

Greater Paraburdoo

Statement Addressing the 10 Clearing Principles

CPS 5090/3

RTIO-HSE-0353636

Rio Tinto, June 2021

Statement addressing the 10 clearing principles

Rio Tinto Iron Ore Pty Ltd (Rio Tinto) is evaluating the potential development of a number of iron ore deposits within the Greater Paraburdoo locality, in the Pilbara region of Western Australia. A Permit to Clear Native Vegetation for this work has previously been approved under the Environmental Protection Act 1986 Hamersley Iron Pty Ltd – Paraburdoo Mine Project (CPS 5090/3). This Permit allows the clearing of up to 595 ha of native vegetation.

A new application to amend CPS 5090/3 to increase the clearing limit to 655 ha is currently being sought and forms the basis for this Statement against the 10 Clearing Principles. The application area has also been reduced from 5,696.67 ha to 5,666.25 ha to exclude environmentally significant areas.

The application area is situated within an area that has previously been subject to a Level 2 Fauna Survey (Astron Environmental Services (Astron) 2018b) and a Detailed Flora and Vegetation Survey (Astron 2018a). Both of these surveys encompassed a larger area with which the current application area lies within.

Based on specialist assessment of the application area and discussion below, it is deemed that the Proposal is unlikely to be at variance with the 10 Clearing Principles under Schedule 5 of the EP Act if current conditions of CPS 5090/3 are retained.

1. **Comprises high level of biological diversity**

Native vegetation should not be cleared if it comprises a high level of biological diversity.

The Pilbara is one of Australia's 15 National Biodiversity Hotspots (DotEE 2018) and is a secondary centre of endemism and species richness for *Acacia*, *Triodia*, *Corymbia* and *Sida* in Western Australia (Maslin 2001; Kendrick 2001; Maslin and van Leeuwen 2008). The Hamersley sub-region of the Pilbara has been identified by the Threatened Species Scientific Committee for the Australian Government Biodiversity Hotspots as it provides habitat for a number of threatened, endemic and fire-sensitive species and communities.

The application area occurs within the Pilbara and Gascoyne bioregions and the Hamersley (PIL03) and Ashburton (GAS01) sub-regions. The Hamersley sub-region is described as: 'dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001b)'. The Ashburton sub-region is described as 'Mountainous range country divided by broad flat valleys of shales, sandstones and conglomerates with vegetation described a mulga or snakewood low woodlands over hardpans, with low mixed shrublands on hills and areas supporting large areas of *Triodia* (Kendrick 2001a)'.

Sixteen vegetation types lie within the application area (Astron 2018a) (Table 1). All 16 vegetation units are considered well represented in the wider area by Astron and do not support assemblages of species that are unique, located on restricted landforms, or of high conservation significance. Four vegetation units are considered to be of local conservation significance due to the presence of priority flora (H3, P8, D6 and D8) and one vegetation unit (D7) is considered a potential groundwater

dependent ecosystem. No vegetation assemblages were considered analogous with a listed TEC or PEC.

Vegetation condition over the application area ranges from Excellent to Completely Degraded. Table 2 defines the vegetation condition rating and coinciding coverage within the application area.

Vegetation condition within the application area is mostly Completely Degraded (38.78%) or Good (22.66%) (Table 2). Disturbance has been caused by pastoral activities, historical mining activities, access tracks and haul roads.

Table 1: Vegetation types and vegetation condition within the application area

Vegetation Code	Corresponding vegetation association	Description	Condition	Area (ha) within Application Area	Area %
D1	AanAwTe	<i>Acacia aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland	0.2 (Degraded) to 1 (Excellent)	54.76	0.97
D3	AcAanAwTe	<i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland	0.2 (Degraded) to 1 (Excellent)	192.36	3.39
D7	EcEvAamMgCYPv	<i>Eucalyptus camaldulensis</i> , <i>E. victrix</i> open forest over <i>Acacia ampliceps</i> , <i>Melaleuca glomerata</i> tall shrubland over <i>Cyperus vaginatus</i> open sedgeland	0.2 (Degraded)	74.74	1.32
D8	EvAcMgCEspp	<i>Eucalyptus victrix</i> woodland over <i>Acacia coriacea</i> subsp. <i>pendens</i> , <i>Melaleuca glomerata</i> tall shrubland over * <i>Cenchrus</i> spp. open tussock grassland	0.2 (Degraded) to 0.4 (Poor)	193.32	3.41
D9	AcAanCEspp	<i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat. tall shrubland over * <i>Cenchrus</i> spp. tussock grassland	0.2 (Degraded) to 0.4 (Poor)	142.49	2.51
D10	AanAxTe	<i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall shrubland over mixed open shrubland over <i>Triodia epactia</i> open hummock grassland	0.2 (Degraded) to 1 (Excellent)	67.89	1.20
D14	AcAscCEspp	<i>Acacia citrinoviridis</i> , <i>A. sclerosperma</i> subsp. <i>sclerosperma</i> tall open shrubland over * <i>Cenchrus</i> spp. open tussock grassland	0.2 (Poor)	30.16	0.53
H1	AanAprAteTe	<i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> tall open shrubland over <i>A. tetragonophylla</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland	0.2 (Degraded) to 1 (Excellent)	380.34	6.71
H2	AprGbERsppTe	<i>Acacia pruinocarpa</i> , <i>Grevillea berryana</i> tall open shrubland over <i>Eremophila fraseri</i> subsp. <i>fraseri</i> , <i>E. canaliculata</i> , <i>E. cuneifolia</i> scattered low shrubs over <i>Triodia epactia</i> hummock grassland	0.2 (Poor) to 0.8 (Very Good)	94.67	1.67
H4	AteAsyERcTe	<i>Acacia tetragonophylla</i> , <i>A. synchronicia</i> scattered tall shrubs over <i>Eremophila cuneifolia</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland	0.2 (Degraded) to 1 (Excellent)	806.39	14.23

Vegetation Code	Corresponding vegetation association	Description	Condition	Area (ha) within Application Area	Area %
H8	AanSaoERsppARc	<i>Acacia aneura</i> sens. lat. tall open scrub over <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Eremophila</i> spp. open heath over <i>Aristida contorta</i> open bunch grassland	0.6 (Good) to 1 (Excellent)	38.86	0.69
H11	ArAanERpoERlp	<i>Acacia rhodophloia</i> , <i>A. aneura</i> sens. lat. tall open shrubland over <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i> scattered shrubs over <i>Eriachne pulchella</i> open bunch grassland	1 (Excellent)	13.88	0.24
P1	AanAxAteERcSspp	<i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i> open shrubland over <i>Eremophila cuneifolia</i> , <i>Senna</i> spp. scattered low shrubs	0.2 (Degraded) to 1 (Excellent)	1,298.58	22.92
P2	AanAteSspp	<i>Acacia aneura</i> sens. lat., <i>A. tetragonophylla</i> tall open shrubland over <i>Senna</i> spp. scattered low shrubs	0.4 (Poor) to 1 (Excellent)	51.89	0.92
P4	AanAxAteERcTa	<i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i> , <i>Eremophila cuneifolia</i> shrubland over <i>Triodia angusta</i> hummock grassland	0.6 (Good) to 1 (Excellent)	27.67	0.49
Cleared	Cleared	Cleared	0.1 (Completely Degraded)	2,198.26	38.80
Total area				5,666.26	100

Table 2: Vegetation Condition within the application area

Vegetation Condition	Area (ha)	Area %
0.1 (Completely Degraded)	2,198.26	38.80
0.2 (Degraded)	418.39	7.38
0.4 (Poor)	553.77	9.77
0.6 (Good)	1270.37	22.42
0.8 (Very Good)	848.72	14.98
1 (Excellent)	376.75	6.65
Grand Total	5,666.26	100

A total of 300 confirmed vascular flora taxa, from 50 families and 132 genera were recorded by Astron (2018a). When combined with the previous site data from within the Astron survey area a total of 470 taxa have been recorded. Note the Astron survey area is significantly larger than the application area and the species richness recorded is likely to be greater than what would be expected from the application area. This is likely to reflect a high proportion of the suite of species that occur within the application area. The most represented families were Fabaceae, Poaceae and Malvaceae.

Three conservation significant flora have been recorded within the application area (table 3). These comprise *Hibiscus campanulatus* (P1), *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3) and *Ptilotus trichocephalus* (P4).

Hibiscus campanulatus (P1) is known from 418 points representing a population size of 1,746 individuals within the application area. A further 390 individuals have also been excised from the application area. *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) is known from 58 points representing a population size of 2,251 individuals within the application area and *P. trichocephalus* is known from 69 points representing a population size of 506 individuals within the application area.

Table 3: Priority flora within the application area and all RTIO database records for the Pilbara and Gascoyne.

Taxon	Individuals (records) in the Application Area	Individuals (records) in the RTIO Database
<i>Hibiscus campanulatus</i>	1,746 (418)	18,952 (1,919)
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	2,251 (58)	69,823 (1,254)
<i>Ptilotus trichocephalus</i>	506 (69)	3,846 (293)

Twenty-nine introduced flora have been previously recorded within the application area. This is likely due to the impacts from existing pastoralism and mining/roads/rail infrastructure within the application area. None of these are Weeds of National Significance.

A total of 154 vertebrate fauna species were recorded by Astron (2018b) over an 11,203.4 ha area encompassing the application area. This total comprised two amphibian, 34 reptiles, 94 birds and 24

mammals (including four introduced species). The fauna species assemblage recorded during the survey is considered typical of the Hamersley Range subregion and partial of the Ashburton sub-region.

Four conservation significant species have been recorded within the application area: Pilbara Leaf-nosed Bat (VU), Grey Falcon (VU), Pilbara Olive Python (VU) and Common Sandpiper (MI). These are all classified under the Environment Protection and Biodiversity Act 1999 as 'Matters of National Environmental Significance' species. Core habitats for these species (Semi-permanent water bodies and known bat roosts have been removed from the application area). All these species are mobile, with continuous vegetation and suitable habitat outside the application area allowing for dispersal of these species, and as such they are not considered unlikely to be impacted.

The Astron (2018b) report identified Breakaway and Riverine habitats being highly prospective Short Range Endemic (SRE) habitats. A total of 194 individuals from 20 potential SRE ('Data deficient') species were collected during the survey. Except for *Trinemura* sp. Indet., for which no desktop data are available for representatives of hexapoda, all the potential SRE species from the field survey were also recorded from the WAM database area searches, as such impacts are unlikely be significant to SRE species.

Current conditions on CPS 5090/3 restrict the clearing of riverine habitat and as such the Proposal is unlikely to be at variance with this Principle.

2. Potential impact to any significant habitat for fauna indigenous to Western Australia

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

Six major fauna habitat types occur within the application area (not including cleared areas). As previously mentioned, the majority of the application area has been cleared and is therefore not considered a fauna habitat. The remaining area comprises the following habitats: Riverine, Drainage Line, Breakaway, Rocky Hill, Low Hill, and Stony Plain. The area covered and percentage of each habitat type within the application area is presented in Table 4. The microhabitats of the Riverine and Breakaway habitat types contain ecological features important to conservation listed fauna such as the Pilbara Olive Python, Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat. The Rocky Hill habitat has a distinct herpetofauna assemblage due to the presence of a number of rocky habitat specialists.

Table 4: Fauna habitat within the application area

Habitat type	Area (ha)	Area %
Breakaway	58.03	1.02
Cleared	2198.26	38.78
Drainage Line	361.38	6.37
Low Hill	688.47	12.15
Riverine	126.73	0.02
Rocky Hill	755.04	13.32

Stony Plain	1478.34	26.08
Grand Total	5666.25	100

The Pilbara Leaf-nosed Bat has been recorded over the application area using audio/echolocation recording devices. These locations are within Drainage Line, Riverine and Breakaway habitats. The Pilbara Leaf-nosed Bat predominantly roost within deep, humid caves or old mining shafts near permanent pools in the Pilbara. Two Pilbara Leaf-nosed Bat roosts have been identified as occurring around the Paraburdoo region. The eastern roost is still to be identified however current data indicated it is located north of the Eastern Range mining operation and well outside of the application area. The other is a confirmed maternity roost located in Breakaway habitat adjacent to Ratty Springs. A 250 m buffer has been applied to this location and excised from the application area.

The Grey Falcon was reported opportunistically at one location in 2011 within Riverine habitat near Ratty Springs. This species can be resident or nomadic with a large home range (Pizzey & Knight 2012). The Grey Falcon forages over many habitats types but usually nest along watercourses such as within the Riverine habitats of the application area.

One record of a Pilbara Olive Python was previously recorded in a cleared area between Breakaway and Drainage Line habitat within the application area. This was an anecdotal record reported by mining staff in 2011. Habitat for this species may be present within the application area, particularly the Riverine and Drainage Line habitats which may be suitable for denning. The Pilbara Olive Python may also utilise other habitat types for hunting and dispersal, such as the Breakaway and Rocky Hills.

A single Common Sandpiper was recorded within the Tailings Dam in the application area. This is a Migratory species which may visit Australia in the non-breeding season. They are usually found along shallow, muddy, pebbly or sandy edges of waterbodies (Pizzey & Knight 2012). This species is known to be attracted to artificial waterbodies in the Pilbara such as tailings dams although it may occur as a vagrant to the Drainage Line and Riverine habitats within the application area when surface water is present.

Habitats within the application area are not restricted at the local, sub-regional or regional scale and no uncommon geological units or land systems occur within the application area. The Riverine and Breakaway habitat in the application area are considered particularly significant for fauna. Breakaway habitats are considered suitable for several MNES species including the Pilbara Olive Python, Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat. No maternity caves for Ghost bats occur in the application area, and the known Pilbara Leaf-nosed Bat maternity cave (200m buffer) has been excised from the application area.

The Riverine habitat in the application area is considered significant for fauna because of the deep pools and shallow spring fed pools it provides. These pools act as an important permanent water source for drinking and a refuge for amphibians and waterfowl in the application area. The permanent pool at ratty springs have also been excised from the application area. This habitat contains microhabitats not common in other habitat types such as large tree hollows, hollow logs and moist leaf litter which provide a productive ecosystem attracting and supporting a range of predators and prey. This habitat is likely to supports conservation listed fauna species such as the Pilbara Olive Python and act as foraging sites for Northern Quolls, Ghost Bats and Pilbara Leaf-nosed Bats.

The gullies and valleys of the Rocky Hill habitat contain caves and rock crevices and are likely to be utilised by a range of species, including Pilbara Leaf-nosed Bat, Ghost Bat, Northern Quoll and Pilbara Olive Python (Astron 2018b). The Rocky Hill habitat is widespread in the wider Paraburdoo area and common throughout the Pilbara bioregion.

Drainage Line, Low Hill and Stony Plain habitats provide fewer microhabitat opportunities for terrestrial fauna and are not considered likely to provide significant refuge for species.

Core habitats such as the Pilbara Leaf-nosed Bat maternity cave, satellite roosting cave and permanent water pools at ratty springs have been excised from the application area.

Current conditions on CPS 5090/3 restrict the clearing of riverine habitat and as such the Proposal is unlikely to be at variance with this Principle.

3. **Potential impact to any rare flora**

Native vegetation should not be cleared if it includes or is necessary for the continued existence of rare flora.

One Declared Rare / Threatened flora species, *Aluta quadrata* (Threatened) occurs near the application area. A single population of approximately 2,115 individuals adjacent to Pirraburdoo Creek has been excised from the current application area. Searches in surrounding habitat have not identified additional populations *Aluta quadrata* in the area.

Additionally, the recent NatureMap search returned no additional threatened or rare flora within 20km of the application area (DBCA, 2021). It is considered highly unlikely that any Threatened Flora species would have been overlooked.

The Proposal is unlikely to be at variance with this Principle.

4. **Presence of any threatened ecological communities**

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).

There are no State or Commonwealth listed TECs within or adjacent to the application area.

The Proposal is unlikely to be at variance with this Principle

5. **Significance as a remnant of native vegetation in the area that has been extensively cleared**

Native vegetation should not be cleared if it is significant as remnant vegetation in an area that has been extensively cleared.

The majority of the Pilbara region has not been extensively cleared. However grazing, inappropriate fire regimes and weed invasion have greatly altered the vegetation in some areas. The application area lies within two IBRA bioregions – Pilbara (Hammersley (PIL03) subregion) and Gascoyne (Ashburton (GAS01) subregion).

The current extent of the Beard (1975) mapping unit PIL03 and GAS01 within the Pilbara and Gascoyne IBRA bioregions has been estimated to contain over 99% of the pre-European extent

remaining and are considered to be of 'least concern'. Vegetation types within the application area would not represent remnant stands of extensively cleared vegetation (Table 5).

Table 5: Extent of pre-European vegetation within the application area

	Pre-European Area (ha)	Current Extent (ha)	Remaining %	Conservation Status	% Pre-European Extent in all DBCA-Managed Land
IBRA Bioregion – Pilbara	17,808,657.04	17,731,746.88	99.57	Least Concern	10.12
IBRA Bioregion - Gascoyne	18,075,219.48	18,067,441.44	99.96	Least Concern	10.27
Beard Vegetation Association – State					
567	777,506.85	774,895.91	99.66	Least Concern	25.38
181	1,697,291.35	1,695,240.74	99.88	Least Concern	16.44
82	2,565,901.28	2,553,206.19	99.51	Least Concern	11.51
163	641,917.93	641,847.99	99.99	Least Concern	1.44

The Proposal is not considered to be at variance with this Principle.

6. Impact on any watercourse and / or wetlands

Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

The application area contains two major watercourses, Bellary Creek and Pirraburdoo Creek. Bellary Creek runs through the centre of the application area from north to south. Pirraburdoo Creek runs through the western portion of the application area from north to south. The latter creek contains Ratty Springs which comprises semi-permanent pools which have excised from the application area.

Current conditions on CPS 5090/3 restrict the clearing of riverine habitat and as such the Proposal is unlikely to be at variance with this Principle.

7. Potential to cause appreciable land degradation

Native vegetation should not be cleared if the clearing of vegetation is likely to cause appreciable land degradation.

The study area occurs within the following land systems:

Paraburdoo Land System - Snakewood communities include many low shrubs and perennial grasses which are preferred by grazing animals and are prone to degradation if grazing pressure is excessive. Much of the system is inherently resistant to erosion except for drainage zones (unit 5) which are moderately susceptible.

Marandoo Land System - Mulga shrublands with understorey grasses and shrubs are moderately attractive to grazing animals although more rugged parts are poorly accessible. These shrublands are probably subject to less frequent burning than mulga shrublands with spinifex understoreys.

Rocklea Land System - Spinifex hummock grasslands are poorly accessible and are generally not preferred by livestock. The system is subject to fairly regular burning. The system has very low erosion hazard

Ethel Land System - Mulga short grass forb, stony short grass forb and some samphire pastures of very low productivity and carrying capacity, small inclusions of better quality chenopod pastures on drainage floors; useful ephemeral growth after rain but drought resistance very low, inherently stable due to stony nature although some pasture degradation on drainage floors.

Platform Land System - Vegetation on this system is not preferred by livestock and is of very little use for pastoralism. The system is not susceptible to erosion.

River Land System - Buffel grass and soft spinifex on this system are highly and moderately preferred respectively by livestock. The system is largely stabilised by buffel and spinifex and accelerated erosion is uncommon. However, susceptibility to erosion is high or very high if vegetative cover is removed.

Newman Land System - Much of the system is inaccessible or poorly accessible and is unsuitable for pastoral purposes. The system contains iron ore deposits which are currently being mined and deposits which are likely to be mined in the future. Spinifex is the dominant vegetation and the system is burnt fairly frequently.

Capricorn Land System - Rugged, poorly accessible country with vegetation which is not preferred by livestock; stoniness confers resistance to erosion.

Boolgeeda Land System - Hard spinifex grasslands are not preferred by livestock but soft spinifex is moderately preferred for a few years following fire. Vegetation is generally not prone to degradation and the system is not susceptible to erosion. The system is subject to fairly frequent burning.

Dollar Land System - The system supports vegetation attractive to grazing animals and is prone to degradation if grazing pressure is excessive. Most units are inherently resistant to erosion.

The Proposal is not expected to result in soil erosion, nutrient export, water-logging/flooding, acidification, salinization or deep subsoil compaction. Potential impacts to land degradation in the

longer term as a result of the proposed clearing may be minimised by the implementation of rehabilitation.

The Proposal is unlikely to be at variance with this Principle.

8. Potential to impact on the environmental values of adjacent or nearby conservation areas

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.

Karijini National Park is located approximately 36km east of the application area. Clearing of native vegetation within the application area is not expected to have an impact on this sensitive area.

The Proposal is unlikely to be at variance with this Principle.

9. Potential deterioration in the quality of surface or underground water

Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Permanent water bodies within the Ratty Springs area, have been excised from the current application area. Clearing of riparian vegetation in the surrounding area may cause deterioration to the quality of surface and underground water in this area.

Current conditions on CPS 5090/3 restrict the clearing of riverine habitat in this area and as such the Proposal is unlikely to be at variance with this Principle.

10. Potential of clearing to cause, or exacerbate, the incidence or intensity of flooding

Native vegetation should not be cleared if the clearing of vegetation is likely to cause, or exacerbate, the incidence of flooding.

Local flooding occurs seasonally in the Pilbara region as a result of cyclonic activity and sporadic thunderstorm activity. Altering draining systems within the application area may have effects on the greater landscape and result in greater or more frequent flooding.

Current conditions on CPS 5090/3 restrict the clearing of riverine habitat and as such the Proposal is unlikely to be at variance with this Principle.

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Figures

Figure 1: NVCP CPS 5090/3 Paraburdoo Location

Figure 2: NVCP CPS 5090/3 Paraburdoo Area

Figure 3: NVCP CPS 5090/3 Conservation Significant Flora

Figure 4: NVCP CPS 5090/3 Fauna Habitat

Figure 5: NVCP CPS 5090/3 Land Systems

Figure 6: NVCP CPS 5090/3 Vegetation Types

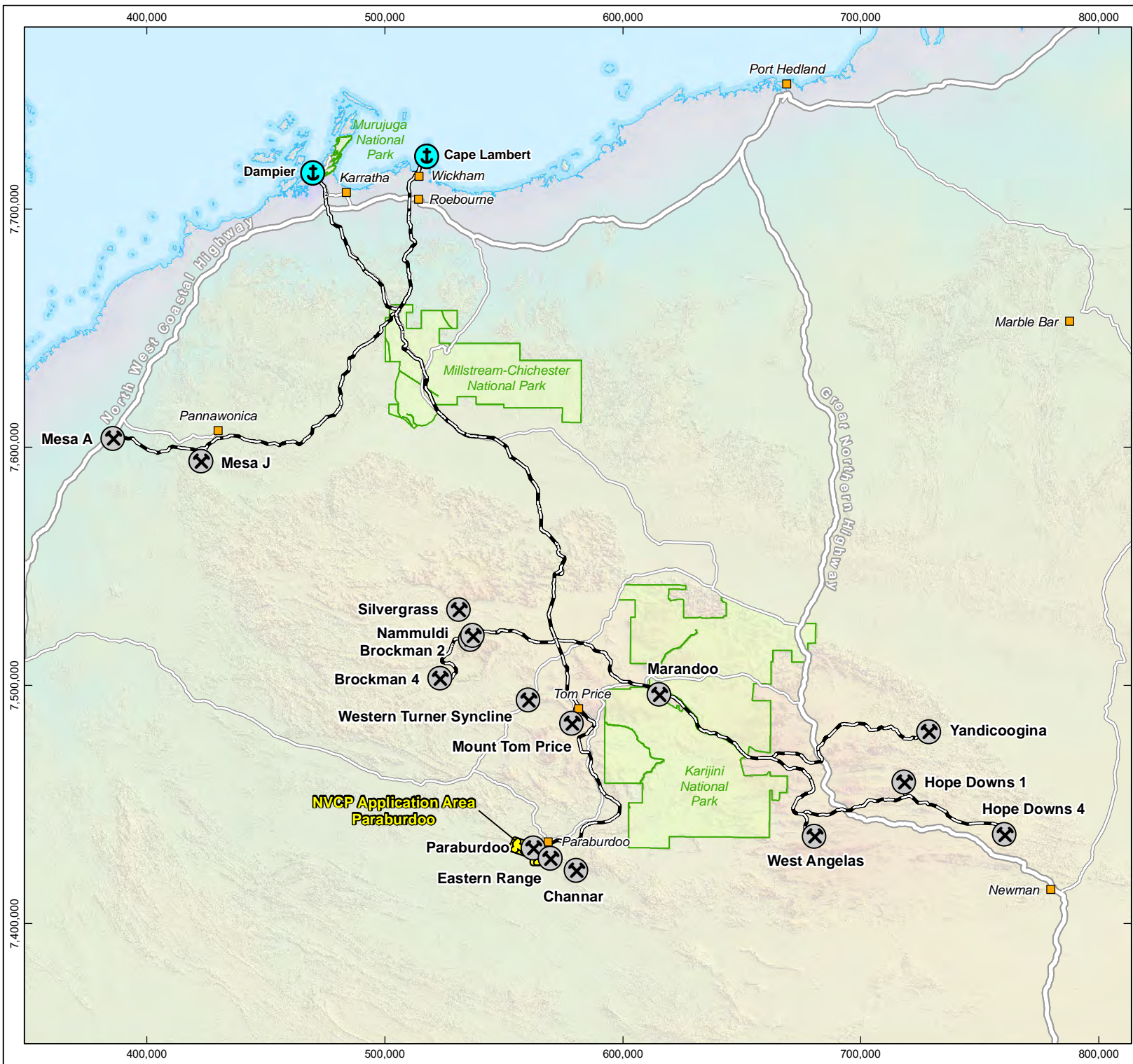
Figure 7: NVCP CPS 5090/3 Vegetation Condition

Appendices

Appendix 1: Likelihood of occurrence criteria for flora and fauna species

Appendix 2: Results of NatureMap data base search

Appendix 3: Astron Biological Surveys



RioTinto

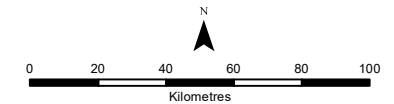
Paraburdoo Project Location

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Date: May 2021

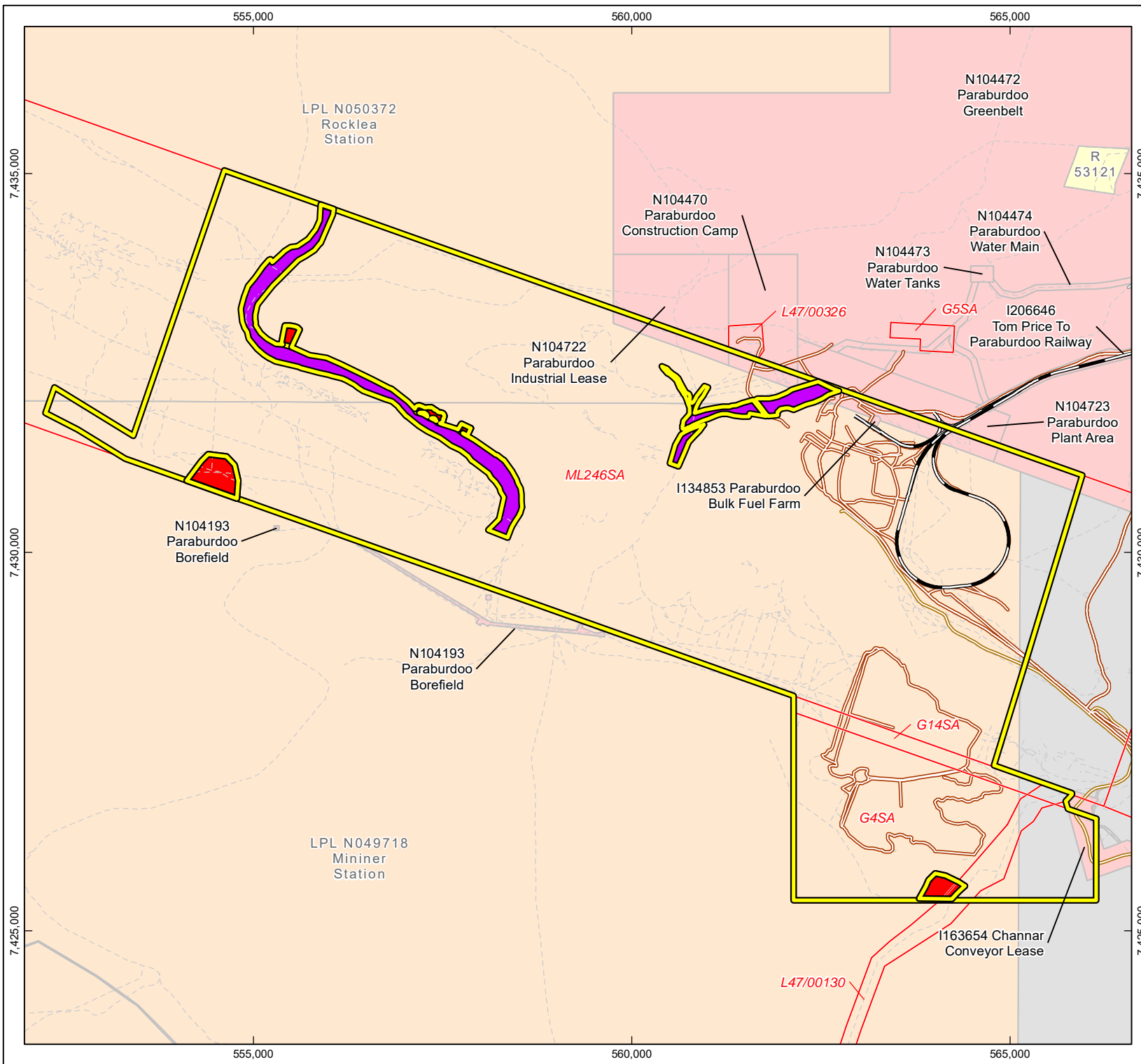
Proj: GDA 1994 MGA Zone 50
Scale: 1:2,225,000 @ A4
gisteam@riotinto.com

Legend

- Rio Tinto Mine
- Port
- Town
- NVCP Application Area
- National Park
- Rio Tinto Railway
- Highway
- Major Road



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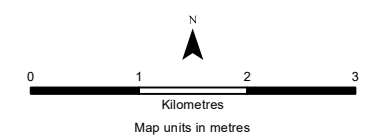
NVCP CPS 5090/3 Paraburdoo

Drawn: A.D.
Plan: PDE0182829v1
Date: June 2021

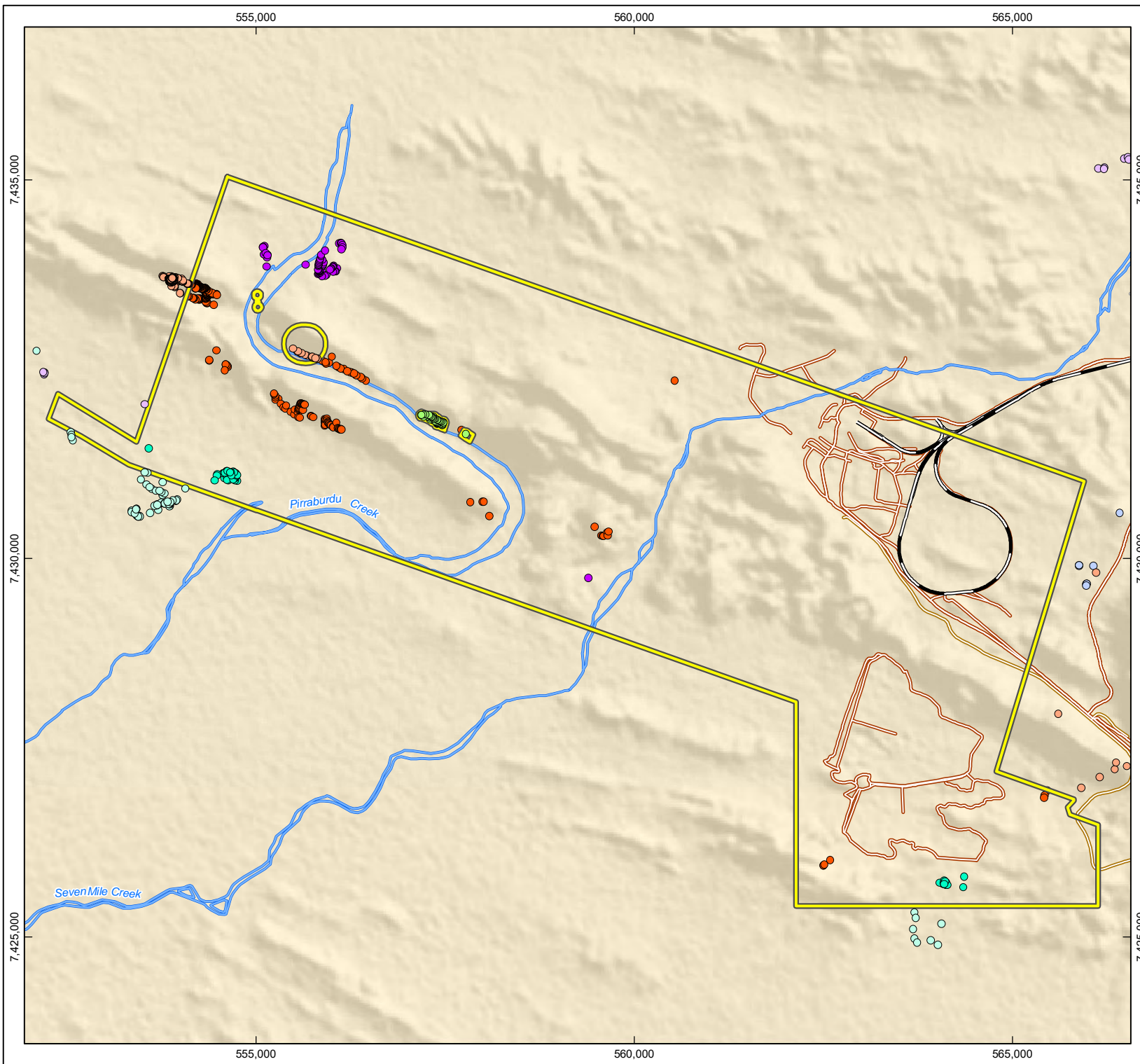
Proj: GDA 1994 MGA Zone 50
Scale: 1:70,000 @ A4
gisteam@riotinto.com

Legend

- CPS 5090
- NVCP Conditions**
 - Clearing not authorised
 - Vegetation management
- Land Administration Act Tenure**
 - General Lease
 - Pastoral Lease
 - Reserve
 - Unallocated Crown Land
 - Other
- Railway
- Site Access Road
- Haul Road
- Track



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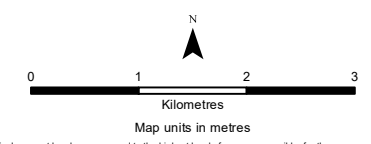
NVCP CPS 5090/3 Conservation Significant Flora

Drawn: A.D.
Plan: PDE0182829v1
Date: June 2021

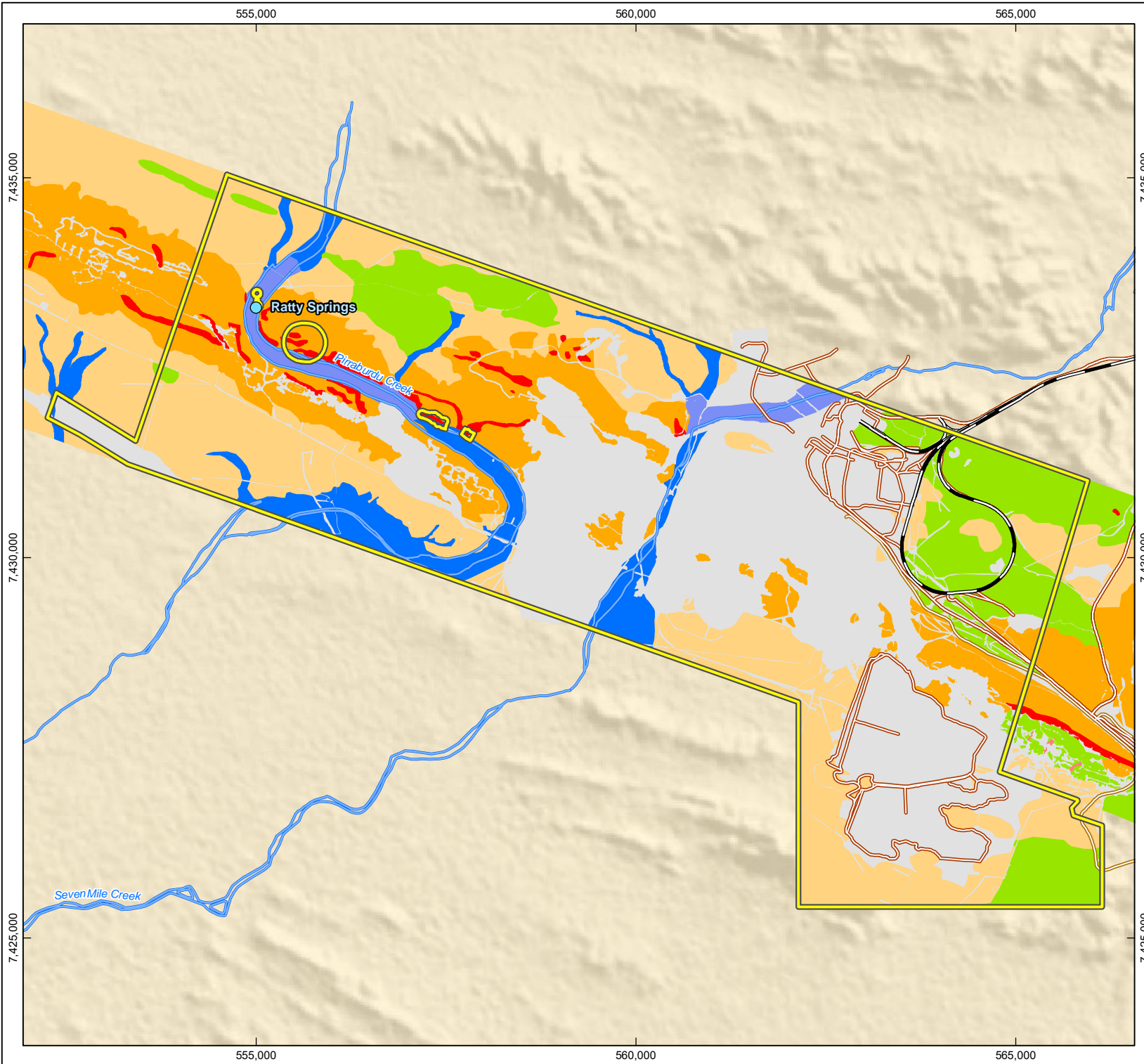
Proj: GDA 1994 MGA Zone 50
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Legend

- NVCP Application Area
- Significant Flora (inside the NVCP application area)
 - P1 - *Hibiscus campanulatus*
 - P3 - *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727)
 - P4 - *Ptilotus trichocephalus*
- Significant Flora (outside the NVCP application area)
 - EN - *Aluta quadrata*
 - P1 - *Hibiscus campanulatus*
 - P3 - *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727)
 - P3 - *Grevillea saxicola*
 - P4 - *Ptilotus trichocephalus*
- Railway
- Site Access Road
- Haul Road
- Major Creek



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NVCP CPS 5090/3 Fauna Habitat Types

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Legend

NVCP Application Area

Fauna Habitat

Breakaway

Cleared

Drainage Line

Gorge

Low Hill

Riverine

Rocky Hill

Stony Plain

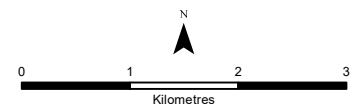
Ratty Springs

Railway

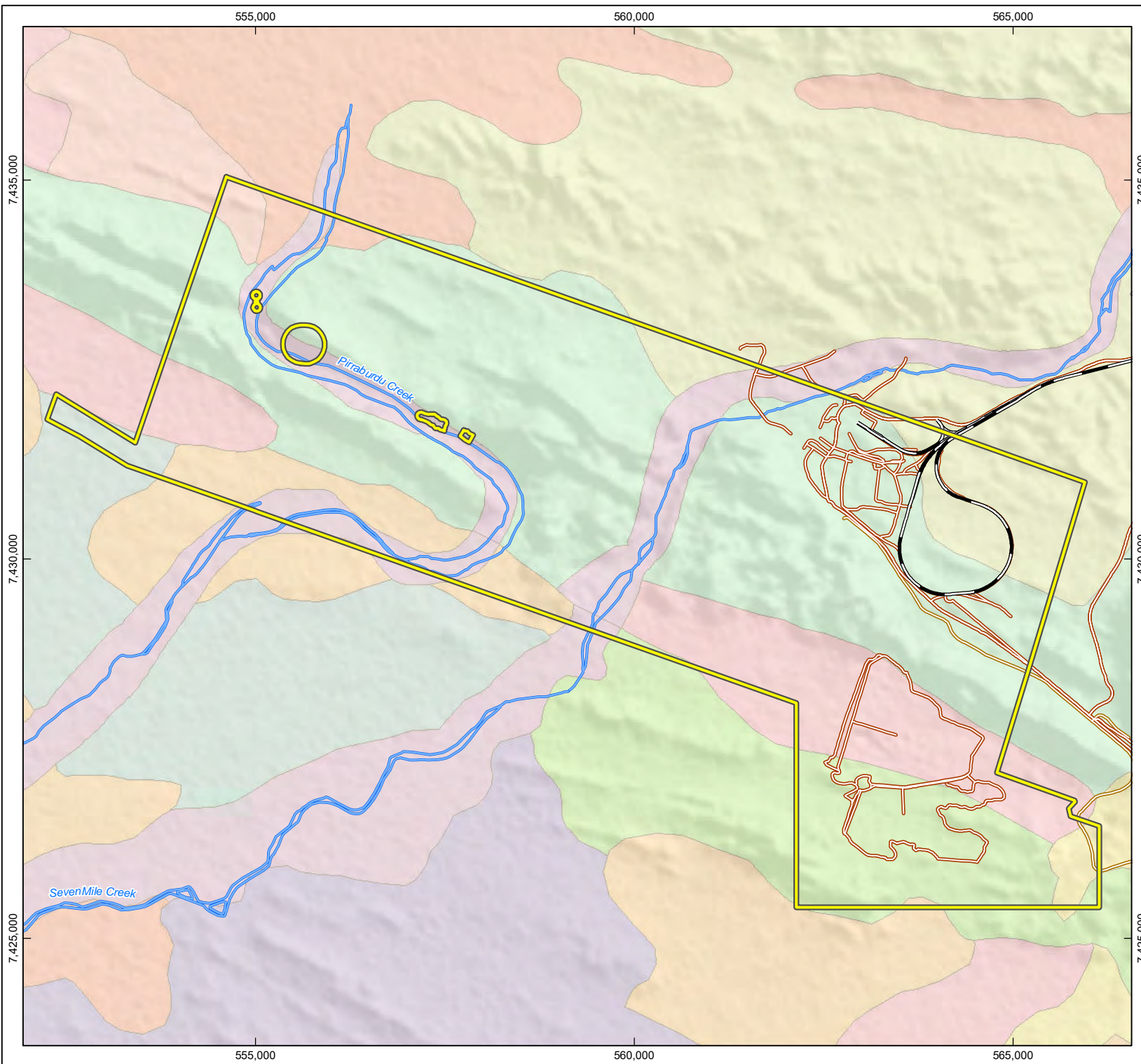
Site Access Road

Haul Road

Major Creek



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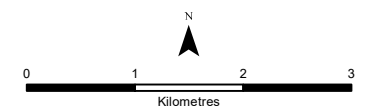
NVCP CPS 5090/3 Land Systems

Drawn: A.D.
Plan: PDE0182829v1
Date: June 2021

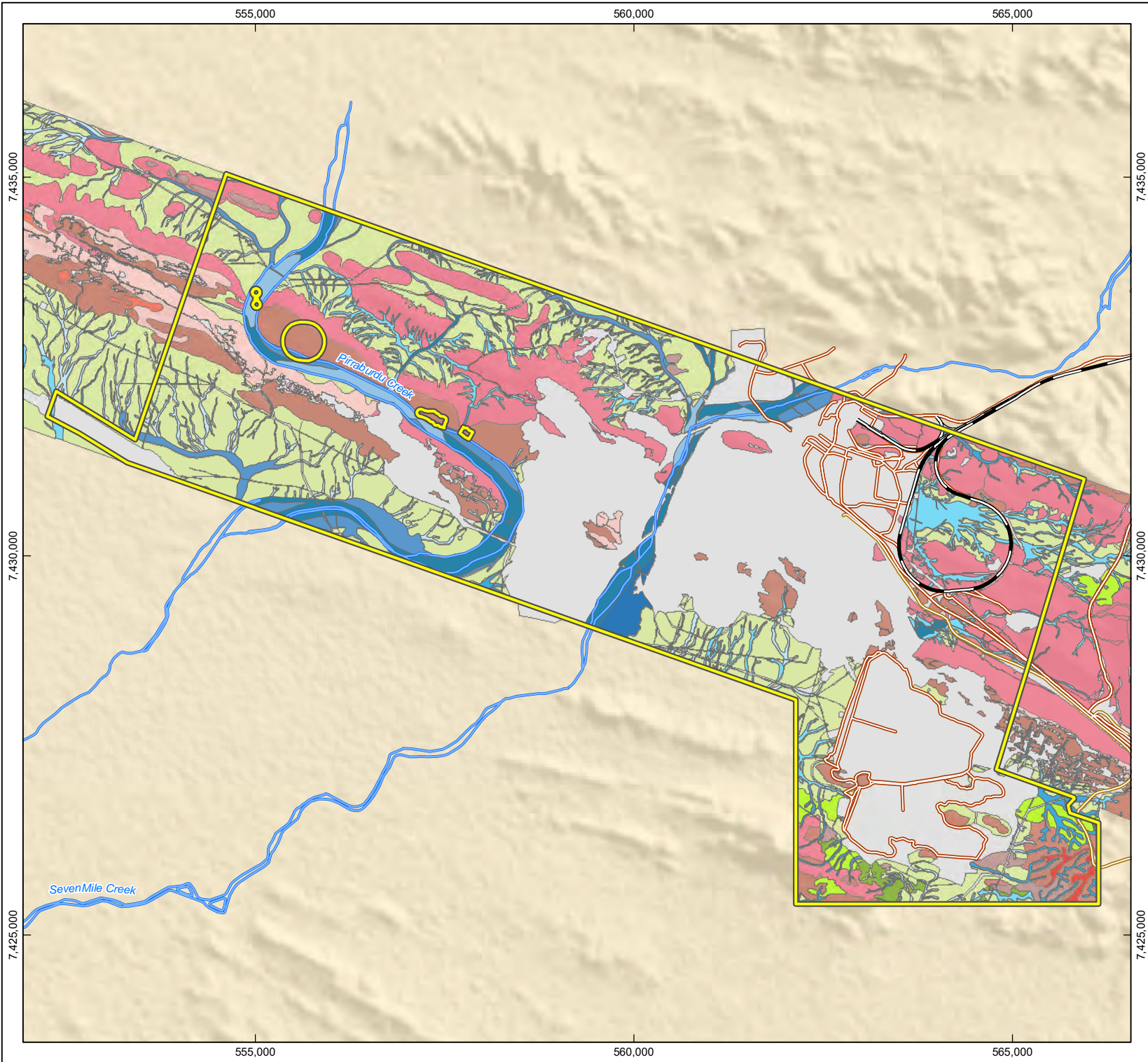
Proj: GDA 1994 MGA Zone 50
Scale: 1:70,000 @ A4
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Legend

- NVCP Application Area
- Land Systems**
 - Boolgeeda Land System
 - Capricorn Land System
 - Dollar Land System
 - Ethel Land System
 - Kooline Land System
 - Marandoo Land System
 - Newman Land System
 - Paraburdoo Land System
 - Platform Land System
 - River Land System
 - Rocklea Land System
- Railway
- Site Access Road
- Haul Road
- Major Creek



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NVCP CPS 5090/3

Vegetation Types

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Date: June 2021

Proj: GDA 1994 MGA Zone 50
Scale: 1:70,000 @ A4
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Legend







- NVCP Application Area
- Railway
- Site Access Road
- Haul Road
- Major Creek

Kilometres
Map units in metres




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Vegetation types - Legend









Hilltops/Hillslopes

	AanAprAteTe - Acacia aneura sens. lat., A. pruinocarpa tall open shrubland over A. tetragonophylla scattered shrubs over Triodia epactia hummock grassland
	ArAanERpoERlp - Acacia rhodophloia, A. aneura sens. lat. tall open shrubland over Eremophila phyllopoda subsp. obliqua scattered shrubs over Eriachne pulchella open bunch grassland
	AprGbERsppTe - Acacia pruinocarpa, Grevillea berryana tall open shrubland over Eremophila fraseri subsp. fraseri, E. Æ canaliculata, E. cuneifolia scattered low shrubs over Triodia epactia hummock grassland
	DpERcrTe - Dodonaea pachyneura, Eremophila cryptothrix tall shrubland over Triodia epactia hummock grassland (Note* Occurs just outside CPS 5090 area)
	AteAsyERcTe - Acacia tetragonophylla, A. synchronica scattered tall shrubs over Eremophila cuneifolia scattered shrubs over Triodia epactia hummock grassland
	AanSaoERsppARc - Acacia aneura sens. lat. tall open scrub over Senna artemisioides subsp. oligophylla, Eremophila spp. open heath over Aristida contorta open bunch grassland


Plains

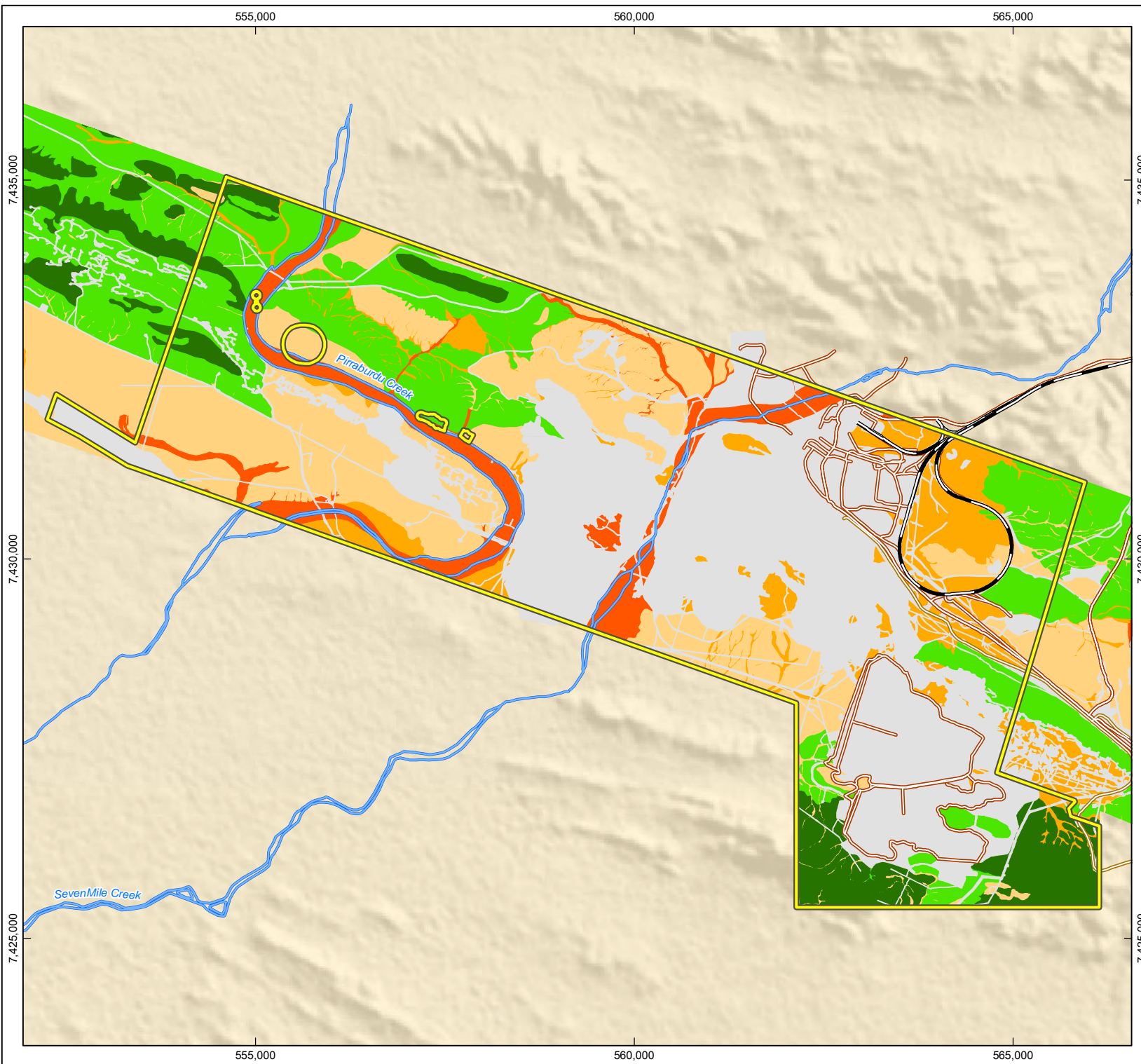
	AanAxAteERcSspp - Acacia aneura sens. Æ lat., A. Æ xiphophylla tall open shrubland over A. tetragonophylla open shrubland over Eremophila cuneifolia, Senna spp. scattered low shrubs
	AanAteSspp - Acacia aneura sens. lat., A. tetragonophylla tall open shrubland over Senna spp. scattered low shrubs
	AanAxAteERcTa - Acacia aneura sens. lat., A. xiphophylla tall open shrubland over A. Æ tetragonophylla, Eremophila cuneifolia shrubland over Triodia angusta hummock grassland

Drainage

	AanAwTe - Acacia aneura sens. lat., A. wanyu tall shrubland over Triodia epactia open hummock grassland
	AciAanAwTe - Acacia citrinoviridis, A. aneura sens. lat., A. wanyu tall shrubland over Triodia epactia open hummock grassland
	CfAciAanTe - Corymbia ferriticola scattered low trees over Acacia citrinoviridis, A. Æ aneura sens. lat. tall shrubland over Triodia epactia open hummock grassland (Note* Occurs just outside CPS 5090 area)
	EcEvAamMgCYPv - Eucalyptus camaldulensis, E. victrix open forest over Acacia ampliceps, Melaleuca glomerata tall shrubland over Cyperus vaginatus open sedgeland
	EvAcMgCEspp - Eucalyptus victrix woodland over Acacia coriacea subsp. pendens, Melaleuca glomerata tall shrubland Cenchrus spp. open tussock grassland
	AciAanCEspp - Acacia citrinoviridis, A. aneura sens. lat. tall shrubland over *Cenchrus species tussock grassland
	AanAxTe - Acacia aneura sens. lat., A. xiphophylla tall shrubland over mixed open shrubland over Triodia epactia open hummock grassland
	AciAscCEspp - Acacia citrinoviridis, A. sclerosperma subsp. sclerosperma tall open shrubland over *Cenchrus spp. open tussock grassland

Special Cases

	HD - Area cleared of vegetation
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NVCP CPS 5090/3 Vegetation Condition

Drawn: A.D.
Plan: PDE0182829v1
Date: June 2021

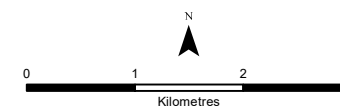
Proj: GDA 1994 MGA Zone 50
Scale: 1:70,000 @ A4
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Legend

NVCP Application Area

Vegetation Condition

- Excellent
- Very Good
- Good
- Poor
- Very Poor
- Completely Degraded
- Railway
- Site Access Road
- Haul Road
- Major Creek



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Appendix 1: Likelihood of occurrence criteria for flora and fauna species

Likelihood of flora occurrence within the application area

Species	Conservation Status	Plant description	Habitat	Likelihood of occurrence
<i>Aluta quadrata</i>	T	Perennial shrub, 0.8 m to 2.6 m high. Flowers white, June.	Edge of creek beds, in gullies, at the base of cliffs, as a cremnophyte in cracks on cliff faces and rocky ridge crests or as an emergent from spinifex.	Unlikely. Approximately 1,746 individuals located within one population have been excised from the application area. Searches in the surrounding area have failed to identify additional populations.
<i>Hibiscus campanulatus</i>	P1	Large, erect shrub to 3 m high. Perennial. Flowers white to mauve, February.	Hill slopes and base of slopes, sheltered or rocky drainage lines below associated cliff-lines or rocky ridges, soils often associated with Canga detrital formations.	Known. Approximately 2,136 individuals have been recorded within the application area.
<i>Eremophila coacta</i>	P3	Perennial. Spreading shrub to 3 m high. Flowers blue to purple, September.	Moderate to steep slopes, along ephemeral drainage lines and laterite hills in mixed shrubland.	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record this taxon from within the application area.
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P3	Erect shrub to 1-3.5m tall.	Plants grow in open rocky slopes, gullies and rock faces associated with large hills and cliffs	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record

Species	Conservation Status	Plant description	Habitat	Likelihood of occurrence
				this taxon from within the application area.
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P3	Annual or biennial. Open, erect herb, to 0.2 m high. Flowers yellow, March to September.	Low undulating plain, swampy plains, stony plains, hill slopes, on red-brown clay soils, calcrete pebbles.	Known. 2,251 individuals have been recorded within the application area.
<i>Grevillea saxicola</i>	P3	Perennial. Erect shrub to 2.5 m high. Flowers February, April, November.	Upper scree/breakaway slopes and crests often associated with banded iron formation outcropping, often in mulga woodlands on orangebrown to red-brown loams with ironstone pebble cover.	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record this taxon from within the application area.
<i>Pilbara trudgenii</i>	P3	Perennial. Gnarled, aromatic shrub, to 1 m high. Flowers September.	Cliff faces, steep rocky slopes and rock screes, usually on skeletal, red stony soils over Brockman Iron Formation.	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record this taxon from within the application area.
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	Perennial. Spreading shrub to 0.5m high. Flowers yellow, August.	Rocky areas, especially scree slopes, rock piles or gullies, on skeletal red soils.	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record this taxon from within the application area.

Species	Conservation Status	Plant description	Habitat	Likelihood of occurrence
<i>Sida</i> sp. Hamersley Range (K. Newbey 10692)	P3	Perennial. Herb or shrub. Flowers August, September or October.	Associated with rocky outcrops and breakaways, also sometimes found in flat areas between hills in shrubby grassland.	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record this taxon from within the application area.
<i>Swainsona thompsoniana</i>	P3	Annual. Prostrate herb to 0.1 m. Flowers mauve-creamyyellow, August to September.	Gibber plains, open flood plains, crabhole plains and gilgai, usually at some elevation and in association with tussock grasses on heavy clay soils.	Unlikely. The application area does not have suitable habitat to support this species.
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3	Perennial. Tussocky grass, 0.9 m to 1.8 m high. Flowers August.	Drainage lines, clay flats, crabhole flats and dark, self-mulching clay soils.	Unlikely. The application area does not have suitable habitat to support this species.
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	Perennial. Shrub, 0.5 m to 1.5 m high. Flowers blue, August to November.	Rocky slopes in open Eucalyptus and Acacia shrublands, often associated with species of <i>Triodia</i> , <i>Ptilotus</i> and <i>Dodonaea</i> on skeletal soils over ironstone.	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record this taxon from within the application area.
<i>Eremophila youngii</i> subsp. <i>lepidota</i>	P4	Perennial. Dense, spreading shrub, (0.2-) 1 - 3 m high. Flowers purple-red-pink, January, March, June or August to September.	Drainage lines subject to periodic flooding, flood plains or on the margins of clay depressions on red-brown soils, occasionally on stony flats, sometimes on semi-saline, clay flats.	Possible. Suitable habitat may be present to support this species however multiple surveys have failed to record this taxon from within the application area.

Species	Conservation Status	Plant description	Habitat	Likelihood of occurrence
<i>Ptilotus trichocephalus</i>	P4	Short-lived perennial. Prostrate, spreading herb. Flowers white, September.	Clay flats, sandy colluvial soils and gibber plains, usually in association with mulga.	Known. 506 individuals have been recorded within the application area.

Likelihood of fauna occurrence within the application area

Species	Common name	Conservation status	Habitat	Likelihood	Potential impact from clearing
Birds					
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	This species has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The species generally forages in shallow water and on bare soft mud at the edges of wetlands. They sometimes venture into grassy areas adjoining wetlands (Higgins 1996).	Known. One individual has been recorded at the Tailings Dam within the application area. The species is expected to only be a seasonal vagrant to the tailings dam area.	Yes.
<i>Amytornis striatus striatus</i>	Striated Gasswren	P4	Preferred habitats are generally associated with sandplains, dunes and stony hills dominated by Triodia, sometimes with Mallee, <i>Acacia</i> or other inland shrubs and coastal scrubs overstorey. In the Pilbara this sub-species occurs over central inland Western Australia (Pizzey & Knight 2012).	No. The application area is not within the known range of this species and the NatureMap record is likely a misidentification.	No.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	Muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass and low vegetation (Pizzey & Knight 2012).	Moderate. May be seasonally present within Riverine habitat.	Yes.
<i>Calidris subminuta</i>	Long-toed Stint	MI	Preferred habitats include tussocky, weedy margins of shallow coastal and inland wetlands, sewerage ponds and tidal mudflats (Pizzey & Knight 2012).	Moderate. May be seasonally present within Riverine a habitat.	Yes.

Species	Common name	Conservation status	Habitat	Likelihood	Potential impact from clearing
<i>Falco hypoleucos</i>	Grey Falcon	VU	Grey Falcon are resident or nomadic visitors to inland parts of all mainland states. They inhabit lightly treed inland plains, gibber deserts, sandridges, pastoral lands, timbered watercourses and seldom in driest deserts (Pizzey & Knight 2012).	Known. One record of this species has been recorded within the Riverine habitat.	Yes.
<i>Malurus lamberti bernieri</i>	Shark Bay Variegated Fairy-wren	VU	This sup-species is only known from the Shark Bay area. The application area is not within the known range of this species and the NatureMap record is likely a misidentification.	Unlikely.	No.
<i>Malurus leucopterus leucopterus</i>	Dirk Hartog Black and White Fairy-wren	VU	This sub-species is only known from Dirk Hartog island in Shark Bay. The application area is not within the known range of this species and the NatureMap record is likely a misidentification.	Unlikely.	No.
<i>Tringa glareola</i>	Wood Sandpiper	MI	Wood Sandpiper prefers well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops (Pizzey & Knight 2012).	Moderate. May be seasonally present within Riverine habitat.	Yes.
Reptiles					
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	VU	Gorges, escarpments and rocky outcrops with natural permanent or ephemeral surface water where it may hunt and / or seek shelter in caves, beneath boulders, in pools of water and occasionally in trees overhanging water. The species prefers deep gorges and water holes in the ranges of the Pilbara region (Pearson 1993). However, the species may have a large home range and so may also be recorded in rocky habitats some distance from surface water features, especially during	Known. One anecdotal record of this species exists in cleared habitat between Drainage Line and Breakaway habitat. The Riverine, Drainage Line and Breakaway	Yes.

Species	Common name	Conservation status	Habitat	Likelihood	Potential impact from clearing
			cooler months. Males have been recorded travelling up to 4 km to locate mates during the breeding season (Pearson 2003; Tutt et al. 2002).	habitat may be suitable to support denning of this species and it may disperse through all habitat types.	
Mammals					
<i>Dasyurus hallucatus</i>	Northern Quoll	EN	In the Pilbara region, Northern Quolls are predominantly found in rocky habitats which provide shelter and denning material. These areas are often surrounded by vegetated habitat used for foraging and dispersal. Northern Quoll make dens in rock crevices, hollow trees and occasionally termite mounds (TSSC 2005).	Likely. This species has not previously been recorded within the application area however the Rocky Hill, Drainage line and Riverine habitats represent good denning and/or foraging habitats for this species. No quolls were recorded by Astron 2018 inside the application area.	Yes.
<i>Macroderma gigas</i>	Ghost Bat	VU	Ghost Bats roost in deep, complex caves beneath bluffs of low, rounded hills, granite rock piles and abandoned mines (Armstrong & Anstee 2000). These features often occur within habitats including gorge/gully, hill crest/hill slope and low hills (Armstrong & Anstee 2000). Ghost bats	Likely. The species has not been detected within the application area despite audio recorders being placed within the	Yes.

Species	Common name	Conservation status	Habitat	Likelihood	Potential impact from clearing
			move between a number of caves seasonally or as dictated by weather conditions, and require a range of cave sites (Hutson et al. 2001).	<p>application area. However, this species can disperse widely depending on season and may opportunistically utilize the application area for foraging and roosting.</p> <p>No breeding or roosting caves were identified by Astron 2018 in the current application area.</p>	
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4	This species favours scree and stony plains habitat where it constructs conspicuous, extensive mounds of small stones. The pebble-mounds are found on gently sloping hills where the ground is stony with continuous small pebbles and is vegetated by spinifex with a sparse overstorey of eucalypts and scattered shrubs of <i>Senna</i> , <i>Acacia</i> and <i>Ptilotus</i> species (Menkhorse and Knight 2011; Start 2008).	Likely. Suitable habitat may be available within the stony hills and slopes of the application area.	Yes.

Species	Common name	Conservation status	Habitat	Likelihood	Potential impact from clearing
<i>Rhinonicteris aurantia</i>	Pilbara Leaf-nosed Bat	VU	Inhabits deep caves and abandoned mine shafts (van Dyck and Strahan 2008). The roost is usually over pools of water in deeper mines, or deep within the mine or cave structure in an area that maintains elevated temperature and humidity. The Pilbara Leaf-nosed Bat has been observed foraging in a variety of habitats such as <i>Triodia</i> hummock grasslands covering low rolling hills and shallow gullies, with scattered <i>Eucalyptus camaldulensis</i> along the creeks (DotE 2021).	Likely. The Pilbara Leaf-nosed Bat is likely to forage in the area however known breeding and roosting caves have been excised from the application area.	Yes.

Appendix 2: Results of NatureMap data base search

NatureMap Species Report

Created By Guest user on 07/04/2021

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 117° 35' 07" E, 23° 13' 44" S
Buffer 20km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	394	761
Priority 1	1	6
Priority 2	1	1
Priority 3	9	16
Priority 4	3	11
Rare or likely to become extinct	1	23
TOTAL	409	818

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct				
1.	19448 <i>Aluta quadrata</i>		T	
Priority 1				
2.	48312 <i>Hibiscus campanulatus</i>		P1	
Priority 2				
3.	42541 <i>Solanum octonum</i>		P2	
Priority 3				
4.	15030 <i>Eremophila coacta</i>		P3	
5.	40643 <i>Eremophila</i> sp. <i>Hamersley Range (K. Walker KW 136)</i>		P3	
6.	29381 <i>Goodenia</i> sp. <i>East Pilbara (A.A. Mitchell PRP 727) (O'Meara's Goodenia)</i>		P3	
7.	44441 <i>Grevillea saxicola</i>		P3	
8.	20311 <i>Pilbara trudgenii</i>		P3	
9.	16616 <i>Sida</i> sp. <i>Barlee Range (S. van Leeuwen 1642)</i>		P3	
10.	33697 <i>Sida</i> sp. <i>Hamersley Range (K. Newbey 10692)</i>		P3	
11.	42142 <i>Swainsona thompsoniana</i>		P3	
12.	17820 <i>Themeda</i> sp. <i>Hamersley Station (M.E. Trudgen 11431)</i>		P3	
Priority 4				
13.	14893 <i>Eremophila magnifica</i> subsp. <i>magnifica</i>		P4	
14.	16040 <i>Eremophila youngii</i> subsp. <i>lepidota</i>		P4	
15.	12239 <i>Ptilotus trichocephalus</i>		P4	
Non-conservation taxon				
16.	4886 <i>Abutilon amplum</i>			
17.	4889 <i>Abutilon cryptopetalum</i>			
18.	4891 <i>Abutilon fraseri</i> (Lantern Bush)			
19.	18120 <i>Abutilon fraseri</i> subsp. <i>fraseri</i>			
20.	4895 <i>Abutilon lepidum</i>			
21.	4901 <i>Abutilon otocarpum</i> (Desert Chinese Lantern)			
22.	43020 <i>Abutilon oxycarpum</i> subsp. <i>Prostrate (A.A. Mitchell PRP 1266)</i>			
23.	42920 <i>Abutilon</i> sp. <i>Dioicum (A.A. Mitchell PRP 1618)</i>			
24.	3209 <i>Acacia ampliceps</i>			
25.	44586 <i>Acacia ampliceps</i> x <i>sclerosperma</i> subsp. <i>sclerosperma</i>			
26.	3217 <i>Acacia aneura</i> (Mulga, Wanari)			
27.	37260 <i>Acacia aptaneura</i>			
28.	3228 <i>Acacia atkinsiana</i>			
29.	3232 <i>Acacia ayersiana</i>			
30.	3241 <i>Acacia bivenosa</i>			
31.	44588 <i>Acacia bivenosa</i> x <i>sclerosperma</i> subsp. <i>sclerosperma</i>			
32.	3260 <i>Acacia citrinoviridis</i>			
33.	13502 <i>Acacia coriacea</i> subsp. <i>pendens</i>			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
34.	3280	<i>Acacia cuspidifolia</i> (Bohemia)			
35.	36418	<i>Acacia incurvaneura</i>			
36.	3434	<i>Acacia maitlandii</i> (Maitland's Wattle)			
37.	3435	<i>Acacia marramamba</i>			
38.	3500	<i>Acacia pruinocarpa</i> (Gidgee)			
39.	29016	<i>Acacia pyrifolia</i> var. <i>morrisonii</i>			
40.	29015	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>			
41.	3519	<i>Acacia rhodophloia</i>			
42.	44584	<i>Acacia rhodophloia</i> x <i>sibirica</i>			
43.	13078	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>			
44.	8949	<i>Acacia sibirica</i> (Bastard Mulga)			
45.	3553	<i>Acacia spondylophylla</i>			
46.	13070	<i>Acacia synchronicia</i>			
47.	3575	<i>Acacia tetanophylla</i>			
48.	3577	<i>Acacia tetragonophylla</i> (Kurara, Wakalpuka)			
49.	3598	<i>Acacia wanyu</i>			
50.	3606	<i>Acacia xiphophylla</i>			
51.	17422	<i>Adriana tomentosa</i> var. <i>tomentosa</i>			
52.	2646	<i>Aerva javanica</i> (Kapok Bush)	Y		
53.	2660	<i>Amaranthus cuspidifolius</i>			
54.	20018	<i>Amaranthus undulatus</i>			
55.	5278	<i>Ammannia multiflora</i>			
56.	19835	<i>Amphipogon sericeus</i>			
57.	2372	<i>Amyema fitzgeraldii</i> (Pincushion Mistletoe)			
58.	11614	<i>Amyema gibberula</i> var. <i>gibberula</i>			
59.	11874	<i>Amyema sanguinea</i> var. <i>sanguinea</i>			
60.	14307	<i>Amyema</i> sp. <i>Fortescue</i> (M.E. Trudgen 5358)			
61.	40910	<i>Androcalva luteiflora</i> (Yellow-flowered Rulingia)			
62.	17797	<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Y		
63.	207	<i>Aristida contorta</i> (Bunched Kerosene Grass)			
64.	217	<i>Aristida nitidula</i> (Flat-awned Threeween)			
65.	1364	<i>Asphodelus fistulosus</i> (Onion Weed)	Y		
66.	229	<i>Astrebula pectinata</i> (Barley Mitchell Grass)			
67.	6202	<i>Astrotricha hamptonii</i> (Ironplant)			
68.	2450	<i>Atriplex amnicola</i> (Swamp Saltbush)			
69.	2453	<i>Atriplex codonocarpa</i> (Flat-topped Saltbush)			
70.	2473	<i>Atriplex quadrivalvata</i>			
71.	2770	<i>Boerhavia coccinea</i> (Tar Vine, Wituka)			
72.		<i>Boerhavia</i> sp.			
73.	6606	<i>Bonamia media</i>			
74.	44782	<i>Bonamia pilbarensis</i>			
75.	750	<i>Bulbostylis barbata</i>			
76.	48325	<i>Calandrinia holtumii</i>			
77.	2869	<i>Calandrinia schistorhiza</i>			
78.	31073	<i>Calandrinia</i> sp. <i>The Pink Hills</i> (F. Obbens FO 19/06)			
79.	7893	<i>Calocephalus knappii</i>			
80.	7895	<i>Calocephalus multiflorus</i> (Yellow-top)			
81.	7905	<i>Calotis multicaulis</i> (Many-stemmed Burr-daisy)			
82.	48291	<i>Capparis spinosa</i> subsp. <i>nummularia</i>			
83.	6567	<i>Carissa lanceolata</i> (Conkerberry, Marnuwiji)			
84.	258	<i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
85.	32	<i>Cheilanthes brownii</i>			
86.	37	<i>Cheilanthes lasiophylla</i> (Woolly Cloak Fern)			
87.	272	<i>Chloris virgata</i> (Feathertop Rhodes Grass)	Y		
88.	33516	<i>Chrysocephalum gilesii</i>			
89.	2985	<i>Cleome oxalidea</i>			
90.	2988	<i>Cleome viscosa</i> (Tickweed, Tjinduwadhu)			
91.	13689	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>			
92.	2776	<i>Commicarpus australis</i> (Perennial Tar Vine)			
93.	6612	<i>Convolvulus clementii</i>			
94.	13560	<i>Corchorus crozophorifolius</i>			
95.	18409	<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>			
96.	18408	<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>			
97.	4865	<i>Corchorus tridens</i>			
98.	16783	<i>Corymbia candida</i>			
99.	17077	<i>Corymbia ferriticola</i>			
100.	17093	<i>Corymbia hamersleyana</i>			
101.	17092	<i>Corymbia opaca</i>			
102.	20175	<i>Crotalaria cunninghamii</i> subsp. <i>sturtii</i>			
103.	3783	<i>Crotalaria medicaginea</i>			

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104.	20179	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>			
105.	41721	<i>Cucumis variabilis</i>			
106.	17118	<i>Cullen leucanthum</i>			
107.	17119	<i>Cullen leucochaetes</i>			
108.	279	<i>Cymbopogon ambiguus</i> (Scentgrass)			
109.	46555	<i>Cynodon prostratus</i>			
110.	774	<i>Cyperus bifax</i> (Downs Nutgrass)			
111.	786	<i>Cyperus cunninghamii</i>			
112.	18318	<i>Cyperus involucratus</i>	Y		
113.	818	<i>Cyperus vaginatus</i> (Stiffleaf Sedge)			
114.	290	<i>Dactyloctenium radulans</i> (Button Grass)			
115.	47241	<i>Datura leichhardtii</i> subsp. <i>leichhardtii</i>	Y		
116.	7164	<i>Dicladanthera forrestii</i>			
117.	311	<i>Digitaria ciliaris</i> (Summer Grass)	Y		
118.	48378	<i>Diplachne fusca</i> subsp. <i>fusca</i>			
119.	12023	<i>Diplopeltis stuartii</i> var. <i>stuartii</i> (Desert Pepperflower)			
120.	11320	<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>			
121.	2499	<i>Dissocarpus paradoxus</i> (Curious Saltbush)			
122.	11406	<i>Dodonaea lanceolata</i> var. <i>lanceolata</i>			
123.	4772	<i>Dodonaea pachyneura</i>			
124.	4773	<i>Dodonaea petiolaris</i>			
125.	4782	<i>Dodonaea viscosa</i> (Sticky Hopbush)			
126.	31274	<i>Duperreya commixta</i>			
127.	2502	<i>Dysphania kalpari</i> (Rat's Tail, Kalpari)			
128.	2504	<i>Dysphania plantaginella</i>			
129.	2506	<i>Dysphania rhadinostachya</i>			
130.	11890	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>			
131.	2511	<i>Enchylaena tomentosa</i> (Barrier Saltbush)			
132.	357	<i>Enneapogon caeruleus</i> (Limestone Grass)			
133.	363	<i>Enneapogon pallidus</i> (Conetop Nineawn)			
134.	365	<i>Enneapogon polyphyllus</i> (Leafy Nineawn)			
135.	368	<i>Enteropogon ramosus</i> (Windmill Grass, Curly Windmill Grass)			
136.	378	<i>Eragrostis dielsii</i> (Mallee Lovegrass)			
137.	380	<i>Eragrostis eriopoda</i> (Woollybutt Grass, Wangumu)			
138.	393	<i>Eragrostis setifolia</i> (Neverfail Grass)			
139.	399	<i>Eragrostis xerophila</i> (Knotty-butt Neverfail)			
140.	2513	<i>Eremophea spinosa</i>			
141.	31471	<i>Eremophila accrescens</i>			
142.	15167	<i>Eremophila canaliculata</i>			
143.	18053	<i>Eremophila cryptothrix</i>			
144.	7192	<i>Eremophila cuneifolia</i> (Pinyuru, T'iranju)			
145.	7205	<i>Eremophila exilifolia</i>			
146.	7208	<i>Eremophila forrestii</i> (Wilcox Bush)			
147.	15052	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>			
148.	17152	<i>Eremophila forrestii</i> subsp. <i>hastiana</i> (Grey Poverty Bush)			
149.	16696	<i>Eremophila fraseri</i> subsp. <i>fraseri</i>			
150.	17519	<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>			
151.	7228	<i>Eremophila lachnocalyx</i> (Woolly-calyxed Eremophila)			
152.	7230	<i>Eremophila latrobei</i> (Warty Fuchsia Bush, Mintjingka)			
153.	17597	<i>Eremophila latrobei</i> subsp. <i>filiformis</i>			
154.	17576	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>			
155.	7234	<i>Eremophila longifolia</i> (Berrigan, Tulypurpa)			
156.	18570	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>			
157.	15164	<i>Eremophila petrophila</i> subsp. <i>petrophila</i>			
158.	17283	<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>			
159.	15160	<i>Eremophila platycalyx</i> subsp. <i>pardalota</i>			
160.	15057	<i>Eremophila reticulata</i>			
161.		<i>Eremophila</i> sp.			
162.	400	<i>Eriachne aristidea</i>			
163.	413	<i>Eriachne mucronata</i> (Mountain Wanderrie Grass)			
164.	417	<i>Eriachne pulchella</i> (Pretty Wanderrie)			
165.	421	<i>Eriachne tenuiculmis</i>			
166.	4335	<i>Erodium cygnorum</i> (Blue Heronsbill)			
167.	35345	<i>Eucalyptus camaldulensis</i> subsp. <i>obtusa</i> (Blunt-budded River Red Gum)			
168.	5684	<i>Eucalyptus kingsmillii</i> (Kingsmill's Mallee)			
169.	18088	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>			
170.	4617	<i>Euphorbia australis</i> (Namana)			
171.	42844	<i>Euphorbia australis</i> var. <i>hispidula</i>			
172.	35303	<i>Euphorbia australis</i> var. <i>subtomentosa</i>			
173.	4620	<i>Euphorbia boophthona</i> (Gascoyne Spurge)			

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174.	9048	<i>Euphorbia careyi</i>			
175.	4623	<i>Euphorbia coghlanii</i> (Namana)			
176.	4647	<i>Euphorbia tannensis</i>			
177.	12097	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i> (Desert Spurge)			
178.	42879	<i>Euphorbia trigonosperma</i>			
179.	6617	<i>Evolvulus alsinoides</i> (Tropical Speedwell)			
180.	11200	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>			
181.	19648	<i>Ficus brachypoda</i>			
182.	35558	<i>Flaveria trinervia</i> (Speedy Weed)	Y		
183.	5203	<i>Frankenia hispidula</i>			
184.	5207	<i>Frankenia magnifica</i>			
185.	3941	<i>Glycine tabacina</i> (Glycine Pea)			
186.	7988	<i>Gnephosis arachnoidea</i> (Cobwebby-headed Gnephosis)			
187.	18361	<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>			
188.	2676	<i>Gomphrena canescens</i> (Batchelors Buttons)			
189.	2680	<i>Gomphrena cunninghamii</i>			
190.	18367	<i>Gomphrena kanisii</i>			
191.	12517	<i>Goodenia cusackiana</i>			
192.	7509	<i>Goodenia forrestii</i>			
193.	7526	<i>Goodenia microptera</i>			
194.	12552	<i>Goodenia muelleriana</i>			
195.	12571	<i>Goodenia pascua</i>			
196.	10982	<i>Goodenia stobbsiana</i>			
197.	7556	<i>Goodenia tenuiloba</i>			
198.	4918	<i>Gossypium robinsonii</i> (Wild Cotton)			
199.	1963	<i>Grevillea berryana</i>			
200.	2099	<i>Grevillea striata</i> (Beefwood)			
201.	19137	<i>Hakea lorea</i> subsp. <i>lorea</i>			
202.	17326	<i>Hamieria kempeana</i>			
203.	17301	<i>Heliotropium chrysocarpum</i>			
204.	6704	<i>Heliotropium conocarpum</i>			
205.	6705	<i>Heliotropium crispatum</i>			
206.	6712	<i>Heliotropium heteranthum</i>			
207.	17307	<i>Heliotropium inexplicitum</i>			
208.	6713	<i>Heliotropium ovalifolium</i>			
209.	17309	<i>Heliotropium pachyphyllum</i>			
210.	6718	<i>Heliotropium tenuifolium</i> (Mamukata)			
211.	4924	<i>Hibiscus burtonii</i>			
212.	4925	<i>Hibiscus coatesii</i>			
213.	4930	<i>Hibiscus goldsworthii</i>			
214.	43022	<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)			
215.	4942	<i>Hibiscus sturtii</i> (Sturt's Hibiscus)			
216.	11651	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>			
217.	11477	<i>Hibiscus sturtii</i> var. <i>platychlamys</i>			
218.	5215	<i>Hybanthus aurantiacus</i>			
219.	3973	<i>Indigofera colutea</i> (Sticky Indigo)			
220.	16644	<i>Indigofera decipiens</i>			
221.	3982	<i>Indigofera monophylla</i>			
222.	3985	<i>Indigofera rugosa</i>			
223.	6633	<i>Ipomoea muelleri</i> (Poison Morning Glory, Yumbu)			
224.	458	<i>Iseilema dolichotrichum</i>			
225.	465	<i>Iseilema vaginiflorum</i> (Red Flinders Grass)			
226.	8088	<i>Ixiochlamys cuneifolia</i>			
227.	6501	<i>Jasminum didymum</i>			
228.	12059	<i>Jasminum didymum</i> subsp. <i>lineare</i> (Desert Jasmine)			
229.	4953	<i>Lawrenzia densiflora</i>			
230.	4955	<i>Lawrenzia glomerata</i>			
231.	19479	<i>Lawrenzia</i> sp. <i>Mulein Station</i> (Setter 317)			
232.	3032	<i>Lepidium muelleri-ferdinandii</i>			
233.	3033	<i>Lepidium oxytrichum</i>			
234.	3035	<i>Lepidium pedicellosum</i>			
235.	3037	<i>Lepidium phlebopetalum</i> (Veined Peppercress)			
236.	3039	<i>Lepidium platypetalum</i> (Slender Peppercress)			
237.	37480	<i>Lobelia arnhemiaca</i>			
238.	36880	<i>Lobelia heterophylla</i> subsp. <i>pilbarensis</i>			
239.	4061	<i>Lotus cruentus</i> (Redflower Lotus)			
240.	2396	<i>Lysiana casuarinae</i>			
241.	2538	<i>Maireana carnosa</i> (Cottony Bluebush)			
242.	2543	<i>Maireana eriosphaera</i>			
243.	2544	<i>Maireana georgei</i> (Satiny Bluebush)			

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244.	2547 <i>Maireana lanosa</i> (Woolly Bluebush)			
245.	2551 <i>Maireana melanocoma</i> (Pussy Bluebush)			
246.	2556 <i>Maireana planifolia</i> (Low Bluebush)			
247.	2560 <i>Maireana pyramidata</i> (Sago Bush)			
248.	2565 <i>Maireana suaedifolia</i>			
249.	2566 <i>Maireana thesioides</i> (Lax Bluebush)			
250.	2567 <i>Maireana tomentosa</i> (Felt Bluebush)			
251.	11662 <i>Maireana tomentosa</i> subsp. <i>tomentosa</i>			
252.	2571 <i>Maireana villosa</i>			
253.	4962 <i>Malvastrum americanum</i> (Spiked Malvastrum)	Y		
254.	76 <i>Marsilea hirsuta</i> (Nardoo)			
255.	5879 <i>Melaleuca bracteata</i> (River Teatree)			
256.	5915 <i>Melaleuca glomerata</i>			
257.	5933 <i>Melaleuca linophylla</i>			
258.	5051 <i>Melhanie oblongifolia</i>			
259.	3614 <i>Neptunia dimorphantha</i> (Sensitive Plant)			
260.	6971 <i>Nicotiana benthamiana</i> (Tjuntiwari)			
261.	49095 <i>Nicotiana karijini</i>			
262.	6976 <i>Nicotiana occidentalis</i> (Native Tobacco)			
263.	11856 <i>Nicotiana occidentalis</i> subsp. <i>occidentalis</i>			
264.	38421 <i>Notoleptopus decaisnei</i>			
265.	7338 <i>Oldenlandia crouchiana</i>			
266.	6651 <i>Operculina aequisejala</i>			
267.	503 <i>Panicum decompositum</i> (Native Millet, Kaltu-kaltu)			
268.	515 <i>Paraneurachne muelleri</i> (Northern Mulga Grass)			
269.	10975 <i>Paspalidium basicladum</i>			
270.	518 <i>Paspalidium clementii</i> (Clements Paspalidium)			
271.	519 <i>Paspalidium constrictum</i> (Knottybutt Grass)			
272.	523 <i>Paspalidium rarum</i> (Rare Paspalidium)			
273.	3675 <i>Petalostylis labicheoides</i> (Slender Petalostylis)			
274.	4680 <i>Phyllanthus maderaspatensis</i>			
275.	11185 <i>Pimelea microcephala</i> subsp. <i>microcephala</i>			
276.	8167 <i>Pluchea dentex</i>			
277.	8168 <i>Pluchea rubelliflora</i>			
278.	12075 <i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>			
279.	2903 <i>Polycarpaea longiflora</i>			
280.	4574 <i>Polygala longifolia</i>			
281.	6653 <i>Polymeria ambigua</i> (Morning Glory)			
282.	2882 <i>Portulaca intraterranea</i>			
283.	2884 <i>Portulaca oleracea</i> (Purslane, Wakati)			
284.	20426 <i>Potamogeton tepperi</i>			
285.	12707 <i>Prostanthera albiflora</i>			
286.	8189 <i>Pseudognaphalium luteoalbum</i> (Jersey Cudweed)			
287.	18154 <i>Psyrax latifolia</i>			
288.	18155 <i>Psyrax suaveolens</i>			
289.	8192 <i>Pterocaulon sphacelatum</i> (Apple Bush, Fruit Salad Plant)			
290.	2690 <i>Ptilotus aevoides</i>			
291.	2696 <i>Ptilotus astrolasius</i>			
292.	2698 <i>Ptilotus auriculifolius</i>			
293.	2704 <i>Ptilotus calostachyus</i> (Weeping Mulla Mulla)			
294.	2706 <i>Ptilotus carinatus</i>			
295.	2711 <i>Ptilotus clementii</i> (Tassel Top)			
296.	2718 <i>Ptilotus drummondii</i> (Narrowleaf Mulla Mulla)			
297.	2721 <i>Ptilotus exaltatus</i> (Tall Mulla Mulla)			
298.	2727 <i>Ptilotus gaudichaudii</i>			
299.	2728 <i>Ptilotus gomphrenoides</i>			
300.	2731 <i>Ptilotus helipteroides</i> (Hairy Mulla Mulla)			
301.	2746 <i>Ptilotus nobilis</i> (Tall Mulla Mulla)			
302.	2747 <i>Ptilotus obovatus</i> (Cotton Bush)			
303.	2751 <i>Ptilotus polystachyus</i> (Prince of Wales Feather)			
304.	2757 <i>Ptilotus schwartzii</i>			
305.	2582 <i>Rhagodia eremaea</i> (Thorny Saltbush)			
306.	13301 <i>Rhodanthe floribunda</i>			
307.	13310 <i>Rhodanthe margarethae</i>			
308.	13238 <i>Rhodanthe maryonii</i>			
309.	4190 <i>Rhynchosia australis</i> (Rhynchosia)			
310.	4191 <i>Rhynchosia minima</i> (Rhynchosia)			
311.	45136 <i>Roebuckiella cuneata</i>			
312.	48896 <i>Roepera kochii</i>			
313.	2443 <i>Rumex vesicarius</i> (Ruby Dock)	Y		

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
314.	30434	<i>Salsola australis</i>			
315.	2357	<i>Santalum lanceolatum</i> (Northern Sandalwood, Yarrnguli)			
316.	4706	<i>Sauropus crassifolius</i>			
317.	12578	<i>Scaevola acacioides</i>			
318.	7644	<i>Scaevola spinescens</i> (Currant Bush, Maroon)			
319.	41646	<i>Schenkia clementii</i>			
320.	13285	<i>Schoenia ayersii</i>			
321.	16257	<i>Schoenoplectus subulatus</i>			
322.	2597	<i>Sclerolaena bicornis</i> (Goathead Burr)			
323.	2603	<i>Sclerolaena cornishiana</i> (Cartwheel Burr)			
324.	2604	<i>Sclerolaena costata</i>			
325.	2606	<i>Sclerolaena cuneata</i> (Yellow Bindii)			
326.	2607	<i>Sclerolaena densiflora</i>			
327.	2611	<i>Sclerolaena eriacantha</i> (Tall Bindii)			
328.	8877	<i>Sclerolaena gardneri</i>			
329.	2619	<i>Sclerolaena lanicuspis</i> (Spinach Burr)			
330.	8213	<i>Senecio magnificus</i> (Showy Groundsel)			
331.	17645	<i>Senna artemisioides</i>			
332.	12279	<i>Senna artemisioides</i> subsp. <i>helmsii</i>			
333.	12280	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>			
334.	12305	<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>			
335.	12307	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>			
336.	12309	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>			
337.	12308	<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>			
338.	12312	<i>Senna notabilis</i>			
339.	18595	<i>Senna</i> sp. <i>Karijini</i> (M.E. Trudgen 10392)			
340.	14577	<i>Senna</i> sp. <i>Meekatharra</i> (E. Bailey 1-26)			
341.	18445	<i>Senna stricta</i>			
342.	46821	<i>Seringia nephrosperma</i> (Free carpel fire-bush)			
343.	4196	<i>Sesbania cannabina</i> (Sesbania Pea)			
344.	4198	<i>Sesbania formosa</i> (White Dragon Tree)			
345.	4969	<i>Sida brownii</i>			
346.	4970	<i>Sida calyxhymenia</i> (Tall Sida)			
347.	4976	<i>Sida echinocarpa</i>			
348.	4977	<i>Sida fibulifera</i> (Silver Sida)			
349.	15110	<i>Sida laevis</i>			
350.	4986	<i>Sida platycalyx</i> (Lifesaver Burr)			
351.	31854	<i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)			
352.	33698	<i>Sida</i> sp. <i>Pilbara</i> (A.A. Mitchell PRP 1543)			
353.	19712	<i>Sida</i> sp. <i>dark green fruits</i> (S. van Leeuwen 2260)			
354.	16617	<i>Sida</i> sp. <i>spiciform panicles</i> (E. Leyland s.n. 14/8/90)			
355.	4989	<i>Sida spinosa</i> (Spiny Sida)			
356.	3072	<i>Sisymbrium orientale</i> (Indian Hedge Mustard)	Y		
357.	7009	<i>Solanum gabrielae</i>			
358.	7014	<i>Solanum horridum</i>			
359.	7018	<i>Solanum lasiophyllum</i> (Flannel Bush, Mindjulu)			
360.	7022	<i>Solanum nigrum</i> (Black Berry Nightshade)	Y		
361.	7029	<i>Solanum phlomoides</i>			
362.	42546	<i>Solanum piceum</i>			
363.	8231	<i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
364.	629	<i>Sporobolus australasicus</i> (Fairy Grass)			
365.	7098	<i>Stemodia grossa</i> (Marsh Stemodia, Mindjaara)			
366.	3074	<i>Stenopetalum anfractum</i>			
367.	8234	<i>Streptoglossa adscendens</i>			
368.	8237	<i>Streptoglossa decurrens</i>			
369.	8238	<i>Streptoglossa liatroides</i>			
370.	3182	<i>Stylobasium spathulatum</i> (Pebble Bush)			
371.	4228	<i>Swainsona forrestii</i>			
372.	4230	<i>Swainsona incei</i>			
373.	4233	<i>Swainsona leeana</i>			
374.	4234	<i>Swainsona maccullochiana</i> (Ashburton Pea)			
375.	13339	<i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>			
376.	12729	<i>Taplinia saxatilis</i>			
377.	45613	<i>Taraxacum khatoonae</i>	Y		
378.	31492	<i>Tecticornia disarticulata</i>			
379.	49016	<i>Tephrosia densa</i>			
380.	41825	<i>Tephrosia rosea</i> var. <i>Fortescue</i> creeks (M.I.H. Brooker 2186)			
381.	42442	<i>Tephrosia</i> sp. <i>NW Eremaean</i> (S. van Leeuwen et al. PBS 0356)			
382.	40060	<i>Tephrosia</i> sp. <i>clay soils</i> (S. van Leeuwen et al. PBS 0273)			
383.	673	<i>Themeda triandra</i>			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
384.	19053	<i>Trachymene pilbarensis</i>			
385.	44241	<i>Trianthema glossostigium</i>			
386.	44260	<i>Trianthema oxycalyptum</i>			
387.	44305	<i>Trianthema pilosum</i>			
388.	44362	<i>Trianthema triquetrum</i>			
389.	4374	<i>Tribulus astrocarpus</i>			
390.	4377	<i>Tribulus hirsutus</i>			
391.	4380	<i>Tribulus occidentalis</i> (Perennial Caltrop)			
392.	18072	<i>Tribulus suberosus</i>			
393.	6727	<i>Trichodesma zeylanicum</i> (Camel Bush, Kumbalin)			
394.	48201	<i>Trigastrotheca molluginea</i>			
395.	13131	<i>Triodia epactia</i>			
396.	704	<i>Triodia wiseana</i> (Limestone Spinifex)			
397.	706	<i>Triaraphis mollis</i> (Needle Grass)			
398.	4875	<i>Triumfetta chaetocarpa</i> (Urchins)			
399.	14694	<i>Triumfetta clementii</i>			
400.	98	<i>Typha domingensis</i> (Bulrush, Djandjidi)			
401.	30716	<i>Vachellia farnesiana</i> (Mimosa Bush)	Y		
402.	4846	<i>Ventilago viminalis</i> (Supplejack, Barndaragu)			
403.	4323	<i>Vigna lanceolata</i> (Maloga Vigna, Wega)			
404.	48987	<i>Vincetoxicum flexuosum</i>			
405.	48986	<i>Vincetoxicum lineare</i>			
406.	7393	<i>Wahlenbergia tumidiflora</i>			
407.	5106	<i>Waltheria indica</i>			
408.	5107	<i>Waltheria virgata</i>			
409.	29095	<i>Zaleya galericulata</i> subsp. <i>galericulata</i>			

Conservation Codes

T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap Species Report

Created By Guest user on 07/04/2021

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 117° 35' 07" E, 23° 13' 44" S
Buffer 20km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	302	2652
Priority 4	3	34
Protected under international agreement	4	6
Rare or likely to become extinct	7	18
TOTAL	316	2710

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Rare or likely to become extinct				
1.	24093 <i>Dasyurus hallucatus</i> (Northern Quoll)		T	
2.	24473 <i>Falco hypoleucos</i> (Grey Falcon)		T	
3.	25238 <i>Liasis olivaceus</i> subsp. <i>barroni</i> (Pilbara Olive Python)		T	
4.	24180 <i>Macroderma gigas</i> (Ghost Bat)		T	
5.	24545 <i>Malurus lamberti</i> subsp. <i>bernieri</i> (Shark Bay variegated fairy-wren)		T	
6.	24548 <i>Malurus leucopterus</i> subsp. <i>leucopterus</i> (Dirk Hartog black and white fairy-wren)		T	
7.	48095 <i>Rhinonictis aurantia</i> (Pilbara) (Pilbara leaf-nosed bat)		T	
Protected under international agreement				
8.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
9.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
10.	24789 <i>Calidris subminuta</i> (Long-toed Stint)		IA	
11.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
Priority 4				
12.	24539 <i>Amytornis striatus</i> subsp. <i>striatus</i> (Striated Grasswren (inland))		P4	
13.	24233 <i>Pseudomys chapmani</i> (Western Pebble-mound Mouse, Ngadjii)		P4	
14.	43368 <i>Rhinonictis aurantia</i> (Orange Leaf-nosed bat)		P4	
Non-conservation taxon				
15.	' <i>Leicacandona</i> ' <i>'carinata</i> ' (PSS)			
16.	' <i>Rockleanitocrella</i> ' sp. 1 (PSS)			Y
17.	<i>Abnitocrella halsei</i>			
18.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
19.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
20.	24264 <i>Acanthiza robustirostris</i> (Slaty-backed Thornbill)			
21.	24265 <i>Acanthiza uropygialis</i> (Chestnut-rumped Thornbill)			
22.	<i>Acariformes</i> sp.			
23.	24281 <i>Accipiter cirrocephalus</i> subsp. <i>cirrocephalus</i> (Collared Sparrowhawk)			
24.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
25.	24282 <i>Accipiter fasciatus</i> subsp. <i>fasciatus</i> (Brown Goshawk)			
26.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
27.	25544 <i>Aegotheles cristatus</i> (Australian Owllet-nightjar)			
28.	<i>Aeolosoma</i> sp. 1 (PSS)			
29.	<i>Aeolosoma</i> sp. 4 (cf <i>travancorensis</i>) (PSS)			
30.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
31.	<i>Amphipoda</i> sp.			
32.	25647 <i>Amytornis striatus</i> (Striated Grasswren)			
33.	24312 <i>Anas gracilis</i> (Grey Teal)			
34.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
35.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
36.	44635 <i>Anilius grypus</i>			
37.	25318 <i>Antaresia perthensis</i> (Pygmy Python)			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
38.	25448	<i>Antaresia stimsoni</i> (Stimson's Python)			
39.	24285	<i>Aquila audax</i> (Wedge-tailed Eagle)			
40.	41324	<i>Ardea modesta</i> (great egret, white egret)			
41.	24340	<i>Ardea novaehollandiae</i> (White-faced Heron)			
42.	24341	<i>Ardea pacifica</i> (White-necked Heron)			
43.	24610	<i>Ardeotis australis</i> (Australian Bustard)			
44.		<i>Areacandona 'scanlonii'</i> (PSS)			
45.		<i>Areacandona</i> sp.			
46.		<i>Areacandona</i> sp. 5' (PSS)			Y
47.		<i>Arrenuridae</i> sp.			
48.		<i>Arrenurus</i> sp. S3 (PSS)			
49.		<i>Arrenurus</i> sp. S4 (PSS)			Y
50.	25566	<i>Artamus cinereus</i> (Black-faced Woodswallow)			
51.	24352	<i>Artamus cinereus</i> subsp. <i>melanops</i> (Black-faced Woodswallow)			
52.	24355	<i>Artamus minor</i> (Little Woodswallow)			
53.	24356	<i>Artamus personatus</i> (Masked Woodswallow)			
54.		<i>Atopobathynella</i> sp. A			
55.	47713	<i>Austronomus australis</i> (White-striped Free-tailed Bat)			
56.	24318	<i>Aythya australis</i> (Hardhead)			
57.		<i>Barnardius zonarius</i>			
58.		<i>Bdelloidea</i> sp.			
59.		<i>Bolborhachium inclinatum</i>			
60.	24251	<i>Bos taurus</i> (European Cattle)	Y		
61.	25331	<i>Brachyuropis approximans</i> (North-western Shovel-nosed Snake)			
62.	25715	<i>Cacatua roseicapilla</i> (Galah)			
63.	24726	<i>Cacatua roseicapilla</i> subsp. <i>roseicapilla</i> (Galah)			
64.	25716	<i>Cacatua sanguinea</i> (Little Corella)			
65.	42307	<i>Cacomantis pallidus</i> (Pallid Cuckoo)			
66.		<i>Calosoma schayeri</i>			
67.		<i>Candonid</i> Genus 2 sp. 1 (PSS)			Y
68.		<i>Candonid</i> Genus 5 sp. 1			
69.	25600	<i>Centropus phasianinus</i> (Pheasant Coucal)			
70.	24564	<i>Certhionyx variegatus</i> (Pied Honeyeater)			
71.	24181	<i>Chaerephon jobensis</i> (Greater Northern Freetail-bat, Northern Mastiff Bat)			
72.	24186	<i>Chalinolobus gouldii</i> (Gould's Wattled Bat)			
73.		<i>Chlaenius australis</i>			
74.	24431	<i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
75.	25580	<i>Cinclosoma castaneothorax</i> (Chestnut-breasted Quail-thrush)			
76.	24288	<i>Circus approximans</i> (Swamp Harrier)			
77.	24289	<i>Circus assimilis</i> (Spotted Harrier)			
78.	25675	<i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
79.	25568	<i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
80.	24416	<i>Corvus bennetti</i> (Little Crow)			
81.	25593	<i>Corvus orru</i> (Torresian Crow)			
82.	24418	<i>Corvus orru</i> subsp. <i>ceciliae</i> (Western Crow)			
83.	24420	<i>Cracticus nigrogularis</i> (Pied Butcherbird)			
84.	25595	<i>Cracticus tibicen</i> (Australian Magpie)			
85.	25596	<i>Cracticus torquatus</i> (Grey Butcherbird)			
86.	30892	<i>Cryptoblepharus ustulatus</i>			
87.	25458	<i>Ctenophorus caudicinctus</i> (Ring-tailed Dragon)			
88.	24865	<i>Ctenophorus caudicinctus</i> subsp. <i>caudicinctus</i> (Ring-tailed Dragon)			
89.	25459	<i>Ctenophorus isolepis</i> (Crested Dragon, Military Dragon)			
90.	24876	<i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)			
91.	24882	<i>Ctenophorus nuchalis</i> (Central Netted Dragon)			
92.	24886	<i>Ctenophorus reticulatus</i> (Western Netted Dragon)			
93.	25036	<i>Ctenotus duricola</i>			
94.	25044	<i>Ctenotus hanloni</i>			
95.	25045	<i>Ctenotus helenae</i>			
96.	25463	<i>Ctenotus pantherinus</i> (Leopard Ctenotus)			
97.	25060	<i>Ctenotus pantherinus</i> subsp. <i>acripes</i> (Leopard Ctenotus)			
98.	25064	<i>Ctenotus pantherinus</i> subsp. <i>ocellifer</i> (Leopard Ctenotus)			
99.	25072	<i>Ctenotus rubicundus</i>			
100.	25071	<i>Ctenotus rutilans</i>			
101.	25073	<i>Ctenotus saxatilis</i> (Rock Ctenotus)			
102.	25077	<i>Ctenotus serventyi</i>			
103.	25465	<i>Ctenotus uber</i> (Spotted Ctenotus)			
104.	25080	<i>Ctenotus uber</i> subsp. <i>uber</i> (Spotted Ctenotus)			
105.	25089	<i>Cyclodomorphus melanops</i> subsp. <i>elongatus</i> (Slender Blue-tongue)			
106.	25375	<i>Cyclorana maini</i> (Sheep Frog)			
107.	24322	<i>Cygnus atratus</i> (Black Swan)			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
108.	25547	<i>Dacelo leachii</i> (Blue-winged Kookaburra)			
109.	24304	<i>Dacelo leachii</i> subsp. <i>leachii</i> (Blue-winged Kookaburra)			
110.	24091	<i>Dasykaluta rosamondae</i> (Little Red Kaluta)			
111.	24998	<i>Delma elegans</i>			
112.	25001	<i>Delma nasuta</i>			
113.	25002	<i>Delma pax</i>			
114.	25297	<i>Demansia rufescens</i> (Rufous Whipsnake)			
115.		<i>Deminutiocandona</i> 'stomachosa' (PSS)			
116.		<i>Deminutiocandona</i> cf. 'quasimica' (PSS)			
117.		<i>Diacyclops cockingi</i>			
118.		<i>Diacyclops humphreysi humphreysi</i>			
119.		<i>Diacyclops sobeprolatus</i>			
120.	25607	<i>Dicaeum hirundinaceum</i> (Mistletoebird)			
121.	25608	<i>Dicrurus bracteatus</i> (Spangled Drongo)			
122.	24926	<i>Diplodactylus conspicillatus</i> (Fat-tailed Gecko)			
123.	24944	<i>Diplodactylus savagei</i> (Southern Pilbara Beak-faced Gecko)			
124.	25094	<i>Egernia formosa</i>			
125.		<i>Egretta novaehollandiae</i>			
126.	25540	<i>Elanus caeruleus</i> (Black-shouldered Kite)			
127.	47937	<i>Euseyornis melanops</i> (Black-fronted Dotterel)			
128.	24631	<i>Emblema pictum</i> (Painted Finch)			
129.		<i>Eolophus roseicapillus</i>			
130.	24570	<i>Epthianura tricolor</i> (Crimson Chat)			
131.	24837	<i>Eremiornis carteri</i> (Spinifex-bird)			
132.	24379	<i>Erythronys cinctus</i> (Red-kneed Dotterel)			
133.	24368	<i>Eurostopodus argus</i> (Spotted Nightjar)			
134.	25621	<i>Falco berigora</i> (Brown Falcon)			
135.	25622	<i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
136.	25623	<i>Falco longipennis</i> (Australian Hobby)			
137.	24474	<i>Falco longipennis</i> subsp. <i>longipennis</i> (Australian Hobby)			
138.	24041	<i>Felis catus</i> (Cat)	Y		
139.	25727	<i>Fulica atra</i> (Eurasian Coot)			
140.	25301	<i>Furina ornata</i> (Moon Snake)			
141.	42314	<i>Gavicalis virescens</i> (Singing Honeyeater)			
142.	24958	<i>Gehyra punctata</i>			
143.	24957	<i>Gehyra purpurascens</i>			
144.	24959	<i>Gehyra variegata</i>			
145.	24401	<i>Geopelia cuneata</i> (Diamond Dove)			
146.	25585	<i>Geopelia striata</i> (Zebra Dove)			
147.	24403	<i>Geopelia striata</i> subsp. <i>placida</i> (Peaceful Dove)			
148.	24404	<i>Geophaps plumifera</i> (Spinifex Pigeon)			
149.	25530	<i>Gerygone fusca</i> (Western Gerygone)			
150.	47959	<i>Gerygone fusca</i> subsp. <i>mungi</i> (Desert Gerygone)			
151.		<i>Gomphodella</i> cf. sp. 5 (PSS)			Y
152.		<i>Gomphodella</i> sp. 5 (PSS)			Y
153.	24443	<i>Grallina cyanoleuca</i> (Magpie-lark)			
154.		<i>Halacaridae</i> sp. 1 (PSS)			
155.		<i>Halacaridae</i> sp. S3 (PSS)			Y
156.	24295	<i>Haliastur spheurnus</i> (Whistling Kite)			
157.	24297	<i>Hamirostra melanosternon</i> (Black-breasted Buzzard)			
158.	24961	<i>Heteronotia binoei</i> (Bynoe's Gecko)			
159.	24962	<i>Heteronotia spelea</i> (Desert Cave Gecko, Pilbara Cave Gecko)			
160.		<i>Heteropoda hermitis</i>			
161.	47965	<i>Hieraaetus morphnoides</i> (Little Eagle)			
162.	25734	<i>Himantopus himantopus</i> (Black-winged Stilt)			
163.		<i>Karaops martamarta</i>			
164.	24367	<i>Lalage tricolor</i> (White-winged Triller)			
165.		<i>Leiopotherapon unicolor</i>			
166.	25125	<i>Lerista bipes</i>			
167.	30928	<i>Lerista clara</i>			
168.	25135	<i>Lerista flammicauda</i>			
169.	30924	<i>Lerista rolfei</i>			
170.	30925	<i>Lerista verhmens</i>			
171.	25005	<i>Lialis burtonis</i>			
172.	25661	<i>Lichmera indistincta</i> (Brown Honeyeater)			
173.	24582	<i>Lichmera indistincta</i> subsp. <i>indistincta</i> (Brown Honeyeater)			
174.	25392	<i>Litoria rubella</i> (Little Red Tree Frog)			
175.	30933	<i>Lucasium stenodactylum</i>			
176.	30934	<i>Lucasium wombeyi</i>			
177.		<i>Lychas mjobergi</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
178.	<i>Lychas</i> sp. 2			
179.	25489 <i>Macropus robustus</i> (Euro, Biggada)			
180.	24136 <i>Macropus rufus</i> (Red Kangaroo, Marlu)			
181.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
182.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
183.	24544 <i>Malurus lamberti</i> subsp. <i>assimilis</i> (Variegated Fairy-wren)			
184.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
185.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
186.	47994 <i>Megalurus cruralis</i> (Brown Songlark)			
187.	47997 <i>Melanodryas cucullata</i> (Hooded Robin)			
188.	<i>Melanotaenia australis</i>			
189.	<i>Melitidae</i> sp. 1 (PSS)			
190.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
191.	25184 <i>Menetia greyii</i>			
192.	25491 <i>Menetia surda</i>			
193.	25187 <i>Menetia surda</i> subsp. <i>surda</i>			
194.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
195.	<i>Mesocyclops brooksi</i>			
196.	<i>Microcarbo melanoleucos</i>			
197.	25542 <i>Milvus migrans</i> (Black Kite)			
198.	<i>Minasteron minusculum</i>			
199.	25545 <i>Mirafrja javanica</i> (Horsfield's Bushlark, Singing Bushlark)			
200.	25495 <i>Morethia ruficauda</i>			
201.	25193 <i>Morethia ruficauda</i> subsp. <i>exquisita</i>			
202.	24223 <i>Mus musculus</i> (House Mouse)	Y		
203.	<i>Nedsia nr hurlberti</i>			
204.	<i>Nedsia nr</i> sp. 24 (PSS)			
205.	<i>Nedsia</i> sp.			
206.	<i>Nedsia</i> sp. 24 (PSS)			Y
207.	<i>Nematoda</i> sp. 10 (PSS)			Y
208.	25685 <i>Neochmia ruficauda</i> (Star Finch)			
209.	<i>Neosilurus hyrtlii</i>			
210.	24969 <i>Nephurus levis</i> subsp. <i>pilbarensis</i>			
211.	25498 <i>Nephurus wheeleri</i>			
212.	24972 <i>Nephurus wheeleri</i> subsp. <i>cinctus</i>			
213.	24095 <i>Ningau timealeyi</i> (Pilbara Ningau)			
214.	48016 <i>Ninox boobook</i> (Boobook Owl)			
215.	<i>No invertebrates</i>			
216.	25499 <i>Notoscincus ornatus</i>			
217.	25197 <i>Notoscincus ornatus</i> subsp. <i>ornatus</i>			
218.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
219.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
220.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
221.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
222.	<i>Oedura fimbria</i>			
223.	24976 <i>Oedura marmorata</i> (Marbled Velvet Gecko)			
224.	<i>Onthophagus consentaneus</i>			
225.	<i>Onthophagus mjobergi</i>			
226.	<i>Onthophagus pugnator</i>			
227.	24618 <i>Oreocia gutturalis</i> (Crested Bellbird)			
228.	<i>Oribatida</i> group 1 (PSS)			
229.	<i>Origocandona inanitas</i>			
230.	48034 <i>Osphranter robustus</i> (Euro, Biggada)			
231.	<i>Ostracoda</i> (unident.)			
232.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
233.	24624 <i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i> (Rufous Whistler)			
234.	<i>Paramelitidae</i> sp.			
235.	<i>Paramelitidae</i> sp. 2 (PSS)			
236.	<i>Parastenocaris jane</i>			
237.	24627 <i>Pardalotus rubricatus</i> (Red-browed Pardalote)			
238.	24628 <i>Pardalotus striatus</i> subsp. <i>murchisoni</i> (Striated Pardalote)			
239.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
240.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
241.	24144 <i>Petrogale rothschildi</i> (Rothschild's Rock-wallaby)			
242.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
243.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
244.	<i>Phorticosomus gularis</i>			
245.	<i>Phreodrilid</i> with dissimilar ventral chaetae			
246.	<i>Phreodrilid</i> with similar ventral chaetae			
247.	<i>Phreodrilidae</i> sp.			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
248.	<i>Pilbaracandona</i> 'sp. 3' (PSS)			
249.	<i>Pilbaracandona</i> 'sp. 4' (PSS)			Y
250.	<i>Pilbarus millsii</i>			
251.	24101 <i>Planigale ingrami</i> (Long-tailed Planigale)			
252.	<i>Planorbidae</i> sp.			
253.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
254.	24751 <i>Platycercus zonarius</i> subsp. <i>zonarius</i> (Port Lincoln Parrot)			
255.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
256.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
257.	24683 <i>Pomatostomus superciliosus</i> (White-browed Babbler)			
258.	25706 <i>Pomatostomus temporalis</i> (Grey-crowned Babbler)			
259.	24684 <i>Pomatostomus temporalis</i> subsp. <i>rubeculus</i> (Grey-crowned Babbler)			
260.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
261.	<i>Pristina longiseta</i>			
262.	24106 <i>Pseudantechinus woolleyae</i> (Woolley's Pseudantechinus)			
263.	25261 <i>Pseudechis australis</i> (Mulga Snake)			
264.	24235 <i>Pseudomys desertor</i> (Desert Mouse)			
265.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			
266.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
267.	25263 <i>Pseudonaja modesta</i> (Ringed Brown Snake)			
268.	25264 <i>Pseudonaja nuchalis</i> (Gwardar, Northern Brown Snake)			
269.	24390 <i>Psophodes occidentalis</i> (Western Wedgebill, Chiming Wedgebill)			
270.	<i>Ptilonorhynchus guttatus</i>			
271.	42323 <i>Ptilotula keartlandi</i> (Grey-headed Honeyeater)			
272.	48088 <i>Ptilotula penicillata</i> (White-plumed Honeyeater)			
273.	<i>Pygolabis paraburdoo</i>			
274.	<i>Pygolabis</i> sp.			
275.	24278 <i>Pyrrholaemus brunneus</i> (Redthroat)			
276.	<i>Recifella</i> sp P1 (nr <i>umala</i>) (PSW)			
277.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
278.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
279.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
280.	24454 <i>Rhipidura leucophrys</i> subsp. <i>leucophrys</i> (Willie Wagtail)			
281.	<i>Rotifera</i> sp.			
282.	24174 <i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tailed Bat)			
283.	<i>Schizopera roberiverensis</i>			
284.	24200 <i>Scotorepens greyii</i> (Little Broad-nosed Bat)			
285.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
286.	30948 <i>Smicromis brevirostris</i> (Weebill)			
287.	24116 <i>Sminthopsis macroura</i> (Stripe-faced Dunnart)			
288.	25656 <i>Stipiturus ruficeps</i> (Rufous-crowned Emu-wren)			
289.	24946 <i>Strophurus strophurus</i>			
290.	25269 <i>Suta fasciata</i> (Rosen's Snake)			
291.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
292.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
293.	30871 <i>Taeniopygia guttata</i> subsp. <i>castanotis</i> (Zebra Finch)			
294.	24175 <i>Taphozous georgianus</i> (Common Sheath-tailed Bat)			
295.	24176 <i>Taphozous hillii</i> (Hill's Sheath-tail-bat)			
296.	<i>Thereuopoda lesueurii</i>			
297.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
298.	<i>Tiramideopsis lictus</i>			
299.	<i>Tiramideopsis</i> sp.			Y
300.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
301.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
302.	<i>Trichocyclus nigropunctatus</i>			
303.	<i>Trichocyclus varianga</i>			
304.	<i>Trombidioidea</i> sp. C (PSS)			Y
305.	24851 <i>Turnix velox</i> (Little Button-quail)			
306.	41428 <i>Uperoleia saxatilis</i> (Pilbara Toadlet)			
307.	25209 <i>Varanus acanthurus</i> (Spiny-tailed Monitor)			
308.	30825 <i>Varanus bushi</i> (Pilbara Mulga Monitor)			
309.	25211 <i>Varanus caudolineatus</i>			
310.	25212 <i>Varanus eremius</i> (Pygmy Desert Monitor)			
311.	25216 <i>Varanus giganteus</i> (Perentie)			
312.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
313.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			
314.	25311 <i>Vermicella snelli</i>			
315.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
316.	24248 <i>Zyzomys argurus</i> (Common Rock-rat)			

Name	ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Conservation Codes					
T - Rare or likely to become extinct					
X - Presumed extinct					
IA - Protected under international agreement					
S - Other specially protected fauna					
1 - Priority 1					
2 - Priority 2					
3 - Priority 3					
4 - Priority 4					
5 - Priority 5					

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 3: Astron Biological Surveys

**Greater Paraburdoo
Detailed Flora and Vegetation Survey
April 2018**

Prepared for
Rio Tinto



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Greater Paraburdoo

Detailed Flora and Vegetation Survey – April 2018

Prepared for
Rio Tinto




Job Number: 14284-18

Reference: 14284-18-BISR-1Rev0_190123

Revision Status

Rev	Date	Description	Author(s)	Reviewer
A	21/06/2018	Draft Issued for Client Review	B. Eckermann L. Dadour	R. Archibald
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0	23/01/2019	Revised Draft Issued for Client Review	B. Eckermann L. Dadour	J. Atkinson

Approval

Rev	Date	Issued to	Authorised by	
			Name	Signature
A	21/06/2018	J. McShane	S. Pearse	
B	21/12/2018	J. McShane	S. Pearse	
0	23/01/2019	J. McShane	B. Lucas	



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Abbreviations

Abbreviation	Definition
Astron	Astron Environmental Services
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
GDA	Geocentric Datum of Australia
GDE	Groundwater Dependent Ecosystem
GPS	Global Positioning System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
indet.	Indeterminate
km	Kilometre
MNES	Matters of National Environmental Significance
MGA	Map Grid of Australia
NVIS	National Vegetation Information System
P	Priority
PEC	Priority Ecological Community
PFC	Percentage Foliar Cover
sp.	Species (singular)
spp.	Species (plural)
subsp.	Subspecies
survey area	Greater Paraburdoo Development Envelope (approximately 11,203 ha)
T	Threatened
TEC	Threatened Ecological Community
TPFL	Threatened and Priority Flora Database
TP List	Threatened and Priority Flora List
WA Herbarium	Western Australian Herbarium
WC Act	<i>Wildlife Conservation Act 1950</i>
WoNS	Weeds of National Significance

Executive Summary

Rio Tinto is evaluating the potential development of a number of iron ore deposits within the Greater Paraburdoo area. Astron Environmental Services was commissioned to undertake a Detailed (two phase) flora and vegetation assessment of the Greater Paraburdoo Development Envelope, a survey area of 11,203 hectares. Phase 1 was surveyed in two field visits from 20 to 31 July 2017 and 18 to 25 August 2017 with Phase 2 surveyed from 7 to 15 April 2018.

Twenty-one vegetation units were recorded in the survey area, none of which represent a threatened ecological community or priority ecological community. All vegetation units are considered well represented beyond the survey area and do not support assemblages of species that are unique, located on restricted landforms, or of high conservation significance. One vegetation unit (D7) is considered a potential groundwater dependent ecosystem.

Vegetation condition ranged from Excellent to Completely Degraded. An estimated 41.1% of the survey area was rated between Very Good and Excellent, 17.9% was rated as Good and 10.4% was rated between Poor and Degraded. An estimated 30.6% of the survey area was cleared and rated as Completely Degraded. Disturbances included an extensive network of drill lines, drill pads and tracks as well as mining infrastructure in the central areas. Other disturbances included grazing by cattle in the drainage lines and associated plains and parts of the eastern survey area being burnt within the past two to three years. Weed diversity and abundance was highest in drainage lines and alluvial plains; hilltops and slopes generally had lower weed abundance.

There were 300 confirmed vascular flora taxa from 50 families and 132 genera recorded during the current survey. When combined with the previous site data from within the survey area a total of 470 taxa have been recorded. The most represented families were Fabaceae, Poaceae and Malvaceae.

The survey identified seven confirmed taxa of conservation significance; *Aluta quadrata* T, *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1, *Hibiscus campanulatus* P1, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3, *Grevillea saxicola* P3, *Nicotiana umbratica* P3, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3 and one unconfirmed (*Solanum* sp. (indet.)) species of conservation significance. *Solanum octonum* P2 was recorded in previous surveys in and around Doggers Gorge. Botanical collections from this population were not able to be identified as *S. octonum* but matched an undescribed and potentially new taxon given the interim name of *Solanum* sp. (indet.). *Ptilotus trichocephalus* P4 was previously recorded within the survey area but not encountered during the current survey.

Five taxa recorded within the survey area were considered as range extensions of greater than 50 km from their currently known distributions (*Hibiscus sturtii* var. *platychlamys*, *Plumbago zeylanica*, **Ruellia simplex*, *Sida* sp. Golden calyces glabrous (H.N. Foote 32) and *Sida* sp. L (A.M. Ashby 4202). A further two taxa were not able to be confirmed to species level, but could also be considered range extensions (*Frankenia* aff. *hispidula*, *F.* aff. *magnifica*).

Twenty-two introduced flora species (weeds) were recorded during the current survey, none of which are listed as Weeds of National Significance or as declared pests. The occurrence of **Ruellia simplex* (Mexican petunia) is the first record within Western Australia and as a result it is listed as “Unlisted – s14” under the *Biosecurity and Agriculture Management Act 2007*.

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Appendix O: Conservation Significant Flora Species Regional Distribution

Appendix P: Introduced Flora Species (Weed) Location and Descriptions

1 Introduction

1.1 Project Background

Rio Tinto, on behalf of the joint venture participants, is evaluating the potential development of a number of iron ore deposits within the Greater Paraburdoo Operations in the Pilbara region of Western Australia. This report presents the outcome of the Detailed flora and vegetation assessment of the Greater Paraburdoo Development Envelope (the survey area). The survey area is 11,203 ha (Figure 1).

1.2 Scope and Objectives

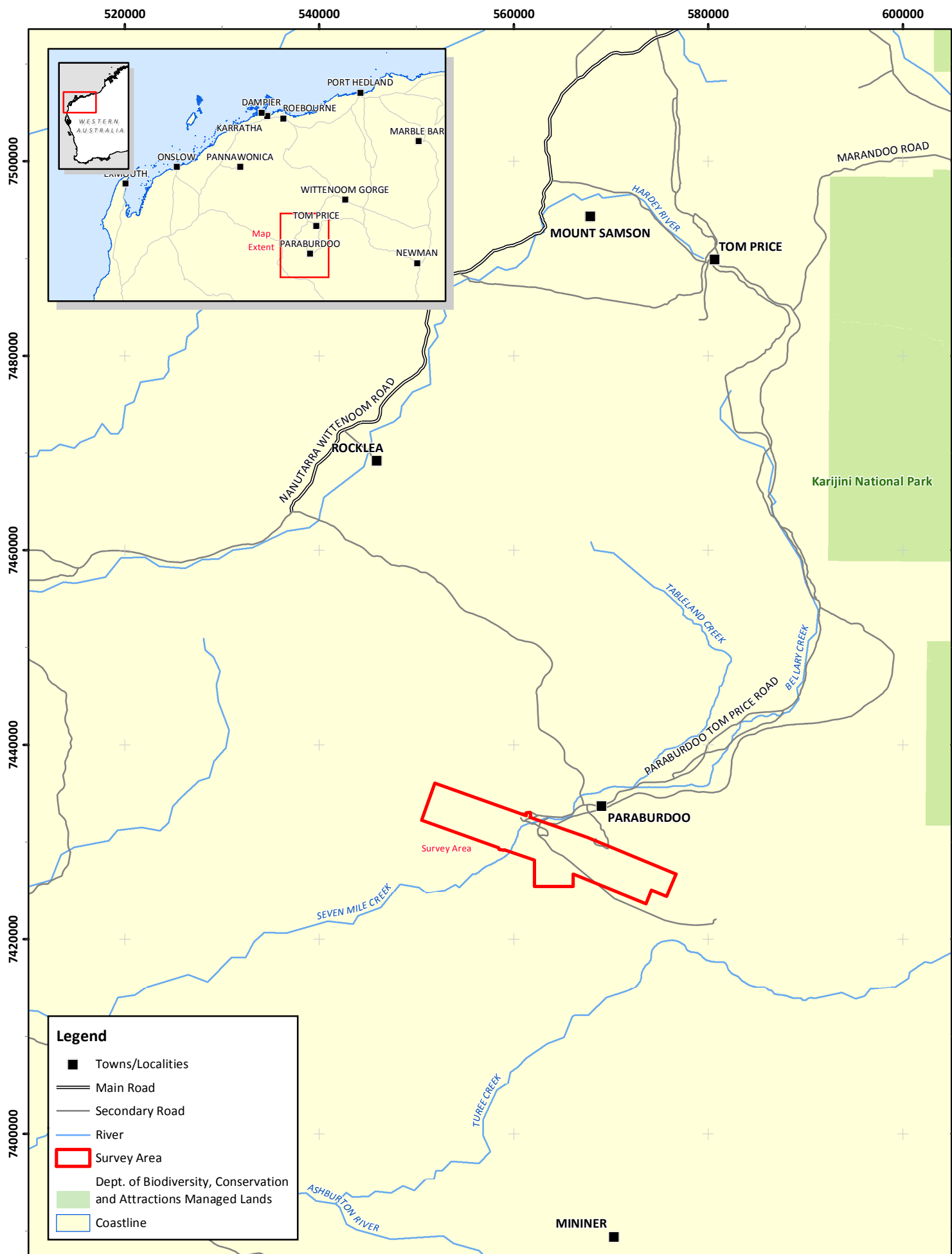
The objective of the assessment was to undertake a Detailed assessment of flora and vegetation values through a desktop assessment and field survey with incorporation of data from previous biological surveys. The resultant data has been utilised to produce this report, which is intended to support and inform the environmental assessment process in accordance with the requirements of the Environmental Protection Authority (EPA). The scope of work was to undertake a:

- desktop assessment, including database searches and literature review of available contextual and project related resources
- dual-phase flora and vegetation assessment, including:
 - establishment of new quadrats to ensure adequate replication within vegetation units (Phase 1) and rescoring these quadrats (Phase 2)
 - ground-truthing, verification and refinement of existing vegetation mapping using quadrats, relevés and mapping notes
 - targeted searches for the presence of threatened (T) and priority (P) flora, and weeds and vegetation of conservation significance
 - mapping of vegetation condition and disturbance within the survey area
 - generation of a vascular flora species list for the survey area.

The scope and key limitations of the survey are outlined in Table 1. Section 3.5 of this report provides more detail on the limitations of the survey.

Table 1: Summary of Astron’s vegetation and flora assessment.

Level of survey	Survey area size	Survey timing	Relevant regulatory guidance documents	Key survey limitations
Detailed dual-phase survey	11,203.4 ha	<ul style="list-style-type: none"> 20 July to 1 August and 18 to 25 August 2017 (Phase 1) 7 to 15 April 2018 (Phase 2) 	<ul style="list-style-type: none"> Position Statement No. 3 (Environmental Protection Authority 2002) Guidance Statement No. 51 (Environmental Protection Authority 2004b) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact (Environmental Protection Authority 2016b) Environmental Factor Guideline - Flora and Vegetation (Environmental Protection Authority 2016a) 	<ul style="list-style-type: none"> Conditions for ephemeral taxa were average to below average. Some limitations for access (rail loop, remote areas in the east of the survey area).



Rio Tinto
Greater Paraburadoo - Detailed Flora and Vegetation Survey, April 2018

Figure 1: Survey area location



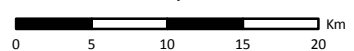
Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50



2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2018).

Based on long-term climatic data from the nearest Bureau of Meteorology weather station at Paraburdoo Aero (Station 007185, approximately 10 km north-east of the survey area) the mean annual rainfall since 1974 is 315 mm. The mean maximum daily temperatures range between 24.8°C and 40.6°C, and range above 30°C for much of the year (Bureau of Meteorology 2018) (Figure 2).

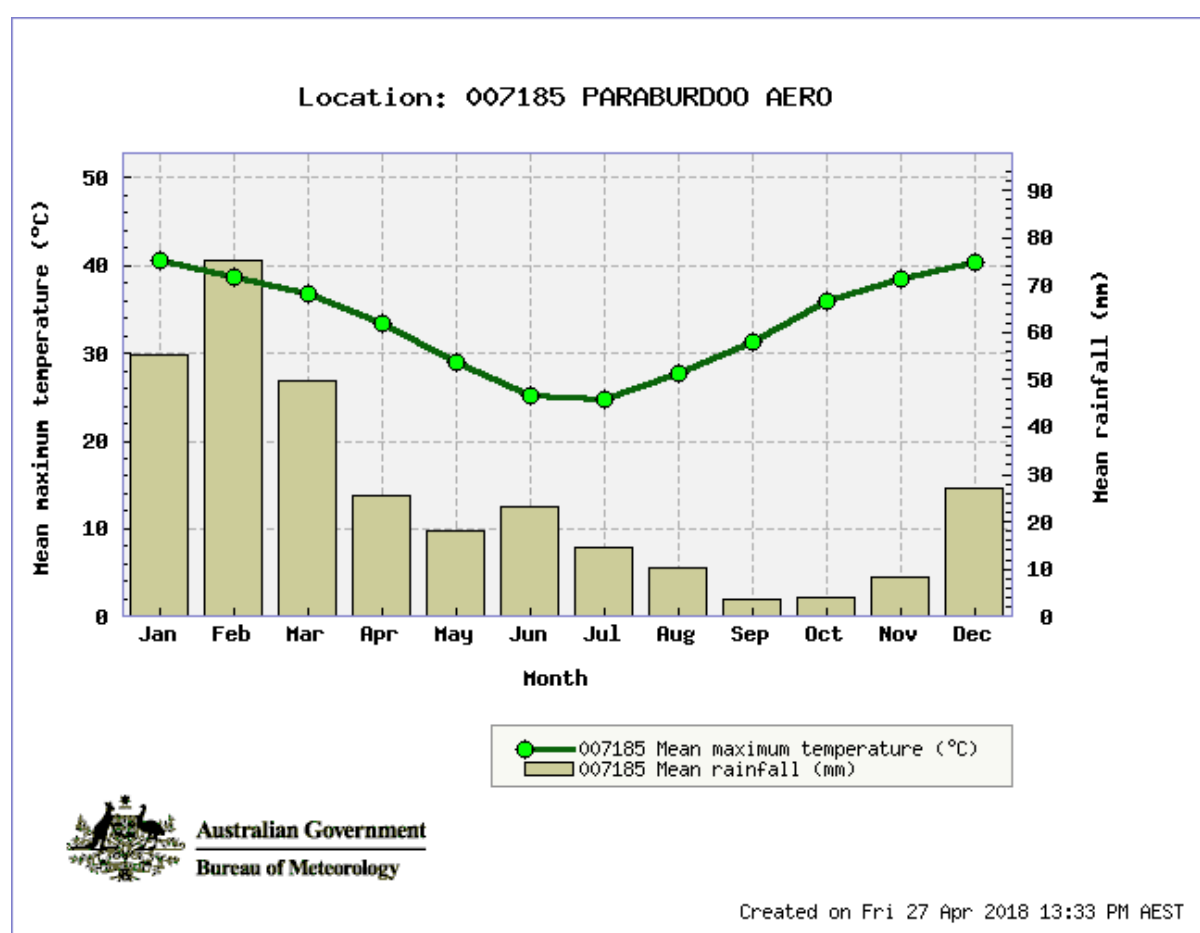


Figure 2: Climate data for Paraburdoo (Station 007185). Mean annual rainfall data has been calculated from 1974 – 2018 and mean maximum temperature has been calculated from 1966 – 2018 (Bureau of Meteorology 2018).

2.1.2 Geology and Soils

The surface geology of the survey area is comprised of 10 units (Stewart et al. 2008), with the Colluvium 3841 being the most dominant (Table 2). Geological mapping of the survey area and surrounds is presented in Figure A.1, Appendix A.

Table 2: Geological units of the survey area (Stewart et al. 2008).

Geological name	Label	Area within survey area (ha)
Colluvium 38491: colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	2,755.7
Hamersley Group: undivided chert, banded iron-formation, jaspilite, dolomite, mudstone, siltstone.	Lch	2,564.6
Brockman Iron Formation: banded iron-formation, chert, mudstone and siltstone.	Lchk	1,816.2
Fortescue Group: metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	1,058.1
Weeli Wolli Formation: banded iron-formation (commonly jaspilitic), mudstone, siltstone; common interlayered metadoleritic sills.	Lchw	1,016.4
Jeerinah Formation: shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	893.9
Alluvium 38485: channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.	Qa	402.4
Calcrete 38497: pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified.	Czk	343.0
Mount McGrath Formation: coarse sandstone, conglomerate, pelite, dolomite.	Lsym	294.4
Bunjina Formation: metabasaltic pillow lava and breccia; metatuff and minor chert.	Abfb	58.7

2.1.3 Surface Water and Hydrology

No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the survey area (Department of the Environment and Energy 2017c, 2017b). The nearest Nationally Important Wetland is Mt. Bruce coolibah-lignum flats located 85 km north-east of the survey area.

Two major creek lines occur in the west of the survey area, Pirraburdoo Creek (including an area of permanent pooling water known as Ratty Springs) and Seven Mile Creek, both of which run into the Minilya River South Branch south of the survey area. One major creek line named Stoney Creek occurs in the east of the survey area and runs into Turee Creek south of the survey area. A number of other smaller unnamed drainage lines occur in the survey area, some of which contain areas of semi-permanent water, such as Doggers Gorge in the east of the survey area.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment and Energy

2016a). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The survey area occurs in the Pilbara Bioregion, of which 5% to 10% is represented in the national reserve system (Department of the Environment and Energy 2016b).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002). The survey area occurs within the Hamersley subregion (10,168.8 ha) of the Pilbara region and the Ashburton subregion (1,034.6 ha) of the Gascoyne region. These subregions are described in the audit as:

- Hamersley PIL3 – dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001b).
- Ashburton GAS1 - Mountainous range country divided by broad flat valleys of shales, sandstones and conglomerates with vegetation described a mulga or snakewood low woodlands over hardpans, with low mixed shrublands on hills and areas supporting large areas of *Triodia* (Kendrick 2001a).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Primary Industries and Regional Development (formerly the Department of Agriculture and Food) outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion covering 181,723 km² and a total of 172 land systems occur in the Gascoyne bioregion covering 183,784 km². Eleven land systems occur in the survey area; four occur within both the Pilbara and Gascoyne bioregions, an additional five occur within the Pilbara bioregion and an additional two occur within the Gascoyne bioregion (Table 3). The layout of these land systems within the survey area is shown in Figure A.2, Appendix A.

Table 3: Distribution of land systems within the survey area.

Land system	Total area within bioregion (ha)	Total area within survey area (ha)	Proportion within survey area (%)
Pilbara bioregion			
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	1,994,339	6,547.1	0.3
Platform - dissected slopes and raised plains supporting shrubby hard spinifex grasslands.	236,390	880.9	0.4
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,847	720.4	<0.1
Capricorn - rugged sandstone hills, ridges, stony footslopes and interfluvies supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	698,396	558.5	<0.1
River - active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	481,994	551.1	0.1
Marandoo - basalt hills and restricted stony plains supporting grassy mulga shrublands.	176,317	523.2	0.3
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,288	185.9	<0.1
Ethel - cobble plains with sparse mulga and other acacia shrublands.	2,886	140.8	4.9
Paraburdoo - basalt derived stony gilgai plains and stony plains supporting snakewood and mulga shrublands with spinifex, chenopods and tussock grasses.	130,774	61.0	<0.1
Gascoyne bioregion			
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	37,022	412.3	1.1
Ethel -cobble plains with sparse mulga and other acacia shrublands.	113,657	233.3	0.2
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	6,021	135.6	2.3
Dollar - stony plains supporting mulga and snakewood shrublands with some chenopod low shrubs.	28,827	91.0	0.3
Table - low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.	138,971	81.7	<0.1
River - active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	73,008	80.6	0.1

2.2.3 Pre-European Vegetation

Beard (1975) completed broad-scale (1:1,000,000) pre-European vegetation mapping at an association level.

Four pre-European vegetation units, 82, 181, 567 and 163 (Shepherd, Beeston, and Hopkins 2002), are associated with the survey area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these four vegetation units in the Pilbara bioregion, Gascoyne bioregion and the survey area.

Table 4: Extent of pre-European vegetation in the survey area (Government of Western Australia 2018).

Vegetation unit	Mapping unit (Beard 1975)	Description	Extent in survey area (ha)	Pre-European extent (ha)	Current extent in bioregion (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
Pilbara bioregion							
82	e16Lr t3Hi	Hummock grasslands, low tree steppe; snappy gum over <i>Triodia wiseana</i>	6,206	2,177,574	2,1652,35	99.4	13.6
181	a1,11Si	Shrublands; mulga and snakewood scrub	2,726	65,090	63,204	97.1	7.8
567	a1,2Sr t1,2Hi	Hummock grasslands, shrub steppe; mulga and kanji over soft spinifex and <i>Triodia basedowii</i>	1,207	776,824	774,213	99.7	25.5
163	ecZi	Shrublands; <i>Eremophila</i> and <i>Cassia</i> dwarf scrub	30	236	231	98.1	-
Gascoyne bioregion							
181	a1,11Si	Shrublands; mulga and snakewood scrub	978	1,520,571	1,520,558	99.9	15.3
163	ecZi	Shrublands; <i>Eremophila</i> and <i>Cassia</i> dwarf scrub	57	388,753	388,690	99.9	-

2.3 State and Commonwealth Conservation Categories and Management

Commonwealth and State regulatory authorities maintain databases of the locations and conservation status of significant flora, fauna and ecological communities in Western Australia.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage Matters of National Environmental Significance (MNES) including listed flora, fauna and ecological communities. These listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables B.1 and B.2, Appendix B.

Ecological communities may be subject to processes that threaten to destroy or significantly modify it across much of its range. These communities are identified as threatened ecological communities (TECs) and are listed at both Commonwealth level under the EPBC Act and State level by the Western Australian Minister for Environment (Table B.3, Appendix B). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a list of priority ecological communities (PECs), which may also be under threat and are assigned one of four priority rankings according to the criteria outlined in Table B.4 (Appendix B).

Under Western Australian legislation, all native flora is protected and it is an offence to ‘take’ protected flora. The *Wildlife Conservation Act 1950* (WC Act)¹ also provides for native plant species to be specially protected when they are under identifiable threat of extinction, are rare, or otherwise in need of special protection (Department of Biodiversity, Conservation, and Attractions 2017a). Such specially protected flora is considered under the WC Act to be ‘declared rare’ (threatened). In addition, due to the diversity of Western Australia’s flora, many species are known from only a few collections or locations, but have not been adequately surveyed. Such flora may be rare or threatened, but cannot be considered for declaration as threatened flora until adequate surveys have been undertaken. These flora species are included on a supplementary conservation list managed by DBCA called the *Priority Flora List* (Table B.5, Appendix B).

2.4 Introduced Flora (Weeds)

Significant weed species are identified at both the state and national level. The Australian Weeds Strategy (Australian Weeds Committee 2012a) identifies Weeds of National Significance (WoNS) which have the potential to impact primary industry and/or environmental and social values. The management of weeds in Western Australia is primarily regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Species listed under this act are allocated one of three declared pest categories which define the required level of management (Department of Agriculture and Food Western Australia 2016). Declared pest categories and listed weed species’ priority ratings are presented in Table B.6, Appendix B.

2.5 Land Use and Tenure

The survey area is located within the Shire of Ashburton. The majority of the survey area is on the Mininer and Rocklea Station pastoral leases. The local area is used for pastoralism, mineral exploration and mining activity. Karijini National Park is the nearest conservation reserve to the survey area, located approximately 26 km to the north-east (Figure 1).

¹From 1 January 2019, the *Wildlife Conservation Act 1950* has been replaced by the *Biodiversity Conservation Act 2016* and its regulations. This survey was completed in 2018 under the WC Act.

3 Methods

3.1 Desktop Assessment

3.1.1 Database Searches

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the *Environmental Protection Act 1986* to prevent incremental degradation of important environmental values such as declared rare (T) flora, TECs or significant wetlands. A search for ESAs in the vicinity of the survey area was conducted using Western Australian government datasets (Department of Water and Environmental Regulation 2017) and the Register of the National Estate dataset (Department of the Environment and Energy 2008).

Database searches were conducted to identify listed conservation significant flora and ecological communities within, or in close proximity to, the survey area. Conservation categories for ecological communities and flora are presented in Appendix B. Search results are presented in Appendix C and details are summarised in Table 5. Introduced flora species were compared to the Department of Primary Industries and Regional Development list, to determine if any have been listed as declared pests (Department of Primary Industries and Regional Development 2018), and the WoNS list (Australian Weeds Committee 2012b). Introduced flora categories are presented in Table B.6, Appendix B.

Table 5: Database searches undertaken.

Database	Date search results received	Search focus	Search area
<i>NatureMap</i> (Department of Biodiversity, Conservation, and Attractions 2017b)	14/07/2017	Flora of conservation significance	Diagonal line with a 20 km buffer running from the north-west to the south-east of the survey area, defined by the coordinates: 23°12'03 S, 117°30'07 E and 23°17'16 S, 117°44'27 E
Threatened and Priority Ecological Communities Database (Department of Biodiversity, Conservation, and Attractions 2017c)	25/08/2017	Listed threatened and priority ecological communities	40 km radius from the survey area boundary
Threatened and Priority Flora Database (TPFL) (Department of Biodiversity, Conservation, and Attractions 2017d)	21/08/2017	Listed threatened and priority flora	50 km radius from the survey area boundary
Threatened and Priority Flora List (TP List) (Department of Biodiversity, Conservation, and Attractions 2017e)	21/08/2017	Listed threatened and priority flora	50 km radius from the survey area boundary
Western Australian Herbarium Flora Database (Department of Biodiversity, Conservation, and Attractions 2017f)			

Database	Date search results received	Search focus	Search area
Protected Matters Search Tool (Department of the Environment and Energy 2017d)	04/07/2017	MNES – flora	20 km radius from a diagonal line running from the north-west to the south-east of the survey area, defined by the coordinates: -23.20083, 117.50056 and -23.28806, 117.74056 (MGA50, GDA94)

3.1.2 Literature Review

Flora and vegetation surveys have previously been commissioned by Rio Tinto within the vicinity of the survey area and supplied to Astron Environmental Services (Astron) for the desktop assessment. The previous survey areas in relation to the current survey area are shown in Figure D.1, Appendix D. The reports reviewed as part of this assessment include:

- Flora, Vegetation and Vertebrate Fauna on 23E/42E Paraburdoo (Mattiske Consulting 1998)
- Eastern Ranges Life of Mine Flora and Vegetation Report NVCP (Rio Tinto 2010a)
- Paraburdoo Mine Area Botanical And Vertebrate Fauna Survey (Ecologia Environment 2011)
- Flora and Vegetation Survey of the Turee Syncline Area (Mattiske Consulting 2011)
- Flora and Vegetation Survey for the Paraburdoo Magazine and the Tom Price Powerline Infrastructure Areas (Pilbara Flora 2011)
- Western Range Phase 2 Vegetation and Flora Report (Biota Environmental Sciences 2012b)
- Western Range Additional Area: Vegetation and Flora Report (Biota Environmental Sciences 2012a)
- Turee Creek Water Pipeline Upgrade and Paraburdoo Town Feeder One Line Replacement (Rio Tinto 2012)
- Flora and Vegetation Assessment of the Eastern Ranges Study Area (Rio Tinto 2014)
- Joe's Crossing Biological Assessment (Astron Environmental Services 2015a)
- Paraburdoo Haul Road Biological Assessment (Astron Environmental Services 2015b)
- Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment (Eco Logical Australia 2016).

Other flora assessments within the survey area that contribute to data including weed and conservation significant flora locations include:

- Eastern Range Rare Flora Surveys (Biota Environmental Sciences 2002)
- Doggers Gorge and Howies Hole Access Rare Flora Survey (Hamersley Iron Pty Ltd 2004)
- Paraburdoo GD_01067a&b (Hamersley Iron Pty Ltd 2005a)
- Paraburdoo Tailings Dam Stage 3 GD_05_01133 (Hamersley Iron Pty Ltd 2005b)
- Paraburdoo 4 East Feasibility and Landfill: Native Vegetation Clearing Permit Report (Biota Environmental Sciences 2008)
- ANFO Shed Relocation and 4 East Structural Drilling NVCP Report (Rio Tinto 2008)
- Flora and Vegetation Survey of the Paraburdoo NLC Mine Pit and North Lobe Creek (Rio Tinto 2009b)

- Botanical Survey for a Drilling Program (AR-08-04080 & AR-08-04081) at Paraburdoo (Rio Tinto 2009a)
- Flora and Vegetation Survey of the Paraburdoo Tailings Dam Southern Cell (PTDSC) Development (Rio Tinto 2009c)
- Paraburdoo 11w Mine Development NVCP (Rio Tinto 2009d)
- Flora and Vegetation of the Paraburdoo Magazine Explosives Compound Construction Area and ANFO Shed Relocation (Rio Tinto 2010b)
- Flora and Vegetation of the Proposed 4 West Waste Dump Extension and Southern Bore Field Collector Upgrade, Paraburdoo (Rio Tinto 2010c)
- Flora and Vegetation of the proposed 4EMP Cutback Waste Dump (AR-09-05178)_NVCP (Rio Tinto 2010d)
- Flora and Vegetation of the proposed 11W & 11W1 Pit Extensions and 11W Waste Dump Extension, Paraburdoo (Rio Tinto 2010e)
- Paraburdoo Weed Inspection and Control Field Visits (Astron Environmental Services 2011)
- Flora and Vegetation Survey of the 4e-Stage 3 Southern Waste Dump NVCP Supporting Report (Rio Tinto 2011a)
- Flora and Vegetation Survey of the 5 West Pit Operations NVCP Supporting Report (Rio Tinto 2011b)
- Assessment to Meet Flora Condition of CPS for AR 8389 and 9607 (Rio Tinto 2013)
- Weed Control Program, Inland Operations, Paraburdoo, 2016 Annual Summary Report (Astron Environmental Services 2016).

3.1.3 Likelihood of Occurrence Assessment

Prior to conducting the Phase 1 field survey in 2017, aerial imagery was interpreted to identify potential habitat types. The conservation significant flora species returned from the database searches were then categorised according to the criteria in Table 6 for potential occurrence within the survey area.

Table 6: Pre-survey criteria used to assess the likely presence of conservation significant flora in the survey area.

Likelihood of occurrence	Pre-survey
Likely	Species previously recorded within the survey area or within 10 km of the survey area and suitable habitat appears to be present in the survey area
Potential	Species previously recorded within 10 km to 20 km of the survey area and/or suitable habitat appears to be present in the survey area
Unlikely	No suitable habitat appears to be present in the survey area

Following the Phase 2 field survey, the likelihood of occurrence of conservation significant flora species not encountered within the survey area was reassessed. Species identified during the desktop assessment as having potential to occur during the desktop exercise were categorised post-field based on the proximity of known populations to the survey area, the presence (and thorough inspection) of suitable habitats within the survey area, the life form, preferred habitat and flowering times for each species.

3.2 Field Survey

3.2.1 Survey Timing and Personnel

The Phase 1 field survey was conducted by Astron Senior Botanist Ben Eckermann (Flora Permit SL011923; DRF Permit 48-1617), and Botanists Lucy Dadour (Flora Permit SL012123) and Linda Vaughan (Flora Permit SL011984), from 20 to 31 July 2017. An additional (Phase 1) field survey was conducted by Ben Eckermann and Linda Vaughan, from 18 to 25 August 2017. The Phase 2 field survey was conducted by Astron Senior Botanist Ben Eckermann (Flora Permit SL012249; DRF Permit 66-1718), and Botanists Dr Kellie McMaster (Flora Permit SL012244), Lucy Dadour (Flora Permit SL012252) and Dr Markus Mikli (Flora Permit SL012330), from 7 to 15 April 2018.

3.2.2 Weather

Daily observations for rainfall and temperature were recorded by Rio Tinto at the Paraburdoo weather station, with long term rainfall and temperature observations being sourced from the Bureau of Meteorology (BoM) at the Paraburdoo Aero station (number 007185), approximately 15 km north-east of the Paraburdoo weather station. Local rainfall and temperatures preceding the survey are presented in Figure 3.

