FLORA AND VEGETATION ASSESSMENT

WOODIE WOODIE MINESITE EXPANSION

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

MBS Environmental

December 2019




DOCUMENT STATUS				
DOCUMENT REFERENCE: MBS1902/72/19				
VERSION	**TYPE**	**AUTHOR/S**	**REVIEWER/S**	**DATE DISTRIBUTED**
V1	Internal review	L Rowles	E Chetwin	
V2	Draft for client	L Rowles/E Chetwin	E Mattiske	1/11/2019
FINAL	Final report	L Rowles	E Mattiske	11/12/2019

(ACN 063 507 175, ABN 39 063 507 175)

PO Box 437
Kalamunda WA 6926
Phone: +61 8 9257 1625
Email: admin@mattiske.com.au

TABLE OF CONTENTS

Page

TABLES

FIGURES

APPENDICES

LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BoM:	Bureau of Meteorology
DBCA:	Department of Biodiversity, Conservation and Attractions (WA)
DotEE:	Department of the Environment and Energy (Commonwealth)
DPIRD:	Department of Primary Industries and Regional Development (WA)
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority (WA)
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
IBRA:	Interim Biogeographical Regionalisation for Australia
Mattiske:	Mattiske Consulting Pty Ltd
NVIS:	National Vegetation Information System
PEC:	Priority ecological community
PMST:	Protected Matters Search Tool
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)
WWME:	Woodie Woodie Mine Expansion

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned by MBS Environmental, on behalf of Consolidated Minerals (ConsMin), to undertake a detailed flora and vegetation assessment of the proposed Woodie Woodie Mine Expansion areas in the eastern Pilbara region of Western Australia. The proposed expansion areas comprise six separate survey areas, totalling 4323 ha, within the development envelope of the mine. The assessment contains two components: a desktop study evaluating data and information from public databases and previous flora and vegetation surveys in the vicinity of the Woodie Woodie mine; and a field survey in order to define vegetation communities in the proposed expansion areas.

The Woodie Woodie Mine Expansion areas are located within the Interim Biogeographical Regionalisation for Australia Pilbara bioregion, and in particular within the Pilbara 1 (Chichester) subregion. It is also within Beard's Fortescue Botanical District, within the Eremaean Botanical Province. The findings of the desktop assessment are summarised as follows:

- **Geology, landforms and soil** – The survey area is situated within the Archaean Pilbara Craton which is overlain in the Woodie Woodie Mine area by Paleozoic sandstone of the Canning Basin. Rocky hills and stony plains dominate the landforms of the Pilbara region. The survey area falls within the Fortescue soil landscape province, which is mainly comprised of stony soils over hilly terrain, red shallow loams and sands elsewhere, with some clays on plains.
- **Land Systems** - Five systems were identified which intersect the proposed mine expansion areas. Generally they consist of rocky hills and slopes, stony plains with hard spinifex grasslands. The Paterson system is likely to be most impacted by clearing of the proposed expansion areas, with 0.98 % of its known extent falling within those areas. This system is also likely the most prone to degradation by overgrazing and erosion.
- **Pre-European Vegetation Associations** – Three sub-associations were identified which intersect the proposed expansion areas. These are low tree-steppe or shrub-steppe with Triodia spp. hummock grasslands with varying tree, mallee or shrub species. Vegetation sub-association 82.0 (low tree-steppe) has the most potential to be impacted by clearing of the expansion areas, with 1.98 % of its known extent occurring within those areas.
- **Flora** – Based on database searched and previous mapping surveys in the area, fifteen priority taxa (no threatened taxa) were identified during the desktop survey as having the potential to occur in the proposed expansion areas. Three of these species have been recorded in the Woodie Woodie area in previous surveys. Nineteen introduced flora taxa were identified as having the potential to occur in the survey areas, twelve of which had been recorded previously in the general area.
- **Vegetation** – Previous flora and vegetation mapping in the Woodie Woodie mine area was carried out by Mattiske Consulting Pty Ltd from 2007-2018. Fifteen vegetation communities were delineated on the basis of the mapping; many of these were expected to be encountered again in the 2019 field survey.
- **Ecological Communities** – No Ecological communities of conservation significance were identified during the desktop assessment.
- **Other Matters of Conservation Significance** – No World or National Heritage Areas, Ramsar Wetlands or National Parks and Reserves are situated within the proposed expansion areas; those nearby are unlikely to be impacted by development of the mine expansion areas.

Following the desktop assessment, a detailed field assessment was conducted by Mattiske Consulting Pty Ltd for seven days in June 2019. A total of 245 quadrats were surveyed in order to sample all vegetation types within the survey areas. The results of the survey are summarised below:

- **Flora** – A total of 276 vascular plant taxa, representative of 116 genera and 403 families, were recorded within the Woodie Woodie Mine Expansion areas in 2019. The majority of taxa recorded were representative of the Fabaceae, Poaceae and Malvaceae families. Species accumulation curve analysis shows that approximately 82 % of the flora species potentially present within the survey area were recorded. No threatened flora species pursuant to Part 2, Division 1, and Subdivision 2 of the *Biodiversity Conservation Act* 2016 and as listed by Department of

Biodiversity, Conservation and Attractions, or pursuant to section 179 of the *Environmental Protection and Biodiversity Conservation Act,* or listed by the Department of the Environment and Energy, were recorded within the Woodie Woodie Mine Expansion areas. One priority flora species, as listed by Department of Biodiversity, Conservation and Attractions, was recorded in three sites within Area 6: *Euphorbia clementii* (Priority 3). Eleven introduced (weed) species were recorded in the expansion areas, of which one, **Calotropis procera*, is a Declared Pest pursuant to section 22 of the BAM Act 2007 according to the Department of Primary Industries and Regional Development.

- **Vegetation**

  - While 33 associated groups were delineated by statistical analysis, an inclusive approach was considered appropriate given interpretation of statistical results combined with aerial imagery, field observations and previous Mattiske mapping. Based on this approach, fifteen vegetation communities were identified (Figure 7) and mapped within the six survey areas (Figures 8.1 to 8.5). Of the fifteen vegetation communities, 11 were consistent with previous Mattiske mapping (codes: 1, 2, 3, 5, 6, 7, 8, 10, 11, 17, and 18) and four were new to the area (codes: 22, 23, 24 and 25). Previous Mattiske vegetation community descriptions have been changed to conform to the NVIS format. Vegetation number codes have continued on from previous Mattiske mapping.

  - Within the survey area the vegetation condition was ranked as either Excellent, Very Good, Good, Poor and 'Completely Degraded 'as per the vegetation condition scale developed by Trudgen.

1. INTRODUCTION

Mattiske Consulting Pty Ltd (Mattiske) was commissioned in March 2019 by MBS Environmental, on behalf of Consolidated Minerals (ConsMin), to conduct a desktop assessment of potential flora and vegetation values and subsequently to perform a detailed flora and vegetation survey within the development envelope of the proposed Woodie Woodie Mine Expansion (WWME) in the Pilbara Region.

1.1 Location and Scope of Proposal

The project area is located approximately 100 km west of Telfer and 120 km east of Nullagine in the eastern Pilbara region of Western Australia (Figure 1). In total, the six proposed expansion areas (survey areas) occupy 4323 ha. Area 1 (tenement M45/640-I) occupies 80.7 ha, Area 2 (tenement M45/1218-I) occupies 121.0 ha, Area 3 (tenement E45/2470-I) occupies 129.0 ha, Area 4 (tenements M45/600-I, M45/637-I, G45/40, M45/601-I and E45/3548) occupies 1464.3 ha, Area 5 (tenement G46/5) occupies 10.0 ha and Area 6 (tenements G46/4, M46/162-I, M46/150-I, M46/383-I and M46/384-I) 2518.0 ha. The purpose of this survey was to identify the flora and vegetation values of each survey area to provide sufficient information regarding potential impacts from clearing for mining approvals.

1.2 Environmental Legislation and Guideline

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The following key Western Australian (state) legislation relevant to this survey includes the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act); and
- *Environmental Protection Act 1986* (EP Act).

Furthermore, key Western Australian guidelines relevant to this survey are the:

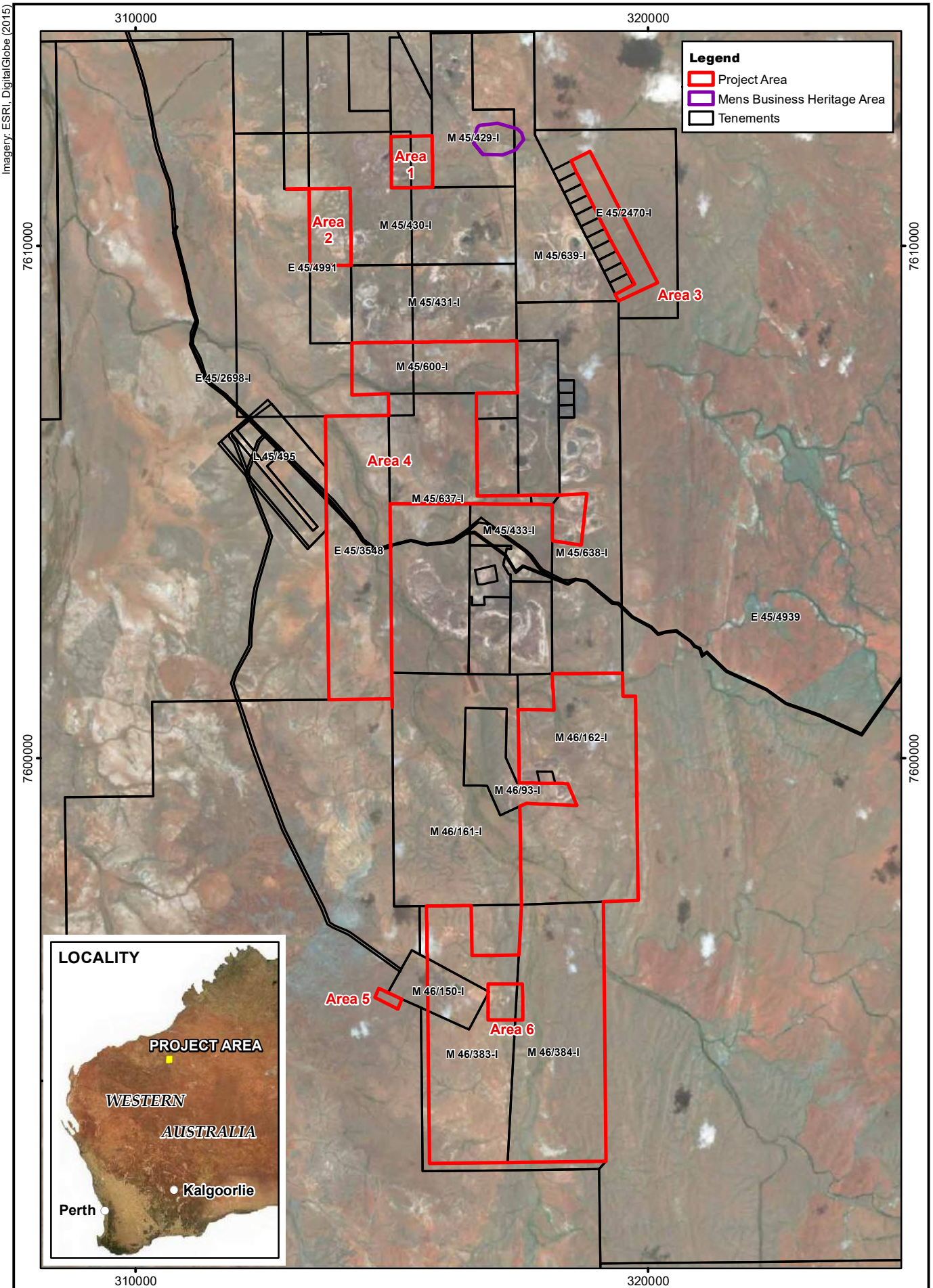
- *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority [EPA] 2016a); and
- *Environmental Factor Guideline: Flora and Vegetation surveys for environmental impact assessment* (EPA 2016b).

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendices A1-A4.

1.3 Objectives

The objective of this survey was to undertake a flora and vegetation assessment of the WWME survey area, more specifically:

- Undertake a desktop study of the flora and vegetation of the project area, with an emphasis on threatened and priority flora, and threatened ecological communities (TECs) and priority ecological communities (PECs);
- Review historical literature and current databases associated with the project area;
- Undertake a detailed survey of each proposed survey area, and collect and identify the vascular plant species present;
- Review the conservation status of the vascular plant species recorded by reference to current literature and listings by the Department of Biodiversity, Conservation and Attractions (DBCA) and plant collections held at the Western Australian State Herbarium (WAH), and listed by the Department of the Environment and Energy (DotEE) under the EPBC Act;
- Define and map the vegetation communities within each survey area;
- Identify and record the location of any threatened and priority flora located within each survey area;
- Identify and record the locations of any Declared Pest organisms within each survey area;
- Define and prepare a vegetation map of the vegetation communities within each survey area;
- Assess the condition of the vegetation communities within each survey area;
- Provide descriptions of the vegetation communities present within each survey area and evaluate their regional significance; and
- Prepare a report summarising the findings.



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_01

Date: October 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project

Locality

Figure: 1

2. METHODS

2.1 Desktop Assessment

A desktop assessment of the ecological values of the proposed WWME was conducted using a range of literature and data sources. Databases accessed for desktop assessment data include:

- Previous datasets collected on the Woodie Woodie lease areas;
- FloraBase (WAH 1998-);
- The Commonwealth EPBC Act 1999 protected matters search tool (PMST) database (DotEE 2019(a));
- The Western Australian Department of Parks and Wildlife NatureMap database (Department of Parks and Wildlife 2007-); and
- Atlas of Living Australia (2019).

Database searches including NatureMap and the PMST incorporated a 40 km buffer from a centre point of the proposed survey area (UTM Zone 51K: 316750 mE, 7603929 mS). In addition to database searches, previous vegetation mapping surveys by Mattiske Consulting (2007a – 2007i; 2008a – 2008e; 2013 and 2018) were reviewed to provide a potential species list for the Woodie Woodie mine area.

Threatened and priority flora species with the potential to occur within the WWME survey area were assigned a rank in terms of their likelihood of occurrence. The rankings Unlikely, Possible and Likely were based on the presence of suitable habitat within the survey area and the proximity of previous records.

2.2 Field Survey

A detailed field assessment of the flora and vegetation of each survey area was undertaken by four experienced botanists from Mattiske Consulting Pty Ltd from the 11th to 17th of June 2019. The survey work was carried out in accordance with methods outlined in *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b). All botanists held valid collection licences to collect flora for scientific purposes, issued under the *BC Act*.

Aerial photographic maps of each survey area were prepared and supplied by CAD Resources. Survey quadrats were selected using aerial photographic maps and other field observations to provide adequate coverage and replication.

A total of 245 survey quadrats (Figure 2), measuring 50 m x 50 m, were selected to sample all vegetation types, with replication, within the survey area. GPS locations of all survey quadrats are provided in Appendix B. The survey quadrats were not pegged. The northwest corner of the quadrat was marked on a GPS unit and a photograph taken from the north-western corner looking southeast.

Flora and vegetation were described and sampled systematically at each survey quadrat, and additional opportunistic collections were undertaken wherever previously unrecorded plants were observed. At each quadrat the following floristic and environmental parameters were recorded:

- GPS location (GDA94 datum, zone 51K);
- Local topography;
- Soil type and colour;
- Outcropping rocks and their type;
- Percentage and type of litter cover and percentage bare ground;
- Approximate time since fire;
- Brief description of the vegetation;
- Vegetation condition (based on Trudgen 1988); and
- For each vascular plant species, the average height and the percentage cover (of both alive and dead material) over the survey quadrat.

Botanists searched for Threatened and Priority flora in an opportunistic manner, on foot whilst en route to survey quadrats (see Figure 2 for track logs).

All plant specimens collected during the field surveys were dried and processed in accordance with the requirements of the WAH. The plant species were identified based on taxonomic literature and through comparison with pressed specimens. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

2.3 Survey Timing

According to the *Technical guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b), the surveys were undertaken in the optimal time for the area, approximately 6 – 8 weeks post wet season (March – June).

To assess survey adequacy a species accumulation curve, based on accumulated species versus quadrats surveyed was prepared (*EstimateS* – Colwell 2013). As the number of survey quadrats increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling based on combined data from all five survey areas, and provided an incidence based coverage estimator of species richness (Chao 2004). When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered to be adequate.

2.4 Analysis of Quadrat Data

Plymouth Routines in Multivariate Ecological Research v6 (PRIMER) statistical analysis software was used to analyse species-by-quadrat data and discriminate survey quadrats on the basis of their species composition (Clarke and Gorley 2015). To down-weight the relative contributions of quantitatively dominant species, a fourth root transformation was applied to the data set. Annual species and singletons (species recorded at a single quadrat and not forming a dominant structural component i.e. =>5 % cover) were excluded from analysis. *Cenchrus ciliaris was retained in analysis because it formed a dominant structural component of some vegetation communities. All other introduced species were removed from analysis. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Data were analysed using a series of multivariate analysis routines including Hierarchical Clustering (CLUSTER), Analysis of Similarity (ANOSIM) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and delineation of individual plant communities.

2.5 Vegetation Descriptions

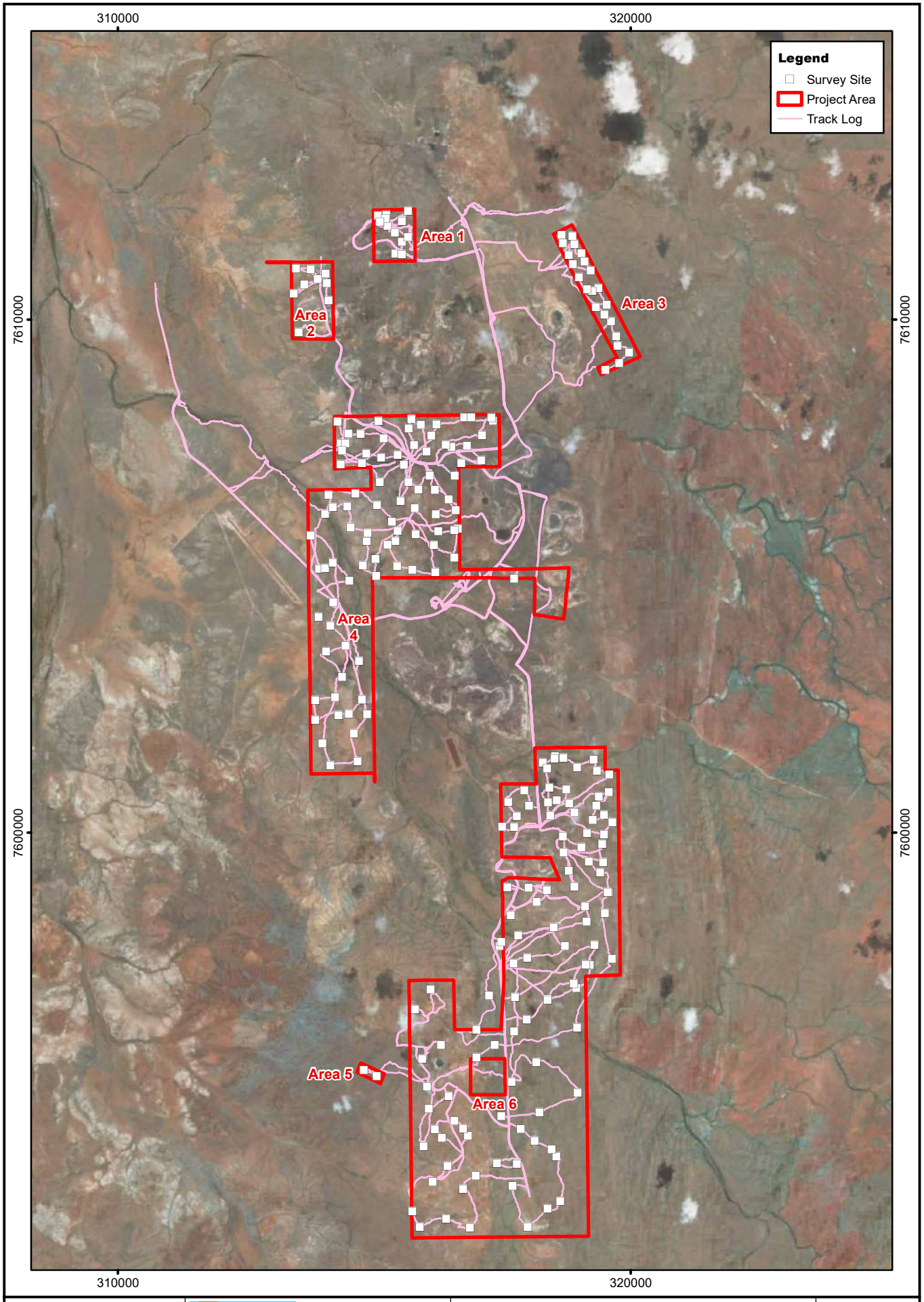
Previous mapping within the project area by Mattiske used vegetation community descriptions based on the structural forms of Australian vegetation as outlined in Beard (1990). More recently vegetation community descriptions are based on the National Vegetation Information System (NVIS; Executive Steering Committee for Australian Vegetation Information 2003; Appendix A5). Vegetation communities identified in this report were described at the association level of the NVIS classification framework, consistent with the Technical guidance – Flora and vegetation surveys for environmental impact assessment (EPA 2016b). Vegetation communities were described and mapped using a combination of aerial imaging, previous vegetation mapping, statistical analysis and field observations.

2.6 Survey Limitations

A general assessment was made of the current survey against a range of factors that may have limited the outcomes and conclusions of this report (Table 1).

Table 1: Potential limitations affecting survey conclusions

Potential survey limitation	Impact on current survey
Availability of contextual information at a regional and local scale	Not a limitation. Mattiske has conducted numerous surveys within the immediate areas surrounding the WWME. Combined with adequate background information sourced from references such as Rangeland Land System surveys, Beard (1975) mapping and online flora and vegetation databases have provided detailed contextual information for the current project.
Competency/experience of team carrying out survey; experience in the bioregion surveyed	Not a limitation. All botanists had extensive experience working within the Pilbara region. Two botanists had undertaken the previous Mattiske 2018 survey in the area surrounding the WWME.
Proportion of flora collected and identification issues	Not a limitation. The timing of the survey was optimal for surveys of flora and vegetation in the Pilbara region (EPA 2016b). The time of the survey was considered appropriate for the collection and recording of vascular plant species, post wet season and annual rains.
Survey effort and extent of survey	Not a limitation. Generally the survey area was thoroughly covered. Survey quadrats were initially selected from high resolution aerial maps, with additional quadrats selected in situ based on in field observations. Low replication of some vegetation communities was unavoidable given their low occurrences within the survey area.
Access restrictions within survey area	Not a limitation. Survey areas had tracks accessing the general area, providing adequate access to undertake surveys by foot.
Survey timing, rainfall, season of survey	Potential limitation. While survey timing was considered optimal (EPA 2016b), rainfall four months prior to the surveys was minimal. For the purposes of vegetation mapping, perennial species were used to define vegetation communities. Therefore while identification to species level was problematic for some flora the dominant structural components were largely definable and discernible between communities.
Disturbances (fire/flood/clearing)	Potential limitation. There had been substantial fire disturbance across the southern portion of Area 6 in previous years. This may limit the ability to discern vegetation communities in this area, due to absent structural components.
Accuracy of data and suitability of statistical analysis	Not a limitation. Measures were taken to improve the robustness of data and analysis (See Methods section).



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_05

Date: October 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640

Author: E M Matttiske | MCPL Ref: MBS1902

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project
Survey Sites and Track Logs

Figure: **2**

3. DESKTOP ASSESSMENT RESULTS & DISCUSSION

3.1 Climate

Beard (1990) described the climate of the Fortescue Botanical District as arid tropical with summer rainfall. Annual precipitation in the Fortescue Botanical District ranges from 250 – 300 mm, with the bulk of the precipitation falling in the summer months between December and March. Cyclonic summer rainfall is characteristic of the area. Telfer, located approximately 100 km to the east of the project area, has an average annual rainfall of 387.3 mm (Bureau of Meteorology [BOM] 2019). Total Rainfall was substantially less than the long-term average in the three months preceding the survey. April received 2.6mm while there was no rainfall in May contrary to the long-term average of 18.7 mm (Figure 3).

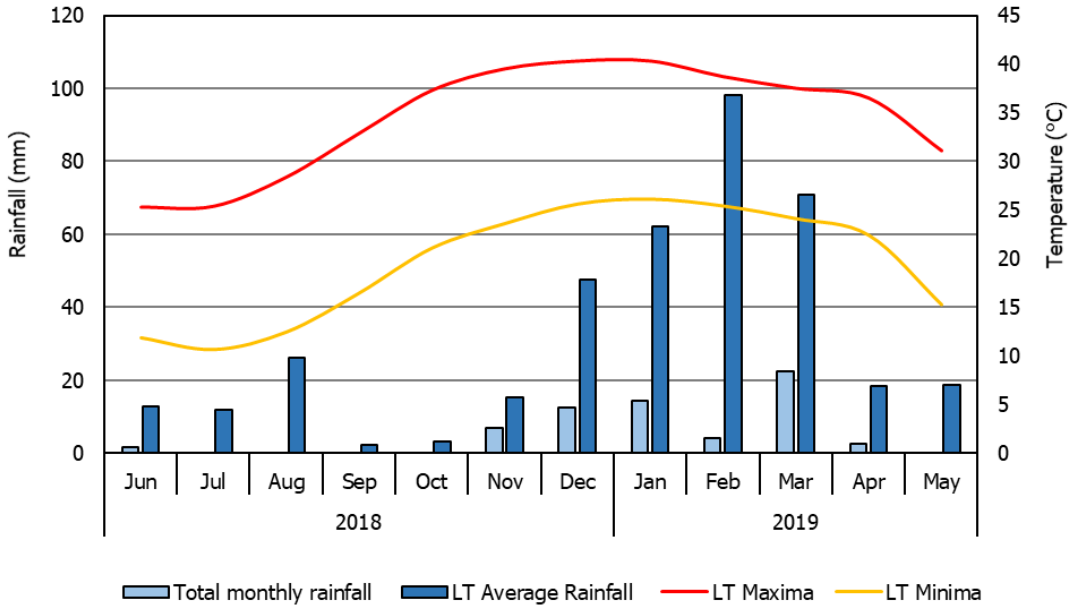


Figure 3: Rainfall and temperature data for the WWME area. LT denotes Long Term. Rainfall and temperature data are from Telfer aero weather station (BoM 2019).

