Ministers North Miscellaneous Licence Area Amendment Surveys and Yandicoogina Creek

Detailed Flora and Vegetation Assessment

Biologic Environmental Survey

Report to BHP Western Australia Iron Ore

December 2020

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3	J. Chick & C. Whyte	C. van den Bergh	S. Wild	29/12/2020

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EXECUTIVE SUMMARY

BHP Western Australia Iron Ore commissioned Biologic Environmental Survey Pty Ltd to undertake a two season Detailed flora and vegetation survey for Yandicoogina Creek, including the Yandicoogina Gorge area, and a single season Detailed Flora and Vegetation Survey and Targeted Flora and Vegetation Survey of additional areas in the Ministers North miscellaneous licence area.

The Yandicoogina Creek survey location is approximately 80 km northeast of the Newman township and extends approximately 26 km along Yandicoogina Creek. The two-season survey area was approximately 1,745 hectares (ha) and includes portions of mineral lease M266SA, miscellaneous licence L47/92, and exploration tenements E47/1329-I, E47/3161-I, E47/3263-I, E47/3261-I E47/3013-I, E47/3074-I, E47/3851, E47/4057 (Figure 1.2). Locations for the single season and targeted flora and vegetation surveys (i.e., Ministers North and surrounds) covered parts of mineral leases M270SA, M274SA, and M266SA and was approximately 2,011 ha in size.

The two season Detailed flora and vegetation survey occurred over two field trips, the first occurred between 9 and 15 September 2019 (168 person hours, including mobilisation and demobilisation). The second phase of the survey was carried out over five days, from 26 March to 30 April 2020 (approximately 204 person hours).

The targeted survey of the Ministers North Area occurred on 30 March and 1 April 2020 and the single season Detailed flora and vegetation survey of the Ministers North Area occurred on 31 March 2020, totalling approximately 66 person hours.

At Yandicoogina Creek, vegetation was sampled with 29 quadrats and two relevés during the first survey, while 23 quadrats were resampled in the second season. Two new quadrats were also established during the second survey. At Ministers North, vegetation was sampled with three quadrats and four relevés, supplemented with targeted searches.

Overall, a total of 279 vascular flora taxa from 51 families and 141 genera were recorded from the Study Area during the current field survey, comprising 262 native and 17 introduced flora taxa. The dominant genera were *Acacia* (17 species), *Corchorus, Ptilotus* and *Senna* (nine species each).

Six conservation significant flora were recorded, *Aristida lazaridis* (P2), *Fimbristylis sieberiana* (P3), *Gymnanthera cunninghamii* (P3), and *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) at Yandicoogina Creek, and *Rostellularia adscendens* var. *latifolia* (P3) and *Goodenia nuda* (P4) at Ministers North.

Seventeen introduced taxa were observed during the survey, comprising **Aerva javanica*, **Argemone ochroleuca* subsp. *ochroleuca*, **Bidens bipinnata*, **Cenchrus ciliaris*, **Cenchrus setiger, *Conyza bonariensis*, **Flaveria trinervia*, **Malvastrum americanum*, **Melinis repens*, **Rumex vesicarius*, **Sigesbeckia orientalis*, **Setaria verticillata*, **Solanum nigrum*, **Sonchus oleraceus*, **Tribulus terrestris*, **Tridax procumbens*, and **Vachellia farnesiana*.

A total of 35 vegetation types from 18 broad floristic formations were described and delineated from the Study Area. Due to access restrictions, only Yandicoogina Creek was surveyed and mapped with

moderate to high confidence. The vast majority of the Ministers North area, as well as the south-western extent of Yandicoogina Creek was access restricted, so the confidence in the vegetation types and delineation of these units is low.

The survey did not identify any vegetation units that are consistent with ecological communities listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Biodiversity Conservation Act 2016* (BC Act). Three vegetation types (MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua) described and mapped within the Yandicoogina Gorge (section of Yandicoogina Creek) are considered to have affinities with the Department of Biodiversity, Conservation and Attractions (DBCA) listed Priority Ecological Communities (PEC): *Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara*. This PEC is listed as Priority 2 and occurs sporadically throughout the Pilbara, with several occurrences in Karijini National Park. The presence of phreatophytic flora, permanent to semi-permanent pools as well as several of the key relictual/ indicator understorey species suggests that portions of the Yandicoogina Gorge represent the PEC.

Of the 35 vegetation types mapped within the Study Area, 12 vegetation types recorded from the Study Area are considered to be of “other” significance as they support priority flora taxa, including Priority 2, Priority 3 and Priority 4 species. Of the 12 vegetation types that are of other significance, the types (MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua) that occur within the Yandicoogina Gorge, support Priority listed flora and have affinities with the PEC are of substantial importance compared to vegetation type ME TpTlo ExAciCh PlApypGoro which supports a population of the Priority 4 species *Goodenia nuda* which occurs extensively throughout the Pilbara.

Yandicoogina Creek and Marillana Creek support groundwater dependent vegetation indicated by the presence of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa*. Marillana Creek was not sampled during the current survey, but Yandicoogina Creek and the Yandicoogina Gorge was subjected to a two season detailed survey. Yandicoogina Gorge supported mature stands of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa* with no obvious signs of canopy decline. The presence of these phreatophytes, and more specifically, the obligate phreatophyte *Melaleuca argentea*, suggests groundwater is persistently at or just below the surface. This is further supported with the presence of numerous water features, with some permanent and potentially representing aquatic groundwater dependent ecosystems (GDEs) (water feature WYAN-07).

The condition of the vegetation within the Study Area ranged from Degraded to Excellent, with the main disturbances associated with weed invasion, pastoralism, mining related clearing and fires. A portion of the Study Area occurs on an active pastoral lease with cattle grazing and trampling evident across the entire Study Area. The creeks and drainage lines were impacted heavily by pastoralism with higher densities of weeds and obvious signs of trampling and grazing from cattle. A recent fire (within the last 12 months) restricted the sampling of the Ministers North area. The vegetation of the Study Area was mostly in an excellent to very good condition.

1 INTRODUCTION

1.1 Background

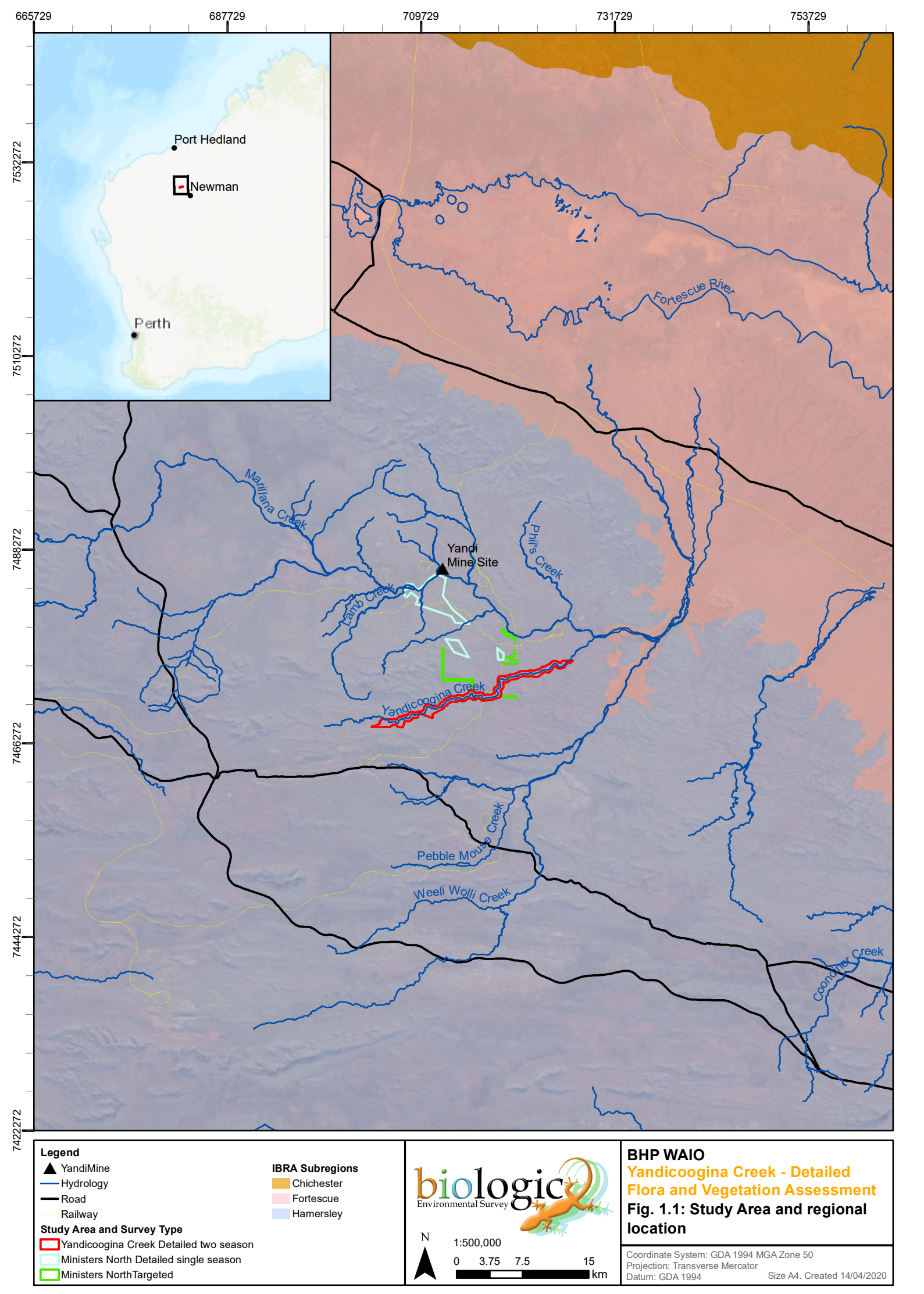
BHP Western Australia Iron Ore (BHP WAIO) commissioned Biologic Environmental Survey Pty Ltd (Biologic) to undertake a two-season Detailed flora and vegetation survey of Yandicoogina Creek (including Yandicoogina Gorge) , a single season Detailed flora and vegetation survey of the Ministers North miscellaneous licence area and Targeted flora surveys of additional areas in the Ministers North miscellaneous licence area (hereafter the Study Area). The Study Area is located in the Pilbara bioregion of Western Australia, directly south of the BHP Yandi mining operation and approximately 80 km northwest of the Newman township (Figure 1.1).

The two-season detailed survey area was approximately 1,745 hectares (ha) and includes portions of mineral lease M266SA, miscellaneous licence L47/92, and exploration tenements E47/1329-I, E47/3161-I, E47/3263-I, E47/3261-I E47/3013-I, E47/3074-I, E47/3851, E47/4057 (Figure 1.2). Locations for the single season and targeted flora and vegetation surveys (i.e., Ministers North and surrounds) covered parts of mineral leases M270SA, M274SA, and M266SA and was approximately 2,011 ha in size.

1.2 Objectives

The overarching objective of the two-season Detailed flora and vegetation survey, the single season Detailed flora and vegetation survey, and the Targeted flora survey (hereafter the survey) was to identify the flora and vegetation of the Study Area and to determine if there are any conservation significant values that need to be considered during any future environmental approvals across the Study Area. The overarching objective was achieved via the following scope of works:

- The completion of a desktop assessment, including the review of previous biological surveys and government and non-government databases;
- The completion of a single season and two-season Detailed flora and vegetation survey and a targeted flora survey within the Study Area;
- A review of the results of the flora and vegetation assessment to determine if there are any significant environmental values within the Study Area; and
- A discussion of the significant environmental values (and remaining environmental values) from a regional and local context.


665729
687729
709729
731729
753729
7532272
7510272
7488272
7466272
7444272
7422272
Port Hedland
Newman
Perth
Fortescue River
Marillana Creek
Yandi
Mine Site
Phils Creek
Lamb Creek
Yandicoogina Creek
Pebble Mouse Creek
Weeli Wolli Creek
Coondiner Creek
Legend
YandiMine
Hydrology
Road
Railway
Study Area and Survey Type
Yandicoogina Creek Detailed two season
Ministers North Detailed single season
Ministers NorthTargeted
IBRA Subregions
Chichester
Fortescue
Hamersley
biologic
Environmental Survey
N
1:500,000
0 3.75 7.5 15
km
BHP WAIO
Yandicoogina Creek - Detailed Flora and Vegetation Assessment
Fig. 1.1: Study Area and regional location
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
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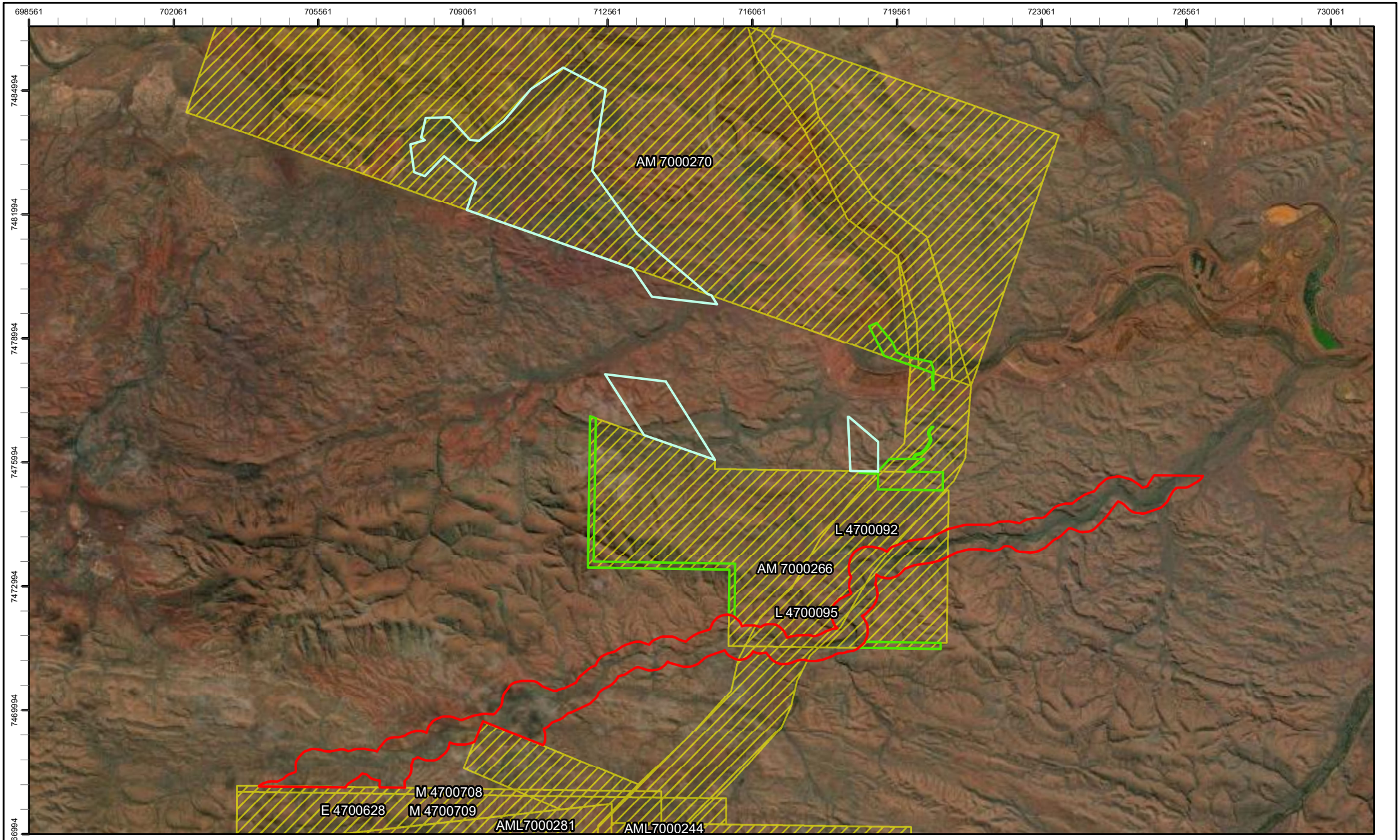

Legend

Study area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

BHP Tenements

biologic Environmental Survey

N

1:115,000

0 1.25 2.5 5 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 1.2: Study Area and BHP WAIO tenure

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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1.3 Background to Protection of Flora and Vegetation

Within Western Australia, all native flora is protected under the *Biodiversity Conservation Act 2016* (BC Act) and any action that has the potential to impact on native flora needs to be approved by relevant State and/ or Federal departments as dictated by the Western Australian *Environmental Protection Act 1986* (EP Act) and the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Some species of flora that are determined to be at risk of extinction or in decline are afforded extra protection under these Acts. For the purposes of this report, these species are called conservation significant species. A summary of applicable legislation and status codes is provided in Table 1.1. Additional information on conservation status codes is provided in Appendix A.

The EPBC Act identifies Threatened Ecological Communities (TECs) as ecological communities at risk of extinction. The BC Act provides for the statutory listing of TECs by the Minister for Environment. The WA Minister for Environment has endorsed 69 ecological communities as threatened under critically endangered (20 communities), endangered (17 communities), vulnerable (28 communities) and presumed totally destroyed (four communities).

For some flora taxa and ecological communities, there is insufficient information to determine their status as threatened. These taxa are generally considered by the Environmental Protection Authority (EPA)/ Department of Biodiversity, Conservation and Attractions (DBCA) as 'conservation significant' for the assessment of development related proposals and are listed on a 'Priority List' (Priorities 1, 2 and 3 for poorly known species and Priority 4 for rare and near threatened species). The Priority List is regularly reviewed and maintained by DBCA. Possible TECs that do not meet the criteria for statutory listing by the Minister for Environment are added to DBCA's 'Priority Ecological Communities' (PECs) lists under Priorities 1, 2, 3, 4 (near threatened) or 5 (conservation dependent).

Table 1.1: Commonwealthand State conservation status codes

Agreement, Act or List	Status Codes
FEDERAL	
Environment Protection and Biodiversity Conservation Act 1999 DoAWE lists threatened flora, which are determined by the Threatened Species Scientific Committee (TSSC) according to criteria set out in the Act. The Act lists flora that are considered to be of conservation significance under one of eight categories (listed under 'Status Codes').	• Extinct (EX) • Extinct in the Wild (EW) • Critically Endangered (CE) • Endangered (EN) • Vulnerable (VU) • Conservation Dependent (CD)
Threatened Ecological Communities (TECs) are those that are at risk of extinction.	• Critically Endangered (CE) • Endangered (EN) • Vulnerable (VU)

Agreement, Act or List	Status Codes
STATE	
Biodiversity Conservation Act 2016 The *Biodiversity Conservation Act 2016* provides for the listing of threatened native flora and Threatened Ecological Communities that need protection as critically endangered, endangered or vulnerable species or ecological communities because they are under identifiable threat of extinction (species) or collapse (ecological communities).	• Schedule 1 (Critically Endangered) (S1 or CR) • Schedule 2 (Endangered) (S2 or EN) • Schedule 3 (Vulnerable) (S3 or VU) • Schedule 4 (Extinct) (S4 or EX)
DBCA Priority list (DBCA) DBCA produces a list of Priority species and ecological communities (e.g. PECs) that have not been assigned statutory protection under the BC Act. This system gives a ranking from Priority 1 to Priority 4 for flora and Priority 1 to Priority 5 for ecological communities.	• Priority 1 (P1) • Priority 2 (P2) • Priority 3 (P3) • Priority 4 (P4) • Priority 5 (P5; for PECs)

2 ENVIRONMENT

2.1 Biogeographical Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA; Thackway & Cresswell, 1995) divides Australia into 89 bioregions and 419 subregions based on climate, geology, landform, native vegetation and species information (Thackway & Cresswell, 1995). The Study Area occurs entirely within the Pilbara bioregion (Figure 1.1), in the southern section of the Pilbara Craton (Kendrick, 2001). The Pilbara bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges (Thackway & Cresswell, 1995). Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses (Bastin, 2008).

The Pilbara bioregion is classified into four separate subregions, Chichester (PIL01), Fortescue (PIL02), Hamersley (PIL03) and Roebourne (PIL04), of which the Study Area is located within the Hamersley subregion (Figure 1.1). The Hamersley subregion is characterised by mountainous area of sedimentary ranges and plateaus, dissected by gorges (Kendrick, 2001). The Hamersley contains extensive open snappy gum woodland and hummock grassland communities on ranges and plateaus, with low mulga woodlands over bunch grasses on fine textured soils in lower areas and valley floors (Kendrick, 2001).

The significant and dominant feature of this subregion is the Hamersley Range. This prominent range feature, 450 kilometres (km) long, is a mountainous plateau which receives significantly higher rainfall than the surrounding subregion giving rise to deeply incised gorges, up to 100 metres (m) deep, containing extensive permanent spring-fed streams and pools (Kendrick, 2001) The Hamersley and Chichester Ranges drain to give rise to the Fortescue Marsh and Fortescue River system (McKenzie *et al.*, 2002).

2.2 Climate

The Pilbara has a semi-desert to tropical climate, with two discrete seasons: a mild and generally dry winter (May to September) and a hot summer when rainfall is most likely (October to April) (Thackway & Cresswell, 1995). The average diurnal temperatures range from 16–32°C and summer maximums regularly exceed 40°C (BoM, 2020a).

The average annual rainfall of the Pilbara is 300 mm, but there are significant fluctuations owing to sporadic summer rainfall (BoM, 2020a), with up to 1,200 mm falling in some locations in some years (McKenzie *et al.*, 2009). The annual average rainfall in the Hamersley subregion is 400 mm (Tille, 2006). Summer rainfall accounts for >60 % of mean annual precipitation and is usually associated with tropical storms in the north or tropical cyclones which impact the coast and move inland (Leighton, 2004). Winter rainfall is generally lighter and is the result of large cold fronts moving north easterly across the state (Leighton, 2004).

Monthly rainfall records from 18.5 km north of the Study Area were available from the Bureau of Meteorology (BoM) weather station at Barimunya (station 505053), however, some observations were missing and there were no long-term records. Long-term climatic data is not available for the Study Area itself, however, long term climatic data is available from the Newman Airport (station 7176), 84 km southeast of the Study Area (BoM, 2020a). The Newman Airport weather station is expected to provide

the most accurate long-term average (LTA) dataset for climatic conditions experienced within the Study Area (Figure 2.1). Newman Airport receives on average 324.3 mm of rainfall each year, with the majority falling during the months of December through to March (BoM, 2020a).

Daytime temperatures are the hottest during the summer months of December to February, with temperatures regularly exceeding 40°C. The average maximum temperature from December to February is 38.6°C, while the average minimum temperature is 24.4°C (Figure 2.1) (BoM, 2020a). The coolest three months of the year coincide with the winter months of June to August, with night-time temperatures regularly falling below 10°C. The average maximum temperature during the coldest three months is 24.1°C, while the average minimum temperature is 7.2°C (Figure 2.1) (BoM, 2020a).

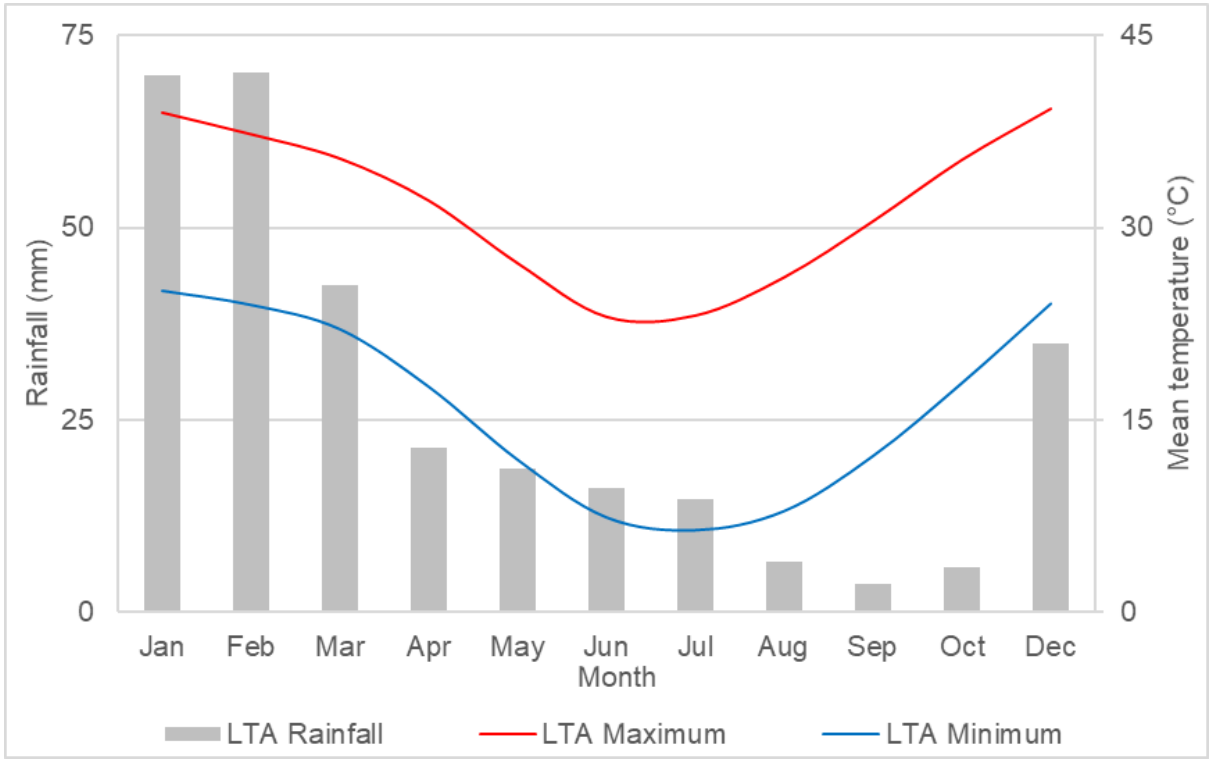


Figure 2.1: Long-term climatic averages (LTA) of monthly rainfall and temperature from Newman Airport (BoM, 2020a).

2.3 Existing Land Use

The Study Area is wholly located within the Shire of East Pilbara Local Government Authority (LGA) and is located south of BHP's Yandi mine (Figure 1.2). The two-season survey area was approximately 1,745 hectares (ha) and includes portions of mineral lease M266SA, miscellaneous licence L47/92, and exploration tenements E47/1329-I, E47/3161-I, E47/3263-I, E47/3261-I E47/3013-I, E47/3074-I, E47/3851, E47/4057 (Figure 1.2). Locations for the single season and targeted flora and vegetation surveys (i.e., Ministers North and surrounds) covered parts of mineral leases M270SA, M274SA, and M266SA and was approximately 2,011 ha in size.

The Study Area includes third-party tenure and associated infrastructure (i.e. railway, transmission lines). The third-party tenure holders include Rio Tinto, Fortescue Metals Group, Mineral Resources and Western Iron Ore Pty Ltd. Rio Tinto's Yandicoogina rail traverses the Ministers North miscellaneous licence survey area.

The majority of the Study Area is located within Unallocated Crown Land (UCL) which covers the eastern portion of the Study Area, while the remaining portions are located within the Juna Downs and Marillana pastoral leases which are actively utilised for the grazing of cattle. Pastoral infrastructure, including tracks and fences, traverse throughout the Study Area.

2.4 Soils and Landforms

The Atlas of Australian Soils (Northcote *et al.*, 1960-1968) was compiled by the Commonwealth Scientific and Industrial Research Organisation (CSIRO, 2009) in the 1960s to provide a consistent national description of Australia's soils. It comprises of a series of ten maps and associated explanatory notes and is published at a scale of 1:2,000,000, but the original compilation was at scales from 1:250,000 to 1:500,000.

The broad soil landscape unit mapping shows the Study Area comprises only Fa13 (Northcote *et al.*, 1960-1968). Fa13 consists of ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations. This unit is largely associated with the Hamersley and Ophthalmia Ranges with predominantly physically limited, shallow soils.

At a finer scale, the Study Area mainly consists of shallow loams and stony soil. Soils on the ranges are predominantly stony and shallow soils with extensive areas without soil cover (van Vreeswyk *et al.*, 2004). Around creek lines red loamy earth and red/brown non cracking clay becomes more prominent (van Vreeswyk *et al.*, 2004).

The Study Area occurs within the Hamersley Plateau Zone. The dominant broad landforms in the Study Area are ranges, extensive flat and gently sloping plains, plains and steep hills and slopes (Northcote *et al.*, 1960-1968). The north-western portions of the Study Area broadly coincide with stony hills, ridges, and dissected ranges of the Hamersley while the southern and central areas coincide with sloping plains and hardpan plains, that then migrate into sandplains in the east (van Vreeswyk *et al.*, 2004).

2.5 Geology

According to the Australian Geological Provinces database, the Study Area is located within the Warakurna Large Igneous Province (Wingate *et al.*, 2004). The Warakurna Large Igneous Province consists of layered mafic-ultramafic intrusions, mafic to felsic volcanic rocks and dykes, extensive mafic sills, swarms of mafic dykes and coeval mafic igneous rocks (Wingate *et al.*, 2004).

The geology of the Hamersley subregion is typified by Proterozoic to Paleoproterozoic sedimentary ranges with banded iron-formation dissected by gorges of shale and dolerite. At a finer scale (1:500,000) the Study Area (GSWA, 2016) is mapped as:

- Brockman Iron Formation (P_-HAb-cib): Banded iron-formation, chert, mudstone, and siltstone; metamorphosed. The Brockman Iron Formation geological unit covers approximately 891 ha (24 %) of the study area, mostly in the centre (Figure 2.2).
- Weeli Wolli Formation (P_-HAj-xci-od): Banded iron-formation (commonly jaspilitic), mudstone, siltstone, and numerous dolerite sills; metamorphosed. The Weeli Wolli Formation occurs at either end of the Study Area covering 2,865 ha (76 %) (Figure 2.2).

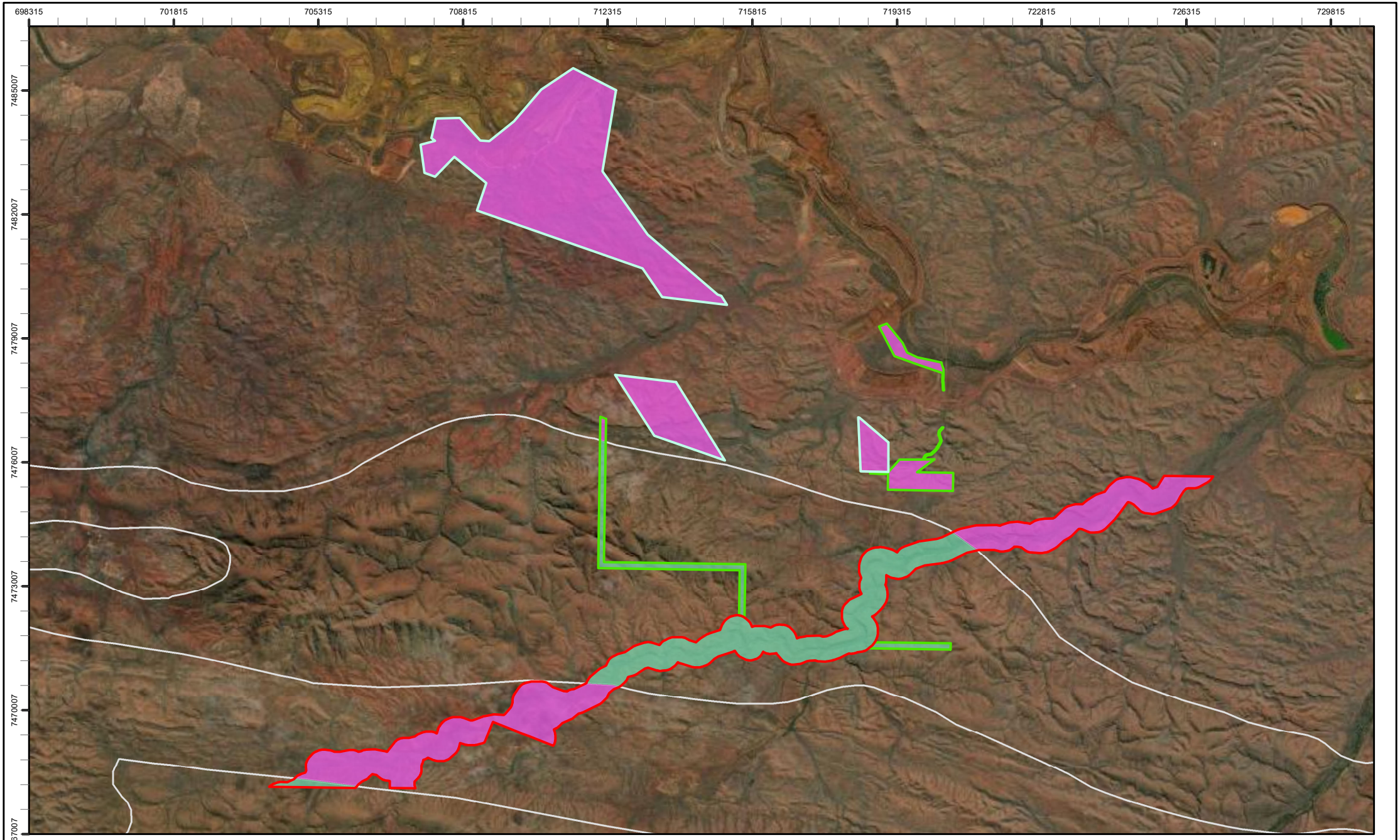
2.6 Land Systems

Work undertaken by a joint team from the (former) Department of Agriculture (now Department of Primary Industries and Regional Development) and the (former) Department of Lands Administration (now Department of Planning, Lands and Heritage) classified the pastoral areas of Western Australia (van Vreeswyk *et al.*, 2004). The purpose of the surveys were to provide a comprehensive description and mapping of the biophysical resources of the pastoral areas, together with an evaluation of the pastoral potential and the condition of the soils and vegetation (van Vreeswyk *et al.*, 2004).

Six land systems have been mapped as occurring across the each Study Area: Newman, Robe, River and Platform at Yandicoogina Creek, and Boolgeeda, Mckay, Newman and Robe at Ministers North (van Vreeswyk *et al.*, 2004) (Figure 2.3). The dominant land system is the Newman land system, which covered approximately 43 % of the Study Area overall (Table 2.1).

Table 2.1: Land systems of the Study Area

Site	Land System	Land Type	Description	Extent in Study Area	
				ha	%
Yandicoogina	Newman	Hills and ranges with spinifex grasslands	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands	1,069	61
	River	River plains with grassy woodlands and tussock grasslands.	Active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	144	8
	Platform	Stony plains with spinifex grasslands	Dissected slopes and raised plains supporting hard spinifex grasslands.	442	25
	Robe	Mesas, breakaways and stony plains with spinifex grasslands	Low plateaux, mesas and buttes of limonites supporting soft spinifex (and occasionally hard spinifex) grasslands.	90	5
			Total	1,745	100



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Geological unit

- Brockman Iron Formation, P_-HAb-cib
- Weeli Wolli Formation, P_-HAj-xci-od

biologic Environmental Survey

N

1:115,000

0 1.25 2.5 5 km

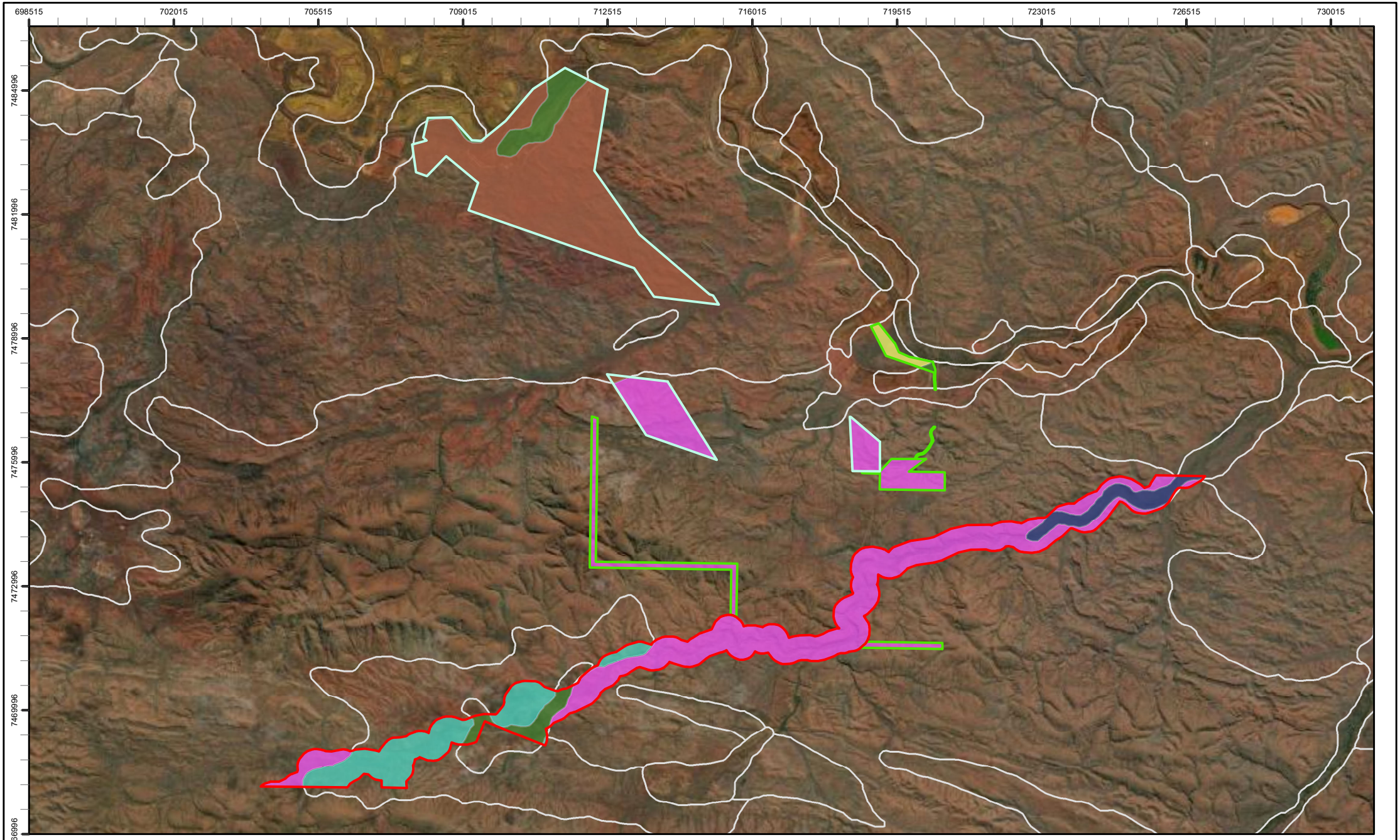
BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 2.2: Broad geology of the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4, Created 14/04/2020



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Land System

- Boolgeeda
- McKay
- Newman
- Platform
- River
- Robe

biologic Environmental Survey

N

1:115,000

0 1.25 2.5 5 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 2.3: Land systems of the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

Site	Land System	Land Type	Description	Extent in Study Area	
				ha	%
Ministers North	Boolgeeda	Stony plains with spinifex grasslands	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	38	2
	Mckay	Hills and ranges with spinifex grasslands	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands.	1277	64
	Newman	Hills and ranges with spinifex grasslands	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands	532	26
	Robe	Mesas, breakaways and stony plains with spinifex grasslands	Low plateaux, mesas and buttes of limonites supporting soft spinifex (and occasionally hard spinifex) grasslands.	164	8
			Total	2,011	100

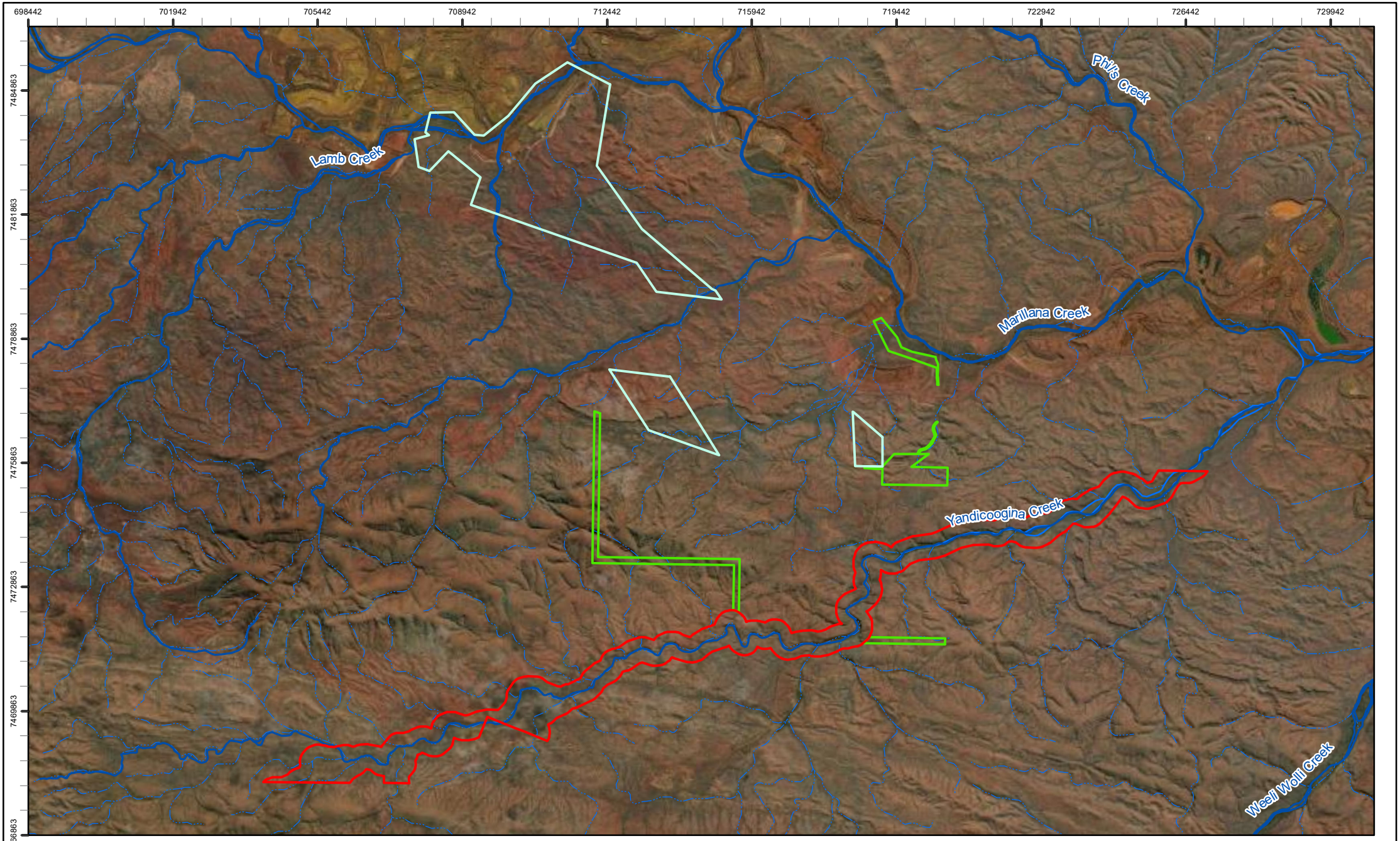
NB: hectare and percentage values have been rounded to the nearest whole number.

2.7 Hydrology

The Study Area is located within the Upper Fortescue River Catchment and the Weeli Wolli/ Marillana sub-catchment. Several ephemeral creeklines traverse the Ministers North mine area, including Marillana, Lamb, Herbert and Yandicoogina creeks. Yandicoogina Creek is approximately 42 km in length and flows northeast into Marillana Creek which drains eastward into Weeli Wolli Creek (Figure 2.4).

Weeli Wolli Creek is approximately 70 km in length and has a catchment area of 4,100 km^2. It flows to the north, where it drains into the Fortescue River via the ecologically significant Fortescue Marsh (Figure 2.4); however, the two systems are only connected during flooding associated with intense cyclonic events (Kendrick, 2001). The Marsh is approximately 40 km downstream, and to the north, of Yandicoogina Creek (Figure 2.4).

The upper reaches of Yandicoogina Creek comprise a relatively broad, un-defined channel, however, in the mid to lower reaches, the creek flows through a gorge system and becomes well defined. It is through this section that the groundwater appears to intercept the surface, forming a series of seeps and pools that that extends for approximately 3.5 km (Yandicoogina Gorge). Numerous expressions of the groundwater can be seen throughout this section of the creek and groundwater dependent vegetation is present along its length. At least one permanent pool is present, which is likely maintained partially by aspect (against a cliff face), but is also likely groundwater fed.



Legend

Study Area and Survey Type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

- Major waterway
- Minor waterway

biologic Environmental Survey

N

1:115,000

0 1.25 2.5 5 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 2.4: Hydrology of the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

2.8 Flora and Vegetation Background

2.8.1 Vegetation Associations

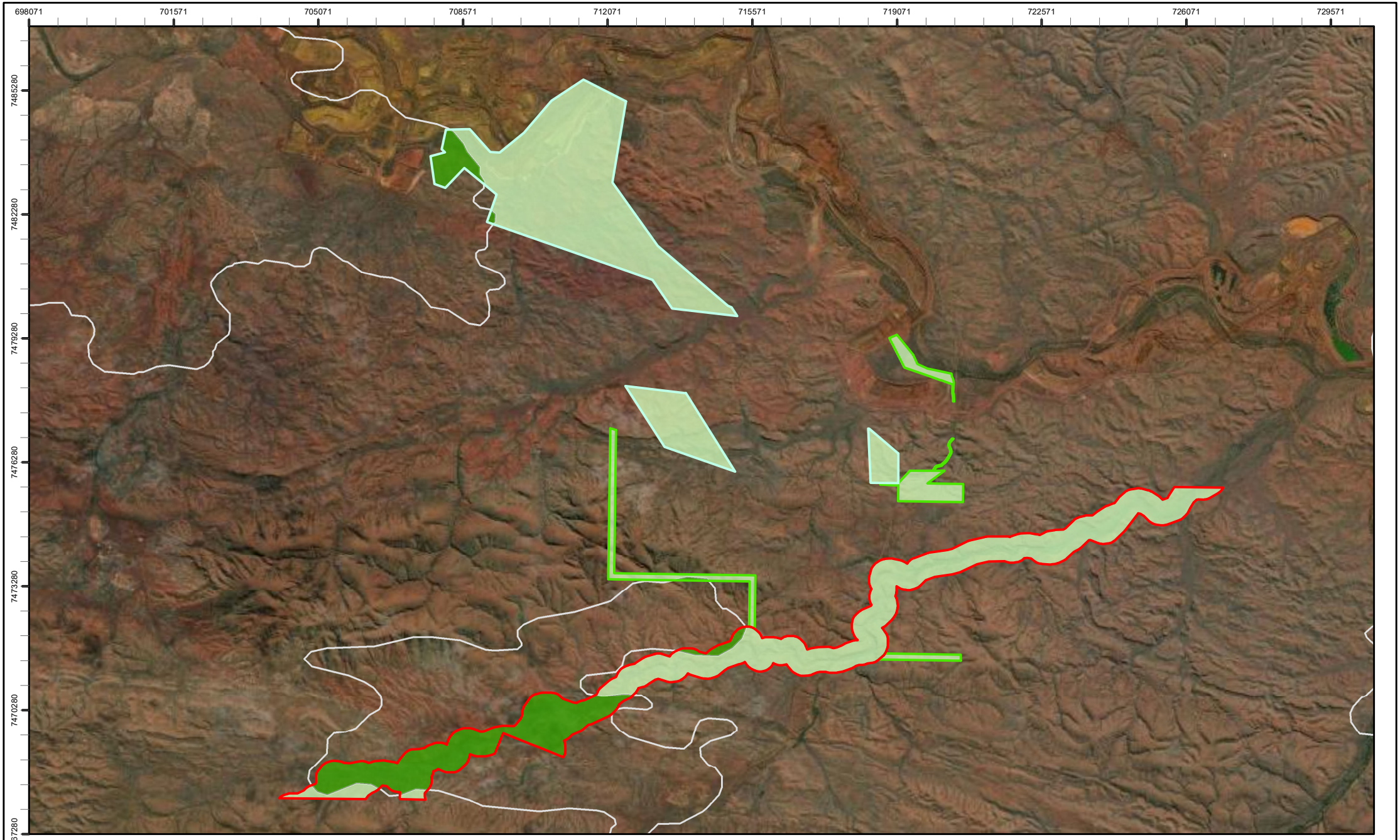
The Study Area is located in the Fortescue Botanical District, which is a part of the Eremaean Province (Beard, 1990). The Fortescue Botanical District is a tree- and shrub-steppe with *Eucalyptus* spp. trees, *Acacia* shrubs, *Triodia pungens* and *Triodia wiseana* hummock grasslands (Beard, 1990). Some mulga (*Acacia aneura* and close relatives) occurs in valleys and there are short-grass plains on alluvia (Beard, 1990). The vegetation associations of the Study Area were mapped by Beard (1975b), in which he classified the following two vegetation associations:

- 18: Low woodland; mulga (*Acacia aneura* and close relatives) (with spinifex) low woodland on the Hamersley Plateau; and
- 82: Hummock grasslands, low tree steppe; snappy gum (*Eucalyptus leucophloia*) over *Triodia wiseana* on ranges and summits (Figure 2.5).

Vegetation association 82 covers the majority of the Study Area (3,071 or 82 %), while the remaining 685 ha (18 %) contains vegetation association 18 (Figure 2.5). Shepherd *et al.* (2002) updated the vegetation association mapping to reflect the National Vegetation Information System (NVIS Technical Working Group) standards (ESCAVI, 2003). The update also accounts for extensive clearing since the Beard (1975a) mapping. At a finer scale, the Study Area is located within the Hamersley system, while the following vegetation system associations occur in the Study Area (Shepherd *et al.*, 2002):

- 18.11: *Acacia* open shrubland / *Ptilotus* mixed open forbland; and
- 82.3: *Eucalyptus* sparse mallee shrubland / *Senna* mixed sparse shrubland / *Triodia* open hummock grassland.

The remaining extent of the vegetation system associations exceeds 98% across four regional scales: State, bioregion (Pilbara), subregion (Hamersley) and Local Government Authority (Shire of East Pilbara) (Government of Western Australia, 2019). Currently, both vegetation system associations (18.11 and 82.3) are represented within the National Reserve System having greater than 19% and 12% of their current bioregional and subregional current within reserves respectively (Government of Western Australia, 2019) (Table 2.2).



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Vegetation Association

- Hammersley (18)
- Hammersley (82)

biologic Environmental Survey

N

1:115,000

0 1.25 2.5 5 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 2.5: Vegetation association mapping in the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

Table 2.2: Regional and local extent of Hamersley System Associations within the Study Area

Code	Scale	Pre-European extent (ha)	Current extent remaining (ha / %)	Current extent remaining within reserves (ha / %)
18	State	580,556	575,852 / 99.19	113,416 / 19.69
	Pilbara	580,512	575,808 / 99.19	113,404 / 19.69
	Hamersley	580,512	575,808 / 99.19	113,404 / 19.69
	LGA	224,292	220,375 / 98.25	44 / 0.02
82	State	2,169,997	2,157,841 / 99.44	262,983 / 12.19
	Pilbara	2,168,702	2,156,547 / 99.44	262,983 / 12.19
	Hamersley	2,158,862	2,146,708 / 99.44	262,244 / 12.22
	LGA	573,313	565,215 / 98.59	0 / 0

NB: LGA (Local Government Authority): Shire of East Pilbara
Reserves – International Union of Nature Conservation (IUCN) Class I-IV reserves (i.e. National Parks, Strict Nature Reserves)
Source: Government of Western Australia (2019); NB: area values have been rounded to the nearest whole number.

2.8.2 Bioregional significance

Under the Convention of Biological Diversity, Australia has worked towards a target of 17% of the continent to be protected as part of the National Reserve System (NRS) (NRSTG, 2009). In building the NRS, priority is given to under-represented bioregions that have less than 10% of their remaining area protected in reserves (NRSTG, 2009). The Pilbara bioregion is an underrepresented bioregion, with less than 10% of its total area protected in reserves. The Hamersley subregion is adequately represented, with more than 13% of the subregional area protected in reserves, with a substantial portion located within Karijini National Park.

Despite the Pilbara bioregion being underrepresented within the NRS, greater than 99% of the bioregional and the Hamersley subregional area remains intact (Government of Western Australia, 2019). As such, it has been determined that any potential vegetation clearing within the Study Area would not substantially impact the biological values of the bioregion (and subregion) as the region will remain intact, and therefore the State retains the ability to adequately reserve vegetation within the Pilbara bioregion (and the Hamersley subregion).

2.8.3 Introduced taxa

Weeds of National Significance

The Commonwealth of Australia, in collaboration with the states and territories, has identified 32 Weeds of National Significance (WoNS) based on an assessment process that prioritises these weeds according to their invasiveness, potential for spread and environmental, social and economic impacts. A list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

Landowners and land managers at all levels are responsible for managing WoNS. State and territory governments are responsible for legislation, regulation and administration of weeds. The WoNS were selected as they require coordination among all levels of government, organisations, and individuals with weed management responsibilities.

Declared Plant Pests

To protect Western Australian agriculture the Department of Primary Industries and Regional Development (DPIRD) (formerly the Department of Agriculture and Food Western Australia, DAFWA) regulates harmful plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Plants that are prevented entry into the state or have control or keeping requirements within the state areknown as declared pests. The main purposes of the BAM Act and its regulations related to DPP are to prevent new plant pests from entering Western Australia, manage the impact and spread of those pests already present in the state and safely manage the use of agricultural chemicals.

The BAM Act has categorised the weeds of Western Australia into four main classifications:

- Declared Pests (under Section 22 of the Act);
- Permitted (under Section 11 of the Act);
- Prohibited (under Section 12 of the Act); and
- Permitted requiring a permit (Section 73, BAM Regulations 2013).

Under the BAM Act all declared plant pests are placed in one of three categories:

- C1 (Exclusion) — Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State;
- C2 (Eradication) — Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still feasible; and
- C3 (Management) — Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Weed Prioritisation

In 2008 Parks and Wildlife developed and implemented an integrated approach to weed management on Parks and Wildlife-managed lands in WA, the Weed Prioritisation Process. It was updated in 2013 and further revised in 2016. Parks and Wildlife prioritised weeds in each region, based on their:

- invasiveness;
- ecological impact;
- potential and current distribution; and
- feasibility of control.

The resulting priorities focus on weeds considered to be high impact, rapidly invasive and still at a population size that can feasibly be eradicated or contained to a manageable size. This means that weed taxa that are already widespread may not be ranked as a high priority. The weed prioritisation for the Pilbara bioregion has recently been revised by Parks and Wildlife. The key priorities are now centred on ‘Priority Alert’ weeds and weeds that receive a rating for ‘ecological impact’ and ‘invasiveness’.

2.8.4 Flora and vegetation of other significance

The EPA (2016b) advises that flora species, subspecies, varieties, hybrids and ecotypes may be considered significant for reasons other than listing as a Threatened or Priority Flora taxa. This may include range extensions, keystone species, relic status, local endemism, and anomalous features.

Similarly, vegetation may be of significance for reasons other than a listing as a TEC or a PEC (EPA, 2004). This may include scarcity, novel combination of species, role as a refuge, restricted distribution and vegetation extent being below a threshold level.