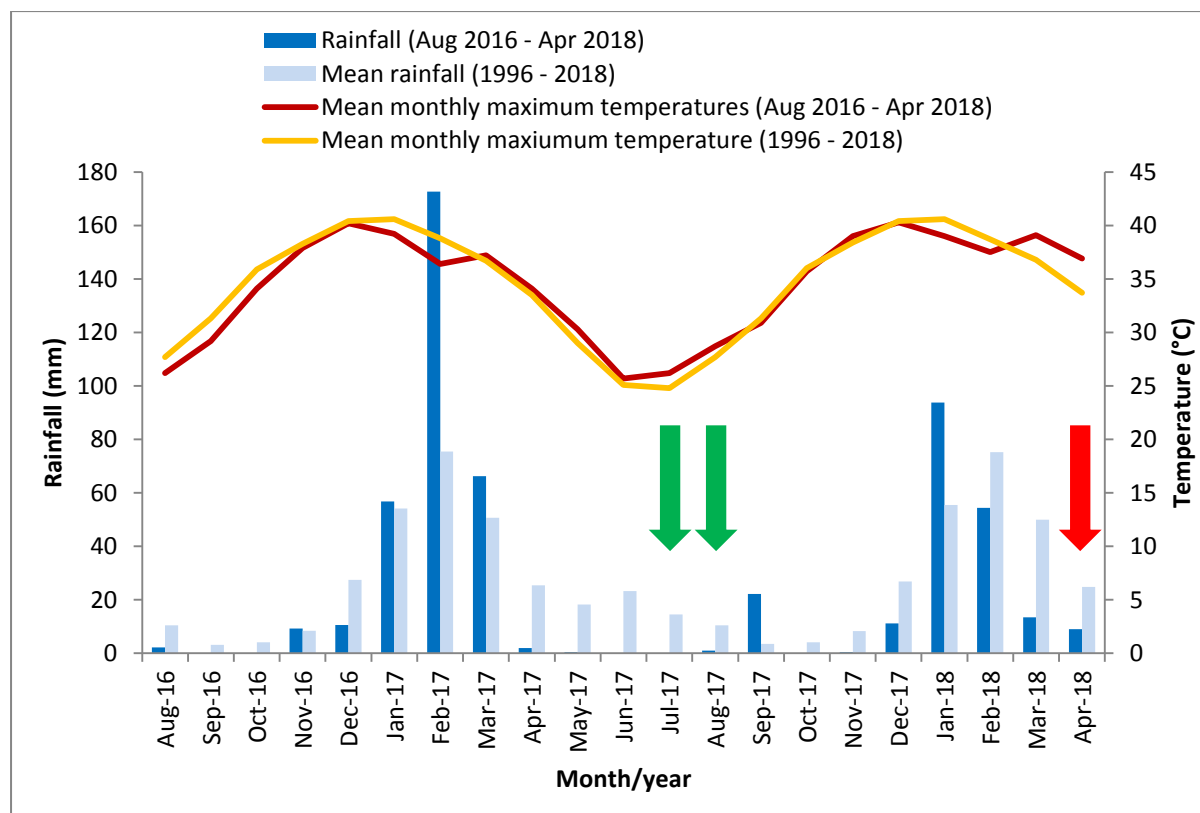


Figure 3: Mean monthly and recorded monthly rainfall (mm) and maximum temperatures (°C). Daily records supplied by Rio Tinto and long term records supplied by BoM from the Paraburdoo Aero station (007185) (Bureau of Meteorology 2018). The green arrows display timing for the Phase 1 surveys, with the red arrow displaying timing for the Phase 2 survey.

Rainfall recorded in the 12 months prior to the second Phase 1 survey in August 2017 was 317.6 mm, 3.2 mm more than the long-term mean of 314.4 mm (Bureau of Meteorology 2018). The majority of this rain fell during the summer cyclone season, with 239.2 mm recorded between February and March 2017. In the three months preceding the first Phase 1 survey in July 2017,

10.4 mm was recorded; the long term mean for the same period is 66.2 mm (Bureau of Meteorology 2018). No rainfall was recorded in the three months preceding the second Phase 1 survey in August 2017. The long term mean rainfall for the same period was 55.9 mm (Bureau of Meteorology 2018).

Rainfall recorded in the 12 months prior to the Phase 2 survey in April 2018 was 230 mm, 84.4 mm less than the long-term mean (Bureau of Meteorology 2018). In the three months preceding the April survey, 191 mm was recorded while the mean average rainfall for the same time period is 180.5 mm (Bureau of Meteorology 2018). The majority of this rain fell during the summer cyclone season, with 171 mm being recorded between January and February 2018. The mean maximum temperature of 37.2°C for April 2018 was above the long term maximum temperature of 33.7°C for April (Bureau of Meteorology 2018) (Figure 3).

3.2.3 Vegetation and Flora Assessment

The survey was undertaken in accordance within the requirements outlined in the Scope of Work provided, dated 25 May 2017, as well as the requirements of the EPA and Rio Tinto policy and guidance documents (Rio Tinto 2017; Environmental Protection Authority 2016b, 2004b, 2002).

Information acquired during the desktop assessment assisted in the design of the field survey prior to Phase 1 in 2017. Pre-survey planning involved the examination of 1:10,000 scale aerial photography to identify potentially different landforms, habitat and vegetation units. It also involved a review of the flora and vegetation assessments previously completed at Greater Paraburdoo (Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011; Rio Tinto 2014, 2010a; Eco Logical Australia 2016) to provide context and identify data gaps. Proposed quadrat locations were identified prior to the field survey according to the replicates required to support the previous vegetation mapping and adjusted on site as appropriate (Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011; Rio Tinto 2014).

A total of 69 sites, comprising 64 quadrats and five relevés were sampled within the survey area over the Phase 1 and 2 surveys. Forty-one quadrats and three relevés were newly established during the Phase 1 survey. Quadrats that were not permanently marked or did not contribute to the required survey site spatial coverage for each vegetation unit were not considered suitable. Quadrats from previous surveys that had been sampled in a single phase were considered for rescored during the current survey (Biota Environmental Sciences 2012a; Ecologia Environment 2011). Quadrats that were not permanently marked or did not contribute to the required survey site spatial coverage for each vegetation unit were not considered suitable. Thirteen sites were identified as suitable, with 11 quadrats and two relevés being rescored and incorporated into the survey program. An additional 11 quadrats that had been sampled in two seasons were also incorporated into the survey program (Biota Environmental Sciences 2012b)

A total of 43 sites were revisited during the Phase 2 survey, comprising rescored all of the 41 quadrats installed in Phase 1 and revisiting two of the three relevés established in Phase 1. One of the relevés (GPR25) was not revisited due to access constraints. In addition to the revisits, one new quadrat (GP45) was established in the H2 vegetation unit during the Phase 2 survey. Survey effort is detailed in Table 7. The data from each surveyed site were used for mapping and floristic analysis purposes.

Mapping notes were also taken to support the vegetation mapping, these recorded location coordinate, photograph, vegetation description, associated species, vegetation condition and fire history (Table 7).

Quadrats were positioned by measuring a square of 50 m by 50 m, in suitable terrain, with the four corners marked with flagging tape and where possible a fence dropper positioned in the north west corner. Dimensions of the quadrat were adjusted according to terrain, drainage and landform features, to represent an estimated 2,500 m². Data from relevé locations were sampled from an area of approximately 2,500 m². In challenging terrain, visual estimation was used to approximate the area.

The following information was collected for each quadrat and relevé:

- Location – coordinates measured using a handheld global positioning system (GPS) unit (MGA50, GDA94) at each of the four corners of the site.
- Recorder and date – personnel involved in sampling that location and the survey date.
- Habitat and slope – a broad description of the surrounding landscape based on landform, topography and soil.
- Soil – including colour and texture.
- Rock type and abundance – general description of geological units and amount of ground covered by rocks.
- Vegetation description – vegetation was described according to level 5 of the National Vegetation Information System (NVIS) (Department of the Environment and Energy 2017a) and classified according to the Aplin (1979) modification of the vegetation classification system of Specht (1970) (Appendix E).
- Vegetation condition – assessed according to the vegetation condition classification adapted from Trudgen (1988) (Appendix E).
- Fire age – estimate of time since the vegetation was last burnt.
- Taxa and foliar cover – percentage foliar cover (PFC) and maximum height were recorded for all vascular plant taxa present within the site. The inventory of associated species was comprehensive for relevé locations, with each flora species present in an estimated quadrat dimension recorded.
- Disturbances – records of any obvious disturbances such as fire, tracks or grazing.
- Photographs – a digital image was taken at the north-west and south-east corners of each quadrat or from a representative location for each relevé.

Table 7: Survey effort for existing and newly installed quadrats and relevés occurring within the survey area.

Author; phase of survey	Number of sites	Name of sites
One phase of survey: Astron (current survey)	1 quadrat 1 relevé 28 mapping notes	Quadrats: GP45 (Wet season) Relevés : GPR25 (Dry Season) Mapping Notes: MNBE01, MNBE02, MNBE03, MNBE04, MNBE05, MNBE06, MNBE07, MNBE08, MNBE09, MNBE10, MNBE11, MNBE12, MNBE13, MNBE14, MNBE15, MNBE16, MNBE17, MNBE18, MNBE19, MNBE20, MNBE21, MNBE22, MNBE23, MNBE24, MNLD01, MNLD02, MNLV01, MNLV02

Author; phase of survey	Number of sites	Name of sites
Two phases of survey Dry season (Phase 1) and Wet season (Phase 2): Astron (current survey)	41 quadrats 2 relevés	Quadrats: GP01, GP02, GP03, GP04, GP05, GP06, GP07, GP08, GP09, GP10, GP11, GP12, GP13, GP14, GP15, GP16, GP17, GP18, GP21, GP20, GP22, GP23, GP24, GP26, GP27, GP28, GP29, GP30, GP31, GP32, GP33, GP34, GP35, GP36, GP37, GP38, GP39, GP40, GP41, GP42, GP43, Relevés: GPR19, GPR44
Two phases of survey: (Ecologia Environment 2011) initial phase and current survey rescore phase (Astron rescore site codes presented in brackets)	6 quadrats 2 relevés	Quadrats: e029(e029-AR), e030(e030-AR), e038(e038-AR), e043(e043-AR), e073(e073-AR), e122(e122-AR) Relevés: e006(e006-AR), e074(e074-AR)
Two phases of survey: (Biota Environmental Sciences 2012a) initial phase and current survey rescore phase (Astron rescore site codes presented in brackets)	5 quadrats	WRA01(WRA01-AR), WRA21(WRA21-AR), WRA23(WRA23-AR), WRA39(WRA39-AR), WRA44(WRA44-AR)
Two phases of survey (Biota Environmental Sciences 2012b) (rescore phase site codes in brackets)	11 quadrats	WRF01(WRR01), WRF02(WRR02), WRF03(WRR03), WRF32(WRR32), WRF34(WRR34), WRF36(WRR36), WRF38(WRR38), WRF41(WRR41), WRF43(WRR43), WRF44(WRR44), WRF45(WRR45)

3.2.4 Vegetation Description and Mapping

Where appropriate, vegetation was described and mapped to be consistent with the descriptions and mapping previously conducted in and adjacent to the survey area (Biota Environmental Sciences 2012b). Astron adopted these vegetation codes and descriptions, and reconciled vegetation polygon boundaries to maintain consistency with those datasets. The vegetation descriptions for some codes were updated to reflect current nomenclature. Where vegetation was observed to no longer represent previous mapping, vegetation polygon boundaries were adjusted and new vegetation descriptions assigned. Vegetation units were described and mapped using the data collected from quadrats and relevés, and followed the same convention as that previously used; the vegetation unit code is described according to the initials of the dominant flora species defining the community. In past mapping units and newly described areas, all members of the *Acacia aneura* complex are referred to as *Acacia aneura* sens. lat. for consistency. Mapping notes were also used to mark changes in vegetation throughout the survey area.

3.2.4.1 Vegetation Condition Mapping

Vegetation condition was mapped according to vegetation unit boundaries throughout the survey area, using a combination of quadrat and relevé data, opportunistic observations and the mean condition rating for each vegetation unit. Vegetation condition was rated at each survey site using the five point Trudgen (1988) scale, and then applied to the whole vegetation unit polygon in which it was mapped. A mean condition rating was calculated for each vegetation unit using the data collected from survey sites and this was applied to any polygons not already attributed with a rating.

3.2.5 Targeted Flora Survey

Previously recorded conservation significant flora records and associated habitat preference information assisted in identifying vegetation units and habitat within the survey area that have potential to support conservation significant flora (Department of Biodiversity, Conservation, and Attractions 2017c, 2017d, 2017e, 2017f; Rio Tinto 2014; Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011). Habitats and vegetation units in the survey area considered to have the potential to support conservation significant flora were strategically targeted in the field to record the presence or absence of conservation significant flora, with preference given to searching areas that had little or no previous survey history. Traverses were spaced according to the accessibility of habitats, but generally observers were 30 m to 50 m apart. Where conservation significant flora was encountered, a waypoint was established to represent one or a number of individuals.

3.3 Taxonomy and Nomenclature

Plant specimens that were not identified in the field were identified in Perth by Johan Hurter and Astron Senior Botanist Ben Eckermann who have worked extensively in the Pilbara region and are highly familiar with the flora of the region. The assigned nomenclature is consistent with the current listing of scientific names recognised by the Western Australian Herbarium (WA Herbarium) and was used for the species list and associated species information collected. Where specimens had inadequate descriptive material to allow confident identification, they were assigned a 'sp.' (species) epithet, indicating that identification could not be confirmed beyond genus level. Range extensions and conservation significant taxa were submitted to the Rio Tinto sponsored taxonomist Steve Dillon at the WA Herbarium for confirmation.

3.4 Floristic Analysis

A species accumulation curve was created in order to examine the adequacy of survey effort, while cluster analyses were completed to examine the relationship between:

- floristic groups and structural vegetation units within the survey area
- survey area quadrats and relevés and their association with quadrats and relevés surveyed at a broader scale.

For the analysis of data collected by Astron only, 58 samples (quadrats and relevés) were classified, with repeat samples from Phase 1 and Phase 2 combined. For the broader regional contextual analysis, quadrats and relevés from Astron Phase 1 and Phase 2 surveys were included in a dataset along with a further 369 sites from a selection of surveys in the locality (Ecologia Environment 2011; Biota Environmental Sciences 2012b, 2012a; Rio Tinto 2014; GHD Pty Ltd 2009; Matiske Consulting 2011).

The species lists from all projects used in the analyses were reconciled to provide consistency in nomenclature. Any taxa not confirmed to species level were removed from the analyses. All weed and annual species were also removed prior to analysis. Singletons (species recorded from only one site) were retained.

The species accumulation curve and cluster analyses were completed by Astron Senior Scientist Dr Aaron Gove using R 3.2.1 (R Development Core Team 2015) and PRIMER v6 software (Clarke and Gorley 2006), respectively. The compositional differences amongst samples were quantified using the Bray-Curtis index of similarity based on presence-absence data, while the dendrograms were created using the Average Linkage method. Following normal convention, statistically significant clusters were those distinguished by a P-value <0.05.

3.5 Limitations

Following completion of the desktop assessment and field surveys, a review of any limitations that may have affected a complete assessment of the data collected was conducted. The limitations listed in Table 8 are based on those suggested as considerations in Guidance Statements 51 and 56 (Environmental Protection Authority 2004a, 2004b).

Table 8: Statement of limitations.

Potential limitation	Statement regarding potential limitation
(i) Sources of information and availability of contextual information Is the region well documented?	Previous biological surveys have been conducted in the broader locality, and broad-scale information is available from Beard (1975) and Payne et al. (1980). Thirty-one previous biological reports within the survey area were available for review (refer to Section 3.1.2), contextual information is therefore not a limiting factor for this survey.
(ii) Scope The level of survey and detail required to undertake the survey. Was there adequate time to complete the survey to the desired standard?	There was adequate time to complete the flora and vegetation surveys, complete vegetation mapping, and conduct targeted searches for threatened and priority flora within the survey area as outlined in the scope of works.
(iii) Proportion of flora and fauna identified, recorded and/or collected Was the survey sampling, timing and intensity considered adequate? Was the survey conducted at what was considered an appropriate time of the year for plant identification? Were any taxonomic groups considered to be under-represented?	The field survey was conducted during seasonally below average conditions for the southern Pilbara region in July and August 2017 (Phase 1) and during seasonally average conditions in April 2018 (Phase 2). Sampling intensity was considered adequate without being comprehensive; the flora taxonomic groups recorded within the survey area were considered well represented. Most taxonomic groups expected within the survey area were well represented, and the total floristic richness was considered comparable to other surveys in the area. Five of the priority flora species assessed as having the potential to occur, likely to occur, or were previously recorded in the survey area (Appendix F) are annual or short-lived perennial species, and as such the dry seasonal conditions are likely to have been a limiting factor to the flora survey.
(iv) Completeness Is there further work which may be required i.e. was the relevant area fully surveyed?	The survey area was considered adequately surveyed to compile a representative list of species, (including priority and introduced flora species), as well as describe and map vegetation at a level appropriate for possible future management decisions.
(v) Mapping reliability Were the aerial photographs, satellite images and site maps available considered adequate to fully understand the area surveyed? Was the mapping generated considered to have a high degree of reliability?	Colour aerial photography at a scale of 1: 10,000 was used to locate the survey area and to assist in navigation and delineation of vegetation boundaries. The aerial photography was of good resolution and, in general, accurately represented ground conditions.

Potential limitation	Statement regarding potential limitation
(vi) Timing When was the survey conducted in terms of season, rainfall, severe weather events etc.? Was the survey conducted at an appropriate time for access, observation of the optimal suite of species and for identification of flowering and fruiting species?	Seasonal conditions were below average for surveying the southern Pilbara region during Phase 1 in July/August 2017 and average during Phase 2 in April 2018. No rainfall was recorded in the three months preceding the Phase 1 field surveys and as a result, many annual and short-lived perennial species were absent. Rainfall was 5.8% above average in the three months preceding the Phase 2 survey, and 1% above average in the 12 months preceding the Phase 2 survey. Dry conditions were recorded during the on-ground survey with many annual or short-lived perennial species already desiccated. The survey timing was not ideal and is considered a limiting factor.
(vii) Disturbance Had the survey area been impacted by any disturbance which may have limited the survey, i.e. fire, flood, accidental human intervention etc.?	The survey area has been significantly affected by mining and exploration operations in the past. A history of pastoral activity and cattle grazing was evident on the plains, floodplains and drainage lines. There was evidence of a fire in the south-eastern section of the survey area over the past two to three years. None of these disturbances limited the outcomes of this survey.
(viii) Intensity In retrospect, was the intensity considered to be adequate?	The intensity of the survey was considered adequate to compile a representative species list, map the vegetation of the survey area to association level with adequate quadrat replication and conduct targeted surveys for priority flora in potential habitat.
(ix) Resources Were the appropriate tools and materials available to complete the task effectively?	Resources were adequate to complete the survey and all appropriate tools and materials required to complete the task were available.
(x) Access Were there any factors limiting access to the survey area?	Much of the survey area was able to be accessed by vehicle; areas that were unable to be reached by vehicle were accessed and traversed by foot. All areas within the rail loop and some isolated vegetation within the mining infrastructure area were not able to be accessed. Areas in the eastern portion of the survey area were remote from track access or the tracks were not accessible by vehicle and poorly searched.
(xi) Experience Were personnel undertaking the field survey and plant identification trained and/or experienced in undertaking the required tasks?	The botanists responsible for undertaking the field survey have considerable experience in conducting vegetation and flora surveys in the Pilbara. The identification of specimens brought back from the field was conducted by Johan Hurter and Ben Eckermann who both have extensive Pilbara botanical experience. Range extensions and conservation significant taxa were submitted to the Rio Tinto sponsored taxonomist Steve Dillon at the WA Herbarium for confirmation.

4 Results

4.1 Desktop Assessment

4.1.1 Environmentally Sensitive Areas

The only ESA intersecting the survey area was the 50 m of vegetation surrounding the locations of *Aluta quadrata* T. The Hamersley Range National Park (1977 boundary, now named Karijini National Park) is also considered an ESA and occurs approximately 26 km north-east of the survey area (Department of the Environment and Energy 2008).

4.1.2 Vegetation and Flora

No EPBC Act listed MNES TECs and no State-listed TECs or PECs have been previously recorded within 40 km of the survey area.

The DBCA TPFL (Department of Biodiversity, Conservation, and Attractions 2017d), TP List (Department of Biodiversity, Conservation, and Attractions 2017e) and WA Herbarium database (Department of Biodiversity, Conservation, and Attractions 2017f) searches indicated a total of 56 conservation significant flora taxa have been previously recorded within 50 km of the survey area (Table F.1, Appendix F) (Department of Biodiversity, Conservation, and Attractions 2017f, 2017e, 2017b, 2017d). This includes one State-listed threatened species, nine P1 taxa, 13 P2 taxa, 26 P3 taxa and seven P4 taxa. The pre-survey desktop assessment indicated nine of the listed conservation significant flora species had been previously recorded, four were considered likely to occur within the survey area and a further eight were considered to have the potential to occur (Table F.1, Appendix F).

4.1.3 Literature Review

Results of the literature review indicate that no TECs or PECs have been previously recorded within, or in the vicinity of the survey area.

Nine currently listed flora taxa of conservation significance have been previously recorded within, or in close proximity to, the survey area: *Aluta quadrata* T, *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1, *Hibiscus campanulatus* P1, *Solanum octonum* P2, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3, *Grevillea saxicola* P3, *Nicotiana umbratica* P3, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3 and *Ptilotus trichocephalus* P4 (Table 9) (Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011; Rio Tinto 2010a, 2014, 2012; Eco Logical Australia 2016; Mattiske Consulting 1998, 2011; Pilbara Flora 2011).

Table 9: Summary of relevant vegetation and flora surveys in the vicinity of the current survey area.

Survey parameter	Mattiske Consulting (1998)	Rio Tinto Iron Ore (2010a)	ecologia Environment (2011)	Mattiske Consulting (2011)	Pilbara flora (2011)	Biota Environmental Sciences (2012b)	Biota Environmental Sciences (2012a)	Rio Tinto Iron Ore (2012)	Rio Tinto Iron Ore (2014)	Astron Environmental Services (2015a)	Astron Environmental Services (2015b)	Eco Logical (2016)
Survey area size (ha)	3,691	1,740	5,655	9,197	697	10,500	4,423	203	2,132	80	142	272
Survey focus	Consolidation of biological values	Native Vegetation Clearing Permit (NVCP)	Single phase Level 2	Baseline survey	NVCP	Two phase Level 2	Single phase Level 2	NVCP	NVCP	Biological Assessment	Biological Assessment	NVCP
Survey timing	N/A	Jul 2010	Jul-Aug 2011	Jun 2011	Nov 2010	May 2011	Sep 2011	Mar 2012	May-Jun and Jul 2014	Nov 2014	Feb 2015	May and Aug 2015
Seasonal conditions	N/A	Average	Average	Optimal	Poor	Optimal	Not optimal	Optimal	Average	Below average	Below average	Optimal
Survey effort (quadrats/relevés)	206 sites	102 quadrats 135 relevés	77 quadrats	122 sampling sites	73 relevés 92 mapping points	38 quadrats	49 quadrats	38 relevés 110 mapping notes	55 quadrats 140 relevés	4 quadrats 7 relevés	19 relevés	33 relevés
Total vegetation units mapped	17	50	22	30	19	22	22	14	62	5	11	11
Conservation significant ecological communities recorded	0	0	0	0	0	0	0	0	0	0	0	0
Total species recorded	195	191	294	230	174	311	326	252	214	62	141	263
Conservation significant flora species recorded (currently listed - as at July 2017)	0	1	2	0	0	6	2	2	5	0	1	7
<i>Aluta quadrata</i> T			✓			✓						
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1									✓			
<i>Hibiscus campanulatus</i> P1						✓		✓	✓			✓
<i>Solanum octonum</i> P2									✓			✓
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3						✓	✓	✓				
<i>Grevillea saxicola</i> P3									✓		✓	✓
<i>Nicotiana umbratica</i> P3						✓						✓
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3		✓				✓			✓			✓
<i>Ptilotus trichocephalus</i> P4			✓			✓	✓					✓

4.2 Field Survey


4.2.1 Vegetation



There were 21 vegetation units recorded within the survey area. Part of the survey area has been mapped previously and presented in the following reports:



- Eastern Ranges Life of Mine Flora and Vegetation Report NVCP (Rio Tinto 2010a)
- Paraburdoo Mine Area Botanical And Vertebrate Fauna Survey (Ecologia Environment 2011)
- Western Range Phase 2 Vegetation and Flora Report (Biota Environmental Sciences 2012b)
- Western Range Additional Area: Vegetation and Flora Report (Biota Environmental Sciences 2012a)
- Flora and Vegetation Assessment of the Eastern Ranges Study Area (Rio Tinto 2014)
- Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment: Native Vegetation Clearing Permit – Supporting Report (Eco Logical Australia 2016).



Areas where vegetation had been removed for roads, tracks and mining activities were mapped as 'cleared'. Vegetation mapping, quadrat, relevé and mapping note locations are presented in Figure G.1 Appendix G, site data is provided in Appendix H, and vegetation unit descriptions and representative photos are presented in Table 10. All previous vegetation sampling site locations are presented in Appendix I.


Table 10: Vegetation units described for the survey area.


Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Vegetation of Hills and Ridges				
<p>H1 – AanAprAteTe <i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> tall open shrubland over <i>A. tetragonophylla</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>Eremophila cuneifolia</i>, <i>E. jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne mucronata</i>, <i>E. pulchella</i>, <i>Gomphrena cunninghamii</i>, <i>Grevillea berryana</i>, <i>Maireana georgei</i>, <i>Polycarpaea longiflora</i>, <i>Psydrax suaveolens</i>, <i>Ptilotus obovatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Senna glutinosa</i> subsp. <i>glutinosa</i>, <i>Solanum lasiophyllum</i>, <i>Tribulus suberosus</i></p>	GP04, GP20, WRF38, WRF41, WRF45, MNBE01, MNBE02, MNBE06, MNBE17	Degraded – Excellent	1,871.2 (16.7 %)	 <p>Plate 1: Vegetation unit H1 – AanAprAteTe.</p>



Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>H2 – AprGbERsppTe <i>Acacia pruinocarpa</i>, <i>Grevillea berryana</i> tall open shrubland over <i>Eremophila fraseri</i> subsp. <i>fraseri</i>, <i>E. canaliculata</i>, <i>E. cuneifolia</i> scattered low shrubs over <i>Triodia epactia</i> hummock grassland</p> <p>Associated species: <i>Acacia aneura</i> sens. lat., <i>A. tetragonophylla</i>, <i>Bulbostylis barbata</i>, <i>Eremophila cryptothrix</i>, <i>E. jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>Eriachne pulchella</i>, <i>Euphorbia boophthona</i>, <i>Maireana georgei</i>, <i>Paspalidium clementii</i>, <i>Ptilotus obovatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Senna glutinosa</i> subsp. <i>glutinosa</i>, <i>S. stricta</i>, <i>Solanum lasiophyllum</i>, <i>Tribulus suberosus</i></p>	GP42, GP45, WRF36, MNBE23	Degraded – Excellent	273.3 (2.4%)	 <p>Plate 2: Vegetation unit H2 – AprGbERsppTe.</p>
<p>H3 – DpERcrTe <i>Dodonaea pachyneura</i>, <i>Eremophila cryptothrix</i> tall shrubland over <i>Triodia epactia</i> hummock grassland</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>A. pruinocarpa</i>, <i>A. tetragonophylla</i>, <i>Bulbostylis barbata</i>, <i>Cheilanthes brownii</i>, <i>Dodonaea petiolaris</i>, <i>Eremophila latrobei</i> (various subspecies), <i>Eriachne mucronata</i>, <i>E. pulchella</i> subsp. <i>pulchella</i>, <i>Grevillea berryana</i>, <i>Marsdenia australis</i>, <i>Paspalidium clementii</i>, <i>Ptilotus schwartzii</i> var. <i>schwartzii</i>, <i>P. obovatus</i>, <i>Sida fibulifera</i>, <i>S. sp. Excedentifolia</i> (J.L. Egan 1925), <i>Solanum lasiophyllum</i>, <i>Tribulus suberosus</i></p>	GP01, GP02	Very Good – Excellent	13.3 (0.1%)	 <p>Plate 3: Vegetation unit H3 – DpERcrTe.</p>


Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>H4 – AteAsyERcTe <i>Acacia tetragonophylla</i>, <i>A. synchronicia</i> scattered tall shrubs over <i>Eremophila cuneifolia</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland</p> <p>Associated species: <i>Acacia pruinocarpa</i>, <i>Bulbostylis barbata</i>, <i>Cleome viscosa</i>, <i>Corchorus crozophorifolius</i>, <i>Cucumis variabilis</i>, <i>Enneapogon caeruleus</i>, <i>Eremophila fraseri</i> subsp. <i>fraseri</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne mucronata</i>, <i>Indigofera monophylla</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>glutinosa</i>, <i>S. stricta</i>, <i>Sida echinocarpa</i>, <i>Solanum cleistogamum</i>, <i>S. lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i>, <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i></p>	e029-AR, e030-AR, GP12, GP16, WRF43, MNBE08, MNBE09, MNBE20	Degraded – Excellent	1,349.7 (12.0%)	 <p>Plate 4: Vegetation unit H4 – AteAsyERcTe.</p>
<p>H5 – AteERfTw <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Eremophila fraseri</i> subsp. <i>fraseri</i> scattered shrubs over <i>Triodia wiseana</i> hummock grassland</p> <p>Associated species: <i>Acacia pyrifolia</i>, <i>*Aerva javanica</i>, <i>Cymbopogon ambiguus</i>, <i>Eremophila cuneifolia</i>, <i>Gomphrena cunninghamii</i>, <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i></p>	GP28, GP30, MNBE12, MNBE14	Good – Excellent	30.9 (0.3%)	 <p>Plate 5: Vegetation unit H5 – AteERfTw.</p>


Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>H8 – AanSaoERsppARc <i>Acacia aneura</i> sens. lat. tall open scrub over <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>Eremophila</i> spp. open heath over <i>Aristida contorta</i> open bunch grassland</p> <p>Associated species: <i>Acacia tetragonophylla</i>, <i>*Aerva javanica</i>, <i>*Cenchrus ciliaris</i>, <i>Corchorus crozophorifolius</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila cuneifolia</i>, <i>E. forrestii</i> subsp. <i>forrestii</i>, <i>Gomphrena cunninghamii</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>Senna glutinosa</i> subsp. <i>x luerssenii</i>, <i>S. stricta</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i></p>	e122-AR, GP31, WRF03, MNBE11	Good – Excellent	45.3 (0.4%)	 <p>Plate 6: Vegetation unit H8 – AanSaoERsppARc.</p>
<p>H11 – ArAanERpoERlp <i>Acacia rhodophloia</i>, <i>A. aneura</i> sens. lat. tall open shrubland over <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i> scattered shrubs over <i>Eriachne pulchella</i> open bunch grassland</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>A. macraneura</i>, <i>A. pruinocarpa</i>, <i>A. tetragonophylla</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>Eremophila fraseri</i> subsp. <i>fraseri</i>, <i>E. jucunda</i> subsp. <i>pulcherrima</i>, <i>Gomphrena canescens</i> subsp. <i>canescens</i>, <i>Goodenia microptera</i>, <i>Grevillea berryana</i>, <i>Heliotropium heteranthum</i>, <i>Portulaca oleracea</i>, <i>Psyrdrax latifolia</i>, <i>Ptilotus exaltatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Solanum cleistogamum</i>, <i>S. lasiophyllum</i>, <i>Trianthema glossostigmum</i>, <i>Tribulus suberosus</i>, <i>Trigastrotheca molluginea</i>, <i>Triodia epactia</i></p>	GP07, GP09, GP10, GP17, MNBE05, MNBE10, MNBE21, MNBE24, MNLD02	Good – Excellent	155.6 (1.4%)	 <p>Plate 7: Vegetation unit H11 – ArAanERpoERlp.</p>



Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>H12 – EIIAprGbTe <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over <i>Acacia pruinocarpa</i>, <i>Grevillea berryana</i> scattered tall shrubs over <i>Triodia epactia</i> hummock grassland</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>A. sibirica</i>, <i>A. tetragonophylla</i>, <i>Bulbostylis barbata</i>, <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>, <i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne mucronata</i>, <i>E. pulchella</i>, <i>Ptilotus schwartzii</i> var. <i>schwartzii</i>, <i>Senna glutinosa</i> subsp. <i>glutinosa</i>, <i>Trachymene oleracea</i> subsp. <i>oleracea</i></p>	GP06, GP14, GP40, MNBE03, MNBE04, MNBE13, MNBE22, MNLD01	Good – Excellent	848.2 (7.6%)	 <p>Plate 8: Vegetation unit H12 – EIIAprGbTe.</p>



Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Vegetation of Stony Plains				
<p>P1 – AanAxAteERcSspp <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i> open shrubland over <i>Eremophila cuneifolia</i>, <i>Senna</i> spp. scattered low shrubs</p> <p>Associated species: <i>Acacia synchronicia</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>*Cenchrus ciliaris</i>, <i>Corchorus crozophorifolius</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caeruleus</i>, <i>E. polyphyllus</i>, <i>Eriachne pulchella</i>, <i>Gomphrena kanisii</i>, <i>Goodenia tenuiloba</i>, <i>Hybanthus aurantiacus</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Paraneurachne muelleri</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus aervoides</i>, <i>Ptilotus exaltatus</i>, <i>P. obovatus</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>x luerssenii</i>, <i>S. stricta</i>, <i>Sporobolus australasicus</i>, <i>Trianthema glossostigmum</i>, <i>Tribulus suberosus</i>, <i>Tridonia epactia</i></p>	WRA39-AR, WRF02, WRF32, WRF34	Degraded – Excellent	1,875.7 (16.7%)	 <p>Plate 9: Vegetation unit P1 – AanAxAteERcSspp.</p>



Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>P2 – AanAteSspp <i>Acacia aneura</i> sens. lat., <i>A. tetragonophylla</i> tall open shrubland over <i>Senna</i> spp. scattered low shrubs</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>Aristida contorta</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne pulchella</i>, <i>Gomphrena canescens</i> subsp. <i>canescens</i>, <i>Grevillea berryana</i>, <i>Heliotropium heteranthum</i>, <i>Maireana melanocoma</i>, <i>Portulaca oleracea</i>, <i>Ptilotus exaltatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Senna artemisioides</i> subsp. <i>helmsii</i>, <i>S. stricta</i>, <i>Solanum cleistogamum</i>, <i>S. lasiophyllum</i>, <i>Tribulus suberosus</i>, <i>Trigastrotheca molluginea</i>, <i>Triodia epactia</i></p>	GP22, GP34, GP36, MNBE18	Good – Excellent	68.7 (0.6%)	 <p>Plate 10: Vegetation unit P2 – AanAteSspp.</p>
<p>P4 – AanAxAteERcTa <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i>, <i>Eremophila cuneifolia</i> shrubland over <i>Triodia angusta</i> hummock grassland</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>A. synchronica</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Goodenia forrestii</i>, <i>Lawrencia densiflora</i>, <i>Lepidium pedicellsum</i>, <i>Maireana georgei</i>, <i>Paspalidium clementii</i>, <i>Ptilotus clementii</i>, <i>P. obovatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>x luerssenii</i>, <i>Sida echinocarpa</i>, <i>Solanum horridum</i>, <i>S. lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i>, <i>Trigastrotheca molluginea</i></p>	GP24, GP32, GP37, MNBE16	Good – Excellent	27.7 (0.2%)	 <p>Plate 11: Vegetation unit P4 – AanAxAteERcTa.</p>



Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>P8 – AxSsTdFhMg <i>Acacia xiphophylla</i> tall open shrubland over <i>Senna stricta</i> open shrubland over <i>Tecticornia disarticulata</i>, <i>Frankenia</i> aff. <i>hispidula</i>, <i>Maireana georgei</i> low open shrubland</p> <p>Associated species: <i>Acacia synchronicia</i>, <i>A. tetragonophylla</i>, <i>Cynodon prostratus</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caeruleus</i>, <i>Eremophila cuneifolia</i>, <i>Eriachne pulchella</i>, <i>Grevillea berryana</i>, <i>Maireana eriosphaera</i>, <i>M. melanocoma</i>, <i>Paspalidium clementii</i>, <i>Polycarpaea longiflora</i>, <i>Portulaca oleracea</i>, <i>Ptilotus exaltatus</i>, <i>P. obovatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Salsola australis</i>, <i>Scaevola acacioides</i>, <i>S. spinescens</i>, <i>Sclerolaena eriacantha</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>x luerssenii</i>, <i>Trianthema glossostigmum</i>, <i>Tribulus suberosus</i></p>	GP21, GP26, GP39	Good – Excellent	48.1 (0.4%)	 <p>Plate 12: Vegetation unit P8 – AxSsTdFhMg.</p>

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Vegetation of Drainage Lines				
<p>D1 – AanAwTe <i>Acacia aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Associated species: <i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618) , <i>Acacia aptaneura</i>, <i>A. tetragonophylla</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>*Cenchrus ciliaris</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Eremophila cuneifolia</i>, <i>E. jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne mucronata</i>, <i>Hibiscus campanulatus</i> P1, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Maireana georgei</i>, <i>Paspalidium clementii</i>, <i>Ptilotus obovatus</i>, <i>Santalum lanceolatum</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>Solanum lasiophyllum</i>, <i>Tribulus suberosus</i></p>	GP15, GP33, GPR44	Degraded – Excellent	63.3 (0.6%)	 <p>Plate 13: Vegetation unit D1 – AanAwTe.</p>

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>D3 – AciAanAwTe <i>Acacia citrinoviridis</i>, <i>A. aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Associated species: <i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618), <i>Acacia pyrifolia</i>, <i>A. tetragonophylla</i>, *<i>Aerva javanica</i>, <i>Corchorus crozophorifolius</i>, <i>Cucumis variabilis</i>, <i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>, <i>Duperreya commixta</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Hybanthus aurantiacus</i>, <i>Indigofera monophylla</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>Rhynchosia minima</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90), <i>Sporobolus australasicus</i>, <i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606), <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i></p>	GP03, GP38, GP41	Degraded – Excellent	432.9 (3.9%)	 <p>Plate 14: Vegetation unit D3 – AciAanAwTe.</p>
<p>D6 – CfAciAanTe <i>Corymbia ferriticola</i> scattered low trees over <i>Acacia citrinoviridis</i>, <i>A. aneura</i> sens. lat. tall shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Associated species: <i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618), <i>Acacia pruinocarpa</i>, <i>A. pyrifolia</i>, <i>A. tetragonophylla</i>, *<i>Cenchrus ciliaris</i>, <i>Cleome viscosa</i>, <i>Corchorus crozophorifolius</i>, <i>Cymbopogon ambiguus</i>, <i>Dodonaea pachyneura</i>, <i>Duperreya commixta</i>, <i>Eremophila fraseri</i> subsp. <i>fraseri</i>, <i>E. latrobei</i> subsp. <i>glabra</i>, <i>Eriachne mucronata</i>, <i>Gomphrena cunninghamii</i>, <i>Hibiscus campanulatus</i> P1, <i>Indigofera monophylla</i>, <i>Pluchea dentex</i>, <i>Ptilotus obovatus</i>, *<i>Rumex vesicarius</i></p>	GP05, GP29, GPR19, GPR25, MNBE15, MNLV02	Poor – Excellent	28.4 (0.3%)	 <p>Plate 15: Vegetation unit D6 – CfAciAanTe.</p>

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>D7 – EcEvAamMgCYPv <i>Eucalyptus camaldulensis</i>, <i>E. victrix</i> open forest over <i>Acacia ampliceps</i>, <i>Melaleuca glomerata</i> tall shrubland over <i>Cyperus vaginatus</i> open sedgeland</p> <p>Associated species: <i>Acacia citrinoviridis</i>, <i>A. coriacea</i> subsp. <i>pendens</i>, <i>Ammannia baccifera</i>, <i>*Cenchrus ciliaris</i>, <i>*C. setiger</i>, <i>Cucumis variabilis</i>, <i>Eragrostis tenellula</i>, <i>Euphorbia biconvexa</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>*Malvastrum americanum</i>, <i>Melaleuca linophylla</i>, <i>Petalostylis labicheoides</i>, <i>Phyllanthus maderaspatensis</i>, <i>Pluchea rubelliflora</i>, <i>Rhynchosia minima</i>, <i>*Sonchus oleraceus</i>, <i>Stemodia grossa</i>, <i>Typha domingensis</i></p>	e038-AR, e074-AR, GP27, WRF01	Degraded – Good	78.2 (0.7%)	 <p>Plate 16: Vegetation unit D7 – EcEvAamMgCYPv.</p>
<p>D8 – EvAcMgCEspp <i>Eucalyptus victrix</i> woodland over <i>Acacia coriacea</i> subsp. <i>pendens</i>, <i>Melaleuca glomerata</i> tall shrubland over <i>*Cenchrus</i> spp. open tussock grassland</p> <p>Associated species: <i>Acacia citrinoviridis</i>, <i>A. pyrifolia</i>, <i>*Aerva javanica</i>, <i>*Cenchrus ciliaris</i>, <i>*C. setiger</i>, <i>Cleome viscosa</i>, <i>Corchorus crozophorifolius</i>, <i>Cucumis variabilis</i>, <i>Cyperus vaginatus</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Petalostylis labicheoides</i>, <i>Pluchea rubelliflora</i>, <i>Stemodia grossa</i>, <i>Tephrosia rosea</i> var. <i>Fortescue</i> creeks (M.I.H. Brooker 2186)</p>	GP13, WRA01-AR, WRA21-AR, WRF44	Degraded – Poor	215.1 (1.9%)	 <p>Plate 17: Vegetation unit D8 – EvAcMgCEspp.</p>

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>D9 – AciAanCEspp <i>Acacia citrinoviridis</i>, <i>A. aneura</i> sens. lat. tall shrubland over *<i>Cenchrus</i> species tussock grassland</p> <p>Associated species: <i>Acacia synchronicia</i>, <i>A. tetragonophylla</i>, *<i>Aerva javanica</i>, *<i>Cenchrus ciliaris</i>, <i>Corchorus crozophorifolius</i>, <i>Cucumis variabilis</i>, <i>Duperreya commixta</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Eremophila cuneifolia</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>Sporobolus australasicus</i></p>	e006-AR, e043-AR, GP23, WRA44-AR, MNBE19, MNLV01	Degraded – Poor	157.3 (1.4%)	 <p>Plate 18: Vegetation unit D9 – AciAanCEspp.</p>
<p>D10 – AanAxTe <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall shrubland over mixed open shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Associated species: <i>Acacia synchronicia</i>, <i>A. tetragonophylla</i>, <i>A. wanyu</i>, *<i>Cenchrus ciliaris</i>, *<i>C. setiger</i>, <i>Cynodon prostratus</i>, <i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>, <i>Duperreya commixta</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila cuneifolia</i>, <i>E. forrestii</i> subsp. <i>forrestii</i>, <i>Frankenia</i> aff. <i>hispidula</i>, <i>Lepidium pedicellsum</i>, <i>L. platypetalum</i>, <i>Maireana georgei</i>, <i>M. thesioides</i>, <i>M. tomentosa</i> subsp. <i>tomentosa</i>, <i>Pterocaulon sphacelatum</i>, <i>Ptilotus obovatus</i>, <i>Scaevola spinescens</i>, <i>Sclerolaena eriacantha</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>x luerssenii</i>, <i>S. stricta</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i></p>	e073-AR, GP43, WRA23-AR	Degraded – Excellent	136.1 (1.2%)	 <p>Plate 19: Vegetation unit D10 – AanAxTe.</p>

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
<p>D13 – AciTerTe <i>Acacia citrinoviridis</i> tall shrubland over <i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186) low open shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Associated species: <i>Acacia pyrifolia</i>, <i>A. tetragonophylla</i>, <i>Corchorus crozophorifolius</i>, <i>Cucumis variabilis</i>, <i>Dodonaea pachyneura</i>, <i>Duperreya commixta</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caeruleus</i>, <i>Glycine canescens</i>, <i>Gomphrena cunninghamii</i>, <i>Goodenia microptera</i>, <i>Hibiscus campanulatus</i> P1, <i>Hybanthus aurantiacus</i>, <i>Indigofera monophylla</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Petalostylis labicheoides</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>Rhagodia eremaea</i>, <i>Solanum lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i>, <i>Trigastrotheca molluginea</i></p>	GP08, GP11, GP18, MNBE07	Good – Very Good	24.6 (0.2%)	 <p>Plate 20: Vegetation unit D13 – AciTerTe.</p>
<p>D14 – AciAscCEspp <i>Acacia citrinoviridis</i>, <i>A. sclerosperma</i> subsp. <i>sclerosperma</i> tall open shrubland over <i>*Cenchrus</i> spp. open tussock grassland</p> <p>Associated species: <i>*Cenchrus ciliaris</i>, <i>*C. setiger</i>, <i>Ptilotus obovatus</i></p>	GP35	Degraded	30.2 (0.3%)	 <p>Plate 21: Vegetation unit D14 – AciAscCEspp.</p>

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Cleared	N/A	Completely degraded	3,429.5 (30.6%)	N/A

4.2.1.1 Vegetation of Local Significance

Five vegetation units described and mapped within the survey area are considered to be of local conservation significance: H3, P8, D6, D7 and D8.

The H3 vegetation unit occurred on the steep south-facing slopes in the west of the survey area. Biota (2012a) noted that *Aluta quadrata* T was generally found in association with this vegetation unit, however the single population of *A. quadrata* T within the survey area was found in different vegetation. Despite this, the H3 vegetation unit has conservation significance at a local scale due to its association with threatened flora.

The P8 vegetation unit occurred in the valleys and lower slopes north of the Eastern Range operations in the survey area. While this vegetation unit did not support conservation significant flora or have affinity with any described TECs or PECs, the presence of *Acacia xiphophylla* (snakewood) on slopes and the understorey assemblage of low shrubs dominated by *Frankenia* spp. and chenopods, in particular *Tecticornia disarticulata*, was considered unusual. The P8 vegetation unit occurs across a relatively small range within the survey area and upon review of previous work was not observed outside of this range. As such the P8 vegetation unit is considered to have some conservation significance at a local scale.

The D6 vegetation unit occurred on the deeper incised gorges in the Eastern Range and Doggers Gorge sections of the survey area. This habitat supports a number of conservation significant flora taxa including *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1, *Hibiscus campanulatus* P1, *Grevillea saxicola* P3, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3 and *Solanum* sp. (indet.). Due to the restricted nature of the habitat and the association with conservation significant flora the D6 vegetation unit has conservation significance at a local scale. The D3 vegetation unit supports a similar suite of conservation significant flora in some instances, but is more widely distributed and generally characterised by minor drainage lines, as such the D3 vegetation unit is not considered to have conservation significance at a local scale.

The D7 vegetation unit occurred on major drainage lines that supported the potential GDE species *Eucalyptus camaldulensis*, *E. victrix* and *Sesbania formosa* and is therefore considered to have some conservation significance at a local scale. To a lesser extent the D8 vegetation unit also supported the potential GDE species *E. victrix* and may have some conservation significance at a local scale.

The remaining vegetation associations recorded in the survey area represent what may be expected on similar landforms in the broader Hamersley and Gascoyne subregions and are not considered locally restricted (Kendrick 2001b, 2001a; Beard 1975). No vegetation assemblages were considered analogous with a listed TEC or PEC.

4.2.1.2 Ecosystems at Risk

As part of the biodiversity audit of each IBRA bioregion carried out by the then Department of Conservation and Land Management, a number of ecological communities were identified as 'ecosystems at risk' (McKenzie, May, and McKenna 2002). This audit was conducted prior to the formal PEC listing process and many of the ecological communities highlighted were subsequently raised to PEC status. There were a number of ecological communities not raised to PEC status that were identified through this audit, two of which have relevance to the survey area (Kendrick 2001b):

- Lower-slope mulga – this community was represented by the vegetation unit H1 within the survey area. A total of 1,871.2 ha of H1 were mapped and the vegetation condition ranged from 'Degraded' to 'Excellent' and was often affected by the presence of weeds.

- Major ephemeral watercourses – this community was represented by the vegetation unit D7 and to a lesser extent D8 within the survey area. A combined total of 293.3 ha of D7 and D8 were mapped and the vegetation condition ranged from ‘Degraded’ to ‘Good’ and was affected by the presence of weeds and grazing.

4.2.1.3 Groundwater Dependent Ecosystems

Of the 21 vegetation units present within the survey area, one (D7) is considered as a potential groundwater dependent ecosystem (GDE) due to the presence of an assemblage of vegetation that is likely to be dependent on groundwater. Each of the three major creek systems, Pirraburdoo Creek, Seven Mile Creek and Stoney Creek, as well as Doggers Gorge support areas of pools of an unknown permanency and riparian vegetation that relies on this water source for ecological processes. At the time of survey each of the three creek systems and Doggers Gorge had some areas of pooling.

4.2.1.4 Vegetation Condition

Vegetation in the survey area ranged from ‘Excellent’ to ‘Completely Degraded’ (Trudgen 1988) condition (Table 11) (Figure J.1, Appendix J). Vegetation of the drainage lines and associated plains was generally of low quality due to the presence of introduced flora (in particular *Cenchrus* spp.) and grazing pressure from cattle. Vegetation of the hills and slopes were of better quality but still showed the influence of historic clearance and introduced flora species. Generally the areas nearer to the operating mining areas were also affected by dust.

An extensive network of drill lines, drill pads and tracks exists throughout the survey area. Mining infrastructure occurs in the central parts of the survey area. Together this cleared vegetation accounts for 3,429.5 ha (30.6%) in the survey area. A number of colonising species were observed regenerating on some of these tracks, but most remained cleared of vegetation.

Table 11: Vegetation condition recorded for the survey area.

Vegetation condition	Total mapped area within the survey area (ha)	Proportion of survey area (%)
Excellent	1,843.0	16.5
Very Good	2,761.0	24.6
Good	2,008.1	17.9
Poor	706.9	6.3
Degraded	454.9	4.1
Completely Degraded	3,429.5	30.6

4.2.1.5 Floristic Groups – Current Survey

Based on classification analysis, there were 23 significant floristic groups identified within the survey area. Of the 58 sites assessed from the survey area, six were represented by a single survey site Table 12.

Table 12: Floristic groups identified by one site in the survey area and corresponding vegetation unit.

Quadrat/ relevé	Quadrat/relevé description	Structural vegetation association
GP11	<i>Acacia citrinoviridis</i> , (<i>Grevillea berryana</i>) tall open scrub over <i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186) open shrubland over <i>Corchorus crozophorifolius</i> , <i>Ptilotus obovatus</i> low open shrubland	D13
GP23	<i>Acacia citrinoviridis</i> tall shrubland over <i>Corchorus crozophorifolius</i> scattered low shrubs over <i>*Cenchrus ciliaris</i> , (<i>*Cenchrus setiger</i>) tussock grassland	D9
GPR25	<i>Corymbia ferriticola</i> scattered low trees over <i>Acacia citrinoviridis</i> tall shrubland over <i>Eriachne mucronata</i> , <i>*Cenchrus ciliaris</i> , <i>Cymbopogon ambiguus</i> very open tussock grassland	D6
GP34	<i>Acacia tetragonophylla</i> tall shrubland over <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i> scattered shrubs over <i>Aristida contorta</i> , <i>Eriachne pulchella</i> subsp. <i>dominii</i> very open tussock grassland with <i>Trigastrotheca molluginea</i> , <i>Goodenia microptera</i> scattered herbs	P2
GP45	<i>Acacia pruinocarpa</i> tall open shrubland over <i>Triodia epactia</i> hummock grassland	H2
WRA21-AR	<i>Eucalyptus victrix</i> open woodland over <i>Acacia citrinoviridis</i> , (<i>Melaleuca glomerata</i> , <i>A. coriacea</i> subsp. <i>pendens</i>) tall open scrub over <i>*Cenchrus ciliaris</i> , (<i>*C. setiger</i>) open tussock grassland	D8

Site GP11 occurred in vegetation unit D13 associated with drainage lines south of the Eastern Range area. Drainage units may not cluster together when assessed using multivariate analysis; this can be partially attributed to flora species from the surrounding vegetation being present that may not be representative of the drainage vegetation, as such the species composition at this site is not considered unique. This site presented next to other D13 sites in the dendrogram shown in Figure K.2 (Appendix K).

Site GP23 occurred in the drainage lines vegetation unit D9, which is a highly disturbed unit dominated by **Cenchrus* spp. The vegetation structure and species diversity of this unit was modified by the presence of **Cenchrus* spp. at high densities which is likely to have affected the diversity of other species that occurred. This site presented next to other D9 sites in the dendrogram shown in Figure K.2 (Appendix K).

Site GPR25 occurred in vegetation unit D6 associated with drainage lines in a gorge in the Eastern Range area. This site occurred in a deep gorge adjacent to cleared areas for mining and was affected by the presence of dust and weeds. Drainage units may not cluster together using multivariate analysis; this can be partially attributed to flora species from the surrounding vegetation being present that may not be representative of the drainage vegetation, as such the species composition at this site is not considered unique. This site presented next to other D6 sites in the dendrogram shown in Figure K.2 (Appendix K).

Site GP34 occurred in the stony plains vegetation unit P2 south of the tailings storage facility. The occurrence of vegetation unit P2 in this area was influenced by the nearby drainage line and this may explain why species composition was considered unique. This site does present near other P2 sites in the dendrogram shown in Figure K.2 (Appendix K).

Site GP45 occurred in the hills and ridges vegetation unit H2 in the west of the survey area. The occurrence of vegetation unit H2 in this area was previously mapped by Biota (2012a) and is a narrow polygon. It is possible that the species assemblage at this site was influenced by the

surrounding vegetation, however this site does present near another H2 site in the dendrogram shown in Figure K.2 (Appendix K).

Site WRA21-AR occurred in the drainage lines vegetation unit D8 in the west of the survey area. As with site GP11, drainage units may not cluster together using multivariate analysis, although this site does fall next to other D8 sites in the dendrogram shown in Figure K.2 (Appendix K).

4.2.1.6 Floristic Groups – Broader Regional Context

Multivariate floristic analysis of 469 regional sites using presence/absence of perennial native taxa identified 109 significant clusters (Figure K.3 to Figure K.9, Appendix K). Sites from the current survey were present in 44 of these significant clusters, with 26 consisting exclusively of sites from the current survey. The inclusion of both Phase 1 and Phase 2 as separate sites contributed to the formation of these significant clusters. Sites from the same projects tended to cluster together, in particular GHD (2009), Mattiske (2011) and Rio Tinto (2014). Sites from similar habitats and vegetation within the survey area also tended to cluster together.

4.2.2 Flora

There were 300 confirmed vascular flora taxa, from 50 families and 132 genera, recorded during the current survey. The dominant native plant families were Fabaceae, Poaceae and Malvaceae, with 50, 33 and 32 confirmed taxa represented respectively. *Acacia* and *Eremophila* were the most frequently recorded genera (Table 13). Nineteen taxa; *Abutilon* sp., *Boerhavia* sp., *Cheilanthes* sp., *Clerodendrum* sp., *Dysphania* sp., *Eremophila* sp., *Eucalyptus* sp., *Euphorbia biconvexa*?, *Euphorbia* sp., *Euphorbia boophthona*?, *Goodenia* sp., *Maireana* sp., *Pterocaulon* sp., *Sclerolaena* sp., *Sida* ?sp. L (A.M. Ashby 4202), *Sida* sp., *Solanum* sp. (indet), *Streptoglossa* sp. and *Tephrosia* sp., were unable to be identified to species level due to insufficient diagnostic material and may represent additional taxa for the survey area. Based on the diagnostic material available, one species was considered likely to be conservation significant taxa; *Solanum* sp. (indet) and is discussed in section 4.2.2.1. None of the other 18 species were considered likely to be conservation significant taxa. A species list from the current survey and a matrix indicating species recorded within each quadrat or relevé is presented in Appendix L.

The species accumulation curve indicates that 72% and 91% of the potential total species pool available at the time of the surveys was recorded, including opportunistic observations. The species accumulation curve indicates that the total number of species has reached an asymptote, and that sampling has been near-exhaustive (Appendix K).

A total of 352 confirmed vascular flora taxa were recorded from sites within the survey area in the three previous major surveys (Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011). When combined with the confirmed taxa from the current survey (Phase 1 and Phase 2), a total of 470 vascular flora taxa have been recorded within the survey area. A list of taxa recorded during the current survey is presented in Table L.1, Appendix L. A compiled list of taxa recorded during the three previous major surveys (Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011) and each phase of the current survey is presented in Table L.2, Appendix L. A species by site matrix for taxa recorded in sites established during the current survey is presented in Table L.3, Appendix L. A species by site matrix for taxa recorded within the survey during the three previous major surveys (Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011) and the rescores performed during the current survey is presented in Table L.4, Appendix L.

Table 13: Taxa most frequently recorded in the survey area.

Family	Number of taxa
Fabaceae	50
Poaceae	33
Malvaceae	32
Chenopodiaceae	21
Scrophulariaceae	18
Amaranthaceae	16
Genus	Number of taxa
<i>Acacia</i>	23
<i>Eremophila</i>	18
<i>Maireana</i>	9
<i>Ptilotus</i>	9
<i>Sida</i>	9
<i>Hibiscus</i>	9

4.2.2.1 Conservation Significant Flora

Systematic searches were conducted in 18 targeted search polygons for the State listed threatened flora species, *Aluta quadrata* T, with no new occurrences being located in the survey area. Additional systematic searches were focused on visiting areas known or considered likely to support conservation significant flora, with preference given to searching areas supporting P1 or P2 taxa. The combined (Phase 1 and 2) field program identified seven confirmed taxa of conservation significance and one unconfirmed (*Solanum* sp. (indet.)) taxon of conservation significance (Table 14). Conservation significant flora locations from this survey are mapped in Figure N.1 to Figure N.6, Appendix N and regional distributions of all records sourced from the Rio Tinto database are shown in Figure O.1 to Figure O.8, Appendix O. Habitat and abundance details for these taxa are summarised below and in Table 15. Survey effort, as shown by track log traverses within the survey area, is presented in Figure M.1 to Figure M.2, Appendix M.

Table 14: Conservation significant flora recorded in the survey area during the current survey.

Conservation significant taxa	Phase 1	Phase 2
<i>Aluta quadrata</i> T	✓	
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1	✓	✓
<i>Hibiscus campanulatus</i> P1	✓	✓
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3	✓	✓
<i>Grevillea saxicola</i> P3	✓	✓
<i>Nicotiana umbratica</i> P3	✓	
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	✓	✓
<i>Solanum</i> sp. (indet.)		✓

Aluta quadrata T was recorded from one previously known population on canga outcropping on the northern margin of Pirraburdoo Creek; individuals within this population were counted and their

locations recorded using a handheld GPS. No further populations of *A. quadrata* were encountered during the current survey.

Eremophila sp. Hamersley Range (K. Walker KW 136) P1 was recorded from two populations and known from a further three single points from a previous survey (Rio Tinto 2014). Two of these previous survey points were visited and no individuals were found, these have been removed from Figure N.1 and Table N.2 (Appendix N). One of the populations was systematically searched with a total of 2,568 individuals recorded. The second population was not re-visited due to time and access constraints.

Hibiscus campanulatus P1 occurs throughout the survey area, in particular around the Eastern Range area and was generally associated with the drainage features, gorges and south facing slopes. Systematic searches were not conducted for this species and the population numbers presented in Table 15 are not a comprehensive assessment of the numbers occurring in the survey area, which would likely support many thousands more individuals than recorded to date. Individuals were marked opportunistically during the current survey.

Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3 was recorded from three populations during the current survey and known from a further five populations from previous surveys. It appeared to be highly habitat restricted and occurred in association with calcrete soils and low calcrete hills within the survey area. None of the known populations have been systematically searched due to seasonal conditions and time constraints (all individuals encountered were senescing at the time of survey) and as such the abundance presented in Table 15 is an underestimation. A number of potential habitat targets around the northern floodplains of the Pirraburdoo Creek and the plains north of the Western Range area were searched. It may occur elsewhere within the survey area on calcrete soils not targeted during the current survey.

Grevillea saxicola P3 was recorded from four populations from the current survey and known from a further 11 populations from previous surveys. It was generally associated with the lower slopes and associated drainage features of ironstone hills, particularly in the valleys to the north of Eastern Range around Mount Misery. None of the known populations have been systematically searched and as such the abundance presented in Table 15 is an underestimation. It may occur elsewhere within the survey area in suitable habitat not targeted during the current survey.

Nicotiana umbratica P3 was recorded from one opportunistic collection during the Phase 1 survey within the eastern survey area and three occurrences from previous surveys. It was located at the base of a rocky slope in a shady ironstone gorge near Doggers Gorge. It was not systematically searched for during the Phase 1 survey or revisited during Phase 2, due to timing constraints, and as such the abundance presented in Table 15 is an underestimation. It may occur elsewhere within the survey area in suitable habitat not targeted during the survey.

Sida sp. Barlee Range (S. van Leeuwen 1642) P3 was recorded from four populations during the current survey and known from a further 19 populations from previous surveys. It was generally associated with the steep slopes and rocky outcrops of gorges and drainage features of ironstone hills. None of the known populations have been systematically searched and as such the abundance presented in Table 15 is an underestimation. It may occur elsewhere within the survey area in suitable habitat not targeted during the current survey.

Solanum octonum P2 was recorded previously in and around Doggers Gorge (Eco Logical Australia 2016; Rio Tinto 2014), but had not been encountered during the Phase 1 survey. The Doggers Gorge population was revisited during Phase 2 and four sterile specimens were collected for confirmation. These were submitted to Steve Dillon, Rio Tinto sponsored taxonomist at the WA Herbarium. It was found that the material collected in the field could not be matched to *S. octonum* and did not match

any described *Solanum*. The submitted specimens did match a single sheet from a collection made approximately 2 km north and named *Solanum* sp. (indet.). This single sheet was accompanied by a note stating 'belongs to *S. sturtianum* subgroup, but does not match any species named'. The note was written by Tony Bean, the *Solanum* taxonomist who had separated the *S. sturtianum* group (to which *S. octonum* belongs) and published the work in 2013 (Bean 2013).

It is considered likely that any previously recorded locations of *S. octonum* within the survey area will match the undescribed *Solanum* sp. (indet.), but collections with flowering and fruiting material are required to be certain. It is also likely that if it is a new taxon, it will be of conservation significance, given the lack of vouchered material and the fact that five of the eight new species described in 2013 (Bean 2013) have priority status (Steve Dillon, 5th June 2018, pers. comm.). In the interim, all previous records of *S. octonum* from the survey area have been presented as *Solanum* sp. (indet.) (Table 15).

Ptilotus trichocephalus P4 was previously recorded from a number of locations on the stony plains in the south of the survey area (Biota Environmental Sciences 2012a; Ecologia Environment 2011; Hamersley Iron Pty Ltd 2005b). Previously recorded locations were visited during both phases of survey to determine whether this ephemeral taxon could be observed during the seasonal conditions, however no individuals were found. It is possible that additional populations occur within the survey area and would be more likely to be encountered during favourable seasonal conditions.

Table 15: Conservation significant flora recorded in the survey area.

Species	Current survey recorded abundance	Total abundance in survey area ¹	Regional abundance ²	Habitat	Vegetation unit/s
<i>Aluta quadrata</i> T	1,017	1,017	42,612	Edge of creek beds, base of cliffs, rocky crevices, near crest of ridge.	D9, H1
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1	2,656	2,658	6,961	High in the landscape, cliff tops, gorge tops, steep rocky slopes, skeletal red-brown soils.	D3, D6, H1, H12
<i>Hibiscus campanulatus</i> P1	4,638	8,957	13,952	Hill slopes, base of slopes, rocky gully areas, often on Canga detritals.	D1, D3, D6, D7, D8, D9, D10, D13, H1 H2, H4, H12, P1, P8
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3	2,422	2,433	73,395	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains, stony plains, hill slopes.	D1, D3, D9, H4, P1, P8
<i>Grevillea saxicola</i> P3	226	548	2,089	Low rocky hill, red-brown sandy loam with ironstone pebble cover, steep scree slopes.	D3, D6, D10, D11, D12, D13, H1, H2, H4, H5, P2, P8
<i>Nicotiana umbratica</i> P3	5	9	145	Shallow soils. Rocky outcrops.	D8, H12
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	142	534	11,865	Skeletal red soils pockets. Steep slope.	D3, D6, D8, H1, H12
<i>Ptilotus trichocephalus</i> P4 ³	0	671	4,535	Sandy soils, colluvial plains.	P1
<i>Solanum</i> sp. (indet.) ⁴	72	123	123	Rocky gullies, gorges.	D6, D8, H12

¹ – Includes all previous points that occur within the survey area (Table N.2, Appendix N).

² – Includes all records from Rio Tinto database.

³ – Species not observed in current survey (Phase 1 or 2), but previously recorded within survey area (Table N.2, Appendix N).

⁴ – Includes previous records of *Solanum octonum* P2 that are now considered as *Solanum* sp. (indet.).

4.2.2.2 Post-survey Likelihood of Occurrence of Conservation Significant Flora

With a greater understanding of the landforms, soils and habitats of the survey area, the list of conservation significant flora identified during the desktop exercise as having the potential to occur was reviewed for likelihood of occurrence (Table F.1, Appendix F). This review identified six priority flora taxa that have been recorded within 20 km of the survey area and are still considered to have potential to occur within the survey area; *Sida* sp. Hamersley Range (K. Newbey 10692) P1, *Hibiscus*

sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2, *Eremophila coacta* P3, *Pilbara trudgenii* P3, *Eremophila magnifica* subsp. *magnifica* P4 and *Ptilotus mollis* P4 (Appendix F).

There were three taxa recorded from previous projects that were reported at the time as being potentially new taxon; *Eriachne* sp. Western Range (2012b), *Corchorus* sp. aff. *sidoides* (2014) and *Abutilon* sp. which was considered to possibly be a new subspecies of *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) P1 (2016). No taxa matching the descriptions for either of these three were encountered as part of the current survey.

4.2.2.3 Range Extensions

Four native taxa recorded within the survey area were considered as range extensions of greater than 50 km from their currently known distributions (*Hibiscus sturtii* var. *platyklamys*, *Plumbago zeylanica*, *Sida* sp. Golden calyces glabrous (H.N. Foote 32) and *Sida* sp. L (A.M. Ashby 4202). A further two taxa were not able to be confirmed to species level, but would also be considered range extensions; *Frankenia* aff. *hispidula* and *F.* aff. *magnifica* (Table 16). Specimens of each of these taxa have been confirmed by the Rio Tinto sponsored taxonomist (Steve Dillon) at the WA Herbarium. The *Frankenia* genus has been undergoing taxonomic revision at the WA Herbarium and it is possible that *F.* aff. *magnifica* will be raised to a phrase name as part of this work. It is unknown whether the leaf characters which led to the name of *F.* aff. *hispidula* being applied will be sufficient to warrant a phrase name. At this stage it is unknown whether any conservation significance will be applied to either of these two taxa (S. Dillon, pers. comm., 18th December 2018). Four of these range extension taxa were also recorded in previous surveys and are presented in Table 16. One introduced (weed) species; **Ruellia simplex* is considered a range extension (Section 4.2.2.4). During the process of consolidating species data from previous work within the survey area, it was noted that numerous other species would also have been significant range extensions but were not presented in the previous reporting. As these records cannot be confirmed they are not presented within this report.

Table 16: Range extension taxa recorded during the survey.

Taxa	Surveys species previously recorded			
	Current survey	ecologia Environment (2011)	Biota Environmental Sciences (2012b)	Rio Tinto Iron Ore (2014)
<i>Frankenia</i> aff. <i>hispidula</i>	✓			
<i>Frankenia</i> aff. <i>magnifica</i>	✓	✓		
<i>Hibiscus sturtii</i> var. <i>platyklamys</i>	✓	✓		
<i>Plumbago zeylanica</i>	✓		✓	
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	✓			
<i>Sida</i> sp. L (A.M. Ashby 4202)	✓			✓
<i>*Ruellia simplex</i>	✓			

4.2.2.4 Introduced Flora (Weeds)

Weed diversity in the survey area is considered high with 22 weed taxa recorded in the current survey. A total of 28 weed taxa have been recorded from all current and previous surveys within the survey area. None of the weed species recorded are listed as a WoNS (Australian Weeds Committee 2012b), or listed as declared pest plants in Western Australian under the BAM Act (Department of Primary Industries and Regional Development 2018). Habitat and abundance details for each weed taxa are summarised in Table 17.

The occurrence of **Ruellia simplex* (Mexican petunia) is the first record within Western Australia and as a result it is listed as “Unlisted – s14” under the BAM Act (Department of Primary Industries and Regional Development 2018). It is a weed of waterways and riparian vegetation and is becoming widely naturalised in the warmer parts of eastern Australia (Weeds of Australia Biosecurity Queensland Edition 2016). It was recorded from a sterile collection in Seven Mile Creek during the Phase 1 survey and was revisited during the Phase 2 survey to collect diagnostic material. Waypoints were collected for 38 individuals; however, this was not an exhaustive count of the population which may extend further along this creek in either direction.

Photographs and descriptions of weeds within the survey area are presented in Table P.1 (Appendix P). Indicative weed locations are mapped in Figure P.1, Appendix P and presented in Table P.2, Appendix P. However, locations are indicative only and weed distribution is much higher than presented, especially in the disturbed and cleared areas. An increase in weed species distribution would also be likely in a survey following summer rainfall.

Table 17: Introduced flora species (weeds) recorded in the survey area.

Species	Family	Current survey recorded abundance	Total abundance in surveys area ¹	Habitat
<i>*Aerva javanica</i> (kapok bush)	Amaranthaceae	749	9,429	Disturbed, major and minor drainage, plains and hills
<i>*Argemone ochroleuca</i> subsp. <i>ochroleuca</i> (Mexican poppy)	Papaveraceae	19	20,495	Disturbed major drainage
<i>*Bidens bipinnata</i> (bipinnate beggartick)	Asteraceae	182	188	Major and minor drainage
<i>*Cenchrus ciliaris</i> (buffel grass)	Poaceae	7,309	36,360	Disturbed, plains, major and minor drainage, base of low hills
<i>*Cenchrus setiger</i> (birdwood grass)	Poaceae	5,155	7,576	Disturbed, major and minor drainage, plains
<i>*Chloris barbata</i> (purpletop chloris)	Poaceae	6	364	Major drainage
<i>*Citrullus colocynthis</i> ²	Cucurbitaceae	0	22	Major drainage
<i>*Citrullus amarus</i>	Cucurbitaceae	1	4	Major drainage
<i>*Cynodon dactylon</i> (couch grass)	Poaceae	20	159	Major drainage
<i>*Echinochloa colona</i> (awnless barnyard grass)	Poaceae	5	7	Major drainage
<i>*Euphorbia hirta</i> (asthma plant)	Euphorbiaceae	102	102	Major drainage
<i>*Flaveria trinervia</i> (speedy weed)	Asteraceae	19	38	Disturbed, major and minor drainage
<i>*Lactuca serriola</i> (prickly lettuce) ²	Asteraceae	0	27	Disturbed, major and minor drainage

Species	Family	Current survey recorded abundance	Total abundance in surveys area ¹	Habitat
* <i>Malvastrum americanum</i> (spiked malvastrum)	Malvaceae	77	266	Disturbed, major and minor drainage
* <i>Melochia pyramidata</i> ²	Malvaceae	0	1	Major and minor drainage
* <i>Passiflora foetida</i> subsp. <i>hispida</i> (stinking passion flower)	Passifloraceae	300	310	Major and minor drainage
* <i>Phoenix dactylifera</i> (date palm)	Arecaceae	3	3	Major drainage
* <i>Ricinus communis</i> (castor oil plant) ²	Euphorbiaceae	0	3	Disturbed areas
* <i>Ruellia simplex</i> (Mexican petunia)	Acanthaceae	39	39	Major drainage
* <i>Rumex vesicarius</i> (ruby dock)	Apocynaceae	27	3,442	Disturbed, major and minor drainage, hilltops and slopes.
* <i>Setaria verticillata</i> (whorled pigeon grass)	Poaceae	124	128	Major and minor drainage
* <i>Sisymbrium orientale</i> (Indian hedge mustard)	Brassicaceae	1	4	Major and minor drainage
* <i>Solanum nigrum</i> (black berry nightshade)	Solanaceae	8	52	Major drainage
* <i>Sonchus oleraceus</i> (common sowthistle)	Asteraceae	27	389	Major and minor drainage
* <i>Trianthema portulacastrum</i> (giant pigweed) ²	Aizoaceae	0	10	Major and minor drainage, roadsides and disturbed areas
* <i>Tribulus terrestris</i> (caltrop) ²	Zygophyllaceae	0	13	Disturbed areas
* <i>Vachellia farnesiana</i> (mimosa bush)	Fabaceae	5	104	Major drainage
* <i>Washingtonia filifera</i>	Arecaceae	2	3	Major drainage

¹ - Includes all previous points that occur within the survey area (Table P.2, Appendix P), an assumption of one individual was made where no abundance data was collected.

² - Species not observed in current survey (Phase 1 or 2), but within survey area (Table P.2, Appendix P).

5 Discussion

5.1 Overview of the Survey Area

The survey area is characterised by the major ironstone ranges of the Western Range, Paraburdoo and Eastern Range with hills and slopes dominated by *Acacia*, *Eremophila* and *Triodia* species. These are incised by two major creek lines in the west of the survey area, Pirraburdoo Creek (including an area of permanent pooling water known as Ratty Springs) and Seven Mile Creek, as well as a major creek line named Stoney Creek in the east of the survey area and a series of gorges and minor ephemeral drainage lines which are generally highly impacted by weeds, in particular **Cenchrus ciliaris* (buffel grass) and **C. setiger* (birdwood grass). The adjacent detrital plains generally support snakewood (*Acacia xiphophylla*) and mulga (*A. aneura* sens. lat.) communities, with isolated calcrete low hills.

5.2 Vegetation

The vegetation recorded generally represents what would be expected from similar landforms in the broader Hamersley and Gascoyne subregion. Twenty-one vegetation units were mapped within the survey area and 23 statistically significant groups were identified from the floristic analysis. This indicates that the scale of mapping based on visual interpretation was conservative and appropriate for the floristic diversity of the survey area.

Of the 23 groups identified from the floristic analysis, six were formed by individual survey sites: GP11, GP23, GPR25, GP34, GP45 and WRA21. None of these sites is likely to represent unique or conservation significant vegetation in the survey area. The 23 groups identified showed some pattern of grouping according to the structural vegetation associations, including landforms.

One of the vegetation units (D7) was considered as a potential GDE due to the presence of pooled water and associated riparian vegetation. The obligate phreatophyte species *Melaleuca argentea* was not recorded within the D7 vegetation unit or within the survey area more broadly, however the facultative phreatophyte taxa *Eucalyptus camaldulensis* subsp. *refulgens*, *E. victrix* and *Sesbania formosa* were recorded consistently within the D7 vegetation unit.

The vegetation condition within the survey area has been influenced by a long history of disturbance from mining and pastoral land uses. Weed species diversity and densities are high in areas associated with drainage features, tracks and historically disturbed sites. Areas within the survey area are currently being used for running cattle, with evidence of grazing pressure being observed in vegetation associated with drainages and water sources. There was also evidence of recent fire (in the last two years) throughout large areas in the south-east of the survey area.

There were three vegetation units that did not achieve the minimum of three permanent sites established; H3, H5 and D14. Each of these vegetation units occurred in small areas which restricted the available habitat to establish the desired quadrat repetition.

The survey area lies within the Pre-European vegetation 82, 181, 567 and 163; all have an above 97% pre-European extent remaining, well above The Australian and New Zealand Environment and Conservation Council 30% retention target (Commonwealth of Australia 2001) and the criteria for 10% level of pre-clearing extent as representing 'endangered' adopted by the EPA (Environmental Protection Authority 2000).

5.3 Flora

The suite of flora species recorded was considered typical of what may be expected in the area (Beard 1975; Kendrick 2001b; Desmond, Kendrick, and Chant 2001) and aligns with what has been previously recorded in surrounding areas (Biota Environmental Sciences 2012b, 2012a; Ecologia Environment 2011; Rio Tinto 2010a, 2014, 2012; Eco Logical Australia 2016; Mattiske Consulting 1998, 2011; Pilbara Flora 2011). The high number of *Eremophila* taxa recorded highlights the proximity to the Ashburton IBRA region and the Gascoyne flora.

Despite rainfall conditions being below average preceding the Phase 1 and Phase 2 surveys, the floristic diversity was considered reasonably high, with an estimated 72% to 91% (difference is based on four models of comparison) of flora sampled, based on comparison of the total species pool. It is likely however, that many of the annuals and herbaceous species that were noted would have been more widespread throughout suitable habitats in better seasonal conditions. Specimens generally had adequate material to allow confident identification.

Aluta quadrata T was recorded from a previously known population on the northern margin of Pirraburdoo Creek on hill slopes of outcropping canga. This population represents the smallest of the three known populations of *A. quadrata* T and is approximately 8 km from the nearest locations to the west. There are 18 records of *A. quadrata* T listed with the WA Herbarium, with a range of approximately 43 km (Department of Biodiversity, Conservation, and Attractions 2018). No new populations of *A. quadrata* T were found during the current survey and given the survey effort expended during previous and current surveys, it is considered unlikely that any undiscovered populations occur within the survey area.

Eremophila sp. Hamersley Range (K. Walker KW 136) P1 was recorded from two populations during Phase 1 in association with rugged upper slopes and gorges in the Eastern Range area. During the Phase 2 survey, the western most of these two populations was systematically searched, however the eastern most population was not revisited due to time and access constraints. As such the numbers presented in Table 15 in Section 4.2.2.1 are likely to be an underrepresentation of the population extent within the survey area. There were three previous locations of single individuals recorded within the survey area (Rio Tinto 2014). Two of these locations were visited and no individuals were found, and the third occurred in an inaccessible area and was not visited. There are 15 records of *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1 listed with the WA Herbarium, with a range of approximately 385 km (Department of Biodiversity, Conservation, and Attractions 2018).

Hibiscus campanulatus P1 was recorded from a number of populations throughout the survey area but in greatest density around the Eastern Range area. It is likely be more widespread and in greater numbers than recorded as it was encountered in the majority of drainage lines surveyed. A conservative estimate would double the number of individuals recorded during previous and current surveys. There are 22 records of *H. campanulatus* P1 listed with the WA Herbarium, with a range of approximately 180 km (Department of Biodiversity, Conservation, and Attractions 2018). Despite this broad range of distribution, *H. campanulatus* P1 is known to be highly localised around the Paraburdoo and Channar areas.

Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3 was recorded from a number of populations throughout the survey area in association with calcrete habitats. None were systematically searched due to seasonal conditions and time constraints and it may occur elsewhere within the survey area on calcrete soils. There are 41 records of *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3 listed with the WA Herbarium, with a range of over 500 km (Department of Biodiversity, Conservation, and Attractions 2018).

Grevillea saxicola P3 was recorded from a number of populations throughout the survey area in association with the lower slopes and associated drainage features of ironstone hills, particularly in the valleys to the north of Eastern Range around Mount Misery. None of the known populations have been systematically searched and it may occur elsewhere within the survey area in suitable habitat. There are 37 records of *G. saxicola* P3 listed with the WA Herbarium, with a range of over 300 km (Department of Biodiversity, Conservation, and Attractions 2018).

Nicotiana umbratica P3 was recorded from one population during Phase 1 at the base of a rocky slope in a shady ironstone gorge near Doggers Gorge. There were three previous locations of single individuals recorded from previous surveys. None of these populations were systematically searched due to time constraints and as such, *N. umbratica* P3 is likely to be more widespread than recorded within the survey area. There are 27 records of *N. umbratica* P3 listed with the WA Herbarium, with a range of over 450 km (Department of Biodiversity, Conservation, and Attractions 2018).

Sida sp. Barlee Range (S. van Leeuwen 1642) P3 was recorded from a number of populations throughout the survey area in association with steep slopes, rocky outcrops, gorges and drainage features of ironstone hills. None of the known populations have been systematically searched and it may occur elsewhere within the survey area in suitable habitat. There are 47 records of *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3 listed with the WA Herbarium, with a range of approximately 400 km (Department of Biodiversity, Conservation, and Attractions 2018).

The previous records of *Solanum octonum* P2 within the survey area are considered likely to match the undescribed *Solanum* sp. (indet.), as presented in Section 4.2.2.1. This new taxon is considered likely to be of conservation significance and requires further collections of reproductive material to confirm and describe. From limited survey effort it appears likely to be restricted to the eastern section of the survey area, however more widespread systematic searches have not been conducted. The range and extent of this species outside of the survey area is not currently known.

Ptilotus trichocephalus P4 was previously recorded from a number of populations on the stony plains in the south of the survey area. No individuals were encountered during either phase of the current survey despite visits to known populations to assess the likelihood of encountering this ephemeral taxon in season. It may occur elsewhere within the survey area in suitable habitat and would be more likely to be encountered during favourable seasonal conditions. There are 18 records of *P. trichocephalus* P4 listed with the WA Herbarium, with a range of approximately 260 km (Department of Biodiversity, Conservation, and Attractions 2018).

There were six conservation significant taxa still considered to have the potential to occur within the survey area following the post-field review of likelihood of occurrence (Table F.1, Appendix F). The preferred habitat for each of the following six taxa was present within the survey area.

Sida sp. Hamersley Range (K. Newbey 10692) P1 is known from 2 km east south-east of the survey area. Recent fires had affected sections of the eastern part of the survey area and these areas were not thoroughly searched. There is greatest potential for this taxon to occur in this part of the survey area and due to the proximity of the known population it is considered to have the potential to still occur. There are 15 records of *Sida* sp. Hamersley Range (K. Newbey 10692) P1 listed with the WA Herbarium, with a range of approximately 220 km (Department of Biodiversity, Conservation, and Attractions 2018).

Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2 is known from 19 km north-east of the survey area. It is morphologically similar to *H. campanulatus* P1 and occurs in similar rocky drainage line and rocky slope habitat. It is considered to have some potential to occur in suitable habitat in the survey area. There are 18 records of *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2

listed with the WA Herbarium, with a range of approximately 200 km (Department of Biodiversity, Conservation, and Attractions 2018).

Eremophila coacta P3 is known from 0.4 km east of the survey area. Recent fires had affected sections of the eastern part of the survey area and these areas were not thoroughly searched. There is greatest potential for this taxon to occur in this part of the survey area and due to the proximity of the known population it is considered to have the potential to still occur. There are 12 records of *E. coacta* P3 listed with the WA Herbarium, with a range of approximately 110 km (Department of Biodiversity, Conservation, and Attractions 2018).

Pilbara trudgenii P3 is known from 0.1 km north of the survey area. Due to the proximity of the known population and the limited survey effort in this rugged part of the survey area it is considered to have the potential to still occur. It was noted that areas of suitable breakaway habitat adjacent to the known population were searched and reported in Rio Tinto (2014). Despite these searches not recording any *P. trudgenii* P3 individuals it was noted that “it is still possible that there are very small isolated populations occurring high on cliff faces” Rio Tinto (2014). There are 11 records of *P. trudgenii* P3 listed with the WA Herbarium, with a range of approximately 130 km (Department of Biodiversity, Conservation, and Attractions 2018).

Eremophila magnifica subsp. *magnifica* P4 is known from 5 km north-east of the survey area. Due to the proximity of the known population and the limited survey effort in the north-eastern part of the survey area it is considered to have the potential to still occur in suitable rocky slope habitat. There are 41 records of *E. magnifica* subsp. *magnifica* P4 listed with the WA Herbarium, with a range of over 300 km (Department of Biodiversity, Conservation, and Attractions 2018).

Ptilotus mollis P4 is known from 3 km south-east of the survey area. Due to the proximity of the known population, the limited survey effort in this south-eastern part of the survey area and the fact that recent fire had affected areas in the east of the survey area it is considered to have the potential to still occur. There are 34 records of *P. mollis* P4 listed with the WA Herbarium, with a range of approximately 700 km (Department of Biodiversity, Conservation, and Attractions 2018).

The **Ruellia simplex* (Mexican petunia) collected from Seven Mile Creek is the first record for Western Australia. As this hasn't been previously recorded in Western Australia it is listed as “Unlisted – s14” under the BAM Act (Department of Primary Industries and Regional Development 2018). It has become naturalised in warmer parts of eastern Australia and is widespread in coastal districts of Queensland and is becoming naturalised in coastal districts of northern New South Wales. **Ruellia simplex* inhabits waterways, riparian vegetation, dams, ponds, wetlands and drainage ditches in sub-tropical and tropical regions and is regarded as an environmental weed with the potential to form dense monocultures in riparian vegetation (Weeds of Australia Biosecurity Queensland Edition 2016). The presence of flowering material indicated the potential for seed production and movement of plants within the creek. The population of **Ruellia simplex* was not systematically surveyed and it is possible that more individuals extend further along the creek than currently recorded.

5.4 Contextual Analysis

Five vegetation units recorded within the survey area are considered to be of local significance because of uniqueness, restricted occurrence and association with conservation significant flora.

The H3 vegetation unit occurred on the steep south facing slopes in the west of the survey area. It was described in Biota (2012a) as occurring in gullies and on the slopes of steep-sided valleys on the south of the Western Range and was noted as the main unit from which *Aluta quadrata* T was

recorded. It was also reported in Ecologia (2011) from an area previously mapped and reported in Biota (2012a) which occurs within the current survey area. The single population of *A. quadrata* T within the survey area was not recorded from vegetation unit H3 but in similar habitat on the rocky hill slope vegetation unit H1 and adjacent drainage. No vegetation units comparable with H3 were described in projects assessed within 50 km of the survey area. Due to the relationship with *A. quadrata* T the H3 vegetation unit was considered to have conservation significance at a local scale.

The P8 vegetation unit occurred in the valleys and lower slopes north of the Eastern Range operations in the survey area. It was first described within the current survey area as vegetation unit 'P-XIP' in Rio Tinto (2010a). This same occurrence was further defined as vegetation unit 'P-XIP-Td' in Rio Tinto (2014) and noted as being 'vegetation of significance'. It was described as 'a novel association within mountain valley systems of the study area, due to the presence of low shrubland of *Tecticornia disarticulata* by which it is characterised' (Rio Tinto 2014). It was hypothesised that the presence of *T. disarticulata* may suggest the occurrence of brackish water as a result of gypsum sediments or marine siltstones in the surrounding area however this was unable to be confirmed (Rio Tinto 2014). It was noted that the P-XIP-Td vegetation unit appeared relatively restricted as it was known from only one other location approximately 15 km to the west at Western Range (Rio Tinto 2014), however no similar vegetation was described from the Western Range in Biota (2012a). Upon review of site data from Biota (2012a) the only occurrences of *T. disarticulata* and *Frankenia magnifica* were in quadrats described from the stony plains vegetation unit P1. It is possible that vegetation present at Western Range and mapped as P1 may have been analogous to P8 but was not identified by Biota (2012a). No other vegetation comparable with P8 was described from projects within 50 km of the survey area and as such the P8 vegetation unit is considered to have some conservation significance at a local scale.

The D6 vegetation unit occurred on the deeper incised gorges in the Eastern Range and Doggers Gorge sections of the survey area. Similar vegetation units were described from these areas as 'CfAcidpERcrTe' in Ecologia (2011), 'UR-DG-o1 and UR-DG-o2' in Rio Tinto (2014) (2010,) and as '11' in Eco Logical (2016). Rio Tinto (2014) discussed UR-DG as vegetation of low to moderate significance as it provides riparian habitat for priority flora, riparian flora and fauna. This habitat supports a number of conservation significant flora taxa including *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1, *Hibiscus campanulatus* P1, *Grevillea saxicola* P3, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3 and *Solanum* sp. (indet.). Similar vegetation was also described from Turee Creek as 'W' in GHD (2009) and as '12b' in Matiske (2011). Although the D6 vegetation unit appears to occur across a wide range, the flora species which inhabit these gorge habitats can be localised and may have conservation significance (as for *H. campanulatus* P1). As such the D6 vegetation unit is considered to have some conservation significance at a local scale.

The D7 vegetation unit occurred on major drainage lines that supported the potential GDE species *Eucalyptus camaldulensis*, *E. victrix* and *Sesbania formosa* and was originally described as D7 in Biota (2012b, 2012a) and Ecologia (2011). Similar vegetation units were described from the survey area as '9' in EcoLogical (2016) and from Turee Creek as '1a' in Matiske (2011). Despite the D7 vegetation unit appearing to occur across a wide range, it is analogous to the Ecosystem at Risk 'major ephemeral watercourses' as described in Kendrick (2001b) and has some conservation significance at a local scale. To a lesser extent the D8 vegetation unit also supported *E. victrix* and may have some conservation significance at a local scale.

The remaining vegetation associations recorded in the survey area represent what may be expected on similar landforms in the broader Hamersley and Gascoyne subregions and are not considered locally restricted (Kendrick 2001b, 2001a; Beard 1975). No vegetation assemblages were considered analogous with a listed TEC or PEC.

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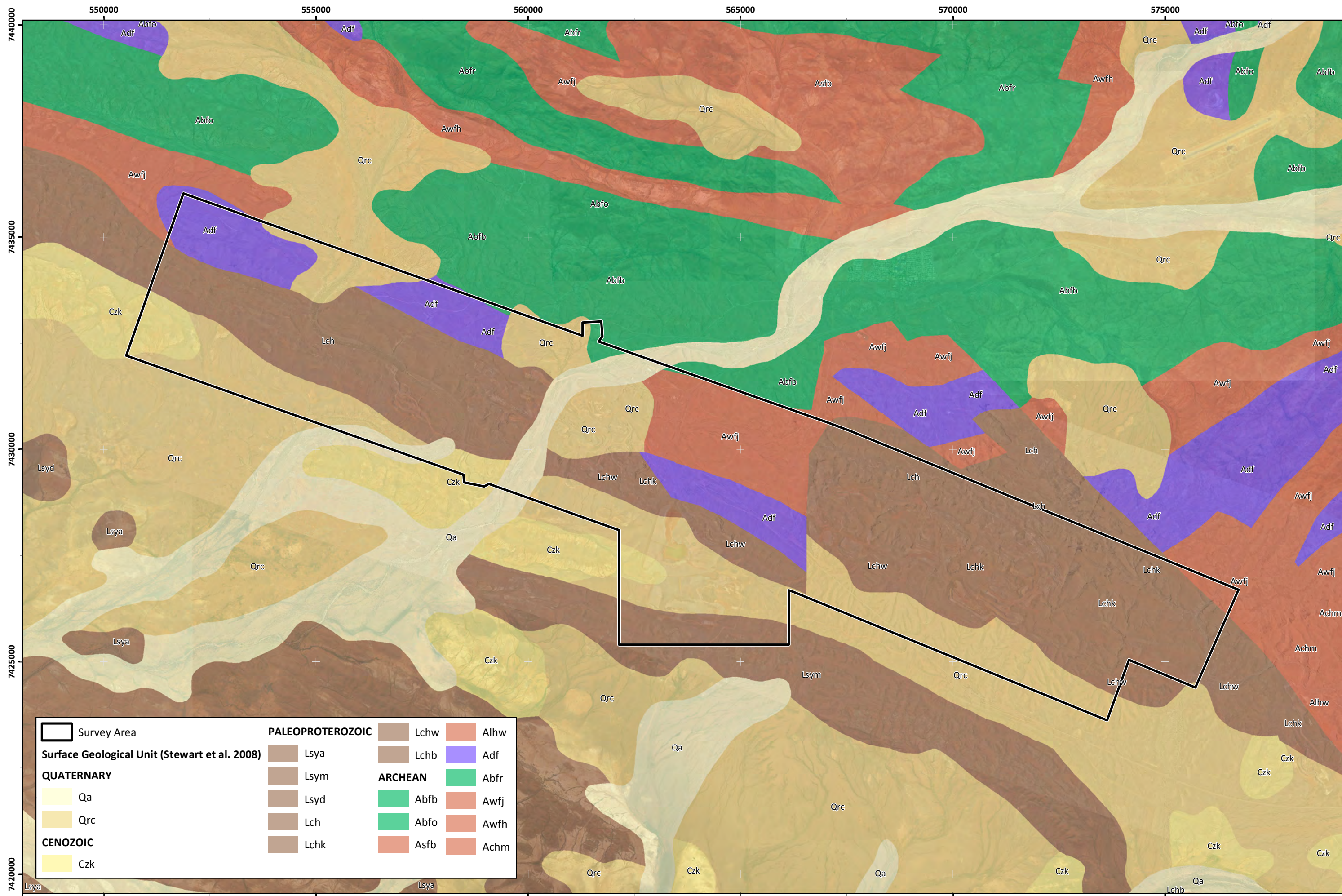
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Appendix A: Geology, Land Systems, Pre-European Vegetation, Land Use and Tenure Mapping of the Survey Area

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Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure A.1: Geological units of the Paraburdoo survey area

Author: L. Dadour

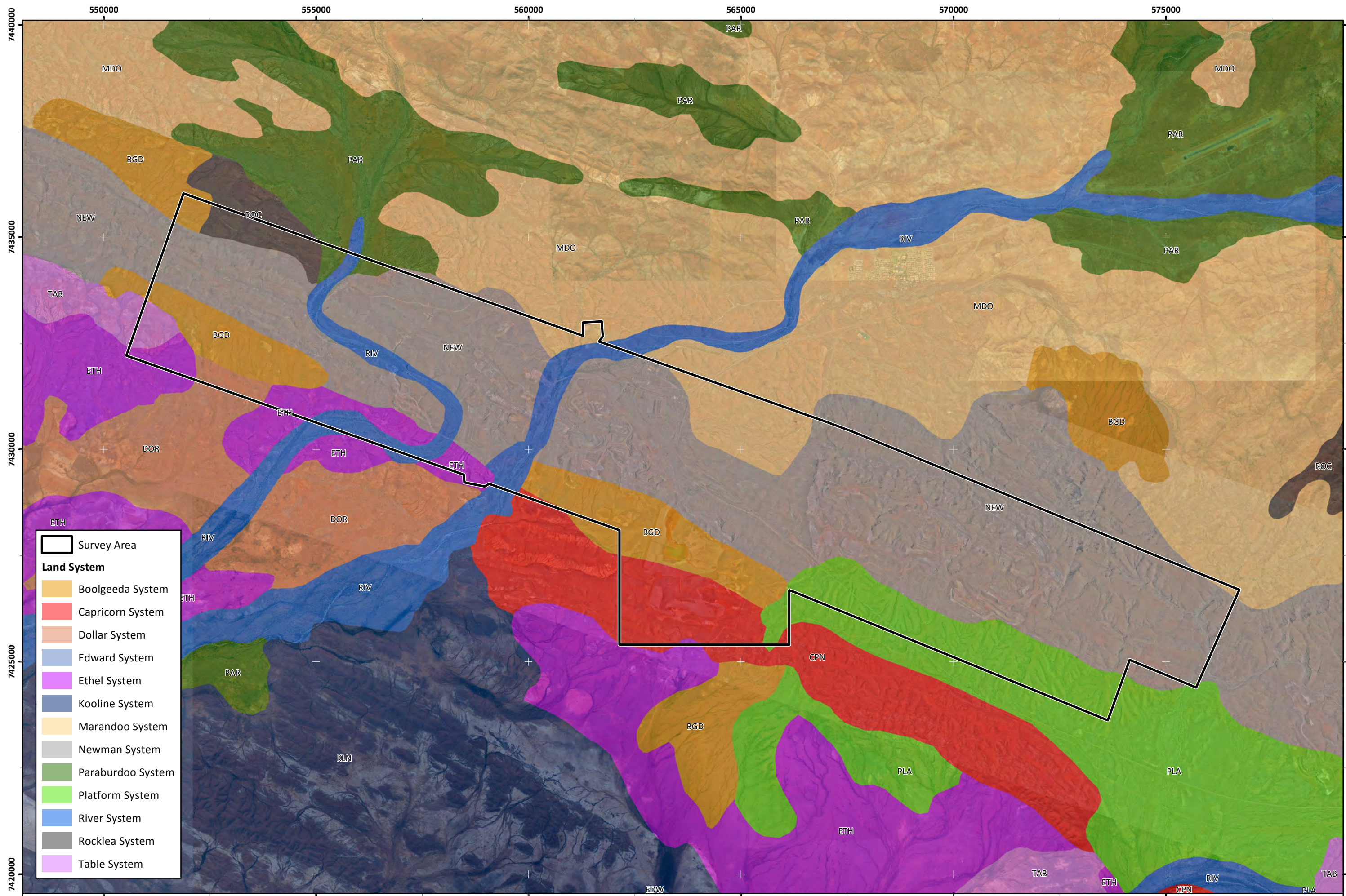
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Date: 13-12-2018

Coordinate System: GDA 1994 MGA Zone 50
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Figure Ref: 14284-18-BIDR-1RevB_181213_FigA01_Geo



Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure A.2: Land systems of the Paraburdoo survey area

Author: L. Dadour

Drawn: C. Dyde

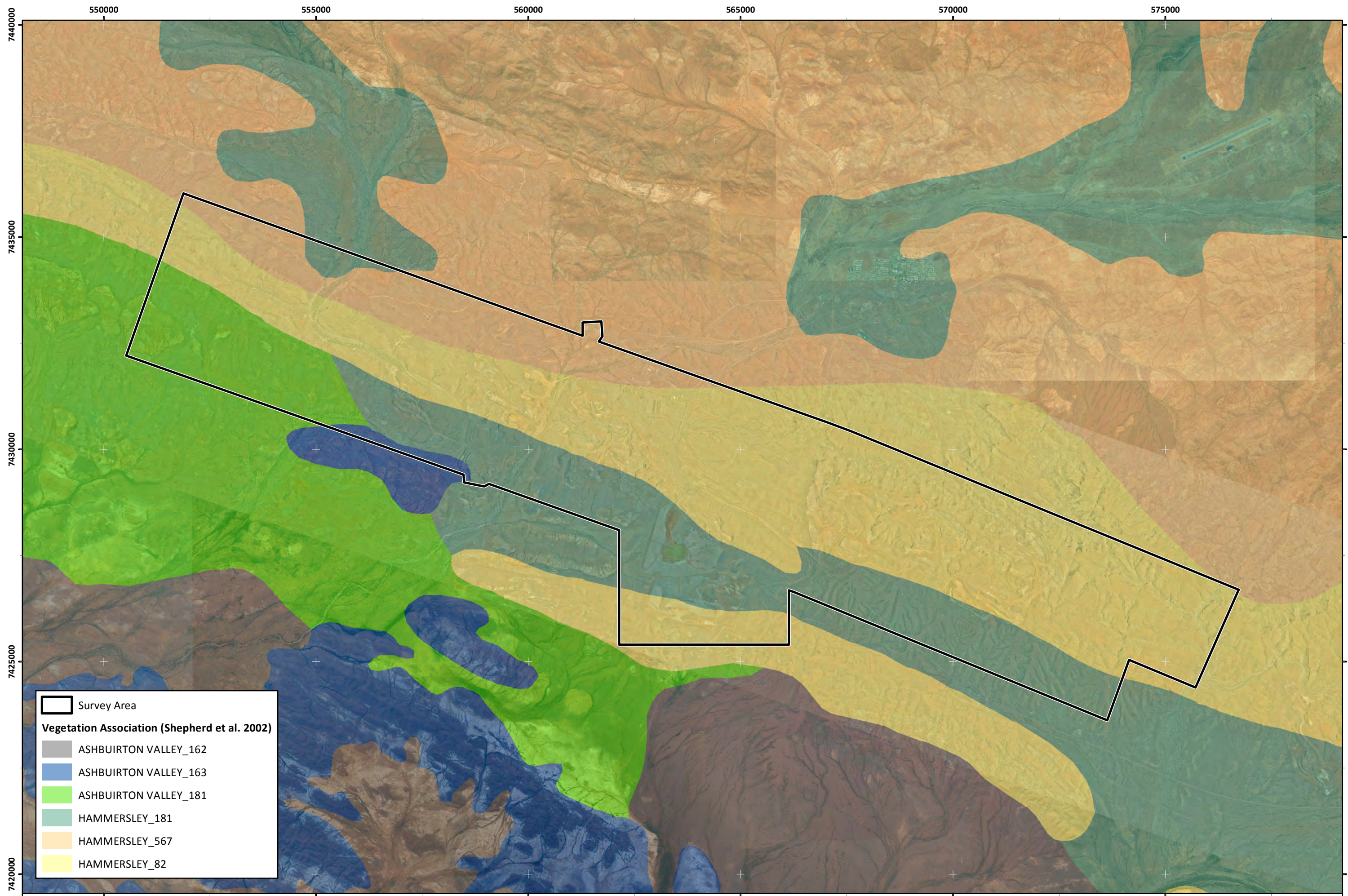
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Figure Ref: 14284-18-BIDR-1RevB_181213_FigA02_LandSys

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Km





Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure A.3: Pre-European vegetation of the Paraburdoo survey area

Author: L. Dadour

Drawn: C. Dyde

Date: 13-12-2018

Figure Ref: 14284-18-BIDR-1RevB_181213_FigA03_PreEuroVeg

Coordinate System: GDA 1994 MGA Zone 50

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Appendix B: Conservation Categories for Flora and Ecological Communities and Categories for Introduced Flora

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Table B.1: Categories and definitions for threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (V)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	<p>Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied:</p> <ul style="list-style-type: none"> • the taxa is a species of fish; • the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; • the management plan is in force under a law of the Commonwealth or of a State or Territory; • cessation of the management plan would adversely affect the conservation status of the taxa • fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.

Table B.2: Definitions and criteria for threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment and Conservation 2013).

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Table B.3: Categories of Threatened Ecological Communities (Department of Environment and Conservation 2013).

PD: Presumed Totally Destroyed
<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
CR : Critically Endangered
<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <p>i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</p> <p>ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</p> <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>

En: Endangered

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

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

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

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

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

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

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

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

VU: Vulnerable

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

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

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

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

Table B.4: Definitions and criteria for Priority Ecological Communities (Department of Environment and Conservation 2013).

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-known ecological communities
<p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
P4: Priority Four
<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation dependent species are placed in Priority 5.

Table B.5: Priority species under Western Australian *Wildlife Conservation Act 1950* (Department of Parks and Wildlife 2015)

P1: Priority One – Poorly known taxa
Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail 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.
P2: 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.
P3: Priority Three – Poorly known taxa
Taxa that 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.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
(a) 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. (b) 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. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5: Priority Five: Conservation dependent 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.

Note: From 1 January 2019, the *Wildlife Conservation Act 1950* (WC Act) has been replaced by the *Biodiversity Conservation Act 2016* and its regulations. This survey was completed in 2018 under the WC Act.

The management of introduced flora species in Western Australia is now regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). A list of declared pests, including ‘pest’ plants is provided under the BAM Act, which has been updated to incorporate a number of other Acts that are administered by the Department of Agriculture and Food Western Australia. Declared pests can fall into two categories: one that relates to the prevention of introducing the species or eradicating it; and the other relates to managing the species and whether it can be kept (i.e. for scientific purposes, education or other purpose).

The threat and risk posed to site-specific biodiversity values, influences to rehabilitation success, primary production, infrastructure assets or human health will differ depending on the unique characteristics of each site and the associated land management practice or operation. Therefore site or project specific weed assessments and priorities should be reviewed for each project.

As per introduced flora species, the BAM Act seeks to establish a modern biosecurity regulatory scheme to prevent serious animal pests from entering the State and becoming established, and to minimise the spread and impact of any that are already present within the State. Declared animal pests fall into three categories as Gazetted under the *Biosecurity and Agriculture Management Regulations 2013*. These categories are outlined in Table B.6.

Table B.6: Declared pests control categories as gazetted under the *Biosecurity and Agriculture Management Regulations 2013*.

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

Appendix C: Database Searches

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Department of Biodiversity,
Conservation and Attractions

Your Ref: 14284-17
Our Ref: 19-0817FL
Enquiries: Steve Martin
Phone: (08) 9219 9522
Email: flora.data@dbca.wa.gov.au

Astron Environmental Services

129 Royal Street
East Perth WA 6004

Attention: Daniel Roocke

Dear Daniel Roocke,

REQUEST FOR THREATENED AND PRIORITY FLORA INFORMATION

I refer to your request of 09 August 2017 for Threatened (Declared Rare) and Priority Flora information in the Paraburdoo area. The search was conducted within the area of the shapefile you submitted with an additional 50km buffer.

A search was undertaken for this area of **(1)** the Department's *Threatened (Declared Rare) and Priority Flora* database (for results, see "TPFL" – coordinates are GDA94), **(2)** the *Western Australian Herbarium Specimen* database for Threatened and Priority flora species opportunistically collected in the area of interest (for results, see "WAHERB" – coordinates are GDA94 – see condition number 4 in the attached 'Conditions in Respect of Supply') and **(3)**, the Department's *Threatened and Priority Flora List* [this list is searched using 'place names'. This list, which may also be used as a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "TP List"]. The results are attached electronically to this email.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the ninth point, which refers to the requirement to undertake field investigations for the accurate determination of Threatened and Priority flora occurrence at a site. *The information supplied should be regarded as an indication only of the Threatened and Priority flora that may be present and may be used as a target list in any surveys undertaken.*

The information provided does not preclude you from obtaining and complying with, where necessary, land clearing approvals from other agencies.

An invoice for \$ 300 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of Threatened and Priority flora you encounter in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss Threatened and Priority flora management, please contact Dr Ken Atkins, Manager, Species and Communities Branch, on (08) 9219 9511.

Yours faithfully

Steve Martin

.....
THREATENED FLORA DATABASE OFFICER
for the Director General

21 August 2017



THREATENED AND PRIORITY FLORA INFORMATION

Conditions with Respect to the Supply of Information

- The data supplied may not be provided to any other organisations, nor be used for any purpose other than for the project for which it has been originally provided for; without the prior consent of the Executive Director, Department of Biodiversity, Conservation and Attractions.
- Specific locality information for threatened flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for threatened flora may not be used in reports without the written permission of the Executive Director, Department of Biodiversity, Conservation and Attractions. Reports may only show generalised locations at a low resolution or, where necessary, show specific locations without identifying species. Species and Communities Branch is to be contacted for guidance on the presentation of threatened flora information.
- The Department of Biodiversity, Conservation and Attractions respects the privacy of private landowners who may have threatened and priority flora on their property. Threatened and priority flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners must only be made through the Department of Biodiversity, Conservation and Attractions.
- The development of the Perth Herbarium database was not originally intended for electronic mapping (eg. GIS ArcView). The latitude and longitude coordinates for each entry are not verified prior to being data based. It is only in recent times that collections have been submitted with GPS coordinates. Therefore, be aware when using this data in ArcView that some records may not plot to the locality description given with each collection.
- Acknowledgment of the Department Biodiversity, Conservation and Attractions as the source of data is to be made in any published material and cited as Biodiversity, Conservation and Attractions (2017) Threatened and Priority Flora Database Search for [search area] accessed on the [date of search]. Prepared by the Species and Communities Branch for [Requesters name and company] for [purpose of search].
- Copies of all such publications are to be forwarded to the Department of Biodiversity, Conservation and Attractions, Attention; the Manager, Species and Communities Branch.

Disclaimers with Respect to the Supply of Information

- Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Biodiversity, Conservation and Attractions accepts no responsibility for this.
- Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
- It should be noted that the supplied data does not necessarily represent a comprehensive listing of the threatened flora of the area in question. Its comprehensiveness is dependent on the amount of surveys carried out within a specified area. The receiving organisation should consider engaging a botanist, if required, to undertake a survey of the area under consideration.



ABBREVIATIONS USED IN THREATENED AND PRIORITY FLORA DATABASE

VESTING

AAP	Aboriginal Planning Authority
AGR	Chief Executive, Dep. of Agriculture
ALT	Aboriginal Land Trust
APB	Agricultural Protection Board of WA
BGP	Botanical Gardens & Parks Authority
BSA	Boy Scouts Association
CC	Conservation Commission – NPNCA - LFC
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
CRW	Crown
DAG	Dep. of Agriculture
DOW	Dep. of Water
DPI	Dep. of Planning
EXD	Exec Direc CALM
FES	Fire and Emergency Services Aust.
HOW	Dep. of Housing/State Housing Commission
ILD	Industrial Lands Develop. Auth
LAC	LandCorp
LGA	Shire/LGA
MAG	Minister for Agriculture
MCB	Metropolitan Cemeteries Board
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
PLB	Pastoral Lands Board
PRI	Private/Freehold
RAI	Public Transport Authority
REL	Religious Organisation
SPC	State Planning Commission
SYN	Synergy (ex Western Power)

SWA	State of Western Australia
TEL	Telstra
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

PURPOSES

ABR	Aboriginal Reserve
ACC	Access Track
AER	Aerodrome
AIR	Airport
ARS	Agricultural Research Station
BAP	Baptist Union of WA
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CMN	Communications
COM	Common
CON	Conservation Park
CPK	Car Park
CRM	Conservation & Resource Management
DEF	Defence
DRA	Drain
EDE	Educational Endowment
EDU	Educational purposes
UWA	
ENE	Enjoyment of Natural Environ.
EPL	Ex-pastoral Lease (Sect 33(2) CALM Act)
EPS	Explosives
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
FP	Foreshore Purposes
GE	General Lease
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes

HER	Heritage trail
HOS	Hospital
KEN	Kennels
LGA	LGA/Shire Requirements
LPR	Landscape Protection
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PCR	Proposed for Conservation
PFF	Protection of Flora & Fauna
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
PMC	Protection of Meteorite Crater
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUR	Purchase Lease
PUT	Public Utility
QUA	Quarry
RAC	Racecourse
RAD	Radio Station
REC	Recreation
REH	Rehabilitation/Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAL	Saleyards
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHO	Showgrounds
SNN	Sanitary
SOI	Soil Conservation
STO	Stopping place
STK	Stock Route
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
UCL	Unallocated Crown Land
UNK	Unknown
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WLS	Wildlife Sanctuary
WOO	Firewood



ABBREVIATIONS USED IN THE WESTERN AUSTRALIAN HERBARIUM DATABASE

Geocode Method - The method that was used to record the latitude and longitude.

Auto - Indicates that the coordinate data in the record was created automatically (i.e. by software), usually by creating a coordinate from information provided in the Nearest Named Place or Locality textual description fields.

GAP - Acronym for "Generalised Arbitrary Point" as used in HISPID. GAP indicates that the coordinate data was obtained manually from the Nearest Named Place or Locality textual description fields.

GPS - Acronym for "Global Positioning System". GPS indicates that the coordinate data in the record was obtained from a GPS unit by the collector of the specimen.

MAN - Shorthand for manual. MAN indicates that the coordinate data was created by hand using some method not allowed for by one of the other manual Geocode Method values, in particular, TOPO, GAP, or GPS.

TOPO - Shorthand for topographic map. TOPO indicates that the coordinate data was obtained by plotting textual locality details against a topographic map.

None - Indicates that no coordinate data has been supplied by the collector.

Unknown - Indicates that there is no known method for determining the coordinate data. Should be used if the collector provided no indication of how they sampled the specimen's coordinate data.

PREC (Precision) - precision ratings for coordinates.

Precision 1: Absolutely precise (to nearest 100m or nearest second) and must be GPS determined. For example 35°26'42"S 123°40'26"E

Precision 2: Falling within a diameter of 3km (ca 2 minutes) or if no GPS mentioned in collecting notes. (The location must be able to be pinpointed on a 1:250 000 map, a spot locality. For example 35°26'42"S 123°40'26"E

Precision 3: Falling within a diameter of 10km (ca 7 minutes) or for degrees and minutes, where seconds have not been given. For example 35°26'_"S 123°40'_"E

Precision 4: Falling within a diameter of ca 50km (30 minutes). For example 35°26'_"S 123°40'_"E

Precision 5: Where a location is a prescribed large geographical area within a state or only the state is given. Diameter is greater than 50km. For example 35°_"_"S 123°_"_"E

Precision 6: used when localities are New Holland, Eastern Australia or Not given. Fields will be left blank.



CONSERVATION CODES

For Western Australian Flora and Fauna

T Threatened species

Listed as Specially Protected under the *Wildlife Conservation Act 1950*, published under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

- Fauna that is rare or likely to become extinct are declared to be fauna that is in need of special protection
- Flora that are extant and considered likely to become extinct, or rare and therefore in need of special protection, are declared to be rare flora

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

The assessment of the conservation status of these species is based on their national extent.

X Presumed extinct species

Listed as Specially Protected under the *Wildlife Conservation Act 1950*, published under Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora (which may also be referred to as Declared Rare Flora).

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.

IA Migratory birds protected under an international agreement

Listed as Specially Protected under the *Wildlife Conservation Act 1950*, listed under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), relating to the protection of migratory birds.

S Other specially protected fauna

Listed as Specially Protected under the *Wildlife Conservation Act 1950*. Fauna declared to be in need of special protection, otherwise than for the reasons mentioned for Schedules 1, 2 or 3, are published under Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Threatened Fauna and Flora are ranked according to their level of threat using IUCN Red List categories and criteria. *For example:* Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is listed as 'Specially Protected' under the *Wildlife Conservation Act 1950*, published under Schedule 1, and referred to as a 'Threatened' species with a ranking of 'Endangered'.

CR Critically Endangered - considered to be facing an extremely high risk of extinction in the wild.

EN Endangered - considered to be facing a very high risk of extinction in the wild.

VU Vulnerable - considered to be facing a high risk of extinction in the wild.

A list of the current rankings can be downloaded from the Parks and Wildlife Threatened Species and Communities webpage at <http://dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/>

P Priority species

Species that maybe threatened or near threatened but are data deficient, have not yet been adequately surveyed to be listed under the Schedules of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation dependent species that are subject to a specific conservation program are placed in Priority 5.

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

1: Priority One: Poorly-known species

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

2: Priority Two: Poorly-known species

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

3: Priority Three: Poorly-known species

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

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

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

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

5: Priority Five: Conservation Dependent species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies, variety or forma).

Threatened and Priority Ecological Community buffers in WA

UNDER NO CIRCUMSTANCES IS THIS DATA TO BE PROVIDED TO ANY THIRD PARTIES, for more details see conditions for the supply of this information.

Citation

Title: Threatened and Priority Ecological Community buffers in WA
Custodian: Department of Parks and Wildlife

Description

Abstract: Ecological communities throughout WA that are "Presumed Totally Destroyed", "Critically Endangered", "Endangered", "Vulnerable", "Priority 1-5", "Lower Risk" and "Not evaluated". Communities are based on various life-forms including plants, invertebrates and micro-organisms.

Geographical Bounding Box

North: -14.788854
South: -35.005719
East: 128.870214
West: 113.765525

Data Currency and Status

Beginning Date: 1/1/94
Ending Date: current
Maintenance/Update: As requested

Access

Stored Data ESRI shapefile
Format:
Coordinate GCS_GDA_1994
System:

Access
Constraints:

Digital data is only available with written permission of the custodian. In addition, some occurrence data eg. location of sites on private land, is password restricted.

Data Quality

Positional
Accuracy:

Point location data within occurrences usually from GPS fix, usually within 100 metres. Some digitized from hard copy.

Attribute
Accuracy:

Not documented.

Logical
Consistency:

Not documented.

Completeness:

Information on specific communities was obtained from regional, subregional or specific habitat surveys of floristic communities, invertebrate communities, wetland assemblages and communities of micro-organisms.

Attributes List:

<u>Name</u>	<u>Description</u>
BDY_ID	Associated boundary polygon unique identifier
OCC_UNIQUE	Unique occurrence identifier
COM_ID	Shortened community name identifier
COM_NAME	Community name
CT_DESC	State listed Category of Threat
S_ID_COUNT	Number of Site IDs within a buffer
FIRST_S_ID	First site identifier
LAST_S_ID	Last site identifier
BUFFER	Buffer radius from site ID or boundary in metres

General Information:

buffers

- The buffer radius around each occurrence of a TEC or PEC is included to help ensure that developments with potential to impact groundwater or surface water are picked up.
- For wetland TEC or PECs we seek to include an area within the buffer zone that is intended to help protect groundwater and surface water. The area required to protect different types of wetlands from a variety of hydrological impacts will, of course, differ.
- For upland TEC or PECs that are believed not to be groundwater dependent, the buffer area radius encompasses the TEC or PEC site location recorded in the TEC database, and extends at least to the furthest point in the occurrence. This is to ensure that the 'buffer' area encompasses at least the entire TEC or PEC. This means that some linear occurrences may need a larger buffer radius to encompass the entire occurrence.
- Occurrences with a buffer distance of 0 are no longer extant.



Contact Information

Contact Organisation: Department of Parks and Wildlife
Contact Position: TEC Ecologist, Species and Communities Branch
Mail Address: Locked Bag 104, Bentley Delivery Centre
Suburb/Locality: Kensington
Country/State: WA
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Metadata Information

Metadata Date: [current](#)

DEPARTMENT OF PARKS AND WILDLIFE

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES INFORMATION

CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data are to be made in writing to the Director General, Department of Parks and Wildlife
Attention: Species and Communities Branch
2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the data custodian (Val English), Species and Communities Branch.
3. Specific locality information for threatened and priority ecological communities (TECs/PECs) is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for TECs/PECs may not be used in public reports without the written permission of the Director General, Department of Parks and Wildlife. Publicly available reports may only show generalised locations (ie buffer locations). The TEC database manager is to be contacted for guidance on the presentation of TEC/PEC information.
4. Note that the Department of Parks and Wildlife respects the privacy of private landowners who may have threatened and priority ecological communities on their property. Locations of TECs/PECs identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Environment and Conservation.
5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Parks and Wildlife accepts no responsibility for this.
6. Receiving organisations must also recognise that the Threatened Ecological Communities database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
7. It should be noted that the supplied data do not necessarily represent a comprehensive listing of the threatened and priority ecological communities of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. Private property has been relatively little surveyed. The receiving organisation should employ a consultant, if there is any likelihood of the presence of any threatened or priority ecological community, to undertake a survey of the area under consideration.
8. Acknowledgment of the Department of Parks and Wildlife as source of the data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Parks and Wildlife, Attention: Manager, Species and Communities Branch.

Greater Paraburdoo Flora Search

Created By Guest user on 14/07/2017

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Line'
Vertices 23° 12' 03" S, 117° 30' 07" E 23° 17' 16" S, 117° 44' 27" E
Group By Family

Family	Species	Records
Acanthaceae	3	5
Aizoaceae	4	8
Amaranthaceae	21	37
Apocynaceae	3	3
Araliaceae	2	3
Asphodelaceae	1	2
Asteraceae	26	42
Boraginaceae	9	14
Brassicaceae	7	11
Campanulaceae	3	4
Capparaceae	1	2
Caryophyllaceae	1	1
Chenopodiaceae	29	39
Cleomaceae	2	3
Convolvulaceae	9	18
Cucurbitaceae	1	1
Cyperaceae	5	9
Euphorbiaceae	10	13
Fabaceae	69	172
Frankeniaceae	2	5
Gentianaceae	1	1
Geraniaceae	1	1
Goodeniaceae	12	24
Lamiaceae	2	4
Loranthaceae	5	7
Lythraceae	1	1
Malvaceae	45	102
Marsileaceae	1	1
Molluginaceae	1	2
Moraceae	1	1
Myrtaceae	14	43
Nyctaginaceae	3	3
Oleaceae	2	4
Papaveraceae	1	1
Phyllanthaceae	3	6
Poaceae	37	52
Polygalaceae	1	1
Polygonaceae	1	1
Portulacaceae	5	11
Potamogetonaceae	1	1
Primulaceae	1	1
Proteaceae	4	13
Pteridaceae	3	6
Rhamnaceae	2	2
Rubiaceae	4	8
Santalaceae	1	5
Sapindaceae	5	9
Scrophulariaceae	24	84
Solanaceae	12	20
Surianaceae	1	4
Thymelaeaceae	1	2
Typhaceae	1	1
Violaceae	1	5
Zygophyllaceae	6	8
TOTAL	412	827

Name ID Species Name Naturalised Conservation Code ¹Endemic To Query Area

Acanthaceae

1. 7164 *Dicladanthera forrestii*
2. 11320 *Dipteracanthus australasicus* subsp. *australasicus*
3. 17326 *Hamieria kempeana*

Aizoaceae

4. 44241 *Trianthema glossostigma*
5. 44305 *Trianthema pilosum*
6. 44362 *Trianthema triquetrum*

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
7.	29095 <i>Zaleya galericulata</i> subsp. <i>galericulata</i>			
Amaranthaceae				
8.	2646 <i>Aerva javanica</i> (Kapk Bush)	Y		
9.	2660 <i>Amaranthus cuspidifolius</i>			
10.	20018 <i>Amaranthus undulatus</i>			
11.	18361 <i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>			
12.	2676 <i>Gomphrena canescens</i> (Batchelors Buttons)			
13.	2680 <i>Gomphrena cunninghamii</i>			
14.	2690 <i>Ptilotus aervoides</i>			
15.	2696 <i>Ptilotus astrolasius</i>			
16.	2698 <i>Ptilotus auriculifolius</i>			
17.	2704 <i>Ptilotus calostachyus</i> (Weeping Mulla Mulla)			
18.	2706 <i>Ptilotus carinatus</i>			
19.	2711 <i>Ptilotus clementii</i> (Tassel Top)			
20.	2718 <i>Ptilotus drummondii</i> (Narrowleaf Mulla Mulla)			
21.	2728 <i>Ptilotus gomphrenoides</i>			
22.	2731 <i>Ptilotus helipteroides</i> (Hairy Mulla Mulla)			
23.	2741 <i>Ptilotus macrocephalus</i> (Featherheads)			
24.	41001 <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> (Yellow Tails)			
25.	2747 <i>Ptilotus obovatus</i> (Cotton Bush)			
26.	2751 <i>Ptilotus polystachyus</i> (Prince of Wales Feather)			
27.	2757 <i>Ptilotus schwartzii</i>			
28.	12239 <i>Ptilotus trichocephalus</i>		P4	
Apocynaceae				
29.	6567 <i>Carissa lanceolata</i> (Conkerberry, Marnuwiji)			
30.	6599 <i>Rhyncharhena linearis</i> (Bush Bean, Wintjulanypa)			
31.	13100 <i>Tylophora cinerascens</i>			
Araliaceae				
32.	6202 <i>Astrotricha hamptonii</i> (Ironplant)			
33.	19053 <i>Trachymene pilbarensis</i>			
Asphodelaceae				
34.	1364 <i>Asphodelus fistulosus</i> (Onion Weed)	Y		
Asteraceae				
35.	7836 <i>Angianthus tomentosus</i> (Camel-grass)			
36.	43104 <i>Apowollastonia hamersleyensis</i>			
37.	7878 <i>Brachyscome iberidifolia</i>			
38.	7893 <i>Calocephalus knappii</i>			
39.	7895 <i>Calocephalus multiflorus</i> (Yellow-top)			
40.	7905 <i>Calotis multicaulis</i> (Many-stemmed Burr-daisy)			
41.	33516 <i>Chrysocephalum gilesii</i>			
42.	35558 <i>Flaveria trinervia</i> (Speedy Weed)	Y		
43.	8088 <i>Ixioclamys cuneifolia</i>			
44.	12638 <i>Olearia mucronata</i>		P3	
45.	8153 <i>Olearia xerophila</i>			
46.	20311 <i>Pilbara trudgenii</i>		P3	
47.	8168 <i>Pluchea rubelliflora</i>			
48.	8189 <i>Pseudognaphalium luteoalbum</i> (Jersey Cudweed)			
49.	8192 <i>Pterocaulon sphacelatum</i> (Apple Bush, Fruit Salad Plant)			
50.	13301 <i>Rhodanthe floribunda</i>			
51.	13310 <i>Rhodanthe margarethae</i>			
52.	13238 <i>Rhodanthe margonii</i>			
53.	13285 <i>Schoenia ayersii</i>			
54.	8213 <i>Senecio magnificus</i> (Showy Groundsel)			
55.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
56.	8234 <i>Streptoglossa adscendens</i>			
57.	8237 <i>Streptoglossa decurrens</i>			
58.	8238 <i>Streptoglossa liatroides</i>			
59.	12729 <i>Taplinia saxatilis</i>			
60.	45613 <i>Taraxacum khatoonae</i>	Y		
Boraginaceae				
61.	17301 <i>Heliotropium chrysocarpum</i>			
62.	6704 <i>Heliotropium conocarpum</i>			
63.	6705 <i>Heliotropium crispatum</i>			
64.	6712 <i>Heliotropium heteranthum</i>			
65.	17307 <i>Heliotropium inexplicitum</i>			
66.	6713 <i>Heliotropium ovalifolium</i>			
67.	17309 <i>Heliotropium pachyphyllum</i>			

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68.	6718	<i>Heliotropium tenuifolium</i> (Mamukata)			
69.	6727	<i>Trichodesma zeylanicum</i> (Camel Bush, Kumbalin)			
Brassicaceae					
70.	3032	<i>Lepidium muelleri-ferdinandii</i>			
71.	3033	<i>Lepidium oxytrichum</i>			
72.	3035	<i>Lepidium pedicellosum</i>			
73.	3037	<i>Lepidium phlebopetalum</i> (Veined Peppergrass)			
74.	3039	<i>Lepidium platypetalum</i> (Slender Peppergrass)			
75.	3072	<i>Sisymbrium orientale</i> (Indian Hedge Mustard)	Y		
76.	3074	<i>Stenopetalum anfractum</i>			
Campanulaceae					
77.	37480	<i>Lobelia arnhemiaca</i>			
78.	36880	<i>Lobelia heterophylla</i> subsp. <i>pilbarensis</i>			
79.	7393	<i>Wahlenbergia tumidiflora</i>			
Capparaceae					
80.	48291	<i>Capparis spinosa</i> subsp. <i>nummularia</i>			
Caryophyllaceae					
81.	2903	<i>Polycarpha longiflora</i>			
Chenopodiaceae					
82.	2453	<i>Atriplex codonocarpa</i> (Flat-topped Saltbush)			
83.	2473	<i>Atriplex quadrivalvata</i>			Y
84.	2499	<i>Dissocarpus paradoxus</i> (Curious Saltbush)			
85.	2502	<i>Dysphania kalpari</i> (Rat's Tail, Kalpari)			
86.	2504	<i>Dysphania plantaginella</i>			
87.	2506	<i>Dysphania rhadinostachya</i>			
88.	11890	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>			
89.	2511	<i>Enchylaena tomentosa</i> (Barrier Saltbush)			
90.	2513	<i>Eremophea spinosa</i>			
91.	2538	<i>Maireana carnosae</i> (Cottony Bluebush)			
92.	2543	<i>Maireana eriosphaera</i>			
93.	2544	<i>Maireana georgei</i> (Satiny Bluebush)			
94.	2547	<i>Maireana lanosa</i> (Woolly Bluebush)			
95.	2551	<i>Maireana melanocoma</i> (Pussy Bluebush)			
96.	2556	<i>Maireana planifolia</i> (Low Bluebush)			
97.	2565	<i>Maireana suaedifolia</i>			
98.	2566	<i>Maireana thesioides</i> (Lax Bluebush)			
99.	2567	<i>Maireana tomentosa</i> (Felt Bluebush)			
100.	11662	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>			
101.	2571	<i>Maireana villosa</i>			
102.	2582	<i>Rhagodia eremaea</i> (Thorny Saltbush)			
103.	30434	<i>Salsola australis</i>			
104.	2597	<i>Sclerolaena bicornis</i> (Goathead Burr)			
105.	2603	<i>Sclerolaena cornishiana</i> (Cartwheel Burr)			
106.	2606	<i>Sclerolaena cuneata</i> (Yellow Bindii)			
107.	2611	<i>Sclerolaena eriactha</i> (Tall Bindii)			
108.	8877	<i>Sclerolaena gardneri</i>			
109.	2619	<i>Sclerolaena lanicuspis</i> (Spinach Burr)			
110.	31492	<i>Tecticornia disarticulata</i>			
Cleomaceae					
111.	2985	<i>Cleome oxalidea</i>			
112.	2988	<i>Cleome viscosa</i> (Tickweed, Tjinduwadhu)			
Convolvulaceae					
113.	6606	<i>Bonamia media</i>			
114.	44782	<i>Bonamia pilbarensis</i>			
115.	6612	<i>Convolvulus clementii</i>			
116.	31274	<i>Duperreya commixta</i>			
117.	6617	<i>Evolvulus alsinoides</i> (Tropical Speedwell)			
118.	11200	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>			
119.	6633	<i>Ipomoea muelleri</i> (Poison Morning Glory, Yumbu)			
120.	6651	<i>Operculina aequiseipala</i>			
121.	6653	<i>Polymeria ambigua</i> (Morning Glory)			
Cucurbitaceae					
122.	41721	<i>Cucumis variabilis</i>			
Cyperaceae					
123.	774	<i>Cyperus bifax</i> (Downs Nutgrass)			
124.	786	<i>Cyperus cunninghamii</i>			

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125.	18318	<i>Cyperus involucratus</i>	Y		
126.	818	<i>Cyperus vaginatus</i> (Stiffleaf Sedge)			
127.	16257	<i>Schoenoplectus subulatus</i>			

Euphorbiaceae

128.	17422	<i>Adriana tomentosa</i> var. <i>tomentosa</i>			
129.	42844	<i>Euphorbia australis</i> var. <i>hispidula</i>			
130.	35303	<i>Euphorbia australis</i> var. <i>subtomentosa</i>			
131.	4620	<i>Euphorbia boophthona</i> (Gascoyne Spurge)			
132.	9048	<i>Euphorbia careyi</i>			
133.	4623	<i>Euphorbia coghlani</i> (Namana)			
134.		<i>Euphorbia</i> sp.			
135.	4647	<i>Euphorbia tannensis</i>			
136.	12097	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i> (Desert Spurge)			
137.	42879	<i>Euphorbia trigonosperma</i>			

Fabaceae

138.	3209	<i>Acacia ampliceps</i>			
139.	44586	<i>Acacia ampliceps</i> x <i>sclerosperma</i> subsp. <i>sclerosperma</i>			
140.	3217	<i>Acacia aneura</i> (Mulga, Wanari)			
141.	37260	<i>Acacia aptaneura</i>			
142.	3228	<i>Acacia atkinsiana</i>			
143.	3232	<i>Acacia ayersiana</i>			
144.	3241	<i>Acacia bivenosa</i>			
145.	44588	<i>Acacia bivenosa</i> x <i>sclerosperma</i> subsp. <i>sclerosperma</i>			
146.	3260	<i>Acacia citrinoviridis</i>			
147.	13502	<i>Acacia coriacea</i> subsp. <i>pendens</i>			
148.	3280	<i>Acacia cuspidifolia</i> (Bohemia)			
149.	3360	<i>Acacia hamersleyensis</i>			
150.	36418	<i>Acacia incurvaneura</i>			
151.	3434	<i>Acacia maitlandii</i> (Maitland's Wattle)			
152.	3435	<i>Acacia marriamamba</i>			
153.	3500	<i>Acacia pruinocarpa</i> (Gidgee)			
154.	29016	<i>Acacia pyrifolia</i> var. <i>morrisonii</i>			
155.	29015	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>			
156.	3519	<i>Acacia rhodophloia</i>			
157.	44584	<i>Acacia rhodophloia</i> x <i>sibirica</i>			
158.	13078	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>			
159.	8949	<i>Acacia sibirica</i> (Bastard Mulga)			
160.	3553	<i>Acacia spondylophylla</i>			
161.	13070	<i>Acacia synchronicia</i>			
162.	3577	<i>Acacia tetragonophylla</i> (Kurara, Wakalpuka)			
163.	29531	<i>Acacia thoma</i>			
164.	3598	<i>Acacia wanyu</i>			
165.	3606	<i>Acacia xiphophylla</i>			
166.	3774	<i>Crotalaria cunninghamii</i> (Green Birdflower, Bilbun)			
167.	20175	<i>Crotalaria cunninghamii</i> subsp. <i>sturtii</i>			
168.	3783	<i>Crotalaria medicaginea</i>			
169.	20179	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>			
170.	17118	<i>Cullen leucanthum</i>			
171.	17119	<i>Cullen leucochaetes</i>			
172.	3941	<i>Glycine tabacina</i> (Glycine Pea)			
173.	3973	<i>Indigofera colutea</i> (Sticky Indigo)			
174.	16644	<i>Indigofera decipiens</i>			
175.	17961	<i>Indigofera fractiflexa</i>			
176.	3982	<i>Indigofera monophylla</i>			
177.	3985	<i>Indigofera rugosa</i>			
178.	4061	<i>Lotus cruentus</i> (Redflower Lotus)			
179.	3614	<i>Neptunia dimorphantha</i> (Sensitive Plant)			
180.	3675	<i>Petalostylis labicheoides</i> (Slender Petalostylis)			
181.	4190	<i>Rhynchosia australis</i> (Rhynchosia)			
182.	4191	<i>Rhynchosia minima</i> (Rhynchosia)			
183.	17645	<i>Senna artemisioides</i>			
184.	12279	<i>Senna artemisioides</i> subsp. <i>helmsii</i>			
185.	12280	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>			
186.	12307	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>			
187.	12309	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>			
188.	12308	<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>			
189.	18451	<i>Senna hamersleyensis</i>			
190.	12312	<i>Senna notabilis</i>			
191.	18595	<i>Senna</i> sp. <i>Karjini</i> (M.E. Trudgen 10392)			

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192.	14577	<i>Senna</i> sp. <i>Meekatharra</i> (E. Bailey 1-26)			
193.	18445	<i>Senna stricta</i>			
194.	4196	<i>Sesbania cannabina</i> (<i>Sesbania</i> Pea)			
195.	4198	<i>Sesbania formosa</i> (<i>White Dragon Tree</i>)			
196.	4228	<i>Swainsona forrestii</i>			
197.	4230	<i>Swainsona incei</i>			
198.	4233	<i>Swainsona leana</i>			
199.	4234	<i>Swainsona maccullochiana</i> (<i>Ashburton Pea</i>)			
200.	42142	<i>Swainsona thompsoniana</i>		P3	
201.	41825	<i>Tephrosia rosea</i> var. <i>Fortescue creeks</i> (M.I.H. Brooker 2186)			
202.	41811	<i>Tephrosia</i> sp. <i>Fortescue</i> (A.A. Mitchell 606)			
203.	42442	<i>Tephrosia</i> sp. NW <i>Eremaean</i> (S. van Leeuwen et al. PBS 0356)			
204.	40060	<i>Tephrosia</i> sp. <i>clay soils</i> (S. van Leeuwen et al. PBS 0273)			
205.	30716	<i>Vachellia farnesiana</i> (<i>Mimosa Bush</i>)	Y		
206.	4323	<i>Vigna lanceolata</i> (<i>Maloga Vigna</i> , <i>Wega</i>)			
Frankeniaceae					
207.	5207	<i>Frankenia magnifica</i>			
208.	5212	<i>Frankenia setosa</i> (<i>Bristly Frankenia</i>)			
Gentianaceae					
209.	41646	<i>Schenkia clementii</i>			
Geraniaceae					
210.	4335	<i>Erodium cygnorum</i> (<i>Blue Heronsbill</i>)			
Goodeniaceae					
211.	12517	<i>Goodenia cusackiana</i>			
212.	7509	<i>Goodenia forrestii</i>			
213.	7526	<i>Goodenia microptera</i>			
214.	12552	<i>Goodenia muelleriana</i>			
215.	12571	<i>Goodenia pascua</i>			
216.	12574	<i>Goodenia prostrata</i>			
217.	7545	<i>Goodenia scaevolina</i> (<i>Ngurubi</i>)			
218.	29381	<i>Goodenia</i> sp. <i>East Pilbara</i> (A.A. Mitchell PRP 727) (<i>O'Meara's Goodenia</i>)		P3	
219.	10982	<i>Goodenia stobbsiana</i>			
220.	7556	<i>Goodenia tenuiloba</i>			
221.	12578	<i>Scaevola acacioides</i>			
222.	7644	<i>Scaevola spinescens</i> (<i>Currant Bush</i> , <i>Maroon</i>)			
Lamiaceae					
223.	13689	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>			
224.	12707	<i>Prostanthera albiflora</i>			
Loranthaceae					
225.	2372	<i>Amyema fitzgeraldii</i> (<i>Pincushion Mistletoe</i>)			
226.	11614	<i>Amyema gibberula</i> var. <i>gibberula</i>			
227.	11874	<i>Amyema sanguinea</i> var. <i>sanguinea</i>			
228.	14307	<i>Amyema</i> sp. <i>Fortescue</i> (M.E. Trudgen 5358)			
229.	2396	<i>Lysiana casuarinae</i>			
Lythraceae					
230.	5278	<i>Ammannia multiflora</i>			
Malvaceae					
231.	4886	<i>Abutilon amplum</i>			
232.	4889	<i>Abutilon cryptopetalum</i>			
233.	4891	<i>Abutilon fraseri</i> (<i>Lantern Bush</i>)			
234.	18120	<i>Abutilon fraseri</i> subsp. <i>fraseri</i>			
235.	4895	<i>Abutilon lepidum</i>			
236.	4901	<i>Abutilon otocarpum</i> (<i>Desert Chinese Lantern</i>)			
237.	42920	<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)			
238.	40910	<i>Androcalva luteiflora</i> (<i>Yellow-flowered Rulingia</i>)			
239.	13560	<i>Corchorus crozophorifolius</i>			
240.	18409	<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>			
241.	18408	<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>			
242.	4865	<i>Corchorus tridens</i>			
243.	4918	<i>Gossypium robinsonii</i> (<i>Wild Cotton</i>)			
244.	4924	<i>Hibiscus burtonii</i>			
245.	48312	<i>Hibiscus campanulatus</i>		P1	
246.	4925	<i>Hibiscus coatesii</i>			
247.	4930	<i>Hibiscus goldsworthii</i>			
248.	43022	<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)			
249.	4942	<i>Hibiscus sturtii</i> (<i>Sturt's Hibiscus</i>)			

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250.	11651	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>			
251.	11477	<i>Hibiscus sturtii</i> var. <i>platychlamys</i>			
252.	4953	<i>Lawrenzia densiflora</i>			
253.	4955	<i>Lawrenzia glomerata</i>			
254.	4962	<i>Malvastrum americanum</i> (Spiked Malvastrum)	Y		
255.	46816	<i>Seringia elliptica</i> (Showy fire-bush)			
256.	46821	<i>Seringia nephrosperma</i> (Free carpel fire-bush)			
257.	4969	<i>Sida brownii</i>			
258.	4970	<i>Sida calyxhymenia</i> (Tall Sida)			
259.	4971	<i>Sida cardiophylla</i>			
260.	4976	<i>Sida echinocarpa</i>			
261.	4977	<i>Sida fibulifera</i> (Silver Sida)			
262.	15110	<i>Sida laevis</i>			
263.	16616	<i>Sida</i> sp. <i>Barlee Range</i> (S. van Leeuwen 1642)		P3	
264.	31854	<i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)			
265.	33697	<i>Sida</i> sp. <i>Hammersley Range</i> (K. Newbey 10692)		P1	
266.	33698	<i>Sida</i> sp. <i>Pilbara</i> (A.A. Mitchell PRP 1543)			
267.	20253	<i>Sida</i> sp. <i>Shovelanna Hill</i> (S. van Leeuwen 3842)			
268.	19712	<i>Sida</i> sp. <i>dark green fruits</i> (S. van Leeuwen 2260)			
269.	16617	<i>Sida</i> sp. <i>spiciform panicles</i> (E. Leyland s.n. 14/8/90)			
270.	4989	<i>Sida spinosa</i> (Spiny Sida)			
271.	4875	<i>Triumfetta chaetocarpa</i> (Urchins)			
272.	14694	<i>Triumfetta clementii</i>			
273.	4879	<i>Triumfetta leptacantha</i>			
274.	5106	<i>Waltheria indica</i>			
275.	5107	<i>Waltheria virgata</i>			

Marsileaceae

276. 76 *Marsilea hirsuta* (Nardoo)

Molluginaceae

277. 48201 *Trigastrotheca molluginea*

Moraceae

278. 19648 *Ficus brachypoda*

Myrtaceae

279. 19448 *Aluta quadrata* T

280. 16783 *Corymbia candida*

281. 17077 *Corymbia ferriticola*

282. 17093 *Corymbia hamersleyana*

283. 17092 *Corymbia opaca*

284. 35345 *Eucalyptus camaldulensis* subsp. *obtus* (Blunt-budded River Red Gum)

285. 5655 *Eucalyptus gamophylla* (Twin-leaf Mallee, Warilu)

286. 13528 *Eucalyptus kingsmillii* subsp. *kingsmillii*

287. 18088 *Eucalyptus leucophloia* subsp. *leucophloia*

288. 18058 *Eucalyptus repullulans*

289. 5875 *Melaleuca argentea* (Silver Cadjeput, Bandaran)

290. 5879 *Melaleuca bracteata* (River Teatree)

291. 5915 *Melaleuca glomerata*

292. 5933 *Melaleuca linophylla*

Nyctaginaceae

293. 2770 *Boerhavia coccinea* (Tar Vine, Wituka)

294. *Boerhavia* sp.

295. 2776 *Commicarpus australis* (Perennial Tar Vine)

Oleaceae

296. 6501 *Jasminum didymum*

297. 12059 *Jasminum didymum* subsp. *lineare* (Desert Jasmine)

Papaveraceae

298. 17797 *Argemone ochroleuca* subsp. *ochroleuca* Y

Phyllanthaceae

299. 38421 *Notoleptopus decaisnei*

300. 4680 *Phyllanthus maderaspatensis*

301. 4706 *Sauropus crassifolius*

Poaceae

302. 19835 *Amphipogon sericeus*

303. 203 *Aristida anthoxanthoides* (Yellow Threawn)

304. 207 *Aristida contorta* (Bunched Kerosene Grass)

305. 217 *Aristida nitidula* (Flat-awned Threawn)

306. 229 *Astrebula pectinata* (Barley Mitchell Grass)

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
307.	258 <i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
308.	272 <i>Chloris virgata</i> (Feathertop Rhodes Grass)	Y		
309.	279 <i>Cymbopogon ambiguus</i> (Scentgrass)			
310.	46555 <i>Cynodon prostratus</i>			
311.	311 <i>Digitaria ciliaris</i> (Summer Grass)	Y		
312.	357 <i>Enneapogon caeruleus</i> (Limestone Grass)			
313.	360 <i>Enneapogon lindleyanus</i> (Wiry Nineawn, Purple-head Nineawn)			
314.	363 <i>Enneapogon pallidus</i> (Conetop Nineawn)			
315.	365 <i>Enneapogon polyphyllus</i> (Leafy Nineawn)			
316.	378 <i>Eragrostis dielsii</i> (Mallee Lovegrass)			
317.	380 <i>Eragrostis eriopoda</i> (Woollybutt Grass, Wangumu)			
318.	393 <i>Eragrostis setifolia</i> (Neverfail Grass)			
319.	<i>Eragrostis</i> sp.			
320.	400 <i>Eriachne aristidea</i>			
321.	403 <i>Eriachne benthamii</i> (Swamp Wanderrie)			
322.	413 <i>Eriachne mucronata</i> (Mountain Wanderrie Grass)			
323.	421 <i>Eriachne tenuiculmis</i>			
324.	458 <i>Iseilema dolichotrichum</i>			
325.	465 <i>Iseilema vaginiflorum</i> (Red Flinders Grass)			
326.	19124 <i>Leptochloa fusca</i> subsp. <i>fusca</i>			
327.	503 <i>Panicum decompositum</i> (Native Millet, Kaltu-kaltu)			
328.	515 <i>Paraneurachne muelleri</i> (Northern Mulga Grass)			
329.	10975 <i>Paspalidium basicladum</i>			
330.	518 <i>Paspalidium clementii</i> (Clements Paspalidium)			
331.	519 <i>Paspalidium constrictum</i> (Knottybutt Grass)			
332.	629 <i>Sporobolus australasicus</i> (Fairy Grass)			
333.	17820 <i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)		P3	
334.	673 <i>Themeda triandra</i>			
335.	681 <i>Triodia brizoides</i>			
336.	13131 <i>Triodia epactia</i>			
337.	704 <i>Triodia wiseana</i> (Limestone Spinifex)			
338.	706 <i>Triaraphis mollis</i> (Needle Grass)			

Polygalaceae

339. 41365 *Polygala glaucifolia*

Polygonaceae

340. 2443 *Rumex vesicarius* (Ruby Dock)

Y

Portulacaceae

341. 2869 *Calandrinia schistorhiza*
 342. 31131 *Calandrinia* sp. Black angular seeds (A.A. Mitchell PRP 1661)
 343. 31073 *Calandrinia* sp. The Pink Hills (F. Obbens FO 19/06)
 344. 2882 *Portulaca intraterranea*
 345. 2884 *Portulaca oleracea* (Purslane, Wakati)

Potamogetonaceae

346. 20426 *Potamogeton tepperi*

Primulaceae

347. 6483 *Samolus junceus*

Proteaceae

348. 1963 *Grevillea berryana*
 349. 44441 *Grevillea saxicola*
 350. 2099 *Grevillea striata* (Beefwood)
 351. 19137 *Hakea lorea* subsp. *lorea*

P3

Pteridaceae

352. 32 *Cheilanthes brownii*
 353. 37 *Cheilanthes lasiophylla* (Woolly Cloak Fern)
 354. 8462 *Cheilanthes tenuifolia* (Rock Fern)

Rhamnaceae

355. 16189 *Cryptandra monticola*
 356. 4846 *Ventilago viminalis* (Supplejack, Barndaragu)

Rubiaceae

357. 7338 *Oldenlandia crouchiana*
 358. 18154 *Psydrax latifolia*
 359. 18155 *Psydrax suaveolens*
 360. 13339 *Synaptantha tillaeacea* var. *tillaeacea*

Santalaceae

361. 2357 *Santalum lanceolatum* (Northern Sandalwood, Yarnguli)

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Sapindaceae				
362.	12023 <i>Diplopeltis stuartii</i> var. <i>stuartii</i> (Desert Pepperflower)			
363.	11406 <i>Dodonaea lanceolata</i> var. <i>lanceolata</i>			
364.	4772 <i>Dodonaea pachyneura</i>			
365.	4773 <i>Dodonaea petiolaris</i>			
366.	4782 <i>Dodonaea viscosa</i> (Sticky Hopbush)			
Scrophulariaceae				
367.	31471 <i>Eremophila accrescens</i>			
368.	15167 <i>Eremophila canaliculata</i>			
369.	15030 <i>Eremophila coacta</i>		P3	
370.	18053 <i>Eremophila cryptothrix</i>			
371.	7192 <i>Eremophila cuneifolia</i> (Pinyuru, T'iranjū)			
372.	7205 <i>Eremophila exilifolia</i>			
373.	15052 <i>Eremophila forrestii</i> subsp. <i>forrestii</i>			
374.	17152 <i>Eremophila forrestii</i> subsp. <i>hastieana</i> (Grey Poverty Bush)			
375.	16696 <i>Eremophila fraseri</i> subsp. <i>fraseri</i>			
376.	17519 <i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>			
377.	7228 <i>Eremophila lachnocalyx</i> (Woolly-calyxed Eremophila)			
378.	7230 <i>Eremophila latrobei</i> (Warty Fuchsia Bush, Mintjingka)			
379.	17597 <i>Eremophila latrobei</i> subsp. <i>filiformis</i>			
380.	17576 <i>Eremophila latrobei</i> subsp. <i>latrobei</i>			
381.	7234 <i>Eremophila longifolia</i> (Berrigan, Tulypurpa)			
382.	14893 <i>Eremophila magnifica</i> subsp. <i>magnifica</i>		P4	
383.	18570 <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>			
384.	15164 <i>Eremophila petrophila</i> subsp. <i>petrophila</i>			
385.	17283 <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>			
386.	15160 <i>Eremophila platycalyx</i> subsp. <i>pardalota</i>			
387.	15057 <i>Eremophila reticulata</i>			
388.	40643 <i>Eremophila</i> sp. <i>Hamersley Range</i> (K. Walker KW 136)		P1	
389.	23997 <i>Eremophila tietkensis</i>			
390.	16040 <i>Eremophila youngii</i> subsp. <i>lepidota</i>		P4	
Solanaceae				
391.	47241 <i>Datura leichhardtii</i> subsp. <i>leichhardtii</i>	Y		
392.	6971 <i>Nicotiana benthamiana</i> (Tjuntiwari)			
393.	11856 <i>Nicotiana occidentalis</i> subsp. <i>occidentalis</i>			
394.	6980 <i>Nicotiana umbratica</i>		P3	
395.	7009 <i>Solanum gabrielae</i>			
396.	7014 <i>Solanum horridum</i>			
397.	7018 <i>Solanum lasiophyllum</i> (Flannel Bush, Mindjulu)			
398.	7022 <i>Solanum nigrum</i> (Black Berry Nightshade)	Y		
399.	42541 <i>Solanum octonum</i>		P2	
400.	7029 <i>Solanum phlomoides</i>			
401.	42546 <i>Solanum piceum</i>			
402.	7036 <i>Solanum sturtianum</i> (Thargomindah Nightshade)			
Surianaceae				
403.	3182 <i>Stylobasium spathulatum</i> (Pebble Bush)			
Thymelaeaceae				
404.	11185 <i>Pimelea microcephala</i> subsp. <i>microcephala</i>			
Typhaceae				
405.	98 <i>Typha domingensis</i> (Bulrush, Djandjid)			
Violaceae				
406.	5215 <i>Hybanthus aurantiacus</i>			
Zygophyllaceae				
407.	4374 <i>Tribulus astrocarpus</i>			
408.	4377 <i>Tribulus hirsutus</i>			
409.	4380 <i>Tribulus occidentalis</i> (Perennial Caltrop)			
410.	18072 <i>Tribulus suberosus</i>			
411.	4392 <i>Zygophyllum iodocarpum</i>			
412.	4393 <i>Zygophyllum kochii</i>			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
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¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/07/17 13:11:57

[Summary](#)

[Details](#)

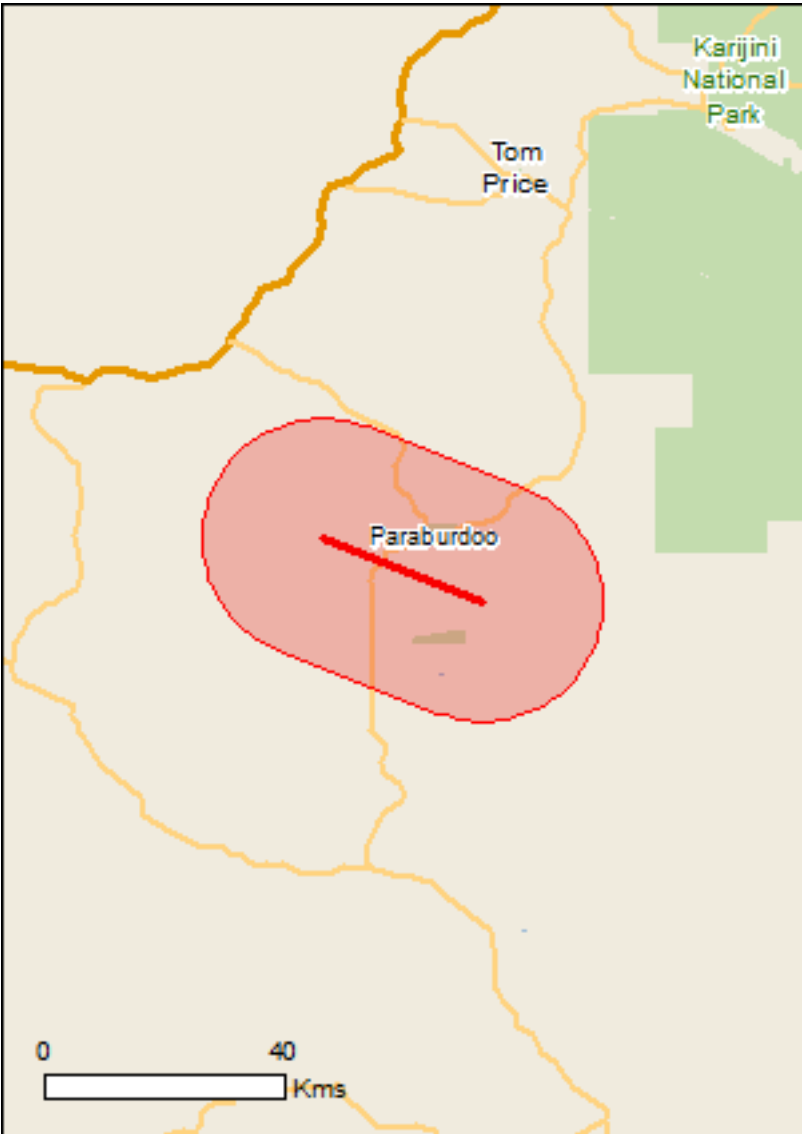
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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[Coordinates](#)

[Buffer: 20.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	9
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [331]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Plants		
Lepidium catapycnon Hamersley Lepidium, Hamersley Catapycnon [9397]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		

Name	Threatened	Type of Presence
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name	Threatened	Type of Presence
Commonwealth Land -		
Listed Marine Species		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-23.20083 117.50056,-23.28806 117.74056

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
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- [Australian Government, Department of Defence](#)
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- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

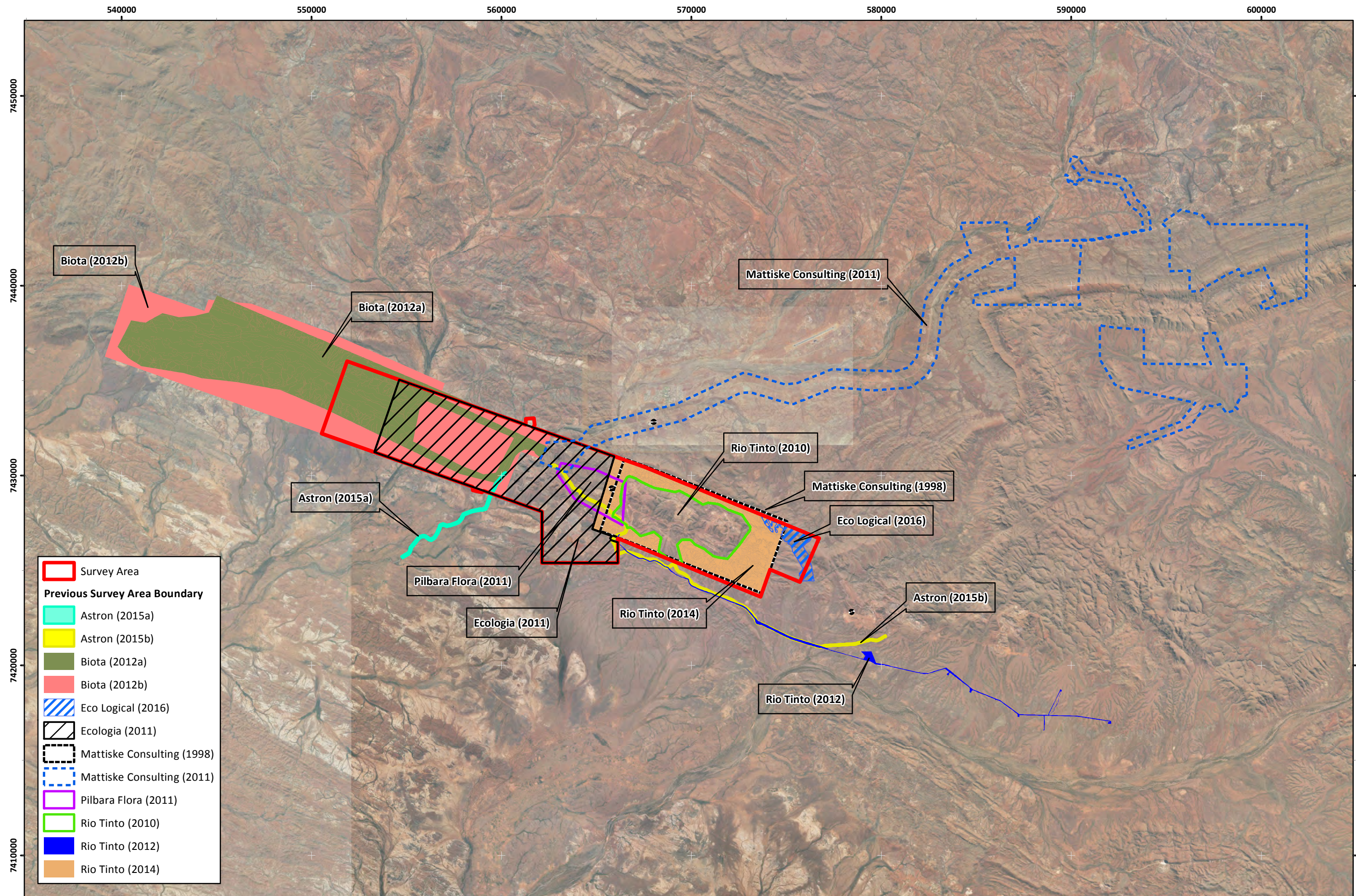
The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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Appendix D: Previous Survey Area Locations

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Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure D.1: Previous survey area locations

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Appendix E: Vegetation Classification and Condition Scales

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Table E.1: Vegetation Classification System Specht (1970) as modified by Aplin (1979).

