



**Western  
Botanical**

# Flora and Vegetation of the MLF37 and BH3 Heap-Leach Waste Rock Landforms

Prepared for: Shire of Yilgarn and Covalent Lithium Pty Ltd

Report Ref: WB1006



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2. Incorporating (i) client feedback, (ii) inserting additional image of <i>Brachyloma stenolobum</i> and map of <i>Phebalium</i> sp. Parker Range Rd and (iii) Impact Assessment	G. Cockerton	1 <sup>st</sup> June 2023	1 <sup>st</sup> June 2023

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## 1. Executive Summary

The Shire of Yilgarn is undertaking a road upgrade and maintenance works south and south-west of the townships of Southern Cross and Marvel Loch. This includes realignments and sealing of Stubbs Street and Parker Range Road south of Moorine Rock, the newly constructed Parker Range Road diversion around the Mt Caudan minesite and a section of the Marvel Loch to Forrestania Road from the Parker Range Road intersection to the Mt Holland minesite. The realignment, widening and sealing is required due to anticipated increase in traffic as a result of expanded mining operations within the area.

Two rehabilitated waste rock landforms (WRL) adjacent to the Marvel Loch – Forrestania (MLF) road alignment have been identified for use as road building material, reducing the need for development of new borrow pits in uncleared native vegetation, as follows:

- MLF37, a 3.92 ha WRL at 37 km south of Marvel Loch wholly within tenement M77/1292, approximately 13.2 km south of the intersection of the Marvel Loch – Forrestania Rd and the Parker Range Rd then 410 metres west of the road).
- BH3, a 5.74 ha WRL at the abandoned British Hill minesite wholly within tenement M77/1256 (22.3 km south of the intersection of the Marvel Loch – Forrestania Rd and the Parker Range Rd then 3.87 km south-west of the road).

Both are situated in former heap-leach gold mining operations and lie wholly within formerly cleared and now rehabilitated areas.

The majority of flora present on both sites are widespread local endemic species. No Threatened Flora were recorded within or immediately adjacent to either study area. Priority flora and Species of Interest (SOI, new taxa) were recorded at both sites in low numbers. These were:

Site	Taxon	Status	# of plants within Footprint	# of plants Known Regionally (WB data)	# of plants known (DBCA data)	# of Populations Known (DBCA data) <sup>1</sup>
MLF37	<i>Acacia asepala</i>	P2	<b>5</b>	34,719	n/a	13
	<i>Eucalyptus</i> aff. <i>salubris</i> glaucous branchlet form (WB40196)	SOI	<b>few</b>	very widespread	0	1
	<i>Phebalium</i> sp. Parker Range Road long leaf (WB40838)	SOI	<b>1</b>	6,906	0	0
BH3	<i>Brachyloma stenolobum</i> (P1)	P1	<b>2</b>	632	n/a	2
	<i>Balaustion grandibracteatum</i> subsp. <i>juncturum</i>	P2	<b>2</b>	8,308	n/a	20
	<i>Verticordia stenopetala</i>	P3	<b>10</b>	34,379	n/a	19
	<i>Phebalium</i> sp. British Hill (WB41040)	SOI	<b>112</b>	36,836	0	1

<sup>1</sup> Utilising WAHERB data available on the Florabase website

## 2. Introduction

The Shire of Yilgarn is undertaking a road upgrade and maintenance works south and south-west of the townships of Southern Cross and Marvel Loch. This includes realignments and sealing of Stubbs Street and Parker Range Road south of Moorine Rock, the newly constructed Parker Range Road diversion around the Mt Caudan minesite and a section of the Marvel Loch to Forrestania Road from the Parker Range Road intersection to the Mt Holland minesite. The realignment, widening and sealing is required due to anticipated increase in traffic as a result of expanded mining operations within the area.

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Both are situated in former heap-leach gold mining operations and lie wholly within formerly cleared and now rehabilitated areas.

As one of the road users, Covalent Lithium Pty Ltd (Covalent) engaged Western Botanical to undertake a Targeted Survey of the MLF37 and BH3 WRL sites to identify the flora that has established at the two sites. Assessments were conducted to support the clearing applications allowing use of these materials in road construction.

### 2.1. Project Background

### 2.2. Previous surveys

Western Botanical is currently assessing the flora and vegetation of the Moorine Rock to Mt Holland road alignment for the purposes of road upgrading (widening, sealing and realignment as required). This involves a Detailed Assessment of flora and vegetation throughout the alignment to EPA Guidance 2016 requirements. The botanical assessment of the alignment is being managed by Covalent while the road building project is being managed by the Shire of Yilgarn with funding provided by Covalent.

The MLF37 site lies within the Contextual Zone of the Marvel Loch – Forrestania road alignment flora and vegetation assessment Study Area and as such has had the vegetation associations surrounding the MLF37 site characterised and mapped.

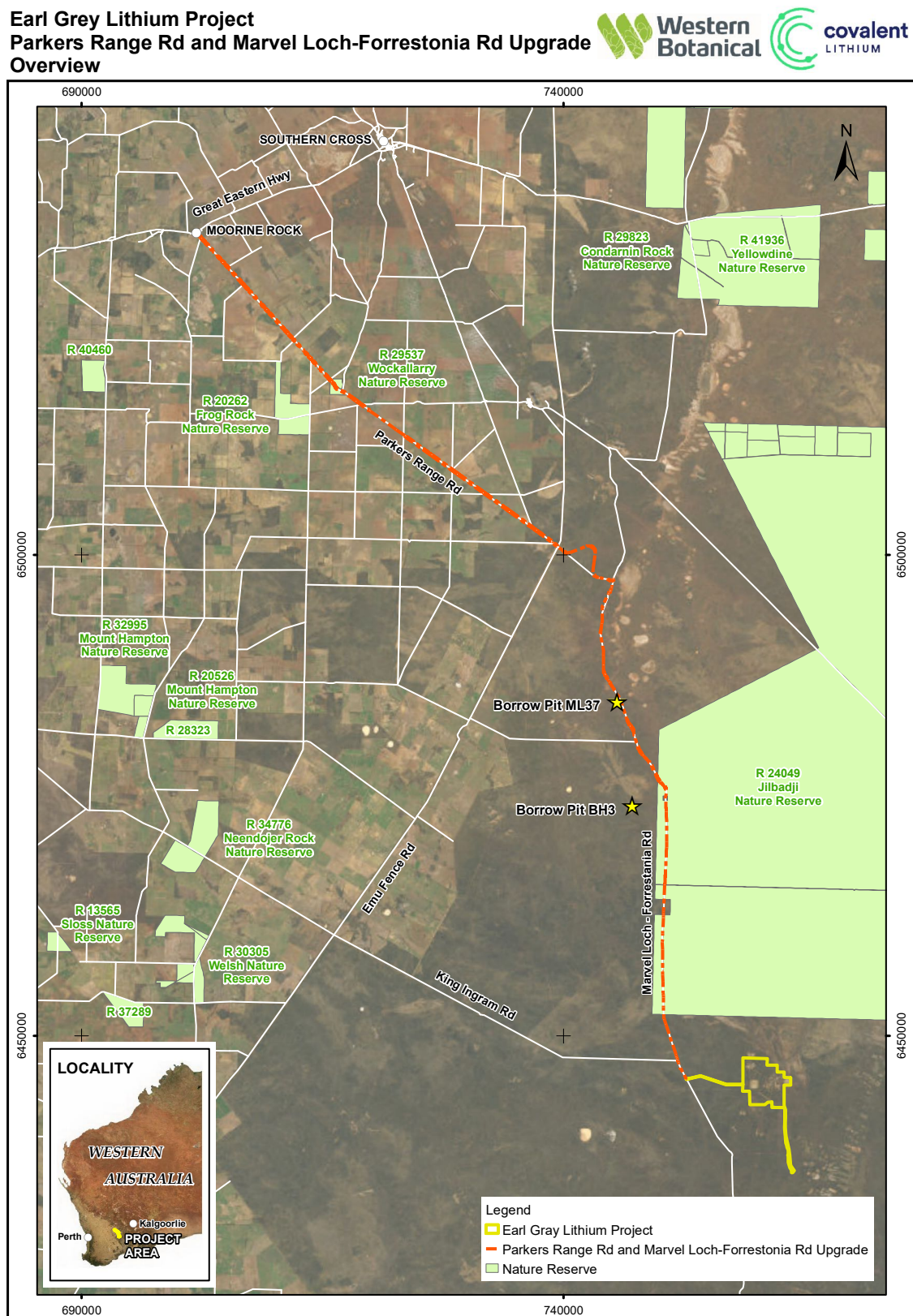
Western Botanical has previously assessed the flora and vegetation of the British Hill minesite in preparation of re-opening of the site for further gold mining (Western Botanical 2020). However, this project has stalled pending approval of a final scope of works presented to the tenement holder to complete the required flora and vegetation assessments to EPA Guidance 2016 requirements. Assessment of the road leading to the British Hill site remains as yet incomplete with the flora and vegetation of the mining tenement surrounding the BH3 WRL site is largely complete. The BH3 site lies within the area mapped for the British Hill tenement holder (Western Botanical 2000).

Both these projects in areas immediately adjacent to the current study areas, which has facilitated reliable identification of the flora of both sites.

### **2.3. Current Survey**

### **2.4. Physical and Biological Environment**

The physical environment (climate, geology, soil landscapes) and the biological environment (IBRA regions, Land System, Beard Pre-European Vegetation, Priority Ecological communities and publicly known significant flora of the region prior to commencement of the Detailed Survey of the Moorine Rock – Forrestania road alignment) are presented in Western Botanical 2023a, Appendix 1.

**Figure 1. Site locations of MLF37 and BH3**



### 3. Methods

The current survey of both the MLF37 and BH3 sites involved walking each Study Area at 5 to 10m spacings between observers or in wandering traverses, as was deemed appropriate for each site. As the vegetation of both sites was relatively sparse, the latter was often appropriate for assessing the species present. The MLF site was assessed on 13<sup>th</sup> May 2023 while the BH3 site was assessed on 12<sup>th</sup> May and again on 25<sup>th</sup> May 2023 to record some Priority flora locations.

Operators assessing the sites were highly experienced in the flora of the region between Moorine Rock and Mt Holland and led by a Senior Botanist. Species were largely identified in the field and specimens were taken of the majority of flora for verification and record keeping. All specimens taken were recorded using a Fulcrum App with location coordinates +/- 2.5m accuracy. Significant flora species that were recognised as either Priority flora (P1 to P4) or Species of Interest (SOI, representing new taxa) were entered directly into iPads running an ArcGIS Field Maps App with an accuracy of +/- 2.5 to 3m. Numbers of each significant flora species were counted / estimated within a 5 m radius of each point and that data presented on maps within this report.

#### 3.1. Desktop Survey

Western Botanical (2023a), Appendix 1, states: “The Study Area intersects two bioregions (Avon Wheatbelt and Coolgardie) and lies within the Merredin and Southern Cross subregions of these bioregions respectively. The Merredin subregion has been extensively cleared for agricultural use with only ~21% of pre-European vegetation remaining. The Coolgardie subregion currently retains ~96% of its pre-European vegetation. Approximately 46 km of the Study Area along the northern portion of the Parker Range Road is located adjacent to cleared (freehold) agricultural land, with narrow roadside remnants. The remainder of the Study Area is located within the western boundary of the Great Western Woodlands with extensive native vegetation either side of the alignment. The Study Area intersects the Wockallarry Nature Reserve and the Jilbadgi Nature Reserve.

Within the region, monthly rainfall peaks from late autumn throughout winter with an average annual rainfall of 292.8 mm. Thirteen soil landscape zones are intersected by the Study Area with the majority of the area occurring on gently sloping to gently undulating plateau areas, or uplands (on granites, gneisses, and allied rocks) and undulating sandy plains with small salt lakes or clay pans.

Three hydrographic sub-catchments of the Avon River Basin are traversed by the Study Area; Lake Julia (northern end of Study Area), Yellowdine (mid-section) and Lake Eva (southern end). The Department of Water and Environmental Regulation groundwater salinity database indicates groundwater salinities in the area range predominantly from 14,000 mg/L to 35,000 mg/L (highly saline), the exception being where paleochannels are intercepted (>35,000 mg/L; brine) around the Moorine Rock townsite and a section of the Study Area extending approximately 7.8 km south along the Marvel Loch-Forrestania Road (from the Parker Range Road intersection).

The flora of this region is incredibly diverse and subject to continual taxonomic and conservation status review. Database searches (state and national) and a literature review indicate 126 flora taxa of conservation significance have been recorded (or may occur) within a 50 km radius of the Study Area. Twenty taxa of conservation significance (one Threatened, five Priority 1, four Priority 2, nine Priority 3 and one Priority 4) have been recorded within the boundary of the Study Area with an additional 66 taxa (three Threatened, 24 Priority 1, eight Priority 2, 20 Priority 3 and 11 Priority 4) assessed as having the potential to occur within the Study Area.

The Study Area is located within the mapped buffer zones of three ecological communities of conservation significance;

- ‘Ironcap Hills vegetation assemblages (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone formation)’ Priority Ecological Community (PEC) (Priority 3);
- ‘Plant Assemblages of the Parker Range System’ PEC (Priority 3); and
- ‘Eucalypt Woodland of the Western Australian Wheatbelt’ PEC (Priority 3). This PEC is synonymous with the Commonwealth listed Threatened Ecological Community (TEC) under the *EPBC Act* (DBCA, 2022d).

Three Environmentally Sensitive Areas are present within the Study Area;

- the Jilbadgi Nature Reserve which is listed on the Register of the National Estate.
- the region of roadside vegetation within 50 m of the Threatened flora species *Banksia dolichostyla*. This species is present adjacent to the roadside from about the intersection of King Ingram Road southwards to the turnoff into the Mt Holland minesite.
- the Commonwealth listed ‘Eucalypt Woodland of the Western Australian Wheatbelt’ TEC under the *EPBC Act*.”

Both waste rock landforms being considered for use as road building materials are situated wholly within previously cleared land with some regeneration of native flora on and around each site.

### 3.2. Flora Specimen Identification

Flora collected at each study area were verified using the combined resources of the WA Herbarium’s Reference Herbarium, Western Botanical’s reference collection of the local region and relevant texts and on-line resources.

### 3.3. Significant Flora

Significant flora points were recorded using GPS with an accuracy of between 2.5 to 3m. Specimens have been retained for vouchering at WAHEWRB if required.



### **3.4. Weeds**

Weeds were recorded as observed.

## 4. Results and Discussion

### 4.1. MLF37 Waste Rock Landform

The MLF 37 site, within M77/1292, is poorly rehabilitated with little native vegetation establishing within the alkaline gravely-loamy waste rock landform and with less than 2% projected foliar cover of native species, Plate 1 and Plate 2. The site is largely dominated by annual weeds *Dittrichia graveolens*, *Centaurea melitensis* and *Sonchus oleraceus*. Native vegetation consists of a few scattered *Acacia* and *Melaleuca* shrubs, a few eucalypts and low numbers of individuals of other endemic species. Fifty-five species were recorded in total consisting of:

- The majority of flora present on the MLF37 site are widespread local endemic species.
- 40 endemic flora including one Priority flora species (5 plants of *Acacia asepala* (P2)); one widespread novel species (*Eucalyptus* aff. *salubris* glaucous branchlet form (WB40196)) and one novel species known from the Parker Range area (*Phebalium* sp. Parker Range Road long leaf (WB40838)). The novel species are treated here as Species of Interest (SOI);
- 2 non-endemic *Acacia* species remaining not fully identified which may have been introduced in rehabilitation activities;
- Two non-endemic (weed) *Atriplex* species (*Atriplex canescens* – an American species, *Atriplex amnicola* – a non-endemic WA native species native to the Gascoyne region) which must have been introduced in rehabilitation activities;
- 3 minor annual weed species (*Dittrichia graveolens*, *Centaurea melitensis*, *Sonchus oleraceus*) which dominate the site.

Species recorded on the MLF37 waste rock landform are presented in Table 1. Three species, including two likely non-endemic *Acacia* species that were probably introduced in rehabilitation, remain as yet not fully identified. These do not match any known species with Conservation Significance in the area. The significant species are discussed below.

The MLF37 site is developed within, and surrounded by, the E16 Vegetation Association *Eucalyptus longicornis* dominated tall woodland with *E. salmonophloia* and *Eucalyptus* aff. *salubris* glaucous branchlet form (WB40196) on red fine sandy loam with calcrete nodules (Western Botanical, in prep.) which is in Excellent condition.



**Plate 1. View of the northern face of the MLF37 WRL****Plate 2. View of the top of the MLF37 WRL**



**Table 1. Species of the MLF37 waste rock landform**

Family	Taxon	Status	# Plants
Apocynaceae	<i>Alyxia buxifolia</i>		
Asteraceae	<i>Angianthus tomentosus</i>		
Asteraceae	<i>Centaurea melitensis</i>	Weed	
Asteraceae	<i>Dittrichia graveolens</i>	Weed	
Asteraceae	<i>Olearia muelleri</i>		
Asteraceae	<i>Sonchus oleraceus</i>	Weed	
Boraginaceae	<i>Halgania andromedifolia</i>		
Chenopodiaceae	<i>Atriplex amnicola</i>	Non-endemic WA native - Weed	
Chenopodiaceae	<i>Atriplex bunburyana</i>		
Chenopodiaceae	<i>Atriplex canescens</i>	Weed	
Chenopodiaceae	<i>Beyeria sulcata</i> var. <i>gracilis</i>		
Chenopodiaceae	<i>Maireana brevifolia</i>		
Chenopodiaceae	<i>Maireana carnosus</i> sens lat.		
Chenopodiaceae	<i>Sclerolaena diacantha</i>		
Chenopodiaceae	<i>Sclerolaena drummondii</i>		
Cyperaceae	<i>Schoenus</i> sp.	Indet.	
Euphorbiaceae	<i>Beyeria sulcata</i> var. <i>brevipes</i>		
Fabaceae	<i>Acacia acuminata</i>		
Fabaceae	<i>Acacia asepala</i>	Priority 2	5
Fabaceae	<i>Acacia assimilis</i> subsp. <i>assimilis</i>		
Fabaceae	<i>Acacia erinacea</i>		
Fabaceae	<i>Acacia merrallii</i>		
Fabaceae	<i>Acacia</i> sp. Indet.	Indet., non-endemic	
Fabaceae	<i>Acacia</i> sp. Indet.	Indet., non-endemic	
Fabaceae	<i>Daviesia argillacea</i>		
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>		
Fabaceae	<i>Templetonia sulcata</i>		
Goodeniaceae	<i>Scaevola spinescens</i>		
Loranthaceae	<i>Amyema miquelii</i>		
Myrtaceae	<i>Eucalyptus</i> aff. <i>salubris</i> glaucous branchlet form (WB40196)	Sp. nov.	few
Myrtaceae	<i>Eucalyptus longicornis</i>		
Myrtaceae	<i>Eucalyptus salmonophloia</i>		
Myrtaceae	<i>Melaleuca johnsonii</i>		
Myrtaceae	<i>Melaleuca lanceolata</i> sens lat.		
Poaceae	<i>Amphipogon caricinus</i>		
Rutaceae	<i>Phebalium</i> sp. Parker Range Road long leaf (WB40838)	Sp. nov.	1
Santalaceae	<i>Exocarpos aphyllus</i>		

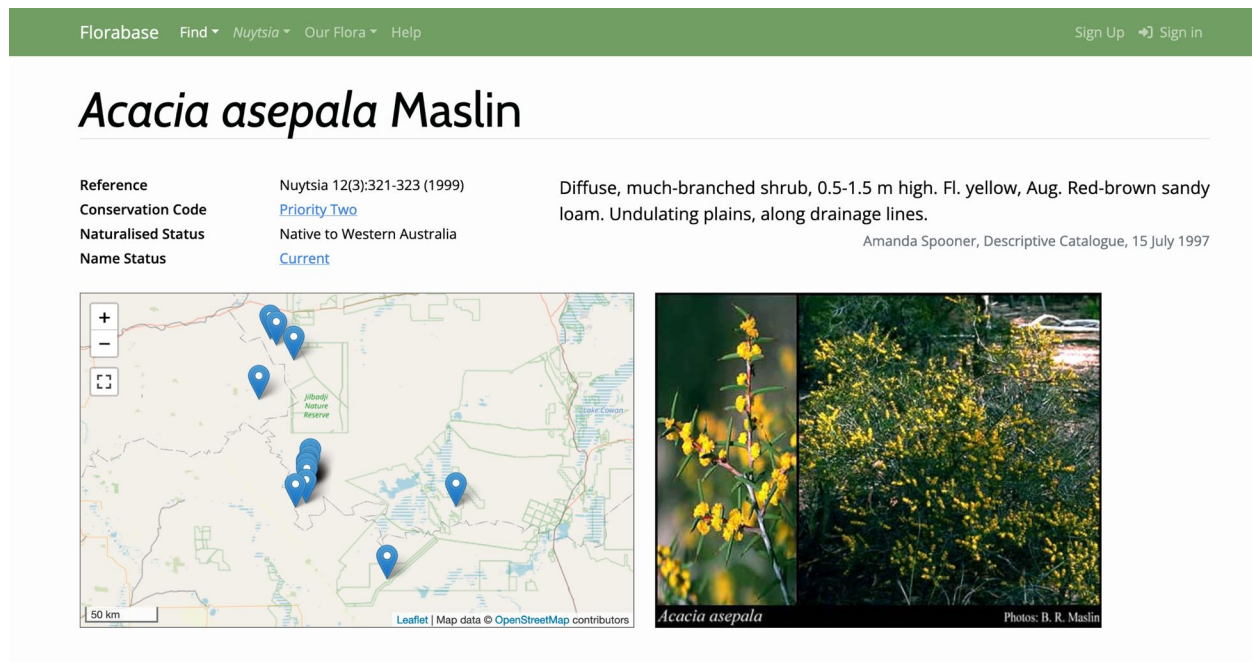
Family	Taxon	Status	# Plants
Santalaceae	Exocarpos capnodioides		
Santalaceae	Leptomeria preissii		
Sapindaceae	Dodonaea stenozyga		
Scrophulariaceae	Eremophila decipiens subsp. linearifolia		
Scrophulariaceae	Eremophila ionantha		
Scrophulariaceae	Eremophila oppositifolia		
Scrophulariaceae	Eremophila scoparia		
Solanaceae	Lycium australe		
Zygophyllaceae	Roepera glauca		
Zygophyllaceae	Roepera sp. Indet.		

Of the species present, the Priority and novel species are discussed below.

***Acacia asepala* (P2)** is a long-lived low to medium shrub to 1.2m tall x up to 3m wide, Plate 3. It is common under *Eucalyptus longicornis*, *E. salmonophloia* and occasional *Eucalyptus* aff. *salubris* glaucous branchlet form (WB40196) trees on alkaline loams with calcrete nodules in the area either side (east and west) of the Parker Range and has been widely recorded adjacent to the Marvel Loch – Forrestania Road alignment south of the Parker Range Road intersection. In current studies for Covalent on this alignment, within a band 50m either side of the existing road alignment, Western Botanical has counted 24,719 plants of *Acacia asepala*, Figure 3, demonstrating that it is locally abundant. These plants were large and mature with substantial lignotubers and occurred in long-unburnt vegetation at densities of 1 to 0.5 plants per 100 sq. metres.

In contrast, on the south-western side of the Parker Range, in an area of recently burnt (approximately 10 to 12 yrs. ago) tall eucalypt woodland, *Acacia asepala* plants were observed in mid 2022 by Western Botanical to be regenerating very effectively. Plants regenerating from seed and from lignotuber were noted to about 0.6m tall (Western Botanical 2022), occurring in densities of over 1 plant per sq. metre with an overall population exceeding 10,000 plants. This population is excluded from the numbers quoted above but included in the discussion of the species overall.

More broadly, *Acacia asepala* is known between Southern Cross and Frank Hann National Park, Figure 2.

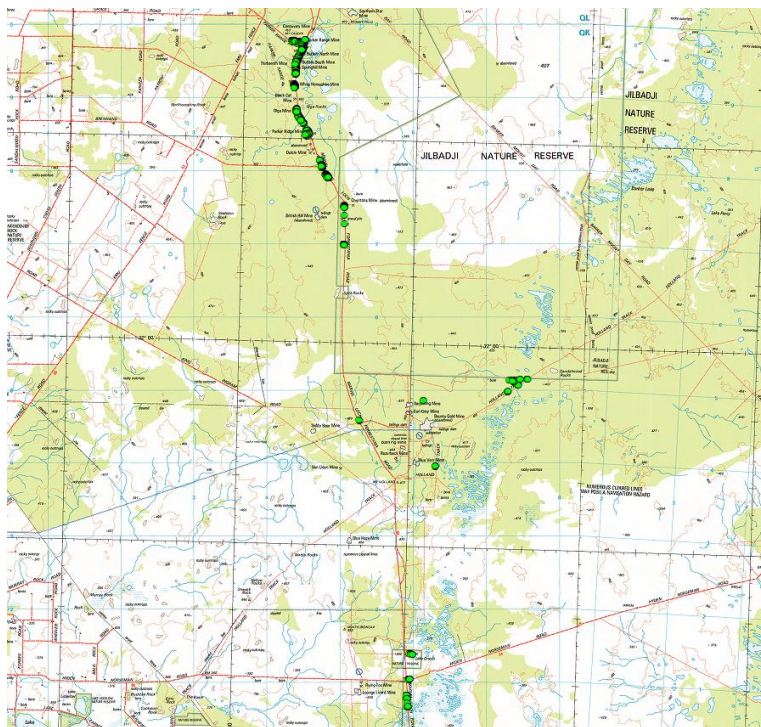
**Figure 2. Regional distribution of *Acacia asepala* (P2) (Florabase)**

Five plants of *Acacia asepala* P2 were noted on the MLF37 WRL with a further 8 plants observed outside but close to the WRL footprint, Figure 6. Those to be taken represent an insignificant proportion of the local population.



**Plate 3. A young *Acacia asepala* plant (image taken Parker Range Rd)**

**Figure 3. *Acacia asepala* mapped by Western Botanical in the local area.**





***Eucalyptus* aff. *salubris* glaucous branchlet form (WB40196)** is a widespread and locally abundant species that is in the process of being recognised as a new species. It is closely allied to *Eucalyptus salubris* (Gimlet), Plate 4, and is widely distributed over an area of at least 400 x 400 km from near Merredin eastwards to south-east of Norseman, and northwards to near Menzies. While the species does not as yet appear on the WA Herbarium FloraBase website, it has been reviewed by eucalypt specialist Mr. Malcolm French and the genetic differences within *E. salubris* are noted within Binks *et. al.* (2021).

The number of individuals of *Eucalyptus* aff. *salubris* glaucous branchlet form (WB40196) on the WRL were not counted as it is locally very abundant and dominates woodlands on heavier red-brown clay soils in the broader region and is not considered to warrant conservation listing.

**Plate 4. *Eucalyptus* aff. *salubris* glaucous branchlet form (WB40196) (taken adjacent to the Marvel Loch – Forrestania road alignment)**





***Phebalium* sp. Parker Range Road long leaf (WB40838)** is a new species that has recently been recognised by Western Botanical and which is locally common in the Marvel Loch - Parker Range area, Plate 5. In current studies for Covalent on this alignment, within a band 50m either side of the existing road alignment, Western Botanical has counted in excess of 6,906 plants of *Phebalium* sp. Parker Range Road long leaf (WB40838). It has also been recorded in low numbers on the flanks of the central and southern Parker Range in studies for the Australian Lithium Alliance (Western Botanical 2022) suggesting it is locally uncommon but reasonably widespread in the Marvel Loch – Parker Range area. These latter populations are excluded from the local population numbers noted above. It is associated with rocky lateritic and weathered ironstone landforms from near Marvel Loch to the Parker Range as far south near British Hill, Figure 4.

**Plate 5. An individual plant of *Phebalium* sp. Parker Range Road long leaf (WB40838) on the MLF37 WRL.**

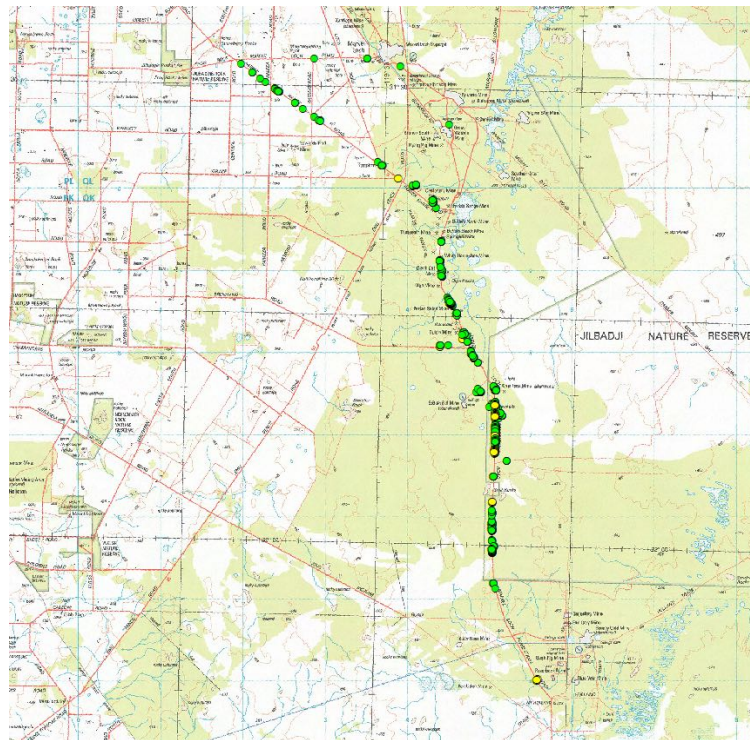


*Phebalium* is a genus in need of taxonomic revision. A previous review *Phebalium* at the WA Herbarium conducted by Western Botanical found four widely distributed specimens matching *Phebalium* sp. Parker Range Road long leaf (WB40838) (Perth 04134168 (Lake Magenta NR; PERTH 05950929 near Cascade; PERTH 00939692 near Norseman and PERTH 06048439 near Menzies in WA. Western Botanical has also encountered the species at the Helena and Aurora Range in the Mt Manning Conservation Park (WB9196 and WB35642). The species seems widespread but not recognised taxonomically and is unlikely to be considered conservation-significant, Figure 5.



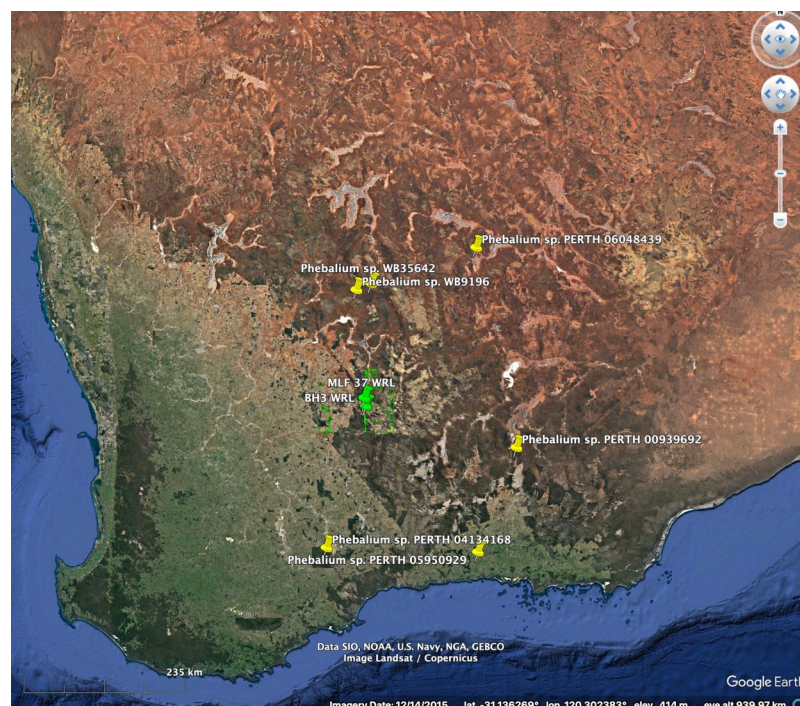
The taking of an individual plant on the MLF37 WRL is not considered significant in a local or regional sense. Significant flora noted at the MLF37 WRL site are presented in Figure 6.