2.8.5 Groundwater dependent ecosystems

Groundwater-Dependent Ecosystems (or GDEs) are ecosystems that rely upon groundwater for their continued existence (BoM, 2020b). GDEs can be represented by many different assemblages of biota which rely on groundwater, and as a result come in many forms. For terrestrial ecosystems there are three key types of GDE (BoM, 2020b);

1. Aquatic ecosystems; that rely on the surface expression of groundwater – this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs.
2. Terrestrial ecosystems; that rely on the subsurface presence of groundwater–this includes all vegetation ecosystems or Groundwater Dependent Vegetation (GDV).
3. Subterranean ecosystems; this includes cave and aquifer ecosystems.

Aboveground terrestrial GDEs are typically characterised by the presence of flora species that rely on groundwater (i.e. phreatophytes). Phreatophytes may be classified as either obligate or facultative phreatophytes depending on their reliance on groundwater (Eamus *et al.*, 2016):

- Obligate phreatophytes are flora species confined to habitats with access to groundwater.
- Facultative phreatophytes are flora species that can utilise groundwater to satisfy a proportion of their ecological water requirement (EWR) when it is available. However, some individuals may also satisfy their EWR by relying solely on uptake from upper unsaturated soils layers where groundwater is inaccessible.

The BoM has developed the Groundwater Dependent Ecosystems Atlas (GDE Atlas) as a national dataset of Australian GDEs to inform groundwater planning and management (BoM, 2020b). It is the first and only national inventory of GDEs in Australia.

The GDE Atlas contains information about three key types of ecosystems: Aquatic ecosystems; Terrestrial ecosystems; and Subterranean ecosystems. Importantly, the GDE Atlas also includes the national inflow-dependent landscapes layer which is derived from remotely sensed data. This layer indicates the likelihood that a landscape is accessing water in addition to rainfall (such as soil moisture, surface water or groundwater), and generally represents a potential GDE dataset for all areas not yet studied or investigated in any detail.

The GDE mapping in the GDE Atlas comes from two broad sources:

- National assessment – national-scale analysis based on a set of rules that describe potential for groundwater/ ecosystem interaction and available Geographic Information Systems (GIS) data.
- Regional studies – more detailed analysis undertaken by various State and regional agencies using a range of different approaches including field work, analysis of satellite imagery and application of rules/conceptual models.

The BoM GDE Atlas indicates that the Study Area has potential to support GDEs based on the terrestrial GDE (Appendix B) and terrestrial inflow-dependent ecosystems (IDEs) (Appendix B) assessment. The Study Area has a moderate (from national assessment) potential for GDEs while is highly likely to support IDEs (BoM, 2020b).

Interestingly, Weeli Wolli Creek which is a known terrestrial and aquatic GDE, only has a moderate potential to support GDEs. This may be a function of the national-scale analysis following a set of rules which utilised imagery at a 25 m resolution (Doody *et al.*, 2017). The national-scale is an initial remotely-sensed task of the overall project with follow-up surveys and investigations required to determine actual GDEs.

2.8.6 Sheet-flow dependent ecosystems

Mulga is a large, variable and taxonomically complex group of plants allied to *Acacia aneura* that dominate significant areas of the vast Australian arid zone (Maslin *et al.*, 2012). The term Mulga is also used to describe vegetation communities in which these taxa predominate (Maslin *et al.*, 2012). A recent revision of the Mulga group (*Acacia aneura* and its close relatives) classified 12 separate entities, excluding informal variants, putative hybrids and intergrades (Maslin & Reid, 2012). The structure and patterning of mulga communities varies from strongly banded (groved) through to open shrublands and woodlands across the landscape (Page & Grierson, 2012). The bandings act as a sink for nutrients and water to infiltrate the soil and are readily available for uptake by the flora located within the banding. This banding and overland sheet-flow supports a diverse biota within the Mulga bands and plays and important ecological function which is well documented (Dawson & Ahern, 1973; Saco *et al.*, 2007; Winkworth, 1973).

Preliminary review of the Study Area and available aerial imagery identified that there were no obvious signs of mulga banding which would indicate sheet-flow dependent ecosystems. Of the six land systems occurring in the Study Area, the Boolgeeda land system may be subject to sheet flow along the stony lower plains from the low hills, rises and stony slopes/ upper plains (van Vreeswyk *et al.*, 2004). The Boolgeeda land system occurred in the Ministers North targeted flora survey area (Figure 2.3), however, the vegetation present did not display obvious banding or grooving/ intergroving which would indicate sheet-flow dependency.

3 METHODOLOGY

3.1 Compliance

The survey was carried out in accordance with the Western Australian EPA and BHP WAIO guidelines for the environmental surveying and reporting of flora and vegetation. The following guidelines, procedures and documents were utilised prior to, during and after completion of the field survey:

- EPA (2018) Statement of Environmental Principles, Factors and Objectives;
- EPA (2016a) Environmental Factor Guideline: Flora and Vegetation;
- EPA (2016b) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment;
- BHP WAIO's Biological Survey Spatial Data Requirements (SPR-IEN-EMS-015) (BHP, 2018a); and
- BHP WAIO's Vegetation and Flora Survey Procedure (0124627) (BHP, 2018b).

3.2 Desktop Assessment

3.2.1 Literature review

Background information on the Study Area and surrounds was compiled prior to, during and after the field survey. Historic vegetation mapping conducted by Beard (1975a) and Shepherd *et al.* (2002), land systems mapping (van Vreeswyk *et al.*, 2004), and the IBRA classification system (Desmond *et al.*, 2001) were consulted to provide broad contextual knowledge of the vegetation types likely to be encountered within the Study Area. The literature review also considered 41 previous field surveys of relevance to the Study Area (Table 3.1). The surveys were obtained from BHP WAIO and the Index of Biological Surveys for Assessments (IBSA) online portal. The previous surveys are located within a radius of 20 km from the Study Area or have relevance to the survey (e.g. riparian vegetation).

Table 3.1: Literature sources used for the review

Survey Title	Reference	Survey Type	Distance from Study Area (km)
Area C West to Yandi Level 2 Flora and Vegetation Survey	Onshore (2014b)	Level 2	Adjacent
Yandicoogina Creek Reconnaissance Vegetation Survey	Onshore (2018b)	Reconnaissance	Adjacent
Area C to Yandi Flora and Vegetation Survey	Astron (2010a)	Level 2	Adjacent - S
Mining Area C Rail Corridor Rare Flora Survey	Biota (2002)	Targeted Survey	Adjacent - S
Mining Area C Rail Corridor Rare Flora Survey Phase 2	Biota (2003)	Targeted Survey	Adjacent - S
Mining Area C Biological Survey	Ecologia (1998)	Level 2	Adjacent - S
Mining Area C to Yandi Rail Line Baseline Weed Survey	ecologia (2001)	Targeted Survey	Adjacent - S

Survey Title	Reference	Survey Type	Distance from Study Area (km)
Mining Area C Packsaddle Village and Access Road Rare and Priority Flora Survey	ecologia (2002)	Targeted Survey	Adjacent - S
Area C: Deposits D, E and F Biological Survey	Ecologia (2004a)	Level 2	Adjacent - S
Area C R-Deposit Flora and Vegetation Assessment	ENV (2007)	Level 2	Adjacent - S
Area C South Flank Deposit Flora and Vegetation Assessment	ENV (2008b)	Level 2	Adjacent - S
Jinayri to Area C Access Corridor Flora and Vegetation Assessment	ENV (2010c)	Level 2	Adjacent - S
South Flank NVCP Extension Flora, Vegetation and Fauna Assessment	ENV (2010d)	Level 2	Adjacent - S
Area C and Surrounds Flora and Vegetation Survey	Onshore (2011)	Level 2	Adjacent - S
South Flank Level 2 Flora and Vegetation Survey	Onshore (2012)	Level 2	Adjacent - S
Field Survey or Priority and Rare Flora Area C South Flank	Pilbara Flora (2008a)	Targeted Survey	Adjacent - S
Area C Mining Operation Environmental Management Plan (Revision 4) A, D, P1 And P3 Deposits	Woodman (2009)	Level 2	Adjacent - S
Camp Hill Exploration Leases Flora and Fauna Report	Onshore and Biologic (2011)	Level 2 (Flora)	Adjacent - SW
Tandanya Level 2 Flora and Vegetation Survey	Onshore (2013)	Level 2	Adjacent - W
Pineapple Hill Tenements Level 2 Flora and Vegetation Survey	Onshore (2016d)	Level 2	Adjacent - W
Consolidation of Regional Vegetation Mapping BHP Billiton Iron Ore Pilbara Tenure	Onshore (2014a)	Review	Adjacent and surrounding
Survey for *Goodenia stellata* and Flora of Interest	HGM (1997)	Targeted Survey	5 km N
Marillana Creek Western Access Corridor Biological Assessment	HGM (1999)	Level 2	5 km N
Marillana Creek Riparian Flora and Vegetation Survey	Onshore (2015c)	Level 2	5 km N
Packsaddle West Vegetation and Flora Survey and Fauna Assessment	Astron (2010b)	Level 2[1]	10 km SSW
Fork South and Parallel Ridge Exploration Lease Flora and Vegetation Assessment	ENV (2008a)	Level 2	10 km SW
Coondewanna Flats Coolibah Lignum Priority Ecological Community Flora and Vegetation Survey	Pilbara Flora (2008b)	Level 2	12 km S
Western 2 and Western 1 Waste Dump Flora and Vegetation Assessment	ENV (2009b)	Level 2	18 km NE

[1] Now referred to as a "Detailed Flora and Vegetation Survey" (EPA, 2016b)

Survey Title	Reference	Survey Type	Distance from Study Area (km)
Yandi Life of Mine Flora and Fauna	Maunsell (2003)	Targeted Survey	18 km NE
Lease M47/292 and E4 Drill Lines Flora and Vegetation Survey	Maunsell (2004)	Level 2	18 km NE
South Flank to Jinidi Level 2 Flora and Vegetation Survey	Biota (2012)	Level 2	20 km NW
Jinayri Mining Lease Flora and Vegetation Survey	(ENV, 2010b)	Level 2	20 km SE
Targeted Flora Survey – Fortescue Marsh Tenements	Onshore (2015a)	Targeted Survey	24 km NE
Area C Packsaddle Range Biological Survey	Ecologia (2004b)	Level 2	24 km SSW
Packsaddle Wastewater Treatment Plant Flora and Vegetation Survey	Ecologia (2005)	Level 2	24 km SSW
Coondewanna Flats Flora and Vegetation Assessment	Astron (2011)	Level 2	26 km SSW
Jinayri Iron Ore Project Flora Survey	Ecologia (2009)	Level 2	30 km SE
Level 2 Flora and Vegetation Survey – Fortescue Valley Tenement	Onshore (2016a)	Level 2	32 km N
Area C West NVCP Flora, Vegetation and Fauna Assessment	(ENV, 2010a)	Level 2	35 km NE
Karijini National Park Tenements - Flora and Vegetation Risk Assessment	Onshore (2015b)	Level 1[2]	42 km WSW
Level 2 Riparian & Aquatic Flora and Vegetation Survey Jimblebar Creek and Innawally Pool	Onshore (2016b)	Level 2 Riparian & Aquatic	131 km ESE

3.2.2 Database searches

Database searches were undertaken to generate a list of vascular flora taxa previously recorded within, and near, the Study Area, including introduced species and taxa of conservation significance. The database searches also identified ecological communities/ vegetation types of conservation significance that occur, or may occur, within, and near, the Study Area. Conservation codes for flora and vegetation of conservation significance are provided in Appendix A. Six database searches were conducted around a central coordinate (22°48'1.1016"S; 119°4'57.108"E), with varying buffers as deemed appropriate (Table 3.2).

Table 3.2: Details of database searches conducted

Provider	Reference	Database	Parameters
Department of Biodiversity, Conservation and Attractions	DBCA (2020a)	Threatened and Priority Ecological Communities	Circle of radius 40 km centred on the coordinates: 22°48'1.1016"S; 119°4'57.108"E

[2] Now referred to as a "Reconnaissance Flora and Vegetation Survey" (EPA, 2016b)

Provider	Reference	Database	Parameters
Department of Biodiversity, Conservation and Attractions	DBCA (2020b)	Threatened and Priority Flora	Circle of radius 50 km centred on the coordinates: 22°48'1.1016"S; 119°4'57.108"E
Department of Biodiversity, Conservation and Attractions	DBCA (2020c)	NatureMap	Circle of radius 30 km centred on the coordinates: 22°48'1.1016"S; 119°4'57.108"E
Department of Agriculture, Water and the Environment (formerly Department of the Environment and Energy)	DAWE (2020)	Protected Matters Search (MNES)	Circle of radius 50 km centred on the coordinates: 22°48'1.1016"S; 119°4'57.108"E
Atlas of Living Australia	ALA (2020)	Occurrence search	Circle of radius 30 km centred on the coordinates: 22°48'1.1016"S; 119°4'57.108"E
Department of Primary Industry and Regional Development (DPIRD)	DPIRD (2020)	Declared Plants Database (WAOL)[3]	Search of the Shire of East Pilbara local government area.

NB: MNES – Matters of National Environmental Significance; WAOL – Western Australian Organism List

The conservation significant flora taxa identified from the database searches were assessed and ranked on the likelihood of occurring within the Study Area (see Section 4.2). The rankings were assigned using the following definitions presented in Table 3.3.

Table 3.3: Flora likelihood of occurrence decision matrix

Occurrence categories	Habitat categories (within the Study Area)			
	Core/ critical habitat present	**Suitable habitat present/ within known distribution**	**Marginal habitat present/ adjacent to known distribution**	**No suitable habitat present/ outside of known distribution**
Recorded in the Study Area	Confirmed	Confirmed	Confirmed	Confirmed
Recorded within <5 km	Highly Likely	Likely	Possible	Possible
Recorded within 5-15 km	Likely	Possible	Possible	Unlikely
Recorded within 15 - 50 km	Possible	Possible	Unlikely	Unlikely
Recorded >50 km	Possible	Unlikely	Unlikely	Highly Unlikely
Species considered locally/ regionally extinct	Unlikely	Unlikely	Highly Unlikely	Highly Unlikely

[3] Filtered to only include declared plant pests listed under Section 22 of the *Biosecurity and Agricultural Management Act 2007*.

3.3 Field Survey

3.3.1 Survey type, timing and weather

The field survey was undertaken with due consideration given to:

- Environmental Factor Guideline. Flora and Vegetation (EPA, 2016a);
- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b); and
- BHP WAIO's Vegetation and Flora Survey Procedure (0124627) (BHP, 2018b).

A two-season Detailed flora and vegetation survey of Yandicoogina Creek and a single season Detailed flora and vegetation survey and targeted flora survey of the Ministers North miscellaneous licence area was requested by BHP. This survey intensity was deemed to be the most appropriate based on the known environmental values of the Study Area and the previous flora and vegetation survey work (see Section 3.2.1). A breakdown of the survey and intensity is detailed below and presented in Table 3.4. Prior to the field surveys a site reconnaissance survey was completed within a portion of Yandicoogina Creek, concentrating on Yandicoogina Gorge. The reconnaissance survey was completed by Clinton van den Bergh, Jessica Delaney (Biologic Principal Aquatic Ecologist) and Suzi Wild (BHP Principal - Biodiversity) with the aim to review the flora, vegetation and aquatic values, while also determining access through the Study Area.

Table 3.4: Survey timing and climatic conditions (Newman Aero weather station)

Area	Survey Dates	Max. Temp. range (°C)	Min. Temp range (°C)	Rainfall (mm)
Yandicoogina Creek – Reconnaissance	30 April to 3 May 2019	31.9 – 27.0	11.1 – 10.6	0
Yandicoogina Creek – Phase 1	9 to 15 September 2019	35.5 – 33.2	18.6 – 7.4	0
Yandicoogina Creek – Phase 2	26 to 30 March 2020	40.1 – 38.8	23.9 – 20.8	0
Ministers North – Detailed	31 March 2020	38.4	23.6	0
Ministers North - Targeted	30 March and 1 April 2020	39.3 – 37.5	22.5 – 19.4	0

Yandicoogina Creek

A two-season Detailed flora and vegetation survey was completed within the Yandicoogina Creek component of the Study Area. The initial, or phase one, survey was undertaken over 7 days, equivalent to 168-person hours, between 9 and 15 September 2019 (including mobilisation and demobilisation). The day time climatic conditions during the field survey (hot temperatures with clear skies; BoM, 2020a) were not restrictive to completing the majority of the survey on foot.

The phase one survey was undertaken following below-average rainfall, with only 33.8 mm received at Barimunya in the six months preceding the survey (BoM, 2020a) (Figure 3.1). Although there was a

rainfall event in August 2019 (12 mm) recorded at the Barimunya weather station, it is likely this rainfall soaked through to the aquifers or evaporated from the surface and was not readily available for the local flora to utilise. This was confirmed during the phase one survey with dry conditions observed across the Study Area, excluding intermittent pools within the Yandicoogina Gorge section of Yandicoogina Creek. No rain was received in the weeks prior to or during the phase one survey.

The final, or phase two, survey was undertaken over five days, between 26 and 30 of March 2020, equivalent to 204 person hours. The phase two survey followed above average rainfall for the months of January and February (295.2 mm) (BoM, 2020a) (Figure 3.1). This above average rainfall resulted in the presence of numerous large water features present along Yandicoogina Creek. The last substantial rainfall event occurred on 9 and 10 February 2020 (116 mm) (BoM, 2020a), which occurred approximately six weeks prior to the field survey. This timing (six to eight weeks post wet season) is considered ideal according to the EPA (2016b) and BHP (2018b).

Ministers North Miscellaneous Licence Area

A single-season Detailed flora and vegetation survey (31 March 2020) and a targeted flora and vegetation survey (30 March and 1 April 2020) of the Ministers North area was carried out, totalling approximately 66 person hours. The Ministers North miscellaneous licence area was under sampled due to access restrictions imposed by third party tenure holders during the unprecedented COVID-19 pandemic. This is discussed further in Section 3.7.

As detailed above, the field survey occurred following above average rainfall for the month of January and February, resulting in optimal survey conditions (Figure 3.1). This was inidicated by the presence of numerous annual and ephemeral flora that are present following sufficient wet season rainfall.

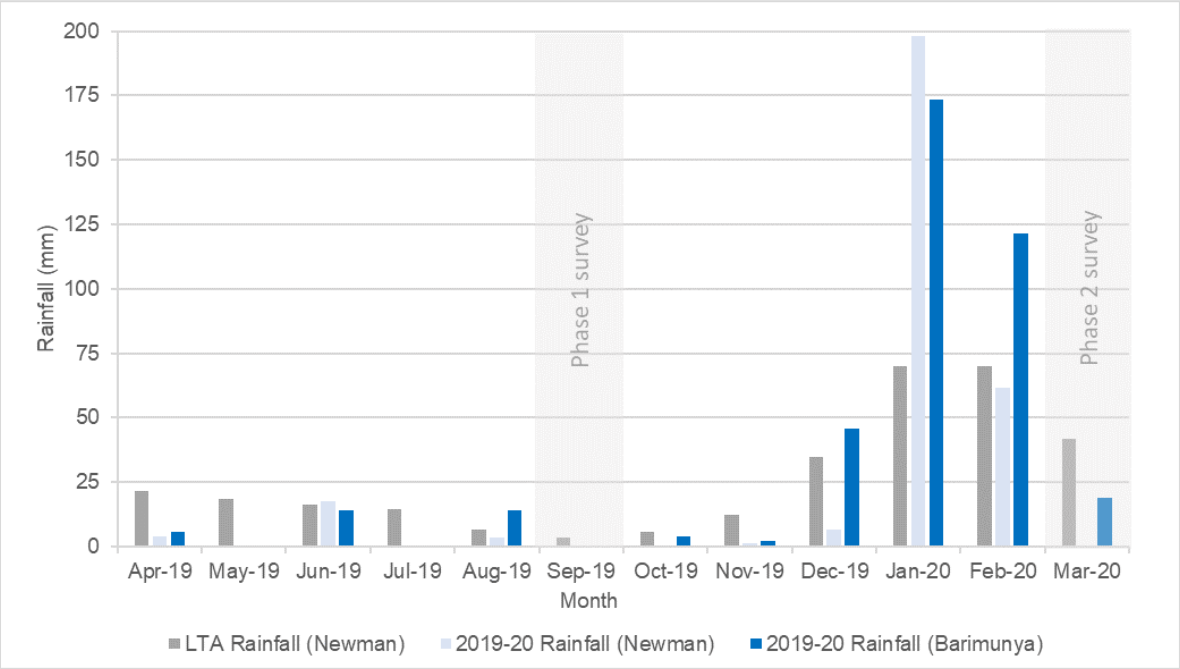


Figure 3.1: LTA monthly rainfall for Newman Airport (7176) and monthly rainfall totals (2019–2020) for Newman Airport and Barimunya Airport (505053) (BoM, 2020a).

3.3.2 Survey team and licensing

The field survey was led by Mr Clinton van den Bergh, a principal botanist with over 14 years' experience. Clinton was assisted by Mr Sam Coultas, Ms Emily Eakin-Busher and Ms Kaylin Geelhoed (Table 3.5) during the field survey. Clinton meets the minimum requirements (5+ years' experience in the bioregion) to lead and manage a flora survey in the Pilbara, as prescribed by the EPA (EPA, 2016b).

The collection of flora specimens occurred under flora collecting permits pursuant to the *Biodiversity Conservation Act 2016* (BC Act) (Table 3.5). Clinton, Sam, and Emily also hold *Authorisation To Take Threatened Flora* for identification purposes (Table 3.5).

Table 3.5: Survey team experience and licences to collect

Personnel	Experience/ qualifications	Role	Survey Period	Collecting Licences
Clinton van den Bergh	BSc (Hons) & PGradDip 14 years' experience	Team Lead – Principal Botanist	Phase 1 & 2	FB62000105 & 59-1819
Sam Coultas	BSc 7 years' experience	Botanist	Phase 1 & 2	FB62000017 & 60-1819
Emily Eakin-Busher	BSc (Hons) & PhD (current) 3 years' experience	Graduate Botanist	Phase 2	FB62000160 & 53-1920
Kaylin Geelhoed	BSc 1 year experience	Graduate Botanist	Phase 2	FB62000238

3.3.3 Flora and vegetation survey design

Prior to the field survey, aerial photography (Scale 1:30,000) of the Study Area and Google Earth Pro©, were reviewed, along with previous vegetation mapping (Biota, 2017; Onshore, 2018a, 2014b, 2015c), land systems mapping (van Vreeswyk *et al.*, 2004) and soil landscape mapping (Northcote *et al.*, 1960-1968), to determine broad preliminary vegetation unit boundaries. Following the review of the aerial imagery and broad contextual information, survey plans were designed to ensure the Study Area was appropriately traversed, sampled and targeted to capture the data required for a Detailed flora and vegetation survey.

3.3.4 Detailed survey

Quadrats were established and sampled in the Study Area, with relevés and mapping points added as necessary. Where practical, at least three quadrats were established in each of the preliminary vegetation type areas, to ensure that each vegetation type occurring within the Study Area was captured by the survey and described appropriately and in accordance with EPA (2016b). The Study Area was constrained by the availability of access tracks so some areas of the Study Area were not accessed. Furthermore, the unprecedented COVID-19 pandemic limited access to certain areas of the Study Area, which resulted in the under sampling of the vegetation. This is discussed further in Section 3.7.

The quadrats measured 2,500 m^2 in size (50 m by 50 m or 100 m by 25 m) with corners orientated to intercardinal points; northwest, northeast, south west and southeast (any deviation from this was recorded in the site data). The phase 1 sample sites in Yandicoogina Creek were not permanently marked (with a post) as it was likely that the posts would have been removed following large rainfall events. The location of these sample sites were recorded with a Trimble Catalyst Antenna with accuracy

below one metre, allowing the re-sampling of the sites. The sample sites established in the Ministers North area were recorded using the Trimble Catalyst Antenna.

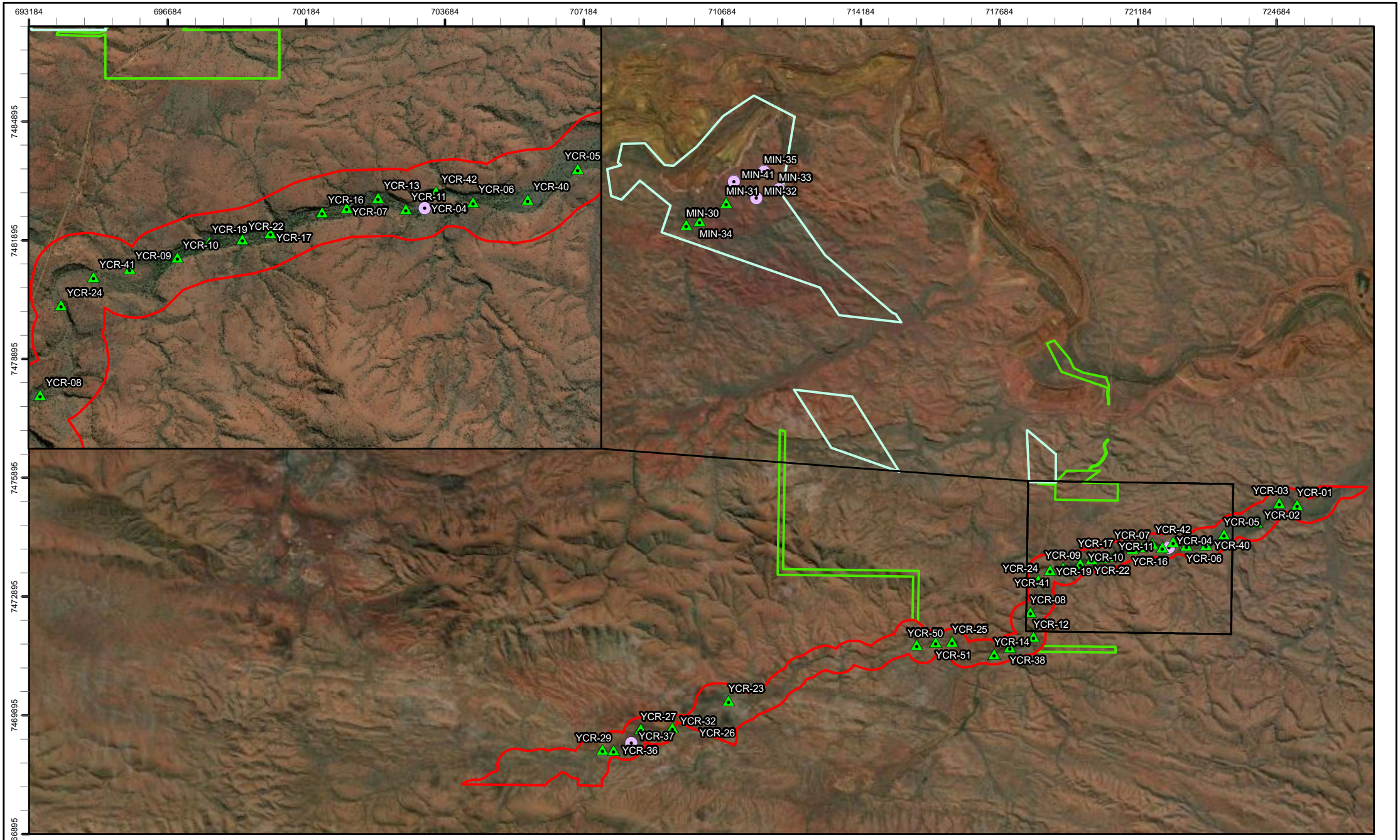
Relevés were sampled in vegetation that was already sampled sufficiently or showed signs of disturbance (e.g., heavy cattle grazing) that hindered an accurate determination of the typical vegetation structure and diversity. The relevés also ensured adequate spatial coverage across the Study Area and assisted with delineation of vegetation boundaries when the vegetation type had already been sufficiently sampled. Information recorded for the relevés was from a central coordinate to an approximate radius of 50 m, depending on the condition and structure of the vegetation.

Mapping notes were collected across the Study Area to assist with vegetation type and condition mapping and where the vegetation was severely impacted by fire (i.e. Ministers North). The mapping notes recorded basic information on the vegetation type and condition.

During phase one of the two-season survey for Yandicoogina Creek (2019), 29 quadrats were established and supplemented by two relevés (Figure 3.2; Appendix C), and seven mapping points. During phase two (2020), 23 of the original 29 quadrats were resampled, while two new quadrats were established (YCR-50 and YCR-51). To further assist with vegetation mapping across Yandicoogina Creek, an additional 15 mapping points were recorded in 2020, mostly concentrated in Yandicoogina Gorge. In the Ministers North area (2020) only three quadrats and four relevés (Appendix C) were sampled across the one field day. Access to Ministers North was limited due to mine blasting and restrictions to access third party tenure. Furthermore, a substantial portion (greater than 50%) of the Study Area had been burnt within 12 months previous to the field survey. The access restrictions, fire and blasting constraints are discussed further in Section 3.7.

All vascular flora taxa within each of the quadrats and relevés (including overhang from plants rooted outside the boundary of quadrats) were recorded, with their corresponding height and cover class (excluding relevés). A brief summary of the vegetation assemblage at each site was also recorded to aid in producing vegetation association descriptions (NVIS Technical Working Group, 2017) (Appendix D). In addition, the following information was recorded at each quadrat (and relevé):

- quadrat (or relevé) number;
- date of survey;
- personnel;
- GPS coordinates of the northwest corner (GDA 94) (only a central coordinate was taken for relevés);
- site photograph – taken from the northwest corner, facing southeast or from the north or west depending on quadrat size and orientation;
- soil characteristics (texture and colour);
- geology (type, size and nature of any rocks, stones, gravel, or outcropping);
- topography (landform type and aspect);
- vegetation condition (based on Trudgen, 1988) (Appendix E);
- disturbance (if present); and
- approximate time since last fire.



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Sampling site

- Quadrat
- Releve

biologic Environmental Survey

N

1:120,000

0 1.25 2.5 5 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 3.2: Flora sampling sites

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

Any flora taxa observed opportunistically in the vicinity of quadrats, or while completing meandering traverses in the Study Area were also recorded. For any populations of taxa known to be conservation significant or introduced flora observed, a GPS location and a count of the individuals present, or percentage foliage cover for a given area, were recorded.

3.3.5 Targeted searches

Prior to the survey, a list of conservation significant flora known to, with the likelihood to, or potential to occur within the Study Area was compiled. Field personnel familiarised themselves with photographs, reference samples and descriptions of these taxa before conducting the survey.

During the survey, targeted searching was undertaken for any flora of conservation significance during meandering traverses of the Study Area (Figure 3.3), focussing on habitat and features considered likely to support conservation significant flora (i.e. hill summits, gorges, and drainage lines).

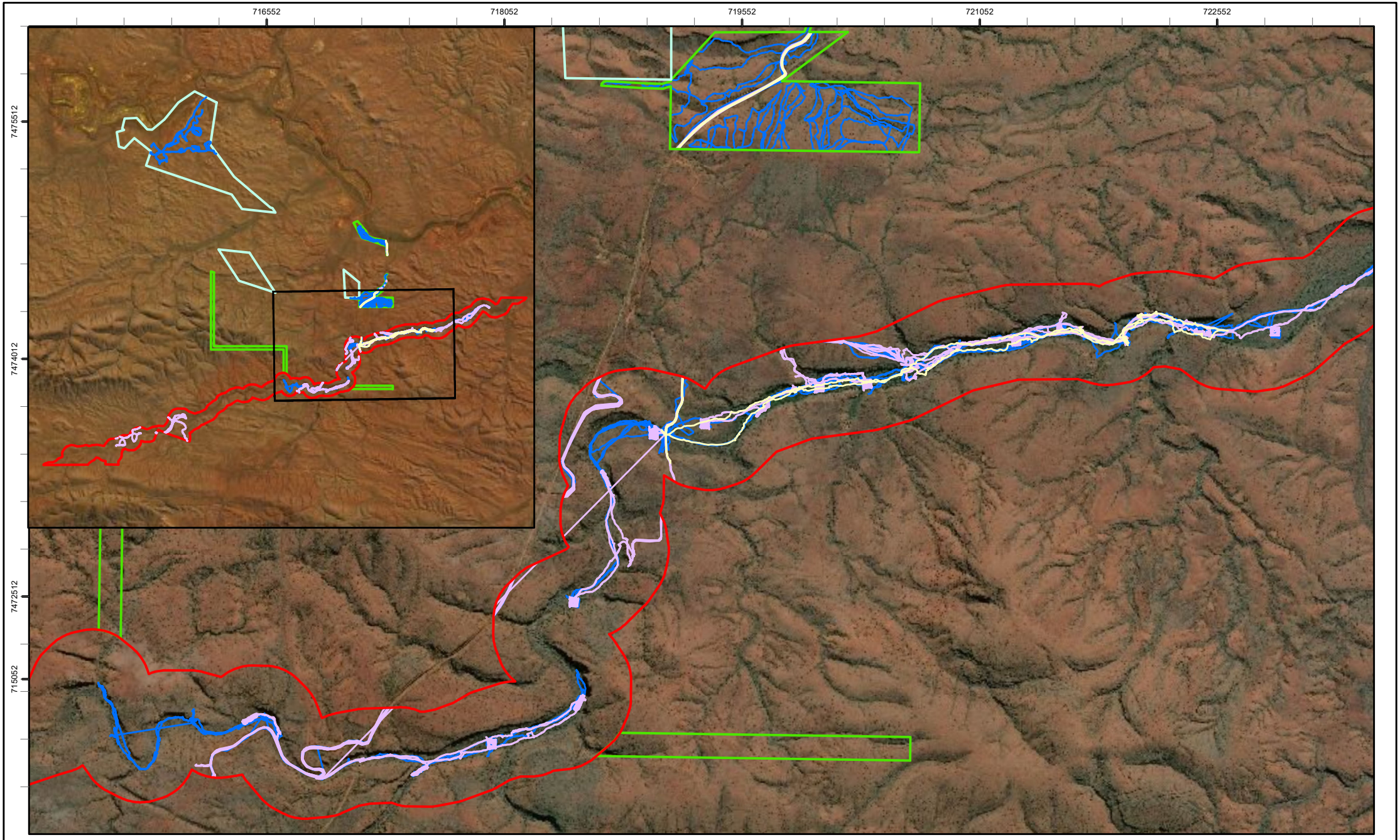
In addition to targeted searching for specific priority listed flora taxa in particular habitats, personnel actively searched for all priority listed flora taxa and opportunistic flora taxa while completing quadrats and traversing the Study Area. Personnel also identified suitable habitat for targeted searches while travelling within the Study Area.

Where conservation significant flora taxa were located in the field, a GPS coordinate of the individual was taken, or, if the species existed within a small population, a central coordinate with an approximate 20 m radius was used. Generalised information was collected for each occurrence, including an estimate of the number of individuals, reproductive status, condition and broad vegetation community and condition.

Threatened and Priority Flora Report Forms will be provided to the Parks and Wildlife Division (Parks and Wildlife) of DBCA, as required under the flora collecting permits. Conservation significant flora specimens have and will be vouchered with the Western Australian Herbarium (WAH), where required and appropriate.

3.3.6 Introduced taxa

Where significant environmental weeds (weeds of national significance and Declared Plant Pests listed under Section 22 of the BAM Act) are identified in the field, searches were conducted within a minimum radius of 20 m from the given specimen, to document the number of individual plants and map the spatial extent of the infestation. The methodology and information collected for significant environmental weeds was consistent with that of conservation significant flora.



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

- Reconnaissance Trip
- Phase 1
- Phase 2

biologic Environmental Survey

N

1:30,000

0 0.35 0.7 1.4 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 3.3: Site Traverses

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 22/06/2020

3.3.7 Identification of flora specimens

Plant taxa that could not be identified during the field survey were collected for subsequent identification. Identifications were carried out by Biologic's team of taxonomists (Table 3.6), utilising the WAH's reference collection, taxonomic keys, reference material, and personal collections. All taxa were checked against Florabase© (version 2.9.31; WAH, 1998-) to ensure their currency and validity. Employees of the Western Australian Herbarium were also consulted for several difficult to identify specimens. In particular, WAH confirmed *Fimbristylis sieberiana* and *Sida* sp. Barlee Range (S. van Leeuwen 1642).

Any conservation significant flora taxa, including potential threatened and priority species, range extensions and potential new taxa have been verified and vouchered (if appropriate) at the WAH.

Table 3.6: Taxonomy team and experience

Personnel	Experience/ qualifications	Survey Period
Dr Rachel Meissner	BSc (Hons) & PhD 19+ years ecological research experience	Phase 1
Sharnya Yates	BSc 15+ years' taxonomy	Phase 2
Sam Coultas	BSc 7 years' experience	Phase 1 & 2
Emily Eakin-Busher	BSc (Hons) & PhD (current) 3 years' experience	Phase 1 & 2

3.3.8 Groundwater dependent and sheet-flow dependent vegetation

The survey included an assessment of vegetation that may be reliant on groundwater for part or all of their lifecycle. The determination of groundwater dependency was undertaken with a review of the flora assemblage present within the Study Area and a review of the literature. The review concentrated on flora species that are considered obligate/ facultative phreatophytes or mesophytic[4]/ hydrophytic[5] flora species. The key species that were utilised in the determination of sub-surface presence of groundwater included (but not limited to):

- *Melaleuca argentea;*
- *Eucalyptus camaldulensis;*
- *Eucalyptus victrix;*
- *Melaleuca* spp. (in particular *M. bracteata, M. linophylla* and *M. glomerata*);
- *Fimbristylis* spp. (in particular *F. sieberiana*);
- *Cyperus* spp. (in particular *C. vaginatus*);
- *Eleocharis* spp. (in particular *E. geniculata*);
- *Lobelia* spp. (in particular *L. arnhemica*); and

4 Mesophytes are plants that require a moderately continuous (outside of drought) supply of moisture (and potentially surface moisture).

5 Hydrophytes are plants which live in waterlogged soil or partly or wholly submerged in water. Generally associated with aquatic flora.

- *Imperata cylindrica*.

In addition to GDEs and Groundwater Dependent Vegetation (GDV) the survey delineated and described communities that are or could potentially be sheet-flow dependent determined through landform position, vegetation patterning and species composition. Contextual information, for example, land system data, was also used to determine the occurrence of sheet-flow dependent ecosystems.

3.4 Statistical Analyses

3.4.1 Floristic Community Types

Data Transformation

All statistics were carried out using R version 4.0.0 (R Core Team, 2018). Flora data from the Yandicoogina Creek area were recorded on a cover abundance basis, with an estimate of the foliage cover of each species made at each site. The hummock grasslands of the Pilbara can exceed 50% cover within a quadrat, while most other taxa cover less than 1% of a quadrat. To allow for this large disparity in cover and the potential for ambiguities in determining cover between observers, the cover values were reduced to cover codes, based on an adapted Braun-Blanquet method (1 = <1%; 2 = 1-5%; 3 = 6-25%; 4 = 26-50%; 5 = 51-75%; and 6 = >75%). The dataset only included sample sites from the Yandicoogina Creek Study Area as the three Ministers North quadrats would were sampled once and only covered a minor portion of the Study Area. Due to access issues and fire, the majority of the Ministers North area was not sampled. The three Ministers North quadrats would have not grouped with the Yandicoogina Creek quadrats as they were located on stony hills and rises and weed infested minor drainage line. Several taxa were removed from the analysis, including weed species (i.e. **Cenchrus ciliaris*) and singletons (taxa only observed once). One relevé (YCR-37) was also removed from the dataset due to low species diversity (two taxa). The final dataset utilised in the analysis included 164 flora taxa from 30 sample sites.

Hierarchical clustering

The cover code values for the floristic data recorded for each quadrat were compiled in R before a resemblance matrix and dendrogram were created. The similarity testing was undertaken using the Bray Curtis coefficient. Vegetation units were distinguished visually in a dendrogram based on a Similarity Profile Test cluster analysis.

The presence of ephemeral taxa is strongly influenced by seasonal rainfall, and can be highly variable in the Pilbara (van Etten & Fox, 2004). The weather conditions prior to the survey directly influence the presence of ephemeral taxa. Newman Aero received well above average rainfall in January 2020, while February 2020 and March 2020 were below average (Figure 3.1) (BoM, 2020a). Observations made in the field by the lead botanist indicated that ephemeral taxa diversity and density was not excessively high that it would have influenced the analysis. As such, the ephemeral taxa were included in the analysis. Ephemeral taxa can also be short-lived perennials and may persist for some time. To confirm the field observations, several permutations of the analysis was undertaken with and without ephemeral taxa and it was determined that the ephemeral taxa is not influencing the grouping of sites.

Species Accumulation Curve

The observed flora taxa were not examined using a species accumulation curve due to the limited access to parts of the Study Area. The lack of data for restricted sections of the Study Area would likely underrepresent the actual flora taxa present.

3.5 Vegetation Unit Mapping

Broad vegetation mapping was conducted in the field, with vegetation boundaries delineated over aerial photography. Following the completion of the quadrat sampling and taxonomic identifications, the broad vegetation units were refined based on the floristic data collected from the quadrats and relevés, the statistical outputs and the existing vegetation mapping occurring across the Study Area. The vegetation type mapping was then digitised using GIS software.

Vegetation associations were delineated and described using the flora sampling data, such as vegetation structure collected from the quadrats, relevés and mapping points. Vegetation associations were then described based on the dominant taxa, foliar cover and height of the three traditional strata (upper, mid and lower/ground). This method of vegetation type determination is consistent with EPA (2016b) and BHP (2018b).

The vegetation types have been described to Level 5 (Vegetation Association) in the NVIS hierarchical structure (NVIS Technical Working Group, 2017) and have been coded in accordance with BHP (2018b) standards. The mapping reliability is considered to range from high to low across the Study Area, due to extrapolation of the mapping for regions which could not be traversed. The vegetation mapping for the Ministers North area relied on the existing mapping that has occurred to date. This was a result of the fire, limited access and the survey only occurred over one day.

3.6 Vegetation Condition Mapping

Vegetation condition was assessed in the Study Area using the BHP (2018b) vegetation condition scale adapted from Keighery (1994) and Trudgen (2002) (Appendix D). The vegetation condition is based on the level of disturbance observed and this was recorded at each sampling site. Additional notes were taken while traversing the Study Area and used to broadly map vegetation condition boundaries. The vegetation condition mapping was then digitised using GIS software.

3.7 Potential Limitations and Constraints

There are a number of possible limitations and constraints that can affect the adequacy of vegetation and flora surveys (EPA, 2016b). The limitations of the current assessment are presented in accordance with the Technical Guidance (EPA, 2016b) (Table 3.7).

The phase one survey was undertaken outside of the optimal survey time for the Pilbara bioregion (March–June is considered optimal, EPA, 2016b) and followed below-average rainfall (33.8 mm in the six months prior at station 505053, BoM, 2020a). The lack of rain was emphasised by the dry conditions observed in the field. The perennial species observed during phase one generally lacked flowering and fruiting material, while many annual and ephemeral taxa were likely absent. However, the phase one survey was undertaken with the knowledge that sites would be revisited during the optimal survey time.

The phase two survey followed well above average rainfall and approximately six weeks following the last substantial rainfall event (see Figure 3.1) which presented the ideal time to complete the survey. As a result of these optimal conditions, a large number of annual and perennial flora species were present and flowering, ensuring confidence in the identifications.

Some taxa observed and collected were difficult to identify to species or infraspecies level due to the lack of suitable material (i.e. flowers, fruits) to aid confident taxonomic identifications. From the phase one survey, six taxa were tentatively identified to species or infraspecies level, while 20 were only identified to genus level. An additional taxon has only been identified to family level (Malvaceae sp.). Following the phase two survey, six taxa were only identified to genus level. None of the taxa that have been tentatively identified are analogous with conservation significant flora highly likely, likely, or potentially occurring in the Study Area.

Both phases of the field survey were constrained by events that were out of the control of Biologic and BHP WAIO. The key events included: the COVID-19 pandemic; fire; and limited vehicle access. During the phase one survey the field team lost approximately 12 person hours of survey time to a punctured tyre. This resulted in some areas of the Yandicoogina Creek area not being adequately surveyed. At the time this was not considered to be a constraint as the field team were going to return and fill the "gaps".

Prior to the phase 2 survey Australia was experiencing the impacts of the COVID-19 pandemic. To minimise the risk of infections across the state and the potential impacts it could have on the resources sector, several of the thirdparty tenure holders revoked access to their tenure and associated infrastructure. This restriction in access severely hampered the ability to complete the phase 2 field survey, especially for the Ministers North area. The majority of the Ministers North area occurs within third party tenure that had restricted access. As a result, only three quadrats and four relevés across one day were sampled within the Ministers North area.

To compound the issues, approximately half (50 %) of the Ministers North area had been severely impacted by a fire less than 12 months prior to the survey. This resulted in a further reduced survey area, while access was limited to the remainder. Mine blasting on a further survey day restricted access eventuating in only one day (or 24 person hours) of survey effort.

The Yandicoogina Creek area was also constrained by access. The track that resulted in a tyre puncture during the phase 1 survey also caused another tyre puncture. The track was overgrown and washed out in sections ensuring that access to the south-western portion of the Study Area was constrained. As a result, the six quadrats in this area were only sampled during the phase 1 field survey.

Table 3.7: Survey limitations and constraints

Limitation	Constraint	Comment
Availability of contextual information at a regional and local scale	No	Sufficient contextual information was available for the Study Area, including broad information on land systems and vegetation associations. Previous biological survey work has occurred around Yandicoogina Creek and Ministers North, and data and reports were available prior to this assessment.

Limitation	Constraint	Comment
Competency/ experience of the team carrying out the survey, including experience in the bioregion surveyed	No	The field survey was led by an experienced botanist with over 14 years' experience, exceeding the minimum requirements to manage flora and vegetation surveys in the Pilbara bioregion (EPA, 2016b). During 2020, each team was led by a botanist with over 5 years' Pilbara experience, and both have previously surveyed the Study Area.
Proportion of flora recorded and/or collected, any identification issues	No	The phase one field survey (September 2019) was undertaken following below average rainfall, resulting in dry soil and surrounds. A proportion of the flora expected to occur (i.e. annuals and ephemerals) were therefore under-represented and under-sampled during phase one. During the phase two survey, following sufficient rainfall, annuals and ephemerals were observed and identified across the Study Area.
Was the appropriate area fully surveyed (effort and extent)	Yes	The Study Area was traversed and surveyed on foot, with all major vegetation types visited in Yandicoogina Creek. The south-western portion of Yandicoogina Creek is under sampled due to vehicle access issues. A substantial portion of the Ministers North area was not accessible due to the COVID-19 pandemic. Furthermore, a fire had impacted approximately half of the accessible area. As a result, Ministers North lacks sufficient sampling. However, this area has been previously traversed with the major vegetation units described and delineated. As a result, the constraint is only considered to be moderate.
Access restrictions within the survey area	Yes	In general, the Study Area was easily accessible via mining and exploration tracks. In the Yandicoogina Creek area, a track to the south western portion of the study area had become overgrown since phase one and therefore prevented resampling of six quadrats. During the first day of the survey, permission to access to non-BHP tenure was withdrawn. The sections of the Ministers North area which could be visited were greatly reduced. These access restrictions meant that only the north and far east portions of the Ministers North area were able to be surveyed.
Survey timing, rainfall, season of survey	No	The phase one field survey (September 2019) was undertaken following below average rainfall, resulting in dry soil and surrounds. A proportion of the flora expected to occur (i.e. annuals and ephemerals) were under-represented and under-sampled during phase one. Phase two was undertaken following above-average rainfall in January and February of 2020, and occurred during a period considered optimal (March to June for the Eremaean region; EPA, 2016b). The survey occurred approximately six weeks following the last substantial rainfall event resulting in ideal survey conditions.

Limitation	Constraint	Comment
Disturbance that may have affected the results of survey such as fire, flood or clearing	No	The Study Area is located within active pastoral leases and current mining exploration tenements. In the Yandicoogina Creek vegetation was generally in very good condition with limited evidence of fire, although weeds were prevalent in locations. The north-eastern portion of the Ministers North area had been impacted by fire within 12 months of the field survey. This severely limited the ability to define and describe the vegetation structure as it showed minimal signs of recovery. As the field survey across Ministers North was already constrained by events out of our control, and the fact that the area has previously been mapped, the disturbance resulting from the fire is not a constraint.

4 RESULTS

4.1 Literature Review

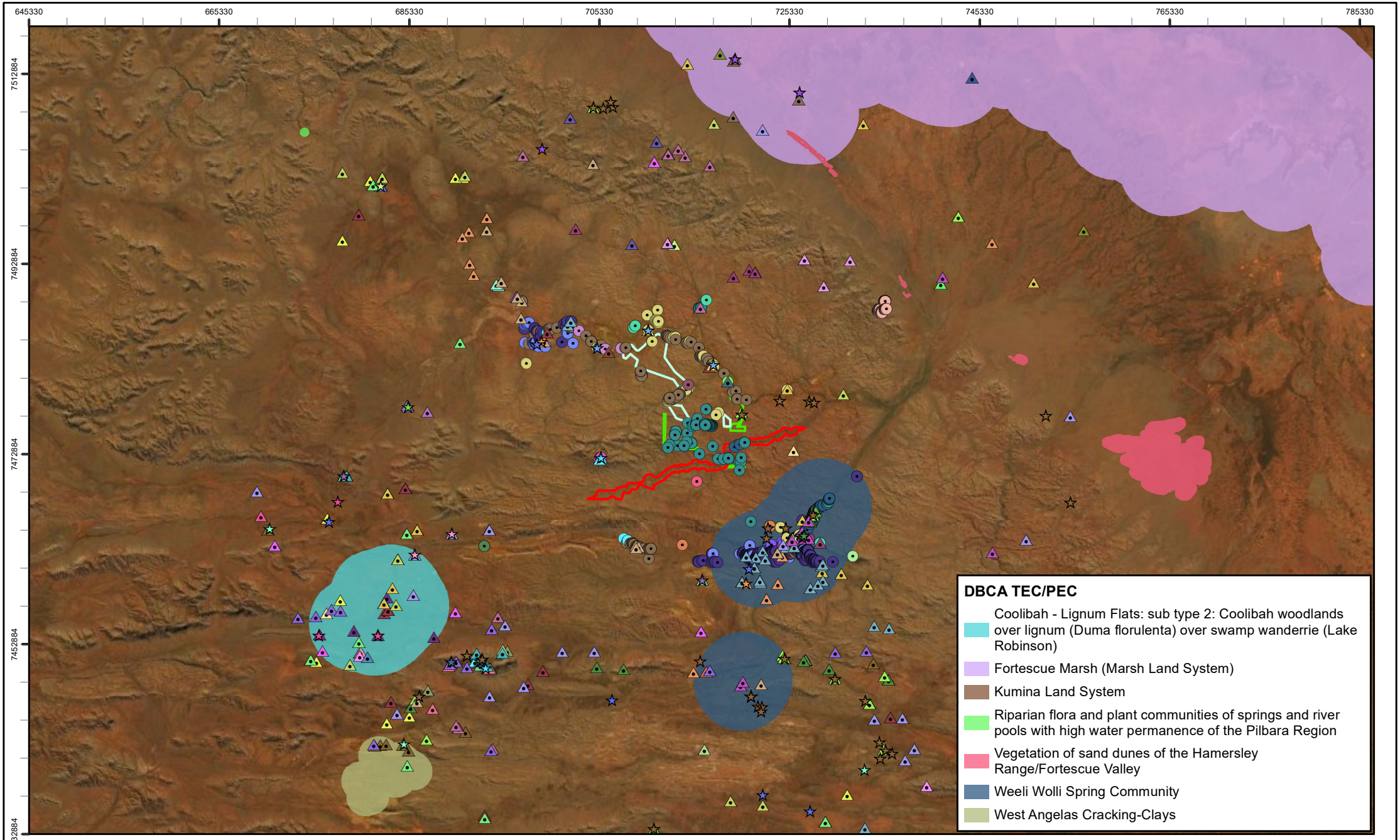
The results and outcomes of the review of 41 flora and vegetation reports identified from the literature review are presented in Appendix F. The literature review identified 61 conservation significant flora species (Priority 1, Priority 2, Priority 3 and Priority 4 taxa), however, only eight have been recorded within the Study Area, *Aristida lazaridis* (P2), *Eremophila* sp. Hamersley Range (K. Walker KW 136) (P3), *Fimbristylis sieberiana* (P3), *Gymnanthera cunninghamii* (P3), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), *Acacia bromilowiana* (P4) and *Goodenia nuda* (P4) (Figure 4.1). The reports, excluding Onshore (2014a) which includes all of BHP WAIO Pilbara tenure, did not identify any conservation significant vegetation associations (Appendix F).

4.2 Database Search Results

4.2.1 Flora of Conservation Significance

A total of 61 priority listed flora taxa were identified from the database searches (Appendix G). Only three threatened flora taxa are known to occur within the Pilbara bioregion (WAH, 1998-), and these are all considered highly unlikely to occur in the Study Area.

Of the 61 priority listed taxa, nine are listed as Priority 1, ten are listed as Priority 2, 35 are listed as Priority 3, and the remaining seven taxa are listed as Priority 4. The database searches did not indicate that any of the 61 priority listed taxa had previously been recorded within the Study Area (Figure 4.1). All flora taxa of conservation significance identified during the desktop assessment were assessed and ranked on the likelihood of occurring within the Study Area. (Appendix H). The eight confirmed priority listed flora taxa from the literature review were classified as confirmed. From the remaining database search results, three priority flora taxa were considered highly likely, three priority taxa were considered likely to occur in the Study Area, and nine priority taxa were considered to possibly occur within the Study Area.