3.2 Geology

The proposed WWME is situated within the Fortescue Province (Tille 2006) and Beard's (1990) Fortescue Botanical District. The Fortescue province lies over the Pilbara Craton which includes the Archaean rocks of the East and West Pilbara Granite-Greenstone Terranes, in the north (Tille 2006). Included in these terranes are granitoid rocks, basic and ultrabasic volcanic rocks, and acidic volcanic rocks. Present alongside these rocks are the Archaean shale, siltstone and wacke and granitic intrusions of the Mallina Basin; the Archaean greywacke of the Mosquito Creek Basin; and the late Archaean-Palaeoproterozoic basalt and sandstone of the Marble Bar Sub-basin. The south of the Pilbara Craton is dominated by the Hamersley Basin, with the Archaean basalt, shale, sandstone, conglomerate, tuff and carbonate of the Northwest and Northeast Pilbara Sub-basins. This group is known as the Fortescue Group which then forms the Chichester ranges. The Hamersley Range has formed on the southern portion of the province over the late Archaean-Palaeoproterozoic metamorphosed banded iron formations, shales, dolerite, carbonate, chert and rhyolite associated with the South Pilbara Sub-basin. These rocks then form the Hamersley group and contribute to the Ophthalmia Fold Belt. The Carboniferous-Permian sandstone of the Wallal Embayment of the Canning Basin is found along the Oakover River in the north-east of the province. Mesoproterozoic sandstones and shales occur as part of the Manganese Group (an outlier of the Collier Basin) in the south-east of the province (Tille 2006).

3.3 Landforms

Landforms in the Fortescue province are dominated by rocky hills and stony plains (Tille 2006). Rugged hills, ridges, dissected plateaux and mountains are found on the basalt, banded iron formation and sandstone of the Hamersley Basin. The most prominent of these ridges are the Chichester and Hamersley Ranges. On the Chichester Ranges, stony gilgai plains are found on the basaltic plateau surface. Broad sandy plains are also common on the coastal plains in addition to alluvial plains along the Fortescue River. Hardpan wash plains are found in the Fortescue Valley and Hamersley Plateau. Beard (1990) described the province as a particularly mountainous region rising to 1250 m, primarily with hard alkaline soils on plains and pediments, with shallow and skeletal soils on the ranges.

3.4 Soil Landscapes

The soil landscapes of the Fortescue province consist primarily of stony soils over hilly terrain, with red shallow loams sands. Hard cracking clays can be found on basaltic plateau surfaces, red shallow loams on the granitic stony plains, red shallow loams and non-cracking clays on the stony footslopes and plains beneath basaltic hills (Tille 2006). The alluvial plains consist of red loamy earths, red/brown non-cracking clays, hard cracking clays, self-mulching cracking clays, red deep loamy duplexes and Red shallow sandy duplexes. Deposits of deep red alluvial sands are found on active floodplains and river terraces. Hardpan wash plains are found in the province and are characterised by red loamy earths and red-brown hardpan shallow loams. Calcareous shallow loams are also found within the province, associated with calcrete outcrops (Tille 2006).

3.5 Beard's Vegetation Mapping

The WWME survey area falls within the Fortescue Botanical District, as part of the Eremaean Botanical Province (Beard 1975; 1990). The area is situated close to the borders of both the Canning and Keartland Botanical Districts (the Great Sandy Desert and the Little Sandy Desert Biogeographical Regions respectively). A summary of each of these botanical districts is set out below (Beard 1990).

- **Fortescue Botanical District** – The vegetation is dominated by tree and shrub-steppe communities with *Eucalyptus* trees, *Acacia* shrubs and *Triodia pungens* and *Triodia wiseana* hummock grasses. The valley floors and creek lines are typically dominated by Mulga (*Acacia aneura*) communities over shrubs and a range of grasses.
- **Canning Botanical District** – Predominantly tree steppe grading to shrub steppe in the southeast of the District, comprising open hummock grassland of *Triodia pungens* and *Triodia schinzii* with scattered trees of *Owenia reticulata*, *Eucalyptus* spp. and shrubs of *Acacia* and *Grevillea*.
- **Keartland Botanical District** – Shrub steppe of *Acacia* and *Grevillea* and *Triodia* spp. on and between dunes, patches of desert oak and Mulga.

3.6 IBRA Biogeographical Subregions

The Pilbara Bioregion has been defined in the Interim Biogeographical Regionalisation for Australia (IBRA7; Thackway and Cresswell 1995, DotEE 2019b). The six survey areas are situated within the Pilbara 1 (PIL1 Chichester) subregion, and are in close proximity to the borders of two other subregions: approximately 30 km south-west of the IBRA7 Great Sandy Desert 2 (GSD2 Mackay) and approximately 15 km west of the IBRA7 Little Sandy Desert 2 (LSD2 – Trainor) subregion borders. A summary of each of these subregions is set out below.

- **PIL1 Chichester Subregion** – Kendrick and McKenzie (2001) described the Chichester subregion as comprising the northern section of the Pilbara craton, where undulating Archaean granite and basalt plains occur, including significant areas of basaltic ridges. Floristically, the plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, whilst on ranges, tree steppes of *Eucalyptus leucophloia* occur.
- **GSD2 Mackay Subregion** – Kendrick (2001) described the Mackay subregion as comprising Quaternary red longitudinal sand dune fields overlying Jurassic and Cretaceous sandstones of the

Canning and Armadeus Basins. Floristically, the subregion is comprised mainly of tree steppe grading to shrub steppe in the south; comprising open hummock grassland of *Triodia pungens* and *Triodia schinzii* with scattered trees of *Owenia reticulata* and bloodwood (*Corymbia* spp.), and *Acacia* spp. shrubs, *Grevillea wickhamii* and *Grevillea refracta*. In the north-western section of this region, monsoonal influences are apparent.

- **LSD2 Trainor Subregion** – Cowan and Kendrick (2001) described the Trainor subregion as red centre desert on Neoproterozoic sedimentary basement (Officer Basin), with red Quarternary dune fields with abrupt Proterozoic sandstone ranges of the Bangemall Basin. Floristically, on sandy surfaces, there are shrub steppes of *Acacia* spp., *Aluta maisonneuvei* and *Grevillea* spp., over *Triodia schinzii*. On stony hills there is predominantly sparse shrub steppe over *Triodia basedowii*, with Eucalypt and Coolibah communities and bunch grasslands on alluvial deposits and drainage lines associated with ranges. Cowan and Kendrick (2001) noted that within this subregion, **Cenchrus ciliaris* is widespread, common and increasing, most likely at the exclusion of native species.

3.7 Land systems

The regional land system mapping by Van Vreeswyk *et al*. (2004) delineated a series of mapping units in the Pilbara region. Van Vreeswyk *et al*. (2004) described the main central area of the Pilbara Biogeographic Region (Chichester subregion) as predominantly vegetation formations of tree and shrub steppe (hummock grassland) communities with *Eucalyptus* trees, *Acacia* shrubs and *Triodia pungens* and *Triodia wiseana* hummock grasses. Mulga (*Acacia aneura*) communities occur in valleys and short bunch grasslands occur on alluvial plains.

Five land systems were identified intersecting the expansion areas. These were the Billygoat, Coongimah, Oakover, Paterson and Rocklea Systems. A brief description of each land system follows.

- **Billygoat Land System (map unit 287Bl)** – Dissected plains and slopes supporting hard spinifex grasslands. The majority of vegetation within this system is not preferred by livestock and is not degraded and is generally not susceptible to accelerated erosion. This system is restricted to the eastern Pilbara region, where it accounts for an area of 2,235 km² (Van Vreeswyk et al. 2004).
- **Coongimah Land System (map unit 287Cg)** – Plateau surfaces, low hills with steep slopes and undulating uplands supporting hard spinifex grasslands. The hard spinifex grasslands are not preferred by livestock and not prone to degradation, although may be subject to fairly regular burning and has a very low erosion risk. It is restricted to the eastern Pilbara region, where it accounts for an area of 3,244 km² (Van Vreeswyk et al. 2004).
- **Oakover System (map unit 287Ok) –** Breakaways, mesas, plateaux and stony plains of calcrete supporting hard spinifex shrubby grasslands. The hard spinifex grasslands are not preferred by livestock and not prone to degradation, although may be subject to fairly regular burning. Restricted to the eastern Pilbara region, it accounts for an area of 1,529 km² (Van Vreeswyk et al. 2004).
- **Paterson System (map unit 287Pt) –** Stony and sandy plains with isolated low hills of sandstone or conglomerate supporting hard spinifex (and occasionally soft spinifex) grasslands and minor tussock grasslands. The hard spinifex grasslands are not preferred by livestock, however young soft spinifex is moderately preferred and prone to degradation if overgrazed. This system is generally not prone to erosion except for areas of alluvial plains and drainage lines where vegetation is depleted. A relatively small system, accounting for an area of 818 km² (Van Vreeswyk et al. 2004).
- **Rocklea Land System (map unit 287Rk)** – Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands. The spinifex hummock grasslands within this system tend to be poorly accessible and are generally not preferred by livestock. The system is subject to fairly regular burning and has a very low erosion hazard. Widely occurring across the Pilbara region, this system accounts for an area of 22,993 km² (Van Vreeswyk et al. 2004).

The land systems intersecting the expansion areas are displayed in Figure 4 and summarised in Table 1. The land system with the highest proportion of overall coverage within the six WWME survey areas is the Paterson system, with 0.98 % of its known extent falling within the survey areas.

Table 2: Land systems intersecting the Woodie Woodie Mine Expansion Areas, 2019
Proportions highlighted in bold indicate land systems considered in the discussion below.

	Land System	State Coverage (ha)	Survey Area	
			Area (ha)	% of State Coverage
Area 1	287Cg	321533.90	80.71	0.03
Area 2	287Cg	321533.91	14.75	<0.01
	287Pt	81333.24	106.29	0.13
Area 3	287Rk	267331.06	129.02	0.05
Area 4	287Cg	321533.90	400.78	0.12
	287Ok	138068.68	392.38	0.28
	287Pt	81333.24	671.20	0.83
Area 5	287Bl	218101.30	9.99	<0.01
Area 6	287Bl	218101.30	117.90	0.05
	287Cg	321533.90	1716.14	0.53
	287Pt	81333.24	22.34	0.03
	287Rk	267331.06	661.61	0.25

3.8 Pre-European Vegetation

The pre-European vegetation dataset, prepared through the National Land and Water Resources Audit, describes vegetation in relation to natural resource boundaries commonly used for environmental reporting (Shepherd et al. 2002). A total of 819 vegetation associations were recognised in Western Australia, ranging from tall forests, through to a wide variety of forests and woodlands, shrublands and grasslands, mostly with an overstorey of trees. The identification of the original pre-European and current extent of each of the vegetation types assist in providing baselines for managing issues such as land clearing. Although the extent of native vegetation remains largely intact within the inland areas of Western Australia, the structure and floristic composition have been altered since European settlement through grazing by introduced animals such as sheep, cattle, goats and rabbits, mining activities and by altered fire regimes (Shepherd et al. 2002).

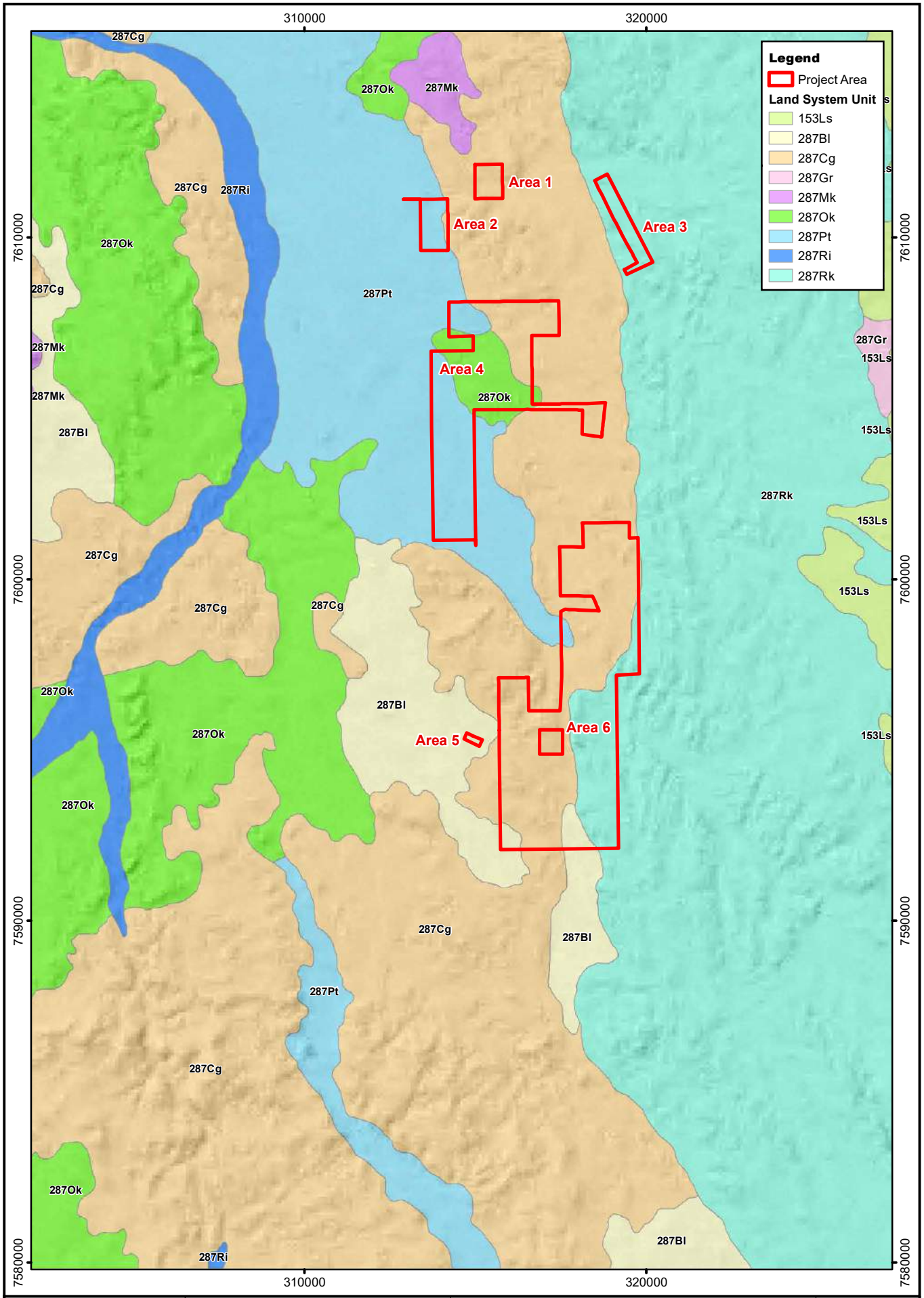
Three vegetation sub-associations were identified within the six expansion areas; 82.0, 173.1 and 177.1. Vegetation sub-association 82.0 is defined as a low tree-steppe with *Triodia wiseana* hummock grasslands, scattered with *Eucalyptus brevifolia* trees. Vegetation sub-association 173.1 is defined as a shrub-steppe with *Triodia* spp. hummock grasslands and scattered *Acacia* spp. shrubs or *Eucalyptus* spp. mallees. Vegetation sub-association 177.1 is defined as a sparse shrub-steppe of *Acacia bivenosa* with *Triodia* spp. hummock grasslands and sparse shrubs (Shepherd et al. 2002, Department of Agriculture and Food 2012). Pre-European vegetation associations intersecting each expansion area are displayed in Figure 5 and their respective coverage summarised in Table 3.

In total the five survey areas will account for 1015 ha of vegetation sub-association 82.0 (1.98 %), 2073 ha of sub-association 173.1 (0.33 %) and 1235 ha of sub-association 177.1 (0.73 %).

Table 3: Pre-European Vegetation intersecting the Woodie Woodie Mine Expansion Areas, 2019

Proportions highlighted in bold indicate vegetation associations considered in the discussion below.

SURVEY AREA	Vegetation Sub-Association	State Coverage (ha)	Survey Area	
			Area (ha)	% of State Coverage
Area 1	173.1	622599.20	80.705	0.01
Area 2	177.1	169494.00	121.044	0.07
Area 3	173.1	622599.20	129.024	0.02
Area 4	173.1	622599.20	616.356	0.10
	177.1	169494.00	848.006	0.50
Area 5	177.1	169494.00	9.987	0.01
Area 6	82.0	51302.69	1247.158	1.98
	173.1	622599.20	255.945	0.20
	177.1	169494.00	1014.881	0.15



N

0 1 2 km

Scale: 1:150,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_02

Date: October 2019 | Rev: A | A4

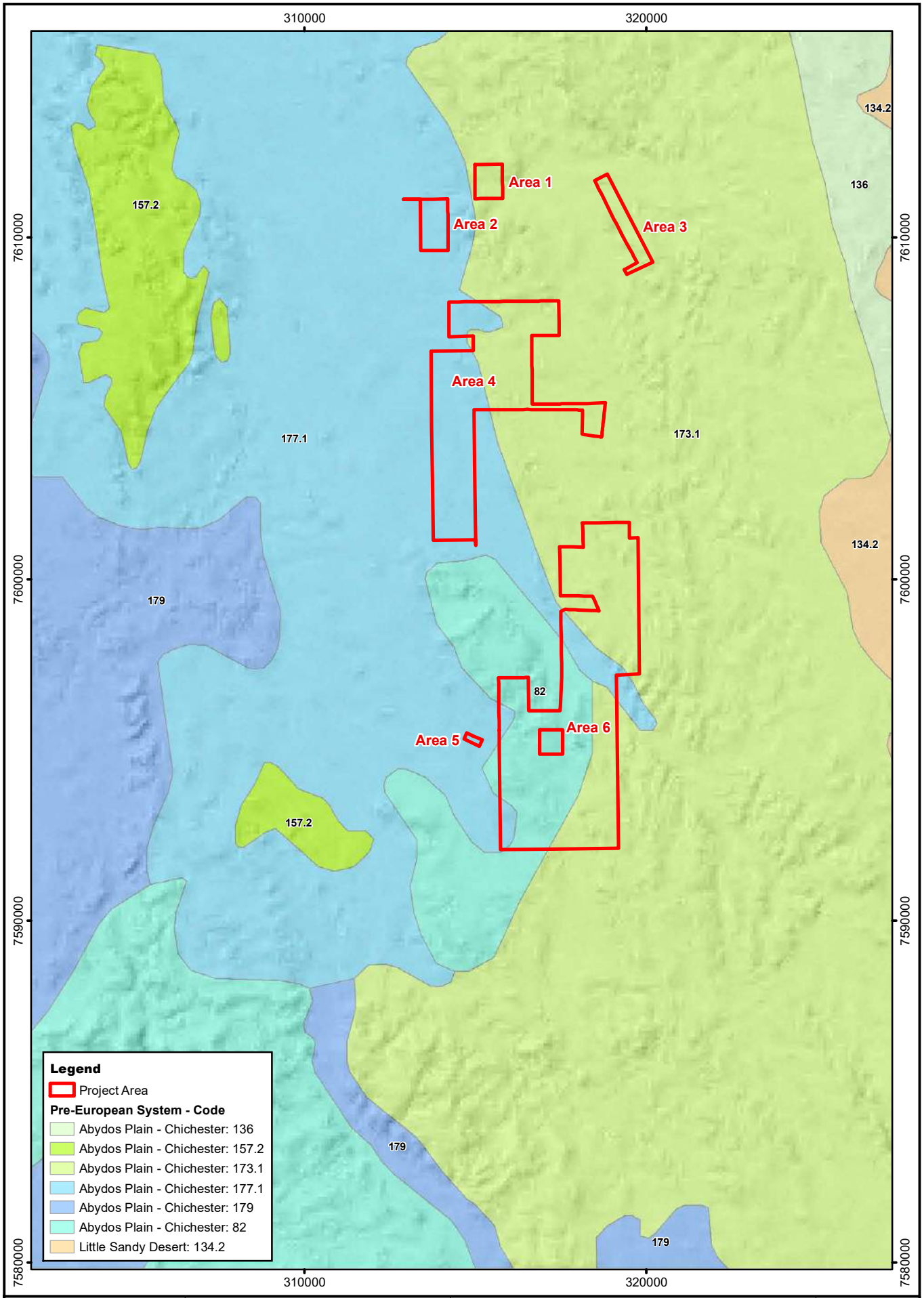
Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640

Author: E M Matttiske | MCPL Ref: MBS1902

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project
Land Systems

Figure: **4**



N

0 1 2 km

Scale: 1:150,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_03

Date: October 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project

Pre-European Vegetation

Figure: 5

3.9 Flora

A total of 604 vascular plant taxa, representative of 197 genera and 61 families, have the potential to occur within the WWME survey areas, based on NatureMap, *EPBC Act* Protected Matters search results and previous Mattiske surveys (Mattiske Consulting Pty Ltd 2007-2018) (Appendix C). The most commonly represented families were Fabaceae (120 taxa), Poaceae (80 taxa) and Malvaceae (59 taxa).

Fifteen priority flora taxa (see Appendix A for definitions) were identified as having the potential to occur within the survey areas (Appendix C). The desktop search also identified nineteen introduced (exotic) flora taxa (including one Declared Pest) which have potential to occur within the WWME survey areas.

3.9.1 Threatened and Priority Flora

No threatened flora taxa pursuant to the *EPBC Act* and as listed by DotEE (2019c) or pursuant to the *BC Act* and listed by DBCA (DBCA 2018a, 2018b) were identified in the Desktop assessment of the WWME survey areas.

The fifteen priority flora taxa identified during the desktop assessment (DBCA 2018b) (Appendix C) comprise four taxa ranked as Priority 1, two as Priority 2, eight as Priority 3 and one taxon as Priority 4. WAH (1998-) and Atlas of Living Australia (2019) records of the various priority flora taxa indicate that collections have been made either in the vicinity of the Woodie Woodie mining area or they are within 40 km of the proposed survey areas. Ten of these species, including the three species which were found near the WWME area in previous surveys (Mattiske Consulting Pty Ltd 2007-2018) - *Aristida jerichoensis var. subspinulifera*, *Goodenia sp. East Pilbara* (A.A. Mitchell PRP 727) and *Lepidium amelum* - have been classified as 'Possible' in their likelihood of occurrence. The remaining species are ranked as 'Unlikely' to occur in the WWME survey areas. Appendix D lists the likelihood of each of the potential priority flora species.

3.9.2 Introduced (Exotic) Flora

Nineteen exotic flora taxa were identified during the desktop assessment as having the likelihood of occurring within the survey areas (Appendix C), six of which are from the Poaceae family. Twelve of these taxa were recorded in previous surveys conducted by Mattiske teams (Mattiske Consulting Pty Ltd 2007-2018) within the project area. The taxa identified in the assessment were; **Aerva javanica, *Argemone ochroleuca* subsp. *ochroleuca, *Calotropis procera, *Cenchrus ciliaris, *Cenchrus setiger, *Chloris barbata, *Chloris virgata, *Citrullus amarus, *Citrullus colocynthis, *Cynodon dactylon, *Datura leichhardtii, *Diplachne fusca* subsp. *uninervia, *Flaveria trinervia, *Malvastrum americanum, *Passiflora foetida* var. *hispida, *Portulaca pilosa, *Rumex vesicarius, *Sonchus oleraceus* and **Vachellia farnesiana*.

Of these species, only **Calotropis procera* was classified as a Declared (Plant) Pest according to the Department of Primary Industries and Regional Development ([DPIRD] 2019). It is also on the Department of Parks and Wildlife's (n.d.) Priority Alert list for the Pilbara region. Eleven of the potential introduced species have an Ecological Impact of "High" and a "Rapid" Invasiveness ranking according to the Pilbara region weed species rankings (Department of Parks and Wildlife n.d.). None of the potential introduced taxa are listed as a Weed of National Significance (DotEE 2019d).

3.10 Vegetation Communities

Previous Mattiske surveys have identified a total of 21 vegetation types, delineated by statistical analysis, combined with aerial imagery and field observations. Vegetation number codes have continued on from previous Mattiske mapping. The previous vegetation community descriptions have been changed to conform to the current NVIS format and are listed below.

1 *Eucalyptus victrix* and *Eucalyptus camaldulensis* mid open woodland, over *Acacia coriacea* subsp. *pendens, Atalaya hemiglauca* and *Acacia trachycarpa* tall sparse shrubland, over *Cyperus vaginatus* low sparse sedgeland, over **Cenchrus ciliaris* mid grassland along major watercourses.

2 *Eucalyptus victrix* mid open woodland, over *Atalaya hemiglauca, Petalostylis labicheoides* and *Acacia trachycarpa* tall sparse shrubland, over **Cenchrus ciliaris* mid tussock grassland associated with major watercourses.

3 *Corymbia hamersleyana* low isolated trees, over *Petalostylis labicheoides, Acacia ancistrocarpa* and *Grevillea wickhamii* tall sparse shrubland, over *Triodia longiceps* mid sparse hummock grassland and **Cenchrus ciliaris* mid sparse tussock grassland along minor watercourses.

4 Tall Shrubland of *Acacia arida, Acacia bivenosa, Acacia synchronicia* over patches of *Triodia basedowii* and *Triodia pungens* with *Grevillea wickhamii* subsp. *hispidula* and emergent *Corymbia hamersleyana* on flats and lower slopes.

5 *Acacia arida, Acacia bivenosa* and *Acacia synchronicia* tall sparse shrubland, over *Triodia longiceps, Triodia wiseana* and *Triodia basedowii* mid open hummock grassland and patches of **Cenchrus ciliaris* and *Sporobolus australasicus* low open grassland on flats, occasionally associated with watercourses.