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
Trees > 30 m	Tall closed forest	Tall open Forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees < 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs > 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs < 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, sedges, herbs	Closed tussock grassland/ sedgeland/ herbland	Tussock grassland/ sedgeland/ herbland	Open tussock grassland/ sedgeland/ herbland	Very open tussock grassland/ sedgeland/ herbland	Scattered tussock grasses/ sedges/ herbs

Table E.2: Vegetation condition scale as adapted from Trudgen (1988).

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

Appendix F: Threatened and Priority Flora Species Likelihood of Occurrence within the Survey Area

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Table F.1: Likelihood of occurrence of threatened and priority flora previously recorded within 50 km of the survey area (NatureMap (Department of Biodiversity, Conservation and Attractions 2017b), TPFL (Department of Biodiversity, Conservation and Attractions 2017d), TP List (Department of Biodiversity, Conservation and Attractions 2017e), WA Herbarium (Department of Biodiversity, Conservation and Attractions 2017f)). The TP List database is searched using place names. As a result, a number of the records obtained from this database may occur beyond 50 km of the survey area.

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
Threatened						
<i>Aluta quadrata</i>	Shrub, 0.8 m to 2.6 m high. Flowers white, June.	Perennial	Edge of creek beds, in gullies, at the base of cliffs, as a cremnophyte in cracks on cliff faces and rocky ridge crests or as an emergent from spinifex.	Recorded within survey area	Previously recorded	Recorded
Priority 1						
<i>Eremophila appressa</i>	Spreading, weeping, open shrub, 1 m to 3 m high.	Perennial	Rocky slopes on manganese derived soils but also on massive ironstone.	28 km ESE of the survey area	Unlikely	Unlikely
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	Erect shrub. White-cream-yellow-pink-purple flowers, August to September.	Perennial	Open rocky slopes, gullies and rock faces associated with large hills and cliffs, high in the landscape, skeletal red-brown soils.	Recorded within survey area	Previously recorded	Recorded
<i>Eremophila</i> sp. Mt Channar Range (C. Keating & M.E. Trudgen CK 408)	Wispy, delicate 1 m to 2 m high	Perennial	Rocky slope, south facing slope. Known from two records near Mt Channar.	25 km E of the survey area	Unlikely	Unlikely
<i>Eremophila</i> sp. Snowy Mountain (S. van Leeuwen 3737)	Rounded shrub to 1 m high.	Perennial	Summit of hill, high in the landscape, skeletal red gritty soils over massive ironstone of the Brockman Iron Formation.	38 km ESE of the survey area	Potential	Unlikely
<i>Helichrysum oligochaetum</i>	Erect herb to 0.25 m high. Flowers August to November.	Annual	Depressions, floodplains, creek lines, red-brown clay and loam soils.	44 km WSW of the survey area	Unlikely	Unlikely

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
<i>Hibiscus campanulatus</i>	Large, erect shrub to 3 m high. Flowers white to mauve, February.	Perennial	Hill slopes and base of slopes, sheltered or rocky drainage lines below associated cliff-lines or rocky ridges, soils often associated with Canga detrital formations.	Recorded within survey area	Previously recorded	Recorded
<i>Hibiscus</i> sp. Mt Brockman (E. Thoma ET 1354) PN	Shrub to 3 m high. Flowers purple, February to August.	Perennial	Hill summits, gorges, sheltered or rocky drainage lines below associated cliff-lines or rocky ridges, skeletal red-brown soils.	50 km N of the survey area	Unlikely	Unlikely
<i>Rhodanthe ascendens</i>	Ascending herb, to 0.1 m high. Flowers yellow, August.	Annual	Flat terrain, low in landscape, stony gibber with red cracking clay soils or areas with sand over clay.	96 km ENE of the survey area	Unlikely	Unlikely
<i>Sida</i> sp. Hamersley Range (K. Newbey 10692)	Semi-prostrate to upright shrub to 2 m high. Flowers September to October.	Perennial	Gorges, base of cliffs, rocky outcrops and breakaways, sometimes found in flat areas between hills in shrubby grassland.	2 km ESE of the survey area	Likely	Potential
<i>Tetratheca fordiana</i>	Dwarf shrub to 0.4 m high. Flowers June to July, September.	Perennial	Generally occurs above 750 m, often on predominantly north-facing cliffs and large rock outcrops of the Brockman Iron Formation, some evidence to suggest the nearby evidence of shale formations may play a role in distribution.	93 km NE of the survey area	Unlikely	Unlikely
Priority 2						
<i>Adiantum capillus-veneris</i>	Rhizomatous herb (fern), to 0.2 m high.	Perennial	Calcareous soils derived from calcrete, limestone or dolomite, just above the waterline of shaded banks and cliff faces along small, perennial rivers in low-altitude woodland, where there is a marked dry season, also occurs on calcareous cliff faces above the sea surf.	125 km NE of the survey area	Unlikely	Unlikely
<i>Aristida calycina</i> var. <i>calycina</i>	Compactly or loosely tufted grass, 0.3 m to 1.3 m high.	Perennial	Red earths, sands, alluvial soils.	251 km NNE of the survey area	Unlikely	Unlikely

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
<i>Aristida lazaridis</i>	Tufted grass, 0.4 m to 1.5 m high. Flowers April.	Perennial	Hard spinifex hummock grassland of <i>Triodia</i> spp. with a sparse overstorey of <i>Eucalyptus leucophloia</i> , apparently confined to sandy or loamy soils but also found on clay soils.	108 km ENE of the survey area	Unlikely	Unlikely
<i>Cladium procerum</i>	Densely tufted grass-like or herb (sedge). Flowers November.	Perennial	Coastal swamps or along watercourses, perennial streams and pond edges or along streams in deep gorges of the Hamersley Range, alluvial soils.	124 km NNE of the survey area	Unlikely	Unlikely
<i>Eremophila pusilliflora</i>	Low spreading shrub, flowers purple, July to April.	Perennial	Gibber plains, low scree slopes adjacent to plains, alluvial plains.	44 km NE of the survey area	Unlikely	Unlikely
<i>Euphorbia australis</i> var. <i>glabra</i>	Spreading herb or groundcover.	Annual	Sump, low in the landscape on alluvial cracking clay loamy soil, gritty with ironstone fragments, saline flats.	94 km NNE of the survey area	Unlikely	Unlikely
<i>Euphorbia inappendiculata</i> subsp. <i>inappendiculata</i>	Spreading procumbent herb.	Short-lived perennial	In hummock grassland of <i>Triodia epactia</i> over very open grassland of <i>*Cenchrus ciliaris</i> , on red loamy depressions interspersed with quartzite on a plain, high in the landscape on broken rocky screes on stony rich red clay soils.	107 km NNE of the survey area	Unlikely	Unlikely
<i>Hibiscus</i> sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	Spindly upright shrub to 3 m high. Flowers May to July.	Perennial	Sheltered or rocky drainage lines below associated cliff-lines or rocky ridges, skeletal red-brown stony soil over massive ironstone of the Brockman Iron Formation.	19 km NE of the survey area	Potential	Potential
<i>Indigofera ixocarpa</i>	Shrub, to 1 m high. Flowers pink, May.	Perennial	Gorges, gullies, hills and drainage lines, skeletal red soils over massive ironstones but also on granite.	54 km NNE of the survey area	Unlikely	Unlikely
<i>Isotropis parviflora</i>	Shrub, 0.1 m high. Flowers white/pink, March.	Perennial	Hill slopes with mallee or with hard spinifex on ironstone.	134 km NE of the survey area	Unlikely	Unlikely
<i>Oxalis</i> sp. Pilbara (M. E. Trudgen 12725)	Herb. Flowers May.	Annual/ephemeral	Shaded areas around rock outcrops and gullies and on gully walls.	26 km NE of the survey area	Unlikely	Unlikely

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
<i>Scaevola</i> sp. Hamersley Range basalts (S. van Leeuwen 3675)	Shrub, to 1 m high. Flowers July to August.	Perennial	Slopes and hilltops on skeletal brown gritty soils over mostly basaltic volcanic rock, typically associated with low shrublands over hummock grasses.	28 km NNE of the survey area	Unlikely	Unlikely
<i>Solanum octonum</i>	Erect shrub 0.8 m to 1.5 m high. Flowers purple, June to September.	Perennial	Gorge tops, red sandy soil with <i>Triodia</i> , steep hillslopes with skeletal soil and riverine areas with gritty sand.	155 km WSW of the survey area	Previously recorded ¹	Unlikely
Priority 3						
<i>Acacia dawsoniana</i>	Spreading shrub, 0.3 to 1.5(-2) m high. Flowers yellow, July to September.	Perennial	Lower scree slopes and bajada outwash fans of rocky banded ironstone ranges and ridges, often with diffuse but well incised drainage lines, on rocky red skeletal loams.	90 km NNE of the survey area	Unlikely	Unlikely
<i>Acacia effusa</i>	Low, dense, spreading, somewhat viscid shrub, 0.3 m to 1 m high, bark 'minniritchi'. Flowers yellow, May to August.	Perennial	Lower scree slopes of low rocky ranges, often along diffuse drainage lines, or on the bajada alluvial plain at the base of large banded ironstone mountains and ranges, on rocky red loams with surface strew of rocks in spinifex.	90 km NNE of the survey area	Unlikely	Unlikely
<i>Ampelopteris proliferata</i>	Rhizomatous fern, to 4 m high.	Perennial	In water or in wet ground near freshwater swamps, besides rivers, pools and lakes.	130 km NE of the survey area	Unlikely	Unlikely
<i>Dampiera ananyma</i>	Multi-stemmed herb, to 1 m high. Flowers June to September.	Perennial	Hummock grasslands on hill slopes and summits above 1000 m, on skeletal red-brown soils over massive banded ironstone of the Brockman Iron Formation, also recorded on meta-basalts, shales and jaspilite.	41 km NNE of the survey area	Unlikely	Unlikely

¹ Refer to Section 4.2.2.1 in relation to *Solanum octonum* for reasoning on its potential likelihood.

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
<i>Dampiera metallorum</i>	Rounded, multi-stemmed herb, to 0.5 m high. Flowers blue, April or June or October.	Perennial	Hill summits or upper slopes above 1000 m, on skeletal red-brown gravelly soils over massive banded ironstone of the Brockman Iron Formation.	99 km NE of the survey area	Unlikely	Unlikely
<i>Eremophila coacta</i>	Spreading shrub to 3 m high. Flowers blue to purple, September.	Perennial	Moderate to steep slopes, along ephemeral drainage lines and laterite hills in mixed shrubland.	0.4 km E of the survey area	Likely	Potential
<i>Eremophila rigens</i>	Shrub or tree, 1.5 m to 3.5 m high. Flowers white-blue, September.	Perennial	Stony slopes and on clay flats along drainage channels, usually with <i>Acacia</i> spp.	49 km SW of the survey area	Unlikely	Unlikely
<i>Eremophila shonae</i> subsp. <i>diffusa</i>	Erect, open, straggly shrub, ca 0.4 m high. Flowers purple, August to October.	Perennial	Stony or shaly red-brown clay loams or yellow/red sandy soils in mulga woodland or open shrubland.	282 km SSE of the survey area	Unlikely	Unlikely
<i>Euphorbia stevenii</i>	Somewhat succulent herb, to 0.5 m high.	Annual or perennial	Often found on floodplains on sandy or clay-loam soils.	106 km ENE of the survey area	Unlikely	Unlikely
<i>Geijera salicifolia</i>	Tree, 1.5 m to 6 m high. Flowers white, September.	Perennial	Scree slopes and gorges on skeletal stony soils.	51 km NNE of the survey area	Unlikely	Unlikely
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	Open, erect herb, to 0.2 m high. Flowers yellow, March to September.	Annual or biennial	Low undulating plain, swampy plains, stony plains, hill slopes, on red-brown clay soils, calcrete pebbles.	Recorded within survey area	Previously recorded	Recorded
<i>Grevillea saxicola</i>	Erect shrub to 2.5 m high. Flowers February, April, November.	Perennial	Upper scree/breakaway slopes and crests often associated with banded iron formation outcropping, often in mulga woodlands on orange-brown to red-brown loams with ironstone pebble cover.	Recorded within survey area	Previously recorded	Recorded

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
<i>Gunniopsis propinqua</i>	Prostrate herb to 0.1 m high. Flowers August to September.	Annual or perennial	Lateritic outcrops, winter-wet sites, stony sandy loams.	21 km NE of the survey area	Potential	Unlikely
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	Shrub or herb 0.2 m to 2m high. Flowers May to July.	Perennial	Coarse alluvium in high-energy creek lines or along steep slopes on skeletal soils overlaying coarse breccias from the Brockman Iron Formation.	39 km E of the survey area	Unlikely	Unlikely
<i>Nicotiana umbratica</i>	Erect, herb, 0.3 m to 0.7 m high. White flowers, April to June.	Short-lived annual or perennial	Rocky outcrops under the shade of large boulders in protected locations on shallow soils.	Recorded within survey area	Previously recorded	Recorded
<i>Olearia mucronata</i>	Densely branched, unpleasantly aromatic shrub, 0.6 m to 1 m high. Flowers white and yellow, August to December or January.	Perennial	Mesic areas amongst ironstone boulders and along creek lines.	15 km NE of the survey area	Potential	Unlikely
<i>Pilbara trudgenii</i>	Gnarled, aromatic shrub, to 1 m high. Flowers September.	Perennial	Cliff faces, steep rocky slopes and rock screes, usually on skeletal, red stony soils over Brockman Iron Formation.	0.1 km N of the survey area	Likely	Potential
<i>Polymeria distigma</i>	Prostrate trailing herb. Flowers pink, April to July.	Short-lived perennial	Rangelands, road verges and disturbed areas on sandy soils in Pindan and on cracking clays.	95 km N of the survey area	Unlikely	Unlikely
<i>Ptilotus crosslandii</i>	Prostrate herb. Flowers white, September to October.	Short-lived perennial	Sandy soils on colluvial plains.	212 km NNE of the survey area	Unlikely	Unlikely
<i>Ptilotus subspinescens</i>	Compact shrub, to 0.8 m high. Flowers February, July, September.	Short-lived perennial	Hummock grassland between mesas of ironstone, mainly on rocky and scree slopes, particularly on calcareous substrates.	52 km NW of the survey area	Unlikely	Unlikely

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	Herb or shrub, 0.1 m to 0.3 m high. Flowers blue-purple-violet, April to May.	Short-lived perennial	Protected areas near watercourses or along shaded rocky ridges, often in dry gullies and gorges on ironstone soils.	39 km NNE of the survey area	Unlikely	Unlikely
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	Spreading shrub to 0.5m high. Flowers yellow, August.	Perennial	Rocky areas, especially scree slopes, rock piles or gullies, on skeletal red soils.	Recorded within survey area	Previously recorded	Recorded
<i>Solanum kentrocaule</i>	Shrub 0.5 m to 1.5 m high. Flowers mauve or purple.	Perennial	Hillsides and mountain tops between 700 m to 1,250 m altitude or occasionally in creek-beds, on skeletal red-brown soils over ironstone or on basalt scree.	23 km NE of the survey area	Unlikely	Unlikely
<i>Swainsona thompsoniana</i>	Prostrate herb to 0.1 m. Flowers mauve-cream-yellow, August to September.	Annual	Gibber plains, open flood plains, crabhole plains and gilgai, usually at some elevation and in association with tussock grasses on heavy clay soils.	11 km NNE of the survey area	Potential	Unlikely
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	Tussocky grass, 0.9 m to 1.8 m high. Flowers August.	Perennial	Drainage lines, clay flats, crabhole flats and dark, self-mulching clay soils.	11 km NNE of the survey area	Potential	Unlikely
<i>Triodia basitricha</i>	Hummock grass, 0.3 m high. Flowers February, July.	Perennial	Stony ironstone crests, rocky and gravelly slopes of mountains or low hills.	62 km NNE of the survey area	Unlikely	Unlikely

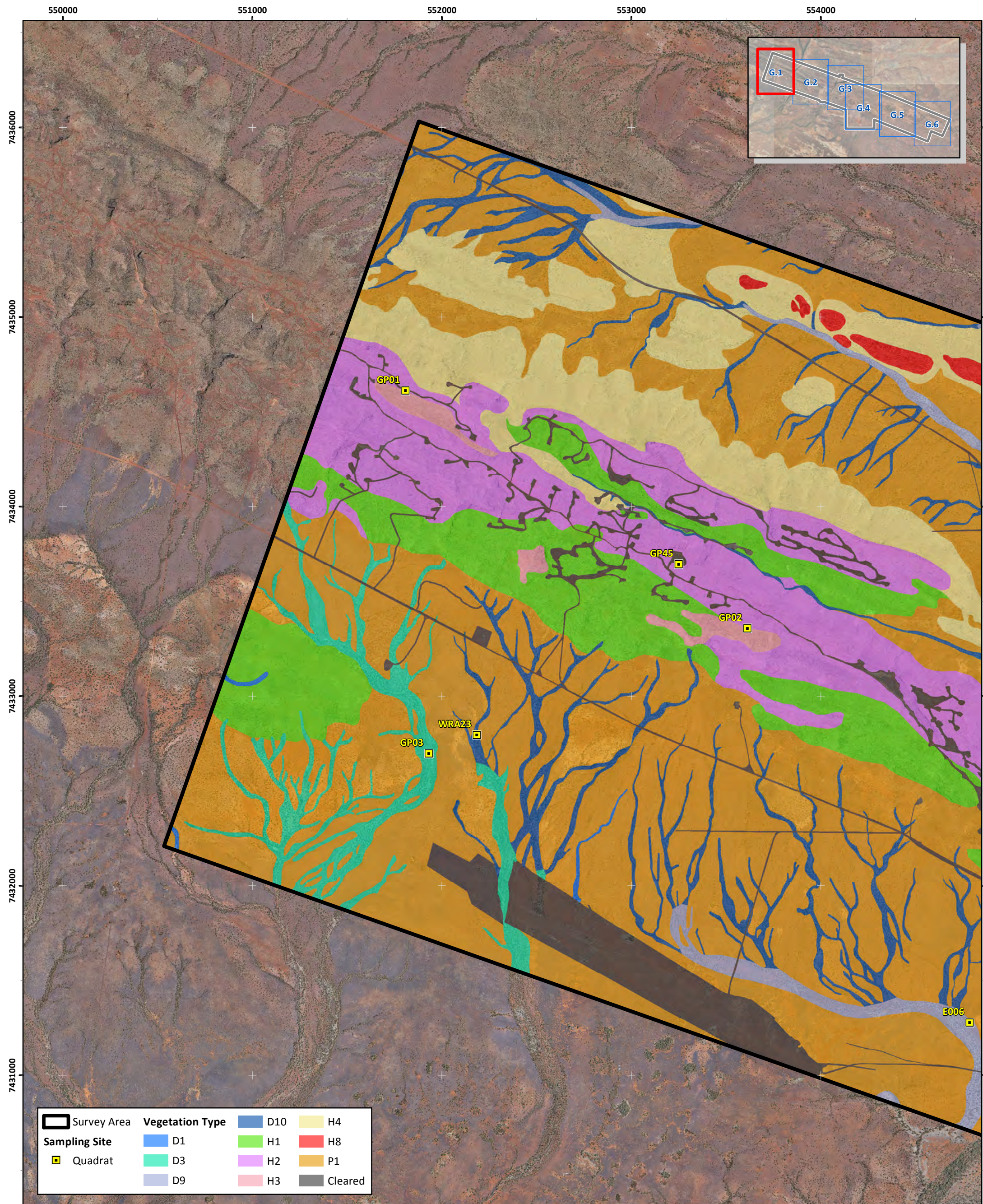
Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
Priority 4						
<i>Acacia bromilowiana</i>	Tree or shrub, to 12 m high, bark dark grey, fibrous; phyllodes more or less glaucous and slightly pruinose; inflorescence in spikes. Flowers yellow/pink, July to August.	Perennial	High in the landscape on steep slopes, ridge tops and breakaways, often in gullies and sheltered places that comprise a substrate of banded ironstone or massive basalts, on red skeletal stony loams and orange-brown pebbly, gravel loams.	49 km NNE of the survey area	Unlikely	Unlikely
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	Shrub, 0.5 m to 1.5 m high. Flowers blue, August to November.	Perennial	Rocky slopes in open <i>Eucalyptus</i> and <i>Acacia</i> shrublands, often associated with species of <i>Triodia</i> , <i>Ptilotus</i> and <i>Dodonaea</i> on skeletal soils over ironstone.	5 km NE of the survey area	Likely	Potential
<i>Eremophila youngii</i> subsp. <i>lepidota</i>	Dense, spreading shrub, (0.2-) 1 - 3 m high. Flowers purple-red-pink, January, March, June or August to September.	Perennial	Drainage lines subject to periodic flooding, flood plains or on the margins of clay depressions on red-brown soils, occasionally on stony flats, sometimes on semi-saline, clay flats.	11 km ESE of the survey area	Potential	Unlikely
<i>Lepidium catapycnon</i>	An open, woody herb or shrub with zigzag stems, 0.2 to 0.3 m in height. Flowers white, October.	Perennial	In open woodland usually in hilly areas, frequently on south-facing slopes on skeletal soils on shales and ironstone, occasionally found on road-verges and road-cuttings.	54 km NNE of the survey area	Unlikely	Unlikely
<i>Ptilotus mollis</i>	Compact shrub, to 0.5 m high, soft grey foliage. Flowers white/pink, May or September.	Perennial	Steep rocky sites, usually in full sun on massive ironstone formations.	3 km SE of the survey area	Potential	Potential
<i>Ptilotus trichocephalus</i>	Prostrate, spreading herb. Flowers white, September.	Short-lived perennial	Clay flats, sandy colluvial soils and gibber plains, usually in association with mulga.	Recorded within survey area	Previously recorded	Recorded

Species	Habit and flowering information	Life form	Habitat	Distance to nearest record	Likelihood of occurrence	
					Pre-survey	Post-survey
<i>Rhynchosia bungarensis</i>	Compact, prostrate shrub, to 0.5 m high. Flowers May to November.	Short-lived perennial	Rock piles, gorges, river beds and alluvial soils in shrubland or woodland along river courses, on pebbly, shingly coarse sands amongst boulders.	120 km NE of the survey area	Unlikely	Unlikely

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Appendix G: Vegetation Unit Mapping and Site Locations

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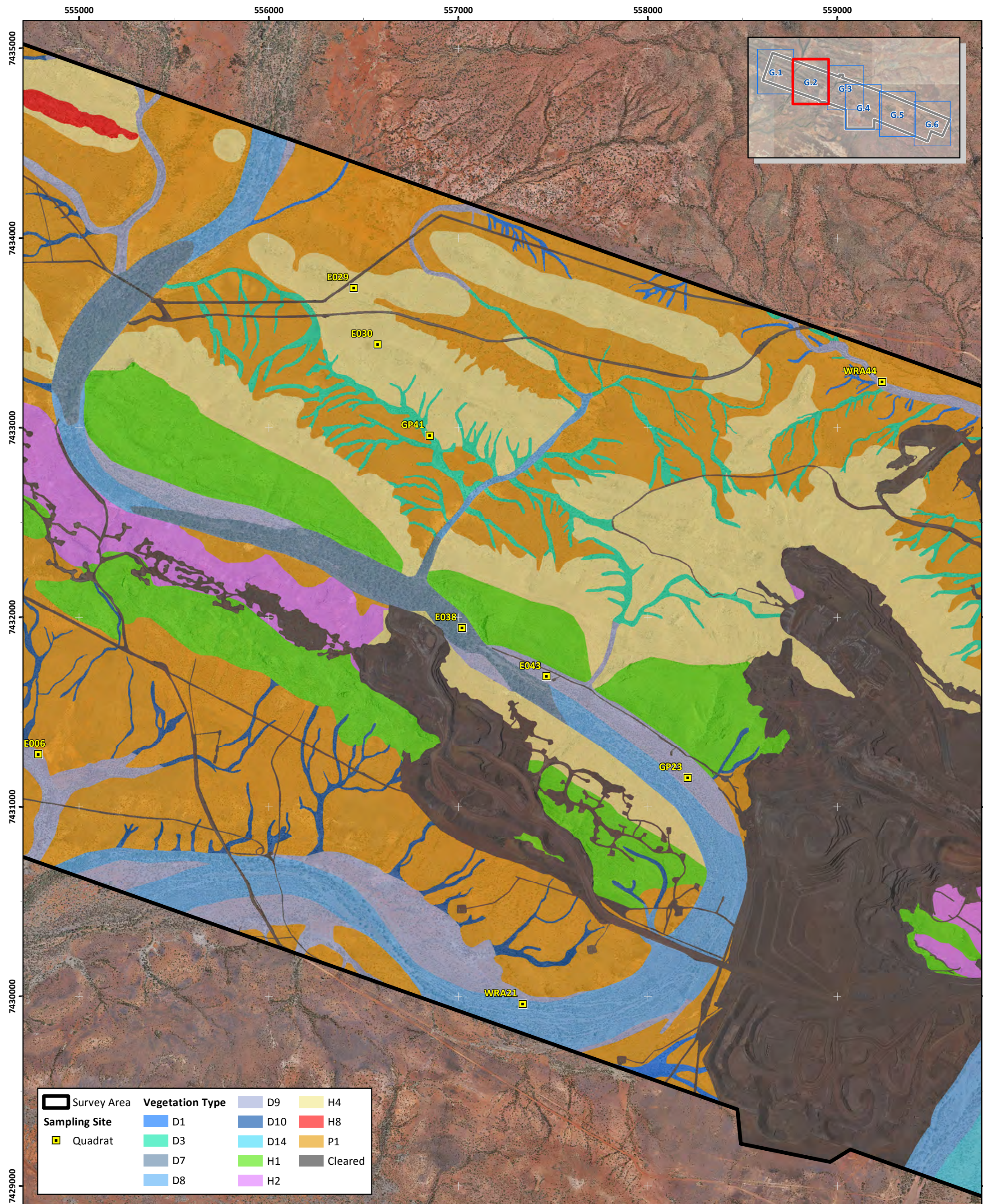
Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure G.1: Vegetation unit mapping and site locations



Author: B. Eckermann	Date: 13-12-2018	<div>Coordinate System: GDA 1994 MGA Zone 50</div> <div><div></div>Metres</div> <div>02004006008001,000</div>
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-1RevB_181213_FigG_VegMap	





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure G.2: Vegetation unit mapping and site locations

Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

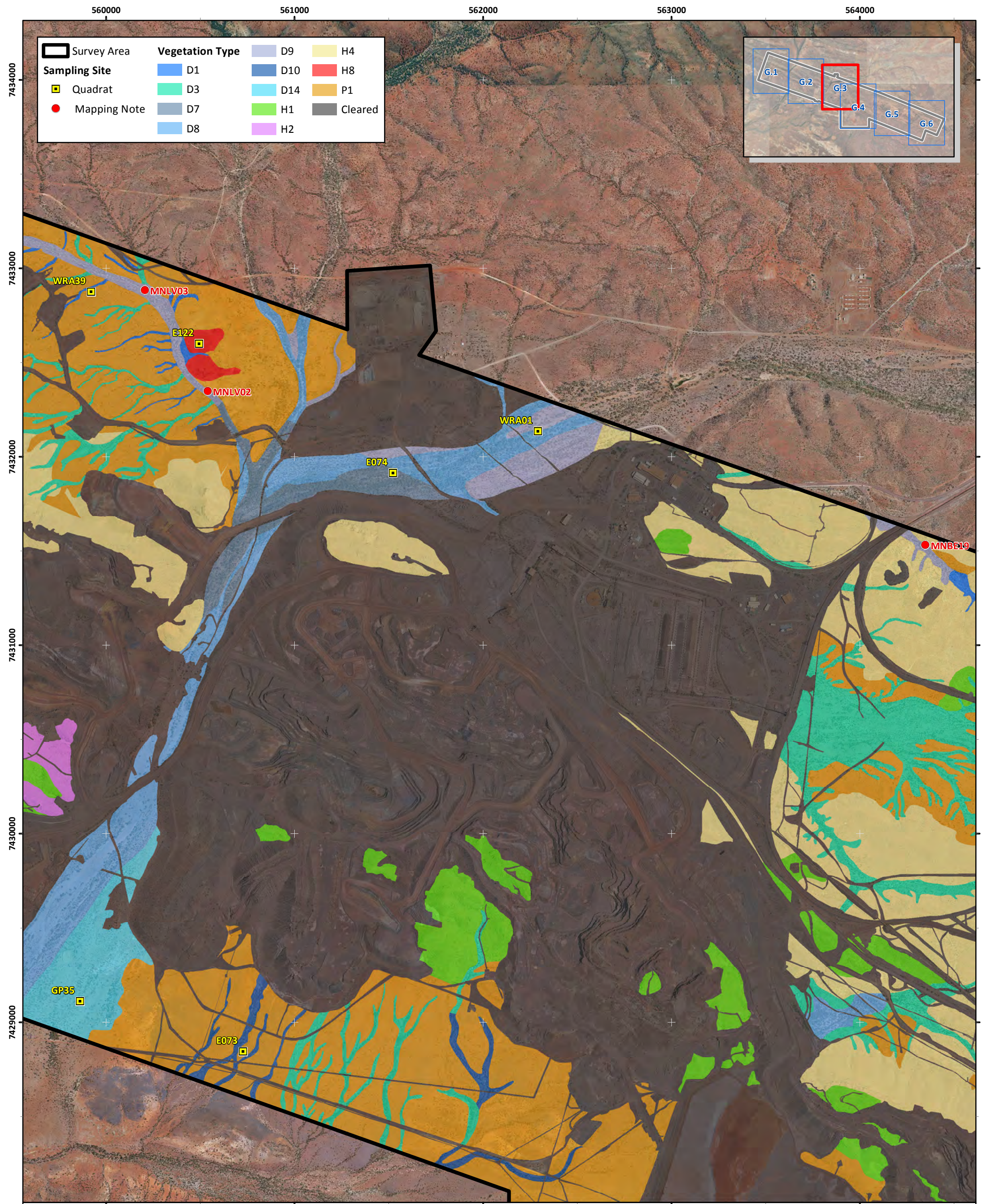
Figure Ref: 14284-18-BIDR-1RevB_181213_FigG_VegMap



Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure G.3: Vegetation unit mapping and site locations



Author: B. Eckermann

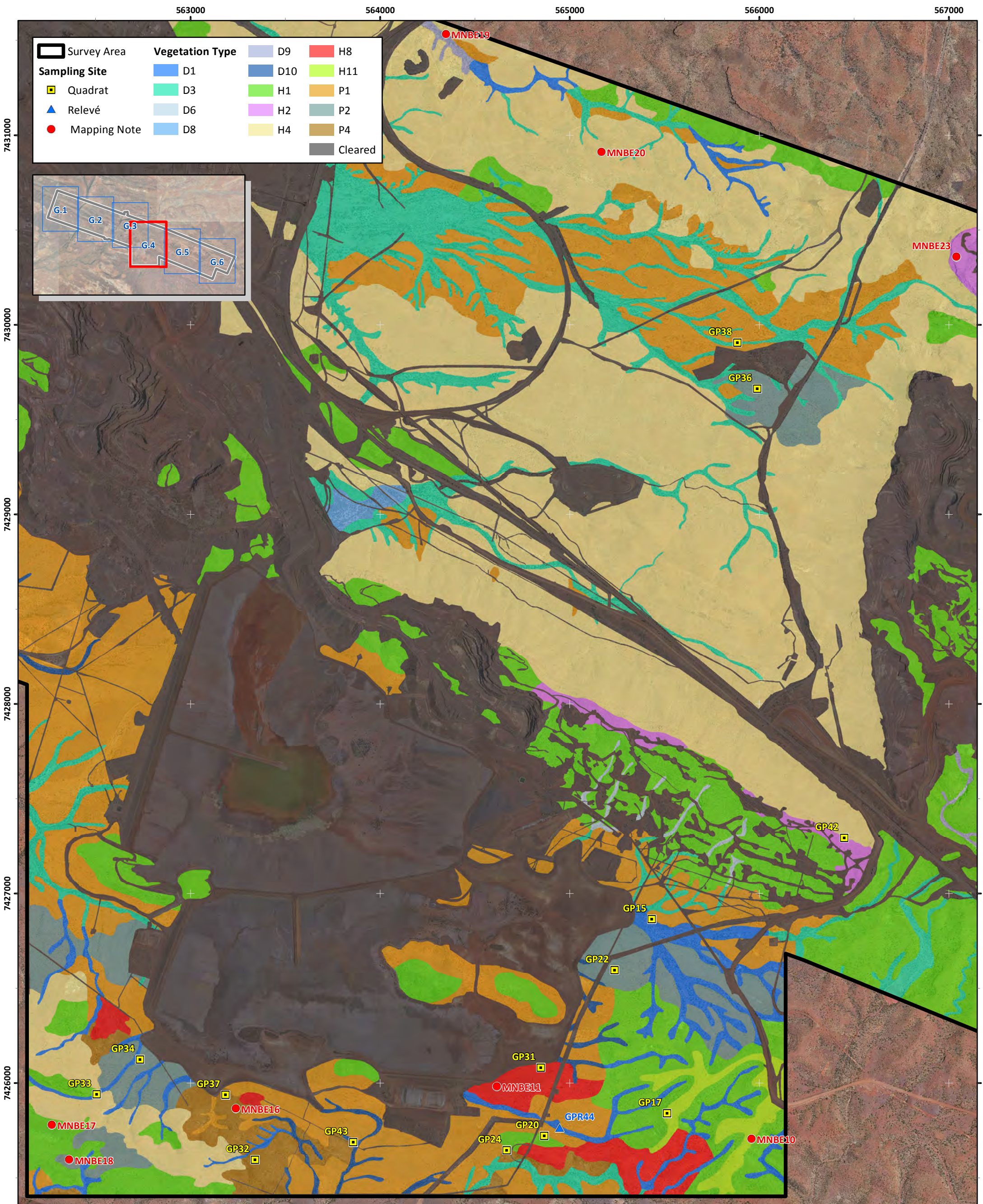
Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigG_VegMap

Coordinate System: GDA 1994 MGA Zone 50



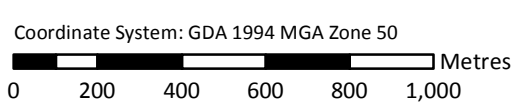


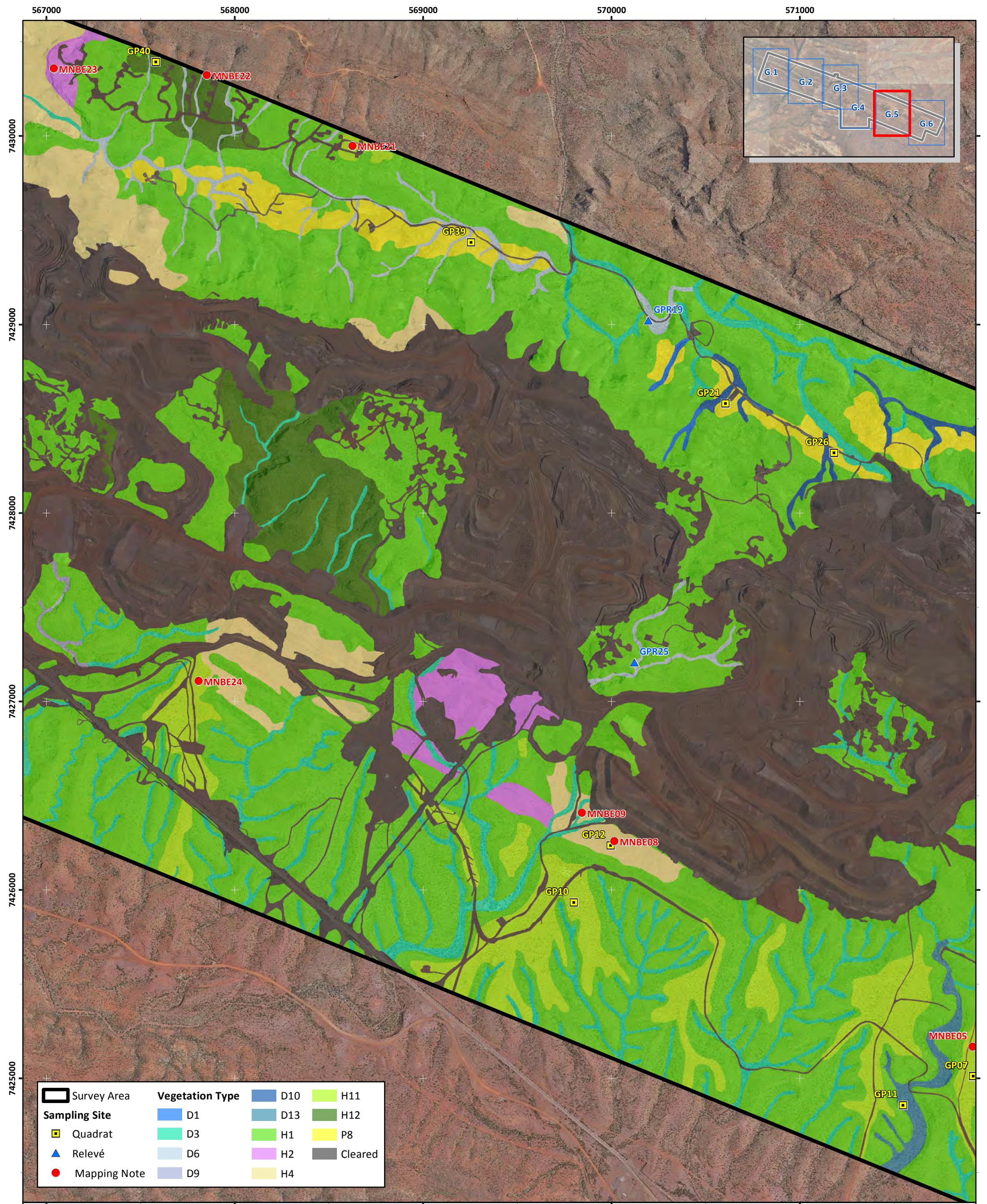
Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure G.4: Vegetation unit mapping and site locations



Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-1RevB_181213_FigG_VegMap





Survey Area

Sampling Site

Quadrat

Relevé

Mapping Note

Vegetation Type

D1

D3

D6

D9

D10

D13

H1

H2

H4

H11

H12

P8

Cleared

Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure G.5: Vegetation unit mapping and site locations

Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigG_VegMap

Coordinate System: GDA 1994 MGA Zone 50

0

200

400

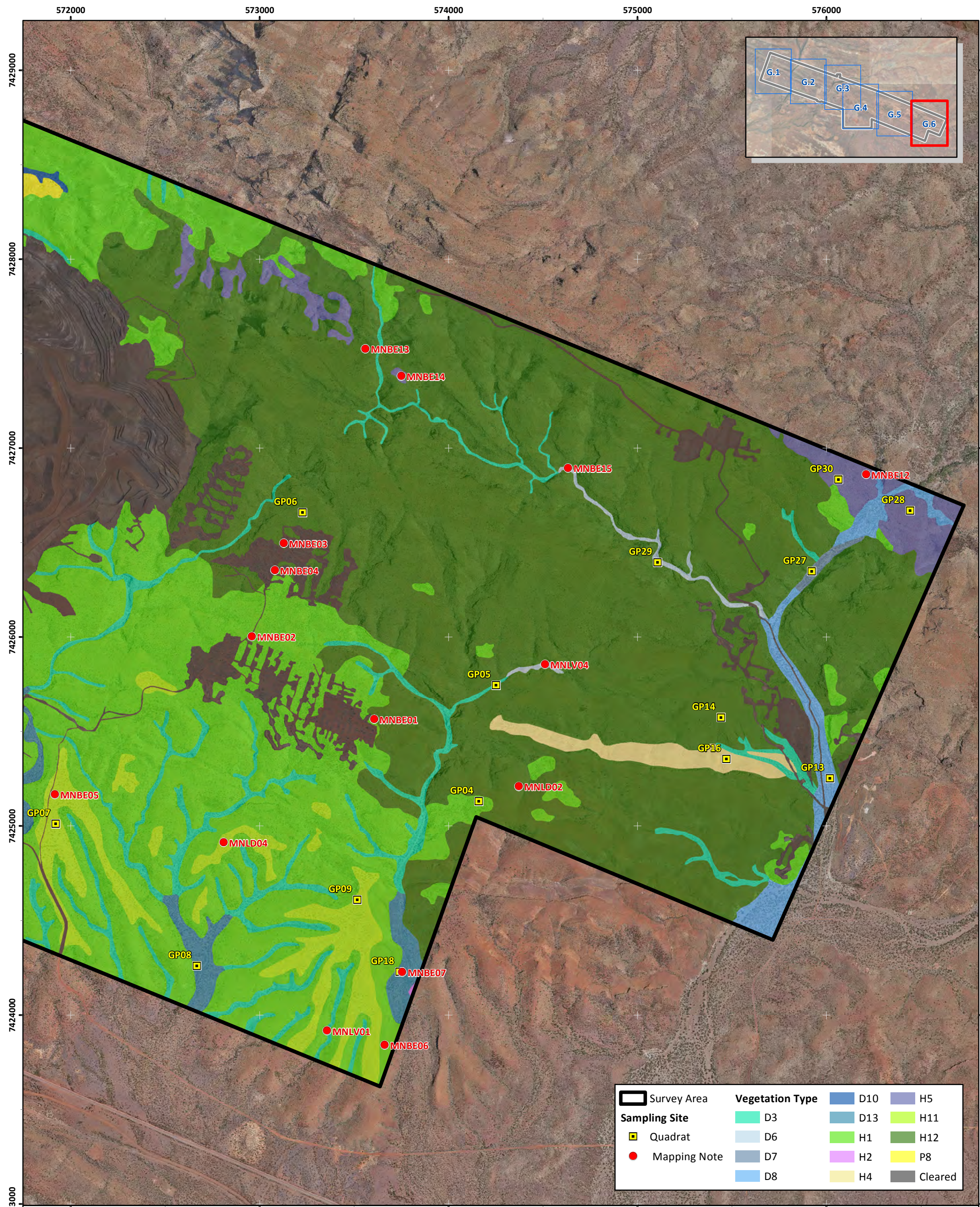
600

800

1,000

Metres





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure G.6: Vegetation unit mapping and site locations

Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigG_VegMap



Coordinate System: GDA 1994 MGA Zone 50



Vegetation of Hills and Ridges

<div></div>	H1	AanAprAteTe: <i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> tall open shrubland over <i>A. tetragonophylla</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland
<div></div>	H2	AprGbERsppTe: <i>Acacia pruinocarpa</i> , <i>Grevillea berryana</i> tall open shrubland over <i>Eremophila fraseri</i> subsp. <i>fraseri</i> , <i>E. canaliculata</i> , <i>E. cuneifolia</i> scattered low shrubs over <i>Triodia epactia</i> hummock grassland
<div></div>	H3	DpERcrTe: <i>Dodonaea pachyneura</i> , <i>Eremophila cryptothrix</i> tall shrubland over <i>Triodia epactia</i> hummock grassland
<div></div>	H4	AteAsyERcTe: <i>Acacia tetragonophylla</i> , <i>A. synchronicia</i> scattered tall shrubs over <i>Eremophila cuneifolia</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland

Vegetation of Stony Plains

<div></div>	P1	AanAxAteERcSpp: <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i> open shrubland over <i>Eremophila cuneifolia</i> , <i>Senna</i> spp. scattered low shrubs
<div></div>	P2	AanAteSspp: <i>Acacia aneura</i> sens. lat., <i>A. tetragonophylla</i> tall open shrubland over <i>Senna</i> spp. scattered low shrubs

Vegetation of Drainage Lines

<div></div>	D1	AanAwTe: <i>Acacia aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland
<div></div>	D3	AciAanAwTe: <i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland
<div></div>	D6	CfAciAanTe: <i>Corymbia ferriticola</i> scattered low trees over <i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat. tall shrubland over <i>Triodia epactia</i> open hummock grassland
<div></div>	D7	EcEvAamMgCYPv: <i>Eucalyptus camaldulensis</i> , <i>E. victrix</i> open forest over <i>Acacia ampliceps</i> , <i>Melaleuca glomerata</i> tall shrubland over <i>Cyperus vaginatus</i> open sedgeland
<div></div>	D8	EvAcMgCEspp: <i>Eucalyptus victrix</i> woodland over <i>Acacia coriacea</i> subsp. <i>pendens</i> , <i>Melaleuca glomerata</i> tall shrubland over <i>*Cenchrus</i> spp. open tussock grassland

<div></div>	H5	AteERfTw: <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Eremophila fraseri</i> subsp. <i>fraseri</i> scattered shrubs over <i>Triodia wiseana</i> hummock grassland
<div></div>	H8	AanSaoERsppARc: <i>Acacia aneura</i> sens. lat. tall open scrub over <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Eremophila</i> spp. open heath over <i>Aristida contorta</i> open bunch grassland
<div></div>	H11	ArAanERpoERlp: <i>Acacia rhodophloia</i> , <i>A. aneura</i> sens. lat. tall open shrubland over <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i> scattered shrubs over <i>Eriachne pulchella</i> open bunch grassland
<div></div>	H12	ElIAprGbTe: <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over <i>Acacia pruinocarpa</i> , <i>Grevillea berryana</i> scattered tall shrubs over <i>Triodia epactia</i> hummock grassland

<div></div>	P4	AanAxAteERcTa: <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i> , <i>Eremophila cuneifolia</i> shrubland over <i>Triodia angusta</i> hummock grassland
<div></div>	P8	AxSsTdFhMg: <i>Acacia xiphophylla</i> tall open shrubland over <i>Senna stricta</i> open shrubland over <i>Tecticornia disarticulata</i> , <i>Frankenia magnifica</i> , <i>Maireana georgei</i> low open shrubland
<div></div>	D9	AciAanCEspp: <i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat. tall shrubland over <i>*Cenchrus</i> spp. tussock grassland
<div></div>	D10	AanAxTe: <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall shrubland over mixed open shrubland over <i>Triodia epactia</i> open hummock grassland
<div></div>	D13	AciTErTe: <i>Acacia citrinoviridis</i> tall shrubland over <i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186) low open shrubland over <i>Triodia epactia</i> open hummock grassland
<div></div>	D14	AciAscCEspp: <i>Acacia citrinoviridis</i> , <i>A. sclerosperma</i> subsp. <i>sclerosperma</i> tall open shrubland over <i>*Cenchrus</i> spp. open tussock grassland

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Appendix H: Vegetation Sample Site Data

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Site: GP01
Location: Map 1
Date: 2018-04-14
MGA Zone: 50
Habitat: Hillslope
Slope: >35-50°
Soil: Dark reddish brown silty clay loam
Rock type: Ironstone
Rock Abundance: >50%
Vegetation Type: H3
Vegetation: *Acacia pruinocarpa*, *A. aptaneura*, *Grevillea berryana* tall open shrubland over *Eremophila exilifolia* scattered low shrubs over *Triodia epactia* hummock grassland
Veg Condition: Very Good
Fire Age: >10 years



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.4
<i>Acacia aptaneura</i>	3.0	3.0
<i>Acacia pruinocarpa</i>	3.0	3.5
<i>Acacia tetragonophylla</i>	0.1	3.0
<i>Amyema gibberula</i> var. <i>gibberula</i>	0.1	parasite
<i>Aristida contorta</i>	0.1	0.2
* <i>Bidens bipinnata</i>	0.1	0.1
<i>Bulbostylis barbata</i>	0.1	0.2
<i>Cheilanthes brownii</i>	0.1	0.05
<i>Dodonaea pachyneura</i>	0.1	1.2
<i>Dodonaea petiolaris</i>	0.1	1.0

Name	Cover (%)	Height (m)
<i>Eremophila exilifolia</i>	1.0	0.6
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>	0.1	1.5
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.4
<i>Eriachne mucronata</i>	0.1	0.3
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	0.1
<i>Eucalyptus</i> sp.	0.1	2.5
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.15
<i>Grevillea berryana</i>	1.0	2.5
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Marsdenia australis</i>	0.1	twiner
<i>Paspalidium clementii</i>	0.1	0.25
<i>Ptilotus calostachyus</i>	0.1	1.1
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.2
<i>Sida fibulifera</i>	0.1	0.2
<i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)	0.1	0.35
<i>Solanum lasiophyllum</i>	0.1	0.5
<i>Tribulus suberosus</i>	0.1	0.5
<i>Triodia epactia</i>	35.0	0.35

* denotes weed species

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	3.0	3.0
<i>Acacia pruinocarpa</i>	3.0	3.5
<i>Acacia tetragonophylla</i>	0.1	3.0
* <i>Bidens bipinnata</i>	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cheilanthes brownii</i>	0.1	0.1
<i>Dodonaea pachyneura</i>	0.1	1.2
<i>Dodonaea petiolaris</i>	0.1	1.0
<i>Duperreya commixta</i>	0.1	twiner
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Eremophila exilifolia</i>	1.0	1.0
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>	0.1	1.5
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.0
<i>Eriachne mucronata</i>	0.1	0.3
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Eucalyptus</i> sp.	0.1	2.5
<i>Grevillea berryana</i>	1.0	2.5
<i>Marsdenia australis</i>	0.1	twiner
<i>Paspalidium clementii</i>	0.1	0.3
<i>Psydrax suaveolens</i>	0.1	0.7
<i>Ptilotus obovatus</i>	0.1	0.7
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Scaevola acacioides</i>	0.1	1.0
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.2

Name	Cover (%)	Height (m)
<i>Sida fibulifera</i>	0.1	0.2
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.3
<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)	0.1	0.1
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia epactia</i>	35.0	0.4

* denotes weed species

Site: GP02

Location: Map 3

Date: 2018-04-14

MGA Zone: 50

Habitat: Hillslope

Slope: >35-50°

Soil: Dark reddish brown sandy loam

Rock type: Ironstone

Rock Abundance: >50%

Vegetation Type: H3

Vegetation: *Corymbia ferritcola* scattered low trees over *Acacia pruinocarpa*, *Grevillea berryana*, *A. rhodophloia*, *A. aptaneura* tall open shrubland over *Eremophila latrobei* subsp. *latrobei*, *Dodonaea petiolaris*, *D. pachyneura* open shrubland over *Triodia epactia* hummock grassland with *Eriachne mucronata* very open tussock grassland

Veg Condition: Excellent

Fire Age: >10 years

Type: Quadrat

Described by: KM

Easting: 553613

Northing: 7433359



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	2.5
<i>Acacia pruinocarpa</i>	3.0	3.5
<i>Acacia rhodophloia</i>	1.0	3.2
<i>Acacia tetragonophylla</i>	0.1	0.4
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cheilanthes brownii</i>	0.1	0.2
<i>Cymbopogon ambiguus</i>	0.1	0.6
<i>Dodonaea pachyneura</i>	1.0	1.7
<i>Dodonaea petiolaris</i>	2.0	1.2
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	2.0	1.5

Name	Cover (%)	Height (m)
<i>Eriachne mucronata</i>	2.0	0.3
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1.5	2.5
<i>Grevillea berryana</i>	2.0	3.2
<i>Hibiscus burtonii</i>	0.1	0.3
<i>Hibiscus coatesii</i>	0.1	0.3
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3
<i>Marsdenia australis</i>	0.1	twiner
<i>Paspalidium clementii</i>	0.1	0.15
<i>Polycarpaea longiflora</i>	0.1	0.1
<i>Psydrax suaveolens</i>	0.1	0.5
<i>Ptilotus calostachyus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Sida fibulifera</i>	0.1	0.3
<i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)	0.1	0.25
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.6
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia epactia</i>	45.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	2.5
<i>Acacia pruinocarpa</i>	3.0	3.5
<i>Acacia rhodophloia</i>	1.0	3.2
<i>Acacia tetragonophylla</i>	0.1	2.0
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cheilanthes brownii</i>	0.1	0.2
<i>Corymbia ferriticola</i>	1.5	3.0
<i>Cymbopogon ambiguus</i>	0.1	0.6
<i>Dodonaea pachyneura</i>	1.0	2.0
<i>Dodonaea petiolaris</i>	2.0	1.6
<i>Duperreya commixta</i>	0.1	2.0
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	2.0	1.7
<i>Eriachne mucronata</i>	2.0	0.3
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.2
<i>Grevillea berryana</i>	2.0	3.2
<i>Hibiscus burtonii</i>	0.1	0.6
<i>Hibiscus coatesii</i>	0.1	0.3
<i>Maireana georgei</i>	0.1	0.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3
<i>Paspalidium clementii</i>	0.1	0.15
<i>Polycarpaea longiflora</i>	0.1	0.1
<i>Portulaca oleracea</i>	0.1	0.1
<i>Psydrax suaveolens</i>	0.1	2.0
<i>Ptilotus obovatus</i>	0.1	0.4

Name	Cover (%)	Height (m)
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.5
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.3
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.3
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.6
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia epactia</i>	45.0	0.4

Site: GP03**Location:** Map 2**Date:** 2018-04-14**MGA Zone:** 50**Habitat:** Minor creek**Slope:** 0-5°**Soil:** Red brown sandy loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** D3

Vegetation: *Acacia citrinoviridis*, *A. wanyu* tall shrubland over *Enchylaena tomentosa* var. *tomentosa* scattered shrubs over *Ptilotus obovatus*, *Dipteracanthus australasicus* subsp. *australasicus* low open shrubland over **Cenchrus ciliaris*, (**C. setiger*) very open tussock grassland

Veg Condition: Poor**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 551932**Northing:** 7432697**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Abutilon lepidum</i>	0.1	0.2
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.3
<i>Acacia citrinoviridis</i>	18.0	7.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	0.4
<i>Acacia tetragonophylla</i>	0.1	3.0
<i>Acacia wanyu</i>	12.0	2.5
<i>*Aerva javanica</i>	0.1	0.5
<i>*Cenchrus ciliaris</i>	7.0	0.6
<i>*Cenchrus setiger</i>	1.0	0.5

Name	Cover (%)	Height (m)
<i>Corchorus crozophorifolius</i>	0.1	0.4
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dicladanthera forrestii</i>	0.1	0.3
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	1.0	0.4
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	1.0	2.0
<i>Enneapogon caeruleus</i>	0.1	0.1
<i>Enneapogon polyphyllus</i>	0.1	0.1
<i>Eriachne pulchella</i>	0.1	0.1
<i>Glycine canescens</i>	0.1	twiner
<i>Hybanthus aurantiacus</i>	0.1	0.2
<i>Indigofera monophylla</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Maireana georgei</i>	0.1	0.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.4
* <i>Malvastrum americanum</i>	0.1	0.4
<i>Melhania oblongifolia</i>	0.1	0.3
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Ptilotus obovatus</i>	2.0	0.4
<i>Rhagodia eremaea</i>	0.1	1.1
<i>Rhynchosia minima</i>	0.1	twiner
<i>Santalum spicatum</i>	0.1	1.0
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	2.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	2.0
<i>Sida echinocarpa</i>	0.1	0.4
<i>Solanum piceum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	0.1	0.7
<i>Tribulus suberosus</i>	0.1	0.5
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.4
<i>Triodia epactia</i>	0.1	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.2
<i>Abutilon lepidum</i>	0.1	0.2
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.3
<i>Acacia citrinoviridis</i>	18.0	6.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.5
<i>Acacia tetragonophylla</i>	0.1	3.0
<i>Acacia wanyu</i>	12.0	2.5
* <i>Aerva javanica</i>	0.1	0.5
* <i>Cenchrus ciliaris</i>	7.0	0.6
* <i>Cenchrus setiger</i>	1.0	0.5
<i>Cleome viscosa</i>	0.1	0.3
<i>Corchorus crozophorifolius</i>	0.1	0.4
<i>Cucumis variabilis</i>	0.1	twiner

Name	Cover (%)	Height (m)
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	1.0	0.4
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	1.0	2.0
<i>Enneapogon polyphyllus</i>	0.1	0.1
<i>Eriachne pulchella</i>	0.1	0.1
<i>Glycine canescens</i>	0.1	twiner
<i>Hibiscus coatesii</i>	0.1	1.2
<i>Hybanthus aurantiacus</i>	0.1	0.3
<i>Indigofera monophylla</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	twiner
<i>Maireana georgei</i>	0.1	0.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.4
* <i>Malvastrum americanum</i>	0.1	0.4
<i>Melhania oblongifolia</i>	0.1	0.3
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.1
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Ptilotus obovatus</i>	2.0	0.4
<i>Rhagodia eremaea</i>	0.1	1.1
<i>Rhynchosia minima</i>	0.1	twiner
<i>Santalum spicatum</i>	0.1	2.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.7
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	2.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	2.0
* <i>Setaria verticillata</i>	0.1	0.2
<i>Sida echinocarpa</i>	0.1	0.3
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum piceum</i>	0.1	1.1
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.4
<i>Tribulus suberosus</i>	0.1	0.5
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.4
<i>Triodia epactia</i>	0.1	0.4

* denotes weed species

Site: GP04**Location:** Map 19**Date:** 2018-04-10**MGA Zone:** 50**Habitat:** Hillslope**Slope:** >5-10°**Soil:** Red brown sandy loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** H1

Vegetation: *Acacia pteraneura* tall shrubland over *A. tetragonophylla* scattered shrubs over *Ptilotus schwartzii* var. *schwartzii* scattered low shrubs over *Triodia epactia* open hummock grassland with *Eriachne pulchella* scattered tussock grasses

Veg Condition: Excellent**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 574160**Northing:** 7425130**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia incurvaneura</i>	15.0	3.5
<i>Acacia pruinocarpa</i>	1.0	1.8
<i>Acacia synchronicia</i>	0.1	0.3
<i>Acacia tetragonophylla</i>	2.0	1.5
<i>Aristida holathera</i> var. <i>holathera</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	0.1	0.6
<i>Eremophila exilifolia</i>	0.1	0.4
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	0.3
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.8
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.0

Name	Cover (%)	Height (m)
<i>Eriachne mucronata</i>	1.0	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0.1	1.0
<i>Goodenia microptera</i>	0.1	0.2
<i>Goodenia</i> sp.	0.1	0.2
<i>Grevillea berryana</i>	0.5	2.5
<i>Ptilotus calostachyus</i>	0.5	0.4
<i>Scaevola acacioides</i>	0.1	1.0
<i>Senna stricta</i>	0.1	0.6
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Trianthema glossostigmum</i>	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.5
<i>Triodia epactia</i>	20.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia pruinocarpa</i>	0.1	2.3
<i>Acacia pteraneura</i>	15.0	3.5
<i>Acacia synchronicia</i>	0.1	0.2
<i>Acacia tetragonophylla</i>	1.0	1.5
<i>Eremophila cuneifolia</i>	0.1	0.9
<i>Eremophila exilifolia</i>	0.1	0.5
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.1
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.3
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.2
<i>Eriachne pulchella</i>	1.0	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0.1	4.0
<i>Goodenia microptera</i>	0.1	0.05
<i>Grevillea berryana</i>	0.1	3.0
<i>Maireana georgei</i>	0.1	0.1
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	1.0	0.5
<i>Scaevola acacioides</i>	0.1	1.0
<i>Senna stricta</i>	0.1	0.7
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Trianthema glossostigmum</i>	0.1	0.03
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia epactia</i>	15.0	0.6

Site: GP05**Location:** Map 19**Date:** 2018-04-10**MGA Zone:** 50**Habitat:** Minor creek**Slope:** 0-5°**Soil:** Red brown clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** D6**Vegetation:** *Acacia citrinoviridis*, (*Hibiscus campanulatus*) tall shrubland over *Triodia epactia* open hummock grassland with *Eriachne mucronata*, *Cymbopogon ambiguus* very open tussock grassland and *Gomphrena cunninghamii* scattered herbs**Veg Condition:** Very Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 574252**Northing:** 7425744**Phase 1 Speies List**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	1.5
<i>Acacia citrinoviridis</i>	20.0	4.0
<i>Acacia pyrifolia</i>	0.1	0.6
<i>Acacia tetragonophylla</i>	0.1	1.7
<i>Boerhavia coccinea</i>	0.1	0.25
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cleome viscosa</i>	0.1	0.4
<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>	0.1	0.2
<i>Corchorus crozophorifolius</i>	0.1	1.0
<i>Corymbia ferriticola</i>	0.1	3.0

Name	Cover (%)	Height (m)
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	1.0	0.6
<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.1	0.15
<i>Dodonaea pachyneura</i>	0.1	1.5
<i>Duperreya commixta</i>	0.1	twiner
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	0.1	0.15
<i>Eremophila cryptothrix</i>	0.1	1.6
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.6
<i>Eremophila</i> sp.	0.1	1.1
<i>Eriachne mucronata</i>	2.0	0.25
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0.1	4.0
<i>Euphorbia australis</i> var. <i>hispidula</i>	0.1	0.1
<i>Euphorbia boophthona</i>	0.1	0.1
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Hibiscus campanulatus</i> P1	5.0	2.5
<i>Indigofera monophylla</i>	0.1	0.05
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Notoleptopus decaisnei</i>	0.1	0.15
<i>Paspalidium clementii</i>	0.1	0.15
<i>Pluchea dentex</i>	0.1	0.25
<i>Polycarpaea longiflora</i>	0.1	0.25
<i>Psydrax latifolia</i>	0.1	1.0
<i>Pterocaulon sphacelatum</i>	0.1	0.5
<i>Ptilotus obovatus</i>	0.1	0.4
* <i>Rumex vesicarius</i>	0.1	0.05
<i>Scaevola acacioides</i>	0.1	1.8
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	1.2
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	1.0
<i>Stemodia grossa</i>	0.1	0.35
<i>Tephrosia</i> sp.	0.1	0.4
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.4
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.4
<i>Triodia epactia</i>	15.00	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	2.2
<i>Acacia citrinoviridis</i>	20.0	6.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	1.6
<i>Acacia tetragonophylla</i>	0.1	0.6
<i>Amaranthus cuspidifolius</i>	0.1	0.2
<i>Boerhavia coccinea</i>	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.2
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cleome viscosa</i>	0.1	0.3
<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>	0.1	0.8

Name	Cover (%)	Height (m)
<i>Corchorus crozophorifolius</i>	0.1	0.9
<i>Corymbia ferriticola</i>	0.1	4.5
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	1.0	0.8
<i>Duperreya commixta</i>	0.1	twiner
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.8
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.1	1.4
<i>Eriachne mucronata</i>	3.0	0.5
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0.1	4.5
<i>Gomphrena cunninghamii</i>	1.5	0.2
<i>Grevillea berryana</i>	0.1	0.5
<i>Hibiscus campanulatus</i> P1	5.0	2.5
<i>Indigofera monophylla</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	twiner
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.2
<i>Oldenlandia crouchiana</i>	0.1	0.05
<i>Paspalidium clementii</i>	0.1	0.1
<i>Pluchea dentex</i>	0.1	0.4
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Psydrax latifolia</i>	0.1	0.8
<i>Pterocaulon sphacelatum</i>	0.1	0.4
<i>Ptilotus clementii</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.1	1.1
<i>Rhagodia eremaea</i>	0.1	1.0-
<i>Rhynchosia minima</i>	0.1	twiner
<i>Scaevola acacioides</i>	0.1	1.3
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.5
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	0.1	0.4
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Stemodia grossa</i>	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.2
<i>Triodia epactia</i>	12.0	0.6

* denotes weed species

Site: GP06

Location: Map 18

Date: 2018-04-10

MGA Zone: 50

Habitat: Hillslope

Slope: >20-35°

Soil: Red brown sandy loam

Rock type: Ironstone

Rock Abundance: >50%

Vegetation Type: H12

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia tetragonophylla* scattered tall shrubs over *A. citrinoviridis* scattered shrubs over *Triodia epactia* hummock grassland

Veg Condition: Excellent

Fire Age: >10 years

Type: Quadrat

Described by: BE

Easting: 573228

Northing: 7426659



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	0.5	1.5
<i>Acacia pruinocarpa</i>	1.0	1.0
<i>Acacia sibirica</i>	0.1	1.3
<i>Acacia tetragonophylla</i>	1.0	1.5
<i>Corchorus crozophorifolius</i>	0.1	0.2
<i>Cymbopogon ambiguus</i>	0.1	0.4
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	0.1	0.25
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	0.2
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.5

Name	Cover (%)	Height (m)
<i>Eriachne mucronata</i>	0.1	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2.0	6.0
<i>Euphorbia boophthona</i>	0.1	0.25
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Goodenia stobbsiana</i>	0.1	0.3
<i>Grevillea berryana</i>	1.0	1.5
<i>Indigofera monophylla</i>	0.1	0.2
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Psyrax latifolia</i>	0.1	0.7
<i>Ptilotus calostachyus</i>	0.1	0.35
<i>Ptilotus obovatus</i>	0.1	0.35
<i>Scaevola acacioides</i>	0.1	1.3
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.2
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.2
<i>Triodia epactia</i>	40.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	0.5	1.9
<i>Acacia pruinocarpa</i>	0.1	1.2
<i>Acacia rhodophloia</i>	0.1	1.1
<i>Acacia sibirica</i>	0.1	1.6
<i>Acacia tetragonophylla</i>	1.0	2.5
<i>Cleome viscosa</i>	0.1	0.2
<i>Cucumis variabilis</i>	0.1	twiner
<i>Eremophila cuneifolia</i>	0.1	0.2
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.7
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.1	1.3
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.5
<i>Eriachne pulchella</i>	0.1	0.2
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1.5	6.0
<i>Euphorbia boophthona</i>	0.1	0.1
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Goodenia stobbsiana</i>	0.1	0.4
<i>Grevillea berryana</i>	0.1	1.5
<i>Indigofera monophylla</i>	0.1	0.4
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Oldenlandia crouchiana</i>	0.1	0.1
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Scaevola acacioides</i>	0.1	1.1
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.2
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Solanum phlomoides</i>	0.1	0.2
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Tribulus suberosus</i>	0.1	0.2
<i>Triodia epactia</i>	40.0	0.6

Site: GP07**Location:** Map 17**Date:** 2018-04-09**MGA Zone:** 50**Habitat:** Plain**Slope:** 0-5°**Soil:** Red brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** H11

Vegetation: *Acacia rhodophloia*, *A. aptaneura* tall open shrubland over *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Ptilotus schwartzii* var. *schwartzii* scattered low shrubs over *Triodia epactia* very open hummock grassland with *Eriachne pulchella* open tussock grassland

Veg Condition: Excellent**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 571921**Northing:** 7425011**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.5	3.0
<i>Acacia pruinocarpa</i>	0.1	2.0
<i>Acacia rhodophloia</i>	3.0	3.0
<i>Acacia tetragonophylla</i>	0.1	1.9
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cymbopogon ambiguus</i>	0.1	0.35
<i>Digitaria brownii</i>	0.1	0.35
<i>Duperreya commixta</i>	0.1	twiner
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.0
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	1.1

Name	Cover (%)	Height (m)
<i>Eriachne pulchella</i>	35.0	0.1
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.1
<i>Goodenia microptera</i>	0.1	0.1
<i>Grevillea berryana</i>	0.1	0.1
<i>Heliotropium heteranthum</i>	0.1	0.02
<i>Portulaca oleracea</i>	0.1	0.01
<i>Psyrax latifolia</i>	0.1	0.6
<i>Ptilotus calostachyus</i>	0.1	0.38
<i>Ptilotus exaltatus</i>	0.1	0.25
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.3
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Tribulus suberosus</i>	0.1	0.3
<i>Trigastrotheca molluginea</i>	0.1	0.15
<i>Triodia epactia</i>	0.1	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	2.0	4.2
<i>Acacia pruinocarpa</i>	0.1	2.1
<i>Acacia rhodophloia</i>	3.0	4.0
<i>Acacia sibirica</i>	0.1	4.0
<i>Acacia tetragonophylla</i>	0.1	1.8
<i>Aristida contorta</i>	0.1	0.3
<i>Dodonaea petiolaris</i>	0.1	0.5
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.1
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.5
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.1	1.2
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	1.1
<i>Eriachne pulchella</i>	20.0	0.15
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.25
<i>Goodenia microptera</i>	0.1	0.05
<i>Grevillea berryana</i>	0.1	0.2
<i>Heliotropium heteranthum</i>	0.1	0.02
<i>Hibiscus sturtii</i>	0.1	0.3
<i>Paspalidium clementii</i>	0.1	0.1
<i>Phyllanthus erwinii</i>	0.1	0.02
<i>Portulaca oleracea</i>	0.1	0.03
<i>Psyrax latifolia</i>	0.1	0.6
<i>Ptilotus exaltatus</i>	0.1	0.1
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	1.0	0.5
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.3
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.4
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Tribulus suberosus</i>	0.1	0.5
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia epactia</i>	2.0	0.6

Site: GP08**Location:** Map 19**Date:** 2018-04-10**MGA Zone:** 50**Habitat:** Minor creek**Soil:** Dark reddish brown silty loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** D13

Vegetation: *Acacia citrinoviridis*, (*A. tetragonophylla*, *A. pruinocarpa*, *Dodonaea petiolaris*, *Hibiscus campanulatus*) tall shrubland over *Tephrosia* sp. Fortescue (A.A. Mitchell 606), *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Triodia epactia* open hummock grassland

Veg Condition: Very Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 572669**Northing:** 7424260**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.2
<i>Acacia aptaneura</i>	0.1	3.5
<i>Acacia citrinoviridis</i>	14.0	3.5
<i>Acacia pruinocarpa</i>	1.0	4.5
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.0
<i>Acacia tetragonophylla</i>	3.0	3.0
* <i>Bidens bipinnata</i>	0.1	0.3
<i>Bonamia pilbarensis</i>	0.1	0.1
<i>Bulbostylis turbinata</i>	0.1	0.1
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dodonaea pachyneura</i>	0.1	1.2

Name	Cover (%)	Height (m)
<i>Dodonaea petiolaris</i>	1.0	2.2
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.5
<i>Enneapogon caeruleus</i>	0.1	0.15
<i>Eremophila cuneifolia</i>	0.1	0.2
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	0.6
<i>Eremophila latrobei</i>	0.1	1.0
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	2.0
<i>Euphorbia biconvexa</i>	0.1	0.4
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	0.2
<i>Glycine canescens</i>	0.1	twiner
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Goodenia microptera</i>	0.1	0.2
<i>Grevillea berryana</i>	0.1	2.5
<i>Hibiscus campanulatus</i> P1	1.0	2.2
<i>Hybanthus aurantiacus</i>	0.1	0.2
<i>Indigofera monophylla</i>	0.1	0.4
<i>Isotropis forrestii</i>	0.1	0.4
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
* <i>Malvastrum americanum</i>	0.1	0.3
<i>Marsdenia australis</i>	0.1	twiner
<i>Paspalidium clementii</i>	0.1	0.2
<i>Pluchea dentex</i>	0.1	0.35
<i>Polycarpha longiflora</i>	0.1	0.2
<i>Psyrax latifolia</i>	0.1	0.6
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Rhagodia eremaea</i>	0.1	1.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.5	2.0
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	0.2
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.15
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	1.0	1.5
<i>Tribulus suberosus</i>	0.1	0.5
<i>Trigastrotheca molluginea</i>	0.1	0.1
<i>Triodia epactia</i>	29.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Acacia aptaneura</i>	0.1	3.5
<i>Acacia citrinoviridis</i>	14.0	4.0
<i>Acacia pruinocarpa</i>	1.0	4.5
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	3.0	3.0

Name	Cover (%)	Height (m)
* <i>Bidens bipinnata</i>	0.1	0.3
<i>Boerhavia coccinea</i>	0.1	0.1
<i>Bonamia pilbarensis</i>	0.1	0.1
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	0.1	0.2
<i>Cleome viscosa</i>	0.1	0.3
<i>Corchorus crozophorifolius</i>	0.1	0.7
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	0.1	1.0
<i>Dodonaea pachyneura</i>	0.1	1.2
<i>Dodonaea petiolaris</i>	1.0	2.2
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.7
<i>Enneapogon caeruleus</i>	0.1	0.1
<i>Eremophila cuneifolia</i>	0.1	1.6
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	0.6
<i>Eremophila latrobei</i>	0.1	1.0
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	2.0
<i>Eriachne mucronata</i>	0.1	0.3
<i>Euphorbia biconvexa</i>	0.1	0.3
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	0.2
<i>Glycine canescens</i>	0.1	twiner
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Grevillea berryana</i>	0.1	3.0
<i>Hibiscus campanulatus</i> P1	1.0	2.3
<i>Hybanthus aurantiacus</i>	0.1	0.3
<i>Indigofera monophylla</i>	0.1	0.8
<i>Isotropis forrestii</i>	0.1	0.5
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
* <i>Malvastrum americanum</i>	0.1	0.3
<i>Marsdenia australis</i>	0.1	twiner
<i>Paspalidium clementii</i>	0.1	0.3
<i>Petalostylis labicheoides</i>	0.1	1.2
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.2
<i>Psydrax latifolia</i>	0.1	0.8
<i>Ptilotus obovatus</i>	0.1	1.1
<i>Rhagodia eremaea</i>	0.1	1.3
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.5	2.1
<i>Senna stricta</i>	0.1	1.6
<i>Sida fibulifera</i>	0.1	0.2
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	0.2
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	1.0	1.5
<i>Tribulus suberosus</i>	0.1	0.5
<i>Trigastrotheca molluginea</i>	0.1	0.1
<i>Triodia epactia</i>	29.0	0.5

* denotes weed species

Site: GP09**Location:** Map 19**Date:** 2018-04-09**MGA Zone:** 50**Habitat:** Plain**Slope:** 0-5°**Soil:** Red brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** H11**Vegetation:** *Acacia rhodophloia*, (*A. aptaneura*) tall shrubland over *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Eriachne pulchella* subsp. *dominii* open tussock grassland**Veg Condition:** Excellent**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 573517**Northing:** 7424609**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia aneura</i>	1.0	4.0
<i>Acacia pruinocarpa</i>	0.1	2.5
<i>Acacia rhodophloia</i>	20.0	4.0
<i>Aristida contorta</i>	0.1	0.35
<i>Bulbostylis barbata</i>	0.1	0.07
<i>Cucumis variabilis</i>	0.1	twiner
<i>Enneapogon caeruleus</i>	0.1	0.25
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Eremophila latrobei</i>	0.1	1.0
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.0	1.5
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	35.0	0.1
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.25

Name	Cover (%)	Height (m)
<i>Gomphrena cunninghamii</i>	0.1	0.15
<i>Goodenia microptera</i>	0.1	0.35
<i>Goodenia stobbsiana</i>	0.1	0.2
<i>Grevillea berryana</i>	0.1	2.0
<i>Heliotropium heteranthum</i>	0.1	0.03
<i>Portulaca oleracea</i>	0.1	0.1
<i>Pterocaulon sphacelatum</i>	0.1	0.38
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus helipteroides</i>	0.1	0.2
<i>Ptilotus exaltatus</i>	0.1	0.4
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Tribulus suberosus</i>	0.1	0.35
<i>Trigastrotheca molluginea</i>	0.1	0.15
<i>Triodia epactia</i>	0.5	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	4.0
<i>Acacia pruinocarpa</i>	0.1	2.2
<i>Acacia rhodophloia</i>	11.0	4.0
<i>Acacia tetragonophylla</i>	0.1	3.0
<i>Aristida contorta</i>	0.1	0.2
<i>Boerhavia coccinea</i>	0.1	0.1
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cucumis variabilis</i>	0.1	twiner
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.2
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.0	1.5
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	12.0	0.1
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.2
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Goodenia microptera</i>	0.1	0.1
<i>Grevillea berryana</i>	0.1	2.5
<i>Heliotropium heteranthum</i>	0.1	0.1
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.2
<i>Paspalidium clementii</i>	0.1	0.2
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus helipteroides</i>	0.1	0.1
<i>Ptilotus exaltatus</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.3
<i>Rhagodia eremaea</i>	0.1	0.4
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.8
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia epactia</i>	1.0	0.4

Site: GP10

Location: Map 17

Date: 2018-04-10

MGA Zone: 50

Habitat: Plain

Soil: Dark reddish brown sandy loam

Rock type: Ironstone

Rock Abundance: >50%

Vegetation Type: H11

Vegetation: *Acacia rhodophloia*, (*A. aptaneura*) tall open shrubland over *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Triodia epactia* very open hummock grasses with *Eriachne pulchella* subsp. *dominii* very open tussock grassland

Veg Condition: Excellent

Fire Age: >10 years

Type: Quadrat

Described by: KM

Easting: 569801

Northing: 7425935



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	3.5
<i>Acacia rhodophloia</i>	4.0	3.0
<i>Acacia tetragonophylla</i>	0.1	1.5
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cheilanthes brownii</i>	0.1	0.2
<i>Corchorus crozophorifolius</i>	0.1	0.2
<i>Enneapogon caeruleus</i>	0.1	0.1
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.4
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4
<i>Eremophila latrobei</i>	0.1	2.1
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.0	1.1

Name	Cover (%)	Height (m)
<i>Eriachne pulchella</i>	1.0	0.15
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.2
<i>Goodenia microptera</i>	0.1	0.3
<i>Grevillea berryana</i>	0.1	0.4
<i>Heliotropium heteranthum</i>	0.1	0.1
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Paspalidium clementii</i>	0.1	0.2
<i>Psydrax latifolia</i>	0.1	0.4
<i>Psydrax suaveolens</i>	0.1	1.0
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Santalum lanceolatum</i>	0.1	0.6
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.1
<i>Solanum horridum</i>	0.1	0.25
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Trianthema glossostigmum</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	1.2
<i>Triodia epactia</i>	1.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	3.5
<i>Acacia rhodophloia</i>	4.0	3.0
<i>Acacia tetragonophylla</i>	0.1	1.5
<i>Cheilanthes brownii</i>	0.1	0.2
<i>Digitaria brownii</i>	0.1	0.3
<i>Dodonaea petiolaris</i>	0.1	1.2
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.8
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4
<i>Eremophila latrobei</i>	0.1	1.2
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.0	1.1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	6.0	0.15
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.2
<i>Goodenia microptera</i>	0.1	0.1
<i>Grevillea berryana</i>	0.1	4.5
<i>Heliotropium heteranthum</i>	0.1	0.02
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.15
<i>Hybanthus aurantiacus</i>	0.1	0.15
<i>Marsdenia australis</i>	0.1	1.2
<i>Paspalidium clementii</i>	0.1	0.15
<i>Portulaca oleracea</i>	0.1	0.05
<i>Psydrax latifolia</i>	0.1	0.5
<i>Psydrax suaveolens</i>	0.1	1.6
<i>Ptilotus helipteroides</i>	0.1	0.02
<i>Ptilotus exaltatus</i>	0.1	0.5
<i>Santalum lanceolatum</i>	0.1	1.2

Name	Cover (%)	Height (m)
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.1
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.4
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	1.1
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia epactia</i>	7.0	0.6

Site: GP11**Location:** Map 17**Date:** 2018-04-09**MGA Zone:** 50**Habitat:** Major creek**Slope:** 0-5°**Soil:** Red brown**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** D13**Vegetation:** *Acacia citrinoviridis*, (*Grevillea berryana*) tall open scrub over *Tephrosia rosea* var. *Fortescue* creeks (M.I.H. Brooker 2186) open shrubland over *Corchorus crozophorifolius*, *Ptilotus obovatus* low open shrubland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 571548**Northing:** 7424858**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.5
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	1.0
<i>Acacia aptaneura</i>	0.1	5.0
<i>Acacia citrinoviridis</i>	35.0	7.0
<i>Acacia pyrifolia</i>	0.1	1.7
<i>Amaranthus undulatus</i>	0.1	0.45
* <i>Bidens bipinnata</i>	0.1	0.25
* <i>Cenchrus setiger</i>	0.1	0.4
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	0.1	5.0
<i>Corchorus crozophorifolius</i>	2.0	0.9

Name	Cover (%)	Height (m)
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	0.1	0.45
<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.1	0.4
<i>Dodonaea pachyneura</i>	0.1	1.8
<i>Dodonaea petiolaris</i>	0.1	0.5
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.0
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.4
<i>Eriachne mucronata</i>	0.1	0.3
<i>Eriachne pulchella</i>	0.1	0.15
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	0.1
<i>Glycine canescens</i>	0.1	twiner
<i>Gomphrena cunninghamii</i>	0.1	0.15
<i>Grevillea berryana</i>	0.1	4.0
<i>Hybanthus aurantiacus</i>	0.1	0.25
<i>Indigofera monophylla</i>	0.1	0.6
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Notoleptopus decaisnei</i>	0.1	0.25
<i>Paspalidium rarum</i>	0.1	0.2
<i>Petalostylis labicheoides</i>	0.1	2.1
<i>Pluchea dentex</i>	0.1	0.3
<i>Polycarpaea longiflora</i>	0.1	0.25
<i>Ptilotus calostachyus</i>	0.1	0.35
<i>Ptilotus obovatus</i>	1.0	1.0
<i>Rhagodia eremaea</i>	0.1	1.0
* <i>Rumex vesicarius</i>	0.1	0.2
<i>Santalum lanceolatum</i>	0.1	4.0
* <i>Setaria verticillata</i>	0.1	0.4
<i>Solanum cleistogamum</i>	0.1	0.15
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tephrosia rosea</i> var. <i>Fortescue creeks</i> (M.I.H. Brooker 2186)	3.0	1.1
<i>Triodia epactia</i>	0.5	0.35
<i>Waltheria indica</i>	0.1	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.4
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.5
<i>Acacia citrinoviridis</i>	35.0	7.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	1.3
* <i>Bidens bipinnata</i>	0.1	0.3
* <i>Cenchrus ciliaris</i>	0.1	0.6
* <i>Cenchrus setiger</i>	0.1	0.6
<i>Corchorus crozophorifolius</i>	2.0	0.9
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	0.1	0.9

Name	Cover (%)	Height (m)
<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.1	0.3
<i>Dodonaea pachyneura</i>	0.1	1.6
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.6
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.3
<i>Eriachne mucronata</i>	0.1	0.4
<i>Eriachne pulchella</i>	0.1	0.2
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Grevillea berryana</i>	3.0	6.0
<i>Hybanthus aurantiacus</i>	0.1	0.4
<i>Indigofera monophylla</i>	0.1	0.5
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.2
<i>Paspalidium rarum</i>	0.1	0.25
<i>Petalostylis labicheoides</i>	0.1	1.3
<i>Pluchea dentex</i>	0.1	0.4
<i>Polycarpaea longiflora</i>	0.1	0.25
<i>Ptilotus obovatus</i>	2.0	0.9
<i>Rhagodia eremaea</i>	0.1	1.2
<i>Santalum lanceolatum</i>	0.1	3.0
* <i>Setaria verticillata</i>	0.1	0.4
<i>Solanum cleistogamum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	3.0	1.1
<i>Triodia epactia</i>	0.1	0.6
<i>Waltheria indica</i>	0.1	0.5

* denotes weed species

Site: GP12

Location: Map 17

Date: 2018-04-10

MGA Zone: 50

Habitat: Hillslope

Slope: >5-10°

Soil: Dark reddish brown sandy loam

Rock type: Ironstone

Rock Abundance: >50%

Vegetation Type: H4

Vegetation: *Acacia tetragonophylla* scattered tall shrubs over *Eremophila cuneifolia* scattered shrubs over *Indigofera monophylla*, *Senna stricta* scattered low shrubs over *Triodia epactia* hummock grassland

Veg Condition: Excellent

Fire Age: >10 years

Type: Quadrat

Described by: KM

Easting: 569995

Northing: 7426237



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia pyrifolia</i>	0.1	2.2
<i>Acacia sibirica</i>	0.1	1.0
<i>Acacia tetragonophylla</i>	1.0	2.5
<i>Aristida contorta</i>	0.1	0.3
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	0.1	0.4
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.3
<i>Eremophila cuneifolia</i>	1.5	1.2
<i>Eremophila exilifolia</i>	0.1	0.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.2
<i>Eriachne pulchella</i>	0.1	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1.0	3.0
<i>Indigofera monophylla</i>	1.5	0.3
<i>Maireana melanocoma</i>	0.1	0.3
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.4
<i>Polycarpha longiflora</i>	0.1	0.15
<i>Ptilotus calostachyus</i>	0.1	0.3
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	1.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.1
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	2.0
<i>Senna stricta</i>	0.5	1.0
<i>Sida echinocarpa</i>	0.1	0.3
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.6
<i>Sporobolus australasicus</i>	0.1	0.15
<i>Swainsona maccullochiana</i>	0.1	0.4
<i>Tephrosia</i> sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.6
<i>Triodia epactia</i>	35.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.2
<i>Acacia sibirica</i>	0.1	1.0
<i>Acacia tetragonophylla</i>	1.0	2.5
<i>Boerhavia</i> sp.	0.1	0.15
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cleome viscosa</i>	0.1	0.15
<i>Cymbopogon ambiguus</i>	0.1	1.0
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.4
<i>Enneapogon caerulescens</i>	0.1	0.25
<i>Eremophila cuneifolia</i>	1.5	1.2
<i>Eremophila exilifolia</i>	0.1	1.1
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.3
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.2
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Euphorbia biconvexa</i> ?	0.1	0.3
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Indigofera monophylla</i>	1.5	0.4
<i>Maireana melanocoma</i>	0.1	0.7
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.4
<i>Paspalidium clementii</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Ptilotus clementii</i>	0.1	0.05
<i>Ptilotus exaltatus</i>	0.1	0.1

Name	Cover (%)	Height (m)
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.3
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	1.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.1
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.0
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	2.0
<i>Senna stricta</i>	0.5	1.0
<i>Sida echinocarpa</i>	0.1	0.25
<i>Solanum cleistogamum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.6
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Swainsona maccullochiana</i>	0.1	0.4
<i>Tephrosia</i> sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.2
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.6
<i>Triodia epactia</i>	35.0	0.4

? denotes unconfirmed ID

Site: GP13

Location: Map 20

Date: 2018-04-08

MGA Zone: 50

Habitat: Major creek

Slope: 0-5°

Soil: Red brown sand

Rock type:

Rock Abundance: >50%

Vegetation Type: D8

Vegetation: *Eucalyptus victrix*, *E. camaldulensis* low open woodland over *Melaleuca glomerata*, (*M. linophylla*) tall open scrub over **Cenchrus ciliaris*, (**C. setiger*) open tussock grassland

Veg Condition: Degraded

Fire Age: >10 years

Type: Quadrat

Described by: BE

Easting: 576018

Northing: 7425252



Phase1 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.1
<i>*Aerva javanica</i>	0.1	0.35
<i>Amaranthus undulatus</i>	0.1	0.4
<i>*Cenchrus ciliaris</i>	24.0	0.4
<i>*Cenchrus setiger</i>	5.0	0.4
<i>Cleome viscosa</i>	0.1	0.35
<i>Corchorus crozophorifolius</i>	0.1	0.9
<i>Cyperus vaginatus</i>	0.5	0.45
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.35
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.2
<i>Eriachne mucronata</i>	0.1	0.25

Name	Cover (%)	Height (m)
<i>Eucalyptus camaldulensis</i>	1.0	12
<i>Eucalyptus victrix</i>	2.0	13
<i>Euphorbia biconvexa</i>	0.1	0.35
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Melaleuca glomerata</i>	26.0	3.0
<i>Melaleuca linophylla</i>	5.0	4.0
<i>Notoleptopus decaisnei</i>	0.1	0.2
<i>Pluchea dentex</i>	0.1	0.4
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.1	0.9
<i>Rhynchosia minima</i>	0.1	twiner
<i>Stemodia grossa</i>	0.1	0.25
<i>Stylobasium spathulatum</i>	0.1	1.2
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	0.5	0.2
<i>Triodia epactia</i>	0.1	0.35

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.3
<i>Acacia citrinoviridis</i>	0.1	3.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	0.1	2.5
* <i>Aerva javanica</i>	0.1	0.5
<i>Amaranthus undulatus</i>	0.1	0.1
<i>Boerhavia coccinea</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	24.0	0.8
* <i>Cenchrus setiger</i>	5.0	0.8
<i>Cleome viscosa</i>	0.1	0.5
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cyperus vaginatus</i>	0.1	0.5
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.3
<i>Eriachne mucronata</i>	0.1	0.4
<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>	1.0	8.0
<i>Eucalyptus victrix</i>	1.0	9.0
<i>Euphorbia biconvexa</i> ?	0.1	0.4
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Melaleuca glomerata</i>	28.0	4.5
<i>Melaleuca linophylla</i>	3.0	4.0
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.1
<i>Phyllanthus maderaspatensis</i>	0.1	0.1
<i>Pluchea dentex</i>	0.1	0.2
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Rhagodia eremaea</i>	0.1	1.8

Name	Cover (%)	Height (m)
<i>Rhynchosia minima</i>	0.1	twiner
<i>Stylobasium spathulatum</i>	0.1	0.6
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.6
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	0.1	0.6
<i>Triodia epactia</i>	0.1	0.3

* denotes weed species

? denotes unconfirmed ID

Site: GP14
Location: Map 20
Date: 2018-04-09
MGA Zone: 50
Habitat: Hillslope
Slope: >10-20°
Soil: Red brown sandy loam
Rock type: Ironstone
Rock Abundance: >50%
Vegetation Type: H12
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia epactia* hummock grassland
Veg Condition: Excellent
Fire Age: >10 years



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia pruinocarpa</i>	1.0	1.8
<i>Acacia sibirica</i>	0.1	1.0
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.3
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.5
<i>Eriachne pulchella</i>	0.1	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1.0	3.0
<i>Polycarpha longiflora</i>	0.1	0.15
<i>Ptilotus calostachyus</i>	0.1	0.3
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	2.0

Name	Cover (%)	Height (m)
<i>Solanum lasiophyllum</i>	0.1	0.6
<i>Tribulus suberosus</i>	0.1	0.6
<i>Triodia epactia</i>	30.0	0.5

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia pruinocarpa</i>	0.1	1.8
<i>Acacia sibirica</i>	0.1	1.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.6
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1.0	3.0
<i>Polygala glaucifolia</i>	0.1	0.1
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.3
<i>Scaevola acacioides</i>	0.1	1.1
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.1
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	2.0
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.5
<i>Tribulus suberosus</i>	0.1	0.6
<i>Triodia epactia</i>	35.0	0.4

Site: GP15

Location: Map 13

Date: 2018-04-10

MGA Zone: 50

Habitat: Drainage depression

Slope: 0-5°

Soil: Red brown sandy clay

Rock type: Basalt

Rock Abundance: 10-20%

Vegetation Type: D1

Vegetation: *Acacia wanyu*, (*A. xiphophylla*, *A. citrinoviridis*, *A. aptaneura*) tall open scrub over *Ptilotus obovatus* scattered shrubs over *Triodia epactia* very open hummock grassland

Veg Condition: Poor

Fire Age: >10 years

Type: Quadrat

Described by: KM

Easting: 565433

Northing: 7426865



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.3
<i>Acacia aptaneura</i>	2.0	5.0
<i>Acacia citrinoviridis</i>	4.0	5.0
<i>Acacia tetragonophylla</i>	0.1	1.6
<i>Acacia wanyu</i>	25.0	4.0
<i>Acacia xiphophylla</i>	5.0	4.0
<i>Aristida contorta</i>	0.1	0.15
* <i>Cenchrus ciliaris</i>	3.0	0.4
* <i>Cenchrus setiger</i>	2.0	0.4
<i>Cleome viscosa</i>	0.1	0.35
<i>Corchorus crozophorifolius</i>	0.1	1.1

Name	Cover (%)	Height (m)
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dicladanthera forrestii</i>	0.1	0.3
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	10.0	0.45
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.2
<i>Enneapogon caerulescens</i>	0.1	0.15
<i>Eragrostis tenellula</i>	0.1	0.25
<i>Eremophila cuneifolia</i>	0.1	1.7
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	1.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.2
<i>Eriachne mucronata</i>	0.1	0.45
<i>Euphorbia biconvexa</i>	0.1	0.25
* <i>Flaveria trinervia</i>	0.1	0.45
<i>Hibiscus campanulatus</i> P1	0.1	0.35
<i>Hybanthus aurantiacus</i>	0.1	0.35
<i>Indigofera monophylla</i>	0.1	0.4
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Lepidium pedicellosum</i>	0.1	0.2
<i>Maireana georgei</i>	0.1	0.15
<i>Marsdenia australis</i>	0.1	twiner
<i>Paspalidium clementii</i>	0.1	0.2
<i>Pluchea dentex</i>	0.1	0.4
<i>Pterocaulon sphacelatum</i>	0.1	0.4
<i>Ptilotus calostachyus</i>	0.1	0.5
<i>Ptilotus obovatus</i>	0.5	1.0
<i>Rhagodia eremaea</i>	0.1	1.6
<i>Santalum lanceolatum</i>	0.1	1.9
<i>Scaevola acacioides</i>	0.1	1.2
<i>Scaevola spinescens</i>	0.1	0.6
<i>Sclerolaena eriacantha</i>	0.1	0.15
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	1.7
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.5
<i>Solanum piceum</i>	0.1	0.4
<i>Sporobolus australasicus</i>	0.1	0.06
<i>Stemodia grossa</i>	0.1	0.35
<i>Triodia epactia</i>	10.0	0.45

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	2.0	5.0
<i>Acacia citrinoviridis</i>	4.0	5.0
<i>Acacia synchronicia</i>	0.1	2.3
<i>Acacia tetragonophylla</i>	0.1	1.6
<i>Acacia wanyu</i>	25.0	4.0
<i>Acacia xiphophylla</i>	5.0	4.0
* <i>Cenchrus ciliaris</i>	0.1	0.25
* <i>Cenchrus setiger</i>	0.1	0.25
<i>Cleome viscosa</i>	0.1	0.05

Name	Cover (%)	Height (m)
<i>Corchorus crozophorifolius</i>	0.1	1.2
<i>Cucumis variabilis</i>	0.1	1.2
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.4
<i>Dysphania</i> sp.	0.1	0.1
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.0
<i>Eragrostis tenellula</i>	0.1	0.25
<i>Eremophila cuneifolia</i>	0.1	1.7
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	1.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.6
<i>Euphorbia biconvexa</i>	0.1	0.4
<i>Hybanthus aurantiacus</i>	0.1	0.1
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	1.4
<i>Maireana georgei</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.5	1.1
<i>Rhagodia eremaea</i>	0.1	1.6
<i>Santalum lanceolatum</i>	0.1	1.8
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.5
<i>Trianthema triquetrum</i>	0.1	0.05
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.2
<i>Triodia epactia</i>	10.0	0.5

* denotes weed species

Site: GP16
Location: Map 20
Date: 2018-04-09
MGA Zone: 50
Habitat: Hillslope
Slope: >35-50°
Soil: Reddish brown sandy loam
Rock type: Shale
Rock Abundance: >50%
Vegetation Type: H4
Vegetation: *Acacia pyrifolia* var. *pyrifolia* scattered tall shrubs over *Triodia epactia* open hummock grassland
Veg Condition: Excellent
Fire Age: >10 years



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia pruinocarpa</i>	0.1	0.8
<i>Acacia pyrifolia</i>	1.0	2.5
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cleome viscosa</i>	0.1	0.3
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Cucumis variabilis</i>	0.1	twiner
<i>Enneapogon caerulescens</i>	0.1	0.15
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.4
<i>Eremophila reticulata</i>	0.1	0.5
<i>Euphorbia careyi</i>	0.1	0.1
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Indigofera monophylla</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.8
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.5
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.3
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	1.1
<i>Triodia epactia</i>	20.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia pruinocarpa</i>	0.1	0.8
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.5	2.5
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cleome viscosa</i>	0.1	0.2
<i>Corchorus crozophorifolius</i>	0.1	0.8
<i>Cucumis variabilis</i>	0.1	twiner
<i>Enneapogon caeruleus</i>	0.1	0.1
<i>Eremophila cuneifolia</i>	0.1	0.9
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.4
<i>Eremophila reticulata</i>	0.1	0.1
<i>Euphorbia careyi</i>	0.1	0.1
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Indigofera monophylla</i>	0.1	0.3
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.1
<i>Ptilotus exaltatus</i>	0.1	0.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.8
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.5
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.5
<i>Tribulus suberosus</i>	0.1	0.2
<i>Triodia epactia</i>	25.0	0.4

Site: GP17**Location:** Map 13**Date:** 2018-04-12**MGA Zone:** 50**Habitat:** Hillcrest**Slope:** >5-10°**Soil:** Red brown sandy clay loam**Rock type:** Basalt**Rock Abundance:** >50%**Vegetation Type:** H11

Vegetation: *Acacia pruinocarpa*, *Grevillea berrymanna*, *A. aptaneura*, *A. rhodophloia*, *A. tetragonophylla* tall open shrubland over *Eremophila phyllopoda* subsp. *obliqua*, *E. jucunda* subsp. *pulcherrima* scattered low shrubs over *Triodia epactia* scattered hummock grasses with *Eriachne pulchella* subsp. *dominii* scattered tussock grasses

Veg Condition: Excellent**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 565515**Northing:** 7425841

Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	3.0
<i>Acacia pruinocarpa</i>	1.0	4.0
<i>Acacia rhodophloia</i>	1.0	3.0
<i>Acacia tetragonophylla</i>	0.5	3.0
<i>Aristida contorta</i>	0.5	0.2
<i>Bulbostylis barbata</i>	0.1	0.06
<i>Calandrinia</i> sp. The Pink Hills (F. Obbens FO 19/06)	0.1	0.02
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.5	0.5

Name	Cover (%)	Height (m)
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	1.4
<i>Eriachne pulchella</i>	2.0	0.1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	0.15
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.25
<i>Goodenia microptera</i>	0.1	0.15
<i>Grevillea berryana</i>	0.5	4.0
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.3
<i>Portulaca oleracea</i>	0.1	0.01
<i>Psydrax latifolia</i>	0.1	0.35
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.06
<i>Santalum lanceolatum</i>	0.1	0.2
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Trianthema glossostigmum</i>	0.1	0.01
<i>Tribulus suberosus</i>	0.1	0.35
<i>Trigastrotheca molluginea</i>	0.1	0.15
<i>Triodia epactia</i>	1.0	0.35

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	3.0
<i>Acacia pruinocarpa</i>	1.0	4.0
<i>Acacia rhodophloia</i>	1.0	3.0
<i>Acacia tetragonophylla</i>	0.5	3.0
<i>Aristida contorta</i>	0.1	0.2
<i>Duperreya commixta</i>	0.1	twiner
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.5	0.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	0.8
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	1.5	0.1
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.2
<i>Goodenia microptera</i>	0.1	0.1
<i>Grevillea berryana</i>	1.0	4.0
<i>Maireana</i> sp.	0.1	0.1
<i>Portulaca oleracea</i>	0.1	0.1
<i>Psydrax latifolia</i>	0.1	0.35
<i>Psydrax suaveolens</i>	0.1	1.2
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia epactia</i>	1.0	0.4

Site: GP18

Location: Map 19

Date: 2018-04-09

MGA Zone: 50

Habitat: Minor creek

Soil: Red brown sandy loam

Rock type: Ironstone

Rock Abundance: 20-50%

Vegetation Type: D13

Vegetation: *Acacia citrinoviridis* tall shrubland over *Tephrosia rosea* var. *Fortescue* creeks (M.I.H. Brooker 2186), *Ptilotus obovatus* open shrubland over *Triodia epactia* open hummock grassland

Veg Condition: Good

Fire Age: >10 years

Type: Quadrat

Described by: KM

Easting: 573741

Northing: 7424229



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	1.0
<i>Acacia citrinoviridis</i>	20.0	5.0
<i>Acacia pruinocarpa</i>	0.1	0.8
<i>Acacia pyrifolia</i>	0.1	3.0
<i>Acacia tetragonophylla</i>	0.1	3.0
* <i>Aerva javanica</i>	0.1	0.4
<i>Amaranthus cuspidifolius</i>	0.1	0.4
<i>Boerhavia</i> sp.	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.15
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cleome viscosa</i>	0.1	0.3
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	0.1	1.0

Name	Cover (%)	Height (m)
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	0.1	0.4
<i>Dodonaea pachyneura</i>	0.1	1.5
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.1
<i>Enneapogon caeruleus</i>	0.1	0.15
<i>Eremophila cuneifolia</i>	0.1	0.15
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.8
<i>Glycine canescens</i>	0.1	twiner
<i>Gomphrena cunninghamii</i>	0.1	0.15
<i>Goodenia microptera</i>	0.1	0.1
<i>Hibiscus campanulatus</i> P1	0.1	0.4
<i>Hybanthus aurantiacus</i>	0.1	0.3
<i>Indigofera monophylla</i>	0.1	0.4
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
* <i>Malvastrum americanum</i>	0.1	0.2
<i>Marsdenia australis</i>	0.1	twiner
<i>Notoleptopus decaisnei</i>	0.1	0.1
<i>Paspalidium basicladum</i>	0.1	0.2
<i>Petalostylis labicheoides</i>	0.1	2.0
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Pterocaulon sphacelatum</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	1.0	0.7
<i>Rhagodia eremaea</i>	0.1	1.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.2
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	0.2
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	1.0
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tephrosia rosea</i> var. <i>Fortescue</i> creeks (M.I.H. Brooker 2186)	2.0	1.1
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.4
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	1.5
<i>Trigastrotheca molluginea</i>	0.1	0.1
<i>Triodia epactia</i>	12.0	0.4
<i>Triumfetta clementii</i>	0.1	0.3
<i>Waltheria indica</i>	0.1	0.2

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	1.0
<i>Acacia citrinoviridis</i>	20.0	6.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	3.0
<i>Acacia tetragonophylla</i>	0.1	3.0

Name	Cover (%)	Height (m)
* <i>Aerva javanica</i>	0.1	0.4
<i>Boerhavia coccinea</i>	0.1	0.15
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cleome viscosa</i>	0.1	0.3
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	0.1	2.0
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Cucumis variabilis</i>	0.1	0.6
<i>Cymbopogon ambiguus</i>	0.1	0.4
<i>Dodonaea pachyneura</i>	0.1	1.5
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.1
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.8
<i>Eriachne mucronata</i>	0.1	0.3
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Hibiscus campanulatus</i> P1	0.1	0.9
<i>Hybanthus aurantiacus</i>	0.1	0.3
<i>Indigofera monophylla</i>	0.1	0.4
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	1.2
<i>Marsdenia australis</i>	0.1	0.4
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.1
<i>Paspalidium clementii</i>	0.1	0.15
<i>Petalostylis labicheoides</i>	0.1	2.0
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Pterocaulon sphacelatum</i>	0.1	0.6
<i>Ptilotus obovatus</i>	1.0	1.1
<i>Rhagodia eremaea</i>	0.1	1.6
<i>Rhynchosia minima</i>	0.1	1.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.2
<i>Sida fibulifera</i>	0.1	0.2
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	1.0
<i>Sporobolus australasicus</i>	0.1	0.05
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	2.0	1.1
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trigastrotheca molluginea</i>	0.1	0.1
<i>Triodia epactia</i>	12.0	0.4
<i>Triumfetta clementii</i>	0.1	0.3
<i>Waltheria indica</i>	0.1	0.5

* denotes weed species

Site: GPR19**Location:** Map 16**Date:** 2018-04-13**MGA Zone:** 50**Habitat:** Minor creek**Soil:** Light reddish brown sand**Rock Abundance:** >50%**Vegetation Type:** D6

Vegetation: *Corymbia ferriticola* low open woodland over *Acacia citrinoviridis*, (*Grevillea saxicola*) tall open scrub over *Triodia epactia* very open hummock grassland with **Cenchrus ciliaris*, (*Cymbopogon ambiguus*, *Eriachne mucronata*) open tussock grassland

Veg Condition: Good**Fire Age:** >10 years**Type:** Relevé**Described by:** KM**Easting:** 570196**Northing:** 7429021**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.5
<i>Acacia citrinoviridis</i>	29.0	5.0
<i>Acacia pruinocarpa</i>	0.1	3.0
<i>Acacia pyrifolia</i>	0.1	1.6
<i>Acacia synchronicia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	0.1	0.4
<i>*Aerva javanica</i>	0.1	0.4
<i>Amaranthus undulatus</i>	0.1	0.3
<i>Aristida contorta</i>	0.1	0.3
<i>*Cenchrus ciliaris</i>	2.0	0.5
<i>Cleome viscosa</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Corymbia ferritcola</i>	2.0	7.0
<i>Cymbopogon ambiguus</i>	1.0	0.8
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.3
<i>Dodonaea pachyneura</i>	0.1	1.2
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.4
<i>Enneapogon caeruleus</i>	0.1	0.3
<i>Enneapogon polyphyllus</i>	0.1	0.3
<i>Eriachne mucronata</i>	0.1	0.3
<i>Eriachne pulchella</i>	0.1	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0.1	8.0
<i>Euphorbia biconvexa</i>	0.1	0.3
<i>Glycine canescens</i>	0.1	twiner
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Gossypium robinsonii</i>	0.1	2.0
<i>Grevillea saxicola</i> P3	4.0	6.0
<i>Hibiscus campanulatus</i> P1	0.1	1.3
<i>Indigofera monophylla</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Lepidium pedicellsum</i>	0.1	0.4
<i>Maireana georgei</i>	0.1	0.3
<i>Notoleptopus decaisnei</i>	0.1	0.1
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Rhagodia eremaea</i>	0.1	1.2
<i>Rhynchosia minima</i>	0.1	twiner
* <i>Rumex vesicarius</i>	0.1	0.1
<i>Salsola australis</i>	0.1	0.5
<i>Santalum lanceolatum</i>	0.1	2.5
<i>Scaevola acacioides</i>	0.1	0.8
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.8
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.0
<i>Sida fibulifera</i>	0.1	0.1
<i>Solanum piceum</i>	0.1	1.5
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Swainsona maccullochiana</i>	0.1	0.3
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.1
<i>Triodia epactia</i>	8.0	0.4
<i>Triodia wiseana</i>	0.1	0.5

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.4
<i>Acacia citrinoviridis</i>	29.0	5.0
<i>Acacia pruinocarpa</i>	0.1	4.0

Name	Cover (%)	Height (m)
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	1.6
<i>Acacia synchronicia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	0.1	0.8
* <i>Aerva javanica</i>	0.1	0.5
<i>Aristida contorta</i>	0.1	0.3
* <i>Bidens bipinnata</i>	0.1	0.3
<i>Boerhavia coccinea</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	8.0	0.5
<i>Cleome viscosa</i>	0.1	0.3
<i>Corchorus crozophorifolius</i>	0.1	0.8
<i>Corymbia ferriticola</i>	2.0	7.0
<i>Cucumis variabilis</i>	0.1	0.3
<i>Cymbopogon ambiguus</i>	1.0	0.8
<i>Digitaria brownii</i>	0.1	0.1
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.4
<i>Dodonaea pachyneura</i>	0.1	1.8
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.3
<i>Enneapogon polyphyllus</i>	0.1	0.4
<i>Eremophila cryptothrix</i>	0.1	1.4
<i>Eriachne mucronata</i>	1.0	0.3
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0.1	8.0
<i>Euphorbia australis</i> var. <i>subtomentosa</i>	0.1	0.02
<i>Euphorbia biconvexa</i>	0.1	0.3
<i>Glycine canescens</i>	0.1	twiner
<i>Gossypium robinsonii</i>	0.1	2.5
<i>Grevillea saxicola</i> P3	4.0	6.0
<i>Hibiscus campanulatus</i> P1	0.1	1.3
<i>Indigofera monophylla</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Lepidium pedicellsum</i>	0.1	0.3
<i>Maireana georgei</i>	0.1	0.3
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.1
<i>Polycarpaea longiflora</i>	0.1	0.1
<i>Ptilotus obovatus</i>	0.1	0.8
<i>Rhagodia eremaea</i>	0.1	1.2
<i>Rhynchosia minima</i>	0.1	twiner
<i>Santalum lanceolatum</i>	0.1	2.5
<i>Scaevola acacioides</i>	0.1	1.6
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.0
<i>Sida fibulifera</i>	0.1	0.1
<i>Solanum piceum</i>	0.1	1.5
<i>Triodia epactia</i>	8.0	0.4
<i>Triodia wiseana</i>	0.1	0.4

* denotes weed species

Site: GP20
Location: Map 13
Date: 2018-04-10
MGA Zone: 50
Habitat: Hillslope
Slope: >10-20°
Soil: Red brown sandy loam
Rock type: Dolerite
Rock Abundance: >50%
Vegetation Type: H1
Vegetation: *Acacia aptaneura* tall open shrubland over *Senna stricta*, *S. glutinosa* subsp. x *luerssenii*, *A. tetragonophylla* open shrubland
Veg Condition: Good
Fire Age: >10 years



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.2
<i>Acacia aptaneura</i>	2.0	5.0
<i>Acacia pruinocarpa</i>	0.1	3.0
<i>Acacia synchronicia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	1.0	2.0
<i>Acacia wanyu</i>	0.1	1.2
<i>Aristida contorta</i>	1.0	0.3
<i>Bulbostylis barbata</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	0.1	0.4
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.15
<i>Enneapogon caeruleascens</i>	0.1	0.2

Name	Cover (%)	Height (m)
<i>Eremophila cuneifolia</i>	0.1	1.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.2
<i>Eriachne pulchella</i>	0.1	0.1
<i>Euphorbia careyi</i>	0.1	0.1
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.3
<i>Hibiscus sturtii</i>	0.1	0.2
<i>Maireana melanocoma</i>	0.1	0.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3
<i>Paspalidium clementii</i>	0.1	0.15
<i>Portulaca oleracea</i>	0.1	0.1
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.2
<i>Sclerolaena eriacantha</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.6
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	2.0	1.5
<i>Senna stricta</i>	3.0	1.1
<i>Sida echinocarpa</i>	0.1	0.2
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.7
<i>Trigastrotheca molluginea</i>	0.1	0.1
<i>Triodia epactia</i>	0.1	0.3

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.2
<i>Acacia aptaneura</i>	2.0	5.0
<i>Acacia synchronicia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	1.0	2.0
<i>Acacia wanyu</i>	0.1	1.2
<i>Acacia xiphophylla</i>	0.1	3.0
<i>Aristida contorta</i>	0.1	0.1
<i>Bulbostylis barbata</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	0.1	0.4
<i>Duperreya commixta</i>	0.1	0.1
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.15
<i>Eremophila cuneifolia</i>	0.1	1.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.2
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.1
<i>Hibiscus sturtii</i>	0.1	0.15
<i>Maireana melanocoma</i>	0.1	0.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Portulaca oleracea</i>	0.1	0.05
<i>Ptilotus exaltatus</i>	0.1	0.05
<i>Ptilotus obovatus</i>	0.1	0.2
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Sclerolaena eriacantha</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.6
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	2.0	1.5
<i>Senna stricta</i>	3.0	1.1
<i>Sida echinocarpa</i>	0.1	0.2
<i>Solanum horridum</i>	0.1	0.2
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Trianthema glossostigmum</i>	0.1	0.05
<i>Tribulus suberosus</i>	0.1	0.5
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia epactia</i>	0.1	0.3

* denotes weed species

Site: GP21**Location:** Map 16**Date:** 2018-04-13**MGA Zone:** 50**Habitat:** Hillslope**Slope:** >10-20°**Soil:** Brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** P8**Vegetation:** *Acacia xiphophylla* tall open shrubland over *Senna stricta*, (*A. wanyu*, *A. tetragonophylla*) open heath over *Maireana georgei* scattered low shrubs over *Sclerolaena eriacantha* scattered low herbs**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** KM**Easting:** 570605**Northing:** 7428581**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia synchronicia</i>	0.1	0.1
<i>Acacia tetragonophylla</i>	0.5	1.4
<i>Acacia xiphophylla</i>	2.0	3.5
* <i>Cenchrus ciliaris</i>	0.1	0.39
<i>Cynodon prostratus</i>	0.1	0.03
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.45
<i>Enneapogon caeruleus</i>	0.1	0.35
<i>Eremophila cuneifolia</i>	0.1	1.0
<i>Eriachne pulchella</i>	1.0	0.2
<i>Frankenia</i> aff. <i>magnifica</i>	0.1	0.25
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.25

Name	Cover (%)	Height (m)
<i>Grevillea berryana</i>	0.1	2.2
<i>Lepidium pedicellum</i>	0.1	0.25
<i>Maireana eriosphaera</i>	0.1	0.15
<i>Maireana georgei</i>	0.5	0.2
<i>Maireana melanocoma</i>	0.1	0.3
<i>Paspalidium rarum</i>	0.1	0.3
<i>Polycarpaea longiflora</i>	0.1	0.15
<i>Portulaca oleracea</i>	0.1	0.05
<i>Ptilotus calostachyus</i>	0.1	0.7
<i>Ptilotus exaltatus</i>	0.1	0.4
<i>Ptilotus obovatus</i>	0.1	1.1
<i>Salsola australis</i>	0.1	0.3
<i>Scaevola acacioides</i>	0.1	1.5
<i>Scaevola spinescens</i>	0.1	0.6
<i>Sclerolaena eriacantha</i>	1.0	0.15
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.7
<i>Senna stricta</i>	35.0	1.5
<i>Solanum cleistogamum</i>	0.1	0.1
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tecticornia disarticulata</i>	0.1	0.5
<i>Trianthema glossostigmum</i>	0.1	0.04
<i>Trianthema triquetrum</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.35
<i>Triodia wiseana</i>	0.1	0.35

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	4.0
<i>Acacia rhodophloia</i>	0.1	3.0
<i>Acacia synchronicia</i>	0.1	0.4
<i>Acacia tetragonophylla</i>	0.5	1.4
<i>Acacia wanyu</i>	0.5	1.6
<i>Acacia xiphophylla</i>	2.0	3.5
<i>Atriplex codonocarpa</i>	0.1	0.2
* <i>Cenchrus ciliaris</i>	0.1	0.25
<i>Duperreya commixta</i>	0.1	0.5
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.8
<i>Eremophila cuneifolia</i>	0.1	1.0
<i>Frankenia</i> aff. <i>magnifica</i>	0.1	0.25
<i>Grevillea berryana</i>	0.1	2.5
<i>Lepidium pedicellum</i>	0.1	0.4
<i>Maireana eriosphaera</i>	0.1	0.15
<i>Maireana georgei</i>	0.5	0.2
<i>Maireana melanocoma</i>	0.1	0.2
<i>Paspalidium rarum</i>	0.1	0.1
<i>Portulaca oleracea</i>	0.1	0.05
<i>Ptilotus exaltatus</i>	0.1	0.05

Name	Cover (%)	Height (m)
<i>Ptilotus obovatus</i>	0.1	1.1
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.8
<i>Salsola australis</i>	0.1	0.1
<i>Scaevola spinescens</i>	0.1	0.6
<i>Sclerolaena eriacantha</i>	1.0	0.15
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.25
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	1.7
<i>Senna stricta</i>	35.0	1.2
<i>Solanum cleistogamum</i>	0.1	0.15
<i>Tecticornia disarticulata</i>	0.1	0.5
<i>Trianthema glossostigmum</i>	0.1	0.02
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia wiseana</i>	0.1	0.3

* denotes weed species

Site: GP22**Location:** Map 13**Date:** 2018-04-10**MGA Zone:** 50**Habitat:** Plain**Slope:** 0-5°**Soil:** Red brown sandy loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** P2**Vegetation:** *Acacia aptaneura*, *A. tetragonophylla*, *Grevillea berryana* tall open shrubland over *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Eriachne pulchella* very open tussock grassland**Veg Condition:** Excellent**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 565236**Northing:** 7426596**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	2.0	3.5
<i>Acacia rhodophloia</i>	0.1	2.0
<i>Acacia tetragonophylla</i>	1.5	2.5
<i>Aristida contorta</i>	0.1	0.3
<i>Calandrinia</i> sp. The Pink Hills (F. Obbens FO 19/06)	0.1	0.05
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.2
<i>Eriachne pulchella</i>	1.0	0.1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	0.2
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Goodenia microptera</i>	0.1	0.2
<i>Grevillea berryana</i>	0.5	2.1
<i>Heliotropium heteranthum</i>	0.1	0.1
<i>Hibiscus burtonii</i>	0.1	0.3
<i>Maireana melanocoma</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.4
<i>Scaevola acacioides</i>	0.1	1.5
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.25
<i>Senna stricta</i>	0.5	1.1
<i>Sida echinocarpa</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Trianthema glossostigmum</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	1.1
<i>Trigastrotheca molluginea</i>	0.1	0.15
<i>Triodia epactia</i>	0.1	0.2

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	2.0	3.8
<i>Acacia rhodophloia</i>	0.1	2.0
<i>Acacia tetragonophylla</i>	1.5	2.5
<i>Aristida contorta</i>	0.1	0.2
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Enneapogon polyphyllus</i>	0.1	0.2
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.3
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	1.2
<i>Eriachne pulchella</i>	2.5	0.1
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.2
<i>Goodenia microptera</i>	0.1	0.1
<i>Grevillea berryana</i>	0.5	3.0
<i>Heliotropium heteranthum</i>	0.1	0.1
<i>Maireana melanocoma</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Psydrax suaveolens</i>	0.1	2.0
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus exaltatus</i>	0.1	0.1
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Scaevola acacioides</i>	0.1	1.5
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.3
<i>Senna stricta</i>	0.1	1.1
<i>Sida echinocarpa</i>	0.1	0.4
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Trianthema glossostigmum</i>	0.1	0.1

Name	Cover (%)	Height (m)
<i>Tribulus suberosus</i>	0.1	1.2
<i>Trigastrotheca molluginea</i>	0.1	0.1
<i>Triodia epactia</i>	0.1	0.2

Site: GP23**Location:** Map 6**Date:** 2018-04-12**MGA Zone:** 50**Habitat:** Drainage depression**Slope:** 0-5°**Soil:** Sand**Rock type:** Basalt, Calcrete, Ironstone**Rock Abundance:** >50%**Vegetation Type:** D9**Vegetation:** *Acacia citrinoviridis* tall shrubland over *Corchorus crozophorifolius* scattered low shrubs over **Cenchrus ciliaris*, (**Cenchrus setiger*) tussock grassland**Veg Condition:** Degraded**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 558211**Northing:** 7431154**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	25.0	4.0
<i>Acacia pyrifolia</i>	0.5	2.3
<i>*Aerva javanica</i>	0.5	0.35
<i>*Cenchrus ciliaris</i>	40.0	0.6
<i>*Cenchrus setiger</i>	1.0	0.4
<i>*Citrullus amarus</i>	0.5	0.5
<i>Corchorus crozophorifolius</i>	0.5	1.1
<i>Cucumis variabilis</i>	0.5	twiner
<i>Duperreya commixta</i>	0.5	twiner
<i>Eriachne pulchella</i>	0.5	0.1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.5	0.15

Name	Cover (%)	Height (m)
<i>Gomphrena cunninghamii</i>	0.5	0.1
<i>Petalostylis labicheoides</i>	0.5	2.2
<i>Phyllanthus maderaspatensis</i>	0.5	0.45
<i>Plumbago zeylanica</i>	0.5	0.3
<i>Pterocaulon sphacelatum</i>	0.5	0.4
* <i>Rumex vesicarius</i>	0.5	0.15
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	0.5	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	15.0	7.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	0.3
<i>Acacia tetragonophylla</i>	0.1	1.2
* <i>Aerva javanica</i>	0.1	0.4
<i>Amaranthus undulatus</i>	0.1	0.2
* <i>Cenchrus ciliaris</i>	30.0	0.6
* <i>Cenchrus setiger</i>	4.0	0.6
<i>Corchorus crozophorifolius</i>	0.5	0.8
<i>Cucumis melo</i>	0.1	twiner
<i>Cucumis variabilis</i>	0.1	twiner
<i>Duperreya commixta</i>	0.1	twiner
<i>Euphorbia biconvexa</i>	0.1	0.3
<i>Ipomoea muelleri</i>	0.1	twiner
<i>Petalostylis labicheoides</i>	0.1	2.5
<i>Phyllanthus maderaspatensis</i>	0.1	0.3
<i>Plumbago zeylanica</i>	0.1	0.2
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	0.1	0.6

* denotes weed species

Site: GP24**Location:** Map 13**Date:** 2018-04-10**MGA Zone:** 50**Habitat:** Hillslope**Soil:** Red brown sandy loam**Slope:** >10-20°**Rock type:** Dolerite**Rock Abundance:** >50%**Vegetation Type:** P4**Vegetation:** *Acacia aptaneura*, *A. xiphophylla*, *A. tetragonophylla* tall open shrubland over *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Triodia angusta* open hummock grassland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 564669**Northing:** 7425647**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.3
<i>Acacia aptaneura</i>	2.0	3.5
<i>Acacia synchronicia</i>	0.5	0.8
<i>Acacia tetragonophylla</i>	1.0	2.5
<i>Acacia xiphophylla</i>	2.0	2.2
<i>Boerhavia</i> sp.	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cheilanthes brownii</i>	0.1	0.1
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.3
<i>Duperreya commixta</i>	0.1	twiner

Name	Cover (%)	Height (m)
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.4
<i>Enneapogon caerulescens</i>	0.1	0.3
<i>Eremophila cuneifolia</i>	0.1	0.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.1	0.4
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.0	1.3
<i>Eriachne pulchella</i>	0.1	0.1
<i>Grevillea berryana</i>	0.1	1.5
<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)	0.1	0.5
<i>Hibiscus sturtii</i>	0.1	0.2
<i>Lawrenzia densiflora</i>	0.1	0.1
<i>Lepidium pedicellsum</i>	0.1	0.3
<i>Maireana melanocoma</i>	0.1	0.3
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.4
<i>Paspalidium clementii</i>	0.1	0.2
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus clementii</i>	0.1	0.4
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Scaevola acacioides</i>	0.1	1.1
<i>Scaevola spinescens</i>	0.1	0.5
<i>Sclerolaena eriacantha</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.3
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.2
<i>Sida echinocarpa</i>	0.1	0.3
<i>Solanum horridum</i>	0.1	0.4
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.15
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trigastrotheca molluginea</i>	0.1	0.1
<i>Triodia angusta</i>	25.0	0.5

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.3
<i>Acacia aptaneura</i>	2.0	4.0
<i>Acacia tetragonophylla</i>	1.0	2.5
<i>Acacia xiphophylla</i>	2.0	3.0
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cheilanthes brownie</i>	0.1	0.1
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	3.0
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.5
<i>Enneapogon caerulescens</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	0.1	1.0
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4

Name	Cover (%)	Height (m)
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.1	1.0
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.0	1.3
<i>Goodenia microptera</i>	0.1	0.1
<i>Grevillea berryana</i>	0.1	1.5
<i>Hibiscus</i> sp. Gardneri (A.L. Payne PRP 1435)	0.1	0.5
<i>Hibiscus sturtii</i>	0.1	0.3
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Lepidium pedicellsum</i>	0.1	0.3
<i>Maireana melanocoma</i>	0.1	0.3
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.4
<i>Paspalidium clementii</i>	0.1	0.2
<i>Pluchea dentex</i>	0.1	0.3
<i>Portulaca oleracea</i>	0.1	0.1
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus clementii</i>	0.1	0.1
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.5
<i>Scaevola acacioides</i>	0.1	1.2
<i>Scaevola spinescens</i>	0.1	0.5
<i>Sclerolaena eriacantha</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.3
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	1.3
<i>Sida echinocarpa</i>	0.1	0.4
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.2
<i>Solanum horridum</i>	0.1	3.0
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia angusta</i>	25.0	0.5

* denotes weed species

Site: GPR25**Location:** Map 17**Date:** 2017-08-19**MGA Zone:** 50**Habitat:** Minor Creek**Soil:** Sand**Vegetation Type:** D6**Vegetation:** *Corymbia ferriticola* scattered low trees over *Acacia citrinoviridis* tall shrubland over *Eriachne mucronata*, **Cenchrus ciliaris*, *Cymbopogon ambiguus* very open tussock grassland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Relevé**Described by:** LV BE**Easting:** 570123**Northing:** 7427205**Phase 1 Species List (no Phase 2)**

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	15.0	6.0
<i>Acacia marramamba</i>	0.1	1.1
<i>Acacia pruinocarpa</i>	0.1	2.5
<i>Acacia tetragonophylla</i>	0.1	2.3
<i>Amaranthus undulatus</i>	0.1	0.25
<i>Aristida contorta</i>	0.1	0.2
<i>Astrotricha hamptonii</i>	0.1	0.7
<i>Boerhavia burbridgeana</i>	0.1	0.06
<i>Bulbostylis barbata</i>	0.1	0.05
* <i>Cenchrus ciliaris</i>	1.0	0.45
<i>Cleome viscosa</i>	0.1	0.25
<i>Clerodendrum</i> sp.	0.1	1.5
<i>Corymbia ferriticola</i>	1.0	4.0

Name	Cover (%)	Height (m)
<i>Cymbopogon ambiguus</i>	1.0	0.45
<i>Dodonaea pachyneura</i>	0.1	1.5
<i>Duperreya commixta</i>	0.1	twiner
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.2
<i>Eremophila latrobei</i> subsp. <i>glabra</i>	0.1	1.1
<i>Eriachne mucronata</i>	3.0	3.0
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	0.15
<i>Ficus brachypoda</i>	0.1	1.0
<i>Gomphrena cunninghamii</i>	0.1	0.15
<i>Hibiscus campanulatus</i> P1	0.1	0.15
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.25
<i>Paspalidium clementii</i>	0.1	0.1
<i>Pluchea dentex</i>	0.1	0.35
<i>Prostanthera albiflora</i>	0.1	1.5
<i>Ptilotus obovatus</i>	0.1	0.6
* <i>Rumex vesicarius</i>	0.1	0.3
<i>Sida</i> sp. Shovelanna Hill (S. van Leeuwen 3842)	0.1	0.35
<i>Solanum cleistogamum</i>	0.1	0.25
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.6
<i>Triodia epactia</i>	0.1	0.4

* denotes weed species

Site: GP26**Location:** Map 16**Date:** 2018-04-13**MGA Zone:** 50**Habitat:** Plain**Slope:** 0-5°**Soil:** Dark reddish brown sandy loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** P8**Vegetation:** *Acacia xiphophylla*, *A. tetragonophylla*, *A. wanyu* tall open shrubland over *Senna stricta* scattered low shrubs**Veg Condition:** Excellent**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 571181**Northing:** 7428320**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia synchronicia</i>	0.1	0.2
<i>Acacia tetragonophylla</i>	1.0	2.5
<i>Acacia wanyu</i>	0.1	3.0
<i>Acacia xiphophylla</i>	3.0	2.5
<i>Aristida contorta</i>	0.1	0.3
<i>Atriplex codonocarpa</i>	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cynodon prostratus</i>	0.1	0.1
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.4
<i>Enneapogon caerulescens</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	0.1	1.2

Name	Cover (%)	Height (m)
<i>Eriachne pulchella</i>	0.1	0.1
<i>Frankenia</i> aff. <i>hispidula</i>	0.1	0.3
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.2
<i>Grevillea berryana</i>	0.1	0.4
<i>Hibiscus sturtii</i>	0.1	0.2
<i>Lepidium platypetalum</i>	0.1	0.4
<i>Maireana carnosa</i>	0.1	0.2
<i>Maireana georgei</i>	0.1	0.2
<i>Maireana melanocoma</i>	0.1	0.2
<i>Maireana suaedifolia</i>	0.1	0.7
<i>Paspalidium clementii</i>	0.1	0.1
<i>Polycarpaea longiflora</i>	0.1	0.1
<i>Portulaca oleracea</i>	0.1	0.1
<i>Pterocaulon sphacelatum</i>	0.1	0.4
<i>Ptilotus calostachyus</i>	0.1	0.3
<i>Ptilotus exaltatus</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Rhagodia eremaea</i>	0.1	1.0
<i>Scaevola acacioides</i>	0.1	0.2
<i>Scaevola spinescens</i>	0.1	1.0
<i>Sclerolaena densiflora</i>	0.1	0.2
<i>Sclerolaena eriacantha</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.3
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	0.7
<i>Senna stricta</i>	1.0	0.7
<i>Sida echinocarpa</i>	0.1	0.3
<i>Sida fibulifera</i>	0.1	0.4
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Tecticornia disarticulata</i>	0.1	0.4
<i>Trianthema glossostigmum</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia synchronicia</i>	0.1	0.2
<i>Acacia tetragonophylla</i>	1.0	2.5
<i>Acacia wanyu</i>	1.0	2.0
<i>Acacia xiphophylla</i>	3.0	3.0
<i>Aristida contorta</i>	0.1	0.3
<i>Atriplex codonocarpa</i>	0.1	0.3
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cynodon prostratus</i>	0.1	0.1
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.4
<i>Enneapogon caerulescens</i>	0.1	0.1
<i>Eremophila cuneifolia</i>	0.1	1.2

Name	Cover (%)	Height (m)
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.5
<i>Eriachne mucronata</i>	0.1	0.3
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Frankenia</i> aff. <i>hispidula</i>	0.1	0.3
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.2
<i>Grevillea berryana</i>	0.1	0.4
<i>Hibiscus sturtii</i>	0.1	0.1
<i>Indigofera monophylla</i>	0.1	0.2
<i>Maireana carnosa</i>	0.1	0.1
<i>Maireana georgei</i>	0.1	0.2
<i>Maireana melanocoma</i>	0.1	0.2
<i>Maireana suaedifolia</i>	0.1	0.5
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3
<i>Paraneurachne muelleri</i>	0.1	0.5
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Pterocaulon sphacelatum</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Rhagodia eremaea</i>	0.1	1.0
<i>Scaevola acacioides</i>	0.1	1.6
<i>Scaevola spinescens</i>	0.1	1.2
<i>Sceroleana</i> sp.	0.1	0.1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.3
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	1.0
<i>Senna stricta</i>	1.0	0.7
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.3
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Tecticornia disarticulata</i>	0.1	0.4
<i>Trianthema glossostigmum</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.4
<i>Trigastrotheca molluginea</i>	0.1	0.1

* denotes weed species

Site: GP27

Location: Map 20

Date: 2018-04-09

MGA Zone: 50

Habitat: Major Creek

Slope: 0-5°

Soil: Sand

Rock type: Ironstone

Rock Abundance: >50%

Vegetation Type: D7

Vegetation: *Eucalyptus victrix*, (*E. camaldulensis* subsp. *refulgens*) woodland over *Melaleuca glomerata*, (*M. linophylla*) tall open shrubland over **Cenchrus ciliaris*, **C. setiger* open tussock grassland with *Cyperus vaginatus* scattered sedges and *Pluchea rubelliflora*, *Stemodia grossa* very open herbland

Veg Condition: Degraded

Fire Age: >10 years

Type: Quadrat

Described by: BE

Easting: 575923

Northing: 7426348



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Abutilon cryptopetalum</i>	0.1	1.2
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	1.5
<i>Acacia ampliceps</i>	0.1	2.0
<i>Acacia citrinoviridis</i>	0.1	3.0
<i>Acacia pyrifolia</i>	0.1	2.0
<i>Acacia tetragonophylla</i>	0.1	1.7
<i>Adriana tomentosa</i>	0.1	0.25
<i>Amaranthus undulatus</i>	0.1	0.37
<i>Ammannia baccifera</i>	0.1	3.0
<i>*Cenchrus ciliaris</i>	20.0	0.45

Name	Cover (%)	Height (m)
<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>	0.1	1.5
<i>Corchorus crozophorifolius</i>	0.1	0.5
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cyperus vaginatus</i>	1.0	1.1
<i>Dicladanthera forrestii</i>	0.1	0.4
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.3
<i>Eragrostis tenellula</i>	0.1	0.3
<i>Eucalyptus camaldulensis</i>	2.0	12
<i>Eucalyptus victrix</i>	19.0	11
<i>Glycine canescens</i>	0.1	twiner
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Melaleuca glomerata</i>	8.0	4.0
<i>Phyllanthus maderaspatensis</i>	0.1	0.25
<i>Pluchea rubelliflora</i>	3.0	0.5
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Rhynchosia minima</i>	0.1	twiner
* <i>Sonchus oleraceus</i>	0.1	0.7
<i>Stemodia grossa</i>	1.0	0.25
<i>Stylobasium spathulatum</i>	0.1	1.6

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.7
<i>Acacia ampliceps</i>	0.1	2.4
<i>Acacia bivenosa</i>	0.1	1.5
<i>Acacia citrinoviridis</i>	0.1	1.9
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	1.8
<i>Amaranthus undulatus</i>	0.1	0.2
* <i>Cenchrus ciliaris</i>	15.0	0.9
* <i>Cenchrus setiger</i>	10.0	0.9
<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>	0.1	1.1
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cyperus vaginatus</i>	1.0	0.8
<i>Dicladanthera forrestii</i>	0.1	0.3
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.3
<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>	2.0	12.0
<i>Eucalyptus victrix</i>	19.0	12.0
<i>Glycine canescens</i>	0.1	twiner
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Melaleuca glomerata</i>	8.0	5.0
<i>Melaleuca linophylla</i>	1.0	3.5
<i>Operculina aequiseapala</i>	0.1	twiner
<i>Phyllanthus maderaspatensis</i>	0.1	0.3
<i>Pluchea rubelliflora</i>	3.0	0.4
<i>Ptilotus obovatus</i>	0.1	0.8
<i>Rhynchosia minima</i>	0.1	twiner

Name	Cover (%)	Height (m)
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.5
<i>Stemodia grossa</i>	1.0	0.3
<i>Stylobasium spathulatum</i>	0.1	1.8

* denotes weed species

Site: GP28
Location: Map 20
Date: 2018-04-09
MGA Zone: 50
Habitat: Riseslope
Slope: >10-20°
Soil: Brown clay loam
Rock type: Dolerite
Rock Abundance: >50%
Vegetation Type: H5
Vegetation: *Triodia wiseana* hummock grassland
Veg Condition: Good
Fire Age: 5-10 years

Type: Quadrat
Described by: BE
Easting: 576443
Northing: 7426670



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	0.6
<i>Acacia pyrifolia</i>	0.5	0.5
<i>Acacia tetragonophylla</i>	0.1	2.1
* <i>Aerva javanica</i>	0.1	0.4
<i>Aristida contorta</i>	0.1	35
* <i>Cenchrus ciliaris</i>	0.1	0.4
<i>Corchorus laniflorus</i>	0.5	0.5
<i>Dicladanthera forrestii</i>	0.1	0.35
<i>Eremophila cuneifolia</i>	0.5	0.65
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.5	0.7
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.35
<i>Eremophila reticulata</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Eriachne mucronata</i>	0.1	0.3
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Hibiscus goldsworthii</i>	0.1	0.5
<i>Iseilema membranaceum</i>	0.1	0.06
<i>Polycarpaea longiflora</i>	0.1	0.25
<i>Ptilotus clementii</i>	0.4	0.11
<i>Ptilotus obovatus</i>	0.1	1.0
<i>Salsola australis</i>	0.1	0.3
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.25
<i>Triodia wiseana</i>	50.0	0.5
<i>Triumfetta clementii</i>	0.1	0.35

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	0.5
<i>Acacia tetragonophylla</i>	0.1	2.2
* <i>Aerva javanica</i>	0.1	0.05
<i>Aristida contorta</i>	0.1	0.2
* <i>Cenchrus ciliaris</i>	0.1	0.6
<i>Cleome viscosa</i>	0.1	0.1
<i>Corchorus laniflorus</i>	0.1	0.5
<i>Enneapogon polyphyllus</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	0.1	0.8
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.8
<i>Eriachne pulchella</i>	0.1	0.2
<i>Euphorbia biconvexa</i>	0.1	0.05
<i>Euphorbia boophthona</i>	0.1	0.2
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Heliotropium conocarpum</i>	0.1	0.05
<i>Hibiscus goldsworthii</i>	0.1	0.6
<i>Oldenlandia crouchiana</i>	0.1	0.1
<i>Paspalidium clementii</i>	0.1	0.2
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Ptilotus clementii</i>	0.1	0.1
<i>Ptilotus exaltatus</i>	0.1	0.03
<i>Ptilotus obovatus</i>	0.1	0.8
<i>Salsola australis</i>	0.1	0.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.6
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.15
<i>Swainsona maccullochiana</i>	0.1	0.05
<i>Tribulus suberosus</i>	0.1	0.2
<i>Triodia wiseana</i>	40.0	0.6
<i>Triumfetta clementii</i>	0.1	0.2

* denotes weed species

Site: GP29**Location:** Map 20**Date:** 2018-04-09**MGA Zone:** 50**Habitat:** Major Creek**Slope:** >5-10°**Soil:** Brown**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** D6**Vegetation:** *Corymbia ferriticola* low open woodland over *Acacia citrinoviridis*, *Hibiscus campanulatus* tall open shrubland over **Cenchrus ciliaris* scattered tussock grasses with *Pluchea dentex* very open herbland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 575107**Northing:** 7426395**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	1.7
<i>Acacia citrinoviridis</i>	7.0	5.0
<i>Acacia pruinocarpa</i>	0.1	2.0
<i>Acacia pyrifolia</i>	0.1	1.5
* <i>Aerva javanica</i>	0.1	0.45
<i>Aristida holathera</i> var. <i>holathera</i>	0.1	0.4
<i>Astrotricha hamptonii</i>	0.1	2.0
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cheilanthes</i> sp.	0.1	0.1
<i>Cleome viscosa</i>	0.1	0.4
<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Corchorus crozophorifolius</i>	0.1	0.5
<i>Corymbia ferritcola</i>	2.0	5.0
<i>Cymbopogon ambiguus</i>	0.1	0.5
<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.1	0.25
<i>Dodonaea pachyneura</i>	0.1	1.6
<i>Duperreya commixta</i>	0.1	twiner
<i>Eremophila cryptothrix</i>	0.1	1.3
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.2
<i>Eremophila latrobei</i> subsp. <i>glabra</i>	0.1	1.2
<i>Eremophila petrophila</i> subsp. <i>petrophila</i>	0.1	1.0
<i>Eriachne mucronata</i>	22.0	0.35
<i>Gomphrena cunninghamii</i>	0.1	0.15
<i>Hibiscus campanulatus</i> P1	2.0	1.8
<i>Indigofera monophylla</i>	0.1	0.2
<i>Pluchea dentex</i>	3.0	0.35
<i>Polycarpaea longiflora</i>	0.1	0.3
<i>Psydrax latifolia</i>	0.1	2.1
<i>Pterocaulon sphacelatum</i>	0.1	0.4
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Rhynchosia minima</i>	0.1	twiner
* <i>Rumex vesicarius</i>	0.1	0.1
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	0.4
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	0.1	0.36
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Solanum piceum</i>	0.1	1.3
<i>Themeda triandra</i>	0.1	0.7
<i>Tribulus suberosus</i>	0.1	0.5
<i>Triodia epactia</i>	0.1	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	1.7
<i>Acacia citrinoviridis</i>	7.0	5.0
<i>Acacia macraneura</i>	0.1	6.0
<i>Acacia pruinocarpa</i>	0.1	3.0
<i>Acacia rhodophloia</i>	0.1	4.0
<i>Acacia tetragonophylla</i>	0.1	1.3
* <i>Aerva javanica</i>	0.1	0.5
<i>Aristida nitidula</i>	0.1	0.4
<i>Astrotricha hamptonii</i>	0.1	0.1
<i>Bulbostylis barbata</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	1.5	0.5
<i>Cheilanthes brownie</i>	0.1	0.1
<i>Cleome viscosa</i>	0.1	0.4
<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>	0.1	0.5
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Corymbia ferritcola</i>	2.0	6.0
<i>Cucumis variabilis</i>	0.1	twiner

Name	Cover (%)	Height (m)
<i>Cymbopogon ambiguus</i>	0.1	0.5
<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.1	0.2
<i>Dodonaea pachyneura</i>	0.1	0.6
<i>Duperreya commixta</i>	0.1	twiner
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.2
<i>Eremophila latrobei</i> subsp. <i>glabra</i>	0.1	1.2
<i>Eriachne mucronata</i>	0.1	0.4
<i>Euphorbia</i> sp.	0.1	0.1
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Grevillea berryana</i>	0.1	2.5
<i>Hibiscus campanulatus</i> P1	2.0	3.0
<i>Hybanthus aurantiacus</i>	0.1	0.2
<i>Indigofera monophylla</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Paspalidium clementii</i>	0.1	0.3
<i>Pluchea dentex</i>	3.0	0.3
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Psyrax latifolia</i>	0.1	3.0
<i>Ptilotus obovatus</i>	0.1	0.3
<i>Rhynchosia minima</i>	0.1	twiner
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.8
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Solanum</i> sp. indet	0.1	0.6
<i>Themeda triandra</i>	0.1	1.0
<i>Tribulus suberosus</i>	0.1	1.0
<i>Triodia epactia</i>	0.1	0.4

* denotes weed species

Site: GP30
Location: Map 20
Date: 2018-04-09
MGA Zone: 50
Habitat: Hillslope
Slope: >35-50°
Soil: Reddish brown sandy loam
Rock type: Ironstone
Rock Abundance: >50%
Vegetation Type: H5
Vegetation: *Triodia wiseana* hummock grassland
Veg Condition: Very Good
Fire Age: 5-10 years

Type: Quadrat
Described by: BE
Easting: 576063
Northing: 7426835



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia pruinocarpa</i>	0.1	0.7
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.5	2.1
* <i>Aerva javanica</i>	0.1	0.4
<i>Clerodendrum floribundum</i> var. <i>floribundum</i>	0.1	2.2
<i>Cullen leucochaetes</i>	0.1	1.7
<i>Eremophila cryptothrix</i>	0.1	1.5
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.6
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	1.2
<i>Maireana thesioides</i>	0.1	0.3
<i>Paspalidium clementii</i>	0.1	0.2
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	0.1	0.15
<i>Solanum cleistogamum</i>	0.1	0.2

Name	Cover (%)	Height (m)
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Triodia wiseana</i>	35.0	0.6

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia arida</i>	0.1	1.1
<i>Acacia pruinocarpa</i>	0.1	0.7
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.1
* <i>Aerva javanica</i>	0.1	0.3
<i>Boerhavia coccinea</i>	0.1	0.1
<i>Cleome viscosa</i>	0.1	0.05
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	0.1	2.0
<i>Cullen leucochaetes</i>	0.1	1.6
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	1.4
<i>Eriachne pulchella</i>	0.1	0.2
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	1.2
<i>Polycarpaea longiflora</i>	0.1	0.25
<i>Ptilotus exaltatus</i>	0.1	0.03
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Sporobolus australasicus</i>	0.1	0.3
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.05
<i>Triodia wiseana</i>	35.0	0.6

* denotes weed species

Site: GP31

Location: Map 13

Date: 201-04-12

MGA Zone: 50

Habitat: Hillslope

Slope: >20-35°

Soil: Red brown sandy clay loam

Rock type: Basalt

Rock Abundance: >50%

Vegetation Type: H8

Vegetation: *Acacia tetragonophylla*, *A. aptaneura*, *A. wanyu* tall open shrubland over *Senna stricta*, *Eremophila cuneifolia*, *E. phyllopoda* subsp. *obliqua* open shrubland over *E. jucunda* subsp. *pulcherrima* scattered low shrubs

