rainfall (e.g. 2012, 2014 and 2016) and during early compliance monitoring (2018). This species was also not detected in 2024. Whilst resident White-winged Fairywrens and Purple-backed (Variegated) Fairywrens have been generally detected every year during baseline and compliance monitoring, Splendid Fairywrens were not recorded every year, suggesting transient presence, or population fluctuations. Similarly, Rufous Fieldwren are not detected every year and were absent (2020) or limited detection (2021). However, this species was detected at most fauna sites in 2024 and regularly recorded on Song Meters.

Similar to spring 2022 water was present in all the dams, and the, which influenced the records for waterbirds / shorebirds across the site in water and non-water habitats. Water in the South Eliza temporary watersource also attracted many species and waterbirds were nesting and breeding at the site. One species, the Australian Pratincole had not been detected since baseline and was present at a number of sites. Three new species were detected; Pelican, Rufous Songlark and Red-necked Avocet. The total number of bird species was increased from 2023, and within the upper range of baseline, and is likely reflective of the presence of water across the site, preceding rainfall beneficial impacts on short-lived vegetation and Song Meter detection (extra survey effort) at some sites. Noting only 10 additional species were detected via Song Meter that were not detected via bird survey and Song Meters were also deployed in 2023.

EPBC listed species

Only one EPBC listed threatened fauna was detected throughout the spring 2024 survey; Sharp-tailed Sandpiper (Vulnerable), also listed as Migratory. This species has been recorded at the site previously, most recently in 2021. In 2024, three individuals were detected at the South Eliza Wetland. Previously similar small numbers have been detected at the North Eliza Dam and the Tjungu Village Effluent Irrigation Area (which is no longer in use). One other EPBC Migratory species was also detected at the South Eliza Dam; Common Sandpiper, also previously detected on site at North Eliza Dam (in 2018). EPBC listed Plains Mouse were not detected (via trapping or camera), and there was limited evidence of surface activity around gilgais. This species has not been detected since 2017 (via standard fauna trapping) and is detected typically following a prolonged period of good rainfall. Similar to previous compliance surveys, whilst not detected at Carrapateena, Plains Mouse were detected during baited camera trapping at the South Gap offset site in 2024; however, only one Plains Mouse was detected (cameras deployed at 12 sites ongoing). The offset area, located southeast of Carrapateena on the banks of Lake Torrens, received 212 mm of rainfall, with most falling in July and November of 2024. This follows an ongoing decrease in numbers. The single South Gap detection was in June, hence none were detected during the timing of the spring survey at Carrapateena. Similarly, other small mammals were detected in low but stable rates, lower rates in Oct 2024 (<2), higher rates in July -August (1-8 detections per 100 trap nights). Whist Plains Mice were originally detected at Carrapateena via annual pitfall trapping, future consideration could be given to establishing a bait camera trap program, similar to South Gap to increase detection. In addition, review of rainfall conditions preceding the next annual survey should be considered, prior to deciding whether the annual 2025 survey should be in autumn or spring. One option may be to deploy cameras in autumn through to the physical trapping survey in spring. Autumn deployment of cameras would need to follow suitable sustained rainfall and could coincide with other monitoring that is not season dependent (e.g. LFA, weed monitoring).

Pest species

Whilst evidence of pest species was noted (House Sparrows at camps, Rabbits at several locations), there was no major increase in presence of pest fauna species was observed as part of the survey, i.e. observations of rabbits, sparrow numbers and cats was maintained / less than previous and House Mice were detected in low numbers (captured at Site 1, and Site 16). However, it is noted that the rabbit warren at Site 15 remains active and requires management. No Feral Pigeons or foxes were detected. All of these species have been recorded previously, in low numbers and hence does not constitute an increase in pest species present, therefore the site is considered compliant against OMC criteria related to pests.

Plate 4.1: The less common Eastern Striped Skink captured again at Site 16

4.2 Compliance against Obligations

As indicated in Section 1.1.1 above, the approved PEPR for ML 6471 outlines a number of monitoring commitments required to demonstrate compliance against the mine lease 6471 conditions (Table 1.1) and the approved environmental outcomes (Table 1.2) for the Operation. Table 4.1 below provides a summary of compliance against the conditions and outcomes based on the results of the spring 2024 survey.

All mine lease conditions and outcomes are currently being met.

Table 4.1: PEPR ML 6471 Compliance Reporting, spring 2024

Date	Monitoring Requirement/s	Achievement Value	Locations	Compliant / Non-Compliant	Evidence	Actions / Recommendations
October 2024 (spring)	ML 6471 Schedule 6, Condition 6, Condition 28.1 MPL 149 Schedule 6, Condition 10, MLP 152 to 154 Schedule 6 Condition 6 MLP 156 Schedule 6 Condition 3 OMC WP1 / WP2 Annual (spring) survey	No introduction of • new species of weeds declared or listed under relevant legislation • plant pathogens • pests (including feral animals) when compared to previously recorded weed species and introduced fauna. No sustained increase in the abundance of existing weed or pest species in the land compared to previous survey records.	Weed monitoring transects (CWM01-CWM07, NWM01-NWM03) Flora Sites 1- 7; 9 – 13; 15 - 22 Opportunistic and targeted observations across Operation area	Compliant	No new species of weeds declared or listed under relevant legislation were recorded at flora sites, weed transects, or elsewhere within the Operational area in October 2024. Existing known Declared weeds are Bathurst Burr, Athel Pine and Prickly Pear. No new populations of Bathurst Burr recorded, although existing known populations remain high. No increase in size of the known small populations of Athel Pine, which is being actively controlled. No increase in the size of the existing documented small population of Prickly Pear, which is being actively controlled. In 2024, new locations of existing weeds were recorded for 2 perennial species and 4 annual herbaceous species; annual species Maltese Thistle (*Centaurea melitensis*), Mallow (*Malva parviflora*) and Scarlet Pimpernel (*Lysimachia arvensis*) (previously recorded at dams, effluent irrigation areas and/or watercourses). New 2024 locations include high moisture habitats and coincided with the non-occurrence of these species at some previously recorded sites. Hence, there was no net increase in these weeds. These locations are outside of mining lease activities and their occurrence is habitat related rather than due to mining activities. Smooth Mustard (*Sisymbrium erysimoides*), an annual has been abundant and regularly recorded within the operational area during baseline and compliance monitoring. Its occurrence at a new location coincided with its non-occurrence at some previously recorded locations and there was no net increase in the population across the operational area. The perennial herb, Trailing Verbena (*Verbena supina*) was recorded in 2024 at North Eliza Dam for the first time. However, it was not recorded in 2024 at Anzac Dam where it has been previously recorded. Its preferred habitat is high moisture environments and its occurrence at North Eliza Dam is likely due to increased water in the dam, rather than to mining-related activities. Wards Weed (*Carrichtera annua*) is not declared but has the potential to spread rapidly. Two plants were recorded along the WAR for the first time in 2024, and its presence is likely related to being introduced on tyres of mine-related vehicles. Its only previous occurrence within the operational area was on the Southern Access Road. This population has not been re-recorded, hence to date there has been no net or sustained increase in Wards Weed. The population of Tree Tobacco (*Nicotiana glauca*) remains high at South Eliza dam, with potential to increase due to the disturbed and higher soil moisture habitat of the dam (rather than due to mining related activities). An extensive population of Bitter Melon (*Citrullus lanatus*) was recorded in 2022 and 2023 along the Western Access Road shoulder. It is likely that the population increased due to soil disturbance during the WAR construction. However, in 2024, its population along the WAR at designated weed transects was much reduced. In summary, to date there has been no net or sustained increases in the population of any weed species recorded. House Sparrow numbers slightly reduced at the exploration camp, where worker occupancy was high at the time of survey. House Sparrow recorded previously during baseline. Rabbit presence observed at more sites, presence is sustained. Cats only detected at one location (sand dunes).	Ongoing weed monitoring at flora sites 1-22 and weed transects CWM01 - CWM07, and opportunistic and targeted observations (camp, effluent irrigation areas, spill areas, dams). Ongoing opportunistic observations, including revisiting sites where weeds have been identified in spring 2024. Weed management by BHP in response to data reported here, in particular continued ongoing management of Bathurst Burr. Any new individuals to be controlled by environmentally sensitive methods, including manual grubbing and disposal of vegetative matter or spraying where appropriate and will not impact drainage lines / water habitats. Continue control of Athel Pine (support station owner) and monitoring of Opuntia at homestead. Control all newly located populations of Opuntia (as reported by BHP ecology staff). Bitter Melon be environmentally controlled along the exposed shoulder of the WAR. Wards Weed, if detected, to be environmentally controlled along the exposed shoulder of the WAR. Ongoing monitoring of birds, including House Sparrows. Monitoring of rabbit / cat population and control as required (e.g. active warren at Site 15).

Date	Monitoring Requirement/s	Achievement Value	Locations	Compliant / Non-Compliant	Evidence	Actions / Recommendations
October 2024 (spring)	ML 6741 Schedule 6 Condition 14 OMC AQ2 Annual (spring) survey	No adverse impacts on the diversity and abundance of native vegetation at monitoring sites directly attributed to dust deposition from mining operations or mine related activities when compared to baseline native vegetation conditions unless an SEB has been approved in accordance with the relevant legislation	Flora Sites 1-22 See Figure 9.3 of the PEPR. Figure 2.1	Compliant at Monitoring Sites.	Specific dust transects established and surveyed in 2020 covering a range of habitats including sites downwind from spoil heap. No dust detected on all transects except those downwind of spoil heap. No death of vegetation noted in 2020 due to dust. Previously existing flora survey sites (1-16, excluding 8 and 14, plus 17- 22) were monitored for native plant species diversity (RAM) and abundance (Jessup transects) in spring 2024 and data collected was compared with baseline data. Results indicated a trend in species diversity that correlates with seasonal conditions. While the diversity of long-lived drought-resistant species has remained stable since 2018, and in line with baseline data, short-lived species diversity has correlated with seasonal rainfall but has remained within the baseline range. Similar to autumn 2023, in spring 2024, the equal highest short-lived species diversity during compliance monitoring was recorded. There is no clear difference in species diversity between control and impact sites. No adverse impacts on the diversity and abundance of native vegetation at monitoring sites due to mining activities have been detected.	Ongoing vegetation monitoring at general flora sites and vegetation data comparison with baseline data continued. Ongoing analysis of control vs impact sites against baseline monitoring data and compliance monitoring data during operation phase.
October 2024 (spring)	ML 6471 Schedule 6 Condition 17 OMC TSF6 / SWRF1 Annual survey	No adverse impact on the diversity and abundance of native vegetation and water dependent ecosystems attributed to tailing seepage when compared to baseline native vegetation conditions (unless an SEB has been approved). No adverse impact on the diversity and abundance of native vegetation and water dependant ecosystems attributed to reduced surface water flows caused by mining operations when compared to baseline conditions (Appendix C5 Ecological Baseline) unless a significant environmental benefit has been approved in accordance with the relevant legislation. Linked to Native Vegetation Outcome (Schedule 6 Condition 11)	Eliza Creek monitoring (Flora Sites 10, and 17-20 (which include Canopy Cover transects). See Figure 9.3 of the PEPR (BHP 2024).	Non-compliant / ongoing / SEB to be paid	<u>Decant Dam seepage event</u> In spring, adverse impact on native vegetation immediately downstream of the TSF was recorded. In late 2022 / early 2023 saline seepage from the TSF extended beyond the approved impact zone. The area impacted by the saline seepage was surveyed in May 2023, and April 2024, and damage to native vegetation (death and dieback) was recorded over an area of approximately 0.4 ha beyond the approved impact zone. No impact on vegetation was noted at monitoring Site 17, 270 m downstream from the TSF and within 50 m of the impacted vegetation. The impact area was again surveyed In October 2024, when no further damage to Eliza Creek vegetation had been detected since April 2024, and no further extent of damage was anticipated. Refer separate report to BHP. <u>Regular monitoring sites</u> Eliza Creek monitoring results indicate no adverse impact on the diversity and abundance of native vegetation due to mining activities. Vegetation is monitored at Flora Sites 17-20 established in Eliza Creek at increasing distance from the proposed TSF dam wall, covering both Western Myall and Red Gum habitat. RAM, Jessup transects and Canopy Cover data is collected at all four sites, representing current (baseline) condition, species diversity, abundance and tree health prior to TSF construction. Monitoring at Flora Site 10 (furthest distance from TSF, in Eliza Creek), also includes Jessup and RAM (baseline 2012-2017; compliance 2018 until present). Jessup transect results indicate no obvious trends in abundance of long-lived perennial species, RAM site results indicated no obvious trends in total flora species diversity; Canopy Cover transect results indicate no obvious trends in canopy cover of dominant species. Tailings dam storage facility Stage 1 construction completed just prior to spring 2019 survey, and now operational. Eliza Creek has not flowed since pre TSF construction, there was however a controlled release from the decant dam in June 2019, with flow only recorded to 600m downstream of the TSF and no adverse impact on flora at the downstream monitoring sites has resulted from this controlled release. Baseline vegetation condition data of all Eliza Creek monitoring sites saved within baseline database for future comparison.	Ongoing vegetation monitoring at Flora Sites 17-20 for RAM, Jessup transects and Canopy Cover (which reflects a leading indicator of tree health) to enable monitoring of potential impacts, and trends in diversity and abundance of native vegetation. Adaptive management of monitoring program as required if leading indicators indicate potential impacts (e.g. canopy cover measures in close proximity to tailings dam wall). Consideration of repeat of remote sensing vegetation cover estimates on a periodic basis, as a cost-effective way to track changes in vegetation cover downstream of the TSF embankment. No further formal monitoring of Decant Dam seepage is considered necessary as no further extent of damage is considered likely. An SEB offset (required under the Native Vegetation Act 1991) will be paid as per the NVMP associated with the PEPR (Appendix C BHP 2024). In formal monitoring is suggested at the same time as annual formal canopy cover survey of Site 17 to note any further decline or regeneration of the area and conduct a RAM if there is any evidence of increase in the area that is offset via SEB.

Date	Monitoring Requirement/s	Achievement Value	Locations	Compliant / Non-Compliant	Evidence	Actions / Recommendations
October 2024 (spring)	ML 6471 Schedule 2 Condition 28.2 MPL 152 Schedule 2 Condition 13.2 OMC EPBC1 Annual survey or opportunistic sighting	Any records of sightings and recordings of the Thick-billed Grasswren are provided to the BDBSA to enable effective monitoring and record keeping, as per the Recovery Plan Actions.	Bird monitoring Sites 1-22 (which overlap with Flora Sites 1-22, and include Fauna sites 1-6, 15, 16). See Figure 9.2, 9.3 of the PEPR (BHP 2024). Opportunistic observations across project area.	Compliant	EPBC1: No records of the Thick-billed Grasswren were reported during the spring 2024 survey at any of the 20 bird survey locations or opportunistically, including sites where Song Meters were deployed, so no records were provided to the BDBSA to facilitate effective population monitoring and record keeping. Song meters were deployed at 7 fauna sites (excluded site 3), South Eliza Dam, Eliza Creek (Site 10) and Site 7 in Bosworth creek.	Ongoing bird surveys across all flora sites 1-22 and opportunistically to establish trends with baseline and compliance data. Report any future records of Thick- billed Grasswren to the BDBSA.
October 2024 (spring)	ML 6471 Schedule 2 Condition 28.2 MPL 152 Schedule 2 Condition 13.3 OMC EPBC 2 Annual survey or opportunistic sighting	Any records of sightings or captures of the Plains Mouse are provided to the BDBSA to enable effective monitoring and record keeping, as per the Recovery Plan Actions.	Fauna sites 1-6, 15, 16 for fauna trapping. See 9.2 of the PEPR (BHP 2024).	Compliant	EPBC2: No records of the Plains Mouse were reported during the spring 2024 survey at any of the 8 established fauna trapping sites, so no records were provided to the BDBSA to facilitate effective monitoring and record keeping.	Ongoing pitfall trapping at 8 established fauna trapping sites to demonstrate species ongoing presence at site during periods of irruptive population growth and that refuge habitat continues to be effective despite mine operation. Report any future records of Plains Mouse to the BDBSA.
October 2024 (spring)	ML 6471 Schedule 2 Condition 28.2 MPL 152 Schedule 2 Condition 13.4 OMC EPBC 3 Annual survey or opportunistic sighting	Any records of sightings or recordings of the Night Parrot are provided to the Night Parrot Recovery Team to enable effective monitoring and record keeping.	Bird monitoring sites 1-22 (which overlap with Flora Sites 1-22, and include Fauna sites 1-6, 15, 16). See Figure 9.2 of the PEPR (BHP 2024). Opportunistic observations across project area.	Compliant	EPBC3: No records of the Night Parrot were reported during the spring 2024 survey at any of the 20 bird survey locations or opportunistically or via Song Meter, so no records were provided to the Night Parrot Recovery Team to facilitate effective monitoring and record keeping. Noting two EPBC listed species were detected opportunistically at South Eliza Dam (Sharp-tailed Sandpiper and Common Sandpiper and results will be provided to the BDBSA as part of permit renewal process.	Ongoing bird surveys across all flora sites 1-22 and opportunistically to establish trends with construction now underway. Report any future records of Night Parrot to the BDBSA.
October 2024 (spring)	ML 6471 Schedule 6 Condition 1, 5, 8, 9 OMC LUP4 Annual LFA monitoring	Rehabilitation has achieved, or is likely to achieve, a landscape function equivalent to that of adjacent analogue LFA sites.	Baseline (analogue) LFA data from sites CEF1-CEF7 (shown in Figure 9.3 of the Carrapateena PEPR BHP 2024). Rehabilitation monitoring at four locations (Airport Laydown and Ventia Laydown, Midway Quarry, Tjungu).	Compliant	Baseline LFA data established from analogue sites. Site rehabilitation monitoring continued in spring 2024. LFA sites established at four locations (LFAAL1, LFAVOL2, LFQUA3, LFATJU4) with two transects at each site. LFA trends are established and show improvement at all sites. With the original airport site (deep ripped) and new Tjungu site (deep ripped and hand seeded), showing the best results. Use of PCQ method and LFA Established Method enabled.	Continue LFA monitoring at rehabilitation sites. Given demonstration of positive trends, plan to establish new analogue sites adjacent sites that are performing well (e.g. airport). Suggest Tjungu has reached analogue and no longer requires monitoring.

4.3 Suitability of Data for Informing Compliance

4.3.1 Overview

The data collected during the spring 2024 survey is considered to provide meaningful data to determine compliance against the mine conditions and approved outcomes. The survey methods employed enabled comparison between impact and control sites, as well as comparison with baseline data. Construction / operational compliance monitoring data has now been collected since 2018. Results have been presented as text, tables and graphs, enabling demonstration of compliance against the established outcomes and measurement criteria, and representation of initial construction/operational compliance data trends.

4.3.2 RAM quadrats

The RAM data provided quantitative data on species diversity present within each of the Flora Survey sites assessed. Further details added to the data here regarding woody long-lived perennial species enables a more thorough examination of the difference between climate and/or grazing impacts against potential impacts from mining operations. Comparison with the range of species diversity values collected during the baseline survey period has enabled an easy visual indication of current site diversity. Well defined survey sites have meant the survey area has been accurately repeatable, providing consistent results. Long-lived perennial diversity has been very stable, while short-lived species diversity has shown a very strong correlation with yearly rainfall totals, indicating the survey method provides accurate and meaningful data. Since 2021, data has been further explored further by comparing species diversity for sites of similar habitat, regardless of distance to mining infrastructure. This was done to determine if there were any trends in species diversity emerging regardless of distance to mining infrastructure.

4.3.3 Jessup transects

The Jessup transects provided quantitative data on the number of adults and juveniles present for long-lived perennial shrubs. This provides information on the health and vitality of individuals within a population, for example, it indicates if recruitment is occurring, or whether the population is declining, increasing, or staying the same. Combined with qualitative observations made on plant health (including defoliation and/or presence of dust on foliage) this will help inform if there has been an adverse impact on the diversity and abundance of long-lived woody native vegetation directly attributed to dust deposition from mining operations or mining related activities when compared to baseline native vegetation conditions. Results from these surveys enables reporting against compliance conditions. In 2020, the number of species analysed increased from two (Bladder Saltbush and Plains Lantern Bush) to four species (additionally, Samphire and Sea-heath), in response to widespread foliage loss of the two dominant species (Bladder Saltbush and Samphire) at the Stony Tableland sites. In 2021, 2022, 2023 and 2024, the key three species were analysed in detail, providing insightful data on trends in population abundance in both palatable and non-palatable species, and species that are widespread across the lease. Plains Lantern Bush was not analysed due increased variability in the baseline and compliance data. In 2023 and 2024, the population trends during compliance monitoring of another species were also analysed, but in less detail; Bush Minuria (a daisy). Qualitative observations suggested high variability of this moderately palatable and moderately drought-resistant species between survey periods, including apparent declines in 2019 and 2020. The results showed that the three most common and widespread species have continued to increase since 2020, following declines in 2019. Similarly, the Jessup data has been very effective in reflecting population changes of Bush Minuria due to climate.

Prior to the 2021 survey, at the Eliza Creek sites, analysis was confined to comparison of net perennial species diversity between recording periods, which had remained relatively stable between 2018 - 2020. In 2021, the analysis was expanded to compare trends in the abundance of individual perennial species, namely the nine most abundant species at Eliza Creek Jessup transects. This analysis was continued in 2022 and further expanded in 2023 and 2024 to include a total of 10 species. This has proven a valuable tool for determining potential trends in populations of individual species, rather than simply comparing total species diversity.

4.3.4 Canopy cover transects

The canopy cover transects record the presence of canopy foliage along a fixed 100 m transect. Within individual canopies, there may be from 1 to 10 or more recordings, depending on the width of the canopy. The technique is objective and does not rely on observer estimations of individual tree canopy intactness. By repeating the survey along a fixed transect, it is estimated that the technique can detect changes in both individual canopy “completeness” and canopy cover for the whole tree stand, where there is a change in foliage extent of as little as 20%. Tree stress or death is expected to show up in densitometer results.

The technique is considered suitable for informing whether there has been a change in the health of the dominant trees on Eliza Creek and is seen as a leading indicator of tree stress. Results from these surveys will therefore contribute to the reporting against compliance conditions related to impacts in Eliza Creek.

Since 2019 visual estimates of canopy cover are also undertaken to complement the densitometer canopy cover assessments. Visual estimates of individual tree canopies enable identification of individual tree canopy health and provide a time frame for potential canopy loss. Results to date show that the densitometer results are broadly in alignment with visual estimates.

Since 2021 additional trees have been recorded along the transects. These were trees whose canopy intercepted the canopy but had not done so previously and/or which now met the criteria for recording. By including new trees that meet the survey requirements as the trees along the transects mature, the transition in age classes and maturation of new recruits has been effectively demonstrated by the surveys of the canopy cover transects as part of the overall health of tree vegetation within Eliza Creek.

The canopy cover data is considered to provide an objective method of determining trends in canopy health across the whole of the transect, including documenting tree deaths and recruitment. The trial in 2019 of using remote sensing of aerial imagery to estimate vegetative cover in increments downstream from the TSF embankment is considered a useful additional tool to monitor vegetation health within Eliza Creek.

4.3.5 Weed transects

Weed transects represent a repeatable, temporal examination of weed diversity and abundance at the site and are not time consuming to conduct. They are aligned along roads and intersect drainage lines and dam outlets, which are considered to be the key sources and/or vectors of seed spread. As such, the weed transects represent a key method (when coupled with weed data from rangelands assessments and opportunistic observations) to directly address a number of mine conditions and outcomes.

4.3.6 LFA transects

LFA at two rehabilitation sites at the mine site commenced in 2019, and two more were introduced in 2022. In 2023, all sites were surveyed using the established LFA method (as opposed to the Bank and Trough method applicable only for the very early stages of assessment). Introduction of the PCQ Method (an extension of the Established Method) has proven very useful for reporting on the density of vegetation as it establishes within the rehabilitation sites, and especially when vegetation along the LFA transect has been absent or very sparse. The current methods are considered suitable to demonstrate change at the rehabilitation sites over time, as vegetation trends towards the 'baseline' / analogue condition. Current methods have already been successful in detecting notable differences in the success of the four sites, reflective of the different rehabilitation methods applied on the ground. For example, the deep cross ripped / handed seeded Tjungu site no longer requires monitoring and the deep ripped Aerodrome site only requires the LFA established method moving forward. This data is useful for future rehabilitation around the broader mining lease area and meeting OMC requirements.

