Kantra Copper Limited

Kanmantoo Copper Mine

EPBC 2013/6965 Compliance Report

30 October 2026



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Definitions

Abbreviation	Definition
Acacia pycnantha (A. pycnantha)	Open woodland community dominated by *Acacia pycnantha*
DAWE	Australian Department of Agriculture, Water and the Environment
Botanic Gardens	South Australian Seed Conservation Centre, Botanic Gardens of Adelaide
BushRAT	Bushland Rapid Assessment Technique/ DEWNR SA
CD	Compact Disk
CEO	Kantra's Chief Executive Officer, Mr Lachlan Wallace
DCCEEW	Department for Climate Change, Energy, the Environment and Water
DEM	Department for Energy and Mining SA
DEW	Department for Environment, and Water, SA
DSD	Department of State Development, South Australia
DPC	Department of the Premier and Cabinet, South Australia
EBS Ecology	Fauna and Flora Consultancy division of the EBS Group, Adelaide SA
EBS Restoration	Ecological restoration division of the EBS Group, Adelaide SA
EPBC 2013/6965	Approval granted to disturb vegetation under provisions of the EPBC Act
EPBC Act	Environmental Protection and Biodiversity Conservation Act (1999)
Eucalyptus odorata (E. odorata)	Critically endangered grassy woodland community dominated by *Eucalyptus odorata*
Kantra	Kantra Copper Limited
KCM	Kanmantoo Copper Mine
LFA	Landscape Function Analysis/ Ludwig & Tongway (1997)
Lomandra effusa (*L. effusa*)	Critically endangered natural temperate grassland vegetation community dominated by *Lomandra effusa*
ML	Mining Lease 6345
NRM Act	Natural Resources Management Act 2004 (SA)
NVMP	Native Vegetation Management Plan
PEPR	Program for Environmental Protection and Rehabilitation
SA	South Australia
SEB-Offset	Significant Environmental Benefit - Offset. New vegetation areas established to offset clearance.
SMA	Seed Multiplication Area/ 5ha seed multiplication plot
SPA	Seed Production Area/ 1ha intensive seed farm

Executive Summary

This report summarises Kantra Copper compliance with the conditions of approval for Controlled Action EPBC 2013/6965 and implementation of the Native Vegetation Management Plan (NVMP) for the Kanmantoo Copper Mine Extension. It covers the 2024/2025 and 2025/2026 reporting periods, from 11 September 2024 to 11 September 2026.

Kantra are compliant with the approved vegetation clearance limits and no non-approved activities were undertaken during the reporting periods. A DCCEEW compliance audit completed in May 2025 found Kantra compliant with Conditions 1 to 7.

Monitoring included annual Landscape Function Analysis. The designated offset areas are on Kantra-owned land and have been excluded from future development, although the Heritage Agreements proposed in the NVMP have not yet been established.

Kantra did not complete a 2024/2025 compliance report therefore this report has been expanded to address the 2024/2025 and the 2025/2026 reporting periods.

Approximately 27 ha of SEB-Offset activities have commenced to date. Activities during the reporting periods focused on maintaining existing offsets through weed control, rabbit and other grazing-pressure management, and minor fence repairs; no further expansion of SEB-Offset plantings has occurred. During the 2026/2027 reporting period, Kantra intends to review the success of existing SEB-Offset areas, update maps and associated spatial layers, and prepare a five-year Rehabilitation and Restoration Plan. The plan will guide rehabilitation and restoration across the mining lease and offset areas for 2027–2032, addressing soil and overburden requirements, pest management, seed collection, monitoring and further investigations needed to improve restoration outcomes.

2 Background

The Kanmantoo Copper Mine (ML6345) is located approximately 45km SE of Adelaide, near the townships of Kanmantoo and Callington. The 440ha mining lease (ML) is on the eastern side of the Mt Lofty ranges, within a 425mm rainfall zone. The Kanmantoo Copper Mine (KCM) is operated by Kantra Copper (previously Hillgrove Copper) Pty Ltd.

The original mine site contained several underground workings from the mid to late 19th century and the original Kanmantoo Copper Mine open pit, which was in operation from 1970 until 1976. Kantra undertook exploration work at the site from 2004, which proved up additional mineral resources adjacent to and below the historical Kavanagh open pit. This led to Kantra commencing open pit mining and processing ore on the site from 2011. Mining of the main open pit - Giant - was completed in May 2019 with final ore from the depth extensions of the West Kavanagh lode and the processing of stockpiled ore concluded in March 2020. After a period of site care and maintenance and exploration drilling, the development of an underground operation focussed on mining ore from underneath the open pits commenced in June 2023. First underground stope production occurred in December 2023 and first copper concentrate production occurred in February 2024. This underground operation will not involve removing vegetation from the site.

The ML contains a range of remnant native vegetation, including stands of Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia and Iron–grass (*Lomandra effusa*) Natural Temperate Grassland of South Australia, both of which are listed as critically endangered under the EPBC Act (1999). The ML's vegetation has been significantly altered by more than 150-years of agriculture and mining; however, remnant stands of native vegetation can be found within the ML, varying in condition from SEB-Offset classes of 2:1 to 8:1. The clearance of 1.8ha of Peppermint Box grassy woodland and 3.4ha of Iron-grass natural temperate grassland was required to allow extension of open pit mining activities under the Life of Mine Extension proposal, ('the LOM Extension').

The LOM Extension was approved under a revised Program for Environmental Protection and Rehabilitation (PEPR), regulated by the South Australian Department for Energy and Mining, or DEM[1] henceforth the 'Regulator'. Both clearances were deemed 'controlled actions' under the EPBC Act, requiring approval by the Australian Department of the Environment and Energy (ADEE)[2] before the LOM Extension PEPR could be approved by the Regulator. A NVMP was written to encompass the controlled actions associated with the LOM Extension. The NVMP was subsequently approved and permission to proceed under the conditions outlined in the approval document for this action (Ref: EPBC 2013/6965 dated 6 May 2014). Both controlled actions commenced on 11 September 2014, with due notice provided to the DAWE and the Regulator.

This document is an annual compliance report demonstrating that the controlled actions have been carried out within the 13 conditions attached to EPBC 2013/6965 and that progress has been made against the delivery of SEB-offsets required by EPBC 2013/6965. This report has been published as close as possible to 'within '*3-months of every 12-month anniversary of the commencement of the action*', as required by the approval granted on 6 May 2014.

[1] Formerly Department of Premier & Cabinet SA (DPC) and prior to that Department of State Development (DSD)

[2] Now the Department of Climate Change, Energy, the Environment and Water

3 Conditions associated with Controlled Action EPBC 2013/6965

The following table lists the conditions applied to Controlled Action EPBC 2013/6965 and Kantra's compliance with each condition. Details associated with Kantra's actions relating to each condition during the period from 11 September 2024 to 11 September 2026 are presented in Section 4 (below).

Condition No.	Conditions applied to the approval of EPBC 2013/6965	Compliance status
1	The person undertaking the action must not clear more than 1.8ha of the ecological community *Peppermint Box Grassy Woodland* of South Australia within ML 6345	Compliant (refer section 4.1)
2	The person undertaking the action must not clear more than 3.4 ha of the ecological community *Iron-grass Natural Temperate Grassland of South Australia* within ML 6345	Compliant (refer section 4.2)
3	To assist in mitigating the impacts of the proposal on Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia, the person taking the action must prepare and submit a Kanmantoo Copper Mines Native Vegetation Management Plan (NVMP) for the Minister's written approval prior to commencement of the action. The NVMP must be in accordance with the National Recovery Plan for the Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia 2012 and the National Recovery Plan for the Iron-grass Natural Temperate Grassland of South Australia 2012. The NVMP must include;	Compliant. A Native Vegetation Management Plan was approved by the Minister 6 May 2014 and describes management of EPBC listed SEB-Offset areas.
3a	Management actions are undertaken to improve the ecological quality of Peppermint Box and Iron-grass communities within ML6345 and offset lands and protect (them) from degradation for the duration of the action	Compliant (refer section 4.7 NVMP)
3b	Regeneration and revegetation strategies implemented for Peppermint Box and Iron-grass communities within the proposed SEB-Offset areas to improve the ecological quality of these areas	Compliant (refer section NVMP)
3c	An ecological monitoring program is undertaken to monitor success of management actions within the NVMP and define measurable targets of management actions, performance indicators and adaptive management framework for the duration of the action's impact	Compliant (refer section NVMP)
4	To compensate for the loss of 1.8ha of *Peppermint Box* and 3.4ha of *Iron-grass* communities, the person taking the action must secure the lands identified as the SEB-Offset Area as a conservation offset	Compliant (refer section 4.1 & 4.2)
5	The person taking the action must provide written evidence to the Department of their compliance with Condition 4 to clearly define the location and boundaries of the offset sites prior to the commencement of the action	Compliant (refer section 4.5)

6	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 (refer section 4.6)
7	The person taking the action must maintain accurate records substantiating all activities associated with or relevant to these conditions of approval and make them available upon request to the Department	Compliant (refer section 4.7)
8	Within 3-months of every 12-month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval	Not compliant (refer Section 4.8)
9	Upon direction of the Minister, the person taking the action must ensure that an independent audit of compliance is conducted and a report submitted to the Minister	Agreed. No audit yet requested (refer section 4.9)
10	If the person undertaking the action wishes to carry out any activity otherwise than in accordance with the NVMP as specified in the conditions, the person taking the action must submit to the Department for the Minister's written approval a revised version of the NVMP	Compliant (refer section 4.11)
11	If the Minister believes that it is necessary or convenient for the better protection of listed threatened species and ecological communities to do so, the Minister may request that the person taking the action make specified revisions to the NVMP and submit the revised NVMP for the Minister's written approval	Compliant No request received as of 11 September 2026
12	If at any time after 5-years from the date of this approval, the person taking the action has not substantially commenced the action, then the person taking the action must not substantially commence the action without the written agreement of the Minister	Compliant The action was commenced on 11 September 2014
13	Unless otherwise agreed to in writing by the Minister, the person taking the action must publish the NVMP referred to in these conditions of approval on their website. The NVMP must be published on the website within 1-month of being approved. The NVMP must remain on their website for the life of the action.	Compliant NVMP is available on the Kantra website: https://kantra.com/environment/

4 Details of compliance with EPBC 2013/6965 conditions

Details of Kantra compliance with each condition associated with EPBC 2013/6965 is summarised in the following sections.

4.1 Peppermint Box clearance areas

In accordance with the approved NVMP, no more than 1.8ha of Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia has been cleared within ML 6345 since the commencement date of 11 September 2014. Figure 1 below shows the approved clearance limit and Figure 2 shows precise areas of Peppermint Box Grassy Woodland and Iron grass Natural Temperate Grassland of South Australia cleared within ML 6345 after 11 September 2014.

4.2 Iron-grass clearance areas

In accordance with the approved NVMP, no more than 3.4ha of 8:1 Iron grass Natural Temperate Grassland of South Australia and 1.01ha of 6:1 and 4:1 Iron grass Natural Temperate Grassland of South Australia has been cleared within ML 6345 since the commencement date of 11 September 2014.

4.3 Native Vegetation Management Plan Submission

A Native Vegetation Management Plan (NVMP) was written to address the disturbance of vegetation communities and provision of SEB-Offsets associated with the controlled actions approved by EPBC 2013/6965. Kantra's NVMP for controlled action EPBC 2013/6965 was approved on 6 of May 2014. It specifically addresses the following approval conditions:

3a. Management actions designed to improve the ecological quality of Peppermint Box grassy woodland and Iron-grass natural temperate grassland and offset lands for the duration of the action.

3b. Regeneration and revegetation strategies for Peppermint Box woodland and Iron-grass natural temperate grassland within the proposed 'SEB-Offset areas' to improve the ecological quality of these areas.

3c. An ecological monitoring program to monitor the success of the management actions in the NVMP and define measurable targets of management actions, performance indicators and an adaptive management framework for the duration of the action's impact on Peppermint Box grassy woodland and Iron-grass natural temperate grassland.



Figure 1: PEPR-Approved clearance limit

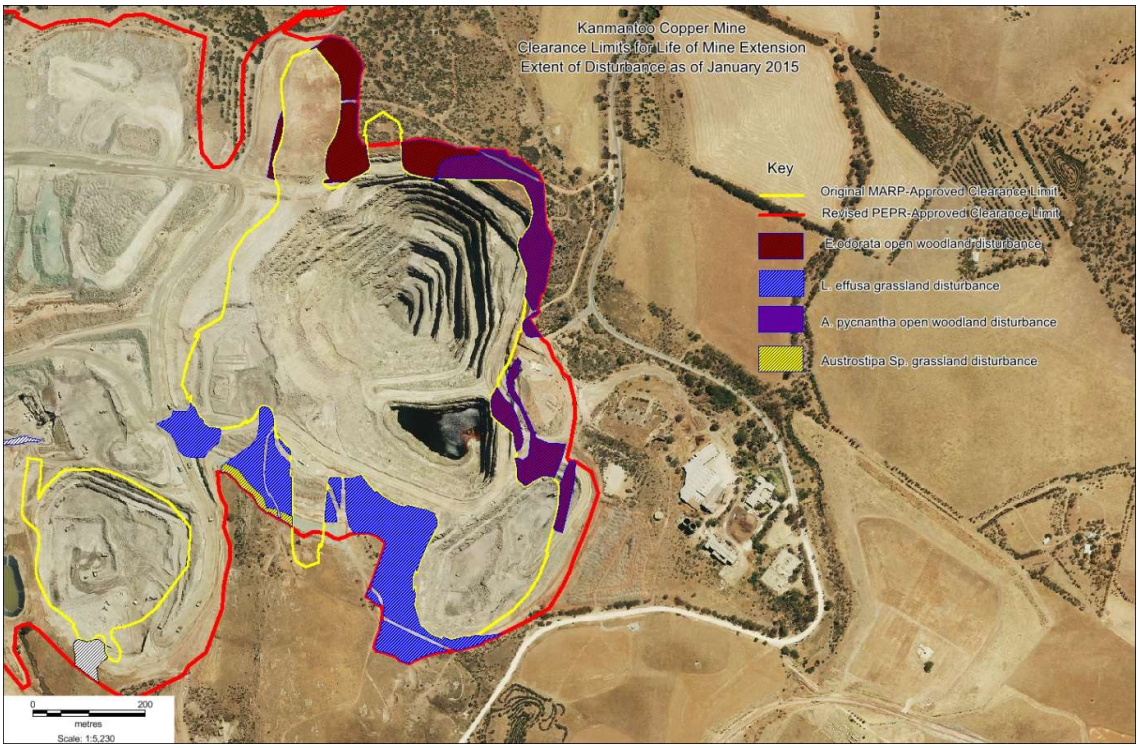


Figure 2: Disturbance of vegetation communities as current date

4.4 Security of SEB-Offset areas

SEB-offsets for the removal of vegetation under the controlled action are shown in Figure 3.

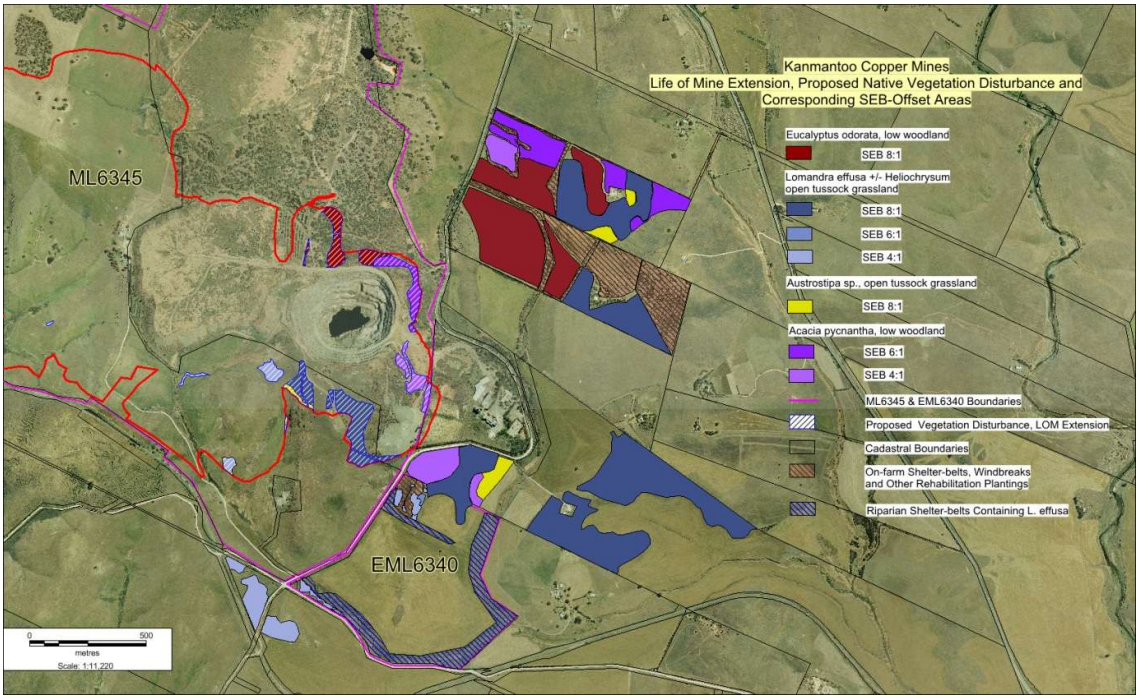


Figure 3: Approved disturbance areas and approved SEB-Offsets associated with action EPBC 2013/6965

All SEB-Offsets are located directly adjacent to the Kanmantoo Copper Mine on Kantra-owned properties. Kantra has quarantined the SEB-Offset areas from future development and has designated them as 'SEB-Offset blocks' to the exclusion of all other activities. Details of the land titles associated with each land parcel and the SEB-Offsets assigned to each patch are described below and in the NVMP on p30, 'Table 3', and in Table 1.

Kantra intends to establish the designated SEB-Offset areas as conservation areas protected under Heritage Agreements (or similar), as stated in the NVMP, however this has not yet occurred. Under a revised NVMP to be submitted for approval, Kantra may seek approval to move part of the SEB-offset establishment onto equivalent areas of farming land, remnant vegetation or other land owned by Kantra, or may seek approval for payment into a fund in lieu of offset establishment if or when such an instrument is developed as part of a review of the Act.

Table 1 Kantra-owned properties and their assigned SEB-Offsets

Property Name	Parcel ID: Title ID (All Owned by Kantra)	Allocated Offset Patches (ref NVMP)*	Offset Types
141 Mine Rd	F160800 A61: CT5548/435	38, 39, 40, **41**, **42**, **43**, 44, 45, 46, 47	E. odorata (8:1), L. effusa (8:1), Austrostipa (8:1), A. pycnantha (6:1 & 4:1)
Mulawa	F1636 A1: CT5516/79	**48**, **49**, **50**	E. odorata (8:1), L. effusa (8:1)
Ferguson	D80644 A21: CT5863/768	**51**, **55**	L. effusa (8:1)
Lot 25	D60948 A25: CT5892/419	52, **53**, 54, 56, 57, 58, 62	*L. effusa* (8:1, 6:1 & 4:1), *Austrostipa* (8:1)
Back-Callington Rd/ Éclair Mine Rd (Carmen's East)	D4767 A4: CT5552/582 and D30934 Q1: CT5366/650	59, 60, 61	L. effusa (4:1)

* Bold patch numbers denotes EPBC SEB-Offset patches

4.5 Written evidence of compliance: SEB-Offset area establishment

Evidence of the SEB offset locations and boundaries of the offset areas supplied to DCEEW 18 October 2013 and receipted 21 October 2013 (evidence previously supplied).

4.6 Notification of commencement

Notification of commencement of the action was provided 11 September 2014 (evidence previously supplied).

4.7 Record keeping: Implementation of the Offset and NVMP

A compliance audit, facilitated under condition 7 of the approval, was completed by DCCEEW in May 2025. The objective of the audit was to effectively assess the compliance requirements of the auditee against the conditions of the approval and associated management plans. Kantra was determined compliant with conditions one through to seven (Appendix 1). Two recommendations were made as part of the audit:

1. Continue to implement the conditions of approval until the expiry of the approval.
2. Update maps in the Annual Compliance Reports to reflect current cleared amounts and offsets.

Kantra intend to update all maps and associated spatial layers during the 2026/2027 reporting period. New maps will be supplied with the 2026/2027 EPBC Compliance Report.

Kantra maintains a range of records associated with delivery of the outcomes required by the NVMP and the conditions associated with EPBC 2013/6965. A range of preparatory activities and studies have been undertaken by Kantra as reported in previous compliance reports. Details of activities undertaken September 2024 to September 2026, studies completed and records of progress under the NVMP are documented in this compliance report and previous reports (supplied on request).

Documentary evidence of progress on actions specified by the NVMP for September 2014 to September 2026 is provided in the following sections.

4.7.1 Sharefarmer Negotiations – Removal of Grazing & Cropping Pressure from Designated SEB-offset Areas (NVMP Item 5.2.1)

Objective: To halt farming and livestock grazing activity within areas allocated for SEB-offset plantings as a first step to re-establishing native vegetation within assigned allotments on Hillgrove-owned land immediately adjacent to the Kanmantoo Mining Lease.

Consultation with share farmers and removal of commercial farming initially commenced in 2015 on 141 Mine Road and Mulawa. Changes to farming activities comprised exclusion of grazing and cropping practices as described in Figure 7. Consultation with sharefarmers will continue as the area of cropping land is used to progressively establish SEB-offsets is expanded.

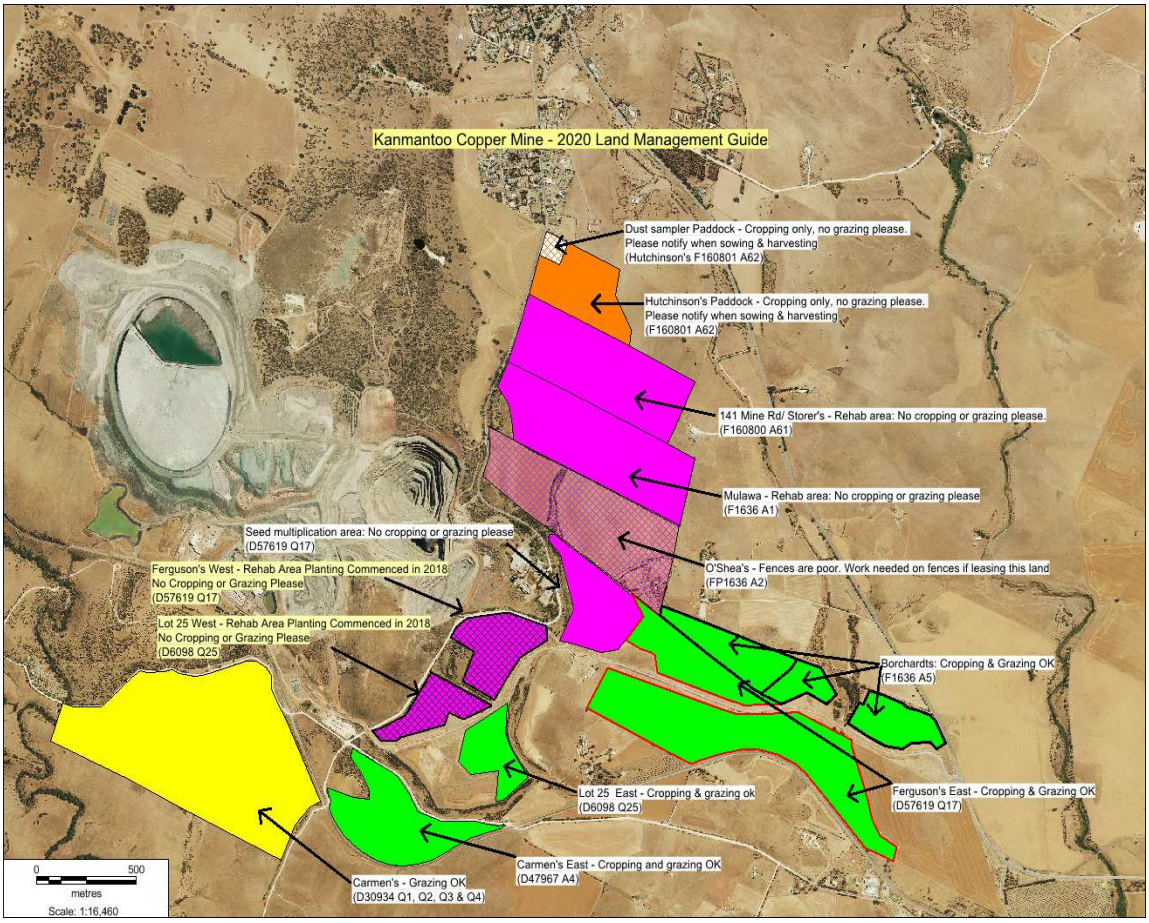


Figure 7: Kantra's Land management instructions to sharefarmer (2023).

4.7.2 Scheduling Offset Programs for Each Offset Patch (NVMP item 5.2.2)

Objective: Schedule the commencement of SEB-offset work to coincide with corresponding approved land clearance areas within the ML as dictated by the Mine Plan.

SEB-Offset commencements have occurred in accordance with EPBC 2013/6965. 27 ha of EPBS SEB offset are currently underway.

Kantra intend to prepare a 5-year rehabilitation and restoration management plan during the 2026/2027 reporting period. The plan will forecast revegetation and restoration activities across the ML and SEB-offset areas and will address:

- Overburden and soil requirements for revegetation,
- Targeted pest species programs to ensure successful outcomes;
- Seed collection and storage requirements for the 5 year period,
- Monitoring programs required to determine outcome success; and
- Investigations required to improve confidence in successful outcomes.

Figure 8 illustrates the projected total area of mine landform rehabilitation and SEB-offsets. These areas are collectively associated with initial ML approval and the NVMP approved by EPBC 2013/6965.

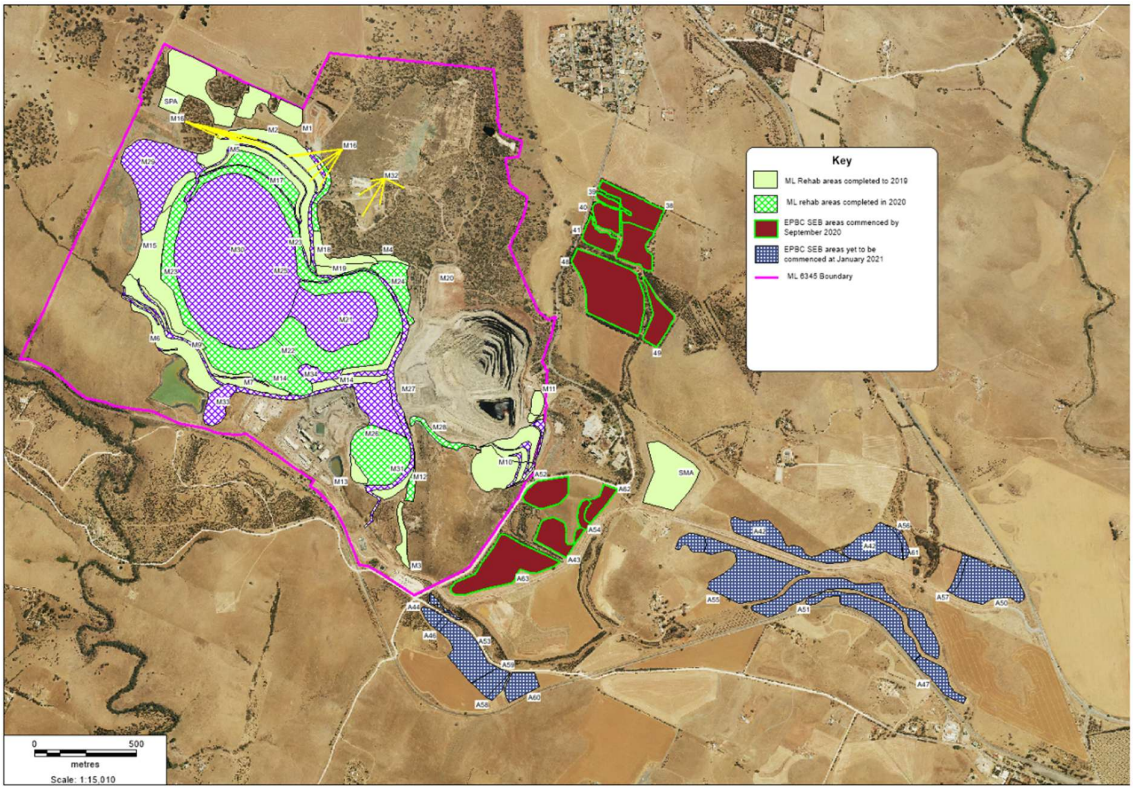


Figure 8: Projected cumulative area of Mine rehabilitation and SEB-Offset program

4.7.3 Surveying proposed revegetation plots within assigned SEB offset land parcels (NVMP Item 5.2.3)

Objective: Conduct detailed surveys of designated SEB-offset patches to ensure that they meet initial requirements in terms of area, land class and aspect for their intended offset vegetation type. If any area is determined as unsuitable, survey and allocate equivalent land parcels within Hillgrove-owned land immediately adjacent to the ML.

SEB-Offset areas were surveyed and assessed by Umwelt (formerly EBS Ecology) in 2015 for suitability (Appendix 2). Subsequent to this (in 2020) a variation was submitted to move the location of EPBC SEB-offsets to areas on the ML. The final agreed offset locations are provided in Figure 8.

4.7.4 Install and maintain rabbit-proof fencing to protect land parcels or individual SEB-patches as appropriate (NVMP Item 5.2.4)

Objectives: Contain and control feral herbivores and other feral animals within designated land parcels or SEB-offset patches. Prevent reintroduction of feral pests into designated offset areas from surrounding properties. Protect new offset vegetation from grazing by feral and domestic animals. Allow native seed reserves to accumulate within offset patches, both in the short and long term. Regularly inspect and maintain fences to ensure that pest reintroduction does not occur following control.

No rabbit proof fencing was installed during this reporting period. Maintenance of existing fences during this reporting period involved minor repairs identified during fence inspections.

4.7.5 Purchase of specialist equipment and/or engagement of Contractors (NVMP item 5.2.5)

Objectives: When SEB-offset plans for the LOM extension have been approved, ensure that planned SEB offset programs are appropriately resourced through internal budget allocations and executed either through direct employment of staff and purchase of specialist equipment or through engagement of appropriately skilled and equipped contractors or other groups.

Management of SEB areas is budgeted annually. EBS Restoration is the principal contractor responsible for SEB-Offset establishment, weed control and feral animal control on designated SEB areas as outlined in the NVMP. Umwelt (previously EBS-Ecology) is the principal contractor responsible for fauna and flora surveying.

4.7.6 Commence weed control and feral animal control programs within designated SEB-offset areas prior to planting and through the establishment phase (NVMP item 5.2.6)

Objectives: Control feral animal populations within fenced SEB-offset areas prior to the commencement of planting operations. Maintain population control through ongoing feral animal control programs during the life of the SEB-offset program.

Control pest plants within designated SEB-offset areas. Begin weed population reduction prior to SEB-offset planting and continue weed control throughout the establishment phase.

Considerable weed control work was completed in the SEB-offsets during this reporting period. Activities including brush cutting, mowing, spot-spraying and selective boom-spraying.

Rabbit control was carried out during this reporting period at several sites associated with offset plantings.

Kangaroo numbers have steadily increased in recent years, both within the ML and in the surrounding region. Management of Kangaroo populations was conducted during the reporting period.

Detailed reporting on pest control is provided in Appendix 3 and Appendix 4.

4.7.7 Investigative studies to quantify the parameters for successful revegetation on specific SEB-offset patches (NVMP item 5.2.7)

Objectives: Conduct a range of detailed site-specific studies to define and understand the significance of parameters which may have a direct impact on the establishment and success of SEB-offset vegetation in particular offset patches.

Use Landscape Function Analysis and vegetation surveys on assigned offset patches prior to the commencement of on-ground works to define the benchmark state of each patch as a means of objectively assessing progress towards required offset outcomes.

Apply the outcomes of investigative studies to pre-sowing land preparation, foundation seed mix compositions, planting methodologies, post sowing management and follow-up maintenance programs for specific SEB-offset patches.

Several investigative studies were conducted in preparation for the establishment of SEB-Offset plantings on the designated offset patches:

1. South Australian Seed Conservation Centre (2015), Germination Research on Selected Taxa for the Kanmantoo Restoration Technology Project, Progress Report August 2015. Report to Hillgrove Resources. Botanic Gardens of Adelaide, South Australia:

    a. Soil seed bank studies to investigate the effective depth of topsoil pre-stripping prior to direct seeding of SEB-Offset patches.

    b. Germination research on selected taxa – particularly research into seed treatments to break dormancy in *Lomandra effusa* as a precursor to direct seeding. This work was lab based in 2013-2014 and was extended to small-scale field trials on SEB-Offset patches during 2015.

    c. Seed viability studies for direct-seeding species as a guide to direct seeding seed mix composition

2. EBS (2015), Kanmantoo Copper Mine, Environmental Management, Revegetation and SEB Offset Program, Annual Report 2014. Report to Hillgrove Resources. EBS Restoration, Adelaide:

    a. Preliminary studies into the efficacy of topsoil pre-stripping prior to direct seeding as a means of converting cropping land into SEB-Offset vegetation. This work was conducted within the Mining Lease during 2013 and 2014.

3. Coles R.B., (2015) Report on Kanmantoo Cryptogams September 2015. Report to Hillgrove Resources:

    a. Studies into the Cryptogamic cover at Kanmantoo, as a precursor to research which will endeavour to culture or collect sufficient Cryptogamic material for inclusion in direct

seeding and hydroseeding programs

No new investigative studies were commenced during this reporting period. Further investigative studies will be scheduled in future reporting periods as required.

4.7.8 & 9 Commencement of vegetation enhancement programs for remnant native vegetation located during detailed site studies and adjustment of offset patch boundaries where necessary (NVMP item 5.2.8 &9)

Objectives: Delineate, protect and enhance any native vegetation remnants identified during detailed site studies. Incorporate any remnant native vegetation into the establishment of appropriate SEB offset patches

Vegetation condition assessment suggests there is potential to improve the overall quality of remnant vegetation areas within the ML and on adjacent Kantra-owned properties.

Vegetation enhancement has commenced in a section of McFarlane Hill within the ML and in two additional areas outside the ML, between Mine Rd and Back-Callington Rd, labelled as 'Carmen's East' and 'Lot 25', below. These areas will provide linkages to SEB-offsets when they are established.

Kantra initiated the 'Storer' project in 2026. The project encompasses restoration of 20-hectares of threatened-bird canopy habitat and forms a key piece of the Kanmantoo habitat corridor. Work on the project to date includes:

1. Significant rabbit management to reduce grazing pressures;
2. Weed control programs;
3. Construction of ephemeral wetlands; and planting of native flora species.

On-ground surveys did not indicate that either the SEB-Offset patch boundaries or the initially mapped property boundaries required adjustment during this reporting period.

4.7.10 Build-up seed reserves/ order seeds (NVMP item 10)

Objectives: Build up seed reserves and order specific seed supplies or tube stock to meet planting schedules. Ensure that adequate seed supplies and tube stock are available for scheduled offset patch planting and replanting programs at the various stages of patch establishment. Ensure that only species represented in ML floristic communities are included in planting programs. Ensure that local provenance seed and tube stock sources are used wherever possible. If supplies of local species are needed and can't be obtained from local sources, ensure they are acquired from sources as near as practical to the ML in the first instance or from other sources within the same climatic conditions as a last resort.

Kantra has invested considerable effort into the development of seed production, seed collection, broad-acre seed multiplication and seed storage capacity. These programs involve collecting, multiplying and nurturing local-provenance genetic material. Within seed multiplication areas, particular care is taken to support the growth of parent plants with minimal inputs to prevent possible epigenetic creep that could be fostered if seed are allowed to be grown under 'soft' conditions, for example, through fertilising or over-irrigation to drive seed production volume at the expense of seed quality. Kantra has not purchased additional seed from external sources to date, with all direct seeded patches being established using locally collected or locally grown seed.

Activities in the seed reserve and seed store have been limited to maintenance activities for this reporting period. Details of seed reserves are contained in the EBS annual report (Appendix 4).

4.7.11 Land preparation (NVMP item 5.2.11)

Objectives: Schedule and conduct land preparation activities to meet offset-patch establishment programs. Carry out pre-sowing and pre-planting weed reduction programs to reduce both the levels of weed competition in newly established plantings and subsequent weed contamination in mature offset vegetation patches. Carry out on-ground works necessary to prevent soil erosion during patch establishment or ameliorate current erosion features in patch areas where possible before planting. Carry out any cultivation or soil amelioration activities necessary for patch establishment prior to sowing.

No land preparation activities were carried out over the reporting period as no new SEB-offset area were established. Kantra continue to implement weed management programs on SEB-Offset areas. The success of offset activities will be reviewed during the 2026/2027 reporting period and determine if any new activities are required to manage weeds and/or erosion.

4.7.12 Planting programs (NVMP item 5.2.12)

Objectives: Schedule planting programs in accordance with seed and tube stock availability to meet land preparation, seasonal deadlines and SEB offset patch requirements. Tailor offset patch species lists and/or seed mixes to deliver the required floristic species range and planting densities necessary to successfully establish the required SEB offsets for the LOM extension. Use planting methods which are best suited to the terrain being sown and the vegetation type being established. Involve the local community, local groups and local contractors wherever possible to ensure benefit to our community and increase both interest in the SEB offset program and ownership by our communities.

27 ha of SEB-Offset area has been direct seeded or tube stock planted to date. Further expansion of SEB-offset plantings did not proceed during this reporting period. Kantra will review the success of SEB activities to date and prepare a Rehabilitation and Restoration Plan forecasting seeding and planting for a 5-year period.

4.7.13 Assess results and adjust methods (NVMP Item 13)

Objectives: Regularly objectively assess the establishment and development of offset patches against known patch analogues by recognised means. Continue with establishment methodologies where they are proven to be successful and adjust processes where they are proven to be inappropriate.

Landscape Function Analysis has been completed annually in SEB-Offset areas, the 2025 LFA report is provided in Appendix 5. Patch success will be reviewed over the 2026/2027 reporting period. The results of the review will inform the development of the Rehabilitation and Restoration Plan.

4.7.14 Replanting and Amendment Programs (NVMP item 5.2.14)

Objectives: Monitor and address poor offset patch establishment through appropriate replant programs. Identify and address plant losses caused by adverse seasonal events as required.

Landscape Function Analysis has been completed annually in SEB-Offset areas, the 2025 LFA report is provided in Appendix 5. Patch success will be reviewed over the 2026/2027 reporting period. The results of the review will inform the development of the Rehabilitation and Restoration Plan.

4.7.15 Establish heritage agreement (NVMP Item 5.2.15)

Objectives: Protect successful SEB offset areas from future disturbance through the establishment of recognised Heritage Agreements defined as follows: "A Heritage Agreement is a private conservation area, established in perpetuity through an agreement (contract) between the landholder and the Minister for Sustainability, Environment and Conservation"

Kantra entered into a heritage agreement (14609361) on the 'Carmen's East' offset area (CT 5366/650) on 11 September 2025. Kantra will continue to identify future opportunities to establish new heritage agreements on suitable offset areas.

4.8 EPBC Act - Compliance Report for EPBC 2013/6965

Due to personnel movements and limited resourcing, the compliance report for the 2024/2025 reporting period was not completed. The 2025/2026 (this) report will encompass both the 2024/2025 and the 2025/2026 reporting periods and is intended to satisfy Kantra's obligation to prove compliance with the conditions associated with EPBC 2013/6965. It is considered that this adequately addresses the NVMP and progress is being made.

This report is available on the Kantra website: https://kantra.com/environment/

Previous compliance reports can be provided on request.

4.9 Participation in audit (if required)

Kantra will actively assist with an audit of compliance with EPBC 2013/6965 if requested to do so.

4.10 Approval for non-approved activities

Non-approved activities have not been undertaken during this reporting period.

4.11 Revision of NVMP (if required by the Minister)

Mine activities have proceeded in accordance with approvals. A formal request for revision of the NVMP has not been received from The Minister at the time of writing this report.

4.12 5-year sunset date for commencement

Work commenced according to approvals on the 11 September 2014. Subsequently, the 5-year sunset date for commencement will not apply to this approval.

4.13 Publication of Native Vegetation Management Plan

The relevant NVMP is published on the Kantra web page. They can be accessed via the following link: https://kantra.com/environment/

5 Conclusion

Kantra Copper will continue to work towards complying with the approval granted by EPBC 2013/6965.

Vegetation disturbance associated with EPBC 2013/6965 was commenced on 11 September 2014 and continued to the approved limit of disturbance during the initial reporting period (11 September 2014 to 11 September 2015).

Kantra have addressed all of the elements outlined by the Controlled Action. Progress has been made on the establishment of SEB-Offset areas, with approximately 27ha of plantings commenced by the end of this reporting period.

Seed production programs and wild-seed seed collection programs are continuing. Adequate seed supplies were available for the future SEB-offset plantings and the Mine landform rehabilitation hydroseeding program.

Kantra intend to review the success of SEB activities to date and prepare a Rehabilitation and Restoration Plan for the ML and SEB-Offset areas. The Plan will inform the management and monitoring of rehabilitation and restoration activities 2027 – 2032.

Kantra will continue to work actively towards establishment of assigned SEB-Offsets.

Appendix 1 EPBC ComplianceAudit Report

Australian Government
Department of Climate Change, Energy, the Environment and Water

Compliance Audit Report

Kanmantoo Copper Mine Expansion, Kanmantoo, SA (EPBC 2013/6965)

Hillgrove Resources Limited ACN: 004 297 116

Report prepared by
Environmental Audit Section

9 May 2025



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Document Control

Version	Description	Approval	Date
0.1	Draft Audit Report	Tom Long - Director	07 May 2025
0.2	Draft released to Auditee	John Crocker – Environment Officer Hillgrove Resources	08 May 2025
1	Final Audit Report	Helen Hodgkins – Assistant Director	09 May 2025

Audit Details

Report Title	Compliance Audit of Kanmantoo Copper Mine Expansion, Kanmantoo, SA (EPBC 2013/6965)
Auditee Name	Hillgrove Resources Limited
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Audit Lead	Helen Hodkins – Lead Auditor audit@dcceew.gov.au
Audit Team	Simone Davey – Senior Auditor
Audit Date	February 2025 – May 2025
On-site Audit Details	Date of on-site audit: 9 April 2025 Location: 440 Mine Road, Kanmantoo Helen Hodgkins DCCEEW – Lead Auditor Simone Davey DCCEEW – Senior Auditor John Crocker – Hillgrove Resources – Environmental Officer Steve McGovern – EBS Ecology - Ecologist

Background

On 6 May 2014 a delegate for the Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approved the Kanmantoo Copper Mine Expansion, Kanmantoo, SA (EPBC 2013/6965). The approval contains 13 conditions and includes requirements to mitigate and offset impacts from the actions on the listed threatened communities of the Peppermint Box (*Eucalyptus odorata)* Grassy Woodland of South Australia and the Iron-grass Natural Temperate Grassland of South Australia. No variations to the approval have been made.

The action commenced on 11 September 2014 and all clearing for the expansion has been completed and the implementation of the Native Vegetation Monitoring Plan (NVMP) is ongoing. Since the approval was granted the activity of mining had slowed due to market factors but at the time of the audit mining activities had increased. The approval has effect until 31 December 2064.

On 24 February 2025 the Department of Climate Change, Energy, the Environment and Water (department) commenced a compliance audit of Hillgrove Resources Limited (auditee) to assess compliance with the requirements and conditions of the approval (EPBC 2013/6965). The compliance audit was facilitated under condition 7 of the approval and was undertaken by an experienced auditor from the department.

Audit Methodology

This section of the report contains the audit methodology that was implemented to audit the Kanmantoo Copper Mine Expansion, Kanmantoo, SA against the conditions of the EPBC 2013/6965 approval and its associated plans.

Audit Objective

The objective of the audit was to effectively assess the compliance requirements of the auditee against the conditions of the approval and associated management plans.

Audit Criteria

The audit checklist and criteria were developed to address obligations required under the relevant approval instrument and measures required by associated management plans.

Audit Scope

The scope of the audit was to assess compliance with disturbance (land clearing), offset and commencement notification conditions.

The following conditions were within scope of this audit 1, 2, 3, 4, 5, 6 and 7.

Audit Process

The compliance audit commenced in February 2025. The analysis and audit findings were completed in May 2025.

The compliance audit was undertaken by desktop review of documentation and evidence provided by the auditee. Prior to the commencement of the audit, a letter of intent to audit was sent to the auditee on 24 February 2025 to ensure that the auditor and auditee were both suitably informed to conduct the audit.

An on-site audit was conducted on 9 April 2025 and included an opening meeting, interviews with Hillgrove Resources Limited personnel and relevant project contractors, document review, site visit to the offset areas and a closing meeting

Audit Terminology

The following terms were used to record findings during this audit.

Compliant	Sufficient and appropriate information presented to demonstrate the compliance of a particular requirement.
Observation	An observation may be made about issues relevant to the protection of a matter of national environmental significance when the issue is not strictly related to compliance or non-compliance with a condition.

Audit Findings

Of the 7 conditions assessed under the approval, the audit found the following:

- Compliance with all conditions of approval examined.

Summary of audit findings

A summary of the audit findings for each condition examined are contained in the table below. For a full list of conditions, please refer to the EPBC Act approval provided at **Attachment A.**

Condition	Audit Finding	Summary
1	*Compliant*	*Less than 1.8h a of Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia ecological community was cleared.*
2	*Compliant*	*Less than 3.4 ha of the Iron-grass Natural Temperate Grassland of South Australia ecological community was cleared.*
3	*Compliant*	*A Native Vegetation Monitoring Plan was approved by the Minister prior to commencement of the action and is actively being implemented.*
4	*Compliant*	*The auditee secured lands as identified in the SEB-Offsets (Schedule 2) as a conservation offset.*
5	*Compliant*	*Written evidence of securing the offsets was referred to the department within the specified timeframe.*
6	*Compliant*	*Notification of the commencement of the action was received by the department within the specified timeframe.*
7	*Compliant*	*The auditee is maintaining records to determine compliance with the approval and has provided them on request to the auditor.*

Observations

The auditors made the following observations during the audit:

1. Fencing needs to be more secure in the offset areas to minimise trespass; and

2. Noted that Lomandra has failed to establish as planned in the NVMP. The auditor recommends that the approval holder reach out to the Post Approval Section to submit an amended NMVP now that more data is known about the performance of the Threatened Ecological Communities.

Auditee comments

The auditee provided comment on this report to the department in correspondence dated 8 May 2025.

‘I have reviewed the audit report and I can confirm that it is a fair and true account of the audit conducted on-site at Kanmantoo on the 9th of April 2025’.

RECOMMENDATIONS

1. Continue to implement the conditions of approval until the expiry of the approval.

2. Update maps in the Annual Compliance Reports to reflect current cleared amounts and offsets.

ATTACHMENTS

Attachment	
Attachment A	*Approval decision notification (EPBC 2013/6965)*

FINAL REPORT DISTRIBUTION

- Hillgrove Resources Limited
- Department of Climate Change, Energy, the Environment and Water.

Appendix 2 Kanmantoo Copper Mine Flora and Fauna Survey – New SEB Areas

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Kanmantoo Copper Mine Flora and Fauna Survey - New SEB Areas

Kanmantoo Copper Mine Flora and Fauna Survey – New SEB Areas

27 January 2015

Version 1

Prepared by EBS Ecology for Hillgrove Resources

Document Control					
Revision No.	Date issued	Authors	Reviewed by	Date Reviewed	Revision type
1	14/12/2015	S. Lattanzio	A. Sinel	12/12/2015	Draft
	27/01/2015	S. Lattanzio			Final

Distribution of Copies			
Revision No.	Date issued	Media	Issued to
1	14/12/2015	Electronic	John Crocker, Hillgrove Resources
	27/01/2015	Electronic	John Crocker, Hillgrove Resources

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CITATION: EBS Ecology (2014) *Flora and Fauna Survey – New SEB Areas.* Report to Hillgrove Resources. EBS Ecology, Adelaide.

Front cover photo: Mixed Mallee +/- *Allocasuarina verticillata* (Drooping She-oak) over exotic / native grassland.

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GLOSSARY AND ABBREVIATION OF TERMS

BDBSA	Biological Database of South Australia (managed by DEWNR)
DEWNR	Department of Environment, Water and Natural Resources
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EBS	Environmental and Biodiversity Services
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
NPW Act	*National Parks and Wildlife Act 1972*
NRM Act	*Natural Resources Management Act 2004*
NVC	Native Vegetation Council
Project site	area assessed by EBS Ecology
SEB	Significant Environmental Benefit
ssp.	sub-species
spp.	species (plural)

1 INTRODUCTION

EBS Ecology was commissioned by Hillgrove Resources to undertake a flora and fauna survey of the new SEB areas adjacent the Kanmantoo Copper Mine project site. This is to assist in satisfying some of the Avoidance, Mitigation and Management Measures set out in the Kanmantoo Copper Program for Environment Protection and Rehabilitation (PEPR) (Coffey 2009). The PEPR is the key operational document for the mining project and details information on environmental control measures and outcome-based performance criteria.

The new SEB area is approximately 109.5 ha of mostly open country, a large proportion of which has been cropped or grazed and contains very little native vegetation. There are a few isolated patches of *Lomandra effusa* (Scented Mat-rush) and a few areas where native grass populations still persist amidst exotic grasslands.

The aim of the project is to identify, protect and ultimately enhance any native vegetation remnants within the new areas of farming land allocated to SEB-offset establishment for the life of mine extension. Information from the flora and fauna survey including information on weed species and feral animal activity will be used to establish future control programs.

