Level 1 Flora and Vegetation Survey Racetrack, Mulgarrie Well & the Mt Jewell Western/ Eastern Haul Road

FINAL REPORT

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Prepared For

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Executive Summary

Botanica Consulting was commissioned by Norton Gold Fields Ltd to undertake a Level 1 flora and vegetation survey of four survey areas within the Paddington Operations north of Kalgoorlie-Boulder:

1. Racetrack;
2. Mulgarrie Well;
3. Mt Jewell – Eastern Haul Road; and
4. Mt Jewell – Western Haul Road.

The Racetrack survey area is located on the western side of the the Goldfields highway approximately 13.5km south east of the Paddington Main Offices. The three remaining survey areas (Mulgarrie Well, Mt Jewell – Eastern Haul Road and Mt Jewell – Western Haul Road) are located on the eastern side of the Goldfields Highway approximately 17km north east of the Paddington Main Offices. The survey covered an area of approximately 1260 ha (of which 4ha was cleared/ rehabilitated).

28 vegetation communities were identified within the four survey areas, which were represented by a total of 26 Families, 56 Genera and 130 Taxon including sub-species and variants. No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were identified within the survey area. No Priority Flora taxa as listed by the Department of Parks and Wildlife were identified within the survey areas. An unidentified taxon of *Ricinocarpos* sp. was identified within the Mt Jewell – Western Haul Road survey area which has been identified by the Western Australian Herabarium as a potentially new species. This taxon had been previously identified in the surrounding area from previous flora and vegetation surveys conducted by Botanica Consulting. Until this taxon has been formally classified it is considered a Flora of Conservation Significance.

None of the vegetation communities within the survey areas were found to have National Environmental Significance as defined by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. No Threatened Ecological Communities pursuant to Commonwealth legislation or as listed by the Department of Parks and Wildlife were recorded within the survey area. The survey areas are not located within an Environmentally Sensitive Area, however approximately 37ha of the Mulgarrie Well survey area is located within a Schedule 1 Area centred around the historic town site of Mulgarrie Well (Class C Reserve), as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Based on the Keighery vegetation health rating scale, all 28 vegetation communities were rated as ‘good’, which depicts that vegetation structure has been affected by multiple disturbances (grazing, pastoral land use, mining activities and exploration); however it still retains its basic structure and has the ability to regenerate naturally.

Three introduced species were identified within the Racetrack survey area:

1. *Carthamus lanatus* (Saffron Thistle)
2. *Centaurea melitensis* (Maltese Cockspur); and
3. *Dittrichia graveolens* (Stinkwort).

According to the Department of Agriculture and Food Western Australia, *Carthamus lanatus* is listed as a Declared Plant under Section 22 of the *Biosecurity and Agriculture Management Act 2007*.

1 Introduction

1.1 Project Description

Botanica Consulting (BC) was commissioned by Norton Gold Fields Ltd (Norton) to conduct a Level 1 Flora and Vegetation Survey of four survey areas within the Paddington Operations:

1. Racetrack;
2. Mulgarrie Well;
3. Mt Jewell – Eastern Haul Road; and
4. Mt Jewell – Western Haul Road.

The survey areas were located within 17 tenements as shown in Figure 1. The survey covered an area of approximately 1260 ha (of which 4ha was cleared/ rehabilitated). The Racetrack survey is located within the Paddington Operations approximately 13.5km south east of the Paddington main offices. The Mulgarrie Well, Mt Jewell – Western Haul Road and Mt Jewell – Eastern Haul Road are all located to the east of the Goldfields highway approximately 17km north east of the Paddington Main offices (Figure 2). The aim of the survey was to produce a vegetation map and taxa list, as well as document the occurrence of any Threatened Ecological Communities (TEC), Priority Ecological Communities (PEC), and Threatened or Priority Flora taxa within the survey areas.

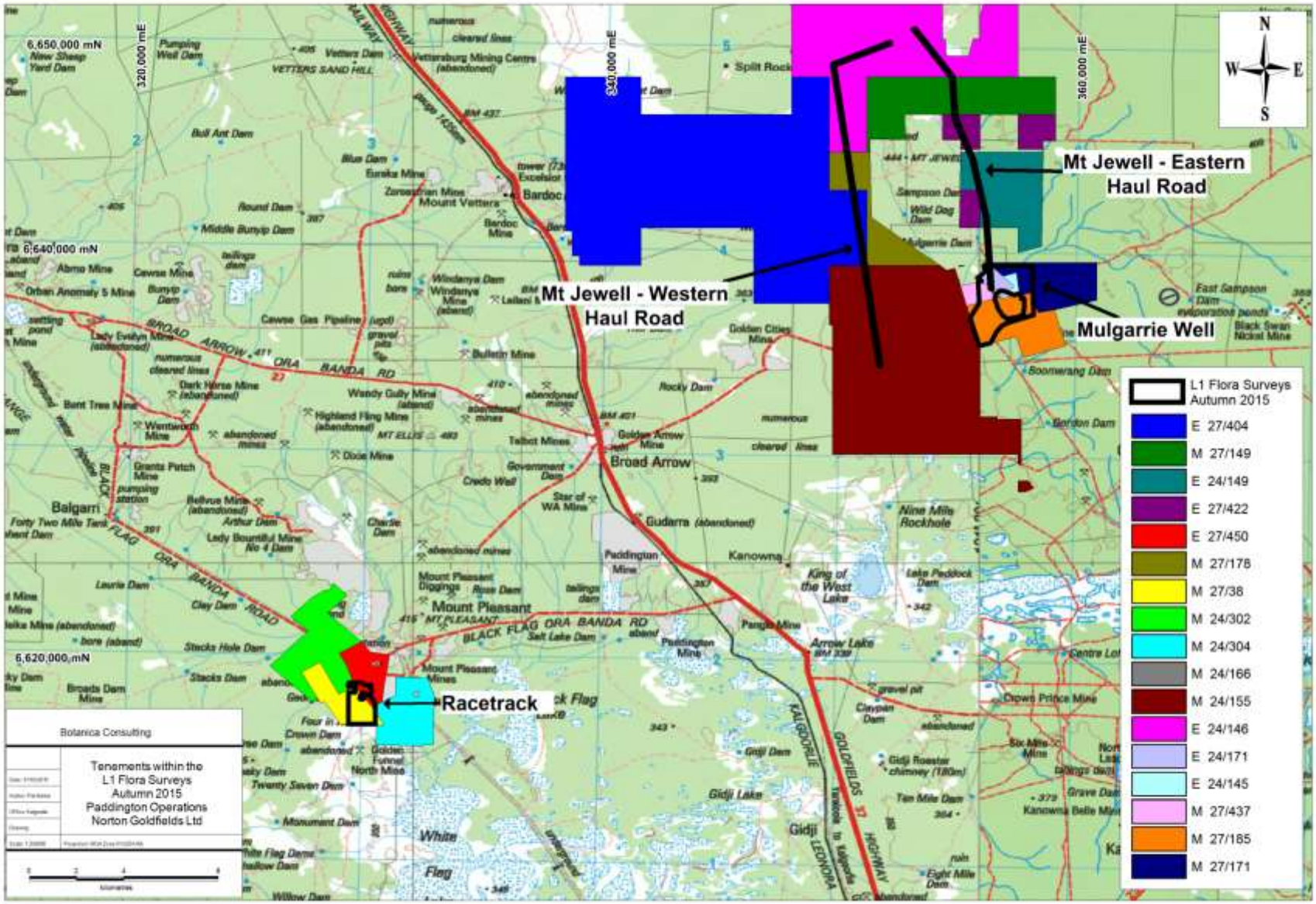

Figure 1: Tenements within the survey areas

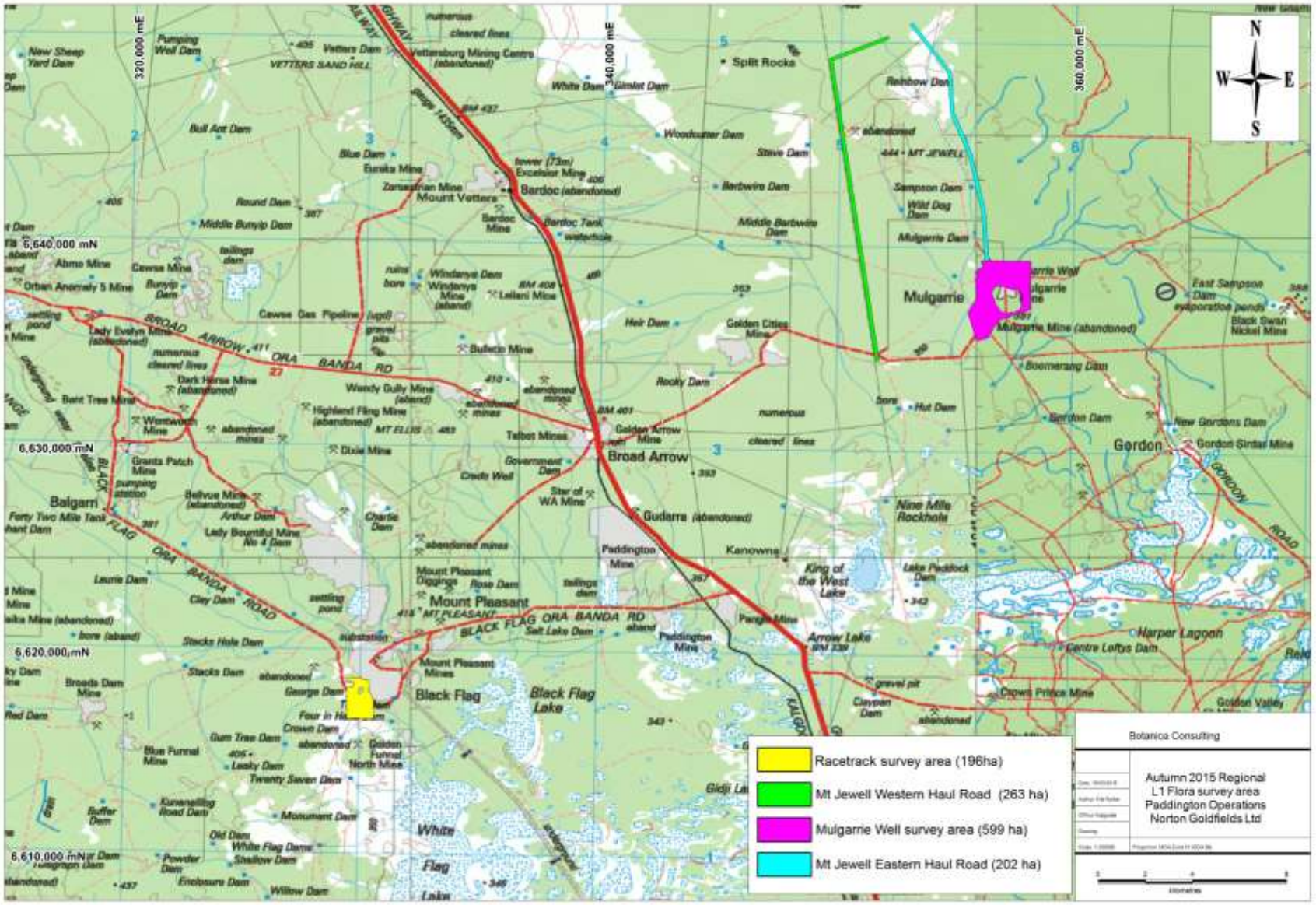

Figure 2: Regional map of the survey areas

1.2 Previous Relevant Flora Surveys

The following flora and vegetation surveys have been conducted by BC within the region surrounding the current survey areas. Results of these surveys provide useful background information about the local region and assist with desktop assessments of the survey areas. A map showing the locations of these previous flora surveys in relation to the current survey areas is provided in Figure 3.

1.2.1 Golden Cities Level 1 Flora and Vegetation Survey, Botanica Consulting, March 2008

BC was commissioned by Paddington Gold Pty Ltd (Paddington) to survey an area within the Golden Cities project (M24/564 and M24/565) covering an area of approximately 538ha (excluding current mining activity areas), located 40km north of Kalgoorlie-Boulder. The Golden Cities survey area is located approximately 4.5km west of the southern most extremity of the Mt Jewell – Western Haul Road.

Three vegetation groups were recorded within the survey area: Salmon Gum woodland; *Eucalyptus* Creek line vegetation; and Acacia woodland. The dominant families were Chenopodiaceae, Mimosaceae and Myrtaceae. These vegetation groups were comprised of 21 Families, 26 Genera and 59 Species. No Threatened Flora pursuant to Subsection 2 of Section 23F of the Western Australian *Wildlife Conservation (WC) Act 1950*, and the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* were recorded in the area, however one Priority Flora taxon was recorded; *Eremophila* sp. Mt Jackson (G.J. Keighery 4372) (P1). This taxon is no longer listed as a Priority Flora species (WAHERB, 2015).

1.2.2 Lignum Dam Tenement E24/146 Level 1 Flora and Vegetation Survey, Botanica Consulting, January 2011

BC was commissioned by Pioneer Resources Ltd to conduct a Level 1 reconnaissance Flora and Vegetation survey of the Lignum Dam deposit for the Mount Jewell Gold Project, located approximately 54km north of Kalgoorlie - Boulder. The survey covered an area of approximately 1145ha and was conducted between the 18th and the 22nd of December, 2010. Approximately 1.2km of the northern section of the Mt Jewell – Western Haul Road is located within the Ligum Dam survey area.

12 vegetation groups and one sub-group were identified within the survey area:

1. *Casuarina pauper* woodland over *Maireana sedifolia*;
2. *Eucalyptus salmonophloia* woodland over *Maireana sedifolia*;
3. *Acacia burkittii* shrubland on stony rise;
4. *Eucalyptus clelandii* woodland over *Eremophila interstans*;
5. *Eucalyptus trichopoda* Mallee woodland over *Acacia kalgoorliensis*;
6. *Acacia quadrimarginea* shrubland;

7. *Eucalyptus trichopoda* Mallee woodland over *Triodia scariosa*;
8. *Eucalyptus* and *Casuarina* mixed woodland;
9. *Eucalyptus ravida* woodland over *Atriplex vesicaria* (sub-group *E. ravida* thicket);
10. *Eucalyptus concinna* Mallee woodland over *Triodia scariosa*;
11. *Acacia* sp. narrow phyllode shrubland; and
12. *Eucalyptus concinna* Mallee woodland over *Senna artemisioides* subsp. *filifolia.*

These groups were represented by a total of 22 Families, 50 Genera and 109 Species (including subspecies and variants). No Threatened Flora, pursuant to the *WC Act 1950* or the *EPBC Act 1999* were located during the survey. No Priority Flora species were identified within the survey area. None of the vegetation groups have National Environmental Significance as defined by the Commonwealth *EPBC Act* 1999. There were no PEC as listed by the Department of Envirionment and Conservation (now known as the Department of Parks and Wildlife) or TEC as listed under Commonwealth legislation recorded within the survey area.

During the survey an unidentified *Ricinocarpos* sp was located. A sample of this species was provided to the Western Australian Herbarium for identification and was found to be a new, unclassified species.

Three weed species; *Salvia verbenaca, Carthamus lanatus* and *Centaurea melitensis* were identified in the survey area. According to the Department of Agriculture and Food (WA) *Carthamus lanatus* (Saffron thistle) is listed as a Declared Plant under Section 22 of the *Biosecurity and Agriculture Management (BAM) Act 2007*.

Based on Keighery (1994), the health condition of the 12 vegetation groups within the area surveyed were classed as being in a "good" health condition. A good health condition is defined as vegetation *"Structure affected multiple disturbances. Retains basic structure, has ability to regenerate"*.

1.2.3 Mt Jewell Haul road Level 2 Flora and Vegetation Survey, Botanica Consulting, August 2012.

BC was commissioned by Carrick Gold Limited (now known as Kal North Gold Mines Limited) to undertake a Level 2 flora and vegetation survey of the proposed Mt Jewel haul road, located approximately 48km north of Kalgoorlie-Boulder, Western Australia. The survey was conducted from the 17th to the 19th July 2012, covering an area of approximately 458ha. The northern most end of this survey area intersects the Mt Jewell – Eastern Haul Road survey area. 31 quadrats were established within the survey area.

11 vegetation communities were identified within the survey area:

1. Open low woodland of *Casuarina pauper* over low scrub of *Senna artemisioides* subsp*. filifolia* and dwarf scrub of *Ptilotus obovatus*;
2. Low woodland of *Casuarina pauper* over low scrub of *Maireana sedifolia* and dwarf scrub of *Ptilotus obovatus*;
3. Low woodland of *Eucalyptus lesouefii* over low scrub of *Maireana sedifolia* on rocky rise;
4. Scrub of *Acacia aneura/Acacia burkittii/Acacia ramulosa* over low scrub of *Dodonaea lobulata*;
5. Open low woodland of *Casuarina pauper* over scrub of *Acacia aneura* and low scrub of *Dodonaea lobulata* and *Senna artemisioides* subsp*. filifolia*;
6. Low woodland of *Eucalyptus salmonophloia/Eucalyptus salubris* over heath of mixed chenopods;
7. Mallee of *Eucalyptus concinna/Eucalyptus oleosa* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus*;
8. Scrub of *Acacia aneura/Acacia burkittii/Acacia ramulosa* in drainage area;
9. Very open mallee of *Eucalyptus oleosa* over scrub of *Acacia aneura/Acacia oswaldii/Acacia ramulosa/Acacia* sp. narrow phyllode;
10. Very open mallee of *Eucalyptus leptopoda* over scrub of *Acacia ramulosa* and dwarf scrub of *Eremophila forrestii*; and
11. Open mallee of *Eucalyptus leptopoda* over scrub of *Acacia caesaneura/Acacia ramulosa* over mid-dense hummock grass of *Triodia scariosa*.

These 11 vegetation communities were represented by a total of 28 Families, 51 Genera and 123 Species (including sub-species and variants). No Threatened Flora species, pursuant to subsection (2) of section 23F of the *WC Act 1950* and the Commonwealth *EPBC Act 1999* were identified within the survey area. There were no Priority Flora species as listed by the Department of Parks and Wildlife (DPaW) identified within the survey area.

Results of the PATN analysis revealed that with a few exceptions, namely quadrats of the three *Casuarina* vegetation communities and Very open mallee of *Eucalyptus oleosa* over scrub of *Acacia aneura/Acacia oswaldii/Acacia ramulosa/Acacia* sp. narrow phyllode vegetation community, the majority of the quadrats of a given vegetation community delineated in the field were grouped together in the PATN analysis. However of the 11 vegetation communities identified in the field only four contained only those quadrats designated to that respective vegetation community. Within all the other vegetation communities delineated from the PATN analysis there was a high degree of intermixing between vegetation communities with an individual grouping containing quadrats from anywhere up to three different vegetation communities. This result is not surprising given that majority of the vegetation communities had an upper/middle stratum of *Acacia/Casuarina* and an understorey of *Dodonaea lobulata, Ptilotus obovatus and Senna artemisioide*s subsp. *filifolia*. This intermixing suggests that the

species composition of the vegetation communities within the area is highly homogeneous with minimal distinct vegetation boundaries despite presence of distinct habitats including rocky outcrops, drainage areas, flat plains and hillslopes.

None of the vegetation communities have National Environmental Significance as defined by the *EPBC Act 1999*. No TEC pursuant to Commonwealth legislation or PEC as listed by the DPaW were recorded within the survey area. The nearest PEC is the Priority 3 'Mount Belches *Acacia quadrimarginea/Ptilotus obovatus* banded ironstone community' which is located approximately 80km south east of the survey area.

The survey area is not located in an Environmentally Sensitive Area (ESA) or within a Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Vegetation) Regulation 2004*. There are two areas of DPaW managed land approximately 15km from the Mt Jewel haul road; the Goongarrie National Park to the north-west and the Bullock Holes Timber Reserve to the south-east.

According to Keighery's vegetation health rating scale (1994), all eleven of the vegetation communities within the area were rated as being in 'very good' health. No introduced species were identified within the survey area.

1.2.4 Golden Flag Level 1 Flora and Vegetation Survey, Botanica Consulting, March 2013

BC was commissioned by Norton to undertake a Level 1 flora and vegetation survey within the Golden Flag survey area, located approximately 27km north-west of Kalgoorlie-Boulder. The survey was conducted on the 14th February 2013, covering an area of approximately 51ha. The Golden Flag survey area is located approximately 4.6km west of the Racetrack survey area.