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

biologic Environmental Survey

N

1:500,000

0 5 10 20 km

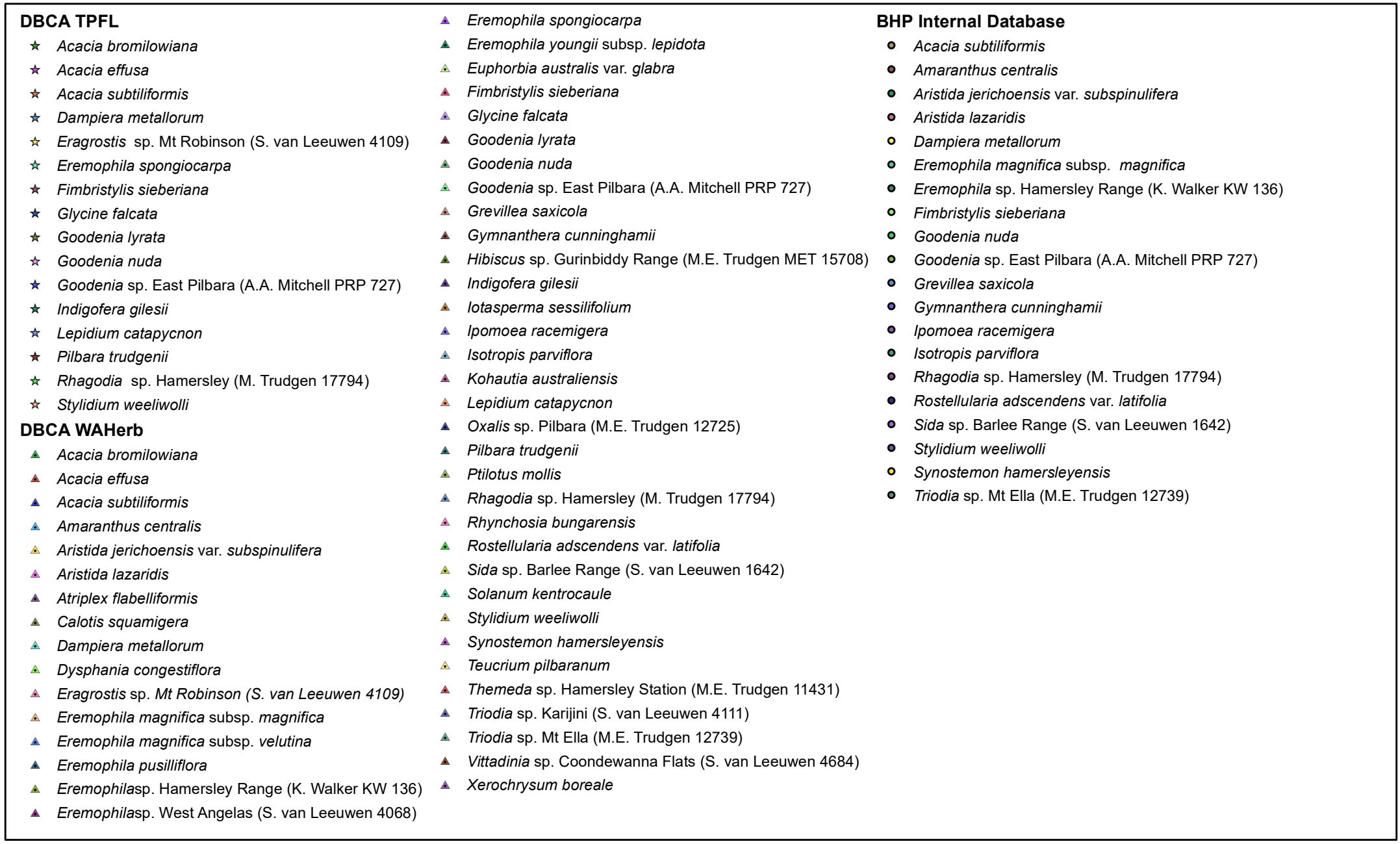
BHP WAIO

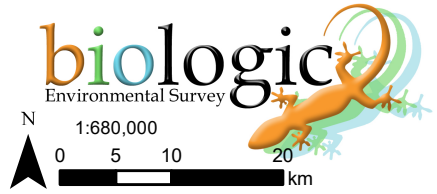
Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.1a: Conservation significant flora and ecological communities database search results

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 22/06/2020





BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.1b: Conservation significant flora and ecological communities database search results

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4, Created 22/06/2020

Table 4.1: Conservation significant flora taxa known to occur near the Study Area based on the desktop assessment

Taxon	Location
Confirmed	
Aristida lazaridis (P2)	Yandicoogina Creek
Eremophila sp. Hamersley Range (K. Walker KW 136) (P3)	Ministers North
Fimbristylis sieberiana (P3)	Yandicoogina Creek
Gymnanthera cunninghamii (P3)	Yandicoogina Creek
Rostellularia adscendens var. *latifolia* (P3)	Yandicoogina Creek & Ministers North
Sida sp. Barlee Range (S. van Leeuwen 1642) (P3)	Yandicoogina Creek & Ministers North
Acacia bromilowiana (P4)	Ministers North
Goodenia nuda (P4)	Ministers North
Highly Likely	
Ipomoea racemigera (P2)	0.5 km E
Isotropis parviflora (P2)	2.4 km S
Lepidium catapycnon (P4)	0.2 km S
Likely	
Amaranthus centralis (P3)	1.1 km N
Dampiera metallorum (P3)	3.3 km N
Stylidium weeliwolli (P3)	9.1 km SSE
Possible	
Synostemon hamersleyensis (P1)	15.1 km N
Eremophila magnifica subsp. *magnifica* (P3)	15.9 km SSE
Euphorbia australis var. *glabra* (P3)	12.5 km WNW
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (P3)	6.3 km WNW
Polymeria distigma (P3)	12.8 km E
Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)	10.3 km SSE
Ptilotus mollis (P4)	18.5 km SW
Rhynchosia bungarensis (P4)	9.5 km N
Themeda sp. Hamersley Station (M.E. Trudgen 11431) (P4)	10.6 km E

4.2.2 Vegetation of Conservation Significance

There is only one TEC (listed under the BC Act) relevant to vegetation that occurs in the Pilbara region. This TEC, Themeda Grasslands on Cracking Clays, is restricted to cracking clay alluvial soils near Tom Price, which do not occur in the Study Area The TEC and PEC database search (DBCA, 2020c) showed six PECs within 40 km of the Study Area (Figure 4.1);

- Coolibah - Lignum Flats: sub type 2: Coolibah woodlands over lignum (Duma florulenta) over swamp wanderrie (Lake Robinson) (P1);
- Fortescue Marsh (Marsh Land System) (P1);
- Weeli Wolli Spring Community (P1);
- West Angelas Cracking-Clays (P1);
- Vegetation of sand dunes of the Hamersley Range/Fortescue Valley (P3); and
- Kumina Land System (P3).

Given these are restricted to particular landforms and land systems, they are not expected to occur within the Study Area.

4.2.3 Introduced Taxa

The NatureMap (DBCA, 2020a), Protected Matters (DAWE, 2020), ALA (ALA, 2020) and The Western Australian Organism List (WAOL) (DPIRD, 2020) database searches identified a list of 82 introduced taxa that could occur within the Study Area. The list of introduced taxa known to occur or potentially occur within the Study Area (Appendix I) was reviewed to identify Weeds of National Significance (WoNS) and Declared Plant Pests (DPP).

Weeds of National Significance

Of the list of introduced taxa identified during the desktop assessment as occurring in or near the Study Area, 31 are listed as WoNS (Appendix I). The 31 WoNS were identified from the WAOL database search for the entire Shire of East Pilbara and occur or may potentially occur within the shire boundaries. No other database search or literature review identified any WoNS. These taxa include numerous *Opuntia, Austrocylindropuntia* and *Cylindropuntia* species that are grouped together in the WoNS listing.

Declared Plant Pests

The desktop assessment identified 49 DPPs (including numerous cacti species that are all listed as DPPs, Appendix I), previously recorded or potentially located within the Shire of East Pilbara. The desktop assessment did not identify any DPPs as occurring within, or immediately adjacent to, the Study Area.

Weed Prioritisation

Fifteen introduced taxa have been identified by Parks and Wildlife as 'Priority Alerts' for the Pilbara region, including **Azadirachta indica, *Calotropis procera, *Chloris gayana, *Clitoria ternatea, *Cryptostegia grandiflora, *Cylindropuntia* spp*., *Euphorbia tirucalli, *Jatropha gossypifolia, *Lantana camara, *Moringa oleifera, *Ricinus communis, *Schinus molle* var*. areira, *Vachellia nilotica, *Washingtonia robusta* and **Xanthium strumarium*. None of these introduced 'Priority Alerts' taxa are expected to occur in the Study Area.

4.3 Flora Composition

A total of 279 vascular flora taxa from 51 families and 141 genera were recorded from the Study Area during the current field survey (Appendix J). The total number of vascular flora taxa recorded comprised of 262 native taxa and 17 introduced taxa (Appendix J). A total of 128 vascular flora taxa were recorded from Ministers North miscellaneous licence area, while 248 vascular flora taxa were recorded from Yandicoogina Creek. Twenty-eight (28) flora taxa were exclusively recorded from Ministers North, with these species occurring along the stony hills and plains that were not sampled within Yandicoogina Creek. One hundred and fifty (150) flora taxa were exclusively recorded from Yandicoogina Creek with the majority of these species occurring within the major drainage line, which was not sampled within Ministers North.

The dominant families equate to 46% of the total taxa recorded and comprised Fabaceae (49 representatives), Poaceae (46 representatives), and Malvaceae (33 representatives). Of the 51 families recorded, 25 were represented by one taxon, which equates to 9% of the total taxa recorded.

The dominant genera comprised *Acacia* (17 taxa), followed by *Corchorus, Ptilotus* and *Senna* (9 taxa each). Of the 141 genera recorded, 93 were represented by only one taxon, which equates 33% of the total taxa recorded.

4.4 Sampling and Survey Efficacy

4.4.1 Sampling Intensity

A total of 39 sites were sampled across the Study Area (seven at Ministers North and 32 at Yandicoogina Creek) during the present survey, 34 of which were quadrats. BHP (2018b) suggest that the intensive sampling of quadrats (i.e. during detailed surveys) shall allow for a minimum of one quadrat per square kilometre (km^2). The Study Area is approximately 37.56 km^2 in size, therefore, the sampling of 34 sites across the Study Area did not adequately addresses BHP's minimum survey intensity. However, the sampling of 31 quadrats within the 17.45 km^2 Yandicoogina Creek area is adequate, while the three quadrats within Ministers North is severely under sampled. The key reason for the under sampling of Ministers North is the restriction in access across the majority of the area.

Details on the size of the survey areas for many of the surveys nearby are limited, however, the sampling intensity of the current survey was similar in terms of the number of sites per hectare (Table 4.2). The surveys presented ranged from 0.003 to 0.038 sites per hectare. The number of sampling sites per hectare for Yandicoogina Creek (0.018) was adequate when compared to the surveys presented in Table 4.2. The sampling intensity for Ministers North (0.002) was low due to access restrictions.

Not all the reports reviewed in the desktop assessment are included in Table 4.2 due to survey type and missing information in the reports (i.e. size of the respective study areas). These results indicate that additional survey effort may contribute a higher vascular flora taxa count than what was observed during the survey.

Table 4.2: Comparison of survey intensity and effort in the Study Area

Survey	Study Area (ha)	Taxa recorded	Sampling sites	Sites/ ha
Onshore (2015c)	1,027	399	40	0.038
Astron (2010a)	2,181	91	27	0.012
This Survey	**3,756**	**279**	**34**	**0.009**
Onshore (2011)	15,000	304	138	0.009
Onshore (2014b)	23,500	427	170	0.007
Onshore (2016b)	18,955	407	63	0.003

4.4.2 Unknown Flora

Some taxa observed and collected were difficult to identify to species or infraspecies level due to the lack of suitable material (i.e. flowers, fruits) to aid confident taxonomic identifications. The phase one survey (at Yandicoogina Creek) tentatively identified six taxa to species or infraspecies level, while a further 20 were only identified to genus level. An additional taxon was only identified to family level (Malvaceae sp.). The key reason for the tentative identifications is the lack of flowering and/ or fruiting material to aid confident identifications.

The phase two survey occurred after above average rainfall, and presented an opportunity to identify the unknown flora species to the highest taxonomic level possible. Following the phase two survey, only six taxa were identified to genus level, with the majority of the unknown flora from phase one confidently identified. None of the six taxa that have been tentatively identified to genus level are analogous with conservation significant flora that were confirmed as occurring, or any that were highly likely, likely, or potentially occurring in the Study Area.

4.5 Flora of Conservation Significance

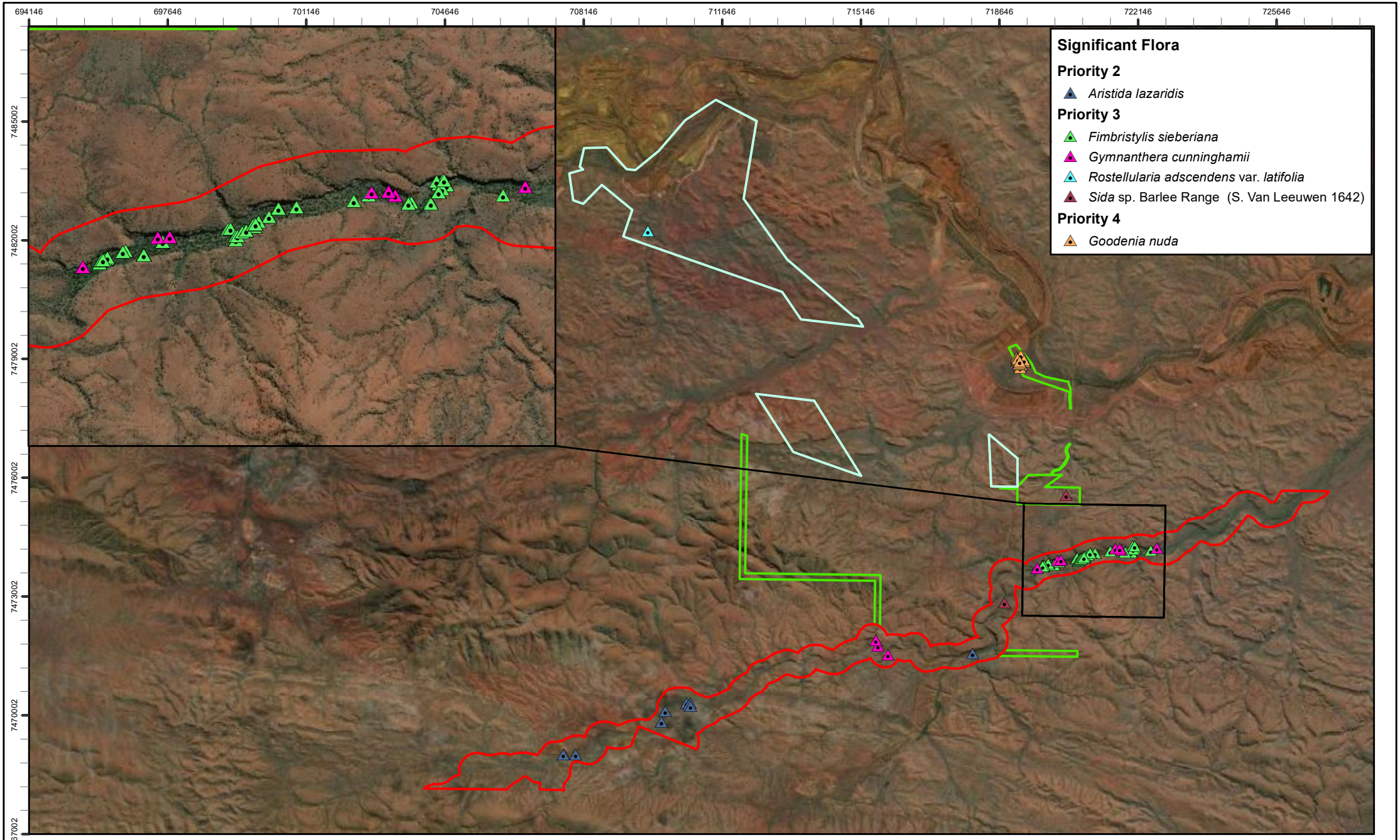
4.5.1 Federal and State Listing

The desktop assessment did not identify any federal or state listed threatened flora species as occurring in, or near, the Study Area. The field survey did not record any threatened flora occurring, or likely to occur within the Study Area. The vegetation and habitats present within the Study Area and the known locations of threatened flora confirm that it is highly unlikely that any threatened flora would occur.

A total of six Priority listed flora were recorded from the Study Area, including *Aristida lazaridis* (P2), *Fimbristylis sieberiana* (P3), *Gymnanthera cunninghamii* (P3), and *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) from Yandicoogina Creek, and *Rostellularia adscendens* var. *latifolia* (P3), Sida sp. Barlee Range (S. van Leeuwen 1642) (P3) and *Goodenia nuda* (P4) were recorded at Ministers North (Figure 4.3).

Of the eight Priority listed flora identified as occurring in the Study Area from the literature review (Table 4.1), the current survey recorded six of them. *Eremophila* sp. Hamersley Range (K. Walker KW 136) (P3) and *Acacia bromilowiana* (P4) were not recorded from the Study Area, however, the known locations of these two Priority taxa within the Study Area (Figure 4.1) were not visited due to access restrictions.

Aristida lazaridis listed as a Priority 2 taxon and is described as a large perennial tussock grass generally found on sandy or loamy soils (WAH, 1998-) in association with drainage or floodplain areas. The current survey recorded *Aristida lazaridis* (Plate 4.1) from ten point locations totalling 2,085 individuals (Figure 4.2). One location of *Aristida lazaridis* was recorded to the east of the rail bridge that crosses over Yandicoogina Creek, while the majority of the records were from further upstream where the creek is broader with a higher occurrence of alluvial plains adjacent to the creek (Figure 4.2). The majority of the individuals were recorded from vegetation type FP TpTw PlAdApyp TtEuaDict, while two were recorded were from vegetation type MA EvEco AtpGoroAnl TtEuaCyo and one record was from vegetation type MA MgAcpGoro EuaTtErmu EvEco.



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

biologic Environmental Survey

N

1:120,000

0 1.25 2.5 5 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.2: Conservation significant flora recorded in the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

Plate 4.1: *Aristida lazaridis* population recorded from upper reaches of Yandicoogina Creek. Photo taken by Biologic in September 2019

Fimbristylis sieberiana is listed as a Priority 3 taxon and is described as a shortly rhizomatous tufted perennial sedge which grows up to 0.6 m tall. It flowers between May and June and occurs in pockets of soil and mud, generally along drainage lines (WAH, 1998-). *Fimbristylis sieberiana* (Plate 4.2) was recorded from the Yandicoogina Gorge area within vegetation types MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua. A total of 868 individuals from 49 point locations were recorded from the Yandicoogina Creek (Figure 4.2). In general, the individuals were recorded adjacent to perennially wet portions of the creek that supported a high diversity and cover of sedge and hydrophytic/ mesophytic flora species.

Plate 4.2: *Fimbristylis sieberiana* population recorded from lower reaches of Yandicoogina Creek (within Yandicoogina Gorge). Photo taken by Biologic in September 2019 & March 2020

Gymnanthera cunninghamii (Plate 4.3) is a Priority 3 taxon that is described as an erect, woody shrub that grows to 1.5 m high with cylindrical, glabrous stems. It releases a milky latex if cut, and is conspicuously lenticellate (Rio Tinto & WAH, 2015). It produces cream to green yellow flowers from January to December (Rio Tinto & WAH, 2015). The current survey recorded 47 individuals from ten point locations (Figure 4.2). The individuals were recorded from six vegetation types (FP EuaTtErmu

AtpCuleGoro Tefc, MA Eco EuaTtSogl AtpGoroCule, MA EcoEv EuaTtCyo Mg, MA EcoMa AtpCuleGoro TtEuaSopl, MA EvEcoAcp Mg PldClvPhm and MA MaEco CyvTydFis TtEua). The individuals were mostly recorded from the lower reaches within the Yandicoogina Gorge section of Yandicoogina Creek, with three records to the west of the rail bridge.

Plate 4.3: *Gymnanthera cunninghamii* population recorded from lower reaches of Yandicoogina Creek (within Yandicoogina Gorge). Photo taken by Biologic in September 2019 & March 2020

Rostellularia adscendens var. *latifolia* (Plate 4.4) is a Priority 3 taxon that is described as a herb or small shrub growing to 0.1-0.3 m high. It produces blue-purple-violet flowers in April through to May and mostly occurs on ironstone soils near creeks and rocky hills (WAH, 1998-). It was recorded from one location, a minor drainage line, within the Ministers North miscellaneous licence area (Figure 4.2). The individual(s) were recorded during the March 2020 field survey and a count on the number of individuals was not completed.

Plate 4.4: *Rostellularia adscendens* var. *latifolia*. Photography by E. Wajon.
Image used with the permission of the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions (https://florabase.dpaw.wa.gov.au/help/copyright). Accessed on Saturday, 20 June 2020.

Sida sp. Barlee Range (S. van Leeuwen 1642) is a Priority 3 taxon and is described as a rounded, densely woolly to velvety shrub that is mostly found in skeletal soils of cliff faces. It has hairy stems and foliage with a felted appearance, and flowers around August. *Sida* sp. Barlee Range (S. van Leeuwen 1642) (Plate 4.5) was recorded from two point locations totalling five individuals (Figure 4.2). One record

was from the gorge slopes of Yandicoogina Creek outside of the riparian zone, while the remaining record was from the Ministers North area (Figure 4.2).

Plate 4.5: *Sida* sp. Barlee Range (S. van Leeuwen 1642) recorded from Yandicoogina Creek (left) and Ministers North (right). Photo taken by Biologic in September 2019 and March 2020.

Goodenia nuda is a Priority 4 taxon and is described as a prostrate or erect to ascending herb which grows up to 0.5 m high, with basal leaves that are prominently three veined. *Goodenia nuda* produces yellow flowers with maroon centres between April and August (Carolin, 2020; Rio Tinto & WAH, 2015; WAH, 1998-). *Goodenia nuda* (Plate 4.6) was recorded from 20 point locations totalling 89 individuals (Figure 4.2). The individuals were recorded from a drainage/ floodplain near Marillana Creek within the Ministers North area.

Plate 4.6: *Goodenia nuda* recorded from Ministers North. Photo taken by Biologic in September 2019 and March 2020.

4.5.2 Review of Significant Flora Highly Likely to Occur in the Study Area

The desktop assessment identified three Priority listed taxa as Highly Likely to occur within the Study Area (Section 4.2.1). The three Priority listed taxa, *Ipomoea racemigera* (P2), *Isotropis parviflora* (P2) and *Lepidium catapycnon* (P4), have previously been recorded from within 3 km of the Study Area (Table 4.1). Following the completion of the field survey, the three priority listed taxa are still considered

Highly Likely to occur in the Study Area. *Isotropis parviflora* and *Lepidium catapycnon* are known to occur in close proximity to the Ministers North area, while suitable habitat extends across the Study Area. The key reason that the three Priority listed taxa are still considered Highly Likely to occur is the restriction in access. The access restrictions meant that only 66 person hours were spent traversing the Ministers North area. This limited survey intensity resulted in only a portion of the Study Area was traversed, which only partially covered some of the suitable habitat within the Study Area.

4.5.3 Review of Significant Flora Likely to Occur in the Study Area

The desktop assessment identified three Priority listed taxa as Highly Likely to occur within the Study Area (Section 4.2.1). The three Priority listed taxa, *Amaranthus centralis* (P3), *Dampiera metallorum* (P3) and *Stylidium weeliwolli* (P3), have previously been recorded from within 10 km of the Study Area (Table 4.1), while suitable habitat is present. Following the completion of the field survey, *Stylidium weeliwolli* is now highly unlikely to occur. Suitable habitat for *Stylidium weeliwolli* occurs within the Yandicoogina Gorge section of Yandicoogina Creek. Yandicoogina Gorge was traversed extensively (Figure 3.3) with no individuals identified. Although suitable habitat is still present, the extensive searching resulted in the assessment that *Stylidium weeliwolli* is highly unlikely to occur.

Dampiera metallorum is still considered likely to occur within the Ministers North area, mostly restricted to the western portion of Ministers North area within the hillcrests and upper summits of the Hancock Range. Known records are within 10 km to the west on the upper summits of Hancock Range (Figure 4.1).

Amaranthus centralis is now considered possible to occur in the Study Area. Suitable habitat (Marillana Creek, Yandicoogina Creek and associated drainage lines and floodplains) is present within the Study Area, with no individuals recorded from Yandicoogina Creek. It is possible that individuals occur within Marillana Creek and associated floodplains, however only a portion of this creek and habitat was searched.

4.5.4 Review of Significant Flora with Potential to Occur in the Study Area

Nine priority listed taxa, *Synostemon hamersleyensis* (P1), *Eremophila magnifica* subsp*. magnifica* (P3), *Euphorbia australis* var*. glabra* (P3), *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3), *Polymeria distigma* (P3), *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3), *Ptilotus mollis* (P4), *Rhynchosia bungarensis* (P4) and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P4), were considered to potentially occur in the Study Area based on known records and habitat present. Following the completion of the field survey the nine Priority listed taxa are now considered unlikely to occur. Suitable to marginal habitat is present for some of the taxa (*Rhynchosia bungarensis*, *Ptilotus mollis*), while habitat is absent for others (i.e. *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) and *Rhagodia* sp. Hamersley (M. Trudgen 17794)).

It can not be said that the Priority listed taxa unequivocally do not occur in the Study Area, as the entire Study Area has not been traversed. This is particularly pertinent for the Ministers North area which had access restrictions and was only partially surveyed.

4.5.5 Flora of other significance

Several flora species recorded from the Study Area matched the criteria for flora of "other" significance (Table 4.3). The majority of the flora are considered to be of significance due to range extensions, while other species recorded from Yandicoogina Creek are of note as they are mostly restricted to permanently wet or semi-permanently wet habitats (i.e. springs, seeps and permanent waterholes) (this is discussed further in Section 4.8). No other flora species recorded from the Study Area are of "other" significance.

Table 4.3: Flora of "other" significance from the Study Area

Species	Location	Comment
Imperata cylindrica	Yandicoogina Creek	Records (ALA, 2020; DBCA, 2020a; WAH, 1998-) suggest that *Imperata cylindrica* occurs sporadically through the Pilbara, with most records from WA in the Kimberley. The occurrence of *Imperata cylindrica* in the Pilbara suggest it is a relictual species from a wetter past. The authors knowledge of the flora species is that it also occurs at Millstream, Palm Springs, Munjina Gorge and several pools within Karijini National Park. The record within Yandicoogina Creek is currently the most easterly known record in the Pilbara. Furthermore, *Imperata cylindrica* almost exclusively occurs in permanently wet habitats (i.e. springs or pools), suggesting that groundwater is close to the surface at the location within Yandicoogina Creek. *Imperata cylindrica* is also an indicator species for the Pilbara Pools PEC. The presence of *Imperata cylindrica* in the Study Area is discussed further in Section 4.8.
Dodonaea viscosa subsp. *angustissima*	Yandicoogina Creek	Currently not known to occur in the Pilbara (ALA, 2020; DBCA, 2020a; WAH, 1998-), so would represent a range extension of more than 170 km to the northwest. The specimen has been vouchered with the Western Australian Herbarium.
?Rotala occultiflora	Yandicoogina Creek	Currently only known from one record in the Pilbara (near Brockman mine site), with the majority of the records from the Kimberley (ALA, 2020; DBCA, 2020a; WAH, 1998-). The specimen collected from Yandicoogina Creek was poor so the identification is only tentative. The specimen has been submitted for further identification with the Western Australian Herbarium.

Species	Location	Comment
Triodia biflora	Yandicoogina Creek	Has previously been recorded from Yandicoogina Creek, however, it occurs patchily through the central Hamersley Range in gorges, below cliffs or on ironstone ridges near mountain summits. Although not formally listed as a Priority species, Barrett *et al.* (2017) recommend a Priority 3 ranking is required due to the patchy distribution, with numerous occurrences under immediate threat from mining.

4.6 Introduced Flora Taxa

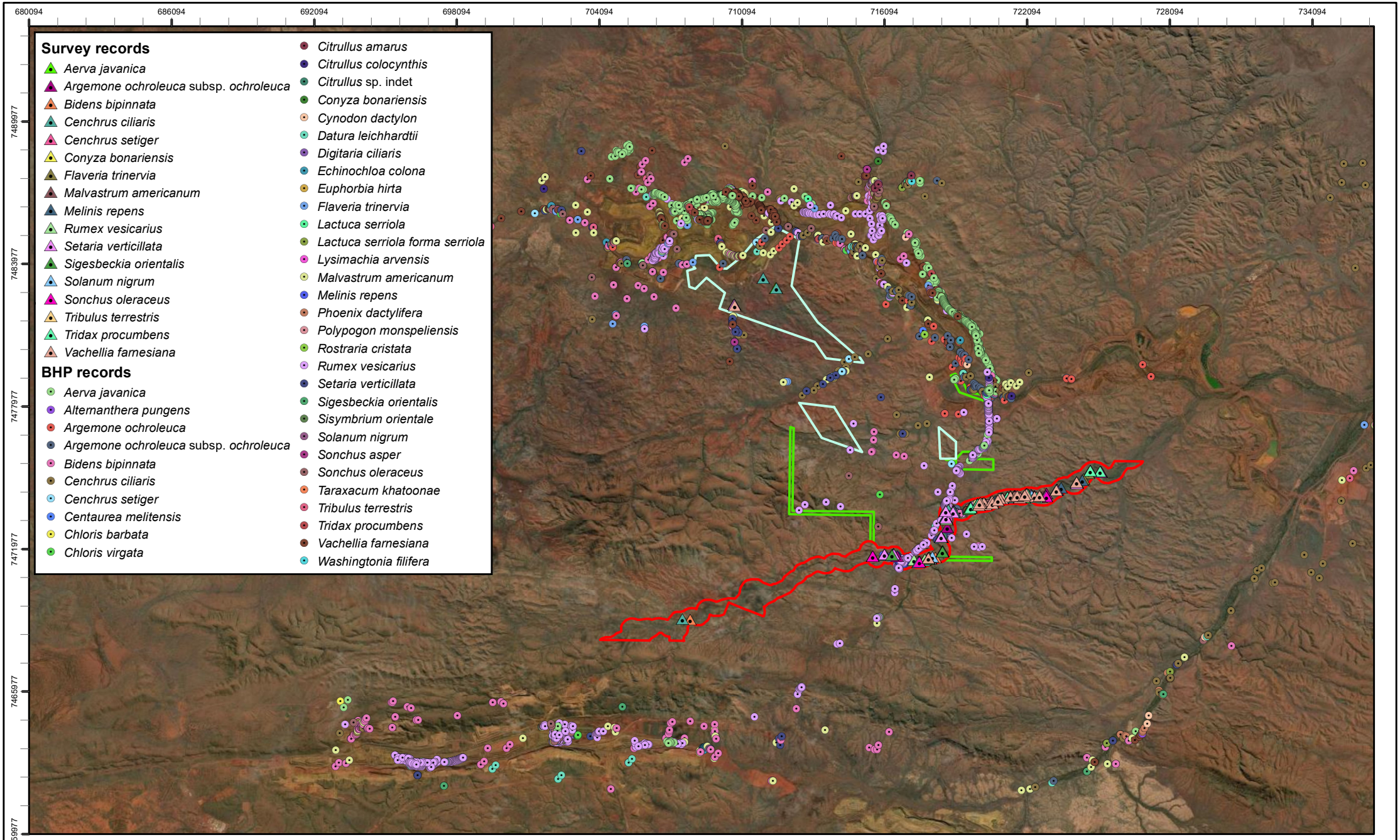
Seventeen introduced taxa were observed during the survey, comprising **Aerva javanica*, **Argemone ochroleuca* subsp. *ochroleuca*, **Bidens bipinnata*, **Cenchrus ciliaris*, **Cenchrus setiger, *Conyza bonariensis*, **Flaveria trinervia*, **Malvastrum americanum*, **Melinis repens*, **Rumex vesicarius*, **Setaria verticillata*, **Sigesbeckia orientalis*, **Solanum nigrum*, **Sonchus oleraceus*, **Tribulus terrestris*, **Tridax procumbens*, and **Vachellia farnesiana*. These introduced taxa are not listed as WoNS or Declared Plant Pests under the BAM Act. The introduced taxa were generally recorded in association with Yandicoogina Creek (Figure 4.3). It is likely that cattle (which were observed along Yandicoogina Creek) are spreading the weeds through the Study Area, while large rainfall and flood events are allowing the proliferation of the weeds downstream of Yandicoogina Creek.

The most frequently observed taxa were **Vachellia farnesiana, *Cenchrus ciliaris*, **Setaria verticillata*, and **Melinis repens* which were seen in 20 or more locations (Table 4.4). However, **Argemone ochroleuca* subsp. *ochroleuca* was the most abundant taxon observed, with large outbreaks seen along sections of the creek (Plate 4.7). It is likely that **Argemone ochroleuca* subsp. *ochroleuca* would be the most frequently observed taxa following sufficient rainfall events and the timing of the survey.

**Argemone ochroleuca* subsp. *ochroleuca* is an annual herb which can grow up to 1 m high (WAH, 1998-). It is spiny with a yellow latex, and known to occur on creek edges, riverbanks and roadsides (WAH, 1998-). **Argemone ochroleuca* subsp. *ochroleuca* is toxic to humans and cattle and can occur in dense stands in stream beds.

**Vachellia farnesiana* (Plate 4.8) was recorded on 30 separate occasions with the majority (29) of the records from Yandicoogina Creek (Figure 4.3). Although **Vachellia farnesiana* was recorded the highest number of times, most occurrences had less than three individuals.

**Cenchrus ciliaris* (Plate 4.9) was dominant along Yandicoogina Creek and the minor drainage lines within the Ministers North area. The individuals of **Cenchrus ciliaris* showed signs of drought stress during the phase one survey but appeared healthy during phase two. In total, **Cenchrus ciliaris* was recorded from 28 locations, with the majority located on the drainage lines (Figure 4.3). Although only recorded on 28 occasions, the number of individuals was estimated to be large, with extents exceeding several thousand individuals. Other notable weeds are displayed in Plate 4.10.



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

biologic Environmental Survey

N

1:200,000

0 2.25 4.5 9 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.3: Introduced flora locations in the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

Table 4.4: Introduced flora recorded from the Study Area

Species	Location	Point Locations	Individuals (estimate)
**Aerva javanica*	Ministers North & Yandicoogina Creek	3	>25
**Argemone ochroleuca* subsp. *ochroleuca*	Yandicoogina Creek	11	>5,000
**Bidens bipinnata*	Ministers North & Yandicoogina Creek	16	>550
**Cenchrus ciliaris*	Ministers North & Yandicoogina Creek	28	>2,500
**Cenchrus setiger*	Ministers North	1	>20
**Conyza bonariensis*	Yandicoogina Creek	6	>50
**Flaveria trinervia*	Yandicoogina Creek	8	>60
**Malvastrum americanum*	Yandicoogina Creek	2	>20
**Melinis repens*	Yandicoogina Creek	20	>250
**Rumex vesicarius*	Yandicoogina Creek	11	>140
**Setaria verticillata*	Yandicoogina Creek	27	>600
**Sigesbeckia orientalis*	Yandicoogina Creek	12	>250
**Solanum nigrum*	Yandicoogina Creek	7	>30
**Sonchus oleraceus*	Yandicoogina Creek	12	>50
**Tribulus terrestris*	Yandicoogina Creek	1	2
**Tridax procumbens*	Yandicoogina Creek	12	>180
**Vachellia farnesiana*	Ministers North & Yandicoogina Creek	30	~35

Plate 4.7: *_Argemone ochroleuca_ subsp. _ochroleuca_ in creekline and flowering. Photo taken by Biologic in September 2019 and March 2020

Plate 4.8: ****Vachellia farnesiana* **recorded from Yandicoogina Creek. Photos taken by Biologic in March 2020

Plate 4.9: ****Cenchrus ciliaris* **extents within Yandicoogina Creek. Photos taken by Biologic in March 2020.

Plate 4.10: Additional weeds recorded from the Study Area (**Conyza bonariensis***, ****Bidens bipinnata***, ****Sonchus oleraceus***, ****Setaria verticillata***, ****Sigesbeckia orientalis,*** *****Rumex vesicarius***, ****Flaveria trinerva***, ****Solanum nigrum***, ****Aerva javanica***). Photos taken by Biologic in September 2019 and March 2020.**

4.7 Vegetation Units

4.7.1 Broad Floristic Formations

Eighteen (18) broad floristic formations were described from the Study Area (Table 4.5), based on the dominant growth form and the dominant land cover genus for the dominant stratum. In addition to the 18 broad floristic formations, two mapping units were also mapped and described from the Study Area, Cleared and Rehab. The broad floristic formations were:

- *Acacia* high shrubland;
- *Acacia* low open forest;
- *Acacia* open scrub;
- *Acacia* shrubland;
- *Corymbia* low woodland;
- *Eriachne* open tussock grassland;
- *Eucalyptus* low woodland;
- *Eucalyptus* mid open woodland;
- *Eucalyptus* mid to low open woodland;
- *Eulalia* mid tussock grassland;
- *Melaleuca* high open forest;
- *Melaleuca* high shrubland;
- *Melaleuca* mid woodland;
- *Themeda* open tussock grassland;
- *Themeda* tussock grassland;
- *Triodia* hummock grassland;
- *Triodia* mid hummock grassland; and
- *Triodia* open hummock grassland.

The dominant broad floristic formations based on extent across the Study Area are the *Triodia* hummock grasslands formations (*Triodia* hummock grassland, *Triodia* mid hummock grassland and *Triodia* open hummock grassland), covering greater than 65 % of the Study Area. The *Triodia* hummock grassland supported the greatest number of vegetation types (13). Of the 18 broad floristic formations, 11 were represented by one vegetation type.

4.7.2 Vegetation Types

A total of 35 vegetation types were described and delineated from the Study Area (Table 4.5; Figure 4.4) based on the three dominant genera within the three traditional strata (upper, middle and lower). A substantial portion of the Study Area was not traversed or sampled, so the existing vegetation mapping occurring across the Study Area was utilised to determine vegetation type extent. The vegetation type determination for the Yandicoogina Creek area (YCR sample sites) was determined via statistical analysis and review of hierarchical clustering (Appendix L). The vegetation types were described from the following ten landforms:

- Floodplains and Drainage Areas;
- Footslopes;
- Gorges and Gullys;
- Hill crests and upper hill slopes;
- Hill slopes and undulating low hills;
- Major drainage lines;

- Medium drainage lines;
- Minor drainage lines
- Sand plains; and
- Stony plains.

Where relevant, the vegetation type mapping in the Study Area was completed to ensure consistency between this survey, the recent survey work completed within and adjacent to the Study Area (Biota, 2017; Onshore, 2016a, 2014b, 2015c) and the consolidated regional vegetation mapping completed by Onshore (2014a).

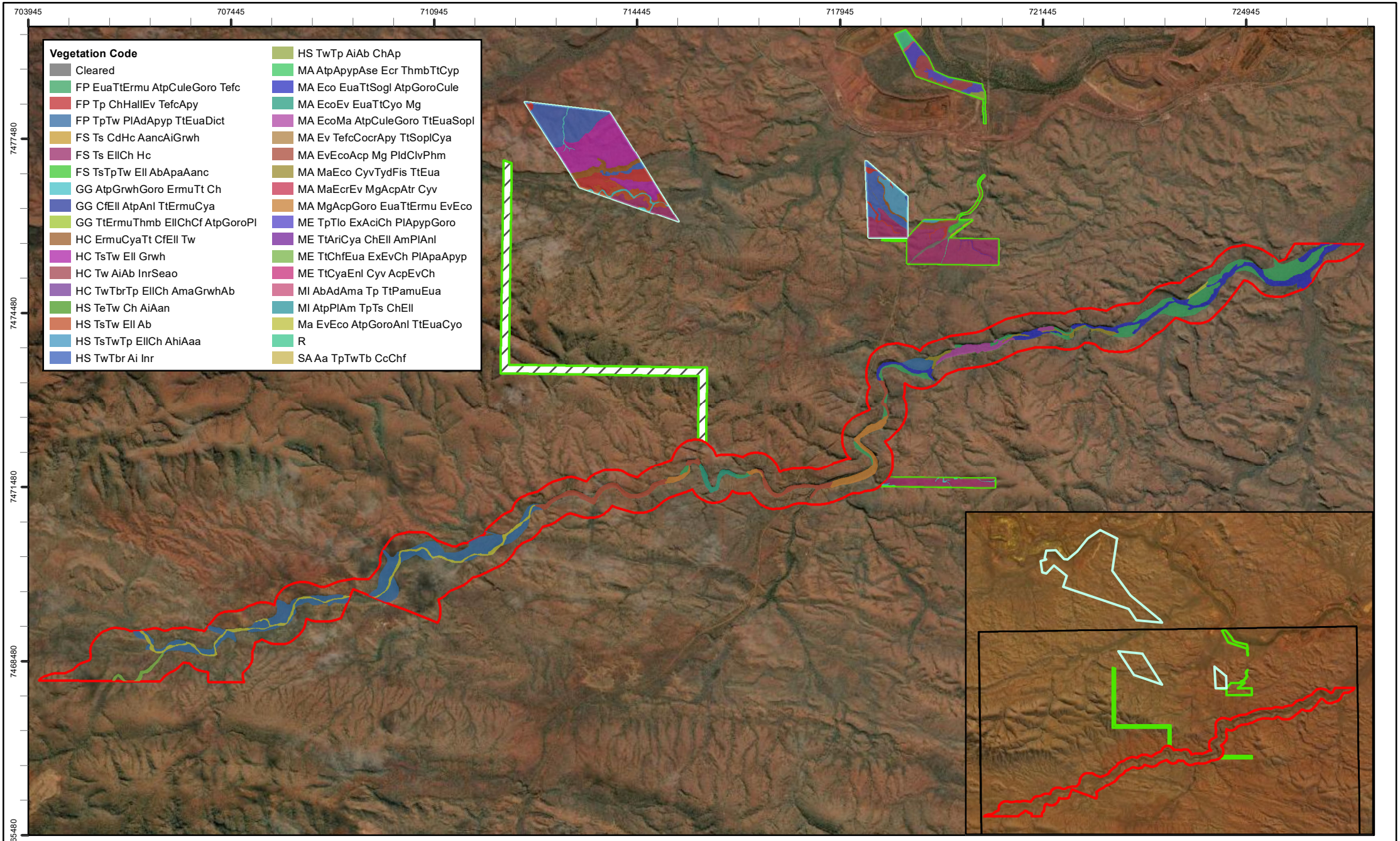
Table 4.5: Vegetation Types delineated from the Study Area

Code	Vegetation Type	Extent (ha / %)
***Acacia* high shrubland**		
MA AtpApypAse Ecr ThmbTtCyp	High Shrubland of *Acacia tumida* var. *pilbarensis, Acacia pyrifolia* var. *pyrifolia* and *Acacia sericophylla* with Scattered Trees of *Eucalyptus camaldulensis* subsp. *refulgens* over Open Tussock Grassland of *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Themeda triandra* and *Cymbopogon procerus* on brown loam and gravels on major drainage channels	23 / 1
***Acacia* low open forest**		
SA Aa TpTwTb CcChf	Low Open Forest of *Acacia aptaneura* over Open Hummock Grassland of *Triodia pungens, Triodia wiseana* and *Triodia basedowii* over Open Tussock Grassland of **Cenchrus ciliaris* and *Chrysopogon fallax* on red brown sandy loam on sandy plains and undulating low hillslopes	2 / <1
***Acacia* open scrub**		
GG AtpGrwhGoro ErmuTt Ch	Open scrub of *Acacia tumida* var. *pilbarensis, Grevillea wickhamii* subsp. *hispidula*, *Gossypium robinsonii* over very open tussock grassland of *Eriachne mucronata*, *Themeda triandra* with very open hummock grassland of *Triodia pungens* and scattered low trees of *Corymbia hamersleyana* in gorges and gullies.	8 / <1
MI AtpPlAm TpTs ChEll	Open Scrub of *Acacia tumida* var. *pilbarensis, Petalostylis labicheoides* and *Acacia monticola* over Open Hummock Grassland of *Triodia pungens* and *Triodia vanleeuwenii* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* on minor drainage lines	2 / <1
***Acacia* shrubland**		
MI AbAdAma Tp TtPamuEua	Shrubland of *Acacia bivenosa, Acacia dictyophleba* and *Acacia maitlandii* over Open Hummock Grassland of *Triodia pungens* over Open Tussock Grassland of *Themeda triandra, Paraneurachne muelleri* and *Eulalia aurea* on brown sandy loam on minor drainage lines	3 / <1
***Corymbia* low woodland**		
GG CfEll AtpAnl TtErmuCya	Low Woodland of *Corymbia ferriticola* and *Eucalyptus leucophloia* subsp. *leucophloia* over High Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Androcalva luteiflora* over Open Tussock Grassland of *Themeda triandra, Eriachne mucronata* and *Cymbopogon ambiguus* on brown silty loam in gorges and gullies	<1 / <1
***Eriachne* open tussock grassland**		
HC ErmuCyaTt CfEll Tw	Open Tussock Grassland of *Eriachne mucronata, Cymbopogon ambiguus* and *Themeda triandra* with Low Open Woodland of *Corymbia ferriticola* and *Eucalyptus leucophloia* subsp. *leucophloia* and Very Open Hummock Grassland of *Triodia wiseana* on brown sandy loam on clifflines	17 / 1
***Eucalyptus* low woodland**		
MA Ev TefcCocrApy TtSoplCya	Low Woodland of *Eucalyptus victrix* over Low Shrubland of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Corchorus crozophorifolius* and *Acacia pyrifolia* over Open Tussock Grassland of *Themeda triandra, Sorghum plumosum* and *Cymbopogon ambiguus* on brown sand on major drainage lines	4 / <1

Code	Vegetation Type	Extent (ha / %)
MA Eco EuaTtSogl AtpGoroCule	Mid open woodland (to mid woodland) of *Eucalyptus camaldulensis* subsp. *obtusa* (with occasional *Melaleuca argentea*) over high to mid open tussock grassland of *Eulalia aurea, Themeda triandra* and *Sorghum plumosum* with high sparse shrubland of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Cullen leucanthum* on red/ brown sandy clay loam on major drainage lines	62 / 3
MA EcoMa AtpCuleGoro TtEuaSopl	Mid open woodland of *Eucalyptus camaldulensis* subsp. *obtusa* and *Melaleuca argentea* over high open shrubland of *Acacia tumida* var. *pilbarensis, Cullen leucanthum* and *Gossypium robinsonii* over high to mid open tussock grassland *Themeda triandra, Eulalia aurea* and *Sorghum plumosum* on brown silty clay loam on major drainage lines	16 / 1
***Eucalyptus* mid to low open woodland**		
MA EcoEv EuaTtCyo Mg	Mid to low open woodland of *Eucalyptus camaldulensis* subsp. *obtusa* and *Eucalyptus victrix* over mid open tussock grassland of *Eulalia aurea, Themeda triandra* and *Cymbopogon obtectus* over mid sparse shrubland of *Melaleuca glomerata* on brown loamy sand on major drainage lines	9 / <1
MA EvEco AtpGoroAnl TtEuaCyo	Mid to low open woodland of *Eucalyptus victrix* and *Eucalyptus camaldulensis* subsp. *obtusa* over high sparse shrubland of *Acacia tumida* var. *pilbarensis, Gossypium robinsonii* and *Androcalva luteiflora* over mid open tussock grassland of *Themeda triandra, Eulalia aurea* and *Cymbopogon obtectus* on red sandy clay loam on major drainage lines	32 / 1
MA EvEcoAcp Mg PldClvPhm	Mid to low open woodland of *Eucalyptus victrix, Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia coriacea* subsp. *pendens* over high open shrubland of *Melaleuca glomerata* over low sparse herbland of *Pluchea dentex, Cleome viscosa* and *Phyllanthus maderaspatensis* on red/ brown clay loam on major drainage lines	38 / 2
***Eulalia* mid tussock grassland**		
FP EuaTtErmu AtpCuleGoro Tefc	Mid tussock grassland of *Eulalia aurea, Themeda Triandra* and *Eriachne mucronata* (**Cenchrus ciliaris*) with mid to high shrubland (to open shrubland) of *Acacia tumida* var. *pilbarensis, Cullen leucanthum* and *Gossypium robinsonii* over low scattered shrubs of *Tephrosia rosea* var. Fortescue Creeks (M.I.H. Brooker 2186) on red/ brown sandy clay loam on drainage area/ floodplains	86 / 4
***Melaleuca* high open forest**		
MA MaEcrEv MgAcpAtr Cyv	High Open Forest of *Melaleuca argentea, Eucalyptus camaldulensis* var. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Melaleuca glomerata, Acacia coriacea* subsp. *pendens* and *Acacia trachycarpa* over Very Open Sedges of *Cyperus vaginatus* on major drainage lines	73 / 3
***Melaleuca* high shrubland**		
MA MgAcpGoro EuaTtErmu EvEco	High shrubland (to high open shrubland) of *Melaleuca glomerata, Acacia coriacea* subsp. *pendens* and *Gossypium robinsonii* over mid open tussock grassland of *Eulalia aurea, Themeda triandra* and *Eriachne mucronata* with mid to low open woodland (to sparse woodland) of *Eucalyptus victrix* and *Eucalyptus camaldulensis* subsp. *obtusa* on brown clayey loam sand on major drainage lines	27 / 1
***Melaleuca* mid woodland**		
MA MaEco CyvTydFis TtEua	Mid woodland of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa* over high to low open sedgeland of *Cyperus vaginatus, Typha domingensis* and *Fimbristylis sieberiana* over mid sparse tussock grassland of *Themeda triandra* and *Eulalia aurea* on black clay loam on major drainage lines	10 / <1
***Themeda* open tussock grassland**		
ME TtAriCya ChEll AmPlAnl	Open Tussock Grassland of *Themeda triandra, Aristida inaequiglumis* and *Cymbopogon ambiguus* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia monticola*, *Petalostylis labicheoides* and *Androcalva luteiflora* on medium drainage lines	1 / <1,

Code	Vegetation Type	Extent (ha / %)
ME TtCyaEnl Cyv AcpEvCh	Open Tussock Grassland of *Themeda triandra, Cymbopogon ambiguus* and *Enneapogon lindleyanus* with Open Sedges of *Cyperus vaginatus* with Low Open Woodland of *Acacia coriacea* subsp. *pendens, Eucalyptus victrix* and *Corymbia hamersleyana* on brown silty loam on medium drainage lines	13 / 1
***Themeda* tussock grassland**		
GG TtErmuThmb EllChCf AtpGoroPl	Tussock Grassland of *Themeda triandra, Eriachne mucronata* and *Themeda* sp. Mt Barricade with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* and *Corymbia ferriticola* over High Shrubland of *Acacia tumida* var. *pilbarensis, Gossypium robinsonii* and *Petalostylis labicheoides* on gorges and gullies	2 / <1
ME TtChfEua ExEvCh PlApaApyp	Tussock grassland of *Themeda triandra, Chrysopogon fallax* and *Eulalia aurea* with low open woodland of *Eucalyptus xerothermica, Eucalyptus victrix* and *Corymbia hamersleyana* over shrubland of *Petalostylis labicheoides, Acacia pachyacra* and *Acacia pyrifolia* var. *pyrifolia* on red/brown sandy loam on medium drainage lines	5 / <1
***Triodia* hummock grassland**		
FP Tp ChHallEv TefcApy	Open Hummock Grassland of *Triodia pungens* with Low Open Woodland of *Corymbia hamersleyana, Hakea lorea* subsp. *lorea* and *Eucalyptus victrix* over Low Open Shrubland of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) and *Acacia pyrifolia* on brown sandy loam on floodplains and drainage lines	43 / 2
FS Ts CdHc AancAiGrwh	Hummock Grassland of *Triodia vanleeuwenii* with Low Open Woodland of *Corymbia deserticola* subsp. *deserticola* and *Hakea chordophylla* over Open Shrubland of *Acacia ancistrocarpa, Acacia inaequilatera* and *Grevillea wickhamii* subsp. *hispidula* on footslopes	1 / <1
FS TsTpTw Ell AbApaAanc	Hummock Grassland of *Triodia vanleeuwenii, Triodia pungens* and *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and Open Shrubland of *Acacia bivenosa, Acacia pachyacra* and *Acacia ancistrocarpa* on footslopes	62 / 3
HC TsTw Ell Grwh	Hummock Grassland of *Triodia vanleeuwenii* and *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and High Open Shrubland of *Grevillea wickhamii* subsp. *hispidula* on brown sandy loam on hillcrests and upper slopes	91 / 4
HC Tw AiAb InrSeao	Hummock Grassland of *Triodia wiseana* with High Open Shrubland of *Acacia inaequilatera* and *Acacia bivenosa* over Low Open Shrubland of *Indigofera rugosa* and *Senna artemisioides* subsp. *oligophylla* on red silty loam on dolerite hill crests and upper slopes	681 / 30
HC TwTbrTp EllCh AmaGrwhAb	Hummock Grassland of *Triodia wiseana, Triodia brizoides* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over High Open Shrubland of *Acacia maitlandii, Grevillea wickhamii* subsp. *hispidula* and *Acacia bivenosa* on upper hillslopes and hillcrests	28 / 1
HS TeTw Ch AiAan	Hummock Grassland of *Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* on red brown sandy loam on granite and quartz hill slopes and footslopes	<1 / <1
HS TsTwTp EllCh AhiAaa	Hummock Grassland of *Triodia vanleeuwenii, Triodia wiseana* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over Low Open Shrubland of *Acacia hilliana* and *Acacia adoxa* var. *adoxa* on hillslopes and undulating hills	210 / 9
HS TwTbr Ai Inr	Hummock Grassland of *Triodia wiseana* and *Triodia brizoides* with High Open Shrubland of *Acacia inaequilatera* and Low Open Shrubland of *Indigofera rugosa* on brown sandy loam on dolerite hillslopes	135 / 6

Code	Vegetation Type	Extent (ha / %)
HS TwTp AiAb ChAp	Hummock Grassland of *Triodia wiseana* and *Triodia pungens* with High Open Shrubland of *Acacia inaequilatera* and *Acacia bivenosa* (wispy form) and Scattered Low Trees of *Corymbia hamersleyana* and *Acacia pruinocarpa* on hillslopes with brown sandy loam	2 / <1
ME TpTlo ExAciCh PlApypGoro	Hummock Grassland of *Triodia pungens* and *Triodia longiceps* with Low Woodland of *Eucalyptus xerothermica, Acacia citrinoviridis* and *Corymbia hamersleyana* over High Shrubland of *Petalostylis labicheoides, Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* on medium drainage lines	43 / 2
***Triodia* mid hummock grassland**		
FP TpTw PlAdApyp TtEuaDict	Mid hummock grassland of *Triodia pungens* (*Triodia wiseana*) with high to mid open shrubland of *Petalostylis labicheoides, Acacia dictyophleba* and *Acacia pyrifolia* var. *pyrifolia* over low sparse tussock grassland of *Themeda triandra, Eulalia aurea* and *Digitaria ctenantha* on red/ brown sandy clay loam on drainage area/ floodplains	125 / 5
***Triodia* open hummock grassland**		
FS Ts EllCh Hc	Open hummock grassland of *Triodia vanleeuwenii* with low open woodland of *Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana* over scattered tall shrubs of *Hakea chordophylla* over low open shrubland of *Acacia hilliana* on footslopes	131 / 6
HS TsTw Ell Ab	Open hummock grassland of *Triodia vanleeuwenii, Triodia wiseana* with low open woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over open shrubland of *Acacia bivenosa* on dark reddish brown sandy clay loam on lower hill slopes.	16 / 1
Other mapping units		
R	Rehabilitated vegetation	39 / 2
Cl	Cleared	264 / 11



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Not Mapped

biologic Environmental Survey

N

1:82,000

0 0.75 1.5 3 km

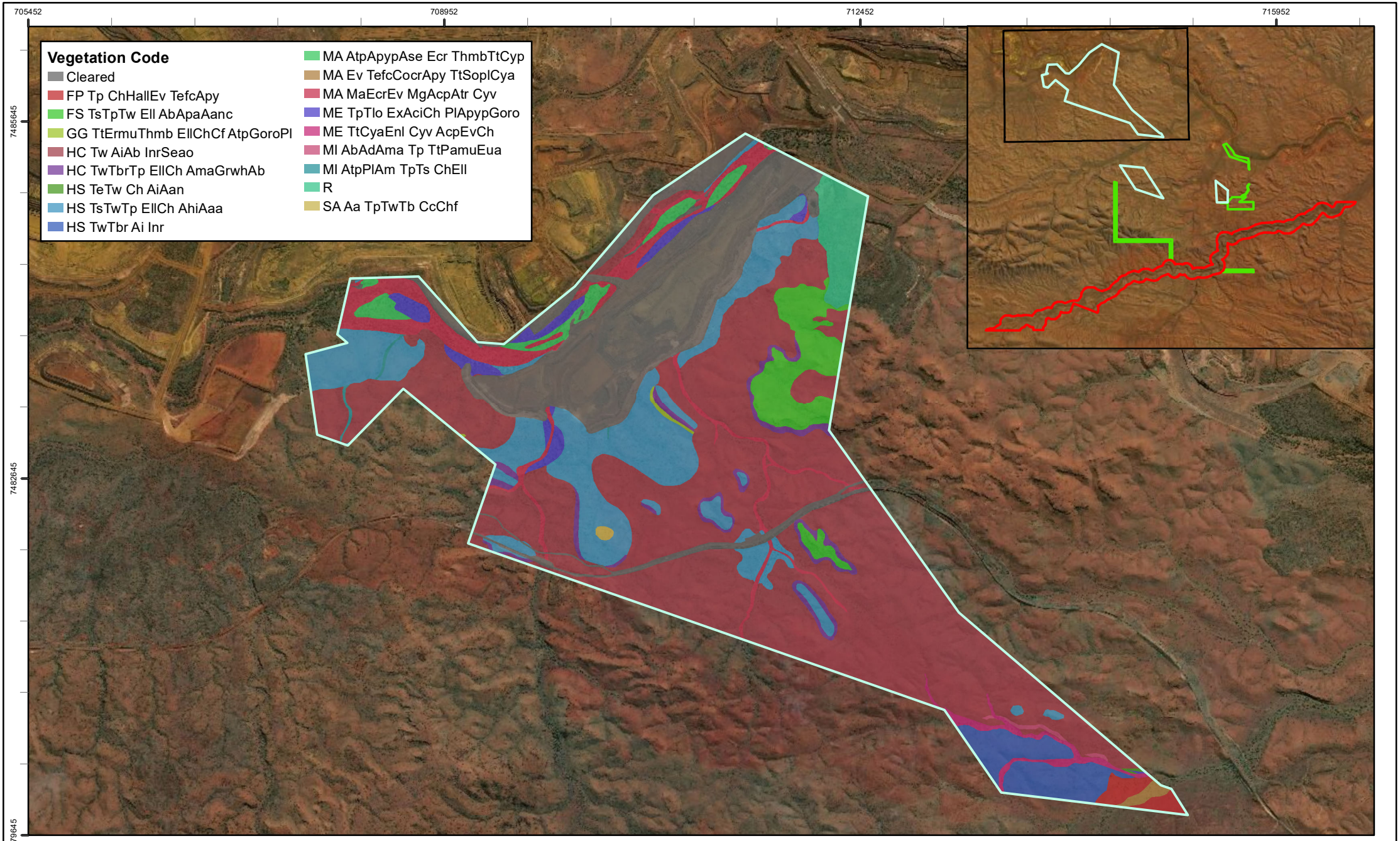
BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.4a: Vegetation type mapping in the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Not Mapped

biologic Environmental Survey

N

1:40,000

0 0.45 0.9 1.8 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.4b: Vegetation type mapping in the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

4.8 Vegetation of Conservation Significance

4.8.1 Federal and State listing

The desktop assessment (Section 4.2.2) did not identify any known TECs or PECs as potentially occurring within the Study Area. The vegetation associations described and delineated from the Study Area are not considered to be analogous with any TECs known to occur in the Pilbara bioregion.