The objectives of the project were to:

- Survey for signs of any remnant native plant species and native vegetation communities
- Identify and map areas of on-farm native species plantings
- Compile an overall native vegetation species list
- Conduct a survey of native birds and other animals and map occurrences
- Map remnant native vegetation, assigning SEB offset ratios to any patches where possible
- Map areas of pest plants or individual pest plants where possible
- Map any rabbit warrens/ fox dens or areas of high rabbit/fox activity

2 BACKGROUND INFORMATION

The new SEB offset areas are adjacent to the Kanmantoo Mine. SEB offset areas associated with the Life of Mine (LOM) extension have been located as near as possible to the Mine Lease (ML) on suitable Hillgrove-owned land parcels. The Kanmantoo Copper Project is located approximately 44 kilometres east-southeast of Adelaide, South Australia. The new SEB project area is approximately 109.5 hectares and is comprised of five properties (Figure 1). The area has an average rainfall in the range of 400 to 450 millimetres and is within the Mount Lofty District Council area.

The adjacent Kanmantoo mine has experienced several periods of mining activity, from 1846 to 1874 and then again from 1971 to 1976 before low copper prices forced to mine to close. In 2003 Hillgrove Resources began an exploration program and in 2008 a mining lease for the Kanmantoo Copper Project was granted.

All properties within the new SEB areas have been managed under a mixed cropping / sheep grazing regime for over 100 years. Cropping has been confined to the flats which are characterized by deep alluvial soils. Grazing has been on crop stubble and the higher/rocky areas, which have skeletal topsoils over weathered parent rock. As a result, there are only small remnant patches of native vegetation remaining in the new SEB areas which have persisted, including native grasslands and a Mallee community.

For detailed background information refer to documents; *Kanmantoo Copper Project MARP* (Coffey 2009) and *Kanmantoo Copper Project Mining Lease Proposal, Main Report* (Hillgrove Resources 2007).

SEB Offset

The primary management objectives of the offset area will be the protection and enhancement (and control of threatening processes such as weed invasion and grazing) of the Mixed Mallee and the *Lomandra effusa* Tussock Grassland vegetation communities, and habitat for dependant fauna species such as the Diamond Firetail (*Stagonopleura guttata)* and Brushtail Possum (*Trichosurus vulpecula*). The management measures will include the prevention of impacts from stock grazing, overgrazing by native species, weed invasion and revegetation, with Hillgrove proposing to meet its SEB obligations by:

- Providing for the ongoing protection and management of remnant native vegetation within the Mine Lease Area (MLA).
- Excluding stock from the offset area.
- Upon project onset, commencing rehabilitation of areas dominated by introduced pasture
- Revegetation
- Managing weeds in areas of remnant native vegetation in the MLA
- Supporting community initiatives occurring offsite through donation of plants, equipment and funding (if necessary).

It is intended that an SEB offset will be created on the assigned areas through the following means:

- Removing agricultural activity from allocated areas
- Installing rabbit-proof fencing and controlling rabbits/hares/foxes within fenced areas
- Carrying out ongoing weed control programs to remove introduced plant species
- Carrying out erosion mitigation works within assigned areas where possible
- Planting local plant species derived from local provenance seed within designated vegetation areas to create areas of high-value vegetation
- Following up planting programs with infill plantings where required
- Progressively providing nesting boxes, perches and/or refuges for local fauna within revegetated patches as they become increasingly capable of supporting local fauna populations.
- Involving local community groups and local contractors in all work where possible (to create both regional interest and regional employment)
- Protecting SEB-offset patches through appropriate Heritage Agreements

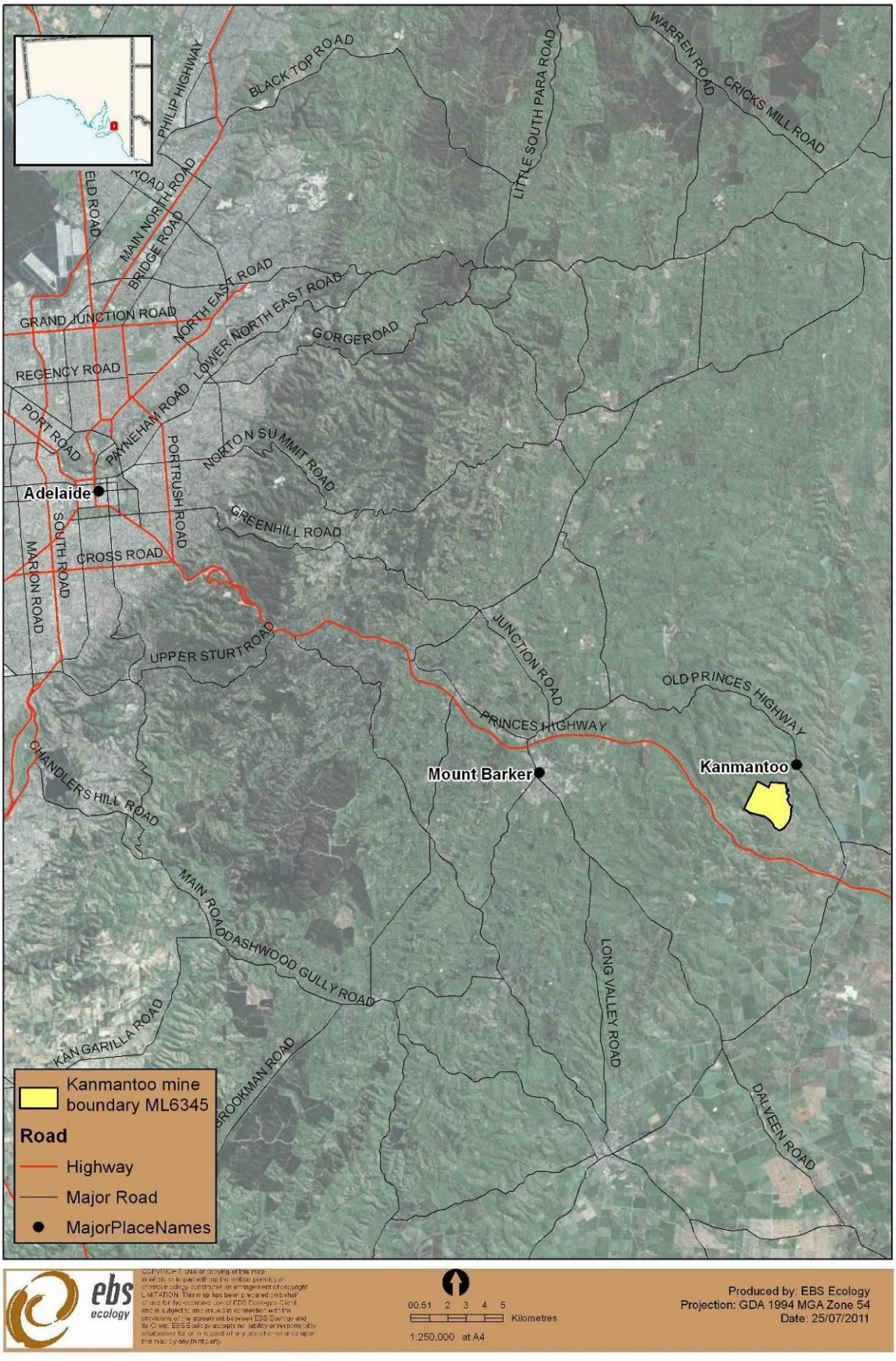


Figure 1. Location of project area.

3 METHODS

3.1 Field survey

3.1.1 Weather conditions during the survey

Weather conditions for the two components of the survey ranged from warm to cool. Wind speeds were generally low to fresh during the bird survey (Table1).

Table 1. Mount Barker Weather Station daily weather observations, spring 2014.,.

Date	Min temp.	Max temp.	Rain	Time	Temp.	Rel. humid.	Wind direct-ion	Wind speed	Activity
	°C		mm		°C	%		km/h	
23/10/2014	11.6	25.6	0	9am	12.7	97	SE	7	Flora and fauna survey
				3pm	25.0	53	SSE	7	
27/10/2014	10.6	17.3	9.4	9am	14.9	72	WSW	30	Flora and fauna survey
				3pm	15.3	71	SW	11	
06/11/2014	5.2	27.0	0	9am	16.9	48	WNW	7	Bird survey and spotlighting
				3pm	26.5	26	SW	4	

Source: Bureau of Meteorology. www.bom.gov.au

3.1.2 Vegetation associations and condition

Vegetation associations within the new SEB areas were mapped and described. Within each association the dominant species, structural form, presence of understorey species, and condition was recorded (Table 2). Observations were also made on the quality of the habitat for fauna species within the project area (e.g. presence of hollows, fallen logs, leaf litter, wetlands, dense shrubby refuge etc).

The survey methodology utilised was the BushRAT (Bushland Rapid Assessment Technique) assessment. This method, which was recently developed by DEWNR, is a rapid assessment technique derived from the Nature Conservation Society of South Australia's 'Bushland Condition Monitoring' methodology, for assessment of native vegetation offsets under the Native Vegetation Act. It is intended that the technique will be employed for most assessments undertaken under the Native Vegetation Act, which will likely include clearance via clearance application, clearance via regulation, potential SEB offset areas, Heritage Agreement assessments and compliance assessments. The vegetation associations are identified within each 'application area' and then assessed against the corresponding 'benchmark' vegetation community identified as part of the BCM Manuals.

Each BushRat assessment identified is termed a 'vegetation association', within which a representative 100 x 100m quadrat is surveyed. A single datasheet is completed per site which a number of standard indicators are scored. Three 'components' of the biodiversity value of the sites are measured and scored: vegetation condition, conservation value and landscape context. Vegetation condition is the main component for which field data is gathered.

Each identified vegetation association is related to a 'Benchmark' Vegetation Community. The 'Benchmark' vegetation communities describe 'intact' vegetation and so can help us determine how much a vegetation association has changed from its historic structure and composition.

Two associations did not require a BushRat assessment, one being the Planted Windbreak / Amenity Planting association and the Plantation associations. The Planted Windbreak / Amenity Plantings will remain intact and may not require any management activities other than weed control. The Plantation association will require a BushRat assessment at a later date as there may be some vegetation removal required before any revegetation or other management activities take place.

Table 2. SEB ratios used to rate condition of vegetation associations.

Con-dition	SEB ratio	% total indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
Very Poor	0:1	<10%	No overstorey stratum remaining.	Complete destruction of indigenous understorey* (by grazing &/or introduced plants).	Vegetation structure no longer intact (e.g. removal of one or more vegetation strata). Scope for regeneration, but not to a state approaching good condition without intensive management. Dominated by very aggressive weeds. Partial or extensive clearing (> 50% of area). Evidence of heavy grazing (tracks, browse lines, species changes, complete depletion of soil surface crust).	Where proposed clearance is considered to be minor and of limited biodiversity impact, e.g. lopping of overhanging limbs only or minor clearance of shrubs in areas otherwise considered as highly disturbed.
	1:1	10-19%	Scattered trees in poor health and/or representing an immature stand.	Almost complete destruction of indigenous understorey* (by grazing &/or introduced plants) - reduced to scattered clumps and individual plants.		
	2:1	20-29%	Scattered trees either immature in good health, or mature in poor/moderate health. Alternatively, the dominant overstorey stratum is largely intact and an immature stand (or regrowth), and is generally in poor health.			Where proposed clearance is in areas dominated by introduced species, the area of native vegetation is largely reduced to scattered trees, indigenous understorey reduced to scattered clumps and individual plants.
Poor	3:1	30-39%	Dominant overstorey stratum is largely intact and a moderately healthy mature stand.	Heavy loss of native plant species (by grazing &/or introduced plants). The understorey* consists predominately of alien species, although a small number of natives persist.	Vegetation structure substantially altered (e.g. one or more vegetation strata depleted). Retains basic vegetation structure or the ability to regenerate it. Very obvious signs of long-term or severe disturbance. Weed dominated with some very aggressive weeds. Partial clearing (10 – 50% of area). Evidence of moderate grazing (tracks, browse lines, soil surface crust extensively broken).	
	4:1	40-49%	Dominant overstorey stratum is largely intact and is a healthy mature stand with high wildlife habitat value (e.g. hollows).			Where the proposed clearance is of mostly intact overstorey vegetation but there is still considerable weed infestation amongst the understorey flora
Moderate	5:1	50-59%	Dominant overstorey stratum is largely intact – any condition+	Moderate loss of native understorey diversity. Weed-free areas small. Substantial invasion of aliens resulting in significant competition, but native understorey* persists; for example, may be a low proportion of native species and a high native cover, or a high proportion of native species and low native cover.	Vegetation structure altered (e.g. one or more vegetation strata depleted). Most seed sources available to regenerate original structure. Obvious signs of disturbance (e.g. tracks, bare ground). Minor clearing (<10% of area). Considerable weed infestation with some aggressive weeds. Evidence of some grazing (tracks, soil surface crust patchy).	
	6:1	60-69%	Dominant overstorey stratum is largely intact – any condition+	Moderate but not severe weed infestation amongst the understorey flora.		Where the proposed clearance is of mostly intact overstorey vegetation with moderate but not severe weed infestation amongst the understorey flora. Clearance is **not** seriously at variance with the Principles.

Con-dition	SEB ratio	% total indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
Good	7:1	70-79%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.	Vegetation structure intact (e.g. all strata intact). Disturbance minor, only affecting individual species. Only non-aggressive weeds present. Some litter build-up.	
	8:1	80-89%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.		Where the proposed clearance is of mostly intact overstorey and understorey vegetation, weed infestation is moderate to low, but the original vegetation is still dominant. Clearance is assessed by the Native Vegetation Council to be at variance with the Principles.
Excellent	9:1	> 89%	Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand.	Diverse vegetation with very little weed infestation.Understorey largely undisturbed, minimal loss of plant species diversity. Very little or no sign of alien vegetation in the understorey*; resembles probable pre-European condition.	All strata intact and botanical composition close to original. Little or no signs of disturbance. Little or no weed infestation. Soil surface crust intact. Substantial litter cover.	
	10:1		Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand, with high habitat value (e.g. hollows).			Where the proposed clearance is of diverse vegetation with very little weed infestation. Clearance is assessed by the Native Vegetation Council to be seriously at variance with the Principles.

*Or all strata if the upper and lower strata are difficult to distinguish

+ Ratio assessment will largely depend upon condition of understorey associated with an intact overstorey stratum.

Adapted from '*Guide to Roadside Vegetation Survey Methodology for South Australia*', (Stokes *et al.* 1998) and '*Guidelines for a Native Vegetation Significant Environmental Benefit Policy*', (DWLBC 2005).

3.1.3 Bird Survey

A roaming process was used to survey for birds within the project area. One surveyor undertook a roaming survey for one hour in the morning and afternoon over one day. Habitat usage by birds was also recorded whilst surveying these areas. The roaming process allowed for coverage of changing habitat across the site. Seven survey areas were assigned a waypoint to ensure an even spread across the project area.

3.1.4 Mammal and nocturnal fauna survey

A fauna specific survey was not undertaken during this assessment however opportunistic sightings of fauna species were recorded, to provide an indication of the habitat value of the site for native fauna. Rabbit warrens / fox dens and areas of high rabbit / fox activity were recorded.

Spotlighting was undertaken within wooded habitats in search of the Common Brushtail Possum. All five properties were surveyed over one night for up to two hours commencing approximately one hour after dusk. Any other species observed opportunistically were also recorded.

3.1.5 Active searching

Active searching of the project area was conducted for two hours during the day in order to detect any additional small mammals or reptiles.

3.2 Survey Limitations

At the time the survey was undertaken, not all plant species may have been visibly present. Some species such as native orchids and lilies are particularly hard to detect when not in flower. As a consequence, it is possible that species were not detected. It should be noted however, that the number of species missing from the species list is expected to be low and data collected is considered adequate to make a reasonable assessment of potential impacts of the proposed works on flora and fauna.

Although effort was taken to ensure all visibly present species were observed and recorded, it is likely that not all species present were observed in the two day survey period.

4 RESULTS

4.1 Field survey

The flora/fauna component of the survey was undertaken on the 23rd and 27th October 2014 by EBS staff Chris Harrison and Serina Lattanzio. The bird survey and spotlighting was undertaken on the 6th November 2014 by EBS staff Alison Derry and Travis How. The majority of the project area was traversed on foot to record all vegetation associations, condition, fauna species and habitat.

4.1.1 Flora species

A total of 96 (57 native and 39 exotic) flora species were recorded during the field survey. A summary of these flora species, and the vegetation associations in which they were recorded, is provided Appendix 1. Three flora species listed under the NPW Act were recorded during the field survey, the state rare *Eucalyptus fasciculosa* (Pink Gum), *Eucalyptus conglobata* ssp. *conglobata* (Port Lincoln Mallee), both of which were planted, and *Rytidosperma tenuius* (Short-awn Wallaby-grass).

4.1.2 Vegetation associations

Eight broad vegetation associations were observedduring the field survey (Figure 2). Within the designated survey area, most of the vegetation was of poor condition. The majority of the survey area has been previously cleared or consisted of immature trees; however some areas had good ground cover of leaf litter, moss and rocks. There were two patches of planted vegetation present (some may be remnant but difficult to distinguish for some species). Vegetation condition ranged from very poor (SEB condition rating 0:1) to moderate (SEB 6:1) (Figure 3). Each vegetation association is further described below with representative photos. Appendix 1 details individual flora species recorded within each vegetation association.

Vegetation associations recorded within the project area:

1. Mixed Mallee +/- *Allocasuarina verticillata* (Drooping She-oak) over Exotic / Native Grassland
2. Exotic Grassland / Grazing Land
3. Plantation
4. Cropping Land
5. Planted Windbreak / Amenity Planting
6. Native Grassland
7. *Lomandra effusa* (Scented Mat-rush) Open Grassland
8. *Acacia pycnantha* (Golden Wattle) Tall Shrubland

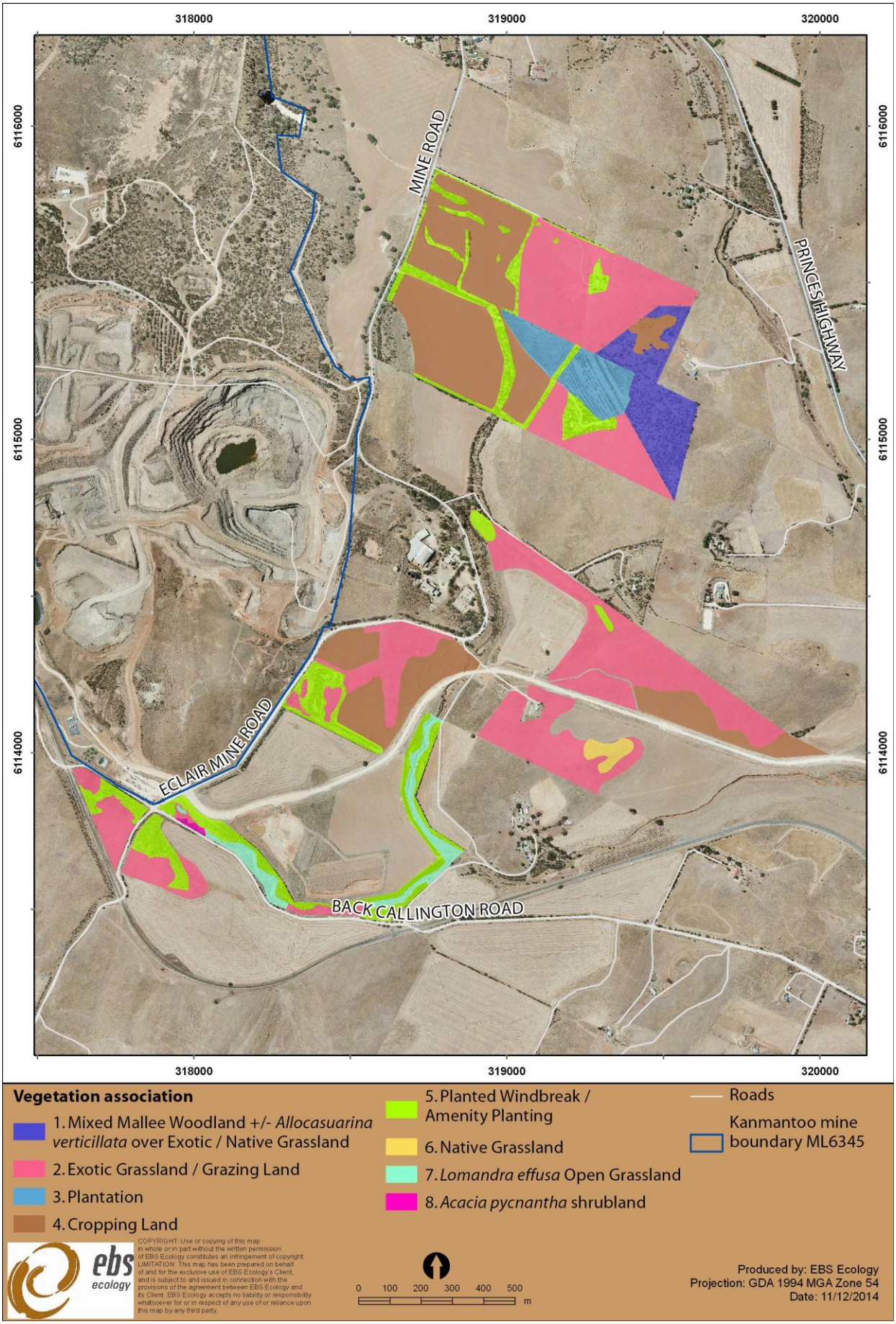


Figure 2. Vegetation associations observed within the new SEB areas.

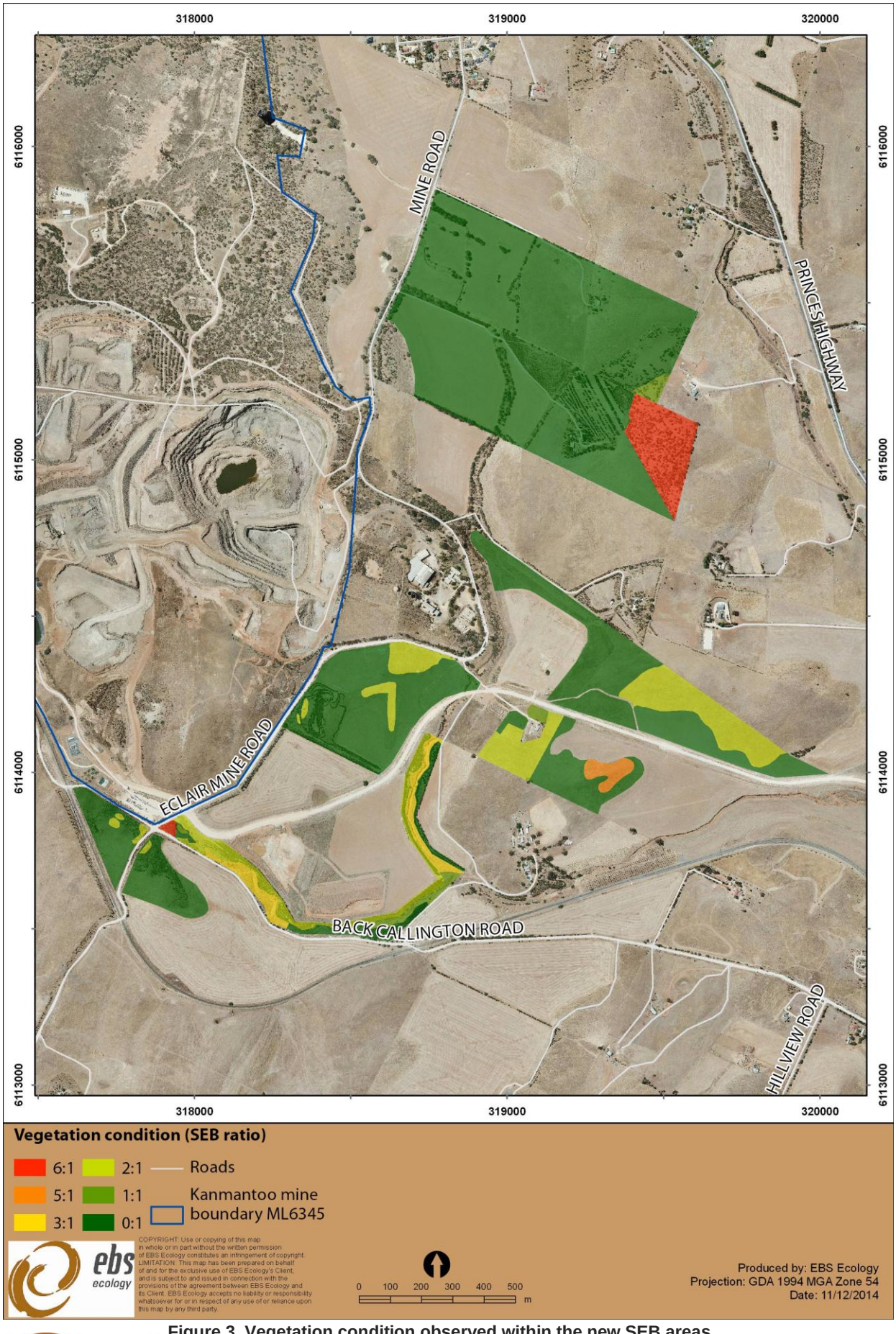


Figure 3. Vegetation condition observed within the new SEB areas.

Association 1: Mixed Mallee +/- Allocasuarina verticillata (Drooping She-oak) over Exotic / Native Grassland

Vegetation Association 1 was located within the 141 Mine Road and Mulewa properties with the association located on the western end of each of the properties. Association 1 was dominated by a mix of upper and midstorey species including *Eucalyptus leucoxylon* ssp. (South Australian Blue Gum), *Eucalyptus socialis* (Red Mallee), *Allocasuarina verticillata* (Drooping She-oak), *Acacia argyrophylla* (Silver Mulga-bush), *Callitris gracilis* (Southern Cypress Pine), *Senna sp.* (Senna) and *Santalum acuminatum* (Quandong). Native species in the understorey was predominantly dominated by *Rytidosperma caespitosum* (Common Wallaby-grass), *Enchylaena tomentosa* var. *tomentosa* (Ruby Saltbush) and *Austrostipa scabra* ssp. (Rough Spear-grass). Dominant weed species in the understorey consisted of *Echium plantagineum* (Salvation Jane) and *Avena barbata* (Bearded Oat).

The 141 Mine Road property was in poor condition, with the understorey dominated by exotic species. The condition improved at the rocky outcrop (SE corner) where there was good native grass cover. This area appeared to be direct seeded with self seeding regeneration from the direct seeding and adjacent properties, with the possibility of the presence of remnant vegetation.

The understorey on the Mulewa property was in good condition with native grass cover, plentiful cover of leaf litter, moss and a rocky outcrop. The vegetation appeared to be remnant with some planted local and exotic species such as *Eucalyptus cladocalyx* ssp. (Sugar Gum).

The condition of Vegetation Association 1was considered very poor (0:1) to moderate (6:1). Refer to Figures 4 and 5 for a representative photo.



Figure 4. Mixed Mallee +/- *Allocasuarina verticillata* (Drooping She-oak) over Exotic/Native Grassland: 141 Mine Rd.



Figure 5. Mixed Mallee +/- *Allocasuarina verticillata* (Drooping She-oak) over Exotic/Native Grassland: Mulewa.

BushRat Assessment

A number of key management activities, such as feral animal management, weed management and understorey revegetation, would need to be implemented to manage the areas as a suitable offset.

Following the BushRat assessment the remnant scored for Association 1:

- Unit Biodiversity Score = 68
- Total Biodiversity Score = 3889.6

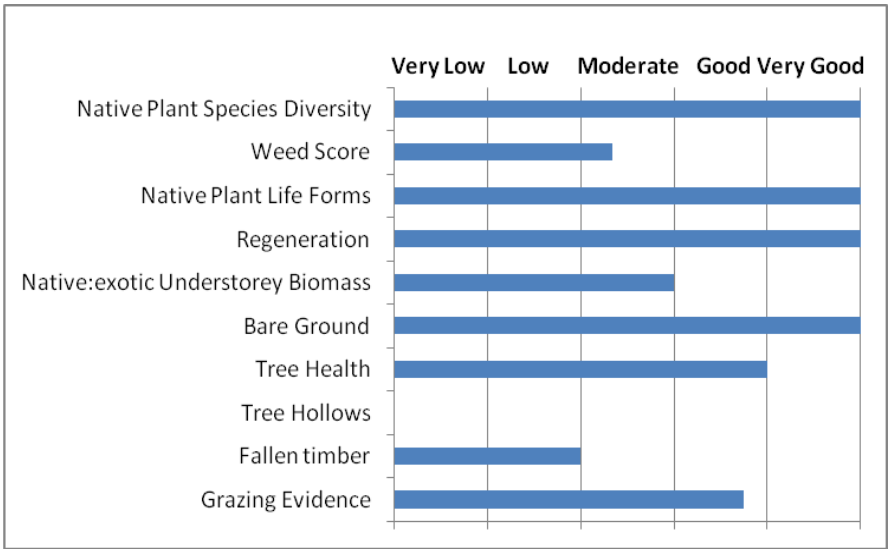


Figure 6. BushRat assessment Association 1 against benchmark community.

Association 2: Exotic Grassland / Grazing Land

This association has been highly modified and was dominated by exotic herbs and grasses including *Avena barbata* (Bearded Oat)*, Echium plantagineum* (Salvation Jane), *Trifolium angustifolium* (Narrow-leaf Clover) and *Gomphocarpus cancellatus* (Broad-leaf Cotton-bush). This association was located on all five properties. Much of this association was used as grazing land. In areas where there was no stock present, grazing pressure from stock was evident.

Scattered native species including *Austrostipa scabra* ssp. (Rough Spear-grass), *Enneapogon nigricans* (Black-head Grass) and *Convolvulus remotus* (Grassy Bindweed) were location within association two.

The condition of Vegetation Association 2 was considered very poor (0:1). Refer to Figure 7 for a representative photo.



Figure 7. Exotic Grassland / Grazing Land.

BushRat Assessment

A number of key management activities, such as feral animal management, weed management and understorey revegetation, would need to be implemented to manage the areas as a suitable offset.
Following the BushRat assessment the remnant scored for Association 2:

- Unit Biodiversity Score = 38
- Total Biodiversity Score = 4089.18

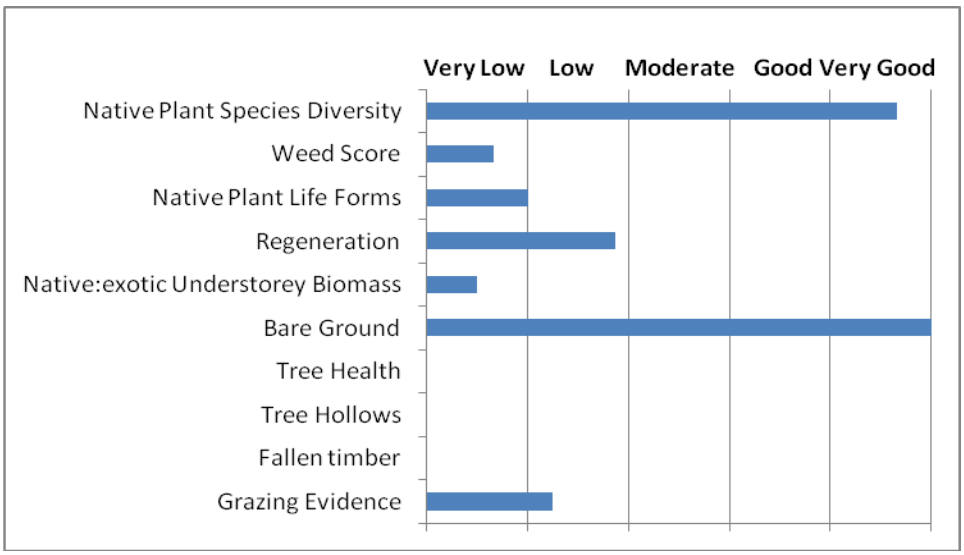


Figure 8. BushRat assessment Association 2 against benchmark community.

Association 3: Plantation

Association 3 is located on the Mulewa property only. There were three different plantations: *Pinus radiata* (Radiata Pine), *Callitris gracilis* (Southern Cypress Pine) and *Melaleuca uncinata* (Broombush) all within close vicinity of each other located in mid section of the property. The understorey mainly consisted of exotic grasses and herbs.

The condition of vegetation association one was considered very poor (0:1). Refer to Figure 8, 9 and 10 for a representative photo. No BushRat assessment was undertaken for this association.



Figure 9. *Pinus radiata* plantation.



Figure 10. *Callitris gracilis* plantation.



Figure 11. *Melaleuca uncinata* plantation.

Association 4: Cropping Land

Association 4 is located on the 141 Mine Road, Ferguson and Mulewa properties. The cropping land was predominantly wheat with exotic species such as *Avena barbata* (Bearded Oat) and *Hordeum vulgare* (Barley) scattered around the edges. This association was considered to be in very poor condition (0:1). Refer to Figure 11 for a representative photo.



Figure 12. Cropping land.

BushRat Assessment

A number of key management activities, such as feral animal management, weed management and understorey revegetation, would need to be implemented to manage the areas as a suitable offset.

Following the BushRat assessment the remnant scored for Association 4:

- Unit Biodiversity Score = 36
- Total Biodiversity Score = 2541

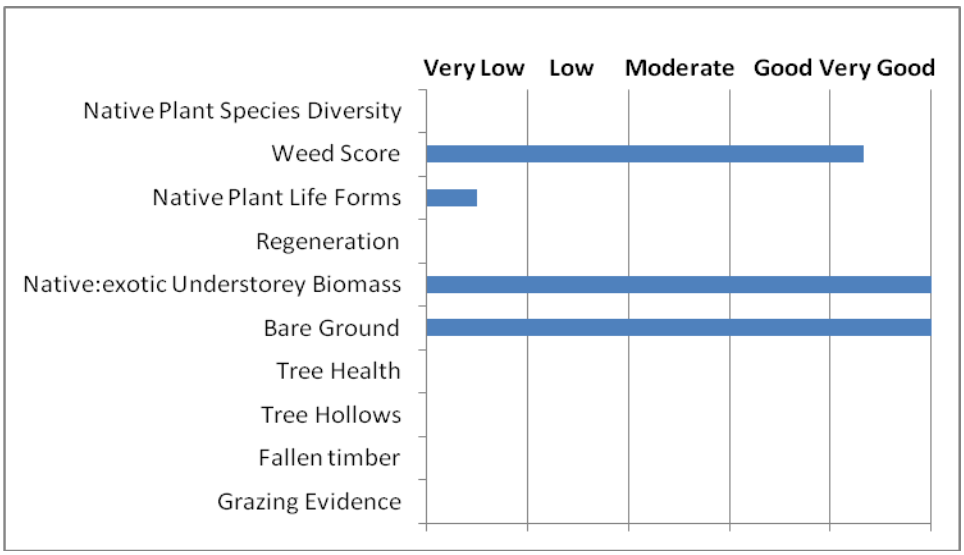


Figure 13. BushRat assessment Association 4 against benchmark community.

Association 5: Planted Windbreak / Amenity Planting

Vegetation Association 5 was located on all five properties. It was evident that the majority of the plantings were undertaken by direct seeding in either rows (windbreak) or large areas. There was a mix of local and non-local species including *Eucalyptus leucoxylon* ssp. (South Australian Blue Gum), *Eucalyptus cladocalyx* ssp. (Sugar Gum), *Callistemon* sp. (Bottlebrush), *Acacia victoriae* ssp. (Elegant Wattle), *Corymbia maculata* (Spotted Gum) and *Myoporum platycarpum* ssp. (False Sandlewood). The amenity plantings were located within vicinity of the dwellings and included *Ficus carica* (Edible Fig), *Agave americana* (Century Plant), *Olea europaea* ssp. *europaea* (Olive) and *Opuntia* spp. (Prickly Pear). Much of the understorey was an exotic grassland / herbland with some native grasses. This association was considered to be in very poor condition (0:1). Refer to Figure 12 and 13 for a representative photo. No BushRat assessment was undertaken for this association.



Figure 14. Planted windbreak on the Mulewa property.



Figure 15. Amenity planting on the Mulewa property.

Association 6: Native Grassland

Vegetation Association 6 was located on the Ferguson (3) property in a small patch towards the eastern end of the property. This patch was recently grazed with sheep present on the site. The association contained a mix of native species. Dominant species includes *Enneapogon nigricans* (Black-head Grass), *Rytidosperma caespitosum* (Common Wallaby-grass) and *Vittadinia gracilis* (Woolly New Holland Daisy). Dominant exotic species included *Avena barbata* (Bearded Oat) and *Echium plantagineum* (Salvation Jane).

This association was considered to be in moderate condition (0:5). Refer to Figure 14 for a representative photo.



Figure 16. Native Grassland.

BushRat Assessment

A number of key management activities, such as feral animal management, weed management and understorey revegetation, would need to be implemented to manage the areas as a suitable offset.

Following the BushRat assessment the score for Association 6:

- Unit Biodiversity Score = 42
- Total Biodiversity Score = 42

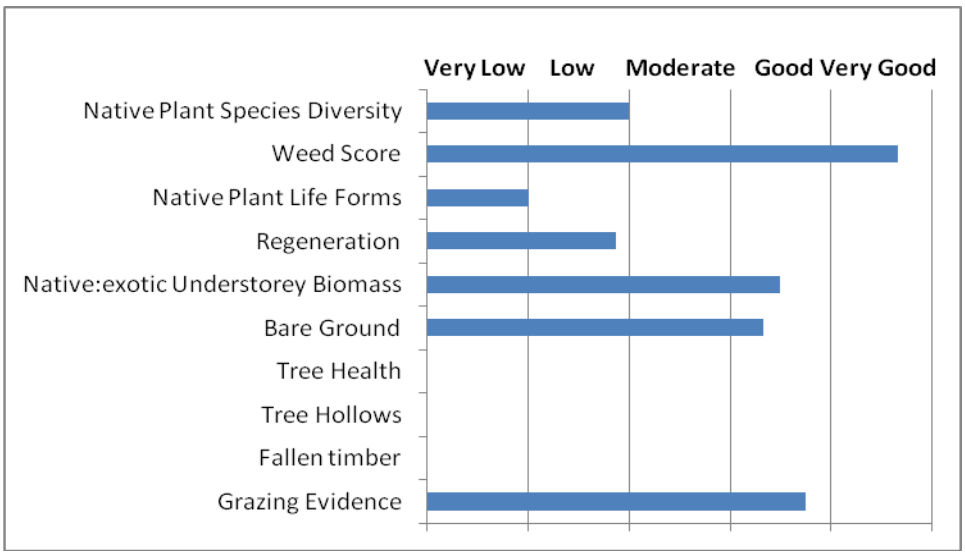


Figure 17. BushRat assessment Association 6 against benchmark community.

Association 7: Lomandra effusa (Scented Mat-rush) Open Grassland

There were two large and one small *Lomandra effusa* open grassland patches located within the Lot 25 property. Dominant species within the area include *Lomandra effusa* (Scented Mat-rush), *Aristida contorta* (Curly Wire-grass), *Austrostipa blackii* (Crested Spear-grass) and *Rytidosperma setaceum* (Small-flower Wallaby-grass). Dominant exotic species include *Avena barbata* (Bearded Oat), *Cynara cardunculus* ssp. *flavescens* (Artichoke Thistle) (located in the drainage line) and *Echium plantagineum* (Salvation Jane).

The vegetation condition varied within the patches and ranged from very poor (1:1) to poor (3:1). Refer to Figure 15 for a representative photo.



Figure 18. *Lomandra effusa* (Scented Mat-rush) Open Grassland.

BushRat Assessment

A number of key management activities, such as feral animal management, weed management and understorey revegetation, would need to be implemented to manage the areas as a suitable offset.
Following the BushRat assessment the remnant scored for Association 7:

- Unit Biodiversity Score = 45
- Total Biodiversity Score = 328.5

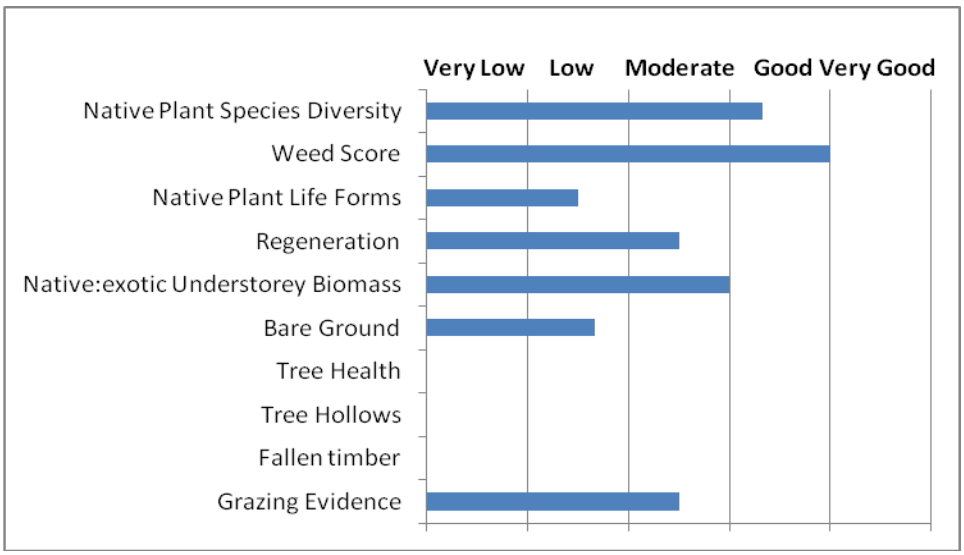


Figure 19. BushRat assessment Association 7 against benchmark community.

Association 8: Acacia pycnantha Tall Shrubland

The *Acacia pycnantha* (Golden Wattle) Tall Shrubland association was located on the Carmen property. This association was a small remnant stand located on the fence line. The dominant species within the understorey was *Enchylaena tomentosa* (Ruby Saltbush), *Lomandra effusa* (Scented Mat-rush), *Euphorbia terracina* (False Caper) and *Avena barbata* (Bearded Oat).

This association was considered to be in very poor condition (2:1). Refer to Figure 16 for a representative photo.



Figure 20. *Acacia pycnantha* (Golden Wattle) Tall Shrubland.

BushRat Assessment

A number of key management activities, such as feral animal management, weed management and understorey revegetation, would need to be implemented to manage the areas as a suitable offset.
Following the BushRat assessment the remnant scored for Association 8:

- Unit Biodiversity Score = 49
- Total Biodiversity Score = 7.84

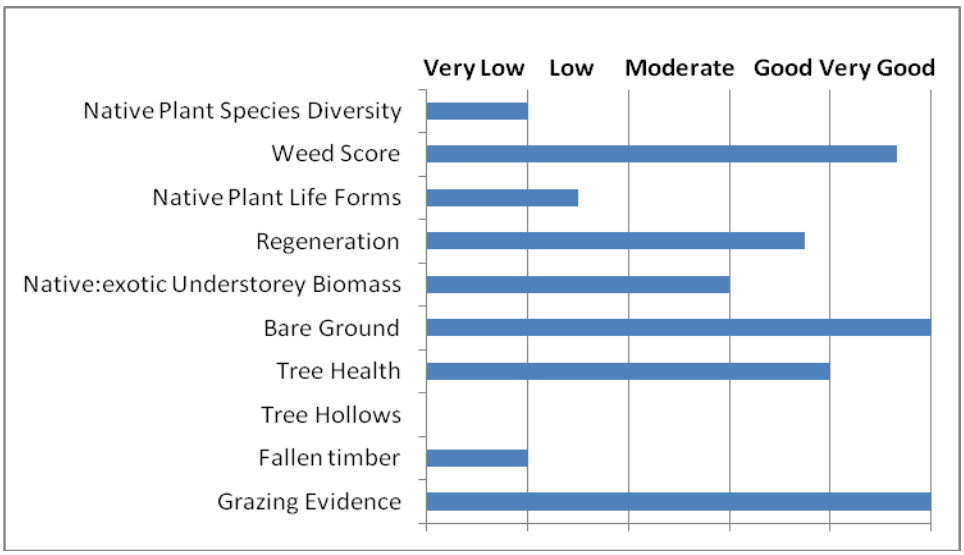


Figure 21. BushRat Assessment Association 8 against Benchmark community

4.1.3 Significant weed species

Thirty nine exotic species were observed within the project site. Eight of these species are classed as declared under the *Natural Resources Management Act 2004*, and a further 10 were considered environmental weeds (Table 3). Environmental weeds have the potential to cause significant environmental impacts, however their control is not legislated. Landholders are obliged to control declared weeds on their property, as they are known to cause significant economic, social and environmental impacts.

Table 3. Declared and environmental weeds.

Species Name	Common Name	Declared	Environmental
Arctotheca calendula	Cape Weed		✓
Asphodelus fistulosus	Onion Weed		✓
Avena barbata	Bearded Oat		✓
Briza minor	Lesser Quaking-grass		✓
Echium plantagineum	Salvation Jane	✓	
Euphorbia terracina	False Caper	✓	
Galenia pubescens var. pubescens	Coastal Galenia		✓
Hypochaeris radicata	Rough Cat's Ear		✓
Lycium ferocissimum	African Boxthorn	✓	
Marrubium vulgare	Horehound	✓	
Olea europaea ssp. europaea	Olive	✓	
Opuntia sp.	Prickly Pear	✓	
Oxalis pes-caprae	Soursob	✓	
Pinus radiata	Radiata Pine		✓
Rosa canina	Dog Rose	✓	
Salvia verbenaca var.	Wild Sage		✓
Scabiosa atropurpurea	Pincushion		✓
Schinus molle	Pepper-tree		✓

Status:
Declared: Declared plant under the *Natural Resources Management Act 2004*.
Environmental: Environmental weed (DTEI Environmental Weeds List).

4.2 Bird Survey

A total of 216 bird observations of 34 bird species (including three introduced species) were recorded at random locations throughout the project area (**Error! Reference source not found.**). The Meliphagidae Family was most represented with six bird species observed. These species were the Red Wattlebird (*Anthochaera carunculata*), Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*), White-plumed Honeyeater (*Lichenostomus penicillatus*), Singing Honeyeater (*Lichenostomus virescens*), Brown-headed Honeyeater (*Melithreptus brevirostris*) and New Holland Honeyeater (*Phylidonyris novaehollandiae*). The Musk Lorikeet (*Glossopsitta concinna*) (39 individuals) and the Australian Magpie (*Gymnorhina tibicen*) (25 individuals) were the most abundant species present.

Three state threatened species were located within the new SEB area during the bird survey, the Rare Glossy Ibis (*Plegadis falcinellus*) and White-winged Chough (*Corcorax melanorhamphos*), and the Vulnerable Diamond Firetail (*Stagonopleura guttata*). Each species is further described below.

Glossy Ibis (*Plegadis falcinellus*)

Two individuals of the Glossy Ibis (*Plegadis falcinellus*) were located within the Ferguson (1) property within the vicinity of the Exotic Grassland / Grazing Land association, and amenity plantings in the adjacent property. The Glossy Ibis frequents swamps and lakes throughout much of the Australian mainland, but is most numerous in the north. It is a non-breeding visitor to Tasmania and the south-west of Western Australia. The Glossy Ibis requires shallow water and mudflats, so is found in well-vegetated wetlands, floodplains, mangroves and rice fields.

The Glossy Ibis is both migratory and nomadic. Its range expands inland after good rains, but its main breeding areas seem to be in the Murray-Darling Basin of New South Wales and Victoria, the Macquarie Marshes in New South Wales, and in southern Queensland. Glossy Ibis often move north in autumn then return south to their main breeding areas in spring and summer. This species is likely to be an infrequent visitor to the SEB monitoring sites, based on the proximity of the site to floodplain areas near the Murray River at Murray Bridge.

Diamond Firetail (*Stagonopleura guttata*)

The methodology used as part of the fauna monitoring within the new SEB areas, is a replica of those used within the ML. This included targeted surveys on conservation rated species including the state vulnerable Diamond Firetail. Surveying for the Diamond Firetail involved a roaming process within a wooded habitat. The species preferred habitat type consists of *Eucalyptus odorata* (Peppermint Box) Woodland. Although there was no such habitat located within the Mulewa property a single Diamond Firetail was observed and heard calling from a power line which stretched across the *Melaleuca uncinata* plantation and the Planted Windbreak / Amenity Planting association. This was the only observation of Diamond Firetail recorded within both the ML and new SEB areas during the 2014 spring survey.

Diamond Firetails typically live in a wide range of eucalypt dominated vegetation communities usually consisting of a grassy understory, including woodland, forest and mallee. They are ground-feeders that predominantly eat ripe and half-ripe seeds of various grasses but are also known to feed on seeds of herbs, bushes and trees.

White-winged Chough (*Corcorax melanorhamphos*)

The *White-winged Chough* has a state listing of Rare, and is considered to be uncommon in the; eleven individuals were recorded within the new SEB project area on the Mulewa property within the Planted Windbreak association. White-winged Choughs are found in open forests and woodlands. They tend to prefer the wetter areas, with lots of leaf-litter, for feeding, and available mud for nest building. They forage through the leaf litter; the diet includes termites, beetles, worms, insects, grain, and snails. White-winged Choughs build deep, cup-shaped nest of grasses held together with mud or sometimes manure in a tree fork. Breeding is communal with all members of the family helping to raise the young. It is not uncommon to observe White-winged Choughs around the Kanmantoo Mine Area, with 34 individuals and numerous nests also observed within the ML during the spring 2014 survey.