4.3.7 Fauna surveys

Fauna trapping undertaken during spring 2024 was comparable to the effort undertaken in spring 2018-2023, on the basis that the most important data is species diversity rather than species abundance. Despite warmer conditions and a thunderstorm during mid spring, overall fauna diversity was comparable with previous baseline survey periods and with the spring/autumn 2018-2023 survey numbers. Dams were full, and there was an increase in bird diversity detection across Carrapateena that was likely related to water presence (South Eliza Dam), vegetation condition, as well as complementary methods for detection (e.g. Song Meter, also used in 2023). The overall capture rates increased from 2023, was above the compliance capture rate to date and well within the baseline range. For mammals, however diversity rates were at the lower end of baseline ranges, primarily given limited detection of rodents and no captures of Planigales. For reptiles, captures were high and the diversity was the highest to date, above compliance and baseline; 18 species detected. Fauna trapping represents the greatest opportunity to definitively record the EPBC listed Plains Mouse, and to demonstrate persistence of this species at the site throughout mining operations, which is an important outcome for BHP. As such, fauna trapping is still considered a requirement for informing impacts of the mining operation on conservation significant fauna. As suggested in the 2020 survey report, camera trapping at the designated fauna sites (outside of the fauna trapping project) may provide improved results, however this would need to align with preceding rainfall conditions. During the annual compliance surveys non-baited camera trapping has been used in 2021 - 2024 concurrently with open pitfall sites and a range of species detected (e.g. during 2024 species include Fat-tailed Dunnart, Stripe-faced Dunnart, Tessellated Gecko, Mulga Snake and small *Pseudomys sp.* likely

P. hermannsburgensis, given captured at the site two days prior). Baited camera trapping without opening pits similar to the South Gap EPBC offset program may detect Plains Mouse, particularly following suitable rainfall events. It is noted that Plains Mouse were again detected via baited camera traps at the South Gap in 2024, however in 2024, following substantially reduced rainfall, only one Plains Mouse was detected (June at one site). It is suggested that the population is declining as occurs naturally in response to climatic factors (e.g. lower rainfall) (Nature Conservation 2025).

Bird surveys continue to provide good indications of overall site species diversity, with numbers increasing from 2020-2023 and reflective of baseline conditions. Most of the historic sites are relatively homogeneous from a habitat perspective, but greater diversity observed at some sites appears to align with creek line sites, drainage lines and dune sites with taller and diverse vegetation. There are no historic records of any EPBC listed threatened birds at the site (apart from newly listed Blue-winged Parrot, Southern Whiteface and Sharp-tailed Sandpiper), but regardless, the mine conditions require reporting of future records of EPBC listed species. This would not be possible without some level of bird survey. In some years State-listed species are also detected, however no State-listed species were detected in 2024. A number of waterbirds and shorebirds were detected at dams and the South Eliza temporary wetland during the survey, including Sharp-tailed Sandpiper (EPBC Vulnerable and Migratory) and Common Sandpiper (EPBC Migratory), both species have been recorded in the Carrapateena dams previously. Many resident birds were breeding, and different types of bird families were well represented. Resident White-wing Fairy Wrens, Purple-backed Fairywrens and Rufous Fieldwrens were present across the site at multiple locations, however the nomadic Splendid Fairywrens were not detected. New bird records for the site included Pelican (although dead, not far from the TSF), Rufous Songlark and Red-necked Avocet. Australian Pratincoles were also present at a number of sites and these had not been detected at the site since baseline surveys. The bird survey results are in compliance with the OMC and provide a positive story at Carrapateena for balancing mining and the environment in arid conditions.

Opportunistic reptile observations provide a good return on investment, and are considered an important part of the overall fauna survey program to inform diversity data. As per active fauna trapping, opportunistic reptile observations are considered suitable for informing overall impacts of the mining operation on fauna diversity. Both reptile and mammal diversity was in the range of baseline surveys, with reptile diversity increased from previous years. In 2024, the bulk of the reptile diversity was from trap captures, given the warmer day time temperatures, this data contributes to the 'capture rate' as a snapshot measure of abundance. Of the reptiles that were detected, several species had juveniles present (e.g. Earless Dragons, Bynoe's Gecko, Southern Four-toed Slider). Of note, the Four-toed Slider (a juvenile) has not been detected baseline and not previously recorded during compliance monitoring. In addition, during the 2021 spring survey the Eastern Stripe Skink was detected at Site 16, not previously recorded since baseline and this species was detected again in 2024 at Site 16.

Feral mice were detected in low numbers at two fauna sites (control Site 1 and impact Site 16), no cats were detected, aside from tracks in the dunes of Site 21. Rabbits were detected at several locations and a warren remains active near Site 15. Hence ongoing feral animal control is required.

4.4 Recommendations for future surveys and data analysis

Construction / operational compliance monitoring has been conducted since autumn 2018, involving two surveys in 2018, and annual surveys thereafter. Hence there have been eight complete fauna and flora surveys, and additionally, a separate dust impact survey and separate Eliza Creek flora and canopy cover survey. There have been two autumn and seven spring surveys. The period 2018 to 2024 has covered extreme low rainfall years (2018 and 2019 when yearly rainfall totals for the year were in the 10% decile), average rainfall years and well above average seasonal rainfall events. This compares well with the baseline survey duration and climate patterns, namely 2012 to 2017 when rainfall totals varied from below average to well above average. During the compliance monitoring period to date, there has been no evidence of impact from mining activity on any of the PEPR Leading Indicators that relate to fauna and flora outcome measurement criteria. Fauna and flora species diversity has been within the baseline range, there have been no new declared weeds or increase in abundance of declared or listed weeds and no long-term population trends evident in existing weeds. The health of Eliza Creek vegetation has remained stable. All short-term changes to date in flora and fauna diversity, perennial plant population abundances, and canopy health at Eliza Creek transects have been attributed to variation in seasonal and/or yearly rainfall.

The compliance OMC require annual monitoring to occur at the sites. However, the formal fauna trapping surveys could be conducted every two years and supplemented annually with other techniques such as camera trapping, Song Meter deployment and bird surveys. It is recommended that as a minimum, bird surveys, cameras (baited, if not trapping) Song Meters continue to be used annually, which require less survey effort. If bird surveys are conducted without fauna trapping, the program could occur in late autumn or early spring and target EPBC listed species such as Blue-winged Parrot, previously detected at the site during autumn surveys.

It is recommended that all sites surveyed in 2024 be re-surveyed in either autumn or spring 2025, using the same survey techniques (without fauna trapping if conducted in autumn 2025 and with fauna trapping if conducted in spring 2025). It is recommended that the seasonal timing of the survey remain flexible. In the arid zone, flora diversity, and often fauna diversity, reflects rainfall events, rather than a specific season. Mean monthly rainfall for the nearest long-term weather station, Woomera indicates highest rainfall means occur between November and March rather than winter; but can be extremely variable year to year. Hence for compliance monitoring, comparison of data across the operation for sites undergoing the same climatic conditions, as well as comparison of baseline and previous compliance monitoring ranges for a range a climatic and grazing conditions is good practice, rather than a focus on comparisons to baseline data alone.

The spring 2024 survey was conducted in October 2024, when conditions were very warm and there was an extreme wind event and thunderstorms. Reptile diversity and abundance was high, bird diversity was high and mammal diversity and abundance was within the baseline range. For the small mammals, rodents were in low numbers, but this is reflective of the climate in the months preceding the survey (i.e. fluctuating rainfall, below average). Rodents have also historically been detected in lower numbers in the baseline and compliance surveys, with the exception of higher rainfall years (e.g. 2012, 2014, 2017 and 2022). Flora diversity was very high due to the diversity of short-lived species. It is recommended that surveys be conducted in either September/October or late March to April, when daily temperatures are not extreme and compliant with animal ethics requirements. The preference for an autumn or spring survey should be determined by seasonal conditions in the previous six months, namely consideration should be given to conducting the survey in response to particular climatic conditions (i.e., good rainfall) in order to maximise the chance of demonstrating compliance against some conditions (in particular, the presence of Plains Mouse).

Baseline data in Eliza Creek commenced in 2018 and includes conducting eight surveys of on ground canopy cover data recording. This has provided an indication of the inherent variability in the data, and the dynamic response of Red Gum canopies to seasonal conditions. At Eliza Creek medium to longer term trends in plant health are of major concern, rather than seasonal changes. Given that monitoring has been established since 2018, and additional reporting of individual tree health has been established, yearly surveys of Eliza Creek are considered sufficient. It is recommended that additional remote sensing reporting be continued, to supplement on-ground data.

Further details regarding future recommendations are provided below.

4.4.1 RAM quadrats

RAM sites represent a key measure of flora species diversity, abundance (as per Crown Separation Ratio categories) and grazing impact and should continue across the site, annually, as per the outcome measurement criteria for the mine lease (OMC SWRF1, TSF6, AQ2). To date, the construction / operational phase monitoring data results have indicated species diversity has remained within the baseline range. This survey technique used during compliance monitoring reports upon both long-lived and short-lived species diversity, the latter largely influenced by weather events.

Flora Sites 21 and 22, were established on dunes in autumn 2018 to monitor this previously un-surveyed dune habitat within the Operation area. This monitoring should continue annually to address potential impacts from the WAR on dune habitat to address the agreed outcomes for OMCs WP1 and WP2. Given that Jessup transects are not undertaken at these sites, consider which current OMCs these dune sites are addressing.

The Jessup transects monitor populations only of long-lived perennial shrubs and trees. Despite the longevity of the species monitored, compliance monitoring has shown relatively large fluctuations in populations that correlate with large variations in yearly rainfall totals. Some species monitored have relatively small populations. Annual monitoring is considered necessary for early detection of changes in populations that may result in the potential loss of a species at a site.

For all sites excluding site 21 and 22, Jessup monitoring should continue annually to address the agreed outcomes for the Operation (OMC SWRF1, TSF6, AQ2).

4.4.2 Data analysis of RAM quadrats and Jessup transects

To date compliance monitoring has categorised sites as either control or impact sites, defined as sites either greater than 2 km or less than 2 km, respectively from mining infrastructure. The 2 km criteria was based on a literature review of the likely potential distance of dust and/or noise impact upon vegetation and dust impact modelling. All sites along Eliza Creek, however, were deemed to be potential impact sites, regardless of distance downstream from the TSF. During compliance monitoring, however, the WAR has been developed, the Northern Wellfield Supply Road (Khamsin Road) receives greater usage, and the SAR is no longer widely used. The 2023 reporting (Jacobs 2023) recommended a review of the classification of sites as impact or control. In particular, recommended that impact Sites 4 and 6 be changed from impact to control. This recommendation has been implemented in the current report.

In addition to analysing results collectively for control sites and collectively for impact sites, past and current reporting analysis has included plant species abundance and diversity trends at a site level, by habitat, and at a landscape level for the whole Operational Area. Do date there are not emerging trends related to mining, and there is climate related variation for some species. It is recommended that these analyses are scaled back and only undertaken if leading indicators are triggered to detect potential trends in abundance and diversity that may otherwise be masked, and/or to detect trends due to impacts that may operate at different scales.

4.4.3 Canopy cover transects

Canopy cover assessment should continue, given transects have been assessed in Eliza Creek on nine occasions since 2018. This has provided an indication of variability in the data – both actual variation in tree canopy health (due to long term change and/or seasonal variability) and inherent variability or "noise" in the method. The numbering of individual trees and installation of permanent posts along each transects has increased the precision of the transect alignment each survey. This has reduced the inherent "noise" in the data. The continued use of the densitometer rather than relying purely on visual estimates of crown intactness, is strongly recommended. The canopy cover transects are 100 m long, providing a sufficient number of densitometer canopy readings to provide precision and accuracy in quantifying canopy cover for the transect as a whole. The method is relatively objective as it does not rely on "eyeball" estimates of whole canopy intactness where there is often variation between observers' estimates. For assessment of individual tree canopy intactness, "eyeball" assessments (no tools) of canopy intactness provide data on population trends – detecting loss of trees or tree gain along the transect and perhaps more accurate estimates of individual canopy intactness than provided by a densitometer which provides only a few foliage recordings per canopy.

The densitometer method, and visual estimates of individual canopy intactness, therefore are complementary, and both methods should be used to assess tree health at each survey. It is recommended than annual surveys are sufficient.

Continuation of the Eliza Creek canopy cover data is expected to detect potential tree stress and death overtime and will contribute to addressing the agreed outcomes for the Operation (OMC SWRF1, TSF6, AQ2).

In addition to the formal canopy cover monitoring, it is recommended as good practice to visit the Decant Dam impact area that is upstream from Site 17 in Eliza Creek and briefly document status (photos and description). While the impact is being offset with an SEB, future decline and / or regeneration of the area should be briefly documented and further assessment (e.g. RAM) undertaken if required.

4.4.4 Weed transects

The 2021 survey increased the number of weed transects surveyed to also include Northern Wellfield locations, and a weed transect towards the western end of the newly constructed WAR. These were re-surveyed in 2022, 2023 and 2024. The location of weed transects is considered to be a good representation of sites across the mineral leases that capture locations for potential spread of weeds due to mining related activities. There are three weed transects along the Western Access Road including alongside the Gatehouse, near the administration and spoil heap area, and along minor access roads. Targeted locations, where weed populations are considered most likely on site (particularly dams, effluent irrigation areas, and the villages) were also re-surveyed recording the general location and densities of all weeds present. Weed transects CWM01 and CWM02 are located along the SAR, which now receives very little mining-related vehicle traffic. However, the transects are still within current mineral leases, and include populations of the declared weed, Bathurst Burr, plus several non-declared weeds that favour high moisture habitats. For this reason, it is recommended that these two transects continue.

The weed transects and targeted survey locations are considered a very efficient way of detecting new weeds or an increase (or decline) in existing weed populations, as evidenced by the post-construction data. Collection of weed data should continue as per the spring 2024 survey at assigned transects and opportunistically around the site to address the agreed outcomes for the Operation (Outcome measurement criteria WP1, WP2) and Mineral Lease condition 6 (sixth schedule) and MPL 156 conditions. Populations of Bathurst Burr should be revisited and monitored to determine success of control efforts.

4.4.5 LFA

The LFA data collected presents a simple means to graphically show changes in indices, and to also compare the indices with previously collected data from analogue sites considered broadly representative of natural conditions across the mine lease. The establishment of the Midway Quarry and Tjungu sites in 2023 provided a greater opportunity to monitor rehabilitation success as well as variation in techniques (e.g., deep cross ripping, plus hand seeding). Continued data collection will enable opportunities for ongoing data analysis, and a determination of when recorded indices approach or reach the range of the analogue data.

The LFA data collected (and PCQ data) indicates that the Tjungu site has successfully rehabilitated to a level comparable with, or even exceeding reference habitat. Likewise, plant and soil parameter data at aerodrome site shows that this site is approaching reference site means. The LFA established and PCQ data at the Midway Quarry shows the site is beginning restoration and LFA indices have improved annually since 2022, when the site was established. In contrast, the LFA data at the Ventia site recorded no successful restoration in 2024, and the PCQ data recorded only the very initial stages of habitat restoration along one transect. In addition, one Ventia transect has been decommissioned, as the transect had been compromised.

It is recommended that LFA is not needed at the Tjungu site because it is successfully rehabilitated. It is also recommended that the Ventia site be prepared for restoration again by deep ripping of trenches. LFA and PCQ should continue at the Midway Quarry site in 2025. At the Aerodrome site, only the LFA established method should continue, given the plant density, the PCQ is no longer required.

4.4.6 Fauna surveys

Similar to 2018 -2023, single pitfall trapping lines provided suitable capture of small mammals and reptiles during the 2024 survey. The most common mammal species that have been captured across all baseline surveys were still detected, with all small mammal captures made in pitfall traps. It is recommended that pitfall trapping is retained in order to detect presence or absence of Plains Mouse as per PEPR condition EPBC2, in addition to continuing to monitor habitat condition (flora monitoring). As suggested following the spring 2022 survey, increased rainfall in the region (spring and summer) resulted in an autumn survey in 2023 instead of spring survey, however Plains Mouse were not detected. Similarly, Plains Mouse were not detected in 2024. As per 4.3.7 above, Plains Mouse has been detected via baited camera trap at the South Gap offset area, but in low numbers since mid- 2022, so detection at Carrapateena may still occur in the future, but more likely following periods of above average rainfall.

To increase the chance of detection of Plains Mouse at Carrapateena, particularly at control sites 1 and 2, options may include:

- increasing the number of lines and pits open at fauna sites during the next survey
- setting up targeted baited Elliot traps at good quality gilgais, at the established fauna sites. E.g. 5 baited Elliot traps at 10 sites, 100m apart, for a standard four night survey
- setting up baited camera traps similar to South Gap (noting there would be greater success at sites where predators (e.g. cats) are under control. Flora site 12 is noted to have good areas of gilgais. These could be set up away from fauna trap lines, if trapping occurs concurrently.
- as per above consider whether bi-annual survey should be undertaken moving forward (i.e. consider during PEPR update).

As mentioned in Jacobs (2022, 2023), some pits within lines were decreasing in integrity and it is noted that the site environmental team have undertaken activities to replace pit bases and or patch holes. Initially pit bases were replaced by using silicon to attach a plastic mesh base, whilst these were suitable for dunnarts and native mice in the short-term, they may not withstand presence of Planigales or House Mice or increased numbers of small mammals (as occurred in 2022), given the tendency for these species to chew holes in the bases, hence regular maintenance / checking is still required. As per 3.3.6 above, replacement metal bases have been installed in the pitfall traps for the majority of the lines. These bases were highly successful and even facilitated capture of the elusive Dwarf Skink (Plate 4.2). The bases drain well, do not get too hot (remain at least 2-5 degrees lower than ambient temperature) and are also easy to see the trapped fauna (given 60 cm deep). As per previous surveys, the lids of the semi-permanent pits need to be pushed down correctly before tech screws are applied to ensure there are no gaps that enable small mammals or reptiles to get through and be trapped outside of a survey period. The site environmental team have ordered more pit bases for the remaining sites and these will be installed by the site environmental team prior to the 2025 annual survey or during the 2025 survey, given ease of installation.

Results for single pit line trapping continues to be comparable to baseline results and in general, mid-late spring is a suitable time to undertake an annual survey. For 2025, spring is probably ideal given the dry preceding summer of 2024/2025, an autumn survey would only be an option if there was heavy steady rainfall in later summer and early autumn, to maximise the chance of demonstrating compliance with the PEPR conditions. Double pit lines for a subset of impact and all control sites, and opening 7 traps, may also maximise detection, however this would require extra effort and may increase the length of the survey. Fauna trapping should continue at the mine site until such time as it can be clearly demonstrated that conservation significant species (in particular) persist alongside the operational mine, but this should be considered and discussed following the next PEPR update. Noting that two EPBC listed species were detected in spring 2024 opportunistically, rather than via formal trapping. Camera trapping outside the survey period, given the success at South Gap offset area, using alternate, less labour-intensive methods (without baits) or more labour intensive (with baits) may also be an option, i.e. aligning cameras with short lengths of fauna fence line to direct fauna into view. However, given the presence of cats at the site, regular checks would be required to avoid increasing predation of small mammals at trapping sites.

Whilst reptile diversity is interesting and provides a good indicator for overall site conditions, it does not specifically relate to PEPR conditions, and therefore use of funnel traps could be ceased in the future and reptile diversity could be collected opportunistically and via pitfall captures alone, particularly during the spring surveys when reptiles are more active. However, setting and checking funnel traps requires minimal additional effort compared with additional pitfall lines and provides opportunity to trap snakes where present, it is suggested that funnel trapping be retained at the current time.

The bird surveys at fauna sites, flora sites and water points currently provide valuable data regarding overall avifauna diversity at the sites, and birds are expected to respond to mine impacts such as noise and traffic if levels are unacceptable to them. In addition, pest bird species are also monitored e.g. House Sparrows still present (low numbers). For this reason, bird surveys should be continued during operational compliance monitoring until data patterns are clear, and to meet PEPR conditions related to Thick-billed Grasswren and Night Parrot records (EPBC1 and EPBC 3) as well as conditions related to pests (WP1, WP2). Survey at water points (particularly pre-dawn and post dusk) as well as spotlighting / night call detection is also an important survey technique to detect whether the Night Parrot is present at the site. A value-add for 2023/2024 included deployment of Song Meters to detect nocturnal, dawn and dusk species at both chenopod shrubland sites and representative creekline sites (e.g. Eliza Creek Site 10, Bosworth Creek Site 7). Noting that threatened species were detected via Song Meter in autumn 2023 (e.g. Blue-winged Parrot). In 2024 Song Meter results included detection of one common dusk species; Owlet Night Jar (*Aegotheles cristatus*). This species was also detected in 2023 via Song Meter, but had not been detected during bird surveys. No other nocturnal / dusk bird species were detected. Five diurnal microbat species were also detected on Song Meters that can be deployed to capture both bird and bat call data. Detection via acoustic methods is far more efficient than trapping or spotlighting for microbat fauna and useful to regularly compare against baseline data.