6 *Corymbia aspera* and *Corymbia hamersleyana* low isolated trees, over *Hakea lorea* and *Acacia inaequilatera* tall isolated shrubs, over *Triodia wiseana, Triodia basedowii* and *Triodia longiceps* mid open hummock grassland on slopes and hilltops.

7 *Acacia synchronicia, Acacia bivenosa* and *Acacia arida* tall sparse shrubland, over *Triodia longiceps, Triodia wiseana* and *Triodia pungens* mid open hummock grassland on flats and lower slopes.

8 *Hakea lorea* low isolated trees, over *Acacia bivenosa, Acacia arida* and *Acacia synchronicia* mid sparse shrubland, over *Triodia wiseana* and *Triodia longiceps* mid sparse hummock grassland and **Cenchrus ciliaris* mid sparse tussock grassland on hills and slopes.

9 Hummock Grassland of *Triodia pungens* with patches of *Cymbopogon ambiguus* and *Acacia synchronicia* and emergent *Corymbia hamersleyana* on flats and lower slopes.

10 *Corymbia hamersleyana* low open woodland, over *Acacia bivenosa, Acacia arida* and *Grevillea wickhamii* tall sparse shrubland, over *Triodia wiseana, Triodia basedowii* and *Triodia pungens* mid open hummock grassland on undulating plains and slopes.

11 *Acacia bivenosa* and *Acacia trachycarpa* tall isolated shrubs, over *Maireana* sp. and *Eremophea spinosa* low sparse shrubland, over **Cenchrus ciliaris* and *Sporobolus australasicus* mid sparse grassland on pale red/brown clayey flats.

12 Open Scrub of *Senna artemisioides* subsp. *oligophylla, Hakea lorea* subsp. *lorea* and *Atalaya hemiglauca* over mixed shrubs, herbs and grasses on rocky slopes.

13 Thicket of *Acacia ancistrocarpa, Acacia bivenosa* and *Senna artemisioides* subsp. *oligophylla* over mixed small shrubs and *Triodia* spp. on rehabilitation areas.

14 Open Low Woodland of *Atalaya hemiglauca* with *Corymbia hamersleyana* over *Corchorus lasiocarpus* subsp. *lasiocarpus*, **Aerva javanica, Eriachne mucronata* and *Triodia epactia* on minor watercourses.

15 *Eucalyptus victrix* mid isolated trees, over *Typha domingensis* and *Cyperus vaginatus* mid sedgeland and *Stemodia grossa* mid sparse forbland, over **Cenchrus ciliaris* mid sparse grassland on seasonally inundated peaty flats.

16 Hummock Grassland of *Triodia basedowii* with *Petalostylis labicheoides, Acacia arida, Grevillea wickhamii* subsp. *hispidula* and *Hakea lorea* subsp. *lorea* on undulating slopes.

17 *Acacia synchronicia, Acacia bivenosa* and *Grevillea wickhamii* tall sparse shrubland, over *Triumfetta maconochieana, Hibiscus coatesii* and *Cleome viscosa* low sparse shrubland, over *Triodia pungens* and *Triodia wiseana* mid sparse hummock grassland and *Eriachne mucronata* mid sparse tussock grassland on rocky outcrops.

18 *Corymbia hamersleyana* and *Corymbia aspera* low open woodland, over *Acacia arida, Acacia ancistrocarpa* and *Acacia tumida* tall open shrubland, over *Triodia pungens* and *Triodia wiseana* mid sparse hummock grassland on drainage lines with clayey soils.

19 *Acacia tumida, Grevillea wickhamii* and *Petalostylis labicheoides* tall shrubland, over *Triodia wiseana* and *Triodia pungens* mid open hummock grassland along minor gullies.

20 *Corymbia aspera* and *Corymbia hamersleyana* low open woodland, over *Eremophila exilifolia, Acacia arida* and *Tribulus suberosus* mid sparse shrubland, over *Eriachne ciliata* low isolated grasses on stony hilltops.

21 *Corymbia aspera* and *Corymbia hamersleyana* low open woodland, over *Acacia tumida, Petalostylis labicheoides* and *Grevillea wickhamii* mid open shrubland, over *Triodia pungens* and *Triodia wiseana* mid open hummock grassland and *Eulalia aurea* mid sparse grassland along major watercourses.

3.11 Threatened and Priority Ecological Communities

No TECs as listed at Commonwealth (DotEE 2019e) or State level (DBCA 2018c) or PECs listed at State level (DBCA 2019a) were identified as potentially occurring within the proposed WWME survey areas.

3.12 World Heritage Areas and Ramsar Wetlands

No World Heritage Areas or Ramsar wetlands are located within the proposed WWME survey areas (DotEE 2019f, 2019g).

3.13 National Heritage Properties

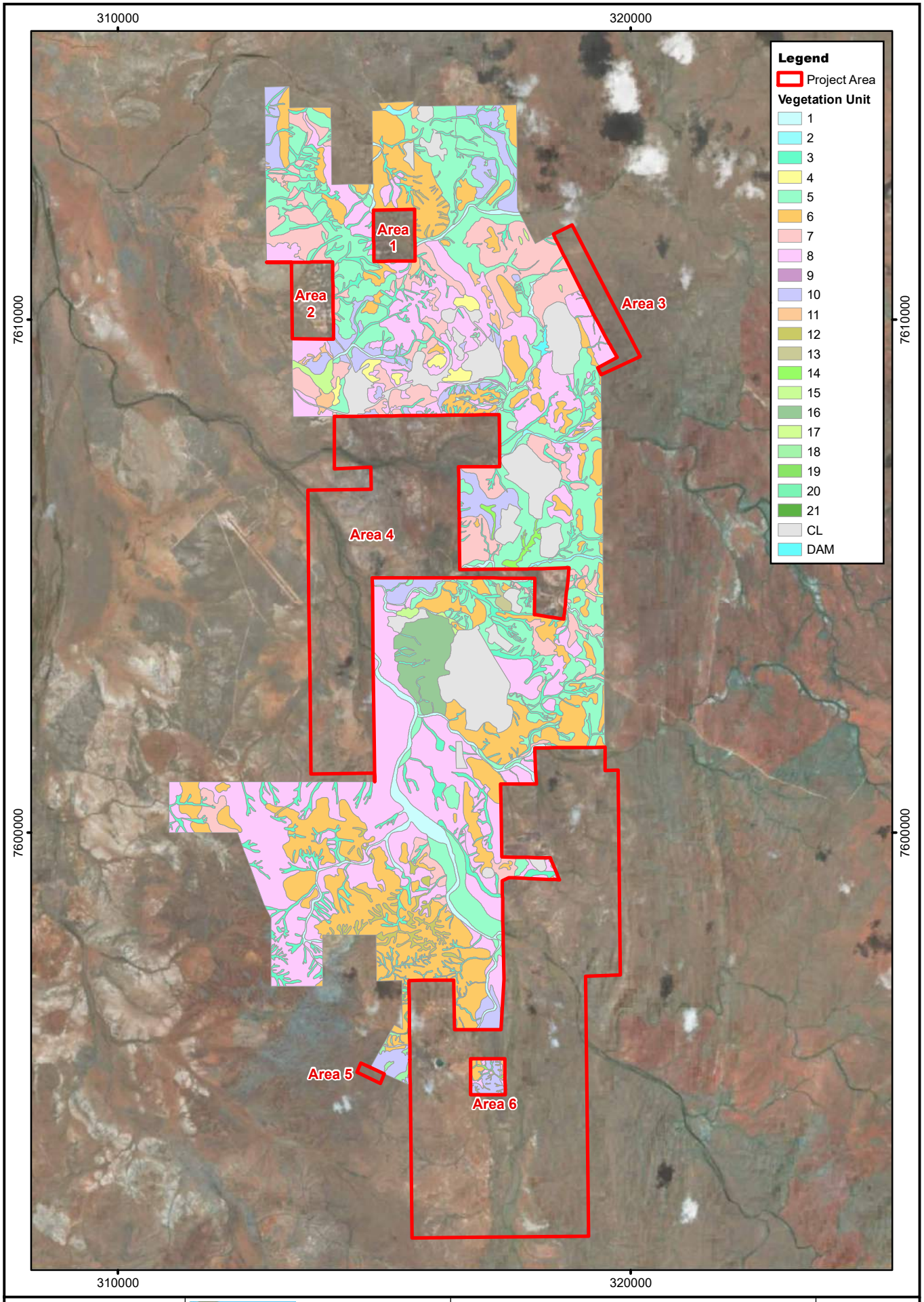
No National Heritage areas are located within the proposed WWME survey areas (2019h).

3.14 National Parks and Reserves

The southern end of the proposed WWME is located approximately 70 km northwest of the boundary of Karlamilyi National Park, the second largest national park in Australia (DBCA 2019b).

Meentheena Station, a proposed addition to the National Reserve System (gazettal in progress; Protected Planet 2019) is located less than 50 km northwest of the northwest end of the WWME survey areas.

Construction of the WWME should have no impact on these national parks and reserves.



N

0 0.6 1.2 km

Scale: 1:100,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_04

Date: October 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project

Vegetation

Figure: **6**

4. FIELD SURVEY - RESULTS

4.1 Flora

A total of 276 vascular plant taxa, representative of 116 genera and 43 families, were recorded within the Woodie Woodie Mine Expansion areas in 2019. The majority of taxa recorded were representative of the Fabaceae (53 taxa), Poaceae (41 taxa), Malvaceae (29 taxa) and Amaranthaceae (18 taxa) families (see Appendix C for a complete species list and Appendix E for species by survey area).

Of the 276 total taxa, 47 were not identified to species level. This was usually due to the lack of suitable material on the plants at the time of the survey. Although the survey was conducted during the recommended post wet season period (EPA 2016a), the region received significantly less rainfall during the four months preceding the survey (29.0 mm) than that of the long-term average (206.9 mm). This reduced the availability of flowering and fruiting material present on specimens required for their identification.

A species accumulation curve (Colwell 2013) was used to evaluate the sampling adequacy and is presented in Figure 7. The incidence-based coverage estimator of species richness was 332. Based on this value and the total of 276 taxa recorded (in the 245 vegetation mapping quadrats *only*) approximately 82 % of the flora species potentially present within the survey area were recorded.

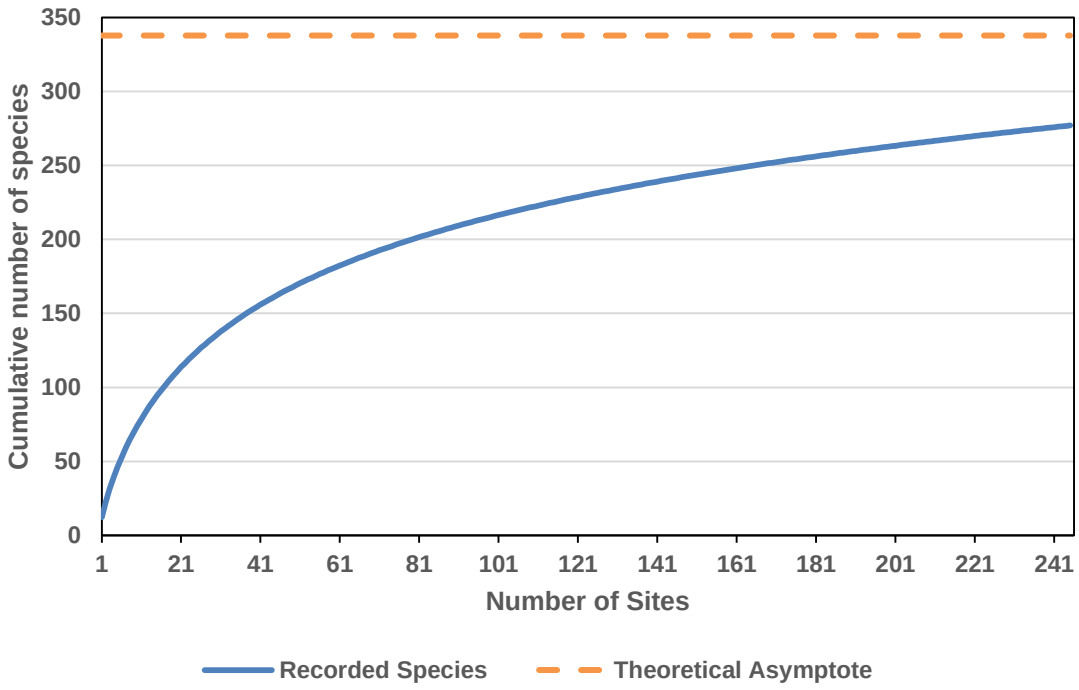


Figure 7: Species Accumulation Curve for the Woodie Woodie Mine Expansion Areas, 2019

4.2 Threatened and Priority Flora

No threatened flora species pursuant to Part 2, Division 1, and Subdivision 2 of the *BC Act* and as listed by DBCA (2019a), or pursuant to section 179 of the *EPBC Act* or listed by the DotEE (2019c), were recorded within the Woodie Woodie Mine Expansion areas.

One priority flora species, *Euphorbia clementii* (P3), was recorded within the survey area within Area 6 (see Appendices C and E). This species is an erect herb, occurring on gravelly/stony ground on hillsides, often associated with *Corymbia hamersleyana*. This species was recognized in the desktop assessment as having the potential to occur in the survey areas; it had been recorded in 2007 on the edge of survey Area 6 (WAH 1998-). In 2019, this species was recorded at three sites within Area 6 on the Woodie Woodie Mine Expansion areas (319177mE & 7598570mN; 317752mE & 7596795mN; 317446mE & 7597796mN). This herb occurs in a range of locations in the Pilbara region and currently is known from 28 records at the State Herbarium of Western Australia (WAH 1998-).

4.3 Introduced (Weed) Species and Declared Pest (Plant) Organisms

Of the 276 flora species recorded in the Woodie Woodie Mine Expansion areas in 2019, eleven are introduced species (Appendices C, F), of which one, **Calotropis procera*, is a Declared Pest pursuant to section 22 of the BAM Act 2007 according to the DPIRD (2019). **Calotropis procera* is assigned an s22 status, but classified as Exempt for its keeping category (Appendix A3). It is also on Department of Parks and Wildlife's (n.d.) Priority Alert list for the Pilbara region. Of the remaining ten introduced species, **Aerva javanica* and **Cenchrus ciliaris* were the most widely distributed and dominant introduced species within the survey areas. The other eight recorded introduced species were generally minimally distributed within the survey areas project areas, although most occurred in survey area A4 (Appendix E).

None of these introduced species are Weeds of National Significance (DotEE 2019d; Appendix F).

According to DBCA's weed prioritisation process (Department of Parks and Wildlife 2013), for the Pilbara region six of the eleven recorded introduced taxa are ranked 'High' for ecological impact and 'Rapid' for invasiveness (DBCA n.d.).

Three of the introduced taxa recorded in the WWME areas in 2019 had not previously been recorded in the general Woodie Woodie area by Mattiske (2007-2018): **Argemone ochroleuca* subsp. *ochroleuca*, **Cenchrus setiger* and **Echinochloa colona*.

4.4 Vegetation

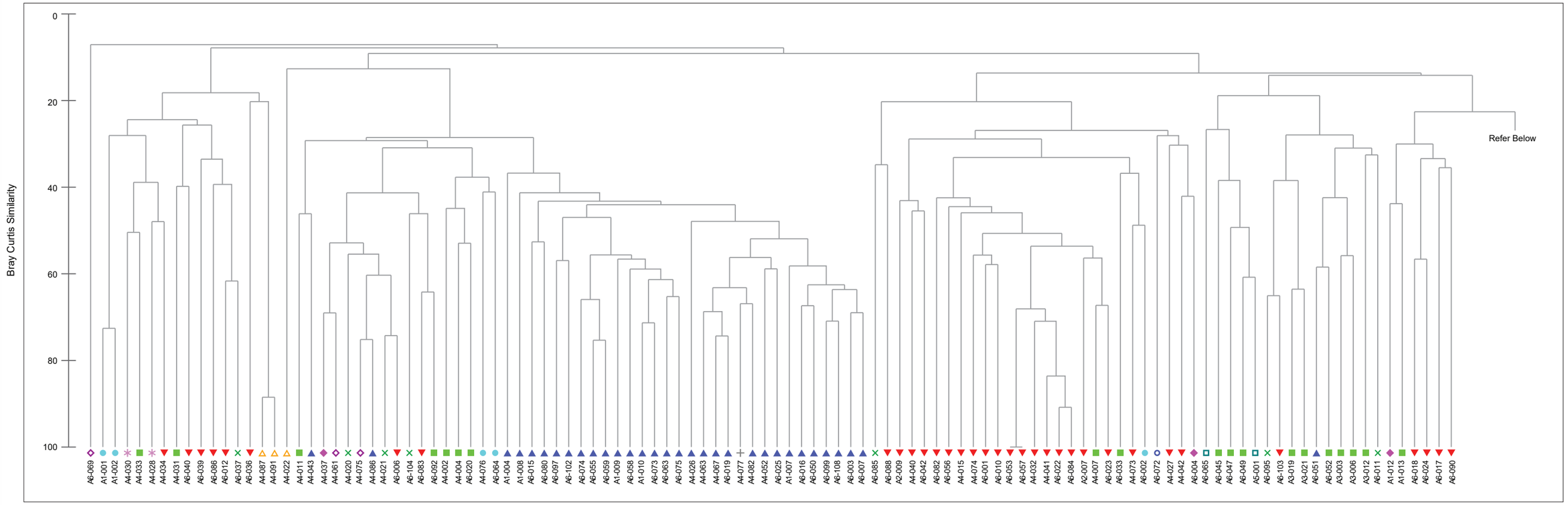
4.4.1 Statistical Analysis

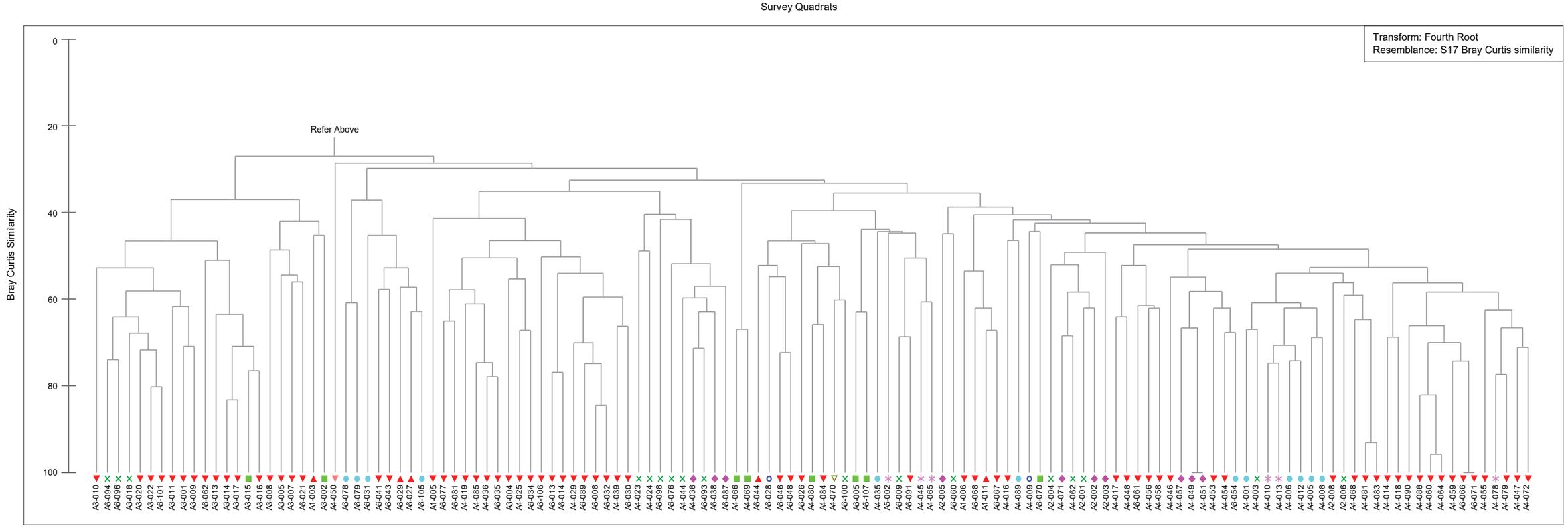
Cluster analysis was performed utilising a species-by-quadrat resemblance matrix (Bray-Curtis similarity) in order to group survey sites based on species composition. To down-weight the relative contributions of dominant species, a fourth root transformation was applied to the dataset. Annual species, species not identified to a species level and singletons (species recorded at a single quadrat) were all excluded from statistical analysis. *Cenchrus ciliaris remained in the dataset as it formed a dominant structural component of some communities. Hierarchical Clustering was used in conjunction with Similarity Profile (SIMPROF), Similarity Percentages (SIMPER), quadrat descriptions, quadrat photos and aerial photographs; combining these methods increased the understanding of quadrat inter-relations and thus the ability to accurately delineate those quadrats based on species composition.

Similarity Profile Analysis (SIMPROF) was able to identify 33 significantly associated groups of quadrats (Pi = 3.121; p = <0.001; Appendix E), with 7 isolated quadrats having no statistical similarity with any other quadrat. Broadly, analysis defined 11 groups of quadrats. The largest group contained sites with a mix of *Acacia* shrubs (*Acacia arida*, *Acacia bivenosa* and *Acacia synchronicia*) over Triodia species (*Triodia epactia,*

Triodia longiceps and Triodia wiseana) on low plains and slopes. Another major group was separated based on the presence of major watercourses, communities which included species such as *Atalaya hemiglauca, Eucalyptus victrix* and **Cenchrus ciliaris*.

A small group of sample sites were separated based on the presence of a *Corymbia candida* and *Triodia* spp. a community which occurred in very small proportions throughout the WWME. Another small group was separated by the presence of *Acacia sclerosperma* shrubland which had quite low representation across the WWME. One isolated sample site was separated by the presence *Eucalyptus leucophloia,* a species not present in any other quadrats throughout the WWME. Another single site was separated with no other similar quadrats as it contained *Typha domingensis*, a species which did not occur at any other site. The remaining groups were generally separated by differences in the composition of tall and low shrubs over *Triodia* spp.





1 2 3 5 6 7 8
10 11 17 18 22 23 24 25

CAD Ref: g1415_Dend_F01
Date: Nov 2019 | Rev: A | A3

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Mattiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202

Woodie Woodie mine expansion project
Hierarchical Cluster of Floristic Community Types
Group Average

Figure **8**

4.4.2 Vegetation Communities

While 33 associated groups were delineated by statistical analysis, an inclusive approach was considered appropriate given interpretation of statistical results combined with aerial imagery, field observations and previous Mattiske mapping. Based on this approach, fifteen vegetation communities were identified (Figure 7) and mapped within the six survey areas (Figures 8.1 to 8.5). Of the fifteen vegetation communities, 11 were consistent with previous Mattiske mapping (codes: 1, 2, 3, 5, 6, 7, 8, 10, 11, 17, and 18) and four were new to the area (codes: 22, 23, 24 and 25). Previous Mattiske vegetation community descriptions have been changed to conform with NVIS format. Vegetation number codes have continued on from previous Mattiske mapping.

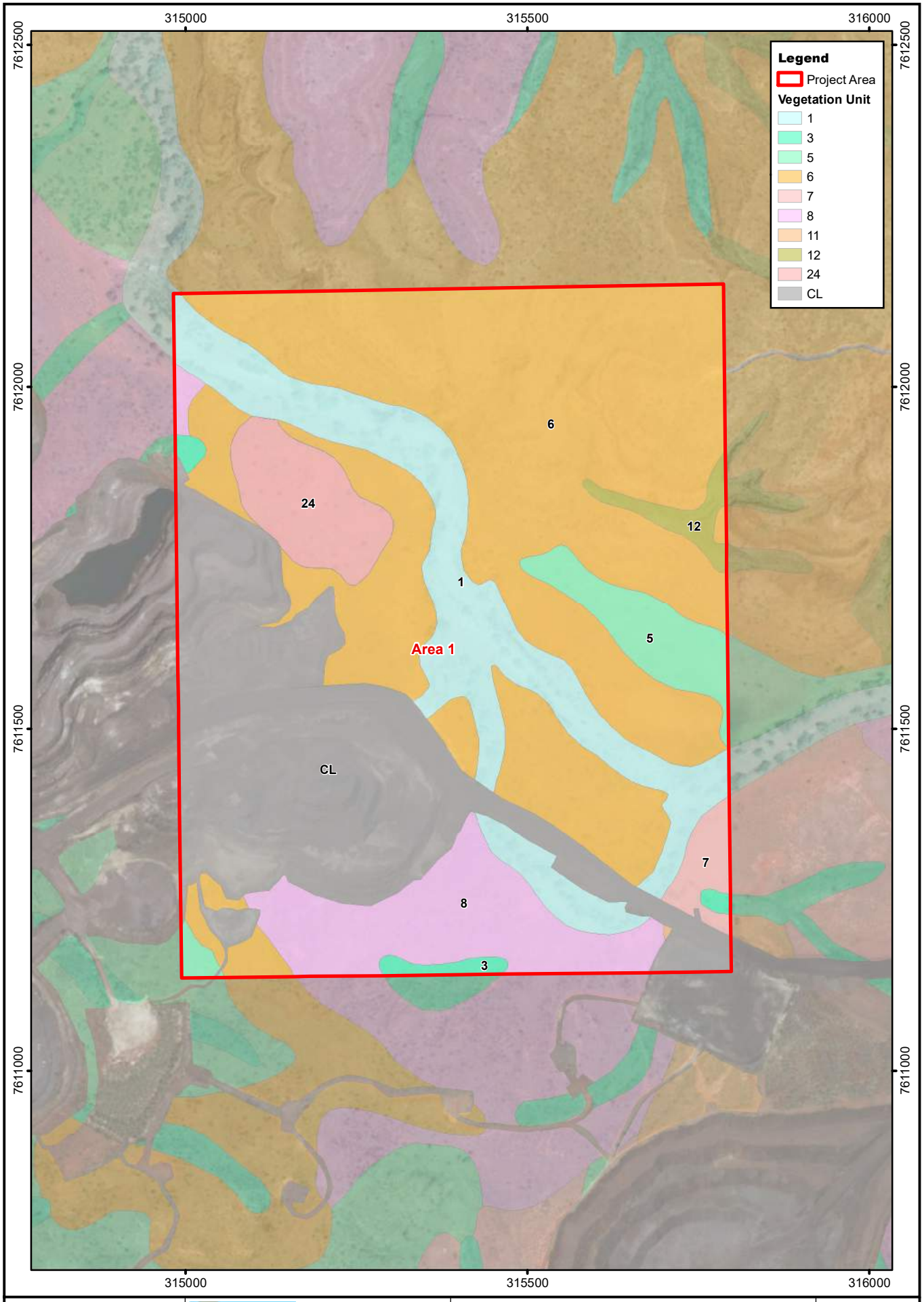
Within the 6 survey areas, the vegetation generally consisted of isolated trees over tall Acacia shrubs over Triodia hummock grasslands. Across the total area of the WWME community 7 was dominant (50.93 %), followed by vegetation community 8 (12.45 %), Cleared land (8.14 %) and vegetation community 1 (7.65%), with the remaining vegetation communities making up 28.81 %. By survey area, Area 1 was dominated by vegetation community 6, Area 2 was heavily dominated by vegetation community 7, Area 3 was dominated by vegetation community 7, Area 4 was dominated by vegetation community 7, Area 5 was dominated by vegetation community 10 and Area 6 was dominated by community 7(Table 5).

