Western Ridge Pipeline

Reconnaissance Flora and Vegetation Survey

Biologic Environmental Survey

Report to BHP Western Australian Iron Ore

August 2021

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EXECUTIVE SUMMARY

BHP Western Australian Iron Ore (BHP WAIO) are investigating the biological values of potential pipeline options for the Western Ridge area to provide local and contextual information to inform future environmental approvals. BHP WAIO commissioned Biologic Environmental Survey to undertake a single season reconnaissance flora and vegetation survey of three separate portions totalling 1,720 hectares (the Survey Area). The Survey Area is located within the Pilbara and Gascoyne bioregions, approximately 23 kilometres (km) southwest to 10 km east of Newman, and is partly located within BHP Iron Ore, and BHP Billiton Minerals tenements, encompassing off tenure and mining operational areas. Additionally, Biologic completed a concurrent reconnaissance flora and vegetation survey of an area just south of the Whaleback mine site (Whaleback Survey Area).

The reconnaissance flora and vegetation survey was undertaken over eight days between 24 and 31 March 2021, with all major vegetation communities visited and sampled. During the field survey, daytime climatic conditions were hot temperatures with clear skies. Limited rainfall was recorded for the Newman area in the weeks preceding the field survey, although total rainfall was above average in the three months prior to the survey. Conditions within the Survey Area were relatively wet with a high number of annual/ biannual flora taxa growing at the time of the field survey.

The flora and vegetation of the Survey Area was sampled with 109 relevés, 36 mapping notes and opportunistic sampling. This data, along with an additional 21 relevé sites from the Whaleback Survey Area, was used to record and described the vegetation types and their condition, and to collect an inventory of flora taxa present.

A total of 250 confirmed vascular flora taxa from 37 families and 111 genera were recorded from the Survey Area, comprising 241 native taxa and nine introduced taxa. With the inclusion of the confirmed vascular flora taxa recorded from the Whaleback Survey Area, the total number of confirmed vascular flora taxa across both Survey Areas increases to 267, comprising 258 native and nine introduced taxa.

The desktop assessment identified 35 significant taxa which had varying likelihoods of occurring within the Survey Area. It was considered highly unlikely that any Threatened flora would occur within the Survey Area. One Priority Listed taxon was considered highly likely to occur, and two Priority Listed taxa were likely to occur. The remainder were ranked as possible, unlikely, or highly unlikely to occur within the Survey Area.

Two Priority Listed flora taxa were recorded within the Survey Area. During the survey, *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) was recorded from 59-point locations with a total of 66 individuals. An additional priority listed taxon, *Ipomoea racemigera* (P2), was found by a subsequent survey conducted by Biologic for BHP WAIO that overlapped the current Survey Area, totalling 56 individuals from six-point locations. Suitable habitat for several significant taxa was identified from the Survey Area, however, no individuals were recorded. Due to the presence of suitable habitat and the low-intensity sampling of reconnaissance surveys, five taxa are still considered possible to occur within the Survey Area. An additional ten taxa were considered significant for other reasons, including seven range extensions, one hybrid and two species that filled substantial distribution gaps (locality holes).

Nine introduced taxa, **Aerva javanica*, **Bidens bipinnata,* **Cenchrus ciliaris*, **Cenchrus setiger*, **Cynodon dactylon*, **Echinochloa colona*, **Malvastrum americanum*, **Setaria verticillata*, and **Vachellia farnesiana* were recorded from the Survey Area. None are listed as weeds of national significance, declared pests or considered to be of priority for management in the Pilbara region. The most frequently observed introduced taxa were **C. ciliaris* (41 sites and 45 opportunistic locations) and **B. bipinnata* (23 sites, as well as three opportunistic locations).

A total of 26 vegetation types from 17 broad floristic formations were described and delineated from the Survey Area. The dominant broad floristic formation was *Triodia* low hummock grassland which supported five vegetation types (673 ha or 39 %). The *Acacia*-dominated floristic formations (which included nine broad floristic formations) supported a total of 12 vegetation types which together made up approximately 41 % of the Survey Area (710 ha). Vegetation types were found across nine landforms, including stony plain, drainage area/ floodplain, hillcrest/ upper hillslope, hillslope and undulating low hill, calcrete plain, major drainage line, medium drainage line, minor drainage line and gilgai plain.

The vegetation types described from the Survey Area are not considered to be analogous with any known Threatened or Priority Ecological Communities occurring in the Pilbara region. Vegetation type GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte shares affinities with Priority one PEC, 'West-Angelas Cracking-Clays', due to its' location on cracking-clays (gilgai plain) and presence of; *Astrebla elymoides*, *Astrebla pectinata*, and *Sida fibulifera*. However, as these species did not form a dominant part of the vegetation structure (recorded as scattered) it was determined that this vegetation type does not represent the 'West-Angelas Cracking-Clays' PEC.

Several vegetation types throughout the Survey Area were considered significant for other reasons, including those considered to be 'ecosystems at risk' for the Hamersley subregion. These were SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri (analogous with grove/ inter-grove mulga, eastern Hamersley Range), FP AaAinAte(±ExEg) CcEnpoChf BbClvAbl, SP AaAptAp AteSeglErff EnpoCcArc, FP AaApAte SeglMam EnpoEmuAri Tp (analogous with valley floor mulga) and MA EcrEv AciAcp CcCsEuaMahElp (analogous with major ephemeral water courses).

Two mapped vegetation types, MA EcrEv AciAcp CcCsEuaMahElp and ME CcCsChf EvAci Aads, are considered to be groundwater dependent vegetation, due to the presence of *Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* and several other mesic-indicator flora. MA EcrEv AciAcp CcCsEuaMahElp is likely to have a moderate dependence on groundwater and may potentially represent a groundwater dependent ecosystem, whereas ME CcCsChf EvAci Aads is likely to have low groundwater-dependence and is unlikely to represent a groundwater dependent ecosystem. These vegetation types coincide with major and medium drainage lines that run through the Survey Area, and include the Fortescue River in the northeast, Gingianna Pool adjacent to Great Northern Hwy, Western Creek in the southwest portion, Whaleback Creek near Marble Bar Road, as well a number of unnamed rivers.

One mapped vegetation type, SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri, is considered to be a sheet-flow dependent ecosystem. This low woodland vegetation contained two mulga species,

Acacia aptaneura and *Acacia incurvaneura*, and exhibited distinct groving/ intergroving typical for landforms prone to overland sheet-flow of water. This vegetation type broadly aligned with the Spearhole Land System which is known to support sheet-flow ecosystems.

The condition of the vegetation in the Survey Area ranged from completely degraded to excellent, with the majority in good or better condition (86%). The most common impacts to the vegetation were from cattle grazing and trampling, which is more evident across floodplains and drainage lines.

1 INTRODUCTION

1.1 Background

BHP Western Australian Iron Ore (BHP WAIO) are investigating the biological values of potential pipeline options for the Western Ridge area (hereafter referred to as the Survey Area) to provide local and contextual information to inform future environmental approvals. The Survey Area comprises three separate portions, referred to as the southwest, central and northeast portions (from west to east across the Survey Area), and located approximately 23 kilometres (km) southwest to 10 km east of Newman and covers a total area of approximately 1,720 hectares (ha) (Figure 1.1).

To support future approvals, BHP WAIO commissioned Biologic Environmental Survey Pty Ltd (Biologic) to undertake a single season reconnaissance flora and vegetation survey of the Survey Area. The Survey Area is located within the Pilbara and Gascoyne bioregions (Figure 1.1), and is partly located within BHP Iron Ore, and BHP Billiton Minerals tenements, encompassing off tenure and mining operational areas (Figure 1.2). Biologic completed a concurrent reconnaissance flora and vegetation survey of an area adjacent to the Survey Area, just south of the Whaleback mine site, for which a separate memo report is being produced (referred to in this report as 'Whaleback Survey Area').

The flora and vegetation assessment does not apply to any specific development proposed by BHP WAIO; however, the assessment will be used to inform future environmental assessments within and more broadly in the vicinity of the Survey Area. This report documents the findings of this assessment, which consisted of a desktop assessment and field survey comprising a reconnaissance survey and limited targeted sampling.

1.2 Objectives

The overarching objective of the single season reconnaissance flora and vegetation survey (hereafter the Survey) was to identify the flora and vegetation values of the Survey Area and to determine if there are any significant values that need to be considered during any future environmental assessments across the Survey 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 reconnaissance flora and vegetation survey across the Survey Area and relevant regional context;
- A review of the results of the flora and vegetation survey to determine if there are any significant environmental values within the Survey Area; and
- A discussion of the significant environmental values (and remaining environmental values) in a regional and local context.

760000
770000
780000
790000
7410000
7400000

Newman
Welsh Dr
Newman Dr
Gun Club Rd
Marble Bar Rd
Great Northern Hwy

Legend

- Survey Area
- Local Road
- State Road
- Local Government Authority

IBRA Subregion

- Augustus
- Fortescue
- Hamersley

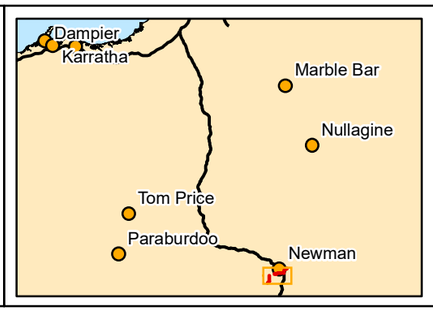
N

biologic Environmental Survey

Scale: 1:90,000

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 1.1: Survey Area and regional location

760000 770000 780000 790000

7410000 7400000

G 52/131 G 52/143 G 52/138 G 52/240 G 52/276 E 52/2009-I L 52/185
G 52/148 G 52/152 L 47/92
G 52/158 G 52/162
G 52/166 G 52/169
52/171 G 52/182 G 52/186
G 52/190 G 52/194
52/187 G 52/198 G 52/201
G 52/206 G 52/210
G 52/216
G 52/219
G 52/227 G 52/233
52/230

ML 244SA
Mt Whaleback

Mt Newman
29, 30, 35

Newman

Marble Bar Rd

E 5201894

G 52/279
G 52/262
G 52/265
G 52/268 G 52/277
G 52/269
M 266SA G 52/272 G
52/274

L 52/199
E
52/3360-I
E 52/3448-I

E 52/3361-I

PRAIRIE
DOWNS
STATION

E 5203366

ETHEL CREEK
STATION

E 5203671

E 5203366

ETHEL CREEK
STATION

Great Northern Hwy

Legend

- Survey Area
- Operating Mine
- State Road
- Current BHP Tenement

Tenement Holder

- GATEWAY PROJECTS WA PTY LTD
- GREENMOUNT RESOURCES PTY LTD
- HAMERSLEY IRON PTY. LIMITED

Ex-Pastoral Lease

- ETHEL CREEK STATION
- PRAIRIE DOWNS STATION

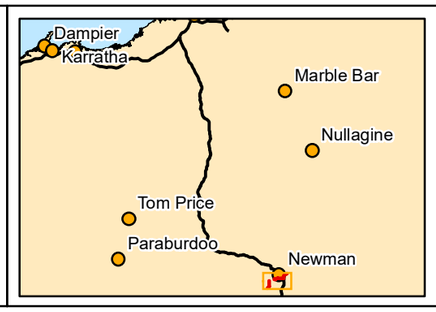
N

biologic Environmental Survey

Scale: 1:90,000

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/07/2021



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Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 1.2: Survey Area and BHP tenure

1.3 Legislation and Compliance

1.3.1 Compliance

The survey was carried out in a manner consistent with the Western Australian Environmental Protection Authority (EPA), Department of Biodiversity, Conservation and Attractions (DBCA) and BHP WAIO guidelines for the environmental surveying and reporting of flora and vegetation. The following guidelines, procedures and documents were used 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 WAIO, 2020); and
- BHP WAIO's Vegetation and Flora Survey Procedure (0124627) (BHP, 2018).

1.3.2 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).

Flora taxa 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 are called significant flora taxa. 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. The Western Australian Minister for Environment has endorsed 69 ecological communities as threatened under four categories: critically endangered (20), endangered (17), vulnerable (28) and presumed totally destroyed (four).

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 'significant' for all development related approvals 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 (poorly known), 4 (near threatened) or 5 (conservation dependent).

Table 1.1: Conservation significance assessment guidelines

Agreement, Act or List	Status Codes
Federal	
EPBC Act The Department of Agriculture, Water, and the Environment (DAWE) 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 the categories listed under 'Status Codes'.	Species • Extinct (EX) • Extinct in the Wild (EW) • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU) • Conservation Dependent (CD)
TECs are those that are at risk of extinction.	TECs • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU)
State	
BC Act The BC Act provides for the listing of threatened native flora and TECs 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).	Species • Extinct (EX) • Extinct in the Wild (EW) • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU)
	TECs • Presumed Totally Destroyed (PD) • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU)
DBCA Priority List DBCA produces a list of Priority species and ecological communities that have not been assigned statutory protection under the BC Act. This system gives a ranking from Priority 1 to Priority 5.	• Priority 1 (Poorly-known species/ ecological communities) (P1) • Priority 2 (Poorly-known species/ ecological communities) (P2) • Priority 3 (Poorly-known species/ ecological communities) (P3) • Priority 4 (Rare, Near Threatened species/ ecological communities, in need of monitoring) (P4) • Priority 5 (Conservation dependent ecological communities) (P5)

1.3.3 Introduced Flora

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 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 are known as declared pests (DPs). The main purposes of the BAM Act and its regulations related to DPs 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 Pests listed under Section 22 (not including pests listed under Section 12 of the BAM Act; Prohibited Pests) are placed in one of three control 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 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.

Prohibited pests listed under Section 12 of the BAM Act are assigned separate control categories:

- Category 1 (C1) – Exclusion: if in the opinion of the Minister introduction of the prohibited organism into the State or a part of the State should be prevented; and
- Category 2 (C2) – Eradication: if in the opinion of the Minister eradication of the prohibited organism from the State or a part of the State is feasible.

Weed Prioritisation

In 2008, the Department of Parks and Wildlife (now DBCA) developed and implemented an integrated approach to weed management on Parks and Wildlife-managed lands in Western Australia, the Weed Prioritisation Process (DBCA, 2013). It was updated in 2013 and further revised in 2016. Weeds were prioritised 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 the DBCA. The key priorities are now centred on ‘Priority Alert’ weeds and weeds that receive a rating for ‘ecological impact’ and ‘invasiveness’.

2 ENVIRONMENT

2.1 Biogeography

The Survey Area is located in the southern section of the Pilbara Craton (Kendrick, 2001) in the Pilbara and Gascoyne bioregions (Figure 1.1), as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway & Cresswell, 1995). The Pilbara bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges, with predominantly mulga low woodlands or snappy gum over bunch and hummock grasses (Thackway & Cresswell, 1995).

The Pilbara bioregion is classified into four separate subregions, Chichester (PIL01), Fortescue (PIL02), Hamersley (PIL03) and Roebourne (PIL04), of which the Survey Area is located within the Hamersley subregion (Figure 1.1). The Hamersley subregion is characterised by mountainous areas 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 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 Range (to the south) and Chichester Range (to the north) drain to give rise to the Fortescue Marsh and Fortescue River system (McKenzie *et al.*, 2002).

The Gascoyne bioregion is characterised by Proterozoic sedimentary and granite ranges divided by broad flat valleys. Vegetation is dominated by open mulga woodlands on the shallow earthy loams over hardpan on the plains, with mulga scrub and *Eremophila* shrublands occurring on the shallow stony loams of the ranges (Thackway & Cresswell, 1995).

The Gascoyne bioregion is classified into three separate subregions, Ashburton (GAS01), Carnegie (GAS02), and Augustus (GAS)3). The southern and eastern sections of the Survey Area are located within the Augustus subregion. The Augustus subregion is characterised by rugged low sedimentary and granite ranges divided by broad flat valleys (Desmond *et al.*, 2001). Vegetation is dominated by mulga woodland with *Triodia,* occurring on the shallow stony loams on rises, while the shallow earthy loams over hardpan on the plains are covered by Mulga parkland (Desmond *et al.*, 2001). This subregion contains the headwaters of the Ashburton and Fortescue Rivers (Desmond *et al.*, 2001).

2.2 Existing Land Use and Tenure

The Survey Area is comprised of three mining tenements held by BHP Billiton Minerals Pty Ltd and BHP Iron Ore (Jimblebar) Pty Ltd (a subsidiary of the BHP Group), which include one mining lease, one mineral lease and one exploration licence (Figure 1.2). Three other exploration licences occur across the Survey Area, with these held by Gateway Projects WA Pty Ltd (E 5203366), Greenmount Resources Pty Ltd (E 5203671), and Hamersley Iron Pty Limited (E 5201894).

The southwest portion and the lower half of the central portion are located within the Ethel Creek pastoral lease and on the edge of Prairie Downs pastoral lease, which are actively utilised for the grazing of cattle. Pastoral infrastructure, including tracks and fences, exists within the Survey Area, while mining and exploration works occur to the north (Mt Whaleback). The Survey Area is located within the Shire of East Pilbara and the Shire of Meekatharra local government authorities (LGA) (Figure 1.1).

2.3 Climate

The Pilbara bioregion has a semi-desert to tropical climate, with rainfall occurring sporadically throughout the year, although mostly during summer (Thackway & Cresswell, 1995). Summer rainfall is usually the result of tropical storms in the north or tropical cyclones that impact upon the coast and move inland (Leighton, 2004). The winter rainfall is generally lighter and is the result of cold fronts moving north easterly across the state (Leighton, 2004). Meanwhile, the Gascoyne bioregion has a desert/ arid climate with a bimodal rainfall pattern of predominantly winter rainfall in the west, and summer rainfall in the east (Bastin & ACRIS, 2008; Desmond *et al.*, 2001).

Long-term climatic data are not available for the Survey Area itself; however, long term climatic data are available from the Bureau of Meteorology (BoM) weather station at Newman Airport (Station 7176), 1.9 km south east of the Survey Area (BoM, 2020). Newman Airport is expected to provide the most accurate long-term average (LTA) dataset for climatic conditions experienced within the Survey Area (Figure 2.1).

The average annual rainfall for Newman ranges from 200–400 millimetres (mm), although there are significant fluctuations between years (BoM, 2021a), with up to 1,200 mm falling in some locations in some years (McKenzie *et al.*, 2009). Annual rainfall on the Chichester and Hamersley Ranges is 400 mm (Tille, 2006).

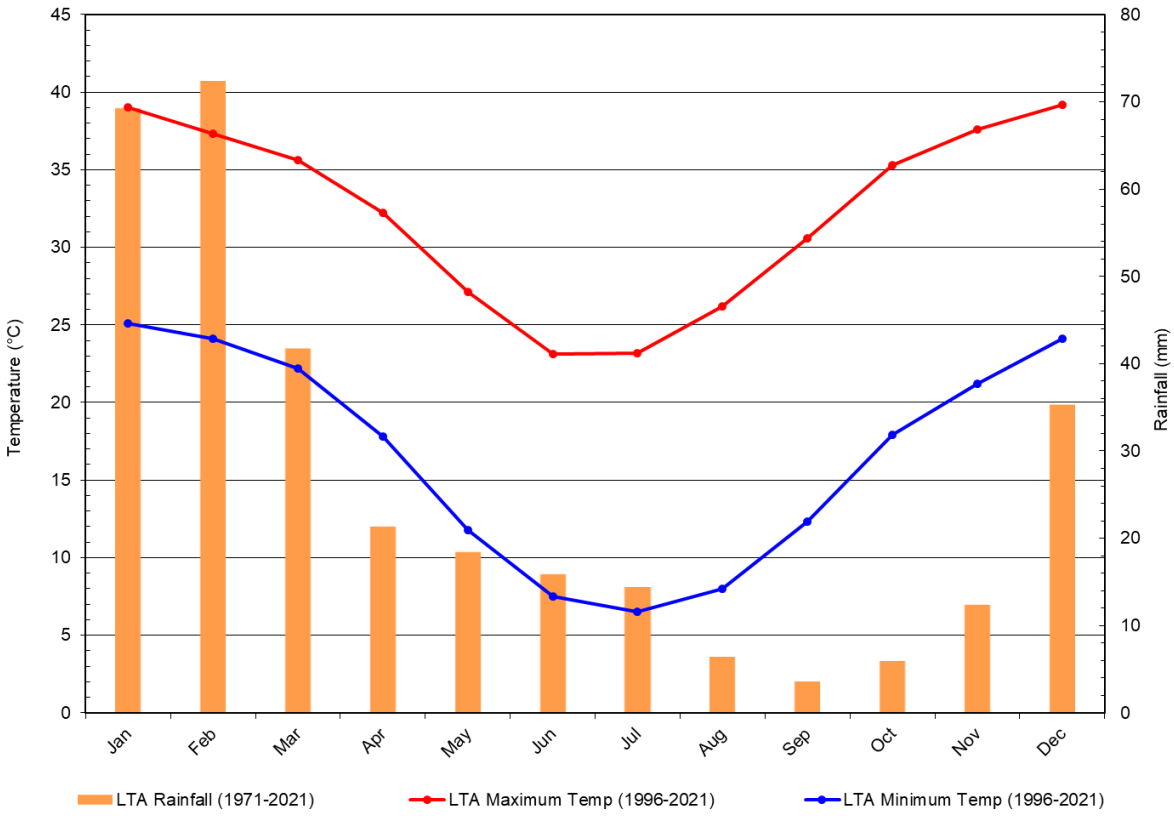


Figure 2.1: Long-term rainfall and temperature from Newman Airport Station 7176 (BoM, 2021a)

2.4 Geology

According to the Australian Geological Provinces database, the Survey Area is located mostly within the Warakurna Large Igneous Province (Geoscience Australia, 2021). This database was compiled Australia-wide with spatial data captured at a wide scale of approximately 1:1 million. The Warakurna Large Igneous Province consists of layered mafic-ultramafic intrusions, mafic to felsic volcanic rocks and dykes, extensive mafic sills and swarms of mafic dykes (Wingate *et al.*, 2004). The Warakurna Large Igneous Province consists of coeval mafic igneous rocks. The bulk of the magmatic products emplaced between 1,078 and 1,070 million years ago, along an east-west swath approximately 800 km wide and 2,400 km long (Wingate *et al.*, 2004). Portions of the Survey Area are also located within the Fortescue Basin, Hamersley Basin, and the Sylvania Dome Provinces (Geoscience Australia, 2021).

The Fortescue Basin overlies the Pilbara Craton and entirely consists of the Fortescue Group, which is predominantly a volcanic succession, characterised by basaltic rocks. The Hamersley Basin then overlies the Fortescue Basin, consisting of banded iron formation, chert, pelite, felsic volcanic rocks, dolostone, and dolomitic mudstone. The Sylvania Dome or Inlier is an Archaean granite-greenstone outcrop with mafic- ultra mafic sills that is located within the Hamersley and Fortescue Basins (Hickman *et al.*, 2010; Tyler, 1991).

At a finer scale (1:500,00) bedrock geology of the Survey Area (GSWA, 2016) is shown in Figure 2.2. The most dominant unit across the Survey Area is the Bunjinah Formation (A-Fou-bbo) at 506 ha or 29 % (Table 2.1).

Table 2.1: Bedrock geology units of the Survey Area

Bedrock Geology Unit	Description	Survey Area	
		ha	%
Bunjinah Formation (A-FOu-bbo)	Pillowed and massive basaltic flows; basaltic breccia and basaltic volcanic sandstone; minor chert; amygdaloidal basalt flows occur in upper parts of formation; metamorphosed	506	29
Sylvania Inlier granitic unit (A-g-PYV)	Granite to granodiorite; metamorphosed and variably foliated	425	25
Fortescue Group (A-FO-od)	Dolerite dyke or sill	376	22
Jeerinah Formation (A-FOj-xs-b)	Siliciclastic sedimentary rocks, mafic volcanic rocks and minor felsic volcanic rocks; local carbonate rocks, chert, and dolerite sills	374	22
Marra Mamba Iron Formation (A-Ham-cib)	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed	40	2
Total		**1,720**	**100**

NB: values have been rounded to the nearest whole number

760000
770000
780000
790000
7410000
7400000
Newman
Marble Bar Rd
Great Northern Hwy

Legend

- Survey Area
- State Road

Interpreted Bedrock Geology

- A-FO-od; Fortescue Group
- A-FOj-xs-b; Jeerinah Formation
- A-FOu-bbo; Bunjinah Formation
- A-HAd-kd; Wittenoom Formation
- A-HAm-cib; Marra Mamba Iron Formation
- A-cc-PYV; Sylvania Inlier greenstones
- A-g-PYV; Sylvania Inlier granitic unit
- AP_-HAu-xsl-ci; Mount McRae Shale and Mount Sylvia Formation
- P_-HAb-cib; Brockman Iron Formation
- P_-HAj-xci-od; Weeli Wolli Formation

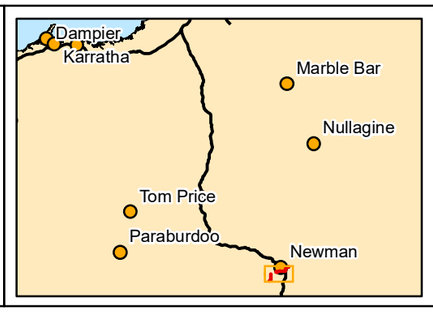
N

biologic Environmental Survey

Scale: 1:90,000

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 2.2: Broad geology of the Survey Area

2.5 Soils and Landforms

The Atlas of Australian Soils (Northcote *et al.*, 1960-1968) was compiled by Commonwealth Scientific and Industrial Research Organisation (CSIRO) in the 1960s to provide a consistent national description of Australia's soils. It comprises of a series of 10 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 units that have been mapped across the Survey Area comprise Oc64, Fa13, and BE6 (Northcote *et al.*, 1960-1968) (Table 2.2 and Figure 2.3). The majority of the Survey Area is mapped as BE6 occurring across both the southwest and northeast portions. A small corner of the central portion is mapped as Fa13, and soil unit BE6 runs through all three portions.

Table 2.2: Soil landscape units mapped within the Survey Area

Soil Unit	Description	Survey Area	
		ha	%
BE6	Extensive flat and gently sloping plains that sometimes have a surface cover of gravels and on which red-brown hardpan frequently outcrops: chief soils are shallow earthy loams	890	52
Oc64	Low stony hills and dissected pediments on granite with occasional basic dykes: chief soils are hard. Soils with predominantly physical limitations; hard-setting soils with dispersible clay subsoils.	802	46
Fa13	Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams along with some soils on the steeper slopes.	28	2
Total		**1,720**	**100**

NB: values have been rounded to the nearest whole number

At a finer scale, the Survey Area consists of soils varying from shallow to deep red brown loams, stony soils, deep sands, to cracking and non-cracking clays. Stony soils predominately occur on hills and ridges with some areas of calcareous shallow loams. Deep red brown sands are located on sandy levees and sand sheets compared to more shallow red sands on some stony plains. Undulating plains have non-cracking clays, whilst the flatter plains and drainage floors have cracking clays. Red shallow loam is common across the Survey Area from the hills and ridges to footslopes and plains with areas of deeper loamy soil on gilgai plains (van Vreeswyk *et al.*, 2004).

The Survey Area occurs within the Hamersley Plateaus Zone. The dominant broad landforms in the Survey Area are low stony hills, ranges with dykes and dissections, and extensive flat and gently sloping plains (Northcote *et al.*, 1960-1968).

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7400000
Newman
Marble Bar Rd
Great Northern Hwy

Legend

Survey Area
State Road

Soil Unit

BE6
Fa13
Fa14
Oc64

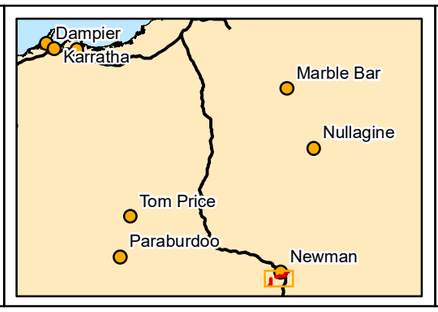
N

biologic Environmental Survey

Scale: 1:90,000

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 2.3: Soil landscape units of the Survey Area

2.6 Land Systems

Work undertaken by a joint team from the Department of Primary Industries and Regional Development (DPIRD) (formerly Department of Agriculture) and the Department of Planning, Lands and Heritage (formerly Department of Lands Administration) classified the pastoral areas of Western Australia (Payne *et al.*, 1988; 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 (Payne *et al.*, 1988; van Vreeswyk *et al.*, 2004).

Six land systems have been mapped as occurring across the Survey Area; Elimunna, McKay, Newman, River, Rocklea and Spearhole (Payne *et al.*, 1988; van Vreeswyk *et al.*, 2004) (Table 2.3 and Figure 2.4). The dominant land system is the Elimunna land system, which covered approximately 42 % of the Survey Area (Table 2.3). The Elimunna land system is described as 'stony plains on basalt supporting sparse *Acacia* and *Senna* shrublands and patchy tussock grasslands' (Table 2.3).

Table 2.3: Land Systems of the Survey Area

Land System	Land Type	Description	Extent in Survey Area	
			Ha	%
Elimunna	Stony plains with *Acacia* shrublands	Stony plains on basalt supporting sparse *Acacia* and *Senna* shrublands and patchy tussock grasslands.	726	42
Rocklea	Hills and ranges with spinifex grasslands	Basalt hills, plateaux, lower slopes, and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.	519	30
Spearhole	Wash plains on hardpan with mulga shrublands	Gently undulating gravelly hardpan plains and dissected slopes supporting groved mulga shrublands and hard spinifex.	308	18
McKay	Hills and ranges with spinifex grasslands	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands.	84	5
Newman	Hills and ranges with spinifex grasslands	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	48	3
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.	34	2
		Total	**1,720**	**100**

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

760000
770000
780000
790000
7410000
7400000
Newman
Marble Bar Rd
Great Northern Hwy

Legend

- Survey Area
- State Road

Land System

- Boolgeeda System
- Divide System
- Egerton System
- Elimunna System
- McKay System
- Newman System
- Prairie System
- River System
- Robe System
- Rocklea System
- Spearhole System
- Sylvania System
- Washplain System

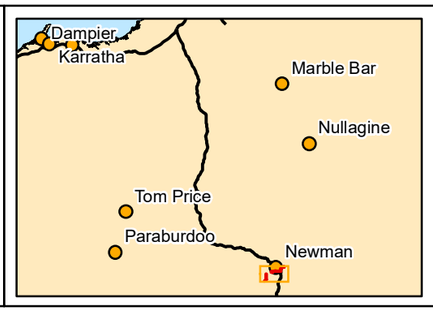
N

biologic Environmental Survey

Scale: 1:90,000

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 2.4: Land systems of the Survey Area

2.7 Hydrology and Hydrogeology

The surface and groundwater hydrology of the Pilbara is highly variable as a result of a dynamic climate with severe droughts and major flooding (DoW, 2010). Streamflow's are usually a direct response to rainfall and are therefore highly seasonal and variable. Most runoff occurs from January to March as a result of episodic cyclonic activities (DoW, 2010).

The Survey Area is located within the Fortescue River basin, which extends from the Upper Fortescue River, along the Fortescue Marsh, and through the Lower Fortescue River. At a finer scale, the Survey Area is located within the Upper Fortescue River Catchment and occurs primarily within the Ophthalmia Dam and overlaps with an unnamed sub-catchment along Marble Bar road (Figure 2.5). The north-eastern point of the Survey Area crosses a section of the Fortescue River, whilst the south-eastern point crosses Western Creek (Figure 2.5). Several unnamed drainage lines are located throughout the Survey Area.

The Fortescue River is a major drainage line that crosses a small section of the Survey Area in the northeast. It is an ephemeral river system that flows during rainfall events associated with cyclonic activity or large summer storms. However, the Survey Area intersects the Fortescue River near the Ophthalmia Dam, where surface water is apparent most of the year. Gingianna Pool is another ephemeral drainage system that intersects a small section of the Survey Area, and likely overflows into the Fortescue River following significant rainfall events. Western Creek is a medium and, at times, major ephemeral drainage line that passes through the southwestern edge of the Survey Area, flowing into the Fortescue River approximately 13 km east of the Survey Area.

Surface water hydrology within the Survey Area is regulated by minor drainage lines that flow from the west or south-west to the north and north-east (Figure 2.5). These minor drainage lines end up discharging into the Fortescue River.

Groundwater originates from direct infiltration by rainfall and from surface water flows. Groundwater occurs throughout the Pilbara but is most easily located and accessed near surface water drainage lines (alluvial channels). The most significant aquifers can be grouped into three types: alluvial aquifers that are either unconsolidated sedimentary aquifers or chemically deposited aquifers, consolidated sedimentary (or sedimentary rock) aquifers and fractured rock aquifers. Broadly, the groundwater associated with the Survey Area is located within fractured and weathered rock aquifers. Groundwater is stored in fractures and voids in the rocks and therefore tends to be localised. Groundwater recharge is also episodic and affected by direct infiltration of rainfall over areas where the rocks are fractured.

760000
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790000
7410000
7400000

Newman
Gingianna Pool
Marble Bar Rd
Warrawanda Creek
Warrawanda Creek
Fortescue River
Western Creek
Great Northern Hwy
Fortescue River
Western Creek
Spearhole Creek
Sylvania Creek

Legend

- Survey Area
- State Road

Surface Hydrology

- Minor
- Major

Fortescue River Upper Subcatchment

- Ophthalmia Dam
- Unnamed

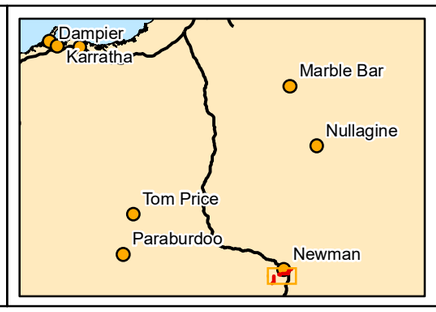
N

biologic Environmental Survey

Scale: 1:90,000

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 2.5: Hydrology of the Survey Area

2.7.1 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystems that rely upon groundwater for their continued existence (BoM, 2021b). 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, 2021b);

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, 2021b). 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 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 a small proportion of the Survey Area has the potential to support GDEs based on the terrestrial GDE (Appendix B) and terrestrial in-flow dependent ecosystems (IDEs) (Appendix B) assessment. The majority of the Survey Area has a low GDE potential (national assessment), while small sections of the Survey Area which intersect more major drainage landform

features (including the Fortescue River in the far northeast, Gingianna Pool in the central portion and Western Creek in the far southwest) have a moderate potential for GDEs. These small sections are also considered highly likely to support IDEs, while the rest of the Survey Area is considered likely or has not been assessed for IDEs (BoM, 2021b).

2.7.2 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 an important ecological function which is well documented (Dawson & Ahern, 1973; Saco *et al.*, 2007; Winkworth, 1973).

Of the six land systems occurring in the Survey Area, the Elimunna, and Spearhole land systems, which support hardpan plains that are relatively level, can be subject to sheet-flow (van Vreeswyk *et al.*, 2004). The Elimunna land system occurs in the northeast and central areas, while the Spearhole land system in the southwest of the Survey Area. Preliminary review of aerial imagery identified that there are obvious signs of mulga banding in the southwest of the Survey Area, which may indicate ecosystems dependent on sheet-flow.

2.8 Flora and Vegetation Background

2.8.1 Pre-European Vegetation

The Survey Area is located in the Fortescue Botanical District, which is a part of the Eremaean Province (Beard, 1990). The Fortescue Botanical District is essentially a tree- and shrub-steppe with *Eucalyptus* trees, *Acacia* shrubs, *Triodia pungens* and *Triodia wiseana* (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 Survey Area were mapped by Beard (1975), in which he classified the following three vegetation associations (Figure 2.6):

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

The majority of the Survey Area was mapped as vegetation association 29, while a band through the central areas and into the northeast corner was mapped as vegetation association 18 (Figure 2.6).

Shepherd *et al.* (2002) reinterpreted and 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 Beard (1975) mapping. Shepherd *et al.* (2002) created a series of 'systems' to assist in removing mosaic vegetation associations originally mapped by Beard (1975); however, some mosaics still occur. The Survey Area is located within the Hammersley, and Kumarina Hills Systems, and under Shepherd *et al.* (2002) comprises:

- Hammersley 18.11: *Acacia* open shrubland / *Ptilotus* mixed open forbland;
- Hammersley 82.3: *Eucalyptus* sparse mallee shrubland / *Senna* mixed sparse shrubland / *Triodia* open hummock grassland and;
- Kumarina 29.0: *Acacia* isolated clumps of shrubs.

The current extent of each of the vegetation system associations remaining exceeds 98% across the four regional scales: State, bioregion (Pilbara, Gascoyne), subregion (Hamersley, Augustus) and Local Government Authority (Shire of East Pilbara and Shire of Meekatharra) (Government of Western Australia, 2019) (Table 2.4 and Table 2.5). Currently only two of the 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 extent within reserves, respectively (Government of Western Australia, 2019) (Table 2.4). However, vegetation system association 29.0, of the Kumarina Hills system association (Table 2.5), is not represented within the National Reserve System (Government of Western Australia, 2019).

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7400000
Newman
Marble Bar Rd
Great Northern Hwy

Legend

Survey Area
State Road

Pre-European Vegetation

HAMMERSLEY_18
HAMMERSLEY_82
KUMARINA HILLS_18
KUMARINA HILLS_216
KUMARINA HILLS_29

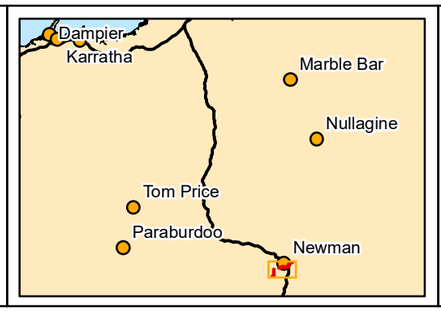
N

biologic Environmental Survey

Scale: 1:90,000

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 2.6: Vegetation associations of the Survey Area

Table 2.4: Regional and local extent of the Hamersley System Associations within the Survey Area

Code	Survey Area (ha / %)	Scale	Pre-European extent (ha)	Current extent remaining (ha / %)	Current extent remaining within reserves (ha / %)
18.11	666.67	State	580,556	575,851 / 99.19	113,404 / 19.69
		Pilbara	580,512	575,808 / 99.19	113,404 / 19.69
		Hamersley	580,512	575,808 / 99.19	113,404 / 19.69
		Shire of East Pilbara	224,292	220,375 / 98.25	44.41 / 0.02
		Shire of Meekatharra	25,265	25,265 / 100	n/a
82.3	331.24	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
		Shire of East Pilbara	573,313	565,215 / 98.59	n/a
		Shire of Meekatharra	78, 311	78,016 / 99.62	n/a

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.

Table 2.5: Regional and local extent of the Kumarina Hills System Association within the Survey Area

Code	Survey Area (ha / %)	Scale	Pre-European extent (ha)	Current extent remaining (ha / %)	Current extent remaining within reserves (ha / %)
29.0	722.52	State	784,575	784,364 / 99.97	n/a
		Gascoyne	780,622	780,429 / 99.98	n/a
		Augustus	780,337	780,144 / 99.98	n/a
		Shire of East Pilbara	42,853	42,645 / 99.51	n/a
		Shire of Meekatharra	732,193	732,191 / 100.00	n/a

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). Both the Pilbara and Gascoyne bioregions are underrepresented bioregions, with both having less than 10% of its total area protected in reserves. The Hamersley subregion is adequately represented, with more than 12% of the subregional area protected in reserves, while the Augustus subregion is underrepresented, with less than 5% of the subregional area protected in reserves.

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

3 METHODOLOGY

3.1 Desktop Assessment

3.1.1 Database searches

Database searches were undertaken to generate a list of vascular flora taxa previously recorded within, and near, the Survey Area, including introduced and significant taxa. The database searches also identified ecological communities/ vegetation types of significance that occur, or may occur, within and near the Survey Area. Conservation codes for flora and vegetation of significance are provided in Appendix A. Six database searches were conducted around a central coordinate (23°27'5.04"S; 119°41'35.16"E), with varying buffers as deemed appropriate (Table 3.1).

Table 3.1: Database searches conducted for the Survey Area

Purpose	Database	Search Radius
To identify flora species and communities previously recorded within the Survey Area and its vicinity, in particular those of significance	DBCA's Threatened & Priority Flora; and Threatened and Priority Ecological Communities databases (DBCA, 2021b, 2021c)	40 km
	DBCA's NatureMap (DBCA, 2021a)	40 km
	Atlas of Living Australia (ALA) (ALA, 2021)	40 km
To identify potential species listed under the Commonwealth EPBC Act within the Survey Area	DAWE Protected Matters Search Tool (PMST) (DAWE, 2021)	40 km
To identify declared pest plants within the Survey Area	Declared Plants Database – Western Australian Organism List (WAOL) (DPIRD, 2021)	Shire of East Pilbara

3.1.2 Literature review

Background information on the Survey Area and surrounds was compiled prior to, during and after the field survey, to determine likely species assemblages and potential significant taxa. Historic vegetation mapping conducted by Beard (1975) 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 Survey Area. The literature review also considered 37 previous field and desktop surveys of relevance to the Survey Area (Table 3.2). The previous surveys and assessments that were considered were provided by BHP WAIO and the Index of Biological Surveys for Assessments (IBSA). All are located within a radius of 10 km from the Survey Area.