Plate 4.2: Dwarf Skink, stubbie holder refuge, new metal bases and temperature data-logger

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Appendices

Appendix A. Photologs spring 2024

Appendix A1. Photolog, Rangeland Flora Sites

CAR001	
	
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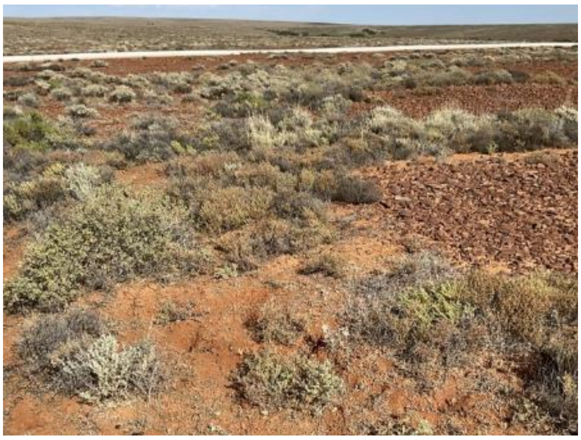	
Appendix Plate A1.3: Facing west	Appendix Plate A1.4: Facing south

CAR002	
	
Appendix Plate A1.5: Facing north	Appendix Plate A1.6: Facing east
	
Appendix Plate A1.7: Facing west	Appendix Plate A1.8: Facing south

CAR003	
	
Appendix Plate A1.9: Facing north	Appendix Plate A1.10: Facing east
	
Appendix Plate A1.11: Facing west	Appendix Plate A1.12: Facing south

CAR004	
	
Appendix Plate A1.13:Facing north	Appendix Plate A1.14: Facing east
	
Appendix Plate A1.15: Facing west	Appendix Plate A1.16: Facing south

CAR005	
	
Appendix Plate A1.17: Facing north	Appendix Plate A1.18: Facing east
	
Appendix Plate A1.19: Facing west	Appendix Plate A1.20: Facing south

CAR006	
	
Appendix Plate A1.21: Facing north	**Appendix Plate A1.22: Facing east**
	
Appendix Plate A1.23: Facing west	**Appendix Plate A1.24: Facing south**

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	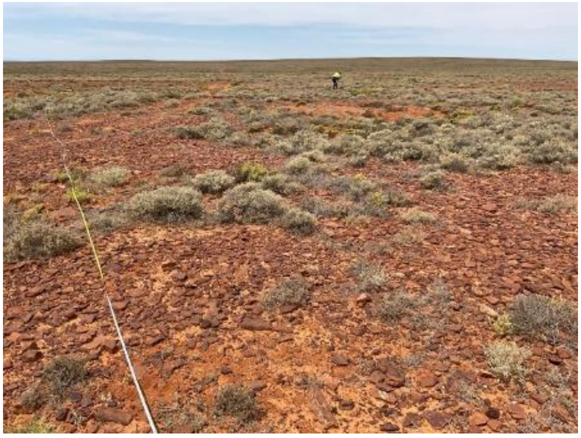
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CAR013	
	
Appendix Plate A1.45:Facing north	Appendix Plate A1.46: Facing east
	
Appendix Plate A1.47: Facing west	Appendix Plate A1.48: Facing south

CAR015	
	
Appendix Plate A1.49: Facing north	Appendix Plate A1.50: Facing east
	
Appendix Plate A1.51: Facing west	Appendix Plate A1.52: Facing south

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	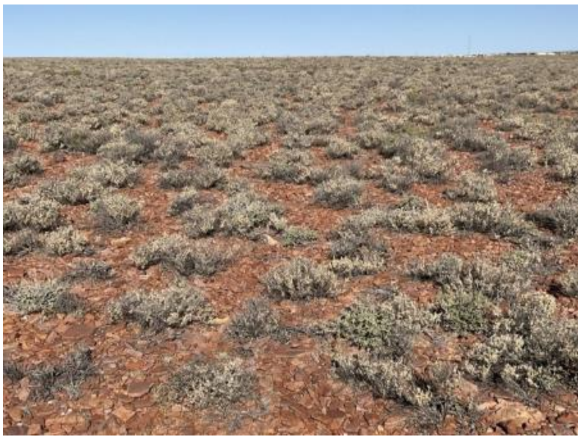
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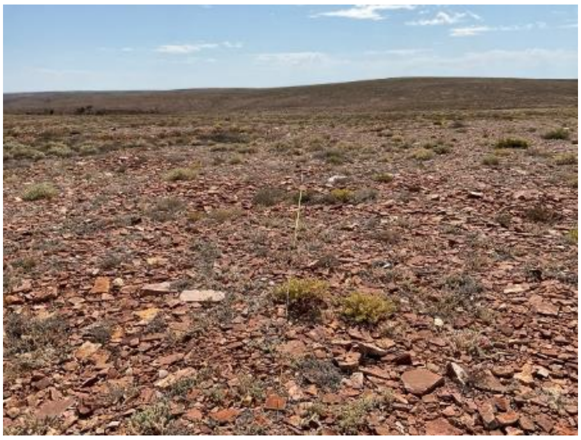
CAR020	
	
Appendix PlateA1.69: Facing north	**Appendix Plate A1.70: Facing east**
	
Appendix Plate A1.71: Facing west	**Appendix Plate A1.72: Facing south**

CAR021	
	
Appendix Plate A1.73: Facing north	**Appendix Plate A1.74: Facing east**
	
Appendix Plate A1.75: Facing west	**Appendix Plate A1.76: Facing south**

CAR022	
	
Appendix Plate A1.77: Facing north	Appendix Plate A1.78: Facing east
	
Appendix Plate A1.79: Facing west	Appendix Plate A1.80: Facing south

Appendix A2. Photolog, Jessup Transects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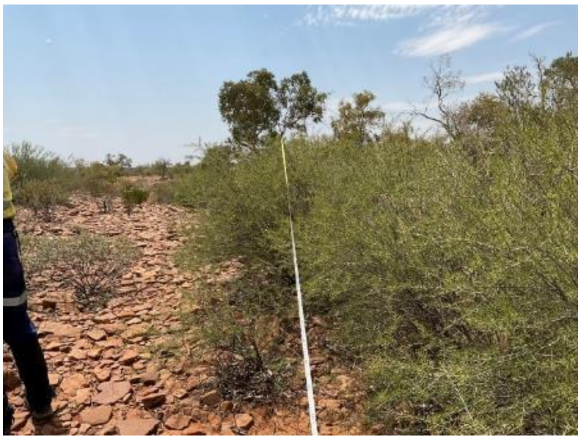
Appendix Plate A2.7: CAR007	**Appendix Plate A2.8: CAR009**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	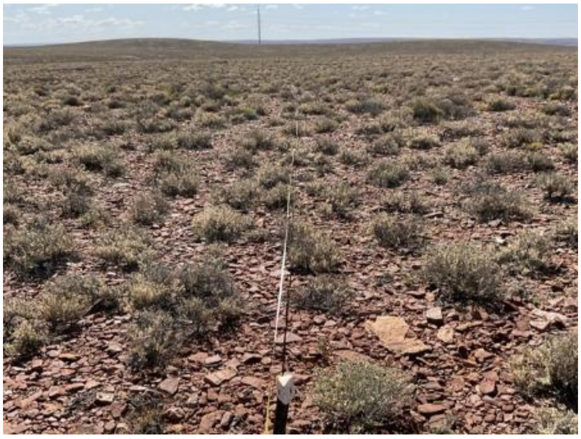
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Appendix Plate A2.15: CAR017	**Appendix Plate A2.16: CAR018**

	
Appendix Plate A2.17: CAR019	**Appendix Plate A2.18: CAR020**

Appendix A3. Photolog, Canopy Cover Transects Eliza Creek

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CAR019	
	
Appendix Plate A3.5: Transect A	**Appendix Plate A3.6: Transect B**

	
Appendix Plate A3.7: Transect A	**Appendix Plate A3.8: Transect B**

Appendix A4. Photolog, Weed Survey

CWM01 0m	
	
Appendix Plate A4.1: Western side of road, facing north	Appendix Plate A4.2: Western side of road, facing south
	
Appendix Plate A4.3: Eastern side of road, facing north	Appendix Plate A4.4: Eastern side of road, facing south

CWM01 250m	
	
Appendix Plate A4.5: Western side of road, facing north	Appendix Plate A4.6: Western side of road, facing south
	
Appendix Plate A4.7: Eastern side of road, facing north	Appendix Plate A4.8: Eastern side of road, facing south

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Western side of road, facing north</td><td>Appendix Plate A4.10:
Western side of road, facing south</td></tr>
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Eastern side of road, facing north</td><td>Appendix Plate A4.12:
Eastern side of road, facing south</td></tr>
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Western side of road, facing north</td><td>Appendix Plate A4.14:
Western side of road, facing south</td></tr>
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Eastern side of road, facing north</td><td>Appendix Plate A4.16:
Eastern side of road, facing south</td></tr>
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CWM01 1000m	
	
Appendix Plate A4.17: Western side of road, facing north	Appendix Plate A4.18: Western side of road, facing south
	
Appendix Plate A4.19: Eastern side of road, facing north	Appendix Plate A4.20: Eastern side of road, facing south

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Northern side of road, facing east</td><td>Appendix Plate A4.22:
Northern side of road, facing west</td></tr>
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<tr><td>Appendix Plate A4.23:
Southern side of road, facing east</td><td>Appendix Plate A4.24:
Southern side of road, facing west</td></tr>
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CWM02 250m	
	
Appendix Plate A4.25: Northern side of road, facing east	Appendix Plate A4.26: Northern side of road, facing west
	
Appendix Plate A4.27: Southern side of road, facing east	Appendix Plate A4.28: Southern side of road, facing west

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CWM02 750m	
	
Appendix Plate A4.33: Eastern side of road, facing north	Appendix Plate A4.34: Eastern side of road, facing south
	
Appendix Plate A4.35: Western side of road, facing north	Appendix Plate A4.36: Western side of road, facing south

CWM02 1000m	
	
Appendix Plate A4.37: Eastern side of road, facing north	Appendix Plate A4.38: Eastern side of road, facing south
	
Appendix Plate A4.39: Western side of road, facing north	Appendix Plate A4.40: Western side of road, facing south

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CWM03 250m	
	
Appendix Plate A4.45: Northern side of road, facing east	Appendix Plate A4.46: Northern side of road, facing west
	
Appendix Plate A4.47: Southern side of road, facing east	Appendix Plate A4.48: Southern side of road, facing west

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CWM04 500m	
	
Appendix Plate A4.69: Eastern side of road, facing north	Appendix Plate A4.70: Eastern side of road, facing south
	
Appendix Plate A4.71: Western side of road, facing north	Appendix Plate A4.72: Western side of road, facing south

CWM04 750m	
	
Appendix Plate A4.73: Eastern side of road, facing north	Appendix Plate A4.74: Eastern side of road, facing south
	
Appendix Plate A4.75: Western side of road, facing north	Appendix Plate A4.76: Western side of road, facing south

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CWM05 250m	
	
Appendix Plate A4.85: Northern side of road, facing east	Appendix Plate A4.86: Northern side of road, facing west
	
Appendix Plate A4.87: Southern side of road, facing east	Appendix Plate A4.88: Southern side of road, facing west

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CWM05 750m	
	
Appendix Plate A4.93: Northern side of road, facing east	Appendix Plate A4.94: Northern side of road, facing west
	
Appendix Plate A4.95: Southern side of road, facing east	Appendix Plate A4.96: Southern side of road, facing west

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CWM06 0m	
	
Appendix Plate A4.101: Northern side of road, facing east	Appendix Plate A4.102: Northern side of road, facing west
	
Appendix Plate A4.103: Southern side of road, facing east	Appendix Plate A4.104: Southern side of road, facing west

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CWM06 1000m	
	
Appendix Plate A4.117: Northern side of road, facing east	Appendix Plate A4.118: Northern side of road, facing west
	
Appendix Plate A4.119: Southern side of road, facing east	Appendix Plate A4.120: Southern side of road, facing west

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CWM07 500m	
	
Appendix Plate A4.125: Facing north	Appendix Plate A4.126: Facing south

CWM07 750m	
	
Appendix Plate A4.127: Facing north	Appendix Plate A4.128: Facing south

CWM07 1000m	
	
Appendix Plate A4.129: Facing north	Appendix Plate A4.130: Facing south

NWM01 0m	
	
Appendix Plate A4.131: Facing east	**Appendix Plate A4.132: Facing west**

NWM01 250m	
	
Appendix Plate A4.133: Facing east	**Appendix Plate A4.134: Facing west**

NWM01 500m	
	
Appendix Plate A4.135: Facing east	**Appendix Plate A4.136: Facing west**

NWM01 750m	
	
Appendix Plate A4.137: Facing east	**Appendix Plate A4.138: Facing west**

NWM01 1000m	
	
Appendix Plate A4.139: Facing east	**Appendix Plate A4.140: Facing west**

NWM02 0m	
	
Appendix Plate A4.141: Facing east	**Appendix Plate A4.142: Facing west**

NWM02 250m	
	
Appendix Plate A4.143: Facing east	**Appendix Plate A4.144: Facing west**

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NWM03 0m	
	
Appendix Plate A4.151: Facing north	**Appendix Plate A4.152: Facing south**

NWM03 250m	
	
Appendix Plate A4.153: Facing north	**Appendix Plate A4.154: Facing south**

NWM03 500m	
	
Appendix Plate A4.155: Facing north	Appendix Plate A4.156: Facing south

NWM03 750m	
	
Appendix Plate A4.157: Facing north	Appendix Plate A4.158: Facing south

NWM03 1000m	
	
Appendix Plate A4.159: Facing north	**Appendix Plate A4.160: Facing south**

Appendix A5. Photolog, LFA Sites

Appendix Plate A5.1: LFA Site Aerodrome, transect 1A, start facing north (2024)

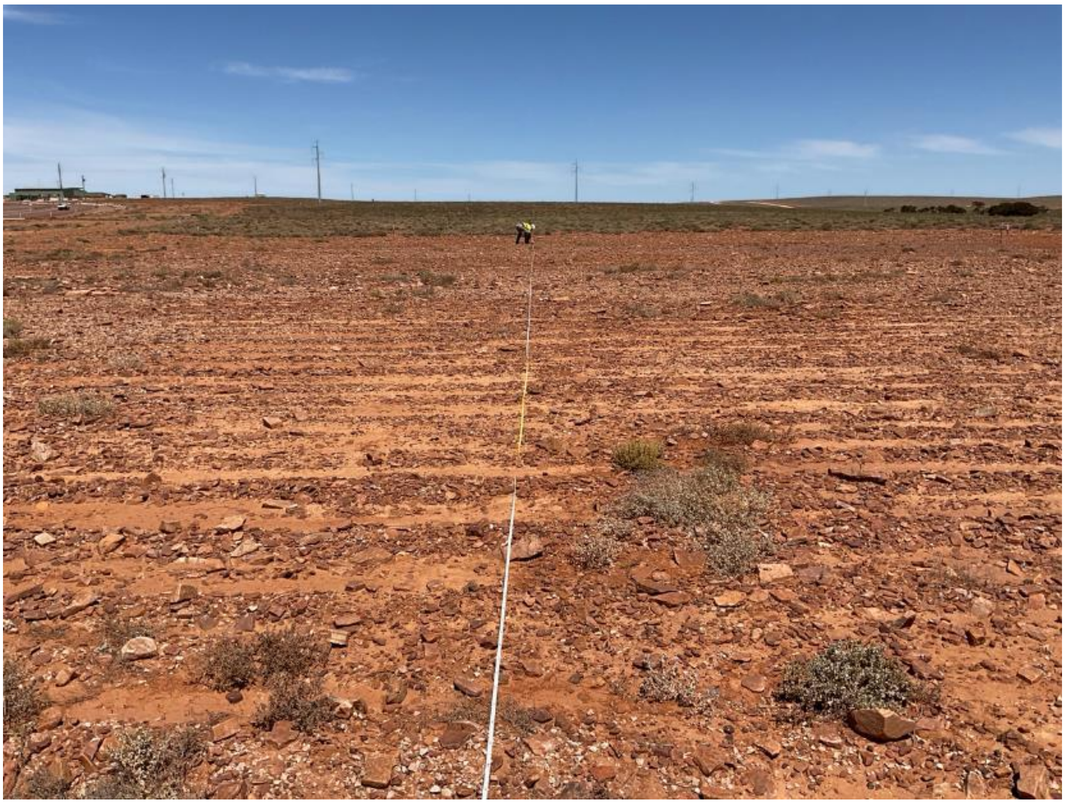
Appendix Plate A5.2: LFA Site Aerodrome, transect 1A, end facing south (2024)

Appendix Plate A5.3: LFA Site Aerodrome, transect 1B, start facing northwest (2024)

Appendix Plate A5.4: LFA Site Aerodrome, transect 1B, send facing southeast (2024)

Appendix Plate A5.5: LFA Site Ventia, transect 2A, start facing north, transect decomissioned (2024)

Appendix Plate A5.6: LFA Site Ventia, transect 2B, start facing north (2024)

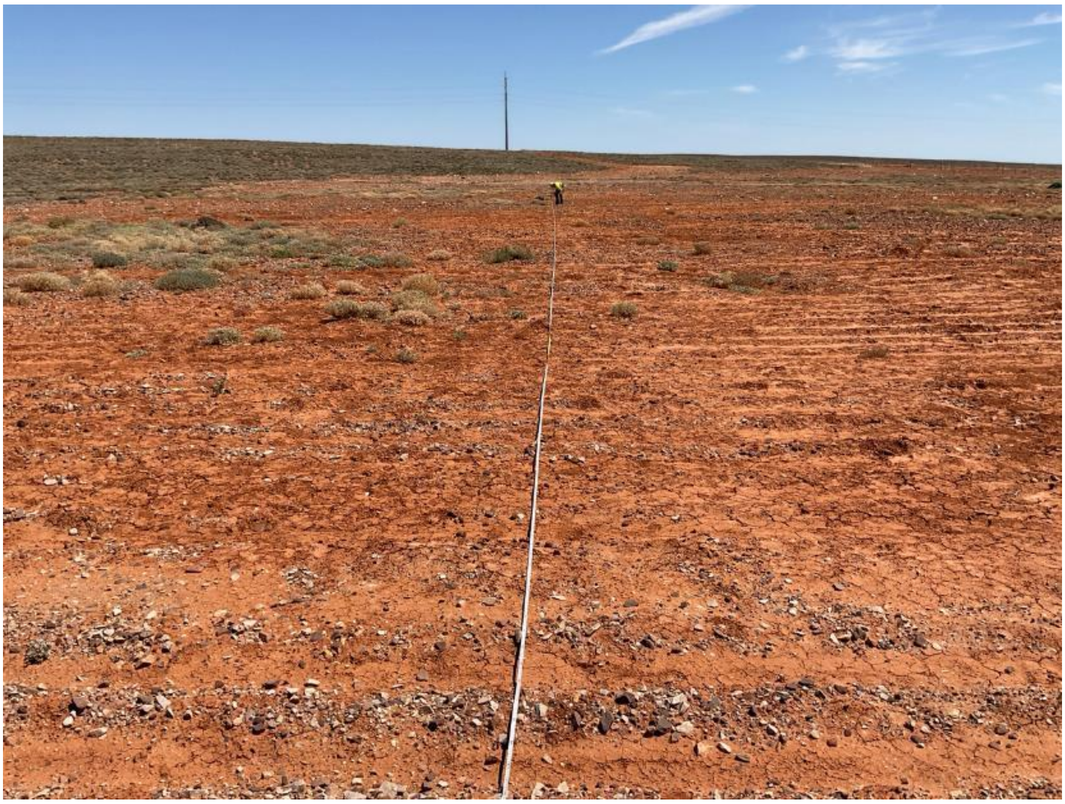


Appendix Plate A5.7: LFA Site Ventia, transect 2B, end facing south (2024)

Appendix Plate A5.8: LFA Site Ventia, transect 2B, vegetation patch off transect (2024)

Appendix Plate A5.9: LFA Site Midway Quarry, transect 3A, start facing end (2024)

Appendix Plate A5.10: LFA Site Midway Quarry, transect 3A, dense patch off transect (2024)



Appendix Plate A5.11: LFA Site Midway Quarry, transect 3A, end facing start (2024)

Appendix Plate A5.12: LFA Site Midway Quarry, transect 3B, start facing end (2024)

Appendix Plate A5.13: LFA Site Midway Quarry, transect 3B, end facing start (2024)

Appendix Plate A5.14: LFA Site Tjungu, transect 4A, start facing end (2024)

Appendix Plate A5.15: LFA Site Tjungu, transect 4A, end facing start (2024)

Appendix Plate A5.16: LFA Site Tjungu, transect 4A, off transect diversity (2024)

Appendix Plate A5.17: LFA Site Tjungu, transect 4B, start facing end (2024)

Appendix Plate A5.18: LFA Site Tjungu, transect 4A, end facing start (2024)

Appendix B. Rangeland (RAM) Data

Appendix B1. Cumulative species list

The following is a cumulative list of flora species recorded at RAM sites (Flora Sites 1 – 22), spring 2024, including life span status, and the number of sites at which they were recorded.

Table B1.1: Cumulative flora list (RAM sites) for Carrapateena, spring 2024

Family	Scientific Name	Common Name	Number of Records	
			Long-lived	Short-lived
MALVACEAE	*Abutilon halophilum*	Plains Lantern-bush	11	
MALVACEAE	*Abutilon otocarpum*	Desert Lantern-bush	4	
FABACEAE	*Acacia aneura*	Mulga	1	
FABACEAE	*Acacia ligulata*	Umbrella Bush	2	
FABACEAE	*Acacia oswaldii*	Umbrella Wattle	1	
FABACEAE	*Acacia papyrocarpa/ Acacia* sp. *Blyth*[1]	Western Myall	7	
FABACEAE	*Acacia ramulosa* var.	Horse Mulga	1	
FABACEAE	*Acacia tetragonophylla*	Dead Finish	4	
SAPINDACEAE	*Alectryon oleifolius* ssp. *canescens*	Bullock Bush	1	
AMARANTHACEAE	*Alternanthera denticulata*	Lesser Joyweed		1
ANACAMPSEROTACEAE	*Anacampseros australiana*	Australian Anacampseros		5
POACEAE	*Aristida contorta*	Curly Wire-grass		1
POACEAE	*Aristida holathera* var.	Tall Kerosene Grass		2
ASPARAGACEAE	*Arthropodium fimbriatum*	Nodding Vanilla-lily		2
POACEAE	*Astrebla pectinata*	Barley Mitchell-grass	8	
AMARANTHACEAE	*Atriplex fissivalvis*	Gibber Saltbush		2
AMARANTHACEAE	*Atriplex holocarpa*	Pop Saltbush		10
AMARANTHACEAE	*Atriplex velutinella*	Sandhill Saltbush		2
AMARANTHACEAE	*Atriplex vesicaria*	Bladder Saltbush	16	
NYCTAGINACEAE	*Boerhavia* sp.	Tar-vine		1
ASTERACEAE	*Brachyscome ciliaris* var.	Variable Daisy		3
ASPHODELACEAE	*Bulbine semibarbata*	Small Leek-lily		9
ASTERACEAE	*Calotis hispidula*	Hairy Burr-daisy		7
ASTERACEAE	*Centaurea melitensis**	Malta Thistle		1
ASTERACEAE	*Centipeda crateriformis ssp.*	Sneezeweed		2
PTERIDACEAE	*Cheilanthes lasiophylla*	Woolly Cloak-fern		1
AMARANTHACEAE	*Chenopodium curvispicatum*	Cottony Goosefoot	3	
AMARANTHACEAE	*Chenopodium desertorum* ssp.	Desert Goosefoot	3	
ASTERACEAE	*Chrysocephalum pterochaetum*	Shrub Everlasting		1
CONVOLVULACEAE	*Convolvulus remotus*	Grassy Bindweed		1
AMARYLLIDACEAE	*Crinum flaccidum*	Murray Lily		4
FABACEAE	*Crotalaria eremaea* ssp.	Loose-flowered Rattle-pod		1
FABACEAE	*Cullen cinereum*	Annual Scurf-pea		5
FABACEAE	*Cullen pallidum*	White Scurf-pea		2
POACEAE	*Dactyloctenium radulans*	Button-grass		1
APIACEAE	*Daucus glochidiatus*	Native Carrot		5
POACEAE	*Digitaria brownii*	Cotton Panic-grass	4	
AMARANTHACEAE	*Dissocarpus biflorus* var.	Two-horn Saltbush		4
AMARANTHACEAE	*Dissocarpus paradoxus*	Ball Bindyi		8
SAPINDACEAE	*Dodonaea lobulata*	Lobed-leaf Hop-bush	5	
SAPINDACEAE	*Dodonaea viscosa* ssp. *angustissima*	Narrow-leaf Hop-bush	3	
POLYGONACEAE	*Duma florulenta*	Lignum	3	
AMARANTHACEAE	*Einadia nutans* ssp.	Climbing Saltbush	6	
AMARANTHACEAE	*Enchylaena tomentosa* var. *tomentosa*	Ruby Saltbush	9	
POACEAE	*Enneapogon avenaceus*	Common Bottle-washers		8
POACEAE	*Enteropogon acicularis*	Umbrella Grass		1
POACEAE	*Eragrostis australasica*	Cane-grass	1	
POACEAE	*Eragrostis setifolia*	Bristly Love-grass	13	
SCROPHULARIACEAE	*Eremophila glabra* ssp. *glabra*	Tar Bush	1	
SCROPHULARIACEAE	*Eremophila latrobei* ssp. *glabra*	Crimson Emubush	3	