Table 4: Vegetation community descriptions for the Woodie Woodie Mine Expansion Areas, 2019. Descriptions based on NVIS format.

MATTISKE VEGETATION CODE	VEGETATION DESCRIPTION
1	*Eucalyptus victrix* and *Eucalyptus camaldulensis* mid open woodland, over *Acacia coriacea* subsp. *pendens*, *Atalaya hemiglauca* and *Acacia trachycarpa* tall sparse shrubland, over *Cyperus vaginatus* low sparse sedgeland, over **Cenchrus ciliaris* mid grassland on red-brown sandy loam along major watercourses.
2	*Eucalyptus victrix* mid open woodland, over *Atalaya hemiglauca*, *Petalostylis labicheoides* and *Acacia trachycarpa* tall sparse shrubland, over **Cenchrus ciliaris* mid tussock grassland on red-brown clay on flats, minor drainage channels and associated with major watercourses.
3	*Corymbia hamersleyana* low isolated trees, over *Petalostylis labicheoides*, *Acacia ancistrocarpa* and *Grevillea wickhamii* tall sparse shrubland, over *Triodia longiceps* mid sparse hummock grassland and **Cenchrus ciliaris* mid sparse tussock grassland on red-brown sand/clay/loam, sometimes with gravel, on flats and minor watercourses.
5	*Acacia arida*, *Acacia bivenosa* and *Acacia synchronicia* tall sparse shrubland, over *Triodia longiceps*, *Triodia wiseana* and *Triodia basedowii* mid open hummock grassland and patches of **Cenchrus ciliaris* and *Sporobolus australasicus* low open grassland on red sand and clay loam on flats, occasionally associated with watercourses.
6	*Corymbia aspera* and *Corymbia hamersleyana* low isolated trees, over *Hakea lorea* and *Acacia inaequilatera* tall isolated shrubs, over *Triodia wiseana*, *Triodia basedowii* and *Triodia longiceps* mid open hummock grassland on red-brown clay and loam with gravel on slopes and hilltops.
7	*Acacia synchronicia*, *Acacia bivenosa* and *Acacia arida* tall sparse shrubland, over *Triodia longiceps*, *Triodia wiseana* and *Triodia pungens* mid open hummock grassland on orange-red loam, clay loam, sandy loam on flats and lower slopes.
8	*Hakea lorea* low isolated trees, over *Acacia bivenosa*, *Acacia arida* and *Acacia synchronicia* mid sparse shrubland, over *Triodia wiseana* and *Triodia longiceps* mid sparse hummock grassland and **Cenchrus ciliaris* mid sparse tussock grassland on brown clay and loam with rocks and pebbles on hills and slopes.
10	*Corymbia hamersleyana* low open woodland, over *Acacia bivenosa*, *Acacia arida* and *Grevillea wickhamii* tall sparse shrubland, over *Triodia wiseana*, *Triodia basedowii* and *Triodia pungens* mid open hummock grassland on red-brown clay/sand/loam, with some gravel, on undulating plains and slopes.
11	*Acacia bivenosa* and *Acacia trachycarpa* tall isolated shrubs, over *Maireana* sp. and *Eremophea spinosa* low sparse shrubland, over **Cenchrus ciliaris* and *Sporobolus australasicus* mid sparse grassland on pale red/brown clayey flats.
17	*Acacia synchronicia*, *Acacia bivenosa* and *Grevillea wickhamii* tall sparse shrubland, over *Triumfetta maconochieana*, *Hibiscus coatesii* and *Cleome viscosa* low sparse shrubland, over *Triodia pungens* and *Triodia wiseana* mid sparse hummock grassland and *Eriachne mucronata* mid sparse tussock grassland on red clay and loam on rocky outcrops.
18	*Corymbia hamersleyana* and *Corymbia aspera* low open woodland, over *Acacia arida*, *Acacia ancistrocarpa* and *Acacia tumida* tall open shrubland, over *Triodia pungens* and *Triodia wiseana* mid sparse hummock grassland on clayey soils on flats and drainage channels.
22	*Acacia sclerosperma* subsp. *sclerosperma* tall open shrubland over *Acacia bivenosa* mid isolated clumps of shrubs over *Triodia epactia* and *Eulalia aurea* sparse grassland on red clayey or sandy soil associated with minor drainage lines.
23	*Eucalyptus leucophloia* subsp. *leucophloia* low isolated clumps of trees over *Triodia longiceps* and *Eriachne mucronata* open grassland on skeletal, stony orange soil on breakaways and upper slopes.
24	*Corymbia candida* mid open woodland over *Acacia arida* mid sparse shrubland over *Triodia epactia* and *Triodia wiseana* open hummock grassland on orange rocky clayey loam and sandy loam on stony hilltops.
25	*Typha domingensis* tall open forbland over *Cyperus vaginatus* open sedgeland over *Triodia wiseana* and *Triodia longiceps* sparse hummock grassland on grey-orange clay with pebbles on flats with permanent inundation.

Table 5: Area coverage of vegetation communities within the Woodie Woodie Mine Expansion Areas, 2019

Survey area	Vegetation community	Area (ha) for each survey area	Percentage of each survey area
Area 1	1	10.87	13.46
	3	0.70	0.86
	5	2.89	3.59
	6	35.00	43.37
	7	1.08	1.34
	8	6.80	8.43
	11	0.02	0.02
	12	0.89	1.11
	24	3.35	4.15
	CL	19.11	23.68
Area 2	3	1.64	1.35
	5	11.47	9.47
	7	33.51	27.69
	8	26.08	21.54
	CL	48.35	39.95
Area 3	3	16.65	12.91
	6	0.26	0.20
	7	108.82	84.34
	8	3.30	2.56
Area 4	1	123.19	8.41
	2	8.53	0.58
	3	42.29	2.89
	5	54.48	3.72
	6	100.06	6.83
	7	772.10	52.73
	8	143.35	9.79
	10	54.44	3.72
	11	54.15	3.70
	17	2.03	0.14
	22	6.68	0.46
	23	0.12	0.01
	25	0.45	0.03
	CL	102.48	7.00
Area 5	1	196.75	1970.08
	3	100.76	1008.96
Area 6	5	167.90	6.67
	6	128.95	5.12
	7	1286.39	51.09
	8	361.92	14.37
	10	68.59	2.72
	11	2.35	0.09
	12	0.12	0.00
	18	16.69	0.66
	22	4.70	0.19
	23	0.75	0.03
	CL	182.12	7.23



N

0 50 100 m

Scale: 1:7,500
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_07

Date: November 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

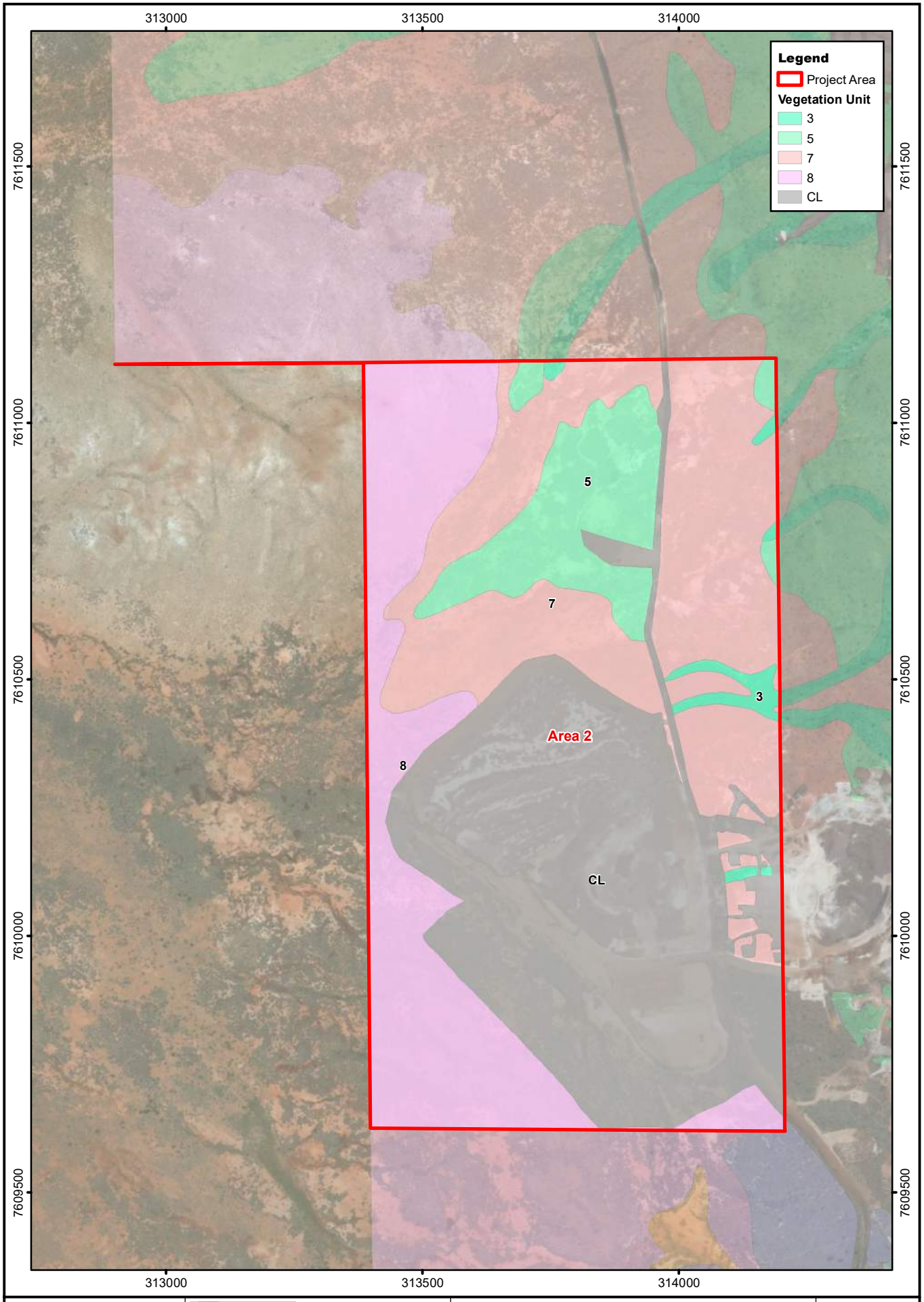
Woodie Woodie mine expansion project

Vegetation

Area 1

Figure:

9.1



N

0 60 120 m

Scale: 1:10,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_08

Date: November 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640

Author: E M Matttiske | MCPL Ref: MBS1902

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

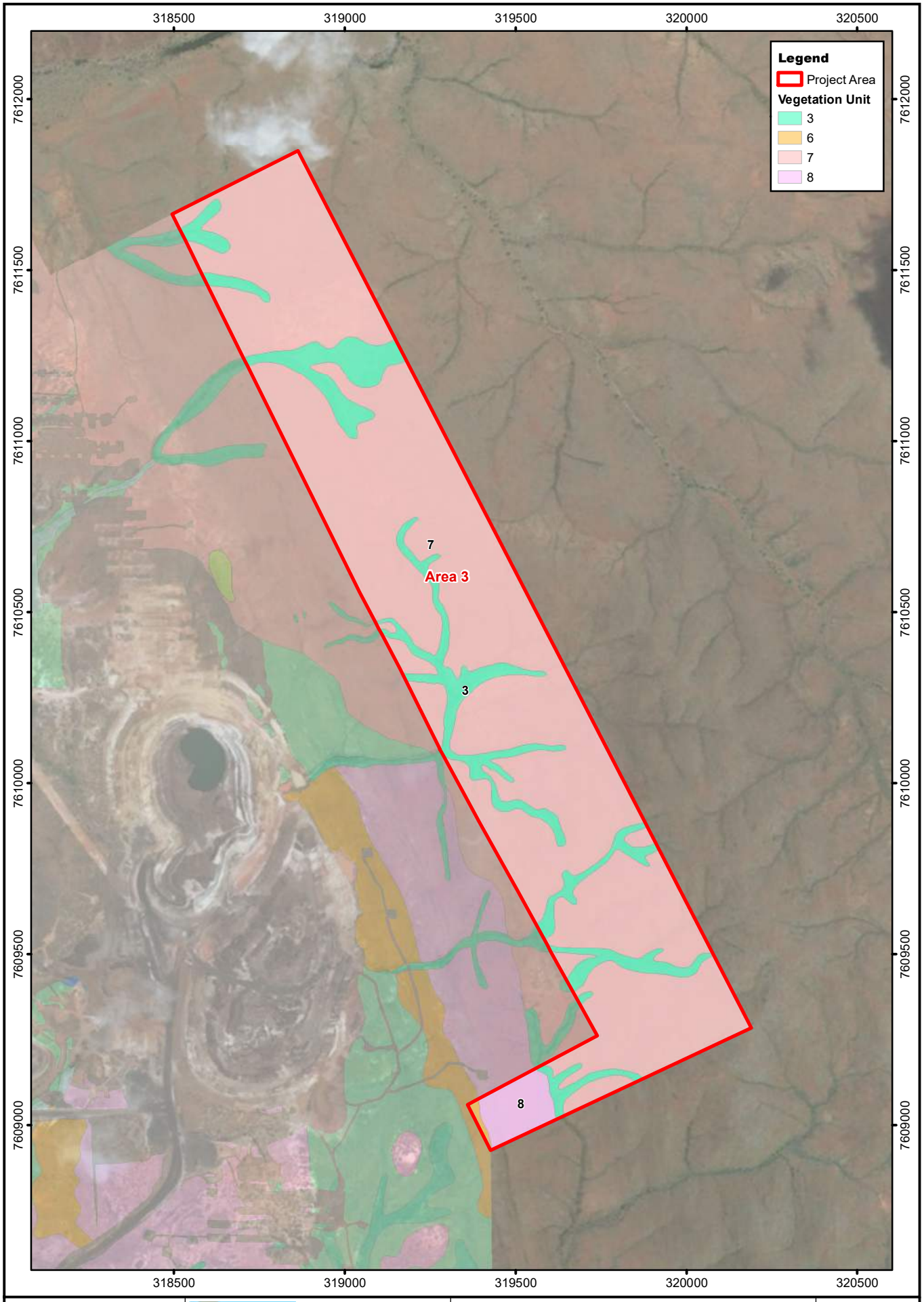
Woodie Woodie mine expansion project

Vegetation

Area 2

Figure:

9.2



N

0 100 200 m

Scale: 1:15,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_09

Date: November 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640

Author: E M Matttiske | MCPL Ref: MBS1902

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

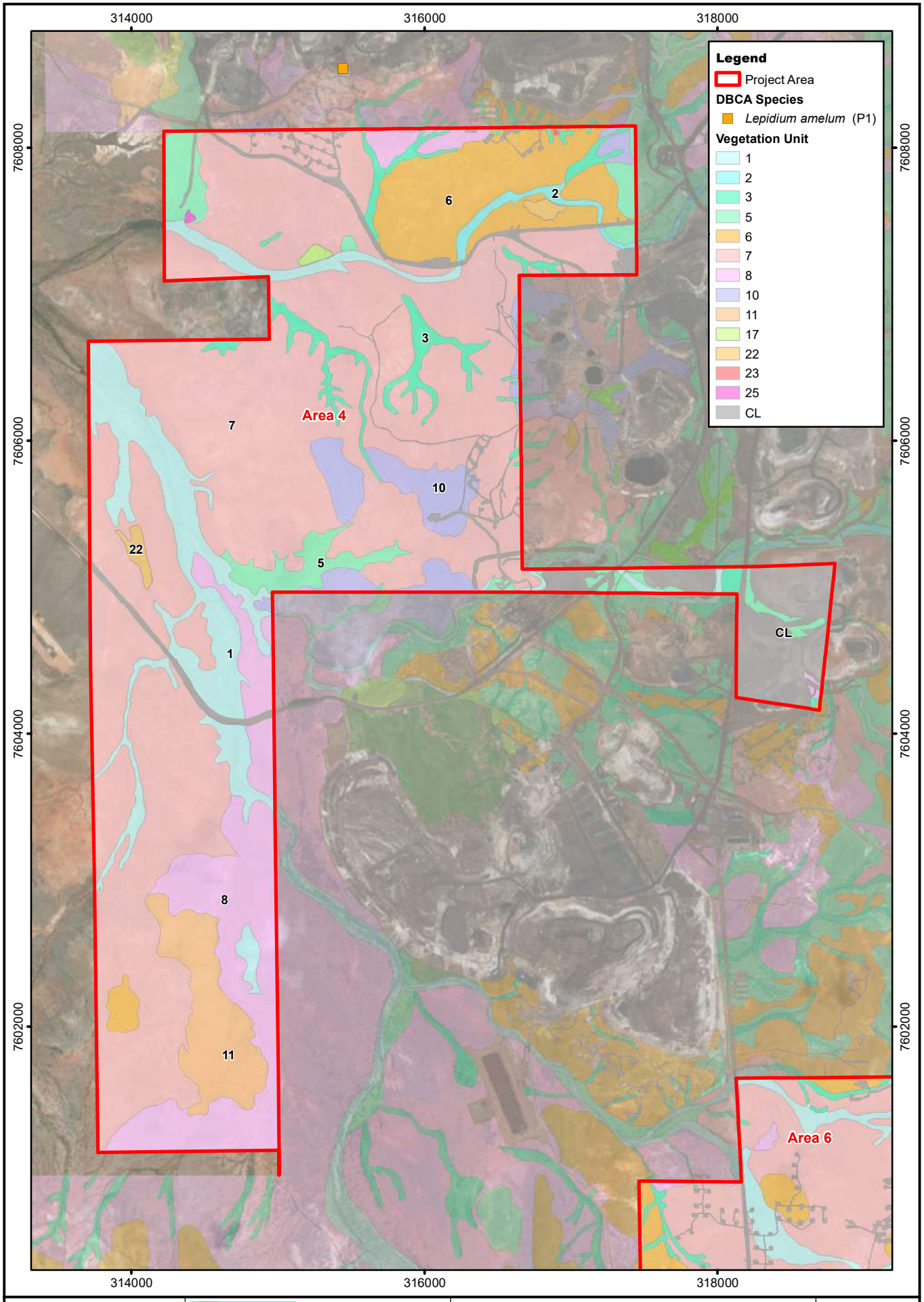
Woodie Woodie mine expansion project

Vegetation

Area 3

Figure:

9.3



N

0 230 460 m

Scale: 1:35,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_10

Date: November 2019 | Rev: A | A4

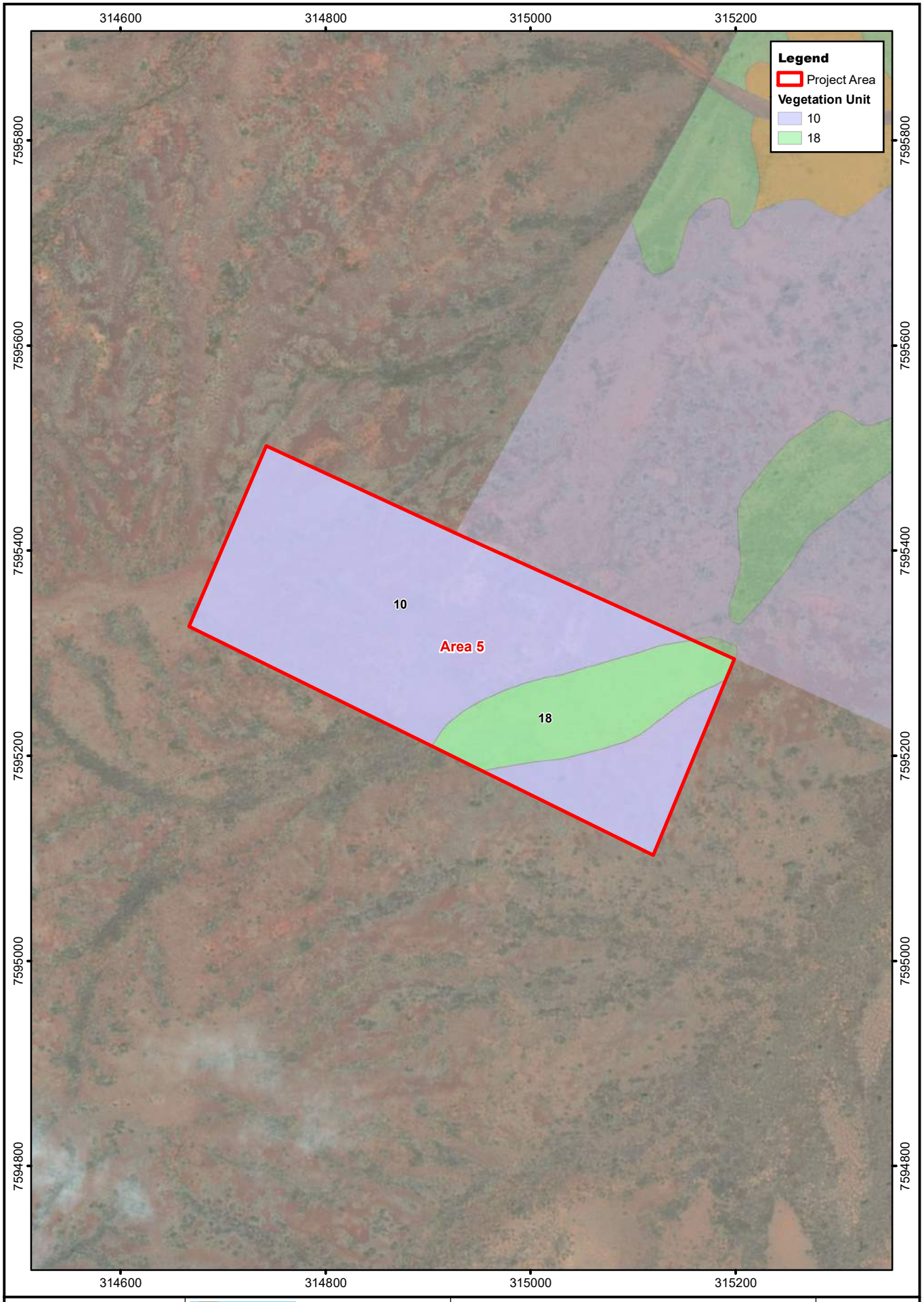
Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project

Vegetation

Area 4

Figure: **9.4**



N

0 30 60 m

Scale: 1:5,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_11

Date: November 2019 | Rev: A | A4

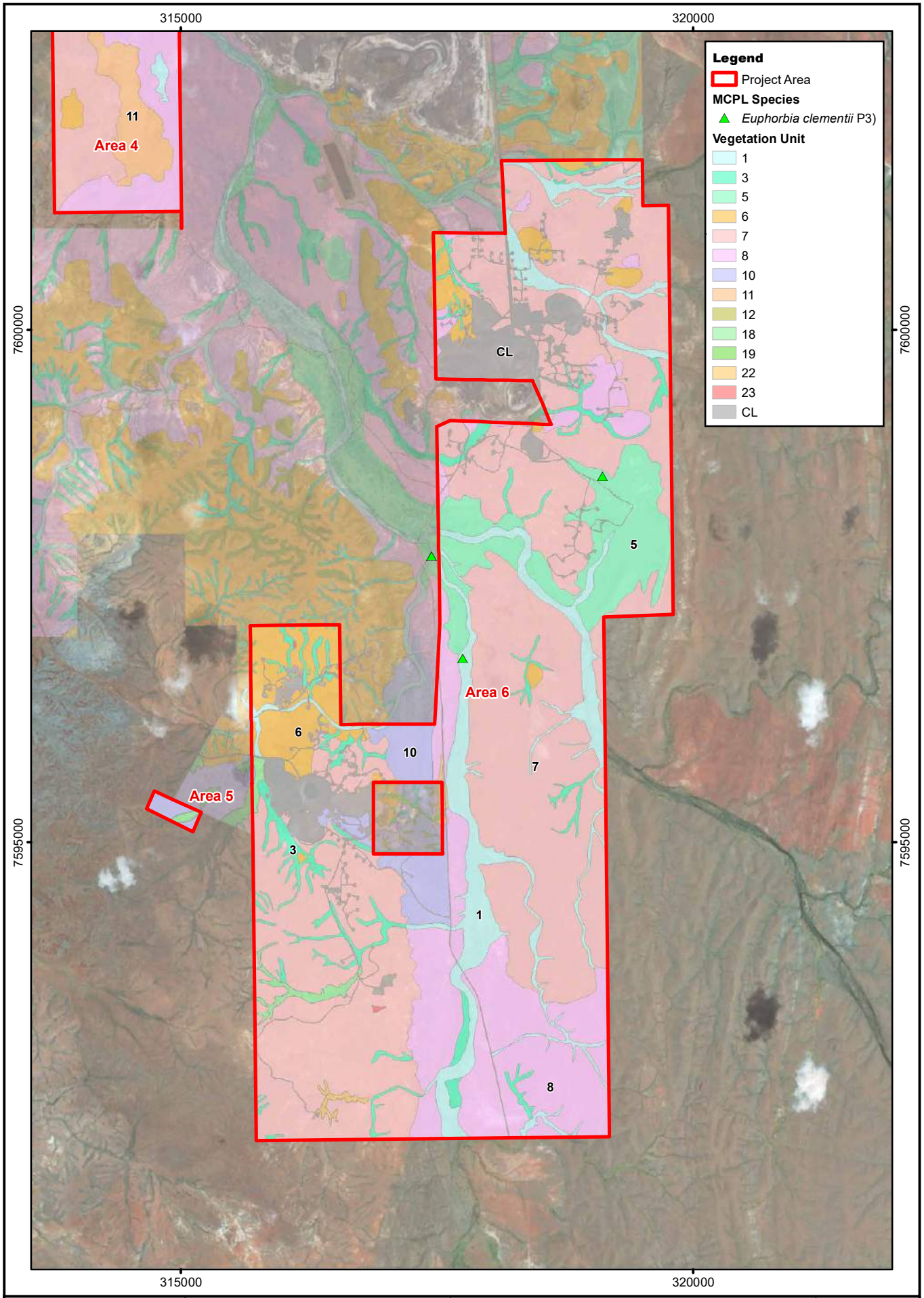
Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project

Vegetation

Area 5

Figure: **9.5**



N

0 340 680 m

Scale: 1:50,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_13

Date: November 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project

Vegetation

Area 6

Figure: **9.6**

4.5 Threatened and Priority Ecological Communities

No TEC's or PEC's were inferred to occur within any of the six survey areas.