The vegetation and floristic assemblage present within Yandicoogina Gorge have affinities with the Priority 2 Ecological Community: Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara (hereafter referred to as the Pilbara Pools PEC). Three vegetation types mapped within Yandicoogina Gorge have affinities with the PEC, namely MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua. It must be noted that vegetation type MA Eco EuaTtSogl AtpGoroCule extends beyond Yandicoogina Gorge upstream and downstream with these extents not considered to have affinities with the PECs. The PEC potentially extends 88 ha within the Study Area.

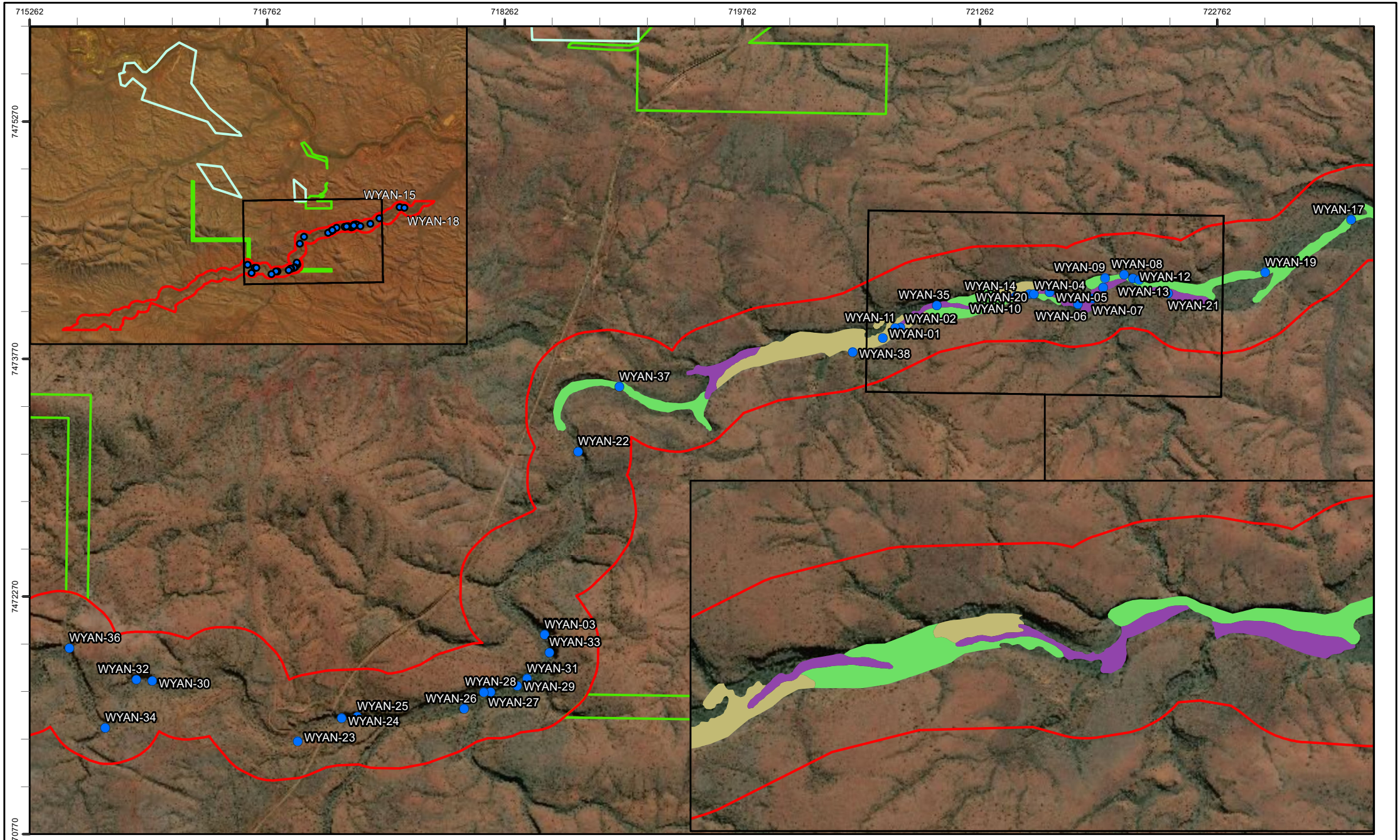
The vegetation types (and Yandicoogina Gorge) support numerous pools, with some permanent throughout the year, while others are persistent and may only dry up following extended droughts. The flora species recorded from Yandicoogina Gorge includes species that are consistent with the PEC, including *Imperata cylindrica* and *Fimbristylis sieberiana* (P3). These species are almost exclusively restricted to riparian zones of permanent wetlands with high soil moisture maintained by groundwater flows.

Yandicoogina Gorge is deeply incised with a consistently high canopy cover from obligate and facultative phreatophytes, including *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa*. Additional hydrophytic/ mesophytic flora species, consistent with persistently high soil moisture, were recorded within Yandicoogina Gorge, including:

- *Acacia coriacea* subsp. *pendens*;
- *Ammannia baccifera;*
- *Cyperus vaginatus;*
- *Eleocharis geniculata;*
- *Drosera finlaysoniana;*
- *Elytrophorus spicatus;*
- *Eucalyptus victrix;*
- *Fimbristylis microcarya*;
- *Fimbristylis sieberiana*;
- *Gymnanthera cunninghamii;*
- *Imperata cylindrica;*
- *Lipocarpha microcephala;*
- *Lobelia arnhemiaca;*
- *Marsilea hirsuta;*
- *Melaleuca bracteata;*
- *Phyllanthus baccatus;*
- *Plumbago zeylanica;*
- *Schoenoplectus subulatus;*
- *Sorghum plumosum*; and
- *Typha domingensis*.

4.8.2 Vegetation of other significance

The vegetation types do not represent any known TECs, while three of the vegetation types are of local to subregional significance due to the presence of the Pilbara Pools PEC. Broadly the vegetation types occur throughout the Hamersley subregion, while the vegetation present within Yandicoogina Gorge is locally restricted.



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Pilbara Pools PEC

- MA Eco EuaTtSogl AtpGoroCule
- MA EcoMa AtpCuleGoro TtEuaSopl
- MA MaEco CyvTydFis TtEua

- Water Features

biologic Environmental Survey

N

1:30,000

0 0.35 0.7 1.4 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.5: Pilbara Pools PEC mapping and water features

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

The nearest known record of the Pilbara Pools PEC is located approximately 55 km to the northwest within Munjina Gorge, while further occurrences are known from Palm Springs on Caves Creek (225 km west), on Mindy Mindy Creek (30 km southeast) and within Karijini National Park (Hamersley Gorge, Wittenoom Gorge, Dales Gorge and Kalamina Gorge).

In addition to the presence of the Pilbara Pools PEC, 12 other vegetation types recorded from the Study Area support priority flora taxa, including Priority 2, Priority 3 and Priority 4 species (Table 4.6). The vegetation types that support Priority 2 species are of more importance than the vegetation types that support Priority 4 species, however the significance of these vegetation types has not been determined. Further information is presented in Section 5.2.

Table 4.6: Locally significant vegetation associations recorded from the Study Area

Code	Extent (ha / %)	Comment
FP EuaTtErmu AtpCuleGoro Tefc	86/ 4	Supports populations of Priority 3 *Fimbristylis sieberiana*. Although these records occur along the ecotone with vegetation type MA MaEco CyvTydFis TtEua
MA MaEco CyvTydFis TtEua	10 / <1	Supports substantial numbers of *Fimbristylis sieberiana* (P3), as well as the Priority 3 *Gymnanthera cunninghamii*.
FP TpTw PlAdApyp TtEuaDict	125 / 5	Supports substantial portions of *Aristida lazaridis* (P2) within the upper reaches of Yandicoogina Creek.
MA Eco EuaTtSogl AtpGoroCule	62 / 3	Supports minor populations of *Fimbristylis sieberiana* (P3) within Yandicoogina Gorge
MA EcoEv EuaTtCyo Mg	9 / <1	Supports two occurrences of *Gymnanthera cunninghamii* (P3)
MA EcoMa AtpCuleGoro TtEuaSpol	16 / 1	Supports large occurrences of *Fimbristylis sieberiana* (P3), *Gymnanthera cunninghamii* and the relictual mesophytic taxon *Imperata cylindrica*
MA EvEco AtpGoroAnl TtEuaCyo	32 / 1	Supports minor occurrences of *Aristida lazaridis* (P2) in the upper reaches of Yandicoogina Creek
MA EvEcoAcp Mg PldClvPhm	38 / 2	Supports a minor occurrence of *Gymnanthera cunninghamii* (P3), but occurs at the ecotone with MA EcoEv EuaTtCyo Mg, which supports additional occurrences of *Gymnanthera cunninghamii*.
MA MgAcpGoro EuaTtErmu EvEco	27 / 1	Supports a small occurrence of *Aristida lazaridis* (P2)
FS Ts EllCh Hc	131 / 6	Supports a small occurrence of *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3). Located on the south facing breakaway slope in the Ministers North area
ME TpTlo ExAciCh PlApypGoro	43 / 2	Supports a large occurrence of the Priority 4 taxon *Goodenia nuda*, while one additional occurrence occurs within the adjacent MI AbAdAma Tp TtPamuEua vegetation type.
MA MaEcrEv MgAcpAtr Cyv	73 / 3	Supports a small occurrence of *Rostellularia adscendens* var. *latifolia* (P3)

4.9 Groundwater Vegetation and Features

4.9.1 Groundwater dependent ecosystems/ vegetation

The Study Area incorporates Yandicoogina Creek, which is a major drainage line that flows into Marillana Creek and further into the regionally significant Weeli Wolli Creek, but downstream of Weeli Wolli Spring. Yandicoogina Creek is an ephemeral creek that flows during substantial rainfall events associated with cyclonic activity or large summer storms. The upper reaches of Yandicoogina Creek comprise a relatively broad, un-defined channel, however, in the mid to lower reaches, the creek flows through a gorge system (located within the Ministers North tenement) and becomes well defined. Within this gorge section, groundwater seems to move closer to the natural surface with the occasional surface expression (most notably at water feature WYAN-07) resulting in a series of permanent to semi-permanent pools.

The presence of groundwater at or just below the surface is further emphasised by the presence of obligate phreatophytic flora, most notably, large mature *Melaleuca argentea* trees (in excess of 15 to 20 m in height). Large mature *Eucalyptus camaldulensis* subsp. *obtusa* (facultative phreatophyte) trees were also present throughout Yandicoogina Gorge. Furthermore, the understorey consisted of flora species that are commonly referred to as hydrophytic or mesophytic. These species, as well as *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa,* included:

- *Imperata cylindrica*;
- *Acacia ampliceps*;
- *Cullen leucanthum*;
- *Melaleuca bracteata*;
- *Gymnanthera cunninghamii*;
- *Plumbago zeylanica*;
- *Cyperus vaginatus*;
- *Typha domingensis*;
- *Fimbristylis sieberiana*;
- *Schoenoplectus subulatus*;
- *Eleocharis geniculata*;
- *Ammannia baccifera*; and
- Submerged macrophytes, including *Myriophyllum* spp., *Chara* spp., *Potamogeton* spp. and *Vallisneria* spp.

A substantial amount of literature and knowledge on groundwater and environmental water requirements is known for *Melaleuca argentea* (Graham *et al.*, 2003; lamontagne *et al.*, 2005; Landman *et al.*, 2003; McLean, 2014; O'Grady *et al.*, 2006) and *Eucalyptus camaldulensis* subsp. *obtusa* (Collof, 2014; Davies, 1953; Gibson *et al.*, 1994; Heinrich, 1990; Marshall *et al.*, 1997; Mensforth *et al.*, 1994; Morris & Collopy, 1999), while comparatively less information is known on the groundwater use strategies of the above understorey species. However, they are generally accepted as hydrophytic/ mesophytic and occur in association with drainage lines and groundwater within close proximity to the surface.

4.9.2 Water Features

A total of 38 water features (Appendix M) have been recorded within the Study Area from numerous surveys completed by Biologic in 2019 and 2020, with all of them located within Yandicoogina Creek. The water features extend from the lower reaches (eastern end of Yandicoogina Creek area) upstream about 1 km west of the rail bridge. A high proportion (18) of the features were recorded from within Yandicoogina Gorge with many of them observed during phase one and two suggesting a level of permanence.

One of the 18 features within Yandicoogina Gorge is considered an aquatic GDE and is persistent throughout the year. The feature is a large, deep (beyond 5 m in depth) pool located up against a cliff face, and is heavily shaded from *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa* canopy (Plate 4.11). The water feature supported a dense sedge layer of *Typha domingensis, Schoenoplectus subulatus* with *Fimbristylis sieberiana* (P3) present along the margins. Submerged macrophytes (*Chara* spp., *Vallisneria nana* and *Ruppia* spp.) were also present within the pool.

Plate 4.11: Large, deep water feature located within Yandicoogina Gorge (WYAN-07)

Numerous other water features occurred within Yandicoogina Gorge, with numerous features present during phase one and phase two. The two years (2018 and 2019) prior to the survey experienced well below average rainfall (for the Newman weather station 7176; 322.2 mm compared to a two year combined total of 648.6 mm) (BoM, 2020a) which would have placed pressure on any semi-permanent or persistent ephemeral pools within Yandicoogina Creek. As several pools, including WYAN-07, were present during phase one, the permanence of these pools is considered to be high. The heavy shading from the dense canopy, as well as the gorge (Yandicoogina Gorge is orientated in an east-west direction providing consistent shade from the gorge wall) also provide ideal conditions for surface water permanence.

Intriguingly, the phase two survey did record additional water features, with some very large features downstream and upstream of Yandicoogina Gorge, but these features within Yandicoogina Gorge were not substantially larger than what was observed during phase one. Following the above average rainfall in January and February 2020 leading into phase two survey, one would expect the water features to be substantially larger than what was observed in phase one. However, this did not seem to be the case, with some features slightly smaller during phase two than phase one.

A series of large, persistent ephemeral pools were present within Yandicoogina Creek during the March 2020 field survey (Plate 4.12). These pools were absent during the 2019 dry season survey and were present following the above average rainfall during January and February 2020. Some of these pools extended for several hundred metres and generally occurred in the upper reaches of Yandicoogina Creek, especially within the mid-section of the creek as the gorge feature becomes more prominent (Figure 4.5).

Plate 4.12: Two extensive features located upstream of Yandicoogina Gorge on Yandicoogina Creek (WYAN-03 on left; WYAN-36 on right)

During the first phase, 16 semi-permanent or permanent waterbodies were recorded within the Study Area (Yandicoogina Creek), while a further 22 were recorded during the second phase. The water features ranged in size from a couple of metres in length to several features that were approximately 100 m in length (Plate 4.12). It is likely that temporary waterbodies will be present in the Study Area after substantial rainfall events, with their longevity determined by the amount, intensity, and frequency of the rainfall in the immediate region and within the catchment. The larger pools are considered to be semi-permanent (Plate 4.13), while smaller (and some larger pools) (Plate 4.14) within the Yandicoogina Gorge area of Yandicoogina Creek are considered to be permanent or only dry up during prolonged periods of drought.

Plate 4.13: Examples of additional semi-permanent to persistent ephemeral water features present outside of Yandicoogina Gorge (WYAN-37 on left and WYAN-15 on right)

Plate 4.14: Examples of additional water features present within Yandicoogina Gorge (WYAN-35 on left and WYAN-13 on right)

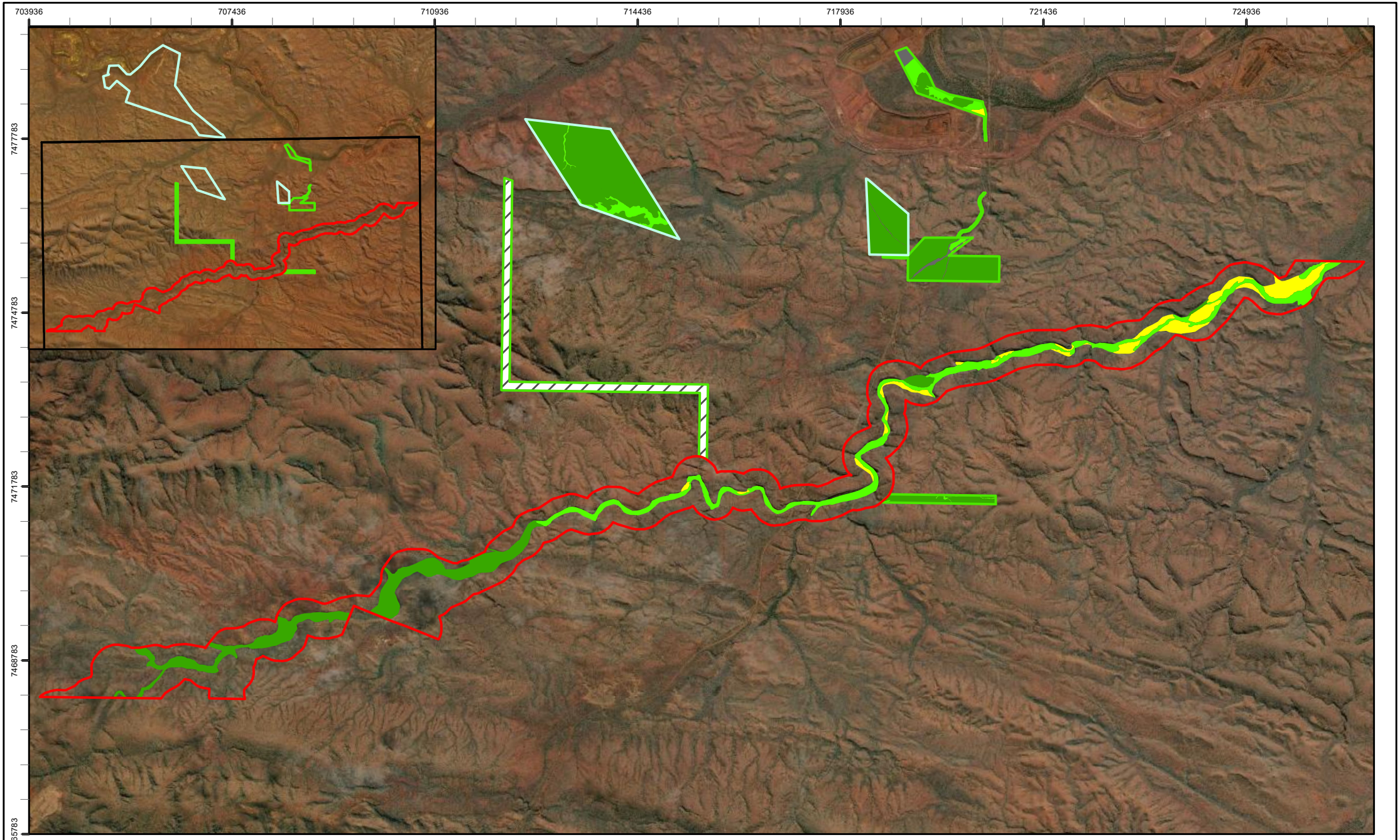
4.10 Vegetation Condition

The condition of the vegetation within the Study Area ranged from Degraded to Excellent (Table 4.7 and Figure 4.6). The main disturbances observed in the Study Area were associated with weed invasion, pastoralism, mining related clearing and fires. A portion of the Study Area occurs on an active pastoral lease with cattle grazing and trampling evident across the entire Study Area. The creeks and drainage lines were impacted heavily by pastoralism with higher densities of weeds and obvious signs of trampling and grazing from cattle. This was also evident within Yandicoogina Gorge with numerous weed species present, with many of these species transported via cattle.

Yandicoogina Creek was classified as poor to excellent in condition. The most evident disturbance was weed invasion and to a lesser extent, cattle grazing/ trampling. Substantial portions (approximately 40%) of the Study Area were rated as being in Very Good condition. These portions of the Study Area coincided with areas lower in the landscape, where cattle would visit on a regular basis. Weed presence was also more noticeable, as was the grazing and trampling pressures from cattle. The movement of weeds would also be more pronounced in the creek following flow events.

Ministers North was classified as degraded to excellent. Approximately 50% of the accessible Ministers North area had been subjected to a fire within the last 12 to 24 months, with the majority of the vegetation scorched and showing signs of recovery. Throughout this section of the Ministers North area, relevés were sampled as opposed to quadrats due to the altered structure and dominance of fire ephemerals.

The Ministers North area has also been impacted by historical and ongoing mining and exploration related works. Numerous tracks, rail corridors, power lines, mine pits and associated infrastructure occur, with some of these impacts (namely rail corridor and associated track) extending into the Yandicoogina Creek area. These impacted areas have been mapped as cleared.



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Vegetation Condition

- Excellent
- Very Good
- Good
- Poor
- Cleared
- Not Mapped

biologic Environmental Survey

N

1:82,000

0 0.75 1.5 3 km

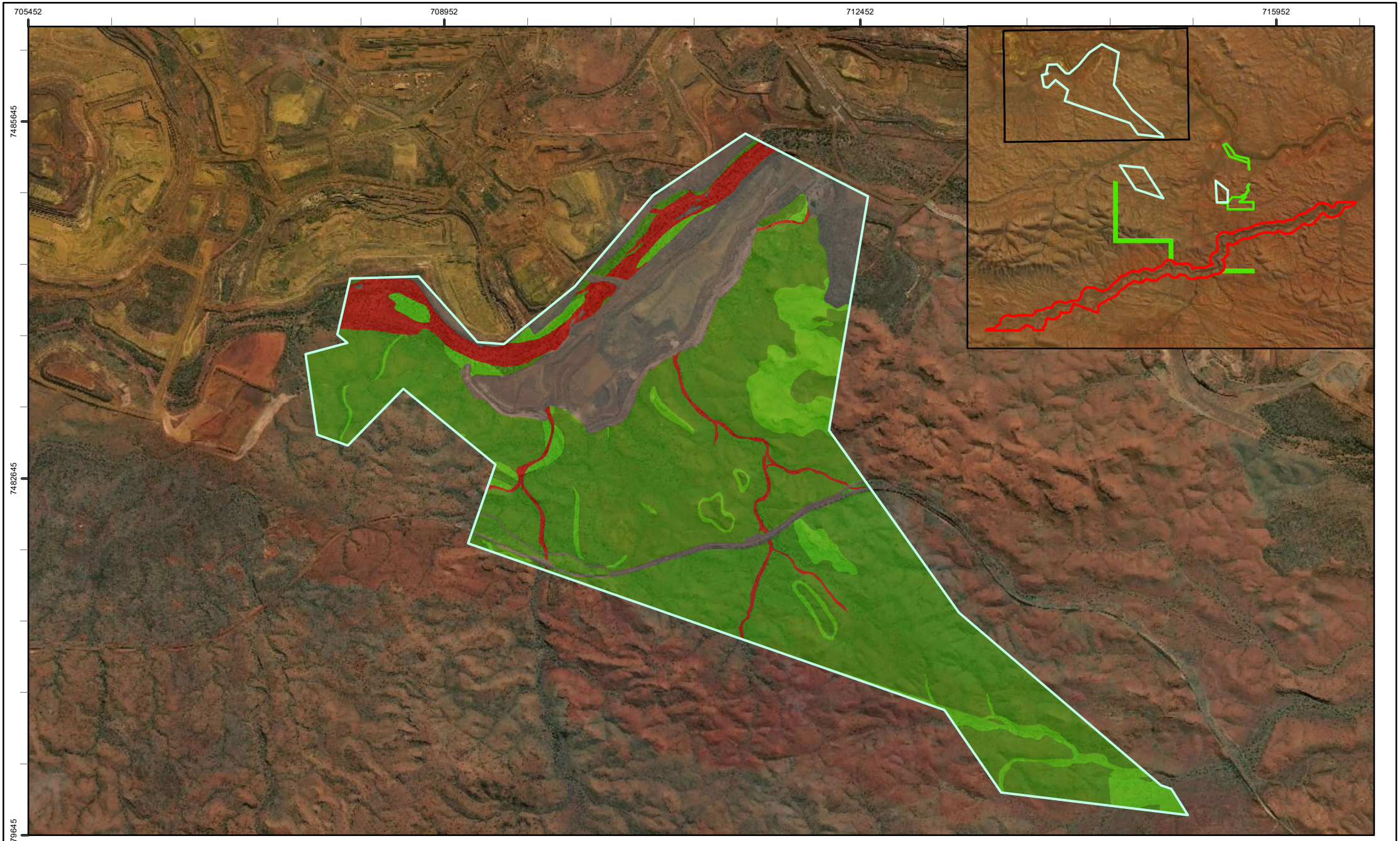
BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.6a: Vegetation condition mapping of the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020



Legend

Study Area and survey type

- Yandicoogina Creek Detailed two season
- Ministers North Detailed single season
- Ministers NorthTargeted

Vegetation Condition

- Excellent
- Very Good
- Good
- Poor
- Cleared
- Not Mapped

biologic Environmental Survey

N

1:40,000

0 0.45 0.9 1.8 km

BHP WAIO

Yandicoogina Creek - Detailed Flora and Vegetation Assessment

Figure 4.6b: Vegetation condition mapping of the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A4. Created 14/04/2020

Table 4.7: Vegetation condition extent in the Study Area

Area	Condition	Extent (ha / %)	Comment
Yandicoogina	Excellent	162 / 39	Occurred across the majority of the Study Area and showed negligible signs of disturbances. Minor cattle trampling and grazing was the most evident disturbance.
	Very Good	172 / 42	Occurred across large portions of the Study Area and coincided with areas subjected to more frequent cattle grazing and trampling. Minor weed occurrences were also evident.
	Good	76 / 18	Generally occurred in association with drainage lines and floodplains, areas subjected to recent, intense wildfires and vegetation associations with a high weed presence. Cattle grazing and trampling was more evident in some locations (i.e. drainage lines).
Ministers North	Excellent	1,301 / 69	Occurred across the stony hills and rises which supported a native structure with minimal signs of disturbance
	Very Good	196 / 10	Occurred across large portions of the area and coincided with numerous landforms and vegetation types. Signs of disturbance from weeds, cattle grazing and mining were evident but not to the detriment of the vegetation present.
	Good	3 / <1	Weeds and associated impacts were more prevalent, while clearing and mining related impacts evident.
	Poor	96 / 5	Occurred in association with drainage lines that were heavily impacted by weeds, especially invasive weeds like **Cenchrus ciliaris*.
	Cleared	297 / 16	Occurred along rail corridors, tracks and high voltage transmission lines. Also coincided with mine pits and associated infrastructure. The rehabilitated areas were also considered to be cleared for the purpose of this assessment as they were note sampled, so condition could not be ascertained.

5 DISCUSSION

The following section discusses the results of the Survey and places the significant results in a regional and local context, consistent with the requirements of EPA (2016b).

5.1 Flora

A total of 279 vascular flora taxa from 51 families and 141 genera were recorded from the Study Area during the current field survey, comprising 262 native taxa and 17 introduced taxa (Appendix J). This total includes six conservation significant flora taxa; *Aristida lazaridis* (P2), *Fimbristylis sieberiana* (P3), *Gymnanthera cunninghamii* (P3), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), and *Goodenia nuda* (P4).

The floral diversity recorded from the Study Area is not considered to be exceptionally high, however, the Ministers North area was under sampled due to access restrictions. Furthermore, the western extent of the Yandicoogina Creek area was also under sampled due to access restrictions (overgrown track with wash outs). The floral diversity would be higher if the entire Study Area was adequately sampled. This high diversity would be consistent with the varied landforms within the Study Area (i.e. major drainage lines, hillcrests, summits, gorges, gullies, floodplains, undulating hills).

5.1.1 Conservation significant flora

Aristida lazaridis (P2) was recorded from Yandicoogina Creek, with substantial occurrences in the upper reaches associated with floodplains and drainage areas. Currently, *Aristida lazaridis* is known from 21 specimens held at the Western Australian herbarium (WAH, 1998-) and 20 locations by DBCA (DBCA, 2020a). Biologic have recorded populations of *Aristida lazaridis* 25 km to the west and undisclosed occurrences approximately 35 km to the south. The majority of the known records extend from the northern portion of Karijini National Park to the southeast towards Rio Tinto's Hope Downs 4 mine site.

The records of *Aristida lazaridis* in the Study Area are not considered to be regionally significant as numerous occurrences are known within 50 km of the Study Area. The occurrences within the Study Area are locally important as the flora species is listed as a Priority 2, however they are not locally significant. This is due to the proximity of additional occurrences to the Study Area.

Fimbristylis sieberiana (P3) was recorded extensively from Yandicoogina Gorge, which is consistent with the mesophytic habitat required to support populations. The individuals were recorded from moist black clay loam adjacent to permanent and semi-permanent water features. *Fimbristylis sieberiana* is known from the Pilbara and Kimberley regions and almost exclusively occurs with springs and seeps that provide persistently wet soil as ideal habitat. Currently there are 24 specimens with WAH (1998-), while the DBCA know of 40 records (DBCA, 2020a). The majority of the records are from persistently wet sites, including Millstream, Caves Creek, gorges in Karijini National Park and Weeli Wolli Spring (DBCA, 2020a). There are also numerous records from the Kimberley region, associated with gorge and drainage line habitats (WAH, 1998-).

The records of *Fimbristylis sieberiana* in the Study Area are not regionally significant, but they do have a level of local significance as the records fill a knowledge gap between Weeli Wolli Spring and the gorges

in Karijini National Park. The records also suggest the presence of a groundwater dependent ecosystem, which are restricted in the arid Pilbara.

Gymnanthera cunninghamii is known to occur throughout the Pilbara, mainly restricted to mesophytic environments (DBCA, 2020a; WAH, 1998-). Biologic have recorded numerous individuals from major rivers and creek in the northern and central Pilbara, while 39 specimens have been vouchered with WAH (1998-). *Gymnanthera cunninghamii* generally occurs in situations with groundwater located close to the surface, or with ephemeral/ semi-permanent/ permanent surface water expression. Numerous locations of *Gymnanthera cunninghamii* have been recorded from the conservation estate (e.g. Walyarta Conservation Park and the Dampier Archipelago) (DBCA, 2020a; WAH, 1998-). A previous record has been located within Ethel Gorge.

The occurrences of *Gymnanthera cunninghamii* are not considered to be regionally or locally significant, as numerous records occur in close proximity, with known occurrences on Marillana and Weeli Wolli Creek. Although the occurrences within the Study Area are not locally significant, *Gymnanthera cunninghamii* is still listed as a Priority 3 taxon and is rare across the Pilbara.

Rostellularia adscendens var. *latifolia* (P3) occurs extensively throughout the southern Pilbara, with records from Paraburdoo/ Tom Price in the west to Newman in the east (DBCA, 2020a; WAH, 1998-). Additional records are known from Marble Bar and further to the northeast (DBCA, 2020a; WAH, 1998-). Currently WAH holds 42 specimens, while the DBCA has 41 known records, with almost all records occurring in the Pilbara.

The record within the Ministers North area is not regionally or locally significant as BHP currently holds records for numerous other occurrences across the Yandi, Ministers North and Mining Area C locality. As detailed with *Gymnanthera cunninghamii*, *Rostellularia adscendens* var. *latifolia* is still listed as a Priority 3 taxon and is rare across the Pilbara.

Sida sp. Barlee Range (S. van Leeuwen 1642) (P3) occurs extensively across the Hamersley Range with WAH currently holding 56 specimens, while the DBCA have 52 known records (DBCA, 2020a; WAH, 1998-). The records extend from the western Pilbara (Bungaroo Valley) to the eastern Pilbara (Hancock Range and beyond). The BHP internal database has numerous occurrences of *Sida* sp. Barlee Range (S. van Leeuwen 1642) within the Ministers North and Ministers North to Yandi Corridor area, with known occurrences from the Study Area.

The occurrences of *Sida* sp. Barlee Range (S. van Leeuwen 1642) are not considered to be regionally or locally significant, as numerous records occur in close proximity. Although the occurrences within the Study Area are not locally significant, *Sida* sp. Barlee Range (S. van Leeuwen 1642) is still listed as a Priority 3 taxon and is rare across the Pilbara.

Goodenia nuda (P4) occurs extensively across the Pilbara in a variety of habitats, with substantial records from the Hamersley and Fortescue subregions (DBCA, 2020a; WAH, 1998-). Numerous locations of *Goodenia nuda* have been recorded from BHP tenure in the Newman locality (Biologic, 2009, 2019; ENV, 2009a, 2012; GHD, 2011; Onshore, 2016c, 2018c). *Goodenia nuda* does not seem to be restricted locally

or regionally (a few records occur in the Little Sandy Desert and Gascoyne bioregions) (DBCA, 2020a; WAH, 1998-).

The survey did not identify any Federal or State threatened (declared rare) flora taxa listed under the EPBC Act or the BC Act.

5.1.2 Flora of other significance

Four other flora taxa recorded during the Survey are considered to be significant due to range extensions, geographically restricted, or uncommon in the Pilbara.

Imperata cylindrica was recorded from Yandicoogina Creek (Plate 5.1) within Yandicoogina Gorge. *Imperata cylindrica* more commonly occurs in the wetter Kimberley region and the records in the Pilbara are relictual occurrences from a wetter past. *Imperata cylindrica* in the Pilbara almost exclusively occurs in association with persistently wet environments associated with springs or seeps. Occurrences are known Munjina Gorge, Palm Springs, Mindy Mindy Creek, pools in Karijini National Park and Millstream.

The occurrence of *Imperata cylindrica* is currently the most easterly known occurrence in the Pilbara and furthermore, *Imperata cylindrica* is a key indicator species for the Pilbara Pools PEC. Interestingly, the occurrence of *Imperata cylindrica* was not located at a water feature, while the occurrence was slightly more upslope than the main channel of Yandicoogina Creek. This suggests that groundwater is at or immediately below the surface across the entire channel (at least in this location) and *Imperata cylindrica* potentially does not persist in high flow/ velocity environments (i.e. the main channel).

Plate 5.1: *Imperata cylindrica* occurrence from the north side of Yandicoogina Gorge. Photo taken by Biologic September 2019 and March 2020

Dodonaea viscosa subsp. *angustissima* is not currently known to occur in the Pilbara (ALA, 2020; DBCA, 2020a; WAH, 1998-), so the records in the Study Area represent a range extension of more than 170 km to the northwest. The specimen has been vouchered with the Western Australian Herbarium for further clarification and to fill the “gap” in the knowledge.

Two specimens collected during the phase two survey were identified as ?*Rotala occultiflora* due to poor material available at the time of the survey. Currently *Rotala occultiflora* is only known from one record in the Pilbara (near Brockman mine site), with the majority of the records from the Kimberley (ALA, 2020; DBCA, 2020a; WAH, 1998-). The specimen collected from Yandicoogina Creek was poor so the

identification is only tentative and has been submitted with WAH for further identification and to potentially fill a gap in the current known distribution.

Triodia biflora occurs patchily through the central Hamersley Range in gorges, below cliffs or on ironstone ridges near mountain summits. Although not formally listed as a Priority species, Barrett et al. (2017) recommend a Priority 3 ranking is required due to the patchy distribution, with numerous occurrences under immediate threat from mining. *Triodia biflora* was recorded several times within Yandicoogina Creek. Generally, individuals occurred at the base of gorges, rockpiles, and breakaways.

5.2 Vegetation

The survey did not identify any vegetation units that are consistent with ecological communities listed as threatened under the EPBC Act or the BC Act. Three vegetation types (MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua) described and mapped within Yandicoogina Gorge (section of Yandicoogina Creek) are considered to have affinities with the Pilbara Pools PEC. The presence of phreatophytic flora, permanent to semi-permanent pools as well as several of the key relictual/ indicator understorey species suggests that portions of Yandicoogina Gorge represent the PEC.

The Pilbara Pools PEC is listed as a Priority 2 Ecological Community and includes flora with restricted distributions or populations that are highly disjunct. The key species that have restricted distributions or are highly disjunct that were recorded from Yandicoogina Gorge are *Imperata cylindrica*, and *Fimbristylis sieberiana* (P3). These two taxa are almost exclusively confined to riparian zones of permanent wetlands with high soil moisture.

Fimbristylis sieberiana occurred throughout Yandicoogina Gorge, with higher occurrences from braided channels that supported high soil moisture and occasional surface water expression. *Imperata cylindrica* was recorded from the northern side of Yandicoogina Gorge towards the western end. The occurrence was slightly upslope, away from any high flow events. In addition to *Imperata cylindrica* and *Fimbristylis sieberiana*, numerous other mesophytic/ hydrophytic taxa were recorded, with many of these species restricted to riparian zones with high soil moisture. These taxa include *Eleocharis geniculata, Melaleuca argentea, Eucalyptus camaldulensis* subsp. *obtusa, Cyperus vaginatus* and *Lobelia arnhemica*.

Within the Yandicoogina Gorge area, 18 water features were observed during both phases of the survey. The phase one survey occurred in September 2019 following two dry years, while the phase two survey occurred following above average rainfall for January and February 2020. Intriguingly, the size and extent of the water features within Yandicoogina Gorge did not markedly alter over the two phases, suggesting a consistent permanency of the features. Several of the water features may also represent aquatic GDEs, most notable water feature WYAN-07, which is a large, deep permanent pool that would rely on groundwater to maintain surface expression, while also being regularly “topped up” by inflow from flood events. These inflow events are not considered to be the key source of surface water, as the above average rainfall leading into phase two did not drastically alter the water levels. This suggests that surface water flows through the area quickly, or infiltrates to the sub-surface layer and continues downstream, expressing in several locations.

Apart from vegetation types MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua, the remainder of the vegetation types recorded from the Study Area were not considered to be regionally or locally significant, as they are well represented from a regional context across the Pilbara bioregion, especially the vegetation types from the Ministers North area. The vegetation types mapped from Yandicoogina Creek are likely represented within major drainage lines located close to the Study Area, including Marillana Creek, Weeli Wolli Creek and Mindy Mindy Creek.

The vegetation system associations (18 and 82), as mapped by Beard (1975b), are considered to have a moderate and a low priority reservation status, respectively, for the Hamersley subregion (Kendrick, 2001). This suggests low regional significance, however, the vegetation system associations are broad and probably do not reflect the complexity within the Study Area, which is mostly located within a stretch of approximately 3.5 km along Yandicoogina Creek (Yandicoogina Gorge, Figure 4.4).

Of the 35 vegetation types mapped within the Study Area, 12 vegetation types recorded from the Study Area are considered to be of “other” significance as they support priority flora taxa, including Priority 2, Priority 3 and Priority 4 species (Table 4.6). Of the 12 vegetation types that are of other significance, the types (MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua) that occur within Yandicoogina Gorge, support Priority listed flora and have affinities with the Pilbara Pools PEC and are of substantial importance compared to vegetation type ME TpTlo ExAciCh PlApypGoro which supports a population of the Priority 4 species *Goodenia nuda*.

Vegetation types supporting occurrences of *Rostellularia adscendens* var. *latifolia, Sida* sp. Barlee Range (S. van Leeuwen 1642) and *Goodenia nuda* are not regionally or locally significant as numerous occurrences of these taxa extend across BHP tenure. The BHP internal database occurrences extend across numerous vegetation types and have been recorded from Yandi, Ministers North, Mining Area C and South Flank operations/ exploration projects.

Vegetation type FP TpTw PlAdApyp TtEuaDict supported substantial occurrences of the Priority 2 species *Aristida lazaridis*. The vegetation type is locally important as it supports the substantial occurrences, however *Aristida lazaridis* has been recorded from nearby and does not seem to be restricted to this particular vegetation type (or any variations).

Yandicoogina Creek and Marillana Creek support groundwater dependent vegetation indicated by the presence of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa*. Marillana Creek is currently impacted by mining operations at Yandi, while impacts to Yandicoogina Creek and more specifically Yandicoogina Gorge, are currently unknown. However, the upper canopy of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa* did not show any decline, suggesting that groundwater impacts are non-existent or currently negligible. Marillana Creek was not sampled during the current survey due to access issues, but Yandicoogina Creek and Yandicoogina Gorge was subjected to a two season detailed survey.

Yandicoogina Gorge supported mature stands of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa* with no obvious signs of canopy decline. The presence of these phreatophytes, and more specifically, the obligate phreatophyte *Melaleuca argentea*, suggests groundwater is persistently at or just

below the surface. This is further supported with the presence of numerous water features, with some permanent and potentially representing aquatic GDEs (water feature WYAN-07). Other potential flora species which indicate a high soil moisture availability/ persistence included:

- *Acacia coriacea* subsp. *pendens;*
- *Acacia ampliceps;*
- *Cullen leucanthum;*
- *Ammannia baccifera;*
- Extensive stands of *Cyperus vaginatus*;
- *Fimbristylis sieberiana* (P3);
- *Gymnanthera cunninghamii* (P3);
- *Imperata cylindrica;*
- Extensive stands of *Typha domingensis*;
- *Eleocharis geniculata;*
- *Lobelia arnhemica;*
- *Rotala occultiflora;*
- *Melaleuca glomerata;*
- *Schoenoplectus subulatus;* and
- *Plumbago zeylanica*.

5.3 Survey Limitations

Substantial portions of the Ministers North area and the south-western extent of the Yandicoogina Creek area was not access due to restrictions resulting from overgrown tracks, wash outs, vehicle limitations and withdrawal of access from third party tenure holders. Approximately half of the Ministers North area occurred on third party tenure that restricted access during the phase two (March and April 2020) survey. Furthermore, approximately 50% of the remaining Ministers North area that was accessible had been impacted by a fire within 12 months of the field survey. Essentially this resulted in the Ministers North area being under sampled. The mapping of vegetation types and condition relied on the existing mapping occurring of the Study Area. For the most part, this extrapolated mapping was sufficient, however the northern portions of the Ministers North area relied on the regional consolidated vegetation mapping which is broad and may not reflect the actual on-ground vegetation types.

The western and southern targeted survey extents within the Ministers North area were not visited, while only the southern extent was mapped. The eastern extent was not mapped due to the difficulty in accessing and the potential complexities in vegetation as it occurs across some extensive summits and deep gorges and gullies. The two central portions of the Ministers North area that required the single season sampling were mapped using extrapolation techniques. The existing mapping for Ministers North and the Ministers North to Yandi Corridor provided recent, detailed vegetation types to extrapolate with, resulting in a moderate confidence.

The south-western portion of the Yandicoogina Creek area was only partially visited during phase one. Attempts were made during phase two, however, the track was overgrown with wash outs, resulting in the survey team pulling out of this area. The vegetation type and condition mapping was undertaken with a moderate confidence due to the limited sampling.

6 CONCLUSION

A two-season Detailed flora and vegetation survey of Yandicoogina Creek and a single season Detailed flora and vegetation survey and targeted flora and vegetation survey of the Ministers North area were completed. A total of 34 quadrats and six relevés were sampled in the Study Area, with the floristic data used to determine the vegetation associations and their condition. The survey recorded:

- A total of 279 vascular flora taxa from 51 families and 141 genera were recorded from the Study Area during the current field survey, comprising 262 native taxa and 17 introduced taxa
- Six priority listed taxa;
    - *Aristida lazaridis* (P2)
    - *Fimbristylis sieberiana* (P3)
    - *Gymnanthera cunninghamii* (P3)
    - *Rostellularia adscendens* var. *latifolia* (P3)
    - *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3)
    - *Goodenia nuda* (P4)
- No WoNS or DPP were recorded from the Study Area;
- 35 vegetation types from 18 broad floristic formations were described and delineated from the Study Area;
- No TECs were recorded from the Study Area;
- Three vegetation types; MA Eco EuaTtSogl AtpGoroCule, MA EcoMa AtpCuleGoro TtEuaSopl and MA MaEco CyvTydFis TtEua; have affinities with the Pilbara Pools PEC. The Pilbara Pools PEC occurs within the Yandicoogina Gorge area;
- Terrestrial and aquatic GDEs, represented by obligate phreatophytes, hydrophytic/ mesophytic understorey and permanent pools occur within Yandicoogina Gorge;
- 38 water features occur across the Study Area, with 18 confined to the 3.5 km stretch of Yandicoogina Creek (Yandicoogina Gorge) (Figure 4.5);
- The vegetation condition ranged from poor to excellent, with the majority considered to be excellent or very good; and
- The dominant disturbing activities were weed invasion and cattle grazing/ trampling.

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8 APPENDICES

Appendix A: State and Federal Conservation Codes

International Union for Conservation of Nature

Category	Definition
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LTC	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Threatened Flora Species	
Extinct (EX)	A native species is eligible to be included in the Extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	A native species is eligible to be included in the Extinct in the Wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CR)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the Conservation Dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming Vulnerable, Endangered or Critically Endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; or (iii) the plan of management is in force under a law of the Commonwealth of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Category	Definition
Threatened Ecological Communities	
Critically Endangered	An ecological community is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	An ecological community is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered nor endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Biodiversity Conservation Act 2016

Category	Definition
Threatened Flora Species	
Critically Endangered (CR)	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". Published under schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.
Endangered (EN)	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". Published under schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.
Vulnerable (VU)	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". Published under schedule 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
Extinct in the Wild (EW)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened flora species listed as extinct in the wild.

Category	Definition
Threatened Ecological Communities	
Critically Endangered (CR)	An ecological community is eligible for listing in the category of critically endangered ecological community at a particular time if, at that time — (a) it is facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines; and (b) listing in that category is otherwise in accordance with the ministerial guidelines.
Endangered (EN)	An ecological community is eligible for listing in the category of endangered ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community; and (b) it is facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.
Vulnerable (VU)	An ecological community is eligible for listing in the category of vulnerable ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community or an endangered ecological community; and (b) it is facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.
Collapsed	An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time — (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover — (i) its species composition or structure; or (ii) its species composition and structure.

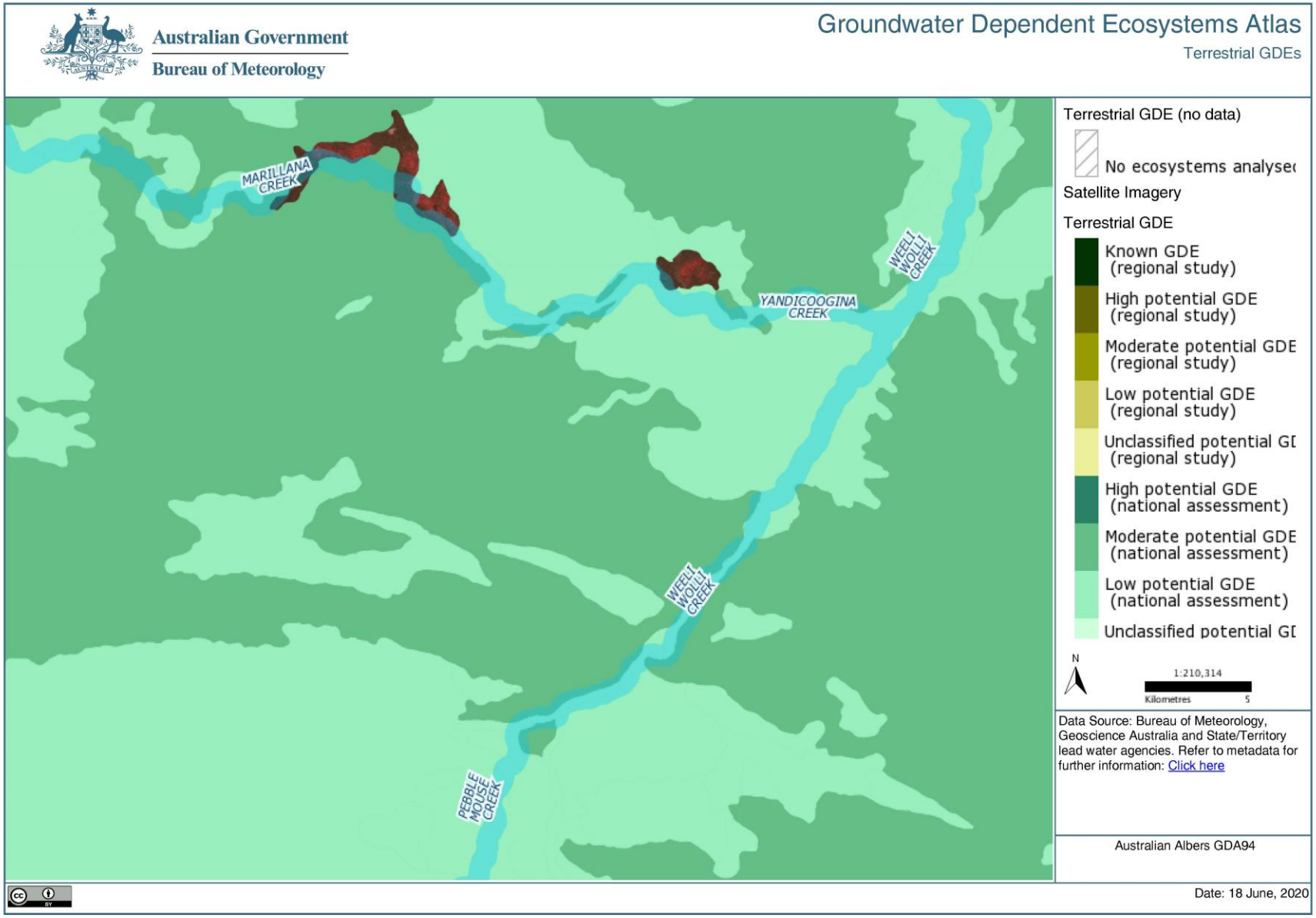
Department of Biodiversity, Conservation and Attractions Priority Definitions

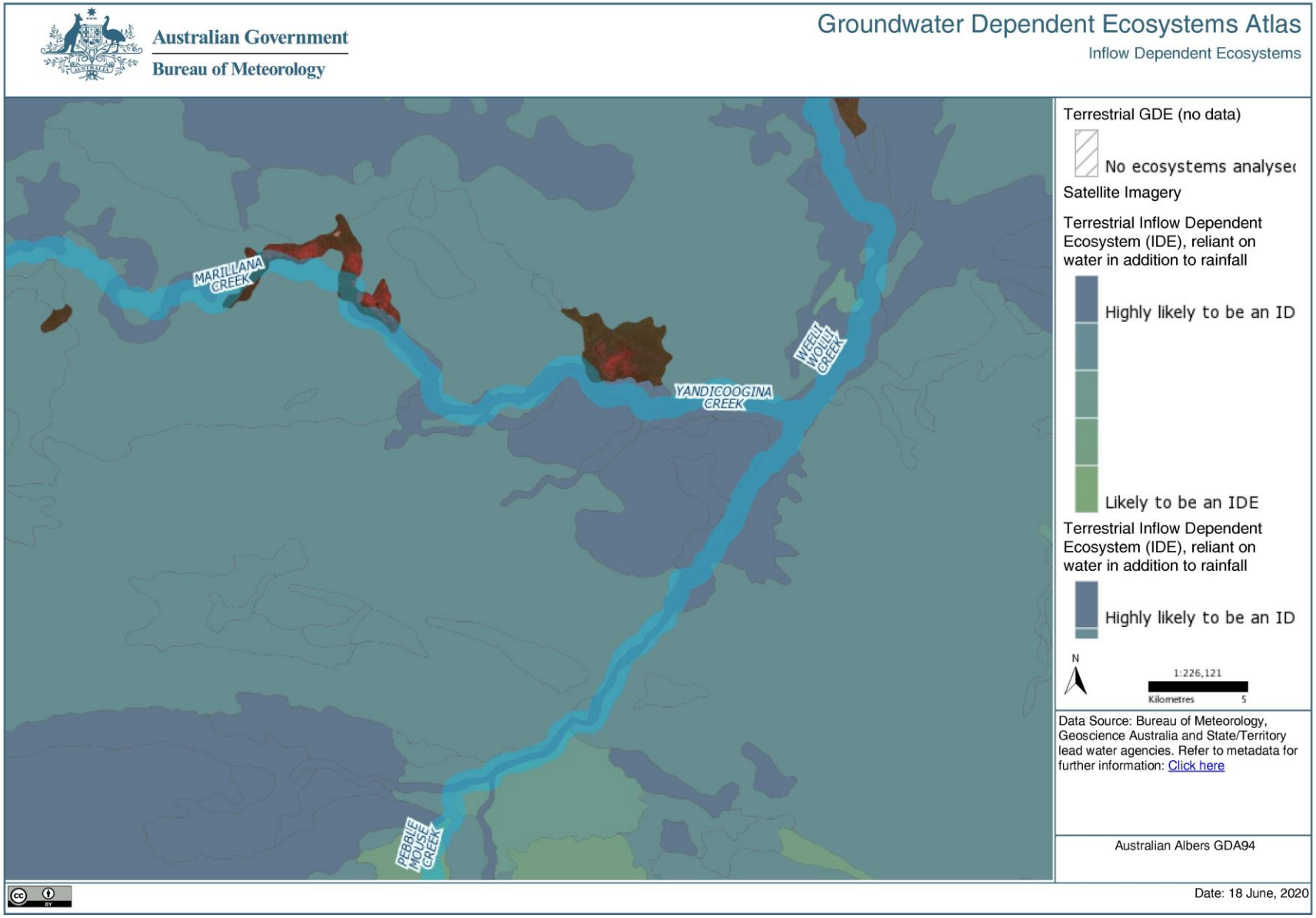
Category	Definition
Threatened Flora Species	
Priority 1 (P1)	**Poorly-known Species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral 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.
Priority 2 (P2)	**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.
Priority 3 (P3)	**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.
Priority 4 (P4)	**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.