Family	Scientific Name	Common Name	Number of Records	
			Long-lived	Short-lived
SCROPHULARIACEAE	*Eremophila oppositifolia* ssp. *oppositifolia*	Opposite-leaved Emubush	2	
SCROPHULARIACEAE	*Eremophila serrulata*	Green Emubush	5	
MYRTACEAE	*Eucalyptus camaldulensis* ssp. *arida*	Northern River Red Gum	3	
POACEAE	*Eulalia aurea*	Silky Brown-top	4	
EUPHORBIACEAE	*Euphorbia drummondii group*	Spurge		2
EUPHORBIACEAE	*Euphorbia stevenii*	Bottletree Spurge		6
EUPHORBIACEAE	*Euphorbia tannensis* ssp. *eremophila*	Desert Spurge		7
SANTALACEAE	*Exocarpos aphyllus*	Leafless Cherry	4	
FRANKENIACEAE	*Frankenia serpyllifolia*	Thyme Sea-heath	13	
FRANKENIACEAE	*Frankenia subteres*	Frankenia	1	
ASTERACEAE	*Glossocardia bidens*	Native Cobbler's-pegs		1
ASTERACEAE	*Gnephosis arachnoidea*	Spidery Button-flower		8
GOODENIACEAE	*Goodenia fascicularis*	Silky Goodenia		2
AIZOACEAE	*Gunniopsis quadrifida*	Sturt's Pigface		1
MALVACEAE	*Hibiscus krichauffianus*	Velvet-leaf Hibiscus		1
POACEAE	*Iseilema membranaceum*	Small Flinders-grass		1
BRASSICACEAE	*Lepidium phlebopetalum*	Veined Peppercress		12
FABACEAE	*Lotus cruentus*	Red-flower Lotus		5
SOLANACEAE	*Lycium australe*	Australian Boxthorn	1	
PHYLLANTHACEAE	*Lysiandra fuernrohrii*	Sand Spurge	1	
AMARANTHACEAE	*Maireana aphylla*	Cotton-bush	12	
AMARANTHACEAE	*Maireana appressa*	Pale-fruit Bluebush	12	
AMARANTHACEAE	*Maireana astrotricha*	Low Bluebush	1	
AMARANTHACEAE	*Maireana astrotricha*	Low Bluebush	1	
AMARANTHACEAE	*Maireana eriantha*	Woolly Bluebush	4	
AMARANTHACEAE	*Maireana georgei*	Satiny Bluebush	1	
AMARANTHACEAE	*Maireana pyramidata*	Black Bluebush	3	
AMARANTHACEAE	*Maireana spongiocarpa*	Spongy-fruit Bluebush	8	
AMARANTHACEAE	*Maireana turbinata*	Top-fruit Bluebush	2	
MALVACEAE	*Malvastrum americanum var. americanum*	Malvastrum		5
MARSILEACEAE	*Marsilea drummondii*	Common Nardoo		3
ASTERACEAE	*Minuria cunninghamii*	Bush Minuria	13	
SCROPHULARIACEAE	*Myoporum montanum*	Native Myrtle	6	
SOLANACEAE	*Nicotiana velutina*	Velvet Tobacco		4
AMARANTHACEAE	*Osteocarpum dipterocarpum*	Two-wing Bonefruit		5
POACEAE	*Panicum decompositum* var. *decompositum*	Native Millet		2
POACEAE	*Paractaenum novae-hollandiae* ssp. *reversum*	Barbed-wire Grass		1
THYMELAEACEAE	*Pimelea microcephala* ssp. *microcephala*	Shrubby Riceflower	2	
THYMELAEACEAE	*Pimelea simplex*	Desert Riceflower		1
PLANTAGINACEAE	*Plantago drummondii*	Dark Plantain		4
ASTERACEAE	*Pluchea rubelliflora*	Winged Plains-bush		3
ASTERACEAE	*Podolepis davisiana*	Button Podolepis		3
ASTERACEAE	*Podolepis* sp.	Copper-wire Daisy		1
ASTERACEAE	*Polycalymma stuartii*	Poached-egg Daisy		2
PORTULACACEAE	*Portulaca oleracea*	Common Purslane		2
ASTERACEAE	*Pterocaulon sphacelatum*	Apple-bush		3
AMARANTHACEAE	*Ptilotus nobilis*	Yellow-tails		1
AMARANTHACEAE	*Ptilotus obovatus*	Silver Mulla Mulla	7	
AMARANTHACEAE	*Rhagodia spinescens*	Spiny Saltbush	6	
ASTERACEAE	*Rhodanthe floribunda*	White Everlasting		2
ASTERACEAE	*Rhodanthe* sp.	Everlasting		1
ASTERACEAE	*Rhodanthe stricta*	Slender Everlasting		8
ZYGOPHYLLACEAE	*Roepera eremaea*	Climbing Twinleaf		1
ZYGOPHYLLACEAE	*Roepera howittii*	Clasping Twinleaf		2
ZYGOPHYLLACEAE	*Roepera* sp.	Twinleaf		1
ACANTHACEAE	*Rostellularia adscendens* ssp.	Pink Tongues		5
AMARANTHACEAE	*Salsola australis*	Buckbush		6
SANTALACEAE	*Santalum lanceolatum*	Plumbush	5	
GOODENIACEAE	*Scaevola spinescens*	Spiny Fanflower	4	
AMARANTHACEAE	*Sclerolaena brachyptera*	Short-wing Bindyi		10
AMARANTHACEAE	*Sclerolaena diacantha*	Grey Bindyi		2

Family	Scientific Name	Common Name	Number of Records	
			Long-lived	Short-lived
AMARANTHACEAE	*Sclerolaena divaricata*	Tangled Bindyi		15
AMARANTHACEAE	*Sclerolaena intricata*	Tangled Bindyi		11
AMARANTHACEAE	*Sclerolaena patenticuspis*	Spear-fruit Bindyi		3
AMARANTHACEAE	*Sclerolaena* sp.	Bindyi		1
AMARANTHACEAE	*Sclerolaena ventricosa*	Salt Bindyi		6
FABACEAE	*Senna artemisioides ssp. helmsii*	Blunt-leaf Senna	5	
FABACEAE	*Senna artemisioides ssp. oligophylla*	Limestone Senna	1	
FABACEAE	*Senna artemisioides* ssp. *X artemisioides*	Silver Senna	5	
FABACEAE	*Senna artemisioides* ssp. *X sturtii*	Grey Senna	3	
POACEAE	*Setaria constricata*	Knotty-butt Paspalidium	1	
MALVACEAE	*Sida ammophila*	Sand Sida		2
MALVACEAE	*Sida corrugata* var.	Corrugated Sida		5
MALVACEAE	*Sida fibulifera*	Pin Sida		8
MALVACEAE	*Sida intricata*	Twiggy Sida	10	
MALVACEAE	*Sida petrophila*	Rock Sida	6	
BRASSICACEAE	*Sisymbrium erysimoides**	Smooth Mustard		3
SOLANACEAE	*Solanum lithophilum*	Velvet Potato-bush		3
SOLANACEAE	*Solanum quadriloculatum*	Plains Nightshade		5
ASTERACEAE	*Sonchus oleraceus**	Common Sow-thistle		2
POACEAE	*Sporobolus actinocladus*	Ray Grass		14
CELASTRACEAE	*Stackhousia* sp.	Candles		2
FABACEAE	*Swainsona* sp.	Swainson-pea		1
AMARANTHACEAE	*Tecticornia medullosa*	Samphire	13	
AMARANTHACEAE	*Tecticornia pergranulata* ssp. *divaricata*	Black-seed Samphire	2	
AMARANTHACEAE	*Tecticornia tenuis*	Slender Samphire	4	
LAMIACEAE	*Teucrium racemosum*	Grey Germander		2
POACEAE	*Themeda triandra*	Kangaroo Grass	2	
ASPARAGACEAE	*Thysanotus baueri*	Mallee Fringe-lily		1
ASPARAGACEAE	*Thysanotus* sp.	Fringe-lily		1
AIZOACEAE	*Trianthema triquetrum*	Red Spinach		2
BORAGINACEAE	*Trichodesma zeylanicum* var. *zeylanicum*	Camel Bush		2
ASTERACEAE	*Vittadinia gracilis*	Woolly New Holland Daisy		1
CAMPANULACEAE	*Wahlenbergia* sp.	Native Bluebell		3
COLCHICACEAE	*Wurmbea australis*	Inland Nancy		1
POACEAE	*Zygochloa paradoxa*	Sandhill Cane-grass	2	

[1]*Acacia sp. Blyth Range* is a poorly known entity, formerly known as *Acacia affin. papyrocarpa*. It is most common in the vicinity of Lake Torrens, NW edge of Flinders Ranges and near Bltyh Range in WA. Factsheet - Acacia sp. Blyth Range (W.V.Fitzgerald s.n. 1898) [affin. papyrocarpa] "Further field and laboratory studies are needed to determine the status of this taxon. It is clearly related to *A. papyrocarpa,* but differs most obviously in having rather rigid, often subterete, ±pungent phyllodes and minutely appressed hairy pods." In the Carrapateena operational area, the taxon of the trees is still under review.

Appendix B2. Site specific descriptive statistics, grazing impact

Table B2.1: Plant diversity, life span, grazing impact, life stages and cover/abundance per RAM Site

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
Flora Site 1 / CAR001	*Abutilon halophilum*	Plains Lantern-bush	Y	4	Mixed	>50	<50	0
	Astrebla pectinata	Barley Mitchell-grass	Y	4	Mixed	<50	>50	0
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	<50	0
	Bulbine semibarbata	Small Leek-lily	N	1				
	Dissocarpus paradoxus	Ball Bindyi	N	3				
	Eragrostis setifolia	Bristly Love-grass	Y	2	Mixed	<50	>50	0
	Euphorbia tannensis ssp. *eremophila*	Desert Spurge	N	1				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	1	Adult	>50	0	0
	Goodenia fascicularis	Silky Goodenia	N	1				
	Maireana aphylla	Cotton-bush	Y	1	Adult	>50	0	0
	Maireana appressa	Pale-fruit Bluebush	Y	1	Adult	>50	<50	0
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	2	Adult	<50	>50	0
	Malvastrum americanum var.	Malvastrum	N	1				
	Minuria cunninghamii	Bush Minuria	Y	2	Adult	0	>50	<50
	Nicotiana velutina	Velvet Tobacco	N	1				
	Portulaca oleracea	Common Purslane	N	1				
	Rhodanthe floribunda	White Everlasting	N	1				
	Roepera howittii	Clasping Twinleaf	N	1				
	Sclerolaena brachyptera	Short-wing Bindyi	N	4				
	Sclerolaena divaricata	Tangled Bindyi	N	4				
	Sclerolaena intricata	Tangled Bindyi	N	3				
	Sida intricata	Twiggy Sida	Y	2	Adult	0	0	0
	Sporobolus actinocladus	Ray Grass	N	4				
	Tecticornia medullosa	Samphire	Y	3	Mixed	>50	0	0
	Site 1 Totals: 24 (long-lived = 11, short-lived = 13)							
Flora Site 2 / CAR002	*Abutilon halophilum*	Plains Lantern-bush	Y	3	Adult	>50	0	0
	Anacampseros australiana	Australian Anacampseros	N	1				
	Astrebla pectinata	Barley Mitchell-grass	Y	2	Adult	<50	>50	<50
	Atriplex holocarpa	Pop Saltbush	N	2				
	Atriplex vesicaria	Bladder Saltbush	Y	4	Mixed	>50	<50	0
	Brachyscome ciliaris var.	Variable Daisy	N	1				
	Calotis hispidula	Hairy Burr-daisy	N	1				
	Cullen cinereum	Annual Scurf-pea	N	2				
	Daucus glochidiatus	Native Carrot	N	1				
	Dissocarpus paradoxus	Ball Bindyi	N	2				
	Eragrostis setifolia	Bristly Love-grass	Y	3	Adult	0	0	>50
	Euphorbia tannensis ssp. *eremophila*	Desert Spurge	N	1				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	3	Adult	>50	0	0
	Lepidium phlebopetalum	Veined Peppercress	N	1				
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	3	Adult	>50	0	0
	Plantago drummondii	Dark Plantain	N	1				
	Ptilotus nobilis	Yellow-tails	N	1				
	Rhodanthe sp.	Everlasting	N	1				
	Salsola australis	Buckbush	N	3				
	Sclerolaena brachyptera	Short-wing Bindyi	N	4/5				
	Sclerolaena divaricata	Tangled Bindyi	N	4				
	Sclerolaena intricata	Tangled Bindyi	N	4				
	Sclerolaena ventricosa	Salt Bindyi	N	3				
	Sporobolus actinocladus	Ray Grass	N	3				
	Tecticornia medullosa	Samphire	Y	3	Adult	>50	0	0
	Thysanotus baueri	Mallee Fringe-lily	N	1				
	Trianthema triquetrum	Red Spinach	N	2				
	Wahlenbergia sp.	Native Bluebell	N	1				
	Site 2 Totals: 28 (long-lived = 7, short-lived = 21)							

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
Flora Site 3 / CAR003	*Abutilon halophilum*	Plains Lantern-bush	Y	3	Adult	>50	0	0
	Anacampseros australiana	Australian Anacampseros	N	3				
	Arthropodium fimbriatum	Nodding Vanilla-lily	N	1				
	Astrebla pectinata	Barley Mitchell-grass	Y	2	Adult	>50	<50	0
	Atriplex fissivalvis	Gibber Saltbush	N	2				
	Atriplex holocarpa	Pop Saltbush	N	2				
	Atriplex vesicaria	Bladder Saltbush	Y	4	Mixed	>50	<50	0
	Brachyscome ciliaris var.	Variable Daisy	N	1				
	Bulbine semibarbata	Small Leek-lily	N	3				
	Calotis hispidula	Hairy Burr-daisy	N	1				
	Centipeda crateriformis		N	1				
	Cullen cinereum	Annual Scurf-pea	N	1				
	Daucus glochidiatus	Native Carrot	N	3				
	Dissocarpus paradoxus	Ball Bindyi	N	3				
	Eragrostis setifolia	Bristly Love-grass	Y	2	Adult	0	>50	0
	Euphorbia stevenii	Bottletree Spurge	N	1				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	2	Mixed	>50	0	0
	Lepidium phlebopetalum	Veined Peppercress	N	1				
	Lotus cruentus	Red-flower Lotus	N	1				
	Maireana appressa	Pale-fruit Bluebush	Y	3	Adult	<50	>50	0
	Maireana eriantha	Woolly Bluebush	Y	1	Mixed	0	>50	0
	Minuria cunninghamii	Bush Minuria	Y	2/4	Mixed	>50	0	0
	Plantago drummondii	Dark Plantain	N	3				
	Podolepis davisiana	Button Podolepis	N	1				
	Portulaca oleracea	Common Purslane	N	3				
	Rhodanthe stricta	Slender Everlasting	N	3				
	Salsola australis	Buckbush	N	3				
	Sclerolaena brachyptera	Short-wing Bindyi	N	2				
	Sclerolaena divaricata	Tangled Bindyi	N	3				
	Sclerolaena intricata	Tangled Bindyi	N	2/4				
	Sclerolaena ventricosa	Salt Bindyi	N	2				
	Sida fibulifera	Pin Sida	N	2				
	Sida intricata	Twiggy Sida	Y	2	Adult	0	>50	0
	Sporobolus actinocladus	Ray Grass	N	2/3				
	Tecticornia medullosa	Samphire	Y	5	Mixed	>50	0	0
	Tecticornia tenuis	Slender Samphire	Y	1	Mixed	>50	0	0
	Wahlenbergia sp.	Native Bluebell	N	1				
	Site 3 Totals: 37 (long-lived = 11, short-lived = 26)							
Flora Site 4 / CAR004	*Abutilon halophilum*	Plains Lantern-bush	Y	1	Adult	>50	>50	0
	Atriplex holocarpa	Pop Saltbush	N	2				
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	0	0
	Brachyscome ciliaris var.	Variable Daisy	N	3				
	Bulbine semibarbata	Small Leek-lily	N	2				
	Calotis hispidula	Hairy Burr-daisy	N	1				
	Convolvulus remotus	Grassy Bindweed	N	1				
	Daucus glochidiatus	Native Carrot	N	3				
	Dissocarpus biflorus var.	Two-horn Saltbush	N	1				
	Dissocarpus paradoxus	Ball Bindyi	N	1				
	Eragrostis setifolia	Bristly Love-grass	Y	3	Adult	<50	>50	<50
	Euphorbia stevenii	Bottletree Spurge	N	1				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	3	Adult	>50	0	0
	Lepdiium phlebopetalum	Phebalium	N	3				
	Maireana appressa	Pale-fruit Bluebush	Y	3	Adult	<50	>50	0
	Minuria cunninghamii	Bush Minuria	Y	1	Adult	0	>50	0
	Osteocarpum dipterocarpum	Two-wing Bonefruit	N	3				
	Rhodanthe stricta	Slender Everlasting	N	3				
	Sclerolaena brachyptera	Short-wing Bindyi	N	2				
	Sclerolaena divaricata	Tangled Bindyi	N	2/4				
	Sclerolaena ventricosa	Salt Bindyi	N	4				
	Sida fibulifera	Pin Sida	N	3				
	Sida intricata	Twiggy Sida	Y	3	Adult	0	>50	<50

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Sporobolus actinocladus	Ray Grass	N	2/4				
	Tecticornia medullosa	Samphire	Y	2	Mixed	>50	0	0
	Tecticornia tenuis	Slender Samphire	Y	2	Mixed	>50	0	0
	Site 4 Totals: 26 (long-lived = 9, short-lived = 17)							
Flora Site 5 / CAR005	*Abutilon halophilum*	Plains Lantern-bush	Y	4	Mixed	>50	<50	0
	Anacampseros australiana	Australian Anacampseros	N	2				
	Atriplex holocarpa	Pop Saltbush	N	3				
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	<50	0
	Bulbine semibarbata	Small Leek-lily	N	2				
	Dissocarpus paradoxus	Ball Bindyi	N	1				
	Enneapogon avenaceus	Common Bottle-washers	N	2				
	Eragrostis setifolia	Bristly Love-grass	Y	2	Adult	>50	<50	0
	Frankenia serpyllifolia	Thyme Sea-heath	Y	4	Adult	>50	0	0
	Gnephosis arachnoidea	Spidery Button-flower	N	3				
	Lepidium phlebopetalum	Veined Peppercress	N	3				
	Maireana aphylla	Cotton-bush	Y	3	Adult	>50	<50	0
	Maireana appressa	Pale-fruit Bluebush	Y	2	Adult	<50	>50	0
	Maireana turbinata	Top-fruit Bluebush	Y	2	Adult	0	>50	0
	Minuria cunninghamii	Bush Minuria	Y	2	Adult	<50	>50	<50
	Osteocarpum dipterocarpum	Two-wing Bonefruit	N	3				
	Roepera sp.	Twinleaf	N	1				
	Sclerolaena brachyptera	Short-wing Bindyi	N	2				
	Sclerolaena divaricata	Tangled Bindyi	N	3				
	Sclerolaena intricata	Tangled Bindyi	N	1				
	Sclerolaena ventricosa	Salt Bindyi	N	2				
	Sida fibulifera	Pin Sida	N	2				
	Sporobolus actinocladus	Ray Grass	N	4				
	Tecticornia medullosa	Samphire	Y	4	Mixed	>50	0	0
	Site 5 Totals: 24 (long-lived = 9, short-lived = 15)							
Flora Site 6 / CAR006	*Astrebla pectinata*	Barley Mitchell-grass	Y	1	Adult	0	>50	0
	Atriplex holocarpa	Pop Saltbush	N	2				
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	<50	0
	Bulbine semibarbata	Small Leek-lily	N	3				
	Cullen cinereum	Annual Scurf-pea	N	1				
	Eragrostis setifolia	Bristly Love-grass	Y	2/4	Adult	<50	>50	0
	Euphorbia stevenii	Bottletree Spurge	N	2/4				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	2	Adult	>50	0	0
	Gnephosis arachnoidea	Spidery Button-flower	N	3				
	Maireana aphylla	Cotton-bush	Y	1	Adult	>50	0	0
	Maireana appressa	Pale-fruit Bluebush	Y	1	Adult	0	>50	>50
	Minuria cunninghamii	Bush Minuria	Y	4	Adult	<50	>50	<50
	Osteocarpum dipterocarpum	Two-wing Bonefruit	N	1				
	Podolepis davisiana	Button Podolepis	N	3				
	Rhodanthe stricta	Slender Everlasting	N	1				
	Sclerolaena brachyptera	Short-wing Bindyi	N	2				
	Sclerolaena divaricata	Tangled Bindyi	N	2				
	Sclerolaena intricata	Tangled Bindyi	N	2				
	Sclerolaena ventricosa	Salt Bindyi	N	2/4				
	Sida fibulifera	Pin Sida	N	3				
	Sida intricata	Twiggy Sida	Y	1	Adult	0	>50	0
	Sporobolus actinocladus	Ray Grass	N	3/4				
	Tecticornia medullosa	Samphire	Y	2/4	Mixed	>50	0	0
	Wahlenbergia sp.	Native Bluebell	N	1				
	Site 6 Totals: 24 (long-lived = 9, short-lived =15)							
Flora Site 7 / CAR007	*Abutilon halophilum*	Plains Lantern-bush	Y	1	Mixed	>50	0	0
	Aristida contorta	Curly Wire-grass	N	2				
	Astrebla pectinata	Barley Mitchell-grass	Y	1	Adult	0	<50	>50
	Atriplex holocarpa	Pop Saltbush	N	3				
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	<50	0
	Calotis hispidula	Hairy Burr-daisy	N	2				

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Dodonaea viscosa ssp. *angustissima*	Narrow-leaf Hop-bush	Y	1	Adult	>50	0	0
	Enneapogon avenaceus	Common Bottle-washers	N	4				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	3	Mixed	>50	0	0
	Frankenia subteres		Y	1	Mixed	>50	0	0
	Gnephosis arachnoidea	Spidery Button-flower	N	4				
	Gunniopsis quadrifida	Sturt's Pigface	N	1				
	Lotus cruentus	Red-flower Lotus	N	1				
	Maireana appressa	Pale-fruit Bluebush	Y	2	Mixed	>50	0	0
	Maireana astrotricha	Low Bluebush	Y	1	Mixed	>50	<50	<50
	Maireana georgei	Satiny Bluebush	Y	2	Mixed	0	>50	<50
	Maireana pyramidata	Black Bluebush	Y	2	Adult	>50	<50	0
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	2	Mixed	0	>50	0
	Malvastrum americanum var.	Malvastrum	N	1				
	Minuria cunninghamii	Bush Minuria	Y	4	Adult	0	>50	<50
	Myoporum montanum	Native Myrtle	Y	1	Adult	>50	0	0
	Osteocarpum dipterocarpum	Two-wing Bonefruit	N	4				
	Pimelea simplex	Pimelea	N	3				
	Pterocaulon sphacelatum	Apple-bush	N	1				
	Ptilotus obovatus	Silver Mulla Mulla	Y	2	Mixed	>50	<50	0
	Sclerolaena intricata	Tangled Bindyi	N	4				
	Sclerolaena patenticuspis	Spear-fruit Bindyi	N	2				
	Sida intricata	Twiggy Sida	Y	2	Mixed	>50	<50	<50
	Sida petrophila	Rock Sida	Y	1	Mixed	<50	>50	0
	Solanum quadriloculatum	Plains Nightshade	N	1				
	Sporobolus actinocladus	Ray Grass	N	3				
	Stackhousia sp.	Candles	N	2				
	Tecticornia pergranulata ssp. *divaricata*	Black-seed Samphire	Y	5	Mixed	>50	0	0
	Tecticornia tenuis	Slender Samphire	Y	3	Mixed	>50	0	0
	Thysanotus sp.	Fringe-lily	N	1				
	Site 7 Totals: 35 (long-lived = 18, short-lived = 17)							
Flora Site 9 / CAR009	*Abutilon halophilum*	Plains Lantern-bush	Y	3	Mixed	>50	<50	0
	Acacia papyrocarpa	Western Myall	Y	6	Mixed	>50	0	0
	Astrebla pectinata	Barley Mitchell-grass	Y	2	Mixed	0	<50	>50
	Atriplex fissivalvis	Gibber Saltbush	N	2				
	Atriplex vesicaria	Bladder Saltbush	Y	4	Mixed	>50	<50	0
	Calotis hispidula	Hairy Burr-daisy	N	2				
	Centipeda sp.	Sneezeweed	N	1				
	Cullen cinereum	Annual Scurf-pea	N	1				
	Dactyloctenium radulans	Button-grass	N	1				
	Dissocarpus paradoxus	Ball Bindyi	N	3				
	Enchylaena tomentosa	Ruby Saltbush	Y	2	Mixed	>50	<50	0
	Enneapogon avenaceus	Common Bottle-washers	N	2				
	Eremophila glabra ssp.	Tar Bush	Y	1	Adult	>50	0	0
	Eremophila oppositifolia ssp.	Opposite-leaved Emubush	Y	1	Adult	0	0	>50
	Euphorbia tannensis ssp. *eremophila*	Desert Spurge	N	1				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	3	Mixed	<50	>50	0
	Gnephosis arachnoidea	Spidery Button-flower	N	2				
	Lotus cruentus	Red-flower Lotus	N	1				
	Maireana aphylla	Cotton-bush	Y	1	Adult	<50	>50	0
	Maireana appressa	Pale-fruit Bluebush	Y	2	Mixed	>50	0	0
	Maireana eriantha	Woolly Bluebush	Y	2	Mixed	>50	<50	0
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	2	Adult	>50	<50	0
	Minuria cunninghamii	Bush Minuria	Y	2	Mixed	0	>50	<50
	Myoporum montanum	Native Myrtle	Y	2	Young	>50	0	0
	Panicum decompositum var. *decompositum*	Native Millet	N	1				
	Ptilotus obovatus	Silver Mulla Mulla	Y	2	Mixed	>50	<50	0
	Rhodanthe stricta	Slender Everlasting	N	3				
	Rostellularia adscendens	Pink Tongues	N	2				