**Figure 4. *Phebalium* sp. Parker Range Road long leaf (WB40838) recorded by Western Botanical 2022-23**

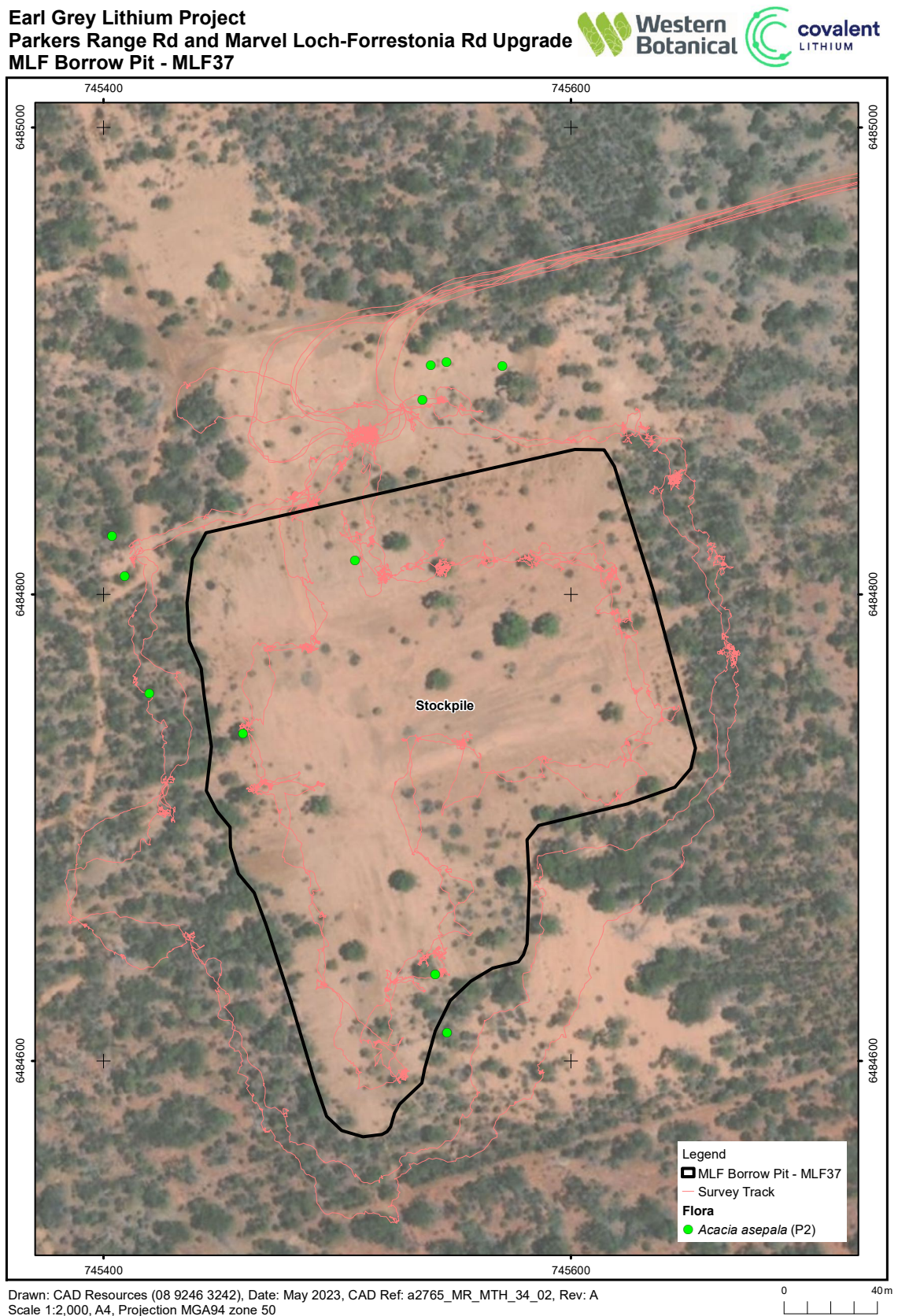


Key: *Phebalium* sp. Parker Range Rd (WB40838) (SOI)- green dots

**Figure 5. Broader distribution of *Phebalium* sp. Parker Range Road long leaf (WB40838) in Western Australia**





**Figure 6. Priority Flora of the MLF37 site.**

## 4.2. BH3 Waste Rock Landform

The BH3 site, within M77/1256, is situated adjacent to the British Hill gold deposit and represents a rehabilitated heap-leach waste landform. Its surface is characterised by a hard setting red-brown silty sand with abundant laterite pizolitic gravel and some ferricrete. Erosion rills up to 2m deep are present on the slopes of the WRL.

The site has been revegetated with 85 species of local endemic flora species which appear to have been either direct seeded on to the site or returned in topsoil used for this purpose. Dominant species include *Acacia assimilis* subsp. *assimilis*, *Melaleuca lanceolata*, *M. lateriflora*, *Allocasuarina acutivalvis*, and occasional eucalyptus spp. trees and mallees. The overall projected foliar cover is estimated a 5% but is variable and there are relatively large areas with little native vegetation present and other areas with denser patches. Weeds are absent. Species present are presented in Table 2.

The majority of flora present on the BH3 WRL site are widespread local endemic species. The site does support individuals of three Priority flora and one Species of Interest (new, undescribed taxon):

- *Brachyloma stenolobum* (P1) - 2 plants
- *Balaustion grandibracteatum* subsp. *juncturum* (P2) - 2 plants
- *Verticordia stenopetala* (P3) - 10 plants
- *Phebalium* sp. British Hill (WB41040) (SOI) - 112 plants

The majority of these are situated on the fringe of the dump area and are included within the study area for context. Direct impacts to the majority can be avoided on the margins of the BH3 WRL if required. These are discussed below and locations of these are presented in Figure 14.

Five species, including two *Acacia* species, a *Lepidosperma* species, a *Maireana* and a *Dampiera* species remain as yet not fully identified. These do not match any known species with Conservation Significance in the area.

One species, *Gastrolobium musaceum*, represents a minor (70km) northerly range extension. It has not been specifically surveyed on site.



***Brachyloma stenolobum* (P1)** is a single stemmed shrub to 1.5m at maturity which has been found to be uncommon in *Allocasuarina spinosissima* / *A. corniculata* Shrublands on shallow sandplains over laterite gravel in the area between the southern Parker Range and Mt Holland. Regionally it is known from two loci between Mt Holland and south-east of Lake Johnson, Figure 7.

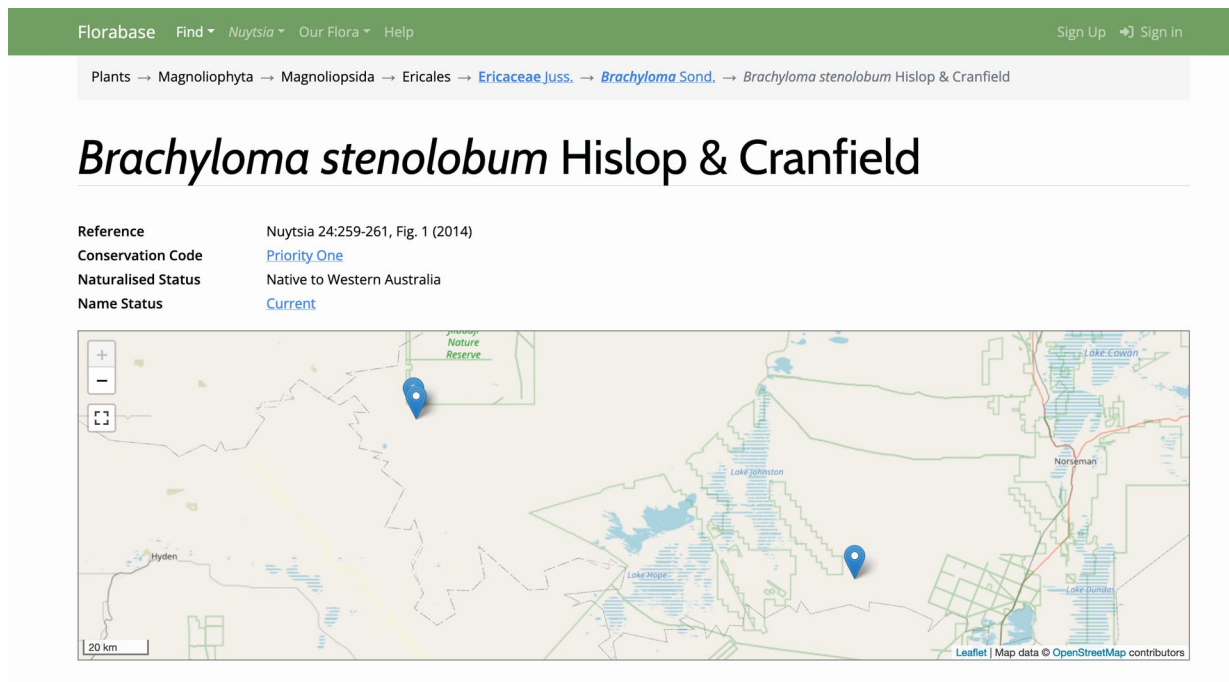
Two plants occur on the WRL, at the top of the slope on the northern side of the central part of the WRL, Plate 6 and Plate 7. Western Botanical has recorded 632 plants of *Brachyloma stenolobum* within the 100m wide alignment assessed in roadside vegetation in the region from the southern end of the Parker Range to Mt Holland, Figure 8.

This species is easily overlooked in the field and is best surveyed for when in flower (winter to late spring). While surveys undertaken for *Brachyloma stenolobum* presented here were undertaken in the species' flowering period, surveys were of limited areas (and are on-going) and it is likely more widespread and abundant than data to date indicates. The 2 plants occurring on the BH3 WRL are not considered a significant proportion of the likely overall population of the species.

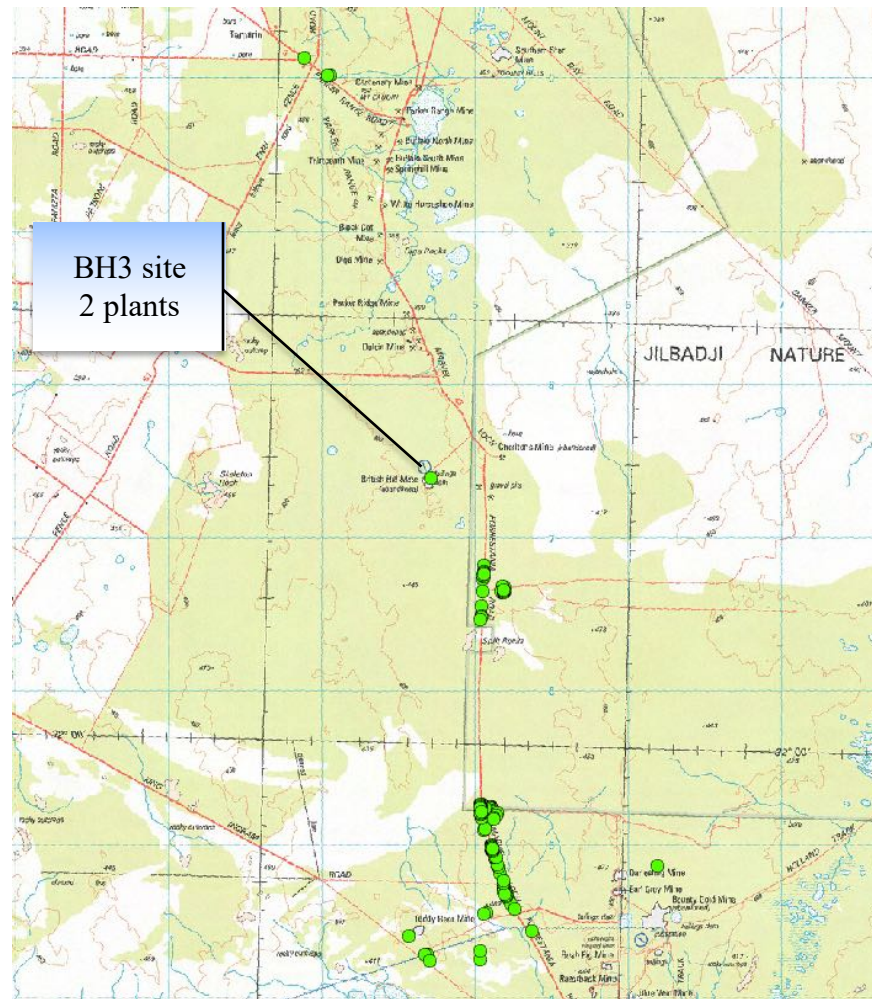
**Plate 6. Two *Brachyloma stenolobum* (P1) plants on the BH3 WRL**





**Plate 7. *Brachyloma stenolobum* P1 foliage and flowers, BH3 WRL, about actual size.****Figure 7. Regional distribution of *Brachyloma stenolobum* (P1) (Florabase)**

**Figure 8. Distribution of *Brachyloma stenolobum* as recorded by Western Botanical (2022-23, in prep.)**





***Balaustion grandibracteatum* subsp. *juncturum* (P2)** is a small wispy plant to 0.6m with pink flowers in Spring, Plate 8. At the time of assessment plants were holding dried fruits and were readily noted. Regionally, it is known from the Parker Range southwards to Forresteria and occurs in reasonably high numbers in *Allocasuarina acutivalvis* shrublands on lateritic gravel rises and in *Allocasuarina spinosissima* / *A. corniculata* shrublands associated shallow sandplains over laterite.

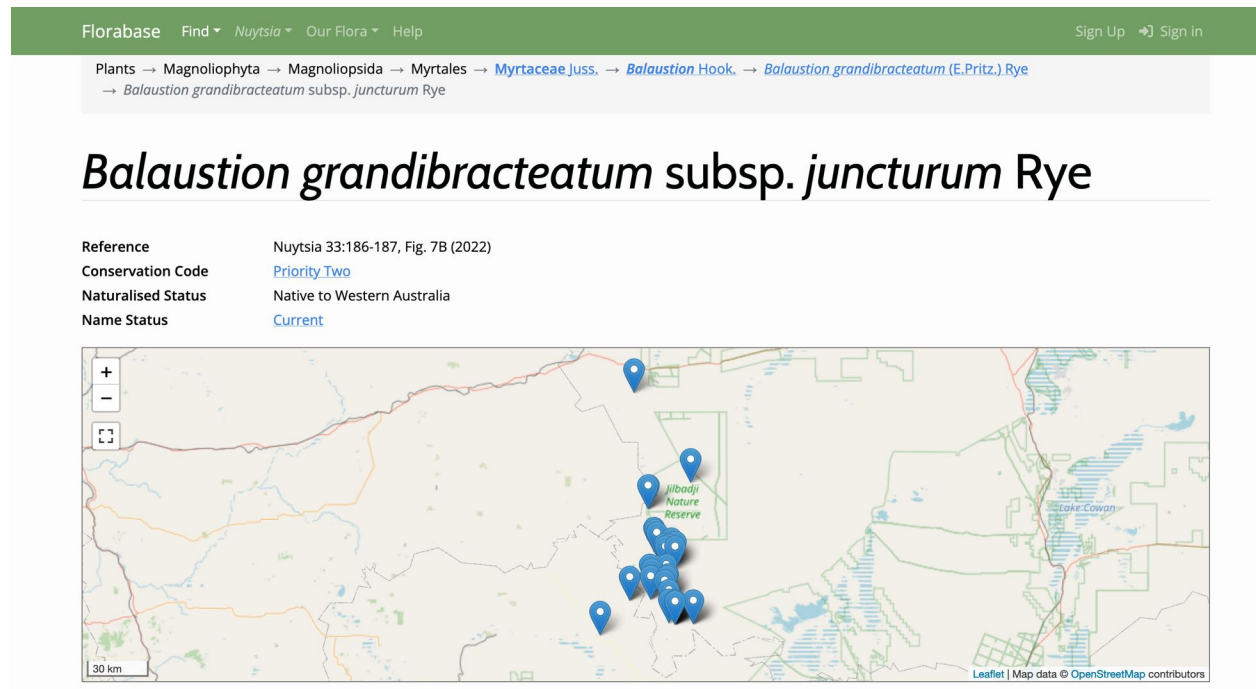
Western Botanical has recorded 8,308 plants of *Balaustion grandibracteatum* subsp. *juncturum* in the vicinity of the road alignment from Parker Range to Mt Holland. This species is easily overlooked in the field and is best surveyed for when in flower (late Spring). While surveys undertaken for *Balaustion grandibracteatum* subsp. *juncturum* presented here were mostly undertaken in the species' flowering period, surveys were of limited areas (and are on-going) and it is likely more widespread and abundant than data to date indicates. The 2 plants occurring on the BH3 WRL are not considered a significant proportion of the local population.

**Plate 8. *Balaustion grandibracteatum* subsp. *juncturum* (P2) (Spring 2022)**





**Figure 9. Regional distribution of *Balaustion grandibracteatum* subsp. *juncturum* (P2). (Florabase)**



**Figure 10. Distribution of *Balaustion grandibracteatum* subsp. *juncturum* (P2) as recorded by Western Botanical (2022-23, in prep.)**





*Verticordia stenopetala* (P3) is a low shrub to 0.4m with pink flowers in late Spring, Plate 9. At the time of assessment, plants were holding dried flowers and were readily recognised. Regionally it is known from yellow sandplains over laterite gravel and low gravely rises under *Allocasuarina acutivalvis*, *A. spinosissima* and *A. corniculata*, from near Bullfinch to south of Forrestania, Figure 11.

Western Botanical has recorded 34,379 plants of *Verticordia stenopetala* in the region from Parker Range to Mt Holland. While surveys undertaken for *Verticordia stenopetala* presented here were mostly undertaken in the species' flowering period, surveys were of limited areas (and are on-going) and it is likely more widespread and abundant than data to date indicates. The 10 plants occurring on the BH3 WRL are not considered a significant proportion of the local population.

**Plate 9. *Verticordia stenopetala* (late Spring 2022)**





**Figure 11. *Verticordia stenopetala* (P3) (Florabase)**

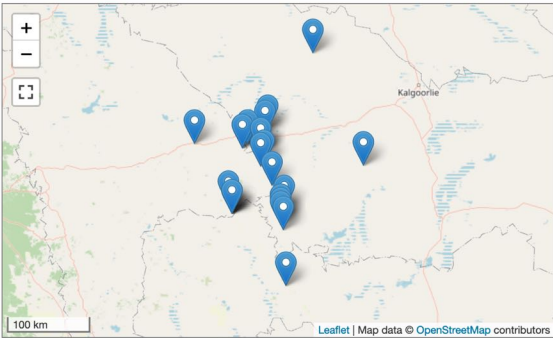


Florabase Find **Nuytsia** Our Flora Help Sign Up Sign in

Plants → Magnoliophyta → Magnoliopsida → Myrtales → **Myrtaceae Juss.** → **Verticordia DC.** → *Verticordia stenopetala* Diels

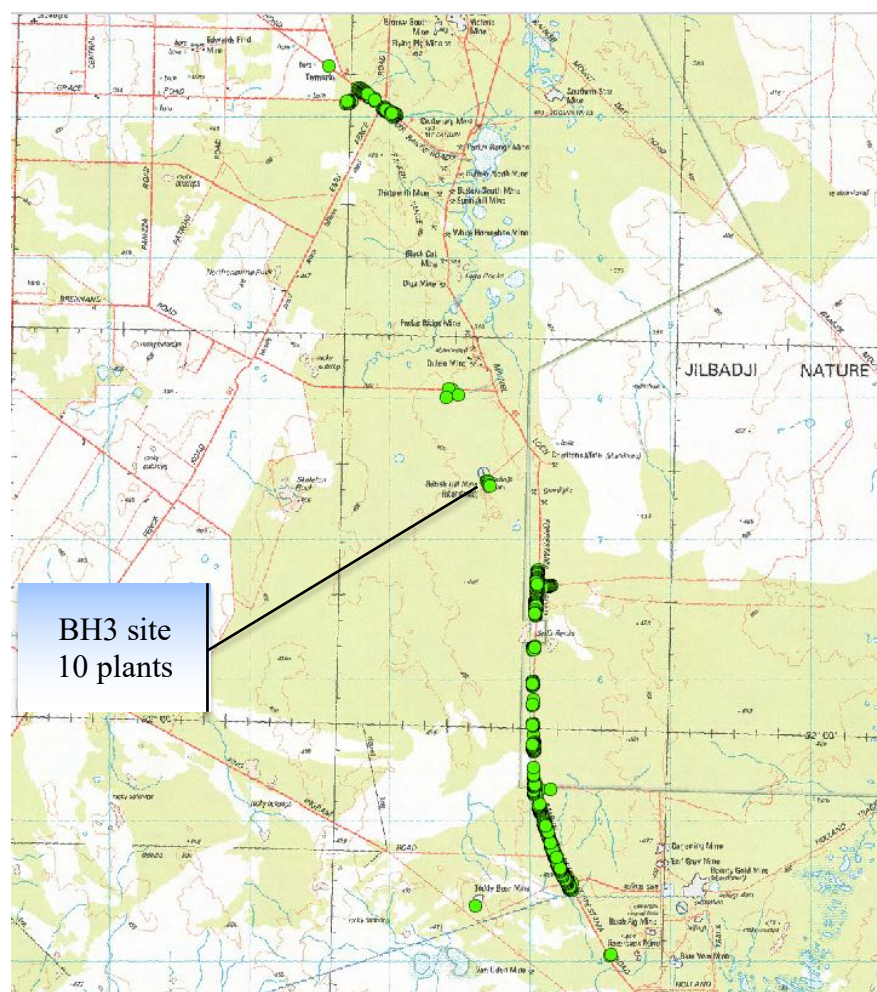
## *Verticordia stenopetala* Diels

Reference Bot.Jahrb.Syst. 35:402 (1904)  
 Conservation Code **Priority Three**  
 Naturalised Status Native to Western Australia  
 Name Status **Current**

Shrub, 0.2-0.6(-1.3) m high. Fl. pink/pink-purple-red, Oct to Dec or Jan. Yellow sand, sometimes with gravel. Undulating plains.  
 Grazyna Paczkowska, Descriptive Catalogue, 20 February 1996

*Verticordia stenopetala* Photos: E.A. Berndt

**Figure 12. Distribution of *Verticordia stenopetala* (P3) as recorded by Western Botanical (2022-23, in prep.)**

*Phebalium* sp. British Hill (WB41040) (SOI) is a newly recognised species endemic to the British Hill area. It is housed at the WA Herbarium as *Phebalium* aff. *tuberosum* (Cockerton, G.; Cockerton, S.; Warden, J. WB40140). It is a low dense shrub to 0.7m, Plate 10, related to *Phebalium tuberosum* but differs in numerous floral and vegetative characters but has not yet been listed by the WA Herbarium as a distinct taxon.

*Phebalium* sp. British Hill (WB41040) has been recorded by Western Botanical at five sub-populations:

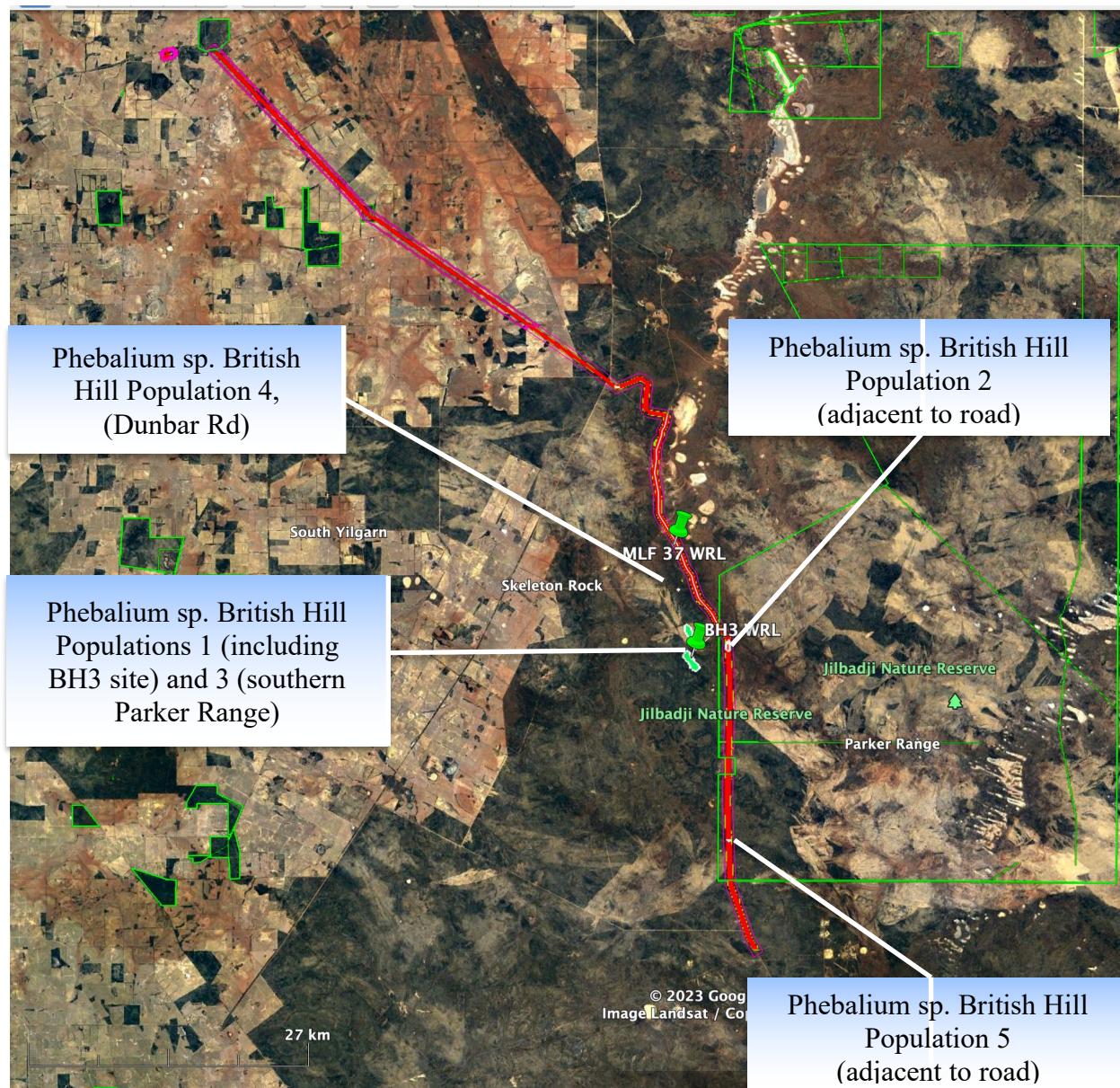
1. Population 4 on the south side of Dunbar Rd, 1.67 km west of the Marvel Loch – Forrestania Rd, estimated 100 plants;
2. Population 2 adjacent to the Marvel Loch – Forrestania Road with ~5,500 plants.
3. Populations 1 at the British Hill deposit area, 29,736 plants
4. Population 3 in the southern Parker Range for Australian Lithium Alliance (Western Botanical 2022) with a population approaching 1,000 individuals.
5. Population 5 at 11 km north of the Mt Holland minesite turnoff, ~ 500 plants.

The total population of *Phebalium* sp. British Hill counted to date is approximately 36,836 plants in five sub-populations. The 112 plants of *Phebalium* sp. British Hill (WB41040) mostly on the perimeter of the BH3 WRL is not considered a significant proportion of the local population.

**Plate 10. *Phebalium* sp. British Hill (WB41040)**





**Figure 13. *Phebalium* sp. British Hill (WB41040)**

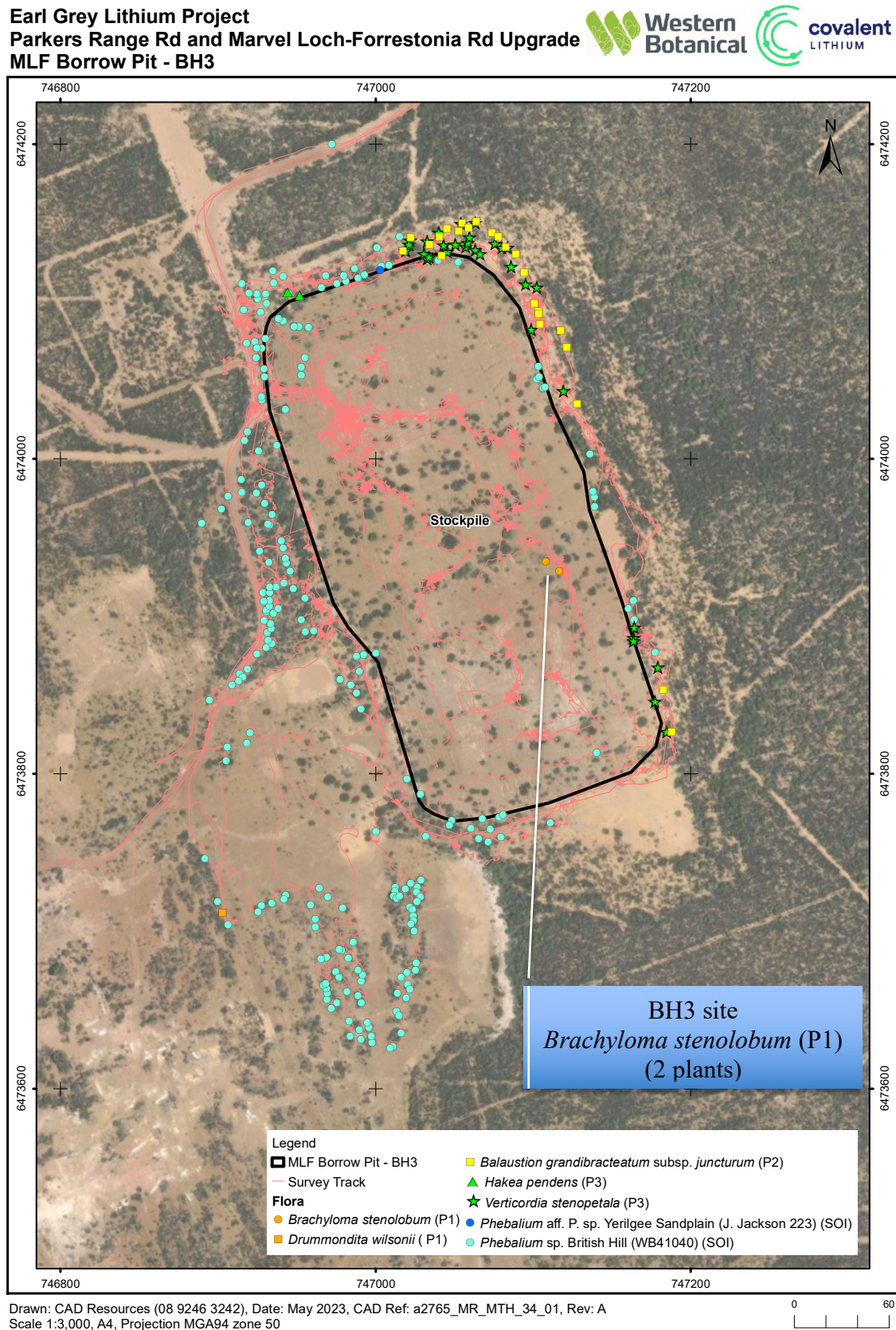
**Table 2. Species present on the BH3 waste rock landform**

Family	ID verified	Cons Status	# Plants
Amaranthaceae	Ptilotus polystachyus		
Apocynaceae	Alyxia buxifolia		
Asteraceae	Asteridea athrixoides		
Asteraceae	Olearia muelleri		
Asteraceae	Podotheca gnaphalioides		
Asteraceae	Waitzia fitzgibbonii		
Casuarinaceae	Allocasuarina acutivalvis		
Casuarinaceae	Allocasuarina campestris		
Casuarinaceae	Allocasuarina corniculata		
Casuarinaceae	Allocasuarina helmsii		
Chenopodiaceae	Atriplex acutibractea subsp. Karoniensis		
Chenopodiaceae	Eriochiton sclerolaenoides		
Chenopodiaceae	Maireana carnosa		
Chenopodiaceae	Maireana georgei		
Chenopodiaceae	Maireana radiata		
Chenopodiaceae	Maireana sp.	Indet.	
Chenopodiaceae	Sclerolaena drummondii		
Cupressaceae	Callitris preissii		
Cyperaceae	Lepidosperma sp. GC-817	Indet.	
Cyperaceae	Mesomelaena preissii		
Dilleniaceae	Hibbertia eatoniae		
Dilleniaceae	Hibbertia pungens		
Ericaceae	Acrotriche lancifolia		
Ericaceae	Brachyloma stenolobum	P1	2
Euphorbiaceae	Beyeria sulcata var. brevipes		
Euphorbiaceae	Boronia ternata subsp. austrofoliosa		
Fabaceae	Acacia assimilis subsp. assimilis		
Fabaceae	Acacia beauverdiana		
Fabaceae	Acacia erinaceae		
Fabaceae	Acacia merrallii		
Fabaceae	Acacia neurophylla subsp. erugata		
Fabaceae	Acacia nigripilosa subsp. nigripilosa		
Fabaceae	Acacia sp. Indet	Indet.	
Fabaceae	Acacia sp. Indet.	Indet.	
Fabaceae	Acacia steedmanii		
Fabaceae	Acacia yorkrakinensis		
Fabaceae	Daviesia argillacea		
Fabaceae	Gastrolobium floribundum		
Fabaceae	Gastrolobium musaceum	70km Range Extension	Not counted
Fabaceae	Jacksonia nematoclada		
Fabaceae	Leptosema daviesioides		
Goodeniaceae	Dampiera sp. Indet.	indet.	
Goodeniaceae	Scaevola spinescens (broad leaf, spiny form)		
Haloragaceae	Glischrocaryon aureum		

Family	ID verified	Cons_Status	# Plants
Malvaceae	Alyogyne hakeifolia		
Myrtaceae	Balaustion grandibracteatum subsp. juncturum	P2	2
Myrtaceae	Eucalyptus aff. salubris glaucous branchlet form (WB40196)	SOI	Not counted
Myrtaceae	Eucalyptus burracoppinensis		
Myrtaceae	Eucalyptus capillosa subsp polyclada		
Myrtaceae	Eucalyptus comitae-vallis		
Myrtaceae	Eucalyptus horistes		
Myrtaceae	Eucalyptus platycorys		
Myrtaceae	Eucalyptus rigidula		
Myrtaceae	Eucalyptus salmonophloia		
Myrtaceae	Eucalyptus sheathiana		
Myrtaceae	Eucalyptus tephroclada		
Myrtaceae	Euryomyrtus maidenii		
Myrtaceae	Melaleuca acuminata		
Myrtaceae	Melaleuca calyptroides		
Myrtaceae	Melaleuca cordata		
Myrtaceae	Melaleuca hamata		
Myrtaceae	Melaleuca lateriflora		
Myrtaceae	Melaleuca laxiflora		
Myrtaceae	Melaleuca pauperiflora subsp. fastigiata		
Myrtaceae	Micromyrtus erichsenii		
Myrtaceae	Thryptomene kochii		
Myrtaceae	Verticordia stenopetala	P3	10
Poaceae	Amphipogon caricinus		
Poaceae	Aristida contorta		
Poaceae	Austrostipa drummondii		
Proteaceae	Grevillea eriostachya		
Proteaceae	Grevillea excelsior		
Proteaceae	Grevillea obliquistigma subsp. obliquistigma		
Proteaceae	Grevillea paradoxa		
Proteaceae	Hakea erecta		
Proteaceae	Hakea francisiana		
Proteaceae	Hakea subsulcata		
Proteaceae	Isopogon scabriusculus		
Proteaceae	Persoonia coriacea		
Proteaceae	Persoonia striata		
Rhamnaceae	Stenanthemum stipulosum		
Rutaceae	Phebalium sp. British Hill (WB40140)	SOI	112
Santalaceae	Exocarpos aphyllus		
Santalaceae	Exocarpos sparteus		
Santalaceae	Leptomeria lehmannii		



Figure 14. Significant flora of the BH3 waste rock landform





## 5. Impact Assessment

An assessment of local and regional distributions and impact assessment is presented in Table 3 and Table 4.