Category	Definition
Priority Ecological Communities	
Priority 1 (P1)	**Poorly-known ecological communities** Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2 (P2)	**Poorly-known Ecological Communities** Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3 (P3)	**Poorly-known Ecological Communities** (iii) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Category	Definition
Priority 4 (P4)	**Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.** (iii) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5 (P5)	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix B: Groundwater Dependent Ecosystem Atlas output (BoM, 2020b)


Australian Government
Bureau of Meteorology
Groundwater Dependent Ecosystems Atlas
Terrestrial GDEs
MARILLANA CREEK
YANDICOOGINA CREEK
WEELI WOLLI CREEK
WEELI WOLLI CREEK
PEBBLE MOUSE CREEK
Terrestrial GDE (no data)
No ecosystems analysed
Satellite Imagery
Terrestrial GDE
Known GDE (regional study)
High potential GDE (regional study)
Moderate potential GDE (regional study)
Low potential GDE (regional study)
Unclassified potential GDE (regional study)
High potential GDE (national assessment)
Moderate potential GDE (national assessment)
Low potential GDE (national assessment)
Unclassified potential GDE
N
1:210,314
Kilometres
5
Data Source: Bureau of Meteorology, Geoscience Australia and State/Territory lead water agencies. Refer to metadata for further information: Click here
Australian Albers GDA94
Date: 18 June, 2020


Australian Government
Bureau of Meteorology
Groundwater Dependent Ecosystems Atlas
Inflow Dependent Ecosystems
MARILLANA CREEK
YANDICOOGINA CREEK
WEEJU WOULI CREEK
PEBBLE MOUSE CREEK
Terrestrial GDE (no data)
No ecosystems analysed
Satellite Imagery
Terrestrial Inflow Dependent Ecosystem (IDE), reliant on water in addition to rainfall
Highly likely to be an ID
Likely to be an IDE
Terrestrial Inflow Dependent Ecosystem (IDE), reliant on water in addition to rainfall
Highly likely to be an ID
N
1:226,121
Kilometres
5
Data Source: Bureau of Meteorology, Geoscience Australia and State/Territory lead water agencies. Refer to metadata for further information: Click here
Australian Albers GDA94
Date: 18 June, 2020

Appendix C: Sample Site Data

Yandi Creek — Site YAN-50

Date	28/03/2020
Described by	SC & EEB
Type	Q 100m x 25m
Location	MGA Zone 50 715596 mE; 7471676 mN 119.101090 E -22.848860 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	Low open *Eucalyptus victrix* woodland with occasional scattered *Eucalyptus camaldulensis* over mid sparae shrubland of *Melaleuca glomerata* over low open tussock grassland of *Eulalia aurea*, *Themeda triandra* and *Cymbopogon obtectus.*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia maitlandii	0.1		0.6		
Acacia pyrifolia var. *pyrifolia*	0.1		0.6		
Acacia tumida var. *pilbarensis*	0.1		2.2		
Achyranthes aspera	0.1		0.4		
Alternanthera nana	0.1		0.1		
Alternanthera nodiflora	0.1		0.2		
Amaranthus undulatus	0.1		0.2		
Atalaya hemiglauca	0.1		3		
Bidens bipinnata	0.1		0.2		
Bulbostylis barbata	0.1		0.1		
Centipeda minima subsp. *macrocephala*	0.1		0.1		
Cleome viscosa	0.1		0.3		
Cucumis variabilis	0.1		0.1		
Cymbopogon obtectus	1		0.6		
Cyperus iria	0.1		0.4	YAN50-02	
Digitaria brownii	0.1		0.4	YAN 50-07	
Eragrostis elongata	0.1		0.3		
Eragrostis tenellula	0.1		0.3		
Eriachne mucronata	0.1		0.3		
Eucalyptus camaldulensis subsp. *obtusa*	2		12		
Eucalyptus victrix	10		8		
Eulalia aurea	5		0.7		
Euphorbia biconvexa	0.1		0.2		
Evolvulus alsinoides var. *decumbens*	0.1		0.1		
Evolvulus alsinoides var. *villosicalyx*	0.1		0.1		
Fimbristylis microcarya	0.1		0.1	YAN50-05	
Fimbristylis microcarya	0.1		0.1	YAN50-06	
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Goodenia lamprosperma	0.1		0.2		
Heliotropium cunninghamii	0.1		0.1		
Ipomoea muelleri				YAN50-04	
Isotropis sp. Arid zone (G. Byrne 2775)	0.1		0.3		
Melaleuca glomerata	5		2.5		
Paspalidium basicladum	0.1		0.2	YAN13-01	
Paspalidium clementii	0.1		0.1	YAN50-08	
Phyllanthus maderaspatensis	1		0.4		
Pluchea dentex	0.1		0.3	YCR10-02	
Polycarpaea longiflora				YAN50-03	
Ptilotus fusiformis	0.1		0.3	YAN50-01	
Setaria verticillata	0.1		0.3		
Sonchus oleraceus	0.1		0.2		
Stemodia viscosa	0.1		0.1		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	1		0.4		

Themeda triandra	1	1
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.3
Triodia pungens	0.1	0.2
Triumfetta clementii	0.1	0.3
Waltheria indica	0.1	0.5

Yandi Creek — Site YAN-51

Date	28/03/2020
Described by	SC & EEB
Type	Q 100m x 25m
Location	MGA Zone 50 716075 mE; 7471738 mN 119.105750 E -22.848240 S
Veg Condition	Good
Soil	Loamy Sand
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus camalduensis* mid open woodland over *Melaleuca glomerata* sprase mid shrubs over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) mid sparse shrubs over low open herbland and grassland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia tumida var. *pilbarensis*	0.1		1		
Alternanthera nodiflora	0.1		0.1		
Amaranthus undulatus	0.1		0.3		
Ammannia multiflora	0.1		0.3	Eebop01	
Bergia pedicellaris	0.1		0.1		
Bidens bipinnata	0.1		0.3		
Boerhavia coccinea	0.1		0.1	YAN51-03	
Bulbostylis barbata	0.1		0.1		
Centipeda minima subsp. *macrocephala*	0.1		0.1		
Cleome viscosa	0.1		0.1		
Corchorus incanus subsp. *lithophilus*	0.1		0.5	Ycr41.10	
Crotalaria medicaginea var. *neglecta*	0.1		0.1		
Cucumis variabilis	0.1		0.1		
Cymbopogon obtectus	1		0.9		
Cyperus difformis	0.1		0.5	YAN51-08	
Cyperus iria	0.1		0.5	YAN50-02	
Digitaria brownii	0.1		0.1	Yan50-07	
Digitaria ctenantha	0.1		0.5	YAN51-04	
Drosera finlaysoniana	0.1		0.1		
Elytrophorus spicatus	0.1		0.2	YAN51-05	
Eragrostis elongata	0.1		0.5		
Eragrostis tenellula	0.1		0.4		
Eriachne mucronata	0.1		0.3		
Eriachne pulchella subsp. *dominii*	0.1		0.1		
Eucalyptus camaldulensis subsp. *obtusa*	15		10		
Eucalyptus victrix	1		9		
Eulalia aurea	1		0.6		
Euphorbia biconvexa	0.1		0.1		
Fimbristylis microcarya	0.1		0.2	YAN50-05	
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Goodenia lamprosperma	0.1		0.2		
Grevillea wickhamii subsp. *hispidula*	0.1		0.5		
Heliotropium cunninghamii	0.1		0.1		
Hybanthus aurantiacus	0.1		0.2		
Ipomoea plebeia				YAN51-02	
Isotropis sp. Arid zone (G. Byrne 2775)	0.1		0.5		
Lipocarpha microcephala	0.1		0.3	YAN51-06	
Ludwigia perennis	0.1		0.3	YAN51-10	
Marsilea hirsuta	0.1		0.1		
Melaleuca glomerata	2		2.5		
Melinis repens	0.1		0.5		
Oldenlandia galioides				YAN51-01	
Paspalidium clementii	0.1		0.1	YAN50-08	
Paspalidium clementii	0.1		0.3	YAN13-01	

Phyllanthus maderaspatensis	0.1	0.3	
Pluchea dentex	1	0.3	
Polycarpaea longiflora	0.1	0.2	YAN50-03
Ptilotus fusiformis	0.1	0.3	YAN50-01
Rotala ? occutiflora	0.1	0.1	YAN51-09
Rotala diandra	0.1	0.1	SCOPP03
Setaria verticillata	0.1	0.3	
Stemodia viscosa	0.1	0.3	
Stylobasium spathulatum	0.1	1	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	2	0.5	
Themeda triandra	0.1	0.4	
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.3	
Waltheria indica	0.1	0.3	

Yandi Creek — Site YCR-01

Date	12/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 725202 mE; 7475223 mN 119.194146 E -22.815580 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus camaldulensis* and occasional *Eucalyptus victrix* mid open woodland over *Eulalia aurea*, *Themeda triandra* and *Sorghum plumosum* mid open tussock grassland with *Cullen leucanthum*, *Gossypium robinsonii* and *Acacia tumida* high to mid sparse shrubland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon cunninghamii	0.1	0	0.2	Ycr01.07	
Abutilon macrum	0.1			Ycr01.06	
Abutilon sp. Indet	0.1				
Acacia coriacea subsp. *pendens*	0.1		6		
Acacia pyrifolia var. *pyrifolia*	0.1		0.5		
Acacia tumida var. *pilbarensis*	1		3		
Achyranthes aspera	0.1	0	0.2	Ycr01.09	
Alternanthera nana	0.1	0	0.2	Ycr01.08	
Alternanthera nodiflora	0.1		0.3		
Amaranthus undulatus	0.1		0.4		
Ammannia baccifera	0.1		0.2		
Amyema sanguinea var. *sanguinea*	0.1		0.1	Ycr01.10	
Atalaya hemiglauca	0.1		1		
Cenchrus ciliaris	0.1		0.4		
Centipeda minima subsp. *macrocephala*	0.1		0.1		
Cleome viscosa	0.1		0.3		
Cleome viscosa	0.1		0.3		
Conyza bonariensis	0.1		0.6		
Corchorus tridens	0.1		0.3		
Cucumis variabilis	0.1		0.1		
Cullen leucanthum	2		3		
Cymbopogon obtectus	0.1		0.8		
Cyperus vaginatus	0.1		0.4		
Diplachne fusca subsp. *fusca*	0.1			YCR01.04	
Eleocharis geniculata	0.1		0.1		
Enteropogon ramosus	0.1		0.4		
Eragrostis elongata	0.1		0.3		
Eragrostis tenellula	0.1		0.2		
Eucalyptus camaldulensis subsp. *obtusa*	20		12		
Eucalyptus victrix	0.1		8		
Eulalia aurea	10		0.8		
Euphorbia coghlanii	0.1		0.3		
Euphorbia coghlanii	0.1		0.3	Yan	
Euphorbia tannensis subsp. *eremophila*	0.1			Ycr01.03	
Evolvulus alsinoides var. *decumbens*	0.1		0.3		
Fimbristylis microcarya	0.1		0.3	YAN12.02	
Flaveria trinervia	0.1	0	0.4		
Gomphrena canescens subsp. *canescens*	0.1		0.2		
Goodenia lamprosperma	0.1		0.2		
Gossypium robinsonii	1		3		
Heliotropium chrysocarpum	0.1		0.1	YCR01.02	
Lepidium muelleri-ferdinandii	0.1			Ycr01.1	
Maireana sp. Indet	0.1		0.3		

Malvastrum americanum	0.1		0.5	
Marsilea hirsuta	0.1		0.1	
Melaleuca argentea	0.1		10	
Melaleuca glomerata	0.1		2.5	
Phyllanthus maderaspatensis	0.1	0	0.3	
Pluchea dentex	0.1			Ycr10.04
Portulaca oleracea	0.1		0.1	
Pseudognaphalium luteoalbum	0.1			YCR16-06
Pterocaulon sphacelatum	0.1		0.3	
Ptilotus exaltatus	0.1		0.2	
Schoenoplectus subulatus	0.1		0.6	
Setaria verticillata	0.1		0.2	
Sida fibulifera	0.1		0.2	
Solanum nigrum	0.1		0.3	
Sonchus oleraceus	0.1		0.1	
Sorghum plumosum	0.1		1.5	
Stemodia grossa	0.1		0.4	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1		0.5	
Themeda triandra	8		0.9	
Trichodesma zeylanicum var. *zeylanicum*	0.1		0.5	
Tridax procumbens	0.1		0.3	
Typha domingensis	0.1		1	
Waltheria indica	0.1		0.3	

Yandi Creek — Site YCR-02

Date	12/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 724186 mE; 7474787 mN 119.184312 E -22.819647 S
Veg Condition	Good
Soil	Sandy Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Cenchrus ciliaris* and *Themeda triandra* and *Paraneurachne muelleri* tussock grassland with isolated clumps of *Triodia pungens* hummock grasses with tall open shrubland of *Gossypium robinsonii*, *Cullen leucanthum* and *Atalaya hemiglauca.*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon sp. Indet				Ycr01.05	
Acacia coriacea subsp. *pendens*		0	2		
Acacia dictyophleba		<1 %	3		
Acacia pyrifolia var. *pyrifolia*		0	1.6		
Acacia tumida var. *pilbarensis*		0	2.5		
Acrachne racemosa	0.1		0.4	Yan02.01	
Androcalva luteiflora		0	1.5		
Aristida contorta		0	0.1		
Atalaya hemiglauca		1-5%	2.5		
Bidens bipinnata	0.1		0.3		
Boerhavia coccinea	0.1		0.2		
Bulbostylis barbata	0.1		0.1		
Cenchrus ciliaris		40			
Chrysocephalum apiculatum subsp. *pilbarense*					
Cleome viscosa		0	0.2		
Corchorus crozophorifolius	0.1		0.6		
Corchorus lasiocarpus subsp. *parvus*		0	0.3		
Cullen leucanthum		<1 %	3		
Digitaria brownii	0.1		0.7	Yan02.06	
Duperreya commixta		0			
Enneapogon caerulescens	0.1		0.2	Yan02.08	
Enneapogon lindleyanus		0	0.3		
Enneapogon polyphyllus	0.1		0.3	Yan02.02	
Eragrostis eriopoda		0	0.3		
Eremophila longifolia		0	1		
Eriachne mucronata		0	0.3		
Eucalyptus camaldulensis subsp. *obtusa*		<1 %	14		
Eulalia aurea		0	0.7		
Euphorbia australis var. *subtomentosa*	0.1		0.2		
Euphorbia tannensis subsp. *eremophila*		0	0.3		
Evolvulus alsinoides var. *decumbens*	0.1		0.2		
Evolvulus alsinoides var. *villosicalyx*	0.1		0.2		
Gomphrena canescens subsp. *canescens*	0.1		0.2		
Goodenia microptera		0	0.2		
Goodenia muelleriana	0.1		0.2	Yan02.03	
Gossypium australe		0	0.2		
Gossypium robinsonii		10-25%	2.2		
Grevillea pyramidalis subsp. *leucadendron*		0	2.8	YCR02-01	
Hakea lorea subsp. *lorea*		0	4.5		
Heliotropium cunninghamii	0.1		0.3		
Hibiscus sturtii var. *platychlamys*	0.1		0.3	Yan41	
Jasminum didymum subsp. *lineare*		0	0.2		
Melhania oblongifolia	0.1		0.3	Yan02.04	
Paraneurachne muelleri		0	0.1		

Petalostylis labicheoides		0	2.1	
Polymeria ambigua	0.1		0.2	Yan02.05
Portulaca oleracea	0.1		0.2	
Pseudognaphalium luteoalbum	0.1		0.2	
Ptilotus astrolasius		0	0.4	
Ptilotus exaltatus		0	0.1	
Ptilotus gaudichaudii	0.1		0.3	
Rhynchosia minima	0.1			
Salsola australis		0	0.3	
Santalum lanceolatum	0.1		1	
Senna artemisioides subsp. *helmsii*		0	0.5	
Senna artemisioides subsp. *oligophylla*		0	0.6	
Senna artemisioides subsp. × *artemisioides*		0	1	YCR02-02
Senna glutinosa subsp. *glutinosa*		0	1	
Senna notabilis		0	0.2	
Setaria verticillata	0.1		0.3	
Sida fibulifera		0	0.1	
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)				
Sorghum plumosum	0.1		1.8	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.4	
Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)	0.1		0.2	Yan
Themeda triandra		<1 %	0.6	
Tribulus terrestris	0.1		0.2	
Trichodesma zeylanicum var. *zeylanicum*	0.1		0.3	
Trigastrotheca molluginea	0.1		0.2	
Triodia pungens		<1 %	0.3	
Triodia wiseana		0	0.3	
Waltheria indica	0.1		0.4	

Yandi Creek — Site YCR-03

Date	12/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 724752 mE; 7475251 mN 119.189760 E -22.815386 S
Veg Condition	Very Good
Soil	Sand
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Themeda triandra*, *Cymbopogon obtectus* and *Eulalia aurea* mid tussock grassland with *Eucalyptus camaldulensis* low open woodland over *Acacia tumida* var. *pilbarensis* and *Cullen leucanthum* high sparse shrubland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. pendens		0	4		
Acacia tumida var. *pilbarensis*		<1 %	3		
Alternanthera nana		0	0.2		
Amaranthus undulatus		0	0.3		
Amaranthus undulatus		0	0.8		
Amyema sanguinea var. *sanguinea*		0			
Androcalva luteiflora		0	1.8		
Atalaya hemiglauca		0	1.5		
Cenchrus ciliaris		<1 %	0.6		
Cleome viscosa		0	0.3		
Corchorus crozophorifolius		<1 %	1.5	Ycr03.01	
Corchorus lasiocarpus subsp. *parvus*	0.1		0.7	Ycr22opp1	
Crotalaria medicaginea var. *neglecta*		0	0.3		
Cucumis variabilis	0.1		0.1		
Cullen leucanthum		<1 %	3		
Cymbopogon obtectus		>75%	1.2		
Cyperus vaginatus		0	0.6		
Eriachne mucronata					
Eucalyptus camaldulensis subsp. *obtusa*		12	10		
Eucalyptus victrix		0	8		
Eulalia aurea		33.3-50%	0.8		
Euphorbia coghlanii		0	0.2		
Gomphrena canescens subsp. *canescens*		0	0.2		
Gossypium robinsonii		0	2		
Heliotropium cunninghamii	0.1		0.3		
Indigofera monophylla				Ycr41.05	
Jasminum didymum subsp. *lineare*		0	0.8		
Melaleuca glomerata		0	2		
Melinis repens		0	0.3		
Phyllanthus maderaspatensis		0	0.3		
Polycarpaea longiflora		0	0.3		
Ptilotus rotundifolius		0	0.9		
Rhynchosia minima	0.1		0.4		
Sorghum plumosum				Ycr10.02	
Stemodia grossa		0	0.4		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.8		
Themeda triandra		>75%	1		
Trichodesma zeylanicum var. *zeylanicum*		0	0.5		
Tridax procumbens	0.1		0.1		
Tridax procumbens		0	0.2		
Triodia pungens		0	0.5		
Vigna lanceolata		0			
Waltheria indica		0	0.3		

Yandi Creek — Site YCR-04

Date	11/09/2019
Described by	CvdB & SC
Type	R
Location	MGA Zone 50 721968 mE; 7474132 mN 119.162800 E -22.825858 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Melaleuca argentea* and *Eucalyptus camaldulensis* mid open woodland over *Typha domingensis*, *Cyperus vaginatus* and *Schoenoplectus subulatus* high open sedgeland over *Eulalia aurea*, *Themeda triandra* mid sparse tussock grassland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Cyperus vaginatus					
Eucalyptus camaldulensis					
Eulalia aurea					
Melaleuca argentea					
Schoenoplectus subulatus					
Themeda triandra					
Typha domingensis					

Yandi Creek — Site YCR-05

Date	12/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 723357 mE; 7474467 mN 119.176287 E -22.822644 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus camaldulensis* and *Melalueca argentea* mid woodland over *Acacia tumida* var. *pilbarensis* and *Gossypium robinsonii* over open tussock grassland of *Eulalia aurea* and *Themeda triandra*.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon macrum	0.1		0.2	YAN05-02	
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	0.1		0.3		
Acacia coriacea subsp. *pendens*		0	4		
Acacia pyrifolia var. *pyrifolia*		0	0.5		
Acacia tumida var. *pilbarensis*		25-33.3%	2.5		
Acrachne racemosa	0.1		0.3	Yan 51	
Alternanthera nodiflora	0.1		0.1		
Amaranthus undulatus		0	0.1		
Ammannia multiflora	0.1		0.1	EBOPP1	
Androcalva luteiflora		0	1.3		
Argemone ochroleuca subsp. *ochroleuca*		0	0.1		
Atalaya hemiglauca		0	2.2		
Bergia pedicellaris	0.1		0.1		
Boerhavia coccinea	0.1		0.1	YAN50	
Cenchrus ciliaris		0	0.4		
Centipeda minima subsp. *macrocephala*	0.1		0.1		
Cleome viscosa		0	0.3		
Corchorus crozophorifolius		0	0.8		
Corchorus incanus subsp. *lithophilus*	0.1		0.4		
Crotalaria medicaginea var. *neglecta*		0	0.1		
Cullen leucanthum		1-5%	2.2		
Cymbopogon obtectus		0	0.3		
Cyperus iria	0.1		0.1		
Cyperus vaginatus		0	1		
Enneapogon lindleyanus	0.1		0.3		
Eragrostis elongata		0	0.3		
Eragrostis tenellula		0	0.2		
Eriachne mucronata		0	0.3		
Eucalyptus camaldulensis subsp. *obtusa*		25	15		
Eucalyptus victrix		1-5%	12		
Eulalia aurea		50-75%	0.8		
Euphorbia biconvexa		0	0.2		
Evolvulus alsinoides var. *villosicalyx*	0.1		0.1		
Fimbristylis microcarya	0.1		0.1	Yan50	
Flaveria trinervia		0	0.3		
Gomphrena canescens subsp. *canescens*	0.1		0.2		
Goodenia lamprosperma		0	0.1		
Gossypium robinsonii		1-5%	2.4		
Indigofera monophylla				Ycr41.05	
Melaleuca argentea		<1 %	10		
Melaleuca glomerata		0	2.5		
Petalostylis labicheoides		0	2		
Phyllanthus maderaspatensis		0	0.2		

Pluchea dentex				Ycr10.04
Ptilotus exaltatus		0	0.3	
Rhynchosia minima	0.1		0.1	
Rumex vesicarius	0.1		0.3	
Setaria verticillata		0	0.3	
Sorghum plumosum				Ycr10.02
Stemodia grossa		0	0.2	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.4	
Themeda triandra		5-10%	0.6	
Trichodesma zeylanicum var. *zeylanicum*		0	0.3	
Tridax procumbens				
Triodia pungens		0	0.1	
Vachellia farnesiana		0	0.5	
Vigna lanceolata		0	0.1	
Waltheria indica		0	0.3	

Yandi Creek — Site YCR-06

Date	12/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 722416 mE; 7474184 mN 119.167159 E - 22.825323 S
Veg Condition	Excellent
Soil	Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	*Eucalyptus camaldulensis* and *Melaleuca argentea* woodland over a tall closed *Cyperus vaginatus* and *Typha domingensis* sedgeland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*		0	1.8		
Achyranthes aspera		1-5%	3		
Atalaya hemiglauca		0	1		
Capparis spinosa subsp. *nummularia*					
Cenchrus ciliaris		0	0.5		
Clerodendrum floribundum					
Conyza bonariensis		0	0.3		
Cullen leucanthum		0	2.5		
Cymbopogon obtectus		0	1.1		
Cyperus vaginatus		60	1.2		
Duperreya commixta					
Eleocharis geniculata				SCopp01	
Eucalyptus camaldulensis subsp. *obtusa*		25	22		
Eulalia aurea		0	0.6		
Fimbristylis sieberiana		0	0.3		
Gossypium robinsonii		0	2		
Ipomoea muelleri					
Lobelia arnhemiaca				YCR16-05	
Melaleuca argentea		15	18		
Melaleuca glomerata		0	1.5		
Phyllanthus baccatus				SCOpp-09	
Pluchea dentex		0	0.3		
Setaria verticillata					
Solanum nigrum		0	0.7		
Sonchus oleraceus					
Stemodia grossa		0	0.3		
Tridax procumbens		0	0.1		
Triodia pungens					
Typha domingensis		25-33.3%	1.5		
Vachellia farnesiana		0	1		
Vincetoxicum flexuosum				YCR4204	
Wahlenbergia tumidifructa		0	0.3		

Yandi Creek — Site YCR-07

Date	11/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 721260 mE; 7474147 mN 119.155905 E - 22.825810 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus camaldulensis* (and isolated *Melaleuca argentea*) mid open woodland over *Themeda triandra*, *Eulalia aurea* and *Cymbopogn obtectus* mid open tussock grassland with *Acacia tumida*, *Gossypium robinsonii* and *Cullen leucanthum* high sparse shrubland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*		0	2.5		
Acacia monticola		0	0.4		
Acacia pyrifolia var. *pyrifolia*		0	1.5		
Acacia tumida var. *pilbarensis*		1-5%	3		
Alternanthera nodiflora					
Amaranthus undulatus		0	0.4		
Androcalva luteiflora		0	1.8		
Atalaya hemiglauca		0	3		
Bidens bipinnata					
Cenchrus ciliaris					
Chrysopogon fallax		0	0.8		
Cleome viscosa		0	0.3		
Clerodendrum floribundum var. *angustifolium*		0	1.4		
Corchorus crozophorifolius		0	0.5		
Corchorus incanus subsp. *lithophilus*					
Corchorus lasiocarpus subsp. *parvus*		0	0.5		
Crotalaria medicaginea var. *neglecta*					
Cullen leucanthum		<1 %	3		
Cymbopogon obtectus		<1 %	1		
Cyperus vaginatus		0	0.5		
Digitaria brownii					
Dodonaea viscosa subsp. *angustissima*		0	0.5		
Enneapogon robustissimus					
Eragrostis elongata		0	0.4		
Eragrostis tenellula		0	0.2		
Eriachne mucronata		0	0.5		
Eucalyptus camaldulensis subsp. *obtusa*		20	14		
Eucalyptus victrix					
Eulalia aurea		>75%	0.5		
Euphorbia biconvexa		0	0.1		
Euphorbia biconvexa		0	0.3		
Gomphrena canescens subsp. *canescens*		0	0.3		
Goodenia lamprosperma		0	0.2		
Gossypium robinsonii		<1 %	3		
Grevillea wickhamii subsp. *hispidula*		0	1.3		
Indigofera monophylla				Ycr41.05	
Jasminum didymum subsp. *lineare*		0	0.6		
Melaleuca argentea		<1 %	5		
Melaleuca glomerata		0	1.5		
Melinis repens		0	0.4		
Phyllanthus maderaspatensis		0	0.4		
Pluchea dentex				Ycr10.04	
Polycarpaea longiflora		0	0.2		

Ptilotus exaltatus	0	0.1	
Rhynchosia minima	0	0.1	Ycr07.01
Salsola australis	0	0.5	
Setaria verticillata			
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0	1.8	
Sonchus oleraceus	0	0.3	
Stemodia grossa	0	0.3	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0	0.4	
Themeda triandra	10	0.8	
Tridax procumbens	0	0.2	
Vigna lanceolata			
Waltheria indica	0	0.5	

Yandi Creek — Site YCR-08

Date	13/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 718468 mE; 7472498 mN 119.128950 E -22.841064 S
Veg Condition	Excellent
Soil	Clayey Sand
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eulalia aurea*, *Themeda triandra* and *Eriachne mucronata* mid open tussock grassland with *Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* and *Gossypium robinsonii* high open shrubland with *Eucalyptus victrix* and *Acacia coriacea* subsp. *pendens* low open woodland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*		5-10%	8		
Acacia pyrifolia var. *pyrifolia*		0	2		
Acacia tumida var. *pilbarensis*		<1 %	3		
Achyranthes aspera		0	0.4		
Alternanthera nana		0	0.2		
Alternanthera nodiflora	0.1		0.2		
Amaranthus undulatus	0.1		0.3		
Ammannia baccifera	0.1		0.2		
Argemone ochroleuca subsp. *ochroleuca*		0	0.1		
Atalaya hemiglauca		0	4		
Bidens bipinnata	1		0.4		
Boerhavia coccinea	0.1		0.2		
Cenchrus ciliaris		0	0.4		
Cleome viscosa		0	0.3		
Corchorus incanus subsp. *lithophilus*		0	0.4		
Cucumis variabilis	0.1				
Cymbopogon obtectus		0	0.8		
Cyperus bifax	0.1		0.3		
Cyperus vaginatus		0	0.5		
Elytrophorus spicatus	0.1		0.3		
Eragrostis elongata	0.1		0.3		
Eragrostis tenellula	0.1		0.3		
Eriachne mucronata		<1 %	0.4		
Eucalyptus victrix		12	10		
Eulalia aurea		15	0.6		
Euphorbia coghlanii		0	0.2		
Euphorbia coghlanii	0.1		0.2		Yan11-03
Euphorbia tannensis subsp. *eremophila*	0.1		0.4		
Fimbristylis microcarya	0.1		0.3		Yan12.02
Gomphrena canescens subsp. *canescens*	0.1		0.2		
Goodenia lamprosperma		0	0.3		
Gossypium australe		0	0.6		
Gossypium robinsonii		<1 %	3		
Grevillea wickhamii subsp. *hispidula*		0	0.6		
Heliotropium cunninghamii		0	0.3		YCR08.01
Hybanthus aurantiacus		0	0.3		
Ipomoea muelleri	0.1				
Isotropis sp. Arid zone (G. Byrne 2775)					YCR19-03
Marsilea hirsuta	0.1		0.1		Yan16.02
Melaleuca glomerata		>75%	4		
Melinis repens		0	0.4		
Phyllanthus maderaspatensis		0	0.3		
Pluchea dentex					Ycr10.04

Polycarpaea longiflora		0	0.4	
Pterocaulon sphacelatum		0	0.3	
Ptilotus exaltatus		0	0.3	
Ptilotus gaudichaudii	0.1		0.2	
Ptilotus obovatus		0	0.4	
Rumex vesicarius		0	0.4	
Salsola australis		0	0.5	
Setaria verticillata	0.1		0.5	
Stemodia grossa	0.1		0.3	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.8	
Themeda triandra		1-5%	0.8	
Trichodesma zeylanicum var. *zeylanicum*		0	0.9	
Triodia biflora				Ycr22.02
Triodia pungens		0	0.6	
Vigna lanceolata	0.1			
Waltheria indica		0	0.4	

Yandi Creek — Site YCR-09

Date	10/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 719286 mE; 7473627 mN 119.136760 E -22.830764 S
Veg Condition	Excellent
Soil	Silty Clay Loam
Rock Type	CID
Fire Age	Moderate (3 to 5 yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Mid hummock grassland of *Triodia pungens* and *Triodia wiseana* with tall open shrubland of *Acacia inaequilatera*, *Acacia pachyacra* and *Grevillea wickhamii* over mid sparse shrubland of *Senna glutinosa* subsp. *glutinosa*, *Senna artemisioides* subsp. *oligophylla* and *Corchorus* sp.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia adoxa var. *adoxa*		0	0.2		
Acacia bivenosa		<1 %	1.5		
Acacia dictyophleba		0	1.5		
Acacia inaequilatera		50-75%	3		
Acacia pachyacra		<1 %	2.5		
Acacia pyrifolia var. *pyrifolia*		0	0.2		
Acacia tumida var. *pilbarensis*	0.1		1.3		
Bulbostylis barbata	0.1		0.1		
Cleome viscosa	0.1		0.1		
Corchorus lasiocarpus subsp. *parvus*		0	0.5		
Corymbia hamersleyana		0	0.2		
Dampiera candicans		0	0.3		
Eriachne mucronata	0.1		0.3		
Eriachne pulchella subsp. *dominii*	0.1		0.1		
Euphorbia coghlanii	0.1		0.2	Yan11-03	
Goodenia stobbsiana		0	0.5		
Gossypium australe		0	0.9		
Gossypium robinsonii		0	2		
Grevillea wickhamii subsp. *hispidula*		5-10%	2.5		
Hakea chordophylla		<1 %	2.5		
Hibiscus sturtii var. *platychlamys*				YC49-02	
Indigofera monophylla	0.1		0.2		
Paraneurachne muelleri		0	0.3		
Polycarpaea holtzei	0.1		0.1		
Ptilotus astrolasius		0	0.4		
Ptilotus calostachyus		0	0.5		
Ptilotus exaltatus	0.1		0.1		
Ptilotus gaudichaudii	0.1		0.3		
Senna artemisioides subsp. *oligophylla*		<1 %	1.2		
Senna glutinosa subsp. *glutinosa*		<1 %	2		
Senna glutinosa subsp. *pruinosa*		0	1		
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)				YCR09-01	
Tribulus hirsutus	0.1		0.3		
Trigastrotheca molluginea					
Triodia pungens		40	0.5		
Triodia vanleeuwenii		<1 %	0.2		
Triodia wiseana		10	0.4		

Yandi Creek — Site YCR-10

Date	10/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 719725 mE; 7473721 mN 119.141020 E -22.829863 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Acacia tumida* var. *pilbarensis*, *Cullen leucanthum* and *Gossypium robinsonii* high shrubland over *Themeda triandra*, *Eulalia aurea* and *Sorghum plumosum* tussock grassland with *Eucalyptus camaldulensis* subsp. *obtusa* mid scattered trees
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon macrum		0	0.5		
Acacia bivenosa		0	1.6		
Acacia pyrifolia var. pyrifolia		0	3.5		
Acacia tumida var. pilbarensis		65	3.5		
Achyranthes aspera	0.1		0.3		
Amaranthus undulatus		0	0.4	Ycr10.06	
Androcalva luteiflora		0	1.5		
Atalaya hemiglauca		0	2.5		
Cenchrus ciliaris		<1 %	0.4		
Clerodendrum floribundum var. angustifolium			0.1	2.3	
Cullen leucanthum		25-33.3%	3.5	Ycr10.01	
Cyperus vaginatus		0	0.5		
Enteropogon ramosus		0	0.6		
Eragrostis elongata		0	0.3	Ycr10.07	
Eragrostis tenellula	0.1		0.2		
Eriachne mucronata		0	0.4		
Eucalyptus camaldulensis subsp. obtusa		<1 %	12		
Eulalia aurea		5-10%	0.8		
Gossypium robinsonii		1-5%	4		
Grevillea wickhamii subsp. hispidula		0	0.4		
Indigofera georgei				Ycr10.05	
Indigofera monophylla				Ycr41.05	
Malvastrum americanum		0	0.2		
Melinis repens		0	0.5		
Paspalidium tabulatum	0.1		0.4	Yan10.01	
Phyllanthus maderaspatensis		0	0.4		
Pluchea dentex				Ycr10.04	
Rumex vesicarius	0.1		0.3		
Setaria verticillata		0	0.4		
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		0	1.4		
Sigesbeckia orientalis	0.1		0.3	YAN16.03	
Sorghum plumosum				Ycr10.02	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.7		
Themeda triandra		33.3-50%	0.9		
Tridax procumbens		0	0.3	Ycr10.03	
Vigna lanceolata		0	0.2		
Waltheria indica		0	0.3		

Yandi Creek — Site YCR-11

Date	11/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 721796 mE; 7474129 mN 119.161131 E -22.825909 S
Veg Condition	Very Good
Soil	Medium Clay
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	Mid *Melaleuca argentea* woodland over mid grassland of *Themeda triandra* and *Eulalia aurea* with open sedgeland of *Cyperus vaginatus* and *Typha domingensis* with sparse tall shrubland of *Acacia tumida* var. *pilbarensis*, *Cullen leucanthum* and *Gossypium robinsonii*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia bivenosa		0	0.5		
Acacia coriacea subsp. *pendens*		0	10		
Acacia pyrifolia var. *pyrifolia*		0	2		
Acacia tumida var. *pilbarensis*		<1 %	2.5		
Ammannia baccifera	0.1		0.1		
Androcalva luteiflora	0.1		0.4		
Centipeda minima subsp. *macrocephala*				YCR16-04	
Chrysopogon fallax	0.1		1		
Cleome viscosa	0.1		0.3		
Cullen leucanthum		0	2		
Cymbopogon obtectus		0	1.2		
Cyperus vaginatus		5-10%	0.6		
Eleocharis geniculata				SCopp01	
Eragrostis elongata		0	0.3		
Eragrostis tenellula		0	0.1		
Eriachne mucronata	0.1		0.3		
Eucalyptus camaldulensis subsp. *obtusa*		<1 %	14		
Eulalia aurea		25-33.3%	0.8		
Euphorbia coghlanii	0.1		0.2	YAN11-03	
Fimbristylis sieberiana	Count	0	0.2	YCR19-07	
Goodenia lamprosperma	0.1		0.1		
Gossypium robinsonii		1-5%	2		
Indigofera monophylla					
Lobelia arnhemiaca				YCR16-05	
Melaleuca argentea		40	16		
Melaleuca glomerata		0	1.5		
Phyllanthus maderaspatensis		0	0.1		
Pluchea dentex				Ycr10.04	
Schoenoplectus subulatus				SCopp-05	
Sonchus oleraceus		0	0.2		
Stemodia grossa		0	0.2		
Stemodia viscosa		0	0.2		
Themeda triandra		20	1		
Triodia pungens	0.1		0.5		
Typha domingensis		>75%	2		
Vachellia farnesiana		0	1		
Vigna lanceolata		0			
Vincetoxicum lineare		0			

Yandi Creek — Site YCR-12

Date	13/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 718548 mE; 7471886 mN 119.129816 E -22.846582 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	Tall shrubland of *Melaleuca glomerata* with low open woodland of *Eucalyptus victrix* and *Acacia coriacea* subsp. *pendens* over open mid grassland of *Eulalia aurea* and *Themeda triandra*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*		50-75%	9		
Acacia pyrifolia var. *pyrifolia*		0	0.3		
Acacia tumida var. *pilbarensis*		0	2.5		
Alternanthera nana	0.1		0.2		
Alternanthera nodiflora		0	0.1		
Alysicarpus muelleri	0.1		0.4	Yan12.03	
Amaranthus undulatus	0.1		0.3		
Ammannia baccifera	0.1		0.2		
Atalaya hemiglauca		0	4		
Bidens bipinnata	0.1		0.4		
Boerhavia coccinea		0	0.1		
Centipeda minima subsp. *macrocephala*				YCR16-04	
Cleome viscosa		0	0.3		
Corchorus incanus subsp. *lithophilus*		0	0.4		
Corchorus lasiocarpus subsp. *parvus*		0	0.4		
Crotalaria medicaginea var. *neglecta*	0.1		0.3		
Cucumis variabilis	0.1		0.1		
Cymbopogon obtectus		0	0.6		
Cyperus vaginatus		25-33.3%	0.6		
Dodonaea viscosa subsp. *angustissima*		0	2		
Dodonaea viscosa subsp. *angustissima*				YCR12-01	
Enneapogon lindleyanus		0	0.4		
Enteropogon ramosus		0	0.4		
Eragrostis elongata		0	0.3		
Eragrostis tenellula	0.1		0.3		
Eriachne mucronata		0	0.4		
Eucalyptus camaldulensis subsp. *obtusa*		<1 %	14		
Eucalyptus victrix		15	10		
Eulalia aurea		15	0.8		
Euphorbia biconvexa	0.1		0.2	Yan11-03	
Fimbristylis microcarya	0.1		0.3	Yan12.02	
Glycine canescens				Ycr13.02	
Gomphrena canescens subsp. *canescens*		0	0.1		
Goodenia lamprosperma	0.1		0.3		
Gossypium robinsonii	0.1		0.2		
Ipomoea muelleri	0.1		0.1		
Ipomoea plebeia	0.1		0.1	Yan12.01	
Isotropis sp. Arid zone (G. Byrne 2775)				YCR19-03	
Jasminum didymum subsp. *lineare*		0			
Melaleuca glomerata		35	3		
Melinis repens	0.1		0.3		
Phyllanthus maderaspatensis		0	0.3		
Pluchea dentex		0	0.3		
Polycarpaea longiflora		0	0.1		

Pterocaulon sphacelatum		0	0.3	
Ptilotus obovatus		0	0.4	
Rhynchosia minima		0	0.2	
Santalum lanceolatum		0	2	
Senna glutinosa subsp. *glutinosa*		0	1	
Setaria verticillata		0	0.4	
Sigesbeckia orientalis	0.1		0.3	Yan16.03
Sigesbeckia orientalis				SCOPP10
Sorghum plumosum				Ycr10.02
Stemodia grossa		0	0.4	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.4	
Themeda triandra		10	0.7	
Trichodesma zeylanicum var. *zeylanicum*	0.1		0.3	
Triodia biflora				Ycr22.02
Triodia pungens		1-5%	0.4	
Triodia wiseana		0	0.4	
Vigna lanceolata		0	0.1	
Waltheria indica		0	0.3	

Yandi Creek — Site YCR-13

Date 11/09/2019
Described by CvdB & SC
Type Q 50m x 50m
Location MGA Zone 50
721552 mE; 7474227 mN
119.158740 E
-22.825050 S
Veg Condition Very Good
Soil Silty Clay Loam
Rock Type Conglomerate
Fire Age Old (6+ yr)
Habitat Major Drainage Line
Vegetation *Acacia tumida* var. *pilbarensis*, *Cullen leucanthum* and *Gossypium robinsonii* high open shrubland over *Themeda triandra*, *Eulalia aurea* and *Chrysopogon fallax* mid open tussock grassland with *Eucalyptus camaldulensis* and occasional *Melaleuca argentea* mid open woodland
Notes

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia bivenosa		0	2		
Acacia coriacea subsp. *pendens*		0	3		
Acacia pyrifolia var. *pyrifolia*		<1 %	1.5		
Acacia tumida var. *pilbarensis*		20	3		
Amaranthus undulatus	0.1		0.3		
Androcalva luteiflora		<1 %	1.3		
Atalaya hemiglauca		0	3		
Bidens bipinnata	0.1		0.3		
Cenchrus ciliaris		0	0.5		
Chrysopogon fallax		1-5%	0.9		
Cleome viscosa	0.1		0.2		
Clerodendrum floribundum var. *angustifolium*		0	1.6		
Clerodendrum floribundum var. *angustifolium*		0	2.5	Ycr13.03	
Crotalaria medicaginea var. *neglecta*	0.1		0.3		
Cucumis variabilis	0.1		0.1		
Cullen leucanthum		25-33.3%	4		
Cymbopogon obtectus		0	1		
Cyperus vaginatus		0	0.8		
Dichanthium fecundum		0	0.4	Ycr13.01	
Dodonaea viscosa subsp. *angustissima*		0	3.5		
Duperreya commixta		0	0.1		
Eragrostis elongata		0	0.4		
Eragrostis tenellula	0.1		0.2		
Eriachne mucronata		<1 %	0.5		
Eucalyptus camaldulensis subsp. *obtusa*		12	16		
Eulalia aurea		25-33.3%	0.7		
Euphorbia coghlanii	0.1		0.3	Yan11-03	
Fimbristylis sieberiana	0.1		0.3		
Glycine canescens		0	0.1	Ycr13.02	
Gossypium robinsonii		1-5%	3.5		
Gymnanthera cunninghamii		0	0.6		
Indigofera monophylla		0	0.5	Ycr41.05	
Isotropis sp. Arid zone (G. Byrne 2775)		0	0.6	YCR19-03	
Melaleuca argentea		1-5%	10		
Melaleuca bracteata		0	1.6		
Melaleuca glomerata		0	1.4		
Paspalidium basicladum	0.1		0.2	Yan13-01	
Phyllanthus maderaspatensis	0.1		0.2		
Pluchea dentex		0	0.4	Ycr10.04	
Pterocaulon sphacelatum		0	0.5		
Rhynchosia minima	0.1		0.1		
Setaria verticillata	0.1		0.2		
Sonchus oleraceus	0.1		0.2		

Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.6	
Themeda triandra		10	0.9	
Tinospora smilacina		0	0.1	Ycr13.04
Trichodesma zeylanicum var. *zeylanicum*		0	0.9	
Typha domingensis		0	0.9	
Vachellia farnesiana		0	0.6	
Vigna lanceolata	0.1		0.1	
Waltheria indica		0	0.4	

Yandi Creek — Site YCR-14

Date	13/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 717564 mE; 7471435 mN 119.120289 E -22.850778 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	*Melaleuca glomerata* tall open shrubland with mid open woodland of *Eucalyptus victrix*, *Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia coriacea* subsp. *pendens* over scattered herbs and grasses
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*		25-33.3%	8		
Acacia pyrifolia var. *pyrifolia*		0	0.5		
Achyranthes aspera		0	0.3		
Alternanthera nodiflora		0	0.2		
Amaranthus undulatus		0	0.3		
Androcalva luteiflora		0	0.8		
Atalaya hemiglauca	0.1		1.6		
Bidens bipinnata	0.1		0.2		
Boerhavia coccinea		0	0.1		
Cenchrus ciliaris		0	0.3		
Centipeda minima subsp. *macrocephala*	0.1		0.1		
Cleome viscosa		0	0.2		
Clerodendrum floribundum var. *angustifolium*					
Corchorus lasiocarpus subsp. *parvus*		0	0.3		
Cucumis variabilis		0			
Cymbopogon obtectus		0	0.8		
Cynanchum floribundum	0.1				Yan14.01
Cyperus vaginatus		0	0.5		
Dodonaea viscosa subsp. *angustissima*		0	1.2		
Duperreya commixta		0			
Dysphania rhadinostachya subsp. *rhadinostachya*		0	0.1		
Enneapogon lindleyanus		0	0.2		
Eragrostis tenellula	0.1		0.3		
Eucalyptus camaldulensis subsp. *obtusa*		25-33.3%	16		
Eucalyptus victrix		25-33.3%	12		
Eulalia aurea		0	0.6		
Euphorbia biconvexa		0	0.3		
Euphorbia biconvexa	0.1		0.3		Yan11-03
Gomphrena canescens subsp. *canescens*		0	0.2		
Gossypium robinsonii		0	2		
Heliotropium tenuifolium	0.1		0.2		
Melaleuca bracteata		0	1.2		
Melaleuca glomerata		20	4.5		
Melinis repens		0	0.3		
Nicotiana occidentalis					YCR14-01
Paspalidium clementii		0	0.3		
Phyllanthus baccatus					SCOpp-09
Phyllanthus maderaspatensis		0	0.3		
Pluchea dentex		0	0.1		Ycr10.04 Long
Pseudognaphalium luteoalbum					YCR16-06
Pterocaulon sphacelatum	0.1		0.3		
Ptilotus gaudichaudii		0	0.2		
Rhynchosia minima		0	0.2		

Rumex vesicarius		0	0.2	
Salsola australis	0.1		0.2	
Setaria verticillata		0	0.3	
Sigesbeckia orientalis	0.1		0.4	Yan16.03
Solanum nigrum	0.1		0.5	
Sonchus oleraceus		0	0.2	
Sorghum plumosum				Ycr10.02
Stemodia grossa		0	0.2	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.4	
Themeda triandra		0	0.5	
Tinospora smilacina	0.1		0.1	
Trachymene oleracea subsp. *oleracea*		0	0.3	
Trichodesma zeylanicum var. *zeylanicum*		0	0.6	
Vincetoxicum flexuosum				YCR4204
Waltheria indica		0	0.2	

Yandi Creek — Site YCR-16

Date	11/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 721051 mE; 7474100 mN 119.153879 E -22.826270 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus camaldulensis* subsp. *obtusa* and *Melaleuca argentea* mid open woodland over *Typha domingensis* and *Cyperus vaginatus* mid to high open sedgeland over *Pluchea dentex*, sparse herbland
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*		0	2.5		
Acacia maitlandii	0.1		1.2		
Acacia pyrifolia var. *pyrifolia*		0	0.6		
Acacia tumida var. *pilbarensis*		0	3		
Alternanthera nodiflora		0	0.2	YCR16-03	
Amaranthus undulatus		0	0.2		
Amaranthus undulatus	0.1		0.6		
Ammannia baccifera	0.1		0.2		
Argemone ochroleuca subsp. *ochroleuca*		0	0.2		
Atalaya hemiglauca		0	3		
Bergia pedicellaris	0.1		0.1	Yan16.01	
Cenchrus ciliaris	0.1		0.6		
Centipeda minima subsp. *macrocephala*				YCR16-04	
Chrysopogon fallax		0	1.3		
Cleome viscosa		0	0.3		
Cleome viscosa	0.1		0.3		
Crotalaria medicaginea var. *neglecta*		0	0.2		
Cucumis variabilis	0.1		0.1		
Cullen leucanthum		0	3		
Cymbopogon obtectus		0	0.4		
Cyperus vaginatus		5-10%	0.4		
Eleocharis geniculata				Scopp01	
Enneapogon robustissimus	0.1		0.5	Yan07.01	
Eragrostis elongata		0	0.4		
Eragrostis tenellula		0	0.2		
Eragrostis tenellula	0.1		0.2		
Eriachne mucronata		0	0.3		
Eucalyptus camaldulensis subsp. *obtusa*		12	18		
Eulalia aurea		<1 %	0.5		
Euphorbia coghlanii	0.1		0.2	Yan11-03	
Evolvulus alsinoides var. *decumbens*	0.1		0.2		
Fimbristylis sieberiana		0	0.3	YCR16-08	
Fimbristylis sieberiana				YCR16-09	
Gomphrena canescens subsp. *canescens*	0.1		0.2		
Goodenia lamprosperma		0	0.2		
Gossypium robinsonii		0	3		
Gossypium robinsonii	0.1		2		
Indigofera monophylla				Ycr41.05	
Lobelia arnhemiaca				YCR16-05	
Marsilea hirsuta	0.1		0.1	Yan16.02	
Melaleuca argentea		10	16		
Melinis repens		0	0.4		
Nicotiana occidentalis		0	0.3	YCR-16-01	
Phyllanthus maderaspatensis		0	0.2		

Phyllanthus maderaspatensis	0.1		0.2	
Pluchea dentex				Ycr10.04
Polycarpaea longiflora	0.1		0.2	
Pseudognaphalium luteoalbum				YCR16-06
Pterocaulon sphacelatum		0	0.3	
Pterocaulon sphacelatum		0	0.3	Ycr16 02
Schoenoplectus subulatus				CVopp.05
Setaria verticillata		0	0.3	
Sigesbeckia orientalis	0.1		0.3	Yan16.03
Solanum nigrum		0	0.4	
Sonchus oleraceus		0	0.2	
Sorghum plumosum				Ycr10.02
Stemodia grossa	0.1		0.2	
Stemodia viscosa		0	0.1	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.3	
Themeda triandra		<1 %	0.6	
Tridax procumbens		0	0.1	
Typha domingensis		10	3	
Vachellia farnesiana		0	20	
Vigna lanceolata	0.1			
Wahlenbergia tumidifructa		0	0.1	
Waltheria indica	0.1		0.3	

Yandi Creek — Site YCR-17

Date	11/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 720566 mE; 7473934 mN 119.149181 E -22.827826 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Tall closed shrubland of *Acacia tumida* var. *pilbarensis*, *Cullen leucanthum* and *Gossypium robinsonii* over tussock grassland of *Eulalia aurea*, *Themeda triandra* and *Eriachne mucronata* with sparse *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186).
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon cryptopetalum		<1 %	0.6		
Abutilon macrum	0.1		0.5	YAN1701	
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)				YCR17-01	
Acacia pyrifolia var. *pyrifolia*		5-10%	2.3		
Acacia tumida var. *pilbarensis*		40	2.5		
Amaranthus undulatus	0.1		0.3		
Androcalva luteiflora		1-5%	1.9		
Aristida holathera var. *holathera*	0.1		0.1		
Atalaya hemiglauca		<1 %	2		
Boerhavia coccinea	0.1		0.1	YAN51-03	
Cenchrus ciliaris		0	0.2		
Chrysocephalum apiculatum subsp. *pilbarense*	0.1		0.2		
Cleome viscosa	0.1		0.3		
Corchorus incanus subsp. *lithophilus*	0.1		0.3		
Corchorus lasiocarpus subsp. *parvus*		0	0.4		
Crotalaria medicaginea var. *neglecta*	0.1		0.3		
Cullen leucanthum		10	2.6		
Duperreya commixta		0			
Enneapogon lindleyanus		0	0.3		
Eriachne mucronata		0	0.4		
Eucalyptus camaldulensis subsp. *obtusa*		1-5%	6		
Eulalia aurea		15	1.2		
Euphorbia australis var. *subtomentosa*	0.1		0.1		
Euphorbia biconvexa	0.1		0.1		
Evolvulus alsinoides var. *villosicalyx*	0.1		0.1		
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Gomphrena canescens subsp. *canescens*				Yan25-01	
Gossypium robinsonii		25-33.3%	2.2		
Grevillea wickhamii subsp. *hispidula*		0	2		
Heliotropium cunninghamii	0.1		0.1		
Indigofera monophylla		0	0.4		Big
Isotropis sp. Arid zone (G. Byrne 2775)				YCR19-03	
Notoleptopus decaisnei	0.1		0.1		
Paraneurachne muelleri	0.1		0.4		
Petalostylis labicheoides		<1 %	2.2		
Pluchea dentex		0	0.3	Ycr10.04 Long	
Polycarpaea longiflora	0.1		0.1	Yan50-03	
Portulaca oleracea	0.1		0.1		
Pterocaulon sphacelatum	0.1		0.2		
Ptilotus exaltatus	0.1		0.1		
Ptilotus fusiformis	0.1		0.1	Yan50-01	
Ptilotus obovatus		0	0.3		

Salsola australis		0	0.3
Santalum lanceolatum		0	1.6
Senna venusta		0	0.3
Setaria verticillata	0.1		0.1
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)			
Sorghum plumosum		<1 %	1
Stylobasium spathulatum	0.1		0.8
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		1-5%	0.6
Themeda triandra		10	1.5
Trichodesma zeylanicum			
Triodia pungens		0	0.2
Waltheria indica		0	0.4