Table 3.2: Literature sources used for the review

Survey Title	Reference	Distance from Survey Area (km)
Detailed Flora and Vegetation Surveys		
Baseline Biological & Soil Surveys and Mapping for ML244SA West of the Fortescue River	Biota (2001)	Partially overlaps Survey Area
Orebody 35 and Surrounds Flora and Vegetation Survey	GHD (2011b)	Partially overlaps Survey Area
Western Ridge Biological Survey	Onshore (2014b)	Partially overlaps Survey Area
Coombanbunna Well Detailed Flora and Vegetation Survey	Biologic (2020a)	Partially overlaps Survey Area
Mt Whaleback OB30 and OB35 Soil and Biological Survey	HGM (1999b)	Adjacent north
Western Ridge Exploration Project Biological Survey	ecologia (2005)	Adjacent west
Western Ridge Exploration Project Biological Survey	ecologia (2006a)	Adjacent north & west
Mount Whaleback Flora & Vegetation Assessment – Phase III	ENV (2006a)	Adjacent north
Newman Power Network Flora and Fauna Survey	Biologic (2009)	Adjacent north
Whaleback Flora & Vegetation Survey and Fauna Assessment	Onshore and Biologic (2009)	Adjacent north
Whaleback TSF Flora, Vegetation and Fauna Assessment	Astron (2010)	Adjacent north
Orebody 35 Vegetation Clearing Permit Area Flora and Fauna Assessment	ENV (2010)	Adjacent west
Mt Whaleback East Flora, Vegetation and Fauna Assessment	ENV (2011a)	Adjacent north
Eastern Ridge (OB23/24/25) Flora and Vegetation Assessment	ENV (2012)	Adjacent north
Western Ridge Detailed Flora and Vegetation Survey	Biologic (2020b)	Adjacent south
RGP4 Newman Hub Infrastructure Area Flora and Vegetation Assessment	ENV (2006c)	1 km north
RRG4 Newman Hub Topsoil Stockpile and Borrow Areas for Construction Flora and Vegetation Assessment	ENV (2006d)	1.5 km northwest
Whaleback Power Station Flora and Vegetation Assessment	ENV (2009c)	4.4 km north
Myopic Project Area, Newman Flora and Fauna Assessment	GHD (2008b)	5.2 km northwest
Proposed Kurra Village Extension Area Flora and Vegetation Assessment	ENV (2006b)	5.5 km north
Newman to Yandi Transmission Line Flora and Vegetation Assessment	ENV (2009b)	5.5 km north

Survey Title	Reference	Distance from Survey Area (km)
Reconnaissance flora and vegetation surveys		
Level 1 flora and fauna surveys along the Great Northern Highway for Jimblebar mine module transport	Eco Logical (2012)	1.3 km west
Homestead Creek Culvert Flora and Vegetation Assessment	ENV (2009a)	1.5 km northeast
Newman Power Line Corridor Level 1 Flora and Fauna Survey	Eco Logical (2011)	1.9 km north
Coolibah Village Level 1 Flora and Vegetation Survey and Level 1 Fauna Assessment	Astron (2014)	4.3 km southeast
Kurra Village Targeted Flora, Vegetation and Fauna Survey	Onshore (2015)	5.1 km north
Targeted flora surveys		
Newman Hub: Priority Flora and Weed Survey	ecologia (2004)	Adjacent north
Regional Search for *Lepidium catapycnon* in the Greater Newman Area (Pilbara), Western Australia	ENV (1999b)	2.8 km north
Field Search and Observations of *Lepidium catapycnon* Populations, Mt. Whaleback, Newman	ENV (1999a)	5 km north
Newman Ammonium Nitrate Storage Facility Conservation Significant Flora Survey	ecologia (2006b)	6.3 km north
Newman Ammonium Nitrate Storage Facility - Phase 2 Conservation Significant Flora Survey	ecologia (2006c)	6.3 km north
Mt. Whaleback *Lepidium catapycnon* Survey	HGM (1997)	8 km northwest
Follow-up Survey of Mt. Whale back *Lepidium catapycnon* Population	HGM (1999a)	8 km northwest
Desktop assessments / reviews		
Consolidation of Regional Vegetation Mapping BHP Billiton Iron Ore Pilbara Tenure	Onshore (2014a)	Partially overlaps Survey Area
Western Ridge Southern Tenements Flora and Vegetation Desktop Assessment	Onshore (2016)	Partially overlaps Survey Area
Whaleback AML 7/244 Flora and Vegetation and Vertebrate Fauna Review	Onshore (2013)	Adjacent north
Western Ridge E52/3448 Desktop Flora and Fauna Assessment	Onshore (2018)	Adjacent north

3.2 Survey type, timing and weather

A single season reconnaissance flora and vegetation survey was requested by BHP WAIO. The field survey was undertaken over eight days, equivalent to approximately 168 person hours, between 24 and 31 March 2021 (including mobilisation and demobilisation). The day time climatic conditions during the field survey (hot temperatures and clear skies; BoM, 2021a) were suitable to complete the survey on foot.

Rainfall in the months preceding the field survey was variable, with below long-term averages recorded through most of the dry season. Rainfall was below long-term averages for most of the wet season as well, except February which recorded well above the long-term average for the month (169 mm) (Figure 3.1). In total, the rainfall received in the 11 months prior to the survey (April 2020 to February 2021, 309.00 mm) was well above annual long-term average for the same period, 275.1 mm (BoM, 2021a). The weeks preceding the survey received well below-average rainfall, with March recording 6.6 mm compared to the average of 41.7 mm, with all March rainfall occurring prior to the field survey. However, conditions within the Survey Area were still relatively wet, with a high number of annual or short-lived perennial flora taxa growing at the time of the field survey.

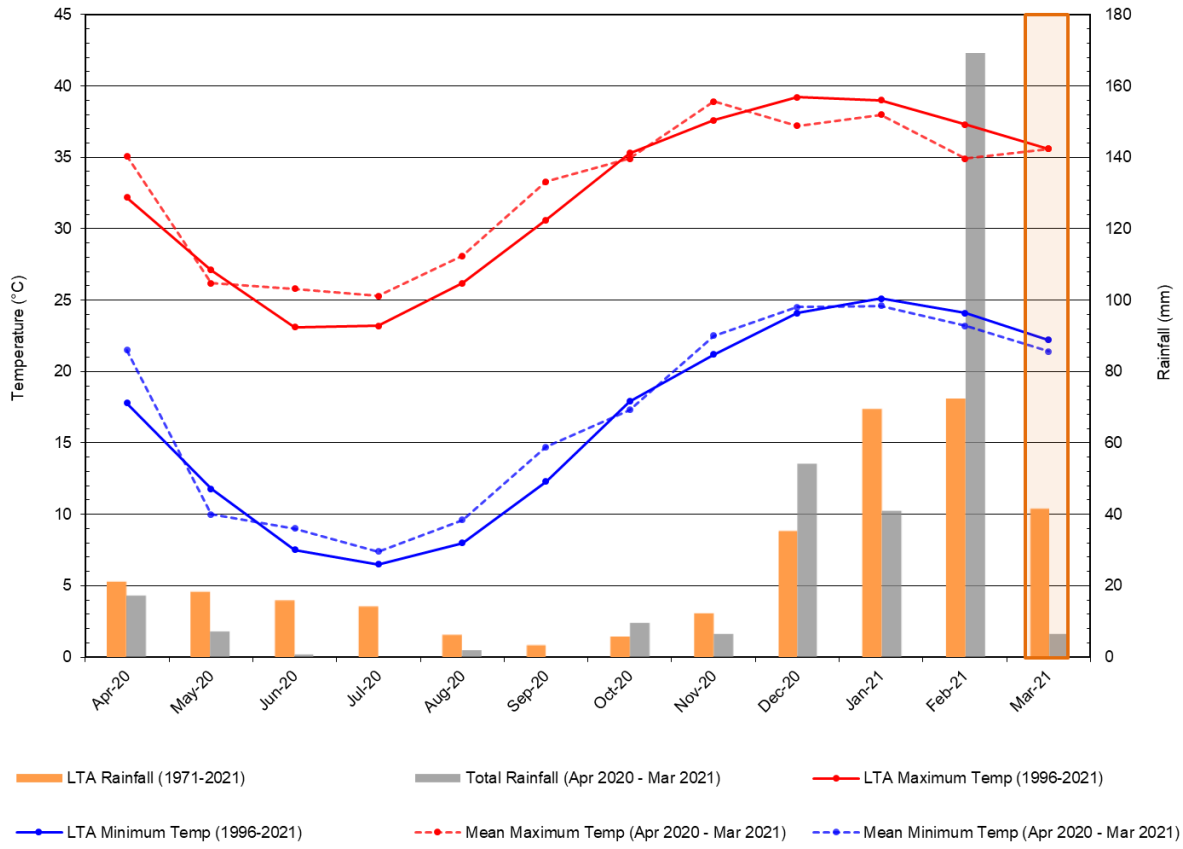


Figure 3.1: Monthly and long-term average rainfall and climatic data for Newman Airport (station 7176; BoM, 2020).

3.3 Survey team and licensing

The field survey was managed by Mr Clinton van den Bergh, a principal botanist with over 14 years' experience, and meets the minimum requirements (5+ years' experience in the bioregion) to lead and manage a flora survey in the Pilbara. Clinton was assisted in the field by botanist Mary van Wees, who has over five years' experience conducting flora and vegetation surveys in the Pilbara. Details of the survey team and licences are provided in Table 3.3.

Table 3.3: Survey team and licensing

Team Member	Role	Survey Dates	Flora Licence	Threatened Flora Licence
Clinton van den Bergh	Principal botanist and field survey lead	24 – 31 March 2021	FB62000105	TFL 59-1819
Mary van Wees	Botanist	24 – 31 March 2021	-	-

3.4 Field Survey

3.4.1 Reconnaissance flora and vegetation survey

Aerial photography (Scale 1:15,000) of the Survey Area and Google Earth Pro©, were used with previous vegetation mapping (Beard, 1975; Shepherd *et al.*, 2002) and soil landscape mapping (Northcote *et al.*, 1960-1968), to determine broad preliminary vegetation type boundaries prior to the field survey. Reconnaissance surveys are traditionally sampled at a low intensity via relevés (unmarked area within which data is collected; EPA, 2016a) and mapping points (unmarked area within which the vegetation unit and condition is broadly described).

Where practical, at least one sampling site (relevé) was established in each of the preliminary vegetation type areas (Figure 3.2), to ensure that each vegetation type occurring within the Survey Area was captured by the survey and described appropriately in accordance with EPA (2016b) guidelines. The entire Survey Area was accessible via vehicle and on foot, with all the major landforms and vegetation units traversed and sampled.

A total of 109 relevé sites were sampled across the Survey Area, while an additional 21 relevé sites were sampled within the Whaleback Survey Area (Table 3.4; Appendix C). Dominant vascular flora taxa within each relevé were recorded. Taxa not yet recorded from relevés or during site traverses, were also recorded to document a comprehensive species list for the Survey Area. A brief summary of the condition and vegetation assemblage at each site was also recorded to aid in producing vegetation unit descriptions (NVIS Technical Working Group, 2017). In addition, the following information was recorded at each site:

- relevé number;
- date of survey;
- personnel;
- a central GPS coordinate (GDA 94);
- site photograph of the representative vegetation unit, generally facing south-east;
- soil characteristics (texture and colour);
- geology (type, size and nature of any rocks, stones, gravel, or outcropping);

- topography (landform type and aspect);
- vegetation condition (Appendix E);
- vegetation structure, including the dominant flora species in the three traditional strata, upper, mid and lower;
- disturbance (if present);
- approximate time since last fire; and
- GPS coordinates for significant or introduced flora.

Flora taxa observed opportunistically in the vicinity of sample sites, or while traversing the Survey Area, were also recorded. For any populations of taxa known to be of significance or introduced, a GPS location and a count of the individuals present, or percentage foliage cover for a given area, were recorded (see Section 3.4.2).

Table 3.4: Sample sites (relevés) for each Survey Area

Pipeline Survey Area	Whaleback Survey Area
WRP-001, WRP-002, WRP-003, WRP-019, WRP-020, WRP-021, WRP-022, WRP-023, WRP-024, WRP-025, WRP-026, WRP-027, WRP-028, WRP-029, WRP-030, WRP-031, WRP-032, WRP-033, WRP-034, WRP-035, WRP-036, WRP-037, WRP-038, WRP-039, WRP-040, WRP-041, WRP-042, WRP-043, WRP-044, WRP-045, WRP-046, WRP-047, WRP-048, WRP-049, WRP-050, WRP-051, WRP-052, WRP-053, WRP-054, WRP-055, WRP-056, WRP-057, WRP-058, WRP-059, WRP-060, WRP-061, WRP-062, WRP-063, WRP-064, WRP-065, WRP-066, WRP-067, WRP-068, WRP-069, WRP-070, WRP-071, WRP-072, WRP-073, WRP-074, WRP-075, WRP-076, WRP-077, WRP-078, WRP-079, WRP-080, WRP-081, WRP-082, WRP-083, WRP-084, WRP-085, WRP-086, WRP-087, WRP-088, WRP-089, WRP-090, WRP-091, WRP-092, WRP-093, WRP-094, WRP-095, WRP-096, WRP-097, WRP-098, WRP-099, WRP-101, WRP-102, WRP-103, WRP-104, WRP-105, WRP-106, WRP-107, WRP-108, WRP-109, WRP-110, WRP-111, WRP-116, WRP-117, WRP-118, WRP-119, WRP-120, WRP-121, WRP-122, WRP-123, WRP-124, WRP-125, WRP-126, WRP-127, WRP-128, WRP-129	WRP-004, WRP-005, WRP-006, WRP-007, WRP-008, WRP-009, WRP-010, WRP-011, WRP-012, WRP-013, WRP-014, WRP-015, WRP-016, WRP-017, WRP-018, WRP-100, WRP-112, WRP-113, WRP-114, WRP-115, WRP-130

3.4.2 Targeted searches

Prior to the survey, a list of significant flora known, highly likely, likely or possible, to occur within the Survey Area was compiled as part of the desktop assessment. Field personnel familiarised themselves with photographs, reference samples and descriptions of these taxa before conducting the survey. Once on the ground, personnel actively searched while traversing the Survey Area focussing on habitat and features considered likely to support significant flora (i.e., hill summits, gorges, and drainage lines) (Figure 3.2).

Where 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. For larger populations the extent was mapped using a GPS to record the spatial extent of the population. 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. Significant flora specimens will be vouchered with the Western Australian Herbarium (WAH), where required and appropriate.

The targeted searches also focused on significant environmental weeds (Weeds of National Significance and Declared Pests listed under Section 22 of the BAM Act). Any such weeds located in the Survey Area had their locations noted and 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.

760000 765000 770000 775000

7405000 7400000

WRP-043 WRP-045 WRP-044 WRP-047 WRP-046 WRP-050 WRP-049 WRP-048 WRP-051 WRP-053 WRP-052 WRP-055 WRP-054 WRP-057 WRP-056 WRP-058 WRP-060 WRP-059 WRP-061 WRP-063 WRP-064 WRP-066 WRP-068 WRP-065 WRP-067 WRP-069 WRP-070 WRP-071 WRP-072 WRP-073 WRP-074 WRP-075 WRP-079 WRP-076 WRP-078 WRP-077 WRP-083 WRP-084 WRP-082 WRP-085 WRP-081 WRP-080 WRP-086 WRP-092 WRP-087 WRP-091 WRP-089 WRP-090 WRP-088

Newman

Legend

- Survey Area
- Relevé
- Traverse

N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021

Dampier Karratha Marble Bar Nullagine Tom Price Paraburdoo Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 3.2a: Flora sample sites and traverses

780000
785000
790000
7415000
7410000

WRP-020
WRP-022
WRP-001
WRP-024
WRP-002
WRP-021
WRP-003
WRP-026
WRP-019
WRP-028
WRP-023
Marble Bar Rd
WRP-025
Great Northern Hwy
Newman
WRP-027
WRP-029
WRP-030
WRP-031
WRP-032
WRP-034
WRP-033
WRP-037
WRP-036
WRP-038
WRP-035
WRP-042
WRP-040
WRP-039
WRP-096
WRP-041
WRP-093
WRP-095
WRP-094
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WRP-004
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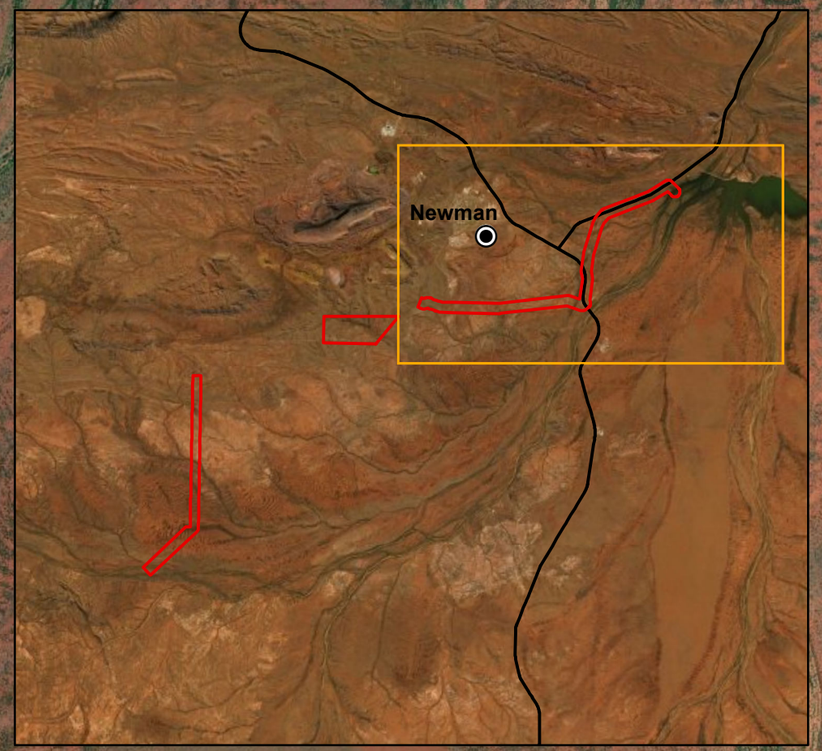
WRP-005
WRP-006
WRP-018
WRP-017
WRP-130



Legend

- Survey Area
- State Road
- Relevé
- Traverse

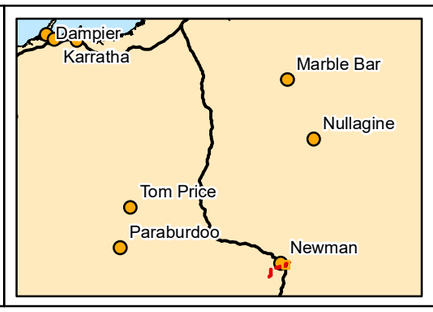
N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 3.2c: Flora sample sites and traverses

770000 775000 780000 785000

7415000 7410000

Newman

Great Northern Hwy

Marble Bar Rd

WRP-025 WRP-027 WRP-029 WRP-030 WRP-031 WRP-032 WRP-034 WRP-033 WRP-037 WRP-038 WRP-036 WRP-035 WRP-042 WRP-040 WRP-039 WRP-096 WRP-041 WRP-093 WRP-095 WRP-094 WRP-097 WRP-098 WRP-099 WRP-004 WRP-100 WRP-005 WRP-006 WRP-018 WRP-017 WRP-008 WRP-007 WRP-112 WRP-009 WRP-130 WRP-107 WRP-016 WRP-015 WRP-104 WRP-103 WRP-102 WRP-108 WRP-013 WRP-012 WRP-010 WRP-113 WRP-014 WRP-115 WRP-114 WRP-119 WRP-011 WRP-116 WRP-126 WRP-118 WRP-120 WRP-123 WRP-121 WRP-111

Legend

- Survey Area
- State Road
- Relevé
- Traverse

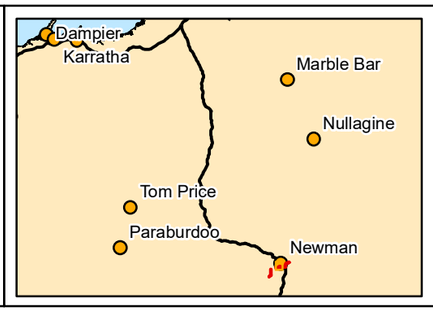
N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 3.2b: Flora sample sites and traverses

3.4.3 Flora

Nomenclature and Specimen Identification

Plant taxa that could not be identified during the field survey were collected, assigned a unique number for tracking purposes, and pressed for subsequent identification. Identifications were carried out by Biologic taxonomists, Dr Rachel Meissner and Mr Samuel Coultas, utilising the Western Australian Herbarium's reference collection, taxonomic keys and reference material. All taxa were checked against Florabase© (version 2.9.31; WAH, 1998-) to ensure their currency and validity.

Specimens of flora taxa that were Threatened, Priority listed, unique or unusual, range extensions or new weed species for the region have been verified and vouchered (if appropriate) at the Western Australian Herbarium.

3.4.4 Vegetation

Vegetation Mapping

Broad vegetation mapping was conducted in the field, with vegetation boundaries delineated over aerial photography. Following the completion of sampling and taxonomic identifications, broad vegetation units were refined based on the review of floristic data collected from the quadrats and relevé. The vegetation mapping was then digitised using geographic information systems (GIS) software.

Vegetation types were delineated and described from aerial imagery utilising flora sampling data. The vegetation structure information collected from the quadrats, relevé and mapping points was reviewed to describe the vegetation types based on the dominant taxa, foliar cover and height of the three traditional strata (upper, mid and lower/ground) (Appendix D). This method of vegetation type determination is consistent with EPA (2016b) and BHP (2018).

The vegetation types have been described to Level 5 (Vegetation Association) in the NVIS hierarchical structure (NVIS Technical Working Group, 2017) and coded in accordance with BHP (2018) standards. Landforms for each vegetation type were denoted at the start of each vegetation code e.g. vegetation type FP AaAinAte(±ExEg) CcEnpoChf BbClvAbl occurred on floodplains as denoted by 'FP'. Vegetation types which occurred across more than one landform were classified based on the landform which was most common. The mapping reliability is high across the Survey Area, with the majority of the Survey Area traversed and all vegetation units sampled.

Where relevant and appropriate, the vegetation mapping was completed to ensure consistency between the Survey Area and adjacent or nearby vegetation mapping previously surveyed by Biologic (Biologic, 2020a, 2020b).

Vegetation Condition

Vegetation condition was defined within the Survey Area using the BHP (2018) vegetation condition scale which has been adapted from Keighery (1994) and Trudgen (1988), and is also presented in the EPA Technical Guidance (EPA, 2016b) (Appendix E). The vegetation condition was determined based on the level of disturbance observed in the area. Condition was recorded at each sampling

site, while additional notes were taken while traversing the Survey Area and used to broadly map vegetation condition boundaries. The vegetation condition mapping was then digitised using GIS software.

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 Survey Area and a review of the literature. The review concentrated on flora species that are considered obligate/ facultative phreatophytes or mesophytic/ hydrophytic flora species.

The single season reconnaissance flora and vegetation 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 (i.e., land system mapping) was also used to determine the occurrence of sheet-flow dependent ecosystems.

3.5 Assessment of Occurrence

Significant flora species identified in the desktop assessment were assessed per taxa for their likelihood of occurrence in the Survey Area. Biologic utilises botanical expertise and a decision matrix to guide a preliminary assessment prior to mobilisation. Following the field survey, the occurrence assessment is reviewed taking into account ground-truthing of existing significant flora records and presence of suitable habitat. The decision matrix is outlined at Table 3.5. Appendix F presents the full occurrence assessment table with both preliminary (pre-survey) and revised (post-survey) likelihood of occurrence.

Table 3.5: Assessment of Occurrence Decision Matrix

		Habitat categories (within the Survey 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**
Species Records / Occurrence Categories	**Recorded in the Survey 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 -40 km	Possible	Possible	Unlikely	Unlikely
	Recorded >40 km	Possible	Unlikely	Unlikely	Highly Unlikely
	Species considered locally/regionally extinct	Unlikely	Unlikely	Highly Unlikely	Highly Unlikely

3.6 Potential Limitation 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 3.6).

Table 3.6: 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 Survey Area, including broad information on land systems and vegetation associations. The Survey Area is located immediately southwest of the Mt Whaleback mine operated by BHP. An extensive amount of biological survey work has occurred across Mt Whaleback and surrounds, as well as surveys within the Survey Area, the data and reports of which were all available for this assessment.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	No	The survey was led by a Principal Botanist with over 14 years' experience. The lead botanist met the minimum requirements to manage a flora and vegetation field survey in the Pilbara bioregion (EPA, 2016b).
Proportion of flora recorded and/or collected, any identification issues	No	The reconnaissance survey was designed to document broad information about the Survey Area. The information collected was sufficient for the survey purpose.
Was the appropriate area fully surveyed (effort and extent)	No	The Survey Area was traversed and surveyed on foot with all major vegetation types visited. The Survey Area was more than 1,720 ha in size, and it was not feasible to traverse the entire Survey Area. The survey intensity and coverage (related to relevé sampling) match that of which is required for a reconnaissance survey and is not considered to be a constraint (see section 4.4).
Access restrictions within the survey area	No	The Survey Area was accessed via mining, exploration and pastoral tracks which provided access across most of the Survey Area. Much of the Survey Area was traversed with the survey completed on foot and via vehicle.
Survey timing, rainfall, season of survey	No	The survey was undertaken during a period which is considered to be optimal, between March and June for the Eremaean region (EPA, 2016b). A substantial amount of rainfall was received in February (169.0 mm compared to the LTA of 72.3 mm), however, the weeks preceding the survey in March received well below-average rainfall. Only a small percentage of specimens (approx. 2.6%) were not confidently identified down to species or subspecies level. Furthermore, the Survey Area contained a substantial number of annual or short-lived perennial flora, particularly for annual grasses. The pre-survey conditions and survey timing were, therefore, not a constraint.
Disturbances that may have affected the results of survey such as fire, flood or clearing	No	Sections of the Survey Area are located within active pastoral leases and close to current mining operations. Disturbances recorded during the survey included grazing, trampling, weeds and tracks. Disturbances were highest within areas that have high cattle visitation (i.e., drainage lines and mulga flats). These disturbances did not limit the results of the survey.

4 RESULTS

4.1 Desktop Assessment

The results and outcomes of the review of 37 flora and vegetation reports identified from the literature review are presented in Appendix G. The literature review identified 15 significant flora taxa as having been previously recorded in close proximity to the Survey Area; *Acacia subtiliformis* (P3), *Aristida jerichoensis* var. *subspinulifera* (P3), *Aristida lazaridis* (P2), *Eremophila magnifica* subsp. *magnifica* (P4), *Eremophila magnifica* subsp. *velutina* (P3), *Euphorbia australis* var. *glabra* (P3) (recorded as *Euphorbia* sp. Mt Bruce flats (S. van Leeuwen 3861) (P2)), *Goodenia nuda* (P4), *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3), *Gymnanthera cunninghamii* (P3), *Indigofera gilesii* (P3), *Ipomoea racemigera* (P2), *Isotropis parviflora* (P2), *Lepidium catapycnon* (P4), *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3), and *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3). All of these taxa were also identified by one or more of the database searches, with the exception of *Euphorbia australis* var. *glabra* (P3).

One DP and WoNS was also recorded in close proximity to the Survey Area (**Tamarix aphylla*; ENV, 2012). The 37 reports, excluding Onshore (2014a) which includes all of BHP WAIO Pilbara tenure, did not identify any significant vegetation associations occurring near the Survey Area (Appendix G). However, one vegetation association identified from Onshore (2016) was closely affiliated to the West Angelas Cracking-Clays Priority Ecological Community (Priority 1).

4.1.1 Flora of significance

A total of 35 significant flora taxa (those listed under the EPBC Act, BC Act, or DBCA's Priority List) were identified from the database searches (within 40 km of the Survey Area) (Appendix H). Of the 35 taxa, one is listed as Threatened, six are listed as Priority 1 taxa, six are listed as Priority 2 taxa, 16 are listed as Priority 3, and six are listed as Priority 4 taxa.

An occurrence assessment was conducted prior to mobilisation (see Table 3.5, full list at Appendix F). One taxon, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3), was determined as highly likely to occur, two flora taxa (*Swainsona thompsoniana* (P3) and *Goodenia nuda* (P4)) were determined as likely to occur, and seven were determined as possible to occur in the Survey Area (Table 4.1). The rest of the significant taxa identified pre-survey included 22 considered unlikely to occur, and three considered highly unlikely to occur within the Survey Area.

730000 760000 790000 820000 850000 880000

7440000 7410000 7380000

Marble Bar Rd

Newman

Great Northern Hwy

Taxon

T

- *Seringia exastia*

P1

- *Acacia corusca*
- *Eremophila capricornica*
- *Eremophila rhegos*
- *Eremophila* sp. West Angelas (S. van Leeuwen 4068)
- *Vittadinia* sp. Coondewanna Flats (S. van Leeuwen 4684)

P2

- *Aristida lazaridis*
- *Euphorbia inappendiculata* var. *inappendiculata*
- *Goodenia hartiana*
- *Ipomoea racemigera*
- *Isotropis parviflora*

P3

- *Acacia subtiliformis*
- *Amaranthus centralis*
- *Aristida jerichoensis* var. *subspinulifera*
- *Crotalaria smithiana*
- *Eremophila magnifica* subsp. *velutina*
- *Eremophila rigida*
- *Eremophila* sp. Hamersley Range (K. Walker KW 136)
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727)
- *Gymnanthera cunninghamii*
- *Indigofera gilesii*
- *Maireana prosthecochaeta*
- *Rhagodia* sp. Hamersley (M. Trudgen 17794)
- *Swainsona thompsoniana*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431)
- *Triodia* sp. Mt Ella (M.E. Trudgen 12739)

P4

- *Acacia bromilowiana*
- *Eremophila magnifica* subsp. *magnifica*
- *Eremophila youngii* subsp. *lepidota*
- *Goodenia berringbinensis*
- *Goodenia nuda*
- *Lepidium catapycnon*

Legend

- Survey Area
- Study Area
- State Road

DBCA TEC/PEC

- Ethel Gorge - Endangered
- Fortescue Valley Sand Dunes - Priority 3

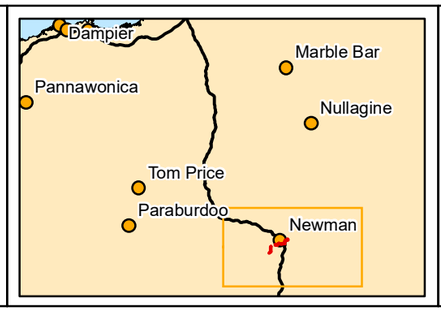
N

biologic Environmental Survey

Scale: 1:480,000

0 10 20 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/07/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.1: Conservation significant flora and TEC/PEC database search results

Table 4.1: Occurrence assessment preliminary classification.

Taxon	Description (WAH, 1998-)	Location
Highly Likely		
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.	0.4 km SE
Likely		
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.	1.5 km N
Goodenia nuda (P4)	Erect to ascending herb, to 0.5 m high. Fl. yellow, Apr to Aug. Mulga hardpan plains, undulating plains, floodplains, minor drainage lines on red sandy-loams, clay-loams.	> 0.1 km N
Possible		
Hibiscus campanulatus (P1)	Erect bushy shrub, 1-3.5 m high. Fl. White/pale pink. Brown loamy to skeletal soils. Rocky gullies, ironstone range.	10 km NW
Ipomoea racemigera (P2)	Creeping annual, herb or climber. Fl. white.	14.9 km ENE
Isotropis parviflora (P2)	Shrub, 0.1 m high. Fl. white/pink, Mar. Valley slope of ironstone plateau.	7.5 km NNW
Aristida jerichoensis var. *subspinulifera* (P3)	Compactly tufted perennial, grass-like or herb, 0.3-0.8 m high, lemma groove muricate. Hardpan plains.	3.3 km NW
Gymnanthera cunninghamii (P3)	Erect shrub, 1-2 m high. Fl. cream-yellow-green, Jan to Dec. Sandy soils.	4.8 km NE
Indigofera gilesii (P3)	Shrub, to 1.5 m high. Fl. purple-pink, May or Aug. Pebbly loam. Amongst boulders & outcrops, hills.	12.8 km NNW
Lepidium catapycnon (P4)	Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag. Fl. white, Oct. Skeletal soils. Hillsides.	5.6 km NW

4.1.2 Vegetation of significance

Two Threatened Ecological Communities (TECs) listed under the BC Act are recognised for the Pilbara region of Western Australia (DBCA, 2018). Neither of these TECs are listed under the federal EPBC Act. One TEC, 'Ethel Gorge aquifer stygobiont community' (EN) was identified as occurring within 40 km of the Survey Area (partially overlapping Survey Area) during the database search (Figure 4.1). However, this TEC does not represent terrestrial vegetation and is not considered any further.

A total of 43 PECs are recognised for the Pilbara region, of which 34 are relevant for terrestrial vegetation (DBCA, 2020). One PEC was identified by the database search as occurring within 40 km of the Survey Area, 'Vegetation of sand dunes of the Hamersley Range/Fortescue Valley (previously Fortescue Valley Sand Dunes)' (Figure 4.1). This Priority three PEC consists of red linear iron-rich sand dunes on the Divide Land system at the junction of the Hamersley Range and Fortescue Valley, between Kalgan Creek and the low hills to the west. A small number are vegetated with *Acacia dictyophleba* scattered tall shrubs over *Crotalaria cunninghamii*, *Trichodesma zeylanicum* var. *grandiflorum* open shrubland. They are regionally rare, small and fragile and highly susceptible to threatening processes including weed invasion, grazing by cattle, altered fire regimes, erosion and clearing for mining and infrastructure (DBCA, 2020).

4.1.3 Introduced flora taxa from database searches

The NatureMap (DBCA, 2021a), Protected Matters (DAWE, 2021), ALA (ALA, 2021) and The Western Australian Organism List (WAOL) (DPIRD, 2021) database searches identified a list 74 introduced taxa that may potentially occur within the Survey Area. The list of introduced taxa known to occur or potentially occur within the Survey Area (Appendix I) was reviewed to identify Weeds of National Significance (WoNS) and Declared Pests (DPs).

Weeds of National Significance and Declared Pests

Of the list of introduced taxa identified during the desktop assessment as occurring in or near the Survey Area, 30 are listed as WoNS (Appendix I). The 30 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. The 30 taxa include numerous *Opuntia* and *Cylindropuntia* species that are grouped together in the WoNS listing. The desktop assessment identified 48 DPs (including numerous cacti species that are all listed as DPs, Appendix I), previously recorded or potentially located within the Shire of East Pilbara.

The desktop assessment did not identify any WoNS or DPs as occurring within the Survey Area but identified **Tamarix aphylla* as occurring in close proximity to the Survey Area. **Tamarix aphylla* has previously been recorded approximately 5 km northwest of the Survey Area by GHD (2008b).

Weed Prioritisation

Fifteen introduced taxa have been identified by Parks and Wildlife as 'Priority Alert' weeds for the Pilbara region, comprising **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*.

No Priority Alert weeds have previously been recorded within the Survey Area. None of these introduced taxa are expected to occur in the Survey Area.

4.2 Field Survey

4.2.1 Flora

A total of 250 confirmed vascular flora taxa from 37 families and 111 genera were recorded from the Survey Area during the field survey. The total number of confirmed vascular flora taxa comprised 241 native taxa and nine introduced taxa (Appendix J). The total number of confirmed vascular flora taxa recorded from the field survey increases to 267, comprising 258 native and nine introduced taxa (Appendix J), when the taxa from the adjacent (north) Whaleback Survey Area are included in the total.

An additional seven specimens could not be confirmed due to lack of diagnostic material for identification. Of these unconfirmed taxa, two were identified to genus level only, and five were given tentative (?) identifications at either genus, species or subspecies level. None of these unconfirmed specimens were expected to be taxa of significance.

The dominant families equate to 51 % of the total taxa recorded and comprised Poaceae (53), Fabaceae (49), and Malvaceae (26). Of the 37 families recorded, 17 were represented by one taxon, which equates to 6.8 % of the total taxa recorded.

The dominant genera make up 19 % of the total taxa recorded and comprised *Acacia* (25), *Ptilotus* (12), and *Senna* (11). Of the 111 genera recorded, 68 were represented by only one taxon, which equates to 27 % of the total taxa recorded.

4.2.2 Significant Flora

Threatened Flora

The desktop assessment (as part of the EPBC Protected Matters Search) identified one Threatened flora taxon, *Pityrodia augustensis*, as occurring more than 200 km southwest of the Survey Area, however this species is restricted to Mount Augustus in the Gascoyne bioregion and is highly unlikely to occur in the Pilbara or in the Survey Area.

The field survey recorded one Threatened taxon, *Seringia exastia*. A recent revision of the *Seringia* genus found that *Seringia exastia* (T) and *Seringia elliptica* (not threatened) are the same species, with the latter consequently being subsumed into *S. exastia* (Binks *et al.*, 2020). *Seringia exastia* (T), a species previously only known to occur in the Kimberley, now has a much more widespread distribution (primarily in the Pilbara and mid-West). A nomination to delist the species has been made to the WA Threatened Species Scientific Committee and is expected to be authorised. Until the change is officially made, *Seringia exastia* is still listed as Threatened, however for the purposes of this report it is not considered significant and will not be discussed further.

Priority Flora

The desktop assessment identified 34 priority listed flora taxa as potentially occurring within the Survey Area (refer to Section 4.1.1). One priority listed taxon was recorded from the Survey Area during the field survey: *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) (Figure 4.2). An additional priority listed taxon, *Ipomoea racemigera* (P2), was found by a subsequent survey conducted by Biologic for BHP WAIO that overlapped the current Survey Area where Western Creek and an unnamed creek cross the southwest portion (Biologic, in prep).

Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)

Rhagodia sp. Hamersley (M. Trudgen 17794) is a Priority 3 taxon which occurs in the Eremaean Botanical Province, in the Pilbara and Gascoyne regions (WAH, 1998-). It is described as a lax shrub or scramble with small lanceolate leaves and not aromatic compared to the common *Rhagodia eremaea* (Rio Tinto & WAH, 2015). *Rhagodia* sp. Hamersley (M. Trudgen 17794) produces small red drupelets following flowering, which can occur following favourable conditions (Rio Tinto & WAH, 2015). It has been recorded from mulga on cracking clays, however Biologic has recorded *Rhagodia* sp. Hamersley (M. Trudgen 17794) from varying habitats including low rocky slopes, rocky drainage lines and stony plains near to, and north of Newman (unpublished survey data).

The Western Australian Herbarium currently have 67 records for this species, while Biologic are aware of thousands of individuals near to, and north of Newman (unpublished survey data). In the Survey Area, *Rhagodia* sp. Hamersley (M. Trudgen 17794) was recorded from 59-point locations, totalling 66 individuals (Figure 4.2). The taxon was found in vegetation type SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri which is considered to be sheet-flow dependent vegetation (see section 4.2.4).

Plate 4.1: *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) (photographs captured by Biologic staff during various 2021 surveys)

***Ipomoea racemigera* (P2)**

Ipomoea racemigera is described as a pilose, creeping annual herb or climber with twining stems (WAH, 1998-) (Plate 4.2). It has a cymose inflorescence bearing 1–2, funnel-shaped white flowers from March to August, or throughout the year under favourable conditions (WAH, 1998-). It closely resembles *Ipomoea plebeia*, differing only in having glabrous to very sparsely hairy upper leaf surfaces and moderately pilose lower surfaces, compared to the evenly pilose upper and lower surface of *Ipomoea plebeia* (Keybase, 2020). *Ipomoea racemigera* has previously been recorded on sandy soils occurring along medium and major watercourses in the Pilbara region of Western Australia from Newman to Kununurra, as well as in similar habitats in the Northern Territory, South Australia, and Queensland (ALA, 2021; WAH, 1998-).

The Western Australian Herbarium currently have six records for *Ipomoea racemigera* (WAH, 1998-). Within the Survey Area, this taxon was recorded from six-point locations, totalling 56 individuals (Figure 4.2). An additional 528 individuals from 124-point locations were recorded by Biologic (in prep) in the adjacent Western Creeks survey area. The taxon was found in vegetation type ME CcCsChf EvAci Aads which is considered to be groundwater dependent vegetation (see section 4.2.4).

Plate 4.2: *Ipomoea racemigera* (P2) in the Survey Area (Biologic photos taken during Western Creeks survey)

Flora 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, but is not limited to, range extensions, keystone species, relic status, local endemism and anomalous features. Based on these features, ten taxa recorded from the Survey Area were flora of "other" significance (Table 4.2). Seven taxa are range extensions (RE) whereby the record from the Survey Area has considerably extended the known distribution. Two taxa filled substantial gaps in their known distributions, otherwise known as locality holes (LH).

Table 4.2: Flora taxa of other significance

Taxon	Significance	Description
Abutilon fraseri subsp. *fraseri*	LH	Locality hole between records around Karijini and Fortescue Marsh and two disjunct records over 900 km east on the border with NT. Closest record is approx. 90 km northwest.
Acacia colei var. *colei*	RE	Range extension to the south. Closest record approx. 162 km north.
Corchorus incanus subsp. *lithophilus*	RE	Range extension to the south. Closest record approx. 120 km northwest on the edge of Karijini NP.
Corchorus parviflorus	RE	Range extension to the south. Closest record is approx. 100 km north.
Eriachne ciliata	RE	Range extension to the southeast/ south. Closest record is approx. 174 km northwest.
Senna artemisioides subsp. *oligophylla* x hybrid	Other	Hybridisation is a common occurrence for many Fabaceae genera. This taxon is not a recognised hybrid by WAH, nor is it considered to be locally or regionally significant.
Tribulus platypterus	LH	Fills a locality hole between Mt Egerton, Karijini and Karlamilyi National Parks. Closest record is approx. 137 km northwest, near Mulga Downs Station.
Triumfetta clementii	RE	Range extension to the southeast. Closest record is 129 km north.
Vincetoxicum flexuosum	RE	Range extension to the southeast. Closest record is approx. 118 km northwest near Gudai-Darri.

760000
770000
780000
790000
7410000
7400000
Marble Bar Rd
Newman

Legend

Survey Area
State Road

Taxon

Ipomoea racemigera - P2
Rhagodia sp. Hamersley (M. Trudgen 17794) - P3

N

biologic Environmental Survey

Scale: 1:90,000
0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/08/2021

Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.2: Flora of conservation significance recorded in the Survey Area

Introduced Flora

Nine introduced taxa were recorded from the Survey Area: **Aerva javanica*, **Bidens bipinnata,* **Cenchrus ciliaris*, **Cenchrus setiger*, **Cynodon dactylon,* **Echinochloa colona,* **Malvastrum americanum*, **Setaria verticillata,* and **Vachellia farnesiana*. The introduced taxa are not listed as WoNS or DPs under the BAM Act, or as 'Priority Alert' weeds by Parks and Wildlife.

The most frequently observed introduced flora taxa, **Cenchrus ciliaris* and **Bidens bipinnata*, were recorded in many of the floristic sites and opportunistically across the Survey Area (Figure 4.3).

**Cenchrus ciliaris* was a dominant understorey species, recorded at 41 floristic sites and a further 45 opportunistic locations, with approximately 34,660 individuals recorded throughout the Survey Area, generally occurring along drainage lines, floodplains, and track edges. **Cenchrus ciliaris* was commonly aerial seeded as a fodder crop for pastures and has since spread throughout arid and tropical regions of Australia (Hussey *et al.*, 2007). Spread occurs mainly by seeds transported through waterways, roads, and potentially by cattle.

**Bidens bipinnata* occurred at 23 floristic sites, as well as a further three opportunistic locations. Approximately 4,320 individuals of **Bidens bipinnata* were recorded, generally along drainage lines and on stony plains.