Five vegetation communities were identified within the survey area:

1. Very open tree mallee of *Eucalyptus celastroides/Eucalyptus griffithsii* over open low scrub *Allocasuarina helmsii/Melaleuca lateriflora* and dwarf shrub of *Scaevola spinescens*;
2. Open low scrub of *Melaleuca* aff. *pauperiflora* over open low scrub *Dodonaea viscosa* subsp. *angustissima* and open dwarf scrub of *Frankenia interioris/Tecticornia pergranulata*;
3. Open scrub of *Acacia* sp. narrow phyllode (B.R. Maslin 7831) over open low scrub *Melaleuca lateriflora* and hummock grass of *Triodia scariosa*;
4. Low woodland of *Eucalyptus clelandii* over open scrub of *Acacia* sp. narrow phyllode (B.R. Maslin 7831) and dwarf scrub of *Scaevola spinescens*; and
5. Low woodland of *Eucalyptus salmonophloia* over open scrub of *Casuarina pauper* and dwarf scrub of *Maireana sedifolia.*

These five vegetation communities were represented by a total of 24 Families, 42 Genera and 82 Species (including sub-species and variants). No Threatened Flora species, pursuant to subsection (2) of section 23F of the *WC Act 1950* and the Commonwealth *EPBC Act 1999* were identified within the Golden Flag survey area. There were no Priority Flora species as listed by the DPaW identified within the Golden Flag survey area.

None of the vegetation communities have National Environmental Significance as defined by the Commonwealth *EPBC Act 1999*. No TEC pursuant to Commonwealth legislation or PEC as listed by the DPaW were recorded within the Golden Flag survey area. The survey area is not located in an ESA or within a Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Vegetation) Regulation 2004*.

According to Keighery's vegetation health rating scale (1994), all five vegetation communities within the area were rated as being in 'good' health. One introduced species were identified within the survey area; *Salvia verbenaca* (Wild Sage). According to the DAFWA this species is not listed as a Declared Plant under the *BAM Act 2007*.

1.2.5 Vegetation Assessment of the Royal Standard North Project area, Botanica Consulting, February 2014

BC was commissioned by Norton to undertake a desktop assessment and reconnaissance site assessment of the Royal Standard Project area (Tenements: M24/304 & M24/265) located approximately 28km north-west of Kalgoorlie-Boulder, Western Australia. The assessment was conducted on the 6th of February 2014, and covered an area of approximately 4.3ha (of which 3.4 ha has been cleared). The Royal Standard North Project area is located approximately 2km east of the Racetrack survey area.

The Royal Standard Project consisted of mining three open pits two of which are existing pits (Royal Standard West Pit and Royal Standard East Pit). As these areas have been previously cleared for mining no vegetation communities were present within these areas. One vegetation community was identified within Royal Standard North Pit area; Low woodland of *Eucalyptus salmonophloia* over a low mixed chenopod scrub.

The Low woodland of *Eucalyptus salmonophloia* over a low mixed chenopod scrub vegetation community was represented by a total of 13 Families, 21 Genera and 37 Species (including sub-species and variants). No Threatened Flora species pursuant to the *WC Act 1950* and the Commonwealth *EPBC Act 1999* were recorded within the survey area. No Priority Flora species were identified within the survey area.

The survey area does not have National Environmental Significance as defined by the *EPBC Act 1999*. No TECs pursuant to Commonwealth legislation or listed by the DPaW were recorded within the survey area. No PECs as listed by the DPaW were recorded within the survey area.

The Royal Standard Project is not located in an ESA, but it is located within a Schedule 1 Area, described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.* The Schedule 1 Area encompasses the boundary of the Water Reserve 3701. The Project area is not located within a DPaW managed land. It does however lie within the Great Western Woodlands which is considered by The Wilderness Society to be of global biological and conservation importance as one of the largest and healthiest temperate woodlands on Earth, containing many endemic species.

According to Keighery's vegetation health rating scale (1994), the Low woodland of *Eucalyptus salmonophloia* over a low mixed chenopod scrub vegetation community was rated as being in 'good' health. Much of the area has been disturbed by exploration activities and clearing for vehicle access. One introduced species were identified within the Project area, *Salvia verbenaca* (Wild Sage). According to the DAFWA this species is not listed as a Declared Plant under Section 22 of the *BAM Act 2007*.

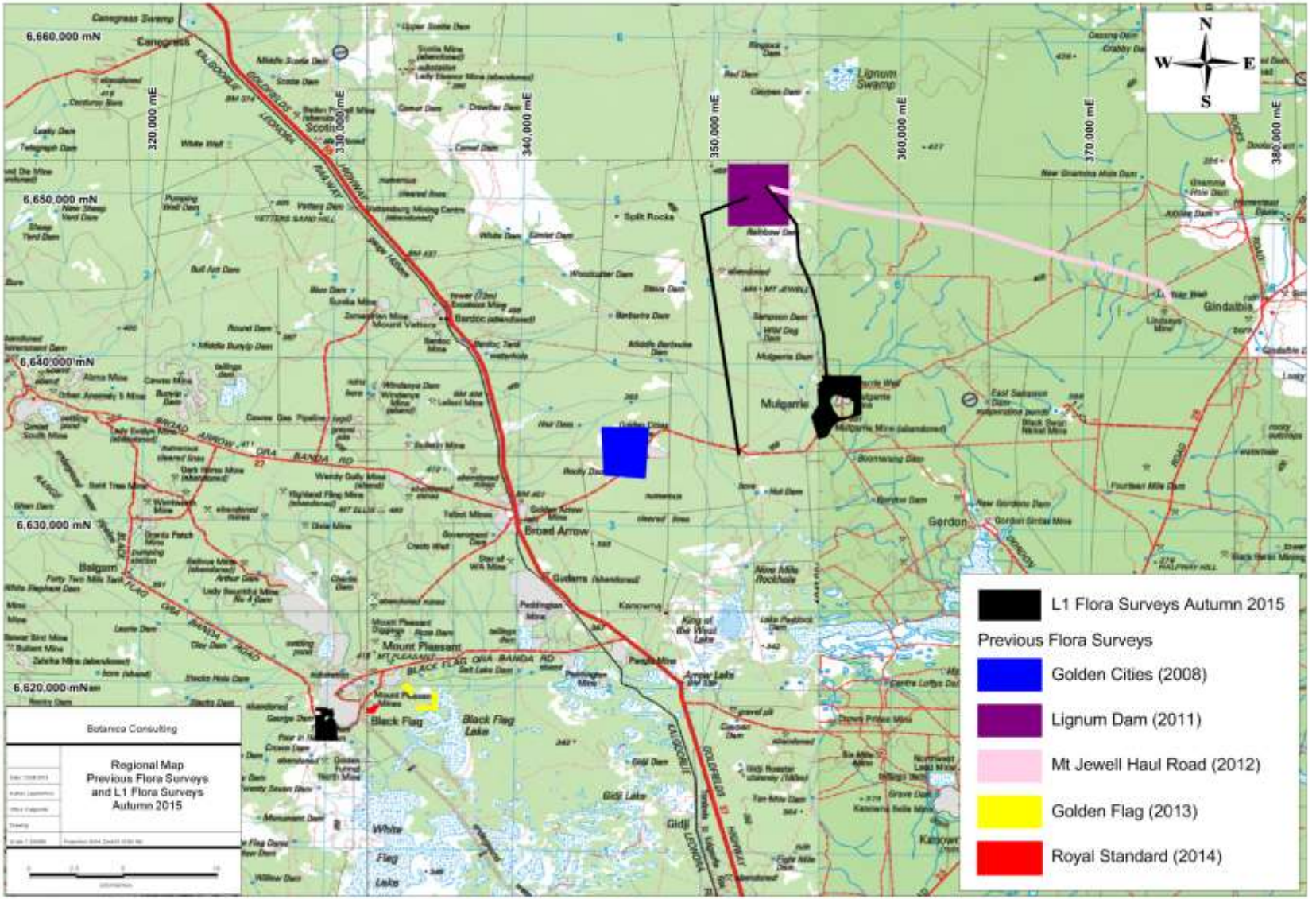

Figure 3: Regional Map of previous flora surveys in relation to the current survey areas (survey areas not to scale)

2 Regional Biophysical Environment

2.1 Regional Environment

Three of the survey areas (Mulgarrie well, Mt Jewell – Eastern Haul Road and the Mt Jewell – Western Haul Road) lie within the Murchison Region of the Eremaean Province of WA in a region known as the Austin Botanical District which consists of predominantly mulga low woodland on plains and reduces to scrub on hills (Beard, 1990). The Murchison Region is further divided into subregions, based on the Interim Biogeographic Regionalisation of Australia (IBRA), with the survey areas located within the Eastern Murchison (MUR1) subregion (Cowan, 2001).

The Racetrack survey area lies within the Coolgardie Region of the Eremaean Province of WA in a region known as the Coolgardie Botanical District which consists of predominantly Mulga low woodland on plains and reduces to scrub on hills (Beard, 1990). The Coolgardie Region is further divided into subregions, based on the IBRA, with the survey area located within the Eastern Goldfields (COO3) subregion (Cowan, 2001).

A map showing the locations of the survey areas in relation to IBRA subregions is provided in Figure 4.

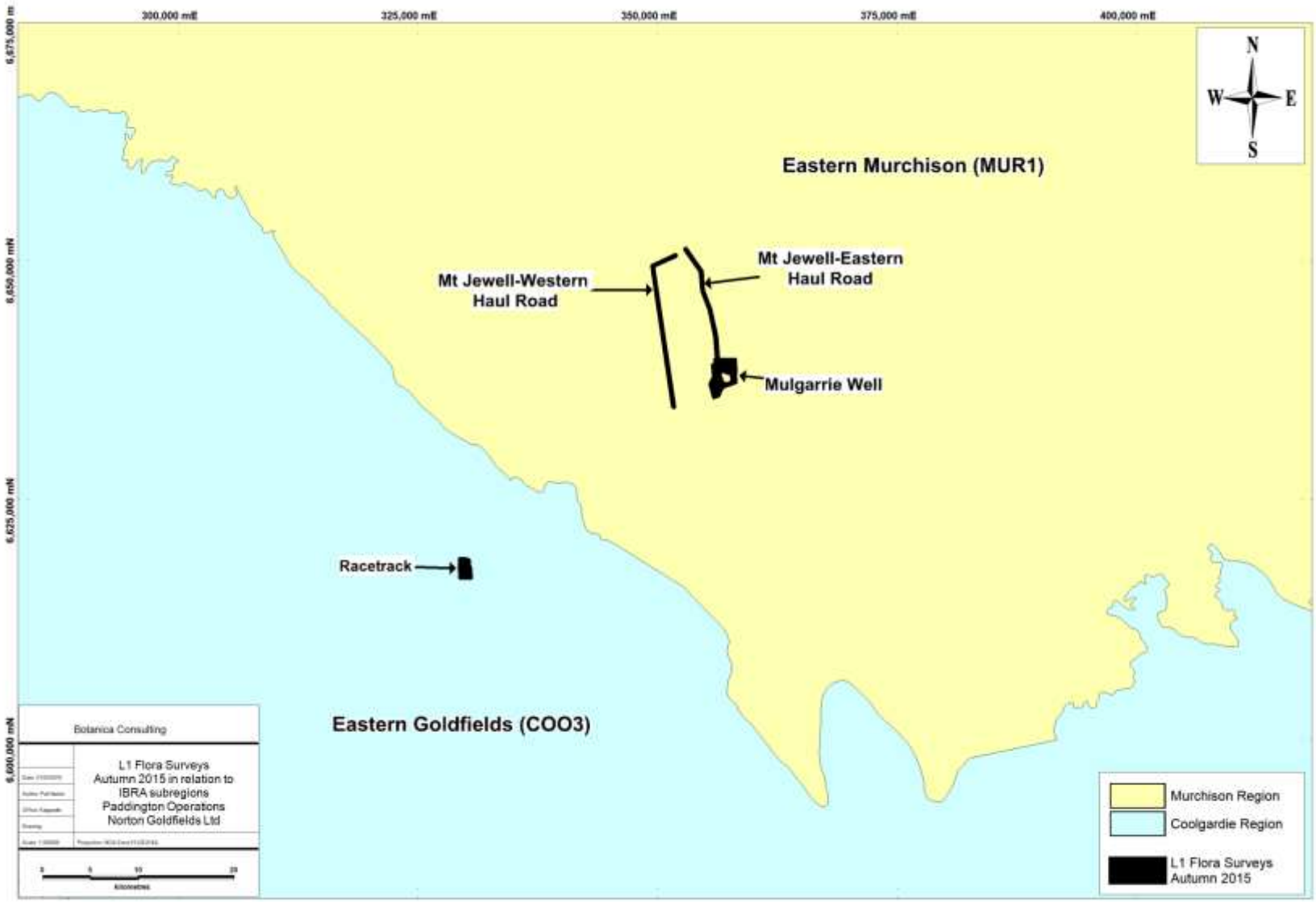

Figure 4: Location of survey areas in relation to the IBRA subregions

2.2 Great Western Woodlands

The Racetrack survey area lies within the Great Western Woodlands, located approximately 12km from the western boundary. The Great Western Woodlands is considered by The Wilderness Society of WA to be of global biological and conservation importance as one of the largest and healthiest temperate woodlands on Earth, containing many endemic taxa. The region covers almost 16 million hectares, 160,000 square kilometres, from the southern edge of the Western Australian Wheat belt to the pastoral lands of the Mulga country in the north, the inland deserts to the northeast, and the treeless Nullarbor Plain to the east (Figure 5).

The area provides an eastward connection between southwest forests and inland deserts (Gondwana Link) as well as linking the north-west passage to Shark Bay. The majority of the Great Western Woodlands is unallocated crown land (61.1%) with other interests including pastoral leases (20.4%), conservation reserves (15.4%) unallocated crown land ex pastoral managed by the (DPaW 2011a) (2%) and private land (approximately 1%) (Watson *et. al.,* 2008).

No specific management strategy applies to the Great Western Woodlands, rather an approach to conservation which occurs across all land tenures and when different stakeholders work together with biodiversity in mind. The central component of this approach is to identify and conserve key large-scale, long term ecological processes that drive connectivity between ecosystems and taxa. The Great Western Woodlands currently includes towns, highways, roads, railways, private property, Crown Reserves, agricultural activities and mining tenements.

Figure 5: Location of Great Western Woodlands in relation to the survey areas

2.3 Topography & Soils

The Eastern Goldfields subregion lies on the Yilgarn Craton's 'Eastern Goldfields Terrains'. The relief is subdued and comprised of gently undulating plains interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying geology is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas. A series of large playa lakes in the western half are the remnants of an ancient major drainage line (Cowan, 2001).

The Eastern Murchison subregion lies on the northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton. This subregion is characterised by its internal drainage and extensive area of elevated red desert sandplains (Cowan, 2001). Calcrete aquifers located in the northern part of the subregion are known to support a wide range of subterranean fauna. Another important feature of the system is the salt lake systems associated with the occluded Paleo within drainage system. Beard (1990) describes the topography of the region as undulating with occasional ranges of low hills and extensive sandplains located in the East. The dominant soil type is a shallow earthy loam, overlying red-brown hardpan. Red earthy sands can be found on the sandplains.

2.4 Vegetation

Vegetation of the Coolgardie Botanical District in the Coolgardie Region is predominantly Eucalyptus woodland in the valleys, with dense Acacia and Allocasuarina thickets dominating the rocky ironstone ridges found near the South-West Province border (Beard, 1990). The under-storey of the Eucalyptus woodland is primarily composed of sclerophyllous shrubs such as Melaleuca or soft-leaved, glaucous shrubs including Atriplex where soils are more alkaline (Beard, 1990). The vegetation of the Eastern Goldfields subregion is of Mallees, Acacia thickets and shrub heaths on sand plains. Diverse Eucalyptus woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. The area is rich in endemic Acacias (Cowan, 2001).

Vegetation of the the Austin Botanical District in the Murchison Region is predominantly Mulga low woodlands on plains, often rich in ephemerals, which reduce to scrub on hills. It is also characterised by hummock grasslands, Saltbush shrublands and Halosarcia shrublands (Beard, 1990; Cowan, 2001).

The DAFWA GIS file (2011) indicates that the survey areas are located within Pre-European Beard seven vegetation associations as shown in Figure 6. The extent of these associations as described by the DAFWA is provided in Table 1.

Table 1: Remaining Beard Vegetation Associations within Western Australia (DAFWA, 2011)

Veg association	Pre-European Extent (ha)	Current Extent (ha)	Pre-European extent remaining (%)	% of Current extent within DPaW managed lands	Vegetation Description (Beard, 1990)
Coolgardie 125	9090.22	8902.02	97.93	0	Bare areas; salt lakes
Coolgardie 540	50554.73	48376.17	95.69	0	Succulent steppe with open low woodland; sheoak over saltbush
Barlee 10	65387.97	64757.47	99.04	4.71	Medium woodland; red mallee group
Barlee 20	1172537.57	1169909.21	99.78	15.04	Low woodland; mulga mixed with Allocasuarina cristata & Eucalyptus sp (e6?)
Barlee 555	22475.98	22468.35	99.97	18.15	Hummock grasslands, mallee steppe; red mallee over spinifex Triodia scariosa
Barlee 529	62202.81	62102.10	99.84	4.47	Succulent steppe with open low woodland; mulga & sheoak over bluebush
Kununulling 468	184812.50	181666.50	98.30	53.7	Medium woodland; salmon gum & goldfields blackbutt

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated taxa loss, while areas with less than 10% are considered “endangered”. Development within the survey areas will not significantly reduce the extent of these associations.

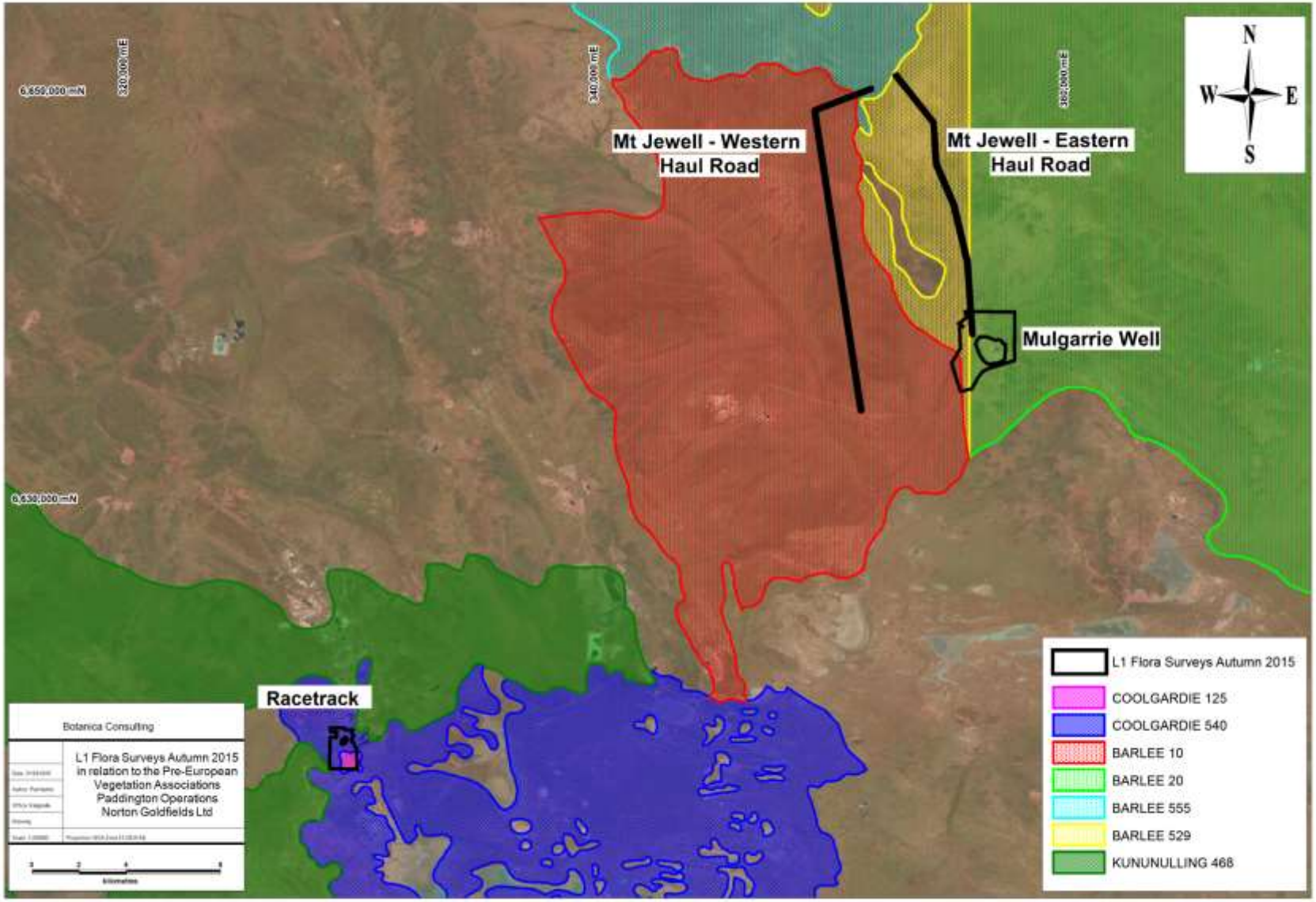

Figure 6: Pre European Vegetation Associations in relation to the survey areas

2.5 Soil Landscape Systems

The survey areas occur within the Kalgoorlie Province (26) (DAFWA, 2014) which consists of an extensive plateau of low relief. Flat to undulating plains with small valleys (occasionally broken by low narrow rocky hills, ridges, tors and bosses) are most commonly found on granitic terrain. On these plains may be found some silcrete duricrust, claypans, salt lakes with dunes and lunettes, gilgai areas, small remnants of sand plain, and small dune tracts. Low breakaways with short saline foot slopes are also occasionally present (DAFWA, 2014b).