**Table 3. Regional Distribution of Significant Species**

Site	Taxon	Status	Regional Distribution
MLF37	<i>Acacia asepala</i>	P2	Common and abundant in populations from Parker Range to Frank Hann National Park on alkaline soils
	<i>Eucalyptus</i> aff. <i>salubris</i> glaucous branchlet form (WB40196)	SOI	Very widespread from east of Merredin to SE of Norseman to Menzies on low lying clay soils
	<i>Phebalium</i> sp. Parker Range Road long leaf (WB40838)	SOI	Widespread but poorly collected from Lake Magenta Nature Reserve to Norseman to Menzies and Mt Manning Conservation Park on stony soils
BH3	<i>Brachyloma stenolobum</i> (P1)	P1	Uncommon and poorly collected from two sites: (i) Mt Holland and (ii) SE of Lake Johnson
	<i>Balaustion grandibracteatum</i> subsp. <i>juncturum</i>	P2	Locally common, abundant after fire, from Parker Range to Forrestania on sand and laterite soils
	<i>Verticordia stenopetala</i>	P3	Locally common, abundant after fire, from north of Southern Cross to Forrestania on sand and laterite soils
	<i>Phebalium</i> sp. British Hill (WB41040)	SOI	Locally abundant to co-dominant in understorey in the British Hill area on sand and laterite soils

**Table 4. Impact Assessment for Significant Species**

Site	Taxon	Status	# of plants within Footprint	# of plants Known Regionally (WB data)	# of plants known (DBCA data)	# of Populations Known (DBCA data) <sup>2</sup>
MLF37	<i>Acacia asepala</i>	P2	5	34,719	n/a	13
	<i>Eucalyptus</i> aff. <i>salubris</i> glaucous branchlet form (WB40196)	SOI	few	very widespread	0	1
	<i>Phebalium</i> sp. Parker Range Road long leaf (WB40838)	SOI	1	6,906	0	0
BH3	<i>Brachyloma stenolobum</i> (P1)	P1	2	632	n/a	2
	<i>Balaustion grandibracteatum</i> subsp. <i>juncturum</i>	P2	2	8,308	n/a	20
	<i>Verticordia stenopetala</i>	P3	10	34,379	n/a	19
	<i>Phebalium</i> sp. British Hill (WB41040)	SOI	112	36,836	0	1

<sup>2</sup> Utilising WAHERB data available on the Florabase website

## 6. Assessment Against the 10 Clearing Principles

**Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.**

Both sites proposed to be utilised for road building materials represent rehabilitated waste rock landforms formerly used in heap-leach gold mining. The MLF37 site has 40 endemic flora and the BH3 site has 85 species of endemic flora. While these are good numbers for rehabilitated landforms, they are not considered exceptionally high and are representative of the surrounding landscapes.

The Project is not at variance with this principle.

**Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.**

The rehabilitated WRL sites have low vegetated cover and are not considered to represent unique habitat for fauna species.

The Project is not at variance with this principle.

**Principle (c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.**

No Threatened flora are known within the two study areas. There is one Priority for a known at the MLF37 site and three Priority flora and one species on interest (new species) known at the BH3 site.

The Project is not at variance with this principle.

**Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.**

Both study areas represent rehabilitated waste dumps and neither qualify for assessment as 'Eucalypt Woodland of the Western Australian Wheatbelt' PEC (Priority 3) which is synonymous with the Commonwealth listed Threatened Ecological Community (TEC) under the EPBC Act (DBCA, 2022d).

The Project is not at variance with this principle.

**Principle (e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.**

Both study areas lie within the uncleared portion of the Coolgardie Biogeographic Region with extensive native vegetation surrounding them.

The Project is / is not at variance with this principle.

**Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.**

Neither study area is associated with a water course or wetland area.

The Project is not at variance with this principle.

**Principle (g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.**

Neither site will cause land degradation. The use of waste rock material alleviates the need for clearing of native vegetation for borrow pits in these areas.

The Project is / is not at variance with this principle.

**Principle (h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.**

Both study areas are small in area and neither lie immediately adjacent to any Conservation reserve. The Jilbadji Nature Reserve lies east of the Marvel Loch – Forrestania Road, east of both study sites. The MLF37 site lies 5.13 km north-west of the NW border of the Jilbadji Nature Reserve while the BH3 site lies 2.58 km west of the western border of the Jilbadji Nature Reserve.

The Project is not at variance with this principle.

**Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.**

Both projects involve removal of waste rock landforms to approximately the former ground level at each site. Neither project will have any impact on groundwater quality.

The Project is not at variance with this principle.

**Principle (j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.**

Both projects involve removal of waste rock landforms to approximately the former ground level at each site. Neither project will have any impact on surface water flows or cause any ponding or flooding.

The Project is not at variance with this principle.

## 7. Limitations

Limitation	Discussion
<b>Available sources of contextual information</b>	Western Botanical is currently undertaking extensive surveys in the region between Moorine Rock and Forrestania and has previously conducted surveys at British Hill and the Parker range. The flora and vegetation of this region is well known to Western Botanical. This is not a limitation for the proposal.
<b>The Scope of the survey</b>	Both projects are relatively simple study sites and the Scope was adequate to assess the rehabilitation vegetation occurring on each WRL. This is not a limitation for the proposal. The vegetation adjacent to the constructed landforms has not been assessed.
<b>Proportion of flora collected and identified</b>	The majority of specimens collected and flora encountered have been adequately identified. Few specimens remain unidentified and those do not resemble any known significant flora of the region. This is not a Limitation for the proposal
<b>Completeness and further work which may be needed</b>	The vegetation on the wastedumps has been adequately assessed. This is not a limitation for the proposal. The vegetation adjacent to the constructed landforms has not been assessed.
<b>Mapping reliability</b>	Mapping was conducted using GIS and data capture was undertaken using iPads and hand-held GPS with an accuracy of +/- 3m. This is not a limitation for the proposal.
<b>Timing: weather, season</b>	Surveys of the two study areas were undertaken in May 2023. As Western Botanical is very familiar with the flora of the region, species encountered were either readily recognised in the field or collected for verification, which was largely successfully undertaken where adequate material was available. This is not a limitation for the proposal.
<b>Disturbances</b>	Both sites represent constructed landforms with vegetation being an estimated 10 years old on each. This is not a limitation for the proposal.
<b>Intensity</b>	Study areas were small and adequately assessed in traverses. This is not a limitation for the proposal.
<b>Resources</b>	Adequate staff and other resources were available to undertake the surveys. Following initial survey, a supplementary assessment of Priority Flora was undertaken, ensuring a thorough assessment of both sites. This is not a limitation for the proposal.
<b>Access</b>	Both sites had ready access to the small study sites. This is not a limitation for the proposal.

<b>Experience levels</b>	All staff utilised on the project have had over 1 years' experience working in the region between Moorine Rock and Mt Holland with senior staff having over 4 years' experience in same. Geoff Cockerton has over 30 years' experience in the flora of W.A. This is not a limitation for the proposal.
--------------------------	---

## 8. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology) Flora Taking (Biological Assessment) License No. – FB620000542, Senior Botanist	1	1	1	1
Lindsay Shelton B.Sc. Hons (Botany) Flora Taking (Biological Assessment) License No. – FB620000496, Botanist	1	1	1	
Dr. Nicole Dakin Flora Taking (Genetics and Botany) License No. – FB620000492 Botanist	1	1	1	
Gemma Grigg B.Sc. (Environmental Science) Flora Taking (Biological Assessment) License No. – FB620000493 Botanist	1	1		
Doug Lievense B.Sc. (Biology) Flora Taking (Biological Assessment) License No. – FB620000351, Senior Botanist	1	1		
Alex Chapman B.Sc. (Botany) Botanist	1	1		

## 9. Acknowledgements

- CAD Resources Pty Ltd is thanked for data management and map production.



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Western Botanical (2023a) *Desktop Review of Flora and Vegetation: Mt Holland Logistics Haul Road*. Consultant's report to Covalent Lithium Pty Ltd. Report Ref: WB999.

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**Appendix 1. Western Botanical (2023a) *Desktop Review of Flora and Vegetation: Mt Holland Logistics Haul Road*. Consultant's report to Covalent Lithium Pty Ltd. Report Ref: WB999.**



**Western  
Botanical**

Desktop Review of Flora and Vegetation:  
Mt Holland Logistics Haul Road

Prepared for: Covalent Lithium Pty. Ltd.

Report Ref: WB999





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Report No: WB999

Client Name: Covalent Lithium Pty. Ltd.

Client Address: 8 St. Georges Terrace, Perth WA 6000

Version	Prepared By	Approved for Issue	Issue Date
1	B. Jeanes G. Cockerton	29 <sup>th</sup> March 2023	29 <sup>th</sup> March 2023
1.1 Minor Edits, incorporation of ESA map	B. Jeanes G. Cockerton	24 <sup>th</sup> April 2023	8 <sup>th</sup> May 2023

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*This report has been designed for double-sided printing*

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## 1. Executive Summary

Covalent Lithium Pty. Ltd. (Covalent) plan to develop the Earl Grey Lithium Project which comprises an open cut mine and concentrator at the former Mount Holland Gold Mine, near Mount Holland, approximately 105 km south of Southern Cross, and a refinery within the industrial area of Kwinana. The realignment, widening and sealing of a section of the existing Marvel Loch – Forrestania Road and Parker Range Road is required to allow haulage access to Great Eastern Highway.

Covalent commissioned Western Botanical to conduct a Detailed Assessment of the flora and vegetation of the proposed Mt Holland Logistics Haul Road (hereafter referred to as the Study Area). As part of this, a desktop review was implemented to provide contextual information, particularly regarding flora and vegetation of conservation significance, prior to the completion of extensive floristic survey of the route. The Study Area is approximately 115 km in length and 10,914 ha in size. In the area adjacent to freehold land (cleared agricultural area) the Study Area is 200 m wide extending to a 1 km diameter in areas of native vegetation. The Study Area lies entirely within the Shire of Yilgarn.

The Study Area intersects two bioregions (Avon Wheatbelt and Coolgardie) and lies within the Merredin and Southern Cross subregions of these bioregions respectively. The Merredin subregion has been extensively cleared for agricultural use with only ~21% of pre-European vegetation remaining. The Coolgardie subregion currently retains ~96% of its pre-European vegetation. Approximately 46 km of the Study Area along the northern portion of the Parker Range Road is located adjacent to cleared (freehold) agricultural land, with narrow roadside remnants. The remainder of the Study Area is located within the western boundary of the Great Western Woodlands with extensive native vegetation either side of the alignment. The Study Area intersects the Wockallary Nature Reserve and the Jilbadgi Nature Reserve.

Within the region, monthly rainfall peaks from late autumn throughout winter with an average annual rainfall of 292.8 mm. Thirteen soil landscape zones are intersected by the Study Area with the majority of the area occurring on gently sloping to gently undulating plateau areas, or uplands (on granites, gneisses, and allied rocks) and undulating sandy plains with small salt lakes or clay pans.

Three hydrographic sub-catchments of the Avon River Basin are traversed by the Study Area; Lake Julia (northern end of Study Area), Yellowdine (mid-section) and Lake Eva (southern end). The Department of Water and Environmental Regulation groundwater salinity database indicates groundwater salinities in the area range predominantly from 14,000 mg/L to 35,000 mg/L (highly saline), the exception being where paleochannels are intercepted (>35,000 mg/L; brine) around the Moorine Rock townsite and a section of the Study Area extending approximately 7.8 km south along the Marvel Loch-Forrestania Road (from the Parker Range Road intersection).

The flora of this region is incredibly diverse and subject to continual taxonomic and conservation status review. Database searches (state and national) and a literature review indicate 126 flora taxa of conservation significance have been recorded (or may occur) within a 50 km radius of the Study Area. Twenty taxa of conservation significance (one Threatened, five Priority 1, four Priority 2, nine Priority 3 and one Priority 4) have been recorded within the boundary of the Study Area with an additional 66 taxa (three Threatened, 24 Priority 1, eight Priority 2, 20 Priority 3 and 11 Priority 4) assessed as having the potential to occur within the Study Area.

The Study Area is located within the mapped buffer zones of three ecological communities of conservation significance;

- 'Ironcap Hills vegetation assemblages (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone formation)' Priority Ecological Community (PEC) (Priority 3);
- 'Plant Assemblages of the Parker Range System' PEC (Priority 3); and
- 'Eucalypt Woodland of the Western Australian Wheatbelt' PEC (Priority 3). This PEC is synonymous with the Commonwealth listed Threatened Ecological Community (TEC) under the *EPBC Act* (DBCA, 2022d).

Three Environmentally Sensitive Areas are present within the Study Area;

- the Jilbadgi Nature Reserve which is listed on the Register of the National Estate.
- the region of roadside vegetation within 50 m of the Threatened flora species *Banksia dolichostyla*. This species is present adjacent to the roadside from about the intersection of King Ingram Road southwards to the turnoff into the Mt Holland minesite.
- the Commonwealth listed 'Eucalypt Woodland of the Western Australian Wheatbelt' TEC under the *EPBC Act*.

## **2. Introduction**

### **2.1. Project Background**

Covalent Lithium Pty. Ltd. (Covalent) plan to develop the Earl Grey Lithium Project (EGLP) which comprises an open cut mine and concentrator located at the former Mt Holland Gold Mine (previously the Bounty Gold Operation), located approximately 105 km south of Southern Cross (Figure 1) and a refinery within the industrial area of Kwinana. Ore will be transported to the refinery by road, necessitating the realignment, widening and sealing of a section of the existing Marvel Loch – Forrestania Road and Parker Range Road to allow haulage access to Great Eastern Highway.

Covalent commissioned Western Botanical to conduct a Detailed Assessment of the flora and vegetation of the proposed Mt Holland Logistics Haul Road (hereafter referred to as the Study Area). As part of this, a desktop review was implemented to provide contextual information, prior to the completion of extensive floristic surveys. The Study Area is approximately 115 km in length and 1 km in width where remnant or uncleared native vegetation is present. Within the cleared agricultural area, the Study Area is restricted to a width of up to 200 m. In total, the Study Area is approximately 10,914 ha in size and extends along the Marvel Loch – Forrestania Road (from the intersection of the Mt Holland mine access road) onto the Parker Range Road, culminating at the intersection of Great Eastern Highway, immediately west of the Moorine Rock townsite (Figure 2). The Moorine Rock Siding load-out area is also included. The Study Area lies entirely within the Shire of Yilgarn (Figure 1).

The objective of the desktop review was to provide contextual information on the Study Area prior to completion of field surveys. This was achieved through a literature review of flora and vegetation assessments previously conducted within the vicinity of the Study Area in addition to a search of various State and Commonwealth databases to identify known flora and vegetation of conservation significance.

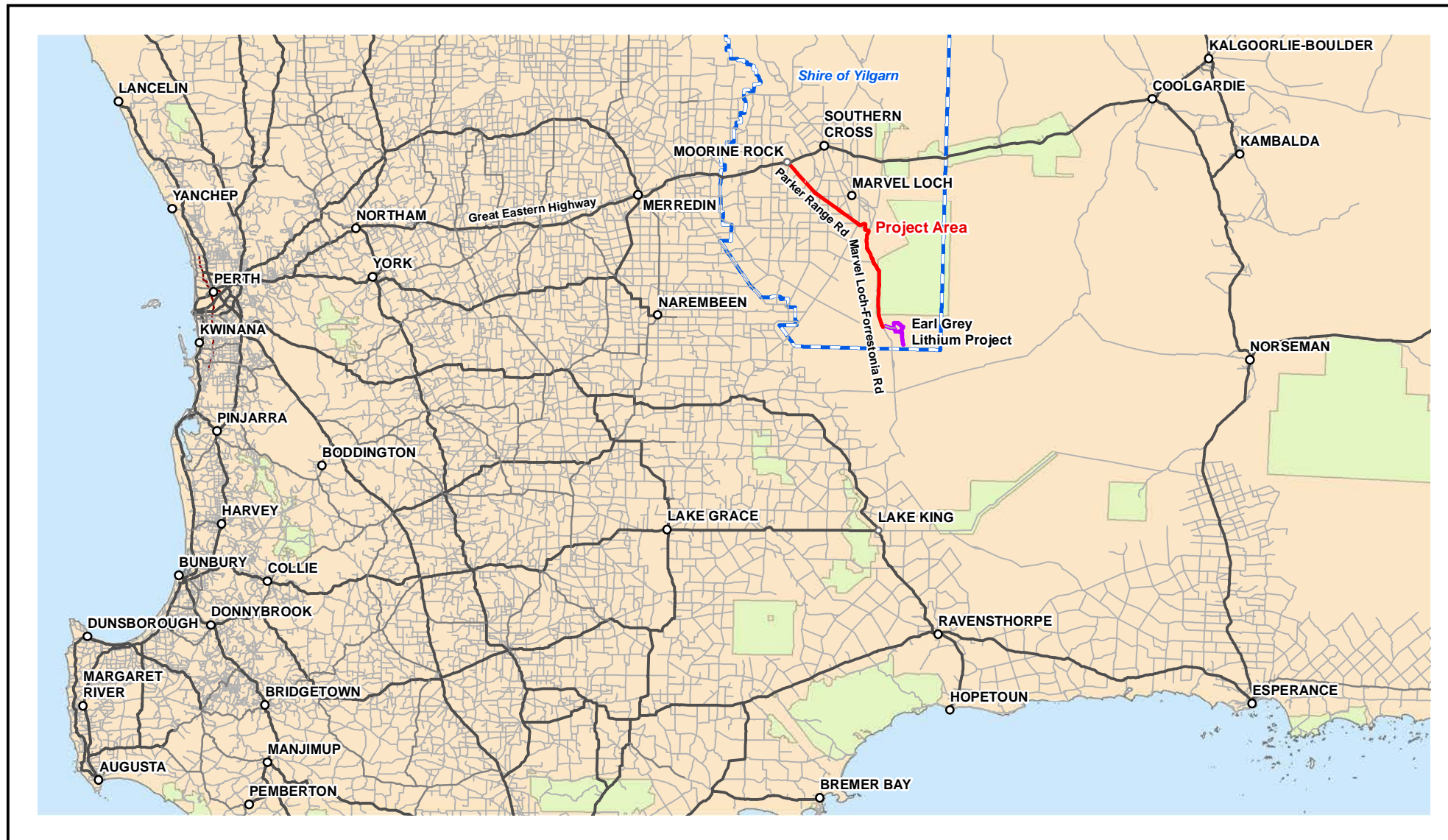
### **2.1. Land Use**

The Study Area includes the Parker Range Road in its entirety and a section of the Marvel Loch – Forrestania Road, both of which are Crown land. The Study Area extends approximately 500 m either side of these roads into remnant or uncleared native vegetation (where present) in unallocated Crown land or nature reserves (Wockallarry Nature Reserve and Jilbadgi Nature Reserve). In the cleared agricultural area, the Study Area lies adjacent to freehold land and has generally narrow roadside remnants.

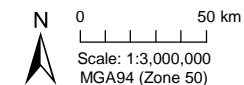


**Figure 1. Location of the Study Area**

# Earl Grey Lithium Project Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade - Locality



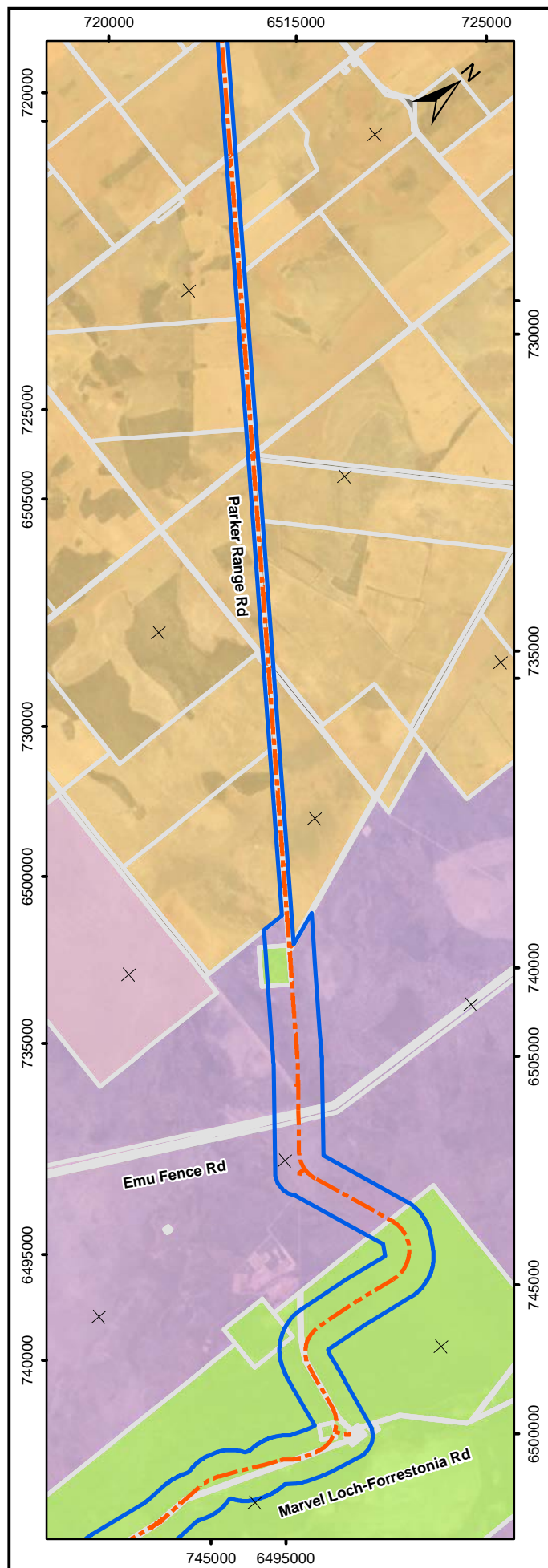
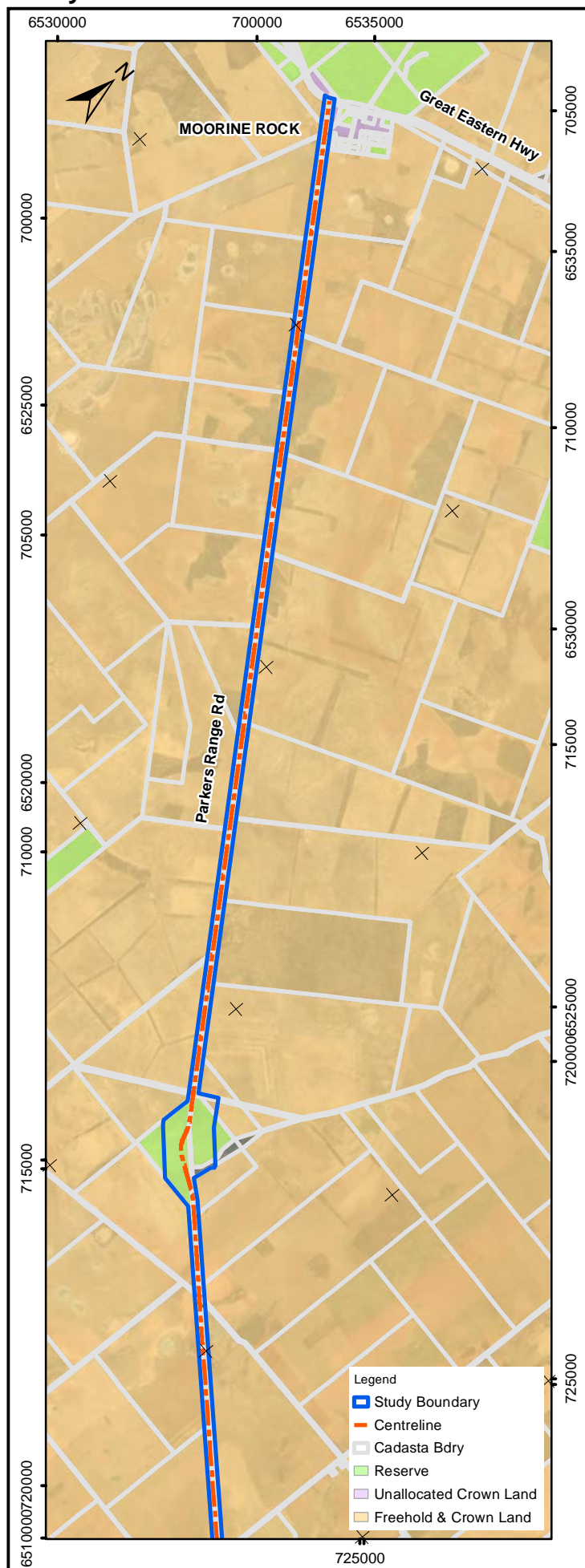
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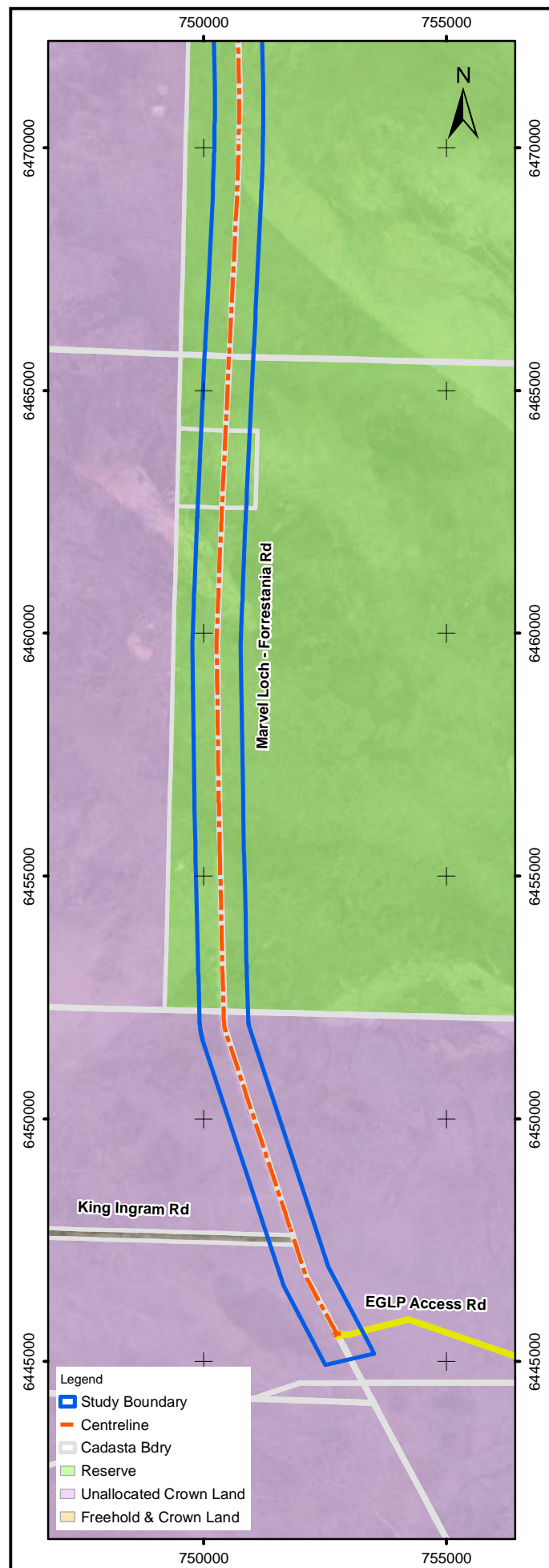
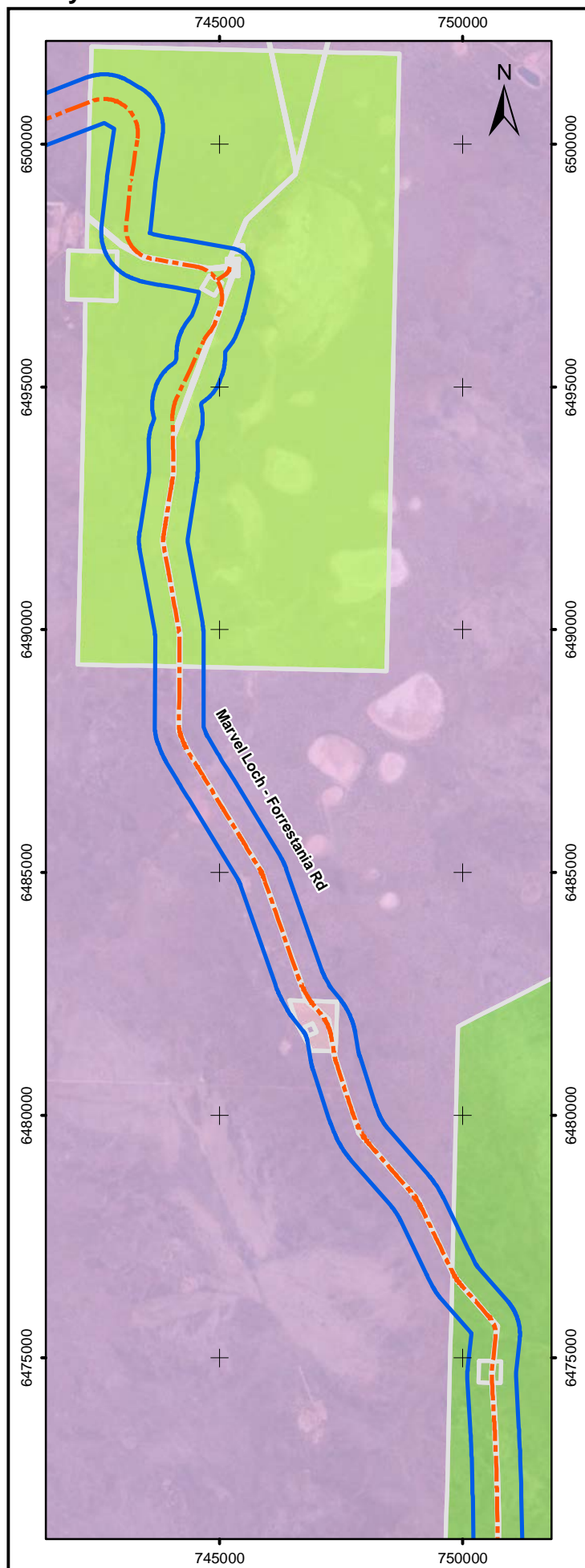
**Figure 2. Study Area with Cadastre**



# Earl Grey Lithium Project Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade Study Area - Sheet 1 of 2



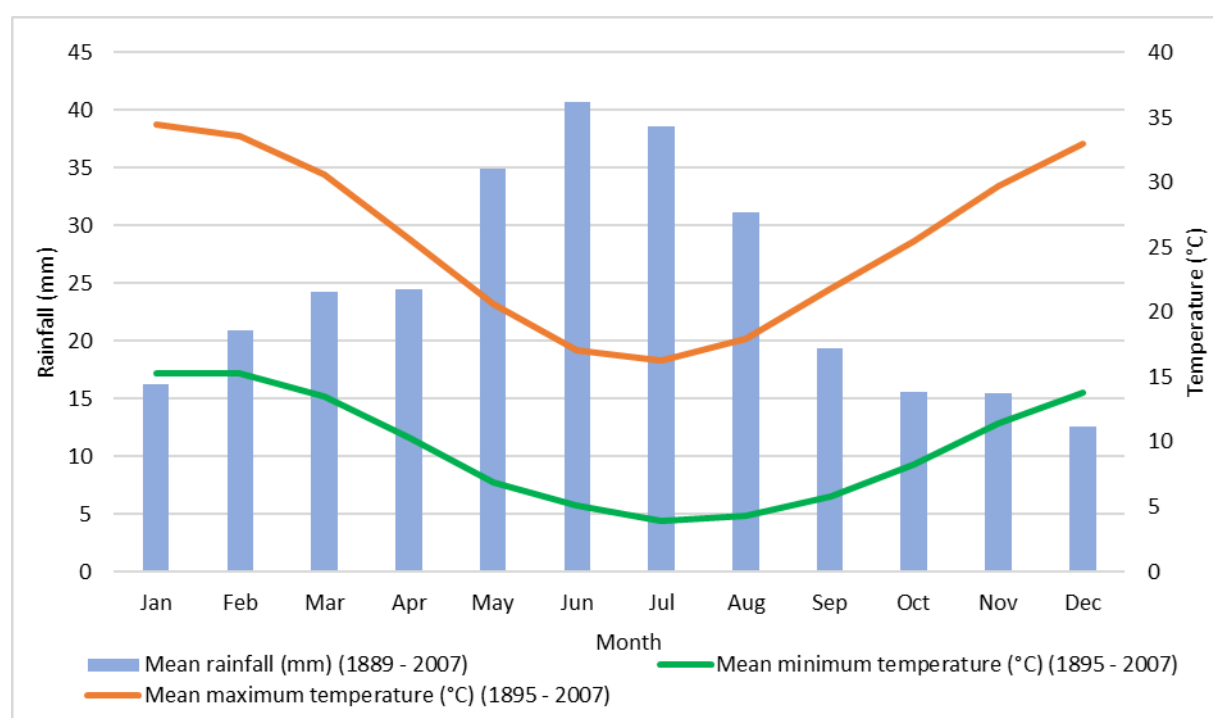
**Earl Grey Lithium Project  
Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade  
Study Area - Sheet 2 of 2**



## 2.2. Physical Environment

### 2.2.1. Climate

The Study Area is in a semi-arid (dry) warm Mediterranean climate (Beecham, 2001). Average annual rainfall is 292.8 mm, as recorded at the Bureau of Meteorology (BoM) Southern Cross weather station (number 012074), located approximately 105 km to the north of the Study Area. Although closed in 2007, this weather station provides the largest relevant climate dataset (1889 – 2007) for the Study Area. The Southern Cross Airfield weather station now provides climatic data for the region. Average monthly rainfall peaks from late autumn throughout winter (May–August), with the highest average rainfall occurring in June (40.7 mm). Mean maximum daily temperatures range from 16.3 °C in July to 34.5 °C in January with mean minimum temperatures ranging from 4.4 °C in July to 14.2 °C in January/February (Figure 3) (BoM, 2023a).