Cenchrus setiger* and **Malvastrum americanum* were recorded at 19 (15 floristic sites and four opportunistic locations) and 14 (floristic sites) point locations, respectively, with approximately 4,520 individuals of **Cenchrus setiger* and 835 individuals of **Malvastrum americanum* recorded throughout the Survey area. All remaining introduced species (Aerva javanica*, **Cynodon dactylon*, **Echinochloa colona*, **Setaria verticillata* and **Vachellia farnesiana*) were recorded from five or fewer locations.

760000
765000
770000
775000
7405000
7400000

Newman

Legend

Survey Area

Taxon

- **Bidens bipinnata*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Malvastrum americanum*
- **Vachellia farnesiana*

N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021

Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.3a: Introduced flora recorded in the Survey Area

770000
775000
780000
785000
7415000
7410000
Newman
Great Northern Hwy
Marble Bar Rd
Newman

Legend

Survey Area
State Road

Taxon

**Aerva javanica*
**Bidens bipinnata*
**Cenchrus ciliaris*
**Cenchrus setiger*
**Malvastrum americanum*
**Setaria verticillata*
**Vachellia farnesiana*

N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021

Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.3b: Introduced flora recorded in the Survey Area

780000
785000
790000
7415000
7410000
Great Northern Hwy
Marble Bar Rd
Newman
Newman
Legend
Survey Area
State Road
Taxon
*Aerva javanica
*Bidens bipinnata
*Cenchrus ciliaris
*Cenchrus setiger
*Cynodon dactylon
*Malvastrum americanum
*Setaria verticillata
*Vachellia farnesiana
N
biologic Environmental Survey
Scale: 1:47,000
0 1 2 Km
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 14/07/2021
Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman
BHP WAIO
Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey
Figure 4.3c: Introduced flora recorded in the Survey Area

4.2.3 Vegetation

Broad floristic formations

Seventeen broad floristic formations were described from the Survey Area, based on the dominant growth form and land cover genus for the dominant stratum. The broad floristic formations were:

- *Acacia* low open woodland;
- *Acacia* low woodland;
- *Acacia* mid to tall sparse shrubland;
- *Acacia* tall open to sparse shrubland;
- *Acacia* tall shrubland to tall open shrubland;
- *Acacia* tall sparse shrubland;
- *Acacia* tall sparse shrubland to scattered shrubs;
- *Acacia* tall to mid open shrubland;
- *Acacia* tall to mid sparse shrubland;
- **Cenchrus* mid tussock grassland;
- *Eremophila* mid to low sparse shrubland;
- *Eucalyptus* low woodland to low open woodland;
- *Eucalyptus* low open woodland;
- *Senna* mid to low sparse shrubland;
- *Triodia* low hummock grassland;
- *Triodia* mid hummock grassland and;
- *Triodia* mid sparse hummock grassland.

The dominant broad floristic formation (based on extent across the Survey Area) was *Triodia* low hummock grassland which supported five vegetation types (673 ha or 39 %). The *Acacia*-dominated floristic formations (nine) supported a total of 12 vegetation types which together made up approximately 41 % of the Survey Area (710 ha). The introduced grass **Cenchrus ciliaris* dominated one floristic formation, encompassing three vegetation types, though this formation was limited to less than 5 % (81 ha) of the Survey Area. The remainder of the broad floristic formations, which included the other two *Triodia*-dominated floristic formations as well as those dominated by *Eremophila*, *Eucalyptus* and *Senna*, supported one vegetation type each (Figure 4.4 & Table 4.3).

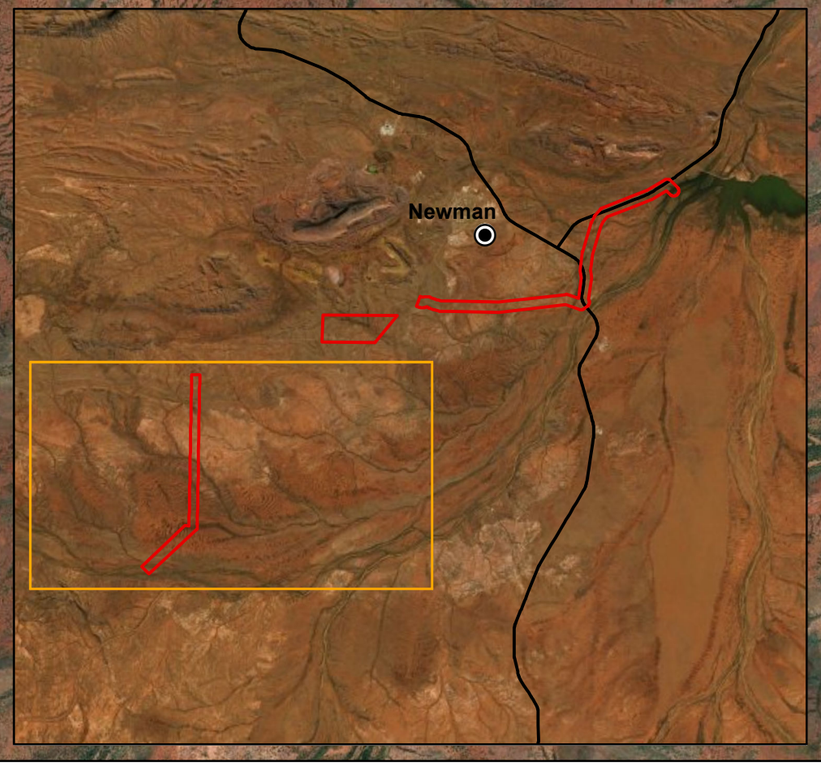
760000 765000 770000 775000

7405000

7400000

Vegetation Type

- CP TragTpTw AbAsySeao Ese
- FP SeaoSesmSegl AaAsyAte ArcEnpoDar
- FP Tlo CcErarDar Ex
- FP Tp(±Tw) AssAdErlo EnpoTtChf
- FP Trag(±Tw) AbAsyAsi EgExCh
- GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte
- HS Aa SeglErplErlt EnpoEmu
- HS Ts(±TragTw) AbHallAads SeahSeglErfs
- HS Tw AinAbAads EgEllCh
- HS TwTbrTp AbErfsAi
- MA EcrEv AciAcp CcCsEuaMahElp
- ME CcCsChf EvAci Aads
- SP AaAinAsy ErffSeglErma ArcTw
- SP AaAptAp AteSeglErff EnpoCcArc
- SP AaAteAsy SeahSeaoErlc EnpoArcDar
- SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri
- SP AteAsyAa SeglSeahSesm EnpoCcArc SccSclnSaa
- Cleared



Legend

- Survey Area

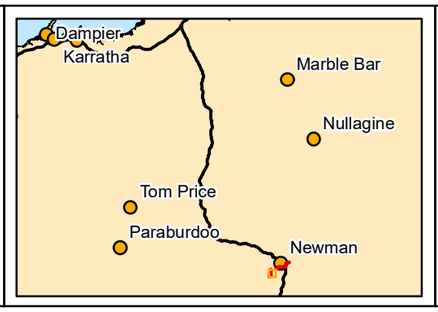
N

biologic Environmental Survey

Scale: 1:49,100

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.4a: Vegetation types recorded in the Survey Area

770000 775000 780000 785000

7415000 7410000

Newman

Great Northern Hwy

Marble Bar Rd

Vegetation Type

- CP TragTpTw AbAsySeao Ese
- FP AaAinAte(±ExEg) CcEnpoChf BbClvAbl
- FP AaApAte SeglMam EnpoEmuAri Tp
- FP AadsAsiAte CcEnpoArc ChEx
- FP AssAteApr ArhhErxArc(±Tp) Cocd
- FP CcCsChf AaApAte Ex
- FP CcCsChf AciAaAin ExEgCocd
- FP EgCh TtCcPamu AdSalPl
- FP SeaoSesmSegl AaAsyAte ArcEnpoDar
- FP Tp(±Tw) AssAdErlo EnpoTtChf
- FP Trag(±Tw) AbAsyAsi EgExCh
- GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte
- HS Aa SeglErplErlt EnpoEmu
- HS Ts(±TragTw) AbHallAads SeahSeglErfs
- HS Tw AinAbAads EgEllCh
- MA EcrEv AciAcp CcCsEuaMahElp
- ME CcCsChf EvAci Aads
- Rehab
- SP AaAin ErfsSeglErlt EnpoCc
- SP AaApErfs ArcEnpoCc SeaoErcuRhe
- SP AteAsyAa SeglSeahSesm EnpoCcArc SctSclnSaa
- Cleared

Legend

- Survey Area
- State Road

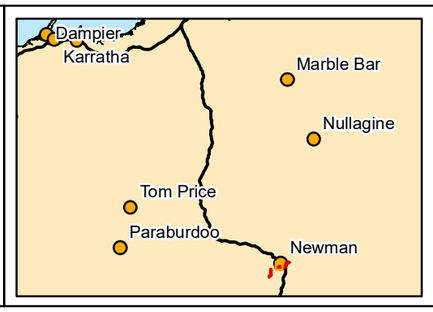
N

biologic Environmental Survey

Scale: 1:49,100

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.4b: Vegetation types recorded in the Survey Area

780000 785000 790000 795000

7415000

7410000

Vegetation Type

- CP TragTpTw AbAsySeao Ese
- FP AaApAte SeglMam EnpoEmuAri Tp
- FP AadsAsiAte CcEnpoArc ChEx
- FP AssAteApr ArhhErxArc(±Tp) Cocd
- FP CcCsChf AaApAte Ex
- FP CcCsChf AciAaAin ExEgCocd
- FP SeaoSesmSegl AaAsyAte ArcEnpoDar
- FP Tp(±Tw) AssAdErlo EnpoTtChf
- FP Trag(±Tw) AbAsyAsi EgExCh
- HS Ts(±TragTw) AbHallAads SeahSeglErfs
- HS Tw AinAbAads EgEllCh
- MA EcrEv AciAcp CcCsEuaMahElp
- ME CcCsChf EvAci Aads
- Open Water
- Rehab
- SP AaAin ErfsSeglErlt EnpoCc
- SP AaApErfs ArcEnpoCc SeaoErcuRhe
- SP AteAsyAa SeglSeahSesm EnpoCcArc SectSclnSaa
- Cleared

Marble Bar Rd

Great Northern Hwy

Newman

Newman

Legend

- Survey Area
- State Road

N

biologic Environmental Survey

Scale: 1:49,100

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021

Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.4c: Vegetation types recorded in the Survey Area

Vegetation types

A total of 26 vegetation types were described and delineated from the Survey Area (Figure 4.4, Table 4.3). The vegetation types were located across nine landforms;

- stony plain;
- drainage area/ floodplain;
- hillcrest/ upper hillslope;
- hillslope and undulating low hill;
- calcrete plain;
- major drainage line;
- medium drainage line;
- minor drainage line and;
- gilgai plain.

The dominant landform across the Survey Area was stony plains (565 ha / 33 %) followed by drainage area/ floodplain (511 ha / 30 %).

Three mapping units were also delineated from the Survey Area; ‘Cleared’, ‘Open Water’ and ‘Rehab’. ‘Cleared’ consisted of roads, tracks and buildings/ infrastructure. ‘Open Water’ was mapped in the northeast of the Survey Area in line with where the Fortescue River discharges into Ophthalmia Dam. Small patches of rehabilitation were observed in association with the Mt Whaleback mine site and old tracks and were mapped as ‘Rehab’. A total of 97 % of the Survey Area was comprised of native vegetation, including all vegetation types and the ‘Rehab’ mapping unit.

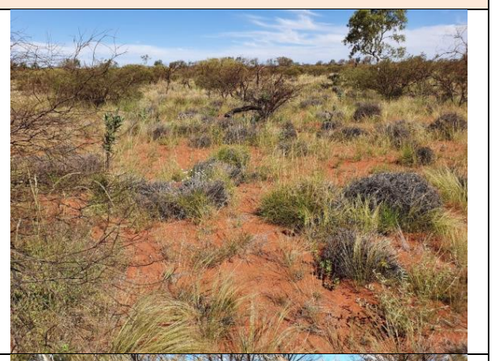
Table 4.3: Vegetation type descriptions

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
Acacia low open woodland						
FP AaAinAte(±ExEg) CcEnpoChf BbClvAbl	Low open woodland of *Acacia aptaneura*, *Acacia incurvaneura*, and *Acacia tetragonophylla* (± *Eucalyptus xerothermica*, *Eucalyptus gamophylla*) over low open tussock grassland of **Cenchrus ciliaris*, *Enneapogon polyphyllus*, *Chrysopogon fallax* with low scattered herbs of **Bidens bipinnata*, *Arivela viscosa*, *Abutilon lepidum* on brown clay loam on drainage areas/ floodplains and minor drainage lines.	WRP-013, WRP-114, WRP-115, WRP-116, WRP-119, WRP-120, WRP-127, WRP-129	45.2 / 2.6	• Nil	Very Good to Degraded	
SP AaAptAp AteSeglErff EnpoCcArc	Low open woodland of *Acacia aptaneura*, *Acacia pteraneura*, and *Acacia pruinocarpa* over mid sparse shrubland to scattered shrubs of *Acacia tetragonophylla*, *Senna glutinosa* subsp. ×*luerssenii*, and *Eremophila forrestii* subsp. *forrestii* over low sparse tussock grassland of *Enneapogon polyphyllus*, **Cenchrus ciliaris*, and *Aristida contorta* on brown silty clay loam on stony plain.	WRP-054, WRP-055, WRP-057, WRP-071, WRP-072, WRP-073, CVM14^	37.2 / 2.2	• Nil	Very Good to Degraded	
Acacia low woodland						
SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri	Low woodland of *Acacia incurvaneura*, *Acacia aptaneura*, *Acacia subcontorta* (±*Grevillea berryana*, *Acacia pruinocarpa*, and *Corymbia candida* subsp. *dipsodes*) over mid scattered shrubs of *Eremophila forrestii* subsp. *forrestii*, *Senna glaucifolia*, and *Senna artemisioides* subsp. *helmsii* over low scattered tussock grasses to isolated patches of *Enneapogon polyphyllus*, *Aristida contorta*, and *Aristida inaequiglumis* on brown clay loam on hardpans and stony plains.	WRP-074, WRP-075, WRP-076, WRP-077, WRP-078, WRP-079, WRP-080, WRP-081, WRP-082, WRP-083, WRP-084, WRP-085, WRP-086	188.7 / 11.0	• Sheet-flow dependent ecosystem • 59 point locations totaling 66 individuals of *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3)	Very Good to Poor	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
Acacia mid to tall sparse shrubland						
SP AaAteAsy SeahSeaoErlc EnpoArcDar	Mid to tall sparse shrubland of *Acacia aptaneura*, *Acacia tetragonophylla*, and *Acacia synchronicia* over low sparse shrubland to scattered shrubs of *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, and *Eremophila lachnocalyx* over low scattered tussock grasses to isolated patches of tussock grasses of *Enneapogon polyphyllus*, *Aristida contorta*, and *Dactyloctenium radulans* on brown clay loam on stony plains.	WRP-062, WRP-065, WRP-066, WRP-067, WRP-068	46.4 / 2.7	• Nil	Very Good to Good	
SP AaApErfs ArcEnpoCc SeaoErcuRhe	Mid to tall sparse shrubland to isolated patches of shrubs of *Acacia aptaneura*, *Acacia paraneura*, and *Eremophila fraseri* subsp. *fraseri* over low sparse tussock grassland of *Aristida contorta*, *Enneapogon polyphyllus*, and **Cenchrus ciliaris* with low scattered shrubs of *Senna artemisioides* subsp. *oligophylla*, *Eremophila cuneifolia*, and *Rhagodia eremaea* on brown clay loam on stony plains.	WRP-033, WRP-037, WRP-039, CVM08^	78.6 / 4.6	• Nil	Excellent to Degraded	
Acacia tall open to sparse shrubland						
HS Aa SeglErplErlt EnpoEmu	Tall open to sparse shrubland of *Acacia aptaneura* over mid sparse shrubland of *Senna glutinosa* subsp. ×*luerssenii*, *Eremophila* ?*platycalyx*, and *Eremophila latrobei* over low scattered tussock grasses of *Enneapogon polyphyllus*, and *Eriachne mucronata* on brown silty loam on hillslopes and upper hillslopes/hillcrests.	WRP-010, WRP-012, WRP-052, CVM30^	3.0 / 0.2	• Nil	Excellent to Very Good	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
Acacia tall shrubland to tall open shrubland						
FP AaApAte SeglMam EnpoEmuAri Tp	Tall shrubland to tall open shrubland of *Acacia aptaneura*, *Acacia paraneura* and *Acacia tetragonophylla* over mid to low scattered shrubs of *Senna glutinosa* subsp. ×*luerssenii*, and *Maireana melanocoma* over low scattered, tussock and hummock grasses of *Enneapogon polyphyllus*, *Eriachne mucronata*, *Aristida inaequiglumis* and *Triodia pungens* on brown clay loam on stony plains and drainage areas/ floodplains.	WRP-015, WRP-101, WRP-103, WRP-107, CVM24^	60.9 / 3.5	• Nil	Excellent to Good	
Acacia tall sparse shrubland						
SP AaAin ErfsSeglErlt EnpoCc	Tall sparse shrubland of *Acacia aptaneura*, and *Acacia incurvaneura* over mid scattered shrubs of *Eremophila fraseri* subsp. *fraseri*, *Senna glutinosa* subsp. ×*luerssenii* and *Eremophila latrobei* over low scattered tussock grasses of *Enneapogon polyphyllus*, and **Cenchrus ciliaris* on brown silty clay loam on stony plains.	WRP-019, WRP-094, WRP-096	96.0 / 5.6	• Nil	Good	
SP AaAinAsy ErffSeglErma ArcTw	Tall sparse shrubland of *Acacia aptaneura*, *Acacia incurvaneura*, and *Acacia synchronicia* over mid to low scattered shrubs of *Eremophila forrestii* subsp. *forrestii*, *Senna glutinosa* subsp. ×*luerssenii*, and *Eremophila ?margarethae* over low scattered tussock grasses of *Aristida contorta* with isolated patches of low hummock grasses of *Triodia wiseana* on brown silty clay loam on stony plains.	WRP-088, WRP-089	22.5 / 1.3	• Nil	Very Good to Good	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
Acacia tall sparse shrubland to scattered shrubs						
SP AteAsyAa SeglSeahSesm EnpoCcArc ScctScInSaa	Tall sparse shrubland to scattered shrubs of *Acacia tetragonophylla*, *Acacia synchronicia*, and *Acacia aptaneura* over mid scattered shrubs of *Senna glutinosa* subsp. ×*luerssenii*, *Senna artemisioides* subsp. *helmsii*, and *Senna* sp. Meekatharra (E. Bailey 1-36) over low scattered tussock grasses of *Enneapogon polyphyllus*, **Cenchrus ciliaris*, and *Aristida contorta* with low scattered chenopod shrubs of on brown clay loam on stony plains.	WRP-038, WRP-040, WRP-056, WRP-058, WRP-060, WRP-063, WRP-064	95.7 / 5.6	• Nil	Excellent to Poor	
Acacia tall to mid open shrubland						
FP AadsAsiAte CcEnpoArc ChEx	Tall to mid open shrubland of *Acacia* ?*adsurgens*, *Acacia sibirica*, and *Acacia tetragonophylla* over low open tussock grassland of **Cenchrus ciliaris*, *Enneapogon polyphyllus*, and *Aristida contorta* with low scattered trees of *Corymbia hamersleyensis*, and *Eucalyptus xerothermica* on brown clay loam on drainage areas/ floodplains.	WRP-025, WRP-109, WRP-121, WRP-123	96.7 / 5.6	• Nil	Very Good to Degraded	
Acacia tall to mid sparse shrubland						
FP AssAteApr ArhhErxArc(±Tp) Cocd	Tall to mid sparse shrubland of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia tetragonophylla*, and *Acacia pruinocarpa* over low open tussock grassland of *Aristida holathera* var. *holathera*, *Eragrostis xerophila*, *Aristida contorta* ± low scattered hummock grasses of *Triodia pungens* with low scattered trees of *Corymbia candida* subsp. *dipsodes* on loamy sand on drainage areas/ floodplains.	WRP-035	21.4 / 1.2	• Nil	Very Good	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
**Cenchrus* mid tussock grassland						
FP CcCsChf AciAaAin ExEgCocd	Mid tussock grassland of **Cenchrus ciliaris*, **Cenchrus setiger*, and *Chrysopogon fallax* with tall open shrubland of *Acacia citrinoviridis*, *Acacia aptaneura*, and *Acacia incurvaneura* with low open woodland of *Eucalyptus xerothermica*, *Eucalyptus gamophylla*, and *Corymbia candida* subsp. *dipsodes* on brown clay loam on drainage areas/ floodplains.	WRP-018, WRP-022, WRP-027, WRP-035, WRP-097, WRP-099	38.5 / 2.2	• Nil	Good to Degraded	
FP CcCsChf AaApAte Ex	Mid tussock grassland of **Cenchrus ciliaris*, **Cenchrus setiger*, and *Chrysopogon fallax* with tall sparse shrubland to scattered trees of *Acacia aptaneura*, *Acacia paraneura*, and *Acacia tetragonophylla* with low scattered trees of *Eucalyptus xerothermica* on brown clay loam on drainage areas/ floodplains and minor drainage lines.	WRP-016, WRP-041, WRP-105, CVM23^	12.5 / 0.7	• Nil	Poor to Degraded	
ME CcCsChf EvAci Aads	Mid tussock grassland of **Cenchrus ciliaris*, **Cenchrus setiger* and *Chrysopogon fallax* with low to mid open woodland of *Eucalyptus victrix* and *Acacia citrinoviridis* over tall scattered shrubs of *Acacia ?adsurgens* on brown clay loam on medium drainage lines.	WRP-002, WRP-029, WRP-069	30.0 / 1.7	• Groundwater Dependent Vegetation • Water feature • 56 individuals of *Ipomoea racemigera* (P2) from six-point locations	Very Good to Degraded	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
Eremophila mid to low sparse shrubland						
GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte	Mid to low sparse shrubland of *Eremophila lachnocalyx*, and *Senna artemisioides* subsp. *oligophylla* over low sparse tussock grassland of *Eriachne flaccida*, *Enneapogon polyphyllus*, and *Dichanthium sericeum* subsp. *humilius* (± *Astrebla elymoides*, *Astrebla pectinata*) with tall scattered shrubs of *Acacia aptaneura*, and *Acacia tetragonophylla* on brown clay loam on cracking clays and gilgai plains.	WRP-087, WRP-102, CVM26^	5.7 / 0.3	• Cracking clay / gilgai plains	Very Good to Degraded	
Eucalyptus low open woodland						
FP EgCh TtCcPamu AdSalPl	Low open woodland of *Eucalyptus gamophylla*, and *Corymbia hamersleyana* over mid to low open tussock grassland of *Themeda triandra*, **Cenchrus ciliaris*, and *Paraneurachne muelleri* with tall scattered shrubs of *Acacia dictyophleba*, *Santalum lanceolatum*, and *Petalostylis labicheoides* on brown loamy sand on drainage areas/ floodplains.	WRP-005, WRP-006, CVM01^, CVM05^	2.0 / 0.1	• Nil	Very Good to Good	
Eucalyptus low woodland to low open woodland						
MA EcrEv AciAcp CcCsEuaMahElp	Low woodland to low open woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and occasional *Eucalyptus victrix* tall sparse shrubland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* over mid open tussock grassland of **Cenchrus ciliaris*, **Cenchrus setiger* and *Eulalia aurea* with low sparse herbland/ sedgeland of *Marsilea hirsuta* and *Eleocharis pallens* on brown medium clay on major and medium drainage lines.	WRP-001, WRP-032, WRP-090, CVM15^	25.8 / 1.5	• Groundwater Dependent Vegetation • Gingianna Pool	Good to Poor	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
Senna mid to low sparse shrubland						
FP SeaoSesmSegl AaAsyAte ArcEnpoDar	Mid to low sparse shrubland of *Senna artemisioides* subsp. *oligophylla*, *Senna* sp. Meekatharra (E. Bailey 1-36), and *Senna glutinosa* subsp. ×*luerssenii* with tall scattered shrubs of *Acacia aptaneura*, *Acacia synchronicia*, and *Acacia tetragonophylla* over low scattered tussock grasses of *Aristida contorta*, *Enneapogon polyphyllus*, and *Dactyloctenium radulans* on brown clay loam on drainage areas/ floodplain.	WRP-042, WRP-059, WRP-095, WRP-130, Mvw01^, CVM11^, CVM12^, CVM13^	74.0 / 4.3	• Nil	Excellent to Degraded	
Triodia low hummock grassland						
CP TragTpTw AbAsySeao Ese	Low hummock grassland of *Triodia angusta*, *Triodia pungens*, and *Triodia wiseana* with mid to tall sparse shrubland to scattered shrubs of *Acacia bivenosa* (wispy form), *Acacia synchronicia*, and *Senna artemisioides* subsp. *oligophylla* with low scattered tree of *Eucalyptus socialis* subsp. *eucentrica* on red-brown clay loam on calcrete stony plains and platforms.	WRP-003, WRP-030, WRP-031, WRP-092, WRP-128, CVM16^, CVM28^, CVM29^	76.1 / 4.4	• Nil	Excellent to Degraded	
FP Trag(±Tw) AbAsyAsi EgExCh	Low hummock grassland of *Triodia angusta*, ± *Triodia wiseana* with mid to low scattered shrubs of *Acacia bivenosa*, *Acacia synchronicia*, and *Acacia sibirica* with occasional low scattered trees of *Eucalyptus gamophylla*, *Eucalyptus xerothermica*, and *Corymbia hamersleyana* on brown clay loam on low slopes, drainage areas/ floodplains and undulating hills.	WRP-008, WRP-048, WRP-049, WRP-110, WRP-111, CVM03^, CVM20^, CVM31^	50.9 / 3.0	• Nil	Excellent to Very Good	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
FP Tp(±Tw) AssAdErlo EnpoTtChf	Low hummock grassland of *Triodia pungens*, ± *Triodia wiseana* with mid to tall sparse shrubland of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia dictyophleba*, and *Eremophila longifolia* over mid to low sparse tussock grassland of *Enneapogon polyphyllus*, *Themeda triandra*, and *Chrysopogon fallax* on brown silty clay loam on drainage areas/ floodplains and minor drainage lines.	WRP-007, WRP-021, WRP-034, WRP-043, WRP-044, WRP-046, WRP-053, WRP-061, WRP-093, WRP-112, CVM06^, CVM07^, CVM34^	104.3 / 6.1	• Nil	Excellent to Good	
HS Ts(±TragTw) AbHallAads SeahSeglErfs	Low hummock grassland of *Triodia vanleeuwenii* ± *Triodia angusta*, and *Triodia wiseana* with mid to tall sparse shrubland to scattered shrubs of *Acacia bivenosa*, *Hakea lorea* subsp. *lorea*, and *Acacia adsurgens* over low scattered shrubs of *Senna artemisioides* subsp. *helmsii*, *Senna glutinosa* subsp. ×*luerssenii*, and *Eremophila fraseri* subsp. *fraseri* on brown silty loam on undulating low hills.	WRP-004, WRP-011, WRP-020, WRP-023, WRP-024, WRP-026, WRP-051, WRP-070, WRP-108, WRP-117, CVM10^, CVM18^, CVM32^	157.1 / 9.1	• Nil	Excellent to Very Good	
HS Tw AinAbAads EgEllCh	Low hummock grassland of *Triodia wiseana* with mid to tall sparse shrubland to scattered shrubs of *Acacia inaequilatera*, *Acacia bivenosa*, and *Acacia adsurgens* with low scattered trees of *Eucalyptus gamophylla*, *Eucalyptus leucophloia* subsp. *leucophloia*, and *Corymbia hamersleyana* on brown silty loam on undulating hills and lower slopes.	WRP-009, WRP-014, WRP-017, WRP-028, WRP-045, WRP-047, WRP-050, WRP-098, WRP-100, WRP-104, WRP-106, WRP-113, WRP-118, WRP-122, WRP-124, WRP-125, WRP126, CVM02^, CVM04^, CVM09^, CM17^, CVM19^, CVM21^, CVM25^, CVM33^, CVM34^,	284.7 / 16.5	• Nil	Excellent to Good	

Code	Description	Sample Sites	Extent (ha / %)	Significant features	Condition	Photo
Triodia mid hummock grassland						
HS TwTbrTp AbErfsAi	Mid hummock grassland of *Triodia wiseana, Triodia brizoides* and *Triodia pungens* with mid to tall open shrubland *Acacia bivenosa, Eremophila fraseri* subsp. *fraseri* and *Acacia inaequilatera* on red silty loam on hillslopes, hillcrest/ upper hillslopes and undulating low hills.	CBW-21, WRI-09, WRI-12, WRI-13, WRI-83, WRI-84. Sampled as part of Biologic (2020b).	3.1 / 0.2	• Nil	Excellent	
Triodia mid sparse hummock grassland						
FP Tlo CcErarDar Ex	Mid sparse hummock grassland of *Triodia longiceps* over low sparse tussock grassland of **Cenchrus ciliaris*, *Eriachne aristidea* and *Dactyloctenium radulans* with low scattered trees of *Eucalyptus xerothermica* on brown clay loam on drainage areas/ floodplain.	WRP-091	4.4 / 0.3	• Nil	Poor	
Cleared	Cleared	-	50.3 / 2.9	-	Cleared	
Open Water	Open Water	-	8.5 / 0.5	-		-
Rehab	Rehab	-	0.4 / 0.02	-		-
Totals			**1,720.0 / 100.0**			

^ Mapping note

4.2.4 Significant Vegetation

Federal and State listed vegetation

The desktop assessment (Section 4.1.2) identified one vegetation-relevant state-listed PEC as being within 40 km of the Survey Area. The 'Vegetation of sand dunes of the Hamersley Range/Fortescue Valley (previously Fortescue Valley Sand Dunes)' (P3) PEC is associated with sand dunes of the Hamersley Ranges and Fortescue Valley, with the closest occurrence being more than 37 km north. The Survey Area did not contain any sand dunes or associated dune vegetation, and thus it was concluded that this PEC does not occur.

Vegetation type GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte shares affinities with Priority one PEC, 'West-Angelas Cracking-Clays'. This PEC is described as open tussock grasslands of *Astrebla pectinata*, *Astrebla elymoides*, *Aristida latifolia*, in combination with low scattered shrubs of *Sida fibulifera*, on basalt (Jerrinah formation) derived cracking-clay loam depressions and flowlines. It occurs throughout the central and eastern Hamersley Range from near Tom Price east to Newman (DBCA, 2020). Vegetation type GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte occurred on cracking clay and contained key species typical of the PEC; *Astrebla elymoides*, *Astrebla pectinata*, and *Sida fibulifera*. *Astrebla elymoides* was present in WRP-087 and *Astrebla pectinata* was present in WRP-102 but neither species was a dominant part of the grassland stratum at these relevés. *Astrebla* was observed again at mapping note CVM-26 (Plate 4.3). *Sida fibulifera* was found in both relevés but did not form a major part of the vegetation structure. The mapped vegetation type contained additional strata (mid to low sparse shrubland, and tall scattered shrubs) and species (*Eremophila lachnocalyx*, *Senna artemisioides* subsp. *oligophylla*, *Acacia aptaneura* and *Acacia tetragonophylla*) that are not typical for the 'West-Angelas Cracking-Clays' PEC. Consequently, the cracking-clay vegetation type found within the Survey Area it is not considered to represent this PEC.

None of the other vegetation types described and delineated from the Survey Area are considered to be analogous with any TECs and PECs known to occur in the Pilbara region.

Plate 4.3: Mapping note CVM-26 (L) and *Astrebla pectinata* at relevé WRP-102 (R)

Vegetation of other significance

The EPA (2016b) advises that vegetation may be of significance for reasons other than a listing as a TEC or a PEC. This may include, although is not limited to, scarcity, novel combination of species, role as a refuge, restricted distribution and vegetation extent being below a threshold level.

Vegetation type SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri in the southwest portion of the Survey Area supported the Priority 3 plant *Rhagodia* sp. Hamersley (M. Trudgen 17794). It is therefore locally significant in providing suitable habitat for this species. This vegetation type also supports sheet-flow dependent vegetation, which is discussed further along in section 4.2.4.

Five vegetation types within the Survey Area are analogous with several 'ecosystems at risk' for the Hamersley IBRA subregion (Kendrick, 2001) (Table 4.4). Vegetation type SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri displays mulga groving and is analogous with 'Grove/ inter-grove mulga of the eastern Hamersley Range'. Vegetation types containing mulga species as dominant components (*Acacia aptaneura*, *Acacia incurvaneura*, *Acacia paraneura* and *Acacia pteraneura*) of either woodland, open woodland, or shrubland can be considered 'valley floor mulga'. Mulga present as open to sparse shrubland, or as scattered shrubs was not classed 'at risk'. There were no eligible mulga vegetation types present on lower slopes ('lower-slope mulga). All major ephemeral water courses are described as being at risk by Kendrick (2001) and include the major drainage lines across the Survey Area. Threatening processes for these ecosystems include stock, weeds, frequent fires and mining (Kendrick, 2001).

Table 4.4: 'Ecosystems at risk' within the Survey Area

Ecosystem at risk	Analogous vegetation type(s)	Landform(s)
Grove/ inter-grove mulga, eastern Hamersley Range	SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri	Stony plains
Valley floor mulga	FP AaAinAte(±ExEg) CcEnpoChf BbClvAbl, SP AaAptAp AteSeglErff EnpoCcArc, FP AaApAte SeglMam EnpoEmuAri Tp	Drainage areas/ floodplains, stony plains/ hardpans
Major ephemeral water courses	MA EcrEv AciAcp CcCsEuaMahElp	Major and medium drainage lines

Groundwater Dependent Ecosystems

Two mapped vegetation types, MA EcrEv AciAcp CcCsEuaMahElp and ME CcCsChf EvAci Aads, are considered to be Groundwater Dependent Vegetation (GDV). These vegetation types coincide with major and medium drainage lines that run through the Survey Area, as discussed in section 2.7 (Figure 2.5; Figure 4.5). Vegetation type MA EcrEv AciAcp CcCsEuaMahElp was found in major drainage lines at the northeast tip of the Survey Area where it intersects the Fortescue River, adjacent to Gingianna Pool, and along Western Creek in the far southwest. ME CcCsChf EvAci Aads occurred in medium drainage lines adjacent to the major drainage lines of the Fortescue River and Western Creek, as well as three other minor unnamed creeklines. Two surface water features were found within MA EcrEv AciAcp CcCsEuaMahElp (WWRP-06 at the Fortescue River and WWRP-04 at Gingianna Pool) and one was found along an unnamed creekline in ME CcCsChf EvAci Aads (WWRP-07) (Figure 4.5).

The field survey recorded two key riparian tree species, *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix*. *Eucalyptus camaldulensis* subsp. *refulgens* is primarily a facultative phreatophyte[1] and is generally found near rivers and major creek systems with a shallow water table (2 – 5 m below ground) (Landman, 2001). In some locations, however, where soil moisture is consistently recharged by streamflow, *Eucalyptus camaldulensis* may not require groundwater at all and would be termed a vadophyte[2] (SKM, 2012). *Eucalyptus victrix* is primarily a vadophyte and generally occurs in drier areas than *Eucalyptus camaldulensis*. Groundwater studies by Loomes (2010) have shown that the mean minimum water level depth occurring under *Eucalyptus victrix* populations was somewhat greater than that for *Eucalyptus camaldulensis*. The water use strategy of *Eucalyptus victrix* appears to be highly plastic and opportunistic, enabling survival in a wide range of ecohydrological settings (Pfautsch *et al.*, 2014). Several other riparian taxa which indicate persistent (at varying levels) soil moisture presence were found during the field survey (Table 4.5). Limited information is known on the water use strategies of such species, although they are considered unlikely to be groundwater dependent. These species readily grow in areas of the landscape which receive seasonal throughflow and focusing of surface runoff (i.e., minor creeklines) following rainfall events and are therefore reliant on varying degrees of water available within the riparian zone. No obligate phreatophytes[3] were found in the Survey Area.

Vegetation type MA EcrEv AciAcp CcCsEuaMahElp contained both *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* as well as a number of taxa more typical of larger drainage systems and/ or permanent pools such as *Acacia coriacea* subsp. *pendens*, *Eleocharis pallens* and *Melaleuca glomerata* (these were not found in any other vegetation type). *Melaleuca glomerata* is a widespread arid-zone paperbark and can occur in association with spring-fed pools (SKM, 2001). Vegetation type MA EcrEv AciAcp CcCsEuaMahElp is likely to have a moderate dependence upon access to groundwater and potentially represents a GDE. Vegetation type ME CcCsChf EvAci Aads contained *Eucalyptus victrix*, however *Eucalyptus camaldulensis* subsp. *refulgens*, *Melaleuca glomerata* and *Eleocharis pallens* were absent (Table 4.5). This vegetation type is likely to have a low dependence upon access to groundwater, particularly in dry conditions, but is unlikely to represent a GDE. The actual usage of groundwater for both vegetation types, however, is dependent upon the underlying geology, hydrogeology, aquifer levels and characteristics, as well as seasonal climatic fluctuations.

GDV vegetation types, MA EcrEv AciAcp CcCsEuaMahElp and ME CcCsChf EvAci Aads are locally significant and the major drainage lines are also considered 'ecosystems at risk' on a subregional scale, as previously discussed. However, due to the long and linear nature of the Survey Area, their presence and coverage within the Survey Area are minimal, at approximately 56 ha or 3.2 %.

[1] Facultative phreatophytes are deep-rooted plants which utilise groundwater to satisfy at least some portion of their EWR (Environmental Water Requirement) but if required, may also satisfy their total EWR via soil moisture (SKM, 2010).

[2] Vadophytes are plants commonly associated with drainage lines which rely on moisture in the soil surface profiles and are independent of groundwater

[3] Obligate phreatophytes are deep-rooted plants which utilise groundwater to satisfy some or all of their EWR (SKM, 2010).

Table 4.5: Riparian flora taxa recorded from the Survey Area (information collated from Cook & Eamus, 2018; SKM, 2001, 2012; WAH, 1998-)

Taxon	Lifeform	Ecohydrological category/ interpretation	Ecohydrological notes	MA EcrEv AciAcp CcCsEuaMahElp	ME CcCsChf EvAci Aads
Eucalyptus camaldulensis subsp. *refulgens*	Tree	Facultative phreatophyte/ Vadophyte	Medium to high groundwater dependence	✓	
Eucalyptus victrix	Tree	Vadophyte/ Facultative phreatophyte	Medium groundwater dependence	✓	✓
Eucalyptus xerothermica	Tree	Vadophyte/ Facultative phreatophyte	Low to Moderate groundwater dependence		✓
Melaleuca glomerata	Shrub/ Tree	Vadophyte/ Facultative phreatophyte (inferred)	Potentially dependent on groundwater	✓	
Acacia citrinoviridis	Tree/ Shrub	Mesic indicator - low level	Potentially dependent on groundwater	✓	✓
Acacia coriacea subsp. *pendens*	Shrub/ Tree	Mesic indicator - low level	Potentially dependent on groundwater	✓	
Cyperus vaginatus	Perennial Sedge	Mesic indicator - moderate level	Not groundwater dependent.	✓	✓
Eleocharis pallens	Perennial Sedge	Emergent macrophyte	Taxon grows in swamps and pools. May be indirectly groundwater-dependent if growing in spring-fed pools.	✓	
Schoenoplectiella dissachantha	Perennial Sedge	Mesic indicator - moderate level	Not groundwater dependent.	✓	
Marsilea hirsuta	Perennial Fern	Mesic indicator - moderate level	Not groundwater dependent.	✓	✓
Sesbania cannabina	Annual Herb or Shrub	Mesic indicator - low level	Dependent on seasonal surface water flows for germination and growth. Not groundwater dependent.	✓	✓
Alternanthera angustifolia	Annual Herb	Mesic indicator - low level		✓	✓
Alternanthera denticulata	Annual/ Perennial Herb	Mesic indicator - low level			✓
Alternanthera nana	Herb or Shrub	Mesic indicator - low level	Not groundwater dependent.	✓	
Leptochloa digitata	Perennial Grass	Mesic indicator - low level	Not groundwater dependent.	✓	

760000
765000
770000
775000
7405000
7400000
VWRP-07
Newman
Legend
Survey Area
Water Feature
Vegetation Type
Gilgai Plain (cracking clay)
GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte
Groundwater Dependent Ecosystem
ME CcCsChf EvAci Aads
MA EcrEv AciAcp CcCsEuaMahElp
Sheet-flow Dependent Ecosystem
SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri
N
biologic Environmental Survey
Scale: 1:47,000
0 1 2 Km
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021
Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman
BHP WAIO
Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey
Figure 4.5a: Significant features in the Survey Area

770000
775000
780000
785000
7415000
7410000

Newman
Great Northern Hwy
Marble Bar Rd
VWRP-04
Gingianna Pool

Legend

Survey Area
Water Feature
State Road

Vegetation Type

Gilgai Plain (cracking clay)

GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte

Groundwater Dependent Ecosystem

ME CcCsChf EvAci Aads

MA EcrEv AciAcp CcCsEuaMahElp

N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021

Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.5b: Significant features in the Survey Area

780000
785000
790000
7415000
7410000
Newman
Great Northern Hwy
Marble Bar Rd
VWRP-06
VWRP-04
Gingianna Pool

Legend

- Survey Area
- Water Feature
- State Road

Vegetation Type

Groundwater Dependent Ecosystem

- ME CcCsChf EvAci Aads
- MA EcrEv AciAcp CcCsEuaMahElp

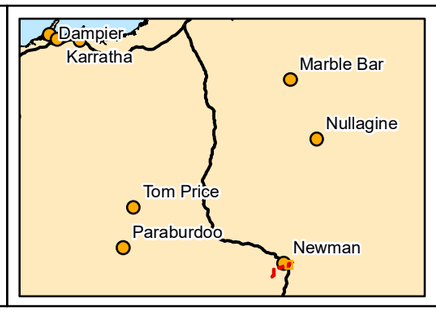
N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.5c: Significant features in the Survey Area

Sheet-flow Dependent Ecosystems

Vegetation type SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri is considered to represent a sheet-flow dependent ecosystem (Figure 4.5). This vegetation type is a low woodland containing two mulga species, *Acacia aptaneura* and *Acacia incurvaneura*. The grove/ intergrove structure was evident from aerial photography and was confirmed by on-ground observation. The vegetation occurred on brown clay loam on hardpan and stony plains. Groves were longitudinally oriented strips of low mulga woodland over low scattered tussock grasses, whilst intergrove areas were relatively bare with only scattered shrubs and tussock grasses (Plate 4.4; Plate 4.5). This is typical of banded vegetation whereby the groves intercept overland sheet flow resulting in accumulation of biomass and unique flora assemblages. Several species were recorded in vegetation type SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri that did not occur elsewhere within the Survey Area, including *Acacia subcontorta*, *Eragrostis eriopoda*, *Indigofera georgei*, *Maireana villosa*, *Monachather paradoxus*, *Paspalidium clementii*, *Ptilotus schwartzii* var. *schwartzii* and *Senna glaucifolia*. Groved vegetation systems play an important part in controlling erosion on landforms that are prone to sheetflow (Saco *et al.*, 2007).

SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri was located in the southwest portion of the Survey Area and broadly coincided with the Spearhole Land System, which is known to support sheet flow. The vegetation occurring in association with the Elimunna land system (which is also known to support sheet flow) occurred in the northeast and central areas of the Survey Area. The vegetation in this area contained several mulga-dominated vegetation types. However, there was no obvious mulga banding or groving/ intergroving which would indicate sheet-flow dependency and therefore this part of the Survey Area is not considered to contain sheet-flow dependent ecosystems.

Further mulga woodlands/ shrubland were recorded across the Survey Area, however these communities either did not display any banding or occurred in association with landforms not subject to sheet-flow.

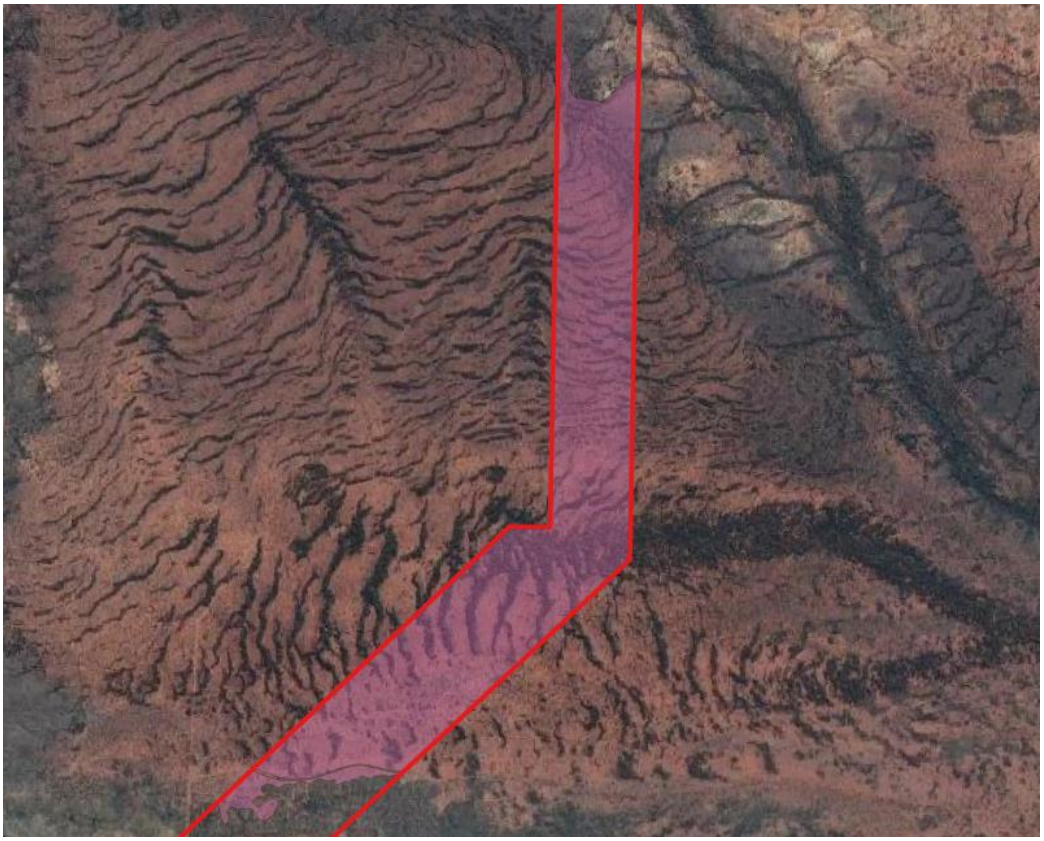


Plate 4.4: Aerial imagery of mulga grove/ intergrove vegetation structure (pink shading indicates vegetation type SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri)

Plate 4.5: Sheet-flow dependent vegetation within the Survey Area, with mulga groves/ banding (L) and sparse intergrove vegetation with a band of mulga in the distance (R)

Water Features

Water features are a limiting factor for many ecosystems (James *et al.*, 1995), particularly within arid-zone ecosystems such as the Pilbara and often represent areas of comparatively high ecological productivity (Murray *et al.*, 2003) by providing specific ecosystem functions supporting unique and important biological diversity at both local and regional scales (depending on the size and function of the water feature) (Boulton & Hancock, 2006; Humphreys, 2006; Murray *et al.*, 2006).

Three water features were recorded within the Survey Area during the field survey (Figure 4.5). Of the three water features recorded, one (WWRP-01) is a section of the Fortescue River where water pools for prolonged periods following rainfall events and is likely to be semi-permanent. The extent of this water feature extends well beyond the boundary of the Survey Area and forms a continuation of the MA EcrEv AciAcp CcCsEuaMahElp vegetation type. Water feature WWRP-02 was located adjacent to Gingianna Pool and WWRP-03 was found along an unnamed creekline in the southwest portion of the Survey Area. Both WWRP-02 and WWRP-03 are likely to be seasonal, with the presence of water likely due to recent rainfall preceding the field survey.

4.2.5 Vegetation Condition

The condition of the vegetation within the Survey Area ranged from completely degraded to excellent (Table 4.6 and Figure 4.6). The majority of the vegetation was in good or higher condition (1477 ha / 86 %). The main disturbances observed were associated with pastoralism. There were signs of cattle grazing and trampling across of the Survey Area, excluding the hillcrests and ridges. It is likely that the main introduced taxa, **Cenchrus ciliaris* would have been transported across the Survey Area via pastoralism and cattle grazing. The areas of the Survey Area lower in the landscape were more heavily impacted by cattle, including the floodplains and drainage lines.

Table 4.6: Vegetation condition extent in the Survey Area

Condition	Extent (ha / %)	Comment
Excellent	473.1 / 27.5	Excellent vegetation was found on most of the central Survey Area portion, and small areas of the southwest and northeast portions. Majority was located on hillslopes (321 ha).
Very Good	543.8 / 31.6	Vegetation in very good condition was found across large parts of each Survey Area portion. Majority was located on drainage areas/ floodplains, stony plains and hillslopes (206 ha, 170 ha, 117 ha respectively).
Good	460.3 / 26.8	Good vegetation was found across all three Survey Area portions. Majority was located on stony plains (337 ha).
Poor	127.5 / 7.4	Vegetation in poor condition was found along and south of Marble Bar Rd and along drainage lines throughout the Survey Area. Majority was located on drainage areas/ floodplains (84 ha).
Degraded	65.2 / 3.8	Degraded vegetation was found in association with roads and infrastructure in the northeast portion, as well as drainage lines in the central and southwest Survey Area portions. Majority was located on drainage areas/ floodplains (49 ha).
Completely Degraded	0.4 / 0.02	Rehab mapping unit
Cleared	50.3 / 2.9	Cleared mapping unit
N/A	8.5 / 0.5	Open water mapping unit
TOTAL	1720.4 / 100	

760000 765000 770000 775000

7405000

7400000

Newman

Legend

Survey Area

Vegetation Condition

Excellent

Very Good

Good

Poor

Degraded

Cleared

N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021

Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.6a: Vegetation condition in the Survey Area

770000
775000
780000
785000
7415000
7410000
Newman
Great Northern Hwy
Marble Bar Rd

Legend

- Survey Area
- State Road

Vegetation Condition

- Excellent
- Very Good
- Good
- Poor
- Degraded
- Completely Degraded
- Cleared

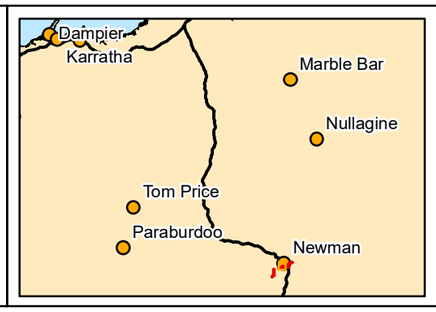
N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021



BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.6b: Vegetation condition in the Survey Area

780000
785000
790000
7415000
7410000
Marble Bar Rd
Great Northern Hwy
Newman
Newman

Legend

- Survey Area
- State Road

Vegetation Condition

- Excellent
- Very Good
- Good
- Poor
- Degraded
- Completely Degraded
- Cleared

N

biologic Environmental Survey

Scale: 1:47,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 20/10/2021

Dampier
Karratha
Marble Bar
Nullagine
Tom Price
Paraburdoo
Newman

BHP WAIO

Western Ridge Pipeline Reconnaissance Flora and Vegetation Survey

Figure 4.6c: Vegetation condition in the Survey Area

4.3 Review of Occurrence Assessment

The review of occurrence assessment provides detailed reasoning for species considered highly likely to possible to occur pre-survey, as well as two taxa that were upgraded from an unlikely pre-survey likelihood (Table 4.7). One significant taxon, *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3), was confirmed to occur in the Survey Area during the field survey. This taxon was considered unlikely to occur pre-survey.

The level of survey (reconnaissance) was taken into account for the post-survey likelihood assessment. It is unlikely that medium to large perennial taxa were missed within the relevés sampled and areas traversed (Figure 3.2); however, for significant flora where suitable habitat was noted, it is possible that they may still occur in areas that were not intensively traversed.

Two taxa identified by the desktop assessment, *Ipomoea racemigera* (P2) and *Aristida lazaridis* (P2), were found by a concurrent survey conducted by Biologic (Biologic, in prep). *Ipomoea racemigera* (P2) was found where the two survey areas overlapped, and its likelihood was thus upgraded to confirmed. *Aristida lazaridis* (P2) was recorded approximately1 km to the west of the Pipeline Survey Area. Suitable habitat was found in the Survey Area, and as such, the likelihood for *Aristida lazaridis* (P2) has been upgraded to possible.

The remainder of the significant species, with a pre-survey likelihood of unlikely or highly unlikely, are displayed in Appendix F. Fourteen out of 22 unlikely taxa were downgraded to highly unlikely, primarily due to there being limited or absent suitable habitat or because they were large perennial taxa. All species assessed as highly unlikely to occur remained so post-survey.

Table 4.7: Post-survey assessment of occurrence for significant flora

Taxon	Post-survey likelihood	Reason for change in likelihood
Pre-survey likelihood – Highly Likely		
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (P3)	Possible	Species is an inconspicuous small annual/ biannual herb that is likely to have been growing at the time of survey, if present. Limited suitable habitat was observed (calcrete plains/ vegetation type CP TragTpTw AbAsySeao Ese, 76.1 ha / 4.4% of the Survey Area). It is still possible that this species occurs within areas of calcrete plains that were not intensively traversed.
Pre-survey likelihood – Likely		
Swainsona thompsoniana (P3)	Likely	Inconspicuous small annual herbs that may not have been growing at the time of survey. Suitable habitat present within Survey Area.
Goodenia nuda (P4)	Likely	
Pre-survey likelihood – Possible		
Ipomoea racemigera (P2)	Confirmed	Confirmed within the Survey Area by a concurrent survey (Biologic, in prep).
Aristida jerichoensis var. *subspinulifera* (P3)	Possible	Suitable habitat present within Survey Area. Taxon is a short-lived perennial tussock grass that grows throughout the year following substantial rainfall events. Due to the lower than average rainfall in the weeks preceding the survey, conditions may not have been favourable for germination/ growth

Taxon	Post-survey likelihood	Reason for change in likelihood
		of this taxon. As it may not have been present at time of survey it is still considered possible to occur.
Gymnanthera cunninghamii (P3)	Unlikely	Limited suitable habitat observed within Survey Area. Conspicuous perennial taxon unlikely to have been missed.
Hibiscus campanulatus (P1)	Highly Unlikely	Marginal or unsuitable habitat for these taxa was observed within the Survey Area during the field survey.
Isotropis parviflora (P2)	Highly Unlikely	
Indigofera gilesii (P3)	Highly Unlikely	
Lepidium catapycnon (P4)	Highly Unlikely	
Pre-survey likelihood – Unlikely		
Aristida lazaridis (P2)	Possible	Suitable habitat present within the Survey Area. Record found approximately 1 km from the Survey Area by Biologic (in prep).
Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)	Confirmed	Confirmed within the Survey Area.

4.4 Survey Adequacy

A total of 109 sites (130 including the Whaleback Survey Area) have been sampled across the Survey Area (all relevés), totalling 0.06 sites sampled per hectare of native vegetation. The number of sites sampled per hectare can be highly variable depending on the total survey area size, survey area shape and the number of different vegetation types present; however, reconnaissance surveys are typically less intensive than detailed flora and vegetation surveys. The sampling intensity of the Survey Area is consistent with the flora and vegetation surveys reviewed in the desktop assessment, ranging from 0.004 to 1.25 sites per hectare (Table 4.8). It should be noted that not all the reports reviewed in the desktop assessment contained the relevant survey details (i.e., survey area size) and therefore their survey intensity is unknown.

Table 4.8: Comparison of known survey intensity and effort in the Survey Area

Survey	Study			Taxa Counts			Significant flora	
	Area (ha)	Sampling intensity	Sites per ha	Total	Families	Genera	Priority flora	Introduced
Biota (2001)	17,060	60	0.004	380	98	168	-	11
Onshore and Biologic (2009)	2,609	30	0.01	201	40	100	-	17
ENV (2012)	8,830	51	0.01	422	52	167	4	19
ENV (2011b)	703	15	0.02	127	31	64	-	7
GHD (2011a)	6100	123	0.02	347	48	159	3	13
ENV (2010)	844	29	0.03	189	37	86	-	3
Biologic (2020b)	1204	39	0.03	152	29	70	-	3
Biologic (2020a)	1,745	50	0.03	185	34	91	-	9
ENV (2006c)	250	10	0.04	168	39	99	-	8
GHD (2008a)	3,600	141	0.04	321	52	141	-	14
Biologic (2021) – current survey	~ 2,230	130	0.06	267	38	118	2	9
ENV (2009c)	~170	10	0.06	124	28	65	-	5
Astron (2014)	120	8	0.07	54	21	35	-	2

Survey	Study			Taxa Counts			Significant flora	
	Area (ha)	Sampling intensity	Sites per ha	Total	Families	Genera	Priority flora	Introduced
ENV (2009b)	~2,300	180	0.08	501	58	172	6	14
ENV (2009a)	35	5	0.14	80	24	53	-	6
Onshore (2014b)	720	128	0.18	199	32	93	-	7
ENV (2006d)	220	45	0.2	285	47	115	-	13
Eco Logical (2011)	52	14	0.27	33	6	15	-	2
Astron (2010)	23	7	0.3	71	18	38	-	2
ENV (2006b)	30	9	0.3	117	25	59	-	7
Eco Logical (2012)	~3	3	1	52	14	26	-	1
Onshore (2015)	28	35	1.25	125	25	73	-	15
ENV (2006a)	-	81	-	243	42	117	1	7
ecologia (2006a)	-	36	-	152	35	79	-	3
HGM (1999b)	-	10	-	206	44	101	-	4
ecologia (2005)	-	7	-	91	28	47	-	-

5 CONCLUSION

A single season reconnaissance flora and vegetation survey was completed over eight days across the Survey Area, with all major vegetation communities visited and sampled. A total of 109 relevés were sampled in the Survey Area, with an additional 21 relevés being sampled in the adjacent Whaleback Survey Area. The floristic data recorded was used to determine the vegetation types and their condition within the Survey Area. Work was completed to a level sufficient enough to meet EPA requirements. The key findings of the survey:

- A total of 250 confirmed vascular flora taxa from 37 families and 111 genera, comprising 241 native and nine introduced taxa. The total increases to 267 confirmed flora taxa, comprising 258 native and nine introduced taxa, when the taxa from the adjacent Whaleback Survey Area are included in the total;
- One significant listed flora taxon was recorded from the Survey Area:
    - *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) – 66 individuals recorded from 59-point locations and;
    - *Ipomoea racemigera* (P2) – 56 individuals from six-point locations (recorded from a concurrent Biologic survey which overlapped the Survey Area).
- Ten taxa considered to be flora of “other” significance, including seven range extensions, two locality holes and one hybrid;
- Nine introduced taxa recorded within the Survey Area: **Aerva javanica*, **Bidens bipinnata,* **Cenchrus ciliaris*, **Cenchrus setiger*, **Cynodon dactylon, *Echinochloa colona, *Malvastrum americanum*, **Setaria verticillata,* and **Vachellia farnesiana*. None are listed as WoNS, DPs or ‘Priority Alert’ weeds, with the most frequently observed taxa being **C. ciliaris* and **B. bipinnata*;
- 26 vegetation types were described and delineated from 17 broad floristic formations across nine landforms;
- No TECs or PECs were recorded from the Survey Area;
- One vegetation type, GP ErlcSeao ErfcEnpoDish(±AselAspe) AaAte, shared affinities with priority 1 PEC ‘West-Angelas Cracking-Clays’, but was determined not to represent the ‘‘West-Angelas Cracking-Clays’;
- Five vegetation types, SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri, FP AaAinAte(±ExEg) CcEnpoChf BbClvAbl, SP AaAptAp AteSeglErff EnpoCcArc, FP AaApAte SeglMam EnpoEmuAri Tp and MA EcrEv AciAcp CcCsEuaMahElp, are considered an ‘ecosystem at risk’ for the Hamersley subregion;
- Two vegetation types are considered to be groundwater dependent vegetation
    - MA EcrEv AciAcp CcCsEuaMahElp likely has moderate dependence on groundwater and may represent a groundwater dependent ecosystem and;
    - ME CcCsChf EvAci Aads likely has low dependence on groundwater but is unlikely to represent a groundwater dependent ecosystem
- One vegetation type, SP AinAaAsu(±GrbAprCocd) ErffSegfSeah EnpoArcAri, is considered to be a sheet-flow dependent ecosystem; and

- The vegetation condition ranged from completely degraded to excellent, with the majority (86%) considered to be in good or better condition.

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7 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; (iii) the plan of management is in force under a law of the Commonwealth or 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.

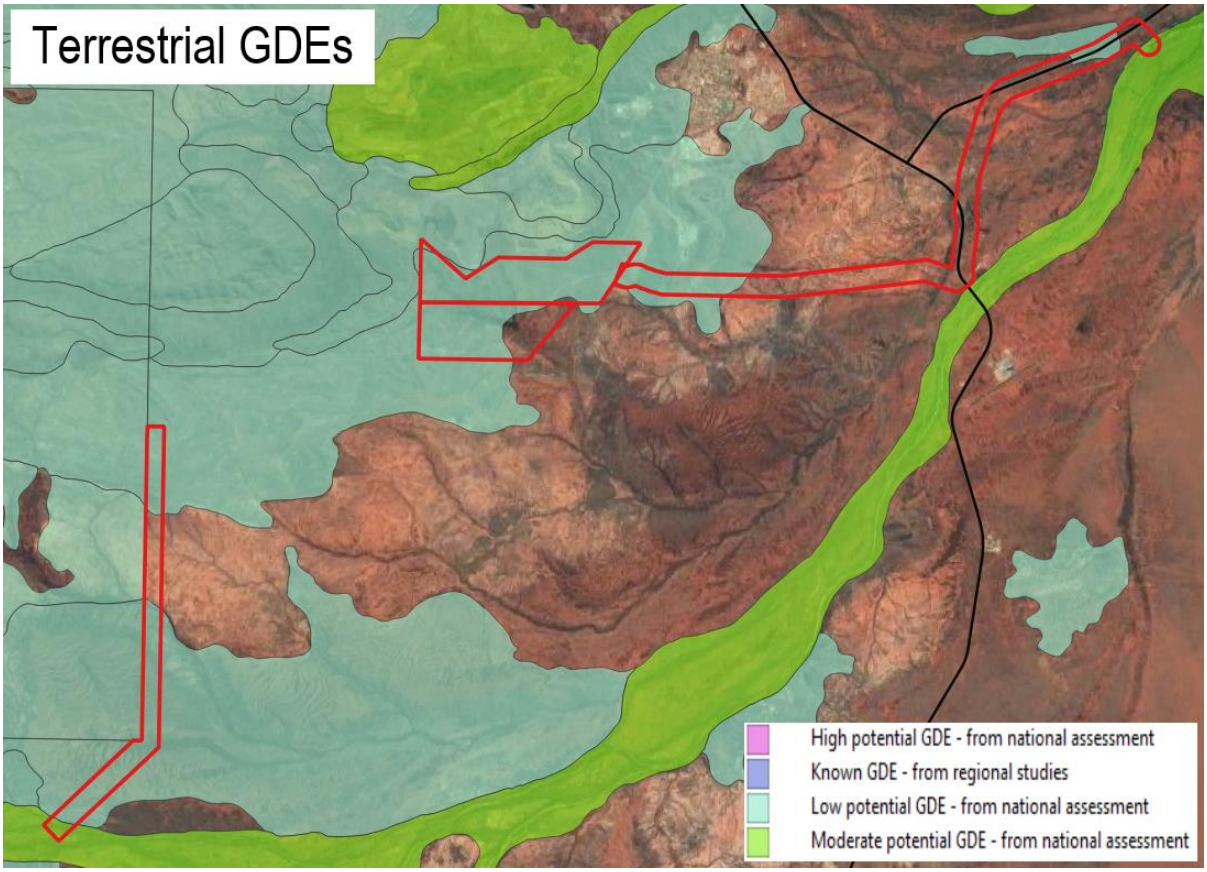
Department of Biodiversity, Conservation and Attractions Priority Definitions

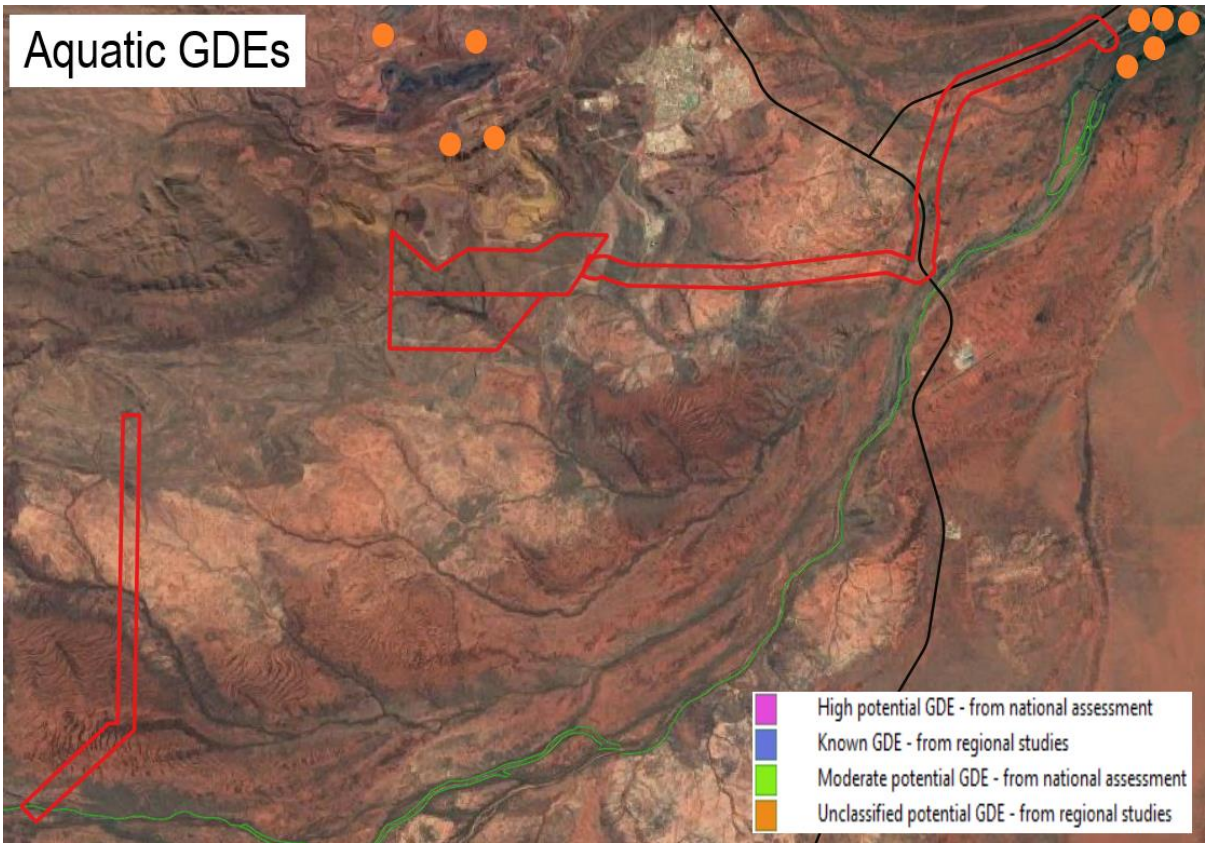
Category	Definition
Priority Flora Species	
Priority 1 (P1)	**Poorly-known Species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral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

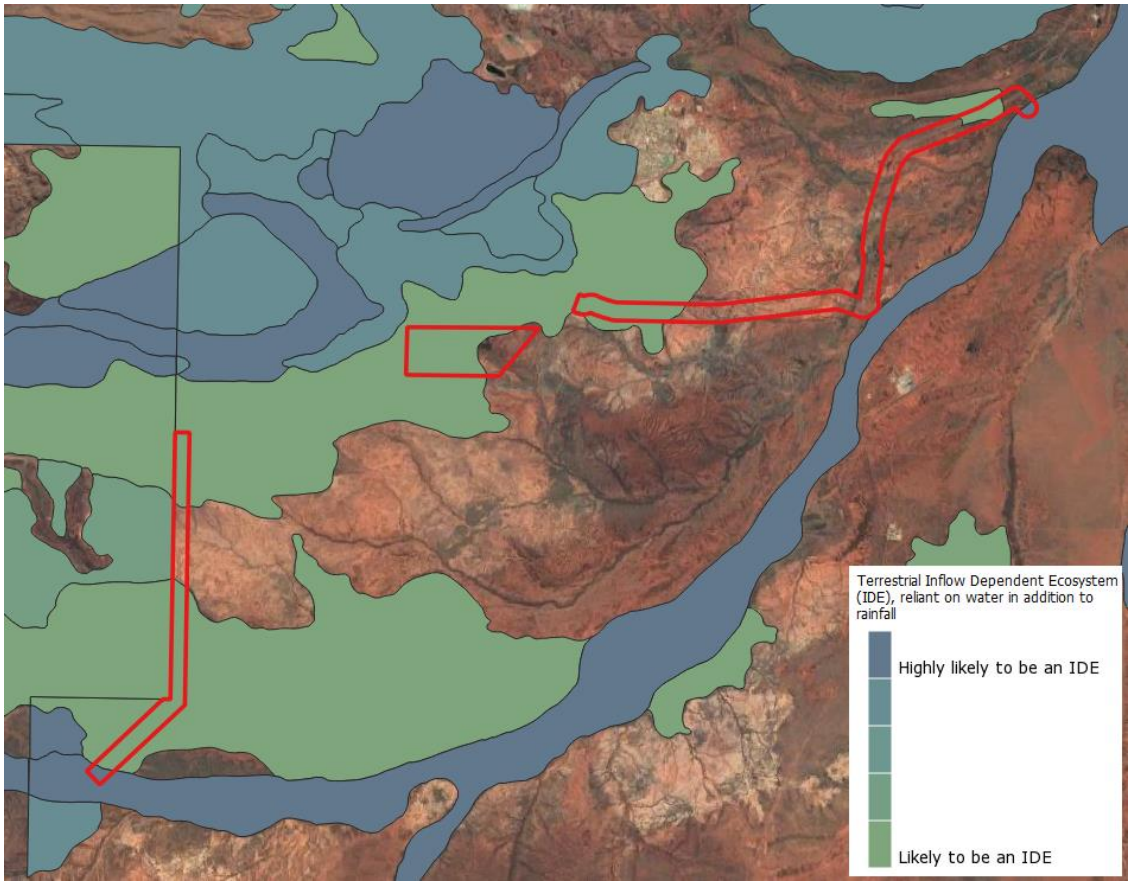
Category	Definition
Priority Ecological Communities	
Priority 1 (P1)	**Poorly-known ecological communities** Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under 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** (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

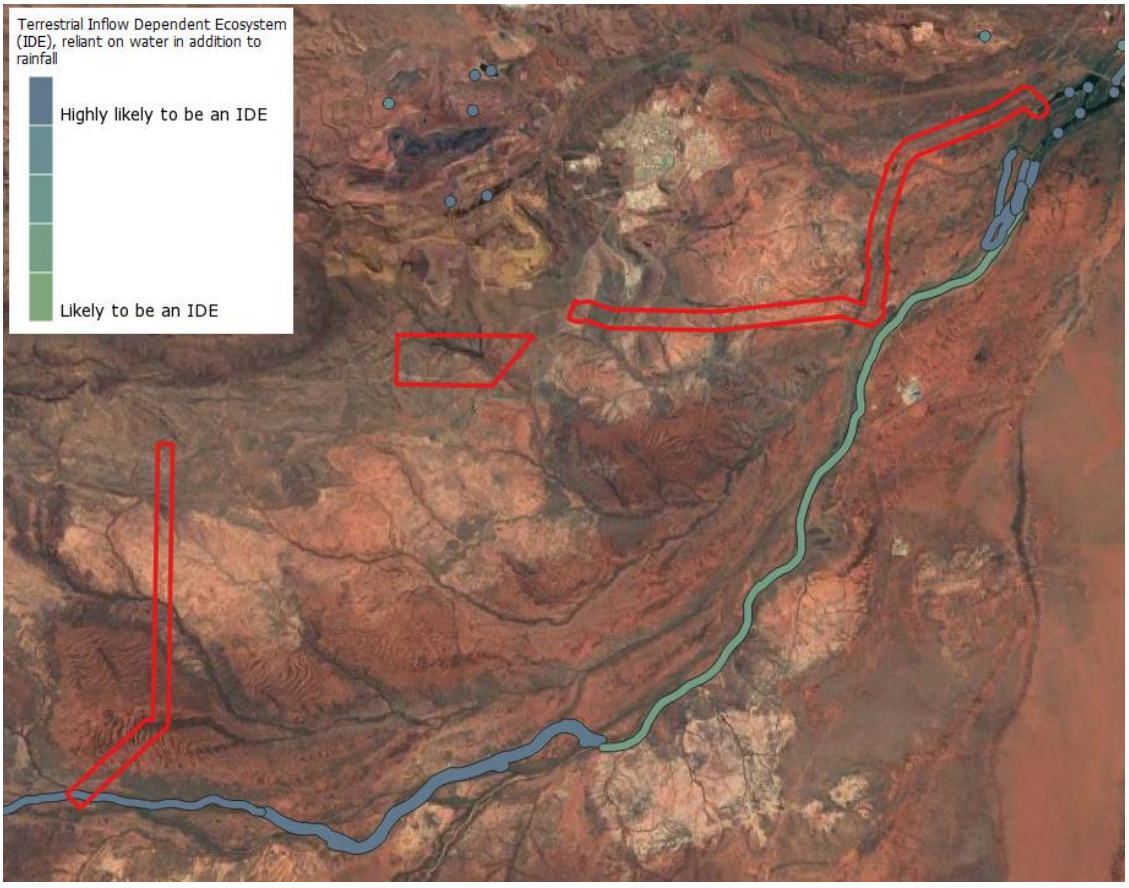
Category	Definition
Priority 4 (P4)	**Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.** (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 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: GDE Atlas Assessment Output (BoM, 2012)


Terrestrial GDEs
High potential GDE - from national assessment
Known GDE - from regional studies
Low potential GDE - from national assessment
Moderate potential GDE - from national assessment


Aquatic GDEs
High potential GDE - from national assessment
Known GDE - from regional studies
Moderate potential GDE - from national assessment
Unclassified potential GDE - from regional studies


Terrestrial Inflow Dependent Ecosystem (IDE), reliant on water in addition to rainfall
Highly likely to be an IDE
Likely to be an IDE


Terrestrial Inflow Dependent Ecosystem (IDE), reliant on water in addition to rainfall
Highly likely to be an IDE
Likely to be an IDE

Appendix C: Sample Site Data

Western Ridge Pipeline **Site WRP-001**

Date	24/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	789769 mE; 7415446 mN
	119.8339 E -23.345002 S
Veg Condition	Poor
Soil	Light Medium Clay
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* low open woodland over *Marsilea hirsuta* low sparse herbland.

SPECIES LIST

Name	Specimen
Alternanthera angustifolia	WRP001.03
**Echinochloa colona*	WRP001.04
Eragrostis elongata	WRP001.02
Eucalyptus camaldulensis subsp. *refulgens*	
Eucalyptus victrix	
Goodenia lamprosperma	
Marsilea hirsuta	
Schoenoplectiella dissachantha	WRP001.01
Sesbania cannabina	

Western Ridge Pipeline **Site WRP-002**

Date	24/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 789512 mE; 7415307 mN 119.8314 E -23.346307 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Triodia pungens* low open hummock grassland with *Eucalyptus victrix* low scattered trees over *Acacia synchronicia* mid scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Codonocarpus cotinifolius	
Eremophila cuneifolia	
Eucalyptus victrix	
Evolvulus alsinoides var. *decumbens*	
Gomphrena canescens	
Hakea lorea subsp. *lorea*	
Paraneurachne muelleri	
Ptilotus clementii	
Rhynchosia minima	
Salsola australis	
Sida fibulifera	
Solanum lasiophyllum	
Triodia pungens	

Western Ridge Pipeline **Site WRP-003**

Date	24/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 788636 mE; 7414901 mN 119.8230 E -23.350118 S
Veg Condition	Very Good
Soil	Silty Loam
Rock Type	Limestone
Fire Age	Moderate (3 to 5 yr)
Habitat	Calcrete Plain
Vegetation	*Triodia pungens* low open hummock grassland with *Eucalyptus socialis* subsp. *eucentrica* low scattered trees over fire ephemeral and herbs.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Codonocarpus cotinifolius	
Eucalyptus socialis subsp. *eucentrica*	WRP003.01
Indigofera monophylla	
Ptilotus clementii	WRP003.02
Ptilotus exaltatus	
Senna artemisioides subsp. *oligophylla*	
Tribulus hirsutus	
Triodia pungens	

Western Ridge Pipeline **Site WRP-019**

Date	26/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 787959 mE; 7414564 mN 119.8164 E -23.353281 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Tall *Acacia incurvaneura* shrubland over *Hakea lorea* subsp. *lorea* with *Abutilon macrum* over dense **Cenchrus ciliaris* tussock grassland.

SPECIES LIST

Name	Specimen
Abutilon macrum	WRP019.05
Abutilon otocarpum	WRP019.06
Acacia incurvaneura	WRP019.01
Acacia tetragonophylla	
**Cenchrus ciliaris*	
Digitaria ctenantha	WRP019.03
Enneapogon polyphyllus	WRP019.04
Eremophila ?forrestii	WRP019.02
Eremophila latrobei	
Evolvulus alsinoides	
Gomphrena canescens	
Goodenia muelleriana	
Ipomoea calobra	WRP019.07
**Malvastrum americanum*	
Portulaca oleracea	
Ptilotus exaltatus	
Sida fibulifera	
Solanum lasiophyllum	
Sporobolus australasicus	

Western Ridge Pipeline **Site WRP-020**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 789272 mE; 7415678 mN 119.8290 E -23.343002 S
Veg Condition	Very Good
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Triodia vanleeuwenii* and *Triodia pungens* low hummock grassland with *Acacia pruinocarpa*, *Hakea lorea* subsp. *lorea* and *Acacia pachyacra* tall sparse shrubland over *Senna artemisioides* subsp. *helmsii*, *Acacia sibirica* and *Senna glutinosa* subsp. x *luerssenii* mid to low scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia pachyacra	
Acacia pruinocarpa	
Acacia sibirica	WRP020.01
**Cenchrus ciliaris*	
Hakea lorea subsp. *lorea*	
Senna glutinosa subsp. x *luerssenii*	
Triodia pungens	
Triodia vanleeuwenii	

Western Ridge Pipeline **Site WRP-021**

Date	26/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50
	787848 mE; 7414910 mN
	119.8153 E -23.350183 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	Tall *Acacia sibirica* shrubs over low open *Triodia pungens* hummock grassland.

SPECIES LIST

Name	Specimen
Abutilon macrum	WRP019.05
Acacia bivenosa	
Acacia sibirica	WRP021.01
Acacia synchronicia	
**Bidens bipinnata*	
Duperreya commixta	
Enneapogon polyphyllus	
Evolvulus alsinoides	
Goodenia microptera	
Indigofera monophylla	
Portulaca filifolia	
Ptilotus exaltatus	
Senna glutinosa subsp. x *luerssenii*	
Triodia pungens	

Western Ridge Pipeline **Site WRP-022**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 789089 mE; 7415603 mN 119.8273 E -23.343709 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Corymbia candida* subsp. *dipsodes* low open woodland over **Cenchrus ciliaris*, *Chrysopogon fallax* and *Eriachne flaccida* mid to low open tussock grassland with *Acacia aptaneura* mid to tall scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia sclerosperma subsp. *sclerosperma*	
**Cenchrus ciliaris*	
Chrysopogon fallax	
Corymbia candida subsp. *dipsodes*	
**Cynodon dactylon*	
Dichanthium sericeum subsp. *humilius*	
**Echinochloa colona*	WRP001.04
Eragrostis tenellula	
Eriachne flaccida	WRP022.01
Rhynchosia minima	
Sesbania cannabina	

Western Ridge Pipeline **Site WRP-023**

Date	26/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50
	786723 mE; 7414203 mN
	119.8044 E -23.356755 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	Tall open *Acacia incurvaneura* with *Corymbia hamersleyana* over *Abutilon macrum* and *Abutilon otocarpum* over low open *Triodia pungens* and *Triodia vanleeuwenii* hummock grassland

SPECIES LIST

Name	Specimen
Abutilon macrum	WRP019.05
Abutilon otocarpum	WRP019.06
Acacia ?adsurgens	WRP023.01
Acacia ancistrocarpa	
Acacia incurvaneura	WRP019.01
Aristida contorta	
**Cenchrus ciliaris*	
Corymbia hamersleyana	
Evolvulus alsinoides	
Gomphrena canescens	
Goodenia microptera	
Goodenia muelleriana	
Hakea lorea subsp. lorea	
Indigofera monophylla	
Paraneurachne muelleri	
Ptilotus astrolasius	
Ptilotus calostachyus	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. x *luerssenii*	
Tribulus suberosus	
Triodia vanleeuwenii	

Western Ridge Pipeline **Site WRP-024**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 788642 mE; 7415338 mN 119.8229 E -23.346182 S
Veg Condition	Very Good
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Hillslope
Vegetation	*Triodia vanleeuwenii* low hummock grassland with *Acacia bivenosa*, *Acacia tetragonophylla* and *Acacia pruinocarpa* tall scattered shrubs with *Eucalyptus leucophloia* subsp. *leucophloia* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia catenulata subsp. occidentalis	
Acacia tetragonophylla	
Eucalyptus leucophloia subsp. leucophloia	
Indigofera monophylla	
Ptilotus calostachyus	
Ptilotus rotundifolius	
Triodia vanleeuwenii	

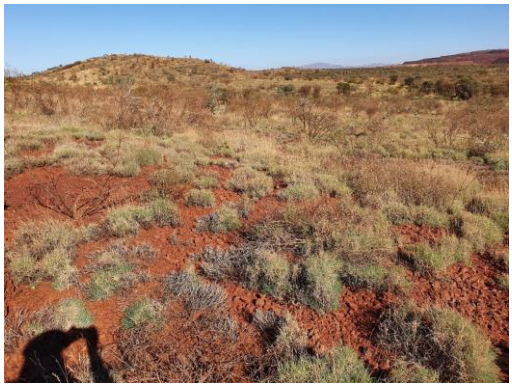
Western Ridge Pipeline **Site WRP-025**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 786081 mE; 7413685 mN 119.7982 E -23.361546 S
Veg Condition	Poor
Soil	Silty Loam
Rock Type	Conglomerate
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia ?adsurgens* tall open woodland with isolated low *Corymbia hamersleyana* trees over patches of **Cenchrus ciliaris*, *Enneapogon polyphyllus* and *Aristida contorta* low tussock grassland with scattered low shrubs.

SPECIES LIST

Name	Specimen
Abutilon macrum	
Acacia ?adsurgens	WRP023.01
Arivela viscosa	
**Bidens bipinnata*	
**Cenchrus ciliaris*	
Crotalaria medicaginea var. neglecta	
Enneapogon polyphyllus	
Goodenia muelleriana	
Ipomoea muelleri	
Iseilema eremaeum	
Kennedia prorepens	
Senna artemisioides subsp. oligophylla	
Sida platycalyx	
Sporobolus australasicus	
Themeda triandra	
Trichodesma zeylanicum var. zeylanicum	

Western Ridge Pipeline **Site WRP-026**



Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 787379 mE; 7414722 mN 119.8107 E -23.351962 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Hillslope
Vegetation	*Triodia vanleeuwenii* low hummock grassland with *Acacia bivenosa*, *Hakea lorea* subsp. *lorea* and *Senna glutinosa* subsp. *pruinosa* mid to tall sparse shrubland with occasional *Eucalyptus leucophloia* subsp. *leucophloia* low trees.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia hilliana	
Acacia inaequilatera	
Aristida holathera var. *holathera*	
Hakea lorea subsp. *lorea*	
Ptilotus astrolasius	
Ptilotus calostachyus	
Senna glutinosa subsp. *pruinosa*	
Senna glutinosa subsp. x *luerssenii*	
Triodia vanleeuwenii	

Western Ridge Pipeline **Site WRP-027**

Date	26/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 785585 mE; 7413225 mN 119.7935 E -23.365776 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Closed **Cenchrus ciliaris* grassland with scattered tall *Corymbia hamersleyana* with low scattered *Acacia citrinoviridis* and *Acacia incurvaneura.*

SPECIES LIST

Name	Specimen
Acacia citrinoviridis	
Acacia incurvaneura	WRP019.01
**Bidens bipinnata*	
Boerhavia coccinea	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Chrysopogon fallax	
Corymbia hamersleyana	
Crotalaria medicaginea var. *neglecta*	
Enteropogon ramosus	
Eremophila longifolia	
Evolvulus alsinoides	
Gomphrena canescens	
Hakea lorea subsp. *lorea*	
Indigofera linifolia	
**Malvastrum americanum*	
Pterocaulon sphacelatum	
Salsola australis	
Themeda triandra	

Western Ridge Pipeline **Site WRP-028**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 786410 mE; 7414410 mN 119.8013 E -23.354946 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Hillslope
Vegetation	*Triodia wiseana* low hummock grassland with *Acacia catenulata* subsp. *occidentalis*, *Acacia bivenosa* and *Acacia tetragonophylla* mid to tall sparse shrubland over *Eremophila cuneifolia* low scattered shrubs with *Eucalyptus leucophloia* subsp. *leucophloia* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia catenulata subsp. *occidentalis*	
Acacia tetragonophylla	
Aristida contorta	
Eremophila cuneifolia	
Eriachne pulchella subsp. *pulchella*	
Eucalyptus leucophloia subsp. *leucophloia*	
Senna glutinosa subsp. x *luerssenii*	
Tribulus suberosus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-029**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 785699 mE; 7413147 mN 119.7946 E -23.366465 S
Veg Condition	Degraded
Soil	Clayey Sand
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	*Eucalyptus victrix* and *Acacia citrinoviridis* low to mid open woodland over low **Cenchrus ciliaris* tussock grassland.

