

**2025
ACOL - operated
Ravensworth
Underground Mine
Vegetation Monitoring
Report**

for
Ashton Coal Operations Ltd,
Camberwell, NSW

Prepared by
DnA Environmental
August 2025



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Executive summary

Ashton Coal Operations Pty Ltd (ACOL) operates the Ashton Coal Project (ACP) located approximately 14 kilometres (km) north-west of Singleton in the Camberwell district of the upper Hunter Valley, NSW. The ACP was granted approval for integration with adjacent Ravensworth Underground Mine (RUM) and extraction of coal resources from a portion of unmined reserves at the RUM. The ACOL- Operated Ravensworth Underground Mine is referred to as RUMEx. Approximately 45 ha of Endangered Ecological Community (EEC) Central Hunter Grey Box—Ironbark woodland (PCT 1603) will be affected by subsidence, with subsidence cracking likely to require remediation. Approximately 1ha of woodland and/or grassland is also predicted to be lost due to ponding and/or prolonged inundation.

Part of the approval conditions include establishing an annual monitoring program to assess vegetation condition to ensure there are no further impacts from underground mining on these woodlands. The RUMEx vegetation monitoring program was established in May 2025 by DnA Environmental and applies monitoring procedures as for other ACP rehabilitation/vegetation monitoring programs. This involves comparing a range of ecological performance targets and/or completion criteria in RUMEx woodland against woodland reference sites which are unaffected by mining. The monitoring programs comply and have been consistent with a range of conditions specified within approval documents, management systems and associated Management Plans consistent with various revisions of and those current at the time, government regulations, best practice guidelines and current ACP Rehabilitation Management Plans.

Specifically, this vegetation monitoring report aims to:

- Describe the RUMEx vegetation monitoring program;
- Present a range of ecological data recorded from four Central Hunter Grey Box—Ironbark Woodland monitoring sites established in the RUMEx, which will be assessed over time;
- Compare these ecological data against completion criteria targets assessed simultaneously in three woodland reference sites;
- Establish six photo-monitoring points, targeting areas predicted to be impacted by ponding and/or subsidence cracking;
- Identify any changes in condition in woodland vegetation in areas not predicted to be affected by underground mining; and
- Provide a range of management recommendations that may be required to improve woodland condition and/or meet completion criteria targets.

RUMEx woodland were comprised of various densities of *Allocasuarina luehmannii* and *Eucalyptus crebra* and variable levels of tree regeneration and scattered shrubs. The herbaceous understorey was comprised of mosaics of dead leaf litter, scattered perennial ground covers and patches of moss were relatively common. The loam - clay loam soils were typically moderately hard, crusted and highly stable, however there may have been small localised bare patches as a result of animal disturbance and areas of localised deposition as litter became mobilised during high rainfall events.

RUMEx woodland had relatively high floristic diversity and typically dominated by a variety of native grasses with *Aristida* species and *Microlaena stipoides* (Weeping Rice-grass) being most common. Soils were comparable to woodland reference sites and slightly to moderately acidic, non-saline, non-sodic and were high in organic matter but low in nutrients (P, N) and CEC.

Results of 2025 monitoring program indicate that currently, all RUMEx woodland monitoring had similar composition, structure and function as woodland reference sites, with some minor exception. Compared to Central Hunter Grey Box—Ironbark Woodlands (PCT 1603) published benchmarks, RUMEx woodland and woodland reference sites had a similar composition, however there tended to be lower levels of cover provided by trees,

shrubs, grasses and forbs. There were typically higher levels of litter cover, however logs and large trees were limited or absent.

Nine priority weeds were also recorded in RUMEx woodland monitoring and woodland reference sites. Weed and pest monitoring and control will be required as part of ACP's ongoing management commitments. Care to avoid non target species control, especially beneath mature trees and appropriate handling and destruction of weed material and seeds should also be a priority biosecurity method.

Variations in ecological condition in RUMEx woodland is likely to occur as a result of changes in seasonal conditions, with increased levels disturbance and grazing by animals expected during prolonged dry conditions areas. In the absence of livestock grazing, it will be imperative that some degree of macropod grazing is retained as integral in the management of woodland areas. Regular monitoring of macropod numbers and other pest animals and associated disturbance should be ongoing.

Woodland and pasture reference sites are situated in ACOL farmland areas also require ongoing management and maintenance in order to manage herbage biomass and weeds. Since 2023, light grazing by cattle has occurred, however overgrazing needs to be avoided as it will impact on completion criteria targets. Periods of grazing exclusion and/or the construction of protective fencing may need to be considered to protect the integrity of reference sites.

Ongoing monitoring will assess a range of ecological indicators over time and compare these changes against woodland reference sites unaffected by underground mining. Photo-graphic and quantitative data will allow detection in changes and/or deterioration, different to those occurring in woodland reference sites, or beyond those predicted as a result of underground mining. The monitoring program will also the assess adequacy of rehabilitation where required and provide guidance on RUMEx woodland management requirements.

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1 Introduction: 2025 RUMEx monitoring report

1.1 RUMEx

Ashton Coal Operations Pty Ltd (ACOL) has operated the Ashton Coal Project (ACP) located approximately 14 kilometres (km) north-west of Singleton in the upper Hunter Valley, NSW since 2002. The ACP and the Ravensworth Mine Complex are neighbouring open cut and underground coal mining complexes that share a common mining lease boundary. In July 2022, DPE approved modifications under DA 104/96 to enable ACOL to access and extract approved but unmined coal resources from a portion of the Ravensworth Underground Mine (RUM; ACOL 2023).

The RUMEx project will undertake modifications to allow connections between the two neighbouring mines via non-subsiding first workings. To facilitate this integration of operations, part of four Glencore mining leases were transferred to ACOL in December 2022 (ML 1834, ML 1835, ML 1836 and ML 1837). Surface infrastructure required at the RUMEx, is associated with the ventilation, gas and water management required to facilitate the underground operations. The RUMEx longwall panels are located beneath the Ravensworth Mine Complex, Ravensworth South and AGL Void 5 open cut mining operations.

Mining operations and rehabilitation associated with these open cut operations are managed by Glencore and AGL, respectively. ACOL will continue to consult with Glencore and AGL to align rehabilitation and associated Forward Programs with that planned for Ravensworth Mine Complex and Ravensworth South. Layout of the ACP and ACOL operated RUM showing underground long-wall mining seams is provided in Figure 1-1 (ACOL 2023).

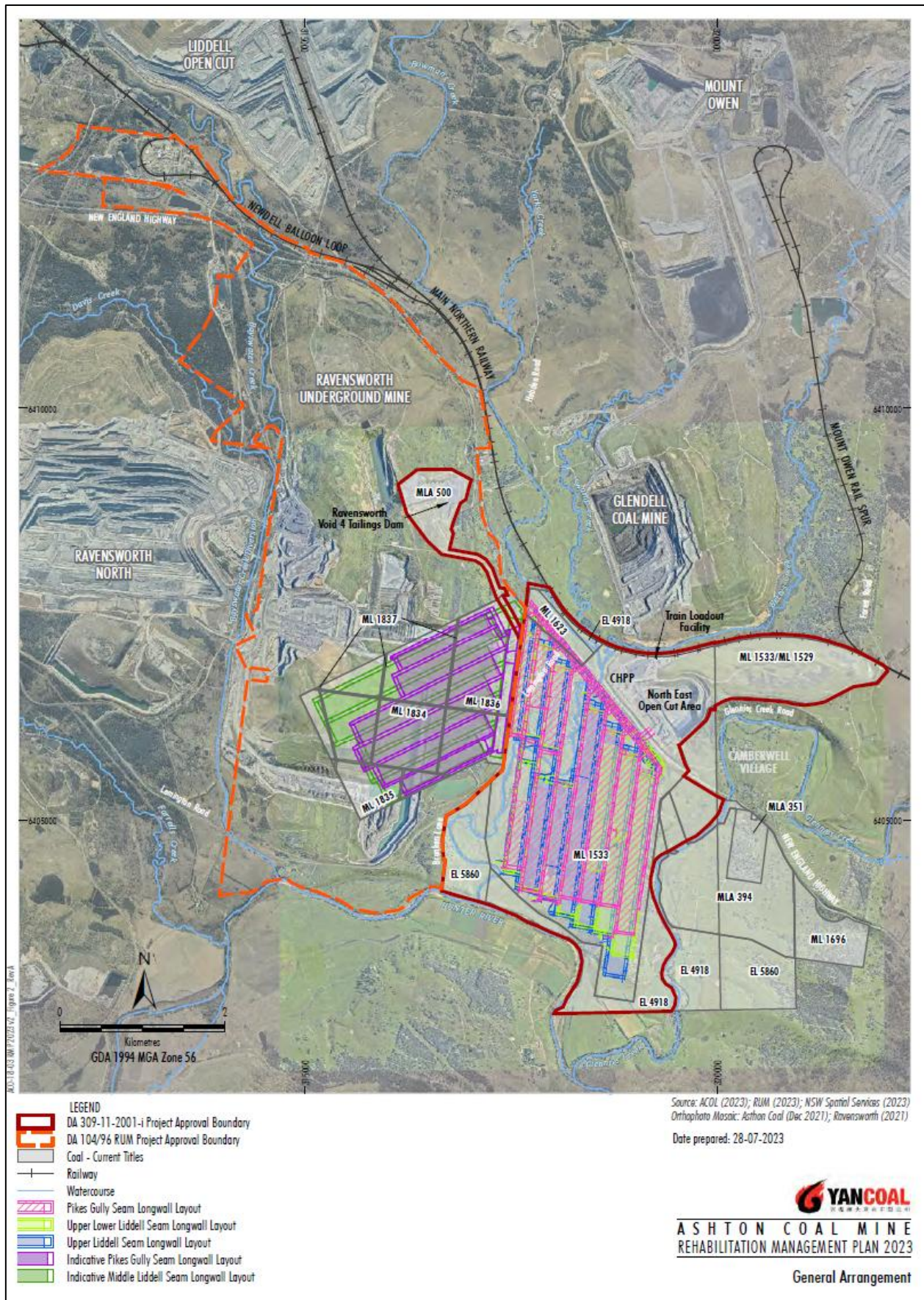


Figure 1-1. Layout of ACP and RUM showing underground long-wall mining seams (ACOL 2023).

1.2 Local environment

The ACP is bounded by the Main Northern Railway to the north, Glennies Creek Road and Glennies Creek to the east, the Hunter River to the south and sections of Brunkers Lane/Lemington Road to the west. The lands held by ACOL consist generally of undulating foothills, with the main topographic feature being a ridge line located in the eastern portion of the site which trends in a north-south direction.

The majority of ACP is dominated by native grasslands after extensive clearing of eucalypt woodland following European settlement for the purposes of agriculture. Scattered isolated trees or small areas of regrowth woodland occur throughout the native grasslands and there are now significant areas *Allocasuarina luehmannii* (Bullock) regrowth which have established since the mine took ownership.

Alluvial floodplains of Glennies and Bowman's Creeks have historically been cropped or pasture improved, with weeds often abundant in the now fallow paddocks. Bowman's and Glennies Creeks are primarily dominated by narrow linear bands of *Casuarina cunninghamiana* (River Oak) Forest. Riparian habitats along Bowmans and Glennies Creek form part of a fragmented corridor south along the Hunter River and Wollombi Brook. This corridor is likely to be important for fauna movement from the surrounding area into vegetation and habitats of Wollemi National Park on the southern ranges of the Hunter Valley.

1.3 Vegetation communities

There is approximately 45ha of remnant woodland overlying the RUMEx is dominated by *Allocasuarina luehmannii* and *Eucalyptus crebra* (Narrow-leaved Ironbark), and sub-dominant *Eucalyptus moluccana* (Grey Box) with a predominately grassy groundcover (Hunter Eco 2023). Along with patches of adjoining Derived Native Grassland (DNG) they were considered to conform to PCT 1603 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter. DNG patches of PCT 1603 were a mix of native grasses and herbs, along with exotic species (Hunter Eco 2023).

The project area also contains rehabilitated *Acacia pendula* (Weeping Myall) woodland on RUM overburden emplacements, as well as other woodland rehabilitation and areas of exotic grassland. Monitoring of these rehabilitation areas are managed by Glencore and AGL respectively and are not relevant to this monitoring report.

1.4 Threatened ecological communities

Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter (PCT 1603) and DNGs within 30 m of a woodland patch have been determined by Hunter Eco (2023) to conform to:

- The Biodiversity Conservation (BC) Act listed Endangered Ecological Community (EEC), Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions, hereafter referred to as Central Hunter Grey Box – Ironbark Woodland.
- The Environmental Protection and Biodiversity Conservation Act (EPBC) Act listed Critically Endangered Ecological Community (CEEC), Central Hunter Valley eucalypt forest and woodland.

DNG areas greater than 30 m away from remnant patches do not conform the Central Hunter Valley eucalypt forest and woodland CEEC.

Eucalyptus camaldulensis (River Red Gum) population in the Hunter catchment is listed as endangered under the BC Act. Hunter Eco (2023) recorded a population of 19 mature *Eucalyptus camaldulensis* approximately 500 m to the south of the southeastern corner of RUMEx. The population extends along Bowmans Creek and along the Hunter River to the west, however it was not identified within the RUMEx project area (Hunter Eco 2023, NSW

Government 2024b). Review of aerial imagery and contours suggests that floodplains capable of supporting *Eucalyptus camaldulensis* are absent from the Application Area (Hunter Eco 2023).

1.4.1 Narrow-leaved Ironbark - Bull Oak - Grey Box Woodland

As described by the NSW BioNet Vegetation Classification (NSW Government 2025c), PCT 1603 is an open grassy woodland dominated by *Allocasuarina luehmannii* (Bull Oak), and the sub-dominant *Eucalyptus crebra* (Narrow-leaved Ironbark) and *E. moluccana* (Grey Box). The understorey is sparse and generally consists of *Acacia amblygona* (Fan Wattle), *Daviesia genistifolia* (Broom Bitter Pea), *A. linifolia* (White Wattle), *Bursaria spinosa* (Native Boxthorn) and *Eremophila deserti* (Turkeybush). The ground cover is relatively depauperate of species, with occasional *Aristida vagans* (Threeawn Speargrass), *Cymbopogon refractus* (Barbed Wire Grass), *Dichelachne rara*, *Microlaena stipoides* (Weeping Grass), *Lomandra glauca* (Pale Mat-rush), *Cheilanthes sieberi* (Poison Rock Fern) and *Dichondra repens* (Kidney Weed).



Figure 1-2. Narrow-leaved Ironbark - Bull Oak - Grey Box woodland at RUMEx.

1.4.2 Derived native grasslands

At ACP, open pasture areas are typically dominated by derived native grasslands with scattered regrowth *Allocasuarina luehmannii* (Bulloak). The floodplains of Bowman's and Glennies Creeks have historically been cropped and left to naturally regenerate and are currently dominated by a variety of agricultural weeds. Derived native grasslands are dominated by a diverse range of native grasses and herbs/forbs and agricultural weeds. Common species include *Aristida ramosa*, *A. vagans* (Wiregrasses), *Bothriochloa decipiens* (Redgrass), *Cymbopogon refractus* (Barbed-wire Grass), *Sporobolus creber* (Western Rat's Tail Grass), *Digitaria divaricatissima* (Umbrella Grass) and *Rytidosperma* species (Wallaby Grasses). An example of derived native grassland is provided in Figure 1-3.



Figure 1-3. Derived native grassland with scattered Bulloak regeneration.

2 Predicted impacts of RUMEx

2.1 Subsidence

A detailed assessment of subsidence impacts arising from longwall mining of LW403-406 is provided in the Subsidence Assessment (SCT 2024). SCT (2024) estimate maximum vertical subsidence within areas of PCT 1603 to be 1.7 m, with levels of tilt and strain to result in minor cracks and changes to the surface (Figure 2-1), but generally imperceptible in a bushland setting. Remediation may be required, however, surface cracking or vertical subsidence is not expected to impact threatened species or threatened species habitat.

The endangered population *Eucalyptus camaldulensis* population occurs outside the RUMEx. While cracking and surface changes are not predicted to impact this area, the population may be subject to groundwater drawdown. Small dams that are situated in the southeast of RUMEx are also expected to be impacted by the subsidence movements.

2.2 Ponding

Areas of ponding are predicted to affect 1 ha of vegetation. This corresponds to approximately 0.5 ha of the BC Act listed Central Hunter Grey Box – Ironbark Woodland, and approximately 0.9 ha of the EPBC Act listed Central Hunter Valley eucalypt forest and woodland (EcoLogical 2024).

Prolonged inundation is likely to lead to vegetation dieback and changes in habitat for fauna and flora species. Prolonged inundation may also result in dieback of all vegetation strata and permanent loss of groundcover and loss of access to habitat features located at ground level (large woody debris, litter, surface rock; Figure 2-2). Impacts to vegetation surrounding areas of ponding, as a result of the ponding are considered unlikely. Predicted impacts of surface cracking and ponding are provided in Figure 2-3 and Figure 2-4.



Figure 2-1. Tilt and strain results in changes to the landform surface and subsidence cracks require remediation.



Figure 2-2. Impacts of ponding can lead to loss of woodland habitat and an increase in wetland habitat.

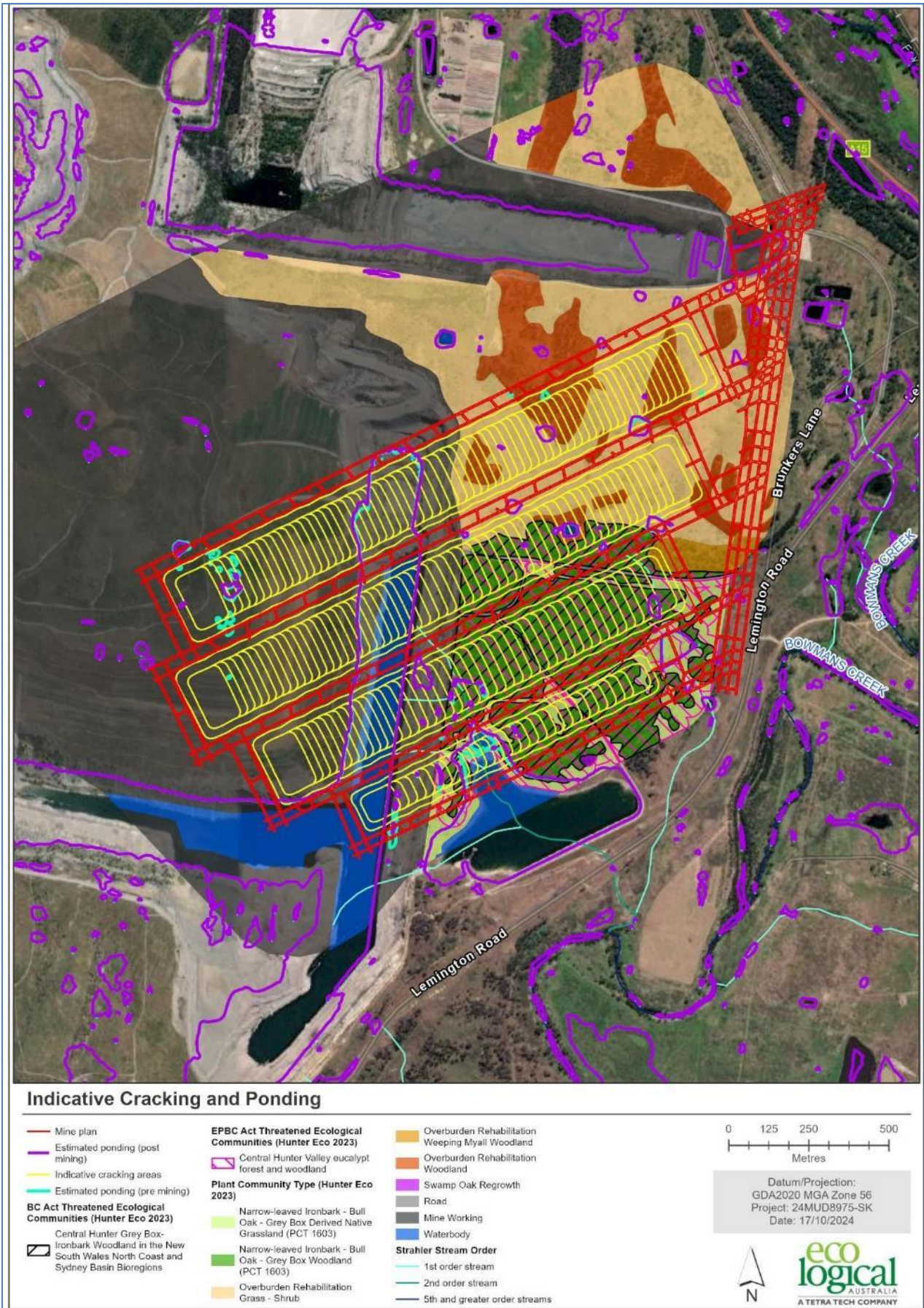


Figure 2-3. Predicted cracking and ponding (EcoLogical 2024).

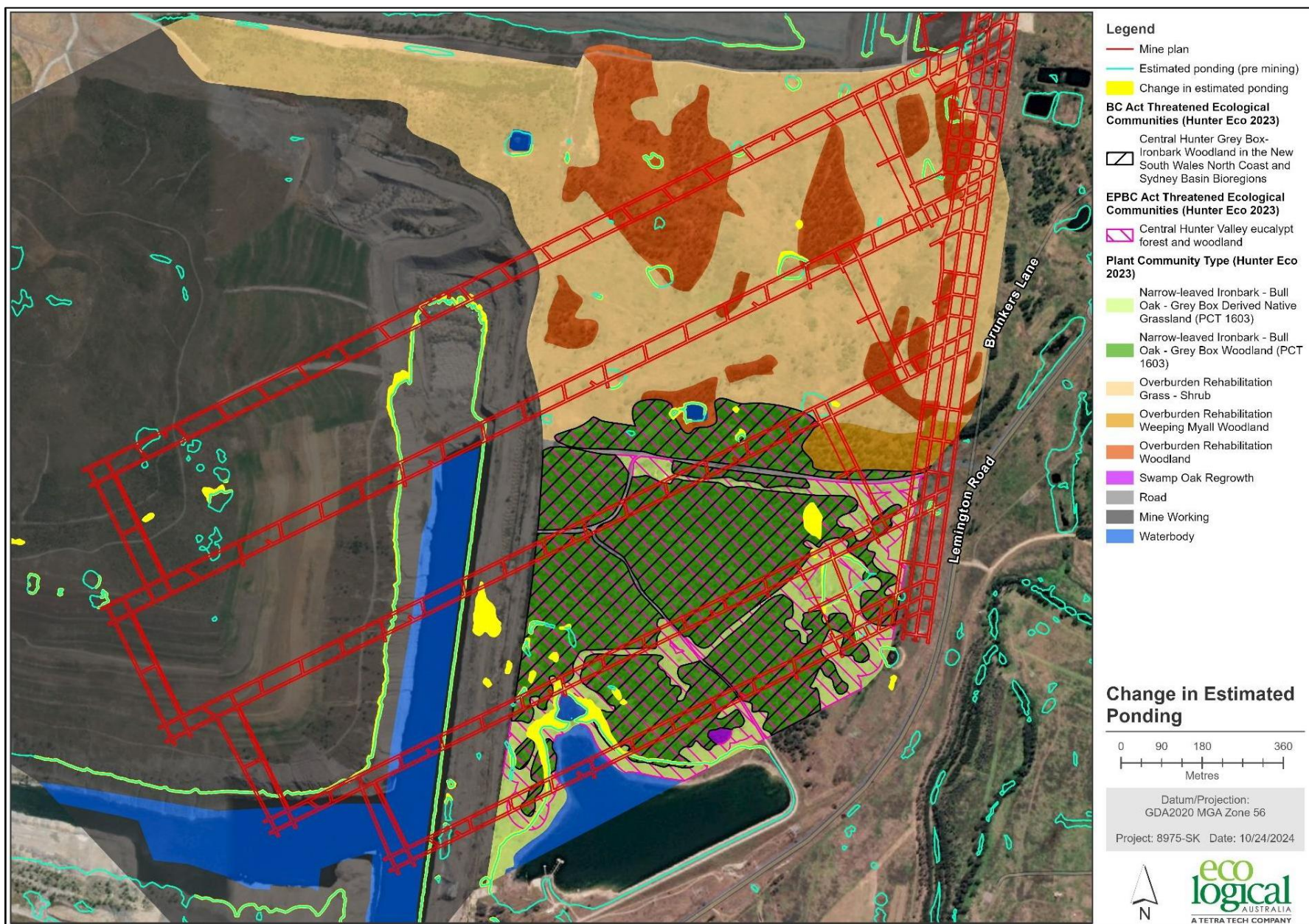


Figure 2-4. Estimated changes in ponding (EcoLogical 2024).

3 RUMEx Monitoring program

3.1 Objectives

In accordance with the Consolidated Consent Subsidence Performance Measure, there needs to be a negligible impact to endangered ecological communities because of mining of LW403-406 (EcoLogical 2024). Key risks to TECs due to mining of LW403-406 is the potential for tree death and floristic composition alteration due to subsidence related ponding. Primary objectives of the RUMEx vegetation monitoring program therefore, is to ensure there is no adverse impact on, and no decrease in extent of Central Hunter Grey Box—Ironbark Woodland or Central Hunter eucalypt forest and woodland within the LW403-406 Application Area.

Recommendations for inclusion in the monitoring program (EcoLogical 2024) include:

- Assess vegetation to ensure compliance with the following literature and compare to baseline extent:
 - Central Hunter Grey Box—Ironbark Woodland: *Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions - endangered ecological community listing* (NSW Scientific Committee 2010).
 - Central Hunter eucalypt forest and woodland: *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s266B) Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community* (TSSC 2015).
- Undertake photo monitoring in areas within the mapped extent of the TECs where ponding is predicted twice per year;
- Set-up permanent photo monitoring points, with photographs facing north, south, east, west and vertical to be captured twice per year;
- Compare canopy projected foliage cover with previous years, and with control sites in unmined Central Hunter Grey Box—Ironbark Woodland and Central Hunter eucalypt forest and woodland.

It is also recommended that ACOL monitor potential inundation/ponding following rainfall events at permanent photo monitoring points.

3.2 Monitoring Methodology

Rehabilitation monitoring methodology and determination of completion criteria were developed in 2008 for NEOC rehabilitation and Underground Mining Surface Vegetation monitoring and has been documented in “Rehabilitation monitoring methodology and determination of completion criteria for Ashton Coal” (DnA Environmental and Carbon Based Environmental 2009a). It has also been applied to vegetation monitoring of Bowman’s Creek and Southern Voluntary Conservation Area (SVCA).

Subsequently, the vegetation monitoring program established at RUMEx follows methodologies as outlined in ACOLs annual Rehabilitation Monitoring Program (ACOL 2023, EcoLogical 2024, DnA Environmental 2025a) and incorporates a combination of:

- Photo-point monitoring;
- Landscape Function Analysis (LFA; Tongway and Hindley 1995, 1996, 2003, 2004);
- Accredited soil analyses; and
- Ecosystem diversity and habitat values based on and adapted from the BioBanking/Biometric Assessment Methodologies (e.g. Gibbons 2002, Gibbons *et al* 2005, 2008) and Biometric Manual 3.1 (NSW Department of Environment, Climate Change and Water (DECCW 2011, OEH 2014), noting that these BAM methods have evolved, but were relevant at that time. Maintaining original monitoring

procedures and/or methodologies were considered to be essential to ensure continuity and integrity of monitoring data, allow direct comparison of ecological data and provide relevance to the long-term monitoring programs.

More recently, ACOL's monitoring programs have also adapted to regulatory requirements of Rehabilitation Management Plans (RMPs) and Associated Annual rehabilitation Report and Forward Program for large mines Codes of Practice (NSW Resources Regulator 2023, 2025) and current ACOL Rehabilitation Management Plan (ACOL 2023) and Forward program (ACOL 2025). To keep up to date with changes in regulatory guidelines, the most current BAM methods (OEH 2020) were also undertaken. BAM attributes associated with target vegetation community composition, structure and function requirements are compared to relevant reference sites and/or specific Plant Community Type (PCTs), as set out in NSW Resources Regulator rehabilitation guidelines (NSW Resources Regulator 2025).

Results of ecological monitoring are first presented in a comparative summary of a selection of ecological performance indicators or KPIs against their corresponding reference sites in order to assess trends over time. The performance of RUMEx monitoring sites against completion criteria is provided, as represented by an appropriately coloured box that aligns with each of the main rehabilitation phases. To address recent changes in rehabilitation monitoring guidelines, BAM attributes including composition, structure and function associated with target vegetation communities have also been compared to relevant reference sites, as well as published benchmarks associated with PCT 1603. When these criteria are comparable to or higher than recorded in reference sites, completion criteria are considered to have been met

Ecological monitoring at ACP has been undertaken in autumn in all monitoring years. Field surveys were undertaken by Andrew Johnston (DnA Environmental) and Ray Mjadwesch (Mjadwesch Environmental Service Support) and this year (2025) were undertaken during 5th – 14th May. Reports continue to be prepared by Dr Donna Johnston and Andrew Johnston.

Monitoring of NEOC overburden emplacement rehabilitation, farmland areas overlying and potentially affected by underground long-wall mining, SVCA (including the OEH monitoring forms), Bowman's Creek and associated Diversion Channels and River Red Gum population are provided in separate reports (DnA Environmental 2019 - 2025 a, b, c, d).

3.3 Monitoring quadrats

Full monitoring methodology consisted of using 20 x 20 m quadrats, positioned such that the base line forms the basis for the LFA transect which must face down slope. Vegetation transect monitoring typically occurs along the contour at the 10 m interval that runs perpendicular and to the right of the LFA transect. Four marker pegs are used to establish a permanent transect position. GPS readings are taken to ensure quadrats can be relocated over time. Permanent photo-points are also established at various marker pegs of the monitoring plot to record changes in these attributes over time. The layout of the 20 x 20 m monitoring quadrats is provided in Appendix 1. BAM functional attributes are measured within a 50 x 20 m quadrat that extends past the central 20 x 20 m monitoring plot.

3.4 Landscape Function Analyses

Landscape Function Analyses (LFA) is a methodology used to assess key indicators of ecosystem function including landscape organisation and soil surface condition as a measure of how well the landscape retains and uses vital resources. It was developed by CSIRO scientists Tongway and Hindley (Tongway 1994, Tongway and Hindley 1995, 1996, 2003, 2004). The indicators used quantify the utilisation of the vital landscape resources of

water, topsoil, organic matter and perennial vegetation in space and time. The LFA methodology collects data at two “nested” spatial scales (Tongway and Hindley 2004) including:

1. At coarse scale, **landscape organisation** is characterised. Patches and interpatches, indicators of resource regulation, are mapped at the 0.5 to 100 m scale from a gradient-oriented transect (making sense of landscape heterogeneity); and
2. At fine scale, **soil surface assessment** (soil “quality”) examines the status of surface processes at about the 1-m scale, with rapidly assessed indicators on the patches and interpatches identified at coarse scale.

At each scale, parameters are calculated that reflect several aspects of landscape function. In the first stage, patches and interpatches are identified and recorded along a line oriented directly down slope. Sometimes there are several different types of each patch/interpatch which provides a measure of heterogeneity or “**landscape organisation**”.

In the second stage, called “**soil surface condition**” (**SSC**) assessment, it is possible to assess and monitor soil quality using simple indicators including:

- Rain splash protection;
- Perennial vegetation cover;
- Litter;
 - Percent litter cover;
 - Origin of the litter;
 - Extent of decomposition;
- Cryptogam cover;
- Crust Brokenness;
- Soil Erosion Type and Severity;
- Deposited Materials;
- Soil Surface Roughness;
- Surface Nature (resistance to disturbance);
- Slake Test; and
- Soil Surface Texture.