**Figure 3. Long-term average climate data for Southern Cross (weather station number 012074) (1889 – 2007) (BoM, 2023a).**

### 2.2.2. Geology

The Study Area lies within the southern section of the Archaean Southern Cross-Forrestania Greenstone Belt, which extends over 300 km in Western Australia (WA). The Study Area traverses seven bedrock and three regolith geological units (Table 1, Figure 4).

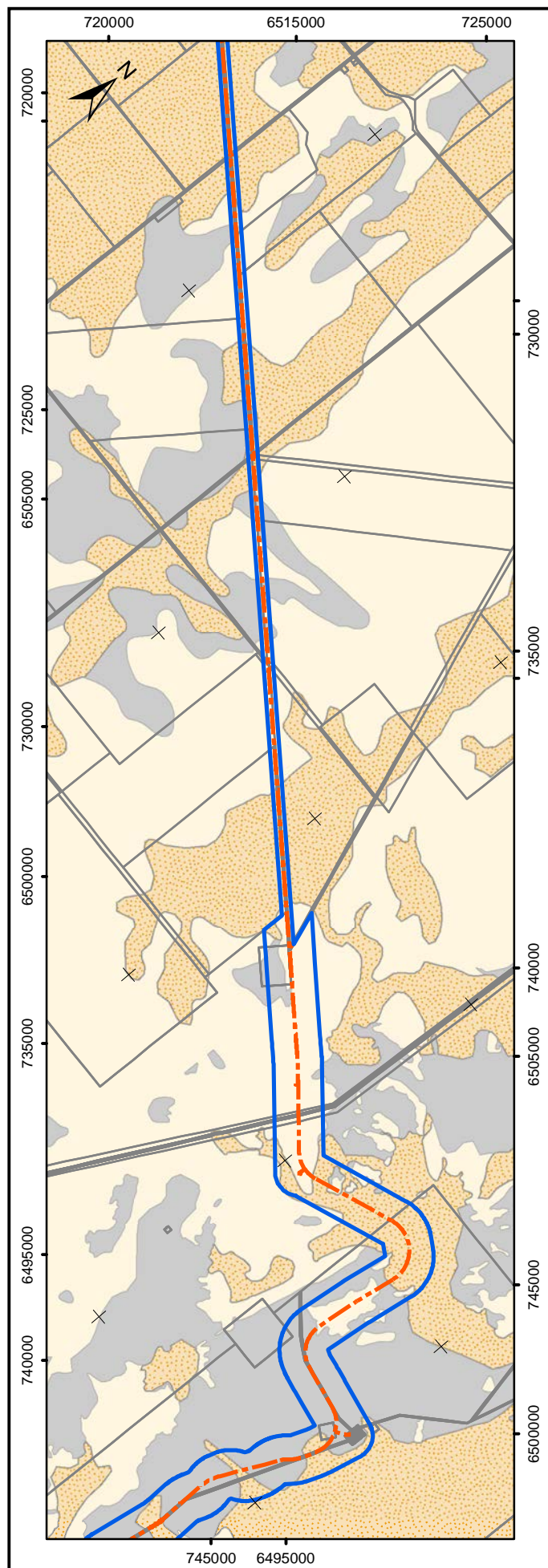
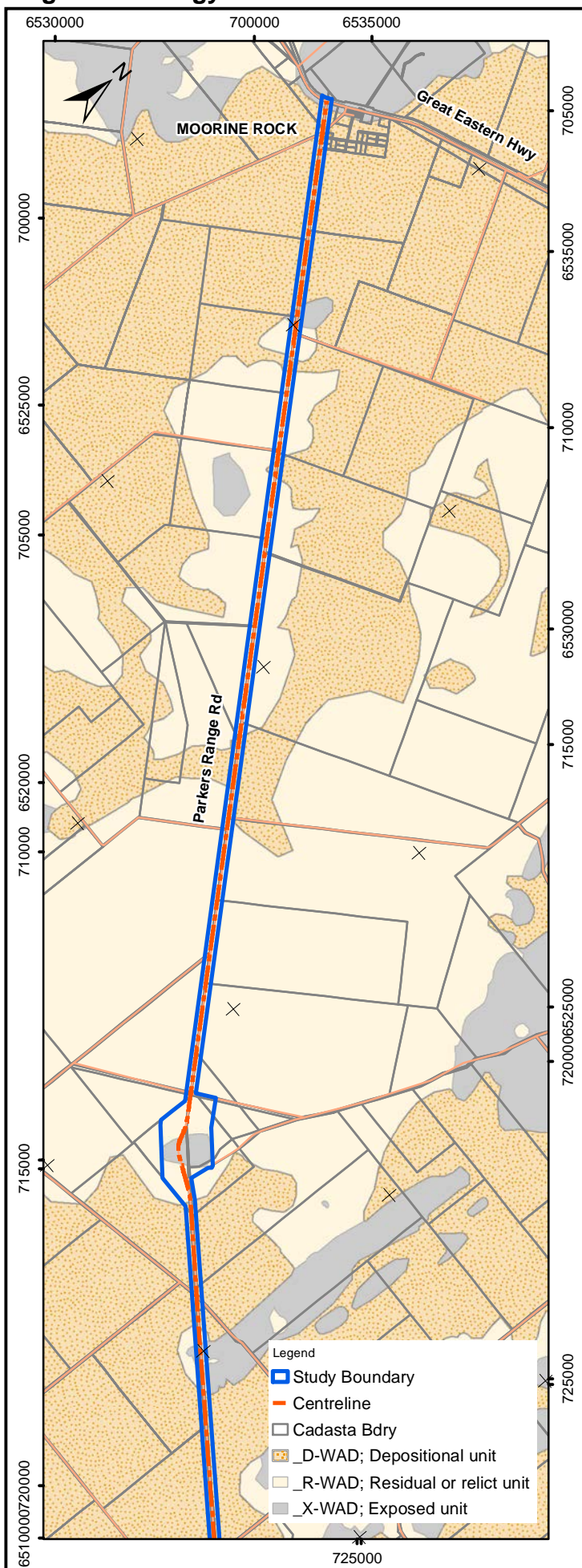


**Table 1. Geology of the Study Area (DMIRS, 2018a, 2018b)**

Code	Name	Description
<b>Bedrock Geology</b>		
A-mgss-Y	Yilgarn Craton granites	Foliated metagranite, locally gneissic; may include amphibolite lenses; includes deeply weathered rock
A-mw-YYO	Youanmi Terrane greenstones	Metamorphosed mafic igneous rock, undivided
A-s-YYO		Clastic sedimentary rock dominant; metamorphosed
A-md-YYO		Metasedimentary rock, undivided; includes metamorphosed sandstone, siltstone, shale, and chert; commonly deeply weathered
A-mu-YYO		Metamorphosed ultramafic rock, undivided; typically deeply weathered
A-xmuk-mi-YYO		Metakomatiite, metachert, and metamorphosed banded iron-formation
A-SDB-mg	Big Bell Suite	Metagranite; commonly foliated; includes granodiorite to monzogranite
<b>Regolith Geology</b>		
D		Sediments derived from residual or erosional landforms, which includes colluvial, sheetwash, alluvial, lacustrine, sandplain, eolian and marine deposits
X		Exposed bedrock outcrops, saprolite, and saprock
R		Residual or relict material; includes ferruginous, siliceous, and calcareous duricrust

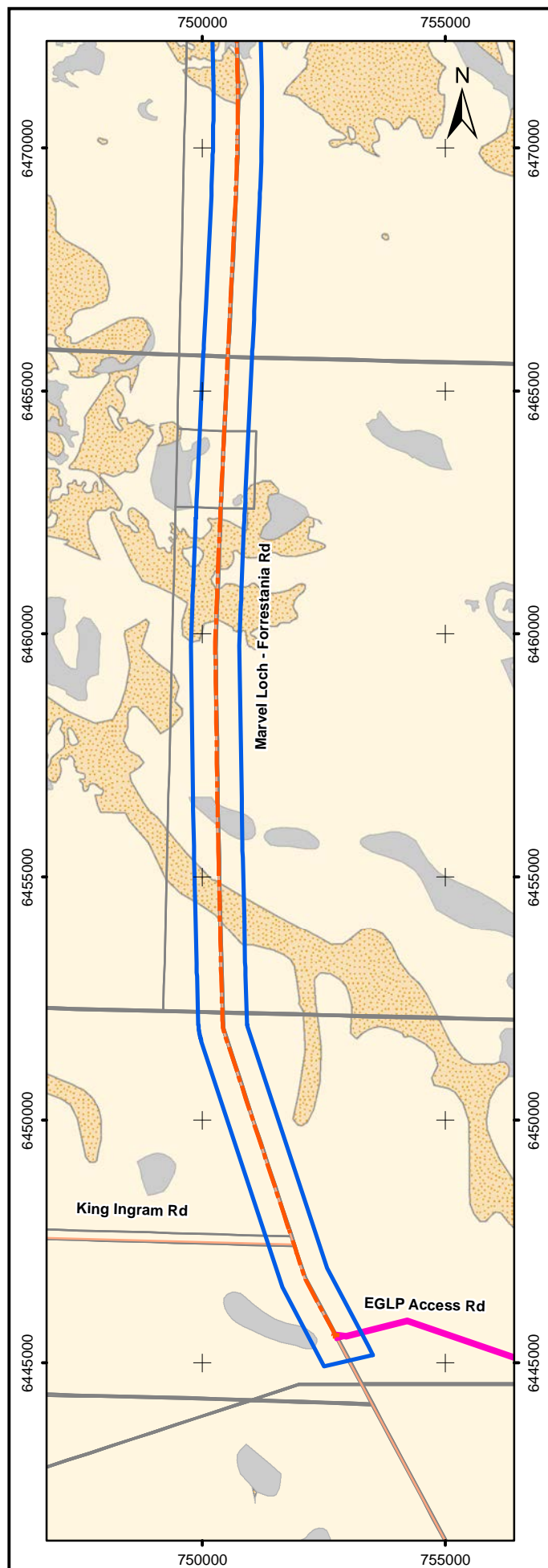
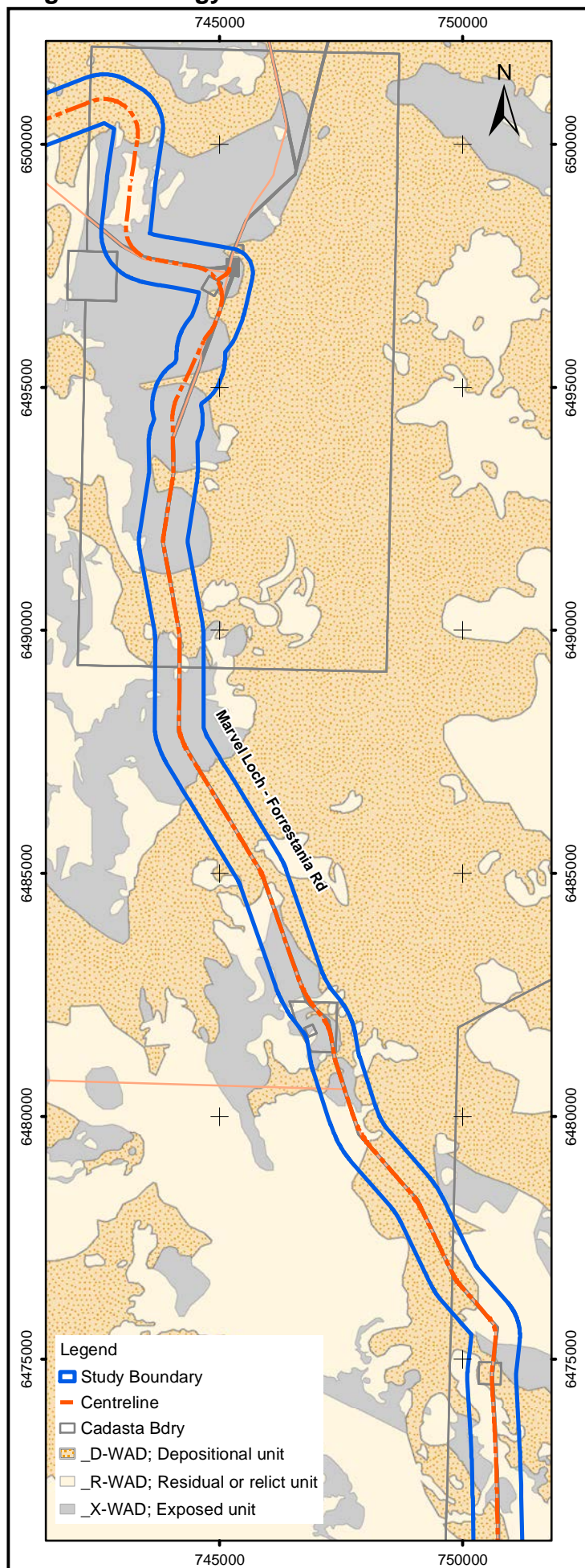
**Figure 4. Regolith Geology of the Study Area.**

Earl Grey Lithium Project  
Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade  
Regolith Geology - Sheet 1 of 2





**Earl Grey Lithium Project  
Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade  
Regolith Geology - Sheet 2 of 2**



### 2.2.3. Soil Landscape Zones

Soil landscape mapping of WA has been completed by the Department of Primary Industries and Regional Development (DPIRD) through the compilation of various surveys at differing scales (varying from 1:20,000 to 1:3,000,000). The mapping conforms to a nested hierarchy which was established to manage the varying scales and subsequent levels of information evident across the surveys (DPIRD, 2023a). The Study Area is located across 13 soil landscape zones, as presented in Table 2 and Figure 5. Dominant soil landscape zones include the AC1 atlas system (~40% of the Study Area), DD15 atlas system (~19%) and the Ya28 atlas system (~15%).

**Table 2. Soil landscape zones of the Study Area (DPIRD, 2023a)**

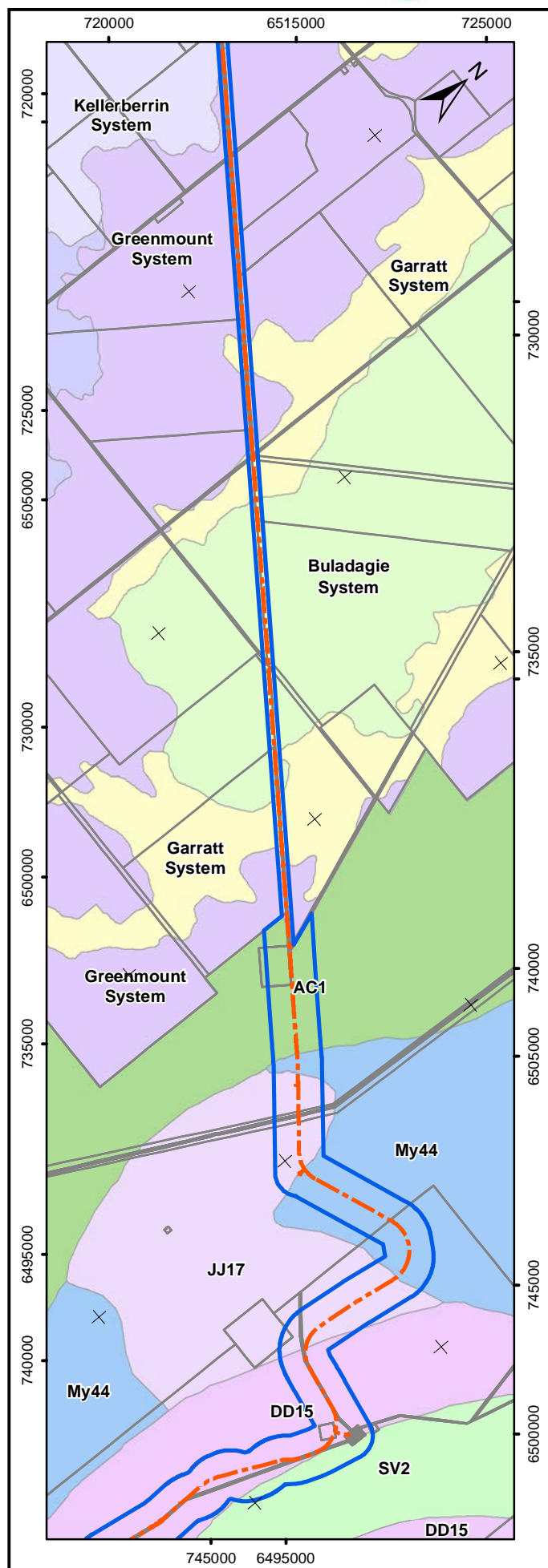
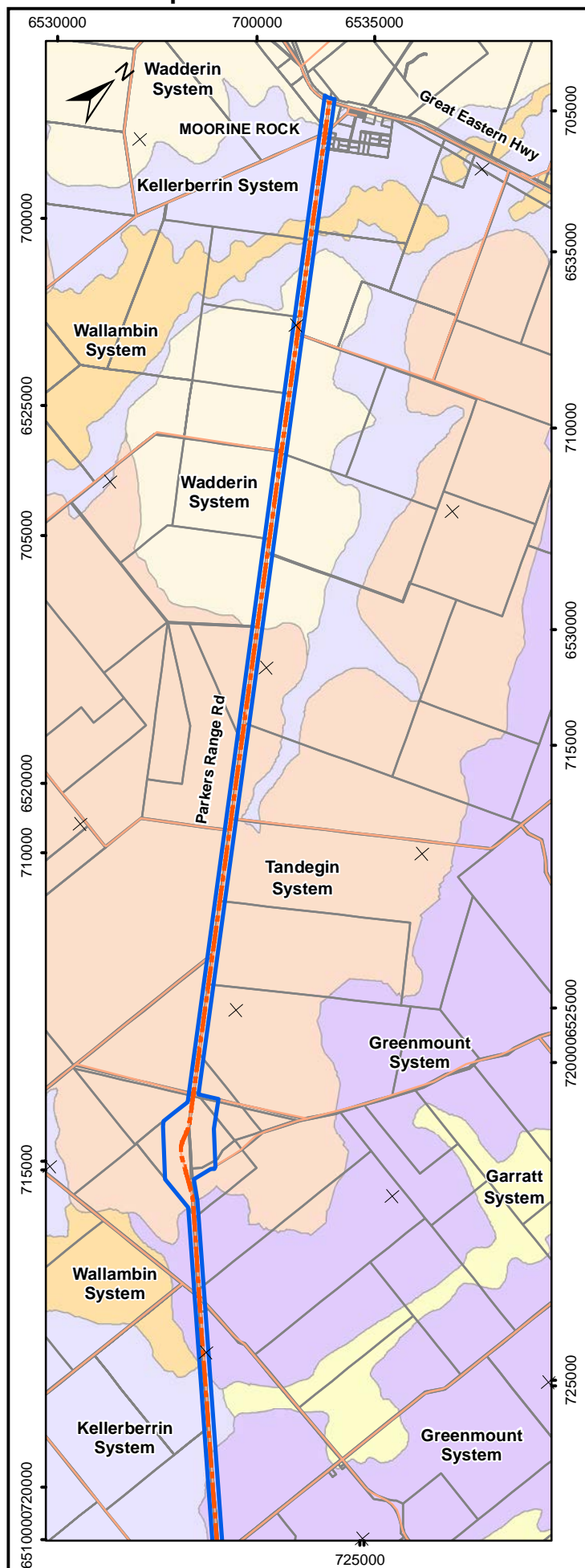
Map unit name	Description	Area (ha)	% of Study Area
Buladagic system	Gently undulating upland plains and subdued rises in the Eastern Zone of Ancient Drainage. 'Fresh' red rocky loams, yellow sands and sandy earths and shallow duplexes.	122.50	1.55
Garratt system	Lower slopes and footslopes adjacent to salt lakes in the eaten Zone of Ancient Drainage. Loamy earth (mostly calcareous), hard cracking clay and alkaline shallow duplex.	59.24	0.75
Greenmount system	Gently undulating rises to rolling low hills in the eastern Zone of Ancient Drainage. Loamy earth (mostly red, calcareous and clayey and stoney.	254.64	3.24
Kellerberrin system	Valley floors, in the central Zone of Ancient Drainage, with alkaline red shallow loamy duplex, alkaline grey sandy duplexes mainly in branch valleys (shallow and deep), calcareous loamy earth and hard cracking clay. Salmon Gum-Gimlet-Wandoo Woodlands.	82.32	1.04
Tandegin system	Sandplain dominated interfluvies with weakly indurated lateritised crests and upper slopes and long colluvial yellow sandplain upper to lower slopes. Unlateritised surfaces dominated by sodic and alkaline duplex soils.	380.09	4.84
Wadderin system	Gently undulating rises on mixed gneissic terrain largely stripped of lateritic mantles with sandy duplexes and some sands and gravels, vegetated by Mallee and Kwongan heath.	168.11	2.13
Wallambin system	Salt lake chains, in the central Zone of Ancient Drainage, with salt lake soil and calcareous loamy earth. Mallee, Morrel woodland and saltbush-bluebush-samphire flats.	6.89	0.09
AC1 atlas system	Gently sloping to gently undulating plateau areas, or uplands, on granites, gneisses, and allied rocks, with long gentle slopes and, in places, abrupt erosional scarps.	3,173.29	40.33
DD15 atlas system	Undulating plains with some low dunes, seasonal lakes, and clay pans.	1,530.23	19.44
JJ17 atlas system	Small ranges of metasediments (whitestones), some rock outcrops.	442.51	5.62

Map unit name	Description	Area (ha)	% of Study Area
My44 atlas system	Undulating ridge and low hilly terrain with some mesas and buttes and small valley plains.	391.34	4.97
SV2 atlas system	Saline valleys with some dunes including barchan forms--salt lake channels, mostly devoid of true soils, and their fringing areas	106.34	1.35
Ya28 atlas system	Sandy plains with some clay pans and small salt lakes, dunes, and lunettes	1,152.18	14.65
Total		7,869.68	100

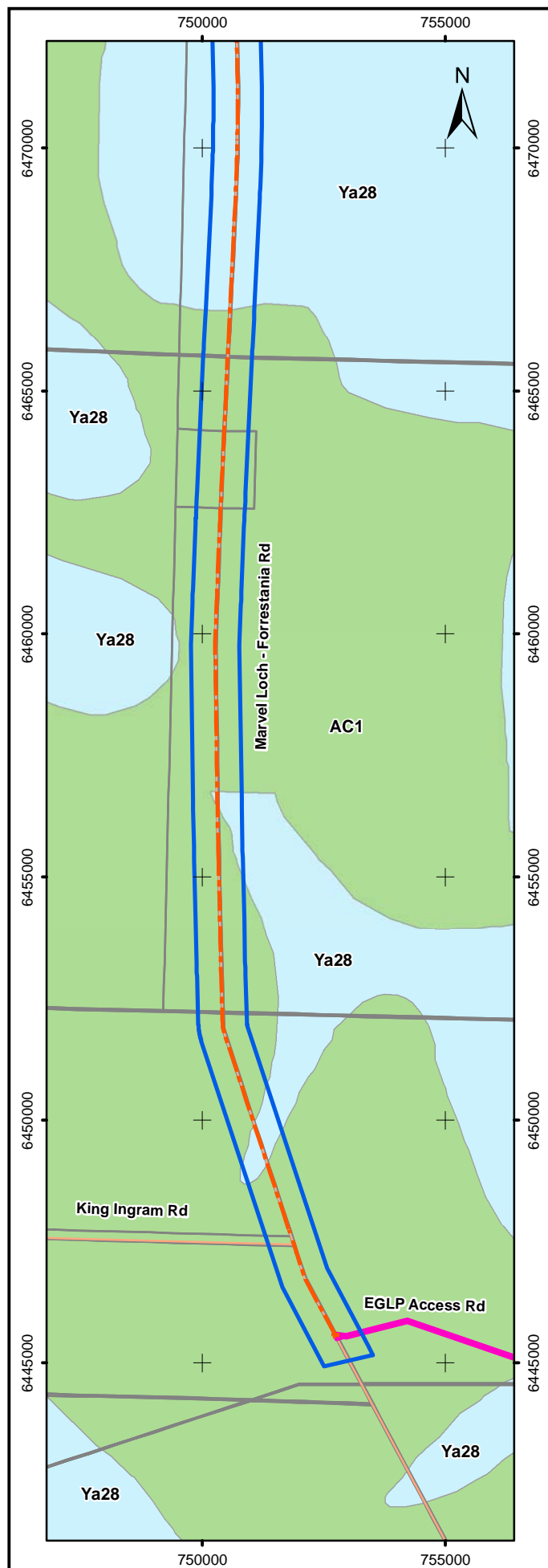
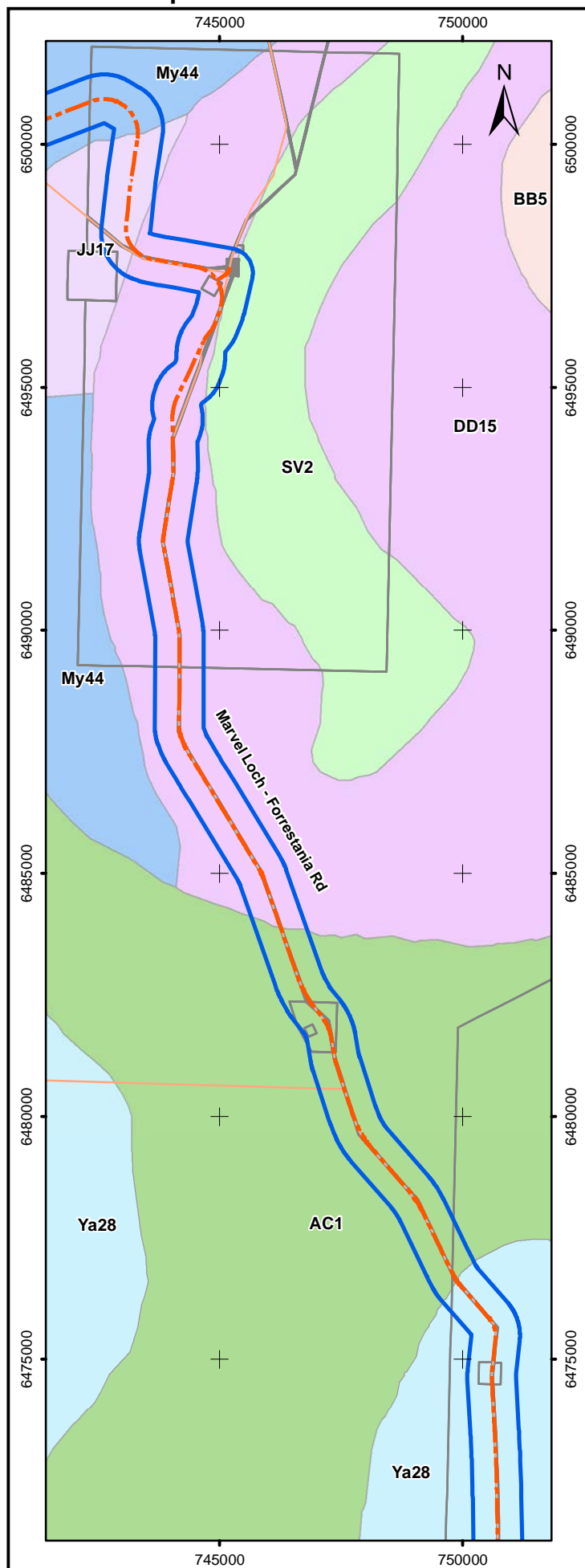


**Figure 5. Soil Landscapes of the Study Area.**

# Earl Grey Lithium Project Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade Soil Landscapes - Sheet 1 of 2



**Earl Grey Lithium Project  
Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade  
Soil Landscapes - Sheet 2 of 2**





#### 2.2.4. Hydrology and Hydrogeology

The Study Area is located across two hydrological zones;

- Northern Zone of Ancient Drainage: an ancient plain of low relief and lateritic uplands on weathered granite. Ranges and stony plains occur in the north-east. No connected drainage is present. The remnant salt lake chains occur in ancient drainage systems which flow only in very wet years (DPIRD, 2023b). The northern end of the Study Area (up to just south of Wockallarry Nature Reserve) falls within this zone.
- Southern Cross Zone: comprises rises and low hills on Archaean greenstones, with broad valleys often containing salt lake chains. Soils are usually red, loamy to clayey and calcareous (DPIRD, 2023b). Majority of Study Area is located within this zone.

The Study Area is located within the Avon River Basin in the Swan Avon/Yilgarn hydrographic catchment. It traverses the Lake Julia, (northern end of Study Area), Yellowdine (mid-section) and Lake Eva (southern end) hydrographic sub-catchments (DPIRD, 2023b).

The Department of Water and Environmental Regulation (DWER) groundwater salinity database (DWER, 2023a) indicates groundwater salinities in the Study Area range predominantly from 14,000 mg/L to 35,000 mg/L (highly saline). Where the Study Area intersects paleochannels associated with salt lake chains, groundwater salinity is >35,000 mg/L (brine). This occurs at two locations; the northern end of the Study Area (3.4 km in length) around the Moorine Rock townsite; and a section of the Study Area extending approximately 7.8 km south along the Marvel Loch-Forrestania Road from the Parker Range Road intersection (DWER, 2023a). Surface flow in these areas occurs only in periods of high rainfall.

### 2.3. Biological Environment

#### 2.3.1. Interim Biogeographic Regionalisation of Australia (IBRA)

The Study Area intersects the Merredin subregion (AVW-01) of the Avon Wheatbelt bioregion and the Southern Cross subregion (COO-02) of the Coolgardie bioregion;

- Merredin subregion (AVW-01) is 6,566,022 ha in size and occurs within the Avon Wheatbelt bioregion. The bioregion is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton. The gently undulating landscape of low relief supports proteaceous scrubheaths on residual lateritic uplands and derived sandplains; mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands on Quaternary alluvials and eluvials. The Merredin subregion is characterised as an ancient peneplain with low relief and no connected drainage. The salt lakes present occur as remnants of ancient drainage systems that now only function in very wet years. Lateritic uplands are dominated by yellow sandplain (Beecham, 2001). Approximately 20.96% of pre-European vegetation (see Section 2.3.2) currently remains within this subregion, of which only 1.4% is protected (reserved) for conservation (DBCA, 2018).

- Southern Cross subregion (COO-02) is 7,041,232 ha in size and occurs within the Coolgardie bioregion. The subregion comprises gently undulating uplands dissected by broad valleys with bands of low greenstone hills. It lies on the 'Southern Cross Terrains' of the Yilgarn Craton. The granite strata of Yilgarn Craton are interrupted by parallel intrusions of Archaean Greenstone. Drainage is occluded. Valleys have Quaternary duplex and gradational soils, and include chains of saline playa-lakes. Dominant vegetation includes:
  - diverse *Eucalyptus* woodlands (*Eucalyptus salmonophloia*, *E. salubris*, *E. transcontinentalis*, *E. longicornis*) around salt lakes, on the low greenstone hills, valley alluvials and broad plains of calcareous earths;
  - dwarf shrublands of samphire on salt lake surfaces;
  - swards of *Borya constricta*, with stands of *Acacia acuminata* and *Eucalyptus loxophleba* on granite basement outcrops at mid-levels in the landscape; and
  - Mallees (*Eucalyptus leptopoda*, *E. platycorys* and *E. scyphocalyx*) and scrub-heaths (*Allocasuarina corniculata*, *Callitris preissii*, *Melaleuca uncinata* and *Acacia beauverdiana*) on uplands of yellow sandplains, gravelly sandplains and laterite breakaways as well as on sand lunettes associated with playas along the broad valley floors, and sand sheets around the granite outcrops (Cowan *et al.*, 2001).

Approximately 96.06% of pre-European vegetation remains within this subregion, of which 16.21% is protected (reserved) for conservation (DBCA, 2018).

### 2.3.2. Pre-European Vegetation

The pre-European vegetation mapping of Western Australia dataset maps the original native vegetation presumed to have existed prior to European settlement. It is based predominantly on the published and unpublished mapping of J.S. Beard. The first broad-scale vegetation mapping of Western Australia was conducted by Beard in 1979 with several revisions and updates resulting in the most recent and comprehensive iteration, detailed in Beard *et al.* (2013).