Veg Condition: Very Good

Fire Age: >10 years

Type: Quadrat

Described by: LD

Easting: 564848

Northing: 7426083



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	4.0
<i>Acacia tetragonophylla</i>	3.0	2.2
<i>Acacia wanyu</i>	0.5	3.5
<i>Acacia xiphophylla</i>	0.1	3.5
<i>Aristida contorta</i>	0.5	0.35
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Eremophila cuneifolia</i>	0.5	0.6
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.5	0.5
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.0	1.5
<i>Eriachne pulchella</i>	0.5	0.25

Name	Cover (%)	Height (m)
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	3.0
<i>Maireana melanocoma</i>	0.1	0.25
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	0.1	0.25
<i>Portulaca oleracea</i>	0.1	0.03
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.35
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.6
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	0.6
<i>Senna stricta</i>	1.0	1.3
<i>Solanum cleistogamum</i>	0.1	0.15
<i>Tribulus suberosus</i>	0.1	0.35
<i>Trigastrotheca molluginea</i>	0.1	0.25

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	1.0	4.0
<i>Acacia tetragonophylla</i>	3.0	3.0
<i>Acacia wanyu</i>	0.5	3.5
<i>Acacia xiphophylla</i>	0.1	3.5
<i>Aristida contorta</i>	0.1	0.3
<i>Bulbostylis barbata</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	0.1	0.4
<i>Eremophila cuneifolia</i>	1.0	1.3
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.5	0.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	1.4
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.25
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.2
<i>Heliotropium heteranthum</i>	0.1	0.1
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Maireana melanocoma</i>	0.1	0.25
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	0.1	0.1
<i>Portulaca oleracea</i>	0.1	0.1
<i>Ptilotus exaltatus</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Sclerolaena eriacantha</i>	0.1	0.3
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.7
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.0
<i>Senna stricta</i>	2.0	1.5
<i>Solanum cleistogamum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Trianthema glossostigmum</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.3
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia epactia</i>	0.1	0.4

* denotes weed species

Site: GP32**Location:** Map 11**Date:** 2018-04-10**MGA Zone:** 50**Habitat:** Hillcrest**Slope:** 0-5°**Soil:** Red brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** P4**Vegetation:** *Eremophila phyllopoda* subsp. *obliqua*, *E. cuneifolia*, *Senna stricta* open shrubland over *E. jucunda* subsp. *pulcherrima* low open shrubland over *Triodia angusta* open hummock grassland**Veg Condition:** Very Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 563340**Northing:** 7425597**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp.	0.1	0.2
<i>Acacia aptaneura</i>	0.5	3.5
<i>Acacia synchronicia</i>	0.1	1.3
<i>Acacia tetragonophylla</i>	0.5	1.5
<i>Aristida contorta</i>	0.1	0.25
<i>Enneapogon caerulescens</i>	0.1	0.25
<i>Eremophila cuneifolia</i>	1.0	1.1
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	2.0	0.4
<i>Eremophila latrobei</i>	0.1	1.2
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	2.0	1.6
<i>Eremophila reticulata</i>	0.1	1.2

Name	Cover (%)	Height (m)
<i>Eriachne mucronata</i>	0.1	0.35
<i>Goodenia forrestii</i>	0.1	0.25
<i>Heliotropium inexplicitum</i>	0.1	0.15
<i>Lawrenzia densiflora</i>	0.1	0.25
<i>Lepidium pedicellosum</i>	0.1	0.35
<i>Maireana georgei</i>	0.1	0.15
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus clementii</i>	0.1	0.25
<i>Ptilotus obovatus</i>	0.1	0.35
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	0.4
<i>Sida echinocarpa</i>	0.1	0.3
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.15
<i>Solanum horridum</i>	0.1	0.1
<i>Sporobolus australasicus</i>	0.1	0.05
<i>Tribulus suberosus</i>	0.1	0.3
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia angusta</i>	55.0	0.35

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	5.5
<i>Acacia synchronicia</i>	0.1	1.2
<i>Acacia tetragonophylla</i>	0.1	1.5
<i>Aristida contorta</i>	0.1	0.2
<i>Enneapogon caerulescens</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	1.0	1.2
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	2.0	0.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	2.0	1.5
<i>Eremophila reticulata</i>	0.1	1.3
<i>Eriachne mucronata</i>	0.1	0.4
<i>Eriachne pulchella</i>	0.1	0.2
* <i>Flaveria trinervia</i>	0.1	0.3
<i>Goodenia forrestii</i>	0.1	0.3
<i>Indigofera cuspidata</i>	0.1	0.6
<i>Indigofera monophylla</i>	0.1	0.4
<i>Maireana georgei</i>	0.1	0.4
<i>Maireana melanocoma</i>	0.1	0.3
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3
<i>Oldenlandia crouchiana</i>	0.1	0.05
<i>Paspalidium clementii</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.05
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Scaevola spinescens</i>	0.1	1.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.8
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.4
<i>Senna stricta</i>	1.0	1.2

Name	Cover (%)	Height (m)
<i>Sida echinocarpa</i>	0.1	0.3
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.3
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.3
<i>Tribulus suberosus</i>	0.1	0.3
<i>Trigastrotheca molluginea</i>	0.1	0.15
<i>Triodia angusta</i>	25.0	0.6

* denotes weed species

Site: GP33**Location:** Map 11**Date:** 2018-04-12**MGA Zone:** 50**Habitat:** Drainage depression**Slope:** 0-5°**Soil:** Red brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** 10-20%**Vegetation Type:** D1**Vegetation:** *Acacia aneura* tall shrubland over *Eremophila phyllopoda* subsp. *obliqua* open shrubland over *Triodia epactia* open hummock grassland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** LD**Easting:** 562505**Northing:** 7425941**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.35
<i>Acacia aneura</i>	15.0	3.7
<i>Acacia aptaneura</i>	0.1	1
<i>Acacia pruinocarpa</i>	0.1	3.6
<i>Acacia tetragonophylla</i>	0.5	2.6
<i>Bulbostylis barbata</i>	0.1	0.15
* <i>Cenchrus ciliaris</i>	0.1	0.5
<i>Cymbopogon ambiguus</i>	0.1	0.45
<i>Dodonaea pachyneura</i>	0.1	1.0
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.5
<i>Eremophila cuneifolia</i>	0.1	0.6

Name	Cover (%)	Height (m)
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.4
<i>Eremophila latrobei</i>	0.1	1.5
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	2.0	1.2
<i>Eremophila reticulata</i>	0.1	1.7
<i>Grevillea berryana</i>	0.1	3.8
<i>Hibiscus campanulatus</i> P1	0.1	2.1
<i>Maireana georgei</i>	0.1	0.3
<i>Paspalidium clementii</i>	0.1	0.2
<i>Polycarpaea longiflora</i>	0.1	0.3
<i>Psyrax latifolia</i>	0.1	0.7
<i>Ptilotus obovatus</i>	0.1	0.8
<i>Santalum lanceolatum</i>	0.1	2.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.5
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.6
<i>Sida</i> ? sp. L (A.M. Ashby 4202)	0.1	0.2
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.35
<i>Tribulus suberosus</i>	0.1	0.35
<i>Trigastrotheca molluginea</i>	0.1	0.2
<i>Triodia epactia</i>	25.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.3
<i>Acacia aneura</i>	15.0	4.0
<i>Acacia aptaneura</i>	0.1	1.0
<i>Acacia pruinocarpa</i>	0.1	3.6
<i>Acacia tetragonophylla</i>	0.1	2.7
<i>Bonamia pilbarensis</i>	0.1	0.1
<i>Bulbostylis barbata</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	0.1	0.4
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	0.1	0.3
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dodonaea pachyneura</i>	0.1	2.0
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	0.1	0.1
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.0
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	0.1	1.2
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	0.1	0.5
<i>Eremophila latrobei</i>	0.1	2.0
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	2.0	1.7
<i>Eremophila reticulata</i>	0.1	1.2
<i>Eriachne mucronata</i>	0.1	0.3
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Euphorbia boophthona</i> ?	0.1	0.2
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	0.2
<i>Gomphrena cunninghamii</i>	0.1	0.2

Name	Cover (%)	Height (m)
<i>Grevillea berryana</i>	0.1	3.5
<i>Hibiscus campanulatus</i> P1	0.1	2.2
<i>Hibiscus coatesii</i>	0.1	0.8
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Maireana georgei</i>	0.1	0.3
<i>Oldenlandia crouchiana</i>	0.1	0.2
<i>Paspalidium clementii</i>	0.1	0.2
<i>Phyllanthus maderaspatensis</i>	0.1	0.2
<i>Polycarpaea longiflora</i>	0.1	0.3
<i>Portulaca oleracea</i>	0.1	0.2
<i>Psyrax latifolia</i>	0.1	0.5
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.3
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.6
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	1.7
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Solanum phlomoides</i>	0.1	0.3
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.5
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.3
<i>Trigastrotheca molluginea</i>	0.1	2.0
<i>Triodia epactia</i>	25.0	0.4

* denotes weed species

? denotes unconfirmed ID

Site: GP34**Location:** Map 11**Date:** 2018-04-12**MGA Zone:** 50**Habitat:** Plain**Slope:** 0-5°**Soil:** Reddish brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** P2

Vegetation: *Acacia tetragonophylla* tall shrubland over *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Aristida contorta*, *Eriachne pulchella* subsp. *dominii* very open tussock grassland with *Trigastrotheca molluginea*, *Goodenia microptera* scattered herbs

Veg Condition: Excellent**Fire Age:** 5-10 years**Type:** Quadrat**Described by:** KM**Easting:** 562734**Northing:** 7426126**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia tetragonophylla</i>	12.0	2.5
<i>Aristida contorta</i>	15.0	0.4
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Enneapogon caeruleus</i>	0.1	0.3
<i>Enneapogon polyphyllus</i>	0.1	0.3
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	3.0	1.6
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	6.0	0.2
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.5	0.3
<i>Maireana melanocoma</i>	0.1	0.3
<i>Maireana planifolia</i>	0.1	0.6

Name	Cover (%)	Height (m)
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	0.1	0.15
<i>Ptilotus obovatus</i>	0.1	0.2
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.6
<i>Sclerolaena densiflora</i>	0.1	0.1
<i>Senna stricta</i>	0.1	0.7
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.6
<i>Trigastrotheca molluginea</i>	4.0	0.3
<i>Triodia epactia</i>	0.1	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	3.0
<i>Acacia tetragonophylla</i>	12.0	2.5
<i>Acacia wanyu</i>	0.1	0.3
<i>Aristida contorta</i>	1.5	0.25
<i>Boerhavia coccinea</i>	0.1	0.1
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	0.1	0.1
<i>Corchorus crozophorifolius</i>	0.1	0.4
<i>Dodonaea petiolaris</i>	0.1	0.2
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Enneapogon polyphyllus</i>	0.1	0.2
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	1.5	1.6
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	1.5	0.1
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.2
<i>Goodenia microptera</i>	0.5	0.05
<i>Maireana melanocoma</i>	0.1	0.3
<i>Maireana planifolia</i>	0.1	0.6
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	0.1	0.1
<i>Ptilotus helipteroides</i>	0.1	0.05
<i>Ptilotus obovatus</i>	0.1	0.2
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.6
<i>Sclerolaena densiflora</i>	0.1	0.15
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	1.5
<i>Senna stricta</i>	0.1	0.6
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Solanum piceum</i>	0.1	0.5
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Trianthema glossostigmum</i>	0.1	0.02
<i>Tribulus suberosus</i>	0.1	0.6
<i>Trigastrotheca molluginea</i>	1.0	0.2
<i>Triodia epactia</i>	0.1	0.4
<i>Tripogonella loliiformis</i>	0.1	0.05

Site: GP35
Location: Map 8
Date: 2018-04-14
MGA Zone: 50
Habitat: Plain
Slope: 0-5°
Soil: Red brown clay loam
Rock Abundance: 2-10%
Vegetation Type: D14
Vegetation: *Acacia citrinoviridis* scattered tall shrubs over **C. setiger* tussock grassland
Veg Condition: Degraded
Fire Age: >10 years

Type: Quadrat
Described by: KM
Easting: 559861
Northing: 7429111



Phase1 Species List

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	1.0	4.0
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>	1.0	2.2
* <i>Aerva javanica</i>	0.1	0.5
* <i>Cenchrus ciliaris</i>	35.0	0.35
* <i>Cenchrus setiger</i>	1.0	0.4
<i>Ptilotus obovatus</i>	0.5	1.3

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	1.0	4.0
* <i>Aerva javanica</i>	0.1	0.6
* <i>Cenchrus setiger</i>	35.0	0.8

* denotes weed species

Site: GP36**Location:** Map 12**Date:** 2018-04-14**MGA Zone:** 50**Habitat:** Plain**Slope:** 0-5°**Soil:** Red brown clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** P2**Vegetation:** *Acacia aptaneura*, *A. pteraneura* tall open shrubland over *A. tetragonophylla*, *Eremophila phyllopoda* subsp. *obliqua* scattered shrubs over *Eriachne pulchella* subsp. *dominii* open tussock grassland**Veg Condition:** Excellent**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 565990**Northing:** 7429664**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	3.0	4.5
<i>Acacia macraneura</i>	0.1	3.5
<i>Acacia tetragonophylla</i>	1.0	2.0
<i>Aristida contorta</i>	0.1	0.35
<i>Cymbopogon ambiguus</i>	0.1	0.4
<i>Enneapogon caerulescens</i>	0.1	0.35
<i>Eremophila latrobei</i>	0.1	1.9
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	0.5
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	40.0	0.2
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.35
<i>Goodenia tenuiloba</i>	0.1	0.35

Name	Cover (%)	Height (m)
<i>Grevillea saxicola</i> P3	0.1	5.0
<i>Heliotropium heteranthum</i>	0.1	0.02
<i>Maireana eriosphaera</i>	0.1	0.3
<i>Maireana thesioides</i>	0.1	0.3
<i>Portulaca oleracea</i>	0.1	0.03
<i>Psydrax suaveolens</i>	0.1	1.8
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.4
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.5
<i>Senna stricta</i>	0.1	1.0
<i>Sida</i> sp.	0.1	0.35
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Tribulus suberosus</i>	0.1	1.3
<i>Triodia epactia</i>	0.1	0.5

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	3.0	4.5
<i>Acacia pteraneura</i>	2.0	4.0
<i>Acacia tetragonophylla</i>	1.0	1.9
<i>Aristida contorta</i>	0.1	0.3
<i>Cymbopogon ambiguus</i>	0.1	0.3
<i>Duperreya commixta</i>	0.1	twiner
<i>Enneapogon caeruleus</i>	0.1	0.3
<i>Eremophila latrobei</i> subsp. <i>glabra</i>	0.1	0.6
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.5	1.6
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	20.0	0.15
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.3
<i>Goodenia microptera</i>	0.1	0.05
<i>Grevillea saxicola</i> P3	0.1	4.2
<i>Heliotropium heteranthum</i>	0.1	0.02
<i>Hybanthus aurantiacus</i>	0.1	0.4
<i>Maireana georgei</i>	0.1	0.3
<i>Maireana thesioides</i>	0.1	0.3
<i>Pluchea dentex</i>	0.1	0.3
<i>Portulaca oleracea</i>	0.1	0.03
<i>Psydrax suaveolens</i>	0.1	3.0
<i>Ptilotus exaltatus</i>	0.1	0.2
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.5
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.6
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.7
<i>Senna stricta</i>	0.1	0.7
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.8
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.7
<i>Solanum lasiophyllum</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Tribulus suberosus</i>	0.1	0.5
<i>Triodia epactia</i>	0.1	0.6

Site: GP37**Location:** Map 11**Date:** 2018-04-12**MGA Zone:** 50**Habitat:** Hillslope**Slope:** >10-20°**Soil:** Brown sandy clay loam**Rock type:** Basalt**Rock Abundance:** >50%**Vegetation Type:** P4**Vegetation:** *Acacia tetragonophylla*, *A. xiphophylla* tall open shrubland over *Eremophila cuneifolia* open shrubland over *Triodia angusta* hummock grassland**Veg Condition:** Very Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** KM**Easting:** 563186**Northing:** 7425938**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	4.0
<i>Acacia bivenosa</i>	0.1	2.0
<i>Acacia tetragonophylla</i>	1.0	3.0
<i>Acacia wanyu</i>	0.1	1.2
<i>Acacia xiphophylla</i>	0.1	2.3
<i>Corchorus crozophorifolius</i>	0.1	0.5
<i>Enneapogon caeruleus</i>	0.1	0.3
<i>Eremophila cuneifolia</i>	15.0	1.5
<i>Eremophila latrobei</i>	0.1	0.2
<i>Goodenia forrestii</i>	0.1	0.3
<i>Hybanthus aurantiacus</i>	0.1	0.2

Name	Cover (%)	Height (m)
<i>Indigofera monophylla</i>	0.1	0.3
<i>Lepidium pedicellum</i>	0.1	0.25
<i>Maireana georgei</i>	0.1	0.25
<i>Maireana thesioides</i>	0.1	0.4
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	0.1	0.02
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.0
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.35
<i>Streptoglossa</i> sp.	0.1	0.15
<i>Tribulus suberosus</i>	0.1	0.2
<i>Triodia angusta</i>	40.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	4.0
<i>Acacia bivenosa</i>	0.1	2.0
<i>Acacia synchronicia</i>	0.1	0.3
<i>Acacia tetragonophylla</i>	1.0	3.0
<i>Acacia wanyu</i>	0.1	1.3
<i>Acacia xiphophylla</i>	1.0	2.3
* <i>Cenchrus ciliaris</i>	0.1	0.3
<i>Cymbopogon ambiguus</i>	0.1	1.1
<i>Duperreya commixta</i>	0.1	0.4
<i>Eremophila cuneifolia</i>	9.0	1.2
<i>Goodenia forrestii</i>	0.1	0.25
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Hybanthus aurantiacus</i>	0.1	0.6
<i>Indigofera monophylla</i>	0.1	0.3
<i>Lepidium pedicellum</i>	0.1	0.3
<i>Maireana georgei</i>	0.1	0.25
<i>Maireana thesioides</i>	0.1	0.4
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Psydrax latifolia</i>	0.1	1.3
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.8
<i>Rhynchosia minima</i>	0.1	0.4
<i>Scaevola spinescens</i>	0.1	1.3
<i>Sclerolaena eriacantha</i>	0.1	0.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.5
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.0
<i>Senna stricta</i>	0.1	1.2
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Trianthema glossostigmum</i>	0.1	0.05
<i>Tribulus suberosus</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Triodia angusta</i>	31.0	0.5

* denotes weed species

Site: GP38**Location:** Map 12**Date:** 2018-04-15**MGA Zone:** 50**Habitat:** Drainage depression**Slope:** 0-5°**Soil:** Reddish brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** 20-50%**Vegetation Type:** D3

Vegetation: *Acacia citrinoviridis* tall shrubland over *Ptilotus obovatus*, *Corchorus crozophorifolius* open shrubland over *Dipteracanthus australasicus* subsp. *australasicus*, (*Hybanthus aurantiacus*) low open shrubland over *Triodia epactia* very open hummock grassland with **Cenchrus ciliaris*, *Eriachne mucronata*, **C. setiger* very open tussock grassland

Veg Condition: Poor**Fire Age:** >10 years**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.6
<i>Acacia citrinoviridis</i>	29.0	6.0
<i>Acacia tetragonophylla</i>	0.1	1.7
<i>*Aerva javanica</i>	0.1	0.4
<i>Amaranthus undulatus</i>	0.1	0.3
<i>*Cenchrus ciliaris</i>	0.5	0.5
<i>Cleome viscosa</i>	0.1	0.4
<i>Corchorus crozophorifolius</i>	0.1	0.5
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	3.0	0.45

Name	Cover (%)	Height (m)
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.6
<i>Eriachne mucronata</i>	3.0	0.4
<i>Euphorbia biconvexa</i>	0.1	0.4
<i>Gomphrena cunninghamii</i>	0.1	0.2
<i>Grevillea saxicola</i> P3	0.1	5.0
<i>Hybanthus aurantiacus</i>	0.1	0.3
<i>Indigofera monophylla</i>	0.1	0.4
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	2.0
<i>Phyllanthus maderaspatensis</i>	0.1	0.3
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.5	0.55
<i>Rhynchosia minima</i>	0.1	twiner
<i>Santalum lanceolatum</i>	0.1	2.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.6
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.6
<i>Abutilon lepidum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	0.1	0.4
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.4
<i>Triodia epactia</i>	2.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.4
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.4
<i>Acacia aptaneura</i>	0.1	5.5
<i>Acacia citrinoviridis</i>	28.0	6.0
<i>Acacia tetragonophylla</i>	0.1	1.2
* <i>Aerva javanica</i>	0.1	0.6
<i>Aristida contorta</i>	0.1	0.4
* <i>Cenchrus ciliaris</i>	7.0	0.6
* <i>Cenchrus setiger</i>	2.0	0.6
<i>Cleome viscosa</i>	0.1	0.2
<i>Corchorus crozophorifolius</i>	1.0	1.3
<i>Corymbia ferriticola</i>	0.1	5.0
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	5.0	0.4
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.8
<i>Enneapogon caeruleus</i>	0.1	0.1
<i>Eremophila cuneifolia</i>	0.1	0.6
<i>Eremophila latrobei</i> subsp. <i>glabra</i>	0.1	0.9
<i>Eriachne mucronata</i>	3.0	0.5
<i>Eriachne pulchella</i>	0.1	0.1
<i>Glycine canescens</i>	0.1	twiner
<i>Grevillea saxicola</i> P3	0.1	5.0
<i>Hybanthus aurantiacus</i>	1.0	0.4

Name	Cover (%)	Height (m)
<i>Indigofera monophylla</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	2.0
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.1
<i>Phyllanthus maderaspatensis</i>	0.1	0.05
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Portulaca oleracea</i>	0.1	0.1
<i>Psydrax latifolia</i>	0.1	0.6
<i>Ptilotus obovatus</i>	3.0	1.2
<i>Rhagodia eremaea</i>	0.1	1.2
<i>Santalum lanceolatum</i>	0.1	1.8
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	0.8
<i>Senna glaucifolia</i>	0.1	1.5
<i>Senna stricta</i>	0.1	0.6
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.8
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	0.1	0.3
<i>Tribulus suberosus</i>	0.1	0.3
<i>Triodia epactia</i>	4.0	0.5

* denotes weed species

Site: GP39**Location:** Map 14**Date:** 2018-04-13**MGA Zone:** 50**Habitat:** Foothlope**Slope:** >10-20°**Soil:** Brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** P8**Vegetation:** *Acacia xiphophylla* tall open shrubland over *Senna stricta* scattered shrubs over *Frankenia* aff. *hispidula*, *Tecticornia disarticulata*, *Maireana georgei* low open shrubland**Veg Condition:** Very Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** BE**Easting:** 569255**Northing:** 7429437**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia synchronicia</i>	0.1	0.1
<i>Acacia tetragonophylla</i>	0.1	0.6
<i>Acacia xiphophylla</i>	2.0	3.0
<i>Amaranthus undulatus</i>	0.1	0.1
<i>Cynodon prostratus</i>	0.1	0.05
<i>Dodonaea pachyneura</i>	0.1	1.0
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.6
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	0.1	0.4
<i>Frankenia</i> aff. <i>hispidula</i>	3.0	0.3
<i>Maireana eriosphaera</i>	0.1	0.15
<i>Maireana georgei</i>	0.1	0.2

Name	Cover (%)	Height (m)
<i>Maireana melanocoma</i>	0.1	0.35
<i>Maireana thesioides</i>	0.1	1.2
<i>Paspalidium clementii</i>	0.1	0.05
<i>Ptilotus calostachyus</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Salsola australis</i>	0.1	0.3
<i>Scaevola spinescens</i>	0.1	1.4
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.6
<i>Senna stricta</i>	0.1	1.1
<i>Tecticornia disarticulata</i>	1.0	0.6
<i>Trianthema glossostigmum</i>	0.1	0.02
<i>Tribulus suberosus</i>	0.1	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp.	0.1	0.1
<i>Acacia synchronicia</i>	0.1	1.5
<i>Acacia tetragonophylla</i>	0.1	1.4
<i>Acacia xiphophylla</i>	3.0	4.0
* <i>Cenchrus ciliaris</i>	0.1	0.3
<i>Cynodon prostratus</i>	0.1	0.03
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.4
<i>Dodonaea pachyneura</i>	0.1	0.7
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.8
<i>Eriachne pulchella</i>	0.1	0.1
<i>Frankenia</i> aff. <i>hispidula</i>	2.0	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Maireana georgei</i>	0.5	0.3
<i>Maireana melanocoma</i>	0.1	0.6
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.2
<i>Paspalidium clementii</i>	0.1	0.1
<i>Portulaca oleracea</i>	0.1	0.05
<i>Ptilotus exaltatus</i>	0.1	0.1
<i>Ptilotus obovatus</i>	0.1	0.7
<i>Rhagodia eremaea</i>	0.1	0.1
<i>Scaevola spinescens</i>	0.1	1.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.8
<i>Senna stricta</i>	0.5	1.1
<i>Solanum horridum</i>	0.1	0.2
<i>Streptoglossa bubakii</i>	0.1	0.3
<i>Tecticornia disarticulata</i>	1.0	0.5
<i>Trianthema glossostigmum</i>	0.1	0.02
<i>Tribulus suberosus</i>	0.1	0.3
<i>Triodia epactia</i>	0.1	0.5

* denotes weed species

Site: GP40

Location: Map 14

Date: 2018-04-13

MGA Zone: 50

Habitat: Hillslope

Slope: >10-20°

Soil: Reddish brown sandy loam

Rock type: Ironstone

Rock Abundance: >50%

Vegetation Type: H12

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Grevillea berryana*, *Acacia tetragonophylla*, *A. pruinocarpa* tall open shrubland over *Eremophila jucunda* subsp. *pulcherrima* low open shrubland over *Triodia epactia* open hummock grassland with *Eriachne mucronata* scattered tussock grasses

Veg Condition: Excellent

Fire Age: 5-10 years

Type: Quadrat

Described by: BE

Easting: 567582

Northing: 7430395



Phase 1 Species List

<i>Acacia pruinocarpa</i>	0.5	4.0
<i>Acacia tetragonophylla</i>	1.0	2.2
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Dysphania plantaginella</i>	0.1	0.05
<i>Eremophila cuneifolia</i>	0.1	0.8
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.5
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	8.0	0.9
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.1	1.7
<i>Eremophila reticulata</i>	0.1	1.3
<i>Eriachne mucronata</i>	2.0	0.4
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	0.1

<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2.0	8.0
<i>Grevillea berryana</i>	2.0	3.5
<i>Paspalidium clementii</i>	0.1	0.25
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	0.1	0.15
<i>Psyrax suaveolens</i>	0.1	2.1
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.5
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.2
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.8
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.1
<i>Triodia epactia</i>	27.0	0.6

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia pruinocarpa</i>	0.5	4.0
<i>Acacia tetragonophylla</i>	1.0	2.3
<i>Cynodon prostratus</i>	0.1	0.02
<i>Eremophila cuneifolia</i>	0.1	0.8
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.6
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	7.0	0.9
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.1	1.7
<i>Eremophila reticulata</i>	0.1	1.3
<i>Eriachne mucronata</i>	1.5	0.4
<i>Eriachne pulchella</i>	0.1	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	3.0	9.0
<i>Grevillea berryana</i>	2.0	3.5
<i>Polycarpaea longiflora</i>	0.1	0.3
<i>Psyrax suaveolens</i>	0.1	1.7
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Senna glaucifolia</i>	0.1	0.9
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	2.1
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	0.1	0.8
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.5
<i>Senna stricta</i>	0.1	0.4
<i>Solanum horridum</i>	0.1	0.1
<i>Triodia epactia</i>	27.0	0.6

Site: GP41

Location: Map 5

Date: 2018-04-14

MGA Zone: 50

Habitat: Drainage depression

Slope: 0-5°

Soil: Brown sandy clay loam

Rock type: Basalt, Ironstone

Rock Abundance: 20-50%

Vegetation Type: D3

Vegetation: *Acacia citrinoviridis*, (*A. wanyu*, *A. tetragonophylla*) tall shrubland over *Senna artemisioides* subsp. *oligophylla* scattered shrubs over *Corchorus crozophorifolius*, *Indigofera monophylla* low open shrubland over *Triodia epactia* open hummock grassland with **Cenchrus ciliaris*, **C. setiger* open tussock grassland

Veg Condition: Degraded

Fire Age: >10 years

Type: Quadrat

Described by: BE

Easting: 556850

Northing: 7432958



Phase 1 Species List

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	10.0	6.0
<i>Acacia pruinocarpa</i>	0.1	4.0
<i>Acacia pyrifolia</i>	0.1	1.7
<i>Acacia tetragonophylla</i>	0.5	2.3
<i>Acacia wanyu</i>	1.0	2.5
<i>*Aerva javanica</i>	0.1	1.0
<i>*Cenchrus ciliaris</i>	3.0	0.35
<i>*Cenchrus setiger</i>	1.0	0.45
<i>Corchorus crozophorifolius</i>	0.5	0.5

Name	Cover (%)	Height (m)
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	0.1	0.35
<i>Cymbopogon ambiguus</i>	0.1	0.4
<i>Duperreya commixta</i>	0.1	twiner
<i>Eremophila cuneifolia</i>	0.1	1.2
<i>Eremophila exilifolia</i>	0.1	0.9
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.6
<i>Eremophila reticulata</i>	0.1	1.1
<i>Heliotropium chrysocarpum</i>	0.1	0.3
<i>Hybanthus aurantiacus</i>	0.1	0.35
<i>Indigofera monophylla</i>	0.1	0.4
<i>Polycarpaea longiflora</i>	0.1	0.25
<i>Ptilotus obovatus</i>	0.1	1.2
<i>Rhynchosia minima</i>	0.1	twiner
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.2
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.5
<i>Solanum cleistogamum</i>	0.1	0.3
<i>Triodia epactia</i>	20.0	4.0

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	6.0
<i>Acacia citrinoviridis</i>	12.0	6.0
<i>Acacia pruinocarpa</i>	0.1	5.0
<i>Acacia tetragonophylla</i>	0.5	2.5
<i>Acacia wanyu</i>	1.0	3.5
* <i>Aerva javanica</i>	0.1	0.7
<i>Cleome viscosa</i>	0.1	0.3
* <i>Cenchrus ciliaris</i>	8.0	0.6
* <i>Cenchrus setiger</i>	7.0	0.8
<i>Corchorus crozophorifolius</i>	1.0	0.8
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	0.1	1.2
<i>Duperreya commixta</i>	0.1	twiner
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	0.1	1.4
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.5
<i>Eremophila reticulata</i>	0.1	1.1
<i>Euphorbia biconvexa</i>	0.1	0.3
<i>Heliotropium chrysocarpum</i>	0.1	0.4
<i>Hibiscus sturtii</i> var. <i>platyphlamys</i>	0.1	1.1
<i>Hybanthus aurantiacus</i>	0.1	0.4
<i>Indigofera monophylla</i>	1.0	0.6
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	0.1	0.2
<i>Polycarpaea longiflora</i>	0.1	0.2
<i>Ptilotus obovatus</i>	0.1	1.2
<i>Rhynchosia minima</i>	0.1	twiner

Name	Cover (%)	Height (m)
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	1.0	1.6
<i>Solanum cleistogamum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Solanum piceum</i>	0.1	0.6
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.3
<i>Triodia epactia</i>	20.0	0.6

* denotes weed species

Site: GP42**Location:** Map 13**Date:** 2018-04-12**MGA Zone:** 50**Habitat:** Hillslope**Slope:** >35-50°**Soil:** Red brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** H2**Vegetation:** *Acacia pruinocarpa*, *Grevillea berrryana*, *A. rhodophloia*, *A. aneura* tall open shrubland over *Eremophila exilifolia* open shrubland over *E. jucunda* subsp. *pulcherrima* low open shrubland over *Triodia epactia* open hummock grassland**Veg Condition:** Excellent**Fire Age:** >10 years**Notes:** Minor wheel rut through site, *Acacia aptaneura* just outside quadrat.**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia aneura</i>	0.5	5.0
<i>Acacia pruinocarpa</i>	2.0	3.0
<i>Acacia rhodophloia</i>	1.0	3.0
<i>Bulbostylis barbata</i>	0.1	0.05
<i>Eremophila cuneifolia</i>	0.1	1.3
<i>Eremophila exilifolia</i>	6.0	1.3
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	5.0	0.45
<i>Eremophila latrobei</i>	0.1	1.1
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	0.4

Name	Cover (%)	Height (m)
<i>Eriachne mucronata</i>	0.1	0.2
<i>Eriachne pulchella</i>	0.1	0.1
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.15
<i>Gomphrena cunninghamii</i>	0.1	0.06
<i>Grevillea berryana</i>	1.0	4.0
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Paspalidium clementii</i>	0.1	0.2
<i>Ptilotus calostachyus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.25
<i>Scaevola acacioides</i>	0.1	1.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.2
<i>Solanum horridum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.35
<i>Sporobolus australasicus</i>	0.1	0.15
<i>Tribulus suberosus</i>	0.1	0.25
<i>Triodia epactia</i>	25.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aneura</i>	0.5	5.0
<i>Acacia pruinocarpa</i>	2.0	3.5
<i>Acacia rhodophloia</i>	1.0	3.5
<i>Acacia tetragonophylla</i>	0.1	0.4
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Eremophila cuneifolia</i>	0.1	1.2
<i>Eremophila exilifolia</i>	6.0	1.3
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	5.0	0.8
<i>Eremophila latrobei</i>	0.1	1.1
<i>Eriachne mucronata</i>	0.1	0.25
<i>Eriachne pulchella</i>	0.1	0.1
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Grevillea berryana</i>	1.0	4.0
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Hybanthus aurantiacus</i>	0.1	0.4
<i>Maireana georgei</i>	0.1	0.2
<i>Paspalidium clementii</i>	0.1	0.15
<i>Portulaca oleracea</i>	0.1	0.05
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.3
<i>Solanum horridum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia epactia</i>	25.0	0.4

Site: GP43**Location:** Map 11**Date:** 2018-04-12**MGA Zone:** 50**Habitat:** Minor creek**Slope:** 0-5°**Soil:** Brown sand**Rock type:** Ironstone**Rock Abundance:** 20-50%**Vegetation Type:** D10

Vegetation: *Acacia xiphophylla*, (*A. aneura*, *A. wanyu*, *A. tetragonophylla*) tall open scrub over *Senna* sp. Meekatharra (E. Bailey 1-26) scattered shrubs over *Triodia epactia* open hummock grassland with **Cenchrus ciliaris* scattered tussock grasses

Veg Condition: Good**Fire Age:** >10 years**Type:** Quadrat**Described by:** KM**Easting:** 563860**Northing:** 7425688**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.4
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.4
<i>Acacia aneura</i>	0.5	4.5
<i>Acacia coriacea</i> subsp. <i>pendens</i>	0.1	1.0
<i>Acacia synchronicia</i>	0.1	1.6
<i>Acacia tetragonophylla</i>	0.5	3.0
<i>Acacia wanyu</i>	0.5	4.5
<i>Acacia xiphophylla</i>	35.0	4.5
<i>*Cenchrus ciliaris</i>	0.5	0.4
<i>*Cenchrus setiger</i>	0.1	0.4

Name	Cover (%)	Height (m)
<i>Dicladanthera forrestii</i>	0.1	0.4
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.35
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.4
<i>Eremophila cuneifolia</i>	0.1	1.6
<i>Eremophila latrobei</i>	0.1	0.4
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.5
<i>Eremophila platycalyx</i> subsp. <i>pardalota</i>	0.1	1.2
<i>Eremophila reticulata</i>	0.1	1.9
<i>Eriachne mucronata</i>	0.1	0.35
<i>Frankenia</i> aff. <i>hispidula</i>	0.1	0.3
<i>Hibiscus coatesii</i>	0.1	0.4
<i>Lawrenzia densiflora</i>	0.1	0.35
<i>Lepidium platypetalum</i>	0.1	0.35
<i>Maireana georgei</i>	0.1	0.3
<i>Maireana thesioides</i>	0.1	1.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3
<i>Pterocaulon sphacelatum</i>	0.1	0.2
<i>Ptilotus calostachyus</i>	0.1	0.8
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Scaevola spinescens</i>	0.5	1.3
<i>Sclerolaena eriacantha</i>	0.1	0.21
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.5
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	0.4
<i>Senna stricta</i>	0.1	1.0
<i>Solanum cleistogamum</i>	0.1	0.35
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Streptoglossa decurrens</i>	0.1	0.3
<i>Tecticornia disarticulata</i>	0.1	0.4
<i>Tribulus suberosus</i>	0.1	0.35
<i>Triodia angusta</i>	0.1	0.4
<i>Triodia epactia</i>	15.0	0.4

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	0.1	0.4
<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	0.1	0.4
<i>Acacia aneura</i>	0.5	4.5
<i>Acacia cuspidifolia</i>	0.1	4.0
<i>Acacia synchronicia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	0.5	3.0
<i>Acacia wanyu</i>	0.5	4.5
<i>Acacia xiphophylla</i>	35.0	4.5
* <i>Aerva javanica</i>	0.1	0.7
<i>Boerhavia coccinea</i>	0.1	0.05
* <i>Cenchrus ciliaris</i>	0.5	0.5

Name	Cover (%)	Height (m)
* <i>Cenchrus setiger</i>	0.1	0.6
<i>Duperreya commixta</i>	0.1	1.8
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.8
<i>Eragrostis tenellula</i>	0.1	0.25
<i>Eremophila cuneifolia</i>	0.1	1.6
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	0.6
<i>Eremophila latrobei</i>	0.1	1.4
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	0.1	1.5
<i>Eremophila platycalyx</i> subsp. <i>pardalota</i>	0.1	1.2
<i>Eremophila reticulata</i>	0.1	1.9
* <i>Flaveria trinervia</i>	0.1	0.3
<i>Frankenia</i> aff. <i>hispidula</i>	0.1	0.2
<i>Grevillea berryana</i>	0.1	1.6
<i>Hibiscus coatesii</i>	0.1	0.7
<i>Lawrenzia densiflora</i>	0.1	0.1
<i>Lepidium platypetalum</i>	0.1	0.3
<i>Maireana georgei</i>	0.1	0.3
<i>Maireana thesioides</i>	0.1	1.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3
<i>Marsdenia australis</i>	0.1	2.0
<i>Portulaca oleracea</i>	0.1	0.1
<i>Ptilotus obovatus</i>	0.1	0.4
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.3
<i>Scaevola spinescens</i>	0.1	1.3
<i>Sclerolaena eriacantha</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	1.4
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.5
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	0.1	1.2
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.5	1.5
<i>Senna stricta</i>	0.1	0.8
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.4
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tecticornia disarticulata</i>	0.1	0.9
<i>Trianthema triquetrum</i>	0.1	0.05
<i>Tribulus suberosus</i>	0.1	0.4
<i>Triodia angusta</i>	0.1	0.4
<i>Triodia epactia</i>	15.0	0.5

* denotes weed species

Site: GPR44**Location:** Map 11**Date:** 2018-04-14**MGA Zone:** 50**Habitat:** Minor creek**Soil:** Reddish brown sandy clay loam**Rock type:** Ironstone**Rock Abundance:** >50%**Vegetation Type:** D1**Vegetation:** *Acacia aptaneura*, (*A. macraneura*) tall shrubland over *Eremophila latrobei* subsp. *latrobei*, *E. phyllopoda* subsp. *obliqua* open shrubland over *E. jucunda* subsp. *pulcherrima* low open shrubland over *Triodia epactia* hummock grassland**Veg Condition:** Excellent**Fire Age:** 5-10 years**Type:** Relevé**Described by:** LD**Easting:** 564948**Northing:** 7425763**Phase 1 Species List**

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	12.0	6.0
<i>Acacia macraneura</i>	2.0	5.0
<i>Acacia rhodophloia</i>	0.1	3.0
<i>Acacia tetragonophylla</i>	0.1	2.2
<i>Aristida contorta</i>	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	0.1	0.2
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	5.0	0.8
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	3.0	1.8
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	2.0	1.5
<i>Eriachne mucronata</i>	0.1	0.4

Name	Cover (%)	Height (m)
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	0.1
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.3
<i>Gomphrena cunninghamii</i>	0.1	0.1
<i>Hibiscus burtonii</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	1.7
<i>Paspalidium clementii</i>	0.1	0.2
<i>Psydrax suaveolens</i>	0.1	1.8
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Solanum sturtianum</i>	0.1	0.5
<i>Tribulus suberosus</i>	0.1	0.5
<i>Triodia epactia</i>	35.0	0.7

Phase 2 Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	12.0	5.5
<i>Acacia macraneura</i>	2.0	4.5
<i>Acacia rhodophloia</i>	0.1	3.0
<i>Acacia tetragonophylla</i>	0.1	2.2
<i>Aristida contorta</i>	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	0.1	0.2
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.3
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	5.0	0.8
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	3.0	1.8
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	2.0	1.5
<i>Eriachne mucronata</i>	0.1	0.45
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	0.1	0.1
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.2
<i>Goodenia microptera</i>	0.1	0.1
<i>Hibiscus burtonii</i>	0.1	0.3
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	0.1	0.2
<i>Maireana</i> sp.	0.1	0.2
<i>Paspalidium clementii</i>	0.1	0.2
<i>Phyllanthus maderaspatensis</i>	0.1	0.1
<i>Pluchea dentex</i>	0.1	0.3
<i>Portulaca oleracea</i>	0.1	0.1
<i>Psydrax suaveolens</i>	0.1	1.0
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.3
<i>Triodia epactia</i>	35.0	0.6

Site: GPR45
Location: Map 3
Date: 2018-04-14
MGA Zone: 50
Habitat: Hillcrest
Soil: Dark reddish brown silty clay loam
Rock type: Ironstone
Rock Abundance: >50%
Vegetation Type: H2
Vegetation: *Acacia pruinocarpa* tall open shrubland over *Triodia epactia* hummock grassland
Veg Condition: Very Good



Phase 2 Species List (no Phase 1)

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	0.7
<i>Acacia pruinocarpa</i>	2.0	3.0
* <i>Bidens bipinnata</i>	0.1	0.2
<i>Bulbostylis barbata</i>	0.1	0.1
<i>Cucumis variabilis</i>	0.1	twiner
<i>Eremophila canaliculata</i>	0.1	0.4
<i>Eremophila cuneifolia</i>	0.1	0.8
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	0.1
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	0.1	0.2
<i>Goodenia stobbsiana</i>	0.1	0.4
<i>Grevillea berryana</i>	0.1	2.0
<i>Paraneurachne muelleri</i>	0.1	0.2
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	0.1	0.4
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.4

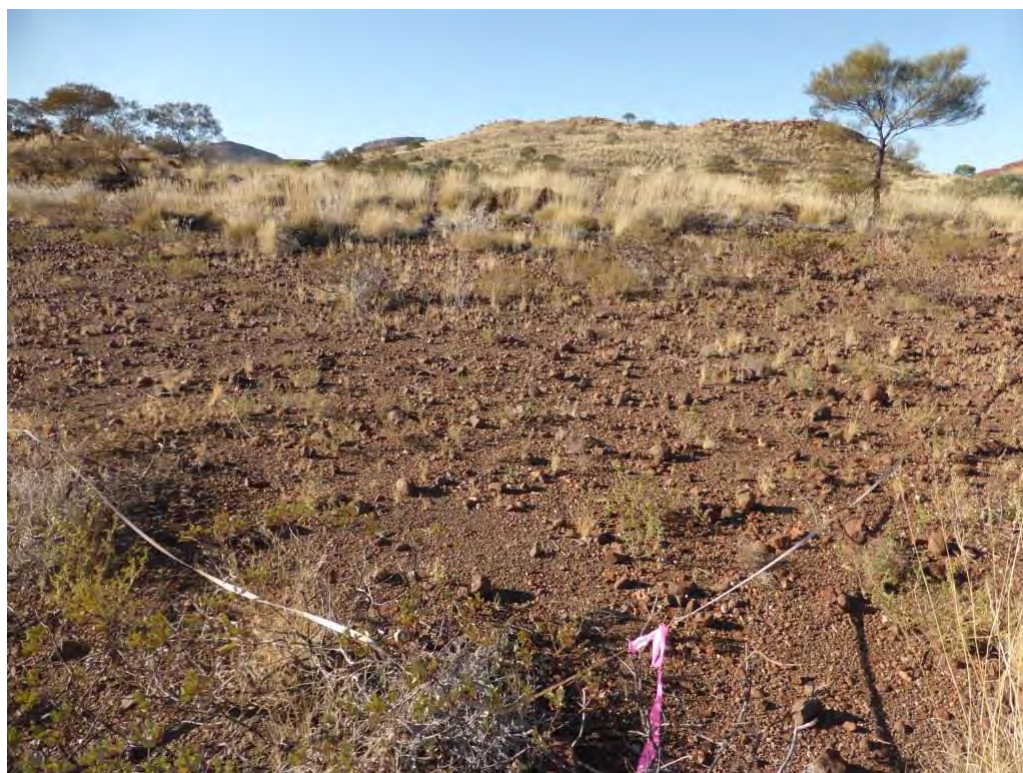
Name	Cover (%)	Height (m)
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	0.1	1.4
<i>Senna stricta</i>	0.1	0.4
<i>Sida fibulifera</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.4
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.2
<i>Triodia epactia</i>	35.0	0.4

* denotes weed species

Site: e006-AR**Location:** Map 4**Date:** 2017-07-25**MGA Zone:** 50**Habitat:** Floodplain**Soil:** Brown sandy loam**Rock type:** Ironstone**Vegetation Type:** D9**Vegetation:** *Acacia wanyu* tall open scrub over *A. tetragonophylla* scattered shrubs over **Cenchrus ciliaris* tussock grassland with *Trianthema oxycalyptum* var. *oxycalyptum* open herbland**Veg Condition:** Degraded**Fire Age:** >10 years**Type:** Relevé (rescore of ecologia 2011 quadrat)**Described by:** LV**Easting:** 554785**Northing:** 7431278**Species List**

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	3.0
<i>Acacia synchronicia</i>	0.1	1.6
<i>Acacia tetragonophylla</i>	1.0	1.2
<i>Acacia wanyu</i>	31.0	2.5
<i>Acacia xiphophylla</i>	0.1	4.0
<i>*Cenchrus ciliaris</i>	60.0	0.35
<i>Chrysopogon fallax</i>	0.1	0.3
<i>Cleome viscosa</i>	0.1	0.35
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.35
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	1.3
<i>Eremophila cuneifolia</i>	0.1	1.0
<i>Eriachne mucronata</i>	0.1	0.09
<i>Eriachne pulchella</i>	0.1	0.04
<i>Frankenia</i> aff. <i>hispidula</i>	0.1	0.3
<i>Lepidium muelleri-ferdinandii</i>	0.1	0.3
<i>Lepidium pedicellsum</i>	0.1	0.35
<i>Lepidium platypetalum</i>	0.1	0.3
<i>Maireana villosa</i>	0.1	1.1
<i>Pterocaulon sphacelatum</i>	0.1	0.5
<i>Rhagodia eremaea</i>	0.1	1.2
<i>Sclerolaena cuneata</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	1.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.5
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.1	1.6
<i>Sporobolus australasicus</i>	0.1	0.09
<i>Trianthema oxycalyptum</i> var. <i>oxycalyptum</i>	15.0	0.1

* denotes weed species

Site: e029-AR**Location:** Map 5**Date:** 2017-07-23**MGA Zone:** 50**Habitat:** Plain**Soil:** Reddish brown sandy loam**Rock type:** Ironstone**Vegetation Type:** H4**Vegetation:** *Grevillea berryana* scattered tall shrubs over *Eremophila cuneifolia* open shrubland over *Acacia tetragonophylla*, *E. forrestii* subsp. *forrestii* low open shrubland over *Triodia epactia* hummock grassland**Veg Condition:** Very Good**Fire Age:** >10 years**Type:** Quadrat (rescore of ecologia 2011 quadrat)**Described by:** LD**Easting:** 556450**Northing:** 7433736**Species List**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.2
<i>Acacia synchronicia</i>	0.1	0.4
<i>Acacia tetragonophylla</i>	2.0	0.6
* <i>Aerva javanica</i>	0.1	0.4
<i>Aristida holathera</i> var. <i>holathera</i>	0.1	0.3
<i>Cleome viscosa</i>	0.1	0.4
<i>Corchorus crozophorifolius</i>	0.1	0.3
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Eremophila cuneifolia</i>	2.0	1.5
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	1.0	0.3
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.5	1.2
<i>Eriachne mucronata</i>	0.1	0.3
<i>Goodenia microptera</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Grevillea berryana</i>	1.0	3.5
<i>Heliotropium chrysocarpum</i>	0.1	0.2
<i>Paraneurachne muelleri</i>	0.1	0.4
<i>Pterocaulon sphacelatum</i>	0.1	0.1
<i>Ptilotus helipteroides</i>	0.1	0.3
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.3
<i>Salsola australis</i>	0.1	0.3
<i>Sclerolaena eriacantha</i>	0.1	0.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.4
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.4
<i>Solanum cleistogamum</i>	0.1	0.2
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tephrosia</i> sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.3
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	1.0
<i>Triodia epactia</i>	30.0	0.4
<i>Triumfetta clementii</i>	0.1	0.3

* denotes weed species

Site: e030-AR**Location:** Map 5**Date:** 2017-07-23**MGA Zone:** 50**Habitat:** Hillslope**Soil:** Red brown sandy loam**Rock type:** Ironstone**Vegetation Type:** H4

Vegetation: *Acacia pruinocarpa* scattered tall shrubs over *Eremophila fraseri* subsp. *fraseri*, *A. tetragonophylla*, *Senna artemisioides* subsp. *oligophylla* open shrubland over *E. cuneifolia* scattered low shrubs over *Triodia epactia* hummock grassland with *Themeda triandra* very open tussock grassland

Veg Condition: Excellent**Fire Age:** >10 years**Notes:** power poles**Type:** Quadrat (rescore of ecologia 2011 quadrat)**Described by:** LD**Easting:** 556576**Northing:** 7433439

Species List

Name	Cover (%)	Height (m)
<i>Abutilon lepidum</i>	0.1	0.3
<i>Acacia pruinocarpa</i>	1.0	3.5
<i>Acacia tetragonophylla</i>	1.0	2.0
<i>Aristida holathera</i> var. <i>holathera</i>	0.1	0.4
<i>Corchorus crozophorifolius</i>	0.1	0.4
<i>Corchorus lasiocarpus</i>	0.1	0.3
<i>Cucumis variabilis</i>	0.1	twiner
<i>Duperreya commixta</i>	0.1	twiner
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Eremophila cryptothrix</i>	0.1	1.2
<i>Eremophila cuneifolia</i>	1.0	0.8

Name	Cover (%)	Height (m)
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	3.0	1.2
<i>Eriachne mucronata</i>	0.1	0.3
<i>Indigofera monophylla</i>	0.1	0.4
<i>Ptilotus obovatus</i>	0.1	0.5
<i>Rhynchosia minima</i>	0.1	twiner
<i>Scaevola acacioides</i>	0.1	0.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	1.0	1.2
<i>Sida echinocarpa</i>	0.1	0.4
<i>Solanum cleistogamum</i>	0.1	0.3
<i>Solanum lasiophyllum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Themeda triandra</i>	4.0	0.4
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.2
<i>Tribulus suberosus</i>	0.1	0.6
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.5
<i>Triodia epactia</i>	40.0	0.4

Site: e038-AR**Location:** Map 5**Date:** 2017-07-30**MGA Zone:** 50**Habitat:** Major creek**Soil:** Sandy loam**Vegetation Type:** D7**Vegetation:** *Eucalyptus camaldulensis* open forest over *Melaleuca bracteata* tall open scrub over *Acacia ampliceps* scattered shrubs with **Passiflora foetida* var. *hispida* very open vineland over *Cyperus vaginatus* sedgeland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat (rescore of ecologia 2011 quadrat)**Described by:** LV**Easting:** 557020**Northing:** 7431944**Species List**

Name	Cover (%)	Height (m)
<i>Acacia ampliceps</i>	1.0	2.0
<i>Acacia coriacea</i> subsp. <i>pendens</i>	0.1	2.5
<i>Adriana tomentosa</i>	0.1	0.4
<i>Ammannia baccifera</i>	0.1	0.2
<i>*Cenchrus setiger</i>	0.5	0.6
<i>Centipeda minima</i>	0.1	0.1
<i>Cyperus vaginatus</i>	50.0	0.6
<i>Duperreya commixta</i>	0.1	twiner
<i>Eragrostis tenellula</i>	0.1	0.3
<i>Eucalyptus camaldulensis</i>	60.0	15
<i>Euphorbia biconvexa</i>	0.1	0.35
<i>Gossypium robinsonii</i>	0.1	0.3
<i>*Malvastrum americanum</i>	0.1	0.4

Name	Cover (%)	Height (m)
<i>Melaleuca bracteata</i>	32.0	5.5
<i>Melaleuca glomerata</i>	0.1	1.3
* <i>Passiflora foetida</i> var. <i>hispida</i>	2.0	4.0
<i>Petalostylis labicheoides</i>	0.1	4.0
<i>Phyllanthus maderaspatensis</i>	0.1	0.35
<i>Pluchea rubelliflora</i>	0.1	0.4
<i>Pseudognaphalium luteoalbum</i>	0.1	0.15
<i>Rhynchosia minima</i>	0.1	twiner
* <i>Solanum nigrum</i>	0.1	0.35
* <i>Sonchus oleraceus</i>	0.1	0.35
<i>Stemodia grossa</i>	0.1	0.35
* <i>Vachellia farnesiana</i>	0.1	0.45

* denotes weed species

Site: e043-AR**Location:** Map 6**Date:** 2017-07-30**MGA Zone:** 50**Habitat:** Major creek**Soil:** Light reddish brown sandy loam**Vegetation Type:** D9**Vegetation:** *Acacia citrinoviridis* tall open shrubland over **Cenchrus ciliaris* open tussock grassland**Veg Condition:** Degraded**Fire Age:** >10 years**Type:** Quadrat (rescore of ecologia 2011 quadrat)**Described by:** LD**Easting:** 557466**Northing:** 7431688

Species List

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	8.0	8.0
<i>Acacia coriacea</i> subsp. <i>pendens</i>	0.1	1.2
<i>Acacia pyrifolia</i>	0.1	0.5
<i>Acacia synchronicia</i>	0.1	2.5
* <i>Aerva javanica</i>	0.1	0.4
<i>Bonamia media</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	28.0	0.4
<i>Corchorus crozophorifolius</i>	0.1	0.6
<i>Enneapogon caerulescens</i>	0.1	0.1
<i>Eremophila cuneifolia</i>	0.1	0.5
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	0.1	0.5
<i>Euphorbia australis</i> var. <i>hispidula</i>	0.1	0.05
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.2
<i>Hakea lorea</i> subsp. <i>lorea</i>	0.1	4.0
<i>Heliotropium pachyphyllum</i>	0.1	0.2

Name	Cover (%)	Height (m)
<i>Indigofera monophylla</i>	0.1	0.3
<i>Petalostylis labicheoides</i>	0.1	1.2
<i>Polycarpaea longiflora</i>	0.1	0.1
<i>Ptilotus obovatus</i>	0.1	1.2
<i>Sida</i> sp.	0.1	0.3
<i>Solanum horridum</i>	0.1	0.1
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tephrosia supina</i>	0.1	0.2

* denotes weed species

Site: e073-AR**Location:** Map 8**Date:** 2017-08-22**MGA Zone:** 50**Habitat:** Plain**Soil:** Red brown sandy clay loam**Rock type:** Ironstone**Vegetation Type:** D10**Vegetation:** *Acacia xiphophylla* tall open shrubland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat (rescore of ecologia 2011 quadrat)**Described by:** LV**Easting:** 560727**Northing:** 7428844

Species List

Name	Cover (%)	Height (m)
<i>Acacia synchronicia</i>	0.5	2.0
<i>Acacia tetragonophylla</i>	0.1	1.1
<i>Acacia wanyu</i>	0.1	0.3
<i>Acacia xiphophylla</i>	3.0	2.5
* <i>Aerva javanica</i>	0.1	0.5
<i>Atriplex codonocarpa</i>	0.1	0.3
* <i>Cenchrus setiger</i>	0.1	0.4
<i>Cynodon prostratus</i>	0.1	0.06
<i>Enneapogon caeruleus</i>	0.1	0.3
<i>Eremophila cuneifolia</i>	0.1	1.6
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	1.0
<i>Frankenia</i> aff. <i>hispidula</i>	0.1	0.3
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	0.1	0.25
<i>Lawrencina glomerata</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Lepidium pedicellosum</i>	0.1	0.15
<i>Lepidium platypetalum</i>	0.1	0.45
<i>Maireana eriosphaera</i>	0.1	0.2
<i>Maireana georgei</i>	0.1	0.15
<i>Maireana thesioides</i>	0.1	1.0
<i>Petalostylis labicheoides</i>	0.1	0.4
<i>Ptilotus exaltatus</i>	0.1	0.1
<i>Salsola australis</i>	0.1	0.3
<i>Scaevola spinescens</i>	0.1	0.6
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	1.1
<i>Sporobolus australasicus</i>	0.1	0.1

* denotes weed species

Site: e074-AR**Location:** Map 9**Date:** 2017-07-30**MGA Zone:** 50**Habitat:** Major creek**Vegetation Type:** D7

Vegetation: *Eucalyptus camaldulensis* open woodland over *Melaleuca linophylla*, (*Acacia coriacea* subsp. *pendens*, *A. ampliceps*) tall open scrub over **Vachellia farnesiana* scattered shrubs over *Cynodon prostratus*, (**Cenchrus setiger*, **C. ciliaris*) very open tussock grassland with *Typha domingensis*, *Cyperus vaginatus* very open sedgeland

Veg Condition: Good**Fire Age:** >10 years**Type:** Relevé (rescore of ecologia 2011 quadrat)**Described by:** LV**Easting:** 561523**Northing:** 7431915

Species List

Name	Cover (%)	Height (m)
<i>Acacia ampliceps</i>	1.0	3.0
<i>Acacia citrinoviridis</i>	0.5	3.5
<i>Acacia coriacea</i> subsp. <i>pendens</i>	2.0	7.0
<i>Acacia synchronicia</i>	0.1	0.6
<i>*Aerva javanica</i>	0.1	0.5
<i>Amaranthus undulatus</i>	0.1	0.5
<i>*Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	0.1	0.06
<i>*Cenchrus ciliaris</i>	1.0	1.2
<i>*Cenchrus setiger</i>	1.0	1.5
<i>*Chloris barbata</i>	0.1	0.7
<i>Cleome viscosa</i>	0.1	0.3
<i>Corchorus crozophorifolius</i>	0.1	0.45
<i>Cynodon prostratus</i>	7.0	0.2

Name	Cover (%)	Height (m)
<i>Cyperus vaginatus</i>	3.0	0.5
<i>Dichromochlamys dentatifolia</i>	0.1	0.1
<i>Eriachne pulchella</i>	0.1	0.15
<i>Eucalyptus camaldulensis</i>	4.0	22.0
<i>Euphorbia australis</i> var. <i>hispidula</i>	0.1	0.02
<i>Euphorbia biconvexa</i>	0.1	0.25
* <i>Euphorbia hirta</i>	0.1	0.25
* <i>Flaveria trinervia</i>	0.1	0.4
<i>Heliotropium ammophilum</i>	0.1	0.2
* <i>Ruellia</i> sp. (aff. <i>simplex</i>)	0.1	0.6
<i>Ipomoea muelleri</i>	0.1	twiner
<i>Lepidium muelleri-ferdinandii</i>	0.1	0.2
<i>Lepidium oxytrichum</i>	0.1	0.2
* <i>Malvastrum americanum</i>	0.1	0.35
<i>Melaleuca linophylla</i>	45.0	3.0
* <i>Passiflora foetida</i> var. <i>hispida</i>	0.1	4.0
<i>Phyllanthus maderaspatensis</i>	0.1	0.35
<i>Pterocaulon</i> sp.	0.1	0.3
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Rhynchosia minima</i>	0.1	twiner
<i>Sesbania formosa</i>	0.1	4.0
* <i>Sisymbrium orientale</i>	0.1	0.1
* <i>Solanum nigrum</i>	0.1	0.6
* <i>Sonchus oleraceus</i>	0.1	0.6
<i>Stemodia grossa</i>	0.1	0.3
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.4
<i>Typha domingensis</i>	3.0	2.3
* <i>Vachellia farnesiana</i>	1.0	1.2
<i>Vigna lanceolata</i> var. <i>lanceolata</i>	0.1	twiner
<i>Waltheria indica</i>	0.1	0.35

* denotes weed species

Site: e122-AR**Location:** Map 7**Date:** 2017-07-23**MGA Zone:** 50**Habitat:** Hillslope**Soil:** Red brown sandy loam**Rock type:** Basalt**Vegetation Type:** H8**Vegetation:** *Acacia tetragonophylla* scattered tall shrubs over *Eremophila cuneifolia* scattered shrubs over *Ptilotus obovatus*, *Senna stricta* low open shrubland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat (rescore of ecologia 2011 quadrat)**Described by:** LV**Easting:** 560494**Northing:** 7432602

Species List

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp.	0.1	0.3
<i>Acacia aneura</i>	0.1	2.2
<i>Acacia synchronicia</i>	0.1	2.2
<i>Acacia tetragonophylla</i>	1.0	2.1
<i>Acacia xiphophylla</i>	0.1	2.5
* <i>Aerva javanica</i>	0.1	0.6
<i>Aristida contorta</i>	0.1	0.2
* <i>Cenchrus ciliaris</i>	0.1	0.35
<i>Corchorus crozophorifolius</i>	0.1	0.45
<i>Enneapogon caeruleus</i>	0.1	0.15
<i>Eremophila cuneifolia</i>	1.0	1.1
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	0.5
<i>Indigofera monophylla</i>	0.1	0.35

Name	Cover (%)	Height (m)
<i>Maireana georgei</i>	0.1	0.15
<i>Maireana melanocoma</i>	0.1	0.3
<i>Ptilotus exaltatus</i>	0.1	0.3
<i>Ptilotus obovatus</i>	1.0	0.6
<i>Salsola australis</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.5	0.6
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.3
<i>Senna stricta</i>	1.0	0.45
<i>Sida</i> sp.	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.3
<i>Triodia epactia</i>	0.1	0.35

* denotes weed species

Site: WRA01-AR**Location:** Map 9**Type:** Quadrat (rescore of Biota 2012b quadrat)**Date:** 2017-07-3**Described by:** LD**MGA Zone:** 50**Easting:** 562292**Northing:** 7432136**Habitat:** Major creek**Soil:** Dark reddish brown sandy loam**Vegetation Type:** D8

Vegetation: *Eucalyptus camaldulensis* open forest over *Melaleuca linophylla* tall open shrubland over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), **Aerva javanica* low open shrubland over **Cenchrus ciliaris*, (**C. setiger*) tussock grassland

Veg Condition: Degraded**Fire Age:** >10 years

Species List

Name	Cover (%)	Height (m)
<i>Acacia ampliceps</i>	0.1	1.0
<i>Acacia coriacea</i> subsp. <i>pendens</i>	0.1	5.0
<i>Acacia pyrifolia</i>	0.1	1.2
* <i>Aerva javanica</i>	1.0	0.3
<i>Alternanthera nodiflora</i>	0.1	0.3
<i>Amaranthus cuspidifolius</i>	0.1	0.3
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	0.1	0.05
<i>Capparis spinosa</i> subsp. <i>nummularia</i>	0.1	1.6
* <i>Cenchrus ciliaris</i>	35.0	0.5
* <i>Cenchrus setiger</i>	8.0	0.4
<i>Cleome viscosa</i>	0.1	0.3
<i>Corchorus crozophorifolius</i>	0.1	0.5
<i>Cucumis variabilis</i>	0.1	twiner

Name	Cover (%)	Height (m)
<i>Cyperus vaginatus</i>	0.1	0.4
* <i>Echinochloa colona</i>	0.1	0.1
<i>Eucalyptus camaldulensis</i>	31.0	15.0
<i>Ipomoea muelleri</i>	0.1	twiner
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Lepidium muelleri-ferdinandii</i>	0.1	0.3
<i>Melaleuca linophylla</i>	9.0	2.5
* <i>Passiflora foetida</i> var. <i>hispida</i>	0.1	twiner
<i>Petalostylis labicheoides</i>	0.1	3.0
<i>Pluchea rubelliflora</i>	0.1	0.2
<i>Pseudognaphalium luteoalbum</i>	0.1	0.2
<i>Rhynchosia australis</i>	0.1	twiner
<i>Rhynchosia minima</i>	0.1	twiner
* <i>Rumex vesicarius</i>	0.1	0.3
<i>Sesbania formosa</i>	0.1	0.4
* <i>Sonchus oleraceus</i>	0.1	0.1
<i>Stemodia grossa</i>	0.1	0.3
<i>Stylobasium spathulatum</i>	0.1	0.3
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	2.0	0.6
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	2.5
<i>Typha domingensis</i>	0.1	1.5

* denotes weed species

Site: WRA21-AR**Location:** Map 6**Date:** 2017-08-22**MGA Zone:** 50**Habitat:** Major creek**Vegetation Type:** D8**Vegetation:** *Eucalyptus victrix* open woodland over *Acacia citrinoviridis*, (*Melealeuca glomerata*. *A. coriacea* subsp. *pendens*) tall open scrub over **Cenchrus ciliaris*, (**C. setiger*) open tussock grassland**Veg Condition:** Degraded**Fire Age:** >10 years**Type:** Quadrat (rescore of Biota 2012b quadrat)**Described by:** LV**Easting:** 557341**Northing:** 7429959**Species List**

Name	Cover (%)	Height (m)
<i>Acacia citrinoviridis</i>	35.0	3.5
<i>Acacia coriacea</i> subsp. <i>pendens</i>	1.0	7.0
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.6
<i>*Cenchrus ciliaris</i>	20.0	0.6
<i>*Cenchrus setiger</i>	2.0	0.5
<i>Cleome viscosa</i>	0.1	0.35
<i>Corchorus crozophorifolius</i>	0.1	0.4
<i>Cucumis variabilis</i>	0.1	twiner
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.35
<i>Eriachne mucronata</i>	0.1	0.35
<i>Eucalyptus victrix</i>	3.0	11
<i>Indigofera monophylla</i>	0.1	0.35
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.6
<i>*Malvastrum americanum</i>	0.1	0.35
<i>Melaleuca glomerata</i>	1.0	3.0
<i>Petalostylis labicheoides</i>	0.5	1.9

Name	Cover (%)	Height (m)
* <i>Rumex vesicarius</i>	0.1	0.45
<i>Sesbania cannabina</i>	0.1	1.3
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	0.5	1.5

* denotes weed species

Site: WRA23-AR

Location: Map 2

Date: 2017-07-25

MGA Zone: 50

Habitat: Minor creek

Soil: Reddish brown sandy loam

Rock type: Ironstone

Vegetation Type: D10

Vegetation: *Acacia xiphophylla*, (*A. tetragonophylla*) tall shrubland over *Ptilotus obovatus*, *Senna artemisioides* subsp. *helmsii* open shrubland over *Lepidium platypetalum* scattered low shrubs

Veg Condition: Good

Fire Age: >10 years

Type: Quadrat (rescore of Biota 2012b quadrat)

Described by: LD

Easting: 552185

Northing: 7432796



Species List

Name	Cover (%)	Height (m)
<i>Acacia aptaneura</i>	0.1	4.0
<i>Acacia synchronicia</i>	0.1	2.5
<i>Acacia tetragonophylla</i>	5.0	3.0
<i>Acacia xiphophylla</i>	12.0	3.5
<i>Boerhavia coccinea</i>	0.1	0.1
* <i>Cenchrus ciliaris</i>	0.1	0.4
<i>Corchorus crozophorifolius</i>	0.1	1.6
<i>Cynodon prostratus</i>	0.1	0.1
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.4
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.7
<i>Enneapogon caeruleus</i>	0.1	0.2
<i>Enneapogon lindleyanus</i>	0.1	0.2

Name	Cover (%)	Height (m)
<i>Eremophila cuneifolia</i>	0.1	2.2
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.1	1.2
<i>Frankenia setosa</i>	0.1	0.3
<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)	0.1	0.8
<i>Hybanthus aurantiacus</i>	0.1	0.2
<i>Indigofera monophylla</i>	0.1	0.3
<i>Lepidium pedicellsum</i>	0.5	0.5
<i>Lepidium platypetalum</i>	1.0	0.7
<i>Maireana georgei</i>	0.1	0.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.5
<i>Marsdenia australis</i>	0.1	twiner
<i>Paspalidium clementii</i>	0.1	0.2
<i>Pterocaulon sphacelatum</i>	0.1	0.3
<i>Ptilotus obovatus</i>	2.0	2.0
<i>Rhagodia eremaea</i>	0.1	1.3
<i>Sclerolaena costata</i>	0.1	0.2
<i>Sclerolaena eriacantha</i>	0.1	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	1.0	1.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.5	1.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.5
<i>Senna stricta</i>	0.1	1.0
<i>Sida echinocarpa</i>	0.1	0.2
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	1.8
<i>Solanum horridum</i>	0.1	0.3
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.5
<i>Triodia epactia</i>	0.5	0.4

* denotes weed species

Site: WRA39-AR**Location:** Map 7**Date:** 2017-07-25**MGA Zone:** 50**Habitat:** Plain**Soil:** Dark reddish brown sandy loam**Rock type:** Ironstone**Vegetation Type:** P1**Vegetation:** *Acacia xiphophylla* tall open shrubland**Veg Condition:** Good**Fire Age:** >10 years**Type:** Quadrat (rescore of Biota 2012b quadrat)**Described by:** LD**Easting:** 559921**Northing:** 7432876**Species List**

Name	Cover (%)	Height (m)
<i>Acacia tetragonophylla</i>	0.5	1.0
<i>Acacia xiphophylla</i>	9.0	3.5
<i>Aristida contorta</i>	0.1	0.4
* <i>Cenchrus ciliaris</i>	0.1	0.4
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.3
<i>Enneapogon caeruleus</i>	0.1	0.15
<i>Eremophila cuneifolia</i>	0.1	1.1
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	0.2
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	0.1	0.15
<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)	0.1	0.5
<i>Hibiscus sturtii</i>	0.1	0.3
<i>Maireana georgei</i>	0.1	0.2
<i>Maireana melanocoma</i>	0.1	0.2
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	0.1	0.3

Name	Cover (%)	Height (m)
<i>Paspalidium clementii</i>	0.1	0.15
<i>Ptilotus aervoides</i>	0.1	0.1
<i>Ptilotus exaltatus</i>	0.1	0.15
<i>Ptilotus obovatus</i>	0.1	0.6
<i>Sclerolaena cuneata</i>	0.1	0.25
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.1	0.7
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	0.1	1.1
<i>Senna stricta</i>	0.5	0.6
<i>Solanum horridum</i>	0.1	0.5
<i>Solanum lasiophyllum</i>	0.1	0.25
<i>Sporobolus australasicus</i>	0.1	0.15
<i>Trianthema glossostigmum</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	0.6

* denotes weed species

Site: WRA44-AR**Location:** Map 7**Date:** 2017-07-25**MGA Zone:** 50**Habitat:** Minor creek**Soil:** Brown sandy loam**Vegetation Type:** D9

Vegetation: *Acacia citrinoviridis*, (*Senna artemisioides* subsp. *oligophylla*) tall open scrub over *Ptilotus obovatus* scattered shrubs over *Corchorus crozophorifolius* scattered low shrubs over **Cenchrus ciliaris*, (**C. setiger*) tussock grassland

Veg Condition: Degraded**Fire Age:** >10 years**Type:** Quadrat (rescore of Biota 2012b quadrat)**Described by:** LV**Easting:** 559237**Northing:** 7433242

Species List

Name	Cover (%)	Height (m)
<i>Abutilon lepidum</i>	0.1	0.35
<i>Acacia aneura</i>	0.1	6.5
<i>Acacia citrinoviridis</i>	65.0	7.5
<i>Acacia coriacea</i> subsp. <i>pendens</i>	0.1	3.5
<i>Acacia tetragonophylla</i>	0.1	2.1
<i>*Aerva javanica</i>	0.1	0.5
<i>Amyema fitzgeraldii</i>	0.1	parasite
<i>*Cenchrus ciliaris</i>	45.0	0.4
<i>*Cenchrus setiger</i>	1.0	0.4
<i>Corchorus crozophorifolius</i>	1.0	0.5
<i>Cucumis variabilis</i>	0.1	twiner
<i>Cymbopogon ambiguus</i>	0.1	0.4
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	0.1	0.3

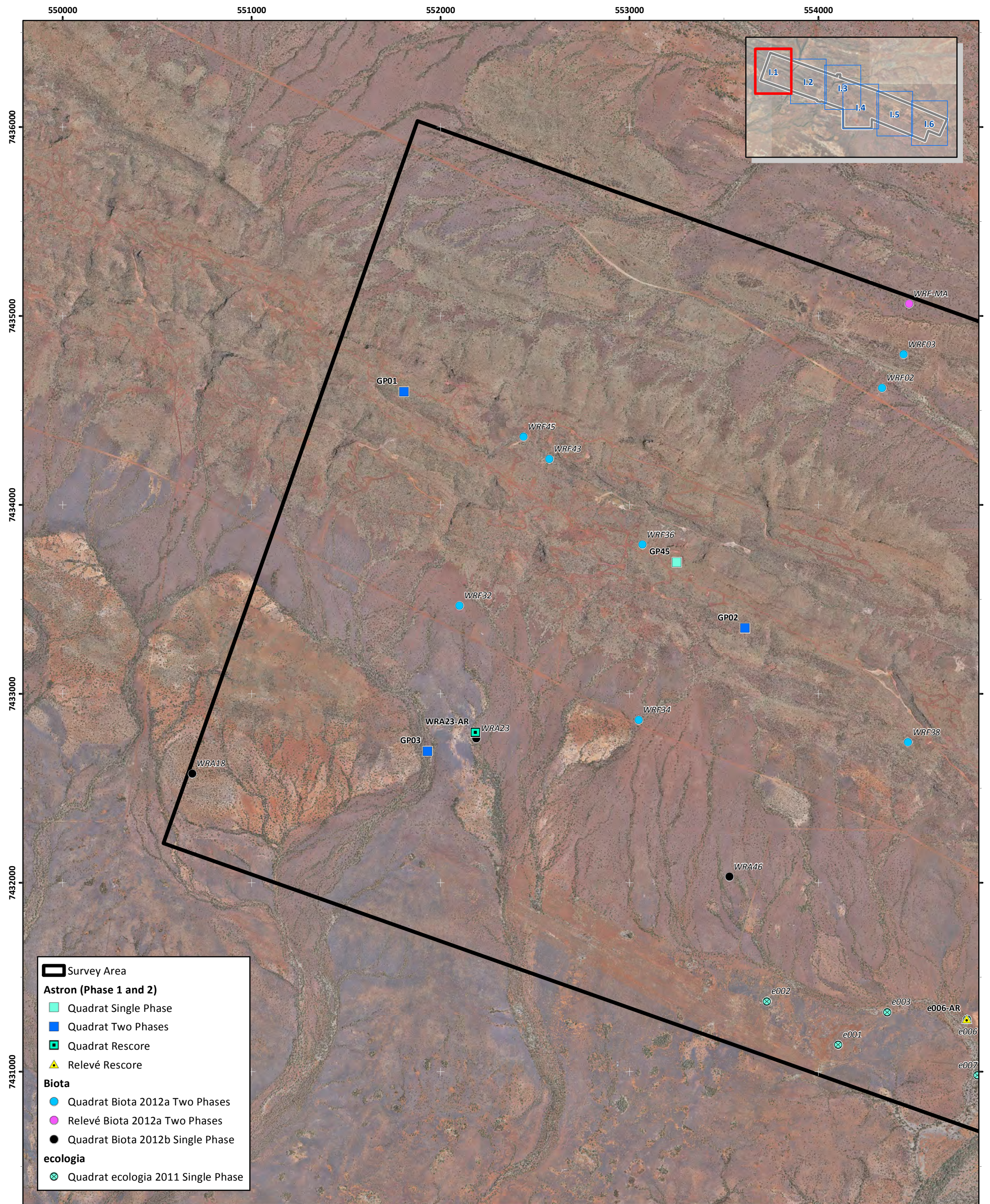
Name	Cover (%)	Height (m)
<i>Duperreya commixta</i>	0.1	twiner
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.1	0.35
<i>Enneapogon caeruleus</i>	0.1	0.15
<i>Eremophila cuneifolia</i>	0.1	1.0
<i>Glycine canescens</i>	0.1	twiner
<i>Hybanthus aurantiacus</i>	0.1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	0.5
<i>Maireana georgei</i>	0.1	0.35
<i>Notoleptopus decaisnei</i>	0.1	0.35
<i>Paraneurachne muelleri</i>	0.1	0.25
<i>Polycarpaea longiflora</i>	0.1	0.35
<i>Ptilotus obovatus</i>	1.0	1.0
<i>Rhynchosia minima</i>	0.1	twiner
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	4.0	2.1
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.6
<i>Solanum lasiophyllum</i>	0.1	0.35
<i>Solanum sturtianum</i>	0.1	1.2
<i>Sporobolus australasicus</i>	0.1	0.1
<i>Tribulus suberosus</i>	0.1	1.0
<i>Triodia epactia</i>	0.1	0.25

* denotes weed species

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Appendix I: Previous Vegetation Sampling Site Locations

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Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure I.1: Current and previous vegetation sampling site locations

Author: B. Eckermann

Date: 13-12-2018

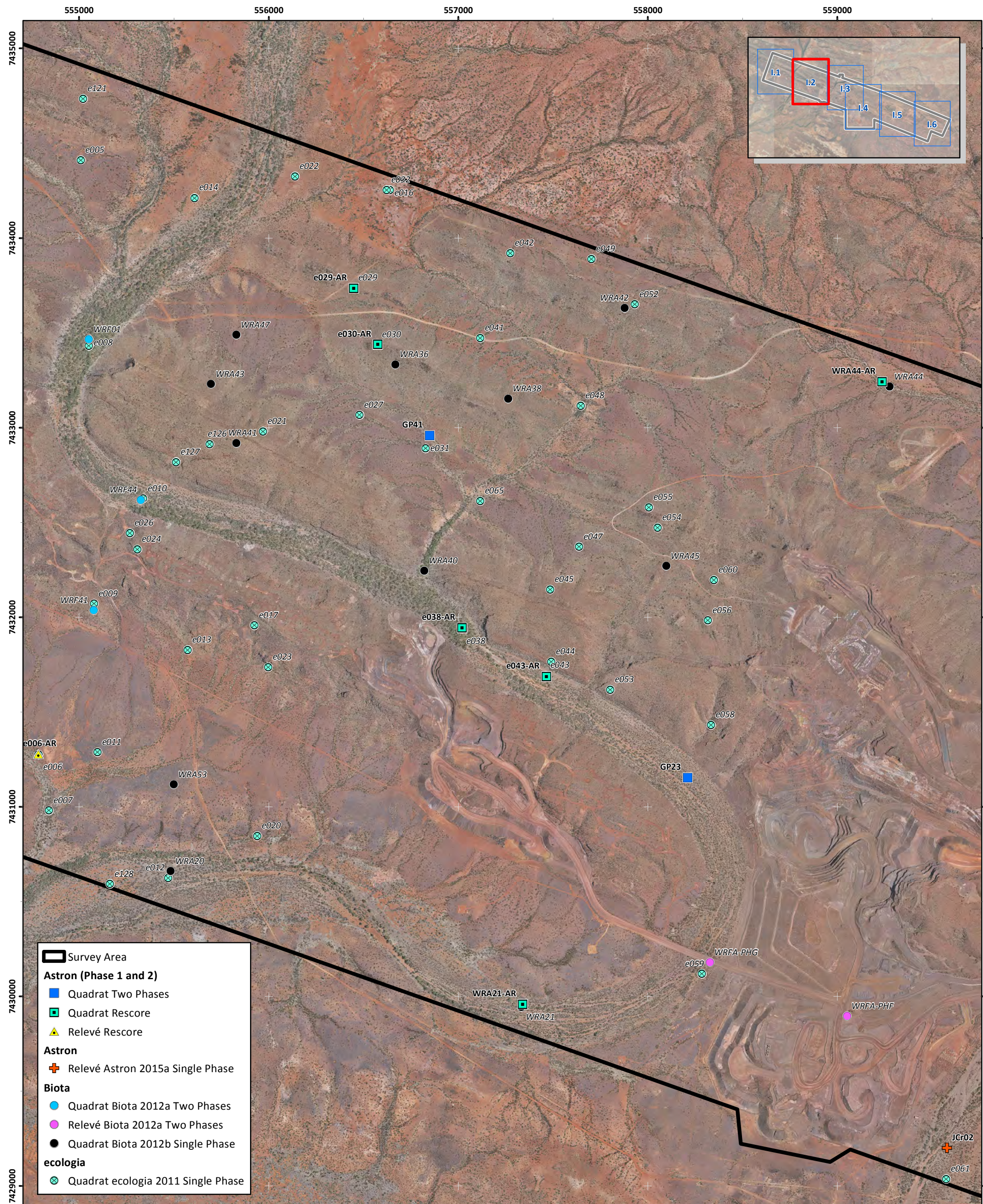
Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigI_SamplingSite

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres





Survey Area

Astron (Phase 1 and 2)

Quadrat Two Phases

Quadrat Rescore

Relevé Rescore

Astron

Relevé Astron 2015a Single Phase

Biota

Quadrat Biota 2012a Two Phases

Relevé Biota 2012a Two Phases

Quadrat Biota 2012b Single Phase

ecologia

Quadrat ecologia 2011 Single Phase

Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure I.2: Current and previous vegetation sampling site locations

Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-1RevB_181213_FigI_SamplingSite

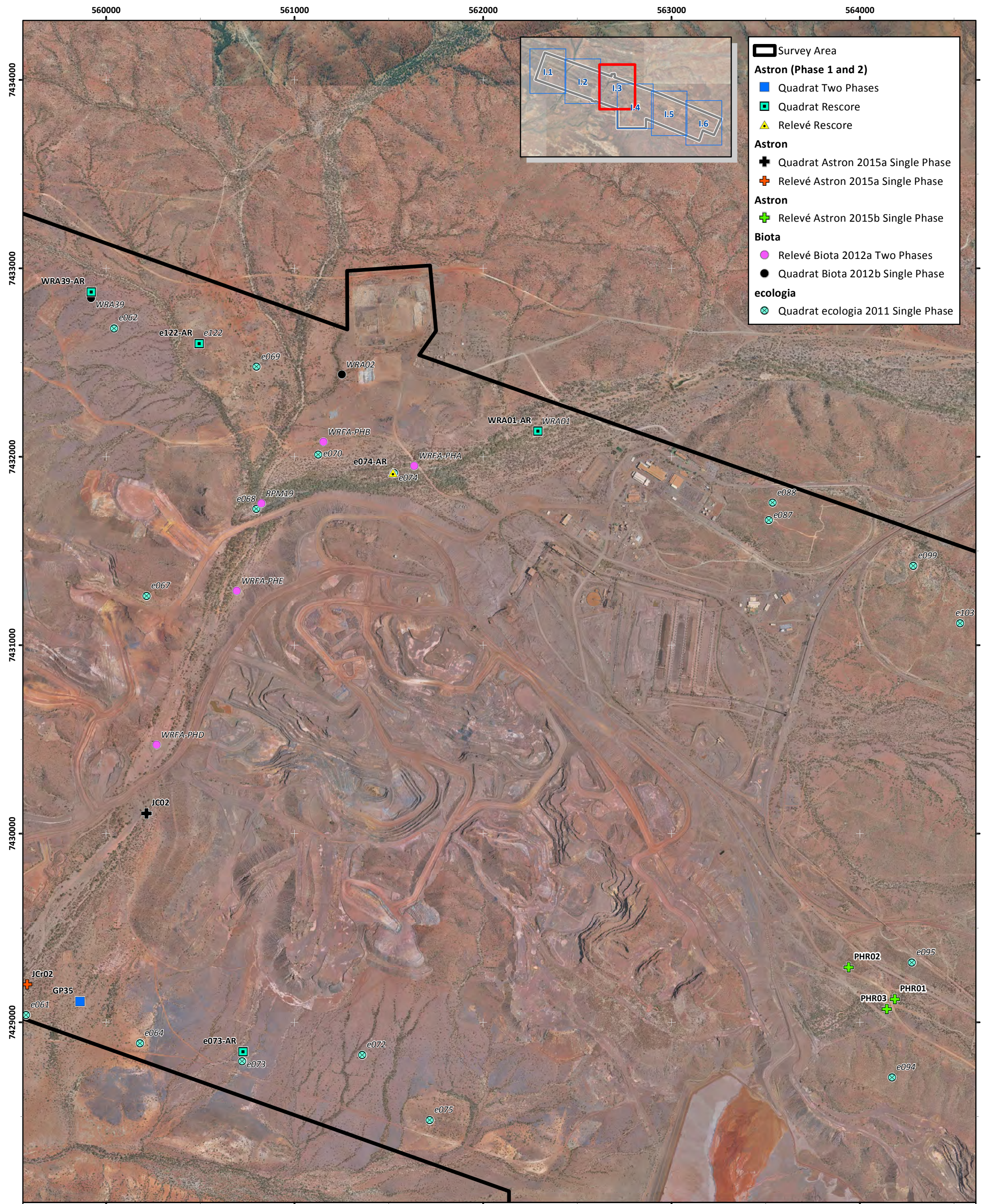
Coordinate System: GDA 1994 MGA Zone 50

02004006008001,000

Metres

N

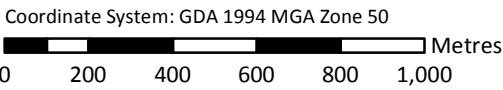


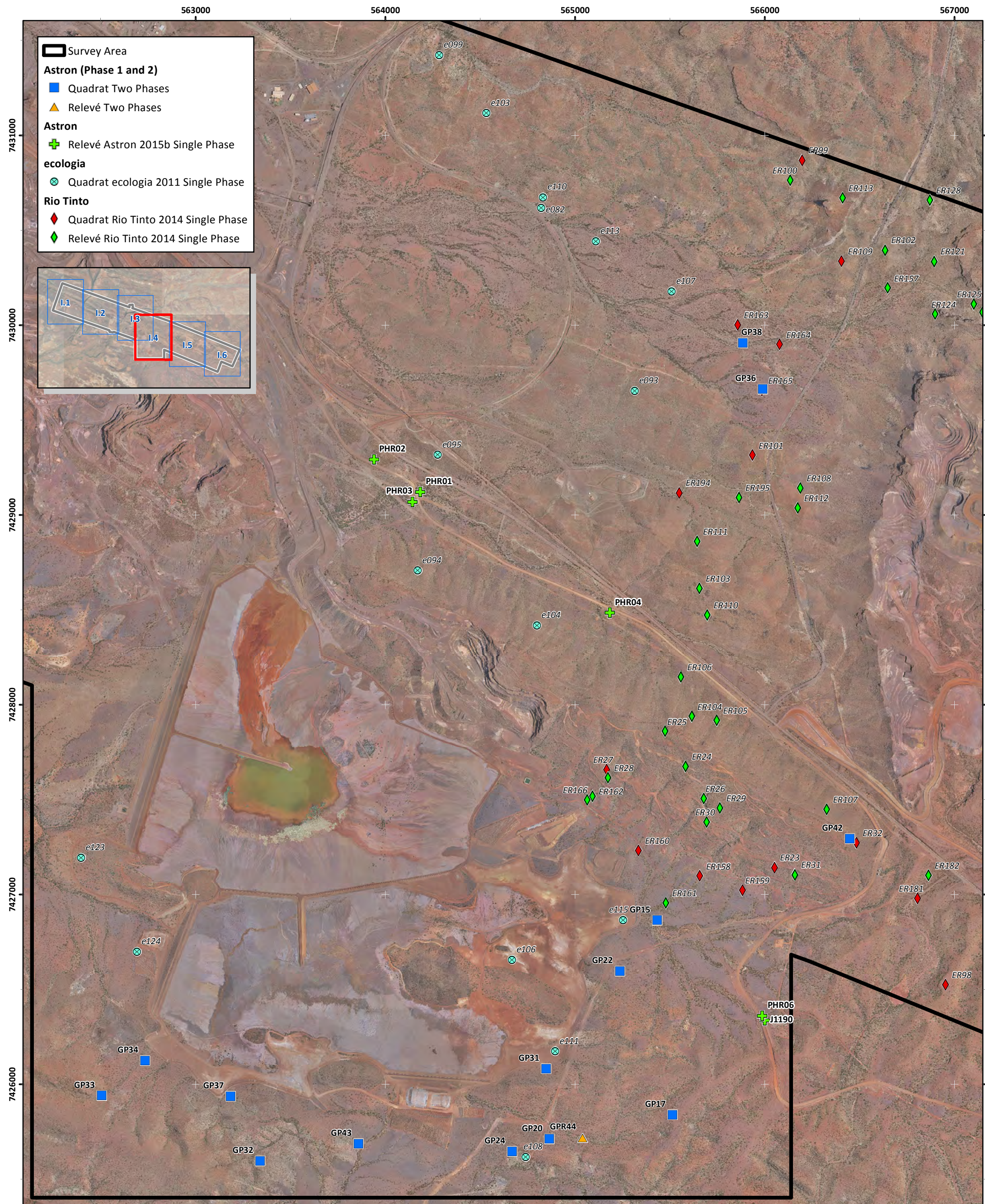


Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018
Figure I.3: Current and previous vegetation sampling site locations



Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-1RevB_181213_FigI_SamplingSite



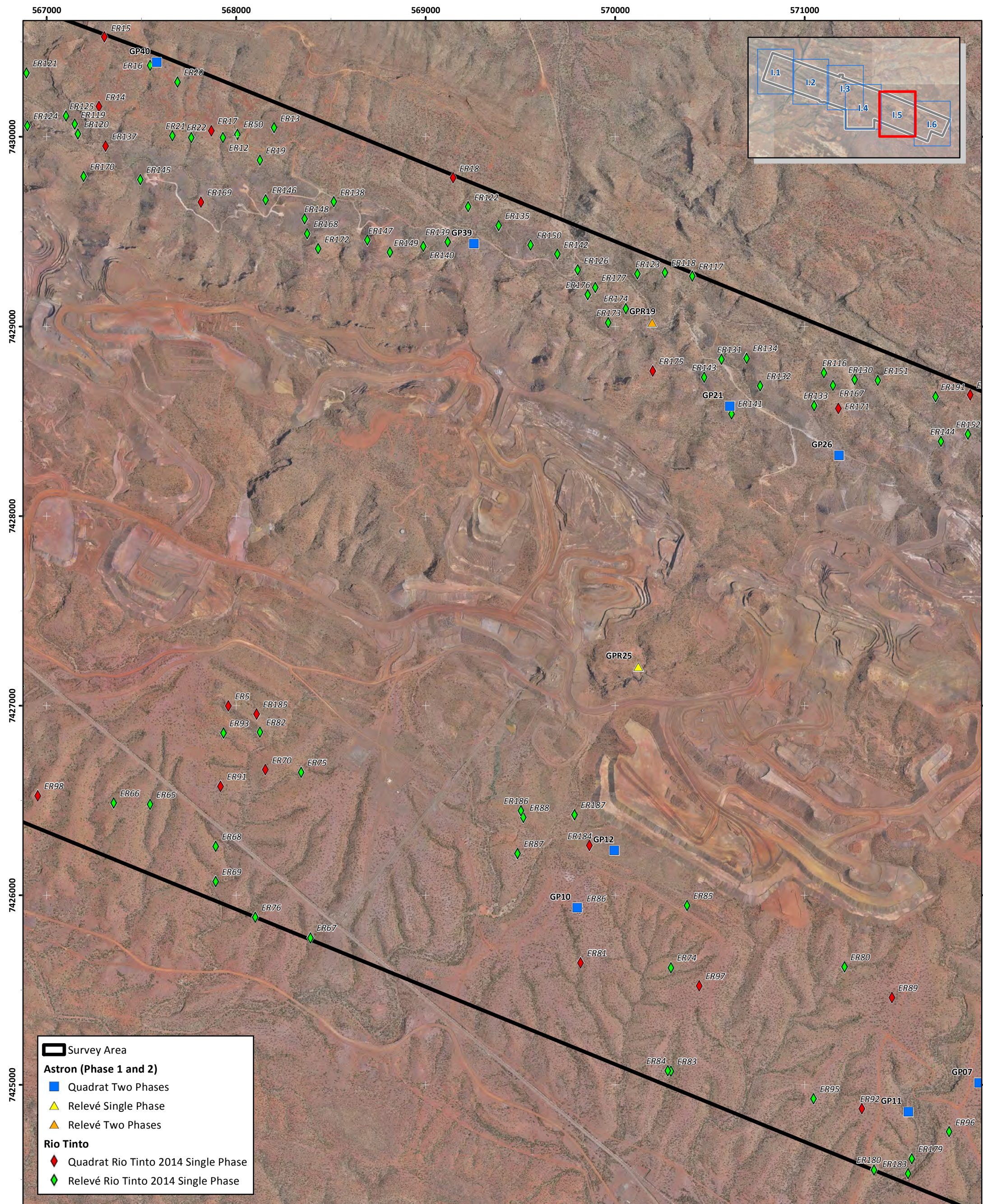


Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018



Figure I.4: Current and previous vegetation sampling site locations

Author: B. Eckermann	Date: 13-12-2018	<p>Coordinate System: GDA 1994 MGA Zone 50</p>
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-1RevB_181213_Fig1_SamplingSite	



Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure I.5: Current and previous vegetation sampling site locations

Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-1RevB_181213_FigI_SamplingSite

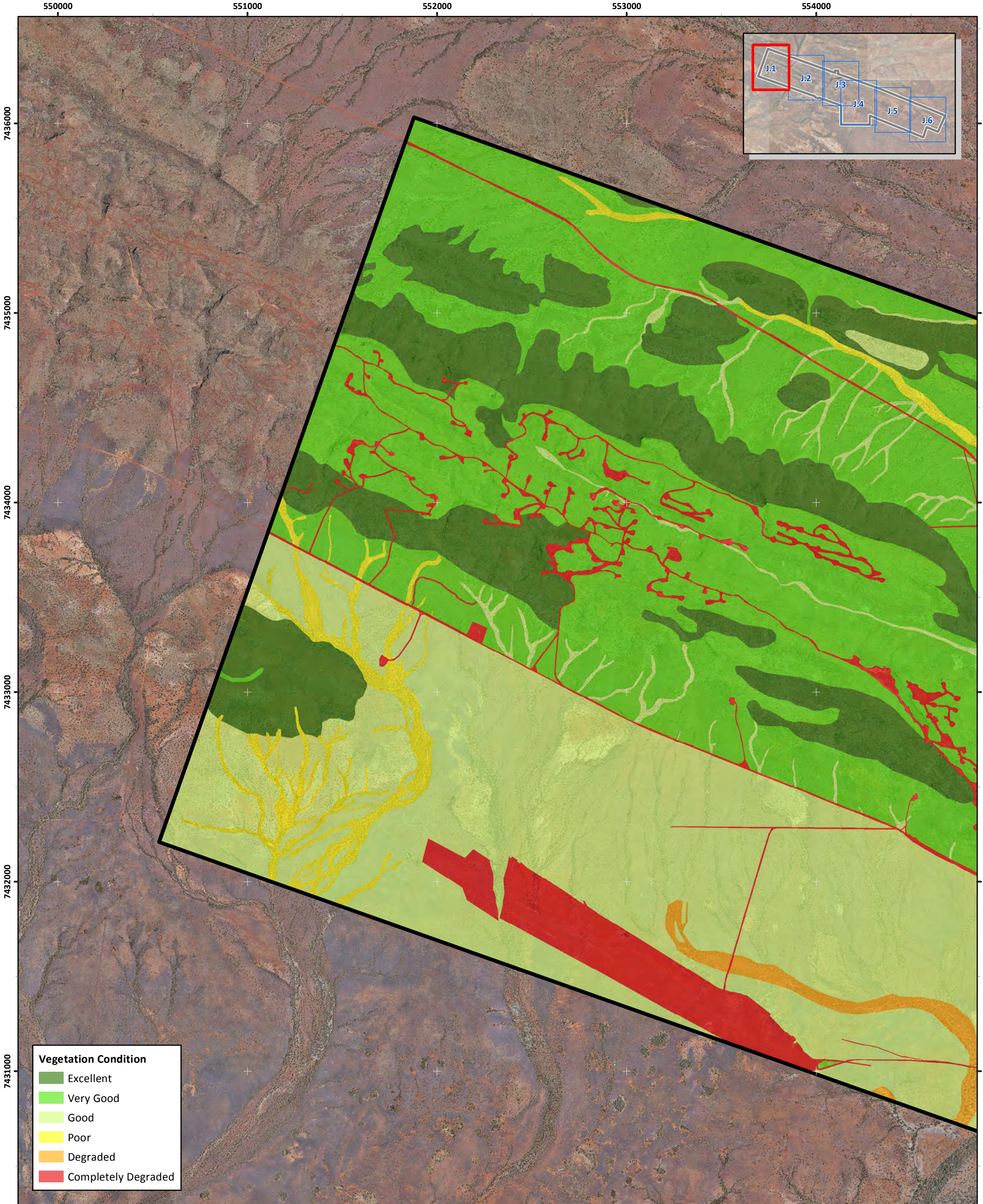
Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres



Appendix J: Vegetation Condition Mapping

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Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure J.1: Vegetation condition mapping

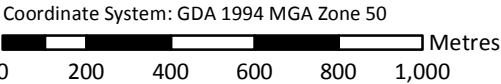


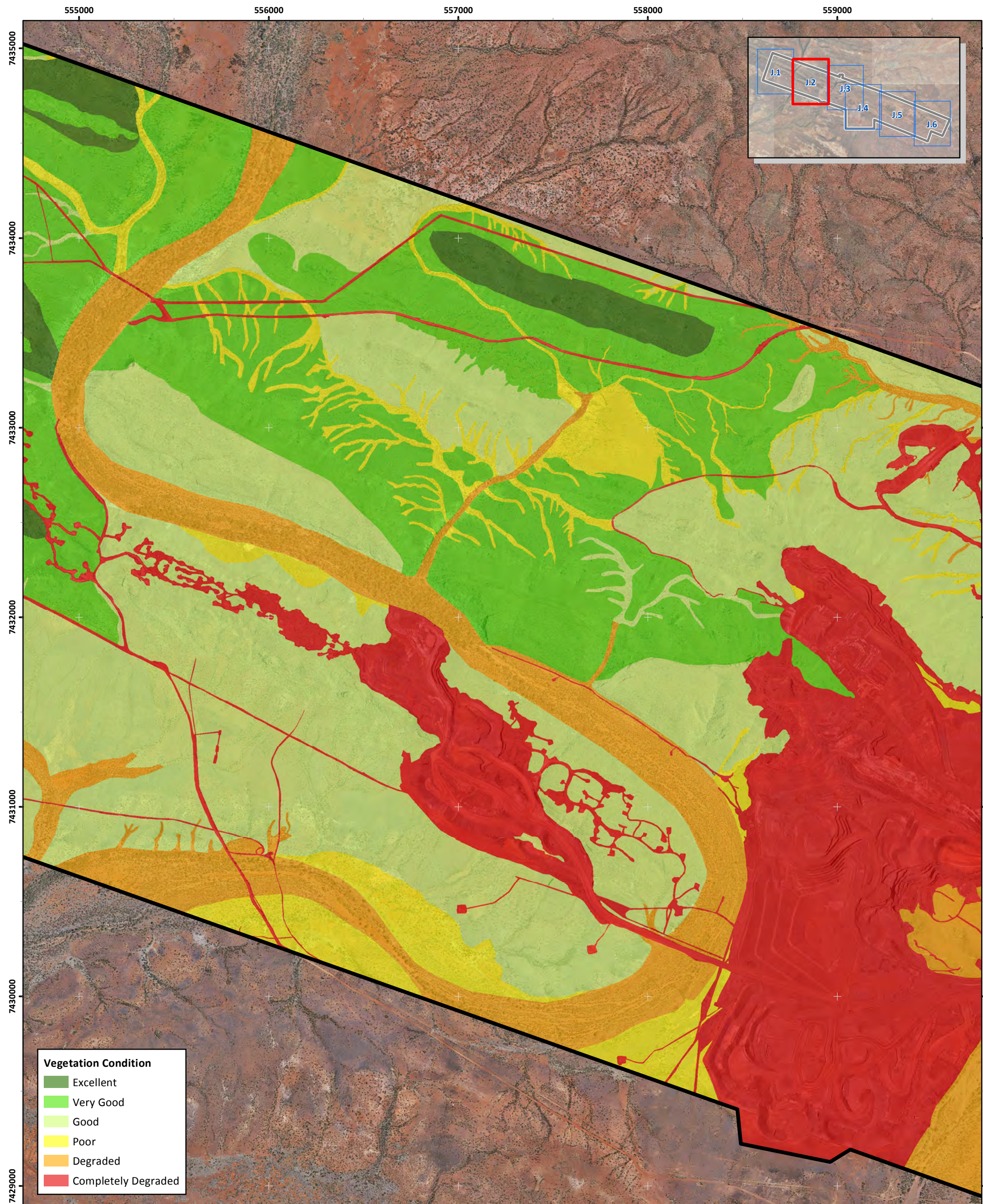
Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigJ_Cond





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

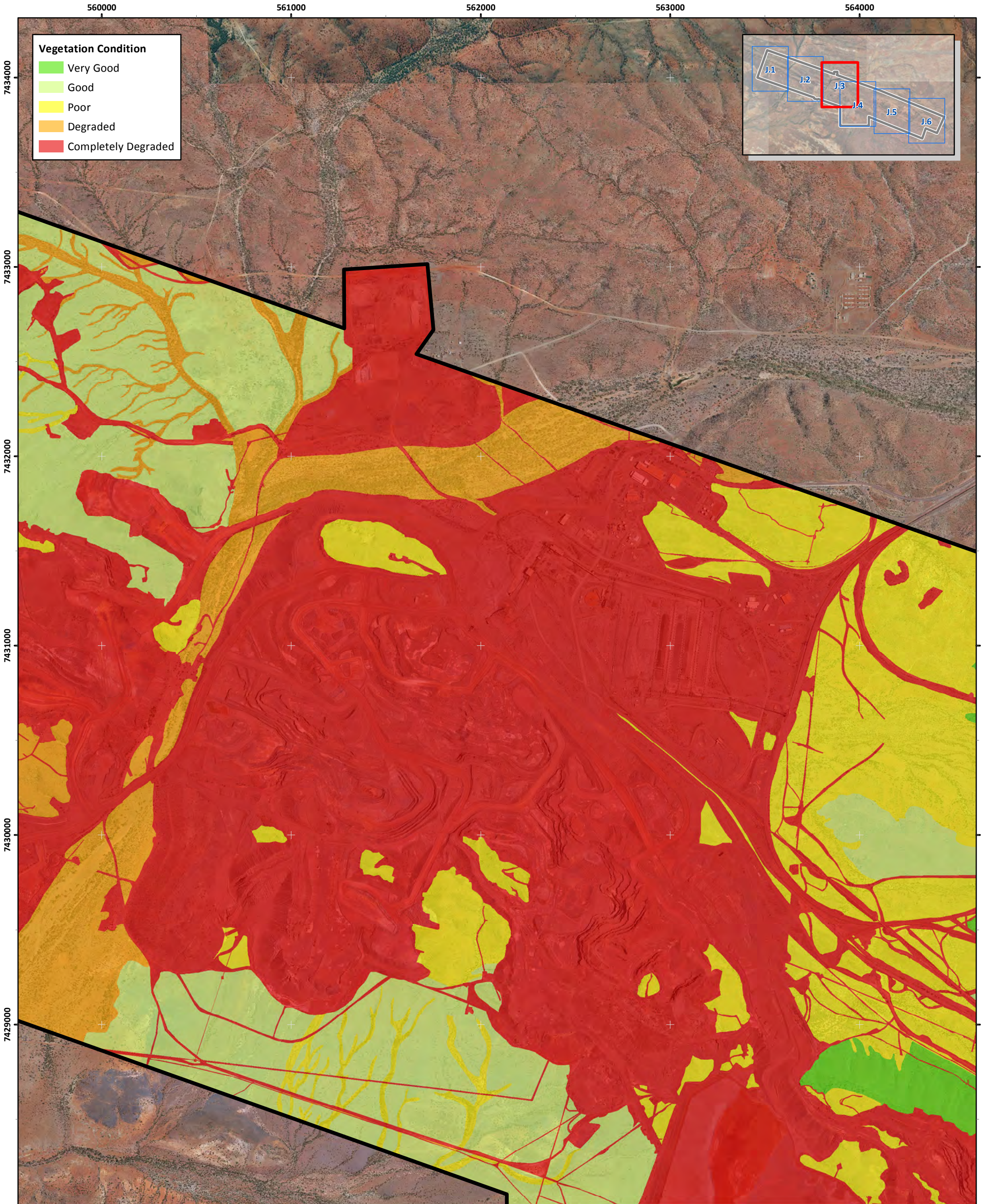
Figure J.2: Vegetation condition mapping

Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigJ_Cond



Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure J.3: Vegetation condition mapping



Author: B. Eckermann

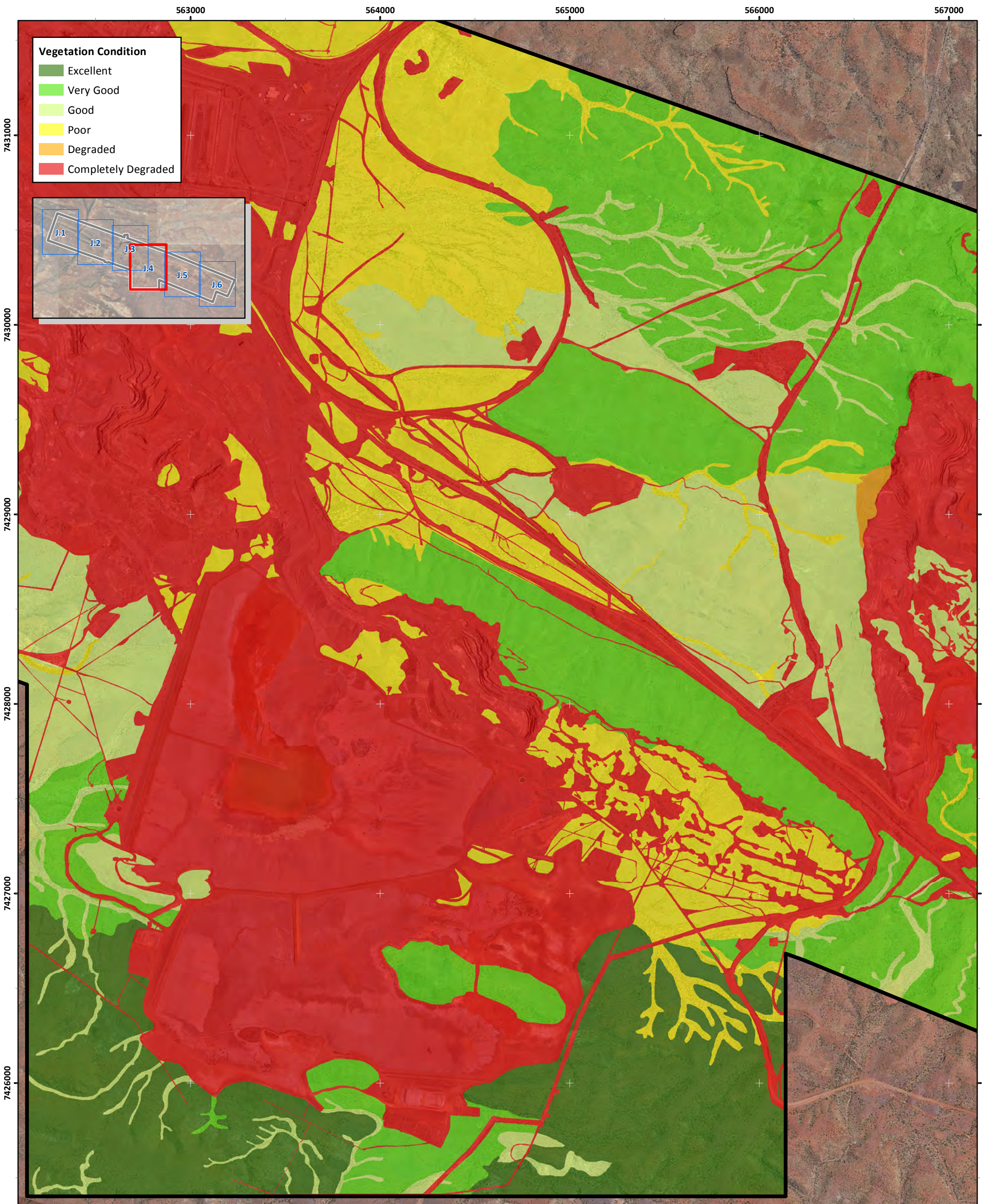
Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigJ_Cond

Coordinate System: GDA 1994 MGA Zone 50





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure J.4: Vegetation condition mapping

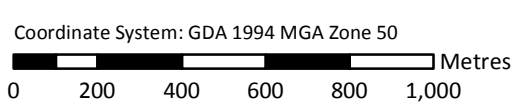


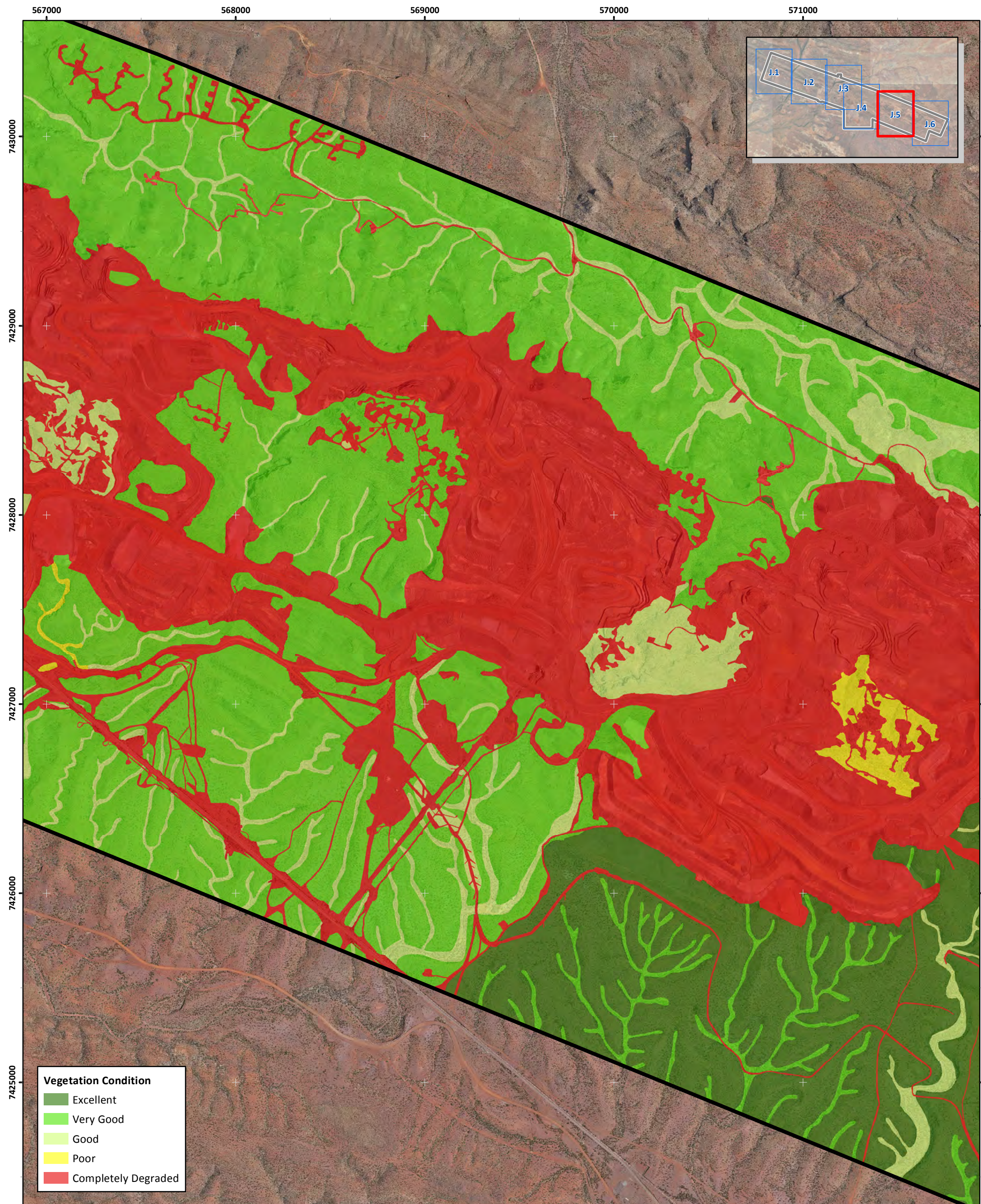
Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigJ_Cond



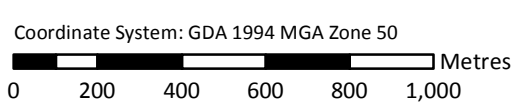


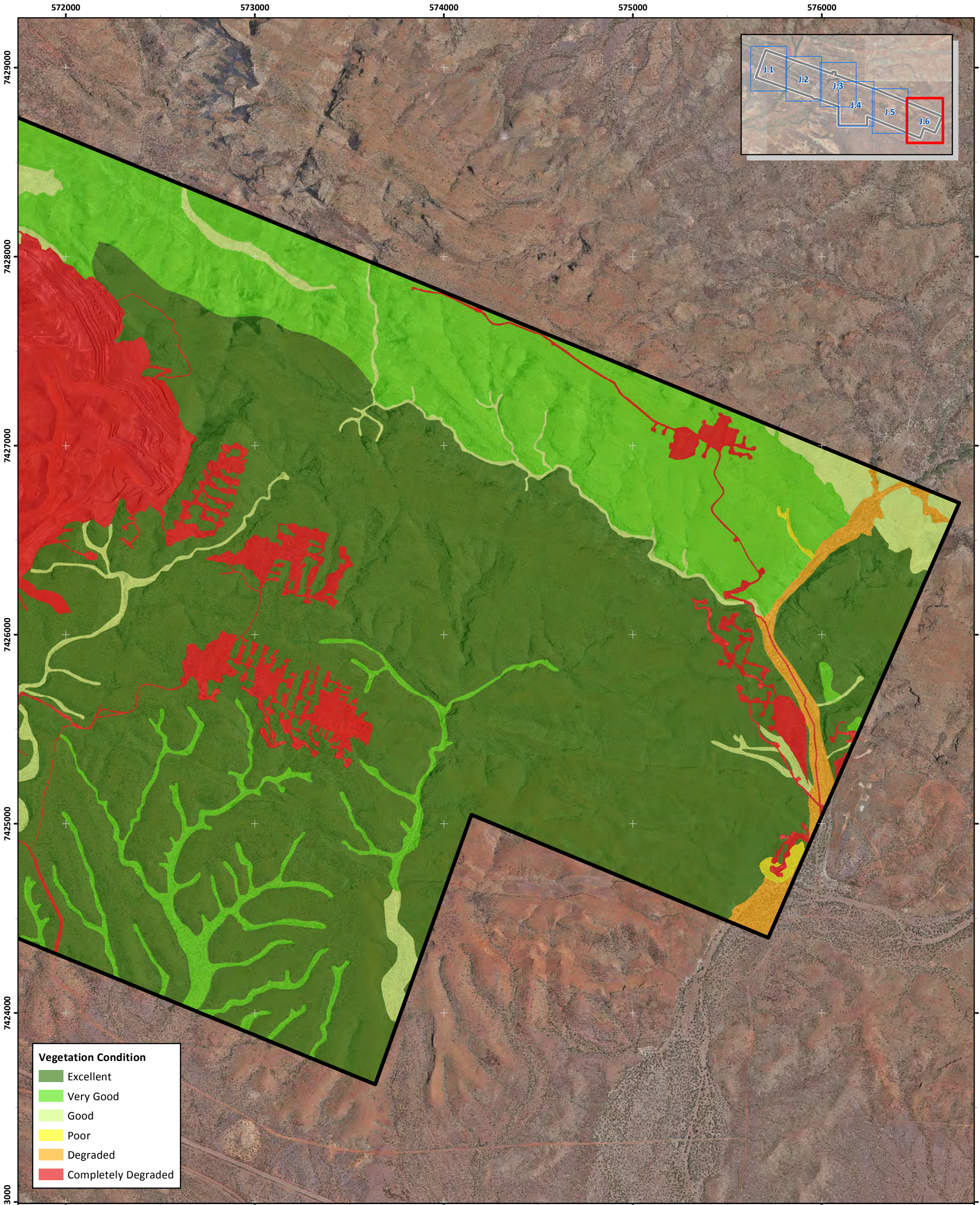
Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure J.5: Vegetation condition mapping



Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-1RevB_181213_FigJ_Cond





Vegetation Condition

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

Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure J.6: Vegetation condition mapping

Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-1RevB_181213_FigJ_Cond

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres




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Appendix K: Floristic Analysis

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1 Floristic Analysis

1.1 Sampling Effort

Sampling effort was assessed using a species accumulation curve and modelled estimates of the total species pool. Species accumulation curves are created by randomly sampling an incremental number of samples, and plotting the mean number of species sampled at each sample size. Species estimators are particular statistical models of species accumulation which are employed to estimate the total species pool available. Four different species estimators were compared: Chao 2, Jackknife 1, Jackknife 2, and Bootstrap (Colwell and Coddington 1994). All analysis was performed in R 3.2.1 (R Development Core Team 2015) using the package ‘Vegan’.

1.2 Vegetation Classification

Similarity amongst vegetation quadrats was assessed using a dendrogram which was based on Sorensen’s index of Similarity (equivalent to Bray-Curtis similarity when applied to presence-absence data). The dendrogram was constructed using the UPGMA (Unweighted Pair Group Method with Arithmetic Mean) method (or ‘group average’ method), within Primer. Significant clusters of samples were identified using the Simprof test (Clarke, Somerfield, and Gorley 2008). In order to understand the current survey in regional context, a separate analysis was carried out to include all quadrats from six previous surveys in the locality (ecologia Environment 2011; Biota Environmental Sciences 2012b, 2012a; Rio Tinto Iron Ore 2014; GHD Pty Ltd 2009; Mattiske Consulting 2011).

1.3 Floristic Community Groups

1.3.1 Sampling Effort

A total of 269 species from the Astron surveys were included in the floristic analysis. Quadrat and relevé data from the Phase 1 and Phase 2 surveys were included (opportunistic records were excluded) and names not confirmed to species level and hybrids were removed from the analysis. The species accumulation curve indicates that the total number of species has reached an asymptote, and that sampling has been near-exhaustive (Figure K.1). This is highlighted by the fact that the final 10% increase in sampling effort only led to a 3% increase in species sampled.

The species estimators suggest that there were between 302 and 383 species available in the pool at the time of the surveys. This suggests that between 70% and 89% of the total species pool has been sampled from quadrats and relevés (Table K.1). Including opportunistic observations, 275 confirmed species were recorded within the survey area, indicating that between 72% and 91% of the potential total species pool available at the time of the surveys was recorded.

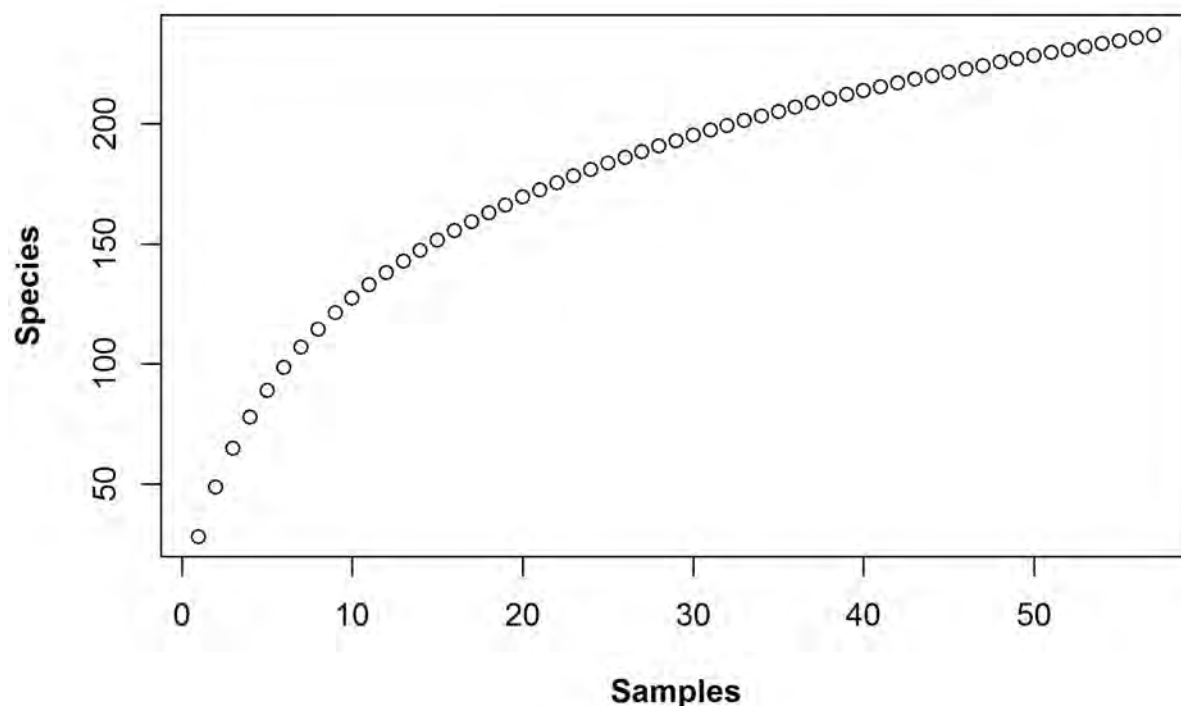


Figure K.1: Species accumulation curve for all Astron quadrats and relevés surveyed.

Table K.1: Total number of taxa sampled in comparison to estimates of the total species pool based on several models.

	Observed	Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of Species	269	353	342	383	302
Estimated % of total flora sampled	-	76	79	70	89

1.3.2 Vegetation Classification

Dendrogram production combined with the Simprof statistical test for the current survey led to the identification of 23 distinct floristic clusters (Figure K.2). Of these clusters, six were formed by individual samples: GP11, GP23, GP34, GP45, GPR25 and WRA21. Clusters generally showed some pattern of grouping according to the structural vegetation units described within the survey area and related to similar landforms.

Analysis of the presence/absence of perennial native taxa within a broader regional dataset included sites from Biota Environmental Sciences (2012b, 2012a), ecologia Environment (2011), GHD (2009), Mattiske (2011) and Rio Tinto (2014) and led to the identification of 109 significant clusters (Figure K.3 to Figure K.9). Twenty-six of these clusters were made up of individual quadrats/relevés from the current survey; these sites had been assigned to 17 structural vegetation units described within the survey area (Table K.2).

Table K.2: Structural vegetation units assigned for sites comprising a significant cluster.

Landform	Structural vegetation unit	Site (quadrat/releve)
Hills and Ridges	H1	GP20
	H2	GP45
	H3	GP01, GP02
	H4	GP12
	H5	GP30
	H8	GP31
	H12	GP40
Stony Plains	P2	GP34
	P4	GP24, GP32, GP37
	P8	GP21, GP26, GP39
Drainage Lines	D3	GP03
	D6	GPR19, GPR25
	D7	GP27
	D8	GP13
	D9	GP23
	D10	e073-AR, GP43
	D13	GP08, GP11, GP18

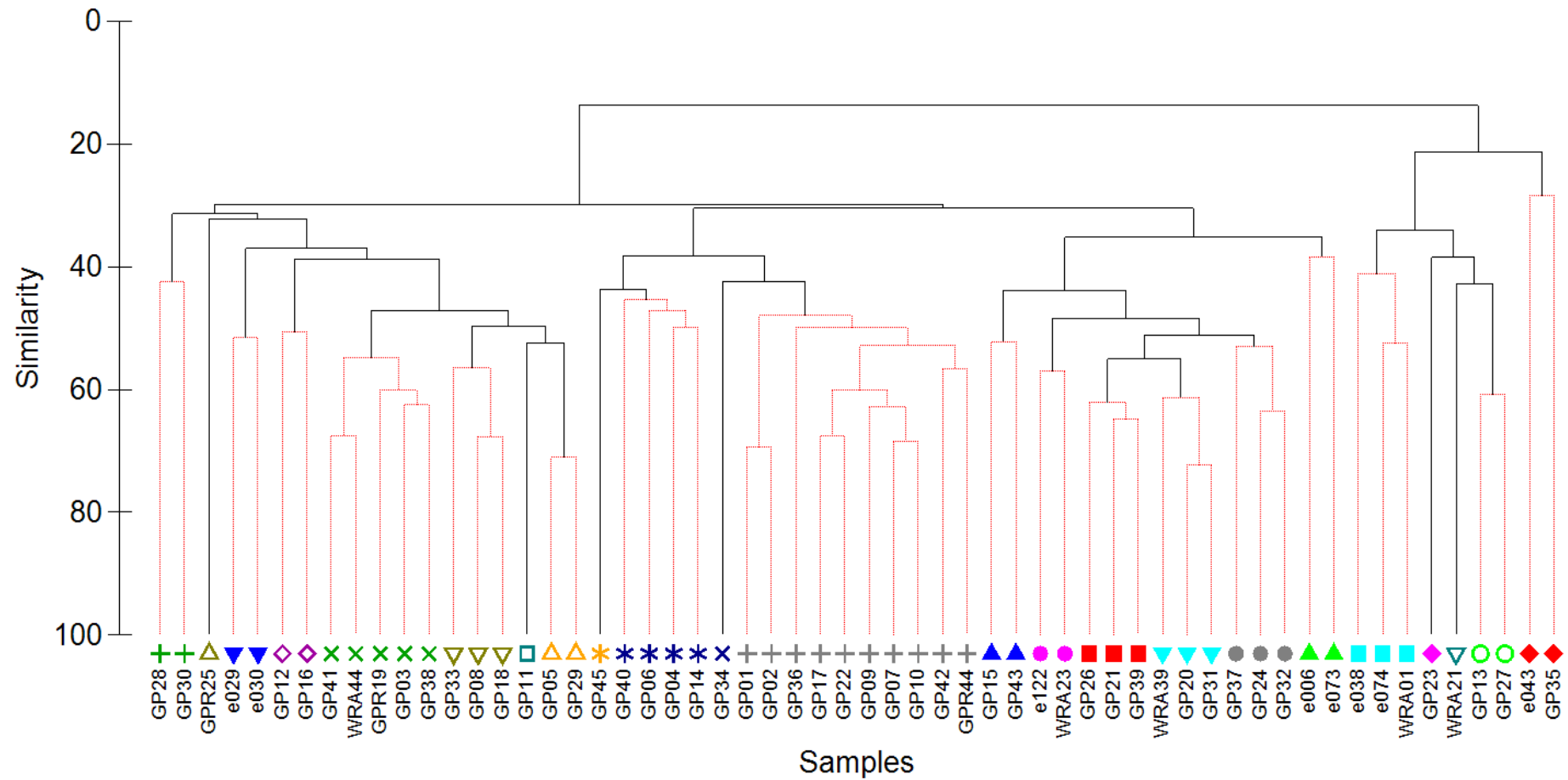


Figure K.2: Dendrogram showing relationship between Astron survey quadrats and relevés according to the degree of shared species (Sorensen's Index). Significant clusters are distinguished by solid black lines and distinct symbols.

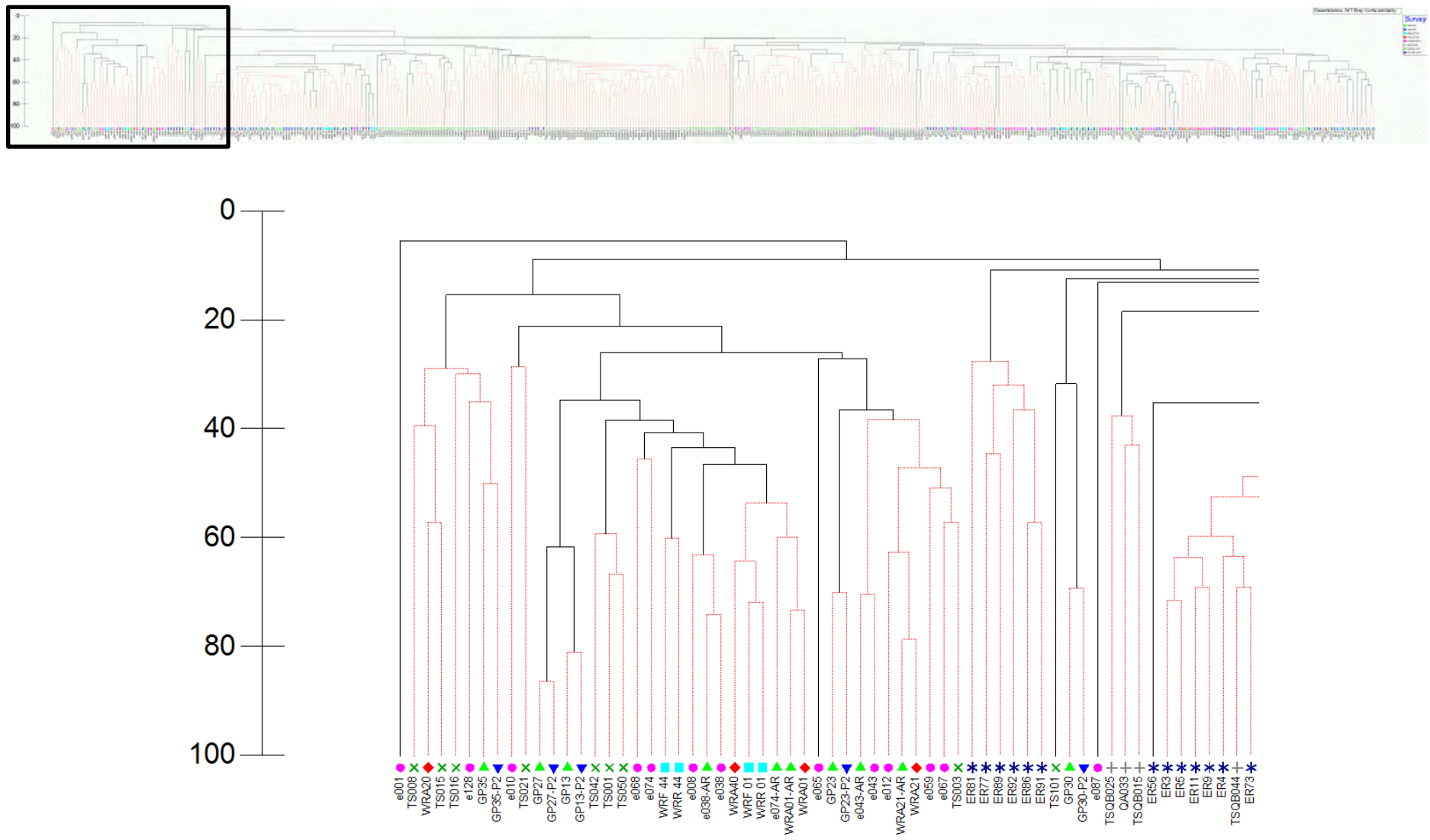


Figure K.3: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

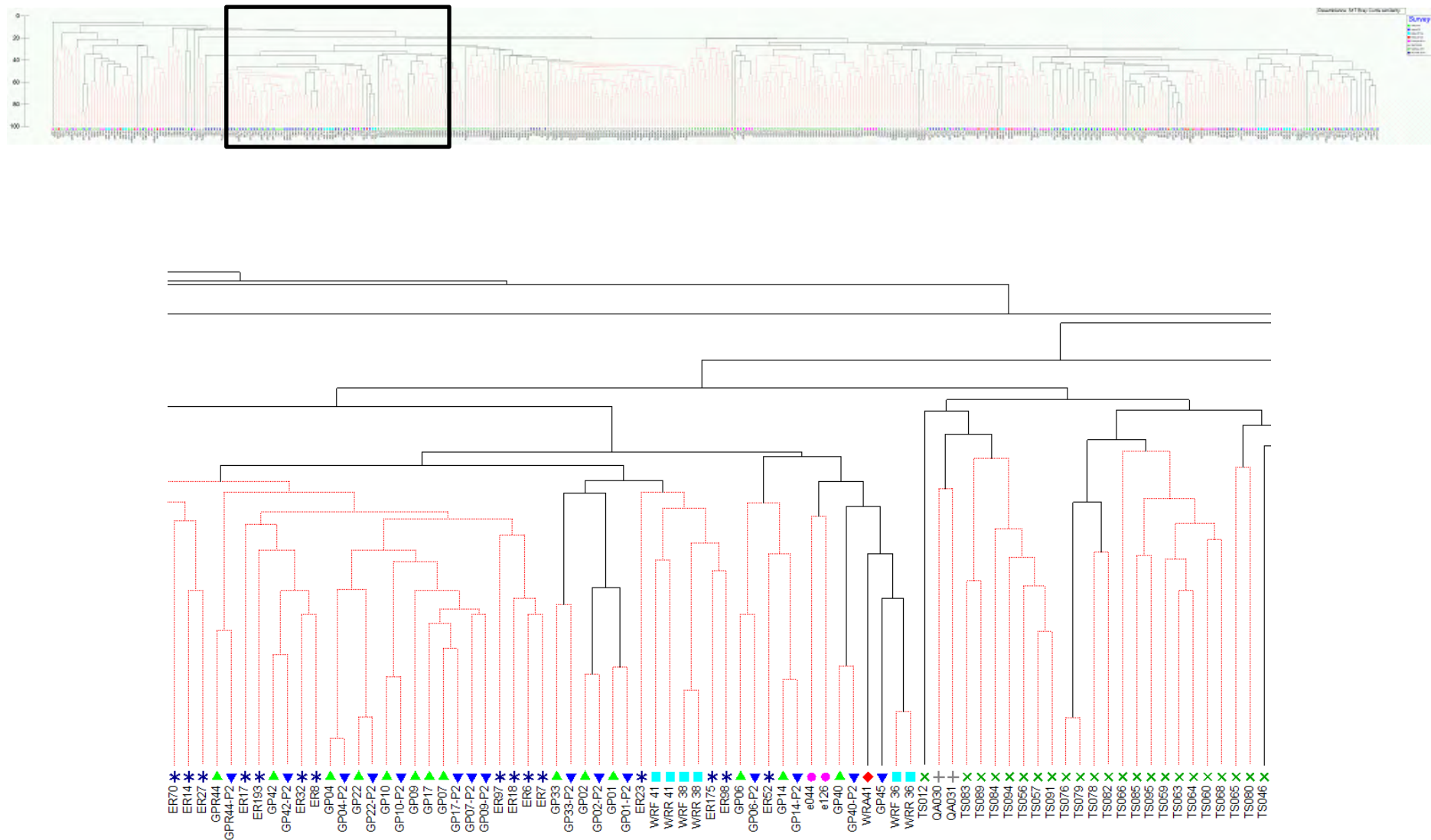


Figure K.4: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

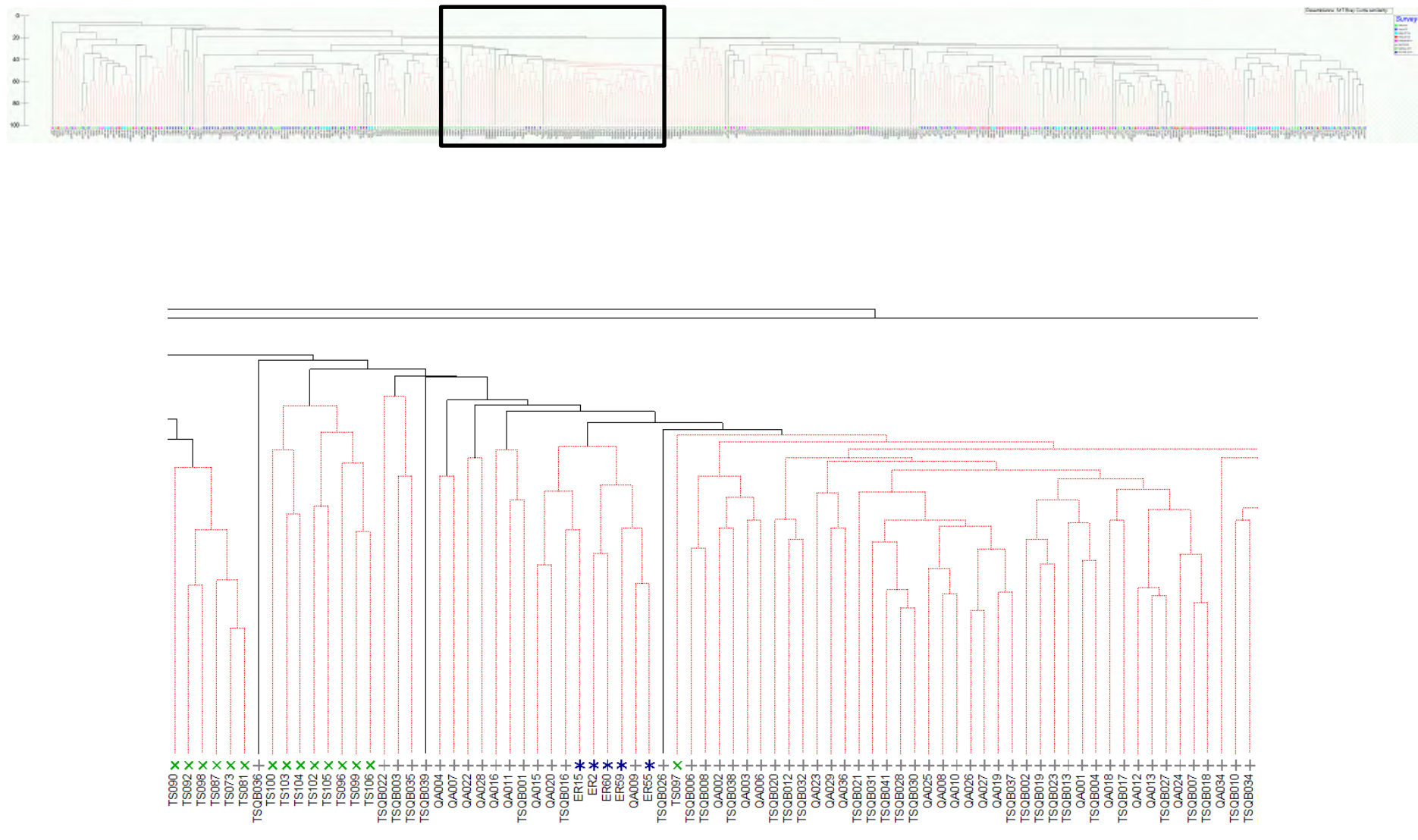


Figure K.5: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

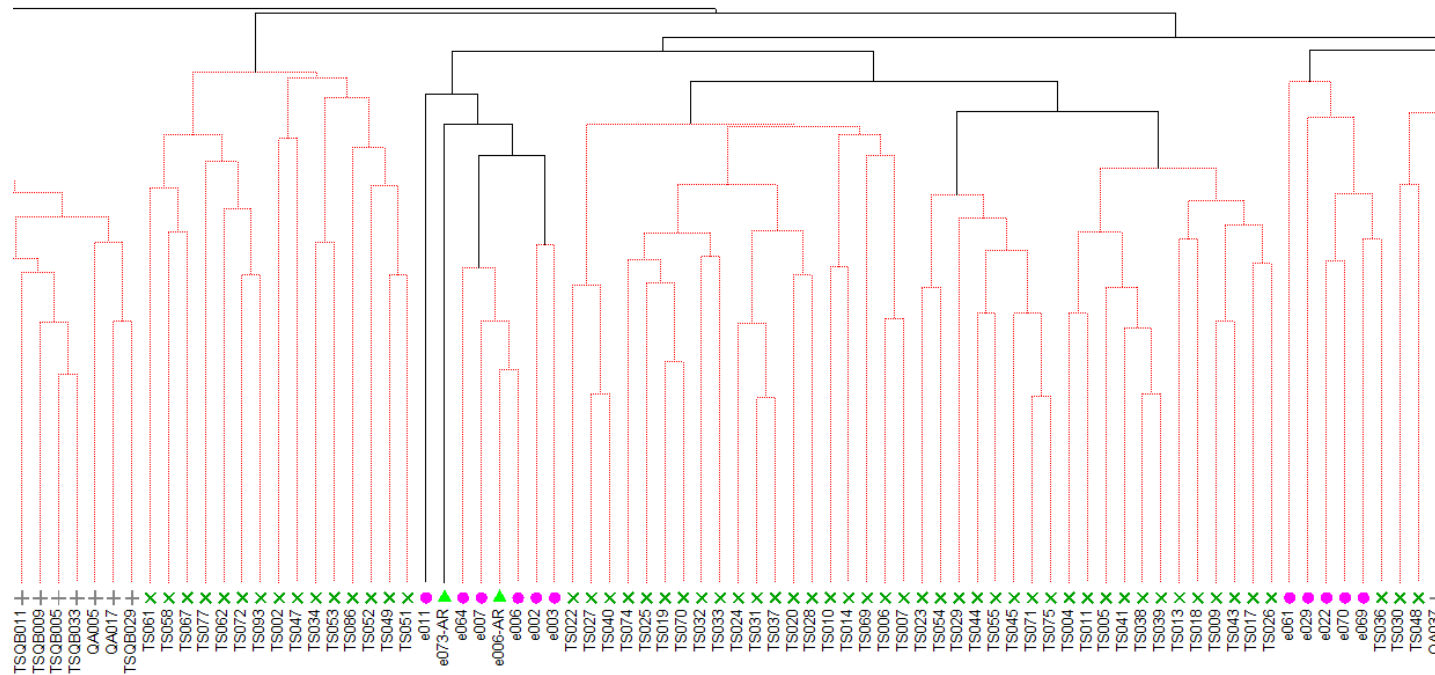
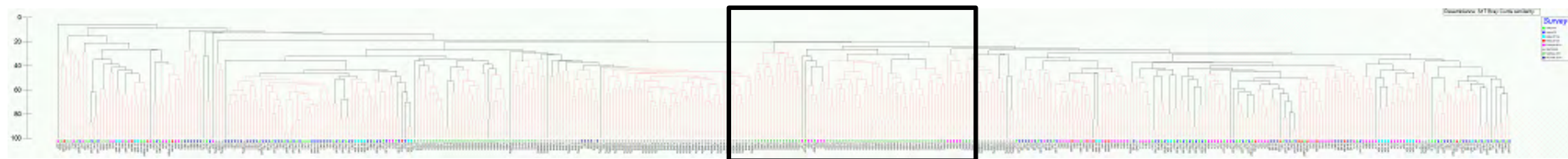


Figure K.6: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

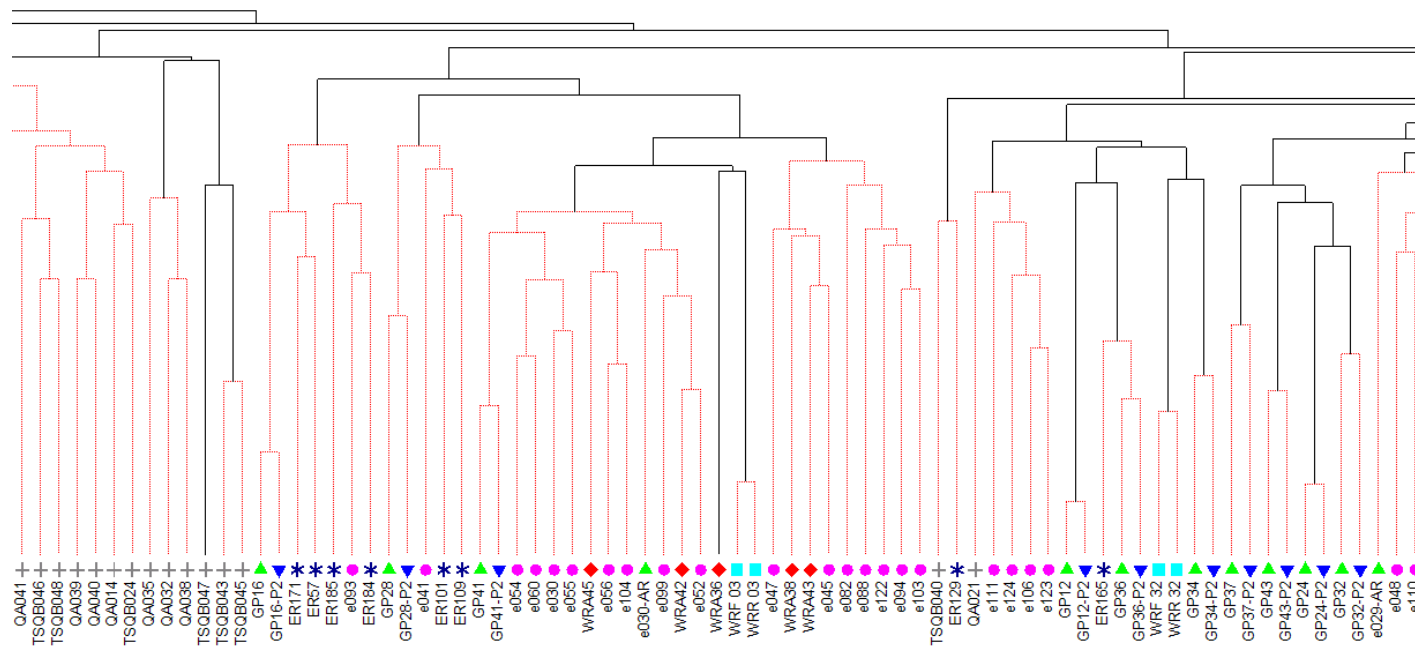
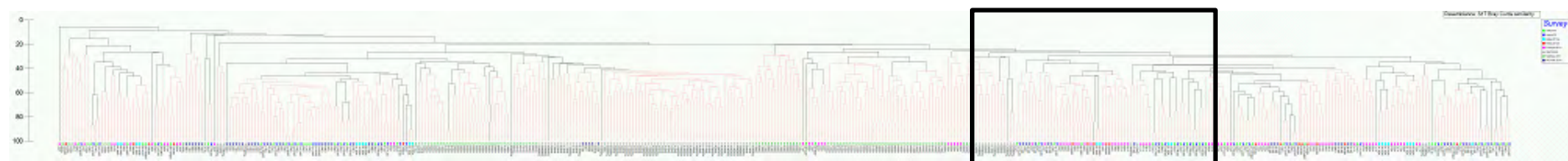
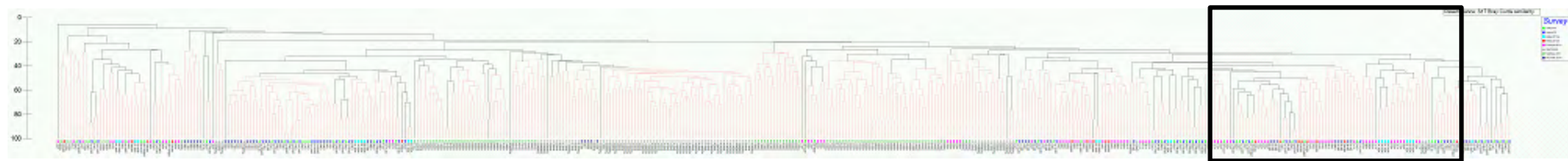


Figure K.7: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.