SPECIES LIST

Name	Specimen
Acacia citrinoviridis	
Alternanthera angustifolia	WRP001.03
**Bidens bipinnata*	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
**Echinochloa colona*	WRP001.04
Eragrostis tenellula	
Eucalyptus victrix	
Eulalia aurea	
Goodenia lamprosperma	
**Malvastrum americanum*	
Phyllanthus maderaspatensis	
Sesbania cannabina	
**Setaria verticillata*	
Triodia pungens	

Western Ridge Pipeline **Site WRP-030**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 785326 mE; 7412247 mN 119.7911 E -23.374648 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Limestone
Fire Age	Moderate (3 to 5 yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Triodia angusta* low hummock grassland with *Acacia pachyacra*, *Melaleuca eleuterostachya* and *Senna artemisioides* subsp. *oligophylla* mid to low scattered shrubs.

SPECIES LIST

Name	**Specimen**
Acacia pachyacra	
Acacia sclerosperma subsp. *sclerosperma*	
**Cenchrus ciliaris*	
Codonocarpus cotinifolius	
Melaleuca eleuterostachya	
Ptilotus exaltatus	
Salsola australis	
Senna artemisioides subsp. *oligophylla*	
Stylobasium spathulatum	
Triodia angusta	

Western Ridge Pipeline **Site WRP-031**

Date	26/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50
	785561 mE; 7412230 mN
	119.7934 E -23.374761 S
Veg Condition	Degraded
Soil	Light Clay
Rock Type	Limestone
Fire Age	Old (6+ yr)
Habitat	Calcrete Plain
Vegetation	Scattered *Acacia incurvaneura* and *Corymbia hamersleyana* trees over low **Aerva javanica*, **Cenchrus setiger* and **Cenchrus ciliaris* shrubland and tussock grassland.

SPECIES LIST

Name	Specimen
Acacia incurvaneura	WRP019.01
Acacia sclerosperma subsp. *sclerosperma*	
**Aerva javanica*	
Arivela viscosa	
Boerhavia coccinea	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Corymbia hamersleyana	
Duperreya commixta	
Enneapogon polyphyllus	WRP019.04
Gomphrena canescens	
**Malvastrum americanum*	
Ptilotus exaltatus	
Rhagodia eremaea	
Senna artemisioides subsp. *oligophylla*	
Sida fibulifera	WRP031.01
Solanum lasiophyllum	
Tephrosia sp. Newman (A.A. Mitchell PRP 29)	

Western Ridge Pipeline **Site WRP-032**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 785362 mE; 7411904 mN 119.7915 E -23.377739 S
Veg Condition	Good
Soil	Medium Clay
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Wetland
Vegetation	*Eucalyptus camaldulensis* subsp. *refulgens* low woodland over *Marsilea hirsuta* herbland and *Eleocharis pallens* scattered sedges.

SPECIES LIST

Name	Specimen
Eleocharis pallens	WRP032.02
Eucalyptus camaldulensis subsp. *refulgens*	
Marsilea hirsuta	WRP032.01

Western Ridge Pipeline **Site WRP-033**

Date	26/03/2021			
Described by	CvdB			
Type	Relevé			
Location	MGA Zone 50			
	785359	mE;	7410145	mN
	119.7918	E	-23.393608	S
Veg Condition	Good			
Soil	Clay Loam			
Rock Type	BIF			
Fire Age	Old (6+ yr)			
Habitat	Stony Plain			
Vegetation	Patches of *Acacia paraneura*, *Acacia synchronicia* mid to tall sparse shrubland over *Senna artemisioides* subsp. *oligophylla*, *Rhagodia eremaea* and *Eremophila cuneifolia* low scattered shrubs over patches of *Aristida contorta* and **Cenchrus ciliaris* low open tussock grassland.			

SPECIES LIST

Name	Specimen
Acacia paraneura	
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
Arivela viscosa	
**Cenchrus ciliaris*	
Eragrostis xerophila	WRP033.01
Eremophila cuneifolia	
Eremophila lachnocalyx	
Hakea preissii	
Heliotropium tenuifolium	
Portulaca filifolia	
Portulaca oleracea	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla*	
Sporobolus australasicus	
Tephrosia sp. Newman (A.A. Mitchell PRP 29)	WRP010.03

Western Ridge Pipeline **Site WRP-034**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 785220 mE; 7411167 mN 119.7903 E -23.384411 S
Veg Condition	Very Good
Soil	Loamy Sand
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Sand Plain
Vegetation	*Triodia pungens* low hummock grassland with *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia dictyophleba* and *Acacia tetragonophylla* mid to tall scattered shrubs over *Ptilotus astrolasius* scattered low shrubs.

SPECIES LIST

Name	Specimen
Acacia paraneura	
Acacia sclerosperma subsp. *sclerosperma*	
Acacia synchronicia	
Acacia tetragonophylla	
**Cenchrus ciliaris*	
Chrysocephalum apiculatum subsp. *pilbarense*	
Codonocarpus cotinifolius	
Goodenia microptera	
Goodenia muelleriana	
Pterocaulon sphacelatum	
Ptilotus astrolasius	
Tribulus astrocarpus	
Triodia pungens	

Western Ridge Pipeline **Site WRP-035**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 784571 mE; 7409658 mN 119.7842 E -23.398136 S
Veg Condition	Very Good
Soil	Loamy Sand
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Sand Plain
Vegetation	*Acacia sclerosperma* subsp. *sclerosperma*, *Acacia tetragonophylla* and *Acacia pruinocarpa* tall to mid sparse shrubland over *Aristida holathera* var. *holathera*, *Eragrostis xerophila* and *Aristida contorta* low open tussock grassland with *Triodia pungens* low scattered hummock grasses and *Corymbia candida* subsp. *dipsodes* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia sclerosperma subsp. *sclerosperma*	
Aristida contorta	
Aristida holathera var. *holathera*	
Aristida inaequiglumis	WRP005.01
Corchorus parviflorus	
Corymbia candida subsp. *dipsodes*	
Eragrostis xerophila	WRP005.02
Eucalyptus xerothermica	
Fimbristylis dichotoma	
Goodenia vilmoriniae	
Paraneurachne muelleri	
Ptilotus helipteroides	
Stemodia viscosa	
Triodia pungens	

Western Ridge Pipeline **Site WRP-036**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 784853 mE; 7409688 mN 119.7870 E -23.397816 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Acacia aptaneura*, *Corymbia candida* subsp. *dipsodes* low woodland over *Acacia sclerosperma* subsp. *sclerosperma* tall sparse shrubland over **Echinochloa colona* low open tussock grassland over herbs dominated by *Marsilea hirsuta.*

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia sclerosperma subsp. *sclerosperma*	
Alternanthera angustifolia	WRP001.03
Corymbia candida subsp. *dipsodes*	
**Echinochloa colona*	WRP001.04
Marsilea hirsuta	

Western Ridge Pipeline **Site WRP-037**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 783981 mE; 7409974 mN 119.7784 E -23.395388 S
Veg Condition	Excellent
Soil	Clay Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Acacia aptaneura*, *Eremophila fraseri* subsp. *fraseri* and *Acacia tetragonophylla* mid to tall open shrubland over *Aristida contorta* and *Enneapogon polyphyllus* low sparse tussock grassland with scattered *Corymbia candida* subsp. *dipsodes* low trees.

SPECIES LIST

Name	Specimen
Acacia aptaneura	WRP037.01
Aristida contorta	
Arivela viscosa	
Chrysopogon fallax	
Corymbia candida subsp. *dipsodes*	
Enneapogon polyphyllus	WRP019.04
Eremophila fraseri subsp. *fraseri*	
Ptilotus helipteroides	
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *helmsii*	
Sida platycalyx	

Western Ridge Pipeline **Site WRP-038**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 782653 mE; 7409701 mN 119.7655 E -23.398083 S
Veg Condition	Excellent
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia synchronicia*, *Acacia tetragonophylla* and *Senna glutinosa* subsp. x *luerssenii* mid to tall sparse shrubland over *Senna* sp. Meekatharra (E. Bailey 1-26) low scattered shrubs over *Aristida contorta* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
Enneapogon polyphyllus	
Portulaca filifolia	
Sclerolaena eriacantha	WRP038.01
Senna glutinosa subsp. x *luerssenii*	
Senna sp. Meekatharra (E. Bailey 1-26)	WRP038.02

Western Ridge Pipeline **Site WRP-039**

Date	26/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 783501 mE; 7409598 mN 119.7738 E -23.398870 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Sand Plain
Vegetation	Open scattered *Acacia macraneura* over open mixed shrubland of *Arivela viscosa* and *Senna* sp. Meekatharra (E. Bailey 1-26) over *Boerhavia coccinea* and *Enneapogon polyphyllus.*

SPECIES LIST

Name	Specimen
Abutilon macrum	WRP019.05
Acacia macraneura	WRP039.01
Acacia tetragonophylla	
Arivela viscosa	
Boerhavia coccinea	
Chrysopogon fallax	
Dactyloctenium radulans	
Dichanthium sericeum subsp. *humilius*	
Enneapogon polyphyllus	WRP019.04
Enteropogon ramosus	WRP039.02
Evolvulus alsinoides	
Gomphrena canescens	
**Malvastrum americanum*	
Portulaca cyclophylla	MvW.01
Portulaca filifolia	
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *helmsii*	
Senna sp. Meekatharra (E. Bailey 1-26)	WRP038.02
Sida fibulifera	
Trianthema triquetrum	

Western Ridge Pipeline **Site WRP-040**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 782235 mE; 7409542 mN 119.7614 E -23.399594 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Acacia synchronicia*, *Acacia paraneura* and *Acacia tetragonophylla* mid to tall sparse shrubland over *Senna* sp. Meekatharra (E. Bailey 1-36) low scattered shrubs over *Sclerolaena cuneata*, *Sclerolaena lanicuspis* and *Salsola australis* low chenopod scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Boerhavia coccinea	WRP040.02
**Cenchrus ciliaris*	
Dactyloctenium radulans	
Sclerolaena bicornis	
Sclerolaena cuneata	
Sclerolaena lanicuspis	WRP040.01
Senna sp. Meekatharra (E. Bailey 1-26)	
Trianthema triquetrum	

Western Ridge Pipeline **Site WRP-041**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 781215 mE; 7409371 mN 119.7515 E -23.401308 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Minor Drainage Line
Vegetation	**Cenchrus ciliaris* and *Chrysopogon fallax* mid tussock grassland with *Acacia paraneura*, *Eremophila longifolia* and *Acacia tetragonophylla* mid to tall sparse shrubland with *Eucalyptus xerothermica* low scattered trees.

SPECIES LIST

Name	Specimen
Abutilon fraseri subsp. *fraseri*	WRP041.01
Acacia paraneura	
Acacia tetragonophylla	
**Aerva javanica*	
Aristida holathera var. *holathera*	
**Cenchrus ciliaris*	
Chloris sp. Indet	
Cucumis variabilis	
Dactyloctenium radulans	
Duperreya commixta	
Eremophila longifolia	
Eucalyptus xerothermica	
Hakea lorea subsp. *lorea*	
**Malvastrum americanum*	
Neptunia dimorphantha	
Ptilotus obovatus var. *obovatus*	
Rhynchosia minima	
Salsola australis	
Santalum lanceolatum	
Senna artemisioides subsp. *oligophylla*	
Sida fibulifera	

Western Ridge Pipeline **Site WRP-042**

Date	26/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 781565 mE; 7409658 mN 119.7549 E -23.398663 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Senna glutinosa* subsp. x *luerssenii* and *Senna* sp. Meekatharra (E. Bailey 1-36) mid open shrubland with *Acacia paraneura* and *Acacia pruinocarpa* tall scattered shrubs over scattered tussock and hummock grasses including *Triodia wiseana* and *Enneapogon caerulescens.*

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP023.01
Acacia paraneura	
Acacia tetragonophylla	
**Cenchrus ciliaris*	
Enneapogon caerulescens	
Eragrostis xerophila	
Eremophila forrestii subsp. *forrestii*	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. x *luerssenii*	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-043**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	766330 mE; 7405984 mN
	119.6066 E -23.434366 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Moderate (3 to 5 yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Triodia pungens* low hummock grassland with *Eriachne mucronata*, *Enneapogon polyphyllus* and *Themeda triandra* low sparse tussock grassland with *Acacia bivenosa*, *Eremophila longifolia* and *Acacia maitlandii* mid to tall scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia inaequilatera	
Acacia maitlandii	
Acacia tetragonophylla	
Aristida contorta	
Arivela viscosa	
Boerhavia coccinea	
Enneapogon polyphyllus	
Enteropogon ramosus	
Eremophila fraseri subsp. *fraseri*	
Eremophila longifolia	
Eriachne mucronata	
Evolvulus alsinoides var. *decumbens*	
Heliotropium tenuifolium	
Melhania oblongifolia	WRP043.01
Salsola australis	
Senna artemisioides subsp. *oligophylla*	
Themeda triandra	
Triodia pungens	

Western Ridge Pipeline **Site WRP-044**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766434 mE; 7405738 mN 119.6076 E -23.436571 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Open *Triodia pungens* hummock grassland with scattered *Acacia paraneura* and *Acacia bivenosa* shrubs

SPECIES LIST

Name	Specimen
Abutilon fraseri subsp. *fraseri*	
Acacia bivenosa	
Acacia dictyophleba	
Acacia pachyacra	
Acacia paraneura	
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
Chrysopogon fallax	
Enchylaena tomentosa var. *tomentosa*	
Eremophila forrestii subsp. *forrestii*	
Eremophila lachnocalyx	
Eremophila longifolia	
Hakea lorea subsp. *lorea*	
Heliotropium tenuifolium	
Senna artemisioides subsp. *oligophylla*	
Senna artemisioides subsp. x *artemisioides*	
Sida fibulifera	
Sporobolus australasicus	
Themeda triandra	
Triodia pungens	

Western Ridge Pipeline **Site WRP-045**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766227 mE; 7405866 mN 119.6056 E -23.435450 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Moderate (3 to 5 yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana* low open hummock grassland with *Acacia inaequilatera* mid to tall scattered shrubs over *Ptilotus rotundifolius* and *Senna artemisioides* subsp. *oligophylla* low scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia inaequilatera	
Aristida contorta	
Eriachne pulchella subsp. *pulchella*	
Goodenia microptera	
Goodenia stobbsiana	
Heliotropium tanythrix	WRP045.02
Ptilotus astrolasius	
Ptilotus clementii	
Ptilotus polystachyus	WRP045.01
Ptilotus rotundifolius	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. *pruinosa*	
Tribulus hirsutus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-046**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	766441 mE; 7405406 mN
	119.6077 E -23.439565 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Triodia pungens* and *Triodia wiseana* low open hummock grassland with *Acacia ?adsurgens*, *Eremophila fraseri* subsp. *fraseri* and *Acacia inaequilatera* mid to tall open shrubland over *Enneapogon polyphyllus* and *Aristida contorta* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Abutilon cunninghamii	WRP006.01
Acacia ?adsurgens	WRP046.01
Acacia inaequilatera	
Acacia paraneura	
Acacia tetragonophylla	
Aristida contorta	
Corchorus incanus subsp. *lithophilus*	WRP046.02
Enneapogon polyphyllus	WRP019.04
Eremophila fraseri subsp. *fraseri*	
Goodenia muelleriana	
Paraneurachne muelleri	
Pterocaulon sphacelatum	
Triodia pungens	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-047**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766169 mE; 7405501 mN 119.6051 E -23.438750 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana* low open hummock grassland with *Eremophila ?platycalyx*, *Senna glutinosa* subsp. *pruinosa* and *Ptilotus obovatus* var. *obovatus* mid to low sparse shrubland with *Acacia bivenosa* tall scattered shrubs with occasional *Eucalyptus leucophloia* subsp. *leucophloia* low trees.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia tetragonophylla	
Eremophila ?platycalyx	WRP047.01
Eriachne mucronata	
Ptilotus obovatus var. *obovatus*	
Senna glutinosa subsp. *pruinosa*	
Senna glutinosa subsp. x *luerssenii*	
Tribulus suberosus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-048**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766352 mE; 7405041 mN 119.6069 E -23.442875 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Hillslope
Vegetation	*Triodia angusta* and *Triodia wiseana* low to mid hummock grassland with *Acacia ?adsurgens*, *Acacia synchronicia* and *Acacia bivenosa* mid to tall sparse shrubland over *Eremophila cuneifolia* and *Ptilotus obovatus* var. *obovatus* low scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP046.01
Acacia bivenosa	
Acacia synchronicia	
Eremophila cuneifolia	
Eriachne mucronata	
Indigofera monophylla	
Ptilotus obovatus var. *obovatus*	
Scaevola spinescens	
Senna glutinosa subsp. *pruinosa*	
Senna glutinosa subsp. x *luerssenii*	
Triodia angusta	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-049**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766348 mE; 7405149 mN 119.6069 E -23.441898 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia angusta* low hummock grassland with low *Eriachne mucronata* tussock grasses, low *Ptilotus obovatus* var. *obovatus* shrubs and mid *Eremophila fraseri* subsp. *fraseri* and *Acacia paraneura* shrubs.

SPECIES LIST

Name	Specimen
Abutilon fraseri subsp. *fraseri*	
Acacia tetragonophylla	
Corchorus incanus subsp. *lithophilus*	WRP046.02
Cucumis variabilis	
Eremophila lachnocalyx	
Eriachne mucronata	
Pterocaulon sphacelatum	
Ptilotus obovatus var. *obovatus*	
Rhynchosia minima	
Triodia angusta	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-050**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	766155 mE; 7405254 mN
	119.6050 E -23.440986 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana* low open hummock grassland with *Acacia paraneura* and *Eucalyptus gamophylla* low scattered trees over *Acacia paraneura, Acacia inaequilatera* and *Acacia bivenosa* tall scattered shrubs.

SPECIES LIST

Name	Specimen
Abutilon fraseri subsp. *fraseri*	
Abutilon sp. Indet	
Acacia bivenosa	
Acacia inaequilatera	
Acacia paraneura	
Acacia tetragonophylla	
Aristida contorta	
Boerhavia coccinea	
Enneapogon polyphyllus	
Eremophila ?platycalyx	WRP047.01
Eucalyptus gamophylla	
Evolvulus alsinoides var. *decumbens*	
Indigofera monophylla	
Ptilotus astrolasius	
Ptilotus obovatus var. *obovatus*	
Ptilotus polystachyus	WRP045.01
Senna artemisioides subsp. *oligophylla*	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-051**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766267 mE; 7404816 mN 119.6061 E -23.444918 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Hillslope
Vegetation	*Triodia vanleeuwenii* and *Triodia wiseana* low open hummock grassland with *Acacia ?adsurgens* and *Acacia inaequilatera* tall sparse shrubland over *Senna glutinosa* subsp. x *luerssenii* and *Eremophila fraseri* subsp. *fraseri* mid to low scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP046.01
Acacia inaequilatera	
Aristida contorta	
Duperreya commixta	
Eremophila fraseri subsp. *fraseri*	
Hakea lorea subsp. *lorea*	
Ptilotus obovatus var. *obovatus*	
Ptilotus polystachyus	WRP045.01
Senna glutinosa subsp. x *luerssenii*	
Triodia vanleeuwenii	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-052**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	766211 mE; 7404585 mN
	119.6056 E -23.447011 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Shale
Fire Age	Old (6+ yr)
Habitat	Breakaway
Vegetation	*Acacia pteraneura* low open woodland over *Senna glutinosa* subsp. x *luerssenii, Eremophila ?platycalyx* and *Ptilotus obovatus* var. *obovatus* mid to low scattered shrubs over *Enneapogon polyphyllus* scattered low tussock grasses.

SPECIES LIST

Name	Specimen
Acacia pteraneura	
Enneapogon polyphyllus	WRP019.04
Eremophila ?platycalyx	WRP047.01
Gomphrena canescens	
Hibiscus sturtii var. *campylochlamys*	WRP005.03
Ptilotus exaltatus	
Ptilotus obovatus var. *obovatus*	
Senna glutinosa subsp. x *luerssenii*	

Western Ridge Pipeline **Site WRP-053**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766275 mE; 7404662 mN 119.6063 E -23.446306 S
Veg Condition	Excellent
Soil	Light Clay
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Hillcrest/ Upper Hillslope
Vegetation	Open *Triodia pungens* hummock grassland with emergent *Eremophila latrobei* shrubs.

SPECIES LIST

Name	Specimen
Eremophila latrobei	
Eremophila platycalyx subsp. *pardalota*	
Eriachne mucronata	
Ptilotus obovatus var. *obovatus*	
Ptilotus polystachyus	
Senna glutinosa subsp. x *luerssenii*	
Triodia pungens	

Western Ridge Pipeline **Site WRP-054**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766295 mE; 7404341 mN 119.6065 E -23.449198 S
Veg Condition	Very Good
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia paraneura* low open woodland over *Senna glutinosa* subsp. x *luerssenii*, *Senna artemisioides* subsp. x *artemisioides* and *Tribulus suberosus* mid to low sparse shrubland over isolated patches of **Cenchrus ciliaris, Aristida contorta* and *Enneapogon caerulescens* tussock grasses.

SPECIES LIST

Name	Specimen
Acacia paraneura	
Acacia tetragonophylla	
Aristida contorta	
**Cenchrus ciliaris*	
Enneapogon caerulescens	
Enteropogon ramosus	
Eriachne mucronata	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. x *artemisioides*	
Senna glutinosa subsp. x *luerssenii*	
Tribulus suberosus	

Western Ridge Pipeline **Site WRP-055**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766102 mE; 7404255 mN 119.6046 E -23.450005 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Acacia paraneura* and *Acacia pteraneura* low woodland with *Acacia tetragonophylla* and *Acacia bivenosa* over *Senna artemisioides* subsp. *helmsii* and *Senna glutinosa* subsp. x *luerssenii* shrubs over *Enneapogon polyphyllus* and **Cenchrus ciliaris* tussock grasses.

SPECIES LIST

Name	Specimen
Abutilon oxycarpum	
Acacia bivenosa	
Acacia paraneura	
Acacia pteraneura	
Acacia tetragonophylla	
**Cenchrus ciliaris*	
Chrysopogon fallax	
Enneapogon polyphyllus	
Eremophila ?forrestii	WRP019.02
Gomphrena canescens	
Heliotropium tenuifolium	
Rhynchosia minima	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. x *luerssenii*	
Sida fibulifera	
Sporobolus australasicus	

Western Ridge Pipeline **Site WRP-056**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766410 mE; 7403872 mN 119.6077 E -23.453416 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia tetragonophylla, Acacia synchronicia* and occasional *Acacia aptaneura* mid to tall scattered shrubs over *Senna glutinosa* subsp. x *luerssenii, Senna artemisioides* subsp. *helmsii* and *Senna* sp. Meekatharra (E. Bailey 1-36) low scattered shrubs over *Enneapogon* scattered tussock grasses.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Acacia tetragonophylla	
**Cenchrus setiger*	
Portulaca cyclophylla	
Portulaca oleracea	
Ptilotus obovatus var. *obovatus*	
Ptilotus roei	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. x *luerssenii*	
Senna sp. Meekatharra (E. Bailey 1-26)	WRP038.02
Sporobolus australasicus	
Trianthema triquetrum	

Western Ridge Pipeline **Site WRP-057**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766150 mE; 7403930 mN 119.6052 E -23.452928 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Open *Acacia aptaneura* woodland with *Acacia tetragonophylla* over *Eremophila forrestii* subsp. *forrestii* and *Eremophila lachnocalyx* over thick tussock grasses of *Dactyloctenium radulans*, *Enneapogon polyphyllus, Enteropogon ramosus* and **Cenchrus ciliaris.*

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia tetragonophylla	
Aristida contorta	
Arivela viscosa	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Dactyloctenium radulans	
Enneapogon polyphyllus	
Enteropogon ramosus	WRP039.02
Eremophila forrestii subsp. *forrestii*	
Eremophila lachnocalyx	
Heliotropium tenuifolium	
**Malvastrum americanum*	

Western Ridge Pipeline **Site WRP-058**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766195 mE; 7403631 mN 119.6057 E -23.455625 S
Veg Condition	Good
Soil	Sandy Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia Tetragonophylla*, *Acacia synchronicia* and occasional *Acacia aptaneura* mid to tall scattered shrubs over *Senna artemisioides* subsp. *helmsii*, *Senna glutinosa* subsp. x *luerssenii* and *Senna artemisioides* subsp. *oligophylla* low to mid scattered shrubs over *Enneapogon caerulescens low* scattered tussock grasses with patches of **Cenchrus ciliaris*.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Acacia tetragonophylla	
Arivela viscosa	
**Cenchrus ciliaris*	
Enneapogon caerulescens	
Hibiscus sturtii var. *platychlamys*	CVMVopp.03
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. x *luerssenii*	

Western Ridge Pipeline **Site WRP-059**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766315 mE; 7403422 mN 119.6069 E -23.457491 S
Veg Condition	Degraded
Soil	Light Clay
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	Open herbland of *Portulaca cyclophylla* and *Trianthema triquetrum* with emergent shrubs of *Acacia tetragonophylla*, *Senna artemisioides* subsp. *helmsii* and *Eremophila lachnocalyx.*

SPECIES LIST

Name	Specimen
Acacia tetragonophylla	
Boerhavia coccinea	
Dactyloctenium radulans	
Enteropogon ramosus	WRP039.02
Eremophila lachnocalyx	
Iseilema membranaceum	
Portulaca cyclophylla	MvW.01
Senna artemisioides subsp. *helmsii*	
Trianthema triquetrum	

Western Ridge Pipeline **Site WRP-060**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766243 mE; 7403463 mN 119.6062 E -23.457134 S
Veg Condition	Poor
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Acacia tetragonophylla, Acacia synchronicia* and **Vachellia farnesiana* mid to tall scattered shrubs over **Cenchrus ciliaris*, *Dactyloctenium radulans* and *Enneapogon polyphyllus* low scattered tussock grasses with *Ptilotus obovatus* var. *obovatus* and *Enchylaena tomentosa* var. *tomentosa* scattered low shrubs.

SPECIES LIST

Name	Specimen
Boerhavia coccinea	
**Cenchrus ciliaris*	
Dactyloctenium radulans	
Enchylaena tomentosa var. *tomentosa*	
Enteropogon ramosus	WRP039.02
Eremophila lachnocalyx	
**Malvastrum americanum*	
Portulaca oleracea	
Rhagodia eremaea	
Trianthema triquetrum	
**Vachellia farnesiana*	

Western Ridge Pipeline **Site WRP-061**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766160 mE; 7403235 mN 119.6054 E -23.459202 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	Open *Triodia pungens* hummock grassland with low shrubland of *Acacia sibirica* and *Acacia tetragonophylla* with *Senna glutinosa* subsp. x *luerssenii*.

SPECIES LIST

Name	Specimen
Acacia sibirica	WRP62.01
Acacia tetragonophylla	
Enneapogon polyphyllus	
Indigofera monophylla	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. x *luerssenii*	
Tephrosia sp. Newman (A.A. Mitchell PRP 29)	
Triodia pungens	

Western Ridge Pipeline **Site WRP-062**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766270 mE; 7403270 mN 119.6065 E -23.458867 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura, Acacia tetragonophylla* and *Acacia inaequilatera* mid to tall shrubland over *Ptilotus obovatus* var. *obovatus*, *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *oligophylla* low sparse shrubland over *Triodia wiseana* low sparse hummock grassland.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia inaequilatera	
Acacia tetragonophylla	
Aristida contorta	
**Cenchrus ciliaris*	
Eremophila forrestii subsp. *forrestii*	
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla*	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-063**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766348 mE; 7403112 mN 119.6072 E -23.460284 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia synchronicia* and *Acacia tetragonophylla* with occasional patches of *Acacia aptaneura* mid to tall scattered shrubs over *Senna glutinosa* subsp. x *luerssenii, Senna artemisioides* subsp. *helmsii* and *Tribulus suberosus* low scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
Eremophila latrobei	
Hakea lorea subsp. *lorea*	
Portulaca filifolia	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. x *luerssenii*	
Sporobolus australasicus	
Tribulus suberosus	

Western Ridge Pipeline **Site WRP-064**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766190 mE; 7402996 mN 119.6057 E -23.461353 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	Open *Acacia tetragonophylla* and *Acacia aptaneura* over scattered *Senna artemisioides* subsp. *helmsii* and *Eremophila lachnocalyx* shrubs.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia tetragonophylla	
Aristida contorta	
**Cenchrus setiger*	
Eremophila lachnocalyx	
Heliotropium heteranthum	WRP064.01
**Malvastrum americanum*	
Portulaca filifolia	
Portulaca oleracea	
Rhagodia eremaea	
Sclerolaena cornishiana	WRP064.02
Senna artemisioides subsp. *helmsii*	

Western Ridge Pipeline **Site WRP-065**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766123 mE; 7402530 mN 119.6051 E -23.465572 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura* over tussock *Enneapogon polyphyllus*, *Enteropogon ramosus, Dactyloctenium radulans* and *Gomphrena canescens*.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Aristida contorta	
**Cenchrus setiger*	
**Cynodon convergens*	
Dactyloctenium radulans	
Dichanthium sericeum subsp. *humilius*	
Enneapogon polyphyllus	
Enteropogon ramosus	WRP039.02
Eriachne mucronata	
Gomphrena canescens	
Heliotropium tenuifolium	
Portulaca filifolia	
Ptilotus roei	
Sporobolus australasicus	

Western Ridge Pipeline **Site WRP-066**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766162 mE; 7402798 mN 119.6055 E -23.463142 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia synchronicia* mid to tall scattered shrubs over *Senna artemisioides* subsp. *oligophylla*, *Eremophila lachnocalyx* low to mid scattered shrubs over *Cynodon convergens*, *Aristida inaequiglumis* and *Dichanthium sericeum* subsp. *humilius* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Aristida inaequiglumis	
Cynodon convergens	WRP015.01
Dichanthium sericeum subsp. *humilius*	
Eremophila lachnocalyx	
Iseilema membranaceum	
Rhynchosia minima	
Senna artemisioides subsp. *oligophylla*	
Sida fibulifera	
Tephrosia sp. Newman (A.A. Mitchell PRP 29)	WRP010.03
**Vachellia farnesiana*	

Western Ridge Pipeline **Site WRP-067**

Date	27/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766198 mE; 7402253 mN 119.6059 E -23.468060 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	Open *Acacia aptaneura* shrubland with *Acacia tetragonophylla* over low *Senna artemisioides* subsp. *helmsii* shrubland over *Enneapogon polyphyllus* tussock grasses.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia tetragonophylla	
**Cenchrus setiger*	
Cynodon convergens	
Dichanthium sericeum subsp. *humilius*	
Enneapogon polyphyllus	WRP019.04
Eriachne flaccida	
Heliotropium tenuifolium	
Iseilema membranaceum	
Neptunia dimorphantha	
Portulaca filifolia	
Portulaca oleracea	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla*	
Senna hamersleyensis	WRP068.01
Tephrosia sp. Newman (A.A. Mitchell PRP 29)	

Western Ridge Pipeline **Site WRP-068**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766344 mE; 7402628 mN 119.6073 E -23.464649 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura*, *Eremophila fraseri* subsp. *fraseri* and *Acacia rhodophloia* mid to tall sparse shrubland over *Senna artemisioides* subsp. *helmsii* low scattered shrubs over *Eriachne mucronata* and *Aristida contorta* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Aristida contorta	
Eremophila fraseri subsp. *fraseri*	
Eriachne mucronata	
Eriachne pulchella subsp. *pulchella*	
Heliotropium tenuifolium	
Ptilotus helipteroides	
Senna artemisioides subsp. *helmsii*	
Senna hamersleyensis	WRP068.01

Western Ridge Pipeline **Site WRP-069**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766358 mE; 7401942 mN 119.6075 E -23.470833 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Medium Drainage Line
Vegetation	**Cenchrus ciliaris*, **Cenchrus setiger* and *Chrysopogon fallax* mid tussock grassland with *Acacia citrinoviridis* and *Acacia ?adsurgens* tall sparse shrubland with *Eucalyptus victrix* low to mid scattered trees.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP023.01
Acacia citrinoviridis	
Alternanthera denticulata	
**Bidens bipinnata*	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Centipeda minima subsp. *macrocephala*	
Corchorus tridens	
Cyperus vaginatus	
Eragrostis tenellula	
Eucalyptus victrix	
**Malvastrum americanum*	
Marsilea hirsuta	
Portulaca oleracea	

Western Ridge Pipeline **Site WRP-070**

Date	27/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	766215 mE; 7401703 mN
	119.6062 E -23.473020 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Triodia vanleeuwenii* low hummock grassland with *Senna glutinosa* subsp. x *luerssenii*, *Acacia ?adsurgens* and *Acacia aptaneura* mid to tall sparse shrubland with *Acacia pruinocarpa* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP046.01
Acacia aptaneura	
Acacia pruinocarpa	
Acacia tetragonophylla	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. *pruinosa*	
Senna glutinosa subsp. x *luerssenii*	
Triodia vanleeuwenii	

Western Ridge Pipeline **Site WRP-071**

Date	28/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 766288 mE; 7401493 mN 119.6069 E -23.474903 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	Tall open *Acacia aptaneura* and *Acacia tetragonophylla* shrubland over *Senna glutinosa* subsp. x *luerssenii, Senna artemisioides* subsp. *helmsii* and *Eremophila forrestii* subsp. *forrestii* over *Enneapogon polyphyllus* and *Aristida contorta* tussock grasses.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
**Cenchrus ciliaris*	
Duperreya commixta	
Enneapogon polyphyllus	
Eremophila forrestii subsp. *forrestii*	
Eriachne mucronata	
Gomphrena canescens	
Heliotropium tenuifolium	
Portulaca oleracea	
Ptilotus astrolasius	
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *helmsii*	
Senna sp. Meekatharra (E. Bailey 1-26)	
Tribulus suberosus	

Western Ridge Pipeline **Site WRP-072**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	766143 mE; 7401244 mN
	119.6056 E -23.477166 S
Veg Condition	Very Good
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura* and *Acacia pruinocarpa* low open woodland over *Triodia pungens* low sparse hummock grassland with *Senna glutinosa* subsp. x *luerssenii, Tribulus suberosus* and *Acacia tetragonophylla* mid sparse shrubland.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia pruinocarpa	
Acacia rhodophloia	
Acacia tetragonophylla	
Duperreya commixta	
Enneapogon polyphyllus	WRP019.04
Eremophila ?platycalyx	WRP047.01
Eriachne pulchella subsp. *pulchella*	
Paraneurachne muelleri	
Ptilotus exaltatus	
Senna glutinosa subsp. x *luerssenii*	
Tribulus suberosus	
Triodia pungens	

Western Ridge Pipeline **Site WRP-073**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766246 mE; 7401028 mN 119.6066 E -23.479104 S
Veg Condition	Very Good
Soil	Silty Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura* and *Acacia incurvaneura* low open woodland over *Senna glutinosa* subsp. x *luerssenii*, *Acacia tetragonophylla* and *Eremophila forrestii* subsp. *forrestii* mid to tall scattered shrubs over isolated patches of hummock and tussock grasses.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia incurvaneura	WRP073.01
Acacia pruinocarpa	
Acacia rhodophloia	
Enneapogon polyphyllus	WRP019.04
Eremophila forrestii subsp. *forrestii*	
Ptilotus obovatus var. *obovatus*	
Senna glutinosa subsp. x *luerssenii*	
Sida ectogama	
Tribulus suberosus	
Triodia pungens	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-074**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766066 mE; 7400638 mN 119.6049 E -23.482655 S
Veg Condition	Good
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Hardpan Plain
Vegetation	*Acacia incurvaneura* and *Acacia aptaneura* with occasional *Acacia pruinocarpa* and *Grevillea berryana* low woodland over *Enneapogon polyphyllus, Aristida contorta* and *Digitaria brownii* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Abutilon otocarpum	
Acacia incurvaneura	WRP073.01
Acacia pruinocarpa	
Acacia subcontorta	WRP074.01
Afrohybanthus aurantiacus	
Aristida contorta	
Aristida inaequiglumis	WRP005.01
**Bidens bipinnata*	
Cheilanthes sieberi	
Enneapogon polyphyllus	WRP019.04
Grevillea berryana	WRP074.03
Ipomoea calobra	WRP074.02
Solanum lasiophyllum	

Western Ridge Pipeline **Site WRP-075**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766327 mE; 7400666 mN 119.6075 E -23.482356 S
Veg Condition	Very Good
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia incurvaneura*, *Acacia pruinocarpa* and *Grevillea berryana* low open woodland over *Eremophila forrestii* subsp. *forrestii, Senna artemisioides* subsp. *oligophylla* x ? (hybrid) mid sparse shrubland over *Enneapogon polyphyllus* and *Triodia pungens* scattered tussock and hummock grassland.

SPECIES LIST

Name	Specimen
Acacia incurvaneura	WRP073.01
Acacia paraneura	
Acacia subcontorta	WRP074.01
Aristida contorta	
Aristida inaequiglumis	WRP005.01
Enneapogon polyphyllus	WRP019.04
Eragrostis xerophila	WRP005.02
Eremophila forrestii subsp. *forrestii*	
Evolvulus alsinoides var. *decumbens*	
Grevillea berryana	WRP074.03
Hakea lorea subsp. *lorea*	
Hibiscus sturtii var. *campylochlamys*	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla* x ? (hybrid)	CVMVopp.05
Senna glaucifolia	WRP075.01
Sida ectogama	
Sida fibulifera	
Triodia pungens	

Western Ridge Pipeline **Site WRP-076**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	766305 mE; 7400258 mN
	119.6073 E -23.486038 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia incurvaneura* tall scattered shrubs over *Senna artemisioides* subsp. *helmsii* scattered mid shrubs over isolated patches of *Aristida contorta* tussock grasses.

SPECIES LIST

Name	Specimen
Acacia incurvaneura	WRP073.01
Aristida contorta	
**Bidens bipinnata*	
Cheilanthes sieberi	
Eriachne pulchella subsp. *pulchella*	
Perotis rara	
Ptilotus obovatus var. *obovatus*	
Ptilotus schwartzii var. *schwartzii*	
Senna artemisioides subsp. *helmsii*	
Senna glaucifolia	WRP075.01
Sida ectogama	

Western Ridge Pipeline **Site WRP-077**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766268 mE; 7399575 mN 119.6071 E -23.492213 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia incurvaneura*, *Acacia subcontorta* and *Acacia aptaneura* low woodland over *Digitaria brownii, Aristida inaequiglumis* and *Enneapogon polyphyllus* low open tussock grassland.

SPECIES LIST

Name	Specimen
Abutilon macrum	WRP103.02
Acacia incurvaneura	WRP073.01
Acacia pruinocarpa	
Acacia subcontorta	WRP074.01
Afrohybanthus aurantiacus	
Aristida inaequiglumis	WRP005.01
**Bidens bipinnata*	
Cheilanthes sieberi	
Digitaria brownii	WRP077.01
Grevillea berryana	WRP074.03
Ipomoea calobra	WRP074.02
Panicum decompositum	
Paspalidium clementii	WRP077.02
Psydrax suaveolens	
Senna artemisioides subsp. *oligophylla* x ? (hybrid)	CVMVopp.05
Senna notabilis	
Sida ectogama	
Sida fibulifera	

Western Ridge Pipeline **Site WRP-078**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766144 mE; 7399837 mN 119.6058 E -23.489864 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia subcontorta*, *Acacia incurvaneura* and *Acacia aptaneura* tall scattered shrubs over *Senna glaucifolia* and *Ptilotus schwartzii* var. *schwartzii* low scattered shrubs over isolated patches of *Aristida contorta*.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia incurvaneura	WRP073.01
Acacia pruinocarpa	
Acacia subcontorta	WRP074.01
Aristida contorta	
**Bidens bipinnata*	
Cheilanthes sieberi	
Eriachne pulchella subsp. *pulchella*	
Grevillea berryana	WRP074.03
Monachather paradoxus	
Psydrax suaveolens	
Ptilotus schwartzii var. *schwartzii*	
Senna glaucifolia	WRP075.01
Triodia vanleeuwenii	

Western Ridge Pipeline **Site WRP-079**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766100 mE; 7400184 mN 119.6053 E -23.486746 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia subcontorta*, *Acacia incurvaneura* and *Grevillea berryana* low woodland over *Enneapogon polyphyllus*, *Digitaria brownii, Aristida inaequiglumis* and *Aristida contorta* low sparse tussock grassland over *Afrohybanthus aurantiacus* low sparse herbland.

SPECIES LIST

Name	Specimen
Abutilon otocarpum	
Acacia incurvaneura	WRP073.01
Acacia subcontorta	WRP074.01
Afrohybanthus aurantiacus	
Aristida contorta	
Aristida inaequiglumis	WRP005.01
**Bidens bipinnata*	
Cheilanthes sieberi	
Digitaria brownii	WRP077.01
Enneapogon polyphyllus	WRP019.04
Gomphrena canescens	
Grevillea berryana	WRP074.03
Hibiscus sturtii var. *campylochlamys*	
Ipomoea calobra	WRP074.02
Psydrax suaveolens	
Thyridolepis mitchelliana	MvWopp003

Western Ridge Pipeline **Site WRP-080**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	765446 mE; 7398015 mN
	119.5993 E -23.506423 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura* and *Grevillea berryana* low open woodland over *Triodia wiseana* low sparse hummock grassland with *Senna artemisioides* subsp. *oligophylla* x hybrid, *Eremophila forrestii* subsp. *forrestii* and *Senna artemisioides* subsp. *helmsii* low scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP023.01
Acacia aptaneura	
Aristida contorta	
Cheilanthes sieberi	
Enneapogon polyphyllus	WRP019.04
Eragrostis eriopoda	WRP080.01
Grevillea berryana	WRP074.03
Ptilotus obovatus var. *obovatus*	
Ptilotus schwartzii var. *schwartzii*	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla* x ? (hybrid)	CVMVopp.05
Senna glaucifolia	WRP075.01
Sida ectogama	
Sida fibulifera	
Tephrosia sp. Newman (A.A. Mitchell PRP 29)	WRP010.03
Tribulus hirsutus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-081**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	765923 mE; 7398340 mN
	119.6039 E -23.503411 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia subcontorta*, *Acacia incurvaneura* and *Acacia pruinocarpa* low woodland over *Aristida inaequiglumis*, *Monachather paradoxus* and *Aristida contorta* tussock grasses.