The Kalgoorlie Province is further divided into six soil-landscape zones, with the survey areas located within the Kambalda Zone (265) and the Norseman Zone (266). The Kambalda Zone is characterized by flat to undulating plains (with hills, ranges and some salt lakes and stony plains) on greenstone and granitic rocks of the Yilgarn Craton. The soils are generally calcareous loamy earths and red loamy earths with salt lakes soils and some red-brown hardpan shallow loams and red sandy duplexes. The Norseman Zone is characterized by flat to undulating plains (with some sandplains and salt lakes) on granitic rocks of the Yilgarn Craton. The soils are generally calcareous loamy earths, yellow sandy and loamy earths, red-loamy earths, red deep sands and salt lake soils. The survey area is located within eight landscape systems of the Kambalda and Norseman Zone which are detailed in Table 2 and as shown in Figure 7.

Table 2: Soil Landscape Mapping Units within the survey areas (DAFWA, 2014b)

Mapping Unit	Soil Landscape System
265Mx40	Flat to undulating valley plains and pediments; some rock outcrop
265Gu	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands
265Il	Plains with ironstone gravel or calcrete mantles supporting eucalypt woodlands and mulga-casuarina shrublands
265Ki	Gently undulating sandplains, with scattered granite outcrop supporting spinifex hummock grasslands, mulga shrublands and mallees
265Le	Low greenstone hills and stony plains supporting mixed chenopod shrublands
265Mo	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstorey
266Yo	Sandy plains supporting tall shrublands of mulga and bowgada with patchy wanderrie grasses
266Cm	Alluvial plains supporting eucalypt woodlands with halophytic understoreys and acacia shrublands

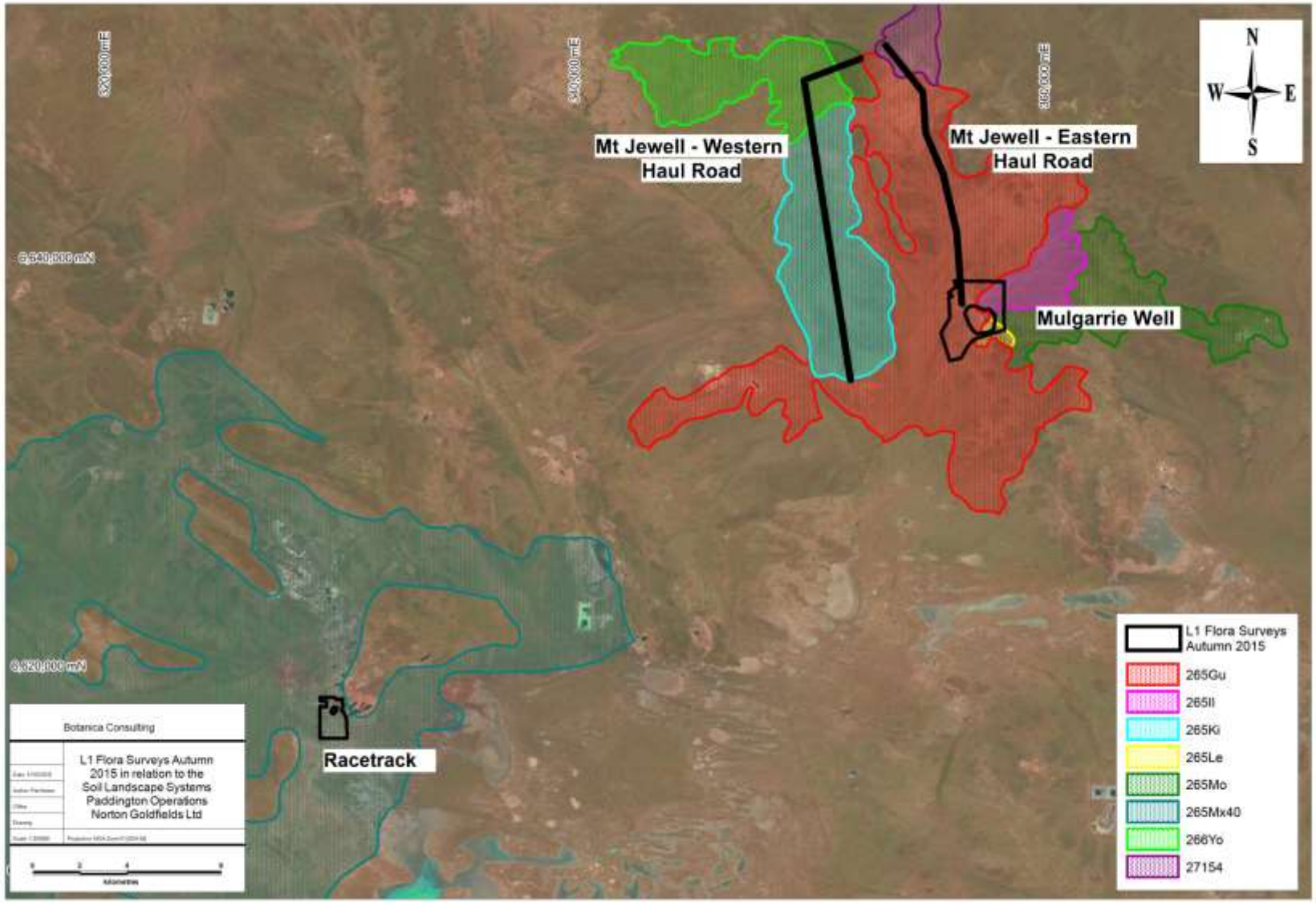

Figure 7: Location of the survey areas in relation to Soil Landscape Systems

2.6 Climate

The climate of the Eastern Goldfields subregion is characterised as an arid to semi-arid climate with rainfall sometimes in summer but mainly winter rainfall and annual rainfall of approximately 200-300mm (Beard, 1990; Cowan, 2001). The climate of the Eastern Murchison subregion is characterised as an arid climate with mainly winter rainfall and annual rainfall of approximately 200mm (Beard, 1990; Cowan, 2001). Monthly rainfall and annual data for the Kalgoorlie-Boulder Airport weather station (#12038) located approximately 40km south-east of the survey areas is shown in Figure 8 and Figure 9 (Bureau of Meteorology, BOM, 2015).

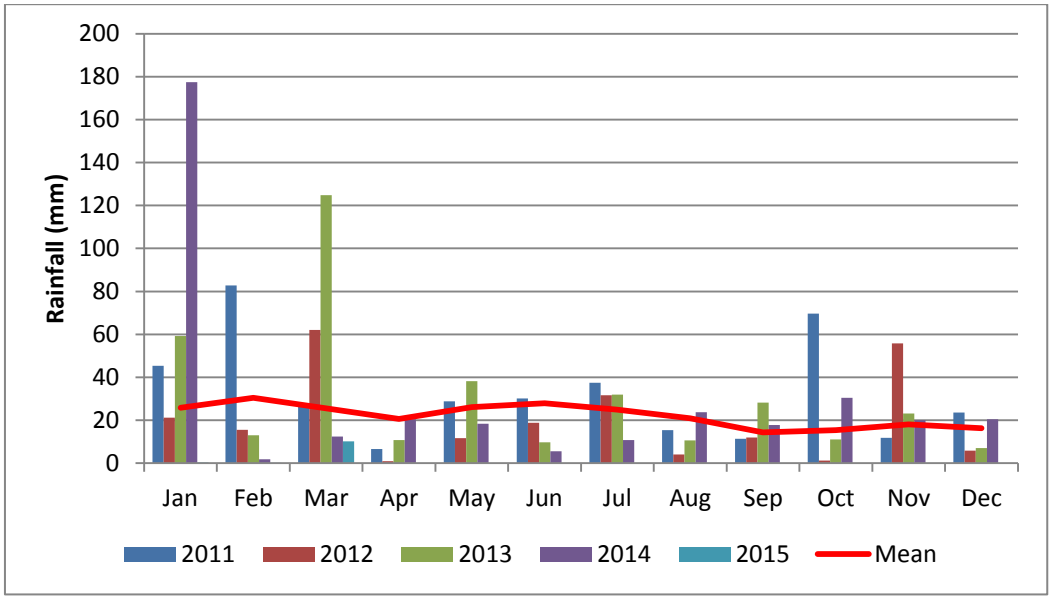

Figure 8: Monthly rainfall from January 2011 to March 2015 and mean monthly rainfall (January 1939 to March 2015) for the Kalgoorlie-Boulder Airport weather station (#12038) (BOM, 2015)

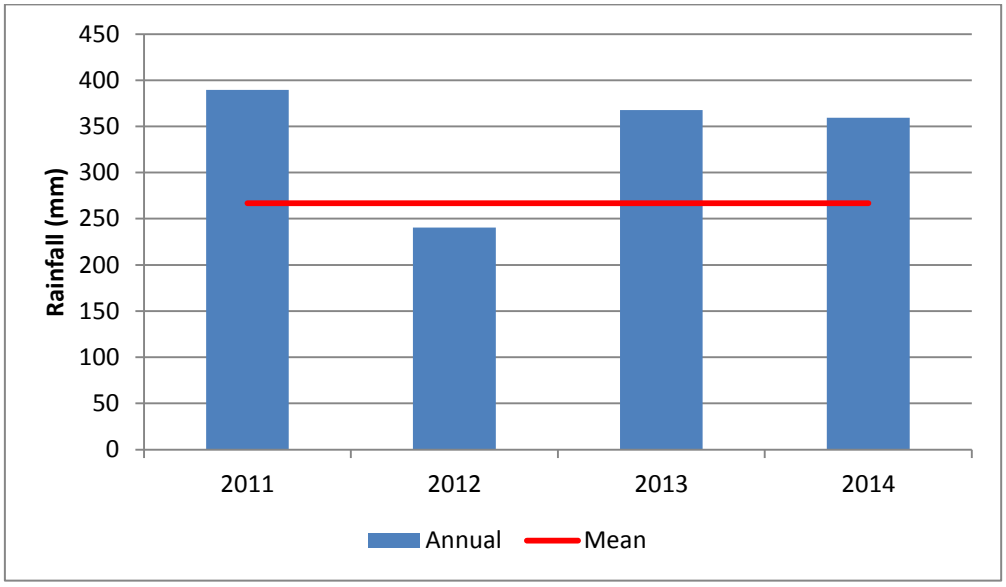

Figure 9: Annual rainfall from January 2011 to December 2014 and mean annual rainfall (January 1939 to December 2014) for the Kalgoorlie-Boulder Airport weather station (#12038) (BOM, 2015)

2.7 Land Use

The dominant land uses of the Eastern Goldfields subregion as pasture land (38%) and nature reserves (4.5%) with the remaining areas used for mining, exploration activities and freehold (Cowan, 2001). The dominant land uses of the Eastern Murchison subregion are grazing native pastures (85.47%), unallocated crown land (11.34%), conservation (1.4%) and mining (1.79%) (Cowan, 2001).

2.8 Survey Objectives

The objectives of the survey were to:

1. Compile a broad scale vegetation community flora map and taxa list of the survey areas (Appendix 3 and 4);
2. Document and map locations of any Threatened or Priority listed flora taxa located; (Appendix 4 and 5);
3. Assess the regional and local conservation status of plant taxa and ecological communities within the survey areas; and
4. Identify occurrences of any “Declared and Environmental” weeds within the survey areas.

3 Survey Methodology

3.1 Desktop Assessment

Prior to the field survey, the results of the combined search of the DPaW Declared Rare and Priority Flora databases were obtained by BC. These significant flora taxa were examined on the Western Australian Herbarium's web page (WAHERB, 2015) prior to the survey to familiarise staff with their appearance. Locations of Threatened and Priority Flora taxa revealed in the databases search were overlaid on aerial photography of the area. Vegetation descriptions of locations and available pictures of the Priority Flora were obtained from Florabase. Priority Flora locations listed by the DPaW within and/or surrounding the survey area were visited in order to confirm their existence. Table 3 lists the definitions of Declared Rare and Priority ratings under the *WC Act 1950* as extracted from Florabase (WAHERB, 2015).

Table 3: **Definitions of Rare and Priority Flora taxa (WAHERB, 2015)**

T: Declared Rare Flora – Extant taxa taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X: Declared Rare flora – Presumed Extinct taxa taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
1: Priority One – Poorly known taxa taxa that are known from one or a few collections or sight records (generally <five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, West rail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes
2: Priority Two – Poorly Known taxa taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes
3: Priority Three – Poorly known taxa taxa which are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4: Priority Four – Rare, near threatened or other taxa in need of monitoring Rare. taxa 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 taxa are usually represented on conservation lands. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.
5: Priority Five – Conservation Dependant taxa taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years

3.2 Sampling and Analysis Methods

BC was commissioned by Norton to conduct a Level 1 flora and vegetation survey of four areas for Paddington Operations; Racetrack, Mulgarrie Well, Mt Jewell Western Haul Road and Mt Jewell Eastern Haul Road survey areas. The survey was conducted on the 23rd and 24th of March 2015 covering an area of approximately 1260 ha (of which 4ha within the Racetrack survey area was cleared/rehabilitated). The objective of the survey was to document all observed "Declared Rare and Priority Flora" taxa encountered and the occurrences of any "Environmental or Declared Weeds" observed within or adjacent to the survey areas. The survey areas were traversed by two people on foot and All-Terrain vehicle. Figure 10 provides a map of the area traversed throughout the survey.

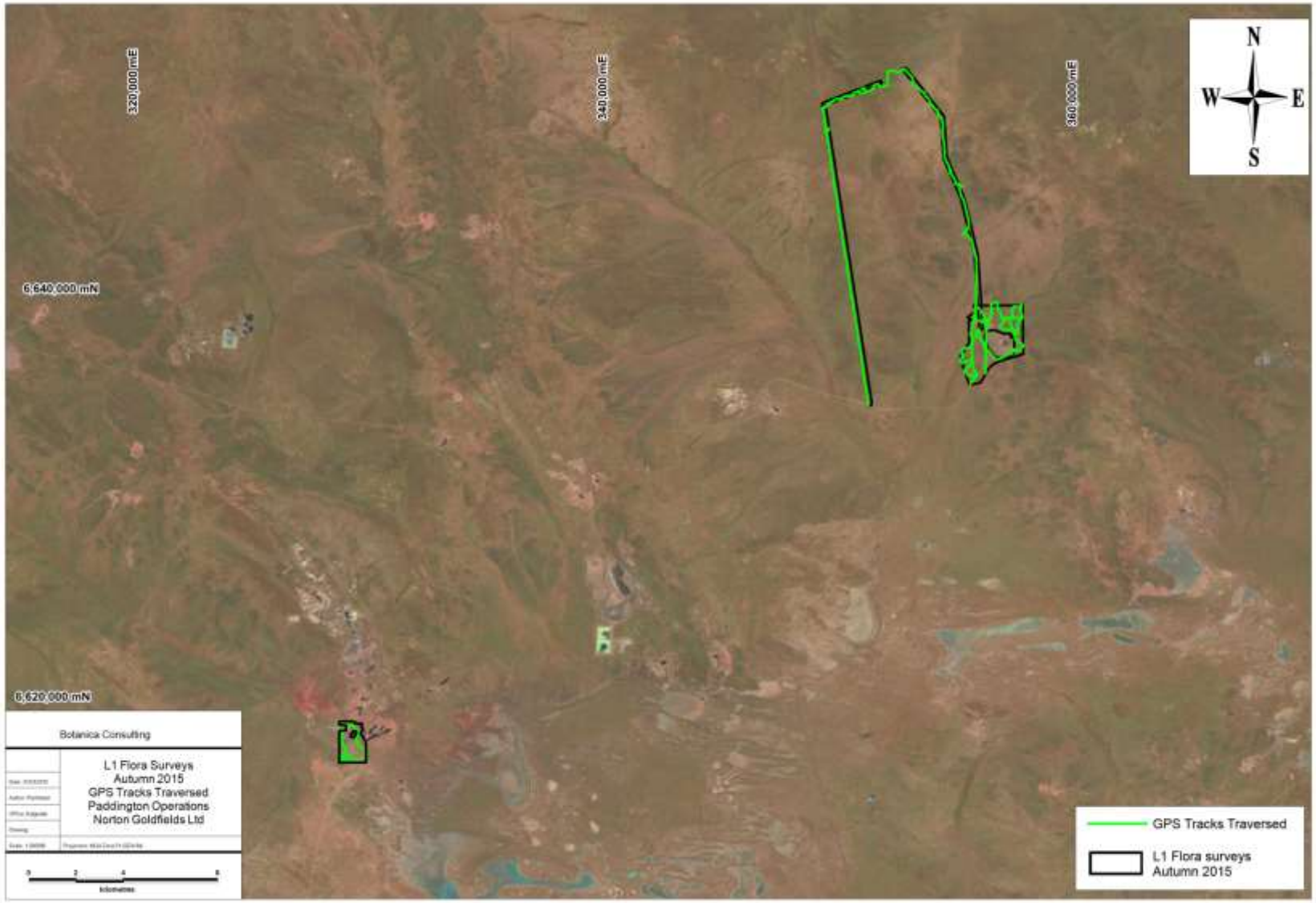

Figure 10: GPS tracks traversed throughout the survey areas

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the co-ordinates of the boundaries between existing vegetation communities.

At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of Threatened Flora if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and the Western Australian Herbarium. Presence/absence data of taxa from sample sites of similar vegetation was then compiled forming the best representative vegetation communities. Similar vegetation communities were recognised visually in the field.

3.2.1 Personnel involved

- Jim Williams - Environmental Consultant/Botanist (Diploma of Horticulture)
- Pat Harton - Environmental Consultant (Bachelor of Environmental Science)

3.2.2 Scientific licences

Table 4: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL011001	21-05-2015
Pat Harton	SL011004	21-05-2015

3.3 Flora survey limitations and constraints

It is important to note that there are limitations involved with conducting flora surveys, despite the careful planning that is put into their design. Such limitations that can occur are listed in Table 5 below.

Table 5: Limitations and constraints associated with the flora and vegetation survey

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted by All-terrain vehicles and on foot.
Experience levels	Not a constraint	The BC staff members who conducted the survey were regarded as suitably qualified and experienced. **Coordinating Botanist:** Jim Williams **Field Staff:** Jim Williams & Pat Harton **Data Interpretation:** Jim Williams & Pat Harton
Timing of survey, weather & season	Minor constraint	Fieldwork was carried out in March outside of the EPA's recommended timing for flora surveys (i.e. spring) and many taxa were not in flower. However based on the scale of the survey and the coordinating botanists local knowledge of flora in the region the timing of the survey was considered appropriate.
Sources of information	Not a constraint	BC was able to obtain information about the area from previous research conducted within the Goldfields which enabled adequate background information about the region.
Mapping reliability	Not a constraint	BC obtained a high resolution ortho aerial image to assist with vegetation mapping.
Area disturbance	Minor constraint	The area has been subject to multiple disturbances including access tracks, extensive grazing, historic exploration and rehabilitation. However the majority of the area comprised of native vegetation rated as being in 'good' or 'very good' health.
Survey Intensity	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a Level 1 survey completed to identify vegetation communities and any DRF/Priority Flora.
Resources	Not a constraint	The DPaW provided threatened flora information which was used to complete the survey. Other information was utilised from previous BC surveys in the Goldfields area.
Completeness	Minor constraint	In the opinion of BC the survey area was covered sufficiently. BC estimate that approximately 80% of the flora taxa in the survey area were recorded. This estimation takes into account the timing of the survey and the experience of the botanists undertaking the work. The vegetation communities for this study were based on visual descriptions of locations in the field. The distribution of these vegetation communities outside the study area is not known, however vegetation communities identified were categorized via comparison to vegetation distributions throughout Australia given on the Australian National Vegetation Information System (DoE, 2015b)

4 Results

4.1 Desktop Assessment

The results of the combined search of the DPaW's Flora of Conservation Significance databases did not reveal any Declared Rare or Priority flora within the survey areas boundary. There was however 17 Priority Flora taxa listed within a 25km radius of the survey areas (Appendix 6). Five of these Priority Flora have the potential to occur in the area based on habitat requirements identified within the area as listed in Table 6.

Table 6: Priority Flora with the potential to occur within the survey areas (WAHERB, 2015)

Species	Conservation Code	Description (WAHERB, 2015)
Acacia epedunculata	P1	Low spreading, becoming rounded, multi-stemmed shrub, 0.5–0.65 m high. Fl. yellow, Aug. Yellow sand. Sandplains.
Angianthus prostratus	P3	Prostrate annual, herb. Fl. white-yellow, Jul to Sep. Red clay or loamy soils. Saline depressions.
Eremophila praecox	P1	Broom-like shrub, 1.5-3 m high. Fl. purple, Oct or Dec. Red/brown sandy loam. Undulating plains.
Gnephosis sp. Norseman (K.R. Newbey 8096)	P3	Low spreading annual, herb, 0.03-0.07 m high, 0.08-0.18 m wide. Subsaline loam. Moderately exposed flat
Ptilotus rigidus	P1	Description unavailable

4.2 Conservation Significant Flora

No Threatened Flora taxa pursuant to subsection (2) of section 23F of the *WC Act 1950* and Section 179 of the Commonwealth *EPBC Act 1999* and were identified within the survey areas. No Priority Flora taxa as listed by the DPaW were identified withn the survey areas.