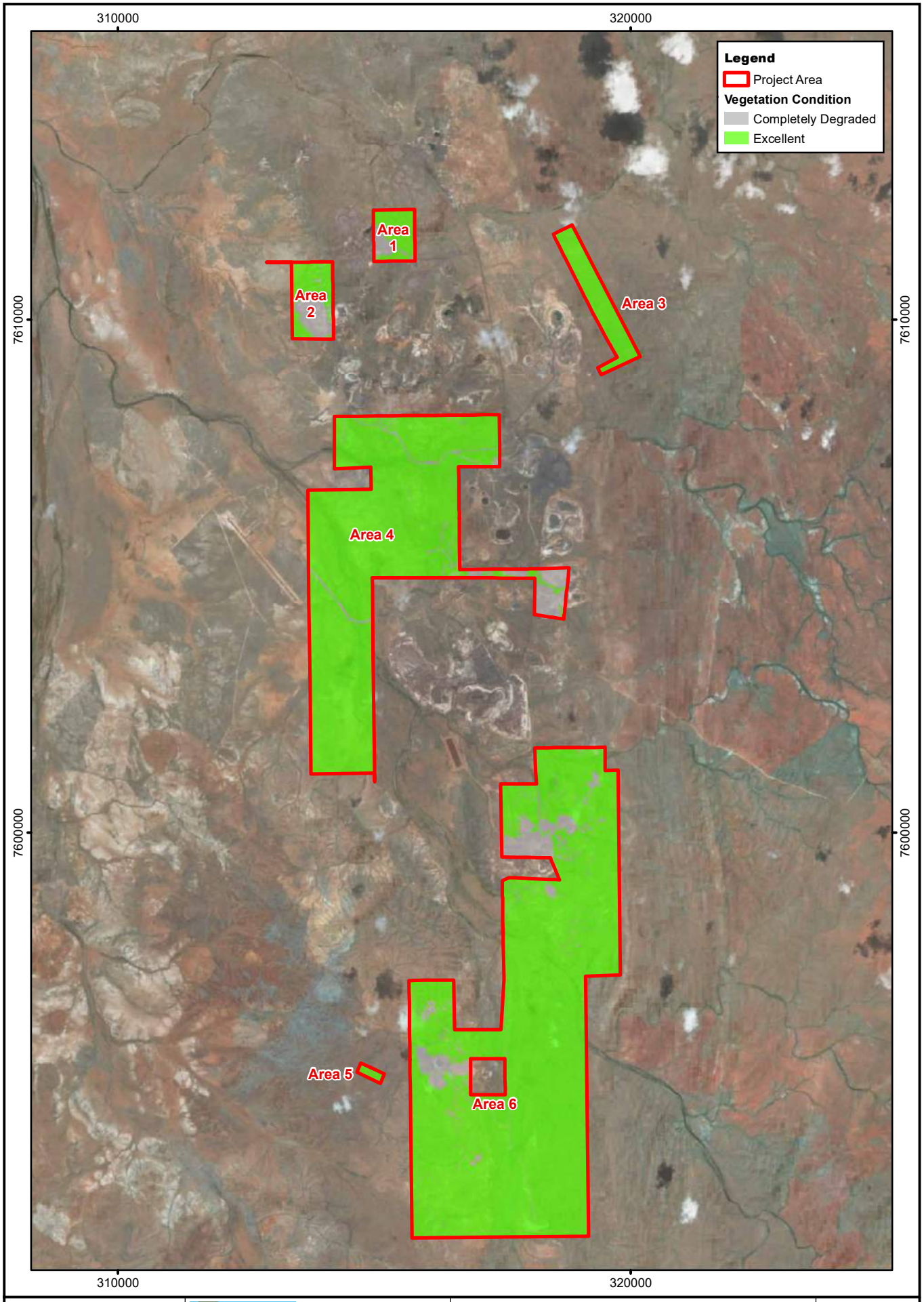
4.6 Vegetation Condition

Within the survey area the vegetation condition was ranked as either 'Excellent', 'Very Good', 'Good', 'Poor' or 'Degraded' as per the vegetation condition scale developed by Trudgen (1988).

Vegetation in all six areas was generally considered to be in 'Excellent' condition with the exception of land cleared for mining activities, which were categorised as 'Completely Degraded' (Table 6, Figure 10). Sites were qualified in terms of disturbance by the observation of cattle and vehicle tracks and the presence and density of weed species. Sites along watercourses or drainage lines tended to be more degraded, likely due to increased cattle activity near potential water sources and the corresponding spread of weeds via cattle and the movement of water. Sites on slopes and away from vehicle tracks were generally in better condition and were categorised as 'Very Good' or 'Excellent'. Some of the sites summarized in Appendix G were 'Good' or 'Very Good'; however as the specific sites were too small to map separately in most instances the condition mapping reflected the overall condition in the respective wider mapping areas.

Table 6: Vegetation condition (percentage) of vegetation communities mapped within the Woodie Woodie Mine Expansion Areas, 2019

Condition	Project area (%)	Area 1 (%)	Area 2 (%)	Area 3 (%)	Area 4 (%)	Area 5 (%)	Area 6 (%)
Excellent	91.86	76.32	60.05	100	93	100	92.77
Completely Degraded	8.14	23.68	39.95	0	7	0	7.23



N

0 0.7 1.4 km

Scale: 1:100,000
MGA94 (Zone 51)

CAD Ref: a1415_WW_f13_14

Date: November 2019 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref: MBS1902
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Woodie Woodie mine expansion project

Vegetation Condition

Figure: **10**

5. DISCUSSION AND CONCLUSIONS

5.1 Flora Species

A total of 276 vascular plant taxa, representative of 116 genera and 403 families, were recorded within the Woodie Woodie Mine Expansion areas in 2019. The majority of taxa recorded were representative of the Fabaceae (53 taxa), Poaceae (41 taxa), Malvaceae (29 taxa) and Amaranthaceae (18 taxa) families (see Appendix C for a complete species list and Appendix E for species by survey area).

Of the 276 total taxa, 47 were not identified to species level. This was usually due to the lack of suitable material on the plants at the time of the survey. Although the survey was conducted during the recommended post wet season period (EPA 2016a), the region received significantly less rainfall during the four months preceding the survey than that of the long-term average. This reduced the availability of flowering and fruiting material present on specimens, required for their identification.

5.2 Priority Flora Species

No threatened flora species pursuant to Part 2, Division 1, and Subdivision 2 of the *BC Act* and as listed by DBCA (2019a), or pursuant to section 179 of the *EPBC Act* or listed by the DotEE (2019c), were recorded within the Woodie Woodie Mine Expansion areas.

One priority flora species, *Euphorbia clementii* (P3), was recorded within the survey area within Area 6 (see Appendices C and E). This species is an erect herb, occurring on gravelly/stony ground on hillsides. This species was recognized previously as having the potential to occur in the survey areas (Mattiske Consulting Pty Ltd). In 2019, this species was recorded at three sites within Area 6 on the Woodie Woodie Mine Expansion areas (319177mE & 7598570mN; 317752mE & 7596795mN; 317446mE & 7597796mN).

5.3 Introduced Flora Species

Of the 276 flora species recorded in the Woodie Woodie Mine Expansion areas in 2019, thirteen were introduced species, of which one, **Calotropis procera*, was a Declared Pest pursuant to section 22 of the BAM Act 2007 according to the DPIRD (2019). **Calotropis procera* is assigned an s22 status, requiring that it not be imported into WA while being 'Exempt' from keeping restrictions (Appendix A3). Management of this species is advisable to avoid the spread of this species, however there is no control requirement listed according to the DPIRD (2019).

Of the remaining twelve introduced species, **Aerva javanica* and **Cenchrus ciliaris* were the most widely distributed and dominant introduced species within the survey areas. The remaining ten introduced species were generally minimally distributed within the survey areas project areas, although most occurred in survey area A4 (Appendix E).

None of these introduced species are Weeds of National Significance (DotEE 2019d; Appendix F).

5.4 Vegetation Communities

A total of 15 vegetation communities were recorded within the WWME. None of these communities contained areas representative of TECs or PECs. The vegetation communities present occurred on a range of different associated soils and landforms, the survey area contained creek lines, low hills and plains to the north of the WWME and large expanse of steep rocky hills bounding the south. These landforms were mostly associated with gravel over orange brown clay loam soils supporting *Acacia* shrubs over different species of *Triodia* including; *Triodia epactia, Triodia longiceps* and *Triodia wiseana.* Creekline communities consisted of broad systems which include *Eucalyptus victrix*, *Eucalyptus camaldulensis* and various

Corymbia species through the associated gullies and drainage lines. Open plain areas generally consisted of Acacia shrubs such as *Acacia arida*, *Acacia bivenosa and Acacia synchronicia* over mixed grasses such as *Triodia epactia*, *Triodia longiceps* and *Triodia wiseana*.

Most vegetation communities are well represented at a local, sub regional and regional scale, with the exception of one community type, community 25, which occurs only once throughout the WWME. Community 25 contains Typha domingensis over *Cyperus vaginatus* and mixed *Triodia species*. This community is located at the current discharge point for mine dewatering at Woodie Woodie, creating a novel environment with high soil moisture levels, differentiating this site from all other WWME survey sites which were markedly dry.

Community 7 was most represented throughout the WWME and is characterized by tall shrubs such as *Acacia arida*, *Acacia bivenosa* and *Acacia synchronicia* over *Triodia longiceps*, *Triodia pungens* and *Triodia wiseana*. The high representation of Community 7 can be associated with the Coongimah Land System which consists of vegetation across flats and slopes, and contributes the greatest proportion of land cover in the WWME areas surveyed.

5.5 Vegetation Condition

Throughout the WWME area disturbance was observed in the form of infrastructure cleared for mining operations, drill line and exploration tracks, animals such as cattle and the presence of invasive plant species. Cattle activity significantly degrades vegetation condition by grazing native vegetation, trampling and compacting soil leading to erosion by wind and water. Communities containing water courses are likely to attract cattle as they search for drinking water, more palatable vegetation which grows in areas of greater soil moisture and shade from sun exposure provided by larger *Eucalyptus* trees in the creek lines. **Cenchrus ciliaris* was observed to have formed a structural component to several vegetation groups in the WWME such as communities 1,2 and 3. **Cenchrus ciliaris* is known to have a large impact on local ecosystems; altering fire regimes, soil erosion rates, ground surface temperatures and causing a reduction in species richness (Marshall et al. 2012).

Vegetation in all six areas was generally considered to be between categories 'Very Good' to 'Excellent' with the exception of cleared land for mining activities, which were categorised as 'Completely Degraded' (Table 6). Sites were qualified in terms of disturbance by the presence of animal and vehicle tracks and the presence and density of weed species. Sites along watercourse or drainage lines tended to be more degraded due to the increased activity of cattle near potential water sources and the corresponding spread of weeds via cattle and the movement of water. Sites on slopes and away from vehicle tracks were generally in better condition and were categorised as 'Very Good' or 'Excellent'.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the desktop and field survey of the flora and vegetation in the WWME demonstrated no specific botanical concerns associated with potential clearing for mining. Potential environmental issues may arise when interacting with major watercourses, particularly in Areas 4 and 6. Major watercourses often facilitate introduced species and cattle activity. Activities in these areas may aid the spread of introduced species further afield. Therefore, it is recommended that major watercourses remain intact where possible and undisturbed. General vehicle weed hygiene should always be followed. While the Declared Pest **Calotropis procera* has no control classification according to the DPIRD (2019), early control would be considered prudent to prevent infestations expanding beyond their current range within the WWME.

7. ACKNOWLEDGEMENTS

The authors would like to thank Sarah Thomas and environmental team at Woodie Woodie operations and Jonathon Barker at MBS Environmental for their assistance with this project. The authors would also like to thank taxonomists from the Western Australian Herbarium for their plant identification support.

8. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

NAME	POSITION	PROJECT INVOLVEMENT	FLORA COLLECTION PERMITS
Dr EM Mattiske	Managing Director & Principal Ecologist	Planning, managing, reporting	N/A
Mr L Rowles	Project Leader	Planning, fieldwork, data analysis, reporting	FB62000020
Mr R Dharmarajan	Experienced Botanist	Fieldwork	FB62000028
Ms K Lambert	Experienced Botanist	Fieldwork	FB62000023
Mr A Barrett	Experienced Botanist	Fieldwork	FB62000030
Ms E Chetwin	Botanist	Reporting	N/A
Ms S Zhai	Botanist	Assisted with reporting	N/A
Mr B Ellery	Experienced Botanist	Plant identification	N/A

9. REFERENCES

Atlas of Living Australia 2019, *Atlas of Living Australia*. Available from: https://www.ala.org.au/. 03 August 2019.

Beard, JS 1975, *Vegetation Survey of Western Australia – Pilbara, 1:1,000,000 Vegetation Series – Explanatory notes to sheet 5*, University of Western Australia Press, Nedlands, Western Australia.

Beard, JS 1990, *Plant Life of Western Australia*. Kangaroo Press, Kenthurst NSW.

Biodiversity Conservation Act 2016 (WA)

Biosecurity and Agriculture Management Act 2007 (WA)

Bureau of Meteorology 2019, *Climate data online*, Commonwealth of Australia. Available from: http://www.bom.gov.au/climate/data/?ref=ftr. 31st of October 2019.

Chao, A 2004, 'Species richness estimation', in: *Encyclopaedia of statistical sciences*, eds. N Balakrishnan, CB Read & B Vidakovic, Wiley, New York.

Clarke, KR & Gorley, RN 2015*, PRIMER v7 - User Manual/Tutorial*, PRIMER-e, Devon, United Kingdom.

Colwell, RK 2013, *EstimateS – Statistical estimation of species richness and shared species from samples*, Version 9. Available from: viceroy.colorado.edu/estimates. 03 August 2019.

Cowan, M and Kendrick, P 2001, 'Little Sandy Desert 2 (LSD2 – Trainor subregion)', in: *A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002*, eds. JE May & NL McKenzie, Department of Conservation and Land Management, Western Australia, pp. 413-422.

Bureau of Meteorology 2019, Climate data online, Commonwealth of Australia. Available from: http://www.bom.gov.au/climate/data/?ref=ftr. 03 April 2019.

Department of Agriculture and Food 2012, *Pre-European Vegetation Look Up Table*. Available from: https://catalogue.data.wa.gov.au/dataset/pre-european-dpird-006/resource/d6ce041c-8f7a-4309-9f52-44c1b617a4c8, viewed 03 October, 2019.

Department of Biodiversity, Conservation and Attractions 2018a, *Wildlife Conservation (Rare Flora Notice 2018) – 11 September 2018.* Available from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/flora_notice.pdf. 03 October 2019.

Department of Biodiversity, Conservation and Attractions 2018b, *Threatened and Priority Flora List – 05 December 2018*. Available from: https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants. 03 October 2019.

Department of Biodiversity, Conservation and Attractions 2018c*, List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment - 28 June 2018.* Available from: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_for_the_environment_june_2018.pdf. 03 October 2019.

Department of Biodiversity, Conservation and Attractions 2019a, *Priority Ecological Communities for Western Australia Version 28 (17 January 2019)*. Available from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority%20ecological%20communities%20list%20_Jan%202019.pdf,. 03 October 2019.

Department of Biodiversity, Conservation and Attractions 2019b, *Karlamilyi National Park*, https://parks.dpaw.wa.gov.au/park/karlamilyi. 13 October 2019.

Department of Biodiversity, Conservation and Attractions 2019c, *Conservation codes for Western Australian flora and fauna, January 2019*. Available from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation%20code%20definitions.pdf. 03 October 2019.

Department of Environment and Conservation 2013, *Definitions, categories and criteria for Threatened and Priority Ecological Communities*. Available from: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf. 03 October 2019.

Department of the Environment and Energy 2019a, *Protected Matters Search Tool*. Available from: http://www.environment.gov.au/epbc/protected-matters-search-tool. 03 August 2019.

Department of the Environment and Energy 2019b, *Australia's bioregions (IBRA).* Available from: http://www.environment.gov.au/topics/land/national-reserve-system/science-maps-and-data/australias-bioregions-ibra. 03 October 2019.

Department of the Environment and Energy 2019c, *EPBC Act List of Threatened Flora*. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora. 03 August 2019.

Department of the Environment and Energy 2019d, *Weeds of National Significance.* Available from: http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html. 03 October 2019.

Department of the Environment and Energy 2019e, *EPBC Act List of Threatened Ecological Communities*. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl. 03 October 2019.

Department of the Environment and Energy 2019f, *Australia's world heritage list*. Available from: http://www.environment.gov.au/heritage/places/world-heritage-list. 03 October 2019.

Department of the Environment and Energy 2019g, *Australian Ramsar wetlands*. Available from: http://www.environment.gov.au/water/wetlands/australian-wetlands-database/australian-ramsar-wetlands. 03 October 2019.

Department of the Environment and Energy 2019h, *Australia's national heritage list.* Available from: http://www.environment.gov.au/heritage/places/national-heritage-list. 03 October 2019.

Department of Parks and Wildlife 2007-, *NatureMap - mapping Western Australia's biodiversity*. Available from: http://naturemap.dec.wa.gov.au. 03 August 2019.

Department of Parks and Wildlife 2013, *Weed prioritisation process for DPaW (formerly DEC) – "An integrated approach to weed management on DPaW-managed lands in WA", November 2013*, Government of Western Australia. Available from: https://www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/156-how-does-dpaw-manage-weeds, 17 October2018.

Department of Parks and Wildlife n.d., Pilbara impact and invasiveness rankings. Available from: https://www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/156-how-do-we-manage-weeds, 17 October 2019.

Department of Primary Industries and Regional Development 2019, *Western Australian Organism List*. Available from: https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol. 03 October 2019.

Environmental Protection Act 1986 (WA)

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

Environmental Protection Authority 2016a, *Environmental Factor Guideline - Flora and Vegetation,* Environmental Protection Authority, Perth, WA.

Environmental Protection Authority 2016b, *Technical Guidance – Flora and vegetation surveys for environmental impact assessment*, Environmental Protection Authority, Western Australia.

Executive Steering Committee for Australian Vegetation Information 2003, *Australian vegetation attribute manual: National vegetation information system, version 6.0*, Department of the Environment and Heritage, Canberra.

Kendrick, P 2001, 'Great Sandy Desert 2 (GSD2 – Mackay subregion)' in: *A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002*, eds. JE May & NL McKenzie, Department of Conservation and Land Management, Western Australia, pp. 332-342.

Kendrick, P and McKenzie, N 2001, 'Pilbara 1 (PIL1 – Chichester subregion)', in: *A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002*, eds. JE May & NL McKenzie, Department of Conservation and Land Management, Western Australia, pp. 547-558.

Mattiske Consulting Pty Ltd 2007a, *Flora and vegetation Survey of Tenement M46/435 (including the Gulch Prospect), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, August 2007.

Mattiske Consulting Pty Ltd 2007b, *Flora and vegetation survey of tenement M46/513 Warri Warri Creek, Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, October 2007.

Mattiske Consulting Pty Ltd 2007c, *Flora and vegetation survey of tenement M45/429 (including Sat/Nav and Radio Hill deposits), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, October 2007.

Mattiske Consulting Pty Ltd 2007d, *Flora and vegetation survey of tenement M45/430 (including Big Mac, Ghost Hunter, Sardine, Topvar and Whodowe prospects), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, October 2007.

Mattiske Consulting Pty Ltd 2007e, *Flora and vegetation survey of the Eat tenement, Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, October 2007.

Mattiske Consulting Pty Ltd 2007f, *Flora and Vegetation Survey of Tenement M45/433 (including Chutney West Deposit), Woodie Woodie*. Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Pty Ltd, August 2007.

Mattiske Consulting Pty Ltd 2007g, *Flora and vegetation survey of the tenement M45/638 (including Camp East, Paystar and Vespa prospects), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, October 2007.

Mattiske Consulting Pty Ltd 2007h, *Flora and vegetation survey of the tenement M46/93 (including Kia deposit), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, October 2007.

Mattiske Consulting Pty Ltd 2007i, *Flora and vegetation survey of tenement M46/435 (including the Gulch Prospect), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, October 2007.

Mattiske Consulting Pty Ltd 2008a, *Flora and vegetation survey of tenements M45/432, M45/517 and M45/637 (including Area 1 prospect), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, September 2008.

Mattiske Consulting Pty Ltd 2008b, *Flora and vegetation survey of Chris D tenement - M45/639, Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, September 2008.

Mattiske Consulting Pty Ltd 2008c, *Flora and vegetation survey of Fault North tenement - M45/383 (Part), Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, December 2008.

Mattiske Consulting Pty Ltd 2008d, *Flora and vegetation survey of Greensnake tenements M45/637, M45/107, M46/108, M46/92, M46/137, M46/162 & M46/161, Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, December 2008.

Mattiske Consulting Pty Ltd 2008e, An updated *Flora and vegetation survey of Chris D tenements M45/639, G45/279, G45/280, G45/281, G45/282, G45/283 and G45/284, Woodie Woodie.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, December 2008.

Mattiske Consulting Pty Ltd 2013, *Flora and Vegetation of the Woodie Woodie South and Max Prospects.* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, April 2013.

Mattiske Consulting Pty Ltd 2018, *Detailed Flora and Vegetation Assessment Woodie Woodie Project Expansion Area* Unpublished report prepared for MBS Environmental on behalf of Consolidated Minerals Limited, August 2018.

Protected Planet 2019, *Meentheena Station in Australia*. Available from: https://www.protectedplanet.net/555576766. 28 October 2019.

Shepherd, DP, Beeston, GR & Hopkins, AJM 2002, *Native vegetation in Western Australia – extent, type and status*. Resource management technical report 249, Department of Agriculture, Western Australia.

Thackway, R and Cresswell, ID 1995, *An interim biogeographic regionalisation for Australia - a framework for establishing the national system of reserves*. Australian Nature Conservation Agency, Canberra, Australian Capital Territory.

Tille, P 2006, *Soil-landscapes of Western Australia's Rangelands and Arid Interior,* Resource Management Technical Report 313, Department of Agriculture, Western Australia.

Trudgen, ME 1988, *A report on the flora and vegetation of the Port Kennedy area*. Unpublished report prepared for Bowman Bishaw and Associates, West Perth, WA.

Van Vreeswyk, AME, Payne, AL, Leighton, KA & Hennig, P 2004, *An inventory and condition survey of the Pilbara region, Western Australia*, Tech. Bull. 92, Department of Agriculture, South Perth, WA.

Western Australian Herbarium 1998-, *FloraBase - the Western Australian Flora*. Available from: https://florabase.dpaw.wa.gov.au. 03 August 2019.

APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions ([DBCA] 2018a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act (DBCA 2019c). Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from DBCA (2019c).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EX	**Presumed extinct species**	Species that have been adequately searched for and there is no reasonable doubt that the last individual has died (listed under Schedule 4 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (DBCA 2019c). **Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species**, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation*. The DBCA categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from DBCA (2019c).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (28 June 2018)* (under Part 2, Division 2, Subdivision 1 of the BC Act; DBCA 2018c). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the DBCA (and former equivalent departments) have been identifying and informally listing TECs since 1994. Some of these TECs are endorsed by the Federal Minister as threatened, and some of these are also listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
PD	**Presumed Totally Destroyed**	An ecological community will be listed as PD if there are no recent records of the community being extant **and either** of the following applies: **1.** Records within the last 50 years have not been confirmed despite thorough searches or known likely habitats; or **2.** All occurrences recorded within the last 50 years have since been destroyed.
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2019a) in the *Priority Ecological Communities for Western Australia – Version 28 (17 January 2019)*. Similarly to priority flora, PECs are not afforded the same level of legislative protection as the TECs, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The DBCA categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2019).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: NVIS STRUCTURAL FORMATION TERMINOLOGY

Note: Adapted from Executive Steering Committee for Australian Vegetation Information (2003).