SPECIES LIST

Name	Specimen
Acacia incurvaneura	WRP073.01
Acacia pruinocarpa	
Acacia subcontorta	WRP074.01
Aristida inaequiglumis	WRP005.01
**Bidens bipinnata*	
Cheilanthes sieberi	
Eremophila latrobei	
Evolvulus alsinoides var. *decumbens*	
Grevillea berryana	WRP074.03
Ipomoea calobra	WRP074.02
Monachather paradoxus	WRP081.01
Senna glaucifolia	
Thyridolepis mitchelliana	MvWopp003

Western Ridge Pipeline **Site WRP-082**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766160 mE; 7398694 mN 119.6062 E -23.500173 S
Veg Condition	Poor
Soil	Silty Clay Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Acacia aptaneura*, *Acacia subcontorta* and *Corymbia candida* subsp. *dipsodes* low woodland over *Enneapogon polyphyllus* and *Aristida inaequiglumis* open tussock grassland.

SPECIES LIST

Name	Specimen
Abutilon lepidum	WRP004.03
Abutilon otocarpum	
Acacia aptaneura	
Acacia subcontorta	WRP074.01
Aristida inaequiglumis	WRP005.01
Arivela viscosa	
**Bidens bipinnata*	
**Cenchrus ciliaris*	
Corymbia candida subsp. *dipsodes*	
Enneapogon polyphyllus	WRP019.04
**Malvastrum americanum*	
Pterocaulon sphacelatum	
Ptilotus obovatus var. *obovatus*	

Western Ridge Pipeline **Site WRP-083**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 766112 mE; 7399025 mN 119.6057 E -23.497202 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia ?adsurgens*, *Acacia paraneura* and *Acacia subcontorta* tall scattered shrubs over *Ptilotus schwartzii* var. *schwartzii* low scattered shrubs over scattered tussock grasses.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP023.01
Acacia paraneura	
Acacia subcontorta	WRP074.01
Aristida contorta	
Cheilanthes sieberi	
Eriachne pulchella subsp. *pulchella*	
Grevillea berryana	WRP074.03
Indigofera georgei	
Maireana villosa	WRPopp.01
Panicum decompositum	
Portulaca filifolia	
Ptilotus obovatus var. *obovatus*	
Ptilotus roei	
Ptilotus schwartzii var. *schwartzii*	

Western Ridge Pipeline **Site WRP-084**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 765842 mE; 7398612 mN 119.6031 E -23.500971 S
Veg Condition	Poor
Soil	Clay Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Acacia aptaneura*, *Acacia subcontorta* and *Acacia incurvaneura* with occasional *Corymbia candida* subsp. *dipsodes* low woodland over *Enneapogon polyphyllus*, *Aristida contorta* and *Aristida inaequiglumis* low sparse tussock grassland with **Bidens bipinnata*, *Indigofera georgei* and *Ptilotus obovatus* var. *obovatus* low scattered shrubs and herbs.

SPECIES LIST

Name	Specimen
Abutilon otocarpum	
Acacia aptaneura	
Acacia incurvaneura	WRP073.01
Acacia subcontorta	WRP074.01
Aristida contorta	
Aristida inaequiglumis	WRP005.01
Arivela viscosa	
**Bidens bipinnata*	
Chrysopogon fallax	
Corymbia candida subsp. *dipsodes*	
Eremophila forrestii subsp. *forrestii*	
Grevillea berryana	WRP074.03
Indigofera georgei	
Ptilotus obovatus var. *obovatus*	
Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)	CVMVopp.06

Western Ridge Pipeline **Site WRP-085**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	765478 mE; 7398298 mN
	119.5996 E -23.503860 S
Veg Condition	Poor
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Acacia incurvaneura*, *Acacia subcontorta* and *Grevillea berryana* low woodland with *Corymbia candida* subsp. *dipsodes* low trees over *Aristida inaequiglumis*, *Aristida contorta* and *Enneapogon polyphyllus* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Acacia incurvaneura	WRP073.01
Acacia subcontorta	WRP074.01
Aristida contorta	
Aristida inaequiglumis	WRP005.01
**Bidens bipinnata*	
Corymbia candida subsp. *dipsodes*	
Enneapogon polyphyllus	WRP019.04
Grevillea berryana	WRP074.03
Indigofera georgei	
Ipomoea calobra	WRP074.02
Psydrax suaveolens	
Vincetoxicum lineare	

Western Ridge Pipeline **Site WRP-086**

Date	28/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 764923 mE; 7397743 mN 119.5943 E -23.508960 S
Veg Condition	Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	Tall *Acacia subcontorta* with *Acacia incurvaneura* and *Grevillea berryana* shrubs over *Enneapogon polyphyllus* and *Digitaria ctenantha* tussock grasses.

SPECIES LIST

Name	Specimen
Acacia incurvaneura	WRP073.01
Acacia subcontorta	WRP074.01
Aristida inaequiglumis	WRP005.01
**Bidens bipinnata*	
Digitaria ctenantha	WRP019.03
Enneapogon polyphyllus	WRP019.04
Eremophila latrobei	
Gomphrena canescens	
Grevillea berryana	WRP074.03
Senna glaucifolia	
Sida ectogama	
Tribulus suberosus	

Western Ridge Pipeline **Site WRP-087**

Date	28/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 764430 mE; 7397098 mN 119.5895 E -23.514857 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	*Cynodon convergens* tussock grassland.

SPECIES LIST

Name	Specimen
Arivela viscosa	
Astrebla elymoides	WRP87.01
Boerhavia coccinea	
Cynodon convergens	
Dichanthium sericeum subsp. *humilius*	
Enchylaena tomentosa var. *tomentosa*	
Enneapogon polyphyllus	
Eragrostis xerophila	
Heliotropium tenuifolium	
Iseilema membranaceum	
Portulaca filifolia	
Ptilotus roei	
Rhagodia eremaea	
Salsola australis	
Senna hamersleyensis	WRP068.01
Sida fibulifera	
Trianthema triquetrum	

Western Ridge Pipeline **Site WRP-088**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 764034 mE; 7396622 mN 119.5858 E -23.519218 S
Veg Condition	Good
Soil	Silty Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura* and *Acacia synchronicia* tall sparse shrubland over *Acacia tetragonophylla*, *Senna glutinosa* subsp. x *luerssenii* and *Eremophila ?margarethae* mid to low scattered shrubs over patches of *Aristida contorta* low tussock grasses.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
Dactyloctenium radulans	
Eremophila ?margarethae	WRP088.01
Eremophila forrestii subsp. *forrestii*	
Maireana triptera	
Portulaca filifolia	
Ptilotus obovatus var. *obovatus*	
Rhagodia eremaea	
Santalum acuminatum	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. x *luerssenii*	
Trianthema triquetrum	

Western Ridge Pipeline **Site WRP-089**

Date	28/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 764489 mE; 7396978 mN 119.5901 E -23.515934 S
Veg Condition	Very Good
Soil	Medium Clay
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	Open *Acacia incurvaneura* over scattered *Eremophila forrestii* subsp. *forrestii* over open *Triodia wiseana* and *Aristida contorta* hummock and tussock grasses.

SPECIES LIST

Name	Specimen
Acacia incurvaneura	WRP089.01
Acacia pruinocarpa	
Acacia rhodophloia	
Aristida contorta	
Boerhavia coccinea	
Enneapogon polyphyllus	
Eremophila forrestii subsp. *forrestii*	
Eriachne pulchella	
Gomphrena canescens	
Portulaca oleracea	
Ptilotus astrolasius	
Ptilotus obovatus var. *obovatus*	
Rhagodia eremaea	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-090**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 763895 mE; 7396873 mN 119.5843 E -23.516975 S
Veg Condition	Poor
Soil	Sand
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Major Drainage Line
Vegetation	*Eucalyptus victrix*, *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* mid to low open woodland over **Cenchrus ciliaris*, **Cenchrus setiger* and *Eulalia aurea* mid open tussock grassland.

SPECIES LIST

Name	Specimen
Acacia citrinoviridis	
Acacia coriacea subsp. *pendens*	
Alternanthera nana	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Centipeda minima subsp. *macrocephala*	
Cyperus vaginatus	
Eragrostis tenellula	
Eucalyptus victrix	
Eulalia aurea	
Leptochloa digitata	CVopp.02
**Malvastrum americanum*	
Marsilea hirsuta	
Phyllanthus maderaspatensis	
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	
Themeda triandra	

Western Ridge Pipeline **Site WRP-091**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 763917 mE; 7397008 mN 119.5845 E -23.515761 S
Veg Condition	Poor
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Triodia longiceps* mid sparse hummock grassland over **Cenchrus ciliaris*, *Eriachne aristidea* and *Dactyloctenium radulans* low sparse tussock grassland with *Eucalyptus xerothermica* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia citrinoviridis	
Acacia tetragonophylla	
Boerhavia coccinea	
**Cenchrus ciliaris*	
Dactyloctenium radulans	
Eriachne aristidea	
Eucalyptus xerothermica	
Hakea lorea subsp. *lorea*	
Triodia longiceps	

Western Ridge Pipeline **Site WRP-092**

Date	28/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 764023 mE; 7397091 mN 119.5856 E -23.514992 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Limestone
Fire Age	Old (6+ yr)
Habitat	Calcrete Plain
Vegetation	*Triodia angusta* low hummock grassland with *Eucalyptus socialis* subsp. *eucentrica* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Eucalyptus socialis subsp. *eucentrica*	
Ptilotus polystachyus	WRP045.01
Triodia angusta	

Western Ridge Pipeline **Site WRP-093**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	779525 mE; 7409451 mN
	119.7349 E -23.400874 S
Veg Condition	Very Good
Soil	Silty Clay Loam
Rock Type	None Discernible
Fire Age	Moderate (3 to 5 yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Triodia pungens* low open hummock grassland with *Acacia dictyophleba, Acacia pachyacra* and *Eremophila longifolia* mid to tall open shrubland over *Chrysopogon fallax*, *Enneapogon polyphyllus* and *Aristida inaequiglumis* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Abutilon otocarpum	
Acacia ancistrocarpa	
Acacia aptaneura	
Acacia bivenosa	
Acacia dictyophleba	
Acacia maitlandii	
Acacia pachyacra	
Acacia pruinocarpa	
Acacia tetragonophylla	
Aristida inaequiglumis	WRP005.01
Arivela viscosa	
Boerhavia coccinea	
**Cenchrus ciliaris*	
Chrysopogon fallax	
Corchorus lasiocarpus subsp. *parvus*	
Corymbia hamersleyana	
Crotalaria medicaginea var. *neglecta*	
Cymbopogon ambiguus	
Enneapogon polyphyllus	WRP019.04
Eremophila longifolia	
Eucalyptus xerothermica	
Eulalia aurea	
Glinus lotoides	WRP093.01
Paraneurachne muelleri	
Ptilotus astrolasius	
Ptilotus exaltatus	
Ptilotus helipteroides	
Ptilotus polystachyus	
Santalum lanceolatum	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla*	
Sida fibulifera	
Triodia pungens	

Western Ridge Pipeline **Site WRP-094**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 779846 mE; 7409323 mN 119.7381 E -23.401973 S
Veg Condition	Good
Soil	Silty Loam
Rock Type	Quartz
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura* tall sparse shrubland over Eremophila fraseri subsp. fraseri, Senna glutinosa subsp. x luerssenii and juvenile *Acacia aptaneura* mid scattered shrubs over *Triodia pungens* low scattered hummock grasses and *Enneapogon polyphyllus* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Abutilon cunninghamii	WRP006.01
Acacia aptaneura	
Acacia pruinocarpa	
Acacia tetragonophylla	
Aristida contorta	
**Bidens bipinnata*	
Boerhavia coccinea	
**Cenchrus ciliaris*	
Duperreya commixta	
Enneapogon polyphyllus	WRP019.04
Eremophila fraseri subsp. *fraseri*	
Eremophila latrobei	
Heliotropium tenuifolium	
Indigofera monophylla	
Ptilotus clementii	
Ptilotus roei	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. x *luerssenii*	
Senna notabilis	
**Setaria verticillata*	
Sporobolus australasicus	
Triodia pungens	

Western Ridge Pipeline **Site WRP-095**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 780246 mE; 7409486 mN 119.7420 E -23.400441 S
Veg Condition	Good
Soil	Silty Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Senna artemisioides* subsp. *helmsii, Senna artemisioides* subsp. *oligophylla* and *Acacia synchronicia* mid to low scattered shrubs over *Aristida contorta*, *Enneapogon polyphyllus* and *Dactyloctenium radulans* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
Boerhavia coccinea	
Calandrinia schistorhiza	WRP095.01
**Cenchrus ciliaris*	
Dactyloctenium radulans	
Enneapogon polyphyllus	WRP019.04
Eremophila fraseri subsp. *fraseri*	
Goodenia muelleriana	
Iseilema membranaceum	
Portulaca filifolia	
Portulaca oleracea	
Ptilotus roei	
Rhagodia eremaea	
Rhynchosia minima	
Senna artemisioides subsp. *helmsii*	
Senna artemisioides subsp. *oligophylla*	
Tragus australianus	WRP095.02
Trianthema triquetrum	

Western Ridge Pipeline **Site WRP-096**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	780465 mE; 7409557 mN
	119.7441 E -23.399757 S
Veg Condition	Good
Soil	Silty Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Acacia aptaneura* low open woodland over *Senna glutinosa* subsp. x *luerssenii*, *Acacia aptaneura* and *Eremophila latrobei* mid to tall scattered shrubs over *Enneapogon polyphyllus*, **Cenchrus ciliaris* and *Eriachne mucronata* low scattered tussock grasses.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia tetragonophylla	
Aristida contorta	
Aristida inaequiglumis	WRP005.01
**Cenchrus ciliaris*	
Enchylaena tomentosa var. *tomentosa*	
Enneapogon polyphyllus	
Eremophila latrobei	
Eriachne mucronata	
Eriachne pulchella subsp. *pulchella*	
Eulalia aurea	
Perotis rara	
Polycarpaea corymbosa	WRP096.01
Portulaca filifolia	
Ptilotus obovatus var. *obovatus*	
Senna glutinosa subsp. x *luerssenii*	
Tragus australianus	WRP095.02
Tribulus suberosus	
Trichodesma zeylanicum var. *zeylanicum*	

Western Ridge Pipeline **Site WRP-097**

Date	29/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 778335 mE; 7409591 mN 119.7233 E -23.399822 S
Veg Condition	Degraded
Soil	Light Clay
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Minor Drainage Line
Vegetation	Open *Corymbia candida* subsp. *dipsodes*, *Acacia aptaneura* and *Acacia citrinoviridis* woodland over closed **Cenchrus ciliaris* and *Triodia angusta* hummock grassland.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia bivenosa	
Acacia citrinoviridis	
Acacia synchronicia	
Acacia tetragonophylla	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Corymbia candida subsp. *dipsodes*	
Enchylaena tomentosa var. *tomentosa*	
Hakea lorea subsp. *lorea*	
Ptilotus exaltatus	
Rhynchosia minima	
Sclerolaena diacantha	WRP097.01
Sclerolaena eriacantha	WRP038.01
Triodia angusta	
**Vachellia farnesiana*	

Western Ridge Pipeline **Site WRP-098**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 778233 mE; 7409764 mN 119.7223 E -23.398278 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Basalt Outcrops
Vegetation	*Triodia wiseana* low hummock grassland with *Acacia bivenosa, Acacia inaequilatera* and *Hakea lorea* subsp. *lorea* mid to tall sparse shrubland.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia inaequilatera	
Acacia tetragonophylla	
Corchorus incanus subsp. *lithophilus*	WRP046.02
Corchorus lasiocarpus subsp. *parvus*	
Duperreya commixta	
Eremophila fraseri subsp. *fraseri*	
Goodenia muelleriana	
Hakea lorea subsp. *lorea*	
Ptilotus astrolasius	
Ptilotus polystachyus	
Scaevola amblyanthera var. *amblyanthera*	
Senna artemisioides subsp. *oligophylla*	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-099**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	777710 mE; 7409595 mN
	119.7172 E -23.399884 S
Veg Condition	Poor
Soil	Clayey Sand
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Minor Drainage Line
Vegetation	**Cenchrus ciliaris, *Cenchrus setiger* and *Themeda triandra* mid open tussock grassland with *Acacia citrinoviridis, Santalum lanceolatum* and *Petalostylis labicheoides* tall open shrubland with *Eucalyptus xerothermica* and *Acacia citrinoviridis* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia citrinoviridis	
Arivela viscosa	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Duperreya commixta	
Eucalyptus xerothermica	
Eulalia aurea	
Evolvulus alsinoides var. *decumbens*	WRP099.01
Paraneurachne muelleri	
Petalostylis labicheoides	
Santalum lanceolatum	
Sporobolus australasicus	
Themeda triandra	
Triodia angusta	

Western Ridge Pipeline **Site WRP-101**

Date	29/03/2021			
Described by	MvW			
Type	Relevé			
Location	MGA Zone 50			
	774626	mE;	7408079	mN
	119.6873	E	-23.414090	S
Veg Condition	Excellent			
Soil	Clay Loam			
Rock Type	Quartz			
Fire Age	Old (6+ yr)			
Habitat	Sandy/ Stony Plain			
Vegetation	*Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia synchronicia* tall shrubland over open *Senna glutinosa* subsp. x *luerssenii* over *Maireana melanocoma* and *Enneapogon polyphyllus* chenopod shrubs and tussock grasses.			

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia synchronicia	
Acacia tetragonophylla	
Aristida contorta	
Aristida inaequiglumis	WRP005.01
Dichanthium sericeum subsp. *humilius*	
Enneapogon polyphyllus	
Eragrostis xerophila	
Euphorbia biconvexa	
Gomphrena canescens	
Goodenia muelleriana	
Hakea preissii	
Heliotropium tenuifolium	
Maireana melanocoma	
Portulaca filifolia	
Ptilotus exaltatus	
Rhynchosia minima	
Senna glutinosa subsp. x *luerssenii*	
Senna sp. Meekatharra (E. Bailey 1-26)	
Sida fibulifera	
Tragus australianus	WRP095.02

Western Ridge Pipeline **Site WRP-102**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 774897 mE; 7407979 mN 119.6900 E -23.414944 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Eremophila lachnocalyx*, *Senna artemisioides* subsp. *oligophylla* and *Rhagodia eremaea* mid to low sparse shrubland over *Eriachne flaccida, Enneapogon polyphyllus* and *Dichanthium sericeum* subsp. *humilius* low sparse tussock grassland with *Acacia aptaneura* and *Acacia tetragonophylla* tall scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Aristida contorta	
Astrebla pectinata	WRP102.02
**Cenchrus ciliaris*	
Corchorus tridens	
Cucumis melo	WRP102.03
Cynodon convergens	WRP015.01
Dichanthium sericeum subsp. *humilius*	
Enneapogon polyphyllus	
Eremophila lachnocalyx	
Eriachne flaccida	
Indigofera linifolia	
Neptunia dimorphantha	WRP102.01
Operculina aequisepala	WRP102.04
Rhagodia eremaea	
Senna artemisioides subsp. *oligophylla*	
Sida fibulifera	
Tephrosia sp. Newman (A.A. Mitchell PRP 29)	WRP010.03
Tribulus suberosus	

Western Ridge Pipeline **Site WRP-103**

Date	29/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 775221 mE; 7408395 mN 119.6931 E -23.411134 S
Veg Condition	Excellent
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	Low open *Acacia aptaneura* and *Acacia tetragonophylla* over *Senna glutinosa* subsp. x *luerssenii* and *Eremophila ?platycalyx* over low open *Enneapogon polyphyllus*, *Eriachne mucronata* and *Triodia pungens* tussock and hummock grasses.

SPECIES LIST

Name	Specimen
Abutilon macrum	WRP103.02
Acacia ?adsurgens	WRP104.02
Acacia aptaneura	
Acacia synchronicia	
Acacia tetragonophylla	
Anthobolus leptomerioides	
**Cenchrus ciliaris*	
Enneapogon polyphyllus	WRP019.04
Eremophila ?platycalyx	WRP047.01
Eremophila platycalyx subsp. *pardalota*	
Eriachne mucronata	
Evolvulus alsinoides	
Gomphrena canescens	
Maireana melanocoma	
Paraneurachne muelleri	
Ptilotus obovatus var. *obovatus*	
Senna glutinosa	WRP103.01
Senna glutinosa subsp. x *luerssenii*	
Senna sp. Meekatharra (E. Bailey 1-26)	
Themeda triandra	
Tribulus suberosus	

Western Ridge Pipeline **Site WRP-104**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50
	775476 mE; 7408558 mN
	119.6955 E -23.409624 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana* low hummock grassland with *Acacia inaequilatera*, *Grevillea berryana* and *Acacia ?adsurgens* mid to tall sparse shrubland.

SPECIES LIST

Name	Specimen
Abutilon lepidum	WRP104.03
Acacia ?adsurgens	WRP104.02
Acacia bivenosa	
Acacia inaequilatera	
Acacia pruinocarpa	
Eremophila ?platycalyx	WRP104.03
Eremophila latrobei subsp. *latrobei*	
Grevillea berryana	WRP104.01
Indigofera monophylla	
Paraneurachne muelleri	
Ptilotus astrolasius	
Ptilotus polystachyus	
Tribulus suberosus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-105**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 774881 mE; 7408353 mN 119.6897 E -23.411576 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Minor Drainage Line
Vegetation	**Cenchrus setiger*, **Cenchrus ciliaris* and *Chrysopogon fallax* low tussock grassland with *Acacia aptaneura* and *Acacia sibirica* tall scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia sibirica	
Acacia tetragonophylla	
**Bidens bipinnata*	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Chrysopogon fallax	
Duperreya commixta	
Hakea lorea subsp. *lorea*	
**Malvastrum americanum*	

Western Ridge Pipeline **Site WRP-106**

Date	29/03/2021
Described by	CvdB & MvW
Type	Relevé
Location	MGA Zone 50 775405 mE; 7408908 mN 119.6948 E -23.406474 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	*Triodia wiseana* low hummock grassland with *Acacia inaequilatera*, *Acacia pruinocarpa* and *Acacia ?adsurgens* mid to tall sparse shrubland over *Senna artemisioides* subsp. *oligophylla*, *Corchorus incanus* subsp. *lithophilus* and *Ptilotus astrolasius* low scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP104.02
Acacia inaequilatera	
Acacia pruinocarpa	
Acacia tetragonophylla	
Aristida contorta	
Corchorus incanus subsp. *lithophilus*	WRP046.02
Dipteracanthus australasicus subsp. *australasicus*	
Eremophila latrobei subsp. *latrobei*	
Euphorbia boophthona	
Ptilotus astrolasius	
Ptilotus obovatus var. *obovatus*	
Scaevola amblyanthera var. *amblyanthera*	
Senna artemisioides subsp. *oligophylla*	
Tribulus hirsutus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-107**

Date	29/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 774988 mE; 7408976 mN 119.6907 E -23.405933 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Sandy/ Stony Plain
Vegetation	Low open *Acacia aptaneura* and *Acacia paraneura* shrubland with scattered *Corymbia hamersleyana* trees over *Triodia pungens* hummock grassland.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP104.02
Acacia aptaneura	
Acacia paraneura	
Acacia pruinocarpa	
Aristida contorta	
Corymbia hamersleyana	
Enneapogon polyphyllus	WRP019.04
Eriachne pulchella	
Gomphrena canescens	
Goodenia muelleriana	
Hibiscus coatesii	CVopp.11
Pterocaulon sphacelatum	
Ptilotus astrolasius	
Senna glutinosa subsp. x *luerssenii*	
Solanum lasiophyllum	
Triodia pungens	

Western Ridge Pipeline **Site WRP-108**

Date	29/03/2021			
Described by	CvdB & MvW			
Type	Relevé			
Location	MGA Zone 50			
	774227	mE;	7407983	mN
	119.6834	E	-23.415024	S
Veg Condition	Excellent			
Soil	Silty Loam			
Rock Type	Dolerite			
Fire Age	Old (6+ yr)			
Habitat	Basalt Outcrops			
Vegetation	*Triodia vanleeuwenii* low open hummock grassland with *Eremophila fraseri* subsp. *fraseri*, *Senna artemisioides* subsp. *oligophylla* and *Acacia adsurgens* mid to low sparse shrubland over *Themeda triandra, Eriachne mucronata* and *Enneapogon polyphyllus* low scattered tussock grasses.			

SPECIES LIST

Name	Specimen
Acacia adsurgens	
Cucumis variabilis	
Enneapogon polyphyllus	
Eremophila fraseri subsp. *fraseri*	
Eriachne mucronata	
Santalum lanceolatum	WRP108.02
Senna artemisioides subsp. *oligophylla*	
Themeda triandra	WRP108.01
Tribulus suberosus	
Triodia vanleeuwenii	

Western Ridge Pipeline **Site WRP-109**

Date	29/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 775089 mE; 7408756 mN 119.6917 E -23.407900 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Stony Plain
Vegetation	Open *Acacia ?adsurgens* and *Acacia sibirica* over *Triodia pungens* and *Enneapogon polyphyllus* hummock and tussock grasses.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP109.01
Acacia sibirica	WRP109.02
Aristida inaequiglumis	
**Bidens bipinnata*	
Cheilanthes sieberi	
Chrysopogon fallax	
Dichanthium sericeum subsp. *humilius*	
Digitaria brownii	
Evolvulus alsinoides	
Gomphrena canescens	
Hibiscus burtonii	WRP010.04
Sporobolus australasicus	
Themeda triandra	
Triodia pungens	

Western Ridge Pipeline **Site WRP-110**

Date	30/03/2021			
Described by	CvdB			
Type	Relevé			
Location	MGA Zone 50			
	773830	mE;	7408091	mN
	119.6795	E	-23.414114	S
Veg Condition	Excellent			
Soil	Silty Loam			
Rock Type	Dolerite			
Fire Age	Old (6+ yr)			
Habitat	Stony Plain			
Vegetation	*Triodia angusta* and *Triodia wiseana* low hummock grassland with *Acacia synchronicia*, *Acacia bivenosa* and *Acacia sibirica* mid to tall scattered shrubs with *Eucalyptus gamophylla* low scattered mallee trees.			

SPECIES LIST

Name	**Specimen**
Acacia aptaneura	
Acacia bivenosa	
Acacia sibirica	
Acacia synchronicia	
Duperreya commixta	
Eucalyptus gamophylla	
Goodenia vilmoriniae	
Indigofera monophylla	
Paraneurachne muelleri	
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. x *luerssenii*	
Tribulus suberosus	
Triodia angusta	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-111**

Date	30/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 773632 mE; 7407916 mN 119.6776 E -23.415723 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	BIF
Fire Age	Old (6+ yr)
Habitat	Footslope
Vegetation	Mid dense *Triodia angusta* and *Triodia wiseana* hummock grassland with open low *Acacia bivenosa* and *Acacia synchronicia* shrubland.

SPECIES LIST

Name	Specimen
Acacia synchronicia	
Corchorus incanus subsp. *lithophilus*	WRP046.02
Corchorus laniflorus	
Eriachne mucronata	
Goodenia muelleriana	
Indigofera monophylla	
Paraneurachne muelleri	
Pterocaulon sphacelatum	
Ptilotus exaltatus	
Ptilotus polystachyus	
Scaevola amblyanthera var. *centralis*	WRP005.04
Senna glutinosa subsp. *pruinosa*	
Tribulus hirsutus	
Tribulus suberosus	
Trichodesma zeylanicum var. *zeylanicum*	
Triodia angusta	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-116**

Date	30/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 773559 mE; 7408907 mN 119.6767 E -23.406795 S
Veg Condition	Good
Soil	Clayey Sand
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Acacia aptaneura* and *Acacia rhodophloia x sibirica* low open woodland over *Enneapogon polyphyllus, Chrysopogon fallax, Dactyloctenium radulans* and *Perotis rara* low open tussock grassland.

SPECIES LIST

Name	Specimen
Abutilon otocarpum	
Acacia rhodophloia x *sibirica*	WRP116.02
Arivela viscosa	
**Bidens bipinnata*	
Bulbostylis barbata	WRP116.01
**Cenchrus ciliaris*	
Chrysopogon fallax	
Corchorus tridens	
Dactyloctenium radulans	
Dichanthium sericeum subsp. *humilius*	
Enneapogon polyphyllus	
Eriachne mucronata	
Goodenia muelleriana	
Hakea lorea subsp. *lorea*	
Hibiscus sturtii var. *campylochlamys*	WRP005.03
Iseilema membranaceum	
**Malvastrum americanum*	
Paspalidium constrictum	WRP112.01
Perotis rara	
Polycarpaea corymbosa	WRP096.01
Ptilotus helipteroides	
Sida fibulifera	
Sporobolus australasicus	
Tragus australianus	WRP095.02

Western Ridge Pipeline **Site WRP-117**

Date	30/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 773043 mE; 7408886 mN 119.6717 E -23.407069 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia vanleeuwenii* and *Triodia angusta* low hummock grassland with *Acacia bivenosa*, *Senna* sp. Meekatharra (E. Bailey 1-26) and *Acacia synchronicia* mid to tall sparse shrubland with *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia synchronicia	
Eriachne pulchella subsp. *pulchella*	
Eucalyptus leucophloia subsp. *leucophloia*	
Ptilotus astrolasius	
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. x *luerssenii*	
Senna sp. Meekatharra (E. Bailey 1-26)	
Triodia angusta	
Triodia vanleeuwenii	

Western Ridge Pipeline **Site WRP-118**

Date	30/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 772736 mE; 7408594 mN 119.6687 E -23.409758 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana, Triodia angusta* low hummock grassland with *Acacia bivenosa* (wispy) tall sparse shrubland with *Eucalyptus leucophloia* subsp. *leucophloia* and occasional *Eucalyptus socialis* subsp. *eucentrica* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia tetragonophylla	
Eucalyptus leucophloia subsp. *leucophloia*	
Eucalyptus socialis subsp. *eucentrica*	
Jasminum didymum subsp. *lineare*	
Triodia angusta	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-119**

Date	30/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 772675 mE; 7408925 mN 119.6681 E -23.406780 S
Veg Condition	Very Good
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Open low *Acacia incurvaneura* and *Acacia tetragonophylla* shrubs over tussock grasses of **Cenchrus ciliaris*, *Enneapogon polyphyllus* and *Chrysopogon fallax*, and *Triodia pungens* hummock grasses.

SPECIES LIST

Name	Specimen
Abutilon sp. Indet	
Acacia inaequilatera	
Acacia incurvaneura	WRP119.01
Acacia tetragonophylla	
Arivela viscosa	
**Bidens bipinnata*	
**Cenchrus ciliaris*	
Chrysopogon fallax	
Enneapogon polyphyllus	WRP019.04
Euphorbia biconvexa	
Evolvulus alsinoides	
Goodenia muelleriana	
Iseilema membranaceum	
Kennedia prorepens	
Ptilotus exaltatus	
Rhagodia eremaea	
Sida fibulifera	
Sporobolus australasicus	
Triodia pungens	

Western Ridge Pipeline **Site WRP-120**

Date	30/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 772980 mE; 7408365 mN 119.6712 E -23.411788 S
Veg Condition	Poor
Soil	Silty Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Boulders/ Rockpiles
Vegetation	*Acacia aptaneura* and *Acacia tetragonophylla* tall sparse shrubland over **Cenchrus ciliaris* low sparse tussock grassland over herbs dominated by *Trianthema triquetrum* and *Boerhavia coccinea.*

SPECIES LIST

Name	Specimen
Acacia aptaneura	
Acacia synchronicia	
Acacia tetragonophylla	
Boerhavia coccinea	
**Cenchrus ciliaris*	
Cucumis variabilis	
Cynodon prostratus	
Eremophila latrobei	
Eriachne mucronata	
Rhagodia eremaea	
Senna artemisioides subsp. *helmsii*	
Senna glutinosa subsp. x *luerssenii*	
Trianthema triquetrum	
Vincetoxicum flexuosum	WRC20-02

Western Ridge Pipeline **Site WRP-121**

Date	30/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 772812 mE; 7407894 mN 119.6696 E -23.416066 S
Veg Condition	Degraded
Soil	Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Open *Acacia tetragonophylla, Acacia ?adsurgens* and *Acacia sibirica* tall Shrubland over mid tussock grasses of **Cenchrus ciliaris* and *Triodia pungens* hummock grasses.

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP023.01
Acacia sclerosperma subsp. *sclerosperma*	
Acacia sibirica	WRP004.01
Acacia tetragonophylla	
Aristida inaequiglumis	WRP005.01
Arivela viscosa	
**Bidens bipinnata*	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Chrysopogon fallax	
Dactyloctenium radulans	
Enneapogon polyphyllus	WRP019.04
Eremophila lachnocalyx	
Evolvulus alsinoides	
Iseilema membranaceum	
Portulaca filifolia	
Ptilotus exaltatus	
Ptilotus obovatus var. *obovatus*	
Rhagodia eremaea	
Sida fibulifera	
Sporobolus australasicus	
Triodia pungens	

Western Ridge Pipeline **Site WRP-122**

Date	30/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 773504 mE; 7408461 mN 119.6763 E -23.410827 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana* low hummock grassland with *Acacia adsurgens*, *Senna glutinosa* subsp. x *luerssenii* and *Acacia tetragonophylla* mid sparse shrubland with *Acacia inaequilatera* and *Hakea lorea* subsp. *lorea* tall scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia adsurgens	
Acacia inaequilatera	
Acacia tetragonophylla	
Aristida contorta	
Hakea lorea subsp. *lorea*	
Paraneurachne muelleri	
Senna glutinosa subsp. x *luerssenii*	
Sporobolus australasicus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-123**

Date	30/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 773319 mE; 7408068 mN 119.6745 E -23.414405 S
Veg Condition	Degraded
Soil	Light Clay
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	Low shrubland of *Acacia ?adsurgens* and *Acacia tetragonophylla* over mid tussock grassland of **Cenchrus ciliaris* and *Dactyloctenium radulans.*

SPECIES LIST

Name	Specimen
Acacia ?adsurgens	WRP023.01
Acacia inaequilatera	
Acacia pachyacra	
Acacia tetragonophylla	
Arivela viscosa	
Boerhavia coccinea	
**Cenchrus ciliaris*	
**Cenchrus setiger*	
Chrysopogon fallax	
Dactyloctenium radulans	
Duperreya commixta	
Enneapogon polyphyllus	WRP019.04
Euphorbia biconvexa	
Evolvulus alsinoides var. *villosicalyx*	
Hakea lorea subsp. *lorea*	
Hibiscus sturtii var. *campylochlamys*	WRP005.03
Iseilema membranaceum	
Ptilotus exaltatus	
Ptilotus obovatus var. *obovatus*	
Rhynchosia minima	
Sporobolus australasicus	

Western Ridge Pipeline **Site WRP-124**

Date	30/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 773900 mE; 7408398 mN 119.6801 E -23.411331 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia wiseana* low hummock grassland with *Acacia bivenosa, Acacia inaequilatera* and *Hakea lorea* subsp. *lorea* tall scattered shrubs.

SPECIES LIST

Name	Specimen
Acacia inaequilatera	
Duperreya commixta	
Eremophila fraseri subsp. *fraseri*	
Hakea lorea subsp. *lorea*	
Ptilotus obovatus var. *obovatus*	
Ptilotus polystachyus	
Ptilotus rotundifolius	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. *pruinosa*	
Senna glutinosa subsp. x *luerssenii*	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-125**

Date	30/03/2021
Described by	MvW
Type	Relevé
Location	MGA Zone 50 773646 mE; 7408204 mN 119.6777 E -23.413128 S
Veg Condition	Excellent
Soil	Clay Loam
Rock Type	Dolerite
Fire Age	Old (6+ yr)
Habitat	Hillcrest/ Upper Hillslope
Vegetation	Open *Triodia wiseana* hummock grassland with open low *Eremophila fraseri subsp. fraseri* and *Ptilotus rotundifolius* with emergent *Acacia inaequilatera* trees.

SPECIES LIST

Name	Specimen
Acacia inaequilatera	
Acacia tetragonophylla	
Aristida contorta	
Corchorus incanus subsp. *lithophilus*	
Enneapogon polyphyllus	
Eremophila fraseri subsp. *fraseri*	
Indigofera monophylla	
Ptilotus rotundifolius	
Senna artemisioides subsp. *helmsii*	
Tribulus hirsutus	
Triodia pungens	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-126**

Date	30/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 774162 mE; 7408326 mN 119.6827 E -23.411938 S
Veg Condition	Excellent
Soil	Silty Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Hillslope
Vegetation	*Triodia wiseana* low hummock grassland with *Acacia inaequilatera, Hakea lorea* subsp. *lorea* and *Acacia tetragonophylla* mid to tall scattered shrubs with *Eucalyptus gamophylla* low scattered trees.

SPECIES LIST

Name	Specimen
Acacia bivenosa	
Acacia inaequilatera	
Acacia tetragonophylla	
Eucalyptus gamophylla	
Hakea chordophylla	
Hakea lorea subsp. *lorea*	
Ptilotus astrolasius	
Ptilotus clementii	
Tribulus hirsutus	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-127**

Date	31/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 774058 mE; 7408765 mN 119.6816 E -23.407997 S
Veg Condition	Good
Soil	Silty Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Acacia aptaneura* low open woodland over *Digitaria ctenantha, Chrysopogon fallax* and *Enneapogon polyphyllus* low open tussock grassland with *Abutilon lepidum*, *Hibiscus sturtii* var. *campylochlamys* and *Evolvulus alsinoides* var. *decumbens* scattered low shrubs and herbs.

SPECIES LIST

Name	Specimen
Abutilon cryptopetalum	
Abutilon lepidum	WRP004.03
Acacia aptaneura	
Aristida contorta	
Arivela viscosa	
**Bidens bipinnata*	
**Cenchrus ciliaris*	
Chrysopogon fallax	
Dactyloctenium radulans	
Digitaria ctenantha	WRP019.03
Dipteracanthus australasicus subsp. *australasicus*	
Enneapogon polyphyllus	WRP019.04
Evolvulus alsinoides var. *decumbens*	
Gomphrena canescens	
Hibiscus burtonii	WRP010.04
Hibiscus sturtii var. *campylochlamys*	WRP005.03
Iseilema membranaceum	
Paspalidium constrictum	WRP112.01
Perotis rara	
Ptilotus exaltatus	
Ptilotus helipteroides	
Rhagodia eremaea	
Sporobolus australasicus	
Triodia pungens	

Western Ridge Pipeline **Site WRP-128**

Date	31/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 774274 mE; 7408938 mN 119.6837 E -23.406395 S
Veg Condition	Excellent
Soil	Clay Loam
Rock Type	Granite
Fire Age	Old (6+ yr)
Habitat	Undulating Low Hills
Vegetation	*Triodia angusta* and *Triodia wiseana* low hummock grassland with *Acacia bivenosa, Acacia synchronicia* and *Senna glutinosa* subsp. x *luerssenii* mid to tall scattered shrubs with *Eucalyptus socialis* subsp. *eucentrica* low scattered trees.

SPECIES LIST

Name	**Specimen**
Acacia bivenosa	
Acacia synchronicia	
Acacia tetragonophylla	
Duperreya commixta	
Enneapogon polyphyllus	
Eucalyptus socialis subsp. *eucentrica*	
Ptilotus obovatus var. *obovatus*	
Senna artemisioides subsp. *oligophylla*	
Senna glutinosa subsp. x *luerssenii*	
Senna sp. Meekatharra (E. Bailey 1-26)	
Triodia angusta	
Triodia wiseana	

Western Ridge Pipeline **Site WRP-129**

Date	31/03/2021
Described by	CvdB
Type	Relevé
Location	MGA Zone 50 774500 mE; 7408709 mN 119.6860 E -23.408427 S
Veg Condition	Poor
Soil	Sandy Clay Loam
Rock Type	None Discernible
Fire Age	Old (6+ yr)
Habitat	Drainage Area/ Floodplain
Vegetation	*Acacia aptaneura* low open woodland over *Digitaria ctenantha*, *Chrysopogon fallax* and *Enneapogon polyphyllus* low open tussock grassland with **Bidens bipinnata*, *Hibiscus sturtii* var. *campylochlamys* and *Abutilon lepidum* low scattered herbs and shrubs.