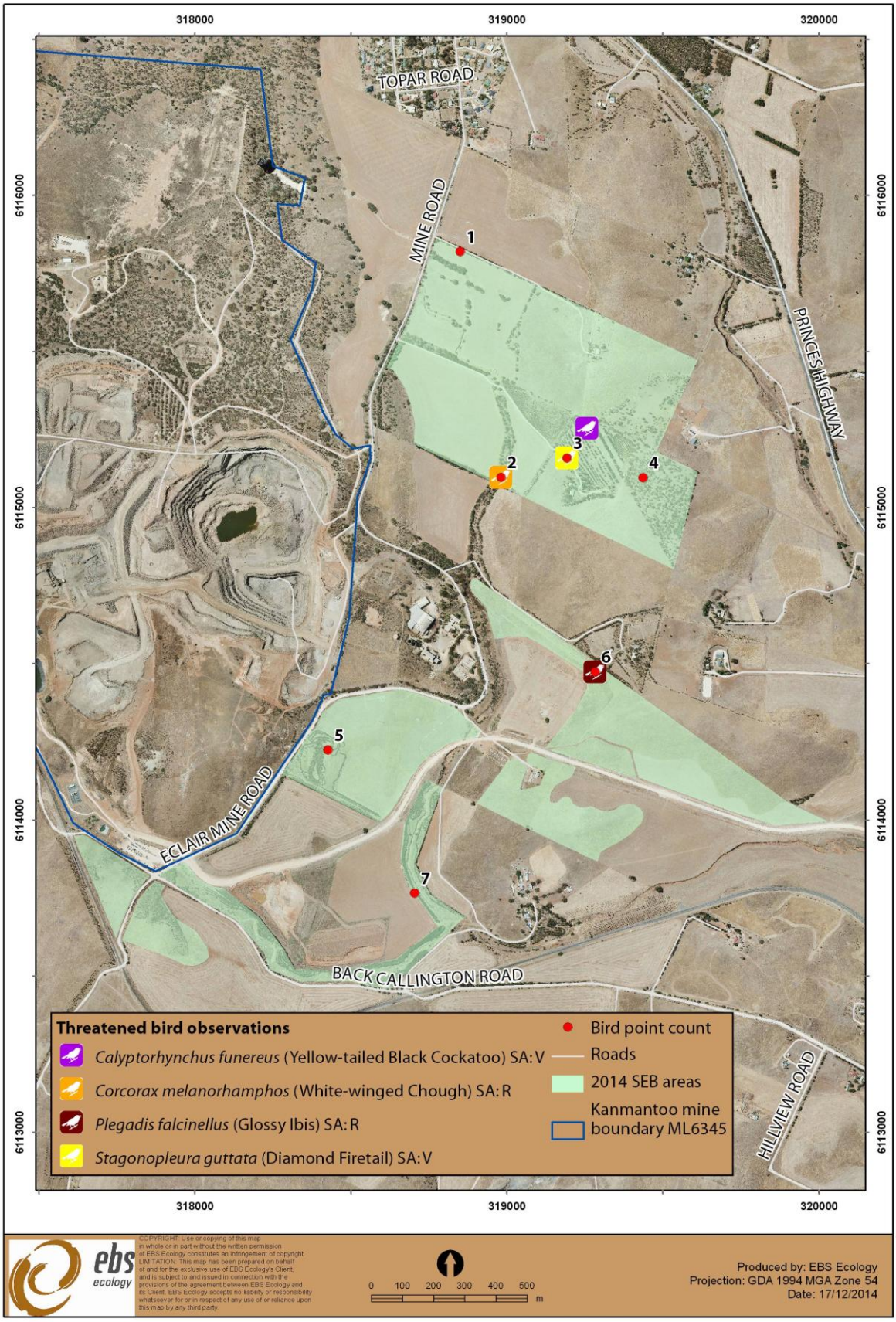


Figure 22. Location of bird surveys and threatened bird observations.

4.3 Mammal and nocturnal fauna survey

A total of six fauna species were observed within the new SEB areas during the flora assessment and include two bird species, three mammals and one reptile species (Table 4). One conservation significant species was detected during the field survey, the state vulnerable Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*).

Three mammal species were recorded during the spotlighting survey, the Western Grey Kangaroo (*Macropus fuliginosus*), the European Rabbit (*Oryctolagus cuniculus*) and the Common Brushtail Possum (*Trichosurus vulpecula*) (Table 4). The targeted state rare Common Brushtail Possum was observed during the survey, with nine observations (Figure 18).

Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*)

A flock of 15 Yellow-tailed Black Cockatoos were observed during the flora assessment, with all individuals being at flight when observed. The habitat over which they were flying was the *Pinus radiata* and *Callitris gracilis* plantations.

The species prefers mainly stringybark forests and woodlands with a heath understory and adjacent pines. They have also benefitted from large scale pine plantations, finding this a ready source of available food. As a result large flocks can often be found in and around these plantations. They have also been noted within areas of the Mount Lofty Ranges preferring broad vegetation groups consisting of grassy woodland, heath woodland and heath forest.

Common Brushtail Possum (*Trichosurus vulpecula*)

The Common Brushtail Possum was observed within eight different locations, some within close proximity of each other. The Brushtail Possum was located within the Mulewa, Ferguson (1 & 3), Lot 25 and the Carmen properties, mostly within or close to the Planted Windbreak / Amenity Planting association.

The Common Brushtail Possum (*Trichosurus vulpecula*) is listed as rare in South Australia due to suffering a significant decline in abundance and reduction in its range across the state, mainly brought about by loss of habitat and predation. They are commonly found at night in the canopies of eucalypt and she-oak woodlands, mainly feeding on the leaves, flowers and fruits. They often use tree hollows as preferred den sites which are generally around 10 cm in diameter (Ecological Associates 2006). Suitable feeding and possible nesting habitat in mature eucalypts would be available across the site in the scattered groups of eucalypts (Planted Windbreaks), however they have limited mobility across fragmented landscapes, and are vulnerable to fox and cat predation inhibiting their ability to relocate to other suitable areas (Ecological Associates 2006). It is unknown how far individuals will move to find necessary resources.

Table 4. Fauna species identified during the field survey and spotlighting.

Scientific Name	Common Name	Method	Conservation Status		Total number observed
			AUS	SA	
Birds					
Calyptorhynchus funereus	Yellow-tailed Black Cockatoo	Observed (within the Pinus Radiata and Callitris gracilis plantation)		V	15
Gymnorhina tibicen	Australian Magpie	Observed (scattered throughout the project area)			5
Mammals					
Macropus fuliginosus	Western Grey Kangaroo	observed, scats, spotlighting (scattered throughout the project area)			15
*Oryctolagus cuniculus**	European Rabbit	warrens, scats, diggings, spotlighting (scattered throughout the project area)			8
*Ovis aries**	Sheep	observed, scats			-
Trichosurus vulpecula	Common Brushtail Possum	Spotlighting (scattered throughout the project area)		R	9
Reptiles					
Tiliqua rugosa	Sleepy Lizard	Observed (Mine Rd and Mulewa property)			3

* denotes exotic species

SA: South Australia (*National Parks and Wildlife Act 1972*). **Conservation Codes: V:** Vulnerable, **R:** Rare

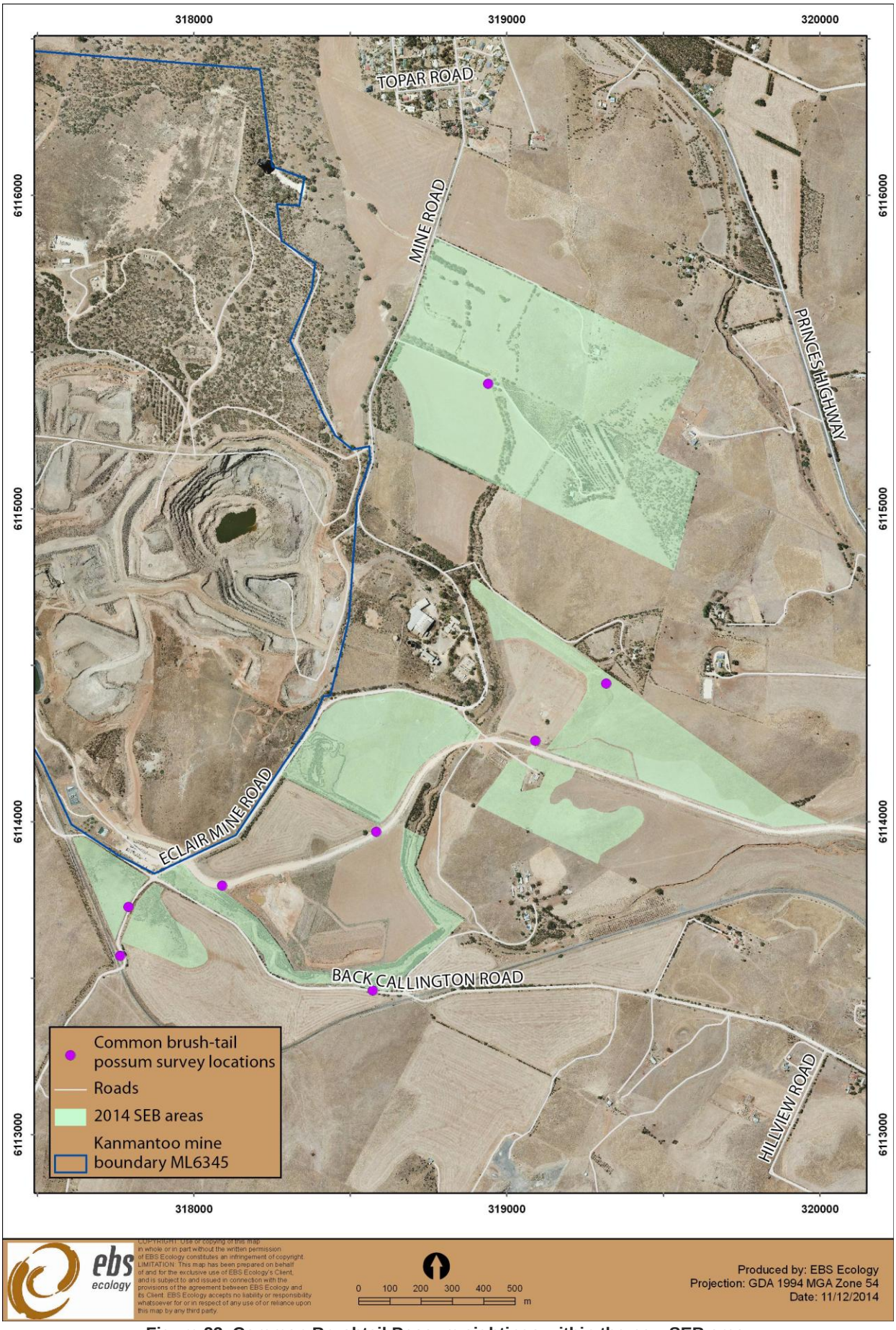


Figure 23. Common Brushtail Possum sightings within the new SEB area.

A total of 12 rabbit warrens were located across the five properties (Table 5, Figure 20). Some warrens have several entrances and had evidence of being active (scats and tracks) (Figure 19). It is possible that not all rabbit warrens were detected during the current survey. There were no evident signs of fox activity observed during the survey.

Table 5. Rabbit warren locations.

Easting	Northing	Comments	Property
319519	6115413	Active	141 Mine Road
319428	6115361	Active	141 Mine Road
319374	6115261	Active	141 Mine Road
318940	6115398		Mulewa
319266	6114508	Active	Ferguson
319318	6114441		Ferguson
319091	6114258		Ferguson
318583	6113967		Ferguson
318572	6113460		Lot 25
318090	6113795		Lot 25
317765	6113571		Carmen's
317791	6113727		Carmen's



Figure 24. Rabbit warrens located on the 141 Mine Road property.

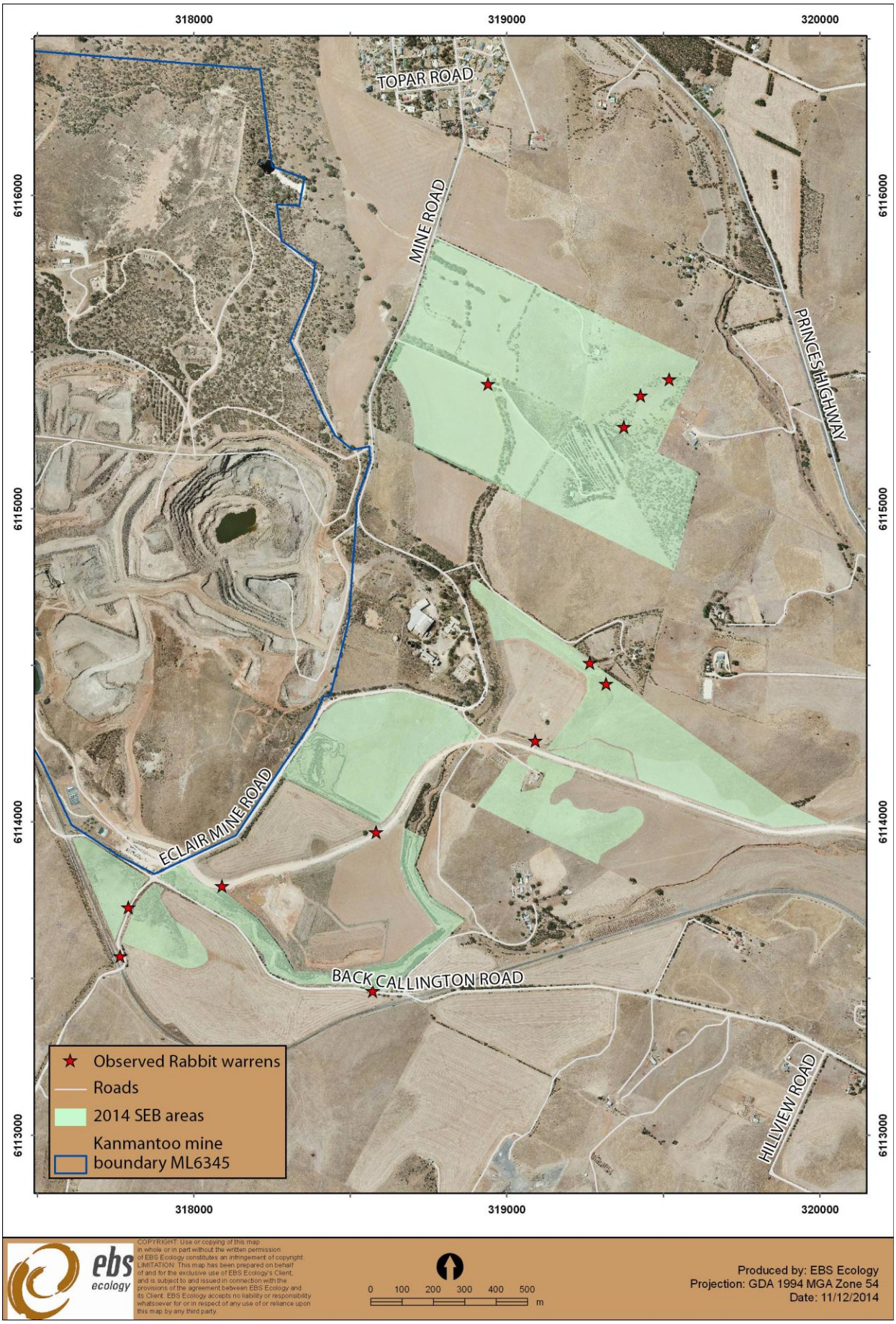


Figure 25. Rabbit warren locations within the new SEB area.

5 PROPERTY ASSESSMENT

141 Mine Road

The 141 Mine Road property encompasses several associations and included Mixed Mallee, Exotic Grassland (grazing), Cropping Land and a Planted Windbreak / Amenity Plantings associations (Figure 21). The overall condition of this property was very poor.

There were several active and large rabbit warrens with several entrances/exits observed within this property, the majority located toward the south eastern part of the property within the Mixed Mallee association. Refer to Table 5 and Figure 20 for warren locations.

Recommendations

- Remove exotic amenity plantings around the dwelling
- Retain planted windbreaks
- Undertake rabbit control, warren ripping
- Remove and control woody weeds such as Dog Rose and Boxthorn
- Enhance the vegetation within Association 1 in the south east of the property with typical mallee understorey species
- Erect bat and/or bird boxes within association 1
- Undertake revegetation of the exotic grassland and the cropping land
- Assess the erosion and undertake mitigation measures if required

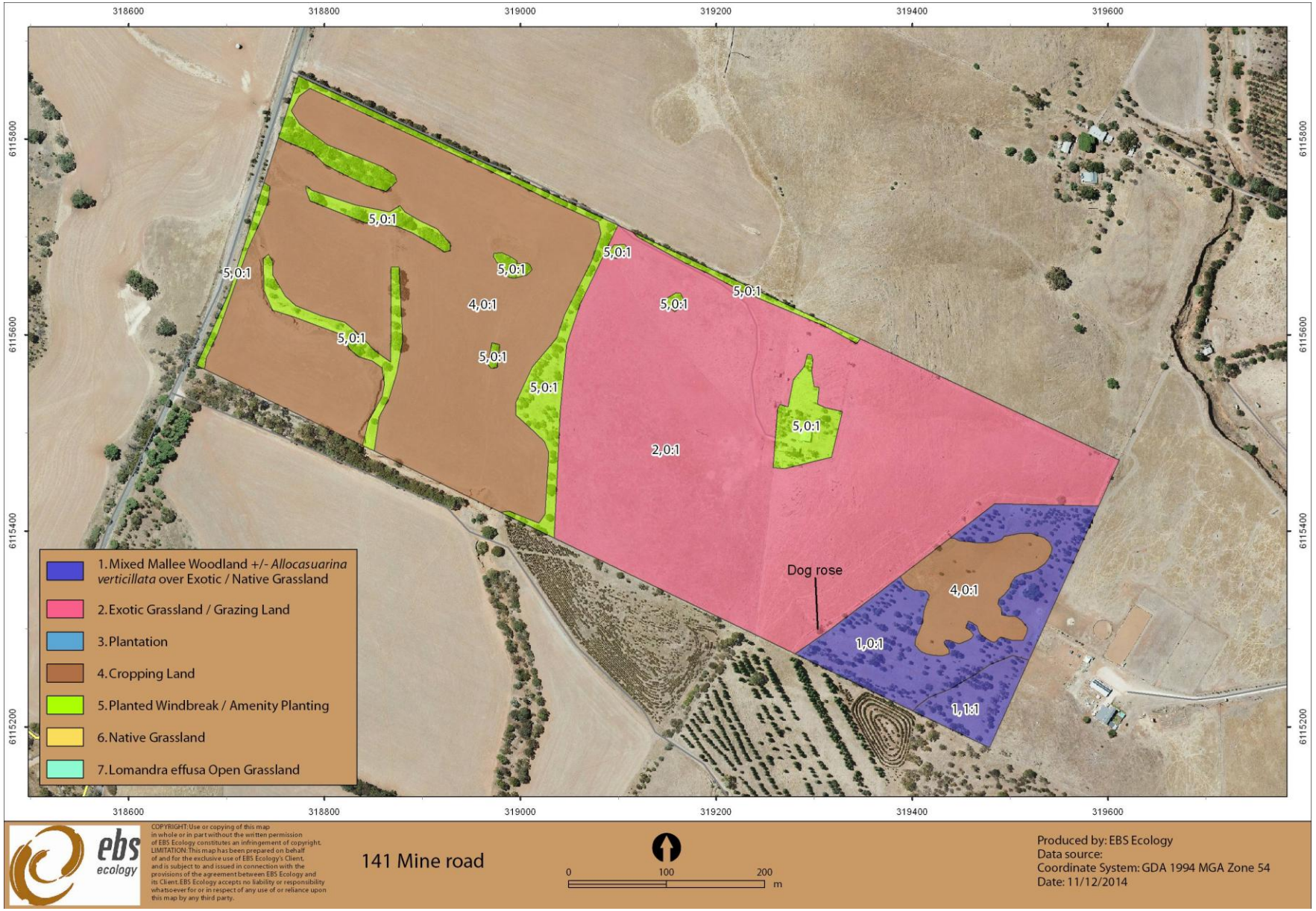


Figure 26. Current vegetation associations and condition of the 141 Mine Road property.

Mulewa

The associations located on the Mulewa property include Mixed Mallee, Exotic Grassland (grazing), Plantation, Cropping land and Planted Windbreak / Amenity Plantings (Figure 22). The majority of the property was in very poor condition. The Mixed Mallee located in the north eastern section of the property was in moderate condition and contained a good mix of native species.

There were three different sections on the property with a plantation association, two of which contained *Melaleuca uncinata* (Broom Bush) and one which contained *Pinus radiata* (Radiata Pine) and *Callitris gracilis* (Southern Cypress Pine). There were very few understorey species located in the plantation association. It is recommended that the Broom Bush and the Southern Cypress Pines are to be thinned out allowing the understorey to regenerate. It is also recommended that the Radiata Pines are removed and replanted with species similar to the adjacent mixed mallee association because the seeds are spread by Cockatoos and are invasive to other natural stratums.

Recommendations

- Remove exotic amenity plantings around the dwelling
- Retain planted windbreaks
- Undertake rabbit control, warren ripping where required
- Undertake weed control where required
- Retain the vegetation within Association 1 in the north east of the property, undertake weed control where necessary.
- Erect bat and/or bird boxes within association 1
- The vegetation within Association 1 may be used as a seed source for revegetation purposes
- Remove the Radiata Pine in the plantation association
- Thin out the Broom Bush and the Southern Cypresss Pine to allow natural regeneration of the understorey or undertake revegetation
- Undertake revegetation of the exotic grassland and the cropping land
- Assess the erosion and undertake mitigation measures if required

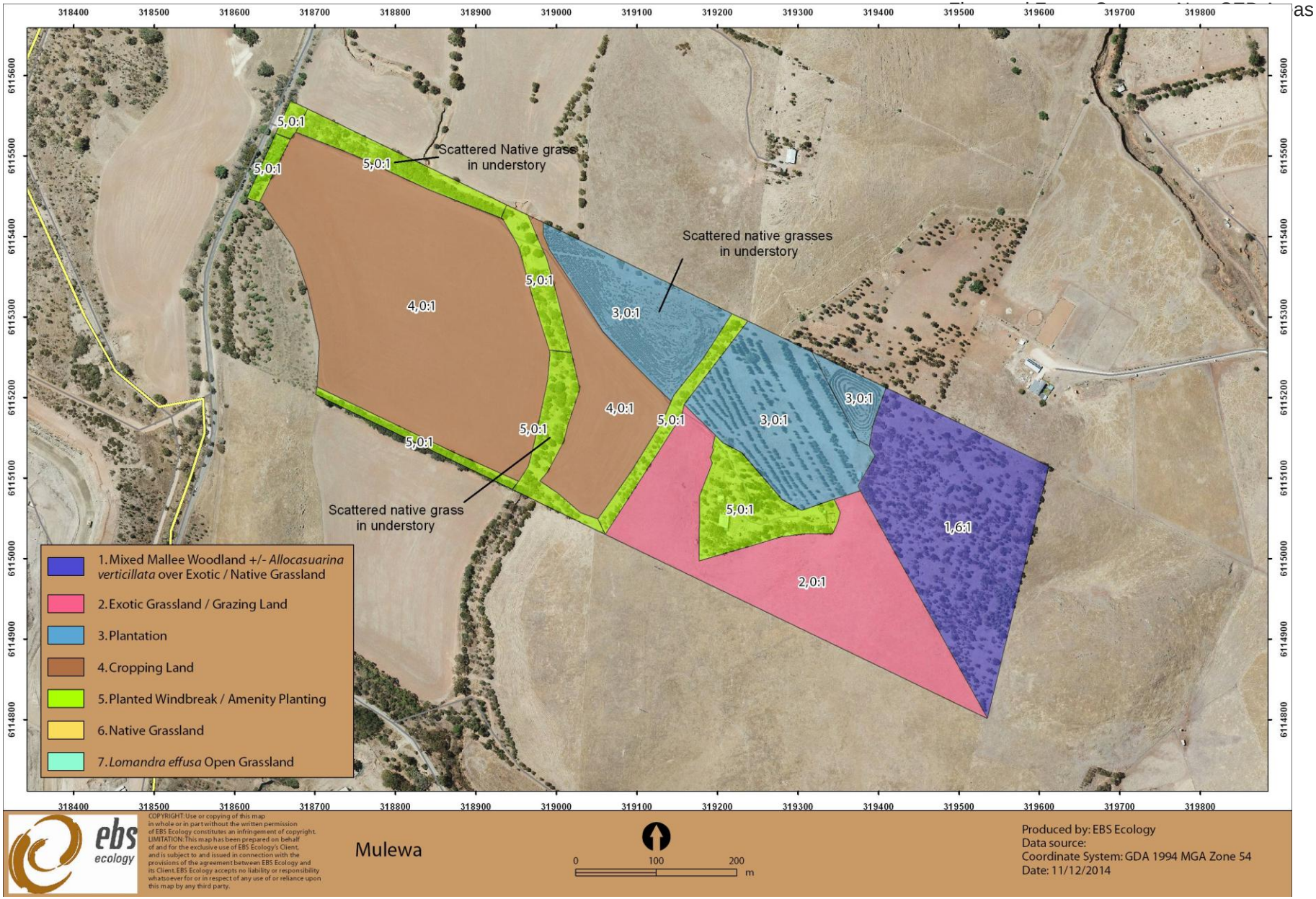


Figure 27. Current vegetation associations of the Mulewa property.

Ferguson

The associations located on the Ferguson properties include an Exotic Grassland (grazing), Cropping Land, Planted Windbreak / Amenity Planting and a Native Grassland (Figures 23, 24 and 25). The majority of the property was in very poor condition except for the Native Grassland which was considered to be in good condition.

The Ferguson property has been split into three different sections. Ferguson one was predominantly an exotic grassland with a small section of cropping land. There were also three areas which had evidence of revegetation of approximately two years of age. There was a stockpile site which was heavily infested with weeds. There were scattered native grasses such as Spear Grass and Wallaby Grass within the property.

Ferguson two was predominantly cropping land and an exotic grassland. Within the exotic grassland there were several patches of native grasses such as Spear Grass and Wallaby Grass. There was also a small patch of scattered *Lomandra effusa* (Scented Mat-rush). The Ferguson two sections also contained an amenity planting undertaken by direct seeding.

Ferguson three was predominantly encompassed by an exotic grassland / grazing land with scattered *Maireana brevifolia* (Short-leaf Bluebush). There was a small patch of native grassland on the property towards the eastern side.

Recommendations

- Remove exotic amenity plantings around the dwelling
- Retain the Planted Windbreaks / Amenity Plantings (revegetation)
- Undertake rabbit control, warren ripping where required
- Undertake weed control where required
- Undertake revegetation of the exotic grassland and the cropping lands within all three sections
- Undertake weed control within the Native Grassland Association
- Undertake regular weed control on the stockpiles within section1

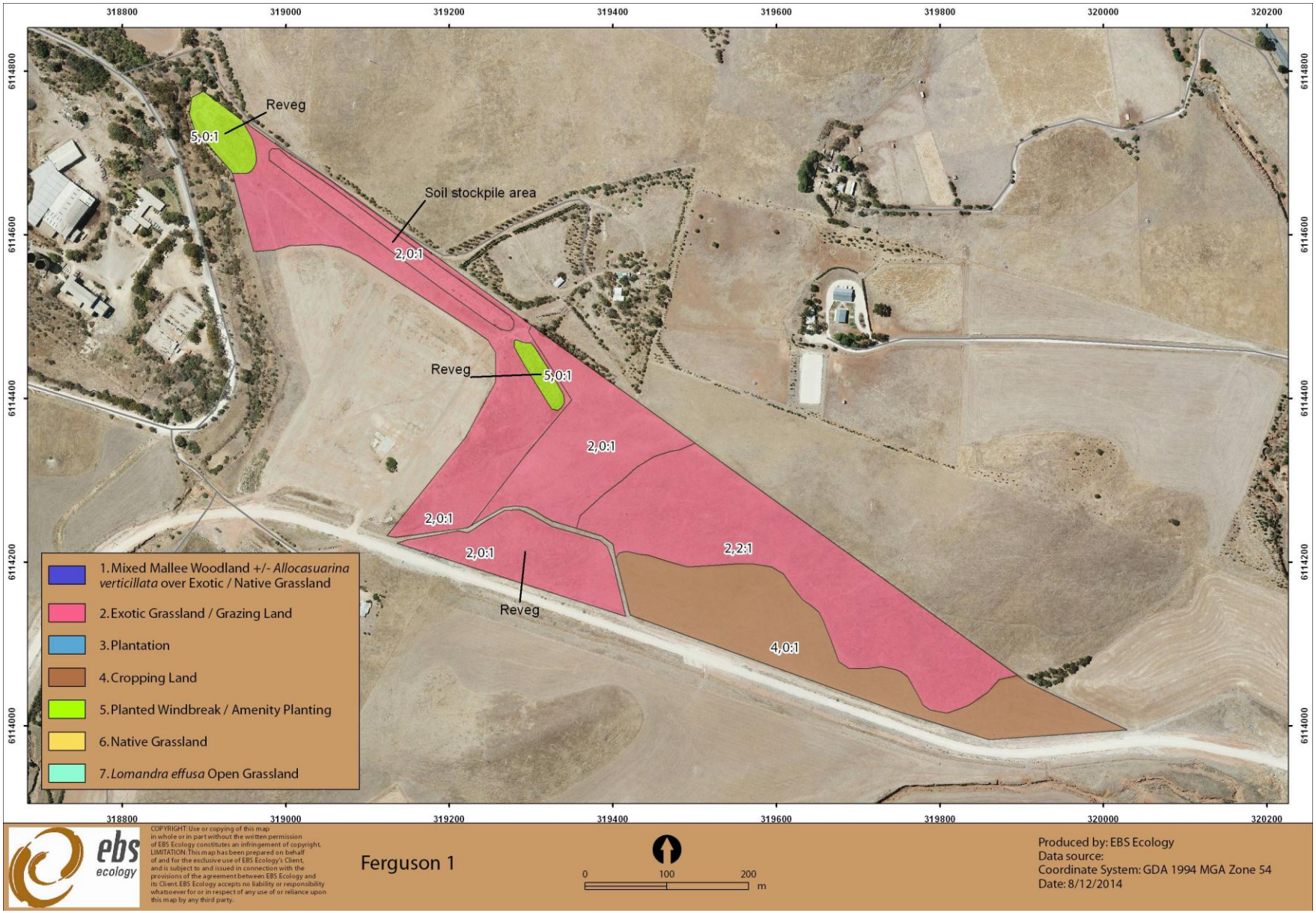


Figure 28. Current vegetation associations and condition of the Ferguson 1 property.

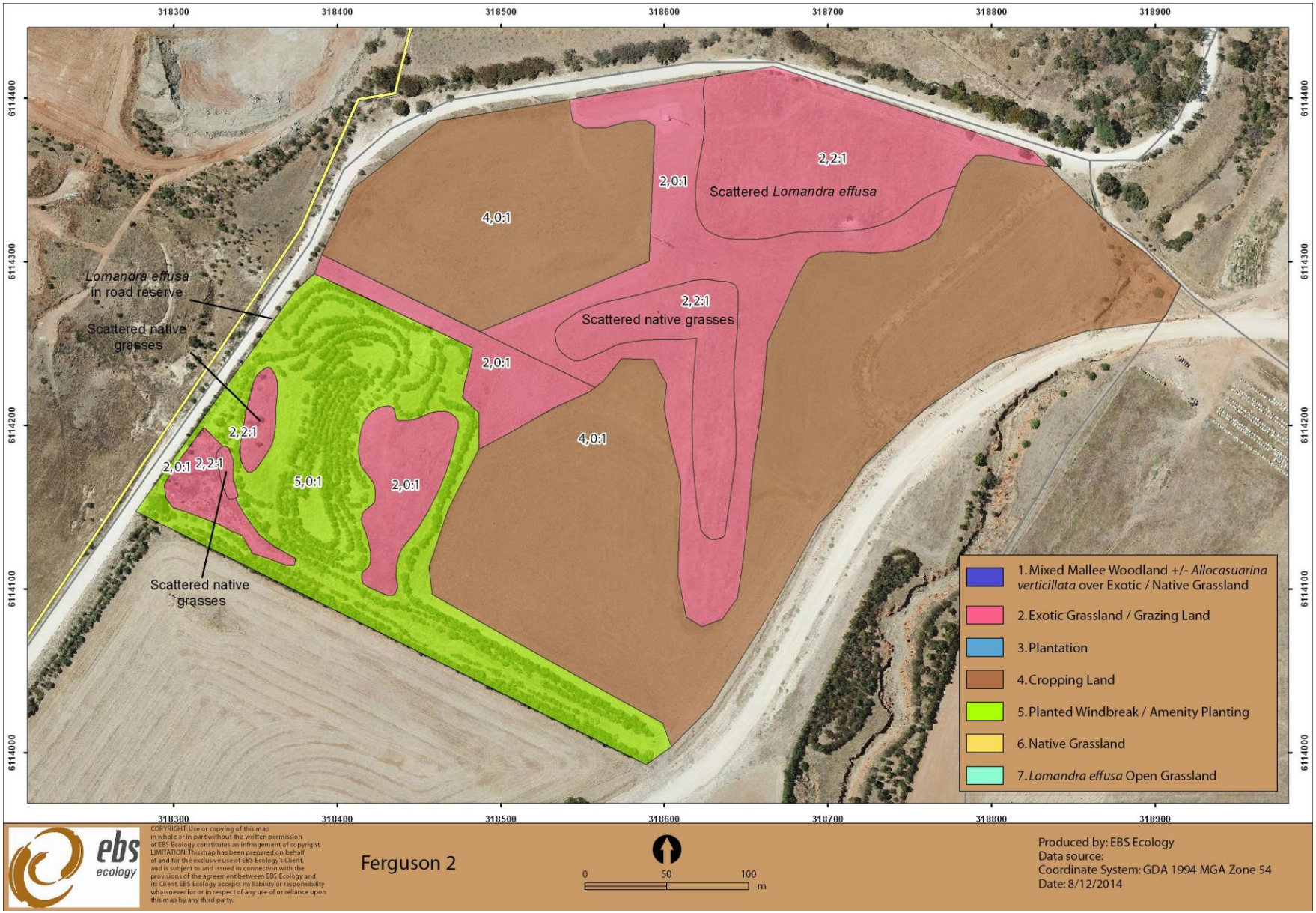


Figure 29. Current vegetation associations and condition of the Ferguson 2 property.



Figure 30. Current vegetation associations and condition of the Ferguson 3 property.

Lot 25

Lot 25 contained several vegetation associations including Exotic Grassland, Planted Windbreak / Amenity Planting, *Lomandra effusa* (Scented Mat-rush) Open Grassland and *Acacia pycnantha* (Golden Wattle) Tall Shrubland (Figure 26). The condition of the vegetation was predominantly very poor with one patch toward the south western end of the property which was of moderate condition.

Several patches of the *Lomandra effusa* Open Grassland was located within this property. This association was located within the mid section of the property and along the roadside. There was a drainage line that ran through the property, toward the north eastern end it was infested with *Cynara cardunculus* ssp. *flavescens* (Artichoke Thistle).

The understorey within the Planted Windbreak consisted of moss and leaf litter, providing habitat for small reptiles and invertebrates. The patch of vegetation in the north-west corner had a mix of overstorey and understorey species, including a good leaf littler cover and moss.

There was a small patch of remnant *Acacia pycnantha* (Golden Wattle) Tall Shrubland. This association was isolated and the understorey was predominantly exotic with some native species persisting.

Recommendations

- Retain the Planted Windbreaks / Amenity Plantings (revegetation)
- Undertake rabbit control, warren ripping where required
- Undertake weed control where required, in particular where *Lomandra effusa* is present
- Eradicate the Artichoke Thistle along the drainage line



Figure 31. Current vegetation associations and condition of Lot 25.

Carmens

The Carmen property was a mix of an Exotic Grassland and Amenity Plantings, the vegetation condition was very poor (Figure 27). There were several native grass and *Acacia pycnantha* patches located within the property. Two Rabbit warrens were located within close proximity to the roadside.

Recommendations

- Retain the Amenity Plantings
- Undertake rabbit control / warren ripping where required
- Undertake weed control where required
- Undertake revegetation of the exotic grassland

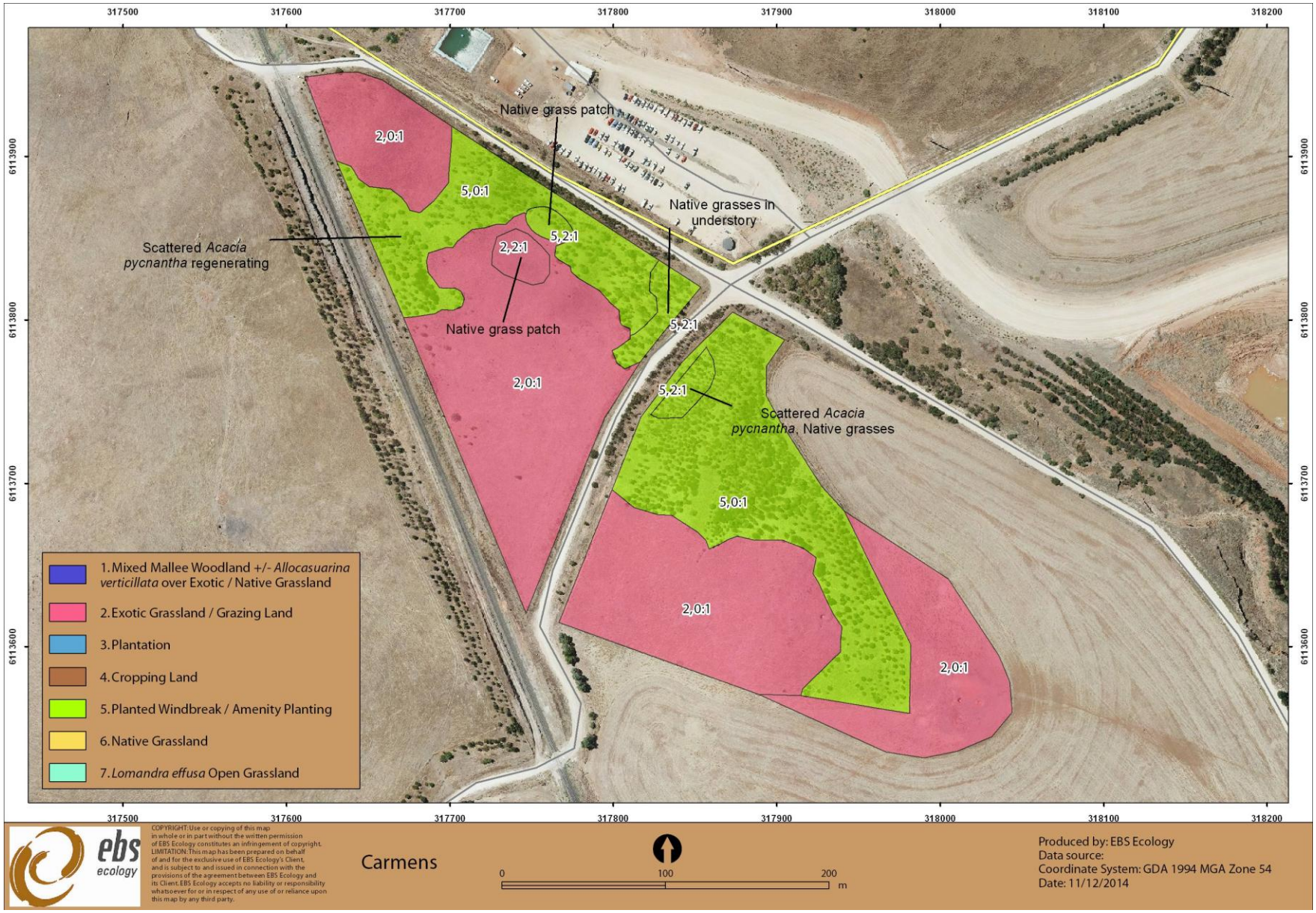


Figure 32. Current vegetation associations and condition of the Carmen's property.

6 REFERENCES

Coffey Natural Systems (2009) *Mining and Rehabilitation Program, Main Report - Kanmantoo Copper Project.* Coffey Natural Systems Pty Ltd, Adelaide.

Ecological Associates (2006) *Distribution and status of Brushtail Possums on the Lower Eyre Peninsula following the January 2005 bushfire*. Prepared for the Department for Environment and Heritage.

Pizzey, G. and Knight, F. (1997) *Field Guide to the Birds of Australia.* Angus and Robertson, Sydney.

7 APPENDICES

Appendix 1. Species list for each vegetation association

Species Name	Common Name	Conservation Status		Association							
		AUS	SA	1	2	3	4	5	6	7	8
Acacia argyrophylla	Silver Mulga-bush			✓							
Acacia cyclops	Western Coastal Wattle			✓							
Acacia melanoxylon	Blackwood			✓							
Acacia paradoxa	Kangaroo Thorn			✓							
Acacia pycnantha	Golden Wattle				✓					✓	✓
**Agave sp.*	Century Plant							✓			
**Aira sp.*	Hair-grass			✓							
Allocasuarina verticillata	Drooping Sheoak			✓	✓						
**Arctotheca calendula*	Cape Weed				✓					✓	
Aristida contorta	Curly Wire-grass				✓				✓	✓	
**Asphodelus fistulosus*	Onion Weed				✓						
Atriplex semibaccata	Berry Saltbush									✓	
Austrostipa blackii	Crested Spear-grass				✓			✓		✓	
Austrostipa elegantissima	Feather Spear-grass				✓					✓	
Austrostipa scabra ssp.	Rough Spear-grass			✓	✓				✓		
**Avena barbata*	Bearded Oat			✓	✓	✓	✓	✓	✓	✓	✓
**Briza minor*	Lesser Quaking-grass			✓	✓						
**Bromus diandrus*	Great Brome				✓				✓	✓	
Bursaria spinosa ssp. spinosa	Sweet Bursaria			✓							
Callistemon sp.	Bottlebrush										
Callitris gracilis	Southern Cypress Pine			✓		✓		✓			
Chloris sp.	Windmill Grass/Chloris				✓					✓	
Convolvulus remotus	Grassy Bindweed				✓				✓		
Correa glabra var.	Rock Correa			✓							
**Corymbia maculata*	Spotted Gum							✓			
**Cynara cardunculus ssp. flavescens*	Artichoke Thistle				✓					✓	
Dianella revoluta var.	Black-anther Flax-lily							✓			
Dodonaea viscosa ssp. spatulata	Sticky Hop-bush			✓							
**Echium plantagineum*	Salvation Jane			✓	✓	✓	✓	✓	✓	✓	✓
Enchylaena tomentosa var. tomentosa	Ruby Saltbush			✓						✓	✓
Enneapogon nigricans	Black-head Grass			✓	✓				✓	✓	
Eremophila longifolia	Weeping Emubush			✓							
**Erodium botrys*	Long Heron's-bill				✓						
Eucalyptus cladocalyx ssp.	Sugar Gum			✓				✓			
Eucalyptus conglobata ssp. conglobata	Port Lincoln Mallee		R*					✓			
Eucalyptus fasciculosa	Pink Gum		R					✓			
Eucalyptus leucoxylon ssp.	South Australian Blue Gum			✓				✓			
Eucalyptus odorata	Peppermint Box			✓				✓			
Eucalyptus porosa	Mallee Box							✓			
Eucalyptus socialis ssp.	Beaked Red Mallee			✓							
Eucalyptus sp.				✓			✓				
**Euphorbia terracina*	False Caper				✓			✓		✓	✓
**Ficus carica*	Edible Fig							✓			
**Galenia pubescens var. pubescens*	Coastal Galenia			✓	✓					✓	
Glycine sp.	Glycine				✓						
**Glycyrrhiza glabra*	Liquorice								✓		
**Gomphocarpus cancellatus*	Broad-leaf Cotton-bush			✓	✓					✓	

Species Name	Common Name	Conservation Status		Association							
		AUS	SA	1	2	3	4	5	6	7	8
Haloragis aspera	Rough Raspwort				✓						
**Hordeum vulgare*	Barley			✓	✓	✓	✓	✓		✓	
**Hypochaeris glabra*	Smooth Cat's Ear			✓	✓					✓	
**Hypochaeris radicata*	Rough Cat's Ear								✓		
Juncus flavidus	Yellow Rush				✓					✓	
**Lolium sp.*	Ryegrass			✓						✓	
Lomandra effusa	Scented Mat-rush				✓			✓		✓	✓
Lomandra micrantha ssp.	Small-flower Mat-rush				✓			✓		✓	
Lomandra multiflora ssp. dura	Hard Mat-rush			✓							
**Lycium ferocissimum*	African Boxthorn				✓						
Maireana brevifolia	Short-leaf Bluebush				✓					✓	
Maireana enchylaenoides	Wingless Fissure-plant								✓	✓	
**Malva sp.*	Mallow				✓						
**Marrubium vulgare*	Horehound				✓						
Melaleuca lanceolata	Dryland Tea-tree			✓							
Melaleuca uncinata	Broombush					✓					
Myoporum platycarpum ssp.	False Sandalwood							✓			
**Nicotiana glauca*	Tree Tobacco			✓						✓	
**Olea europaea ssp. europaea*	Olive							✓			
**Opuntia sp.*	Prickly Pear				✓	✓					
**Oxalis pes-caprae*	Soursob				✓						
**Pinus radiata*	Radiata Pine							✓			
Pittosporum angustifolium	Native Apricot			✓							
Ptilotus parvifolius	Small-leaf Mulla Mulla				✓						
Ptilotus sp.	Mulla Mulla				✓				✓	✓	
Ptilotus spathulatus	Pussy-tails			✓						✓	
Rhagodia sp.	Saltbush			✓							
Rhodanthe floribunda	White Everlasting				✓					✓	
**Rosa canina*	Dog Rose			✓	✓						
Rytidosperma caespitosum	Common Wallaby-grass			✓	✓			✓	✓		
Rytidosperma setaceum	Small-flower Wallaby-grass			✓						✓	
Rytidosperma tenuius	Short-awn Wallaby-grass		R					✓			
Salsola australis	Buckbush				✓						
**Salvia verbenaca var.*	Wild Sage							✓		✓	
Santalum acuminatum	Quandong			✓							
**Scabiosa atropurpurea*	Pincushion				✓						
**Schinus molle*	Pepper-tree			✓	✓	✓					
Senecio sp.	Groundsel							✓			
Senna sp.	Senna			✓							
**Sisymbrium erysimoides*	Smooth Mustard				✓						
**Sisymbrium sp.*	Wild Mustard				✓				✓		
**Trifolium arvense var. arvense*	Hare's-foot Clover			✓	✓	✓				✓	
**Trifolium repens*	White Clover			✓	✓						
**Trifolium sp.*	Clover			✓	✓			✓	✓		
**Triticum aestivum*	Wheat				✓						
Vittadinia cuneata var.	Fuzzy New Holland Daisy				✓						
Vittadinia gracilis	Woolly New Holland Daisy				✓				✓		
**Vulpia myuros f.*	Fescue							✓			
Wahlenbergia sp.	Native Bluebell								✓		

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Appendix 3 EBS Restoration Annual Report 2024 – 2025



Kanmantoo Copper Mine
On-ground Environmental Management Report
2024-2025

Kanmantoo Copper Mine
On-ground Environmental Management Report
2024-25

01/09/25

Prepared by EBS Restoration for Hillgrove Resources

Document Control					
Report No.	Date issued	Authors	Reviewed by	Date Reviewed	Revision type
1.0	4/09/2025	S. McGovern	G. Glazier	5/09/2025	Draft

Distribution of Copies			
Report No.	Date issued	Media	Issued to
1.0	12/09/2025	Electronic	John Crocker, Hillgrove Resources

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CITATION: EBS (2022) *Kanmantoo Copper Mine, On-ground Environmental Management Report 2024-25,* Hillgrove Resources. EBS Restoration, Adelaide.

Front cover photo: *Eucalyptus odorata in seed, second generation from seed collected on site*

EXECUTIVE SUMMARY

EBS Restoration has continued to undertake rehabilitation activity on behalf of Hillgrove Resources since 2011. A wide range of environmental works have been carried out both within the mine lease, and on associated properties and infrastructure with a wider aim of assisting Hillgrove Resources to meet their environmental gaols and obligations contained within their own plans and relevant mining acts.

These programs and activities have rehabilitated disturbed areas within the lease, improved built landforms and assisted with the protection of native flora and fauna within the lease and surrounding areas, as well as illustrating to the local community Hillgrove's commitment to stewardship of the local environment.

On ground works undertaken during the 2024-2025 reporting period have been of a similar nature to the previous year, again largely due to there being no new areas added requiring rehabilitation.

Key outcomes from the 2024-2025 (01 Sep 2024 to 31 Aug 2025) reporting period include:

- A reduced seed collection program continued into the 2024-2025 period, with approximately 980 kilograms of seed remaining in storage at the EBS Warehouse.
- Provision of seed management services, including storage and handling of collected seed.
- Ongoing management of areas of existing vegetation, including remnant, rehabilitated and built landforms through weed control activities such as tractor slashing, spraying, brush cutting, pest control and woody weed control where appropriate.
- Maintenance of the Seed Production Area (SPA) is still at a reduced capacity (caretaker mode) - with a view towards possible future rejuvenation to ensure a continued source of material for future works programs if needed. Tasks include basic infrastructure maintenance, weeding and slashing.
- Maintenance and enhancement of the Seed Multiplication Area (SMA). Activities undertaken include broad acre slashing, spraying, targeted weed control, fence repairs, and pest control.
- Fire and risk reduction activities including firebreak boundary slashing, pedestrian access clearing, removal of fallen trees and organic material and infrastructure maintenance.
- Pest control activities including rabbit control through fumigation and warren destruction, rodent control around seed storage areas, and fence repairs to reduce risk of grazing pressure and unauthorised public access into areas of rehabilitation.
- Provision of seed samples to Botanic Gardens research laboratory for viability testing.