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Salsola australis	Buckbush	N	1				
	Sclerolaena brachyptera	Short-wing Bindyi	N	4				
	Sclerolaena divaricata	Tangled Bindyi	N	4				
	Sclerolaena intricata	Tangled Bindyi	N	4				
	Sida corrugata	Corrugated Sida	N	1				
	Sida intricata	Twiggy Sida	Y	2	Adult	0	0	0
	Solanum quadriloculatum	Plains Nightshade	N	2				
	Sporobolus actinocladus	Ray Grass	N	4				
	Swainsona sp.	Swainson-pea	N	1				
	Tecticornia medullosa	Samphire	Y	3	Mixed	>50	0	0
	Tecticornia pergranulata ssp. *divaricata*	Black-seed Samphire	Y	5	Mixed	>50	<50	0
	Tecticornia tenuis	Slender Samphire	Y	3	Mixed	>50	0	0
	Vittadinia gracilis	Woolly New Holland Daisy	N	1				
	Site 9 Totals: 41 (long-lived = 19, short-lived = 22)							
Flora Site 10 / CAR010	*Abutilon otocarpum*	Desert Lantern-bush	Y	3	Mixed	>50	0	0
	Acacia papyrocarpa	Western Myall	Y	3	Mixed	>50	0	0
	Acacia tetragonophylla	Dead Finish	Y	3	Mixed	>50	0	0
	Alternanthera denticulata	Lesser Joyweed	N	1				
	Chenopodium desertorum ssp.	Desert Goosefoot	Y	1	Adult	>50	<50	0
	Chrysocephalum pterochaetum	Shrub Everlasting	N	3				
	Daucus glochidiatus	Native Carrot	N	3				
	Digitaria brownii	Cotton Panic-grass	Y	2	Adult	0	>50	0
	Dodonaea lobulata	Lobed-leaf Hop-bush	Y	3	Mixed	>50	0	0
	Duma florulenta	Lignum	Y	2	Mixed	>50	0	0
	Einadia nutans ssp.	Climbing Saltbush	Y	1	Adult	>50	<50	0
	Enchylaena tomentosa	Ruby Saltbush	Y	4	Mixed	>50	<50	0
	Enteropogon acicularis	Umbrella Grass	N	2				
	Eragrostis setifolia	Bristly Love-grass	Y	1	Adult	<50	<50	>50
	Eremophila serrulata	Green Emubush	Y	1	Mixed	>50	0	0
	Eucalyptus camaldulensis ssp. *arida*	Northern River Red Gum	Y	2/4	Mixed	>50	0	0
	Exocarpos aphyllus	Leafless Cherry	Y	1	Adult	>50	0	0
	Iseilema membranaceum	Small Flinders-grass	N	2				
	Lepidium phlebopetalum	Veined Peppercress	N	3				
	Maireana aphylla	Cotton-bush	Y	1	Adult	0	>50	0
	Malvastrum americanum var.	Malvastrum	N	1				
	Marsilea drummondii	Common Nardoo	N	1				
	Myoporum montanum	Native Myrtle	Y	3	Mixed	>50	0	0
	Pluchea rubelliflora		N	3				
	Pterocaulon sphacelatum	Apple-bush	N	3				
	Ptilotus obovatus	Silver Mulla Mulla	Y	4	Mixed	>50	<50	0
	Rhagodia spinescens	Spiny Saltbush	Y	2	Mixed	>50	0	0
	Rhodanthe stricta	Slender Everlasting	N	1				
	Rostellularia adscendens ssp.	Pink Tongues	N	3				
	Santalum lanceolatum	Plumbush	Y	3	Mixed	>50	0	0
	Scaevola spinescens	Spiny Fanflower	Y	3	Mixed	>50	<50	0
	Senna artemisioides ssp. *helmsii*	Blunt-leaf Senna	Y	4	Mixed	>50	0	0
	Senna artemisioides ssp. *X artemisioides*	Silver Senna	Y	3	Adult	>50	0	0
	Sida petrophila	Rock Sida	Y	4	Mixed	0	>50	0
	Stackhousia sp.	Candles	N	1				
	Themeda triandra	Kangaroo Grass	Y	2/4	Mixed	0	>50	0
	Site 10 Totals: 36 (long-lived = 23, short-lived = 13)							
Flora Site / CAR011	*Abutilon halophilum*	Plains Lantern-bush	Y	5	Mixed	>50	0	0
	Acacia papyrocarpa	Western Myall	Y	4	Mixed	>50	<50	0
	Anacampseros australiana	Australian Anacampseros	N	3				
	Arthropodium fimbriatum	Nodding Vanilla-lily	N	1				
	Astrebla pectinata	Barley Mitchell-grass	Y	4	Mixed	>50	<50	0
	Atriplex holocarpa	Pop Saltbush	N	2				
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	>50	<50

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Bulbine semibarbata	Small Leek-lily	N	3				
	Enchylaena tomentosa	Ruby Saltbush	Y	2	Mixed	>50	<50	0
	Eragrostis australasica	Cane-grass	Y	1	Mixed	0	0	>50
	Eragrostis setifolia	Bristly Love-grass	Y	3	Mixed	0	>50	0
	Eremophila serrulata	Green Emubush	Y	1	Adult	>50	0	0
	Euphorbia tannensis ssp. *eremophila*	Desert Spurge	N	1				
	Exocarpos aphyllus	Leafless Cherry	Y	1	Adult	>50	<50	0
	Frankenia serpyllifolia	Thyme Sea-heath	Y	2	Mixed	>50	0	0
	Gnephosis arachnoidea	Spidery Button-flower	N	2				
	Lepidium phlebopetalum	Veined Peppercress	N	1				
	Maireana aphylla	Cotton-bush	Y	2	Adult	0	>50	0
	Maireana appressa	Pale-fruit Bluebush	Y	3	Mixed	>50	<50	0
	Maireana eriantha	Woolly Bluebush	Y	3	Mixed	>50	<50	0
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	3	Mixed	0	>50	0
	Minuria cunninghamii	Bush Minuria	Y	4	Mixed	0	<50	>50
	Podolepis sp.	Copper-wire Daisy	N	1				
	Rhagodia spinescens	Spiny Saltbush	Y	2	Mixed	>50	<50	0
	Rhodanthe stricta	Slender Everlasting	N	3				
	Sclerolaena diacantha	Grey Bindyi	N	5				
	Sclerolaena divaricata	Tangled Bindyi	N	5				
	Sclerolaena intricata	Tangled Bindyi	N	5				
	Sclerolaena patenticuspis	Spear-fruit Bindyi	N	4				
	Sida corrugata	Rock Sida	N	1				
	Sida intricata	Twiggy Sida	Y	1	Adult	>50	0	0
	Sporobolus actinocladus	Ray Grass	N	5				
	Tecticornia medullosa	Samphire	Y	5	Mixed	>50	0	0
	Site 11 Totals: 33 (long-lived = 18, short-lived = 15)							
Flora Site 12/ CAR012	*Atriplex holocarpa*	Pop Saltbush	N	4				
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	<50	>50	<50
	Bulbine semibarbata	Small Leek-lily	N	3				
	Calotis hispidula	Hairy Burr-daisy	N	3				
	Dissocarpus biflorus var.	Two-horn Saltbush	N	3				
	Dissocarpus paradoxus	Ball Bindyi	N	3				
	Eragrostis setifolia	Bristly Love-grass	Y	2/4	Mixed	0	>50	<50
	Euphorbia stevenii	Bottletree Spurge	N	3				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	3	Adult	>50	<50	0
	Lepidium phlebopetalum	Veined Peppercress	N	3				
	Maireana appressa	Pale-fruit Bluebush	Y	1	Adult	>50	0	0
	Minuria cunninghamii	Bush Minuria	Y	2/4	Adult	0	>50	<50
	Plantago drummondii	Dark Plantain	N	1				
	Sclerolaena divaricata	Tangled Bindyi	N	5				
	Sclerolaena intricata	Tangled Bindyi	N	4				
	Sclerolaena patenticuspis	Spear-fruit Bindyi	N	4				
	Sida fibulifera	Pin Sida	N	3				
	Sida intricata	Twiggy Sida	Y	4	Mixed	0	>50	<50
	Sporobolus actinocladus	Ray Grass	N	4				
	Tecticornia medullosa	Samphire	Y	4	Mixed	>50	0	0
	Site 12 Totals: 20 (long-lived = 7, short-lived = 13)							
Flora Site 13 / CAR013	*Abutilon halophilum*	Plains Lantern-bush	Y	4	Adult	<50	>50	0
	Atriplex holocarpa	Pop Saltbush	N	5				
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	<50	0
	Dissocarpus biflorus var.	Two-horn Saltbush	N	3				
	Dissocarpus paradoxus	Ball Bindyi	N	3				
	Eragrostis setifolia	Bristly Love-grass	Y	3	Mixed	0	<50	>50
	Euphorbia stevenii	Bottletree Spurge	N	3				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	3	Mixed	>50	0	0
	Maireana aphylla	Cotton-bush	Y	1	Adult	0	>0	0
	Maireana appressa	Pale-fruit Bluebush	Y	3	Adult	>50	>50	0
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	3	Adult	0	<50	>50
	Minuria cunninghamii	Bush Minuria	Y	3	Adult	0	>50	<50

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Nicotiana velutina	Velvet Tobacco	N	1				
	Rhodanthe floribunda	White Everlasting	N	1				
	Rhodanthe stricta	Slender Everlasting	N	1				
	Sclerolaena brachyptera	Short-wing Bindyi	N	3				
	Sclerolaena diacantha	Grey Bindyi	N	4				
	Sclerolaena divaricata	Tangled Bindyi	N	4				
	Sclerolaena intricata	Tangled Bindyi	N	4				
	Sida fibulifera	Pin Sida	N	3				
	Sida intricata	Twiggy Sida	Y	3	Mixed	0	>50	<50
	Solanum quadriloculatum	Plains Nightshade	N	1				
	Sporobolus actinocladus	Ray Grass	N	3				
	Tecticornia medullosa	Samphire	Y	4	Mixed	>50	0	0
	Site 13 Totals: 24 (long-lived = 10, short-lived = 14)							
Site 15 / CAR015	*Atriplex holocarpa*	Pop Saltbush	N	2				
	Atriplex vesicaria	Bladder Saltbush	Y	4	Mixed	>50	0	0
	Bulbine semibarbata	Small Leek-lily	N	3				
	Calotis hispidula	Hairy Burr-daisy	N	1				
	Dissocarpus biflorus var.	Two-horn Saltbush	N	3				
	Enneapogon avenaceus	Common Bottle-washers	N	3				
	Euphorbia tannensis ssp. *eremophila*	Desert Spurge	N	1				
	Frankenia serpyllifolia	Thyme Sea-heath	Y	2	Adult	>50	0	0
	Gnephosis arachnoidea	Spidery Button-flower	N	3				
	Lepidium phlebopetalum	Veined Peppercress	N	3				
	Lotus cruentus	Red-flower Lotus	N	1				
	Maireana aphylla	Cotton-bush	Y	2	Adult	>50	0	0
	Maireana appressa	Pale-fruit Bluebush	Y	1	Adult	0	>50	0
	Maireana turbinata	Top-fruit Bluebush	Y	1	Adult	0	0	>50
	Minuria cunninghamii	Bush Minuria	Y	1	Mixed	0	>50	0
	Plantago drummondii	Dark Plantain	N	1				
	Rhodanthe stricta	Slender Everlasting	N	1				
	Salsola australis	Buckbush	N	3				
	Sclerolaena brachyptera	Short-wing Bindyi	N	2				
	Sclerolaena divaricata	Tangled Bindyi	N	5				
	Sclerolaena ventricosa	Salt Bindyi	N	4				
	Sida fibulifera	Pin Sida	N	3				
	Sida intricata	Twiggy Sida	Y	2	Adult	0	>50	<50
	Sporobolus actinocladus	Ray Grass	N	1				
	Tecticornia medullosa	Samphire	Y	2	Adult	>50	0	0
	Site 15 Totals: 25 (long-lived = 8, short-lived = 17)							
Flora Site 16 / CAR016	*Abutilon halophilum*	Plains Lantern-bush	Y	4	Mixed	<50	>50	0
	Astrebla pectinata	Barley Mitchell-grass	Y	3	Mixed	>50	>50	<50
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed			
	Bulbine semibarbata	Small Leek-lily	N	1				
	Cullen cinereum	Annual Scurf-pea	N	2				
	Enneapogon avenaceus	Common Bottle-washers	N	1		0	>50	<50
	Eragrostis setifolia	Bristly Love-grass	Y	3	Adult			
	Euphorbia stevenii	Bottletree Spurge	N	1		>50	0	0
	Frankenia serpyllifolia	Thyme Sea-heath	Y	3	Adult			
	Goodenia fascicularis	Silky Goodenia	N	1				
	Lepidium phlebopetalum	Veined Peppercress	N	1				
	Lotus cruentus	Red-flower Lotus	N	1		>50	<50	0
	Maireana appressa	Pale-fruit Bluebush	Y	1	Adult	>50	0	0
	Maireana eriantha	Woolly Bluebush	Y	2	Adult	<50	0	>50
	Minuria cunninghamii	Bush Minuria	Y	3	Adult	<50	>50	0
	Osteocarpum dipterocarpum	Two-wing Bonefruit	N	1				
	Panicum decompositum var. *decompositum*	Native Millet	N	1				
	Podolepis davisiana	Button Podolepis	N	1				
	Sclerolaena brachyptera	Short-wing Bindyi	N	4				
	Sclerolaena divaricata	Tangled Bindyi	N	3				

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Sclerolaena intricata	Tangled Bindyi	N	2				
	Sida fibulifera	Pin Sida	N	2				
	Sporobolus actinocladus	Ray Grass	N	4				
	Tecticornia medullosa	Samphire	Y	3	Adult	>50	0	0
	Site 16 Totals: 24 (long-lived = 9, short-lived =15)							
Flora Site 17 / CAR017	*Abutilon halophilum*	Plains Lantern-bush	Y	3	Adult	>50	0	0
	Acacia papyrocarpa	Western Myall	Y	6	Mixed	>50	0	0
	Acacia tetragonophylla	Dead Finish	Y	3	Mixed	>50	0	0
	Anacampseros australiana	Australian Anacampseros	N					
	Atriplex vesicaria	Bladder Saltbush	Y	5	Mixed	>50	<50	0
	Chenopodium desertorum ssp.	Desert Goosefoot	Y	1	Adult	>50	0	0
	Crinum flaccidum	Murray Lily	N					
	Dodonaea lobulata	Lobed-leaf Hop-bush	Y	5	Mixed	>50	<50	0
	Einadia nutans ssp.	Climbing Saltbush	Y	3	Adult	>50	>50	0
	Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush	Y	4	Mixed	>50	<50	0
	Eremophila latrobei ssp. *glabra*	Crimson Emubush	Y	4	Adult	>50	0	0
	Eremophila serrulata	Green Emubush	Y	3	Adult	>50	0	0
	Eulalia aurea	Silky Brown-top	Y			>50	>50	<50
	Exocarpos aphyllus	Leafless Cherry	Y	1	Adult	>50	0	0
	Gnephosis arachnoidea	Spidery Button-flower	N					
	Lepidium phlebopetalum	Veined Peppercress	N					
	Maireana aphylla	Cotton-bush	Y	3	Mixed	0	>50	<50
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	3	Adult	0	>50	<50
	Ptilotus obovatus	Silver Mulla Mulla	Y	5	Mixed	>50	0	0
	Rhagodia spinescens	Spiny Saltbush	Y	1	Adult	>50	<50	0
	Rostellularia adscendens	Pink Tongues	N					
	Santalum lanceolatum	Plumbush	Y	3	Mixed	>50	0	0
	Scaevola spinescens	Spiny Fanflower	Y	3	Mixed	<50	>50	0
	Sclerolaena divaricata	Tangled Bindyi	N					
	Senna artemisioides ssp. *helmsii*	Blunt-leaf Senna	Y	3	Adult	>50	0	0
	Senna artemisioides ssp. *oligophylla*	Limestone Senna	Y	3	Adult	>50	0	0
	Senna artemisioides ssp. *X artemisioides*	Silver Senna	Y	3	Mixed	>50	0	0
	Sida petrophila	Rock Sida	Y	3	Mixed	0	>50	0
	Solanum quadriloculatum	Plains Nightshade	N					
	Tecticornia medullosa	Samphire	Y	2	Adult	>50	0	0
	Site 17 Totals: 30 (long-lived = 23 / short-lived = 7)							
Flora Site 18 / CAR018	*Abutilon otocarpum*	Desert Lantern-bush	Y	2	Adult	>50	0	0
	Acacia aneura	Mulga	Y	1	Adult	<50	>50	0
	Acacia papyrocarpa	Western Myall	Y	5	Mixed	>50	<50	0
	Atriplex vesicaria	Bladder Saltbush	Y	4	Mixed	>50	<50	0
	Boerhavia sp.	Tar-vine	N	3				
	Cheilanthes lasiophylla	Woolly Cloak-fern	N	1				
	Chenopodium curvispicatum	Cottony Goosefoot	Y	3	Adult	>50	0	0
	Chenopodium desertorum ssp.	Desert Goosefoot	Y	2	Adult	>50	<50	0
	Crinum flaccidum	Murray Lily	N	1				
	Digitaria brownii	Cotton Panic-grass	Y	4	Adult	0	>50	0
	Dodonaea lobulata	Lobed-leaf Hop-bush	Y	4	Mixed	>50	0	0
	Enchylaena tomentosa	Ruby Saltbush	Y	4	Mixed	>50	0	0
	Eremophila latrobei ssp. *glabra*	Crimson Emubush	Y	4	Mixed	>50	0	0
	Eremophila oppositifolia ssp.	Opposite-leaved Emubush	Y	1	Adult	0	0	>50
	Eulalia aurea	Silky Brown-top	Y	4	Adult	>50	<50	<50
	Exocarpos aphyllus	Leafless Cherry	Y	1	Adult	>50	0	0
	Gnephosis arachnoidea	Spidery Button-flower	N	3				
	Lepidium phlebopetalum	Veined Peppercress	N	2				
	Maireana aphylla	Cotton-bush	Y	1	Adult	>50	<50	0
	Maireana spongiocarpa	Spongy-fruit Bluebush	Y	2/4	Mixed	>50	<50	0
	Myoporum montanum	Native Myrtle	Y	2	Mixed	>50	0	0
	Ptilotus obovatus	Silver Mulla Mulla	Y	4	Mixed	>50	0	0

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Rhagodia spinescens	Spiny Saltbush	Y	2	Adult	>50	0	0
	Rostellularia adscendens ssp.	Pink Tongues	N	1				
	Santalum lanceolatum	Plumbush	Y	2	Mixed	>50	0	0
	Scaevola spinescens	Spiny Fanflower	Y	2	Mixed	>50	0	0
	Sclerolaena divaricata	Tangled Bindyi	N	1				
	Senna artemisioides ssp. *helmsii*	Blunt-leaf Senna	Y	2	Mixed	>50	0	0
	Senna artemisioides ssp. *X artemisioides*	Silver Senna	Y	3	Adult	>50	0	0
	Senna artemisioides ssp. *X sturtii*	Grey Senna	Y	2	Mixed	>50	0	0
	Sida corrugata	Corrugated Sida	N	3				
	Sida petrophila	Rock Sida	Y	3	Adult	>50	0	0
	Solanum lithophilum	Velvet Potato-bush	N	3				
	*Sonchus oleraceus**	Common Sow-thistle	N	1				
	Sporobolus actinocladus	Ray Grass	N	2/4				
	Teucrium racemosum	Grey Germander	Y	2	Adult	>50	0	0
	Wurmbea australis	Inland Nancy	N	1				
	Site 18 Totals: 36 (long-lived =24, short-lived = 12)							
Flora Site 19 / CAR019	*Abutilon otocarpum*	Desert Lantern-bush	Y	2	Adult	>50	0	0
	Acacia papyrocarpa	Western Myall	Y	4	Mixed	>50	0	0
	Acacia tetragonophylla	Dead Finish	Y	4	Adult	>50	0	0
	Atriplex vesicaria	Bladder Saltbush	Y	2	Mixed	>50	0	0
	Chenopodium curvispicatum	Cottony Goosefoot	Y	1	Adult	>50	0	0
	Crinum flaccidum	Murray Lily	N	1				
	Digitaria brownii	Cotton Panic-grass	Y	1	Adult	0	0	0
	Dodonaea lobulata	Lobed-leaf Hop-bush	Y	4/5	Mixed	>50	0	0
	Duma florulenta	Lignum	Y	2	Adult	>50	0	0
	Einadia nutans ssp.	Climbing Saltbush	Y	2/4	Mixed	>50	0	0
	Enchylaena tomentosa	Ruby Saltbush	Y	4	Mixed	>50	0	0
	Enneapogon avenaceus	Common Bottle-washers	N	3				
	Eragrostis setifolia	Bristly Love-grass	Y	2/4	Adult	0	>50	<50
	Eremophila serrulata	Green Emubush	Y	1	Adult	>50	0	0
	Eucalyptus camaldulensis ssp. *arida*	Northern River Red Gum	Y	2/4	Mixed	>50	0	0
	Eulalia aurea	Silky Brown-top	Y	2/4		>50	>50	<50
	Maireana aphylla	Cotton-bush	Y	3	Adult	>50	<50	0
	Malvastrum americanum var.	Malvastrum	N	3				
	Marsilea drummondii	Common Nardoo	N	3				
	Myoporum montanum	Native Myrtle	Y	2/4	Mixed	>50	0	0
	Pluchea rubelliflora		N	2/4				
	Pterocaulon sphacelatum	Apple-bush	N	3				
	Ptilotus obovatus	Silver Mulla Mulla	Y	4	Adult	>50	0	0
	Santalum lanceolatum	Plumbush	Y	2/4	Mixed	>50	0	0
	Scaevola spinescens	Spiny Fanflower	Y	2	Mixed	>50	<50	0
	Sclerolaena divaricata	Tangled Bindyi	N	1				
	Senna artemisioides ssp. *helmsii*	Blunt-leaf Senna	Y	2/4	Mixed	>50	0	0
	Senna artemisioides ssp. *X artemisioides*	Silver Senna	Y	2	Adult	>50	0	0
	Senna artemisioides ssp. *X sturtii*	Grey Senna	Y	2	Mixed	>50	0	0
	Sida corrugata var.	Corrugated Sida	N	2				
	Sida petrophila	Rock Sida	Y	2	Adult	>50	0	0
	Solanum lithophilum	Velvet Potato-bush	N	2				
	*Sonchus oleraceus**	Common Sow-thistle	N	1				
	Teucrium racemosum	Grey Germander	N	1				
	Trianthema triquetrum	Red Spinach	N	1				
	Site 19 Totals: 36 (long-lived = 23, short-lived = 13)							