These 11 features are compiled and calculated into three indices of soil quality (Figure 3-1):

1. **Stability** (that is, resistance to accelerated erosion);
2. **Infiltration** (the rate soil absorbs water); and
3. **Nutrient Cycling** (the way plant litter and roots decompose and become available for use by other plants).

Landscape Organisation Indices (LOI) combined with LFA soil surface indices provide valuable quantitative ecological data that can be re-measured over time to assess changes in the condition or function of a landscape or part of the landscape. Whilst LFA is a quick, consistent and reliable measure of landscape function, it does not capture changes in vegetation structure, floristic diversity or other biodiversity attributes.

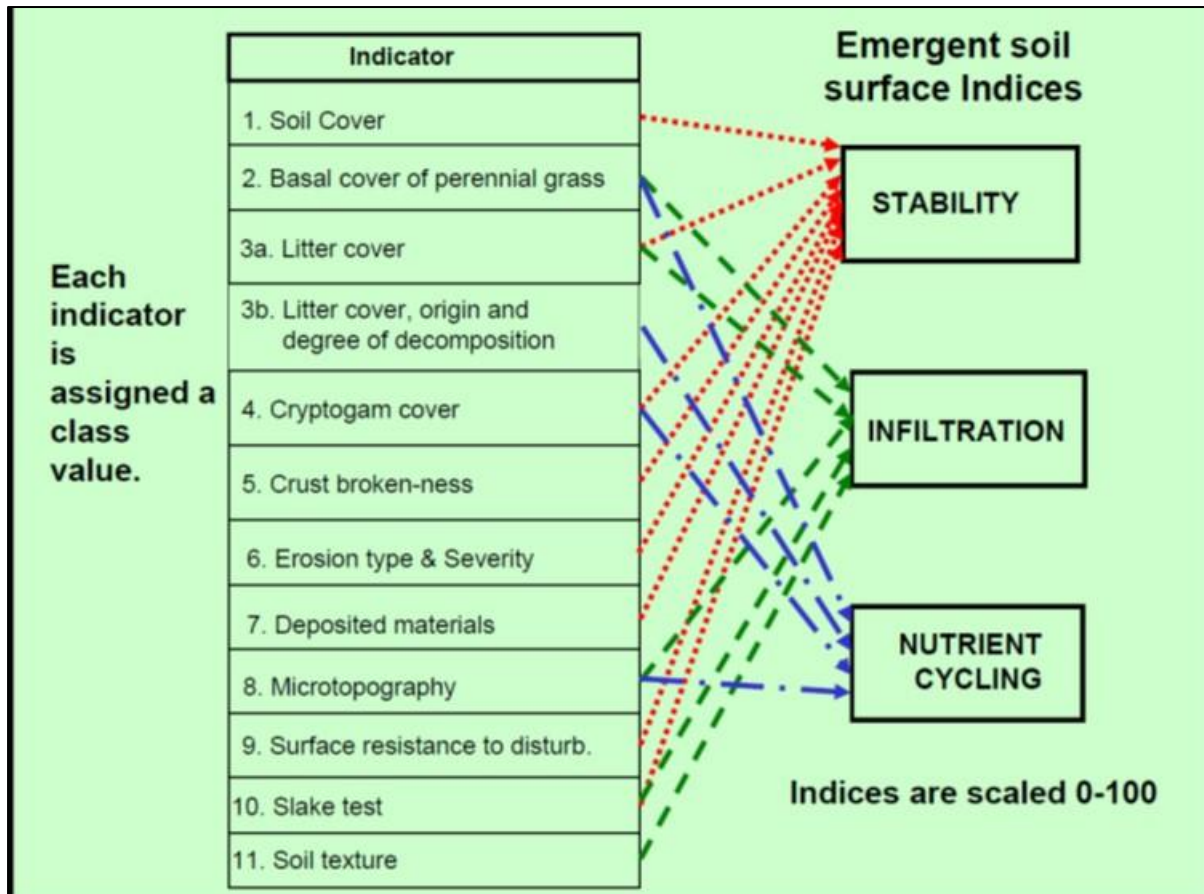


Figure 3-1. How the three indices of soil quality are derived from soil assessment attributes (Tongway and Hindley 2004).

3.5 Soil analyses

Soil samples are obtained using standard soil sampling techniques where at least 12 samples are taken at each monitoring site and bulked together. Soil samples are sent to Southern Cross University at their National Association of Testing Authorities (NATA) accredited laboratory for analysis. Soil analysis consist of assessing the parameters pH, electrical conductivity (EC), Available calcium (Ca), magnesium (Mg), potassium (K), nitrate nitrogen (N), sulphur (S), organic matter (OM), exchangeable sodium (Na), Ca, Mg, K, hydrogen (H), cation exchange capacity (CEC), available and extractable phosphorus (P), micronutrients Zinc (Zn), manganese (Mn), iron (Fe), copper (Cu), boron (B), silicon (Si), aluminium (Al), molybdenum (Mo), cobalt (Co) and selenium (Se) and total carbon. The heavy metals including cadmium (Cd), lead (Pb), arsenic (As), chromium (Cr), nickel (Ni), mercury (Hg) and silver (Ag) are also tested.

A report with analysis and desirable levels recommended in the agricultural industry is provided by the laboratory and is provided in Appendix 6. Exchangeable sodium percentages are calculated as a measure of sodicity or dispersion.

Soil related performance indicators have a lower and upper target derived from the local reference sites. Desirable agricultural ranges based on the 'Albrecht' and 'Reams' concepts are also considered acceptable soil related targets.

3.6 Monitoring structural diversity, floristic and other biodiversity attributes

In addition to LFA, assessments of various biodiversity components are also undertaken to monitor changes in particular plants and groups of plants through the various successional phases and to document and/or identify critical changes or management actions required. Some simple and rapid procedures for making these assessments were developed by CSIRO scientists (2002, Gibbons *et al* 2005, Gibbons *et al* 2008). They were developed for assessment of habitat quality across a range of vegetation types in the southern NSW Murray-Darling Basin and formed the basis of the Biometric Model used in the Property Vegetation Planning Process (DECCW 2011). Some adaptations were made to reduce monitoring effort where possible, and to incorporate aspects of newly formed revegetation sites or sites in the early stages of recovery.

Ecological assessments are undertaken in 20 x 20 m quadrats and provide quantitative data that measures changes in:

- Ground cover composition and habitat characteristics including % cover in 10 repeated 1 m lengths every 2 m along the 20 m vegetation transect provided by:
 - dead leaf litter;
 - annual plants;
 - perennial plants;
 - cryptogams;
 - logs; and
 - rocks.
- Vegetation structure and projected foliage cover at 0 – 0.5 and increasing 2m height increments to >6.0 m height in 10 repeated 1 m lengths every 2 m along the 20 m vegetation transect. A guide to assessing “percent foliage cover” is provided in Appendix 2.
- Floristic diversity and growth forms.
- Shrub and juvenile tree density and diversity.
- Tree and mature shrub density, diversity and health condition; and
- Other habitat attributes such as the presence of hollows, fire scars, mistletoe and the production of buds, flowers and fruit in 20 x 20 m quadrat.

3.7 Biodiversity Assessment Method (BAM)

BAM full floristics includes an assessment of species richness and percent (%) foliage cover by growth form undertaken within 20 x 20 m monitoring plots. BAM Functional attributes such as assessments of litter cover, logs and large trees (>50 cm) are undertaken in a 50 x 20 m plot that extends beyond the 20 m vegetation transect. The methodology undertaken follows BAM (OEH 2020) and/or Biodiversity Conservation Trusts (BCT) Environmental Monitoring Module (EMM; NSW BCT 2022).

4 RUMEx monitoring sites

4.1 Woodland reference sites

Eucalypt woodland occurring on ACP is predominantly regrowth and occurs within the then, proposed SEOC footprint (ERM 2009, ACOL 2009). These tended to be dominated by *E. crebra* (Narrow-leaved Ironbark) with scattered occurrences of *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and/or *Allocasuarina luehmannii* (Bulloak), with a predominantly grassy ground cover. NSW Government Environment and Heritage current mapping software application “Trees Near Me” and SEED map (NSW Government 2025a, 2025b) indicate woodlands occurring on ACP and surrounds are Central Hunter Ironbark grassy woodland (PCT 3431).

Woodland areas associated with the SEOC footprint were originally mapped as Central Hunter Ironbark - Spotted Gum - Grey Box Forest (ERM 2009, ACOL 2009), a listed TEC (PCT3315). Central Hunter Ironbark - Spotted Gum - Grey Box Forest (PCT 3315) shares characteristics with but is not Central Hunter Grey Box – Ironbark Woodland (PCT 1603), which has been mapped as occurring at ACOL management RUM area (EcoLogical 2024). “Trees near me” and SEED map also identifies woodland occurring on ACOL managed RUM as also being Central Hunter Ironbark grassy woodland (PCT 3431).

Most areas of remnant woodland therefore conform to and are currently mapped by NSW Government mapping applications as Central Hunter Ironbark grassy woodland (PCT 3431). Conservation advice associated with PCT 3431 however also relates to the NSW Central Hunter Grey Box-Ironbark Woodland TEC (PCT 1603) and Commonwealth Central Hunter Valley Eucalypt Forest and Woodland CEEC, where a patch satisfies condition thresholds as per Section 1.5.3 of the Conservation Advice (NSW Government 2025c).

An example of regrowth Central Hunter Ironbark grassy woodland (PCT 3431) used as woodland reference sites is provided in Figure 4-1.



Figure 4-1. An example of regrowth Central Hunter Ironbark grassy woodland.

4.2 RUMEx monitoring sites

Four 20 x 20m monitoring quadrats and six photo-points were established in areas where there was, or potential to be general subsidence, subsidence cracking, subsidence rehabilitation and/or ponding in native woodland and grassland areas. Locations were guided by predicted subsidence cracking and ponding (Figure 2-3, Figure 2-4; EcoLogical 2024). The location of RUMEx monitoring sites, woodland reference sites and permanent photo-points are provided in Figure 4-1. GPS Coordinates and other site-specific information are provided in Appendix 3.

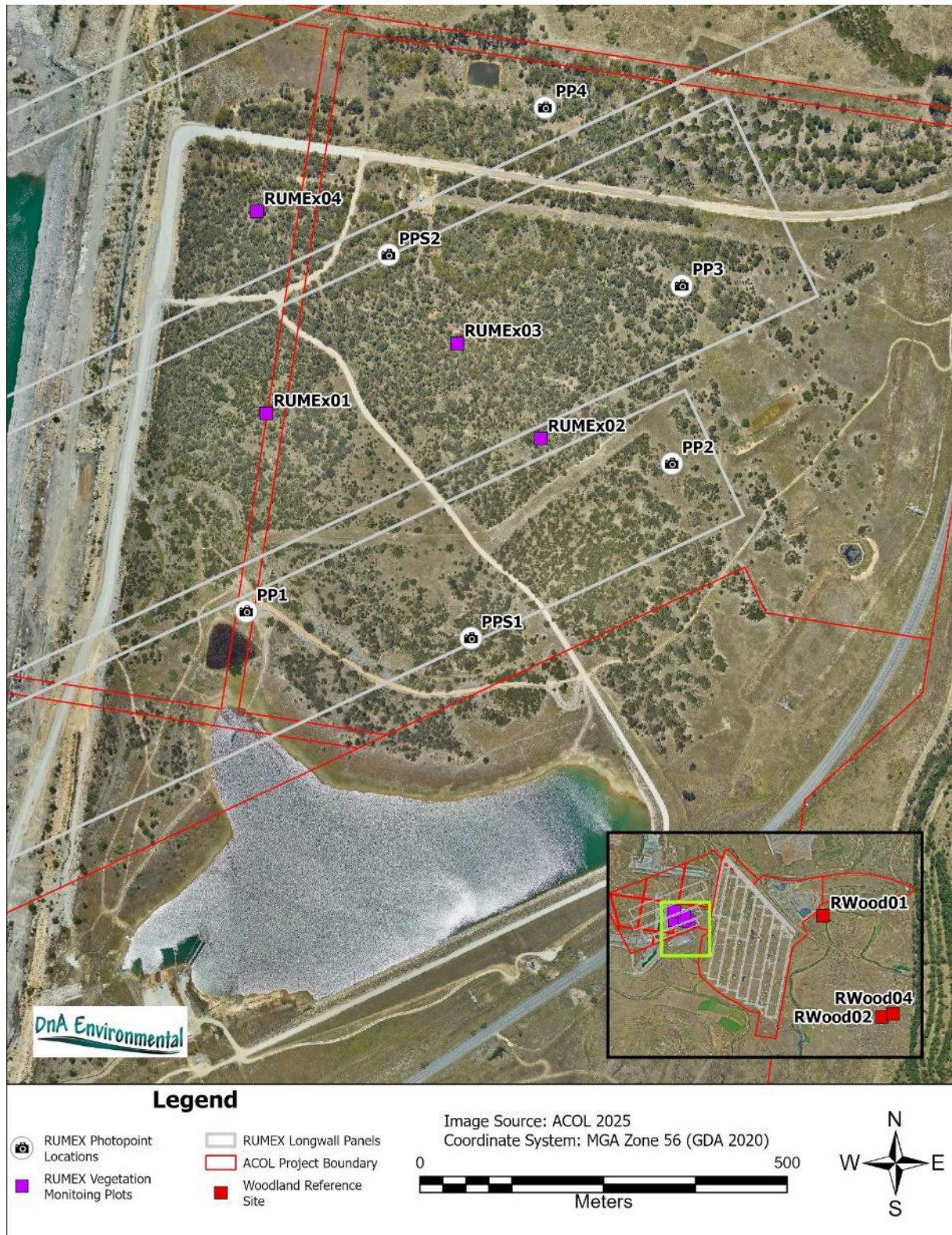


Figure 4-1. Location of RUMEx monitoring sites and permanent photo-points (PPS = subsidence PP; PP = Ponding).

5 Rainfall

Since monitoring commenced at ACP in 2008 there have been extreme rainfall conditions and combined with simultaneous changes in total grazing pressure, there have been significant impact on the composition and diversity of the vegetation. These seasonal influences have been reflected in the range of ecological monitoring data at ACP, especially during the droughts and floods over the last few years.

The long-term average annual rainfall at Singleton (Elderslie) is 726 mm (BoM 2025) however annual rainfall recorded at ACOL since 2008 has been highly variable (Figure 5-1). An annual rainfall graph since 2008 indicates that particularly dry periods occurred 2009 – 2010 and 2012, with the lowest annual rainfall being recorded for three consecutive years during 2017 to 2019, where rainfall ranged from 426 – 535 mm. Since the drought, above average rainfall was experienced during 2020 - 2022 which caused significant and extensive flooding across much of eastern Australia. At ACOL, totals of 1050 – 1341 mm were recorded.

Since March 2023, below average rainfall occurred throughout the year with a total of only 496 mm being recorded for the year. Despite low rainfall conditions in January and March, above average rainfall was recorded throughout most of 2024 with a total annual rainfall of 900 mm (Figure 5-2). Dry conditions returned over the summer months 2024-2025, followed by above average rainfall during March and April this year. Rainfall relevant to the monitoring program and recorded to the end of April 2025 was 325 mm and was similar to the expected average of 321 mm for the same yearly period. While 240 mm was recorded in May, approximately 220 mm was recorded after the monitoring event.

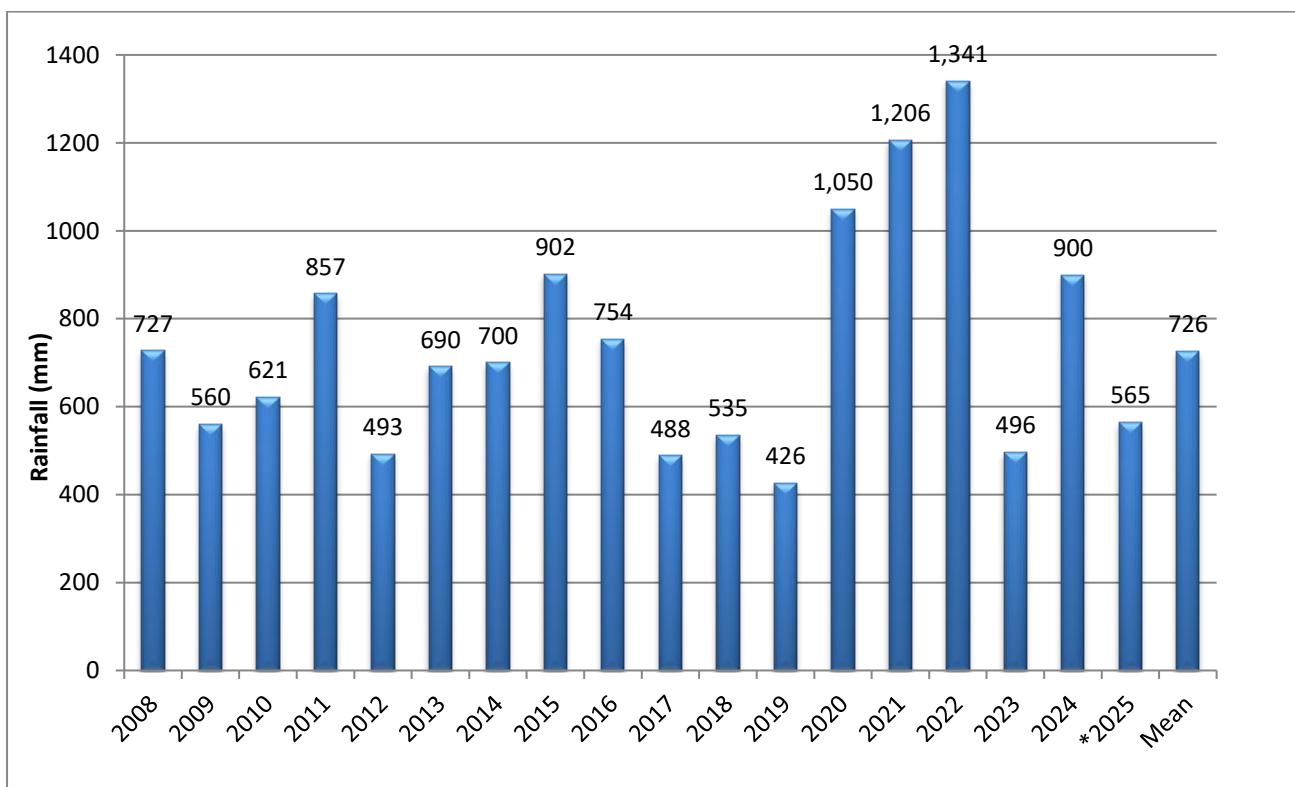


Figure 5-1. Annual rainfall recorded at ACP from 2008 – *May 2025 compared to mean rainfall recorded at Singleton (Elderslie) (BoM 2025).

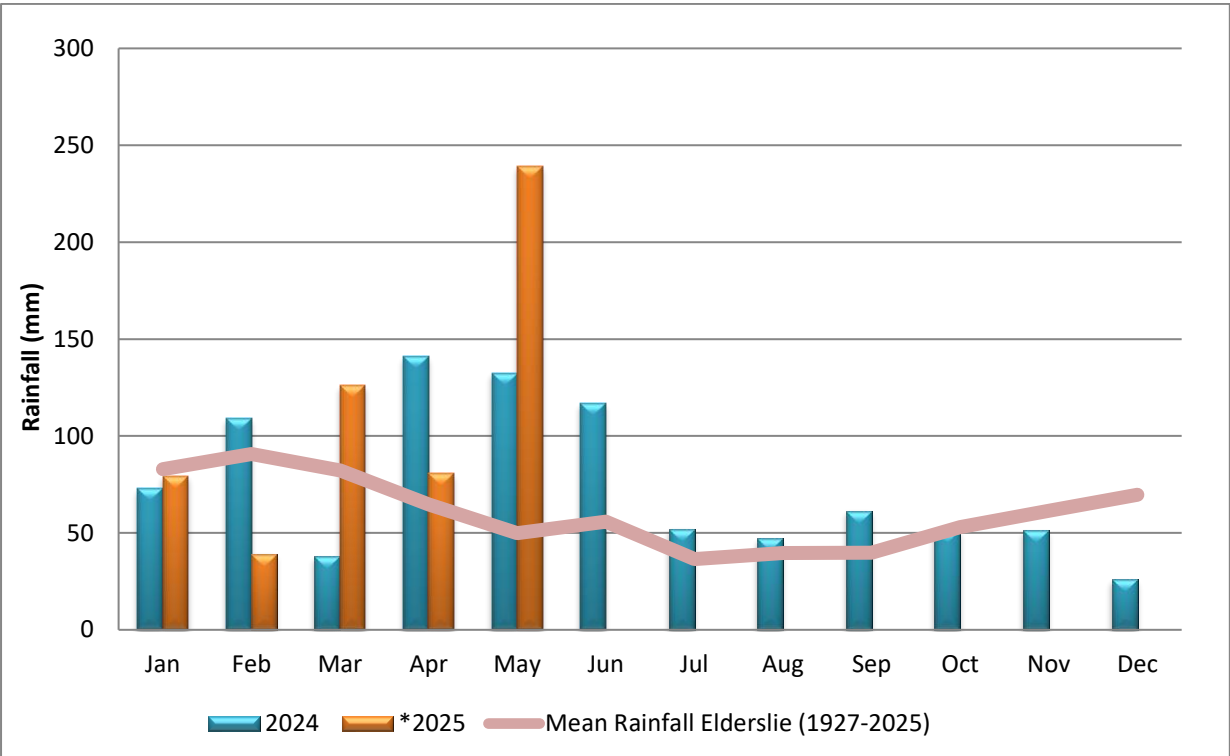


Figure 5-2. Monthly rainfall data recorded at ACP from January 2024 to May 2025 compared to the monthly mean rainfall for Singleton (Elderslie) (BoM 2025).

6 Results: RUMEx woodland monitoring sites

6.1 Photo-point monitoring

Photographs taken from a permanent photo-point along LFA and vegetation transects in RUMEx monitoring quadrats and woodland reference sites are provided in Table 6-1.

Table 6-1. Photo-points of RUMEx monitoring quadrats and woodland reference sites.

Site	2025 (LFA transect)	2025 (Vegetation transect)
RUMEx01		
RUMEx02		
RUMEx03		

Site	2025 (LFA transect)	2025 (Vegetation transect)
RUMEx04		
RWood01		
RWood02		
RWood04		

6.2 Ecological trends and performance against a selection of ecological performance indicators

The following section provides a summary of a range of ecological performance indicators obtained from RUMEx monitoring sites compared to woodland reference sites.

6.2.1 Landscape Function Analyses

6.2.1.1 Landscape Organisation

A patch is an area within an ecosystem where resources such as soil and litter tend to accumulate, while areas where resources are mobilised and transported away are referred to as interpatches. Landscape Organisation Indices (LOI) are calculated by the length of the patches divided by the length of the transect to provide an index or percent (LO) of the transect which is occupied by functional patch areas (Tongway and Hindley 2004).

Woodland reference sites consisted of moderate density regrowth woodlands with relatively high levels of canopy cover and an understorey of perennial grasses and forbs. Two woodland sites (RWood02 and RWood04) contained high levels of perennial ground covers and moderately well-developed litter layers. In RWood01, grasses and other ground covers were more scattered and the litter layer was less developed, however cryptogams were more abundant due to reduced levels of ground cover. In RWood01, there were also scattered Bullock seedlings which have significantly grown and there continued to be a network of macropod tracks resulting in some minor bare areas. Since drought in 2019, functional patch areas have remained high despite the introduction of light cattle grazing in RWood02 and RWood04 in 2023 and were slowly increasing in RWood01. The effects of dry conditions in 2023 and/or disturbances however continue to be evident in RWood01, with a reduction in LO recorded this year. This year LO in the woodland reference sites was 88 – 100% (Figure 6-1).

RUMEx woodland monitoring sites were typically moderate to high density regrowth woodland, with mosaics of dead leaf litter, scattered perennial ground covers and patches of moss were relatively common and this year 100% LO was recorded in all sites.

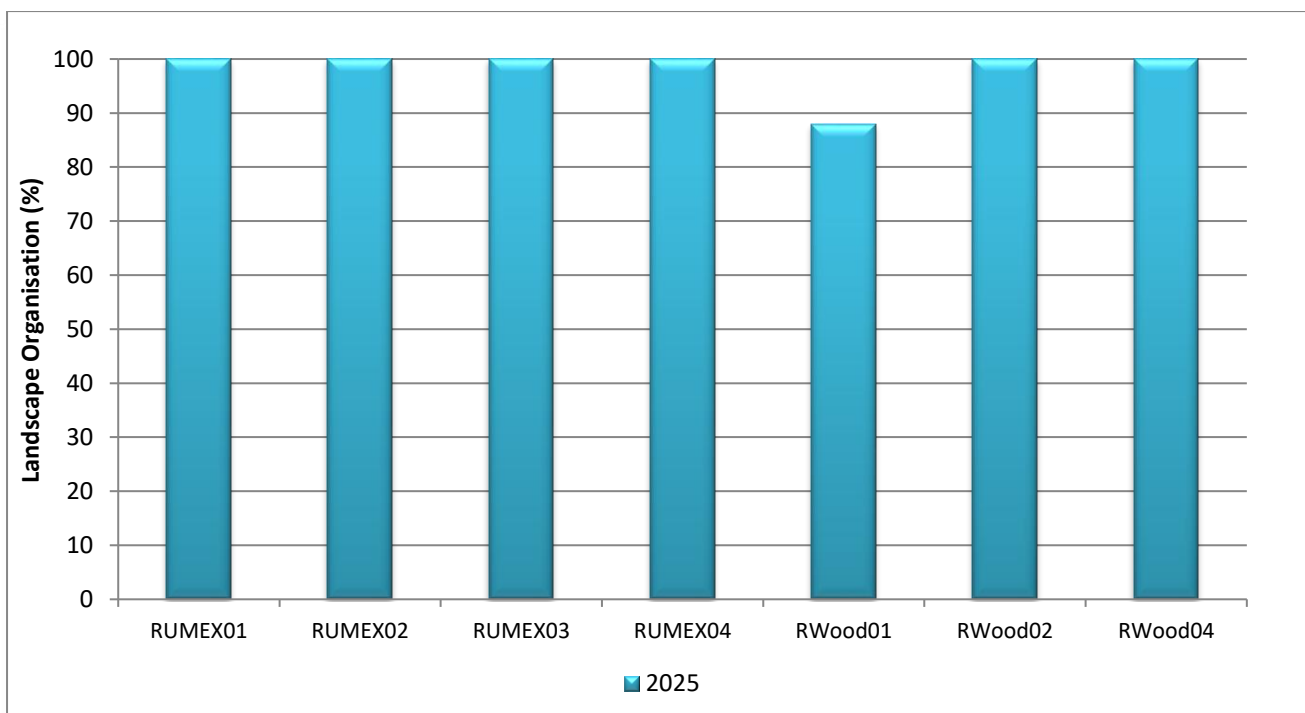


Figure 6-1. Landscape Organisation recorded in woodland monitoring sites.

6.2.1.2 Soil surface assessments

6.2.1.2.1 Stability

Stability in woodland reference sites was largely provided by moderate density regrowth eucalypts, scattered sub-shrubs, perennial grasses and forbs and well-developed litter layer. The clay loam soils were hard to moderately hard and very stable. Previously there was some evidence of localised deposition as litter has become mobilised during rainfall events and minor erosion of animal tracks had occurred in RWood01. Improved seasonal conditions since the drought in 2019 have resulted in an increase in perennial plant covers in all three reference sites. Since 2023 conditions became dry and combined with light grazing by cattle since then, a marginal reduction in stability indices has been recorded, with indices of 68.0 – 71.0 recorded this year (Figure 6-2).

In RUMEx woodland, stability was also provided by regrowth trees and the litter layer was typically in slight to moderate states of decomposition. The soil surface was hard and crusted and patches of moss (cryptogams) were often abundant. There was negligible erosion however there may have been small localised bare patches as a result of animal disturbance and areas of localised deposition as litter became mobilised during high rainfall events. The loam - clay loam soils were highly stable. This year stability was slightly low in RUMEx02 compared to woodland reference sites, with indices ranging from 67.5 – 75.5.

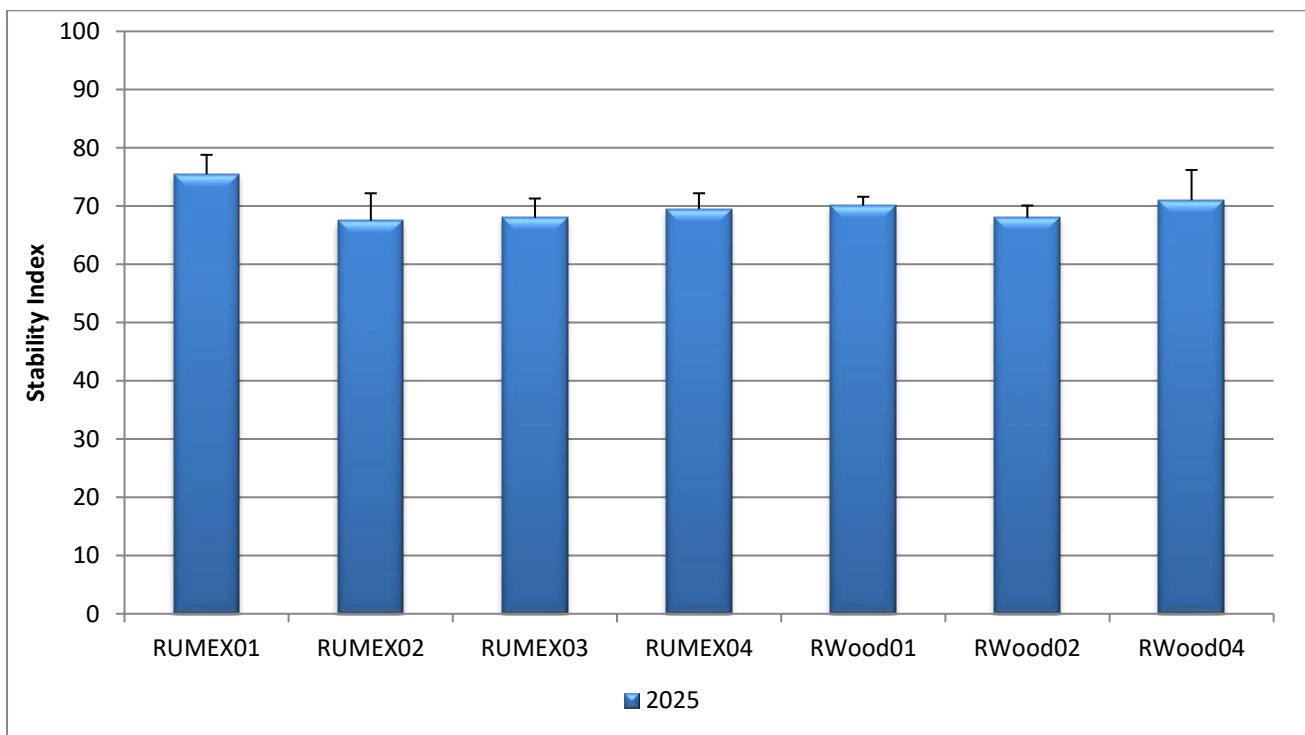


Figure 6-2. LFA stability indices recorded in woodland monitoring sites.

6.2.1.2.2 Infiltration

In woodland reference sites, clay loam soils contained a soil surface crust and were typically moderately hard. Woodland areas maintained good ground cover and all sites had moderate to high levels of litter cover and were generally very stable. In RWood01, ground cover was more scattered and cryptogams were relatively abundant on otherwise bare soil. Despite the dry conditions and introduction of light grazing by cattle in two reference sites, infiltration capacity remained relatively high, to provide a target range of 45.7 – 56.3 this year.