SPECIES LIST

Name	Specimen
Abutilon fraseri subsp. *fraseri*	WRP129.01
Abutilon lepidum	WRP004.03
Acacia aptaneura	
Acacia tetragonophylla	
Aristida inaequiglumis	WRP005.01
**Bidens bipinnata*	
**Cenchrus ciliaris*	
Chrysopogon fallax	
Corymbia candida subsp. *dipsodes*	
Dactyloctenium radulans	
Digitaria ctenantha	WRP019.03
Enneapogon polyphyllus	WRP019.04
Eriachne mucronata	
Euphorbia biconvexa	
Hibiscus sturtii var. *campylochlamys*	WRP005.03
Iseilema membranaceum	
Kennedia prorepens	
Paraneurachne muelleri	
Paspalidium constrictum	WRP112.01
Perotis rara	
Ptilotus helipteroides	
Ptilotus polystachyus	
Senna artemisioides subsp. *helmsii*	
Sida fibulifera	
Triodia pungens	

Western Ridge Pipeline Site Opps

SPECIES LIST

Name	Specimen
Abutilon cunninghamii	CVOPP.14
Acacia ancistrocarpa	
Acacia citrinoviridis	
Acacia colei var. *colei*	
Acacia hilliana	
Acacia maitlandii	
Acacia paraneura	
Acacia paraneura	
Acacia pruinocarpa	
Acacia rhodophloia	
Acacia rhodophloia	
Acacia sclerosperma subsp. *sclerosperma*	
**Aerva javanica*	
Afrohybanthus aurantiacus	
Amyema gibberula var. *gibberula*	CVOPP.10
Androcalva luteiflora	
Anthobolus leptomerioides	
**Bidens bipinnata*	
**Bidens bipinnata*	
**Bidens bipinnata*	
Boerhavia coccinea	
**Cenchrus ciliaris*	
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**Cenchrus setiger*	
**Cenchrus setiger*	
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**Cenchrus setiger*	
Chloris pumilio	
Chloris pumilio	Cvopp.02
Chrysocephalum apiculatum subsp. *pilbarense*	
Chrysocephalum gilesii	Cvopp.04
Chrysopogon fallax	
Corchorus tridens	
Corymbia candida subsp. *dipsodes*	
Corymbia candida subsp. *dipsodes*	
Corymbia candida subsp. *dipsodes*	
Corymbia hamersleyana	
**Cynodon dactylon*	
Cyperus difformis	Cvopp.01
Dampiera candicans	
Dichanthium sericeum subsp. *humilius*	
Dicladanthera forrestii	
Digitaria brownii	Cvmvopp.04
Duperreya commixta	
Enneapogon caerulescens	
Eragrostis falcata	Cvmvopp.02
Eragrostis tenellula	
Eremophila forrestii subsp. *forrestii*	
Eremophila longifolia	
Eriachne aristidea	
Eriachne ciliata	
Eriachne flaccida	
Eriachne lanata	
Eucalyptus gamophylla	
Goodenia cusackiana	
Goodenia triodiophila	
Gossypium robinsonii	
Grevillea striata	MvW006
Grevillea striata	
Grevillea striata	
Hakea lorea subsp. *lorea*	
Hibiscus coatesii	CVopp.11
Hibiscus sturtii var. *platychlamys*	Cvmvopp.03
Iseilema eremaeum	
Isotropis iophyta	
Maireana pyramidata	CVopp.13
Melaleuca glomerata	
Melaleuca glomerata	
Neptunia dimorphantha	
Phyllanthus maderaspatensis	
Pluchea ferdinandi-muelleri	
Psydrax suaveolens	
Ptilotus calostachyus	
Ptilotus gaudichaudii	
Ptilotus gomphrenoides	
Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)	
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Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)	
Scaevola spinescens	
Sclerolaena bicornis	
Senna artemisioides subsp. oligophylla x ? (hybrid)	CVMVopp.05
Seringia exastia	
Sporobolus australasicus	
Stemodia viscosa	
Themeda triandra	CVMVopp.01
Thyridolepis mitchelliana	
Trianthema triquetrum	
Tribulus platypterus	
Triodia longiceps	
Triumfetta clementii	Cvopp.12
Vachellia farnesiana	
Vachellia farnesiana	
Vachellia farnesiana	
Vachellia farnesiana	
Vincetoxicum lineare	

Appendix D: Vegetation Structure Definition

NVIS Vegetation Structural Classifications

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

Growth Form	Height ranges (m)	Structural Formation Classes						
tree, palm	>30 Tall 10-30 Mid <10 Low	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	10-30 Tall <10 Mid <3 Low	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, fern	>2 Tall 1-2 Mid <1 Low	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	10-30 Tall <10 Mid <3 Low	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	>2 Tall 1-2 Mid <1 Low	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	>2 Tall 1-2 Mid		chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs

Growth Form	Height ranges (m)	Structural Formation Classes						
	<1 Low	closed chenopod shrubland						
samphire shrub	>0.5 Low <0.5 Low	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	>2 Tall <2 Tall	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	>0.5 Mid <0.5 Low	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grasses
other grass	>0.5 Mid <0.5 Low	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	>0.5 Mid <0.5 Low	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	>0.5 Mid <0.5 Low	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	>0.5 Mid <0.5 Low	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	>2 Tall 1-2 Tall <1 Low	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumpsof ferns	ferns
bryophyte	<0.5	closed bryophyte land	bryophyte land	open bryophyte land	sparse bryophyte land	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	>30 Tall 10-30 Med <10 Low	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	<1 Tall 0-0.5 Low	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics

Growth Form	Height ranges (m)	Structural Formation Classes						
seagrass	<1 Tall	closed seagrass bed	Seagrass bed	open seagrass bed	sparse seagrass bed	isolated seagrasses	isolated clumps of seagrasses	seagrasses

From: NVIS Structural Formation Terminology (Australian Vegetation Attribute Manual Version 6.0 August 2003 http://www.environment.gov.au/erin/nvis/publications/avam/pubs/vegetation-attribute-manual-6.pdf)

* Foliage Cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is similar to the Crown type of Walker and Hopkins (1990) but is applied to a stratum or plot rather than an individual crown. It is generally not directly measured in the field for the upper stratum, although it can be measured by various line interception methods for ground layer vegetation. For the attribute COVER CODE in the Stratum table, the ground cover category refers to ground foliage cover not percentage cover.

** Crown Cover (canopy cover) as per Walker and Hopkins (1990). Although relationships between the two are dependent on season, species, species age etc. (Walker & Hopkins, 1990), the crown cover category classes have been adopted as the defining measure.

*** The percentage cover is defined as the percentage of a strictly defined plot area, covered by vegetation. This can be an estimate and is a less precise measure than using, for example, a point intercept transect methods on ground layer, or overstorey vegetative cover. That is for precisely measured values (e.g. crown densitometer or point intercept transects) the value measured would be 'foliage' cover. Where less precise or qualitative measures are used these will most probably be recorded as 'percentage' cover.

Appendix E: Vegetation Condition Definition

Vegetation Condition Scale (adapted from Keighery (1994) and Trudgen (1988))

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: Significant Flora Assessment of Occurrence

Taxon	Conservation Code			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
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.	Yes	Yes	0.4 km SE	Highly Likely	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.	Yes	Yes	1.5 km N	Likely	Possible
Goodenia nuda	P4			Erect to ascending herb, to 0.5 m high. Fl. yellow, Apr to Aug. Mulga hardpan plains, undulating plains, floodplains, minor drainage lines on red sandy-loams, clay-loams.	Yes	Yes	4.5 km NE	Likely	Possible
Hibiscus campanulatus	P1			Erect bushy shrub, 1-3.5 m high. Fl. White/pale pink. Brown loamy to skeletal soils. Rocky gullies, ironstone range.	Possible	Adjacent	10 km NW	Possible	Highly Unlikely
Ipomoea racemigera	P2			Creeping annual, herb or climber. Fl. white.	Possible	Yes	2.8 km NNW	Possible	Confirmed
Isotropis parviflora	P2			Shrub, 0.1 m high. Fl. white/pink, Mar. Valley slope of ironstone plateau.	Possible	Yes	7.5 km NNW[4]	Possible	Highly Unlikely
Aristida jerichoensis var. *subspinulifera*	P3			Compactly tufted perennial, grass-like or herb, 0.3-0.8 m high, lemma groove muricate. Hardpan plains.	Possible	Yes	3.3 km NW	Possible	Possible
Gymnanthera cunninghamii	P3			Erect shrub, 1-2 m high. Fl. cream-yellow-green, Jan to Dec. Sandy soils.	Possible	Yes	4.8 km NE	Possible	Unlikely
Indigofera gilesii	P3			Shrub, to 1.5 m high. Fl. purple-pink, May or Aug. Pebbly loam. Amongst boulders & outcrops, hills.	Possible	Yes	12.8 km NNW	Possible	Highly Unlikely
Lepidium catapycnon	P4			Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag. Fl. white, Oct. Skeletal soils. Hillsides.	Yes	Adjacent	5.6 km NW	Possible	Highly Unlikely
Acacia corusca	P1			Shrub, 1.5-5(-7) m high. Red brown sandy loam soils. Hill slopes, hillcrests, drainage lines.	No	No	25.8 km ENE	Unlikely	Highly Unlikely
Eremophila capricornica	P1			Compact shrub, 0.2-0.5(-0.75) m high. Fl. blue-purple. Red brown loam soil. Hardpan plain over granite.	Possible	No	27.6 km ENE	Unlikely	Unlikely
Eremophila rhegos	P1			Erect shrub, ca 1 m high. Fl. blue-purple-white, Sep. Skeletal stony loam over granite.	No	No	27.6 km SE	Unlikely	Highly Unlikely
Eremophila sp. West Angelas (S. van Leeuwen 4068)	P1			Spindly shrub, 0.4-3 m high. Skeletal brown-red soil or loam. Hill slopes and summits.	No	No	32.9 km NW	Unlikely	Highly Unlikely
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	P1			Erect annual herb, 0.3-1 m high. Fl. cream. Red-brown sandy loam. Drainage areas, floodplains, flat and/or stony plains.	Possible	Yes	22.6 km ESE	Unlikely	Unlikely
Aristida lazaridis	P2			Tufted perennial, grass-like or herb, 0.4-1.5 m high. Fl. green/purple, Apr. Sand or loam. Floodplains, drainage lines.	Possible	No	29.9 km NW	Unlikely	Possible
Euphorbia inappendiculata var. *inappendiculata*	P2			Prostrate annual herb, to 0.1 m high. Red brown clay loam. Flat plain, cracking clay floodplain, gentle slopes.	Possible	Yes	23.5 km E	Unlikely	Highly Unlikely
Oxalis sp. Pilbara (M.E. Trudgen 12725)	P2			Annual herb, 0.1-0.3 m high. Fl. Yellow. Brown sandy loam or clay. Gorge, ironstone outcrops, gully, shaded areas, creeklines.	Possible	Adjacent	41.2 km NW	Unlikely	Unlikely
Acacia subtiliformis	P3			Spindly, slender, erect shrub, to 3.5 m high, phyllodes green; inflorescence in heads to 6 mm diameter; peduncles red. Fl. yellow, Jun. On rocky calcrete plateau.	No	No	31 km NNW	Unlikely	Highly Unlikely
Amaranthus centralis	P3			Annual herb, decumbent or erect to 0.6 m high. Red clay loam or sand. Flats, plains, granite outcrops, riverbanks.	No	No	39.4 km NE	Unlikely	Highly Unlikely
Crotalaria smithiana	P3			Annual, herb, to 0.4 m high. Fl. yellow, Jun. Regeneration site on floodplain.	Possible	No	20.7 km NNE	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.	No	Yes	26.9 km SE	Unlikely	Highly Unlikely
Eremophila rigida	P3			Bushy shrub, 0.3-4 m high. Fl. cream, Sep. Red sand alluvium. Hardpan plains, stony clay depressions.	Possible	Yes	16.6 km S	Unlikely	Highly Unlikely
Eremophila sp. Hamersley Range (K. Walker KW 136)	P3			Erect shrub, 1-3 m high. Fl. White/pale blue. Red brown sandy clay loam. Upper slopes, gullies, gorges.	Possible	Yes	5 km NW	Unlikely	Highly Unlikely
Maireana prosthecochaeta	P3			Open, densely-leaved shrub, 0.3-0.6 m high. Laterite. Hills, salty places.	No	No	21.2 km SSW	Unlikely	Highly Unlikely
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3			Tall spindly shrub, 1.5-4 m high. Fl. yellow. Red brown sandy loam or clay, ironstone plain. Undulating plains, floodplain.	Possible	Yes	17.6 km NNE	Unlikely	Confirmed
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.	Possible	Yes	23.7 km NNE	Unlikely	Unlikely
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.	No	Yes	15.3 km NNW	Unlikely	Highly Unlikely

[4] Nearest record recorded by ENV (2012)

Taxon	Conservation Code			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood Pre-survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Acacia bromilowiana	P4			Tree or shrub, to 12 m high, bark dark grey, fibrous; 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	32.9 km NW	Unlikely	Highly Unlikely
Eremophila magnifica subsp. *magnifica*	P4			Shrub, 0.5-1.5 m high. Fl. blue, Aug to Nov. Skeletal soils over ironstone. Rocky screes.	No	Adjacent	5.7 km NNW	Unlikely	Highly 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.	Possible	Yes	11.8 km NNE	Unlikely	Highly Unlikely
Goodenia berringbinensis	P4			Ascending annual, herb, 0.1-0.3 m high. Fl. yellow, Oct. Red sandy loam. Along watercourses.	Possible	Yes	17.3 km ESE	Unlikely	Unlikely
Goodenia hartiana	P2			Erect to spreading, multistemmed perennial, herb or shrub (sub-shrub). Fl. blue-purple. Sand. Sand dune swales, sandhills.	No	No	20.9 km E	Highly Unlikely	Highly Unlikely
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.	No	No	45.9 km WNW	Highly Unlikely	Highly Unlikely
Pityrodia augustensis	T		VUL	Bushy shrub, ca 1 m high. Fl. purple/purple-red, Aug to Sep. Amongst rocks on slopes or in drainage lines.	No	No	>200 km SW	Highly Unlikely	Highly Unlikely

Appendix G: Key Findings from the Literature Review

Survey Details	Methods	Results	Significant Findings	Limitations
Biota (2001) **Client**: BHP Iron Ore Pty Ltd **Type**: Biological Survey **Location**: Mining Lease 244SA (partially overlaps Survey Area) **Timing:** September – October 2000	• 60 detailed floristic sites (quadrats) • Targeted Searches	• 380 plant taxa from 98 families and 168 genera • 27 vegetation associations • Four major landform groups • 11 introduced flora species	• One Priority flora species recorded: ○ *Eriachne tenuiculmis* (P3) – no longer a priority flora species	• Poor seasonal conditions • Recently burnt • Lack of aerial photography for portion of survey area
GHD (2011a) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Orebody 35 and Surrounds (partially overlaps Survey Area) **Timing:** May and August 2010	• Desktop assessment • 88 detailed floristic sites (quadrats) • 35 relevé plots • Opportunistic collections	• 347 plant taxa from 48 families and 159 genera • 22 vegetation associations • 10 broad floristic formations • Vegetation condition ranged from 'Pristine' to 'Completely Degraded' • 13 introduced taxa	• Three Priority flora taxa recorded: ○ *Gymnanthera cunninghamii* (P3) ○ *Indigofera gilesii* subsp. *gilesii* (P4) (now *Indigofera gilesii* (P3)) ○ *Goodenia nuda* (P4)	• No substantial limitations
Onshore (2014a) **Client**: BHP Billiton Iron Ore **Type**: Mapping Consolidation **Location**: BHP's central, eastern and mainline rail tenements (partially overlaps Survey Area) **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 ○ Review and consolidation of raw and spatial data	• 15 landform types described and mapped • 218 vegetation associations • 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[5], 14 P1, 11 P2, 26 P3, and four P4 • 56 introduced weed taxa, including seven recognised as Declared Pests under the BAM Act • Three introduced weed taxa that 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 mapping linework and overlapping datasets • Mis-identification of keystone plant taxa. • Gaps in vegetation datasets.

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

Survey Details	Methods	Results	Significant Findings	Limitations
Onshore (2014b) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Western Ridge (partially overlaps Survey Area) **Timing**: June 2014	• Desktop assessment • 12 detailed floristic sites (quadrats) • 116 relevé plots • Opportunistic collections	• 199 plant taxa from 32 families and 93 genera • 17 vegetation associations • 10 broad floristic formations • Vegetation condition ranged from 'Excellent' to 'Good' • Seven introduced flora species	• One Priority listed flora taxon and one taxon of interest recorded: ○ *Calotis latiuscula* – no longer a priority flora species ○ *Aristida* cf. *nitidula* (species of interest)	• No substantial limitations
Onshore (2016) **Client**: BHP Billiton Iron Ore **Type**: Desktop Assessment **Location**: Western Ridge Southern Tenements (partially overlaps Survey Area) **Timing**: October 2016	• Desktop assessment	• 13 vegetation associations • Nine broad floristic formations	• Significant flora identified as likely to occur in the study area: ○ *Aristida lazaridis* (P2) ○ *Calotis latiuscula* (P3) – no longer a priority flora species ○ *Eremophila magnifica* subsp. *magnifica* (P4) ○ *Eremophila magnifica* subsp. *velutina* (P3) ○ *Goodenia nuda* (P4) ○ *Gymnanthera cunninghamii* (P3) ○ *Indigofera gilesii* (P3) ○ *Ipomoea racemigera* (P2) ○ *Isotropis parviflora* (P2) ○ *Lepidium catapycnon* (P4) ○ *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3) • One vegetation association closely affiliated to the West Angelas Cracking Clay PEC (P1). • Three vegetation associations supporting Mulga Low Open Forest were representative of 'Valley Floor Mulga' within the Hamersley subregion (considered an ecosystem at risk)	• No substantial limitations

Survey Details	Methods	Results	Significant Findings	Limitations
Biologic (2020a) **Client**: BHP Western Australia Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Coombanbunna Well (partially overlaps Survey Area) **Timing:** March 2019	• Desktop assessment • 44 detailed floristic sites (quadrats) • Six relevé plots • Targeted searching	• 185 plant taxa from 34 families and 91 genera • 18 vegetation associations • Nine broad floristic formations • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • Nine introduced flora species	• No significant flora or ecological communities recorded	• Poor seasonal conditions
HGM (1999b) **Client**: BHP Iron Ore Pty Ltd **Type**: Biological Survey **Location**: Orebody 30 and 35 (adjacent north) **Timing**: August 1999	• 10 detailed floristic sites (quadrats) • Opportunistic collections	• 206 plant taxa from 44 families and 101 genera • Five vegetation associations • Four introduced flora species	• One priority listed flora taxon: ○ *Triumfetta leptacantha* (P3) – no longer a priority flora species	• Poor seasonal conditions
ecologia (2004) **Client**: BHP Billiton Iron Ore **Type**: Targeted flora survey and weed survey **Location**: Newman Hub (adjacent north) **Timing**: June 2004	• Desktop assessment • Linear transects • Opportunistic collections	• Five vegetation associations • Four introduced flora species	• No significant flora species recorded	• No substantial limitations
ecologia (2005) **Client**: BHP Billiton Iron Ore **Type**: Biological Survey **Location**: Western Ridge (adjacent west) **Timing**: May 2005	• Seven detailed floristic sites (quadrats) • Targeted searching	• 91 plant taxa from 28 families and 47 genera • Three vegetation types • No introduced flora species	• No significant flora or ecological communities recorded	• Recently burnt in some areas
ecologia (2006a) **Client**: BHP Billiton Iron Ore **Type**: Biological Survey **Location**: Western Ridge (adjacent north & west) **Timing**: May – June 2006	• 36 proposed drill pads surveyed (20m x 20m) • 1 km of track line surveyed (10m x 10m)	• 152 plant taxa from 35 families and 79 genera • Five vegetation types • Three introduced flora species	• One Priority flora species recorded: ○ *Calotis latiuscula* – no longer a priority flora species	• Poor seasonal conditions

Survey Details	Methods	Results	Significant Findings	Limitations
ENV (2006a) **Client**: BHP Billiton Iron Ore **Type**: Flora and Vegetation Assessment **Location**: Mt Whaleback and Orebody 29 (adjacent north) **Timing:** August 2006	• Desktop assessment • 81 detailed floristic sites (quadrats) • Relevé plots • Opportunistic collections • Targeted searching	• 243 plant taxa from 42 families and 117 genera • Ten broad floristic formations • Vegetation condition ranged from 'Excellent' to 'Poor' • Seven introduced flora species	• One significant flora taxon recorded: ○ *Lepidium catapycnon* (T) – now a P4	• No substantial limitations
Biologic (2009) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Newman Power Network (adjacent north) **Timing:** July 2009	• Desktop assessment • All species recorded and identified from over 132 km of power lines • Targeted searching	• 319 plant taxa from 54 families and 148 genera • 10 vegetation associations • Vegetation condition ranged from 'Very Good' to 'Totally Degraded' • 14 introduced flora species	• One Priority listed taxon: ○ *Goodenia nuda* (P3) – now a P4	• No substantial limitations
Onshore and Biologic (2009) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Vegetation **Location**: Whaleback mine site (adjacent north) **Timing**: June 2009	• Desktop assessment • 30 detailed floristic sites (quadrats) • Relevé plots • Opportunistic collections	• 201 plant taxa from 40 families and 100 genera • Nine vegetation associations • Seven broad floristic formations • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • 17 introduced flora species	• No significant flora or ecological communities recorded	• Poor seasonal conditions
Astron (2010) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Mt Whaleback Tailings Storage Facility (adjacent north) **Timing**: March 2010	• Desktop assessment • Five detailed floristic sites (quadrats) • Two relevé plots • Opportunistic collections	• 71 plant taxa from 18 families and 38 genera • Three vegetation associations • One broad floristic formation • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • Two introduced flora species	• No significant flora or ecological communities recorded	• Timing of Survey (poor seasonal conditions)

Survey Details	Methods	Results	Significant Findings	Limitations
ENV (2010) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Orebody 35 (adjacent west) **Timing:** December 2009	• Desktop assessment • 28 detailed floristic sites (quadrats) • One relevé plot • Opportunistic collections	• 189 plant taxa from 37 families and 86 genera • 10 vegetation associations • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • Three introduced flora species	• One Priority listed taxon: ○ *Tephrosia* sp. Pilbara Ranges (S. van Leeuwen 4246) – now known as *Tephrosia oxalidea* which is not a priority taxon	• Timing of survey
ENV (2011a) **Client**: BHP Billiton Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Whaleback East (adjacent north) **Timing:** January 2011	• Desktop assessment • 15 detailed floristic sites (quadrats) • Three relevé plots • Opportunistic collections	• 127 plant taxa from 31 families and 64 genera • Eight vegetation associations • Vegetation condition ranged from 'Pristine' to 'Completely Degraded' • Seven introduced flora species	• No significant flora or ecological communities recorded	• Timing of survey

ENV (2012)
Client: BHP Billiton Iron Ore
Type: Detailed Flora and Vegetation Survey
Location: Eastern Ridge (adjacent north)
Timing: April & July 2011
	• Desktop assessment
	• 51 detailed floristic sites (quadrats)
	• One mapping note
	• Opportunistic collections
		• 422 plant taxa from 52 families and 167 genera
		• 13 vegetation associations
		• Ten broad floristic formations
		• Vegetation condition ranged from 'Pristine' to 'Completely Degraded'
		• 19 introduced flora species
			• Five Priority listed flora taxa recorded:
			  ○ *Aristida jerichoensis* var. *subspinulifera* (P1) – now a P3
			  ○ *Calotis latiuscula* (P3) – no longer a priority flora species
			  ○ *Goodenia nuda* (P4)
			  ○ *Eremophila magnifica* var. *velutina* (P3)
			  ○ *Isotropis parviflora* (P2)
			• One Weed of National Significance and Declared Pest recorded:
			  ○ **Tamarix aphylla*
				• No substantial limitations

Onshore (2013)
Client: BHP Billiton Iron Ore
Type: Desktop Assessment
Location: Mt Whaleback (8.6 km north)
Timing: April 2013
	• Desktop assessment
	• Consolidation of 40 flora and vegetation reports completed at Mt Whaleback
		• 352 plant taxa from 48 families and 147 genera
		• 20 vegetation associations
		• Six broad floristic formations
		• Vegetation condition ranged from 'Pristine' to 'Completely Degraded'
		• 19 introduced flora species
			• Three Priority listed flora taxa recorded:
			  ○ *Calotis latiuscula* – no longer a priority flora species
			  ○ *Eremophila magnifica* subsp. *magnifica* (P4)
			  ○ *Lepidium catapycnon* (T) – now a P4
				• No substantial limitations

Survey Details	Methods	Results	Significant Findings	Limitations
Onshore (2018) **Client**: BHP Billiton Iron Ore **Type**: Desktop Assessment **Location**: Western Ridge Exploration Tenement (adjacent north) **Timing**: November 2018	• Desktop Assessment	• 13 vegetation associations • Six broad floristic formations	• One Threatened and 37 Priority flora taxa identified as potentially occurring within the vicinity of the study area. • Significant flora identified as likely to occur in the study area: ○ *Calotis latiuscula* (P3) – no longer a priority flora species ○ *Eremophila magnifica* subsp. *magnifica* (P4) ○ *Goodenia nuda* (P4) ○ *Ipomoea racemigera* (P2) • Two vegetation associations supporting Mulga Low Open Forest were representative of 'Valley Floor Mulga' within the Hamersley subregion (considered an 'ecosystem at risk')	• No substantial limitations
Biologic (2020b) **Client**: BHP Western Australia Iron Ore **Type**: Detailed Flora and Vegetation Survey **Location**: Western Ridge exploration tenement (adjacent south) **Timing:** March 2019	• Desktop assessment • 34 detailed floristic sites (quadrats) • Five relevé plots • Additional 45 quadrats and five relevés sampled in Coombanbunna Well • Targeted searching	• 152 plant taxa from 29 families and 70 genera • 16 vegetation associations • Seven broad floristic formations • Vegetation condition ranged from 'Excellent' to 'Degraded' • Three introduced flora species • Additional 66 native taxa and six introduced species from Coombanbunna Well • Total of 209 native flora taxa and nine introduced flora species	• No significant flora or ecological communities recorded	• Poor seasonal conditions • Proportion of flora recorded and/or collected
ENV (2006c) **Client**: Mine and Port Developments Joint Venture **Type**: Flora and Vegetation Assessment **Location**: RGP4 Newman hub infrastructure area (1 km north) **Timing:** September 2006	• Desktop assessment • Ten detailed floristic sites (quadrats) • Relevé plots • Opportunistic collections	• 168 plant taxa from 39 families and 99 genera • 11 vegetation associations • Seven broad floristic formations • Eight introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations

Survey Details	Methods	Results	Significant Findings	Limitations
Eco Logical (2012) **Client:** BHP Billiton Iron Ore **Type:** Reconnaissance Flora and Vegetation Survey **Location:** Great Northern Highway (1.3 km west) **Timing:** August 2011	• Desktop assessment • Three detailed floristic sites (quadrats) • Opportunistic collections	• 52 plant taxa from 14 families and 26 genera • Seven vegetation associations • Vegetation condition ranged from 'Pristine' to 'Completely Degraded' • One introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations
ENV (2006d) **Client**: Mine and Port Developments Joint Venture **Type**: Flora and Vegetation Assessment **Location**: RGP4 Newman hub stockpile and borrow areas for construction (1.5 km northwest) **Timing:** October 2006	• Desktop assessment • 41 detailed floristic sites (quadrats) • Four relevé plots • Opportunistic collections	• 285 plant taxa from 47 families and 115 genera • Seven broad floristic formations • 13 introduced flora species	• One Priority listed flora species recorded: ○ *Acacia kenneallyi* (P3)[6]	• No substantial limitations
ENV (2009a) **Client**: BHP Billiton Iron Ore **Type**: Reconnaissance Flora and Vegetation Survey **Location**: Homestead Creek Culvert (1.5 km northeast) **Timing:** July 2009	• Desktop assessment • Four detailed floristic sites (quadrats) • One relevé plot • Opportunistic collections	• 80 plant taxa from 24 families and 53 genera • Three vegetation associations • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • Six introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations
Eco Logical (2011) **Client:** BHP Billiton Iron Ore **Type:** Reconnaissance Flora and Vegetation **Location:** Newman power line corridor (1.9 km north) **Timing:** August 2011	• Desktop assessment • Relevé plots • Opportunistic collections	• 33 plant taxa from 6 families and 15 genera • 14 vegetation associations • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • Three introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations

[6] *Acacia kenneallyi* is restricted to the northern Kimberley region of Western Australia and the Whaleback record was a misidentification.

Survey Details	Methods	Results	Significant Findings	Limitations
ENV (1999b) **Client**: BHP Iron Ore Pty Ltd **Type**: Targeted Flora Survey **Location**: Greater Newman Area (2.8 km north) **Timing**: September & November 1999	• Targeted searching	• No introduced flora species	• One significant flora taxon recorded: ○ *Lepidium catapycnon* (T) – now a P4 • Eight new populations identified	• No substantial limitations
Astron (2014) **Client**: BHP Billiton Iron Ore **Type**: Reconnaissance Flora and Vegetation Survey **Location**: Coolibah Village (4.3 km southeast) **Timing**: May 2014	• Desktop assessment • Eight relevé plots • Opportunistic collections	• 54 plant taxa from 21 families and 35 genera • Three vegetation associations • Three broad floristic formations • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • Two introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations
ENV (2009c) **Client**: WorleyParsons Services **Type**: Detailed Flora and Vegetation Survey **Location**: Whaleback Power Station (4.4 km north) **Timing:** April 2009	• Desktop assessment • Seven detailed floristic sites (quadrats) • Three relevé plots • Opportunistic collections • Targeted searching	• 124 plant taxa from 28 families and 65 genera • Seven vegetation associations • Vegetation condition ranged from 'Excellent' to 'Completely Degraded' • Five introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations
ENV (1999a) **Client**: BHP Iron Ore Pty Ltd **Type**: Targeted Flora Survey **Location**: Mt Whaleback and surrounds (5 km north) **Timing**: June – August 1999	• Targeted searching • Ten foot traverses	• No introduced flora species	• One significant flora taxon recorded: ○ *Lepidium catapycnon* (T) – now a P4 ○ 36 sub-populations of *Lepidium catapycnon* identified during the survey	• No substantial limitations
Onshore (2015) **Client**: BHP Billiton Iron Ore **Type**: Reconnaissance Flora and Vegetation Survey **Location**: Kurra Village (5.1 km north) **Timing**: December 2014	• Desktop assessment • 35 relevé plots • Targeted searching • Opportunistic collections	• 125 plant taxa from 25 families and 73 genera • 14 vegetation associations • 10 broad floristic formations • Vegetation condition ranged from 'Good' to 'Degraded' • 15 introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations

Survey Details	Methods	Results	Significant Findings	Limitations

GHD (2008a)
Client: BHP Billiton Iron Ore
Type: Detailed Flora and Vegetation Survey
Location: Myopic Project Area (5.2 km northwest)
Timing: May – June 2008
	• Desktop assessment
	• 119 detailed floristic sites (quadrats)
	• 22 relevé plots
	• Targeted searching
		• 321 plant taxa from 52 families
		• Nine vegetation types
		• Four major landscape types
		• Vegetation condition ranged from 'Pristine' to 'Good'
		• 14 introduced flora species
			• Two priority listed flora taxa:
			  ○ *Brunonia* sp. Long hairs (D.E. Symon 2440) – no longer a priority flora species
			  ○ *Triumfetta leptacantha* – no longer a priority flora species
			• Four range extensions:
			  ○ *Fimbristylis leucocolea* (250 km south)
			  ○ *Acacia cuthbertsonii* subsp. *cuthbertsonii* (50 km north)
			  ○ *Acrachne racemose* (100 km east)
			  ○ **Pennisetum setaceum* (400 km south)
			• One Weed of National Significance and Declared Pest recorded:
			  ○ **Tamarix aphylla*
				• Poor seasonal conditions

ENV (2006b) **Client**: Mine and Port Developments Joint Venture **Type**: Flora and Vegetation Assessment **Location**: Kurra Village (5.5 km north) **Timing:** September 2006	• Desktop assessment • Nine detailed floristic sites (quadrats) • Relevé plots • Opportunistic collections	• 117 plant taxa from 25 families and 59 genera • Nine vegetation associations • Two broad floristic formations • Seven introduced flora species	• No significant flora or ecological communities recorded	• No substantial limitations

Survey Details	Methods	Results	Significant Findings	Limitations
ENV (2009b) **Client**: WorleyParsons Services **Type**: Detailed Flora and Vegetation Survey **Location**: Newman to Yandi Transmission Line (5.5 km north) **Timing:** May 2009	• Desktop assessment • 151 detailed floristic sites (quadrats) • 29 relevé plots • Opportunistic collections • Targeted searching	• 501 plant taxa from 58 families and 172 genera • 30 vegetation associations • Vegetation condition ranged from 'Pristine' to 'Completely Degraded' • 14 introduced flora species	• One Threatened and seven Priority flora taxa recorded: ○ *Lepidium catapycnon* (T) – now a P4 ○ *Goodenia* sp. East Pilbara (AA Mitchell PRP 727) (P1) – now a P3 ○ *Euphorbia* sp. Mt Bruce flats (S. van Leeuwen 3861) (P2)[7] ○ Vigna sp. Central (M.E. Trudgen 1626) (P2)[8] ○ Acacia subtiliformis (P3) ○ Goodenia nuda (P3) – now a P4 ○ Rhagodia sp. Hamersley (M. Trudgen 17794) (P3) ○ Tephrosia sp. Pilbara Ranges (S. van Leeuwen 4246) (P3)[9]	• Poor seasonal conditions
ecologia (2006b) **Client**: BHP Billiton Iron Ore **Type**: Targeted flora survey **Location**: Proposed ammonium nitrate storage facility (6.3 km north) **Timing**: January 2006	• Targeted searching • Walking transects	• 64 plant taxa • Two vegetation types • One introduced flora taxon	• No significant flora recorded	• No substantial limitations
ecologia (2006c) **Client**: BHP Billiton Iron Ore **Type**: Targeted flora survey **Location**: Proposed ammonium nitrate storage facility (6.3 km north) **Timing**: April 2006	• Targeted searching • Walking transects	• 122 plant taxa from30 families and 58 genera • Five vegetation types • Three introduced flora species	• No significant flora recorded	• No substantial limitations

[7] *Euphorbia* sp. Mt Bruce flats (S. van Leeuwen 3861) is not current and is more recently known as *Euphorbia australis* var. *glabra*, a Priority 3 species.
[8] *Vigna* sp. Central (M.E. Trudgen 1626) is not current and is more recently known as *Vigna* sp. Hamersley clay (A.A. Mitchell PRP 113), which is not listed as a Priority flora species.
[9] *Tephrosia* sp. Pilbara Ranges (S. van Leeuwen 4246) is not current and is more recently known as *Tephrosia oxalidea* which is not listed as a Priority flora species.

Survey Details	Methods	Results	Significant Findings	Limitations
HGM (1997) **Client**: BHP Iron Ore Pty Ltd **Type**: Targeted Flora Survey **Location**: Mt Whaleback and surrounds (8 km northwest) **Timing**: November 1996 & January 1997	• Targeted searching • Traversed transects	• No introduced flora species	• One significant flora taxon recorded: ○ *Lepidium catapycnon* (T) – now a P4 • 3,184 live and 1,048 dead individuals of *Lepidium catapycnon*	• Poor seasonal conditions
HGM (1999a) **Client**: BHP Iron Ore Pty Ltd **Type**: Targeted Flora Survey **Location**: Mt Whaleback and surrounds (8 km northwest) **Timing**: May 1999	• Follow up survey, relocating and resurveying identified and established populations	• No introduced flora species	• One significant flora taxon recorded: ○ *Lepidium catapycnon* (T) – now a P4	• No substantial limitations

Appendix H: Database Search Results

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Acanthaceae	*Dicladanthera forrestii*	●	●								
	Dipteracanthus australasicus		●								
	Dipteracanthus australasicus subsp. *australasicus*	●									
Aizoaceae	*Trianthema glossostigmum*	●	●								
	Trianthema pilosum	●	●								
	Trianthema triquetrum	●	●								
Alismataceae	*Sagittaria platyphylla*						●				Y
Amaranthaceae	*Alternanthera angustifolia*	●	●								
	Alternanthera nana	●	●								
	Alternanthera nodiflora	●	●								
	Alternanthera pungens	●	●								Y
	Amaranthus centralis				●			P3			
	Amaranthus cuspidifolius	●	●								
	Amaranthus mitchellii	●	●								
	Amaranthus undulatus	●	●								
	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 exaltatus	●									
	Ptilotus fusiformis	●	●								
	Ptilotus gaudichaudii	●	●								
	Ptilotus gomphrenoides	●	●								
	Ptilotus helipteroides	●	●								
	Ptilotus incanus	●	●								
	Ptilotus nobilis		●								
	Ptilotus obovatus	●	●								
	Ptilotus polystachyus	●	●								
	Ptilotus rotundifolius	●	●								
	Ptilotus schwartzii	●	●								
	Ptilotus xerophilus		●								
Apocynaceae	*Calotropis procera*						●				Y
	Cryptostegia madagascariensis						●				Y
	Cynanchum floribundum	●	●								
	Gymnanthera cunninghamii	●		●	●			P3			
Araceae	*Pistia stratiotes*						●				Y

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Araceae cont.	*Zantedeschia aethiopica*						●				Y
Araliaceae	*Astrotricha hamptonii*	●	●								
	Hydrocotyle ranunculoides						●				Y
	Trachymene bialata	●	●								
	Trachymene glaucifolia		●								
	Trachymene oleracea	●	●								
	Trachymene oleracea subsp. *oleracea*	●									
Asparagaceae	*Asparagus asparagoides*						●				Y
Asteraceae cont.	*Actinobole oldfieldianum*	●	●								
	Bidens bipinnata	●	●								Y
	Bidens subalternans		●								Y
	Bidens subalternans var. *araneosa*	●									Y
	Bidens subalternans var. *simulans*	●									Y
	Brachyscome ciliaris		●								
	Brachyscome rudallensis	●	●								
	Calocephalus beardii	●	●								
	Calocephalus knappii		●								
	Calocephalus pilbarensis	●	●								
	Calotis hispidula	●	●								
	Calotis latiuscula	●									
	Calotis multicaulis	●	●								
	Calotis plumulifera	●	●								
	Centipeda minima		●								
	Centipeda minima subsp. *macrocephala*	●									
	Chondrilla juncea						●				Y
	Chrysocephalum apiculatum	●	●								
	Chrysocephalum gilesii		●								
	Chrysocephalum pterochaetum	●	●								
	Erigeron bonariensis		●								Y
	Erigeron sp.	●									Y
	Flaveria trinervia	●	●								Y
	Gnephosis arachnoidea		●								
	Ixiochlamys cuneifolia	●	●								
	Lactuca saligna	●	●								Y
	Leiocarpa semicalva		●								
	Leiocarpa semicalva subsp. *semicalva*	●									
	Minuria integerrima	●	●								
	Olearia fluvialis		●								
	Olearia xerophila		●								
	Onopordum acaulon						●				Y
	Peripleura virgata	●									
	Pluchea ferdinandi-muelleri		●								
	Podolepis capillaris	●	●								
	Pterocaulon sphacelatum	●	●								
	Rhodanthe charsleyae	●	●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Asteraceae cont.	*Rhodanthe floribunda*	●	●								
	Rhodanthe margarethae	●	●								
	Rhodanthe polakii	●	●								
	Rhodanthe propinqua		●								
	Rhodanthe sterilescens	●	●								
	Rhodanthe stricta	●	●								
	Roebuckiella similis	●	●								
	Rutidosis helichrysoides	●	●								
	Rutidosis helichrysoides subsp. *helichrysoides*	●									
	Silybum marianum						●				Y
	Sonchus asper		●								Y
	Sonchus oleraceus	●	●								Y
	Streptoglossa cylindriceps	●	●								
	Streptoglossa decurrens	●	●								
	Streptoglossa liatroides	●	●								
	Streptoglossa odora	●	●								
	Symphyotrichum squamatum	●	●								Y
	Vittadinia arida		●								
	Vittadinia eremaea	●	●								
	Vittadinia virgata		●								
	Xanthium spinosum						●				Y
	Xanthium strumarium						●				Y
Boraginaceae	*Echium plantagineum*						●				Y
	Halgania erecta	●	●								
	Halgania solanacea		●								
	Heliotropium cunninghamii	●	●								
	Heliotropium heteranthum	●	●								
	Heliotropium ovalifolium		●								
	Heliotropium pachyphyllum	●	●								
	Heliotropium tanythrix	●	●								
	Heliotropium tenuifolium	●	●								
	Trichodesma zeylanicum	●	●								
	Trichodesma zeylanicum var. *zeylanicum*	●									
Brassicaceae	*Lepidium catapycnon*	●	●	●	●			P4			
	Lepidium echinatum	●	●								
	Lepidium muelleri-ferdinandii		●								
	Lepidium oxytrichum		●								
	Lepidium pedicellosum	●	●								
	Lepidium phlebopetalum	●	●								
	Lepidium pholidogynum		●								
	Lepidium platypetalum	●	●								
	Stenopetalum decipiens	●	●								
	Stenopetalum nutans		●								
	Stenopetalum velutinum	●	●								
Cactaceae	*Austrocylindropuntia cylindrica*						●				Y