Resen

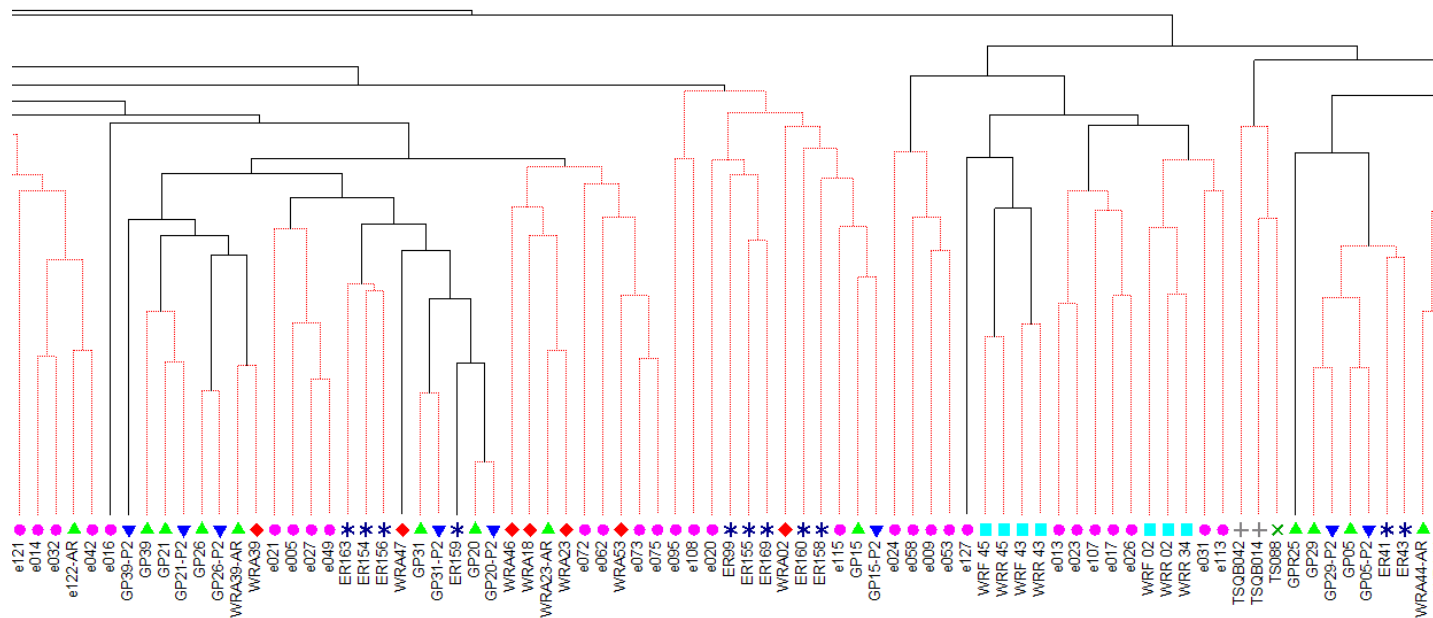
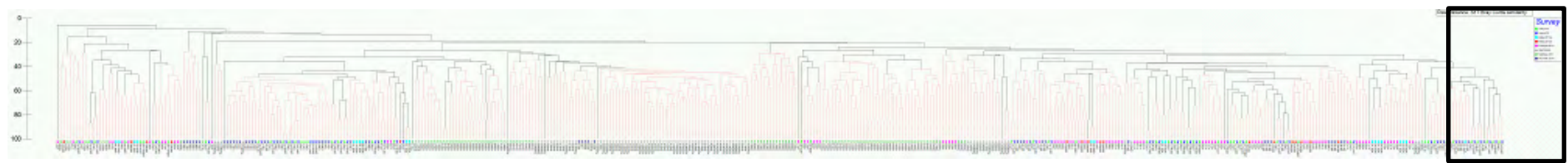


Figure K.8: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.



nblance: S17 Bray Curtis similarity

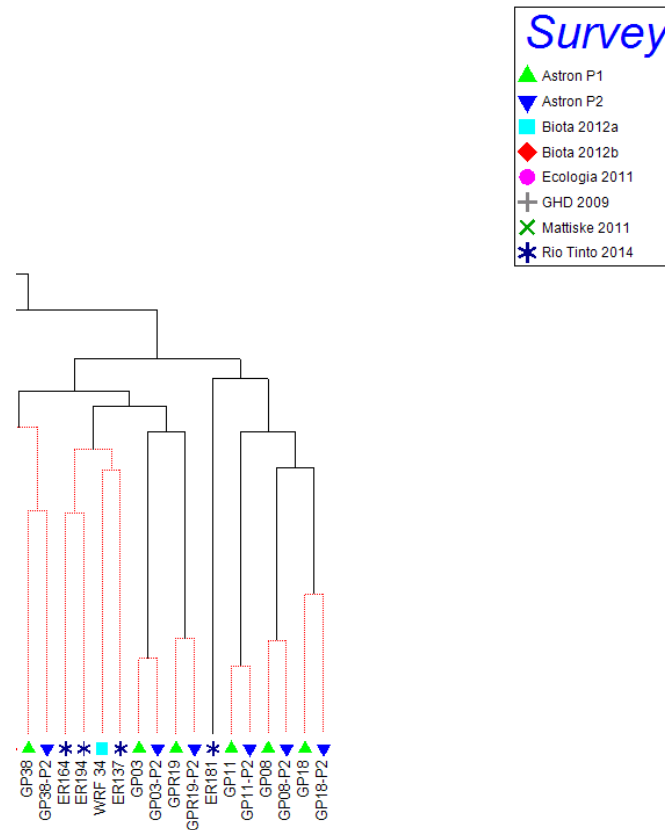


Figure K.9: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

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Appendix L: Vascular Flora Species List and Site by Species Matrix

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Table L.1: Vascular flora species recorded during the Phase 1 and Phase 2 survey.

Family	Species	Conservation status	Weed
Acanthaceae	<i>Dicladanthera forrestii</i>		
	<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>		
	<i>Ruellia simplex</i>		*
	<i>Ruellia</i> sp. (aff. <i>simplex</i>)		*
Aizoaceae	<i>Trianthema glossostigma</i>		
	<i>Trianthema oxycalyptum</i> var. <i>oxycalyptum</i>		
	<i>Trianthema triquetrum</i>		
Amaranthaceae	<i>Aerva javanica</i>		*
	<i>Alternanthera nodiflora</i>		
	<i>Amaranthus cuspidifolius</i>		
	<i>Amaranthus undulatus</i>		
	<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>		
	<i>Gomphrena canescens</i> subsp. <i>canescens</i>		
	<i>Gomphrena cunninghamii</i>		
	<i>Ptilotus aervoides</i>		
	<i>Ptilotus calostachyus</i>		
	<i>Ptilotus clementii</i>		
	<i>Ptilotus gaudichaudii</i> subsp. <i>gaudichaudii</i>		
	<i>Ptilotus helipteroides</i>		
	<i>Ptilotus macrocephalus</i>		
	<i>Ptilotus exaltatus</i>		
	<i>Ptilotus obovatus</i>		
	<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>		
Apocynaceae	<i>Marsdenia australis</i>		
Araliaceae	<i>Astrotricha hamptonii</i>		
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>		
Arecaceae	<i>Phoenix dactylifera</i>		*
	<i>Washingtonia filifera</i>		*
Asteraceae	<i>Bidens bipinnata</i>		*
	<i>Centipeda minima</i>		
	<i>Dichromochlamys dentatifolia</i>		
	<i>Flaveria trinervia</i>		*
	<i>Pluchea dentex</i>		
	<i>Pluchea rubelliflora</i>		
	<i>Pseudognaphalium luteoalbum</i>		
	<i>Pterocaulon</i> sp.		
	<i>Pterocaulon sphacelatum</i>		
	<i>Sonchus oleraceus</i>		*
	<i>Streptoglossa bubakii</i>		
	<i>Streptoglossa decurrens</i>		
	<i>Streptoglossa</i> sp.		
Boraginaceae	<i>Heliotropium ammophilum</i>		

Family	Species	Conservation status	Weed
Boraginaceae (cont.)	<i>Heliotropium chrysocarpum</i>		
	<i>Heliotropium conocarpum</i>		
	<i>Heliotropium heteranthum</i>		
	<i>Heliotropium inexplicitum</i>		
	<i>Heliotropium pachyphyllum</i>		
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>		
Brassicaceae	<i>Lepidium muelleri-ferdinandii</i>		
	<i>Lepidium oxytrichum</i>		
	<i>Lepidium pedicellosum</i>		
	<i>Lepidium platypetalum</i>		
	<i>Sisymbrium orientale</i>		*
Campanulaceae	<i>Lobelia heterophylla</i>		
Capparaceae	<i>Capparis spinosa</i> subsp. <i>nummularia</i>		
Caryophyllaceae	<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>		
	<i>Polycarpaea longiflora</i>		
Chenopodiaceae	<i>Atriplex codonocarpa</i>		
	<i>Dysphania plantaginella</i>		
	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>		
	<i>Dysphania</i> sp.		
	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>		
	<i>Maireana carnosae</i>		
	<i>Maireana eriosphaera</i>		
	<i>Maireana georgei</i>		
	<i>Maireana melanocoma</i>		
	<i>Maireana planifolia</i>		
	<i>Maireana</i> sp.		
	<i>Maireana suaedifolia</i>		
	<i>Maireana thesioides</i>		
	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>		
	<i>Maireana villosa</i>		
	<i>Rhagodia eremaea</i>		
	<i>Salsola australis</i>		
	<i>Sclerolaena costata</i>		
	<i>Sclerolaena cuneata</i>		
	<i>Sclerolaena densiflora</i>		
	<i>Sclerolaena eriacantha</i>		
	<i>Sclerolaena eriacantha</i>		
	<i>Sclerolaena</i> sp.		
	<i>Tecticornia disarticulata</i>		
Cleomaceae	<i>Cleome viscosa</i>		
Convolvulaceae	<i>Bonamia media</i>		
	<i>Bonamia pilbarensis</i>		
	<i>Duperreya commixta</i>		

Family	Species	Conservation status	Weed
Convolvulaceae (cont.)	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>		
	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		
	<i>Ipomoea muelleri</i>		
	<i>Operculina aequisejala</i>		
Cucurbitaceae	<i>Citrullus amarus</i>		*
	<i>Cucumis melo</i>		
	<i>Cucumis variabilis</i>		
Cyperaceae	<i>Bulbostylis barbata</i>		
	<i>Bulbostylis turbinata</i>		
	<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>		
	<i>Cyperus vaginatus</i>		
Euphorbiaceae	<i>Adriana tomentosa</i>		
	<i>Euphorbia australis</i> var. <i>hispidula</i>		
	<i>Euphorbia australis</i> var. <i>subtomentosa</i>		
	<i>Euphorbia biconvexa</i>		
	<i>Euphorbia biconvexa</i> ?		
	<i>Euphorbia boophthona</i>		
	<i>Euphorbia careyi</i>		
	<i>Euphorbia hirta</i>		*
	<i>Euphorbia</i> sp.		
	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>		
	<i>Euphorbia boophthona</i> ?		
Fabaceae	<i>Acacia ampliceps</i>		
	<i>Acacia aneura</i>		
	<i>Acacia aptaneura</i>		
	<i>Acacia arida</i>		
	<i>Acacia bivenosa</i>		
	<i>Acacia citrinoviridis</i>		
	<i>Acacia coriacea</i> subsp. <i>pendens</i>		
	<i>Acacia cuspidifolia</i>		
	<i>Acacia incurvaneura</i>		
	<i>Acacia macraneura</i>		
	<i>Acacia maitlandii</i>		
	<i>Acacia marramamba</i>		
	<i>Acacia pruinocarpa</i>		
	<i>Acacia pteraneura</i>		
	<i>Acacia pyrifolia</i>		
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>		
	<i>Acacia rhodophloia</i>		
	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		
	<i>Acacia sibirica</i>		
	<i>Acacia synchronicia</i>		
	<i>Acacia tetragonophylla</i>		

Family	Species	Conservation status	Weed
Fabaceae (cont.)	<i>Acacia wanyu</i>		
	<i>Acacia xiphophylla</i>		
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>		
	<i>Cullen leucochaetes</i>		
	<i>Glycine canescens</i>		
	<i>Indigofera cuspidata</i>		
	<i>Indigofera monophylla</i>		
	<i>Isotropis forrestii</i>		
	<i>Petalostylis labicheoides</i>		
	<i>Rhynchosia australis</i>		
	<i>Rhynchosia minima</i>		
	<i>Senna artemisioides</i> subsp. <i>helmsii</i>		
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>		
	<i>Senna glaucifolia</i>		
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>		
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>		
	<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>		
	<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)		
	<i>Senna stricta</i>		
	<i>Sesbania cannabina</i>		
	<i>Sesbania formosa</i>		
	<i>Swainsona complanata</i>		
	<i>Swainsona maccullochiana</i>		
	<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)		
	<i>Tephrosia</i> sp.		
	<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)		
	<i>Tephrosia</i> sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)		
	<i>Tephrosia supina</i>		
	<i>Vachellia farnesiana</i>		*
	<i>Vigna lanceolata</i> var. <i>lanceolata</i>		
Frankeniaceae	<i>Frankenia</i> aff. <i>hispidula</i>		
	<i>Frankenia</i> aff. <i>magnifica</i>		
	<i>Frankenia setosa</i>		
Goodeniaceae	<i>Goodenia forrestii</i>		
	<i>Goodenia microptera</i>		
	<i>Goodenia</i> sp.		
	<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P3	
	<i>Goodenia stobbsiana</i>		
	<i>Goodenia tenuiloba</i>		
	<i>Scaevola acacioides</i>		
	<i>Scaevola spinescens</i>		
Lamiaceae	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>		

Family	Species	Conservation status	Weed
Lamiaceae (cont.)	<i>Clerodendrum floribundum</i> var. <i>floribundum</i>		
	<i>Clerodendrum</i> sp.		
	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>		
	<i>Prostanthera albiflora</i>		
Loranthaceae	<i>Amyema fitzgeraldii</i>		
	<i>Amyema gibberula</i> var. <i>gibberula</i>		
Lythraceae	<i>Ammannia baccifera</i>		
Malvaceae	<i>Abutilon cryptopetalum</i>		
	<i>Abutilon fraseri</i> subsp. <i>fraseri</i>		
	<i>Abutilon lepidum</i>		
	<i>Abutilon</i> sp.		
	<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)		
	<i>Corchorus crozophorifolius</i>		
	<i>Corchorus laniflorus</i>		
	<i>Corchorus lasiocarpus</i>		
	<i>Gossypium robinsonii</i>		
	<i>Hibiscus burtonii</i>		
	<i>Hibiscus campanulatus</i>	P1	
	<i>Hibiscus coatesii</i>		
	<i>Hibiscus goldsworthii</i>		
	<i>Hibiscus</i> sp. Gardneri (A.L. Payne PRP 1435)		
	<i>Hibiscus sturtii</i>		
	<i>Hibiscus sturtii</i> var. <i>campylocllamys</i>		
	<i>Hibiscus sturtii</i> var. <i>grandiflorus</i>		
	<i>Hibiscus sturtii</i> var. <i>platycllamys</i>		
	<i>Lawrencia densiflora</i>		
	<i>Lawrencia glomerata</i>		
	<i>Malvastrum americanum</i>		*
	<i>Melhania oblongifolia</i>		
	<i>Sida</i> ?sp. L (A.M. Ashby 4202)		
	<i>Sida echinocarpa</i>		
	<i>Sida fibulifera</i>		
	<i>Sida</i> sp.		
	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	
	<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)		
	<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)		
	<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		
	<i>Sida</i> sp. Shovelanna Hill (S. van Leeuwen 3842)		
	<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)		
	<i>Sida</i> sp. L (A.M. Ashby 4202)		
	<i>Triumfetta clementii</i>		
	<i>Waltheria indica</i>		
Molluginaceae	<i>Trigastrotheca molluginea</i>		

Family	Species	Conservation status	Weed
Moraceae	<i>Ficus brachypoda</i>		
Myrtaceae	<i>Aluta quadrata</i>	T	
	<i>Corymbia ferritcola</i>		
	<i>Eucalyptus camaldulensis</i>		
	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>		
	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>		
	<i>Eucalyptus</i> sp.		
	<i>Eucalyptus victrix</i>		
	<i>Melaleuca bracteata</i>		
	<i>Melaleuca glomerata</i>		
	<i>Melaleuca linophylla</i>		
Nyctaginaceae	<i>Boerhavia burbridgeana</i>		
	<i>Boerhavia coccinea</i>		
	<i>Boerhavia</i> sp.		
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>		
Papaveraceae	<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>		*
Passifloraceae	<i>Passiflora foetida</i> var. <i>hispida</i>		*
Phyllanthaceae	<i>Notoleptopus decaisnei</i>		
	<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>		
	<i>Phyllanthus erwinii</i>		
	<i>Phyllanthus maderaspatensis</i>		
Plantaginaceae	<i>Stemodia grossa</i>		
Plumbaginaceae	<i>Plumbago zeylanica</i>		
Poaceae	<i>Aristida burbridgeae</i>		
	<i>Aristida contorta</i>		
	<i>Aristida holathera</i> var. <i>holathera</i>		
	<i>Aristida nitidula</i>		
	<i>Cenchrus ciliaris</i>		*
	<i>Cenchrus setiger</i>		*
	<i>Chloris barbata</i>		*
	<i>Chrysopogon fallax</i>		
	<i>Cymbopogon ambiguus</i>		
	<i>Cynodon prostratus</i>		
	<i>Digitaria brownii</i>		
	<i>Echinochloa colona</i>		*
	<i>Enneapogon caeruleus</i>		
	<i>Enneapogon lindleyanus</i>		
	<i>Enneapogon polyphyllus</i>		
	<i>Eragrostis tenellula</i>		
	<i>Eriachne mucronata</i>		
	<i>Eriachne pulchella</i>		
	<i>Eriachne pulchella</i> subsp. <i>dominii</i>		
	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>		

Family	Species	Conservation status	Weed
Poaceae (cont.)	<i>Iseilema membranaceum</i>		
	<i>Paraneurachne muelleri</i>		
	<i>Paspalidium basicladum</i>		
	<i>Paspalidium clementii</i>		
	<i>Paspalidium rarum</i>		
	<i>Setaria verticillata</i>		*
	<i>Sporobolus australasicus</i>		
	<i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)		
	<i>Themeda triandra</i>		
	<i>Triodia angusta</i>		
	<i>Triodia epactia</i>		
	<i>Triodia wiseana</i>		
	<i>Tripogonella loliiformis</i>		
Polygalaceae	<i>Polygala glaucifolia</i>		
	<i>Rumex vesicarius</i>		*
Portulacaceae	<i>Calandrinia</i> sp. The Pink Hills (F. Obbens FO 19/06)		
	<i>Portulaca oleracea</i>		
Proteaceae	<i>Grevillea berryana</i>		
	<i>Grevillea saxicola</i>	P3	
	<i>Hakea lorea</i> subsp. <i>lorea</i>		
Pteridaceae	<i>Cheilanthes brownii</i>		
	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>		
	<i>Cheilanthes</i> sp.		
Rubiaceae	<i>Oldenlandia crouchiana</i>		
	<i>Psydrax latifolia</i>		
	<i>Psydrax suaveolens</i>		
Santalaceae	<i>Santalum lanceolatum</i>		
	<i>Santalum spicatum</i>		
Sapindaceae	<i>Dodonaea pachyneura</i>		
	<i>Dodonaea petiolaris</i>		
Scrophulariaceae	<i>Eremophila canaliculata</i>		
	<i>Eremophila cryptothrix</i>		
	<i>Eremophila cuneifolia</i>		
	<i>Eremophila exilifolia</i>		
	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>		
	<i>Eremophila fraseri</i>		
	<i>Eremophila fraseri</i> subsp. <i>fraseri</i>		
	<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>		
	<i>Eremophila latrobei</i>		
	<i>Eremophila latrobei</i> subsp. <i>filiformis</i>		
	<i>Eremophila latrobei</i> subsp. <i>glabra</i>		
	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		
	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>		

Family	Species	Conservation status	Weed
Scrophulariaceae (cont.)	<i>Eremophila petrophila</i> subsp. <i>petrophila</i>		
	<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>		
	<i>Eremophila platycalyx</i> subsp. <i>pardalota</i>		
	<i>Eremophila reticulata</i>		
	<i>Eremophila</i> sp.		
	<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	
Solanaceae	<i>Nicotiana benthamiana</i>		
	<i>Nicotiana umbratica</i>	P3	
	<i>Solanum cleistogamum</i>		
	<i>Solanum horridum</i>		
	<i>Solanum lasiophyllum</i>		
	<i>Solanum nigrum</i>		*
	<i>Solanum phlomoides</i>		
	<i>Solanum piceum</i>		
	<i>Solanum</i> sp. (indet)	?Conservation significant	
	<i>Solanum sturtianum</i>		
Surianaceae	<i>Stylobasium spathulatum</i>		
Typhaceae	<i>Typha domingensis</i>		
Violaceae	<i>Hybanthus aurantiacus</i>		
Zygophyllaceae	<i>Tribulus suberosus</i>		

Table L.2: Vascular flora species list for the survey area.

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Acanthaceae	<i>Dicladanthera forrestii</i>	X	X	X	X	
	<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	X	X	X	X	X
	* <i>Ruellia</i> sp. (aff. <i>simplex</i>)		X			
	<i>Ruellia simplex</i>	X				
Aizoaceae	<i>Trianthema glossostigma</i>	X	X	X	X	
	<i>Trianthema oxycalyptum</i> var. <i>oxycalyptum</i>		X			X
	<i>Trianthema triquetrum</i>	X	X			X
Amaranthaceae	* <i>Aerva javanica</i>	X	X	X	X	X
	<i>Alternanthera nana</i>			X		
	<i>Alternanthera nodiflora</i>		X		X	
	<i>Amaranthus cuspidifolius</i>	X	X	X	X	
	<i>Amaranthus undulatus</i>	X	X			X
	<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	X	X			
	<i>Gomphrena canescens</i> subsp. <i>canescens</i>	X	X	X		X
	<i>Gomphrena cunninghamii</i>	X	X	X		X
	<i>Gomphrena kanisii</i>			X	X	X
	<i>Ptilotus aervoides</i>		X	X	X	
	<i>Ptilotus auriculifolius</i>			X	X	X
	<i>Ptilotus calostachyus</i>		X	X		X
	<i>Ptilotus clementii</i>	X	X	X		X
	<i>Ptilotus gaudichaudii</i> subsp. <i>gaudichaudii</i>		X			
	<i>Ptilotus helipteroides</i>	X	X	X		X
	<i>Ptilotus macrocephalus</i>		X	X		
	<i>Ptilotus exaltatus</i>	X	X	X	X	X
	<i>Ptilotus obovatus</i>	X	X	X	X	X
	<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	X	X	X		

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Amaranthaceae (cont.)	<i>Surreya diandra</i>					X
Apocynaceae	<i>Marsdenia australis</i>	X	X	X		
Araliaceae	<i>Astrotricha hamptonii</i>		X			
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	X	X	X		
	<i>Trachymene pilbarensis</i>			X		
Arecaceae	* <i>Phoenix dactylifera</i>	X				
	* <i>Washingtonia filifera</i>	X				
Asteraceae	* <i>Bidens bipinnata</i>	X	X	X		
	<i>Blumea tenella</i>					X
	<i>Calotis multicaulis</i>					X
	<i>Centipeda minima</i>		X			X
	<i>Centipeda minima</i> subsp. <i>macrocephala</i>			X		
	<i>Dichromochlamys dentatifolia</i>		X			
	* <i>Flaveria trinervia</i>	X	X			X
	<i>Pluchea dentex</i>	X	X			
	<i>Pluchea rubelliflora</i>	X	X	X	X	X
	<i>Pseudognaphalium luteoalbum</i>		X	X	X	
	<i>Pterocaulon serrulatum</i>					X
	<i>Pterocaulon</i> sp.		X			
	<i>Pterocaulon sphacelatum</i>	X	X	X		
	<i>Pterocaulon sphaeranthoides</i>			X	X	
	* <i>Sonchus oleraceus</i>		X	X	X	X
	<i>Streptoglossa bubakii</i>	X				
	<i>Streptoglossa decurrens</i>		X			
	<i>Streptoglossa</i> sp.		X			
Boraginaceae	<i>Heliotropium ammophilum</i>		X			

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Boraginaceae (cont.)	<i>Heliotropium chrysocarpum</i>	X	X			X
	<i>Heliotropium conocarpum</i>	X				
	<i>Heliotropium heteranthum</i>	X	X	X		
	<i>Heliotropium inexplicitum</i>		X	X		
	<i>Heliotropium pachyphyllum</i>		X			
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	X	X	X	X	
Brassicaceae	<i>Lepidium muelleri-ferdinandii</i>		X		X	X
	<i>Lepidium oxytrichum</i>		X			
	<i>Lepidium pedicellosum</i>	X	X	X	X	X
	<i>Lepidium pholidogynum</i>			X		
	<i>Lepidium platypetalum</i>	X	X		X	X
	* <i>Sisymbrium orientale</i>		X		X	
Campanulaceae	<i>Lobelia heterophylla</i>		X			
Capparaceae	<i>Capparis spinosa</i> subsp. <i>nummularia</i>		X	X	X	
Caryophyllaceae	<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	X	X			
	<i>Polycarpaea longiflora</i>	X	X	X	X	X
Celastraceae	<i>Denhamia cunninghamii</i>					X
Chenopodiaceae	<i>Atriplex codonocarpa</i>	X	X			
	<i>Dysphania plantaginella</i>		X			
	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	X	X	X		
	<i>Dysphania</i> sp.	X				
	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	X	X	X	X	X
	<i>Maireana carnosae</i>	X	X			
	<i>Maireana eriosphaera</i>	X	X			
	<i>Maireana georgei</i>	X	X	X		
	<i>Maireana melanocoma</i>	X	X	X	X	X
	<i>Maireana planifolia</i>	X	X	X		

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Chenopodiaceae (cont.)	<i>Maireana</i> sp.	X				
	<i>Maireana suaedifolia</i>	X	X			
	<i>Maireana thesioides</i>	X	X			
	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	X	X		X	
	<i>Maireana villosa</i>		X	X		X
	<i>Rhagodia eremaea</i>	X	X	X		
	<i>Salsola australis</i>	X	X	X		X
	<i>Sclerolaena costata</i>		X			
	<i>Sclerolaena cuneata</i>		X		X	X
	<i>Sclerolaena densiflora</i>	X	X	X	X	X
	<i>Sclerolaena eriacantha</i>	X	X	X	X	X
	<i>Sclerolaena</i> sp.	X				
	<i>Tecticornia disarticulata</i>	X	X			
Cleomaceae	<i>Cleome viscosa</i>	X	X	X	X	X
Convolvulaceae	<i>Bonamia media</i>		X			X
	<i>Bonamia pilbarensis</i>	X	X	X		
	<i>Bonamia</i> sp.			X		
	<i>Convolvulus clementii</i>			X		
	<i>Duperreya commixta</i>	X	X	X	X	X
	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	X				
	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	X	X	X		
	<i>Ipomoea muelleri</i>	X	X		X	X
	<i>Ipomoea plebeia</i>			X		
	<i>Operculina aequisejala</i>	X		X	X	
Cucurbitaceae	* <i>Citrullus colocynthis</i>			X		X
	* <i>Citrullus amarus</i>		X	X		
	<i>Cucumis</i> ? <i>picrocarpus</i>			X		

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Cucurbitaceae (cont.)	<i>Cucumis melo</i>	X				
	<i>Cucumis variabilis</i>	X	X	X	X	X
Cyperaceae	<i>Bulbostylis barbata</i>	X	X	X		
	<i>Bulbostylis turbinata</i>		X			
	<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	X	X			
	<i>Cyperus vaginatus</i>	X	X	X	X	X
	<i>Schoenoplectus subulatus</i>			X		
Euphorbiaceae	<i>Adriana tomentosa</i>		X			X
	<i>Euphorbia</i> aff. <i>australis</i> var. 3			X		
	<i>Euphorbia australis</i> var. <i>hispidula</i>		X			X
	<i>Euphorbia australis</i> var. <i>subtomentosa</i>	X				
	<i>Euphorbia biconvexa</i>	X	X	X		X
	<i>Euphorbia biconvexa</i> ?	X				
	<i>Euphorbia boophthona</i>	X	X	X		X
	<i>Euphorbia boophthona</i> ?	X				
	<i>Euphorbia careyi</i>	X	X			
	<i>Euphorbia coghlanii</i> /trigonosperma				X	
	* <i>Euphorbia hirta</i>	X	X			
	<i>Euphorbia</i> sp.	X		X		
	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	X				
Fabaceae	<i>Acacia ampliceps</i>	X	X	X	X	X
	<i>Acacia aneura</i>	X	X			
	<i>Acacia aneura</i> sens. lat			X	X	
	<i>Acacia aptaneura</i>	X	X			
	<i>Acacia arida</i>	X				
	<i>Acacia bivenosa</i>	X	X			
	<i>Acacia citrinoviridis</i>	X	X	X	X	X

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Fabaceae (cont.)	<i>Acacia coriacea</i> subsp. <i>pendens</i>		X	X	X	X
	<i>Acacia cuspidifolia</i>	X				
	<i>Acacia inaequilatera</i>			X		
	<i>Acacia incurvaneura</i>		X			
	<i>Acacia macraneura</i>	X	X			
	<i>Acacia maitlandii</i>		X			
	<i>Acacia marramamba</i>		X	X		
	<i>Acacia pruinocarpa</i>	X	X	X		X
	<i>Acacia pteraneura</i>	X	X			
	<i>Acacia pyrifolia</i>		X		X	X
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	X	X			
	<i>Acacia rhodophloia</i>	X	X	X		
	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		X			
	<i>Acacia sibirica</i>	X	X			
	<i>Acacia synchronicia</i>	X	X	X	X	X
	<i>Acacia tetragonophylla</i>	X	X	X	X	X
	<i>Acacia wanyu</i>	X	X	X		
	<i>Acacia xiphophylla</i>	X	X	X	X	X
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>		X		X	
	<i>Cullen leucochaetes</i>	X	X			
	<i>Glycine canescens</i>	X	X	X		
	<i>Indigofera cuspidata</i>	X				
	<i>Indigofera monophylla</i>	X	X	X	X	X
	<i>Isotropis forrestii</i>	X	X			
	<i>Petalostylis labicheoides</i>	X	X	X	X	X
	<i>Rhynchosia australis</i>		X			
	<i>Rhynchosia minima</i>	X	X	X		X

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Fabaceae (cont.)	<i>Senna artemisioides</i> subsp. <i>helmsii</i>	X	X	X	X	X
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	X	X	X	X	X
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>			X		
	<i>Senna glaucifolia</i>	X				X
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	X	X	X		X
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	X		X		
	<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	X	X	X	X	X
	<i>Senna glutinosa</i> subsp. x <i>luerssenii</i> x <i>stricta</i>			X		
	<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	X	X			
	<i>Senna stricta</i>	X	X	X	X	
	<i>Sesbania cannabina</i>		X	X		X
	<i>Sesbania formosa</i>	X	X		X	
	<i>Swainsona complanata</i>		X			
	<i>Swainsona decurrens</i>			X		
	<i>Swainsona maccullochiana</i>	X	X			
	<i>Swainsona stenodonta</i>					X
	<i>Tephrosia rosea</i> var. <i>clementii</i>					X
	<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	X	X		X	
	<i>Tephrosia</i> sp.		X			
	<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	X	X	X		X
	<i>Tephrosia</i> sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	X	X			
	<i>Tephrosia supina</i>		X		X	X
	* <i>Vachellia farnesiana</i>		X			
	<i>Vigna lanceolata</i> var. <i>lanceolata</i>		X			
Frankeniaceae	<i>Frankenia</i> aff. <i>magnifica</i>		X			
	<i>Frankenia</i> aff. <i>hispidula</i>		X			
	<i>Frankenia hispidula</i>	X				

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Frankeniaceae (cont.)	<i>Frankenia magnifica</i>	X				X
	<i>Frankenia setosa</i>		X			
Gentianaceae	<i>Schenkia clementii</i>				X	
Goodeniaceae	<i>Goodenia forrestii</i>	X	X			
	<i>Goodenia microptera</i>	X	X			
	<i>Goodenia</i> sp.		X			
	<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) (P3)	X	X			
	<i>Goodenia stobbsiana</i>	X	X			
	<i>Goodenia tenuiloba</i>		X	X		
	<i>Scaevola acacioides</i>	X	X	X		
	<i>Scaevola spinescens</i>	X	X			X
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>					X
Lamiaceae	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	X	X	X		
	<i>Clerodendrum floribundum</i> var. <i>floribundum</i>	X	X			
	<i>Clerodendrum</i> sp.		X			
	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>		X			
	<i>Prostanthera albiflora</i>		X			
Loranthaceae	<i>Amyema fitzgeraldii</i>		X		X	
	<i>Amyema gibberula</i> var. <i>gibberula</i>		X			
Lythraceae	<i>Ammannia baccifera</i>		X	X		X
Malvaceae	<i>Abutilon cryptopetalum</i>		X			
	<i>Abutilon fraseri</i>			X		
	<i>Abutilon fraseri</i> subsp. <i>fraseri</i>	X	X			
	<i>Abutilon lepidum</i>	X	X	X		X
	<i>Abutilon otocarpum</i>			X		
	<i>Abutilon</i> sp.	X	X			
	<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	X	X	X		

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Malvaceae (cont.)	<i>Corchorus crozophorifolius</i>	X	X	X	X	X
	<i>Corchorus laniflorus</i>	X	X			
	<i>Corchorus lasiocarpus</i>		X			
	<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>			X		
	<i>Gossypium robinsonii</i>	X	X			X
	<i>Hibiscus</i> aff. <i>sturtii</i>			X		
	<i>Hibiscus burtonii</i>	X	X			
	<i>Hibiscus campanulatus</i>	X	X			
	<i>Hibiscus coatesii</i>	X	X			
	<i>Hibiscus goldsworthii</i>	X	X			
	<i>Hibiscus haynaldii</i>			X		
	<i>Hibiscus</i> sp. Gardneri (A.L. Payne PRP 1435)	X	X	X	X	
	<i>Hibiscus sturtii</i>	X	X			X
	<i>Hibiscus sturtii</i> var. aff. <i>grandiflorus</i>			X		
	<i>Hibiscus sturtii</i> var. <i>campyloclamyx</i>	X	X			
	<i>Hibiscus sturtii</i> var. <i>grandiflorus</i>		X			
	<i>Hibiscus sturtii</i> var. <i>platyclamyx</i>	X				
	<i>Lawrenzia densiflora</i>	X	X			
	<i>Lawrenzia glomerata</i>		X			
	* <i>Malvastrum americanum</i>	X	X	X		X
	<i>Melhania oblongifolia</i>	X	X	X		
	<i>Sida brownii</i>					X
	<i>Sida echinocarpa</i>	X	X			
	<i>Sida fibulifera</i>	X	X			
	<i>Sida</i> sp.		X			
	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P3)	X	X			
	<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	X	X	X		

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Malvaceae (cont.)	<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)	X	X			
	<i>Sida</i> sp. Shovelanna Hill (S. van Leeuwen 3842)	X	X			
	<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	X	X	X	X	X
	<i>Sida</i> sp. L (A.M. Ashby 4202)	X	X			
	<i>Sida</i> ?sp. L (A.M. Ashby 4202)		X			
	<i>Triumfetta clementii</i>	X	X	X		
	<i>Waltheria indica</i>	X	X			
Molluginaceae	<i>Trigastrotheca molluginea</i>	X	X			
Moraceae	<i>Ficus brachypoda</i>		X			
Myrtaceae	<i>Eucalyptus camaldulensis</i>		X		X	X
	<i>Aluta quadrata</i> (T)		X			
	<i>Corymbia ferriticola</i>	X	X	X		
	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>	X		X		
	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	X	X			
	<i>Eucalyptus</i> sp.	X				
	<i>Eucalyptus victrix</i>	X	X	X	X	
	<i>Eucalyptus xerothermica</i>					X
	<i>Melaleuca bracteata</i>		X	X		X
	<i>Melaleuca glomerata</i>	X	X	X	X	
	<i>Melaleuca linophylla</i>	X	X	X	X	X
Nyctaginaceae	<i>Boerhavia burbidgeana</i>		X			
	<i>Boerhavia coccinea</i>	X	X	X	X	X
	<i>Boerhavia gardneri</i>			X		
	<i>Boerhavia</i> sp.	X	X	X		
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>	X	X	X	X	
Papaveraceae	* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>		X	X	X	X
Passifloraceae	* <i>Passiflora foetida</i> var. <i>hispida</i>	X	X			X

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Phyllanthaceae	<i>Notoleptopus decaisnei</i>		X	X	X	
	<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>	X				
	<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i>			X		
	<i>Phyllanthus erwinii</i>	X				
	<i>Phyllanthus maderaspatensis</i>	X	X	X	X	X
Plantaginaceae	<i>Stemodia grossa</i>	X	X	X	X	X
Plumbaginaceae	<i>Plumbago zeylanica</i>	X	X	X		
Poaceae	<i>Aristida burbridgeae</i>		X			
	<i>Aristida contorta</i>	X	X	X	X	
	<i>Aristida holathera</i> var. <i>holathera</i>		X			X
	<i>Aristida nitidula</i>	X				
	* <i>Cenchrus ciliaris</i>	X	X	X	X	X
	* <i>Cenchrus setiger</i>	X	X	X	X	X
	* <i>Chloris barbata</i>		X			X
	<i>Chrysopogon fallax</i>		X			X
	<i>Cymbopogon ambiguus</i>	X	X	X		
	<i>Cymbopogon obtectus</i>				X	X
	* <i>Cynodon dactylon</i>			X		
	<i>Cynodon prostratus</i>	X	X	X	X	X
	<i>Dactyloctenium radulans</i>				X	X
	<i>Digitaria brownii</i>	X	X			
	* <i>Echinochloa colona</i>		X	X		
	<i>Enneapogon caeruleus</i>	X	X	X	X	X
	<i>Enneapogon lindleyanus</i>		X	X		
	<i>Enneapogon polyphyllus</i>	X	X	X		
	<i>Eragrostis cumingii</i>			X		
	<i>Eragrostis tenellula</i>	X	X	X		X

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Poaceae (cont.)	<i>Eriachne mucronata</i>	X	X	X	X	
	<i>Eriachne pulchella</i>	X	X	X	X	X
	<i>Eriachne pulchella</i> subsp. <i>dominii</i>	X	X	X		
	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>		X	X		
	<i>Iseilema dolichotrichum</i>			X		
	<i>Iseilema eremaeum</i>					X
	<i>Iseilema membranaceum</i>		X			
	<i>Paraneurachne muelleri</i>	X	X	X	X	X
	<i>Paspalidium basicladum</i>		X			
	<i>Paspalidium clementii</i>	X	X	X	X	
	<i>Paspalidium constrictum</i>			X		
	<i>Paspalidium rarum</i>	X	X			
	* <i>Setaria verticillata</i>	X	X			
	<i>Sporobolus australasicus</i>	X	X	X	X	X
	<i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)		X			
	<i>Themeda triandra</i>	X	X	X	X	X
	<i>Tragus australianus</i>				X	
	<i>Triodia angusta</i>	X	X			
	<i>Triodia epactia</i>	X	X	X	X	X
	<i>Triodia wiseana</i>	X	X			
	<i>Tripogonella loliiformis</i>	X				
Polygalaceae	<i>Polygala glaucifolia</i>	X		X		
Polygonaceae	* <i>Rumex vesicarius</i>	X	X	X	X	
Portulacaceae	<i>Calandrinia schistorhiza</i>			X		
	<i>Calandrinia</i> sp.			X		
	<i>Calandrinia</i> sp. The Pink Hills (F. Obbens FO 19/06)		X	X		
	<i>Portulaca intraterranea</i>				X	

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Portulacaceae (cont.)	<i>Portulaca oleracea</i>	X	X	X		
Proteaceae	<i>Grevillea berryana</i>	X	X	X		X
	<i>Grevillea saxicola</i> (P3)	X	X			
	<i>Hakea chordophylla</i>			X		
	<i>Hakea lorea</i> subsp. <i>lorea</i>		X			X
Pteridaceae	<i>Cheilanthes brownii</i>	X	X	X		
	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	X	X			
	<i>Cheilanthes</i> sp.		X			
Rubiaceae	<i>Oldenlandia crouchiana</i>	X		X		X
	<i>Psyrax latifolia</i>	X	X			
	<i>Psyrax suaveolens</i>	X	X	X		
Santalaceae	<i>Santalum lanceolatum</i>	X	X			X
	<i>Santalum spicatum</i>	X	X			
Sapindaceae	<i>Dodonaea viscosa</i>			X		
	<i>Dodonaea pachyneura</i>	X	X	X		
	<i>Dodonaea petiolaris</i>	X	X	X		
Scrophulariaceae	<i>Eremophila canaliculata</i>	X		X		X
	<i>Eremophila cryptothrix</i>	X	X	X		
	<i>Eremophila cuneifolia</i>	X	X	X	X	X
	<i>Eremophila exilifolia</i>	X	X	X		
	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	X	X	X	X	
	<i>Eremophila fraseri</i>		X			
	<i>Eremophila fraseri</i> subsp. <i>fraseri</i>	X	X	X		X
	<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	X	X	X		X
	<i>Eremophila latrobei</i>	X	X	X		
	<i>Eremophila latrobei</i> subsp. <i>filiformis</i>	X	X	X		
	<i>Eremophila latrobei</i> subsp. <i>glabra</i>	X	X			

Family	Species	Phase 2 Astron 2018	Phase 1 Astron 2017	Biota 2012a ¹	Biota 2012b ¹	ecologia 2011 ²
Scrophulariaceae (cont.)	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	X	X	X		
	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>	X				
	<i>Eremophila petrophila</i> subsp. <i>petrophila</i>		X			
	<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	X	X	X		
	<i>Eremophila phyllopoda</i> x <i>exilifolia</i>			X		
	<i>Eremophila platycalyx</i> subsp. <i>pardalota</i>	X	X			
	<i>Eremophila reticulata</i>	X	X	X		
	<i>Eremophila</i> sp.		X			
	<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) (P1)	X	X			
Solanaceae	<i>Nicotiana benthamiana</i>		X	X		
	<i>Nicotiana umbratica</i> (P3)		X			
	<i>Solanum cleistogamum</i>	X	X			
	<i>Solanum ferocissimum</i>					X
	<i>Solanum horridum</i>	X	X	X		
	<i>Solanum lasiophyllum</i>	X	X	X	X	X
	* <i>Solanum nigrum</i>		X			
	<i>Solanum phlomoides</i>	X				X
	<i>Solanum piceum</i>	X	X			
	<i>Solanum</i> sp. (indet)	X				
	<i>Solanum sturtianum</i>		X		X	
Surianaceae	<i>Stylobasium spathulatum</i>	X	X		X	
Typhaceae	<i>Typha domingensis</i>		X	X		X
Violaceae	<i>Hybanthus aurantiacus</i>	X	X	X	X	
Zygophyllaceae	<i>Tribulus hirsutus</i>					X
	<i>Tribulus suberosus</i>	X	X	X	X	X
	* <i>Tribulus terrestris</i>					X

* denotes weed species

¹ – Includes taxa recorded from sites occurring within current survey area.

² – Includes taxa recorded from entire project.

Table L.3: Species by site matrix for vascular flora species for Phase 1 and Phase 2.

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GPR19	GPR25	GPR44	OPPS		
<i>Abutilon cryptopetalum</i>																									X																							
<i>Abutilon fraseri</i>																																																
<i>Abutilon fraseri</i> subsp. <i>fraseri</i>			X					X			X																									X				X		X						
<i>Abutilon lepidum</i>			X																																	X												
<i>Abutilon otocarpum</i>																																																
<i>Abutilon</i> sp.																														X							X											
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	X		X		X						X		X		X			X	X				X		X		X				X				X				X		X							
<i>Acacia amplexeps</i>																									X																							
<i>Acacia aneura</i>									X																							X							X	X								
<i>Acacia aneura</i> sens. lat.																																																
<i>Acacia aptaneura</i>	X	X					X	X	X	X	X				X		X		X	X	X		X				X			X	X	X	X		X	X	X			X					X			
<i>Acacia arida</i>																													X																			
<i>Acacia bivenosa</i>																									X											X												
<i>Acacia citrinoviridis</i>			X		X	X		X			X		X		X			X				X				X						X				X					X	X						
<i>Acacia coriacea</i> subsp. <i>pendens</i>																																																
<i>Acacia cuspidifolia</i>																																																
<i>Acacia inaequilatera</i>																																																
<i>Acacia incurvaneura</i>				X																																												
<i>Acacia macraneura</i>																											X								X												X	
<i>Acacia marramamba</i>																																															X	
<i>Acacia pruinocarpa</i>	X	X		X		X	X	X	X					X		X	X	X	X									X	X			X						X	X	X		X	X	X				
<i>Acacia pteraneura</i>				X																															X													
<i>Acacia pyrifolia</i>					X						X	X				X		X				X			X	X	X							X								X						
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>			X		X			X			X	X	X			X		X				X			X	X	X		X														X					
<i>Acacia rhodophloia</i>		X				X	X		X	X							X				X	X						X													X					X	X	
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>																																		X														
<i>Acacia sibirica</i>						X	X					X		X																																		
<i>Acacia synchronicia</i>				X											X				X	X				X	X						X				X		X					X		X				
<i>Acacia tetragonophylla</i>	X	X	X	X	X	X	X	X	X	X		X	X		X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
<i>Acacia wanyu</i>			X												X				X	X				X						X			X						X		X							
<i>Acacia xiphophylla</i>															X				X	X			X	X						X					X		X				X							
<i>Adriana tomentosa</i>																									X																							
* <i>Aerva javanica</i>			X										X					X				X					X	X	X					X				X			X		X				X	
<i>Alternanthera nana</i>																																																
<i>Alternanthera nodiflora</i>																																																
<i>Aluta quadrata</i> (T)																																																X
<i>Amaranthus cuspidifolius</i>					X													X																														
<i>Amaranthus undulatus</i>											X		X									X			X											X	X					X	X					
<i>Ammannia baccifera</i>																									X																							
<i>Amyema fitzgeraldii</i>																																																
<i>Amyema gibber</i>																																																

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GP49	GP25	GP44	OPPS
<i>Boerhavia coccinea</i>					X			X	X		X		X					X										X				X								X		X				
<i>Boerhavia gardneri</i>																																														
<i>Boerhavia</i> sp.												X						X					X																							
<i>Bonamia media</i>																																														
<i>Bonamia pilbarensis</i>								X																							X															
<i>Bonamia</i> sp.																																														
<i>Bulbostylis barbata</i>	X	X			X		X		X	X		X		X		X	X	X	X				X	X			X		X		X	X					X		X		X		X	X		
<i>Bulbostylis turbinata</i>								X																																						
<i>Calandrinia schistorhiza</i>																																														
<i>Calandrinia</i> sp.																																														
<i>Calandrinia</i> sp. The Pink Hills (F. Obbens FO 19/06)																	X				X																									
<i>Calotis multicaulis</i>																																														
<i>Capparis spinosa</i> subsp. <i>nummularia</i>																																														
* <i>Cenchrus ciliaris</i>			X		X						X		X		X			X	X	X		X	X	X	X	X	X		X		X		X		X	X	X		X		X	X		X		
* <i>Cenchrus setiger</i>			X								X		X		X							X			X								X			X		X		X						
<i>Centipeda minima</i>																																														
<i>Centipeda minima</i> subsp. <i>macrocephala</i>																																														
<i>Cheilanthes brownii</i>	X	X								X													X					X																		
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>								X																									X	X										X		
<i>Cheilanthes</i> sp.																											X																			
* <i>Chloris barbata</i>																																														
<i>Chrysopogon fallax</i>																																														
<i>Citrullus colocynthis</i>																																														
* <i>Citrullus amarus</i>																							X																					X		
<i>Cleome viscosa</i>			X		X	X		X			X	X	X		X	X		X								X	X	X								X			X			X	X			
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>											X							X										X																	X	
<i>Clerodendrum floribundum</i> var. <i>floribundum</i>																												X																		
<i>Clerodendrum</i> sp.																																												X		
<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>					X																					X		X																		
<i>Codonocarpus cotinifolius</i>																																														
<i>Convolvulus clementii</i>																																														
<i>Corchorus crozophorifolius</i>			X		X	X		X		X	X		X		X	X		X				X			X		X				X				X	X			X							
<i>Corchorus laniflorus</i>																											X																			
<i>Corchorus lasiocarpus</i>																																														
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>																																														
<i>Corymbia ferritcola</i>		X			X																							X								X						X	X		X	
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>																																						X								
<i>Cucumis</i> ? <i>picrocarpus</i>																																														
<i>Cucumis melo</i>																							X																							
<i>Cucumis variabilis</i>			X		X	X		X	X		X	X	X		X	X		X				X			X		X				X					X			X	X						
<i>Cullen leucochaites</i>																												X																		
<i>Cymbopogon ambiguus</i>		X			X	X	X	X			X	X						X										X				X			X	X					X	X		X		
<i>Cymbopogon obtectus</i>																																														

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GPR19	GPR25	GPR44	OPPS		
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>			X										X		X								X		X											X	X			X								
<i>Dodonaea pachyneura</i>	X	X			X			X			X							X									X					X									X	X						
<i>Dodonaea petiolaris</i>	X	X					X	X		X	X																						X															
<i>Dodonaea viscosa</i>																																																
<i>Duperreya commixta</i>	X	X	X		X		X	X			X						X		X	X		X	X				X							X	X	X	X		X		X	X						
<i>Dysphania plantaginella</i>																																						X										
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>					X	X																										X																
<i>Dysphania</i> sp.															X																																	
<i>*Echinochloa colona</i>																																																
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>			X					X			X	X	X		X			X	X	X			X	X							X					X	X				X			X				
<i>Enneapogon caeruleus</i>	X		X					X	X	X		X			X	X		X	X	X	X		X	X							X	X	X		X	X	X	X		X			X					
<i>Enneapogon lindleyanus</i>																																																
<i>Enneapogon polyphyllus</i>			X																	X							X					X										X						
<i>Eragrostis cumingii</i>																																																
<i>Eragrostis tenellula</i>															X											X															X							
<i>Eremophila canaliculata</i>																																									X					X		
<i>Eremophila cryptothrix</i>					X										X	X		X	X	X			X	X			X	X			X	X	X			X	X	X	X	X	X	X		X			X	
<i>Eremophila cuneifolia</i>				X		X		X				X			X	X		X	X	X			X	X			X			X	X	X				X	X	X	X	X	X	X	X					
<i>Eremophila exilifolia</i>	X			X								X																										X	X							X		
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>				X		X		X																																	X							
<i>Eremophila fraseri</i>																																															X	
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>				X	X		X		X	X	X						X				X						X	X	X								X	X					X					
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>				X		X	X		X	X		X		X	X		X		X		X		X	X			X			X	X	X					X		X						X			
<i>Eremophila latrobei</i>								X	X	X																					X	X			X	X				X	X							
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>	X																																															
<i>Eremophila latrobei</i> subsp. <i>glabra</i>																											X								X								X					
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		X			X	X																	X												X											X		
<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>																																																X
<i>Eremophila petrophila</i> subsp. <i>petrophila</i>																											X																					
<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>	X			X		X	X	X	X	X		X		X	X	X	X	X	X		X									X	X	X	X		X					X	X				X	X		
<i>Eremophila phyllopoda</i> x <i>exilifolia</i>																																																
<i>Eremophila platycalyx</i> subsp. <i>pardalota</i>																																											X					
<i>Eremophila reticulata</i>																X											X				X	X						X	X									
<i>Eremophila</i> sp.					X																																											
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) (P1)																																																X
<i>Eriachne mucronata</i>	X	X		X	X	X		X			X		X		X			X						X			X	X				X	X			X		X	X		X	X	X					
<i>Eriachne pulchella</i>			X	X		X	X			X	X	X		X			X		X	X	X	X	X	X			X		X	X	X			X		X	X	X		X			X					
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	X	X							X	X		X		X			X		X				X							X		X	X		X						X				X			
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	X	X																															X					X								X		
<i>Eucalyptus camaldulensis</i>													X													X																						
<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>													X												X																							
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>		X		X	X	X					X			X																									X				X					
<i>Eucalyptus</i> sp.	X																																															
<i>Eucalyptus victrix</i>													X													X																						
<i>Eucalyptus xerothermica</i>																																																
<i>Eucalytpus</i> sp.	X																																															
<i>Euphorbia</i> aff. <i>australis</i> var. 3																																																
<i>Euphorbia australis</i> var. <i>hispidula</i>					X																																											
<i>Euphorbia australis</i> var. <i>subtomentosa</i>																																																
<i>Euphorbia biconvexa</i>								X					X		X							X					X									X								X				
<i>Euphorbia biconvexa?</i>											X	X																																				

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GPR19	GPR25	GPR44	OPPS		
<i>Euphorbia boophthona</i>					X	X																				X																						
<i>Euphorbia careyi</i>					X	X										X			X							X																						
<i>Euphorbia coghlanii/trigonosperma</i>																																																
* <i>Euphorbia hirta</i>																																															X	
<i>Euphorbia</i> sp.																											X																					
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>																																																
<i>Euphoria boophthona</i> ?																																X																
<i>Evolvulus alsinoides</i> var. <i>decumbens</i>																																	X														X	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>								X			X						X				X	X										X												X				
<i>Ficus brachypoda</i>																																													X			
* <i>Flaveria trinervia</i>															X																X																	
<i>Frankenia</i> aff. <i>hispidula</i>																								X																								
<i>Frankenia</i> aff. <i>magnifica</i>																				X																											X	
<i>Frankenia magnifica</i>																																																
<i>Frankenia setosa</i>																																																
<i>Glycine canescens</i>	X	X	X					X			X							X								X																	X					
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	X	X					X			X									X		X			X																								
<i>Gomphrena canescens</i> subsp. <i>canescens</i>									X								X			X										X			X		X											X		
<i>Gomphrena cunninghamii</i>					X	X		X	X		X	X	X			X		X				X				X	X	X				X											X	X	X			
<i>Gomphrena kanisii</i>																																																
<i>Goodenia forrestii</i>																															X					X												
<i>Goodenia microptera</i>				X			X	X	X	X							X	X			X		X									X		X											X			
<i>Goodenia</i> sp.				X																																												
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) (P3)																																															X	
<i>Goodenia stobbsiana</i>						X			X																																	X						
<i>Goodenia tenuiloba</i>																																																
<i>Gossypium robinsonii</i>																																												X				
<i>Grevillea berryana</i>	X	X		X	X	X	X	X	X	X	X						X			X	X		X	X				X				X					X											
<i>Grevillea saxicola</i> (P3)																				X	X		X	X											X											X		
<i>Hakea chordophylla</i>																																																
<i>Hakea lorea</i> subsp. <i>lorea</i>																																																
<i>Heliotropium ammophilum</i>																																																
<i>Heliotropium chrysocarpum</i>																																																
<i>Heliotropium conocarpum</i>																											X																					
<i>Heliotropium heteranthum</i>							X		X	X											X									X					X													
<i>Heliotropium inexplicitum</i>																																X																
<i>Heliotropium pachyphyllum</i>																																																
<i>Hibiscus</i> aff. <i>sturtii</i>																																																
<i>Hibiscus burtonii</i>		X																			X																										X	
<i>Hibiscus campanulatus</i> (P1)					X			X							X			X										X					X										X	X			X	
<i>Hibiscus coatesii</i>		X	X																																													
<i>Hibiscus goldsworthii</i>																											X																					
<i>Hibiscus haynaldii</i>																																																
<i>Hibiscus</i> sp. Gardneri (A.L. Payne PRP 1435)																								X																								
<i>Hibiscus sturtii</i>							X												X					X	X																						X	
<i>Hibiscus sturtii</i> var. aff. <i>grandiflorus</i>																																																
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>										X													X							X			X														X	
<i>Hibiscus sturtii</i> var. <i>grandiflorus</i>																								X																								
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>																								X																								
<i>Hybanthus aurantiacus</i>			X					X		X	X				X			X										X						X	X	X				X	X							
<i>Indigofera cuspidata</i>																																X																
<i>Indigofera monophylla</i>			X		X	X		X			X	X			X	X		X						X			X				X												X					

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GPR19	GPR25	GPR44	OPPS
<i>Ipomoea muelleri</i>																						X																								
<i>Ipomoea plebeia</i>																																														
<i>Iseilema dolichotrichum</i>																																														
<i>Iseilema eremaeum</i>																																														
<i>Iseilema membranaceum</i>																																														
<i>Isotropis forrestii</i>								X																			X																			
<i>Jasminum didymum</i> subsp. <i>lineare</i>	X		X		X	X		X			X		X		X		X	X							X			X	X			X										X		X		
<i>Lawrenzia densiflora</i>																							X								X													X		
<i>Lawrenzia glomerata</i>																																														
<i>Lepidium muelleri-ferdinandii</i>																																														
<i>Lepidium oxytrichum</i>																																														
<i>Lepidium pedicellosum</i>															X						X		X								X										X		X			
<i>Lepidium pholidogynum</i>																																										X				
<i>Lepidium platypetalum</i>																								X																						
<i>Lobelia heterophylla</i>																																												X		
<i>Maireana carnosa</i>																								X																						
<i>Maireana eriosphaera</i>																				X														X			X									
<i>Maireana georgei</i>		X	X	X											X					X				X							X	X		X	X				X	X						
<i>Maireana melanocoma</i>												X							X	X	X		X	X						X	X		X												X	
<i>Maireana planifolia</i>																																	X													
<i>Maireana</i> sp.																	X																											X		
<i>Maireana suaedifolia</i>																								X																						
<i>Maireana thesioides</i>																												X							X	X		X								
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>		X	X						X			X							X				X	X							X			X	X							X				
<i>Maireana villosa</i>																																														
<i>*Malvastrum americanum</i>			X					X										X																												
<i>Marsdenia australis</i>	X	X						X		X					X			X																												
<i>Melaleuca bracteata</i>																																														
<i>Melaleuca glomerata</i>													X													X																				
<i>Melaleuca linophylla</i>													X													X																				
<i>Melhania oblongifolia</i>			X																																											
<i>Nicotiana benthamiana</i>																																												X		
<i>Nicotiana umbratica</i> (P3)																																												X		
<i>Notoleptopus decaisnei</i>					X						X		X					X																								X				
<i>Notoleptopus decaisnei</i> var. <i>decaisnei</i>			X		X						X		X			X		X																		X					X					
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i>																																														
<i>Oldenlandia crouchiana</i>					X	X																					X				X	X														
<i>Operculina aequisejala</i>																										X																				
<i>Paraneurachne muelleri</i>																								X																		X				
<i>Paspalidium basicladum</i>																																														
<i>Paspalidium clementii</i>	X	X			X		X	X	X	X		X			X				X	X				X	X		X	X	X		X	X					X	X					X	X		
<i>Paspalidium constrictum</i>																																														
<i>Paspalidium rarum</i>											X										X																									
<i>*Passiflora foetida</i> var																																														

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GP49	GP55	GP64	OPPS	
<i>Polygala glaucifolia</i>														X																																	
<i>Portulaca intraterranea</i>																																															
<i>Portulaca oleracea</i>		X	X				X	X	X	X		X					X	X	X	X	X		X	X					X	X	X			X	X	X	X			X	X				X		
<i>Prostanthera albiflora</i>																																															
<i>Pseudognaphalium luteoalbum</i>																																															
<i>Psyrax latifolia</i>					X	X	X	X		X							X										X				X				X	X									X		
<i>Psyrax suaveolens</i>	X	X								X							X				X													X											X		
<i>Pterocaulon serrulatum</i>																																															
<i>Pterocaulon</i> sp.																																															
<i>Pterocaulon sphacelatum</i>				X				X	X						X			X			X	X	X	X			X				X												X				
<i>Pterocaulon sphaeranthoides</i>																																															
<i>Ptilotus aervoides</i>																																															
<i>Ptilotus auriculifolius</i>																																															
<i>Ptilotus calostachyus</i>	X	X		X		X	X	X	X		X	X		X	X		X		X	X	X		X						X	X				X	X		X			X	X						
<i>Ptilotus clementii</i>					X							X											X				X				X																
<i>Ptilotus helipteroides</i>									X	X																							X														
<i>Ptilotus macrocephalus</i>																																															
<i>Ptilotus exaltatus</i>							X		X	X		X				X	X	X	X	X	X			X		X		X		X				X				X									
<i>Ptilotus obovatus</i>	X	X	X		X	X		X	X		X		X		X		X	X	X	X			X	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X		X	X		
<i>Ptilotus obovatus</i> var. <i>obovatus</i>																																															
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>	X	X		X		X	X		X			X		X			X		X	X	X		X	X					X	X	X	X		X	X		X		X	X	X					X	
<i>Rhagodia eremaea</i>			X		X			X	X		X		X		X				X					X													X	X							X		
<i>Rhynchosia australis</i>																																															
<i>Rhynchosia minima</i>			X		X								X					X								X		X								X	X						X				
* <i>Ruellia simplex</i>																																															X
* <i>Ruellia</i> sp. (aff. <i>simplex</i>)																																															
* <i>Rumex vesicarius</i>					X						X											X						X															X	X			X
<i>Salsola australis</i>																				X							X																	X			
<i>Santalum lanceolatum</i>										X	X				X		X																													X	
<i>Santalum spicatum</i>			X																																												
<i>Scaevola acacioides</i>	X			X	X	X								X	X					X	X		X	X																					X		
<i>Scaevola spinescens</i>															X					X			X	X							X					X							X				
<i>Sclerolaena</i> sp.																								X																							
<i>Schenkia clementii</i>																																															
<i>Schoenoplectus subulatus</i>																																															
<i>Sclerolaena costata</i>																																															
<i>Sclerolaena cuneata</i>																																															
<i>Sclerolaena densiflora</i>																								X									X														
<i>Sclerolaena eriacantha</i>															X				X	X			X	X						X						X											

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GPR19	GPR25	GPR44	OPPS
<i>Sida</i> ?sp. L (A.M. Ashby 4202)																															X															
<i>Sida brownii</i>																																														
<i>Sida echinocarpa</i>			X									X							X		X		X	X						X																
<i>Sida fibulifera</i>	X	X						X										X					X								X									X	X					
<i>Sida</i> sp.																																	X													
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P3)					X																						X																		X	
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	X	X					X		X	X													X	X										X										X		
<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)	X	X																																												
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)																																														X
<i>Sida</i> sp. Shovelanna Hill (S. van Leeuwen 3842)																																										X			X	
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)										X																	X				X			X		X			X							
<i>Sida</i> sp. L (A.M. Ashby 4202)								X										X																												
<i>*Sisymbrium orientale</i>																																														
<i>Solanum cleistogamum</i>		X		X	X	X					X	X					X				X						X		X	X			X				X			X			X	X		
<i>Solanum ferocissimum</i>																																														
<i>Solanum horridum</i>	X		X					X		X			X					X	X				X	X							X	X				X	X		X		X					
<i>Solanum lasiophyllum</i>	X	X		X	X	X	X	X	X	X	X	X		X		X	X	X	X		X		X	X			X	X	X	X	X	X		X	X	X			X	X	X	X			X	
<i>*Solanum nigrum</i>																																														
<i>Solanum phlomoides</i>						X																										X														
<i>Solanum piceum</i>			X												X													X					X						X						X	
<i>Solanum</i> sp. (indet)																											X																			X
<i>Solanum sturtianum</i>																																														X
<i>*Sonchus oleraceus</i>																										X																				
<i>Sporobolus australasicus</i>			X					X		X	X	X			X			X	X	X			X				X		X		X					X			X	X	X		X			
<i>Stemodia grossa</i>					X								X		X											X																				
<i>Streptoglossa bubakii</i>																																				X										
<i>Streptoglossa decurrens</i>																																														
<i>Streptoglossa</i> sp.																																														
<i>Stylobasium spathulatum</i>													X													X																				
<i>Surreya diandra</i>																																														
<i>Swainsona complanata</i>																																														X
<i>Swainsona decurrens</i>																																														
<i>Swainsona maccullochiana</i>												X															X															X				
<i>Swainsona stenodonta</i>																																														
<i>Tecticornia disarticulata</i>																				X				X												X				X						
<i>Tephrosia rosea</i> var. <i>clementii</i>																								X																						
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)			X								X		X		X			X																									X			
<i>Tephrosia</i> sp.					X																																									
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)			X					X					X									X															X									
<i>Tephrosia</i> sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)												X																																		
<i>Tephrosia supina</i>																																														
<i>Themeda triandra</i>																											X																			
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	X				X	X						X						X										X			X	X						X			X					
<i>Trachymene pilbarensis</i>																																														
<i>Tragus australianus</i>																																														
<i>Trianthema glossostigium</i>				X							X						X		X	X	X			X						X																

Species	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP17	GP18	GP20	GP21	GP22	GP23	GP24	GP26	GP27	GP28	GP29	GP30	GP31	GP32	GP33	GP34	GP35	GP36	GP37	GP38	GP39	GP40	GP41	GP42	GP43	GP45	GPR19	GPR25	GPR44	OPPS	
<i>Trianthema triquetrum</i>															X					X																											
<i>Tribulus hirsutus</i>																																															
<i>Tribulus suberosus</i>	X	X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X		X	X			X	X		X	X	X	X		X	X	X	X		X	X	X	X	X		X	
* <i>Tribulus terrestris</i>																																															
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>			X		X					X					X	X		X														X										X					
<i>Trigastrotheca molluginea</i>							X	X	X								X	X	X	X	X		X	X					X	X	X	X															X
<i>Triodia angusta</i>																							X								X																
<i>Triodia epactia</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X							X		X		X	X		X		X	X	X	X	X	X	X	X	X		
<i>Triodia wiseana</i>																				X							X		X														X				
<i>Tripogonella loliiformis</i>																											X					X															
<i>Triumfetta clementii</i>																		X									X																				
<i>Typha domingensis</i>																																															
* <i>Vachellia farnesiana</i>																																															
<i>Vigna lanceolata</i> var. <i>lanceolata</i>																																															
<i>Waltheria indica</i>											X							X																													
* <i>Washingtonia filifera</i>																																															X

? denotes unconfirmed ID

* denoted introduced flora (weed) species

Table L.4: Species by site matrix for vascular flora species for all ecologia 2011 sites ('e' prefix) and Astron rescores of ecologia 2011 sites ('e' prefix, -AR suffix); all Biota 2012b sites (WRA prefix) and Astron rescores of Biota 2012b sites (WRA prefix, -AR suffix) and Biota 2012a sites (WRF prefix) and Biota 2012a rescores (WRR prefix).

[illegible]

[illegible]

Species	e006	e006.AR	e029	e029.AR	e030	e030.AR	e038	e038.AR	e043	e043.AR	e073	e073.AR	e074	e074.AR	e122	e122.AR	WRA01	WRA01.AR	WRA21	WRA21.AR	WRA23	WRA23.AR	WRA39	WRA39.AR	WRA44	WRA44.AR	WRF.01	WRR.01	WRF.02	WRR.02	WRF.03	WRR.03	WRF.32	WRR.32	WRF.34	WRR.34	WRF.36	WRR.36	WRF.38	WRR.38	WRF.41	WRR.41	WRF.43	WRR.43	WRF.44	WRR.44	WRF.45	WRR.45	
<i>Dicladanthera forrestii</i>																								X										X															
<i>Digitaria brownii</i>																																																	
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	X	X																		X	X	X			X	X		X							X														
<i>Dodonaea pachyneura</i>																																																	
<i>Dodonaea petiolaris</i>																																															X	X	
<i>Dodonaea viscosa</i>																																																	
<i>Duperreya commixta</i>						X		X	X						X							X			X	X		X	X						X								X	X			X		
<i>Dysphania plantaginella</i>																																																	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>																																																	
<i>Dysphania</i> sp.																																																	
<i>*Echinochloa colona</i>																		X																													X		
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	X	X									X										X	X	X	X	X	X	X							X	X														
<i>Enneapogon caerulescens</i>			X	X	X	X			X	X	X	X			X	X			X		X	X	X	X	X	X			X		X	X	X	X								X		X					
<i>Enneapogon lindleyanus</i>																					X											X	X																
<i>Enneapogon polyphyllus</i>																																X	X	X	X	X	X											X	
<i>Eragrostis cumingii</i>																												X																					
<i>Eragrostis tenellula</i>								X					X																X																	X	X		
<i>Eremophila canaliculata</i>											X																										X	X											
<i>Eremophila cryptothrix</i>						X																															X	X							X	X			
<i>Eremophila cuneifolia</i>		X	X	X	X	X				X	X	X			X	X				X	X	X	X	X					X	X	X	X	X	X	X	X							X	X	X		X	X	
<i>Eremophila exilifolia</i>																																	X	X															
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>				X								X				X				X	X			X							X	X																	
<i>Eremophila fraseri</i>																																																	
<i>Eremophila fraseri</i> subsp. <i>fraseri</i>				X	X	X			X	X																											X	X						X					
<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>			X												X																																		

[illegible]

Species	e006	e006.AR	e029	e029.AR	e030	e030.AR	e038	e038.AR	e043	e043.AR	e073	e073.AR	e074	e074.AR	e122	e122.AR	WRA01	WRA01.AR	WRA21	WRA21.AR	WRA23	WRA23.AR	WRA39	WRA39.AR	WRA44	WRA44.AR	WRF.01	WRR.01	WRF.02	WRR.02	WRF.03	WRR.03	WRF.32	WRR.32	WRF.34	WRR.34	WRF.36	WRR.36	WRF.38	WRR.38	WRF.41	WRR.41	WRF.43	WRR.43	WRF.44	WRR.44	WRF.45	WRR.45							
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>																																																							
<i>Hybanthus aurantiacus</i>																					X				X	X			X	X				X	X	X																			
<i>Indigofera cuspidata</i>																																																							
<i>Indigofera monophylla</i>					X	X			X	X	X				X	X			X	X	X	X			X										X																				
<i>Ipomoea muelleri</i>													X	X				X	X																																				
<i>Ipomoea plebeia</i>																												X																		X									
<i>Iseilema dolichotrichum</i>																														X			X	X									X												
<i>Iseilema eremaeum</i>															X																																								
<i>Iseilema membranaceum</i>																																																							
<i>Isotropis forrestii</i>																																																							
<i>Jasminum didymum</i> subsp. <i>lineare</i>																	X	X	X	X					X	X	X	X	X	X						X	X					X	X			X	X								
<i>Lawrenzia densiflora</i>																																																							
<i>Lawrenzia glomerata</i>												X																																											
<i>Lepidium muelleri-ferdinandii</i>		X											X	X			X	X																																					
<i>Lepidium oxytrichum</i>														X																																									
<i>Lepidium pedicellosum</i>	X	X					X				X	X									X	X																								X	X								
<i>Lepidium pholidogynum</i>																													X																		X	X							
<i>Lepidium platypetalum</i>	X	X									X	X									X	X																																	
<i>Lobelia heterophylla</i>																																																							
<i>Maireana carnosia</i>																																																							
<i>Maireana eriosphaera</i>												X																																											
<i>Maireana georgei</i>												X					X					X		X		X				X						X	X					X	X			X	X								
<i>Maireana melanocoma</i>											X				X	X							X	X					X																	X					X				
<i>Maireana planifolia</i>																																																							
<i>Maireana</i> sp.																																																							
<i>Maireana suaedifolia</i>																																																							
<i>Maireana thesioides</i>												X																																											
<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>																					X	X	X	X																															
<i>Maireana villosa</i>	X	X	X																																	X				X	X														
<i>*Malvastrum americanum</i>							X	X						X						X									X																	X	X								
<i>Marsdenia australis</i>																						X																																	
<i>Melaleuca bracteata</i>							X	X																				X																											
<i>Melaleuca glomerata</i>								X																																															

Species	e006	e006.AR	e029	e029.AR	e030	e030.AR	e038	e038.AR	e043	e043.AR	e073	e073.AR	e074	e074.AR	e122	e122.AR	WRA01	WRA01.AR	WRA21	WRA21.AR	WRA23	WRA23.AR	WRA39	WRA39.AR	WRA44	WRA44.AR	WRF.01	WRR.01	WRF.02	WRR.02	WRF.03	WRR.03	WRF.32	WRR.32	WRF.34	WRR.34	WRF.36	WRR.36	WRF.38	WRR.38	WRF.41	WRR.41	WRF.43	WRR.43	WRF.44	WRR.44	WRF.45	WRR.45				
<i>Plumbago zeylanica</i>																												X																								
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>																																																				
<i>Polycarpaea longiflora</i>					X				X	X							X						X		X	X					X	X					X	X	X	X	X	X	X		X	X						
<i>Polygala glaucifolia</i>																							X													X																
<i>Portulaca intraterranea</i>																							X																													
<i>Portulaca oleracea</i>																																		X	X									X				X				
<i>Prostanthera albiflora</i>																																																				
<i>Pseudognaphalium luteoalbum</i>								X									X	X																											X							
<i>Psyrax latifolia</i>																																																				
<i>Psyrax suaveolens</i>																																							X	X						X	X					
<i>Pterocaulon serrulatum</i>							X						X																																							
<i>Pterocaulon</i> sp.														X																																						
<i>Pterocaulon sphacelatum</i>		X		X																								X																								
<i>Pterocaulon sphaeranthoides</i>																					X	X																						X		X						
<i>Ptilotus aervoides</i>																							X	X					X	X																						
<i>Ptilotus auriculifolius</i>									X						X						X			X					X	X														X								
<i>Ptilotus calostachyus</i>									X																				X																							
<i>Ptilotus clementii</i>			X																														X											X		X						
<i>Ptilotus helipteroides</i>			X	X																															X																	
<i>Ptilotus macrocephalus</i>																																																				
<i>Ptilotus exaltatus</i>				X							X	X			X	X	X				X		X	X					X	X	X	X		X		X	X							X					X			
<i>Ptilotus obovatus</i>			X	X	X	X			X	X	X			X	X	X			X		X	X	X	X	X	X			X	X					X	X			X	X												
<i>Ptilotus obovatus</i> var. <i>obovatus</i>																																																				
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>																													X	X							X	X	X	X		X	X	X			X	X				
<i>Rhagodia eremaea</i>		X																				X																														
<i>Rhynchosia australis</i>																		X																																		
<i>Rhynchosia minima</i>					X	X		X						X	X			X									X						X	X											X							
<i>*Ruellia simplex</i>																																																				
<i>*Ruellia</i> sp. (aff. <i>simplex</i>)														X																																						
<i>*Rumex vesicarius</i>																	X	X		X																												X				
<i>Salsola australis</i>				X					X		X	X			X	X															X														X							
<i>Santalum lanceolatum</i>					X																																															
<i>Santalum spicatum</i>																																																				
<i>Scaevola acacioides</i>						X																																														

Species	e006	e006.AR	e029	e029.AR	e030	e030.AR	e038	e038.AR	e043	e043.AR	e073	e073.AR	e074	e074.AR	e122	e122.AR	WRA01	WRA01.AR	WRA21	WRA21.AR	WRA23	WRA23.AR	WRA39	WRA39.AR	WRA44	WRA44.AR	WRF.01	WRR.01	WRF.02	WRR.02	WRF.03	WRR.03	WRF.32	WRR.32	WRF.34	WRR.34	WRF.36	WRR.36	WRF.38	WRR.38	WRF.41	WRR.41	WRF.43	WRR.43	WRF.44	WRR.44	WRF.45	WRR.45	
<i>Sesbania cannabina</i>							X							X				X	X		X							X															X	X					
<i>Sesbania formosa</i>													X				X	X																															
* <i>Setaria verticillata</i>																																																	
<i>Sida</i> ?sp. L (A.M. Ashby 4202)																																																	
<i>Sida brownii</i>			X																																														
<i>Sida echinocarpa</i>						X																X																											
<i>Sida fibulifera</i>										X						X																																	
<i>Sida</i> sp.										X						X																																	
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P3)																																																	
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)																												X																					
<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)																																																	
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)																																																	
<i>Sida</i> sp. Shovelanna Hill (S. van Leeuwen 3842)																																																	
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)				X											X						X	X			X	X			X		X	X												X					
<i>Sida</i> sp. L (A.M. Ashby 4202)																																																	
* <i>Sisymbrium orientale</i>													X				X																																
<i>Solanum cleistogamum</i>				X		X								X																																			
<i>Solanum ferocissimum</i>									X																																								
<i>Solanum horridum</i>										X												X		X					X		X	X			X							X							
<i>Solanum lasiophyllum</i>			X	X		X								X									X	X		X																	X						
* <i>Solanum nigrum</i>								X					X																																				
<i>Solanum phlomoides</i>															X																																		
<i>Solanum piceum</i>																																																	
<i>Solanum</i> sp. (indet)																																																	
<i>Solanum sturtianum</i>																							X		X	X																							
* <i>Sonchus oleraceus</i>							X	X	X					X			X	X							X	X																			X				
<i>Sporobolus australasicus</i>		X		X	X	X				X	X	X			X	X					X	X	X	X	X	X	X		X	X	X	X										X		X				X	
<i>Stemodia grossa</i>							X	X					X				X	X										X	X																				
<i>Streptoglossa bubakii</i>																																																	
<i>Streptoglossa decurrens</i>																																																	
<i>Streptoglossa</i> sp.																																																	
<i>Stylobasium spathulatum</i>																	X	X																															
<i>Surreya diandra</i>	X																																																
<i>Swainsona complanata</i>																																																	
<i>Swainsona decurrens</i>																												X																					
<i>Swainsona maccullochiana</i>																																																	
<i>Swainsona stenodonta</i>			X												X																																		
<i>Tecticornia disarticulata</i>																																																	
<i>Tephrosia rosea</i> var. <i>clementii</i>													X																																				
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)														X			X	X	X	X								X			X	X			X														
<i>Tephrosia</i> sp.																																																	

Species	e006	e006.AR	e029	e029.AR	e030	e030.AR	e038	e038.AR	e043	e043.AR	e073	e073.AR	e074	e074.AR	e122	e122.AR	WRA01	WRA01.AR	WRA21	WRA21.AR	WRA23	WRA23.AR	WRA39	WRA39.AR	WRA44	WRA44.AR	WRF.01	WRR.01	WRF.02	WRR.02	WRF.03	WRR.03	WRF.32	WRR.32	WRF.34	WRR.34	WRF.36	WRR.36	WRF.38	WRR.38	WRF.41	WRR.41	WRF.43	WRR.43	WRF.44	WRR.44	WRF.45	WRR.45								
<i>Tragus australianus</i>																							X																																	
<i>Trianthema glossostigmum</i>																				X		X	X						X	X			X	X																						
<i>Trianthema oxycalyptum</i> var. <i>oxycalyptum</i>	X	X																																																						
<i>Trianthema triquetrum</i>											X																																													
<i>Tribulus hirsutus</i>			X												X																																									
<i>Tribulus suberosus</i>				X	X	X					X				X	X					X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
* <i>Tribulus terrestris</i>			X																																																					
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>				X		X											X	X	X													X														X	X						X			
<i>Trigastrotheca molluginea</i>																																																								
<i>Triodia angusta</i>																																																								
<i>Triodia epactia</i>			X	X	X	X			X						X	X					X	X			X	X				X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
<i>Triodia wiseana</i>																																																								
<i>Tripogonella loliiformis</i>																																																								
<i>Triumfetta clementii</i>				X																										X		X	X													X	X						X			
<i>Typha domingensis</i>													X	X				X										X	X																											
* <i>Vachellia farnesiana</i>								X						X																																										
<i>Vigna lanceolata</i> var. <i>lanceolata</i>														X																																										
<i>Waltheria indica</i>														X																																										
* <i>Washinatonia filifera</i>																																																								

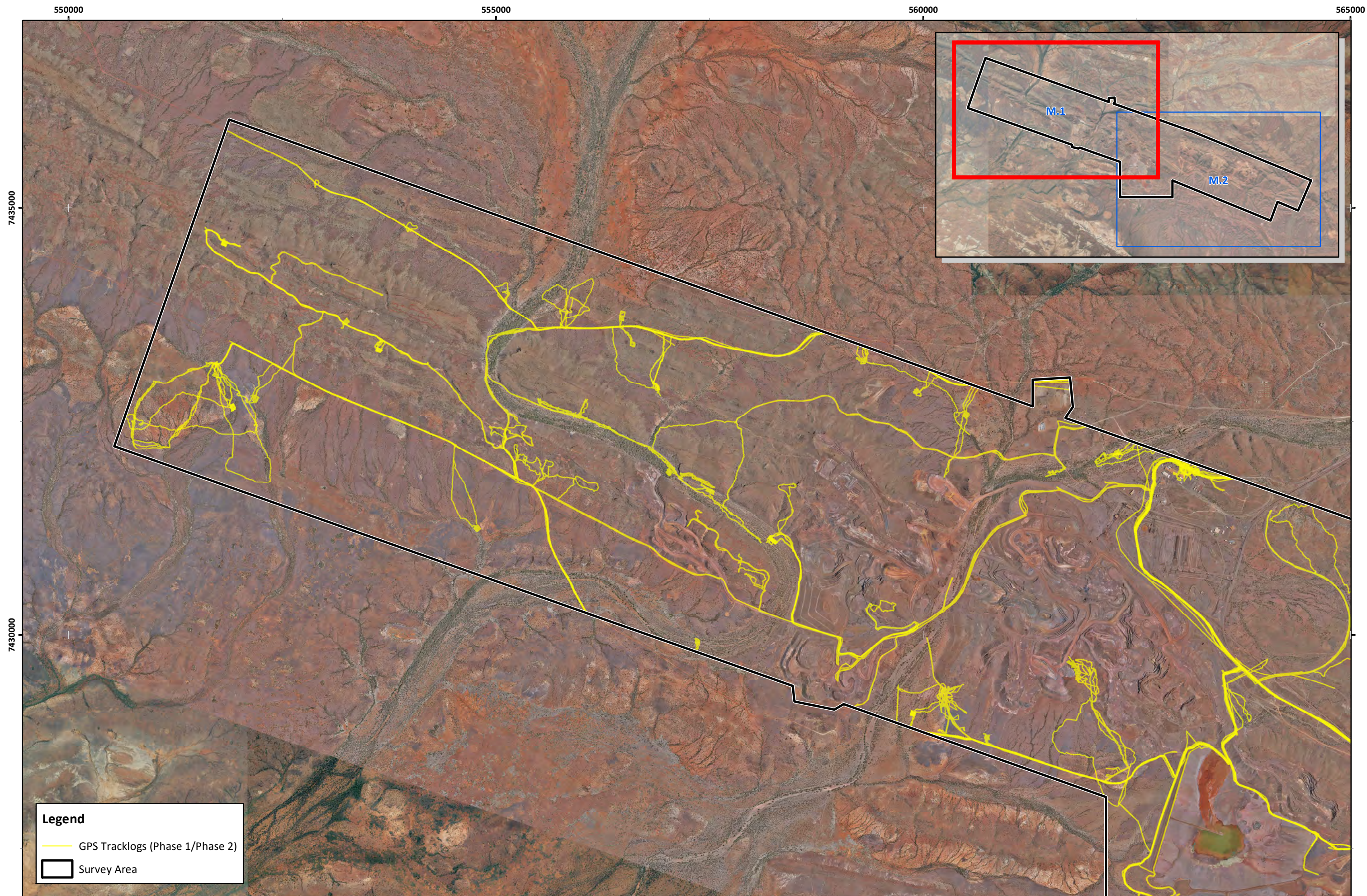
? denotes unconfirmed ID

* denoted introduced flora (weed) species

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Appendix M: Track Log Mapping

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Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure M.1: GPS tracklog mapping

Author: B. Eckermann

Drawn: C. Dyde

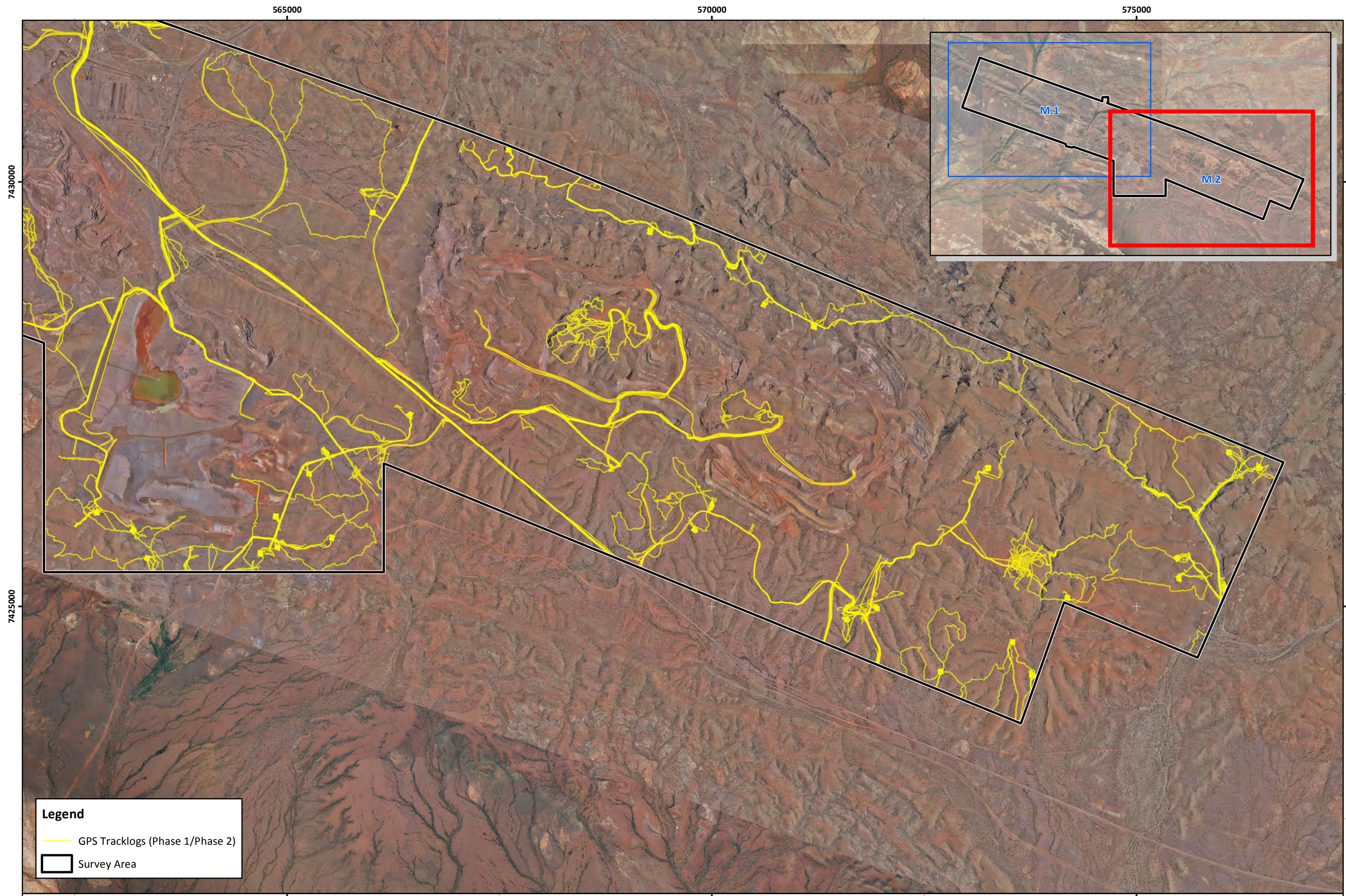
Date: 13-12-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



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Figure Ref: 14284-18-BIDR-3RevB_181213_FigM1_Tracklog



Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure M.2: GPS tracklog mapping

Author: B. Eckermann

Drawn: C. Dyde

Date: 13-12-2018

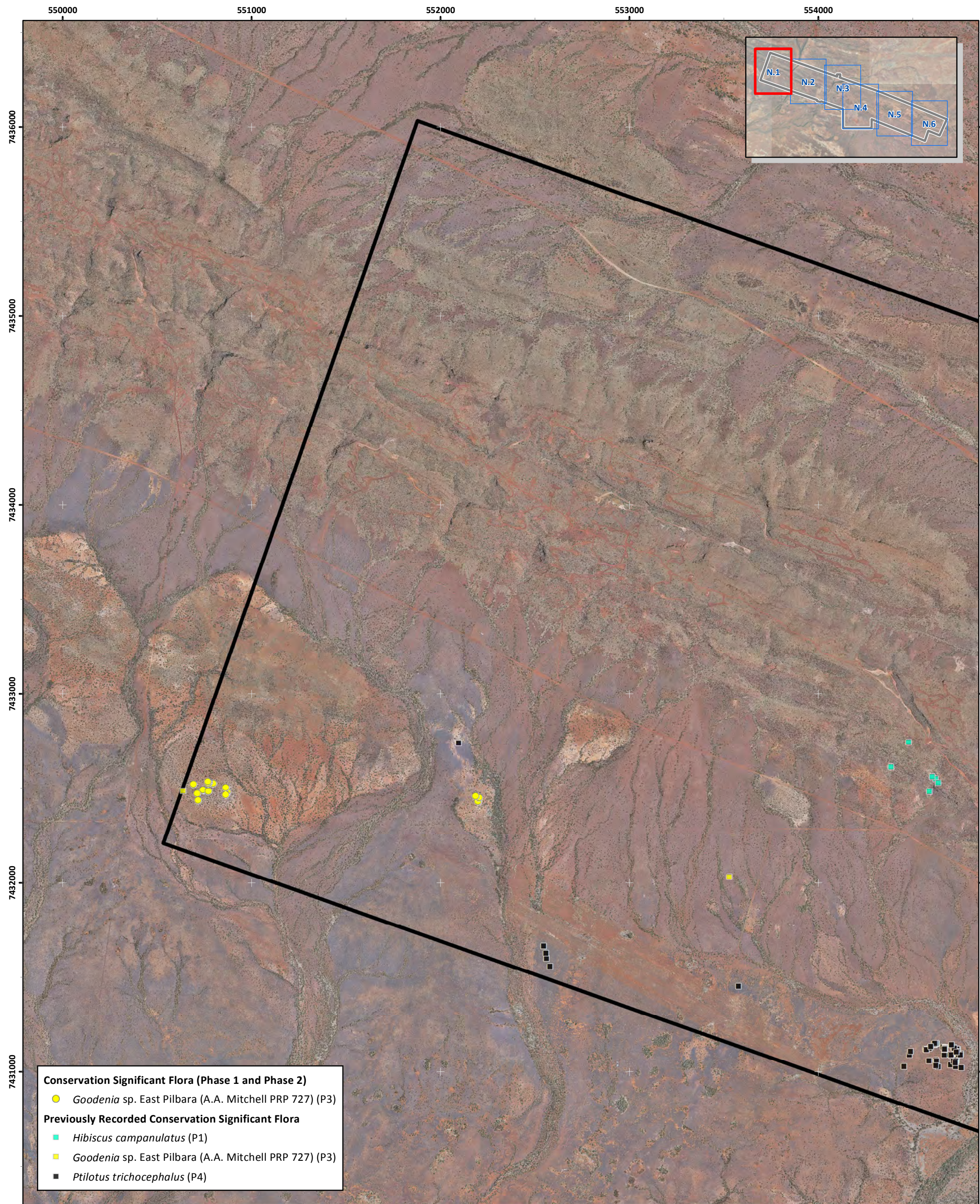
Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



Figure Ref: 14284-18-BIDR-3RevB_181213_FigM2_Tracklog

Appendix N: Conservation Significant Flora Locations and Descriptions

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- Conservation Significant Flora (Phase 1 and Phase 2)**
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3)
- Previously Recorded Conservation Significant Flora**
- *Hibiscus campanulatus* (P1)
 - *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3)
 - *Ptilotus trichocephalus* (P4)

Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure N.1: Conservation significant flora locations

Author: B. Eckermann

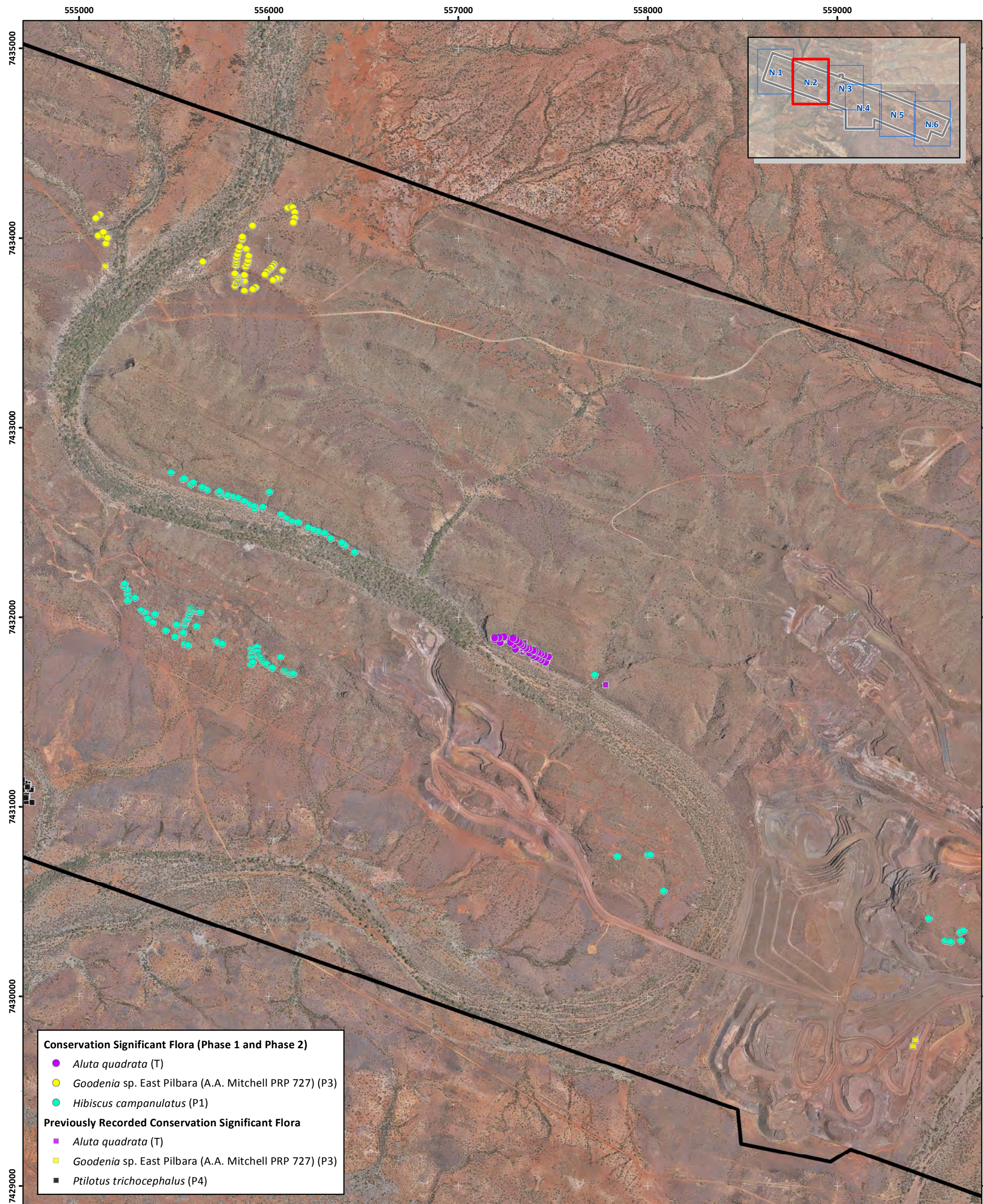
Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-3RevB_181213_PriFlora_FigN

Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres



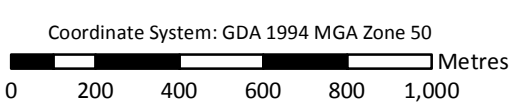


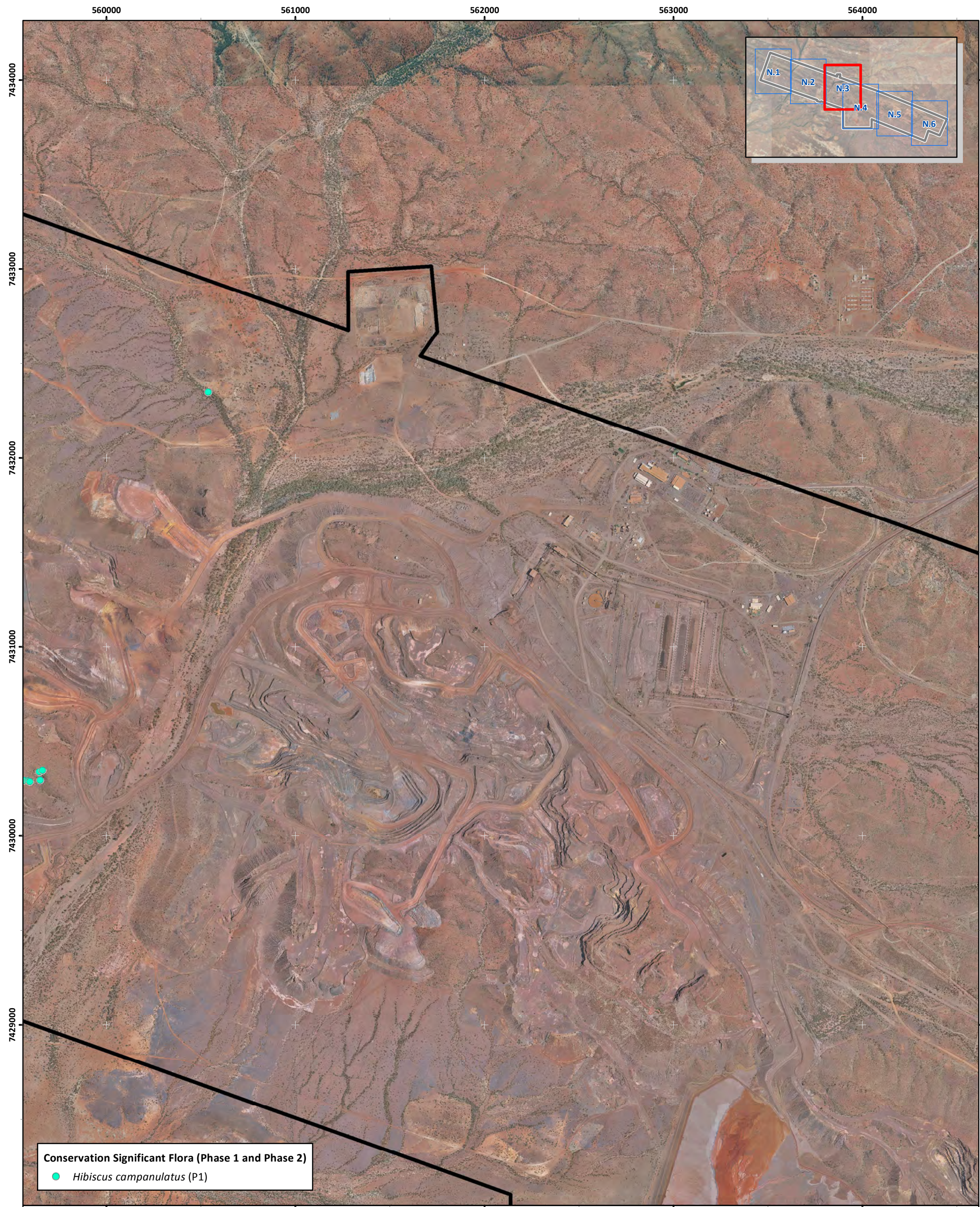
Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure N.2: Conservation significant flora locations



Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-3RevB_181213_PriFlora_FigN





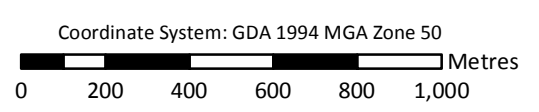
Conservation Significant Flora (Phase 1 and Phase 2)

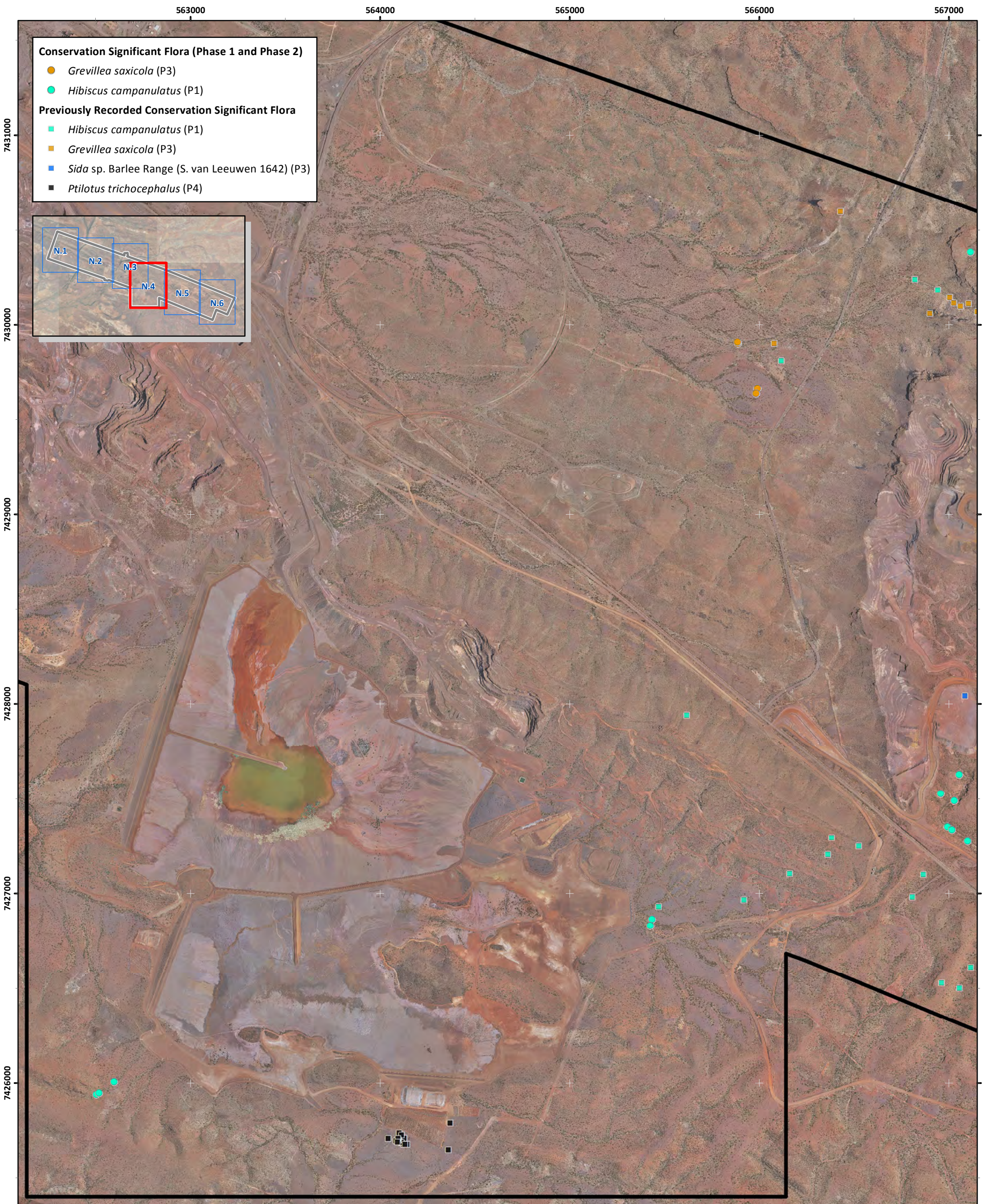
● *Hibiscus campanulatus* (P1)

Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure N.3: Conservation significant flora locations

Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-3RevB_181213_PriFlora_FigN





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure N.4: Conservation significant flora locations

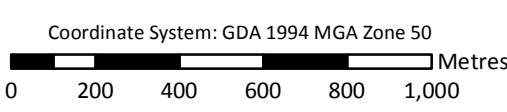


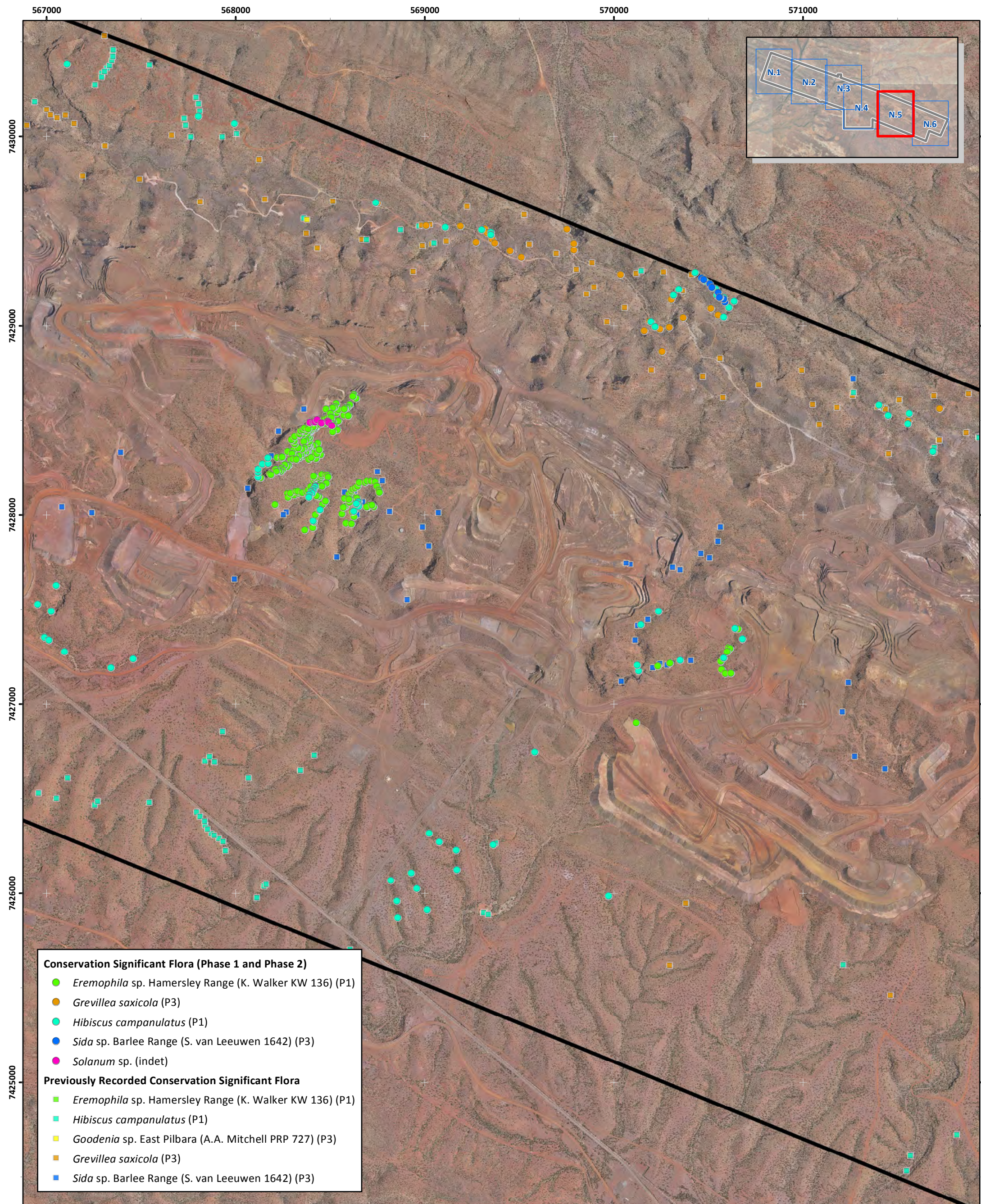
Author: B. Eckermann

Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-3RevB_181213_PriFlora_FigN





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure N.5: Conservation significant flora locations

Author: B. Eckermann

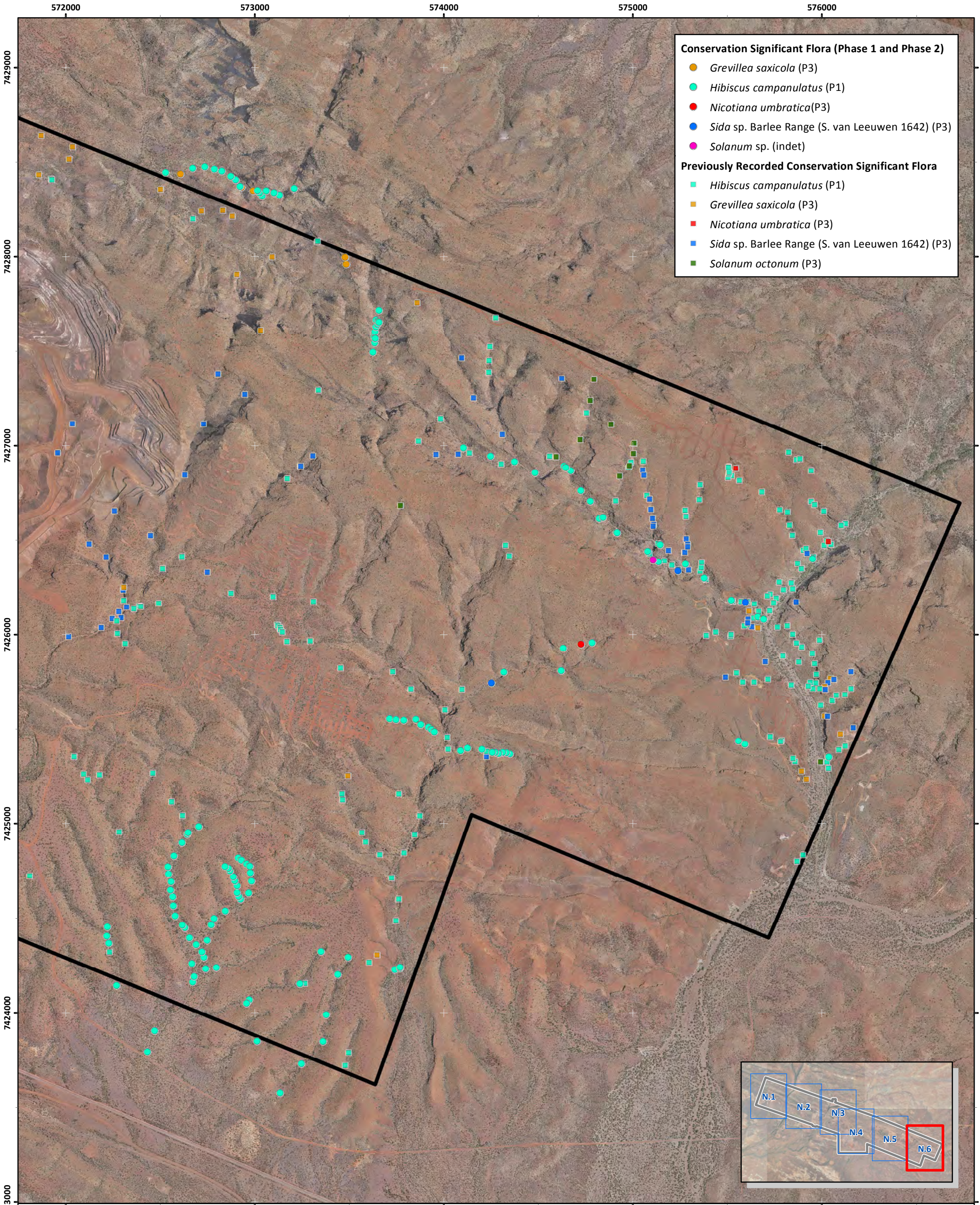
Date: 13-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-3RevB_181213_PriFlora_FigN

Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres





- Conservation Significant Flora (Phase 1 and Phase 2)**
- *Grevillea saxicola* (P3)
 - *Hibiscus campanulatus* (P1)
 - *Nicotiana umbratica*(P3)
 - *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3)
 - *Solanum* sp. (indet)
- Previously Recorded Conservation Significant Flora**
- *Hibiscus campanulatus* (P1)
 - *Grevillea saxicola* (P3)
 - *Nicotiana umbratica* (P3)
 - *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3)
 - *Solanum octonum* (P3)

Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure N.6: Conservation significant flora locations






Author: B. Eckermann	Date: 13-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-3RevB_181213_PriFlora_FigN




Coordinate System: GDA 1994 MGA Zone 50



0 200 400 600 800 1,000 Metres

N

Table N.1: Conservation significant flora recorded in the survey area.

Species	Description ¹	Habitat ¹
<p><i>Aluta quadrata</i> T</p> 	<p>Perennial shrub, 0.8 m to 2.6 m high. Flowers white, June.</p>	<p>Edge of creek beds, base of cliffs, rocky crevices, near crest of ridge.</p>
<p><i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1</p> 	<p>Erect perennial shrub. Flowers white-cream-yellow-pink-purple, August to September.</p>	<p>High in the landscape, cliff tops, gorge tops, steep rocky slopes, skeletal red-brown soils.</p>
<p><i>Hibiscus campanulatus</i> P1</p> 	<p>Large, erect perennial shrub to 3 m high. Flowers white to mauve, February.</p>	<p>Hill slopes, base of slopes, rocky gully areas, often on Canga detritals.</p>

Species	Description ¹	Habitat ¹
<p><i>Solanum octonum</i> P2²</p>  <p>Photo: (Eco Logical Australia 2016)</p>	<p>Erect shrub 0.8 m to 1.5 m high. Flowers purple, June to September.</p>	<p>Gorge tops, red sandy soil with <i>Tridodia</i>, steep hillslopes with skeletal soil and riverine areas with gritty sand.</p>
<p><i>Solanum</i> sp. (indet.)³ (No photo available)</p>	<p>Erect shrub 0.8 m to 1.5 m high.</p>	<p>Gorges, steep hillslopes with skeletal soil.</p>
<p><i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3</p> 	<p>Open annual or biennial erect herb, to 0.2 m high. Flowers yellow, March to September</p>	<p>Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains, stony plains, hill slopes.</p>
<p><i>Grevillea saxicola</i> P3</p> 	<p>Erect perennial shrub to 2.5 m high. Flowers February, April, November.</p>	<p>Low rocky hill, red-brown sandy loam with ironstone pebble cover, steep scree slopes.</p>

Species	Description ¹	Habitat ¹
<p><i>Nicotiana umbratica</i> P3</p> 	<p>Erect, short-lived annual or perennial herb, 0.3 m to 0.7 m high. White flowers, April to June.</p>	<p>Shallow soils. Rocky outcrops</p>
<p><i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3</p> 	<p>Spreading perennial shrub to 0.5 m high. Flowers yellow, August.</p>	<p>Skeletal red soils pockets. Steep slope.</p>

¹ – Florabase (Western Australian Herbarium 1998-2017).

² – Species not observed in current survey, but previously recorded within survey area. For project presence see Table N.2.

³ – Undescribed taxon, see Section 4.2.2.1. Description and habitat taken from records in current survey.

Table N.2: Conservation significant flora recorded in the survey area (GDA94, Zone 50).

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Aluta quadrata</i> T	A	3	10	557465	7431769
		3	10	557448	7431782
		3	10	557443	7431790
		3	10	557441	7431792
		3	10	557436	7431792
		3	10	557436	7431795
		3	10	557435	7431799
		3	10	557429	7431798
		3	10	557428	7431801
		3	10	557422	7431804
		3	10	557414	7431806
		3	10	557405	7431812
		3	10	557401	7431815
		3	10	557396	7431815
		3	1	557397	7431821
		3	20	557389	7431822
		3	20	557373	7431826
		3	20	557360	7431829
		3	4	557352	7431832
		3	20	557343	7431838
		3	20	557336	7431841
		3	10	557326	7431849
		3	10	557324	7431854
		3	20	557320	7431858
		3	20	557315	7431862
		3	20	557307	7431868
		3	10	557297	7431874
		3	10	557289	7431879
		3	10	557275	7431884
		3	10	557258	7431885
		3	10	557251	7431888
		3	10	557240	7431885
		3	10	557234	7431883
		3	10	557228	7431883
		3	10	557218	7431882
		3	10	557203	7431884
		3	10	557193	7431883
		0.5	7	557461	7431765
		1	7	557461	7431763
		2	8	557438	7431773
		2	10	557424	7431782
		2	10	557413	7431788
		3	20	557394	7431798
		3	10	557377	7431810
		3	30	557303	7431833
		3	10	557295	7431857
		3	10	557276	7431867
		3	20	557222	7431868
		4	30	557476	7431791

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Aluta quadrata</i> T	A	4	20	557454	7431800
		4	30	557436	7431808
		3	20	557423	7431815
		3	30	557406	7431824
		3	30	557395	7431826
		3	30	557373	7431835
		3	30	557357	7431839
		3	30	557344	7431849
		3	30	557332	7431858
		3	30	557322	7431868
		3	30	557305	7431881
		3	30	557291	7431891
		1	30	557241	7431896
		2	30	557215	7431894
		2	10	557193	7431892
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1	A	-	1	568390	7428290
		-	1	570615	7427163
		0.5	2	570617	7427163
		0.5	3	570589	7427162
		0.5	1	570569	7427183
		0.5	6	570655	7427397
		0.5	3	570679	7427343
		1	20	568443	7428345
		1	10	568430	7428323
		1	10	568401	7428304
		1	10	568388	7428294
		0.5	5	568322	7428295
		0.5	5	568304	7428296
		0.5	5	568414	7428204
		0.5	5	570296	7427217
		0.5	1	570232	7427201
	F	0.5	1	569310	7425898
	M	1	10	568505	7428484
		1	5	568511	7428488
		1	5	568529	7428485
		1	20	568543	7428498
		1	10	568516	7428493
		1	3	568506	7428491
		1	5	568492	7428487
		1	15	568477	7428485
		1	15	568467	7428507
		1	20	568469	7428501
		1	20	568471	7428501
		1	20	568485	7428511
		1	20	568498	7428514
		1	20	568499	7428534
		1	20	568514	7428557
		1	20	568535	7428539
		1	20	568545	7428556
		1	20	568545	7428556

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1	M	1	20	568579	7428569
		1	20	568586	7428578
		1	10	568573	7428528
		1	15	568596	7428525
		1	15	568597	7428526
		0.1	3	568625	7428636
		0.1	10	568637	7428616
		0.1	5	568620	7428626
		1	15	568621	7428610
		1	20	568604	7428582
		1	15	568591	7428568
		1	15	568579	7428566
		0.1	5	568576	7428559
		1	10	568533	7428588
		1	10	568525	7428571
		1	10	568513	7428565
		1	15	568479	7428559
		0.1	2	568501	7428536
		0.5	10	568506	7428516
		0.1	5	568511	7428484
		0.1	5	568512	7428481
		0.1	5	568521	7428471
		0.1	10	568519	7428462
		0.1	10	568516	7428453
		1	10	568531	7428455
		1	10	568539	7428448
		1	10	568513	7428437
		1	10	555654	7433876
		1	10	555677	7433874
		1	10	555102	7434013
		0.1	5	568243	7428302
		0.1	2	568245	7428309
		0.1	5	568247	7428306
		2	20	568432	7428177
		2	20	568444	7428170
		2	20	568442	7428172
		1	10	568435	7428160
		0.1	3	568422	7428155
		0.1	5	568421	7428152
		2	20	568422	7428148
		1	15	568414	7428134
		3	40	568414	7428138
		0.1	2	568411	7428127
		0.1	4	568410	7428124
		0.1	6	568400	7428122
		0.1	2	568404	7428115
		0.1	4	568390	7428107
		0.1	6	568391	7428101
		0.1	12	568388	7428092
		0.1	12	568442	7428096

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Eremophila</i> sp. Hamersley Range (K Walker KW 136) P1	M	0.1	13	568588	7428073
		0.1	1	568651	7428072
		0.1	6	568614	7428108
		0.1	8	568617	7428083
		0.1	2	568643	7428089
		0.1	2	568632	7428078
		0.1	4	568648	7428069
		0.1	5	568649	7428055
		0.1	2	568651	7428050
		0.1	2	568652	7428045
		0.1	2	568660	7428045
		0.1	5	568640	7428060
		0.1	13	568671	7428048
		0.1	12	568701	7428052
		0.1	14	568699	7428041
		0.1	18	568704	7428050
		0.1	4	568704	7428050
		0.1	4	568693	7428043
		0.1	4	568731	7428043
		0.1	4	568739	7428044
		0.1	10	568721	7428051
		0.1	4	567982	7430065
		0.1	2	568196	7429938
		0.1	5	555873	7433776
		0.1	4	555873	7433806
		0.1	10	555879	7433851
		0.1	8	555888	7433866
		0.1	10	568210	7428055
		0.1	5	568367	7427919
		0.1	6	568409	7427931
		0.1	6	568416	7427963
		0.1	8	568423	7428001
		0.1	12	568444	7428024
		0.1	10	568460	7428056
		0.1	2	568476	7428074
		0.1	1	568576	7428087
		0.1	2	568579	7428044
		0.1	1	568563	7428006
		0.1	8	568570	7428040
		0.1	8	568584	7427954
		0.1	8	568613	7427952
		0.1	22	568627	7427990
		0.1	16	568618	7428017
		0.1	13	568602	7428068
		0.1	9	568599	7428083
		0.1	6	555916	7433731
		0.1	21	555872	7433723
		0.1	3	555143	7433972
		0.1	3	568394	7428361
		0.1	3	555151	7434008

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1	M	0.1	6	555137	7434014
		0.1	33	555111	7434124
		0.1	20	555094	7434112
		0.1	15	555089	7434105
		0.1	15	573485	7427961
		0.1	11	573489	7427961
		0.1	30	573479	7427997
		0.1	4	573208	7428362
		0.1	5	573131	7428326
		0.5	10	573103	7428340
		0.1	3	573040	7428321
		0.1	9	573027	7428339
		0.1	2	572992	7428350
		0.1	4	573061	7428350
		0.1	5	573016	7428351
		0.1	18	572932	7428368
		0.1	4	572923	7428373
		0.1	14	572899	7428408
		0.1	16	572873	7428425
		0.1	8	572827	7428453
		0.1	8	572787	7428465
		0.1	9	572737	7428476
		0.1	8	572673	7428469
		0.1	15	572608	7428439
		0.1	8	572530	7428445
		0.1	11	574774	7426707
		0.1	12	574725	7426763
		0.1	22	574671	7426868
		0.1	5	574599	7426961
		0.1	3	574603	7426967
		0.1	19	574600	7426973
		0.1	11	574588	7426972
		0.1	16	574693	7427291
		0.1	24	574691	7427299
		0.1	3	574754	7427373
		0.1	5	575364	7427041
		0.1	23	568225	7428082
		0.1	9	568237	7428073
		0.1	12	568242	7428071
		0.1	6	568279	7428075
		0.1	31	568282	7428103
		10	38	568281	7428099
		15	42	568275	7428113
		2	26	568278	7428092
		0.5	18	568282	7428103
		0.5	12	568311	7428106
		5	27	568290	7428115
		10	14	568279	7428142
		0.5	5	568321	7428126
		0.5	12	568317	7428125

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1	M	0.1	33	568332	7428115
		0.1	22	568328	7428120
		2	23	568336	7428123
		0.5	14	568335	7428126
		0.1	6	568330	7428125
		0.5	17	568375	7428125
		0.5	18	568354	7428118
		0.5	10	568378	7428123
		5	28	568385	7428131
		2	12	568391	7428131
		0.1	1	568399	7428149
		0.5	23	568400	7428152
		2	18	568417	7428177
		1	24	568414	7428183
		1	8	568418	7428194
		1	16	568428	7428198
		20	39	568440	7428193
		1	10	568452	7428196
		0.2	8	568456	7428206
		0.2	7	568457	7428215
		0.5	12	568477	7428214
		0.2	4	568478	7428215
		0.1	8	568487	7428212
		15	35	568489	7428199
		0.5	23	568480	7428166
		2	22	568458	7428151
		3	11	568429	7428101
		1	19	568601	7428080
		0.1	7	568608	7428081
		0.1	1	568601	7428110
		0.1	9	568602	7428119
		0.1	3	568613	7428125
		0.1	3	568620	7428135
		0.1	4	568635	7428149
		0.1	12	568633	7428141
		3	12	568638	7428145
		2	7	568645	7428152
		0.5	7	568655	7428170
		2	11	568429	7428101
		2	13	568601	7428080
		1	7	568608	7428081
		5	8	568601	7428110
		0.5	13	568602	7428119
		5	0	568613	7428125
		10	23	568620	7428135
		5	13	568635	7428149
		20	35	568633	7428141
		15	17	568638	7428145
		10	26	568645	7428152
		10	28	568655	7428170

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3	A	0.5	10	550759	7432488
		0.5	10	550750	7432488
		0.5	10	550744	7432492
		0.5	20	550772	7432526
		0.5	20	550771	7432535
		0.5	5	552198	7432431
		0.5	10	552204	7432450
		0.5	5	552187	7432458
		1	20	550774	7432484
		0.5	5	555822	7433750
		0.5	10	555829	7433766
		0.5	10	555839	7433766
		0.5	30	555848	7433772
		0.5	30	555845	7433779
		0.5	30	555841	7433785
		0.5	30	555839	7433791
		0.5	20	555836	7433802
		0.5	50	555828	7433805
		0.5	50	555822	7433814
		0.5	30	555827	7433857
		0.5	60	555829	7433870
		0.5	60	555830	7433882
		0.5	50	555832	7433898
		0.5	50	555836	7433915
		0.5	50	555843	7433937
		0.5	20	555848	7433956
		0.5	20	555861	7433992
		0.5	20	555862	7434008
		0.5	30	555915	7434065
		0.5	100	556101	7434159
		0.5	100	556121	7434168
		0.5	100	556128	7434162
		0.5	100	556138	7434136
		0.5	20	556138	7434107
		0.5	20	556131	7434082
		0.5	10	556028	7433864
		0.5	30	556024	7433855
		0.5	30	556014	7433845
		0.5	30	555999	7433831
		0.5	30	555990	7433823
		0.5	30	555981	7433810
	C	-	8	550640	7432486
		-	1	553528	7432031
	I	-	1	559398	7429737
	L	-	1	559411	7429769
	M	1	50	555153	7434007
		1	50	555150	7434002
		1	50	568420	7428352
		1	50	568423	7428338
		1	50	568419	7428335

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3	M	1	50	568431	7428338
		1	50	568428	7428328
		0.1	20	568438	7428333
		0.1	20	568451	7428319
		0.1	20	568426	7428300
		0.1	20	568414	7428322
		1	50	568408	7428327
		1	50	568405	7428331
		1	50	568383	7428334
		1	50	568377	7428333
		0.1	20	568373	7428333
		1	50	568359	7428328
		0.1	10	568353	7428311
		0.1	20	568347	7428318
		1	50	568333	7428317
		0.1	10	568409	7427931
		0.1	7	568416	7427963
		0.1	7	568410	7427966
		0.1	35	568423	7428001
		0.1	30	568448	7428027
		0.1	40	568444	7428024
		0.1	2	568460	7428056
		0.1	25	568468	7428067
		0.1	6	568476	7428074
		0.1	5	568684	7428172
		0.1	50	568695	7428179
		0.1	50	568703	7428176
		0.1	10	568717	7428179
<i>Grevillea saxicola</i> P3	A	0.5	2	569752	7429510
		0.5	10	569789	7429401
		0.5	10	569788	7429434
		0.5	10	570036	7429271
		0.5	20	570160	7428974
		0.5	5	570255	7428863
		0.5	10	570366	7429043
		0.5	5	570512	7429091
		0.5	5	571407	7428578
		0.5	5	571447	7428526
		0.5	5	571555	7428496
		0.5	5	571721	7428563
		0.5	10	571690	7428333
		0.5	6	570189	7429024
		1	7	570243	7428983
		1	10	570293	7428993
		0.5	1	570551	7429056
		1	7	570304	7429138
		4	1	570196	7429021
		0.1	1	565990	7429664
		0.1	1	565885	7429906
		0.5	1	565982	7429638

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Grevillea saxicola</i> P3	F	0.5	1	565887	7429899
		0.5	1	569271	7429442
		1	10	569319	7429512
		1	10	569331	7429491
		0.5	5	569357	7429458
		0.5	3	569370	7429438
		0.5	1	569511	7429363
		0.5	4	569451	7429397
		0.5	10	569190	7429527
		0.5	5	569008	7429531
		0.5	5	568750	7429648
		0.5	1	573495	7425254
		0.5	1	572674	7424176
		0.5	5	573648	7424306
		2	4	572504	7428357
		1	2	572720	7428242
		0.5	1	572833	7428244
		5	10	572883	7428214
		2	4	572908	7427907
		1	2	573032	7427609
		0.5	1	573093	7427999
		1	2	572310	7426251
		0.5	1	572038	7428581
		1	2	571716	7428393
		0.5	1	571687	7428351
		0.5	1	571691	7428630
		0.5	1	571720	7428395
		0.5	3	571861	7428433
		0.5	1	571873	7428640
		0.5	1	572021	7428516
		4	8	571263	7428721
		0.5	1	571261	7428630
		0.5	1	571393	7428571
		0.5	4	571433	7428558
		2	4	571451	7428323
		0.5	1	571508	7428607
		0.5	14	570294	7425620
		0.5	1	571460	7425461
		0.5	25	570380	7425947
		0.5	1	570766	7428688
		0.5	1	570993	7428766
		0.5	1	571050	7428584
		0.5	4	571086	7428478
		0.5	1	571178	7428569
		5	10	570561	7428828
		3	6	570056	7429096
		0.5	1	570118	7429278
		1	2	570198	7428767
		0.5	1	570263	7429285
		1	2	570363	7429186

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Grevillea saxicola</i> P3	F	0.5	1	570410	7429272
		0.5	1	570470	7428733
		0.5	7	570576	7428620
		1	2	569552	7429431
		1	2	569526	7429589
		1	2	569553	7429431
		0.5	1	569696	7429382
		3	6	569802	7429298
		0.5	1	569856	7429168
		1	2	569884	7429334
		4	8	569895	7429206
		1	2	569964	7429022
		0.5	4	568985	7429531
		2	4	568988	7429424
		0.5	5	569027	7429535
		0.5	10	569038	7429432
		0.5	1	569115	7429448
		0.5	1	569224	7429631
		2	4	568376	7429490
		1	2	568434	7429411
		5	10	568516	7429658
		0.5	4	568670	7429456
		0.5	1	568939	7429288
		0.5	1	567494	7429776
		1	2	567664	7430008
		5	10	567814	7429656
		0.5	1	568125	7429878
		1	2	568156	7429669
		0.5	1	567309	7430534
		0.5	1	566898	7430059
		0.5	2	567003	7430143
		0.5	2	567024	7430114
		0.5	3	567059	7430098
		0.5	1	567103	7430112
		1	2	567148	7430068
		0.5	1	567195	7429792
		0.5	1	567310	7429951
		1	2	567311	7429951
		0.5	1	565985	7429657
		0.5	2	566079	7429899
		1	2	566427	7430597
	G	-	7	576097	7425475
		-	4	576074	7425680
		-	2	576044	7425769
		-	1	575892	7425279
		-	1	575918	7425236
		-	1	576010	7426473
		-	1	576014	7425725
		-	2	576014	7425569
		-	5	575921	7426430

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Grevillea saxicola</i> P3	G	-	1	575605	7426175
		-	1	575757	7426193
		-	3	575744	7426169
		-	2	575662	7426036
		-	2	575628	7426042
		-	1	575506	7426889
		-	6	575604	7426053
		-	3	575609	7426081
		-	5	575614	7426125
		-	10	575589	7426047
		-	10	575606	7426062
		-	3	573860	7427755
	M	0.1	1	565990	7429664
		0.1	2	565885	7429906
		4	12	570196	7429021
		0.1	3	568337	7428303
		0.1	5	568337	7428312
		3	5	568307	7428303
		1	3	568296	7428306
		1	3	568311	7428312
<i>Hibiscus campanulatus</i> P1	A	1	9	573714	7425556
		0.5	10	573748	7425551
		0.5	10	573788	7425548
		0.5	10	573853	7425553
		0.5	10	573879	7425526
		0.5	10	573919	7425511
		0.5	10	573934	7425500
		0.5	10	574088	7425386
		0.5	10	574349	7425370
		0.5	10	574331	7425376
		0.5	10	574311	7425378
		0.5	5	574290	7425371
		0.5	5	574271	7425377
		0.5	20	574257	7425377
		0.5	20	574201	7425395
		0.5	20	574125	7425401
		0.5	10	574784	7425958
		0.5	2	573768	7424234
		0.5	3	573768	7424241
		0.5	3	573012	7423851
		0.5	5	572972	7424069
		0.5	7	572797	7424239
		0.5	2	572741	7424233
		0.5	2	572222	7424456
		0.5	5	572219	7424407
		0.5	3	572229	7424368
		0.5	1	572271	7424144
		0.5	4	569581	7426746
		0.5	5	573134	7423578
		0.5	10	573247	7423730

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	A	0.5	10	573361	7423849
		0.5	10	573379	7423991
		1	20	573439	7424203
		3	30	573495	7424294
		3	30	573351	7424324
		3	10	573240	7424153
		0.5	3	572958	7424051
		0.5	4	572433	7423794
		0.5	5	572472	7423905
		0.5	10	572673	7424163
		0.5	10	572680	7424191
		0.5	20	572732	7424294
		0.5	20	572722	7424322
		0.5	20	572691	7424361
		0.5	20	572656	7424398
		0.5	20	572631	7424451
		0.5	20	572618	7424464
		1	20	572580	7424513
		0.5	20	572571	7424566
		0.5	20	572568	7424614
		1	20	572556	7424649
		0.5	20	572558	7424693
		0.5	20	572545	7424735
		0.5	20	572541	7424772
		0.5	20	572574	7424830
		0.5	20	572616	7424901
		0.5	20	572643	7424945
		0.5	20	572649	7424954
		0.5	20	572704	7424986
		0.5	10	572914	7424820
		0.5	10	572931	7424807
		0.5	10	572958	7424788
		0.5	10	572975	7424776
		0.5	10	572977	7424740
		0.5	7	572984	7424696
		0.5	3	572968	7424633
		0.5	3	572925	7424602
		0.5	10	572917	7424616
		0.5	20	572907	7424635
		0.5	8	572907	7424672
		0.5	10	572896	7424697
		0.5	10	572888	7424719
		0.5	1	572870	7424751
		0.5	10	572861	7424765
		0.5	20	572843	7424774
		0.5	6	572845	7424539
		0.5	10	572786	7424500
		0.5	10	572771	7424466
		0.5	20	572749	7424383
		0.5	5	569972	7425985

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	A	0.5	10	576035	7425353
		0.5	5	569362	7426257
		0.5	10	569023	7426318
		1	30	569077	7426272
		1	20	569167	7426228
		0.5	7	569170	7426124
		0.5	10	569012	7425914
		1	20	568957	7426025
		0.5	10	568928	7426107
		0.5	10	568820	7426067
		0.5	8	568853	7425959
		0.5	10	568857	7425872
		1	20	575592	7425421
		1	20	575558	7425438
		1	20	575660	7426094
		0.5	1	565425	7426831
		0.5	10	571399	7428581
		0.5	10	571448	7428526
		0.5	10	571552	7428482
		0.5	20	571559	7428536
		0.5	1	570217	7428996
		0.5	6	570314	7429162
		1	20	570341	7429194
		1	10	570579	7429045
		5	20	570607	7429096
		4	20	570634	7429130
		0.5	6	570581	7429148
		1	20	570428	7429282
		0.5	7	570464	7429250
		1	30	570484	7429238
		1	30	570517	7429205
		1	30	570538	7429196
		0.5	20	570543	7429161
		0.5	4	557720	7431697
		6	50	556264	7432451
		3	50	556158	7432500
		2	30	556095	7432522
		2	20	555904	7432594
		2	50	555817	7432635
		2	50	555749	7432651
		2	30	555591	7432701
		2	30	555548	7432729
		1	10	556454	7432344
		1	10	556404	7432379
		3	20	556386	7432394
		5	30	556239	7432460
		2	10	556123	7432504
		2	30	555970	7432582
		7	40	555841	7432629
		1	10	555676	7432672

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	A	5	20	555651	7432686
		5	20	555603	7432710
		3	10	555556	7432732
		3	10	556005	7432661
		4	20	555297	7432104
		2	20	555349	7432025
		2	70	556327	7432416
		6	50	556295	7432443
		4	40	556208	7432473
		2	20	556066	7432544
		3	30	555872	7432613
		4	40	555783	7432641
		3	40	555735	7432660
		3	30	555486	7432765
		3	30	555742	7432664
		3	30	555785	7432644
		3	30	555928	7432572
		3	30	555923	7432587
		2	20	555257	7432089
		2	20	555257	7432124
		2	20	555256	7432147
		2	10	555239	7432163
		0.5	4	555242	7432177
		0.5	5	573950	7425487
		2	20	574317	7425802
		1	20	574620	7425810
		0.5	10	574632	7425929
		5	1	574252	7425744
		1	1	572669	7424260
		0.1	1	565433	7426865
		0.1	1	573741	7424229
		0.1	1	570196	7429021
		2	1	575107	7426395
		0.1	1	562505	7425941
		0.1	1	570123	7427205
		0.5	1	555557	7431860
		1	10	555514	7431960
		0.5	10	555402	7432016
		0.5	4	555329	7432039
		3	20	555364	7431992
		0.5	3	555390	7431971
		0.5	10	555458	7431930
		0.5	4	555507	7431898
		1	10	558083	7430556
		1	30	559480	7430413
		0.5	6	570349	7427232
		0.5	5	570130	7427175
		0.5	3	570235	7427490
		0.5	4	566989	7427356
		1	10	567026	7427489

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	A	0.5	9	567052	7427627
		0.5	7	566955	7427527
		1	8	575950	7426402
		0.5	8	575689	7426085
		0.5	20	562519	7425949
		0.5	6	562599	7426007
		0.5	4	569301	7429508
		0.5	1	569350	7429494
		0.5	6	569350	7429481
		0.5	2	555576	7431854
		0.5	6	555620	7431953
		0.5	5	555640	7432026
		0.5	5	555634	7432027
		0.5	5	555630	7432030
		0.5	10	555622	7432030
		0.5	10	555611	7432034
		0.5	10	555604	7432040
		0.5	10	555595	7432046
		0.5	10	555588	7432047
		0.5	10	555588	7432037
		0.5	5	555585	7432022
		0.5	2	555580	7432011
		0.5	1	555573	7431990
		0.5	2	555567	7431982
		0.5	2	555563	7431975
		0.5	2	555558	7431961
		0.5	1	555552	7431920
		0.5	5	555723	7431879
		0.5	5	555731	7431870
		0.5	10	555756	7431862
		0.5	5	555909	7431836
		0.5	5	555921	7431833
		0.5	5	555941	7431821
		0.5	5	555950	7431800
		0.5	5	555954	7431792
		0.5	5	555961	7431782
		0.5	5	555968	7431770
		0.5	5	555979	7431761
		0.5	5	555990	7431754
		0.5	5	556014	7431737
		0.5	10	556020	7431733
		0.5	10	556081	7431718
		0.5	10	556093	7431713
		0.5	10	556103	7431706
		0.5	10	556115	7431701
		0.5	10	556123	7431706
		0.5	10	556131	7431703
		0.5	1	556063	7431792
		0.5	5	555940	7431845
		0.5	5	555911	7431813

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	A	0.5	5	555910	7431796
		0.5	5	555913	7431787
		0.5	2	555917	7431762
		0.5	5	555908	7431750
		0.5	5	558013	7430748
		0.5	5	557999	7430747
		0.5	1	557839	7430739
		0.5	2	559567	7430294
		0.5	2	559587	7430292
		0.5	5	559596	7430288
		0.5	1	559651	7430295
		0.5	1	559647	7430339
		0.5	2	559663	7430347
		0.5	10	570142	7427420
		0.5	5	570639	7427400
		0.5	5	570679	7427345
		0.5	1	567097	7427277
		0.5	1	567014	7427338
		0.5	3	566992	7427353
		0.5	2	567460	7427240
		0.5	3	567342	7427192
		0.5	5	575691	7426081
		0.5	10	573657	7427715
		0.5	10	573642	7427665
		0.5	10	573651	7427658
		0.5	10	573657	7427653
		0.5	10	573650	7427643
		0.5	10	573640	7427628
		0.5	10	573636	7427603
		0.5	10	573633	7427596
		0.5	10	573632	7427574
		0.5	10	573638	7427566
		0.5	10	573634	7427544
		0.5	10	573625	7427494
		0.5	1	574104	7426989
		0.5	20	574247	7426944
		0.5	20	574374	7426915
		0.5	5	574482	7426858
		0.5	30	574636	7426893
		0.5	30	574645	7426885
		0.5	5	574841	7426619
		0.5	30	574822	7426614
		0.5	20	574916	7426539
		0.5	20	574912	7426541
		0.5	20	574912	7426541
		0.5	20	575144	7426477
		0.5	10	575078	7426442
		0.5	20	575135	7426387
		0.5	20	575277	7426375
		0.5	20	575376	7426300

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	A	0.5	10	575520	7426182
		0.5	2	569109	7429522
		0.5	5	568741	7429651
		0.5	5	567994	7430069
		0.5	5	567804	7430106
		0.5	10	567111	7430384
		-	1	573756	7424227
		-	1	574633	7426896
		0.1	5	556264	7432451
	B	-	1	554475	7432744
		-	3	554619	7432551
		-	10	554601	7432562
		-	50	554632	7432529
		-	3	554619	7432551
		-	10	554601	7432562
		-	50	554632	7432529
		-	1	554382	7432613
	F	0.5	1	574721	7427031
		12	25	574755	7427173
		0.5	1	574775	7427238
		3	7	573866	7427024
		3	7	574136	7426961
		5	10	574304	7426903
		2	5	574326	7426474
		0.5	1	574326	7426474
		1	2	574347	7426417
		0.5	1	574560	7426944
		2	5	574275	7427676
		3	7	573984	7427142
		0.5	1	574158	7427252
		1	5	573731	7425804
		2	50	574006	7425602
		0.5	2	574019	7425459
		0.5	30	574023	7425395
		0.5	25	574096	7425712
		7	15	574227	7425382
		1	15	573462	7425155
		1	50	573465	7425126
		1	50	573567	7424953
		3	5	573587	7424903
		1	25	573661	7424836
		1	10	573723	7424713
		0.5	1	573747	7424488
		1	25	573762	7425156
		1	20	573762	7424602
		1	50	573790	7424846
		2	50	573827	7425713
		1	50	573846	7424941
		0.5	1	573873	7425042
		20	80	573497	7423790

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	F	1	5	572674	7424176
		1	5	572674	7424176
		2	4	573265	7424155
		1	20	573478	7423720
		0.5	20	573605	7424267
		5	8	572674	7428200
		12	20	573330	7428079
		7	15	573334	7428083
		2	4	573172	7426826
		1	10	573241	7426893
		3	7	573338	7427293
		1.5	2	573135	7426032
		3	7	572514	7426349
		3	7	572616	7426414
		3	7	572875	7426219
		1	10	573098	7426199
		1.5	2	573120	7426053
		1.5	2	573124	7426046
		1.5	2	573134	7426037
		1.5	2	573138	7426027
		1.5	2	573146	7426014
		1.5	2	573171	7425964
		0.5	1	573294	7425968
		3	5	573311	7426175
		1.5	2	573455	7425824
		1	25	572389	7426152
		3	7	572308	7426181
		2	5	572316	7425954
		1	50	572362	7426136
		20	100	572399	7426149
		3	7	572462	7425268
		1	10	572492	7426165
		1	5	572561	7425116
		1	5	572620	7425043
		1	10	571691	7428354
		3	7	571716	7428393
		2	5	571720	7428395
		1.5	2	571925	7428412
		0.5	2	571928	7428406
		0.5	1	571265	7428645
		0.5	2	571423	7428566
		0.5	2	571546	7424533
		0.5	1	571210	7425623
		0.5	2	571566	7424612
		2	5	571811	7424723
		9	20	572047	7425354
		7	15	572097	7425263
		12	30	572118	7425233
		3	5	572180	7425259
		1	20	572233	7424321

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	F	2	3	572284	7424957
		1	15	572271	7426072
		3	5	572275	7426007
		0.5	1	571050	7428584
		0.5	8	570144	7429291
		1	20	570363	7429186
		0.5	1	570410	7429272
		0.5	1	569802	7429298
		0.5	7	568970	7429527
		0.5	2	568988	7429424
		0.5	1	569049	7429437
		1	15	567912	7426288
		1	50	567873	7426316
		1	15	567887	7426306
		1	20	567934	7426272
		1	15	567947	7426225
		3	5	568114	7425976
		3	5	568152	7426037
		3	5	568162	7426046
		3	7	568606	7425704
		0.5	5	569310	7425898
		0.5	2	569335	7425888
		0.5	20	569374	7426264
		0.5	6	568872	7429507
		0.5	1	568361	7429569
		0.5	1	568692	7429455
		20	80	568342	7426649
		1	25	567840	7426361
		5	10	567545	7426479
		0.5	5	567794	7426429
		1	25	567812	7426406
		1	25	567836	7426381
		6	20	567839	7426699
		1	50	567852	7426340
		12	30	567863	7426721
		3	5	567890	7426694
		0.5	1	567932	7426856
		0.5	1	568068	7426610
		3	7	568343	7426650
		1.5	2	568417	7426729
		1	25	567811	7430136
		0.5	5	567729	7430096
		0.5	6	567737	7430059
		0.5	1	567764	7429998
		1	20	567790	7430208
		1	25	567804	7430175
		0.5	1	567814	7429656
		3	7	567930	7429999
		0.5	1	568007	7430015
		3	3	567321	7430363

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	F	3	7	567295	7430335
		3	7	567294	7430316
		0.5	5	566819	7430238
		0.5	3	566939	7430185
		-	2	567259	7430274
		3	7	567308	7430345
		2	2	567335	7430377
		2	2	567346	7430404
		2	2	567352	7430438
		4	5	567353	7430423
		2	2	567355	7430458
		0.5	1	567546	7430379
		3	7	567103	7430112
		0.5	1	567148	7430068
		1	5	567195	7429792
		0.5	1	567310	7429951
		0.5	1	566959	7426528
		0.5	1	566805	7426981
		0.5	1	566863	7427101
		3	2	567054	7426501
		1	5	567114	7426610
		3	5	567257	7426466
		3	7	567272	7426485
		0.5	1	566115	7429810
		1	5	565468	7426930
		2	10	565616	7427939
		0.5	1	565919	7426966
		3	7	566159	7427106
		0.5	2	566361	7427207
		0.5	1	566380	7427294
		0.5	1	566523	7427251
	G	-	37	576122	7425412
		-	20	576165	7425509
		-	50	576054	7425650
		-	40	576074	7425680
		-	10	576120	7425683
		-	5	576152	7425715
		-	1	576089	7425391
		-	15	575900	7424835
		-	10	575856	7425329
		-	1	576034	7425293
		-	2	576026	7425327
		-	10	576031	7425354
		-	10	575846	7425345
		-	2	575867	7424801
		-	1	575943	7426705
		-	130	575828	7426579
		3	7	576033	7426493
		-	56	575775	7426661
		-	21	575817	7426648

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	G	-	36	575844	7426525
		-	1	575990	7426541
		-	1	575824	7426966
		-	20	575864	7426925
		-	2	575882	7426930
		-	1	575942	7426868
		-	1	575960	7426688
		-	1	576009	7426652
		-	2	576124	7426586
		-	10	576101	7426577
		-	20	576047	7426478
		-	5	576025	7426497
		-	30	576010	7426473
		-	5	575891	7425935
		-	1	575837	7425734
		-	20	575993	7425626
		-	10	575988	7425715
		-	30	575951	7425714
		-	30	575966	7425745
		-	30	575937	7425748
		-	30	575970	7425790
		-	5	575961	7425847
		-	20	575948	7425900
		-	10	575986	7425972
		-	10	575865	7425956
		-	50	575845	7426002
		-	20	575787	7425442
		-	10	575927	7425728
		-	15	575876	7425856
		-	20	575725	7425461
		-	20	575780	7425435
		-	1	575844	7426242
		-	62	575901	7426448
		-	1	575914	7426456
		-	1	575871	7426376
		-	2	575773	7426278
		-	1	575725	7426214
		-	1	575711	7426205
		-	20	575954	7426412
		-	20	575921	7426430
		-	50	575890	7426348
		-	5	575527	7426178
		-	10	575571	7426175
		-	5	575605	7426175
		-	25	575863	7426173
		-	40	575837	7426274
		-	30	575796	7426237
		-	50	575757	7426193
		-	50	575642	7426162
		-	1	575792	7425888

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	G	-	10	575665	7426123
		-	10	575815	7426047
		-	20	575763	7426041
		-	10	575744	7426169
		-	5	575722	7426126
		-	10	575640	7425750
		-	30	575714	7425764
		-	20	575638	7426087
		-	1	575544	7426881
		-	1	575563	7426816
		-	27	575522	7426841
		-	28	575681	7426756
		-	1	575503	7426832
		-	1	575506	7426852
		-	1	575509	7426859
		-	1	575504	7426887
		-	20	575437	7426014
		-	5	575604	7426053
		-	20	575609	7426081
		-	5	575489	7425775
		-	20	575547	7425798
		-	50	575581	7425750
		-	5	575517	7425993
		-	1	575519	7426001
		-	50	575589	7426047
		-	50	575606	7426062
		-	5	575387	7425996
		-	10	575355	7426336
		-	1	575271	7426437
		5	10	575361	7426355
		0.1	1	575386	7426292
		-	2	575283	7426507
		-	50	575363	7426383
		-	50	575275	7426437
		-	50	575289	7426478
		-	10	575294	7426343
		-	10	575239	7426345
		-	50	575290	7426465
		-	1	575276	7426658
		-	1	575055	7426918
		-	1	575058	7426844
		-	1	575074	7426737
		-	1	575089	7426718
		-	1	575095	7426662
		-	2	575104	7426613
		-	1	575281	7426625
		-	2	575350	7426714
		-	1	575355	7426794
		-	1	575110	7426582
		-	2	575107	7426572

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	G	-	30	575133	7426483
		-	30	575206	7426368
		-	20	575166	7426391
		-	40	575089	7426429
		-	75	574930	7426840
		-	1	574990	7426913
		-	32	574977	7426887
		-	35	574909	7426707
		-	17	574884	7427112
		-	2	574244	7427524
		-	2	574239	7427450
		-	1	574237	7427390
	J	-	100	554585	7432482
	M	5	200	574252	7425744
		1	1	572669	7424260
		0.1	1	573741	7424229
		2	1	575107	7426395
		0.1	18	562505	7425941
		0.1	2	570196	7429021
		0.1	10	568306	7428342
		0.1	10	568276	7428335
		0.1	10	568299	7428323
		0.1	10	568293	7428292
		0.1	10	568281	7428263
		0.1	10	568274	7428256
		0.1	5	568260	7428266
		0.1	20	568244	7428249
		2	20	568250	7428239
		2	20	568239	7428229
		2	20	568230	7428233
		2	20	568212	7428243
		2	20	568216	7428231
		2	20	568181	7428219
		2	20	568188	7428212
		2	20	562150	7432078
		2	20	562139	7432070
		0.1	3	562105	7432066
		1	20	562083	7432033
		5	30	562084	7432032
		5	30	562082	7432041
		5	30	562062	7432041
		5	30	562016	7432027
		5	30	562006	7432031
		5	30	562049	7432007
		5	30	562055	7432012
		5	30	562065	7432020
		5	30	562084	7432023
		5	30	562081	7432028
		5	30	562096	7432034
		3	20	562122	7432049