In RUMEx woodland, soils were crusted and litter cover was variable however, typically there were moderate to high levels of litter cover in slight to moderate states of decomposition. Most sites had moderate soil hardness, except in RUMEx1 where soils were very hard. Infiltration indices ranged from 34.9 – 52.2 and were low compared to woodland reference sites, except RUMEx03 (Figure 6-3).

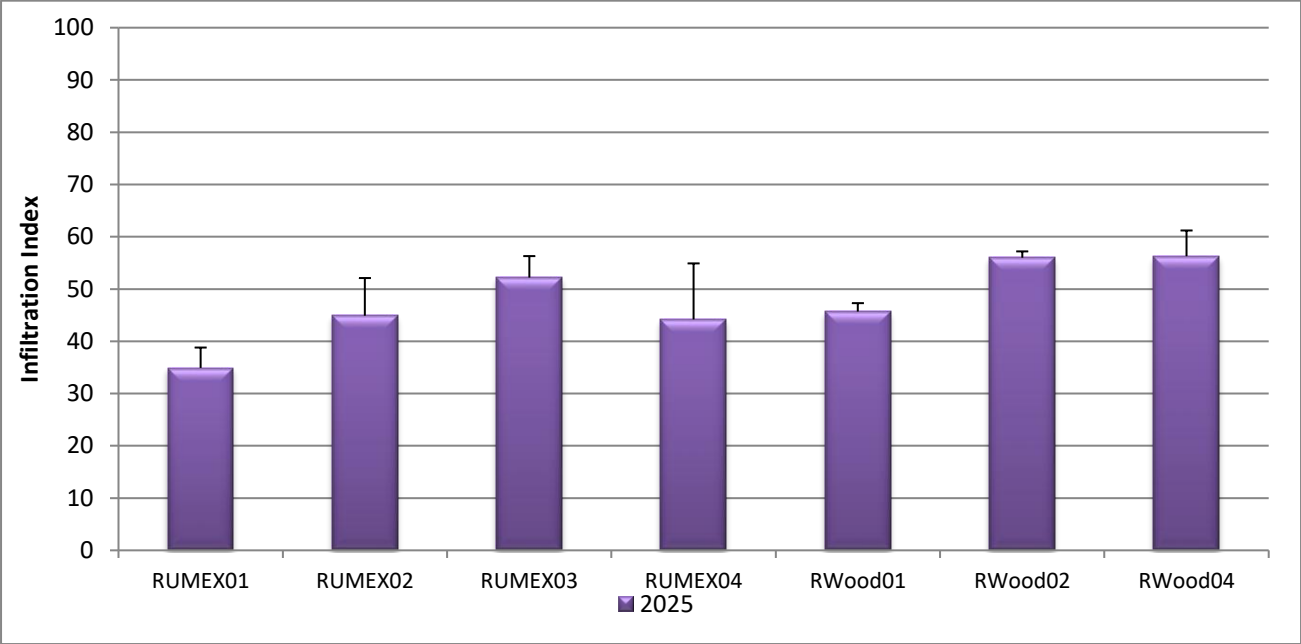


Figure 6-3. LFA infiltration indices recorded in woodland monitoring sites.

6.2.1.2.3 Nutrient recycling

Nutrient recycling capacity is also dependent on similar ecological attributes as for infiltration, with woodland reference sites having mature tree canopies, well developed and decomposing litter layers and moderately dense cover of grasses and scattered shrubs. This year indices ranged from 46.8 – 52.7 (Figure 6-4). Nutrient recycling indices in RUMEx woodland ranged from 39.3 – 52.4 and were low compared to woodland reference sites, except in RUMEx03.

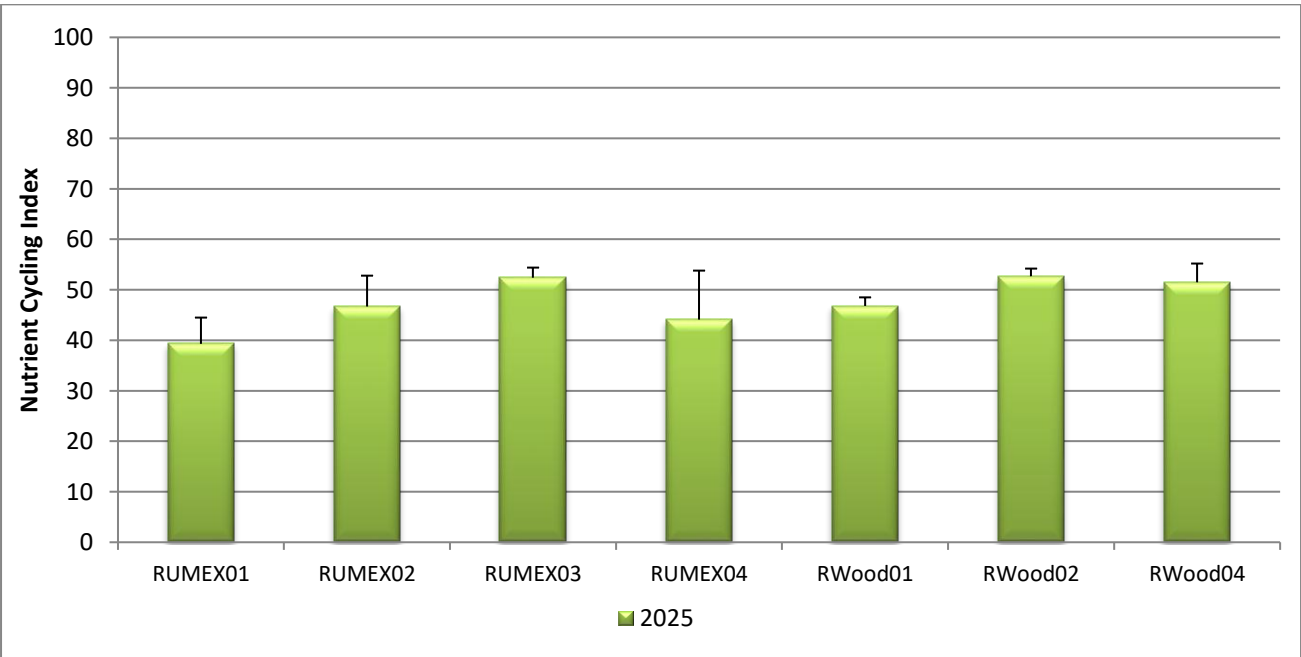


Figure 6-4. LFA nutrient recycling indices recorded in woodland monitoring sites.

6.2.2 Most function rehabilitation sites

The sum of LFA stability, infiltration and nutrient recycling indices provide an indication of the most functional to least functional monitoring site recorded in 2025 and have been provided in Figure 6-5. Woodland reference sites RWood04 and RWood02 were the most ecologically functional sites, with a sum of scores of 179 and 177, closely followed by RUMEx03 with 173. There were minor differences between RWood01, RUMEx02 and RUMEx04 which had scores 163 – 158, while RUMEx01 had the lowest sum of scores this year with 150. Examples of ground cover in woodland monitoring sites in 2025 is provided in Table 6-2.

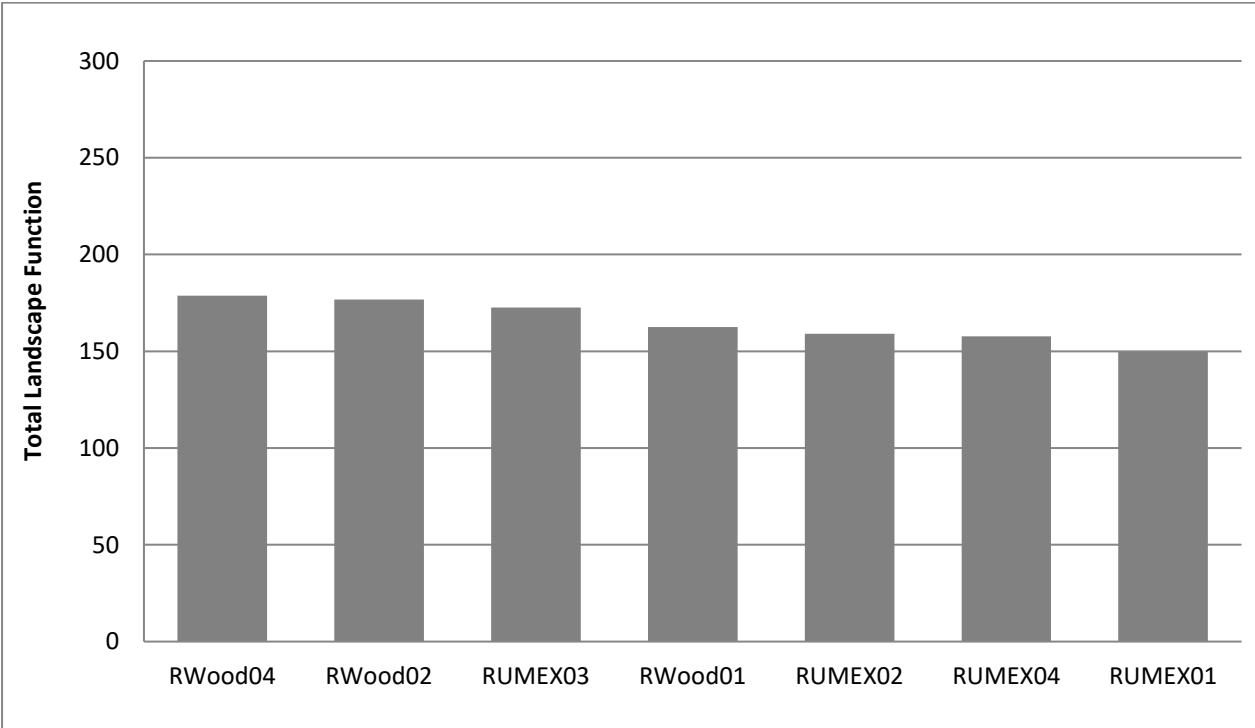


Figure 6-5. Sum of LFA stability, infiltration and nutrient recycling components indicating the most functional to least functional monitoring site recorded in 2025.

Table 6-2. Examples of ground cover in woodland monitoring sites in 2025.





6.2.1 Trees and mature shrubs

6.2.1.1 Density

Densities of trees (>5 cm dbh) in woodland reference sites were variable between sites, with minor changes having been recorded over the years due to mortality and/or increased sapling growth. This year, there were 15 - 80 live individuals per monitoring quadrat, equating to a stem density of 375 – 2000 stems per hectare (Figure

6-6, Table 6-3). In RUMEx woodland, tree densities ranged from 26 – 44 per monitoring plot or 650 – 1100 stems per hectare. No mature shrubs were recorded.

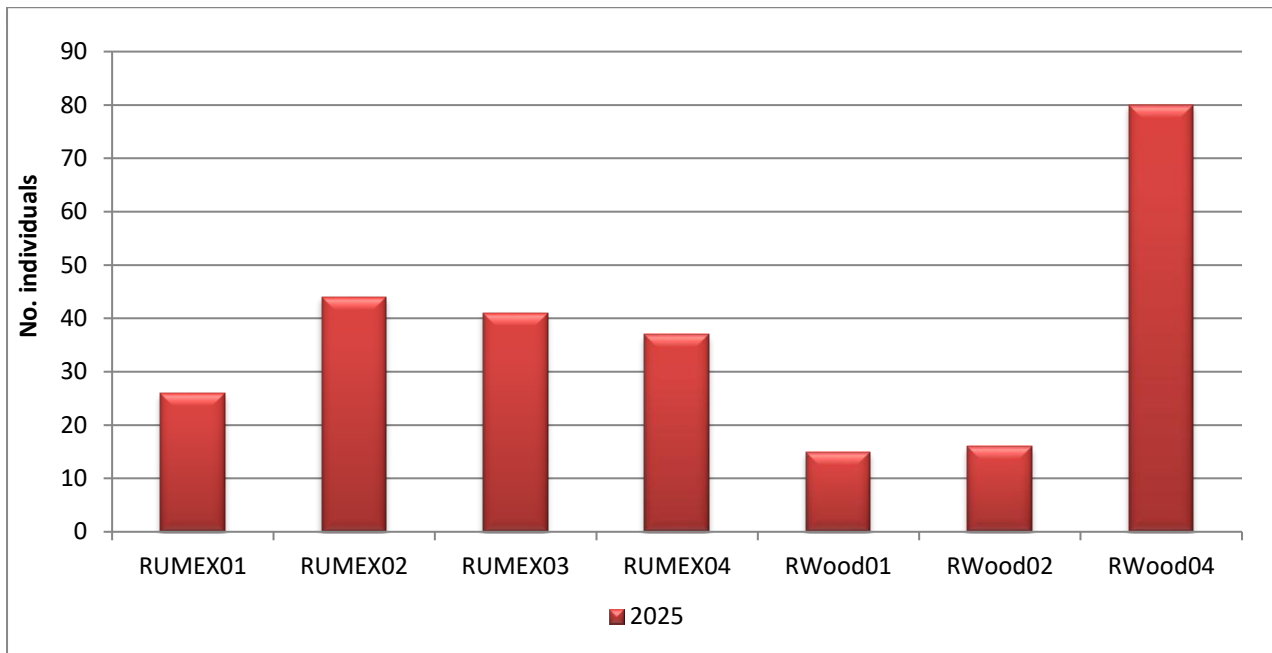


Figure 6-6. Live tree densities (>5cm dbh) in woodland monitoring sites.

6.2.1.2 Diversity

Woodland reference sites had one or two species, with RWood01 dominated by *Allocasuarina leuhamanii* (Bulloak) and *Eucalyptus moluccana* (Grey Box), while other two sites were dominated by *Eucalyptus crebra* (Narrow-leaf Ironbark). In surrounding woodland, *E. tereticornis* (Forest Red Gum) and *Angophora floribunda* (Rough-barked Apple) may also have been present. RUMEx woodland were also comprised of various densities of *Allocasuarina leuhamanii* and *Eucalyptus crebra* (Figure 6-7, Table 6-3).

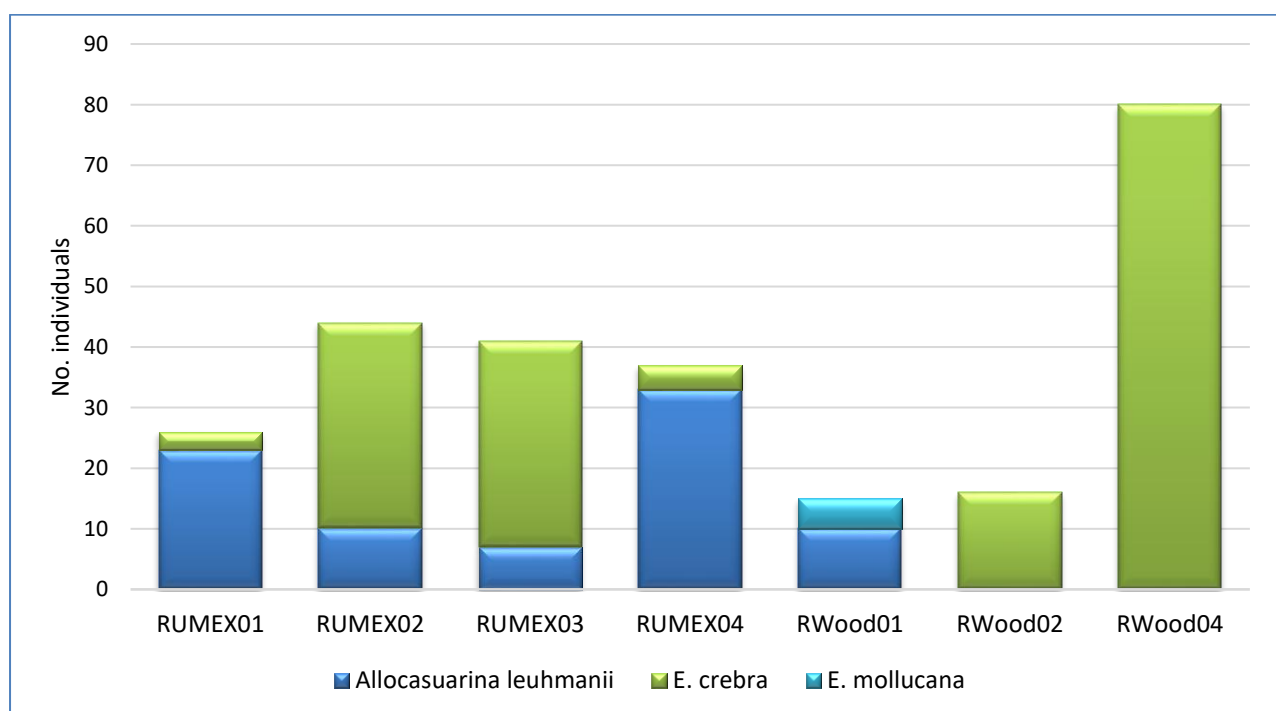


Figure 6-7. Densities of tree species in woodland monitoring sites in 2025.

6.2.1.3 Condition

Average dbh in woodland reference sites ranged from 11 – 17 cm, with maximums being 22 - 35 cm and indicative of the relatively young regrowth woodland in the local area (Table 6-3). Trees were typically in good to moderate health however there has been an increase in [dead] stags and there were many individuals with advanced dieback in RWood04. In RWood01, this appears to be due to spray drift when spraying for exotic *Olea europaea* (European Olive), while RWood02 and RWood04 had been affected by historical wildfire and/or drought, with very dry conditions experienced throughout 2023 (Table 6-3). One *Allocasuarina luehmannii* was bearing mature fruit in RWood01.

In RUMEx woodland, average dbh was 10 – 14 cm, with maximums of 28 – 50 cm. Most individuals tended to be moderate health, however 4 – 12% had advanced dieback and 5 – 20% were dead stags in three of four sites. All RUMEx sites had a small number of individuals bearing reproductive structures, however no mistletoe or tree hollows were recorded. A small quantity of logs was recorded in two sites, while only 3 large trees (>50 cm dbh) were recorded the larger 20 x 50 m functional BAM plot.

Table 6-3. Summary of tree populations and health condition in 2025.

Site Name	20 x 20 m plots													50 x 20 m plots		
	No species	Average dbh (cm)	Max dbh (cm)	Min dbh (cm)	Total trees	No. with multiple limbs	% Live trees	% Healthy	% Medium Health	% Advanced Dieback	% Dead	% Mistletoe	% Flowers / fruit	Trees with hollows (>5cm)	Total Logs (m)	Large trees (> 50cm dbh)
RUMEx01	2	10	28	6	26	4	100	54	42	4	0	0	8	0	9	0
RUMEx02	2	14	34	5	48	12	92	15	69	8	8	0	2	0	6	2
RUMEx03	2	12	50	5	51	1	80	27	41	12	20	0	8	0	0	1
RUMEx04	2	14	29	5	39	5	95	8	77	10	5	0	13	0	28	0
RWood01	2	12	25	5	16	3	94	44	50	0	6	0	6	0	6.5	1
RWood02	1	17	35	7	17	3	94	59	35	0	6	0	0	0	0.5	0
RWood04	1	11	22	5	81	2	99	16	70	12	1	0	0	0	2.5	0

6.2.2 Shrubs and juvenile trees

6.2.2.1 Density

Densities of native shrubs and juvenile trees (<5 cm dbh) varied significantly across woodland reference sites with 22 – 121 individuals per monitoring plot equating to stems densities of 550 – 3025 per hectare (Figure 6-8, Table 6-4). Juvenile *Olea europaea* (European Olive), an exotic species has been sprayed in RWood01 as part of ACP's weed control program, however 16 individuals remain (Figure 6-9). In RUMEx woodland, there was also significant variation in native shrub and juvenile tree densities with relatively high densities of tree regeneration occurring in RUMEx01 and RUMEx02. A small number of exotic shrubs were also recorded in three RUMEx sites.

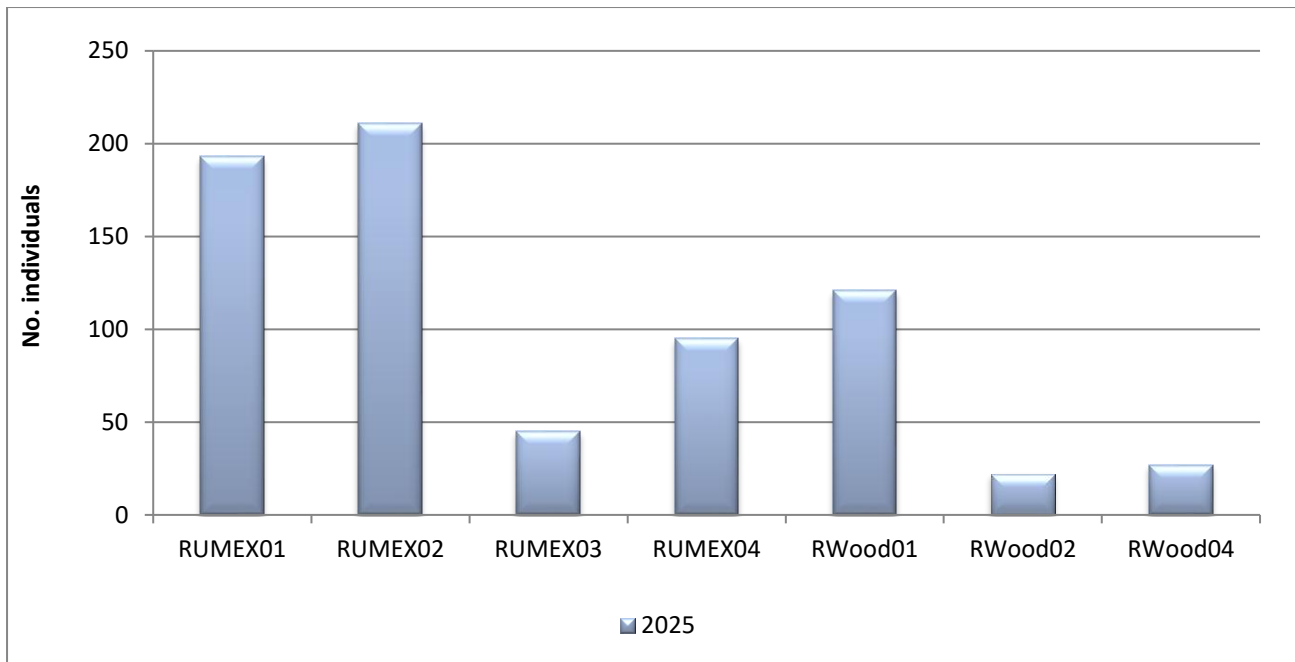


Figure 6-8. Native shrubs and juvenile trees recorded woodland monitoring sites.

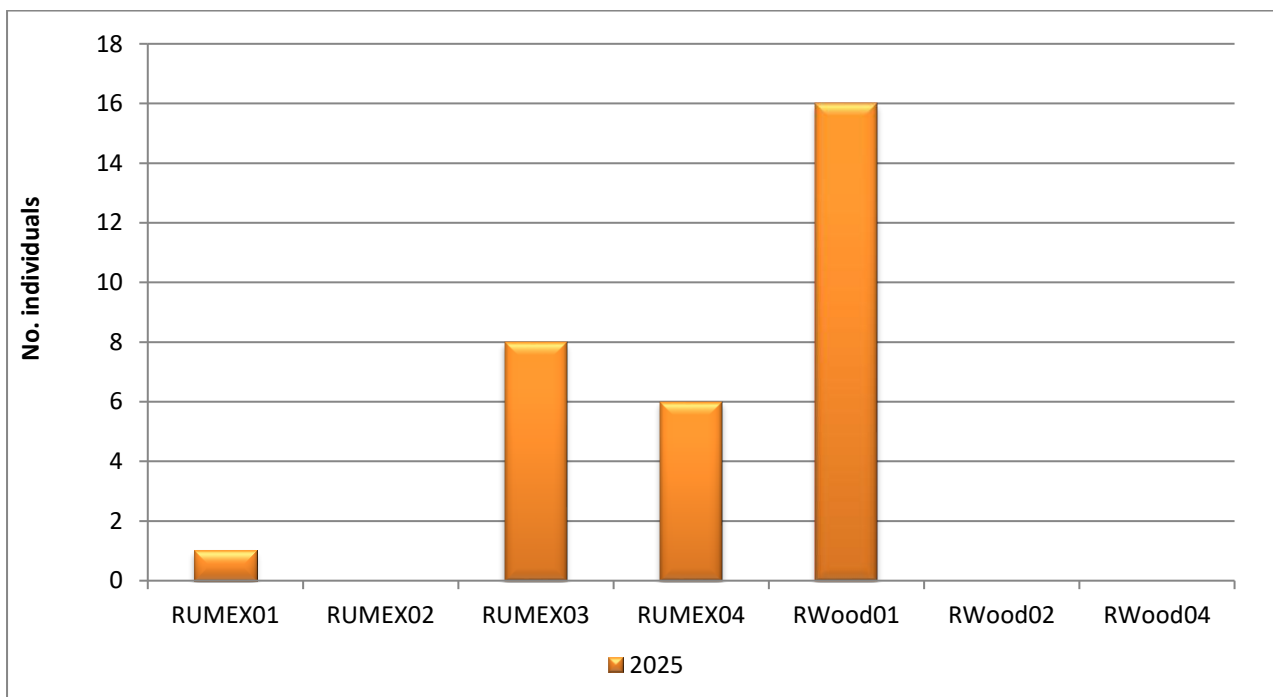


Figure 6-9. Exotic shrubs and juvenile trees recorded woodland monitoring sites.

6.2.2.2 Diversity

In woodland reference sites there were 2 - 3 different shrubs and/or juvenile tree species (Table 6-4). In RWood01 the most abundant was *Allocasuarina luehmannii* seedlings/saplings, while there were also scattered *Myoporum montanum* (Western Boobialla) and one exotic species *Olea europaea* was recorded. Remaining woodland sites primarily had seedlings/saplings of *Eucalyptus crebra* and *Allocasuarina luehmannii*, with one *Acacia falcata* (Hickory Wattle) seedling recorded in RWood02.

Similarly, in RUMEx woodland there were 3 – 6 species, with most being juvenile *Allocasuarina luehmannii* (Bulloak) and *Eucalyptus crebra*. Other native shrubs were less common and may have included *Acacia amblygona* (Fan Wattle), *Acacia salicina* (Willow Wattle), *Daviesia genistifolia* (Broom Bitter Pea) and/or

Myoporum montanum (Western Boobialla). A small number of exotic shrubs including *Lycium ferocissimum* (African Boxthorn) were recorded in RUMEx01 and RUMEx04, while one *Lantana camara* (Lantana) was recorded in RUMEx03.

6.2.2.3 Height

In woodland reference sites, seedlings were recorded across all height classes, with relatively high densities > 2.0 m in RWood01 (Table 6-4, Figure 6-10). In RUMEx woodland, seedling in all height categories were also recorded however most individuals were less than 1.0 m in height.

Table 6-4. Summary of shrub and juvenile tree populations in woodland monitoring sites in 2025.

Site Name	0-0.5m	0.5-1.0m	1.0-1.5m	1.5-2.0m	>2.0m	Total	No. species	% endemic
RUMEx01	88	62	22	4	18	194	6	99
RUMEx02	39	52	34	34	52	211	5	100
RUMEx03	30	14	6	1	2	53	5	85
RUMEx04	43	31	11	10	6	101	3	94
RWood01	33	22	13	24	45	137	3	88
RWood02	14	1	1	0	6	22	3	100
RWood04	7	5	6	1	8	27	2	100

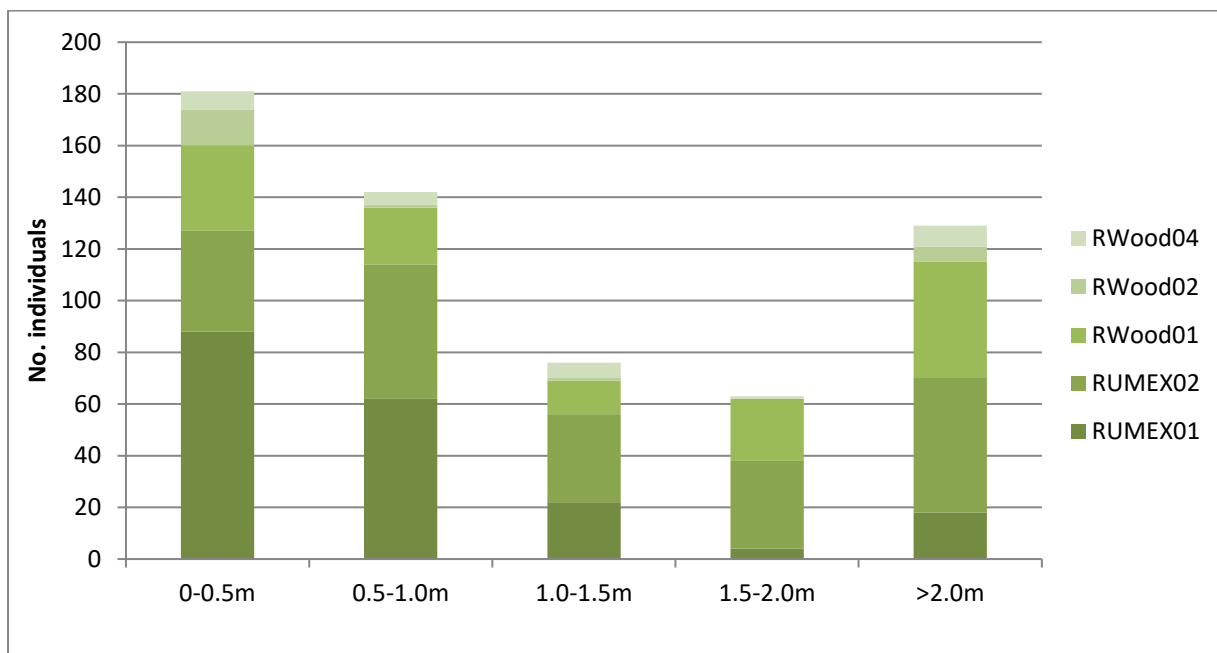


Figure 6-10. Number of individuals in each height class in 2025.

6.2.3 Total ground cover

Total ground cover, which is a combination of leaf litter, annual plants, cryptogams, rocks, logs and live perennial plants (<0.5 m in height) recorded every 2 m along the 20 m vegetation transect and averaged over these ten repetitions is provided in Figure 6-11. In reference site RWood01, there continues to be disturbance and networks of animal tracks throughout the area, while there was light cattle grazing in the other two sites, and this year 52 – 99.5% total ground cover was recorded. In RUMEx woodland, there were high levels of total ground cover despite minor bare patches caused by animal disturbance, with 92 - 100% total ground cover.

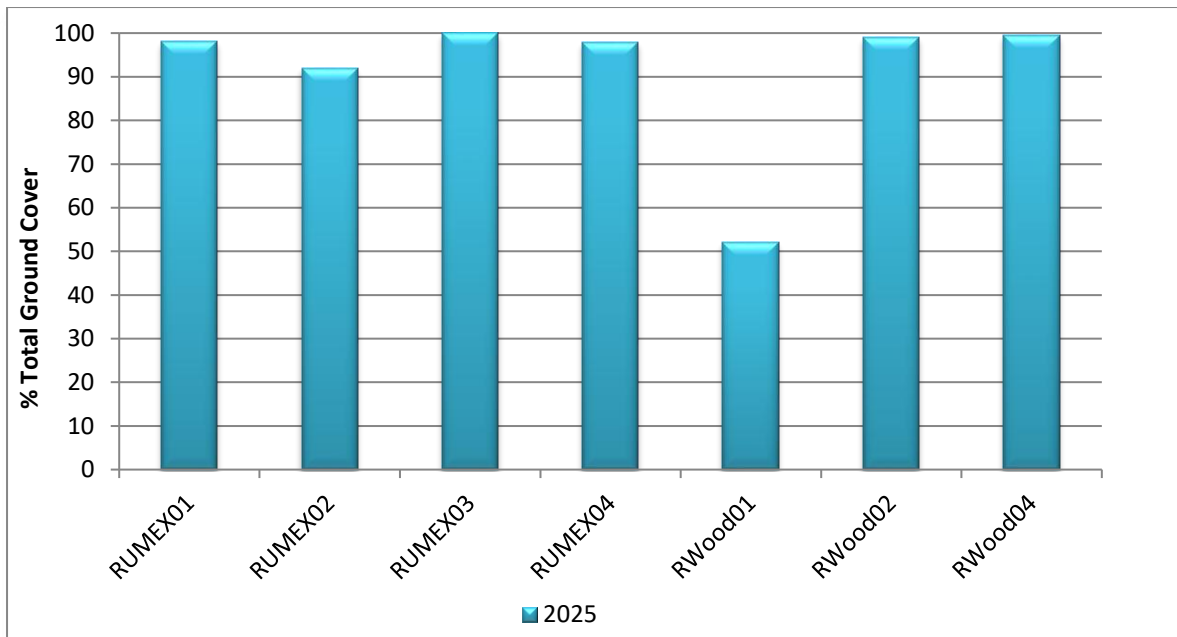


Figure 6-11. Average total ground cover recorded in woodland monitoring sites.