COVER CHARACTERISTICS							
Foliage cover*	70-100	30-70	10-30	<10	≈0	0-5	unknown
Crown cover**	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
% cover***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
Cover code	d	c	i	r	bi	bc	unknown

GROWTH FORM	HEIGHT RANGES (m)	STRUCTURAL FORMATION CLASSES						
tree, palm	<10, 10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1, 1-2, >2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1, 1-2, >2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1, 1-2, >2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5, >0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	spare samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2, >2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5, >0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grassland	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5, >0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	<0.5, >0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5, >0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	<0.5, >0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	<1, 1-2, >2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10, 10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	0-0.5, <1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	0-0.5, <1	closed seagrass bed	seagrass bed	open seagrass bed	sparse seagrasses	isolated seagrasses	isolated clumps of seagrasses	seagrasses

APPENDIX B: GPS LOCATION OF SURVEY AREAS IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Survey Area	Quadrat	Location (GDA94, Zone 51K)	
		Easting (mE)	Northing (mN)
A1	A1-001	315666	7612115
	A1-002	315546	7611918
	A1-003	315264	7611826
	A1-004	315082	7612021
	A1-005	315239	7612037
	A1-006	315420	7611285
	A1-007	315546	7611272
	A1-008	315543	7611512
	A1-009	315220	7611965
	A1-010	315412	7611696
	A1-011	315110	7611904
	A1-012	315665	7611606
	A1-013	325686	7611818
A2	A2-001	313477	7610987
	A2-002	313764	7610983
	A2-003	313902	7610790
	A2-004	313434	7610506
	A2-005	313638	7610687
	A2-006	313528	7609755
	A2-007	314055	7610895
	A2-008	314080	7610707
	A2-009	314112	7610369
A3	A3-001	319621	7609969
	A3-002	319493	7610090
	A3-003	319328	7610248
	A3-004	319538	7610288
	A3-005	319376	7610610
	A3-006	319260	7610556
	A3-007	319157	7610596
	A3-008	318996	7610819
	A3-009	318877	7611083
	A3-010	318660	7611647
	A3-011	318681	7611486
	A3-012	318800	7611261
	A3-013	318866	7611635
	A3-014	318913	7611475
	A3-015	319044	7611292
	A3-016	319107	7611138
	A3-017	319226	7610959
	A3-018	319517	7609019
	A3-019	319784	7609158
	A3-020	319981	7609357
	A3-021	319752	7609495
	A3-022	319726	7609675

APPENDIX B: GPS LOCATION OF SURVEY AREAS IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Survey Area	Quadrat	Location (GDA94, Zone 51K)	
		Easting (mE)	Northing (mN)
A4	A4-001	315782	7607550
	A4-002	315677	7607880
	A4-003	315730	7608061
	A4-004	315915	7607952
	A4-005	316023	7607428
	A4-006	316117	7607738
	A4-007	316222	7607962
	A4-008	316760	7608093
	A4-009	316902	7608097
	A4-010	317323	7608027
	A4-011	317288	7608091
	A4-012	317114	7607753
	A4-013	315816	7605818
	A4-014	316174	7605604
	A4-015	316565	7605365
	A4-016	316632	7605920
	A4-017	316566	7605898
	A4-018	316255	7605877
	A4-019	315800	7606323
	A4-020	314709	7603352
	A4-021	314871	7602306
	A4-022	314602	7601938
	A4-023	314685	7601397
	A4-024	314150	7601307
	A4-025	313997	7601742
	A4-026	314205	7604490
	A4-027	315583	7607171
	A4-028	315674	7606836
	A4-029	315868	7606689
	A4-030	316083	7606962
	A4-031	316190	7606679
	A4-032	316456	7606500
	A4-033	316593	7606287
	A4-034	316205	7606212
	A4-035	315459	7605885
	A4-036	315031	7605335
	A4-037	315046	7605006
	A4-038	314780	7605209
	A4-039	314856	7605683
	A4-040	314878	7605847
	A4-041	314148	7604030
	A4-042	314445	7603647
	A4-043	314066	7603537
	A4-044	314373	7603037
	A4-045	316192	7605075
	A4-046	315088	7608028
	A4-047	314742	7607771
	A4-048	314501	7607781
	A4-049	314293	7608012
	A4-050	314350	7607590
	A4-051	314447	7607590

APPENDIX B: GPS LOCATION OF SURVEY AREAS IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Survey Area	Quadrat	Location (GDA94, Zone 51K)	
		Easting (mE)	Northing (mN)
A4	A4-052	314376	7607450
	A4-053	315191	7607693
	A4-054	315520	7606461
	A4-055	315420	7605688
	A4-056	315264	7605613
	A4-057	315454	7605204
	A4-058	315746	7605124
	A4-059	313767	7605794
	A4-060	313928	7605143
	A4-061	314043	7605156
	A4-062	314198	7605263
	A4-063	314518	7604913
	A4-064	313917	7604211
	A4-065	317735	7604956
	A4-066	315110	7606838
	A4-067	314768	7607210
	A4-068	314352	7607186
	A4-069	314849	7607397
	A4-070	315137	7607320
	A4-071	315458	7607366
	A4-072	316574	7606958
	A4-073	316707	7607203
	A4-074	317095	7607255
	A4-075	316813	7607543
	A4-076	316505	7607529
	A4-077	316400	7607560
	A4-078	315347	7606068
	A4-079	315064	7606383
	A4-080	314636	7606613
	A4-081	314113	7606590
	A4-082	314049	7606221
	A4-083	314202	7606354
	A4-084	314475	7606363
	A4-085	314542	7605952
	A4-086	314762	7602593
	A4-087	314513	7602318
	A4-088	314311	7602289
	A4-089	313849	7602194
	A4-090	313854	7602586
	A4-091	314239	7602649
A5	A5-001	315056	7595261
	A5-002	314801	7595373
A6	A6-001	319591	7601135
	A6-002	319351	7601208
	A6-003	319281	7601427
	A6-004	318967	7601278
	A6-005	318694	7601459
	A6-006	318534	7601496
	A6-007	318526	7601449
	A6-008	318295	7601364
	A6-009	318382	7601258

APPENDIX B: GPS LOCATION OF SURVEY AREAS IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Survey Area	Quadrat	Location (GDA94, Zone 51K)	
		Easting (mE)	Northing (mN)
A6	A6-010	318441	7600333
	A6-011	318806	7599263
	A6-012	318912	7598944
	A6-013	319148	7598267
	A6-014	319117	7598570
	A6-015	317816	7598003
	A6-016	317752	7596795
	A6-017	319305	7597812
	A6-018	319212	7597420
	A6-019	318944	7596974
	A6-020	318392	7596767
	A6-021	317983	7596356
	A6-022	319580	7598838
	A6-023	319506	7598437
	A6-024	319639	7597541
	A6-025	318965	7596204
	A6-026	317355	7595866
	A6-027	317002	7595623
	A6-028	316099	7596947
	A6-029	316304	7595870
	A6-030	317734	7600112
	A6-031	317495	7600127
	A6-032	317784	7600323
	A6-033	317614	7600606
	A6-034	317931	7600827
	A6-035	318022	7600526
	A6-036	318680	7599927
	A6-037	319051	7599719
	A6-038	317993	7597568
	A6-039	318730	7597799
	A6-040	318508	7598162
	A6-041	316828	7594094
	A6-042	316738	7594232
	A6-043	316564	7594384
	A6-044	316185	7594222
	A6-045	316323	7594051
	A6-046	316073	7594625
	A6-047	315969	7593898
	A6-048	316462	7594866
	A6-049	316037	7595050
	A6-050	317446	7597796
	A6-051	317242	7596830
	A6-052	317001	7596165
	A6-053	318753	7600851
	A6-054	318420	7600888
	A6-055	318394	7600594
	A6-056	318562	7600636
	A6-057	318810	7600584
	A6-058	318916	7600403
	A6-059	319455	7599788
	A6-060	319473	7599429

APPENDIX B: GPS LOCATION OF SURVEY AREAS IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Survey Area	Quadrat	Location (GDA94, Zone 51K)	
		Easting (mE)	Northing (mN)
A6	A6-061	319193	7599448
	A6-062	319131	7597431
	A6-063	318899	7597069
	A6-064	318388	7596745
	A6-065	316435	7593495
	A6-066	316146	7593184
	A6-067	315746	7592606
	A6-068	315887	7592304
	A6-069	316406	7592465
	A6-070	316869	7592295
	A6-071	316737	7593044
	A6-072	316980	7593302
	A6-073	317484	7597863
	A6-074	317716	7597446
	A6-075	317734	7596120
	A6-076	319385	7600701
	A6-077	319580	7600780
	A6-078	319338	7600519
	A6-079	319270	7600245
	A6-080	319490	7600346
	A6-081	319652	7600200
	A6-082	319488	7599953
	A6-083	319156	7599990
	A6-084	319553	7598834
	A6-085	319409	7599217
	A6-086	318700	7599604
	A6-087	317671	7598385
	A6-088	318180	7598641
	A6-089	318371	7598872
	A6-090	318012	7598924
	A6-091	317602	7598928
	A6-092	317705	7593107
	A6-093	318000	7592305
	A6-094	318388	7592665
	A6-095	318634	7592814
	A6-096	318557	7593680
	A6-097	318462	7593818
	A6-098	318137	7593985
	A6-099	317867	7594213
	A6-100	317483	7594467
	A6-101	318223	7594536
	A6-102	318974	7594926
	A6-103	318168	7595521
	A6-104	317686	7595136
	A6-105	315794	7596553
	A6-106	315941	7595585
	A6-107	317401	7593544
	A6-108	317790	7593536

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Acanthaceae	*Dicladanthera forrestii*				x	x
Aizoaceae	*Trianthema cusackianum*				x	
	Trianthema glossostigmum		x	x	x	
	Trianthema oxycalyptrum var. *oxycalyptrum*					x
	Trianthema pilosum		x	x		
	Trianthema triquetrum			x	x	x
	Trianthema turgidifolium			x		x
	Trianthema sp.					x
Amaranthaceae	*Achyranthes aspera*		x	x	x	x
	* *Aerva javanica*		x	x	x	x
	Alternanthera angustifolia		x	x		
	Alternanthera denticulata			x		
	Alternanthera nana				x	x
	Alternanthera nodiflora		x	x	x	x
	Amaranthus cuspidifolius				x	x
	Amaranthus undulatus		x	x	x	x
	Gomphrena affinis subsp. *pilbarensis*		x	x	x	x
	Gomphrena cunninghamii		x	x	x	x
	Gomphrena sordida			x		
	Gomphrena sp.					x
	Ptilotus aervoides		x	x	x	
	Ptilotus arthrolasius			x		
	Ptilotus astrolasius		x		x	x
	Ptilotus auriculifolius		x	x	x	x
	Ptilotus axillaris		x	x	x	x
	Ptilotus calostachyus		x	x	x	x
	Ptilotus clementii		x	x	x	
	Ptilotus drummondii			x		
	Ptilotus exaltatus		x	x	x	x
	Ptilotus fusiformis				x	x
	Ptilotus gaudichaudii				x	
	Ptilotus helipteroides				x	
	Ptilotus incanus				x	x
	Ptilotus latifolius			x		
	Ptilotus obovatus		x		x	x
	Ptilotus polystachyus		x	x	x	
	Ptilotus roei		x	x		
	Ptilotus sp.				x	x
Apocynaceae	* *Calotropis procera*				x	x
	Carissa lanceolata				x	x
	Cynanchum floribundum		x	x	x	x
	Cynanchum viminale				x	
	Cynanchum viminale subsp. *australe*		x	x	x	x
	Marsdenia australis				x	

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Araliaceae	*Trachymene oleracea*		x	x		
	Trachymene oleracea subsp. *oleracea*		x	x	x	x
	Trachymene sp.		x			
Asteraceae	*Calocephalus* sp.		x			
	Calotis multicaulis		x	x		
	Calotis sp.		x			
	Centipeda minima			x	x	x
	Centipeda minima subsp. *macrocephala*				x	
	Centipeda minima subsp. *minima*		x	x		
	* *Flaveria trinervia*				x	x
	Ixiochlamys cuneifolia		x	x		
	Pentalepis trichodesmoides		x			
	Pentalepis trichodesmoides subsp. *trichodesmoides*		x	x		
	Pluchea dentex		x	x	x	x
	Pluchea ferdinandi-muelleri				x	x
	Pluchea rubelliflora		x	x	x	
	Pluchea tetranthera				x	
	Pluchea sp.					x
	Pseudognaphalium luteoalbum				x	
	Pterocaulon serrulatum				x	
	Pterocaulon serrulatum var. *velutinum*		x	x	x	
	Pterocaulon sphacelatum		x	x	x	x
	Pterocaulon sphaeranthoides				x	
	Pterocaulon sp.					x
	Rhodanthe margarethae		x	x		
	* *Sonchus oleraceus*				x	
	Streptoglossa ?decurrens				x	
	Streptoglossa odora		x	x	x	
	Streptoglossa sp.					x
	Asteraceae sp.				x	x
Boraginaceae	*Ehretia saligna*		x		x	
	Ehretia saligna var. *saligna*		x	x		
	Heliotropium ammophilum		x	x		
	Heliotropium chrysocarpum			x	x	
	Heliotropium crispatum		x	x	x	x
	Heliotropium cunninghamii		x	x	x	x
	Heliotropium epacrideum			x		
	Heliotropium glabellum			x	x	
	Heliotropium glanduliferum		x	x		
	Heliotropium ovalifolium				x	x
	Heliotropium pachyphyllum				x	x
	Heliotropium skeleton				x	
	Heliotropium tanythrix				x	
	Heliotropium tenuifolium		x	x		
	Heliotropium transforme		x	x		
	Heliotropium sp.		x		x	x
	Trichodesma zeylanicum		x	x	x	x

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Brassicaceae	*Lepidium amelum*	P1	x	x	x	
	Lepidium pholidogynum		x	x		
	Lepidium sp.					x
Byblidaceae	*Byblis filifolia*			x		
Campanulaceae	*Lobelia arnhemiaca*		x	x	x	
	Wahlenbergia sp.		x	x		
Capparaceae	*Capparis spinosa*				x	
	Capparis spinosa subsp. *nummularia*		x	x	x	
	Capparis umbonata				x	
	Capparis sp.					x
Caryophyllaceae	*Polycarpaea corymbosa*				x	x
	Polycarpaea corymbosa var. *corymbosa*			x		
	Polycarpaea holtzei		x	x	x	x
	Polycarpaea longiflora		x	x	x	x
Celastraceae	*Stackhousia intermedia*				x	
	Stackhousia muricata				x	
	Stackhousia muricata subsp. annual (W.R. Barker 2172)			x		
	Stackhousia sp. swollen gynophore (W.R. Barker 2041)			x		
Chenopodiaceae	*Atriplex ?bunburyana*				x	
	Atriplex codonocarpa		x	x		
	Atriplex holocarpa		x	x		
	Chenopodium gaudichaudianum				x	
	Dissocarpus paradoxus			x		
	Dysphania kalpari				x	
	Dysphania plantaginella		x	x		
	Dysphania pumilio					x
	Dysphania rhadinostachya				x	x
	Dysphania rhadinostachya subsp. *rhadinostachya*			x		
	Dysphania sphaerosperma		x	x		
	Dysphania sp.					x
	Eremophea spinosa				x	
	Maireana georgei				x	
	Maireana melanocoma		x	x	x	
	Maireana tomentosa subsp. *tomentosa*				x	
	Maireana sp.				x	x
	Rhagodia eremaea		x	x	x	x
	Salsola australis				x	
	Sclerolaena bicornis					x
	Sclerolaena convexula				x	
	Sclerolaena cornishiana		x	x	x	x
	Sclerolaena costata		x	x	x	x
	Sclerolaena densiflora		x	x	x	
	Sclerolaena deserticola				x	

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Chenopodiaceae (contined)	*Sclerolaena eriacantha*				x	
	Sclerolaena lanicuspis				x	
	Sclerolaena sp.				x	x
	Chenopodiaceae sp.					x
Cleomaceae	*Cleome uncifera* subsp. *uncifera*			x		
	Cleome viscosa			x	x	x
Convolvulaceae	*Bonamia erecta*				x	
	Bonamia linearis				x	
	Bonamia media				x	
	Bonamia pilbarensis				x	x
	Bonamia sp.				x	x
	Duperreya commixta				x	x
	Evolvulus alsinoides				x	x
	Evolvulus alsinoides var. *decumbens*			x		
	Evolvulus alsinoides var. *villosicalyx*			x		x
	Evolvulus sp.					x
	Ipomoea coptica		x	x		x
	Ipomoea muelleri		x	x	x	x
	Ipomoea sp.					x
	Operculina aequisepala				x	
	Polymeria ambigua		x	x	x	x
	Polymeria calycina		x		x	
	Polymeria longifolia				x	x
Cucurbitaceae	* *Citrullus amarus*				x	x
	* *Citrullus colocynthis*		x	x		
	Cucumis melo				x	
	Cucumis variabilis		x		x	x
	Cucumis sp. Chichester Range (A.A. Mitchell et al.				x	
	Cucumis sp.		x		x	x
Cyperaceae	*Bulbostylis barbata*		x	x	x	
	Cyperus cunninghamii subsp. *cunninghamii*				x	x
	Cyperus difformis		x	x	x	
	Cyperus hesperius		x	x		
	Cyperus ixiocarpus					x
	Cyperus squarrosus		x	x		
	Cyperus vaginatus		x	x	x	x
	Eleocharis geniculata		x	x		
	Fimbristylis depauperata				x	
	Fimbristylis dichotoma		x	x		x
	Fimbristylis simulans				x	x
	Fimbristylis sp.		x	x	x	
	Schoenoplectus subulatus		x	x		
	Schoenus falcatus			x		

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Elatinaceae	*Bergia henshallii*		x	x		
	Bergia perennis subsp. *obtusifolia*		x	x		
Eriocaulaceae	*Eriocaulon cinereum*			x		
Euphorbiaceae	*Adriana tomentosa*					x
	Adriana tomentosa var. *hookeri*		x	x		
	Adriana tomentosa var. *tomentosa*		x	x		
	Euphorbia albrechtii			x		
	Euphorbia australis		x		x	x
	Euphorbia australis var. *australis*			x		
	Euphorbia australis var. *hispidula*			x		
	Euphorbia australis var. *subtomentosa*		x	x		x
	Euphorbia biconvexa				x	
	Euphorbia boophthona				x	x
	Euphorbia careyi		x	x	x	x
	Euphorbia clementii	P3	x	x		x
	Euphorbia coghlanii		x	x	x	x
	Euphorbia drummondii				x	
	Euphorbia myrtoides		x	x		
	Euphorbia tannensis subsp. *eremophila*		x	x		
	Euphorbia trigonosperma		x	x		
	Euphorbia vaccaria var. *erucoides*		x	x		
	Euphorbia vaccaria var. *vaccaria*			x		
	Euphorbia sp.		x		x	x
Fabaceae	*Acacia acradenia*		x	x	x	
	Acacia adoxa				x	x
	Acacia adoxa var. *adoxa*		x		x	x
	Acacia adsurgens		x	x		
	Acacia ampliceps		x	x	x	x
	Acacia anaticeps			x		
	Acacia ancistrocarpa		x	x	x	x
	Acacia aneura				x	
	Acacia arida		x	x	x	x
	Acacia balsamea		x	x		
	Acacia bivenosa		x	x	x	x
	Acacia bivenosa x *sclerosperma* subsp. *sclerosperma*					x
	Acacia citrinoviridis				x	x
	Acacia colei var. *colei*		x	x		x
	Acacia coriacea				x	
	Acacia coriacea subsp. *pendens*			x	x	x
	Acacia cuthbertsonii subsp. *cuthbertsonii*				x	
	Acacia drepanocarpa subsp. *latifolia*				x	x
	Acacia fecunda	P1	x	x		
	Acacia glaucocaesia				x	x
	Acacia hilliana		x	x	x	x
	Acacia inaequilatera		x	x	x	x
	Acacia jensenii			x		

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Fabaceae (continued)	*Acacia ligulata*		x	x	x	
	Acacia maitlandii		x	x	x	x
	Acacia monticola				x	
	Acacia orthocarpa		x			
	Acacia pachycarpa			x		
	Acacia pruinocarpa				x	x
	Acacia ptychophylla		x	x	x	
	Acacia pyrifolia		x		x	
	Acacia pyrifolia var. *morrisonii*		x	x		
	Acacia pyrifolia var. *pyrifolia*		x	x		x
	Acacia retivenea subsp. *clandestina*		x	x		
	Acacia robeorum		x	x		
	Acacia sclerosperma subsp. *sclerosperma*		x	x	x	x
	Acacia setulifera	P1	x			
	Acacia stellaticeps			x		
	Acacia synchronicia		x	x	x	x
	Acacia trachycarpa		x	x	x	x
	Acacia tumida			x	x	x
	Acacia tumida var. *kulparn*			x		
	Acacia tumida var. *pilbarensis*				x	x
	Acacia victoriae				x	
	Acacia wanyu		x	x	x	
	Acacia ampliceps				x	
	Acacia pyrifolia var. *morrisonii*				x	
	Acacia stenophylla				x	
	Acacia sp. Ripon Hills (B.R. Maslin 8460)		x	x		
	Acacia sp.		x		x	x
	Aenictophyton reconditum subsp. *reconditum*			x		
	Alysicarpus muelleri				x	
	Cajanus cinereus		x	x		
	Chamaecrista symonii		x	x		
	Crotalaria cunninghamii			x	x	
	Crotalaria medicaginea			x		
	Crotalaria medicaginea var. *neglecta*		x	x	x	
	Crotalaria ramosissima		x	x		
	Crotalaria sp.					x
	Cullen cinereum					x
	Cullen lachnostachys				x	x
	Cullen leucanthum		x	x	x	x
	Cullen ?leucochaites					x
	Cullen martinii				x	
	Cullen pogonocarpum				x	x
	Cullen stipulaceum			x	x	
	Cullen sp.				x	x
	Dichrostachys spicata		x	x		
	Erythrina vespertilio		x	x		
	Gompholobium polyzygum				x	x
	Gompholobium simplicifolium			x		
	Indigofera ammobia	P3		x		

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Fabaceae (continued)	*Indigofera boviperda* subsp. *eremaea*			x		
	Indigofera colutea		x	x	x	x
	Indigofera linifolia		x	x	x	
	Indigofera monophylla		x	x	x	x
	Indigofera rugosa		x	x	x	
	Indigofera trita		x	x		
	Indigofera trita subsp. *trita*		x			x
	Indigofera sp.				x	x
	Isotropis atropurpurea		x	x	x	x
	Lotus australis		x	x		
	Mirbelia viminalis				x	
	Petalostylis cassioides				x	
	Petalostylis labicheoides		x	x	x	x
	Psoralea sp.		x			
	Rhynchosia bungarensis	P4		x		
	Rhynchosia minima			x	x	x
	Senna artemisioides subsp. *helmsii*		x	x	x	x
	Senna artemisioides subsp. *oligophylla*		x	x	x	x
	Senna artemisioides subsp. *x sturtii*		x			
	Senna glaucifolia				x	
	Senna ?glutinosa				x	
	Senna glutinosa subsp. *glutinosa*				x	x
	Senna glutinosa subsp. *pruinosa*		x	x	x	x
	Senna glutinosa subsp. *x luerssenii*		x	x	x	x
	Senna notabilis		x	x	x	x
	Senna pleurocarpa var. *angustifolia*				x	
	Senna sericea				x	x
	Senna symonii		x	x	x	
	Senna venusta		x	x	x	x
	Senna sp.					x
	Sesbania cannabina		x	x	x	x
	Sesbania formosa		x	x		
	Swainsona decurrens		x	x	x	
	Swainsona formosa		x		x	
	Swainsona microphylla			x		
	Swainsona sp.				x	
	Templetonia hookeri		x	x	x	
	Tephrosia arenicola			x		
	Tephrosia oxalidea		x	x	x	
	Tephrosia rosea		x	x	x	x
	Tephrosia rosea var. *clementii*		x	x	x	
	Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)					x
	Tephrosia sp. D Kimberley Flora (R.D. Royce 1848)			x		
	Tephrosia sp. Dunes (J.R. Maconochie 938)		x	x		
	Tephrosia sp. NW Eremaean (S. van Leeuwen et		x	x		x
	Tephrosia supina		x	x	x	
	Tephrosia virens				x	
	Tephrosia sp.		x		x	
	Thinicola incana			x		

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Fabaceae (continued)	* *Vachellia farnesiana*		x	x	x	x
	Vigna lanceolata		x	x		
	Vigna lanceolata var. *lanceolata*		x	x		
	Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)				x	
	Vigna sp.					x
	Fabaceae sp.				x	
Goodeniaceae	*Dampiera atriplicina*	P3	x	x		
	Dampiera candicans				x	x
	Dampiera cinerea		x	x		
	Goodenia armitiana		x	x		
	Goodenia azurea subsp. *hesperia*			x		
	Goodenia cusackiana		x	x	x	
	Goodenia hartiana	P2		x		
	Goodenia lamprosperma		x	x		
	Goodenia microptera			x	x	x
	Goodenia muelleriana		x	x	x	x
	Goodenia pedicellata	P1	x	x		
	Goodenia ramelii		x			
	Goodenia ?scaevolina					x
	Goodenia stobbsiana		x	x	x	x
	Goodenia tenuiloba				x	
	Goodenia triodiophila			x	x	x
	Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	P3			x	
	Goodenia sp.				x	x
	Scaevola amblyanthera			x	x	
	Scaevola amblyanthera var. *centralis*				x	x
	Scaevola browniana				x	
	Scaevola browniana subsp. *browniana*				x	
	Scaevola spinescens				x	
	Scaevola sp.					x
	Goodeniaceae sp.					x
Gyrostemonaceae	*Codonocarpus cotinifolius*				x	x
Haloragaceae	*Haloragis gossei* var. *gossei*				x	
	Haloragis trigonocarpa		x			
	Myriophyllum verrucosum		x	x		
Hydrocharitaceae	*Najas marina*			x		
	Vallisneria nana		x	x		
Lamiaceae	*Clerodendrum floribundum* var. *ovatum*				x	
	Clerodendrum tomentosum var. *lanceolatum*		x			
	Clerodendrum tomentosum var. *tomentosum*		x	x	x	
	Clerodendrum sp.		x			
	Dicrastylis cordifolia			x	x	
	Dicrastylis doranii			x		
	Newcastelia cladotricha			x		