Yandi Creek — Site YCR-19

Date	10/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 720011 mE; 7473861 mN 119.143783 E -22.828560 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	*Eucalyptus camaldulensis* subsp. *obtusa* and *Melaleuca argentea* mid woodland over tall open shrubland of *Cullen leucanthum*, *Acacia tumida* var. *pilbarensis* and *Gossypium robinsonii* over sparse mixed grassland of *Cenchrus ciliaris*, *Themeda triandra* and *Eulalia aurea*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia bivenosa	0.2		1.5		
Acacia colei var. *colei*	0.2		0.8		
Acacia coriacea subsp. *pendens*	0.2		1.8		
Acacia maitlandii	0.1		2		
Acacia monticola	0.1		1.6		
Acacia pyrifolia var. *pyrifolia*	0.2		1.6		
Acacia tumida var. *pilbarensis*	10		3.5		
Amaranthus undulatus	0.1		0.3		
Androcalva luteiflora	0.2		1.2		
Atalaya hemiglauca	0.1		2.5		
Blumea tenella	0.1		0.1	YAN1901	
Cenchrus ciliaris	2		0.5		
Cleome viscosa	0.1		0.2		
Crotalaria medicaginea var. *neglecta*	0.1		0.1	YCR19-06	
Cullen leucanthum	5		3		
Cymbopogon obtectus	0.1		0.5	Yan1902	
Cyperus vaginatus	0.5		1		
Duperreya commixta	0.1				
Eragrostis elongata	0.2		0.3		
Eragrostis tenellula	0.1		0.1		
Eriachne mucronata	0.2		0.5	YCR19-02	
Eucalyptus camaldulensis subsp. *obtusa*	20		18		
Eulalia aurea	10		1		
Euphorbia biconvexa	0.1		0.1	YCR19-05	
Fimbristylis sieberiana				Opp	
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Gossypium robinsonii	2		2		
Grevillea wickhamii subsp. *hispidula*	0.1		1.4		
Isotropis sp. Arid zone (G. Byrne 2775)	0.1		0.1	YCR19-03	
Melaleuca argentea	10		18		
Melinis repens	0.3		0.3		
Phyllanthus maderaspatensis	0.1		0.2		
Pluchea dentex	0.1		0.3		
Polycarpaea longiflora					
Pterocaulon sphacelatum	0.1		0.2		
Ptilotus auriculifolius	0.1		0.1		
Setaria verticillata	0.1		0.3		
Sigesbeckia orientalis	0.1		0.1		
Sorghum plumosum	1		1		
Stemodia grossa	0.1		0.1		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.5		0.5		

Themeda triandra	0.5	1	
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.2	
Tridax procumbens			
Tridax procumbens	0.1	0.1	
Triodia pungens	0.1	0.3	
Typha domingensis	1	2	
Vachellia farnesiana	0.1	0.3	
Vigna lanceolata	0.1		
Vincetoxicum flexuosum	0.1	0.6	Ycr42.04
Wahlenbergia tumidifructa	0.1	0.3	YCR19-01
Waltheria indica	0.1	0.3	

Yandi Creek — Site YCR-22

Date	10/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 720319 mE; 7473875 mN 119.146780 E -22.828391 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa* low open woodland over *Eulalia aurea*, *Themeda triandra* and *Sorghum plumosum* mid open tussock grassland over *Acacia tumida* var. *pilbarensis*, *Cullen leucanthum* and *Gossypium robinsonii* high open shrubland
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		0	0.6	Ycr22.01	
Acacia bivenosa		0	1.5		
Acacia pyrifolia var. *pyrifolia*		0	2.5		
Acacia tumida var. *pilbarensis*		10	4		
Amaranthus undulatus	0.1		0.3		
Androcalva luteiflora		0	0.5		
Atalaya hemiglauca		0	1.5		
Bidens bipinnata	0.1		0.2		
Boerhavia coccinea	0.1		0.2	YAN51-03	
Cenchrus ciliaris		0	0.6		
Cleome viscosa		0	0.2		
Clerodendrum floribundum var. *angustifolium*			0.1	0.3	
Corchorus lasiocarpus subsp. *parvus*		0	0.8		
Crotalaria medicaginea var. *neglecta*	0.1		0.3		
Cucumis variabilis	0.1		0.1		
Cullen leucanthum		25-33.3%	4		
Cymbopogon obtectus		<1 %	0.9		
Cyperus vaginatus		0	0.8		
Enneapogon lindleyanus		0	0.5		
Enteropogon ramosus		0	0.5		
Eragrostis elongata		0	0.4		
Eragrostis tenellula		0	0.3		
Eriachne mucronata		0	0.4		
Eucalyptus camaldulensis subsp. *obtusa*		50-75%	16		
Eulalia aurea		12	0.8		
Euphorbia biconvexa	0.1		0.3		
Fimbristylis dichotoma	0.1		0.2		
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Gossypium robinsonii		<1 %	4		
Grevillea wickhamii subsp. *hispidula*		0	0.7		
Indigofera monophylla		0	0.4	Ycr41.05	
Ipomoea plebeia				Yan51-02	
Isotropis sp. Arid zone (G. Byrne 2775)		0	0.6	YCR19-03	
Marsilea hirsuta	0.1		0.1		
Melaleuca argentea		20	15		
Melaleuca glomerata		0	1.8		
Melinis repens		0	0.3		
Notoleptopus decaisnei	0.1		0.1		
Phyllanthus maderaspatensis	0.1		0.2		
Pluchea dentex		0	0.3	Ycr10.04	
Polycarpaea holtzei	0.1		0.1	YAN22-02	
Polycarpaea longiflora	0.1		0.1	Yan50-03	
Pterocaulon sphacelatum	0.1		0.1		

Ptilotus auriculifolius	0.1		0.1	
Ptilotus fusiformis	0.1		0.3	YAN50-01
Rhynchosia minima	0.1		0.1	
Schoenoplectus subulatus	0.1		0.9	
Setaria verticillata	0.1		0.3	
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		0	1.7	
Sigesbeckia orientalis	0.1		0.2	Yan16.03
Sorghum plumosum		<1 %	1.1	Ycr10.02
Stemodia grossa	0.1		0.2	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.6	
Themeda triandra		25-33.3%	1	
Trichodesma zeylanicum var. *zeylanicum*		0	1	
Tridax procumbens	0.1		0.1	
Triodia biflora		0	0.6	Ycr22.02
Triodia pungens		0	0.4	
Typha domingensis		<1 %	2.2	
Vachellia farnesiana		0	1.5	
Vigna lanceolata	0.1		0.1	
Waltheria indica		0	0.4	

Yandi Creek — Site YCR-23

Date	14/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 710846 mE; 7470265 mN 119.055012 E -22.862200 S
Veg Condition	Excellent
Soil	Sandy Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Triodia pungens* hummock grassland with *Acacia dictyophleba*, *Acacia bivenosa* and *Petalostylis labicheoides* high to mid open shrubland over *Digitaria ctenantha*, *Themeda triandra* and *Eulalia aurea* low sparse tussock grassland with *Eucalyptus xerothermica* low scattered trees
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia bivenosa	0		2		
Acacia dictyophleba	12		3	Ycr23.01	
Acacia maitlandii	0		2		
Acacia pachyacra	0		1.7		
Acacia pyrifolia var. *pyrifolia*	0		1.5		
Alternanthera nana	0		0.2		
Androcalva luteiflora	0		1.6		
Aristida inaequiglumis	0		0.6	Ycr23.02	
Bonamia erecta	0		0.3		
Chrysocephalum apiculatum subsp. *pilbarense*			0.4		
Chrysopogon fallax	0		0.4		
Eucalyptus gamophylla	0		2		
Eulalia aurea	0		0.3		
Eulalia aurea	0		0.4		
Hakea lorea subsp. *lorea*	0		3.5		
Petalostylis labicheoides	0		3.5		
Pterocaulon sphacelatum	0		0.2		
Ptilotus obovatus	0		0.3		
Scaevola parvifolia subsp. *pilbarae*	0		0.3		
Senna artemisioides subsp. × *artemisioides*	0		1		
Senna pleurocarpa	0		0.6		
Seringia elliptica	0		0.4		
Themeda triandra	0		0.6		
Triodia pungens	45		0.5		

Yandi Creek — Site YCR-24

Date	13/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 718660 mE; 7473304 mN 119.130711 E -22.833765 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	*Eucalyptus victrix* low open woodland over isolated clumps of shrubs and grasses over low sparse herbs
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia pyrifolia var. *pyrifolia*		0	0.3		
Acacia tumida var. *pilbarensis*		0	2		
Achyranthes aspera		0	0.2		
Alternanthera nana		0	0.2		
Alternanthera nodiflora	0.1		0.2		
Amaranthus undulatus		0	0.2		
Ammannia baccifera	0.1		0.3		
Ammannia multiflora	0.1		0.2		
Argemone ochroleuca subsp. *ochroleuca*		0	0.3		
Atalaya hemiglauca		0	1.5		
Bidens bipinnata	0.1		0.2		
Boerhavia coccinea		0			
Cenchrus ciliaris		0	0.5		
Centipeda minima subsp. *macrocephala*		0	0.1	YCR16-04	
Cleome viscosa		0	0.3		
Cucumis variabilis		0			
Cyperus vaginatus		0	0.5		
Dysphania rhadinostachya subsp. *rhadinostachya*		0	0.2		
Elytrophorus spicatus	0.1		0.2		
Eragrostis cumingii	0.1		0.2	Yan40.01	
Eragrostis tenellula		0	0.2		
Eragrostis tenellula	0.1		0.3		
Eriachne mucronata		0	0.4		
Eriachne pulchella subsp. *dominii*		0	0.1	YCR2403	
Eucalyptus victrix		15	10		
Eulalia aurea		0	0.5		
Euphorbia coghlanii		0	0.1		
Euphorbia tannensis subsp. *eremophila*		0	0.3		
Flaveria trinervia		0	0.3		
Gomphrena canescens subsp. *canescens*		0	0.1		
Goodenia lamprosperma		0	0.3		
Gossypium robinsonii		0	1.8		
Marsilea hirsuta	0.1		0.2	Yan16.02	
Melinis repens		0	0.3		
Phyllanthus maderaspatensis		0	0.3	YCR2401	
Pluchea dentex		0	0.2	Ycr10.04	
Polycarpaea longiflora		0	0.2		
Polymeria ambigua	0.1		0.2	Yan02.05	
Pterocaulon sphacelatum		0	0.2		
Ptilotus exaltatus		0	0.3		
Ptilotus gaudichaudii	0.1		0.3		
Rotala diandra	0.1		0.1	Yan24.03	
Rotala occultiflora	0.1		0.1	Yan24.04	
Rumex vesicarius		0	0.2		

Salsola australis		0	0.3	
Schoenoplectus subulatus	0.1		0.2	YAN24.01
Setaria verticillata		0	0.2	
Sorghum plumosum		0	0.5	Ycr10.02
Stemodia grossa		0	0.2	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.3	
Themeda triandra		0	0.5	
Trachymene oleracea subsp. *oleracea*		0	0.4	YCR2402
Trichodesma zeylanicum var. *zeylanicum*		0	0.6	
Triodia pungens		0	0.1	
Vigna lanceolata		0		
Waltheria indica		0	0.3	

Yandi Creek — Site YCR-25

Date	13/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 716486 mE; 7471765 mN 119.109751 E -22.847936 S
Veg Condition	Excellent
Soil	Loamy Sand
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	Mid tussock grassland of *Eulalia aurea*, *Eriachne mucronata* and *Themeda triandra* with low open woodland of *Eucalyptus victrix* and *Acacia coriacea* subsp. *pendens* over tall sparse shrubland of *Acacia tumida* var. *pilbarensis* and *Melaleuca glomerata*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		0	0.4	YCR17-01	
Acacia coriacea subsp. *pendens*		5-10%	7		
Acacia maitlandii		0	2.5		
Acacia pyrifolia var. *pyrifolia*		0	1		
Acacia tumida var. *pilbarensis*		25-33.3%	3		
Achyranthes aspera	0.1		0.3		
Acrachne racemosa	0.1		0.5	YAN25-02	
Alternanthera nana	0.1		0.1		
Alternanthera nodiflora		0	0.1		
Amaranthus undulatus	0.1		0.2		
Ammannia baccifera	0.1		0.3		
Atalaya hemiglauca		0	3		
Bidens bipinnata		0	0.1		
Bulbostylis barbata	0.1		0.1		
Centipeda minima subsp. *macrocephala*	0.1		0.1		
Cleome viscosa		0	0.2		
Corchorus incanus subsp. *lithophilus*		0	0.5		
Corchorus lasiocarpus subsp. *parvus*		0	0.5		
Crotalaria medicaginea var. *neglecta*	0.1		0.1		
Cucumis variabilis		0			
Cymbopogon obtectus		0	0.8		
Cyperus iria	0.1		0.4		
Cyperus vaginatus		0	0.6		
Elytrophorus spicatus	0.1		0.1		
Enneapogon lindleyanus		0	0.3		
Enneapogon polyphyllus	0.1		0.3		
Eragrostis elongata		0	0.2		
Eragrostis tenellula		0	0.2		
Eragrostis tenellula	0.1		0.3		
Eriachne mucronata		25	0.5		
Eucalyptus camaldulensis subsp. *obtusa*		25-33.3%	14		
Eucalyptus victrix		10	10		
Eulalia aurea		15	0.8		
Euphorbia biconvexa	0.1		0.1		
Evolvulus alsinoides var. *decumbens*	0.1		0.1		
Evolvulus alsinoides var. *villosicalyx*	0.1		0.1		
Fimbristylis microcarya	0.1		0.1	Yan50-05	
Gomphrena canescens subsp. *canescens*		0	0.2		
Gomphrena canescens subsp. *canescens*	0.1		0.3	YAN25-01	
Goodenia lamprosperma		0	0.2		
Gossypium robinsonii		0	2		
Grevillea wickhamii subsp. *hispidula*		0	1		
Heliotropium cunninghamii	0.1		0.1		
Indigofera fractiflexa subsp. *fractiflexa*		0	0.2	YCR25-01	

Ipomoea muelleri	0.1		0.1	Yan50-04
Ipomoea plebeia				Yan51-02
Isotropis sp. Arid zone (G. Byrne 2775)				YCR19-03
Melaleuca glomerata		<1 %	4	
Melinis repens		0	0.5	
Paspalidium clementii	0.1		0.1	Yan50-08
Phyllanthus maderaspatensis		0	0.2	
Phyllanthus maderaspatensis	0.1		0.3	
Pluchea dentex		0	0.3	Ycr10.04
Polycarpaea longiflora	0.1		0.1	Yan50-03
Pseudognaphalium luteoalbum		0	0.1	YCR16-06
Ptilotus exaltatus	0.1		0.1	
Ptilotus fusiformis	0.1		0.3	Yan50-01
Rhynchosia minima	0.1		0.1	
Rotala diandra	0.1		0.1	
Salsola australis		0	0.3	
Setaria verticillata		0	0.2	
Setaria verticillata	0.1		0.3	
Sigesbeckia orientalis	0.1		0.3	
Stemodia viscosa	0.1		0.1	
Streptoglossa bubakii		0	0.4	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.4	
Themeda triandra		25-33.3%	0.7	
Trachymene oleracea subsp. *oleracea*		0	0.5	
Trichodesma zeylanicum var. *zeylanicum*		0	0.5	
Triodia biflora		0	0.7	Ycr22.02
Triodia pungens		0	0.3	
Wahlenbergia tumidifructa		0	0.3	
Waltheria indica	0.1		0.3	

Yandi Creek — Site YCR-26

Date	14/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 710116 mE; 7469787 mN 119.047968 E -22.866610 S
Veg Condition	Excellent
Soil	Sandy Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Triodia pungens* hummock grassland with *Petalostylis labicheoides*, *Acacia pyrifolia* var. *pyrifolia* and *Eremophila longifolia* high to mid shrubland with isolated patches of tussock grassland
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia dictyophleba		0	3		
Acacia maitlandii		0	1		
Acacia pyrifolia var. *pyrifolia*		<1 %	1.6		
Acacia tumida var. *pilbarensis*		0	2.2		
Alternanthera nana		0	0.2		
Amyema sanguinea		0			
Androcalva luteiflora		0	1.5		
Aristida lazaridis		0	0.4		
Bonamia erecta		0	0.3		
Centipeda minima subsp. *macrocephala*		0	0.2	YCR16-04	
Chrysocephalum apiculatum subsp. *pilbarense*					
Cleome viscosa		0	0.2		
Duperreya commixta		0			
Enneapogon polyphyllus		0	0.3		
Eremophila longifolia		<1 %	1.8		
Eriachne mucronata		0	0.5		
Eulalia aurea		0	0.6		
Indigofera georgei		0	0.6	Ycr26.01	
Indigofera monophylla		0	0.3		
Isotropis sp. Arid zone (G. Byrne 2775)		0	0.4	YCR19-03	
Jasminum didymum subsp. *lineare*		0	0.6		
Paraneurachne muelleri		0	0.3		
Petalostylis labicheoides		12	3		
Ptilotus astrolasius		0	0.3		
Ptilotus obovatus		0	0.4		
Santalum lanceolatum		0	1.7		
Scaevola parvifolia subsp. *pilbarae*		0	0.3		
Senna artemisioides subsp. × *artemisioides*		0	0.8		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.5		
Themeda triandra		<1 %	0.8		
Triodia pungens		55	0.6		

Yandi Creek — Site YCR-27

Date	14/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 708628 mE; 7469556 mN 119.033501 E -22.868875 S
Veg Condition	Excellent
Soil	Sandy Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	*Eucalyptus camaldulensis* subsp. *obtusa* mid open woodland over tall sparse shrubs of *Acacia tumida* var. *pilbarensis* over low sparse shrubs of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) over scattered herbs and grasses
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia maitlandii		0	2		
Acacia pruinocarpa		0	3		
Acacia pyrifolia var. *pyrifolia*		0	2	YCR27-02	
Acacia tumida var. *pilbarensis*		1-5%	2.5		
Alternanthera nana		0	0.1		
Androcalva luteiflora		0	0.8		
Capparis lasiantha		0			
Capparis umbonata		0	1.2	YCR27-04	
Cleome viscosa		0	0.3		
Clerodendrum floribundum var. *angustifolium*		0	0.8		
Cucumis variabilis		0			
Cymbopogon obtectus		0	0.5		
Dodonaea viscosa subsp. *angustissima*		0	1		
Enneapogon polyphyllus		0	0.2		
Eragrostis cumingii		0	0.3		
Eremophila longifolia		0	1		
Eriachne mucronata		0	0.4		
Eucalyptus camaldulensis subsp. *obtusa*		15	18		
Eucalyptus victrix		1-5%	12		
Eulalia aurea		<1 %	0.6		
Euphorbia coghlanii		0	0.4		
Ficus brachypoda		0	3		
Gomphrena canescens subsp. *canescens*		0	0.1		
Goodenia lamprosperma		0	0.3	YCR27-01	
Gossypium robinsonii		0	1.8		
Grevillea wickhamii subsp. *hispidula*		0	3		
Isotropis sp. Arid zone (G. Byrne 2775)				YCR19-03	
Jasminum didymum subsp. *lineare*		0			
Petalostylis labicheoides		0	1		
Phyllanthus maderaspatensis		0	0.2		
Pluchea dentex		0	0.2		
Polycarpaea longiflora		0	0.1		
Ptilotus astrolasius		0	0.4		
Ptilotus gaudichaudii		0	0.2		
Santalum lanceolatum		0	0.8		
Sida sp. Articulation below (A.A. Mitchell PRP 1605)		0	0.4	YCR27-03	
Stylobasium spathulatum		0	1.2		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		<1 %	0.4		
Themeda triandra		0	0.4		
Trichodesma zeylanicum var. *zeylanicum*		0	0.7		
Triodia pungens		0	0.4		

Yandi Creek — Site YCR-29

Date	14/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 707661 mE; 7469027 mN 119.024148 E -22.873779 S
Veg Condition	Excellent
Soil	Sand
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus camaldulensis* subsp. *obtusa* and *Eucalyptus victrix* mid open woodland over *Acacia tumida* var. *pilbarensis*, *Dodonaea viscosa* subsp. *spatulata* and *Gossypium robinsonii* high sparse shrubland over *Themeda triandra*, *Eulalia aurea* and *Cymbopogon obtectus* mid very open tussock grassland
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia bivenosa		0	0.6		
Acacia maitlandii		0	2		
Acacia pyrifolia var. *pyrifolia*		0	0.5		
Acacia tumida var. *pilbarensis*		33.3-50%	3		
Alternanthera nana		0	0.3		
Androcalva luteiflora		0	1.2		
Aristida holathera var. *holathera*		0	0.3		
Atalaya hemiglauca		0	6		
Boerhavia coccinea		0	0.1		
Cenchrus ciliaris		0	0.4		
Cleome viscosa		0	0.3		
Corchorus laniflorus		0	0.4		
Cucumis variabilis		0			
Dodonaea viscosa subsp. *angustissima*		<1 %	2		
Duperreya commixta		0			
Enneapogon polyphyllus		0	0.6		
Eragrostis cumingii		0	0.3		
Eriachne mucronata		0	0.4		
Eucalyptus camaldulensis subsp. *obtusa*		15	12		
Eucalyptus victrix		5-10%	10		
Eulalia aurea		<1 %	0.6		
Euphorbia coghlanii		0	0.2		
Evolvulus alsinoides var. *decumbens*		0	0.2		
Gomphrena canescens subsp. *canescens*		0	0.2		
Goodenia lamprosperma		0	0.2		
Gossypium robinsonii		<1 %	3		
Grevillea wickhamii subsp. *hispidula*		0	2.5		
Heliotropium tenuifolium		0	0.2		
Isotropis sp. Arid zone (G. Byrne 2775)		0	0.6		YCR19-03
Jasminum didymum subsp. *lineare*		0	0.6		
Melaleuca glomerata		0	2.5		
Petalostylis labicheoides		0	0.1		
Phyllanthus maderaspatensis		0	0.3		
Pluchea dentex		0	0.3		Ycr10.04
Polycarpaea longiflora		0	0.2		
Ptilotus exaltatus		0	0.2		
Ptilotus obovatus		0	0.3		
Santalum lanceolatum		0	3		
Senna artemisioides subsp. × *artemisioides*		0	0.6		
Senna notabilis		0	0.2		
Solanum lasiophyllum		0	0.3		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.5		

Themeda triandra	1-5%	0.6
Trichodesma zeylanicum var. *zeylanicum*	0	0.6
Triodia pungens	0	0.6
Triumfetta chaetocarpa	0	0.3
Waltheria indica	0	0.3

Yandi Creek — Site YCR-32

Date	14/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 709431 mE; 7469585 mN 119.041318 E -22.868518 S
Veg Condition	Excellent
Soil	Loamy Sand
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus victrix* low open woodland over *Themeda triandra*, *Eulalia aurea* and *Cymbopogon obtectus* mid open tussock grassland with *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *hispidula* and *Androcalva luteiflora* high sparse shrubland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia bivenosa		0	2		
Acacia maitlandii		0	0.5		
Acacia pyrifolia var. *pyrifolia*		0	0.8		
Acacia tumida var. *pilbarensis*		25-33.3%	3.5		
Amaranthus undulatus		0	0.4		
Androcalva luteiflora		0	1.5		
Cassytha capillaris		0			
Cleome viscosa		0	0.2		
Cymbopogon obtectus		0	0.9		
Dodonaea viscosa subsp. *angustissima*		0	0.9		
Eriachne mucronata		0	0.3		
Eucalyptus victrix		0	15		
Eucalyptus victrix		12	9		
Eulalia aurea		1-5%	0.6		
Gomphrena canescens subsp. *canescens*		0	0.2		
Goodenia lamprosperma		0	0.2		
Gossypium robinsonii		0	3		
Grevillea wickhamii subsp. *hispidula*		<1 %	4		
Heliotropium tenuifolium		0	0.2		
Hybanthus aurantiacus		0	0.2		
Isotropis sp. Arid zone (G. Byrne 2775)			0.5	YCR19-03	
Jasminum didymum subsp. lineare		0	0.6		
Melaleuca glomerata		0	1.5		
Petalostylis labicheoides		0	3		
Phyllanthus maderaspatensis		0	0.4		
Pluchea dentex		0	0.3	Ycr10.04	
Polycarpaea longiflora		0	0.2		
Santalum lanceolatum		0	0.8		
Sida sp. Golden calyces glabrous (H.N. Foote 32)		0	0.8		
Stylobasium spathulatum		0	1.4		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.6		
Themeda triandra		33.3-50%	0.8		
Trichodesma zeylanicum var. *zeylanicum*		0	0.8		
Triodia pungens		0	0.6		
Triodia wiseana		0	0.2		

Yandi Creek — Site YCR-36

Date	14/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 707945 mE; 7469022 mN 119.026917 E -22.873785 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Mid tussock grassland of *Themeda triandra* and *Eulalia aurea* with tall open shrubland of *Acacia tumida* var. *pilbarensis*, *Petalostylis labicheoides* and *Acacia dictyophleba* with sparse mid hummock grasses of *Triodia pungens* with scattered trees and herbs
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	0		0.4	YCR17-01	
Acacia bivenosa	0		2		
Acacia dictyophleba	0		2.2		
Acacia maitlandii	0		2.2		
Acacia pyrifolia var. *pyrifolia*	0		2.8		
Acacia tumida var. *pilbarensis*	50-75%		2.8		
Alternanthera nana	0		0.1		
Androcalva luteiflora	0		2		
Aristida inaequiglumis	0		0.9		
Aristida lazaridis	0		0.6		
Bidens bipinnata	0		0.1		
Chrysocephalum apiculatum subsp. *pilbarense*					
Chrysopogon fallax	0		0.7		
Cleome viscosa	0		0.2		
Cucumis variabilis	0				
Dodonaea viscosa subsp. *angustissima*	0		1.4		
Duperreya commixta	0				
Eriachne mucronata	0		0.5		
Eucalyptus victrix	0		8		
Eulalia aurea	10		0.6		
Euphorbia boophthona	0		0.4		
Gossypium australe	0		0.4		
Gossypium robinsonii	0		0.8		
Grevillea wickhamii subsp. *hispidula*	0		0.4		
Indigofera georgei	0		1.3		
Isotropis sp. Arid zone (G. Byrne 2775)				YCR19-03	
Petalostylis labicheoides	50-75%		3		
Phyllanthus maderaspatensis	0		0.1		
Pluchea dentex	0		0.2		
Ptilotus obovatus	0		0.4		
Santalum lanceolatum	0		2		
Senna artemisioides subsp. *oligophylla*	0		1		
Senna notabilis	0		0.5		
Stylobasium spathulatum	0		0.6		
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0		0.4		
Themeda triandra	20		0.7		
Triodia pungens	15		0.4		
Waltheria indica	0		0.3		

Yandi Creek — Site YCR-37

Date	14/09/2019
Described by	CvdB & SC
Type	R
Location	MGA Zone 50 708389 mE; 7469196 mN 119.031227 E -22.872160 S
Veg Condition	Very Good
Soil	Clayey Sand
Rock Type	Conglomerate
Fire Age	Recent (0 to 2 yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Triodia pungens* hummock grassland with *Petalostylis labicheoides*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia dictyophleba* mid to high open shrubland over *Themeda triandra* and *Eulalia aurea* very open tussock grassland with *Eucalyptus xerothermica* and *Corymbia hamersleyana* low scattered trees.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia dictyophleba					
Acacia pyrifolia var. *pyrifolia*					
Corymbia hamersleyana					
Eucalyptus xerothermica					
Eulalia aurea					
Petalostylis labicheoides					
Themeda triandra					
Triodia pungens					

Yandi Creek — Site YCR-38

Date	13/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 717949 mE; 7471603 mN 119.124025 E -22.849209 S
Veg Condition	Good
Soil	Clayey Sand
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* and *Acacia tumida* var. *pilbarensis* high open shrubland with *Eucalyptus victrix* and *Eucalyptus camaldulensis* subsp. *obtusa* mid to low sparse woodland over *Eulalia aurea*, *Themeda triandra* and *Eriachne mucronata* mid sparse tussock grassland
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon lepidum		0	0.2		
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		0	1		
Acacia coriacea subsp. *pendens*		10-25%	4		
Acacia maitlandii		0	0.4		
Acacia pyrifolia var. *pyrifolia*		0	1.8		
Acacia tumida var. *pilbarensis*		5-10%	3		
Achyranthes aspera		0	0.4		
Alternanthera nodiflora		0	0.2		
Amaranthus undulatus		0	0.5		
Ammannia baccifera	0.1		0.2		
Androcalva luteiflora		0	1.8		
Argemone ochroleuca subsp. *ochroleuca*		0	0.1		
Aristida lazaridis		0	0.4	Ycr38.02	
Atalaya hemiglauca		0	0.5		
Bidens bipinnata		0	0.2		
Boerhavia coccinea		0	0.1		
Cenchrus ciliaris		0	0.6		
Chrysopogon fallax		0	0.6		
Cleome viscosa		0	0.3		
Clerodendrum floribundum var. *angustifolium*		0	0.4		
Corchorus incanus subsp. *lithophilus*		0	0.6		
Crotalaria medicaginea var. *neglecta*		0	0.2		
Cucumis variabilis		0			
Cymbopogon obtectus		0	0.5		
Cyperus vaginatus		0	0.5		
Digitaria brownii		0	0.6	YcR38.01	
Dodonaea viscosa subsp. *angustissima*		0	1.5		
Duperreya commixta		0			
Dysphania rhadinostachya subsp. *rhadinostachya*		0	0.2	YCR4202	
Enneapogon lindleyanus		0	0.4		
Eragrostis elongata		0	0.2		
Eragrostis tenellula		0	0.2		
Eriachne mucronata		0	0.5		
Eucalyptus camaldulensis subsp. *obtusa*		10-25%	13		
Eucalyptus victrix		50-75%	10		
Eulalia aurea		25-33.3%	0.5		
Euphorbia coghlanii		0	0.4		
Fimbristylis microcarya	0.1		0.3	Yan12.02	
Flaveria trinervia		0	0.4		
Glycine canescens		0		Ycr13.02	
Gomphrena canescens subsp. *canescens*		0	0.2		

Goodenia lamprosperma		0	0.2	
Gossypium australe		0	0.6	
Gossypium robinsonii		0	3	
Grevillea wickhamii subsp. *hispidula*		0	3	
Heliotropium cunninghamii		0	0.2	
Isotropis sp. Arid zone (G. Byrne 2775)		0	0.4	YCR19-03
Jasminum didymum subsp. *lineare*		0	0.6	
Melaleuca bracteata		0	2	
Melaleuca glomerata		12	4.5	
Melinis repens		0	0.3	
Paspalidium clementii		0	0.4	
Phyllanthus baccatus		0	0.8	SCOpp-09
Phyllanthus maderaspatensis		0	0.3	
Pluchea dentex		0	0.3	Ycr10.04
Polycarpaea longiflora		0	0.3	
Pseudognaphalium luteoalbum		0	0.2	YCR16-06
Pterocaulon sphacelatum		0	0.3	
Ptilotus exaltatus		0	0.2	
Ptilotus gaudichaudii		0	0.4	
Rhodanthe margarethae		0	0.4	
Rumex vesicarius		0	0.5	
Santalum lanceolatum		0	1.4	
Setaria verticillata		0	0.3	
Sigesbeckia orientalis		0	0.3	Scopp.10
Sigesbeckia orientalis	0.1		0.3	Yan16.03
Sonchus oleraceus		0	0.5	
Sorghum plumosum		0	0.9	Ycr10.02
Stemodia grossa		0	0.4	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.6	
Themeda triandra		5-10%	0.8	
Tinospora smilacina		0		Ycr13.04
Trichodesma zeylanicum var. *zeylanicum*		0	0.5	
Triodia biflora		0	0.4	Ycr22.02
Triodia pungens		0	0.4	
Vachellia farnesiana		0	1.6	
Waltheria indica		0	0.3	

Yandi Creek — Site YCR-40

Date	12/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 722901 mE; 7474197 mN 119.171883 E -22.825146 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	CID
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Eulalia aurea*, *Themeda triandra* and *Cenchrus ciliaris* tussock grassland with mid open shrubland of *Cullen leucanthum*, *Atalaya hemiglauca* and *Acacia tumida* var. *pilbarensis*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*		0	2.1		
Acacia dictyophleba		0	2		
Acacia pruinocarpa		0	2		
Acacia pyrifolia var. *pyrifolia*		0	1.5		
Acacia tumida var. *pilbarensis*		1-5%	2.3		
Acrachne racemosa	0.1		0.5	YAN50	
Amaranthus undulatus	0.1		0.1		
Androcalva luteiflora		0	1.4		
Aristida holathera var. *holathera*	0.1		0.2		
Atalaya hemiglauca		1-5%	2.7		
Boerhavia coccinea	0.1		0.1	YAN51-03	
Bulbostylis barbata	0.1		0.1		
Cenchrus ciliaris		25-33.3%	0.5		
Chrysocephalum apiculatum subsp. *pilbarense*		0	0.2		
Cleome viscosa	0.1		0.2		
Corchorus tridens	0.1		0.1		
Corymbia hamersleyana					
Cullen leucanthum		1-5%	2.5		
Dodonaea viscosa subsp. *angustissima*		0	2		
Duperreya commixta		0			
Enneapogon lindleyanus		0	0.3		
Enneapogon polyphyllus	0.1		0.1		
Eragrostis cumingii	0.1		0.1	YAN40.01	
Eragrostis eriopoda		0	0.3		
Eriachne mucronata	0.1		0.3		
Eulalia aurea	0.1		0.4		
Euphorbia australis var. *subtomentosa*	0.1		0.1		
Euphorbia biconvexa	0.1		0.1		
Euphorbia tannensis subsp. *eremophila*		0	0.3		
Evolvulus alsinoides var. *decumbens*		0	0.1		
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Goodenia triodiophila		0	0.3	YCR40-02	
Gossypium australe		0	0.5		
Gossypium robinsonii		0	2		
Grevillea pyramidalis subsp. *leucadendron*		0	4		
Grevillea wickhamii subsp. *hispidula*		0	2		
Hakea lorea subsp. *lorea*		0	4		
Heliotropium cunninghamii	0.1		0.2		
Hibiscus sturtii var. *platychlamys*		0	0.3	YCR40-04	
Indigofera linnaei	0.1		0.1		
Jasminum didymum subsp. *lineare*		0	0.1		
Melhania oblongifolia	0.1		0.3	YAN40.04	
Paraneurachne muelleri	0.1		0.3		
Perotis rara	1		0.1		
Petalostylis labicheoides		0	2		

Polymeria ambigua	0.1		0.1	YAN40.02
Pterocaulon sphacelatum		0	0.3	
Ptilotus astrolasius		0	0.3	
Ptilotus auriculifolius	0.1		0.2	
Rhynchosia minima		0		
Senna artemisioides subsp. *helmsii*	0.1		0.5	
Senna artemisioides subsp. *oligophylla*		0	1	
Senna glutinosa subsp. *glutinosa*		0	1	
Setaria verticillata	0.1		0.3	
Sida ? fibulifera				YCR40-01
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		0	0.6	
Sonchus oleraceus	0.1		0.1	
Sorghum plumosum		0	1	
Stemodia grossa	0.1		0.1	
Streptoglossa bubakii		0	0.3	YCR40-03
Stylobasium spathulatum		0	1.1	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		0	0.4	
Themeda triandra		50-75%	0.6	
Tribulus hirsutus	0.1		0.1	
Triodia pungens		0	0.3	
Waltheria indica	0.1		0.2	

Yandi Creek — Site YCR-41

Date	9/09/2019
Described by	CvdB & SC
Type	Q 50m x 50m
Location	MGA Zone 50 718974 mE; 7473560 mN 119.133729 E -22.831411 S
Veg Condition	Very Good
Soil	Sand
Rock Type	Siltstone/ Mudstone
Fire Age	Moderate (3 to 5 yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Eriachne mucronata*, *Chrysopogon fallax* and *Eulalia aurea* open tussock grassland with *Androcalva luteiflora*, *Acacia tumida* var. *pilbarensis* and *Grevillea wickhamii* subsp. *hispidula* mid to tall sparse shrubland over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) low sparse shrubland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia bivenosa		<1 %	0.1		
Acacia dictyophleba		0	2.2		
Acacia monticola	0.1		1		
Acacia pruinocarpa	0.1		0.6		
Acacia pyrifolia var. *pyrifolia*		<1 %	1.6		
Acacia tumida var. *pilbarensis*		<1 %	1.6		
Alternanthera nana	0.1		0.1		
Amaranthus undulatus	0.1		0.1		
Androcalva luteiflora		25-33.3%	1.3		
Aristida holathera var. *holathera*	0.1		0.5		
Atalaya hemiglauca		0	1.2		
Boerhavia coccinea		0	0.2		
Bulbostylis barbata	0.1		0.1		
Cenchrus ciliaris		0	0.4		
Chrysopogon fallax		<1 %	0.7		
Cleome viscosa		0	0.2	Ycr41.08	
Cleome viscosa		0	0.3		
Corchorus incanus subsp. *incanus*		0	0.6	Ycr41.10	
Corchorus lasiocarpus subsp. *parvus*		0	0.6	Ycr41.12	
Corymbia hamersleyana		0	6		
Cymbopogon obtectus	0.1		0.4		
Dampiera candicans	0.1		0.4		
Duperreya commixta		0	0.1		
Enneapogon lindleyanus		0	0.6	Ycr41.14	
Eragrostis eriopoda		0	0.5	Ycr41.02	
Eriachne ? mucronata		15	0.5	Ycr41.01	
Eulalia aurea		<1 %	0.5		
Euphorbia australis var. *subtomentosa*		0	0.1	Ycr41.04	
Euphorbia coghlanii		0	0.4		
Euphorbia tannensis subsp. *eremophila*	0.1		0.3		
Evolvulus alsinoides var. *decumbens*		0	0.3		
Gomphrena canescens subsp. *canescens*		0	0.2		
Goodenia cusackiana	0.1		0.1		
Goodenia microptera		0	0.2		
Gossypium australe		0	1		
Gossypium robinsonii		0	1.2		
Grevillea wickhamii subsp. *hispidula*		<1 %	2		
Hakea chordophylla		0	1.5		
Hakea lorea subsp. *lorea*	0.1		2.5		
Heliotropium cunninghamii	0.1		0.2		
Heliotropium sp. Indet		0	0.2		
Hibiscus sturtii var. *platychlamys*	0.1		0.3	YAN41-06	
Hybanthus aurantiacus	0.1		0.1		

Indigofera monophylla		0	0.3	Ycr41.05
Ipomoea muelleri	0.1		0.1	
Isotropis sp. Arid zone (G. Byrne 2775)	0.1		0.1	
Isotropis sp. Indet		0	0.5	Ycr41.13
Melhania oblongifolia	0.1		0.2	YAN41-04
Paraneurachne muelleri		0	0.1	
Petalostylis labicheoides		0	1.5	
Phyllanthus maderaspatensis		0	0.4	
Pluchea dentex	0.1		0.3	YAN41-01
Pluchea sp. Indet		0	0.1	
Polycarpaea corymbosa	0.1		0.3	YAN41-02
Polycarpaea longiflora		0	0.1	
Polymeria mollis	0.1		0.1	YAN41-03
Portulaca oleracea	0.1		0.1	
Pterocaulon sphacelatum		0	0.3	Ycr41.06
Ptilotus astrolasius		0	0.4	
Ptilotus auriculifolius	0.1		0.1	
Ptilotus exaltatus		0	0.3	
Ptilotus fusiformis	0.1		0.1	
Rhynchosia minima	0.1		0.1	
Rumex vesicarius		0	0.3	
Salsola australis		<1 %	0.5	
Santalum lanceolatum		0	1.8	
Scaevola parvifolia subsp. *pilbarae*		0	0.2	
Senna artemisioides subsp. *oligophylla*		0	0.6	
Senna glutinosa subsp. *glutinosa*		0	1.3	
Senna notabilis	0.1		0.1	
Setaria verticillata	0.1		0.3	
Sida fibulifera		0	0.2	
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		0	0.6	Ycr41.11
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		1-5%	0.6	Ycr41.07
Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)	0.1		0.3	YAN41-05
Themeda triandra		<1 %	1	
Trachymene oleracea subsp. *oleracea*	0.1		0.4	
Trichodesma zeylanicum var. *zeylanicum*		0	0.6	
Trigastrotheca molluginea		0	0.1	
Triodia pungens		0	0.6	
Triodia vanleeuwenii	0.1		0.2	
Triumfetta clementii		0	0.3	Ycr41.09
Waltheria indica		0	0.3	Ycr41.03

Yandi Creek — Site YCR-42

Date	11/09/2019
Described by	CvdB & SC
Type	Q 100m x 25m
Location	MGA Zone 50 722083 mE; 7474290 mN 119.163907 E -22.824412 S
Veg Condition	Very Good
Soil	Sand
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	Mid woodland of *Eucalyptus camaldulensis* subsp. *obtusa* and *Melaleuca argentea* over *Cyperus vaginatus* open sedgeland with tall sparse shrubland of *Acacia tumida* var. *pilbarensis* and *Cullen leucanthum* over open grassland of *Eulalia aurea* and *Themeda triandra*
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*	0.1		3		
Acacia pyrifolia var. *pyrifolia*	0.1		0.7		
Acacia tumida var. *pilbarensis*	4		2.5		
Amaranthus undulatus	0.1		0.4		
Atalaya hemiglauca	0.1		0.9		
Brachychiton acuminatus				Opp	
Bulbostylis barbata	0.1		0.1		
Capparis spinosa subsp. *nummularia*	0.1		0.7		
Cenchrus ciliaris	0.1		0.5		
Centipeda minima subsp. *macrocephala*	0.1		0.1		
Chloris pectinata	0.1		0.6		
Cleome viscosa	1		0.3		
Conyza bonariensis	0.1		0.3		
Corchorus crozophorifolius	0.1		1.2		
Corchorus incanus subsp. *lithophilus*	0.1		0.4		
Corchorus incanus subsp. *lithophilus*	0.1		0.6		
Corchorus lasiocarpus	0.1		0.3		
Crotalaria medicaginea var. *neglecta*	0.1		0.1		
Cullen leucanthum	2		3		
Cymbopogon obtectus	2		0.8		
Cyperus vaginatus	4		1		
Dodonaea viscosa subsp. *angustissima*	0.1		0.3		
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1		0.1	YCR4202	
Eleocharis geniculata	0.1		0.1		
Eragrostis elongata	0.1		0.3		
Eragrostis tenellula	0.1		0.2		
Eriachne mucronata	0.1		0.5		
Eucalyptus camaldulensis subsp. *obtusa*	20		20		
Eucalyptus victrix	5		14		
Eulalia aurea	4		1		
Euphorbia biconvexa	0.1		0.1		
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Goodenia lamprosperma	0.1		0.1		
Gossypium robinsonii	1		2		
Hybanthus aurantiacus	0.1		0.1		
Melaleuca argentea	10		12		
Melaleuca glomerata	0.1		1.5		
Melinis repens	0.2		0.8		
Phyllanthus baccatus	0.2		1.5		
Phyllanthus maderaspatensis	0.1		0.3		
Pluchea dentex	0.2				

Pseudognaphalium luteoalbum	0.1	0.2	
Ptilotus exaltatus	0.1	0.1	
Rhodanthe margarethae	0.1	0.3	
Rhodanthe margarethae			YCR4201
Rhynchosia minima	0.1	0.1	
Setaria verticillata	0.1	0.3	
Sigesbeckia orientalis	0.1	0.3	
Sonchus oleraceus	0.1	0.1	
Sorghum plumosum	2	1	
Stemodia grossa	0.1	0.3	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.4	
Themeda triandra	1	0.8	
Tridax procumbens	0.1	0.1	
Triodia pungens	0.1	0.4	
Triodia wiseana	0.1	0.3	
Typha domingensis	1	2	
Vachellia farnesiana	0.1	0.5	
Vigna lanceolata	0.1		
Vincetoxicum flexuosum	0.1		YCR4204
Waltheria indica	0.1	0.4	

Ministers North Site MIN-30

Date	31/03/2020
Described by	CvdB & KG
Type	Q 100m x 25m
Location	MGA Zone 50 709781 mE; 7482276 mN 119.043020 E -22.753900 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	*Cenchrus ciliaris*, *Cenchrus setiger* and *Eulalia aurea* mid tussock grassland with *Eucalyptus victrix* mid to low sparse woodland over *Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* and *Atalaya hemiglauca* tall sparse shrubland.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Abutilon fraseri	0.1		0.2	MIN30.02	
Acacia bivenosa	0.1		1.2		
Acacia coriacea subsp. *pendens*	2		5		
Acacia maitlandii	0.1		0.9		
Acacia pyrifolia var. *pyrifolia*	0.1		0.6		
Alternanthera nana	0.1		0.2		
Alysicarpus muelleri	0.1		0.3		
Amaranthus undulatus	0.1		0.4		
Atalaya hemiglauca	0.1		5		
Bidens bipinnata	0.1		0.1		
Boerhavia coccinea	0.1		0.1		
Cenchrus ciliaris	20		0.6		
Cenchrus setiger	25		0.7		
Cleome viscosa	0.1		0.3		
Corchorus crozophorifolius	0.1		1.2		
Crotalaria medicaginea var. *neglecta*	0.1		0.3		
Cucumis variabilis	0.1				
Cymbopogon obtectus	0.1		0.3		
Cyperus vaginatus	0.1		0.5		
Duperreya commixta	0.1				
Enneapogon lindleyanus	0.1		0.4		
Eremophila longifolia	0.1		4		
Eriachne mucronata	0.1		0.4		
Eucalyptus victrix	3		11		
Eulalia aurea	0.1		0.7		
Euphorbia biconvexa	0.1		0.3	YAN11-03	
Euphorbia tannensis subsp. *eremophila*	0.1		0.2		
Evolvulus alsinoides var. *decumbens*	0.1		0.2		
Evolvulus alsinoides var. *villosicalyx*	0.1		0.1		
Glycine canescens	0.1				
Gomphrena canescens subsp. *canescens*	0.1		0.1		
Gomphrena canescens subsp. *canescens*	0.1		0.2	MIN30.04	
Gossypium australe	0.1		0.7		
Gossypium robinsonii	0.1		3		
Heliotropium cunninghamii	0.1		0.1	YAN	
Indigofera colutea	0.1		0.2		
Indigofera linifolia	0.1		0.2		
Jasminum didymum subsp. *lineare*	0.1				
Melaleuca glomerata	1		3		
Melhania oblongifolia	0.1		0.3	MIN30.01	
Phyllanthus maderaspatensis	0.1		0.2		
Pluchea dentex	0.1		0.2		
Polycarpaea longiflora	0.1		0.1		
Rhynchosia minima	0.1		0.1		

Rostellularia adscendens var. *latifolia*	0.1	0.2	MIN30.03
Salsola australis	0.1	0.4	
Senna artemisioides subsp. *helmsii*	0.1	0.3	
Senna artemisioides subsp. *oligophylla*	0.1	1.2	
Setaria verticillata	0.1	0.3	
Solanum lasiophyllum	0.1	0.4	
Sorghum plumosum	0.1	0.7	YAN
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	30	
Themeda triandra	1	0.8	
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.1	
Triodia wiseana	0.1	0.8	
Vachellia farnesiana	0.1	2	

Ministers North — Site MIN-31

Date	31/03/2020
Described by	CvdB & KG
Type	Q 50m x 50m
Location	MGA Zone 50 710783 mE; 7482834 mN 119.052700 E -22.748740 S
Veg Condition	Excellent
Soil	Sandy Loam
Rock Type	Shale
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana* hummock grassland with *Eucalyptus leucophloia* low sparse woodland over *Acacia hilliana*, *Grevillea wickhamii* and *Senna glutinosa* subsp. *glutinosa* mid to tall scattered shrubs.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia adoxa var. *adoxa*	0.1		0.8		
Acacia hilliana	0.1		0.8		
Acacia maitlandii	0.1		1.8		
Acacia pruinocarpa	0.1		1.5		
Cleome viscosa	0.1		0.4		
Cymbopogon obtectus	0.1		0.4		
Eriachne lanata	0.1		0.3	MIN31.03	
Eriachne mucronata	0.1		0.3	MIN31.04	
Eriachne pulchella subsp. *dominii*	0.1		0.1	MIN31.01	
Eucalyptus leucophloia subsp. *leucophloia*	4		7		
Fimbristylis simulans	0.1		0.1	MIN31.02	
Goodenia triodiophila	0.1		0.3		
Grevillea wickhamii subsp. *hispidula*	0.1		2.2	MIN31.06	
Paspalidium clementii	0.1		0.1	MIN31.05	
Ptilotus calostachyus	0.1		0.1		
Senna artemisioides subsp. *oligophylla*	0.1		0.8		
Senna glutinosa subsp. *glutinosa*	0.1		1.8		
Solanum lasiophyllum	0.1		0.4		
Triodia wiseana	40		0.5		

Ministers North — Site MIN-32

Date	31/03/2020
Described by	CvdB & KG
Type	R
Location	MGA Zone 50 711543 mE; 7482958 mN 119.060080 E -22.747520 S
Veg Condition	Good
Soil	Sandy Loam
Rock Type	CID
Fire Age	Recent (0 to 2 yr)
Habitat	Medium Drainage Line
Vegetation	*Eucalyptus camaldulensis* and *Eucalyptus victrix* low sparse woodland over *Cenchrus ciliaris*, *Themeda triandra* and *Eriachne mucronata* mid to low sparse tussock grassland with *Tephrosia rosea* var Fortescue Creeks (M.I.H. Brooker 2186) and fire ephemeral low scattered shrubs.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia coriacea subsp. *pendens*					
Aerva javanica					
Alysicarpus muelleri					
Boerhavia coccinea					
Cenchrus ciliaris					
Cleome viscosa					
Crotalaria medicaginea var. *neglecta*					
Cymbopogon obtectus					
Cyperus vaginatus					
Enneapogon lindleyanus				Ycr	
Eragrostis eriopoda					
Eriachne mucronata					
Eucalyptus camaldulensis subsp. *obtusa*					
Eucalyptus victrix					
Eulalia aurea					
Euphorbia biconvexa				Yan11-03	
Evolvulus alsinoides var. *villosicalyx*					
Goodenia muelleriana				Yan02.03	
Gossypium australe					
Hybanthus aurantiacus					
Indigofera colutea					
Indigofera linifolia					
Indigofera rugosa					
Melaleuca glomerata					
Phyllanthus maderaspatensis					
Polycarpaea longiflora					
Rhynchosia minima					
Senna notabilis					
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)					
Themeda triandra					
Trichodesma zeylanicum var. *zeylanicum*					

Ministers North — Site MIN-33

Date	31/03/2020
Described by	CvdB & KG
Type	R
Location	MGA Zone 50 712119 mE; 7483181 mN 119.065660 E -22.745440 S
Veg Condition	Very Good
Soil	Sandy Loam
Rock Type	BIF
Fire Age	Recent (0 to 2 yr)
Habitat	Breakaway
Vegetation	*Eucalyptus leucophloia* subsp. *leucophloia* low scattered trees over *Triodia wiseana* low scattered hummock grasses with *Eriachne ciliata* low scattered tussock grasses.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia adoxa var. *adoxa*					
Acacia pruinocarpa					
Amphipogon sericeus				MIN33.01	
Cleome viscosa					
Dampiera candicans					
Eriachne aristidea					
Eriachne lanata					
Eucalyptus leucophloia subsp. *leucophloia*					
Goodenia stobbsiana					
Hakea chordophylla					
Heliotropium inexplicitum				MIN33.02	
Ptilotus calostachyus					
Senna glutinosa subsp. *glutinosa*					
Senna glutinosa subsp. *pruinosa*					
Themeda triandra					
Triodia wiseana					

Ministers North — Site MIN-34

Date	31/03/2020
Described by	CvdB & KG
Type	Q 50m x 50m
Location	MGA Zone 50 710116 mE; 7482378 mN 119.046270 E -22.752940 S
Veg Condition	Excellent
Soil	Sandy Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Hillcrest/ Upper Hillslope
Vegetation	*Triodia wiseana* mid hummock grassland with *Eucalyptus leucophloia* subsp. *leucophloia* low sparse woodland over *Acacia hilliana*, *Acacia adoxa* var. *adoxa* and *Senna glutinosa* subsp. *glutinosa* low to mid scattered shrubs.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia adoxa var. *adoxa*	0.1		0.4		
Acacia hilliana	1		1.2		
Cleome viscosa	0.1		0.3		
Codonocarpus cotinifolius	0.1		1.3		
Eriachne lanata	0.1		0.3	MIN31.03	
Eriachne mucronata	0.1		0.3	MIN31.04	
Eucalyptus leucophloia subsp. *leucophloia*	2		7		
Goodenia stobbsiana	0.1		0.3		
Grevillea wickhamii subsp. *hispidula*	0.1		0.9	MIN31.06	
Hakea lorea subsp. *lorea*	0.1		1.8		
Ptilotus calostachyus	0.1		0.2		
Ptilotus rotundifolius	0.1		1		
Senna artemisioides subsp. *oligophylla*	0.1		0.3		
Senna glutinosa subsp. *glutinosa*	0.1		1.5		
Senna glutinosa subsp. *pruinosa*	0.1		1.6		
Solanum lasiophyllum	0.1		0.3		
Themeda triandra	0.1		0.4		
Triodia wiseana	0.6		45		

Ministers North — Site MIN-35

Date	31/03/2020
Described by	CvdB & KG
Type	R
Location	MGA Zone 50 711746 mE; 7483628 mN 119.061970 E -22.741450 S
Veg Condition	Very Good
Soil	Sandy Loam
Rock Type	Dolerite
Fire Age	Recent (0 to 2 yr)
Habitat	Hillcrest/ Upper Hillslope
Vegetation	*Triodia wiseana* sparse hummock grassland with *Senna* spp.
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia tetragonophylla					
Bulbostylis barbata					
Cleome viscosa					
Eriachne pulchella subsp. *dominii*				MIN31.01	
Gossypium australe					
Ptilotus exaltatus					
Senna artemisioides subsp. *oligophylla*					
Senna glutinosa subsp. *glutinosa*					
Senna glutinosa subsp. *pruinosa*					
Triodia wiseana					

Ministers North — Site MIN-41

Date	31/03/2020
Described by	CvdB & KG
Type	R
Location	MGA Zone 50 710983 mE; 7483375 mN 119.054570 E -22.743830 S
Veg Condition	Good
Soil	Loamy Sand
Rock Type	CID
Fire Age	Recent (0 to 2 yr)
Habitat	Medium Drainage Line
Vegetation	*Eulalia aurea*, *Cenchrus ciliaris* and *Themeda triandra* mid open tussock grassland with *Eucalyptus victrix* mid to low scattered trees over shrubs
Notes	

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia dictyophleba					
Aristida holathera var. *holathera*				MIN41.01	
Cenchrus ciliaris					
Cyperus vaginatus					
Malvastrum americanum					
Rhynchosia minima					
Senna artemisioides subsp. × *artemisioides*					
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)					

Appendix D: Vegetation Structure Definition

Vegetation classification for the Pilbara (based on Specht (1970) as modified by Aplin (1979) and Trudgen (2002))

Height Class	Canopy Cover				
	100-70%	70-30%	30-10%	10-2%	<2%
Trees > 30 m	High Closed Forest	High Open Forest	High Woodland	High Open Woodland	Scattered Tall Trees
Trees 10-30 m	Closed Forest	Open Forest	Woodland	Open Woodland	Scattered Trees
Trees < 10 m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland	Scattered Low Trees
Mallee	Closed Mallee	Mallee	Open Mallee	Very Open Mallee	Scattered Mallee
Shrubs > 2 m	Closed Scrub	Open Scrub	High Shrubland	High Open Shrubland	Scattered Tall Shrubs
Shrubs 1-2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland	Scattered Shrubs
Shrubs < 1 m	Low Closed Heath	Low Open Heath	Low Shrubland	Low Open Shrubland	Scattered Low Shrubs
Hummock Grass	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Very Open Hummock Grassland	Scattered Hummock Grasses
Tussock Grass	Closed Tussock Grassland	Tussock Grassland	Open Tussock Grassland	Very Open Tussock Grassland	Scattered Tussock Grasses
Bunch Grass	Closed Bunch Grassland	Bunch Grassland	Open Bunch Grassland	Very Open Bunch Grassland	Scattered Bunch Grasses
Sedges	Closed Sedges	Sedge	Open Sedges	Very Open Sedges	Scattered Sedges
Herbs	Closed Herbs	Herbs	Open Herbs	Very Open Herbs	Scattered Herbs

Appendix E: Vegetation Condition Definition

Vegetation Condition Scale (adapted from Keighery (1994) and Trudgen (2002))

Condition Scale	Description
Excellent (1)	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement
Very Good (2)	Some relatively slight signs of damage caused by human activities since European settlement. For example, some sings of damage to tree trunks cause by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good (3)	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor (4)	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded (5)	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded (6)	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or ‘parkland cleared’ with their flora comprising weed or crop species with isolated native trees or shrubs.