6.2.4 Structural composition

RWood01 had significant areas of bare ground often covered with cryptogams and there were scattered perennial ground covers. In RWood02 and RWood04, ground cover was dominated by higher levels of dead leaf litter and perennial ground covers, with occasional annual plants. Scattered rocks were recorded in two sites and logs also provided some limited cover in RWood02 (Figure 6-12). In RUMEx woodland, there were typically higher levels of dead leaf litter and scattered perennial ground covers, with cryptogams and annual plants recorded in low abundance in two sites. There may be a small occurrence of rocks and/or logs in one or two sites.

In woodland reference site RWood01, scattered Bullock saplings provided limited levels of foliage cover and the mature canopy >6.0 m remained quite sparse with 6% cover. In remaining two reference sites, Ironbark saplings provided some low foliage cover due to low hanging branches, while mature canopy cover > 6.0 m tall provided 13 - 23% cover. In RUMEx woodland, Bullock regenerating provided variable levels of low foliage cover, while mature tree canopies provided 15 – 27% cover on average. The structure of woodland monitoring sites has been illustrated in Figure 6-12.

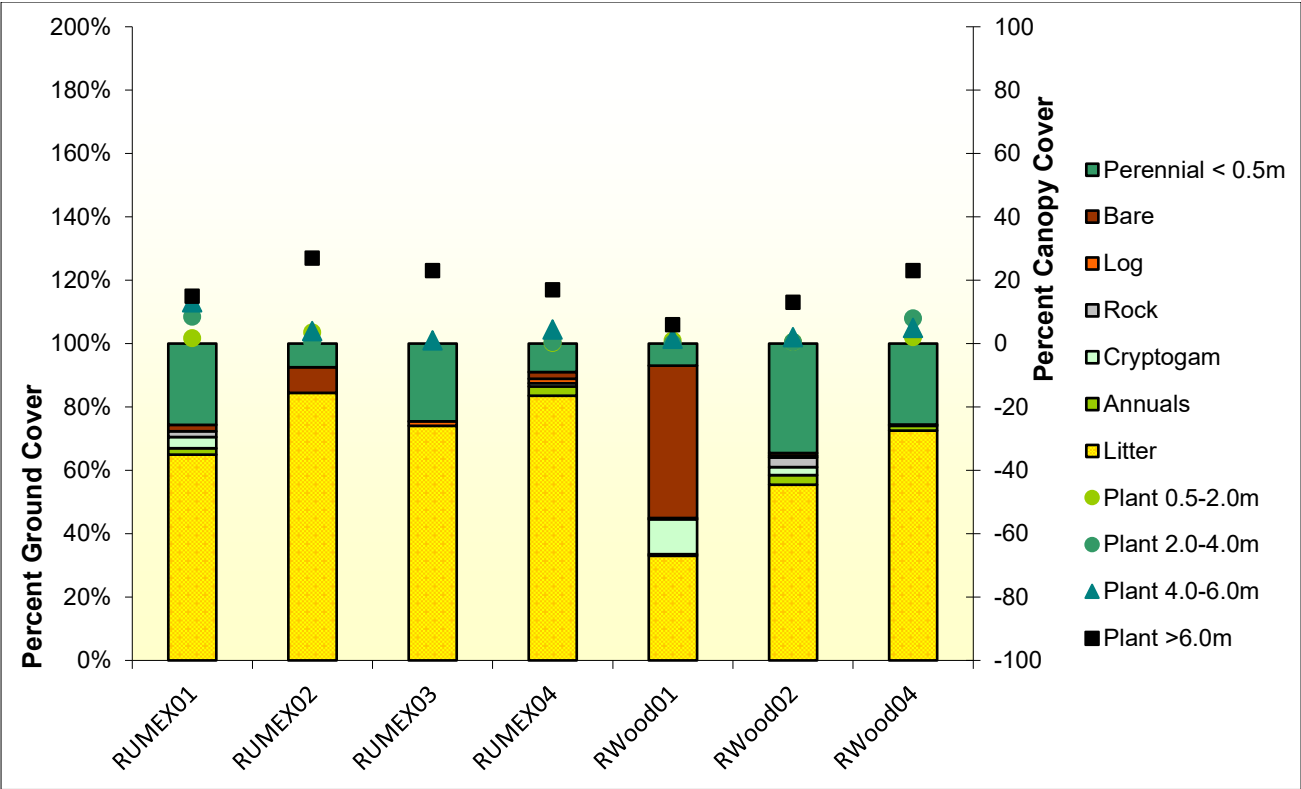


Figure 6-12. Average percent ground cover and projected foliage cover recorded in woodland monitoring sites in 2025.

Table 6-5. Structure of woodland monitoring sites in 2025.

RUMEx01	RUMEx02
	
RUMEx03	RUMEx04
	



6.2.5 Floristic diversity

Total floristic diversity is significantly influenced by seasonal conditions and levels of grazing intensity. Diversity can also be influenced by rehabilitation methods as well as stage of successional development and/or management intervention/s of the areas. At ACP, floristic diversity was lowest in 2019 at the end of three years of drought and has typically increased with improved seasonal conditions since 2020 (DnA Environmental 2025a). This year, 57 – 65 plants were recorded in 20 x 20 m woodland reference sites of which 31 – 32% were exotic species (Figure 6-13, Figure 6-14). In RUMEx woodland, there was also relatively high diversity with a total of 52 – 59 species of which 22 – 31% were exotic species.

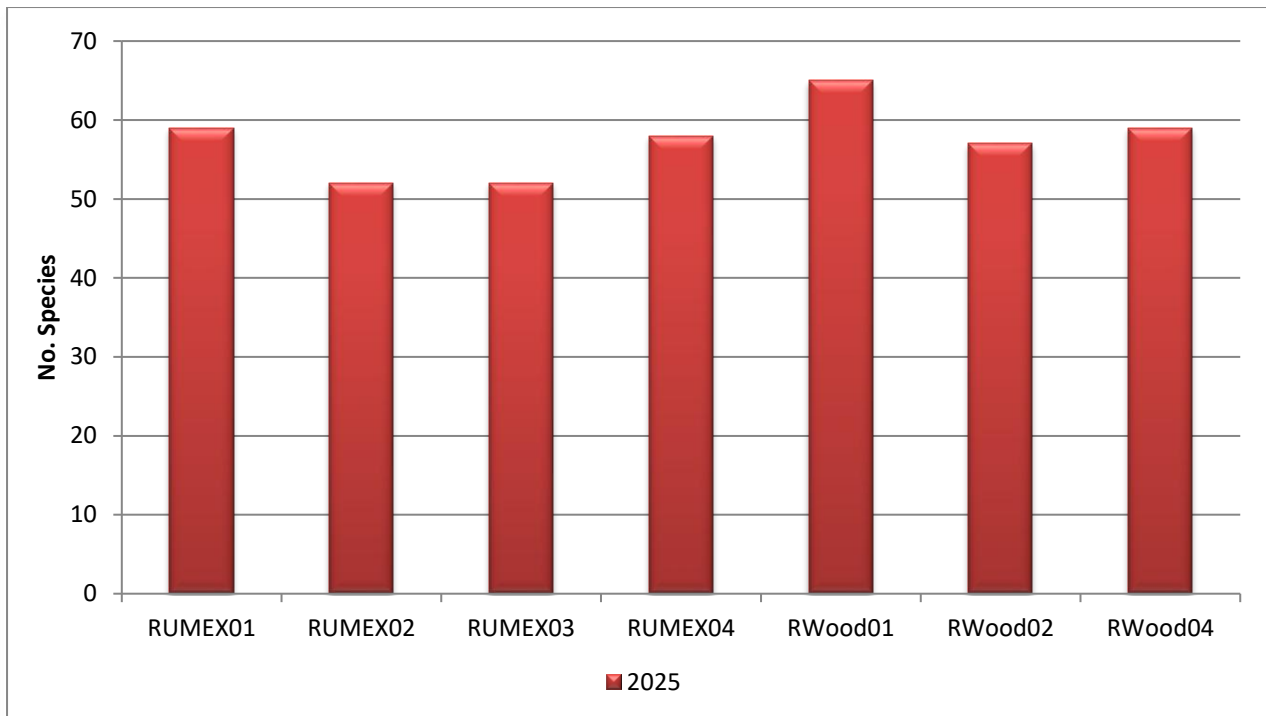


Figure 6-13. Total species diversity recorded in woodland monitoring sites.

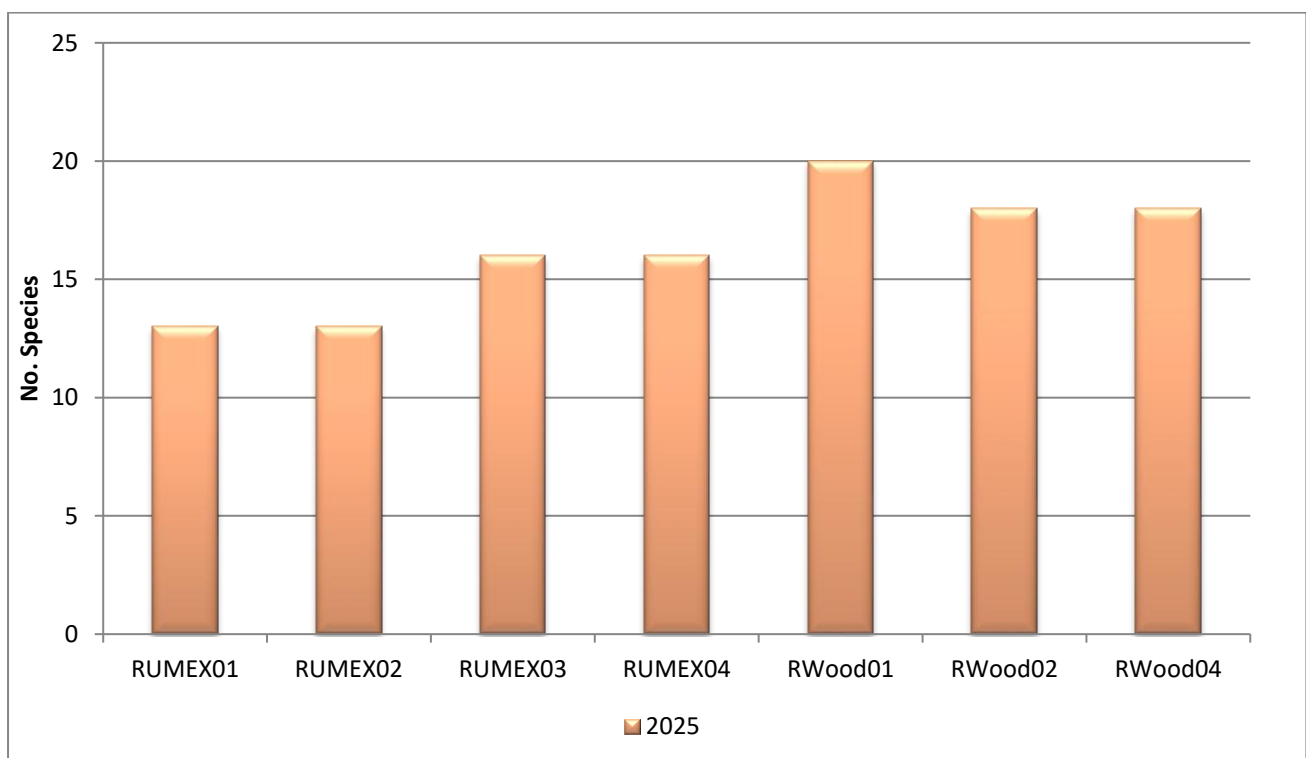


Figure 6-14. Exotic species diversity recorded in woodland monitoring sites.

6.2.6 Vegetation composition

Woodland reference sites were relatively diverse communities and were comprised of two tree species, up to two shrubs and had 4 – 5 sub-shrubs (Figure 6-15). Herbs were particularly abundant with 33 - 38 species and there were 9 – 15 grass species as well as 1 - 4 reeds, one fern and one to two cactus species. RUMEx woodland had a similar composition of species, except there was slightly lower diversity of herbs/forbs in three of four sites.

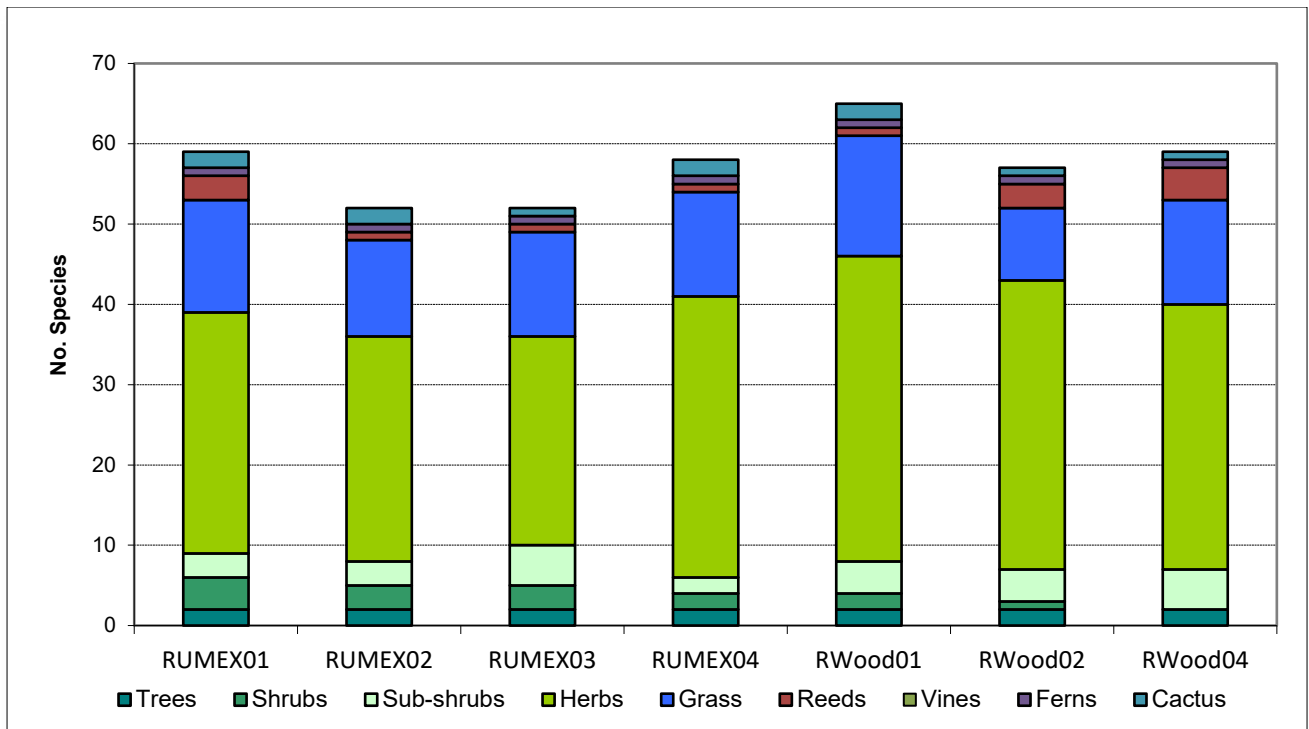


Figure 6-15. Composition of vegetation in woodland monitoring sites in 2025.

6.2.7 Most abundant species

The most abundant ground cover species recorded in each monitoring site this year is provided in Table 6-6. The most abundant ground covers are those that occupied an area 2.0 m x 2.0 m and provide 1.0% (one percent) foliage cover or more per 20 x 20 m monitoring plot.

RUMEx woodland sites had varying levels of cover provided by *Allocasuarina luehmannii* and *E. crebra* which may have provided up to 20% cover at any one site. The understorey tended to be dominated by a variety of native grasses with *Aristida* species and *Microlaena stipoides* (Weeping Rice-grass) being most common, while *Dichondra repens* (Kidney Weed) was also relatively abundant in some sites. Priority weed, *Senecio madagascariensis* (Fireweed) was also abundant in RUMEx04. Woodland reference sites were comprised of similar species with *Senecio madagascariensis* (Fireweed) being abundant in RWood02 and RWood04. A comprehensive list of flora recorded in each monitoring plot in 2025 is provided in Appendix 4.

Table 6-6. Most abundant species recorded in woodland monitoring sites in 2025.

Exotic	Scientific Name	Common Name	Growth form	RUMEx01	RUMEx02	RUMEx03	RUMEx04	RWood01	RWood02	RWood04
	<i>Allocasuarina luehmannii</i>	Bulloak	t	10	10		20	20		
	<i>Eucalyptus crebra</i>	Narrow-leaf Ironbark	t	6	20	20	5		10	25
	<i>Eucalyptus moluccana</i>	Grey Box	t					8		
	<i>Eremophila debilis</i>	Amulla	ss			1				
	<i>Cyperus gracilis</i>	Slender Flat-sedge	r							5
	<i>Dichondra repens</i>	Kidney Weed	h	5	1				2	2
*	<i>Senecio madagascariensis</i>	Fireweed	h				3		10	5
	<i>Calotis cuneifolia</i>	Purple Burr Daisy	h							1

Exotic	Scientific Name	Common Name	Growth form	RUMEx01	RUMEx02	RUMEx03	RUMEx04	RWood01	RWood02	RWood04
	<i>Aristida vagans</i>	Wire Grass	g	5		2	2			
	<i>Microlaena stipoides</i>	Weeping Rice-grass	g	5		2	2		20	2
	<i>Aristida ramosa</i>	Threeawn Grass	g	4		2	2			
	<i>Cymbopogon refractus</i>	Barbed-wire Grass	g	2					2	
	<i>Austrostipa scabra</i>	Speargrass	g		2		1			2
	<i>Rytidosperma richardsonii</i>	Wallaby Grass	g			10				
	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	g			1				
	<i>Cheilanthes sieberi</i>	Rock Fern	f				1			

Key to growth forms: t = tree; s = shrub; ss = sub-shrub; h = herb/forb; g = grass, r = reed/rush/sedge; v = vine; f = fern; c = cactus

6.2.8 Rill Assessment

Rill assessments are undertaken to identify potential rills of concern with these having dimensions of 10cm x 30 cm (0.03 m²) or greater (Nichols 2005). The extent of soil loss due to rilling if present, is presented as the total cross-sectional areas of the rills. No rilling was recorded in any RUMEx woodland monitoring site.

6.2.9 Soil analyses

The following section provides the results of a select range of key soil characteristics demonstrating change over time. Comprehensive analyses and full soil analyses report as provided by the NATA accredited laboratory is provided in Appendix 6.

6.2.9.1 pH

Figure 6-16 shows soil pH recorded in RUMEx woodland sites compared to reference sites and “desirable pH” in medium soils prescribed by the agricultural industry (NSW EPA 1998). Soil pH in woodland reference sites ranged from 5.6 – 6.3, with these being slightly to moderately acidic (Bruce & Rayment 1982), with pH in RUMEx woodland within this range.

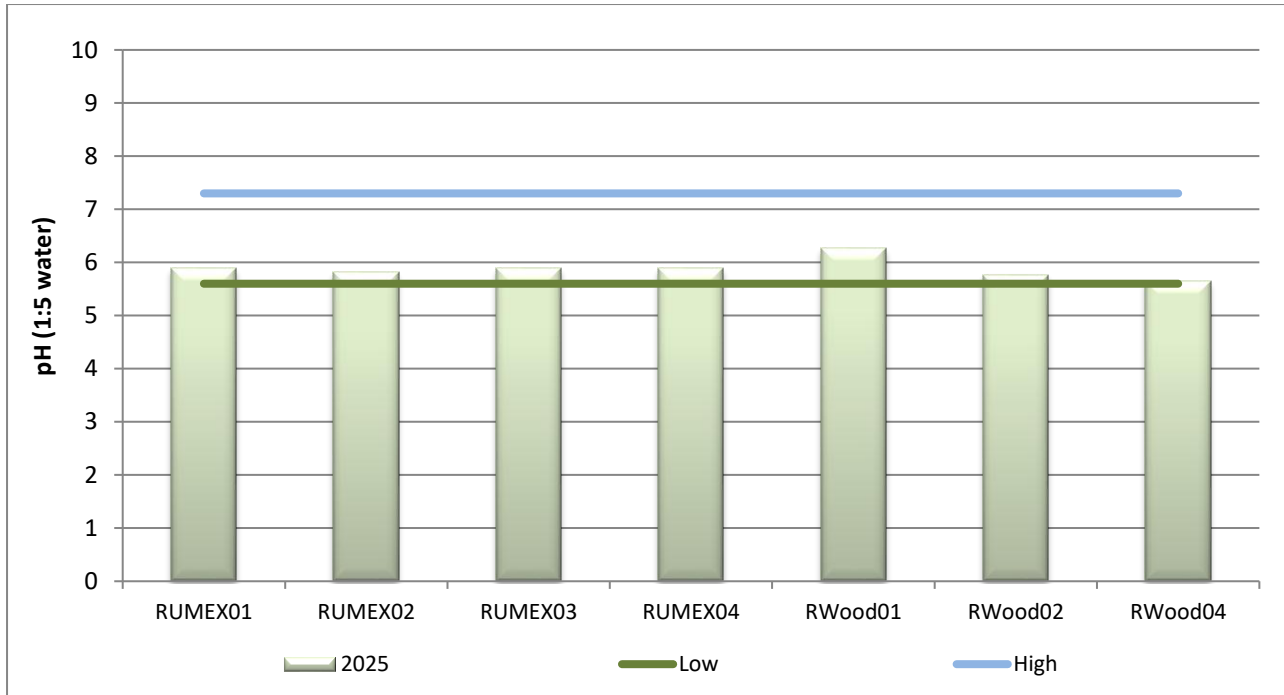


Figure 6-16. pH values recorded in woodland monitoring sites compared to desirable agricultural levels.

6.2.9.2 Electrical conductivity

Figure 6-17 shows the Electrical Conductivity (EC) recorded in RUMEx woodland compared to reference sites and “desirable” level as prescribed by the agricultural industry in medium soils. EC in woodland reference sites remained low with 0.051 – 0.082 dS/cm, indicating low levels of soluble salts in the soil profile and soils are non-saline. EC in RUMEx02 and RUMEx03 was elevated compared to other sites however all were well within desirable levels with 0.070 – 0.100 dS/cm (Figure 6-17; Slavich and Petterson 1993).

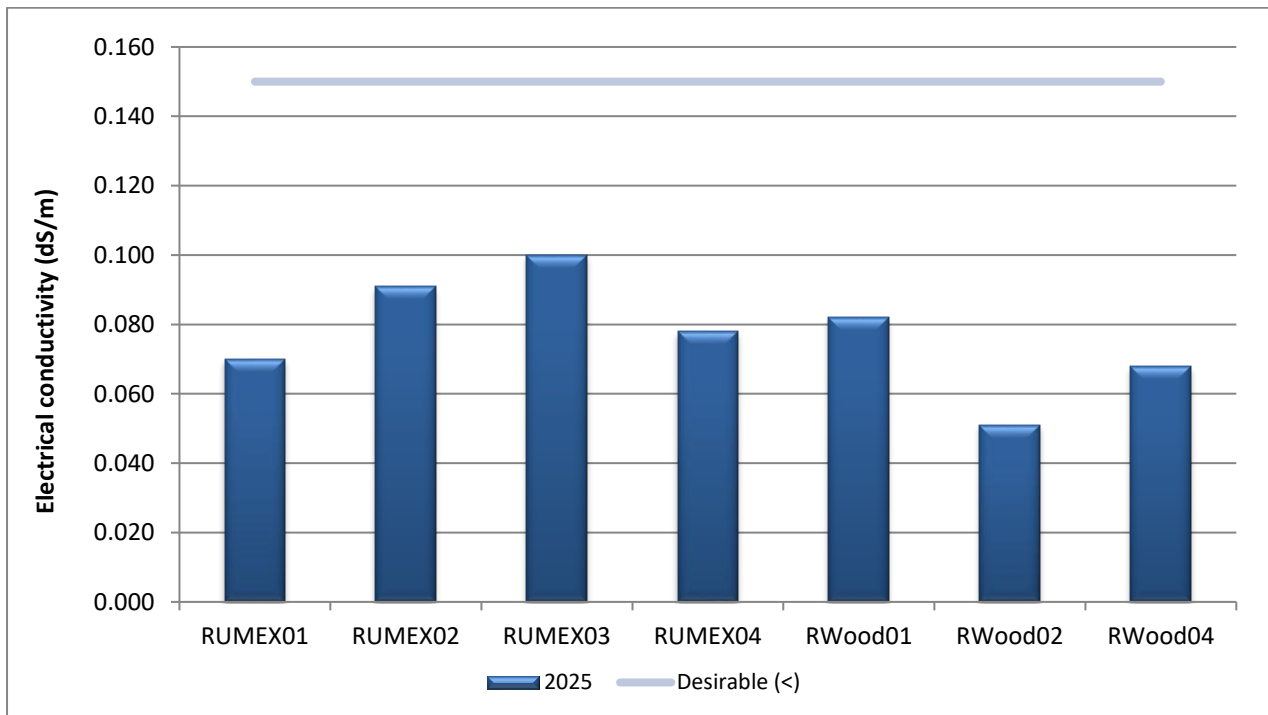


Figure 6-17. EC recorded in woodland monitoring sites compared to desirable agricultural levels.

6.2.9.3 Organic Matter

Organic Matter (OM) in woodland reference sites was highly variable between sites and with 5.1 – 10.3% OM was well above agricultural guidelines, while in RUMEx woodland, OM was similar with 6.8 – 11.1% (Figure 6-18).

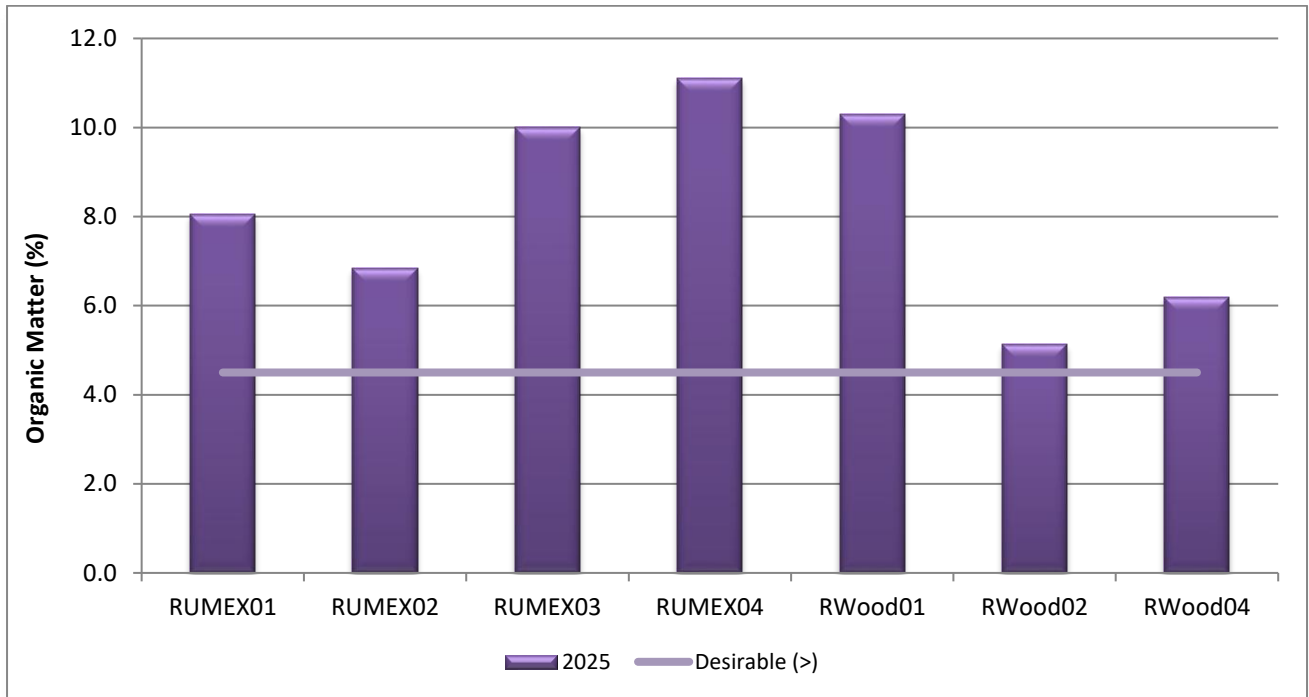


Figure 6-18. OM content recorded in woodland monitoring sites compared to desirable agricultural levels.

6.2.9.4 Phosphorous

Phosphorous (P) concentrations in woodland reference sites were well below desirable agricultural levels indicating low nutrient levels, with concentrations of 6.8 - 13 mg/kg (Figure 6-19). Soils in RUMEx woodland were also very low 5.7 – 8.5 mg/kg.

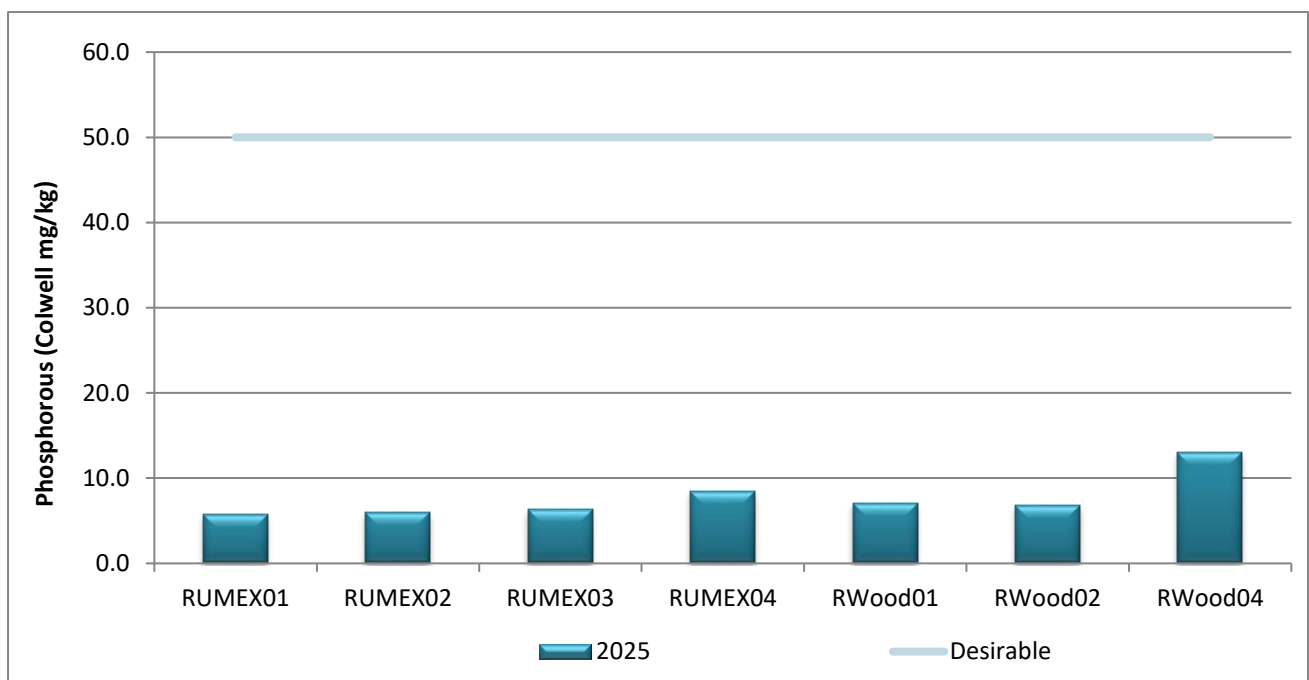


Figure 6-19. P levels recorded in woodland monitoring sites compared to desirable agricultural levels.