An unidentified taxon of *Ricinocarpos* sp. was identified within the Mt Jewell – Western Haul Road survey area, which has been identified by taxonomic specialist Mike Hislop of the Western Australian Herabarium as a potentially new species (Plate 1). This taxon had been previously identified in the surrounding area from a previous flora and vegetation survey conducted by BC (see Section 1.2.2). Until this taxon has been formally classified it is considered a Flora of Conservation Significance.

This taxon (*Ricinocarpos* sp.) was identified within the Forest of *Casuarina pauper* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa* vegetation community. Eight locations of this taxon have been recorded (Appendix 3), one of which occurs within the survey area with the remaining seven located directly south/south-east (within 1.5km) of the Mt Jewell-Western Haul Road (Appendix 2).

Plate 1: *Ricinocarpos* sp. (CS)

4.3 Vegetation Communities

28 broad vegetation communities were identified within the four survey areas (Table 7). Vegetation communities have been classified using the National Vegetation Information System (NVIS) Level 4 classifications and using Muir 1977 life form/habit classifications provided in (Appendix 7). These communities were represented by a total of 26 Families, 56 Genera and 130 Taxa, (including sub-species and variants) as listed in Appendix 4. A map showing the vegetation communities present in the survey area is provided in Appendix 3.

Table 7: Summary of vegetation communities and area (ha and %) within the survey areas

Survey Area	Vegetation Code*	Vegetation Community	Area (ha)	Area (%)
Racetrack	CLP-OFW1	Open low woodland of *Pittosporum angustifolium* over open low scrub of *Acacia kalgoorliensis* and dense low heath of *Atriplex vesicaria/ Tecticornia halocnemoides*	127	65
	CLP-AS1	Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria*	24	12
	RH-CFW/EW1	Open low woodland of *Casuarina pauper/ Eucalyptus clelandii* over low scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp. *angustifolia* and dwarf scrub of *Maireana glomerifolia/ M. triptera*	23	12
	CLP-EW1	Low woodland of *Eucalyptus salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata*	12	6
	CLP-CFW/OFW1	Open low woodland of *Casuarina pauper/ Pittosporum angustifolium* over open scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp *angustifolia* and dwarf scrub of *Atriplex vesicaria/ Tecticornia halocnemoides*	8	4
Cleared Vegetation			2	1
Total			**196**	**100**
Mulgarrie Well	CLP-AFW1	Open low woodland of *Acacia caesaneura/ Casuarina pauper* with occasional tree mallee of *Eucalyptus oleosa* over low scrub of *Acacia burkittii* and dwarf scrub of *Maireana sedifolia*	312	52
	CLP-AFW2	Forest of *Acacia caesaneura* over low scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Maireana sedifolia*	150	25
	RH-EW1	Low woodland of *Eucalyptus clelandii* over scrub of *Eremophila interstans* subsp. *virgata* and low scrub of *Acacia erinacea*	34	6
	CLP-EW2	Low woodland of *Eucalyptus clelandii/ E. oleosa* over low scrub of *Acacia hemiteles/ Eremophila scoparia* and dwarf scrub of *Maireana sedifolia*	65	11
	CLP-EW3	Low woodland of *Eucalyptus clelandii/ E. salmonophloia/ E. transcontinentalis* over open low scrub of *Acacia burkittii/A. tetragonophylla/ Eremophila scoparia* and dwarf scrub of *Atriplex nummularia* subsp. *spathulata/ A. vesicaria/*	38	6

Survey Area	Vegetation Code*	Vegetation Community	Area (ha)	Area (%)
		Maireana sedifolia		
Total			**599**	**100**
Mt Jewell - Eastern Haul Road	CLP-AFW/CFW1	Open low woodland of *Acacia incurvaneura/ Casuarina pauper* over scrub of *Acacia jennerae* and dense low heath of *Cratystylis subspinescens*	57	31
	CLP-AFW3	Forest of *Acacia caesaneura* over scrub of *Senna artemisioides* subsp. *filifolia* and open low scrub of *Maireana sedifolia*	16	9
	CLP-CFW/EW1	Open low woodland of *Casuarina pauper/ Eucalyptus salmonophloia* over heath of *Senna artemisioides* subsp. *filifolia* and low heath of *Maireana sedifolia*	67	36
	CLP-CFW1	Low woodland of *Casuarina pauper* over open low scrub of *Acacia tetragonophylla/ Dodonaea lobulata* and low heath of *Maireana sedifolia*	23	12
	CLP-AFW/CFW2	Open low woodland of *Acacia caesaneura/ Casuarina pauper* over scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Senna artemisioides* subsp. x *artemisioides*	9	5
	CLP-EW4	Low woodland of *Eucalyptus ravida* over open scrub of *Eremophila interstans* subsp. *virgata* and low heath of *Atriplex vesicaria/ Maireana sedifolia*	13	7
Total			**185**	**100**
Mt Jewell - Western Haul Road	RP-CFW1	Forest of *Casuarina pauper* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*	9	3
	RH-EW2	Forest of *Eucalyptus flavida* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*	4	2
	B-AFW1	Dense thicket of *Acacia quadrimarginea* over low scrub of *Philotheca microcephala* and open dwarf scrub of *Ptilotus obovatus* on breakaway	3	1
	RH-MWS1	Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia kalgoorliensis* and dwarf scrub of *Dodonaea microzyga*	1	0.4
	RH-EW3	Forest of *Eucalyptus clelandii* over low scrub of *Eremophila interstans* subsp. *virgata* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*	4	2
	CLP-AFW4	Thicket of *Acacia caesaneura/ A. burkittii* over low scrub of *Dodonaea lobulata* and open hummock grass of *Triodia scariosa*	65	25
	CLP-MWS1	Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus/ Senna artemisioides* subsp. *filifolia*	38	14
	RH-CFW1	Forest of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*	13	5
	CLP-MWS2	Open tree mallee of *Eucalyptus concinna/ E. loxophleba* subsp. *lissophloia* over scrub of *Acacia burkittii* and mid-dense hummock grass of *Triodia scariosa*	5	2

Survey Area	Vegetation Code*	Vegetation Community	Area (ha)	Area (%)
	CLP-MWS3	Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila caperata* and mid-dense hummock grass of *Triodia scariosa*	74	28
	CLP-AFW5	Open low woodland of *Acacia incurvaneura* over dense thicket of *Acacia coolgardiensis* and dwarf scrub of *Euryomyrtus maidenii*	31	12
	CLP-EOW1	Open low woodland of *Eucalyptus salmonophloia/ E. transcontinentalis* and very open tree mallee of *E. oleosa* over low scrub of *Acacia hemiteles* and open hummock grass of *Triodia scariosa*	16	6
Total			**263**	**100**

*B-Breakaway; CLP-Clay Loam Plain; RH-Rocky Hillslope; RP-Rocky Plain
A-Acacia; C-Casuarina; E-Eucalyt; O-Other; M-Mallee
FW-Forest and Woodlands; OW-Open Woodlands; S-Shrublands; W-Woodlands; WS-Woodlands and Shrublands;

Racetrack Survey Area

4.3.1 Open low woodland of *Pittosporum angustifolium* over open low scrub of *Acacia kalgoorliensis* and dense low heath of *Atriplex vesicaria/ Tecticornia halocnemoides*

The total flora recorded within this vegetation community was represented by a total of 15 Families, 25 Genera and 35 Taxa (Plate 2). No Threatened or Priority Flora taxa were identified within this vegetation community. Two introduced taxa were recorded in this vegetation community; *Centaurea melitensis* (Maltese Cockspur) and *Dittrichia graveolens* (Stinkwort). According to the DAFWA (2014) these taxa are not listed as a Declared Plant under Section 22 of the *BAM Act 2007*. Dominant taxa from the vegetation assemblage are shown in Table 8. According to the NVIS list of Major Vegetation Groups (MVG), this vegetation community is best represented by the MVG10 – Other Forests and Woodlands (DoE, 2015b).

Table 8: Vegetation assemblage of Open low woodland of *Pittosporum angustifolium* over open low scrub of *Acacia kalgoorliensis* and dense low heath of *Atriplex vesicaria/ Tecticornia halocnemoides*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Pittosporum angustifolium*
Shrub 1.5-2m	2-10%	*Acacia kalgoorliensis*
Shrub <0.5m	70-100%	*Atriplex vesicaria* *Tecticornia halocnemoides*

Plate 2: Open low woodland of *Pittosporum angustifolium* over open low scrub of *Acacia kalgoorliensis* and dense low heath of *Atriplex vesicaria/ Tecticornia halocnemoides*

4.3.2 Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria*

The total flora recorded within this vegetation community was represented by a total of 10 Families, 21 Genera and 30 Taxa (Plate 3). No Threatened or Priority Flora taxa were identified within this vegetation community. Three introduced taxa were recorded in this vegetation community; *Carthamus lanatus* (Saffron Thistle), *Centaurea melitensis* (Maltese Cockspur) and *Dittrichia graveolens* (Stinkwort). According to the DAFWA (2014) *Carthamus lanatus* is listed as a Declared Plant under Section 22 of the *BAM Act 2007*. Dominant taxa from the vegetation assemblage are shown in Table 9. According to the NVIS, this vegetation community is represented by MVG16-Acacia Shrublands (DoE, 2015b).

Table 9: Vegetation assemblage of Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub >2m	10-30%	*Acacia jennerae*
Shrub 1-1.5m	30-70%	*Atriplex bunburyana* *Maireana pyramidata*
Shrub <0.5m	10-30%	*Atriplex vesicaria*

Plate 3: Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria*

4.3.3 Open low woodland of *Casuarina pauper/ Eucalyptus clelandii* over low scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp. *angustifolia* and dwarf scrub of *Maireana glomerifolia/ M. triptera*

The total flora recorded within this vegetation community was represented by a total of 14 Families, 18 Genera and 28 Taxa (Plate 4). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 10. According to the NVIS, this vegetation community is represented by MVG8- Casuarina Forest and Woodlands and MVG5 – Eucalypt Woodlands (DoE, 2015b).

Table 10: Vegetation assemblage of Open low woodland of *Casuarina pauper/ Eucalyptus clelandii* over low scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp. *angustifolia* and dwarf scrub of *Maireana glomerifolia/ M. triptera*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Casuarina pauper* *Eucalyptus clelandii*
Shrub 1.5-2m	10-30%	*Acacia kalgoorliensis* *Eremophila oldfieldii* subsp. *angustifolia*
Shrub <0.5m	10-30%	*Maireana glomerifolia* *Maireana triptera*

Plate 4: Open low woodland of *Casuarina pauper/ Eucalyptus clelandii* over low scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp. *angustifolia* and dwarf scrub of *Maireana glomerifolia/ M. triptera*

4.3.4 Low woodland of *Eucalyptus salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata*

The total flora recorded within this vegetation community was represented by a total of 11 Families, 21 Genera and 28 Taxa (Plate 5). No Threatened or Priority Flora taxa were identified within this vegetation community. Three introduced taxa were recorded in this vegetation community; *Carthamus lanatus* (Saffron Thistle), *Centaurea melitensis* (Maltese Cockspur) and *Dittrichia graveolens* (Stinkwort). According to the DAFWA (2014) *Carthamus lanatus* is listed as a Declared Plant under Section 22 of the *BAM Act 2007*. Dominant taxa from the vegetation assemblage are shown in Table 11. According to the NVIS, this vegetation community is best represented by MVG5 – Eucalypt Woodlands (DoE, 2015b).

Table 11: Vegetation assemblage of Low woodland of *Eucalyptus salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus salmonophloia*
Shrub 1.5-2m	2-10%	*Acacia kalgoorliensis*
Shrub <0.5m	10-30%	*Atriplex vesicaria* *Maireana pyramidata* *Tecticornia disarticulata*

Plate 5: Low woodland of *Eucalyptus salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata*

4.3.5 Open low woodland of *Casuarina pauper/ Pittosporum angustifolium* over open scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp *angustifolia* and dwarf scrub of *Atriplex vesicaria/ Tecticornia halocnemoides*

The total flora recorded within this vegetation community was represented by a total of 13 Families, 16 Genera and 20 Taxa (Plate 6). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 12. According to the NVIS, this vegetation community is represented by MVG8- Casuarina Forest and Woodlands and MVG10 – Other Forests and Woodlands (DoE, 2015b).

Table 12: Vegetation assemblage of Open low woodland of *Casuarina pauper/ Pittosporum angustifolium* over open scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp *angustifolia* and dwarf scrub of *Atriplex vesicaria/ Tecticornia halocnemoides*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Casuarina pauper* *Pittosporum angustifolium*
Shrub 1.5-2m	2-10%	*Acacia kalgoorliensis* *Eremophila oldfieldii* subsp. *angustifolia*
Shrub <0.5m	10-30%	*Atriplex vesicaria* *Tecticornia halocnemoides*

Plate 6: Open low woodland of *Casuarina pauper/ Pittosporum angustifolium* over open scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp *angustifolia* and dwarf scrub of *Atriplex vesicaria/ Tecticornia halocnemoides*

Mulgarrie Well Survey Area

4.3.6 Open low woodland of *Acacia caesaneura/ Casuarina pauper* with occasional tree mallee of *Eucalyptus oleosa* over low scrub of *Acacia burkittii* and dwarf scrub of *Maireana sedifolia*

The total flora recorded within this vegetation community was represented by a total of 12 Families, 15 Genera and 31 Taxa (Plate 7). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 13. According to the NVIS, this vegetation community is comprised of MVG6- Acacia Forests and Woodlands (DoE, 2015b).

Table 13: Vegetation assemblage of Open low woodland of *Acacia caesaneura/ Casuarina pauper* and very open tree mallee of *Eucalyptus oleosa* over low scrub of *Acacia burkittii* and dwarf scrub of *Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia caesaneura* *Casuarina pauper*
Mallee Tree Form	2-10%	*Eucalyptus oleosa*
Shrub 1.5-2m	10-30%	*Acacia burkittii*
Shrub 0.5-1m	10-30%	*Maireana sedifolia*

Plate 7: Open low woodland of *Acacia caesaneura/ Casuarina pauper* with occasional tree mallee of *Eucalyptus oleosa* over low scrub of *Acacia burkittii* and dwarf scrub of *Maireana sedifolia*

4.3.7 Forest of *Acacia caesaneura* over low scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Maireana sedifolia*

The total flora recorded within this vegetation community was represented by a total of 16 Families, 22 Genera and 36 Taxa (Plate 8). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 14. According to the NVIS, this vegetation community is best represented by MVG6- Acacia Forests and Woodlands (DoE, 2015b).

Table 14: Vegetation assemblage for Forest of *Acacia caesaneura* over low scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Acacia caesaneura*
Shrub 1.5-2m	10-30%	*Acacia ramulosa* var. *ramulosa*
Shrub 0.5-1m	10-30%	*Maireana sedifolia*

Plate 8: Forest of *Acacia caesaneura* over low scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Maireana sedifolia*

4.3.8 Low woodland of *Eucalyptus clelandii* over scrub of *Eremophila interstans* subsp. *virgata* and low scrub of *Acacia erinacea*

The total flora recorded within this vegetation community was represented by a total of 8 Families, 10 Genera and 16 Taxa (Plate 9). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 15. According to the NVIS, this vegetation community is best represented by MVG5-Eucalypt Woodlands (DoE, 2015b).

Table 15: Vegetation assemblage Low woodland of *Eucalyptus clelandii* over scrub of *Eremophila interstans* subsp. *virgata* and low scrub of *Acacia erinacea*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus clelandii*
Shrub >2m	10-30%	*Eremophila interstans* subsp. *virgata*
Shrub 0.5-1m	10-30%	*Acacia erinacea*

Plate 9: Low woodland of *Eucalyptus clelandii* over scrub of *Eremophila interstans* subsp. *virgata* and low scrub of *Acacia erinacea*

4.3.9 Low woodland of *Eucalyptus clelandii/ E. oleosa* over low scrub of *Acacia hemiteles/ Eremophila scoparia* and dwarf scrub of *Maireana sedifolia*

The total flora recorded within this vegetation community was represented by a total of 7 Families, 10 Genera and 21 Taxa (Plate 10). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 16. According to the NVIS, this vegetation community is best represented by MVG5-Eucalypt Woodlands (DoE, 2015b).

Table 16: Vegetation assemblage of Low woodland of *Eucalyptus clelandii/ E. oleosa* over low scrub of *Acacia hemiteles/ Eremophila scoparia* and dwarf scrub of *Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus clelandii* *Eucalyptus oleosa*
Shrub 1.5-2m	10-30%	*Acacia hemiteles* *Eremophila scoparia*
Shrub <0.5m	10-30%	*Maireana sedifolia*

Plate 10: Low woodland of *Eucalyptus clelandii/ E. oleosa* over low scrub of *Acacia hemiteles/ Eremophila scoparia* and dwarf scrub of *Maireana sedifolia*

4.3.10 Low woodland of *Eucalyptus clelandii/ E. salmonophloia/ E. transcontinentalis* over open low scrub of *Acacia burkittii/A. tetragonophylla/ Eremophila scoparia* and dwarf scrub of *Atriplex nummularia* subsp. *spathulata/ A. vesicaria/ Maireana sedifolia*

The total flora recorded within this vegetation community was represented by a total of 10 Families, 13 Genera and 25 Taxa (Plate 11). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 17. According to the NVIS, this vegetation community is best represented by MVG5-Eucalypt Woodlands (DoE, 2015b).

Table 17: Vegetation assemblage of Low woodland of *Eucalyptus clelandii/ E. salmonophloia/ E. transcontinentalis* over open low scrub of *Acacia burkittii/A. tetragonophylla/ Eremophila scoparia* and dwarf scrub of *Atriplex nummularia* subsp. *spathulata/ A. vesicaria/ Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus clelandii* *Eucalyptus salmonophloia* *Eucalyptus transcontinentalis*
Shrub 1.5-2m	2-10%	*Acacia burkittii* *Acacia tetragonophylla* *Eremophila scoparia*
Shrub 0.5-1m	10-30%	*Atriplex nummularia* subsp. *spathulata* *Atriplex vesicaria* *Maireana sedifolia*

Plate 11: Low woodland of *Eucalyptus clelandii/ E. salmonophloia/ E. transcontinentalis* over open low scrub of *Acacia burkittii/A. tetragonophylla/ Eremophila scoparia* and dwarf scrub of *Atriplex nummularia* subsp. *spathulata/ A. vesicaria/ Maireana sedifolia*

Mt Jewell – Eastern Haul Road survey area

4.3.11 Open low woodland of *Acacia incurvaneura/ Casuarina pauper* over scrub of *Acacia jennerae* and dense low heath of *Cratystylis subspinescens*

The total flora recorded within this vegetation community was represented by a total of 12 Families, 18 Genera and 30 Taxa (Plate 12). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 18. According to the NVIS, this vegetation community is best represented by MVG6- Acacia Forests and Woodlands and MVG8- Casuarina Forest and Woodlands (DoE, 2015b).

Table 18: Vegetation assemblage of Open low woodland of *Acacia incurvaneura/ Casuarina pauper* over scrub of *Acacia jennerae* and dense low heath of *Cratystylis subspinescens*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Acacia incurvaneura* *Casuarina pauper*
Shrub >2m	10-30%	*Acacia jennerae*
Shrub 0.5-1m	70-100%	*Cratystylis subspinescens*

Plate 12: Open low woodland of *Acacia incurvaneura/ Casuarina pauper* over scrub of *Acacia jennerae* and dense low heath of *Cratystylis subspinescens*

4.3.12 Forest of *Acacia caesaneura* over scrub of *Senna artemisioides* subsp. *filifolia* and open low scrub of *Maireana sedifolia*

The total flora recorded within this vegetation community was represented by a total of 12 Families, 15 Genera and 28 Taxa (Plate 13). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 19. According to the NVIS, this vegetation community is best represented by MVG6- Acacia forests and Woodlands (DoE, 2015b).

Table 19: Vegetation assemblage of Forest of *Acacia caesaneura* over scrub of *Senna artemisioides* subsp. *filifolia* and open low scrub of *Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Acacia caesaneura*
Shrub 1.5-2m	10-30%	*Senna artemisioides* subsp. *filifolia*
Shrub 0.5-1m	2-10%	*Maireana sedifolia*

Plate 13: Forest of *Acacia caesaneura* over scrub of *Senna artemisioides* subsp. *filifolia* and open low scrub of *Maireana sedifolia*

4.3.13 Open low woodland of *Casuarina pauper/ Eucalyptus salmonophloia* over heath of *Senna artemisioides* subsp. *filifolia* and low heath of *Maireana sedifolia*

The total flora recorded within this vegetation community was represented by a total of 11 Families, 15 Genera and 27 Taxa (Plate 14). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 20. According to the NVIS, this vegetation community is best represented by MVG8- Casuarina forest and woodlands and MVG5-Eucalypt Woodlands (DoE, 2015b).