Appendix F: Key Findings from the Literature Review

Study details	Methods	Results	Significant findings	Limitations
Astron (2010b) **Client**: BHP Billiton Iron Ore **Type**: Single season [6]Level 2 Flora and Vegetation Survey and Level 1 Fauna Assessment **Location**: Packsaddle West, BHP Pilbara tenure **Timing**: Survey completed in March and April 2010	• 120 detailed floristic sampling sites • 8 relevés	• 283 flora species • 48 families • 106 genera • Four weed taxa • 27 vegetation associations	• *Aristida jerichoensis* var. *subspinulifera* (P1, now P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Eremophila magnifica* subsp. *magnifica* (P4)	• Timing of field survey
Astron (2010a) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Area C to Yandi, BHP Pilbara tenure **Timing**: September 2010	• 20 detailed floristic sampling sites • 7 relevés	• 91 flora species • 20 families • 43 genera • 13 vegetation associations from five broad floristic formations	• *Acacia bromilowiana* (P4)	• Timing of field survey
Astron (2011) **Client**: BHP Billiton Iron Ore **Type**: Two phase Level 2 Flora and Vegetation Survey **Location**: Coondewanna Flats **Timing**: May 2011	• 40 detailed floristic sampling sites • 3 relevés	• 308 flora species • 48 families • 132 genera • Six weed taxa • 17 vegetation associations	• *Aristida jerichoensis* var. *subspinulifera* (P1, now P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Acacia bromilowiana* (P4) • *Goodenia nuda* (P4) • Presence of two sub-types of Coolibah-lignum flats: ○ 528 ha of Coolibah (*Eucalyptus victrix*) woodland over Lignum (*Muehlenbeckia florulenta*) over Swamp Wandiree (*Eriachne benthamii*) (P1) ○ 2,293 ha of Coolibah (*Eucalyptus victrix*) and Mulga (*Acacia aneura*) woodland over Lignum (*Muehlenbeckia florulenta*) and tussock grasses on clay plains (P3)	• None

[6] Level 2 flora and vegetation surveys are now referred to as “Detailed Surveys”

Study details	Methods	Results	Significant findings	Limitations
Biota (2002) **Client**: BHP Billiton Iron Ore **Type**: Targeted Survey **Location**: Mining Area C Rail Corridor, BHP Pilbara tenure **Timing**: February 2002	• Traversed transects along proposed rail alignment	• Three Priority flora species • One undescribed flora species	• [7]*Triodia biflora* (P2) • [8]*Themeda* sp. Mt Barricade (M.E. Trudgen 2471) (P3) • [9]*Triumfetta leptacantha* (P3)	• Limited survey area (rail corridor centreline and up to 100 m either side) • Timing of field survey • Limited access in some areas (e.g. Cliff faces of Yandi Creek)
Biota (2003) **Client**: BHP Billiton Iron Ore **Type**: Targeted Survey (2nd phase) **Location**: Mining Area C Rail Corridor Access Tracks and Borrow pits, BHP Pilbara tenure **Timing**: February 2003	• Traversed transects along proposed rail alignment	• Five Priority flora species	• [10]*Triodia biflora* (P2) • [11]*Eriachne tenuiculmis* (P3) • [12]*Themeda* sp. Mt Barricade (M.E. Trudgen 2471) (P3) • [13]*Triumfetta leptacantha* (P3) • [14]*Goodenia stellata* (P4)	• Limited survey area (rail corridor centreline and up to 100 m either side) • Limited access in some areas (e.g. Cliff faces of Yandi Creek)

[7] *Triodia biflora* is no longer listed as a Priority flora species.
[8] *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) is no longer listed as a Priority flora species.
[9] *Triumfetta leptacantha* is no longer listed as a Priority flora species.
[10] *Triodia biflora* is no longer listed as a Priority flora species.
[11] *Eriachne tenuiculmis* is no longer listed as a Priority flora species.
[12] *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) is no longer listed as a Priority flora species.
[13] *Triumfetta leptacantha* is no longer listed as a Priority flora species.
[14] *Goodenia stellata* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
Biota (2012) **Client**: BHP Billiton Iron Ore **Type**: Level 2 Flora and Vegetation Survey **Location**: South Flank to Jindi **Timing**: March, April and August 2011	• 47 detailed floristic sampling sites • 8 relevés	• 453 flora species • 52 families • 169 genera • 15 weed taxa • Two fungi and one liverwort • 35 vegetation associations from 12 broad floristic formations	• [15]Lepidium catapycnon (Vulnerable) • [16]Grevillea sp. Turee (J. Bull & G. Hopkinson ONS JJ 01.01) (P1) • Acacia subtiliformis (P3) • Goodenia lyrata (P3) • Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (P3) • Rostellularia adscendens var. latifolia (P3) • Eremophila magnifica subsp. magnifica (P4) • Goodenia nuda (P4) • Ptilotus mollis (P4)	• Entire study area not systematically traversed
Ecologia (1998) **Client**: BHP Billiton Iron Ore **Type**: Detailed Biological Survey **Location**: Mining Area C **Timing**: April and May 1997	• 132 detailed floristic sampling sites • 29 traversed transects	• 422 flora species • 53 families • 161 genera • Six weed taxa • 17 vegetation associations	• [17]*Triumfetta leptacantha* (P3) • [18]*Triumfetta maconochieana* (P3) • [19]*Brachychiton acuminatus* (P4) • *Eremophila magnifica* subsp. *magnifica* (P4)	• Limited access
ecologia (2001) **Client**: BHP Billiton Iron Ore **Type**: Weed Survey **Location**: Mining Area C to Yandi Rail Line **Timing**: October 2001	• Traversed transects	• Two weed taxa	• None	• None

[15] *Lepidium catapycnon* is no longer listed as a Threatened flora species. It is now listed as Priority 4.
[16] *Grevillea* sp. Turee is now known as *Grevillea Saxicola,* and is now listed as a Priority 3 flora species..
[17] *Triumfetta leptacantha* is no longer listed as a Priority flora species.
[18] *Triumfetta maconochieana* is no longer listed as a Priority flora species.
[19] *Brachychiton acuminatus* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
ecologia (2002) **Client**: BHP Billiton Iron Ore **Type**: Targeted Survey **Location**: Mining Area C Packsaddle Village and Access Road **Timing**: June 2002	• Traversed transects	• Two Priority 4 taxa	• [20]*Eucalyptus pilbarensis* (P4) • [21]*Goodenia stellata* (P4)	• None
Ecologia (2004a) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Fauna Survey **Location**: Area C: Deposits D, E and F **Timing**: November 2004	• 35 detailed floristic sampling sites	• 181 flora species • 37 families • 86 genera • 8 vegetation associations	• [22]*Olearia fluvialis* (P2) • [23]*Triumfetta leptacantha* (P3)	• None
Ecologia (2004b) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Fauna Survey **Location**: Area C Packsaddle Range **Timing**: April and May 2004	• 52 detailed floristic sampling sites • Traversed transects	• 215 flora species • 42 families • 102 genera • 2 weed taxa • 7 vegetation associations	• [24]*Euphorbia drummondii* subsp. Pilbara (B.G. Thomson 3503) (P2) • [25]*Themeda* sp. Mt Barricade (M.E. Trudgen 2471) (P3) • [26]*Triumfetta leptacantha* (P3)	• None
Ecologia (2005) **Client**: BHP Billiton Iron Ore **Type**: Targeted Survey **Location**: Packsaddle Wastewater Treatment Plant **Timing**: August 2005	• Traversed transects	• One weed taxon	• None	• None

[20] *Eucalyptus pilbarensis* is no longer listed as a Priority flora species.
[21] *Goodenia stellata* is no longer listed as a Priority flora species.
[22] *Olearia fluvialis* is no longer listed as a Priority flora species.
[23] *Triumfetta leptacantha* is no longer listed as a Priority flora species.
[24] *Euphorbia drummondii* subsp. Pilbara (B.G. Thomson 3503) has formally changed to *Euphorbia inappendiculata*, which has since been divided into two variants; *Euphorbia inappendiculata* var. *inappendiculata* (P2) and *Euphorbia inappendiculata* var. *queenslandica* (P1)
[25] *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) is no longer listed as a Priority flora species.
[26] *Triumfetta leptacantha* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
Ecologia (2009) **Client**: BHP Billiton Iron Ore **Type**: Two phase Level 2 Flora and Vegetation Survey **Location**: Jinayri Project Area **Timing**: October to November 2005 and March 2006	• 48 detailed floristic sampling sites • Traversed	• 342 flora species • 49 families • 128 genera • 4 weed taxa	• [27]*Tephrosia* sp. Pilbara Ranges (S. van Leeuwen 4246) (P3)	• None
ENV (2007) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Area C R-Deposit **Timing**: September 2006	• 72 detailed floristic sampling sites	• 231 flora species • 45 families • 101 genera • 2 weed taxa • 9 vegetation associations	• [28]*Triumfetta leptacantha* (P3) • *Eremophila magnifica* subsp. *magnifica* (P4)	• None
ENV (2008a) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Fork South and Parallel Ridge Exploration Lease **Timing**: August 2007	• 52 detailed floristic sampling sites • Traversed transects	Fork South: • 326 flora species • 50 families • 139 genera • 18 vegetation associations Parallel Ridge: • 282 flora species • 47 families • 121 genera • 12 vegetation associations Both: • 6 weed taxa	Fork South: • [29]*Triumfetta leptacantha* (P3) • *Sida* sp. Barlee Range (ME Trudgen 12739) (P3) • *Triodia* sp. Mt. Ella (ME Trudgen 12739) (P3) • *Eremophila magnifica* subsp. *magnifica* (P4) Parallel Ridge: • *Eremophila magnifica* subsp. *magnifica* (P4)	• None

[27] *Tephrosia* sp. Pilbara Ranges (S. van Leeuwen 4246) is now known as *Tephrosia oxalidea*, and is no longer listed as a Priority flora species.
[28] *Triumfetta leptacantha* is no longer listed as a Priority flora species.
[29] *Triumfetta leptacantha* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
ENV (2008b) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Area C South Flank **Timing**: December 2007	• 109 detailed floristic sampling sites	• 328 flora species • 53 families • 137 genera • 3 weed taxa • 29 vegetation associations in eight landform categories	• [30]*Spartothamnella puberula* (P2) • *Sida* sp. Barlee Range (ME Trudgen 12739) (P3) • [31]*Triumfetta leptacantha* (P3) • *Eremophila magnifica* subsp. *magnifica* (P4)	• None
ENV (2009b) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Yandi Western 2 and Western 1 Waste Dump **Timing**: September 2007	• 16 detailed floristic sampling sites	• 328 flora species • 36 families • 76 genera • 3 weed taxa • 9 vegetation associations	• *Rostellularia adscendens* var. *latifolia* (P3)	• None
ENV (2010c) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey and Targeted Survey **Location**: Jinayri to Area C Access Corridor **Timing**: March 2009	• 42 detailed floristic sampling sites • 3 relevés • Traversed transects	• 293 flora species • 43 families • 114 genera • 5 weed taxa • 10 vegetation associations	• *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3) • *Acacia subtiliformis* (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • Priority 1 Weeli Wolli Spring PEC	• None
ENV (2010d) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation and Level 1 Fauna Assessment **Location**: South Flank NVCP Extension **Timing**: November 2009	• 41 detailed floristic sampling sites • 1 relevés	• 222 flora species • 36 families • 95 genera • 2 weed taxa • 14 vegetation associations	• *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3)	• None

[30] *Spartothamnella puberula* is no longer considered to occur in Western Australia
[31] *Triumfetta leptacantha* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
ENV (2010c) **(ENV, 2010b)** **Client**: BHP Billiton Iron Ore **Type**: Level 2 Flora and Vegetation Survey **Location**: Jinayri Mining Lease **Timing**: March 2008	• 328 detailed floristic sampling sites • 14 relevés	• 371 flora species • 47 families • 142 genera • 14 vegetation associations and 3 broad floristic formations • 8 weed taxa	• *Goodenia* sp. East Pilbara (AA Mitchell PRP 727) (P1; now P3) • *Rhagodia* sp.Hamersley (M. Trudgen 17794) (P3) • *Goodenia nuda* (P3; now P4) • [32]*Indigofera gilesii* subsp. *gilesii* (P3)	• None
ENV (2010d) **Client**: BHP Billiton Iron Ore **Type**: Level 2 Flora and Vegetation **Location**: Area C West NVCP project area **Timing**: March 2010	• 248 detailed floristic sampling sites • Relevés	• 526 flora species • 53 families • 171 genera • Eight weed taxa • Ten vegetation associations	• *Eremophila magnifica* subsp. *magnifica* (P4) • *Eremophila magnifica* subsp. *velutina* (P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) • *Triodia* sp. Mt Ella (ME Trudgen 12739) (P3)	• None
HGM (1997) **Client**: BHP Billiton Iron Ore **Type**: Targeted Survey **Location**: Yandi – Marillana Creek **Timing**: May 1997	• Traversed transects	• [33]*Goodenia stellata* (P2)	• Over 5000 individuals of *Goodenia stellata* (P2)	• None
HGM (1999) **Client**: BHP Billiton Iron Ore **Type**: Single season Biological Survey **Location**: Marillana Creek Western Access Corridor **Timing**: April 1999	• 22 detailed floristic sampling sites • Traversed transects	• 195 flora species • 40 families • 98 genera • 2 weed taxa • 25 vegetation associations	• [34]*Goodenia stellata* (P2)	• None

[32] *Indigofera gilesii* subsp. *gilesii* is now known as *Indigofera gilesii*
[33] *Goodenia stellata* is no longer listed as a Priority flora species.
[34] *Goodenia stellata* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
Maunsell (2003) **Client**: BHP Billiton Iron Ore **Type**: Flora and Fauna Targeted Survey **Location**: Yandi Mine **Timing**: September 2003	• Traversed transects	• One priority 2 taxon • One priority 4 taxon • 2 weed taxa	• [35]*Olearia fluvialis* (P2) • [36]*Goodenia stellata* (P4)	• None
Maunsell (2004) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Lease M47/292 and E4 Drill Lines **Timing**: December 2003	• Revisited sites	• 7 previously recorded vegetation associations	• [37]*Olearia fluvialis* (P2)	• None

[35] *Olearia fluvialis* is no longer listed as a Priority flora species.
[36] *Goodenia stellata* is no longer listed as a Priority flora species.
[37] *Olearia fluvialis* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
Onshore (2011) **Client**: BHP Billiton Iron Ore **Type**: Two season Level 2 Flora and Vegetation Survey **Location**: Area C and Surrounds **Timing**: November 2009 – June 2010	• 510 detailed floristic sampling sites • Traversed transects	Northern area: • 206 flora species • 45 families • 97 genera Southern area: • 219 flora species • 36 families • 99 genera Both: • 10 weed taxa • 37 vegetation associations	• [38]*Lepidium catapycnon* (T) • *Aristida jerichoensis* subsp. *subspinulifera* (P1, now P3) • *Aristida lazaridis* (P2) • [39]*Spartothamnella puberula* (P2) • *Stylidium weeliwolli* (P2, now P3) • *Vittadinia* sp. Coondewanna Flats (S. van Leeuwen 4684) (P2, now P1) • *Acacia subtiliformis* (P3) • [40]*Euphorbia inappendiculata* (P3) • *Fimbristylis sieberiana* (P3) • *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3) • *Nicotiana umbratica* (P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) • *Eremophila magnifica* subsp. *magnifica* (P4) • *Goodenia nuda* (P4) • Minor range extensions for 12 flora taxa • Presence of Priority 1 PEC Weeli Wolli Spring Community	• None

[38] *Lepidium catapycnon* is no longer listed as a Threatened flora species. It is now listed as Priority 4.

[39] *Spartothamnella puberula* is no longer considered to occur in Western Australia

[40] *Euphorbia inappendiculata* is no longer listed as a Priority flora species. It has since been divided into two variants of *Euphorbia inappendiculata*; *Euphorbia inappendiculata* var. *inappendiculata* (P2) and *Euphorbia inappendiculata* var. *queenslandica* (P1)

Study details	Methods	Results	Significant findings	Limitations
Onshore and Biologic (2011) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation and Level 1 Fauna Assessment **Location**: Camp Hill Exploration Leases **Timing**: August 2010	• 138 detailed floristic sampling sites	• 304 flora species • 49 families • 126 genera • 7 weed taxa • 28 vegetation associations	• [41]*Lepidium catapycnon* (T) • *Aristida jerichoensis* subsp. *subspinulifera* (P1, now P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Triodia* sp. Mt. Ella (ME Trudgen 12739) (P3) • *Acacia bromilowiana* (P4) • *Eremophila magnifica* subsp. *magnifica* (P4)	• None

[41] *Lepidium catapycnon* is no longer listed as a Threatened flora species. It is now listed as Priority 4.

Study details	Methods	Results	Significant findings	Limitations
Onshore (2012) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: South Flank **Timing**: 2011	• 220 detailed floristic sampling sites • Traversed transects	• 386 flora species • 50 families • 160 genera • 8 weed taxa • 34 vegetation associations	• [42]*Lepidium catapycnon* (T) • *Aristida jerichoensis* subsp. *subspinulifera* (P1, now P3) • *Aristida lazaridis* (P2) • *Pilbara trudgenii* (P2, now P3) • [43]*Spartothamnella puberula* (P2) • *Dampiera metallorum* (P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) • *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3) • *Triodia* sp. Mt. Ella (ME Trudgen 12739) (P3) • *Acacia bromilowiana* (P4) • *Eremophila magnifica* subsp. *magnifica* (P4) • *Ptilotus mollis* (P4) • Presence of two sub-types of Coolibah-lignum flats: ○ Coolibah (*Eucalyptus victrix*) woodland over Lignum (*Muehlenbeckia florulenta*) over Swamp Wandiree (*Eriachne benthamii*) (P1) ○ Coolibah (*Eucalyptus victrix*) and Mulga (*Acacia aneura*) woodland over Lignum (*Muehlenbeckia florulenta*) and tussock grasses on clay plains (P3)	• None

[42] *Lepidium catapycnon* is no longer listed as a Threatened flora species. It is now listed as Priority 4.
[43] *Spartothamnella puberula* is no longer considered to occur in Western Australia

Study details	Methods	Results	Significant findings	Limitations
Onshore (2013) **Client**: BHP Billiton Iron Ore **Type**: Two season Level 2 Flora and Vegetation Survey **Location**: Tandanya **Timing**: August and October 2011, May and June 2012	• 574 detailed floristic sampling sites • Relevés where necessary	• 587 flora species • 59 families • 201 genera • 16 weed taxa • 37 vegetation associations	• [44]*Lepidium catapycnon* (T) • *Triodia* sp. Karijini (S. van Leeuwen 4111) (P1) • *Aristida jerichoensis* subsp. *subspinulifera* (P1, now P3) • *Aristida lazaridis* (P2) • [45]*Brachyscome* sp. Wanna Munna Flats (S. van Leeuwen 4662) (P1) • *Oxalis* sp. Pilbara (M.E. trudgen 12725) (P2) • *Pilbara trudgenii* (P2, now P3) • [46]*Spartothamnella puberula* (P2) • *Dampiera metallorum* (P3) • *Eremophila magnifica* subsp. *velutina* (P3) • *Goodenia lyrata* (P3) • [47]*Indigofera* sp. Gilesii (M.E. Trudgen 15869) (P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) • [48]*Swainsona* sp. Hamersley Station (A.A. Mitchell 196) (P3) • *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3) • *Triodia* sp. Mt. Ella (ME Trudgen 12739) (P3) • *Acacia bromilowiana* (P4) • *Eremophila magnifica* subsp. *magnifica* (P4) • Presence of two sub-types of Coolibah-lignum flats: ○ Coolibah (*Eucalyptus victrix*) woodland over Lignum (*Muehlenbeckia florulenta*) over Swamp Wandiree (*Eriachne benthamii*) (P1) ○ Coolibah (*Eucalyptus victrix*) and Mulga (*Acacia aneura*) woodland over Lignum (*Muehlenbeckia florulenta*) and tussock grasses on clay plains (P3)	• None

[44] *Lepidium catapycnon* is no longer listed as a Threatened flora species. It is now listed as Priority 4.

Study details	Methods	Results	Significant findings	Limitations
Onshore (2014b) **Client**: BHP Billiton Iron Ore **Type**: Two season Level 2 Flora and Vegetation Survey **Location**: Area C West to Yandi **Timing**: May to June 2011, August 2012, August 2013	• 170 detailed floristic sampling sites • Relevés where necessary	• 428 flora species • 58 families • 174 genera • 12 weed taxa • 23 vegetation associations	• *Aristida jerichoensis* subsp. *subspinulifera* (P1, now P3) • [49]*Sauropus* sp. Koodaideri detritals (J. Naaykens & J. Hurter JH 11213) (P1) • *Vittadinia* sp. Coondewanna Flats (s. Van Leeuwen 4684) (P1) • [50]*Spartothamnella puberula* (P2) • *Acacia effusa* (P3) • *Acacia subtiliformis* (P3) • *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3) • *Gymnanthera cunninghamii* (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) • *Acacia bromilowiana* (P4) • *Goodenia nuda* (P4) • *Rhynchosia bungarensis* (P4)	• None

[45] *Brachyscome* sp. Wanna Munna Flats (S. van Leeuwen 4662) has formally changed to *Roebuckiella similis*, which is no longer listed as a Priotiy flora species.
[46] *Spartothamnella puberula* is no longer considered to occur in Western Australia.
[47] *Indigofera* sp. Gilesii (M.E. Trudgen 15869) has formally changed to *Indigofera gilesii*, which is still listed as a Priotiy 3 flora species.
[48] *Swainsona* sp. Hamersley Station (A.A. Mitchell 196) has formally changed to *Swainsona thompsoniana*, which is still listed as a Priotiy 3 flora species.
[49] *Sauropus* sp. Koodaideri detritals (J. Naaykens & J. Hurter JH 11213) has formally changed to *Synostemon hamersleyensis*, which is still listed as a Priotiy 1 flora species.
[50] *Spartothamnella puberula* is no longer considered to occur in Western Australia.

Study details	Methods	Results	Significant findings	Limitations
Onshore (2014a) **Client**: BHP Billiton Iron Ore **Type**: Mapping Consolidation **Location**: BHP Pilbara tenure **Timing**: Mapping consolidation completed in 2015. Additional field surveys completed in July and August 2013	A combination of: • Review of historical surveys; • Field surveys to fill 'gaps'; • Consolidation of vegetation mapping; • Review significant plant taxa; • Review of introduced weed taxa; • Consolidation of vegetation condition mapping; and Review and consolidation of raw and spatial data/	• 15 landform types described and mapped 218 vegetation associations classified under 53 broad floristic formations	• Themeda grasslands on cracking clay TEC present. • Six PECs represented in the Study Area • 57 significant plant taxa including one threatened 14 P1, 11 P2, 26 P3, and four P4. • 56 introduced weed taxa, including seven recognised as Declared Plant Pests under the BAM Act. • Three introduced weed taxa are listed as WoNS (**Jatropha gossypifolia, *Parkinsonia aculeata* and **Tamarix aphylla*).	• Timing of historical field surveys. • Detail in raw data lacking. • Variability in scope and resources for previous baseline surveys. • Variability in completeness of raw data. • Vegetation classification variable. • Vegetation mapping linework and overlapping datasets. • Mis-identification of keystone plant taxa. • Gaps in vegetation datasets

Study details	Methods	Results	Significant findings	Limitations
Onshore (2015b) **Client:** BHP Billiton Iron Ore **Type:** Targeted Survey **Location:** Karajini National Park Tenement E470015 **Timing:** November 2014	Targeted searches	• One Threatened Flora • 7 Priority Flora Taxa • 12 vegetation associations and seven broad floristic formations	• [51]*Lepidium catapycnon* (T) • *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) (P2) • *Pilbara trudgenii* (P2) • *Grevillea saxicola* (P3) • *Rhagodia* sp. Hamersley (M.Trudgen 17794) (P3) • *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) • *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3) • *Olearia mucronata* (P3).	• None
Onshore (2015a) **Client:** BHP Billiton Iron Ore **Type:** Targeted Flora Survey **Location:** Fortescue Marsh Tenements **Timing:** May 2015	Targeted searches	• 5 Priority Flora	• *Eremophila spongiocarpa* (P1) • *Teucrium pilbaranum* (P1) • *Stackhousia clementii* (P3) • *Eremophila youngii* subsp. *lepidota* (P4) • *Goodenia nuda* (P4)	• None
Onshore (2015c) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey, Riparian Vegetation Monitoring **Location**: Marillana Creek **Timing**: June 2015	• 40 detailed floristic sampling sites • 237 relevé sites Riparian Vegetation Monitoring: • 5 belt traversed transects	• 399 flora species • 58 families • 186 genera • 22 weed taxa • 22 vegetation associations Riparian Vegetation Monitoring: • 70 flora species • 59 families • 11 weed taxa • 22 vegetation associations	• *Aristida lazaridis* (P2) • *Ipomoea racemigera* (P2) • *Amaranthus centralis (P3)* • *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • *Goodenia nuda* (P4)	• None

[51] *Lepidium catapycnon* is no longer listed as a Threatened flora species. It is now listed as Priority 4.

Study details	Methods	Results	Significant findings	Limitations
Onshore (2016a) **Client:** BHP Billiton Iron Ore **Type:** Single season Level 2 Flora and Vegetation Survey **Location:** Fortescue Valley Tenements **Timing:** October 2016	• 70 detailed floristic sampling sites • 100 relevé sites • Targeted Searches	• 300 flora species • 44 families • 131 genera • Nine weed taxa • 16 vegetation associations	• *Atriplex flabelliformis* (P3) • *Calotis squamigera* (P1) • *Eremophila spongiocarpa* (P1) • *Eremophila youngii* subsp. *lepidota* (P4) • *Goodenia nuda* (P4) • *Nicotiana heterantha* (P1) • *Samolus* sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702) (P1) • *Tecticornia globulifera* (P1) • *Tecticornia* sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063) (P1) • Two significant range extensions: ○ *Sclerolaena clelandii* (300 km to the northwest) • *Swainsona unifoliolate* (550 km to the west)	• Timing of field survey • Limited access in some areas
Onshore (2016b) **Client:** BHP Billiton Iron Ore **Type:** Level 2 Riparian Flora and Vegetation Survey **Location:** Jimblebar Creek and Innawally Pool **Timing:** August 2016	• 15 sampling sites • Relevé sites • Targeted Searches	• 242 flora species • 42 families • 117 genera • Five weed taxa • 11 vegetation associations	• *Rhagodia sp. Hamersley (M. Trudgen 17794)* (P3) • *Goodenia nuda* (P4)	• Seasonal conditions

Study details	Methods	Results	Significant findings	Limitations
Onshore (2016d) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Pineapple Hill Tenements **Timing**: September 2016	• 63 detailed floristic sampling sites	• 407 flora species • 55 families • 174 genera • 18 vegetation associations	• *Aristida jerichoensis* subsp. *subspinulifera* (P1, now P3) • *Eremophila* sp. Hamersley Range (K. Walker KW 136) (P1) • *Triodia* sp. Karijini (S. van Leeuwen 4111) (P1) • *Vittadinia* sp. Coondewanna Flats (s. Van Leeuwen 4684) (P1) • *Aristida lazaridis* (P2) • *Oxalis* sp. Pilbara (M.E. trudgen 12725) (P2) • [52]*Calotis latiuscula* (P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • *Triodia* sp. Mt. Ella (ME Trudgen 12739) (P3) • *Goodenia nuda* (P4) • *Eremophila magnifica* subsp. *magnifica* (P4) • Significant range extension of *Crassula tetramera*	• None
Onshore (2018b) **Client**: BHP Billiton Iron Ore **Type**: Reconnaissance Flora and Vegetation Survey **Location**: Yandicoogina Creek **Timing**: November 2018	• Reconnaissance survey	• Five priority listed flora • 10 vegetation associations	• *Aristida lazaridis* (P2) • *Fimbristylis sieberiana* (P3) • *Gymnanthera cunninghamii* (P3) • *Rostellularia adscendens var. latifolia* (P3) • *Sida sp. Barlee Range (S. van Leeuwen 1643)* (P3)	• Limited access in some areas • Seasonal conditions

[52] *Calotis latiuscula* is no longer listed as a Priority flora species.

Study details	Methods	Results	Significant findings	Limitations
Pilbara Flora (2008b) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey **Location**: Coondewanna Flats **Timing**: May 2008	• 3 detailed floristic sampling sites • 96 relevé sites	• 32 flora taxa • 18 families • 31 genera	• 53*Swainsona* sp. Hamersley Station (A.A. Mitchell 196) (P3) • Presence of two sub-types of Coolibah-lignum flats assessed as being in "Good" condition: ○ Coolibah (*Eucalyptus victrix*) woodland over Lignum (*Muehlenbeckia florulenta*) over Swamp Wandiree (*Eriachne benthamii*) (P1) ○ Coolibah (*Eucalyptus victrix*) and Mulga (*Acacia aneura*) woodland over Lignum (*Muehlenbeckia florulenta*) and tussock grasses on clay plains (P3)	• None
Pilbara Flora (2008a) **Client**: BHP Billiton Iron Ore **Type**: Targeted Survey **Location**: Area C South Flank **Timing**: May 2008	• Traversed transects	• Two Priority flora taxa	• [54]*Triumfetta leptacantha* (P3) • *Eremophila magnifica* subsp. *magnifica* (P4)	• Timing of field survey • Limited access in some areas
Woodman (2009) **Client**: BHP Billiton Iron Ore **Type**: Single season Level 2 Flora and Vegetation Survey and Gap Analysis **Location**: Area C A, D, P1 And P3 Deposits **Timing**: 2008	• 62 detailed floristic sampling sites • Statistical gap analysis using PATN	• 413 flora taxa • 55 families • 165 genera • 9 weed taxa • 15 vegetation associations	• [55]*Olearia fluvialis* (P2) • [56]*Euphorbia inappendiculata* (P3) • *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) • *Rostellularia adscendens* var. *latifolia* (P3) • *Triumfetta leptacantha* (P3) • *Eremophila magnifica* subsp. *magnifica* (P4)	• No survey limitations discussed

[53] *Swainsona* sp. Hamersley Station (A.A. Mitchell 196) has formally changed to *Swainsona thompsoniana*, which is still listed as a Priotiy 3 flora species.

[54] *Triumfetta leptacantha* is no longer listed as a Priority flora species.

[55] *Olearia fluvialis* is no longer listed as a Priority flora species.

[56] *Euphorbia inappendiculata* is no longer listed as a Priority flora species. It has since been divided into two variants of *Euphorbia inappendiculata*; *Euphorbia inappendiculata* var. *inappendiculata* (P2) and *Euphorbia inappendiculata* var. *queenslandica* (P1)

Appendix G: Database Search Results

Parks and Wildlife Service DBCA (DBCA, 2020c)

EPBC Act Protected Matters Search (DAWE, 2020)

NatureMap (DBCA, 2020a)

Atlas of Living Australia (ALA, 2020)

Western Australian Organism List (DPIRD, 2020)

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
Acanthaceae	*Dipteracanthus australasicus*			•						
Aizoaceae	*Trianthema glossostigmum*			•						
	Trianthema pilosum			•						
	Trianthema triquetrum			•						
Alismataceae	*Sagittaria platyphylla*					•				Y
Amaranthaceae	*Alternanthera angustifolia*			•						
	Alternanthera denticulata			•						
	Amaranthus centralis	•							3	
	Amaranthus cuspidifolius			•						
	Gomphrena canescens			•						
	Gomphrena cunninghamii			•	•					
	Gomphrena kanisii			•	•					
	Gomphrena lanata			•						
	Gomphrena sordida			•						
	Ptilotus aervoides			•						
	Ptilotus aphyllus			•	•					
	Ptilotus astrolasius			•						
	Ptilotus auriculifolius			•						
	Ptilotus axillaris			•						
	Ptilotus calostachyus			•						
	Ptilotus carinatus			•						
	Ptilotus clementii			•						
	Ptilotus drummondii			•						
	Ptilotus gaudichaudii			•						
	Ptilotus gomphrenoides			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Ptilotus helipteroides			•						
	Ptilotus incanus			•						
	Ptilotus nobilis			•						
	Ptilotus obovatus			•						
	Ptilotus polystachyus			•						
	Ptilotus roei			•						
	Ptilotus rotundifolius			•						
	Ptilotus schwartzii			•						
	Ptilotus subspinescens	•							3	
	Ptilotus tetrandrus	•							1	
	Ptilotus wilsonii	•							1	
Apocynaceae	*Calotropis procera*					•				Y
	Cryptostegia madagascariensis					•				Y
	Cynanchum floribundum			•	•					
	Gymnanthera cunninghamii	•		•					3	
Araceae	*Pistia stratiotes*					•				Y
	Zantedeschia aethiopica					•				Y
Araliaceae	*Hydrocotyle ranunculoides*					•				Y
	Trachymene oleracea			•						
Asparagaceae	*Asparagus asparagoides*					•				Y
Asteraceae	*Bidens bipinnata*				•					Y
	Blumea tenella			•						
	Calocephalus beardii			•						
	Calocephalus pilbarensis			•	•					
	Calocephalus sp. Wittenoom (A.S.George 1082)				•					

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Calotis latiuscula	•		•					3	
	Calotis multicaulis			•						
	Centipeda minima subsp. *macrocephala*			•						
	Centipeda thespidioides			•	•					
	Chondrilla juncea					•				Y
	Chrysocephalum apiculatum subsp. pilbarense			•						
	Chrysocephalum gilesii			•						
	Chrysocephalum pterochaetum			•						
	Flaveria trinervia			•						Y
	Gnephosis arachnoidea			•	•					
	Iotasperma sessilifolium	•		•					3	
	Minuria integerrima			•	•					
	Minuria sp. Little Sandy Desert (S. van Leeuwen 4919)	•							1	
	Olearia stuartii			•						
	Onopordum acaulon					•				Y
	Peripleura arida			•						
	Pluchea dentex			•						
	Pluchea dunlopii			•	•					
	Pluchea ferdinandi-muelleri			•	•					
	Pluchea rubelliflora			•	•					
	Podolepis capillaris			•						
	Podolepis eremaea			•						
	Pseudognaphalium luteoalbum			•						
	Pterocaulon sphacelatum			•						
	Pterocaulon sphaeranthoides			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Rhodanthe charsleyae			•						
	Rhodanthe floribunda			•	•					
	Roebuckiella similis			•						
	Rutidosis helichrysoides			•						
	Rutidosis helichrysoides subsp. helichrysoides			•						
	Schoenia cassiniana			•						
	Silybum marianum					•				Y
	Streptoglossa decurrens			•	•					
	Streptoglossa macrocephala			•						
	Vittadinia arida				•					
	Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	•		•					1	
	Xanthium spinosum					•				Y
	Xanthium strumarium					•				Y
	Xerochrysum boreale	•							3	
Bixaceae	*Cochlospermum macnamarae*	•							1	
Boraginaceae	*Echium plantagineum*					•				Y
	Halgania erecta			•						
	Halgania solanacea var. Mt Doreen (G.M. Chippendale 4206)			•						
	Heliotropium cunninghamii			•	•					
	Heliotropium heteranthum			•						
	Trichodesma zeylanicum var. *zeylanicum*			•						
Brassicaceae	*Lepidium catapycnon*	•		•					4	
	Lepidium echinatum			•						
	Lepidium muelleri-ferdinandii			•						
	Lepidium oxytrichum			•	•					

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Lepidium pedicellosum			•						
	Lepidium phlebopetalum			•						
	Lepidium pholidogynum			•						
	Stenopetalum anfractum			•						
	Stenopetalum decipiens			•	•					
	Stenopetalum velutinum			•						
Cactaceae	*Austrocylindropuntia cylindrica*					•				Y
	Austrocylindropuntia subulata					•				Y
	Cylindropuntia fulgida					•				Y
	Cylindropuntia imbricata					•				Y
	Cylindropuntia kleiniae					•				Y
	Cylindropuntia pallida					•				Y
	Cylindropuntia tunicata					•				Y
	Opuntia elata					•				Y
	Opuntia elatior					•				Y
	Opuntia engelmannii					•				Y
	Opuntia ficus-indica					•				Y
	Opuntia microdasys					•				Y
	Opuntia monacantha					•				Y
	Opuntia polyacantha					•				Y
	Opuntia puberula					•				Y
	Opuntia stricta					•				Y
	Opuntia tomentosa					•				Y
Campanulaceae	*Wahlenbergia tumidifructa*			•	•					
Capparaceae	*Capparis spinosa*			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
Caryophyllaceae	*Polycarpaea corymbosa*			•	•					
	Polycarpaea corymbosa var. corymbosa			•						
	Polycarpaea holtzei			•						
	Polycarpaea involucrata			•						
	Polycarpaea longiflora			•	•					
Celastraceae	*Macgregoria racemigera*			•						
	Stackhousia clementii	•							3	
Chenopodiaceae	*Atriplex semilunaris*			•						
	Atriplex spinulosa	•							1	
	Dysphania kalpari			•						
	Dysphania melanocarpa			•						
	Dysphania rhadinostachya subsp. *inflata*			•						
	Dysphania rhadinostachya subsp. *rhadinostachya*			•						
	Maireana amoena			•						
	Maireana carnosa			•						
	Maireana georgei			•						
	Maireana melanocoma			•						
	Maireana planifolia			•						
	Maireana prosthecochaeta	•		•					3	
	Maireana pyramidata			•	•					
	Maireana thesioides			•	•					
	Maireana tomentosa			•						
	Maireana triptera			•						
	Maireana villosa			•						
	Rhagodia eremaea			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Rhagodia sp. Hamersley (M. Trudgen 17794)	•		•					3	
	Sclerolaena convexula			•						
	Sclerolaena cornishiana			•						
	Sclerolaena costata			•						
	Sclerolaena densiflora			•						
	Sclerolaena diacantha			•						
	Sclerolaena eriacantha			•						
	Sclerolaena lanicuspis			•	•					
	Sclerolaena minuta			•	•					
	Tecticornia bibenda	•							1	
	Tecticornia medusa	•							3	
	Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	•		•					1	
	Tecticornia globulifera	•							1	
	Tecticornia willisii	•							1	
Cleomaceae	*Cleome viscosa*			•						
Colchicaceae	*Wurmbea deserticola*			•						
Convolvulaceae	*Bonamia erecta*			•						
	Bonamia rosea			•						
	Duperreya commixta			•						
	Evolvulus alsinoides				•					
	Evolvulus alsinoides var. decumbens			•						
	Evolvulus alsinoides var. *villosicalyx*			•						
	Ipomoea muelleri			•						
	Ipomoea plebeia			•						
	Ipomoea racemigera	•		•					2	

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
Cucurbitaceae	*Citrullus lanatus*			•						Y
Cyperaceae	*Bulbostylis barbata*			•	•					
	Bulbostylis turbinata			•						
	Cyperus betchei subsp. commiscens			•						
	Cyperus bifax			•	•					
	Cyperus concinnus			•						
	Cyperus cunninghamii			•						
	Cyperus difformis			•						
	Cyperus iria			•	•					
	Cyperus ixiocarpus			•						
	Cyperus pulchellus			•						
	Cyperus squarrosus			•	•					
	Cyperus vaginatus			•	•					
	Eleocharis pallens			•	•					
	Fimbristylis dichotoma			•						
	Fimbristylis elegans			•						
	Fimbristylis eremophila			•						
	Fimbristylis microcarya			•	•					
	Fimbristylis sieberiana	•							3	
	Fimbristylis simulans			•						
	Lipocarpha microcephala			•	•					
	Schoenoplectiella dissachantha			•						
	Schoenoplectiella laevis			•						
Ditrichaceae	*Eccremidium arcuatum*			•						
Droseraceae	*Drosera finlaysoniana*			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
Elatinaceae	*Bergia pedicellaris*			•						
Euphorbiaceae	*Euphorbia boophthona*			•						
	Euphorbia coghlanii			•						
	Euphorbia inappendiculata				•					
	Euphorbia inappendiculata var. inappendiculata	•		•					2	
	Euphorbia porcata			•	•					
	Jatropha gossypiifolia					•				Y
Fabaceae	*Acacia adoxa var. adoxa*			•						
	Acacia adsurgens			•						
	Acacia ancistrocarpa			•						
	Acacia aphanoclada	•							1	
	Acacia aptaneura			•	•					
	Acacia arida			•						
	Acacia ayersiana			•						
	Acacia balsamea			•						
	Acacia bivenosa			•	•					
	Acacia bivenosa x sclerosperma subsp. sclerosperma			•						
	Acacia bromilowiana	•		•					4	
	Acacia catenulata subsp. *occidentalis*			•						
	Acacia citrinoviridis			•						
	Acacia clelandii			•						
	Acacia coriacea subsp. *pendens*			•						
	Acacia cuspidifolia			•						
	Acacia cyperophylla var. *omearana*	•							1	
	Acacia dictyophleba			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Acacia effusa	•							3	
	Acacia fecunda	•							1	
	Acacia hilliana			•						
	Acacia inaequilatera			•						
	Acacia kempeana			•						
	Acacia ligulata			•						
	Acacia macraneura			•						
	Acacia maitlandii			•						
	Acacia marramamba			•						
	Acacia melleodora			•						
	Acacia monticola			•						
	Acacia mulganeura			•	•					
	Acacia orthocarpa			•						
	Acacia pachyacra			•						
	Acacia paraneura			•						
	Acacia pruinocarpa			•						
	Acacia pteraneura			•	•					
	Acacia pyrifolia				•					
	Acacia pyrifolia var. morrisonii			•						
	Acacia pyrifolia var. *pyrifolia*			•						
	Acacia ramulosa var. linophylla			•						
	Acacia rhodophloia			•	•					
	Acacia sclerosperma			•	•					
	Acacia sclerosperma subsp. *sclerosperma*			•						
	Acacia sericophylla			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Acacia sibirica			•						
	Acacia sp. East Fortescue (J. Bull & D. Roberts ONS A 27.01)			•					1	
	Acacia sp. Jimblebar (S. van Leeuwen 1342)			•						
	Acacia sp. Nullagine (B.R. Maslin 4955)	•							1	
	Acacia subcontorta			•						
	Acacia subtiliformis	•		•					3	
	Acacia synchronicia			•	•					
	Acacia tenuissima			•						
	Acacia trudgeniana			•						
	Acacia tumida var. *pilbarensis*			•						
	Acacia victoriae			•						
	Acacia wanyu			•						
	Aenictophyton reconditum subsp. macrophyllum			•						
	Alhagi maurorum					•				Y
	Cajanus marmoratus			•						
	Crotalaria smithiana	•		•					3	
	Cullen cinereum			•						
	Cullen lachnostachys			•						
	Daviesia arthropoda	•							3	
	Glycine canescens			•						
	Gompholobium oreophilum			•						
	Indigofera ammobia	•							3	
	Indigofera colutea			•						
	Indigofera georgei			•						
	Indigofera gilesii	•		•					3	

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Indigofera ixocarpa	•							2	
	Indigofera monophylla			•						
	Isotropis atropurpurea			•						
	Isotropis parviflora	•		•					2	
	Jacksonia aculeata			•						
	Kennedia prorepens			•						
	Mirbelia ramulosa			•						
	Mirbelia viminalis			•						
	Muelleranthus trifoliolatus			•						
	Parkinsonia aculeata		•			•				Y
	Petalostylis cassioides			•						
	Petalostylis labicheoides			•						
	Prosopis glandulosa x velutina					•				Y
	Senna alata					•				Y
	Senna artemisioides subsp. *helmsii*			•						
	Senna artemisioides subsp. *oligophylla*			•						
	Senna glutinosa				•					
	Senna glutinosa subsp. *glutinosa*			•						
	Senna glutinosa subsp. *pruinosa*			•						
	Senna glutinosa subsp. x luerssenii			•						
	Senna hamersleyensis			•						
	Senna notabilis			•						
	Senna obtusifolia					•				Y
	Senna sp. Billabong (J.D. Alonzo 721)			•						
	Senna symonii			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Senna venusta			•						
	Swainsona decurrens			•	•					
	Swainsona oroboides			•						
	Tephrosia oxalidea			•						
	Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)			•						
	Tephrosia sp. clay soils (S. van Leeuwen et al. PBS 0273)			•						
	Tephrosia sp. deserts (J.R. Maconochie 1403)			•						
	Tephrosia sp. Newman (A.A. Mitchell PRP 29)			•	•					
	Tephrosia sp. Northern (K.F. Kenneally 11950)			•						
	Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)			•	•					
	Tephrosia sp. Willowra (G.M.Chippendale 4809)			•	•					
	Ulex europaeus					•				Y
	Vigna lanceolata				•					
	Vigna lanceolata var. lanceolata			•						
	Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)			•						
Frankeniaceae	*Frankenia glomerata*	•							4	
	Frankenia setosa			•	•					
Goodeniaceae	*Brunonia australis*			•						
	Dampiera candicans			•						
	Dampiera cinerea			•						
	Goodenia armitiana			•						
	Goodenia berringbinensis	•		•					4	
	Goodenia lamprosperma			•						
	Goodenia lyrata	•							3	
	Goodenia microptera			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Goodenia modesta	•							3	
	Goodenia muelleriana			•	•					
	Goodenia nuda	•		•					4	
	Goodenia pedicellata	•							1	
	Goodenia prostrata			•						
	Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	•		•					3	
	Goodenia sp. Sandy Creek (R.D. Royce 1653)			•	•					
	Goodenia tenuiloba			•						
	Goodenia triodiophila			•						
	Goodenia vilmoriniae			•						
	Scaevola acacioides			•						
	Scaevola browniana			•						
	Scaevola browniana subsp. browniana			•						
	Scaevola parvifolia subsp. *pilbarae*			•						
	Scaevola spinescens			•	•					
	Velleia connata			•						
	Velleia glabrata			•						
Gyrostemonaceae	*Codonocarpus cotinifolius*			•						
Haloragaceae	*Gonocarpus ephemerus*			•						
	Haloragis gossei			•						
Iridaceae	*Moraea flaccida*					•				Y
	Moraea miniata					•				Y
Lamiaceae	*Dicrastylis cordifolia*			•						
	Dicrastylis kumarinensis			•						
	Dicrastylis mitchellii	•		•					1	

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Newcastelia cephalantha			•						
	Newcastelia hexarrhena			•						
	Teucrium pilbaranum	•							2	
Lauraceae	*Cassytha capillaris*			•						
Loganiaceae	*Mitrasacme connata*			•						
Loranthaceae	*Amyema fitzgeraldii*			•						
	Amyema gibberula var. gibberula			•						
	Amyema preissii			•						
Lythraceae	*Ammannia multiflora*			•						
	Rotala diandra			•						
Malvaceae	*Abutilon amplum*			•						
	Abutilon fraseri			•						
	Abutilon lepidum			•						
	Abutilon macrum			•						
	Abutilon malvifolium			•	•					
	Abutilon oxycarpum			•	•					
	Abutilon oxycarpum subsp. Prostrate (A.A. Mitchell PRP 1266)			•						
	Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)			•						
	Abutilon sp. Pilbara (W.R. Barker 2025)			•						
	Androcalva luteiflora			•						
	Corchorus crozophorifolius			•						
	Corchorus lasiocarpus			•	•					
	Corchorus lasiocarpus subsp. lasiocarpus			•						
	Corchorus lasiocarpus subsp. *parvus*			•						
	Corchorus sidoides			•	•					

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Corchorus sidoides subsp. *sidoides*			•						
	Corchorus sp. Hamersley Range hilltops (S. van Leeuwen 3826)			•						
	Corchorus tridens			•						
	Gossypium hirsutum			•						
	Hibiscus arenicola			•						
	Hibiscus austrinus var. austrinus			•						
	Hibiscus burtonii			•	•					
	Hibiscus campanulatus			•					1	
	Hibiscus haynaldii			•						
	Hibiscus sp. Carnarvon (S. van Leeuwen 5110)	•							1	
	Hibiscus sturtii			•	•					
	Hibiscus sturtii var. truncatus			•						
	Hibiscus verdcourtii			•						
	Malvastrum americanum			•	•					Y
	Seringia elliptica			•						
	Seringia nephrosperma			•						
	Sida arsiniata			•						
	Sida brownii			•	•					
	Sida calyxhymenia			•						
	Sida cardiophylla			•						
	Sida echinocarpa			•						
	Sida ectogama			•	•					
	Sida fibulifera			•						
	Sida kingii			•						
	Sida sp. Barlee Range (S. van Leeuwen 1642)	•							3	

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Sida sp. dark green fruits (S. van Leeuwen 2260)			•						
	Sida sp. Excedentifolia (J.L. Egan 1925)			•						
	Sida sp. Pilbara (A.A. Mitchell PRP 1543)			•						
	Sida sp. Shovelanna Hill (S. van Leeuwen 3842)			•						
	Sida sp. tiny glabrous fruit (A.A. Mitchell PRP1152)			•						
	Sida sp. verrucose glands (F.H. Mollemans 2423)			•						
	Triumfetta leptacantha			•						
	Triumfetta maconochieana			•						
	Waltheria virgata			•						
Molluginaceae	*Hypertelis cerviana*			•						
	Trigastrotheca molluginea			•						
Montiaceae	*Calandrinia balonensis*			•						
	Calandrinia stagnensis			•						
	Calandrinia tepperiana			•						
Myrtaceae	*Calytrix carinata*			•						
	Corymbia aspera			•						
	Corymbia candida			•						
	Corymbia candida subsp. dipsodes			•						
	Corymbia deserticola subsp. *deserticola*			•						
	Corymbia ferriticola			•						
	Corymbia hamersleyana			•						
	Eucalyptus camaldulensis subsp. obtusa			•						
	Eucalyptus kingsmillii			•						
	Eucalyptus leucophloia			•						
	Eucalyptus leucophloia subsp. *leucophloia*			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Eucalyptus repullulans			•						
	Eucalyptus rowleyi	•		•					3	
	Eucalyptus semota	•							1	
	Eucalyptus socialis			•	•					
	Eucalyptus trivalva			•						
	Eucalyptus xerothermica			•						
	Lamarchea sulcata			•						
	Melaleuca glomerata			•						
Nyctaginaceae	*Boerhavia coccinea*			•						
	Boerhavia repleta			•						
Orobanchaceae	*Buchnera linearis*			•						
	Striga squamigera			•						
Phrymaceae	*Peplidium maritimum*			•						
Phyllanthaceae	*Phyllanthus erwinii*			•	•					
	Phyllanthus maderaspatensis			•						
	Phyllanthus virgatus			•						
	Synostemon rhytidospermus			•						
Plantaginaceae	*Stemodia viscosa*			•	•					
Poaceae	*Acrachne racemosa*			•						
	Alloteropsis cimicina			•	•					
	Amphipogon caricinus			•						
	Amphipogon sericeus			•						
	Aristida contorta			•	•					
	Aristida holathera			•						
	Aristida inaequiglumis			•	•					

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Aristida jerichoensis				•					
	Aristida jerichoensis var. *subspinulifera*	•		•					3	
	Aristida lazaridis	•		•					2	
	Cenchrus setiger			•						Y
	Chloris pectinata			•						
	Chloris pumilio			•						
	Chrysopogon fallax			•						
	Cymbopogon ambiguus			•	•					
	Cymbopogon obtectus			•	•					
	Cynodon dactylon			•						Y
	Cynodon prostratus			•						
	Dichanthium fecundum			•						
	Dichanthium sericeum subsp. sericeum			•						
	Digitaria brownii			•						
	Digitaria ctenantha			•						
	Digitaria longiflora			•	•					
	Diplachne fusca subsp. muelleri			•						
	Echinochloa colona			•						Y
	Elytrophorus spicatus			•						
	Enneapogon caerulescens			•						
	Enneapogon robustissimus			•						
	Eragrostis cumingii			•						
	Eragrostis dielsii			•						
	Eragrostis elongata			•	•					
	Eragrostis eriopoda			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Eragrostis leptocarpa			•						
	Eragrostis olida			•	•					
	Eragrostis pergracilis			•						
	Eragrostis speciosa			•						
	Eragrostis tenellula			•						
	Eragrostis xerophila			•						
	Eriachne aristidea			•						
	Eriachne lanata			•	•					
	Eriachne mucronata			•						
	Eriachne obtusa			•						
	Eriachne pulchella subsp. dominii			•						
	Eriachne tenuiculmis			•						
	Eriochloa pseudoacrotricha			•						
	Eulalia aurea			•						
	Iseilema eremaeum			•						
	Iseilema membranaceum			•						
	Leptochloa digitata			•						
	Monachather paradoxus			•	•					
	Panicum decompositum			•						
	Panicum effusum			•						
	Paraneurachne muelleri			•						
	Paspalidium clementii			•						
	Paspalidium constrictum			•						
	Paspalidium rarum			•						
	Perotis rara			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Schizachyrium fragile			•						
	Setaria surgens			•						
	Sporobolus actinocladus			•						
	Sporobolus australasicus			•						
	Themeda sp. Hamersley Station (M.E. Trudgen 11431)	•		•					3	
	Thyridolepis xerophila			•						
	Tragus australianus			•						
	Triodia angusta			•						
	Triodia basedowii			•	•					
	Triodia birriliburu	•							3	
	Triodia longiceps			•						
	Triodia melvillei			•						
	Triodia pungens			•						
	Triodia schinzii			•	•					
	Triodia sp. Mt Ella (M.E. Trudgen 12739)	•		•					3	
	Triodia vanleeuwenii			•						
	Tripogonella loliiformis			•						
	Xerochloa imberbis			•						
	Yakirra australiensis var. australiensis			•						
Polygalaceae	*Polygala glaucifolia*			•						
	Comesperma sabulosum	•		•					3	
	Comesperma viscidulum	•							4	
Polygonaceae	*Rumex vesicarius*			•						Y
Portulacaceae	*Portulaca cyclophylla*			•						
	Portulaca filifolia			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Portulaca oleracea			•						
	Portulaca pilosa			•						Y
Primulaceae	*Samolus* sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)	•		•					1	
Proteaceae	*Grevillea juncifolia*				•					
	Grevillea juncifolia subsp. *juncifolia*			•						
	Grevillea saxicola	•							3	
	Grevillea striata			•	•					
	Hakea lorea subsp. lorea			•						
	Hakea preissii			•						
Pteridaceae	*Cheilanthes austrotenuifolia*			•	•					
	Cheilanthes lasiophylla			•	•					
Rhamnaceae	*Cryptandra monticola*			•						
	Ventilago viminalis			•						
	Ziziphus mauritiana					•				Y
Ricciaceae	*crinita*			•						
Rosaceae	*Rubus ulmifolius*					•				Y
Rubiaceae	*Oldenlandia galioides*			•	•					
	Psydrax suaveolens			•	•					
Ruppiaceae	*Ruppia polycarpa*			•						
Santalaceae	*Anthobolus leptomerioides*			•						
	Santalum lanceolatum			•	•					
	Santalum spicatum			•						
Sapindaceae	*Diplopeltis stuartii var. stuartii*			•						
	Dodonaea coriacea			•						
Scrophulariaceae	*Eremophila anomala*	•							1	