6.2.9.5 Nitrate

Nitrate (N) concentrations in woodland reference sites were significantly lower than desirable agricultural level with concentrations of 1.2 – 2.3 mg/kg (Figure 6-20). In RUMEx woodland N was also very low with 0.3 – 0.7 mg/kg.

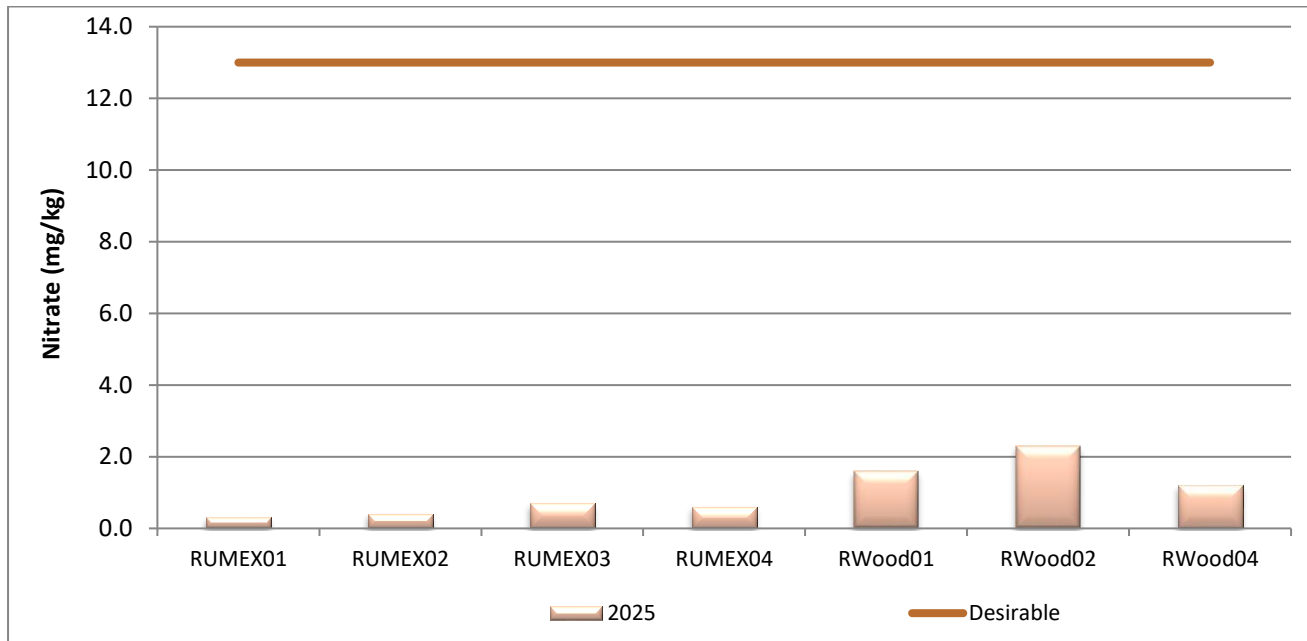


Figure 6-20. N levels recorded in woodland monitoring sites compared to desirable agricultural levels.

6.2.9.6 Cation Exchange Capacity

Cation Exchange Capacity (CEC) is the capacity of the soil to hold the major cations (calcium, magnesium, sodium and potassium) and is also a measure of the potential fertility of the soil. There was high variation in CEC between reference sites with CEC's of 6.8 – 14.3 cmol/kg (Figure 6-21). CEC in RUMEx woodland was similar with 9.4 - 11.9 cmol/kg.

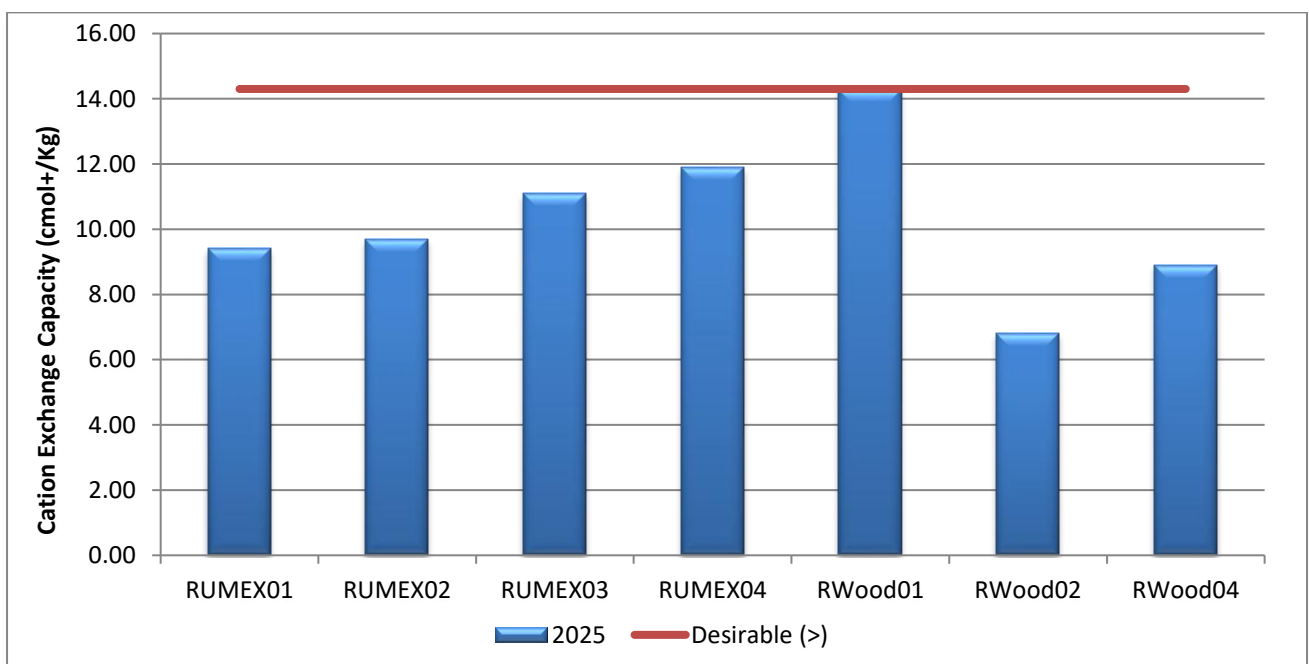


Figure 6-21. CEC recorded in woodland monitoring sites compared to desirable agricultural levels.

6.2.9.7 Exchangeable Sodium Percentage (ESP)

Sodicity refers to a significant proportion of sodium in the soil compared to other cations with soil considered to be sodic when there is sufficient sodium to interfere with its structural stability which often interferes with plant growth. Sodic soils tend to suffer from poor soil structure including hard soil, hardpans, surface crusting and rain pooling on the surface, which can affect water infiltration, drainage, plant growth, cultivation and site accessibility. Woodland reference sites had variable ESPs and ranged from 1.6 – 4.0%, while in RUMEx woodland, ESP ranged from 2.8 – 4.3% and all were below the 5% sodic threshold (Figure 6-22; Isbell 1996).

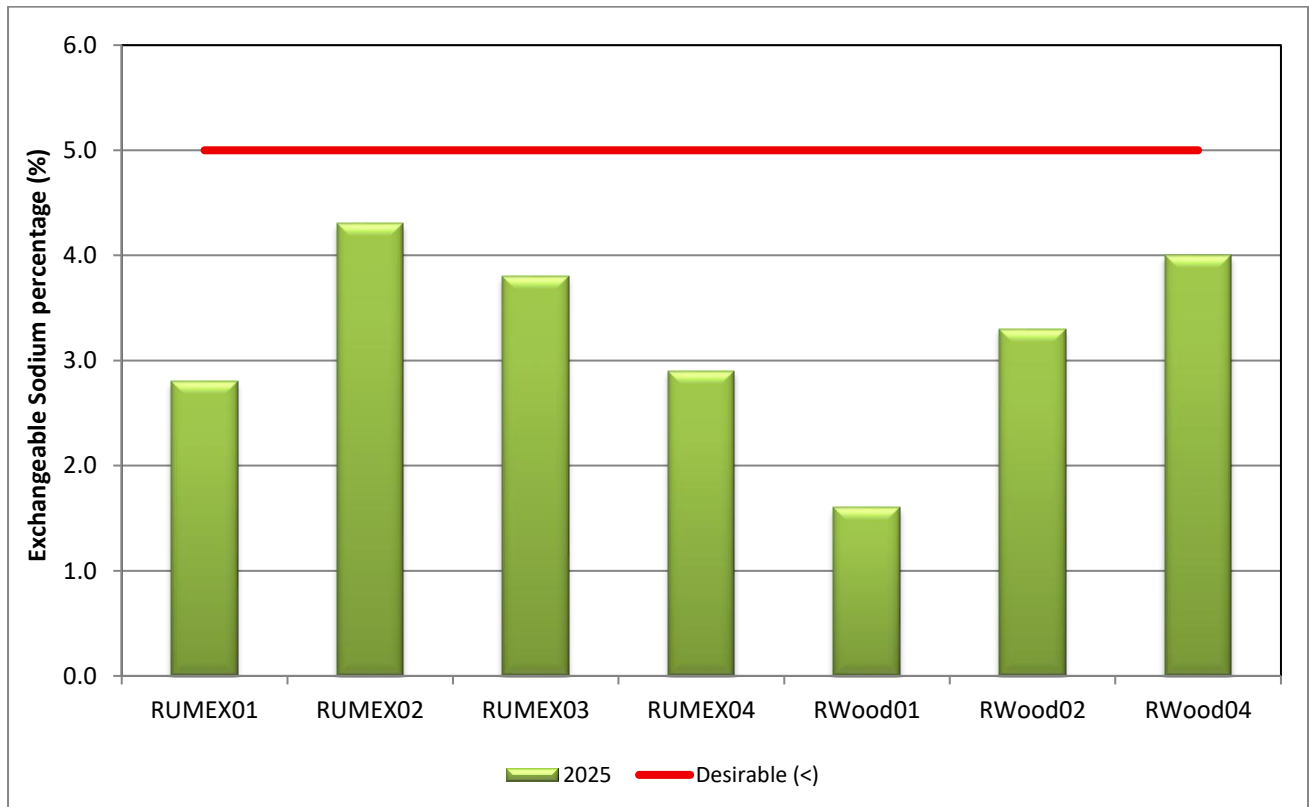


Figure 6-22. ESP recorded in woodland monitoring sites compared to desirable agricultural levels.

7 Performance of RUMEx monitoring sites against completion criteria

Table 7-1 presents the performance of RUMEx woodland monitoring sites in meeting completion criteria targets in 2025. Completion criteria targets are met if they fall within or exceed specified target ranges recorded in woodland reference sites, as represented by an appropriately coloured box that aligns with each of the main rehabilitation phases. Striped, brown coloured boxes indicates that soil performance indicator targets may not necessarily be similar to local soils, but they do fall within agricultural industry guidelines. The complete KPI table of woodland monitoring sites against completion criteria and secondary performance indicators in 2025 is provided in Appendix 5 respectively.

Table 7-1. Performance of RUMEx woodland monitoring sites compared to completion criteria targets in 2025.

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	RUMEx01	RUMEx02	RUMEx03	RUMEx04
<i>Performance indicators are quantified by the range of values obtained from replicated reference sites assessed in 2025</i>						2025	2025	2025	2025
Phase 3: Landform establishment and stability	Landform slope, gradient	Landform suitable for final landuse and generally compatible with surrounding topography and final landform design	Slope	Landform is generally compatible within the context of the local topography and final landform design.	< Degrees (18°)	5	5	3	4
	Subsidence cracking	No visible subsidence cracking	No. Subsidence Cracks	Woodland impacted by mine subsidence are restored and comparable to the reference sites	No.	0	0	0	0
			Sum of subsidence cracks width	Provides an assessment of the extent of subsidence cracking and demonstrates that repair works have been satisfactory	m	0	0	0	0
Phase 4: Growth medium development	Soil chemical, physical properties and amelioration	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH	pH is typical of the surrounding landscape or falls within desirable ranges provided by the agricultural industry	pH (5.6-7.3)	5.9	5.8	5.9	5.9
			Organic Matter	Organic Matter levels are typical of the surrounding landscape, increasing or fall within desirable ranges provided by the agricultural industry	% (>4.5)	8.1	6.8	10.0	11.1
			Phosphorous	Available Phosphorus is typical of the surrounding landscape or fall within desirable ranges provided by the agricultural industry	mg/kg (50)	5.7	6.0	6.3	8.5
Phase 5: Ecosystem & Landuse Establishment	Landscape Function Analysis (LFA): Landform stability and organisation	Landform is stable and performing as it was designed to do	LFA Stability	The LFA stability index provides an indication of the sites stability and is comparable to or trending towards that of the local remnant vegetation	%	75.5	67.5	68	69.5

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	RUMEx01	RUMEx02	RUMEx03	RUMEx04
	Vegetation diversity	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	LFA Landscape organisation	The Landscape Organisation Index provides a measure of the ability of the site to retain resources and is comparable to the local remnant vegetation	%	100	100	100	100
			Diversity of shrubs and juvenile trees	The diversity of shrubs and juvenile trees with a stem diameter < 5cm is comparable to the local remnant vegetation.	species/area	6	5	5	3
				The percentage of shrubs and juvenile trees with a stem diameter < 5cm dbh which are local endemic species and these percentages are comparable to the local remnant vegetation	% population	99	100	85	94
			Total species richness	The total number of live plant species provides an indication of the floristic diversity of the site and is comparable to the local remnant vegetation	No./area	59	52	52	58
			Native species richness	The total number of live native plant species provides an indication of the native plant diversity of the site and that it is greater than or comparable to the local remnant vegetation	>No./area	46	39	36	42
			Exotic species richness	The total number of live exotic plant species provides an indication of the exotic plant diversity of the site and that it is less than or comparable to the local remnant vegetation	<No./area	13	13	16	16
			Density of shrubs and juvenile trees	The density of eucalypts is comparable to the local remnant vegetation	No./area	68	6	4	10
				The density of acacias is comparable to the local remnant vegetation	No./area	37	7	2	0
				The density of other endemic shrubs is comparable to the local remnant vegetation	No./area	88	198	39	85
				The density of exotic / non endemics comparable to the local remnant vegetation	<No./area	1	0	8	6
	Vegetation density	Vegetation contains a density of species comparable to that of the local remnant vegetation							

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	RUMEx01	RUMEx02	RUMEx03	RUMEx04
				The percentage of eucalypts is comparable to the local remnant vegetation	% population	35	3	8	10
	Ecosystem composition	The vegetation is comprised by a range of growth forms comparable to that of the local remnant vegetation	Trees	The number of tree species regardless of age comprising the vegetation community is comparable to the local remnant vegetation	No./area	2	2	2	2
			Shrubs	The number of shrub species regardless of age comprising the vegetation community is comparable to the local remnant vegetation	No./area	4	3	3	2
			Herbs	The number of herbs or forb species comprising the vegetation community is comparable to the local remnant vegetation	No./area	30	28	26	35
			Grasses	The number of grass species comprising the vegetation community is comparable to the local remnant vegetation	No./area	14	12	13	13
Phase 6: Ecosystem & Landuse Development	Landscape Function Analysis (LFA): Landform function and ecological performance	Landform is ecologically functional and performing as it was designed to do	LFA Infiltration	LFA infiltration index provides an indication of the sites infiltration capacity and is comparable to or trending towards that of the local remnant vegetation	%	34.9	44.9	52.2	44.2
			LFA Nutrient recycling	LFA nutrient recycling index provides an indication of the sites ability to recycle nutrient and is comparable to or trending towards that of the local remnant vegetation	%	39.3	46.7	52.4	44.1
	Protective ground cover	Ground layer contains protective ground cover and habitat structure comparable with the local remnant vegetation	Perennial plant cover (< 0.5m)	Percent ground cover provided by live perennial vegetation (<0.5m in height) is comparable to the local remnant vegetation	%	25.7	7.5	24.5	9
			Total Ground Cover	Total groundcover is the sum of protective ground cover components (as described above) and that it is comparable to the local remnant vegetation	%	98	92	100	97.9

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	RUMEx01	RUMEx02	RUMEx03	RUMEx04
	Ecosystem growth and natural recruitment	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the local remnant vegetation	shrubs and juvenile trees 0 - 0.5m in height	The number of shrubs or juvenile trees <0.5m in height provides an indication of establishment success and/or natural ecosystem recruitment and is comparable to the local remnant vegetation	No./area	88	39	30	43
			shrubs and juvenile trees 0.5 - 1m in height	The number of shrubs or juvenile trees 0.5-1m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation	No./area	62	52	14	31
			shrubs and juvenile trees 1.5 - 2m in height	The number of shrubs or juvenile trees 1.5-2m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation	No./area	4	34	1	10
	Ecosystem structure	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5 - 2 m	Projected foliage cover provided by perennial plants in the 0.5 - 2m vertical height stratum indicates the community structure is comparable to the local remnant vegetation	% cover	1.7	3.5	0	0.2
			Foliage cover 2 - 4m	Projected foliage cover provided by perennial plants in the 2 - 4m vertical height stratum indicates the community structure is comparable to the local remnant vegetation	% cover	8.5	0.5	0	0.5
			Foliage cover >6m	Projected foliage cover provided by perennial plants >6m vertical height stratum indicates the community structure is comparable to the local remnant vegetation	% cover	15	27	23	17
	Tree diversity	Vegetation contains a diversity of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree diversity	The diversity of trees or shrubs with a stem diameter >5cm is comparable to the local remnant vegetation	species/area	2	2	2	2
				The percentage of maturing trees and shrubs with a stem diameter >5cm dbh which are local endemic species and these percentages are comparable to the local remnant vegetation	%	100	100	100	100

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	RUMEx01	RUMEx02	RUMEx03	RUMEx04
	Tree density	Vegetation contains a density of maturing tree and shrubs species comparable to that of the local remnant vegetation	Live Tree and mature shrub density (> 5 cm dbh)	The density of eucalypts is comparable to that of the local remnant vegetation	No./area	3	34	34	4
				The density of acacias is comparable to the local remnant vegetation	No./area	0	0	0	0
				The density of other endemic species is comparable to the local remnant vegetation	No./area	23	10	7	33
				The density of exotic / non endemic species is comparable to the local remnant vegetation	<No./area	0	0	0	0
				The percentage of eucalypts is comparable to the local remnant vegetation	% population	12	77	83	11
	Ecosystem health	The vegetation is in a condition comparable to that of the local remnant vegetation.	Healthy trees	The percentage of the tree population which are in healthy condition and that the percentage is comparable to the local remnant vegetation	% population	54	15	27	8
			Flowers/fruit: Trees	The presence of reproductive structures such as buds, flowers or fruit provides evidence that the ecosystem is maturing, capable of recruitment and can provide habitat resources comparable to that of the local remnant vegetation	% population	8	2	8	13

8 Results of 2025 BAM

According to ACP's RMP and BLMP, completion criteria for RUMEx woodland monitoring sites are to be compared to reference sites, representative of agreed final land use and vegetation community. BAM data have also been compared to PCT 1603.

8.1 RUMEx woodland compared to reference sites

Results from 2025 BAM surveys undertaken in RUMEx woodland compared to woodland reference sites (RWood01, RWood02 and RWood04) are provided in Table 8-1. Dark green shading indicates that criteria recorded in monitoring locations is comparable to or higher than woodland reference sites. Striped, green boxes indicate they were comparable to or higher than PCT 1603 benchmarks (NSW Government BioNet 2025a).

8.1.1 Composition

- Compared to woodland reference sites, the diversity of native trees was the same;
- The diversity of native shrubs and grasses/grass-like plants species was higher;
- The diversity of forbs was slightly low in two monitoring sites, however they were higher than PCT 1603 benchmarks;
- Typically, there was one fern species and an absence of other species in all woodland monitoring sites, while three were recorded in PCT 1603; and
- All RUMEx woodland monitoring sites had a lower diversity of exotic species.

8.1.2 Structure

- Compared to woodland reference sites, all RUMEx woodland sites had a comparable cover of trees and shrubs, noting that shrubs were limited in woodland reference sites compared to PCT 1603;
- RUMEx woodland sites had a similar cover of native grasses/grass-like plants and ferns, while no cover of other species was recorded in any location; and
- All RUMEx woodland sites had a lower cover of exotic plants.

8.1.3 Function

- All rehabilitation sites had high and comparable levels of litter development;
- Logs were recorded in three of four RUMEx woodland sites and similar to reference sites; and
- A limited number of large trees (>50 cm dbh) were recorded in two RUMEx woodland sites, while one was recorded in one reference site. Overall large trees were limited to absent in all woodland monitoring sites.

Table 8-1. Comparison of RUMEx woodland monitoring site BAM data to woodland reference sites.

Criteria	Site Name	RUMEx01	RUMEx02	RUMEx03	RUMEx04	RWood01	RWood02	RWood04
Composition: Native Species Richness	Tree	2	2	2	2	2	2	2
	Shrub	5	6	4	3	3	2	2
	Grass/Grass-like	14	11	11	11	14	11	16
	Forb	24	19	18	25	25	23	20
	Fern	1	1	1	1	1	1	1
	Other	0	0	0	0	0	0	0
Exotic	Exotic Richness (<)	13	13	16	16	20	18	18
Structure: % Native Foliage Cover	Tree	16	30	20.5	25	28	10.1	25.1
	Shrub	1.6	0.6	1.3	0.7	0.7	0.5	0.2
	Grass/Grass-like	17	3.15	18	7.7	1.6	23.6	12.8
	Forb	8.1	2.8	2.5	3.2	3.0	4.6	5.8
	Fern	0.3	0.1	0.1	1	0.3	0.5	0.1
	Other	0	0	0	0	0	0	0
Exotic	% Exotic Cover (<)	1.5	1.9	1.9	4.9	2.9	12.0	6.9
Function	% Litter Cover	74	73	76	88	48	77	90
	Logs (m)	9	6	0	28	6.5	0.5	2.5
	Large Trees	0	2	1	0	1	0	0

8.2 RUMEx woodland monitoring sites compared to PCT 1603 benchmarks

Results from 2025 BAM surveys undertaken in RUMEx woodland and woodland reference sites (RWood01, RWood02 and RWood04) compared to PCT 1603 benchmarks (NSW Government BioNet 2025a) are provided in Table 8-2. Dark green shading indicates that criteria recorded in RUMEx woodland monitoring locations is comparable to or higher than these benchmarks.

Compared to Central Hunter Grey Box—Ironbark Woodlands (PCT 1603) published benchmarks, RUMEx woodland and woodland reference sites had a similar composition, however there tended to be lower levels of cover provided by trees, shrubs, grasses and forbs. There were typically higher levels of litter cover, however logs and large trees were limited or absent.

Table 8-2. ACOL woodland monitoring sites compared to PCT 1603 benchmarks.

Criteria	Site Name	RUMEx01	RUMEx02	RUMEx03	RUMEx04	RWood01	RWood02	RWood04	PCT1603
Composition: Native Species Richness	Tree	2	2	2	2	2	2	2	4
	Shrub	5	6	4	3	3	2	2	6
	Grass/Grass-like	14	11	11	11	14	11	16	10
	Forb	24	19	18	25	25	23	20	13
	Fern	1	1	1	1	1	1	1	1
	Other	0	0	0	0	0	0	0	3
Exotic	Exotic Richness (<)	13	13	16	16	20	18	18	NA
Structure: % Native Foliage Cover	Tree	16	30	20.5	25	28	10.1	25.1	50
	Shrub	1.6	0.6	1.3	0.7	0.7	0.5	0.2	6
	Grass/Grass-like	17	3.15	18	7.7	1.6	23.6	12.8	56
	Forb	8.1	2.8	2.5	3.2	3.0	4.6	5.8	7
	Fern	0.3	0.1	0.1	1	0.3	0.5	0.1	0
	Other	0	0	0	0	0	0	0	1
Exotic	% Exotic Cover (<)	1.5	1.9	1.9	4.9	2.9	12.0	6.9	NA
Function	% Litter Cover	74	73	76	88	48	77	90	50
	Logs (m)	9	6	0	28	6.5	0.5	2.5	40
	Large Trees	0	2	1	0	1	0	0	3

9 Elevated soil test results

Results of comprehensive soil analyses are provided in Appendix 6 with a summarised version highlighting elevated results provided in Table 9-1. Indicative fertility guidelines are based on Albrecht and Reams concepts for achieving ideal soil fertility in clay loam soils. Further detail can be found in “Notes” provided with Soil Analyses results (Appendix 6). Monitoring sites which appear to have elevated levels compared to these indicative guidelines have been highlighted to provide a general indication of how much an element or heavy metal may exceed these guidelines. The colour coding used when comparing against these recommended guidelines is as follows: Green = slightly elevated; Yellow = high; Red = very high; Brown = significantly high; Purple = excessive; Pink = highly excessive.

Results of the soil analyses indicate that soils in RUMEx woodland tended to have elevated levels of sulfur, zinc, manganese and silicon. Iron was significantly high in all woodland reference sites, suggesting iron and other elements occur in naturally elevated levels across the local landscape and/or have been the legacy of a long agricultural [and mining] history.

Table 9-1. Summary of the soil analyses highlighting elevated soil test results.

Parameter	Unit	Medium soil guidelines	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04
Sulfur - KCl extractable	mg/kg	8	14	10	6.2	11	15	16	13
Zinc - DTPA	mg/kg	5	4.8	3.4	3.2	8.3	5.6	5.9	7.5
Manganese - DTPA	mg/kg	22	15.8	30.4	21.5	23.3	23.4	26	23.5
Iron - DTPA	mg/kg	22	115	236	386	237	283	257	238
Silicon - CaCl2 extractable	mg/kg	45	61	43	47	75	69	47	66
Zinc	mg/kg	20–50	43	15	26	54	42	2.2	36

Purple = excessively high; Brown = significantly high; Red = very high; Yellow = moderately high; Green = slightly high

10 Priority and environmental weeds

10.1 Priority weeds

Nine Weeds of National Significance (WoNS) and priority weeds listed for the Hunter Valley LLS region were recorded in RUMEx woodland monitoring and woodland reference sites in 2025 (Table 10-1). *Senecio madagascariensis* (Fireweed) was common in low densities throughout all monitoring sites, however it had become quite abundant in woodland reference sites and in RUMEx04. *Opuntia stricta* (Common Prickly Pear) was also recorded in low abundance in all monitoring locations, while *Opuntia aurantiaca* (Tiger Pear) was recorded in fewer locations.

There were also low occurrences of *Lycium ferocissimum* (African Boxthorn), *Hyparrhenia hirta* (Coolatai Grass) and *Lantana camara* (Lantana) in RUMEx woodland. *Eragrostis curvula* (African Lovegrass) and *Galenia pubescens* (Galenia) were scattered throughout woodland reference sites, but were not recorded in RUMEx woodland sites.

Table 10-1. %PFC of WONS and priority weeds recorded in RUMEx woodland monitoring program, 2025.

Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04	No. sites
<i>Senecio madagascariensis</i>	Fireweed	h	0.1	10	5	0.1	0.1	0.1	3	7
<i>Opuntia stricta</i>	Common Prickly Pear	c	0.1	0.1	0.1	0.25	0.5	0.25	0.5	7
<i>Opuntia aurantiaca</i>	Tiger Pear	c	0.1			0.1	0.1		0.1	4
<i>Eragrostis curvula</i>	African Lovegrass	g	0.25	0.1	0.25					3
<i>Galenia pubescens</i>	Galenia	ss	0.25	0.1	0.1					3
<i>Lycium ferocissimum</i>	African Boxthorn	s				0.1		0.25	0.1	3
<i>Hyparrhenia hirta</i>	Coolatai Grass	g				0.1				1
<i>Lantana camara</i>	Lantana	s						0.1		1
<i>Olea europaea</i>	Olive	s	0.5							1

Key to growth forms: t = tree; s = shrub; ss = sub-shrub; h = herb/forb; g = grass; r = reed/rush/sedge; v = vine; f = fern; c = cactus

10.2 Environmental weeds

Many species of exotic perennial grasses used for erosion control and livestock fodder are recognised as environmental weeds, with more than a hundred species occurring in NSW. The listing of "Invasion of native plant communities by exotic perennial grasses" as a key threatening process has been made in recognition of the increasing evidence that some perennial grass species have significant adverse impacts on biodiversity. Three exotic perennial grasses which are considered environmental weeds were recorded in low abundance in numerous RUMEx woodland monitoring sites (Table 10-2). Over the past few years, there has been an increasing abundance of *Bidens pilosa* (Cobbler's Peg) and *B. subalternans* (Greater Beggars Tick), both annual species that rapidly form large infestations especially in areas of high disturbance, such as along Bowman's Creek and Hunter River (DnA Environmental 2024c, 2025c).

Table 10-2. Environmental weeds recorded in RUMEx monitoring program in 2025.

Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04	No. sites
<i>Megathyrsus maximus</i>	Guinea Grass	g				0.1	0.1	0.1	0.1	4
<i>Chloris gayana</i>	Rhodes Grass	g					0.1	0.1	0.1	3
<i>Bidens subalternans</i>	Greater Beggars Tick	h	0.1	0.1						2
<i>Setaria sphacelata</i>	South African Pigeon Grass	g						0.1	0.1	2
<i>Bidens pilosa</i>	Cobbler's Peg	h	0.1							1
<i>Melinis repens</i>	Red Natal Grass	g	0.1							1

Key to growth forms: t = tree; s = shrub; ss = sub-shrub; h = herb/forb; g = grass, r = reed/rush/sedge; v = vine; f = fern; c = cactus

11 Threatened species

No threatened flora has been recorded in the range of monitoring sites.

12 Additional photo-point monitoring

Additional photo-points were established in areas where subsidence and/or ponding is predicted to occur. Photos taken north, east, south and west and “down” and “up” are provided in Table 12-1 and Table 12-2.

Table 12-1. Additional photo-points N, E, S and W in areas where subsidence and/or ponding is predicted to occur.

No.	North	East	South	West
PPS1: subsidence	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.
PPS2: subsidence	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a forest floor with sparse vegetation and a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.
PP1: ponding	 A photograph showing a grassy field with a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a grassy field with a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a grassy field with a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.	 A photograph showing a grassy field with a red flag marker in the foreground. The date stamp '13 05 2025' is visible in the bottom right corner.

No.	North	East	South	West
PP2: ponding				
PP3: ponding				
PP4 :ponding				

Table 12-2. Additional photo-points taken “down” and “up” in areas where subsidence and/or ponding is predicted to occur.