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Lauraceae	*Cassytha capillaris*				x	
	Cassytha filiformis					x
Loganiaceae	*Mitrasacme connata*		x	x		
Loranthaceae	*Amyema gibberula* var. *gibberula*		x	x		
	Amyema preissii		x	x		
	Amyema sanguinea		x			
	Amyema sanguinea var. *sanguinea*		x	x		
Lythraceae	*Ammannia baccifera*		x	x	x	
	Ammannia multiflora					x
Malvaceae	*Abutilon amplum*				x	
	Abutilon cryptopetalum				x	
	Abutilon cunninghamii		x		x	x
	Abutilon fraseri				x	
	Abutilon lepidum		x	x	x	x
	Abutilon leucopetalum			x		
	Abutilon malvifolium				x	
	Abutilon otocarpum		x	x	x	
	Abutilon oxycarpum		x		x	
	Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		x	x	x	
	Abutilon sp. Pilbara (W.R. Barker 2025)		x			
	Abutilon sp.		x		x	x
	Androcalva loxophylla			x		
	Androcalva luteiflora					x
	Corchorus crozophorifolius				x	
	Corchorus laniflorus					x
	Corchorus lasiocarpus		x	x	x	
	Corchorus lasiocarpus subsp. *lasiocarpus*		x	x	x	
	Corchorus parviflorus			x	x	x
	Corchorus sidoides subsp. *sidoides*				x	x
	Corchorus tridens				x	x
	Corchorus walcottii		x		x	
	Corchorus sp.		x	x	x	x
	Gossypium australe		x	x	x	x
	Gossypium robinsonii		x		x	x
	Hibiscus brachysiphonius		x	x		
	Hibiscus coatesii		x	x	x	x
	Hibiscus leptocladus			x		
	Hibiscus sturtii				x	
	Hibiscus sturtii var. *campylochlamys*				x	x
	Hibiscus sp.				x	x
	Lawrencia densiflora				x	
	* *Malvastrum americanum*		x	x	x	x
	Melhania oblongifolia				x	x
	Melhania sp.		x			
	Seringia elliptica				x	x

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Malvaceae (continued)	*Seringia nephrosperma*				x	
	Sida arenicola			x	x	
	Sida arsiniata					x
	Sida calyxhymenia				x	
	Sida cardiophylla		x	x	x	x
	Sida clementii			x		
	Sida echinocarpa		x		x	
	Sida fibulifera				x	x
	Sida rohlenae subsp. *rohlenae*				x	x
	Sida sp. Articulation below (A.A. Mitchell PRP 1605)				x	
	Sida sp. Excedentifolia (J.L. Egan 1925)				x	
	Sida sp. Pilbara (A.A. Mitchell PRP 1543)				x	
	Sida sp. ?Pilbara (A.A. Mitchell PRP 1543)				x	
	Sida sp. Rabbit Flat (B.J. Carter 626)		x	x		
	Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		x	x		x
	Sida sp. Western sand dunes (P.K. Latz 11980)			x		
	Sida sp.		x		x	x
	Triumfetta chaetocarpa				x	
	Triumfetta clementii			x	x	x
	Triumfetta johnstonii			x		
	Triumfetta maconochieana		x	x	x	x
	Triumfetta propinqua		x	x	x	x
	Triumfetta sp.		x			
	Waltheria indica				x	x
	Waltheria virgata		x	x	x	x
	Malvaceae sp.				x	x
Marsileaceae	*Marsilea drummondii*		x			
	Marsilea exarata		x	x		
	Marsilea hirsuta				x	x
	Marsilea mutica		x	x		
Menispermaceae	*Tinospora smilacina*		x	x	x	x
Molluginaceae	*Glinus lotoides*		x	x		
	Trigastrotheca molluginea		x	x	x	x
Montiaceae	*Calandrinia ptychosperma*				x	
Moraceae	*Ficus brachypoda*		x	x	x	
	Ficus platypoda		x	x		x
Myrtaceae	*Calytrix carinata*				x	x
	Corymbia aspera			x	x	
	Corymbia candida					x
	Corymbia candida subsp. *candida*		x	x		
	Corymbia ferriticola				x	
	Corymbia hamersleyana			x	x	x
	Corymbia opaca		x	x		x

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Myrtaceae (continued)	*Corymbia* sp.					x
	Eucalyptus camaldulensis				x	x
	Eucalyptus camaldulensis subsp. *obtusa*		x	x		
	Eucalyptus camaldulensis subsp. *refulgens*		x	x		
	Eucalyptus gamophylla		x	x		
	Eucalyptus kingsmillii			x		
	Eucalyptus leucophloia		x	x	x	
	Eucalyptus leucophloia subsp. *leucophloia*		x	x		x
	Eucalyptus odontocarpa		x	x		
	Eucalyptus victrix			x	x	x
	Eucalyptus sp.				x	x
	Melaleuca argentea		x	x	x	
	Melaleuca eleuterostachya		x	x		x
	Melaleuca glomerata		x	x	x	x
	Melaleuca lasiandra			x	x	x
	Melaleuca leucadendra		x	x		
Nyctaginaceae	*Boerhavia burbidgeana*		x	x	x	
	Boerhavia coccinea			x		x
	Boerhavia repleta		x	x		
	Boerhavia coccinea				x	
	Boerhavia gardneri				x	
	Boerhavia sp.					x
Papaveraceae	* *Argemone ochroleuca* subsp. *ochroleuca*		x	x		x
Passifloraceae	* *Passiflora foetida* var. *hispida*		x	x		
Phyllanthaceae	*Flueggea virosa* subsp. *melanthesoides*				x	x
	Notoleptopus decaisnei				x	
	Notoleptopus decaisnei var. *decaisnei*					x
	Notoleptopus decaisnei var. *orbicularis*					x
	Phyllanthus maderaspatensis			x	x	x
	Sauropus arenosus	P3	x			
Plantaginaceae	*Stemodia grossa*			x	x	x
	Stemodia viscosa		x	x		
Poaceae	*Amphipogon sericeus*		x	x	x	
	Aristida contorta			x	x	x
	Aristida holathera var. *holathera*				x	x
	Aristida jerichoensis var. *subspinulifera*	P3			x	
	Aristida latifolia				x	
	Aristida sp.					x
	Bothriochloa ewartiana					x
	* *Cenchrus ciliaris*		x	x	x	x
	* *Cenchrus setiger*		x	x		x
	* *Chloris barbata*				x	
	* *Chloris virgata*				x	

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Poaceae (continued)	*Chrysopogon fallax*				x	x
	Cymbopogon ambiguus		x	x	x	x
	Cymbopogon obtectus		x	x		x
	Cymbopogon procerus				x	
	Cynodon convergens					x
	* *Cynodon dactylon*		x	x	x	
	Cynodon prostratus		x	x		
	Dactyloctenium radulans				x	x
	Dichanthium fecundum		x	x	x	
	Dichanthium sericeum				x	
	Dichanthium sericeum subsp. *humilius*				x	
	Diplachne fusca subsp. *fusca*		x	x		x
	* *Diplachne fusca* subsp. *uninervia*		x	x		
	* *Echinochloa colona*					x
	Ectrosia danesii			x		
	Enneapogon caerulescens		x	x	x	x
	Enneapogon lindleyanus		x	x	x	x
	Enneapogon polyphyllus			x	x	x
	Enneapogon sp.					x
	Eragrostis cumingii		x	x	x	x
	Eragrostis desertorum				x	
	Eragrostis dielsii		x	x		
	Eragrostis eriopoda		x	x	x	x
	Eragrostis falcata				x	
	Eragrostis lanicaulis	P3	x	x		
	Eragrostis olida			x	x	
	Eragrostis setifolia				x	
	Eragrostis speciosa		x	x		
	Eragrostis tenellula		x	x	x	x
	Eragrostis xerophila					x
	Eragrostis sp.				x	x
	Eriachne aristidea			x	x	
	Eriachne benthamii					x
	Eriachne ciliata				x	
	Eriachne ?festucacea					x
	Eriachne helmsii		x	x	x	
	Eriachne lanata				x	x
	Eriachne mucronata		x	x	x	x
	Eriachne obtusa				x	
	Eriachne pulchella				x	x
	Eriachne pulchella subsp. *dominii*		x	x	x	
	Eriachne tenuiculmis				x	
	Eriachne sp.				x	x
	Eulalia aurea				x	x
	Iseilema dolichotrichum		x	x	x	
	Iseilema eremaeum				x	
	Iseilema macratherum					x
	Leptochloa digitata			x		
	Monachather paradoxus				x	

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Poaceae (continued)	*Panicum effusum*				x	
	Paractaenum refractum			x		
	Paraneurachne muelleri				x	x
	Paspalidium basicladum				x	
	Paspalidium clementii		x	x	x	
	Paspalidium rarum			x	x	
	Paspalidium sp.				x	
	Perotis rara				x	
	Schizachyrium fragile				x	
	Setaria dielsii		x	x		
	Sorghum amplum			x		
	Sorghum plumosum				x	
	Sporobolus actinocladus				x	x
	Sporobolus australasicus		x	x	x	x
	Sporobolus sp.					x
	Themeda triandra		x		x	x
	Triodia angusta				x	
	Triodia basedowii		x	x	x	x
	Triodia brizoides		x	x	x	
	Triodia epactia				x	x
	Triodia longiceps				x	x
	Triodia pungens				x	
	Triodia schinzii		x	x		
	Triodia scintillans			x		
	Triodia wiseana		x	x	x	x
	Triodia sp.		x		x	x
	Tripogonella loliiformis				x	
	Urochloa holosericea subsp. *velutina*			x		
	Whiteochloa cymbiformis			x		
	Poaceae sp.				x	x
Polygalaceae	*Polygala glaucifolia*			x	x	
	Polygala sp.				x	
Polygonaceae	*Persicaria* sp.		x	x		
	* *Rumex vesicarius*		x	x		
Portulacaceae	*Portulaca australis*		x	x		
	Portulaca oleracea		x	x	x	x
	* *Portulaca pilosa*		x	x		
Portulacaceae	*Portulaca* sp.					x
Potamogetonaceae	*Potamogeton tepperi*		x	x		
	Potamogeton tricarinatus		x	x		
Primulaceae	*Samolus junceus*		x			
	Samolus repens		x	x		
	Samolus repens var. *floribundus*			x		
	Samolus sp. Millstream (M.I.H. Brooker 2076)		x			

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Proteaceae	*Grevillea berryana*				x	
	Grevillea parallela		x			
	Grevillea pyramidalis		x	x	x	x
	Grevillea pyramidalis subsp. *leucadendron*				x	
	Grevillea stenobotrya		x	x		
	Grevillea wickhamii				x	x
	Grevillea wickhamii subsp. *aprica*		x	x		
	Grevillea wickhamii subsp. *hispidula*					x
	Grevillea wickhamii subsp. *macrodonta*		x			
	Hakea divaricata			x		
	Hakea lorea					x
	Hakea lorea subsp. *lorea*		x	x	x	x
Pteridaceae	*Cheilanthes lasiophylla*		x	x		
	Cheilanthes sieberi subsp. *sieberi*				x	
	Platyzoma microphyllum		x			
Rhamnaceae	*Ventilago viminalis*					x
Rubiaceae	*Gardenia resinosa* subsp. *resinosa*		x			
	Oldenlandia crouchiana		x	x	x	x
	Psydrax latifolia		x	x		
	Spermacoce occidentalis		x	x		
	Synaptantha tillaeacea var. *tillaeacea*		x	x		
Santalaceae	*Anthobolus leptomerioides*		x	x	x	x
	Santalum acuminatum					x
	Santalum lanceolatum				x	x
Sapindaceae	*Atalaya hemiglauca*			x	x	x
	Dodonaea coriacea				x	
	Dodonaea lanceolata var. *lanceolata*				x	
	Dodonaea sp.					x
Scrophulariaceae	*Eremophila cuneifolia*		x	x		
	Eremophila exilifolia		x	x	x	
	Eremophila ?fraseri subsp. *fraseri*					x
	Eremophila lanceolata				x	
	Eremophila latrobei subsp. *glabra*		x	x	x	
	Eremophila latrobei subsp. *latrobei*		x	x	x	x
	Eremophila longifolia		x	x	x	
	Eremophila sp. Rudall River (P.G. Wilson 10512)	P2	x	x		
	Eremophila tietkensii		x		x	
	Eremophila sp.		x		x	
Solanaceae	* *Datura leichhardtii*		x		x	x
	Duboisia hopwoodii		x	x		
	Nicotiana benthamiana		x			
	Nicotiana cavicola		x	x		

APPENDIX C: SUMMARY OF POTENTIAL VASCULAR PLANT SPECIES RECORDED IN THE WWME SURVEY AREAS (2019) AND RECORDS OF PREVIOUS MATTISKE SURVEYS (2007-2013; 2018)

Note: * denotes introduced species; P1-P4 denote priority flora species (WAH 1998-; see Appendix A for definitions

FAMILY	SPECIES	SCC	ALA	Nature Map	Mattiske	
					2007-2018	2019
Solanaceae	*Nicotiana occidentalis*			x		
(continued)	*Nicotiana occidentalis* subsp. *occidentalis*		x	x	x	
	Nicotiana umbratica	P3	x			
	Solanum ashbyae				x	
	Solanum centrale		x	x		
	Solanum chippendalei		x	x	x	
	Solanum cleistogamum				x	
	Solanum diversiflorum		x	x	x	x
	Solanum gabrielae		x	x	x	x
	Solanum gilesii				x	
	Solanum horridum		x	x	x	x
	Solanum lasiophyllum		x	x	x	x
	Solanum nigrum					x
	Solanum phlomoides		x	x	x	
	Solanum sp.				x	x
Stylidiaceae	*Levenhookia chippendalei*			x		
	Stylidium fluminense		x			
Thymelaeaceae	*Pimelea ammocharis*		x	x		
Typhaceae	*Typha domingensis*			x	x	x
Violaceae	*Hybanthus aurantiacus*			x	x	x
Zygophyllaceae	*Roepera eichleri*		x			
	Tribulopis angustifolia				x	
	Tribulus cistoides		x		x	
	Tribulus hirsutus		x	x	x	x
	Tribulus macrocarpus		x	x	x	
	Tribulus platypterus		x	x		x
	Tribulus suberosus		x	x	x	x
	Tribulus terrestris					x
	Tribulus sp.					x

APPENDIX D: LIKELIHOOD OF CONSERVATION SIGNIFICANT PLANT SPECIES POTENTIALLY OCCURRING WITHIN THE WWME SURVEY AREAS

Note: SCC denotes State Conservation Code (refer to Appendix A for definitions). IBRA Distribution: CAR– Carnarvon; CEK – Central Kimberley; DAL – Dampierland; GAS – Gascoyne; GID – Gibson desert; GSD – Great Sandy Desert; LSD – Little Sandy Desert; MUR – Murchison; OVP – Ord Victoria Plain; PIL – Pilbara; VIB – Victoria Bonaparte. Ranking of Likelihood of occurrence in survey area is on a Unlikely-Possible-Likely scale (see Section 2.1 for ranking criteria). Information from Florabase (WAH 1998-) and Atlas of Living Australia (2019).

Species	Family	SCC	Description and Habitat	Likelihood of Occurrence
Acacia fecunda	Fabaceae	P1	Description: Erect, obconic shrub to 3 m Habitat: Creeks, drainage lines and hills. Flower colour: Yellow Flowering period: May or August Soils: Quartzite gibbers over grey-red skeletal soil. IBRA Distribution: PIL Florabase records: 15	Possible
Acacia setulifera	Fabaceae	P1	Description: Shrub to 0.5 m Habitat: Amongst rocks Flower colour: Yellow Flowering period: February to August Soils: Shallow sand IBRA Distribution: VBP Florabase records: 3	Unlikely Only one nearby record (1891 – Atlas of Living Australia), other records all from northern Kimberley.
Goodenia pedicellata	Goodeniaceae	P1	Description: Singe-stemmed perennial herb to 0.25 m Habitat: Rocky slopes, crests of small hills. Flower colour: Yellow Flowering period: April to July Soils: Rocky clayey soils. IBRA Distribution: PIL Florabase records: 10	Possible
Lepidium amelum	Brassicaceae	P1	Description: Erect, spreading shrub to 1 m Habitat: Hummock grassland, low open woodland and disturbed sites. Flower colour: White Flowering period: May to August Soils: Sandy loams & stony, calcareous, alkaline soils. IBRA Distribution: PIL Florabase records: 7	Possible
Eremophila sp. Rudall River (P.G. Wilson 10512)	Scrophulariaceae	P2	Description: Shrub to 1.3 m Habitat: Rocky slopes and undulating, shaley, clay plains. Flower colour: Pink-mauve-purple Flowering period: April to September Soils: Silty loam, clay with gravel IBRA Distribution: GSD, LSD, PIL Florabase records: 14	Possible

APPENDIX D: LIKELIHOOD OF CONSERVATION SIGNIFICANT PLANT SPECIES POTENTIALLY OCCURRING WITHIN THE WWME SURVEY AREAS

Note: SCC denotes State Conservation Code (refer to Appendix A for definitions). IBRA Distribution: CAR– Carnarvon; CEK – Central Kimberley; DAL – Dampierland; GAS – Gascoyne; GID – Gibson desert; GSD – Great Sandy Desert; LSD – Little Sandy Desert; MUR – Murchison; OVP – Ord Victoria Plain; PIL – Pilbara; VIB – Victoria Bonaparte. Ranking of Likelihood of occurrence in survey area is on a Unlikely-Possible-Likely scale (see Section 2.1 for ranking criteria). Information from Florabase (WAH 1998-) and Atlas of Living Australia (2019).

Species	Family	SCC	Description and Habitat	Likelihood of Occurrence
Goodenia hartiana	Goodeniaceae	P2	Description: Erect to spreading, multi-stemmed perennial herb or shrub (sub-shrub). Habitat: Sand dune swales. Flower colour: Blue/purple Flowering period: August to September Soils: Red sand IBRA Distribution: GSD, LSD, PIL Florabase records: 23	Unlikely
Aristida jerichoensis var. subspinulifera	Poaceae	P3	Description: Compactly tufted perennial grass to 0.8 m Habitat: Hardpan plains. Flower colour: n/a Flowering period: March to July Soils: Clay, loamy clay, sandy clay IBRA Distribution: GAS, MUR, PIL Florabase records: 37	Possible
Euphorbia clementii	Euphorbiaceae	P3	Description: Erect herb to 0.6 m Habitat: Gravelly hillsides and stony grounds, drainage lines. Associated with *Corymbia hamersleyana* and *Triodia* spp. hummock grassland. Flower colour: White Flowering period: May to Jul Soils: Red-brown clay-loam, sandy clay IBRA Distribution: PIL Florabase records: 28	Possible
Indigofera ammobia	Fabaceae	P3	Description: May-stemmed shrub to 0.5 m Habitat: Red sand dunes Flower colour: Green and purple Flowering period: September Soils: Red sand IBRA Distribution: CEK, DAL, GSD, OVP, PIL Florabase records: 14	Possible
Dampiera atriplicina	Goodeniaceae	P3	Description: Spreading, robust shrub to 0.5 m Habitat: Sandy ridges Flower colour: Pink Flowering period: May or July Soils: Red sand IBRA Distribution: GID, GSD, LSD, PIL Florabase records: 14	Unlikely

APPENDIX D: LIKELIHOOD OF CONSERVATION SIGNIFICANT PLANT SPECIES POTENTIALLY OCCURRING WITHIN THE WWME SURVEY AREAS

Note: SCC denotes State Conservation Code (refer to Appendix A for definitions). IBRA Distribution: CAR– Carnarvon; CEK – Central Kimberley; DAL – Dampierland; GAS – Gascoyne; GID – Gibson desert; GSD – Great Sandy Desert; LSD – Little Sandy Desert; MUR – Murchison; OVP – Ord Victoria Plain; PIL – Pilbara; VIB – Victoria Bonaparte. Ranking of Likelihood of occurrence in survey area is on a Unlikely-Possible-Likely scale (see Section 2.1 for ranking criteria). Information from Florabase (WAH 1998-) and Atlas of Living Australia (2019).

Species	Family	SCC	Description and Habitat	Likelihood of Occurrence
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	Goodeniaceae	P3	Description: Open, erect annual or biennial, herb to 0.2 m Habitat: Low undulating, swampy plains. Flower colour: Yellow Flowering period: February to May, August to October Soils: Red-brown clay soil with calcrete pebbles. IBRA Distribution: GAS, PIL Florabase records: 37	Possible
Sauropus arenosus	Phyllanthaceae	P3	Description: Spreading shrub to 1m Habitat: Red sand dunes Flower colour: Yellow-green/red-pink Flowering period: May Soils: Red-brown sand. IBRA Distribution: GID, GSD, LSD Florabase records: 7	Possible
Eragrostis lanicaulis	Poaceae	P3	Description: Perennial grass or herb to 0.5 m Habitat: Red, sandy clay flats Flower colour: Green Flowering period: March to May/August to October Soils: Sand, sandy clay. IBRA Distribution: GSD, LSD, PIL Florabase records: 11	Unlikely
Nicotiana umbratica	Solanaceae	P3	Description: Erect herb to 0.7 m Habitat: Rocky outcrops Flower colour: White Flowering period: April to June Soils: Shallow soils IBRA Distribution: PIL Florabase records: 18	Possible
Rhynchosia bungarensis	Fabaceae	P4	Description: Compact, prostrate shrub to 0.5 m or climber Habitat: Amongst boulders, also on the banks of flow lines. Flower colour: Yellow Flowering period: May to September Soils: Pebbly, shingly coarse sand. IBRA Distribution: CAR, GAS, PIL Florabase records: 81	Unlikely

APPENDIX E: VASCULAR PLANT SPECIES RECORDED IN THE WOODIE WOODIE EXPANSION AREAS, 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (WAH 1998-).

Family		Species	Mattiske survey 2019					
			Area 1	Area 2	Area 3	Area 4	Area 6	Area 7
Acanthaceae		*Dipteracanthus australasicus*				x		
Aizoaceae		*Trianthema oxycalyptrum* var. *oxycalyptrum*					x	
		Trianthema triquetrum				x	x	
		Trianthema turgidifolium					x	
		Trianthema sp.			x	x		
Amaranthaceae		*Achyranthes aspera*				x	x	
	*	*Aerva javanica*	x	x	x	x	x	
		Alternanthera nana	x				x	
		Alternanthera nodiflora				x	x	
		Amaranthus cuspidifolius					x	
		Amaranthus undulatus	x			x	x	
		Gomphrena affinis subsp. pilbarensis				x		
		Gomphrena cunninghamii	x		x	x	x	
		Gomphrena sp.		x			x	
		Ptilotus astrolasius			x	x	x	
		Ptilotus auriculifolius				x	x	
		Ptilotus axillaris				x		
		Ptilotus calostachyus	x			x	x	
		Ptilotus exaltatus			x	x	x	
		Ptilotus fusiformis	x				x	
		Ptilotus incanus					x	
		Ptilotus obovatus	x				x	
		Ptilotus sp.		x		x	x	x
Apocynaceae	*	*Calotropis procera*				x	x	
		Carissa lanceolata			x	x	x	
		Cynanchum floribundum	x	x			x	
		Cynanchum viminale subsp. *australe*				x		
Araliaceae		*Trachymene oleracea* subsp. *oleracea*	x			x	x	
Asteraceae		*Centipeda minima*				x	x	
	*	*Flaveria trinervia*				x		
		Pluchea dentex	x			x	x	
		Pluchea ferdinandi-muelleri		x				
		Pluchea sp.		x		x	x	
		Pterocaulon sphacelatum	x	x		x	x	
		Pterocaulon sp.	x	x	x	x	x	
		Streptoglossa sp.	x				x	
		Asteraceae sp.					x	
Boraginaceae		*Heliotropium crispatum*	x	x		x		
		Heliotropium cunninghamii		x				
		Heliotropium ovalifolium		x		x	x	
		Heliotropium pachyphyllum				x	x	
		Heliotropium sp.	x			x	x	
		Trichodesma zeylanicum	x			x	x	
Brassicaceae		*Lepidium* sp.					x	
Capparaceae		*Capparis* sp.					x	

APPENDIX E: VASCULAR PLANT SPECIES RECORDED IN THE WOODIE WOODIE EXPANSION AREAS, 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (WAH 1998-).

Family		Species	Mattiske survey 2019					
			Area 1	Area 2	Area 3	Area 4	Area 6	Area 7
Caryophyllaceae		*Polycarpaea corymbosa*			x			
		Polycarpaea holtzei			x			
		Polycarpaea longiflora	x		x	x	x	
Chenopodiaceae		*Dysphania pumilio*	x			x		
		Dysphania rhadinostachya				x	x	
		Dysphania sp.				x		
		Maireana sp.		x		x	x	
		Rhagodia eremaea				x		
		Sclerolaena bicornis				x	x	
		Sclerolaena cornishiana		x		x		
		Sclerolaena costata				x	x	
		Sclerolaena sp.				x		
		Chenopodiaceae sp.				x	x	
Cleomaceae		*Cleome viscosa*	x		x	x	x	
Convolvulaceae		*Bonamia pilbarensis*	x		x	x	x	
		Bonamia sp.	x		x	x	x	
		Duperreya commixta					x	
		Evolvulus alsinoides		x		x	x	
		Evolvulus alsinoides var. *villosicalyx*	x					
		Evolvulus sp.		x				
		Ipomoea coptica					x	
		Ipomoea muelleri	x			x	x	
		Ipomoea sp.	x			x		
		Polymeria ambigua				x	x	
		Polymeria longifolia			x			
Cucurbitaceae	*	*Citrullus amarus*	x			x	x	
		Cucumis variabilis	x			x	x	
		Cucumis sp.	x			x	x	
Cyperaceae		*Cyperus cunninghamii* subsp. *cunninghamii*					x	
		Cyperus ixiocarpus					x	
		Cyperus vaginatus	x			x	x	
		Fimbristylis dichotoma	x				x	
		Fimbristylis simulans			x		x	
Euphorbiaceae		*Adriana tomentosa*				x	x	
		Euphorbia australis			x	x	x	
		Euphorbia australis var. *subtomentosa*		x		x	x	
		Euphorbia boophthona	x	x		x		
		Euphorbia careyi	x		x		x	
		Euphorbia clementii (P3)					x	
		Euphorbia coghlanii	x			x	x	
		Euphorbia sp.	x			x	x	
Fabaceae		*Acacia adoxa*					x	
		Acacia adoxa var. adoxa					x	
		Acacia ampliceps				x	x	
		Acacia ancistrocarpa			x	x	x	x
		Acacia arida	x		x	x	x	x
		Acacia bivenosa	x	x	x	x	x	x
		Acacia bivenosa x *sclerosperma* subsp. *sclerosperma*		x				

APPENDIX E: VASCULAR PLANT SPECIES RECORDED IN THE WOODIE WOODIE EXPANSION AREAS, 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (WAH 1998-).