To date, approximately 140 hectares of hydroseeding, hand seeding, and pre-strip method seeding have been carried out on areas within the Mine lease and adjacent properties (including re-treatment of recalcitrant areas). These areas are continually maintained where necessary to the point where some locations are already self- sustaining communities of native habitat. Many of these locations consisted of

previously degraded farmland, waste landforms, and invasive species dominated areas with limited native vegetation cover.

The following recommendations are once again summarised:

- Rejuvenation of areas used for collecting native grass seed (primarily seeded SEB strips, SPA and SMA) - applicable areas have been used as a resource for multiple years and would benefit from activities such as surface material burning, addition of organic inputs, and additional over sowing of key species.
- Addition of tube stock planting, tree seeding and or niche seeding to improve biodiversity in existing SEB areas with a dominant cover of native grasses.

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1 INTRODUCTION

In accordance with requirements under the *Mining Act 1971* a PEPR (Program for Environmental Protection and Rehabilitation) this report outlines on-ground environmental management actions undertaken September 2024– September 2025. This report has been prepared for the Kanmantoo Copper Mine and Hillgrove Resources.

On-ground environmental action undertaken during the reporting period by EBS Restoration (September 2024 - September 2025) include:

- Provision of project management services
- Native seed collection, cleaning, storage, and inventory.
- Ongoing maintenance within rehabilitation locations including direct seeded pre-strips, hand direct seeding, and hydroseeding areas
- Weed control and enhancement within areas of existing vegetation
- Management of the Seed Production Area (SPA)
- Management of the Seed Multiplication Area (SMA)
- Ongoing management of declared weeds within the mine lease and associated properties
- General maintenance activities as instructed by Hillgrove resources, including infrastructure maintenance
- Tractor slashing, brush cutting, and knock down spraying to reduce fire and hazard risk along boundaries, fence lines and verges
- Invasive pest control, namely Rabbit control and exclusion of grazing animals

1.1 Seed collection, cleaning and management of seed

Throughout the 2024-25 reporting year period EBS Restoration once again undertook the collection, storage and management of native seed for Hillgrove Resources. The focus of seed collection -primarily native grass species- has again reduced significantly from previous years.

Collections occurred between November 2024 and April 2025, primarily in the seeded strips adjacent to the Access Road and the properties located at Mulawa,141 Mine Road and the remnant bushland within the mine lease.

As with previous years, the quantity of native grass seed collected has significantly reduced, with contributing factors such as reduced rainfall during the growth cycle leading up to collection, inclement weather during collection and reduction of progressional recruitment (self-seeding) within the grass strips. This is likely caused by a gradual reduction of the nutrient levels in the soil, with no inputs such as fertiliser or additional seed being applied since 2018-2019.

Recommendations to boost the microbial and plant health of these areas remain as follows:

- Bare/scant areas of cover to be re-sowed with available seed in stock
- Selected pockets of niche seeding/tree seeding to add variety of groundcover and grass species
- Application of fertiliser via liquid or granular delivery among affected areas
- Controlled cool seasonal burn of thatch material in grass strips

An additional possible site for seed collection has been identified by EBS along Back Callington Road (Refer Figure 3). This is a remnant Lomandra paddock owned by Hillgrove and has been rehabilitated during previous years and because of these activities is now presenting possible areas of grasses as a seed resource, mainly C4/Summer grasses such as Enneapogon and Themeda, along with cooler season grasses such as Rytidosperma and Austrostipa.
Removal of grazing pressure, along with successive years of slashing and broadleaf spraying has resulted in a good selection of native grass species in this area, along with assorted groundcover species.

As with previous years native grass collection was undertaken using a Grass Grabber mounted on an ATV. A vehicle trailer is used to safely transport the Grass Grabber/ATV combo between collection sites and to better facilitate the movement of the collected bales of seed.

Approximately 11 kilograms of Austrostipa sp. and Rytidospema were harvested from these areas before the decision was made to cease collections due to lack of available seed along with increased fire risk due to hot, windy conditions.

During late summer and early Autumn, remnant overstory species within the lease were also collected, including Eucalyptus and Allocasuarina. These species are an important part of any future revegetation plans and were collected on an opportunistic basis – reducing the impact of frequent harvesting of key cornerstone species within the remnant bushland within the mine lease.
Drying of collected seed was once again carried out in the EBS warehouse where it is also mulched and stored

Refer Table 1 for 2024--2025 seed collection tally

No excess seed was sold on behalf of Hillgrove Resources during the reporting period, as any remaining seed in stock may be needed for any possible future rehabilitation efforts on site.

During July of 2025, on behalf of Hillgrove EBSR supplied the Seed Research Centre at the South Australian Botanic Gardens with a selection of seed samples from the inventory, for the purposes of viability testing. At the time of writing, preliminary results have indicated that while generally favourable, results can be improved by adapting seed storage to suit different species.

Refer Table 2 for list of seed testing samples

Table 1. 2024-2025 seed collection tally

Species	Batch number	Collection location	Collection date	Amount March 2024
Austrostipa / Rytidosperma mix	EBSKAN283	Kanmantoo mine site and surrounds	Nov-24	11.200 kg
Eucalyptus odorata	EBSKAN285	Kanmantoo mine site and surrounds	Apr-25	1.110 kg
Maireana rohrlachii	EBSKAN286	Kanmantoo mine site and surrounds	Apr-25	0.110 kg
Eucalyptus calycogona	EBSKAN287	Kanmantoo mine site and surrounds	Apr-25	0.155 kg
Allocasuarina verticillata	EBSKAN288	Kanmantoo mine site and surrounds	Apr-25	0.105 kg
Eucalyptus socialis	EBSKAN289	Kanmantoo mine site and surrounds	Apr-25	0.360 kg
Eucalyptus camaldulensis	EBSKAN290	Kanmantoo mine site and surrounds	Apr-25	0.095 kg
		Total (kg)		**13.13 kg**

Table 2. Seed viability testing list

HILLGROVE SEED VIABILITY TESTING		
EUCALYPT SPECIES	BATCH NUMBER	COLLECTION DATE
Eucalyptus camaldulensis	EBSKAN25	2011
Eucalyptus phenax	EBSKAN95	Feb-14
Eucalyptus odorata	EBSKAN226	Jan-19
Eucalyptus odorata	EBSKAN285	Apr-25
GRASS SPECIES		
Themeda triandra	EBSKAN200	Dec-17
Austrostipa/Rytidosperma mix	EBSKAN270	Nov-20
Austrostipa/Rytidosperma mix	EBSKAN280	Nov-22
Austrostipa/Rytidosperma mix	EBSKAN283	Nov-24
HARD COAT SPECIES		
Acacia argyrophylla	EBSKAN93	Dec-13
Enchylaena tomentosa	EBSKAN176	Feb-16
Kennedia prostrata	EBSKAN237	Dec-18
Haredenbergia violacea	EBSKAN257	Dec-19
Acacia acinacea	EBSKAN259	Nov-19
COMPOSITAE / ASSTD		
Vittadinia blackii	EBSKAN157	Oct-15
Allocasuarina verticillata	EBSKAN227	Nov-18
Maireana brevifolia	EBSKAN247	Feb-19
Helichrysum leucopsideum	EBSKAN253	Nov-19
Cullen australasicum	EBSKAN265	Jan-20
Cullen australasicum	EBSKAN271	Nov-20
Maireana brevifolia	EBSKAN274	Mar-21
Maireana rohrlachii	EBSKAN286	Apr-25



Figure 1 ***Eucalyptus socialis*** **- Opportunistic remnant collections from within mine lease, March 2025**



Figure 2 Assorted *Eucalyptus* species – mine lease collections April 2025



Figure 3 ***Lomandra effusa*** **and summer grassland – post tractor slashing, Back Callington rd**

1.2 Revegetation

No further revegetation activities were undertaken during the 2024-2025 reporting period. Hand weeding, selective spot spraying and brush cutting has continued to be carried out around all existing plantings, with the aim of reducing competition from invasive species and to increase the chances of successful establishment and recruitment. Ongoing weed control will continue to be carried out as necessary in the following reporting period to ensure optimal success of planted species and to prevent further invasive species spreading throughout these areas.

Previously planted species from tube stock, including mid and overstorey species have now become well established amongst the revegetation areas, and are now at the stage where they are providing seed for continued recruitment and valuable habitat for fauna species.

Continual monitoring of these areas is important to prevent the introduction of new invasive species into areas of SEB and revegetation, with species such as African Daisy *(Gazania sp.*), Calomba daisy (*Oncosiphon suffruticosum*) and Rhodes Grass (*Chloris virgata)* having been recently recorded in isolated areas around the lease and associated properties. Species such as these can cause significant detrimental impact on areas of rehabilitation, out-competing native species and causing years of works remove established communities. Calomba and African daisy populations are greatly reduced from earlier years, illustrating effectiveness of continued monitoring and control methods.

EBSR, on behalf of Hillgrove once again assisted Second Nature Conservancy (formerly GWLAP) with equipment and resources to set-up and re-stock a holding area for consumables required to carry out an ongoing project, with aims to provide a vegetation corridor throughout the greater Kanmantoo/Callington region. This joint effort between Hillgrove resources and allied external environmental projects is a good illustration of their commitment to their long-term environmental goals, and fostering a good relationship with the local community.

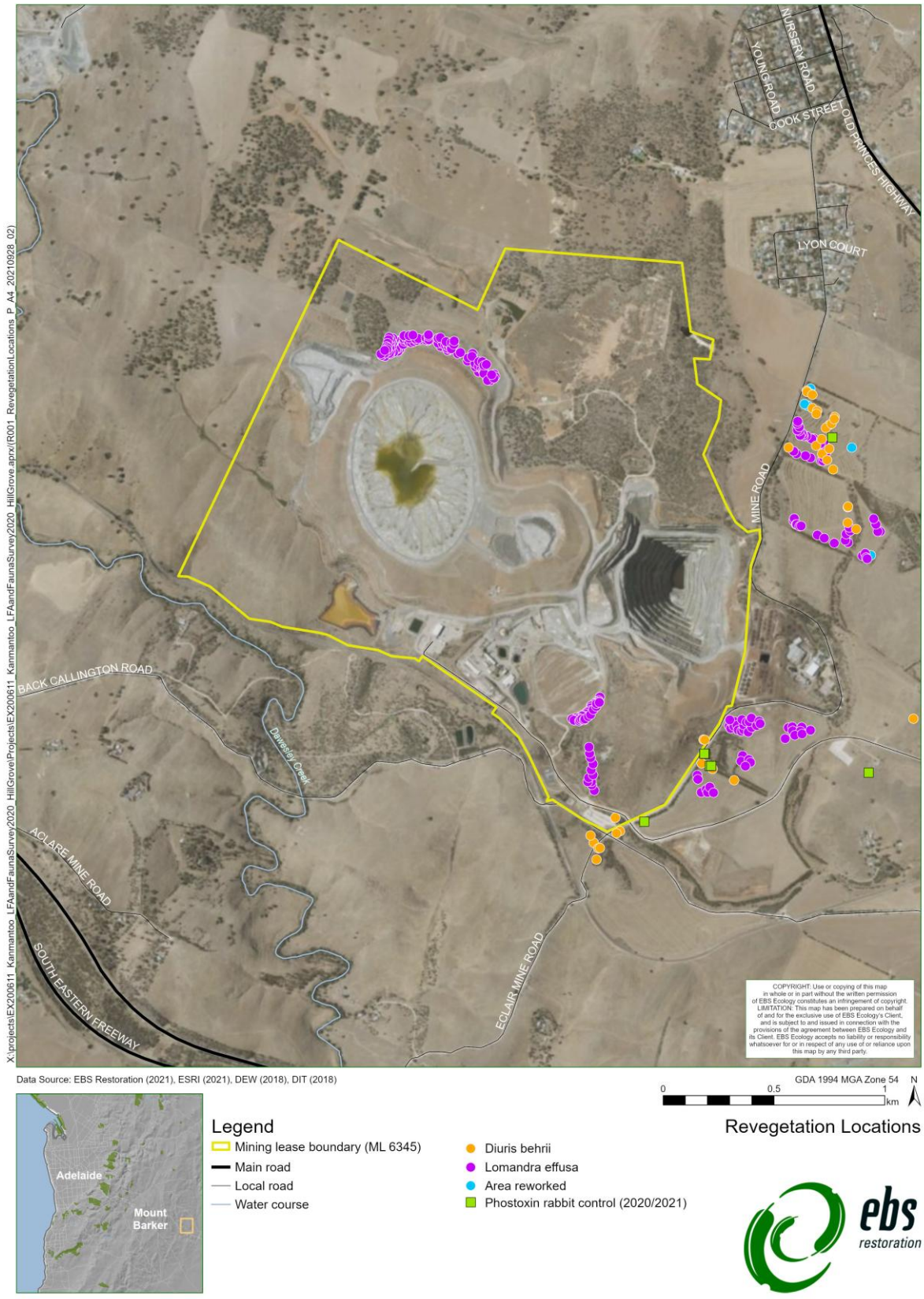


Figure 4a Revegetation locations 2019 and 2020 and Rabbit control 2024-25



Figure 5 Native Chenopod species germinating alongside introduced Gazania, 141 Mine rd

1.3 Management of Seed Production Area (SPA)

The SPA currently is in caretaker mode with minimal works being carried out during the reporting period. These works have been carried out with the purpose of maintaining its base functionality. In the event of it being returned to a valuable seed resource in the future, further works would be needed to see it return to

full capacity, such as replacement of weed matting, repair of irrigation lines and supplemental planting of key species.
A more detailed breakdown of these works can be supplied in the event of the SPA receiving approval for rejuvenation, as there are several options based on timeframes and budget allocations.

This work is also dependent on the final outcomes of the seed viability testing (refer section 1.1), as this report will help determine what species are best suited for use in the SPA, and subsequently as seed resources for future works on site.

Recruitment from native species within the SPA plots has occurred outside the perimeter fencing and is being allowed to spread into the surrounding woodland as in previous years. This will help the SPA blend into the surrounding woodlands if it is no longer needed as a resource and the fence is removed.
This germination of species into the surrounding areas is enabling key species such as native grasses and groundcovers to be re-introduced, as they have previously been grazed into insignificance by stock and kangaroo pressure.

2024-2025 reporting period tasks included:

- Minor repairs to infrastructure, including fencing and removal of fallen trees.
- Removal of dead and damaged plant material
- Knock-down spraying around perimeter fencing
- Hand weeding, brush cutting and spot spraying to control weeds
- Tractor slashing of broadacre grasses
- Continued removal/control of new introduced invasive species

1.4 Management of Seed Multiplication Area (SMA)

As with the previous reporting period, works carried out within the SMA during 2024-2025 were targeted towards weed control and maintenance within the existing grass plots. These activities are designed to prevent the spread of weeds throughout the seeded and surrounding areas, and to encourage further replication of native grasses and understory plants within and surrounding the SMA.

The SMA is located adjacent to the main access road into site, surrounding pastureland and erosion gullies – all of which present multiple opportunities for introduction of new exotic species into the area.

Once the primary resource for key grass species used in the initial stages of the environmental program, recent years have seen a steady and noticeable decline in the ability of the SMA to produce reliable quantities of seed.

This is likely due to a combination of factors such as depletion of soil nutrients, ground compaction, changing seasonal conditions/rainfall as well as the grasses present being of a short-lived perennial species.
As a result, the SMA is now maintained as a potential SEB offset area with the ability to rejuvenate if required.

Small scale/low-cost activities such as niche seeding, tree seeding and tube stock planting could be undertaken to transform this area into an area of SEB while still enabling its use as a valuable resource for seed.
Over-sowing could also be carried out into the remaining grass plots using EBSR equipment on site and seed stock on hand.

During previous years the grasses at the SMA have been left to discharge their seed naturally in the anticipation of greater recruitment and enhancement of native species. This approach is starting to prove successful, with large areas of Chloris truncata and Enneapogon nigricans becoming established along the edges and slopes surrounding the SMA plots. These verges surrounding the SMA plots are also included in the weed control program as these activities have the benefit of assisting the spread of native species within these surrounding areas.

A regular program of weed control has been carried out within the grass plots and surrounding verges, including spot spraying, brush cutting, as well as tractor slashing. These works will give any grass seeds a greater chance at establishing among the bare areas between existing plants, without competition from introduced species. This work is also carried out as fuel load reduction with a view towards decreasing the number of weeds that will be present in the summer months.

1.5 Direct Seeded Pre-stripped areas

Since 2014 approximately thirty-four hectares of degraded farmland has been rehabilitated with the aim of establishing a diverse habitat of native vegetation. No further seeding works have been carried out on behalf of Hillgrove during the 2024-25 period.

A continual program of maintenance works-including slashing, spraying and hand weeding has again been undertaken during this year to enhance and protect the existing areas, with the view to provide an additional resource of native seed for future programs, alongside areas of biodiversity.

Continued germination of desirable native species is regularly observed, although it is often alongside germination of introduced species, facilitating the need for targeted and sensitive weed control (refer figure 5), alongside more broadacre forms of weed control such as tractor slashing and boom-spraying.
Areas within these seeded rows are often disturbed through activities such as vehicle intrusion and track grading, and subsequently often require and receive additional periods of large-scale broadleaf weed control (refer figure 9 for boom spraying of graded track edges).

Partly due to the seasonal conditions, several large Eucalypts already present in these areas have been uprooted and have been moved and placed into various areas within the seeded strips for fauna habitat, and in some cases to provide barriers to stop ingress of vehicles into sensitive areas.

This was carried out using the forklift attachment on the Tractor (refer figures 7 and 8).

(Refer sections 1.1 and 1.6 for further information on suggestions for enhancement and information on works carried out.)

1.6 Maintenance and enhancement of existing vegetation and seeded areas.

Areas included within existing vegetation and seeded areas consist of any remnant vegetation or rehabilitation sites within the Mine lease and properties owned or leased by Hillgrove Resources.
These sites include native woodlands, pockets of remnant vegetation, hillsides, pre-stripped, hand seeded and hydroseeded areas.

Existing vegetation maintenance

Ongoing maintenance and enhancement of existing vegetation has been carried out throughout the 2024-2025 period. A lower-than-average rainfall over the reporting period has led to stresses being placed on existing vegetation within the relevant areas. Several larger trees affected by heat stress have had to be removed or significantly cut back to reduce the risk of damage to vehicles, pedestrians or underlying areas of sensitive vegetation.

As with previous years between June and up to time of this reporting, Bridal creeper (*Asparagus asparagoides*) was and is continuing to be targeted around the edges of the Kavanagh woodlands, Lot 25 rehab areas, Lomandra rehab areas and the Northwest woodlands. This species was spot sprayed using backpack spray packs with Glyphosate and penetrant herbicide mix. Bridal creeper is a highly invasive of and declared species of weed which will easily outcompete and smother large areas of native groundcovers and midstory species if left unchecked.
Other species targeted were Artichoke thistle (*Cynara cardunculus*), Salvation Jane (*Echium plantagineum*) and Horehound (*Marrubium vulgare)* using the same technique.

Weed control was also once again carried out on the southern face of McFarlane hill, with species targeted including Bridal creeper, Artichoke thistle, Horehound (*Marrubium vulgare*) and Scabiosa (*Scabiosa atropurpurea*). McFarlane hill has responded well in previous years to targeted control of these weed species, with a good cover of native Lomandra effusa present in the area and isolated individuals of the rare Marieana rohrlachii. This remnant patch of Maireana was the source of seed which was grown on and transplanted into various locations around the lease in previous years.

Brush cutting has also once again been carried out in this area, particularly along fence lines inaccessible by tractor and around populations of remnant native vegetation.

Seeded areas maintenance

Pre- stripped/ direct seeded sites across the Mine lease and associated properties encompasses a total area of approximately 34 hectares. These locations are easily accessible for the purposes of broadscale weed control, and a variety of maintenance activities are performed regularly to conserve and enhance these assets. Activities performed include:

- Spot spraying, brush cutting, and hand weeding. This approach is undertaken within these areas as it is selective and tailored to the abundance of native species present, (refer figures 6a and 6b). This approach is best suited where there is no opportunity to apply broad acre weed control due to the presence of herbicide-sensitive vegetation also being present.

- Broadacre spraying of all paths, verges, topsoil stockpiles and bare areas within the boundaries of the seeded properties. This process reduces the overall weed load on-site, lessening the likelihood of introduction of new weed species into rehabilitation areas as well as providing greater opportunity for desirable native species to take hold. Areas with maintained/graded tracks such as the Mulawa cottage and SMA/O'Shea's tracks also require additional edge spraying as these earthwork activities typically cause a disturbance of the topsoil, resulting in new areas of weed emergence (refer figure 9).

- Woody weed control using cut and swab method on feral Eucalyptus species emerging in strips and other species such as Flinders Range wattle (*Acacia iteaphylla),* Golden wreath wattle *(Acacia saligna),* Tree tobacco *(Nicotiana glauca)* and Boxthorn *(Lycium ferocissimum)* within SEB areas.

- Tractor slashing of native grasses in strips pre-harvest (typically mid-late winter). This is a light reduction of the height of the grasses and is carried out with the aim of stimulating new growth.

- Tractor slashing of native grasses post-harvest. Removal of the spent seed heads and top 50 percent of the grass enables the plant to develop a stronger root system, and the mulched material forms a ground layer of cover and nutrients for the topsoil. This material slowly breaks down over time and provides valuable nutrients to the soil. This also reduces the available fuel load before the peak fire danger season.

- Continued target spraying and selective brush cutting of introduced species throughout all seeded strips (Refer Figures 5 and 6). Broadleaf weeds such as Salvation Jane (*Echium plantagineum*)

and Capeweed (*Arctotheca calendula*) are sprayed before they reach maturity. The introduced species African daisy (Oncosiphon suffruticosum) has been sprayed where found to limit its spread. This is an aggressive invasive species and was likely introduced via vehicle from off-site.

Species germinated from seed sown into the pre-stripped areas, such as Eucalyptus odorata, a key local overstory species, are now producing large amounts of seed and contributing to recruitment and enhancement of these areas (Refer cover photo). These and other key species such as She-Oak (*Allocasuarina verticillata*) are now showing growth of more than six metres in height in some examples, with associated plant community groundcover colonisers, such as creeping salt bush (*Atriplex semibaccata*) also in abundance.

Additionally, there are continued positive signs of sub-soil and microbial activity occurring, such as the proliferation of Cryptogams within these strips, populating areas which were previously bare of such species before the seeding activities were carried out. Although the drought conditions of late 2024-early 2025 resulted in a marked visual reduction in these species, early signs following the rainfall during the second half of the year are encouraging. Cryptogams include mosses and lichens and are good indicators of healthy soil activity as well as acting as colonisers and binders to prevent erosion and ingress of invasive species.



Figure 6a Spot spraying of targeted weed species, Seeded offset area, Mulawa



Figure 6b Brassica and broadleaf weed species, showing effects of herbicide application, Lot 25 seeded strips



Figure 7 Fallen introduced Eucalypt species to be used as habitat on location – Mulawa 2025



Figure 8 Placing of fallen timber into seeded areas for habitat, Mulawa strips – February 2025

Hydroseeded and Hand Seeded areas

Maintenance of hydroseeding areas again consisted of woody weed treatment and targeted spraying of Artichoke Thistle and Horehound using a backpack spray unit. Locations treated were predominantly on the Emily rehab batter, Smelter Road and areas adjacent to the NW woodlands and SPA.

Woody weed control is also periodically undertaken in these areas where appropriate, with species such as Tree Tobacco *(Nicotiana glauca*), Flinders Range wattle (*Acacia iteaphylla*) and African Boxthorn *(Lycium ferocissimum*) being poisoned and left in situ. Larger specimens are also sometimes cut and left on ground for habitat, and to slowly break down to provide nutrients.

These activities will continue where time and budget allow over the course of the next reporting period.

The hand seeded locations, particularly the Emily batter and amphitheatre section adjacent to the NW woodlands/SPA have shown significant improvement post seeding, with a good selection of species present, and indications of recruitment occurring from these activities.



Figure 9 Boom spraying along graded edges of SEB seeded strips, Mulawa

Additional areas within mine lease

Broadleaf weed control was once again carried out during spring and summer along the access road, erosion gullies and fence lines to control Artichoke thistle (*Cyana cardunculus*) populations. This species spreads easily through seed dispersal and is easily translocated via vehicle and pedestrian activity into SEB areas.

EBSR longline quick spray unit was used when needed for these activities to make the process more efficient and cover a larger area than conventional backpack spraying.

Additionally, Bridal Creeper (*Asparagus asparagoides*) is likewise treated when found, including areas just outside the greater Mine lease such as roadsides, hillsides and fence lines. This is a particularly aggressive invasive species and can smother out wide areas of diverse bushland if left unchecked.

1.7 Hydroseeding

No new hydroseeding was undertaken during the 2024-2025 reporting period.
There are still several leftover pre-prepared bales of hydroseeding mix on hand, which can be easily utilised and amended for any future hydroseeding or hand seeding. Additionally, there is an abundance of seed on hand to tailor seed mixes for any seeding programs if needed.

1.8 Fire reduction programs

Annual hazard reduction works were undertaken between September 2024 and April 2025. As with previous years, this was a protracted period of activity, although unlike the previous reporting years the lower-than-average rainfall coupled with warmer temperatures facilitated a longer period of intermittent hazard reduction activities. As with the previous year, much of the fire reduction was undertaken using a tractor and slashing deck. This is the most efficient and quickest method of reducing flammable material from large areas such as fence lines, hillsides and open paddocks.

Although the bulk of work consisted of cutting firebreaks along boundaries and fence lines, pedestrian areas and active work areas such as infrastructure were also cleared to reduce the risk of snake activity and trip hazards in these areas. Timing of these activities are taken into consideration, with the aim of slashing at optimum times to reduce the chance of regrowth.
Follow up weed spraying of a species-specific and knockdown herbicide was also carried out where possible to reduce the regrowth of vegetation.

EBS Restoration has invested in suitable equipment for hazard and fire reduction tasks, including a 4WD tractor purchased in 2022 and heavy-duty slashing deck with demountable fire-fighting unit to ensure these activities can be undertaken both safely and efficiently.

1.9 Pest management

Pest management activities have continued throughout the mine lease and associated areas as per previous years works.

Fumigation and destruction of Rabbit (*Oryctolagus cuniculus)* warrens has been carried out where needed, with re-treatment of warren complexes carried out in the areas bordering Lot 25 and the access rd. Re-treatment such as this is often needed in such areas when rabbits will re-enter previously treated areas to create new warren systems due to preferable sandy soils and availability of shelter from predatory animals. (Refer Figure 4a for locations)

Treatment consists of locating and sealing all escape holes within the warren system, and delivery of water activated Aluminium phosphide tablets into the remaining warren entrance, which is then sealed. Previous years treatments have also included baiting using Pindone laced carrots, however this would be inefficient given the costs involved with labour and extra monitoring, as well as the increased risk of off target damage to native Fauna.
This process is undertaken within all relevant safety and pest management licensing requirements.

Grazing and damage from Kangaroos (*Macropus* sp.) is an ongoing concern through the majority of SEB and planted areas, particularly among areas of germination and new growth. Most tree guards have been removed in previous years to allow unrestricted growth of new plantings, and the grazing is an opportunistic side effect of having palatable species present in these areas.
There are many species which in their juvenile growth stages are particularly palatable to Macropod species, including Allocasuarina verticillata and Dodonaea viscosa. Continued grazing pressure on such species can result in a reduced diversity of species in revegetation areas if left unchecked.

On-going fence repairs are also carried out on any boundary or dividing/exclusion fences as needed, although several large sections of fencing are in an unserviceable state and would need replacement.

APPENDIX – HILLGROVE SEED INVENTORY

						Total (kg)	
Eucalyptus camaldulensis	EBSKAN025	Kanmantoo mine site	2011	0.910		0.910	
Arthropodium sp.	EBSKAN050	Kanmantoo mine site and surrounds	Dec-12	0.105		0.105	
Cymbopogon ambiguus	EBSKAN092	SPA	Dec-13	11.000		11.000	
Acacia argyrophylla	EBSKAN093	Kanmantoo mine site and surrounds	Dec-13	11.920		11.920	
Eucalyptus phenax	EBSKAN095	Kanmantoo mine site	Feb-14	0.060		0.060	
Enteropogon acicularis	EBSKAN099	SPA	Dec-13	1.400		1.400	
Cassinia arcuata	EBSKAN108	Kanmantoo mine site and surrounds	2014	1.300		1.300	
Callitris canescens	EBSKAN111	Kanmantoo mine site and surrounds	2014	0.080		0.080	
Cymbopogon ambiguus	EBSKAN117	SPA	Dec-14	7.500		7.500	
Senecio quadridentatus	EBSKAN142	SPA	Feb-15	0.082		0.082	
Bothriochloa macra	EBSKAN145	SPA	Feb-15	4.000		4.000	
Convolvulus erubescens	EBSKAN148	SPA		1.800		1.800	
Santalum acuminatum	EBSKAN151	Surrounds	Oct-15	0.013		0.013	
Eucalyptus odorata	EBSKAN155	Kanmantoo mine site	Dec-15	0.757		0.757	
Vittadinia blackii	EBSKAN157	SMA	Oct-15	1.750		1.750	
Helichrysum leucopsideum	EBSKAN160	SPA	Nov-15	0.037		0.037	
Bothriochloa macra	EBSKAN169	SPA	Nov-15	4.000		4.000	
Cymbopogon ambiguus	EBSKAN172	SPA	Nov-15	2.500		2.500	
Enchylaena tomentosa	EBSKAN176	SPA	Feb-16	2.700		2.700	
Enchylaena tomentosa	EBSKAN180	SPA	Apr-17	2.900		2.900	
Eucalyptus odorata	EBSKAN184	Kanmantoo mine site and surrounds	Jan-17	0.033		0.033	
Themeda triandra	EBSKAN189	SPA	Jan-17	1.500		1.500	

Bursaria spinosa	EBSKAN196	Kanmantoo mine site and surrounds	Feb-16	0.038		0.038	
Themeda triandra (includes stalks)	EBSKAN200	SPA / SMA	Dec-17	6.000		6.000	
Chloris truncata	EBSKAN201	SMA	Jan-18	7.500		7.500	
Aristida behriana	EBSKAN202	SMA	Dec-17	0.800		0.800	
Austrostipa blackii	EBSKAN204	surrounding area	Nov-17	1.900		1.900	
Vittadinia sp. Mix	EBSKAN205	surrounding area	Nov-17	0.260		0.260	
Lomandra effusa	EBSKAN210	surrounding area	Nov-17	0.450		0.450	
Helichrysum leucopsideum	EBSKAN211	surrounding area	Nov-17	0.031		0.031	
Arthropodium sp.	EBSKAN213	surrounding area	Nov-17	0.013		0.013	
Acacia pycnantha	EBSKAN221	surrounding area	Dec-17	2.650		2.650	
Bolboschoenus caldwellii	EBSKAN222	surrounding area	Nov-17	0.350		0.350	
Lomandra effusa	EBSKAN223	surrounding area	Nov-17	0.350		0.350	
Vittadinia sp. Mix	EBSKAN224	SMA	Feb-18	0.500		0.500	
Eucalyptus odorata	EBSKAN226	mine lease	Jan-19	2.600		2.600	
Allocasuarina verticillata	EBSKAN227	Kanmantoo mine site and surrounds	Nov-18	2.890		2.890	
Callitris gracillis	EBSKAN228	Kanmantoo mine site and surrounds	Jan-19	0.327		0.327	
Callitris preissii	EBSKAN229	surrounding area	Jan-19	9.580		9.580	
Convolvulus sp	EBSKAN230	SPA	Feb-19	0.654		0.654	
Aristida behriana	EBSKAN232	SMA	Feb-19	1.000		1.000	
Kennedia prostrata	EBSKAN237	SPA	Dec-18	0.220		0.220	
Podolepis rugata	EBSKAN239	Kanmantoo mine site and surrounds	Nov-18	0.080		0.080	
Clematis microphylla	EBSKAN240	surrounding area	Dec-18	0.267		0.267	
Chloris truncata	EBSKAN244	SMA	Jan-19	1.000		1.000	

Enchylaena tomentosa	EBSKAN246	SPA	Feb-19	4.000		4.000	
Maireana brevifolia	EBSKAN247	mine lease and surrounds	Feb-19	4.600		4.600	
Atriplex semibaccata	EBSKAN248	SPA	Feb-19	1.250		1.250	
Eucalyptus camaldulensis	EBSKAN249	Kanmantoo mine site and surrounds	Apr-19	1.030			
Chrysocephalum semipapposum	EBSKAN251	Kanmantoo mine site and surrounds	Nov-19	1.390		1.390	
Chrysocephalum apiculatum	EBSKAN252	Kanmantoo mine site and surrounds	Nov-19	0.680		0.680	
Helichrysum leucopsideum	EBSKAN253	Kanmantoo mine site and surrounds	Nov-19	1.980		1.980	
Podolepis rugata	EBSKAN254	Kanmantoo mine site and surrounds	Dec-19	0.445		0.445	
Olearia pannosa	EBSKAN255	Kanmantoo mine site and surrounds	Nov-19	0.390		0.390	
Ptilotus spathulatus	EBSKAN256	Kanmantoo mine site and surrounds	Nov-19	0.120		0.120	
Hardenbergia violacea	EBSKAN257	Kanmantoo mine site and surrounds	Dec-19	0.380		0.380	
Allocasuarina verticillata	EBSKAN258	Kanmantoo mine site and surrounds	Nov-19	2.650		2.650	
Acacia acinacea	EBSKAN259	Kanmantoo mine site and surrounds	Nov-19	0.440		0.440	

Vittadinia sp. Mix	EBSKAN260	Kanmantoo mine site and surrounds	Nov-19	5.800		5.800	
Maireana brevifolia	EBSKAN261	Kanmantoo mine site and surrounds	Mar-20	2.500		2.500	
Atriplex semibaccata	EBSKAN262	SPA	Feb-20	6.100		6.100	
Enchylaena tomentosa	EBSKAN263	SPA	Feb-20	3.000		3.000	
Convolvulus sp.	EBSKAN264	SPA	Feb-20	0.250		0.250	
Cullen australasicum	EBSKAN265	Kanmantoo mine site and surrounds	Jan-20	0.410		0.410	
Einadia nutans	EBSKAN267	SPA	Jan-20	0.021		0.021	
Austrostipa / Rytidosperma mix	EBSKAN270	Kanmantoo mine site and surrounds	Nov-20	288.500		288.500	
Cullen australasicum	EBSKAN271	Kanmantoo mine site and surrounds	Nov-20	0.285		0.285	
Chrysocephalum semipapposum	EBSKAN272	SPA	Nov-20	0.760		0.760	
Chrysocephalum apiculatum	EBSKAN273	SPA	Nov-20	0.860		0.860	
Maireana brevifolia	EBSKAN274	Kanmantoo mine site and surrounds	Mar-21	0.840		0.840	
Maireana rohrlachii	EBSKAN275	SPA	Feb-21	0.031		0.031	
Kennedia prostrata	EBSKAN276	SPA	Nov-20	0.230		0.230	
Gonocarpus tetragynus	EBSKAN277	SPA	Nov-20	0.092		0.092	
Podolepis rugata	EBSKAN278	SPA	Nov-20	0.430		0.430	
Austrostipa / Rytidosperma mix	EBSKAN279	Kanmantoo mine site and surrounds	Nov-21	398.000		398.000	
Austrostipa / Rytidosperma mix	EBSKAN280	Kanmantoo mine site and surrounds	Nov-22	90.500		90.500	
Themeda triandra (includes stalks)	EBSKAN281	SPA	Jan-23	12.500		12.500	

Austrostipa / Rytidosperma mix	EBSKAN282	Kanmantoo mine site and surrounds	Nov-23	42.000		42.000	
Austrostipa / Rytidosperma mix	EBSKAN283	Kanmantoo mine site and surrounds	Nov-24	11.200		11.200	
Einadia nutans	EBSKAN284	SPA	Feb-19	0.135		0.135	
Eucalyptus odorata	EBSKAN285	Kanmantoo mine site and surrounds	Apr-25	1.110		1.110	
Maireana rohrlachii	EBSKAN286	Kanmantoo mine site and surrounds	Apr-25	0.110		0.110	
Eucalyptus calycogona	EBSKAN287	Kanmantoo mine site and surrounds	Apr-25	0.155		0.155	
Allocasuarina verticillata	EBSKAN288	Kanmantoo mine site and surrounds	Apr-25	0.105		0.105	
Eucalyptus socialis	EBSKAN289	Kanmantoo mine site and surrounds	Apr-25	0.360		0.360	
Eucalyptus camaldulensis	EBSKAN290	Kanmantoo mine site and surrounds	Apr-25	0.095		0.095	

starting weight	**981.541**	**avail now**	**980.511**

EBS Restoration
Unit 5 125 Hayward Avenue
Torrensville SA 5031

Appendix 4 EBS Restoration Annual Report 2025 – 2026



ebs restoration

Kanmantoo Copper Mine
On-ground Environmental Management Report
2025-2026

Kanmantoo Copper Mine
On-ground Environmental Management Report
2025-2026

Prepared by EBS Restoration for Kantra Copper Limited

Document Control					
Report No.	Date issued	Authors	Reviewed by	Date Reviewed	Revision type
1.0	28/09/2026	S. McGovern	G. Glazier	28/09/2026	Draft

Distribution of Copies			
Report No.	Date issued	Media	Issued to
1.0	28/09/2026	Electronic	Viv Naidu, Kantra Copper

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CITATION: EBS (2022) *Kanmantoo Copper Mine, On-ground Environmental Management Report 2025-2026, Kantra Copper Limited*. EBS Restoration, Adelaide.

Front cover photo: *Native Bulbine bulbosa, germinated from seed in SEB seeded strip*

EXECUTIVE SUMMARY

Since 2011, EBS Restoration has continually carried out rehabilitation work on behalf of Kantra Copper (formerly known as Hillgrove Resources). To assist Kantra Copper fulfill the environmental requirements outlined in their own plans and relevant mining laws, a variety of environmental projects have been completed both inside the mine lease and on related assets and infrastructure.

In addition to improving built landforms, rehabilitating disturbed areas within the lease, and helping to preserve native plants and animals within the lease and its environs, these initiatives have demonstrated to the local community Kantra's dedication to environmental stewardship.

On ground works undertaken during the 2025-2026 reporting period have been of a similar nature to the previous year, again largely due to there being no major new areas added requiring rehabilitation.

Key outcomes from the 2025-2026 (01 Sep 2025 to 31 Aug 2026) reporting period include:

- A scaled back seed collection program continued into the 2025-2026 period, with approximately 960 kilograms of seed remaining in storage at the EBS Warehouse. (Refer Appendix for remaining seed tally)
- Provision of seed management services, including storage and handling of collected seed and supply of tailored seed mixes for Hydroseeding (Refer table 1)
- Continuous management of existing vegetation areas, including remnant, rehabilitated, and constructed landforms, using weed control techniques such tractor slashing, spraying, brush cutting, pest control, and, when necessary, woody weed control.
- The Seed Production Area (SPA) is still being maintained at a reduced capacity (caretaker mode) with an eye toward potential future revitalisation to guarantee a continuous supply of material for upcoming projects if necessary. No major works or upgrades have been undertaken at the request of Kantra Copper. Weeding, slashing, and basic infrastructure upkeep are among the tasks carried out.
- Upkeep and improvement of the Seed Multiplication Area (SMA). Broad acre slashing, spraying, targeted weed management, fence maintenance, and pest control are among the activities carried out.
- Fire and risk reduction measures, such as cutting firebreak boundaries, removing fallen trees and organic materials, clearing pedestrian access, and maintaining infrastructure.
- Pest control measures, such as fumigation and warren destruction for rabbits, rodent management in seed storage locations, and fence repairs to lower the possibility of grazing pressure and unauthorised public access to rehabilitation areas.

To date, the Mine lease and surrounding properties have undergone hydroseeding, manual seeding, and pre-stripping seeding on about 144 hectares (including re-treatment of refractory areas). When necessary, these places are continuously maintained to the point where some of them are already self-sustaining native habitat communities. Many of these sites were waste landforms, invasive species-dominated areas with little natural plant cover, and previously degraded agricultural paddocks.

The following recommendations are once again summarised:

- Rejuvenation of areas used for gathering native grass seed (mainly seeded SEB strips, SPA, and SMA); these areas have been used as a resource for several years and would benefit from positive actions such as burning surface material, adding organic inputs, and over-sowing important species.

- To increase biodiversity in existing SEB areas with a predominant cover of native grasses, tube stock planting, tree seeding, and/or niche seeding may be added.

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1 INTRODUCTION

Prepared for Kantra Copper's Kanmantoo Copper Mine, this report addresses the requirements of the *Mining Act 1971* and the Program for Environmental Protection and Rehabilitation (PEPR). It summarises on-ground environmental management activities completed by EBS Restoration between September 2025 and September 2026. These activities are grouped below by work area.

Project management and seed services

- Provision of project management services.
- Native seed collection, cleaning, storage and inventory management.

Rehabilitation and vegetation management

- Ongoing maintenance of rehabilitation areas, including direct-seeded pre-strips, hand direct seeding sites and hydroseeded areas.
- Weed control and enhancement within areas of existing vegetation.
- Management of declared weeds within the mine lease and associated properties.
- Weed control, rabbit control and tube stock planting within new rehabilitation area.

Seed production and multiplication areas

- Management of the Seed Production Area (SPA).
- Management of the Seed Multiplication Area (SMA).

General maintenance, fire risk and pest control

- General maintenance as instructed by Kantra Copper, including infrastructure maintenance.
- Tractor slashing, brush cutting and knockdown spraying to reduce fire and hazard risk along boundaries, fence lines and verges.
- Invasive pest control, including rabbit control and measures to exclude grazing animals.

1.1 Seed collection, cleaning and management of seed

During the 2025–26 reporting period, EBS Restoration again stored and managed native seed for Kantra Copper. No notable seed collection was carried out during this period, with an abundance of seed in stock and resources being re-directed towards other activities on-site.

As in previous years, the availability of native grass seed for collection has declined noticeably. This is likely due to several factors, including reduced rainfall during the growth cycle before collection, unpredictable weather during the collection period, and reduced progressive recruitment through self-seeding within the grass strips. As no fertiliser or additional seed has been applied since 2018–19, soil nutrient levels have likely continued to decline gradually.
Recommendations to boost the microbial and plant health of these areas remain as follows:

- Scarce or bare patches of cover should be resown using stock seed.
- Niche and tree sowing in certain areas to provide a diversity of low, mid and overstory species
- Fertiliser application in impacted regions using liquid or granular delivery
- Regulated cool seasonal thatch material burning in grass strips

No excess seed was sold on behalf of Kantra Copper during the reporting period, as any remaining seed in stock may be needed for any possible future rehabilitation efforts on site. (Refer Appendix for updated table of remaining seed in stock)

Table 1. 2026 Hydroseed mixes for TSF

SPECIES	BATCH NUMBER	AMOUNT (kg)
Eucalyptus phenax	EBSKAN95	0.02
Enchylaena tomentosa	EBSKAN180	0.8
Eucalyptus odorata	EBSKAN226	0.04
Allocasuarina verticillata	EBSKAN227	0.4
Callitris gracilis	EBSKAN228	0.1
Kennedia prostrata	EBSKAN237	0.04
Atriplex semibaccata	EBSKAN248	0.15
Helichrysum leucopsidium	EBSKAN253	0.08
Acacia acinacea	EBSKAN259	0.08
Vittadinia sp.mix	EBSKAN260	0.7
Convolvulus sp.	EBSKAN264	0.04

Rytidosperma/Austrostipa mix	EBSKAN270	14
Cullen australasicum	EBSKAN271	0.1
Chrysocephalum apiculatum	EBSKAN273	0.08
Maireana brevifolia	EBSKAN274	0.2
Gonocarpus tetragynus	EBSKAN277	0.092
Eucalyptus socialis	EBSKAN289	0.04
TOTAL		16.962



Figure 1 Mature Allocasuarina verticillata grown from seed and producing seed in quantity



Figure 2 SPA enclosure pictured after weed control,fence repairs and slashing



Figure 3 Bridal creeper among native vegetation, Mine rd.

1.2 Revegetation

During the 2025–2026 reporting period, no new large-scale revegetation projects were carried out. To lessen competition from invasive species and improve the likelihood of successful establishment and recruitment, hand weeding, selective spot spraying, and brush cutting have continued to be undertaken around all existing areas of concern. To guarantee the best possible outcome for planted species and to stop more invasive species from spreading over these regions, ongoing weed management will continue as needed in the upcoming reporting period.

Midway through the reporting period, a new area of rehabilitation was opened adjacent to the Pine woodlands below the old Mulawa cottage and outbuildings.
Several hectares were ripped using earthmoving equipment to destroy a large established population of Rabbits, and modifications were also made to the existing erosion gully/creek line for the purposes of capturing rainfall run-off and providing habitat for native fauna including Frogs.
To date, around 500 tube stock species have been planted in and around this catchment area, including native sedges and groundcover and overstory species. Planting and hand broadcast of seed will continue during the pre-winter period of 2027 to utilise rainfall for optimum results of revegetation. (Refer Figure 6 for picture of new rehab area)

Weed control, including spot spraying and woody weed control has been commenced to reduce various broadleaf and woody weeds present in the area.
Extensive rabbit control has also been carried out, including fumigation of active warrens and subsequent collapsing of entrances. These works will be ongoing into future reporting periods as there is a large population of Rabbits active within the greater area.
(Refer Figure 8 for locations of intensive rabbit control)

Mid and overstorey species that were previously planted from tube stock have now established themselves in other revegetation regions and are at the point where they are supplying significant habitat for fauna species as well as seed for ongoing recruitment.

Invasive species such as African Daisy (*Gazania sp.*), Calomba daisy (*Oncosiphon suffruticosum*), Rhodes grass (*Chloris gayana*), Bridal Creeper (*Asparagus asparagoides*) and Prickly pear (*Opuntia sp.*) have been found in isolated areas surrounding the lease and related properties, it is crucial to continuously monitor these areas to prevent the introduction of new invasive species into areas of SEB and revegetation. Some of these species are declared weeds and have the potential to seriously harm rehabilitation efforts by outcompeting local species and displacing long-established populations. African daisy and Calomba daisy populations have significantly decreased from previous years, demonstrating the efficacy of ongoing monitoring and control techniques. (Refer figures 3 and 5 for examples of invasive weeds)

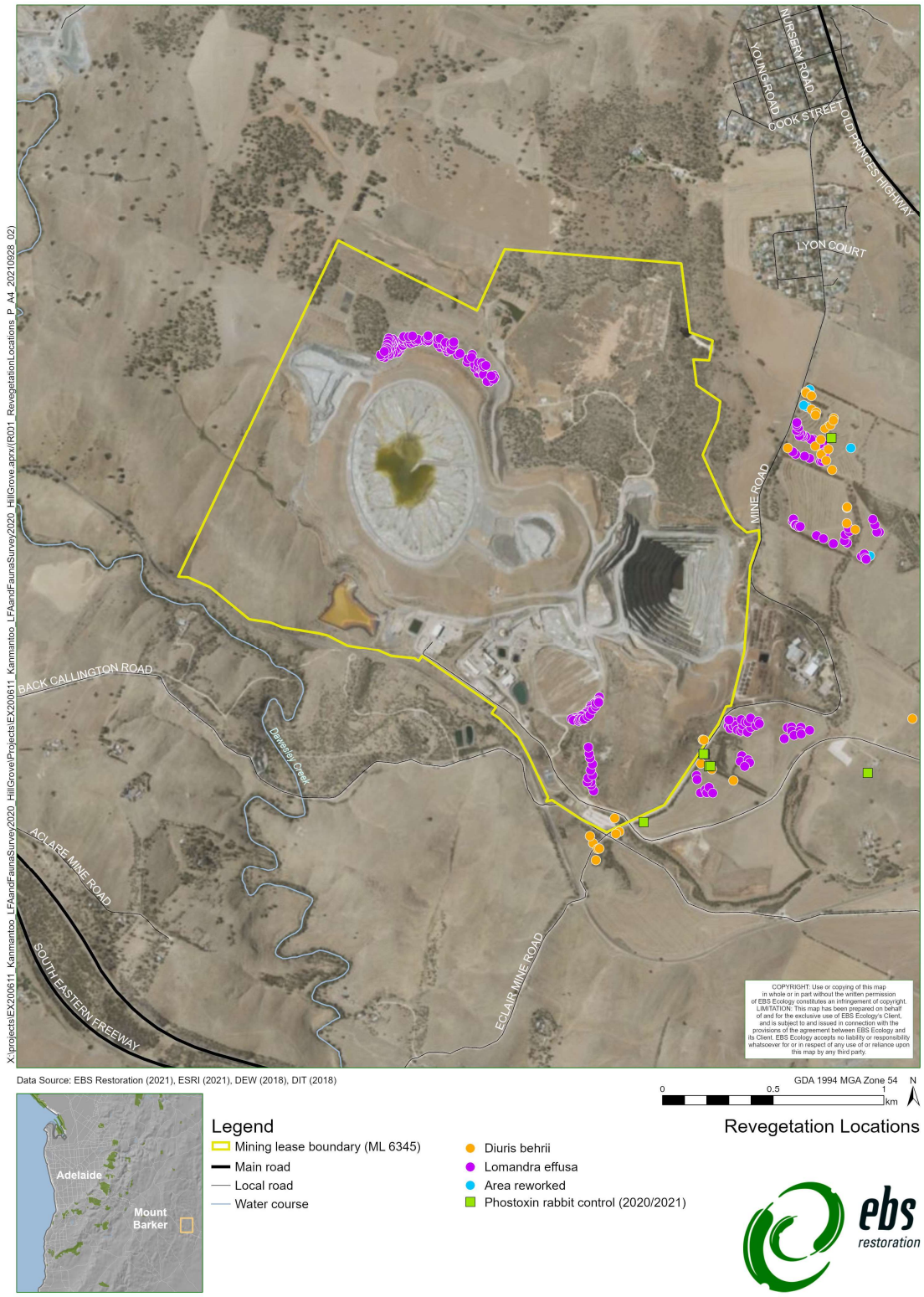


Figure 4 Revegetation locations 2019 and 2020 and Rabbit control 2025-26



Figure 5 Cut and swab treatment of Prickly Pear, Hillside adjacent Access rd

1.3 Management of Seed Production Area (SPA)

At the time of the reporting period, the SPA remains in caretaker mode, with minimal work being done during this period. The goal of these efforts has been to preserve its fundamental functionality. If it were to be used again as a useful seed source in the future, further work would be required to bring it back to full

capacity, including replacing weed matting, fixing irrigation systems, and planting of key revegetation species.
A more detailed breakdown of these works has been supplied in the event of the SPA receiving approval for rejuvenation, as there are several options based on timeframes and budget allocations.