No.	Down	Up
PPS1: subsidence	 A downward view of a grassy area with a red flag labeled 'PPS1' in the center. The ground appears slightly uneven. A date stamp '13 05 2025' is visible in the bottom right corner.	 An upward view of a cloudy sky. A date stamp '13 05 2025' is visible in the bottom right corner.
PPS2: subsidence	 A downward view of a grassy area with a red flag labeled 'PPS2' in the center. The ground is covered with dry sticks and leaves. A date stamp '13 05 2025' is visible in the bottom right corner.	 An upward view of a cloudy sky with tree branches visible in the foreground. A date stamp '13 05 2025' is visible in the bottom right corner.
PP1: ponding	 A downward view of a grassy area with a red flag labeled 'PP1' in the center. The ground appears slightly uneven. A date stamp '13 05 2025' is visible in the bottom right corner.	 An upward view of a cloudy sky. A date stamp '13 05 2025' is visible in the bottom right corner.
PP2: ponding	 A downward view of a grassy area with a red flag in the center. The ground appears slightly uneven. A date stamp '13 05 2025' is visible in the bottom right corner.	 An upward view of a cloudy sky. A date stamp '13 05 2025' is visible in the bottom right corner.

No.	Down	Up
PP3: ponding	 13 05 2025	 13 05 2025
PP4 :ponding	 13 05 2025	 13 05 2025

13 Summary

Results of 2025 monitoring found RUMEx woodland monitoring sites were typically moderate to high density regrowth woodland with canopies >6.0 m tall providing 15 – 27% foliage cover. RUMEx woodland were comprised of various densities of *Allocasuarina luehmannii* and *Eucalyptus crebra*. Most individuals tended to be in good to moderate health, however there were 4 – 12% with advanced dieback and 5 – 20% of total stems were dead stags in three of four sites. There was also significant variation in native shrub and juvenile tree densities with relatively high densities of tree regeneration occurring in two sites (RUMEx01 and RUMEx02). Seedlings were recorded in all height categories, however most individuals were less than 1.0 m in height.

The herbaceous understorey was comprised of mosaics of dead leaf litter in slight to moderate states of decomposition, scattered perennial ground covers and patches of moss were relatively common. There was negligible erosion however there may have been small localised bare patches as a result of animal disturbance and areas of localised deposition as litter became mobilised during high rainfall events. The loam - clay loam soils were typically moderately hard, crusted and highly stable.

In RUMEx woodland, there was also relatively high floristic diversity with a total of 52 - 59 species, of which 22 – 31% were exotic species. RUMEx woodland had a similar composition of species compared to woodland reference sites, except there was slightly lower diversity of herbs/forbs in three of four sites. The understorey tended to be dominated by a variety of native grasses with *Aristida* species and *Microlaena stipoides* (Weeping Rice-grass) being most common, while *Dichondra repens* (Kidney Weed) was also relatively abundant in some sites. Priority weeds *Senecio madagascariensis* (Fireweed) was also abundant in RUMEx04 and in two woodland reference sites.

Soils were comparable to woodland reference sites and were slightly to moderately acidic, non-saline, non-sodic, high in organic matter but low in nutrients (P, N) and CEC. Iron was significantly high in all RUMEx and woodland reference sites, suggesting iron and other elements occur in naturally elevated levels across the local landscape.

Nine Weeds of National Significance (WoNS) and priority weeds listed for the Hunter Valley LLS region were recorded in RUMEx woodland monitoring, with several also recorded in woodland reference sites.

14 Conclusion and recommendations

Approximately 45 ha of woodland overlying ACOL- Operated Ravensworth Underground Mine is referred to as RUMEx, is Endangered Ecological Community (EEC) Central Hunter Grey Box—Ironbark Woodlands (PCT 1603). Modelling predicts subsidence will result in minor cracks and changes to the surface and while remediation may be required, surface cracking or vertical subsidence is not expected to impact threatened species or threatened species habitat. Areas of ponding are predicted to affect approximately 1 ha of vegetation, with prolonged inundation leading to dieback and loss of woodland and/or grassland in directly affected areas.

Part of the conditions of the mining approval include establishing an annual monitoring program to assess vegetation condition to ensure there are no further impacts from underground mining on these woodlands. The RUMEx vegetation monitoring program was established in May 2025 by DnA Environmental and applies monitoring procedures as for other ACP rehabilitation/vegetation monitoring programs.

Currently all RUMEx woodland monitoring sites had similar composition, structure and function as woodland reference sites, with some minor exception. Compared to Central Hunter Grey Box—Ironbark Woodlands (PCT 1603) published benchmarks, RUMEx woodland and woodland reference sites had a similar composition, however there tended to be lower levels of cover provided by trees, shrubs, grasses and forbs. There were typically higher levels of litter cover, however logs and large trees were limited or absent.

Weed monitoring and control should be undertaken as part of ACP's ongoing management commitments. Care to avoid non target species, especially beneath mature trees and appropriate handling and destruction of weed material and seeds should also be a priority biosecurity method. In RUMEx woodland, weed management strategies should include “cut and paste” methods for woody weeds and physical removal of *Opuntia* species.

Variations in ecological condition in RUMEx woodland is likely to occur as a result of changes in seasonal conditions, with increased levels of disturbance and grazing by animals expected during prolonged dry conditions. In the absence of livestock grazing, it will be imperative that some degree of macropod grazing is retained as integral in the management of woodland areas. Regular monitoring of macropod numbers and other pest animals and associated disturbance should be ongoing.

Woodland reference sites situated in ACOL farmland areas also require ongoing management and maintenance in order to manage herbage biomass and weeds. Since 2023, light grazing by cattle has occurred, however overgrazing needs to be avoided as it will impact on completion criteria targets. Periods of grazing exclusion and/or the construction of protective fencing may need to be considered to protect the integrity of reference sites.

Ongoing monitoring will assess a range of ecological indicators over time and compare these changes against woodland reference sites unaffected by underground mining. Photo-graphic and quantitative data will allow detection in changes and/or deterioration, different to those occurring in woodland reference sites, or beyond those predicted as a result of underground mining. The monitoring program will also assess the adequacy of rehabilitation where required and provide guidance on RUMEx woodland management requirements.

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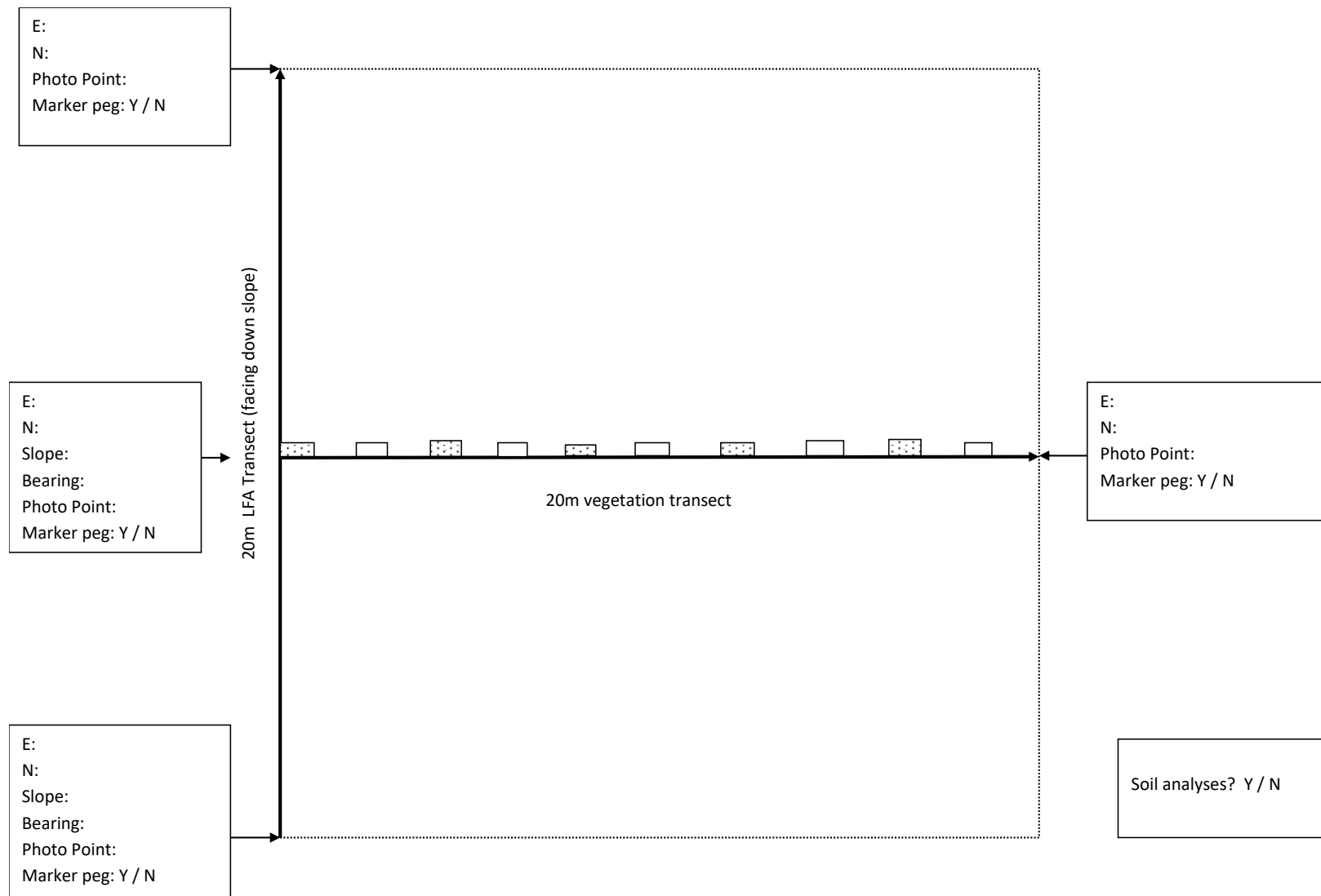
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Appendix 1: Layout of the 20 x 20 m monitoring quadrat



Appendix 2. A guide to assessing “Percent foliage cover”

Gibbons *et al* 2005

BioMetric Tool

Appendix 3

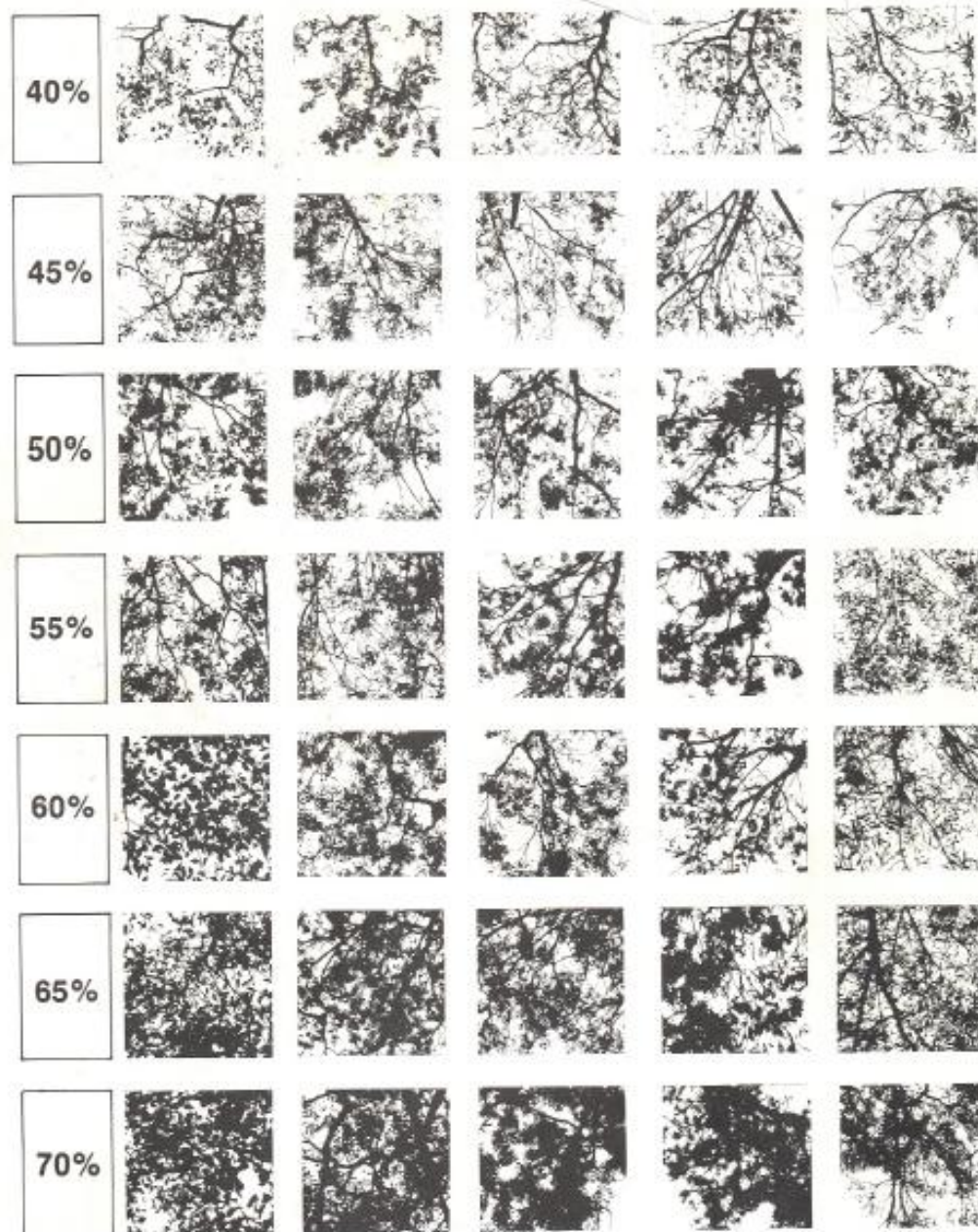


Figure 5 Crown types. Estimate the openness of individual tree or shrub crowns by matching the crown with a photograph. The rows show similar crown types for different leaf sizes (large to small, left to right); *Acacia phyllodes* are in the right hand row. Most Australian woody plants are in the range 40 per cent to 70 per cent.

Figure 2. Diagrams to assist with estimates of per cent foliage cover (from Walker and Hopkins 1998).

Appendix 3: GPS coordinates of monitoring sites

Woodland: GPS Coordinates and other site-specific information for woodland monitoring sites.

Site Reference	LFA Start	LFA Finish	LFA slope°	LFA bearing°	Veg transect start	Veg transect finish	Veg transect bearing°
RWood01	56319989 6406100	56320003 6406092	25	90	56319994 6406098	56319991 6406077	178
RWood02	56321364 6403421	56321349 6403428	5	270	56321357 6403426	56321353 6403436	11
RWood04	56321619 6403510	56321614 6403528	5	335	56321617 6403520	586321634 6403523	67

RUMEx: GPS Coordinates and other site-specific information for RUMEx monitoring sites.

Site Reference	LFA Start	LFA Finish	LFA slope°	LFA bearing°	Veg transect start	Veg transect finish	Veg transect bearing°
RUMEx01	56316638 6405920	56316640 6405899	5	160	56316639 6405909	56316619 6405904	250
RUMEx02	56316954 6405897	56316956 6405916	5	358	56316955 6405908	56316972 6405906	90
RUMEx03	56316856 6406004	56316871 6406005	3	85	56316864 6406004	56376864 6405985	174
*RUMEx04	56316612 6406140	56316623 6406151	4	45	56316617 6406151	56316609 6406162	325

*Plot runs left to right

RUMEx photo-points.: GPS Coordinates

Photo-point	Eastings	Northings
PPS1	56316878	6405667
PPS2	56316775	6406104
PP1	56316619	6405693
PP2	56317105	6405871
PP3	56317113	6406075
PP4	56316952	6406276

Appendix 4: Flora species and cover abundance recorded in woodland monitoring sites in 2025

The presence of each species at each monitoring location and their Percent foliage cover (PFC) is provided in the table below.

Key to habit legend: t = tree; s = shrub; ss =sub-shrub; h = herb; g = grass, r = reed; v = vine; f = fern; c = cactus

Family	exotic	Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04
Adiantaceae		<i>Cheilanthes sieberi</i>	Rock Fern	f	0.25	0.5	0.1	0.25	0.1	0.1	1
Aizoaceae	*	<i>Galenia pubescens</i>	Galenia	ss	0.25	0.1	0.1				
Alliaceae	*	<i>Nothoscordum gracile</i>	Onion Weed	h			0.1				0.1
Anthericaceae		<i>Laxmannia gracilis</i>	Slender Wire Lily	h			0.1				
Apocynaceae	*	<i>Gomphocarpus fruticosus</i>	Swan Plant	ss		0.1	0.1	0.1		0.1	
Asparagaceae		<i>Arthropodium sp.</i>	A Lily	h		0.1			0.1		0.1
Asteraceae	*	<i>Bidens pilosa</i>	Cobbler's Peg	h	0.1						
Asteraceae	*	<i>Bidens subalternans</i>	Greater Beggars Tick	h	0.1	0.1					
Asteraceae		<i>Brachyscome spathulata</i>	Spoon Daisy	h				0.1	0.1	0.1	0.1
Asteraceae		<i>Calocephalus citreus</i>	Lemon Beautyheads	h				0.25	0.1		
Asteraceae		<i>Calotis cuneifolia</i>	Purple Burr Daisy	h		0.25	1				
Asteraceae		<i>Calotis lappulacea</i>	Yellow Burr Daisy	h	0.1			0.1	0.1		0.1
Asteraceae		<i>Chrysocephalum apiculatum</i>	Common Everlasting	h	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Asteraceae	*	<i>Cirsium vulgare</i>	Spear Thistle	h	0.1	0.1			0.1	0.1	0.1
Asteraceae	*	<i>Conyza bonariensis</i>	Fleabane	h	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Asteraceae	*	<i>Cyanthillium [Vernonia] cinereum</i>	Purple Fleabane	h		0.1	0.1		0.25		0.1
Asteraceae		<i>Cymbonotus lawsonianus</i>	Bear's Ear	h	0.1						
Asteraceae		<i>Euchiton involucratus</i>	Star Cudweed	h	0.1			0.1			
Asteraceae	*	<i>Gamochaeta coarctata</i>	Cudweed	h		0.1		0.1			
Asteraceae		<i>Glossocardia bidens</i>	Cobbler's Tack	h	0.1			0.1	0.1	0.1	0.1
Asteraceae	*	<i>Hypochaeris albiflora [microcephala]</i>	White Flatweed	h	0.1	0.25	0.1		0.1	0.1	0.1
Asteraceae	*	<i>Hypochaeris radicata</i>	Flatweed	h		0.1			0.1		
Asteraceae		<i>Lagenophora gracilis</i>	Slender Lagenophora	h	0.1						0.1

Family	exotic	Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04
Asteraceae		<i>Minuria leptophylla</i>	Minnie Daisy	h	0.1						
Asteraceae	*	<i>Richardia stellaris</i>	Field Madder	h	0.1		0.1	0.1		0.1	0.1
Asteraceae	*	<i>Schkuhria pinnata</i>	Dwarf Marigold	h		0.1					
Asteraceae	*	<i>Senecio madagascariensis</i>	Fireweed	h	0.1	10	5	0.1	0.1	0.1	3
Asteraceae		<i>Senecio quadridentatus</i>	Cotton Fireweed	h	0.1						
Asteraceae		<i>Solenogyne belliioides</i>		h				0.1		0.1	
Asteraceae	*	<i>Sonchus oleraceus</i>	Milk Thistle	h			0.1				0.1
Asteraceae		<i>Stuartina muelleri</i>	Spoon Cudweed	h		0.1					
Asteraceae	*	<i>Taraxacum officinale</i>	Dandelion	h						0.1	
Asteraceae		<i>Vittadinia cuneata</i>	Fuzzweed	h				0.1		0.1	0.1
Asteraceae		<i>Vittadinia pustulata</i>	Fuzzweed	h	0.1	0.1					
Brassicaceae	*	<i>Lepidium africanum</i>	Peppergrass	h			0.1				
Brassicaceae	*	<i>Lepidium bonariense</i>	Peppergrass	h	0.1		0.1				
Brassicaceae	*	<i>Lepidium virginicum</i>	Virginian Peppergrass	h					0.1		
Brassicaceae	*	<i>Sisymbrium sp.</i>	A Mustard	h							0.1
Cactaceae	*	<i>Opuntia aurantiaca</i>	Tiger Pear	c	0.1			0.1	0.1		0.1
Cactaceae	*	<i>Opuntia stricta</i>	Common Prickly Pear	c	0.1	0.1	0.1	0.25	0.5	0.25	0.5
Campanulaceae		<i>Wahlenbergia communis</i>	Tufted Bluebell	h	0.1	0.1	0.1	0.1			
Campanulaceae		<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	h				0.25		0.1	0.1
Campanulaceae		<i>Wahlenbergia luteola</i>	Australian Bluebell	h	0.1		0.1	0.1	0.1	0.1	0.1
Campanulaceae		<i>Wahlenbergia sp.</i>	Bluebell	h							0.1
Caryophyllaceae	*	<i>Paronychia brasiliensis</i>	Chilean Whitlow Wort	h			0.1				
Casuarinaceae		<i>Allocasuarina luehmannii</i>	Bullock	t	20	0.1	0.1	10	10	0.5	20
Chenopodiaceae		<i>Einadia hastata</i>	Berry Saltbush	h					0.1		
Chenopodiaceae		<i>Einadia nutans</i>	Climbing Saltbush	h	0.1		0.1		0.1	0.1	0.1
Chenopodiaceae		<i>Einadia trigonos</i>	Fishweed	h		0.1	0.1				

Family	exotic	Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04
Chenopodiaceae		<i>Enchylaena tomentosa</i>	Ruby Saltbush	ss					0.1	0.1	0.1
Chenopodiaceae		<i>Maireana microphylla</i>	Eastern Cottonbush	ss						0.1	
Commelinaceae		<i>Commelina cyanea</i>	Native Wandering Jew	h		0.1	0.1				
Convolvulaceae		<i>Convolvulus erubescens</i>	Australian Bindweed	h	0.1						
Convolvulaceae		<i>Dichondra repens</i>	Kidney Weed	h	0.25	2	2	5	1	0.5	0.5
Cyperaceae		<i>Carex inversa</i>	Knob Sedge	r		0.1	0.1	0.1			
Cyperaceae		<i>Cyperus gracilis</i>	Slender Flat-sedge	r	0.1	0.1	5	0.1	0.1	0.1	0.1
Cyperaceae		<i>Fimbristylis dichotoma</i>	Common Fringe Rush	r		0.1	0.1	0.1			
Euphorbiaceae		<i>Euphorbia [Chamaesyce] dallachyana</i>	Caustic Weed	h	0.1						0.1
Euphorbiaceae		<i>Phyllanthus virgatus</i>	A Spurge	ss				0.1	0.1		
Fabaceae (Faboideae)		<i>Daviesia genistifolia</i>	Broom Bitter Pea	s				0.25			
Fabaceae (Faboideae)		<i>Glycine tabacina</i>	Variable Glycine	h	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fabaceae (Faboideae)		<i>Grona [Desmodium] varians</i>	Slender Tick-trefoil	h	0.1	0.2	0.5	0.25	0.1	0.25	0.1
Fabaceae (Faboideae)	*	<i>Medicago laciniata</i>	Cut-leaf Medic	h	0.1						
Fabaceae (Faboideae)		<i>Oxytes [Desmodium] brachypoda</i>	Large Tick trefoil	ss	0.1	0.2	0.5				0.1
Fabaceae (Faboideae)		<i>Zornia dyctiocarpa</i>	Zornia	h						0.1	
Fabaceae (Mimosoideae)		<i>Acacia amblygona</i>	Fan Wattle	s				0.5	0.1		
Fabaceae (Mimosoideae)		<i>Acacia falcata</i>	A Wattle	s		0.25					
Fabaceae (Mimosoideae)		<i>Acacia salicina</i>	Willow Wattle	s				0.5	0.1	0.1	0.1
Geraniaceae		<i>Geranium solanderi</i>	Native Geranium	h		0.1					
Haloragaceae		<i>Haloragis heterophylla</i>	Rough Raspwort	h		0.1					
Hypericaceae		<i>Hypericum gramineum</i>	Small St. John's Wort	h				0.1			0.1
Juncaceae		<i>Juncus usitatus</i>	A Rush	r			0.1				
Lamiaceae		<i>Mentha satureioides</i>	Native Pennyroyal	h		0.1					
Lomandraceae		<i>Lomandra filiformis</i>	Wattle Mat-rush	h	0.1	0.1	0.1	0.25	0.1	0.1	0.35
Lomandraceae		<i>Lomandra multiflora</i>	Many-flowered Mat-rush	h	0.25	0.1	0.1	0.1	0.1	0.1	0.1

Family	exotic	Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04
Malvaceae	*	<i>Pavonia hastata</i>	Pink Pavonia	ss	0.1						
Malvaceae		<i>Sida corrugata</i>	Corrugated Sida	h	0.1			0.1	0.1		0.1
Malvaceae	*	<i>Sida rhombifolia</i>	Paddy's Lucerne	ss		0.25	0.1			0.1	
Myoporaceae		<i>Eremophila debilis</i>	Amulla	ss	0.1	0.25	0.1	0.25	0.1	1	0.5
Myoporaceae		<i>Myoporum montanum</i>	Western Boobialla	s	0.5				0.1		
Myrtaceae		<i>Eucalyptus crebra</i>	Narrow-leaf Ironbark	t		10	25	6	20	20	5
Myrtaceae		<i>Eucalyptus moluccana</i>	Grey Box	t	8						
Nyctaginaceae		<i>Boerhavia dominii</i>	Tar Vine	h			0.1				
Oleaceae	*	<i>Olea europaea</i>	Olive	s	0.5						
Oxalidaceae		<i>Oxalis perennans</i>	Yellow Wood-sorrel	h	0.1	0.1	0.1	0.1		0.1	0.1
Phormiaceae		<i>Dianella caerulea</i>	Blue Flax Lily	h				0.1			
Phormiaceae		<i>Dianella longifolia</i>	Blueberry Lily	h		0.1					
Phormiaceae		<i>Dianella revoluta</i>	Native Flax Lily	h			0.25		0.1		
Plantaginaceae	*	<i>Plantago lanceolata</i>	Ribwort	h	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Plantaginaceae		<i>Plantago turrifera</i>	Small Sago Weed	h						0.1	
Plantaginaceae		<i>Veronica plebeia</i>	Trailing Speedwell	h		0.1	0.1	0.1			
Poaceae		<i>Anthosachne scabra</i>	Common Wheatgrass	g	0.1						
Poaceae		<i>Aristida ramosa</i>	Threeawn Grass	g			0.25	4		2	2
Poaceae		<i>Aristida vagans</i>	Wire Grass	g	0.1	0.25	0.5	5	0.25	2	2
Poaceae		<i>Austrostipa scabra</i>	Speargrass	g	0.25		2		2	0.5	1
Poaceae		<i>Austrostipa verticillata</i>	Slender Bamboo Grass	g					0.1	1	0.1
Poaceae		<i>Bothriochloa decipiens</i>	Redgrass	g	0.1	0.25	0.1	0.1	0.1	0.1	0.1
Poaceae	*	<i>Chloris gayana</i>	Rhodes Grass	g					0.1	0.1	0.1
Poaceae		<i>Chloris ventricosa</i>	Tall Windmill Grass	g	0.1						
Poaceae		<i>Cymbopogon refractus</i>	Barbed-wire Grass	g	0.1	2	2	2	0.1	0.1	0.1
Poaceae		<i>Cynodon dactylon</i>	Couch	g		0.1	0.1				

Family	exotic	Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04
Poaceae		<i>Dichanthium sericeum</i>	Queensland Bluegrass	g	0.1			0.1	0.1		
Poaceae		<i>Dichelachne micrantha</i>	Shorthair Plumegrass	g	0.1				0.1		
Poaceae		<i>Enteropogon acicularis</i>	Curly Windmill Grass	g						0.1	
Poaceae		<i>Eragrostis brownii</i>	Brown's Lovegrass	g				0.1			
Poaceae	*	<i>Eragrostis curvula</i>	African Lovegrass	g	0.25	0.1	0.25				
Poaceae		<i>Eragrostis leptostachya</i>	Paddock Lovegrass	g		0.1	0.1	0.1			
Poaceae	*	<i>Hyparrhenia hirta</i>	Coolatai Grass	g				0.1			
Poaceae	*	<i>Megathyrsus maximus</i>	Guinea Grass	g				0.1	0.1	0.1	0.1
Poaceae	*	<i>Melinis repens</i>	Red Natal Grass	g	0.1						
Poaceae		<i>Microlaena stipoides</i>	Weeping Rice-grass	g	0.1	20	2	5	0.1	2	2
Poaceae		<i>Panicum effusum</i>	Hairy Panic	g	0.1			0.1			0.1
Poaceae		<i>Panicum simile</i>	Two-colour Panic	g	0.1						
Poaceae		<i>Paspalidium distans</i>		g		0.1	0.1				
Poaceae		<i>Poa sieberiana</i>	Fine-leaf Tussock	g			0.1				
Poaceae		<i>Rytidosperma caespitosum</i>	Wallaby Grass	g					0.1		0.1
Poaceae		<i>Rytidosperma erianthum</i>	Hill Wallaby Grass	g	0.1		0.1	0.1			
Poaceae		<i>Rytidosperma richardsonii</i>	Wallaby Grass	g					0.1	10	
Poaceae	*	<i>Setaria pumila</i>	Pale Pigeon Grass	g				0.1			
Poaceae	*	<i>Setaria sphacelata</i>	South African Pigeon Grass	g						0.1	0.1
Poaceae		<i>Sporobolus creber</i>	Western Rat's-tail Grass	g	0.1	0.5	0.1	0.1		0.1	0.1
Rhamnaceae		<i>Cryptandra amara</i>	Bitter Cryptandra	ss			0.1	0.1	0.1		
Rubiaceae		<i>Asperula conferta</i>	Common Woodruff	h	0.1	0.1		0.1		0.1	0.1
Schrophulariaceae		<i>Brunoniella australis</i>	Blue Trumpet	h	0.1	0.1	0.1	0.25	0.1	0.25	0.1
Solanaceae	*	<i>Lycium ferocissimum</i>	African Boxthorn	s				0.1		0.25	0.1
Solanaceae	*	<i>Solanum chenopodioides</i>	Whitetip Nightshade	h	0.1	0.1					
Solanaceae		<i>Solanum cinereum</i>	Narrawa Burr	h	0.25	0.1	0.1		0.1		0.1

Family	exotic	Scientific Name	Common Name	Growth Form	RWood01	RWood02	RWood04	RUMEx01	RUMEx02	RUMEx03	RUMEx04
Solanaceae	*	<i>Solanum nigrum</i>	Blackberry Nightshade	h			0.1				
Thymelaeaceae		<i>Pimelea curviflora</i>	Curved Rice Flower	ss	0.1						
Verbenaceae	*	<i>Lantana camara</i>	Lantana	s						0.1	
Verbenaceae	*	<i>Verbena litoralis</i>	Coastal Verbena	h	0.25	0.1	0.1	0.1	0.1	0.1	
Verbenaceae	*	<i>Verbena rigida</i>	Veined Verbena	h	0.1	0.1					
Violaceae		<i>Hybanthus monopetalus</i>	Slender Violet Bush	h							0.1

Appendix 5. RUMEx woodland monitoring site performance towards meeting ecological performance indicators

The table below indicates the performance of RUMEx woodland monitoring sites against *Primary* and *Secondary Performance Indicators* recorded from woodland reference sites in 2025. Performance indicators are presented in order of rehabilitation phases and ecosystem succession, beginning with Landform establishment and stability (orange) and ending with indicators of Ecosystem & Land Use Development (blue). Completion criteria are considered to be met when they fall within or exceed specified target ranges recorded in woodland reference sites, as represented by an appropriately coloured box that aligns with each of the main rehabilitation phases. Striped, brown coloured boxes indicates that soil performance indicator targets may not necessarily be similar to local soils, but they do fall within agricultural industry guidelines. Grey shaded boxes indicate that that ecological indicator was not applicable.

Performance of RUMEx woodland monitoring sites against Primary and Secondary Performance Indicators in 2025.