Table 20: Vegetation assemblage Open low woodland of *Casuarina pauper/ Eucalyptus salmonophloia* over heath of *Senna artemisioides* subsp. *filifolia* and low heath of *Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Casuarina pauper* *Eucalyptus salmonophloia*
Shrub 1-1.5m	30-70%	*Senna artemisioides* subsp. *filifolia*
Shrub <0.5m	30-70%	*Maireana sedifolia*

Plate 14: Open low woodland of *Casuarina pauper/ Eucalyptus salmonophloia* over heath of *Senna artemisioides* subsp. *filifolia* and low heath of *Maireana sedifolia*

4.3.14 Low woodland of *Casuarina pauper* over open low scrub of *Acacia tetragonophylla/ Dodonaea lobulata* and low heath of *Maireana sedifolia*.

The total flora recorded within this vegetation community was represented by a total of 14 Families, 20 Genera and 34 Taxa (Plate 15). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 21. According to the NVIS, this vegetation community is best represented by MVG8- Casuarina Forest and Woodlands (DoE, 2015b).

Table 21: Vegetation assemblage of Low woodland of *Casuarina pauper* over open low scrub of *Acacia tetragonophylla/ Dodonaea lobulata* and low heath of *Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Casuarina pauper*
Shrub 1-1.5m	2-10%	*Acacia tetragonophylla* *Dodonaea lobulata*
Shrub 0.5-1m	30-70%	*Maireana sedifolia*

Plate 15: Low woodland of *Casuarina pauper* over open low scrub of *Acacia tetragonophylla/ Dodonaea lobulata* and low heath of *Maireana sedifolia*

4.3.15 Open low woodland of *Acacia caesaneura/ Casuarina pauper* over scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Senna artemisioides* subsp. x *artemisioides*

The total flora recorded within this vegetation community was represented by a total of 10 Families, 11 Genera and 13 Taxa (Plate 16). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 22. According to the NVIS, this vegetation community is best represented by MVG6- Acacia Forests and Woodlands and MVG8- Casuarina Forests and Woodlands (DoE, 2015b).

Table 22: Vegetation assemblage of Open low woodland of *Acacia caesaneura/ Casuarina pauper* over scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Senna artemisioides* subsp. x *artemisioides*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia caesaneura* *Casuarina pauper*
Shrub 1-1.5m	2-10%	*Acacia ramulosa* var. *ramulosa*
Shrub 0.5-1m	10-30%	*Senna artemisioides* subsp. *artemisioides*

Plate 16: Open low woodland of *Acacia caesaneura/ Casuarina pauper* over scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Senna artemisioides* subsp. x *artemisioides*

4.3.16 Low woodland of *Eucalyptus ravida* over open scrub of *Eremophila interstans* subsp. *virgata* and low heath of *Atriplex vesicaria/ Maireana sedifolia*

The total flora recorded within this vegetation community was represented by a total of 8 Families, 10 Genera and 19 Taxa (Plate 17). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 23. According to the NVIS, this vegetation community is best represented by MVG5-Eucalypt Woodlands (DoE, 2015b).

Table 23: Vegetation assemblage of Low woodland of *Eucalyptus ravida* over open scrub of *Eremophila interstans* subsp. *virgata* and low heath of *Atriplex vesicaria/ Maireana sedifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus ravida*
Shrub >2m	2-10%	*Eremophila interstans* subsp. *virgata*
Shrub 0.5-1m	30-70%	*Atriplex vesicaria* *Maireana sedifolia*

Plate 17: Low woodland of *Eucalyptus ravida* over open scrub of *Eremophila interstans* subsp. *virgata* and low heath of *Atriplex vesicaria/ Maireana sedifolia*

Mt Jewell – Western Haul Road survey area

4.3.17 Forest of *Casuarina pauper* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*

The total flora recorded within this vegetation community was represented by a total of 11 Families, 12 Genera and 18 Taxa (Plate 18). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. A potentially new species of *Ricinocarpos* (*Ricinocarpos* sp.) was identified within this vegetation community, at this time the species should be regarded as being a significant taxon and treated as Flora of Conservation Significance until it has been formally classifed. Dominant taxa from the vegetation assemblage are shown in Table 24. According to the NVIS, this vegetation community is best represented by MVG8- Casuarina Forest and Woodlands (DoE, 2015b).

Table 24: Vegetation assemblage of Forest of *Casuarina pauper* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Casuarina pauper*
Shrub 1.5-2m	30-70%	*Acacia kalgoorliensis*
Hummock Grass	10-30%	*Triodia scariosa*

Plate 18: Forest of *Casuarina pauper* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*

4.3.18 Forest of *Eucalyptus flavida* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*

The total flora recorded within this vegetation community was represented by a total of 8 Families, 10 Genera and 14 Taxa (Plate 19). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 25. According to the NVIS, this vegetation community is best represented by MVG5-Eucalypt Woodlands (DoE, 2015b).

Table 25: Vegetation assemblage Forest of *Eucalyptus flavida* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Eucalyptus flavida*
Shrub 1.5-2m	30-70%	*Acacia kalgoorliensis*
Hummock Grass	30-70%	*Triodia scariosa*

Plate 19: Forest of *Eucalyptus flavida* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*

4.3.19 Dense thicket of *Acacia quadrimarginea* over low scrub of *Philotheca microcephala* and open dwarf scrub of *Ptilotus obovatus* on breakaway

The total flora recorded within this vegetation community was represented by a total of 10 Families, 10 Genera and 12 Taxa (Plate 20). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 26. According to the NVIS, this vegetation community is best represented by MVG6- Acacia Forests and Woodlands (DoE, 2015b).

Table 26: Vegetation assemblage of dense thicket of *Acacia quadrimarginea* over low scrub of *Philotheca microcephala* and open dwarf scrub of *Ptilotus obovatus* on breakaway

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub >2m	70-100%	*Acacia quadrimarginea*
Shrub 1.5-2m	10-30%	*Philotheca microcephala*
Shrub <0.5m	2-10%	*Ptilotus obovatus*

Plate 20: Dense thicket of *Acacia quadrimarginea* over low scrub of *Philotheca microcephala* and open dwarf scrub of *Ptilotus obovatus* on breakaway

4.3.20 Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia kalgoorliensis* and dwarf scrub of *Dodonaea microzyga*

The total flora recorded within this vegetation community was represented by a total of 7 Families, 8 Genera and 13 Taxa (Plate 21). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 27. According to the NVIS, this vegetation community is best represented by MVG14 – Mallee Woodlands and Shrublands (DoE, 2015b).

Table 27: Vegetation assemblage of Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia kalgoorliensis* and dwarf scrub of *Dodonaea microzyga*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna*
Shrub >2m	30-70%	*Acacia kalgoorliensis*
Shrub 0.5-1m	10-30%	*Dodonaea microzyga*

Plate 21: Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia kalgoorliensis* and dwarf scrub of *Dodonaea microzyga*

4.3.21 Forest of *Eucalyptus clelandii* over low scrub of *Eremophila interstans* subsp. *virgata* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*

The total flora recorded within this vegetation community was represented by a total of 8 Families, 10 Genera and 19 Taxa (Plate 22). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 28. According to the NVIS, this vegetation community is best represented by MVG5-Eucalypt Woodlands (DoE, 2015b).

Table 28: Vegetation assemblage of Forest of *Eucalyptus clelandii* over low scrub of *Eremophila interstans* subsp. *virgata* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Eucalyptus clelandii*
Shrub >2m	2-10%	*Eremophila interstans* subsp. *virgata*
Shrub 0.5-1m	10-30%	*Senna artemisioides* subsp. *filifolia*

Plate 22: Forest of *Eucalyptus clelandii* over low scrub of *Eremophila interstans* subsp. *virgata* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*

4.3.22 Thicket of *Acacia caesaneura/ A. burkittii* over low scrub of *Dodonaea lobulata* and open hummock grass of *Triodia scariosa*

The total flora recorded within this vegetation community was represented by a total of 10 Families, 12 Genera and 20 Taxa (Plate 23). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 29. According to the NVIS, this vegetation community is best represented by MVG6- Acacia Forests and Woodlands (DoE, 2015b).

Table 29: Vegetation assemblage of Thicket of *Acacia caesaneura/ A. burkittii* over low scrub of *Dodonaea lobulata* and open hummock grass of *Triodia scariosa*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Acacia burkittii* *Acacia caesaneura*
Shrub >2m	10-30%	*Dodonaea lobulata*
Hummock Grass	2-10%	*Triodia scariosa*

Plate 23: Thicket of *Acacia caesaneura/ A. burkittii* over low scrub of *Dodonaea lobulata* and open hummock grass of *Triodia scariosa*

4.3.23 Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus/ Senna artemisioides* subsp. *filifolia*

The total flora recorded within this vegetation community was represented by a total of 7 Families, 9 Genera and 15 Taxa (Plate 24). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 30. According to the NVIS, this vegetation community is best represented by MVG14-Mallee Woodlands and Shrublands (DoE, 2015b).

Table 30: Vegetation assemblage of Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus/ Senna artemisioides* subsp. *filifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna*
Shrub 1.5-2m	30-70%	*Acacia burkittii*
Shrub 0.5-1m	10-30%	*Ptilotus obovatus* *Senna artemisioides* subsp. *filifolia*

Plate 24: Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus/ Senna artemisioides* subsp. *filifolia*

4.3.24 Forest of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*

The total flora recorded within this vegetation community was represented by a total of 7 Families, 9 Genera and 14 Taxa (Plate 25). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 31. According to the NVIS, this vegetation community is best represented by MVG8- Casuarina Forest and Woodlands (DoE, 2015b).

Table 31: Vegetation assemblage of Forest of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Casuarina pauper*
Shrub 1.5-2m	10-30%	*Acacia burkittii*
Shrub 0.5-1m	10-30%	*Senna artemisioides* subsp. *filifolia*

Plate 25: Forest of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*

4.3.25 Open tree mallee of *Eucalyptus concinna/ E. loxophleba* subsp. *lissophloia* over scrub of *Acacia burkittii* and mid-dense hummock grass of *Triodia scariosa*

The total flora recorded within this vegetation community was represented by a total of 9 Families, 9 Genera and 14 Taxa (Plate 26). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 32. According to the NVIS, this vegetation community is best represented by MVG14-Mallee Woodlands and Shrublands (DoE, 2015b).

Table 32: Vegetation assemblage of Open tree mallee of *Eucalyptus concinna/ E. loxophleba* subsp. *lissophloia* over scrub of *Acacia burkittii* and mid-dense hummock grass of *Triodia scariosa*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna* *Eucalyptus loxophleba* subsp. *lissophloia*
Shrub >2m	10-30%	*Acacia burkittii*
Hummock Grass	30-70%	*Triodia scariosa*

Plate 26: Open tree mallee of *Eucalyptus concinna/ E. loxophleba* subsp. *lissophloia* over scrub of *Acacia burkittii* and mid-dense hummock grass of *Triodia scariosa*

4.3.26 Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila caperata* and mid-dense hummock grass of *Triodia scariosa*

The total flora recorded within this vegetation community was represented by a total of 11 Families, 14 Genera and 28 Taxa (Plate 27). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 33. According to the NVIS, this vegetation community is best represented by MVG14 – Mallee Woodlands and Shrublands (DoE, 2015b).

Table 33: Vegetation assemblage of Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila caperata* and mid-dense hummock grass of *Triodia scariosa*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna*
Shrub 1.5-2m	10-30%	*Eremophila caperata*
Hummock grass	30-70%	*Triodia scariosa*

Plate 27: Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila caperata* and mid-dense hummock grass of *Triodia scariosa*

4.3.27 Open low woodland of *Acacia incurvaneura* over dense thicket of *Acacia coolgardiensis* and dwarf scrub of *Euryomyrtus maidenii*

The total flora recorded within this vegetation community was represented by a total of 5 Families, 6 Genera and 10 Taxa (Plate 28). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 34. According to the NVIS, this vegetation community is best represented by MVG6- Acacia Forests and Woodlands (DoE, 2015b).

Table 34: Vegetation assemblage of Open low woodland of *Acacia incurvaneura* over dense thicket of *Acacia coolgardiensis* and dwarf scrub of *Euryomyrtus maidenii*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Acacia incurvaneura*
Shrub >2m	70-100%	*Acacia coolgardiensis*
Shrub <0.5m	10-30%	*Euryomyrtus maidenii*

Plate 28: Open low woodland of *Acacia incurvaneura* over dense thicket of *Acacia coolgardiensis* and dwarf scrub of *Euryomyrtus maidenii*

4.3.28 Open low woodland of *Eucalyptus salmonophloia/ E. transcontinentalis* and very open tree mallee of *E. oleosa* over low scrub of *Acacia hemiteles* and open hummock grass of *Triodia scariosa*

The total flora recorded within this vegetation community was represented by a total of 9 Families, 12 Genera and 19 Taxa (Plate 29). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded in this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 35. According to the NVIS, this vegetation community is best represented by MVG5 – Eucalypt Woodlands (DoE, 2015b).

Table 35: Vegetation assemblage of Open low woodland of *Eucalyptus salmonophloia/ E. transcontinentalis* and very open tree mallee of *E. oleosa* over low scrub of *Acacia hemiteles* and open hummock grass of *Triodia scariosa*

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Eucalyptus salmonophloia* *Eucalyptus transcontinentalis*
Mallee Tree Form	2-10%	*Eucalyptus oleosa*
Shrub 1.5-2m	10-30%	*Acacia hemiteles*
Hummock grass	2-10%	*Triodia scariosa*

Plate 29: Open low woodland of *Eucalyptus salmonophloia/ E. transcontinentalis* and very open tree mallee of *E. oleosa* over low scrub of *Acacia hemiteles* and open hummock grass of *Triodia scariosa*

4.4 Vegetation of Conservation Significance

None of the vegetation communities within the survey area were found to have National Environmental Significance as defined by the Commonwealth *EPBC Act 1999*. No TEC pursuant to Commonwealth legislation or PEC as listed by the DPaW were recorded within the survey areas. The survey area is not located within an ESA, however approximately 37ha of the Mulgarrie Well survey area is located within a Schedule 1 Area , as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. The nearest known conservation area is an ESA centred on the Goongarrie National Park located approximately 13km north of the Mt Jewell – Eastern Haul Road and the Mt Jewell – Western Haul road (Appendix 1).

The Racetrack survey area lies within the Great Western Woodlands, an area recognised as the largest remaining area of intact Mediterranean-climate on Earth, and for its natural and cultural values and its natural resource-related productivity (DPaW, 2010a). The Great Western Woodlands is not formally protected under State or Commonwealth legislation.

4.5 Vegetation Condition

Based on the Keighery vegetation health rating scale (1994) (Appendix 8) all 28 vegetation communities were classed as ‘good’, which depicts vegetation structure significantly altered by very obvious signs of multiple disturbances (access tracks, grazing, exploration and mining activities); however it still retains its basic structure and has the ability to regenerate naturally.

5 Introduced Plant Taxa

Three introduced species were identified within the Racetrack survey area:

1. *Carthamus lanatus* (Saffron Thistle)
2. *Centaurea melitensis* (Maltese Cockspur); and
3. *Dittrichia graveolens* (Stinkwort).

According to the DAFWA, *Carthamus lanatus* is listed as a Declared Plant under Section 22 of the *BAM Act 2007*. Information on the management of this taxon provided by the DAFWA is provided in Appendix 9.

5.1.1 *Carthamus lanatus* (Saffron Thistle)

This taxon is described as an erect, spiny annual, herb, which grows between 0.15-0.7m high, and has leaves with rigid, spiny lobes (Plate 30). It produces yellow flowers from December/January to April. It occurs on a variety of soils and is a common weed of crops, pastures and waste grounds (WAHERB, 2015). This taxon is listed as a Declared Plant under Section 22 of the *BAM Act 2007. Carthamus lanatus* was identified within two vegetation communities in the Racetrack survey area:

1. Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria;* and
2. Low woodland of *Eucalypts salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata.*

Plate 30: *Carthamus lanatus* (Saffron Thistle)

5.1.2 *Centaurea melitensis* (Maltese Cockspur)

This species is described as an erect annual or biennial, herb, which grows between 0.2-1 metre high (Plate 31). It produces yellow flowers from September to December or January to March. It is commonly a weed of roadsides, cultivated areas and other disturbed areas (WAHERB, 2014). *Centaurea melitensis* was recorded within three vegetation communities within the Racetrack survey area:

1. Open low woodland of *Pittosporum angustifolium* over open low scrub of *Acacia kalgoorliensis* and dense low heath of *Atriplex vesicaria/ Tecticornia halocnemoides;*
2. Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria;* and
3. Low woodland of *Eucalypts salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata.*

Plate 31: *Centaurea melitensis* (Maltese cockspur)

5.1.3 *Dittrichia graveolens* (Stinkwort)

This species is described as an erect, bushy, viscid, aromatic annual herb that can grow between 0.1-0.5m high. It produces yellow/yellow-white flowers from January to November (Plate 32). It was found in a variety of soils, and is a weed of waste grounds, along rivers and roadsides (WAHERB, 2015). *Dittrichia graveolens* was recorded within three vegetation communities within the Racetrack survey area:

1. Open low woodland of *Pittosporum angustifolium* over open low scrub of *Acacia kalgoorliensis* and dense low heath of *Atriplex vesicaria/ Tecticornia halocnemoides;*
2. Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria;* and
3. Low woodland of *Eucalypts salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata.*

Plate 32: Image of *Dittrichia graveolens* (stinkwort)

6 Relevant Legislation and Compliance with Recognised Standards

6.1 Commonwealth Legislation

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

The aim of this Act is to protect matters of national environmental significance, and is used by the Commonwealth Department of the Environment (DoE) to list threatened taxa and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance.

The survey areas do not have national environmental significance under the *EPBC Act 1999.* There are no TEC or Threatened Flora as listed under the *EPBC Act 1999* identified within the survey areas.

6.2 State Legislation

6.2.1 Clearing of Native Vegetation

Under Section 51C of the *Environmental Protection (EP) Act 1986* and the *Environmental Protection (Clearing of Native Vegetation) Regulations (Regulations) WA 2004* any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the *EP Act 1986* or under the *Regulations 2004* requires a clearing permit from the Department of Environment Regulation (DER) or Department of Mines and Petroleum (DMP). Under Section 51A of the *EP Act 1986* native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the *EP Act 1986* defines clearing as "*the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above*".

Exemptions under Schedule 6 of the *EP Act 1986* and the *Regulations 2004* do not apply for clearing an area exceeding 10ha per tenement, clearing in ESA's as declared under Section 51B of the *EP Act 1986* or within Schedule 1 Areas as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Vegetation) Regulation 2004.*

Approximately 37ha of the Mulgarrie Well survey area is located within a Schedule 1 Area, centred on the township of and Water Reserve of Mulgarrie Well (Class C Reserve), therefore any clearing within the Mulgarrie Well survey area will require a clearing permit. If the clearing of the other three survey areas exceeds the 10ha per tenement a clearing permit will be required for development within these areas.

6.2.2 Environmental Protection Act WA 1986

This Act pertains to the assessment of applications for clearing permits and aims to protect Declared Rare Flora and Threatened Ecological Communities from clearing. Threatened Ecological Communities are protected even where exemptions for a clearing permit may apply. The Act enforces both financial and/or imprisonment penalties on those who unlawfully damage a Threatened Ecological Community.

The survey area does not contain any TEC or Threatened Flora as listed under the *EPBC Act 1999* or by the DPaW.

6.2.3 Wildlife Conservation Act WA 1950

This Act is used by the Western Australian DPaW to list flora taxa as being protected and the level of protection needed for such flora. Flora taxa are classified as 'Declared Rare Flora' when their populations are geographically restricted or are threatened by local processes. Under this Act all native flora (spermatophytes, Pteridophyta, bryophytes and thallophytes) are protected throughout the State. Financial penalties are enforced under this Act if threatened plant taxa are collected without an appropriate licence.

6.2.4 DPaW Priority lists

The DPaW lists 'Priority' flora taxa which are under consideration for declaration as Rare Flora. Taxa classed as Priority 1-3 are in urgent need of further survey, whereas Priority 4 taxa are considered to have been adequately surveyed but may become vulnerable or rare in future years. Priority 4 taxa are also taxa that have been removed from the threatened taxa list in the past 5 years. Priority 5 taxa are those taxa which are not currently threatened but are subject to a specific conservation program, the cessation of which would result in the taxon likely to become threatened within 5 years The DPaW also lists PECs, which identifies those communities that may need monitoring before possible nomination for TEC status. These priority taxa and communities have no formal legal protection until they are endorsed by the Minister as being Declared Rare Flora and TEC's respectively.