As in previous years, native species recruitment within the SPA plots has also taken place outside the perimeter fence and is being encouraged to spread into the nearby woodland. If the SPA is no longer needed as a resource and the fence is taken down, this will assist it fit in with the neighbouring woodlands. Key species like native grasses and groundcovers, which were previously reduced and under pressure by stock and kangaroo grazing, are being reintroduced thanks to the germination of these plants into the surrounding areas.

(Refer Figure 2 for illustration of SPA after weed control and maintenance)

2025-2026 reporting period tasks included:

- Basic infrastructure repairs, including fencing and removal of fallen trees.
- Removal of dead and damaged plant material
- Knock-down spraying around perimeter fencing
- Hand weeding, brush cutting and spot spraying to control weeds
- Tractor slashing of broadacre grasses
- Continued removal/control of new and existing invasive species

1.4 Management of Seed Multiplication Area (SMA)

Similar to the previous reporting period, weed control and upkeep of the existing grass plots were the main goals of the SMA's 2025–2026 activities. In addition to promoting the continued growth of native grasses and understory plants inside and around the SMA, these measures are intended to stop weeds from spreading throughout the seeded and neighbouring regions.

There are numerous opportunities for the introduction of new invasive species into the area because of the SMA's proximity to the main access road into the site, adjoining pastureland, and erosion gullies.
Invasive species such as Rhodes grass (*Chloris gayana*) and Gazania (*Gazania spp*.) have been first recorded in the SMA before spreading to other areas.

The SMA's capacity to generate consistent amounts of seed has steadily and noticeably declined in recent years. The SMA was once the main source for important grass species used in the early phases of the environmental program.

This is likely caused by numerous factors, including soil nutrient depletion, ground compaction, shifting seasonal conditions and rainfall, and the presence of short-lived perennial grasses.
Consequently, the SMA is currently kept as a possible SEB offset area that can be revitalised or converted if needed.

Small-scale, low-cost initiatives like tube stock planting, tree seeding, and speciality seeding could be used to turn this region into an area of SEB while maintaining its value as a seed supply.
Using on-site EBSR equipment and available seed stock, over-sowing could also be done in the remaining grass patches.

In order to assist with the increase of recruitment and enhancement of native species, the grasses at the SMA have been allowed to spontaneously release their seed in prior years. Tracts of Enneapogon nigricans and Chloris truncata are establishing themselves around the edges and slopes surrounding the SMA plots, indicating that this strategy is beginning to show results. The weed control effort also covers the verges that surround the SMA plots because these activities help native plants proliferate in these regions.

The grass plots and adjoining verges have undergone a routine weed management program that includes tractor slashing, brush cutting, and spot spraying. With no competition from introduced species, these efforts will increase the likelihood that any grass seeds will establish in the empty spaces between existing plants. To reduce the quantity of weeds that will be present during the summer, this activity is also done as fuel load reduction in conjunction with the annual fire break slashing program.

1.5 Direct Seeded Pre-stripped areas

In order to create varied communities and areas of native vegetation, about 34 hectares of damaged farmland have been restored since 2014. During the years 2025–2026, Kantra has not conducted any additional seeding operations of this type (excluding hydroseeding).

This period has seen a continued program of maintenance activities, including but not limited to slashing, spraying, and hand weeding, again being carried out to improve and safeguard the current areas with the added goal of supplying an extra resource of native seed for future initiatives.

Desired native species continue to germinate on a regular basis, but this is frequently accompanied by the germination of introduced invasive species, necessitating sensitive and targeted weed control (see figure 5) in addition to more widespread methods of weed control like boom-spraying and tractor slashing.

Highly invasive weeds such as Cape Weed (*Arctotheca calendula*) have become more present within seeded rows and, due to their habit of rapidly colonising disturbed areas, pose a continual challenge for these areas.

These seeded rows frequently require and receive extra programs of large-scale broadleaf weed control because areas within them are frequently disturbed by activities like vehicle intrusion and track grading (see figure 8 for example of boom spray unit used in large scale broadleaf control).
Broadleaf spraying on a larger scale, while more efficient than targeted spot spraying, is not the preferred method as it poses more risks of off target damage to native species.

As in the previous reporting period, Eucalypts that were previously present in these areas and had toppled or dropped large limbs have been relocated in different parts of the seeded strips to offer habitat for wildlife and, in certain cases, to act as barriers to prevent vehicles from entering sensitive regions.

(Refer sections 1.1 and 1.6 for further information on suggestions for enhancement and information on works carried out.)

1.6 Maintenance and enhancement of existing vegetation and seeded areas.

Any remaining vegetation or rehabilitation sites inside the Mine lease and properties owned or leased by Kantra Copper are included in the current vegetation and seeded areas.
These locations include pre-stripped, hydroseeded, hand-seeded, native forests, hillsides, and regions with remnant vegetation.

Existing vegetation maintenance

Ongoing maintenance and enhancement of existing vegetation has been carried out throughout the 2025-2026 period. A higher-than-average period of rainfall over the cooler months has led to rapid growth of both native and exotic species within the relevant areas, necessitating in an earlier start than normal to the slashing and broadleaf weed control program.

Bridal creeper (*Asparagus asparagoides*) was and is still being targeted around the boundaries of the Kavanagh woodlands, Lot 25 rehab areas, Lomandra rehab areas, and the Northwest woodlands, much as it was in prior years between June and the time of this reporting. Backpack spray packs with a mixture of a penetrant and glyphosate mix were used to spray this species. If left unmanaged, bridal creeper, a highly invasive species of weed, can rapidly outcompete and suffocate extensive areas of native groundcovers and midstory species. Using the same method, Artichoke thistle (C*ynara cardunculus*), Salvation Jane (*Echium plantagineum),* and Horehound (*Marrubium vulgare*) were also targeted.

Additionally, weeds such as Bridal creeper, Artichoke thistle, Horehound (*Marrubium vulgare*), and Scabiosa (*Scabiosa atropurpurea*) were targeted for weed control on the southern face of McFarlane Hill. In prior years, McFarlane Hill has reacted favourably to targeted suppression of these weed species, within a population of the rare Marieana rohrlachii and a remnant population of native Lomandra effusa. Seeds germinated from these populations have been collected, grown on and translocated to different parts of the lease and surrounding SEB areas in previous reporting periods.

Additionally, brush cutting has been done in this area once more, especially around communities of remaining native plants and along fence lines that are unreachable or unsuitable for control by tractor slashing methods.

Seeded areas maintenance

The overall area of pre-stripped/direct seeded sites within the Mine lease and related assets is roughly 34 hectares. For widespread weed control, these sites are generally widely accessible, and a range of maintenance tasks are routinely carried out to preserve and improve these resources. Among the tasks carried out are:

• Hand weeding, brush cutting, and spot spraying. Because it is selective and adaptable to the amount of native species present, this method is used in these locations. This method works best in situations where the presence of herbicide-sensitive flora makes it difficult or inefficient to perform broad-acre weed control.

• All walkways, verges, topsoil heaps, and barren areas inside the limits of the seeded properties are preferably broadacre sprayed. By lowering the overall weed load on the property, this method increases the chances that desirable native species will flourish and decreases the possibility of new weed species being introduced into rehabilitation areas. The Mulawa cottage and SMA/O'Shea's tracks are examples of sites with maintained/graded tracks that need extra edge spraying because these earthwork operations usually disturb the topsoil adjoining the edges of SEB areas, which leads to the establishment of new weed areas.

• In SEB areas, woody weeds like Flinders Range wattle (*Acacia iteaphylla*), Golden wreath wattle (*Acacia saligna*), Tree tobacco (Nicotiana glauca), and Boxthorn (*Lycium ferocissimum)* are controlled with the cut and swab approach.

• Pre-harvest tractor slashing of native grasses in strips (usually in the middle to late winter). The goal of this reduction in grass height and dead material is to encourage fresh growth for the upcoming seed collection.

• After harvest, tractor slashing again of native grasses. The plant can strengthen its root system by removing the top 50% of the grass and spent seed heads, and the mulched material creates a layer of cover and nutrients for the topsoil. Over time, this material gradually decomposes and resupplies the soil with important nutrients. Additionally, this lowers the amount of fuel that is available prior to the warm season with the added benefit of fuel load reduction (Hazard management)

• All seeded strips will continue to receive target spraying and selective brush cutting of introduced species before they mature, with broadleaf weeds like Capeweed (Arctotheca calendula) and Salvation Jane (Echium plantagineum) occasionally having to be treated on multiple occasions due to shifting patterns in

weather and climate. Many weed species present in these areas are highly adaptable and suited to our climate due to their location of origin also being in the southern hemisphere.

Large volumes of seed are currently being produced by species that sprouted from seed planted into the pre-stripped regions, such as Eucalyptus odorata, a significant local overstory species, and are helping to recruit and enhance populations within these areas (Refer Figure 1). These key species, such She-Oak (*Allocasuarina verticillata),* are now growing to heights of over six meters in some cases, while groundcover colonisers from related plant communities, like creeping salt bush (*Atriplex semibaccata*), are now abundant.

Furthermore, there are still encouraging indications of subsurface and microbiological activity, such as the growth of Cryptogams in these strips, which have populated previously uninhabited areas prior to the seeding operations. Early indications following the rainfall during the second half of the reporting period are positive, even if the drought conditions of late 2024–early 2025 caused a noticeable visual drop in these species. In addition to serving as colonisers and binders to stop erosion and the entry of invasive species, cryptogams, which include lichens and mosses, are excellent markers of healthy soil activity.



Figure 6 New area of rehab/reveg. adjacent to Old Mulawa cottage



Figure 7 Flagged locations of new areas of rabbit control undertaken 2025-2026



Figure 8 Flagged locations of areas of intensive rabbit control, new rehab area



Figure 9 Batched mixtures of native seed for TSF hydroseeding



Figure 10 Filling of 500 litre Tractor mounted spray unit for SEB weed control



Figure 11 Active Rabbit warren located under Lomandra effusa, McFarlane Hill

Additional areas within mine lease

To manage the ever-present Artichoke thistle (*Cyana cardunculus*) populations, broadleaf weed treatment was once again implemented in the spring and summer along the access road, erosion gullies, and fence lines. This species is easily translocated into SEB areas by car and pedestrian traffic, as well as through seed dissemination.

For these tasks, EBSR longline spray equipment was utilised where necessary to increase efficiency and cover a greater area than traditional backpack spraying.

Bridal creeper (*Asparagus asparagoides*) is also marked and treated when it is discovered, especially in places like fence lines, roadsides, and slopes that are among the greater Mine lease. Occasionally it may be necessary to treat small populations or induvial plants even if they are just outside the scope of the lease as, if left untreated, these aggressive invasive species have the potential to spread into and suffocate large tracts of diverse wilder bushland and sensitive native vegetation. (Refer Figure 3 for example of Bridal Creeper amongst native vegetation)

1.7 Hydroseeding

During June of 2026, aprox.3.6 hectares of hydroseeding was undertaken by Kantra on the slopes of the TSF. EBSR supplied a mixture of native seed (Refer Table 1 for list) to be applied in conjunction with a standard pasture cover mix with the aim of covering the surfaces with a stable and self-replicating mixture of fast-growing vegetation. (Refer figure 7 for photo of hydroseed mixes)

Several pre-made bales of hydroseeding mix are still available and can be readily used and modified for any upcoming hydroseeding or manual seeding. Furthermore, there is ample quantity of seed available to customise seed mixtures for any seeding initiatives that may be required.

1.8 Fire reduction programs

Between September 2025 and September 2026, annual hazard reduction projects were carried out. This was a prolonged period of activity, like prior years, but in contrast to the previous reporting years, the higher-than-average rainfall and higher temperatures experienced throughout winter and Autumn resulted in early vigorous growth of exotic grasses and weeds. Similar to last year, a tractor and slashing deck were used for much of the fire reduction. This is the fastest and most effective way to remove flammable waste from wide areas such open paddocks, slopes, and fence lines.

Although the bulk of work consisted of cutting firebreaks along boundaries and fence lines, pedestrian areas and active work areas such as water fill points and pedestrian access areas were also cleared to reduce the risk of snake activity, trip hazards and ignition points in these areas. Timing of these activities are taken into consideration, with the aim of slashing at optimum times to reduce the chance of regrowth. Follow up weed spraying of a species-specific and knockdown herbicide was also carried out where possible to reduce the regrowth of vegetation.

To guarantee that these operations can be completed safely and effectively, EBS Restoration has invested in appropriate equipment for hazard and fire reduction jobs, such as a new 4WD tractor purchased in 2025 and a heavy-duty cutting deck with a demountable fire-fighting unit.

1.9 Pest management

In accordance with prior years' efforts, pest management operations have continued across the mine lease and related areas.

The main activity has remained the fumigation and destruction of rabbit (*Oryctolagus cuniculus*) warrens, which has been done in several locations within the mining lease. Additionally, re-treatment of warren complexes has been done in the regions that border Lot 25 and the access road. Because of the favourable sandy soils and the availability of refuge from predators, rabbits will frequently re-enter previously treated areas to establish new warren systems, necessitating re-treatment like this.
(For sites from prior years and rework locations, see Figure 4)

All escape holes in the warren system must be found and blocked, and the remaining warren entrance is treated with water-activated aluminium phosphide tablets before it is sealed. Pindone-laced carrots have also been used as bait in previous years' treatments, although this would be ineffective due to personnel expenses and additional monitoring, as well as the higher danger of off-target damage to native fauna.
This procedure is carried out in accordance with all applicable safety regulations and pest management licence requirements.

In most SEB and cultivated areas, grazing and damage from kangaroos (*Macropus sp*.) is a persistent concern, especially in regions of germination and new growth. The grazing is an opportunistic consequence of having palatable plants in these regions, and the majority of tree guards used at the time of planting have been removed in prior years to permit unfettered growth of new plantings.
During the first part of 2026, Kantra implemented a campaign of targeted culling using licensed shooters, which led to fewer kangaroo observations in several of the SEB and surrounding areas.

Many species, such as Dodonaea viscosa and Allocasuarina verticillata, are especially palatable to Macropod species throughout their juvenile growth phases. If such species are subjected to ongoing grazing pressure, the diversity of species in revegetation regions may decline.

As needed, ongoing fence repairs are also performed on any boundary or dividing/exclusion fences; nonetheless, there remains a number of sections of fence that are in an unserviceable condition and would require replacement.

APPENDIX – KANTRA SEED INVENTORY

Project Name: Kanmantoo Restoration Projects – Kantra Copper						**Sep-26**
Species	**Batch number**	**Collection location**	**Collection date**	**Amount Feb 25**	**Amount remaining**	
						Total (kg)
Eucalyptus camaldulensis	EBSKAN025	Kanmantoo mine site	2011	0.910		0.910
Arthropodium sp.	EBSKAN050	Kanmantoo mine site and surrounds	Dec-12	0.105		0.105
Cymbopogon ambiguus	EBSKAN092	SPA	Dec-13	11.000		11.000
Acacia argyrophylla	EBSKAN093	Kanmantoo mine site and surrounds	Dec-13	11.920		11.920
Eucalyptus phenax	EBSKAN095	Kanmantoo mine site	Feb-14	0.060		0.040
Enteropogon acicularis	EBSKAN099	SPA	Dec-13	1.400		1.400
Cassinia arcuata	EBSKAN108	Kanmantoo mine site and surrounds	2014	1.300		1.300
Callitris canescens	EBSKAN111	Kanmantoo mine site and surrounds	2014	0.080		0.080
Cymbopogon ambiguus	EBSKAN117	SPA	Dec-14	7.500		7.500
Senecio quadridentatus	EBSKAN142	SPA	Feb-15	0.082		0.082
Bothriochloa macra	EBSKAN145	SPA	Feb-15	4.000		4.000
Convolvulus erubescens	EBSKAN148	SPA		1.800		1.800
Santalum acuminatum	EBSKAN151	Surrounds	Oct-15	0.013		0.013
Eucalyptus odorata	EBSKAN155	Kanmantoo mine site	Dec-15	0.757		0.757
Vittadinia blackii	EBSKAN157	SMA	Oct-15	1.750		1.750
Helichrysum leucopsideum	EBSKAN160	SPA	Nov-15	0.037		0.037
Bothriochloa macra	EBSKAN169	SPA	Nov-15	4.000		4.000
Cymbopogon ambiguus	EBSKAN172	SPA	Nov-15	2.500		2.500
Enchylaena tomentosa	EBSKAN176	SPA	Feb-16	2.700		2.700
Enchylaena tomentosa	EBSKAN180	SPA	Apr-17	2.900		2.100

Eucalyptus odorata	EBSKAN184	Kanmantoo mine site and surrounds	Jan-17	0.033		0.033
Themeda triandra	EBSKAN189	SPA	Jan-17	1.500		1.500
Bursaria spinosa	EBSKAN196	Kanmantoo mine site and surrounds	Feb-16	0.038		0.038
Themeda triandra (includes stalks)	EBSKAN200	SPA / SMA	Dec-17	6.000		6.000
Chloris truncata	EBSKAN201	SMA	Jan-18	7.500		7.500
Aristida behriana	EBSKAN202	SMA	Dec-17	0.800		0.800
Austrostipa blackii	EBSKAN204	surrounding area	Nov-17	1.900		1.900
Vittadinia sp. Mix	EBSKAN205	surrounding area	Nov-17	0.260		0.260
Lomandra effusa	EBSKAN210	surrounding area	Nov-17	0.450		0.450
Helichrysum leucopsideum	EBSKAN211	surrounding area	Nov-17	0.031		0.031
Arthropodium sp.	EBSKAN213	surrounding area	Nov-17	0.013		0.013
Acacia pycnantha	EBSKAN221	surrounding area	Dec-17	2.650		2.650
Bolboschoenus caldwellii	EBSKAN222	surrounding area	Nov-17	0.350		0.350
Lomandra effusa	EBSKAN223	surrounding area	Nov-17	0.350		0.350
Vittadinia sp. Mix	EBSKAN224	SMA	Feb-18	0.500		0.500
Eucalyptus odorata	EBSKAN226	mine lease	Jan-19	2.600		2.560
Allocasuarina verticillata	EBSKAN227	Kanmantoo mine site and surrounds	Nov-18	2.890		2.490
Callitris gracillis	EBSKAN228	Kanmantoo mine site and surrounds	Jan-19	0.327		0.227
Callitris preissii	EBSKAN229	surrounding area	Jan-19	9.580		9.580
Convolvulus sp	EBSKAN230	SPA	Feb-19	0.654		0.654
Aristida behriana	EBSKAN232	SMA	Feb-19	1.000		1.000
Kennedia prostrata	EBSKAN237	SPA	Dec-18	0.220		0.180

Podolepis rugata	EBSKAN239	Kanmantoo mine site and surrounds	Nov-18	0.080		0.080
Clematis microphylla	EBSKAN240	surrounding area	Dec-18	0.267		0.267
Chloris truncata	EBSKAN244	SMA	Jan-19	1.000		1.000
Enchylaena tomentosa	EBSKAN246	SPA	Feb-19	4.000		4.000
Maireana brevifolia	EBSKAN247	mine lease and surrounds	Feb-19	4.600		4.600
Atriplex semibaccata	EBSKAN248	SPA	Feb-19	1.250		1.100
Eucalyptus camaldulensis	EBSKAN249	Kanmantoo mine site and surrounds	Apr-19	1.030		
Chrysocephalum semipapposum	EBSKAN251	Kanmantoo mine site and surrounds	Nov-19	1.390		1.390
Chrysocephalum apiculatum	EBSKAN252	Kanmantoo mine site and surrounds	Nov-19	0.680		0.680
Helichrysum leucopsideum	EBSKAN253	Kanmantoo mine site and surrounds	Nov-19	1.980		1.900
Podolepis rugata	EBSKAN254	Kanmantoo mine site and surrounds	Dec-19	0.445		0.445
Olearia pannosa	EBSKAN255	Kanmantoo mine site and surrounds	Nov-19	0.390		0.390
Ptilotus spathulatus	EBSKAN256	Kanmantoo mine site and surrounds	Nov-19	0.120		0.120
Hardenbergia violacea	EBSKAN257	Kanmantoo mine site and surrounds	Dec-19	0.380		0.380
Allocasuarina verticillata	EBSKAN258	Kanmantoo mine site and surrounds	Nov-19	2.650		2.650

Acacia acinacea	EBSKAN259	Kanmantoo mine site and surrounds	Nov-19	0.440		0.440
Vittadinia sp. Mix	EBSKAN260	Kanmantoo mine site and surrounds	Nov-19	5.800		5.100
Maireana brevifolia	EBSKAN261	Kanmantoo mine site and surrounds	Mar-20	2.500		0.360
Atriplex semibaccata	EBSKAN262	SPA	Feb-20	6.100		6.100
Enchylaena tomentosa	EBSKAN263	SPA	Feb-20	3.000		3.000
Convolvulus sp.	EBSKAN264	SPA	Feb-20	0.250		0.210
Cullen australasicum	EBSKAN265	Kanmantoo mine site and surrounds	Jan-20	0.410		0.410
Einadia nutans	EBSKAN267	SPA	Jan-20	0.021		0.021
Austrostipa / Rytidosperma mix	EBSKAN270	Kanmantoo mine site and surrounds	Nov-20	288.500		274.500
Cullen australasicum	EBSKAN271	Kanmantoo mine site and surrounds	Nov-20	0.285		0.185
Chrysocephalum semipapposum	EBSKAN272	SPA	Nov-20	0.760		0.760
Chrysocephalum apiculatum	EBSKAN273	SPA	Nov-20	0.860		0.780
Maireana brevifolia	EBSKAN274	Kanmantoo mine site and surrounds	Mar-21	0.840		0.640
Maireana rohrlachii	EBSKAN275	SPA	Feb-21	0.031		0.031
Kennedia prostrata	EBSKAN276	SPA	Nov-20	0.230		0.230
Gonocarpus tetragynus	EBSKAN277	SPA	Nov-20	0.092		0.000
Podolepis rugata	EBSKAN278	SPA	Nov-20	0.430		0.430
Austrostipa / Rytidosperma mix	EBSKAN279	Kanmantoo mine site and surrounds	Nov-21	398.000		398.000
Austrostipa / Rytidosperma mix	EBSKAN280	Kanmantoo mine site and surrounds	Nov-22	90.500		90.500

Themeda triandra (includes stalks)	EBSKAN281	SPA	Jan-23	12.500		12.500
Austrostipa / Rytidosperma mix	EBSKAN282	Kanmantoo mine site and surrounds	Nov-23	42.000		42.000
Austrostipa / Rytidosperma mix	EBSKAN283	Kanmantoo mine site and surrounds	Nov-24	11.200		11.200
Einadia nutans	EBSKAN284	SPA	Feb-19	0.135		0.135
Eucalyptus odorata	EBSKAN285	Kanmantoo mine site and surrounds	Apr-25	1.110		1.110
Maireana rohrlachii	EBSKAN286	Kanmantoo mine site and surrounds	Apr-25	0.110		0.110
Eucalyptus calycogona	EBSKAN287	Kanmantoo mine site and surrounds	Apr-25	0.155		0.155
Allocasuarina verticillata	EBSKAN288	Kanmantoo mine site and surrounds	Apr-25	0.105		0.105
Eucalyptus socialis	EBSKAN289	Kanmantoo mine site and surrounds	Apr-25	0.360		0.320
Eucalyptus camaldulensis	EBSKAN290	Kanmantoo mine site and surrounds	Apr-25	0.095		0.095
			starting weight	**981.541**		**961.489**

EBS Restoration

Unit 5 125 Hayward Avenue

Torrensville SA 5031



Appendix 5 Kanmantoo Copper Mine Landscape Function Analysis 2025

Kanmantoo Copper Mine

Landscape Function Analysis 2025

FINAL

January 2026

umwelt

Kanmantoo Copper Mine

Landscape Function Analysis 2025

FINAL

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Hillgrove Copper Pty Ltd

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Report No.:	32430/R03
Date:	January 2026

This report was prepared using
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Document Status

Rev No.	Reviewer Name	Date	Approved for Issue Name	Date
V1	Angela Carpenter	19/01/2026	Angela Carpenter	19/01/2026
V2		27/01/2026	Alison Derry	27/01/2026

Executive Summary

The Kanmantoo Copper Mine (Kanmantoo) operations in South Australia continue to implement a long-term Landscape Function Analysis (LFA) monitoring program to assess ongoing environmental management, restoration efforts, and Significant Environmental Benefit (SEB) offset components. Permanent LFA monitoring sites have been established across the Kanmantoo Mining Lease (ML) and SEB areas (together referred to as the 'Project Area'). The vegetation monitoring program commenced in 2011 and is now in its fourteenth year (excluding 2016).

Two Nationally Threatened Ecological Communities occur within the Project Area: *Eucalyptus odorata* (Peppermint Box) Open Woodland and *Lomandra effusa* (Scented Matrush) ± *Lomandra multiflora* subsp. *dura* (Stiff Mat-rush) Open Tussock Grassland. Both communities are listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Permanent LFA monitoring sites established in these communities between 2011 and 2013 serve as baselines to guide restoration targets for rehabilitation and SEB areas.

Over the life of the Kanmantoo monitoring program (2011–2025), LFA indicators have demonstrated overall positive rehabilitation trends. Many rehabilitation plots have reached a level of 'self-sustaining communities,' with native vegetation cover and soil stability comparable to analogue sites after only three to four years. Sites that successfully established vegetation cover have typically shown increasing structural complexity, shifting from primarily grass cover to include shrubs and trees. These successional trends generally follow a pattern of low initial landscape function index values, followed by a rebound period where plant cover supports high stability, infiltration, and nutrient cycling before stabilising toward analogue benchmarks. Based on these early restoration successes, ongoing restoration efforts are expected to continue producing functional landscapes that progressively resemble analogue sites.

The 2025 LFA monitoring program was conducted from 8–10 September 2025 and included the assessment of 13 sites, comprising both analogue sites and rehabilitation sites at various stages of restoration. Climatic variability strongly influenced 2025 results with prolonged dry conditions in preceding years contributing to widespread dieback, particularly among planted Acacia species, leading to reduced structural complexity at several sites. Although the year commenced under relatively dry conditions, significant rainfall in the months prior to the survey triggered rapid growth of exotic species, particularly grasses, and resulted in a marked increase in exotic litter accumulation within interpatch zones. These dynamics contributed to an overall increase in interpatch extent across many sites, even where some soil function indices improved.

Despite these challenges, long-term trends remain positive. Stability values continue to trend toward or above analogue benchmarks at most sites, and nutrient values improved at several locations, in some cases exceeding analogue levels. Infiltration, however, remains below analogue benchmarks at many sites, reflecting constraints associated with increased interpatch area and reduced patch connectivity. Lifeform categories continue to exhibit natural successional shifts, although climatic extremes and exotic species dominance have slowed progress toward analogue benchmarks at some sites.

To strengthen interpretation and management response, additional monitoring was introduced in 2025. Bushland Assessment Methods were applied at each LFA site to record species richness, weed cover, and vegetation condition metrics. The outcomes of these surveys are detailed in a separate report prepared for SEB offset purposes (Umwelt, 2025b). Incorporating species composition and other ecological attributes into ongoing monitoring will provide valuable insights into restoration success and guide adaptive management strategies. Future monitoring should also consider grazing pressure, particularly from kangaroos, which remains unmonitored but may influence vegetation cover and soil stability.

The 2025 results underscore the importance of adaptive management to maintain progress and mitigate pressures from climatic variability and exotic species. Future management will need to actively monitor the outcomes of climatic extremes, such as prolonged droughts and intense rainfall events, and adjust strategies accordingly to sustain ecosystem function. Key priorities include targeted weed and litter management, interventions to improve patch connectivity and infiltration, and enhancements to monitoring design, such as continuing to incorporate species composition indicators and grazing pressure assessments into future surveys. Long-term monitoring remains essential to account for stochastic climate effects and to provide the feedback necessary for timely adaptation and informed decision-making as ecosystem recovery trajectories evolve.

Abbreviations

Abbreviation	Definition / Description
ACA	Derived Acacia pycnantha (Golden Wattle) low woodlands
AN	Analogue
BOM	Bureau of Meteorology
EBS	Environment and Biodiversity Services Pty Ltd – trading as EBS Ecology (now Umwelt)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GRA	Modified hillslope grasslands
Hillgrove	Hillgrove Resources Limited and subsidiary Hillgrove Copper Pty Ltd
IWL	Integrated Waste Landform
Kanmantoo	Kanmantoo Copper Mine
LFA	Landscape Function Analysis: an environmental monitoring technique internationally recognized for measuring and monitoring ecosystem function and rehabilitation progress.
LOM	Lomandra effusa (Scented Mat-rush) +/- Lomandra multiflora subsp. dura (Stiff Mat-rush) Open Tussock Grassland
ML	Mining Lease
ODO	Eucalyptus odorata (Peppermint Box) Woodland
PEPR	Program for Environmental Protection and Rehabilitation
Project Area	Kanmantoo Mining Lease (ML) and Significant Environmental Benefit areas
RH	Rehabilitation
RT	Rehabilitation Transect
SA	South Australia / South Australian
SEB	Significant Environmental Benefit
ssp.	Sub-species
SSA	Soil Surface Assessment
STI	Austrostipa scabra ssp. (Spear Grass) Grassland sites
TSF	Tailings Storage Facility
Umwelt	Umwelt (Australia) Pty Ltd
WRL	Waste Rock Landform

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Appendix 1 Summary of LFA Sites Monitored and Monitoring Frequency 2011–2025

Appendix 2 Landscape Function Analysis (LFA) Results Summary for 2011–2025

Appendix 3 Annual LFA Monitoring Site Photographs

1.0 Introduction

A long-term monitoring program using Landscape Function Analysis (LFA) was implemented by Hillgrove Resources Limited (Hillgrove), circa 2011, to measure the ongoing environmental management, restoration and Significant Environmental Benefit (SEB) offset program components of the Kanmantoo Copper Mine (Kanmantoo from hereon) in South Australia.

Hillgrove is obligated to meet its rehabilitation objectives associated with the Program for Environmental Protection and Rehabilitation (PEPR) for Kanmantoo. Part of the PEPR requires monitoring of nominated areas commissioned to offset clearance of native vegetation associated with mine operations and infrastructure. The monitoring is specifically undertaken to measure the progress of a restoration program over time using the LFA methodology of Tongway and Hindley (2004).

LFA is a tool that brings together a number of different components that, when measured together over time, provide an accurate indication of how a distinct rehabilitation area is performing, and advancing toward a functioning system. The intention of the Kanmantoo LFA monitoring program is to achieve a time series trajectory of land condition across the mine site, enabling critical indicators to be identified, their values analysed and utilised for revision of future management activities (i.e., adaptive management) if required. A comparison with data collected from reference (analogue) sites with similar characteristics, but under ambient conditions, will account for seasonal and external effects beyond the control of the manager and enables a direct comparison of performance. For a system to be developing towards sustainability, it must be accumulating resources faster than they are lost. A functional landscape is one where vital resources such as water, plant litter and topsoil are retained and efficiently used (cycled) within the boundaries of the landscape and released very slowly (Tongway and Ludwig 2006). LFA provides a rapid assessment of this functionality. When applied over time, results can be analysed to identify trends in the progress of the rehabilitation or remediation.

Since 2011, Umwelt (Australia) Pty Ltd (Umwelt) (previously EBS Ecology), has worked with Hillgrove Resources to undertake the ongoing LFA monitoring program across the Kanmantoo Project Area. Details of the monitoring program, associated methodologies and design are described in Kanmantoo Mine Vegetation Monitoring – Landscape Function Analysis (EBS Ecology 2011).

1.1 Objectives

The primary objectives of the 2025 LFA monitoring program are to:

- Repeat LFA at a selection of pre-existing sites established since 2011 at Kanmantoo;
- Provide results of ongoing LFA monitoring data assessed in 2025 across the Kanmantoo Project Area and compare with analogue sites and data from previous years; and
- Discuss the LFA program results to this point and comment on trends observed.

1.2 Project Area

The Project Area is located approximately 45 km south-east of Adelaide in the eastern Mount Lofty Ranges of South Australia (SA) and 1.5 km south-west of the Kanmantoo township. The area is representative of a transitional zone on the eastern face of the Mount Lofty Ranges, between the Adelaide Hills woodland regions and the Murray River Plains mallee. It has a long-term average rainfall of 470 mm (BOM 2025) and encompasses a variety of soil types and geological structures, conducive to an assortment of vegetation types and habitat niches.

Within the Kanmantoo Project Area, the target landscape functionality of natural areas (as characterised by reference sites established within native vegetation communities) is compared with rehabilitated opencast mines and rehabilitated slopes of tailings dams.

2.0 Background

A land condition and restoration monitoring program has been undertaken at Kanmantoo over several years, with initial baseline surveys commencing in 2011. To date, 50 permanent Landscape Function Analysis (LFA) monitoring sites have been established across the Kanmantoo Mining Lease (ML) and SEB areas. These sites include a mix of baseline (analogue) and restoration/rehabilitation locations, each monitored at varying times and frequencies since 2011, in response to evolving restoration activities and monitoring priorities.

Analogue sites were assessed using the LFA method to provide baseline data for comparison with future rehabilitation trajectories. These included three *Lomandra effusa* (Scented Mat Rush) Grassland sites, six *Eucalyptus odorata* (Peppermint Box) Woodland sites, and three *Austrostipa scabra* ssp. (Spear Grass) Grassland sites.

Initially, the areas designated for vegetation restoration were highly degraded pastoral lands historically used for sheep and/or cattle grazing. The soil cover was dominated by exotic pasture species such as *Avena barbata* (Wild Oat), *Phalaris aquatica* (Phalaris), *Festuca* sp. (Fescue), and *Lolium* spp. (Perennial Rye Grass). Remnant woodlands consisted of mature *Eucalyptus odorata* (Peppermint Box) trees, largely lacking native understorey vegetation.

In 2013, a vegetation rehabilitation program commenced, employing a range of proven restoration techniques including inter-row stripping, tube stock planting, and hydroseeding. These methods aim to replicate, as closely as possible, the compositional, structural, and functional characteristics of local pre-European vegetation communities.

The Kanmantoo Mine Native Vegetation Management Plan (Coffey Environments 2010) outlined a series of measures under the *Native Vegetation Act 1991* to offset native vegetation clearance. These included protecting high-quality remnant vegetation, improving the condition of degraded remnants within the Project Area, and revegetating pasture and disturbed areas to reduce exotic biomass and restore native vegetation communities.

Under the current restoration program, five primary methods are being utilised:

- Direct seeding with native seed (following ripping/soil removal);
- Planting native flora seedlings (tube stock);
- Hydroseeding and hand broadcasting of seed on Tailings Storage Facility (TSF) walls;
- Weed control and bush care; and
- Translocation of significant flora such as *Diuris behrii* (Cowslip Orchid).

Since the program commenced, approximately 97 hectares (ha) have been actively managed for rehabilitation and restoration. LFA monitoring has been progressively implemented across these areas to assess ecological function and restoration progress. Monitoring results are compared against analogue sites assessed during the early stages of the program (2011–2013), providing a benchmark for evaluating progress toward a ‘functional’ state (Tongway and Hindley 2004). In 2025, 13 LFA monitoring sites were assessed and compared with the baseline analogue data.

3.0 Methodology

3.1 Survey Timing

The 2025 field survey was conducted from 8 to 10 September 2025.

3.2 Vegetation Rehabilitation Monitoring – Landscape Function Analysis

LFA monitoring sites were established in areas that enable Hillgrove to report on its required lease conditions under the current PEPR. LFA sites have been strategically positioned to enable evaluation of the LFA monitoring program, the following attributes of rehabilitation areas have been considered:

- location of monitoring sites
- representation of vegetation communities
- effectiveness of analogue versus rehabilitation sites as comparable data.

3.2.1 LFA Sites

The 2025 LFA Monitoring program included assessment of 13 sites, comprised of rehabilitation transects (**Table 3.1**, **Figure 3.1**).

Analogue sites were initially established in three different vegetation community types:

- *Eucalyptus odorata* (Peppermint Box) Woodland (ODO);
- *Lomandra effusa* (Scented Mat-rush) +/- Lomandra multiflora subsp. dura (Stiff Mat-rush) Open Tussock Grassland (LOM); and
- *Austrostipa scabra* ssp. (Spear Grass) Grassland sites (STI).

Additional analogue sites were established to match restoration priorities in the following two communities:

1. **Derived *Acacia pycnantha* (Golden Wattle) low woodlands (ACA) – established in 2014**

Examples of this community are located at the north-eastern end of the pit along the degraded edge of the *Eucalyptus odorata* open woodland (**Figure 3.1**). The current community is more accurately described as a *Eucalyptus odorata* open woodland with the overstorey removed, where *Acacia pycnantha* is now dominating as an interim climax community. The sites were therefore considered suitable as analogue sites to obtain LFA target reference figures for *Acacia pycnantha* low woodland rehabilitation sites.

2. **Modified hillslope grasslands (GRA) – established in 2019**

Two of these sites were established within the ML on 'Carmens' paddock, west of the dam and two sites were located outside of the ML on the southern side of Back Callington Road near the weather / dust monitoring station.

Data collection and analysis were undertaken in accordance with the LFA procedures manual developed by Tongway & Hindley (2004). Details of the rehabilitation monitoring program and associated methodologies are described in Kanmantoo Mine Vegetation Monitoring – Landscape Function Analysis (EBS Ecology 2011). A summary of all sites monitored since 2011 is provided in **Appendix 1**.

3.3 Other Monitoring Related to Rehabilitation

Additional surveys conducted during the 2025 monitoring program included monitoring of avifauna (birds) and possums (primarily Common Brushtail – *Trichosurus vulpecula*). Opportunistic fauna sightings were also recorded. Results from the Spring 2025 fauna survey are detailed in Umwelt (2025a).

3.4 Limitations

Given this is a long-term project, monitoring at Kanmantoo has been conducted by various surveyors over the years. Observer bias, which can lead to a systematic difference between the true value and the observed value due to variation between observers, has been minimised to the greatest extent possible. This has been achieved by assigning the same observer to conduct the survey in consecutive years, where feasible, and by providing comprehensive training to new observers to ensure consistency in survey methodology.

Table 3.1 **Selection of Existing LFA Rehabilitation (RH) Sites and Analogue (AN) Sites Assessed in 2025, including Assessment History from 2011–2025**

Site Type	Site Name	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025
RH	KANODO 4	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO 5	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANODO 6	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO 8	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANODO 9	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANODO RT 07	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 10	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 12	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 13	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 14	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANODO RT 15	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 16	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 17	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 18	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
RH	KANODO RT 19	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANODO RT 20	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANODO RT 21	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANLOM RT 01	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANLOM RT 02	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANACA RT 01	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANACA RT 02	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪
RH	KANACA RT 03	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪

Site Type	Site Name	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025
RH	KANGRA RT 01	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
AN	KANGRA 10	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
AN	KANGRA 11	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
AN	KANGRA 12	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	
AN	KANGRA 13	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	

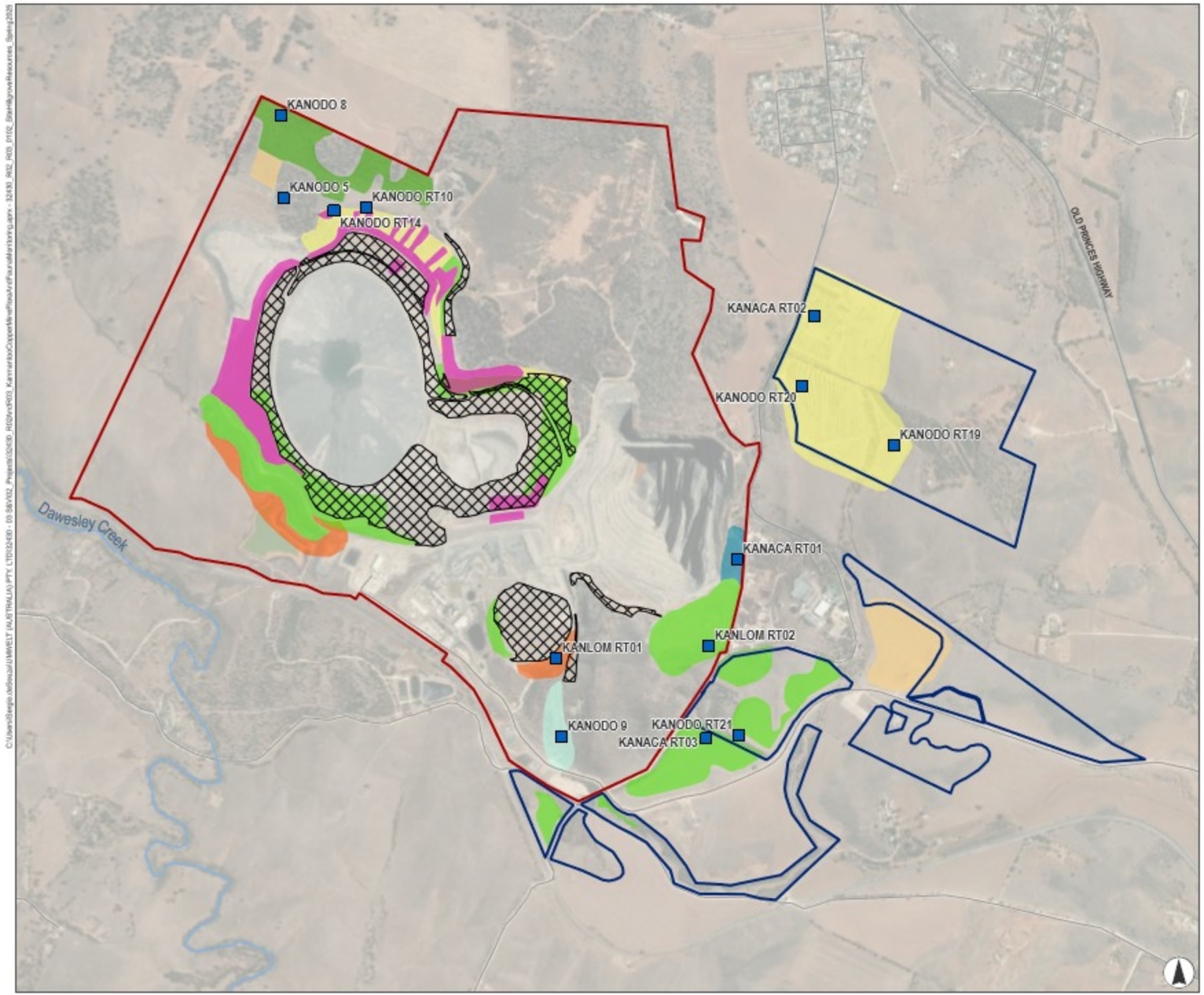


FIGURE 1.2

Sites nominated by Hillgrove Resources for assessment in spring 2025.

Legend

- Kanmantoo Mine (ML 6345)
- SEB Area
- Sites
- Main road
- Local road
- Watercourse

Rehabilitation Works

- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020



0 0.4 0.8

Kilometres

Scale 1:19,780 at A4
GDA2020 MGA Zone 54

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Image Source: ESRI Basemap (2025) | **Data Source:** Umwelt (2025), DIT, DEW (2024)

4.0 LFA Results

4.1 Climate

Daily weather observations were available from the Murray Bridge (Pallamana Aerodrome) weather station (BOM 2025). The weather during the 3-day survey period was variable (**Table 4.1**) (BOM 2025). Temperatures recorded during the survey period were average for the time of year and ranged from a minimum of 0.8°C to a maximum of 20.8°C. Moderate winds and gusts of up to 54 km/hour were recorded during the survey period, but wind conditions were considered milder in the mornings. A total of 7.2 mm of rainfall was recorded over the survey period but had a negligible effect on the surveys conducted. Weather conditions were considered optimal for the majority of the survey period.

Table 4.1 Murray Bridge (Pallamana Aerodrome) (024584) Daily Weather Observations during the Survey Period (BOM 2025)

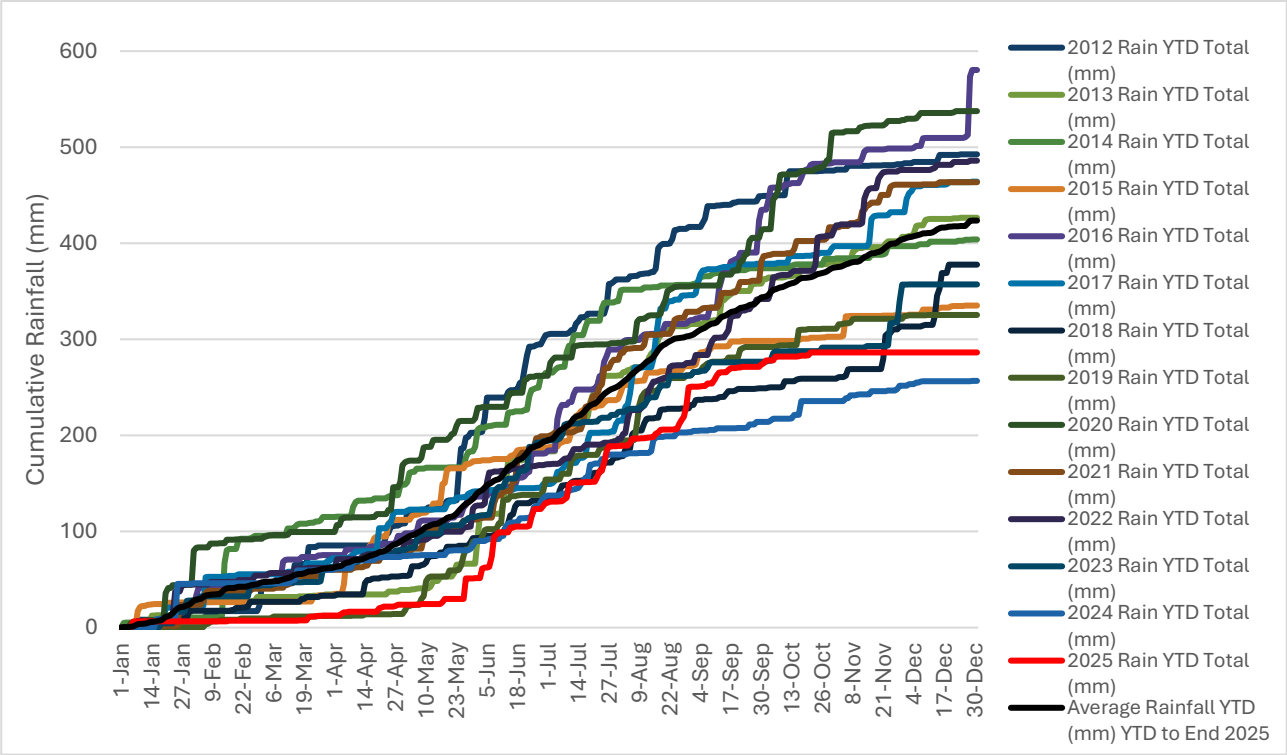
Date	Min air temp (˚C)	Max air temp (˚C)	Rainfall (mm)	Max wind gust			9:00 AM			3:00 PM		
				Direction	Speed (km/h)	Time (local)	Temp (˚C)	Wind direction	Wind speed (km/h)	Temp (˚C)	Wind direction	Wind speed (km/h)
08/09	3.9	20.8	0.0	WNW	39	14:03	15.2	NNW	24	19.9	W	20
09/09	0.8	15.8	0.0	NE	31	12:05	13.1	NE	11	14.8	SE	15
10/09	7.7	15.1	7.2	SW	54	13:29	11.2	S	19	12.8	SW	33

Annual rainfall data (2012-2025) was available from Kanmantoo Cooper Mine (**Graph 4.1**). Annual rainfall data was analysed across the 12 months prior to the September 2025 surveys (i.e. rainfall data was analysed from September 2024 to August 2025). The total annual rainfall in the 12 months leading up to the September 2025 survey period (September 2024 to August 2025) was 303.8 mm. Notably, low rainfall was recorded in early 2025, with only 51.4 mm falling between January and May. Rainfall in 2024 was also below average, with a total of 256.8 mm (**Table 4.2**). In the three months immediately preceding the surveys (June to August 2025), 199.2 mm of rainfall was recorded, indicating a marked increase in precipitation relative to earlier months.

Table 4.2 Kanmantoo Cooper Mine Annual Rainfall Totals 2012–2025

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Rainfall (mm)	492.6	426.6	404	335.2	580.4	464.2	377.8	325.4	537.6	463.6	486	357.2	256.8	286.4*

*Rainfall total for 2025 reflects data as of 21 October 2025; figures for November–December were unavailable at the time of reporting.