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Hibiscus campanulatus</i> P1	M	3	20	562352	7432136
		5	30	568133	7428196
		3	20	568119	7428200
		1	20	568119	7428225
		1	20	568120	7428242
		1	20	568142	7428270
		0.1	2	555893	7433884
		0.5	30	568410	7427966
		0.5	23	568448	7428027
		0.5	35	568625	7428020
<i>Nicotiana umbratica</i> P3	A	0.5	5	574725	7425950
	G	-	1	575993	7425327
		-	1	576033	7426493
		-	1	575544	7426881
		-	1	575544	7426881
<i>Ptilotus trichocephalus</i> P4	C	-	50	552561	7431600
		-	30	552559	7431627
		-	15	553577	7431452
		-	30	552579	7431557
		-	5	552546	7431666
		-	50	552097	7432740
	E	-	1	564101	7425737
		-	5	564360	7425648
		-	1	564128	7425710
		-	3	564124	7425678
		-	3	564143	7425677
		-	10	564114	7425727
		-	1	564103	7425691
		-	1	554623	7431148
		-	4	554620	7431150
		-	2	554585	7431124
		-	4	554735	7431116
		-	2	554726	7431064
		-	1	554736	7431118
		-	15	554698	7431036
		-	10	554737	7431088
		-	2	554752	7431096
		-	1	554713	7431129
		-	1	554669	7431129
		-	4	554676	7431092
		-	1	554659	7431130
		-	60	554480	7431089
		-	3	554728	7431059
		-	1	554613	7431142
		-	30	554723	7431060
		-	49	554724	7431027
		-	3	554610	7431145
		-	5	554730	7431121
		-	10	554717	7431063
		-	7	554665	7431093

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Ptilotus trichocephalus</i> P4	E	-	1	554620	7431061
		-	4	554725	7431106
		-	16	554703	7431084
		-	3	554614	7431150
		-	1	554633	7431025
		-	2	554451	7431026
		-	1	564113	7425686
		-	1	564098	7425701
		-	1	554623	7431055
		-	1	554566	7431119
		-	1	554584	7431057
		-	1	554741	7431090
		-	35	554732	7431119
		-	1	554668	7431129
		-	5	554702	7431089
		-	2	554735	7431107
		-	1	564132	7425678
		-	18	564085	7425696
		-	1	564096	7425708
		-	1	554570	7431117
		-	10	554666	7431126
		-	1	554486	7431107
		-	2	554754	7431021
		-	10	554670	7431124
		-	4	564092	7425689
		-	1	564043	7425708
		-	35	554718	7431124
		-	4	554593	7431134
		-	1	554665	7431089
		-	4	554714	7431056
		-	10	554725	7431056
		-	2	554620	7431032
		-	30	554750	7431089
		-	5	554668	7431116
		-	5	554666	7431119
		-	6	554703	7431142
		-	3	554729	7431105
		-	1	554722	7431046
	H	-	20	564370	7425789
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	A	0.5	20	572908	7424886
		1	10	570586	7429125
		1	10	570579	7429140
		0.5	1	570561	7429149
		0.5	7	570462	7429253
		0.5	20	570475	7429246
		0.5	10	570506	7429223
		0.5	20	570517	7429204
		0.5	20	570550	7429177
		0.5	10	570556	7429150
		0.1	1	575107	7426395

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	A	0.5	1	575238	7426337
		0.5	1	575594	7426171
	D	-	5	572631	7426846
		-	5	572730	7427113
		-	1	572450	7426524
		-	2	572306	7426236
		-	2	572018	7425990
		-	5	571271	7426723
		-	2	572215	7426412
		-	5	572294	7426090
		-	2	572283	7426122
		-	3	572248	7426085
		-	5	571431	7426658
		-	2	570039	7427120
		-	2	570204	7427192
		-	2	571206	7426958
		-	2	570085	7427740
		-	1	572037	7427115
		-	2	570459	7427798
		-	10	570125	7427415
		-	5	568642	7428002
		-	1	568577	7428120
		-	2	568065	7428141
		-	2	568227	7428440
		-	2	567394	7428331
		-	2	568482	7428514
		-	3	568269	7428016
		-	2	568536	7427779
		-	2	569072	7428013
		-	2	568628	7428127
		-	1	568672	7428069
		-	2	568362	7428559
		-	2	572125	7426480
		-	6	572190	7426037
		-	2	572259	7426654
		-	5	567995	7427661
		-	2	570111	7427338
		-	5	568777	7428180
		-	4	570505	7427774
		-	2	571238	7427115
		-	5	568988	7427934
		-	2	572324	7426146
		-	5	570280	7427206
		-	5	572948	7427271
		-	5	568123	7428227
		-	2	569021	7427835
		-	2	570243	7427213
		-	2	568190	7428313
		-	2	572807	7427380
		-	2	570178	7427447

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	D	-	5	568253	7428002
		-	5	568907	7427552
		-	2	570549	7427860
		-	5	567083	7428043
		-	1	570310	7427723
		-	3	570350	7427709
		-	5	570065	7427746
		-	2	571960	7426962
		-	5	570563	7427934
		-	2	570406	7427231
		-	1	568751	7428229
		-	2	568814	7428018
		-	2	567241	7428013
	F	0.5	2	574624	7427356
		0.5	2	574721	7427031
		0.5	2	573959	7426953
		1	2	573959	7426954
		1	3	574076	7426955
		3	6	574095	7427464
		0.5	2	574158	7427252
		2	5	574310	7427059
		0.5	2	574226	7425354
		0.5	2	574226	7425354
		0.5	3	573307	7426946
		0.5	1	573243	7426892
		0.5	2	572750	7426330
		0.5	2	571263	7428721
	G	-	2	576165	7425509
		-	5	576153	7425805
		-	5	576063	7425763
		-	10	576031	7425747
		-	1	575993	7425327
		-	1	575993	7425327
		-	10	576017	7425709
		-	1	576029	7425568
		-	1	575921	7426430
		-	5	575863	7426173
		-	5	575700	7425858
		-	3	575628	7426042
		-	5	575609	7426081
		-	20	575489	7425775
		-	1	575606	7426062
		-	10	575363	7426383
		-	1	575271	7426437
		-	27	575283	7426507
		-	10	575275	7426437
		-	10	575289	7426478
		-	10	575294	7426343
		-	5	575290	7426465
		-	8	575052	7426871

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	G	-	1	575089	7426718
		-	1	575058	7426844
		-	1	575095	7426662
		-	1	575104	7426613
		-	1	575110	7426582
		-	1	575107	7426572
		-	10	575187	7426446
	M	0.1	10	574252	7425744
		0.1	1	575107	7426395
<i>Solanum octonum</i> P2	F	1	3	574594	7426942
		1	3	574624	7427356
		1	3	574721	7427031
		1	3	574775	7427238
		0.5	2	573772	7426683
	G	-	1	575993	7425327
		-	1	575993	7425327
		-	1	575993	7425327
		-	1	575993	7425327
		-	1	575993	7425327
		-	1	575993	7425327
		-	1	575993	7425327
		--	1	575544	7426881
		-	1	575271	7426437
		-	2	575006	7427011
		-	3	575003	7426958
		-	8	574982	7426895
		-	10	574930	7426840
		-	1	574794	7427351
		-	1	574794	7427351
		-	3	574884	7427112
<i>Solanum</i> sp. (indet)	M	0.1	1	575107	7426395
		1	10	568394	7428489
		1	10	568414	7428491
		1	10	568421	7428492
		1	10	568432	7428503
		0.1	5	568455	7428487
		0.1	5	568488	7428496
		0.1	12	568493	7428489
		0.1	9	568510	7428471

¹- Project Source

- A Greater Paraburdoo Detailed Flora and Vegetation Survey – Phase 1 (Astron Environmental Services 2017)
- B Western Range Phase 2 Vegetation and Flora Report (Biota Environmental Sciences 2012b)
- C Western Range Additional Area: Vegetation and Flora Report (Biota Environmental Sciences 2012a)
- D Eastern Ranges Life of Mine Flora and Vegetation Report NVCP (Rio Tinto 2010)
- E Paraburdoo Mine Area Botanical And Vertebrate Fauna Survey (ecologia Environment 2011)
- F Flora and Vegetation Assessment of the Eastern Ranges Study Area (Rio Tinto 2014)

¹⁻ Project	Source
G	Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment (Eco Logical Australia 2016)
H	Paraburdoo tailings dam stage 3 GD_05_01133 (Hamersley Iron Pty Ltd 2005b)
I	Flora and Vegetation Survey of the Paraburdoo NLC Mine Pit and North Lobe Creek (Rio Tinto 2009)
J	Assessment to meet flora condition of CPS for AR 8389 and 9607 (Rio Tinto 2013)
K	Botanical Survey for a Drilling Program (AR-08-04080 & AR-08-04081) at Paraburdoo (Rio Tinto 2009)
L	Paraburdoo GD_01067a&b (Hamersley Iron Pty Ltd 2005a)
M	Greater Paraburdoo Detailed Flora and Vegetation Survey – Phase 2 (current survey)



Threatened and Priority Flora Report Form

Version 1.3 August 2017

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TAXON: <u>Eremophila sp. Hamersley Range (K. Walker KW 136)</u>	TPFL Pop. No: _____
OBSERVATION DATE: <u>10/04/18</u>	CONSERVATION STATUS: <u>P1</u> New population <input type="checkbox"/>
OBSERVER/S: <u>Ben Eckermann, Lucy Dadour, Kellie McMaster and Markus Mikli</u>	PHONE: <u>9421 9600</u>
ROLE: <u>Botanists</u>	ORGANISATION: <u>Astron Environmental Services</u>

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
6 km south of Paraburdoo

DBC DISTRICT: <u>Pilbara Region</u>		LGA: <u>Shire of Ashburton</u>	Reserve No: _____
		Land manager present: <input type="checkbox"/>	
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:
GDA94 / MGA94 <input checked="" type="checkbox"/>	DecDegrees <input type="checkbox"/>	DegMinSec <input type="checkbox"/>	UTMs <input checked="" type="checkbox"/>
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: <u>See attached data</u>		GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>
WGS84 <input type="checkbox"/>	Long / Easting: _____		No. satellites: _____ Map used: _____
Unknown <input type="checkbox"/>	ZONE: _____		Boundary polygon captured: <input type="checkbox"/> Map scale: _____
LAND TENURE:			
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input type="checkbox"/>	Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input checked="" type="checkbox"/>	MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/> SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:	
Alive					Area of pop (m ²): _____ Note: Pls record count as numbers (not percentages) for database.
Dead					

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive

REPRODUCTIVE STATE:	Clonal <input type="checkbox"/>	Vegetative <input checked="" type="checkbox"/>	Flowerbud <input type="checkbox"/>	Flower <input type="checkbox"/>
	Immature fruit <input type="checkbox"/>	Fruit <input type="checkbox"/>	Dehiscent fruit <input type="checkbox"/>	Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☐ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
• Clearing	M	H	M
• Fire	L	M	M
• Weeds	L	M	M

Please return completed form to **Species And Communities Branch DBCA**,
 Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database ☐



Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input checked="" type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input type="checkbox"/>	Red <input checked="" type="checkbox"/>	Well drained <input type="checkbox"/>
Hill <input checked="" type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input checked="" type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input checked="" type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input checked="" type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input checked="" type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
	Specific Landform Element: (Refer to field manual for additional values)				
CONDITION OF SOIL:	Dry <input type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (Mesomelaena tetragona)

1.	_____
2.	_____
3.	_____
4.	_____

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☒ Good ☒ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

DRF PERMIT/ LICENCE No: SL011923, SL012252, SL012244, SL012330

Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licensing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other: _____

Submitter of Record: Lucy Dadour Role: Environmental Scientist Signed: L.D. Date: 18/06/2018

Please return completed form to **Species And Communities Branch DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database ☐



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TAXON:	Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	TPFL Pop. No:	
OBSERVATION DATE:	10/04/18 & 11/04/18 & 13/04/18	CONSERVATION STATUS:	P3 New population <input type="checkbox"/>
OBSERVER/S:	Ben Eckermann, Kellie McMaster and Markus Mikli		PHONE: 9421 9600
ROLE:	Botanists ORGANISATION: Astron Environmental Services		

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
13 km east of Paraburdoo

DBC DISTRICT: Pilbara Region		LGA: Shire of Ashburton	Reserve No:	Land manager present: <input type="checkbox"/>
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:	
GDA94 / MGA94 <input checked="" type="checkbox"/>	DecDegrees <input type="checkbox"/>	DegMinSec <input type="checkbox"/>	UTMs <input checked="" type="checkbox"/>	GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: See attached data		No. satellites: _____ Map used: _____	
WGS84 <input type="checkbox"/>	Long / Easting:		Boundary polygon captured: <input type="checkbox"/> Map scale: _____	
Unknown <input type="checkbox"/>	ZONE:			
LAND TENURE:				
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input type="checkbox"/>	Rail reserve <input type="checkbox"/>	Shire road reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input checked="" type="checkbox"/>	MRWA road reserve <input type="checkbox"/>	Other Crown reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/>	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input checked="" type="checkbox"/> Area observed (m ²): _____				
EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m ² : _____				
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input checked="" type="checkbox"/> Count method: _____ (Refer to field manual for list)				
WHAT COUNTED:	Plants <input checked="" type="checkbox"/>	Clumps <input type="checkbox"/>	Clonal stems <input type="checkbox"/>	
TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:
Alive				
Dead				
				Area of pop (m ²): _____ Note: Pls record count as numbers (not percentages) for database.
QUADRATS PRESENT:	No. _____	Size _____	Data attached <input type="checkbox"/>	Total area of quadrats (m ²): _____
Summary Quad. Totals: Alive				
REPRODUCTIVE STATE:	Clonal <input type="checkbox"/>	Vegetative <input checked="" type="checkbox"/>	Flowerbud <input type="checkbox"/>	Flower <input type="checkbox"/>
	Immature fruit <input type="checkbox"/>	Fruit <input type="checkbox"/>	Dehiscent fruit <input type="checkbox"/>	Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☐ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
• Clearing	M	H	M
• Fire	L	M	M
• Weeds	L	M	M

Please return completed form to **Species And Communities Branch DBCA**,
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Threatened and Priority Flora Report Form

Version 1.3 August 2017

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Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input checked="" type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input checked="" type="checkbox"/>	Brown <input checked="" type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input checked="" type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input type="checkbox"/>	
Flat <input checked="" type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>	Calcrete				
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
CONDITION OF SOIL:	Dry <input type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (Mesomelaena tetragona)

1.	_____
2.	_____
3.	_____
4.	_____

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

DRF PERMIT/ LICENCE No: SL012249, SL012244, SL012330

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SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other: _____

Submitter of Record: Lucy Dadour Role: Environmental Scientist _____ Signed: L.D. Date: 18/06/2018

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TAXON:	Grevillea saxicola	TPFL Pop. No:	
OBSERVATION DATE:	10/04/17	CONSERVATION STATUS:	P3 New population <input type="checkbox"/>
OBSERVER/S:	Ben Eckermann	PHONE:	9421 9600
ROLE:	Botanists	ORGANISATION:	Astron Environmental Services

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place): 5 km south of Paraburdoo			
Reserve No:			
DBC DISTRICT:	Pilbara Region	LGA:	Shire of Ashburton Land manager present: <input type="checkbox"/>
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required) DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input checked="" type="checkbox"/>		METHOD USED: GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>
GDA94 / MGA94 <input checked="" type="checkbox"/>	Lat / Northing: See attached data		No. satellites: _____ Map used: _____
AGD84 / AMG84 <input type="checkbox"/>	Long / Easting:		Boundary polygon captured: <input type="checkbox"/> Map scale: _____
WGS84 <input type="checkbox"/>	ZONE:		
Unknown <input type="checkbox"/>			
LAND TENURE:			
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input type="checkbox"/>	Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input checked="" type="checkbox"/>	MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/> SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT:	Edge survey <input type="checkbox"/>	Partial survey <input type="checkbox"/>	Full survey <input checked="" type="checkbox"/>	Area observed (m ²): _____
EFFORT:	Time spent surveying (minutes): _____		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY:	Actual <input type="checkbox"/>	Extrapolation <input type="checkbox"/>	Estimate <input checked="" type="checkbox"/>	Count method: _____ (Refer to field manual for list)
WHAT COUNTED:	Plants <input checked="" type="checkbox"/>	Clumps <input type="checkbox"/>	Clonal stems <input type="checkbox"/>	
TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:
Alive				
Dead				
				Area of pop (m ²): _____ Note: Pls record count as numbers (not percentages) for database.
QUADRATS PRESENT:	No. _____	Size _____	Data attached <input type="checkbox"/>	Total area of quadrats (m ²): _____
Summary Quad. Totals: Alive				
REPRODUCTIVE STATE:	Clonal <input type="checkbox"/>	Vegetative <input checked="" type="checkbox"/>	Flowerbud <input type="checkbox"/>	Flower <input checked="" type="checkbox"/>
	Immature fruit <input type="checkbox"/>	Fruit <input checked="" type="checkbox"/>	Dehiscent fruit <input type="checkbox"/>	Percentage in flower: _____%

CONDITION OF PLANTS:	Healthy <input type="checkbox"/>	Moderate <input type="checkbox"/>	Poor <input type="checkbox"/>	Senescent <input type="checkbox"/>
COMMENT:				

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
• Clearing	M	H	M
• Fire	L	M	M
• Weeds	L	M	M

Please return completed form to **Species And Communities Branch DBCA**,
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RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database ☐



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Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input checked="" type="checkbox"/>	Well drained <input type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input checked="" type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input checked="" type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input checked="" type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input checked="" type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Corymbia low open woodland (C. ferritcola)
2. Tall open scrub (Acacia citrinoviridis, Grevillea saxicola)
3. Very open hummock grassland (Triodia epactia)
4. Very open tussock grassland (Cenchrus ciliaris, Cymbopogon ambiguus)

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: >10 yrs **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: SL012249

Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licensing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other: _____

Submitter of Record: Lucy Dadour Role: Environmental Scientist _____ Signed: L.D. Date: 18/04/2018

Please return completed form to **Species And Communities Branch DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database ☐



Threatened and Priority Flora Report Form

Version 1.3 August 2017

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au/> under *Standard Report Forms*

TAXON: Sida sp. Barlee Range (S. van Leeuwen 1642)	TPFL Pop. No.: _____
OBSERVATION DATE: 10/04/2018	CONSERVATION STATUS: P3 New population <input type="checkbox"/>
OBSERVER/S: Ben Eckermann	PHONE: 9421 9600
ROLE: Botanist	ORGANISATION: Astron Environmental Services

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
5 km south of Paraburdoo

DBCA DISTRICT: Pilbara region		LGA: Shire of Ashburton	Reserve No.: _____
DATUM: <input checked="" type="checkbox"/> GDA94 / MGA94 <input type="checkbox"/> AGD84 / AMG84 <input type="checkbox"/> WGS84 <input type="checkbox"/> Unknown			
COORDINATES: (If UTM coords provided, Zone is also required) DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input checked="" type="checkbox"/>		METHOD USED: GPS <input type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>	
Lat / Northing: _____		No. satellites: _____ Map used: _____	
Long / Easting: _____		Boundary polygon captured: <input type="checkbox"/> Map scale: _____	
ZONE: _____			
LAND TENURE:			
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input type="checkbox"/>	Rail reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input checked="" type="checkbox"/>	MRWA road reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/>	SLK/Pole _____ to _____
		Shire road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/> Specify other: _____	

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input checked="" type="checkbox"/> Area observed (m ²): _____			
EFFORT: Time spent surveying (minutes): _____		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input checked="" type="checkbox"/> Count method: _____ (Refer to field manual for list)			
WHAT COUNTED:	Plants <input type="checkbox"/>	Clumps <input type="checkbox"/>	Clonal stems <input type="checkbox"/>
TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:
Alive			
Dead			
			Area of pop (m ²): _____
Note: Pls record count as numbers (not percentages) for database.			
QUADRATS PRESENT:	No. _____	Size _____	Data attached <input type="checkbox"/> Total area of quadrats (m ²): _____
Summary Quad. Totals: Alive			
REPRODUCTIVE STATE:	Clonal <input type="checkbox"/>	Vegetative <input checked="" type="checkbox"/>	Flowerbud <input checked="" type="checkbox"/> Flower <input checked="" type="checkbox"/>
	Immature fruit <input type="checkbox"/>	Fruit <input type="checkbox"/>	Dehisced fruit <input type="checkbox"/> Percentage in flower: _____ %

CONDITION OF PLANTS: Healthy ☐ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
• Clearing	L	H	M
• Fire	L	M	M
• Weeds	L	M	M

Please return completed form to **Species And Communities Branch DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

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Threatened and Priority Flora Report Form

Version 1.3 August 2017

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Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input type="checkbox"/>	Red <input checked="" type="checkbox"/>	Well drained <input type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input checked="" type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input checked="" type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input checked="" type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input checked="" type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
2. Open shrubland (Hibbertia sp., Acacia spp.);
3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Acacia tall shrubland (Acacia citrinoviridis, (Hibiscus campanulatus)
2. Open hummock grassland (Triodia epactia)
3. Very open tussock grassland (Eriachne mucronata, Cymbopogon ambiguus)
4. Scattered herbs (Gomphrena cunninghamii)

ASSOCIATED

SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.) _____

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SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other: _____

Submitter of Record: Lucy Dadour Role: Botanist Signed: L.D. Date: 18/06/2018

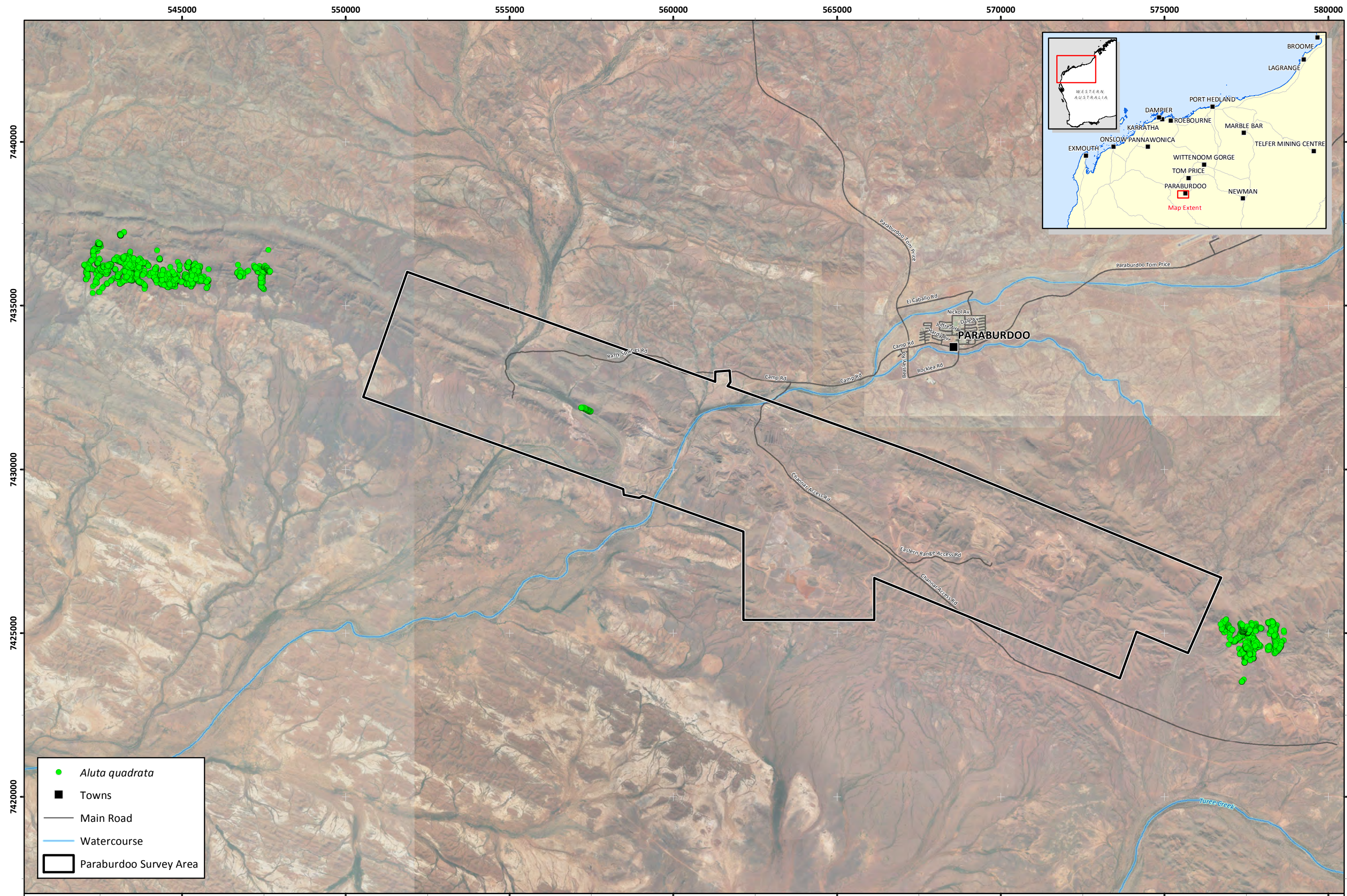
Please return completed form to **Species And Communities Branch DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database ☐

Appendix O: Conservation Significant Flora Species Regional Distribution

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Rio Tinto
Greater Paraburadoo - Detailed Flora and Vegetation Survey, April 2018

Figure O.1: *Aluta quadrata* T regional locations

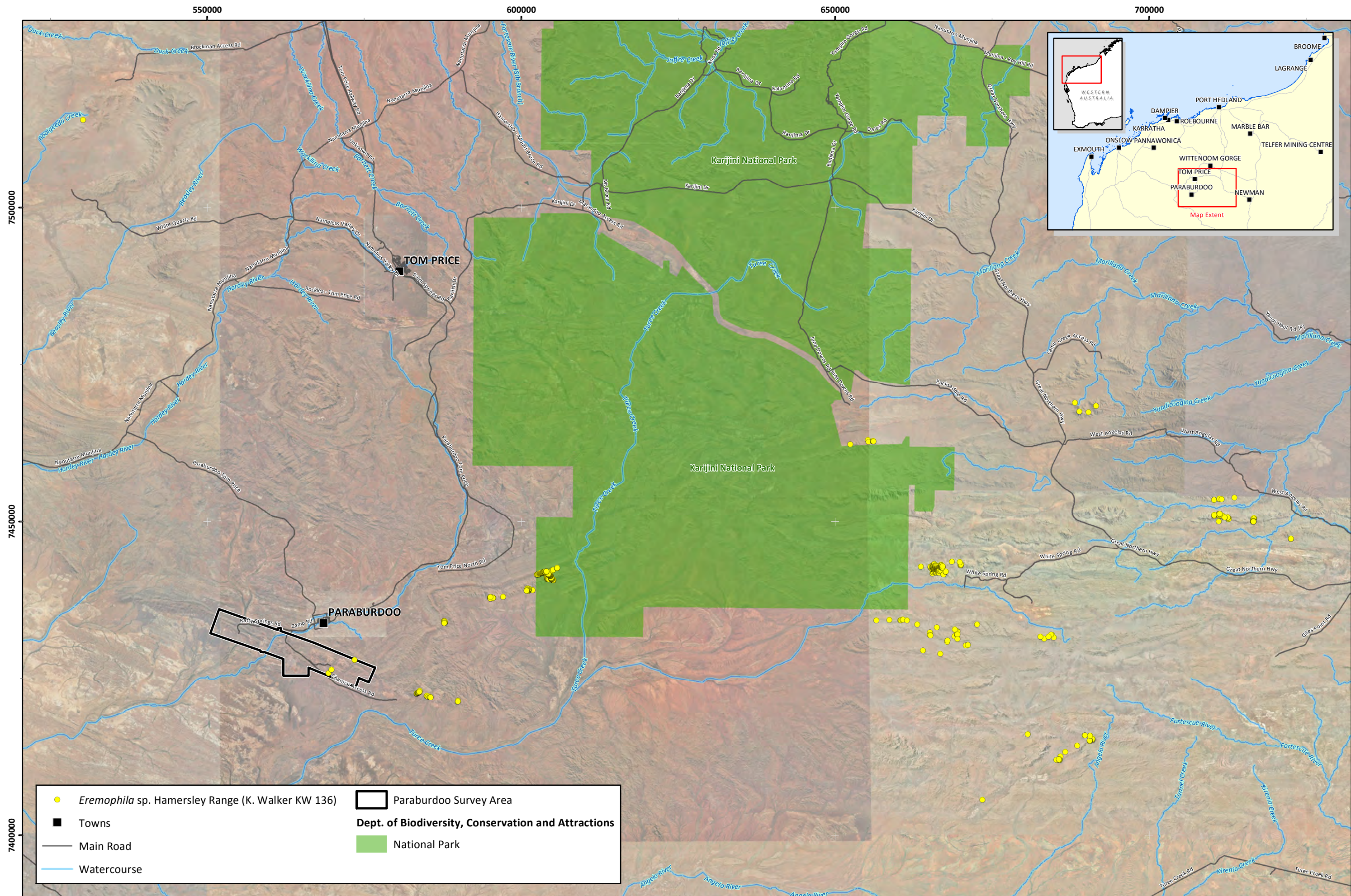
Author: B. Eckermann

Drawn: C. Dyde

Date: 14-12-2018

Figure Ref: 14284-18-BIDR-1RevB_181214_FigO1_Aq





Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure O.2: *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1 regional locations

Author: B. Eckermann

Drawn: C. Dyde

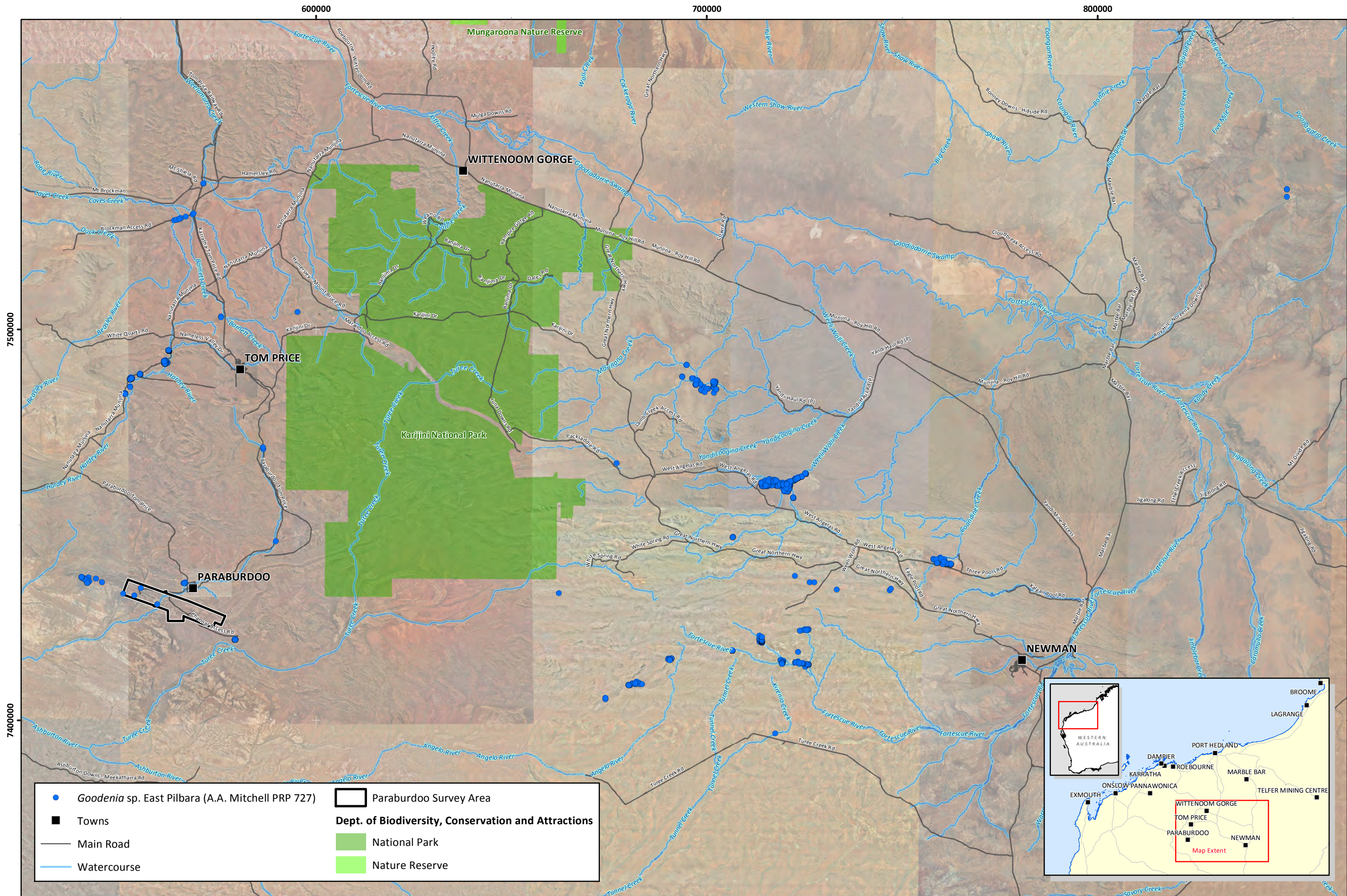
Coordinate System: GDA 1994 MGA Zone 50

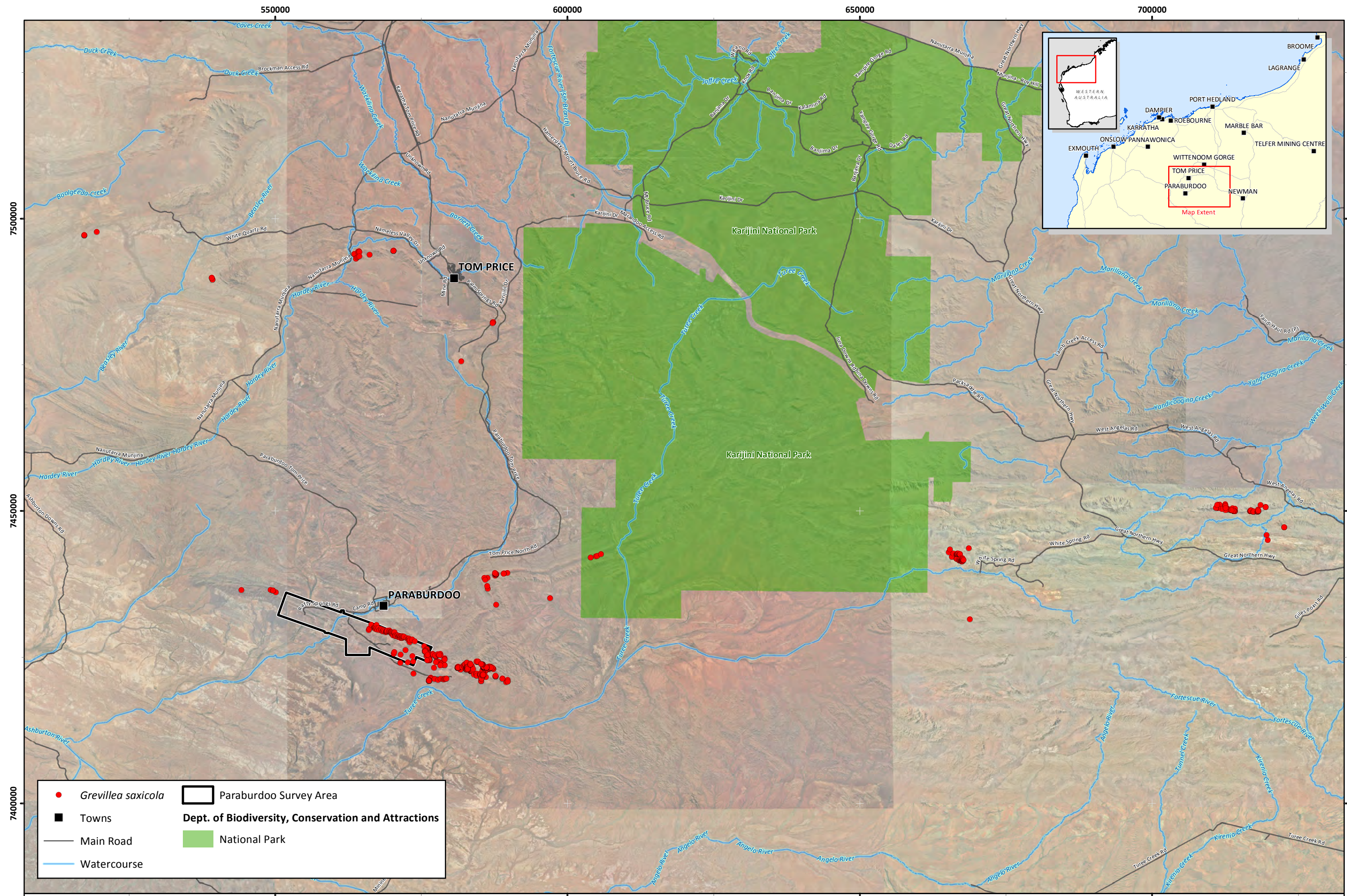
0 5 10 15 20 25 30 35 40 45 50 Km

Date: 14-12-2018

astron
delivering environmental intelligence™

Figure Ref: 14284-18-BIDR-1RevB_181214_FigO2_Er





Rio Tinto
Greater Paraburadoo - Detailed Flora and Vegetation Survey, April 2018

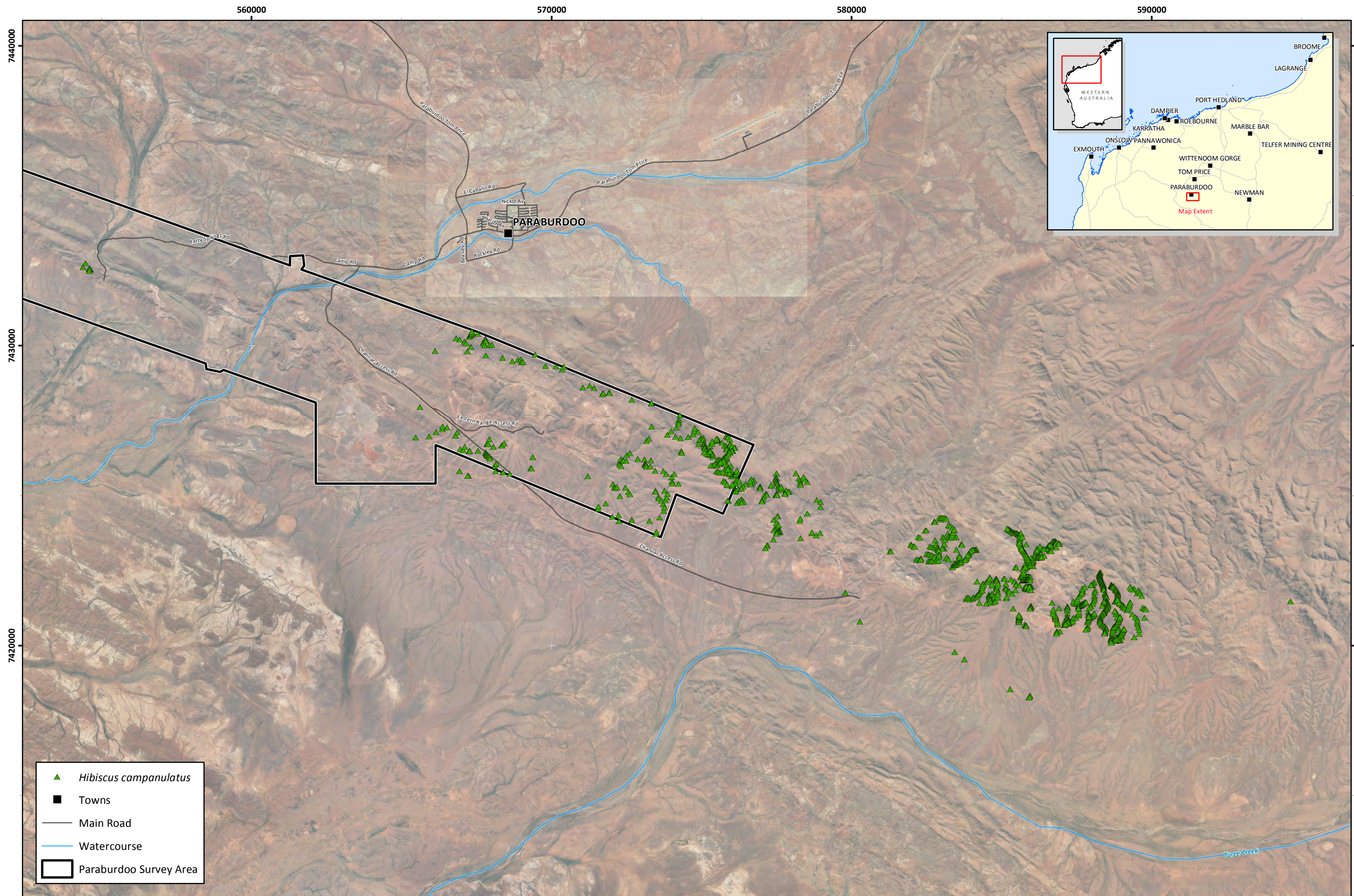
Figure O.4: *Grevillea saxicola* P3 regional locations

Author: B. Eckermann

Drawn: C. Dyde

Date: 14-12-2018

Figure Ref: 14284-18-BIDR-1RevB_181214_FigO4_Grv



Rio Tinto
Greater Paraburadoo - Detailed Flora and Vegetation Survey, April 2018

Figure O.5: *Hibiscus campanulatus* P1 regional locations

Author: B. Eckermann

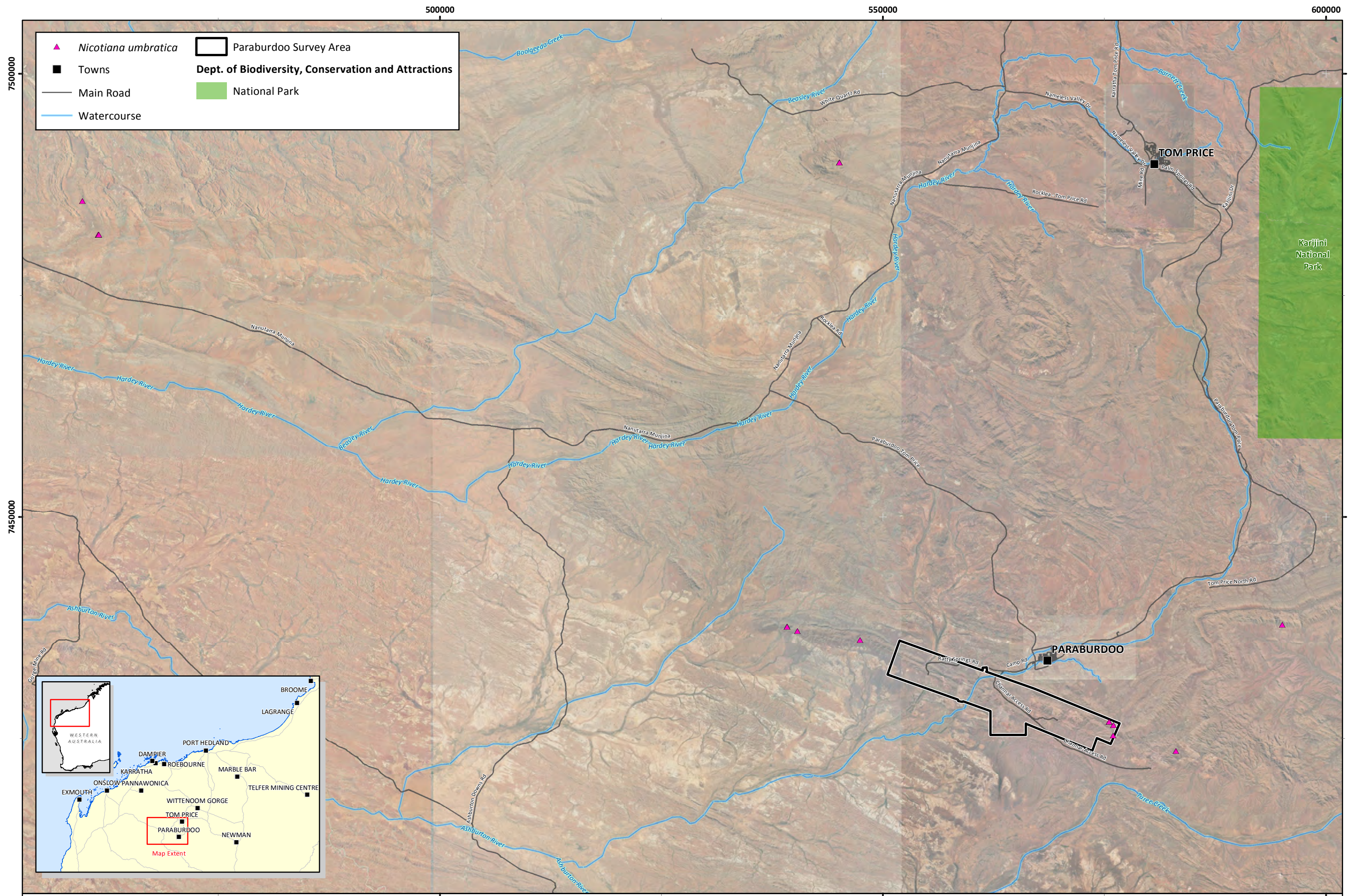
Drawn: C. Dyde

Date: 14-12-2018

Coordinate System: GDA 1994 MGA Zone 50
0 2 4 6 8 10 Km



Figure Ref: 14284-18-BIDR-1RevB_181214_FigO5_Hib



Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure O.6: *Nicotiana umbratica* P3 regional locations

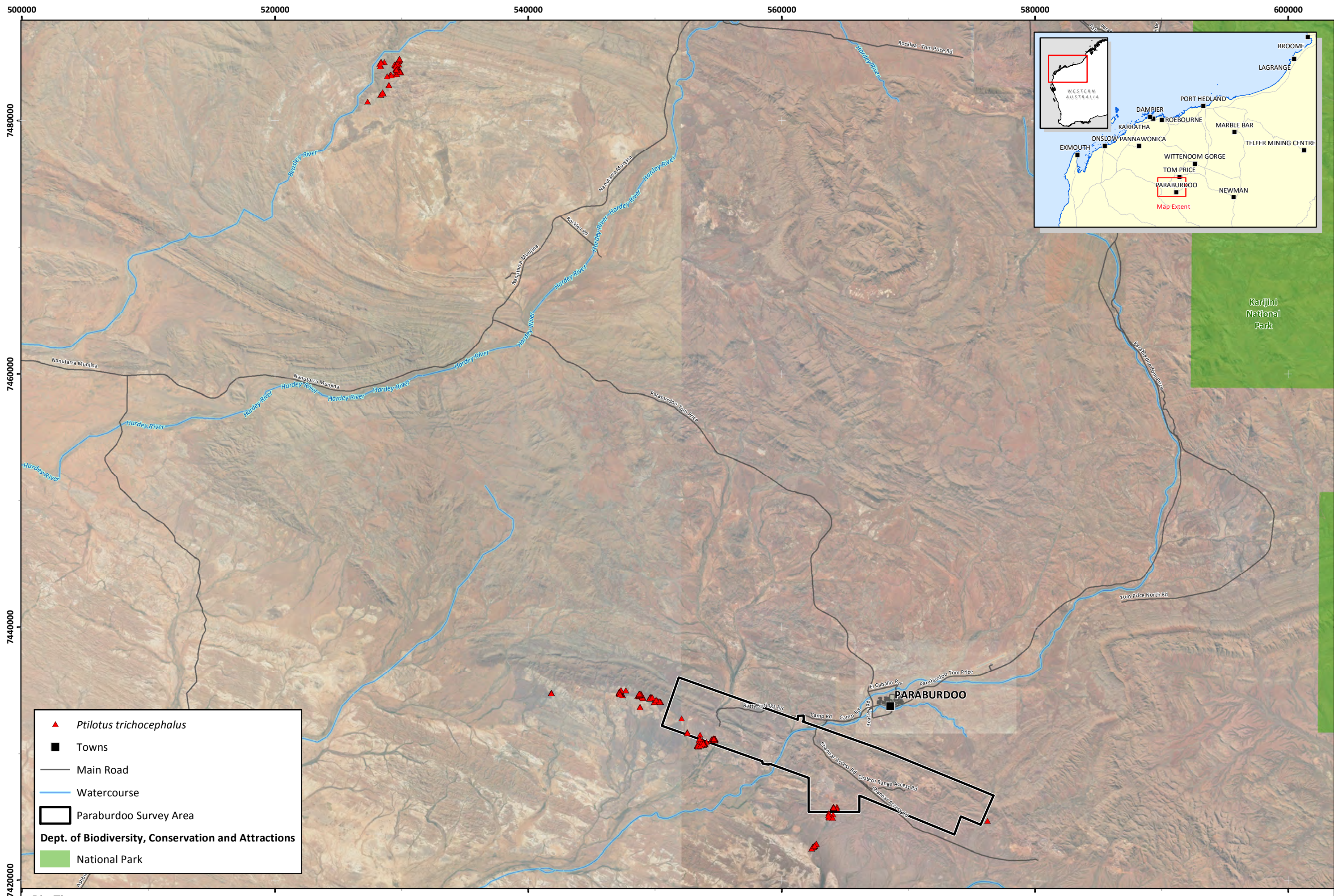
Author: B. Eckermann

Drawn: C. Dyde

Date: 14-12-2018

Figure Ref: 14284-18-BIDR-1RevB_181214_FigO6_Nic





Rio Tinto
Greater Paraburdo - Detailed Flora and Vegetation Survey, April 2018

Figure O.7: *Ptilotus trichocephalus* P4 regional locations

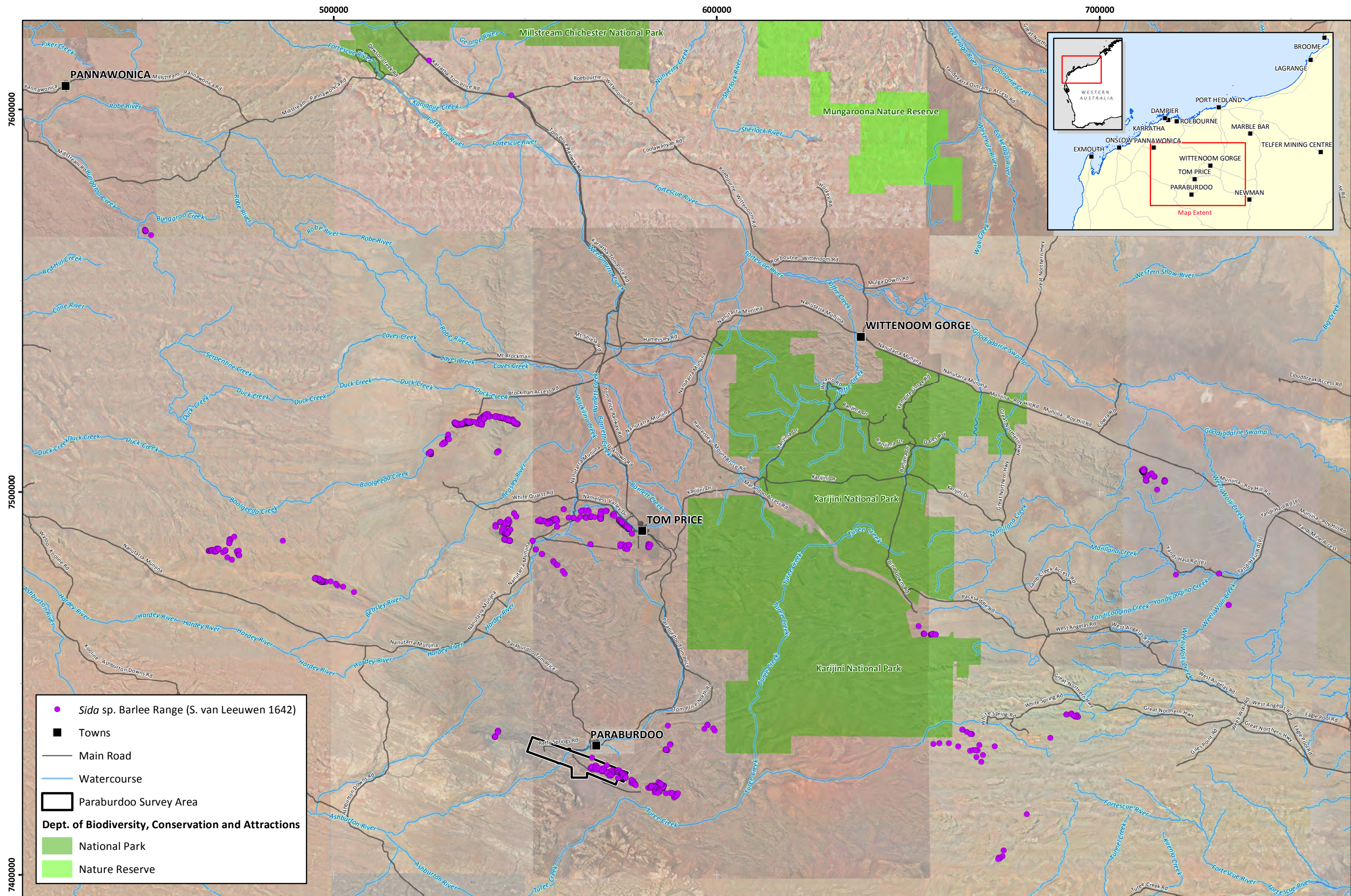
Author: B. Eckermann

Drawn: C. Dyde

Date: 14-12-2018



Figure Ref: 14284-18-BIDR-1RevB_181214_FigO7_Pti



Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure O.8: *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3 regional locations

Author: B. Eckermann

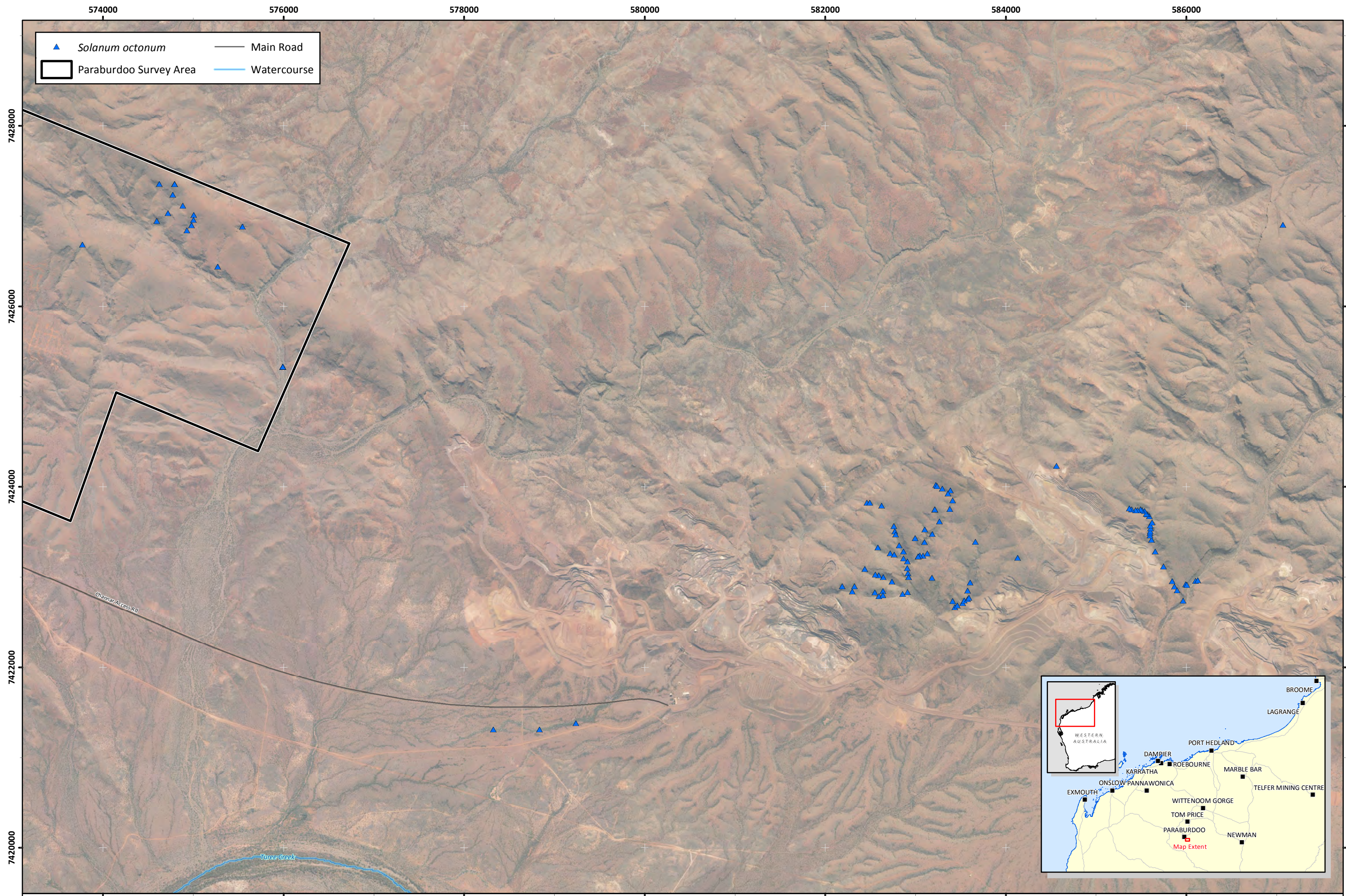
Drawn: C. Dyde

Coordinate System: GDA 1994 MGA Zone 50
0 10 20 30 40 50 Km

Date: 14-12-2018



Figure Ref: 14284-18-BIDR-1RevB_181214_FigO8_Sid



Rio Tinto
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure O.9: *Solanum octonum* P2 regional locations

Author: B. Eckermann

Drawn: C. Dyde

Coordinate System: GDA 1994 MGA Zone 50
0 1 2 3 Km

Date: 14-12-2018

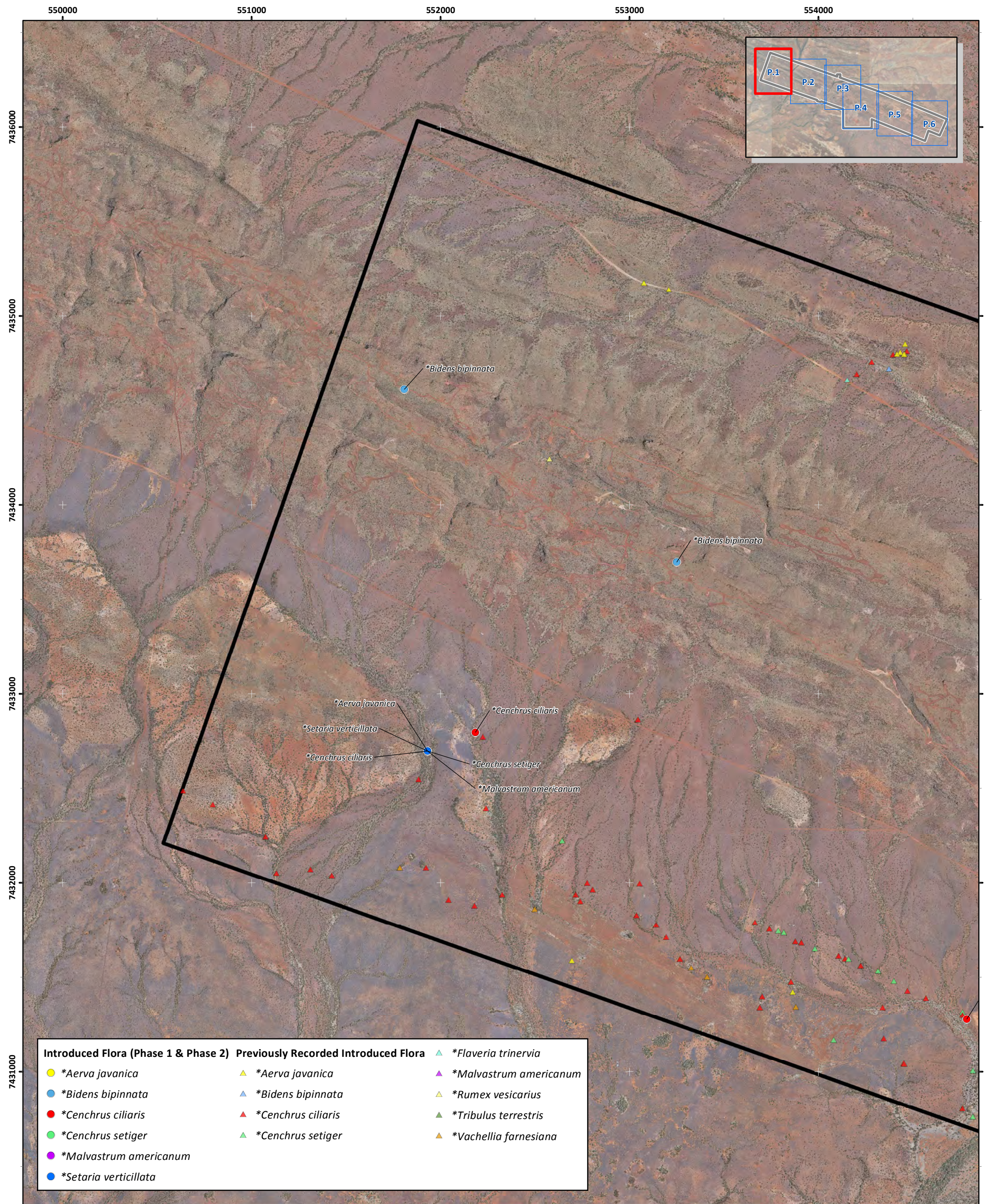


Figure Ref: 14284-18-BIDR-1RevB_181214_FigO9_Sol

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Appendix P: Introduced Flora Species (Weed) Locations and Descriptions

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Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure P.1: Introduced flora species (weed) locations

Author: B. Eckermann

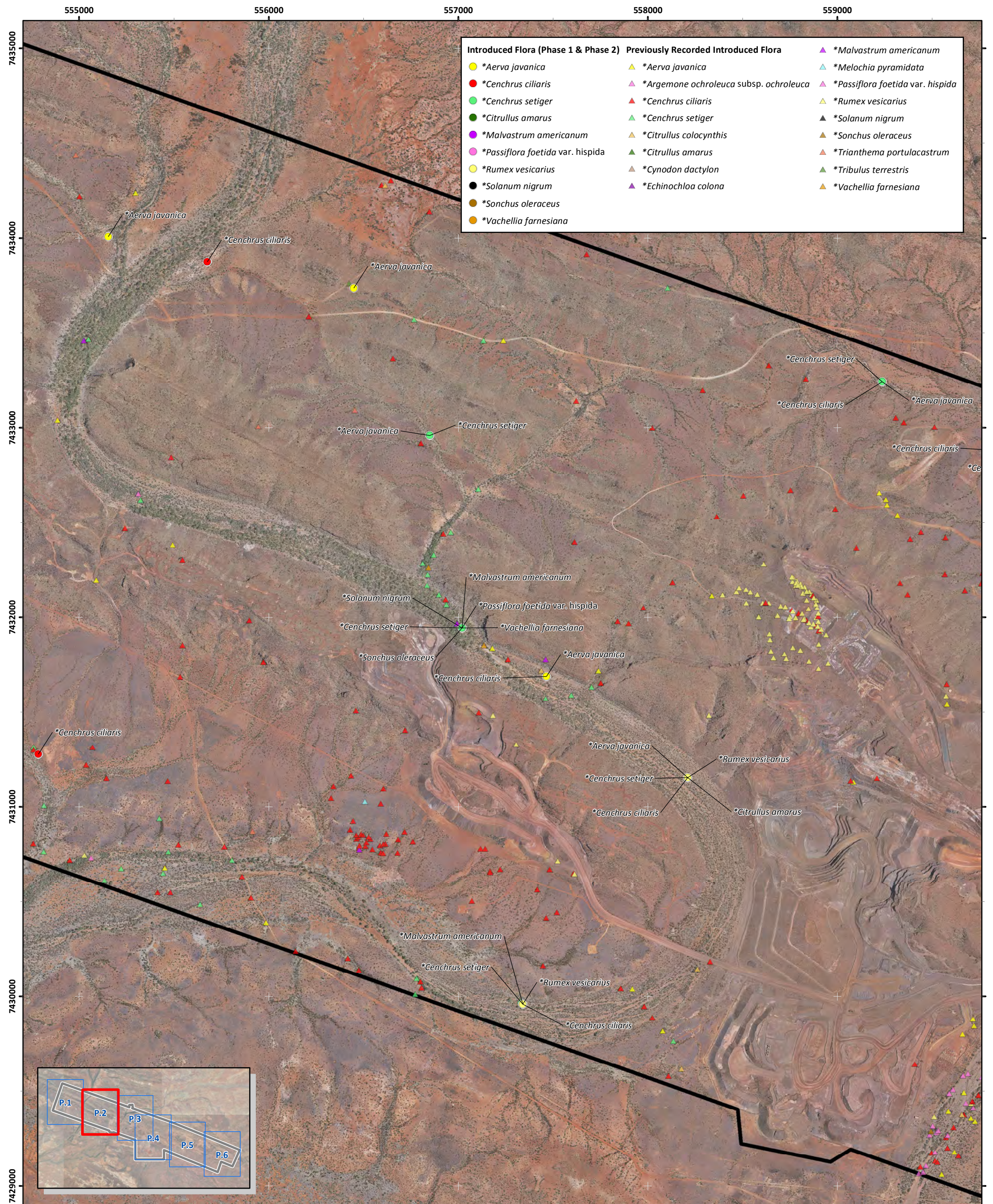
Date: 20-12-2018

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-3RevB_181221_Weeds_FigP

Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

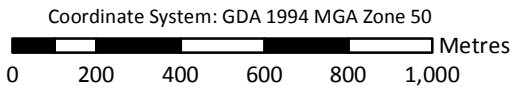
Figure P.2: Introduced flora species (weed) locations

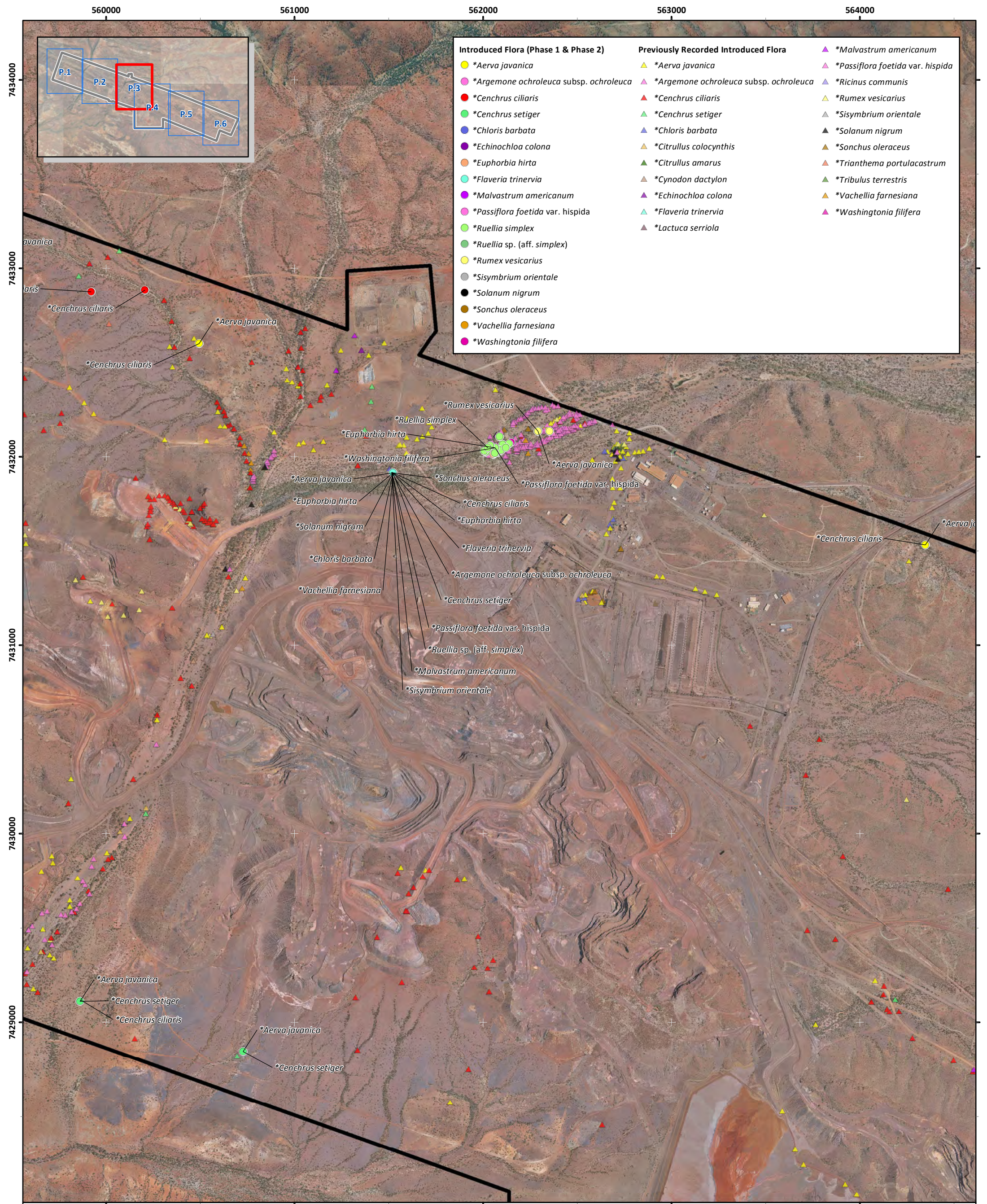
Author: B. Eckermann

Date: 15-01-2019

Drawn: C. Dyde

Figure Ref: 14284-18-BIDR-3RevB_190115_Weeds_FigP



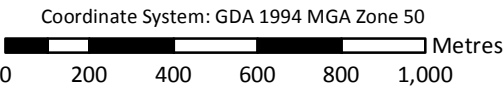


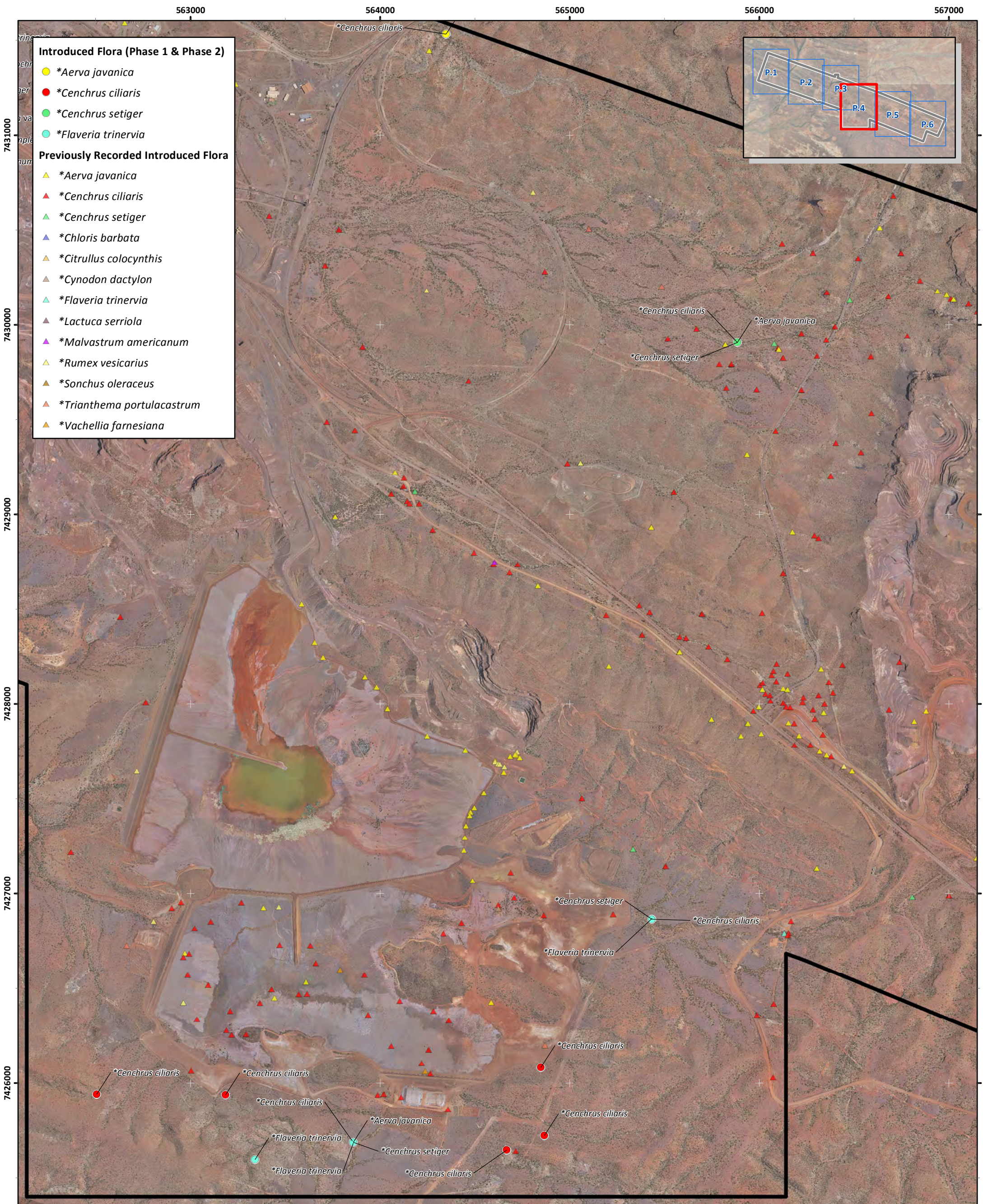
Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure P.3: Introduced flora species (weed) locations



Author: B. Eckermann	Date: 15-01-2019
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-3RevB_190115_Weeds_FigP





Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure P.4: Introduced flora species (weed) locations



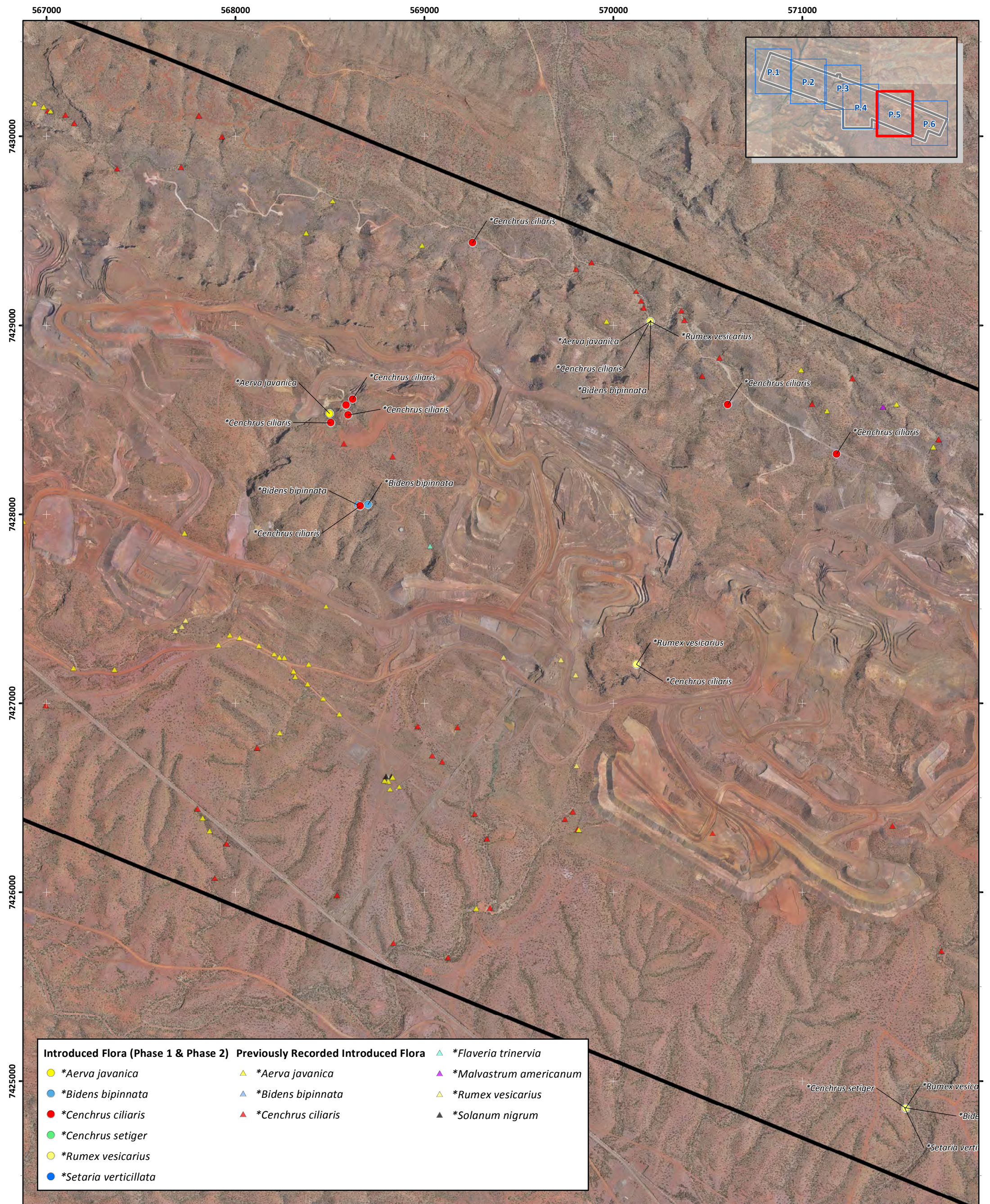
Author: B. Eckermann	Date: 20-12-2018
Drawn: C. Dyde	Figure Ref: 14284-18-BIDR-3RevB_181221_Weeds_FigP

Coordinate System: GDA 1994 MGA Zone 50

02004006008001,000

Metres

N



Rio Tinto Iron Ore
Greater Paraburdoo - Detailed Flora and Vegetation Survey, April 2018

Figure P.5: Introduced flora species (weed) locations

Author: B. Eckermann

Date: 20-12-2018




Drawn: C. Dyde




Figure Ref: 14284-18-BIDR-3RevB_181221_Weeds_FigP




Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres








Table P.1: Weed species recorded in the survey area.




Species	Description ¹	Habitat ¹
<p><i>*Aerva javanica</i> (kapok bush)</p> 	<p>Erect, much-branched perennial, herb, 0.4 m to 1.6 m high. Flowers white, January to October.</p>	<p>Often on sandy soils. Along drainage lines.</p>
<p><i>*Argemone ochroleuca</i> subsp. <i>ochroleuca</i> (Mexican poppy)</p> 	<p>Annual, herb, 0.3 m to 1 m high, spiny, with yellow latex. Flowers white-cream-yellow, February to March or July to November.</p>	<p>Red/white/grey sand, red-brown clay loam. Creek edges, riverbanks, roadsides.</p>
<p><i>*Bidens bipinnata</i> (bipinnate beggartick)</p> 	<p>Erect annual, herb, 0.1 to 0.9(-1.5) m high. Flowers yellow, March to September.</p>	<p>Alluvium, clay, loam over sandstone, limestone. Along rivers and creeks, coastal areas, rocky hillsides.</p>




Species	Description ¹	Habitat ¹
<p><i>*Cenchrus ciliaris</i> (buffel grass)</p> 	<p>Tufted or sometimes stoloniferous perennial, grass-like or herb, 0.2 m to 1.5 m high. Flowers purple, February to October.</p>	<p>White, red or brown sand, stony red loam, black cracking clay.</p>
<p><i>*Cenchrus setiger</i> (birdwood grass)</p> 	<p>Erect, tussocky, stoloniferous perennial, herb or grass-like, to 0.5 m high. Flowers cream-purple, April to May.</p>	<p>Brown sands, red loam, pindan soils. Sand dunes, plains, rangelands, stony hillsides, floodplains.</p>
<p><i>*Chloris barbata</i> (purpletop chloris)</p> 	<p>Annual or perennial (short-lived), grass-like or herb, 0.4 to 0.9(-1.1) m high. Flowers purple, February or April to October.</p>	<p>White or red sand, loam, black clay. Sand dunes, river levees.</p>




Species	Description ¹	Habitat ¹
<p><i>*Citrullus colocynthis</i>²</p> 	<p>Trailing perennial, herb or climber. Flowers yellow, January to October.</p>	<p>Sandy, rocky, stony loam, clay soils, wet soils. In disturbed areas, floodplains.</p>
<p><i>*Citrullus amarus</i></p> 	<p>Trailing annual, herb or climber. Flowers yellow, January to December.</p>	<p>Sandy gravelly soil, loam, clay. Plains, river banks, centres of dry lakes, drainage areas, disturbed areas.</p>
<p><i>*Cynodon dactylon</i> (couch grass)</p> 	<p>Rhizomatous (or stoloniferous), prostrate perennial, grass-like or herb, 0.05 m to 0.3 m high. Flowers green-purple, June to November or February.</p>	<p>Sand, loam, clay.</p>




Species	Description ¹	Habitat ¹
<p><i>*Echinochloa colona</i> (awnless barnyard grass)</p> 	<p>Tufted annual, grass-like or herb, 0.2 to 0.6(-0.9) m high. Flowers green/purple, February to July.</p>	<p>Black sand, black clay. Near watercourses and swamps.</p>
<p><i>*Euphorbia hirta</i> (asthma plant)</p> 	<p>Erect or decumbent, much-branched annual, herb, 0.1 m to 0.8 m high. Flowers yellow-green-white, January to October.</p>	<p>Alluvial soils. Often along watercourses.</p>
<p><i>*Flaveria trinervia</i> (speedy weed)</p> 	<p>Erect annual shrub. Flowers yellow, May to July.</p>	<p>Sandy flat, along watercourses.</p>


Species	Description ¹	Habitat ¹
<p><i>*Lactuca serriola</i> (prickly lettuce)²</p> 	<p>Erect annual or biennial, herb, 0.4 m to 2 m high. Flowers yellow, October to December or January to February.</p>	<p>Roadsides, gardens, cultivated fields, disturbed sites.</p>
<p><i>*Malvastrum americanum</i> (spiked malvastrum)</p> 	<p>Erect perennial, herb or shrub, 0.5 m to 1.3 m high. Flowers yellow-orange, April to July.</p>	<p>Orange/red/yellow sands, gritty alluvial sand, black/brown clay, alluvial cracking clays, limestone, calcrete. Stony ridges and hillsides, floodplains, along drainage lines.</p>
<p><i>*Melochia pyramidata</i>²</p> 	<p>Sprawling to erect annual or perennial, herb or shrub, 0.3 m to 1.5 m high. Flowers white/pink/blue-purple, March to October.</p>	<p>Alluvium, sand, black clay. Along rivers and creeks.</p>

Species	Description ¹	Habitat ¹
<p>* <i>Passiflora foetida</i> var. <i>hispida</i> (stinking passion flower)</p> 	<p>Woody climber (vine with an unpleasant smell), to 9 m high. Flowers cream-white-blue, February to November.</p>	<p>Coastal areas, river and creek banks.</p>
<p>* <i>Phoenix dactylifera</i> (date palm)</p> 	<p>Perennial tree-like monocot (palm), 0.4 m to 8 m high. Flowers July to September.</p>	<p>Edges of permanent pools, watercourses.</p>
<p>* <i>Ricinus communis</i> (castor oil plant)</p> 	<p>Shrub, to 5 m high. Flowers cream-yellow/red, mainly June to September.</p>	<p>Waste grounds.</p>

Species	Description ¹	Habitat ¹
<p><i>*Ruellia simplex</i> (Mexican petunia)</p> 	<p>Erect, rhizomatous perennial herb. Stems glabrous, nodes often ciliate (Royal Botanic Gardens and Domain Trust 2017)</p>	<p>Grows in areas that periodically flood, often near rivers or creeks (Royal Botanic Gardens and Domain Trust 2017)</p>
<p><i>*Rumex vesicarius</i> (ruby dock)</p> 	<p>Erect, stout, fleshy, hollow-stemmed annual, herb, 0.2 m to 1 m high. Flowers red-pink, July to September.</p>	<p>Sandy alluvial soils, gravelly ironstone soils. Along roadsides, in disturbed areas.</p>
<p><i>*Setaria verticillata</i> (whorled pigeon grass)</p> 	<p>Loosely tufted annual, grass-like or herb, 0.1 m to 1.3 m high. Flowers December or January to June.</p>	<p>Sand, clay, loam.</p>

Species	Description ¹	Habitat ¹
<p><i>*Sisymbrium orientale</i> (Indian hedge mustard)</p> 	<p>Erect annual or biennial, herb, 0.1 m to 1 m high. Flowers yellow, March to November.</p>	<p>Disturbed areas.</p>
<p><i>*Solanum nigrum</i> (black berry nightshade)</p> 	<p>Erect perennial, herb or shrub (short-lived), 0.3 m to 1 m high. Flowers white, January to December.</p>	<p>Dampland, along drainage line. Plain, hillslope, disturbed ground. Sand.</p>
<p><i>*Sonchus oleraceus</i> (common sowthistle)</p> 	<p>Erect annual, herb, to 1.5 m high. Flowers yellow, January to December.</p>	<p>Variety of soils. Weed of waste places and disturbed ground.</p>

Species	Description ¹	Habitat ¹
<p><i>*Tribulus terrestris</i> (caltrop)²</p> 	<p>Prostrate annual, herb, plants villous; leaflet pairs 4-7; cocci with distinct divergent, median spines 3 mm to 8 mm long. Flowers yellow, January to December.</p>	<p>Often on sandy soils. Waste places.</p>
<p><i>*Trianthema portulacastrum</i> (giant pigweed)²</p>  <p><i>Trianthema portulacastrum</i> Photos: G. Byrne</p> <p>(Western Australian Herbarium 1998-2018)</p>	<p>Prostrate to decumbent, spreading annual, herb, 0.01 m to 0.2 m high, to 1 m wide. Flowers pink/white, March to September.</p>	<p>Clay, sand. Roadsides, disturbed and cultivated areas.</p>
<p><i>*Vachellia farnesiana</i> (mimosa bush)</p> 	<p>Erect, spreading, thicket-forming, thorny tree or shrub, to 4 m high, bark dark grey, rough; leaves pinnate. Flowers yellow, June to August.</p>	<p>Stony sandy, clay or loam soils, gravel. Low-lying areas, river and creek banks, disturbed sites.</p>

Species	Description ¹	Habitat ¹
<p><i>*Washingtonia filifera</i> (cotton palm)</p> 	<p>Tree-like monocot (palm), 12 m to 25 m high, dense crown of fan-shaped, palmate leaves, old leaves forming "shag" below.</p>	<p>Riverine deltas and floodplains.</p>

¹ – Florabase (Western Australian Herbarium 1998-2018).

² – Species not observed in Phase 1 or Phase 2, but previously recorded within survey area. For project presence see Table P.2.

Table P.2: Locations of weed species recorded in the survey area (GDA94, Zone 50).

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	A	0.5	1	556285	7432410
		0.5	4	555123	7432612
		1	20	555128	7432420
		2	75	555056	7432413
		2	75	555018	7432424
		0.5	2	551944	7432673
		0.5	25	560498	7432750
		1	25	560015	7432967
		0.5	5	556567	7433484
		0.5	1	559311	7433190
		0.5	1	576027	7425219
		0.5	5	569326	7426248
		0.5	20	571448	7428538
		0.5	3	571546	7428480
		0.5	8	569784	7429394
		0.5	10	566053	7429024
		0.5	10	570307	7429026
		0.5	3	561547	7431916
		0.5	2	561536	7431895
		0.1	-	556450	7433736
		0.1	-	557481	7431718
		0.1	-	561523	7431915
		0.1	-	560494	7432602
		0.1	-	551932	7432697
		0.1	-	576018	7425252
		0.1	-	573741	7424229
		0.1	-	570196	7429021
		1	-	562292	7432136
		0.1	-	559237	7433242
		1	25	559724	7429362
		0.5	10	560690	7431031
		0.5	10	559395	7430328
		0.5	3	576260	7426594
		0.5	1	576445	7426626
		0.5	2	559854	7429081
		0.5	1	565901	7429888
		0.5	2	556899	7432887
		1	20	563583	7429339
		1	20	564691	7429640

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	A	0.5	15	564698	7430675
		0.5	1	570233	7427487
		1	10	573490	7427567
		1	50	573961	7427164
		0.5	20	564584	7430746
		0.5	20	564433	7430963
		0.5	20	564160	7431316
		0.5	10	564577	7431582
		0.5	10	564949	7430587
		0.5	1	565157	7430812
		0.5	1	569107	7429523
		2	50	555099	7432646
		0.1	-	560727	7428844
		0.5	-	558211	7431154
		0.1	-	576443	7426670
		0.1	-	575107	7426395
		0.1	-	576063	7426835
		0.1	-	559861	7429111
		0.1	-	565885	7429906
		0.1	-	556850	7432958
		-	-	564348	7431533
		-	-	573750	7427382
	B	-	1	560694	7431290
		-	1	561153	7432082
		-	1	557239	7433457
		-	20	555300	7434239
		-	1	555092	7432196
		-	1	554452	7434796
		-	3	554415	7434798
		-	1	554457	7434850
		-	30	554455	7434798
		-	4	554431	7434806
		-	10	554452	7434796
		-	1	554889	7433039
		-	1	553207	7435140
		-	14	553076	7435176
		-	0	561153	7432082
		-	0	560694	7431290
		-	0	557239	7433457
		-	20	555300	7434239

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	B	-	0	555092	7432196
		-	30	554455	7434798
		-	1	554457	7434850
		-	4	554431	7434806
		-	0	554452	7434796
		-	3	554415	7434798
		-	0	554889	7433039
		-	0	553207	7435140
		-	0	553076	7435176
	C	-	1	561223	7432459
		-	1	562241	7432147
		-	1	561412	7432372
		-	1	561373	7432142
		-	10	561357	7432565
		-	1	561379	7432111
		-	1	561020	7432376
		-	1	560962	7432407
		-	100	560071	7433093
		-	1	559724	7429341
		-	30	557919	7430038
		-	100	559527	7429126
		-	1	557181	7431837
		-	1	559656	7429375
		-	1	559703	7429357
		-	1	557704	7431631
		-	1	559241	7433242
		-	2	558394	7432118
		-	1	557740	7431716
		-	3	556961	7432447
		-	30	555987	7430391
		-	1	558130	7432183
		-	5	558338	7432113
		-	5	558079	7429817
		-	10	557857	7430042
		-	1	557326	7429974
		-	6	555454	7430678
		-	3	555495	7432382
		-	1	553863	7431421
		-	2	553689	7431341
		-	3	552695	7431589

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	D	-	4	568480	7427512
		-	5	568260	7427241
		-	3	568389	7427206
		-	2	568318	7427141
		-	3	566879	7427960
		-	2	566816	7427907
		-	1	567733	7427900
		-	4	567362	7427178
		-	2	567972	7427361
		-	5	567146	7427187
		-	3	566339	7427953
		-	2	566318	7427751
		-	2	566325	7428183
		-	2	566209	7427832
		-	4	566016	7428076
		-	2	566125	7428081
		-	5	566009	7427844
		-	2	565997	7427983
		-	2	565939	7427897
	E	-	0	565101	7430505
		-	0	564260	7431447
		-	0	563492	7431689
		-	0	562372	7427219
		-	0	560774	7432502
		-	0	560190	7431287
		-	0	558261	7430144
		-	0	557106	7432676
		-	0	561504	7431938
		-	0	561102	7432037
		-	0	560468	7432627
		-	0	559549	7429061
		-	0	558322	7431482
		-	0	557438	7431718
		-	0	555445	7430650
	F	0.5	0	573743	7427391
		1	0	573640	7427277
		0.5	0	572958	7428041
		2	0	573079	7427981
		0.5	0	573204	7427791
		2	0	573300	7427779

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	F	1	0	573318	7427817
		1	0	573341	7427854
		0.5	0	573405	7427824
		1	0	573425	7427729
		1	0	573474	7427774
		0.5	0	573480	7427645
		0.5	0	573525	7427557
		5	0	572674	7428200
		5	0	572674	7428200
		0.5	0	572796	7428082
		0.5	0	572286	7426328
		0.5	0	572286	7426328
		0.5	0	571497	7428582
		0.5	0	570993	7428766
		0.5	0	570993	7428766
		0.5	1	571129	7428547
		0.5	0	571130	7428548
		0.5	1	571497	7428582
		0.5	1	571691	7428356
		0.5	0	571692	7428356
		0.5	0	571720	7428395
		0.5	0	571720	7428395
		0.5	0	567799	7426443
		0.5	2	567799	7426443
		0.5	2	567827	7426393
		0.5	0	567828	7426393
		0.5	2	567864	7426326
		0.5	0	567865	7426327
		0.5	3	569816	7426331
		0.5	0	569817	7426332
		0.5	0	568988	7429424
		0.5	0	568988	7429424
		0.5	0	569802	7429298
		0.5	0	569802	7429298
		0.5	0	569964	7429022
		0.5	0	569964	7429022
		0.5	0	569786	7426425
		0.5	0	569331	7426282
		0.5	0	569331	7426282
		0.5	0	569786	7426425

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	F	5	0	569275	7425915
		5	15	569275	7425915
		0.5	0	568235	7426845
		0.5	1	566302	7427133
		0.5	0	566303	7427133
		0.5	0	565748	7427918
		0.5	4	565579	7428276
		0.5	0	565580	7428276
		0.5	0	565748	7427918
		0.5	0	565935	7429315
		0.5	0	565935	7429315
		0.5	0	565698	7428473
		0.5	0	565698	7428473
		0.5	0	568376	7429490
		0.5	0	568376	7429490
		0.5	0	568516	7429658
		0.5	0	568516	7429658
		0.5	0	566938	7430178
		0.5	2	566938	7430177
		0.5	0	566987	7430158
		0.5	1	566987	7430158
		0.5	1	567022	7430133
		0.5	0	567023	7430134
		0.5	0	567148	7430068
		0.5	0	567148	7430068
		5	20	566635	7430511
		5	0	566635	7430511
		0.5	0	566079	7429899
		0.5	0	566079	7429899
		5	20	566102	7429868
		5	0	566103	7429869
		0.5	0	565821	7429895
		0.5	1	565821	7429894
	G	0.1	0	576258	7426628
		-	1	576270	7426829
		-	1	576084	7426807
		-	1	576208	7426607
		20	0	575854	7425262
		-	1	575993	7425327
		-	50	575970	7425419

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	G	-	1	575563	7426816
		-	1	575527	7426178
	H	-	1	566174	7428906
		-	1	566089	7428117
		-	1	566148	7428076
		-	1	565207	7428198
		-	1	565903	7427831
		-	1	564061	7429109
		-	1	563765	7428988
	I	-	50	560146	7430290
		-	0	560568	7431058
		-	20	560271	7430604
		-	5	559816	7430292
		-	0	560616	7431097
		-	50	560352	7431197
		-	1	559085	7431131
		-	100	559576	7431540
		-	0	560740	7431357
		-	3	559918	7431236
		-	0	560537	7431054
		-	1000	560233	7431562
	K	-	0	556871	7432330
	L	-	0	565430	7428930
	M	-	0	565430	7428930
	O	-	20	561564	7429821
		-	0	561565	7429821
	P	-	0	562766	7428006
		-	0	561826	7428577
	R	-	2	564587	7426426
		-	50	563096	7426518
		-	50	562972	7426685
		-	50	562964	7426425
		-	20	563387	7426925
		-	2	563445	7426449
		-	50	563611	7426533
	U	-	0	561902	7429760
		-	0	561697	7429807
	W	1	25	559580	7429200
		1	0	559580	7429200
		0.5	10	560128	7430082

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	W	0.5	5	560212	7430108
		0.5	0	560212	7430108
		1	25	559810	7429649
	X	-	50	564833	7428624
		0.5	0	564186	7429121
		0.5	0	564144	7429069
		-	10	564080	7429221
	Y	-	10	562379	7432190
		-	4	562321	7432142
		-	50	561247	7432565
		-	10	562461	7432237
		-	3	562408	7432205
		-	10	562142	7431975
		-	2	562130	7432079
		-	75	561174	7432380
		-	50	559809	7429615
		-	50	560006	7429899
		-	75	560594	7432240
		-	50	559616	7429178
		-	75	560339	7432584
		-	50	560353	7432478
		-	100	559850	7429765
		-	75	559585	7429394
		-	5	562361	7432179
		-	100	562067	7432356
		-	75	560987	7432397
		-	75	561394	7432539
		-	100	560957	7432469
		-	75	559666	7429494
	Z	1	50	568820	7426545
		1	10	568868	7426559
		1	20	568810	7426588
		1	10	568790	7426593
		1	10	568832	7426608
		1	50	568308	7427169
		1	40	568125	7427306
		1	20	568206	7427261
		1	50	568234	7427242
		1	500	568384	7427103
		1	20	568465	7427024

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	Z	1	10	568551	7426942
		1	1	567913	7427309
		1	20	568024	7427348
		1	20	566355	7427731
		1	1	566488	7427647
		1	20	566153	7427899
		1	2	564548	7427529
		1	10	564250	7427831
		1	15	564450	7427755
		1	1	564607	7427700
		1	2	564687	7427723
		1	20	564721	7427727
		1	20	564712	7427732
		1	10	564737	7427716
		1	5	564653	7427639
		1	1	564498	7427452
		1	1	564478	7427429
		1	2	564474	7427411
		1	1	564454	7427357
		1	1	564448	7427296
		1	1	564443	7427227
		1	10	564041	7427973
		1	100	563588	7428528
		1	15	563656	7428326
		1	10	563701	7428244
		1	10	563922	7428142
		1	50	563983	7428088
		1	10	562806	7432025
		5	60	562882	7432046
		1	10	562851	7432031
		1	10	562828	7432028
		1	4	562541	7431231
		1	5	562544	7431269
		1	5	562582	7431288
		1	20	562630	7431228
		1	50	561477	7432603
		1	5	562954	7431363
		1	1	563128	7431302
		1	2	563178	7431285
		1	2	563240	7431269

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	Z	1	2	562921	7431366
		1	30	562777	7432125
		1	20	562710	7432136
		1	20	562777	7432096
		1	200	562694	7432040
		1	200	562696	7432053
		1	200	562712	7432067
		5	200	562735	7432060
		1	100	562748	7432064
		1	200	562760	7432054
		1	200	562703	7431978
		1	9	562770	7432017
		1	3	562749	7431997
		1	25	562685	7432015
		1	90	562709	7432023
		1	130	562724	7432023
		1	250	562742	7432030
		1	20	562727	7432004
		1	4	562689	7431671
		1	10	562732	7431942
		1	7	562687	7431884
		1	10	562688	7431835
		1	9	562728	7431834
		1	15	562696	7431759
		1	15	562685	7431731
		1	1	562675	7431621
		1	5	562655	7431591
		1	15	562732	7431513
		1	300	562581	7431986
		1	300	562661	7432027
		1	5	562518	7432165
		1	6	562369	7432129
		1	50	562338	7432157
		1	2	564488	7427067
		1	30	561715	7432184
		1	50	561596	7432205
		1	10	561580	7432061
		1	50	561552	7432060
		1	20	561561	7432065
		1	100	561594	7432020

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Aerva javanica</i>	Z	1	50	561677	7432258
		1	30	561023	7432068
		1	100	561729	7432157
		1	40	561710	7432124
		1	20	561679	7432107
		1	20	561650	7432094
		1	20	561596	7432103
		1	40	561049	7432078
		1	50	560893	7432131
		1	50	560535	7432084
		1	20	560607	7432162
		1	20	560630	7432160
		1	50	560313	7432090
		1	10	559935	7432230
		1	50	559886	7432287
		1	5	559807	7432367
		1	30	559713	7429882
		1	50	559659	7429801
		1	50	559719	7429846
		1	50	559317	7432539
		1	50	559220	7432655
		1	100	559255	7432620
		1	50	559261	7432591
	AA	0.1	-	551931.7	7432697
		0.1	-	576017.6	7425252
		0.1	-	573740.8	7424229
		0.1	20	558210.8	7431154
		0.1	30	576443.4	7426670
		0.1	-	575107.5	7426395
		0.1	1	576063.4	7426835
		0.1	5	559861.5	7429111
		0.1	1	565885.4	7429906
		0.1	10	556849.6	7432958
		0.1	3	563859.8	7425688
		0.1	50	570196	7429021
		0.1	3	555895.5	7433907
		0.1	5	555882.7	7433943
<i>*Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	A	0.1	-	561523	7431915
		0.1	-	562292	7432136
		0.5	1	561583	7431918

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	A	0.5	9	561537	7431895
		0.5	7	562567	7432210
	B	-	1	560694	7431290
		-	1	560268	7430474
		-	1	555326	7432618
		-	0	560694	7431290
		-	0	560268	7430474
		-	0	555326	7432618
		-	0	559703	7429357
	C	-	500	562241	7432147
		-	3	557596	7431589
		-	1	555808	7430718
		-	100	559451	7429072
		-	10	555065	7430731
		-	0	560772	7431748
	E	-	0	555313	7432651
		-	0	561504	7431938
		-	0	557438	7431718
		-	0	557438	7431718
	G	-	1	575993	7425327
	I	-	0	560568	7431058
	W	1	100	560100	7429984
		0.5	8	560099	7430055
	Y	-	50	562688	7432170
		-	50	562586	7432186
		-	5	562569	7432179
		-	100	562576	7432183
		-	25	562594	7432191
		-	50	562548	7432174
		-	25	562557	7432181
		-	5	562472	7432225
		-	9	562486	7432199
		-	100	562506	7432165
		-	50	562478	7432161
		-	20	562502	7432209
		-	15	562466	7432136
		-	25	562558	7432174
		-	100	562514	7432158
		-	100	562524	7432166
		-	250	562346	7432251
		-	25	562368	7432277

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Y	-	25	562379	7432267
		-	5	562426	7432127
		-	50	562365	7432108
		-	250	562364	7432106
		-	50	562385	7432150
		-	500	562406	7432126
		-	15	562360	7432177
		-	250	562404	7432117
		-	20	562431	7432207
		-	5	562395	7432153
		-	50	562421	7432151
		-	10	562378	7432189
		-	10	562409	7432206
		-	50	562438	7432132
		-	20	562366	7432162
		-	1	562342	7432093
		-	3	562341	7432138
		-	25	562285	7432067
		-	100	562181	7432028
		-	50	562309	7432131
		-	75	562252	7432071
		-	25	562251	7432062
		-	20	562300	7432020
		-	75	562183	7432068
		-	100	562209	7432058
		-	50	562210	7432102
		-	6	562318	7432135
		-	75	562276	7432060
		-	10	562194	7432069
		-	250	562200	7432052
		-	3	562223	7432217
		-	3	562229	7432224
		-	50	562312	7432263
		-	20	562240	7432236
		-	50	562189	7432198
		-	75	562170	7432185
		-	20	562451	7432224
		-	15	562533	7432167
		-	10	562496	7432232
		-	20	562456	7432136

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Y	-	10	562475	7432227
		-	250	562455	7432149
		-	25	562477	7432141
		-	50	562505	7432223
		-	50	562515	7432224
		-	20	562494	7432152
		-	20	562483	7432144
		-	10	562492	7432202
		-	15	562402	7432112
		-	10	562398	7432135
		-	20	562359	7432154
		-	75	562415	7432121
		-	50	562333	7432247
		-	25	562443	7432218
		-	15	562420	7432201
		-	10	562433	7432152
		-	250	562411	7432144
		-	20	562160	7432169
		-	5	562162	7432186
		-	1	562135	7432033
		-	75	562093	7432027
		-	100	562163	7432068
		-	20	562128	7432065
		-	100	562040	7432072
		-	10	562034	7432063
		-	250	562124	7432076
		-	250	562050	7432013
		-	75	562082	7432051
		-	100	562133	7432049
		-	4	562142	7431972
		-	100	562050	7432077
		-	100	559891	7429730
		-	500	559609	7429510
		-	100	559878	7429747
		-	4	560847	7431959
		-	10	560855	7431967
		-	50	560782	7431870
		-	2	560779	7431890
		-	100	560781	7431879
		-	5	560786	7431896

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Y	-	100	562074	7432017
		-	100	562027	7432042
		-	500	562138	7432046
		-	10	562161	7432180
		-	5	562074	7432115
		-	100	562026	7432029
		-	75	562228	7432044
		-	25	562251	7432070
		-	100	562230	7432087
		-	500	562241	7432052
		-	50	562225	7432051
		-	10	562176	7432053
		-	50	562206	7432080
		-	250	562196	7432078
		-	50	562182	7432067
		-	500	562219	7432090
		-	50	562225	7432051
		-	250	562217	7432100
		-	250	562307	7432072
		-	50	562289	7432072
		-	50	562229	7432064
		-	15	560874	7431994
		-	4	560841	7431945
		-	2	560852	7431952
		-	100	560860	7431969
		-	3	560857	7431977
		-	8	560895	7432015
		-	1	560879	7432002
		-	50	559485	7429269
		-	250	562234	7432078
		-	2	560843	7431947
		-	500	559761	7429573
		-	100	559677	7429438
		-	100	559429	7429067
		-	20	559521	7429282
		-	20	559466	7429108
		-	50	559515	7429177
		-	10	559531	7429291
		-	6	559582	7429267
		-	500	559924	7429828

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Y	-	50	559502	7429316
		-	8	559715	7429412
		-	250	559688	7429592
		-	500	559662	7429581
		-	10	562495	7432220
		-	20	562565	7432183
		-	25	562541	7432170
		-	50	562503	7432156
		-	250	562494	7432161
		-	500	559936	7429867
		-	25	562398	7432271
		-	250	562402	7432136
		-	250	562389	7432110
		-	10	562461	7432237
		-	50	562467	7432153
		-	75	562451	7432137
		-	5	562427	7432211
		-	50	562376	7432121
		-	15	562410	7432188
		-	250	562482	7432163
		-	3	562386	7432175
		-	20	562442	7432151
		-	15	562461	7432224
		-	20	562380	7432169
		-	25	562202	7432206
		-	50	562266	7432257
		-	10	562341	7432168
		-	10	562251	7432054
		-	100	562279	7432256
		-	75	562291	7432061
		-	100	562296	7432260
		-	20	562327	7432143
		-	5	562338	7432091
		-	250	562326	7432080
		-	10	562316	7432087
		-	5	562258	7432250
		-	100	562331	7432086
		-	50	562246	7432053
		-	8	562330	7432263
		-	250	562227	7432054

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Y	-	100	562256	7432066
		-	25	562327	7432080
		-	75	562353	7432101
		-	25	562198	7432046
		-	1	562217	7432092
		-	25	562141	7432081
		-	100	562215	7432051
		-	50	562203	7432117
		-	20	562172	7432098
		-	250	562185	7432048
		-	75	562135	7432079
		-	20	562138	7432030
		-	50	562184	7432038
		-	250	562176	7432041
		-	50	562072	7432065
		-	2	562126	7432002
		-	100	562032	7432009
		-	50	562020	7432047
		-	50	562104	7432059
		-	20	562120	7432007
		-	100	562036	7432051
		-	10	562038	7432107
		-	20	562119	7432003
		-	100	562051	7432055
		-	15	562097	7432133
		-	50	562072	7432055
		-	50	562021	7432039
		-	3	560887	7432012
		-	100	560777	7431879
		-	20	560876	7431999
		-	50	560893	7432034
		-	10	560782	7431883
		-	2	560781	7431893
		-	1000	559589	7429488
		-	500	559785	7429569
		-	500	559915	7429681
		-	250	559863	7429630
		-	100	559818	7429587
		-	500	559845	7429603
	Z	1	6	562712	7432029
		1	2	562490	7432168

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Bidens bipinnata</i>	A	0.5	25	551827	7434574
		0.5	4	571580	7424833
		0.5	5	565880	7426423
		0.5	3	570576	7429039
		0.5	5	571446	7428526
		0.1	-	551809	7434611
		0.1	-	572669	7424260
		0.1	-	571548	7424858
		-	1	554372	7434722
		-	1	552577	7434244
		-	2	552577	7434244
		-	0	554372	7434722
		-	0	552577	7434244
	F	0.5	0	572674	7424176
		0.5	0	572674	7424176
		0.5	0	567892	7426073
		0.5	0	567892	7426073
	AA	0.1	50	551809	7434611
		0.1	20	572668.9	7424260
		0.1	8	571547.6	7424858
		0.1	20	553251.7	7433698
		0.1	5	570196	7429021
		0.1	10	562088.1	7432107
		0.1	20	562065.3	7432048
<i>*Cenchrus ciliaris</i>	A	30	100	556490	7432335
		30	250	551194	7432293
		1	25	551922	7432631
		1	75	560493	7432751
		5	75	559976	7432971
		5	100	561988	7429607
		60	500	559323	7433201
		1	50	569336	7426311
		5	75	565448	7426819
		2	100	570290	7429003
		0.5	8	570636	7429133
		0.5	6	570603	7428561
		50	250	556832	7432209
		1	50	557714	7431671
		1	25	557769	7431755
		0.5	25	557839	7431972

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	A	0.5	10	561579	7431918
		60	-	554785	7431278
		28	-	557481	7431718
		1	-	561523	7431915
		0.1	-	560494	7432602
		7	-	551932	7432697
		24	-	576018	7425252
		3	-	565433	7426865
		0.1	-	573741	7424229
		0.1	-	564867	7425723
		0.1	-	570580	7428540
		0.1	-	564669	7425647
		2	-	570196	7429021
		50	-	560540	7432348
		35	-	562292	7432136
		0.1	-	552185	7432796
		0.1	-	559921	7432876
		45	-	559237	7433242
		7	25	559396	7430324
		0.5	50	570139	7427201
		10	50	567103	7427616
		3	50	575718	7426050
		20	500	557371	7429923
		30	250	559856	7429083
		1	20	564698	7429644
		2	100	564237	7430861
		10	100	559652	7430295
		1	100	573946	7427159
		0.5	10	564584	7430749
		0.5	100	564951	7430587
		10	250	555108	7432641
		0.5	1	566864	7427193
		0.5	-	563860	7425688
		40	-	558211	7431154
		20	-	575923	7426348
		0.1	-	576443	7426670
		0.1	-	575107	7426395
		0.1	-	562505	7425941
		35	-	559861	7429111
		0.5	-	565885	7429906

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
*Cenchrus ciliaris	A	3	-	556850	7432958
		1	-	570123	7427205
		20	-	557341	7429959
		-	-	564348	7431533
		-	-	573756	7424227
		-	-	574633	7426896
	B	-	1	560824	7431754
		-	1	561153	7432082
		-	1	555326	7432618
		-	1	561336	7431955
		-	1	558328	7430183
		-	1	555326	7432618
		-	1	554452	7434796
		-	1	554394	7434794
		-	1	554467	7434813
		-	1	554202	7434692
		-	1	554452	7434796
		-	1	554281	7434757
		-	1	553045	7432864
		-	1	555052	7433465
		-	1	555052	7433465
		-	1	555004	7434221
		-	1	553045	7432864
		-	1	552577	7434244
	C	-	1	561320	7432642
		-	1	561373	7432142
		-	1	561223	7432459
		-	1	561020	7432376
		-	1	560445	7432523
		-	1	561412	7432372
		-	1	561407	7432294
		-	1	561379	7432111
		-	1	559857	7432961
		-	1	559920	7432877
		-	1	560310	7432830
		-	1	560071	7433093
		-	1	558079	7429817
		-	1	557704	7431631
		-	1	557596	7431589
		-	1	557137	7431852

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	C	-	1	555987	7430391
		-	1	556961	7432447
		-	1	558288	7433196
		-	1	557326	7429974
		-	1	555808	7430718
		-	1	555534	7431684
		-	1	556899	7432119
		-	1	556934	7432093
		-	1	559656	7429375
		-	1	555469	7431136
		-	1	562241	7432147
		-	1	561357	7432565
		-	1	560010	7433060
		-	1	559913	7433027
		-	15	559307	7433052
		-	1	559241	7433242
		-	3	559350	7433027
		-	1	559511	7433001
		-	1	559451	7429072
		-	1	559638	7429159
		-	1	559527	7429126
		-	2	558338	7432113
		-	20	557976	7432049
		-	1	558023	7429888
		-	50	558104	7433737
		-	1	558023	7432997
		-	1	558833	7433258
		-	1	557133	7433458
		-	20	556767	7433570
		-	1	558638	7433328
		-	1	557461	7431571
		-	1	556836	7432168
		-	1	556939	7432068
		-	1	556782	7430093
		-	1	555861	7430631
		-	1	555767	7430788
		-	1	556143	7430238
		-	1	555908	7430520
		-	1	557981	7429947
		-	1	557857	7430042

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	C	-	1	556921	7432439
		-	1	557841	7431978
		-	50	557899	7431966
		-	100	557752	7431652
		-	1	557263	7431776
		-	1	556839	7432224
		-	1	556814	7432283
		-	1	558130	7432183
		-	1	556849	7434138
		-	1	557158	7434044
		-	1	557070	7434072
		-	1	556807	7430045
		-	1	556773	7430011
		-	1	556801	7430077
		-	1	557448	7430162
		-	1	556476	7430137
		-	1	556418	7430200
		-	15	556645	7434304
		-	1	556656	7433365
		-	1	556212	7433585
		-	1	555483	7430547
		-	1	555472	7430763
		-	1	555454	7430678
		-	1	555639	7430485
		-	1	555526	7430799
		-	1	555547	7432303
		-	1	555146	7431151
		-	1	555039	7431221
		-	1	555425	7430940
		-	1	555223	7430674
		-	1	555416	7430548
		-	10	554450	7431044
		-	3	554453	7431041
		-	1	554815	7430762
		-	1	554761	7431316
		-	1	554760	7430805
		-	1	554953	7430719
		-	1	554469	7431427
		-	1	554567	7431390
		-	1	554158	7431597

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	C	-	1	554141	7431598
		-	1	554314	7431533
		-	1	554223	7431562
		-	1	554344	7431176
		-	1	554106	7431613
		-	1	554398	7431479
		-	1	553786	7431746
		-	1	553880	7431344
		-	1	553908	7431683
		-	1	553981	7431652
		-	1	553854	7431475
		-	1	553815	7431737
		-	1	553740	7431756
		-	1	553876	7431690
		-	100	553411	7431501
		-	500	553327	7431549
		-	20	553194	7431713
		-	1	553053	7431995
		-	1	553664	7431790
		-	200	553267	7431596
		-	1	553689	7431341
		-	1	553141	7431778
		-	1	553037	7431828
		-	1	552643	7432222
		-	1	552327	7431937
		-	100	552739	7431901
		-	10	552805	7431963
		-	1	552499	7431861
		-	2	552776	7431997
		-	1	552715	7431936
		-	1	551885	7432548
		-	100	552180	7431878
		-	1	551786	7432080
		-	1	551924	7432080
		-	1	552224	7432774
		-	1	552242	7432394
		-	10	552043	7431909
		-	1	551075	7432243
		-	5	550640	7432486
		-	1	551426	7432038

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	C	-	1	551313	7432071
		-	1	551133	7432051
		-	50	550797	7432413
	D	-	0	571735	7425689
		-	50	571475	7426352
		-	20	570524	7426313
		-	0	569348	7425918
		-	50	569125	7425654
		-	1	568837	7425730
		-	4	569041	7426723
		-	50	569266	7426415
		-	20	569176	7426874
		-	4	568965	7426879
		-	20	569095	7426691
		-	3	568575	7428373
		-	50	568833	7428306
		-	20	568538	7425983
		-	5	566684	7427969
		-	5	566738	7428220
		-	50	566587	7429832
		-	60	566290	7428888
		-	50	566376	7429201
		-	5	566403	7429375
		-	20	566779	7429941
		-	1	566536	7429326
		-	5	566591	7429533
		-	5	566366	7428115
		-	5	566334	7427839
		-	5	566232	7428034
		-	50	566283	7427969
		-	20	566269	7427784
		-	20	566438	7428204
		-	20	566292	7427920
		-	5	566378	7427723
		-	50	566343	7427999
		-	1	566311	7428046
		-	5	566387	7428060
		-	4	566227	7428006
		-	4	566065	7428152
		-	10	566004	7428099

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	D	-	50	566074	7428173
		-	4	566018	7428111
		-	20	566090	7428210
		-	5	566032	7428053
		-	4	566055	7428046
		-	5	566148	7428159
		-	5	566183	7427897
		-	20	566162	7427981
		-	20	566058	7428016
		-	5	566125	7428004
		-	5	566141	7427983
		-	0	566311	7428874
	E	-	0	565229	7426891
		-	0	565101	7430505
		-	0	562372	7427219
		-	0	564715	7425642
		-	0	561102	7432037
		-	0	560772	7431748
		-	0	560774	7432502
		-	0	560468	7432627
		-	0	559549	7429061
		-	0	555547	7431853
		-	0	560190	7431287
		-	0	555973	7431762
		-	0	555313	7432651
		-	0	557106	7432676
		-	0	561335	7428851
		-	0	561504	7431938
		-	0	560154	7428913
		-	0	558322	7431482
		-	0	557622	7433141
		-	0	557613	7432397
		-	0	558261	7430144
		-	0	557438	7431718
		-	0	555899	7431982
		-	0	557678	7433915
		-	0	556804	7432916
		-	0	556597	7434280
		-	0	555445	7430650
		-	0	555243	7432468

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	E	-	0	555487	7432843
		-	0	555072	7431314
		-	0	554816	7431006
		-	0	554761	7431301
		-	0	554339	7431340
		-	0	555027	7433457
		-	0	553702	7431398
	F	0.5	0	574539	7426852
		5	0	574660	7426882
		0.5	0	573747	7424488
		0.5	0	573747	7424488
		0.5	0	573172	7426826
		0.5	0	573172	7426826
		1	0	573968	7427142
		3	0	573997	7427120
		3	0	574091	7427017
		1	0	574212	7426933
		0.5	0	574304	7426903
		0.5	0	574304	7426903
		0.5	0	574447	7426862
		1	0	572837	7428050
		4	0	572848	7428050
		0.5	0	573190	7427876
		1	0	573285	7427822
		0.5	0	572674	7428200
		0.5	0	572674	7428200
		1	0	572741	7428123
		0.5	0	572286	7426328
		0.5	0	572286	7426328
		0.5	0	572286	7426328
		5	0	572286	7426328
		0.5	0	572286	7426328
		0.5	0	572286	7426328
		5	0	572286	7426328
		0.5	0	572286	7426328
		0.5	0	571050	7428584
		0.5	0	571050	7428584
		0.5	0	571263	7428721
		0.5	0	571263	7428721
		0.5	0	571720	7428395

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	F	0.5	0	571720	7428395
		3	0	570360	7429077
		1	0	570375	7429028
		0.5	0	570470	7428733
		0.5	0	570470	7428733
		0.5	0	570561	7428828
		0.5	0	570561	7428828
		0.5	4	567800	7426440
		0.5	0	567801	7426441
		5	0	567954	7426257
		5	75	567954	7426257
		1	0	569811	7426334
		1	20	569811	7426333
		0.5	0	570121	7429181
		1	0	569802	7429298
		1	0	569802	7429298
		1	0	569884	7429334
		1	0	569884	7429334
		1	0	570147	7429129
		3	0	570160	7429093
		3.5	0	569331	7426282
		4	0	569331	7426282
		1	0	569744	7426387
		0.5	0	569786	7426425
		0.5	0	569786	7426425
		0.5	0	568117	7426763
		0.5	6	568117	7426763
		0.5	0	567892	7426073
		0.5	0	567892	7426073
		0.5	0	566805	7426981
		0.5	0	566805	7426981
		0.5	0	566999	7426988
		0.5	0	566999	7426988
		1	50	566220	7429654
		1	0	566221	7429655
		2	0	566221	7429955
		6	0	566304	7429836
		1	0	566353	7429919
		1	0	566398	7429991
		1	0	566086	7429438

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	F	5	50	565578	7428276
		5	0	565579	7428276
		0.5	0	565732	7428304
		3	0	565832	7428235
		20	0	565549	7429117
		15	0	565549	7429117
		0.5	0	565985	7429657
		0.5	0	565985	7429657
		0.5	0	565698	7428473
		4	0	565193	7428467
		1	0	565382	7428364
		2	0	565422	7428482
		2	0	565580	7428354
		0.5	0	565614	7428348
		0.5	0	565698	7428473
		2	0	565065	7427501
		2	0	565065	7427501
		20	0	565335	7427233
		15	0	565335	7427233
		1	0	565506	7427144
		1	25	565506	7427144
		1	0	567714	7429838
		0.5	0	567808	7430109
		0.5	1	567808	7430108
		0.5	0	567930	7429999
		0.5	0	567930	7429999
		0.5	0	567148	7430068
		0.5	5	567010	7430135
		0.5	0	567010	7430136
		0.5	0	567103	7430112
		0.5	0	567103	7430112
		0.5	0	567148	7430068
		1	0	567376	7429830
		1	0	566681	7430150
		1	0	566707	7430682
		0.5	0	566745	7430377
		0.5	2	566745	7430377
		1	0	566748	7430378
		1	0	566847	7430233
		1	10	566282	7430377

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	F	1	0	566119	7430429
		1	0	566283	7430378
		1	25	566354	7430171
		1	0	566355	7430171
		0.5	0	566520	7430350
		0.5	0	566079	7429899
		0.5	0	566079	7429899
		1	25	566098	7429875
		1	0	566099	7429876
		0.5	8	566124	7429825
		0.5	0	566125	7429825
		1	0	565668	7429978
		0.5	7	565852	7429791
		0.5	0	565853	7429792
	G	60	0	576258	7426628
		-	1	576270	7426829
		5	0	576033	7426493
		-	1000	576208	7426607
		-	500	575897	7425646
		0.1	0	575854	7425262
		-	1	575993	7425327
		-	1	576038	7425358
		-	700	575937	7425462
		-	20	575993	7425626
		-	1	575844	7426242
		-	20	575605	7426175
		-	100	575642	7426162
		-	750	575689	7425983
		0.1	0	575386	7426292
	H	-	500	566089	7428117
		-	1	565825	7429666
		-	1000	565366	7428520
		-	1	565789	7429793
		-	1	565517	7429925
		-	1	563417	7430573
		-	500	564467	7429705
		-	3500	564726	7428737
		-	1	564989	7429269
		-	1	563910	7429881
		-	500	564061	7429109

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	H	-	50	563765	7428988
		-	250	563712	7430312
		-	50	564869	7430281
		-	500	563784	7430502
	I	-	0	560740	7431357
		-	0	560218	7431629
		-	0	560440	7431673
		-	0	560532	7431656
		-	0	560514	7431741
		-	0	560457	7431708
		-	0	560558	7431648
		-	0	560541	7431648
		-	0	560513	7431667
		-	0	560551	7431669
		-	0	560585	7431659
		-	1000	560272	7430631
		-	0	560616	7431097
		-	50	559918	7431236
		-	0	560465	7430916
		-	0	560456	7430786
		-	0	560537	7431054
		-	0	560568	7431639
		-	0	560222	7431641
		-	0	560237	7431723
		-	0	560393	7431723
		-	0	560524	7431660
		-	0	560449	7431645
		-	0	560500	7431728
		-	0	560236	7431711
		-	50	559840	7431346
		-	0	560258	7431775
		-	0	560452	7431641
		-	100	560159	7431886
		-	100	559801	7430161
		-	0	560446	7431780
		-	0	560438	7431662
		-	0	560435	7431654
		-	0	560377	7431730
		-	100	560034	7431219
		-	0	560370	7431738

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
* <i>Cenchrus ciliaris</i>	I	-	0	560236	7431775
		-	100	560146	7430290
		-	100	560352	7431197
		-	0	560522	7431752
		-	0	560508	7431669
		-	0	560650	7431364
		-	0	560570	7431643
		-	0	560397	7430825
		-	0	560313	7431795
		-	0	560355	7431756
		-	0	560335	7431780
		-	0	560284	7431795
		-	0	560330	7431788
		-	0	560466	7431630
		-	0	560418	7431706
		-	0	560396	7431754
		-	0	560367	7431743
		-	0	560456	7431710
		-	0	560364	7431749
		-	0	560410	7431717
		-	0	560355	7431758
		-	0	560340	7431767
		-	0	560443	7431669
		-	0	560239	7431736
		-	1000	560233	7431562
		-	0	560226	7431790
		-	2	559880	7431362
		-	0	560229	7431688
		-	2	559575	7431647
		-	500	559208	7431152
		-	50	559407	7429643
		-	100	559069	7431137
	J	-	0	558109	7429580
	K	-	0	556871	7432330
	L	-	0	566014	7428477
		-	0	566126	7428688
		-	0	565057	7429272
		-	0	565430	7428930
		-	0	561864	7429755
		-	0	563869	7429440

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	L	-	0	561715	7429807
	M	-	0	566014	7428477
		-	0	565057	7429272
		-	0	565430	7428930
		-	0	563869	7429440
		-	0	566126	7428688
	N	-	0	556436	7431165
		-	0	557169	7430660
		-	0	557609	7430649
		-	0	556592	7431016
		-	0	556718	7430869
		-	0	556446	7430926
		-	0	556330	7431045
		-	0	556680	7430757
		-	0	556461	7431506
		-	0	557525	7430714
		-	0	557417	7430563
		-	0	557464	7430415
		-	0	556720	7431405
		-	0	557109	7431496
		-	0	557306	7431329
		-	0	556617	7430803
		-	0	556593	7430758
		-	0	556464	7430831
		-	0	556511	7430791
		-	0	557521	7430444
		-	0	557221	7430670
		-	0	557073	7430503
		-	0	557118	7430778
		-	0	557142	7430778
		-	0	557168	7430655
		-	0	556762	7430816
		-	0	557483	7430670
		-	0	556548	7430775
		-	0	556537	7430830
		-	0	556478	7430782
		-	0	556529	7430841
		-	0	556500	7430851
		-	0	556621	7430858
		-	0	556472	7430841

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	N	-	0	556431	7430880
		-	0	556342	7431108
		-	0	556683	7430826
		-	0	556588	7430796
		-	0	556463	7430851
		-	0	556516	7430811
		-	0	556479	7430794
		-	0	556606	7430802
		-	0	556488	7430857
		-	0	556604	7430755
		-	0	556606	7431096
	O	-	0	561633	7429715
		-	100	561975	7429456
		-	0	562054	7429330
		-	0	561607	7429683
		-	0	561438	7429450
		-	0	561598	7429590
		-	0	562033	7429162
		-	0	561570	7429211
		-	0	562026	7429286
		-	0	561591	7429592
		-	0	561954	7429291
	P	-	0	562631	7428457
		-	0	562766	7428006
		-	0	561923	7428750
		-	0	561325	7429132
	Q	-	2	559369	7432119
		-	0	558836	7431983
		-	2	559671	7432140
		-	0	559382	7432411
		-	0	559569	7432419
		-	0	559567	7432225
		-	0	559758	7432177
		-	0	559765	7432233
		-	2	559440	7432448
		-	0	558795	7432019
		-	0	559099	7432366
		-	0	558759	7432038
		-	0	558988	7432571
		-	0	558871	7432114

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	Q	-	0	558899	7432003
		-	0	559330	7432181
		-	2	558890	7431956
		-	0	558901	7431929
		-	0	558621	7432076
		-	0	558363	7432530
		-	2	558752	7432669
		-	0	558504	7432641
	R	-	20	564283	7426380
		-	100	564864	7426886
		-	100	564335	7426789
		-	50	564624	7426940
		-	100	564431	7426847
		-	20	564690	7427110
		-	10	564708	7426977
		-	20	564363	7426331
		-	1000	564060	7426196
		-	100	564266	7426049
		-	20	564359	7425863
		-	50	564112	7425926
		-	50	564257	7426177
		-	1000	564220	7426105
		-	20	563988	7425938
		-	50	564020	7425943
		-	60	563192	7426279
		-	20	563211	7426380
		-	1000	563219	7426255
		-	100	562987	7426570
		-	20	563023	7426817
		-	100	562995	7426682
		-	50	563036	7426338
		-	50	562807	7426854
		-	20	562952	7426953
		-	100	563096	7426518
		-	50	562965	7426663
		-	30	563005	7426064
		-	1	562904	7426923
		-	50	563295	7426258
		-	20	563617	7426470
		-	100	563271	7426951

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	R	-	20	563369	7426423
		-	50	563634	7426725
		-	20	563573	7426468
		-	100	563663	7426631
		-	50	563918	7426571
		-	100	563472	7426727
		-	100	563430	7426494
		-	100	564105	7426433
		-	100	563939	7426361
		-	1000	563110	7426853
	S	-	0	569031	7427832
	U	-	0	561549	7429792
		-	0	561681	7429772
	V	-	20	566166	7426856
		-	200	566153	7426790
		-	0	566153	7426790
		-	5	566075	7426418
		-	0	566150	7426780
	W	2	100	559514	7429132
		1	10	559580	7429200
		0.5	0	559580	7429200
		1	25	560212	7430108
		1	0	560212	7430108
		1	75	560012	7429865
		2	75	559711	7429447
	X	-	100	566185	7427784
		6	0	565987	7426360
		-	50	566073	7426029
		-	100	565968	7427963
		-	100	564683	7428694
		-	75	564496	7428797
		-	100	564599	7428737
		35	0	564186	7429121
		5	0	564144	7429069
		-	100	564206	7429057
		-	100	564127	7429192
		-	100	564124	7429148
		-	100	564157	7429056
		-	250	564278	7428916
		-	75	563721	7429488

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	Y	-	250	562295	7432043
		-	20	560969	7432562
		-	100	562405	7432184
		-	30	561034	7432321
		-	30	561085	7432273
		-	20	561196	7432333
		-	20	560634	7432220
		-	30	561137	7432301
		-	30	561057	7432682
		-	30	561141	7432321
		-	20	560626	7432242
		-	20	561037	7432577
		-	30	561034	7432662
		-	20	559985	7429815
		-	20	560747	7431979
		-	30	560766	7431836
		-	30	560679	7432147
		-	30	560660	7432170
		-	30	560646	7432164
		-	30	560600	7432264
		-	30	560711	7432067
		-	30	561019	7432477
		-	20	559832	7429585
		-	20	559909	7429697
		-	30	559743	7429479
		-	30	559572	7429257
		-	30	559612	7429308
		-	20	559496	7429175
		-	20	559436	7429101
		-	30	559666	7429375
		-	20	560032	7429875
		-	30	560364	7432582
		-	100	562540	7432178
		-	50	562480	7432196
		-	50	562208	7432109
		-	30	561031	7432387
		-	30	560767	7431916
		-	30	560712	7432102
		-	30	560736	7432020
		-	30	560590	7432290

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus ciliaris</i>	Y	-	20	560349	7432721
		-	20	561044	7432459
	AA	7	-	551931.7	7432697
		0.1	5	574251.8	7425744
		0.1	10	571547.6	7424858
		24	1000	576017.6	7425252
		0.1	-	565433.4	7426865
		0.1	-	573740.8	7424229
		0.1	-	564866.9	7425723
		0.1	8	570604.9	7428581
		30	1800	558210.8	7431154
		0.1	30	564668.7	7425647
		0.1	-	571180.9	7428320
		15	800	575922.7	7426348
		0.1	2	576443.4	7426670
		1.5	-	575107.5	7426395
		0.1	7	564847.9	7426083
		0.1	12	562505.5	7425941
		0.1	-	563186	7425938
		7	400	565885.4	7429906
		0.1	1	569255.3	7429437
		8	500	556849.6	7432958
		0.5	200	563859.8	7425688
		8	2000	570196	7429021
		0.1	5	562039.9	7432060
		0.1	10	556076.2	7433830
		0.1	4	556057.2	7433790
		1	-	556043.8	7433789
		0.1	-	556023.6	7433780
		60	500	555932.7	7433742
<i>*Cenchrus setiger</i>	A	3	20	557408	7431759
		50	100	556795	7432196
		0.5	5	551923	7432637
		0.5	5	559323	7433204
		0.5	3	571564	7424833
		2	50	571589	7424964
		3	50	565447	7426822
		0.5	10	570289	7429001
		0.5	50	556996	7431905
		1	50	557805	7431855

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus setiger</i>	A	0.5	10	557895	7432083
		0.5	10	561550	7431910
		0.5	-	557020	7431944
		1	-	561523	7431915
		1	-	551932	7432697
		0.1	-	571548	7424858
		5	-	576018	7425252
		2	-	565433	7426865
		8	-	562292	7432136
		1	-	559237	7433242
		2	50	567091	7427290
		2	50	557369	7429913
		80	250	557342	7429727
		0.5	20	559856	7429084
		20	100	560041	7429102
		0.5	25	556901	7432888
		1	20	564988	7430204
		0.5	100	559655	7430296
		20	500	566984	7427360
		5	250	567080	7427521
		0.5	100	564159	7431317
		0.5	100	565175	7431170
		0.1	-	560727	7428844
		0.1	-	563860	7425688
		1	-	558211	7431154
		1	-	559861	7429111
		1	-	556850	7432958
		2	-	557341	7429959
		-	-	564348	7431533
	B	-	1	555326	7432618
		-	1	555326	7432618
		-	1	554281	7434757
		-	1	555052	7433465
		-	1	555052	7433465
	C	-	1	561357	7432565
		-	1	561320	7432642
		-	1	561223	7432459
		-	1	560310	7432830
		-	1	559913	7433027
		-	1	561379	7432111

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus setiger</i>	C	-	1	559857	7432961
		-	1	559511	7433001
		-	1	559656	7429375
		-	1	559638	7429159
		-	1	555767	7430788
		-	1	560071	7433093
		-	1	559527	7429126
		-	1	558023	7432997
		-	1	557841	7431978
		-	1	557263	7431776
		-	1	556934	7432093
		-	1	557137	7431852
		-	1	558023	7429888
		-	1	553740	7431756
		-	1	554223	7431562
		-	1	562241	7432147
		-	1	561412	7432372
		-	1	561373	7432142
		-	1	561407	7432294
		-	1	560010	7433060
		-	1	559241	7433242
		-	1	557704	7431631
		-	1	557857	7430042
		-	1	558079	7429817
		-	1	557981	7429947
		-	1	558638	7433328
		-	50	558104	7433737
		-	1	556921	7432439
		-	1	556801	7430077
		-	1	556807	7430045
		-	1	555861	7430631
		-	1	555908	7430520
		-	1	556143	7430238
		-	1	555987	7430391
		-	2	558338	7432113
		-	1	558135	7429765
		-	1	556939	7432068
		-	1	557596	7431589
		-	1	556961	7432447
		-	1	557461	7431571

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus setiger</i>	C	-	1	556836	7432168
		-	1	556814	7432283
		-	1	556899	7432119
		-	1	556839	7432224
		-	1	556849	7434138
		-	1	557133	7433458
		-	1	557158	7434044
		-	1	557070	7434072
		-	1	556782	7430093
		-	1	557326	7429974
		-	1	556773	7430011
		-	1	556418	7430200
		-	20	556767	7433570
		-	1	556212	7433585
		-	1	555483	7430547
		-	1	555472	7430763
		-	1	555639	7430485
		-	1	555526	7430799
		-	1	555808	7430718
		-	1	555146	7431151
		-	1	555039	7431221
		-	1	555425	7430940
		-	1	555416	7430548
		-	1	555223	7430674
		-	1	554760	7430805
		-	1	554953	7430719
		-	1	554761	7431316
		-	1	554815	7430762
		-	1	554469	7431427
		-	1	554567	7431390
		-	1	554141	7431598
		-	1	554106	7431613
		-	1	554314	7431533
		-	1	554158	7431597
		-	1	554398	7431479
		-	1	553908	7431683
		-	1	553854	7431475
		-	1	553786	7431746
		-	1	553981	7431652
		-	1	553876	7431690

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus setiger</i>	C	-	1	553815	7431737
		-	1	553037	7431828
		-	1	553664	7431790
		-	1	553141	7431778
		-	10	552805	7431963
		-	1	552643	7432222
		-	1	552715	7431936
		-	1	552242	7432394
		-	1	551133	7432051
	E	-	0	560697	7428819
		-	0	561504	7431938
		-	0	559549	7429061
		-	0	557106	7432676
		-	0	556994	7431965
		-	0	556804	7432916
		-	0	555445	7430650
		-	0	555135	7430612
		-	0	554816	7431006
		-	0	554080	7431168
		-	0	555027	7433457
	F	0.5	0	566805	7426981
		0.5	0	566805	7426981
		0.5	0	565335	7427233
		0.5	0	565335	7427233
		0.5	0	566079	7429899
		0.5	0	566079	7429899
		5	0	566476	7430130
		5	50	566476	7430130
	G	-	1	576270	7426829
		5	0	576258	7426628
		-	100	576208	7426607
	H	-	50	563765	7428988
		-	2000	564061	7429109
	K	-	0	556871	7432330
	W	1	20	560212	7430108
		1	0	560212	7430108
	X	0.5	0	564186	7429121
	AA	1	-	551931.7	7432697
		0.1	10	571547.6	7424858
		5	200	576017.6	7425252

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Cenchrus setiger</i>	AA	0.1	-	565433.4	7426865
		4	200	558210.8	7431154
		10	1200	575922.7	7426348
		5	1000	559861.5	7429111
		2	100	565885.4	7429906
		7	400	556849.6	7432958
		0.1	100	563859.8	7425688
<i>*Chloris barbata</i>	A	0.5	5	561541	7431892
		0.1	-	561523	7431915
	C	-	1	561357	7432565
	E	-	0	561504	7431938
	Y	-	1	562119	7432044
		-	1	562048	7432059
		-	10	562034	7432027
	Z	5	60	562539	7431253
		1	20	562578	7431286
		1	30	562507	7431245
		1	10	562725	7432071
		1	20	562745	7431995
		1	2	562695	7432010
		1	10	562716	7432027
		1	10	562703	7432036
		1	5	562691	7431667
		5	100	562674	7431640
		1	70	562730	7431512
		1	7	562647	7432030
<i>*Citrullus colocynthis</i>	B	-	1	555052	7433465
		-	1	555326	7432618
		-	1	555052	7433465
		-	0	555326	7432618
		-	0	555052	7433465
	C	-	1	555454	7430678
		-	1	559656	7429375
		-	1	555472	7430763
	E	-	0	558261	7430144
		-	0	557438	7431718
		-	0	556615	7434279
	J	-	0	558178	7429616
	W	0.5	1	560075	7430011
		0.5	1	560213	7430136

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Citrullus colocynthis</i>	Z	1	2	562527	7431265
		1	3	562719	7432067
		1	3	562735	7432056
<i>*Citrullus amarus</i>	A	0.5	-	558211	7431154
	B	-	1	555326	7432618
	I	-	0	560537	7431054
	Y	-	1	562137	7432079
<i>*Cynodon dactylon</i>	A	20	50	561609	7431932
	B	-	1	561336	7431955
		-	1	560824	7431754
		-	1	555052	7433465
		-	0	561336	7431955
		-	0	560824	7431754
	I	-	0	560650	7431364
		-	0	560465	7430916
	R	-	1	564543	7426973
		-	1	564625	7426921
	Z	20	70	562543	7431269
		1	10	562569	7431284
		5	20	562532	7431224
<i>*Echinochloa colona</i>	A	0.1	5	562292	7432136
	B	-	1	555326	7432618
	C	-	1	561357	7432565
<i>*Euphorbia hirta</i>	A	0.5	1	561582	7431916
		0.1		561523	7431915
	AA	0.1	100	555129	7434031
<i>*Flaveria trinervia</i>	A	0.5	3	569775	7426433
		0.5	2	565438	7426852
		0.5	3	561531	7431895
		0.1	-	561523	7431915
		0.1	-	565433	7426865
		0.5	3	570159	7427255
	B	-	1	554151	7434662
	E	-	0	560772	7431748
		-	0	561504	7431938
	G	0.1	0	576258	7426628
		-	1	576208	7426607
		-	1	575993	7425327
	L	-	0	565057	7429272
	M	-	0	565057	7429272

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Flaveria trinervia</i>	S	-	0	569031	7427832
	V	-	10	566131	7426789
	AA	0.1	1	563340.2	7425597
		0.1	5	563859.8	7425688
<i>*Lactuca serriola</i>	Z	1	20	562585	7431285
		1	2	562715	7432029
		1	5	562728	7432007
<i>*Malvastrum americanum</i>	A	0.5	3	556249	7432433
		0.5	1	551923	7432630
		0.5	2	571429	7428574
		0.5	25	571434	7428568
		0.5	5	557022	7431902
		0.5	2	561582	7431917
		0.1	-	557020	7431944
		0.1	-	561523	7431915
		0.1	-	551932	7432697
		0.1	-	572669	7424260
		0.1	-	573741	7424229
		0.5	3	557347	7429944
		0.5	15	560034	7429097
		0.5	1	567028	7427489
		0.5	1	567057	7427518
		0.1	-	557341	7429959
	B	-	1	555326	7432618
		-	1	555326	7432618
		-	1	555052	7433465
		-	0	555326	7432618
	C	-	40	561357	7432565
		-	1	561373	7432142
		-	1	561223	7432459
		-	50	560071	7433093
		-	20	561320	7432642
		-	1	557461	7431776
		-	1	556814	7432283
		-	20	557137	7431852
		-	1	556782	7430093
		-	10	555808	7430719
		-	5	556899	7432119
		-	10	551786	7432080
	E	-	0	555313	7432651

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Malvastrum americanum</i>	E	-	0	565101	7430505
		-	0	556994	7431965
		-	0	555027	7433457
	F	0.5	2	571425	7428569
		0.5	0	571263	7428721
		0.5	0	571263	7428721
		0.5	0	571426	7428569
	G	0.1	0	576258	7426628
		-	1	576270	7426829
		-	2	576208	7426607
		-	1	575981	7425512
		-	1	575844	7426242
	H	-	1	563784	7430502
	L	-	0	566126	7428688
	M	-	0	566126	7428688
	N	-	0	556479	7430774
	S	-	0	569031	7427832
	X	-	5	564605	7428748
	AA	0.1	12	551931.7	7432697
		0.1	-	572668.9	7424260
<i>*Melochia pyramidata</i>	N	-	0	556508	7431027
<i>*Passiflora foetida</i> var. <i>hispida</i>	A	1	25	556833	7432144
		1	15	556907	7432413
		1	250	557036	7431902
		0.5	5	561579	7431918
		2	-	557020	7431944
		0.1	-	561523	7431915
		0.1	-	562292	7432136
	C	-	1	556814	7432283
		-	5	557137	7431852
	E	-	0	561504	7431938
		-	0	556994	7431965
	I	-	0	560657	7431403
	Z	1	1	562711	7432025
	AA	0.1	2	568172	7428274
<i>*Phoenix dactylifera</i>	AA	-	3	568736.9	7428178
<i>*Ricinus communis</i>	Y	-	3	562136	7432080
<i>*Ruellia simplex</i>	A	0.1	-	561523	7431915
	AA	0.1	2	562138.6	7432070
		0.1	1	562104.7	7432066

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Ruellia simplex</i>	AA	0.1	1	562082.7	7432033
		0.1	1	562081.8	7432041
		0.1	1	562062.4	7432041
		0.1	1	562015.6	7432027
		0.1	1	562006.5	7432031
		0.1	2	562083.8	7432023
		0.1	2	562080.9	7432028
		0.1	1	562095.7	7432034
		0.1	1	562122	7432049
		0.1	2	562088.1	7432107
		0.1	2	562065.3	7432048
		0.1	7	562039.9	7432060
		0.1	12	562024.9	7432048
		0.1	1	562063	7432018
<i>*Rumex vesicarius</i>	A	0.5	10	571413	7428579
		0.5	50	571430	7428574
		0.5	20	571540	7428470
		0.5	5	555105	7432355
		0.5	6	561990	7429597
		0.5	1	574096	7425662
		0.5	15	557511	7430705
		0.5	1	571566	7424836
		0.5	25	571690	7424971
		0.5	10	569323	7426251
		0.5	5	569158	7426238
		0.5	1	570270	7428990
		0.05	-	574252	7425744
		0.1	-	571548	7424858
		0.1	-	570196	7429021
		0.1	-	562292	7432136
		0.5	2	558257	7431090
		0.5	20	559395	7430337
		0.5	1	570166	7427234
		0.5	6	570682	7427315
		0.5	4	568811	7427933
		0.5	2	575586	7426187
		0.5	1	557373	7429921
		0.5	10	559654	7430286
		0.5	1	570262	7427487
		1	20	567323	7427205

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Rumex vesicarius</i>	A	1	2	568413	7428410
		0.5	20	575579	7426177
		0.5	-	558211	7431154
		0.1	-	575107	7426395
		0.1	-	570123	7427205
		0.1	-	557341	7429959
	B	-	1	560694	7431290
		-	1	552577	7434244
		-	0	560694	7431290
	C	-	1	562241	7432147
		-	1	559510	7429365
		-	2	558610	7432280
		-	1	558394	7432118
		-	1	555454	7430678
		-	10	555030	7430745
	D	-	1	569805	7426670
		-	4	569800	7427150
		-	8	569420	7427243
		-	2	569723	7427229
		-	5	567738	7427438
		-	5	567684	7427385
		-	3	567719	7427405
	E	-	0	564260	7431447
		-	0	563492	7431689
		-	0	560190	7431287
		-	0	564807	7430699
		-	0	558322	7431482
	F	0.5	0	574721	7427031
		0.5	0	574721	7427031
	G	0.1	0	576258	7426628
		0.1	0	576033	7426493
		-	5	576054	7425650
		-	2	576152	7425715
		-	2	576165	7425509
		-	3	576208	7426607
		0.1	0	575854	7425262
		-	1	575993	7425327
		-	5	575877	7425677
		-	0	575998	7425460
		-	0	575973	7425498

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Rumex vesicarius</i>	G	-	1	575844	7426242
		-	1	575571	7426175
		-	1	575605	7426175
		-	30	575642	7426162
		-	20	575902	7426301
		-	0	575936	7426355
		-	0	575962	7426376
		-	0	575985	7426417
		-	0	575580	7427104
		-	1	574990	7426913
		-	10	575089	7426429
		-	10	575166	7426391
		-	1	575395	7426173
		-	5	574884	7427112
	H	-	1	563765	7428988
	I	-	30	560272	7430631
		-	0	560443	7431669
		-	0	560313	7431795
		-	0	560457	7431708
		-	0	560537	7431054
		-	0	560552	7431051
		-	20	560094	7431157
		-	50	560176	7431186
		-	0	560284	7431795
		-	0	560330	7431788
		-	0	560435	7431654
		-	0	560335	7431780
		-	0	560438	7431662
		-	0	560393	7431723
		-	50	560010	7431151
		-	20	559977	7431229
		-	200	559840	7431346
		-	50	559918	7431236
		-	0	560367	7431743
		-	0	560340	7431767
		-	0	560364	7431749
		-	50	559572	7431584
		-	0	560397	7430825
		-	0	560452	7431641
		-	0	560370	7431738

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Rumex vesicarius</i>	I	-	0	560449	7431645
		-	1	559575	7431647
	L	-	0	565057	7429272
	M	-	0	565057	7429272
	N	-	0	557525	7430714
		-	0	557306	7431329
		-	0	557614	7430645
	O	-	0	561683	7429770
	Q	-	0	558767	7432207
		-	0	558763	7432187
		-	2	558606	7432076
		-	0	558892	7432051
		-	0	558950	7431757
		-	0	558859	7431948
		-	0	558765	7431841
		-	2	558648	7431823
		-	0	558901	7431858
		-	0	558748	7432002
		-	0	558804	7431826
		-	2	558939	7431907
		-	2	558889	7432090
		-	0	558785	7432191
		-	0	558850	7431970
		-	0	558893	7432002
		-	0	558888	7431997
		-	0	558865	7432121
		-	0	558886	7432069
		-	0	558780	7431995
		-	0	558875	7432103
		-	0	558813	7432018
		-	0	558781	7432167
		-	0	558764	7432031
		-	2	558759	7432212
		-	0	558640	7431912
		-	0	558638	7432075
		-	0	558662	7431785
		-	0	558684	7432008
		-	0	558467	7432134
		-	0	558577	7432120
		-	0	558585	7432000

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Rumex vesicarius</i>	Q	-	2	558910	7431924
		-	0	558805	7432176
		-	0	558824	7431992
		-	0	558851	7432135
		-	0	558850	7431766
		-	2	558826	7432159
		-	2	558899	7431728
		-	0	558898	7431976
		-	0	558847	7432045
		-	0	558810	7432162
		-	2	558837	7432090
		-	0	558820	7431986
		-	0	558914	7431937
		-	2	558895	7431952
		-	0	558899	7432020
		-	0	558817	7432127
		-	0	558873	7431963
		-	2	558480	7432155
		-	0	558643	7431882
		-	0	558518	7432147
		-	0	558720	7431807
		-	0	558745	7431991
		-	0	558540	7432133
		-	0	558700	7432058
		-	0	558730	7431781
		-	0	558519	7432076
		-	2	558838	7432136
		-	0	558724	7432055
		-	0	558783	7432180
		-	0	558791	7432168
	R	-	10	562807	7426854
		-	100	562964	7426425
		-	20	563467	7426929
	S	-	0	569031	7427832
	T	-	40	557184	7431480
	Y	-	1	562350	7432167
		-	1	562310	7432074
		-	2	562393	7432200
		-	3	559704	7429437
	Z	1	50	566446	7427671

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Rumex vesicarius</i>	Z	50	2000	564723	7427745
		1	200	564608	7427695
		1	10	564623	7427684
		1	10	564632	7427681
		1	10	564656	7427668
		1	2	562718	7427647
		1	1	562718	7432068
		1	2	562748	7432062
		1	1	562750	7432066
	AA	0.1	1	568171	7428303
<i>*Setaria verticillata</i>	A	0.5	15	571533	7424849
		0.5	15	571585	7424830
		0.5	25	571593	7424834
		0.5	50	571622	7424656
		0.5	10	571593	7424961
		0.1	-	571548	7424858
	G	0.1	0	576258	7426628
		-	2	576208	7426607
		-	1	575844	7426242
	AA	0.1	3	551931.7	7432697
		0.1	5	571547.6	7424858
<i>*Sisymbrium orientale</i>	A	0.1	-	561523	7431915
	C	-	1	562241	7432147
	I	-	0	560568	7431058
	I	-	0	560537	7431054
<i>*Solanum nigrum</i>	A	0.5	1	556341	7432405
		0.5	1	557042	7431894
		0.5	4	561540	7431892
		0.1	-	557020	7431944
		0.1	-	561523	7431915
	C	-	1	556814	7432283
		-	1	556899	7432119
	E	-	0	560772	7431748
	I	-	0	560634	7431405
	Y	-	1	562071	7432117
		-	1	560881	7432002
		-	1	560845	7431948
	Z	1	20	568791	7426596
		1	2	568798	7426613
		1	5	568827	7426613

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Solanum nigrum</i>	Z	1	1	562689	7432041
		1	3	562709	7432029
		1	2	562701	7432014
		1	3	562704	7432033
		1	1	562715	7431990
<i>*Sonchus oleraceus</i>	A	0.5	1	556546	7432298
		0.5	10	557021	7431898
		0.5	5	561525	7431909
		0.1	-	557020	7431944
		0.1	-	561523	7431915
		0.1	-	562292	7432136
		0.5	3	576019	7426459
		0.5	3	575913	7426340
		0.5	1	567076	7427522
		0.1	-	575923	7426348
	B	-	1	555326	7432618
		-	0	555326	7432618
	C	-	1	562241	7432147
		-	5	557137	7431852
	E	-	0	556994	7431965
		-	0	560772	7431748
		-	0	557438	7431718
	G	0.1	0	576258	7426628
		-	2	576208	7426607
		-	1	575844	7426242
	Y	-	1	562140	7432081
		-	1	562113	7432142
		-	15	562110	7432057
		-	1	560891	7432019
		-	5	562088	7432051
		-	2	562141	7432080
		-	10	562120	7432059
		-	2	562125	7432060
		-	20	559492	7429289
	Z	5	90	562568	7431280
		1	100	562594	7431288
		1	50	562636	7431237
		1	50	562733	7431513
<i>*Trianthema portulacastrum</i>	E	-	0	565229	7426891
		-	0	565485	7430203

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Trianthema portulacastrum</i>	E	-	0	564870	7426199
		-	0	562666	7426724
		-	0	555915	7430871
		-	0	565101	7430505
		-	0	560017	7432707
		-	0	556455	7433092
		-	0	555946	7433005
		-	0	554984	7434437
<i>*Tribulus terrestris</i>	E	-	0	556424	7433762
		-	0	553702	7431398
	Z	1	1	562698	7432048
		1	5	562739	7432059
		1	5	562705	7432035
<i>*Vachellia farnesiana</i>	A	0.5	1	556829	7432143
		0.5	2	557010	7431939
		0.1	-	557020	7431944
		1	-	561523	7431915
	C	-	1	556143	7430238
		-	1	556782	7430093
		-	3	557137	7431852
		-	1	556814	7432283
		-	1	556899	7432119
		-	3	553854	7431475
		-	1	553880	7431344
		-	5	553267	7431596
		-	3	553689	7431341
		-	20	553327	7431549
		-	25	553411	7431501
		-	10	552499	7431861
		-	3	551786	7432080
	E	-	0	554816	7431006
	I	-	0	560724	7431302
	K	-	0	556843	7432261
	R	-	1	564239	7426062
		-	1	563791	7426596
	Y	-	1	562165	7432170
		-	1	562173	7432039
		-	1	560771	7431969
		-	1	560768	7431932
		-	6	562227	7432088

Species	Project ¹	Cover (%)	Abundance	Easting (mE)	Northing (mN)
<i>*Vachellia farnesiana</i>	Y	-	1	562240	7432018
		-	4	562178	7432037
		-	1	560757	7432017
		-	1	560734	7432059
<i>*Washingtonia filifera</i>	Y	-	1	562116	7432071
	AA	0.1	1	562024.9	7432048
		0.1	1	562063	7432018

¹ Project Source

A	Greater Paraburdoo – Detailed Flora and Vegetation Survey (Astron Environmental Services 2017)
B	Western Range Phase 2 Vegetation and Flora Report (Biota Environmental Sciences 2012b)
C	Western Range Additional Area: Vegetation and Flora Report (Biota Environmental Sciences 2012a)
D	Eastern Ranges Life of Mine Flora and Vegetation Report NVCP (Rio Tinto 2010)
E	Paraburdoo Mine Area Botanical And Vertebrate Fauna Survey (ecologia Environment 2011)
F	Flora and Vegetation Assessment of the Eastern Ranges Study Area (Rio Tinto 2014)
G	Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment (Eco Logical Australia 2016)
H	Flora and Vegetation Survey for the Paraburdoo Magazine and the Tom Price Powerline Infrastructure Areas (Pilbara Flora 2011)
I	Flora and Vegetation Survey of the Paraburdoo NLC Mine Pit and North Lobe Creek (Rio Tinto 2009)
J	Flora and Vegetation of the proposed 4 West Waste Dump Extension and Southern Bore Field Collector Upgrade, Paraburdoo (Rio Tinto 2010b)
K	Botanical Survey for a Drilling Program (AR-08-04080 & AR-08-04081) at Paraburdoo (Rio Tinto 2009a)
L	ANFO Shed Relocation and 4 East Structural Drilling NVCP Report (Rio Tinto 2008)
M	Flora and Vegetation of the Paraburdoo Magazine Explosives Compound Construction Area & ANFO Shed Relocation Area (Rio Tinto 2010a)
N.	Flora and Vegetation of the proposed 11W & 11W1 Pit Extensions and 11W Waste Dump Extension, Paraburdoo (Rio Tinto 2010d)
O.	Flora and Vegetation of the proposed 4EMP Cutback Waste Dump (AR-09-05178)_NVCP (Rio Tinto 2010c)
P	Flora and Vegetation Survey of the 4e-Stage 3 Southern Waste Dump NVCP Supporting Report (Rio Tinto 2011a)
Q	Flora and Vegetation Survey of the 5 West Pit Operations NVCP Supporting Report (Rio Tinto 2011b)
R	Flora and Vegetation Survey of the Paraburdoo Tailings Dam Southern Cell (PTDSC) Development (Rio Tinto 2009b)
S	Flora, Vegetation and Vertebrate Fauna on 23E/42E Paraburdoo (Mattiske Consulting 1998)
T	Paraburdoo 11w Mine Development NVCP (Rio Tinto 2009c)
U	Paraburdoo 4 East Feasibility and Landfill: Native Vegetation Clearing Permit Report (Biota Environmental Sciences 2008)
V	Turee Creek Water Pipeline Upgrade and Paraburdoo Town Feeder One Line Replacement (Rio Tinto 2012)

W	Joe's Crossing Biological Assessment (Astron Environmental Services 2015a)
X	Paraburdoo Haul Road Biological Assessment (Astron Environmental Services 2015b)
Y	Paraburdoo Weed Inspection and Control Field Visits (Astron Environmental Services 2011)
Z	Weed Control Program, Inland Operations, Paraburdoo, 2016 Annual Summary Report (Astron Environmental Services 2016)
AA	Greater Paraburdoo – Detailed Flora and Vegetation Survey – Phase 2 (current survey)

**Greater Paraburdoo
Level 2 Fauna Survey
April 2018**

Prepared for
Rio Tinto Iron Ore



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Greater Paraburdoo Level 2 Fauna Survey

Prepared for
Rio Tinto Iron Ore





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Abbreviations

Abbreviation	Definition
ARU	Autonomous Recording Unit
Astron	Astron Environmental Services
DBCA	Department of Biodiversity, Conservation and Attractions
DD	Data deficient
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
GDA94	Geocentric Datum of Australia 1994
Ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
kHz	Kilohertz
Km	Kilometre
MGA	Map Grid of Australia
MNES	Matters of National Environmental Significance
Parks and Wildlife	Department of Parks and Wildlife
PEC	Priority Ecological Community
Rio Tinto	Rio Tinto Iron Ore Pty Ltd
sp.	Species (singular)
spp.	Species (plural)
subsp.	Subspecies
SRE	Short Range Endemic
The 'survey area'	Greater Paraburdoo Development Envelope (approximately 11,200 ha)
TEC	Threatened Ecological Community
WAM	Western Australian Museum
WC Act	<i>Wildlife Conservation Act 1950</i>

Executive Summary

Rio Tinto Iron Ore Pty Ltd is evaluating the potential development of a number of iron ore deposits within the Greater Paraburdoo locality, in the Pilbara region of Western Australia. Astron Environmental Services were commissioned to undertake a Level 2 fauna and Short Range Endemic assessment of the Greater Paraburdoo Development Envelope which is 11,203.4 hectares in size.