Results of the DPaW databases search revealed 17 Priority Flora taxa listed within a 25km radius of the survey areas, of which five had the potential to occur within the survey areas. No Priority Flora taxa were identified within the survey areas.

6.3 EPA Position Statements

The EPA develops Position Statements to inform the public about environmental issues facing Western Australia, and the plans for the future to ensure protection and ecological sustainability of environmentally important ecosystems. It provides a set of principles to assist the public and decision-makers on their responsibilities for managing land with care. These principles also provide the basis for the Environmental Protection Authority to evaluate and report upon achieving environmental and ecological sustainability, and the protection of natural resources.

6.3.1 Position Statement No. 2

Environmental Protection of Native Vegetation in Western Australia (EPA 2000) outlines EPA policy on the protection of native vegetation in Western Australia, particularly in the agricultural area. It identifies basic elements that the EPA should consider when assessing proposals that impact on biological diversity. These include comparison of all proposal options; avoidance of taxa and community extinctions; an expectation that implementing the proposal will not take a vegetation type below the "threshold level" of 30%; and that proponents should demonstrate that on- and off-site impacts can be managed.

The survey areas do not contain any Threatened Flora or TEC suggesting that clearing within the survey area will meet the EPA standards outlined in Position statement No. 2. According to DAFWA (2011) the survey areas occur in the pre-European Beard vegetation associations Coolgardie 125 & 540, Barlee 10, 20, 529 & 555 and Kununulling 468 all of which retain approximately 95-100% of the original pre-European vegetation extent.

6.3.2 Position Statement No. 3

Terrestrial Biological Surveys as an Element of Biodiversity Protection establishes that the EPA has adopted the definition and principles of biological diversity as defined in the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996), and has stipulated the following requirements:

- The quality of information and scope of field surveys should meet standards, requirements and protocols as determined and published by the EPA; and
- The IBRA regionalisations should be used as the largest unit for environmental impact assessment (EIA) decision-making in relation to the conservation of biodiversity.

Pursuant to the IBRA regionalisation's, 26 bioregions in WA, which are affected by a range of different threatening processes and have varying levels of sensitivity to impact, have been identified. Terrestrial biological surveys should provide sufficient information to address both biodiversity conservation and ecological functional values within the context of proposals and the results of surveys should be publicly available.

The flora survey of the study area was planned and implemented as far as practicable according to the EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004). Also, the IBRA regionalisations have been used in preparing the report to identify the conservation status of the area and identify the main threats to the biodiversity of plant taxa in the region.

6.1 Native Vegetation Clearing Principles

Based on the outcomes from the survey undertaken, as presented in this report, BC provides the following comments regarding the native vegetation clearing principles (relevant to vegetation only) listed under Schedule 5 of the *EP Act 1986* (Table 36).

Table 36: **Assessment of survey area against native vegetation clearing principles**

Letter	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	Vegetation identified within the survey area is not considered to be of high biological diversity, and is well represented outside of the proposed impact area.	Development within the survey areas is unlikely to be at variance to this principle
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the *WC Act 1950* and the *EPBC Act 1999* were identified within the survey areas. However a potentially new taxon (*Ricinocarpos* sp.) has been identified within the Mt Jewell-Western Haul Road survey area. Whilst this taxon is not formally listed as Declared Rare Flora, there are only eight recorded locations of this taxon with its currently known distribution located within <1.5km south/south east of the Mt Jewell Western Haul Road.	Development within the survey areas may be at variance to this principle
(d)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of a threatened ecological community (TEC).	No TEC listed under the *EPBC Act 1999* or by the DPaW (2010) occur within the survey area.	Development within the survey area is unlikely to be at variance to this principle
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	According to DAFWA (2011), the survey areas occur in pre-European Beard vegetation associations Coolgardie 125 & 540, Barlee 10, 20, 529 & 555 and Kununulling 468, in the Eastern Goldfields subregion (COO3) and Eastern Murchison (MUR1), which retain approximately 95-100% of their original vegetation extent.	Development within the survey area is unlikely to be at variance to this principle
(f)	Native vegetation should not be cleared if it is growing, in, or in association with, an environment associated with a watercourse or wetland	According to the *Global Map Australia 2001 GIS file* (Geoscience Australia) a Non-Perennial/Intermittent/Fluctuating River/Stream intercepts the Mulgarrie Well, Mt – Jewell Western Haul Road and the Racetrack survey areas (Appendix 1).	Development within the survey area may be at variance to this principle
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	According to DAFWA (2011), the survey area occurs in pre-European Beard vegetation association Coolgardie 125 & 540, Barlee 10, 20, 529 & 555 and Kununulling 468, in the Eastern Goldfields subregion (COO3) and Eastern Murchison (MUR1), which retains approximately 95-100% of the original vegetation extent. Clearing within this vegetation association is not likely to lead to land degradation issues such as salinity, water logging or acidic soils.	Development within the survey area is unlikely to be at variance to this principle
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The survey area is not located within any Conservation areas. The nearest conservation area is an ESA and DPaW managed land (Goongarrie National Park) located approximately 13km north of the survey areas; Development within the survey areas should not pose any threat to this conservation area.	Development within the survey area is unlikely to be at variance to this principle

7 Conclusions

28 vegetation communities were identified within the four survey areas, which were represented by a total of 26 Families, 56 Genera and 130 Taxon including sub-species and variants. No Threatened taxa, pursuant to subsection (2) of section 23F of the *WC Act 1950* and the Commonwealth *EPBC Act 1999* were identified within the survey area. No Priority Flora taxa as listed by the DPaW (2014) were identified within the survey area. An unidentified taxon of *Ricinocarpos* sp. was identified within the Mt Jewell – Western Haul Road survey area which has been identified by the Western Australian Herabarium as a potentially new species. This taxon had been previously identified in the surrounding area from previous flora and vegetation surveys conducted by BC. Until this taxon has been formally classified it is considered a Flora of Conservation Significance.

None of the vegetation communities within the survey areas were found to have National Environmental Significance as defined by the Commonwealth *EPBC Act 1999*. No TEC pursuant to Commonwealth legislation or PEC as listed by the DPaW were recorded within the survey areas. The survey areas are not located within an ESA, however approximately 37ha of the Mulgarrie Well survey area is located within a Schedule 1 Area , as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Based on the Keighery vegetation health rating scale all 28 vegetation communities were rated as 'good'. Three introduced species were identified within the Racetrack survey area. According to the DAFWA, *Carthamus lanatus* is listed as a Declared Plant under Section 22 of the *BAM Act 2007*.

8 Recommendations

- All seed from Eucalyptus species should be be collected prior to clearing within each survey area.
- Forest Products Commission should be contacted regarding the removal of *Santalum spicatum* (Sandalwood) prior to clearing.
- Any disturbance to the *Ricinocarpos* sp. should be avoided and DPaW should be consulted regarding the conservation value of this taxon.
- A targeted search for *Ricinocarpos* sp. to determine population boundary/size is recommended prior to clearing to determine the distribution of this potentially new taxon.

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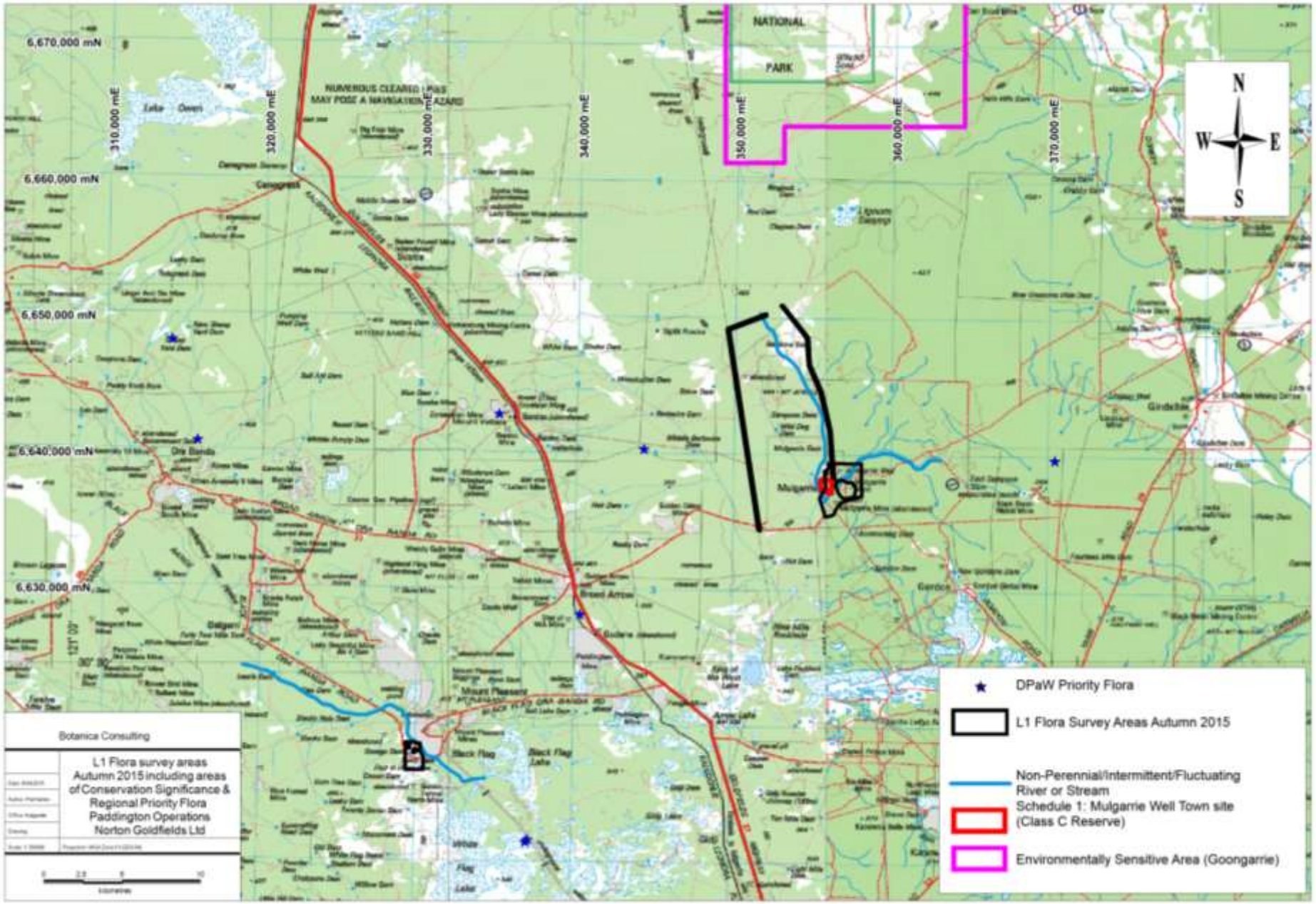
10 Appendices

Appendix 1: Map of the survey area including DPaW listed Flora of Conservation Significance and areas of Conservation Significance (survey area not to scale)

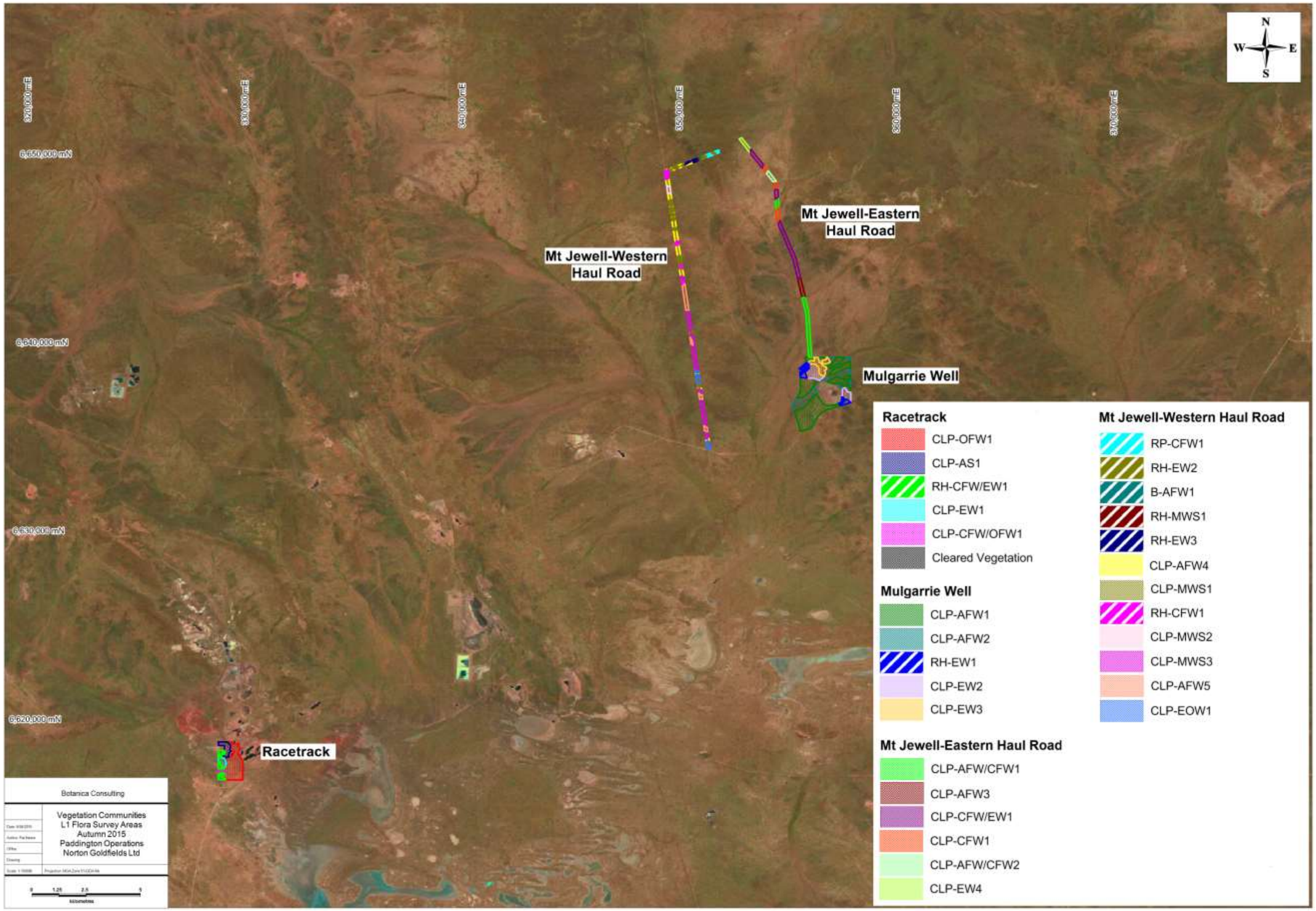


Appendix 2: Corresponding codes for vegetation communities on vegetation maps and taxa List

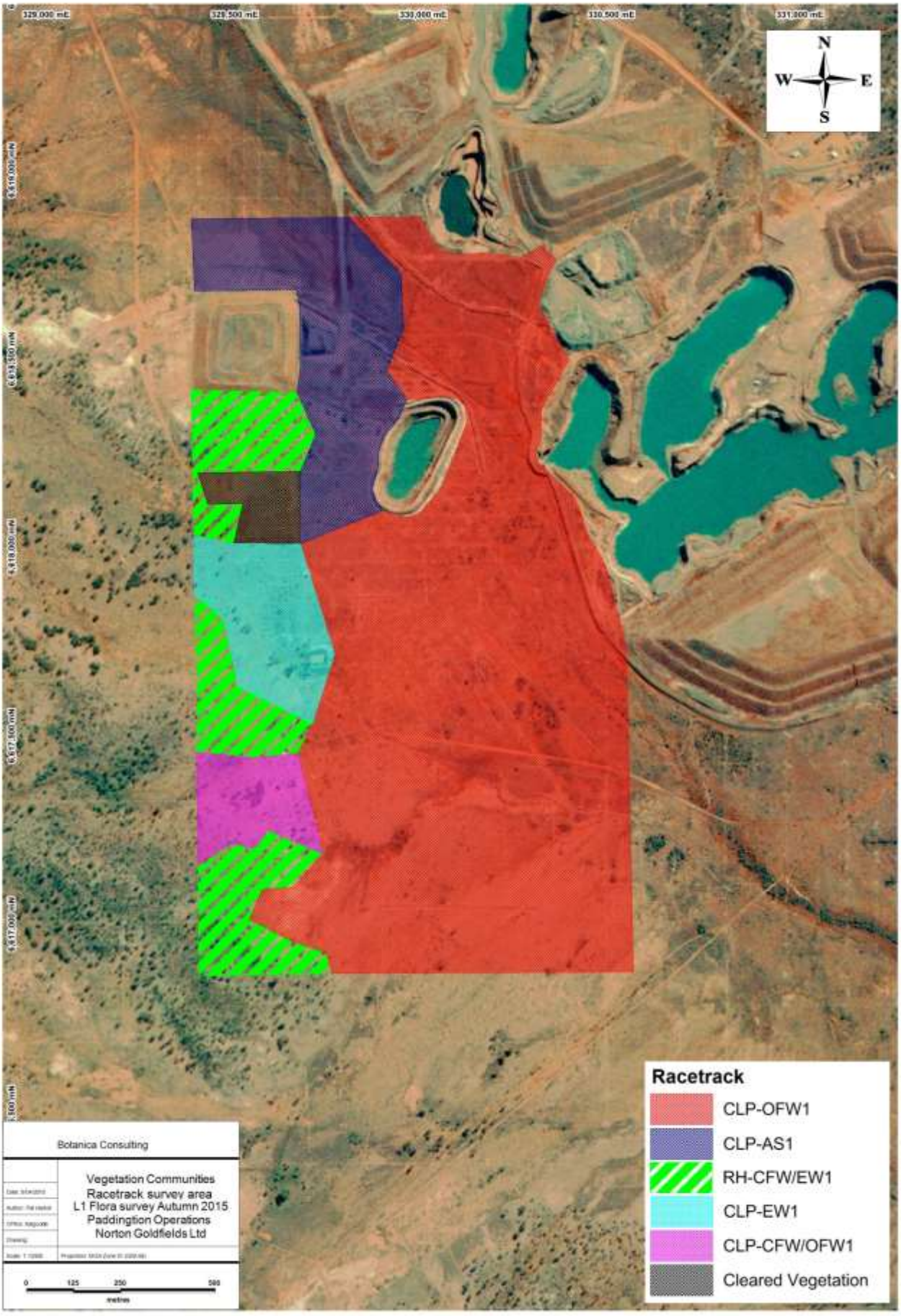
Survey Area	Vegetation Code	Vegetation Community	Area (ha)	Area (%)
Racetrack	CLP-OFW1	Open low woodland of *Pittosporum angustifolium* over open low scrub of *Acacia kalgoorliensis* and dense low heath of *Atriplex vesicaria/ Tecticornia halocnemoides*	**127**	**65**
	CLP-AS1	Scrub of *Acacia jennerae* over heath of *Maireana pyramidata/ Atriplex bunburyana* and dwarf scrub of *Atriplex vesicaria*	**24**	**12**
	RH-CFW/EW1	Open low woodland of *Casuarina pauper/ Eucalyptus clelandii* over low scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp. *angustifolia* and dwarf scrub of *Maireana glomerifolia/ M. triptera*	**23**	**12**
	CLP-EW1	Low woodland of *Eucalyptus salmonophloia* over open low scrub of *Acacia kalgoorliensis* and dwarf scrub of *Atriplex vesicaria/ Maireana pyramidata/ Tecticornia disarticulata*	**12**	**6**
	CLP-CFW/OFW1	Open low woodland of *Casuarina pauper/ Pittosporum angustifolium* over open scrub of *Acacia kalgoorliensis/ Eremophila oldfieldii* subsp *angustifolia* and dwarf scrub of *Atriplex vesicaria/ Tecticornia halocnemoides*	**8**	**4**
Cleared Vegetation			**2**	**1**
Total			**196**	**100**
Mulgarrie Well	CLP-AFW1	Open low woodland of *Acacia caesaneura/ Casuarina pauper* with occasional tree mallee of *Eucalyptus oleosa* over low scrub of *Acacia burkittii* and dwarf scrub of *Maireana sedifolia*	312	52
	CLP-AFW2	Forest of *Acacia caesaneura* over low scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Maireana sedifolia*	150	25
	RH-EW1	Low woodland of *Eucalyptus clelandii* over scrub of *Eremophila interstans* subsp. *virgata* and low scrub of *Acacia erinacea*	34	6
	CLP-EW2	Low woodland of *Eucalyptus clelandii/ E. oleosa* over low scrub of *Acacia hemiteles/ Eremophila scoparia* and dwarf scrub of *Maireana sedifolia*	65	11
	CLP-EW3	Low woodland of *Eucalyptus clelandii/ E. salmonophloia/ E. transcontinentalis* over open low scrub of *Acacia burkittii/A. tetragonophylla/ Eremophila scoparia* and dwarf scrub of *Atriplex nummularia* subsp. s*pathulata/ A. vesicaria/ Maireana sedifolia*	38	6
Total			**599**	**100**
Mt Jewell - Eastern Haul Road	CLP-AFW/CFW1	Open low woodland of *Acacia incurvaneura/ Casuarina pauper* over scrub of *Acacia jennerae* and dense low heath of *Cratystylis subspinescens*	57	31
	CLP-AFW3	Forest of *Acacia caesaneura* over scrub of *Senna artemisioides* subsp. *filifolia* and open low scrub of *Maireana sedifolia*	16	9
	CLP-CFW/EW1	Open low woodland of *Casuarina pauper/ Eucalyptus salmonophloia* over heath of *Senna artemisioides* subsp. *filifolia* and low heath of *Maireana sedifolia*	67	36