J.S. Beard describes thirteen vegetation system associations across the Study Area (Table 3, Figure 6). Statistics on the pre-European and current extent of the Beard vegetation associations of WA has been jointly developed by the DBCA and DWER. These statistics are used in the assessment of development applications and both conservation and land use planning. Based on the 2018 State-wide Vegetation Statistics (DBCA, 2018), a summary of the regional extent (State and Bioregion) of the pre-European vegetation associations present in the Study Area, is presented in Table 3. It should be noted that the two vegetation associations that extend across both bioregions (Skeleton Rock\_1068 and Skeleton Rock\_2048), have not had proportions within each bioregion calculated but rather the total extent of the association in the Study Area is compared against the bioregion extent.

The dominant pre-European vegetation system associations are Eucalypt woodlands or mallee and include Parker\_1068 which accounts for approximately 41% of the Study Area vegetation, Skeleton Rock\_519 (11%) and Skeleton Rock\_1068 (8%). The Parker\_1068 vegetation

association has approximately 88% of its pre-European extent remaining (both at a State and Avon Wheatbelt bioregion level). The Skeleton Rock\_519 association has approximately 83% of its extent remaining state-wide, and 99% remaining within the Coolgardie Bioregion. The Skeleton Rock\_1068 vegetation association has a more restricted distribution across the State and has been subject to land clearing with approximately 54% of its extent remaining state-wide and only 31% within the heavily cleared Avon Wheatbelt bioregion. Its occurrence within the Coolgardie Bioregion remains relatively undisturbed.



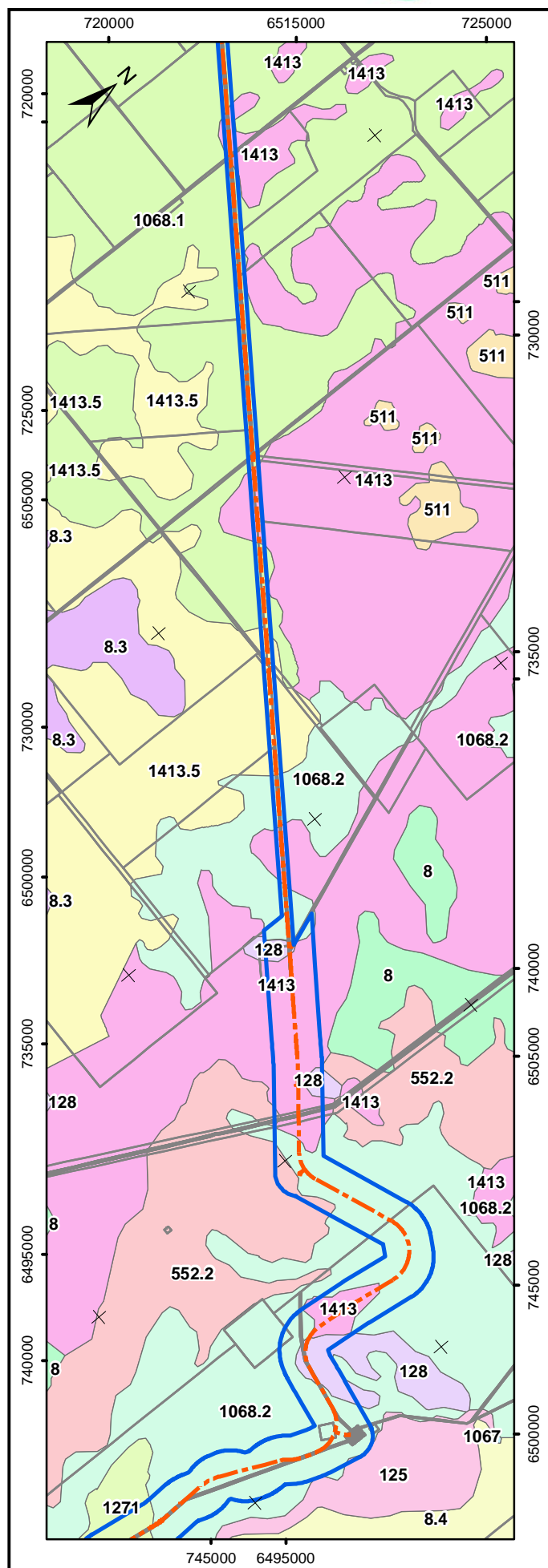
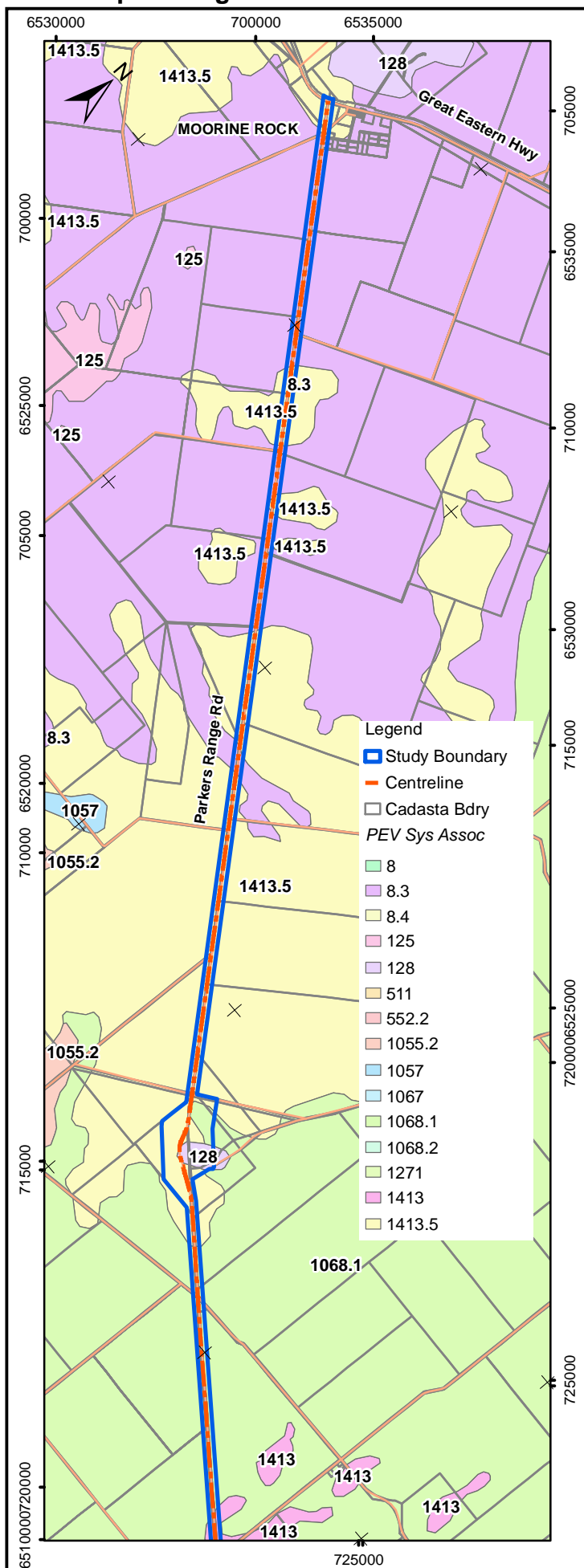
**Table 3. Pre-European vegetation system associations of the Study Area.**

Veg. System	Veg. Assoc.	SA Code	Description	Scale	Pre-European extent (ha)	Current extent (ha) and % remaining	Extent in Study Area (ha)	% within Study Area
Boorabbin	125	12.0	Salt lake, lagoon, clay pan	State	40,718.13	38,198.82 93.81%	11.12	0.03
				Coolgardie Bioregion	40,607.50	38,088.19 93.80%		0.03
Moorine Rock	8	8.3	Wheatbelt; York gum, salmon gum etc. <i>Eucalyptus loxophleba</i> , <i>E. salmonophloia</i> .	State	328,471.35	50,671.62 15.43%	180.84	0.36
				Avon Wheatbelt Bioregion	319,538.96	45,102.86 14.11%		0.40
Moorine Rock	128	128	Bare areas; rock outcrops	State	18,899.94	12,072.08 63.87%	212.25	1.76
				Avon Wheatbelt Bioregion	16, 893.33	10,486.75 62.08%		2.02
Moorine Rock	1413	1413.5	Wattle, casuarina and teatree acacia-allocauarina-melaleuca alliance.	State	337,732.5	130,897.47 38.76 %	436.37	0.33
				Avon Wheatbelt Bioregion	319,735.46	117,911.42 36.68%		0.37
Parker	552	552.2	Wattle, casuarina and teatree acacia-allocauarina-melaleuca alliance.	State	11,607.85	11,264.18 97.04%	47.69	0.42
				Avon Wheatbelt Bioregion	9,734.59	9,650.55 99.14%		0.49
Parker	1068	1068.2	Wheatbelt; York gum, salmon gum etc. <i>Eucalyptus loxophleba</i> , <i>E. salmonophloia</i> .	State	68,472.57	60,251.74 87.99%	3,212.31	5.33
				Avon Wheatbelt Bioregion	32,713.01	28,704.70 87.75%		11.19
Parker	1271	1271	Salt lake, lagoon, clay pan	State	836.38	834.09 99.73%	147.37	17.66
				Avon Wheatbelt Bioregion	836.38	834.09 99.73%		17.66

Veg. System	Veg. Assoc.	SA Code	Description	Scale	Pre-European extent (ha)	Current extent (ha) and % remaining	Extent in Study Area (ha)	% within Study Area
Parker	1413	1413	Wattle, casuarina and teatree acacia-alloacasuarina-melaleuca alliance.	State	11,973.24	6,807.73 56.86%	543.61	7.98
				Avon Wheatbelt Bioregion	8,495.70	4,207.79 49.53%		12.91
Skeleton Rock	519	519.4	Eucalypt shrubland, <i>Eucalyptus eremophila</i> , <i>E. redunca</i> , <i>E. spp.</i>	State	156,242.20	129,453.91 82.85%	865.05	0.66
				Coolgardie Bioregion	56,013.48	55,381.93 98.87%		1.56
Skeleton Rock	1068	1068	Wheatbelt; York gum, salmon gum etc. <i>Eucalyptus loxophleba</i> , <i>E. salmonophloia</i> . Goldfields; gimlet, redwood etc. <i>E. salubris</i> , <i>E. oleosa</i> .	State	30,139.71	16,201.48 53.75%	659.43	4.07
				Avon Wheatbelt Bioregion	20,061.11	6,125.85 30.54%		10.76
				Coolgardie Bioregion	10,041.81	10,040.54 99.99%		6.56
Skeleton Rock	1148	1148.3	Mixed heath with scattered tall shrubs <i>Acacia</i> spp., Proteaceae and Myrtaceae.	State	5,276.00	5,274.51 99.97%	630.82	11.95
				Coolgardie Bioregion	5,259.05	5,257.56 99.97%		11.99
Skeleton Rock	2048	2048.2	Mixed heath with scattered tall shrubs <i>Acacia</i> spp., Proteaceae and Myrtaceae.	State	82,634.67	65,590.71 79.37%	619.19	0.94
				Coolgardie Bioregion	2017.49	2017.49 100%		30.68
				Avon Wheatbelt Bioregion	158.95	115.88 72.90%		100
Yilgarn	1068	1068.1	Medium Woodland. Wheatbelt; York gum, salmon gum etc. <i>Eucalyptus loxophleba</i> , <i>E. salmonophloia</i> .	State	89,909.33	23,811.59 26.48%	303.63	1.27
				Avon Wheatbelt Bioregion	22,044.17	2,399.22 10.88%		12.65
Total							7,869.68 ha	

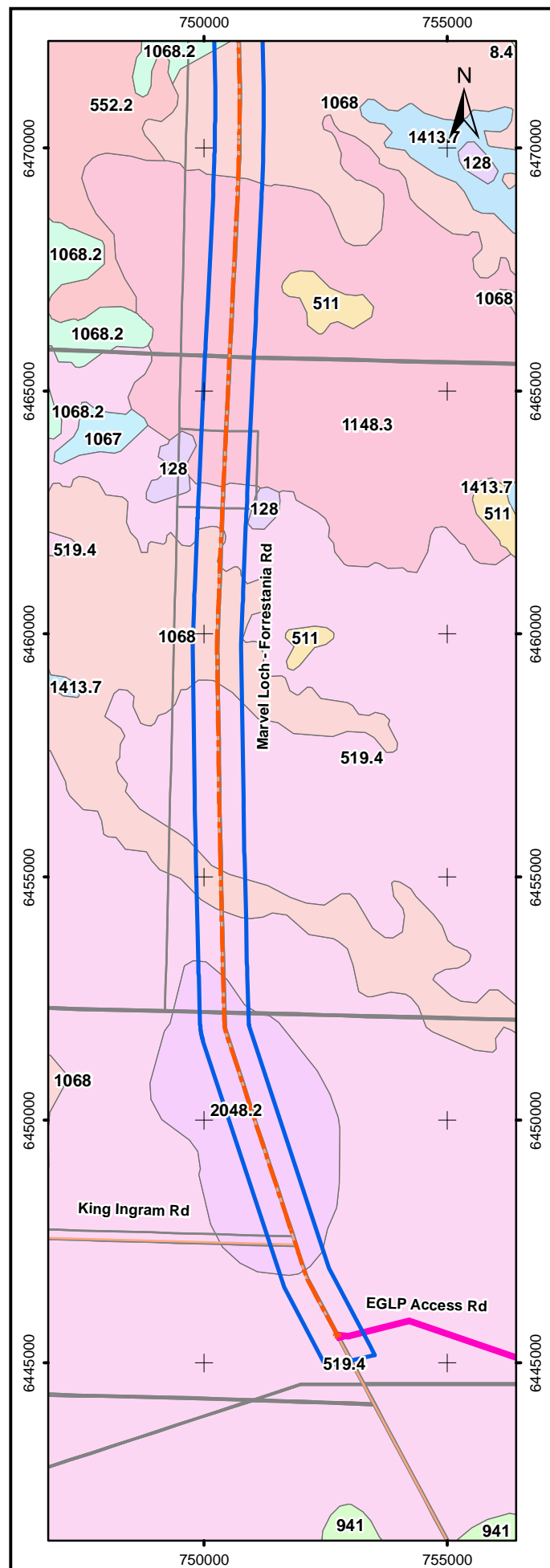
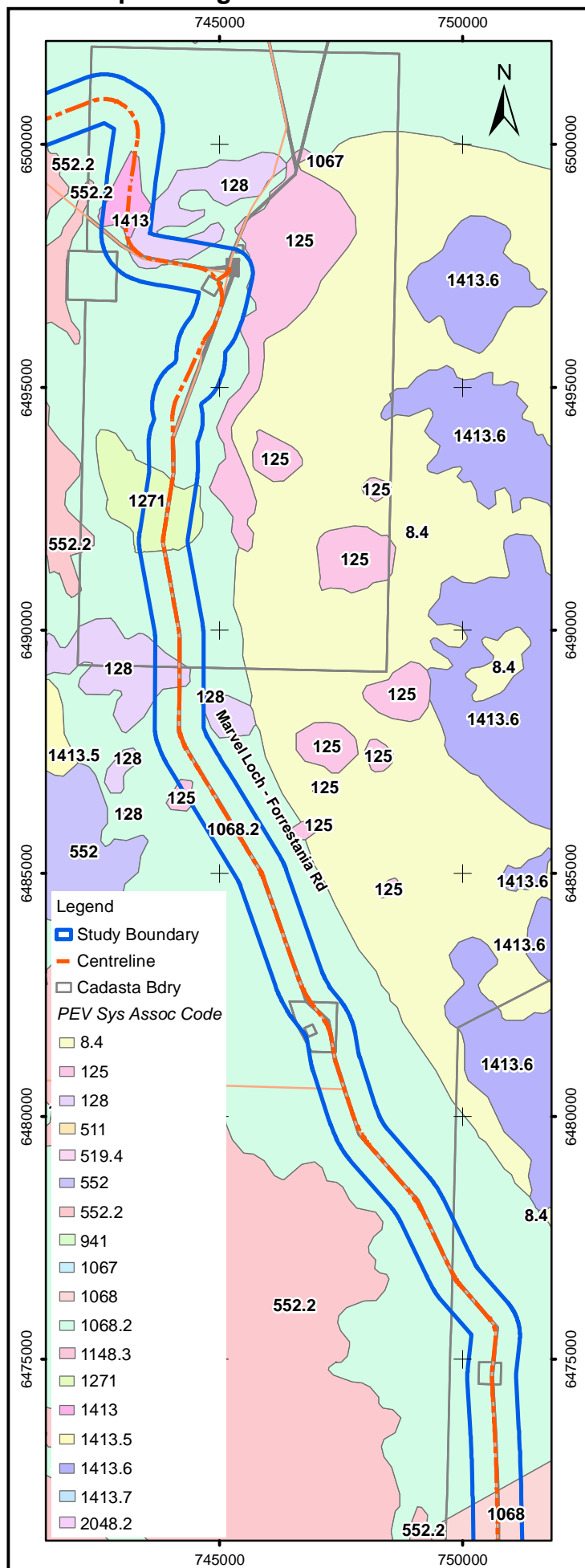
**Figure 6. Pre-European Vegetation of the Study Area.**

**Earl Grey Lithium Project**  
**Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade**  
**Pre European Vegetation - Sheet 1 of 2**





**Earl Grey Lithium Project**  
**Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade**  
**Pre European Vegetation - Sheet 2 of 2**



### 2.3.3. Groundwater Dependent Ecosystems (Terrestrial)

A Groundwater Dependent Ecosystem (GDE) is defined as an ecosystem that relies on groundwater for some or all its water requirements. The GDE Atlas is a national dataset of Australian GDEs to inform groundwater planning and management. The Atlas contains information about three types of ecosystems (aquatic, terrestrial and subterranean) (BoM, 2023b).

The vegetation of the Study Area that remains intact has been mapped as having a low to moderate potential for supporting a terrestrial GDE (BoM, 2023b). This includes woodland vegetation within the Great Western Woodlands (low to moderate) (as described in Section 2.3.7) and Wockallarry Nature Reserve (moderate). The only section of the Study Area mapped as having a high potential is the northern most end (1 km section) at the junction with Great Eastern Highway where vegetation remains intact surrounding the Moorine Rock townsite and the granite outcrop located on the northern side of Great Eastern Highway. Immediately adjacent (but outside of) the Study Area along the Marvel Loch – Forrestania Road, the chain of salt lakes present has resulted in the area being mapped as having a high potential for supporting a terrestrial GDE (BoM, 2023b).

Groundwater in the vicinity of the Early Grey deposit (located adjacent the southern end of the Study Area) is approximately 60 to 70m below surface (10m below surface in the area associated with the borefield) and is saline to hypersaline and therefore unlikely to support GDEs (Blueprint Environmental Strategies, 2017a).

### 2.3.4. Significant Wetlands

There are no wetlands of international (Ramsar) significance within 50 km of the Study Area (DBCA, 2023a). The nearest significant wetland, as listed under the Directory of Important Wetlands in Australia (DIWA) (DBCA, 2023b) is Lake Cronin, located approximately 32 km south of the Study Area. This small lake is the best example of a *Melaleuca*-dominated freshwater lake/marsh in the bioregion (DCCEEW, 2023a). Other significant wetlands in the greater region include: Lake Grace System located 157 km south west of the Study Area; Lake Barlee located 198 km north and Yealering Lakes System located 200 km west-south-west.

### 2.3.5. Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are classes or areas of native vegetation where the exemptions for clearing vegetation under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations) do not apply. They include the following:

- a declared World Heritage property as defined in sections 13 of the *Environment Protection and Biodiversity Conservation Act 1999* of the Commonwealth;
- an area that is included on the Register of the National Estate, because of its natural heritage value, under the *Australian Heritage Council Act 2003* of the Commonwealth;

- a defined wetland and the area within 50 m of the wetland;
- the area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located;
- the area covered by a threatened ecological community;
- a Bush Forever site listed in “Bush Forever” Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission, as described in subclause (3);
- the areas covered by the following policies —
  - (i) the Environmental Protection (Gnangara Mound Crown Land) Policy 1992;
  - (ii) the Environmental Protection (Western Swamp Tortoise) Policy 2002;
- the areas covered by the lakes to which the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 applies;
  - (i) protected wetlands as defined in the Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998;
  - (j) areas of fringing native vegetation in the policy area as defined in the Environmental Protection (Swan and Canning Rivers) Policy 1998.

Three ESAs are present within the Study Area (Figure 7):

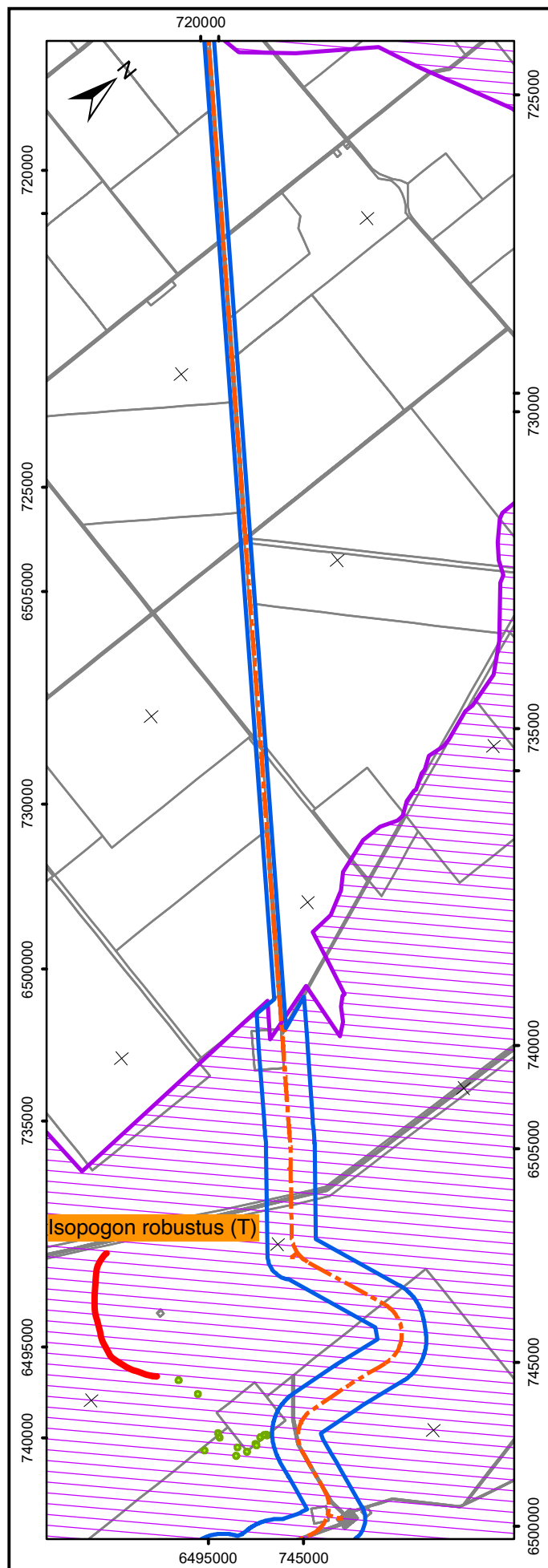
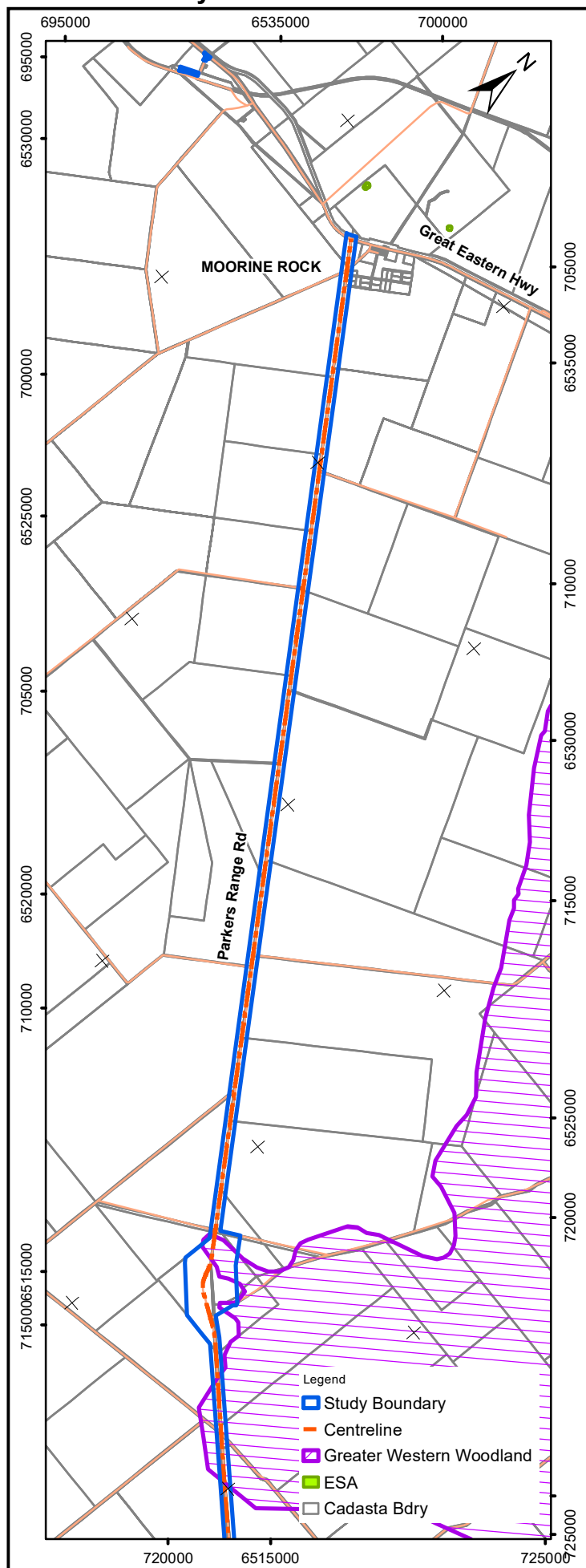
- The Study Area intersects the Jilbadgi Nature Reserve which is listed on the Register of the National Estate and therefore meets the criterion as an ESA.
- *Banksia dolichostyla* is listed as Threatened Flora by the DBCA. This species is present adjacent to the roadside from about the intersection of King Ingram Road southwards to the turnoff into the Mt Holland minesite. This region of roadside within 50m of *Banksia dolichostyla* plants therefore meets the criterion as an ESA.
- The Commonwealth listed ‘Eucalypt Woodland of the Western Australian Wheatbelt’ Threatened Ecological Community (TEC) under the *EPBC Act*, which is synonymous with the State listed Priority 3 PEC of the same name. The area covered by a TEC is classified as an ESA.

Beyond Jilbadgi Nature Reserve, nearby ESAs include (i) the Yellowdine Nature Reserve, located approximately 29 km north-west of the Study Area; and (ii) the Lake Cronin Nature Reserve, 32 km to the south (locations presented in Figure 8). Both are listed on the Register of the National Estate with the latter also containing a defined wetland (DWER, 2023b). Further, *Isopogon robustus* (T) is known from Mt Caudan in the Parker Range which lies to the south of the Study Area where the road diverts around the Mt Caudan minesite (Figure 7) and vegetation within 50m of this species also meets the criterion as an ESA.

**Figure 7. Environmentally Sensitive Areas of the Immediate Region**



# Earl Grey Lithium Project Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade Environmentally Sensitive Areas - Sheet 1 of 2



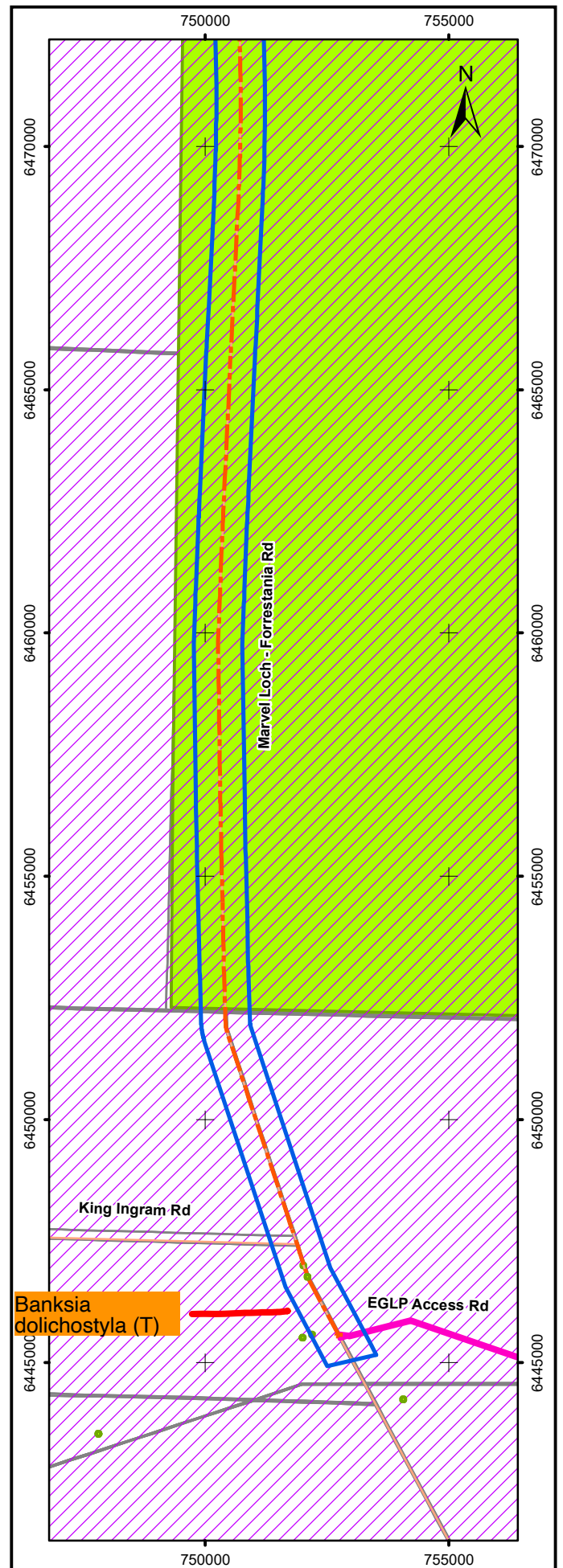
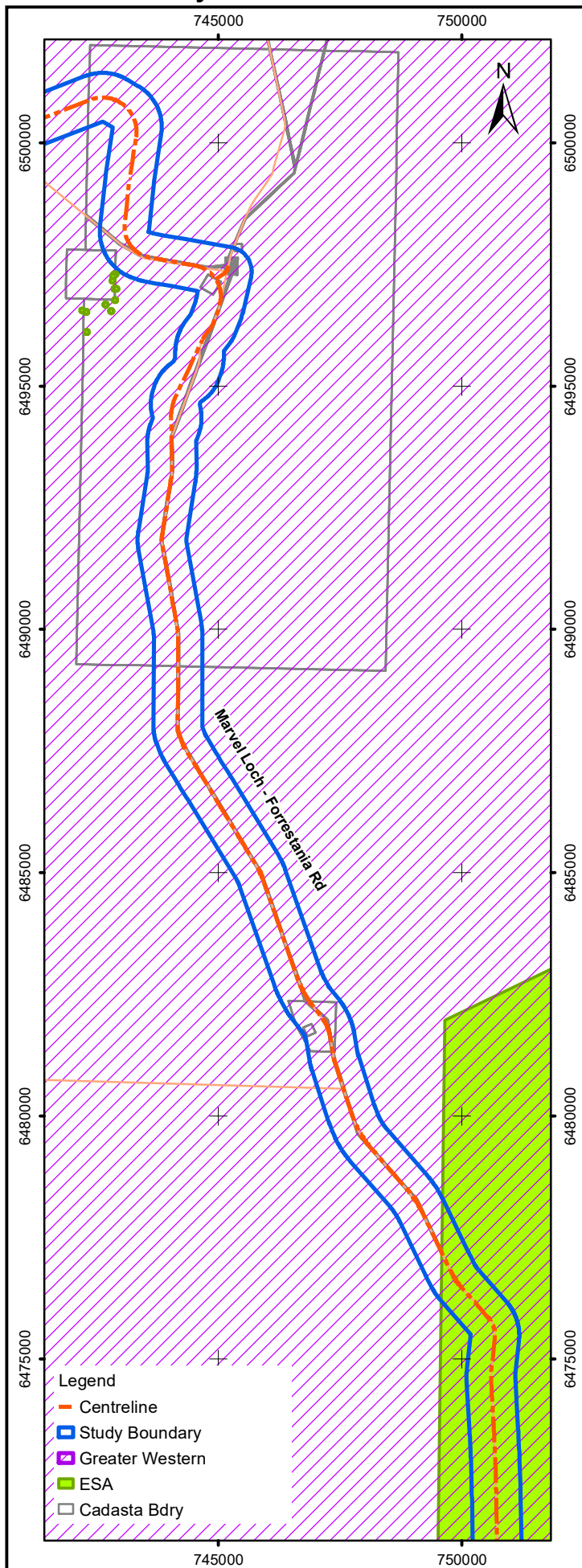
**Earl Grey Lithium Project  
Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade  
Environmentally Sensitive Areas - Sheet 2 of 2**



**Western  
Botanical**



**covalent  
LITHIUM**



### 2.3.6. Conservation Reserves in the Region

There are 34 conservation reserves (DBCA- Legislated Lands) within approximately 50 km of the Study Area (Table 4) (DBCA, 2022a; DAWE, 2023a). The Study Area intersects two reserves; Jilbadji Nature Reserve and Wockallarry Nature Reserve with the Frog Rock Nature Reserve located approximately 2.5 km from the Study Area (Figure 8).