Family	Species	Mattiske survey 2019					
		Area 1	Area 2	Area 3	Area 4	Area 6	Area 7
Fabaceae (continued)	*Acacia citrinoviridis*	x				x	
	Acacia colei var. *colei*			x		x	
	Acacia coriacea subsp. *pendens*	x		x	x	x	
	Acacia drepanocarpa subsp. *latifolia*			x	x		
	Acacia glaucocaesia		x		x	x	
	Acacia hilliana				x	x	
	Acacia inaequilatera	x	x	x	x	x	
	Acacia maitlandii					x	
	Acacia pruinocarpa					x	
	Acacia pyrifolia var. *pyrifolia*	x	x	x	x	x	
	Acacia sclerosperma subsp. *sclerosperma*		x		x	x	
	Acacia synchronicia		x	x	x	x	
	Acacia trachycarpa	x		x	x	x	
	Acacia tumida			x		x	x
	Acacia tumida var. *pilbarensis*					x	x
	Acacia sp.		x		x	x	
	Crotalaria sp.	x				x	
	Cullen cinereum				x		
	Cullen lachnostachys					x	
	Cullen leucanthum	x			x	x	
	Cullen ?*leucochaites*					x	
	Cullen ?*pogonocarpum*				x		
	Cullen sp.		x		x		
	Gompholobium polyzygum					x	
	Indigofera colutea	x					
	Indigofera monophylla	x	x	x	x	x	
	Indigofera trita subsp. *trita*		x				
	Indigofera sp.		x	x		x	
	Isotropis atropurpurea	x			x	x	
	Petalostylis labicheoides	x		x	x	x	
	Rhynchosia minima	x	x	x	x	x	x
	Senna artemisioides subsp. *helmsii*	x		x	x		
	Senna artemisioides subsp. *oligophylla*		x	x	x	x	
	Senna glutinosa subsp. *glutinosa*	x	x	x	x	x	
	Senna glutinosa subsp. *pruinosa*			x		x	
	Senna glutinosa subsp. *xluerssenii*			x	x	x	
	Senna notabilis		x	x	x	x	
	Senna sericea				x	x	
	Senna venusta	x			x	x	
	Senna sp.		x	x	x	x	x
	Sesbania cannabina	x			x	x	
	Tephrosia rosea			x	x	x	
	Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)					x	
	Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)		x				
	Tephrosia sp.	x		x		x	
	* *Vachellia farnesiana*				x		
	Vigna sp.	x					
Goodeniaceae	*Dampiera candicans*			x	x	x	
	Goodenia microptera			x	x	x	
	Goodenia muelleriana		x				
	Goodenia ?*scaevolina*				x	x	x
	Goodenia stobbsiana	x		x	x	x	
	Goodenia triodiophila				x	x	
	Goodenia sp.			x	x		

APPENDIX E: VASCULAR PLANT SPECIES RECORDED IN THE WOODIE WOODIE EXPANSION AREAS, 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (WAH 1998-).

Family	Species	Mattiske survey 2019					
		Area 1	Area 2	Area 3	Area 4	Area 6	Area 7
Goodeniaceae (continued)	*Scaevola amblyanthera var. centralis*				x	x	
	Scaevola sp.	x					
	Goodeniaceae sp.		x	x	x	x	
Gyrostemonaceae	*Codonocarpus cotinifolius*		x				
Lauraceae	*Cassytha filiformis*				x	x	
Lythraceae	*Ammannia multiflora*	x			x	x	
Malvaceae	*Abutilon* ?*cunninghamii*				x		
	Abutilon ?*lepidum*			x			
	Abutilon sp.	x		x	x	x	x
	Androcalva luteiflora					x	
	Corchorus laniflorus	x	x	x	x	x	
	Corchorus parviflorus	x			x	x	
	Corchorus sidoides subsp. *sidoides*					x	
	Corchorus tridens	x	x		x	x	
	Corchorus sp.	x			x	x	
	Gossypium australe	x	x	x	x	x	
	Gossypium robinsonii					x	
	Hibiscus coatesii				x	x	
	Hibiscus sturtii var. *campylochlamys*			x	x	x	
	Hibiscus sp.	x	x		x		
	* *Malvastrum americanum*				x		
	Melhania oblongifolia		x				
	Seringia elliptica				x		
	Sida arsiniata			x		x	
	Sida ?*cardiophylla*				x	x	
	Sida fibulifera		x		x	x	
	Sida rohlenae subsp. *rohlenae*	x					
	Sida ?*sp. spiciform panicles* (E. Leyland s.n. 14/8/90)			x			
	Sida sp.				x	x	x
	Triumfetta clementii			x			
	Triumfetta maconochieana					x	
	Triumfetta propinqua	x			x	x	
	Waltheria indica				x	x	
	Waltheria virgata				x		
	Malvaceae sp.			x	x	x	
Marsileaceae	*Marsilea hirsuta*	x					
Menispermaceae	*Tinospora smilacina*	x					
Molluginaceae	*Trigastrotheca molluginea*	x		x	x	x	
Moraceae	*Ficus platypoda*	x				x	
Myrtaceae	*Calytrix carinata*				x	x	
	Corymbia candida	x				x	
	Corymbia hamersleyana	x	x	x	x	x	x
	Corymbia opaca				x	x	
	Corymbia sp.			x	x	x	
	Eucalyptus camaldulensis	x			x	x	
	Eucalyptus leucophloia subsp. *leucophloia*				x	x	

APPENDIX E: VASCULAR PLANT SPECIES RECORDED IN THE WOODIE WOODIE EXPANSION AREAS, 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (WAH 1998-).

Family		Species	Mattiske survey 2019					
			Area 1	Area 2	Area 3	Area 4	Area 6	Area 7
Myrtaceae (continued)		*Eucalyptus victrix*	x		x	x	x	
		Eucalyptus sp.		x		x		
		Melaleuca eleuterostachya				x		
		Melaleuca glomerata					x	
		Melaleuca lasiandra				x	x	
Nyctaginaceae		*Boerhavia coccinea*	x		x			
		Boerhavia sp.	x	x	x	x	x	
Papaveraceae	*	*Argemone ochroleuca* subsp. *ochroleuca*				x		
Phyllanthaceae		*Flueggea virosa* subsp. *melanthesoides*	x					
		Notoleptopus decaisnei var. *decaisnei*	x	x		x	x	
		Notoleptopus decaisnei var. *orbicularis*					x	
		Phyllanthus maderaspatensis	x		x	x	x	
Plantaginaceae		*Stemodia grossa*	x	x	x	x	x	
Poaceae		*Aristida contorta*			x	x	x	
		Aristida holathera var. *holathera*				x		
		Aristida sp.				x	x	x
		Bothriochloa ewartiana					x	
	*	*Cenchrus ciliaris*	x	x	x	x	x	x
	*	*Cenchrus setiger*					x	
		Chrysopogon fallax			x	x	x	
		Cymbopogon ambiguus	x		x	x	x	x
		Cymbopogon obtectus					x	
		Cynodon convergens				x		
		Dactyloctenium radulans					x	
		Diplachne fusca subsp. *fusca*					x	
	*	*Echinochloa colona*				x		
		Enneapogon caerulescens			x	x		
		Enneapogon lindleyanus	x		x	x	x	
		Enneapogon polyphyllus					x	
		Enneapogon sp.				x		
		Eragrostis cumingii	x			x	x	
		Eragrostis eriopoda		x	x	x	x	
		Eragrostis tenellula	x	x		x	x	
		Eragrostis xerophila				x		
		Eragrostis sp.				x		
		Eriachne benthamii			x		x	
		Eriachne ?festucacea	x		x	x		
		Eriachne lanata					x	
		Eriachne mucronata				x	x	
		Eriachne pulchella		x			x	
		Eriachne sp.	x			x	x	
		Eulalia aurea	x				x	
		Iseilema macratherum				x		
		Paraneurachne muelleri			x	x	x	x
		Sporobolus actinocladus	x			x	x	
		Sporobolus australasicus	x	x	x	x	x	
		Sporobolus sp.				x	x	
		Themeda triandra			x		x	
		Triodia basedowii		x		x	x	
		Triodia epactia	x	x	x	x	x	x

APPENDIX E: VASCULAR PLANT SPECIES RECORDED IN THE WOODIE WOODIE EXPANSION AREAS, 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (WAH 1998-).

Family	Species	Mattiske survey 2019					
		Area 1	Area 2	Area 3	Area 4	Area 6	Area 7
Poaceae (continued)	*Triodia longiceps*		x		x	x	
	Triodia wiseana	x	x	x	x	x	x
	Triodia sp.	x			x	x	
	Poaceae sp.			x	x	x	
Portulacaceae	*Portulaca oleracea*				x		
	Portulaca sp.		x				
Proteaceae	*Grevillea pyramidalis*		x	x	x	x	
	Grevillea wickhamii	x		x	x	x	x
	Grevillea wickhamii subsp. hispidula				x		
	Hakea lorea	x		x	x	x	
	Hakea lorea subsp. *lorea*		x		x	x	
Rhamnaceae	*Ventilago viminalis*	x					
Rubiaceae	*Oldenlandia crouchiana*	x		x		x	
Santalaceae	*Anthobolus leptomerioides*				x	x	x
	Santalum acuminatum				x		
	Santalum lanceolatum					x	
Sapindaceae	*Atalaya hemiglauca*	x		x	x	x	
	Dodonaea sp.					x	
Scrophulariaceae	*Eremophila ?fraseri* subsp. *fraseri*					x	
	Eremophila latrobei subsp. *latrobei*				x	x	
Solanaceae	* *Datura leichhardtii* subsp. *leichhardtii*				x	x	
	Solanum diversiflorum		x		x		
	Solanum gabrielae	x		x		x	
	Solanum horridum		x		x	x	x
	Solanum lasiophyllum	x	x	x	x	x	
	* *Solanum nigrum*				x		x
	* *Solanum* sp.	x		x	x	x	
Typhaceae	*Typha domingensis*				x		
Violaceae	*Hybanthus aurantiacus*	x	x	x	x	x	
Zygophyllaceae	*Tribulus hirsutus*	x		x	x	x	
	Tribulus platypterus					x	
	Tribulus suberosus				x	x	
	Tribulus terrestris				x		
	Tribulus sp.		x		x		

APPENDIX F: SUMMARY OF INTRODUCED SPECIES RECORDED IN THE WOODIE WOODIE MINE EXPANSION AREAS, 2007 to 2019

Note: [1] DPAW - Department of Parks and Wildlife 2013 weed ranking category for the Pilbara region (DPaW 2013); [2] WAOL - Western Australian Organism List (BAM Act 2007, Department of Primary Industries and Regional Development 2019); Ecological Impact Rating: L - Low; M - Medium; H - High; U - Unknown. Invasiveness Rating: S - Slow; M - Moderate; R - Rapid; U - Unknown. [3] WONS - Department of the Environment and Energy 2019 Weeds of National Signifigance List (DotEE 2019).

X Denotes taxa recorded in 2019 assessments of WWME areas

Family	Species	2019	Common name	DPaW[1]		WAOL[2]	WONS [3]
				Ecological Impact Rating	Invasiveness Rating		
Amaranthaceae	*Aerva javanica*	X	Kapok Bush	H	R	Permitted - s11	No
Papaveraceae	*Argemone ochroleuca* subsp. *ochroleuca*	X	Mexican Poppy	U	R	Permitted - s11	No
Apocynaceae	*Calotropis procera*	X	Calotrope	-	-	Declared Pest - s22(2) (Exempt)	No
Poaceae	*Cenchrus ciliaris*	X	Buffel Grass	H	R	Permitted - s11	No
Poaceae	*Cenchrus setiger*	X	Birdwood Grass	H	R	Permitted - s11	No
Cucurbitaceae	*Citrullus amarus*	X	Jam melon	U	M	Permitted - s11	No
Poaceae	*Chloris barbata*		Purpletop Chloris	H	R	Permitted - s11	No
Poaceae	*Chloris virgata*		Feathertop Rhodes Grass	H	R	Permitted - s11	No
Poaceae	*Cynodon dactylon*		Couch Grass	H	R	Permitted - s11	No
Solanaceae	*Datura leichhardtii*	X	Native Thornapple	U	U	Permitted - s11	No
Solanaceae	*Datura leichhardtii* subsp. *leichhardtii*			-	-	-	No
Poaceae	*Echinochloa colona*	X	Awnless Barnyard Grass	H	R	Permitted - s11	No
Asteraceae	*Flaveria trinervia*	X	Speedy Weed	-	-	-	No
Malvaceae	*Malvastrum americanum*	X	Spiked Malvastrum	H	R	Permitted - s11	No
Solanaceae	*Solanum nigrum*		Black Berry Nightshade	L	R	Permitted - s11	No
Asteraceae	*Sonchus oleraceus*		Common Sowthistle	L	R	Permitted - s11	No
Fabaceae	*Vachellia farnesiana*	X	Mimosa Bush	H	R	Permitted - s11	No

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description
Vegetation map code: 1 **Structural** *Eucalyptus victrix* and *Eucalyptus camaldulensis* mid open woodland, over *Acacia coriacea* subsp. *pendens*, *Atalaya hemiglauca* and *Acacia trachycarpa* tall sparse shrubland, over *Cyperus vaginatus* low sparse sedgeland, over **Cenchrus ciliaris* mid grassland. **Associated species** **Aerva javanica, Alternanthera nodiflora, Ammannia baccifera, Centipeda minima, Cyperus difformis, Eragrostis tenellula, Gossypium australe, Marsilea hirsuta, Melaleuca lasiandra, Pseudognaphalium luteoalbum, Sesbania cannabina* and **Vachellia farnesiana.* **Soils and Landforms:** red-brown sandy loam along major watercourses. **Outcropping:** not present **Condition:** Good to Very Good **Area:** 330.81 ha **Proportion of survey area:** 7.65 % **Number of Quadrats:** 32 **Species richness:** 17.0 ± 1.2 (s.e.)
Representative Photograph
 **Site A1-004**

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description
Vegetation map code: 2 **Structural** *Eucalyptus victrix* mid open woodland, over *Atalaya hemiglauca*, *Petalostylis labicheoides* and *Acacia trachycarpa* tall sparse shrubland, over **Cenchrus ciliaris* mid tussock grassland. **Associated species** *Acacia arida, *Aerva javanica, Corymbia hamersleyana, Cymbopogon ambiguus, Gossypium australe, Pterocaulon sphaeranthoides, Sporobolus australasicus, Triodia pungens* and *Triodia wiseana.* **Soils and Landforms:** red-brown clay on flats, minor drainage channels and associated with major watercourses. **Outcropping:** not present **Condition:** Good **Area:** 8.53 ha **Proportion of survey area:** 0.20% **Number of Quadrats:** 1 **Species richness:** 26
Representative Photograph
 **Site A4-007**

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation map code: 3

Structural

Corymbia hamersleyana low isolated trees, over *Petalostylis labicheoides*, *Acacia ancistrocarpa* and *Grevillea wickhamii* tall sparse shrubland, over *Triodia longiceps* mid sparse hummock grassland and **Cenchrus ciliaris* mid sparse tussock grassland.

Associated species

Acacia arida, Acacia bivenosa, Chrysopogon fallax, Indigofera monophylla, Paraneurachne muelleri, Sporobolus australasicus, Stemodia grossa, Tephrosia rosea var. *clementii, Trichodesma zeylanicum, Triodia pungens* and *Triodia wiseana.*

Soils and Landforms: red-brown sand/clay/loam, sometimes with gravel, on flats and minor watercourses.

Outcropping: present

Condition: Very Good to Excellent

Area: 162.04 ha

Proportion of survey area: 3.75 %

Number of Quadrats: 27

Species richness: 16.4 ± 1.3 (s.e.)

Representative Photograph

Site A6-070

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation map code: 5

Structural

Acacia arida, *Acacia bivenosa* and *Acacia synchronicia* tall sparse shrubland, over *Triodia longiceps*, *Triodia wiseana* and *Triodia basedowii* mid open hummock grassland and patches of **Cenchrus ciliaris* and *Sporobolus australasicus* low open grassland.

Associated species

*Acacia ?glaucocaesia, Acacia inaequilatera, Acacia pyrifolia, Acacia trachycarpa, *Aerva javanica, Grevillea pyramidalis, Corchorus lasiocarpus, Indigofera monophylla, Tephrosia rosea* var. *clementii* and *Triodia pungens.*

Soils and Landforms: red sand and clay loam on flats, occasionally associated with watercourses.

Outcropping: not present

Condition: Good to Very Good

Area: 236.75 ha

Proportion of survey area: 5.48 %

Number of Quadrats: 13

Species richness: 10.6 ± 1.9 (s.e.)

Representative Photograph

Site A4-057

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description
Vegetation map code: 6 **Structural** *Corymbia aspera* and *Corymbia hamersleyana* low isolated trees, over *Hakea lorea* and *Acacia inaequilatera* tall isolated shrubs, over *Triodia wiseana*, *Triodia basedowii* and *Triodia longiceps* mid open hummock grassland. **Associated species** *Acacia arida, Acacia bivenosa, Acacia hilliana, Acacia synchronicia, Dampiera candicans, Goodenia stobbsiana, Grevillea wickhamii, Sporobolus australasicus, Trichodesma zeylanicum* and *Triodia pungens.* **Soils and Landforms:** red- brown clay and loam with gravel on slopes and hilltops. **Outcropping:** moderate **Condition:** Excellent **Area:** 264.27 ha **Proportion of survey area:** 6.11 % **Number of Quadrats:** 17 **Species richness:** 13.1 ± 1.3 (s.e.)
Representative Photograph
 **Site A6-105**

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation map code: 7

Structural

Acacia synchronicia, *Acacia bivenosa* and *Acacia arida* tall sparse shrubland, over *Triodia longiceps*, *Triodia wiseana* and *Triodia pungens* mid open hummock grassland.

Associated species

*Acacia ?glaucocaesia, Acacia inaequilatera, *Cenchrus ciliaris, Corchorus lasiocarpus, Corymbia hamersleyana, Goodenia stobbsiana, Hakea lorea, Indigofera monophylla, Polycarpaea holtzei, Ptilotus obovatus* and *Sporobolus australasicus.*

Soils and Landforms: orange-red loam, clay loam, sandy loam on flats and lower slopes.

Outcropping: not present

Condition: Very Good to Excellent

Area: 2201.89 ha

Proportion of survey area: 50.93 %

Number of Quadrats: 105

Species richness: 10.3 ± 0.5 (s.e.)

Representative Photograph

Site A4-027

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation map code: 8

Structural

Hakea lorea low isolated trees, over *Acacia bivenosa*, *Acacia arida* and *Acacia synchronicia* mid sparse shrubland, over *Triodia wiseana* and *Triodia longiceps* mid sparse hummock grassland and **Cenchrus ciliaris* mid sparse tussock grassland.

Associated species

Acacia ?*glaucocaesia, Acacia inaequilatera, Corchorus lasiocarpus, Corymbia hamersleyana, Grevillea pyramidalis, Grevillea wickhamii, Ptilotus axillaris, Sporobolus australasicus* and *Trichodesma zeylanicum.*

Soils and Landforms: brown clay and loam with rocks and pebbles on hills and slopes.

Outcropping: occasional

Condition: Very Good to Excellent

Area: 538.15 ha

Proportion of survey area: 12.45 %

Number of Quadrats: 24

Species richness: 12.6 ± 1.5 (s.e.)

Representative Photograph

Site A3-018

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation map code: 10

Structural

Corymbia hamersleyana low open woodland, over *Acacia bivenosa*, *Acacia arida* and *Grevillea wickhamii* tall sparse shrubland, over *Triodia wiseana*, *Triodia basedowii* and *Triodia pungens* mid open hummock grassland.

Associated species

Acacia ancistrocarpa, Acacia inaequilatera, Corchorus lasiocarpus, Corchorus parviflorus, Eragrostis eriopoda, Eucalyptus leucophloia, Goodenia stobbsiana, Hakea lorea, Pterocaulon sphacelatum, Senna glutinosa subsp. *glutinosa, Sporobolus australasicus, Trichodesma zeylanicum* and *Triodia longiceps.*

Soils and Landforms: red-brown clay/sand/loam, with some gravel, on undulating plains and slopes.

Outcropping: present

Condition: Excellent

Area: 131.11 ha

Proportion of survey area: 3.03 %

Number of Quadrats: 8

Species richness: 12.0 ± 1.7 (s.e.)

Representative Photograph

Site A4-010

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation map code: 11

Structural

Acacia bivenosa and *Acacia trachycarpa* tall isolated shrubs, over *Maireana* sp. and *Eremophea spinosa* low sparse shrubland, over **Cenchrus ciliaris* and *Sporobolus australasicus* mid sparse grassland.

Associated species

Dactyloctenium radulans, Eremophea spinosa, Lawrencia densiflora, Salsola australis, Sporobolus actinocladus, Trianthema cusackianum and *Triodia longiceps.*

Soils and Landforms: pale red/brown clayey flats.

Outcropping: not present

Condition: Good to Very Good

Area: 56.51 ha

Proportion of survey area: 1.31 %

Number of Quadrats: 3

Species richness: 5.7 ± 1.7 (s.e.)

Representative Photograph

Site A4-091

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation map code: 17

Structural

Acacia synchronicia, *Acacia bivenosa* and *Grevillea wickhamii* tall sparse shrubland, over *Triumfetta maconochieana*, *Hibiscus coatesii* and *Cleome viscosa* low sparse shrubland, over *Triodia pungens* and *Triodia wiseana* mid sparse hummock grassland and *Eriachne mucronata* mid sparse tussock grassland.

Associated species

**Aerva javanica, Atalaya hemiglauca, Cymbopogon ambiguus, Cyperus cunninghamii* subsp. *cunninghamii, Eriachne pulchella* subsp. *dominii, Hibiscus coatesii, Polycarpaea holtzei, Senna symonii, Sporobolus australasicus, Triodia longiceps* and *Triumfetta maconochieana.*

Soils and Landforms: red clay and loam on rocky outcrops.

Outcropping: not present to numerous

Condition: Excellent

Area: 2.03 ha

Proportion of survey area: 0.05 %

Number of Quadrats: 1

Species richness: 14

Representative Photograph

Site A4-070

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description
Vegetation map code: 18 **Structural** *Corymbia hamersleyana* and *Corymbia aspera* low open woodland, over *Acacia arida*, *Acacia ancistrocarpa* and *Acacia tumida* tall open shrubland, over *Triodia pungens* and *Triodia wiseana* mid sparse hummock grassland. **Associated species** *Acacia bivenosa, Acacia cuthbertsonii* subsp. *cuthbertsonii, Aristida contorta, Dampiera candicans, Dicrastylis cordifolia, Gompholobium polyzygum, Goodenia stobbsiana, Hibiscus sturtii* var. *campylochlamys, Solanum lasiophyllum* and *Sporobolus australasicus.* **Soils and Landforms:** clayey soils on flats and drainage channels **Outcropping:** not present **Condition:** Good **Area:** 16.27 ha **Proportion of survey area:** 0.38 % **Number of Quadrats:** 2 **Species richness:** 16.5 ± 0.5 (s.e.)
Representative Photograph
 **Site A6-065**

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description
Vegetation map code: 22 **Structural** *Acacia sclerosperma* subsp. *sclerosperma* tall open shrubland over *Acacia bivenosa* mid isolated clumps of shrubs over *Triodia epactia* and *Eulalia aurea* sparse grassland. **Associated species** *Acacia trachycarpa, Atalaya hemiglauca, *Cenchrus ciliaris, *Cenchrus setiger, Eremophila ?fraseri* subsp. *fraseri* and *Themeda triandra.* **Soils and Landforms:** Red clayey or sandy soil associated with minor drainage lines. **Outcropping:** Not present **Condition:** Very Good **Area:** 11.38 ha **Proportion of survey area:** 0.26 % **Number of Quadrats:** 3 **Species richness:** 7.0 ± 3.0 (s.e.)
Representative Photograph
 **Site A6-069**

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation Community Description	
Vegetation map code: 23	
Structural	
Eucalyptus leucophloia subsp. *leucophloia* low isolated clumps of trees over *Triodia longiceps* and *Eriachne mucronata* open grassland.	
Associated species	
Acacia arida, Acacia maitlandii, Senna glutinosa subsp. *glutinosa, Tribulus suberosus* and *Triodia wiseana.*	
Soils and Landforms: Skeletal, stony orange soil on breakaways and upper slopes.	
Outcropping: Numerous, granite.	
Condition: Excellent	
Area: 0.87 ha	**Proportion of survey area:** 0.02 %
Number of Quadrats: 3	**Species richness:** 10.0 ± 4.7 (s.e.)
Representative Photograph	

Site A6-072

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation Community Description	
Vegetation map code: 24	
Structural	
Corymbia candida mid open woodland over *Acacia arida* mid sparse shrubland over *Triodia epactia* and *Triodia wiseana* open hummock grassland.	
Associated species	
Acacia hilliana, Corchorus laniflorus, Fimbristylis dichotoma, Goodenia stobbsiana, Grevillea wickhamii, Hakea lorea and *Trigastrotheca molluginea.*	
Soils and Landforms: Orange rocky clayey loam and sandy loam on stony hilltops.	
Outcropping: Few, ironstone and granite.	
Condition: Very Good	
Area: 3.35 ha	**Proportion of survey area:** 0.08 %
Number of Quadrats: 5	**Species richness:** 10.8 ± 1.2 (s.e.)

Representative Photograph

Site A1-003

APPENDIX G: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN SURVEY AREAS WITHIN THE WOODIE WOODIE MINE EXPANSION AREAS, 2019

Vegetation Community Description

Vegetation Community Description	
Vegetation map code: 25	
Structural *Typha domingensis* tall open forbland over *Cyperus vaginatus* open sedgeland over *Triodia wiseana* and *Triodia longiceps* sparse hummock grassland.	
Associated species *Acacia arida, Acacia glaucocaesia* and *Stemodia grossa.*	
Soils and Landforms: Grey-orange clay with pebbles on flats with permanent inundation.	
Outcropping: Not present	
Condition: Excellent	
Area: 0.45 ha	**Proportion of survey area:** 0.01%
Number of Quadrats: 1	**Species richness:** 13
Representative Photograph	
	
Site A4-050	