Graph 4.1 Kanmantoo Copper Mine Cumulative Rainfall Totals 2012–2025

4.2 LFA Soil Surface Assessment Results

Results for Soil Surface Assessments (SSA) for individual zones and their contribution to whole of site values are provided in **Appendix 2**. Baseline data obtained from multiple analogue sites of the same vegetation association were combined to obtain average values (e.g., KANODO 01, 02 and 03) that are used as target values for rehabilitation sites (see chart columns with error bars below).

4.2.1 *Eucalyptus odorata* (Peppermint Box) Woodland (ODO) Transects

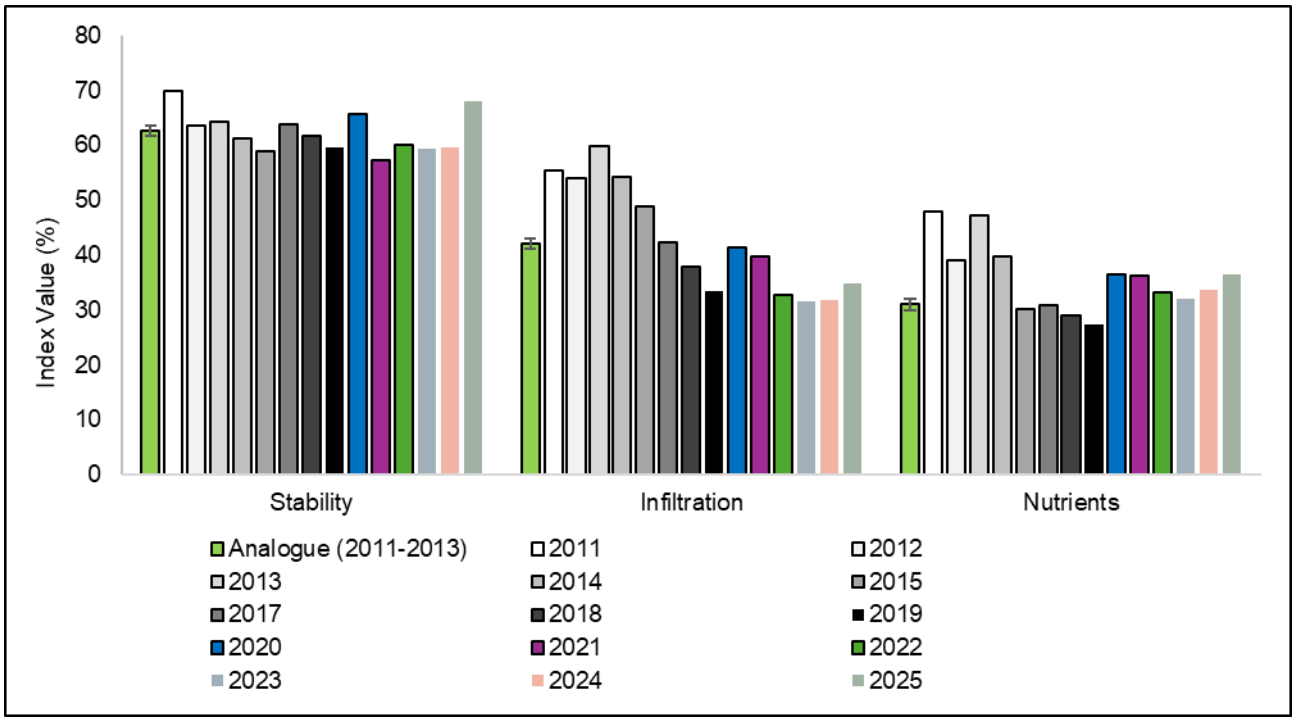
4.2.1.1 KANODO 5

In 2025, Site KANODO 5 showed an increase in stability, infiltration, and nutrient values compared to 2024 (**Graph 4.2**). Since 2011, stability scores at KANODO 5 have generally fluctuated around analogue values, while infiltration and nutrient levels initially peaked above analogue benchmarks between 2011 and 2014, before declining and stabilising around analogue levels in subsequent years.

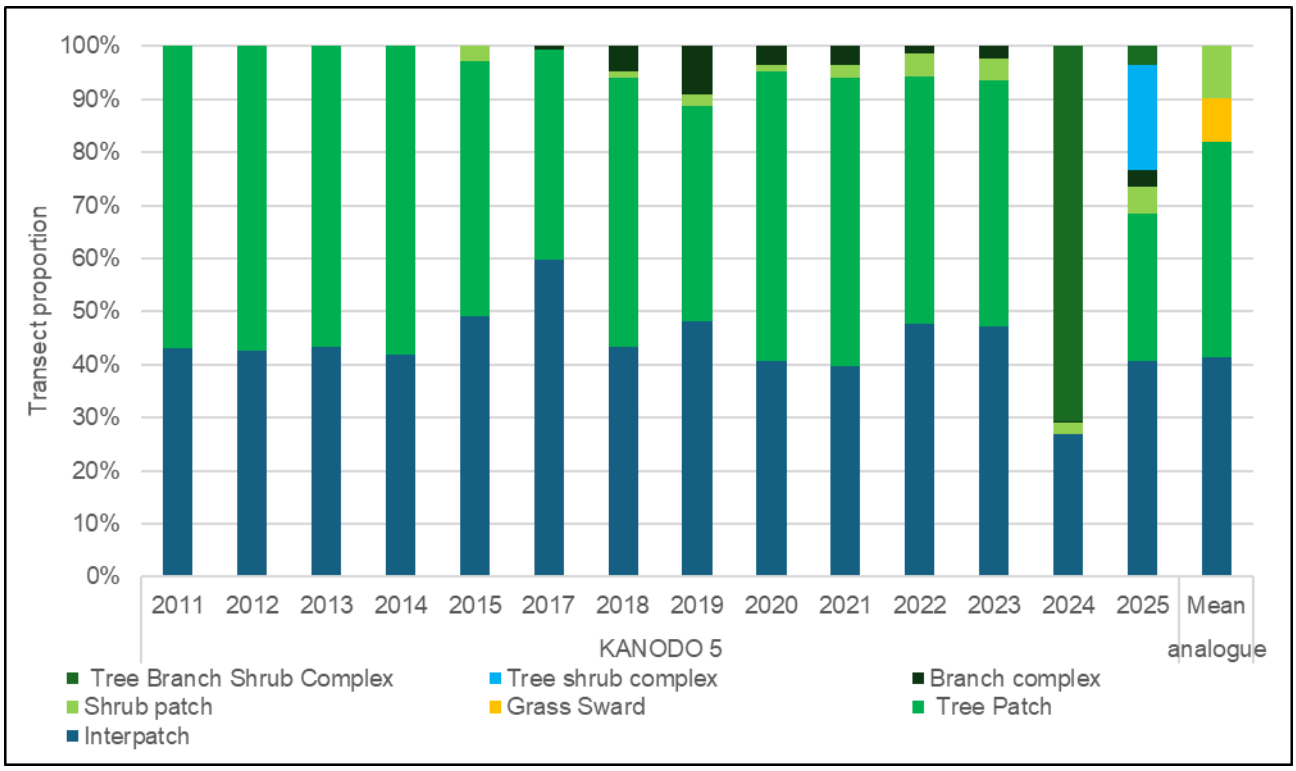
Transect proportions from 2018 to 2023 show a mix of vegetation patches, including tree patch, shrub patch, and branch complex components. In 2024, the tree branch shrub complex became the dominant feature, occupying the majority of the transect. This trend continued in 2025, with the complex persisting as a mix of tree shrub complexes and tree patches (**Graph 4.3**). These complex components were initially absent in the degraded, unrestored community.

The Landscape Organisation Index at KANODO 5 matched the analogue value in 2025 (**Table 4.3**). Since 2011, the number of patch zones per 10 m has generally increased, indicating greater structural complexity, while the average interpatch length has decreased, suggesting improved connectivity. The total patch area (m^2) has fluctuated around the analogue benchmark, with a notable decrease observed in 2025.

Visually, this site shows little physical change in structure. However, due to increased rainfall in the lead-up to the surveys, the lower vegetation stratum shows increased litter cover composed of exotic grasses (**Appendix 3**).



Graph 4.2 **Landscape Function Indices Change (2011-2025) for KANODO 5 with Respect to Mean Analogue Site Values (2011–2013)**



Graph 4.3 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANODO 5**

Table 4.3 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO 5 Rehabilitation Site 2011–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO 5 Rehabilitation 2011	0.4	324.6	8.2	0.6
KANODO 5 Rehabilitation 2012	0.7	252	4.7	0.6
KANODO 5 Rehabilitation 2013	0.5	249.5	6.4	0.6
KANODO 5 Rehabilitation 2014	0.5	256.6	4.6	0.6
KANODO 5 Rehabilitation 2015	1.1	196	2	0.5
KANODO 5 Rehabilitation 2017	0.9	226	5.3	0.4
KANODO 5 Rehabilitation 2018	1.6	178.9	2.7	0.6
KANODO 5 Rehabilitation 2019	2.5	146	1.9	0.5
KANODO 5 Rehabilitation 2020	1.1	203.2	3	0.6
KANODO 5 Rehabilitation 2021	1.4	203.1	2.5	0.6
KANODO 5 Rehabilitation 2022	2.9	155.2	1.5	0.5
KANODO 5 Rehabilitation 2023	2	161.8	2.1	0.5
KANODO 5 Rehabilitation 2024	1.1	250.2	2	0.7
KANODO 5 Rehabilitation 2025	4.3	142.2	1.48	0.6

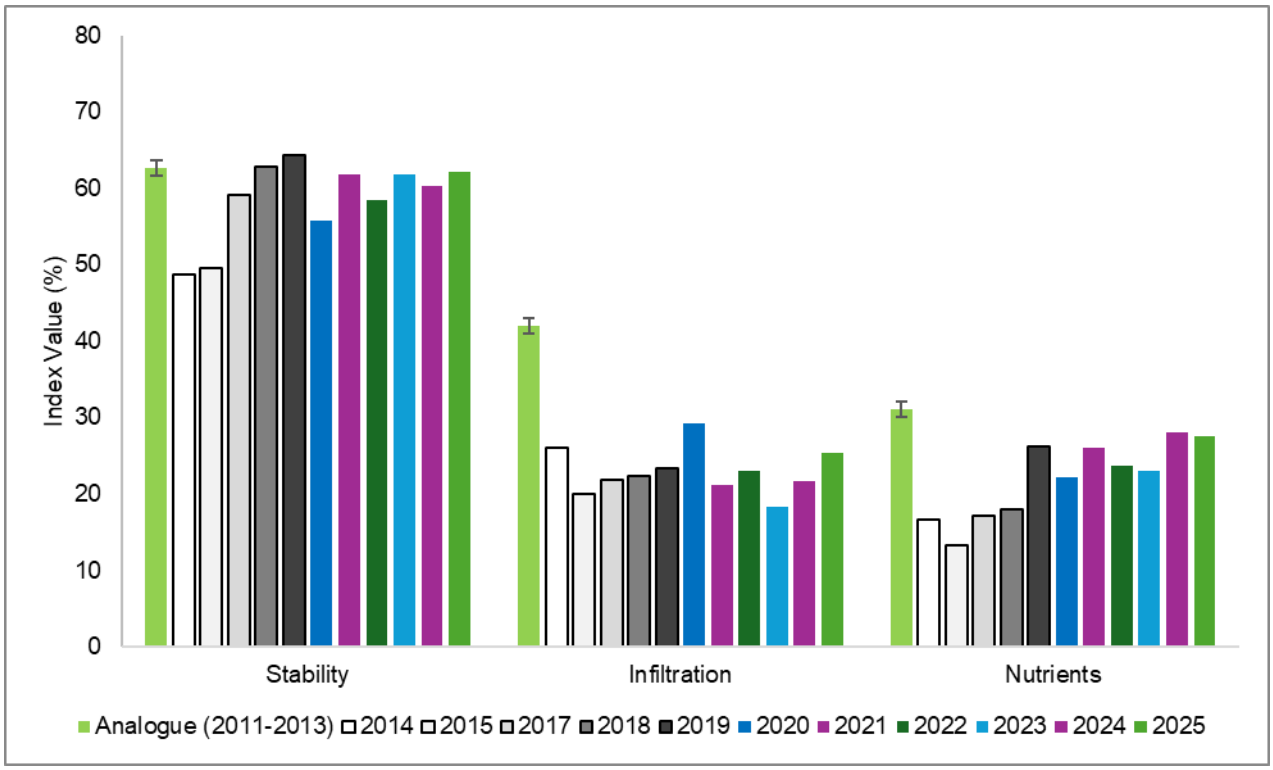
4.2.1.2 KANODO 8

In 2025, Site KANODO 8 showed relatively stable values for stability and nutrients compared to previous years, with infiltration and stability values showing a slight increase since 2024 and nutrient values decreasingly slightly (**Graph 4.4**). Stability and nutrient indices have remained close to analogue levels over time, while infiltration has remained below analogue values.

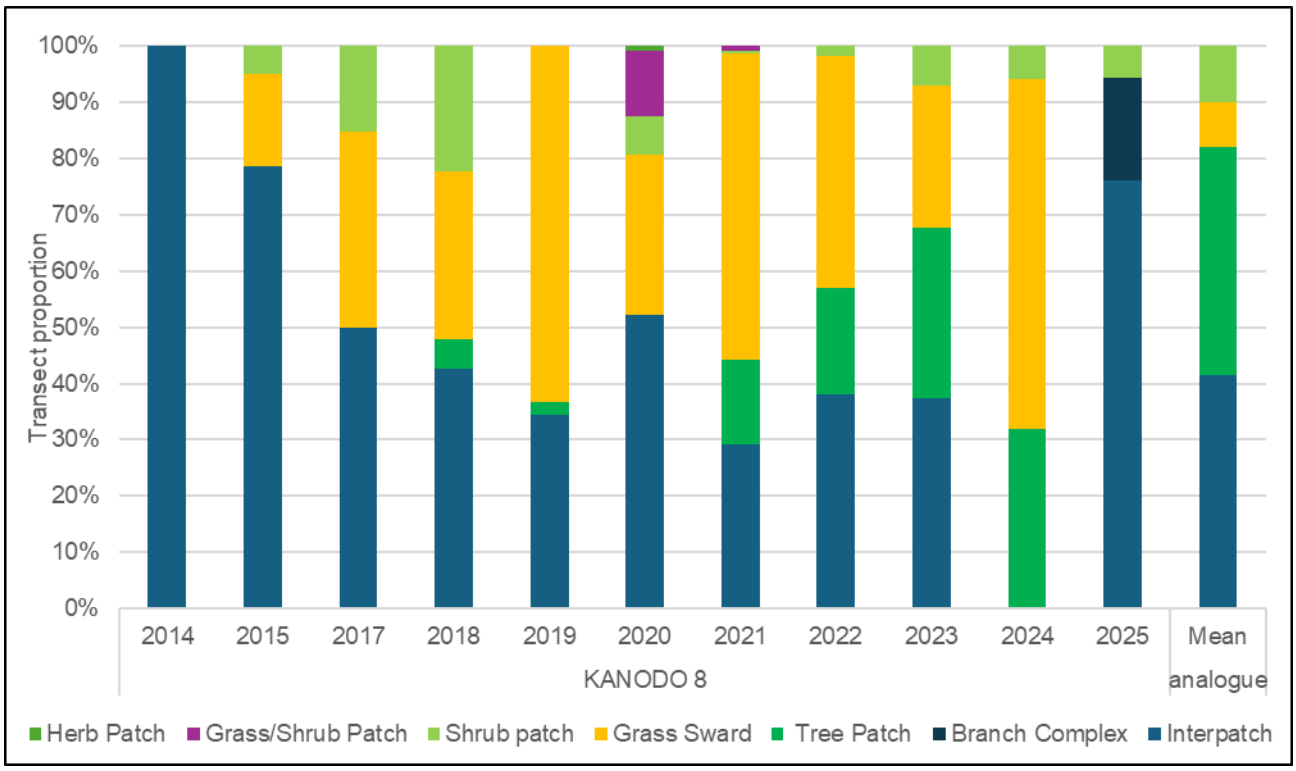
Transect proportions from 2014 to 2024 indicated increasing complexity with the increased presence of tree patches, shrub patches and branch complexes. However, in 2025 a marked increase in interpatch area and branch complexes was observed alongside a loss of grass sward and tree patches (**Graph 4.5**).

The Landscape Organisation Index at KANODO 8 peaked in 2024, exceeding the analogue benchmark, before declining in 2025 (**Table 4.4**). Since 2014, the number of patch zones per 10 m has increased, particularly between 2018 and 2022, indicating a period of enhanced structural complexity. However, in 2025, both the number of patch zones and total patch area declined, while average interpatch length increased, suggesting reduced connectivity and patch cohesion compared to previous years.

Visually, extensive dieback is evident within the site, likely due to very low rainfall during 2024 and early 2025 (**Appendix 3**). This has primarily affected planted Acacia species. This corresponds with the changes observed in transect proportions, where tree patches and grass sward have transitioned to branch complexes and interpatch zones.



Graph 4.4 **Landscape Function Indices Change (2014–2025) for KANODO 8 with Respect to Mean Analogue Site Values (2011–2013)**



Graph 4.5 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANODO 8**

Table 4.4 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO 8 Rehabilitation Site 2011–2025**

Site Type	No. of Patch Zones Per 10 m	Total Patch Area (m^2)	Average Interpatch Length (m)	Landscape Organisational Index
Analogue 2011 -13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO 8 Rehabilitation 2014	0	0	20	0
KANODO 8 Rehabilitation 2015	4.5	20	1.5	0.2
KANODO 8 Rehabilitation 2017	1.3	17.1	4.6	0.4
KANODO 8 Rehabilitation 2018	10.9	5.3	0.4	0.6
KANODO 8 Rehabilitation 2019	11.8	12.4	0.3	0.7
KANODO 8 Rehabilitation 2020	14	15.1	0.5	0.5
KANODO 8 Rehabilitation 2021	17.5	13.9	0.2	0.7
KANODO 8 Rehabilitation 2022	14.9	15.3	0.3	0.6
KANODO 8 Rehabilitation 2023	7.9	29.8	0.6	0.6
KANODO 8 Rehabilitation 2024	4.8	84.2	0	1
KANODO 8 Rehabilitation 2025	2.5	9.5	3.1	0.2

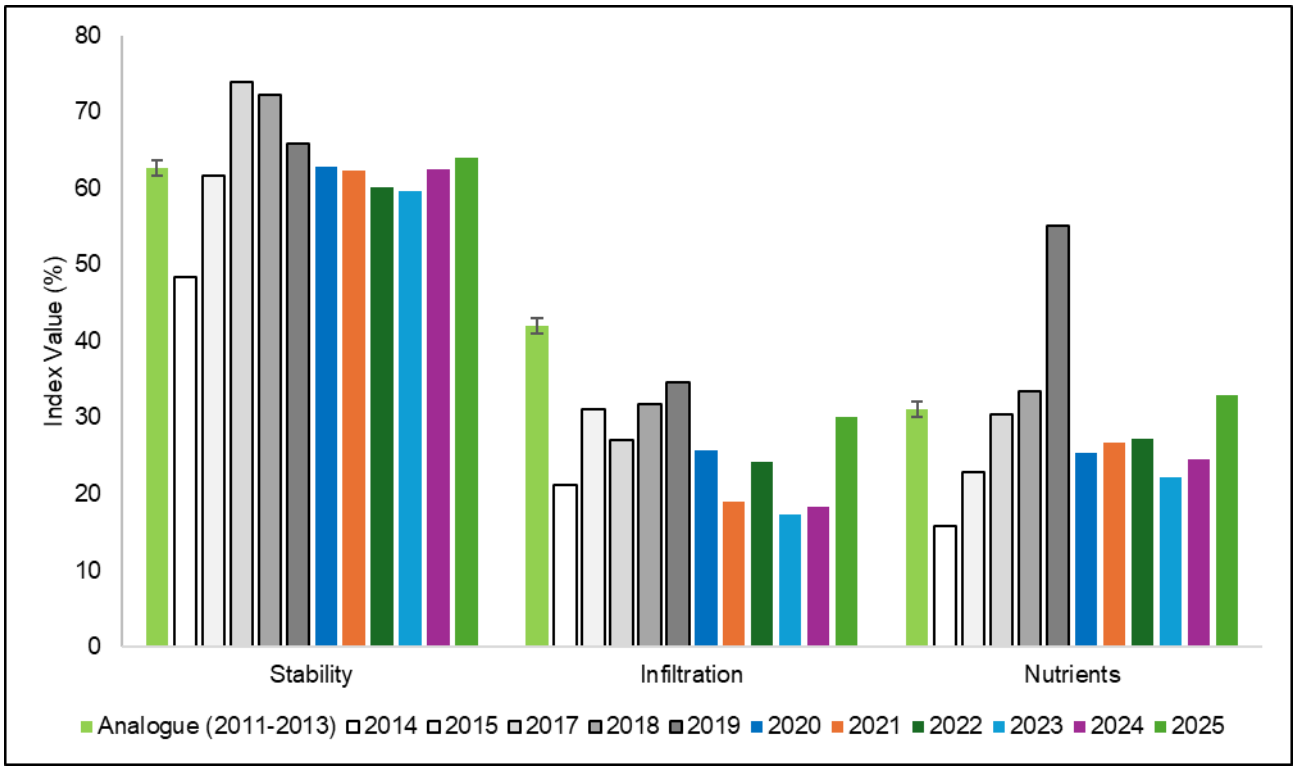
4.2.1.3 KANODO 9

In 2025, Site KANODO 9 showed a slight increase in stability values and a larger increase in infiltration and nutrient values compared to 2024 (**Graph 4.6**). Stability scores at KANODO 9 increased from below analogue values in 2014 to above analogue values in 2018 and 2019, before decreasing and fluctuating around analogue values until 2025. Similarly, infiltration and nutrient levels initially peaked above analogue benchmarks in 2018 and 2019, then declined and fluctuated below analogue values until 2024. In 2025, these values increased closer to analogue levels.

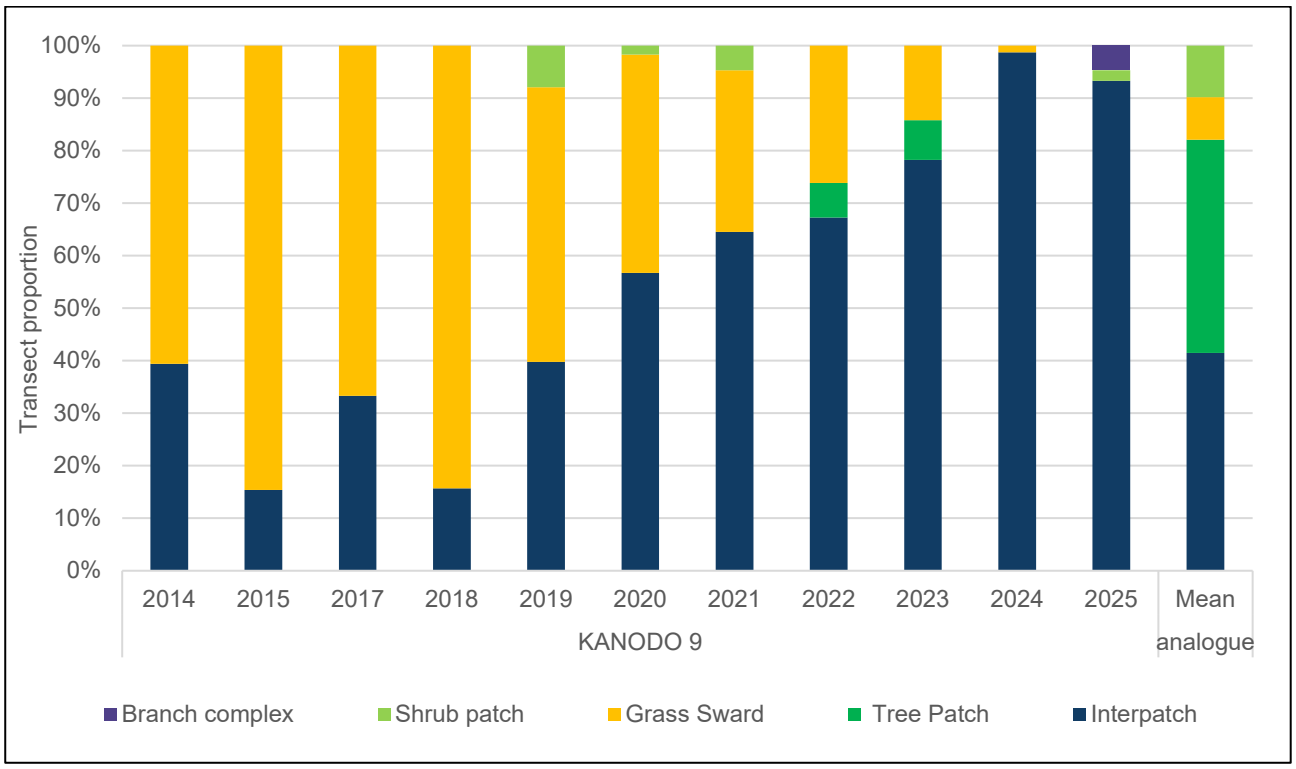
Transect proportions from 2014 to 2018 included a mix of grass sward and interpatch zones, with increasing complexity introduced through shrub and tree patches from 2019 to 2023. However, interpatch area has steadily increased since 2018, with the loss of tree and shrub patches observed in 2024. In 2025, the site was predominantly interpatch, with minimal shrub patches and branch complexes recorded (**Graph 4.7**).

Although the Landscape Organisational Index at KANODO 9 has increased since 2024, the index has steadily declined since 2015 and remains below analogue values in 2025 (**Table 4.5**). Patch metrics have varied across years, with the number of patch zones per 10 m generally increasing from 2014 to 2021 before declining in 2024 and 2025. Total patch area has fluctuated across years, with a notable decrease from 2021 onward. Average interpatch length decreased steadily until 2022, before increasing in 2024 and 2025.

Visually, this site shows little physical change in structure. However, due to increased rainfall in the lead-up to the surveys, the lower vegetation stratum shows increased litter cover composed predominantly of exotic grasses (**Appendix 3**).



Graph 4.6 **Landscape Function Indices Change (2014-2025) for KANODO 9 with Respect to Mean Analogue Site Values (2011–2013)**



Graph 4.7 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANODO 9**

Table 4.5 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO 9 Rehabilitation Site 2011–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO 9 Rehabilitation 2014	3.6	95.5	1.09	0.61
KANODO 9 Rehabilitation 2015	1.9	136.2	0.8	0.9
KANODO 9 Rehabilitation 2017	4.8	111.3	0.76	0.7
KANODO 9 Rehabilitation 2018	2	166.9	0.67	0.84
KANODO 9 Rehabilitation 2019	6	83	0.71	0.6
KANODO 9 Rehabilitation 2020	9.3	28.9	0.61	0.43
KANODO 9 Rehabilitation 2021	12.7	4.9	0.51	0.35
KANODO 9 Rehabilitation 2022	11.2	4.6	0.6	0.33
KANODO 9 Rehabilitation 2023	5.6	3.6	1.39	0.22
KANODO 9 Rehabilitation 2024	0.5	124.4	9.68	0.01
KANODO 9 Rehabilitation 2025	1	1.1	6.15	0.07

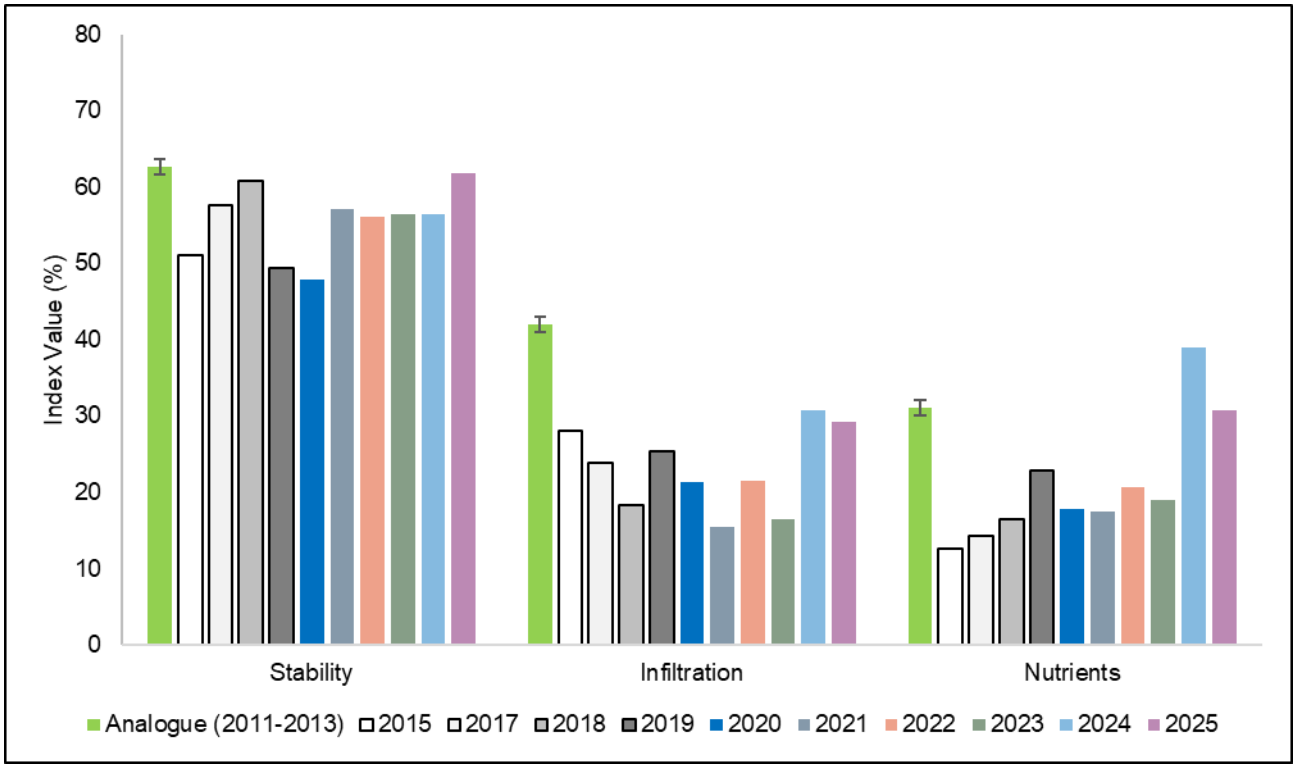
4.2.1.4 KANODO RT10

In 2025, Site KANODO RT 10 showed an increase in stability values, a slight decrease in infiltration values, and a more pronounced decrease in nutrient values compared to 2024 (**Graph 4.8**). Stability scores at KANODO RT 10 increased from below analogue values in 2015 to above analogue values in 2018, then declined and fluctuated just below the analogue benchmark until 2024, before increasing to match it in 2025. Nutrient levels followed a similar trajectory, increasing from 2015 to 2019, then fluctuating at comparable levels through to 2023 while remaining below analogue values. In 2024, nutrient values briefly peaked above the analogue benchmark before returning to match it in 2025. However, Infiltration values have consistently fluctuated below analogue benchmarks since 2015.

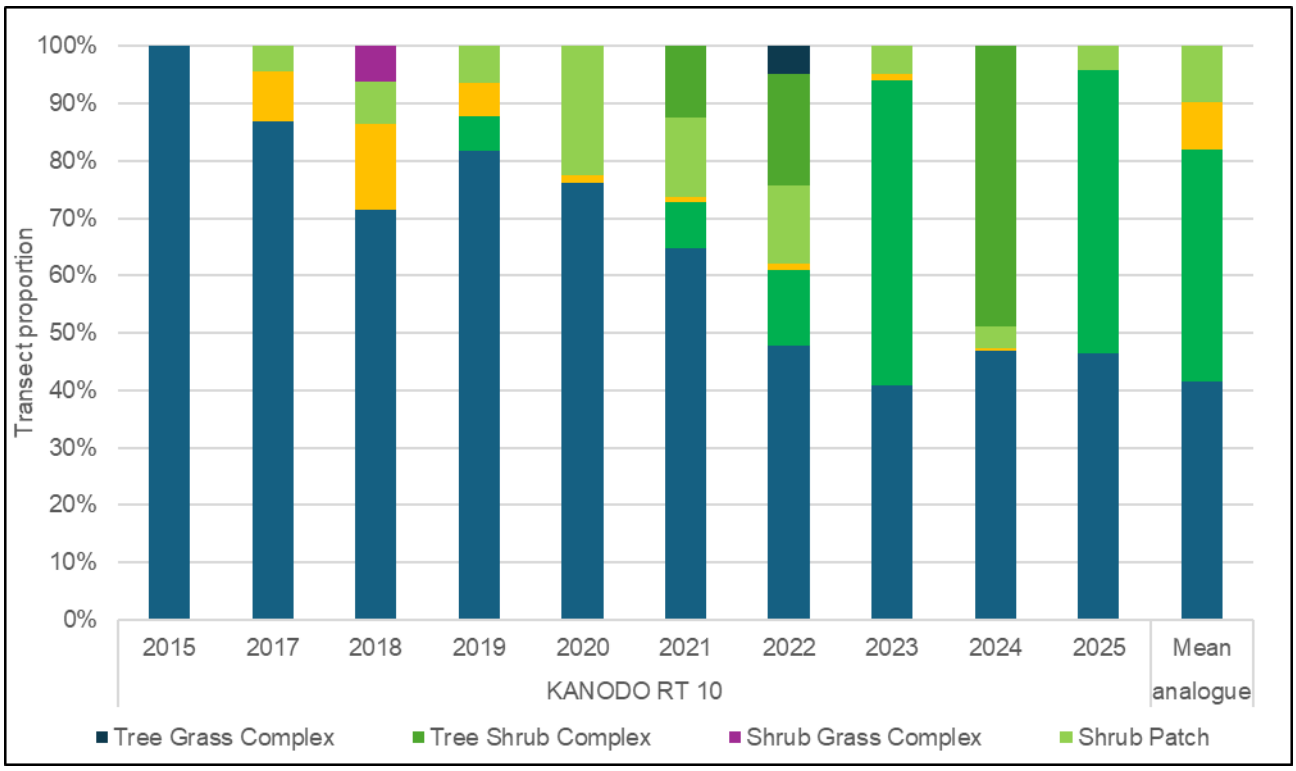
Transect proportions from 2015 to 2025 show a general increase in complexity, with the proportion of interpatch zones decreasing over time and the proportions of shrub patches, tree patches, and vegetation complexes increasing toward benchmark levels (**Graph 4.9**).

The Landscape Organisational Index at KANODO RT 10 has generally increased since 2015 and matched analogue values in 2025 (**Table 4.6**). Patch metrics have varied across years, with the number of patch zones per 10 m generally increasing from 2014 to 2021 before declining in 2024 and 2025. Total patch area has fluctuated across years, with a notable decrease from 2021 onward. Average interpatch length decreased steadily until 2022, before increasing in 2024 and 2025.

Visually, this site shows little physical change in structure. However, due to increased rainfall in the lead-up to the surveys, the lower vegetation stratum shows increased litter cover composed predominantly of exotic grasses (**Appendix 3**).



Graph 4.8 **Landscape Function Indices Change (2015–2025) for KANODO RT10 with Respect to Mean Analogue Site Values (2011–2013)**



Graph 4.9 **Percentage Cover of each of the Surface Soil Assessment Zones Recorded at Site KANODO RT10**

Table 4.6 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO RT10 Rehabilitation Site 2011–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO RT 10 Rehabilitation 2015	0	0	20	0
KANODO RT 10 Rehabilitation 2017	5.3	1.7	1.64	0.13
KANODO RT 10 Rehabilitation 2018	5.3	2.3	1.36	0.29
KANODO RT 10 Rehabilitation 2019	6.4	3.3	1.28	0.18
KANODO RT 10 Rehabilitation 2020	3.7	7	2.07	0.24
KANODO RT 10 Rehabilitation 2021	5.7	21.6	0.98	0.34
KANODO RT 10 Rehabilitation 2022	4.3	42.1	1	0.52
KANODO RT 10 Rehabilitation 2023	3.2	59.8	1.11	0.59
KANODO RT 10 Rehabilitation 2024	2.1	60.6	2.22	0.53
KANODO RT 10 Rehabilitation 2025	2.6	45.8	1.47	0.61

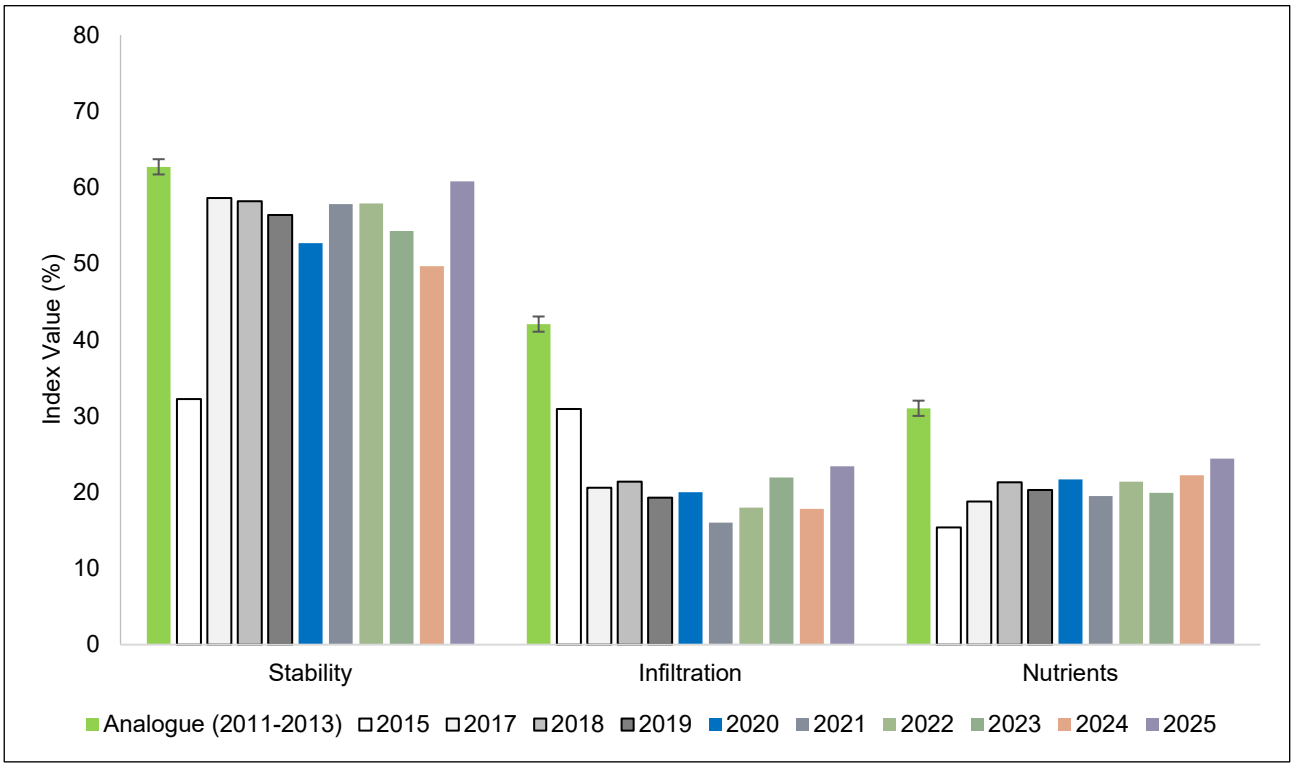
4.2.1.5 KANODO RT14

In 2025, Site KANODO RT 14 showed an increase in stability, infiltration, and nutrient values. Stability scores met analogue values, while infiltration and nutrient values remained below analogue levels (**Graph 4.10**). Stability scores increased from 2015 to 2017, then fluctuated just below analogue values until 2025. Infiltration levels decreased from 2015 to 2017 and continued to fluctuate below analogue values through to 2025. Nutrient values showed a slight upward trend over time but also fluctuated below analogue values.

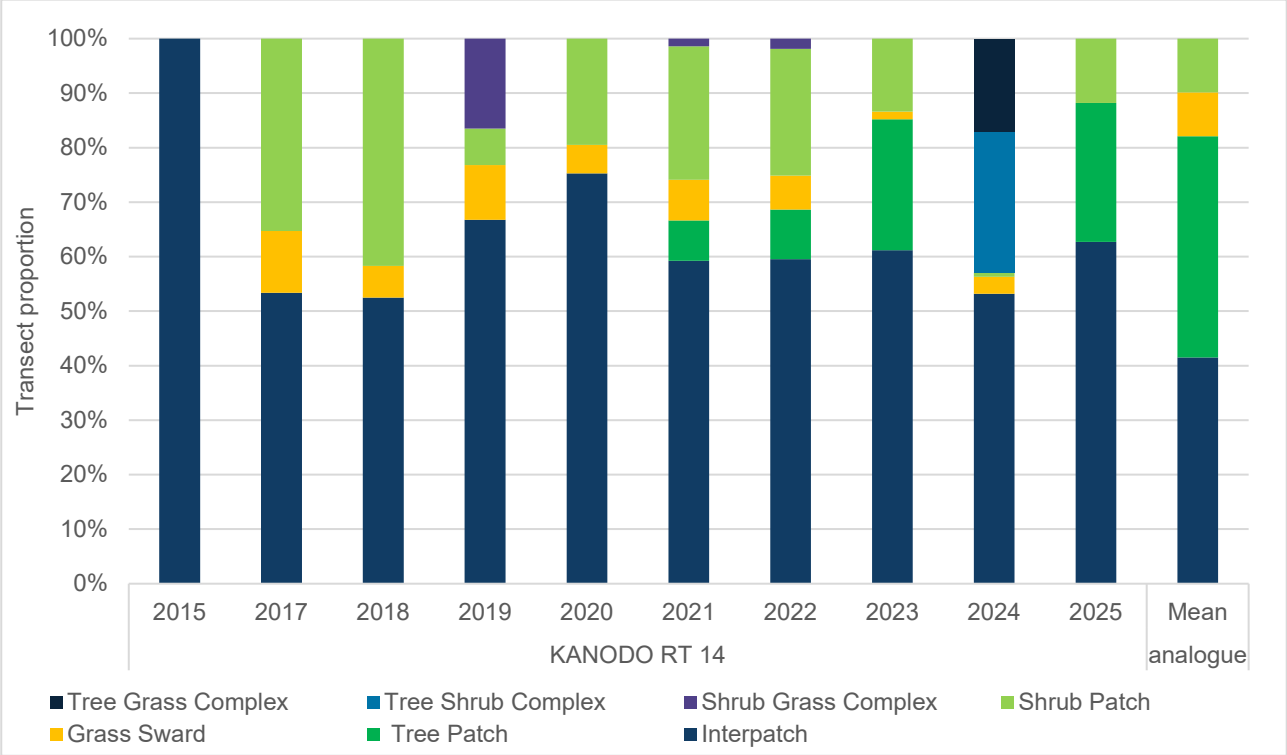
Transect proportions from 2015 to 2025 indicate a general increase in structural complexity, with interpatch zones decreasing and shrub and tree patch proportions increasing toward benchmark levels (**Graph 4.11)**. However, grass patches and complexes containing grasses were not recorded in 2025.

The Landscape Organisation Index at KANODO RT 14 has consistently fluctuated below analogue levels since 2015, with values in 2025 lower than those recorded in 2024 (**Table 4.7**). Patch metrics varied across years, the number of patch zones per 10 m generally increased from 2015 to 2022, followed by a decline from 2023 to 2025. Similarly, average interpatch length fluctuated but showed an overall decrease from 2015 to 2022, then increased from 2023 to 2025. Total patch area fluctuated across years, with a general increase observed from 2015 to 2025.

Visually, the site shows little physical change in structure since 2024, with shrubs and trees present in the foreground of monitoring photos. However, a substantial increase in structural complexity is evident when comparing photos from 2015 to 2025, with a clear succession of shrubs and trees observed across years (**Appendix 3**).



Graph 4.10 Landscape Function Indices Change (2015-2025) for KANODO RT14 with Respect to Mean Analogue Site Values (2011-2013)



Graph 4.11 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANODO RT14**

Table 4.7 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO RT14 Rehabilitation Site 2015–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011 -13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO RT 14 Rehabilitation 2015	0	0	15	0
KANODO RT 14 Rehabilitation 2017	5	22.6	1.3	0.5
KANODO RT 14 Rehabilitation 2018	4.5	24.4	1.2	0.5
KANODO RT 14 Rehabilitation 2019	8.1	12.3	0.8	0.3
KANODO RT 14 Rehabilitation 2020	5.4	13.6	1.4	0.3
KANODO RT 14 Rehabilitation 2021	8.6	15.3	0.7	0.4
KANODO RT 14 Rehabilitation 2022	8.6	19.4	0.7	0.4
KANODO RT 14 Rehabilitation 2023	2.7	45.1	2.7	0.4
KANODO RT 14 Rehabilitation 2024	2.3	72.3	2.6	0.5
KANODO RT 14 Rehabilitation 2025	1.4	43.8	6.97	0.37

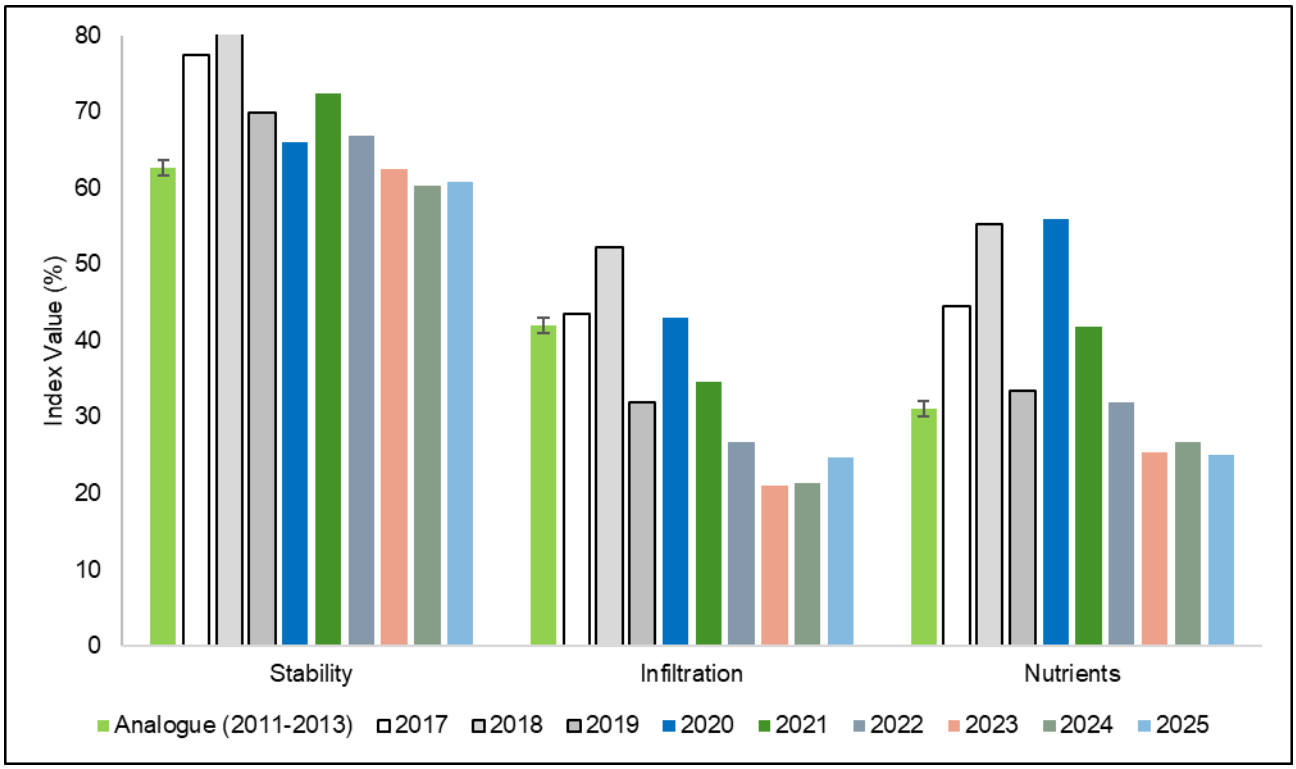
4.2.1.6 KANODO RT19

In 2025, Site KANODO RT 19 showed an increase in stability and infiltration values compared to 2024, while nutrient values decreased slightly (**Graph 4.12**). All indices initially increased between 2017 and 2018 before fluctuating and generally declining over time. Stability values are around analogue benchmarks in 2025, whereas infiltration and nutrient values remain below analogue levels.