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
Flora Site 20 / CAR020	*Abutilon otocarpum*	Desert Lantern-bush	Y	2	Adult	>50	0	0
	Acacia papyrocarpa	Western Myall	Y	3	Adult	>50	<50	0
	Acacia tetragonophylla	Dead Finish	Y	4	Mixed	>50	0	0
	*Centaurea melitensis**	Malta Thistle	N	2				
	Chenopodium curvispicatum	Cottony Goosefoot	Y	1	Adult	>50	0	0
	Crinum flaccidum	Murray Lily	N	1				
	Daucus glochidiatus	Native Carrot	N	2				
	Digitaria brownii	Cotton Panic-grass	Y	4	Adult	<50	<50	0
	Dodonaea lobulata	Lobed-leaf Hop-bush	Y	4	Mixed	>50	>50	<50
	Duma florulenta	Lignum	Y	4	Mixed	>50	0	0
	Einadia nutans ssp.	Climbing Saltbush	Y	2	Mixed	>50	0	0
	Enchylaena tomentosa	Ruby Saltbush	Y	2/4	Adult	>50	0	0
	Enneapogon avenaceus	Common Bottle-washers	N	1				
	Eragrostis setifolia	Bristly Love-grass	Y	1	Adult	>50	>50	0
	Eremophila latrobei ssp. *glabra*	Crimson Emubush	Y	1	Mixed	>50	0	0
	Eremophila serrulata	Green Emubush	Y	2	Adult	>50	0	0
	Eucalyptus camaldulensis ssp. *arida*	Northern River Red Gum	Y	4	Mixed	>50	0	0
	Eulalia aurea	Silky Brown-top	Y	4	Adult	<50	>50	0
	Euphorbia tannensis ssp. *eremophila*	Desert Spurge	N	1				
	Glossocardia bidens	Native Cobbler's-pegs	N	1				
	Lepidium phlebopetalum	Veined Peppercress	N	3				
	Malvastrum americanum var.	Malvastrum	N	3				
	Marsilea drummondii	Common Nardoo	N	1				
	Minuria cunninghamii	Bush Minuria	Y	1	Adult	0	>50	0
	Myoporum montanum	Native Myrtle	Y	2/4	Mixed	>50	0	0
	Pluchea rubelliflora		N	4				
	Ptilotus obovatus	Silver Mulla Mulla	Y	2/4	Mixed	>50	0	0
	Rhagodia spinescens	Spiny Saltbush	Y	1	Adult	>50	>50	0
	Rostellularia adscendens ssp.	Pink Tongues	N	3				
	Santalum lanceolatum	Plumbush	Y	2	Mixed	>50	<50	0
	Senna artemisioides ssp. *helmsii*	Blunt-leaf Senna	Y	3	Mixed	>50	0	0
	Senna artemisioides ssp. *X artemisioides*	Silver Senna	Y	1	Adult	>50	0	0
	Senna artemisioides ssp. *X sturtii*	Grey Senna	Y	1	Adult	>50	0	0
	Setaria constricta	Knotty-butt Paspalidium	Y	2	Adult	< 50	> 50	0
	Sida corrugata var.	Corrugated Sida	N	1				
	Sida petrophila	Rock Sida	Y	4	Mixed	>50	0	0
	*Sisymbrium erysimoides**	Smooth Mustard	N	1				
	Solanum lithophilum	Velvet Potato-bush	N	1				
	Teucrium racemosum	Grey Germander	N	2				
	Themeda triandra	Kangaroo Grass	Y	1	Adult	0	>50	0
	Trichodesma zeylanicum var.	Camel Bush	N	1				
	Site 20 Totals: 41 (long-lived = 25, short-lived = 16)							
Flora Site / CAR021	*Acacia ligulata*	Umbrella Bush	Y	4	Mixed	>50	0	0
	Acacia oswaldii	Umbrella Wattle	Y	1	Adult	0	>50	0
	Alectryon oleifolius ssp. *canescens*	Bullock Bush	Y	1	Adult	0	>50	0
	Aristida holathera var.	#N/A	N					
	Atriplex velutinella	Sandhill Saltbush	N					
	Cullen pallidum	White Scurf-pea	N					
	Dodonaea viscosa ssp. *angustissima*	Narrow-leaf Hop-bush	Y	1	Mixed	<50	>50	0
	Einadia nutans ssp.	Climbing Saltbush	Y	1	Adult	>50	0	0
	Enchylaena tomentosa	Ruby Saltbush	Y	3	Adult	>50	<50	0
	Enneapogon avenaceus	Common Bottle-washers	N					
	Euphorbia drummondii group	Spurge	N					
	Lycium australe	Australian Boxthorn	Y	1	Adult	>50	0	0
	Maireana pyramidata	Black Bluebush	Y	1	Adult	0	>50	0
	Nicotiana velutina	Velvet Tobacco	N					

RAM Site	Scientific Name	Common Name	Long-lived[1]	CSR[2]	Age Class[3]	Grazing Level % of Total Population		
						Intact	Modified	Over-utilised
	Lysiandra fuernrohrii	Sand Spurge	Y	3/4	Mixed	>50	0	0
	Pimelea microcephala ssp. *microcephala*	Shrubby Riceflower	Y	1	Adult	>50	0	0
	Polycalymma stuartii	Poached-egg Daisy	N					
	Roepera eremaea	Climbing Twinleaf	N					
	Salsola australis	Buckbush	N					
	Sida ammophila	Sand Sida	N					
	*Sisymbrium erysimoides**	Smooth Mustard	N	2/4				
	Zygochloa paradoxa	Sandhill Cane-grass	Y	2	Mixed	>50	0	0
	Site 21 Totals: 21 (long-lived = 11, short-lived = 11)							
Site 22 / CAR022	*Acacia ligulata*	Umbrella Bush	Y	4/5	Mixed	0	>50	0
	Acacia ramulosa var.	Horse Mulga	Y	1	Adult			
	Aristida holathera var. *holathera*	Tall Kerosene Grass	N					
	Atriplex velutinella	Sandhill Saltbush	N					
	Crotalaria eremaea ssp.	Loose-flowered Rattle-pod	N					
	Cullen pallidum	White Scurf-pea	N			>50	<50	0
	Dodonaea viscosa ssp. *angustissima*	Narrow-leaf Hop-bush	Y	1	Adult	>50	0	0
	Einadia nutans ssp.	Climbing Saltbush	Y	1	Adult	>50	<50	0
	Enchylaena tomentosa	Ruby Saltbush	Y	3	Adult			
	Euphorbia drummondii group	Spurge	N					
	Hibiscus krichauffianus	Velvet-leaf Hibiscus	N			>50	<50	0
	Maireana pyramidata	Black Bluebush	Y	1	Adult			
	Nicotiana velutina	Velvet Tobacco	N					
	Paractaenum novae-hollandiae ssp. *reversum*	Barbed-wire Grass	N			>50	0	0
	Pimelea microcephala ssp. *microcephala*	Shrubby Riceflower	Y	1	Adult			
	Polycalymma stuartii	Poached-egg Daisy	N			>50	0	0
	Rhagodia spinescens	Spiny Saltbush	Y	1	Adult			
	Roepera howittii	Clasping Twinleaf	N					
	Salsola australis	Buckbush	N					
	Sida ammophila	Sand Sida	N					
	*Sisymbrium erysimoides**	Smooth Mustard	N	4/5				
	Trichodesma zeylanicum var.	Camel Bush	N			>50	0	0
	Zygochloa paradoxa	Sandhill Cane-grass	Y	4	Adult	0	>50	0
	Site 22 Totals: 23 (long-lived = 9, short-lived = 14)							

* Non-native

[1] Long lived woody perennials – refer Appendix C

[2] CSR ratio (Source = DENR (2011). Pastoral Lease Assessment Manual. Pastoral Land Management Group

CLASS	TERM	CSR	FIELD CRITERIA
1	Present	< 12 plants	< 12 plants within 200 m radius
2	Isolated Clumps	>20 spaces	Isolated clumps of two to five woody plants 200 m further apart
3	Isolated Plants	>20 spaces	Isolated plants
4	Very Sparse	6-20 spaces	Well spaced, crowns well separated
5	Sparse	1-5 spaces	Clearly spaced, crowns clearly separated
6	Mid dense	0-0.9 spaces	Crowns touching to slight separation
7	Closed or dense	0	Crowns touching to overlapping

[3] Age Classes: Recorded for Long-lived perennials only; M = Adults and Juveniles present; A = Adults only present; J = Juveniles only present

Appendix C. Flora life span classification

Table B2.1: Long-lived Woody Species Perennial Classification

Family	Scientific Name	Common Name	Long-lived woody? Yes (Y) No (N)
MALVACEAE	*Abutilon halophilum*	Plains Lantern-bush	Y
MALVACEAE	*Abutilon leucopetalum*	Desert Lantern-bush	Y
MALVACEAE	*Abutilon otocarpum*	Desert Lantern	Y
MALVACEAE	*Abutilon* sp.	Lantern-bush	Y
FABACEAE	*Acacia aneura* var.	Mulga	Y
FABACEAE	*Acacia papyrocarpa*	Western Myall	Y
FABACEAE	*Acacia tetragonophylla*	Dead Finish	Y
FABACEAE	*Acacia victoriae* ssp.	Elegant Wattle	Y
SAPINDACEAE	*Alectryon oleifolius* ssp. *canescens*	Bullock Bush	Y
AMARANTHACEAE	*Alternanthera denticulata*	Lesser Joyweed	N
AMARANTHACEAE	*Alternanthera nodiflora*	Common Joyweed	N
LORANTHACEAE	*Amyema maidenii* ssp. *maidenii*	Pale-leaf Mistletoe	Y
LORANTHACEAE	*Amyema quandang* var. *quandang*	Grey Mistletoe	Y
ANACAMPSEROTACEAE	*Anacampseros australiana*	Australian Anacampseros	N
ASTERACEAE	*Anemocarpa podolepidium*	Rock Everlasting	N
ASTERACEAE	*Angianthus* sp.	Cup-flower	N
BRASSICACEAE	*Arabidella glaucescens*	Bluish Cress	N
BRASSICACEAE	*Arabidella* sp.	Native Cress	N
POACEAE	*Aristida anthoxanthoides*	Yellow Three-awn	N
POACEAE	*Aristida contorta*	Curly Wire-grass	N
POACEAE	*Aristida holathera* var. *holathera*	Tall Kerosene Grass	N
POACEAE	*Aristida nitidula*	Brush Three-awn	N
POACEAE	*Aristida* sp.	Three-awn/Wire-grass	N
POACEAE	*Astrebla pectinata*	Barley Mitchell-grass	Y
POACEAE	*Astrebla* sp.	Mitchell-grass	Y
AMARANTHACEAE	*Atriplex fissivalvis*	Gibber Saltbush	N
AMARANTHACEAE	*Atriplex holocarpa*	Pop Saltbush	N
AMARANTHACEAE	*Atriplex lindleyi* ssp.	Baldoo	N
AMARANTHACEAE	*Atriplex lindleyi* ssp. *conduplicata*	Baldoo	N
AMARANTHACEAE	*Atriplex lindleyi* ssp. *inflata*	Corky Saltbush	N
AMARANTHACEAE	*Atriplex lindleyi* ssp. *lindleyi*	Baldoo	N
AMARANTHACEAE	*Atriplex* sp.	Saltbush	N
AMARANTHACEAE	*Atriplex spongiosa*	Pop Saltbush	N
AMARANTHACEAE	*Atriplex turbinata*	A Saltbush	N
AMARANTHACEAE	*Atriplex velutinella*	Sandhill Saltbush	N
AMARANTHACEAE	*Atriplex vesicaria*	Bladder Saltbush	Y
POACEAE	*Austrostipa nitida*	Balcarra Spear-grass	N
POACEAE	*Austrostipa scabra* ssp.	Rough Spear-grass	N
POACEAE	*Austrostipa* sp.	Spear-grass	N
POACEAE	*Austrostipa trichophylla*	Spear-grass	N
ASTERACEAE	*Bidens pilosa*	Cobblers Pegs	N
ASTERACEAE	*Blennospora drummondii*	Dwarf Button-flower	N
NYCTAGINACEAE	*Boerhavia dominii*	Tar-vine	N
NYCTAGINACEAE	*Boerhavia* sp.	Tar-vine	N
ASTERACEAE	*Brachyscome ciliaris* var.	Variable Daisy	N
ASTERACEAE	*Brachyscome ciliaris* var. *lanuginosa*	Woolly Variable Daisy	N
ASTERACEAE	*Brachyscome* sp.	Native Daisy	N
ASPHODELACEAE	*Bulbine semibarbata*	Small Leek-lily	N
ASPHODELACEAE	*Bulbine* sp.	Bulbine-lily	N
MONTIACEAE	*Calandrinia* sp.	Purslane/Parakeelya	N
MONTIACEAE	*Calandrinia volubilis*	Twining Purslane	N
ASTERACEAE	*Calotis hispidula*	Hairy Burr-daisy	N
ASTERACEAE	*Calotis* sp.	Burr-daisy	N
AIZOACEAE	*Carpobrotus rossii*	Native Pigface	Y
ASTERACEAE	*Centipeda cunninghamii*	Common Sneezeweed	N
ASTERACEAE	*Centipeda thespidioides*	Desert Sneezeweed	N
AMARANTHACEAE	*Chenopodium desertorum* ssp.	Desert Goosefoot	Y

Family	Scientific Name	Common Name	Long-lived woody? Yes (Y) No (N)
AMARANTHACEAE	*Chenopodium* sp.	Goosefoot	N
POACEAE	*Chloris pectinata*	Comb Windmill Grass	N
POACEAE	*Chloris* sp.	Windmill Grass/Chloris	N
ASTERACEAE	*Chrysocephalum pterochaetum*	Shrub Everlasting	N
ASTERACEAE	*Chrysocephalum* sp.	Everlasting	N
COMPOSITAE	*Compositae* sp.	Daisy Family	N
CONVOLVULACEAE	*Convolvulaceae* sp.	Bindweed Family	N
CONVOLVULACEAE	*Convolvulus angustissimus* ssp.	Narrow-leaf Bindweed	N
CONVOLVULACEAE	*Convolvulus erubescens complex*	Bindweed	N
CONVOLVULACEAE	*Convolvulus remotus*	Grassy Bindweed	N
CONVOLVULACEAE	*Convolvulus* sp.	Bindweed	N
ASTERACEAE	*Craspedia* sp.	Buttons	N
CRASSULACEAE	*Crassula* sp.	Crassula/Stonecrop	N
AMARYLLIDACEAE	*Crinum flaccidum*	Murray Lily	N
FABACEAE	*Crotalaria eremaea* ssp.	Loose-flowered Rattle-pod	N
FABACEAE	*Cullen australasicum*	Tall Scurf-pea	N
FABACEAE	*Cullen cinereum*	Annual Scurf-pea	N
FABACEAE	*Cullen graveolens*	Native Lucerne	N
FABACEAE	*Cullen pallidum*	Woolly Scurf-pea	N
FABACEAE	*Cullen* sp.	Scurf-pea	N
CONVOLVULACEAE	*Cuscuta* sp.	Dodder	N
POACEAE	*Cymbopogon ambiguus*	Lemon-grass	Y
APOCYNACEAE	*Cynanchum viminale* ssp. *australe*	Caustic Bush	Y
CYPERACEAE	*Cyperus rigidellus*	Dwarf Flat-sedge	N
CYPERACEAE	*Cyperus* sp.	Flat-sedge	N
POACEAE	*Dactyloctenium radulans*	Button-grass	N
APIACEAE	*Daucus glochidiatus*	Native Carrot	N
POACEAE	*Dichanthium sericeum* ssp.	Silky Blue-grass	Y
POACEAE	*Digitaria brownii*	Cotton Panic-grass	Y
POACEAE	*Digitaria divaricatissima* var. *divaricatissima*	Finger Panic-grass	Y
POACEAE	*Digitaria* sp.	Summer-grass	Y
AMARANTHACEAE	*Dissocarpus biflorus* var.	Two-horn Saltbush	N
AMARANTHACEAE	*Dissocarpus paradoxus*	Ball Bindii	N
SAPINDACEAE	*Dodonaea lobulata*	Lobed-leaf Hop-bush	Y
SAPINDACEAE	*Dodonaea viscosa* ssp. *angustissima*	Narrow-leaf Hop-bush	Y
POLYGONACEAE	*Duma florulenta*	Lignum	Y
AMARANTHACEAE	*Dysphania cristata*	Crested Goosefoot	N
AMARANTHACEAE	*Dysphania pumilio*	Clammy Goosefoot	N
POLYGONACEAE	*Duma florulenta*	Lignum	Y
AMARANTHACEAE	*Einadia nutans* ssp. *nutans*	Climbing Saltbush	Y
CYPERACEAE	*Eleocharis pallens*	Pale Spike-rush	N
AMARANTHACEAE	*Enchylaena tomentosa* var.	Ruby Saltbush	Y
POACEAE	*Enneapogon avenaceus*	Common Bottle-washers	N
POACEAE	*Enneapogon cylindricus*	Jointed Bottle-washers	N
POACEAE	*Enneapogon polyphyllus*	Leafy Bottle-washers	N
POACEAE	*Enneapogon* sp.	Bottle-washers / Nineawn	N
POACEAE	*Enteropogon acicularis*	Umbrella Grass	N
POACEAE	*Enteropogon ramosus*	Umbrella Grass	N
POACEAE	*Enteropogon* sp.	Umbrella Grass	N
POACEAE	*Eragrostis australasica*	Cane-grass	Y
POACEAE	*Eragrostis dielsii*	Mulka	N
POACEAE	*Eragrostis eriopoda*	Woollybutt	N
POACEAE	*Eragrostis parviflora*	Soft Love-grass	N
POACEAE	*Eragrostis setifolia*	Bristly Love-grass	Y
POACEAE	*Eragrostis* sp.	Love-grass	Y
POACEAE	*Eragrostis xerophila*	Knotty-butt Neverfail	Y
SCROPHULARIACEAE	*Eremophila duttonii*	Harlequin Emubush	Y
SCROPHULARIACEAE	*Eremophila glabra* ssp.	Tar Bush	Y
SCROPHULARIACEAE	*Eremophila latrobei* ssp.	Crimson Emubush	Y
SCROPHULARIACEAE	*Eremophila maculata* ssp.	Spotted Emubush	Y
SCROPHULARIACEAE	*Eremophila oppositifolia* ssp.	Opposite-leaved Emubush	Y

Family	Scientific Name	Common Name	Long-lived woody? Yes (Y) No (N)
SCROPHULARIACEAE	*Eremophila serrulata*	Green Emubush	Y
GERANIACEAE	*Erodium crinitum*	Blue Heron's-bill	N
GERANIACEAE	*Erodium* sp.	Heron's-bill/Crowfoot	N
MYRTACEAE	*Eucalyptus camaldulensis* ssp.	River Red Gum	Y
POACEAE	*Eulalia aurea*	Silky Brown-top	Y
EUPHORBIACEAE	*Euphorbia drummondii group*	Spurge	N
EUPHORBIACEAE	*Euphorbia* sp.	Spurge	N
EUPHORBIACEAE	*Euphorbia stevenii*	Bottletree Spurge	N
EUPHORBIACEAE	*Euphorbia tannensis* ssp. *eremophila*	Desert Spurge	N
SANTALACEAE	*Exocarpos aphyllus*	Leafless Cherry	Y
ASTERACEAE	*Flaveria trinervia*	Clustered Yellow-tops	N
FRANKENIACEAE	*Frankenia serpyllifolia*	Thyme Sea-heath	Y
FRANKENIACEAE	*Frankenia* sp.	Sea-heath	Y
FRANKENIACEAE	*Frankenia subteres*	Round Sea-heath	Y
MALVACEAE	*Gilesia biniflora*	Western Tar-vine	N
ASTERACEAE	*Glossocardia bidens*	Native Cobbler's-pegs	N
FABACEAE	*Glycine* sp.	Glycine	N
ASTERACEAE	*Gnephosis arachnoidea*	Spidery Button-flower	N
ASTERACEAE	*Gnephosis* sp.	Cup-flower	N
GOODENIACEAE	*Goodenia fascicularis*	Silky Goodenia	N
GOODENIACEAE	*Goodenia lunata*	Stiff Goodenia	N
GOODENIACEAE	*Goodenia pinnatifida*	Cut-leaf Goodenia	N
GOODENIACEAE	*Goodenia* sp.	Goodenia	N
GRAMINEAE	*Gramineae* sp.	Grass Family	N
AIZOACEAE	*Gunniopsis quadrifida*	Sturt's Pigface	Y
BORAGINACEAE	*Heliotropium* sp.	Heliotrope	N
MALVACEAE	*Hibiscus krichauffianus*	Velvet-leaf Hibiscus	N
POACEAE	*Iseilema membranaceum*	Small Flinders-grass	N
ASTERACEAE	*Ixiochlamys cuneifolia*	Silverton Daisy	N
ASTERACEAE	*Ixiochlamys nana*	Small Fuzzweed	N
ASTERACEAE	*Leiocarpa leptolepis*	Pale Plover-daisy	N
BRASSICACEAE	*Lepidium phlebopetalum*	Veined Peppercress	N
BRASSICACEAE	*Lepidium* sp.	Peppercress	N
LILIACEAE	*Liliaceae* sp.	Lily Family	N
ASPARAGACEAE	*Lomandra* sp.	Mat-rush	Y
FABACEAE	*Lotus cruentus*	Red-flower Lotus	N
SOLANACEAE	*Lycium australe*	Australian Boxthorn	Y
AMARANTHACEAE	*Maireana aphylla*	Cotton-bush	Y
AMARANTHACEAE	*Maireana appressa*	Pale-fruit Bluebush	Y
AMARANTHACEAE	*Maireana astrotricha*	Low Bluebush	Y
AMARANTHACEAE	*Maireana coronata*	Crown Fissure-plant	Y
AMARANTHACEAE	*Maireana eriantha*	Woolly Bluebush	Y
AMARANTHACEAE	*Maireana georgei*	Satiny Bluebush	Y
AMARANTHACEAE	*Maireana integra*	Entire-wing Bluebush	Y
AMARANTHACEAE	*Maireana pyramidata*	Black Bluebush	Y
AMARANTHACEAE	*Maireana sedifolia*	Bluebush	Y
AMARANTHACEAE	*Maireana* sp.	Bluebush/Fissure-plant	Y
AMARANTHACEAE	*Maireana spongiocarpa*	Spongy-fruit Bluebush	Y
AMARANTHACEAE	*Maireana turbinata*	Top-fruit Bluebush	Y
AMARANTHACEAE	*Malacocera tricornis*	Goat-head Soft-horns	N
MALVACEAE	*Malvastrum americanum* var.	Malvastrum	N
MARSILEACEAE	*Marsilea drummondii*	Common Nardoo	N
ASTERACEAE	*Minuria cunninghamii*	Bush Minuria	Y
ASTERACEAE	*Minuria denticulata*	Woolly Minuria	N
ASTERACEAE	*Minuria integerrima*	Smooth Minuria	N
ASTERACEAE	*Minuria leptophylla*	Minnie Daisy	N
LOGANIACEAE	*Mitrasacme* sp.	Mitrewort	N
SCROPHULARIACEAE	*Myoporum montanum*	Native Myrtle	Y
AMARANTHACEAE	*Neobassia proceriflora*	Desert Glasswort	N
SOLANACEAE	*Nicotiana velutina*	Velvet Tobacco	N
AMARANTHACEAE	*Osteocarpum acropterum* var.	Bonefruit	N

Family	Scientific Name	Common Name	Long-lived woody? Yes (Y) No (N)
AMARANTHACEAE	*Osteocarpum dipterocarpum*	Two-wing Bonefruit	N
AMARANTHACEAE	*Osteocarpum* sp.	Bonefruit	N
POACEAE	*Panicum decompositum* var.	Native Millet	N
POACEAE	*Panicum* sp.	Panic/Millet	N
POACEAE	*Paractaenum novae-hollandiae* ssp. *reversum*	Barbed-wire Grass	N
PHYLLANTHACEAE	*Lysiandra fuernrohrii*	Sand Spurge	N
THYMELAEACEAE	*Pimelea simplex* ssp. *simplex*	Desert Riceflower	N
PLANTAGINACEAE	*Plantago drummondii*	Dark Plantain	N
ASTERACEAE	*Pluchea rubelliflora*	Plains-bush	N
ASTERACEAE	*Podolepis capillaris*	Wiry Podolepis	N
ASTERACEAE	*Polycalymma stuartii*	Poached-egg Daisy	N
PORTULACACEAE	*Portulaca oleracea*	Common Purslane	N
PORTULACACEAE	*Portulaca* sp.	Purslane	N
ASTERACEAE	*Pterocaulon sphacelatum*	Apple-bush	N
AMARANTHACEAE	*Ptilotus incanus/obovatus*	Mulla	Y
AMARANTHACEAE	*Ptilotus nobilis* ssp.	Yellow-tails	N
AMARANTHACEAE	*Ptilotus obovatus*	Silver Mulla	Y
ASTERACEAE	*Pycnosorus pleiocephalus*	Soft Billy-buttons	N
ASTERACEAE	*Pycnosorus* sp.	Billy-buttons	N
AMARANTHACEAE	*Rhagodia* sp.	Saltbush	Y
AMARANTHACEAE	*Rhagodia spinescens*	Spiny Saltbush	Y
ASTERACEAE	*Rhodanthe corymbiflora*	Paper Everlasting	N
ASTERACEAE	*Rhodanthe floribunda*	White Everlasting	N
ASTERACEAE	*Rhodanthe microglossa*	Clustered Everlasting	N
ASTERACEAE	*Rhodanthe stricta*	Slender Everlasting	N
ASTERACEAE	*Rhodanthe uniflora*	Woolly Daisy	N
FABACEAE	*Rhynchosia australis*	Rhynchosia	N
ZYGOPHYLLACEAE	*Roepera ammophila*	Sand Twinleaf	N
ZYGOPHYLLACEAE	*Roepera aurantiaca* ssp. *aurantiaca*	Shrubby Twinleaf	Y
ZYGOPHYLLACEAE	*Roepera billardierei*	Coast Twinleaf	N
ZYGOPHYLLACEAE	*Roepera crenata*	Notched Twinleaf	N
ZYGOPHYLLACEAE	*Roepera eremaea*	Climbing Twinleaf	N
ZYGOPHYLLACEAE	*Roepera iodocarpa*	Violet Twinleaf	N
ZYGOPHYLLACEAE	*Roepera ovata*	Dwarf Twinleaf	N
ZYGOPHYLLACEAE	*Roepera prismatotheca*	Square-fruit Twinleaf	N
ZYGOPHYLLACEAE	*Roepera* sp.	Twinleaf	N
ACANTHACEAE	*Rostellularia adscendens* var. *pogonanthera*	Pink Tongues	N
POACEAE	*Rytidosperma caespitosum*	Common Wallaby-grass	Y
POACEAE	*Rytidosperma* sp.	Wallaby-grass	Y
AMARANTHACEAE	*Salsola australis*	Buckbush	N
SANTALACEAE	*Santalum lanceolatum*	Plumbush	Y
SANTALACEAE	*Santalum* sp.	Plumbush	Y
AIZOACEAE	*Sarcozona praecox*	Sarcozona	N
GOODENIACEAE	*Scaevola spinescens*	Spiny Fanflower	Y
AMARANTHACEAE	*Sclerolaena anisacanthoides*		N
AMARANTHACEAE	*Sclerolaena bicornis* var. *bicornis*	Goat-head Bindyi	N
AMARANTHACEAE	*Sclerolaena brachyptera*	Short-wing Bindyi	N
AMARANTHACEAE	*Sclerolaena cuneata*	Tangled Bindyi	N
AMARANTHACEAE	*Sclerolaena decurrens*	Green Bindyi	N
AMARANTHACEAE	*Sclerolaena diacantha*	Horned Bindyi	N
AMARANTHACEAE	*Sclerolaena divaricata*	Tangled Bindyi	N
AMARANTHACEAE	*Sclerolaena intricata*	Poverty Bush	N
AMARANTHACEAE	*Sclerolaena parallelicuspis*	Western Copperburr	N
AMARANTHACEAE	*Sclerolaena patenticuspis*	Spear-fruit Copperburr	N
AMARANTHACEAE	*Sclerolaena* sp.	Copperburr	N
#N/A	*Sclerolaena* sp. *Pernatty Station*		N
AMARANTHACEAE	*Sclerolaena tricuspis*	Giant Redburr	N
AMARANTHACEAE	*Sclerolaena ventricosa*	Salt Copperbush	N
ASTERACEAE	*Senecio magnificus*	Showy Groundsel	Y
FABACEAE	*Senna artemisioides* ssp.	Desert Senna	Y
FABACEAE	*Senna artemisioides* ssp. *alicia x ssp. coriacea*	Desert Senna	Y