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Cactaceae cont.	*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 lasiantha*	●	●								
	Capparis umbonata	●	●								
Caryophyllaceae	*Polycarpaea corymbosa*		●								
	Polycarpaea holtzei	●	●								
	Polycarpaea involucrata	●	●								
	Polycarpaea longiflora	●	●								
Celastraceae	*Maytenus* sp. Mt Windell (S. van Leeuwen 846)	●	●								
	Stackhousia intermedia	●	●								
	Stackhousia sp. swollen gynophore (W.R. Barker 2041)	●									
Chenopodiaceae cont.	*Atriplex codonocarpa*	●	●								
	Atriplex lindleyi		●								
	Atriplex semilunaris	●	●								
	Atriplex vesicaria	●	●								
	Dysphania kalpari		●								
	Dysphania melanocarpa	●	●								
	Dysphania rhadinostachya		●								
	Dysphania rhadinostachya subsp. *rhadinostachya*	●									
	Enchylaena tomentosa		●								
	Enchylaena tomentosa var. *tomentosa*	●									
	Maireana carnosa	●	●								
	Maireana georgei	●	●								
	Maireana melanocoma	●	●								
	Maireana planifolia	●	●								
	Maireana prosthecochaeta	●		●	●			P3			
	Maireana pyramidata		●								
	Maireana tomentosa	●	●								
	Maireana triptera		●								
	Maireana villosa		●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Chenopodiaceae cont.	*Rhagodia eremaea*	●	●								
	Rhagodia sp. Hamersley (M. Trudgen 17794)	●		●	●			P3			
	Salsola australis	●	●								
	Sclerolaena convexula	●	●								
	Sclerolaena cornishiana	●	●								
	Sclerolaena costata		●								
	Sclerolaena cuneata	●	●								
	Sclerolaena densiflora		●								
	Sclerolaena diacantha		●								
	Sclerolaena lanicuspis	●	●								
	Sclerolaena minuta	●	●								
	Tecticornia disarticulata	●	●								
Cleomaceae	*Areocleome oxalidea*	●	●								
	Arivela viscosa		●								
Colchicaceae	*Wurmbea deserticola*	●	●								
Convolvulaceae	*Bonamia erecta*	●	●								
	Bonamia pilbarensis	●	●								
	Convolvulus clementii	●	●								
	Evolvulus alsinoides		●								
	Evolvulus alsinoides var. *villosicalyx*	●									
	Ipomoea costata	●	●								
	Ipomoea lonchophylla	●	●								
	Ipomoea muelleri	●	●								
	Ipomoea pes-caprae		●								
	Ipomoea pes-caprae subsp. *brasiliensis*	●									
	Ipomoea plebeia	●	●								
	Ipomoea racemigera	●	●	●				P2			
	Operculina aequisepala	●	●								
	Polymeria ambigua		●								
	Polymeria calycina	●	●								
	Polymeria sp.	●									
Cucurbitaceae	*Austrobryonia pilbarensis*		●								
	Citrullus amarus	●	●								Y
Cyperaceae cont.	*Bulbostylis barbata*	●	●								
	Bulbostylis turbinata	●	●								
	Cyperus betchei		●								
	Cyperus betchei subsp. *commiscens*	●									
	Cyperus bifax	●	●								
	Cyperus cunninghamii		●								
	Cyperus cunninghamii subsp. *cunninghamii*	●									
	Cyperus ixiocarpus	●	●								
	Cyperus pulchellus		●								
	Cyperus tenuiflorus	●	●								Y
	Cyperus vaginatus	●	●								
	Eleocharis pallens	●	●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Cyperaceae cont.	*Fimbristylis dichotoma*	●	●								
	Fimbristylis microcarya	●	●								
	Fimbristylis simulans	●	●								
	Fimbristylis sp.	●									
	Schoenoplectiella laevis	●	●								
Droseraceae	*Drosera finlaysoniana*	●	●								
	Drosera indica		●								
Elatinaceae	*Bergia pedicellaris*	●	●								
Euphorbiaceae	*Euphorbia australis*		●								
	Euphorbia australis var. *subtomentosa*	●									
	Euphorbia biconvexa	●	●								
	Euphorbia careyi	●	●								
	Euphorbia coghlanii	●	●								
	Euphorbia inappendiculata var. *inappendiculata*			●				P2			
	Euphorbia porcata		●								
	Euphorbia tannensis		●								
	Euphorbia tannensis subsp. *eremophila*	●									
	Jatropha gossypiifolia						●				Y
Fabaceae cont.	*Acacia acradenia*	●	●								
	Acacia adoxa		●								
	Acacia adoxa var. *adoxa*	●									
	Acacia adoxa var. *adoxa* x *spondylophylla*	●									
	Acacia adsurgens	●	●								
	Acacia ampliceps	●	●								
	Acacia ancistrocarpa	●	●								
	Acacia aneura		●								
	Acacia aptaneura	●	●								
	Acacia arida	●	●								
	Acacia atkinsiana	●	●								
	Acacia ayersiana	●	●								
	Acacia bivenosa	●	●								
	Acacia bromilowiana			●	●			P4			
	Acacia catenulata		●								
	Acacia catenulata subsp. *occidentalis*	●									
	Acacia citrinoviridis	●	●								
	Acacia coolgardiensis		●								
	Acacia coriacea	●	●								
	Acacia coriacea subsp. *pendens*	●									
	Acacia corusca			●				P1			
	Acacia cuspidifolia	●	●								
	Acacia dictyophleba	●	●								
	Acacia elachantha	●	●								
	Acacia eriopoda	●	●								
	Acacia fuscaneura		●								
	Acacia hamersleyensis	●	●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Fabaceae cont.	*Acacia hilliana*	●	●								
	Acacia inaequilatera	●	●								
	Acacia incurvaneura	●	●								
	Acacia intorta	●									
	Acacia kempeana		●								
	Acacia ligulata		●								
	Acacia macraneura	●	●								
	Acacia maitlandii	●	●								
	Acacia marramamba	●	●								
	Acacia melleodora	●	●								
	Acacia monticola	●	●								
	Acacia mulganeura		●								
	Acacia pachyacra	●	●								
	Acacia pachycarpa	●	●								
	Acacia paraneura	●	●								
	Acacia pruinocarpa	●	●								
	Acacia pteraneura		●								
	Acacia ptychophylla	●	●								
	Acacia pyrifolia		●								
	Acacia pyrifolia var. *morrisonii*	●									
	Acacia pyrifolia var. *pyrifolia*	●									
	Acacia rhodophloia	●	●								
	Acacia rhodophloia x *sibirica*	●	●								
	Acacia sclerosperma		●								
	Acacia sclerosperma subsp. *sclerosperma*	●									
	Acacia sericophylla	●	●								
	Acacia sibirica	●	●								
	Acacia sp. Jimblebar (S. van Leeuwen 1342)	●	●								
	Acacia spondylophylla	●	●								
	Acacia subcontorta		●								
	Acacia subtiliformis			●	●			P3			
	Acacia synchronicia	●	●								
	Acacia tenuissima	●	●								
	Acacia tetragonophylla	●	●								
	Acacia trudgeniana		●								
	Acacia tumida		●								
	Acacia victoriae	●	●								
	Acacia wanyu	●	●								
	Aenictophyton reconditum		●								
	Alhagi maurorum						●				Y
	Crotalaria medicaginea		●								
	Crotalaria medicaginea var. *neglecta*	●									
	Crotalaria smithiana			●				P3			
	Cullen cinereum	●	●								
	Cullen graveolens	●	●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Fabaceae cont.	*Cullen lachnostachys*		●								
	Cullen leucanthum	●	●								
	Cullen leucochaites	●	●								
	Cullen pogonocarpum	●	●								
	Desmanthus virgatus	●	●								Y
	Desmodium campylocaulon	●	●								
	Desmodium filiforme	●	●								
	Glycine canescens		●								
	Gompholobium oreophilum	●	●								
	Gompholobium polyzygum		●								
	Indigofera colutea	●	●								
	Indigofera georgei	●	●								
	Indigofera gilesii	●	●	●	●			P3			
	Indigofera monophylla	●	●								
	Indigofera rugosa	●	●								
	Isotropis atropurpurea	●	●								
	Isotropis iophyta	●									
	Isotropis parviflora	●		●				P2			
	Jacksonia aculeata	●	●								
	Kennedia prorepens	●	●								
	Lotus cruentus	●	●								
	Mirbelia ramulosa	●									
	Mirbelia viminalis	●	●								
	Muelleranthus trifoliolatus	●	●								
	Neptunia dimorphantha	●	●								
	Parkinsonia aculeata						●				Y
	Petalostylis cassioides	●	●								
	Petalostylis labicheoides	●	●								
	Prosopis glandulosa x *velutina*						●				Y
	Rhynchosia australis	●	●								
	Rhynchosia minima		●								
	Senna alata						●				Y
	Senna artemisioides	●	●								
	Senna artemisioides subsp. *filifolia*	●									
	Senna artemisioides subsp. *helmsii*	●									
	Senna artemisioides subsp. *oligophylla*	●									
	Senna ferraria	●	●								
	Senna glaucifolia	●	●								
	Senna glutinosa		●								
	Senna glutinosa subsp. *glutinosa*	●									
	Senna glutinosa subsp. *pruinosa*	●									
	Senna glutinosa subsp. x *luerssenii*	●									
	Senna hamersleyensis	●	●								
	Senna notabilis	●	●								
	Senna obtusifolia						●				Y

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Fabaceae cont.	*Senna occidentalis*	●	●								Y
	Senna sp. Billabong (J.D. Alonzo 721)	●	●								
	Senna sp. Meekatharra (E. Bailey 1-26)	●	●								
	Senna stricta	●	●								
	Senna venusta	●	●								
	Swainsona decurrens	●	●								
	Swainsona formosa		●								
	Swainsona leeana	●	●								
	Swainsona thompsoniana			●				P3			
	Tephrosia densa	●	●								
	Tephrosia oxalidea	●	●								
	Tephrosia rosea		●								
	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. Willowra (G.M. Chippendale 4809)		●								
	Tephrosia supina	●	●								
	Ulex europaeus						●				Y
	Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)	●	●								
Frankeniaceae	*Frankenia setosa*	●	●								
Geraniaceae	*Erodium cygnorum*	●	●								
Goodeniaceae cont.	*Brunonia australis*	●	●								
	Brunonia australis var. A Kimberley Flora (K.F. Kenneally 5452)	●									
	Dampiera candicans	●	●								
	Dampiera cinerea	●	●								
	Dampiera metallorum			●				P3			
	Goodenia azurea		●								
	Goodenia azurea subsp. hesperia	●									
	Goodenia berringbinensis	●		●				P4			
	Goodenia forrestii	●	●								
	Goodenia hartiana			●	●			P2			
	Goodenia lamprosperma	●	●								
	Goodenia microptera	●	●								
	Goodenia mimuloides		●								
	Goodenia muelleriana	●	●								
	Goodenia nuda	●		●				P4			
	Goodenia pascua		●								
	Goodenia prostrata	●	●								
	Goodenia ramelii	●	●								
	Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	●		●	●			P3			
	Goodenia sp. Sandy Creek (R.D. Royce 1653)	●	●								
	Goodenia stellata		●								
	Goodenia stobbsiana	●	●								
	Goodenia tenuiloba	●	●								

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		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Goodeniaceae cont.	*Goodenia triodiophila*	●	●								
	Goodenia vilmoriniae	●	●								
	Scaevola acacioides	●	●								
	Scaevola browniana	●	●								
	Scaevola browniana subsp. *browniana*	●									
	Scaevola parvifolia		●								
	Scaevola parvifolia subsp. *pilbarae*	●									
	Scaevola sp. Mt Nameless (P.A.S. Wurm 1443)	●	●								
	Scaevola spinescens	●	●								
	Velleia connata		●								
	Velleia glabrata	●									
Gyrostemonaceae	*Codonocarpus cotinifolius*	●	●								
Haloragaceae	*Gonocarpus ephemerus*	●	●								
	Haloragis gossei	●	●								
	Haloragis gossei var. *gossei*	●									
	Haloragis maierae	●	●								
Hemerocallidaceae	*Tricoryne* sp. Hamersley Range (S. van Leeuwen 915)		●								
Iridaceae	*Moraea flaccida*						●				Y
	Moraea miniata						●				Y
Lamiaceae	*Clerodendrum floribundum*		●								
	Clerodendrum floribundum var. *angustifolium*	●									
	Dicrastylis cordifolia	●	●								
	Dicrastylis kumarinensis	●	●								
	Newcastelia cephalantha	●	●								
	Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)	●	●								
	Pityrodia augustensis					●		T		VUL	
Lauraceae	*Cassytha capillaris*	●	●								
Loganiaceae	*Mitrasacme connata*	●	●								
Loranthaceae	*Amyema bifurcata*	●	●								
	Amyema fitzgeraldii	●	●								
	Amyema gibberula		●								
	Amyema gibberula var. *gibberula*	●									
	Amyema hilliana	●	●								
	Amyema preissii	●	●								
	Lysiana casuarinae	●	●								
	Lysiana murrayi		●								
	Lysiana subfalcata		●								
Lythraceae	*Ammannia multiflora*	●	●								
	Rotala diandra	●	●								
Malvaceae	*Abutilon amplum*	●	●								
	Abutilon cryptopetalum		●								
	Abutilon cunninghamii	●	●								
	Abutilon fraseri	●	●								
	Abutilon lepidum	●	●								
	Abutilon macrum		●								

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		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Malvaceae cont.	*Abutilon malvifolium*	●	●								
	Abutilon otocarpum	●	●								
	Abutilon oxycarpum	●	●								
	Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	●	●								
	Abutilon sp. Pilbara (W.R. Barker 2025)	●	●								
	Androcalva loxophylla		●								
	Androcalva luteiflora	●	●								
	Corchorus crozophorifolius	●	●								
	Corchorus laniflorus		●								
	Corchorus lasiocarpus	●	●								
	Corchorus lasiocarpus subsp. *lasiocarpus*	●									
	Corchorus lasiocarpus subsp. *parvus*	●									
	Corchorus sp. Hamersley Range hilltops (S. van Leeuwen 3826)	●	●								
	Corchorus tridens	●	●								
	Corchorus walcottii		●								
	Gossypium sturtianum		●								
	Gossypium sturtianum var. *sturtianum*	●									
	Hibiscus austrinus		●								
	Hibiscus austrinus var. *austrinus*	●									
	Hibiscus burtonii	●	●								
	Hibiscus campanulatus	●						P1			
	Hibiscus coatesii	●	●								
	Hibiscus goldsworthii	●	●								
	Hibiscus haynaldii	●	●								
	Hibiscus sturtii	●	●								
	Hibiscus sturtii var. *grandiflorus*	●									
	Hibiscus sturtii var. *truncatus*	●									
	Hibiscus verdcourtii	●	●								
	Malvastrum americanum	●	●								Y
	Seringia exastia	●									
	Seringia nephrosperma	●	●								
	Sida arenicola	●	●								
	Sida brownii	●	●								
	Sida calyxhymenia	●	●								
	Sida cardiophylla	●	●								
	Sida corrugata		●								
	Sida echinocarpa	●	●								
	Sida ectogama		●								
	Sida fibulifera	●	●								
	Sida sp. Excedentifolia (J.L. Egan 1925)	●	●								
	Sida sp. Kathleen Springs (A.C. Beauglehole 26934)		●								
	Sida sp. L (A.M. Ashby 4202)	●	●								
	Sida sp. Pilbara (A.A. Mitchell PRP 1543)	●	●								
	Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	●	●								
	Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	●	●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Malvaceae cont.	*Sida* sp. tiny glabrous fruit (A.A. Mitchell PRP1152)	●									
	Sida trichopoda	●	●								
	Triumfetta leptacantha	●	●								
	Triumfetta maconochieana	●	●								
	Waltheria virgata		●								
Marsileaceae	*Marsilea exarata*	●	●								
	Marsilea hirsuta	●	●								
Molluginaceae	*Hypertelis cerviana*		●								
	Trigastrotheca molluginea		●								
Moraceae	*Ficus brachypoda*	●	●								
Myrtaceae	*Calytrix carinata*	●	●								
	Corymbia aspera	●	●								
	Corymbia candida	●	●								
	Corymbia candida subsp. *dipsodes*	●									
	Corymbia deserticola		●								
	Corymbia deserticola subsp. *deserticola*	●									
	Corymbia ferriticola	●	●								
	Corymbia hamersleyana	●	●								
	Corymbia lenziana		●								
	Corymbia opaca	●	●								
	Corymbia terminalis		●								
	Eucalyptus camaldulensis		●								
	Eucalyptus camaldulensis subsp. *refulgens*	●									
	Eucalyptus ewartiana	●	●								
	Eucalyptus gamophylla	●	●								
	Eucalyptus kingsmillii	●	●								
	Eucalyptus leucophloia		●								
	Eucalyptus leucophloia subsp. *leucophloia*	●									
	Eucalyptus lucasii	●	●								
	Eucalyptus patellaris		●								
	Eucalyptus pilbarensis		●								
	Eucalyptus repullulans	●	●								
	Eucalyptus socialis	●	●								
	Eucalyptus socialis subsp. *eucentrica*	●									
	Eucalyptus striaticalyx		●								
	Eucalyptus trivalva	●	●								
	Eucalyptus victrix	●	●								
	Eucalyptus xerothermica	●	●								
	Lamarchea sulcata	●	●								
	Melaleuca eleuterostachya		●								
	Melaleuca glomerata	●	●								
Nyctaginaceae	*Boerhavia repleta*	●	●								
Oleaceae	*Jasminum didymum*		●								
	Jasminum didymum subsp. *lineare*	●									
Oxalidaceae	*Oxalis* sp. Pilbara (M.E. Trudgen 12725)			●				P2			

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Phrymaceae	*Mimulus gracilis*	●	●								
	Peplidium maritimum		●								
Phyllanthaceae	*Phyllanthus virgatus*	●	●								
	Synostemon rhytidospermus	●	●								
Plantaginaceae	*Stemodia viscosa*	●	●								
Plumbaginaceae	*Plumbago zeylanica*	●	●								
Poaceae	*Amphipogon caricinus*	●	●								
	Amphipogon sericeus	●	●								
	Aristida burbidgeae	●	●								
	Aristida contorta	●	●								
	Aristida inaequiglumis	●	●								
	Aristida jerichoensis var. *subspinulifera*	●		●				P3			
	Aristida latifolia	●	●								
	Aristida lazaridis			●				P2			
	Aristida nitidula	●									
	Aristida obscura	●	●								
	Aristida sp.	●									
	Astrebla elymoides	●	●								
	Austrostipa nitida	●	●								
	Brachyachne prostrata		●								
	Cenchrus ciliaris	●	●			●					Y
	Cenchrus setiger	●	●								Y
	Chloris pectinata	●	●								
	Chloris pumilio	●	●								
	Chloris sp.	●									
	Chloris virgata	●	●								Y
	Chrysopogon fallax	●	●								
	Cymbopogon ambiguus	●	●								
	Cynodon convergens	●	●								
	Cynodon dactylon	●	●								Y
	Cynodon prostratus	●	●								
	Dactyloctenium radulans	●	●								
	Dichanthium fecundum	●	●								
	Dichanthium sericeum		●								
	Dichanthium sericeum subsp. *humilius*	●									
	Dichanthium sericeum subsp. *sericeum*	●									
	Digitaria ammophila	●	●								
	Digitaria brownii	●	●								
	Digitaria ciliaris		●								Y
	Digitaria ctenantha	●	●								
	Diplachne fusca		●								Y
	Diplachne fusca subsp. *muelleri*	●									
	Echinochloa colona	●	●								Y
	Elytrophorus spicatus	●	●								
	Enneapogon avenaceus	●	●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Poaceae cont.	*Enneapogon caerulescens*	●	●								
	Enneapogon lindleyanus	●	●								
	Enneapogon polyphyllus	●	●								
	Enneapogon robustissimus	●	●								
	Enteropogon ramosus	●	●								
	Eragrostis cumingii		●								
	Eragrostis dielsii	●	●								
	Eragrostis elongata	●	●								
	Eragrostis eriopoda	●	●								
	Eragrostis lanipes	●	●								
	Eragrostis leptocarpa	●	●								
	Eragrostis olida	●	●								
	Eragrostis setifolia	●	●								
	Eragrostis speciosa	●	●								
	Eragrostis tenellula	●	●								
	Eragrostis xerophila		●								
	Eriachne aristidea		●								
	Eriachne benthamii		●								
	Eriachne flaccida		●								
	Eriachne lanata	●	●								
	Eriachne mucronata	●	●								
	Eriachne obtusa	●	●								
	Eriachne pulchella		●								
	Eriachne pulchella subsp. *dominii*	●									
	Eriachne pulchella subsp. *pulchella*	●									
	Eriachne tenuiculmis	●	●								
	Eriochloa pseudoacrotricha	●	●								
	Eulalia aurea	●	●								
	Iseilema dolichotrichum	●	●								
	Iseilema eremaeum	●	●								
	Iseilema membranaceum	●	●								
	Iseilema vaginiflorum	●	●								
	Leptochloa digitata	●	●								
	Monachather paradoxus		●								
	Panicum decompositum	●	●								
	Panicum effusum	●	●								
	Paraneurachne muelleri	●	●								
	Paspalidium clementii	●	●								
	Paspalidium constrictum	●	●								
	Paspalidium rarum	●	●								
	Perotis rara	●	●								
	Schizachyrium fragile	●	●								
	Setaria dielsii	●	●								
	Setaria surgens	●	●								
	Setaria verticillata	●	●								Y

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Poaceae cont.	*Sorghum plumosum*		●								
	Sporobolus actinocladus	●	●								
	Sporobolus australasicus	●	●								
	Themeda sp. Hamersley Station (M.E. Trudgen 11431)	●		●				P3			
	Themeda triandra	●	●								
	Thyridolepis mitchelliana		●								
	Thyridolepis xerophila	●	●								
	Tragus australianus	●	●								
	Triodia angusta	●	●								
	Triodia basedowii	●	●								
	Triodia bitextura		●								
	Triodia brizoides	●	●								
	Triodia epactia		●								
	Triodia longiceps	●	●								
	Triodia melvillei	●	●								
	Triodia pungens	●	●								
	Triodia schinzii	●	●								
	Triodia sp. Mt Ella (M.E. Trudgen 12739)	●		●				P3			
	Triodia vanleeuwenii	●	●								
	Triodia wiseana	●	●								
	Triraphis mollis	●	●								
	Urochloa piligera	●	●								
	Urochloa subquadripara		●								
	Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)			●				P1			
	Xerochloa imberbis	●	●								
	Yakirra australiensis		●								
	Yakirra australiensis var. *australiensis*	●									
Polygalaceae	*Polygala glaucifolia*	●	●								
Polygonaceae	*Rumex vesicarius*	●	●								Y
Portulacaceae	*Calandrinia ptychosperma*	●	●								
	Calandrinia quadrivalvis		●								
	Calandrinia reticulata	●	●								
	Calandrinia schistorhiza	●	●								
	Calandrinia stagnensis		●								
	Calandrinia tepperiana	●									
	Portulaca cyclophylla	●	●								
	Portulaca decipiens	●	●								
	Portulaca filifolia	●	●								
	Portulaca intraterranea	●	●								
	Portulaca oleracea		●								
Proteaceae	*Grevillea berryana*		●								
	Grevillea juncifolia		●								
	Grevillea juncifolia subsp. *juncifolia*	●									
	Grevillea pyramidalis	●	●								
	Grevillea stenobotrya	●									

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Proteaceae cont.	*Grevillea striata*	●	●								
	Grevillea wickhamii		●								
	Grevillea wickhamii subsp. *aprica*	●									
	Grevillea wickhamii subsp. *hispidula*	●									
	Hakea chordophylla	●	●								
	Hakea lorea		●								
	Hakea lorea subsp. *lorea*	●									
	Hakea preissii	●	●								
Pteridaceae	*Cheilanthes brownii*	●	●								
	Cheilanthes lasiophylla	●	●								
	Cheilanthes sieberi		●								
	Cheilanthes sieberi subsp. *pseudovellea*	●									
	Cheilanthes sieberi subsp. *sieberi*	●									
	Cheilanthes tenuifolia	●									
Rhamnaceae	*Cryptandra monticola*		●								
	Ziziphus mauritiana						●				Y
Rosaceae	*Rubus anglocandicans*						●				Y
	Rubus laudatus						●				Y
	Rubus rugosus						●				Y
	Rubus ulmifolius						●				Y
Rubiaceae	*Oldenlandia crouchiana*	●									
	Psydrax latifolia	●	●								
Ruppiaceae	*Ruppia polycarpa*	●	●								
Santalaceae	*Anthobolus leptomerioides*	●	●								
	Santalum lanceolatum	●	●								
Sapindaceae	*Diplopeltis stuartii*		●								
	Diplopeltis stuartii var. *stuartii*	●									
	Dodonaea coriacea	●	●								
	Dodonaea lanceolata		●								
	Dodonaea pachyneura	●	●								
Scrophulariaceae	*Eremophila canaliculata*	●	●								
	Eremophila capricornica			●				P1			
	Eremophila clarkei	●	●								
	Eremophila cuneifolia	●	●								
	Eremophila exilifolia	●	●								
	Eremophila flaccida		●								
	Eremophila flaccida subsp. *flaccida*	●									
	Eremophila forrestii		●								
	Eremophila forrestii subsp. *forrestii*	●									
	Eremophila fraseri		●								
	Eremophila fraseri subsp. *fraseri*	●									
	Eremophila galeata	●	●								
	Eremophila incisa	●	●								
	Eremophila jucunda		●								
	Eremophila jucunda subsp. *pulcherrima*	●									

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Scrophulariaceae cont.	*Eremophila lachnocalyx*	●	●								
	Eremophila lanceolata	●	●								
	Eremophila latrobei		●								
	Eremophila latrobei subsp. *latrobei*	●									
	Eremophila longifolia	●	●								
	Eremophila maculata		●								
	Eremophila maculata subsp. *brevifolia*	●									
	Eremophila maculata subsp. *maculata*	●									
	Eremophila magnifica		●								
	Eremophila magnifica subsp. *magnifica*	●		●				P4			
	Eremophila magnifica subsp. *velutina*	●		●				P3			
	Eremophila margarethae	●	●								
	Eremophila platycalyx		●								
	Eremophila platycalyx subsp. Neds Creek (N.H. Speck 1228)	●									
	Eremophila platycalyx subsp. *pardalota*	●									
	Eremophila rhegos	●	●	●				P1			
	Eremophila rigida	●		●				P3			
	Eremophila sp. Hamersley Range (K. Walker KW 136)	●		●				P3			
	Eremophila sp. West Angelas (S. van Leeuwen 4068)			●				P1			
	Eremophila tietkensii		●								
	Eremophila youngii subsp. *lepidota*	●		●				P4			
	Myoporum montanum	●	●								
Solanaceae	*Nicotiana benthamiana*	●	●								
	Nicotiana occidentalis		●								
	Nicotiana occidentalis subsp. *obliqua*	●									
	Nicotiana rosulata		●								
	Nicotiana rosulata subsp. *rosulata*	●									
	Solanum centrale	●	●								
	Solanum cleistogamum	●	●								
	Solanum diversiflorum		●								
	Solanum elaeagnifolium						●				Y
	Solanum elatius	●	●								
	Solanum lachnophyllum		●								
	Solanum lasiophyllum	●	●								
	Solanum linnaeanum						●				Y
	Solanum morrisonii		●								
	Solanum piceum		●								
	Solanum sturtianum		●								
Stylidiaceae	*Stylidium desertorum*		●								
Tamaricaceae	*Tamarix aphylla*						●				Y
Thymelaeaceae	*Pimelea forrestiana*	●	●								
Typhaceae	*Typha domingensis*	●	●								
Verbenaceae	*Lantana camara*						●				Y
Violaceae	*Afrohybanthus aurantiacus*	●	●								
Zygophyllaceae	*Roepera rowelliae*		●								

Family	Taxon	Source						Conservation Code			Introduced
		NM	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Zygophyllaceae cont.	*Roepera similis*		●								
	Tribulus astrocarpus	●	●								
	Tribulus eichlerianus	●									
	Tribulus hirsutus	●	●								
	Tribulus hystrix		●								
	Tribulus macrocarpus	●	●								
	Tribulus suberosus		●								
	Tribulus terrestris		●								Y

Appendix I: Introduced Flora Search Results

Family	Taxon	Source				Declared Pests (DPs)	Weeds of National Significance (WoNS)	Ecological Rating	Invasiveness Rating
		NM	ALA	EPBC	WAOL				
Alismataceae	*Sagittaria platyphylla*				●	Yes	Yes	Not assessed	Not assessed
Amaranthaceae	*Alternanthera pungens*	●	●			No	No	Low	Slow
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
	Bidens subalternans		●			No	No	Not assessed	Not assessed
	Bidens subalternans var. *araneosa*	●				No	No	Not assessed	Not assessed
	Bidens subalternans var. *simulans*	●				No	No	Not assessed	Not assessed
	Chondrilla juncea				●	Yes	No	Not assessed	Not assessed
	Erigeron bonariensis		●			No	No	Not assessed	Not assessed
	Erigeron sp.	●				No	No	Not assessed	Not assessed
	Flaveria trinervia	●	●			No	No	Not assessed	Not assessed
	Lactuca saligna	●	●			No	No	Not assessed	Not assessed
	Onopordum acaulon				●	Yes	No	Not assessed	Not assessed
	Silybum marianum				●	Yes	No	Not assessed	Not assessed
	Sonchus asper		●			No	No	Not assessed	Not assessed
	Sonchus oleraceus	●	●			No	No	Low	Rapid
	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
	Cylindropuntia imbricata				●	Yes	Yes	Not assessed	Not assessed
	Cylindropuntia kleiniae				●	Yes	Yes	Not assessed	Not assessed

Family	Taxon	Source				Declared Pests (DPs)	Weeds of National Significance (WoNS)	Ecological Rating	Invasiveness Rating
		NM	ALA	EPBC	WAOL				
Cactaceae cont.	*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
Cyperaceae	*Cyperus tenuiflorus*	●	●			No	No	Not assessed	Not assessed
Euphorbiaceae	*Jatropha gossypiifolia*				●	Yes	Yes	Not assessed	Not assessed
Fabaceae	*Alhagi maurorum*				●	Yes	No	Not assessed	Not assessed
	Desmanthus virgatus	●	●			No	No	Not assessed	Not assessed
	Parkinsonia aculeata				●	Yes	Yes	High	Rapid
	Prosopis glandulosa x *velutina*				●	Yes	Yes	High	Rapid
	Senna alata				●	Yes	No	Not assessed	Not assessed
	Senna obtusifolia				●	Yes	No	Not assessed	Not assessed
	Senna occidentalis	●	●			No	No	Not assessed	Not assessed
	Ulex europaeus				●	Yes	Yes	Not assessed	Not assessed
Iridaceae	*Moraea flaccida*				●	Yes	No	Not assessed	Not assessed
	Moraea miniata				●	Yes	No	Not assessed	Not assessed
Malvaceae	*Malvastrum americanum*	●	●			No	No	High	Rapid
Poaceae	*Cenchrus ciliaris*	●	●	●		No	No	High	Rapid
	Cenchrus setiger	●	●			No	No	High	Rapid
	Chloris virgata	●	●			No	No	High	Rapid

Family	Taxon	Source				Declared Pests (DPs)	Weeds of National Significance (WoNS)	Ecological Rating	Invasiveness Rating
		NM	ALA	EPBC	WAOL				
Poaceae cont.	*Cynodon dactylon*	●	●			No	No	High	Rapid
	Digitaria ciliaris		●			No	No	Low	Slow
	Diplachne fusca		●			No	No	Not assessed	Not assessed
	Echinochloa colona	●	●			No	No	High	Rapid
	Setaria verticillata	●	●			No	No	High	Rapid
Polygonaceae	*Rumex vesicarius*	●	●			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	*Solanum elaeagnifolium*				●	Yes	Yes	Not assessed	Not assessed
	Solanum linnaeanum				●	Yes	No	Not assessed	Not assessed
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

Family	Taxon	Survey Area	
		Pipelines	Whaleback
Acanthaceae	*Dicladanthera forrestii*	✓	
	Dipteracanthus australasicus subsp. *australasicus*	✓	✓
Aizoaceae	*Trianthema triquetrum*	✓	
Amaranthaceae	**Aerva javanica*	✓	
	Alternanthera angustifolia	✓	
	Alternanthera denticulata	✓	
	Alternanthera nana	✓	
	Gomphrena canescens	✓	✓
	Ptilotus astrolasius	✓	✓
	Ptilotus calostachyus	✓	✓
	Ptilotus clementii	✓	✓
	Ptilotus exaltatus	✓	✓
	Ptilotus gaudichaudii	✓	
	Ptilotus gomphrenoides	✓	
	Ptilotus helipteroides	✓	✓
	Ptilotus obovatus var. *obovatus*	✓	✓
	Ptilotus polystachyus	✓	✓
	Ptilotus roei	✓	
	Ptilotus rotundifolius	✓	✓
	Ptilotus schwartzii var. *schwartzii*	✓	
Apocynaceae	*Vincetoxicum flexuosum*	✓	
	Vincetoxicum lineare	✓	
Asteraceae	**Bidens bipinnata*	✓	✓
	Centipeda minima subsp. *macrocephala*	✓	
	Chrysocephalum apiculatum subsp. *pilbarense*	✓	
	Chrysocephalum gilesii	✓	
	Peripleura arida		✓
	Pluchea ferdinandi-muelleri	✓	
	Pterocaulon sphacelatum	✓	✓
Boraginaceae	*Heliotropium heteranthum*	✓	
	Heliotropium ovalifolium		✓
	Heliotropium tanythrix	✓	
	Heliotropium tenuifolium	✓	✓
	Trichodesma zeylanicum var. *zeylanicum*	✓	✓
Caryophyllaceae	*Polycarpaea corymbosa*	✓	
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*	✓	
	Maireana georgei		✓
	Maireana melanocoma	✓	✓
	Maireana pyramidata	✓	
	Maireana triptera	✓	
	Maireana villosa	✓	
	Rhagodia eremaea	✓	✓
	Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)	✓	
	Salsola australis	✓	
	Sclerolaena bicornis	✓	

Family	Taxon	Survey Area	
		Pipelines	Whaleback
Chenopodiaceae cont.	*Sclerolaena cornishiana*	✓	
	Sclerolaena cuneata	✓	
	Sclerolaena diacantha	✓	
	Sclerolaena eriacantha	✓	
	Sclerolaena lanicuspis	✓	
Cleomaceae	*Arivela viscosa*	✓	✓
Convolvulaceae	*Bonamia pilbarensis*		✓
	Duperreya commixta	✓	✓
	Evolvulus alsinoides var. *decumbens*	✓	✓
	Evolvulus alsinoides var. *villosicalyx*	✓	✓
	Ipomoea calobra	✓	
	Ipomoea muelleri	✓	
	Operculina aequisepala	✓	
Cucurbitaceae	*Cucumis melo*	✓	
	Cucumis variabilis	✓	✓
Cyperaceae	*Bulbostylis barbata*	✓	
	Cyperus difformis	✓	
	Cyperus vaginatus	✓	
	Eleocharis pallens	✓	
	Fimbristylis dichotoma	✓	
	Fimbristylis simulans		✓
	Schoenoplectiella dissachantha	✓	
Euphorbiaceae	*Euphorbia australis* var. *subtomentosa*		✓
	Euphorbia biconvexa	✓	✓
	Euphorbia boophthona	✓	✓
Fabaceae	*Acacia ?adsurgens*	✓	
	Acacia adsurgens	✓	✓
	Acacia ancistrocarpa	✓	
	Acacia aptaneura	✓	✓
	Acacia bivenosa	✓	✓
	Acacia catenulata subsp. *occidentalis*	✓	
	Acacia citrinoviridis	✓	
	Acacia colei var. *colei*	✓	
	Acacia coriacea subsp. *pendens*	✓	
	Acacia dictyophleba	✓	✓
	Acacia hilliana	✓	
	Acacia inaequilatera	✓	✓
	Acacia incurvaneura	✓	
	Acacia macraneura	✓	
	Acacia maitlandii	✓	✓
	Acacia pachyacra	✓	✓
	Acacia paraneura	✓	
	Acacia pruinocarpa	✓	✓
	Acacia pteraneura	✓	
	Acacia pyrifolia var. *pyrifolia*		✓

Family	Taxon	Survey Area	
		Pipelines	Whaleback
Fabaceae cont.	*Acacia rhodophloia*	✓	
	Acacia rhodophloia x *sibirica*	✓	
	Acacia sclerosperma subsp. *sclerosperma*	✓	✓
	Acacia sibirica	✓	✓
	Acacia subcontorta	✓	
	Acacia synchronicia	✓	✓
	Acacia tetragonophylla	✓	✓
	Crotalaria medicaginea var. *neglecta*	✓	
	Indigofera georgei	✓	
	Indigofera linifolia	✓	✓
	Indigofera monophylla	✓	✓
	Isotropis iophyta	✓	
	Kennedia prorepens	✓	✓
	Neptunia dimorphantha	✓	
	Petalostylis labicheoides	✓	✓
	Rhynchosia minima	✓	✓
	Senna artemisioides subsp. *helmsii*	✓	✓
	Senna artemisioides subsp. *oligophylla*	✓	✓
	Senna artemisioides subsp. *oligophylla* x hybrid	✓	
	Senna artemisioides subsp. x *artemisioides*	✓	✓
	Senna glaucifolia	✓	
	Senna glutinosa	✓	
	Senna glutinosa subsp. *glutinosa*		✓
	Senna glutinosa subsp. *pruinosa*	✓	✓
	Senna glutinosa subsp. x *luerssenii*	✓	✓
	Senna hamersleyensis	✓	
	Senna notabilis	✓	✓
	Senna sp. Meekatharra (E. Bailey 1-26)	✓	
	Sesbania cannabina	✓	
	Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	✓	
	Tephrosia sp. clay soils (S. van Leeuwen et al. PBS 0273)		✓
	Tephrosia sp. Newman (A.A. Mitchell PRP 29)	✓	✓
	**Vachellia farnesiana*	✓	
	Vigna lanceolata		✓
Goodeniaceae	*Dampiera candicans*	✓	
	Goodenia cusackiana	✓	
	Goodenia lamprosperma	✓	
	Goodenia microptera	✓	✓
	Goodenia muelleriana	✓	✓
	Goodenia stobbsiana	✓	
	Goodenia triodiophila	✓	
	Goodenia vilmoriniae	✓	✓
	Scaevola amblyanthera var. *amblyanthera*	✓	
	Scaevola amblyanthera var. *centralis*	✓	✓

Family	Taxon	Survey Area	
		Pipelines	Whaleback
Goodeniaceae cont.	*Scaevola spinescens*	✓	
Gyrostemonaceae	*Codonocarpus cotinifolius*	✓	✓
Loranthaceae	*Amyema gibberula* var. *gibberula*	✓	
Malvaceae	*Abutilon cryptopetalum*	✓	✓
	Abutilon cunninghamii	✓	✓
	Abutilon fraseri subsp. *fraseri*	✓	
	Abutilon lepidum	✓	✓
	Abutilon macrum	✓	✓
	Abutilon otocarpum	✓	✓
	Abutilon oxycarpum	✓	
	Abutilon sp. Indet	✓	
	Abutilon sp. Pilbara (W.R. Barker 2025)		✓
	Androcalva luteiflora	✓	
	Corchorus incanus subsp. *lithophilus*	✓	✓
	Corchorus laniflorus	✓	
	Corchorus lasiocarpus subsp. *parvus*	✓	✓
	Corchorus parviflorus	✓	
	Corchorus sp. Indet		✓
	Corchorus tridens	✓	✓
	Gossypium robinsonii	✓	
	Hibiscus burtonii	✓	✓
	Hibiscus coatesii	✓	✓
	Hibiscus sturtii var. *campylochlamys*	✓	✓
	Hibiscus sturtii var. *platychlamys*	✓	
	**Malvastrum americanum*	✓	✓
	Melhania oblongifolia	✓	
	Seringia exastia (T)	✓	
	Sida ectogama	✓	
	Sida fibulifera	✓	✓
	Sida platycalyx	✓	
	Sida sp. Indet		✓
	Triumfetta clementii	✓	
Marsileaceae	*Marsilea hirsuta*	✓	
Molluginaceae	*Glinus lotoides*	✓	
Montiaceae	*Calandrinia schistorhiza*	✓	
Myrtaceae	*Corymbia candida* subsp. *dipsodes*	✓	
	Corymbia hamersleyana	✓	✓
	Eucalyptus camaldulensis subsp. *refulgens*	✓	
	Eucalyptus gamophylla	✓	✓
	Eucalyptus leucophloia subsp. *leucophloia*	✓	✓
	Eucalyptus socialis subsp. *eucentrica*	✓	
	Eucalyptus victrix	✓	
	Eucalyptus xerothermica	✓	✓
	Melaleuca eleuterostachya	✓	
	Melaleuca glomerata	✓	

Family	Taxon	Survey Area	
		Pipelines	Whaleback
Nyctaginaceae	*Boerhavia coccinea*	✓	✓
Oleaceae	*Jasminum didymum* subsp. *lineare*	✓	
Phyllanthaceae	*Phyllanthus maderaspatensis*	✓	
Plantaginaceae	*Stemodia viscosa*	✓	
Poaceae	*Acrachne racemosa*		✓
	Aristida contorta	✓	✓
	Aristida holathera var. *holathera*	✓	✓
	Aristida inaequiglumis	✓	✓
	Astrebla elymoides	✓	
	Astrebla pectinata	✓	
	**Cenchrus ciliaris*	✓	✓
	**Cenchrus setiger*	✓	✓
	Chloris pumilio	✓	
	Chloris sp. Indet	✓	
	Chrysopogon fallax	✓	✓
	Cymbopogon ambiguus	✓	✓
	Cynodon convergens	✓	✓
	**Cynodon dactylon*	✓	
	Cynodon prostratus	✓	
	Dactyloctenium radulans	✓	✓
	Dichanthium sericeum subsp. *humilius*	✓	✓
	Digitaria brownii	✓	✓
	Digitaria ctenantha	✓	✓
	**Echinochloa colona*	✓	
	Enneapogon caerulescens	✓	
	Enneapogon polyphyllus	✓	✓
	Enteropogon ramosus	✓	✓
	Eragrostis elongata	✓	
	Eragrostis eriopoda	✓	
	Eragrostis falcata	✓	
	Eragrostis tenellula	✓	
	Eragrostis xerophila	✓	✓
	Eriachne aristidea	✓	
	Eriachne ciliata	✓	
	Eriachne flaccida	✓	
	Eriachne lanata	✓	
	Eriachne mucronata	✓	✓
	Eriachne pulchella	✓	✓
	Eriachne pulchella subsp. *pulchella*	✓	✓
	Eulalia aurea	✓	✓
	Iseilema eremaeum	✓	
	Iseilema membranaceum	✓	✓
	Leptochloa digitata	✓	
	Monachather paradoxus	✓	
	Panicum decompositum	✓	✓

Family	Taxon	Survey Area	
		Pipelines	Whaleback
Poaceae cont.	*Paraneurachne muelleri*	✓	✓
	Paspalidium clementii	✓	
	Paspalidium constrictum	✓	✓
	Perotis rara	✓	✓
	**Setaria verticillata*	✓	
	Sporobolus australasicus	✓	✓
	Themeda triandra	✓	✓
	Thyridolepis mitchelliana	✓	
	Tragus australianus	✓	
	Triodia angusta	✓	✓
	Triodia longiceps	✓	
	Triodia pungens	✓	✓
	Triodia vanleeuwenii	✓	✓
	Triodia wiseana	✓	✓
Portulacaceae	*Portulaca cyclophylla*	✓	
	Portulaca filifolia	✓	✓
	Portulaca oleracea	✓	✓
Proteaceae	*Grevillea berryana*	✓	
	Grevillea striata	✓	
	Hakea chordophylla	✓	✓
	Hakea lorea subsp. *lorea*	✓	✓
	Hakea preissii	✓	
Pteridaceae	*Cheilanthes sieberi*	✓	
Rubiaceae	*Dolichocarpa crouchiana*		✓
	Psydrax latifolia		✓
	Psydrax suaveolens	✓	
Santalaceae	*Anthobolus leptomerioides*	✓	✓
	Santalum acuminatum	✓	
	Santalum lanceolatum	✓	✓
Sapindaceae	*Dodonaea petiolaris*		✓
Scrophulariaceae	*Eremophila ?forrestii*	✓	
	Eremophila ?margarethae	✓	
	Eremophila ?platycalyx	✓	
	Eremophila cuneifolia	✓	✓
	Eremophila forrestii subsp. *forrestii*	✓	
	Eremophila fraseri subsp. *fraseri*	✓	✓
	Eremophila lachnocalyx	✓	
	Eremophila latrobei	✓	
	Eremophila latrobei subsp. *latrobei*	✓	✓
	Eremophila longifolia	✓	✓
	Eremophila platycalyx subsp. *pardalota*	✓	✓
Solanaceae	*Solanum cleistogamum*		✓
	Solanum lasiophyllum	✓	✓
Surianaceae	*Stylobasium spathulatum*	✓	
Violaceae	*Afrohybanthus aurantiacus*	✓	

Family	Taxon	Survey Area	
		Pipelines	Whaleback
Zygophyllaceae	*Tribulopis angustifolia*		✓
	Tribulus astrocarpus	✓	
	Tribulus hirsutus	✓	✓
	Tribulus platypterus	✓	
	Tribulus suberosus	✓	✓

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