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
Performance indicators are quantified by the range of values obtained from replicated reference sites assessed in 2025							2025	2025	2025	Lower	Upper	2025	2025	2025	2025
Phase 3: Landform establishment and stability	Landform slope, gradient	Landform suitable for final landuse and generally compatible with surrounding topography and final landform design	Slope	Landform is generally compatible within the context of the local topography and final landform design.		< Degrees (18°)	25	5	5	5	25	5	5	3	4
	Subsidence cracking	No visible subsidence cracking	No. Subsidence Cracks	Woodland impacted by mine subsidence are restored and comparable to the reference sites		No.	0	0	0	0	0	0	0	0	0
			Sum of subsidence cracks width	Provides an assessment of the extent of subsidence cracking and demonstrates that repair works have been satisfactory		m	0	0	0	0	0	0	0	0	0
Phase 4: Growth medium development	Soil chemical, physical properties and amelioration	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH	pH is typical of the surrounding landscape or falls within desirable ranges provided by the agricultural industry		pH (5.6-7.3)	6.3	5.8	5.6	5.6	6.3	5.9	5.8	5.9	5.9
			EC	Electrical Conductivity is typical of the surrounding landscape or fall within desirable ranges provided by the agricultural industry		< dS/m (<0.150)	0.082	0.051	0.068	0.051	0.082	0.070	0.091	0.100	0.078

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
			Organic Matter	Organic Matter levels are typical of the surrounding landscape, increasing or fall within desirable ranges provided by the agricultural industry		% (>4.5)	10.3	5.1	6.2	5.1	10.3	8.1	6.8	10.0	11.1
			Phosphorous	Available Phosphorus is typical of the surrounding landscape or fall within desirable ranges provided by the agricultural industry		mg/kg (50)	7.1	6.8	13.0	6.8	13.0	5.7	6.0	6.3	8.5
			Nitrate		Nitrate levels are typical of the surrounding landscape or fall within desirable ranges provided by the agricultural industry	mg/kg (>12.5)	1.6	2.3	1.2	1.2	2.3	0.3	0.4	0.7	0.6
			CEC		Cation Exchange Capacity is typical of the surrounding landscape or fall within desirable ranges provided by the agricultural industry	Cmol+/kg (>14)	14.3	6.8	8.9	6.8	14.3	9.4	9.7	11.1	11.9
			ESP		Exchangeable Sodium Percentage (a measure of sodicity) is typical of the surrounding landscape or fall within desirable ranges provided by the agricultural industry	% (<5)	1.6	3.3	4.0	1.6	4.0	2.8	4.3	3.8	2.9
Phase 5: Ecosystem & Landuse Establishment	Landscape Function Analysis (LFA): Landform stability and organisation	Landform is stable and performing as it was designed to do	LFA Stability	The LFA stability index provides an indication of the sites stability and is comparable to or trending towards that of the local remnant vegetation		%	70.1	68.0	71.0	68.0	71.0	75.5	67.5	68	69.5
			LFA Landscape organisation	The Landscape Organisation Index provides a measure of the ability of the site to retain resources and is comparable to the local remnant vegetation		%	88	100	100	88	100	100	100	100	100
	Vegetation diversity	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Diversity of shrubs and juvenile trees	The diversity of shrubs and juvenile trees with a stem diameter < 5cm is comparable to the local remnant vegetation.		species/ area	3	3	2	2	3	6	5	5	3
				The percentage of shrubs and juvenile trees with a stem diameter < 5cm dbh which are local endemic species and these percentages are comparable to the local remnant vegetation		% population	88	100	100	88	100	99	100	85	94

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
			Total species richness	The total number of live plant species provides an indication of the floristic diversity of the site and is comparable to the local remnant vegetation		No./area	65	57	59	57	65	59	52	52	58
			Native species richness	The total number of live native plant species provides an indication of the native plant diversity of the site and that it is greater than or comparable to the local remnant vegetation		>No./area	45	39	41	39	45	46	39	36	42
			Exotic species richness	The total number of live exotic plant species provides an indication of the exotic plant diversity of the site and that it is less than or comparable to the local remnant vegetation		<No./area	20	18	18	18	20	13	13	16	16
	Vegetation density	Vegetation contains a density of species comparable to that of the local remnant vegetation	Density of shrubs and juvenile trees		The total density of shrubs or juvenile trees with a stem diameter < 5cm is comparable to the local remnant vegetation	No./area	137	22	27	22	137	194	211	53	101
				The density of eucalypts is comparable to the local remnant vegetation		No./area	0	19	26	0	26	68	6	4	10
				The density of acacias is comparable to the local remnant vegetation		No./area	0	1	0	0	1	37	7	2	0
				The density of other endemic shrubs is comparable to the local remnant vegetation		No./area	121	2	1	1	121	88	198	39	85
				The density of exotic / non endemics comparable to the local remnant vegetation		<No./area	16	0	0	0	16	1	0	8	6
				The percentage of eucalypts is comparable to the local remnant vegetation		% population	0	86	96	0	96	35	3	8	10
					The density of endemic shrubs or juvenile trees with a stem diameter < 5cm is comparable to that of the local remnant vegetation	No./area	121	22	27	22	121	193	211	45	95

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
	Ecosystem composition	The vegetation is comprised by a range of growth forms comparable to that of the local remnant vegetation	Trees	The number of tree species regardless of age comprising the vegetation community is comparable to the local remnant vegetation		No./area	2	2	2	2	2	2	2	2	2
			Shrubs	The number of shrub species regardless of age comprising the vegetation community is comparable to the local remnant vegetation		No./area	2	1	0	0	2	4	3	3	2
			Sub-shrubs		The number of sub-shrub species comprising the vegetation community is comparable to the local remnant vegetation	No./area	4	4	5	4	5	3	3	5	2
			Herbs	The number of herbs or forb species comprising the vegetation community is comparable to the local remnant vegetation		No./area	38	36	33	33	38	30	28	26	35
			Grasses	The number of grass species comprising the vegetation community is comparable to the local remnant vegetation		No./area	15	9	13	9	15	14	12	13	13
			Reeds		The number of reed, sedge or rush species comprising the vegetation community is comparable to the local remnant vegetation	No./area	1	3	4	1	4	3	1	1	1
			Vines		The number of vines or climbing species comprising the vegetation community is comparable to the local remnant vegetation	No./area	0	0	0	0	0	0	0	0	0
			Ferns		The number of ferns comprising the vegetation community is comparable to the local remnant vegetation	No./area	1	1	1	1	1	1	1	1	1
			Cactus		The number of cactus comprising the vegetation community is comparable to the local remnant vegetation	<No./area	2	1	1	1	2	2	2	1	2

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
			Aquatic		The number of aquatic plants comprising the vegetation community is comparable to the local remnant vegetation	No./area	0	0	0	0	0	0	0	0	0
Phase 6: Ecosystem & Landuse Development	Landscape Function Analysis (LFA): Landform function and ecological performance	Landform is ecologically functional and performing as it was designed to do	LFA Infiltration	LFA infiltration index provides an indication of the sites infiltration capacity and is comparable to or trending towards that of the local remnant vegetation		%	45.7	56.0	56.3	45.7	56.3	34.9	44.9	52.2	44.2
			LFA Nutrient recycling	LFA nutrient recycling index provides an indication of the sites ability to recycle nutrient and is comparable to or trending towards that of the local remnant vegetation		%	46.8	52.7	51.5	46.8	52.7	39.3	46.7	52.4	44.1
	Protective ground cover	Ground layer contains protective ground cover and habitat structure comparable with the local remnant vegetation	Litter cover		Percent ground cover provided by dead plant material is comparable to the local remnant vegetation	%	33	56	73	33	73	65	84.5	74	83.5
			Annual plants		Percent ground cover provided by live annual plants is comparable to the local remnant vegetation	<%	1	3	2	1	3	2	0	0	3
			Cryptogam cover		Percent ground cover provided by cryptogams (e.g. mosses, lichens) is comparable to the local remnant vegetation	%	11	3	0	0	11	3.5	0	0	1
			Rock		Percent ground cover provided by stones or rocks (> 5cm diameter) is comparable to the local remnant vegetation	%	1	3	0	0	3	1.8	0	0	0
			Log		Percent ground cover provided by fallen branches and logs (>5cm) is comparable to the local remnant vegetation	%	0	1	0	0	1	0	0	1.5	1.4
			Bare ground		Percentage of bare ground is less than or comparable to the local remnant vegetation	< %	48	1	1	1	48	2	8	0	2.1
			Perennial plant cover (< 0.5m)		Percent ground cover provided by live perennial vegetation (<0.5m in height) is comparable to the local remnant vegetation	%	7	35	26	7	35	25.7	7.5	24.5	9

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
			Total Ground Cover	Total groundcover is the sum of protective ground cover components (as described above) and that it is comparable to the local remnant vegetation		%	52	99	100	52	100	98	92	100	97.9
	Ecosystem growth and natural recruitment	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the local remnant vegetation	shrubs and juvenile trees 0 - 0.5m in height	The number of shrubs or juvenile trees <0.5m in height provides an indication of establishment success and/or natural ecosystem recruitment and is comparable to the local remnant vegetation		No./area	33	14	7	7	33	88	39	30	43
			shrubs and juvenile trees 0.5 - 1m in height	The number of shrubs or juvenile trees 0.5-1m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation		No./area	22	1	5	1	22	62	52	14	31
			shrubs and juvenile trees 1 - 1.5m in height	The number of shrubs or juvenile trees 1-1.5m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation		No./area	13	1	6	1	13	22	34	6	11
			shrubs and juvenile trees 1.5 - 2m in height	The number of shrubs or juvenile trees 1.5-2m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation		No./area	24	0	1	0	24	4	34	1	10
			shrubs and juvenile trees >2m in height	The number of shrubs or juvenile trees >2m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation		No./area	45	6	8	6	45	18	52	2	6

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
	Ecosystem structure	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5 - 2 m	Projected foliage cover provided by perennial plants in the 0.5 - 2m vertical height stratum indicates the community structure is comparable to the local remnant vegetation		% cover	1	1	2	1	2	1.7	3.5	0	0.2
			Foliage cover 2 - 4m	Projected foliage cover provided by perennial plants in the 2 - 4m vertical height stratum indicates the community structure is comparable to the local remnant vegetation		% cover	0	1	8	0	8	8.5	0.5	0	0.5
			Foliage cover 4 - 6m	Projected foliage cover provided by perennial plants in the 4 -6m vertical height stratum indicates the community structure is comparable to the local remnant vegetation		% cover	2	2	5	2	5	13	4	1	4.5
			Foliage cover >6m	Projected foliage cover provided by perennial plants >6m vertical height stratum indicates the community structure is comparable to the local remnant vegetation		% cover	6	13	23	6	23	15	27	23	17
	Tree diversity	Vegetation contains a diversity of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree diversity	The diversity of trees or shrubs with a stem diameter >5cm is comparable to the local remnant vegetation		species/area	2	1	1	1	2	2	2	2	2
				The percentage of maturing trees and shrubs with a stem diameter >5cm dbh which are local endemic species and these percentages are comparable to the local remnant vegetation		%	100	100	100	100	100	100	100	100	100
	Tree density	Vegetation contains a density of maturing tree and shrubs	Live Tree and mature shrub density (> 5 cm dbh)		The total density of live trees and/or mature shrubs with a stem diameter > 5cm is comparable to that of the local remnant vegetation	No./area	15	16	80	15	80	26	44	41	37

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
		species comparable to that of the local remnant vegetation		The density of eucalypts is comparable to that of the local remnant vegetation		No./area	5	16	80	5	80	3	34	34	4
				The density of acacias is comparable to the local remnant vegetation		No./area	0	0	0	0	0	0	0	0	0
				The density of other endemic species is comparable to the local remnant vegetation		No./area	10	0	0	0	10	23	10	7	33
				The density of exotic / non endemic species is comparable to the local remnant vegetation		<No./area	0	0	0	0	0	0	0	0	0
				The percentage of eucalypts is comparable to the local remnant vegetation		% population	33	100	100	33	100	12	77	83	11
			Average dbh		Average tree diameter of the tree population provides a measure of age, (height) and growth rate and that it is trending towards that of the local remnant vegetation.	cm	12	17	11	11	17	10	14	12	14
	Ecosystem health	The vegetation is in a condition comparable to that of the local remnant vegetation.	Live trees		The percentage of the tree population which are live individuals and that the percentage is comparable to the local remnant vegetation	% population	94	94	99	94	99	100	92	80	95
			Healthy trees		The percentage of the tree population which are in healthy condition and that the percentage is comparable to the local remnant vegetation	% population	44	59	16	16	59	54	15	27	8

Rehabilitation Phase	Aspect or ecosystem component	RMP Completion criteria	Performance Indicators	Primary Performance Indicators	Secondary Performance Indicators	Unit of measure	RWood01	RWood02	RWood04	Woodland ecosystem range 2025		RUMEx01	RUMEx02	RUMEx03	RUMEx04
			Medium health		The percentage of the tree population which are in a medium health condition and that the percentage is comparable to the local remnant vegetation	% population (if greater than dieback)	50	35	70	35	70	42	69	41	77
			Advanced dieback		The percentage of the tree population which are in a state of advanced dieback and that the percentage is comparable to the local remnant vegetation	% population	0	0	12	0	12	4	8	12	10
			Dead Trees		The percentage of the tree population which are dead (stags) and that the percentage is comparable to the local remnant vegetation	% population	6	6	1	1	6	0	8	20	5
			Mistletoe		The percentage of the tree population which have mistletoe provides an indication of community health and habitat value and that the percentage is comparable to the local remnant vegetation	% population	0	0	0	0	0	0	0	0	0
			Flowers/fruit: Trees	The presence of reproductive structures such as buds, flowers or fruit provides evidence that the ecosystem is maturing, capable of recruitment and can provide habitat resources comparable to that of the local remnant vegetation		% population	6	0	0	0	6	8	2	8	13
			Hollows		The presence of hollows provides evidence that the ecosystem is maturing, and can provide habitat resources comparable to the local remnant vegetation	No./area	0	0	0	0	0	0	0	0	0
			Logs		The presence of logs provides evidence that the ecosystem is maturing, and can provide habitat resources comparable to that of the local remnant vegetation	m	7	1	3	1	7	9	6	0	28

Appendix 6. 2025 ACOL soil analysis – Certificate of Analysis



Soils - Certificate of Analysis - E25-00-5714

Client:	DnA Environmental	Laboratory:	Environmental Analysis Laboratory
Contact:	Andrew Johnston	Contact:	EAL Customer Service Team
Address:	417 Mandurama Road, NSW 2792, Australia	Address:	Military Road, East Lismore NSW 2480, Australia
Telephone:	02 6367 4441	Telephone:	(02) 6620 3678
Email:	andrew@dnaenviro.com.au	Email:	eal@scu.edu.au

Customer reference:	ACOLx49 Soil Samples	Request ID:	EAL/E25-00-5714
Number of samples:	49	Report ID:	E25-00-5714_EALP1_1
Date samples received:	27 May 2025	Issue date:	04 June 2025

Authorised by:	Kris Saville
Position:	Technical Team Leader



Comments: EAL is a NATA accredited laboratory (14960), accredited for compliance with ISO/IEC 17025 - Testing.
Samples received on 23/05/2025.

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				M2008 01	M2008 02	M2008 03	M2009 01	M2010 01
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				5 May 2025	5 May 2025	5 May 2025	5 May 2025	5 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0001	E25-00-5714-0002	E25-00-5714-0003	E25-00-5714-0004	E25-00-5714-0005
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	838	927	1490	1990	1530
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	417	493	502	633	433
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	127	155	127	206	247
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	3.0	29.8	14.8	44.0	29.5
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	6.4	100	25	41	55
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	9.7	490	72	130	130
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	31	420	200	430	350
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	0.8	4.3	9.2	8.1	29.6
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	2.1	4.6	1.9	4.8	2.7
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	9.7	35	12	28	31
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	6.95	6.81	7.79	7.81	6.82
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.071	0.111	0.123	0.174	0.199
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	8.10	8.85	12.1	16.7	14.0
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	3640	3970	5440	7490	6270
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	1620	1770	2430	3340	2800
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	5.18	5.65	5.78	6.58	4.66
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	1410	1540	1570	1790	1270
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	630	687	702	800	567
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.61	0.78	0.63	1.09	1.20
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	534	683	549	957	1050
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	238	305	245	427	468
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.16	0.20	0.26	0.64	0.18
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	81.2	101	132	330	93.9
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	36.2	45.2	58.9	147	41.9
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	2.8	1.7	< 1	< 1	< 1
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	1.3	< 1	< 1	< 1	< 1
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	< 1	< 1	< 1	< 1	< 1
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	< 1	< 1	< 1	< 1	< 1
Calcium - Base Saturation	%	** Calculation	<0.1	58	57	65	67	70
Magnesium - Base Saturation	%	** Calculation	<0.1	37	36	31	26	23
Potassium - Base Saturation	%	** Calculation	<0.1	4.3	5.0	3.3	4.4	6.0
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	1.1	1.3	1.4	2.6	0.9
Aluminium - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hydrogen - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Calcium/Magnesium Ratio	---	** Calculation	<0.1	1.6	1.6	2.1	2.5	3.0
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	14.1	15.5	18.8	25.0	20.0
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	8.1	60.8	15.7	44.0	54.5
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	7.9	5.4	5.8	8.2	12.0
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	81.2	170	43.6	55.3	139
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	1.9	8.8	3.4	4.5	5.4
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.41	1.4	0.58	0.78	0.95
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	53	51	40	65	72
Carbon - Total	%	Inhouse S4a	<0.03	4.22	5.15	3.81	7.10	7.64
Nitrogen - Total	%	Inhouse S4a	<0.02	0.24	0.35	0.27	0.58	0.60
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	17.9	14.6	14.4	12.3	12.8

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				M2008 01	M2008 02	M2008 03	M2009 01	M2010 01
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				5 May 2025	5 May 2025	5 May 2025	5 May 2025	5 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0001	E25-00-5714-0002	E25-00-5714-0003	E25-00-5714-0004	E25-00-5714-0005
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	7.39	9.01	6.67	12.4	13.4
Basic Texture	---	** Inhouse S65	---	Clay Loam	Clay Loam	Clay Loam	Loam	Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	96.8	97.7	145	201	101
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1320	1020	1590	1270	1100
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	2410	4480	4780	6500	4320
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	2160	1510	3480	2330	1360
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	309	1940	593	912	808
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	7520	5120	7950	5620	4550
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	5.98	4.39	4.15	4.32	3.74
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	0.501	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	10.6	10.3	13.1	16.2	12.2
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	15	37	33	43	35
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	20800	11800	21200	12400	15700
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	227	156	338	209	184
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	6.69	6.60	11.1	10.0	8.75
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	16.5	20.9	27.2	57.5	64.1
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	54	155	102	127	116
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	0.147	< 0.1	0.159	0.100
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.0	3.0	2.9	3.4	3.1
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	998	760	909	743	839
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	7.4	5.4	12	7.1	5.9
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	0.81	0.77	0.63	0.66	0.77
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	219	559	347	766	606
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	45	71	79	111	127

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				M2012 03	M2012 04	RWood01	RWood02	RWood04
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				5 May 2025	6 May 2025	7 May 2025	6 May 2025	6 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0006	E25-00-5714-0007	E25-00-5714-0008	E25-00-5714-0009	E25-00-5714-0010
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	1080	901	843	350	401
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	690	562	331	162	265
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	119	95	118	124	103
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	1.8	2.9	2.3	1.6	1.8
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	5.2	6.7	4.0	3.8	5.9
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	6.7	5.7	7.1	6.8	13
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	78	100	12	5.5	9.7
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	1.1	0.4	1.6	2.3	1.2
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	1.2	1.1	3.9	2.7	2.1
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	20	11	14	10	6.2
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	8.83	7.95	6.26	5.76	5.64
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.172	0.084	0.082	0.051	0.068
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	7.28	7.45	9.09	3.64	4.39
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	3270	3340	4080	1630	1970
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	1460	1490	1820	730	881
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	7.28	6.38	4.08	1.97	3.16
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	1980	1740	1110	536	861
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	885	776	496	239	384
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.53	0.46	0.61	0.63	0.54
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	468	401	533	548	469
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	209	179	238	244	209
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.77	0.22	0.23	0.22	0.36
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	397	113	121	114	183
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	177	50.6	53.9	51.0	81.9
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	< 0.01	< 0.01	< 0.01	0.07	0.11
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	< 1	< 1	< 1	13	22
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	< 1	< 1	< 1	5.8	9.9
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	< 0.01	< 0.01	0.30	0.23	0.31
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	< 1	< 1	6.8	5.1	6.9
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	< 1	< 1	3.0	2.3	3.1
Calcium - Base Saturation	%	** Calculation	<0.1	46	51	63	54	50
Magnesium - Base Saturation	%	** Calculation	<0.1	46	44	28	29	36
Potassium - Base Saturation	%	** Calculation	<0.1	3.4	3.2	4.3	9.3	6.0
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	4.9	1.5	1.6	3.3	4.0
Aluminium - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	1.0	1.2
Hydrogen - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	2.1	3.4	3.5
Calcium/Magnesium Ratio	---	** Calculation	<0.1	1.0	1.2	2.2	1.8	1.4
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	15.9	14.5	14.3	6.8	8.9
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	9.1	9.3	4.8	3.4	3.2
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	4.0	3.2	15.8	30.4	21.5
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	72.1	48.6	115	236	386
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	4.0	3.5	0.9	0.5	0.6
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.29	0.41	0.91	0.62	0.76
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	13	13	61	43	47
Carbon - Total	%	Inhouse S4a	<0.03	3.63	4.56	5.88	2.93	3.53
Nitrogen - Total	%	Inhouse S4a	<0.02	0.18	0.22	0.32	0.20	0.20
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	20.2	20.7	18.1	14.4	17.9

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				M2012 03	M2012 04	RWood01	RWood02	RWood04
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				5 May 2025	6 May 2025	7 May 2025	6 May 2025	6 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0006	E25-00-5714-0007	E25-00-5714-0008	E25-00-5714-0009	E25-00-5714-0010
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	6.35	7.98	10.3	5.13	6.18
Basic Texture	---	** Inhouse S65	---	Clay Loam	Clay Loam	Clay Loam	Loam	Loam
Basic Colour	---	** Inhouse S65	---	Grey	Grey	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	251	136	72.3	68.2	149
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1310	1460	979	711	1260
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	5040	3800	1920	686	1310
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	3760	4170	918	676	1420
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	429	414	189	167	253
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	2810	6250	4650	4040	7390
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	4.14	8.04	4.93	2.82	5.39
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	8.44	10.4	6.02	6.73	9.23
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	29	27	11	3.0	6.3
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	21400	19100	17900	8030	14500
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	381	313	222	269	264
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	12.6	13.2	6.63	2.65	5.20
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	22.9	23.1	9.96	7.22	10.3
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	93	91	43	15	26
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.4	2.7	2.1	< 2	2.3
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	725	910	806	654	1010
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	12	12	8.4	3.8	5.4
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	0.56	0.39	0.52	0.33	0.86
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	273	357	315	175	207
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	110	54	52	33	44

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				RGrass01	RGrass02	RGrass03	SVCA 01	SVCA 02
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				7 May 2025	6 May 2025	6 May 2025	9 May 2025	9 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0011	E25-00-5714-0012	E25-00-5714-0013	E25-00-5714-0014	E25-00-5714-0015
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	267	448	371	354	724
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	308	280	238	381	303
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	149	96	123	140	128
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	1.3	1.2	1.4	1.9	2.3
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	4.8	2.6	2.7	3.7	3.7
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	13	5.6	7.1	6.8	7.7
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	7.4	3.6	3.8	5.3	6.0
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	2.3	1.2	2.9	1.3	3.8
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	2.4	2.3	2.5	6.5	3.2
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	9.4	10	5.4	13	17
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	5.77	6.07	5.95	5.85	6.00
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.057	0.043	0.044	0.077	0.100
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	2.59	4.48	3.61	4.13	8.03
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	1160	2010	1620	1860	3600
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	520	899	723	828	1610
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	3.62	3.16	2.80	4.86	3.88
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	986	861	763	1320	1050
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	440	384	341	590	471
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.73	0.55	0.63	0.73	0.70
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	638	478	555	639	616
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	285	213	248	285	275
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.20	0.27	0.21	0.41	0.24
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	102	138	109	210	126
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	45.6	61.7	48.8	93.7	56.1
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	0.07	0.02	0.02	0.04	0.03
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	14	3.0	4.6	7.5	5.4
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	6.3	1.3	2.1	3.3	2.4
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	0.26	0.26	0.24	0.28	0.26
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	5.9	5.8	5.3	6.2	5.8
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	2.6	2.6	2.4	2.8	2.6
Calcium - Base Saturation	%	** Calculation	<0.1	35	51	48	40	61
Magnesium - Base Saturation	%	** Calculation	<0.1	48	36	37	47	29
Potassium - Base Saturation	%	** Calculation	<0.1	9.7	6.2	8.4	7.0	5.4
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	2.7	3.1	2.8	3.9	1.9
Aluminium - Base Saturation	%	** Calculation	<0.1	0.9	0.2	0.3	0.4	0.2
Hydrogen - Base Saturation	%	** Calculation	<0.1	3.5	3.0	3.1	2.7	2.0
Calcium/Magnesium Ratio	---	** Calculation	<0.1	0.7	1.4	1.3	0.9	2.1
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	7.5	8.7	7.5	10.4	13.1
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	5.3	2.1	4.2	4.9	5.2
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	6.8	32.9	25.1	18.4	21.6
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	285	149	183	312	297
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	0.7	0.8	0.9	0.9	0.6
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.46	0.50	0.43	0.80	0.73
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	52	60	43	60	50
Carbon - Total	%	Inhouse S4a	<0.03	2.38	2.23	2.75	4.34	5.25
Nitrogen - Total	%	Inhouse S4a	<0.02	0.16	0.16	0.19	0.28	0.28
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	14.6	14.3	14.2	15.6	18.7

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				RGrass01	RGrass02	RGrass03	SVCA 01	SVCA 02
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				7 May 2025	6 May 2025	6 May 2025	9 May 2025	9 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0011	E25-00-5714-0012	E25-00-5714-0013	E25-00-5714-0014	E25-00-5714-0015
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	4.17	3.90	4.81	7.60	9.19
Basic Texture	---	** Inhouse S65	---	Clay	Clay	Clay Loam	Loam	Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	104	119	99.9	123	80.2
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1220	1240	1120	1250	766
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	693	1180	1030	1020	1780
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1100	1180	897	1320	648
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	158	138	192	224	209
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	6140	8260	6410	6060	4310
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	3.86	4.74	3.98	4.42	4.40
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	6.36	9.32	10.0	8.15	8.18
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	6.2	6.7	6.5	7.6	5.8
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	12100	13900	13100	16200	16200
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	92	567	396	303	215
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	3.26	5.46	4.46	5.42	4.28
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	7.49	7.54	9.45	10.3	9.56
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	32	23	23	32	23
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	< 2	< 2	< 2	< 2	2.5
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	864	839	824	839	838
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	5.0	6.8	6.1	6.5	4.9
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	0.52	0.42	0.40	0.63	0.42
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	190	161	181	277	265
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	36	28	28	49	64

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				SVCA 03	SVCA 04	SVCA 05	SVCA 06	C1
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				9 May 2025	9 May 2025	9 May 2025	10 May 2025	11 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0016	E25-00-5714-0017	E25-00-5714-0018	E25-00-5714-0019	E25-00-5714-0020
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	597	440	690	624	928
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	264	143	415	315	333
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	208	89	153	130	115
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	1.8	1.5	1.6	2.9	2.9
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	3.9	3.7	5.8	5.8	7.4
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	12	5.5	11	8.5	17
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	6.4	6.2	9.3	10	14
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	4.9	2.1	5.9	4.1	7.8
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	5.5	1.9	7.3	1.4	3.2
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	11	6.9	15	5.1	6.1
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	6.04	6.14	6.07	6.81	6.67
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.070	0.047	0.114	0.082	0.097
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	6.31	4.13	6.86	6.08	9.95
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	2830	1850	3080	2730	4460
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	1270	827	1370	1220	1990
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	3.49	1.68	5.21	3.89	4.28
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	950	458	1420	1060	1170
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	424	204	633	473	520
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	1.12	0.40	0.75	0.58	0.56
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	985	347	654	508	489
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	440	155	292	227	218
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.20	0.07	0.37	0.15	0.27
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	102	37.8	189	75.8	139
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	45.4	16.9	84.5	33.8	61.9
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	0.01	0.01	0.01	< 0.01	< 0.01
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	2.4	2.1	2.4	< 1	< 1
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	1.1	< 1	1.1	< 1	< 1
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	0.29	0.21	0.24	< 0.01	< 0.01
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	6.4	4.7	5.5	< 1	< 1
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	2.9	2.1	2.4	< 1	< 1
Calcium - Base Saturation	%	** Calculation	<0.1	55	64	51	57	66
Magnesium - Base Saturation	%	** Calculation	<0.1	31	26	39	36	28
Potassium - Base Saturation	%	** Calculation	<0.1	9.8	6.1	5.6	5.4	3.7
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	1.7	1.1	2.7	1.4	1.8
Aluminium - Base Saturation	%	** Calculation	<0.1	0.1	0.2	< 0.1	< 0.1	< 0.1
Hydrogen - Base Saturation	%	** Calculation	<0.1	2.5	3.2	1.8	< 0.1	< 0.1
Calcium/Magnesium Ratio	---	** Calculation	<0.1	1.8	2.5	1.3	1.6	2.3
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	11.4	6.5	13.4	10.7	15.1
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	3.5	3.4	4.0	1.5	2.3
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	42.1	29.3	14.1	6.4	18.5
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	144	126	166	60.8	84.3
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	0.9	0.3	0.4	0.3	0.6
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.42	0.49	0.67	0.51	0.89
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	55	38	56	49	60
Carbon - Total	%	Inhouse S4a	<0.03	3.00	2.72	4.69	2.67	2.93
Nitrogen - Total	%	Inhouse S4a	<0.02	0.22	0.18	0.28	0.15	0.19
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	13.6	15.4	16.5	17.9	15.6

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				SVCA 03	SVCA 04	SVCA 05	SVCA 06	C1
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				9 May 2025	9 May 2025	9 May 2025	10 May 2025	11 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0016	E25-00-5714-0017	E25-00-5714-0018	E25-00-5714-0019	E25-00-5714-0020
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	5.25	4.76	8.21	4.67	5.13
Basic Texture	---	** Inhouse S65	---	Clay Loam	Loam	Clay Loam	Clay Loam	Clay Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	114	57.7	113	92.1	143
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1840	629	824	846	1390
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	2410	1110	1520	1610	3100
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1800	423	846	946	1720
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	307	142	181	152	217
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	10000	3370	5410	5260	7010
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	3.96	4.41	4.13	3.28	2.74
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	14.5	3.73	6.72	8.37	6.40
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	8.9	3.5	4.2	5.3	5.4
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	15700	6290	9760	12300	11200
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	636	311	124	112	284
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	7.12	3.78	3.94	4.76	3.47
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	10.5	8.32	6.91	7.24	6.59
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	35	18	16	18	30
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	< 2	< 2	< 2	< 2	2.8
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	893	795	740	797	709
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	9.8	4.6	4.1	4.3	5.6
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	0.43	0.28	0.39	0.36	0.20
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	216	166	255	129	216
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	45	30	73	52	62