Family	Scientific Name	Common Name	Long-lived woody? Yes (Y) No (N)
FABACEAE	*Senna artemisioides* ssp. *artemisioides x* ssp. *coriacea*	Desert Senna	Y
FABACEAE	*Senna artemisioides* ssp. *helmsii*	Blunt-leaf Senna	Y
FABACEAE	*Senna artemisioides* ssp. *oligophylla*	Limestone Senna	Y
FABACEAE	*Senna artemisioides* ssp. *X artemisioides*	Silver Senna	Y
FABACEAE	*Senna artemisioides* ssp. *X coriacea*	Broad-leaf Desert Senna	Y
FABACEAE	*Senna artemisioides* ssp. *X sturtii*	Grey Senna	Y
POACEAE	*Setaria constricta*	Knotty-butt Paspalidium	Y
POACEAE	*Setaria* sp.	Pigeon-grass	Y
MALVACEAE	*Sida ammophila*	Sand Sida	N
MALVACEAE	*Sida corrugata* var.	Variable Sida	N
MALVACEAE	*Sida fibulifera*	Pin Sida	N
MALVACEAE	*Sida intricata*	Twiggy Sida	Y
MALVACEAE	*Sida petrophila*	Rock Sida	Y
MALVACEAE	*Sida trichopoda*	Narrow-leaf Sida	N
SOLANACEAE	*Solanum esuriale*	Potato-bush	N
SOLANACEAE	*Solanum quadriloculatum*	Tomato Bush	N
SOLANACEAE	*Solanum sturtianum*	Sturt's Nightshade	Y
POACEAE	*Sporobolus actinocladus*	Ray Grass	N
POACEAE	*Sporobolus caroli*	Yakka Grass	N
CELASTRACEAE	*Stackhousia muricata ssp. Perennial (W.R.Barker 3641)*		N
BRASSICACEAE	*Stenopetalum lineare*	Narrow Thread-petal	N
FABACEAE	*Swainsona* sp.	Swainson-pea	N
ASTERACEAE	*Taraxacum cygnorum*	Dandelion	N
AMARANTHACEAE	*Tecticornia indica* ssp.	Samphire	Y
AMARANTHACEAE	*Tecticornia medullosa*	Samphire	Y
AMARANTHACEAE	*Tecticornia pergranulata* ssp.	Black-seed Samphire	Y
AMARANTHACEAE	*Tecticornia* sp.	Samphire	Y
AMARANTHACEAE	*Tecticornia tenuis*	Slender Samphire	Y
AIZOACEAE	*Tetragonia eremaea*	Annual Spinach	N
AIZOACEAE	*Tetragonia tetragonoides*	Warragul cabbage	N
LAMIACEAE	*Teucrium racemosum*	Grey Germander	N
POACEAE	*Themeda triandra*	Kangaroo Grass	Y
ASPARAGACEAE	*Thysanotus baueri*	Mallee Fringe-lily	N
ASPARAGACEAE	*Thysanotus patersonii*	Twining Fringe-lily	N
ASPARAGACEAE	*Thysanotus* sp.	Fringe-lily	N
ARALIACEAE	*Trachymene glaucifolia*	Blue Parsnip	N
POACEAE	*Tragus australianus*	Red Spinach	N
AIZOACEAE	*Trianthema triquetrum*	Small Hogweed	N
BORAGINACEAE	*Trichodesma zeylanicum* var. *zeylanicum*	Camel Bush	N
POACEAE	*Tripogonella loliiformis*	Purple Plume Grass	N
POACEAE	*Triraphis mollis*	Purple Needle-grass	N
ASTERACEAE	*Vittadinia cuneata* var.	Fuzzy New Holland Daisy	N
ASTERACEAE	*Vittadinia* sp.	New Holland Daisy	N
CAMPANULACEAE	*Wahlenbergia communis*	Tufted Bluebell	N
CAMPANULACEAE	*Wahlenbergia luteola*	Yellow-wash Bluebell	N
CAMPANULACEAE	*Wahlenbergia* sp.	Native Bluebell	N
CAMPANULACEAE	*Wahlenbergia stricta* ssp. *stricta*	Tall Bluebell	N
COLCHICACEAE	*Wurmbea latifolia* ssp. *latifolia*	Early Nancy	N

Appendix D. Jessup Sites raw data

Appendix D1. Jessup raw data – total number of long-lived woody perennial adults and juveniles, spring 2024

Species	Life Stage	Flora Site																		Total
		1	2	3	4	5	6	7	9	10	11	12	13	15	16	17	18	19	20	
Abutilon halophilum	Adult	19	13	4		73			1		176			1	28					315
	Juvenile	2	4			23		1	2		23				25					80
Abutilon otocarpum	Adult									10							4	1	3	18
	Juvenile									3										3
Acacia papyrocarpa	Adult		18						1	1							334	10	1	365
	Juvenile															9		1		10
Acacia tetragonophylla	Adult									25								27	9	61
Atriplex vesicaria	Adult	86	112	143	173	314	152	51	104	1	498	228	180	93	324	142	160	11		2772
	Juvenile	3	9	19	30	77	5	10	39		80	15	42	9	15	17		4		374
Chenopodium curvispicatum	Adult									2						13	5	2		22
Dodonaea lobulta	Adult									29						19	15	112	13	188
	Juvenile																			
Duma florulenta	Adult									7								4	26	37
	Juvenile																		1	1
Einadia nutans	Adult									1						1		11	1	14
Enchylaena tomentosa	Adult									14						58	55	34	6	167
	Juvenile															46	21	6		73
Eremophila latrobei	Adult									2							9		1	12
	Juvenile															1				1
Eremophila oppositifolia	Adult																1			1
Eremophila serrulata	Adult									1	1					2				4
Eremopila oppositifolia	Adult								1											1
Eucalyptus camaldulensis ssp. *arida*	Adult									6								6	7	19
	Juvenile																		2	2
Exocarpos aphyllus	Adult									2										2
Frankenia serpyllifolia	Adult		1	27	3	65	5	9	11		2	1	14	8						146
	Juvenile			1					1											2
Maireana aphylla	Adult										2			21			1			24
Maireana appressa	Adult			5		1	1	11	1				2		2					23
	Juvenile							1												1
Maireana astrotricha	Adult							3												3

Species	Life Stage	Flora Site																		Total
		1	2	3	4	5	6	7	9	10	11	12	13	15	16	17	18	19	20	
Maireana eriantha	Adult					3														3
Maireana spongiocarpa	Adult							4			37					18	19			78
	Juvenile															1				1
Maireana turbinata	Adult					7														7
Maireana turbinata/georgii	Adult							2												2
Minuria cunninghamii	Adult	3		12	1	5	24	1			43	8	3		2					102
	Juvenile			1										4	2					7
Myoporum montanum	Adult									7								25	10	42
	Juvenile									7							1	11	14	33
Ptilotus obovatus	Adult									129						48	97	13	5	292
	Juvenile									4						34	7			45
Rhagodia spinescens	Adult									1						3	7			11
Santalum lanceolatum	Adult									3								2	1	6
	Juvenile									1								2	12	15
Scaevola spinescens	Adult									26						1	2	22	7	58
	Juvenile									2						1		2	2	7
Senna artemisiodes artemisioides	Adult									2										2
Senna artemisiodes helmsii	Adult									1										1
Senna artemisioides ssp. artemisioides	Adult															1		1		2
	Juvenile																3			3
Senna artemisioides ssp. helmsii	Adult																		1	1
Senna artemisioides ssp. oligophylla	Adult															5				5
Senna artemisioides ssp. sturtii	Adult																	1		1
	Juvenile																	1		1
Sida intricata	Adult	3			4			1			2			14						24
Sida intricata/fibulifera	Adult											71								71
Sida petrophila	Adult							3		50						3		4	2	62
	Juvenile							15		6									1	22
Tecticornia medullosa	Adult	1	1	59	2	112	20				3	8	73	2	8					289
	Juvenile			1	0	3							5		8					17
Tecticornia pergranulata	Adult							31	32											63
Tecticornia tenuis	Adult			1	5			6	9											21
	Juvenile				2				8											10
Teucrium racemosum	Adult																	1		1

Appendix D2. Eliza Creek species abundance trends

Acacia tetragonophylla	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	39	28	22	43	37	34	25	25
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	1	0
19	31	27	26	19	26	32	26	27
20	9	6	7	11	14	11	11	9
***A. tetragonophylla* All Sites**	**79**	**61**	**55**	**73**	**77**	**77**	**63**	**61**
Acacia papyrocarpa	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	0	1	0	2	3	0	0	1
17	33	28	30	29	33	37	21	27
18	42	53	15	49	45	63	56	54
19	8	20	11	10	15	13	13	11
20	2	1	1	0	1	1	1	1
***A. papyrocarpa* Totals All Sites**	**85**	**103**	**57**	**90**	**97**	**114**	**91**	**94**
Dodonaea lobulata	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	25	37	25	31	33	25	38	30
17	17	21	24	20	21	22	18	19
18	11	11	13	15	15	14	13	15
19	106	122	116	118	150	128	106	112
20	13	6	12	16	12	20	11	13
***Dodonaea* Totals All Sites**	**172**	**197**	**190**	**200**	**231**	**209**	**186**	**189**
Duma florulenta	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	6	6	8	7	5	8	7	7
17	0	7	0	0	0	0	0	0
18	0	7	0	0	0	0	0	0
19	0	2	5	2	7	7	5	4
20	27	31	24	26	26	24	24	27
***Duma* Totals All Sites**	**33**	**53**	**37**	**35**	**38**	**39**	**36**	**38**
Eremophila latrobei	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	1	1	1	1	0	1	1	2
17	0	0	1	1	1	2	0	1
18	3	7	9	5	11	9	10	9
20	0	0	1	0	1	1	1	1
***E. latrobei* Totals All Sites**	**4**	**8**	**12**	**7**	**13**	**13**	**12**	**13**
Eremophila serrulata	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	2	2	2	0	1	0	1	1
17	1	1	0	1	1	3	2	2
18	2	1	0	4	0	0	0	0
19	1	2	1	2	0	1	0	0
20	0	0	0	0	0	0	0	0
***E. serrulata* Totals All Sites**	**6**	**6**	**3**	**7**	**2**	**4**	**3**	**3**
Maireana spongiocarpa	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
17	nr	14	10	24	12	27	18	19
18	nr	19	11	29	16	33	29	19
***Maireana* Totals All Sites**		**33**	**21**	**53**	**28**	**60**	**47**	**38**
Myoporum montanum	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	23	7	19	23	10	27	5	14
19	27	17	18	15	17	19	36	1
20	16	14	19	16	16	27	20	36
***Myoporum* Totals All Sites**	**66**	**38**	**56**	**54**	**43**	**73**	**61**	**24**
Ptilotus obovatus	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	25	66	31	65	71	105	115	133
17	30	30	31	46	52	95	84	82
18	100	73	48	46	23	97	80	104
19	9	1	5	6	12	18	17	13
20	0	0	3	1	1	2	3	5
***Ptilotus* Totals All Sites**	**164**	**170**	**118**	**164**	**159**	**317**	**299**	**337**

Scaevola spinescens	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	12	21	6	11	22	13	23	28
17	4	4	5	2	3	4	5	2
18	4	3	3	2	1	2	2	2
19	11	9	11	12	15	18	16	24
20	2	1	9	10	6	5	5	9
Scaevola Totals All Sites	**33**	**38**	**34**	**37**	**47**	**42**	**51**	**65**
Senna (all species combined)	2018 Autumn	2018 Spring	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
10	4	2	3	4	5	4	5	3
17	7	4	4	3	6	7	6	6
18	4	6	3	4	2	5	3	3
19	1	3	1	2	0	2	2	3
20	0	0	0	0	0	1	1	1
Senna Totals All Sites	**16**	**15**	**11**	**13**	**13**	**19**	**17**	**16**

Appendix E. Canopy cover visual estimates

Western Myall Transects

Species / Transect	Tree No.	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 Spring
Western Myall / 17A	1	98	100	100	100	100	90
	2	98	100	100	95	100	95
	2b				76	75	65
	2c*						100
	3	100	100	100	100	100	100
	4	40	32	45	41	40	20
	5	95	90	98	95	100	80
	5b			95	90	100	90
	6	86	100	100	100	100	80
	7	86	86	100	98	100	100
	7b			100	100	100	100
	7c			100	100	100	100
	Mean	**86**	**87**	**94**	**90**	**92**	**85**
	SD	**21**	**25**	**17**	**18**	**19**	**23**
Western Myall / 17B	1	100	98	100	98	95	95
	2	95	95	95	90	100	80
	3	95	76	76	78	100	70
	4	76	95	90	86	90	90
	5	100	100	100	100	100	100
	5b			100	95	100	90
	6	72	86	86	77	90	70
	7	90	95	100	100	100	95
	Mean	**90**	**92**	**93**	**91**	**97**	**86**
	SD	**11.3**	**8.4**	**8.8**	**9.4**	**4.6**	**11.6**
Western Myall / 18A	1	86	nr	81	81	100	95
	1b						95
	2	86	nr	81	90	90	80
	3	9	nr	1	5	5	5
	3b					100	100
	4	98	nr	81	100	100	90
	5	98	nr	85.5	100	100	80
	6	98	nr	98	100	100	80
	7	100	nr	85.5	86	100	90
	7a					100	90
	7b					100	90
Western Myall / 18A	7c					100	90
	8	10	nr	0 (died)	0	0	0
	8a				90	100	90
	8c		nr	85.5	86	100	Not intercepted
	8d					100	Not intercepted
	9	95	nr	76.5	77	100	60
	10	95	nr	76.5	100	100	100
	11	100	nr	90.25	100	100	100
	12	100	nr	90.25	100	100	90
	Mean	**81**		**72**	**80**	**89**	**80**
	SD	**34**		**32**	**34**	**31**	**19**
Western Myall / 18B	1	57	nr	8	1	0	5
	1b						60
	2	56	nr	25	40	72	50
	3	29	nr	6	23	12	10
	4	67	nr	49	76	90	70
	5	2	nr	0 (died)	0	0	0
	Mean	**42**	**nr**	**22**	**28**	**35**	**33**
	SD	**27**	**nr**	**20**	**32**	**43**	**31**

*Shaded cells represent trees recorded for first time in 2024

River Red Gum

Species / Transect	Tree No.	2019 Autumn	2019 Spring	2020 Spring	2021 Spring	2022 Spring	2023 Autumn	2024 spring
River Red gum 19A	1	93	88	90	86	81	90	85
	5	40	27	27	27	29	29	30
	7	72	77	90	75	80	100	70
	8	57	72	56	57	63	100	50
	9	26	68	45	63	75	100	70
	10	64	90	72	54	76	100	60
	Mean	**59**	**70**	**63**	**60**	**67**	**87**	**61**
	SD	**24**	**23**	**25**	**20**	**20**	**29**	**19**
Western Myall 19A	2	100	100	100	100	100	100	100
	4b				72	100	100	100
	4c				100	100	100	90
	6	93	100	100	100	100	100	90
	6b				100	100	100	90
	6c				100	90	100	90
	10b				100	100	100	100
	Mean	**97**	**100**	**100**	**96**	**99**	**100**	**95**
	SD	**4**	**0**	**0**	**10**	**4**	**0**	**5**
River Red Gum 19B	1	8	5	9	5	5	4	5
	2	46	86	81	90	96	100	80
	4	51	15	3	0	0	0	0
	5	33	81	56	43	81	100	35
	5A					10	100	20
	6	67	90	86	77	60	100	70
	Mean	**4**	**55**	**47**	**43**	**42**	**67**	**47**
	SD	**22**	**42**	**39**	**41**	**42**	**51**	**31**
Western Myall 19B	6A	100	100	100	100	nr	nr	nr
	7	10	8	5	3	5	15	5
	7B				81	86	100	95
	7C						100	95
	8	100	100	98	93	95	100	90
	5AA					100	100	100
	5B				100	100	100	100
	Mean	**70**	**69**	**68**	**75**	**77**	**86**	**79**
	SD	**52**	**53**	**54**	**41**	**41**	**35**	**37**
River Red Gum 20A	1	55	80	46	68	90	100	80
	2	2	3	2	23	90	90	10
	3	6	11	30	Not recorded	96	100	90
	4	42	72	53	60	63	80	40
	5	34	45	35	18	67	90	60
	6	55	48	53	64	90	100	70
	7	86	88	56	81	98	100	80
	8	18	42	33	18	38	70	35
	10	54	49	49	46	90	90	80
	Mean	**39**	**49**	**40**	**47**	**80**	**91**	**61**
	SD	**27**	**29**	**17**	**25**	**20**	**11**	**27**
River Red Gum 20B	1	24	45	35	28	48	70	70
	2	81	86	68	77	98	100	95
	3	20	36	33	23	67	90	65
	4	81	86	49	56	86	80	80
	Mean	**52**	**63**	**46**	**46**	**75**	**85**	**78**
	SD	**34**	**27**	**16**	**25**	**22**	**13**	**13**
Western Myall 20A (one tree only)	**9**	**100**	**100**	**90**	**77**	**100**	**100**	**70**

Appendix F. Fauna

Table F1: Bird species detected at formal bird survey sites and opportunistic sites at Carrapateena during the spring 2024 survey

Family	Species Name	Common Name	Site																		Opportunistic[1]
			1	2	3	4	5	6	7	9	10	11	15	16	17	18	19	20	21	22	
Podicipedidae	*Tachybaptus novaehollandiae novaehollandiae*	Australasian Grebe								1											DD, NED, SED, AD
Artamidae	*Gymnorhina tibicen*	Australian Magpie	1	1[2]		1		1	1		1			1					1	1	NED, SED
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar					1		1		1										
Motacillidae	*Anthus australis australis*	Australian Pipit		1[2]		1[2]	1	1[2]	1		1	1	1[2]	1[2]							DD, EV, NED, SED, Admin, AD
Glareolinae	*Stiltia isabella*	Australian Pratincole	1	1		1		1[2]	1				1	1							SED, AD
Corvidae	*Corvus coronoides*	Australian Raven	1[2]	1[2]	1	1	1[2]	1[2]	1		1		1	1[2]			1				DD, SED, WAR,
Psittacidae	*Barnardius zonarius zonarius*	Australian Ringneck							1		1							1			YC
Rallidae	*Porzana fluminea*	Australian Spotted Crake																			SED
Anatidae	*Chenonetta jubata*	Australian Wood Duck																			SED
Charadriidae	*Vanellus tricolor*	Banded Lapwing																			DD, SED
Anatidae	*Cygnus atratus*	Black Swan																			SED
Artamidae	*Artamus cinereus*	Black-faced Woodswallow	1	1	1		1		1	1	1	1		1		1	1	1	1		SED, WAR
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel																			DD, NED, SED, AD
Rallidae	*Tribonyx ventralis*	Black-tailed Nativehen								1											SED
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt																			SED
Falconidae	*Falco berigora*	Brown Falcon				1							1								
Locustellidae	*Cincloramphus cruralis*	Brown Songlark				1		1						1							
Psittacidae	*Melopsittacus undulatus*	Budgerigar	1				1		1	1	1			1[2]				1			SED
Acanthizidae	*Acanthiza uropygialis*	Chestnut-rumped Thornbill							1		1							1			
Cinclosomatidae	*Cinclosoma cinnamomeum*	Cinnamon Quailthrush	1	1					1												CWM02
Cacatudiae	*Nymphicus hollandicus*	Cockatiel	1																		SED
Columbidae	*Phaps chalcoptera*	Common Bronzewing							1												
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper																			
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	1						1	1	1				1	1		1	1		NED, SED, AD
Meliphagidae	*Epthianura tricolor*	Crimson Chat	1	1			1	1	1				1	1					1		
Psittacidae	*Northiella haematogaster haematogaster*	Eastern Bluebonnet																			

Family	*Species Name*	Common Name	Site																		Opportunistic[1]
			1	2	3	4	5	6	7	9	10	11	15	16	17	18	19	20	21	22	
Casuariidae	*Dromaius novaehollandiae*	Emu		1					1		1						1			1	DD, SED, WAR
Rallidae	*Fulica atra*	Eurasian Coot																			NED, SED
Hirundinidae	*Petrochelidon ariel*	Fairy Martin							1												NED, SED
Cacatudiae	*Eolophus roseicapillus*	Galah	1				1		1		1		1	1[2]			1	1	1		
Artamidae	*Cracticus torquatus*	Grey Butcherbird	1	1							1				1		1				
Anatidae	*Anas gracilis*	Grey Teal							1	1											
Anatidae	*Aythya australis*	Hardhead																			
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe																			SED
Petroicidae	*Melanodryas cucullata westralensis*	Hooded Robin								1											
Passeridae	*Passer domesticus*	House Sparrow																			EV, Admin
Charadriidae	*Passer domesticus*	Inland Dotterel	1																		CMW02
Cacatudiae	*Cacatua sanguinea sanguinea*	Little Corella	1								1										NED, SED, CWM05
Monarchidae	*Grallina cyanoleuca*	Magpie-lark							1												SED
Charadriidae	*Vanellus miles*	Masked Lapwing																			SED
Artamidae	*Artamus personatus*	Masked Woodswallow	1						1		1	1		1							
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoe Bird									1										
Psittacidae	*Psephotus varius*	Mulga Parrot									1				1	1		1			SED
Falconidae	*Falco cenchroides*	Nankeen Kestrel			1	1	1		1	1				1				1			SED, WAR
Meliphagidae	*Epthianura aurifrons*	Orange Chat				1		1		1			1								SED, AD
Anatidae	*Anas superciliosa*	Pacific Black Duck								1											SED
Pelecanidae	*Pelecanus conspicillatus*	Pelican				1															
Anatidae	*Malacorhynchus membranaceus*	Pink-eared Duck																			SED
Maluridae	*Malurus assimilis*	Purple-backed Fairywren							1	1	1							1		1	
Meropidae	*Merops ornatus*	Rainbow Bee-eater							1		1	1									
Alcedinidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher	1	1																	
Petroicidae	*Petroica goodenovii*	Red-capped Robin																			SED
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel																			SED
Recurvirostridae	*Recurvirostra novaehollandiae*	Red-necked Avocet																			SED
Acanthizidae	*Calamanthus campestris*	Rufous Fieldwren	1	1		1[2]	1[2]	1[2]	1			1	1[2]	1[2]							LFA Aero, LFA Tju
Locustellidae	*Cincloramphus mathewsi*	Rufous Songlark																			SED
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper																			SED
Laridae	*Larus novaehollandiae*	Silver Gull			1																

Family	*Species Name*	Common Name	Site																		Opportunistic[1]
			1	2	3	4	5	6	7	9	10	11	15	16	17	18	19	20	21	22	
Meliphagidae	*Gavicalis virescens*	Singing Honeyeater	1	1				1	1	1	1		1	1[2]	1	1		1	1	1	NED, SED
Meliphagidae	*Acanthogenys rufogularis*	Spiny-cheeked Honeyeater	1	1					1		1		1		1		1	1			DD, SED
Pardalotidae	*Pardalotus striatus*	Striated Pardalote							1		1										
Hirundinidae	*Petrochelidon nigricans*	Tree Martin							1		1							1			NED, SED, AD
Accipitridae	*Aquila audax*	Wedge-tailed Eagle						1				1						1			AD
Hirundinidae	*Hirundo neoxena*	Welcome Swallow				1		1	1		1		1	1[2]							DD, NED, SED, EV, AD
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow				1		1	1[2]				1								
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler							1	1	1			1					1		
Ardeidae	*Egretta novaehollandiae*	White-faced Heron																			SED
Meliphagidae	*Epthianura albifrons*	White-fronted Chat							1				1								SED
Meliphagidae	*Lichenostomus penicillatus*	White-plumed honeyeater																			SED
Maluridae	*Malurus leucopterus*	White-winged Fairywren		1	1		1		1	1	1	1	1	1[2]	1			1		1	DD, SED, LFA Tju
Campephagidae	*Lalage tricolor*	White-winged Triller							1[2]		1										
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail							1		1						1				NED, SED, DD, EV
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner									1										
Estrildidae	*Taeniopygia guttata*	Zebra Finch	1		1	1			1	1	1	1		1				1		1	
		Grand Total	19	14	6	13	10	12	35	15	29	8	14	17	6	4	7	15	7	6	

[1]Opportunistic observation locations: South Eliza Dam (SED), North Eliza Dam (NED), Dawson Dam (DD), Exploration Village (EV), Western Access Road (WAR), Exploration Village (EV), CWM02/5 (weed monitoring sites), YC (Yeltacowie Creek), [2]Observed plus Song meter detection.; Note '1' denotes present, not counts of individuals; Grey cells = EPBC Status. No bird surveys were undertaken at Site 12 and 13 due to unsuitable conditions and limited time available.