Vertebrate Fauna

Seven broad fauna habitat types were recorded in the survey area: Riverine, Drainage Line, Gorge, Breakaway, Rocky Hill, Low Hill, and Stony Plain. Areas of cleared habitat were prevalent throughout the central portion of the survey area where mining infrastructure and operations are concentrated. The Gorge, Riverine and Breakaway habitats in the survey area are considered important for fauna due to the microhabitats they provide such as caves and permanent water pools. The Gorges and Breakaways in particular contain a high diversity of microhabitats; they represent an important site of refuge and habitat for conservation listed fauna.

There were 154 vertebrate fauna species recorded within the survey area, comprising two amphibians, 34 reptiles, 94 birds and 24 mammals (including four introduced species). The fauna species assemblage recorded during the survey is considered typical of the Hamersley Range subregion.

Seven vertebrate species of conservation significance have been recorded within the survey area during the current and previous surveys: Pilbara Olive Python (VU; VU) (*Liasis olivaceus barroni*), Northern Quoll (EN; EN) (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (VU; VU) (*Rhinonicteris aurantia*), Ghost Bat (VU; VU) (*Macroderma gigas*), Grey Falcon (VU) (*Falco hypoleucos*), Common Sandpiper (Mi; IA) (*Actitis hypoleucos*) and Western Pebble-mound Mouse (P4) (*Pseudomys chapmani*). Five of these conservation significant species were recorded in the current survey, with the exception of the Pilbara Olive Python and the Western Pebble-mound Mouse.

Four of the seven recorded conservation listed species are classified under the *Environment Protection and Biodiversity Act 1999* as 'Matters of National Environmental Significance' species: the Pilbara Olive Python, Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat. The Pilbara Olive Python has been previously recorded in the Riverine habitat of the survey area at Seven Mile Creek. The Northern Quoll was recorded twice during the first phase of the current survey in the form of individual scats in the Breakaway and Gorge habitats. The Pilbara Leaf-nosed Bat was recorded at seven of the 16 bat detector locations; all were deemed to be at low activity levels. The Pilbara Leaf-nosed Bat records were from foraging individuals in Breakaway, Drainage Line and Riverine habitats. One previously identified roost within the survey area that is close to Ratty Springs is a confirmed permanent diurnal/maternal roost. The Ghost Bat was recorded once (two possible calls) during the current survey through an acoustic recording in the Breakaway habitat.

A targeted fauna survey, specifically to assess the presence of the Northern Quoll, was undertaken within certain gorges in the Eastern Ranges portion of the survey area. This survey included 20 motion sensitive cameras deployed for 30 to 31 trap nights and 10 habitat assessments. No conservation significant fauna were recorded as part of the targeted fauna survey.

The results suggest that the survey area supports a representative vertebrate fauna assemblage with a varied array of microhabitats for fauna species to exploit. The microhabitats of the Gorge, Riverine and Breakaway habitat types contain ecological features important to conservation listed fauna such as the Pilbara Olive Python, Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat.

Short Range Endemic Invertebrate Fauna

In general, the survey area appears to have great potential to support Short Range Endemic species owing to the abundance of ideal habitats. These include the 'typical' Short Range Endemic target habitats: south facing gorges, slopes and breakaways, but also the presence of significant water bodies such as Ratty Springs and Seven Mile Creek. Prospective Short Range Endemic habitats in the survey area were mapped as Gorge, Breakaway and Riverine habitats.

A total of 194 individuals belonging to 20 potential Short Range Endemic ('Data deficient') species taxa were collected from the survey area. Except for *Trinemura* sp. indet., for which no desktop data are available for representatives of hexapoda, all the potential Short Range Endemic species from the field survey were also recorded from the Western Australian Museum database searches:

- Spiders – Selenopidae sp. indet.
- Pseudoscorpions – *Austrohorus* sp. indet., *Indolpium* 'long chela hand' and *Indolpium* sp. indet.
- Scorpions – *Lychas* sp. indet., *Lychas* 'bituberculatus complex', *Lychas* 'hairy tail complex' and *Lychas* 'aitkeni complex'
- Centipedes – *Mecistocephalus* sp. indet., *Orphnaeus* sp. indet. and *Cryptops* sp. indet.
- Millipedes – *Austrostrophus* sp. indet.
- Silverfish – *Trinemura* sp. indet.
- Slaters – *Buddelundia* '10ts', *Buddelundia* '47TS', *Buddelundia* '50', *Buddelundiinae* sp. indet., *Philosciidae* sp. indet. and *Barrowdillo* '4'
- Snails – *Bothriembryon* 'Pilbara'.

Overall, the composition of Short Range Endemic taxa within this part of the Pilbara remains very poorly known; however, this survey demonstrates that the survey area, and the Paraburdoo range more generally, contains a significant diversity of potential Short Range Endemic species.

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1 Introduction

1.1 Project Background

Rio Tinto Iron Ore Pty Ltd (Rio Tinto), on behalf of the joint venture participants, is evaluating the potential development of a number of iron ore deposits within the Greater Paraburdoo locality, in the Pilbara region of Western Australia. A Pre-feasibility Study has commenced to evaluate the potential development of additional deposits and associated infrastructure near existing Paraburdoo and Eastern Range operations. This report presents the outcome of a Level 2 fauna and Short Range Endemic (SRE) assessment of the Greater Paraburdoo Development Envelope (the survey area). The survey area is 11,203.4 ha (Figure 1).

1.2 Scope and Objectives

The objective was to undertake a two-phase Level 2 vertebrate fauna and targeted SRE invertebrate fauna assessment through a desktop assessment and field survey, and to incorporate data from previous biological surveys. The resultant data are presented in this report, which is intended to support and inform the environmental assessment process in accordance with the requirements of the Environmental Protection Authority (EPA). The scope of works was to undertake a:

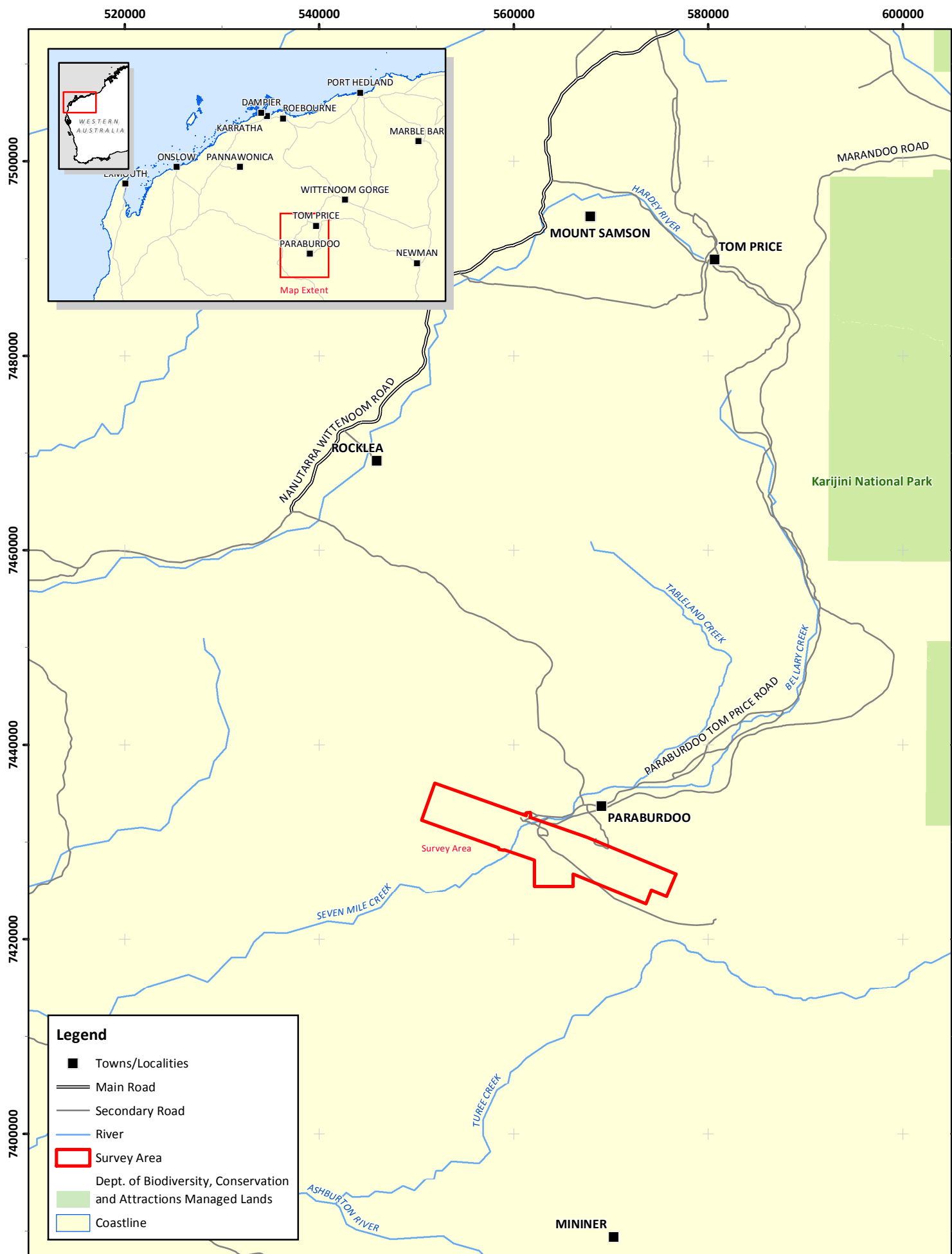
- desktop assessment, including database searches and literature review of available resources
- two-phase vertebrate fauna field survey, including:
 - fauna sampling
 - targeted Matters of National Environmental Significance (MNES) species sampling and searches
 - fauna habitat mapping
- targeted SRE field survey, including:
 - targeted survey and searches
 - dry pitfall trap sampling
 - SRE fauna habitat mapping.

In addition, this report incorporates the methods and results of a targeted fauna survey that was undertaken in selected gorges in the Eastern Ranges portion of the survey area. This included targeted MNES species sampling and searches, motion sensitive cameras and habitat assessments. A more detailed analysis of the data recorded during the targeted survey is covered in the Eastern Range EPA Level 1 Targeted Fauna Survey report (Astron Environmental Services 2018).

The Level 2 fauna survey was completed in accordance with the regulatory guidance detailed in Table 1 and Rio Tinto Data Standards (Rio Tinto Iron Ore 2018). The scope and key limitations of the survey are outlined in Table 1. Section 3.6 of this report provides more detail on the limitations of the survey.

Table 1: Summary of Astron's vertebrate fauna and SRE invertebrate fauna assessment.

Level of survey	Survey area size	Survey timing	Relevant regulatory guidance documents	Key survey limitations
Level 2 two-phase survey	11,203.4 ha	21 July to 1 August 2017 6 to 15 April 2018	<ul style="list-style-type: none"> Position Statement No. 3 (Environmental Protection Authority 2002) Technical Guidance - Terrestrial Fauna Surveys (Environmental Protection Authority 2016c) Technical Guidance – Sampling of Short Range Endemic Invertebrate Fauna (Environmental Protection Authority 2016b) Technical Guidance - Sampling Methods for Terrestrial Fauna (Environmental Protection Authority 2016a) <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) referral guideline for the Endangered Northern Quoll <i>Dasyurus hallucatus</i> (Department of the Environment and Energy 2016) Survey Guidelines for Australia's Threatened Reptiles, Birds, Mammals and Bats (Department of Sustainability Environment Water Population and Communities 2011b; Department of the Environment 2010b; Department of Sustainability Environment Water Population and Communities 2011a; Department of the Environment 2010a) Interim Guidelines for Preliminary Surveys of the Night Parrot (<i>Pezoporus occidentalis</i>) in Western Australia (Department of Parks and Wildlife 2017a) 	<ul style="list-style-type: none"> Species accumulation curves generally did not reach an asymptote, but when taking into account previous records and species recorded from other methods, then a large portion of the predicted assemblage was recorded. Rainfall in the three months preceding Phase 1 of the Astron survey was well below average; however, as this was the dry season survey it is not considered a limiting factor. Below-average rainfall in the months preceding the SRE survey potentially resulted in SRE species richness being under sampled. However, the survey sampled most of the SRE groups expected from the Pilbara. Large portions of the Low Hill and Rocky Hill habitats were impacted by active and exploratory mining activities including; exploration drilling pads, tracks, haul roads, mine pits and associated infrastructure. These are classified as minor limitations only and are not expected to have a major effect on survey outcomes.



Rio Tinto
Greater Paraburadoo Level 2 Fauna Survey, April 2018

Figure 1: Survey area location



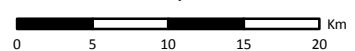
Author: J. Trainer

Date: 16-08-2018

Drawn: C. Dyde

Figure Ref: 14283-18-BIDR-2RevB_180816_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50



2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2018).

Based on long-term climatic data from the nearest Bureau of Meteorology (BoM) weather station at Paraburdoo Aero (Station 007185) (approximately 10 km north-east of the survey area) the mean annual rainfall since 1974 is 315 mm. The mean maximum daily temperatures range between 24.8°C and 40.6°C, and range above 30°C for much of the year (Bureau of Meteorology 2018) (Figure 2).

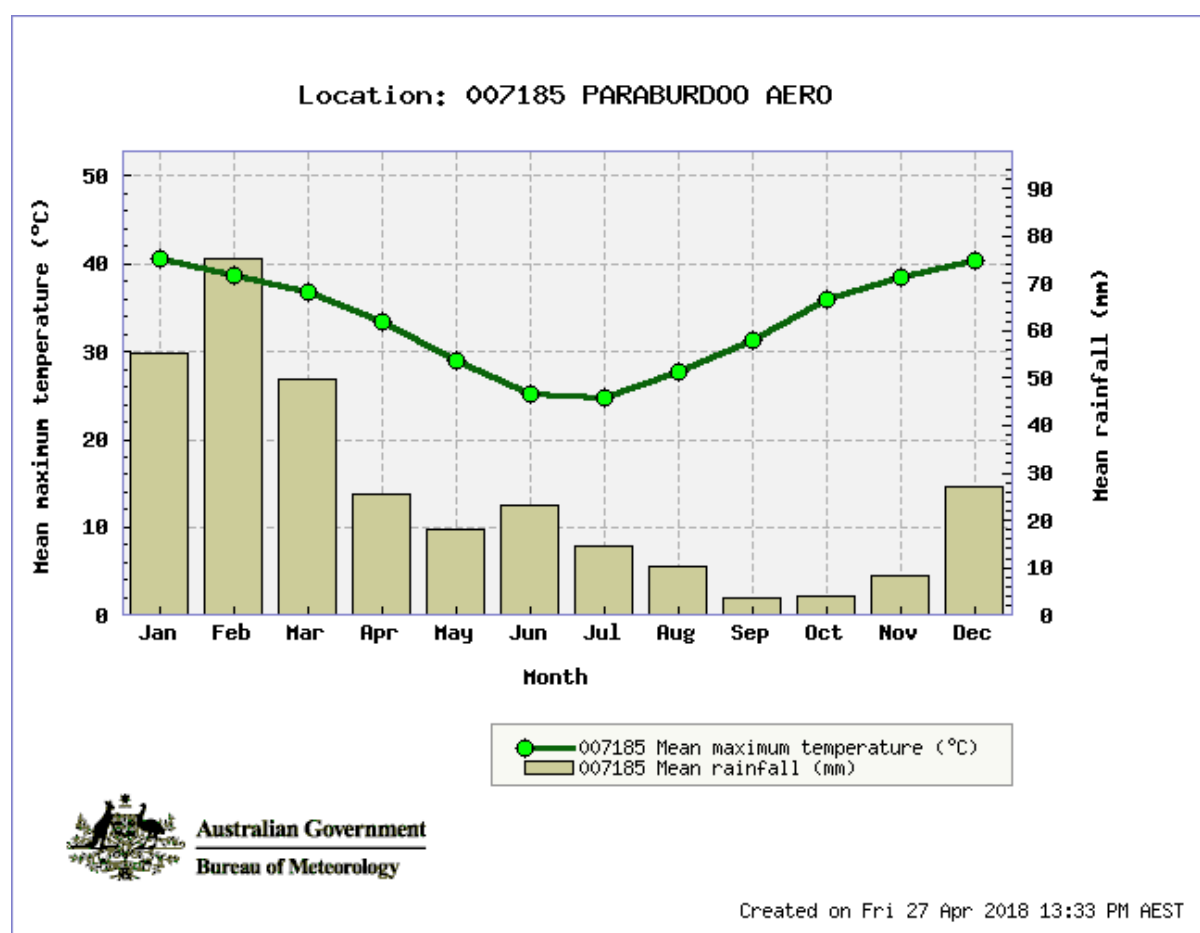


Figure 2: Climate data for Paraburdoo (Station 007185). Mean annual rainfall data has been calculated from 1974 – 2018 and mean maximum temperature has been calculated from 1966 – 2018 (Bureau of Meteorology 2018).

2.1.2 Geology and Soils

The surface geology of the survey area is comprised of 10 units (Stewart et al. 2008), with the Hamersley Group the most dominant (Table 2). Geological mapping of the survey area and surrounds is presented in Figure A.1 (Appendix A).

Table 2: Geological units of the survey area (Stewart et al. 2008).

Geological name	Label	Area within survey area (ha)
Calcrete 38497: Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified.	Czk	343.0
Brockman Iron Formation: banded iron-formation, chert, mudstone and siltstone.	Lchk	1,816.2
Hamersley Group: Undivided chert, banded iron-formation, jaspilite, dolomite, mudstone, siltstone.	Lch	2,564.6
Colluvium 38491: Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	2,755.7
Bunjinah Formation: Metabasaltic pillow lava and breccia; metatuff and minor chert.	Abfb	58.7
Fortescue Group: Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	1,058.1
Jeerinah Formation: Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	893.9
Weeli Wolli Formation: Banded iron-formation (commonly jaspilitic), mudstone, siltstone; common interlayered metadoleritic sills.	Lchw	1,016.4
Mount McGrath Formation: Coarse sandstone, conglomerate, pelite, dolomite.	Lsym	294.4
Alluvium 38485: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.	Qa	402.4

2.1.3 Surface Water and Hydrology

No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the survey area (Department of the Environment and Energy 2017b, 2017a). The nearest Nationally Important Wetland is Mt. Bruce coolibah-lignum flats located 85 km north-west of the survey area.

Ratty Springs and Seven Mile Creek occur within the western end of the survey area, both of which run into the Minilya River South Branch south of the survey area.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment and Energy 2016a). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and

fauna. The survey area occurs in the Pilbara Bioregion, of which 5% to 10% is represented in the national reserve system (Department of the Environment and Energy 2016b).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002). The survey area occurs within the Hamersley subregion (10,168.8 ha) of the Pilbara region and the Ashburton subregion (1,034.6 ha) of the Gascoyne region. These subregions are described in the audit as:

- Hamersley PIL3 – dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as Mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered Snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001b).
- Ashburton GAS1 - Mountainous range country divided by broad flat valleys of shales, sandstones and conglomerates with vegetation described a Mulga or snakewood low woodlands over hardpans, with low mixed shrublands on hills and areas supporting large areas of *Triodia* (Kendrick 2001a).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Agriculture and Food outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion covering 181,723 km² and a total of 172 land systems occur in the Gascoyne bioregion covering 183,784 km². A total of 11 land systems occur in the survey area; four occur within both the Pilbara and Gascoyne bioregions, an additional five occur within the Pilbara bioregion and an additional two occur within the Gascoyne bioregion (Table 3). The layout of these land systems within the survey area is shown in Figure A.2 (Appendix A).

Table 3: Distribution of land systems within the survey area.

Land system	Total area within bioregion (ha)	Total area within survey area (ha)	Proportion within survey area (%)
Pilbara bioregion			
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,847	720.4	<0.1
Capricorn - rugged sandstone hills, ridges, stony footslopes and interfluvies supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	698,396	558.5	<0.1
Ethel - cobble plains with sparse mulga and other acacia shrublands.	2,886	140.8	4.9
Marandoo - basalt hills and restricted stony plains supporting grassy mulga shrublands.	176,317	523.2	0.3
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	1,994,339	6,547.1	0.3
Paraburdoo - basalt derived stony gilgai plains and stony plains supporting snakewood and mulga shrublands with spinifex, chenopods and tussock grasses.	130,774	61.0	<0.1
Platform - dissected slopes and raised plains supporting shrubby hard spinifex grasslands.	236,390	880.9	0.4
River - active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	481,994	551.1	0.1
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,288	185.9	<0.1
Gascoyne bioregion			
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	37,022	412.3	1.1
Dollar - stony plains supporting mulga and snakewood shrublands with some chenopod low shrubs.	28,827	91.0	0.3
Ethel -cobble plains with sparse mulga and other acacia shrublands.	113,657	233.3	0.2
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	6,021	135.6	2.3
River - active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	73,008	80.6	0.1
Table - low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.	138,971	81.7	<0.1

2.2.3 Pre-European Vegetation

Beard (1975) completed broad-scale (1:1,000,000) pre-European vegetation mapping at an association level.

Four pre-European vegetation units, 82, 181, 567 and 163 (Shepherd, Beeston, and Hopkins 2002), are associated with the survey area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these four vegetation units in the Pilbara bioregion, Gascoyne bioregion and the survey area.

Table 4: Extent of pre-European vegetation in the survey area (Department of Parks and Wildlife 2016).

Vegetation association	Mapping unit (Beard 1975)	Description	Extent in survey area (ha)	Pre-European extent (ha)	Current extent in bioregion (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
Pilbara bioregion							
567	a1,2Sr t1,2Hi	Hummock grasslands, shrub steppe; mulga and kanji over soft spinifex and <i>Triodia basedowii</i>	1,207	776,824	774,213	99.7	25.5
82	e16Lr t3Hi	Hummock grasslands, low tree steppe; snappy gum over <i>Triodia wiseana</i>	6,206	2,177,574	2,165,235	99.4	13.6
181	a1,11Si	Shrublands; mulga and snakewood scrub	2,726	65,090	63,204	97.1	7.8
163	ecZi	Shrublands; <i>Eremophila</i> and <i>Cassia</i> dwarf scrub	30	236	231	98.1	-
Gascoyne bioregion							
181	a1,11Si	Shrublands; mulga and snakewood scrub	978	1,520,571	1,520,558	99.9	15.3
163	ecZi	Shrublands; <i>Eremophila</i> and <i>Cassia</i> dwarf scrub	57	388,753	388,690	99.9	-

2.3 State and Commonwealth Conservation Categories and Management

Commonwealth and State regulatory authorities maintain databases of the locations and conservation status of significant flora, fauna and ecological communities in Western Australia.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage MNES including listed flora, fauna and ecological communities. These listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables B.1 and B.6 (Appendix B).

Ecological communities may be subject to processes that threaten to destroy or significantly modify it across much of its range. These communities are identified as threatened ecological communities (TECs) and are listed at both Commonwealth level under the EPBC Act and State level by the Western Australian Minister for Environment (Table B.2, Appendix B). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a list of priority ecological communities (PECs), which may also be under threat and are assigned one of four Priority rankings according to the criteria outlined in Table B.3 (Appendix B).

Under Western Australian legislation, all native fauna is protected and it is an offence to ‘take’ protected fauna. The *Wildlife Conservation Act 1950* also provides for native fauna species to be specially protected when they are considered rare, threatened with extinction, or has a high conservation value (Table B.4, Appendix B). In addition, due to the diversity of Western Australia’s fauna, many species are known from only a few collections or locations, but have not been adequately surveyed. Such fauna may be rare or threatened, but cannot be considered for declaration as Threatened fauna until adequate surveys have been undertaken. These fauna species are included on a supplementary conservation list managed by DBCA called the *Priority Fauna List*. Priority fauna are categorised according to level of threat and other information and the conservation categories are described in Table B.5 (Appendix B).

2.4 Land Use and Tenure

The survey area is located within the Shire of Ashburton. The majority of the survey area is on the Mininer and Rocklea Station pastoral lease. The local area is used for pastoralism, mineral exploration and mining activity.

Karijini National Park is the nearest conservation reserve to the survey area, located approximately 29 km to the north-east (Figure 1).

3 Methods

3.1 Desktop Assessment

A desktop assessment was undertaken to assess whether any conservation listed vertebrate and invertebrate species, SRE invertebrate species or communities, or PECs/TECs were likely to occur within the survey area. For vertebrate species, the review focused on key habitats for conservation listed fauna and species of MNES. For SRE invertebrates, the review focused on invertebrate groups with a known high proportion of SRE species (the SRE groups): centipedes (Chilopoda), harvestmen (Opiliones), millipedes (Diplopoda), non-marine Snails (Gastropoda), pseudoscorpions (Pseudoscorpiones), scorpions (Scorpiones), terrestrial slaters (Isopoda) and spiders (Araneae).

3.1.1 Database Searches

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the *Environmental Protection Act 1986* to prevent incremental degradation of important environmental values such as declared rare flora, TECs or significant wetlands. A search for ESAs in the vicinity of the survey area was conducted using Western Australian government datasets (Department of Water and Environmental Regulation 2017) and the Register of the National Estate dataset (Department of the Environment and Energy 2008). In addition, database searches for fauna were conducted with search details summarised in Table 5. Conservation categories for fauna are provided in Appendix B.

Table 5: Database searches requested.

Database name	Date search results received	Search focus	Search area
NatureMap (Department of Biodiversity, Conservation, and Attractions 2017a)	04/07/2017	Terrestrial fauna and fauna of conservation significance	20 km radius from a diagonal line running from the north-west to the south-east of the survey area, defined by the coordinates: 23°12'04 S, 117°30'03 E and 23°17'07 S, 117°44'26 E
Threatened and Priority Ecological Communities Database (Department of Parks and Wildlife 2017b)	25/08/2017	Listed threatened and priority ecological communities	40 km radius from the survey area boundary
Threatened and Priority Fauna Database (Department of Biodiversity, Conservation, and Attractions 2017b)	21/07/2017	Threatened and Priority fauna species	80 km radius from the survey area boundary
Protected Matters Search Tool (Department of the Environment and Energy 2017c)	04/07/2017	Threatened and Priority fauna species	20 km radius from a diagonal line running from the north-west to the south-east of the survey area, defined by the coordinates: -23.20083, 117.50056 and -23.28806, 117.74056 (MGA50, GDA94)
BirdLife Australia (Birdlife Australia 2017)	04/07/2017	Bird species	40 km buffer around approximate survey area location

Database name	Date search results received	Search focus	Search area
Western Australian Museum Invertebrate Database (Western Australian Museum 2017)	25/06/2017-27/06/2017	Arachnids, myriapods, crustaceans, and molluscs	100 km buffer from survey area bounded by the coordinates: 22.357431, 116.659481 and -- 24.155779, 118.623467 (MGA50, GDA94)

3.1.2 Literature Review

Fauna surveys have been previously commissioned by Rio Tinto within the vicinity of the survey area and supplied to Astron for the desktop assessment. The previous survey areas in relation to the current survey area are shown in Figure 3. The reports reviewed as part of this assessment include:

- Flora, Vegetation and Vertebrate Fauna on 23E/42E Paraburdoo (Mattiske Consulting 1998)
- Turee Syncline Project Vegetation, Flora and Fauna Baseline Surveys (GHD Pty Ltd 2009)
- Eastern Ranges Targeted Fauna Survey (Biota Environmental Sciences 2010)
- A summary of the occurrence of the Pilbara Leaf-nosed Bat at Eastern Ranges and Surrounds (Specialised Zoological 2010)
- Rio Tinto Paraburdoo Mine Area Botanical and Vertebrate Fauna Survey (ecologia Environment 2011)
- Western Range Two-Phase Fauna Survey (Biota Environmental Sciences 2011)
- Monitoring the Presence and Activity of the Pilbara Leaf-nosed Bat at Eastern Ranges, WA (Specialised Zoological 2013)
- Eastern Range Level 1 and Targeted Fauna Survey (Astron Environmental Services 2014)
- Greater Paraburdoo Operations Orange Leaf-nosed Bat Foraging Study (Biota Environmental Sciences 2014)
- Eastern Range Echolocation Survey of Bat Activity (Bat Call WA 2014a)
- Ratty Spring Pilbara Leaf-nosed Bat Roost Census (Bat Call WA 2015)
- Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment (Eco Logical Australia 2016).

3.1.3 Habitat Characterisation

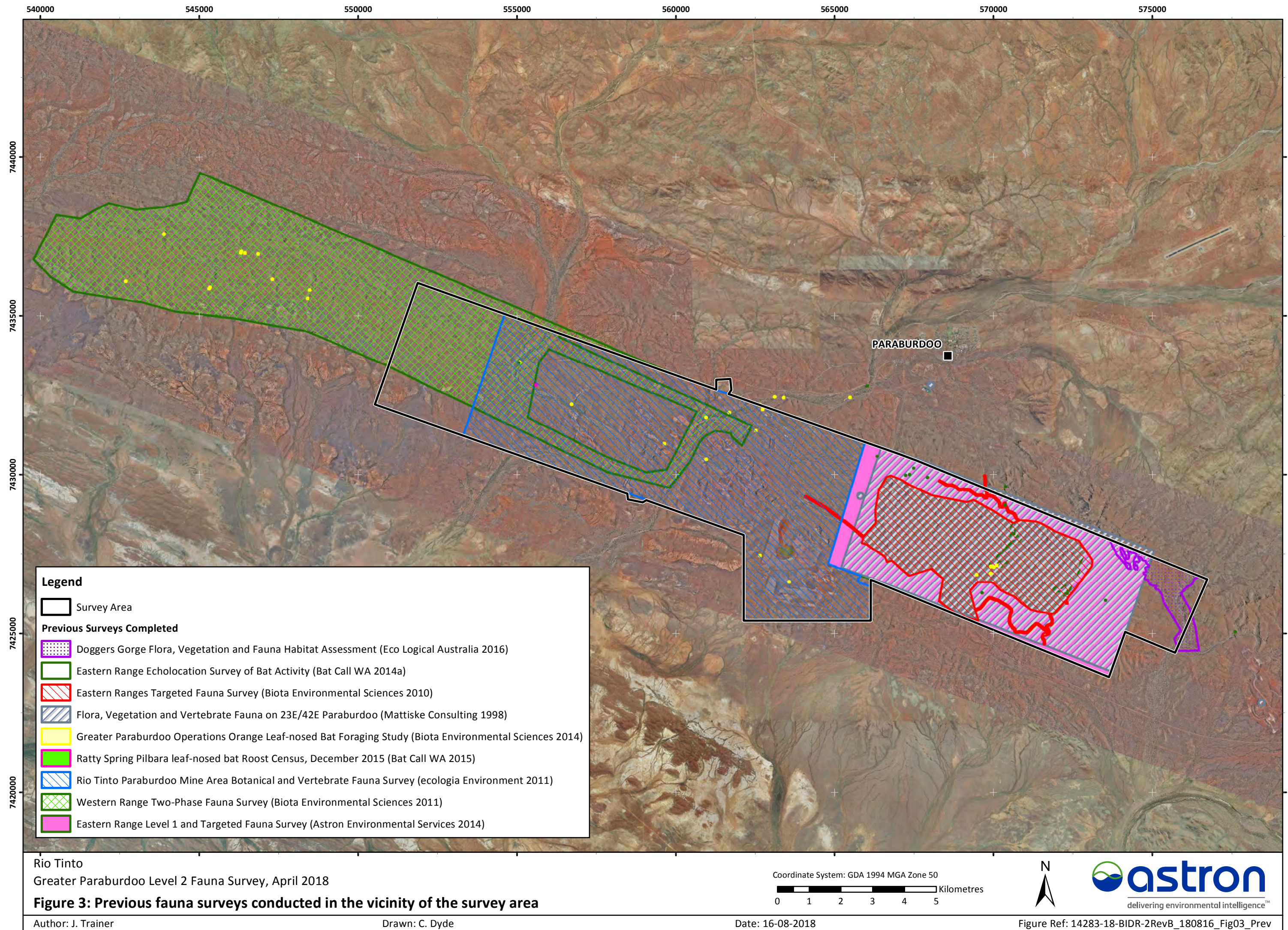
Using orthophotos provided by Rio Tinto and the available literature, the survey area was split into distinct landform types that were evaluated further for their likelihood of conservation listed vertebrate or SRE species occurrence. The assessment followed several criteria, such as the availability of moisture, extent of shade and shelter, and soil and vegetation types. Emphasis was given to landforms (and associated habitats) that may contain 'relict' species (surviving in sheltered and moist conditions) and those that may support habitat specialists (i.e. species restricted to rocky outcrops).

3.1.4 Conservation Assessment

Conservation listed vertebrate fauna species returned from the database searches were categorised for likelihood of occurrence within the survey area prior to the field survey, according to the criteria listed in Table B.7 (Appendix B). Post survey, the likelihood table was re-assessed using the information obtained during the field survey. The additional criteria used for the assessment are

outlined in Table B.7 (Appendix B). The likelihood table was then updated to reflect an improved understanding of the likelihood that a species would actually occur in the survey area.

SRE invertebrates are species with distributions of less than 10,000 km² and their occurrence within their distribution is usually fragmented and highly localised (Harvey 2002; Ponder and Colgan 2002). However, it is often difficult to determine whether or not a species in one of the target SRE groups actually has a range < 10,000 km². For the purpose of desktop review, SRE status was determined by the staff of the Western Australian Museum (WAM) through providing the results of SRE searches of the WAM databases. This assessment was reviewed and supplemented with information contained in previous environmental reports, the published literature and online databases. For morphospecies collected during the survey, the criteria outlined in Table B.8 (Appendix B) were used to determine SRE status. The SRE categories of the WAM (confirmed SRE, potential SRE and widespread species) were used to assess the status of species, with sub-categories applied in accordance with the WAM-Taxonomic Services guidelines (Table B.8, Appendix B).



3.2 Field Survey

3.2.1 Survey Timing and Personnel

The Phase 1 field survey (dry season) was undertaken by John Trainer and Michael Brown. The Phase 2 field survey (post wet season) was also undertaken by John Trainer and Michael Brown, with support from SRE specialist Dr Erich Volschenk and field assistant Sam Mueller. All technical survey personnel have over five years of experience conducting Level 2 vertebrate fauna surveys or invertebrate surveys. The survey was conducted under "Licence to Take Fauna for Scientific Purposes" Permit No. 08-000884-1/08-000884-2.

The Phase 1 field survey was conducted from 20 July to 1 August 2017 and the Phase 2 field survey was conducted from 6 to 15 April 2018. Data from trap sites previously set up in the survey area for the Western Ranges Two-Phase Fauna Survey (Biota Environmental Sciences 2011) were used to supplement the survey data; this survey was completed by Biota from 20 to 29 October 2009 and 3 to 10 May 2010.

The targeted fauna survey was undertaken by Matthew Love and John Trainer with motion sensitive cameras deployed on either the 25 or 26 June 2018 and collected on the 26 or 27 July 2018. A more detailed analysis of the data recorded during the targeted survey is covered in the Eastern Range EPA Level 1 Targeted Fauna Survey report (Astron Environmental Services 2018).

3.2.2 Weather

Daily observations for rainfall and temperature were recorded by Rio Tinto at the Paraburdoo weather station, with long term rainfall and temperature observations being sourced from the Paraburdoo Aero BoM station (number 007185), approximately 15 km north-east of the Paraburdoo weather station. Local rainfall and temperatures preceding the survey are presented in Figure 4.

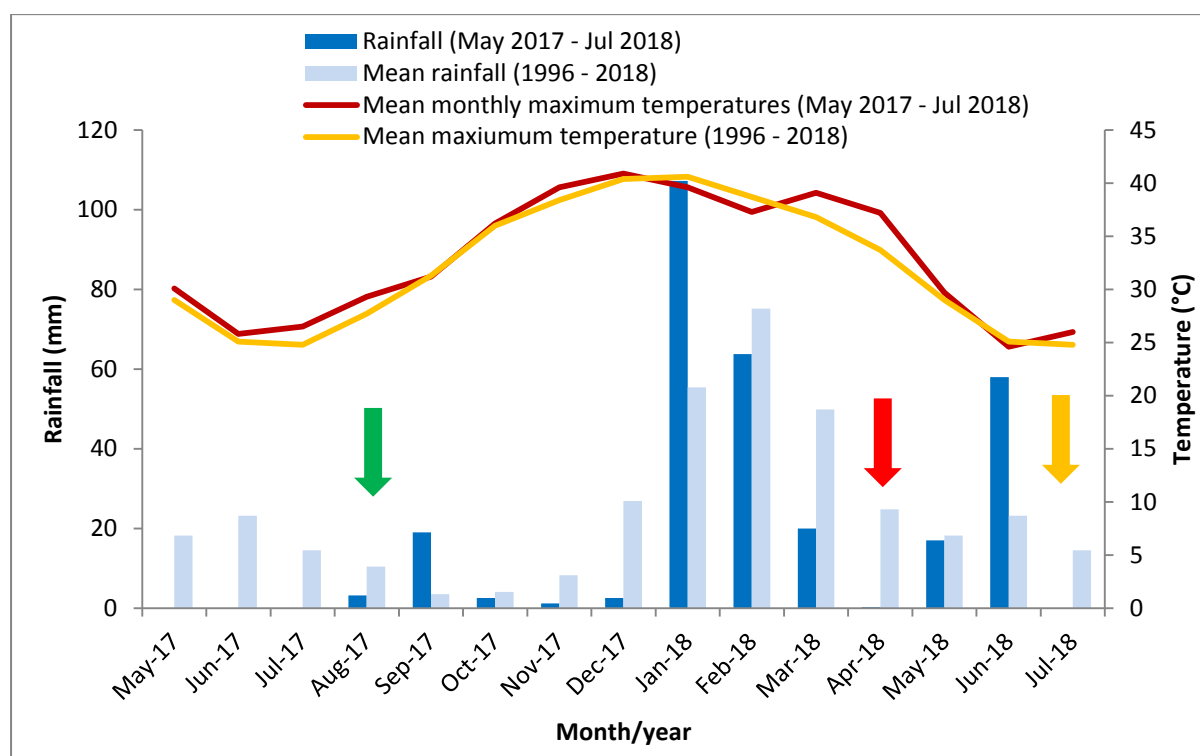


Figure 4: Mean monthly and recorded monthly rainfall (mm) and mean monthly and recorded monthly maximum temperatures (°C). Records from BoM Paraburdoo Aero station (007185) (Bureau of Meteorology 2018). The green arrow displays timing for the Phase 1 survey, with the red arrow displaying timing for the Phase 2 survey and the orange arrow displaying the targeted survey.

The daily maximum temperatures during Phase 1 of the Astron survey averaged $27.8^{\circ}\text{C} \pm 6.0^{\circ}\text{C}$ and daily minimum temperatures averaged $9.4^{\circ}\text{C} \pm 7^{\circ}\text{C}$. Mean maximum daily temperatures were higher during the Astron survey than the long-term means and the mean minimum daily temperatures were comparable to the long-term means for July (Bureau of Meteorology 2018). The recorded annual rainfall preceding the Phase 1 survey in 2017 was 2.4 mm above the long-term mean of 315.2 mm. No rainfall in the 12 weeks preceding the survey was recorded. The mean average rainfall for the same time period was 55.9 mm.

The daily maximum temperatures during Phase 2 of the Astron survey averaged $37.3^{\circ}\text{C} \pm 3.0^{\circ}\text{C}$ and daily minimum temperatures averaged $24.2^{\circ}\text{C} \pm 2.2^{\circ}\text{C}$. Mean maximum daily temperatures were higher during the Astron survey than the long-term means and the mean minimum daily temperatures were comparable to the long-term means for April (Bureau of Meteorology 2018). The recorded annual rainfall preceding the survey in 2018 was 108.6 mm below the long-term mean of 314 mm. In the 12 weeks preceding the survey 161.6 mm of rain was recorded which is slightly below the mean average rainfall for the same time period (180.5 mm).

The weather conditions for the Phase 1 survey conducted by Biota in 2009 included maximum temperatures from 36.6°C to 39.6°C and minimum temperatures from 18°C to 27.2°C . No rain was recorded during the survey. A total of 43.6 mm of rain fell at Paraburdoo during the six months leading up to the survey. This is well below the average of 81 mm for this period (Biota Environmental Sciences 2011).

The weather conditions for the Phase 2 survey conducted by Biota in 2010 included maximum temperatures from 30.3°C to 35.8°C and minimum temperatures from 13°C to 21.6°C . No rain was recorded during the survey. A total of 116.6 mm of rain fell at Paraburdoo during the six months

leading up to the survey. This is well below the average of 159.9 mm for this period (Biota Environmental Sciences 2011).

The daily maximum temperatures during the Eastern Range targeted survey averaged $25.7^{\circ}\text{C} \pm 4.4^{\circ}\text{C}$ and daily minimum temperatures averaged $8.7^{\circ}\text{C} \pm 8.9^{\circ}\text{C}$. Mean maximum daily temperatures were comparable to the long-term mean for July (Bureau of Meteorology 2018). No rainfall occurred during the period the motion cameras were deployed.

3.2.3 Vertebrate Fauna

3.2.3.1 Habitat Assessment

Twenty fauna habitat assessments were conducted during Phase 1 within the seven fauna habitat types present in the survey area (Table C.1, Appendix C). An additional 10 habitat assessments were conducted within the Gorge habitat during the Eastern Range targeted survey (Table C.2, Appendix C). The locations are shown in Figure C.1 (Appendix C) and the following information was collected at each site:

- location – coordinates measured using a handheld GPS (GDA94)
- recorder and date – personnel involved in undertaking the fauna habitat assessment and the survey date
- habitat/landform – position in the landscape - major fauna habitat types were described based on the landform and vegetation
- vegetation type – a broad description of vegetation type and structure
- soils – a brief description of soil type
- microhabitat – presence of specific microhabitat features, for example, leaf litter, logs, burrows, rocky outcrops, rock crevices, hollows, permanent or semi-permanent water
- condition – habitat condition was assessed based on the presence of anthropogenic (human-induced) disturbances, and using the condition ratings suggested by Thompson and Thompson (2010) (Table B.9, Appendix B)
- disturbance – any disturbance such as clearing, fire, weeds, flooding, vehicular, machinery, tracks or grazing
- photographs – a representative photograph was taken of each habitat assessment site.

The information derived from the fauna habitat assessments was used to delineate fauna habitats throughout the survey area, which were then mapped accordingly. The potential for the mapped habitats to provide suitable habitat for MNES species, Pilbara Olive Python (VU; VU) (*Liasis olivaceus barroni*), Northern Quoll (EN; EN) (*Dasyurus hallucatus*), Ghost Bat (VU; VU) (*Macroderma gigas*), Pilbara Leaf-nosed Bat (VU; VU) (*Rhinonictis aurantia*) and Night Parrot (EN; CR) (*Pezoporus occidentalis*) were ranked according to the criteria listed in Table B.10 (Appendix B) and then mapped for each species (Figures G.2 to G.6; Appendix G).

3.2.3.2 Trapping Grids

The trapping program encompassed four Biota trap sites previously surveyed over two phases in October 2009 and May 2010 (Biota Environmental Sciences 2011) and an additional nine trapping sites surveyed over two phases by Astron during this field survey (Table 6). Biota traps sites were located in the Western Range portion of the survey area in Riverine, Low Hill and Stony Plain

habitats. To supplement previous data collected from this trapping effort, Astron set up trap sites across both Western and Eastern Ranges in habitats under-represented (Breakaway, Gorge, Drainage Line and Rocky Hill) during the Biota survey effort. Sites were selected in areas of favourable microhabitats to maximise the likelihood of fauna capture. Trap site GP02 was moved slightly between Phase 1 and Phase 2 of Astron's survey, owing to lack of access from track washouts. The trap site was relocated approximately 200 m along the same Breakaway feature to provide comparable results between the two phases. The location of previous and current trap sites is shown in Figure C.1 (Appendix C).

Biota used the following trap design:

- two trap sites (WSR03 and WSR13) of 10 pitfall traps (20 L buckets and PVC pipes)
- one trap site (WSR12F) of 12 funnel traps (fish-net style)
- one trap site (WSR15E) of 25 Elliot (A) traps (aluminium box-trap).

Astron used the following trap design for the current survey:

- three trap sites (GP05, GP06 and GP07) of 10 pitfall traps (20 L buckets), six funnel traps, 20 Elliot traps and four cage traps (wire mesh cage trap)
- two trap sites in rocky habitats (GP03 and GP04) were established as funnel sites, each with 10 funnels, 20 Elliott traps and four cage traps arranged in a linear layout.
- four trap sites in Gorge and Breakaway habitats (GP01, GP02, GP08 and GP09) were established as cage/Elliott sites, each with 10 Elliott traps and 10 cage traps arranged in a linear layout along suitable habitat features.

All pitfall and funnel traps were used in conjunction with a 100 m drift fence running over the centre of the pit, directing animal movement into the pitfall trap. The trap sites remained open for seven nights during both phases of Astron's trapping program and Phase 1 of the Biota trapping program, and were open for six nights during Phase 2 of the Biota trapping program. Traps were cleared each morning within three hours of sunrise to minimise the potential of trap death. The typical trap arrangement used by Astron is depicted in Figure 5.

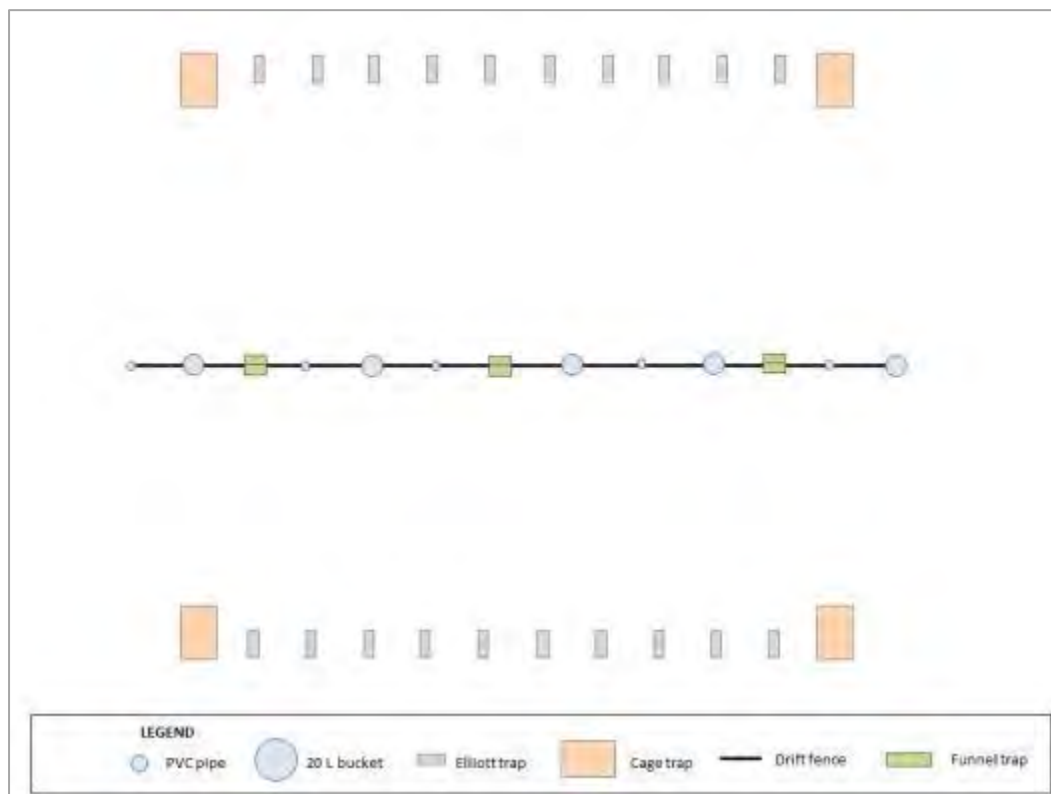


Figure 5: Diagrammatic layout of systematic trapping sites.

3.2.3.3 Avifauna Surveys

Systematic avifauna (bird) censuses were undertaken at each trapping grid for 20 minutes each day on three occasions, resulting in 60 minutes per person of survey effort at each site. This equates to a total of 2,160 minutes (36 hours) of avifauna censuses conducted during the both phases of the Astron survey. All species were recorded from sightings and/or from species-specific bird calls. Opportunistic records of species across the survey area were also recorded and habitats that may support species of conservation significance were targeted.

Biota (2011) undertook avifauna sampling in a similar manner at three of the four trap sites (WSR03, WSR12F and WSR15). Avifauna survey effort ranged between 140 minutes and 180 minutes at each of the sites with a total of 490 minutes avifauna sampling undertaken over both phases of the survey.

3.2.3.4 Motion Sensitive Cameras

During both phases of the Astron survey motion sensitive cameras (Moultrie and Reconyx HC600 HyperFire) were set at 27 locations for between two and six nights with a combined trapping effort of 87 camera trap nights. As part of the targeted fauna survey an additional 20 motion sensitive cameras were deployed within selected gorges of the Eastern Range portion of the survey area for 30 to 31 nights (for an additional trapping effort of 618 camera trap nights). The cameras were baited and placed in prospective/suitable habitat such as cave entrances and water holes aimed at targeting MNES species. Camera locations are shown in Figure C.1 and detailed in Tables C.1, C.2 and C.3 (Appendix C).

3.2.3.5 Acoustic Bat Surveys

Acoustic ultrahigh frequency equipment was used to record the presence of bats, in particular the Pilbara Leaf-nosed Bat and Ghost Bat. Acoustic recording devices (Song Meter (SM) 2 SM2BAT+ and SM4) were positioned in a total of 16 locations to achieve a broad coverage of the survey area. The detectors were set for two to five nights, resulting in a total of 38 recording nights. The locations are depicted in Figure C.1 and detailed in Table C.1 and C.2 (Appendix C). The bat echolocation data collected in the field was analysed by Robert Bullen (Bat Call WA 2018).

3.2.3.6 Active Foraging

Active searches were undertaken in microhabitats suitable for ground-dwelling reptiles and mammals. Active searches included the following:

- searching and recording scats, tracks and other traces
- turning over rock and logs and peeling off bark
- raking soil and leaf litter
- searching rocky habitats in cracks and caves, around water bodies and inside bore hole caps.

3.2.3.7 Targeted Searches

The aim of the targeted searches was to identify areas of potentially suitable habitat for conservation significant fauna, such as caves, and secondary signs including tracks, scats, diggings and burrows. Visual observation for conservation significant fauna habitat was ongoing whilst moving through the survey area. Track logs were recorded using a handheld GPS and are shown in Figure C.1 (Appendix C). Any opportunistic sightings of fauna species were recorded whilst traversing the survey area.

3.2.3.8 Nocturnal Spotlighting

Spotlighting at night was undertaken on foot and from vehicles to target fauna that are nocturnal or crepuscular, particularly conservation significant species. A total of 2,160 minutes (36 hours) of nocturnal spotlighting was undertaken in the survey area over both phases of the Astron survey. Nocturnal spotlighting was undertaken on foot within the Gorge habitat surrounding trap site GP09 (27/07/2017 and 12/04/2018) and GP08 (12/04/2018) and the Riverine habitat surrounding trap site GP01 (28/07/2017 and 10/04/2018), known as Ratty Springs.







3.2.3.9 Night Parrot Survey




Due to the recent discovery of Night Parrot populations in Western Australia, the DBCA have published Interim Guidelines for Preliminary Surveys of Night Parrots in Western Australia (Department of Parks and Wildlife 2017a). The survey area is located in the area mapped as 'High priority for survey' for this species so passive acoustic surveys and Autonomous Recording Units (ARUs) were undertaken in the most prospective habitats (Stony Plain habitat containing *Triodia*).

Passive acoustic surveys were undertaken at two sites in Phase 1 and ARUs were positioned at four sites in Phase 2. Passive acoustic surveys lasted for approximately 15 minutes per site and were undertaken within two hours of sunset during peak calling periods. The ARUs were set at each location for two to three nights and recorded from 1 hour pre-sunset to 1 hour post-dawn. The audio data was recorded at 44.1 kilobits per second and covered the frequency range 100 kilohertz (kHz) to 21,000 kHz which brackets the Night Parrot call frequency range of 1,500 kHz to 3,500 kHz.

The passive acoustic survey locations and ARU locations are depicted in Figure C.1 and detailed in Table C.1 and C.2 (Appendix C).

Table 6: Trapping site locations and survey effort for the current survey.

Site	MGA Zone 50 K		Habitat	Vegetation description	Habitat Condition	Date opened	Date closed	Trap nights	No. of traps	Total trap nights	Photo
	Easting (mE)	Northing (mN)									
GP01	555082	7433160	Breakaway	<i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> shrubland over <i>A. tetragonophylla</i> , <i>Dodonaea pachyneura</i> , <i>Eremophila cryptothrix</i> shrubs over <i>Triodia epactia</i> hummock grassland	0.8 (Very Good)	25/07/2017	1/08/2017	7	20	140	
						8/04/2018	15/04/2018	7	20	140	
GP02	554480	7432904	Breakaway	<i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> shrubland over <i>A. tetragonophylla</i> , <i>Dodonaea pachyneura</i> , <i>Eremophila cryptothrix</i> shrubs over <i>Triodia epactia</i> hummock grassland	0.8 (Very Good)	25/07/2017	1/08/2017	7	20	140	
	554142	7433029				8/04/2018	15/04/2018	7	20	140	
GP03	552465	7434065	Rocky Hill	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> trees over <i>Acacia</i> spp., <i>Grevillea berryana</i> , <i>Eremophila</i> spp. shrubs over <i>Triodia epactia</i> , <i>Triodia wiseana</i> hummock grassland	0.8 (Very Good)	24/07/2017	31/07/2017	7	34	238	
						8/04/2018	15/04/2018	7	34	238	
GP04	573285	7426541	Rocky Hill	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> trees over <i>Acacia</i> spp., <i>Grevillea berryana</i> , <i>Eremophila</i> spp. shrubs over <i>Triodia epactia</i> , <i>Triodia wiseana</i> hummock grassland	0.8 (Very Good)	23/07/2017	30/07/2017	7	34	238	
						7/04/2018	14/04/2018	7	34	238	
GP05	575727	7426094	Drainage Line	<i>Eucalyptus victrix</i> woodland over <i>Acacia</i> spp., <i>Melaleuca glomerata</i> shrubs over * <i>Cenchrus</i> spp. tussock grassland	0.8 (Very Good)	24/07/2017	31/07/2017	7	40	280	
						8/04/2018	15/04/2018	7	40	280	
GP06	569979	7425957	Low Hill	<i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> , <i>A. rhodophloia</i> shrubland over <i>A. tetragonophylla</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Eremophila</i> spp. shrubs over <i>Triodia epactia</i> , <i>Aristida contorta</i> , <i>Eriachne pulchella</i> grassland	0.8 (Very Good)	21/07/2017	28/07/2017	7	40	280	
						8/04/2018	15/04/2018	7	40	280	

Site	MGA Zone 50 K		Habitat	Vegetation description	Habitat Condition	Date opened	Date closed	Trap nights	No. of traps	Total trap nights	Photo
	Easting (mE)	Northing (mN)									
GP07	571937	7425173	Low Hill	<i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> , <i>A. rhodophloia</i> shrubland over <i>A. tetragonophylla</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Eremophila</i> spp. shrubs over <i>Triodia epactia</i> , <i>Aristida contorta</i> , <i>Eriachne pulchella</i> grassland	0.8 (Very Good)	22/07/2017	29/07/2017	7	40	280	
						7/04/2018	14/04/2018	7	40	280	
GP08	575464	7426216	Gorge	<i>Corymbia ferritcola</i> trees over <i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat. shrubland over <i>Triodia epactia</i> hummock grassland	1.0 (High Quality)	23/07/2017	30/07/2017	7	20	140	
						7/04/2018	14/04/2018	7	20	140	
GP09	573613	7425931	Gorge	<i>Corymbia ferritcola</i> trees over <i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat. shrubland over <i>Triodia epactia</i> hummock grassland	1.0 (High Quality)	23/07/2017	30/07/2017	7	20	140	
						7/04/2018	14/04/2018	7	20	140	
Total trap effort											3,752 nights

3.2.4 SRE Invertebrates

3.2.4.1 Habitat Assessment

Fauna habitats within the survey area were mapped for their suitability to support SRE invertebrates as part of an initial desktop assessment (Section 3.1.3) and further refined following the field survey.

3.2.4.2 Active Foraging

Astron sampled a total of 22 systematic sites (including the five pitfall/funnel trapping sites) for SRE fauna across the survey area (Figure C.1, Appendix C). All sites were sampled by active foraging and litter-soil samples. The sites were selected so that they represented the landforms and vegetation associations inferred as prospective in the desktop assessment. Detailed site descriptions, including associated landforms and vegetation features, are provided in Table C.1 and C.2 (Appendix C). The descriptions provide qualitative information about factors influencing the macroclimate (for example, landform, vegetation type, dominant substrate, and indicative plant species) and microclimate (for example, amount of organic matter or existing damage).

Foraging occurred in all habitats and was focused under boulders, crevices in rocky outcrops, at the base of tree logs, under loose tree bark, in moist and dry leaf litter accumulations and in *Triodia* clumps. Searches for mygalomorph spider burrows was by visual inspections. Night-time searching for scorpions was undertaken in conjunction with the nocturnal spotlighting. Leaf litter was sifted *in situ* with a 16 mm soil sieve, and potential SRE invertebrates preserved directly in 98% ethanol. Approximately 1,020 minutes (17 hours) were spent searching the 17 SRE sites (excluding the pitfall/funnel trapping sites). Any potential SRE invertebrates observed in the dry pitfall or funnel traps at each of the five relevant trapping grids were also collected.

3.3 SRE Specimen Identification

The samples were separated and sorted to morphospecies level under a dissecting microscope by Dr Erich Volschenk. Morphological identifications to species level were attempted for all collected specimens. These identifications were based on the available taxonomic literature and keys, environmental reports and online databases. Compound microscopes were used to examine fine taxonomic characters not visible otherwise, for example, trichobothria patterns (sensory hairs) in pseudoscorpions.

Dr Simon Judd contributed information about isopod distributions, SRE assessment and specimen identification. The remaining identifications (scorpions and snails) were carried out by Dr Erich Volschenk. Further details on SRE specimen identification are provided in Appendix D.

3.4 Taxonomy and Nomenclature

For species identified in the desktop assessment, every effort was made to determine the current scientific name for each taxon, including wherever there was doubt as to their true taxonomy (through subsequent name changes). A comprehensive description of SRE taxonomy and nomenclature is provided in Appendix D.

The biology of many SRE species is not well known and the precise distribution and life history are poorly, if at all, documented (Harvey 2002; Harvey et al. 2011). Species identification is often very difficult because few specimens have been collected, reference collections are unavailable, the specimens are the wrong sex or life stage for identification, or they are morphologically cryptic and require DNA analyses. Taxonomic resolution can also be poor, either because there are no published

taxonomic revisions for a group in question (terrestrial isopods in Western Australia), or because there is no expert actively working on one of the SRE groups.

3.5 Statistical Analyses

3.5.1 Sampling Effort

Sampling effort was assessed using species accumulation curves and modelled estimates of the total species pool. Species accumulation curves are created by randomly sampling an incremental number of sites while plotting the total number of species sampled. Species estimators are particular statistical models of species accumulation which estimate the total species pool available. Four species estimators were compared: Chao 2, Jackknife 1, Jackknife 2 and Bootstrap (Colwell and Coddington 1994). Species accumulation curves were created for each faunal group (mammals, birds and herpetofauna) and for the different surveys (Astron survey, Biota Phase 1 and 2 surveys, and all surveys). Species estimations shown were based on all surveys combined. All analyses were performed in R 3.2.1 (R Development Core Team 2016) using the package “Vegan”.

3.5.2 Site Classification

The similarity of species assemblages amongst sites (using all surveys) was assessed using two dimensional ordinations based on Sorensen’s index of similarity amongst sites. Significant groupings of sites by habitat type were identified using the ANOSIM function (Clarke, Somerfield, and Gorley 2008) within the package “Vegan”. Ordinations and ANOSIM tests were performed for each faunal group (mammals, birds and herpetofauna) separately.

3.6 Limitations

Following completion of the desktop assessment and field survey, a review of any limitations that may affect a complete assessment of the data collected was conducted. The limitations listed in Table 7 are based on those suggested as considerations in Technical Guidance - Terrestrial Fauna Surveys (Environmental Protection Authority 2016c).

This assessment combines data collected from Biota’s trapping program in 2010 (Biota Environmental Sciences 2011) with that recorded by Astron. As such, differences in methodology of trap design (lack of funnel and Elliot traps at all Biota sites), survey effort for avian census, acoustic bat sampling (use of SM2 units versus harp trap and AnaBat SD units) and their potential effect on the data are difficult to assess. Although different, the methods previously used are deemed adequate for a Level 2 survey.

The Astron trapping program recorded a comparatively low number of captures and reduced herpetofauna assemblage, however with the addition of the Biota trapping data the species accumulation curves beginning to asymptote (Section 4.2.2.1). The low herpetofauna captures can be partially explained by the trap methods used, with only five out of the 13 trap sites using pitfall traps. Although this is a partial limitation of the survey methods, the herpetofauna assemblage expected to occur in the survey area is common and widespread and is unlikely to include conservation significant fauna (Appendix E).

Due to the number of targeted fauna surveys conducted in the survey area, the populations of conservation significant fauna especially the Pilbara Leaf-nosed Bat and Ghost Bat are well documented (Biota Environmental Sciences 2014; Bat Call WA 2014a, 2015; Specialised Zoological 2013, 2010; Astron Environmental Services 2014; Biota Environmental Sciences 2010).

Most SRE species rely on moisture and are most active following periods of elevated rainfall and comparably low temperatures. The climatic conditions preceding and during both phases of the survey were relatively dry, with below average rainfall recorded. As such, climatic conditions potentially impacted the SRE survey results by under sampling species richness.

Table 7: Statement of limitations for the vertebrate and SRE invertebrate fauna survey.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(i) Competency/experience	No limitation	The ecologists responsible for conducting the survey have extensive experience in conducting Level 2 vertebrate and SRE fauna surveys in the Pilbara.
(ii) Scope What faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions.	No limitation	The survey scope employed was able to be completed and all sampling methods adequately employed. The fauna observed and identified are likely to represent a portion of the suite of species that utilise the survey area.
(iii) Proportion of fauna identified, recorded and/or collected	Minor Limitation	The fauna observed and identified are likely to represent a portion of the suite of species that utilise the survey area. Fauna habitats were able to be adequately described and a list of species likely to be present was prepared based on this assessment. Species accumulation curves generally did not reach an asymptote, but when taking into account previous records as well as species recorded from methods other than trapping, then a large portion of the predicted assemblage was recorded. It is not possible to determine bat species abundance from echolocation records; bat activity levels provide a relative measure of the abundance of each species within the survey area.
(iv) Sources of information Previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches and previous studies in the survey area and region.
(v) Proportion of task achieved. Further work which might be needed?	No limitation	The survey scope employed was able to be completed and all sampling methods adequately employed.
(vi) Timing/weather/season/cycle	Minor limitation	The temperatures during the Astron survey were above or close to the long term average. As such fauna abundance should not have been adversely affected by temperature. Rainfall in the three months preceding Phase 1 of the Astron survey was well below average; however, as this was the dry season survey it is not considered a limiting factor. Climatic conditions potentially impacted the SRE survey results by under sampling species richness. However, the survey sampled most of the SRE groups expected from the Pilbara.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(vii) Disturbances For example fire, flood, accidental human intervention which affected results of survey	Minor limitation	Large portions of the Low Hill and Rocky Hill habitats were affected by active and exploratory mining activities including; exploration drilling pads, tracks, haul roads, mine pits and associated infrastructure. All fauna trap sites and sampling points were, where possible, located away from active mining activities to reduce the impact of these on the data collected. No other disturbances were recorded in the survey area that would have affected the survey results.
(viii) Intensity In retrospect, was the intensity adequate?	No limitation	The intensity of the surveys was considered adequate for a Level 2 assessment.
(xi) Completeness Was the relevant area fully surveyed?	No limitation	All main habitats in the survey area were surveyed and coverage of habitat assessments and targeted surveys completed as part of this assessment and previous survey efforts are considered adequate.
(x) Resources Degree of expertise available in animal identification to taxon level.	No limitation	Adequate resources were available to identify fauna species. All technical personnel involved in identification have extensive experience in conducting Level 2 vertebrate and SRE fauna surveys in the Pilbara. Taxonomic experts were consulted for all SRE fauna groups to help identify the selected taxa.
(xi) Remoteness and/or access problems	Minor limitation	The Eastern Range portion of the survey area and the areas surrounding active mining activities were not able to be accessed during the current survey, however these areas have been previously surveyed, assessed and mapped (Astron Environmental Services 2014).
(xii) Availability of contextual information For example biogeographic information on the region.	No limitation	Database searches and previous fauna surveys in the survey area provide contextual information.

4 Results

4.1 Desktop Assessment

4.1.1 Environmentally Sensitive Areas

No ESAs intersect the survey area, with the nearest ESA Hamersley Range National Park (1977 boundary) approximately 26 km north-east of the survey area (Department of the Environment and Energy 2008).

4.1.2 Vertebrate Fauna

The database searches and literature review results indicate that 271 vertebrate fauna have been previously recorded in the vicinity of the survey area, including four amphibian species, 84 reptile species, 143 bird species and 40 mammal species (including 10 introduced mammal species) (Table E.1-E.4, Appendix E). Of these, 29 species are of conservation significance, including three reptile species, 19 bird species and seven mammal species (Table F.1, Appendix F). Of these, six species were considered to have a 'high' likelihood (inclusive of those previously recorded within the survey area), 18 species were considered to have a 'moderate' likelihood and five were considered to have a 'low' likelihood of occurrence within the survey area (Table F.1, Appendix F). This is based on their respective ecology, habitats considered likely to be present and any previous records from historic survey and database records.

Previous surveys undertaken for Rio Tinto in the vicinity of the survey area recorded six conservation significant vertebrate fauna species: Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Western Pebble-mound Mouse (*Pseudomys chapmani*), Grey Falcon (*Falco hypoleucos*) and Pilbara Olive Python (Table 8). The Rainbow Bee-eater (*Merops ornatus*) and the Eastern Great Egret (*Ardea modesta*) were previously listed as Migratory under the EPBC Act and Schedule 5 under the *Wildlife Conservation Act 1950* (WC Act) but have subsequently been delisted since the Phase 1 survey.

Table 8: Summary of literature review results from surveys conducted within the vicinity of the survey area.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Conservation significant vertebrate fauna recorded
Mattiske (1998)	Paraburdoo Size not stated	Level 1	April 1998	Habitat assessments of 11 sites and opportunistic searches.	None recorded
GHD (2009)	Turee Syncline 3,075 ha	Level 2 (two phase)	June 2008 October 2008	Eleven trapping sites, avifauna census, nocturnal searches and echolocation recordings targeting bat species targeting bat species.	Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>)
Biota (2010)	Eastern Ranges Size not stated	Targeted/ Level 1	October 2010	Targeted searches of suitable habitat and Anabat SD1 acoustic bat call recorders were used to detect the presence of conservation significant fauna species.	Northern Quoll (<i>Dasyurus hallucatus</i>) Pilbara Leaf-nosed Bat (<i>Rhinonictis aurantia</i>) Ghost Bat (<i>Macroderma gigas</i>)
Specialized Zoological (2010)	Eastern Ranges Size not stated	Desktop bat survey	September 2010	A summary of previous Pilbara Leaf-nosed Bat records for the Eastern Ranges area.	Pilbara Leaf-nosed Bat (<i>Rhinonictis aurantia</i>)
Biota (2011)	Western Ranges Size not stated	Level 2 (two phase)	October 2009 May 2010	Habitat assessments, 17 trapping sites, avifauna censuses at each trapping site, foot traverses, targeted searches for both vertebrates and SRE invertebrates, and the use of Anabat SD1 acoustic bat call recorders and harp traps.	Pilbara Olive Python (<i>Liasis olivaceus barroni</i>) Pilbara Leaf-nosed Bat (<i>Rhinonictis aurantia</i>) Ghost Bat (<i>Macroderma gigas</i>) Grey Falcon (<i>Falco hypoleucos</i>) Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>)
Ecologia (2011)	Paraburdoo 5,655 ha	Level 1	July 2011	Avifauna census, habitat assessments and Anabat II acoustic bat call recorders.	None recorded
Specialized Zoological (2013)	Eastern Ranges Size not stated	Targeted bat survey	November 2012	SM2BAT acoustic bat call recorders were used at nine locations for the presence of conservation significant bat species.	Pilbara Leaf-nosed Bat (<i>Rhinonictis aurantia</i>)
Astron (2014)	Eastern Ranges 2,190 ha	Targeted/ Level 1	May 2014	Targeted searches of suitable habitat, motion sensor cameras and SM2 acoustic bat call recorders were used to detect the presence of conservation significant fauna species.	Pilbara Leaf-nosed Bat (<i>Rhinonictis aurantia</i>) Ghost Bat (<i>Macroderma gigas</i>)

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Conservation significant vertebrate fauna recorded
Bat Call WA (2014a)	Eastern Ranges Size not stated	Targeted bat survey	June 2014	SM2BAT acoustic bat call recorders were used at 16 locations for the presence of conservation significant bat species.	Pilbara Leaf-nosed Bat (<i>Rhinonictoris aurantia</i>) Ghost Bat (<i>Macroderma gigas</i>)
Biota (2014)	Greater Paraburdoo Size not stated	Targeted bat survey	February 2014	SM2BAT acoustic bat call recorders were used at 18 locations for the presence of conservation significant bat species.	Pilbara Leaf-nosed Bat (<i>Rhinonictoris aurantia</i>)
Bat Call WA (2015)	Western Ranges Size not stated	Targeted bat survey	December 2015	SM2BAT acoustic bat call recorders were used at Cave entrance supplemented an infrared camera.	Pilbara Leaf-nosed Bat (<i>Rhinonictoris aurantia</i>)
Eco logical (2016)	Doggers Gorge 272 ha	Level 1	August 2015	A Level 1 survey to support an NVCP application.	None recorded

4.1.3 SRE Invertebrates

The database search yielded 3,345 records from within the search area (Appendix E). Of those, 1,328 records were attributed to the SRE groups SREs and potential SREs. The SRE groups represented 154 taxa, of which eight represented named species, 89 represented morphospecies and 57 represented unidentified species belonging to taxa known to contain SRE representatives (Table 9). Previous species records are shown in Figures 4.1 to 4.10 (Appendix D). The majority (148) of these taxa were classified as potential SRE in the WAM sub-category 'Data deficient' (DD) and six were confirmed SRE. The high proportion of potential SREs and undescribed morphospecies indicates a poor state of knowledge about these invertebrates in this region.

Table 9: Summary of Western Australian Museum database search results for SRE and potential SRE taxa (Western Australian Museum 2017).

Order	Named species	Morphospecies	Un-named taxa ("sp.")	Totals
Araneae (spiders)	3	33	15	51
Pseudoscorpiones (pseudoscorpions)	0	9	11	20
Opiliones (harvestmen)	0	1	3	4
Schizomida (short tailed whipscorpions)	0	1	0	1
Scorpiones (scorpions)	1	14	5	20
Geophilomorpha (earth centipedes)	0	4	5	9
Scolopendromorpha: Cryptopidae (cryptic centipedes)	0	2	1	3
Polydesmida (flat back millipedes)	0	4	2	6
Spirobolida	1	1	2	4
Polyxenida (pincushion millipedes)	1	0	1	2
Polyzoniida (sucking millipedes)	0	0	1	1
Isopoda (slaters)	0	16	5	21
Eupulmonata (land snails)	2	4	5	11
Symphyla (micro centipedes)	0	0	1	1
Totals	8	89	57	154

4.2 Field Survey

4.2.1 Vertebrate Fauna Habitat

4.2.1.1 Fauna Habitats

Seven broad fauna habitat types were recorded in the survey area: Riverine, Drainage Line, Gorge, Breakaway, Rocky Hill, Low Hill, and Stony Plain. The habitats are described in Table 10 and mapped in Figure G.1 (Appendix G).

Areas of cleared habitat were prevalent throughout the central portion of the survey area where mining infrastructure and operations were concentrated. The fauna habitats surrounding these areas have been impacted by edge effects, lack of connectivity, grazing and the vegetation is often covered in dust. As such, these fauna habitats were considered 'disturbed' to 'good' condition. The majority of the habitats away from the mining operations were considered 'very good' to 'high quality' condition owing to the lack of disturbances from fire, weeds and grazing. The Riverine habitats were impacted by Buffel Grass, grazing and erosion from livestock. The Gorge and

Breakaway habitats generally had the highest quality fauna habitat condition due to isolation from threatening processes.

Riverine habitat is considered to be of high importance to fauna species providing a range of ecological values to a wide suite of species. This habitat type in the survey area was often narrow linear isolated pockets of riparian vegetation which is usually denser, taller and more diverse than the adjacent Drainage Line habitat. The vegetation was complex and provided a range of micro niches for fauna species to exploit, such as for shelter and foraging. There were also a significant number of permanent and semi-permanent water bodies that provide drinking opportunities for a range of species and attract prey for predators. This habitat supports conservation listed fauna species such as the Pilbara Olive Python and provides foraging sites for Ghost Bats and Pilbara Leaf-nosed Bats.

Drainage Line habitat is a commonly recorded habitat for the Pilbara region and considered to be of low to moderate value to a wide spectrum of fauna species. The Drainage Line habitat typically exhibits a moderate diversity of microhabitats, with some tree hollows and woody debris (logs and leaf litter). Within the survey area this habitat was generally devoid of vegetation when compared to Riverine habitat, with less dense and less complex vegetation. There were some locations with water bodies, albeit less significant and less permanent, which would likely be seasonally inundated during large rainfall events only. Ground dwelling fauna utilise the linear nature of this habitat to traverse between habitats.

Gorge habitat is one of the most restricted habitats in the survey area. Gorges are a common feature of the Pilbara; however, as they tend to be narrow, linear features, gorges represent a small proportion of the total land area. In addition, they represent important shelter or roosting habitat for a number of MNES species, including the Pilbara Olive Python, Ghost Bat, Pilbara Leaf-nosed Bat and Northern Quoll. They may also support Priority listed species such as Long-tailed Dunnart (*Sminthopsis longicaudata*). Occasional deep caves and semi-permanent rock pools were recorded in this habitat type; these habitat features can provide refuge for fauna during harsher drier seasonal conditions. This habitat is considered of high value as it contains a complexity of microhabitats and supports conservation significant fauna species.

Breakaway habitat is a common feature of the Pilbara but because they tend to be narrow, linear features, they represent a small proportion of the total land area. The breakaways of the survey area were often associated with the Mesa habitat. Breakaway habitat contained microhabitats such as crevices, overhangs and shallow caves that provide shelter opportunities for MNES species, including the Pilbara Olive Python and Northern Quoll. The caves have the potential to be used as diurnal roosts and nocturnal feeding roosts for the Ghost Bat, potential den sites for the Northern Quoll and for the Pilbara Olive Python. The Breakaway habitat provides critical habitat values to a number of conservation listed species including MNES, therefore it is considered of high importance for fauna.






Rocky Hill habitat is common and widespread throughout the Pilbara. This habitat generally has low vegetation complexity and low diversity of microhabitats; however, MNES species (such as the Northern Quoll) are likely to traverse and forage within these habitats. Other conservation significant species such as the Western Pebble-mound Mouse and Long-tailed Dunnart may also utilise this habitat. Therefore this habitat is considered of moderate value for fauna.




Low Hill habitat is widespread and common throughout the Pilbara region and although there are a few conservation listed species that may utilise this habitat, they are unlikely to be restricted to it, with the possible exception of the Western Pebble-mound Mouse. This habitat generally has low vegetation complexity and low diversity of microhabitats available for fauna species to exploit. The

soils are generally stony and compact, reducing the potential opportunities for burrowing species. This habitat is considered to be of low value to a broad spectrum of fauna species.

Stony Plain habitat is widespread and common throughout the Pilbara region and although there are a few species of conservation significance that may utilise it, they are not restricted to this habitat type. Conservation significant fauna likely to occur in this habitat type include the Western Pebble-mound Mouse. This habitat generally had low vegetation complexity and microhabitat diversity, it is considered to be of low value for fauna.

Table 10: Fauna habitat types recorded in the survey area.

Habitat type	Extent in survey area (proportion)	Broad habitat description	Vegetation description	Microhabitats	Sites	Habitat condition	Value (broad faunal assemblage and MNES species)	Representative photo
Riverine	131.5 ha (1.2%)	Densely vegetated riparian zones often with permanent and semi-permanent water bodies on stony soils	<i>Eucalyptus camaldulensis</i> , <i>E. victrix</i> trees over <i>Acacia</i> spp., <i>Melaleuca glomerata</i> shrubland over <i>Cyperus vaginatus</i> sedgeland over * <i>Cenchrus</i> spp. tussock grassland	Surface water (permanent and semi-permanent) Dense and varied leaf litter Hollow bearing trees and logs	BAT7, CAM3, CAM5, CAM7, CAM12, CAM13, CAM14, CAM18, CAM19, HA7, HA12, SRE4, SRE5, SRE7, SRE8, SRE12	Good to High Quality	High value to a wide spectrum of fauna species that are likely to reside in Riverine habitats. Moderate value to target MNES species as they are likely to traverse and forage within this habitat type.	
Drainage Line	554 ha (4.9%)	Open drainage areas on stony soils. Water bodies only present during times of heavy inundation	<i>Eucalyptus victrix</i> woodland over <i>Acacia</i> spp., <i>Melaleuca glomerata</i> shrubs over * <i>Cenchrus</i> spp. tussock grassland	Hollow bearing trees and logs Sparse ground cover/vegetation Minimal leaf litter	GP05, BAT4, BAT5, BAT6, BAT8, CAM1, CAM2, CAM6, CAM8, CAM21, CAM26, HA2, HA14, HA18	Disturbed to Good Quality	Moderate value to a wide spectrum of fauna species that are likely to reside in Drainage habitats. Low value to target MNES species as they do not provide significant refugia or shelter.	
Gorge	234.9 ha (2.1%)	Deep often rocky gorges, sometimes with ephemeral or semi-permanent pools	<i>Corymbia ferritcola</i> trees over <i>Acacia citrinoviridis</i> , <i>A. aneura</i> sens. lat. shrubland over <i>Triodia epactia</i> hummock grassland	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	GP08, GP09, BAT1, BAT2, BAT13, BAT14, BAT15, CAM9, CAM10, CAM20, CAM22, CAM23, CAM24, CAM25, CAM26, HA13, HA19, SRE1, SRE2, SRE3, SRE9, SRE14, SRE15, SRE16, SRE17, ERCAM1 to ERCAM 20, ERHA 1 to ERHA10	High Quality	Primary high value habitat for target MNES species. Provides significant refugia/shelter sites and supports a diversity of fauna species.	
Breakaway	136.4 ha (1.2%)	Breakaway or ridge line, falling away to steep scree slope or drainage line	<i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> shrubland over <i>A. tetragonophylla</i> , <i>Dodonaea pachyneura</i> , <i>Eremophila cryptothrix</i> shrubs over <i>Triodia epactia</i> hummock grassland	Caves (roost/feed caves) Cracks and crevices Sheltered leaf litter	GP01, GP02, BAT3, BAT9, BAT11, BAT16, CAM4, CAM11, CAM15, CAM16, CAM17, HA5, HA8, HA16, SRE6, SRE11, SRE13	High Quality	High value to a low diversity of fauna species that are likely to reside in Breakaway habitats. High value to target MNES species as they are likely to roost and den within this habitat type.	
Rocky Hill	2,541.2 ha (22.7%)	Stony hills on high ranges with dissected valleys and gorges	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> trees over <i>Acacia</i> spp., <i>Grevillea berryana</i> , <i>Eremophila</i> spp. shrubs over <i>Triodia epactia</i> , <i>Triodia wiseana</i> hummock grassland	Termite mounds, tree hollows, crevices	GP03, GP04, BAT10, BAT12, HA3, HA4, HA9, HA11, HA15, HA17	Disturbed to High Quality	Moderate value for target MNES species as they are likely to traverse and forage within these habitats. Moderate value to a low diversity of fauna species that are rocky habitat specialists.	

Habitat type	Extent in survey area (proportion)	Broad habitat description	Vegetation description	Microhabitats	Sites	Habitat condition	Value (broad faunal assemblage and MNES species)	Representative photo
Low Hill	2,000.4ha (17.9%)	Low stony hills and slopes with dissected valleys and drainage on stony soils	<i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> , <i>A. rhodophloia</i> shrubland over <i>A. tetragonophylla</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Eremophila</i> spp. shrubs over <i>Triodia epactia</i> , <i>Aristida contorta</i> , <i>Eriachne pulchella</i> grassland	Termite mounds, <i>Triodia</i> hummocks, minimal leaf litter	GP06, GP07, HA1, HA6, HA10, HA20, NP ARU3	Disturbed to High Quality	Low value to a wide spectrum of fauna species that are likely to reside in within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Stony Plain	2,175.4 (19.4%)	Broad flat low lying plains to undulating plain on soft loamy soils	<i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> shrubland over <i>A. tetragonophylla</i> , <i>Eremophila cuneifolia</i> , <i>Senna</i> spp. shrubs	Termite mounds, moderate leaf litter	HA3, HA4, HA11, NP1, NP2, NP ARU1, NP ARU2, NP ARU4, SRE10	Disturbed to High Quality	Low value to a wide spectrum of fauna species that are likely to reside in within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Cleared	3,429.6 ha (30.6%)	Cleared areas from mining and pastoralism activities	Vegetation structure disturbed.	None	None	Highly Degraded	Little value as fauna habitat.	

Key: Cam - camera (active) site/location; HA - habitat assessment site/location; GP- trapping grid site/location; BAT - acoustic bat recording site/location; NP – passive acoustic survey; NP ARU - Nigh Parrot Active Recording Unit location; SRE - Short Range Endemic sample site; ER - prefix indicates survey method undertaken as part of the Eastern Range Targeted Fauna Survey

4.2.1.2 Significant Habitat Areas

Two separate Pilbara Leaf-nosed Bat roosts have been identified as occurring around the Paraburdoo region. Analysis of the number of calls recorded and their seasonality indicates that the roost sites are permanent diurnal/maternal roosts, supporting breeding populations of the species. The Paraburdoo East roost site is still to be identified, but current data indicate that it occurs north of the Eastern Range mining operations and most likely outside of the survey area boundary. The western roost is a confirmed maternal roost located in the Breakaway habitat adjacent to Ratty Springs (Bat Call WA 2015).

The survey area contains two areas that support permanent surface water: Ratty Springs and Seven Mile Creek (Figure G.1 and Table G.1, Appendix G). These areas are refugia for aquatic/moisture dependent fauna, allowing them to remain in the survey area during the dry season. The complex vegetation and presence of water at these sites provides reliable foraging and drinking localities for a range of fauna including the MNES species. The number of Pilbara Leaf-nosed Bat calls previously detected at Ratty Spring was unusually high for a foraging location for the species. This high number combined with the late dry season timing of the detections indicates that Ratty Spring is a primary location for the bats from the Ratty Springs roost to drink and forage immediately after leaving the roost (Bat Call WA 2014b).

The surface water present in Seven Mile Creek is heavily supplemented by discharge from the Primary Plant Discharge Point and the volume of discharge is dependent upon plant water demand at any given time. Plant discharge provides sufficient water for a Riverine ecosystem to be established and supported year round.

Gorge habitats present in the survey area are considered important as refugia on a local scale due to the significant microhabitats they provide, such as caves and water pools. This habitat was considered highly suitable foraging and potential shelter for the MNES, in particular the Gorge habitat of the north-eastern corner of the survey area and the small gorge systems associated with Mount Misery access track, both associated with Eastern Ranges (Figure G.1 and Table G.1, Appendix G). The occurrence of Pilbara Leaf-nosed Bats at Eastern Range is likely to be influenced by the presence of water pools (typically persisting within deeply incised, shaded gorges) and major drainage lines with high levels of biomass (Specialised Zoological 2013).

To a lesser extent the three gorge systems adjacent to the current Eastern Range mine footprint provide significant microhabitats. These three gorge systems are classified as ranging from 'excellent' to 'good' condition; however, evidence of anthropomorphic impacts such as weeds, rubbish, dust and sedimentation are present. These impacts are more pronounced close to the mining activities with the gorges situated to the east of the Eastern Range mine footprint showing little impact (Table C.3, Appendix C). During Astron's 2014 assessment minimal Pilbara Leaf-nosed Bat activity and no Ghost bat activity was recorded in these areas despite the presence of suitable caves for foraging by these species (Astron Environmental Services 2014). Despite these factors the overall condition of the habitat is still considered 'High Quality' and the presence of Northern Quolls (scat and footprint) suggests it still provides suitable habitat for MNES species.

4.2.1.3 *Habitat Suitability for MNES Species*

Northern Quoll

Approximately 371 ha (3%) of the survey area, comprising Gorge and Breakaway habitats, was considered potential shelter and foraging habitat for the Northern Quoll (Table B.10, Appendix B; Figure G.2, Appendix G). The Gorge and Breakaway habitats contain rocky environments of high relief that are particularly important for Northern Quolls in the Pilbara as they provide denning sites for breeding and shelter and diverse microhabitats for foraging.

Approximately 3,227 ha (29%) of the survey area was considered suitable foraging and dispersal habitat, which mostly consisted of Riverine, Drainage Line and Rocky Hill habitats, particularly where these habitats were in close association with the Gorge and Breakaway habitats as they provided microhabitats such as crevices and cracks for foraging (Figure G.2, Appendix G). The remaining 7,605 ha (68%) of the survey area was considered to provide limited foraging and dispersal habitat, consisting of Stony Plain and Low Hill habitats (Figure G.2, Appendix G).

Ghost Bat

Approximately 371 ha (3%) of the survey area, comprising the Gorge and Breakaway habitat, was considered potential shelter and foraging habitat (Table B.10, Appendix B; Figure G.3, Appendix G), due to the presence a number of deep/humid caves that potentially support roost sites. No known diurnal or maternal roosts have been recorded in the survey area. Both Gorge and Breakaway habitats contained caves and deep shelters used as nocturnal feeding roosts. Both habitats contain complex vegetation structures and microhabitats that support prey species and foraging sites for the Ghost Bat.

Approximately 3,227 ha (29%) of the survey area, which consisted of Riverine, Drainage Line and Rocky Hill habitat, was considered suitable foraging and dispersal habitat (Figure G.3, Appendix G). The tall trees found in the Riverine and Drainage Line habitats provide ideal foraging/hunting perches particularly in areas that contain permanent surface water or thick vegetation. The Rocky Hill habitat contains microhabitats such as boulder piles, crack and crevices that support a wide range of prey species for the Ghost Bat.

The remaining 7,605 ha (68%) of the survey area, comprising the Stony Plain and Low Hill habitats, was considered to provide limited foraging and dispersal habitat (Figure G.3, Appendix G).

Pilbara Leaf-nosed Bat

Approximately 371 ha (3%) of the survey area, comprising the Gorge and Breakaway habitat, was considered potential shelter and foraging habitat for this species (Table B.10, Appendix B; Figure G.4, Appendix G), due to the presence of nocturnal refuge caves. The Pilbara Leaf-nosed Bat requires deep, humid, climatically stable caves for diurnal and maternal roost sites. One known permanent diurnal/maternal roost site is located in the survey area near Ratty Springs (Bat Call WA 2015). Other caves located in the Gorge and Breakaway habitats of the survey area, specifically those located in the Eastern Ranges, do not fit these criteria; however, they can be classified as nocturnal refuge caves (Department of the Environment 2017) that are occupied or entered at night for resting or feeding.

Approximately 3,252 ha (29%) of the survey area, which consisted of Riverine, Drainage Line, Rocky Hill habitat and man-made water sources such as the Tailings Dam and the Eastern Range primary crusher pond, was considered suitable foraging and dispersal habitat (Figure G.4, Appendix G). The

Riverine habitat (Ratty Springs and Seven Mile Creek) and permanent pools, ridges and ephemeral creek lines surrounding both roost sites have been shown to provide preferred foraging habitat for the Pilbara Leaf-nosed Bat (Bat Call WA 2014a). The complex vegetation structure, in particular surrounding areas of permanent water, of the Riverine and Drainage Line habitats provide ideal foraging habitat for this species.

The remaining 7,605 ha (68%) of the survey area, comprising the Stony Plain, Rocky Hill and Low Hill habitats, was considered to provide limited foraging and dispersal habitat (Figure G.4, Appendix G).

Pilbara Olive Python

Approximately 503 ha (5%) of the survey area, comprising the Gorge, Breakaway and Riverine habitats, was considered as potential shelter and foraging habitat for the Pilbara Olive Python (Table B.10, Appendix B; Figure G.5, Appendix G). The caves and overhangs of the Gorge and Breakaway habitats provide denning sites and ambush locations frequented by this species. The thick vegetation and log piles/flood refuse provide shelter and ambush locations within the Riverine habitat, especially in areas containing permanent or semi-permanent water sources.

Approximately 3,095 ha (27%) of the survey area was considered suitable foraging and dispersal habitat, which consisted of Rocky Hill and Drainage Line habitats (Figure G.5, Appendix G). These habitats are often adjacent to the more suitable Gorge and Riverine habitats and provide dispersal opportunities for the Pilbara Olive Python.

The remaining 7,605ha (68%) of the survey area was considered to provide limited foraging and dispersal habitat, consisting of Stony Plain and Low Hill habitats (Figure G.5, Appendix G).

Night Parrot

None of the habitats of the survey area support the old, large and unburnt *Triodia* clumps that are considered the primary habitat requirement for the Night Parrot (Department of Parks and Wildlife 2017a). The habitats present were considered unsuitable Night Parrot habitat due to the effects of recent fires (less than 10 years old), pastoral and mining impacts over a long duration, very sparse ground cover vegetation and the lack of chenopod communities or suitable size/age *Triodia* hummocks. As such, the entire survey area (11,203.4 ha) was considered to provide limited foraging and dispersal habitat (Figure G.6, Appendix G).

4.2.2 Vertebrate Fauna Species

There were 154 vertebrate fauna species recorded within the survey area during the survey (Table 11). A complete list of recorded species is provided in Tables E.5-E.9 (Appendix E). The following sections provide detailed results for each major taxonomic group sampled.

Table 11: Number of vertebrate fauna species recorded during the survey.

Fauna taxonomic group	No. of species recorded	No. of conservation significant species recorded	No. of introduced species recorded
Amphibians	2	0	0
Reptiles	34	0	0
Birds	94	2	0
Mammals	24	3	4
Total	154	5	4

4.2.2.1 Herpetofauna

Two amphibian species were recorded during the surveys: *Litoria rubella* and *Cyclorana maini* (Table E.5, Appendix E). Frogs were either sighted or heard calling during targeted searches. No conservation significant species were recorded.

Thirty-four reptile species were recorded during the surveys, 26 of which were from Astron's current survey (Table E.6, Appendix E). The most abundant groups encountered were the skinks (60 records, 33%), followed by the geckos (57 records, 31%). Both of these groups were also the most speciose with eight species each. The most commonly recorded species were *Ctenotus saxatilis* (37 records), *Ctenophorus caudicinctus* and *Heteronotia binoei* (21 and 18 records respectively). The most speciose sites were WSR13 (Riverine) with 10 species and GP07 (Low Hill) with nine species. One species, *Varanus giganteus* was recorded via motion sensitive camera, with all other species recorded at trapping grids. No conservation significant reptile species were recorded during the survey.

Species accumulation curves began to asymptote when all surveys were considered (Figure 6), and based on estimates of total species richness, between 59% and 82% of the total species pool was recorded (Table 12). The survey effort recorded a portion of the herpetofauna present in the survey area. The reduced herpetofauna captures can be partly explained by the trap methods used, with only five out of the 13 trap sites using pitfall traps.

Table 12: Total number of herpetofauna taxa sampled in comparison to estimates of the total species pool based on several models.

	Observed	Estimated			
		Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of species	35	52	52	60	42
Estimated % sampled		68	68	59	82

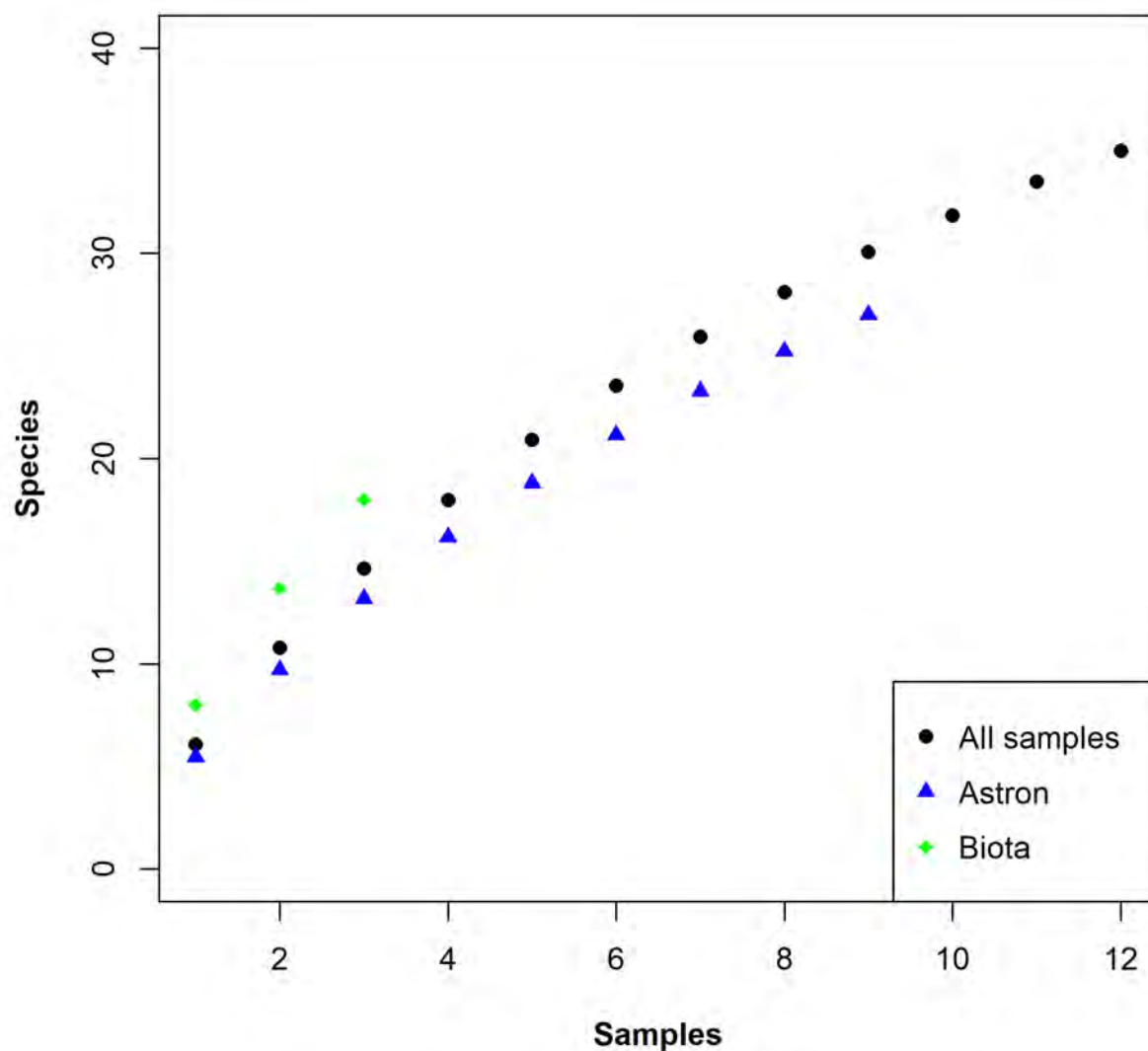


Figure 6: Species accumulation curves for herpetofauna surveys.

There was no significant difference in species composition between habitat types (ANOSIM $R = 0.325$, $P = 0.108$), with each trapping site showing slightly different species compositions (Figure 7).

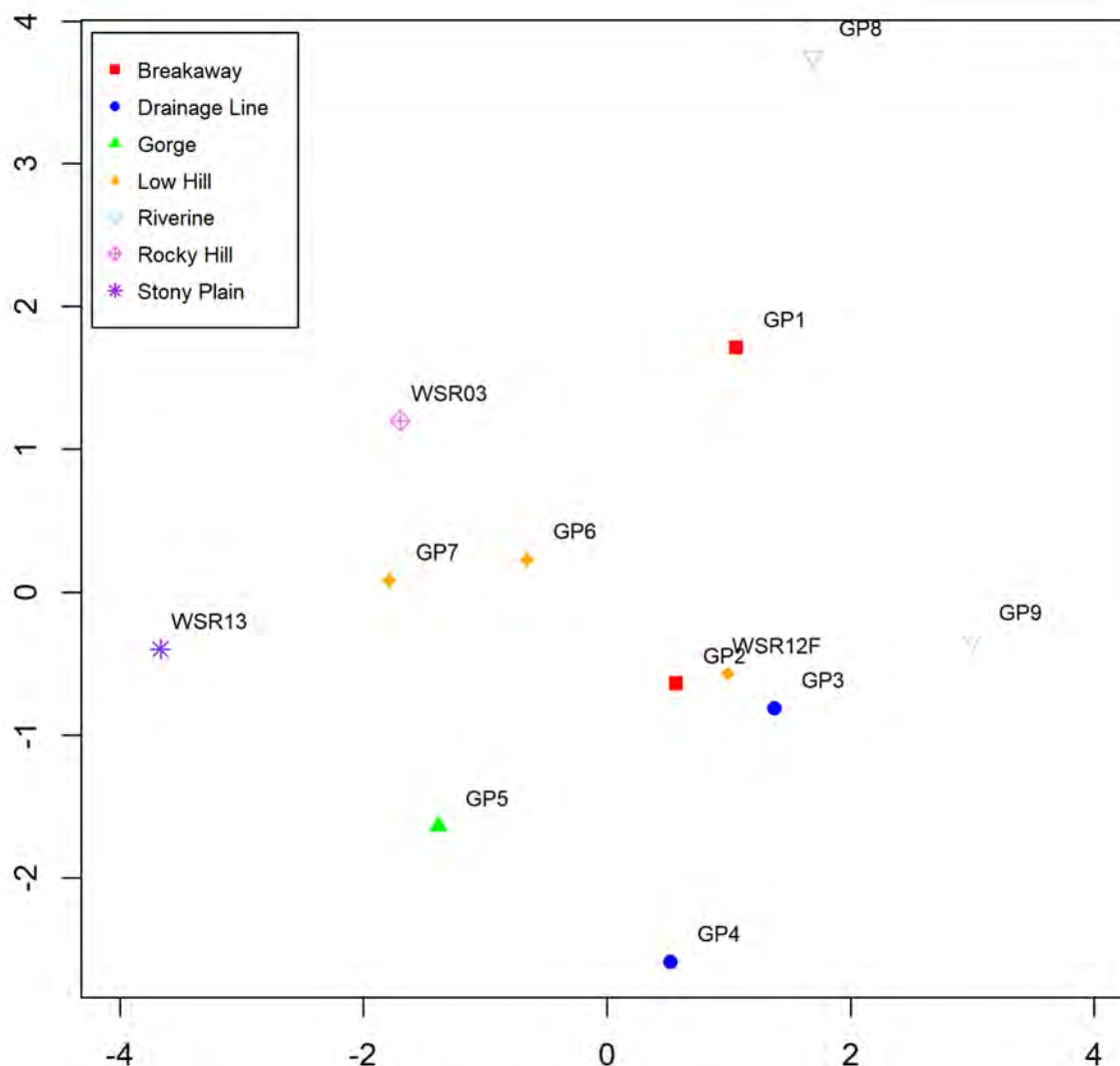


Figure 7: Two-dimensional ordination of herpetofauna species assemblages of each site based on Sorensen's index of similarity.

4.2.2.2 Birds

Ninety-four bird species were recorded during the surveys, 89 of which were from Astron's current survey (Table E.7, Appendix E). The most commonly recorded species was the Zebra Finch (*Taeniopygia guttata*) with 132 records, followed by the Painted Finch (*Emblema pictum*) with 49 records. The most abundant group of birds was the Estrildidae (Finches), with 184 records accounting for 23% of all records. The most speciose families observed were the Accipitridae (Eagles, Kites and Hawks) and Meliphagidae (Honeyeaters), which comprised 12 and eight species, respectively. The most speciose sites were GP05 (Drainage Line) with 26 species and WSR13 (Riverine) and GP01 (Breakaway) both with 24 species. Of the 94 bird species recorded 40 species were not recorded at trapping grids, but from targeted and opportunistic searches.

Two bird species of conservation significance were recorded during the survey. Two individuals of the Grey Falcon (*Falco hypoleucos*), listed as Vulnerable under the WC Act, were recorded on a radio tower in the Eastern Range mining operations. A single individual Common Sandpiper (*Actitis hypoleucos*), listed as Migratory under EPBC Act 1999 and International Agreement under the WC Act, was recorded at the Tailings Dam.

Species accumulation curves were approaching asymptote during the current surveys (Figure 8), and based on estimates of total species richness, between 59% and 87% of the total species pool was recorded (Table 13). As an additional 30 bird species (32%) were recorded opportunistically the survey effort recorded the majority of the avifauna present in the survey area. There was a significant difference in species composition between habitat types (ANOSIM $R = 0.494$, $P=0.027$; Figure 9) with each trapping site loosely grouped with other trap sites in the same habitat type and showing similar species compositions.

Table 13: Total number of bird taxa sampled in comparison to estimates of the total species pool based on several models.

	Observed	Estimated			
		Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of species	64	108	86	101	74
Estimated % sampled		59	74	63	87

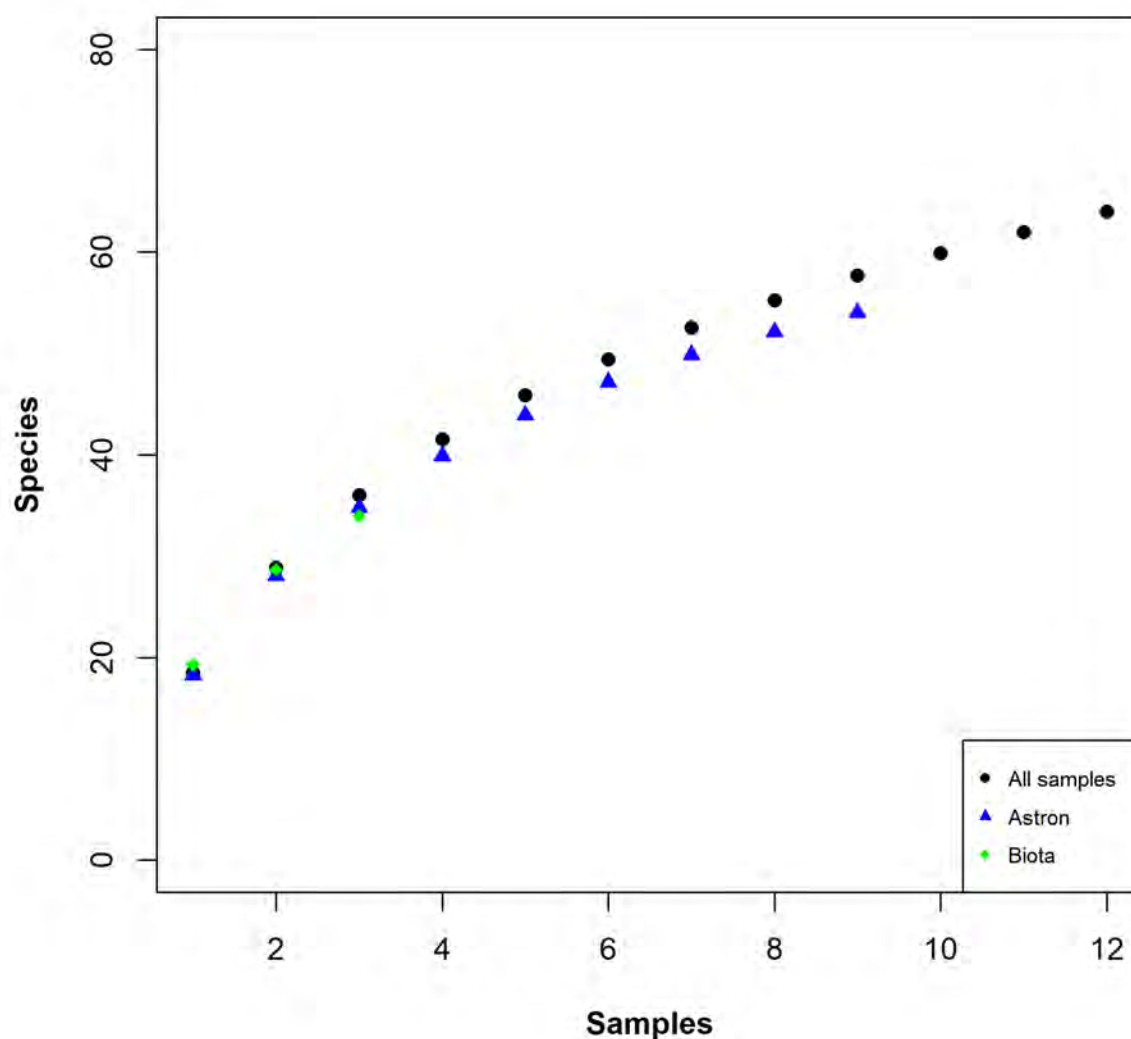


Figure 8: Species accumulation curves for bird surveys.

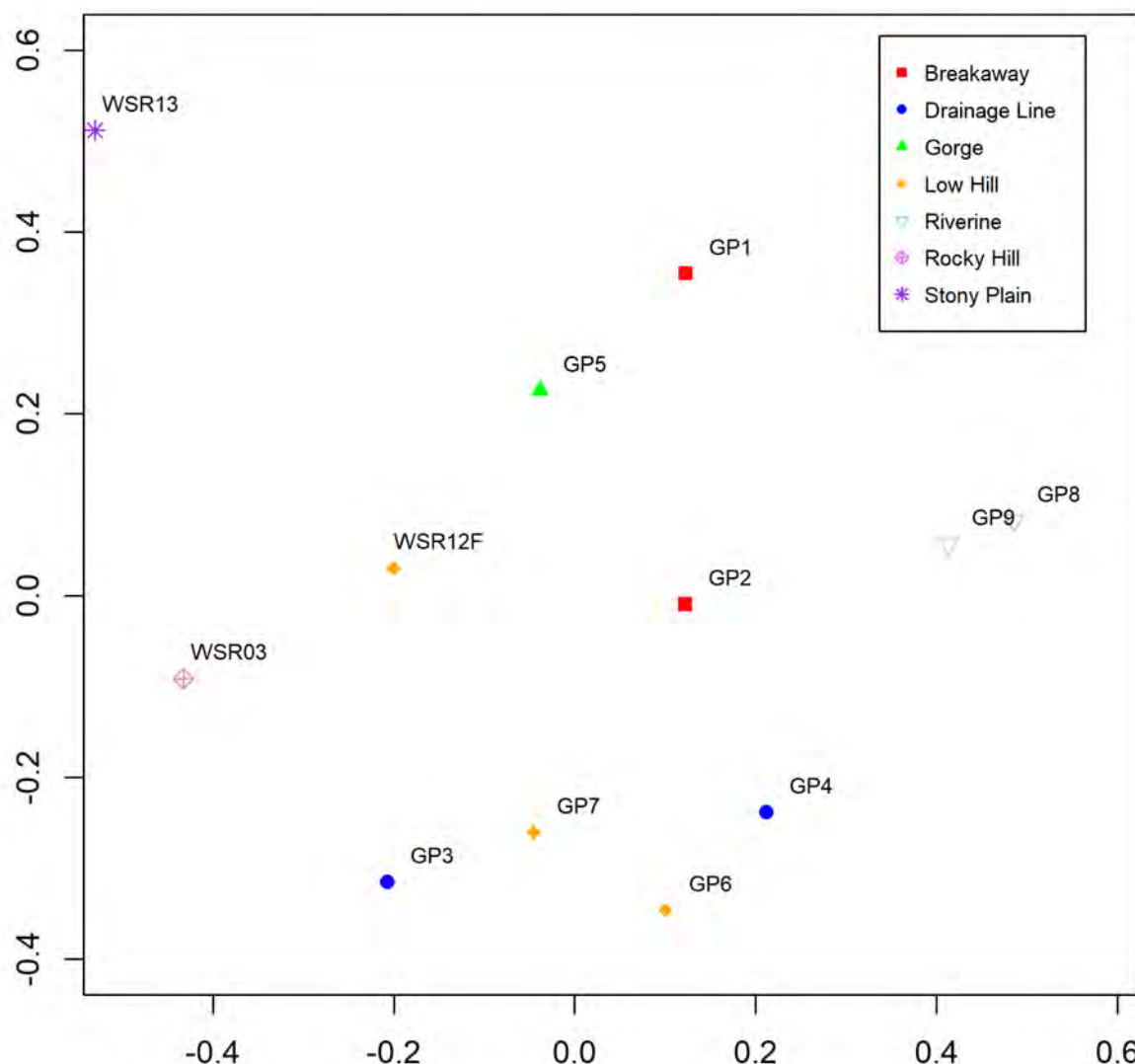


Figure 9: Two-dimensional ordination of bird species assemblages of each site based on Sorensen's index of similarity.

4.2.2.3 Mammals

Twenty-four species of mammal were recorded during the surveys, including four introduced species: Cat (**Felis catus*), Dog/Dingo (**Canis familiaris/dingo*), European Cattle (**Bos taurus*) and House Mouse (**Mus musculus*) (Table E.8-E.9, Appendix E). The most commonly trapped species was the Common Rock-rat (*Zyzomys argurus*) with 30 captures (68% of trap records). Also commonly encountered was Pilbara Ningaui (*Ningaui timealeyi*) with seven captures. The most speciose trapping sites were GP05 (Drainage Line) and GP07 (Low Hill) with four species each. Eleven bat species were recorded from the acoustic recording sites (Table E.9, Appendix E).

Three species of conservation significance were recorded during the survey: Northern Quoll (EN; EN), Pilbara Leaf-nosed Bat (VU; VU) and Ghost Bat (VU; VU).

Species accumulation curves did not reach asymptote during the current surveys (Figure 10), and based on estimates of total species richness, between 64% and 83% of the total species pool were recorded (Table 14). The data does not include any bat species, which make up 46% of the mammal species, as well as an additional three species that were recorded opportunistically. As such, the survey effort recorded the majority of the mammal species present in the survey area. There was a

significant difference in species composition between habitat types (ANOSIM $R = 0.640$, $P=0.011$, Figure 11) with each trap site loosely grouped with other trap sites in the same habitat type and showing similar species compositions.

Table 14: Total number of mammal taxa sampled in comparison to estimates of the total species pool based on several models.

	Observed	Estimated			
		Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of species	10	16	15	17	12
Estimated % sampled		64	69	59	83

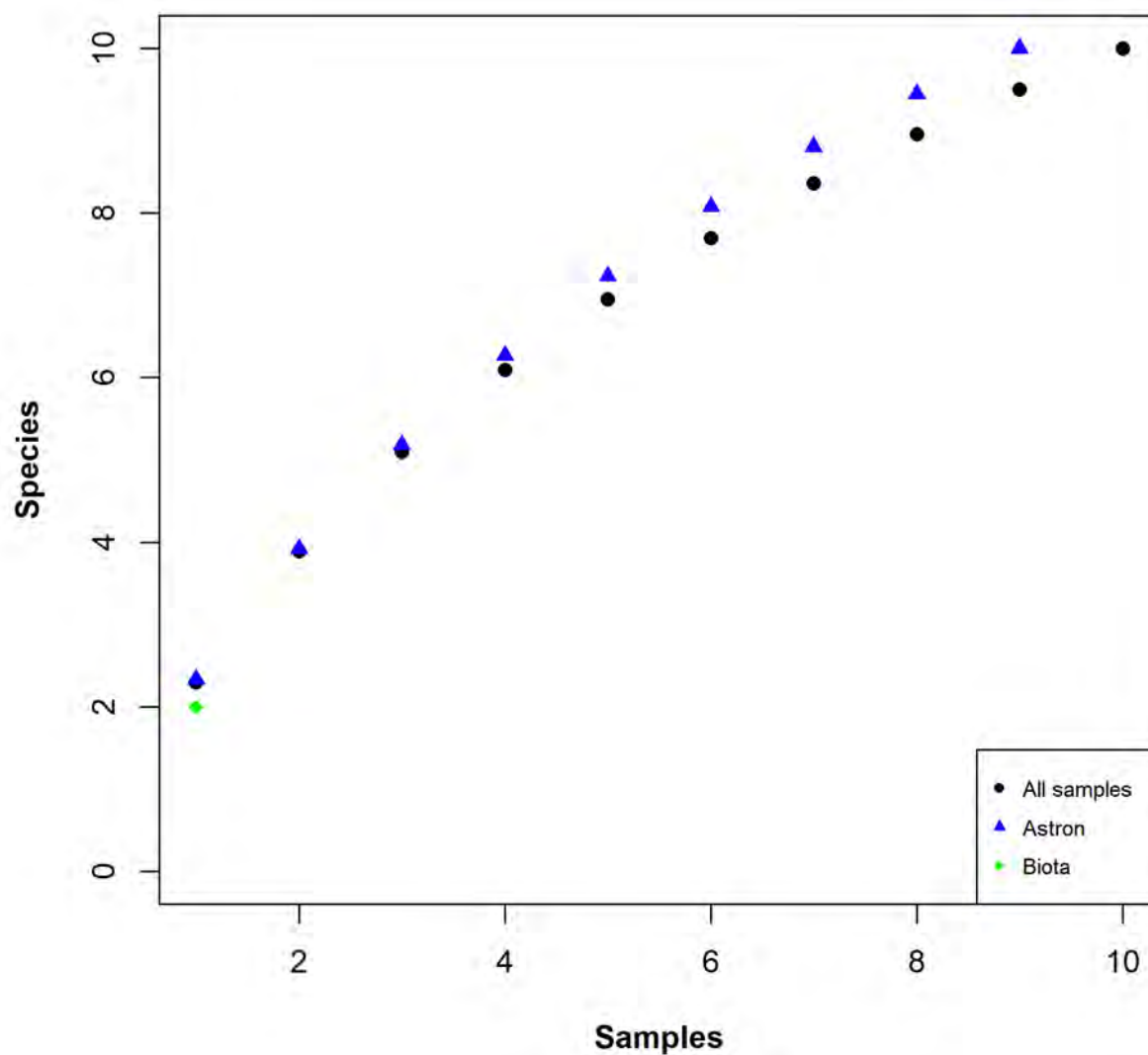


Figure 10: Species accumulation curves for mammal surveys.

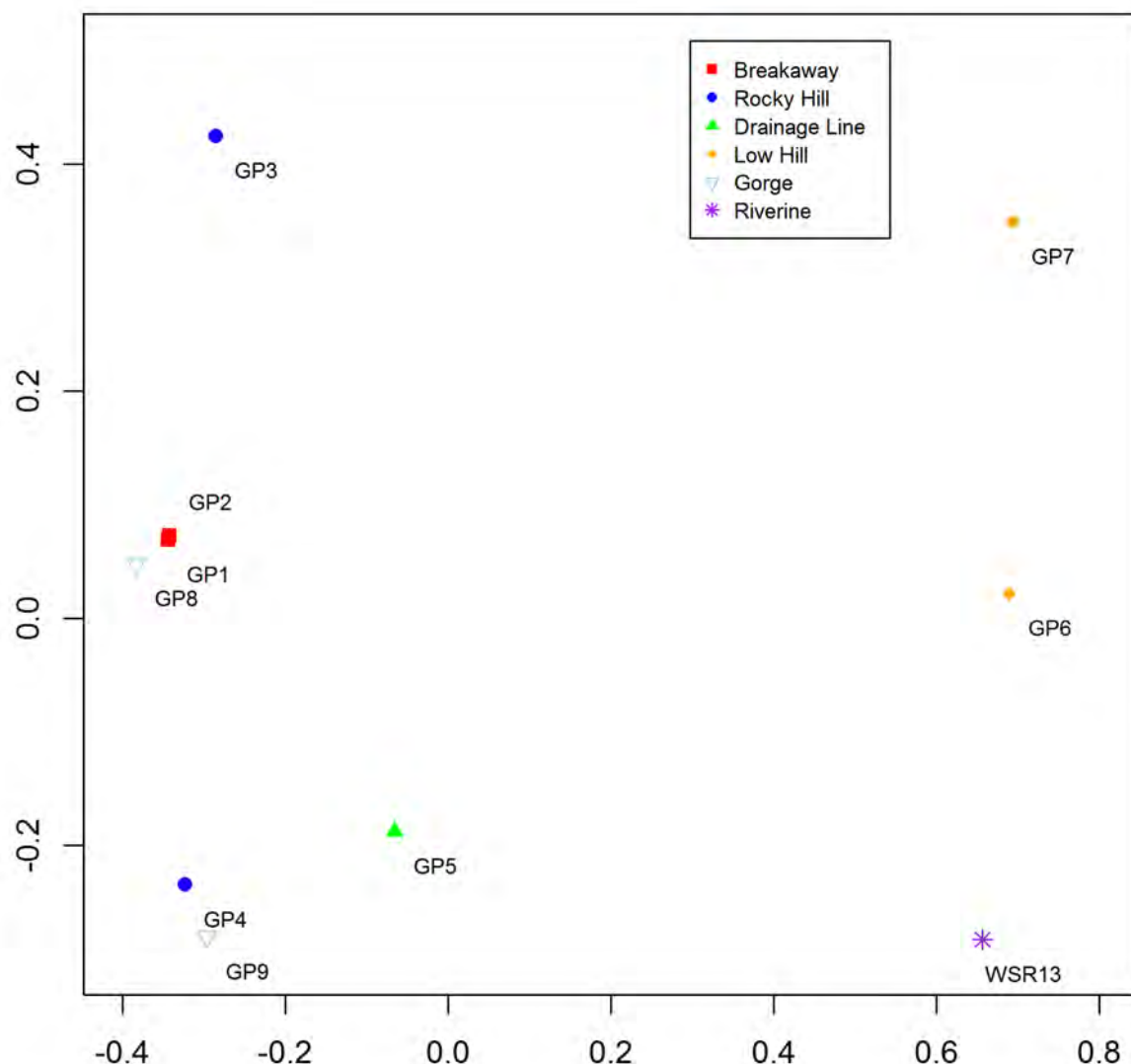


Figure 11: Two-dimensional ordination of mammal species assemblages of each site based on Sorensen's index of similarity.

4.2.2.4 Conservation Listed Species Recorded

Seven vertebrate species of conservation significance have been recorded within the survey area. The locations of these species records from the current survey, as well as previously recorded species, are shown in Figure H.1 and detailed in Table H.1 (Appendix H).

Pilbara Olive Python (*Liasis olivaceus barroni*)

The Pilbara Olive Python (VU; VU) prefers escarpments, deep gorges, water holes and rock piles associated with permanent pools in rocky areas in the ranges of the Pilbara region (Pearson 1993; Wilson and Swan 2010). Microhabitat preferences of the Pilbara Olive Python are under rock piles, on top of rocks or under spinifex (Tutt et al. 2004). Individuals spend the cooler winter months within caves and rock crevices away from water sources. In the warmer summer months, the pythons are found to move around widely, usually in close proximity to water and rock outcrops (Wilson and Swan 2010).

This species is likely to be found within the Gorge, Breakaway and Riverine habitats particularly in the sites that contain semi-permanent and permanent water. The Pilbara Olive Python has been previously recorded in the survey area at Seven Mile Creek (ecologia Environment 2011) (Figure H.1, Appendix H) and in the vicinity of the survey area (Biota Environmental Sciences 2011; GHD Pty Ltd 2009).

Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll (EN; EN) occurs in a variety of habitats (Oakwood 2008) but is commonly found in open lowland savannah forest and rocky escarpments. Rocky areas are a particularly important zone for Northern Quolls in the Pilbara as these areas retain water and provide a diversity of microhabitats. These areas also tend to have greater floristic diversity and productivity resulting in greater prey density compared to non-rocky areas. These rocky areas also provide refuge from feral cats, fire and livestock (Hill and Ward 2010) and provide breeding potential (Department of the Environment 2013).

The Northern Quoll was recorded twice during the survey (Figure H.1 and Table H.1, Appendix H), in the form of individual scats in the Breakaway and Gorge habitats. A Northern Quoll has been previously recorded in the survey area (Biota Environmental Sciences 2010), with a track being identified in a cave within Gorge habitat close to the Eastern Ranges mining operations. A number of Northern Quoll records exist in the general vicinity of the survey area with scats found at two locations at Turee Syncline (Rio Tinto Iron Ore 2017).

Despite the use of cage/Elliott traps and motion sensitive cameras in suitable habitats no Northern Quoll captures have been recorded. This indicates that although suitable and quality habitat is present the population of Northern Quolls in the survey area is likely to be relatively small. The survey area is located at the southern extent of this species known distribution (Department of Biodiversity, Conservation, and Attractions 2017a).

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)

Pilbara Leaf-nosed Bats (VU; VU) are known to require deep caves characterised by high levels of humidity and stable temperatures (Churchill 2008). This is a result of their limited ability to conserve heat and water (Armstrong 2001; Churchill 1991). Caves deep enough to create this environment are relatively uncommon in the Pilbara, with only 20 to 25 roost sites being known (R. Bullen 2014, pers. comm. 20 Oct 2014). Foraging habitat for the Pilbara Leaf-nosed Bat is diverse and includes riparian vegetation, hummock grassland, and sparse tree and shrub savannah (Duncan, Baker, and Montgomery 1999). Roost sites for the Pilbara Leaf-nosed Bat can be classified (Department of the Environment 2017) based on the following criteria:

- Permanent diurnal roosts—occupied year-round and likely the focus for some part of the nine-month breeding cycle; considered as critical habitat that is essential for daily survival.
- Non-permanent breeding (maternal) roosts—evidence of usage during some part of the nine-month breeding cycle (July–March), but not occupied year-round; considered as critical habitat that is essential for both the daily and long-term survival.
- Transitory diurnal roosts—occupied for part of the year only, outside the breeding season (April–June), and which could facilitate long distance dispersal in the region; considered as critical habitat that is essential for both the daily and long-term survival.
- Nocturnal refuge—occupied or entered at night for resting, feeding or other purposes, with perching not a requirement. Excludes overhangs. Not considered critical habitat, but are important for persistence in a local area.

Pilbara Leaf-nosed Bats have also been recorded flying over small watercourses amongst granite boulder terrain, over pools and low shrubs in ironstone gorges, and above low shrubs and around pools in gravelly watercourses with *Melaleuca leucadendron*, such as in Barlee Range Nature Reserve (Armstrong 2001). In the Pilbara, the species has been observed in *Triodia* hummock grasslands covering low rolling hills and shallow gullies, with scattered *Eucalyptus camaldulensis* along the creeks (Armstrong 2001; Churchill 1991).

The Pilbara Leaf-nosed Bat was recorded at seven of the 16 bat detector locations that were all deemed to be at low activity levels (Bat Call WA 2018) (Appendix I). The Pilbara Leaf-nosed Bat records were from foraging individuals in Breakaway, Drainage Line and Riverine habitats.

Numerous surveys for the Pilbara Leaf-nosed Bat have been conducted with a total of 39 records for this species in the survey area (Astron Environmental Services 2014; Biota Environmental Sciences 2010, 2011, 2014; Bat Call WA 2014a, 2015; Specialised Zoological 2010, 2013). Acoustic detections have been made of this species across all habitat types. One roost within the survey area that is close to Ratty Springs is a confirmed permanent diurnal/maternal roost (Bat Call WA 2015). Due to the extensive survey effort and employment of bat detectors across the survey area the presence of the Pilbara Leaf-nosed Bat population and their movements is well documented. As such, the remainder of the caves in the Gorge and Breakaway habitat of the survey area are likely to be classified as transitory diurnal roosts and nocturnal refuge caves.

Ghost Bat (*Macroderma gigas*)

The preferred habitat of Ghost Bats (VU; VU) is considered to be rocky gorges and breakaways that support caves and crevices used as maternity roosts. The Ghost Bat uses different natural formations for various purposes and for groups to persist they generally require habitats that provide:

- a selection of roosting opportunities with night roosts or feeding sites, day roosts and at least one deep cave with characteristics of a maternity roost
- nearby gullies and gorges with vegetation of vertical complexity (diverse vegetation heights and density) and presence of water that would attract prey species
- a productive foraging area within a 5 km to 10 km radius, usually including a good quality riparian drainage line.

Transient roosts and feeding sites are used by small numbers of Ghost Bats, whereas maternity roosts are used by larger colonies (Armstrong and Anstee 2000). Night feeding roosts (feed caves) are typically shallow caves and shelters/overhangs high in the strata and poorly insulated from the elements (Armstrong and Anstee 2000). Transient day roosts are deeper and more complex, have more insulation providing a more stable temperature and typically have one or more large chambers high enough to avoid predators. Maternity roosts provide additional features to support a reproducing population including high temperature (27°C to 33°C) and humidity (>85%) (Armstrong and Anstee 2000). The Ghost Bat can have a relatively small nightly foraging range (up to 2 km from the roost where it has been studied in Queensland) (Tidemann et al. 1985; Pettigrew et al. 1986), but has the flight capability to range widely (Bullen and McKenzie 2002), perhaps tens of kilometres in a night. This is evident from genetic markers, which suggest that males are particularly likely to disperse long distances throughout the landscape (Worthington Wilmer et al. 1994; 1999).

Ghost Bats require caves of varying shapes and sizes to fulfil each of its ecological requirements. Caves usage can be classified into three categories: feed caves, day roosts and maternal roosts.

- Feed caves are typically shallow caves or overhangs high in the strata that are poorly insulated from the elements (Armstrong and Anstee 2000). Ghost Bats hunt at night and use feed caves to consume prey they have captured in the surrounding area. Feed caves often contain Ghost Bat scats and/or feeding remnants (typically feathers and small animal bones).
- Day roosts are generally deep, complex caves or disused mines that contain domed ceilings, fissures or passages which create a stable microclimate. These caves are usually lower in the strata making them well insulated. The stable temperature and elevated humidity of these caves relative to the ambient conditions create physiologically benign conditions (McKenzie and Bullen 2009; Armstrong and Anstee 2000; Hall et al. 1997; Leitner and Nelson 1967).
- Maternal roosts like day roosts are generally deep, complex caves or disused mines that contain domed ceilings, fissures or passages which create a stable microclimate and often contain multiple entrances (McKenzie and Hall 2008). Maternal roosts have a stable temperature of 23°C to 28°C and moderate to high relative humidity of 50% to 100% (Armstrong and Anstee 2000; Churchill 1991; Churchill and Helman 1990; Pettigrew et al. 1986).

The Ghost Bat was recorded at one location (two possible calls) during the current survey through an acoustic recording in the Breakaway habitat (Figure H.1 and Table H.1, Appendix H). Three previous records for the Ghost Bat exist in the survey area (Astron Environmental Services 2014; Biota Environmental Sciences 2011; Bat Call WA 2014a), two of which were acoustic records and one from feeding debris.

Grey Falcon (*Falco hypoleucos*)

The Grey Falcon (VU) is the rarest Australian Falcon and one of the least common raptors. The species is a scarce visitor to the Pilbara where it is found mostly on the coastal plains between the De Grey and Ashburton rivers (Sutton 2010). The Grey Falcon prefers lightly wooded coastal and riverine plains (Johnstone and Storr 1998).

Two Grey Falcons (one adult and a fledged juvenile) were recorded on a radio tower in the Eastern Range mining operations. Two individuals have been previously recorded in the Riverine habitat adjacent to Ratty Springs (Biota Environmental Sciences 2011) (Figure H.1, Appendix H).

Common Sandpiper (*Actitis hypoleucos*)

The Common Sandpiper (Mi; IA) is a non-breeding migrant to a wide variety of habitats, such as riverbanks, estuaries, freshwater seeps on coastal shores, tidal creeks, mangrove swamps and saltmarshes (Johnstone and Storr 1998).

One individual was recorded foraging on the stone wall of the Tailings Dam (Figure H.1 and Table H.1, Appendix H). This species has not been previously recorded in the survey area.

Western Pebble-mound Mouse (*Pseudomys chapmani*)

Although suitable habitat is patchy, extant Western Pebble-mound Mouse (P4) populations are widespread in the extensive ranges of the central and southern Pilbara region (Start 2008). The persistence of abandoned mounds in the Gascoyne and Murchison regions and small, isolated, coastal ranges in the Pilbara indicates considerable recent decline (Start 2008). Colonies occur on the gentler slopes of rocky ranges where the ground is covered by stony mulch and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs, typically *Senna*, *Acacia*

and *Ptilotus* (Start 2008). Mounds are also sited close to narrow ribbons of *Acacia* dominated scrub along incised drainage lines (Start 2008).

No mounds were recorded during the current survey; however, two inactive mounds have been previously recorded within the Low Hill habitat (Biota Environmental Sciences 2011) (Figure H.1, Appendix H). Numerous records of this species exist from the vicinity of the survey area (Biota Environmental Sciences 2011; GHD Pty Ltd 2009; Rio Tinto Iron Ore 2017).

4.2.2.5 Conservation Listed Species Potentially Occurring in the Survey Area

One species, the Long-tailed Dunnart (P4), was not recorded in the survey area but was considered to have a high likelihood of occurring (Table F.1, Appendix F). This species has been recorded from localities surrounding Channar and Tom Price during the Pilbara biodiversity survey (Department of Biodiversity, Conservation, and Attractions 2017a). This species is found in rocky scree and plateau areas, generally with little vegetation or in areas of spinifex hummock grassland, shrubs and open woodland. The Long-tailed Dunnart occurs across the Gibson Desert, Pilbara and Murchison with a patchy distribution restricted to rugged rocky habitats (Van Dyck and Strahan 2008). This species is infrequently captured due to habitat specificity rather than rarity (Gibson and McKenzie 2009) and is expected to occur in the Breakaway, Gorge and Rocky Hill habitats of the survey area.

Fifteen species were not found in the survey area but were all considered to have a moderate likelihood of occurrence: *Ctenotus nigrilineatus* (P1), Lined Soil-crevice Skink (*Notoscincus butleri*, P4), Fork-tailed Swift (*Apus pacificus*, Mi; IA), Glossy Ibis (*Plegadis falcinellus*, Mi; IA), Peregrine Falcon (*Falco peregrinus*, OS), Oriental Plover (*Charadrius veredus*, Mi; IA), Australian Painted Snipe (*Rostratula australis*, EN; EN), Swinhoe's Snipe (*Gallinago megala* Mi; IA), Wood Sandpiper (*Tringa glareola*, Mi; IA), Red-necked Stint (*Calidris ruficollis*, Mi; IA), Long-toed Stint (*Calidris subminuta*, Mi; IA), Pectoral Sandpiper (*Calidris melanotos*, Mi; IA), Sharp-tailed Sandpiper (*Calidris acuminata*, Mi; IA), Curlew Sandpiper (*Calidris ferruginea*, CR and Mi; VU and IA) and Short-tailed Mouse (*Leggadina lakedownensis*, P4) (Table F.1, Appendix F). Although suitable habitat is present within the survey area, these species are either seasonal migrants only present at certain times of the year or they are cryptic species such as Australian Painted Snipe, making individuals difficult to record during fauna surveys.

An additional six species not found in the survey area were considered to have a low likelihood of occurrence due to lack of suitable habitats (Table F.1, Appendix F).

4.2.2.6 Night Parrot Assessment

No calls attributed to the Night Parrot were recorded during two passive acoustic surveys or analysis of the data recorded from the ARUs (Bat Call WA 2018) (Appendix I). The Stony Plain habitat did not support the old, large and unburnt *Triodia* clumps that are considered the primary habitat requirement for this species (Department of Parks and Wildlife 2017a). The Stony Plain habitat and all other habitats in the survey area were considered unsuitable Night Parrot habitat due to the effects of recent fires (less than 10 years old), pastoral and mining impacts over a long duration, very sparse ground cover vegetation and lack of chenopod communities or suitable size/age hummocks. As such, the Night Parrot was classified as having a low likelihood of occurrence in the survey area.

4.2.1 Invertebrate Fauna Habitats

Seven potential SRE habitat types were identified differing in their prospectivity for SRE fauna. The more prospective habitats were Gorge, Breakaway and Riverine habitats, comprising 503 ha (5%) of the survey area. These habitats provide moist, shaded microhabitats that potentially support

relictual endemism. The Drainage Line, Low Hill and Rocky Hill habitats provide a moderate level of habitat suitability for SRE species but lack the moist microhabitats preferred by SRE groups. The fauna habitats' suitability to support SRE species are detailed in Table 15 and mapping is presented in Figure G.1 (Appendix G). The locations where the potential SRE species were collected support this habitat assessment with some habitats being more conducive to certain SREs; however, some potential SREs seem to be driven by other environmental factors. For instance, many potential SREs are recorded from outside of these typical habitats as is reflected by other survey results, where potential SRE species were recorded within the Stony Plain habitats (Biota Environmental Sciences 2011). Potential SRE species were recorded within the majority of habitats in the survey area, with the exclusion of the Rocky Hill and Stony Plain habitats.

Table 15: Suitability of habitat types for SRE fauna within the survey area.

Habitat type	Extent in survey area (ha)	Proportion in survey area (%)	Suitability for SRE
Riverine	131.5	1.2	High
Drainage Line	554.0	4.9	Moderate
Gorge	234.9	2.1	High
Breakaway	136.4	1.2	High
Rocky Hill	2,541.2	22.7	Moderate
Low Hill	2,000.4	17.9	Moderate
Stony Plain	2,175.4	19.4	Low
Cleared	3,429.6	30.6	Low
Total	11,203.4		

Riverine habitats in the survey area comprised linear isolated pockets of riparian vegetation and associated woodlands which are denser, taller and more diverse than the adjacent Drainage Line habitat. The vegetation was complex and provided a range of micro-niches for SRE fauna. Permanent pools of water were present during the survey and the area generally had more moisture than adjacent habitat types. This habitat was sampled as sites SRE4, SRE5, SRE7, SRE8 and SRE12. A total of six potential SRE species were collected from this habitat type: *Indolpium* sp. indet., *Lychas* 'hairy tail complex', *Lychas* 'bituberculatus complex', *Philosciidae* sp. indet., *Buddelundia* '10ts' and *Buddelundia* '50'. Overall, the survey data confirmed the desktop assessment that the Riverine habitat has high suitability for SRE fauna.

Drainage Line habitats were open riverbeds that ran through the survey area. Although some portions of this habitat are well-vegetated, the majority of the Drainage Line habitat in the survey area is open, exposed riverbeds with little leaf litter. This habitat was sampled as site GP05 and the following potential SRE species were recorded: *Lychas* 'hairy tail complex', *Lychas* 'bituberculatus complex', *Philosciidae* sp. indet., *Buddelundia* '47TS' and *Buddelundia* '50'. This habitat was considered to have moderate suitability for SRE fauna.

Gorge habitat was associated with the Rocky Hill or Breakaway habitats, where deeply carved rock incisions and minor drainage lines provide shade and diverse microhabitats. Minor creek lines and water run-offs lead to higher moisture availability compared to the surrounding areas. This was a comparatively rare habitat type in the survey area but due to its prospectivity for SRE species it was well sampled; sites included GP08, GP09, SRE1, SRE2, SRE3, SRE9, SRE14, SRE15, SRE16 and SRE17. A total of 16 potential SRE species were collected from this habitat type: *Selenopidae* sp. indet., *Austrohorus* sp. indet., *Indolpium* 'long chela hand', *Indolpium* sp. indet., *Lychas* 'hairy tail complex', *Lychas* 'bituberculatus complex', *Mecistocephalus* sp. indet., *Orphnaeus* sp. indet., *Cryptops* sp. indet., *Austrostrophus* sp. indet., *Trinemura* sp. indet., *Bothriembryon* 'Pilbara', *Barrowdillo* '4',

Buddelundia '47TS', *Buddelundia* '50' and *Buddelundiinae* sp. indet. The Gorge habitat was considered as having high suitability for SRE fauna.

Breakaway habitat contained exposed rock faces with accumulations of rock boulders and scree. It provides shelter for SRE fauna and diverse microhabitats for both habitat specialists and moisture-dependent SRE fauna. This habitat type was sampled as sites GP01, GP02, SRE6, SRE11 and SRE13. Five potential SRE species were recorded from this habitat: *Selenopidae* sp. indet., *Indolpium* 'long chela hand', *Indolpium* sp. indet., *Buddelundia* '10ts' and *Buddelundia* '50'. Overall, the survey data confirmed the desktop assessment that the Breakaway habitat has high suitability for SRE fauna.

Rocky Hill habitat denoted the high-elevation rock features through the centre of the survey area. This habitat type is deeply incised by creek lines and valleys. No targeted SRE sampling was undertaken in the Rocky Hill habitat; however, vertebrate fauna trap sites GP03 and GP04 were located within this habitat type. One potential SRE species was collected within this habitat type: *Lychas* 'bituberculatus complex'. Based on its rocky microhabitats it is expected to provide habitat for specialist species that live under rocks and gravel, similar to those found in the Breakaway habitats. The Rocky Hill habitat was considered as having moderate suitability for SRE fauna.

Low Hill habitat was widespread in the survey area and was sampled by sites GP06 and GP07. Both sites were generally well-vegetated with *Triodia* and shrubs over a stony surface. Seven potential SRE species were recorded from this habitat: *Selenopidae* sp. indet., *Lychas* 'aitkeni complex', *Lychas* 'bituberculatus complex', *Lychas* sp. indet., *Austrostrophus* sp. indet., *Buddelundia* '47TS' and *Buddelundia* '50'. Overall, the survey data confirmed the desktop assessment that the Low Hill habitat has moderate to low suitability for SRE fauna.

Stony Plain habitat was a widespread habitat type in the survey area and was sampled as site SRE10. This habitat type is generally exposed and has low microhabitat diversity compared to other landforms. The Stony Plain habitat is considered as having low suitability for SRE fauna which was supported by the lack of SRE recorded in this habitat type.

4.2.2 Invertebrate Fauna Species

The field survey yielded a total of 227 invertebrates from 36 taxa, of which, a total of 194 individuals represented 20 potential SRE (DD) taxa (Table 16 and Table E.10, Appendix E). Except for *Trinemura* sp. Indet., for which no desktop data are available for representatives of hexapoda, all the potential SRE species from the field survey were also recorded from the WAM database area searches. The locations of these species records from the current survey are shown in Figure H.2 (Appendix H).

Table 16: Summary of the potential SRE species within the survey area.