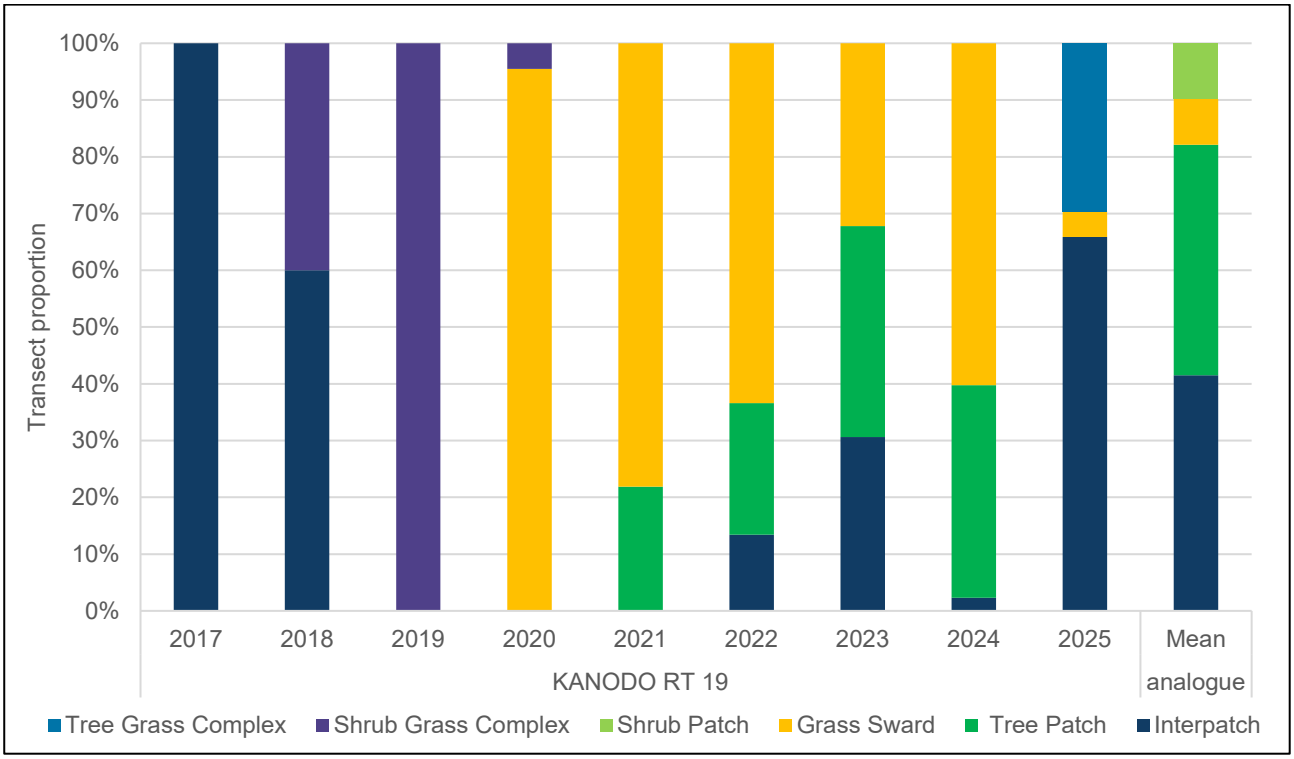
Transect proportions indicate a gradual increase in complexity over time, transitioning from predominantly interpatch zones to shrub–grass complexes and grasses, with trees present in later years. In 2025, tree patches and grass patches combined to form tree–grass complexes, while interpatch areas expanded to their highest cover since rehabilitation began (**Graph 4.13**).

The Landscape Organisation Index has declined over time and remains below analogue levels in 2025 (**Table 4.8**). Patch metrics show that the number of patch zones has generally increased over time and was higher in 2025 than in 2024, exceeding analogue values. However, total patch area has steadily decreased, with 2025 values much lower than 2024 and well below analogue benchmarks. Average interpatch length has increased over time and is just below analogue values in 2025.

Visually, site complexity has increased over time, shifting from cleared interpatch zones to include trees and shrubs. However, in 2025 the understory appeared noticeably dry, with more bare ground visible (**Appendix 3**).



Graph 4.12 Landscape Function Indices Change (2017–2025) for KANODO RT19 with Respect to Mean Analogue Site Values (2011–2013)



Graph 4.13 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANODO RT19**

Table 4.8 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO RT19 Rehabilitation Site 2011-2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO RT 19 Rehabilitation 2017	0.4	125.0	0.0	1.0
KANODO RT 19 Rehabilitation 2018	0.4	125.0	0.0	1.0
KANODO RT 19 Rehabilitation 2019	0.4	125.0	0.0	1.0
KANODO RT 19 Rehabilitation 2020	2.8	120.1	0.0	1.0
KANODO RT 19 Rehabilitation 2021	2.8	170.2	0.0	1.0
KANODO RT 19 Rehabilitation 2022	3.2	94.5	0.6	0.9
KANODO RT 19 Rehabilitation 2023	6.4	62.2	0.6	0.7
KANODO RT 19 Rehabilitation 2024	2.0	147.9	0.6	1.0
KANODO RT 19 Rehabilitation 2025	3.6	21.6	1.6	0.3

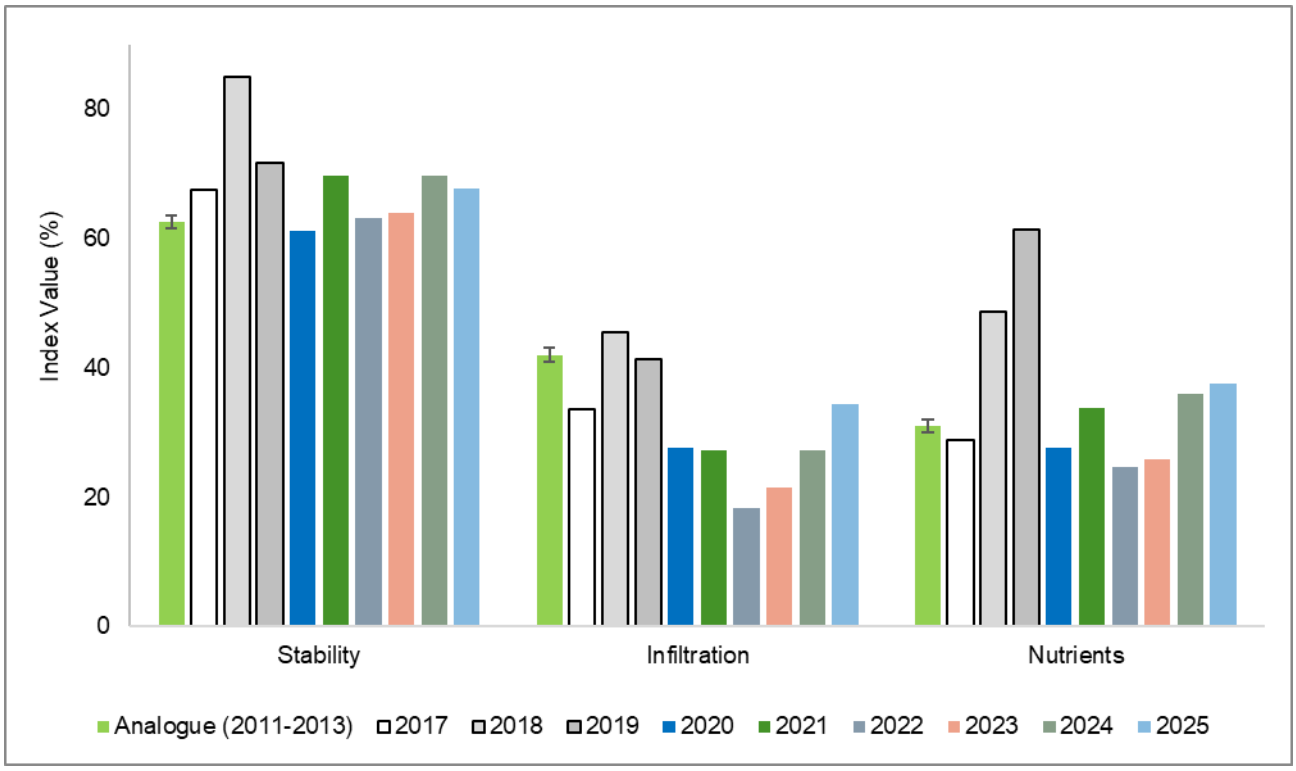
4.2.1.7 KANODO RT20

In 2025, stability values at this site decreased slightly compared to 2024, while infiltration and nutrient values increased (**Graph 4.14**). All indices initially increased between 2017 and 2018, with nutrient levels peaking in 2019. Subsequently, values declined and fluctuated over time, with stability generally fluctuating around analogue benchmarks, infiltration gradually increasing toward analogue benchmarks, and nutrient values rising to slightly above analogue benchmarks in 2025.

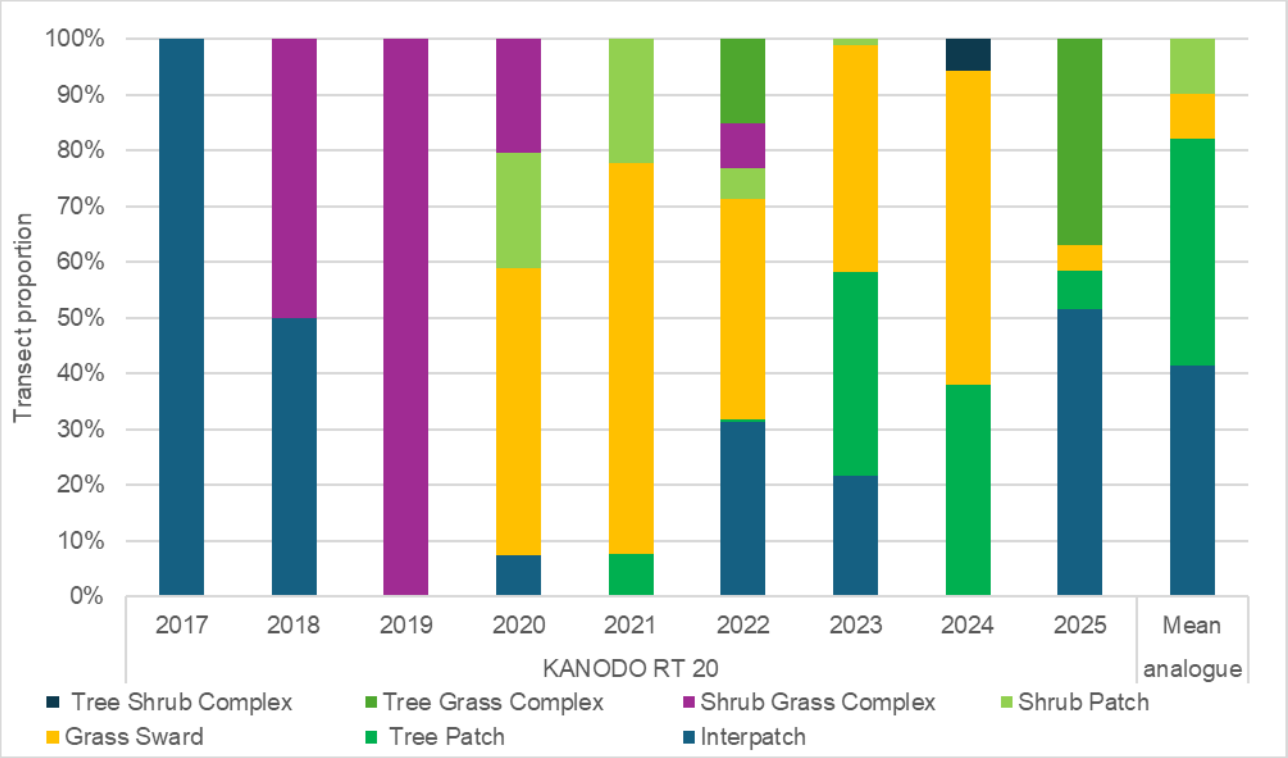
Transect proportions indicate a general increase in complexity since 2017, with interpatch zones transitioning into shrub–grass complexes, shrub patches, and grass patches, alongside the presence of trees from 2021 onward. In 2025, tree–grass complexes were present. However, in 2025 interpatch areas expanded to cover levels similar to those observed in 2018 (**Graph 4.15**).

The Landscape Organisation Index has fluctuated but generally declined over time, with 2025 values just below analogue benchmarks. The number of patch zones initially increased from 2017 to 2023 before declining in 2024 and 2025, though values in 2025 remained above analogue levels. Total patch area has also fluctuated, with 2025 values well below analogue benchmarks. Average interpatch length increased in 2025 compared to the previous year but remains below analogue values (**Table4.9**).

Visually, the site shows increased complexity over time, transitioning from a predominantly interpatch zone to include trees and shrubs. In 2025, the understory exhibited increased exotic litter cover (**Appendix 3**).



Graph 4.14 Landscape Function Indices Change (2017–2025) for KANODO RT20 with Respect to Mean Analogue Site Values (2011–2013)



Graph 4.15 **Percentage Cover of each of the Surface Soil Assessment Zones Recorded at Site KANODO RT20**

Table 4.9 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO RT20 Rehabilitation Site 2011–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO RT 20 Rehabilitation 2017	0.4	125.0	0	1.0
KANODO RT 20 Rehabilitation 2018	0.4	125.0	0	1.0
KANODO RT 20 Rehabilitation 2019	0.4	125.0	0	1.0
KANODO RT 20 Rehabilitation 2020	4.7	106.5	2.3	0.9
KANODO RT 20 Rehabilitation 2021	5.0	173.1	0	1.0
KANODO RT 20 Rehabilitation 2022	8.7	32.1	0.4	0.7
KANODO RT 20 Rehabilitation 2023	6.7	73.6	0.5	0.8
KANODO RT 20 Rehabilitation 2024	4.0	156.3	0.0	1.0
KANODO RT 20 Rehabilitation 2025	3.7	44.3	1.5	0.5

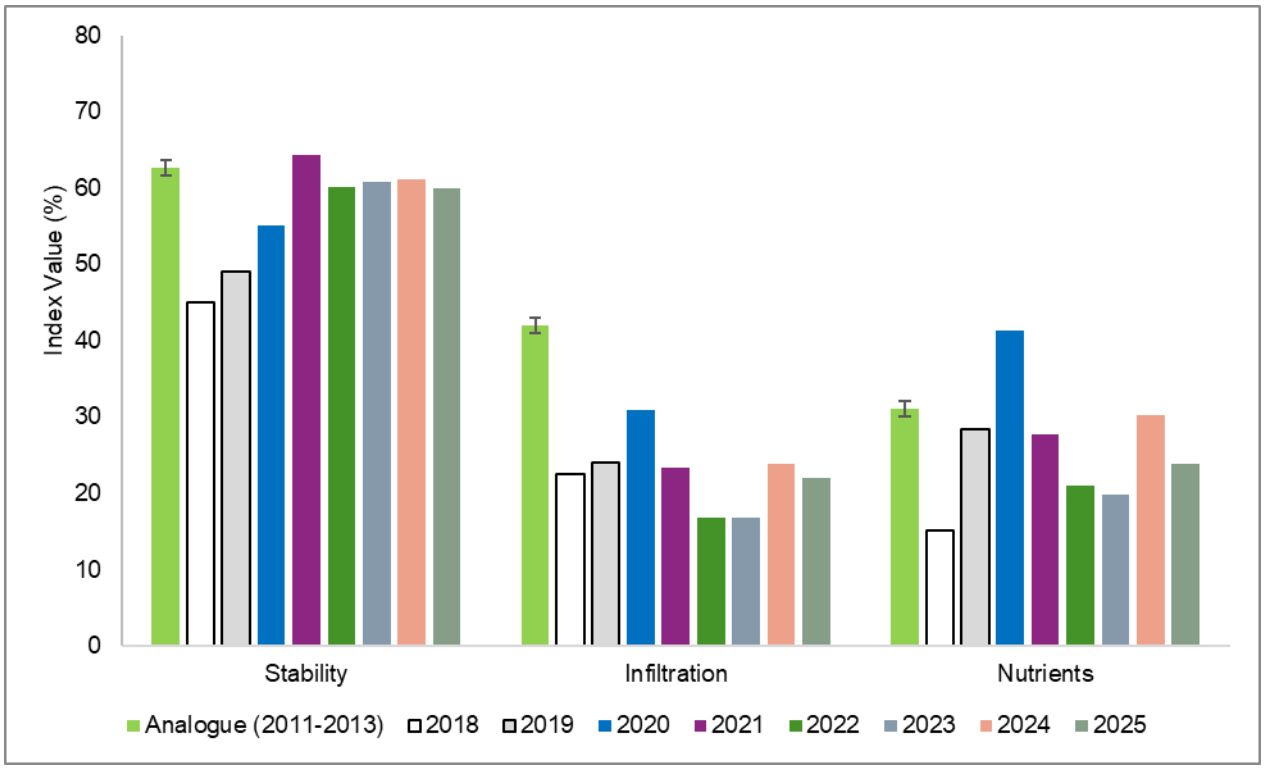
4.2.1.8 KANODO RT21

In 2025, Site KANODO RT 21 showed slight decreases in stability and infiltration values, with a more pronounced decrease in nutrient values when compared to 2024 (**Graph 4.16**). Stability increased from 2018 to 2021 before declining slightly and then fluctuating around analogue benchmarks until 2025. Infiltration and nutrient values both peaked in 2020 before decreasing through 2023 and increasing again in 2024. However, in 2025, both remain below analogue levels.

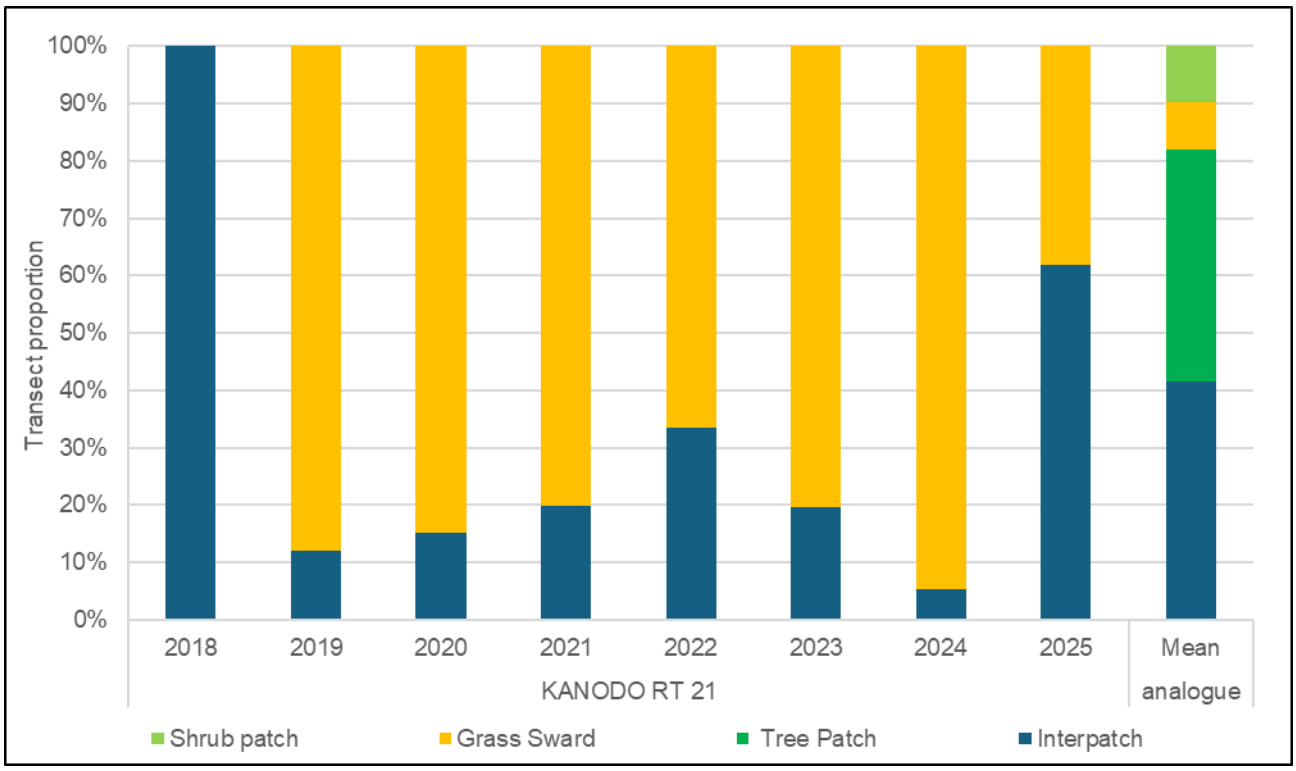
Transect proportions transitioned from an interpatch zone in 2018 to fluctuating cover of grass sward and interpatch zones in subsequent years. In 2025, interpatch zones expanded to their highest levels since 2018 (**Graph 4.17**).

The Landscape Organisation Index has generally declined over time, with 2025 values below analogue benchmarks. The number of patch zones initially increased from 2018 to 2022 before declining in 2023 and 2024. However, values in 2025 were higher than the previous year and exceeded analogue levels. Total patch area has fluctuated but showed a substantial decrease in 2025, remaining well below analogue benchmarks. Average interpatch length has also fluctuated, with 2025 values increasing to just below analogue levels (**Table 4.10**).

Visually, the site appears less dry than in previous years but shows increased exotic litter cover, patches of bare ground, and fewer visible clumps of native grasses (**Appendix 3**).



Graph 4.16 Landscape Function Indices Change (2018–2025) for KANODO RT21 with Respect to Mean Analogue Site Values (2011–2013)



Graph 4.17 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANODO RT21**

Table 4.10 **Summary of the Landscape Organisation Data for KANODO Analogue and KANODO RT21 Rehabilitation Site 2011–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**2.8**	**308.4**	**1.8**	**0.6**
KANODO RT 21 Rehabilitation 2018	0.4	125.0	1.0	1.0
KANODO RT 21 Rehabilitation 2019	2.0	124.5	0.0	1.0
KANODO RT 21 Rehabilitation 2020	6.1	119.1	0.0	1.0
KANODO RT 21 Rehabilitation 2021	3.0	163.3	0.7	0.8
KANODO RT 21 Rehabilitation 2022	10.0	21.5	0.4	0.7
KANODO RT 21 Rehabilitation 2023	4.3	170.5	0.5	0.8
KANODO RT 21 Rehabilitation 2024	1.0	227.1	0.81	0.95
KANODO RT 21 Rehabilitation 2025	3.3	16.4	1.7	0.4

4.2.2 *Lomandra* sp. Open Tussock Grassland (LOM) Transects

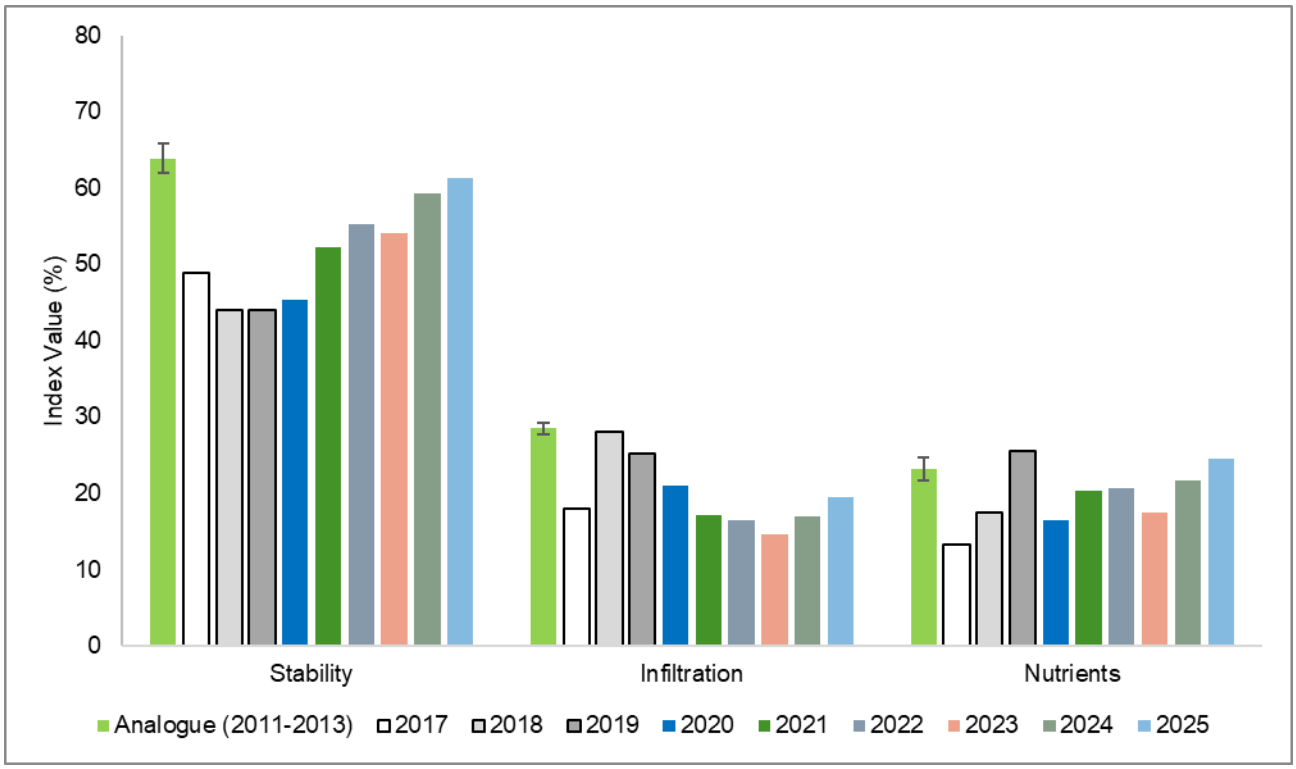
4.2.2.1 KANLOM RT01

In 2025, stability, infiltration, and nutrient values all increased compared to 2024 (**Graph 4.18**). Stability has generally fluctuated but trended upward toward analogue benchmarks since 2017, with 2025 values just below analogue levels. Infiltration initially increased in 2018 before declining until 2023 and then slowly increasing again, though remaining below analogue benchmarks. Nutrient values have fluctuated over time but increased in 2025 to slightly above analogue levels.

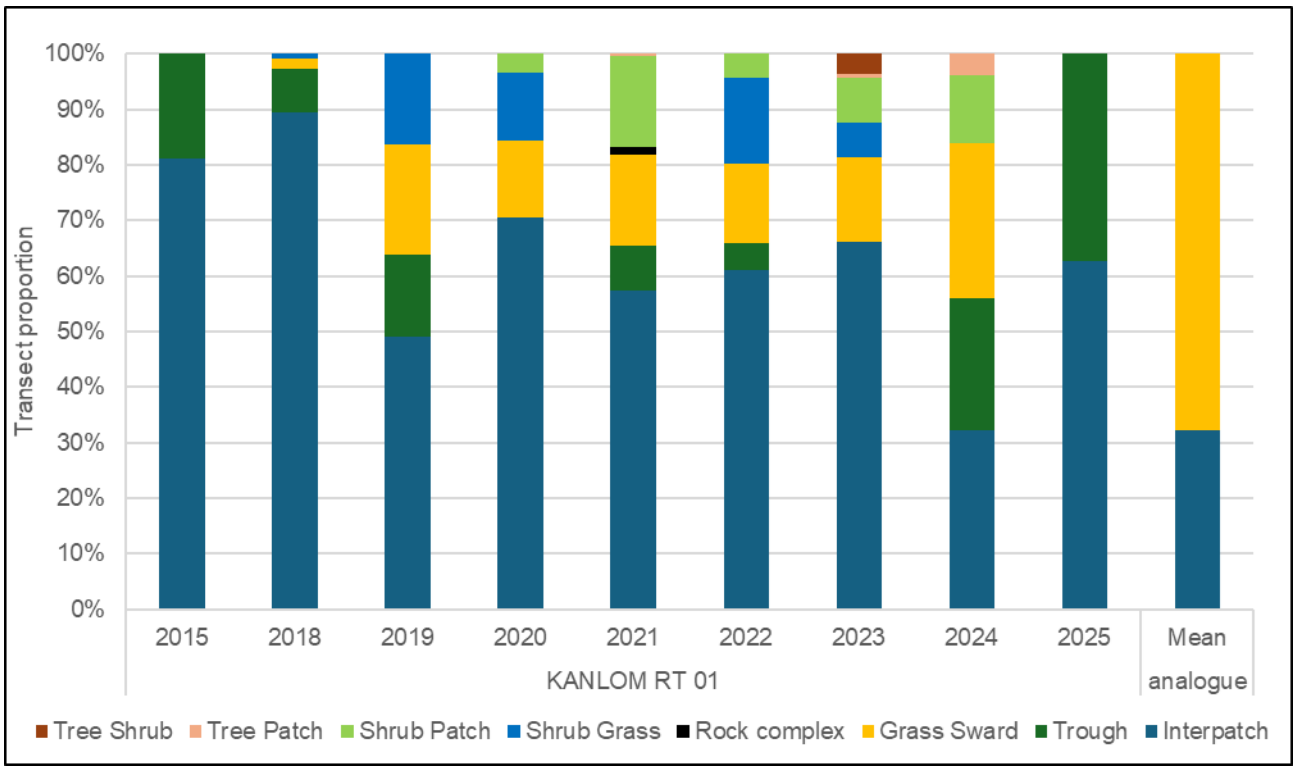
Transect proportions have varied over time, with increasing complexity observed between 2019 and 2024 through the presence of tree–shrub complexes, shrub–grass complexes, and grass sward at fluctuating cover levels. However, in 2025, cover values resembled early rehabilitation conditions, with only troughs and interpatch zones recorded (**Graph 4.19**).

The Landscape Organisation Index has fluctuated but remains below analogue benchmarks, despite being higher in 2025 than in 2024. The number of patch zones generally increased over time until 2024 before decreasing in 2025 to just below analogue values. Total patch area has also fluctuated, with a decrease in 2025 compared to 2024, remaining well below analogue benchmarks. Average interpatch length decreased steadily until 2024 but increased in 2025 to above analogue values (**Table 4.11**).

Visually, the site shows increased complexity across the broader area, with trees and shrubs becoming more prominent over time. However, the site itself in 2025 exhibited large patches of bare ground and increased exotic litter cover, whereas 2023 and 2024 appeared noticeably drier than other years (**Appendix 3**).



Graph 4.18 **Landscape Function Indices Change (2017–2025) for KANLOM RT01 with Respect to Mean Analogue Site Values (2011–2013)**



Graph 4.19 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANLOM RT01**

Table 4.11 **Summary of the Landscape Organisation Data for KANLOM Analogue and KANLOM RT01 Rehabilitation Site 2011–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**4.8**	**95.5**	**0.6**	**0.7**
KANLOM RT 01 Rehabilitation 2017	4.3	45.5	1.7	0.2
KANLOM RT 01 Rehabilitation 2018	2.8	19.3	0.8	0.1
KANLOM RT 01 Rehabilitation 2019	7.1	76.8	0.9	0.5
KANLOM RT 01 Rehabilitation 2020	12.4	31.7	0.6	0.3
KANLOM RT 01 Rehabilitation 2021	13	65.1	0.6	0.4
KANLOM RT 01 Rehabilitation 2022	11.7	37.6	0.5	0.4
KANLOM RT 01 Rehabilitation 2023	7.3	15	1	0.3
KANLOM RT 01 Rehabilitation 2024	17.1	46.3	0.5	0.68
KANLOM RT 01 Rehabilitation 2025	4.7	28.3	1.25	0.37

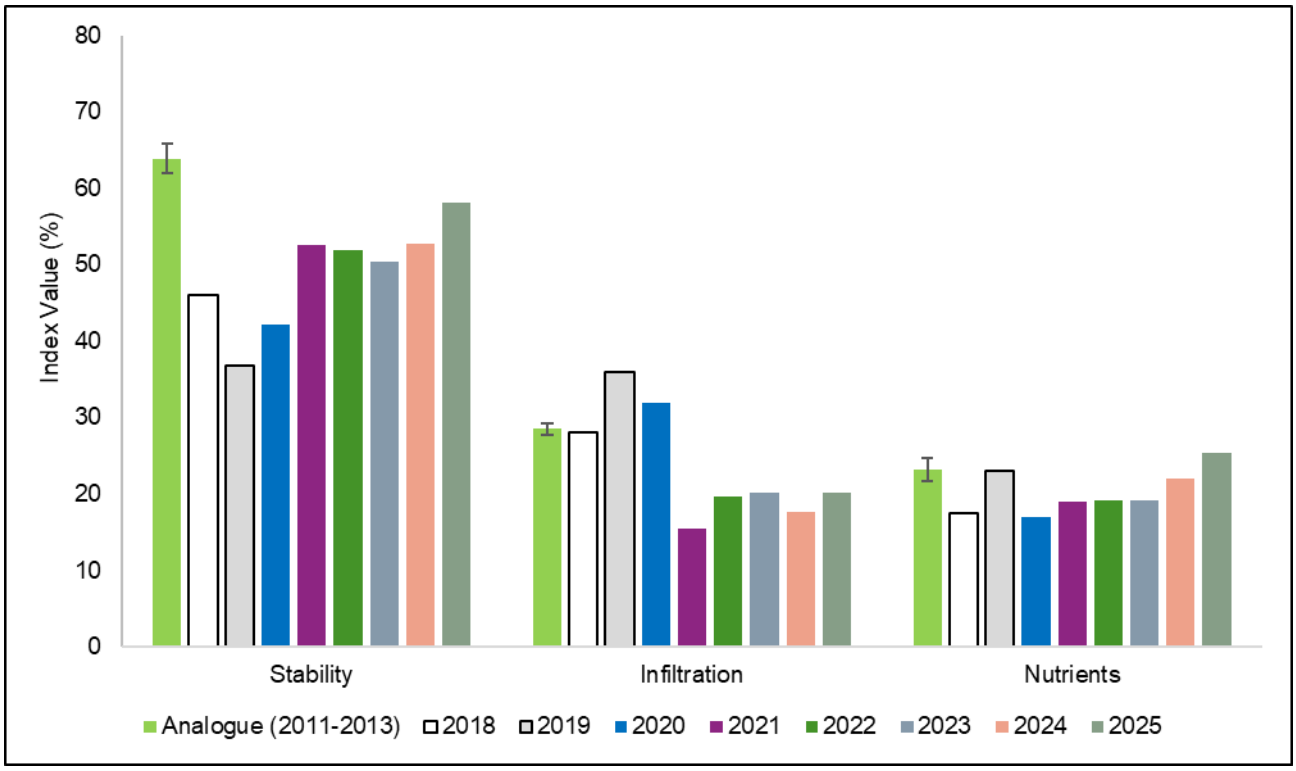
4.2.2.2 KANLOM RT02

In 2025, stability, infiltration, and nutrient values all increased compared to 2024 **(Graph 4.20**). Stability has fluctuated but generally increased over time toward analogue benchmarks. Nutrient values have also fluctuated but show an overall upward trend, reaching slightly above analogue levels in 2025. Infiltration initially peaked in 2019 above analogue benchmarks before declining and fluctuating below analogue values until 2025.

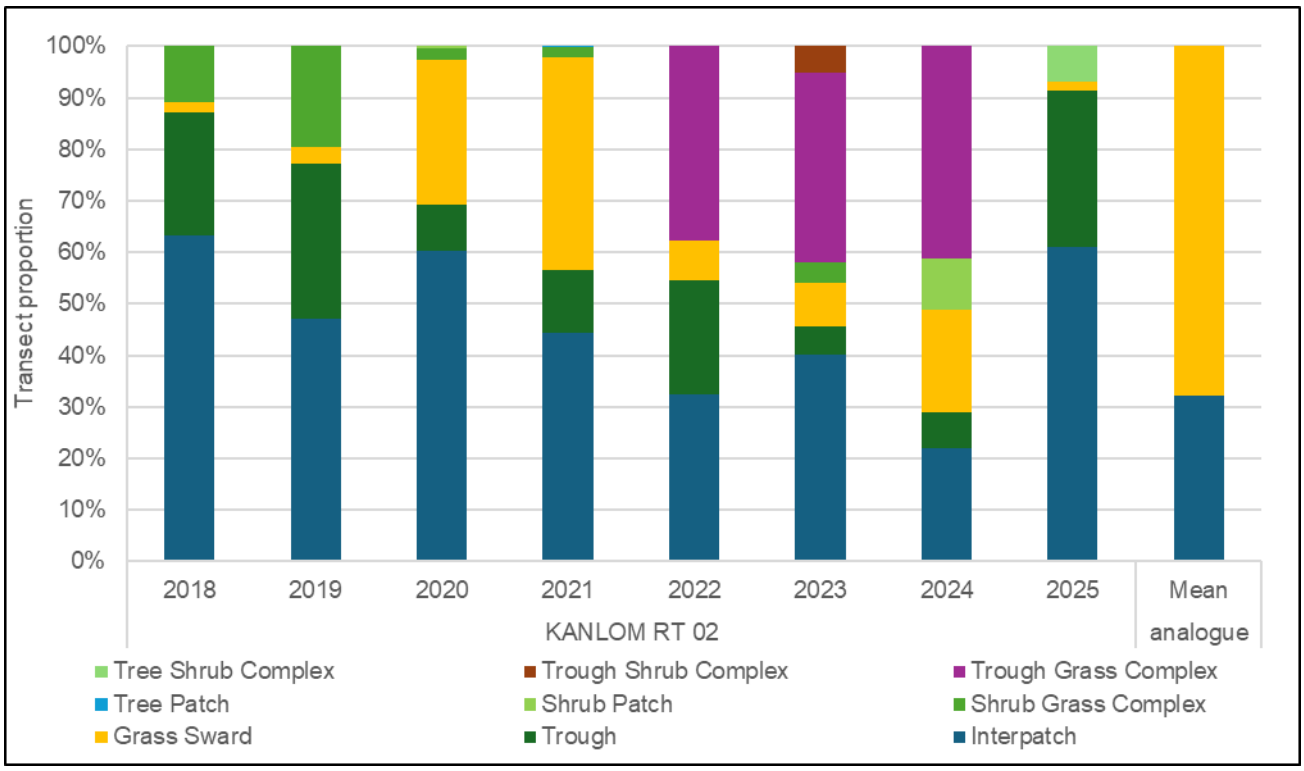
Transect proportions indicate a general increase in complexity over time. The site initially comprised interpatch zones and troughs with limited grass cover and occasional shrub–grass complexes. Over time, grass and grass complexes increased in cover, with larger proportions of trough–grass complexes observed between 2022 and 2024. In 2025, interpatch zones expanded to levels similar to those recorded between 2018 and 2020, alongside small areas of tree–shrub patches, grass sward, and a larger proportion of troughs (**Graph 4.21**).

The Landscape Organisation Index fluctuated but generally increased from 2018 to 2024 before decreasing in 2025 to below analogue benchmarks. The number of patch zones has varied but remained just above analogue values in 2025. Total patch area has fluctuated over time but decreased in 2025 to below analogue benchmarks. Average interpatch length has fluctuated but generally declined over time, increasing again in 2025 and remaining above analogue values (**Table 4.12**).

Visually, the site shows a general increase in complexity across the broader area, with trees and shrubs establishing. However, large interpatch areas with visible bare ground persist. The site appeared noticeably drier in 2023 and 2024 compared to other years (**Appendix 3**).



Graph 4.20 Landscape Function Indices Change (2018–2025) for KANLOM RT02 with Respect to Mean Analogue Site Values (2011–2013)



Graph 4.21 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANLOM RT02**

Table 4.12 **Summary of the Landscape Organisation Data for KANLOM Analogue and KANLOM RT02 Rehabilitation Site 2011–2025**

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2011–13	**4.8**	**95.5**	**0.6**	**0.7**
KANLOM RT 02 Rehabilitation 2018	5.5	49.3	1.2	0.4
KANLOM RT 02 Rehabilitation 2019	6	85.9	1	0.5
KANLOM RT 02 Rehabilitation 2020	9.2	43.9	0.8	0.4
KANLOM RT 02 Rehabilitation 2021	11.1	90	0.6	0.6
KANLOM RT 02 Rehabilitation 2022	6.9	57.5	0.7	0.7
KANLOM RT 02 Rehabilitation 2023	6.9	90.2	0.7	0.6
KANLOM RT 02 Rehabilitation 2024	5.1	113.6	0.7	0.8
KANLOM RT 02 Rehabilitation 2025	5	42.4	1.22	0.39

4.2.3 *Acacia pycnantha* (Golden Wattle) Low Woodland (ACA) Transects

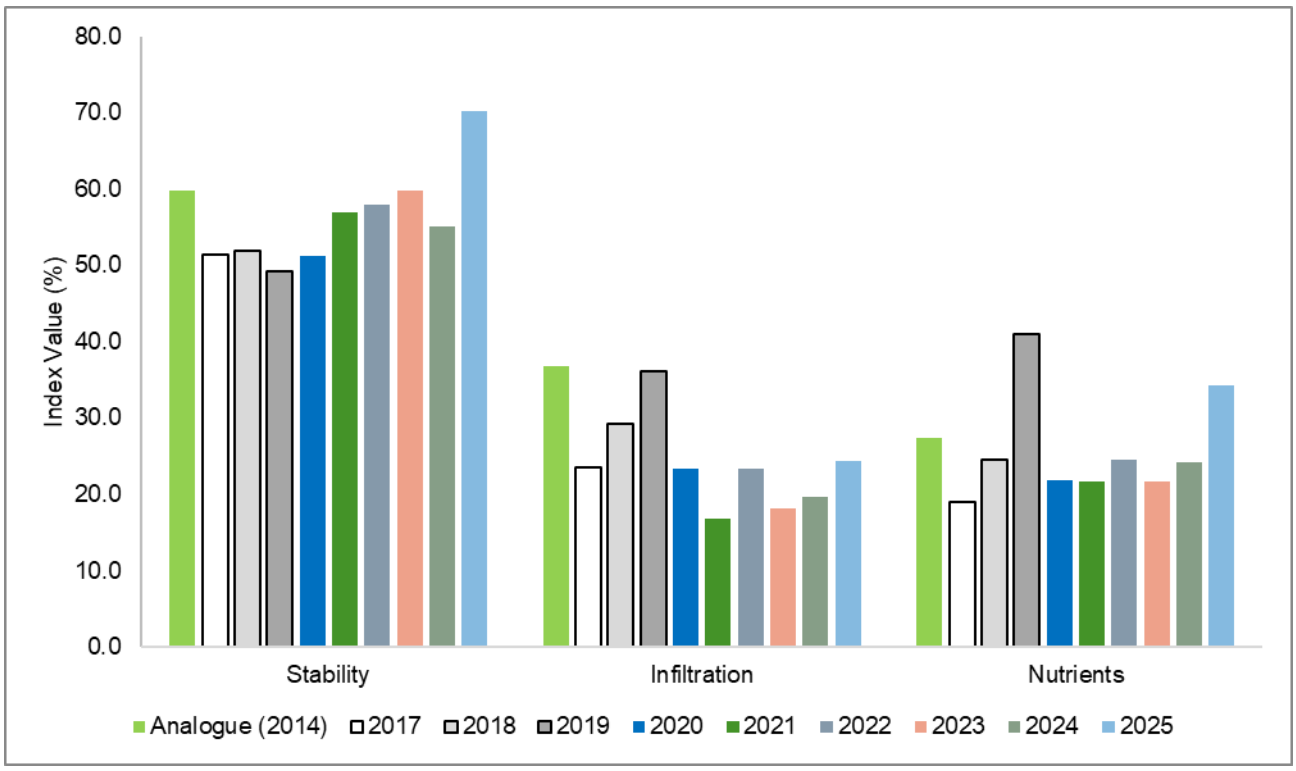
4.2.3.1 KANACA RT01

In 2025, stability, infiltration, and nutrient values all increased markedly compared to 2024 (**Graph4.22**). Stability has generally fluctuated but shows an overall upward trend, with 2025 values above analogue benchmarks. Infiltration and nutrient values both peaked in 2019 before declining and fluctuating until 2021. In 2025, infiltration remained below analogue levels, while nutrient values increased to above analogue benchmarks.

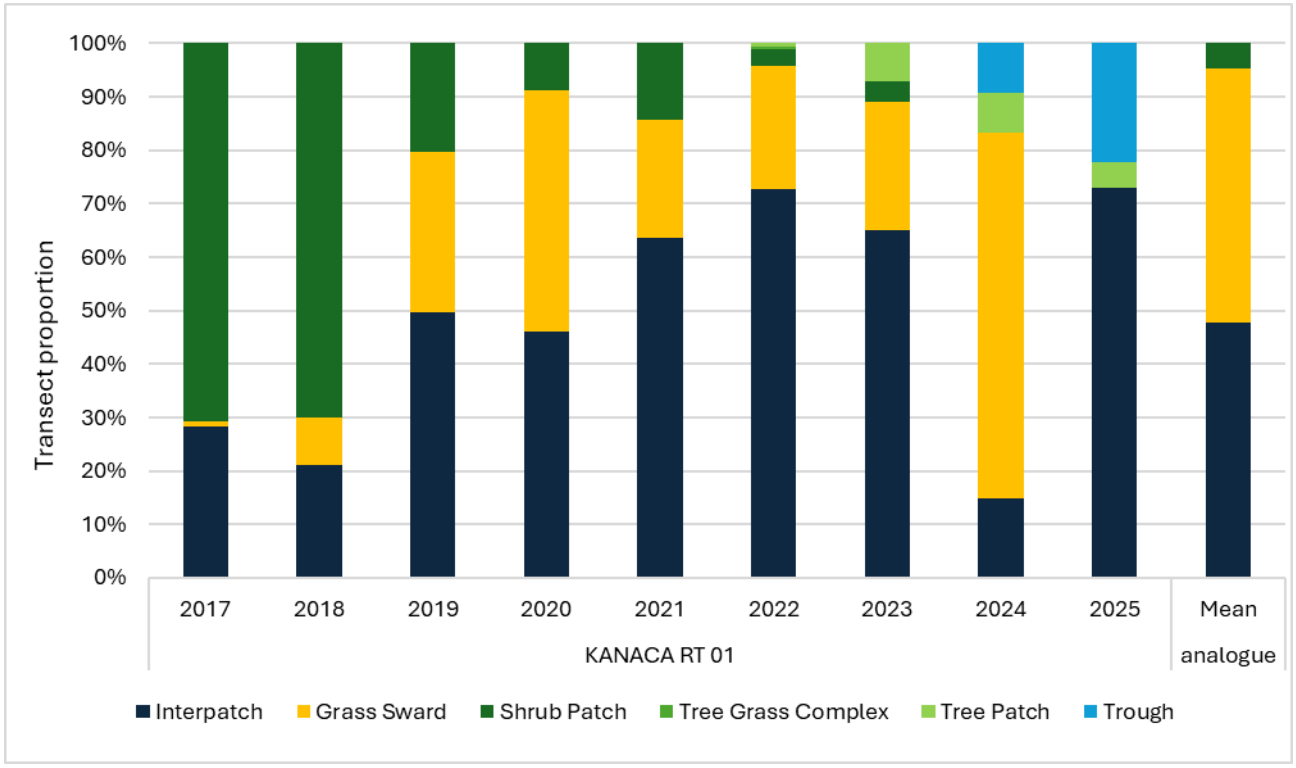
Transect proportions initially comprised predominantly shrub patches in 2017, with interpatch areas and grass sward also present. Over time, interpatch areas expanded, accompanied by a decrease in shrub patches and fluctuating grass sward cover. Tree patches and complexes first appeared in 2022 and increased in cover in 2023, remaining at similar levels through 2025. Troughs were recorded in 2024 and 2025. In 2025, the site was dominated by interpatch zones, with troughs and small areas of tree cover also present (**Graph 4.23**).

The Landscape Organisation Index has fluctuated over time but decreased in 2025 to below analogue benchmarks. The number of patch zones also fluctuated, generally increasing from 2017 to 2022 before declining again through 2025, with 2025 values below analogue levels. Total patch area has fluctuated but generally decreased over time, showing a marked increase above analogue benchmarks in 2024 before declining again in 2025 to below analogue levels. Average interpatch length has fluctuated and increased above analogue benchmarks in 2025 (**Table 4.13**).

Visually, the broader area shows increasing complexity with trees and shrubs establishing. However, the site itself contains large interpatch zones covered with exotic litter in 2025, while 2023 and 2024 appeared noticeably drier with bare patches visible (**Appendix 3**).



Graph 4.22 to **Landscape Function Indices Change (2017–2025) for KANACA RT01 with Respect Mean Analogue Site Values (2014)**



Graph 4.23 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANACA RT01**

Table 4.13 Summary of the Landscape Organisation Data for KANACA Analogue and KANACA RT01 Rehabilitation Site 2014–2025

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2014	**4.7**	**141.6**	**1**	**0.7**
KANACA RT 01 Rehabilitation 2017	7.7	158.3	2.3	0.3
KANACA RT 01 Rehabilitation 2018	4.3	150.3	0.5	0.8
KANACA RT 01 Rehabilitation 2019	8.7	46.7	0.7	0.5
KANACA RT 01 Rehabilitation 2020	9.9	61	0.5	0.5
KANACA RT 01 Rehabilitation 2021	9.6	9.3	0.7	0.4
KANACA RT 01 Rehabilitation 2022	11.5	4.7	0.6	0.3
KANACA RT 01 Rehabilitation 2023	9.9	6.6	0.7	0.4
KANACA RT 01 Rehabilitation 2024	5	172.1	1.1	0.9
KANACA RT 01 Rehabilitation 2025	3.3	91.6	2.23	0.27

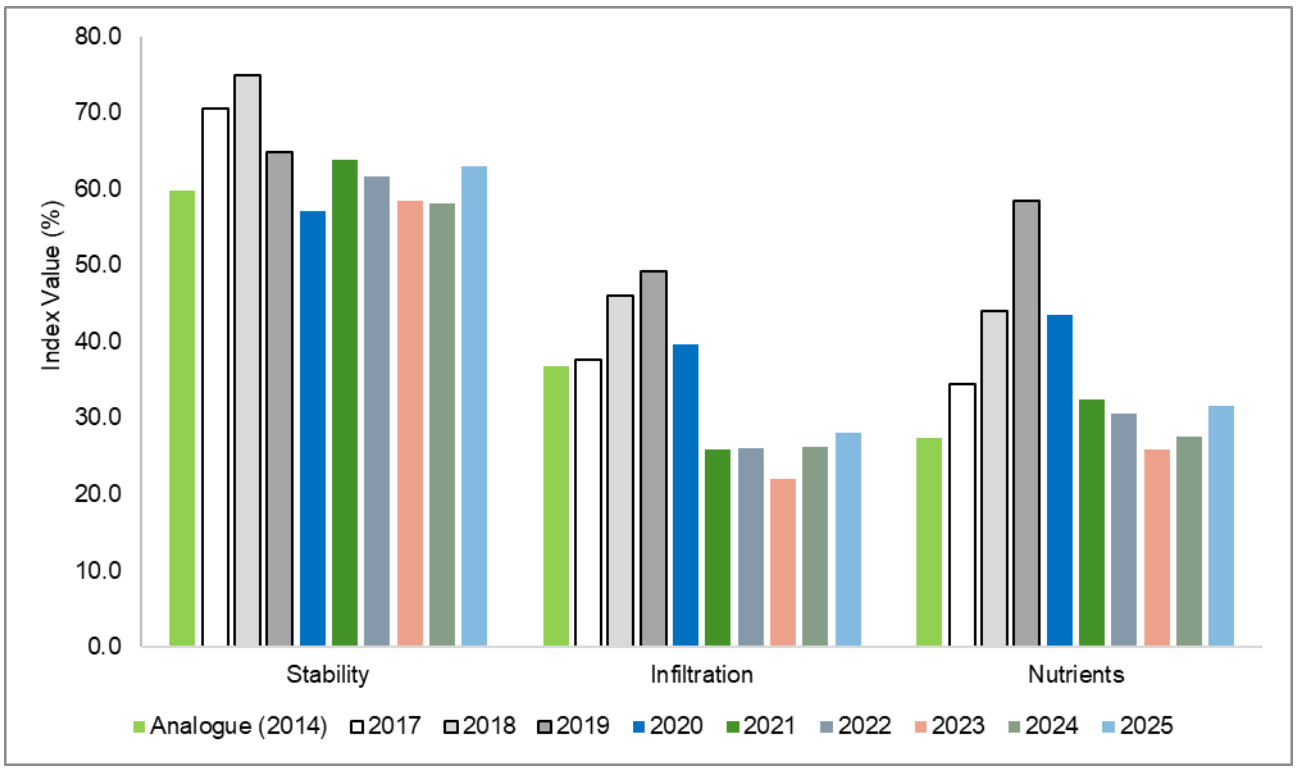
4.2.3.2 KANACA RT02

In 2025, stability, infiltration, and nutrient values all increased compared to 2024 (**Graph 4.24**). All indices showed an initial increase between 2017 and 2018/2019 before declining and then fluctuating at relatively similar levels. In 2025, stability and nutrient values were above analogue benchmarks, while infiltration remained below analogue levels.