Survey Area	Vegetation Code	Vegetation Community	Area (ha)	Area (%)
	CLP-CFW1	Low woodland of *Casuarina pauper* over open low scrub of *Acacia tetragonophylla/ Dodonaea lobulata* and low heath of *Maireana sedifolia*	23	12
	CLP-AFW/CFW2	Open low woodland of *Acacia caesaneura/ Casuarina pauper* over scrub of *Acacia ramulosa* var. *ramulosa* and dwarf scrub of *Senna artemisioides* subsp. x *artemisioides*	9	5
	CLP-EW4	Low woodland of *Eucalyptus ravida* over open scrub of *Eremophila interstans* subsp. *virgata* and low heath of *Atriplex vesicaria/ Maireana sedifolia*	13	7
Total			**185**	**100**
Mt Jewell - Western Haul Road	RP-CFW1	Forest of *Casuarina pauper* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*	9	3
	RH-EW2	Forest of *Eucalyptus flavida* over heath of *Acacia kalgoorliensis* and hummock grass of *Triodia scariosa*	4	2
	B-AFW1	Dense thicket of *Acacia quadrimarginea* over low scrub of *Philotheca microcephala* and open dwarf scrub of *Ptilotus obovatus* on breakaway	3	1
	RH-MWS1	Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia kalgoorliensis* and dwarf scrub of *Dodonaea microzyga*	1	0.4
	RH-EW3	Forest of *Eucalyptus clelandii* over low scrub of *Eremophila interstans* subsp. *virgata* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*	4	2
	CLP-AFW4	Thicket of *Acacia caesaneura/ A. burkittii* over low scrub of *Dodonaea lobulata* and open hummock grass of *Triodia scariosa*	65	25
	CLP-MWS1	Open tree mallee of *Eucalyptus concinna* over thicket of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus/ Senna artemisioides* subsp. *filifolia*	38	14
	RH-CFW1	Forest of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Senna artemisioides* subsp. *filifolia*	13	5
	CLP-MWS2	Open tree mallee of *Eucalyptus concinna/ E. loxophleba* subsp. *lissophloia* over scrub of *Acacia burkittii* and mid-dense hummock grass of *Triodia scariosa*	5	2
	CLP-MWS3	Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila caperata* and mid-dense hummock grass of *Triodia scariosa*	74	28
	CLP-AFW5	Open low woodland of *Acacia incurvaneura* over dense thicket of *Acacia coolgardiensis* and dwarf scrub of *Euryomyrtus maidenii*	31	12
	CLP-EOW1	Open low woodland of *Eucalyptus salmonophloia/ E. transcontinentalis* and very open tree mallee of *E. oleosa* over low scrub of *Acacia hemiteles* and open hummock grass of *Triodia scariosa*	16	6
Total			**263**	**100**

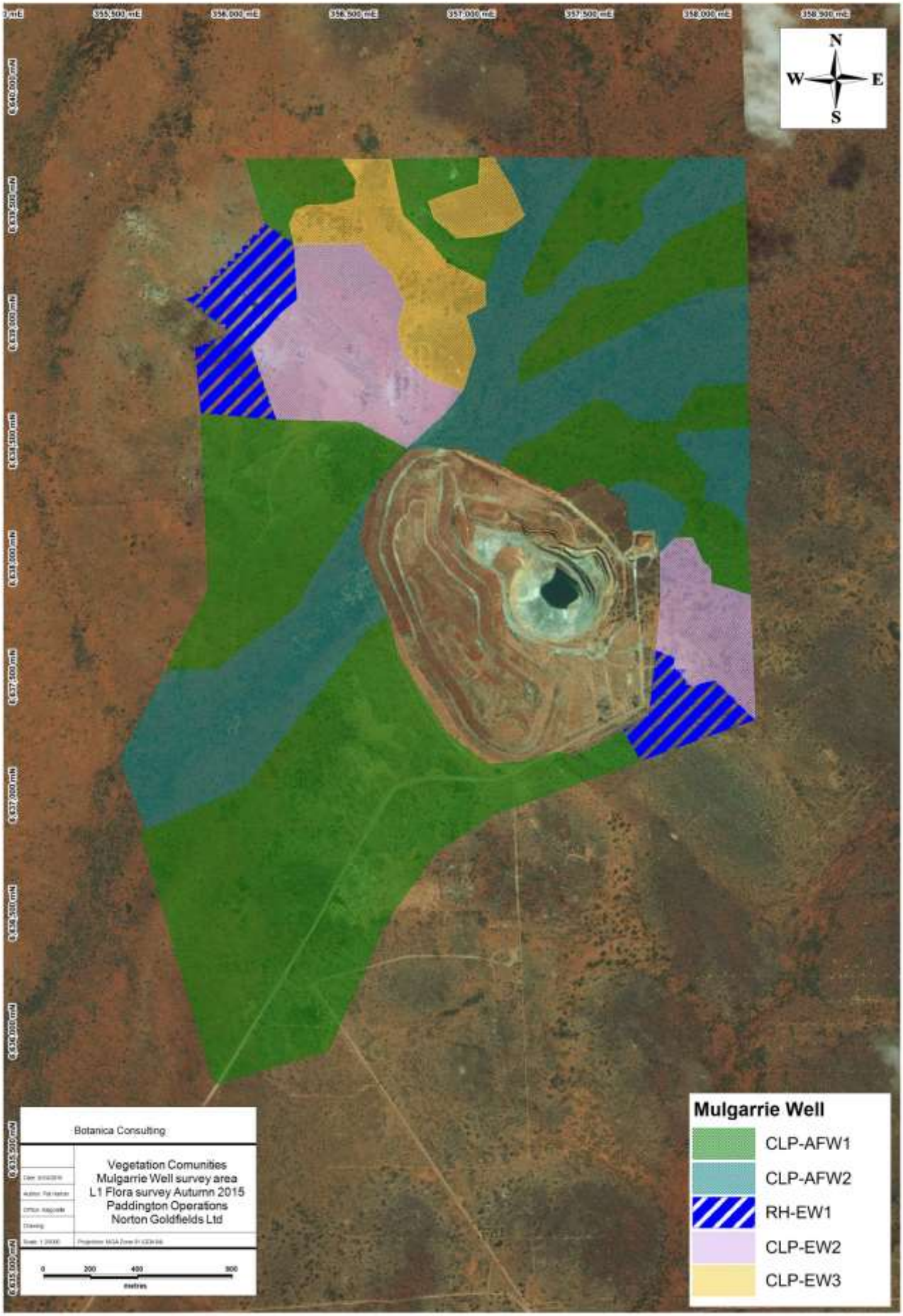
Appendix 3: Total Vegetation map of the survey area



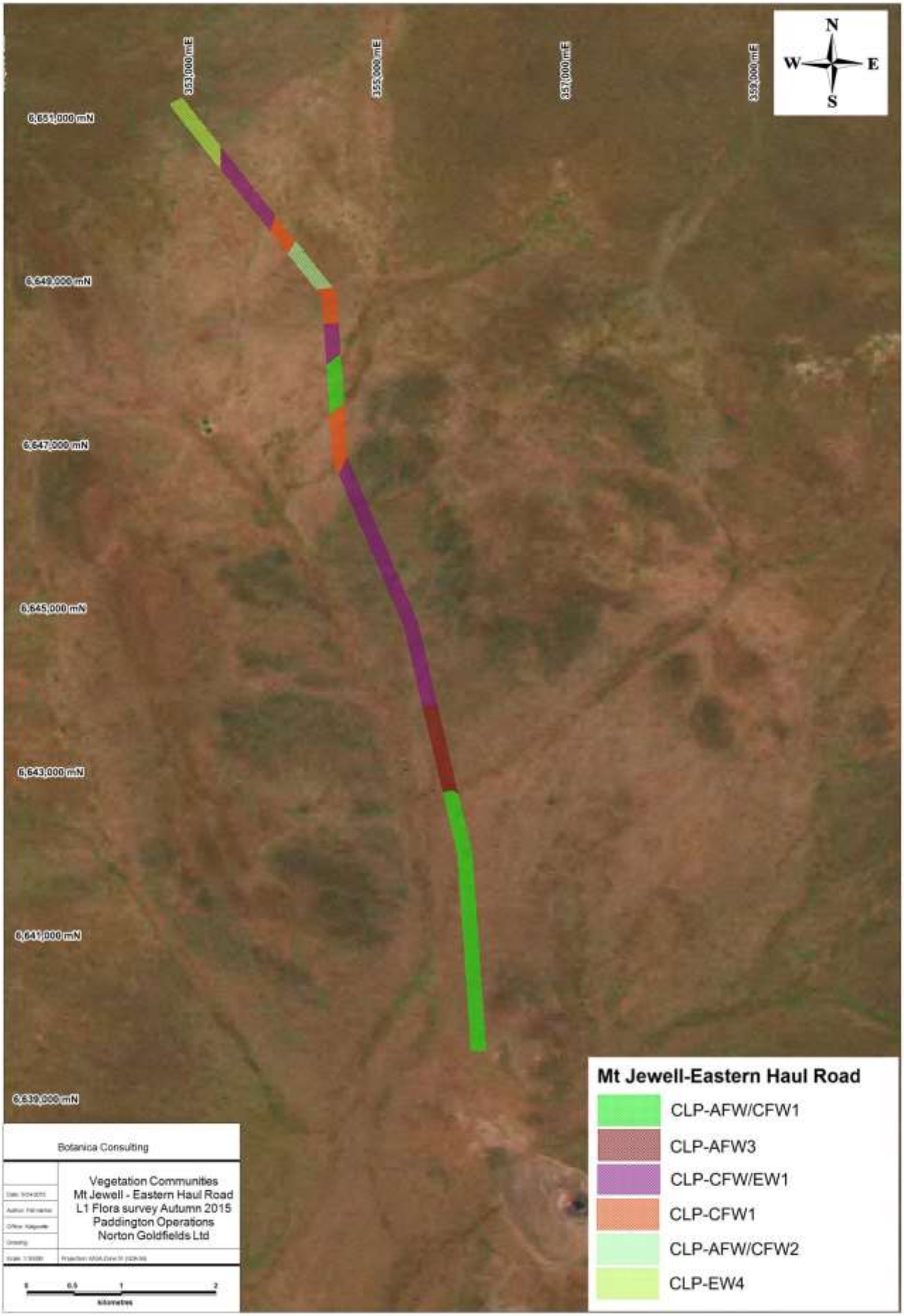
Racetrack Survey Area



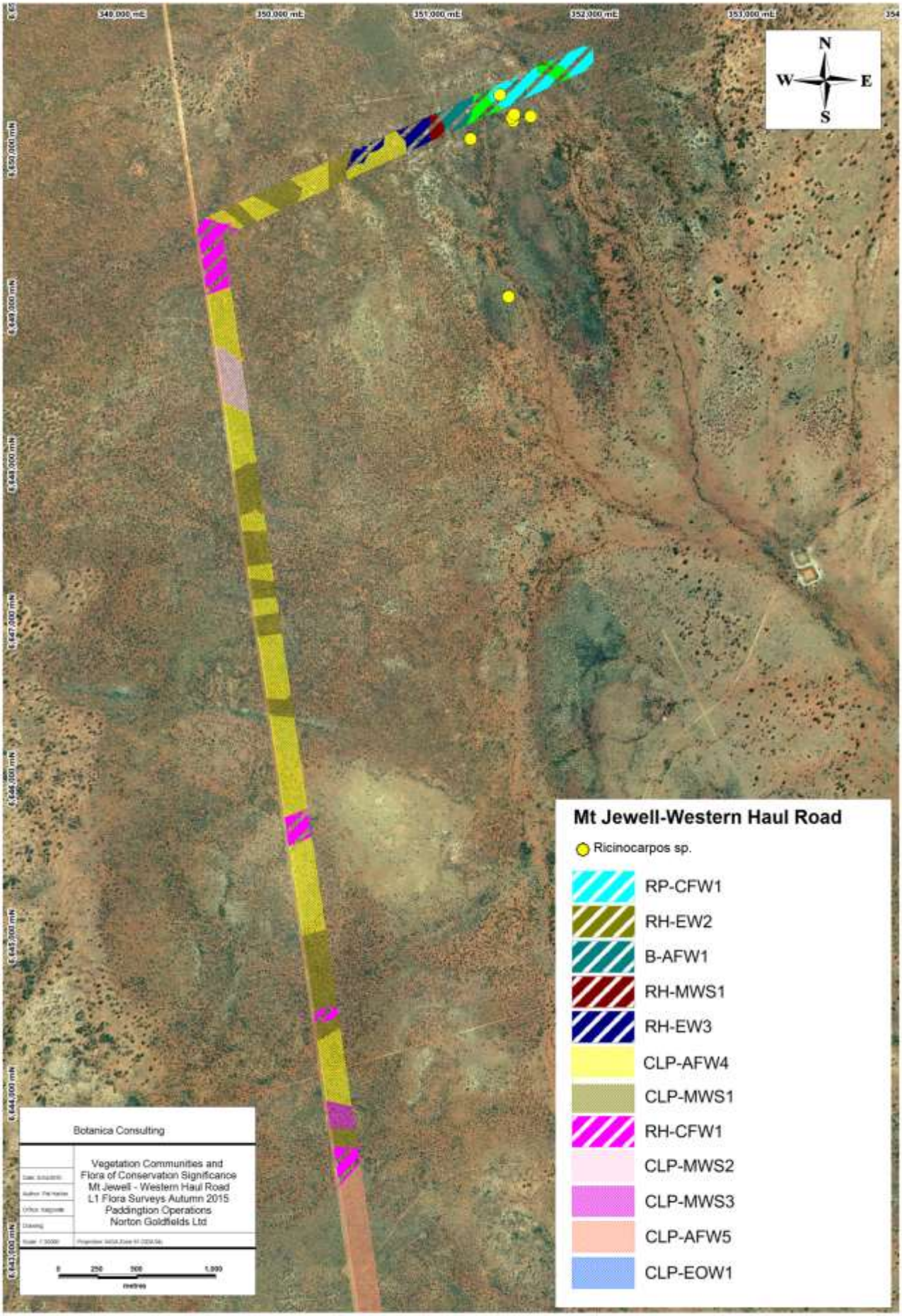
Mulgarrie Well Survey Area

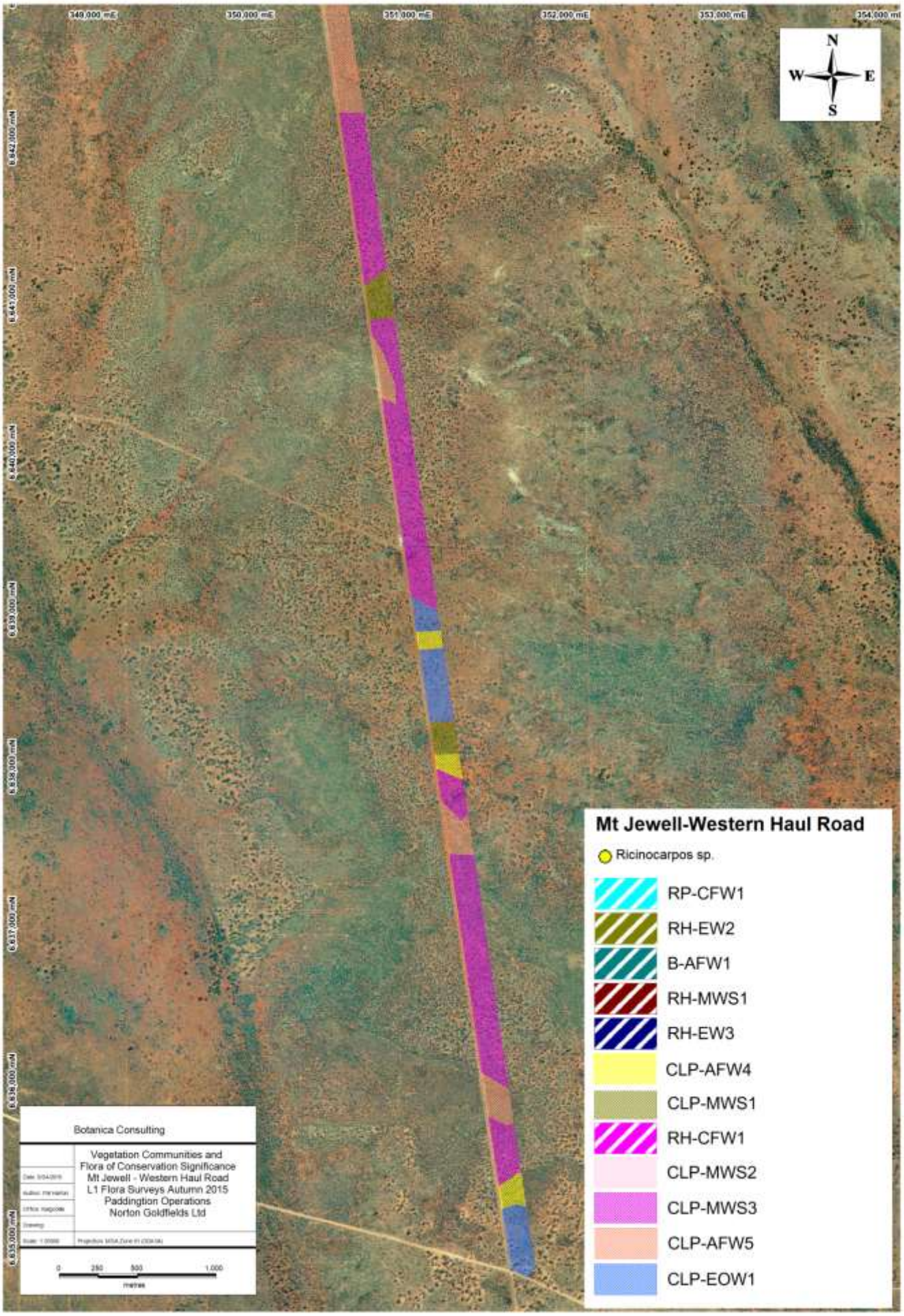


Mt Jewell – Eastern Haul Road Survey Area



Mt Jewell – Western Haul Road Survey area




348,000 mE
350,000 mE
351,000 mE
352,000 mE
353,000 mE
354,000 mE
N
W
E
S
6,842,000 mN
6,841,000 mN
6,840,000 mN
6,839,000 mN
6,838,000 mN
6,837,000 mN
6,836,000 mN
6,835,000 mN
Mt Jewell-Western Haul Road
Ricinocarpos sp.
RP-CFW1
RH-EW2
B-AFW1
RH-MWS1
RH-EW3
CLP-AFW4
CLP-MWS1
RH-CFW1
CLP-MWS2
CLP-MWS3
CLP-AFW5
CLP-EOW1
Botanica Consulting
Vegetation Communities and Flora of Conservation Significance
Mt Jewell - Western Haul Road
L1 Flora Surveys Autumn 2015
Paddington Operations
Norton Goldfields Ltd
0
250
500
1,000
metres

Appendix 4: List of taxa identified within each vegetation community

(CS) Denotes Flora of Conservation Significance; (W) Green Cells and text denotes introduced taxa; Blue cells and text denotes annual taxa (WAHERB, 2015)