The Jilbadji Nature Reserve is 207,213 ha in size and is substantially larger than the average reserve size (114 ha) in the Wheatbelt. It serves as an important fauna refugia site and contains a high diversity of fauna species and flora species endemism (DCCEEW, 2023b). As described in Section 2.5.5, this nature reserve is classified as an ESA. The Wockallarry Nature Reserve is an A Class reserve that is 209 ha in size and is dissected by the Parker Range Road.

**Table 4. DBCA legislated land within the vicinity of the Study Area (DBCA, 2022a; DAWE, 2023a).**

Name	Reserve No.	Reserve Class	~Distance from Study Area
Jilbadji Nature Reserve	24049		Intersects
Wockallarry Nature Reserve	29537	A	Intersects
Frog Rock Nature Reserve	20262	A	2.5 km SW
Un-named	40460		18 km W
Un-named	25801		23 km NE
Unnamed	43219	A	29 km N
Yellowdine Nature Reserve	41936		29 km NW
Unnamed	16000		29 km W
Unnamed	34197	A	30 km WSW
Unnamed	18584		31 km W
Lake Cronin Nature Reserve	36526	A	32 km S
Condarnin Rock Nature Reserve	29823		33 km NNW
Sandford Rocks Nature Reserve	1432	A	34 km ENE
Unnamed	30430	A	34 km NW
Unnamed	28562		35 km W
Unnamed	18583		37 km W
Biljahnne Rock Nature Reserve	29920		41 km NE
Unnamed	27146	A	41 km NW
Baladgie Lake Nature Reserve	42720		42 km NW
Carrabin Nature Reserve	16235	A	42 km W
Un-named	28323	A	43 km W
Unnamed	28940	A	43 km WSW
Un-named	28047	A	44 km SW

Name	Reserve No.	Reserve Class	~Distance from Study Area
Neendojer Rock Nature Reserve	34776		46 km W
Welsh Nature Reserve	30305		47 km W
Welsh Nature Reserve	30305		47 km W
Bushfire Rock Nature Reserve	29535		48 km SW
Bushfire Rock Nature Reserve	29535		48 km SW
Mount Hampton Nature Reserve	20526	A	48 km W
Duladgin Nature Reserve	2179		48 km NNW
Unnamed	36918	A	50 km NE
Marble Rocks Nature Reserve	20528		50 km SW
Lake Hurlston Nature Reserve	27837	A	52 km SW
Unnamed	9927		54 km SSW

### 2.3.7. Great Western Woodlands

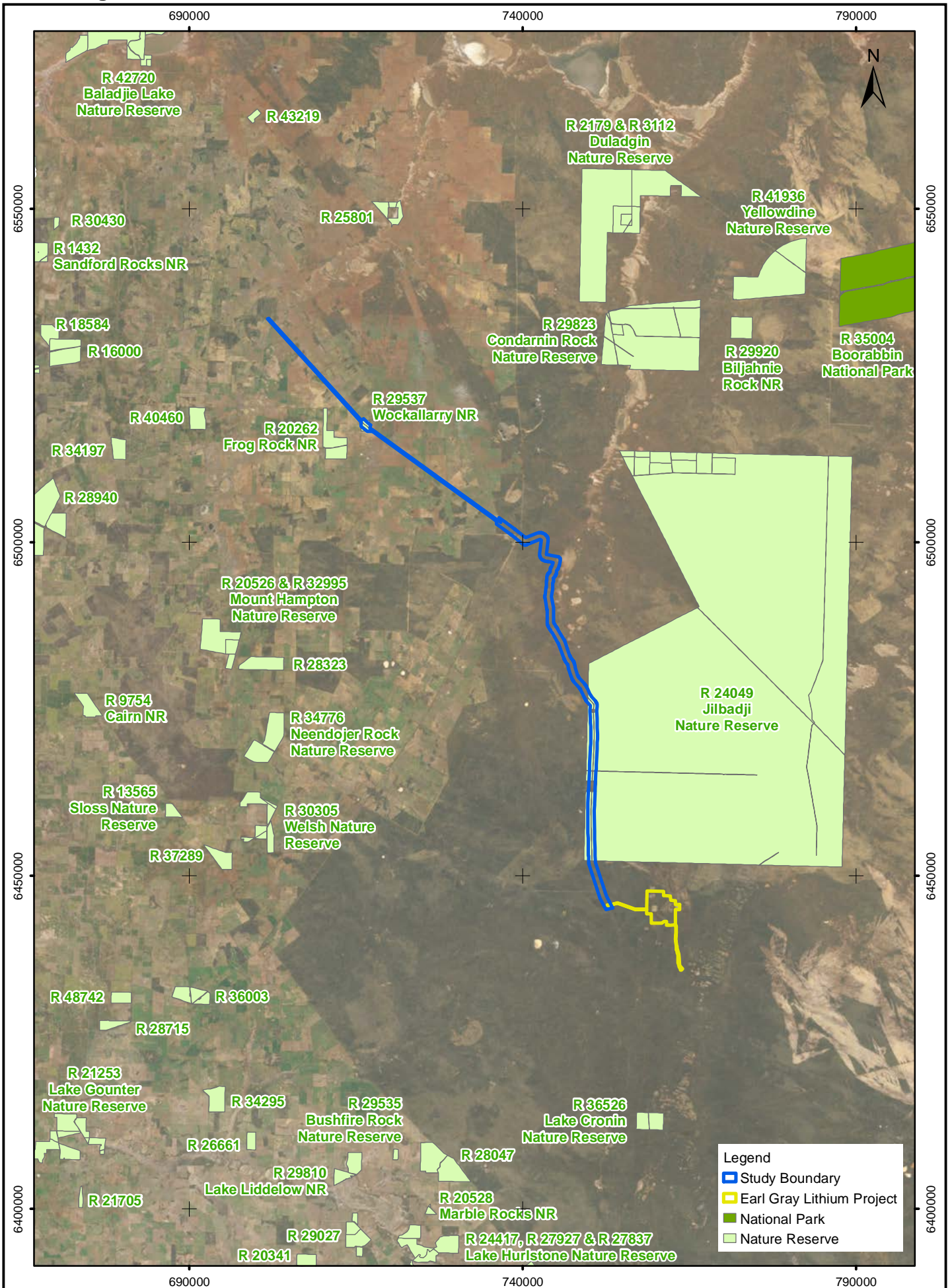
The Great Western Woodlands is an area of 16 million hectares of temperate woodland laying within the central and eastern Coolgardie biogeographic region, east of the extensively cleared agricultural region. It is the largest remaining area of intact Mediterranean climate woodland on Earth and is recognised as having high degrees of endemism and conservation value. Approximately 20% of Australia's known flora occurs within this area. There is almost no permanent water within the region, with surface water draining into, and evaporating from, numerous salt lakes. The Great Western Woodlands is located predominantly on unallocated Crown land, with significant areas of pastoral lease and conservation reserve also present (DEC, 2010).

The Study Area is located within the western boundary of the Great Western Woodlands until it enters the extensively cleared agricultural zone along Parker Range Road (Figure 7).



**Figure 8. Regional DBCA Legislated Land**

**Earl Grey Lithium Project  
Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade  
DBCA Legislated Land**



### **3. Methods**

#### **3.1. Desktop Assessment**

##### **3.1.1. Literature Review**

A review of available literature relevant to the Study Area was undertaken, utilising (but not limited to) the Index of Biodiversity Surveys for Assessment search portal. A total of 19 reports were reviewed, pertaining to the Earl Grey (Mt Holland) Lithium Project area and the Parker Range Iron Ore Project.

Extensive botanical survey has been conducted across the adjacent Earl Grey/Mt Holland Lithium Project area between 2017 – 2021 and 16 reports were reviewed from this project. Previous surveys conducted along the mine access road overlap the current Study Area at the intersection of the Marvel Loch – Forrestania Road.

The Parker Range Iron Ore Project is located approximately 50 km north-west of the Earl Grey Lithium Project. The Marvel Loch – Forrestania Road borders the northern edge of the project, having been redirected to allow for the construction of the minesite. The Study Area lies immediately adjacent the project and within the area surveyed to encompass the current bypass route. Two reports were reviewed from the Parker Range Iron Ore Project, including the Public Environmental Review document (from 2010) which summarised botanical surveys conducted from 2007 – 2010, and the recent (2021) Parker Range Haul Road Project report.

##### **3.1.2. Database Searches**

Database searches were conducted to identify potential Threatened and Priority Flora species, Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs), or other areas of conservation significance that may be encountered during field surveys (Table 5). The DBCA Framework for Conservation Significant Flora; and the Definitions of TECs and PECs are presented in Appendix 1 and Appendix 2.

Subsequent to the database searches, a desktop assessment of the likelihood of each Threatened and Priority flora species, TEC or PEC occurring within the Study Area was performed by considering (a) the proximity of known Conservation Significant flora and communities to the Study Area; and (b) the similarities between supporting habitats for each species and those of the Study Area.

A search of DPIRD's Western Australian Organism List (WAOL) for the Shire of Yilgarn was completed to identify plant species declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) that are known to occur in WA, for the local government area.

**Table 5. Details of database searches conducted.**

Provider	Reference	Database	Search parameters
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA, (2022b)	Threatened and Priority Flora database	50 km radius of Study Area polygon.
	DBCA (2022c)	Western Australian Herbarium Specimen database	
	DBCA (2022d)	Threatened and Priority Ecological Communities database	50 km radius of Study Area polygon.
Department of Agriculture, Water and the Environment (DAWE)	DAWE (2023a)	Protected Matters Search Tool (PMST)	50 km radius of Study Area, based on polygon the length of Study Area and 1km wide.
Department of Primary Industries and Regional Development (DPIRD)	DPIRD (2023c)	Western Australian Organism List	Shire of Yilgarn



## 4. Results

### 4.1. Literature Review

A summary of the key findings, in relation to flora and vegetation, of the 19 reports identified from the literature review are presented in Table 6. Extensive botanical survey work has been conducted across the Earl Grey Mt Holland project area (including the water pipeline route) from 2016 to 2020. Areas previously surveyed intersect the Study Area at two locations; along the Marvel-Loch Forrestania Road (near mine access intersection) and along Parker Range Road from north-west of Wockallarry Nature Reserve to Great Eastern Highway. A total of 47 Threatened and Priority flora have been located during surveys associated with the Earl Grey Mt Holland project area. This included 29 conservation significant taxa within the project's development envelope and a further 18 taxa outside of the envelope that were located in the course of regional targeted flora surveys (Mattiske Consulting, 2021a). The flora of this region is incredibly diverse and subject to continual taxonomic and conservation status review.

Although mapped (within the DBCA TEC/PEC database) as occurring within the 'Ironcap Hills vegetation assemblages' PEC (Priority 3) buffer, the vegetation of the Earl Grey Mt Holland project displayed poor correlation with the PEC and was deemed non-representative (Mattiske Consulting, 2018). A small section of the Study Area intersects this mapped PEC along the Marvel Loch – Forrestania Road (Figure 9) and will therefore require assessment to determine if the vegetation is representative of the PEC. The Earl Grey Mt Holland water pipeline route botanical survey encountered vegetation that was assessed for compatibility with the 'Eucalypt Woodland of the Western Australian Wheatbelt' PEC (Priority 3)/TEC as the latter is mapped as having a scattered occurrence, particularly around the Parker Range Road/Moorine Rock area. Although some areas received a tentative assessment as the PEC/TEC, the majority of the relevant *Eucalyptus* trees occurred outside the road verge on private agricultural land and were therefore inaccessible (for further assessment) but also outside of any possible (direct) impact zone (Mattiske Consulting, 2020b, 2020c).

Biological assessments have been conducted for the Parker Range (Mt Caudan) Iron Ore Project, with the most recent (publicly available) flora and vegetation survey conducted in 2019 – 2020 for a haul road (to the Koolyanobbing Iron Ore mine site). The area surveyed for the proposed Parker Range project haul road intersects the Study Area along Parker Range Road. Twenty five Priority flora species were located within this ~80 km long survey corridor. Earlier survey work conducted from 2007 – 2010 for the Parker Range Iron Ore Project site identified seven Priority Flora species and one Threatened Flora species (*Isopogon robustus*). The Parker Range Iron Ore Project site lies wholly within the 'Plant Assemblages of the Parker Range System 'PEC' (P3).

It should be noted that the Threatened species *Banksia sphaerocarpa* var. *dolichostyla* (as referred to in Table 6) underwent taxonomic review in 2022 and is now known as *Banksia dolichostyla*. The conservation status of this species remains unchanged.

**Table 6. Summary of available reports relevant to the Study Area.**

Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<b>Mt Holland/Earl Grey Lithium Project</b>				
Threatened and Priority Flora Assessment Earl Grey Lithium Project Pre-Clearance Surveys.  Report prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, April 2021a.	Targeted survey for all potential conservation significant flora taxa present within the infrastructure footprint of the mine development envelope. 18 surveys conducted from 2019 – 2020.	29 conservation significant taxa recorded within the project's development envelope. A further 18 conservation significant taxa were recorded outside of the development envelope in the course of regional targeted flora surveys (conducted by various consultancies).	The results of the direct and indirect (total) impacts assessment determined that the total regional population impacts to all conservation significant taxa recorded within the project's development envelope were below the respective thresholds.	Survey area overlaps the Study Area along Marvel-Loch Forrestania Road (near mine access intersection) and along Parker Range Road from north-west of Wockallary Nature Reserve to Great Eastern Highway
Earl Grey Lithium Project Field Survey 14 <sup>th</sup> – 21 <sup>st</sup> March, 2021. Memorandum; vegetation health monitoring transects.  Report prepared by Mattiske Consulting Pty Ltd, March 2021b.	Re-monitoring of vegetation health monitoring transects established in 2019 and 2020. Focusing on <i>Hibbertia glabriuscula</i> (P3), <i>Thryptomene salina</i> (P1), and <i>Thryptomene</i> sp. Hyden (B.J. Lepschi & L.A. Craven 4477) (P1)		<i>Hibbertia glabriuscula</i> (P3) was not recorded at any new locations during this survey, but is likely restricted to open S2 vegetation. The <i>Thryptomene salina</i> (P1) population recorded in November 2020 appeared very restricted and was not present in large numbers. <i>Thryptomene</i> sp. Hyden (B.J. Lepschi & L.A. Craven 4477) (P1) was observed growing in large numbers in open areas of S2 vegetation on pale brown – yellow sand.	Survey area overlaps the Study Area along Marvel-Loch Forrestania Road, just north of mine access road intersection.

Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<p>Targeted Flora Survey – Mt Holland Lithium Project</p> <p>Report prepared for Covalent Lithium Pty Ltd by 360 Environmental, November 2020.</p>	<p>Targeted flora survey of eight conservation significant flora taxa outside of the project disturbance envelope to quantify regional populations.</p>		<p>Four of the targeted species were located with a total of 63,736 individuals recorded outside the project disturbance envelope:</p> <ul style="list-style-type: none"> <li>• <i>Acacia undosa</i> (P3); 59,302 individuals</li> <li>• <i>Microcorys</i> sp. Mt Holland (P1); 3,968</li> <li>• <i>Microcorys</i> sp. Mt Holland – broad leaf; 394</li> <li>• <i>Chamelaucium</i> sp. Parker Range (P1); 52</li> <li>• <i>Eutaxia lasiocalyx</i> (P2); 20</li> </ul>	<p>1 km west of Study Area between minesite and Marvel Loch – Forrestania Road.</p>
<p>Earl Grey Lithium Project Introduced Flora (Weed) Survey</p> <p>Report prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, October 2020a.</p>	<p>Targeted survey for weed species within areas of disturbance</p>	<p>16 weed species representing 7 families and 14 genera</p>	<p>No WoNS or Declared Weeds present</p>	<p>Survey area overlaps the Study Area along Marvel-Loch Forrestania Road (near mine access intersection).</p>
<p>Earl Grey Lithium Project Field Survey 25<sup>th</sup> October 2020. (Water Pipeline TEC Assessment)</p> <p>Memorandum prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, October 2020b.</p>	<p>Field assessment for the Wheatbelt Woodland TEC along the water pipeline corridor. Five areas assessed.</p>		<p>Comment made that trees along the section of Parker Range Road that was assessed occurred in farmland and not road verge.</p>	<p>Overlaps the Study Area along the Parker Range Road (NW of Wockallarry Nature Reserve)</p>

Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<p>Flora and Vegetation Assessment</p> <p>Earl Grey Lithium Project Water Pipeline Alignment Supplementary Report</p> <p>Report prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, September 2020c.</p>	Reconnaissance of two locations (<1.5 ha in total)	No Threatened or Priority flora present. Vegetation in poor to degraded condition.		Immediately adjacent northern end of Study Area near Great Eastern Highway.
<p>Flora and Vegetation Assessment</p> <p>Earl Grey Lithium Project Water Pipeline Corridor</p> <p>Report prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, May 2020d.</p>	Reconnaissance	270 flora taxa from 40 families and 117 genera. Three introduced species.	<i>Verticordia mitodes</i> (P3) recorded. 'Eucalypt Woodlands of the Western Australian Wheatbelt' PEC/TEC present.	Survey area overlaps the Study Area along Marvel-Loch Forrestania Road (near mine access intersection) and along Parker Range Road from north-west of Wockallarry Nature Reserve to Great Eastern Highway
<p>Flora Survey Mt Holland</p> <p>Report prepared Covalent Lithium Pty Ltd by GHD, March 2020.</p>	Targeted of two potential airstrip locations		Six conservation significant flora taxa located: <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T), <i>Microcorys</i> sp. Mt Holland (D. Angus DA 2397) (P1), <i>Eutaxia lasiocalyx</i> (P2), <i>Hakea pendens</i> (P3), <i>Verticordia stenopetala</i> (P3) and <i>Verticordia gracilis</i> (P3).	1 km from southern end of Study Area.



Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<p>Earl Grey Lithium Project Threatened and Priority Flora Assessment Pre-Clearance Surveys.</p> <p>Report prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, December 2019a.</p>	Targeted survey of development envelope for all potential conservation significant taxa		29 flora taxa of conservation significance recorded within development envelope including two Threatened taxa <i>Eremophila verticillata</i> and <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> , 26 Priority flora and one undescribed species ( <i>Hibbertia</i> sp. nov.). The latter is now the Priority 1 species <i>Hibbertia</i> sp. Mt Holland (B. Ellery BE 1437) (Mattiske Consulting, 2021a).	Survey area overlaps the Study Area along Marvel-Loch Forrestania Road (near mine access intersection).
<p>Earl Grey Lithium Mine Regional Flora Survey</p> <p>Report prepared for Covalent Lithium Pty Ltd by Strategen – JBS &amp; G, July 2019.</p>	Targeted survey of multiple locations within the Eastern Wheatbelt for <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T) and <i>Microcorys</i> sp. Mt Holland (D. Angus DA 2397) (P1)		<i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T); located 490 individuals across four sites. <i>Microcorys</i> sp. Mt Holland (D. Angus DA 2397) (P1); no individuals located.	Nearest surveyed site is 8 km west of Study Area along Marvel Loch – Forrestania Road.
<p>Threatened and Priority Flora Assessment Tenement M77/215 Proposed Tracks and Drill Hole Locations.</p> <p>Report prepared for Kidman Resources Ltd, by Mattiske Consulting Pty. Ltd., April 2019b.</p>	Targeted survey		No Threatened or Priority flora, TECs or PECs located.	13 km south-west of southern end of Study Area

Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<p>Earl Grey Lithium Project Targeted Survey: <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T)</p> <p>Report prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, January 2019c.</p>	<p>Targeted survey of Earl Grey Lithium Project area and broader region for <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T)</p>	<p>18 populations located with 16,503 plants recorded.</p>	<p>Total estimated population of 22,586 plants.</p>	<p>Two locations within Study Area (southern end along Marvel Loch – Forrestania Road).</p>
<p>Earl Grey Lithium Project Conservation Significant Flora Targeted Survey</p> <p>Report prepared for Covalent Lithium Pty Ltd by Mattiske Consulting Pty Ltd, January 2019d.</p>	<p>Targeted survey for 21 species of significance within areas of potential clearing (in excess of 10% of their mapped extent)</p>	<p>Seven significant flora taxa located within the proposed infrastructure footprint.</p>	<p>The majority of the targeted taxa will not experience large impacts as a result of vegetation clearing. The taxa which have the greatest potential to be impacted by mine development include (in decreasing order of potential impacts): <i>Eutaxia lasiocalyx</i> (P2), <i>Microcorys</i> sp. Mt Holland (D. Angus DA2397) (P1), <i>Acacia undosa</i> (P3), <i>Labichea rossii</i> (P1), <i>Hakea pendens</i> (P3) and <i>Acacia</i> sp. Mt Holland (B. Ellery BE1147), now <i>Acacia lachnocarpa</i> (P1).</p>	<p>Nearest location is immediately adjacent southern end of Study Area near the intersection of the mine access road and Marvel Loch – Forrestania Road.</p>

Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<p>Statistical Comparison of Vegetation within the Earl Grey Lithium Project with the Ironcap Hills Vegetation Complex.</p> <p>Memorandum prepared for Kidman Resources Ltd, by Mattiske Consulting Pty Ltd, October 2018a.</p>	<p>Statistical comparison of flora survey data from 'Ironcap Hills vegetation assemblages (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone formation)' PEC (P3) (Gibson, 2004) with that of the Earl Grey Lithium Project, as recorded by Mattiske Consulting Pty Ltd.</p>		<p>Based on statistical comparison of the available data, there was poor correlation between the vegetation of the "Ironcap Hills vegetation assemblages" PEC and vegetation recorded within the Earl Grey Lithium Project.</p>	<p>Survey data included area of overlap with Study Area (near intersection of mine access road and Marvel loch – Forrestania Road).</p>
<p>Flora and Vegetation Assessment Early Grey Lithium Project</p> <p>Report prepared for Kidman Resources Ltd, by Mattiske Consulting Pty Ltd, March 2018b.</p>	<p>Detailed</p>	<p>369 flora taxa from 49 families and 140 genera. One introduced species. 26 vegetation communities.</p>	<p><i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T), 11 Priority flora and several undescribed species located. Survey area fell within the buffer of the 'Ironcap Hills vegetation assemblages' (P3) PEC, but none of the landforms or corresponding species communities associated with the PEC were recorded.</p>	<p>Survey area included the mine access road to Marvel-Loch Forrestania Road which overlaps the southern end of the Study Area.</p>

Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<p>Targeted Surveys for Threatened Flora Species <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i>. Summary Report Earl Grey Lithium Project.</p> <p>Report prepared for Kidman Resources Ltd by Blueprint Environmental Strategies, May 2017b.</p>	Summary of previous targeted surveys between 2014 – 2017 within development envelope.	Surveys recorded 521 specimens of <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> from a number of locations including adjacent to the existing landfill, various roads, the accommodation camp and a borrow pit.	No specimens of <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> located in the proposed Project disturbance footprint.	Survey area overlaps the Study Area along Marvel-Loch Forrester Road (near mine access intersection).
<p>Flora and Vegetation of the Earl Grey, Irish Breakfast and Prince of Wales Prospects Mt Holland Project</p> <p>Report prepared for Kidman Resources Ltd, by Mattiske Consulting Pty Ltd, April 2017.</p>	Detailed	184 flora taxa from 35 families and 86 genera	<i>Eutaxia lasiocalyx</i> (P2), <i>Acacia undosa</i> (P3), <i>Hakea pendens</i> (P3), and <i>Calamphoreus inflatus</i> (P4) recorded within the prospects. <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T) located just outside of survey area at Earl Grey.	5 km east
<b>Parker Range (Mt Caudan) Iron Ore Project</b>				



Study details	Survey type	Summary of results	Significant findings	~Distance from Study Area
<p>Baseline flora, vegetation and fauna surveys for the Parker Range Haul Road Project</p> <p>Report prepared for mineral Resources Ltd by Phoenix Environmental Sciences, May 2021.</p>	<p>Detailed surveys conducted Nov 2019 and July 2020.</p> <p>Targeted surveys between Sept – Oct 2020.</p> <p>Haul road extends from the Parker Range Iron Ore mine to the Koolyanobbing Operations.</p>	<p>423 flora taxa from 52 families and 161 genera. Nine introduced species present (no WoNS or Declared Weeds)</p> <p>23 vegetation types identified.</p>	<p>25 Priority flora species located. One new undescribed species recorded: <i>Microcorys</i> sp. nov. (GBW 22/11/2019) (unable to verify if this species has since been identified). A significant (200 km) range extension recorded for <i>Rhagodia ulicina</i>. No Threatened flora located.</p> <p>‘Plant Assemblages of the Parker Range System’ PEC (P3) present. The first recorded instance of *<i>Centaurea benedicta</i> within WA is of potential significance to the State. Location within area surveyed (and proximity to Study Area) not provided in report, no specimen vouchered at WA Herbarium, identity cannot be verified.</p>	<p>Small area overlaps the Study Area at the intersection of Parker Range Road and the proposed haul road for the Parker Range Iron Ore mine.</p>
<p>Summary of survey work undertaken by Botanica Consulting from 2007 to 2010 for the Parker Range Iron Ore Project, as presented in the Parker Range (Mt Caudan) Iron Ore Project Public Environmental Review.</p> <p>Report prepared by Keith Lindbeck and Associates for Cazaly Resources Limited, November 2010.</p>	<p>Level 1 and Level 2 surveys conducted over four areas between 2007 and 2010.</p> <p>Included the Marvel Loch – Forrestania bypass route to the north of the (then proposed) minesite.</p>	<p>268 flora taxa from 48 families and 120 genera.</p> <p>Four introduced species.</p> <p>43 vegetation types identified across the various survey areas.</p>	<p>Seven Priority flora species located. In addition to the <i>Isopogon robustus</i> (T) population (470 plants) previously found near the Parker Range Project area, a further 790 plants were located in the southern parts of the project area. ‘Plant Assemblages of the Parker Range System’ PEC (P3) present.</p>	<p>Study Area overlaps the survey area along the bypass route to the north of the mine.</p>

## 4.1. Database Searches

### 4.1.1. Significant Flora

A total of 104 flora taxa of conservation significance were identified by the DBCA database searches as having been recorded within approximately 50 km of the Study Area (Table 7). This included seven Threatened; 33 Priority 1; 12 Priority 2; 39 Priority 3 and 12 Priority 4 taxa. In addition, the species *Thomasia gardneri*, has been recorded within the search radius near Mt Holland. Commonly referred to as Mt Holland *Thomasia*, this small shrub species has been sampled only once (in 1929) near Mt Holland and is now Presumed Extinct (X) (DCCEEW, 2023c). The P1 taxon *Thryptomene salina* was recorded in November 2020 during a vegetation mapping survey of the Earl Grey Lithium Project by Mattiske Consulting and was re-visited and confirmed in March 2021 (outside its flowering period). This species did not appear in the DBCA database searches however is included in Table 7. The PMST database search returned an additional 21 Threatened flora species that were not identified within the DBCA database searches (Table 7).

In total, 126 flora taxa of conservation significance were identified as a result of database searches and the literature review. A summary of these taxa in regard to description/habitat, nearest known location to the Study Area and an assessment of likelihood of occurrence within the Study Area is presented in Table 7. The latter is based on known distribution and habitat preferences, as sourced from information available from the WA Herbarium (unless otherwise referenced).

A total of 20 species of conservation significance (one Threatened, five Priority 1, four Priority 2, nine Priority 3 and one Priority 4) have been previously recorded within the Study Area (Figure 9). Nine species of conservation significance have been located within 1 km of the Study Area and an additional ten species within 5 km. Of the 106 species not previously recorded within the boundary of the Study Area, 66 species were assessed as having the potential to occur (three Threatened, 24 Priority 1, eight Priority 2, 20 Priority 3 and 11 Priority 4) while 40 species were considered unlikely to occur (Table 7).

**Table 7. Summary of conservation significant flora database search results for the vicinity of the Study Area (sorted by conservation rank) and their likelihood of occurrence within the Study Area (DBCA, 2022b, 2022c; DAW, 2023a).**

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Thomasia gardneri</i>	X	EX	EX	x		Erect, multi-stemmed shrub, to 0.5 m high. Fl. pink-purple, Sept. Yilgarn. Recorded 8.5 km south-east of southern end of Study Area.	Unlikely
<i>Acacia lanuginophylla</i>	T	VU	EN	x	x	Dense shrub, 0.5-1.2 m high. Fl. yellow, Jul to Oct. White/grey sand, clayey sand, gravelly soils. Flats, along drainage lines. Lake Grace, Yilgarn. Recorded 8.5 km south-east of southern end of Study Area.	Possible
<i>Banksia mimica</i>	T	VU	EN		x	Prostrate, lignotuberous shrub, 0.15-0.4 m high. Fl. yellow-brown, Dec or Jan to Feb. White or grey sand over laterite, sandy loam. Augusta Margaret River, Busselton, Gingin, Gosnells, Kalamunda, Nannup, Victoria Plains. Inclusion in database search results appear to be an anomaly.	Unlikely
<i>Banksia dolichostyla</i> (formerly <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> )	T	VU	VU	x	x	Lignotuberous shrub, 1-3 m high. Fl. yellow-orange, Mar to May. Lateritic gravel, grey sand. Esperance, Kondinin, Narembeen, Yilgarn. Recorded within Study Area.	Recorded
<i>Boronia adamsiana</i>	T	VU	VU		x	Erect shrub, 0.3-1 m high. Fl. pink-white, Jul to Oct. Yellow sand/loam over laterite. Flats, road verges. Dalwallinu, Kellerberrin, Merredin, Mount Marshall, Mukinbudin, Nungarin, Trayning, Westonia. Recorded 40 km west of northern end of Study Area (near Westonia).	Unlikely
<i>Boronia revoluta</i>	T	VU	EN		x	Shrub, 0.4-0.8 m high. Fl. pink, Jul to Aug. Stony sandy loam or sand. Plains, hillsides and summits. Kondinin, Kulin, Lake Grace. Record 60 km south of southern end of Study Area.	Unlikely

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Caladenia hoffmanii</i>	T	EN	EN		x	Tuberous, perennial, herb, 0.13-0.3 m high. Fl. green & yellow & red, Aug to Oct. Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies. Chapman Valley, Greater Geraldton, Northampton. Inclusion in database search results appear to be an anomaly.	Unlikely
<i>Caladenia graniticola</i>	T	EN	EN		x	Tuberous, perennial, herb, to 0.21 m high, plant usually single flowered. Fl. green-yellow, Oct. Gritty sandy clay, granite. Near low exposed rock outcrops. Albany, Kulin, Lake Grace. Recorded 95 km south west of southern end of Study Area.	Unlikely
<i>Calectasia pignattiana</i>	T	VU	VU		x	Rhizomatous, prickly herb, to 0.5 m high. Fl. blue-purple, Aug to Oct. Sand to sandy clay over granite or laterite, gravel. Plains and gentle slopes. Dowerin, Dumblebung, Kent, Kondinin, Kulin, Lake Grace, Narrogin, Quairading, Wagin, West Arthur, Wickepin. Recorded 38 km south east of southern end of Study Area.	Unlikely
<i>Dasymalla axillaris</i>	T	EN	CE		x	Dalwallinu, Perenjori, Wongan-Ballidu, Yalgoo. Inclusion in database search results appear to be an anomaly.	Unlikely
<i>Daviesia microcarpa</i>	T	EN	EN		x	Sprawling, tangled shrub, to 0.4 m high, ca 1 m wide. Fl. orange & red, Sep. Weathered gravel. Eastern Goldfield, Southern Cross. Recorded 21 km east-north-east of northern end of Study Area (near Southern Cross).	Unlikely



Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Eremophila resinosa</i>	T	EN	EN		x	Shrub, 1.2-4 m high. Fl. green-white-yellow, Sep to Nov. Granitic soils, sandy loam. Stony gullies, sandplains. Dalwallinu, Greater Geraldton, Kellerberrin, Koorda, Mukinbudin, Nungarin, Perenjori, Trayning, Westonia, Wongan-Ballidu, Yilgarn. Recorded 40 km east of northern end of Study Area (near Westonia).	Unlikely
<i>Eremophila verticillata</i>	T	CE	EN	x	x	Low spreading shrub, up to 0.8 m high, to 1 m wide. Fl. purple-violet, Nov to Dec. Clay loam, loam over limestone. Kulin, Lake Grace, Yilgarn. Recorded 8 km south-east of southern end of Study Area.	Possible
<i>Eremophila virens</i>	T	EN	EN		x	Erect, slender shrub, 1.5-5 m high. Fl. green, Aug to Oct. Red/brown sand. Granite hillsides. Coolgardie, Mukinbudin, Nungarin, Westonia. Recorded 60 km north-west of northern end of Study Area.	Unlikely
<i>Eremophila viscida</i>	T	EN	EN		x	Shrub, 1.2-4 m high. Fl. green-white-yellow, Sep to Nov. Granitic soils, sandy loam. Stony gullies, sandplains. Dalwallinu, Greater Geraldton, Kellerberrin, Koorda, Mukinbudin, Nungarin, Perenjori, Trayning, Westonia, Wongan-Ballidu, Yilgarn. Recorded 40 km west of northern end of Study Area (near Westonia).	Unlikely
<i>Eucalyptus brevipes</i>	T	EN	EN		x	(Mallee), 3-5(-6) m high, bark rough. Fl. white-cream, Oct. White or yellow sand, sandy loam. Granite outcrops. Mount Marshall, Mukinbudin, Nungarin, Westonia. Recorded 57 km north-west of northern end of Study Area.	Unlikely

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Eucalyptus crucis</i> subsp. <i>crucis</i>	T	EN	VU	x	x	(Mallee), 2-8 m high, bark rough, 'minni-ritchi'. Fl. white, Oct or Dec or Jan to Mar. Sand, loam. Granite outcrops. Menzies, Merredin, Mount Marshall, Westonia, Yilgarn. Recorded 1 km north of northern end of Study Area (near Moorine Rock granite outcrop).	Unlikely
<i>Eucalyptus steedmanii</i>	T	VU	VU	x	x	Tree, 2-8(-12) m high, bark smooth. Fl. white, Jan to Mar. Gravelly loam over ironstone, sand. Low hills, undulating plains. Kondinin, Ravensthorpe. Recorded 23 km south-west of southern end of Study Area.	Unlikely
<i>Frankenia parvula</i>	T	EN	EN		x	Procumbent to ascending small shrub. Bruce Rock, Cunderdin, Kellerberrin, Yilgarn. Recorded 53 km north-east of the northern end of the Study Area.	Unlikely
<i>Gastrolobium diabolophyllum</i>	T	CE	CE		x	Erect, open, robust shrub, to 1.5 m high. Fl. Orange, yellow, pink, red, Sep. Yellow-brown sand over laterite. Broadly undulating dunes. Merredin, Yilgarn. Recorded 30 km west-north-west of northern end of Study Area.	Unlikely
<i>Gastrolobium graniticum</i>	T	VU	EN		x	Erect, open shrub, to 2.5 m high. Fl. Yellow, orange, red, Aug to Sep. Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines. Coolgardie, Narembene, Yilgarn. Known as Bodallin Poison. Recorded 52 km north-east of mid section of Study Area.	Unlikely
<i>Isopogon robustus</i>	T	CE	CE	x	x	Shrub, to 1.5 m high. Fl. pink, Oct. Skeletal grey sandy loam, laterite. Ridges. Yilgarn. Recorded 100 m from Study Area (in Parker Range minesite)	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Melaleuca sciotostyla</i>	T	EN	EN		x	Spreading shrub, 0.6-1.5 m high. Fl. Aug. Orange clayey sand with lateritic pebbles. Scree slopes. Bruce Rock, Cunderdin, Dowerin, Kellerberrin, Mount Marshall, Quairading, Tammin, Victoria Plains, Westonia, Wongan-Ballidu, Yilgarn. Recorded 61 km north-west of northern end of Study Area.	Unlikely
<i>Paragoodia crenulata</i>	T	VU	CE		x	Small herbaceous plant with perennial underground parts, and stems to 8 cm long. The leaves are trifoliate and the leaflets have crenulated margins. Fl. Brown and yellow, Jul to Aug. (DSEWPC, 2013). Formerly known as <i>Muelleranthus crenulatus</i> . Kondinin. Recorded 28 km south of southern end of Study Area.	Unlikely
<i>Philotheca falcata</i>	T	EN	CE	x	x	Small, much-branched shrub, 0.15-0.25 m high. Fl. white, Oct. Yilgarn. Recorded 49 km east of northern end of Study Area.	Unlikely
<i>Ricinocarpos brevis</i>	T	EN	EN		x	Shrub, to 1.8 m high. Fl. white, Jun to Jul. Rocky hillslopes, rock outcrops. Menzies, Yilgarn. Recorded 145 km north of northern end of Study Area (listed as occurring in Yilgarn, but no specimens appear on database).	Unlikely
<i>Roycea pycnophylloides</i>	T	VU	EN		x	Perennial, herb, forming densely branched, silvery mats to 1 m wide. Fl. Sep. Sandy soils, clay. Saline flats. Bruce Rock, Cunderdin, Dalwallinu, Kellerberrin, Kent, Kondinin, Kulin, Lake Grace, Quairading, Westonia. Recorded 55 km west-north-west of northern end of Study Area.	Unlikely
<i>Tecticornia flabelliformis</i>	T	VU	VU		x	Erect shrub, to 0.2 m high. Clay. Saline flats. Coolgardie, Kalgoorlie-Boulder, Westonia. Recorded 46 km north of northern end of Study Area.	Unlikely

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Verticordia staminosa</i> var. <i>cylindracea</i>	T	VU	EN		x	Erect, compact shrub, 0.15-1 m high. Fl. green-yellow/yellow-brown, Jul to Oct. Soil pockets. Granite outcrops. Lake Grace. Recorded 117 km south-west of the southern end of the Study Area.	Unlikely
<i>Acacia lachnocarpa</i> (formerly <i>Acacia</i> sp. Mt Holland (B. Ellery BE 1147))	P1			x		Tall dense shrub growing 1 m tall and 0.8 m wide. Branchlets and pods densely woolly. Recorded on clay with large white quartz rocks. (GHD, 2020). Yilgarn Recorded 4 km east of southern end of Study Area.	Possible
<i>Acacia</i> sp. Forrestania (D. Angus DA 3001)	P1			x		Low spinescent shrub growing to 0.2 m high and 0.2 m wide. Recorded on lateritic orange-red clay soils on flats and lower slopes (GHD, 2020). Yilgarn Recorded 8.5 km south-east of southern end of Study Area.	Possible
<i>Beyeria opaca</i>	P1			x		Erect, compact shrub, to 1 m high. Red sandy clay. Dunes, slopes. Dundas, Kondinin. Recorded approximately 15 km south of the Study Area.	Possible
<i>Brachyloma stenolobum</i>	P1			x		Shrub to 1.5 m high and 1.2 m wide, single-stemmed at ground level from a fire-sensitive rootstock. Occurs in mixed heath and <i>Eucalyptus eremophila</i> over <i>Melaleuca</i> on yellow sandplain. (GHD, 2020). Dundas, Yilgarn. Recorded within Study Area.	Recorded



Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Chamelaucium</i> sp. Parker Range (B.H. Smith 1255) <sup>1</sup>	P1			x		In open mallee over open shrubs or in mixed heaths. Associated with <i>Acacia yorkrakinensis</i> , <i>Grevillea pterosperma</i> , <i>Melaleuca hamata</i> , <i>Thryptomene kochii</i> , and <i>Persoonia saundersiana</i> . Yellow sand over laterite. Plains and gentle slopes (Phoenix Environmental Sciences, 2021). Coolgardie, Kondinin, Yilgarn. Recorded within Study Area.	Recorded
<i>Dicrastylis capitellata</i>	P1			x		Low spreading shrub, 0.2-0.25 m high. Fl. blue-purple, May. Loamy sand, sandy loam. Esperance, Kondinin, Yilgarn. Recorded 9 km east of southern end of Study Area.	Possible
<i>Drummondita wilsonii</i>	P1			x		Erect shrub, 0.4-1 m high. Fl. red; green; pink, Jun to Aug. Sand with gravel; pebbles. Yilgarn. Recorded 2.6 km west of Study Area.	Possible
<i>Eremophila adenotricha</i>	P1			x		Erect, bushy, viscid shrub, 0.6-1.2 m high. Fl. blue, Sep. Red/brown earth, clay. Narembeen, Westonia, Yilgarn. Recorded 55 km west of southern end of Study Area.	Unlikely
<i>Eucalyptus retusa</i>	P1			x		Mallee or shrub up to 4 m tall. Forming a lignotuber (CANBR, 2020). Jerramungup, Ravensthorpe, Yilgarn (predominantly near south coast) Recorded 12 km south-west of southern end of Study Area.	Unlikely
<i>Eucalyptus</i> sp. Dunbar Road (D. Nicolle & M. French DN 5466)	P1			x		Mallet to 12m, white smooth bark and glossy green leaves. Fruit and buds similar to <i>E. urna</i> but significantly smaller. Yilgarn Recorded within Study Area.	Recorded

<sup>1</sup> The WA Herbarium collections of *Chamelaucium* sp. Parker Range (B.H. Smith 1255) P1 contain multiple species and taxonomy of this group is under revision.

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Eutaxia</i> sp. North Ironcap (P. Armstrong PA 06/898)	P1			x		Erect spindly shrub, broom-like, growing to 0.2m tall and 0.2m wide. Recorded in shrub mallee over <i>Melaleuca brophyi</i> on undulating plain of red sandy clay loam. Kondinin. Recorded 17 km south of southern end of Study Area.	Unlikely
<i>Glossostigma trichodes</i>	P1			x		Aquatic annual, herb. Pools in granite. Recorded 10 km north-west of Study Area.	Possible
<i>Goodenia heatheriana</i>	P1			x		Annual, herb, to 0.15 m high. Fl. yellow, Sep to Oct. Red crumbly clay, greenstone gravel and cobbles. Lower slopes, moderately exposed gently undulating plain, roadsides. Yilgarn. Recorded 6.5 km north-east of Parker Range Road and Marvel Loch – Forrestania Road intersection.	Possible
<i>Grevillea lissopleura</i>	P1			x		Erect shrub, 0.5-1.2 m high. Fl. Aug. Stony loam on banded ironstone. On ridges. Dundas, Yilgarn. Recorded within Study Area.	Recorded
<i>Grevillea marriottii</i>	P1			x		Open, multi-stemmed, lignotuberous shrub, 0.8-1.2 m high. Fl. green-cream-white, Aug to Oct. Yellow or white sand over laterite. On rises or on tops of lateritic cappings. Kondinin, Yilgarn. Recorded 11 km south of southern end of Study Area.	Unlikely
<i>Grevillea phillipsiana</i>	P1			x		Prickly shrub, 0.8-1.5 m high. Fl. red/red & orange, Jul to Sep. Red sand, stony loam. Granite hills. Recorded 12 km north-east of Study Area.	Possible
<i>Hemigenia</i> sp. Newdegate (E. Bishop 75)	P1			x		Spindly, erect to spreading shrub, 0.2-0.45 m high, to 0.5 m wide. Fl. blue/purple, Sep to Oct. Clay loam. Disturbed sites. Coolgardie, Kondinin, Kulin, Lake Grace, Yilgarn. Recorded 18 km east of northern end of Study Area.	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Hibbertia</i> sp. Mt Holland (B. Ellery BE 1437)	P1			x		Shrub to 0.4 m high x 0.8 m wide, flowers solid yellow, leaves blue-grey-green, soft, hairy. Plants may establish after soil disturbance. Cunderdin, Yilgarn. Recorded 5 km west of Study Area (southern end).	Possible
<i>Hibbertia tuberculata</i>	P1			x		Shrub to 0.45 m high, flowers dull yellow. Kondinin, Yilgarn. Recorded 8.4 km east-south-east of southern end of Study Area.	Possible
<i>Hydrocotyle corynophora</i>	P1			x		Erect, glabrous annual, herb, to about 0.25 m high, basal leaves small, conspicuously stalked, orbicular to rhomboid. Dundas, Yilgarn. Recorded 5.6 km north of Study Area (near Great Victoria Mine).	Possible
<i>Labichea rossii</i>	P1			x		Sub-shrub recorded growing 0.4 m high, stems sparingly branched and semi-erect. Recorded on small ironstone ridge dominated by <i>Allocasuarina</i> - Proteaceae and Myrtaceae with some eucalypts. Grows out of cracks in large outcrops of banded ironstone, often in shade of larger shrubs (GHD, 2020). Found in the Mt Holland region on yellow sand over laterite. Yilgarn. Recorded 11.3 km south-east of southern end of Study Area.	Possible
<i>Lepidosperma</i> sp. Mt Caudan (N. Gibson & M. Lyons 2081)	P1			x		Perennial sedge. Recorded in the Mt Caudan area in <i>Eucalyptus capillosa</i> subsp. <i>polyclada</i> low forest over <i>Melaleuca uncinata</i> . Orange-brown sandy loam, with ironstone gravel, gentle slopes (Phoenix Environmental Sciences, 2021). Yilgarn Recorded 1 km south of Study Area within Parker Range minesite area.	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Lepidosperma</i> sp. Parker Range (N. Gibson & M. Lyons 2094)	P1			x		Coolgardie, Menzies, Yilgarn. Recorded 250 m west of Study Area (within Parker Range minesite area).	Possible
<i>Leucopogon validus</i>	P1			x		Robust, lignotuberous shrub, to about 1.2 m high. Dry, brown, rocky sandy loam, brown-orange sandy clay, gravel, ironstone, sandstone. Low ranges, on and around exposed breakaways. Yilgarn. Recorded 60 m from Study Area within Parker Range minesite area.	Possible
<i>Melaleuca grieviana</i>	P1			x		Compact shrub, to 0.75 m high. Fl. yellow, Jul. Well-drained orange-brown loam, brown clay. Plains, gentle slopes, edge of crop paddocks. Kulin, Narembeen, Wyalkatchem, Yilgarn. Recorded 1.2 km west of Study Area (Marvel Loch – Forrestania Road section). Readily confused with the more common <i>Melaleuca johnsonii</i> .	Possible
<i>Melichrus</i> sp. Coolgardie (K.R. Newbey 8698)	P1			x		Compact shrub, 30 cm high x 30 cm wide. Corolla cream, sepals pale pink. Plants branching close to ground level but probably single stemmed and fire sensitive. Main populations disjunct, 120 to 150 km ENE of Study Area. Note: <i>Melichrus</i> aff. sp. Coolgardie (G. Cockerton WB40869), a shrub 0.8 m x 1.5 m, flowers white, has been recorded within the Study Area (Mt Caudan mine, Parker Range diversion road section).	Possible
<i>Microcorys elatoides</i> Formerly <i>Microcorys</i> sp. Mt Holland (D. Angus DA 2397)	P1			x		Perennial shrub growing 1.5 m tall and 1.2 m wide. Plant multi-stemmed at ground level from fire-tolerant rootstock. Occurs in disturbed areas on brown sandy loam, grey-brown sandy clay, orange clay and ironstone (GHD, 2020). Yilgarn. Recorded within Study Area.	Recorded



Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Millotia newbeyi</i>	P1			x		Slender, upright annual, herb, 0.05-0.1 m high. Fl. cream-yellow, Sep. Red/brown loam, red clay. Undulating plains. Yilgarn. Recorded 5.6 km north of t Study Area near Great Victoria Mine).	Possible
<i>Philotheca apiculata</i>	P1			x		Erect shrub, 0.5-1.5 m high. Fl. white-pink, Aug to Nov. Stony clay loam. Rocky outcrops, hillsides. Coolgardie, Dundas, Esperance, Yilgarn. Recorded 57 km west of Study Area (Marvel Loch - Forrestania Road section).	Unlikely
<i>Rinzia fimbriolata</i>	P1			x		Perennial woody shrub. Found around Bulfinch, Southern Cross and Mt Hampton (ALA, 2023). Yilgarn. Recorded 13 km south-west of Study Area (Parker Range Road midsection).	Possible
<i>Rinzia medifila</i>	P1			x		Occurs in yellow-red sandy soils, occasionally laterite or greenstone, in Eucalyptus woodlands, often with Melaleuca. Known only from Parker Range (GHD, 2020). Small shrub to 1m. Yilgarn. Recorded near boundary of Study Area (west side of Marvel Loch – Forrestania Road).	Possible
<i>Stylidium validum</i>	P1			x		Caespitose perennial, herb, 0.06-0.3 m high, Leaves tufted, oblanceolate, 1.5-10 cm long, 2.2-6 mm wide, apex acute to acuminate, margin entire, glabrous, glaucous. Scape glabrous. Inflorescence paniculate. Fl. white/pink, Sep to Oct. Clayey sand or loam, ironstone, greenstone gravel. Hillslopes and hilltops. Eucalypt woodland, mallee shrubland. Dundas, Kondinin, Yilgarn. Recorded 9 km south-east of southern end of Study Area.	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Thryptomene salina</i>	P1					Spreading, moderately dense shrub, to 1.1 m high. Fl. white-pink, Oct. Deep alluvial sand. On a flat along a saline creek. Kondinin. Recorded 44 km south-west of Study Area. This species was found growing in thick S2 vegetation with tall dense <i>Melaleuca ?scallena</i> immediately north of the Earl Grey mine access road (Mattiske Consulting, 2021a). Specimen not lodged or confirmed from Earl Grey area, as it did not appear in the DBCA database searches.	Possible
<i>Thryptomene</i> sp. Hyden (B.J. Lepschi & L.A. Craven 4477)	P1			x		Domed shrub to about 1.2 5m high that has been observed growing in large numbers on pale brown – yellow sand along the Earl Grey Project access road and the Marvel Loch – Forrestania Road (Mattiske Consulting, 2021a). Specimens do not currently appear on DBCA database for the Earl Grey location. Nearest DBCA recorded location is 54 km west of southern end of Study Area within Narembeen LGA.	Possible
<i>Acacia asepala</i>	P2			x		Diffuse, much-branched shrub, 0.5-1.5 m high. Fl. yellow, Aug. Red-brown sandy loam. Undulating plains, along drainage lines. Dundas, Kondinin, Lake Grace, Yilgarn. Recorded 7.5 km north-east of the Study Area (intersection of Parker Range Road and Marvel Loch – Forrestania Road).	Possible
<i>Acacia concolorans</i>	P2			x		Intricate, sprawling or compact, pungent shrub, 0.1-0.5 m high. Fl. yellow, Jul to Aug. Red/brown loam, clay. Low lateritic hills, flats. Kondinin, Yilgarn. Recorded 0.9 km west of the Study Area (within Parke Range minesite area).	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Balaustion grandibracteatum</i> subsp. <i>juncturum</i> Rye  (formerly both <i>Baeckea</i> sp. Blue Haze Mine (P. Armstrong 06/910) and <i>Baeckea</i> sp. Forrestania (K.R. Newbey 1105))	P2			x		Kondinin, Yilgarn. Large flowered shrub growing to 1.2 m tall. Occurs on yellow-orange lateritic sandy clay loam on undulating plains with open mallee, low to tall shrub heath (GHD, 2020). Recorded within Study Area.	Recorded
<i>Conospermum sigmoideum</i>	P2			x		Erect shrub, 0.2-0.5 m high. Fl. blue, Aug to Sep. Yellow sand. Dundas, Esperance, Kondinin, Lake Grace, Yilgarn. Recorded 13 km south-east of southern end of Study Area.	Possible
<i>Dampiera orchardii</i>	P2			x		Erect perennial, herb, 0.2-0.4 m high. Sand. Dundas, Kent, Lake Grace, Ravensthorpe, Yilgarn. Recorded within Study Area.	Recorded
<i>Eutaxia lasiocalyx</i>	P2			x		Low, spreading, multi-stemmed shrub, to 0.15 m high. Fl. yellow, Nov. Red sandy loam, laterite and quartz gravel. Gentle lower slopes. Coolgardie, Kondinin, Yilgarn. Recorded 1.1 km south of Study Area (within Parker Range minesite area).	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Leucopogon</i> sp. Yellowdine (M. Hislop & F. Hort MH 3194)	P2			x		Coolgardie, Dundas, Yilgarn. In open tall shrubland of <i>Allocasuarina spinosissima</i> , <i>Allocasuarina campestris</i> and <i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i> over open sedge of <i>Ecdeiocola monostachya</i> and <i>Melaleuca cordata</i> over open hummock grassland and rushland of <i>Triodia rigidissima</i> , <i>Lepidobolus preissianus</i> subsp. <i>volubilis</i> and <i>Borya constricta</i> . Yellow-orange sandplain, laterite, sandy loam soil (Phoenix Environmental Sciences, 2021). Previously recorded 56 km west of the Study Area according to the DBCA WA Herbarium database search. However, Florabase indicates this species has been recorded within the Study Area (in Jilbadgi Nature Reserve).	Possible
<i>Lissanthe scabra</i>	P2			x		Rigid, erect, fairly densely branched shrub, to 1 m high, leaf apex aristate, upper leaf surface scabrous; flowers pedicellate above bracteoles. Fl. white, Aug. Dry, white to orange-brown clay, sandy gravel loams, granite. Breakaways, uplands. Coolgardie, Yilgarn. Recorded 5.3 km south-west of the Study Area within Frog Rock Nature Reserve.	Possible
<i>Logania nanophylla</i>	P2			x		Low spreading shrub, 0.1-0.25 m high, to 0.5 m wide. Fl. white, Aug. White sand, pebbly calcareous sandy clay. Sand dunes. Dundas, Yilgarn. Recorded within Study Area.	Recorded
<i>Orianthera exilis</i>	P2			x		Perennial herb. Fl. White. Dundas, Kondinin, Yilgarn. Recorded 8.6 km south-east of the southern end of the Study Area.	Possible



Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Verticordia multiflora</i> subsp. <i>solox</i>	P2			x		Erect to spreading shrub, 0.2-0.6 m high. Fl. yellow, Oct to Dec or Jan. Yellow sand over gravel, sand over granite. Kondinin, Merredin, Narembeen, Yilgarn. Previously recorded within Study Area.	Recorded
<i>Verticordia pulchella</i>	P2			x		Spreading shrub, 0.1-0.45 m high, to 0.7 m wide. Fl. red & pink/yellow/orange, Oct to Nov. Sandy soils over granite. Massive granite areas. Bruce Rock, Yilgarn. Recorded 16.5 km west of Study Area (Marvel Loch – Forrestania Road).	Possible
<i>Acacia crenulata</i>	P3			x		Bushy shrub or tree, 0.7-3 m high. Fl. yellow. Clay, sandy clay, yellow sand. Rocky rises, granite outcrops, breakaways. Coolgardie, Mukinbudin, Westonia, Yilgarn. Recorded 9 km west of northern end of Study Area.	Possible
<i>Acacia desertorum</i> var. <i>nudipes</i>	P3			x		Dense or open shrub or tree (rarely), 0.6-2 m high, phyllodes 16-nerved. Fl. yellow, Aug to Oct. Yellow sand, lateritic gravel. Sandplains, flats. Coolgardie, Yilgarn. Recorded 10 km north-east of Study Area (at Marvel Loch minesite).	Possible
<i>Acacia filifolia</i>	P3			x		Wispy, spindly, single-stemmed shrub or tree, 1.2-3 m high. Fl. yellow, May to Sep. Yellow sand, gravelly lateritic sand. Sandplains. Coorow, Merredin, Mount Marshall, Westonia, Wongan-Ballidu, Yilgarn. Recorded 11.5 km north-east of northern end of Study Area.	Possible
<i>Acacia undosa</i>	P3			x		Dense, spreading shrub, 0.3-1.5 m high. Fl. yellow, Jul to Sep. Sandy clay loam, clayey sand. Undulating plains, low-lying areas. Bruce Rock, Kent, Kondinin, Kulin, Lake Grace, Ravensthorpe, Tammin, Yilgarn. Recorded 5.5 km east of southern end of Study Area.	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Alyogyne</i> sp. Great Victoria Desert (D.J. Edinger 6212)	P3			x		Chapman Valley, Coolgardie, Dumbleyung, Esperance, Kalgoorlie-Boulder, Menzies, Northampton, Swan, Yilgarn. Recorded at Mt Holland in 1929 with the next nearest recorded location being Lake Barker Reserve (in 1971), approximately 80 km east of the Study Area. Taxonomy of <i>Alyogyne</i> is in need of serious revision.	Unlikely
<i>Angianthus micropodioides</i>	P3			x		Erect or decumbent annual, herb, 0.03-0.15 m high. Fl. yellow-white, Nov to Dec or Jan to Feb. Saline sandy soils. River edges, saline depressions, claypans. Canning, Cunderdin, Dalwallinu, Dandaragan, East Fremantle, Greater Geraldton, Kellerberrin, Koorda, Melville, Morawa, Perenjori, Perth, South Perth, Wongan-Ballidu, Yilgarn. Recorded 7.5 km east of Study Area (within Jilbadgi Nature Reserve).	Possible
<i>Austrostipa turbinata</i>	P3			x		Grass to 20cm. Coolgardie, Dundas, Esperance, Kalgoorlie-Boulder, Kellerberrin, Kondinin, Ravensthorpe. Recorded approximately 25 km south of the Study Area.	Possible
<i>Balaustion grandibracteatum</i> (E.Pritz.) Rye subsp. <i>grandibracteatum</i> (formerly <i>Baeckea grandibracteata</i> subsp. Parker Range (K. Newbey 9270))	P3			x		West of Southern Cross – Yellowdine (Rye, 2022). Yilgarn <i>Eucalyptus</i> scattered mallees over <i>Allocasuarina</i> high shrubland over <i>Melaleuca</i> sp., over low open heath over <i>Ecdeiocolea monostachya</i> sedgeland over <i>Schoenus</i> low open sedgeland. Yellow sand over laterite, midslopes (Phoenix Environmental Sciences, 2021). Recorded near boundary (10 m north) of Study Area (on edge of remaining uncleared vegetation) and within Parker Range minesite.	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Banksia viscida</i>	P3			x		Densely branched, non-lignotuberous shrub, 0.4-1 m high. Fl. yellow-orange, Jul to Oct. Gravelly soils. Lateritic rises. Kondinin, Lake Grace. Recorded approximately 19 km south of southern end of Study Area.	Unlikely
<i>Boronia ternata</i> var. <i>promiscua</i>	P3			x		Shrub, 0.3-2 m high. Fl. white-pink, Apr to Nov. Sand, clay, loam, gravel, laterite, limestone. Undulating plains & rises, stony cliffs, breakaways. Bruce Rock, Carnamah, Coolgardie, Dalwallinu, Dumbleyung, Dundas, Esperance, Gnowangerup, Jerramungup, Kent, Kondinin, Koorda, Kulin, Lake Grace, Merredin, Mukinbudin, Narembeen, Nungarin, Perenjori, Ravensthorpe, Three Springs, Westonia, Yilgarn. Recorded 1.2 km west of Study Area (southern section, north of King Ingram Road)	Possible
<i>Bossiaea concinna</i>	P3			x		Erect, prickly shrub, 0.4-1.5 m high. Fl. yellow & red/brown, Jun to Sep. White or red sand, gravel. Coolgardie, Cunderdin, Dalwallinu, Jerramungup, Tammin, Williams, Yilgarn. Recorded 58 km west of southern section of Study Area.	Possible
<i>Chorizema circinale</i>	P3			x		Prostrate, scrambling, wiry shrub, to 0.4 m high. Fl. yellow & orange & red, Sep to Dec. Yellow sand, sandy clay with gravel. Flats, margin of gravel pit. Esperance, Kent, Ravensthorpe, Yilgarn. Recorded within Study Area.	Recorded
<i>Daviesia newbeyi</i>	P3			x		Bushy, multi-stemmed, broom-like shrub, 0.25-1.5 m high. Fl. orange/yellow & red, Aug to Oct. Sand or sandy clay over granite. Rocky slopes. Esperance, Lake Grace, Ravensthorpe. Recorded 91 km south of southern end of Study Area. Inclusion in results appears to be an anomaly.	Unlikely

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	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Daviesia uncinata</i>	P3			x		Intricate, many-stemmed shrub, 0.2-0.7 m high. Fl. yellow & brown, Dec or Jan. Gravelly lateritic sand, loamy sand. Undulating plains. Brookton, Bruce Rock, Corrigin, Dumbleyung, Kent, Kulin, Lake Grace, Narrogin, Pingelly, Quairading, Tammin, West Arthur, Yilgarn. Recorded 40 km west of southern end of Study Area.	Unlikely
<i>Eucalyptus exigua</i>	P3			x		(Mallee), 2-5 m high, bark smooth. Fl. white-cream, Mar. Sandy loam, white sand. Sandplains. Coolgardie, Dundas, Kondinin, Lake Grace, Narembeen, Yilgarn. Recorded within Study Area.	Recorded
<i>Eucalyptus ornata</i>	P3			x		Tree, 6-10 m high, bark smooth, grey. Fl. white. Laterite. Ridges. Kondinin, Kulin, Lake Grace, Narembeen. Recorded 54 km west of southern end of Study Area.	Unlikely
<i>Eucalyptus polita</i>	P3			x		Tree or (rarely mallee), 3-10 m high, bark smooth, glossy green leaves. Loam, sand. Around salt lakes, flats. Coolgardie, Dundas, Esperance, Kondinin, Yilgarn. Recorded within Study Area.	Recorded
<i>Gompholobium cinereum</i>	P3			x		Shrub, to 0.3 m high. Yellow sand, clayey sand, brown loam, sandy gravel, laterite. Well-drained open sites, slopes, plains, roadsides. Coolgardie, Dalwallinu, Greater Geraldton, Mount Marshall, Northampton, Perenjori, Yilgarn. Recorded 25 km south-west of Study Area.	Possible
<i>Grevillea insignis</i> subsp. <i>elliottii</i>	P3			x		Erect, bushy, non-lignotuberous shrub, 1-2 m high. Fl. red/pink & cream & white, Oct. Gravelly sand or loam over ironstone. Hilltops or rises. Kondinin, Lake Grace, Narembeen. Recorded 54 km west of southern end of Study Area.	Unlikely

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<i>Grevillea pilosa</i> subsp. <i>redacta</i>	P3			x		Spreading to prostrate, non-lignotuberous shrub, 0.4-1.2 m high. Fl. red, Feb or Oct or Dec. Sand, laterite. Kondinin, Kulin, Lake Grace, Yilgarn. Recorded 1.4 km south-east of the southern end of the Study Area.	Possible
<i>Hakea pendens</i>	P3			x		Shrub, 2-3 m high, 2.5-3.1 m wide. Fl. pink-white, Sep. Stony loam. Ironstone ridges. Dundas, Yilgarn. Recorded within Study Area.	Recorded
<i>Lepidium genistoides</i>	P3			x		Spreading, dense shrub, 0.25-0.6 m high. Fl. white, Sep to Oct. Sandy loam. Dalwallinu, Koorda, Merredin, Mount Marshall, Mukinbudin, Westonia, Wyalkatchem, Yilgarn. Recorded 7.3 km north-east of Study Area.	Possible
<i>Lepidosperma</i> sp. Pigeon Rocks (H. Pringle 30237)	P3			x		Perennial sedge. Granite rock, granitic sandy loam. Coolgardie, Lake Grace, Menzies, Yilgarn. Recorded 16.5 km north-west of northern end of Study Area.	Unlikely
<i>Styphelia subglaucia</i> (previously <i>Leucopogon</i> sp. Ironcaps (N. Gibson & K. Brown 3070))	P3			x		Erect shrub to 0.8m high with white flowers. Sand over laterite. Kondinin, Merredin, Narembreen, Yilgarn. Recorded 47 km west of Study Area in Welsh Nature Reserve.	Unlikely
<i>Melaleuca ochroma</i>	P3			x		Kondinin, Lake Grace, Yilgarn. Shrub growing 0.7 to 2.5 m tall. Bark is hard and fibrous. Occurs within <i>Melaleuca</i> shrubland, containing emergent mallee eucalypts and Wandoo, <i>Grevillea huegelii</i> over brown clay, whitish sandy-clay, brown clay loam and sandy loam (GHD, 2020). Recorded 900 m west of Study Area, adjacent Jilbadgi Nature Reserve.	Possible



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	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Notisia intonsa</i>	P3			x		Herbaceous annual to 4cm. Coolgardie, Dundas, Kalgoorlie-Boulder, Kondinin, Menzies, Ravensthorpe, Yilgarn. Recorded within Study Area.	Recorded
<i>Oxymyrrhine plicata</i>	P3			x		Spreading shrub to 0.4m tall with white flowers. Esperance, Kondinin, Kulin, Lake Grace. Recorded 22 km south-east of southern end of Study Area.	Possible
<i>Persoonia cymbifolia</i>	P3			x		Erect, spreading shrub, 0.2-0.6(-1) m high. Fl. yellow, Dec or Jan. Sandy soils. On flats or in rock crevices. Esperance, Lake Grace, Yilgarn. Recorded 9.3 km south-west of southern end of Study Area.	Unlikely
<i>Pultenaea daena</i>	P3			x		Dense, prostrate, domed shrub, to 0.07 m high. Fl. yellow, Mar. White to yellow sand or sandy loam, sandy or loamy clay, gravel, limestone, dolomite, laterite. Gently undulating plains, adjacent to salt lakes, in disturbed areas. Recorded 32 km south of southern end of Study Area.	Unlikely
<i>Phlegmatospermum eremaeum</i>	P3			x		Prostrate to spreading annual, herb, 0.02-0.1(-0.2) m high. Fl. white-cream, Jun or Aug to Oct. Stony loam. Coolgardie, Dundas, Esperance, Kalgoorlie-Boulder, Narembeen, Ravensthorpe, Yilgarn. Recorded 16 km east of Study Area (within Battler Mine tenement, south-east of Southern Cross).	Possible
<i>Rinzia torquata</i>	P3			x		Shrub 1.4 m tall and 1.5 m across Kondinin, Kulin, Lake Grace, Merredin, Narembeen, Yilgarn. Recorded within Mt Parker Range minesite, approximately 500 m from Study Area.	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Rinzia triplex</i>	P3			x		Coolgardie, Menzies, Yilgarn. Perennial shrub growing to 1 m high and 0.6 m wide. Occurs on flat and undulating plains of yellow sandy clay loam with lateritic gravel (GHD, 2020). Previously recorded on boundary of Study Area (within privately owned agricultural land).	Recorded
<i>Seringia adenogyna</i>	P3			x		Low shrub. Albany, Dundas, Esperance, Gnowangerup, Jerramungup, Kondinin, Lake Grace, Yilgarn. Recorded 6.4 km south-east of southern end of Study Area.	Possible
<i>Stylidium choreanthum</i>	P3			x		Creeping perennial, herb, 0.01-0.03 m high, to 0.3 m wide. Fl. pink/white, Sep to Nov. White/yellow or red sand. Plains. Coolgardie, Menzies, Yilgarn. Recorded 10.5 km west of Study Area (near Moorine South Road).	Possible
<i>Stylidium sejunctum</i>	P3			x		Caespitose perennial, herb, 0.25-0.45 m high, Leaves tufted, linear to narrowly oblanceolate, 10-30 cm long, 0.8-4 mm wide, apex acute to mucronate, margin involute, glabrous to scabrous. Membranous scale leaves present at base of mature leaves. Scape glandular throughout. Inflorescence paniculate. Fl. white/pink-purple, Sep to Nov. Clayey sand or loam, laterite. Outcrops, upper slopes, breakaways. Mallee and Allocasuarina shrubland. Dundas, Esperance, Kondinin, Kulin, Lake Grace, Yilgarn. Recorded 8.7 km south-east of southern end of Study Area.	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Teucrium diabolicum</i>	P3			x		Dundas, Esperance, Kondinin, Yilgarn. Virgate, perennial subshrub, c. 10–20 cm high, suckering from a thick woody rootstock. Fl. white in Autumn and Spring. Known from a small number of locations in Western Australia's Coolgardie bioregion, mostly between Hyden and Norseman but with one record from near Southern Cross. It grows in red cracking clay or clay loam, usually in shallow depressions or on low undulating plains that support low scrub or heath, or in association with low open woodland (Wege and Davis, 2020). Recorded 22 km east of northern end of Study Area.	Possible
<i>Verticordia gracilis</i>	P3			x		Low, slender shrub, 0.15-0.6 m high. Fl. pink, Oct to Nov. Yellow sand, gravelly sand, sandy loam. Kondinin, Lake Grace, Merredin, Yilgarn. Recorded within Study Area.	Recorded
<i>Verticordia mitodes</i>	P3			x		Spreading shrub, 0.15-0.7 m high. Fl. pink-purple, Oct to Dec or Jan. Yellow sand. Undulating plains. Coolgardie, Merredin, Narembeen, Nungarin, Westonia, Yilgarn. Previously recorded within Study Area.	Recorded
<i>Verticordia stenopetala</i>	P3			x		Shrub, 0.2-0.6(-1.3) m high. Fl. pink/pink-purple-red, Oct to Dec or Jan. Yellow sand, sometimes with gravel. Undulating plains. Previously recorded within Study Area.	Recorded
<i>Banksia shanklandiorum</i>	P4			x		Upright, non-lignotuberous shrub, 0.4-2.5 m high, to 3 m wide. Fl. Jun to Aug. White/yellow sand with lateritic gravel. Dowerin, Merredin, Narembeen, Westonia, Wongan-Ballidu, Yilgarn. Recorded 1.4 km west of Study Area (on the track to Parker Rang South).	Possible

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	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Eremophila biserrata</i>	P4			x		Prostrate shrub, to 3 m wide. Fl. green/yellow-green, Sep to Nov or Mar. Sandy or sandy clay soils. Alluvial flats, salt flats and lakes. Esperance, Kondinin, Lake Grace. Recorded 18 km south-east of southern end of Study Area.	Possible
<i>Eremophila caerulea</i> subsp. <i>merrallii</i>	P4			x		Spreading or sprawling shrub, to 0.35 m high, to 0.8 m wide. Fl. blue-purple, Oct to Dec. Sand, clay or loam. Undulating plains. Bruce Rock, Coolgardie, Kulin, Yilgarn. Recorded 2.3 km west of Study Area within Jilbadgi Nature Reserve.	Possible
<i>Eremophila inflata</i> (formerly <i>Calamphoreus inflatus</i> )	P4			x		Kondinin, Lake Grace, Yilgarn. Erect shrub 0.5 – 3 m tall, occurs in light brown clay loam often with a stony surface, in <i>Eucalyptus</i> woodland (Gimlet and <i>E. longicornis</i> ). Occurs in open areas and on disturbed soils (GHD, 2020). Previously recorded 2.1 km east of the Study Area.	Possible
<i>Eremophila racemosa</i>	P4			x		Erect shrub, 0.5-1.7 m high. Fl. purple-pink-red/white, Mar or Aug to Dec. Sandy or stony loam, clay loam. Undulating plains, roadsides. Dundas, Esperance, Kondinin, Yilgarn. Recorded 7 km south-west of southern end of Study Area.	Possible
<i>Eremophila serpens</i>	P4			x		Prostrate, creeping, forming large patches shrub, 0.03-0.4 m high, forming large patches to 2 m wide. Fl. green/yellow-green, Sep to Dec or Mar to May. White/grey sand, alluvium, loam. Winter-wet depressions, sub-saline flats, drainage lines, salt lakes. Dundas, Esperance, Jerramungup, Kent, Kondinin, Lake Grace, Yilgarn. Recorded 36.4 km west of Study Area (near boundary of cleared agricultural area)	Possible

Taxon	Conservation rank			Database source		Description, habitat and current known distribution (local government areas) (WAH, 1998-; DBCA, 2022f)	Likelihood within Study Area
	DBCA	BC Act	EPBC Act	TPFL/ WAH	PMST		
<i>Eucalyptus georgei</i> subsp. <i>fulgida</i>	P4			x		Tree, 4-20 m high, bark smooth, often hanging in ribbons. Fl. cream-white. Sandy loam, clayey sand. Slight depressions. Dundas, Kondinin, Lake Grace, Yilgarn. Recorded 8.6 km south-east of southern end of Study Area.	Possible
<i>Grevillea neodissecta</i>	P4			x		Coolgardie, Dundas, Kondinin, Yilgarn. Low, rounded prickly shrub growing to 0.3 – 1 m tall. Occurring on sand over laterite, and clay loam (GHD, 2020). Recorded 5.9 km east of Study Area within Jilbadgi Nature Reserve.	Possible
<i>Gyrostemon ditrigynus</i>	P4			x		Shrub, 0.4-1.5 m high. Sand, sandy clay, loam. Plains, low ironstone ridges. Dundas, Esperance, Kondinin, Kulin, Lake Grace, Ravensthorpe, Yilgarn. Recorded 9.3 km south-east of southern end of Study Area.	Possible
<i>Microcorys</i> sp. Forrestania (V. English 2004)	P4			x		Prostrate or erect shrub, 0.35-0.4 m high. Fl. white/purple, Jan or Apr. Yellow sandy clay or red-brown clay. Open woodland or cleared areas. Kondinin, Yilgarn. Recorded 9 km south-east of southern end of Study Area.	Possible
<i>Myriophyllum petraeum</i>	P4			x		Aquatic annual, herb, stems 0.15-0.3 m long. Fl. white, Aug to Dec. Strictly confined to ephemeral rock pools on granite outcrops. Coolgardie, Dundas, Esperance, Kondinin, Lake Grace, Narembeen, Westonia, Yilgarn. Recorded within Study Area.	Recorded
<i>Stenanthemum bremerense</i>	P4			x		Erect or low and spreading shrub, (0.2-)0.3-0.6(-1.4) m high. Orange-brown sandy loam, orange-red gravelly loam, skeletal red loam, laterite, ironstone. Top or sides of outcrops and breakaways. Dundas, Esperance, Yilgarn. Recorded 6.8 km south-east of southern end of Study Area.	Possible



#### 4.1.2. Threatened and Priority Ecological Communities

The Study Area intersects the mapped buffer zones of three ecological communities of conservation significance (DBCA, 2022d) (Figure 9):

- ‘Ironcap Hills vegetation assemblages (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone formation)’ PEC (Priority 3);
- ‘Plant Assemblages of the Parker Range System’ PEC (Priority 3); and
- ‘Eucalypt Woodland of the Western Australian Wheatbelt’ PEC (Priority 3). This PEC is synonymous with the Commonwealth listed TEC under the *EPBC Act*.

A fourth PEC is located approximately 2.7 km west of the Study Area within the Frog Rock Nature Reserve (Figure 9); ‘Granite outcrop pools with endemic aquatic fauna’ PEC (Priority 3).

A section of the Study Area (~160 ha) along the Marvel Loch Road -Forrestania Road falls within the mapped buffer zone of the ‘Ironcap Hills vegetation assemblages’ PEC (Figure 9). The Mt Holland/Earl Grey mine is located within the buffer of this PEC however flora and vegetation surveys conducted by Mattiske Consulting (2018) across the site found that none of the landforms or corresponding species communities associated with the PEC were present.

The ‘Ironcap Hills vegetation assemblages’ PEC is characterised as assemblages on skeletal soils derived from banded ironstone and massive laterites on deeper soils derived from greenstone or decomposing laterites and includes the following vegetation units as described in Gibson (2004):

- species-rich shrublands and mallee shrubland on massive outcrops;
- mallee shrublands and *Allocasuarina* thickets on massive laterite;
- Eucalypt woodlands of *Eucalyptus urna* and *E. salubris* on colluvial flats beneath outcrops or on broad flat ridges, with understorey of *Melaleuca* spp;
- species-poor mallee community dominated by *Eucalyptus calycogona* with emergent *E. salmonophloia* (or occasionally *E. longicornis*) on small colluvial flats in the ranges (DBCA, 2022e).

Approximately 3,760 ha of the Study Area lies within the ‘Plant Assemblages of the Parker Range System’ PEC buffer (Figure 9). This PEC includes all the vegetation units of the Parker Range, as originally described in Beard (1979), including:

- *Eucalyptus sheathiana* with *E. transcontinentalis* and/or *E. eremophila* (now *E. tenera* or *E. tephroclada* in this region) woodland on sandy soils at the base of ridges and low rises;
- *E. longicornis* with *E. corrugata* and *E. salubris* or *E. myriadena* woodland on broad flats;
- *E. salmonophloia* and *E. salubris* woodland on broad flats;
- *Allocasuarina acutivalvis* and *A. corniculata* on deeper sandy soils of lateritic ridges;

- *E. capillosa* (formerly subsp. *polyclada*) and/or *E. loxophleba* (now subsp. *lissophloia*) over *Hakea pendens* thicket on skeletal soils on ridges (laterites, breakaways and massive gossanous caps); and
- *Callitris glaucophylla* low open woodland on massive greenstone ridges (vegetation units as described in Gibson and Lyons, 1998) (DBCA, 2022e).

Within the boundary of the Jilbadgi Nature Reserve, approximately 202 ha of the Study Area intersects the buffer of the 'Eucalypt Woodland of the Western Australian Wheatbelt' PEC/TEC (Figure 9). This PEC/TEC occurs in the IBRA Avon Wheatbelt 1 and 2 and Western Mallee subregions. It also includes outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range, and receive less than 600 mm mean annual rainfall (DBCA, 2022e).

The PEC/TEC is a woodland in which the minimum mature crown cover of the tree canopy is 10%. The key dominant or co-dominant species of the tree canopy are species of *Eucalyptus* trees that typically have a single trunk - most commonly Salmon Gum (*Eucalyptus salmonophloia*), York Gum (*Eucalyptus loxophleba*), Red Morrel (*Eucalyptus longicornis*) or Gimlet (*Eucalyptus salubris*). Several of the other emergent eucalypt species which may be present as a defining species (e.g. Kondinin Blackbutt (*E. kondininensis*), *E. myriadena*, Salt River Gum (*E. sargentii*), Silver Mallet (*E. ornata*) and Mallet (*E. singularis*) are found only in the WA Wheatbelt. Native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs (DoE, 2015).

The mapping of this PEC/TEC within WA represents the indicative present distribution of the ecological community. Ground-truthing is required to verify if a particular site meets the required diagnostic characteristics and minimum condition and size thresholds to be deemed to be the described PEC/TEC (DBCA, 2022e).

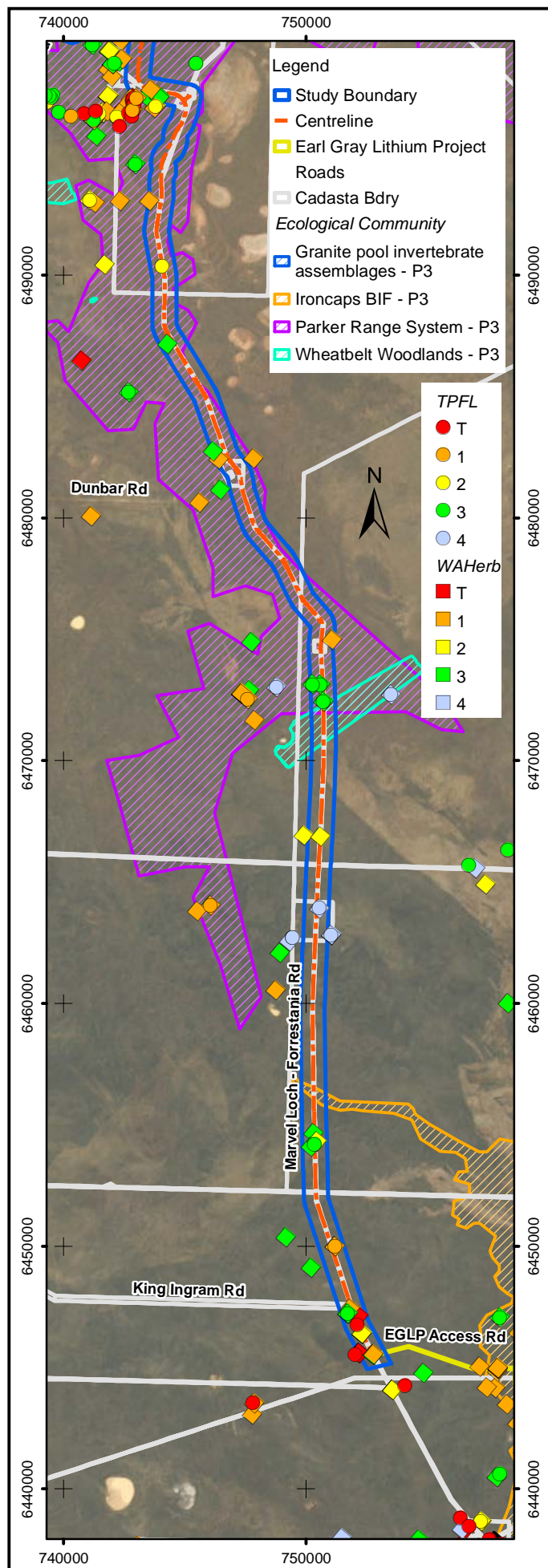
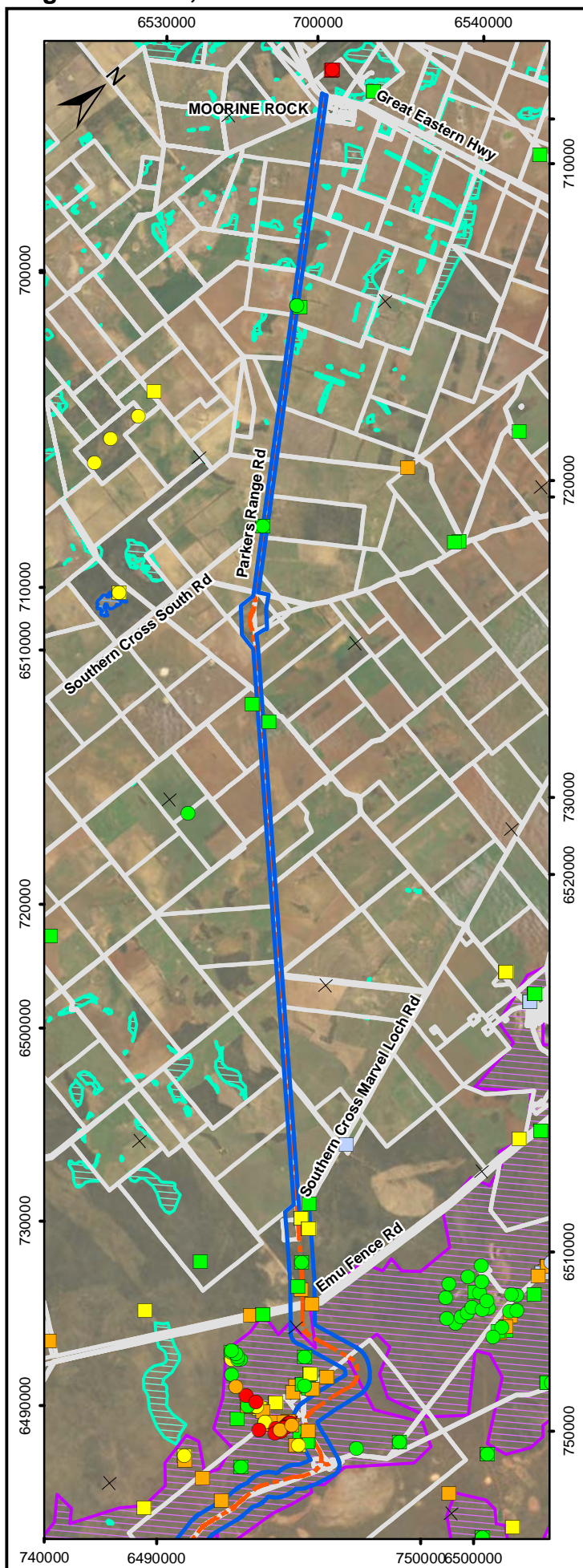
The 'Granite outcrop pools with endemic aquatic fauna' PEC, located approximately 2.7 km from the Study Area within the Frog Rock Nature Reserve, relates to the freshwater pool that may form on the granite outcrop (Frog Rock). Such pools may persist for several months and house a variety of aquatic invertebrates, some of which are endemic to south-west WA (DBCA, 2022e). This landform occurs within the Wockallarry Nature Reserve, bisected by the Parker Range Road, within the Study Area.

#### 4.1.3. Invasive Species

Within the Shire of Yilgarn there are currently 48 flora taxa listed as Declared Pests under Section 22(2) of the BAM Act (DPIRD, 2023c). This includes 29 taxa which are listed as Weeds of National Significance (WoNS) (DAWE, 2023b) (Appendix 5). The literature review of botanical surveys conducted in the area (Table 6) indicated no Declared Pests or WoNS to have been recorded. A weed survey of areas of disturbance within the Earl Grey Lithium Project development envelope, conducted by Mattiske Consulting between 2019 – 2020, recorded 16 weed species across the site, of which *\*Carrichtera annua* (Wards Weed) was the most widespread.

**Figure 9. Regional Threatened and Priority Flora and Priority Ecological Communities**

# Earl Grey Lithium Project Parkers Range Rd and Marvel Loch-Forrestonia Rd Upgrade Regional TPFL, WAHerb and PEC





## 5. Summary

The information collated from the desktop assessment of the Study Area can be summarised as follows:

- The Study Area intersects the Merredin subregion (AVW-01) of the Avon Wheatbelt bioregion and the Southern Cross subregion (COO-02) of the Coolgardie bioregion. Average annual rainfall is 292.8 mm with monthly rainfall peaking from late autumn throughout winter (BoM, 2023a).
- Located across three regolith and seven bedrock geological units (DMIRS, 2018a; 2018b). The Study Area intersects 13 soil landscape zones (DPIRD, 2023a), which are dominated by the AC1 atlas system (~40% of the Study Area), DD15 atlas system (~19%) and the Ya28 atlas system (~15%).
- Groundwater salinities in the Study Area range predominantly from 14,000 mg/L to 35,000 mg/L (highly saline). Where the Study Area intersects paleochannels (associated with salt lakes) around the Moorine Rock townsite and a section extending approximately 7.8 km south along the Marvel Loch-Forrestania Road from the Parker Range Road intersection, groundwater salinity is >35,000 mg/L (brine) (DWER, 2023a).
- The Study Area is located across two hydrological zones; Northern Zone of Ancient Drainage and Southern Cross Zone (majority of Study Area). It is located entirely within the Avon River Basin in the Swan Avon/Yilgarn hydrographic catchment and traverses the Lake Julia (northern end of Study Area), Yellowdine (mid-section) and Lake Eva (southern end) hydrographic sub-catchments (DPIRD, 2023b).
- Thirteen pre-European vegetation system associations occur across the Study Area (where vegetation remains) with the majority pertaining to Eucalypt woodlands or mallee. The dominant pre-European vegetation associations include Parker\_1068 (41% of the Study Area vegetation), Skeleton Rock\_519 (11%) and Skeleton Rock\_1068 (8%).
- The majority of the Study Area has been mapped as having a low to moderate potential for supporting a terrestrial GDE. The northern end of the Study Area (1 km section at the junction with Great Eastern Highway) is mapped as having a high potential where vegetation remains intact surrounding the Moorine Rock townsite and the granite outcrop located on the northern side of Great Eastern Highway (BoM, 2023b).
- The nearest significant wetland, as listed under the Directory of Important Wetlands in Australia (DBCA, 2023b) is Lake Cronin, located approximately 32 km south of the Study Area.



- The Study Area intersects three ESAs: (i) Jilbadgi Nature Reserve which is listed on the Register of the National Estate; and (ii) Marvel Loch – Forrestania road, roadside vegetation supporting *Banksia dolichostyla* (T) between the intersection of Kind Ingram Road and the turnoff to the minesite; and (iii) the Commonwealth listed 'Eucalypt Woodland of the Western Australian Wheatbelt' TEC under the *EPBC Act* (which is synonymous with the State listed PEC of the same name).
- Database searches (state and national) and the literature review indicate 126 flora taxa of conservation significance have been recorded (or may occur) within a 50 km radius of the Study Area. A total of 20 taxa of conservation significance (one Threatened, five Priority 1, four Priority 2, nine Priority 3 and one Priority 4) have been recorded within the boundary of the Study Area with an additional 66 taxa (three Threatened, 24 Priority 1, eight Priority 2, 20 Priority 3 and 11 Priority 4) assessed as having the potential to occur within the Study Area.
- The Study Area intersects the mapped buffer zones of three ecological communities of conservation significance (DBCA, 2022d);
  - 'Ironcap Hills vegetation assemblages (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone formation)' PEC (Priority 3);
  - 'Plant Assemblages of the Parker Range System' PEC (Priority 3); and
  - 'Eucalypt Woodland of the Western Australian Wheatbelt' PEC (Priority 3). This PEC is synonymous with the Commonwealth listed TEC (of the same name) under the *EPBC Act*.

The 'Granite outcrop pools with endemic aquatic fauna' PEC (Priority 3) is located within the Frog Rock Nature Reserve, approximately 2.7 km from the Study Area. This may also occur on the granite outcrop at the Wockallarry Nature Reserve, within the Study Area.

- The Study Area is located within the western boundary of the Great Western Woodlands until it enters the extensively cleared agricultural zone along Parker Range Road.
- Within the Shire of Yilgarn there are 48 flora taxa listed as Declared Pests, including 29 taxa which are listed as Weeds of National Significance (DAWE, 2023b). The literature review of botanical surveys conducted in the area indicated no Declared Pests or WoNS to have been recorded.

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## **Appendix 1. Department of Biodiversity Conservation and Attractions (DBCA) Framework for Conservation Significant Flora**

## DBCA Conservation Codes for Western Australian Flora

Under the Wildlife Conservation Act 1950, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection.

Specially protected flora are species which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected flora are:

### **T Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).

**Threatened fauna** is that subset of ‘Specially Protected Fauna’ listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

**Threatened flora** is that subset of ‘Rare Flora’ listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

### **CR Critically endangered species**

Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”.

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.

**EN Endangered species**

Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”.

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

**VU Vulnerable species**

Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”.

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

**Extinct species**

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

**EX Extinct species**

Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.

**EW Extinct in the wild species**

Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

### **Specially protected species**

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

### **MI Migratory species**

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

### **CD Species of special conservation interest (conservation dependent fauna)**

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

### **OS Other specially protected species**



Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

## **P Priority species**

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

### **1 Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

### **2 Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

### **3 Priority 3: Poorly-known species**

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

### **4 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 are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

**Last updated 3 January 2019**

## **Appendix 2. DBCA Definitions of Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)**

## DEFINITIONS, CATEGORIES AND CRITERIA FOR THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

### 1. GENERAL DEFINITIONS

#### **Ecological Community**

A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A **threatened ecological community** (TEC) is one which is found to fit into one of the following categories; “presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”.

Possible threatened ecological communities that do not meet survey criteria are added to DEC’s Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

An **assemblage** is a defined group of biological entities.

**Habitat** is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.

**Occurrence:** a discrete example of an ecological community, separated from other examples of the same community by more than 20 meters of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

**Adequately Surveyed** is defined as follows:

“An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts.”

**Community structure** is defined as follows:

“The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage” (e.g. Eucalyptus salmonophloia woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).

**Definitions of Modification and Destruction** of an ecological community:

**Modification:** “changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention.”

**Destruction:** “modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention.”

**Note:** Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgment. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be brought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising water table away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

**Threatening processes** are defined as follows:

“Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community.”

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced microorganisms; direct human exploitation and disturbance of ecological communities.

**Restoration** is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

**Rehabilitation** is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

## **2. DEFINITIONS AND CRITERIA FOR PRESUMED TOTALLY DESTROYED, CRITICALLY ENDANGERED, ENDANGERED AND VULNERABLE ECOLOGICAL COMMUNITIES**

### **Presumed Totally Destroyed (PD)**

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B):

- A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- B) All occurrences recorded within the last 50 years have since been destroyed

### **Critically Endangered (CR)**



An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and s found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):

- i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);
- ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

- i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);
- ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
- iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

### **Endangered (EN)**

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):

- i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);
- ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

- i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

- ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;
- iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

### **Vulnerable (VU)**

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B or C):

- A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
- B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
- C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes

### **3. DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES**

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

#### **Priority One:** Poorly-known ecological communities

Ecological communities that are known from very few occurrences with a very restricted distribution (generally  $\leq 5$  occurrences or a total area of  $\leq 100\text{ha}$ ). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

#### **Priority Two:** Poorly-known ecological communities

Communities that are known from few occurrences with a restricted distribution (generally  $\leq 10$  occurrences or a total area of  $\leq 200\text{ha}$ ). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

#### **Priority Three:** Poorly known ecological communities

- (i) 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 or;
- (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;
- (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

**Priority Four:** 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.

- (i) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.
- (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.
- (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

**Priority Five:** 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.

(Department of Environment and Conservation January 2013)

## **Appendix 3. Protected Matters Search Tool Results**

**Insert PMST Report****Australian Government****Department of Climate Change, Energy,  
the Environment and Water**

## EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-Nov-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



## **Appendix 4. Declared Pests -s22(2) of the Yilgarn Local Government Area**

**Declared Pests - s22(2) of the Yilgarn Local Government Area (DPIRD, 2022c).**

<b>Taxon</b>	<b>Control categories</b>	<b>WoNS</b>	<b>Common name</b>
* <i>Alhagi maurorum</i> Medik.	C3 Management		camelthorn
* <i>Asparagus asparagoides</i> (L.) Druce		Y	bridal creeper
* <i>Austrocylindropuntia cylindrica</i> (Juss. ex Lam.) Backeb.	C3 Management	Y	coral cactus, cane cactus
* <i>Austrocylindropuntia subulata</i> (Muehlenpf.) Backeb.	C3 Management	Y	Eve's pin, Eve's needle
* <i>Calotropis procera</i> (Aiton) W.T.Aiton			rubber bush, calotropis
* <i>Chondrilla juncea</i> L.	C3 Management		skeleton weed, rush skeleton weed, naked weed, hogbite, gum succory
* <i>Cryptostegia madagascariensis</i> Bojer ex Decne.			Rubbervine, Madagascar rubbervine
* <i>Cylindropuntia fulgida</i> (Engelm.) F.M.Knuth	C3 Management	Y	coral cactus, boxing glove cactus
* <i>Cylindropuntia imbricata</i> (Haw.) F.M.Knuth	C3 Management	Y	rope pear, devil's rope
* <i>Cylindropuntia kleiniae</i> (DC.) F.M.Knuth	C3 Management	Y	candle cholla, Klein's pencil cactus, Klein's cholla
* <i>Cylindropuntia pallida</i> (Rose) F.M.Knuth	C3 Management	Y	white-spined Hudson pear, Hudson pear (white-spined)
* <i>Cylindropuntia tunicata</i> (Lehm.) F.M.Knuth	C3 Management	Y	thistle cholla, brown-spined Hudson pear, Hudson pear (brown-spined)
* <i>Echium plantagineum</i> L.			salvation Jane, Paterson's curse
* <i>Hydrocotyle ranunculoides</i> L. f.	C3 Management		water pennywort, spaghetti weed, hydrocotyle, grote waternavel, floating marsh pennywort
* <i>Jatropha gossypifolia</i> L.	C3 Management	Y	cotton-leaf physic-nut, bellyache bush
* <i>Lantana camara</i> L.	C3 Management	Y	wild sage, white sage, red-flowered sage, largeleaf lantana, common lantana
* <i>Moraea flaccida</i> (Sweet) Steud.			one-leaf cape tulip
* <i>Moraea miniata</i> Andrews			two-leaf cape tulip
* <i>Onopordum acaulon</i> L.			stemless thistle
* <i>Opuntia elata</i> Salm-Dyck	C3 Management	Y	Riverina pear
* <i>Opuntia elatior</i> Mill.	C3 Management	Y	red-flower prickly pear

Taxon	Control categories	WoNS	Common name
* <i>Opuntia engelmannii</i> Salm-Dyck ex Engelm.	C3 Management	Y	Engelmann's prickly pear, Engelmann's pear
* <i>Opuntia ficus-indica</i> (L.) Mill.	C3 Management		tuna cactus, sweet pricklypear, spiny pest pear, spineless cactus, prickly pear, mission pricklypear, grootdoringturksvy, Indian fig, Boereturksvy
* <i>Opuntia microdasys</i> (Lehm.) Pfeiff.	C3 Management	Y	teddy bear cactus, golden bristle cactus, bunny ears
* <i>Opuntia monacantha</i> Haw.	C3 Management	Y	drooping tree pear
* <i>Opuntia polyacantha</i> Haw.	C3 Management	Y	plains prickly pear
* <i>Opuntia puberula</i> Hort. Vindob. ex Pfeiff.	C3 Management	Y	nopal de tortuga, nopal de culebra
* <i>Opuntia stricta</i> (Haw.) Haw.	C3 Management	Y	erect prickly pear, common prickly pear
* <i>Opuntia tomentosa</i> Salm-Dyck	C3 Management	Y	velvet tree pear, velvet pear
* <i>Parkinsonia aculeata</i> L.	C3 Management	Y	parkinsonia
* <i>Pistia stratiotes</i> L.	C2 Eradication		water lettuce
* <i>Prosopis glandulosa</i> Torr. x * <i>Prosopis velutina</i> Wooton	C2 Eradication, C3 Management	Y	mesquite
* <i>Rubus anglocandicans</i> A.Newton	C3 Management	Y	Blackberry
* <i>Rubus laudatus</i> A.Berger	C3 Management	Y	early blackberry
* <i>Rubus rugosus</i> Sm.	C3 Management	Y	keriberry, Himalayan blackberry
* <i>Rubus ulmifolius</i> Schott	C3 Management	Y	elmleaf blackberry, Thornfree, Loch Ness, Blacksatin
* <i>Sagittaria platyphylla</i> (Engelm.) J.G.Sm.	C3 Management	Y	sagittaria, delta arrowhead
* <i>Senna alata</i> (L.) Roxb.			seven-golden-candlesticks, ringwormshrub, ringwormbush, ringworm senna, empress-candle-plant, emperor's candlesticks, candlestick senna, candle bush, Christmas-candle
* <i>Senna obtusifolia</i> (L.) H.S.Irwin & Barneby			sicklepod senna, sicklepod, coffeeweed, Javabean, Chinese Senna
* <i>Silybum marianum</i> (L.) Gaertn.			variegated thistle, milkthistle, blessed milkthistle

Taxon	Control categories	WoNS	Common name
* <i>Solanum elaeagnifolium</i> Cav.		Y	white horsenettle, silverleaf nightshade
* <i>Solanum linnaeanum</i> Hepper & P.-M.L.Jaeger			apple of Sodom
* <i>Tamarix aphylla</i> (L.) H.Karst.		Y	tamarisk, flowering cypress, athel tree, athel tamarisk, athel pine, athel
* <i>Ulex europaeus</i> L.	C2 Eradication C3 Management	Y	gorse, furze
* <i>Xanthium spinosum</i> L.	C2 Eradication C3 Management		thorny burweed, spiny cocklebur, spiny clotbur, prickly burweed, piikkisappiruoho, dagger weed, dagger cocklebur, burweed, boetebos, Bathurst burr
* <i>Xanthium strumarium</i> L.	C2 Eradication C3 Management		Sheepbur, sea burdock, rough cocklebur, kra chap, karheasappiruoho, kankerroos, hedgehog burweed, heartleaf cocklebur, ditchbur, common cocklebur, cocklebur, clotbur, buttonbur, burweed, abrojill o, Noogoora burr, Bathurst burr
* <i>Zantedeschia aethiopica</i> (L.) Spreng.			calla lily, arum lily
* <i>Ziziphus mauritiana</i> Lam.	C3 Management		Saucunazi, macaniqueira, m'sau, Indian jujube, Chinese apple

### Control categories as listed under the Biosecurity and Agriculture Management Regulations 2013 (DPIRD, 2022c)

Category	Description
C1	Organisms which should be excluded from part or all of Western Australia.
C2	Organisms which should be eradicated from part or all of Western Australia.
C3	Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Unassigned: Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the Act.



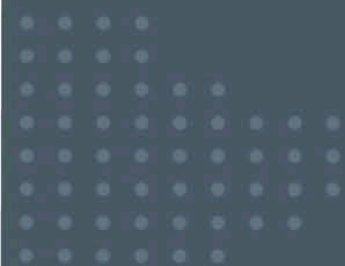




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