Acoustic analysis and bat call identification from Carrapateena, South Australia

Prepared for **Lathwida Environmental Pty Ltd**

Version **29 January 2025**

SZ project reference **SZ754**

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This report should be included as an appendix in any larger submission to Government, and cited as:

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Version history

Date	Note
2025-01-29	Final version

Summary

Bat identifications from bat detector sound files are provided from recordings made in the Carrapateena study area, c. 65 km east of Woomera, near the Carrapateena Arm of Lake Torrens, South Australia.

The dataset submitted for analysis included a total of 539 WAV format bat detector sound files from three recording sites over 8 recording nights (nights of 2024-10-16 – 2024-10-21).

Five species of bat were detected in the recordings (**Tables 1** and **2**; **Figure 1**). All species were identified unambiguously.

Methods

The ultrasonic recordings provided were recorded in WAV sound format from Wildlife Acoustics Song Meter Mini Bat bat detectors. All sound files were inspected in Anabat Insight version 2.1.3 software and Adobe Audition version 23.1.

Species identifications were made based on measurements of characteristic frequency and observation of pulse shape, and with reference to information in Armstrong et al. (2021). Nomenclature follows Jackson and Groves (2015). Distribution information for all bat species considered here was checked against the BatMap resource hosted by the Australasian Bat Society, Inc (https://www.ausbats.org.au/batmap.html) (Milne et al. 2023).

References

Armstrong K.N., Clarke S., Linke A., Scanlon A., Roetman P., Hitch, A.T. and Donnellan S.C. (2021b). Citizen science implements the first intensive acoustics-based survey of insectivorous bat species across the Murray-Darling Basin of South Australia. *Australian Journal of Zoology* 68: 364–381. https://doi.org/10.1071/ZO20051

Jackson, S.M. and Groves, C.P. (2015). *Taxonomy of Australian mammals*. CSIRO Publishing, Victoria.

Milne D.J., Reardon T.B. and Ford G. (2023) BatMap – authoritative distribution maps for Australian bats. *Australian Mammalogy*. 45: 350–355. https://doi.org/10.1071/AM23005

Limitations

The identifications presented in this report have been made within the following context:

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).

2. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further extended comment on these species and the possible impacts of a planned project on bat species were not part of the scope.

3. In the case of the present report, the recording equipment was not set up and supplied by Specialised Zoological. The equipment was operated by the third party during the survey.

4. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.

5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.

6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.

7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be requested.

8. The analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.

9. This version of the document supersedes any previous version. Previous drafts are not authorised by us for submission to the regulator or the public domain.

Table 1. Species identified from all sites combined.

VESPERTILIONIDAE	
Gould's Wattled Bat	*Chalinolobus gouldii*
Lesser Long-eared Bat	*Nyctophilus geoffroyi*
Inland Forest Bat	*Vespadelus baverstocki*
MOLOSSIDAE	
White-striped Free-tailed Bat	*Austronomus australis*
Inland Free-tailed Bat	*Ozimops petersi*

Table 2. Species identifications summarised for all nights across each recording site (see *Table 1* for full species names).

Site	Unit serial	Night	Coordinates	*A. australis*	*C. gouldii*	*O. petersi*	*N. geoffroyi*	*V. baverstocki*
Carra CAR007	SMU13599	16/10/2024	-31.17247, 137.44265	.	.	X	X	X
Carra CAR007	SMU13599	17/10/2024	-31.17247, 137.44265	.	.	X	X	.
Carra CAR007	SMU13599	18/10/2024	-31.17247, 137.44265	.	.	.	X	X
Eliza Creek CAR010	SMU13599	21/10/2024	-31.23181, 137.52590	.	X	.	X	X
South Eliza Dam	SMU13725	18/10/2024	-31.34085, 137.50383	.	X	.	.	X
South Eliza Dam	SMU13725	19/10/2024	-31.34085, 137.50383	.	X	X	X	X
South Eliza Dam	SMU13725	20/10/2024	-31.34085, 137.50383	.	X	X	X	X
South Eliza Dam	SMU13725	21/10/2024	-31.34085, 137.50383	X	X	X	X	X

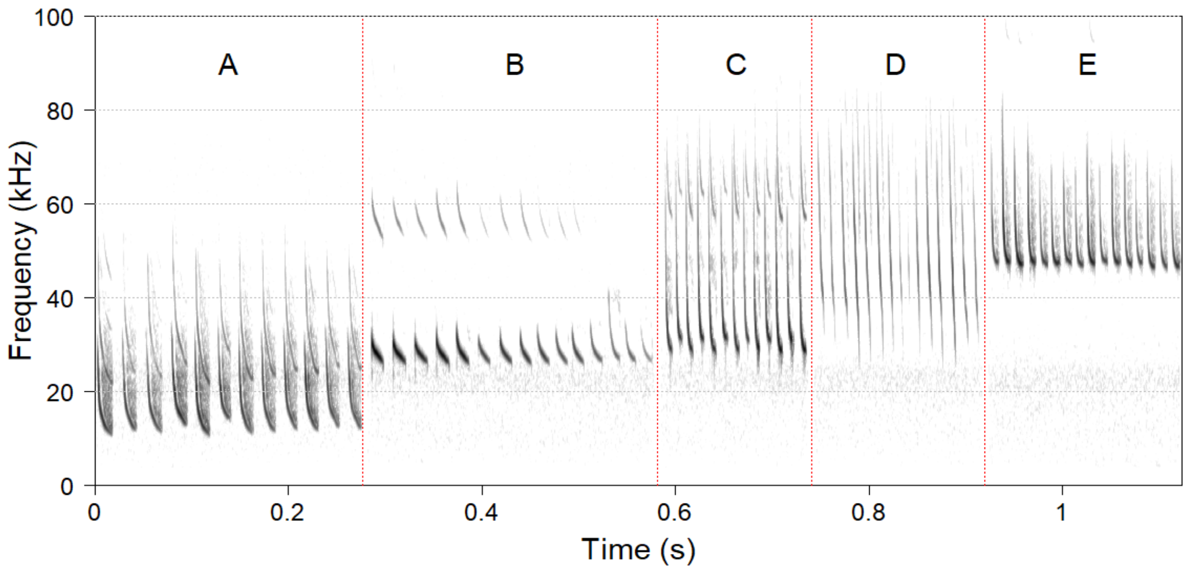

Figure 1. Representative echolocation call sequence portions of the species identified (**A**: *Austronomus australis*; **B**: *Ozimops petersi*; **C**: *Chalinolobus gouldii*; **D**: *Nyctophilus geoffroyi*; **E**: *Vespadelus baverstocki*; time between pulses has been compressed).

Appendix G. Weeds

Appendix G1. Weed summary

Table G1: Weeds recorded at various locations across the Carrapateena Site during baseline (2012-2016) and compliance (autumn 2018 to spring 2024)

Scientific name	Common Name	Location	EBS 2012 – 2016	Years recorded between 2018 and 2023 and (CSR)*	Spring 2024 CSR*
Asphodelus fistulosus	Onion Weed	Dawson Dam	NR	2020 (2)	NR
Brassica tournefortii	Mustard	CWM01	Present	NR	NR
Carrichtera annua	Wards Weed	CWM01	NR	2021 (isolated CSR 4)	
		CWM05	NS	NR	1
Carthamus lanatus	Saffron Thistle	CWM01	Present	2018, 2021, 2023 (1,2)	
		CAR007	Present	NR	
		South Eliza Dam	NS	2021 (2)	2
		Whittata Creek	NS	NS	
Centaurea calcitrapa	Star Thistle	CWM02	Present	NR	
Centaurea melitensis	Malta Thistle	CAR010	Present	2021 (1)	
		CAR018	NS	2021, 2023 (1)	
		CAR020	NS	2021, 2023 (2)	2/4
		CWM01	NS	NR	1/5
		Dawson Dam	NS	2021, 2022 (2)	1/3
Centarium erythraea / tenuiflorum	Centaury	CAR010	Present	NR	
		EV EIA	NS	2018 (1), 2023 (4)	
		Dawson Dam	NS	2020 (4), 2023 (1)	
		Anzac Dam	NS	2022 (1)	
		South Eliza Dam	NS	2022 (2)	
		North Eliza Dam	NS	NR	
		Dawson	NS	2023 (2/4)	
Chenopodium album/murale	Goosefoot	Expo Village EIA	NS	2018, 2019, 2021, 2023 (2/4)	2/4
		Anzac Dam	NS	2018, 2020 - 2023 (1/2/4)	
		Whittata Creek	NS	2021 (1)	
		Dawson Dam	NR	2020 - 2023 (2/3/4)	
Citrullus species, inc. C. colocynthis	Bitter Melon	Anzac Dam	NS	2019 – 2023 (2/3/4)	
		South Eliza Dam	NS	2019, 2020 (2/4)	
		Dawson Dam	NS	2018 – 2020, 2023 (1/2/4)	2
		CWM01	NR	2020, 2022 (1/3)	
		CWM02	NR	2022 (1)	
		CWM05	NS	2020, 2022, 2023 (2/3/4/5)	3

Scientific name	Common Name	Location	EBS 2012 – 2016	Years recorded between 2018 and 2023 and (CSR)*	Spring 2024 CSR*
		CWM06	NR	2020, 2022, 2023 (1/2/3)	
		CWM021	NS	2020, 2022, 2023 (1/2)	
		CWM022	NS	2020, 2022, 2023 (1/2)	
		Tjungu EIA	NS	2023 (1/3)	
Cucumis myriocarpus	Paddy Melon	EV EIA	NS	2020, 2023 (3)	
		CWM01	NR	2020 (3)	
		Dawson Dam	NR	2020, 2023 (2/3/5)	
		South Eliza Dak	NR	2020, 2023 (2/3/5)	
Cynodon dactylon	Couch	Whittata Creek	NS	2021 (2)	2
Erodium sp. including E. cicutarium	Cut-leaf Stork's-bill	CWM02	NR	2020 (1)	
		Dawson Dam	NR	2020 (1)	
		Whittata Creek	NS	2021 (1)	
		Anzac Dam	NR	2020, 2021 (1/2)	
Heliotropium curassavicum	Smooth Heliotrope	North Eliza	NS	2018 – 2023 (2/3/4/5)	2/3
		South Eliza	NS	2018 – 2023 (2/3/4/5)	2/4/5
		Anzac Dam	NS	2018 – 2023 (2/4/5/6)	
		Dawson Dam	NS	2018 – 2023 (2/4/5/6)	2/4/5/6
		CWM02	Present	2019 – 2023 (1/2/3/4/)	3
		Whittata Creek	NS	2021 (2)	
		CWM01	NR	2023 (1)	2
		CWM02	Present	2019 – 2021, 2023 (1/2)	
		CWM06	NR	2023 (1)	
Heliotropium europeum and/or supinum	Spreading Heliotrope	CWM01	Present	2018, 2021 (1/2)	
		CWM02	NR?	NR	
		Anzac Dam	NS	2019 (1)	
		North Eliza Dam	NS	2019 – 2023 (2/3/4)	2
		South Eliza Dam	NS	2021 – 2023 (1/2/4)	2
		Dawson Dam	NS	2018 – 2021 (2/3/4)	2
		Whittata Creek	NS	2021 (2)	
Lepidium africanum	Peppercress	CWM02	Present	NR	
Lysimachia arvensis	Scarlet Pimpernel	Expo Village EIA	NS	2018 – 2022 (2/4)	2/6
		CWM001	NR	2022 (1)	
		CWM006	NR	2020 (1)	
		North Eliza Dam	NS	NR	1
Malva parviflora	Mallow	Anzac Dam	NS	2019 (1)	
		North Eliza Dam	NS	NR	1
		South Eliza Dam	NS	2023 (3)	

Scientific name	Common Name	Location	EBS 2012 – 2016	Years recorded between 2018 and 2023 and (CSR)*	Spring 2024 CSR*
		CWM01	NR	2020, 2022 (1)	
		CWM02	NR	2020, 2023 (2/3)	
Medicago sp. *(including M. minima)*	Medic	CWM01	NR	2022 (1)	
		CWM02	NR	2022 (1)	3
		North Eliza Dam	NS	NR	3
		South Eliza Dam	NS	NE	3
Mesembryanthemum crystallinum	Iceplant	CWM01	NR	2020 (3)	
		South Eliza Dam, EV	NR	2020 (1)	
Mesembryanthemum nodiflorum	Slender Iceplant	CAR001, CAR008, CAR009, CAR010	Present	NR	
Nicotiana glauca	Tree Tobacco	CAR013	Present	2022 (1)	
		Dawson Dam	NS	2023 (1)	
		South Eliza Dam	NS	2018 – 2023 (2/4/5)	2/4
Opuntia sp. [1]	Prickly Pear	Yeltacowie homestead	NS	2018 – 2023 (1)	1
Polygonum aviculare	Wire Weed	Anzac Dam	NS	2019 (1)	
Rostraria pumila	Tiny Bristle Grass	CAR003-CAR005, CAR007, CAR008, CAR012-CAR015, CAR022	CAR003- CAR005, CAR007, CAR008, CAR012-CAR015	CAR004, CAR012 (1) Recorded in 2019 an 2020	
		South Eliza Dam	NS	2019 (3)	
		Expo Villlage	NS	2019 – 2022 (1/2/4)	2
Rumex vesicarius	Rosy Dock	CAR004, CAR013	Present	NR	
Rumex vesicarius	Rosy Dock	CAR007	Present	2020 (1)	
Schinus molle	Pepper Tree	Whittata Creek	NS	2021 (1) Not surveyed other years	
Schismus barbatus	Arabian Grass	CAR003, CAR006, CAR012, CAR014	Present	NR	
Sisymbrium erysimoides	Smooth Mustard	Anzac Dam	NS	2019 (1)	
		Dawson Dam			2/4
		CAR001, CAR009, CAR011, CAR013, CAR014, CAR016	Present	NR	
		CAR010	NS	2021 (1)	
		CAR012, CAR017		2019 (1)	
		CAR020		NR	1
		CAR021		2020, 2022, 2023 (1/2/3/4)	2/4
		CAR022		2019 – 2023 (1/2/3/4)	4/5
		CWM01	NR	2019, 2020, 2022, 2023 (1/2/3/4)	3
		CWM03	Present	NR	
		CWM05	NS	2020, 2021 (1/3)	1/4
		CWM06	NR	2019 – 2023 (1/3)	1/5
		South Eliza Dam	NS	2019, 2020 (3)	3
		Norh Eliza Dam		NR	1/3

Scientific name	Common Name	Location	EBS 2012 – 2016	Years recorded between 2018 and 2023 and (CSR)*	Spring 2024 CSR*
		Expo Village		2020 (2)	2/4
Solanum nigrum	Black Nightshade	Anzac Dam	NS	2019 – 2023 (1)	
		Dawson Dam		2019 – 2020, 2023 (2)	2
		South Eliza Dam		2020, 2023 (1)	1
		Expo Village		2018 – 2021, 2023 (1/2)	1
		Expo Village EIA		2018 – 2021, 2023 (1/2/3/4)	2/3
		Whittata Creek		2021 (1) Not surveyed other years	
		CWM01	Present	2021, 2022 (1)	1
		CWM02		NR	
Sonchus oleraceus	Sow Thistle	Expo Village	NS	2018 (1)	2
		CWM02	NR	NR	3
		Expo Village EIA	NS	2018, 2019, 2021, 2023 (1/3/4)	3/4
		TV EIA	NS	2018 – 2023 (4)	
		CAR006-CAR010, CAR014	Present	NR	
		CAR012		2023 (1)	
		CAR003, CAR011, CAR015		2019 (1)	
		CAR013		2019, 2023 (1)	
		CAR016	NR	2019 (1)	
		CAR018		2023 (1)	1
		CAR019	NS	2020 (1)	1
Tamarix aphylla[1,2]	Athel Pine	Yeltacowie homestead	NS	2018, 2019, 2021 – 2023 (1)	1
Tribulus terrestris	Caltrop	CAR002, CAR005, CAR008-CAR010, CAR013, CAR014	Present	NR	
		CAR020	NS	2020 (1)	
Urtica urens	Stinging Nettle	Exploration Village EIA	NS	2023 (2)	
Verbena supina	Trailing Verbena	Anzac Dam	NS	2022 (2)	
		North Eliza Dam		NR	1
Xanthium spinosum[1]	Bathurst Burr	CWM01	NR	2018, 2019, 2021, 2023 (1/3)	2
		CWM02		2019. 2021, 2023 (2//3/4)	3
		Dawson Dam	NS	2019 – 2023 (4/5)	4/5
		South Eliza Dam		2019, 2021, 2023 (2/3/4/5)	3
		Whittata Creek		2021 (2/5) Not surveyed other years	1

*CSR = Crown Separation Ratio: Abundance recorded using the CSR scale 1 = < 12 individuals; 2 = isolated clumps, 3 = isolated individuals, 4 = plants separated by 6-20 crown widths, 5 = plants separated by 1-5 crown widths

[1] Declared in SA under the Landscapes South Australia 2019 Act. Declared plant species are regulated as to their movement, sale, notification and/or control.

[2] WoNS - Weed of National Significance. Must be controlled within 100 m of a watercourse

[3] EV = Exploration Village, EV EIA = Exploration Village Effluent Irrigation Area. TV EIA = Tjungu Village Effluent Irrigation Area, NR = Not Recorded, site was surveyed, but weed species was not observed; NA = Not applicable, site was discontinued in spring 2018, NS = Not surveyed.

Appendix G2. Weed transect species (baseline and compliance)

Table G2: Weed species recorded along weed transects, baseline and compliance/operational monitoring

Transect*	Species	2012-2016[1]	Years recorded between 2018 and 2023 and (CSR)*	Spring 2024 notes and/or CSR**
CWM01	*Brassica tournefortii* (Mustard)	Present	NR#	NR
CWM01	*Carrichtera annua* (Wards Weed)	NR	2021	NR
CWM01	*Carthamus lanatus* (Saffron Thistle)	Present	2018, 2023 (1)	NR
CWM01	*Centaurea melitensis* (Malta Thistle)	NR	NR	1 plant recorded at small creek
	Cucumis sp. (Paddy Melon)	NR	2020	NR
	Cynodon dactylon (Couch)	NR	2021 (2)	Localised at Whittata creek
	Heliotropium curassavicum (Smooth Heliotrope)	NR	2022 (1), 2023 (1)	Localised at culvert where CSR = 4
	Heliotropium supinum (Spreading Heltiotrope)	Present	2018, 2019, 2021	NR
	Lysimachia arvensis (Scarlet Pimpernel)	NR	2022 (1)	NR
	Malva parviflora (Mallow)	NR	2020, 2022 (1)	NR
	Medicago minima (Medic)	NR	2022 (3)	NR
	Mesembryanthemum crystallinum (Iceplant)	NR	2020	NR
	Sisymbrium erysimoides (Smooth Mustard)	NR	2020, 2022 (1), 2023 (2/4)	NR
	Sonchus oleraceus (Sow Thistle)	Present	2021, 2022 (1), 2023 (1)	NR
	Solanum nigrum (Black Nightshade)	NR	2022 (1)	NR
	Xanthium spinosum (Bathurst Burr)	NR	2018, 2019, 2021, 2023 (3)	Localised, 30+ seedlings at culvert
CWM02	*Centaurea calcitrapa* (Star Thistle)	Present	NR	
	Citrullus Cucumis (Bitter Melon)	NR	2022 (1)	
	Erodium cicutarium (Cut-leaf Stork's-bill)	NR	2020	
	Heliotropium curassavicum (Smooth Heliotrope)	Present	2019, 2020, 2021, 2022 (3), 2023 (2)	Culvert and water's edge CSR =b3
	Lepidium africanum (Peppercress)	Present	NR	
	Malva parviflorus (Mallow)	NR	2020, 2023 (2)	
	Medicago minima (Medic)	NR	2022 (1)	Culvert and water's edge CSR = 4
	Solanum nigrum (Black Nightshade)	NR	2022 (1)	
	Sonchus oleraceus (Sow Thistle)	NR	2022 (1)	Culvert + water's edge CSR = 4
	Xanthium spinosum (Bathurst Burr)	Present	2019, 2021, 2023 (2/4)	Culvert + water's edge CSR = 3
CWM03	*Sisymbrium erysimoides* (Smooth Mustard)	Present	NR	NR
CWM04	*Sonchus oleraceus* (Sow Thistle)	Present	NR	NR
CWM05	*Carrichtera annua* (Wards Weed)	NR	NR	Two dead stalks midway CSR = 1
	Citrullus sp. (Bitter Melon)	NS	2020, 2022 (4/5), 2023 (4/5)	Localised, sparse CSR = 3
	Sisymbrium erysimoides (Smooth Mustard)	NS##	2020	Widespread CSR 1 to 4
CWM06	*Citrullus* sp. (Bitter Melon)	NR	2020, 2022 (1), 2023 (2/3)	
	Lysimachia arvensis (Scarlet Pimpernel)	NR	2020	
	Sisymbrium erysimoides (Smooth Mustard)	NS	2018, 2019, 2020, 2022 (1), 2023 (1)	Widespread CSR 1 to 5
CWM07	No weeds present			
NWM01	*Tribulus terrestris* (Caltrop)	NS	2019	NR

Transect*	Species	2012-2016[1]	Years recorded between 2018 and 2023 and (CSR)*	Spring 2024 notes and/or CSR**
NWM02	*Citrullus* sp. (Bitter Melon)	NS	2019	NR
NWM02	*Cucumis* sp. (Paddy Melon)	NS	2019	NR
NWM03	No weeds present	NS	Nil	Nil