Family	Genus	Taxa	Racetrack Survey Area					Mulgarrie Well Survey Area					Mt Jewell - Eastern Haul Road						Mt Jewell - western Haul Road											
			CLP-OFW1	CLP-AS1	RH-CFW/EW1	CLP-EW1	CLP-CFW/OFW1	CLP-AFW1	CLP-AFW2	RH-EW1	CLP-EW2	CLP-EW3	CLP-AFW/CFW1	CLP-AFW3	CLP-CFW/EW1	CLP-CFW1	CLP-AFW/CFW2	CLP-EW4	RP-CFW1	RH-EW2	B-AFW1	RH-MWS1	RH-EW3	CLP-AFW4	CLP-MWS1	RH-CFW1	CLP-MWS2	CLP-MWS3	CLP-AFW5	CLP-EOW1
Aizoaceae	*Disphyma*	*crassifolium*	*	*	*	*	*																							
Aizoaceae	*Gunniopsis*	*glabra*	*	*		*																								
Amaranthaceae	*Ptilotus*	*nobilis*			*																									
Amaranthaceae	*Ptilotus*	*obovatus*			*			*	*	*	*	*	*	*	*	*	*	*	*		*		*		*	*				
Apocynaceae	*Alyxia*	*buxifolia*																	*		*					*				
Apocynaceae	*Marsdenia*	*australis*			*			*									*													
Asteraceae	*Carthamus*	*lanatus (W)*		*		*																								
Asteraceae	*Centaurea*	*melitensis* (W)	*	*		*																								
Asteraceae	*Cratystylis*	*conocephala*																												*
Asteraceae	*Cratystylis*	*microphylla*			*		*																							*
Asteraceae	*Cratystylis*	*subspinescens*			*		*	*	*			*	*	*	*	*		*												
Asteraceae	*Dittrichia*	*graveolens* (W)	*	*		*																								
Asteraceae	*Olearia*	*muelleri*																										*		*
Asteraceae	*Podolepis*	*capillaris* (A)	*	*		*																								
Casuarinaceae	*Allocasuarina*	*campestris*																	*	*										
Casuarinaceae	*Allocasuarina*	*helmsii*																	*	*										
Casuarinaceae	*Casuarina*	*pauper*	*		*		*	*	*	*		*	*	*	*	*	*	*	*	*			*		*	*				*
Chenopodiaceae	*Atriplex*	*bunburyana*	*	*	*	*		*	*		*	*	*	*	*	*		*												
Chenopodiaceae	*Atriplex*	*codonocarpa (A)*	*	*		*																								
Chenopodiaceae	*Atriplex*	*nummularia* subsp. *spathulata*		*	*							*																		
Chenopodiaceae	*Atriplex*	*stipitata*																												*
Chenopodiaceae	*Atriplex*	*vesicaria*	*	*		*	*					*						*												
Chenopodiaceae	*Chenopodium*	*curvispicatum*																							*					
Chenopodiaceae	*Enchylaena*	*lanata*			*																									
Chenopodiaceae	*Maireana*	*amoena*	*	*		*	*																							
Chenopodiaceae	*Maireana*	*georgei*			*			*	*		*	*	*	*	*	*		*												
Chenopodiaceae	*Maireana*	*glomerifolia*	*	*	*	*	*																							
Chenopodiaceae	*Maireana*	*pyramidata*	*	*		*		*	*			*	*	*	*	*		*												
Chenopodiaceae	*Maireana*	*sedifolia*			*			*	*	*	*	*	*	*	*	*		*												*
Chenopodiaceae	*Maireana*	*tomentosa*	*	*		*																								
Chenopodiaceae	*Maireana*	*trichoptera*			*																									
Chenopodiaceae	*Maireana*	*triptera*							*		*		*	*	*	*	*	*										*		*
Chenopodiaceae	*Rhagodia*	*eremaea*							*				*																	
Chenopodiaceae	*Sclerolaena*	*diacantha*	*	*	*	*		*	*	*	*	*	*	*	*	*		*				*			*					
Chenopodiaceae	*Sclerolaena*	*drummondii*						*	*			*		*																
Chenopodiaceae	*Sclerolaena*	*parviflora*						*	*	*	*	*	*	*	*	*		*							*					
Chenopodiaceae	*Tecticornia*	*disarticulata*	*	*	*	*	*																							
Chenopodiaceae	*Tecticornia*	*halocnemoides*	*	*		*	*																							
Euphorbiaceae	*Ricinocarpos*	Sp. (CS)																	*	*										
Fabaceae	*Acacia*	*burkittii*						*				*		*	*					*		*	*	*	*	*	*	*		
Fabaceae	*Acacia*	*caesaneura*						*	*		*			*	*		*				*			*		*	*	*	*	*
Fabaceae	*Acacia*	*colletioides*									*										*						*	*		*
Fabaceae	*Acacia*	*coolgardiensis*																											*	
Fabaceae	*Acacia*	*erinacea*								*																				
Fabaceae	*Acacia*	*hemiteles*						*		*	*			*					*						*	*	*	*		*
Fabaceae	*Acacia*	*incurvaneura*	*					*					*			*													*	
Fabaceae	*Acacia*	*jennerae*	*	*							*		*		*	*												*		
Fabaceae	*Acacia*	*kalgoorliensis*	*		*	*	*												*	*		*	*							
Fabaceae	*Acacia*	*kempeana*						*												*	*									
Fabaceae	*Acacia*	*ligulata*																										*		
Fabaceae	*Acacia*	*murrayana*								*				*	*	*								*					*	
Fabaceae	*Acacia*	*oswaldii*										*							*							*				
Fabaceae	*Acacia*	*quadrimarginea*																	*	*	*	*		*						
Fabaceae	*Acacia*	*ramulosa*						*	*								*				*			*	*	*				
Fabaceae	*Acacia*	*tetragonophylla*	*	*				*	*	*	*	*	*	*		*	*		*			*		*		*		*		

Family	Genus	Taxa	Racetrack Survey Area					Mulgarrie Well Survey Area					Mt Jewell - Eastern Haul Road						Mt Jewell - western Haul Road											
			CLP-OFW1	CLP-AS1	RH-CFW/EW1	CLP-EW1	CLP-CFW/OFW1	CLP-AFW1	CLP-AFW2	RH-EW1	CLP-EW2	CLP-EW3	CLP-AFW/CFW1	CLP-AFW3	CLP-CFW/EW1	CLP-CFW1	CLP-AFW/CFW2	CLP-EW4	RP-CFW1	RH-EW2	B-AFW1	RH-MWS1	RH-EW3	CLP-AFW4	CLP-MWS1	RH-CFW1	CLP-MWS2	CLP-MWS3	CLP-AFW5	CLP-EOW1
Fabaceae	*Glycyrrhiza*	*acanthocarpa*		*																									
Fabaceae	*Senna*	*artemisioides* subsp. *filifolia*	*					*	*	*	*	*	*	*		*				*		*	*	*	*	*		*		*
Fabaceae	*Senna*	*artemisioides* subsp. *helmsii*													*															
Fabaceae	*Senna*	*artemisioides* subsp. x *artemisioides*						*	*			*	*	*	*	*	*					*					*			
Fabaceae	*Templetonia*	*egena*							*																			*		
Frankeniaceae	*Frankenia*	*setosa*	*	*	*	*							*			*														
Goodeniaceae	*Scaevola*	*spinescens*			*			*	*	*		*		*					*		*	*	*	*		*		*		*
Lamiaceae	*Prostanthera*	*althoferi*																						*					*	
Lamiaceae	*Prostanthera*	*campbellii*																						*						
Lamiaceae	*Westringia*	*cephalantha*																		*							*	*		
Lamiaceae	*Westringia*	*rigida*																										*		
Loranthaceae	*Amyema*	*miquelii*							*																					
Malvaceae	*Brachychiton*	*gregorii*							*				*	*		*	*				*			*			*			
Malvaceae	*Sida*	*calyxhymenia*	*	*		*																								
Malvaceae	*Sida*	*intricata*											*		*	*		*												
Myrtaceae	*Eucalyptus*	*clelandii*			*					*	*	*											*							
Myrtaceae	*Eucalyptus*	*concinna*						*	*													*			*			*	*	
Myrtaceae	*Eucalyptus*	*flavida*																		*							*			
Myrtaceae	*Eucalyptus*	*gracilis*	*		*																		*							
Myrtaceae	*Eucalyptus*	*horistes*																										*		
Myrtaceae	*Eucalyptus*	*leptopoda*																						*			*			
Myrtaceae	*Eucalyptus*	*loxophleba* subsp. *lissophloia*																						*			*			
Myrtaceae	*Eucalyptus*	*oleosa*						*	*	*	*			*					*			*		*	*			*		*
Myrtaceae	*Eucalyptus*	*ravida*				*												*												
Myrtaceae	*Eucalyptus*	*salmonophloia*				*		*	*		*	*	*	*	*	*	*	*												*
Myrtaceae	*Eucalyptus*	*salubris*																					*							
Myrtaceae	*Eucalyptus*	*transcontinentalis*			*						*	*			*			*					*							*
Myrtaceae	*Eucalyptus*	*trichopoda*																	*			*								
Myrtaceae	*Euryomyrtus*	*maidenii*																											*	
Pittosporaceae	*Bursaria*	*occidentalis*							*																					
Pittosporaceae	*Pittosporum*	*angustifolium*	*				*				*		*		*	*	*													
Poaceae	*Aristida*	*contorta*	*	*		*	*																							
Poaceae	*Cymbopogon*	*ambiguus*	*	*		*																								
Poaceae	*Enteropogon*	*ramosus*	*	*		*																								
Poaceae	*Eragrostis*	*dielsii*	*	*		*																								
Poaceae	*Triodia*	*scariosa*																	*	*				*			*	*		*
Proteaceae	*Grevillea*	*acuaria*				*	*													*								*		
Proteaceae	*Grevillea*	*huegelii*																										*		
Proteaceae	*Grevillea*	*nematophylla*							*																		*	*		*
Proteaceae	Grevillea	oligomera																	*											
Proteaceae	*Hakea*	*kippistiana*																			*									
Proteaceae	*Hakea*	*preissii*	*		*											*														
Rhamnaceae	*Cryptandra*	*aridicola*																						*			*			
Rubiaceae	*Psydrax*	*suaveolens*			*																									
Rutaceae	*Phebalium*	*lepidotum*																											*	
Rutaceae	*Phebalium*	*canaliculatum*																						*					*	
Rutaceae	*Philotheca*	*brucei*																			*			*						
Santalaceae	*Exocarpos*	*aphyllus*					*						*			*							*			*		*		
Santalaceae	*Santalum*	*acuminatum*											*			*													*		
Santalaceae	*Santalum*	*spicatum*						*	*				*			*				*	*	*	*			*		*		
Sapindaceae	*Alectryon*	*oleifolius*	*				*		*				*		*	*														
Sapindaceae	*Dodonaea*	*lobulata*			*			*	*	*		*		*	*	*	*		*				*	*	*	*		*		
Sapindaceae	*Dodonaea*	*microzyga*																				*								
Sapindaceae	*Dodonaea*	*stenozyga*																			*									
Sapindaceae	*Dodonaea*	*viscosa*					*																							
Scrophulariaceae	*Eremophila*	*alternifolia*	*					*					*			*														
Scrophulariaceae	*Eremophila*	*caperata*																										*		*
Scrophulariaceae	*Eremophila*	*clarkei*																			*									

Family	Genus	Taxa	Racetrack Survey Area					Mulgarrie Well Survey Area					Mt Jewell - Eastern Haul Road						Mt Jewell - western Haul Road											
			CLP-OFW1	CLP-AS1	RH-CFW/EW1	CLP-EW1	CLP-CFW/OFW1	CLP-AFW1	CLP-AFW2	RH-EW1	CLP-EW2	CLP-EW3	CLP-AFW/CFW1	CLP-AFW3	CLP-CFW/EW1	CLP-CFW1	CLP-AFW/CFW2	CLP-EW4	RP-CFW1	RH-EW2	B-AFW1	RH-MWS1	RH-EW3	CLP-AFW4	CLP-MWS1	RH-CFW1	CLP-MWS2	CLP-MWS3	CLP-AFW5	CLP-EOW1
Scrophulariaceae	*Eremophila*	*decipiens*			*										*			*					*		*					
Scrophulariaceae	*Eremophila*	*glabra*																					*		*					
Scrophulariaceae	*Eremophila*	*granitica*						*	*			*		*	*															
Scrophulariaceae	*Eremophila*	*interstans* subsp. *virgata*								*	*							*					*							
Scrophulariaceae	*Eremophila*	*ionantha*											*			*														
Scrophulariaceae	*Eremophila*	*latrobei*																											*	
Scrophulariaceae	*Eremophila*	*longifolia*							*				*			*	*													
Scrophulariaceae	*Eremophila*	*oldfieldii* subsp. *angustifolia*			*		*	*	*				*	*	*	*			*			*	*		*					
Scrophulariaceae	*Eremophila*	*parvifolia*																					*							*
Scrophulariaceae	*Eremophila*	*platycalyx*																										*		
Scrophulariaceae	*Eremophila*	*pustulata*																					*							
Scrophulariaceae	*Eremophila*	*scoparia*	*		*		*	*	*		*	*	*			*												*		
Scrophulariaceae	*Eremophila*	*serrulata*																						*						
Scrophulariaceae	*Eremophila*	sp. Mt Jackson (G.J. Keighery 4372)								*																				
Solanaceae	*Lycium*	*australe*					*																							
Solanaceae	*Solanum*	*lasiophyllum*	*	*		*		*	*			*		*	*	*		*									*			
Solanaceae	*Solanum*	*orbiculatum*									*				*	*		*												
Thymelaeaceae	*Pimelea*	*microcephala*		*			*		*					*																
Typhaceae	*Typha*	*domingensis*	*	*		*																								

Appendix 5: GPS coordinates for Flora of Conservation Significance recorded by Botanica Consulting (GDA94)

Taxon	Conservation Code	Zone	Easting	Northing
Ricinocarpos sp.	CS	51 J	351411	6650069
Ricinocarpos sp.	CS	51 J	351403	6650088
Ricinocarpos sp.	CS	51 J	351417	6650110
Ricinocarpos sp.	CS	51 J	351325	6650234
Ricinocarpos sp.	CS	51 J	351521	6650097
Ricinocarpos sp.	CS	51 J	351139	6649954
Ricinocarpos sp.	CS	51 J	351358	6649125
Ricinocarpos sp.	CS	51 J	351383	6648953

Appendix 6: DPaW Threatened Flora Database search results within 25km of the survey area (DPaW, 2010)

Taxon	Conservation Code
Acacia epedunculata	P1
Angianthus prostratus	P3
Astartea sp. Bungalbin Hill (K.R. Newbey 8989)	P3
Elachanthus pusillus	P2
Eremophila praecox	P1
Eremophila praecox	P1
Eremophila praecox	P1
Eremophila praecox	P1
Eucalyptus jutsonii	P2
Eucalyptus x *brachyphylla*	P4
Gnephosis intonsa	P1
Gnephosis intonsa	P1
Gnephosis sp. Norseman (K.R. Newbey 8096)	P3
Lepidium fasciculatum	P3
Melaleuca coccinea	P3
Ptilotus procumbens	P1
Ptilotus rigidus	P1

Appendix 7: Muir Life Form/Height Class (Muir, 1977).

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70% -100%	**MID DENSE 30% - 70%**	**SPARSE 10% - 30%**	**VERY SPARSE 2% -10%**
Trees > 30m Trees 15 – 30m Trees 5 – 15m Trees < 5m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
Mallee Tree Form Mallee Shrub Form	Dense Tree Mallee Dense Shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
Shrubs > 2m Shrubs 1.5 – 2m Shrubs 1 – 1.5m Shrubs 0.5 – 1m Shrubs 0 – 0.5m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath B Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
Mat Plants Hummock Grass Bunch grass >0.5m Bunch grass < 0.5m Herbaceous spp.	Dense Mat Plants Dense Hummock Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants Mid-dense Hummock Grass Tall Grass Low Grass Herbs	Open Mat Plants Hummock Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hummock Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
Sedges > 0.5m Sedges < 0.5m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low Sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
Ferns Mosses, liverworts	Dense ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

Appendix 8: Keighery Health rating scale (1994).

Health Description	Definition
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as “parkland cleared’ with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix 9: Department of Agriculture and Food WA Declared Pest Control Methods

Saffron Thistle: Declared Plant Control Methods

Recommended herbicides	*Pre-emergent/cereals:* Chlorsulfuron *Seedling-rosette-flowering:* 2,4-D amine; 2,4-D ester (Low Volatile Ester, LVE); glyphosate + 2,4-D ester; clopyralid; paraquat + diquat; clopyralid™ + MCPA; chlrorsulfuron; metsulfuron *Non-legume pastures:* Clopyralid + MPCA *Up to four leaf stage of weed:* Jaguar® *Up to six leaf stage:* Bromoxynil

Herbicide: 2,4-D amine (Group I) (various trade names: see APVMA link)

Active ingredient	500g/L 2,4-D amine 625g/L 2,4-D amine
Rate of product/ha	For 500g/L concentration: 1.4L 1.4L–2L pastures; use lower rates on seedlings 4L/ha at flowering; spot treatment for pastures 2. For 625 g/L concentration: a. 1.1L–1.6L pastures; use lower rates on seedlings b. 3.2L/ha at flowering; spot treatment for pastures
Time of application	For cereal crops: winter-spring, while weed at rosette stage. Crops must be in early tillering stage.
Remarks	Clover and medic pastures will be damaged at these rates. Alternative is to use "spray grazing", i.e. sublethal dose (0.75L/ha) and follow 10 days later with very heavy grazing using sheep. This will still damage medics. An APVMA permit is required to apply 2,4-D ester (80%) from 1 September until 1 May.
More information and other control methods	Spot spraying 40mL/10L (for 500g/L concentration) or 32mL/10L (for 525g/L concentration) at late bolting to early flowering

Herbicide: 2,4-D ester (Group I) (Low Volatile Ester, LVE)

Active ingredient	600 and 680g/L of 2,4-D ester
Rates of dilution for spot spraying	1:150
Amount of product/10L water	60mL for 400g/L

Herbicide: 2,4-D ester (Group I) (Low Volatile Ester, LVE)	
	40mL for 600g/L
Rate of product/ha	1.6L in pastures for 680g/L 1.8L in pastures for 600g/L 0.8L in cereals for 680g/L 0.7L in cereals for 600g/L
Time of application	Late rosette-bolting-pre-flowering
Remarks	Treatment in pastures will damage clover

Herbicide: Paraquat (Group L) + diquat (Group L)	
Active ingredient	135g/L paraquat and 115g/L diquat
Rates of dilution for spot spraying	1:1000
Amount of product/10L water	10mL
Rate of product/ha	1L
Wetting agent dilution	1:400
Time of application	Early flowering stage
Remarks	Treatment only to prevent seed formation. May not be successful if sprayed too late or plant not thoroughly wetted.
More information and other control methods	Applications at flowering or rain after treatment allows plant to regrow, with two main advantages: little damage is done to annual pastures and there is little chance of further weed germination. Paraquat can be used alone at 1L/ha.

Herbicide: Glyphosate (Group M) + 2,4-D ester (Group I)	
Active ingredient	360g/L (many other concentrations) or 450g/L glyphosate + 600 or 680g/L 2,4-D ester
Rate of product/ha	350mL (360g/L) or 300mL (450g/L) of glyphosate + 55mL (@ 600g/L concentration) or 45mL (@ 680g/L concentration) of 2,4-D ester. Adjust rates if other concentrations are used.
Time of application	Seedling and early flowering stage
Remarks	Treatment at flowering prevents the weed forming viable seed. Medics and clovers will be damaged if applied at seedling stage. Roundup Biactive® would be the preferred glyphosate treatment in wet areas near drains, creeks and ponds.
More information and other control methods	Applications at flowering have two main advantages: little damage is done to annual pastures and there is little chance of further weed germination

Herbicide: Clopyralid (Group I) (various trade names: see APVMA link)	
Active ingredient	300g/L clopyralid

Herbicide: Clopyralid (Group I) (various trade names: see APVMA link)

Rate of product/ha	Canola: 300mL/ha Cereals: 50mL + 1L MCPA amine (500g/L) or 700mL MCPA (LVE)
Time of application	Seedling
Remarks	Cereal crops at four or five leaf stage. Canola crops at two to eight leaf stage.

Herbicide: Clopyralid + MCPA (Group I) (various trade names: see APVMA link)

Active ingredient	750g/kg clopyralid
Rate of product/ha	20g + 1L MCPA (amine) or 700mL MCPA (LVE)
Time of application	Rosettes up to 10cm diameter
More information and other control methods	Clopyralid can also be mixed with 2,4-D amine at 400-700mL/ha. If using this mixture, cereals need to be at five leaf to tillering stage.

Herbicide: Metsulfuron (Group B) (various trade names: see APVMA link)

Active ingredient	600g/kg metsulfuron methyl
Rate of product/ha	5g
Wetting agent dilution	1:1000
Time of application	Young rosettes before they become spiny
Remarks	Apply to wheat, barley, cereal rye and triticale at five leaf stage (Z15)
More information and other control methods	The addition of 1.1-1.6L of MCPA low volatile ester is necessary for good results.

Herbicide: Chlorsulfuron (Group B) (various trade names: see APVMA site)

Active ingredient	750g/kg Chlorsulfuron
Rate of product/ha	20g
Time of application	Pre-emergent to wheat and barley
Remarks	Registered in all states except Western Australia. At this rate claim is for suppression only.

Herbicide: Jaguar®

Active ingredient	250g/L bromoxynil **(Group C)** + 25g/L diflufenican **(Group F)**
Amount of product/10L water	10mL
Rate of product/ha	1L
Time of application	Up to four leaf stage of thistle
Remarks	Useful in cereal crops undersown with clovers and also for pasture

Herbicide: Bromoxynil (Group C) (various trade names: see APVMA link)	
Active ingredient	200g/L bromoxynil
Amount of product/10L water	20mL
Rate of product/ha	2L
Wetting agent dilution	1:400
Time of application	Up to six leaf stage when plants are no more than 50mm diameter
Remarks	Useful in cereal crops undersown with clovers and also for pasture