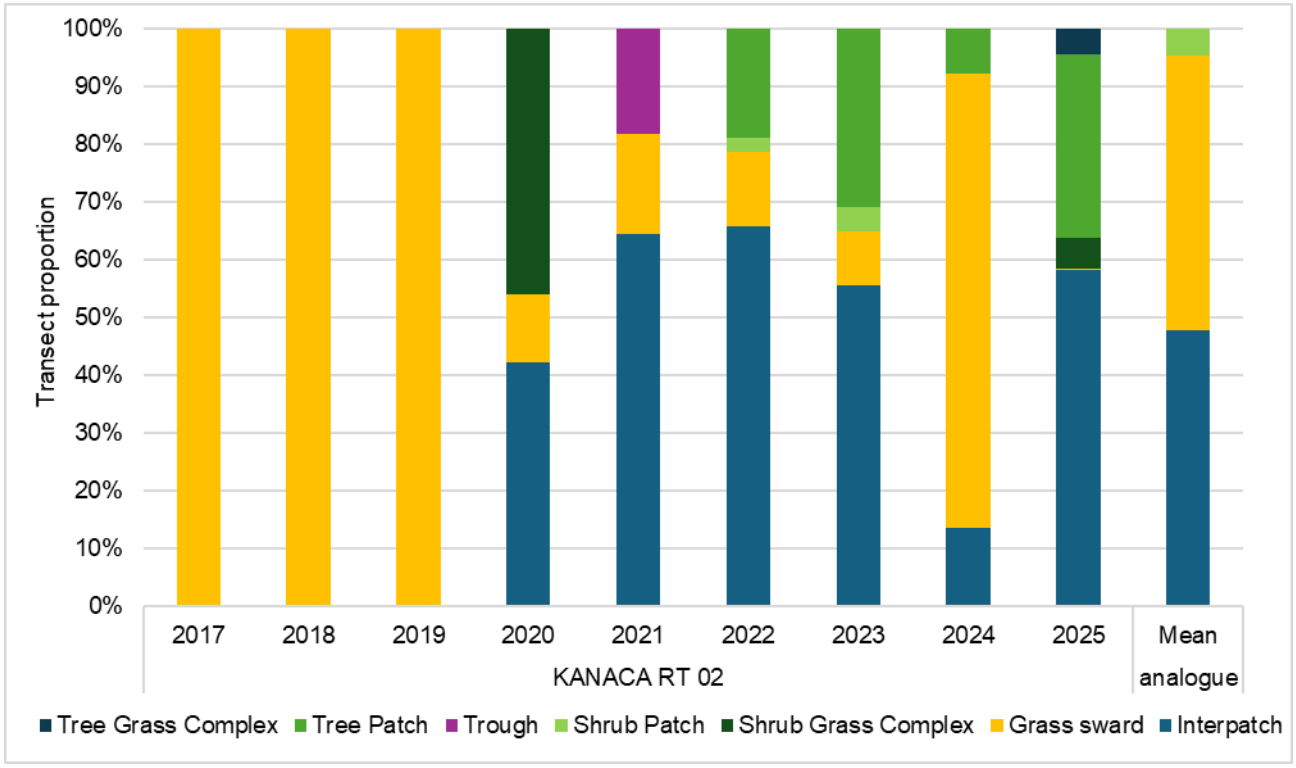
Transect proportions have generally increased in complexity over time. From 2017 to 2019, the site comprised only grass sward. By 2020, this transitioned to predominantly interpatch zones and shrub–grass complexes with some grass sward. In subsequent years, interpatch zones remained the dominant cover, with troughs, tree patches, and shrub patches increasingly present. In 2024, grass sward was once again the dominant cover, while in 2025, proportions resembled those recorded in 2023, with predominantly interpatch zones, tree patches, and some tree–grass and shrub–grass complexes (**Graph 4.25**).

The Landscape Organisation Index has fluctuated but generally decreased over time, with 2025 values below analogue benchmarks. The number of patch zones has also fluctuated, with 2025 values higher than in 2024 but still below analogue levels. Total patch area initially decreased from 2017 to 2023 before increasing in 2024 above analogue benchmarks and then declining again in 2025 to below analogue levels. Average interpatch length has increased over time, with 2025 values above analogue benchmarks (**Table 4.14**).

Visually, the broader area shows a marked increase in complexity, with shrubs and trees becoming more established over time. However, the understory in 2023 and 2024 appeared noticeably drier, and in 2025, bare patches and high cover of exotic litter were evident (**Appendix 3**).



Graph 4.24 **Landscape Function Indices Change (2017–025) for KANACA RT02 with Respect to Mean Analogue Site Values (2014)**



Graph 4.25 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANACA RT02**

Table 4.14 Summary of the Landscape Organisation Data for KANACA Analogue and KANACA RT02 Rehabilitation Site 2014–2025

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2014	**4.7**	**141.6**	**1**	**0.7**
KANACA RT 02 Rehabilitation 2017	1	125	0	1
KANACA RT 02 Rehabilitation 2018	0.4	125	0	1
KANACA RT 02 Rehabilitation 2019	0.4	125	0	1
KANACA RT 02 Rehabilitation 2020	4.4	35.2	1	0.6
KANACA RT 02 Rehabilitation 2021	8	16.3	0.9	0.4
KANACA RT 02 Rehabilitation 2022	7.6	25.1	0.9	0.3
KANACA RT 02 Rehabilitation 2023	4.4	39.1	1.4	0.4
KANACA RT 02 Rehabilitation 2024	1.7	172.1	1.4	0.9
KANACA RT 02 Rehabilitation 2025	2.4	41.9	2.43	0.42

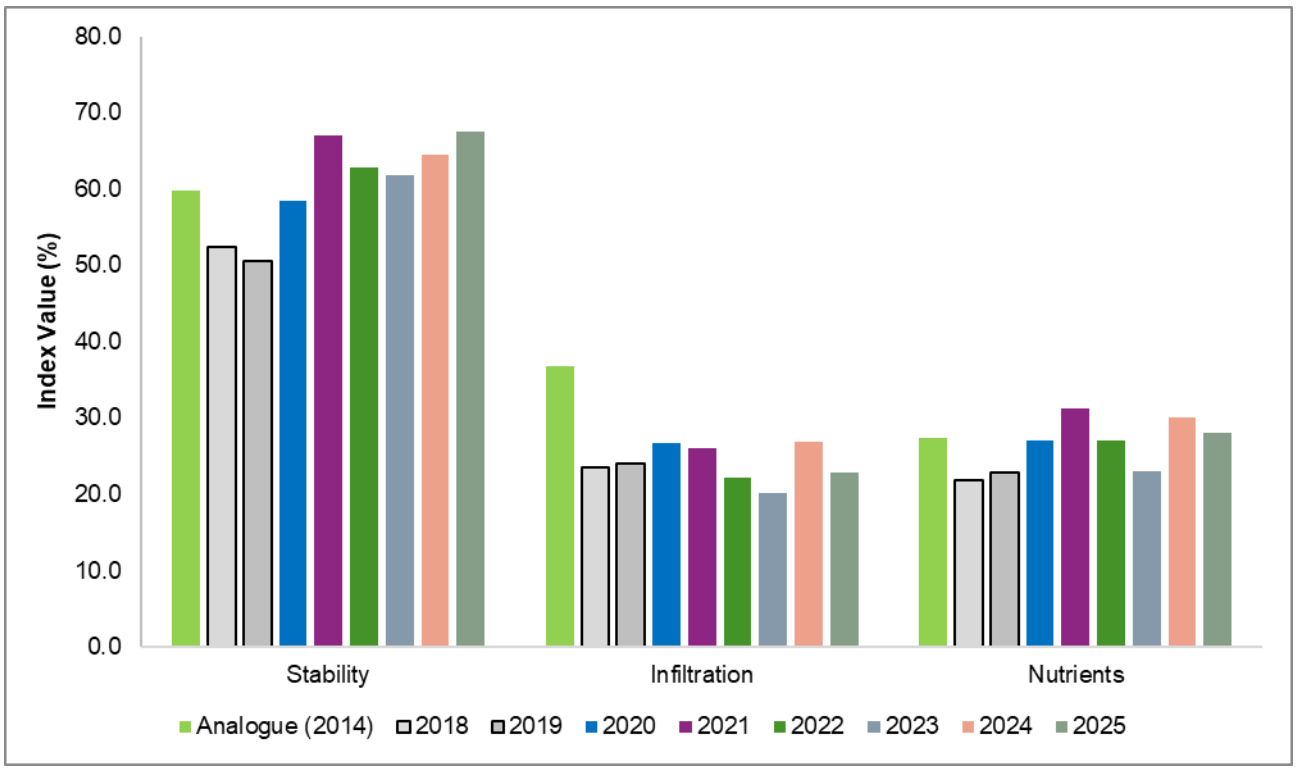
4.2.3.3 KANACA RT03

In 2025, stability increased slightly compared to 2024, while infiltration and nutrient values decreased slightly (**Graph 4.26**). Stability shows a general upward trend over time, with 2025 values above analogue benchmarks. Infiltration has fluctuated below analogue levels from 2018 to 2025, while nutrient values have fluctuated around analogue benchmarks across the same period.

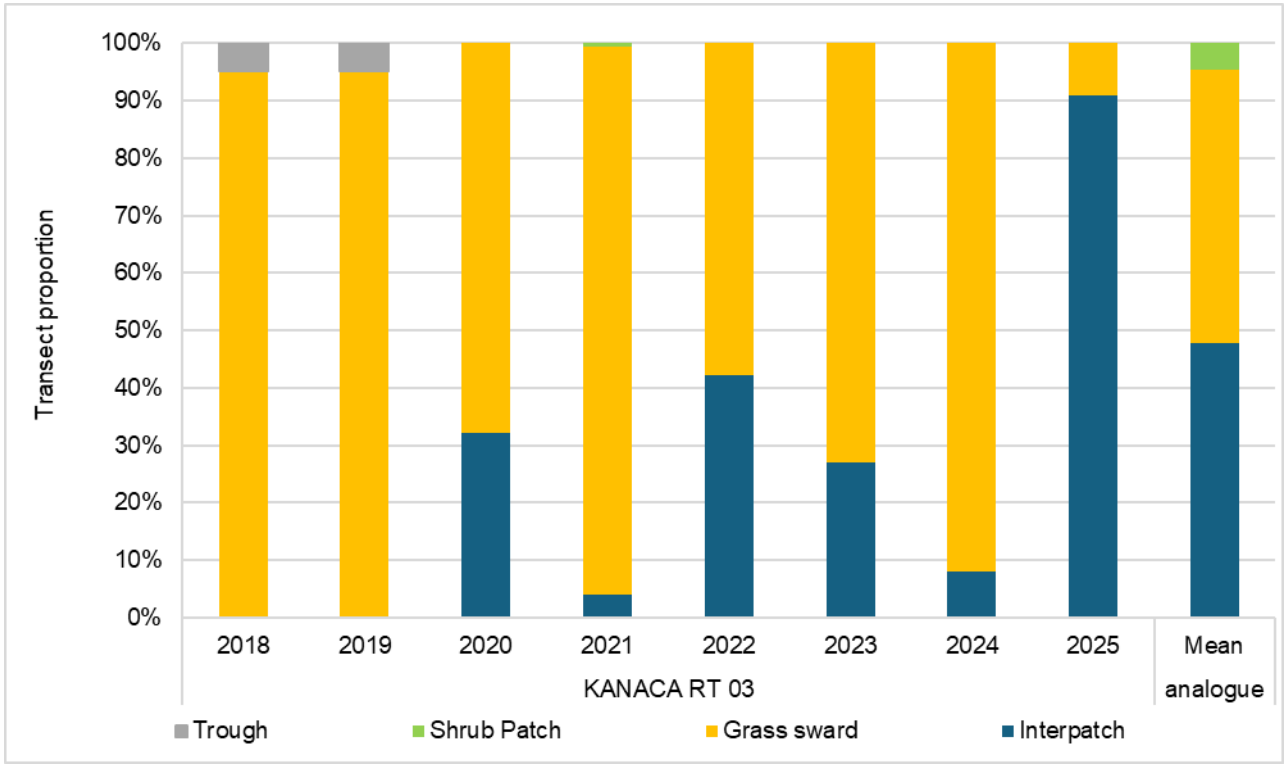
Transect proportions have shown few changes over time. In 2018 and 2019, grass sward was the predominant cover, with small areas of trough recorded. In subsequent years, interpatch areas became the dominant cover, fluctuating in extent alongside grass sward, with no trough recorded. A small amount of shrub was observed in 2021 but not in other years. In 2025, interpatch cover increased markedly, with less than 10% grass sward present (**Graph 4.27**).

The Landscape Organisation Index has fluctuated but generally increased until 2024 before decreasing in 2025 to below analogue benchmarks. The number of patch zones has varied over time and increased in 2025 but remained below analogue levels. Total patch area fluctuated but generally increased until 2021, remaining high through 2024 before decreasing markedly in 2025 to well below analogue benchmarks. Average interpatch length has fluctuated but increased in 2025, remaining above analogue levels (**Table 4.15**).

Visually, the site shows an increase in cover. However, this cover is predominantly exotic litter concentrated within interpatch zones. The site appeared markedly drier in 2023 and 2024, while 2025 exhibited very high exotic litter cover (**Appendix 3**).



Graph 4.26 **Landscape Function Indices Change (2018–2025) for KANACA RT03 with Respect to Mean Analogue Site Values (2014)**



Graph 4.27 **Percentage Cover of Each of the Surface Soil Assessment Zones Recorded at Site KANACA RT03**

Table 4.15 Summary of the Landscape Organisation Data for KANACA Analogue and KANACA RT03 Rehabilitation Site 2014–2025

Site Type	No. of patch zones per 10 m	Total patch area (m^2)	Average interpatch length (m)	Landscape Organisational Index
Analogue 2014	**4.7**	**141.6**	**1**	**0.7**
KANACA RT 03 Rehabilitation 2018	0.3	0.5	14.3	0.1
KANACA RT 03 Rehabilitation 2019	1	173	0	1
KANACA RT 03 Rehabilitation 2020	1.4	232.7	2.6	0.7
KANACA RT 03 Rehabilitation 2021	1.1	486.8	0.7	1
KANACA RT 03 Rehabilitation 2022	3.9	71.8	1.2	0.6
KANACA RT 03 Rehabilitation 2023	2	318.5	1.3	0.7
KANACA RT 03 Rehabilitation 2024	0.5	240.8	3.4	0.9
KANACA RT 03 Rehabilitation 2025	1.5	14.1	5.36	0.09

5.0 Discussion

Over the course of the Kanmantoo monitoring program (2011–2025), LFA indicators have generally demonstrated positive trends in rehabilitation efforts, particularly in relation to soil stability and vegetation cover. Rehabilitation plots typically achieved self-sustaining communities within three to four years, with most sites transitioning from predominantly grass cover to more complex structures incorporating shrubs and trees. These successional patterns align with expected trajectories: initial low landscape function index values followed by a rebound phase as vegetation cover improves, leading to increased stability, infiltration, and nutrient cycling before stabilising near analogue benchmarks. This progression is consistent with findings from similar restoration contexts (Read et al. 2016; Van der Walt et al. 2012).

However, the 2025 results highlight the influence of climatic variability on these trends. Multiple dry years, particularly during 2023 and early 2024, resulted in widespread dieback, most notably among planted Acacia species, reducing structural complexity and increasing interpatch zones across several sites. Although 2025 began with relatively dry conditions, substantial rainfall in the months preceding the surveys promoted rapid growth of exotic groundcover species, particularly annual grasses, and led to a marked increase in exotic litter accumulation within interpatch zones. These dynamics reflect a competitive advantage for exotic species under conditions of reduced native cover combined with elevated soil moisture availability.

Overall, 2025 exhibited a general increase in interpatch extent compared to previous years, driven by two interacting factors: legacy effects of drought-induced dieback and high rainfall immediately prior to surveys, which facilitated the marked increase in exotic species. These changes have implications for patch connectivity and ecosystem function, as evidenced by declining Landscape Organisation Index values at several sites and fluctuating patch metrics. While some sites demonstrated gradual gains in structural complexity over time, the combined effects of climatic extremes and exotic species dominance have constrained progress toward analogue benchmarks.

Soil function indices reflect these patterns. Stability continues to show long-term improvement at most sites, with 2025 values often at or near analogue benchmarks. Nutrient values also improved at several sites, in some cases exceeding analogue levels, likely due to increased organic inputs from exotic litter and episodic moisture availability. In contrast, infiltration remains below analogue benchmarks at many sites, suggesting that increased litter cover and reduced patch connectivity may be limiting infiltration efficiency despite gains in stability. The observed imbalance between stability and infiltration suggests that, although vegetation cover contributes to surface protection, soil physical properties and patch connectivity continue to restrict water entry.

Vegetation structure and patch metrics further illustrate these dynamics. While structural complexity has generally increased over time, 2025 saw a broad expansion of interpatch zones, often accompanied by high exotic litter cover and reduced dominance of native grass sward or shrub/tree patches. Patch metrics indicate that the number of patch zones initially increased after rehabilitation effort began but declined at several sites in 2024–2025 or remained just above or below analogue benchmarks. Generally, total patch area decreased in 2025, with several sites well below analogue values, while average interpatch length increased at multiple sites, in some cases exceeding analogue benchmarks. Where the Landscape Organisation Index declined or remained below analogue in 2025, this typically coincided with increased interpatch extent and litter-dominated surfaces, even when some functional indices improved.

Treatment history continues to influence outcomes. Sites rehabilitated with topsoil placement and bank/trough contour ripping on the Waste Rock Landform achieved LFA function indices at or above analogue levels within the first few years of treatment. In contrast, untreated sites generally exhibited lower values and downward trends in functional indices. Although this distinction is still clear in 2025, the broader climatic signal, dieback coupled with increased exotic species cover, shows that even well-treated sites can experience short-term drops in connectivity and LOI when faced with challenging climatic conditions.

The LFA program provides robust data for detecting trends in functional landscape attributes, and qualitative observations (field notes, photo points) are consistent with quantitative results. However, the absence of non-functional attributes such as species richness and native versus exotic composition in past surveys has limited the ability to evaluate the establishment and persistence of target species. In 2025, Bushland Assessment Methods were also applied at each LFA site to record species richness, weed cover, and vegetation condition metrics. The outcomes of these additional surveys are detailed in a separate report prepared for SEB monitoring purposes (Umwelt 2025b). Continuing to incorporate species composition metrics into ongoing monitoring will strengthen interpretation and management responses. Grazing pressure, particularly from kangaroos, also remains unmonitored but is a plausible driver of vegetation cover dynamics and soil stability, potentially influencing LFA outcomes (Eldridge & Delgado-Baquerizo 2018).

The 2025 results highlight the critical need for adaptive management to maintain progress and mitigate pressures from both climatic variability and exotic species. Future management will need to actively monitor the outcomes of climatic extremes, such as prolonged droughts and intense rainfall events, and adjust strategies accordingly to sustain ecosystem function. Key priorities include targeted weed management, interventions to improve patch connectivity and infiltration, and enhancements to monitoring design, such as continuing to incorporate species composition indicators and grazing pressure assessments into future surveys. Long-term monitoring remains essential, not only to account for stochastic climate effects but also to provide the feedback necessary for timely adaptation and informed decision-making as ecosystem recovery trajectories evolve.

In summary, rehabilitation at Kanmantoo continues to show positive long-term trends in many functional indices and structural attributes where treatments were implemented effectively. However, 2025 highlighted system vulnerability to climatic extremes, with long-term drought effects and pre-survey rainfall pulses combining to increase interpatch extent and exotic litter dominance, reduce patch cohesion, and limit infiltration at several sites. Maintaining progress toward analogue benchmarks will require targeted interventions, alongside continued monitoring to guide adaptive management.

6.0 Recommendations

Recommendations from the 2024 monitoring program were successfully integrated into the 2025 program, with bushland assessment methods applied at each LFA site to capture additional vegetation metrics, enhancing the interpretation of results. However, no grassland sites, specifically *Austrostipa* spp. grasslands or modified hillslope grasslands, were surveyed in 2025. It is recommended that grassland sites be incorporated into the 2026 monitoring program and that bushland assessment methods be applied to a subset of these sites. This will establish a benchmark for species indices and ensure that sites representing a range of vegetation structures are monitored.

7.0 References

Bureau of Meteorology (BOM) (2025). Climate Data Online, Murray Bridge (Pallamana Aerodrome), SA. Station Number: 024584. Accessed at <http://www.bom.gov.au/climate/data/> on 18 March 2025.

Coffey Environments (2010). Native Vegetation Management Plan, Hillgrove Copper Pty Ltd, Kanmantoo Copper Project ML 6345.

EBS Ecology (2011). Kanmantoo Mine Vegetation Monitoring – Landscape Function Analysis. (E00307) Report to Hillgrove Resources. EBS Ecology, Adelaide.

Eldridge, D. J. and Delgado-Baquerizo, M. (2018). Grazing reduces the capacity of Landscape Function Analysis to predict regional-scale nutrient availability or decomposition, but not total nutrient pools. Ecological Indicators, 90, pp. 494-501.

Read, Z.J., King, H.P., Tongway, D.J., Ogilvy, S., Greene, R.S.B. and Hand, G. (2016). Landscape function analysis to assess soil processes on farms following ecological restoration and changes in grazing management. European Journal of Soil Science, 67(4), pp.409-420.

Tongway, D. and Ludwig, J. (2006). Assessment of Landscape Function as an Information Source for Mine Closure. Proceedings of the First International Seminar on Mine Closure, Andy Fourie and Mark Tibbett (eds) Australia, Perth, pp. 21-29.

Tongway, D.J. and Hindley, N.L. (2004). Landscape Function Analysis: Procedures for monitoring and assessing landscapes (with special reference to Minesites and Rangelands). CSIRO, Canberra. CT, Australia: Sustainable Ecosystems, Commonwealth Scientific and Industrial Research Organisation. (Updated as an “LFA Field Procedures,” which is available online: <http://members.iinet.net.au/~lfa_procedures/>).

Umwelt (2025a). Kanmantoo Copper Mine - Fauna Survey 2025. Report to Hillgrove Resources Limited. Umwelt (Australia) Pty Limited, Adelaide.

Umwelt (2025b). Kanmantoo Copper Mine – Native Vegetation Survey. Report to Hillgrove Resources Limited. Umwelt (Australia) Pty Limited, Adelaide.

Van der Walt, L, Cilliers, S.S., Kellner, K., Tongway, D. and van Rensburg, L (2012). Landscape functionality of plant communities in the Impala Platinum mining area, Rustenburg. Journal of Environmental Management 113, pp. 103-116.

Appendix 1

Summary of LFA Sites Monitored and Monitoring Frequency 2011–2025



umwelt

Site Name	Site Type*	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025	Easting	Northing
KANSTI 4	RH	▪	▪	▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	319376	6115483
KANODO RT20	RH	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	318732	6115394
KANODO RT21	RH	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	318482	6114090
KANODO RT19	RH	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	319062	6115176
KANODO RT18	RH	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	318988	6115623
KANODO RT17	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	317308	6115933
KANODO RT16	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	▪	✓▪	✓▪	✓▪	✓▪	▪	317324	6115923
KANODO RT15	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	317348	6115912
KANODO RT14	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	316941	6116079
KANODO RT13	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	▪	✓▪	✓▪	✓▪	✓▪	▪	316974	6116086
KANODO RT12	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	317006	6116086
KANODO RT11	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	317021	6116090
KANODO RT10	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	317051	6116090
KANODO RT07	RH	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	317131	6116083
KANODO 9	RH	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	317807	6114076
KANODO 8	RH	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	316735	6116444
KANODO 7	RH	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	319201	6115552
KANODO 6	RH	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	316537	6116233
KANODO 4	RH	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	316754	6116204
KANODO 5	RH	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	316751	6116127
KANLOM RT02	RH	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	318368	6114430
KANLOM RT01	RH	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	317786	6114369
KANLOM 8	RH	▪	▪	▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	319346	6114276
KANLOM 7	RH	▪	▪	▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	319071	6114078
KANLOM 6	RH	▪	▪	▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318438	6114177

Site Name	Site Type*	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025	Easting	Northing
KANLOM 5	RH	▪	▪	▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318697	6114345
KANLOM 4	RH	▪	▪	▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	319429	6115476
KANGRA RT01	RH	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	319155	6114300
KANACA RT03	RH	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	318361	6114074
KANACA RT02	RH	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	318818	6115697
KANACA RT01	RH	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	318482	6114758
KANACA 4	AN	▪	▪	▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318536	6114302
KANACA 3	AN	▪	▪	▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	319538	6115467
KANLOM 1	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	317961	6114064
KANLOM 2	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	317963	6114040
KANLOM 3	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	317931	6114051
KANODO 1	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	317515	6115604
KANODO 2	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	317528	6115551
KANODO 3	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318229	6115760
KANSTI 1	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318063	6114321
KANSTI 2	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318008	6114283
KANSTI 3	AN	✓▪	✓▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318130	6115752
KANGRA 2	RH	▪	▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	319163	6114317
KANGRA 3	RH	▪	▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	319180	6114339
KANACA 1	AN	▪	▪	▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318326	6115281
KANACA 2	AN	▪	▪	▪	✓▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	318347	6115328
KANGRA 10	AN	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	316490	6114929
KANGRA 11	AN	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	316343	6114870
KANGRA 12	AN	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	317408	6114149
KANGRA 13	AN	▪	▪	▪	▪	▪	▪	▪	✓▪	✓▪	✓▪	✓▪	✓▪	✓▪	▪	317382	6114100

Appendix 2

Landscape Function Analysis (LFA) Results Summary for 2011–2025

umwelt

Landscape Function Indices: Stability

Zones	Stability (%)													
	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025
KANODO*	61.2	60.5	66.3	-	-	-	-	-	-	-	-	-	-	-
KANODO 5	69.8	63.6	64.2	61.3	58.9	63.8	65.1	59.7	65.7	57.3	60.1	59.4	59.6	68.1
KANODO 8	-	-	-	48.7	49.5	49.1	62.9	64.3	55.8	61.8	58.5	61.5	60.4	62.1
KANODO 9	-	-	-	48.5	61.7	74.0	72.2	65.9	62.8	62.3	60.1	59.7	62.6	64.1
KANODO RT 10	-	-	-	-	51.0	57.6	60.9	49.4	47.9	57.1	56.1	56.4	56.5	61.8
KANODO RT 14	-	-	-	-	32.2	58.6	58.2	56.4	52.7	57.8	57.9	54.3	49.7	60.8
KANODO RT 19	-	-	-	-	-	77.5	82.0	49.9	66	72.4	66.9	62.5	60.3	60.9
KANODO RT 20	-	-	-	-	-	67.5	85.0	7.8	61.2	69.7	63.2	64	69.8	67.7
KANODO RT 21	-	-	-	-	-	-	45.0	49.1	55.2	64.3	60.2	60.9	61.2	60
KANLOM*	62.5	61.5	67.7	-	-	-	-	-	-	-	-	-	-	-
KANLOM RT 01	-	-	-	-	-	48.9	42.9	44.0	45.4	52.2	55.3	54.1	59.4	61.4
KANLOM RT 02	-	-	-	-	-	-	46.1	36.8	42.2	52.6	52.0	50.5	52.7	58.1
KANACA RT 01	-	-	-	-	-	51.4	52.0	49.3	51.3	57.0	57.9	59.8	55.1	70.3
KANACA RT 02	-	-	-	-	-	70.5	75.0	64.8	57.1	63.8	61.6	58.6	58.1	63
KANACA RT 03	-	-	-	-	-	-	52.4	50.5	58.4	67.0	62.9	61.9	64.5	67.5

*Analogue sites

Landscape Function Indices: Infiltration

Zones	Infiltration (%)													
	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025
KANODO*	37.5	44.3	44.4	-	-	-	-	-	-	-	-	-	-	-
KANODO 5	55.5	54	60.0	54.2	48.9	42.3	37.9	33.5	41.5	39.7	32.8	31.6	31.9	34.8
KANODO 8	-	-	-	26	20.0	21.9	22.3	23.4	29.3	21.1	23	18.3	21.7	25.4
KANODO 9	-	-	-	21.2	31.2	27.1	31.7	34.6	25.7	19	24.2	17.3	18.4	30.1
KANODO RT 10	-	-	-	-	28.1	23.8	18.3	25.4	21.4	15.4	21.5	16.5	30.8	29.3
KANODO RT 14	-	-	-	-	29.1	20.6	21.4	19.3	20	16.0	18.0	21.9	17.8	23.4
KANODO RT 19	-	-	-	-	-	43.5	52.2	32	43.0	34.6	26.8	21	21.4	24.7
KANODO RT 20	-	-	-	-	-	33.6	45.6	41.1	27.7	27.2	18.3	21.5	27.3	34.4
KANODO RT 21	-	-	-	-	-	-	22.5	24.1	30.9	23.3	16.8	16.9	23.8	22
KANLOM*	27.1	29.4	29	-	-	-	-	-	-	-	-	-	-	-
KANLOM RT 01	-	-	-	-	-	18	30.4	25.2	21	17.1	16.5	14.6	17	19.5
KANLOM RT 02	-	-	-	-	-	-	28	36.0	31.9	15.4	19.6	20.2	17.7	20.1
KANACA RT 01	-	-	-	-	-	23.6	29.2	36.2	23.4	16.8	23.4	18.1	19.6	24.4
KANACA RT 02	-	-	-	-	-	37.7	46.1	49.3	39.7	25.9	26	21.9	26.2	28.1
KANACA RT 03	-	-	-	-	-	-	23.6	24	26.7	26	22.2	20.1	26.9	22.8

*Analogue sites

Landscape Function Indices: Nutrients

Zones	Nutrients (%)													
	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025
KANODO*	26.8	31.7	34.5	-	-	-	-	-	-	-	-	-	-	-
KANODO 5	48.0	39.1	47.3	39.7	30.2	30.9	30.7	27.4	36.6	36.3	33.1	32	33.7	36.5
KANODO 8	-	-	-	16.7	13.3	17.1	17.9	26.2	22.1	26.1	23.7	23	28	27.6
KANODO 9	-	-	-	15.8	22.8	30.4	33.5	55.2	25.4	26.8	27.3	22.1	24.5	32.9
KANODO RT 10	-	-	-	-	12.6	14.3	16.4	22.9	17.8	17.5	20.6	18.9	39	30.7
KANODO RT 14	-	-	-	-	15.4	18.8	21.3	20.3	21.7	19.5	21.4	19.9	22.2	24.4
KANODO RT 19	-	-	-	-	-	44.6	55.3	33.5	56.0	41.8	31.9	25.4	26.7	25.1
KANODO RT 20	-	-	-	-	-	28.8	48.8	61.5	27.7	33.9	24.7	26	36	37.6
KANODO RT 21	-	-	-	-	-	-	15.1	28.4	41.3	27.8	21.0	19.9	30.2	23.8
KANLOM*	21.6	21.9	26.2	-	-	-	-	-	-	-	-	-	-	-
KANLOM RT 01	-	-	-	-	-	13.2	16.7	25.5	16.5	20.3	20.6	17.4	21.7	24.6
KANLOM RT 02	-	-	-	-	-	-	17.5	23.1	16.9	19.0	19.1	19.1	22	25.4
KANACA RT 01	-	-	-	-	-	19	24.6	41.0	21.9	21.7	24.5	21.6	24.2	34.4
KANACA RT 02	-	-	-	-	-	34.4	44.1	58.5	43.5	32.4	30.5	25.8	27.6	31.6
KANACA RT 03	-	-	-	-	-	-	21.9	22.9	27.0	31.2	27.1	23	30	28.0

*Analogue sites

Appendix 3

Annual LFA Monitoring Site Photographs

Site: KANODO 5



2011



2012



2013



2014



2015



2016

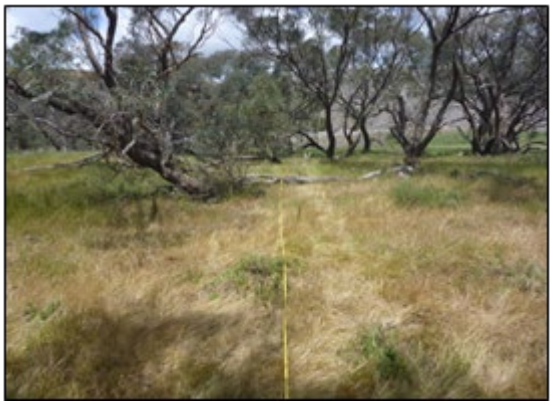


2018



2019

Not surveyed in 2020.



2021

2020



2022



2023



2024



2025

Site: KANODO 8



2014



2015



2016

2017



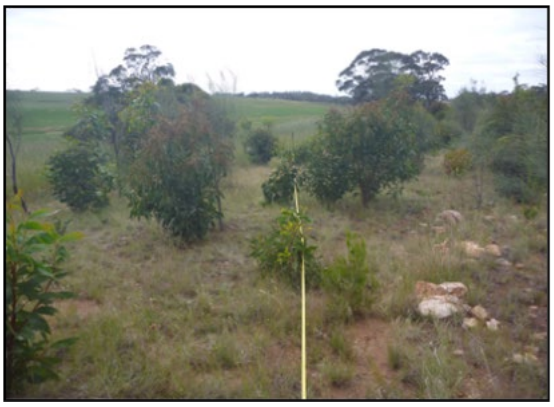
2018



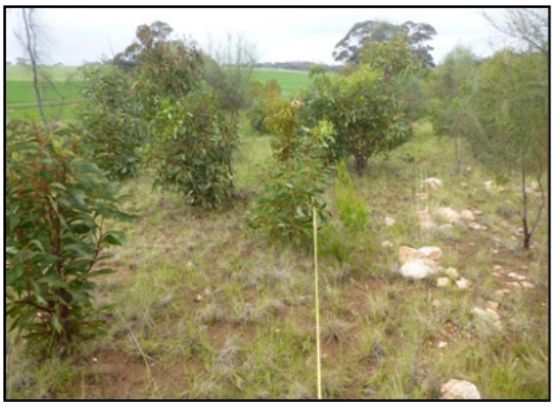
2019



2020



2021



2022



2023



2024



2025

Site: KANODO 9



2014



2015



2016

2017



2018



2019



2020



2021



2022



2023



2024



2025

Site: KANODO RT10



2015

2016



2017



2018



2019

Not surveyed in 2020.

2020



2021



2022



2023

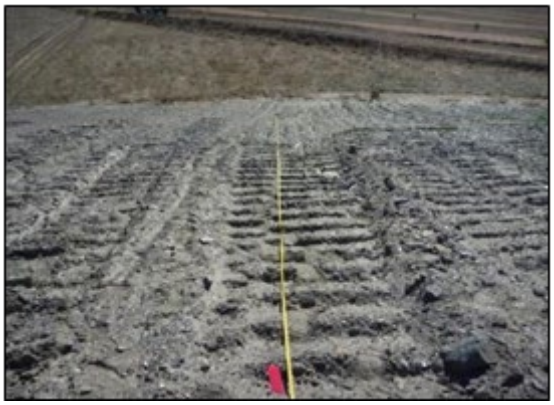


2024



2025

Site: KANODO RT14



2015

2016



2017



2018



2019



2020



2021



2022



2023



2024



2025

Site: KANODO RT19



2017



2018



2019



2020



2021



2022



2023

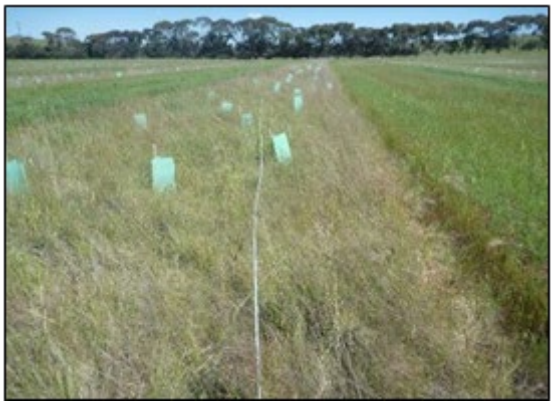


2024



2025

Site: KANODO RT20



2017



2018



2019

2020



2021



2022



2023



2024



2025

Site: KANODO RT21



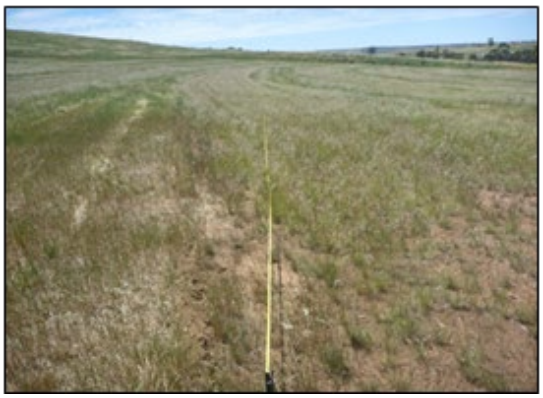
2018



2019



2020



2021



2022



2023



2024



2025

Site: KANLOM RT01



2017



2018



2019



2020



2021



2022



2023



2024

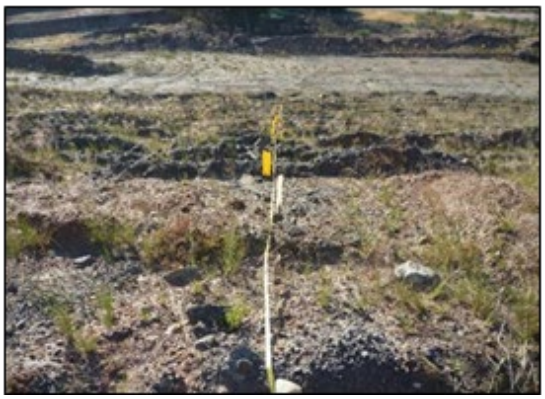


2025

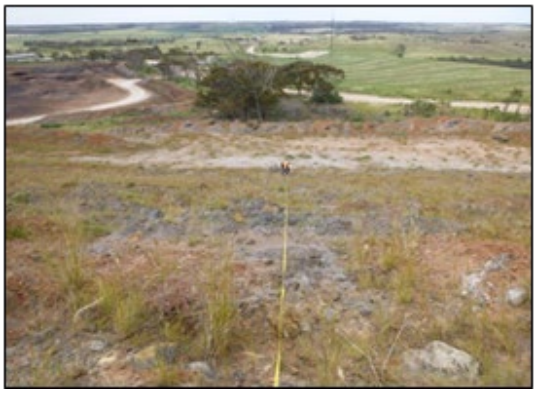
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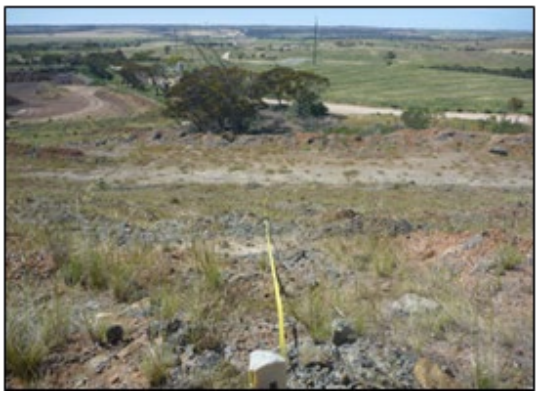
2018



2019



2020



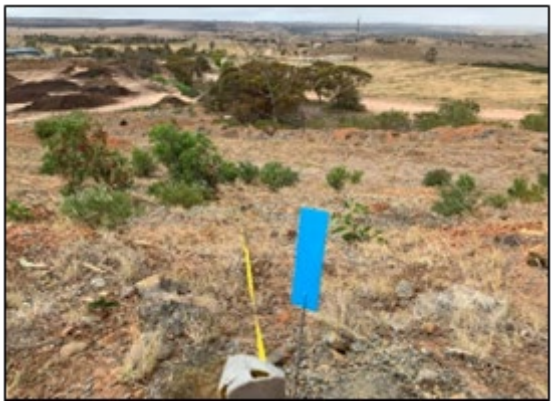
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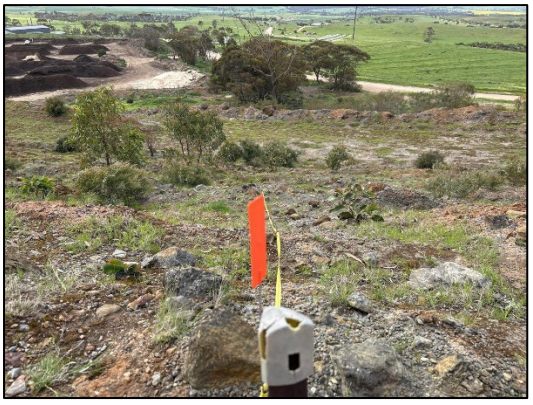
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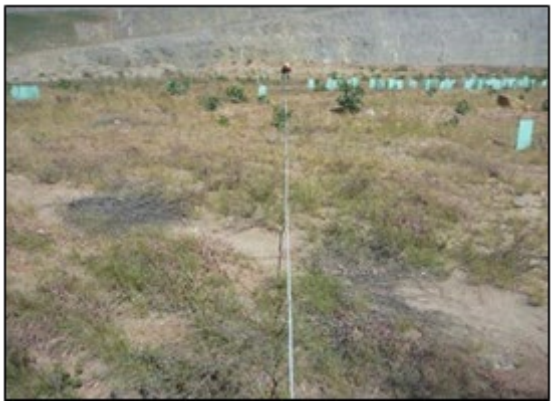


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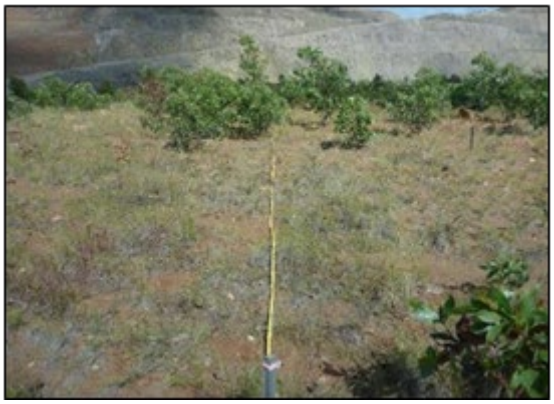
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2017



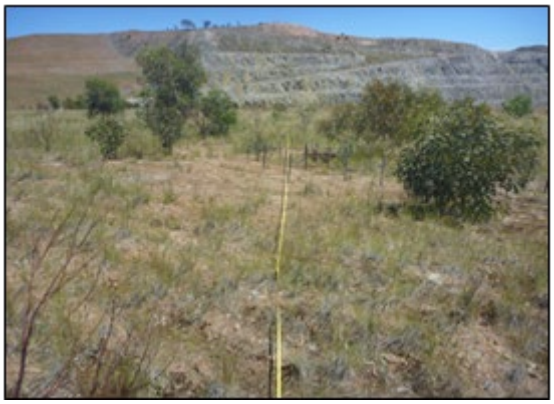
2018



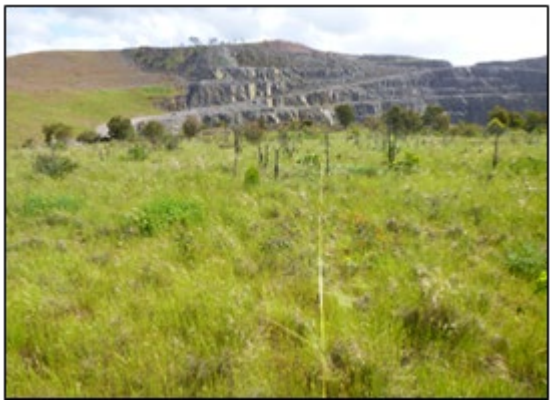
2019



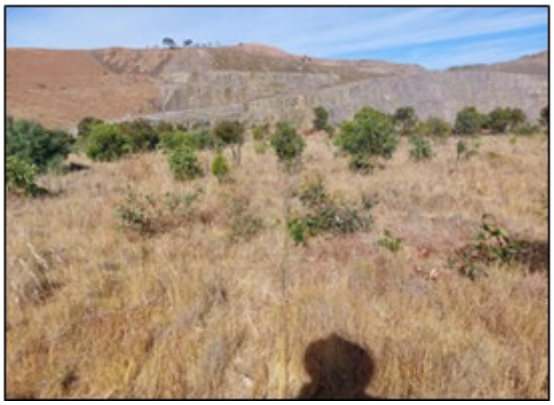
2020



2021



2022



2023



2024

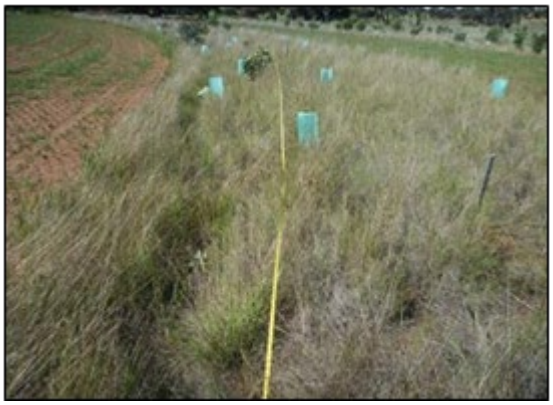


2025

Site: KANACA RT 02



2017



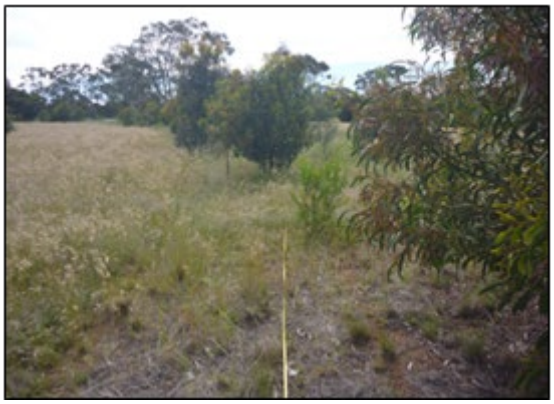
2018



2019



2020



2021



2022



2023



2024



2025

Site: KANACA RT03



2018



2019



2020



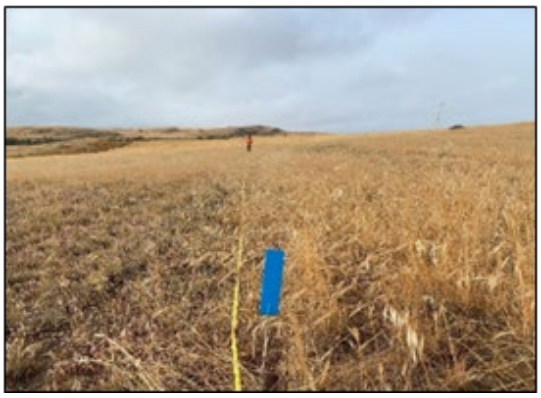
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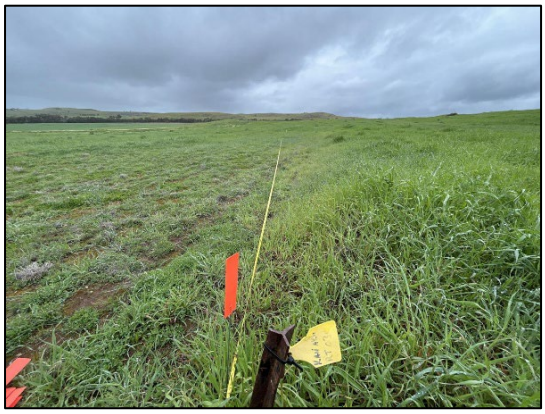
2022



2023



2024



2025

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