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Eremophila appressa	•							1	
	Eremophila capricornica	•		•					1	
	Eremophila cuneifolia			•						
	Eremophila fraseri subsp. fraseri			•						
	Eremophila jucunda subsp. jucunda			•						
	Eremophila lachnocalyx			•						
	Eremophila lanceolata			•	•					
	Eremophila maculata subsp. maculata	•		•						
	Eremophila magnifica subsp. magnifica	•		•					4	
	Eremophila magnifica subsp. *velutina*	•							3	
	Eremophila margarethae			•						
	Eremophila oppositifolia				•					
	Eremophila oppositifolia subsp. angustifolia			•						
	Eremophila platycalyx subsp. platycalyx			•						
	Eremophila pusilliflora	•							2	
	Eremophila rhegos	•		•					1	
	Eremophila rigida	•		•					3	
	Eremophila sp. Hamersley Range (K. Walker KW 136)	•		•					1	
	Eremophila sp. West Angelas (S. van Leeuwen 4068)	•		•					1	
	Eremophila youngii subsp. lepidota	•		•					4	
Solanaceae	*Nicotiana benthamiana*			•						
	Nicotiana occidentalis			•						
	Nicotiana umbratica	•							3	
	Solanum austropiceum			•						
	Solanum centrale			•						

Family	Taxon	Source					Conservation Rating			Introduced
		DBCA	EPBC	NM	ALA	WAOL	EPBC Act	BC Act	DBCA	
	Solanum cleistogamum			•	•					
	Solanum elaeagnifolium					•				Y
	Solanum elatius			•						
	Solanum lasiophyllum			•						
	Solanum linnaeanum					•				Y
	Solanum morrisonii			•						
	Solanum piceum			•						
	Solanum sp. Mosquito Creek (A.A. Mitchell et al. AAM 10795)	•							1	
Stylidiaceae	*Stylidium weeliwolli*	•							3	
Tamaricaceae	*Tamarix aphylla*		•			•				Y
Verbenaceae	*Lantana camara*					•				Y
Violaceae	*Hybanthus aurantiacus*			•						
Zygophyllaceae	*Tribulus astrocarpus*			•	•					
	Tribulus eichlerianus			•						
	Tribulus macrocarpus			•						
	Tribulus minutus	•							1	
	Tribulus terrestris			•						Y

Appendix H: Conservation Significant Flora Likelihood of Occurrence

Source

A: Threatened and Priority Flora Database (DBCA, 2020c)

B: Western Australian Herbarium Specimen Database (DBCA, 2018)

C: NatureMap (DBCA, 2020a)

Taxon	Conservation Code			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	EPBC Act	BC Act	DBCA						
Aristida lazaridis			P2	Tufted perennial, grass-like or herb, 0.4-1.5 m high. Fl. green/purple, Apr. Sand or loam	Yes	Yes	Within	Confirmed	Confirmed
Eremophila sp. Hamersley Range (K. Walker KW 136)			P3	Erect shrub 1-3.5 m tall. Grows in open rocky slopes, gullies and rock faces associated with large hills and cliffs	Yes	Yes	1.5 km S	Confirmed	Confirmed
Fimbristylis sieberiana			P3	Shortly rhizomatous, tufted perennial, grass-like or herb (sedge), 0.25-0.6 m high. Fl. brown, May to Jun. Mud, skeletal soil pockets. Pool edges, sandstone cliffs	Yes	Yes	Within	Confirmed	Confirmed
Gymnanthera cunninghamii			P3	Erect emergent shrub, milky sap, 1-2 m high. Fl. cream-yellow-green, Jan to Dec. Sandy soils. Major drainage lines, rocky creeks	Yes	Yes	10.3 km SE	Confirmed	Confirmed
Rostellularia adscendens var. *latifolia*			P3	Herb or shrub, 0.1-0.3 m high. Fl. blue-purple-violet, Apr to May. Ironstone soils. Near creeks, rocky hills.	Yes	Yes	5.2 km SSE	Confirmed	Confirmed
Sida sp. Barlee Range (S. van Leeuwen 1642)			P3	Spreading shrub, to 0.5 m high. Fl. yellow, Aug. Skeletal red soils pockets. Steep slope	Yes	Yes	Within	Confirmed	Confirmed
Acacia bromilowiana			P4	Tree or shrub, to 12 m high, bark dark grey, fibrous; phyllodes more or less glaucous & slightly pruinose; inflorescence in spikes. Fl. yellow/pink, Jul to Aug. Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds	Possible	Yes	10.8 km SSE	Confirmed	Confirmed
Goodenia nuda			P4	Erect to ascending herb, to 0.5 m high. Fl. yellow, Apr to Aug	Yes	Yes	4.1 km N	Confirmed	Confirmed
Ipomoea racemigera			P2	Creeping annual, herb or climber. Fl. white	Yes	Yes	1.5 km W	Highly Likely	Highly Likely
Isotropis parviflora			P2	Shrub, 0.1 m high. Fl. white/pink, Mar. Valley slopes, slopes of ironstone plateau	Possible	Yes	11.3 km SW	Highly Likely	Highly Likely

Taxon	Conservation Code			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	EPBC Act	BC Act	DBCA						
Lepidium catapycnon			P4	Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag. Fl. white, Oct. Skeletal soils. Hillsides	Yes	Yes	0.2 km S	Highly Likely	Highly Likely
Amaranthus centralis			P3	Annual herb, decumbent or erect to 0.6 m high. Grows in red sand in ephemeral watercourses, sandy to clayey loam on river banks and edges of permanent pools in eucalypt lined channels, or acacia shrubland	Yes	Yes	1.1 km N	Likely	Possible
Dampiera metallorum			P3	Rounded, multistemmed perennial, herb, to 0.5 m high. Fl. blue, Apr or Jun to Oct. Skeletal red-brown gravelly soil over banded ironstone. Steep slopes, summits of hills.	Yes	Yes	3.3 km N	Likely	Likely
Stylidium weeliwolli			P3	Annual, herb, 0.1-0.25 m high, throat appendages 4, rod-shaped. Fl. pink & red, Aug to Sep. Gritty sand soil, sandy clay. Edge of watercourses	Yes	Yes	9.1 km SSE	Likely	Highly Unlikely
Synostemon hamersleyensis			P1	Shrub to 1 m high. Steep slopes, scree, cliffs, gorges. Ironstone	Yes	Yes	15.1 km N	Possible	Unlikely
Euphorbia australis var. *glabra*			P3	Annual prostrate herb, leaves green with a red tinged margins. Drainage lines on clay loam and river sand	Possible	No	12.5 km WNW	Possible	Unlikely
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)			P3	Open, erect annual or biennial, herb, to 0.2 m high. Fl. yellow. Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains	Possible	Yes	6.3 km WNW	Possible	Unlikely
Polymeria distigma			P3	Prostrate trailing herb. Fl. pink, Apr to Jul. Sandy soils.	Possible	Yes	12.8 km E	Possible	Unlikely
Rhagodia sp. Hamersley (M. Trudgen 17794)			P3	Shrub, sometimes scrambling to 4 m high. Recorded from mulga on cracking clays	Possible	Yes	10.3 km SSE	Possible	Unlikely
Themeda sp. Hamersley Station (M.E. Trudgen 11431)			P3	Tussocky perennial, grass-like or herb, 0.9-1.8 m high. Fl. Aug. Red clay. Clay pan, grass plain	No	Yes	10.6 km E	Possible	Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	EPBC Act	BC Act	DBCA						
Eremophila magnifica subsp. *magnifica*			P4	Shrub, 0.5-1.5 m high. Fl. blue-purple, Aug to Sep. Skeletal soils over ironstone. Summits and rocky scree slopes	Possible	Yes	15.9 km SSE	Possible	Unlikely
Ptilotus mollis			P4	Compact shrub, to 0.8 m high. Gentle rocky slopes, screes and the bases of screes	Possible	Yes	18.5 km SW	Possible	Unlikely
Rhynchosia bungarensis			P4	Compact, prostrate shrub, to 0.5 m high. Fl. yellow. Pebbly, shingly coarse sand amongst boulders. Banks of flow line in the mouth of a gully in a valley wall. Granite	Possible	No	9.5 km N	Possible	Unlikely
Calotis squamigera			P1	Procumbent annual, herb, to 0.21 m high. Fl. yellow, Jul. Pebbly loam	No	No	21.1 km NNE	Unlikely	Highly Unlikely
Eragrostis sp. Mt Robinson (S. van Leeuwen 4109)			P1	Tussock-forming perennial, grass-like or herb, to 0.3 m high. Fl. Sep. Red-brown skeletal soils, ironstone. Steep slopes, summits.	Yes	No	20.4 km SW	Unlikely	Unlikely
Eremophila sp. West Angelas (S. van Leeuwen 4068)			P1	Spindly whip shrub, to 3 m high. Skeletal soils over banded ironstone (Brockman Iron Formation). High in landscape, steep rocky slopes and scree, often on summits	Yes	No	20.7 km SSW	Unlikely	Unlikely
Euphorbia inappendiculata var. *queenslandica*			P1	Spreading, procumbent herb, to 0.4 m high. Fl. pink, Aug. Clay soils. Among broken rocky screes	Possible	No	29.1 km NW	Unlikely	Unlikely
Triodia sp. Karijini (S. van Leeuwen 4111)			P1	Hummock grass to 0.9 m high. Steep hillslopes, hillcrests, ironstone outcrops on grey-brown silty loam	Yes	No	18.7 km SW	Unlikely	Unlikely
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)			P1	Erect annual herb with scabrous hairs and adnate cauline leaves. Red-brown sandy clay loam. Drainage lines, floodplains	No	No	17.1 km W	Unlikely	Unlikely
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)			P2	Spindly, upright shrub to 2 m high. Fl. mauve. Sandy soils. High elevation rocky creeks, creeks/gullies running off ranges.	Yes	No	20 km S	Unlikely	Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	EPBC Act	BC Act	DBCA						
Kohautia australiensis			P2	Erect sparsely or much-branched annual, herb, 0.1-0.5 m high. Fl. blue. Low calcrete outcrops.	No	No	14.7 km WSW	Unlikely	Unlikely
Oxalis sp. Pilbara (M.E. Trudgen 12725)			P2	Annual herb to 0.2 m. Shaded ironstone rocky hillslopes, gullies, drainage lines	Possible	No	29.3 km SW	Unlikely	Unlikely
Rhodanthe frenchii			P2	Upright annual, herb, to 0.35 m high. Fl. yellow, Aug to Oct. Stony hills, rocky river banks & outcrops.	No	No	35.5 km NNE	Unlikely	Unlikely
Acacia effusa			P3	Low, dense, spreading, somewhat viscid shrub, 0.3-1 m high, bark 'minni-ritchi'. Fl. yellow, May to Aug. Stony red loam. Scree slopes of low ranges	Possible	No	19.3 km NW	Unlikely	Unlikely
Acacia subtiliformis			P3	Spindly, slender, erect shrub, to 3.5 m high, phyllodes green, new growth slightly viscid, resinous, aromatic; inflorescence in heads to 6 mm diameter; peduncles red. Fl. yellow, Jun. On rocky calcrete plateau	No	Yes	11.2 km SSE	Unlikely	Unlikely
Aristida jerichoensis var. *subspinulifera*			P3	Compactly tufted perennial, grass-like or herb, 0.3-0.8 m high, lemma groove muricate. Hardpan plains	No	Yes	21.5 km W	Unlikely	Unlikely
Atriplex flabelliformis			P3	Herb, 0.5 m high. Gilgai plains and marshes	No	No	30.2 km NNE	Unlikely	Unlikely
Eragrostis crateriformis			P3	Annual, grass-like or herb, 0.1-0.5 m high. Fl. Jan to May or Jul. Clayey loam or clay. Creek banks, depressions.	Possible	Yes	31.9 km NW	Unlikely	Unlikely
Eremophila magnifica subsp. *velutina*			P3	Shrub, 0.5-1.5 m high. Fl. blue-purple, Aug to Sep. Skeletal soils over ironstone. Summits.	Possible	No	29.2 km SW	Unlikely	Unlikely
Eremophila spongiocarpa			P3	Compact, succulent-leaved shrub, to 1 m high. Fl. white, May or Sep. Weakly saline alluvial plain on margins of marsh.	No	No	22.4 km NW	Unlikely	Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	EPBC Act	BC Act	DBCA						
Glycine falcata			P3	Mat-forming perennial, herb, to 0.2 m high. Fl. blue-purple, May or Jul. Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.	No	No	30.7 km NW	Unlikely	Unlikely
Goodenia lyrata			P3	Prostrate herb, with lyrate leaves. Fl. yellow, Aug. Red sandy loam. Near claypan	No	No	18.3 km WSW	Unlikely	Unlikely
Grevillea saxicola			P3	Shrub or small tree (1.0-)2.5-7.0 m tall. Fl. Cream to pale yellow, late spring to early autumn. Orange-brown to red-brown loam soils on the upper scree/breakaway slopes and crests, associated with banded iron formation outcrops	Possible	No	17.8 km S	Unlikely	Unlikely
Indigofera gilesii			P3	Shrub, to 1.5 m high. Fl. purple-pink, May or Aug. Pebbly loam. Amongst boulders & outcrops, hills	Possible	No	24.8 km SSE	Unlikely	Unlikely
Iotasperma sessilifolium			P3	Erect herb. Fl. pink. Cracking clay, black loam. Edges of waterholes, plains	No	No	30.7 km NW	Unlikely	Unlikely
Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)			P3	Spreading annual, herb, 0.05-0.1 m high. Fl. blue, Mar. Cracking clay, basalt. Gently undulating plain with large surface rocks, flat crabholed plain	No	No	31.2 km SW	Unlikely	Unlikely
Pilbara trudgenii			P3	Gnarled, aromatic shrub, to 1 m high. Fl. Sep. Skeletal, red stony soil over ironstone. Hill summits, steep slopes, screes, cliff faces.	Yes	No	18.3 km SSW	Unlikely	Unlikely
Solanum kentrocaule			P3	Spiny, erect perennial shrub, to 0.7 m high. Fl. purple. Steep rocky gullies, gorges, outcrops, cliffs.	Possible	No	20.8 km SW	Unlikely	Unlikely
Stackhousia clementii			P3	Dense broom-like perennial, herb, to 0.45 m high. Fl. green/yellow/brown. Skeletal soils. Sandstone hills	No	Yes	39.8 km W	Unlikely	Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	EPBC Act	BC Act	DBCA						
Triodia sp. Mt Ella (M.E. Trudgen 12739)			P3	Perennial, grass-like or herb, 0.4 m high. Light orange-brown, pebbly loam. Amongst rocks & outcrops, gully slopes	Yes	No	17.2 km SW	Unlikely	Unlikely
Eremophila youngii subsp. *lepidota*			P4	Dense, spreading shrub, (0.2-)1-3 m high. Fl. purple-red-pink, Jan or Mar or Jun or Aug to Sep. Stony red sandy loam. Flats plains, floodplains, sometimes semi-saline, clay flats	No	No	40.9 km NE	Unlikely	Unlikely
Tecticornia globulifera			P1	Low chenopod shrub, 0.4 m high. Salt lakes, marshes	No	No	37.7 km N	Highly Unlikely	Highly Unlikely
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)			P1	Perennial shrub to 0.8 m high. Widespread across the saline flats of the Fortescue Marsh on red-brown clay	No	No	39.1 km NNE	Highly Unlikely	Highly Unlikely
Cladium procerum			P2	Densely tufted perennial, grass-like or herb (sedge), 2 m high. Fl. Nov (?). Perennial pools.	Possible	No	41.7 km NW	Highly unlikely	Highly unlikely
Eremophila pusilliflora			P2	Low spreading shrub, to 0.8 m high. Drainage lines, broad depressions, flood plains. Red sany loam	No	No	35.1 km W	Highly unlikely	Highly unlikely
Teucrium pilbaranum			P2	Upright shrub, 0.2 m high. Fl. white, May or Sep. Clay. Crab hole plain in a river floodplain, margin of calcrete table	No	No	28.8 km SW	Highly Unlikely	Highly Unlikely
Dysphania congestiflora			P3	Erect annual herb 3 - 9 cm tall. Deep red-brown clay on saline floodplains, salt lakes, lake beds, clay flats	No	No	34.5 km N	Highly unlikely	Highly unlikely
Eleocharis papillosa			P3	Tufted perennial herb, to 5 cm. Flowers brown. Clay pans, wetlands, flats. Variety of soils	Possible	Yes	37.1 km NNW	Highly unlikely	Highly unlikely
Swainsona thompsoniana			P3	Prostrate annual herb, to 0.2m high, Fl. blue. higher altitude floodplains, top of hilltops and cracking clays on red-brown clay	No	Yes	40.4 km W	Highly Unlikely	Highly Unlikely
Tecticornia medusa			P3	Erect shrub to 0.7 m. Articles bright green. Flat saline floodplain. Red clay. Samphire flats	No	No	43.9 km NNE	Highly Unlikely	Highly Unlikely

Taxon	Conservation Code			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	EPBC Act	BC Act	DBCA						
Xerochrysum boreale			P3	Erect annual herb with scabrous hairs and adnate cauline leaves. Red-brown sandy clay loam. Drainage lines, floodplains	No	No	38.5 km SE	Highly Unlikely	Highly Unlikely

Appendix I: Introduced Flora Database Results

Family	Taxon	Source				Declared Plant Pests (DPP)	Weeds of National Significance (WoNS)	Ecological	Invasiveness
		NatureMap	ALA	EPBC	WAOL				
Alismataceae	**Sagittaria platyphylla*				●	Yes	Yes	Not assessed	Not assessed
Amaranthaceae	**Aerva javanica*	●	●			No	No	High	Rapid
Apiaceae	**Cyclospermum leptophyllum*	●	●			No	No	Not assessed	Not assessed
Apocynaceae	**Calotropis procera*				●	Yes	No	Not assessed	Not assessed
	**Cryptostegia madagascariensis*				●	Yes	No	Not assessed	Not assessed
Araceae	**Pistia stratiotes*				●	Yes	No	Not assessed	Not assessed
	**Zantedeschia aethiopica*				●	Yes	No	Not assessed	Not assessed
Araliaceae	**Hydrocotyle ranunculoides*				●	Yes	No	Not assessed	Not assessed
Asparagaceae	**Asparagus asparagoides*				●	Yes	Yes	Not assessed	Not assessed
Asteraceae	**Bidens bipinnata*	●	●			No	No	Unknown	Rapid
	**Chondrilla juncea*				●	Yes	No	Not assessed	Not assessed
	**Conyza bonariensis*	●				No	No	Not assessed	Not assessed
	**Flaveria trinervia*	●	●			No	No	Not assessed	Not assessed
	**Lactuca saligna*	●	●			No	No	Not assessed	Not assessed
	**Lactuca serriola*	●	●			No	No	Not assessed	Not assessed
	**Onopordum acaulon*				●	Yes	No	Not assessed	Not assessed
	**Sigesbeckia orientalis*	●	●			No	No	Unknown	Rapid
	**Silybum marianum*					Yes	No	Not assessed	Not assessed
	**Sonchus oleraceus*		●			No	No	Low	Rapid
	**Symphyotrichum squamatum*	●	●			No	No	Not assessed	Not assessed
	**Taraxacum khatoonae*	●				No	No	Not assessed	Not assessed
	**Tridax procumbens*	●	●			No	No	Not assessed	Not assessed
	**Xanthium spinosum*				●	Yes	No	Not assessed	Not assessed
	**Xanthium strumarium*				●	Yes	No	Not assessed	Not assessed
Boraginaceae	**Echium plantagineum*				●	Yes	No	Not assessed	Not assessed
Cactaceae	**Austrocylindropuntia cylindrica*				●	Yes	Yes	Not assessed	Not assessed
	**Austrocylindropuntia subulata*				●	Yes	Yes	Not assessed	Not assessed
	**Cylindropuntia fulgida*				●	Yes	Yes	High	Slow

Family	Taxon	Source				Declared Plant Pests (DPP)	Weeds of National Significance (WoNS)	Ecological	Invasiveness
		NatureMap	ALA	EPBC	WAOL				
	**Cylindropuntia imbricata*				●	Yes	Yes	Not assessed	Not assessed
	**Cylindropuntia kleiniae*				●	Yes	Yes	Not assessed	Not assessed
	**Cylindropuntia pallida*				●	Yes	Yes	Not assessed	Not assessed
	**Cylindropuntia tunicata*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia elata*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia elatior*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia engelmannii*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia ficus-indica*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia microdasys*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia monacantha*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia polyacantha*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia puberula*				●	Yes	Yes	Not assessed	Not assessed
	**Opuntia stricta*				●	Yes	Yes	High	Rapid
	**Opuntia tomentosa*				●	Yes	Yes	Not assessed	Not assessed
Cucurbitaceae	**Citrullus amarus*		●			No	No	Not assessed	Not assessed
Euphorbiaceae	**Jatropha gossypiifolia*				●	Yes	Yes	Not assessed	Not assessed
Fabaceae	**Alhagi maurorum*				●	Yes	No	Not assessed	Not assessed
	**Parkinsonia aculeata*				●	Yes	Yes	High	Rapid
	**Prosopis glandulosa* var. *glandulosa*				●	Yes	Yes	High	Rapid
	**Prosopis glandulosa* × *velutina*				●	Yes	Yes	High	Rapid
	**Senna alata*				●	Yes	No	Not assessed	Not assessed
	**Senna obtusifolia*				●	Yes	No	Not assessed	Not assessed
	**Stylosanthes hamata*		●			No	No	High	Moderate
	**Ulex europaeus*	●	●			Yes	Yes	Not assessed	Not assessed
	**Vachellia farnesiana*				●	No	No	High	Rapid
Iridaceae	**Moraea flaccida*				●	Yes	No	Not assessed	Not assessed
	**Moraea miniata*				●	Yes	No	Not assessed	Not assessed
Malvaceae	**Malvastrum americanum*	●	●			No	No	High	Rapid

Family	Taxon	Source				Declared Plant Pests (DPP)	Weeds of National Significance (WoNS)	Ecological	Invasiveness
		NatureMap	ALA	EPBC	WAOL				
Papaveraceae	**Argemone ochroleuca*	●	●			No	No	Not assessed	Not assessed
Poaceae	**Cenchrus ciliaris*	●	●	●		No	No	High	Rapid
	**Cenchrus echinatus*	●	●			No	No	Moderate	Rapid
	**Cenchrus setiger*	●	●			No	No	High	Rapid
	**Chloris barbata*	●	●			No	No	High	Rapid
	**Chloris virgata*		●			No	No	High	Rapid
	**Digitaria ciliaris*	●	●			No	No	Low	Slow
	**Echinochloa colona*	●	●			No	No	High	Rapid
	**Melinis repens*		●			No	No	Not assessed	Not assessed
	**Paspalum dilatatum*	●	●			No	No	Not assessed	Not assessed
	**Setaria verticillata*	●	●			No	No	High	Rapid
Polygonaceae	**Rumex vesicarius*	●	●			No	No	Not assessed	Not assessed
Portulacaceae	**Portulaca pilosa*		●			No	No	Not assessed	Not assessed
Rhamnaceae	**Ziziphus mauritiana*				●	Yes	No	Not assessed	Not assessed
Rosaceae	**Rubus anglocandicans*				●	Yes	Yes	Not assessed	Not assessed
	**Rubus laudatus*				●	Yes	Yes	Not assessed	Not assessed
	**Rubus rugosus*				●	Yes	Yes	Not assessed	Not assessed
	**Rubus ulmifolius*				●	Yes	Yes	Not assessed	Not assessed
Solanaceae	**Datura leichhardtii*		●			No	No	Unknown	Unknown
	**Datura leichhardtii* subsp. *leichhardtii*	●				No	No	Not assessed	Not assessed
	**Solanum elaeagnifolium*				●	Yes	Yes	Not assessed	Not assessed
	**Solanum linnaeanum*				●	Yes	No	Not assessed	Not assessed
	**Solanum nigrum*	●	●			No	No	Low	Rapid
Tamaricaceae	**Tamarix aphylla*				●	Yes	Yes	High	Rapid
Verbenaceae	**Lantana camara*				●	Yes	Yes	Not assessed	Not assessed
Zygophyllaceae	**Tribulus terrestris*		●			No	No	Unknown	Moderate

Appendix J: Flora Composition

Yandicoogina Creek

Amaranthaceae

Achyranthes aspera
* *Aerva javanica*
Alternanthera nana
Alternanthera nodiflora
Amaranthus undulatus
Gomphrena canescens subsp. *canescens*
Ptilotus astrolasius
Ptilotus auriculifolius
Ptilotus calostachyus
Ptilotus exaltatus
Ptilotus fusiformis
Ptilotus gaudichaudii
Ptilotus obovatus
Ptilotus rotundifolius

Apocynaceae

Cynanchum floribundum
Gymnanthera cunninghamii (P3)
Vincetoxicum flexuosum
Vincetoxicum lineare

Araliaceae

Trachymene oleracea subsp. *oleracea*

Asteraceae

* *Bidens bipinnata*
Blumea tenella
Centipeda minima subsp. *macrocephala*
Chrysocephalum apiculatum subsp. *pilbarense*
* *Conyza bonariensis*
* *Flaveria trinervia*
Pluchea dentex
Pluchea sp. Indet
* *Pseudognaphalium luteoalbum*
Pterocaulon sphacelatum
Rhodanthe margarethae
* *Sigesbeckia orientalis*
* *Sonchus oleraceus*
Streptoglossa bubakii
* *Tridax procumbens*

Boraginaceae

Heliotropium chrysocarpum
Heliotropium cunninghamii
Heliotropium sp. Indet
Heliotropium tenuifolium
Trichodesma zeylanicum
Trichodesma zeylanicum var. *zeylanicum*

Brassicaceae

Lepidium muelleri-ferdinandii

Campanulaceae

Lobelia arnhemiaca

Wahlenbergia tumidifructa

Capparaceae

Capparis lasiantha
Capparis spinosa subsp. *nummularia*
Capparis umbonata

Caryophyllaceae

Polycarpaea corymbosa
Polycarpaea holtzei
Polycarpaea longiflora

Chenopodiaceae

Dysphania rhadinostachya subsp. *rhadinostachya*
Maireana sp. Indet
Salsola australis

Cleomaceae

Cleome viscosa

Convolvulaceae

Bonamia erecta
Duperreya commixta
Evolvulus alsinoides var. *decumbens*
Evolvulus alsinoides var. *villosicalyx*
Ipomoea muelleri
Ipomoea plebeia
Polymeria ambigua
Polymeria mollis

Cucurbitaceae

Cucumis variabilis

Cyperaceae

Bulbostylis barbata
Cyperus bifax
Cyperus difformis
Cyperus iria
Cyperus vaginatus
Eleocharis geniculata
Fimbristylis dichotoma
Fimbristylis microcarya
Fimbristylis sieberiana (P3)
Lipocarpha microcephala
Schoenoplectus subulatus

Droseraceae

Drosera finlaysoniana

Elatinaceae

Bergia pedicellaris

Euphorbiaceae

Euphorbia australis var. *subtomentosa*
Euphorbia biconvexa
Euphorbia boophthona

Euphorbia coghlanii
Euphorbia tannensis subsp. *eremophila*

Fabaceae

Acacia adoxa var. *adoxa*
Acacia ampliceps
Acacia aneura
Acacia bivenosa
Acacia colei var. *colei*
Acacia coriacea subsp. *pendens*
Acacia dictyophleba
Acacia inaequilatera
Acacia maitlandii
Acacia monticola
Acacia pachyacra
Acacia pruinocarpa
Acacia pyrifolia var. *pyrifolia*
Acacia tumida var. *pilbarensis*
Alysicarpus muelleri
Crotalaria medicaginea var. *neglecta*
Cullen leucanthum
Glycine canescens
Indigofera fractiflexa subsp. *fractiflexa*
Indigofera georgei
Indigofera linnaei
Indigofera monophylla
Isotropis sp. Arid zone (G. Byrne 2775)
Isotropis sp. Indet
Petalostylis labicheoides
Rhynchosia minima
Senna artemisioides subsp. *artemisioides*
Senna artemisioides subsp. *helmsii*
Senna artemisioides subsp. *oligophylla*
Senna artemisioides subsp. x *artemisioides*
Senna glutinosa subsp. *glutinosa*
Senna glutinosa subsp. *pruinosa*
Senna notabilis
Senna pleurocarpa
Senna venusta
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)
Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)
Vachellia farnesiana
Vigna lanceolata

Goodeniaceae

Dampiera candicans
Goodenia cusackiana
Goodenia lamprosperma
Goodenia microptera
Goodenia muelleriana
Goodenia stobbsiana
Goodenia triodiophila
Scaevola parvifolia subsp. *pilbarae*

Lamiaceae

Clerodendrum floribundum
Clerodendrum floribundum var. *angustifolium*

Lauraceae

Cassytha capillaris

Loranthaceae

Amyema sanguinea
Amyema sanguinea var. *sanguinea*

Lythraceae

Ammannia baccifera
Ammannia multiflora
Rotala ? occutiflora
Rotala diandra
Rotala occultiflora

Malvaceae

Abutilon cryptopetalum
Abutilon cunninghamii
Abutilon lepidum
Abutilon macrum
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)
Abutilon sp. Indet
Androcalva luteiflora
Brachychiton gregorii
Corchorus crozophorifolius
Corchorus incanus subsp. *incanus*
Corchorus incanus subsp. *lithophilus*
Corchorus laniflorus
Corchorus lasiocarpus
Corchorus lasiocarpus subsp. *parvus*
Corchorus tridens
Gossypium australe
Gossypium robinsonii
Hibiscus sturtii var. *platychlamys*
* *Malvastrum americanum*
Melhania oblongifolia
Seringia elliptica
Sida ? fibulifera
Sida fibulifera
Sida sp. Articulation below (A.A. Mitchell PRP 1605)
Sida sp. Barlee Range (S. van Leeuwen 1642) (P3)
Sida sp. Golden calyces glabrous (H.N. Foote 32)
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)
Triumfetta chaetocarpa
Triumfetta clementii
Waltheria indica

Marsileaceae

Marsilea hirsuta

Menispermaceae

Tinospora smilacina

Molluginaceae

Trigastrotheca molluginea

Moraceae

Ficus brachypoda

Ficus platypoda

Myrtaceae

Corymbia hamersleyana
Eucalyptus camaldulensis
Eucalyptus camaldulensis subsp. *obtusa*
Eucalyptus gamophylla
Eucalyptus victrix
Eucalyptus xerothermica
Melaleuca argentea
Melaleuca bracteata
Melaleuca glomerata

Nyctaginaceae

Boerhavia coccinea

Oleaceae

Jasminum didymum subsp. *lineare*

Onagraceae

Ludwigia perennis

Papaveraceae

* *Argemone ochroleuca* subsp. *ochroleuca*

Phyllanthaceae

Notoleptopus decaisnei
Phyllanthus baccatus
Phyllanthus maderaspatensis

Plantaginaceae

Stemodia grossa
Stemodia viscosa

Plumbaginaceae

Plumbago zeylanica

Poaceae

Acrachne racemosa
Aristida contorta
Aristida holathera var. *holathera*
Aristida inaequiglumis
Aristida lazaridis (P2)
* *Cenchrus ciliaris*
Chloris pectinata
Chrysopogon fallax
Cymbopogon obtectus
Dichanthium fecundum
Digitaria brownii
Digitaria ctenantha
Diplachne fusca subsp. *fusca*
Elytrophorus spicatus
Enneapogon caerulescens
Enneapogon lindleyanus
Enneapogon polyphyllus
Enneapogon robustissimus

Enteropogon ramosus
Eragrostis cumingii
Eragrostis elongata
Eragrostis eriopoda
Eragrostis tenellula
Eriachne ? *mucronata*
Eriachne ciliata
Eriachne mucronata
Eriachne pulchella subsp. *dominii*
Eulalia aurea
Imperata cylindrica
* *Melinis repens*
Paraneurachne muelleri
Paspalidium basicladum
Paspalidium clementii
Paspalidium tabulatum
Perotis rara
* *Setaria verticillata*
Sorghum plumosum
Themeda triandra
Triodia biflora
Triodia pungens
Triodia vanleeuwenii
Triodia wiseana

Polygonaceae

* *Rumex vesicarius*

Portulacaceae

* *Portulaca oleracea*

Proteaceae

Grevillea pyramidalis subsp. *leucadendron*
Grevillea wickhamii subsp. *hispidula*
Hakea chordophylla
Hakea lorea subsp. *lorea*

Rubiaceae

Oldenlandia crouchiana
Oldenlandia galioides

Santalaceae

Santalum lanceolatum

Sapindaceae

Atalaya hemiglauca
Dodonaea viscosa subsp. *angustissima*
Dodonaea viscosa subsp. *spatulata*

Scrophulariaceae

Eremophila longifolia

Solanaceae

Nicotiana benthamiana
Nicotiana occidentalis
Solanum lasiophyllum
* *Solanum nigrum*

Surianaceae

Stylobasium spathulatum

Typhaceae

Typha domingensis

Violaceae

Hybanthus aurantiacus

Zygophyllaceae

Tribulus hirsutus
* *Tribulus terrestris*

Ministers North

Acanthaceae

Rostellularia adscendens var. *latifolia* (P3)

Amaranthaceae

* *Aerva javanica*
Alternanthera nana
Amaranthus undulatus
Gomphrena canescens subsp. *canescens*
Ptilotus calostachyus
Ptilotus clementii
Ptilotus exaltatus
Ptilotus obovatus
Ptilotus rotundifolius

Apocynaceae

Vincetoxicum lineare

Araliaceae

Trachymene oleracea

Asteraceae

* *Bidens bipinnata*
Pluchea dentex

Boraginaceae

Heliotropium cunninghamii
Heliotropium inexplicitum
Heliotropium tenuifolium
Trichodesma zeylanicum var. *zeylanicum*

Capparaceae

Capparis umbonata

Caryophyllaceae

Polycarpaea holtzei
Polycarpaea longiflora

Chenopodiaceae

Salsola australis

Cleomaceae

Cleome viscosa

Convolvulaceae

Bonamia erecta
Duperreya commixta
Evolvulus alsinoides var. *decumbens*
Evolvulus alsinoides var. *villosicalyx*

Cucurbitaceae

Cucumis variabilis

Cyperaceae

Bulbostylis barbata
Cyperus vaginatus
Fimbristylis simulans

Euphorbiaceae

Euphorbia biconvexa
Euphorbia tannensis subsp. *eremophila*

Fabaceae

Acacia adoxa var. *adoxa*
Acacia ancistrocarpa
Acacia bivenosa
Acacia coriacea subsp. *pendens*
Acacia dictyophleba
Acacia hilliana
Acacia inaequilatera
Acacia maitlandii
Acacia pachyacra
Acacia pruinocarpa
Acacia pyrifolia var. *pyrifolia*
Acacia tetragonophylla
Alysicarpus muelleri
Crotalaria medicaginea var. *neglecta*
Cullen stipulaceum
Glycine canescens
Indigofera colutea
Indigofera linifolia
Indigofera monophylla
Indigofera rugosa
Rhynchosia minima
Senna artemisioides subsp. *helmsii*
Senna artemisioides subsp. *oligophylla*
Senna artemisioides subsp. x *artemisioides*
Senna glutinosa subsp. *glutinosa*
Senna glutinosa subsp. *pruinosa*
Senna notabilis
Sesbania cannabina
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)
Tephrosia virens
Vachellia farnesiana

Goodeniaceae

Dampiera candicans
Goodenia microptera
Goodenia muelleriana
Goodenia nuda (P4)
Goodenia stobbsiana
Goodenia triodiophila

Gyrostemonaceae

Codonocarpus cotinifolius

Malvaceae

Abutilon fraseri
Corchorus crozophorifolius
Corchorus lasiocarpus subsp. *lasiocarpus*

Corchorus sp. Indet
Gossypium australe
Gossypium robinsonii
* *Malvastrum americanum*
Melhania oblongifolia
Sida sp. Barlee Range (S. van Leeuwen 1642) (P3)
Triumfetta maconochieana

Molluginaceae

Trigastrotheca molluginea

Myrtaceae

Corymbia hamersleyana
Eucalyptus camaldulensis subsp. *obtusa*
Eucalyptus leucophloia subsp. *leucophloia*
Eucalyptus victrix
Melaleuca glomerata

Nyctaginaceae

Boerhavia coccinea

Oleaceae

Jasminum didymum subsp. *lineare*

Phyllanthaceae

Phyllanthus maderaspatensis

Plantaginaceae

Stemodia grossa

Poaceae

Amphipogon sericeus
Aristida holathera var. *holathera*
Aristida inaequiglumis
* *Cenchrus ciliaris*
* *Cenchrus setiger*
Chrysopogon fallax
Cymbopogon obtectus
Enneapogon lindleyanus
Eragrostis eriopoda
Eriachne aristidea
Eriachne lanata
Eriachne mucronata
Eriachne pulchella subsp. *dominii*
Eulalia aurea
Paraneurachne muelleri
Paspalidium clementii
* *Setaria verticillata*
Sorghum plumosum
Themeda triandra
Triodia brizoides
Triodia vanleeuwenii
Triodia wiseana

Proteaceae

Grevillea pyramidalis subsp. *leucadendron*
Grevillea wickhamii subsp. *hispidula*

Hakea chordophylla
Hakea lorea subsp. *lorea*

Rubiaceae

Oldenlandia crouchiana

Santalaceae

Santalum lanceolatum

Sapindaceae

Atalaya hemiglauca
Dodonaea coriacea

Scrophulariaceae

Eremophila fraseri subsp. *fraseri*
Eremophila longifolia

Solanaceae

Solanum lasiophyllum

Violaceae

Hybanthus aurantiacus

Zygophyllaceae

Tribulus macrocarpus
Tribulus platypterus
Tribulus suberosus

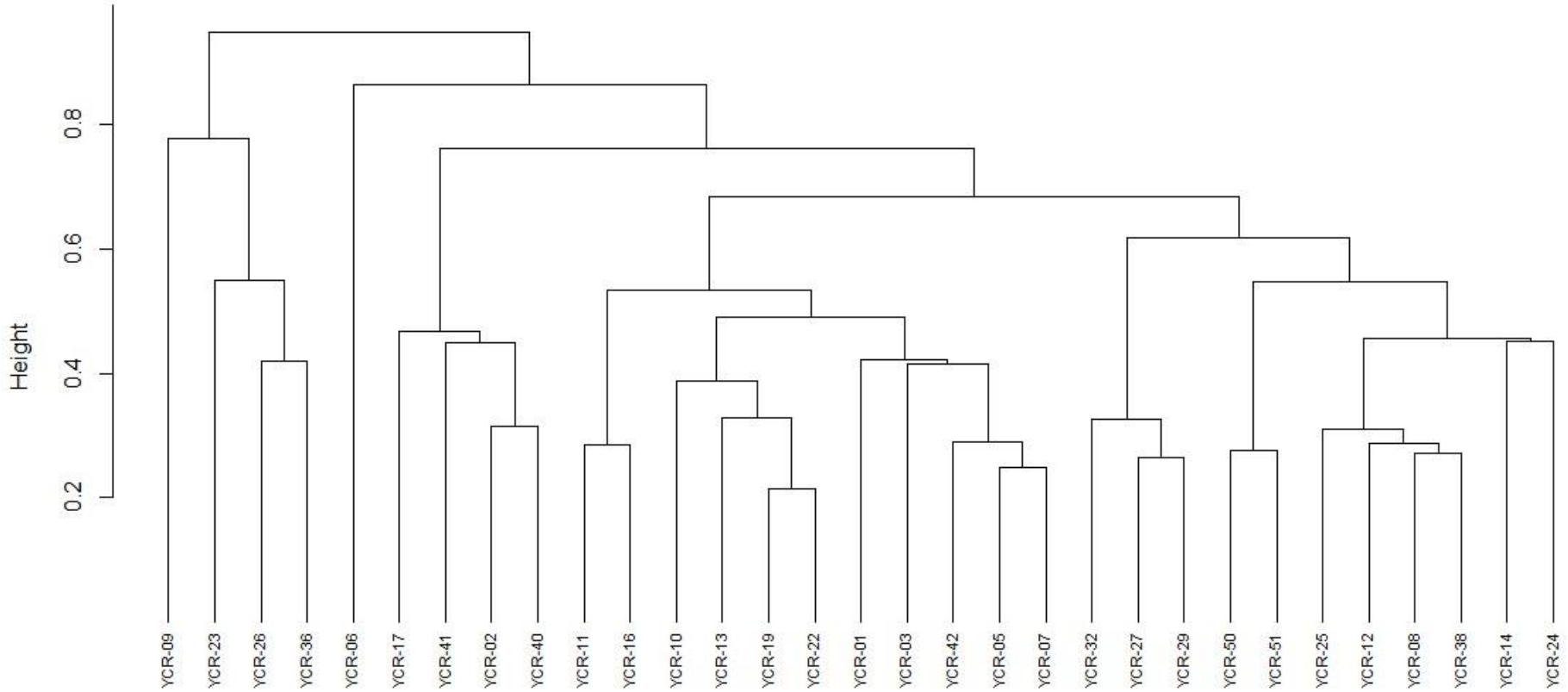
Appendix K: Conservation Significant Flora Locations

Latitude	Longitude	Site ID	Date	Taxon	Number
-22.873953	119.024109	Opp	14/09/2019	*Aristida lazaridis*	1
-22.86368	119.048811	Opp	14/09/2019	*Aristida lazaridis*	3
-22.86612	119.04798	YCR-26	14/09/2019	*Aristida lazaridis*	4
-22.84952	119.12419	YCR-38	13/09/2019	*Aristida lazaridis*	5
-22.873924	119.023906	Opp	14/09/2019	*Aristida lazaridis*	5
-22.87388	119.02694	YCR-36	14/09/2019	*Aristida lazaridis*	6
-22.861814	119.054069	Opp	14/09/2019	*Aristida lazaridis*	11
-22.861817	119.054933	Opp	14/09/2019	*Aristida lazaridis*	15
-22.862225	119.05466	Opp	14/09/2019	*Aristida lazaridis*	35
-22.862452	119.055018	Opp	14/09/2019	*Aristida lazaridis*	2000 m^2
-22.826797	119.152172	Opp	11/09/2019	*Fimbristylis sieberiana*	1
-22.824529	119.163664	Opp	29/03/2020	*Fimbristylis sieberiana*	2
-22.82910	119.14390	YCR-19	10/09/2019	*Fimbristylis sieberiana*	3
-22.829069	119.143886	Opp	10/09/2019	*Fimbristylis sieberiana*	3
-22.827524	119.149465	Opp	11/09/2019	*Fimbristylis sieberiana*	3
-22.828181	119.14998	Opp	11/09/2019	*Fimbristylis sieberiana*	3
-22.82910	119.14390	Opp	10/09/2019	*Fimbristylis sieberiana*	3
-22.828303	119.145134	Opp	10/09/2019	*Fimbristylis sieberiana*	5
-22.827514	119.149632	Opp	11/09/2019	*Fimbristylis sieberiana*	5
-22.825894	119.161443	Opp	29/03/2020	*Fimbristylis sieberiana*	5
-22.824792	119.163417	Opp	29/03/2020	*Fimbristylis sieberiana*	5
-22.825913	119.1616	Opp	29/03/2020	*Fimbristylis sieberiana*	5
-22.829615	119.140956	Opp	30/03/2020	*Fimbristylis sieberiana*	5
-22.828844	119.142674	Opp	10/09/2019	*Fimbristylis sieberiana*	8
-22.82546	119.16767	YCR-06	12/09/2019	*Fimbristylis sieberiana*	10
-22.82545	119.15876	YCR-13	27/03/2020	*Fimbristylis sieberiana*	10
-22.82618	119.15399	YCR-16	11/09/2019	*Fimbristylis sieberiana*	10
-22.825795	119.157782	Opp	29/03/2020	*Fimbristylis sieberiana*	10
-22.82589	119.162847	Opp	11/09/2019	*Fimbristylis sieberiana*	12
-22.827561	119.150554	Opp	11/09/2019	*Fimbristylis sieberiana*	15
-22.827619	119.150489	Opp	11/09/2019	*Fimbristylis sieberiana*	15
-22.827618	119.150569	Opp	11/09/2019	*Fimbristylis sieberiana*	15
-22.827962	119.149969	Opp	11/09/2019	*Fimbristylis sieberiana*	15
-22.825962	119.162864	Opp	27/03/2020	*Fimbristylis sieberiana*	15
-22.828897	119.142505	Opp	10/09/2019	*Fimbristylis sieberiana*	17
-22.827923	119.150075	Opp	11/09/2019	*Fimbristylis sieberiana*	18
-22.827642	119.150598	Opp	11/09/2019	*Fimbristylis sieberiana*	20
-22.827186	119.151206	Opp	12/09/2019	*Fimbristylis sieberiana*	20
-22.827378	119.151213	Opp	29/03/2020	*Fimbristylis sieberiana*	20
-22.827073	119.151485	Opp	29/03/2020	*Fimbristylis sieberiana*	20
-22.824597	119.163252	Opp	29/03/2020	*Fimbristylis sieberiana*	20
-22.825202	119.163383	Opp	29/03/2020	*Fimbristylis sieberiana*	20
-22.829315	119.141414	Opp	30/03/2020	*Fimbristylis sieberiana*	20
-22.82934	119.14112	Opp	30/03/2020	*Fimbristylis sieberiana*	20

Latitude	Longitude	Site ID	Date	Taxon	Number
-22.829366	119.141292	Opp	30/03/2020	*Fimbristylis sieberiana*	20
-22.824832	119.163924	Opp	29/03/2020	*Fimbristylis sieberiana*	25
-22.829417	119.14107	Opp	30/03/2020	*Fimbristylis sieberiana*	25
-22.82631	119.15285	YCR-16	11/09/2019	*Fimbristylis sieberiana*	30
-22.82625	119.152798	Opp	11/09/2019	*Fimbristylis sieberiana*	30
-22.827702	119.150394	Opp	11/09/2019	*Fimbristylis sieberiana*	30
-22.827602	119.150665	Opp	11/09/2019	*Fimbristylis sieberiana*	30
-22.825075	119.163629	Opp	29/03/2020	*Fimbristylis sieberiana*	30
-22.825241	119.163392	Opp	29/03/2020	*Fimbristylis sieberiana*	30
-22.829252	119.141491	Opp	30/03/2020	*Fimbristylis sieberiana*	30
-22.82596	119.16139	YCR-11	11/09/2019	*Fimbristylis sieberiana*	50
-22.827266	119.151128	Opp	27/03/2020	*Fimbristylis sieberiana*	50
-22.827238	119.151281	Opp	29/03/2020	*Fimbristylis sieberiana*	50
-22.82455	119.163741	Opp	29/03/2020	*Fimbristylis sieberiana*	50
-22.829402	119.141181	Opp	30/03/2020	*Fimbristylis sieberiana*	50
-22.78389	119.13491	Opp	1/04/2020	*Goodenia nuda*	1
-22.78191	119.13545	Opp	1/04/2020	*Goodenia nuda*	1
-22.78257	119.13418	Opp	1/04/2020	*Goodenia nuda*	1
-22.78224	119.13539	Opp	1/04/2020	*Goodenia nuda*	1
-22.78182	119.13407	Opp	1/04/2020	*Goodenia nuda*	2
-22.78202	119.13516	Opp	1/04/2020	*Goodenia nuda*	2
-22.78424	119.13489	Opp	1/04/2020	*Goodenia nuda*	2
-22.78162	119.13539	Opp	1/04/2020	*Goodenia nuda*	2
-22.78292	119.13591	Opp	1/04/2020	*Goodenia nuda*	3
-22.78211	119.13421	Opp	1/04/2020	*Goodenia nuda*	4
-22.78151	119.13502	Opp	1/04/2020	*Goodenia nuda*	5
-22.78279	119.13584	Opp	1/04/2020	*Goodenia nuda*	5
-22.78362	119.13487	Opp	1/04/2020	*Goodenia nuda*	5
-22.78359	119.13520	Opp	1/04/2020	*Goodenia nuda*	5
-22.78347	119.13456	Opp	1/04/2020	*Goodenia nuda*	6
-22.78236	119.13435	Opp	1/04/2020	*Goodenia nuda*	7
-22.78252	119.13583	Opp	1/04/2020	*Goodenia nuda*	7
-22.78222	119.13426	Opp	1/04/2020	*Goodenia nuda*	10
-22.78316	119.13487	Opp	1/04/2020	*Goodenia nuda*	10
-22.78276	119.13478	Opp	1/04/2020	*Goodenia nuda*	10
-22.82526	119.15897	YCR-13	11/09/2019	*Gymnanthera cunninghamii*	1
-22.829802	119.139873	Opp	10/09/2019	*Gymnanthera cunninghamii*	1
-22.85016	119.103463	Opp	28/03/2020	*Gymnanthera cunninghamii*	1
-22.848222	119.101005	Opp	28/03/2020	*Gymnanthera cunninghamii*	1
-22.82803	119.144818	Opp	10/09/2019	*Gymnanthera cunninghamii*	2
-22.825467	119.160526	Opp	29/03/2020	*Gymnanthera cunninghamii*	2
-22.824919	119.169125	Opp	29/03/2020	*Gymnanthera cunninghamii*	2
-22.827982	119.145621	Opp	10/09/2019	*Gymnanthera cunninghamii*	3
-22.846828	119.100429	Opp	28/03/2020	*Gymnanthera cunninghamii*	4

Latitude	Longitude	Site ID	Date	Taxon	Number
-22.825203	119.160069	Opp	11/09/2019	*Gymnanthera cunninghamii*	30
-22.75425	119.04297	MIN-30	31/03/2020	Rostellularia *adscendens* var. *latifolia*	5
-22.81324	119.14672	Opp	1/04/2020	*Sida* sp. Barlee Range (S. van Leeuwen 1642)	2
-22.837916	119.131913	Opp	13/09/2019	*Sida s*p. Barlee Range (S. van Leeuwen 1642)	3

Appendix L: Hierarchical clustering (dendrogram) for YCR sample sites


Height
0.2
0.4
0.6
0.8
YCR-09
YCR-23
YCR-26
YCR-36
YCR-06
YCR-17
YCR-41
YCR-02
YCR-40
YCR-11
YCR-16
YCR-10
YCR-13
YCR-19
YCR-22
YCR-01
YCR-03
YCR-42
YCR-05
YCR-07
YCR-32
YCR-27
YCR-29
YCR-50
YCR-51
YCR-25
YCR-12
YCR-08
YCR-38
YCR-14
YCR-24

Appendix M: Water features - details

Latitude	Longitude	Feature ID	Date	Length (m)	Width (m)	Depth (m)
-22.826	119.162	WYAN-01	11/09/2019	10	2	0.3
-22.8281	119.15	WYAN-02	11/09/2019	20	5	1
-22.8275	119.1511	WYAN-03	11/09/2019	30	5	0.2
-22.8262	119.1533	WYAN-04	11/09/2019	10	5	0.8
-22.8255	119.159	WYAN-05	11/09/2019	40	2	0.4
-22.8254	119.1602	WYAN-06	11/09/2019	6	1.5	0.7
-22.8257	119.1629	WYAN-07	11/09/2019	20	10	2
-22.8243	119.1648	WYAN-08	11/09/2019	5	3	0.8
-22.8245	119.1636	WYAN-09	11/09/2019	15	4	0.7
-22.8256	119.1585	WYAN-10	11/09/2019	4	1	0.2
-22.8289	119.1482	WYAN-11	11/09/2019	3.5	0.6	1.5
-22.8275	119.1508	WYAN-12	12/09/2019	30	4	0.2
-22.8245	119.1653	WYAN-13	12/09/2019	5	2	0.4
-22.8246	119.1657	WYAN-14	12/09/2019	15	6	0.5
-22.8253	119.1675	WYAN-15	12/09/2019	40	3	0.2
-22.8256	119.1581	WYAN-16	12/09/2019	3	1	0.3
-22.8311	119.1338	WYAN-17	26/03/2020	25	5	2
-22.8465	119.1002	WYAN-18	28/03/2020	150	15	2
-22.851	119.1025	WYAN-19	28/03/2020	100	7	2
-22.8482	119.1044	WYAN-20	28/03/2020	40	10	1
-22.8482	119.1054	WYAN-21	28/03/2020	100	15	2
-22.8463	119.1298	WYAN-22	28/03/2020	60	20	1
-22.8453	119.1295	WYAN-23	28/03/2020	55	8	1.2
-22.8478	119.1284	WYAN-24	28/03/2020	20	4	0.4
-22.8482	119.1278	WYAN-25	28/03/2020	15	3	0.3
-22.8486	119.1262	WYAN-26	28/03/2020	25	2	0.4
-22.8486	119.1258	WYAN-27	28/03/2020	5	2	0.6
-22.8496	119.1246	WYAN-28	28/03/2020	60	6	0.5
-22.8501	119.118	WYAN-29	28/03/2020	40	4	0.6
-22.8502	119.1171	WYAN-30	28/03/2020	10	4	0.2
-22.8516	119.1144	WYAN-31	28/03/2020	85	7	1
-22.8348	119.1314	WYAN-32	28/03/2020	25	5	1
-22.8255	119.1593	WYAN-33	29/03/2020	5	2	0.3
-22.8241	119.1735	WYAN-34	29/03/2020	15	5	0.2
-22.8149	119.1909	WYAN-35	29/03/2020	30	3	0.4
-22.8153	119.1936	WYAN-36	29/03/2020	50	5	0.5
-22.825	119.1635	WYAN-37	29/03/2020	30	5	1
-22.821	119.1787	WYAN-38	29/03/2020	5	2	0.3

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