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				C2	C3	C4	R1	R3
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				12 May 2025	11 May 2025	11 May 2025	11 May 2025	12 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0021	E25-00-5714-0022	E25-00-5714-0023	E25-00-5714-0024	E25-00-5714-0025
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	907	755	1010	624	551
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	336	264	334	279	279
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	129	162	163	117	161
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	5.2	4.5	5.4	2.6	6.8
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	12	14	13	8.6	23
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	23	27	32	19	44
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	22	26	29	16	31
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	9.8	6.2	8.3	0.7	1.2
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	7.4	3.3	3.4	2.2	2.4
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	11	3.6	9.3	4.7	3.4
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	6.31	6.50	6.70	6.36	6.50
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.109	0.076	0.098	0.041	0.055
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	9.37	7.67	11.2	6.95	5.82
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	4200	3440	5020	3120	2610
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	1880	1540	2240	1390	1170
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	4.18	3.37	4.38	3.54	3.45
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	1140	918	1190	963	939
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	508	410	532	430	419
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.59	0.80	0.84	0.58	0.77
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	513	703	736	510	677
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	229	314	329	228	302
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.24	0.18	0.22	0.20	0.18
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	125	92.8	114	103	92.4
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	55.6	41.4	50.8	45.9	41.2
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	2.0	1.0	1.2	1.3	< 1
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	< 1	< 1	< 1	< 1	< 1
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	0.26	0.28	< 0.01	0.24	0.13
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	5.9	6.3	< 1	5.3	2.9
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	2.6	2.8	< 1	2.4	1.3
Calcium - Base Saturation	%	** Calculation	<0.1	64	62	67	60	56
Magnesium - Base Saturation	%	** Calculation	<0.1	29	27	26	31	33
Potassium - Base Saturation	%	** Calculation	<0.1	4.0	6.5	5.1	5.1	7.5
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	1.7	1.5	1.3	1.7	1.7
Aluminium - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hydrogen - Base Saturation	%	** Calculation	<0.1	1.8	2.3	< 0.1	2.0	1.2
Calcium/Magnesium Ratio	---	** Calculation	<0.1	2.2	2.3	2.6	2.0	1.7
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	14.6	12.3	16.6	11.5	10.4
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	2.9	1.8	2.3	1.5	2.3
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	27.1	26.6	22.0	22.7	21.4
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	118	70.6	65.6	94.0	84.5
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	0.6	0.5	0.5	0.4	0.4
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	1.5	0.62	1.3	0.46	0.54
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	55	51	68	49	44
Carbon - Total	%	Inhouse S4a	<0.03	4.09	2.41	3.30	1.98	2.21
Nitrogen - Total	%	Inhouse S4a	<0.02	0.27	0.16	0.21	0.13	0.15
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	15.3	14.9	15.4	14.9	14.4

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				C2	C3	C4	R1	R3
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				12 May 2025	11 May 2025	11 May 2025	11 May 2025	12 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0021	E25-00-5714-0022	E25-00-5714-0023	E25-00-5714-0024	E25-00-5714-0025
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	7.16	4.22	5.78	3.47	3.87
Basic Texture	---	** Inhouse S65	---	Loam	Clay Loam	Clay Loam	Loam	Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	151	143	100	152	134
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1510	1890	1260	1600	1640
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	3140	3110	2770	3070	2220
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1760	1830	1420	1850	1660
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	260	284	206	234	255
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	6630	8270	6030	7670	6800
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	3.76	3.81	2.12	2.98	2.86
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	6.71	8.06	5.30	8.09	6.41
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	5.6	7.1	4.9	5.9	5.8
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	12000	14000	9890	13000	11900
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	293	451	224	300	305
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	3.97	4.71	3.08	3.93	3.51
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	6.72	7.65	4.97	7.87	6.40
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	30	84	24	30	31
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	4.0	2.5	2.2	2.1	2.2
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	696	858	487	912	725
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	6.0	8.0	4.9	6.3	6.4
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	< 0.2	0.24	< 0.2	0.25	0.21
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	251	141	164	126	159
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	70	49	63	26	35

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				R5	R6	RRG01	Q3	Q4
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				10 May 2025	10 May 2025	12 May 2025	12 May 2025	11 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0026	E25-00-5714-0027	E25-00-5714-0028	E25-00-5714-0029	E25-00-5714-0030
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	663	700	1150	1060	776
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	481	427	646	359	271
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	126	173	139	84	155
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	2.3	2.1	5.6	3.3	3.3
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	8.5	5.2	12	6.7	5.7
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	26	13	37	16	11
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	15	9.3	57	17	14
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	3.2	2.3	4.3	6.7	6.7
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	2.2	4.1	3.4	2.4	2.2
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	12	9.6	12	4.9	6.1
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	7.11	6.32	7.37	7.28	7.08
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.134	0.074	0.103	0.084	0.087
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	6.53	7.72	14.0	9.66	7.55
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	2930	3470	6270	4340	3390
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	1310	1550	2800	1940	1510
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	6.12	5.67	8.59	4.09	3.24
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	1670	1540	2340	1110	882
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	743	689	1040	498	394
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.80	1.06	0.90	0.41	0.70
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	701	929	785	360	612
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	313	415	350	161	273
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	1.44	0.32	0.94	0.39	0.38
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	741	165	485	203	194
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	331	73.5	217	90.5	86.6
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	< 1	< 1	< 1	< 1	< 1
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	< 1	< 1	< 1	< 1	< 1
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	< 0.01	0.29	< 0.01	< 0.01	< 0.01
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	< 1	6.5	< 1	< 1	< 1
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	< 1	2.9	< 1	< 1	< 1
Calcium - Base Saturation	%	** Calculation	<0.1	44	51	57	66	64
Magnesium - Base Saturation	%	** Calculation	<0.1	41	38	35	28	27
Potassium - Base Saturation	%	** Calculation	<0.1	5.4	7.0	3.7	2.8	5.9
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	9.7	2.1	3.9	2.7	3.2
Aluminium - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hydrogen - Base Saturation	%	** Calculation	<0.1	< 0.1	1.9	< 0.1	< 0.1	< 0.1
Calcium/Magnesium Ratio	---	** Calculation	<0.1	1.1	1.4	1.6	2.4	2.3
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	14.9	15.1	24.4	14.6	11.9
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	3.3	2.7	2.7	2.8	2.7
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	17.5	25.2	20.1	12.9	8.1
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	86.6	107	54.2	55.2	80.9
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	0.6	0.7	1.2	0.5	0.4
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.69	0.76	0.91	0.61	0.71
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	74	73	77	65	62
Carbon - Total	%	Inhouse S4a	<0.03	3.05	3.41	3.09	2.18	2.82
Nitrogen - Total	%	Inhouse S4a	<0.02	0.19	0.26	0.21	0.15	0.20
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	16.2	13.2	14.8	14.3	13.9

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				R5	R6	RRG01	Q3	Q4
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				10 May 2025	10 May 2025	12 May 2025	12 May 2025	11 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0026	E25-00-5714-0027	E25-00-5714-0028	E25-00-5714-0029	E25-00-5714-0030
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	5.34	5.97	5.41	3.82	4.94
Basic Texture	---	** Inhouse S65	---	Clay	Clay Loam	Clay Loam	Clay Loam	Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	396	118	327	161	162
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1360	1390	1560	1070	1270
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1870	1700	4230	2580	2390
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1810	1370	3200	1440	1400
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	247	221	453	181	173
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	9550	7880	10500	5360	5240
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	3.37	3.38	2.91	2.77	2.57
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	8.71	7.96	17.9	5.80	5.78
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	6.5	5.7	12	4.6	4.2
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	12100	11500	17100	9960	10000
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	328	335	386	201	174
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	5.79	4.85	17.0	3.26	2.80
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	9.57	8.56	6.46	5.46	5.49
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	26	22	35	24	28
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.6	2.3	3.3	2.5	2.7
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	744	519	578	550	577
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	6.8	6.3	10	4.4	4.1
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	0.31	0.29	0.26	< 0.2	< 0.2
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	218	254	258	223	233
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	86	47	66	54	56

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				Q7	Q9	Q10	CC3	CC4
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				12 May 2025	14 May 2025	11 May 2025	8 May 2025	8 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0031	E25-00-5714-0032	E25-00-5714-0033	E25-00-5714-0034	E25-00-5714-0035
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	1010	996	917	867	850
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	476	297	312	264	278
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	114	159	143	95	120
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	4.3	4.5	4.7	3.1	2.5
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	10	6.6	7.4	5.9	5.1
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	30	13	17	13	9.2
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	39	20	22	16	12
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	15.4	7.1	5.2	0.8	5.9
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	2.1	4.4	4.2	2.2	1.2
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	6.7	5.3	5.6	8.5	5.8
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	7.09	6.92	7.14	7.54	7.34
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.098	0.075	0.083	0.087	0.080
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	10.7	9.98	9.26	9.17	8.22
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	4800	4480	4160	4120	3690
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	2140	2000	1860	1840	1650
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	5.99	3.62	3.87	3.46	3.41
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	1630	986	1050	943	930
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	728	440	470	421	415
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.61	0.80	0.67	0.50	0.56
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	534	696	590	438	490
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	239	311	264	195	219
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.41	0.17	0.17	0.39	0.28
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	213	86.8	89.2	199	144
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	95.2	38.8	39.8	88.9	64.4
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	< 1	< 1	< 1	< 1	< 1
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	< 1	< 1	< 1	< 1	< 1
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	< 1	< 1	< 1	< 1	< 1
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	< 1	< 1	< 1	< 1	< 1
Calcium - Base Saturation	%	** Calculation	<0.1	60	68	66	68	66
Magnesium - Base Saturation	%	** Calculation	<0.1	34	25	28	26	27
Potassium - Base Saturation	%	** Calculation	<0.1	3.4	5.5	4.8	3.7	4.5
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	2.3	1.2	1.2	2.9	2.2
Aluminium - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hydrogen - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Calcium/Magnesium Ratio	---	** Calculation	<0.1	1.8	2.8	2.4	2.6	2.4
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	17.7	14.6	14.0	13.5	12.5
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	2.6	3.3	3.2	2.3	2.2
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	10.2	12.4	13.2	10.0	9.2
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	93.4	71.7	54.9	47.5	47.5
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	0.7	0.5	0.5	0.4	0.4
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.80	0.63	0.56	0.72	0.64
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	65	73	48	58	57
Carbon - Total	%	Inhouse S4a	<0.03	2.89	2.85	2.97	2.64	1.68
Nitrogen - Total	%	Inhouse S4a	<0.02	0.20	0.22	0.21	0.15	0.12
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	14.5	13.1	14.0	17.6	14.2

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				Q7	Q9	Q10	CC3	CC4
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				12 May 2025	14 May 2025	11 May 2025	8 May 2025	8 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0031	E25-00-5714-0032	E25-00-5714-0033	E25-00-5714-0034	E25-00-5714-0035
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	5.06	4.99	5.20	4.62	2.94
Basic Texture	---	** Inhouse S65	---	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	185	141	121	188	161
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1220	1800	1440	1320	1350
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	3080	3600	3180	3280	2850
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	2100	1970	1740	1880	1780
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	300	275	277	218	177
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	7100	7940	6110	6420	6440
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.30	3.69	2.96	3.89	2.87
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	10.4	9.42	6.75	7.70	6.87
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	6.8	7.0	5.4	6.8	5.9
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	12500	14200	12400	14000	12700
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	222	275	265	268	232
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	8.24	5.84	3.91	4.10	3.47
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	5.73	7.30	6.28	7.27	6.58
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	27	38	31	33	29
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.5	2.8	2.6	3.0	2.3
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	585	724	690	704	662
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	6.9	6.8	5.7	6.3	5.1
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	< 0.2	0.26	< 0.2	0.22	< 0.2
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	234	230	295	283	188
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	63	48	53	56	51

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				CC5	UGPast01	UGPast02	UGPast03	UGPast04
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				8 May 2025	12 May 2025	10 May 2025	7 May 2025	7 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0036	E25-00-5714-0037	E25-00-5714-0038	E25-00-5714-0039	E25-00-5714-0040
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	774	609	668	410	436
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	230	250	249	335	324
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	110	290	429	112	143
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	1.7	4.1	8.1	1.6	1.4
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	3.8	12	32	3.2	3.8
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	3.9	54	140	8.3	8.2
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	11	24	65	5.3	5.8
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	2.4	12.0	8.0	4.7	1.9
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	1.7	15.6	6.2	3.1	4.4
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	1.9	14	13	8.3	9.7
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	7.58	6.19	6.22	5.98	6.21
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.072	0.099	0.097	0.058	0.065
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	7.21	6.58	7.28	4.18	4.45
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	3240	2950	3270	1880	2000
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	1450	1320	1460	837	891
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	2.77	3.10	3.04	4.03	4.01
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	753	844	828	1100	1090
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	336	377	370	489	488
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.49	1.61	2.38	0.64	0.78
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	428	1410	2090	558	684
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	191	629	932	249	305
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.19	0.27	0.23	0.26	0.33
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	100	141	117	134	172
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	44.7	62.7	52.4	60.0	76.6
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	< 0.01	< 0.01	< 0.01	0.03	0.02
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	< 1	1.0	< 1	4.9	3.3
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	< 1	< 1	< 1	2.2	1.5
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	< 0.01	0.28	0.24	0.26	0.23
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	< 1	6.3	5.4	5.9	5.2
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	< 1	2.8	2.4	2.6	2.3
Calcium - Base Saturation	%	** Calculation	<0.1	68	56	55	44	45
Magnesium - Base Saturation	%	** Calculation	<0.1	26	26	23	43	41
Potassium - Base Saturation	%	** Calculation	<0.1	4.6	14	18	6.8	8.0
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	1.8	2.3	1.7	2.8	3.4
Aluminium - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	< 0.1	0.3	0.2
Hydrogen - Base Saturation	%	** Calculation	<0.1	< 0.1	2.4	1.8	2.8	2.4
Calcium/Magnesium Ratio	---	** Calculation	<0.1	2.6	2.1	2.4	1.0	1.1
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	10.7	11.8	13.2	9.4	9.8
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	1.6	9.8	7.8	4.3	3.3
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	5.9	27.4	18.8	25.1	21.3
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	26.8	383	370	228	208
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	0.3	1.2	1.1	1.1	0.9
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.51	0.58	0.61	0.42	0.52
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	51	65	66	43	50
Carbon - Total	%	Inhouse S4a	<0.03	1.58	3.98	3.91	3.18	2.96
Nitrogen - Total	%	Inhouse S4a	<0.02	0.10	0.30	0.34	0.22	0.21
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	15.5	13.3	11.6	14.4	14.4

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				CC5	UGPast01	UGPast02	UGPast03	UGPast04
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				8 May 2025	12 May 2025	10 May 2025	7 May 2025	7 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0036	E25-00-5714-0037	E25-00-5714-0038	E25-00-5714-0039	E25-00-5714-0040
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	2.77	6.97	6.84	5.57	5.18
Basic Texture	---	** Inhouse S65	---	Loam	Clay Loam	Clay Loam	Clay	Clay
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	142	106	98.2	90.0	112
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1250	1690	2180	774	1090
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	2500	1550	2350	957	1130
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1520	1150	1300	747	1090
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	148	325	436	170	256
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	5660	5860	6620	5730	7260
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.62	2.82	2.64	3.34	3.98
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	6.19	5.26	6.06	7.35	9.16
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	4.4	5.7	7.3	6.2	7.2
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	12100	8420	8680	10500	31400
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	184	282	325	278	429
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	3.23	2.80	3.44	3.90	4.67
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	6.40	8.26	8.32	8.58	10.3
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	25	32	35	19	25
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.3	< 2	< 2	< 2	< 2
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	587	525	662	562	697
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	4.5	4.4	5.1	4.1	7.0
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	< 0.2	0.27	0.29	0.47	0.45
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	117	307	323	218	213
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	46	63	62	37	42

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				UGPast05	UGPast06	UGWood01	UGWood02	UGWood03
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				8 May 2025	8 May 2025	7 May 2025	7 May 2025	8 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0041	E25-00-5714-0042	E25-00-5714-0043	E25-00-5714-0044	E25-00-5714-0045
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	1190	427	193	256	310
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	551	429	127	162	268
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	205	103	59	85	103
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	12.8	1.3	< 1	1.0	1.5
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	38	4.9	5.1	3.1	3.6
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	150	14	6.9	4.5	11
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	100	8.6	8.5	4.9	5.9
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	8.4	1.7	0.5	1.7	1.3
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	7.6	2.0	2.1	2.7	3.2
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	14	7.1	11	6.9	3.5
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	6.55	6.35	5.21	5.70	5.96
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.101	0.070	0.054	0.046	0.053
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	14.4	4.27	1.90	2.30	3.21
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	6440	1920	851	1030	1440
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	2880	855	380	460	643
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	7.53	5.42	1.41	1.69	3.21
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	2050	1470	383	460	875
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	915	658	171	205	391
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	1.29	0.65	0.32	0.38	0.53
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	1130	568	279	333	466
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	502	254	125	149	208
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.51	0.69	0.17	0.12	0.36
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	264	354	89.2	63.9	184
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	118	158	39.8	28.5	82.0
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	< 0.01	0.01	0.37	0.06	0.04
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	< 1	2.2	74	12	7.1
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	< 1	< 1	33	5.5	3.2
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	< 0.01	0.22	0.45	0.22	0.23
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	< 1	5.0	10	4.9	5.1
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	< 1	2.2	4.5	2.2	2.3
Calcium - Base Saturation	%	** Calculation	<0.1	61	38	41	48	42
Magnesium - Base Saturation	%	** Calculation	<0.1	32	48	31	35	42
Potassium - Base Saturation	%	** Calculation	<0.1	5.4	5.8	6.9	8.0	7.0
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	2.2	6.1	3.8	2.6	4.7
Aluminium - Base Saturation	%	** Calculation	<0.1	< 0.1	< 0.1	8.0	1.3	0.5
Hydrogen - Base Saturation	%	** Calculation	<0.1	< 0.1	2.0	9.8	4.6	3.0
Calcium/Magnesium Ratio	---	** Calculation	<0.1	1.9	0.8	1.3	1.4	1.0
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	23.7	11.3	4.6	4.8	7.6
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	4.1	1.7	3.0	2.8	4.4
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	21.8	9.4	16.1	12.5	20.1
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	199	237	255	226	183
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	1.8	0.9	0.3	0.4	0.6
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.65	0.50	0.27	0.31	0.41
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	78	54	36	35	49
Carbon - Total	%	Inhouse S4a	<0.03	4.68	2.32	2.80	2.23	3.16
Nitrogen - Total	%	Inhouse S4a	<0.02	0.37	0.18	0.16	0.14	0.21
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	12.6	12.8	17.1	16.2	15.1

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				UGPast05	UGPast06	UGWood01	UGWood02	UGWood03
Sample Depth:				10cm	10cm	10cm	10cm	10cm
Sample Date:				8 May 2025	8 May 2025	7 May 2025	7 May 2025	8 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0041	E25-00-5714-0042	E25-00-5714-0043	E25-00-5714-0044	E25-00-5714-0045
Parameter	Unit	Method Reference	LOR	---	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	8.19	4.06	4.90	3.90	5.53
Basic Texture	---	** Inhouse S65	---	Clay	Clay	Loam	Loam	Clay Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Grey	Grey	Grey	Grey
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	211	213	67.2	70.4	125
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1730	903	552	647	779
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	4440	1090	487	602	978
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	2840	1220	421	564	709
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	692	167	128	123	298
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	10400	8150	3610	4020	5740
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.48	3.21	< 2	3.68	3.84
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	17.8	12.3	3.36	5.25	7.49
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	14	6.2	3.1	4.3	5.9
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	16200	11500	4570	10300	12100
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	449	119	88	147	304
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	16.9	5.19	2.33	3.44	4.11
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	6.86	9.64	6.23	7.53	10.0
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	38	12	11	21	24
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	2.6	< 2	< 2	< 2	< 2
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	559	691	829	792	627
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	11	4.9	2.5	5.1	4.8
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	0.39	0.63	0.28	0.43	0.61
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	363	151	134	125	218
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	65	45	35	29	34

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				RUMEx01	RUMEx02	RUMEx03	RUMEx04
Sample Depth:				10cm	10cm	10cm	10cm
Sample Date:				13 May 2025	13 May 2025	13 May 2025	13 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0046	E25-00-5714-0047	E25-00-5714-0048	E25-00-5714-0049
Parameter	Unit	Method Reference	LOR	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<10	314	344	402	471
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	382	368	384	401
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<25	105	98	108	86
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	<1	1.4	1.7	1.7	1.6
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	<1	2.7	3.6	3.6	3.4
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2	<1	5.7	6.0	6.3	8.5
Phosphorus - Bray 2	mg/kg	** Inhouse S3A	<1	6.4	7.2	8.0	10
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	0.3	0.4	0.7	0.6
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37	<0.1	2.9	2.1	2.7	2.4
Sulfur - KCl extractable	mg/kg	** Inhouse S37	<1	11	15	16	13
pH (H2O)	units	Rayment & Lyons 2011 - 4A1	---	5.89	5.81	5.89	5.89
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1	<0.005	0.070	0.091	0.100	0.078
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.05	3.60	3.91	4.79	5.63
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<22	1620	1750	2150	2530
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<10	722	783	961	1130
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.01	4.75	4.58	5.07	5.16
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<2	1290	1250	1380	1400
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<1	577	557	616	627
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.12	0.55	0.51	0.55	0.47
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<112	485	448	480	412
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<50	217	200	214	184
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3	<0.065	0.26	0.42	0.42	0.35
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3	<33	135	216	218	179
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3	<15	60.4	96.6	97.1	79.9
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37	<0.01	0.02	0.03	0.02	0.01
Aluminium - Exchangeable	kg/ha	** Inhouse S37	<1	3.5	5.4	3.3	2.9
Aluminium - Exchangeable	mg/kg	** Inhouse S37	<1	1.6	2.4	1.5	1.3
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1	<0.01	0.26	0.28	0.25	0.24
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1	<1	5.7	6.3	5.5	5.5
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1	<1	2.6	2.8	2.5	2.4
Calcium - Base Saturation	%	** Calculation	<0.1	38	40	43	47
Magnesium - Base Saturation	%	** Calculation	<0.1	50	47	46	43
Potassium - Base Saturation	%	** Calculation	<0.1	5.9	5.3	4.9	4.0
Sodium - Base Saturation (ESP)	%	** Calculation	<0.1	2.8	4.3	3.8	2.9
Aluminium - Base Saturation	%	** Calculation	<0.1	0.2	0.3	0.1	0.1
Hydrogen - Base Saturation	%	** Calculation	<0.1	2.7	2.9	2.2	2.1
Calcium/Magnesium Ratio	---	** Calculation	<0.1	0.8	0.9	0.9	1.1
Effective Cation Exchange Capacity	cmol+/kg	** Calculation	---	9.4	9.7	11.1	11.9
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	8.3	5.6	5.9	7.5
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	23.3	23.4	26.0	23.5
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.5	237	283	257	238
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1	<0.1	0.9	0.7	0.8	1.0
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2	<0.1	0.56	0.66	0.62	0.65
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11	<1	75	69	47	66
Carbon - Total	%	Inhouse S4a	<0.03	4.60	3.90	5.72	6.36
Nitrogen - Total	%	Inhouse S4a	<0.02	0.25	0.20	0.27	0.34
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a	<1	18.8	19.5	21.6	18.9

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Client Sample ID:				RUMEx01	RUMEx02	RUMEx03	RUMEx04
Sample Depth:				10cm	10cm	10cm	10cm
Sample Date:				13 May 2025	13 May 2025	13 May 2025	13 May 2025
Your Client:				ACOL	ACOL	ACOL	ACOL
EAL Sample ID:				E25-00-5714-0046	E25-00-5714-0047	E25-00-5714-0048	E25-00-5714-0049
Parameter	Unit	Method Reference	LOR	---	---	---	---
Estimated Organic Matter	%	Inhouse S4a	<0.04	8.05	6.83	10.0	11.1
Basic Texture	---	** Inhouse S65	---	Loam	Clay Loam	Clay Loam	Loam
Basic Colour	---	** Inhouse S65	---	Brownish	Brownish	Brownish	Brownish
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	113	150	< 50	119
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1140	1050	50.1	978
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1130	1110	707	2170
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	1240	1130	74.2	1870
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	178	217	53.3	426
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	< 1	< 1	< 1	< 1
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	6400	6820	1300	16900
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	5.35	6.99	< 2	3.38
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	7.20	9.03	6.46	40.1
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	11	9.0	3.6	13
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	19300	30400	4710	30400
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	470	476	17	479
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	8.26	7.10	< 1	38.8
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	12.8	13.5	1.22	5.29
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<1	54	42	2.2	36
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<2	< 2	< 2	< 2	3.3
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<50	672	853	594	247
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.05	11	6.6	0.37	16
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	<0.2	0.49	0.62	< 0.2	0.24
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	<50	241	217	256	323
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	45	58	64	50

Guideline:			Heavy Soil Guidelines	Medium Soil Guidelines	Light Soil Guidelines	Sandy Soil Guidelines
Parameter	Unit	Method Reference	---	---	---	---
Calcium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	1150	750	375	175
Magnesium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	160	105	60	25
Potassium - Soluble	mg/kg	** Inhouse S10 - Morgan 1	113	75	60	50
Phosphorus - Soluble	mg/kg	** Inhouse S10 - Morgan 1	15	12	10	5.0
Phosphorus - Bray 1	mg/kg	** Rayment & Lyons 2011 - 9E2	45	30	24	20

Certificate of Analysis

Request ID: EAL/E25-00-5714 Report ID: E25-00-5714_EALP1_1 Issue date: 04 June 2025

Parameter	Unit	Method Reference	Guideline:	Heavy Soil Guidelines	Medium Soil Guidelines	Light Soil Guidelines	Sandy Soil Guidelines
Phosphorus - Colwell	mg/kg	** Rayment & Lyons 2011 - 9B2		80	50	45	35
Phosphorus - Bray 2	mg/kg	** Inhouse S3A		90	60	48	40
Nitrate-N - KCl extractable	mg/kg	** Inhouse S37		15	13	10	10
Ammonium-N - KCl extractable	mg/kg	** Inhouse S37		20	18	15	12
Sulfur - KCl extractable	mg/kg	** Inhouse S37		10.0	8.0	8.0	7.0
pH (H2O)	units	Rayment & Lyons 2011 - 4A1		6.5	6.5	6.3	6.3
Electrical Conductivity	dS/m	Rayment & Lyons 2011 - 3A1		0.200	0.150	0.120	0.100
Calcium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3		15.6	10.8	5.0	1.9
Calcium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3		7000	4816	2240	840
Calcium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3		3125	2150	1000	375
Magnesium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3		2.4	1.7	1.2	0.60
Magnesium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3		650	448	325	168
Magnesium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3		290	200	145	75
Potassium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3		0.60	0.50	0.40	0.30
Potassium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3		526	426	336	224
Potassium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3		235	190	150	100
Sodium - Exchangeable	cmol+/kg	Rayment & Lyons 2011 - 15D3		0.3	0.26	0.22	0.11
Sodium - Exchangeable	kg/ha	Rayment & Lyons 2011 - 15D3		155	134	113	57
Sodium - Exchangeable	mg/kg	Rayment & Lyons 2011 - 15D3		69	60	51	25
Aluminium - Exchangeable	cmol+/kg	** Inhouse S37		0.6	0.5	0.4	0.2
Aluminium - Exchangeable	kg/ha	** Inhouse S37		121	101	73	30
Aluminium - Exchangeable	mg/kg	** Inhouse S37		54	45	32	14
Hydrogen - Exchangeable	cmol+/kg	** Rayment & Lyons 2011 - 15G1		0.6	0.5	0.4	0.2
Hydrogen - Exchangeable	kg/ha	** Rayment & Lyons 2011 - 15G1		13	11	8	3
Hydrogen - Exchangeable	mg/kg	** Rayment & Lyons 2011 - 15G1		6	5	4	2
Calcium - Base Saturation	%	** Calculation		77.6	75.7	65.6	57.4
Magnesium - Base Saturation	%	** Calculation		11.9	11.9	15.7	18.1
Potassium - Base Saturation	%	** Calculation		3.0	3.5	5.2	9.1
Sodium - Base Saturation (ESP)	%	** Calculation		1.5	1.8	2.9	3.3
Aluminium - Base Saturation	%	** Calculation		3.0	3.5	5.2	6.0
Hydrogen - Base Saturation	%	** Calculation		3.0	3.5	5.2	6.0
Calcium/Magnesium Ratio		** Calculation		6.5	6.4	4.2	3.2
Effective Cation Exchange Capacity	cmol+/kg	** Calculation		20.1	14.3	7.8	3.3
Zinc - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1		6.0	5.0	4.0	3.0
Manganese - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1		25	22	18	15
Iron - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1		25	22	18	15
Copper - DTPA	mg/kg	Rayment & Lyons 2011 - 12A1		2.4	2.0	1.6	1.2
Boron - CaCl2 extractable	mg/kg	** Rayment & Lyons 2011 - 12C2		2.0	1.7	1.4	1.0
Silicon - CaCl2 extractable	mg/kg	** Inhouse S11		50	45	40	35
Carbon - Total	%	Inhouse S4a		>3.1	> 2.6	> 2.0	> 1.4
Nitrogen - Total	%	Inhouse S4a		>0.30	> 0.25	> 0.20	> 0.15
Carbon : Nitrogen Ratio	Ratio	Inhouse S4a		10-12	10-12	10-12	10-12
Estimated Organic Matter	%	Inhouse S4a		>5.5	> 4.5	> 3.5	> 2.5
Basic Texture		** Inhouse S65		---	---	---	---
Basic Colour		** Inhouse S65		---	---	---	---
Sodium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		100-500	100-500	100-500	100-500
Potassium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		200-2000	200-2000	200-2000	200-2000
Calcium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		1000-10 000	1000-10 000	1000-10 000	1000-10 000
Magnesium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		500-5000	500-5000	500-5000	500-5000
Phosphorus	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		400-1500	400-1500	400-1500	400-1500
Silver	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		---	---	---	---
Aluminium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		2000-50 000	2000-50 000	2000-50 000	2000-50 000
Arsenic	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		---	1-50	1-50	1-50
Cadmium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		<1	<1	<1	<1
Chromium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		5-1000	5-1000	5-1000	5-1000
Copper	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		20-50	20-50	20-50	20-50
Iron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS		1000-50 000	1000-50 000	1000-50 000	1000-50 000

Parameter	Unit	Method Reference	Guideline: Heavy Soil Guidelines	Medium Soil Guidelines	Light Soil Guidelines	Sandy Soil Guidelines
Manganese	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	200–2000	200–2000	200–2000	200–2000
Nickel	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	5–500	5–500	5–500	5–500
Lead	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	2–200	2–200	2–200	2–200
Selenium	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	0.1–2.0	0.1–2.0	0.1–2.0	0.1–2.0
Zinc	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	20–50	20–50	20–50	20–50
Mercury	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	< 0.2	< 0.2	< 0.2	< 0.2
Boron	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	2–50	2–50	2–50	2–50
Silicon	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	1000–3000	1000–3000	1000–3000	1000–3000
Cobalt	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	5–50	5–50	5–50	5–50
Molybdenum	mg/kg	1:3 Nitric:HCl - APHA 3125 ICPMS	0.5–3.0	0.5–3.0	0.5–3.0	0.5–3.0
Sulfur	mg/kg	1:3 Nitric:HCl - APHA 3120 ICPOES	100–1000	100–1000	100–1000	100–1000
Maximum Soil Chloride Estimate	mg/kg	** Calculation (Electrical Conductivity x 640)	---	---	---	---

Notes:

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
- Conversions to kg/ha = mg/kg x 2.24.
- Soluble salts are included in exchangeable cation results. No pre-wash is carried out unless specifically requested.
- The chloride estimate result (Electrical Conductivity x 640) is considered an estimate, and is generally an over-estimate.
- ** denotes NATA accreditation does not cover the performance of this service.
- All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (available on request or at scu.edu.au/eal).
- Analysis conducted between sample arrival date and reporting date.
- This report is not to be reproduced except in full.
- Results only relate to the item tested.
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
- Guidelines for phosphorus have been reduced for Australian soils.
- Methods from Rayment and Lyons, 2011. Soil Chemical Methods - Australasia. CSIRO Publishing, Collingwood.
- The Morgan 1 Extract is adapted from 'Science in Agriculture', 'Non-Toxic Farming', and 'LaMotte Soil Handbook'.
- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
- Conversions for 1 cmol+/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium