Report No. J020347

Targeted conservation significant flora survey of the Lamb Creek project area

Prepared for: Mineral Resources Limited
Date: 11 January 2022

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Revision	Date	Prepared	Reviewed	Approved
Internal Review	21/09/2020	Cielito Marbus	Marieke Weerheim	Kate George
Draft Report V1	25/09/2020	Marieke Weerheim	Marieke Weerheim	Kate George
	01/02/2021		Sarah Osborne (MRL)	
Draft Report V2	09/09/2021	Marieke Weerheim Kate George	Kate George	Kate George
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Executive summary

Mineral Resources Limited (MRL) proposes to develop an iron ore mine with associated haul road and infrastructure at Lamb Creek. The Lamb Creek project area is located approximately 130 kilometres north-west of Newman in the East Pilbara Region of Western Australia and is accessed via the Great Northern Highway.

The Lamb Creek project area is defined as retention licence R47/19 and miscellaneous licences L47/736, L47/974, L47/1008, and M47/1592. Together these tenements cover an area of 2199 hectares. There is significant overlap between the tenements hence this number is not cumulative.

A targeted conservation significant flora survey was conducted over two phases, from 15-29 April 2020 and 12-17 May 2021. The project area at the time of the survey only included R47/19 and L47/736 and the survey area was based on footprint V1 which has now been superseded. The current footprint V3 extends outside of the survey area by 236 hectares (36%).

The targeted survey covered the following survey areas:

- Mining footprint and haul road corridor within R47/19 (271 hectares) – April 2020
- Haul road corridor within L47/736 (388 hectares) – April 2020
- Intersection version B located within L47/974 (57 hectares) – April 2020
- Great Northern Highway intersection within L47/974 (156 hectares) – May 2021

The entire survey area was covered on foot via systematic parallel traverses. Additional searches on foot and via helicopter were made outside the survey area boundaries to map the population extent of target taxa where these extended outside the survey area, and to search opportunistically for target taxa outside of the proposed project footprint.

The survey recorded one threatened flora taxon (*Seringia exastia* – Critically Endangered) from two locations near the Great Northern Highway. The listing of this species is due to a taxonomic revision where a widespread and a Threatened taxon were merged. Communications from the Department of Biodiversity, Conservation and Attractions (DBCA) confirm that the species is likely to be delisted.

Six species of Priority Flora listed by the Department of Biodiversity, Conservation and Attractions (DBCA) were recorded during the survey, comprising one Priority 2 species (*Aristida lazaridis*), four Priority 3 species (*Aristida jerichoensis* var. *subspinulifera*, *Eremophila* sp. Hamersley Range, *Rhagodia* sp. Hamersley (M.E. Trudgen 17794) *Rostellularia adscendens* var. *latifolia* and one Priority 4 species (*Goodenia nuda*).

One potentially undescribed taxon, *Euphorbia* aff. *ferdinandi* was recorded from the Great Northern Highway intersection area. This taxon may represent a new species.

The most significant finding of the survey was an extensive population of the priority two grass *Aristida lazaridis* from the Great Northern Highway intersection area.

1 Introduction

1.1 Project overview

The Lamb Creek Iron Ore Project comprises a proposed mining area, haul road, and associated infrastructure. The project is situated approximately 130 kilometres north-west of Newman in the Pilbara region of Western Australia.

Mineral Resources Limited (MRL) commissioned Rapallo Environmental (Rapallo) to conduct a targeted conservation significant flora survey of the Lamb Creek Iron Ore Project. The work was commissioned in two phases, with fieldwork completed in April 2020 and May 2021. The surveys covered a combined area of 872 hectares, hereafter referred to as the targeted survey area or simply the survey area.

The project area as well as the proposed footprint have undergone several changes since the surveys were completed, as outlined in section 1.3.

The current Lamb Creek project area (January 2022) comprises retention licence R47/19, miscellaneous licences L47/736, L47/974, L47/1008, and mining lease M47/1592. Together these tenements cover an area of 2199 hectares. There is significant overlap between the tenements (see Figure 1.1 and Table 1.2), hence this number is not cumulative.

1.2 Scope and objectives

The scope of the targeted conservation significant flora survey included:

- Review and refine desktop information on conservation significant flora taxa recorded previously within 30 kilometres of the Lamb Creek project area.
- Produce a list of target taxa for the field survey, based on the latest distribution information and habitat requirements of these species.
- Systematic searches for conservation significant flora across the targeted survey area.
- Mapping point locations and population boundaries of conservation significant flora found within the survey area, and extending outside the survey area where relevant.

The objective of the survey was to provide baseline information on conservation significant flora within the Lamb Creek project (survey area only) in order to inform project planning and environmental impact assessment (EIA), to support approval applications.

1.3 Project area, survey area, and survey periods

1.3.1 April 2020

The first targeted survey took place from 15-19 April 2020. The project area at the time comprised retention licence R47/19 and miscellaneous licence L47/736. A proposed disturbance footprint was provided by MRL in March 2020 (footprint V1).

The April 2020 targeted survey covered the entirety of footprint V1 plus an alternative intersection area for the haul road with the Great Northern Highway, referred to as intersection version B. The survey area covered in April 2020 was 716 hectares. Survey effort is mapped in Figure 3.2.

1.3.2 May 2021

The second targeted survey was completed from 12-17 May 2021. Based on the findings from the 2020 targeted survey, MRL identified an additional area near the Great Northern Highway to be covered by targeted surveys. The May 2021 survey area covered an additional area of 156 hectares.

Total area covered by the April 2020 and May 2021 surveys was 872 hectares (Table 1.1). This area will hereafter be referred to as the targeted survey area. Survey effort is mapped in Figure 3.2.

Table 1.1 Survey areas covered by the targeted flora survey

Survey area description	Survey period	Area size [1]
Mining footprint and part of haul road corridor within R47/19	15-29 April 2020	271 ha
Haul road corridor within L47/736	15-29 April 2020	388 ha
Intersection version B	15-29 April 2020	57 ha
Additional areas near the Great Northern Highway	12-17 May 2021	156 ha
Total area covered by the targeted survey		**872 ha**

Footnotes: 1) The targeted survey area extends by 3 hectares outside of the current December 2021 project area.

An updated project footprint (footprint V2) was provided in July 2021 after both field surveys had been completed. Earlier drafts of this report were based on footprint V2. However, this footprint has now been superseded by footprint V3 as outlined in section 1.3.3.

1.3.3 December 2021

A revised project area and proposed footprint (footprint V3) were provided to Rapallo in December 2021. The revised project area included two new miscellaneous licences, which overlapped significantly with the existing tenements. Table 1.2 lists all tenements included in the Lamb Creek Iron Ore project as per December 2021. A map showing tenements and their overlap is presented in Figure 1.1.

Table 1.2 Tenements of the Lamb Creek Iron Ore project

Tenement	Type	Size	Description
R47/19	Retention Licence	1200 ha	Contains proposed mining area, infrastructure, and the eastern terminus of the haul road.
L47/736	Miscellaneous Licence	390 ha	Contains proposed haul road alignment of footprint V1. Now falls mostly within L47/1008 (2 ha outside)
L47/974	Miscellaneous Licence	120 ha	Adjacent to Great Northern Highway, includes intersection version B. Falls entirely within L47/1008
L47/1008	Miscellaneous Licence	999 ha	Proposed haul road and associated infrastructure areas. Covers majority of L47/736 and all of L47/974.
M47/1592	Mining Lease	1200 ha	Same area as R47/19 (pending conversion)

The project area as per December 2021 is 2199 hectares in size. Since there are significant overlaps between the five tenements listed in Table 1.2, this number is not cumulative.

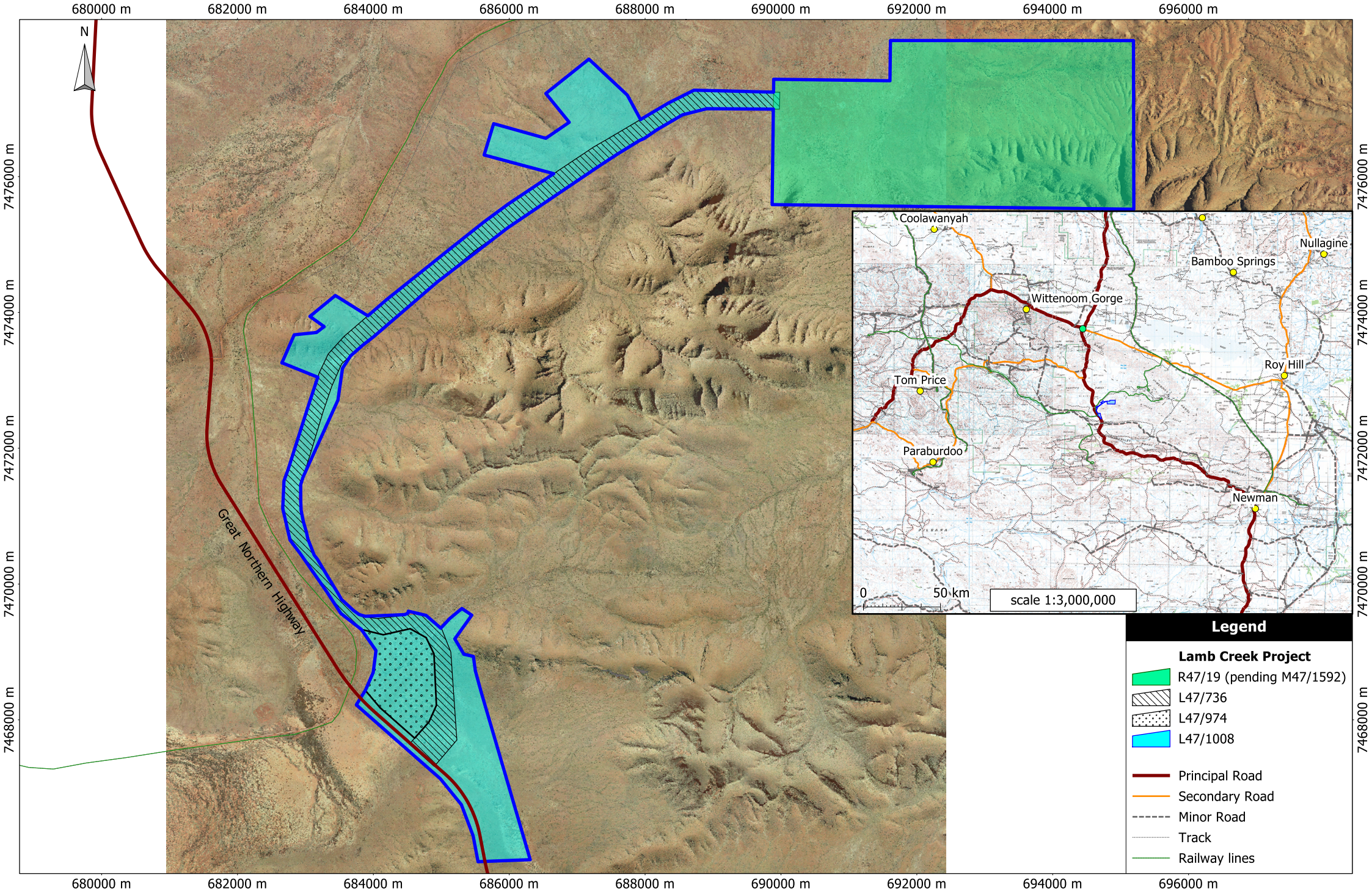
The latest project footprint, provided in December 2021 (footprint V3) is 657 hectares in size. It extends outside of the areas coved by the targeted survey by 236 hectares, hence 36% of proposed footprint V3 remains unsurveyed. The majority of the unsurveyed parts are located in R47/19.

1.4 Definitions

To aid interpretation of this report and associated mapping, Table 1.3 provides explanation of the various components of the Lamb Creek project and associated survey areas, as listed in Table 1.2, and mapped in Figure 1.1 and Figure 1.2.

Table 1.3 Project and survey area definitions

Component	Description
Project area	Project area as per December 2021, comprising tenements R47/19 (pending conversion into M47/1592), L47/736, L47/974, and L47/1008 as listed in Table 1.2. The project area has a total size of 2199 hectares. There is significant overlap between the tenements, so this number is not cumulative.
Survey area	Combined areas covered by the targeted conservation significant flora surveys completed in April 2020 (716 ha) and May 2021 (156 ha) as listed in Table 1.1, totalling an area of 872 hectares. Also referred to as the targeted survey area or the defined survey area, depending on context.
Resource area	General description of R47/19 (M47/1592) in which the proposed mine pit and associated infrastructure will be located.
Haul road corridor	General description of the area in L47/736 in which most of the proposed haul road will be located.
Great Northern Highway intersection (GNHI)	General name given to the area where the proposed haul road intersects the Great Northern Highway. Multiple versions of the intersection have been investigated since March 2020; hence this area is much wider than the rest of the haul road corridor.
Footprint V1	Proposed disturbance footprint provided by MRL in March 2020 and used to develop the initial survey area as defined in section 1.3.
Footprint V2	Revised disturbance footprint provided by MRL in July 2021.
Footprint V3	Revised disturbance footprint provided by MRL in December 2021 and used to calculate impacts to conservation significant flora recorded during the survey.
Adjacent to footprint V3	Within 100 metres of the December 2021 disturbance footprint (footprint V3).
Targeted survey	The combined surveys of April 2020 and May 2021.
Opportunistic records outside of survey area	Individual plants or populations of conservation significant flora recorded outside of the defined survey area, either through mapping of population extent beyond survey area boundaries, ground-truthing helicopter records, or by walking traverses through suitable habitats outside of footprint V1.



Rapallo environmental

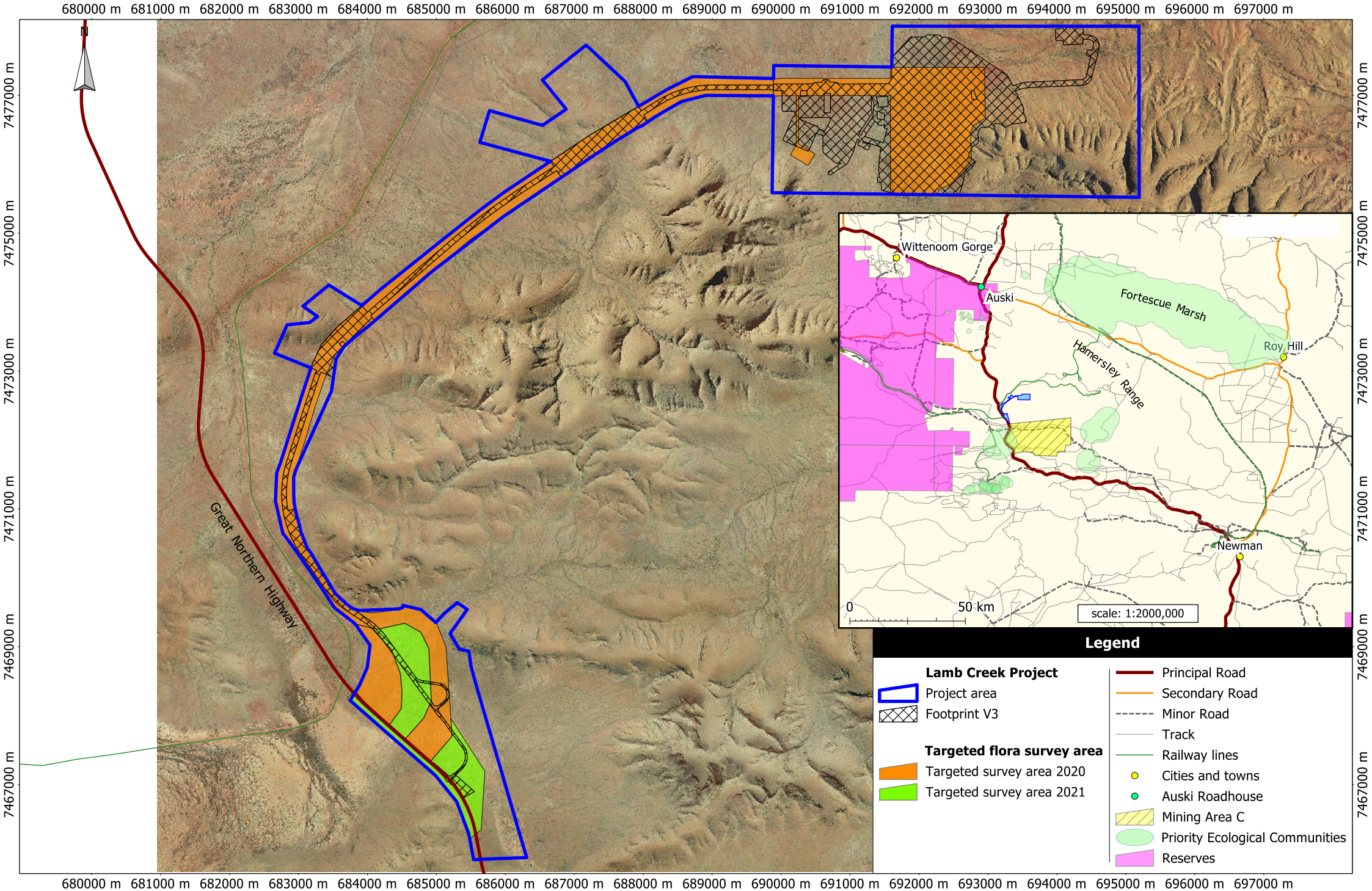
Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:70,000
Datum: MGA94 Zone 50
0 2 km

Figure 1.1

Tenements of the Lamb Creek Iron Ore project area as per December 2021



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Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:70,000
Datum: MGA94 Zone 50
0 2000 m

Figure 1.2

Location of the Lamb Creek project and delineation of the targeted survey area

2 Regional context

2.1 Climate and weather

The Lamb Creek project is situated in the Hamersley subregion (PIL03) of the Pilbara IBRA region, which is part of the Eremaean province (Beard 1990). The climate of the Hamersley IBRA subregion (PIL03) is described as semi-desert tropical. The average rainfall is 300 mm per year, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon (Kendrick 2001). Cyclones develop off the north-west coast and often cross the coastline between Karratha and Port Hedland and move inland over the Fortescue Valley system towards Newman (Beard 1990).

The closest Bureau of Meteorology (BOM) weather station to the survey area is at Newman Airport (station number 007176), located 130 kilometres south-east of the survey area (Figure 1.2). This weather station has been recording rainfall data since 1971 and temperature data since 1996.

Data recorded at Newman Airport (Figure 2.1) shows a mean annual rainfall of 324.3 millimetres (mm). Mean monthly rainfall is highest in February at 70.2 mm, and lowest in September at 3.7 mm. The hottest month is December with a mean maximum temperature of 39.3°C and a mean minimum temperature of 24.1°C. The annual wind records from 9am and 3pm show a dominant easterly throughout the day, with the strongest winds recorded in the morning of up to 30 km/hour (BOM 2021).

Evaporation rates are not recorded at the Newman Airport Weather Station. However, evaporation in the Central Pilbara Region is estimated to be between 2000 mm and 3500 mm per annum, which is approximately ten times greater than annual rainfall (Gardiner 2003). This disparity maintains a typically arid landscape, except for areas located in proximity to river systems and shallow groundwater resources.

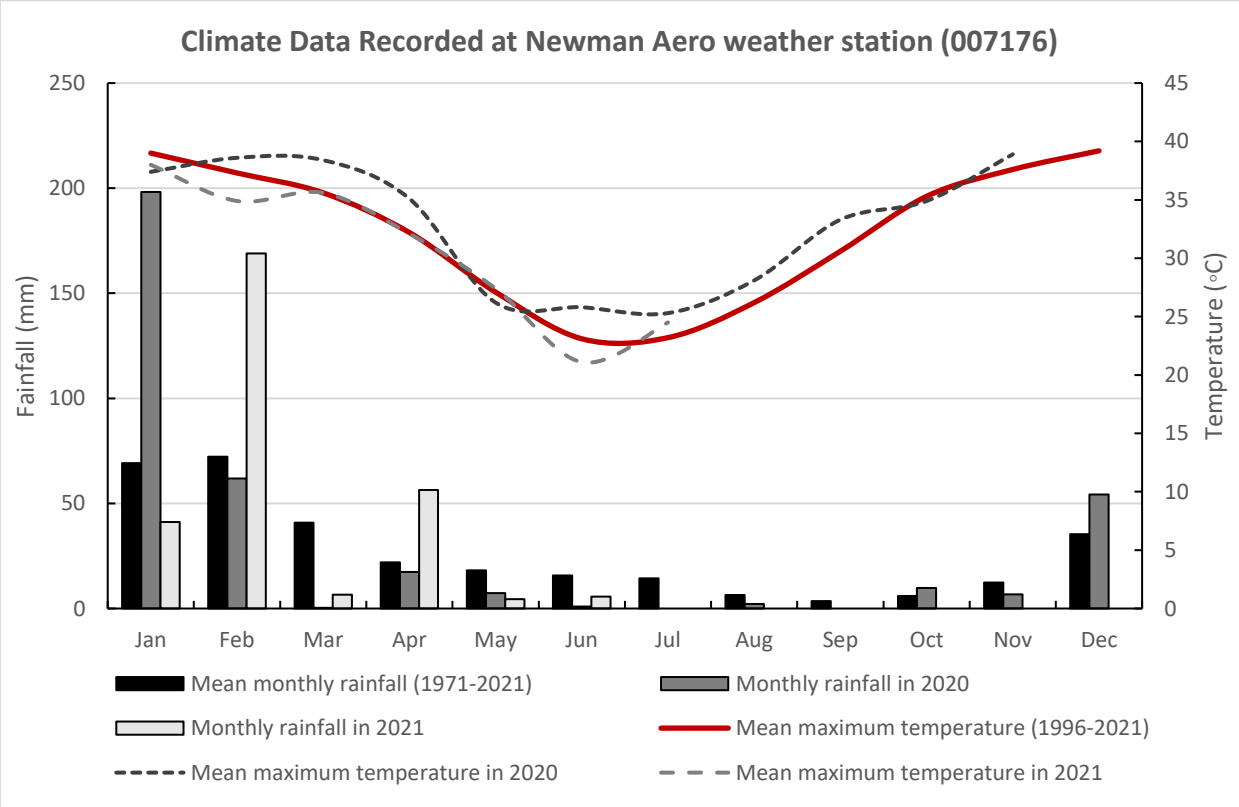


Figure 2.1 Long-term average monthly rainfall and maximum temperature, and 2020 and 2021 monthly rainfall and maximum temperatures recorded at Newman Aero weather station

The 2020 targeted survey was from 15 to 29 April 2020. Rainfall in the three months preceding the survey was higher than average for the region, with a total of 277.8 mm from January to March 2020. Temperatures during the survey were generally warm during the day, ranging from 33.9 °C to 39.7 °C during the day, and mild at night, ranging from 22.9 °C to 26.6 °C (BOM 2021).

The 2021 targeted survey was from 12-17 May 2021. Rainfall over the three months preceding the survey was above average with substantial falls recorded in February (169mm) and April (56.4 mm). Maximum mean temperatures in the month prior to the survey was 32.1 °C in line with the average. Minimum mean temperatures 17.7 °at night as per the average for Newman.

2.2 Biogeography

2.2.1 IBRA bioregions

The bioregions of Australia are described in the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway & Cresswell 1995). Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The latest version, IBRA7, classifies Australia's landscapes into 89 large geographically distinct bioregions and 419 subregions (Department of the Environment and Energy (DotEE) 2012).

The Lamb Creek project is located in the Hamersley (PIL3) subregion of the Pilbara bioregion. The Hamersley subregion comprises the southern section of the Pilbara Craton. It is a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Geographically it is synonymous with the Hamersley vegetation system as described by Beard (1990). The dominant vegetation is mulga low woodland over bunch grasses on fine textured soils in valley floors, and Eucalyptus leucophloia (snappy gum) over *Triodia brizoides* on skeletal soils of the ranges. Regional vegetation is further described in section 2.3. Drainage runs into either the Fortescue River to the north, the Ashburton river to the south, or the Robe river to the west (Kendrick 2001).

2.2.2 Land systems

The Lamb Creek project area traverses five land systems, as mapped by the Western Australian Land Information Authority (2018) and described by Van Vreeswyk *et al*. (2004). These are listed and summarised in Table 2.1.

The majority of the project area falls within the Boolgeeda land system, comprising stony slopes, plains, hills, and drainage floors with spinifex (Table 2.1). This land system underlies the majority of the haul road and resource area.

The Newman land system, comprising rugged mountains, ridges, and plateaux, was the second dominant, intersecting the haul road in two places and covering the south-west and south-eastern corners of the resource area. The McKay and Platform land system occurred in the north-eastern part of the resource area, while the Wannamunna land system only appeared in the southernmost part of the haul road corridor where it intersects the highway.

The vegetation in all but the Wannamunna land system is typified by spinifex grasslands. Wannamunna is characterised by hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands (and occasionally eucalypt woodlands).

Table 2.1 Land systems of the Lamb Creek project area

Name	Land type	Description	Extent
Boolgeeda Land System	Stony plains with spinifex grasslands	Stony lower slopes, stony plains below hills, and narrow sub-parallel drainage floors. Supports hard and soft spinifex grasslands or mulga shrublands. Often occurs below hill systems such as Newman and Rocklea	1330 ha
McKay Land System	Hills and ranges with spinifex grasslands	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands. Relief up to 100 m	44 ha
Newman Land System	Hills and ranges with spinifex grasslands	Rugged high mountains, ridges and plateaux with near vertical escarpments of jaspilite, chert and shale, supporting hard spinifex grasslands. Relief up to 400 m.	499 ha
Platform Land System	Stony plains with spinifex grasslands	Stony upper plains, dissected slopes and drainage floors, supporting hard spinifex grasslands. Erosional surfaces formed by partial dissection of the old tertiary surface. The gently inclined upper plains have extensive marginal dissection zones with gently inclined to steep slopes. Floors incised up to 30 m with steep stable marginal slopes becoming wider downslope.	198 ha
Wannamunna Land System	Wash plains on hardpan with mulga shrublands	Hardpan plains and internal drainage tracts supporting mulga shrubland and woodlands, and occasionally eucalypt woodlands. Depositional surfaces, level hardpan wash plains subject to overland sheet flow. Broad internal drainage flats receiving run-on from adjacent hardpan surfaces; rare channelled tracts but mostly not organised through drainage. Relief up to 5 m.	126 ha

2.2.3 Geology

The project area is located in the south-west corner of the Roy Hill 1:250,000 Geological Survey Sheet (SF50-12: Thorne & Tyler 1997). The geology of the project area is generally defined by the assemblage of prehnite, pumpellyite, epidote, actinolite. Basement rocks comprise the early Proterozoic Brockman Iron Formation and Weeli Wolli Formation. The Brockman Iron Formation consists of banded iron formation (BIF) and shale, while the Weeli Wolli formation consists of BIF separated by shale and siltstone bands, with younger dolerite sills that intersect the sedimentary sequence.

Regionally, the fresh basement rocks are typically overlain by weathered basement rocks which occur as lateritic and basal gravel and/or conglomerate deposits. These weathered deposits underlie early Tertiary Channel Iron Deposits (CID), which are the dominant economic-grade iron deposits in the region. The CID is typically overlain by younger alluvial and colluvial gravels and sediments (Thorne & Tyler 1997).

The project area overlies the following geological units (Thorne & Tyler 1997).

- Brockman Iron Formation (PLHB): banded iron-formation, chert, and pelite (661 hectares);
- Quaternary Alluvium (Qa): unconsolidated silt, sand, and gravel; in drainage channels and on adjacent floodplains;
- Quaternary Alluvium and Colluvium (Qw): red-brown sandy and clayey soil; on low slopes and sheetwash areas; and
- Cainozoic Colluvium (Czc): partly consolidated quartz and rock fragments in silt and sand matrix; old valley-fill deposits.

2.2.4 Soils

The project area is located within the Fortescue botanical district of the Pilbara region (Beard 1990). This region is mountainous, with soils ranging from shallow, stony sandy loams along slopes, to cracking clays, stripped hardpans and calcareous loams along active waterways (Beard 1990).

The landforms of the project area are typical of the eastern Pilbara with rocky hills, small gorges, mostly seasonal watercourses and gravelly loam valleys. The soils are typified by hard red alkaline soils on plains, pediments and alluvial areas, while shallow, skeletal soils are common on ranges that rise to 1,250 metres (Beard 1990). The southern part of eastern Pilbara region is characterised by earthy loams underlain by red-brown hardpan (Beard 1975, 1990).

The project area has two distinct soil and landform assemblages. The eastern and western edges of R47/19 and the majority of the proposed haul road are characterised as soil unit Fa13 (1039 hectares). The central parts of R47/19 and the area adjacent to the Great Northern Highway are characterised as soil unit Fb3 (1160 hectares). These soil units are defined as follows (CSIRO Australia 2018):

- Fa13 – Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations with some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains; and
- Fb3 – High-level valley plains set in extensive areas of unit Fa13. There are extensive areas of pisolitic limonite deposits: principal soils are deep earthy loams (Um5.52) along with small areas of (Gn2.12) soils.

2.2.5 Hydrology

Within the Hamersley (PIL3) subregion drainage runs into either the Fortescue River to the north, the Ashburton river to the south, or the Robe river to the west (Kendrick 2001). The majority of the project area falls within the Fortescue River Upper Catchment with a smaller portion occurring within the Ashburton River Catchment. Nine intermittent creek lines bisect the survey area, draining into the larger Marillana Creek, and ultimately into Weeli Wooli Creek within the Fortescue River basin.

2.2.6 Topography

The project area occurs within the central Hamersley Ranges which dominate the sub-region (Thorne & Tyler 1997). The topography of the region is highly mountainous comprising three smaller ranges: Packsaddle Range in the centre, Jirrpalpur Range in the south and the Hancock Range to the north. The uplands of the survey area fall within the western edge of the Hancock Range.

The project area is located on the western edge of the Hancock Range, a location predominantly characterised by plain and valley floor. The south-eastern corner of the survey area contains significant rocky landforms associated with the Hancock Range.

2.3 Vegetation Communities

2.3.1 Botanical district

The Lamb Creek project area is situated in the Fortescue botanical district of the Pilbara region (Beard 1990), which forms part of the Eremaean Botanical Province. The Pilbara region receives a slightly higher than average rainfall compared to most of the Eremaean, due to the prevalence of cyclones off the coast, but this is not enough to modify the essentially desert appearance of the plant cover (Beard 1990).

The Fortescue botanical district consists predominantly of tree and shrub steppe communities with Eucalyptus trees, Acacia shrubs and spinifex grasses including *Triodia pungens* and *T. wiseana* (Beard 1975). Mulga (species of the *Acacia aneura* complex) occurs in valleys and short-grass plains may be present on alluvial soils (Beard 1990).

2.3.2 Vegetation system-associations

Digital maps (shapefiles) of pre-European vegetation communities, based on state-wide mapping by J.S. Beard at 1:250,000 scale, are published by the Department of Primary Industries and Regional Development (Beard 2018).

Vegetation of the Hamersley (PIL3) IBRA subregion is generally low Mulga woodland over bunch grasses on fine textured soils in the valleys with snappy gums (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001). The mountain tops and gorges of the Hamersley subregion provide refugia for humidophile and/or fire intolerant flora, and support a diversity of range-restricted species (Kendrick 2001).

Beard (1975) mapped the vegetation system-associations of the project area as Hamersley 18: Low woodland of Acacia aneura, and Hamersley 82: Hummock-grass (*Triodia wiseana*) steppe with irregularly scattered *Eucalyptus brevifolia* trees; and Hamersley 18: Low woodland of *Acacia aneura*.

Table 2.2 Beard vegetation system-associations within the Lamb Creek project area (R47/19 and L47/736)

Beard Vegetation System and Association	Extent in project area	Total current extent in Australia (ha) [1)]	Pre-European extent remaining (%) [1)]
Hamersley 18	1297 ha	575 852 ha	99.2%
Hamersley 82	902 ha	2 157 841 ha	99.4%

Footnotes: 1) Numbers from 2018 Statewide Vegetation Statistics (DBCA 2019)

Vegetation that is not a Threatened or Priority Ecological Community may still be considered significant if it has a restricted distribution, or has experienced a degree of historical impact from threatening processes (EPA 2016a). Vegetation types retaining less than 30% of their pre-European extent generally experience accelerated species loss at an ecosystem level (EPA 2000) and are regarded as being 'vulnerable', while vegetation types retaining less than 10% of their original extent are regarded as being 'endangered' (EPA 2000, Shepherd *et al.* 2002, DER 2014a, 2016a).

As presented in Table 2.2, the Hamersley 18 and Hamersley 82 vegetation system-associations intersected by the project area still have close to 100% of their original extent remaining, and would be considered 'least concern' (DER 2014a).

2.3.3 Lamb Creek vegetation mapping

To date two detailed flora and vegetation surveys have been completed at Lamb Creek, in 2012 and 2021, as summarised in Table 2.3. The survey areas partially overlapped, together covering 1605 hectares (73%) of the project area. Approximately 594 hectares (27%) of the current Lamb Creek project area remains unsurveyed (beyond Rapallo's scope of works).

Table 2.3 Existing flora and vegetation surveys

Report title	Survey dates	Survey coverage over project area
Rapallo (2012) Level 2 flora and vegetation survey of the Lamb Creek project	March-April 2012	1394 hectares (63%) of the current project area including entirety of R47/19 and 45% of L47/746
Rapallo (2021a) Detailed flora and vegetation survey of the Great Northern Highway intersection area of the Lamb Creek project	May 2021	252 hectares (11%) of the current project area, comprising southern end of L47/1008

The majority of the project area has been burnt over recent years (after the 2012 survey), with some parts burnt several times (section 2.5). Floristic data and site photos collected in 2020 and 2021 indicate that these fires have changed both vegetation structure and floristic composition relative to 2012 (Rapallo 2021a). The 2021 survey was completed post-fire, but only overlapped with the 2012 survey area by 41 hectares. Re-surveying the 2012 vegetation mapping was beyond Rapallo's scope of works.

2.3.3.1 Lamb Creek flora and vegetation survey March-April 2012

The 2012 flora survey recorded six vegetation types, as listed in Table 2.4. The most widely occurring vegetation type in 2012 was VT1 described as *Eucalyptus gamophylla* woodland over hummock grassland (Table 2.4).

Table 2.4 Vegetation types of the Lamb Creek project area recorded in 2012 (Rapallo 2012).

Type	Vegetation description (2012)	Substrate/Landform	Land System
VT1 – *Eucalyptus gamophylla* woodland over hummock grassland	*Eucalyptus gamophylla* low open woodland over *Acacia elachantha* or **Acacia hilliana*, *Senna glutinosa* subsp. *pruinosa* open shrubland over *Triodia brizoides*, *Triodia wiseana* hummock grassland.	Clay loams with BIF and ironstone pebbles and gravel on open plains and gentle rises.	Boolgeeda, McKay, Newman, Platform
VT2 – *Eucalyptus leucophloia* subsp. *leucophloia* woodland over mixed shrubs over *Triodia wiseana* grassland	*Eucalyptus leucophloia* subsp. *leucophloia*, *Eucalyptus gamophylla* low open woodland over mixed species (typically *Gossypium robinsonii*, *Acacia hilliana*, *Grevillea wickhamii*, *Seringia nephrosperma*) scattered shrubs over *Triodia wiseana* hummock grassland.	Clays and clay loams with BIF and ironstone pebbles, cobbles, and sheetrock in gorges and rocky creeklines and on hillsides and breakaways.	Boolgeeda, Platform
VT3 – *Acacia* shrubland over hummock grassland	*Acacia bivenosa* or *Acacia adsurgens* open shrubland over *Triodia vanleeuwenii*, *Triodia wiseana* hummock grassland.	Sandy clay with ironstone gravel and pebbles on gentle slopes at bases of hills.	Boolgeeda, Newman
VT4 – *Acacia tumida* var. *pilbarensis* scrub in creeklines	*Acacia tumida* var. *pilbarensis* tall open scrub over *Themeda triandra* tussock grassland and *Triodia wiseana* open hummock grassland.	Clay loam and sandy clay with laterite pebbles in drainage lines.	Boolgeeda, Platform

Type	Vegetation description (2012)	Substrate/Landform	Land System
VT5 – Wannamunna Mulga grove	*Acacia aptaneura* low woodland over *Themeda triandra*, *Cymbopogon ambiguus*, *Chrysopogon fallax* open tussock grassland.	Sandy clay and clay on flat plains.	Boolgeeda, Wannamunna
VT6 – *Acacia aptaneura* over hummock grassland	*Acacia aptaneura* and/or *Corymbia deserticola* low woodland over *Acacia elachantha* and mixed *Eremophila* species over *Triodia wiseana* very open hummock grassland.	Broad open drainage system through stony plains with clay soils.	Boolgeeda, Wannamunna

2.3.3.2 Lamb Creek flora and vegetation survey May 2021

The 2021 survey was completed post-fire. Six vegetation types were recorded, and vegetation mapping was revised for the overlap area with the 2012 survey. The entirety of the 2012 vegetation type VT6 has been superseded by 2021 vegetation types C and D, while VT5 occurring in the overlap area has been superseded by 2021 vegetation types A, B, C and D.

Table 2.5 Vegetation types of the Great Northern Highway intersection recorded in 2021 (Rapallo 2021a)

Type	Vegetation description (2021)	Substrate	Land System
A - Low open *Eucalyptus gamophylla* woodland over *Triodia melvillei* and *T. pungens* on stony plain	*Eucalyptus gamophylla* (mallee) and *Corymbia deserticola* subsp. *deserticola* low open woodland; over *Acacia pruinocarpa*, *A. ancistrocarpa*, *A. atkinsiana* sparse shrubland; over isolated low shrubs; over isolated dwarf shrubs; over *Ptilotus calostachyus*, *Ptilotus obovatus*, *Trichodesma zeylanicum* var. *zeylanicum* sparse forbland; over *Triodia melvillei* and *Triodia pungens* sparse hummock grassland.	Stony plain	Boolgeeda (primarily), Wannamunna (minor extent)
B - Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover	*Acacia aptaneura* and *A. pruinocarpa* low open woodland; over sparse tall shrubland including *Eremophila longifolia* and *Santalum lanceolatum*; over mixed isolated shrubs to sparse shrubland; over isolated forbs to open forbland dominated by *Pterocaulon sphacelatum*, *Ptilotus obovatus*, and *Arivela viscosa*; over sparse to medium-dense tussock grassland dominated by *Aristida inaequiglumis*, *A. contorta* and *Themeda triandra*.	Gently sloping clay-loam plain with minor drainage channels and surface drainage	Boolgeeda
C - Mulga and acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	*Acacia aptaneura*, *A. pruinocarpa* low open woodland with occasional *Corymbia deserticola*; over isolated tall shrubs to sparse tall shrubland dominated by *Hakea lorea* subsp. *lorea*, *Acacia elachantha*, *A. aptaneura*, *A. pruinocarpa*, *Santalum lanceolatum*; over isolated medium to dwarf shrubs; over sparse forbland dominated by *Pterocaulon sphacelatum*, *Arivela viscosa*, *Ptilotus obovatus*; over *Triodia pungens* and *T. melvillei* open hummock grassland, with *Themeda triandra*, *Aristida inaequiglumis*, and *A. contorta* open tussock grassland.	Clay-loam plain	Boolgeeda (primarily) Wannamunna (minor extent)

Type	Vegetation description (2021)	Substrate	Land System
D - Mulga, *Hakea lorea*, and *Eucalyptus xerothermica* low open woodland over closed tussock grassland on gently sloping clay-loam plain (no rocks)	Low open woodland of *Acacia aptaneura*, *Hakea lorea* subsp. *lorea*, and *Eucalyptus xerothermica*; over isolated tall to dwarf shrubs; over sparse forbland to isolated forbs dominated by *Pterocaulon sphacelatum*; over closed tussock grassland dominated by *Themeda triandra*, with *Aristida inaequiglumis* and *A. contorta*.	Gently sloping clay-loam plain without rocks	Wannamunna (primarily), Boolgeeda (minor extent)
E - Low mulga woodland over sparse understorey on stony plain	*Acacia aptaneura* low mulga woodland; over *Acacia pachyacra* and *A. ?sibirica* sparse shrubland; over isolated dwarf shrubs; over isolated forbs and ferns; over *Digitaria ammophila*, *Chrysopogon fallax*, *Aristida inaequiglumis* sparse tussock grassland.	Flat stony plain	Boolgeeda
F - *Triodia wiseana* hummock grassland with emergent shrubs and low trees on gently sloping stony plain	*Corymbia hamersleyana* and *Corymbia deserticola* subsp. *deserticola* isolated low trees; over isolated tall shrubs; over *Acacia ancistrocarpa* and mixed *Acacia* spp. sparse shrubland; over isolated dwarf shrubs; over isolated forbs; over *Triodia wiseana* hummock grassland.	Gently sloping stony plain	Boolgeeda

2.3.4 Weeds recorded in the Lamb Creek project area

Eleven weed species have been recorded from the Lamb Creek project to date during the 2012 and 2021 detailed flora and vegetation surveys, as listed in Table 2.6. Weed status is as per the Western Australian Organism List maintained by the Department of Agriculture and Food (DAFWA 2021). None of these weeds are listed as a Declared Pest under the Biosecurity and Agriculture Management Act 2007 (Australian Government 2012, DAFWA 2021).

Table 2.6 Weeds recorded during the 2012 and 2021 detailed flora surveys

Taxonomic Name 2021	Common name	Status 2021 (WAOL)	2012	2021
**Acacia hilliana*	Hill's tabletop wattle	Permitted - s11	9	
**Aerva javanica*	Kapok bush	Permitted - s11		1
**Bidens bipinnata*	Bipinnate beggartick	Permitted - s11	9	16
**Cenchrus ciliaris*	Buffel grass	Permitted - s11	1	30
**Cenchrus setiger*	Birdwood grass	Permitted - s11		12
**Chloris virgata*	Feathertop Rhodes grass	Permitted - s11	1	
**Malvastrum americanum*	Spiked malvastrum	Permitted - s11	1	15
**Melinis repens*	Red natal grass	Permitted - s11		1
**Portulaca oleracea*	Purslane	Permitted - s11	9	9
**Solanum lasiophyllum*	Flannel bush	Permitted - s11	24	6
**Stylosanthes hamata*	Southern pencilflower	Permitted - s11		2

*Footnotes: * indicates a flora taxon is alien to Western Australia, as per FloraBase (WA Herbarium 1998)*

2.4 Reserves and environmentally sensitive areas

Environmentally sensitive areas (ESAs) are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and are selected for their environmental values at state or national levels. The project area does not occur within an ESA, nor are there any ESAs within five kilometres of the project area, as shown by the Department of Environment Regulation (DER) Native Vegetation Map Viewer (DER 2014b).

Karijini National Park is located to the west of the project area, approximately 18 kilometres west of the intersection of the proposed haul road and the Great Northern Highway. Mungaroona Range Nature Reserve is approximately 100 kilometres northwest of the project area. The nearest Nationally Important Wetland is the Fortescue Marsh located 52 km north of the survey area (AWE 2021).

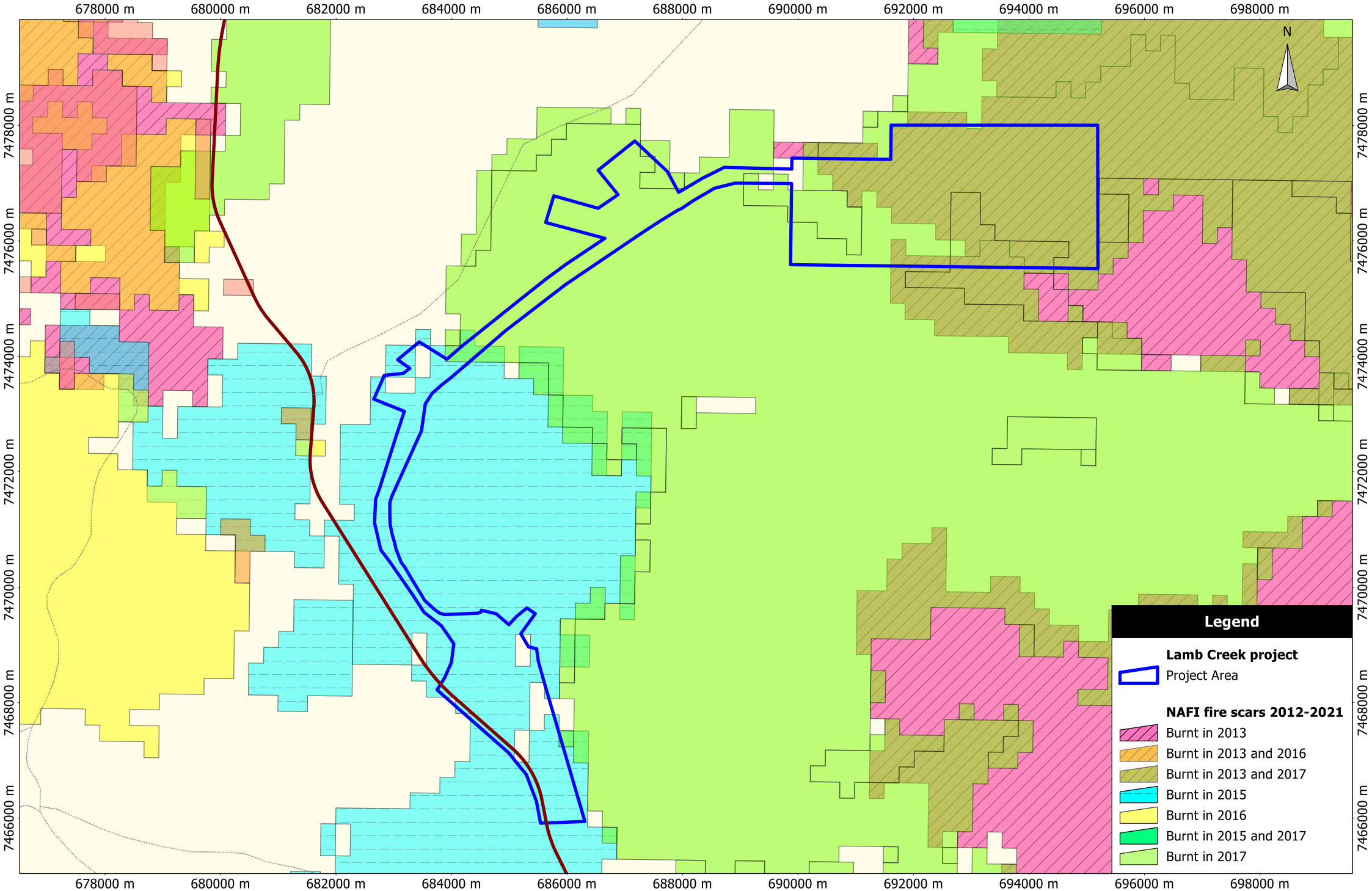
Survey data from 2012 and 2021 indicates that no currently listed Threatened or Priority Ecological Communities (TEC-PEC) occur within the surveyed parts of the Lamb Creek project (Rapallo 2012, 2021a). Further details in section 4.1.2.

2.5 Fire history

Fire mapping for Australia is available from the Northern Australia and Rangelands Fire Information (NAFI 2021) website, with fire scar data available from 2000 to present. The NAFI service displays maps of fire activity based on information from satellites, such as hotspots (locations of recently burning fires) and fire scars (maps of recently burnt country).

The majority of the project area has been burnt over recent years (after the 2012 survey), with some parts burnt several times (NAFI 2021), resulting in a mosaic of different fire ages. Floristic data and site photos collected in 2020 and 2021 indicate that these fires have changed both vegetation structure and floristic composition relative to 2012 (Rapallo 2021b).

Fire mapping over the project area between 2012 and 2021 (NAFI 2021) is shown in Figure 2.2. It must be noted that NAFI data is very broad-scale and does not show the fine-scale mosaic within the project area, nor does the mapping indicate fire intensity.



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Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:80,000
Datum: MGA94 Zone 50
0 3 km

Figure 2.2

NAFI fire scars across the Lamb Creek project area between 2012 and 2021

3 Methods

3.1 Desktop study

The flora desktop study comprised a search of paid and free databases, and a review of available literature relevant to the survey area. The desktop review served to compile a list of conservation significant flora taxa with the potential to occur within the survey area. Conservation codes for Australian flora are detailed Appendix I. Database search parameters are outlined in Table 3.1.

Table 3.1 Flora database search parameters

Source of information	Search area
DBCA (2021a) Threatened and Priority Flora Database (including WA Herbarium database records)	60 km radius centred on project area
DBCA (2021b) Threatened and Priority Ecological Communities (TEC-PEC) database	50 km radius centred on project area
DBCA (2021c) NatureMap online database	40 km radius centred on the project area
Department of Agriculture Water and the Environment (AWE) (2021) Protected Matters search tool	50 km radius centred on the project area

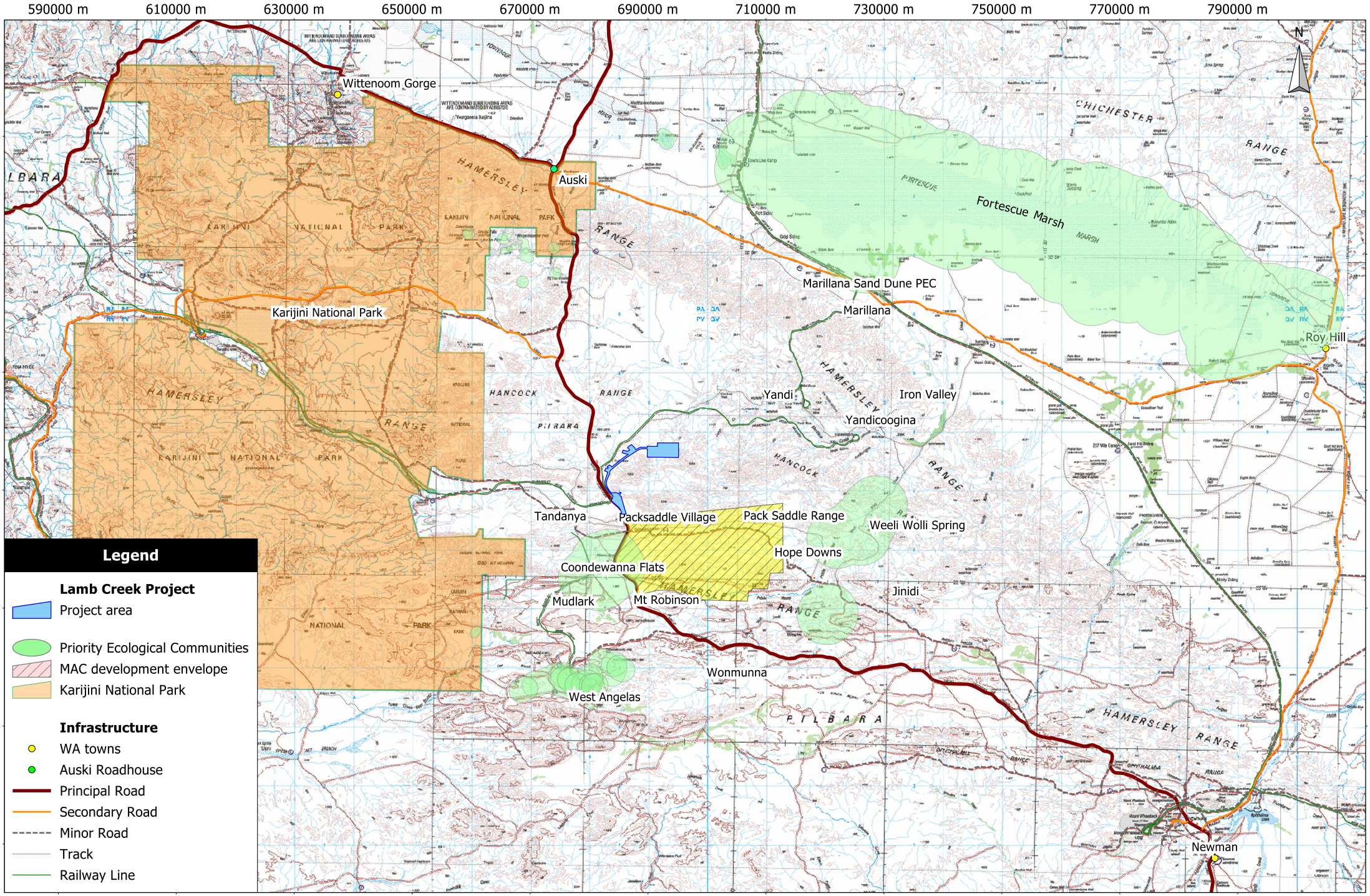
The region has had considerable flora survey effort over the last 20 years predominantly due to flora and vegetation surveys completed within, or partly within, the boundary of the Mining Area C (MAC) Development Envelope between 1997 and 2014. The MAC Development Envelope is approximately 10 kilometres (km) south of R47/19 as showed in the inset map of Figure 1.2 and in Figure 1.3 which provides regional context for the Lamb Creek project. The surveys used as part of the literature review are listed in Appendix II and generally occurred within 50 kilometres of the Lamb Creek project area.

The conservation significant taxa identified in the desktop were reviewed for likelihood of occurrence within the survey area, based on the likelihood categories outlined in Table 3.2. Field based habitat information was only available for 73% of the project area (section 2.3.3). Likelihood scores for the areas not visited by the field team are based on desktop information only. Desktop results and likelihood assessment are presented Appendix II.

Table 3.2 Likelihood assessment criteria

Rank	Criteria
Confirmed	1. The species was recorded on the project area; or 2. The species was recorded directly adjacent (within 500 m) of the project area from habitat continuing into the project area.
Likely to occur	1. There are existing records of the species in close proximity to the project area (within 20 km); and • the species is strongly linked to a specific habitat, which is present in the project area; or • the species has more general habitat preferences, and suitable habitat is present.
May potentially occur	1. There are existing records of the species from the region (within 30 km), however: • the species is strongly linked to a specific habitat, of which only a small amount is present in the project area; or • the species has more general habitat preferences, but only some suitable habitat is present.

Rank	Criteria
	2. There is suitable habitat in the project area, but there are very few or only very old (1999 or before) records from the region.
Unlikely to occur	1. The species is linked to a specific habitat, which is absent from the project area; or 2. Suitable habitat is present, however there are no existing records of the species from the locality despite reasonable previous search effort in suitable habitat; or 3. There is some suitable habitat in the project area, however the species is very infrequently recorded in the locality.
Highly unlikely to occur	1. The species is strongly linked to a specific habitat, which is absent from the project area; and/or 2. The species' range is very restricted and would not include the project area.



Rapallo environmental	Mineral Resources Limited Lamb Creek Project	Lamb Creek Iron Ore Project Targeted conservation significant flora survey (April 2020, May 2021)	Original Size: A4 Scale: 1:800,000 Datum: MGA94 Zone 50 0 25 km	**Figure 3.1** Regional localities

3.2 Field Survey

The survey area was searched over two survey periods, with each period covering a different part, as outlined in section 1.3 and Table 1.3, and mapped in Figure 3.2. The survey teams are listed in Table 3.3. The first survey period was 15-19 April 2020, and the second survey period was 12-17 May 2021.

The survey methods were in accordance with EPA (2016b) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* and aligned with the criteria for a targeted survey.

The targeted survey area as defined in section 1.3 was searched via systematic parallel traverses, spaced approximately 50 meters apart (Figure 3.2). Traverse lines were drawn in a GIS program prior to the survey and uploaded onto hand-held Garmin GPS units for ease of navigation. The spacing of the traverses was determined with consideration given to the openness of the vegetation being surveyed, and the size and visibility of the target species. Where a target species was encountered, survey effort was intensified to locate additional individuals and/or map the extent of populations. Survey effort was also intensified within restricted or unusual landforms such as creek lines, outcroppings, or distinctive soil types.

Additional searches outside of the defined survey areas listed in Table 1.1 were completed to map the extent of conservation significant flora populations beyond the survey area boundaries, as per EPA (2016b) technical guidance, and to opportunistically search areas outside of the 2020 footprint.

During the 2020 survey, additional areas within R47/19 outside the defined survey area were searched opportunistically on foot by means of two traverses selected to sample habitats suitable to several of the target taxa which were not (well) represented in the defined survey area. These habitats included gorges and gullies, elevations greater than 900 m, south facing slopes, and larger creek lines.

Additional reconnaissance work was also completed by helicopter in 2020 to determine the extent of a large population of *Aristida lazaridis* (P2) recorded in the area adjacent to the Great Northern Highway. Identification of this grass from the air was possible because it was noted during the survey that clumps of *A. lazaridis* are distinctly visible from the air when in flower, as shown in Plate 1. During the reconnaissance flights, GPS waypoints were taken from the air, with selective waypoints subsequently ground-truthed on foot.

During the May 2021 survey, helicopters were not provided, and the survey area was small and directly adjacent to a major road. For this reason, searches for conservation significant taxa and mapping population boundaries outside of the defined survey area occurred on foot and from a vehicle.

Plate 1 ***Aristida lazaridis*** **clumps in flower as visible from the air during the 2020 field survey.**

3.2.1 Specimen collection and identification

Flora specimens were collected and pressed as per Western Australian Herbarium (2008) guidelines. Each specimen was assigned a unique field name and field number and was marked with a plant tag containing specimen and location information. All specimens were pressed and dried on the day of collection. Fragile material such as flowers, seed capsules, or very small specimens were sealed in paper bags which were marked as per the plant tags.

Taxonomic identification of flora specimens was completed by Sharnya Thomson-Yates (Table 3.3) (who was also a member of the 2021 field survey team) with the use of the WA Herbarium reference collection, latest flora identification keys, and recent scientific publications.

As per section 7.2 of EPA (2016b) and under flora licence conditions, suitable voucher specimens will be lodged with the Western Australian Herbarium.

3.3 Personnel and licensing

The personnel involved in the field survey, taxonomic identification, and the preparation of this report are listed in Table 3.3. Flora specimens were collected under Flora Taking (Biological Assessment) Licences pursuant to Regulation 62 of the *Biodiversity Conservation Regulations 2018*. As part of the license requirements, a copy of this report will be forwarded to the DBCA.

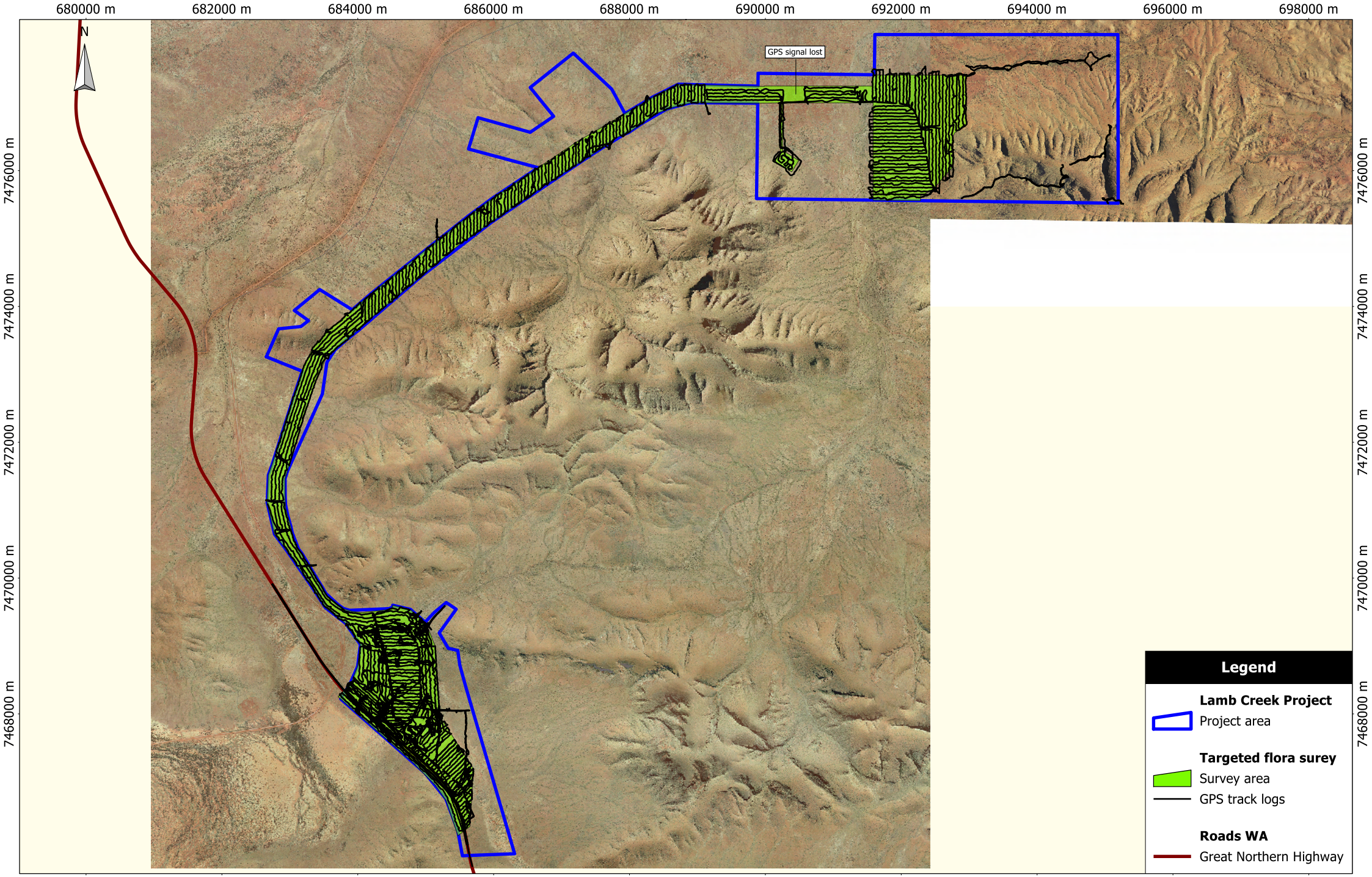
Table 3.3 Personnel involved in the project

Name	Position	Survey 1	Survey 2	Taxonomy	Reporting
Kate George	Principal Environmental Scientist				•
Marieke Weerheim	Senior Environmental Scientist	•	•		•
Cielito Marbus[1)]	Botanist	•			•
Daniel Marsh[2)]	Senior Botanist	•			
Sharnya Thomson-Yates[3)]	Botanical Taxonomist and Senior Botanist		•	•	
Linda Dalgliesh[4)]	Senior Botanist		•		
Joshua Gilovitz[5)]	Senior Botanist		•		

Footnotes: 1) Licence number FB62000066-2; 2) License number FB62000074-2 and TFL 14-1920; 3) License number FB62000183; 4) License number FB6200067-3; 5) License number FB62000331.

3.4 Nomenclature and conservation listing

Flora taxonomy and nomenclature follows FloraBase (WAH 1998-). FloraBase, the Western Australian Herbarium database (via NatureMap DBCA 2021c and the Threatened and Priority Flora database search DBCA 2021a) was utilised to verify conservation codes, distribution records, habitat requirements, and flowering times for the target taxa. Conservation codes cited in this report are as per Appendix I. Conservation codes on FloraBase are the most up to date, whereas the DBCA Threatened (Declared Rare) and Priority Flora List (DBCA 2018) was last updated on 5 December 2018.



Rapallo environmental

Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:70,000
Datum: MGA94 Zone 50
0 2 km

Figure 3.2

Systematic traverses walked during the targeted survey (50 m spacing)

4 Results

4.1 Flora desktop study

4.1.1 Conservation significant taxa

The desktop study found 86 significant vascular flora taxa from within 60 kilometres of the project area, with proximal records mapped in Figure 4.1. An assessment was completed as per Table 3.2 in section 3.1 to estimate the likelihood of occurrence within the project area for each of the conservation significant species identified via the database searches and literature review. Likelihood ranking was updated post-field based on habitat information.[1] Search results and likelihood ranking are presented in Appendix II and summarised in Table 4.1.

Table 4.1 Summary of Lamb Creek desktop results for conservation significant taxa

Likelihood ranking	Status[1]						Total taxa
	VU[2]	CR[3]	P1	P2	P3	P4	
Confirmed	1			1	4	1	**7**
Likely to occur			1	1	3	2	**7**
May potentially occur			1	1	2		**4**
Unlikely to occur		1	7	14	32	4	**58**
Highly unlikely to occur			4	1	5		**10**
Grand Total	**1**	**1**	**13**	**18**	**46**	**7**	**86**

Footnotes:
1. P = Priority (administered by DBCA; Biodiversity Conservation Act 2016 (BC Act)), VU = Vulnerable, CR = Critically Endangered.
2. Listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and BC Act,
3. Listed BC Act only. Refer to Appendix I for detailed explanation of conservation codes.

Two species listed as vulnerable and critically endangered were returned via the threatened and priority flora database search (DBCA 2021a) and the protected matters search (AWE 2021).

- *Thryptomene wittweri* listed as vulnerable under the BC Act and EPBC Act was assessed as unlikely to occur due to habitat requirements and distance of records from the project area (>20 kilometres). This species is not discussed further in this report.
- *Seringia exastia* listed as critically endangered under the BC Act is discussed in section 5.1.1.

Most records were DBCA listed priority flora taxa and the greater majority (80%) were ranked as unlikely to highly unlikely to occur within the Lamb Creek project area (Appendix II). These priority taxa are not discussed further in this report.

Seven conservation significant taxa were confirmed to occur, these are discussed in section 5.1. Eleven significant taxa were assessed as likely to occur, or may potentially occur on the project area, and are discussed in section 5.2.

[1] Habitat information is only available for 73% of the project area, the majority of which has been collected pre-fire.

4.1.2 Conservation significant vegetation

4.1.2.1 Listed conservation significant vegetation

Survey data from 2012 and 2021 indicates that no currently listed TEC or PEC occur within the surveyed parts (73%) of the Lamb Creek project. The nearest known PEC is subtype 2 of the Coolibah-Lignum Flats vegetation community, with the edge of the buffer zone located less than five kilometres south of the survey area (DBCA 2021b) as shown in Figure 4.1.

The Coolibah-Lignum Flats vegetation complex is described as: Woodland or forest of *Eucalyptus victrix* (coolibah) over thicket of *Duma florulenta* (lignum) on red clays in run-on zones. Associated species include *Eriachne benthamii*, *Themeda triandra*, *Aristida latifolia*, *Eulalia aurea* and *Acacia aneura* (DBCA 2021d).

Three sub-types have been identified, of which sub-type 2 occurs near the project with the edge of the buffer zone less than five kilometres from the southern edge of the project area (Figure 3.1, Figure 4.1).

1. Coolibah and mulga (*Acacia aneura*) woodland over lignum and tussock grasses on clay plains (Coondewanna Flats and Wanna Munna Flats) – Priority 3
2. Coolibah woodlands over lignum (*Duma florulenta*) over swamp wandiree (Lake Robinson is the only known occurrence) – Priority 1
3. Coolibah woodland over lignum and silky browntop (*Eulalia aurea*); two occurrences known on Mt Bruce Flats – Priority 1

The 2012 flora and vegetation survey concluded that the Coolibah-Lignum Flats PEC is unlikely to occur in the survey area because neither Coolibah (*E. victrix*) nor lignum species were recorded (Rapallo 2012). These results were supported by the 2021 detailed flora survey (Rapallo 2021a).

Onshore (2013b) reviewed vegetation mapping within Coodewanna Flats and Lake Robinson and confirmed fine-scale mapping for the two sub-types of the Coolibah-lignum Flats. They concluded that the Priority 1 sub-type 2 lies at the lowest point of the Coondewanna Flats associated with Lake Robinson, and the Priority 3(i) sub-type 1 occurs on alluvial flats (Coondewanna Flats) around Lake Robinson, to the south and found that the Great Northern Highway divides the PEC to the west from the MAC Development Envelope. Based on the Onshore (2013b) mapping, the PEC occurs ca. 12 kilometres to the south of the Lamb Creek project area.

4.1.2.2 Locally significant vegetation

Vegetation may be of significance for reasons other than a listing as a TEC or a PEC. This may include, although is not limited to, scarcity, combination of species, role as a refuge, restricted distribution and vegetation extent being below a threshold level (EPA 2004).

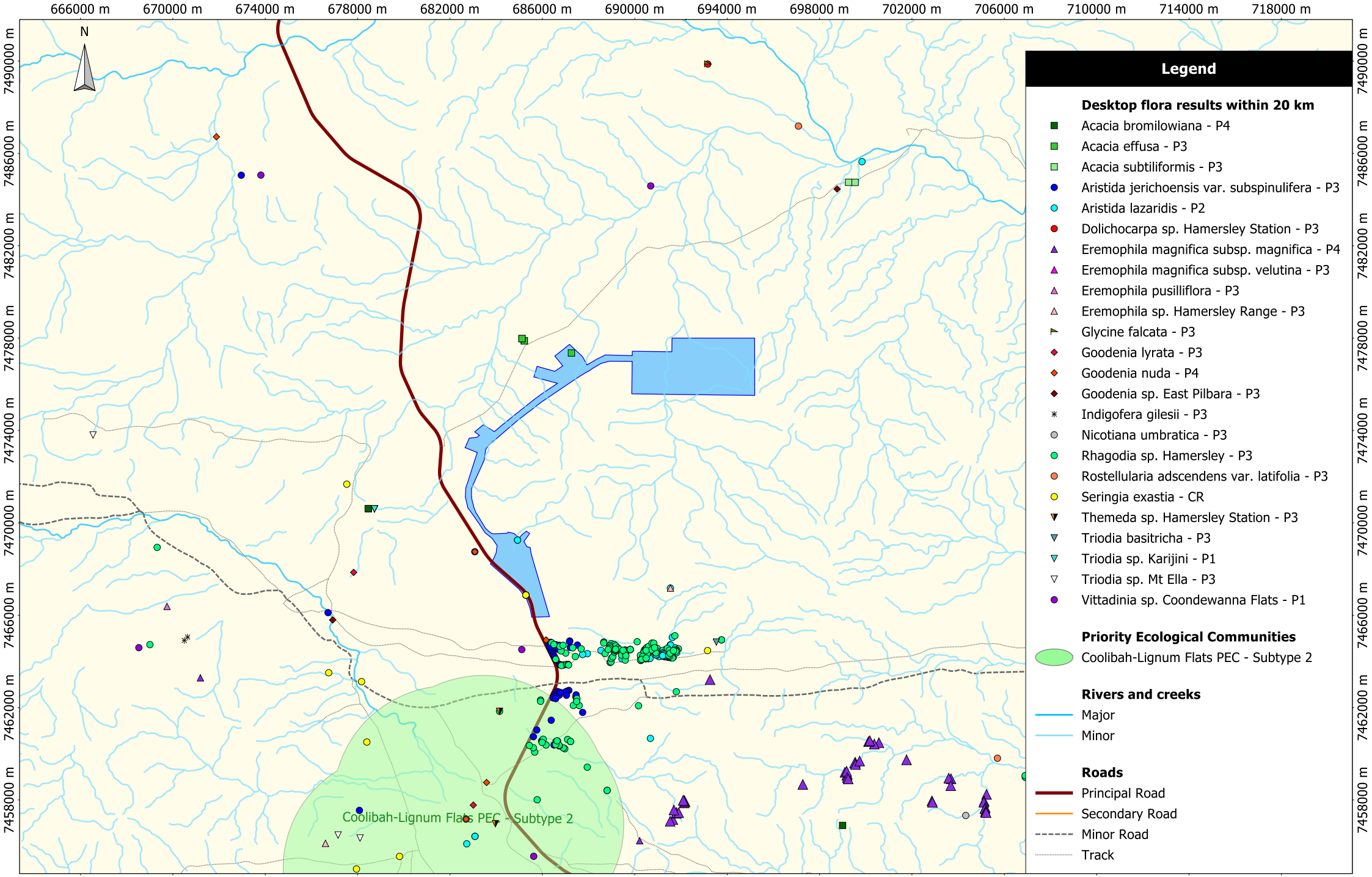
Local significance can be determined where a vegetation type is confined to a specialised habitat and/or landform that is not common in the local area or the vegetation types are supporting conservation significant species or groundwater dependent species.

Vegetation types A, B, C and D recorded in the 2021 survey of the Great Northern Highway intersection area are considered locally significant due to supporting the Priority 2 listed grass *Aristida lazaridis*, as well as other conservation significant species (Rapallo 2021a).

Vegetation types B, C, D and E are also considered locally significant because they contain *Acacia aptaneura* (mulga) as the dominant upper storey species on stony or clay plains and floodplains (Rapallo

2021a). This matches the broad description of ‘valley floor mulga’ which is listed by Kendrick as one of the “ecosystems at risk” (Kendrick 2001).

None of the flora taxa recorded during the 2012 and 2021 flora surveys were indicative of groundwater dependent vegetation. It must be noted that these surveys only covered 73% of the current project aera.



Rapallo environmental

Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:200,000
Datum: MGA94 Zone 50
0 5 km

Figure 4.1

Desktop records of conservation significant flora within 20 km of the Lamb Creek project

4.2 Field survey results

4.2.1 Conservation significant flora species recorded

The targeted flora survey of Lamb Creek recorded eight significant flora taxa. These included one threatened taxon, six priority flora taxa and one taxon considered significant for other reasons as per EPA (2016a, 2016b). Each of these eight taxa is discussed in detail in section 5.1.

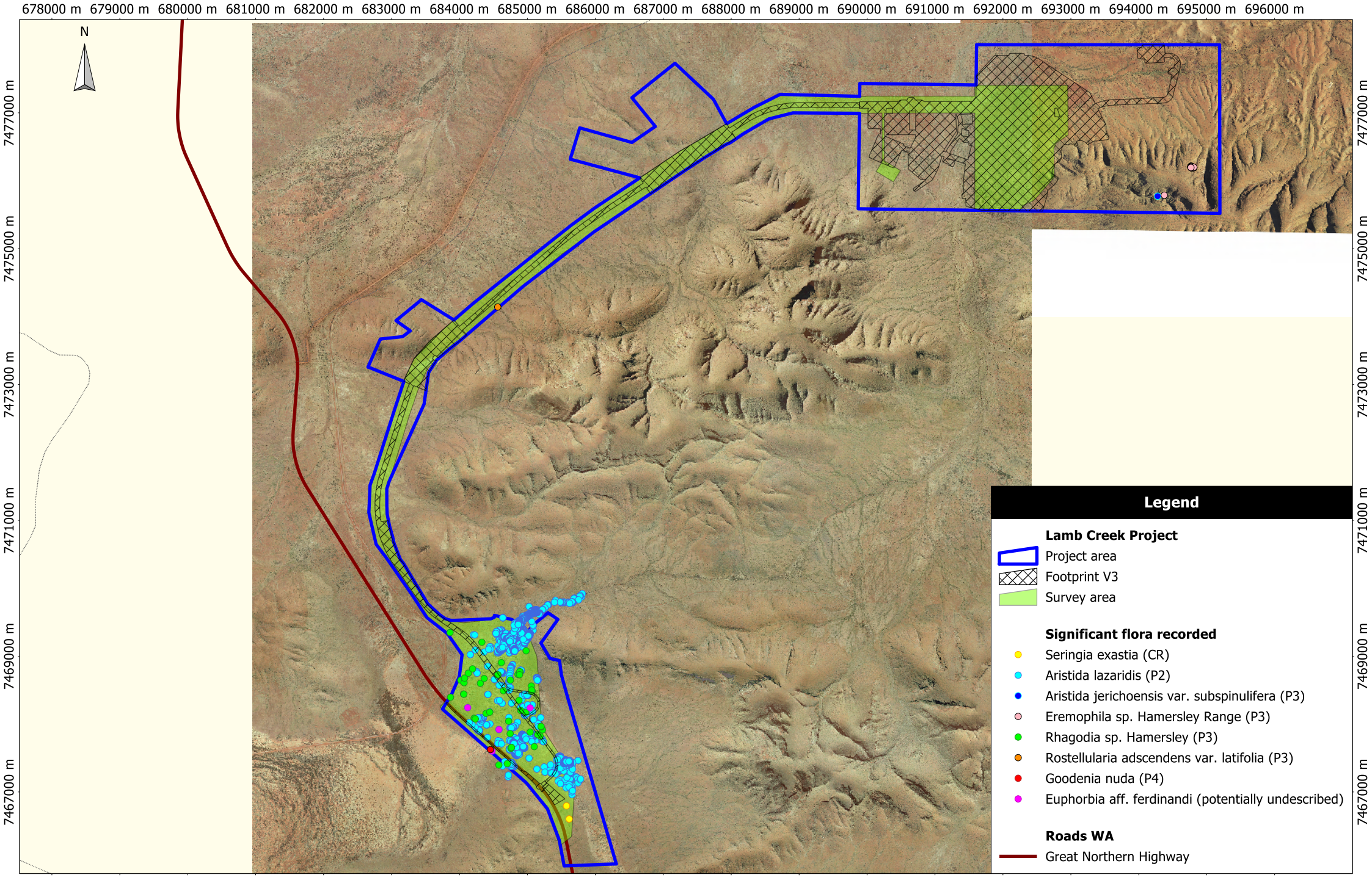
The estimated number of individual plants of each taxon recorded inside and outside the project area, targeted survey area, and footprint V3 are listed in Table 4.2.

Table 4.2 Conservation significant flora taxa recorded during the survey

Taxon	Status	Survey area[1, 2]		Project area[1, 3]		Footprint V3[1, 4]	
		In	Out	In	Out	In	Out
Seringia exastia	Critically Endangered	2		2			2
Aristida lazaridis	Priority 2	8596	4177	9816	2957	75	12698
Aristida jerichoensis var. *subspinulifera*	Priority 3		50	50			50
Eremophila sp. Hamersley Range	Priority 3		36	36			36
Goodenia nuda	Priority 4	50		50			50
Rhagodia sp. Hamersley (M. Trudgen 17794)	Priority 3	49	1	49	1	5	45
Rostellularia adscendens var. *latifolia*	Priority 3	1		1			1
Euphorbia aff. *ferdinandi*	Potentially undescribed	4		4			4

Footnotes:
1) Numbers represent the estimated number of individual plants recorded.
2) Numbers outside the defined survey area were counted opportunistically and while mapping population boundaries.
3) The targeted survey covered 869 hectares (40%) of the project area.
4) The targeted survey covered 421 hectares (64%) of footprint V3.

An overview map of all conservation significant flora recorded during the 2020 and 2021 targeted flora survey is presented in Figure 4.2. The greatest number of different conservation significant flora taxa, as well as the greatest number of individual plants, was recorded in the Great Northern Highway intersection area, as mapped in Figure 4.3. The opportunistic traverses into habitats not covered by the defined survey area recorded an additional two taxa as mapped in Figure 4.4. Conservation significant flora recorded during the survey are described further in section 5.1.



Rapallo environmental

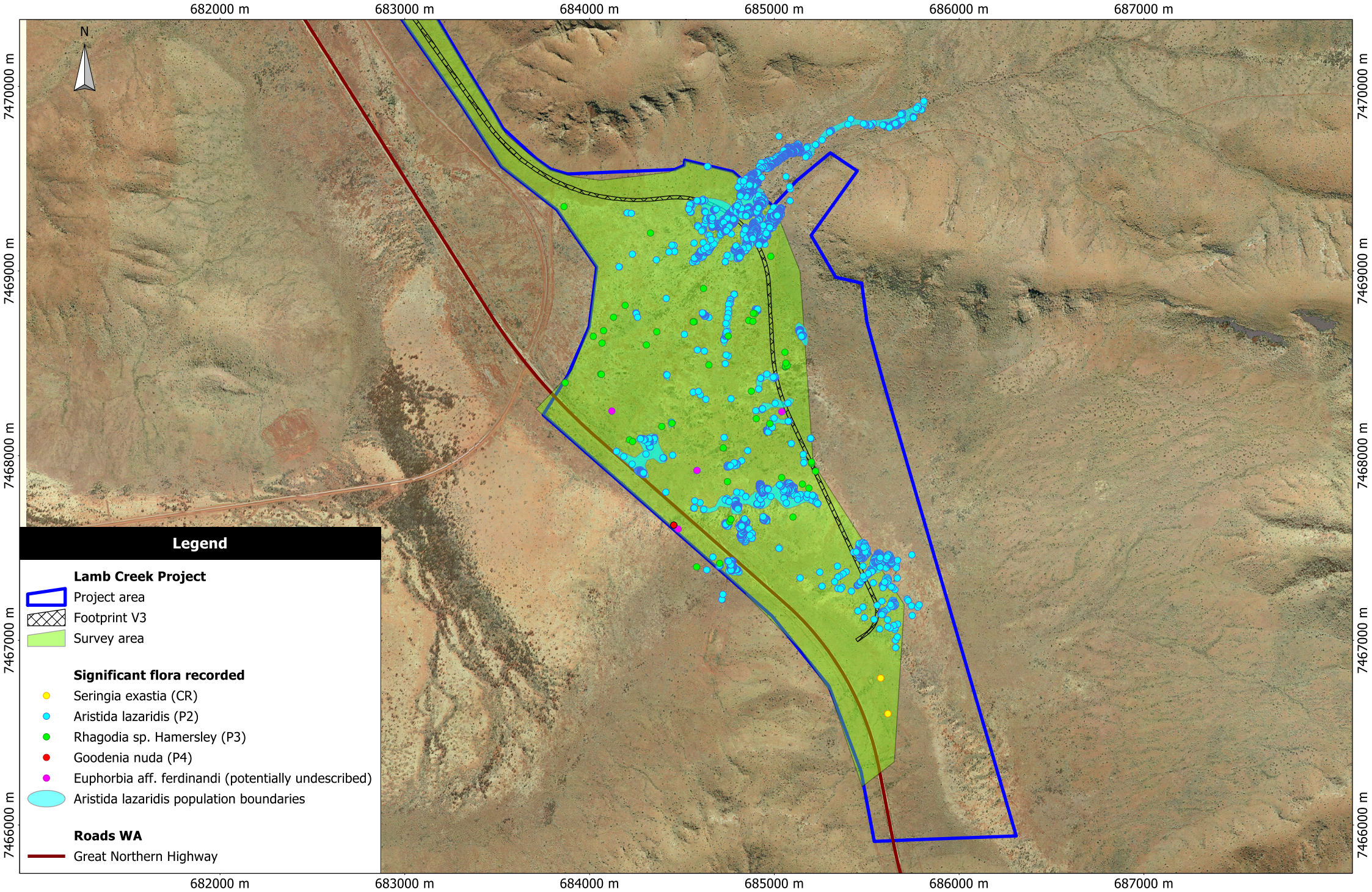
Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:70,000
Datum: MGA94 Zone 50
0 2 km

Figure 4.2

Conservation significant flora recorded at Lamb Creek during the targeted survey



Rapallo environmental

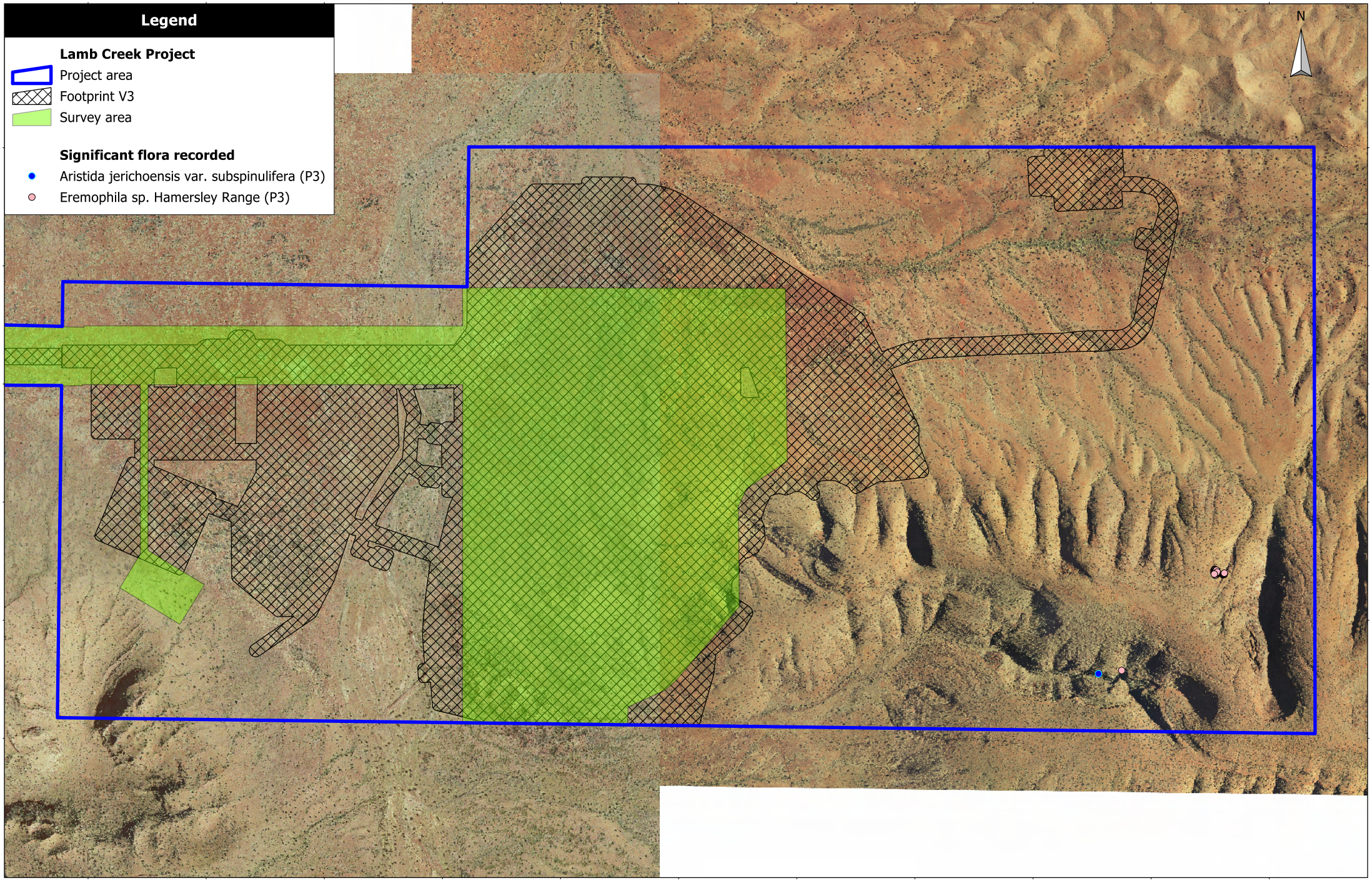
Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:25,000
Datum: MGA94 Zone 50
0 800 m

Figure 4.3

Conservation significant flora recorded in the Great Northern Highway intersection area



Rapallo environmental

Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Targeted conservation significant flora survey (April 2020, May 2021)

Original Size: A4 Scale: 1:20,000
Datum: MGA94 Zone 50
0 500 m

Figure 4.4

Conservation significant flora recorded in the retention licence R47/19

5 Discussion

This section discusses the survey results from a project area, local and regional perspective.

5.1 Significant flora species recorded during the survey

Seven DBCA listed conservation significant flora taxa, and one potentially undescribed taxon, were recorded during the 2020 and 2021 field surveys, both from within the defined survey area and from locations outside and adjacent to the survey area while mapping population boundaries.

Recent flora and vegetation mapping (post-fire) was available for the Great Northern Highway intersection part of the survey area, as described in Rapallo (2021a), while old (pre-fire) mapping was available for the resource area and part of the haul road (Rapallo 2012). The vegetation composition and structure in the 2012 mapped areas has changed as a result of the fire (Rapallo 2021b), which must be kept in mind when interpreting significant flora locations relative to habitat. The vegetation types recorded in 2012 and 2021 are described in section 2.3.3.

The estimated number of individual plants of each conservation significant taxon per vegetation type is presented in Table 5.1 below. Where there is overlap between 2012 and 2021 vegetation mapping, only the 2021 mapping is considered. Mapping completed in 2012, which has limited relevance to flora recorded in 2020 and 2021, is only used where no current 2021 mapping is available.

Approximately 31% of the individual plants recorded were outside of any vegetation mapping. The greater majority of these were *Aristida lazaridis* (P2) records collected when mapping population boundaries outside of the defined targeted survey area. The single record of *Rostellularia adscendens* var. *latifolia* (P3) was also outside of any mapped areas. Interestingly, both records of *Seringia exastia* (CR) were from a previously cleared and revegetated area, and not from a mapped vegetation type.

No conservation significant flora were recorded from 2021 vegetation type F and from 2012 vegetation types VT3 and VT4. The entirety of the 2012 vegetation type VT6 has been superseded by 2021 vegetation types C and D.

The Great Northern Highway Intersection part of the survey area supported the overwhelming majority of conservation significant flora records, and five of the total eight taxa recorded. The overwhelming majority of these records were *Aristida lazaridis* (P2).

The greatest number of conservation significant flora records were from 2021 vegetation types C and D. Outside of 2021 mapping, the greatest number of conservation significant flora records were from 2012 vegetation type VT5. Where there was overlap between the 2012 and 2021 mapping, the 2012 vegetation type VT5 has been superseded by 2021 vegetation types A, B, C and D. The absence of a clear-cut link between 2012 and 2021 vegetation polygons is indicative of the significant changes that have occurred since the 2015 fire. As such, the 2012 vegetation mapping has limited relevance to the habitat that was present during the targeted survey.

Aristida jerichoensis var. *subspinulifera* (P3) and *Eremophila* sp. Hamersley Range (P3) were only recorded from the retention licence R47/19 from areas mapped in 2012 as VT1 and VT2. Both taxa occurred more than a kilometre outside of footprint V3. The retention licence was burnt in 2017, and no current vegetation information is available. However, the land forms associated with vegetation types VT1 and VT2 are unlikely to have changed, and would present some indication of habitat for these taxa.

Table 5.1 Conservation significant flora records relative to 2021 and 2012 vegetation types

Taxon	Status	2021 vegetation types [1]							2012 vegetation types (pre-fire) [2]					Outside of mapped areas	Total
		A	B	C	D	E	F	X	VT1	VT2	VT3	VT4	VT5		
Seringia exastia	Critically Endangered							2							**2**
Aristida lazaridis	Priority 2	125	544	1441	3392	3		4		115			3167	3982	**12773**
Aristida jerichoensis var. *subspinulifera*	Priority 3									50					**50**
Eremophila sp. Hamersley Range	Priority 3								23	13					**36**
Rhagodia sp. Hamersley (M. Trudgen 17794)	Priority 3	1	9	26	4	1				2			6	1	**50**
Rostellularia adscendens var. *latifolia*	Priority 3													1	**1**
Goodenia nuda	Priority 4				50										**50**
Euphorbia aff. *ferdinandi*	Potentially undescribed			3	1										**4**
Totals		**126**	**553**	**1470**	**3447**	**4**	**0**	**6**	**23**	**180**	**0**	**0**	**3173**	**3984**	**12966**

Footnotes:

1. 2021 vegetation types:

A - Low open Eucalyptus gamophylla woodland over Triodia melvillei and T. pungens on stony plain

B - Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover

C - Mulga and acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover

D - Mulga, Hakea lorea, and Eucalyptus xerothermica low open woodland over closed tussock grassland on gently sloping clay-loam plain (no rocks)

E - Low mulga woodland over sparse understorey on stony plain

F - Triodia wiseana hummock grassland with emergent shrubs and low trees on gently sloping stony plain

X – Not a vegetation type. Cleared, rehabilitated, Road

2: 2012 vegetation types:

VT1 – Eucalyptus gamophylla woodland over hummock grassland

VT2 – Eucalyptus leucophloia subsp. leucophloia woodland over mixed shrubs over Triodia wiseana grassland

VT3 – Acacia shrubland over hummock grassland

VT4 – Acacia tumida var. pilbarensis scrub in creeklines

VT5 – Wannamunna Mulga grove

5.1.1 *Seringia exastia* (Critically Endangered)

Seringia exastia (fringed fire-bush) is a small spreading shrub growing up to 1.5 metres tall but usually recorded around 0.5 metres (DBCA 2021c). It has been recorded in flower year-round (WAH 1998-, DBCA 2021a). The species is currently listed as Critically Endangered, but this is due to a taxonomic revision where a threatened and a common species were merged, and the name of the former was adopted as the new name, with the conservation status still attached. The current distribution map published on FloraBase (Western Australian Herbarium 1998) incorporates this revision, showing *Seringia exastia* as widespread across northern Western Australia, ranging from the Coolgardie and Murchison IBRA regions in the south to the Dampierland IBRA region in the north.

Seringia exastia was recorded at two locations near the Great Northern Highway intersection (Figure 4.3). Both locations are outside of footprint V3. The habitat was cleared and disturbed vegetation, and not mapped as a vegetation type (Rapallo 2021a). There is a threatened and priority flora database record of this taxon within the project area, on the south-western side of the Great Northern Highway (DBCA 2021a). This location was visited during the targeted survey, but the taxon was not found.

Communications received from DBCA (24/08/2021) confirm that the species is common and widespread, and that a nomination to delist the species has been prepared and considered by the WA Threatened Species Scientific Committee (TSSC). However, until changes are officially made to the Threatened species list, *S. exastia* is still legally listed as threatened flora, and authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required.

5.1.2 *Aristida lazaridis* (Priority 2)

Aristida lazaridis is a tufted perennial grass ranging from 0.4 to 1.5 m in height which generally flowers in April and May (WAH 1998-, DBCA 2021a). The species has been recorded in clay /loam soils on drainage lines and on slopes. The habitat often comprises mulga low open woodland with or without eucalypts, over a variety of shrubs and herbs, often over tussock grassland but sometimes with *Triodia* hummock grassland (DBCA 2021c).

A large population of *Aristida lazaridis* was recorded on the un-incised loamy valley floor drainage at the southern end of the survey area proximal to the Great Northern Highway (Figure 4.3). An estimated population of 12773 plants from 6757 point locations was recorded over the 2020 and 2021 survey periods combined. The species was recorded from all 2021 vegetation types except type F, with the greatest number of records from vegetation types B, C and D (Rapallo 2021a). Out of the total records for this species, only 75 fall within footprint V3.

Aristida lazaridis occurs as scattered plants to dense patches several hundred to a thousand plants that locally dominate or co-dominate the ground cover. The highest population estimates were recorded where *Aristida lazaridis* occurs as a co-dominant of the tussock grassland understory within vegetation types B, C, and D (Rapallo 2021a). Searches outside the survey area on foot and from helicopter recorded the species extending outside the project area within the narrow valley that runs between the two hill systems that terminate at the southern end of the haul road corridor. Populations and scattered plants identified as potential *Aristida lazaridis* have also been observed from helicopter to the southwest on the western side of the Great Northern Highway. At the time of survey in 2020 the species was in flower and could be spotted from a helicopter. However, due to the presence of six other *Aristida* species recorded from Lamb Creek during the 2012 and 2021 surveys, only ground-truthed records are presented in this

report and mapped in Figure 4.2. Plate 2 shows *Aristida lazaridis* (P2) within its habitat on the loamy drainage floor of the survey area.

Locally, a significant population of *Aristida lazaridis* has been recorded in deep loam soils along an un-incised drainage line north and west of the BHP Packsaddle Village, approximately 7 kilometres south-east of the Lamb Creek population. Onshore (2011a) reported a total of 2405 plants from 94 point locations from this population occurring within six vegetation types with the largest populations occurring within the tussock Grassland with Low Woodland of *Eucalyptus xerothermica* and *Acacia aptaneura*, *Acacia* Low Open Forest and *Triodia* Hummock Grassland vegetation communities (Onshore 2017). The closest threatened flora database records are the *Aristida lazaridis* record from the project area collected in 2012 and a 2018 record of 500+ plants from low open woodland of *Acacia aptaneura* with occasional *Acacia pruinocarpa* and *Eucalyptus xerothermica* over scattered shrubs of *Eremophila longifolia*, *Senna artemisioides* subsp. *oligophylla* and *Senna artemisioides* subsp. *helmsii* over open tussock grassland on red clay loam on floodplains and drainage areas (DBCA 2021a).

Further afield, the species has been recorded from Lake Robinson on the eastern fringe of the Coondewanna Flats (up to 20% cover, Onshore 2013c), Mudlark (up to 15% cover, (Onshore 2013b), Tandanya (up to 20% cover , (Onshore 2013c), and South Flank (13 plants, (Onshore 2012a) and West Angeles (Rio Tinto 2018).

There are 20 specimen records within the Western Australian Herbarium database, with collections from locations across approximately 130 kilometres extending from the Rangers Station at Karijini National Park to near Newman (DBCA 2021c). There are 43 records from the Rio Tinto Priority Flora database (Rio Tinto 2018) extending over 60 kilometres. In addition to these records, this species occurs over a 2,500 kilometre range across the Northern Territory and Queensland (Atlas of Living Australia 2021).

Plate 2 ***Aristida lazaridis*** **(P2) and its habitat**

5.1.3 Aristida jerichoensis var. *subspinulifera* (Priority 3)

Aristida jerichoensis var. *subspinulifera* is a compact tufted perennial grass ranging in height from 0.3 to 0.8 metres (WAH 1998-). Flowering has been recorded in the post-wet season (May) and in the dry season (July, September) (DBCA 2021a). It often occurs in mulga woodlands or acacia shrublands over *Trioda* and/or tussock grassland (DBCA 2021c).

A population of approximately 50 plants was recorded opportunistically in 2020 from a single location in the south-east corner of R47/19 within 2012 vegetation type VT2 (Figure 4.4). This area falls outside of the defined survey area, and the plants were recorded opportunistically during two selective traverses. The population was observed on a south facing rocky slope of a gorge/gully at 820 metres elevation. This location is more than a kilometre outside of footprint V3.

Locally, there is a Western Australian Herbarium record of *Aristida jerichoensis* var. *subspinulifera* from 800 metres northwest of the survey area, from a level plain of orange light clay (DBCA 2021a). *Aristida jerichoensis var. subspinulifera has been recorded* as scattered individuals or more commonly in groups of up to 300 plants within the MAC Development envelope (Onshore 2017) on red brown clay loam on hardpan intergrove plains open mulga woodland and from the Coondewanna Flats PEC (Onshore 2013a).

Compared with the collections made from the MAC Development envelope, and the habitat data in the Western Australian Herbarium database (predominantly collections from clay/loam plains/flats), the Lamb Creek habitat of high elevation, rocky gorge seems odd, however the species has been recorded near Newman on rocky upper hillslope (DBCA 2021c).

Regionally, *Aristida jerichoensis* var. *subspinulifera* has been recorded from BHP Billiton Iron Ore project areas including Area C West to Yandi (scattered plants, Onshore 2014b), Mudlark (up to 100 percent cover, (Onshore 2013b) and the Tandanya tenements up to 100 percent cover, (Onshore 2013c).

There are 39 specimen records within the Western Australian Herbarium database, with collections from locations spread across 290 kilometres extending between Nammuldi to Newman, with outliers in the Little Sandy Desert and Murchison, as well as collections from the Northern Territory and Queensland (DBCA 2021c; (Atlas of Living Australia 2021).

Plate 3 *Aristida jerichoensis* var. *subspinulifera* (P3) in rocky gorge habitat

5.1.4 *Eremophila sp. Hamersley Range (K. Walker KW 136) (Priority 3)*

Eremophila sp. Hamersley Range (K. Walker KW 136) is an erect perennial shrub to 2.5 metres that has been recorded flowering in the post-wet season (June) and dry season (August, September) (WAH 1998-, DBCA 2021a)

Within the survey area, two populations (in close proximity of each other) and one single plant were recorded from the eastern part of R47/19 (Figure 4.4). This area falls outside of footprint V3 by at least one kilometre. The two populations of 23 and 12 individual plants were recorded on the eastern and western slopes of a small gorge/gully within respectively 2012 vegetation types VT1 and VT2 (Plate 4). The single individual was also recorded growing on the flanks of a gorge within VT2. Most plants were 0.5 metres in height, but one individual was greater than 3 metres tall. None of the plants were in flower at the time of the survey, which occurred outside of the common flowering period for this taxon. *Eremophila* sp. Hamersley Range (K. Walker KW 136) is similar to *E. tietkensii*, primarily differing in leaf indumentum and also in floral characters (Biota 2014).

All records of *Eremophila* sp. Hamersley Range were outside of the targeted survey area, and were recorded during two selective traverses through habitat identified as potential for this taxon. Note that only a tiny fraction of potential habitat was searched, and the searches were not systematic. The aerial photograph shows that R47/19 contains a large number of gorge/gullies similar to where this taxon was recorded, including in the south-western corner of R47/19 where the current 2021 footprint extends into unsurveyed areas. It is highly likely that further populations of *Eremophila* sp. Hamersley Range occur within R47/19 including potentially within the unsurveyed part of footprint V3.

Locally, *Eremophila* sp Hamersley Range was not recorded on the MAC development envelope to the south (Onshore 2017), however it has been recorded in the ranges ca. eight kilometres south of the Lamb Creek retention licence (DBCA 2021a) and from Baby Hope Downs ca. 35 kilometres to the southeast of Lamb Creek from five locations in rocky gullies and gorges (Biota 2014).

There are fifteen specimen records within Western Australia, with Western Australian herbarium records from locations spread across 220 kilometres from Paraburdoo to Newman (WAH 1998-) and 345 records, within the Rio Tinto database; recorded from Eastern Range, Channar, Turee Syncline, Karijini National Park, West Angelas, Angelo Central and Hope Downs 1 (Rio Tinto 2016).

Plate 4 *Eremophila* sp. Hamersley Range and its north facing rocky hillside habitat

5.1.5 *Rhagodia sp. Hamersley (M.E. Trudgen 17794) (Priority 3)*

Rhagodia sp. Hamersley is an erect spindly shrub to 2 metres high, found on red sandy clay loam plains and floodplains growing in association with mulga (Western Australian Herbarium 1998-, DBCA 2021a)

Fifty plants were recorded from the Great Northern Highway area (Figure 4.3), often in association with *Acacia aptaneura* (mulga). Records occurred in every 2021 vegetation type except F (Rapallo 2021a). Records to the east of the 2021 survey area were from 2012 vegetation types VT2 and VT5, which may now no longer be relevant.

DBCA and WA Herbarium records for *Rhagodia* sp. Hamersley show flowering for this taxon in the late wet season, post-west season, and dry season. However, the majority of records year-round are of non-flowering plants, which suggest that this taxon is readily recognisable without flowers, and that it may respond to rainfall rather than season. The taxon was recorded in flower during the 2020 and 2021 targeted surveys, as shown in Plate 5.

Locally, 13 populations of *Rhagodia* sp. Hamersley (M. Trudgen 17794) have been recorded within the MAC Development Envelope, the closest 3 kilometres south east of the Lamb Creek project area, from four vegetation communities associated with mulga and tussock grassland (Onshore 2017).

Regionally, the species is widespread on mulga plains on BHP Billiton Iron Ore's Mudlark (192 plants, (Onshore 2013b) and Tandanya (496 plants, (Onshore 2013c), tenements to the west and south-west of the MAC Development Envelope, and from the Jinidi tenement ca. 50 kilometres to the south east of Lamb Creek (scattered plants) (Onshore 2011b).

There are 63 specimen records in the Western Australian Herbarium database, with collection locations spread approximately 290 kilometres extending between Tom Price and Newman (DBCA 2021c).

Plate 5 ***Rhagodia* sp Hamersley (M.E. Trudgen 17794) in flower and growing beneath mulga on the survey area in 2020 (L) and 2021 (R).**

5.1.6 Rostellularia adscendens var. latifolia (Priority 3)

Rostellularia adscendens var. *latifolia* is an erect herb or shrub, 0.1-0.3 meters high , often recorded from loams associated with drainage/floodplain, but also from hillslopes (DBCA 2021c). Flowering has primarily been recorded in the post-wet season (April-May) but also occasionally in the dry season (August) (WAH 1998-, DBCA 2021a)

A single plant was recorded from the bank of a dry rocky creek midway along the proposed haul road alignment within L47/736 (Figure 4.2). No vegetation mapping exists for this location. The specimen was recorded in flower at the time of the survey, as shown in Plate 6. The record occurred approximately 80 meters outside of footprint V3.

Locally there are 13 populations of *Rostellularia adscendens* var. *latifolia* recorded from the MAC Development Envelope, occurring as scattered individuals or populations of up to a maximum of 82 plants across a variety of vegetation types (Onshore 2017), approximately 20 kilometres south east of the Lamb Creek retention licence.

Regionally, the species has been recorded from a number of BHP Billiton Iron Ore's project areas including Area C West to Yandi (67 plants, Onshore 2014), Mudlark (Onshore 2013b) , Tandanya (60 plants, (Onshore 2013c), Jinidi to Mainline (<2 percent cover within Weeli Wolli Creek, Onshore 2012b) and Yandi (<1 percent cover, (Onshore 2011c).

There are 39 specimen records within the Western Australian Herbarium database, with collections from locations spread across approximately 280 kilometres extending between Nammuldi and the Jimblebar to Yandi Railway, with outliers extending to Nullagine (DBCA 2021c).

There are 205 records of *Rostellularia adscendens* var. *latifolia*, within the Rio Tinto database from numerous locations (Rio Tinto 2016).

Plate 6 *Rostellularia adscendens* var. *latifolia* on rocky creek bank within the survey area

5.1.7 Goodenia nuda (Priority 4)

Goodenia nuda is a small herb, approximately 20-30 centimetres tall with yellow flowers. The species is often recorded from seasonally inundated clay soils and drainage lines, often in mulga and has been recorded flowering in the late wet and post-wet season (March-June) but also in the dry season (up until August) (WAH 1998-, DBCA 2021c).

A small population of approximately 50-100 plants was recorded during the 2021 detailed flora survey, from quadrat Q27 (Figure 4.3). This quadrat was situated on the southern side of the Great Northern Highway, and falls outside of footprint V3. *Goodenia nuda* is small, and indistinct without flowers, which indicates that additional plants or populations may have been present at the time of the survey.

Quadrat 27 falls within vegetation type D (Rapallo 2021) and is situated less than 2 kilometres south-east of a WA Herbarium record from a level plain of orange light clay recorded in 2011 (DBCA 2021a). Aerial photos show the soil colour of this clay plain quite clearly, and it extends into the GNHI survey area where Q27 was positioned. The soil at Q27 is described as clay (Plate 7).

There are 101 specimen records within the Western Australian Herbarium database, with collections from locations spread across the Pilbara with outliers in the Great Sandy Desert and Gascoyne and from 808 records, within the Rio Tinto database (Rio Tinto 2018). *Goodenia nuda* is relatively widespread across the Pilbara, recorded from a variety of habitats many associated with drainage WAH 1998-).

Plate 7 ***Goodenia nuda***

5.1.8 Euphorbia aff. ferdinandi (potentially undescribed)

This taxon was recorded from four locations near the Great Northern Highway (Figure 4.3). It was only recognised as a potentially undescribed species, and different from any known species, when the specimen was compared in detail with other *Euphorbia* specimens at the Western Australian Herbarium. Further advice was sought from Steve Dillon at the WA Herbarium, who advised that the specimen differed from *Euphorbia ferdinandi* by having broader seeds and a stigma opposite from what has been described for this species (S. Dillon *pers. comm*., September 2021). All locations of this taxon were within the current project area, but outside of footprint V3.

5.2 Significant species not recorded

Seven species ranked in the desktop as 'likely to occur' and four species ranked as 'may potentially occur (Appendix II) were not recorded during the survey. These taxa are discussed below.

5.2.1 Acacia bromilowiana (Priority 4)

Acacia bromilowiana is a shrub or tree growing to 12 metres that has been recorded on a variety of landforms in the Pilbara including: rocky hills, breakaways, scree slopes, gorges and creek beds, occurring in red skeletal stony loam, orange-brown pebbly gravel loam laterite, banded ironstone and basalt (WAH 1998-; DBCA 2021c). The species generally flowers in the dry season (July-August) but has also been recorded in flower in the post-west season (May) (WAH 1998-, DBCA 2021c).

There is a Western Australian Herbarium record dated 1992 of *Acacia bromilowiana* within 5 kilometres of the project area, recorded from the western side of the Great Northern Highway from high elevation. The species was collected from steep rocky ironstone scree, high in landscape, positioned on the edge of cliff (DBCA 2021a).

Regionally it has been recorded within the MAC Development Envelope, from the upper reaches of a gorge (Onshore 2017) and from the northern slopes of Mount Robinson (>100 plants (Onshore 2012c)). The species also occurs at surrounding BHP Billiton Iron Ore tenements and project areas including Tandanya (167 plants, (Onshore 2013c)), Mudlark 30 plants, (Onshore 2013b) and Area C West to Yandi (30 plants (Onshore 2014a)).

There are 29 specimen records within the Western Australian Herbarium database, with collections recorded from over a 320 kilometre range between Newman and 130 kilometres northwest of Tom Price, with outlying records from west of Rudall River National Park (DBCA 2021c). There are records in the Rio Tinto database from Brockman, Vivash, West Turner Syncline, Tom Price, Karijini National Park, Angelo River, West Angleas, Minga Yard, Rhodes Ridge, Shovellana, Hope Downs and Noreena Downs (Rio Tinto 2016).

Acacia bromilowiana was not recorded during the survey, and was ranked as likely to occur, on the higher elevation areas of the project area, most of which fell outside of the targeted survey area. The species has distinctive dark grey fibrous bark and glaucous and slightly pruinose phyllodes and would have been readily identifiably in the field as a taxon to collect during the survey if present in the areas surveyed. It is possible that *Acacia bromilowiana* occurs in the project area outside the area covered by the current targeted survey, including potentially in the unsurveyed part of the footprint V3.

5.2.2 *Acacia effusa* (Priority 3)

Acacia effusa is a dense, wide-spreading, multi-stemmed, domed or flat-topped, somewhat viscid shrub 0.3–1.2 metres tall. It has grey or greyish red 'minniritchi' bark (Maslin et al. 2010). It flowers May-August (WAH 1998-, DBCA 2021c).

The DBCA threatened and priority flora database shows a record of this *Acacia effusa* taxon within the current project area (Figure 4.1). The record was from 2011, with the site described as a gently inclined footslope with brown sandy loam soil (DBCA 2021a). The location where this taxon was recorded fell outside of the project area at the time of the surveys, and was not visited. No flora and vegetation surveys have been completed over this part of the project area.

Regionally the species has been recorded at Mudlark (Onshore 2013b) and from Area C West to Yandi tenements (Onshore 2014a).

There are 31 specimen records within the Western Australian Herbarium database, with collections recorded from a patchy 110 kilometre range between Marandoo and West Angeles (DBCA 2021c), it is known from a large number of records within the central southern sector of the Pilbara bioregion, including Karijini National Park. Habitat is described as lower scree slopes of low rocky ranges or alluvial plains at the base of banded ironstone ranges. It is often common where it occurs (BHP 2016).

The species was not recorded during the survey and was ranked as likely to occur on the low hills, stony plain and loamy drainage flats proximal to the Great Northern Highway. However, the targeted survey only covered 40% of the current project area.

Acacia effusa is a low spreading shrub with 'minniritchi bark and would have been readily identifiable in the field if it has been present within the survey area.

5.2.3 *Eremophila magnifica subsp. magnifica* (Priority 4)

A mid stratum shrub occurring up to 1.5 metres in height, it has been recorded on skeletal soils over ironstone and occurs on rocky scree slopes (WAH 1998-). Often occurs high in the landscape on steep to moderate slopes, summits, gullies, skeletal red gritty soil over massive banded ironstone. (DBCA 2021c). It generally flowers August to November but has also been recorded flowering in June (WAH 1998-, DBCA 2021c)

Eremophila magnifica subsp. *magnifica* is known to occur 14 kilometres west south-west of the project area from a very steep gully of silty brown loam (DBCA 2021a). There were nine populations of Eremophila magnifica subsp. magnifica represented within the MAC Development (Onshore 2017). Locally it is widespread across ranges in BHP Billiton Iron Ore's Mudlark (Onshore 2013b), Tandanya (Onshore 2013c), and Jinidi tenements (Onshore 2011b), situated to the west, south-west and east of the Proposed MAC Development Envelope. Plant density ranges from scattered individuals to populations of greater than 1,000 plants. The species typically occurs on steep to moderately sloping rocky hill slopes, hill crests, gullies and rocky drainages. *Eremophila magnifica* subsp. *magnifica* is widely collected from similar habitat at BHP Billiton Iron Ore's Eastern (Onshore 2012c) and (Onshore 2014b) operations near Newman.

There are 42 specimen records within the Western Australian Herbarium database, with collections recorded from over a 310 kilometre range between Newman and Mt Farquhar (DBCA 2021c) and 940 records, within the Rio Tinto database (Rio Tinto 2016).

Eremophila magnifica subsp. *magnifica* is a distinctive species, its leaves smell of nutmeg when crushed. It readily distinguishable from the closely related (Priority 3 listed) *E. magnifica* subsp. *velutina* by having glabrous leaves (with ciliate leaf margins) whilst *E. magnifica* subsp. *velutina* has a velvety leaf surface. The species flowers purple, primarily in August to November and would not have been flowering during the survey, however it is identifiable from vegetative material, habit, habitat and leaf surface and would have been readily identifiable in the field as a taxon to collect during if it had been encountered.

The species was not recorded during the targeted survey, and was ranked as likely to occur, on the higher elevation areas of the project area, most of which fell outside of the targeted survey area. It is possible that *Eremophila magnifica* subsp. *magnifica* occurs within the project area, and potentially within the unsurveyed part of footprint V3.

5.2.4 Eremophila pusilliflora (Priority 2)

A low-growing, open shrub 30–50 centimetres high, 50–100 centimetres wide, found on seasonally inundated alluvial plains, growing in red-brown sandy loam soils in open low shrubland with *Acacia aneura, Ptilotus nobilis*, *Goodenia* and *Triodia* species (Buirchell & Brown 2016).

Eremophila pusilliflora was recorded in 1977, 15 kilometres west of the project area on a flat plain with thin soil underlain by partly consolidated colluvium near Packsaddle Bore (DBCA 2021a).

The species is infrequently collected and was not recorded from the MAC development area, despite habitat being present (Onshore 2017).

There are 14 specimen records within the Western Australian Herbarium database, with collections recorded from over a 120 kilometre range between Auki and West Angeles (DBCA 2021c) and records ranging across 60 kilometres from the Rio Tinto Priority Flora database (Rio Tinto 2017).

The species was not recorded during the survey and was ranked as may potentially occur on the project area, noting that the targeted survey only covered 40% of the project area.

Formerly known as *Eremophila forrestii* subsp. Pingandy (M.E. Trudgen 2662), *Eremophila pusilliflora* is related to *E. forrestii*, from which it may be distinguished by its lower-growing habit, consistently smaller leaves, shorter corolla and distinctively pustulate sepals with a glabrous inner surface. The sepals turn reddish pink with age whereas those in E. *forrestii* remain the same colour (Buirchell & Brown 2016).

The species predominantly flowers between April and September but may also flower at other times of the year in response to rainfall (Buirchell & Brown 2016). The timing and conditions were suitable during the survey for flowering and due to its size, it would have been visible to collect if encountered.

5.2.5 Indigofera gilesii (Priority 3)

Indigofera gilesii is an erect perennial shrub to 1.5 metres tall with purple-pink flowers (WAH 1998-). This taxon was recorded in 1997 from a location fifteen kilometres west of the project area, from a broad open gully on the south side of a low hill. It is often recorded high in the landscape on skeletal soils in gorge or gully habitats and has been recorded flowering recorded post-wet season (June) and dry season (August) (DBCA 2021a).

There are 25 specimen records within the Western Australian Herbarium database, with collections sporadically recorded from over a 120 kilometre range from Packsaddle Bore to Newman (DBCA 2021c).

The species was not recorded during the survey, and was ranked as "may potentially occur", on the higher elevation areas of the project area, most of which fell outside of the targeted survey area. The species has been recorded flowering in the post-wet season (May, June) and dry season (August) (WAH 1998-, DBCA 2021c). The timing and conditions were suitable during the survey for flowering and due to its size, it would have been visible to collect if it was encountered.

5.2.6 Isotropis parviflora (Priority 2)

Isotropis parviflora is a low perennial herb or shrub to 0.1 metres in height flowering white to pink during March. Occurs on stony plain, lower slopes, hillcrest/upper slopes (DBCA 2021c). It is known to be a short-lived disturbance species that responds to fire and is often recorded along the berms of access tracks.

There is a record from Packsaddle Village 10 kilometres south of the project area from upper-slope, ironstone outcropping (DBCA 2021a) and it has been recorded from Billiton Iron Ore's Jinidi tenements (Onshore 2011b).

There are 28 specimen records within the Western Australian Herbarium database, with collections recorded from over a 210-kilometre range between Wittenoom Gorge and Newman. Outlier records occur in the Great Sandy Desert and the Tanami (DBCA 2021c)

The species was not recorded during the survey and was ranked as likely to occur on the project area on stony plain, lower slopes, upper slopes and hillcrests.

This species flowers predominantly in the late wet season (March), but flowering has been recorded through to the early dry season (August) (WAH 1998-, DBCA 2021c). The timing and conditions were suitable during the survey. However, due to its small size this taxon could have been overlooked. It is also short-lived post disturbance and may be under-surveyed. The possibility of this taxon occurring in the project area cannot be discounted.

5.2.7 Nicotiana umbratica (Priority 3)

Nicotiana umbratica is an erect, short-lived annual or perennial, herb, 0.3-0.7 metres high that flowers white, April to June and inhabits shallow soils, rocky outcrops (WAH 1998-). This taxon was not flagged in the DBCA search; however, one individual plant was recorded from the MAC development envelope growing under an overhang in a narrow gorge (Onshore 2011a). There are currently 23 records within the Pilbara extending approximately 180 kilometres from Shay gap to Bamboo Springs with an outlier near Karratha (DBCA 2021c).

The species was not recorded during the survey, and was ranked as "may potentially occur" on the project area.

The project area falls outside of the known distribution, however *Nicotiana umbratica* is short-lived and thus may be under-surveyed. This species has been recorded as scattered occurrence in very low numbers across similar habitat in the broader locality. Therefore, if present, it would only occur in low number. The timing and conditions were suitable during the survey however due to its small size this taxon could have been overlooked during the survey.

5.2.8 *Themeda sp. Hamersley Station (M.E. Trudgen 11431) (Priority 3)*

Themeda sp. Hamersley Station (M.E. Trudgen 11431) is a robust tall grass. There are 45 specimen records within the Western Australian Herbarium database, with collections recorded from over a 450 kilometre range from Damper to Newman, with an outlier in the Little Sandy. This species occurs in red clay pans and grass plains (DBCA 2021c). It generally flowers in August, but has been recorded flowering in July and September also (WAH 1998-, DBCA 2021c).

There is a record from the flats on the western side of the Great Northern Highway, six kilometres south of the project area from the Coondewanna Flats (DBCA 2021a) and it has been recorded from Billiton Iron Ore's Mudlark tenements (Onshore 2013b) and Tandanya tenements , (Onshore 2013c).

Themeda sp. Hamersley Station is difficult to distinguish in the field from larger individuals of the common and widespread *Themeda triandra*, which was recorded from 26 locations throughout the project area during the 2012 and 2021 surveys combined (Rapallo 2012, Rapallo 2021a) and formed a dominant component of vegetation types B, C and D of the Great Northern Highway intersection (Rapallo 2021a).

Themeda sp. Hamersley Station (M.E. Trudgen 11431) flowers in August, and the timing of the 2012, 2020 and 2021 surveys (which occurred in April and May) was outside of this flowering period. The species was not recorded during the survey, but was ranked as highly likely to occur within the loamy drainage flats proximal to the Great Northern Highway. Surveys in August are required to determine this.

5.2.9 *Triodia sp. Mt Ella (M.E. Trudgen 12739) (Priority 3)*

Triodia sp. Mt. Ella (M.E Trudgen 12739) is a perennial hummock grass to 30–60 centimetres high, 40–80 centimetres wide, very resinous and sometimes conspicuously stoloniferous. Fertile collections have been made in February and March (Barrett & Trudgen 2018) and also in September (DBCA 2021c). *Triodia* sp. Mt. Ella (M.E Trudgen 12739) a is known to occur 17 kilometres west of the project area proximal to the eastern boundary of Karijini National Park (DBCA 2021a).

The taxon has been recorded from the southern central sector of BHP Billiton Iron Ore's MAC Development Envelope (Onshore 2017). BHP Billiton Iron Ore's Mudlark (Onshore 2013b) and Tandanya, (Onshore 2013c), tenements, and from Rio Tinto's West Angelas project (Trudgen & Casson 1998). Individual occurrences in the Hamersley Range are small in area, mainly occurring at the bases of open to slight gullies on the mid- to upper slopes of large hills; however, some records are from gorges and ridges. Some occurrences are associated with iron-rich substrate in the West Angelas mining area, but the main factor affecting distribution is likely to be the deeper (moisture retaining) soils at the bases of gullies. Most records are from outcropping ironstone or ironstone gravel; the Rudall River occurrence is from creek beds on unknown geology (Barrett & Trudgen 2018). This means that the species is likely to occur, on the higher elevation areas of the project area rather than the stony plain and loamy drainage flats proximal to the Great Northern Highway.

There are 35 specimen records within the Western Australian Herbarium database, with collections recorded from locations extending over 200 kilometres from Karijini National Park to 30 kilometres east of Newman, with an outlying record from Rudall River National (DBCA 2021c). *Triodia* sp. Mt. Ella (M.E Trudgen 12739) is considered to be geographically restricted and uncommon, but unlikely to be rare (Trudgen & Casson 1998).

The species was not recorded during the survey, however, was ranked as likely to occur, on the higher elevation areas of the project area, which fell outside of the targeted survey area. In the field, *Triodia* sp.

Mt. Ella (M.E Trudgen 12739) can be separated from co-occurring species by its spreading form, extremely resinous surfaces and very strong smell of resin (Barrett & Trudgen 2018).

5.2.10 Triodia sp. Karijini (S. van Leeuwen 4111) (Priority 1)

Triodia sp. Karijini (S. van Leeuwen 4111) is a wispy perennial hummock grass to 50–100 centimetres high, non-resinous (DBCA 2021c). *Triodia karijini* belongs to the soft group, sharing the epistomatous (soft type) leaf blades (Barrett et al. 2017).

This taxon was recorded in 2011 four kilometres west of the project area, from a very steep hillslope of grey silty loam (DBCA 2021a) and has been recorded from BHP Billiton Iron Ore's Mudlark tenements (Onshore 2013b). All Western Australian Herbarium records are from high in the landscape; it occurs on or near outcropping ironstone, on summits or steep hillslopes of mountains (Barrett et al. 2017). The species has been recorded flowering recorded during the dry season (September), but most WA Herbarium records do not indicate flowering times (DBCA 2021c) .

There are 16 specimen records within the Western Australian Herbarium database, with collections sporadically recorded from over a 215 kilometre range from Brockman to Mt Robinson, (DBCA 2021c). Populations can be dense but are patchy and restricted to mountain tops and sides (Barrett et al. 2017).

The species was not recorded during the survey, and was ranked as "may potentially occur", on the higher elevation areas of the project area, which fell outside of the targeted survey.

Triodia sp. Karijini may be confused in the field with the common and widespread *Triodia melvillei* which flowers July-October. The latter species occurs within the range of *T. karijini* but can be distinguished by having prominently awned lemmas with midlobe 10–14 millimetres metre long (acute to sub-awned with midlobe 2.0–3.0 millimetre metres long in T*. karijini*), and resinous foliage (non-resinous in *T. karijini*). *Triodia melvillei* also usually occurs on red loam flats, and only rarely on rock on high mountains (Barrett et al. 2017). *Triodia melvillei* was recorded during the 2012 survey from quadrats across the project area (Rapallo 2012), however all flora surveys at Lamb Creek to date have occurred outside of the flowering periods of both species. Therefore *T.* sp. Karijini may potentially occur in the project area.

5.2.11 Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684) (Priority 1)

Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684) is a small annual herb to 30 centimetres recorded flowering post-wet (May) and during the dry season (July, September) This taxon has been recorded three kilometres south of the project area, west of the Great Northern Highway and locally this species has been recorded on the Coondewanna Flats (DBCA 2021a).

There are 17 specimen records within the Western Australian Herbarium database, with collections sporadically recorded from over a 280 kilometre range from Brockman to Newman. This species occurs in woodland to open forest of variety of mulga species and other acacias, or shrubland of acacias and other species, sometimes with eucalyptus, over diverse shrubland, often over open Triodia. Habitat is grassland mulga plain, floodplain, drainage, sandy-clay loam, (DBCA 2021c).

The species was not recorded during the survey, however, was ranked as likely to occur within the loamy plains of the project area, proximal to the Great Northern Highway. This species has been recorded as scattered occurrence in very low numbers across similar habitat in the broader locality. Therefore, if present, it would only occur in low number. The timing and conditions were suitable during the survey however due to its small size this taxon could have been overlooked.

5.3 Survey adequacy and limitations

5.3.1 Level of assessment and survey timing

Survey level and timing were as per client request. A targeted survey was initiated after a desktop review and 2012 survey results indicated a high potential for conservation significant flora occurring in the project area. The survey timing aligned with the recommended primary survey period for the Eremaean Botanical Province (EPA 2016b), and overlapped with the flowering period of the majority of flora taxa identified in the desktop as potential to occur in the survey area. The 2021 survey occurred over a smaller additional area (Table 1.1), and was specifically timed to record further individuals and populations of *Aristida lazaridis* in the area near the Great Northern Highway intersection (Appendix II).

5.3.2 Assessment against EPA technical guidance

The targeted flora survey was conducted in accordance with Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* and aligned with criteria for a targeted survey (EPA 2016b). The EPA technical guidance does not specify recommended methods or survey intensity for targeted surveys. However, it describes traverses of appropriate spacing as a potential method. EPA criteria specific for a targeted survey, and an assessment of the survey against these criteria, is provided in Table 5.2 below.

Table 5.2 Assessment of the survey against EPA technical guidance

EPA (2016b) criteria for targeted flora surveys	Survey met EPA criterion	Details
Targeted surveys should be undertaken when the targeted flora and/or vegetation are most detectable and identifiable in the field, usually when in flower.	Yes	The survey was completed in April 2020 and May 2021 which in the Pilbara is the post-wet season. Out of the 18 taxa identified in the likelihood assessment as confirmed, likely to occur, and may occur in the Lamb Creek project area (section 4.1 and Appendix II) the greater majority (12) had flowering periods that overlapped with the survey periods of April and May. The survey did not overlap with the flowering period for *Eremophila* sp. Hamersley Range, but this taxon could be identified without flowers. Two other taxa were recorded flowering just outside the survey periods, and therefore could possibly flower in April and May because very few records were available. Only two taxa had flowering recorded in the dry season only. In summary, the survey timing was considered appropriate to capture the flowering time of the greater majority of potential flora taxa.
All potentially suitable habitats should be systematically searched	Yes for footprint V1 Partial for footprint V3 No for project area	The survey covered the entirety of the survey area, defined in section 1.3, and thus covered all potentially suitable habitats within. However, the survey area was based on footprint V1 which has now been superseded. The current footprint V3 extends outside of the survey area, with 236 hectares (36%) not surveyed. Based on the 2012 vegetation maps, potentially suitable habitat exists in the areas not covered by the targeted survey. The targeted survey only covered 869 hectares (40%) of the project area, and did not include all the available habitats within. The current project area includes a database record of *Acacia effusa* (Priority 3) which was not visited because it fell outside of the project area at the time of the survey.

EPA (2016b) criteria for targeted flora surveys	Survey met EPA criterion	Details
Sufficient resources should be allocated for field time	Yes	The entirety of the survey area was covered by systematic traverses spaced approximately 50 m apart. EPA guidance only provides recommendations on traverse spacing for the South West Botanical Province (10 m), stating that wider transect widths may be considered acceptable for other Botanical Provinces.
Where the habitat extends outside the survey area, the full extent of a population or community should be surveyed	Yes	*Aristida lazaridis* and *Rhagodia* sp. Hamersley were found to extend beyond the boundaries of the survey area, and mapped accordingly. Extent of the *A. lazaridis* population was mapped up until 1 km north-east of the survey area boundaries. It may extend further. Rhagodia sp. Hamersley was also mapped outside the 2020 survey area, however, the majority of these records subsequently fell within the expanded survey area boundaries searched in 2021. *Rhagodia* sp. Hamersley occurred as individual shrubs spaced widely apart across the 2021 survey area, rather than as patches / populations, hence mapping population boundaries was not applicable.

5.3.3 Survey limitations table

Table 5.3 Limitations of the targeted flora survey

Aspect	Limitation	Discussion
Availability of contextual information at a regional and local scale	No	Sufficient flora and vegetation information was available for the Hamersley subregion (of the Pilbara Bioregion) to place the project area in a regional context. At a local scale, sufficient (publicly available) flora and vegetation surveys have been completed in the vicinity of the project area. This is reflected in the DBCA TPFL and Western Australian Herbarium database results, which yielded over 700 conservation significant flora records within 60 km of the survey area. In addition, there has been a significant body of work completed at Mining Area C which is in close proximity to the Lamb Creek project.
Competency/experience of the team carrying out the survey, including experience in bioregion surveyed	No	Both the 2020 and 2021 surveys were completed by a team of experienced botanists. Individually, the botanists involved in the field survey and reporting work have between 7-20 years' experience completing flora and vegetation surveys throughout Western Australia and in the Pilbara. Sharnya Thomson-Yates is also an experienced botanical taxonomist.
Proportion of flora recorded and/or collected, any identification issues	No	The targeted survey was designed to record specific taxa. The survey timing for both survey periods was within the recommended period for the Eremaean botanical province, and the majority of the target taxa were found to be in flower, enabling a full and positive identification. *Eremophila* sp. hamersley, although not in flower during the survey, could be confidently identified from vegetative material. Based on desktop results the greater majority of the taxa rated as may occur to highly likely to occur in the survey area would have been in flower and readily identifiable during the survey.

Aspect	Limitation	Discussion
Was the appropriate area fully surveyed (effort and extent)	Yes	Survey intensity was considered adequate and appropriate for recording the presence and extent of conservation significant flora in the survey area defined prior to the 2020 and 2021 field surveys. However, this survey area was based on footprint V1 which has since changed. Footprint V3 was provided after the fieldwork has been completed, with 236 hectares (36%) of footprint V3 not covered by the targeted survey. The survey area only covered 869 hectares (40%) of the current project area, with the remaining 60% containing potential habitats for several (additional) conservation significant taxa. The desktop review and likelihood scores of potential conservation significant taxa, as presented in Appendix II, were determined based on field information available for those areas covered by surveys. The current project area contains a 27% portion that has never been surveyed, including a location that contains a DBCA record *of Acacia effusa* (Priority 3). Likelihood scores for the areas not visited by the field team are based on desktop information only.
Access restrictions within the survey area	No	The majority of the project area was accessible by helicopter and some areas were accessible by vehicle. The entirety of the survey area was covered on foot. There were no survey limitations due to access restrictions.
Survey timing, rainfall, season of survey	No	The two field surveys were completed in April 2020 and May 2021, which falls within the primary recommended timing for surveys in the Eremaean botanical province (EPA 2016b), and overlaps with the flowering period of the majority of flora taxa identified in the desktop as potential to occur (see also Table 5.2). The survey area experienced good rainfall over the months preceding both surveys, and nearly all the target taxa recorded were in flower. Overall, survey timing was deemed to be appropriate for the survey area and the region, and for the taxa targeted.
Disturbances that may have affected the results of the survey (e.g. fire, flooding, clearing)	No	The majority of the survey area has been affected by fire, however the purpose of the survey work was to record what is currently present in the project area. Some taxa are fire responders, or favour disturbed conditions.

5.4 Impacts and management

Development within the proposed footprint V3 has the potential to impact conservation significant flora and vegetation through:

- Direct removal of conservation significant flora and vegetation during clearing and earthworks;
- Alteration to the volume of surface water flows causing decline to sheet flow dependent vegetation drainage flats that contain priority flora;
- Increased weed species diversity and density.

5.4.1 Direct clearing

Footprint V3 impacts several priority flora species (Table 4.2). It is recommended that infrastructure be placed to avoid significant conservation flora where possible. Where populations cannot be avoided, as may be the case with *Aristida lazaridis* it is recommended that the infrastructure be placed to avoid the highest densities, provided surface flow is maintained (section 5.4.2).

Existing management strategies used by MRL at their surrounding mining operations such as internal ground disturbance approvals system are important tools for minimising direct clearing impacts and should be applied to the Lamb Creek Iron Ore Project.

5.4.2 Alteration to surface flow

Design of the haul road and mining development should consider surface water flow to minimise obstruction to seasonal overland water flows to the loamy drainage flats proximal to the Great Northern Highway that contain the priority species *Aristida lazaridis* and *Rhagodia* sp. Hamersley and the potential for *Themeda sp. Hamersley Station* (M.E. Trudgen 11431) and *Vittadinia* sp. Coondewanna Flats (S. van Leeuwen 4684).

5.4.3 Weeds

Increasing vehicular access combined with vegetation clearing for the project has the potential to introduce and/or spread weed species that can compete with native vegetation and reduce species diversity. Existing management strategies used by MRL at their surrounding mining operations are important tools for minimising potential impacts.

It is recommended that general and species-specific weed management, hygiene, and monitoring is conducted in accordance with MRL's existing weed management procedures. Management measures may include the following:

- Mobile machinery and equipment brought to site in a clean state;
- Regular inspections for the presence of weeds within areas of disturbance, particularly in high moisture environments such as the loamy drainage flats proximal to the Great Northern Highway and
- Seasonal weed control programmes to be implemented if necessary.

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7 Appendices

List of Appendices

No	Title
Appendix I	Conservation codes for Australian flora
Appendix II	Flora desktop results: Conservation significant flora and likelihood assessment

Appendix I Conservation codes for Australian flora

Threatened species under the Commonwealth EPBC Act

Threatened fauna and flora may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in any one of the following categories:

EX Extinct

EW Extinct in the wild

CR Critically endangered

EN Endangered

VU Vulnerable

CD Conservation dependent

Conservation codes for Western Australian flora under the Western Australian *Biodiversity Conservation Act 2016*

Threatened, Extinct and Specially Protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

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 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 (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 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 (Rare Flora) Notice 2018* for vulnerable flora.

Priority species

Priority species are possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the 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. In this report, priority species are given the codes P1, P2, P3 and P4.

P1 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.

P2 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.

P3 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.

P4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) **Rare**. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) **Near Threatened**. Species that are considered to have been adequately surveyed and that 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.

Appendix II Flora desktop results: Conservation significant flora and likelihood assessment

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Acacia bromilowiana	P4	Tree or shrub to 12 m high	WAH and TPFL : High in landscape, Slope, cliff, gully, crest, summit , very steep	Red skeletal stony loam, orange-brown pebbly,gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds.	May, July, August	Yes but off footprint	Within 20 km	**Likely to occur**
Acacia daweana	P3	Shrub from 0.3- 2m.	WAH: Gentle slopes, Along diffuse drainage area where it leaves low rocky hills. Low shrubland with Triodia basedowii, Acacia bivenosa, A. validinervia and A. maitlandii.	Stony red loamy soils. Low rocky rises, along drainage lines	July-October	Yes	Not within 20km	Unlikely to occur
Acacia effusa	P3	Low, dense, spreading, somewhat viscid shrub, 0.3-1 m high.	WAH: Scree, gentle slope, footslope, creeklines, low iron stone hill, stony plain base of hills , skeletal soils, red brown, Red brown clay loam.	Stony red loam. Scree slopes of low ranges.	May-August	Yes	Recorded in project area in 2011	**Likely to occur**
Acacia subtiliformis	P3	Spindly, slender, erect shrub, to 3.5 m	WAH: Calcrete slope, rise, plain	On rocky calcrete plateau.	April-June	No	Within 20 km	Unlikely to occur
Adiantum capillus-veneris	P2	Perennial small herb from 0.1-0.2m. Frond 1-2 pinnate	WAH: In wet rocky crevices, associated with gorges or springs.	Moist sheleted sites in gorges and on cliff walls.	March, September	No	Not within 20km	Unlikely to occur
Amaranthus centralis	P3	Annual Herb	WAH: Tussock grassland of Themeda triandra, Eulalia aurea and Aristida inaequiglumis with open woodland of Eucalyptus victrix and Corymbia aspera over low open woodland of Corymbia aspera and Hakea lorea subsp. lorea over high open shrubland of Gossypium robi. Low in the landscape, alluvial flats, River banks, Mulga woodland[3]	no info	No info	Yes	Not within 20km	Unlikely to occur
Ampelopteris prolifera	P3	Perennial herb/fern to 4m	no info	Near water or in wet ground.	No info	No	Not within 20km	Unlikely to occur
Aristida jerichoensis var. subspinulifera	P3	Compactly tufted perennial, grass-like or herb, 0.3-0.8 m high	WAH: Plain or Flat, clay/loam. Often mulga woodlands or acacia shrublands over spinifex and/or tussock grassland.	Hardpan plains	May, July, September	Yes	Confirmed	**Confirmed**
Aristida lazaridis	P2	Tufted perennial, grass-like or herb, 0.4-1.5 m high.	WAH: Plain, clay /loam, drainage, slope; often mulga low open woodland with or without Eucalypts, over variety of shrubs and herbs, often over tussock grassland but sometimes with Triodia hummock grassland.	Sand or loam	April, May	Yes	Confirmed	**Confirmed**
Arthropodium vanleeuwenii	P2	Perennial herb 0.3 to nearly 1m.	WAH. Moderately steep facing slopes including banded and Brockman ironstone formations on red-brown, orange-brown loams and sandy loams. Low open woodland of Eucalyptus leucophloia subsp and Corymbia hamersleyana over hummock grassland of Triodia brizoides. Other tussock grassland species include Themeda triandra. Known from two small populations growing above 900 m on south-facing hillslopes of Brockman Iron Formation in the Pilbara bioregion of Western Australia. Associated vegetation includes Eucalyptus leucophloia subsp. leucophloia, Corymbia hamersleyana, Indigofera fractiflexa, Triodia spp. and Themeda triandra. Often found growing under the Triodia and occasionally under the Themeda, very rarely growing in the open. Flowering from mid- to late September. Fruiting from late September to mid-October[4]	No info	October	Yes but off footprint	Not within 20km	Unlikely to occur
Atriplex flabelliformis	P3	Monoecious, erect, rounded perennial, herb, to 0.35 m high.	WAH: Saline areas. Often salt tolerant shrublands, over low open heath.	Clay loam, loam. Saline flats or marshes.	No info	No	Not within 20km	Highly unlikely to occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Barbula ehrenbergii	P1	Moss	Moss. Shaded moist environment on rock face 1.A species of hydric environments [2]	No info	No info	No	Not within 20km	Highly unlikely to occur
Calotis squamigera	P1	Procumbent annual, herb, to 0.21 m high.	WAH: Flat. Red brown loam clay, Stony plain with sandy loam soil. Low woodland of Acacia aptaneura, over open tussock grassland of Aristida contorta and Chrysopogon fallax with high open shrubland of Acacia synchronicia and Psydrax latifolia.	Pebbly loam	July	Yes	Not within 20km	Unlikely to occur
Cladium procerum	P2	Densely tufted perennial, grass-like or herb (sedge), 2 m high.	WAH: Major creeklines , Eucalyptus camaldulensis and Melaleuca argentea open woodland	Perennial pools	July, October, November	No	Not within 20km	Highly unlikely to occur
Dampiera anonyma	P3	Multi-stemmed perennial herb, 0.5 - 1m. Blue purple flower	WAH: Hillside; rocky red ironstone.	Skeletal red-brown gravelly soil over banded ironstone, basalt, shale and Jaspilite. Hills, summits and upper slopes (>1000m)	June, July, September	No	Not within 20km	Unlikely to occur
Dampiera metallorum	P3	Rounded, multi-stemmed perennial, herb, to 0.5 m high.	WAH: Summit of hill, high in landscape, steep slope, skeletal red gritty soil over massive banded ironstone.	Skeletal red-brown gravelly soil over banded ironstone. Steep slopes, summits of hills.	April-October	Yes but off footprint	Not within 20km	Unlikely to occur
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3	no info	WAH: Cracking clay	Spreading annual herb to 10 cm tall, with blue flowers in March; occurs on cracking clay on flat to gently undulating plains with large surface rock	March, May, July	No	Within 20 km	Unlikely to occur
Dysphania congestiflora	P3	no info	WAH: Saline floodplain. Recorded from the western side of Fortescue Marsh from flats on the margin and towards the centre of seasonally inundated flood plains and lake beds, on saline, deep, light-medium to heavy clay soils. A single collection has also been recorded from the Lyndon River in close proximity to Lake Macleod [5]	No info	June, July	No	Not within 20km	Highly unlikely to occur
Eleocharis papillosa	P3	Annual, herb.	WAH: Claypan low dune/berm on eastern edge of wetland.	Red clay over granite, open clay flats. Claypans.	November	No	Not within 20km	Unlikely to occur
Eragrostis crateriformis	P3	Annual, grass-like or herb, 0.17-0.42 m high	WAH: Drainage area / floodplain.	Clayey loam or clay. Creek banks, depressions.	January-July	Yes	Not within 20km	Unlikely to occur
Eragrostis sp. Erect spikelets (P.K. Latz 2122)	P3	Erect perennial grass-like or herb to 0.3 m high	WAH: Near samphire flat. Associated species: Goodenia omeriana, G. forrestii, Cullen cinereum, Scaevola spinescens, Acacia tetragonophylla, A. victoriae. Associated species: Halosarcia spp., Eragrostis falcata (mostly as first year plants), Nicotiana sp., Swainsona sp., Angianthus sp. Low calcrete platforms/rises [12]	No info	No	No	Not within 20km	Highly unlikely to occur
Eragrostis sp. Mt Robinson (S. van Leeuwen 4109)	P1	Tussock-forming perennial, grass-like or herb, to 0.3 m high	WAH and TPFL: Open mallee shrubland; Summit of hill, steep western slopes. Skeletal gritty soil. Massive banded Brockman Iron Formation.	Red-brown skeletal soils, ironstone. Steep slopes, summits.	September	No	Not within 20km	Unlikely to occur
Eremophila magnifica subsp. magnifica	P4	Shrub, 0.5-1.5 m high.	WAH: High in landscape, steep slopes, summits, gullies, skeletal red gritty soil over massive banded ironstone of the Brockman Iron Formation.	Skeletal soils over ironstone. Rocky screes.	June-November	Yes but off footprint	Within 20 km	**Likely to occur**
Eremophila magnifica subsp. velutina	P3	Shrub, 0.5-1.5 m high.	WAH: Summit of steep hill, high in landscape, steep slopes, rock screes and cliff faces, skeletal red stony soil over massive ironstone of the Brockman Iron Formation.	Skeletal soils over ironstone. Summits.	July-October	Yes but off footprint	Not within 20km	Unlikely to occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Eremophila pusilliflora	P2	Shrub to 0.5m	WAH: Low lying associated with drainage lines on red/brown clay loams and ironstone. Low open woodlands scattered with Corymbia hamersleyana and with Acacia aneura, A. inaequlatera, A. pyrifolia over hummock grasslands of T. wiseana, T. pungens and T. brizoides. TPFL: Low lying in valleys, gibber plains above drainage line with Goodenia over red clay loams. Open woodlands of Acacia aneura with Ptilotus exaltatus and Ptilotus helipteroides. Found on seasonally inundated alluvial plains between Turee Creek, Pingandy Creek and drainage systems leading into the Ashburton River, growing in red-brown sandy loam soils in open low shrubland with Acacia aneura, Ptilotus nobilis, Goodenia and Triodia species[6]	No info	April-September and after rainfall	Yes	Within 20 km	May potentially occur
Eremophila sp. Hamersley Range (K. Walker KW 136)	P3	no info	WAH: Rocky gullies and gorges. Steep rocky hill slopes and summits, high in the landscape	No info	June, August, September	Yes but off footprint	Confirmed	**Confirmed**
Eremophila sp. West Angelas (S. van Leeuwen 4068)	P1	no info	WAH: TPFL Summits and slopes of hills, high in the landscape.	No info	August, September	Yes but off footprint, infrequently recorded ain locality	Not within 20km	Unlikely to occur
Eremophila spongiocarpa	P3	Compact, succulent-leaved shrub, to 1 m high.	WAH and TPFL: Saline , Alluvial margin of marsh. Edge of marsh, saline flats, broad plain, floodplain, claypan, Slope of linear dune.	Weakly saline alluvial plain on margins of marsh.	May, August, September	No	Not within 20km	Unlikely to occur
Eremophila youngii subsp. lepidota	P4	Dense, spreading shrub, (0.2-)1-3 m high.	WAH: Mulga woodland or acacia shrublands. Can grow near salt marshes in combination with Atriplex and other chenopods.	Stony red sandy loam. Flats plains, floodplains, sometimes semi-saline, clay flats.	January-March or August, September	Yes	Not within 20km	Unlikely to occur
Euphorbia australis var. glabra	P3	Prostrate herb, 10cm	WAH: Vegetation dominated by Acacia aptaneura. Acacia aff. aneura (long, flat, recurved; F. .MR 35.3), (Eucalyptus xerothermica) low woodland over *Malvastrum americanum, Sida aff. fibulifera low open shrubland over Sporobolus australasicus scattered bunch grasses. Associated Species: Acacia tetragonophylla. Broad, flat plain; calcrete platform to west and major creekline to east. Flat, red brown loam.	Prostrate annual herb. Typically occurs on cracking clay and clay plains	No	Possible	Not within 20km	Unlikely to occur
Euphorbia clementii	P3	Erect herb to 0.6m	TPFL; Sparse low woodland over Senna spp. moderately dense low shrubland over Triodia spp. and other grasses. Rock (Laterite) and red sand. Occasional Eucalyptus leucophloia. TPFL Taxon has been recorded on plains and outwash slopes, and in minor drainage lines or areas of sheet flow. This taxon is typically a fire-responder (and relatively short-lived) and can be observed in large numbers in recently burnt areas. [7]	Gravelly hillsides, stony grounds	May-July	Yes, would be obvious but as is a big post fire coloniser	Not within 20km	Unlikely to occur
Euphorbia inappendiculata var. inappendiculata	P2	small prostrate, much branched annual herb	Acacia aptaneura dominated vegetation. Flat, red brown loam. Recorded in cracking claypans of red sandy clay at Miralga Creek [7]	No info	No info	Yes, infrequently recorded	Not within 20km	Unlikely to occur
Euphorbia inappendiculata var. queenslandica	P2	prostrate annual herb	WAH: Tussock grassland of Astrebla elymoides, Chrysopogon fallax and Urochloa occidentalis var. occidentalis with open herbs of Polymeria longifolia, with high open shrubland of Acacia synchronicia. Cracking clay soil, Gilgai plain.	No info	No info	No	Not within 20km	Unlikely to occur
Euphorbia stevenii	P3	Succulent perennial herb from 0.1-0.5	Gently sloping area to gently undulating. Soils include: Red-brown cracking clay with scattered pebbles and cobbles on the surface. Occurs with many grasses including Astrebla sp, Themeda sp and Aristida sp.	Clay, sandy soils	June	Yes, infrequently recorded in locality	Not within 20km	Unlikely to occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Fimbristylis sieberiana	P3	Shortly rhizomatous, tufted perennial, grass-like or herb (sedge), 0.25-0.6 m high.	WAH: Major drainage, edge of watercourse. With Eleocharis sp. Eucalyptus camaldulensis and Melaleuca argentea open woodland over Acacia pyrifolia var. pyrifolia; Acacia tumida var. pilbarensis and Clerodendrum tomentosum mid sparse shrubland over Cladium procerum and Cyperus vaginatus sedges and Cenchrus ciliaris. Woodland to forest of Eucalyptus camaldulensis and/or Melaleuca leucadendra and Acacia coriacea subsp. pendens over high shrubland.	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	May-August	No	Not within 20km	Unlikely to occur
Geijera salicifolia	P3	Tree from 1.5m-6m	WAH: Growing in flood area at base of gorge wall. Stony.	Skeletal soils, stony soils; Massive rock scree and gorges	September	N	Not within 20km	Unlikely to occur
Glycine falcata	P3	Mat-forming perennial, herb, to 0.2 m high	WAH: Sump, low in landscape. With Cullen and Vittadinia sp., Goodenia pascua and Bulbine pendula. Often low grassland or herbland with Acacia shrublands and hummock grassland, sometimes Eucalypts. Clay soils, cracking clays	Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.		No	Within 20 km	Unlikely to occur
Gompholobium karijini	P2	Low shrub growing to 70 cm tall, with coarsely fibrous, grey bark.	Eucalyptus leucophloia subsp. leucophloia over Triodia sp. Triodia hummock grassland with scattered shrubs and trees on ironstone gravel 9 Breakaway habitats and associated rocky slopes, the top edge of mesas, broadly rocky and rugged upland habitats, and incised gullies/ rocky gullies of the upland areas' and 'mesa top habitat consisting of hill top, mesa top, and broad rolling hill habitats. [10]	Typically occurs on rocky crests and slopes of hill	January, August-September	Yes but rarely collected in locality	Not within 20km	Unlikely to occur
Goodenia lyrata	P3	Prostrate herb with lyrate leaves. Ephemeral	Broad drainage tract in hardpan plain. Mulga woodland. Mulga woodland or acacia shrublands, sometimes with E. victrix, over open shrubland, herbs.	Red sandy loam. Near claypan	May, August, October	No	Within 20 km	Unlikely to occur
Goodenia nuda	P4	Erect to ascending herb, to 0.5 m high.	WAH and TPFL : Variety of habitats	No info	March-August	Yes	Confirmed	**Confirmed**
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	P3	Open, erect annual or biennial, herb, to 0.2 m high.	WAH and TPFL : Variety of habitats with calcrete , Grassland on crabhole clay flats.	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains.	March-May and after rainfall	No	Within 20 km	Unlikely to occur
Grevillea saxicola	P3	Tall shrub or tree	WAH: High in landscape, steep and undulating terrain, skeletal red-brown gritty soil over massive banded ironstone of the Brockman Iron Formation. Mulga woodlands over shrublands with Eremophilas and other species, over Scaevola. No mention of Triodia. Skeletal red-brown sandy loam on steep slopes, rocky hills and ridges, usually growing with Mulga 10	No info	February, March	No	Not within 20km	Unlikely to occur
Gymnanthera cunninghamii	P3	Erect shrub, 1-2 m high.	WAH: South facing ironstone scree slope adjacent to Weeli Wolli Creek.	Sandy soils on islands in river and creek channels	Year-round	No, very scattered distribution.	Not within 20km	Unlikely to occur
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	P2	Shrub to 3m.	Gorges and Gullies associated with ironstone (inc: Brockman ironstone) outcroppings and boulders. Soils include Red-brown loams amongst boulders. Rocky ground high in the landscape. Gullies and gorges. [10]	No info	No info	Yes but off footprint	Not within 20km	Unlikely to occur
Indigofera gilesii	P3	Shrub, to 1.5 m high.	WAH: Near summit of hill, high in landscape, skeletal red-brown stony soil over massive ironstone of the Brockman Iron Formation, Gorge / gully. Red brown skeletal. Continuous ironstone pebbles, Breakaway. Red dry soil.	Pebbly loam. Amongst boulders & outcrops, hills.	May, June, August	No	Within 20 km	May potentially occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Indigofera ixocarpa	P2	Shrub to 1m	WAH: Dry creekline. Ironstone rocks and loamy soil	Skeletal red soils over massive ironstone	May, June, August	Possible, very little info, infrequently recorded at locality	Not within 20km	Unlikely to occur
Iotasperma sessilifolium	P3	Erect herb	WAH: Sump, low in landscape, flat terrain, cracking red clay-loam.	Cracking clay, black loam. Edges of waterholes, plains.	September	N	Not within 20km	Highly unlikely to occur
Ipomoea racemigera	P2	Creeping annual, herb or climber.	WAH: Medium drainage line, fringing vegetation. Open forest of Eucalyptus camaldulensis and Melaleuca argentea	No info	June	N	Not within 20km	Unlikely to occur
Isotropis parviflora	P2	Shrub, 0.1 m high.	WAH: Stony plain, lower slopes, Hillcrest/upper slope.	Valley slope of ironstone plateaus, hill slopes and stony plains.	March-August	Yes	Within 20 km	**Likely to occur**
Kohautia australiensis	P2	Erect sparsely or much-branched annual, herb, 0.1-0.5 m high..	WAH: Calcrete plains, hills and rises	No info	March-May	No	Not within 20km	Unlikely to occur
Lepidium catapycnon	P4	Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag.	Variety of vegetation types, typically with E. leucophloia over Acacias over Triodia. Strong habitat preference for steep upper breakaway slopes of mesa hills where it grows in skeletal light brown loam or sandy loam soils with a large proportion of loose rocks at the surface (50-100 percent) comprising a mixture of banded iron formation (BIF), banded chert and siltstone [11]	Skeletal soils. Hillsides.	May, June, August-November	No	Not within 20km	Unlikely to occur
Lindernia sp. Pilbara (M.N. Lyons & L. Lewis FV 1069)	P1	Annual or perennial herb, to 0.6 cm high	WAH: Claypan, low dune, edge of wetland.	No info	No info	No	Not within 20km	Unlikely to occur
Myriocephalus scalpellus	P1	Semi-erect herb, 0.03-0.08 m high.	WAH: At edge of claypan, In fringing vegetation.	Claypan	June	N	Not within 20km	Unlikely to occur
Nicotiana umbratica	P3	Erect, short-lived annual or perennial, herb, 0.3-0.7 m high. Fl. white, Apr to Jun. Shallow soils. Rocky outcrops.	no info	Shallow soils. Rocky outcrops.	April-June	Yes but off footprint	Not within 20km	Unlikely to occur
Olearia mucronata	P3	Densely branched, unpleasantly aromatic shrub (0.6-1m)	WAH: Steep upper slope, Soil: Red-brown scree boulders (ironstone), stones, base of south facing ironstone cliff, bordering a large scree slope.	Schistose hills along drainage channels	July-January	Yes but off footprint	Not within 20km	Unlikely to occur
Oxalis sp. Pilbara (M.E. Trudgen 12725)	P2	Small annual herb to 10 cm tall. Leaves green above, purple below	WAH: Gorge, gully, cliff	No info	May, July	Yes but off footprint	Not within 20km	Unlikely to occur
Pentalepis trichodesmoides subsp. Hispida	P2	Compact shrub to 1m	WAH: Summit of ridge, high in landscape, steep terrain, skeletal brown gritty soil over metabasaltic pillow lava, breccia; metatuff and minor cherts of the Bunjinah Formation, altitude ca. = 1020 m.	No info	August, September	No	Not within 20km	Unlikely to occur
Pilbara trudgenii	P3	Gnarled, aromatic shrub, to 1 m high.	WAH: Skeletal soil Summit, slopes, screes and cliffs. Brockman Iron Formation. With Eucalyptus leucophloia, E. gamophylla.	Skeletal, red stony soil over ironstone. Hill summits, steep slopes, screes, cliff faces.	July, September	Yes but off footprint	Not within 20km	Unlikely to occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Ptilotus mollis	P4	Compact, perennial shrub, to 0.5 m high, soft grey foliage.	WAH: Steep, rocky scree slope, laterite.	Stony hills and screes.	May, July, September	Yes	Not within 20km	Unlikely to occur
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3	A spindly shrub growing to 2 m tall;	WAH: Mulga over mixed grassland. Emergent eucalypts and Triodia grassland. Very open mulga woodland over patchy mixed grasses. Floodplains, hardpan plains.	Red sandy clay loam plains and floodplains growing in association with Mulga (Acacia aneura)	March, May, September	Yes	Confirmed	**Confirmed**
Rhodanthe ascendens	P1	Ascending annual herb to 0.1m	WAH: Flat terrain, low in landscape, stony gibber with red cracking clay soils. Acacia aneura over Open Tussock Grass of Aristida spp.	Clay, roadside verge	August, September	Yes, infrequently collected	Not within 20km	Unlikely to occur
Rhynchosia bungarensis	P4	Compact, prostrate shrub, to 0.5 m high.	WAH: Creekline in a gorge	Pebbly, shingly coarse sand amongst boulders. Banks of flow line in the mouth of a gully in a valley wall.	November	No	Not within 20km	Unlikely to occur
Rostellularia adscendens var. latifolia	P3	Herb or shrub, 0.1-0.3 m high.	Acacia shrubland, sometimes with Eucalypts and Corymbias, over shrublands and herblands, over tussock grassland, or Triodia pungens hummock grassland.	Ironstone soils. Near creeks, rocky hills.	April, June, August		Confirmed	**Confirmed**
Samolus sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)	P1	Erect perennial herb, 0.3-1.0 m high	Margins of semi-permanent/permanent freshwater pools and the margins of samphire shrublands where creeks discharge freshwater following periods of high rainfall. [13]	No info	September	No	Not within 20km	Highly unlikely to occur
Scaevola sp. Hamersley Range basalts (S. van Leeuwen 3675)	P2	Shrub, to 1 m high	Steep slopes and screes. Growing in Regenerating Open Shrub Mallee of Eucalyptus kingsmillii and E. gamophylla over Dwarf Scrub C/D of Triumfetta sp, Corchorus sp, Hibiscus sp. and Acacia bivenosa over Open Hummock Grass of Triodia sp.	Skeletal, brown gritty soil over basalt. Summits of hills, steep hils.	July-August	No	Not within 20km	Unlikely to occur
Seringia exastia	CR	Shrub	Variety of mulga woodlands, sometimes with Eucalypts, over Acacia shrublands over Trioda pungens hummock grassland. Gully - washout. Red sand/laterite over sandstone.	No info	Year-round	Yes	Confirmed	**Confirmed**
Sida sp. Barlee Range (S. van Leeuwen 1642)	P3	Spreading shrub, to 0.5 m high.	WAH: Cliff line and scree slopes, gorge and steep gully	Skeletal red soils pockets. Steep slope.	August	Yes but off footprint	Not within 20km	Unlikely to occur
Sida sp. Hammersley Range basalts (K. Newbey 10692)	P3	Herb or shrub to 0.15m	Plants growing amongst rocks along the south side of a small ironstone breakaway. Low open woodland over hummock grassland of Triodia sp.	No info	May, August, October	Possible, very little info, infrequently recorded at locality	Not within 20km	Unlikely to occur
Solanum kentrocaule	P3	Perennial shrub to 2.5m	WAH: Near summit of hill, high in landscape, skeletal red-brown stony soil over massive ironstone of the Brockman Iron Formation, steep slopes, steep gullies	No info	May, July, August	No	Not within 20km	Unlikely to occur
Stackhousia clementii	P3	Dense broom-like perennial, herb, to 0.45 m high.	Acacia shrubland, sometimes with E. victrix, over Acacia sclerosperma. WAH: Clay loam plains, drainage plains	Skeletal soils. Sandstone hills.	April, September		Not within 20km	Unlikely to occur
Streptoglossa sp. Cracking clays (S. van Leeuwen et a. PBS 7353)	P3	Multi stemmed annual herb	Cracking clay, Acacia aneura var. longicarpa high open shrubland over Rhagodia eremaea scattered shrubs over Aristida latifolia and Astrebla elymoides scattered tussock grasses. Acacia aneura var. longicarpa 3-5 m < 1-5%; Rhagodia eremaea 0.4-1.2 m < 1%; Aristida latifolia.	No info	June	No	Not within 20km	Unlikely to occur
Stylidium weeliwolli	P3	Annual, herb, 0.1-0.25 m high, throat appendages 4, rod-shaped.	WAH: In damp soil in rock clefts of river bed, permanent pools.	Damp soil in rock clefts of river bed, permanent pools, edge of water courses	July-October	No	Not within 20km	Unlikely to occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Swainsona thompsoniana	P3	Prostrate annual herb to 10 cm high	WAH: Gently sloping area to gently undulating. Soil: Red-brown cracking clay with scattered pebbles and cobbles on the surface. Includes a flowline. Varies to areas of orange-brown cracking clay. Colluvial and alluvial gravels in fan or floodplain	No info	April, June, August	No	Not within 20km	Unlikely to occur
Synostemon hamersleyensis	P1	no info	WAH: Steep scree slope below banded iron formation cliff line with brown sandy loam soil. Steep hillslope, narrow gorge	No info	No info	Yes but off footprint	Not within 20km	Unlikely to occur
Tecticornia globulifera	P1	no info	WAH: Saline flats and marsh with light medium clay soil.	No info	No info	No	Not within 20km	Highly unlikely to occur
Tecticornia medusa	P3	no info	WAH: Growing on the lake bed a few 100 metres from the shoreline. Red clayey sand., Claypan	No info	November	No	Not within 20km	Highly unlikely to occur
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	P1	no info	Samphire flats.	No info	No info	No	Not within 20km	Highly unlikely to occur
Tetratheca fordiana	P2	Dwarf shrub; 0.3-0.4m	WAH: Vertical cliff faces amongst ironstone. Breakaways on Skeletal soils. Scattered low trees of Eucalyptus leucophloia, E. kingsmillii over scattered shrubs of Acacia hamersleyensis over open hummock grassland of Triodia epactia, Triodia wiseana and Triodia sp. Mt Ella (M.E. Trudgen 12739) with scattered tussock grasses of Eriachne mucronata.	Shale pocket amongst ironstone	April, May	No	Not within 20km	Unlikely to occur
Teucrium pilbaranum	P2	Upright shrub, 0.2 m high	WAH: High shrubland of Acacia sclerosperma, Acacia synchronicia, Eremophila longifolia and Acacia citrinoviridis over open herbs of Malvastrum americanum, Corchorus tridens and Cleome viscosa with low open woodland of Acacia citrinoviridis and Acacia aptaneura. Plain with brown clay loam soil.	Crab hole plain in a river floodplain, margin of calcrete table.	May, September	No	Not within 20km	Unlikely to occur
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	Tussocky perennial, grass-like or herb, 0.9-1.8 m high.	Variety of habitats including Mulga woodlands and mixed shrublands. Cracking clays, Red clay. Clay pan, grass plain.	Red clay. Clay pan, grass plain.	July-September	Yes	Within 20 km	**Likely to occur**
Thryptomene wittweri	VU	Spreading or rounded shrub from 0.5 - 1.5(2.1m)	WAH: Growing on tops of cliffs, ledges along cliff, in rock crevices and on boulder screes in shades southerly situations. Skeletal red stony soil. Ironstone. High in landscape, rocks on edge of cliff face and growing on face itself, S aspect, skeletal red-brown soil over massive banded ironstone of the Brockman Iron Formation, lots of rock and large sheets of ironstone on surface.	Skeletal red stony soils. Breakaways, stony creek beds.	April-August	No	Not within 20km	Unlikely to occur
Triodia basitricha	P3	no info	WAH Rehabilitation adjacent to Coondewanna airstrip, Mining Area C: Isolated Eucalyptus victrix and Corymbia hamersleyana, OR isolated Corymbia opaca trees over open to sparse Acacia aptaneura, A. bivenosa, A. pruinocarpa, and other shrubs, sometimes over Triodia, sometimes over low shrubs.	No info	No info	No	Within 20 km	Unlikely to occur
Triodia sp. Karijini (S. van Leeuwen 4111)	P1	no info	WAH: Triodia hummock grassland, variety of species including T. pungens, T. wiseana, often with emergent eucalypts and Corymbias, with Acacia shrublands. Very steep hillslope of grey silty loam.	No info	September	No	Within 20 km	May potentially occur
Triodia sp. Mt Ella (M.E. Trudgen 12739)	P3	Perennial, grass-like or herb, 0.4 m high.	WAH: Rocky creeklines, often grows together with Triodia pungens. With E. leucophloia and C. hamersleyana.	Light orange-brown, pebbly loam. Amongst rocks & outcrops, gully slopes.	February, March, September	Yes	Within 20 km	**Likely to occur**

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at Lamb Creek?	Distance to project area	Likelihood ranking
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	P1	Annual daisy	WAH: Woodland to open forest of variety of mulga species and other acacias, OR shrubland of acacias and other species, sometimes with Eucalypts, over diverse shrubland, often over open Triodia grassland (T. pungens, T. melvillei). Plain, floodplain, drainage, sandy-clay loam,	No info	May, July, September	Yes	Within 20 km	**Likely to occur**
Xerochrysum boreale	P3	no info	WAH: Mulga, stony plain	No info	No info	Yes but rarely collected in locality	Not within 20km	Unlikely to occur

Footnotes:

Additional references to FloraBase and DBCA Threatened and Priority Flora Database (including WA Herbarium records)

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3 *ENV (2013) Christmas Creek Life of Mine Flora and Vegetation Assessment. Report prepared for FMG.*

4 *Dillon and McFarlane (2020). Leeuwen's Lily (Arthropodium vanleeuwenii: Asparagaceae), a remarkable new discovery from the Pilbara, Western Australia. Nuytsia 31: 265–269 https://florabase.dpaw.wa.gov.au/science/nuytsia/963.pdf*

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6 *Buirchell and Brown (2016). New species of Eremophila (Scrophulariaceae): thirteen geographically restricted species from Western Australia. Nuytsia 27: 253–283. https://florabase.dpaw.wa.gov.au/science/nuytsia/780.pdf*

7 *Woodman (2019). Miralga Creek Iron Ore Project, Detailed Flora and Vegetation Survey. Unpublished report (Atlas19-07-01) prepared for Atlas Iron for Atlas Iron Limited*

8 *State Herbarium of South Australia (2021). Euphorbia stevenii - Electronic Flora of South Australia species Fact Sheet. http://flora.sa.gov.au/cgi-bin/speciesfacts_display.cgi?genus=Euphorbia&species=stevenii*

9 *Wilkins and Trudgen (2012). A new species of Gompholobium (Fabaceae: Mirbelieae) from the Pilbara bioregion of Western Australia. Nuytsia. 22(1): 31–40 https://florabase.dpaw.wa.gov.au/science/nuytsia/628.pdf "*

10 *Biota (2014). Baby Hope Downs Flora and Vegetation Survey. Report prepared for Rio Tinto*

11 *Onshore Environmental (2013d) Targeted Survey for Lepidium catapycnon at Karijini National Park. Consultants report prepared for BHP Billiton Iron Ore."*

12 *Biologic (2020). Roy Hill East of Remote MAR Borefield Reconnaissance Flora and Vegetation Survey*

13 *Markey (2017). Floristic survey and mapping of the riparian and halophyte dominated communities on the Fortescue Marsh (Martuyitha), Western Australia. Technical Report · February 2017.*