Order	Family	Species	Field sites	SRE status
Araneae	Selenopidae	Selenopidae sp. indet.	GP07 (Low Hill), GP08 (Gorge), GP09 (Gorge), SRE6 (Breakaway), SRE9 (Gorge), SRE11 (Breakaway), SRE13 (Breakaway), SRE14 (Gorge), SRE15 (Gorge), SRE16 (Gorge)	Potential SRE: DD
Pseudoscorpiones	Olpidae	<i>Austrohorus</i> sp. indet.	SRE2 (Gorge), SRE14 (Gorge), SRE17 (Gorge)	Potential SRE: DD
		<i>Indolpium</i> 'long chela hand'	SRE2 (Gorge), SRE6 (Breakaway)	Potential SRE: DD
		<i>Indolpium</i> sp. indet.	GP08 (Gorge), SRE5 (Riverine), SRE11 (Breakaway), SRE13 (Breakaway)	Potential SRE: DD
Scorpiones	Buthidae	<i>Lychas</i> 'hairy tail complex'	Opp (Riverine), GP05 (Drainage Line), GP08 (Gorge), SRE9 (Gorge), SRE14 (Gorge), SRE15 (Gorge), SRE17 (Gorge)	Potential SRE: DD
		<i>Lychas</i> 'aitkeni complex'	GP06 (Low Hill), GP07 (Low Hill)	Potential SRE: DD
		<i>Lychas</i> 'bituberculatus complex'	Opp (Riverine), GP03 (Rocky Hill), GP05 (Drainage Line), GP07 (Low Hill), SRE3 (Gorge), SRE14 (Gorge), SRE17 (Gorge)	Potential SRE: DD
		<i>Lychas</i> sp. indet.	GP05 (Drainage Line), GP07 (Low Hill)	Potential SRE: DD
Scolopendromorpha	Cryptopidae	<i>Cryptops</i> sp. indet.	SRE14 (Gorge)	Potential SRE: DD
Geophilomorpha	Oryidae	<i>Mecistocephalus</i> sp. indet.	GP05 (Drainage Line), GP08 (Gorge)	Potential SRE: DD
		<i>Orphnaeus</i> sp. indet.	SRE14 (Gorge)	Potential SRE: DD

Order	Family	Species	Field sites	SRE status
Spirobolida	Trigoniulidae	<i>Austrostrophus</i> sp. indet.	GP06 (Low Hill), SRE14 (Gorge), SRE15 (Gorge), SRE16 (Gorge)	Potential SRE: DD
Thysanura	Nicoletiidae	<i>Trinemura</i> sp. indet.	SRE17 (Gorge)	Potential SRE: DD
Eupulmonata	Bothriembryontidae	<i>Bothriembryon</i> 'Pilbara'	Opp (Gorge), SRE15 (Gorge)	Potential SRE: DD
Isopoda	Armadillidae	<i>Buddelundia</i> '10ts'	SRE4 (Riverine), SRE13 (Breakaway)	Potential SRE: DD
		<i>Buddelundia</i> '47TS'	GP05 (Drainage Line), GP06 (Low Hill), GP07 (Low Hill), GP08 (Gorge)	Potential SRE: DD
		<i>Buddelundia</i> '50'	Opp (Riverine), GP05 (Drainage Line), GP06 (Low Hill), GP8 (Gorge), GP09 (Gorge), SRE3 (Gorge), SRE5 (Riverine), SRE6 (Breakaway), SRE7 (Riverine), SRE8 (Riverine), SRE9 (Gorge), SRE12 (Riverine), SRE13 (Breakaway), SRE14 (Gorge), SRE15 (Gorge), SRE16 (Gorge)	Potential SRE: DD
		<i>Buddelundiinae</i> sp. indet.	SRE1 (Gorge), SRE14 (Gorge)	Potential SRE: DD
		<i>Barrowdillo</i> '4'	SRE15 (Gorge)	Potential SRE: DD
		<i>Philosciidae</i> sp. indet.	SRE12 (Riverine)	Potential SRE: DD

5 Discussion

5.1 Vertebrate Fauna

5.1.1 Habitats

Habitats within the survey area are not restricted at the local, sub-regional or regional scale and no uncommon geological units or land systems occur within the survey area. The Gorge and Breakaway habitats in the survey area are considered significant for fauna. Deeply incised gorges, characteristic of the Hamersley subregion, generally have high levels of species endemism and diversity, and are considered important as refugia in a local context (Kendrick 2001b). This is due to the microhabitats they provide such as caves and semi-permanent water pools, which were recorded during the current survey. Gorge and Breakaway habitats are considered suitable for several MNES species including the Pilbara Olive Python, Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat that have all been recorded within the survey area. In a regional context, the Gorge and Breakaway habitats in the Pilbara are restricted to the Chichester and Hamersley Ranges but they are well represented in these areas.

The Gorge habitat located in the Eastern Ranges portion of the survey area (Figure G.1 and Table G.1, Appendix G) provides locally significant habitat for MNES species, in particular for the Pilbara Leaf-nosed Bat. The location of the Paraburdoo East roost is currently thought to be outside of the survey area, however the Eastern Ranges Gorge habitat provides transitory diurnal roosts/nocturnal refuge caves and foraging opportunities for this species, as shown in the previous assessments conducted in the survey area (Astron Environmental Services 2014; Biota Environmental Sciences 2010, 2014; Bat Call WA 2014a; Specialised Zoological 2013).

The Riverine habitat in the survey area is considered significant for fauna. The deep pools and shallow spring fed pools provide an important permanent water source for drinking and a refuge for amphibians and waterfowl in the survey area. This habitat contains microhabitats not common in other habitat types such as large tree hollows, hollow logs and moist leaf litter which provide a productive ecosystem attracting and supporting a range of predators and prey. This habitat supports conservation listed fauna species such as the Pilbara Olive Python and acts as foraging sites for Northern Quolls, Ghost Bats and Pilbara Leaf-nosed Bats. The permanent spring systems in the Ashburton bioregion, such as Ratty Springs are considered refuge sites for resident fauna (Kendrick 2001a).

The gullies and valleys of the Rocky Hill habitat type also contain caves and rock crevices and are likely to be utilised by a range of species, including those of conservation significance. This habitat type has a distinct herpetofauna assemblage due to the presence of a number of rocky habitat specialists, including *Varanus pilbarensis*, *Egernia cygnitos*, *Ctenotus rubicundus* and *Anilius ganei*. The Rocky Hill habitat is widespread and common throughout the Pilbara bioregion and is not restricted to the Chichester and Hamersley Ranges.

The Drainage Line habitats within the survey area are mainly the broad, ephemeral creeks or minor drainage lines that are not likely to provide significant refugia for species. Drainage Line habitats, although not necessarily large in terms of area, are common habitats within the Pilbara/Gascoyne region and immediate surrounds, for example, the Minilya River.

The Low Hill and Stony Plain habitat in the survey area provide fewer microhabitat opportunities for terrestrial fauna and are also more widespread in the immediate vicinity as well as the Hamersley/Ashburton subregions and wider bioregion.

5.1.2 Species

5.1.2.1 General Assemblage

There were 154 vertebrate fauna species, comprising two amphibians, 34 reptiles, 94 birds and 24 mammals (including four introduced species) recorded within the survey area during the current survey. This compares to 114 and 111 species recorded from the wider Paraburdoo area by GHD Pty Ltd (2009) and Biota Environmental Sciences (2011), respectively. The fauna species assemblage recorded during the survey is considered typical of the Hamersley Range subregion as well as a subset of typical fauna assemblages across the Pilbara bioregion. As the survey area also exists within the northern portion of the Ashburton subregion a number of avian species more typical of the Gascoyne bioregion were also recorded, these include the Redthroat (*Pyrrholaemus brunneus*), Inland Thornbill (*Acanthiza apicalis*) and Chiming Wedgebill (*Psophodes occidentalis*).

The number of reptile and amphibian species recorded (36 species) is slightly lower than that recorded during other two-phase surveys in the vicinity (40 to 46 species in comparable surveys) (GHD Pty Ltd 2009; Biota Environmental Sciences 2011). As mentioned in section 4.2.2.1, this can be attributed to the lack of pitfall traps used at many of the trap sites. The number of bird species recorded during the survey (94 species) is higher than other dual season surveys conducted in the area (51 to 53 species) (GHD Pty Ltd 2009; Biota Environmental Sciences 2011). This can be attributed to the number of waterfowl species recorded within the Riverine habitat and at the Tailings Dam. The current survey recorded a comparatively high number of mammal species (24 species) compared to other dual season surveys in the vicinity (15 to 20 species). This was mainly due to the high number of bat species recorded; 11 species were recorded in the current survey using acoustic recordings.

5.1.2.2 Conservation Significant Species

Of the 29 conservation significant species identified in the literature review, seven species have been previously recorded or were recorded during the current survey. An additional species, the Long-tailed Dunnart, was considered to have a 'high' likelihood of occurrence, 15 species to have a 'moderate' likelihood and six species to have a 'low' likelihood.

Recorded MNES Species

The Gorge and Breakaway habitats within the survey area were considered suitable for the target MNES species: Pilbara Olive Python, Ghost Bat, Pilbara Leaf-nosed Bat and Northern Quoll. The majority of the survey area was mapped as low habitat suitability for the target MNES species; Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python (68% of the survey area classified as low habitat suitability for all four species). Low potential habitat for all four species generally comprised areas of disturbed habitat, Stony Plain and Low Hill habitats. These habitats contained no significant refugia or shelter, or semi-permanent or permanent water.

The Pilbara Olive Python was not recorded during the current survey but has been previously recorded in the survey area at Seven Mile Creek (ecologia Environment 2011). This species is likely to be found within the Gorge, Breakaway and Riverine habitats particularly in the locations that contain semi-permanent and permanent water, which has been defined as their preferred habitat (Pearson 1993). The Rocky Hill and Drainage Line habitats (particularly those that contain permanent or semi-permanent pools) are considered suitable foraging and dispersal habitat for the Pilbara Olive Python. All other habitats were considered to provide limited foraging and dispersal habitat for the Pilbara Olive Python.

The Northern Quoll has been recorded at three separate locations within the survey area via secondary evidence (scats and footprints) in the Breakaway and Gorge habitats (Figure H.1 and Table H.1, Appendix H). The Gorge and Breakaway habitats are considered potential shelter and foraging habitat for the Northern Quoll. The Riverine, Drainage Line and Rocky Hill are also considered suitable foraging and dispersal habitats for the Northern Quoll. All other habitats were considered to provide limited foraging and dispersal habitat for the Northern Quoll. Based on the lack of camera triggers and captures, yet the presence of latrine evidence (scats) the survey area (specifically the Gorge and Breakaway habitats) supports a low density population of Northern Quolls (Department of the Environment and Energy 2016).

The Ghost Bat was recorded at one location (two possible calls) during the current survey through an acoustic recording in the Breakaway habitat (Figure H.1 and Table H.1, Appendix H). Three previous records for the Ghost Bat exist in the survey area (Astron Environmental Services 2014; Biota Environmental Sciences 2011; Bat Call WA 2014a) two of which were acoustic records in Gorge habitats and one record from feeding debris located in Breakaway habitat. Given that this species has been only recorded in low numbers on four occasions within the survey area despite searching for feeding debris, scats and the concentrated use of acoustic bat detectors, it is likely that a low density population of this species occurs in the survey area. No maternal or diurnal roost sites have been recorded within the survey area; however, the Gorge and Breakaway habitats were categorised as providing foraging and shelter habitat due to the potential presence of diurnal roost caves and nocturnal feeding roost caves.

Numerous surveys for the Pilbara Leaf-nosed Bat have been conducted with a total of 39 previous records for this species in the survey area (Astron Environmental Services 2014; Biota Environmental Sciences 2010, 2011, 2014; Bat Call WA 2014a, 2015; Specialised Zoological 2010, 2013). Acoustic detections have been made of this species across all habitat types. Two separate Pilbara Leaf-nosed Bat roosts have been identified as occurring around the Paraburdoo region. Analysis of the number of calls recorded and their seasonality indicates that the roost sites are permanent diurnal/maternal roosts, supporting breeding populations of the species. The Paraburdoo East roost site is still to be identified, but current data indicate that it occurs north of the Eastern Range mining operations and most likely outside of the survey area boundary. The western roost is a confirmed maternal roost located in the Breakaway habitat adjacent to Ratty Springs (Bat Call WA 2015).

Due to the extensive survey effort and employment of bat detectors across the survey area the presence of the Pilbara Leaf-nosed Bat population and their movements is well documented. As such, the remainder of the caves in the Gorge and Breakaway habitats of the survey area are likely to be classified as transitory diurnal roosts and nocturnal refuge caves. Previous studies indicate that Ratty Springs, the Eastern Range primary crusher pond, pools on Seven Mile Creek and any permanent pools, ridges and ephemeral creek lines surrounding the roost site provide preferred foraging habitat for the Pilbara Leaf-nosed Bat (Bat Call WA 2014a). The Paraburdoo East roost and the Ratty Springs roost sites are thought to be regionally significant, with the nearest known colonies occurring at Turee Syncline and another colony near Hardey River approximately 25 km north-east and 60 km west of Paraburdoo, respectively (R. Bullen 2018, pers. comm. 16 August 2018).

Other Conservation Significant Species

Other conservation significant species recorded from, or likely to occur, within the survey area include the Grey Falcon, Common Sandpiper, Long-tailed Dunnart and Western Pebble-mound Mouse.

Two individuals of the Grey Falcon (one adult and one juvenile) were recorded on a radio tower in the Eastern Range mining operations and two individuals were previously recorded in the Riverine

habitat adjacent to Ratty Springs (Biota Environmental Sciences 2011) (Figure H.1, Appendix H). This species is sparsely distributed and rarely encountered across its range and is likely to occur within the habitats surrounding communications towers and the Riverine and Drainage Line habitats.

A single Common Sandpiper was recorded foraging on the stone wall of the Tailings Dam (Figure H.1 and Table H.1, Appendix H). Although this is the first record of this species in the survey area, recent records exist for the Paraburdoo and Tom Price waste water plants (Department of Biodiversity, Conservation, and Attractions 2017a). The Common Sandpiper is usually solitary and seldom joins large shorebird flocks (Menkhorst et al. 2017). The shallow, permanent water created by the Tailings Dam provides ideal habitat for migratory shorebirds however, the lack of previous records for this species or other migratory shorebirds and the distance of the survey area away from the coastline suggests it is utilised on an irregular basis.

The Long-tailed Dunnart has not been previously recorded in the survey area, with the closest records occurring approximately 6 km east of the survey area (Department of Biodiversity, Conservation, and Attractions 2017b) in rocky habitats similar to the Rocky Hill habitat found in the survey area. This species is infrequently captured due to habitat specificity rather than rarity (Gibson and McKenzie 2009) and is expected to occur in the Breakaway, Gorge and Rocky Hill habitats of the survey area.

No mounds or individuals of the Western Pebble-mound Mouse were recorded during the current survey, however two inactive mounds have been previously recorded within the Low Hill habitat (Biota Environmental Sciences 2011) (Figure H.1, Appendix H). Numerous records of this species exist from the vicinity of the survey area (Biota Environmental Sciences 2011; Rio Tinto Iron Ore 2017). Generally this species prefer gentle rocky slopes, hills and spurs. As such, the Low Hill and Rocky Hill habitats of the survey area are likely to support this species. These habitats that are suitable for the Western Pebble-mound Mouse are also widespread and common adjacent to the survey area.

5.2 SRE Invertebrates

5.2.1 Habitats

In general, the survey area appears to have great potential to support SRE species owing to the abundance of ideal habitats. These include the ‘typical’ SRE target habitats: south facing gorges, slopes and breakaways, but also the presence of significant water bodies such as Ratty Springs and Seven Mile Creek. Prospective SRE habitats were mapped as Gorge, Breakaway and Riverine habitats in the survey area. These habitats, particularly those associated with the ranges of the northern half of the survey area, almost certainly support a more significant SRE fauna.

5.2.2 Species

The database search results yielded eight named species and 89 named morphospecies from SRE target groups. The high degree of morphospecies most likely reflects the poor level of taxonomic knowledge about SREs in this part of the Pilbara. This position is reflected by the high degree of ‘Data deficient’ potential SRE taxa (148). Assessment of the distributions of these species also indicates very poor coverage of database records from within 10 km of the survey area and nearly all the records are concentrated in the northern third of the database search area, approximately 50 km to 100 km from the survey area (Appendix D).

The Selenopidae family (wall crab spiders) were collected from 10 different sites in the survey area. None of the individuals collected were adults and DNA sequencing would be needed to determine

how many (and which) species are present. As such the specimens were classified as Selenopidae sp. indet. This group is known to contain SREs and/or potential SRE species and as such, these specimens were classified as potential SRE (DD) (Appendix D).

Three potential SRE pseudoscorpions were collected from the survey area: *Austrohorus* sp. indet., *Indolpium* sp. indet. and *Indolpium* 'long chela hand'. The taxonomic resolution of *Austrohorus* and *Indolpium* is poorly resolved in the Pilbara but both genera are thought to contain SRE species; therefore, they are listed as potential SRE (DD) (Appendix D).

Four potential SRE scorpions were collected from the survey area: *Lychas* 'aitkeni complex', *Lychas* sp., *Lychas* 'bituberculatus complex' and *Lychas* 'hairy tail complex'. These scorpions appear to belong to complexes of multiple species, meaning that genetic data has indicated that each species is composed of multiple distinct genetic lineages and potentially different species. While members of these complexes are known from most of the Pilbara, some of the 'species' contained within these complexes appear to be range restricted. As such these species were classified as potential SRE (DD) (Appendix D).

Three potential SRE centipedes were collected from the survey area: *Mecistocephalus* sp., *Orphnaeus* sp. and *Cryptops* sp.. The former two taxa (*Mecistocephalus* sp. and *Orphnaeus* sp.) belong to the order Geophilomorpha, for which taxonomic resolution of species is very poor and is suspected of containing potential SRE species. Representatives of the genus *Cryptops* are rarely sampled in the Pilbara since they live in relatively moist environments. The desktop search revealed two species of *Cryptops* based on molecular data and further unresolved species. Due to the uncertain taxonomy of these species they were classified as potential SRE (DD) (Appendix D).

One potential SRE millipede was collected from the survey area: *Austrostrombus* sp. indet.. A single species is currently described for this genus, however unpublished data from the WAM indicates the presence of more than one species. Due to the uncertain taxonomy of this species it is classified as potential SRE (DD) (Appendix D).

One potential SRE silverfish, tentatively identified to *Trinemura* sp. indet., was collected from the survey area. Members belonging to this family are frequently classified as SRE when sampled from subterranean habitats and rarely collected from epigeal surveys of the Pilbara. As such this species is classified as potential SRE (DD) (Appendix D).

Six potential SRE isopods were collected from the survey area: *Barrowdillo* '4', Philosciidae sp. indet., Buddelundiinae sp. indet., *Buddalundia* '10ts', *Buddalundia* '47TS' and *Buddalundia* '50'. *Buddelundia* '50' and *Barrowdillo* '4' are potential SRE (DD) as both species are only known from restricted distributions in poorly surveyed areas. *Buddelundia* '47TS' and *Buddelundia* '10ts' both represent species complexes that are likely to contain SRE species and are regarded as potential SRE (DD). Buddelundiinae sp. indet. and Philosciidae sp. indet. belong to taxa with uncertain taxonomy and are subsequently classified as potential SRE (DD) (Appendix D).

A single SRE potential snail; *Bothriembryon* 'Pilbara' was collected from the survey area. Records of this species were represented by two long dead shells, from which DNA analysis could not be undertaken. The taxonomy of *Bothriembryon* in the Pilbara is complex and heavily reliant on DNA sequence data. As such these species are classified as potential SRE (DD) (Appendix D).

The survey sampled most of the SRE groups expected from the Pilbara, with the majority of these collected during the second survey when weather conditions were more favourable for SRE activity. The survey area lacked the expected diversity of trapdoor spiders and burrowing scorpions which may be influenced by the very stony nature of the substrate in most habitats sampled.

Overall, the composition of SRE taxa within this part of the Pilbara remains very poorly known; however, this survey demonstrated that the survey area and in general the Paraburdoo range contains a significant diversity of potential SRE species. Most of the taxa sampled represent groups known from the Pilbara. However, it is not clear as to how closely the SREs in Paraburdoo Range relate to those from more well sampled parts of the Pilbara, such as the Hamersley range; for this to be understood, DNA sequencing and analysis would be needed.

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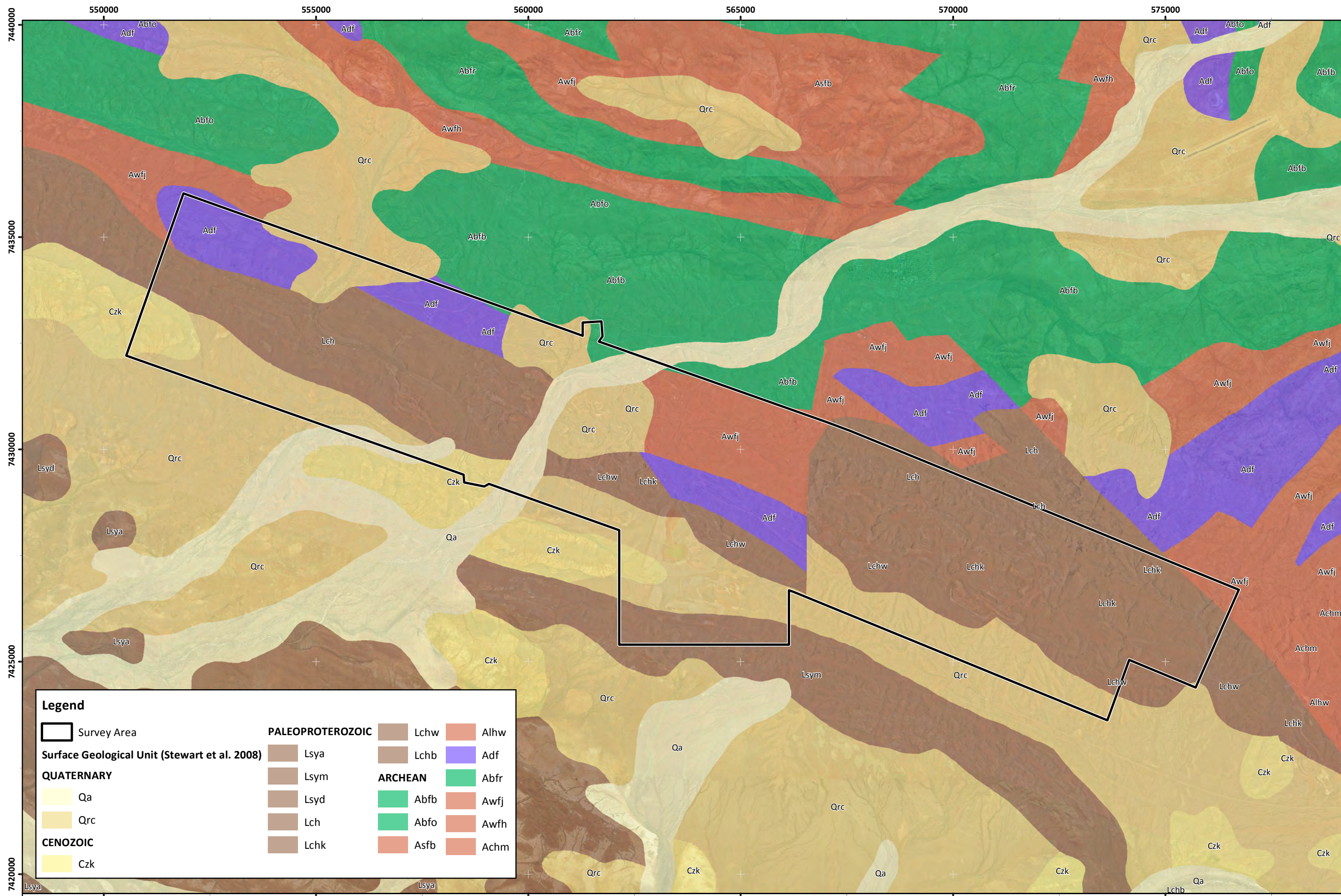
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Appendix A: Background Information Figures

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Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure A.1: Geological Units of the Paraburdoo Survey Area

Author: J. Trainer

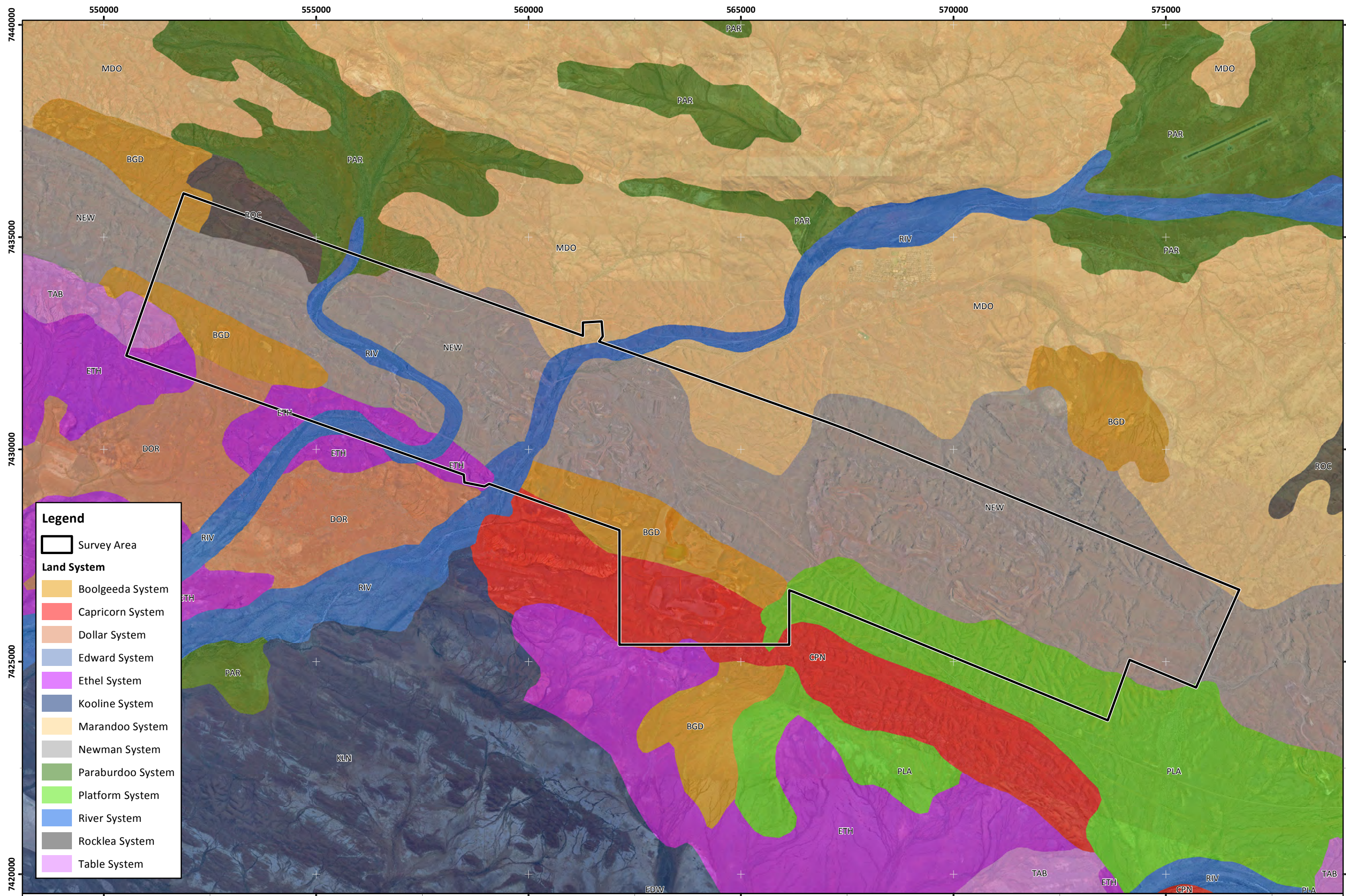
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Date: 16-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 1 2 3 4 5 Km



Figure Ref: 14283-18-BIDR-2RevB_180816_FigA01_Geo



Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure A.2: Land systems of the Paraburdoo Survey Area

Author: J. Trainer

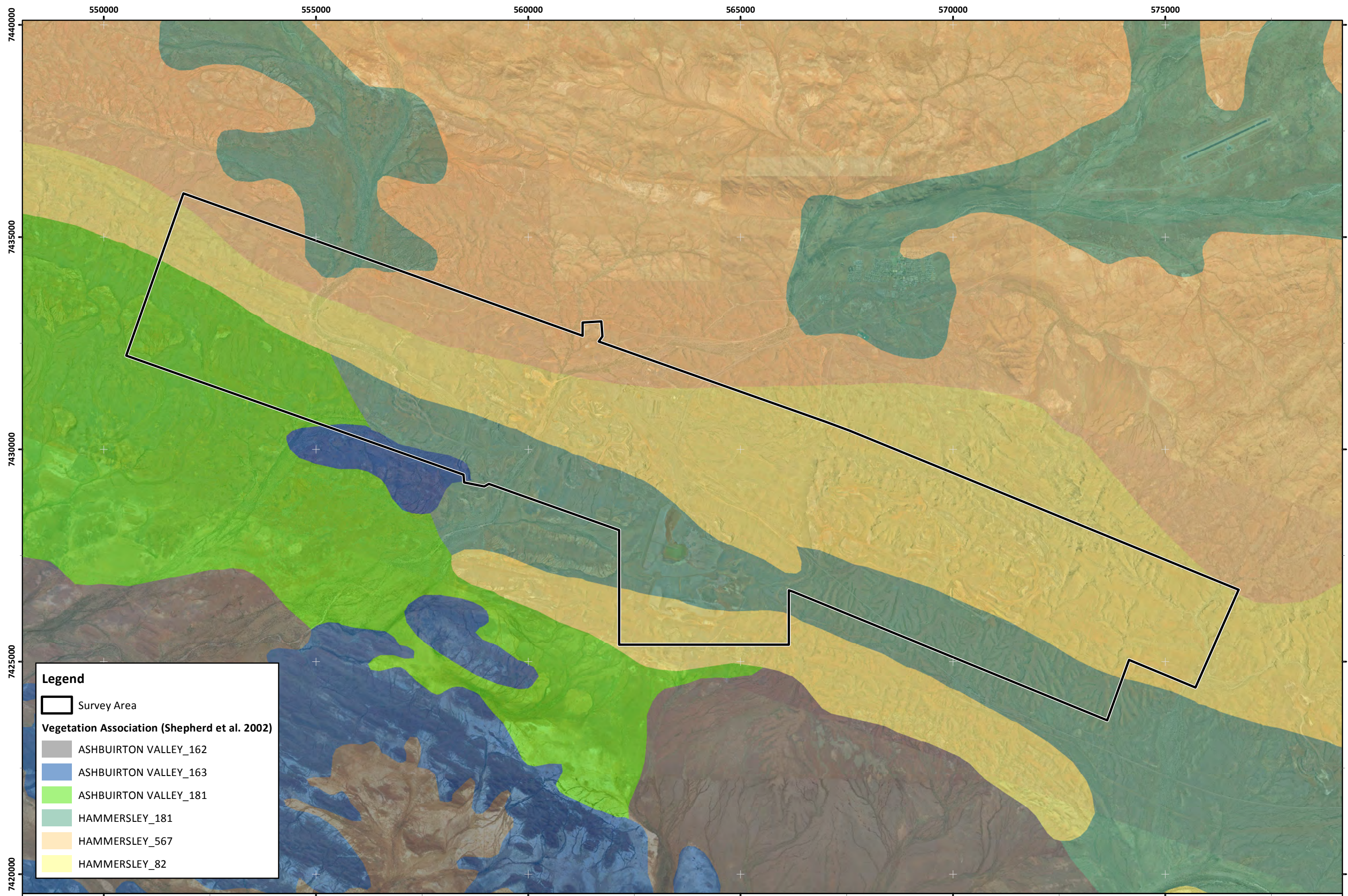
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Date: 16-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 1 2 3 4 5 Km



Figure Ref: 14283-18-BIDR-2RevB_180816_FigA02_LandSys



Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure A.3: Pre-European Vegetation of the Paraburdoo Survey Area

Author: J. Trainer

Drawn: C. Dyde

Date: 16-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 1 2 3 4 5 Km



Figure Ref: 14283-18-BIDR-2RevB_180816_FigA03_PreEuroVeg

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Appendix B: Conservation Fauna Categories, Habitat Condition Scales and Likelihood Criteria

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Table B.1: Categories of Threatened Ecological Communities (Department of Environment and Conservation 2013).

PD: Presumed Destroyed
<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
CR : Critically Endangered
<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <p>i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</p> <p>ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</p> <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>

En: Endangered

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

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

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

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

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

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

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

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

VU: Vulnerable

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

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

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf>

Table B.2: Definitions and criteria for Threatened Ecological Communities (Department of Environment and Conservation 2013).

Three categories exist for listing Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An ecological community may be categorised as:

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf>

Table B.3: Definitions and criteria for Priority Ecological Communities (Department of Environment and Conservation 2013).

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

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf>

Table B.4: Conservation codes for Western Australian fauna (Department of Parks and Wildlife 2017).

Code	Conservation category	Definition
CR	Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Fauna that is rare or likely to become extinct, as critically endangered fauna.
EN	Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Fauna that is rare or likely to become extinct, as endangered fauna.
VU	Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Fauna that is rare or likely to become extinct, as vulnerable fauna.
EX	Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Fauna that is presumed to be extinct.
IA	Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Birds that are subject to international agreements relating to the protection of migratory birds.
CD	Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Fauna that are of special conservation need being species dependent on ongoing conservation intervention.
OS	Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Declared to be fauna that is in need of special protection, otherwise than for the reasons mentioned.

Reference: Department of Parks and Wildlife 2017, *Conservation Codes For Western Australian flora and fauna*, The Government of Western Australia.

Table B.5: Priority species under Western Australian Wildlife Conservation Act 1950 (Department of Parks and Wildlife 2015).

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.

P1: Priority One – Poorly known taxa
Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail 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.
P2: 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.
P3: Priority Three – Poorly known taxa
Taxa that 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.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
(a) 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. (b) 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. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5: Priority Five: Conservation dependent 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.

Reference: Department of Parks and Wildlife 2015, *Conservation Codes For Western Australian flora and fauna*, The Government of Western Australia.

Table B.6: Categories and definitions for EPBC Act listed fauna species.

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalized population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (V)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	<p>Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied:</p> <ul style="list-style-type: none"> i) the taxa is a species of fish; ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; iv) Cessation of the management plan would adversely affect the conservation status of the taxa <p>Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.</p>
Migratory (Mi)	<p>Taxa are considered migratory species;</p> <ul style="list-style-type: none"> i) if they are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II); ii) all migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and iii) Are native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Table B.7: Criteria used to define likelihood occurrence of conservation significant fauna species.

Likelihood of occurrence	Pre-survey	Post-survey
Recorded	N/A	Species or evidence of species recorded during survey.
High	Species has been recorded within the survey area or within 20 km of the survey area and preferred habitat appears to be present.	Core or preferred habitats present in the survey area which are abundant and/or high quality condition. OR Species is known to be cryptic and may not have been detected despite adequate survey effort and suitable habitat present within the survey area. OR Species or evidence of species recorded within the survey area however doubt remains over the taxonomic identification, validity of record.
Moderate	Species has not been recorded from within the survey area, however species has been recorded within 20 km of the survey area and suitable habitat appears to be present.	Core or highly suitable habitats present in the survey area, however, non-cryptic species that was not detected despite adequate survey effort. OR Core or preferred habitats present in the survey area are mainly in poor or modified condition.
Low	Species recorded within 20 km of the survey area but suitable habitat does not appear to be present.	Species has not been recorded in the survey area despite adequate survey effort. OR Species dependent on specific habitats that do not occur in the survey area. OR Species considered locally extinct.

Table B.8: Criteria used to determine SRE status of invertebrates.

Status	Criteria
Confirmed	This species has a high probability of being an SRE based on expert opinion, reference databases or the scientific literature. Usually, this species belongs to a group that is well known taxonomically and contains a high proportion of SRE species. Example: Millipedes belonging to the genus <i>Boreohesperus</i> (Car and Harvey 2013).
Potential	<p>This species has a moderate probability of being an SRE because it belongs to a group with a high proportion of SRE species, has specific biological and/or ecological attributes that may indicate range restriction, or has been collected from a single microhabitat type. Usually, this species will belong to a group with a poorly or moderately resolved taxonomy. Example: Many trapdoor spiders in the infraorder Mygalomorphae (Castalanelli <i>et al.</i> 2014).</p> <p>The WAM recognises the uncertainty involved with this category and lists five sub-categories that may help elucidating this status: i) data deficient because there is insufficient information; ii) habitat indicators that are associated with potential SRE status; iii) morphological indicators; iv) molecular evidence; and v) research and expert knowledge held within the WAM (WAMTS staff 2013). These sub-categories are implicitly addressed as part of the species assessments.</p>

Reference: Car, CA & Harvey, MS 2013, 'A review of the Western Australian keeled millipede genus *Boreohesperus* (Diplopoda, Polydesmida, Paradoxosomatidae)', *ZooKeys*, vol. 290, pp. 1-19.

Castalanelli, MA, Teale, RJ, Rix, MG, Kennington, WJ & Harvey, MS 2013, 'Barcoding of mygalomorph spiders (Araneae: Mygalomorphae) in the Pilbara bioregion of Western Australia reveals a highly diverse biota', *Invertebrate Systematics*, vol. 28, pp. 375-85.

Table B.9: Fauna habitat condition scale (Thompson and Thompson 2010).

Habitat condition	Condition description
High Quality Fauna Habitat (1.0)	These areas closely approximate the vegetation mix and quality that would have been in the area prior to any human induced disturbance. The habitat has connectivity with other habitats and is likely to support the most natural vertebrate fauna assemblage.
Very Good Fauna Habitat (0.8)	These areas show minimal signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) and retain almost all of the characteristics of the habitat had it not been disturbed. The habitat has connectivity with other habitats, and fauna assemblages in these areas are likely to be minimally effected by disturbance.
Good Fauna Habitat (0.6)	These areas show signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat had it not been disturbed. The habitat still retains some connectivity with other habitats but fauna assemblages in these areas are likely to be affected by disturbance. Fauna assemblages in these areas are likely to be similar to what might be expected in this habitat.
Disturbed Fauna Habitat (0.4)	These areas show signs of human induced significant disturbance (e.g. mining, clearing, tracks and roads). Many of the trees, shrubs and undergrowth have died or have been cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain an abundance of weeds or have been damaged by vehicles or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
Highly Degraded Fauna Habitat (<0.2)	These areas often have a significant human induced loss of vegetation, and / or a large number of vehicle tracks and / or have been completely cleared, and / or areas have been heavily grazed or farmed. There is limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to differ significantly from what existed prior to the disturbance, and are often depleted compared to what existed prior to the disturbance.

Reference: Thompson, SA & Thompson, GG 2010, *Terrestrial Vertebrate Fauna Assessments for Ecological Impact Assessment*, Terrestrial Ecosystems, Mt Claremont.

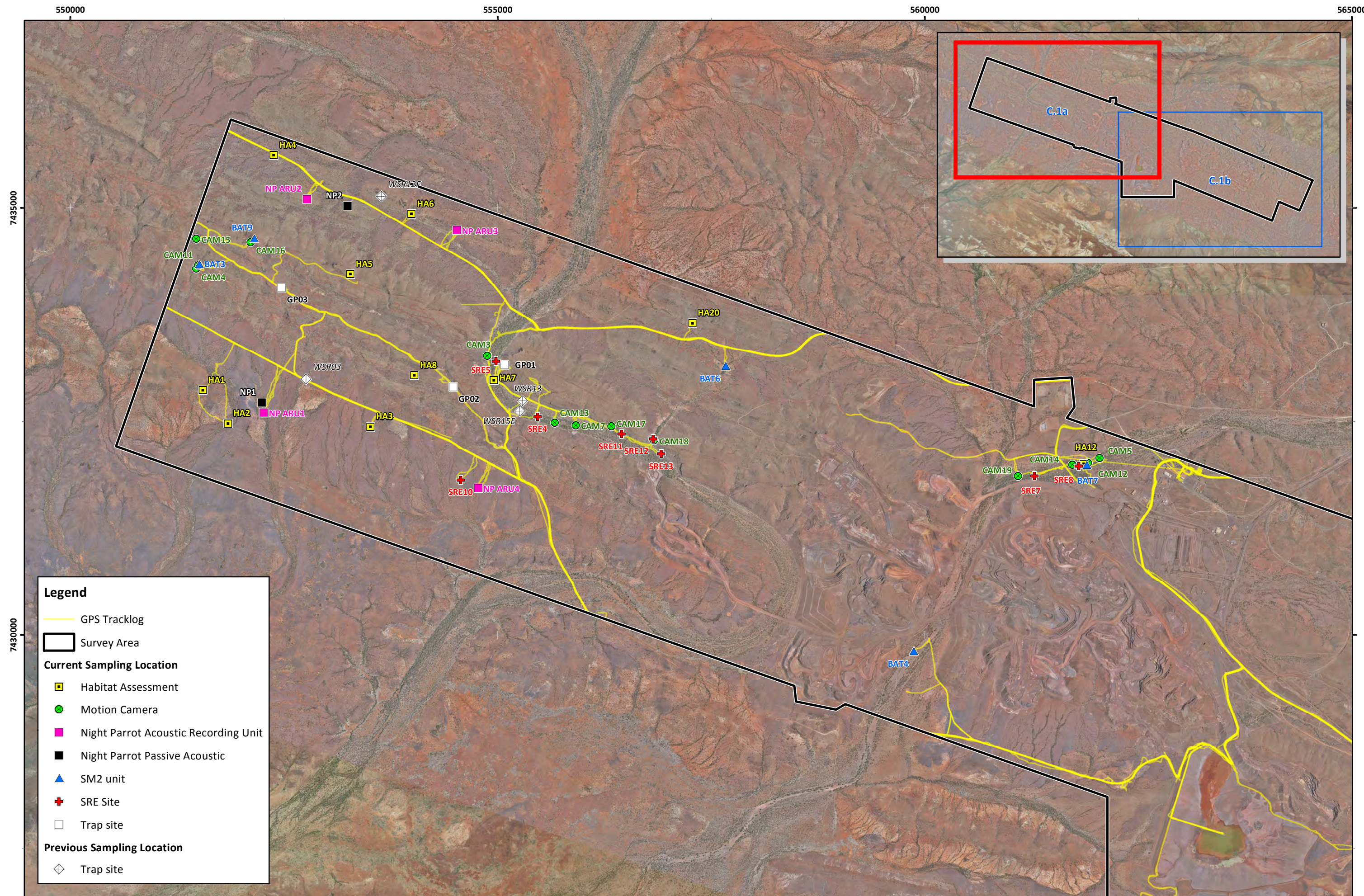
Table B.10: Suitability/significance of habitat ranking criteria for the five target Matters of National Environmental Significance (MNES) species.

Species	Potential shelter and foraging habitat (a)	Suitable foraging and dispersal habitat (b)	Limited foraging and dispersal habitat (c)
Pilbara Olive Python (<i>Liasis olivaceus barroni</i>)	Rocky habitat such as gorges, escarpments and Breakaways along with Drainage lines including or in close proximity to permanent or semi-permanent water holes.	Drainage lines with dense vegetation enabling transitory behaviours and/or providing foraging potential. Rocky habitats that are not in close proximity to water.	Habitat that has limited sheltering and foraging capacity with no permanent or semi-permanent water.
Northern Quoll (<i>Dasyurus hallucatus</i>)	Rocky habitats such as ranges, escarpments, mesas, ranges, gorges, Breakaways and boulder fields. Also major Drainage lines or tree-lined drainage systems that are structurally diverse and contain large diameter trees, termite mounds or hollow logs.	Habitat important for foraging, dispersal and buffering of the species including moderate to small sized Drainage lines and native vegetation in close proximity (within 2 km) denning or shelter habitat.	Habitat that has limited sheltering and foraging capacity and not connected to potential denning/shelter and foraging habitat.
Pilbara Leaf-nosed Bat (<i>Rhinonictis aurantia</i>) and Ghost Bat (<i>Macroderma gigas</i>)	Rocky habitat that contains caves suitable as diurnal or maternity roosts sites, or potentially contains these caves and has not adequately surveyed; OR Areas highly suitable for foraging that are likely to be used on a regular basis.	Habitat important for foraging including diverse rocky terrain, moderately sized Drainage lines and dense complex vegetation stands.	Habitat that has limited ecological value but may provide capacity for transitory movement across the landscape and/or limited foraging potential.
Night Parrot (<i>Pezoporus occidentalis</i>)	Isolated habitat not subjected to predation pressure, fire pressure, and altered habitat from pastoralism and mining activities. Generally roosting habitat that contains old and large spinifex clumps (>50 years unburnt), particularly ring-forming hummocks. OR Areas highly suitable for foraging in close association (<10 km) to potential roosting habitat, including <i>Triodia</i> (particularly at times of mass flowering and seeding) and chenopod communities dominated by <i>Sclerolaena</i> .	Very little is known on the foraging requirements of the Night Parrot. Habitat within 40 km of potential roosting and nesting sites, potentially important for foraging, including chenopod communities (particularly those dominated by <i>Sclerolaena</i>), <i>Triodia</i> and areas rich in herbs, including forbs, grasses and grass-like plants.	Habitat that has limited roosting and foraging potential for the Night Parrot.

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Appendix C: Survey Sampling Locations

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Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure C.1a: Previous and current fauna sampling locations of the Greater Paraburdoo survey area

Author: J. Trainer

Drawn: C. Dyde

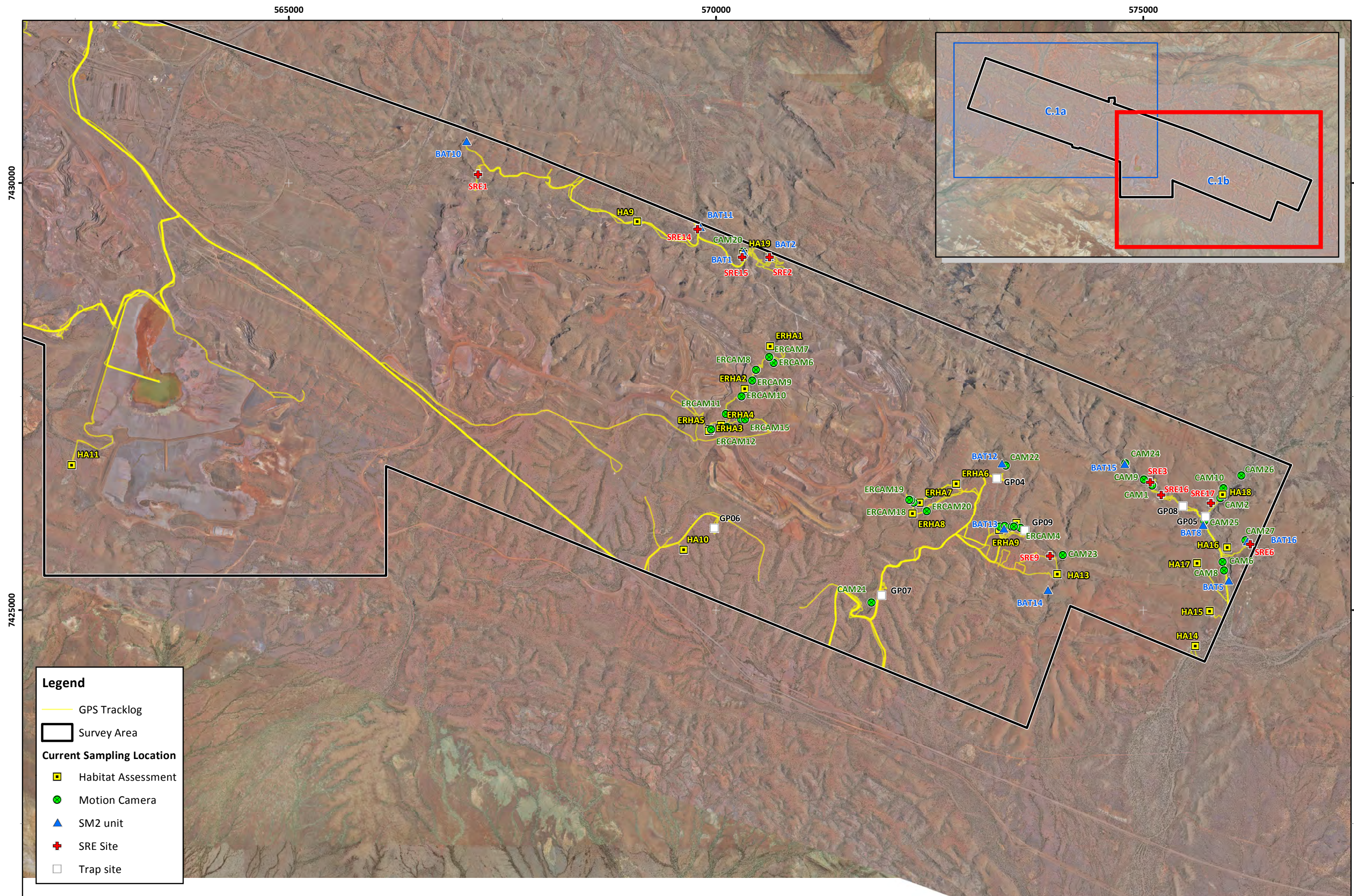
Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



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Figure Ref: 14283-18-BIDR-2RevB_180817_FigC01a_Sampling



Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure C.1b: Previous and current fauna sampling locations of the Greater Paraburdoo survey area

Author: J. Trainer

Drawn: C. Dyde






Date: 17-08-2018






Figure Ref: 14283-18-BIDR-2RevB_180817_FigC01b_Sampling






Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres













Table C.1: Astron Phase 1 fauna sampling locations.





Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
GP01	555082	7433160	Cage/Elliot trapping grid	25/07/2017 – 01/08/2017	Breakaway	0.8	Grazing, tracks, weeds	Caves (roost/feed caves), cracks and crevices, sheltered leaf litter	
GP02	554480	7432904	Cage/Elliot trapping grid	25/07/2017 – 01/08/2017	Breakaway	0.8	Drill pads and tracks	Caves (roost/feed caves), cracks and crevices, sheltered leaf litter	
GP03	552465	7434065	Funnel trapping grid	24/07/2017 – 31/07/2017	Rocky Hill	0.8	Drill pads and tracks	Termite mounds, tree hollows, crevices	
GP04	573285	7426541	Funnel trapping grid	23/07/2017 – 30/07/2017	Rocky Hill	0.8	Drill pads and tracks	Termite mounds, tree hollows, crevices	
GP05	575727	7426094	Trapping grid	24/07/2017 – 31/07/2017	Drainage Line	1.0	Grazing, vehicular tracks	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
GP06	569979	7425957	Trapping grid	21/07/2017 – 28/07/2017	Low Hill	0.8	Vehicular tracks	Termite mounds, <i>Triodia</i> hummocks, minimal leaf litter	
GP07	571937	7425173	Trapping grid	22/07/2017 – 29/07/2017	Low Hill	0.8	Vehicular tracks	Termite mounds, <i>Triodia</i> hummocks, minimal leaf litter	
GP08	575464	7426216	Cage/Elliott trapping grid	23/07/2017 – 30/07/2017	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	
GP09	573613	7425931	Cage/Elliott trapping grid	23/07/2017 – 30/07/2017	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	
HA1	551551	7432866	Habitat assessment	28/07/2017	Low Hill	0.8	Drill lines, tracks	Termite mounds, <i>Triodia</i> hummocks, minimal leaf litter	



Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
HA2	551844	7432476	Habitat assessment	29/07/2017	Drainage Line	0.8	Weeds	Closed vegetation canopy	
HA3	553512	7432437	Habitat assessment	28/07/2017	Stony Plain	0.8	Drill lines, tracks	Termite mounds, minimal leaf litter	
HA4	552381	7435616	Habitat assessment	28/07/2017	Stony Plain	0.8	Nil	Termite mounds, minimal leaf litter	
HA5	553278	7434223	Habitat assessment	28/07/2017	Breakaway	0.8	Drill lines, tracks	Overhangs, crevices, caves	
HA6	553993	7434928	Habitat assessment	28/07/2017	Low Hill	0.8	Tracks	Termite mounds, rock piles, minimal leaf litter	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
HA7	554958	7432982	Habitat assessment	28/07/2017	Riparian	0.8	Drill lines, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	
HA8	554027	7433037	Habitat assessment	29/07/2017	Breakaway	0.8	Drill lines, tracks	Crevices, overhangs	
HA9	569077	7429548	Habitat assessment	31/07/2017	Rocky Hill	0.8	Tracks	Termite mounds, tree hollows, crevices	
HA10	569621	7425706	Habitat assessment	28/07/2017	Low Hill	0.8	Tracks	Termite mounds, minimal leaf litter	
HA11	562463	7426699	Habitat assessment	28/07/2017	Stony Plain	0.8	Grazing, tracks	Termite mounds, minimal leaf litter	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
HA12	561860	7432003	Habitat assessment	31/07/2017	Riverine	0.6	Grazing, tracks, weeds	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	
HA13	573992	7425419	Habitat assessment	31/07/2017	Gorge	0.8	Weeds	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	
HA14	575610	7424580	Habitat assessment	31/07/2017	Drainage Line	0.6	Weeds, grazing and tracks	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	
HA15	575774	7424988	Habitat assessment	31/07/2017	Rocky Hill	0.8	Tracks	Termite mounds, tree hollows, crevices	
HA16	575980	7425732	Habitat assessment	29/07/2017	Breakaway	0.8	Tracks	Crevices, caves, overhangs	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
HA17	575628	7425548	Habitat assessment	29/07/2017	Rocky Hill	0.8	Tracks	Termite mounds, tree hollows, crevices	
HA18	575928	7426351	Habitat assessment	29/07/2017	Drainage Line	0.8	Grazing, weeds	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	
HA19	570320	7429168	Habitat assessment	31/07/2017	Gorge	0.8	Tracks	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	
HA20	557279	7433651	Habitat assessment	1/08/2017	Low Hill	0.8	Nil	Termite mounds, rock piles, minimal leaf litter	
CAM1	575102	7426460	Camera (passive)	26/07/2017 - 29/07/2017	Gorge	1.0	Weeds	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo
CAM2	575902	7426311	Camera (passive)	29/07/2017 - 31/07/2017	Drainage Line	0.8	Weeds	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	No photo
CAM3	554881	7433269	Camera (passive)	25/07/2017 - 29/07/2017	Riverine	0.8	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
CAM4	551472	7434290	Camera (passive)	25/07/2017 - 27/07/2017	Breakaway	0.8	Drill lines, tracks	Crevices, caves, overhangs	No photo






Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
CAM5	562046	7432068	Camera (passive)	27/07/2017 - 29/07/2017	Riverine	0.6	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
CAM6	575927	7425561	Camera (passive)	29/07/2017 - 31/08/2017	Drainage Line	0.8	Tracks and weeds	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	No photo
CAM7	555916	7432454	Camera (passive)	25/07/2017 - 29/07/2017	Riverine	0.8	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
CAM8	575945	7425464	Camera (passive)	29/07/2017 - 31/08/2017	Drainage Line	0.8	Tracks and weeds	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	No photo
CAM9	575006	7426526	Camera (passive)	26/07/2017 - 29/07/2017	Gorge	1.0	Weeds	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo
CAM10	575937	7426426	Camera (passive)	29/07/2017 - 31/08/2017	Gorge	0.8	Weeds	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo
CAM11	551497	7434326	Camera (passive)	25/07/2017 - 27/07/2017	Breakaway	0.8	Drill lines, tracks	Crevices, caves, overhangs	No photo
CAM12	561909	7432015	Camera (passive)	27/07/2017 - 29/07/2017	Riverine	0.6	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
CAM13	555668	7432483	Camera (passive)	25/07/2017 - 29/07/2017	Riverine	0.8	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
CAM14	561728	7431995	Camera (passive)	27/07/2017 - 31/08/2017	Riverine	0.6	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
BAT1	570321	7429185	Acoustic recording	26/07/2017 - 31/07/2017	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo
BAT2	570623	7429132	Acoustic recording	26/07/2017 - 31/07/2017	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo
BAT3	551509	7434340	Acoustic recording	25/07/2017 - 27/07/2017	Breakaway	0.8	Drill lines, tracks	Crevices, caves, overhangs	No photo
BAT4	559872	7429811	Acoustic recording	27/07/2017 - 29/07/2017	Drainage Line	0.6	Tracks, weeds, operational mining	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	No photo
BAT5	576002	7425343	Acoustic recording	29/07/2017 - 31/07/2017	Drainage Line	0.8	Tracks and weeds	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	No photo
BAT6	557671	7433147	Acoustic recording	25/07/2017 - 27/07/2017	Drainage Line	0.8	Tracks	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	No photo
BAT7	561897	7431989	Acoustic recording	27/07/2017 - 29/07/2017	Riverine	0.6	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
BAT8	575700	7425994	Acoustic recording	29/07/2017 - 31/07/2017	Drainage Line	0.8	Tracks and weeds	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	No photo
SRE1	570625	7429128	SRE foraging site	31/07/2017	Gorge	0.6	Drill lines, tracks	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo
SRE2	575082	7426496	SRE foraging site	29/07/2017	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo






Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
SRE3	555468	7432555	SRE foraging site	30/07/2017	Gorge	1.0	Weeds	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	No photo
SRE4	554980	7433204	SRE foraging site	29/07/2017	Riverine	0.8	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
SRE5	576251	7425769	SRE foraging site	29/07/2017	Riverine	0.8	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
SRE6	561285	7431862	SRE foraging site	30/07/2017	Breakaway	1.0	Nil	Crevices, caves, overhangs	
SRE7	561802	7431974	SRE foraging site	30/07/2017	Riverine	0.6	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
SRE8	573909	7425635	SRE foraging site	31/07/2017	Riverine	0.6	Grazing, weeds, tracks	Surface water (permanent and semi-permanent), dense and varied leaf litter, hollow bearing trees and logs	No photo
SRE9	570625	7429128	SRE foraging site	31/07/2017	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	
NP1	552241	7432721	Night Parrot Passive Acoustic	28/07/2017	Stony Plain	0.8	Tracks	Termite mounds, minimal <i>Triodia</i> cover	No photo
NP2	553245	7435023	Night Parrot Passive Acoustic	28/07/2017	Stony Plain	0.8	Tracks	Termite mounds, minimal <i>Triodia</i> cover	No photo






Habitat Condition





1.0 (Excellent)
0.8 (Very Good)
0.6 (Good)
0.4 (Poor)
0.2 (Very Poor)
0.1 (Completely Degraded)






Table C.2: Astron Phase 2 fauna sampling locations.





Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
GP01	555082	7433160	Cage/Elliott trapping grid	08/04/2018 – 15/04/2018	Breakaway	0.8	Grazing, tracks, weeds	Caves (roost/feed caves), cracks and crevices, sheltered leaf litter	
GP02	554142	7433029	Cage/Elliott trapping grid	08/04/2018 – 15/04/2018	Breakaway	0.8	Drill pads and tracks	Caves (roost/feed caves), cracks and crevices, sheltered leaf litter	
GP03	552465	7434065	Funnel trapping grid	08/04/2018 – 15/04/2018	Rocky Hill	0.8	Drill pads and tracks	Termite mounds, tree hollows, crevices	
GP04	573285	7426541	Funnel trapping grid	07/04/2018 – 14/04/2018	Rocky Hill	0.8	Drill pads and tracks	Termite mounds, tree hollows, crevices	
GP05	575727	7426094	Trapping grid	08/04/2018 – 15/04/2018	Drainage Line	1.0	Grazing, vehicular tracks	Hollow bearing trees and logs, sparse ground cover/vegetation, minimal leaf litter	





Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
GP06	569979	7425957	Trapping grid	08/04/2018 – 15/04/2018	Low Hill	0.8	Vehicular tracks	Termite mounds, <i>Triodia</i> hummocks, minimal leaf litter	
GP07	571937	7425173	Trapping grid	07/04/2018 – 14/04/2018	Low Hill	0.8	Vehicular tracks	Termite mounds, <i>Triodia</i> hummocks, minimal leaf litter	
GP08	575464	7426216	Cage/Elliott trapping grid	07/04/2018 – 14/04/2018	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	
GP09	573613	7425931	Cage/Elliott trapping grid	07/04/2018 – 14/04/2018	Gorge	1.0	Nil	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	
CAM15	551472	7434636	Camera (passive)	09/04/2018 - 15/04/2018	Breakaway	0.8	Drill lines	Caves, overhangs, crevices, rock piles	




Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
CAM16	552110	7434597	Camera (passive)	09/04/2018 - 15/04/2018	Breakaway	0.8	Drill lines	Caves, overhangs, crevices, rock piles	
CAM17	556332	7432444	Camera (passive)	09/04/2018 - 14/04/2018	Breakaway	1.0	Nil	Overhangs, crevices	
CAM18	556831	7432276	Camera (passive)	09/04/2018 - 14/04/2018	Riverine	0.8	Grazing	Logs, tree hollows, thick undergrowth, soft soil (burrows), permanent water, pools, leaf litter	
CAM19	561091	7431860	Camera (passive)	11/04/2018 - 15/04/2018	Riverine	0.6	Grazing, roads, weeds	Logs, tree hollows, thick undergrowth, soft soil (burrows), permanent water, pools, leaf litter	
CAM20	570317	7429194	Camera (passive)	13/04/2018 - 15/04/2018	Gorge	1.0	Roads	Caves, overhangs, logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), semi-permanent water, rock pile, leaf litter	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
CAM21	571818	7425089	Camera (passive)	10/04/2018 - 13/04/2018	Drainage Line	0.6	Weeds	Overhangs ,tree hollows, crevices, rock piles	No photo
CAM22	573390	7426689	Camera (passive)	12/04/2018 - 14/04/2018	Gorge	0.6	Drill lines	Overhangs ,tree hollows, crevices, rock piles	No photo
CAM23	574059	7425645	Camera (passive)	10/04/2018 - 14/04/2018	Gorge	0.8	Weeds	Overhangs, logs, crevices	
CAM24	574790	7426718	Camera (passive)	09/04/2018 - 11/04/2018	Gorge	0.8	Weeds	Overhangs, crevices, pools, semi-permanent water	
CAM25	575714	7426039	Camera (passive)	10/04/2018 - 14/04/2018	Gorge	0.8	Weeds	Caves, overhangs, tree hollows, crevices, semi-permanent water	
CAM26	576147	7426574	Camera (passive)	09/04/2018 - 11/04/2018	Drainage Line	0.4	Grazing, weeds	Logs, tree hollows, crevices, thick undergrowth, soft soil (burrows),semi-permanent water	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
CAM27	576196	7425817	Camera (passive)	09/04/2018 - 11/04/2018	Gorge	0.8	Nil	Overhangs, crevices	
BAT9	552154	7434641	Acoustic recording	09/04/2018 - 11/04/2018	Breakaway	0.8	Drill lines	Caves, overhangs, crevices	
BAT10	567081	7430488	Acoustic recording	13/04/2018 - 15/04/2018	Rocky Hill	0.8	Drill lines	Caves, overhangs, rock pile	
BAT11	569816	7429479	Acoustic recording	11/04/2018 - 13/04/2018	Breakaway	0.8	Roads	Caves, overhangs, logs, crevices, rock pile	
BAT12	573345	7426713	Acoustic recording	12/04/2018 - 14/04/2018	Rocky Hill	1	Nil	Crevices, rock pile, old <i>Triodia</i>	




Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
BAT13	573371	7425951	Acoustic recording	09/04/2018 - 11/04/2018	Gorge	0.8	Nil	Caves, overhangs, logs, tree hollows, crevices, semi-permanent water	
BAT14	573883	7425233	Acoustic recording	12/04/2018 - 14/04/2018	Gorge	0.6	Grazing	Overhangs, crevices, rock pile, leaf litter	No photo
BAT15	574783	7426711	Acoustic recording	09/04/2018 - 11/04/2018	Gorge	0.8	Nil	Overhangs, crevices, pools, semi-permanent water	
BAT16	576217	7425801	Acoustic recording	09/04/2018 - 11/04/2018	Breakaway	1	Nil	Caves, crevices	
SRE10	554568	7431813	SRE foraging site	10/04/2018	Stony Plain	0.8	Grazing, roads	Logs, leaf litter	No photo
SRE11	556452	7432350	SRE foraging site	10/04/2018	Breakaway	1	Grazing	Rocky outcrop, crevices, rock pile	


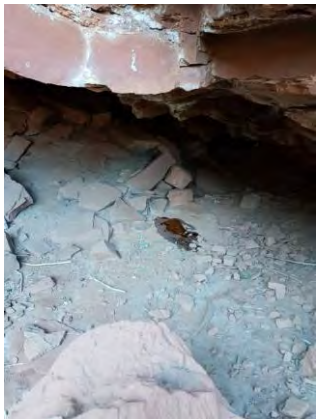


Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
SRE12	556819	7432296	SRE foraging site	10/04/2018	Riverine	0.8	Grazing	Moist, logs, thick undergrowth, permanent water, leaf litter	No photo
SRE13	556916	7432119	SRE foraging site	10/04/2018	Breakaway	1	Grazing	South facing, rocky outcrop, logs, crevices, rock pile	
SRE14	569785	7429460	SRE foraging site	13/04/2018	Gorge	1	Roads	South facing, moist, rocky outcrop, tree hollows, rock pile, leaf litter	
SRE15	570304	7429132	SRE foraging site	13/04/2018	Gorge	1	Roads	South facing, rocky outcrop, overhangs, logs, rock pile	
SRE16	575209	7426344	SRE foraging site	11/04/2018	Gorge	0.8	Nil	Rock pile, leaf litter	No photo
SRE17	575791	7426252	SRE foraging site	11/04/2018	Gorge	0.8	Nil	Logs, tree hollows ,crevices, leaf litter	No photo
NP ARU 1	552263	7432603	Night Parrot Acoustic Recording Unit	09/04/2018 - 12/04/2018	Stony Plain	0.8	Grazing	Logs, thick undergrowth, soft soil (burrows), leaf litter	




Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
NP ARU 2	552769	7435100	Night Parrot Acoustic Recording Unit	12/04/2018 - 14/04/2018	Stony Plain	0.8	Grazing, roads	Leaf litter, termite mounds	
NP ARU 3	554523	7434738	Night Parrot Acoustic Recording Unit	12/04/2018 - 14/04/2018	Low Hill	0.8	Grazing	Logs, crevices, rock pile	
NP ARU 4	554773	7431719	Night Parrot Acoustic Recording Unit	09/04/2018 - 12/04/2018	Stony Plain	0.8	Grazing	Soft soil (burrows), termite mounds	




Habitat Condition
1.0 (Excellent)
0.8 (Very Good)
0.6 (Good)
0.4 (Poor)
0.2 (Very Poor)
0.1 (Completely Degraded)





Table C.3: Astron Eastern Range targeted fauna sampling locations.





Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERCAM1	573321	7425978	Camera (passive)	25/06/2018 – 27/07/2018	Gorge	1.0	None	Caves, overhangs, crevices	
ERCAM2	573376	7425984	Camera (passive)	25/06/2018 – 27/07/2018	Gorge	1.0	None	Rocky outcrop, caves, overhangs, logs, crevices	
ERCAM3	573461	7425975	Camera (passive)	25/06/2018 – 27/07/2018	Gorge	1.0	None	South facing, rocky outcrop, caves, overhangs, crevices	






Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERCAM4	573564	7425963	Camera (passive)	25/06/2018 – 27/07/2018	Gorge	1.0	None	South facing, rocky outcrop, caves, overhangs, logs, crevices	
ERCAM5	573485	7425978	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	1.0	None	Caves, overhangs, crevices	
ERCAM6	570674	7427893	Camera (passive)	26/06/2018 – 26/07/2018	Gorge	1.0	None	Overhangs	
ERCAM7	570623	7427961	Camera (passive)	26/06/2018 – 26/07/2018	Gorge	1.0	Sediment	Rocky outcrop, overhangs, crevices	


Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERCAM8	570468	7427811	Camera (passive)	26/06/2018 – 26/07/2018	Gorge	1.0	None	South facing, moist, caves, overhangs	
ERCAM9	570423	7427685	Camera (passive)	26/06/2018 – 26/07/2018	Gorge	1.0	None	Overhangs	
ERCAM10	570298	7427498	Camera (passive)	26/06/2018 – 26/07/2018	Gorge	0.8	Sediment	Overhangs, crevices	
ERCAM11	570117	7427297	Camera (passive)	26/06/2018 – 26/07/2018	Gorge	0.8	Sediment	Rocky outcrop, caves, overhangs, crevices, rock pile	No photo

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERCAM12	569943	7427115	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	0.8	Sediment	Moist, caves, overhangs, crevices, permanent water	
ERCAM13	570130	7427142	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	0.8	Sediment	South facing, moist, caves, overhangs, logs, crevices, permanent water	
ERCAM14	570296	7427232	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	0.8	Sediment	Rocky outcrop, caves, overhangs, crevices, rock pile	No photo
ERCAM15	570339	7427231	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	0.8	Sediment	Rocky outcrop, caves, overhangs, crevices, rock pile	No photo
ERCAM16	572501	7426357	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	1.0	None	Overhangs, crevices, permanent water, leaf litter	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERCAM17	572312	7426257	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	0.8	Sediment	South facing, moist, caves, overhangs, logs, permanent water, pools, leaf litter	
ERCAM18	572284	7426282	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	1.0	None	South facing, moist, caves, overhangs, log, tree hollows, permanent water, pools, leaf litter	
ERCAM19	572261	7426289	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	1.0	None	Caves, overhangs ,crevices, rock pile	
ERCAM20	572467	7426158	Camera (passive)	26/06/2018 – 27/07/2018	Gorge	1.0	None	Caves, overhangs, crevices, leaf litter	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERHA1	570635	7428087	Habitat assessment	26/06/2018	Gorge	1.0	None	Rocky outcrop, overhangs, crevices	
ERHA2	570336	7427589	Habitat assessment	26/06/2018	Gorge	0.8	Sediment	Overhangs, logs, tree hollows, thick undergrowth, leaf litter	
ERHA3	569933	7427118	Habitat assessment	26/06/2018	Gorge	0.8	Sediment	South facing, moist, caves, overhangs, crevices, semi-permanent water, leaf litter	
ERHA4	570062	7427169	Habitat assessment	26/06/2018	Gorge	0.8	Sediment	South facing, moist, caves, overhangs, semi-permanent water	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERHA5	569914	7427098	Habitat assessment	26/06/2018	Gorge	0.6	Sediment, weeds	South facing, moist, overhangs, logs, tree hollows, crevices, permanent water, leaf litter	
ERHA6	572811	7426476	Habitat assessment	27/07/2018	Gorge	1.0	None	Moist, rocky outcrop, overhangs, crevices	
ERHA7	572381	7426257	Habitat assessment	27/07/2018	Gorge	1.0	None	Overhangs, crevices, thick undergrowth, rock piles	
ERHA8	572300	7426131	Habitat assessment	27/07/2018	Gorge	1.0	None	South facing, moist, rocky outcrops, caves, overhangs	
ERHA9	573311	7425940	Habitat assessment	27/07/2018	Gorge	1.0	None	Moist, rocky outcrops, overhangs, crevices	

Site ID	MGA Zone 50 K		Sampling method	Date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)							
ERHA10	573517	7426020	Habitat assessment	27/07/2018	Gorge	1.0	None	South facing, moist, rocky outcrops, logs, crevices	

Habitat Condition
1.0 (Excellent)
0.8 (Very Good)
0.6 (Good)
0.4 (Poor)
0.2 (Very Poor)
0.1 (Completely Degraded)

Appendix D: Alacran Environmental Services Report

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Short-range Endemic Assessment of Invertebrates from a two-season survey of the Paraburdoo Range

Prepared for
Astron (Rio Tinto)



Lychas 'aitkeni complex'.

Document History

Version	Author	Date submitted	Reviewed
Draft v1	E.S. Volschenk	30 May 2018	John Trainer (Astron)
Final	E.S. Volschenk	10 June 2018	John Trainer (Astron)

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Limitation: This purpose of this report is to inform Astron about the identity and distribution of conservation significant invertebrates (including short-range endemics) within the Paraburdoo Range. *Alacran Environmental Science* accepts no liability or responsibility for any use or reliance on this report for anything other than its purpose. The accuracy and completeness of the information supplied by Astron or other data sources including (but not limited to) The Western Australian Museum, The Australian Bureau of Meteorology or the Western Australian Department of Minerals and Petroleum, have not been reviewed or verified.

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EXECUTIVE SUMMARY

This report presents the findings of a desktop study, and the identification and SRE (short-range endemic) assessment of invertebrates sampled during two field surveys undertaken by Astron. The information in this report is intended to be used by Astron in their preparation of an overarching fauna report for Rio Tinto. The aim of that report was to provide information to Rio Tinto to enhance the level of knowledge of fauna within the "Eastern and Western Paraburdoo Ranges, the Study Area. This information is also intended to inform any future environmental impact assessment (EIA) within the region.

The Study Area is located approximately 4 km South of Paraburdoo with an area of approximately 11,203 ha. A level 2, two phase fauna survey was undertaken by Astron in late July 2017 and again in early April 2018 within the Study Area. In a previous report, Alacran (No. 1712) presented the findings of the Late June Survey and the desktop assessment. This report incorporates the findings of a second season of surveying with the findings of the first survey results and includes some minor taxonomic amendments. This report therefore supersedes report No 1712.

The desktop assessment of SRE invertebrates was undertaken within approximately 40,000 km² square area (the Search Area) centred on the Study Area. Database searches were undertaken for SRE invertebrate records from the WA Museum's Arachnids and Myriapods, Crustaceans and Molluscs databases. These data were edited to enforce consistency in naming and then filtered for SRE's and potential SREs.

The database search revealed yielded 3,345 records from within the Search Area. Of those, 1,328 records were attributed to SRE groups, SREs and Potential SREs. The SRE groups represented 154 taxa, of which eight represented named species, 89 represented named morphospecies and 57 represented unidentified species belonging to taxa known to contain SRE representatives. Six species and morphospecies (one spider and five millipedes) represented SREs with the remaining 148 taxa being Potential SRE owing largely to data deficiency (DD). The high proportion of potential SREs and undescribed morphospecies indicates a poor state of knowledge about these invertebrates in this region. This was also suggested by the concentration of SRE group records in the northern third of the Search Area.

The field survey yielded a total of 227 invertebrates from SRE target taxa, representing 36 different taxa. Sixteen of these species were known to be widespread with the remaining 20 being potential SREs (DD). The potential SREs comprised:

- one spider representing an unidentified species of Selenopidae sp., most likely a species of *Karaops*;
- three pseudoscorpion taxa: *Austrohorus* sp., *Indolpium* 'long chela hand' and *Indolpium* sp.;
- four scorpion taxa: *Lychas* 'bituberculatus complex', *Lychas* 'hairy tail complex', *Lychas* 'aitkeni complex' and *Lychas* sp.,
- two earth centipedes (Geophilomorpha): *Mecistocephalus* sp. indet. and *Orphnaeus* sp. indet.;
- one cryptic centipede (Cryptopidae): *Cryptops* sp.;
- one millipede, *Austrostrophus* sp.;
- six isopods: *Barrowdillo* '4', *Buddelundia* '10ts', *Buddelundia* '47ts', *Buddelundia* '50', *Buddelundiinae* sp. and *Philosciidae* sp.
- one silverfish, putatively a species of *Trinemura*;
- one snail: *Bothriembryon* 'Pilbara'

The first survey yielded 11 taxa and the second survey yielded 19 with eight species sampled during both surveys. While the second survey yielded significantly more species than the first, most of the sites sampled during the second survey were relatively dry, which may have resulted in the survey under-representing the true species richness of SREs in the study area.

The presence of a broad range of SRE's demonstrates that Paraburdoo range has a rich diversity of SRE species. Most of the taxa sampled represent groups known from the elsewhere in the Pilbara; however, it is not clear as to how closely the SREs from Paraburdoo Range are related to those from more well sampled parts of the Pilbara, such as the Hamersley range. An assessment of the species boundaries, using DNA sequence data from the taxa present in this study with those from elsewhere in the Pilbara, may help address this knowledge gap. This survey presents an important starting point to understanding the diversity of Paraburdoo range, but not a definitive one.

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1 INTRODUCTION

1.1 SCOPE

In August 2017, Rio Tinto (Rio) commissioned Astron and Alacran Environmental Science (Alacran) to undertake a single-phase Level 2 fauna survey within a 11,203 ha of the eastern and western Paraburdoo ranges (the Study Area). The results of that survey were presented in ([Alacran 2018](#)). Rio subsequently commissioned a second survey which was undertaken in early April. This report updates Alacran ([2018](#)) to include the data from the second survey and also updates some taxonomic identification in that report.

The overall purpose of these works was to gather information through a desktop study and from two field surveys to enhance the level of knowledge at the locality scale. This work is to provide information for consideration by Rio Tinto for the proposed expansion of the Paraburdoo Iron ore mine and associated infrastructure. This survey will also inform any future environmental impact assessment (EIA). Astron undertook the field survey and preparation of the overarching report.

Alacran provided specialist support for the short-range endemic component of the survey by way of:

- selecting likely field locations within the Study Area to undertake SRE sampling,
- undertaking a desktop assessment including area searches of relevant WA Museum databases,
- identification and SRE assessment of field samples
- participating in the second field survey.

1.2 OVERVIEW

1.2.1 Short-range endemism

Short-range endemics are organisms with small geographic distributions ([Harvey 2002b](#); [Ponder and Colgan 2002](#)), nominally less than 10,000 km² ([Harvey 2002b](#)). These organisms are typically characterised by one or more of the following characteristics:

- limited dispersal capabilities,
- seasonal activity (cooler or wetter periods),
- slow growth, and
- low levels of fecundity.

Their limited dispersal capabilities result in small populations being isolated from each other by inhospitable geographic features such as rivers, rocky ridges or plains. Prolonged isolation between populations eventually results in speciation, with each population becoming genetically and morphologically distinct. Two types of short-range endemism have been recognised: Relictual Endemism and Habitat Specialist Endemism ([Harvey 2002b](#); [Ponder and Colgan 2002](#)).

Relictual SREs result when speciation occurs following the fragmentation of continuous habitat into two or more refugia. In Australia, the primary driver of this over the last 65 million years has been aridification, which acted to isolate formerly widespread species living in mesic forests to small patches of mesic refugia. Relictual SREs include scorpions in the genus *Aops* ([Volschenk and Prendini 2008](#)), pseudoscorpions in the genera

Tyrannochthonius ([Harvey 1991](#); [Edward and Harvey 2008](#)), *Indohya* ([Harvey 1993b](#); [Harvey and Volschenk 2007](#)) and *Idioblothrus* ([Muchmore 1982](#); [Harvey 1993a](#); [Harvey and Leng 2008a](#)) and millipedes in the genus *Antichiropus* ([Car et al. 2013](#); [Car and Harvey 2014](#)). Troglobites (obligate subterranean species) are thought to be extreme examples of relictual SREs; most troglobites from the Pilbara have surface dwelling relatives living in the more mesic forests of northern Australia ([Harvey 2002b](#); [Ponder and Colgan 2002](#)).

Habitat specialist SREs are species that have adapted to very specific environment types, including those found in arid environments (e.g. rocky outcrops or isolated dune systems). These habitats are often relatively young (<10 million years) and therefore are not refugial. Examples of habitat specialist SREs include spiders in the family Selenopidae and pseudoscorpions in the genera *Synsphyronus* ([Harvey 2011](#), [2012](#)) and *Feaella* ([Harvey 1989](#); [Harvey and Volschenk 2007](#)), and scorpions in the genera *Lychas* and *Urodacus*.

2 METHODS

2.1 DEFINING SHORT-RANGE ENDEMISM

Assessment of short-range endemism can be challenging when data for evaluation are absent or limited. Limitations may include any of the following:

- **Poor survey coverage**, e.g. the fauna of an area has not been sampled extensively enough to enable assessment of species distributions. The absence of a species from survey records may not mean that it is absent from the area.
- **Poor taxonomic resolution**, e.g. a species has not been subject to systematic investigation, and/or the identity is either difficult or impossible to determine. Good taxonomic resolution does not necessarily need to be in the form of published revisions, as it can be facilitated by any of the following:
 - a researcher actively working on the group who can authorise identifications,
 - a publicly accessible reference collection, and/or;
 - assessment of species boundaries using genomic methods such as DNA barcoding ([Hebert et al. 2003a](#); [Hebert et al. 2003b](#)).
- **Identification issues**, e.g. surveys sampled life stages of SREs that are impossible to identify based on morphological characters. Examples of relevant taxa include juvenile or female millipedes, mygalomorph spiders and *Urodacus* scorpions. Genomic methods have great potential to overcome this type of limitation.

There are no published systems for assessing the SRE potential for a species. The WA Museum Previously employed the following system to assess SRE-status of invertebrates:

- **Confirmed SRE**: This category applies when the identity of the taxon is unambiguous and its distribution is less than 10 000km² based on publicly available vouchered records. Supporting data can be either genomic (from DNA sequences) or morphological, ideally both.
- **Potential SRE**: This category applies to situations where there are knowledge gaps for the taxon. The following sub-categories further elucidate this status:

- **Data Deficiency (DD):** This category covers taxa for which there is insufficient data available to determine SRE status. Factors that fall under this category include:
 - insufficient geographic information,
 - insufficient taxonomic information, and/or
 - inappropriate life stages prevent identification to species level.
- **Habitat Indicators (H):** This category employs habitat characteristics to evaluate SRE status when habitats are known to support SRE taxa. For example, many species sampled from subterranean habitats are known to be range restricted; a new species discovered from such habitat therefore has greater potential to be range restricted (i.e. a SRE) than widespread.
- **Morphological Evidence (M):** This category uses one or more morphological characters that are characteristic of SRE taxa inhabiting restricted environments, e.g. the specialised morphological features of animals adapted to subterranean habitats, including body markings that are absent or significantly paler than surface dwelling relatives, eyes that are absent or significantly reduced, and/or longer appendages (legs and antennae) than surface relatives.
- **Unpublished Research & Expertise (U):** This category relies on unpublished research or expertise to develop SRE status.

These categories of potential SRE may be helpful in developing conservation priorities; however, each taxon should be assessed on its merit and in accordance with the *Precautionary Principle* ([EPA 2002](#)):
“where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation”.

- **Widespread (not an SRE):** This category applies when vouchered evidence demonstrates a distribution greater than 10,000 km².

2.2 TAXONOMY

The taxonomic nomenclature of invertebrates follows the references detailed in Table 2.1. Morphospecies designations follow the parataxonomy of the scientist(s) working on the group; these informal names are written between single quotation marks rather than being italicised as they are not valid under the International Code of Zoological Nomenclature ([1999](#)).

Alacran follows the “Phylogenetic Species Concept” ([Cracraft 1983](#)) when delineating species or morphospecies:

“A species is the smallest diagnosable cluster of individual organisms within which there is a parental pattern of ancestry and descent.”

2.2.1 Identification

For this report, Dr Simon Judd contributed information about isopod distributions, SRE assessment and specimen identification. The remaining identifications (spiders, pseudoscorpions, scorpions, millipedes, centipedes, silverfish and snails) were carried out by the Dr Erich Volschenk. The references used for species determination are summarised in Table 2.1.

Table 2.1. The following ‘general’ references and collections were used to assist with morphospecies designations

Order	Taxonomic reference	Morphospecies and reference collection
Araneae	(Raven et al. 2002 ; Crews and Harvey 2011 ; Crews 2013 ; World Spider Catalog 2014 ; Rix et al. 2017 (in press))	Reference collection at the WA Museum
Pseudoscorpiones	(Harvey 1992 ; Murienne et al. 2008 ; Harvey 2012, 2013b)	Reference collection at the WA Museum
Scorpiones	(Glauert 1925b, a ; Acosta 1990 ; Kovářik 1997 ; Fet et al. 2000 ; Volschenk et al. 2000 ; Volschenk and Prendini 2008 ; Volschenk et al. 2010)	Morphospecies designation by Dr Erich S Volschenk. Reference collection at the WA Museum and with Dr Erich S. Volschenk.
Chilopoda	(Colloff et al. 2005)	Reference collection at the WA Museum
Diplopoda	(Hoffman 2003)	Reference collection at the WA Museum
Zygentoma	(Smith 1988)	NA
Isopoda	(Judd and Horwitz 2003 ; Schmalfuss 2003 ; Judd 2004 ; Schmidt and Leistikow 2004 ; Schotte et al. 2008 ; Judd and Perina 2013)	Morphospecies designation by Dr Simon Judd. Reference collection at the WA Museum and with Dr Simon Judd.
Gastropoda	(Solem 1985, 1997 ; Johnson et al. 2004 ; Johnson et al. 2012 ; Whisson and Köhler 2012 ; Johnson et al. 2013 ; Whisson and Kirkendale 2014)	Reference collection at the WA Museum

2.2.2 Specimen Lodgement and Data Access

In accordance with *EPA Guidance Statement 20* ([2009](#)), specimens submitted to Alacran Environmental Science for taxonomic identification will be offered to the WA Museum for inclusion in their biological collections.

Supporting data are attached as appendices and are compliant with the data requirements of the Index of Biodiversity Surveys for Assessments (IBSA) of the Department of Water and Environmental Regulation of Western Australia.

2.3 DESKTOP ASSESSMENT

2.3.1 Database search

2.3.1.1 Search area

For this report, the Search Area is defined as the area investigated for SREs surrounding the Study Area. Based on the nominal area threshold for SRE distributions, <10,000 km² ([Harvey 2002b](#)), a square area was generated using “Google™ Earth Pro”, centring on the Study Area and extended approximately 100 km north, south east and west from it. The following corner coordinates of the Search Area was used when undertaking searches from within the WA Museum’s databases: Top left corner (North West): -22.357431, 116.659481; Bottom right corner (South East): -24.155779, 118.623467. The total area searched was approximately 40,000 km² (a square with 200 km sides) (Figure 2.1).

2.3.1.2 Search area data edits and filtering

At the time when the area searches were requested from the WA Museum, limited taxonomic support was provided for database searches with **limited** screening for SREs or subterranean fauna. Database search results constituted data ‘dumps’ of ALL records from within the Search Area requested. Database search results were edited prior to screening for SREs to enforce consistency between the different departmental databases. The following edits and filtering were applied to the combined data:

- 1 A new field “Binomial” was created, into which the Genus and Species field values were concatenated, *e.g.* Genus [Lychas] + Species [‘gracilimanus’] → Binomial [Lychas ‘gracilimanus’]
 - a. Where the genus field was empty, or contained the values “Unknown” or “gen. nov.”, the family rank name was used instead of genus.
 - b. Where both family and genus fields were empty, unknown, the order rank was used in place of the genus.
 - c. all unidentified ‘species’ in the ‘Binomial’ field (*e.g.* “sp. indet.”, “sp. indet. (juvenile)”, “sp?”, “unknown”) were renamed to “sp.”
 - d. All Binomial morphospecies names ending in “sp. n.” were renamed without that suffix, *e.g.* “*Rhagada* ‘pannawonica’ sp. n.” was renamed to *Rhagada* ‘pannawonica’.
- 2 Another field was created called “Ecotype”, into which the ecotype of the species was manually recorded, based on taxon and/or sampling methods:
 - a. **Epigean**: all species obtained through terrestrial survey methods or belonging to taxa only known to be epigean in W.A., *e.g.* trapdoor spiders.
 - b. **Troglobite** and **stygobite**: ‘named’ species or morphospecies obtained using subterranean sampling methods or from taxa known predominantly from subterranean habitats, *e.g.* schizomids.
 - c. **?Epigean**: unidentified species from subterranean survey methods of groups known to contain epigean SREs in the Pilbara, *e.g.* Centipedes from the order Geophilomorpha or family Cryptopidae.

d. **?troglobite**: Unidentified species obtained from subterranean fauna survey methods of orders or families rarely sampled in SRE surveys in the Pilbara, *e.g.* Millipede families Haplodesmidae and Dolodesmidae.

e. **Marine** and **Aquatic**: marine and freshwater species respectively.

- 3 The data were filtered for records with ecotypes of either “epigean” or “?epigean”.
- 4 The SRE status of each species present in the filtered data was assessed according to the SRE categories previously used by the WAMTS and described in **2.1 Defining short-range endemism**.
- 5 The Search Area overlaps much of Barrow Island, which contains several species that either, endemic to the Island, or are on Barrow Island and the nearby Islands including the Montebello Islands, but are not known from the Pilbara mainland. These species were also filtered out.

Filtered data were then used to generate distributions at the family order or class level. Data presented in tables and maps corresponds to the names in the “Binomial”.

Figure 2.1 **Figure title:** Central Pilbara showing the location of the Study Area and the Search Area used to interrogate the WA Museum’s Terrestrial Invertebrates, Crustaceans and Molluscs databases



3 RESULTS

3.1 LITERATURE REVIEW

This review focusses on the data obtained from the Western Australian Museum invertebrate departments as these are based on vouchered reference specimens. Several invertebrate surveys have been undertaken in (or partly in) the search area and these were all corroborated by records in the Western Australian Museum. References to informative literature are made in the "Justification" field of the taxon summary tables.

3.2 WA MUSEUM DATABASE SEARCH

The Area Searches yielded a total of 3,345 records. After filtering applying the SRE data edits and filters (**2.3.1.2 search area data edits and filtering**), that number was reduced to 1,328 records. These were represented by 154 taxa of which eight were named species, 89 were morphospecies and 57 were undetermined taxa, e.g. *Tyrannochthonius* sp. and Chthoniidae sp. The majority (148) of these taxa were potential SRE (data deficient) and six were confirmed SRE.

These results are summarised by Order in Table 3.1. The corresponding data file is embedded within this file as Appendix 1.

Table 3.1. Summary of WA Museum database search results for SRE and potential SRE taxa.

Order	Named species	Morphospecies	Un-named taxa ("sp.")	Totals
Araneae (spiders)	3	33	15	<u>51</u>
Pseudoscorpiones (pseudoscorpions)	0	9	11	<u>20</u>
Opiliones (harvestmen)	0	1	3	<u>4</u>
Schizomida (short tailed whipscorpions)	0	1	0	<u>1</u>
Scorpiones (scorpions)	1	14	5	<u>20</u>
Geophilomorpha (earth centipedes)	0	4	5	<u>9</u>
Scolopendromorpha: Cryptopidae (cryptic centipedes)	0	2	1	<u>3</u>
Polydesmida (flat back millipedes)	0	4	2	<u>6</u>
Spirobolida	1	1	2	<u>4</u>
Polyxenida (pincushion millipedes)	1	0	1	<u>2</u>
Polyzoniida (sucking millipedes)	0	0	1	<u>1</u>
Isopoda (slaters)	0	16	5	<u>21</u>
Eupulmonata (land snails)	2	4	5	<u>11</u>
Symphyla (micro centipedes)	0	0	1	<u>1</u>
Totals	<u>8</u>	<u>89</u>	<u>57</u>	<u>154</u>

3.3 FIELD SURVEY

The field survey yielded a total of 227 specimens, of which 194 belonged to species that are potential SRE (DD). A total of 36 different species were samples of which 20 were potential SRE (DD) and the breakdown of these between trips follows:

- Trip 1 yielded 18 different taxa, of which 11 represented SRE (potential SRE: DD) taxa (Table 3.2).
- Trip 2 yielded 31 different taxa, of which 19 represented SRE (potential SRE: DD) taxa (Table 3.2).

The data file containing these records is attached as Appendix 2.

No data are available for Hexapoda (insects and their relatives) from the WA Museum, to provide regional context for *Trinemura*, subfamily Nucleotiinae. Representatives of this subfamily are frequently recorded from subterranean fauna surveys in the Pilbara and are frequently shown to be SRE using DNA sequences ([Humphreys et al. 2013](#)).

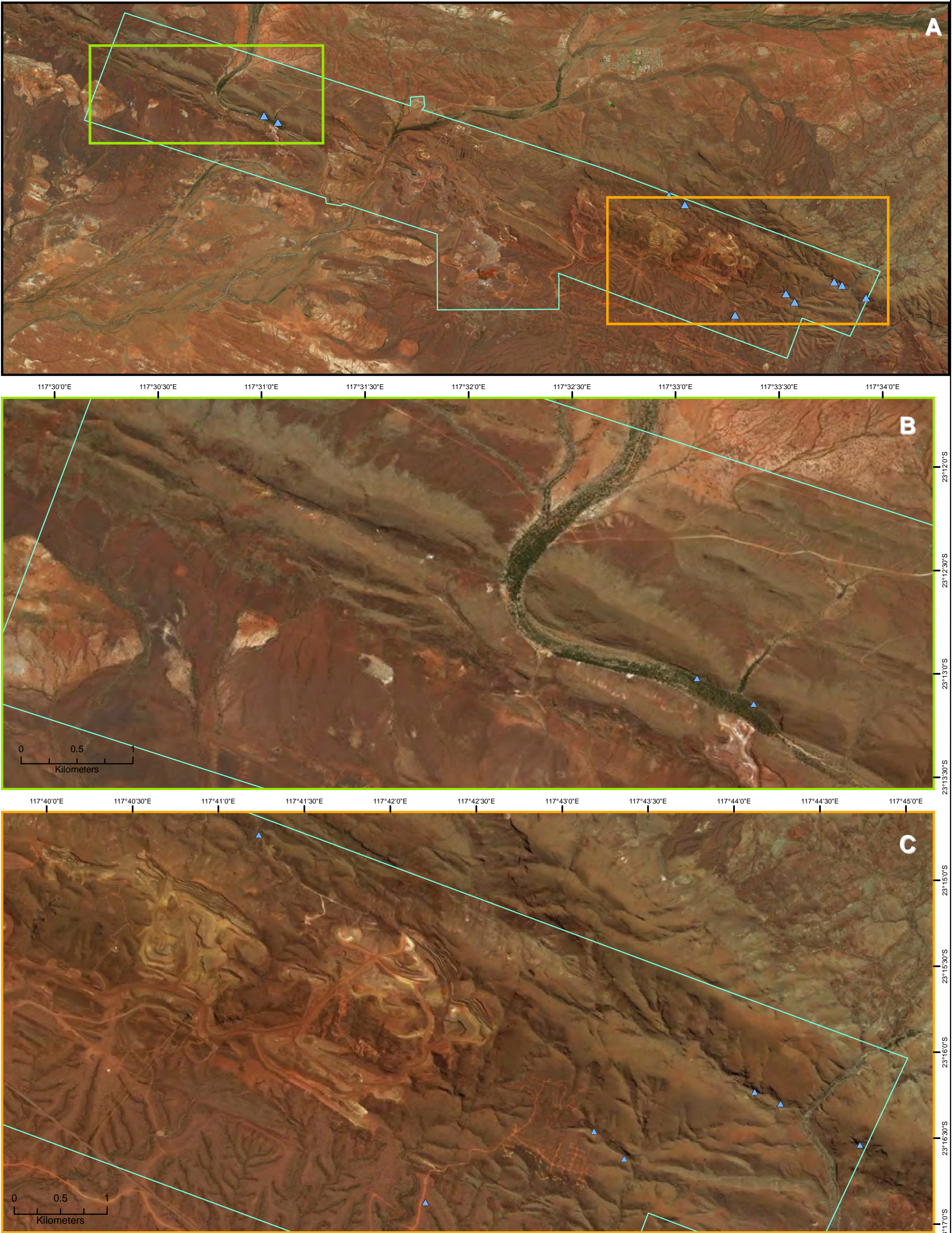
Table 3.2. Taxonomy and SRE status of field survey records.

Class	Order	Family	Species	SRE status
Arachnida	Araneae	Nemesiidae	<i>Aname mellosa</i>	Widespread
Arachnida	Araneae	Selenopidae	<i>Selenopidae</i> sp.	Potential SRE: DD
Arachnida	Pseudoscorpiones	Atemnidae	<i>Oratemnus</i> sp.	Widespread
Arachnida	Pseudoscorpiones	Garypinidae	<i>Amblyolpium</i> sp.	Widespread
Arachnida	Pseudoscorpiones	Olpiidae	<i>Austrohorus</i> sp.	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	<i>Beierolpium</i> '8/4'	Widespread
Arachnida	Pseudoscorpiones	Olpiidae	<i>Euryolpium</i> sp.	Widespread
Arachnida	Pseudoscorpiones	Olpiidae	<i>Indolpium</i> 'long chela'	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	<i>Indolpium</i> sp.	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	<i>Lychas</i> 'harveyi complex'	Widespread
Arachnida	Scorpiones	Buthidae	<i>Lychas</i> 'aitkeni complex'	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	<i>Lychas</i> 'bituberculatus complex'	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	<i>Lychas</i> 'hairy tail complex'	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	<i>Lychas</i> 'pilbara 1'	Widespread
Arachnida	Scorpiones	Buthidae	<i>Lychas</i> sp.	Potential SRE: DD
Chilopoda	Geophilomorpha	Mecistocephalidae	<i>Mecistocephalus</i> sp.	Potential SRE: DD
Chilopoda	Geophilomorpha	Oryidae	<i>Orphnaeus</i> sp.	Potential SRE: DD
Chilopoda	Scolopendromorpha	Cryptopidae	<i>Cryptops</i> sp.	Potential SRE: DD
Chilopoda	Scolopendromorpha	Scolopendridae	<i>Arthrorhabdus paucispinus</i>	Widespread
Chilopoda	Scolopendromorpha	Scolopendridae	<i>Cormocephalus bungalbiensis</i>	Widespread
Chilopoda	Scolopendromorpha	Scolopendridae	<i>Scolopendra laeta</i>	Widespread
Chilopoda	Scolopendromorpha	Scolopendridae	<i>Scolopendra morsitans</i>	Widespread
Chilopoda	Scutigermorpha		<i>Scutigermorpha</i> sp.	Widespread
Diplopoda	Spirobolida	Trigoniulidae	<i>Austrostrophus</i> sp.	Potential SRE: DD
Insecta	Thysanura	Nicoletiidae	<i>Trinemura</i> sp.	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	<i>Barrowdillo</i> '4'	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	<i>Buddelundia</i> '10ts'	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	<i>Buddelundia</i> '47ts'	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	<i>Buddelundia</i> '50'	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	<i>Buddelundiinae</i> 'pes999'	Widespread
Malacostraca	Isopoda	Armadillidae	<i>Buddelundiinae</i> sp.	Potential SRE: DD
Malacostraca	Isopoda	Philosciidae	<i>Philosciidae</i> sp.	Potential SRE: DD
Gastropoda	Eupulmonata	Bothriembryontidae	<i>Bothriembryon</i> 'Pilbara'	Potential SRE: DD
Gastropoda	Eupulmonata	Helicodiscidae	<i>Stenopylis coarctata</i>	Widespread
Gastropoda	Eupulmonata	Pupillidae	<i>Gastrocopta</i> sp.	Widespread
Gastropoda	Eupulmonata	Pupillidae	<i>Pupoides</i> sp.	Widespread

Table 3.3. Survey locations for SRE invertebrates from field the surveys.

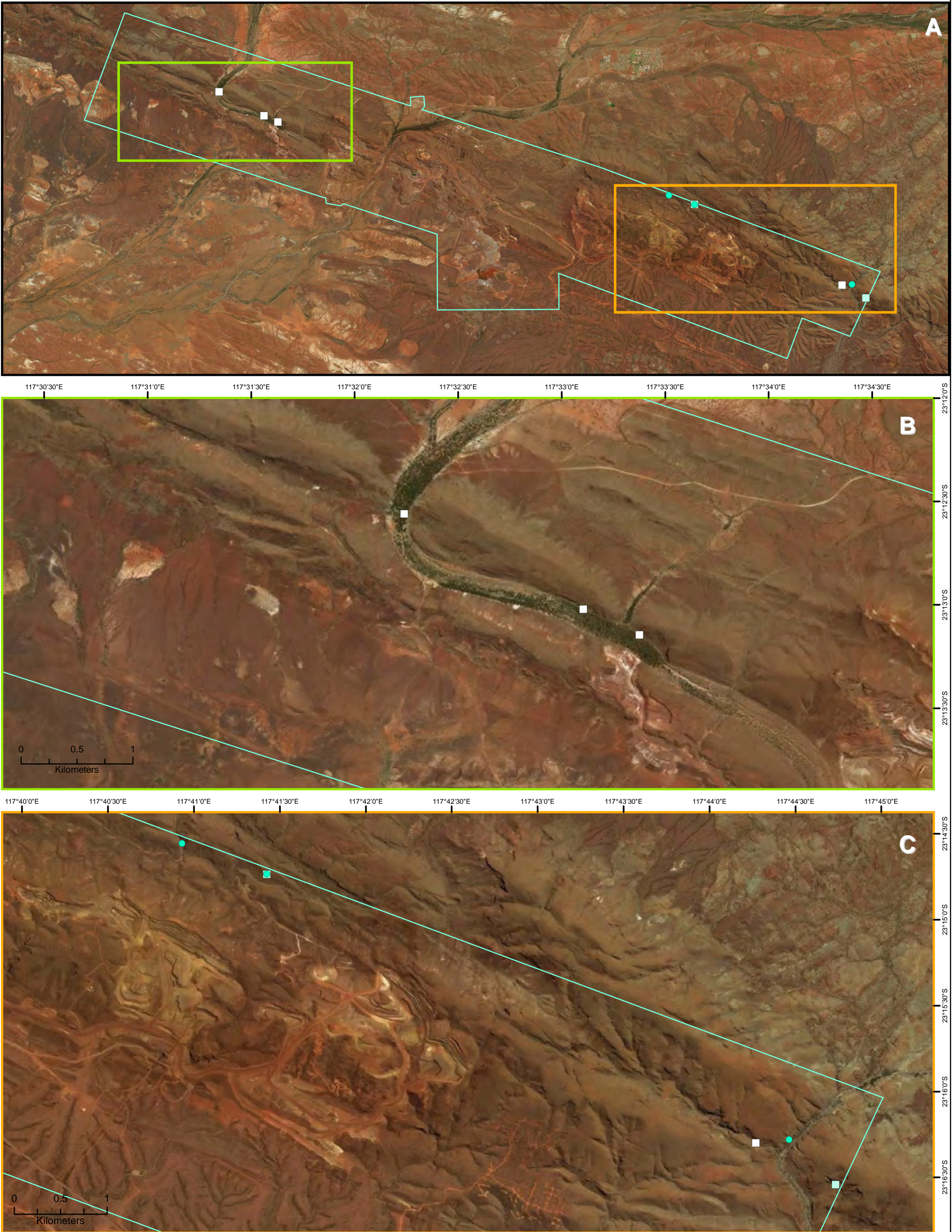
Species	Trip 1 Sites	Trip 2 Sites
<i>Selenopidae</i> sp.	GP07, GP09, SRE6, SRE9	GP08, SRE11, SRE13, SRE14, SRE15, SRE16
<i>Austrohorus</i> sp.	SRE2	SRE14, SRE17
<i>Indolpium</i> 'long chela'	SRE2, SRE6	
<i>Indolpium</i> sp.	SRE5	GP08, SRE11, SRE13
<i>Lychas</i> 'aitkeni complex'		GP06, GP07
<i>Lychas</i> 'bituberculatus complex'	SRE3	GP03, GP05, GP07, Ratty Springs BL, SRE14, SRE17
<i>Lychas</i> 'hairy tail complex'	SRE9	GP05, GP08, Ratty Springs BL, SRE14, SRE15, SRE17
<i>Lychas</i> sp.		GP05, GP07
<i>Mecistocephalus</i> sp.		GP05, GP08
<i>Orphnaeus</i> sp.		SRE14
<i>Cryptops</i> sp.		SRE14
<i>Austrostrophus</i> sp.		GP06, SRE14, SRE15, SRE16
<i>Trinemura</i> sp.		SRE17
<i>Barrowdillo</i> '4'		SRE15
<i>Buddelundia</i> '10ts'	SRE4	SRE13
<i>Buddelundia</i> '47ts'	GP06	GP05, GP06, GP07, GP08
<i>Buddelundia</i> '50'	GP05, GP09, ISO, SRE3, SRE5, SRE6, SRE7, SRE8, SRE9,	GP06, GP08, SRE14, SRE12, SRE13, SRE15, SRE16
<i>Buddelundiinae</i> sp.	SRE1	SRE14
Philosciidae sp.		SRE12
<i>Bothriembryon</i> 'Pilbara'	SNAIL	SRE15

Figure 3.1. Distribution of *Selenopidae* sp. resulting from the field survey: **A**, map of the study area showing extent limits for B and C; **B**, records from Western Paraburdoo Range; **C**, records from Eastern Paraburdoo Range



Client: Astron (Rio Tinto)
Project: Greater Paraburdoo SRE Survey
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Author: E.S. Volschenk
Date: 1 Jun 2018

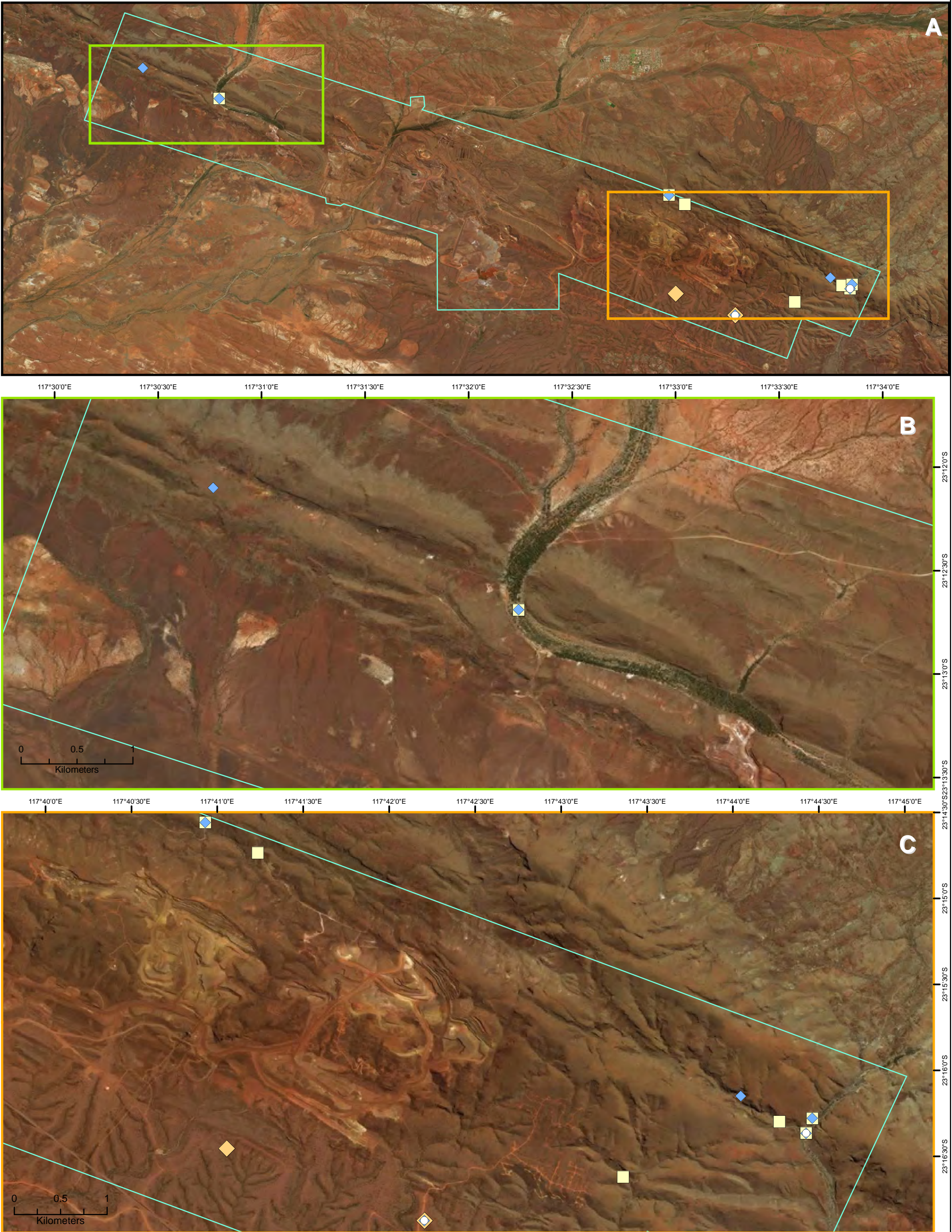
Figure 3.2. Distribution of short-range endemic pseudoscorpions resulting from the field survey: **A**, map of the study area showing extent limits for B and C; **B**, records from Western Paraburdoo Range; **C**, records from Eastern Paraburdoo Range



Client: Astron (Rio Tinto)
Project: Greater Paraburdoo SRE Survey
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Author: E.S. Volschenk
Date: 1 Jun 2018

● *Austrohorus* sp.
■ *Indolpium* 'long chela'
□ *Indolpium* sp.
Study Area Boundary

Figure 3.3. Distribution of short-range endemic scorpions resulting from the field survey: **A**, map of the study area showing extent limits for B and C; **B**, records from Western Paraburdoo Range; **C**, records from Eastern Paraburdoo Range



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Project: Greater Paraburdoo SRE Survey
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Author: E.S. Volschenk
Date: 1 Jun 2018

- *Lychas* sp.
- ◆ *Lychas* 'bituberculatus complex'
- *Lychas* 'hairy tail complex'
- ◆ *Lychas* 'aitkeni complex'
- Study Area Boundary

Figure 3.4 Distribution of short-range endemic centipedes and millipedes resulting from the field survey.

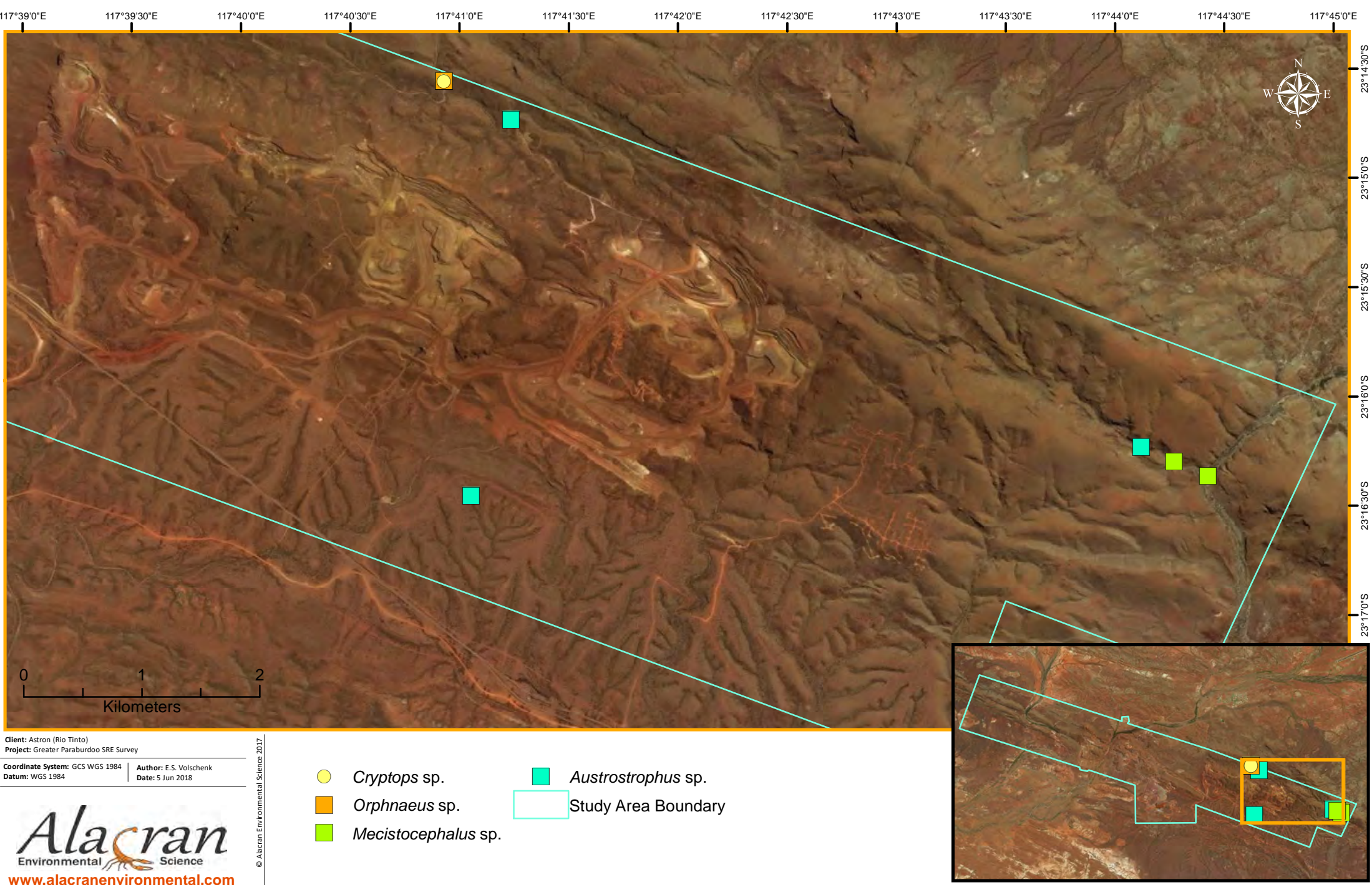
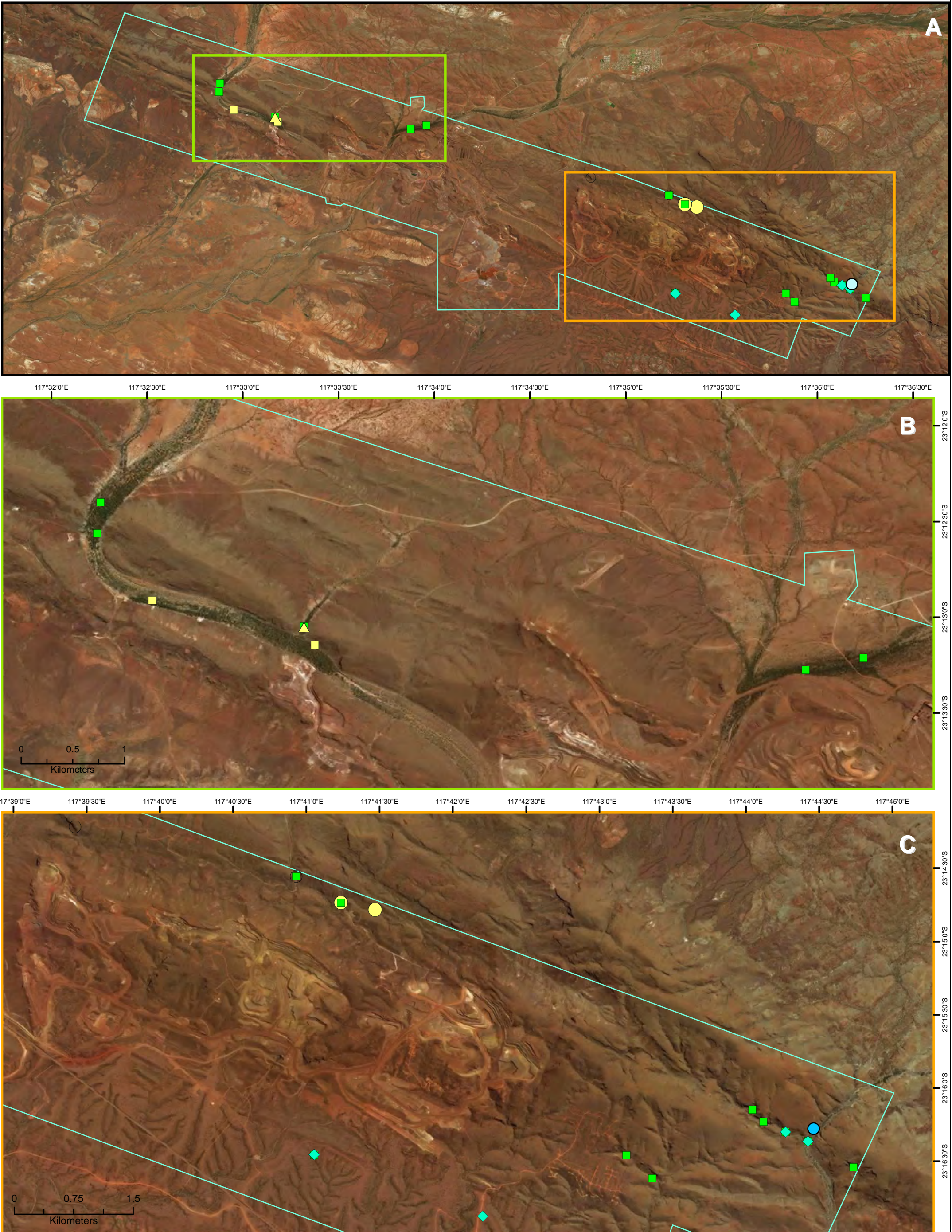


Figure 3.5. Distribution of short-range endemic silverfish, isopods and snails resulting from the field survey: **A**, map of the study area showing extent limits for B and C; **B**, records from Western Paraburdoo Range; **C**, records from Eastern Paraburdoo Range



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Datum: WGS 1984
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Date: 1 Jun 2018

- | | |
|-----------------------------|----------------------------------|
| ○ <i>Trinemura</i> sp. | ■ <i>Buddelundia</i> '10ts' |
| ▲ <i>Barrowdilo</i> '4' | ■ <i>Buddelundia</i> '50' |
| ▲ <i>Philosciidae</i> sp. | ○ <i>Buddelundiinae</i> sp. |
| ◆ <i>Buddelundia</i> '47ts' | ● <i>Bothriembryon</i> 'Pilbara' |

Study Area Boundary

4 DISCUSSION

4.1 ARACHNIDA

Among the classes containing SREs, the arachnids stand out with the number of orders and families that contain SREs. With the exception of most modern spiders, and some pseudoscorpions and mites, most arachnids have relatively poor dispersal capabilities and are therefore significant candidates for exhibiting short-range endemism ([Harvey 2002a](#); [Harvey et al. 2011](#))

4.1.1 Araneae (spiders)

Spiders are instantly recognisable arachnids. In Australia, there are thought to be between 15,000 and 20,000 species, although only approximately 4,000 are currently named ([White and Anderson 2017](#)). Australia's spiders are broadly divided into two groups, the Araneomorphae (modern spiders) and the Mygalomorphae (trapdoor spiders). Most modern spiders are widely distributed and achieve this through 'ballooning'; a process where a spiderling creates and releases a long strand of silk into the wind. The silk strand eventually becomes long enough to 'catch the wind' like a kite, and lift the spiderling into the wind to be deposited elsewhere, potentially many kilometres from its 'take-off' site. In the Pilbara, the modern spiders currently considered to contain SRE's are members of the family *Selenopidae* (wall crab spiders) ([Crews and Harvey 2011](#); [Crews 2013](#)).

Most of Western Australia's SRE spiders are trapdoor spiders. In Western Australia, nine trapdoor spider species are currently listed in the *Wildlife Conservation (Specially Protected Fauna) Notice 2016* ([Western Australian Government 2017](#)); however, none of these are known from the Pilbara region. In the Pilbara, trapdoor spiders are represented by six families: Actinopodidae, Barychelidae, Ctenizidae, Dipluridae, Idiopidae, Nemesiidae and Theraphosidae, of which all except Theraphosidae are known to contain representatives with confirmed or potential short-range distributions ([Harvey et al. 2012](#); [Castalanelli et al. 2014](#); [Rix et al. 2017 \(in press\)](#)).

The Search Area contained 51 spider taxa, of which three were named species, 33 were morphospecies and 15 were unidentified taxa (Table 4.1 and Figure 4.1-Figure 4.3). These taxa were considered Potential SRE (DD) (Table 4.1).

Table 4.1. Table of SRE category Araneae identified from the area search of the WA Museum's Terrestrial Invertebrates Database

Infraorder	Family	Binomial	SRE-Category	Ecotype	Justification
Araneomorphae	Selenopidae	<i>Karaops banyjima</i>	SRE	epigean	WAM data
Araneomorphae	Selenopidae	<i>Karaops</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Actinopodidae	<i>Missulena</i> 'DNA03'	Potential SRE: DD	epigean	(Phoenix 2014a)
Mygalomorphae	Actinopodidae	<i>Missulena</i> 'MYG290'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Actinopodidae	<i>Missulena occatoria</i>	Potential SRE: DD	epigean	potential for several cryptic species with SRE distributions acknowledged in (Harms and Framenau 2013) and (Main 1996)
Mygalomorphae	Actinopodidae	<i>Missulena</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Barychelidae	<i>Aureocrypta</i> 'MYG057'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Barychelidae	<i>Aureocrypta</i> 'MYG246'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Barychelidae	<i>Aureocrypta</i> 'MYG314'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Barychelidae	<i>Aureocrypta</i> 'MYG315'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Barychelidae	<i>Aureocrypta</i> 'paraburdoo'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Barychelidae	<i>Aureocrypta</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Barychelidae	<i>Barychelidae</i> 'bark door bary'	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Barychelidae	<i>Barychelidae</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Barychelidae	<i>Idiommatata</i> 'MYG128'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Barychelidae	<i>Idiommatata</i> 'MYG247'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Barychelidae	<i>Idiommatata</i> sp.	Potential SRE: DD	epigean	Presence of likely SRE species in the Pilbara
Mygalomorphae	Barychelidae	<i>Ozicrypta</i> 'noonamah?'	Potential SRE: DD	epigean	WAM data

Infraorder	Family	Binomial	SRE-Category	Ecotype	Justification
Mygalomorphae	Barychelidae	<i>Synothele</i> 'B07'	Potential SRE: DD	epigean	(Ecologia 2014)
Mygalomorphae	Barychelidae	<i>Synothele</i> 'DNA01'	Potential SRE: DD	epigean	(Phoenix 2014a)
Mygalomorphae	Barychelidae	<i>Synothele</i> 'MYG127'	Potential SRE: DD	epigean	WAM data, <10,000 km
Mygalomorphae	Barychelidae	<i>Synothele</i> 'MYG309'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Barychelidae	<i>Synothele</i> 'MYG310'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Barychelidae	<i>Synothele</i> 'MYG311'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Barychelidae	<i>Synothele</i> 'MYG335'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Barychelidae	<i>Synothele</i> 'paraburdoo'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Barychelidae	<i>Synothele</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Ctenizidae	<i>Conothele</i> 'DNA04'	Potential SRE: DD	epigean	(Phoenix 2014a)
Mygalomorphae	Ctenizidae	<i>Conothele</i> 'MYG280'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Ctenizidae	<i>Conothele</i> 'MYG282'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Ctenizidae	<i>Conothele</i> 'MYG292'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Ctenizidae	<i>Conothele</i> 'MYG293'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Ctenizidae	<i>Conothele</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Ctenizidae	<i>Ctenizidae</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Idiopidae	<i>Eucyrtops</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Idiopidae	<i>Gaius</i> 'MYG286'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Idiopidae	Idiopidae sp.	Potential SRE: DD	epigean	Presence of likely SRE species in the Pilbara
Mygalomorphae	Idiopidae	<i>Idiosoma</i> 'MYG303'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Idiopidae	<i>Idiosoma</i> 'sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Nemesiidae	<i>Aname</i> 'B10'	Potential SRE: DD	epigean	
Mygalomorphae	Nemesiidae	<i>Aname</i> 'hooded'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Nemesiidae	<i>Aname marae</i>	Potential SRE: DD	epigean	(Harvey et al. 2012)
Mygalomorphae	Nemesiidae	<i>Aname</i> 'MYG446'	Potential SRE: DD	epigean	WAM Data

Infraorder	Family	Binomial	SRE-Category	Ecotype	Justification
Mygalomorphae	Nemesiidae	<i>Aname</i> 'N.W. Aust.'	Potential SRE: DD	epigean	WAM Data
Mygalomorphae	Nemesiidae	<i>Aname</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Nemesiidae	<i>Kwonkan</i> 'MYG433'	Potential SRE: DD	epigean	WAM data
Mygalomorphae	Nemesiidae	<i>Kwonkan</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Nemesiidae	Nemesiidae sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs
Mygalomorphae	Nemesiidae	<i>Yilgarnia</i> 'DNA01'	Potential SRE: DD	epigean	
Mygalomorphae	Nemesiidae	<i>Yilgarnia</i> 'DNA02'	Potential SRE: DD	epigean	
Mygalomorphae	Nemesiidae	<i>Yilgarnia</i> sp.	Potential SRE: DD	epigean	this group is known to contain SREs and or potential SREs

The only trapdoor spider found during this survey was a male *Aname mellosa*, a widespread species in the Pilbara ([Harvey et al. 2012](#); [Castalanelli et al. 2014](#)). There was also very little evidence of trapdoor spider burrows in the area. The only burrow found was a lidless burrow very close to the pitfall trap in which the specimen of *Aname mellosa* was obtained and when excavated the burrow was empty. A survey of this level usually yields more specimens and evidence of trapdoor spiders. The low number of trapdoor spiders sampled during the second survey may be due to dry conditions. While dry conditions may have limited their foraging activities, it does not explain the scarcity of burrows seen. Another factor that may influence the diversity of trapdoor spiders (and burrowing scorpions) in the area is the very stony nature of the substrate in most habitats sampled, and which may deter burrowing species. Burrowing scorpions (*Urodacus* spp.) were also absent from this survey and this may corroborate unfavourable substrates for burrowing species.

Spiders belonging to the family Selenopidae were sampled from 10 different sites in both eastern and western sides of Paraburdoo range (Table 3.2, Table 3.3 and Figure 3.1). These are likely to be representatives of the genus *Karaops*, the only genus recorded from Western Australia ([Crews and Harvey 2011](#)). None of the specimens collected were adults, making identification from morphology ambiguous. The only described species from the area search was *Karaops banjima* (Figure 4.1) from the Hamersley range ([Crews 2013](#)). Further clarification on the identity of this species will require adult specimens to be collected or may be possible using DNA barcoding methods. Owing to their ambiguous identification this taxon is considered Potential SRE (DD).

Figure 4.1

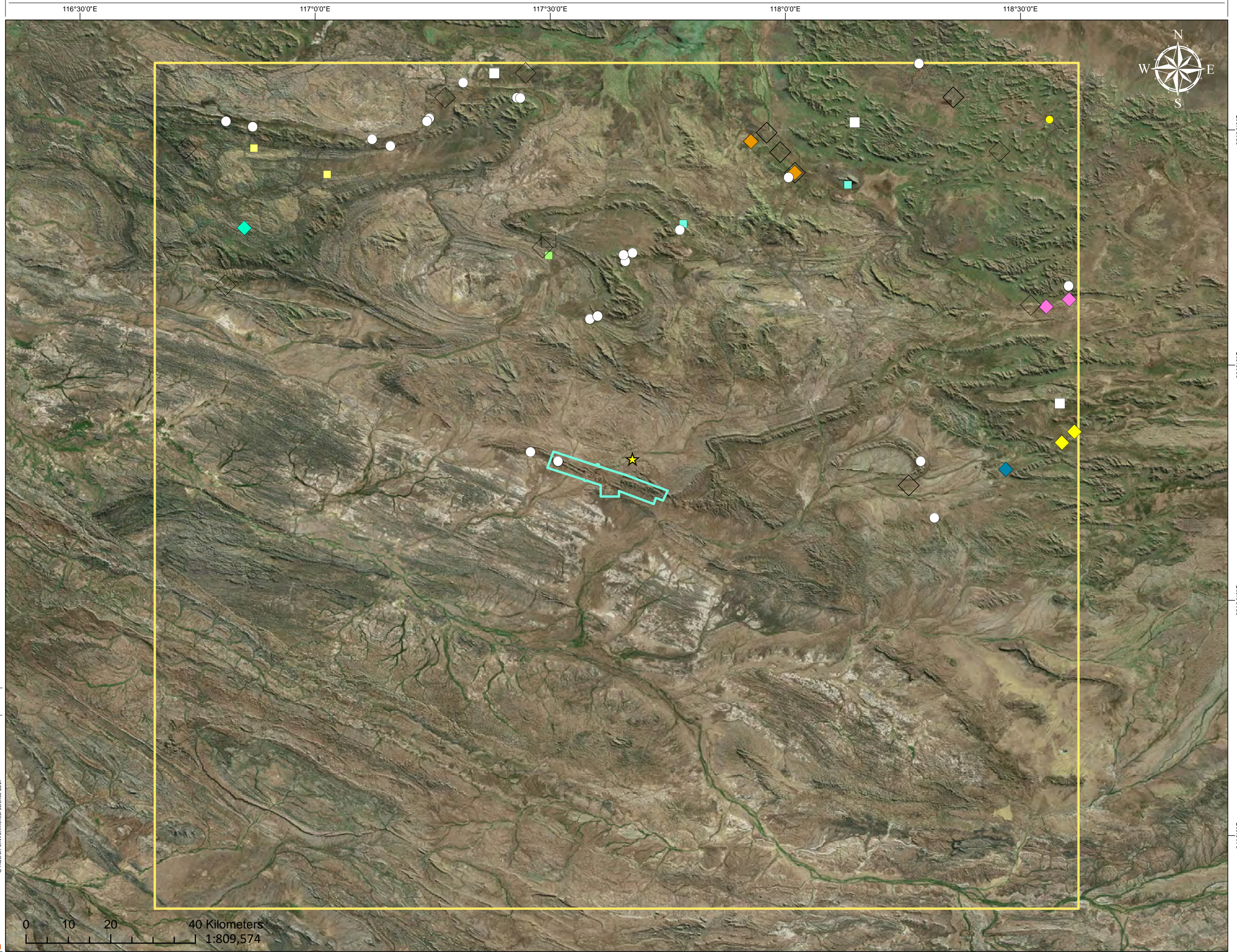
Figure title: Central Pilbara showing the distribution of SRE category spider records from the database Search Area: families Selenopidae, Actinopodidae and Cteniziidae. Number of records in Parentheses.

- Selenopidae**
- *Karaops banyjima* (2)
 - *Karaops* sp. (34)
- Cteniziidae**
- ◆ *Conothele* 'DNA04' (1)
 - ◆ *Conothele* 'MYG280' (3)
 - ◆ *Conothele* 'MYG282' (2)
 - ◆ *Conothele* 'MYG292' (4)
 - ◆ *Conothele* 'MYG293' (1)
 - ◇ *Conothele* sp. (22)
 - Ctenizidae sp. (1)
- Actinopodidae**
- *Missulena occatoria* (8)
 - *Missulena* 'MYG290' (1)
 - *Missulena* 'DNA03' (4)
 - *Missulena* sp. (3)
- ★ Paraburdoo
- Study
- Search

Client: Astron (Rio Tinto)
Project: Greater Paraburdoo - SRE
Project Number: 1712

Coordinate System: GCS WGS 1984
Projection: Transverse Mercator
Datum: WGS 1984

Author: E.S. Volschenk
Date: 12 Oct 2017



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Figure 4.2

Figure title: Central Pilbara showing the distribution of SRE category spider records from the database Search Area: Barychelidae. Number of records in Parentheses.

Barychelidae

- *Aureocrypta* 'MYG057' (1)
- *Aureocrypta* 'MYG246' (2)
- *Aureocrypta* 'MYG314' (1)
- *Aureocrypta* 'MYG315' (1)
- *Aureocrypta* 'paraburdoo' (1)
- *Aureocrypta* sp. (1)
- ▲ Barychelidae 'bark door bary' (2)
- △ Barychelidae sp. (17)
- ▼ *Idiommata* 'MYG128' (1)
- ▼ *Idiommata* 'MYG247' (1)
- ▽ *Idiommata* sp. (1)
- ▲ *Ozicrypta* 'noonamah?' (2)
- *Synothele* 'B07' (1)
- *Synothele* 'DNA01' (3)
- *Synothele* 'MYG127' (3)
- *Synothele* 'MYG309' (8)
- *Synothele* 'MYG310' (3)
- *Synothele* 'MYG311' (2)
- *Synothele* 'MYG335' (1)
- *Synothele* 'paraburdoo' (1)
- *Synothele* sp. (8)
- ★ Paraburdoo
- Study Area
- Search Area

Client: Astron (Rio Tinto)
Project: Short-range endemic invertebrate survey and desktop assessment of the East and West Paraburdoo Ranges
Coordinate System: GCS WGS 1984
Projection: Transverse Mercator
Datum: WGS 1984
Author: E.S. Volschenk
Date: 11 Oct 2017

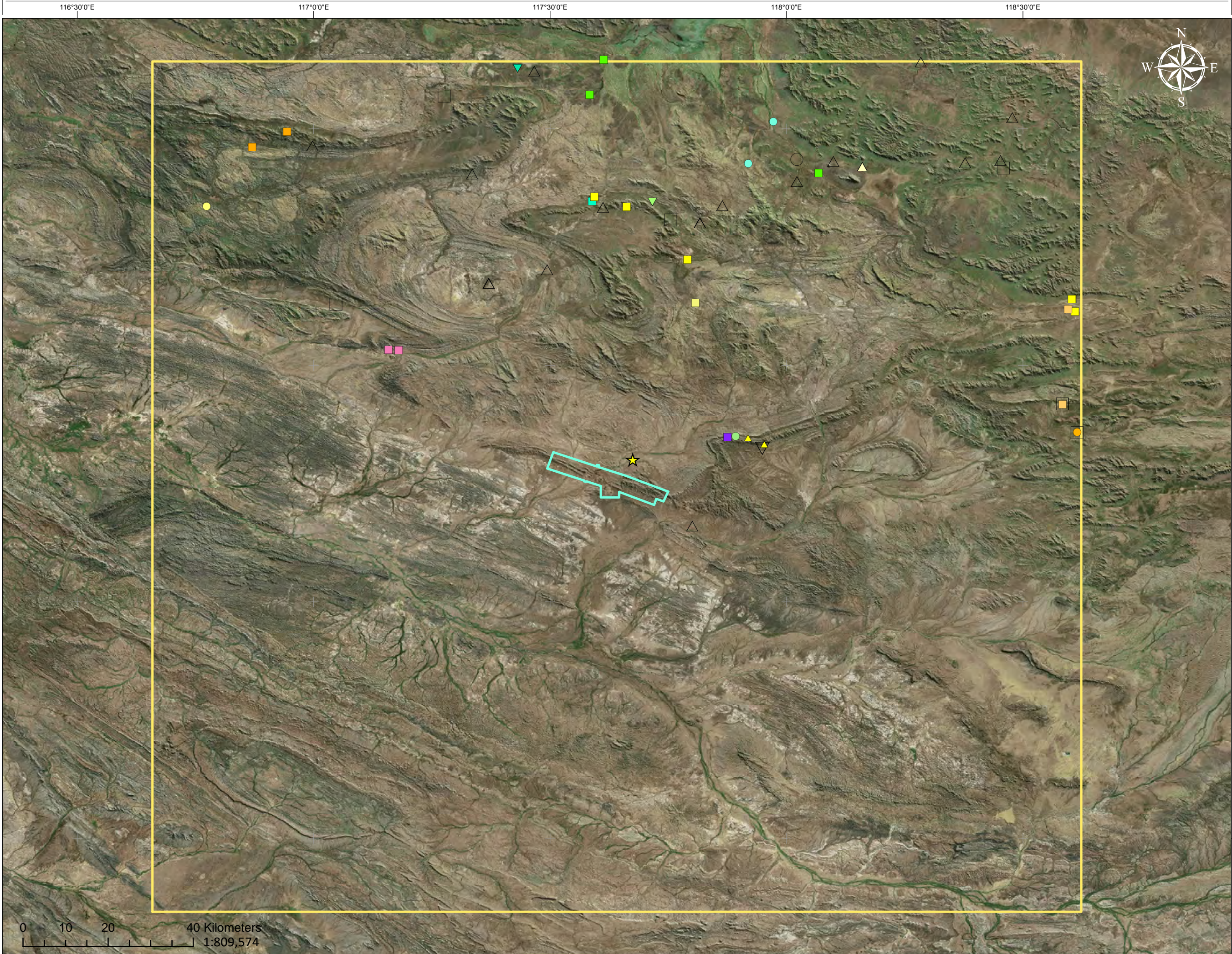


Figure 4.3

Figure title: Central Pilbara showing the distribution of SRE category spider records from the database Search Area: Idiopidae and Nemesiidae. Number of records in Parentheses.

Idiopidae

- Eucyrtops* sp.(1)
- Gaius* 'MYG286'(1)
- Idiopidae sp.(2)
- Idiosoma* 'MYG303'(1)
- Idiosoma* sp.(1)

Nemesiidae

- Aname* 'B10'(1)
- Aname* 'MYG446'(1)
- Aname* 'N.W. Aust.'(1)
- Aname* 'hooded'(5)
- Aname marae*(18)
- Aname* sp.(33)
- Kwonkan* 'MYG433'(5)
- Kwonkan* sp.(6)
- Nemesiidae sp.(16)
- Yilgarnia* 'DNA01'(1)
- Yilgarnia* 'DNA02'(4)
- Yilgarnia* sp.(4)
- Paraburdoo

Study Area

Search Area

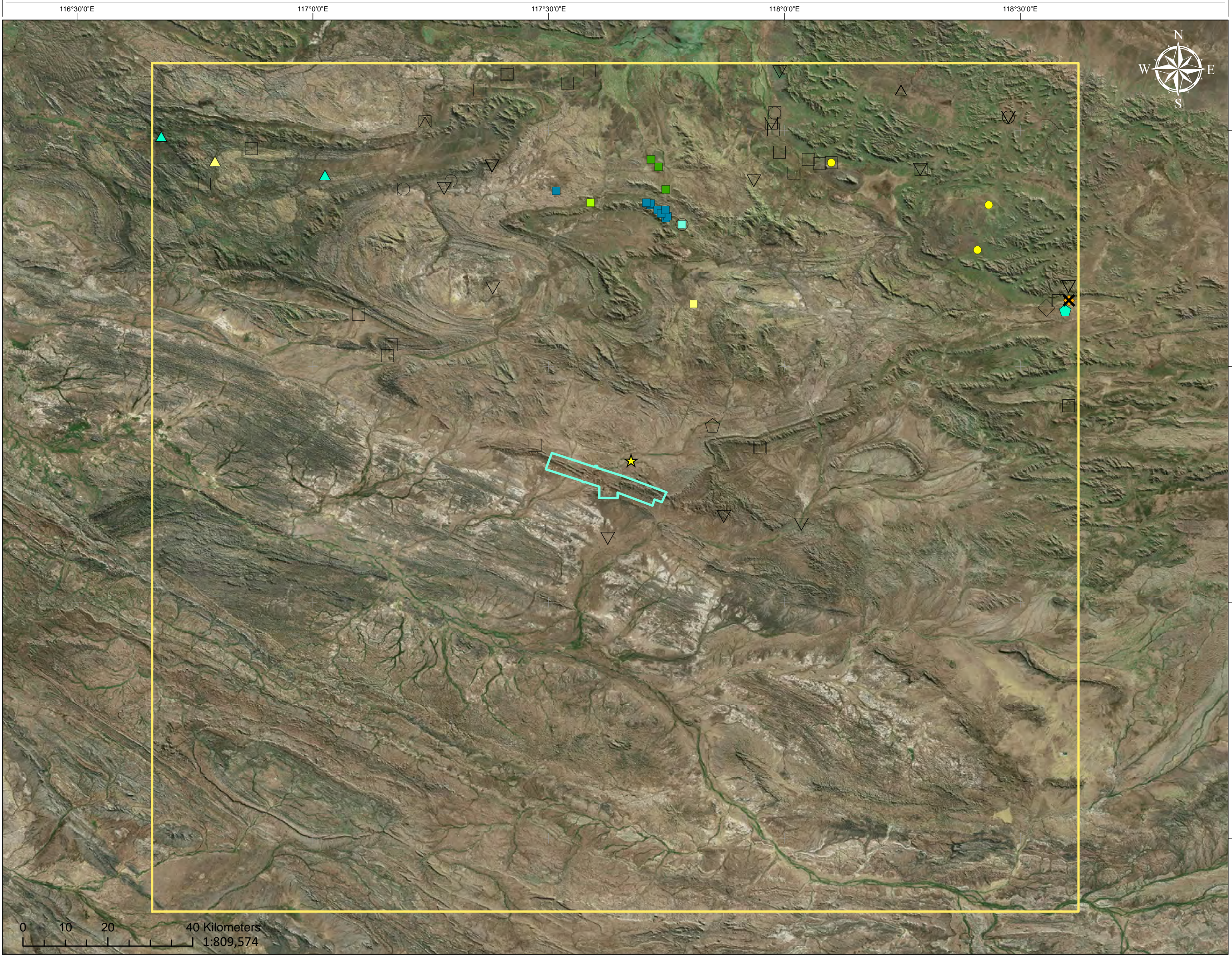
Client: Astron (Rio Tinto)
Project: Short-range endemic invertebrate survey and desktop assessment of the East and West Paraburdoo Ranges

Coordinate System: GCS WGS 1984
Projection: Transverse Mercator
Datum: WGS 1984

Author: E.S. Volschenk
Date: 11 Oct 2017

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4.1.2 Opiliones (harvestmen)

Opiliones appear superficially similar to small spiders, but differ from them by lacking a clearly defined division (constriction) between the cephalothorax and abdomen, as well as in numerous other aspects ([Pinto-da-Rocha et al. 2007](#)). In Australia, 11 families are recorded ([ALA 2017](#)). Some members of this order are SREs while others have wider distribution patterns ([Harvey 2002b](#)). The Pilbara diversity of Opiliones is poorly known but appears to be dominated by the genus *Dampetrus* (Assamiidae) ([DPaW 2017](#)), a diverse but poorly resolved genus confined to northern Australia ([Shear 2001](#)).

The Search Area contained four Opiliones taxa, of which none were named species, one morphospecies was present and three were unidentified taxa (Table 4.2, Figure 4.4). All were considered Potential SRE (DD) (Table 4.2).

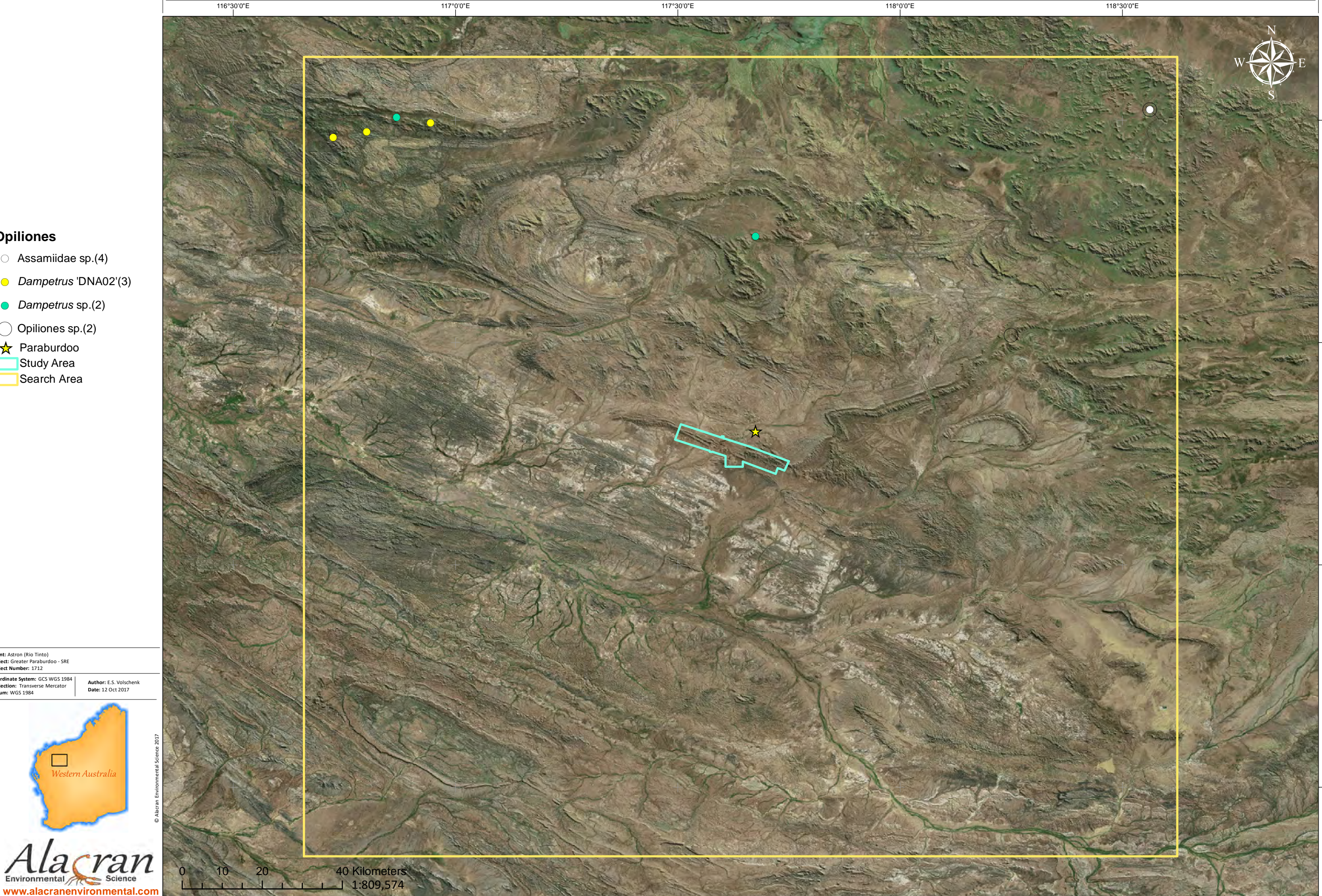
Table 4.2. Table of SRE category Opiliones identified from the area search of the WA Museum's Terrestrial Invertebrates Database

Family	Binomial	SRE-Category	Ecotype	Justification
Assamiidae	Assamiidae sp.	Potential SRE: DD	Epigean	This group contains SRE representatives
Assamiidae	<i>Dampetrus</i> 'DNA02'	Potential SRE: DD	Epigean	This group contains SRE representatives
Assamiidae	<i>Dampetrus</i> sp.	Potential SRE: DD	Epigean	This group contains SRE representatives
	Opiliones sp.	Potential SRE: DD	Epigean	This group contains SRE representatives

No Opiliones were sampled during these surveys; however suitable habitat was observed at rocky scree slopes with leaf litter cover, sites SRE14-SRE17. The absence of Opiliones from the field surveys may be due to the dry conditions observed during both field surveys and their presence cannot be ruled out.

Figure 4.4

Figure title: Central Pilbara showing the distribution of SRE category Opiliones records from the database Search Area. Number of records in Parentheses.



4.1.3 Pseudoscorpions (pseudoscorpions)

Pseudoscorpions superficially resemble scorpions but they are not closely related to them. They are generally much smaller than most scorpions and lack the distinctive tail-like abdomen and stinging telson for which scorpions are infamous. In Western Australian pseudoscorpions are represented by 19 families ([Harvey 2013a](#)). They occur on most undisturbed terrestrial habitats but escape our attention owing to their small size and cryptic behaviour (Harvey 1992). The Pilbara pseudoscorpion fauna are generally poorly known with only a few groups receiving taxonomic attention over the last decade and these are primarily focussed on troglobites: ([Harvey and Edwards 2007](#); [Harvey and Volschenk 2007](#); [Edward and Harvey 2008](#); [Harvey and Leng 2008b](#)). The epigean fauna flagged as SRE's or Potential SRE's are largely undescribed.

The Search Area contained 20 Pseudoscorpion taxa, of which none were named species, nine were morphospecies and 11 were unidentified taxa (Table 4.3 and Figure 4.5). All were considered Potential SRE (DD) (Table 4.3).

Table 4.3. Table of SRE category Pseudoscorpiones identified from the area search of the WA Museum's Terrestrial Invertebrates Database

Family	Binomial	SRE-Category	Ecotype	Justification
Chthoniidae	Chthoniidae sp.	Potential SRE: DD	Epigean	Family contains SRE species in the genera <i>Tyrannochthonius</i> , <i>Lagynochthonius</i> and <i>Austrochthonius</i> (Edward and Harvey 2008)
Chthoniidae	<i>Lagynochthonius</i> sp.	Potential SRE: DD	Epigean	WAM data
Chthoniidae	<i>Tyrannochthonius</i> sp.	Potential SRE: DD	Epigean	Presence of SRE species in this genus (Edward and Harvey 2008)
Olpiidae	<i>Austrohorus</i> sp.	Potential SRE: DD	Epigean	WAM Data
Olpiidae	<i>Indolpium</i> 'long chelal hand'	Potential SRE: DD	Epigean	WAM data
Olpiidae	<i>Indolpium</i> sp.	Potential SRE: DD	Epigean	WAM data
Olpiidae	<i>Xenolpium</i> 'PSE033'	Potential SRE: DD	Epigean	WAM data
Olpiidae	<i>Xenolpium</i> sp.	Potential SRE: DD	Epigean	WAM data
Olpiidae	Olpiidae sp.	Potential SRE: DD	epigean/epigean?	WAM Data
Hyidae	<i>Indohya</i> 'Mt Meharry'	Potential SRE: DD	Epigean	Most <i>Indohya</i> in the Pilbara are SRE
Atemnidae	<i>Oratemnus</i> sp.	Potential SRE: DD	Epigean	WAM Data

Family	Binomial	SRE-Category	Ecotype	Justification
Atemnidae	<i>Paratemnoides</i> sp.	Potential SRE: DD	Epigean	WAM Data
Chernetidae	Chernetidae sp.	Potential SRE: DD	Epigean	Family contains SRE species
Chernetidae	<i>Cordylocheres</i> 'cf. dingo'	Potential SRE: DD	Epigean	WAM Data
Chernetidae	<i>Troglocheres</i> sp.	Potential SRE: DD	epigean/?epigean	WAM Data
Garypidae	<i>Synsphyronus</i> '8/1 Mt Brockman'	Potential SRE: DD	Epigean	WAM Data
Garypidae	<i>Synsphyronus</i> '8/2 Pilbara'	Potential SRE: DD	Epigean	WAM Data
Garypidae	<i>Synsphyronus</i> 'PSE069'	Potential SRE: DD	Epigean	WAM Data
Garypidae	<i>Synsphyronus</i> 'PSE084'	Potential SRE: DD	Epigean	WAM Data
Garypidae	<i>Synsphyronus</i> sp.	Potential SRE: DD	Epigean	Genus contains SRE species

The field survey sampled seven pseudoscorpion taxa from two families: Olpiidae and Atemidae (Table 3.2). Three of these species are Potential SRE (DD) and all belong to the family Olpiidae: *Austrohorus* sp., *Indolpium* 'long chela' and *Indolpium* sp. (Figure 3.2). The taxonomic resolution of *Austrohorus* and *Indolpium* is poorly resolved in the Pilbara but both genera are thought to contain SRE species; therefore, they are Potential SRE (DD). Some representatives of *Indolpium* sp. may be subadults of *Indolpium* 'long chela'. More resolved assessment of their identities may be possible using DNA-barcoding methods.

In the report on the first survey Alacran (2018) referred to the species *Austrohorus* 'GP1' however after examining additional specimens (including those from the second survey), the distinctiveness of *Austrohorus* 'GP1' is less clear and the defining character appear to represent a grade of variation. For this reason, that morphospecies was abandoned and the identity of that specimen changed to *Austrohorus* sp.

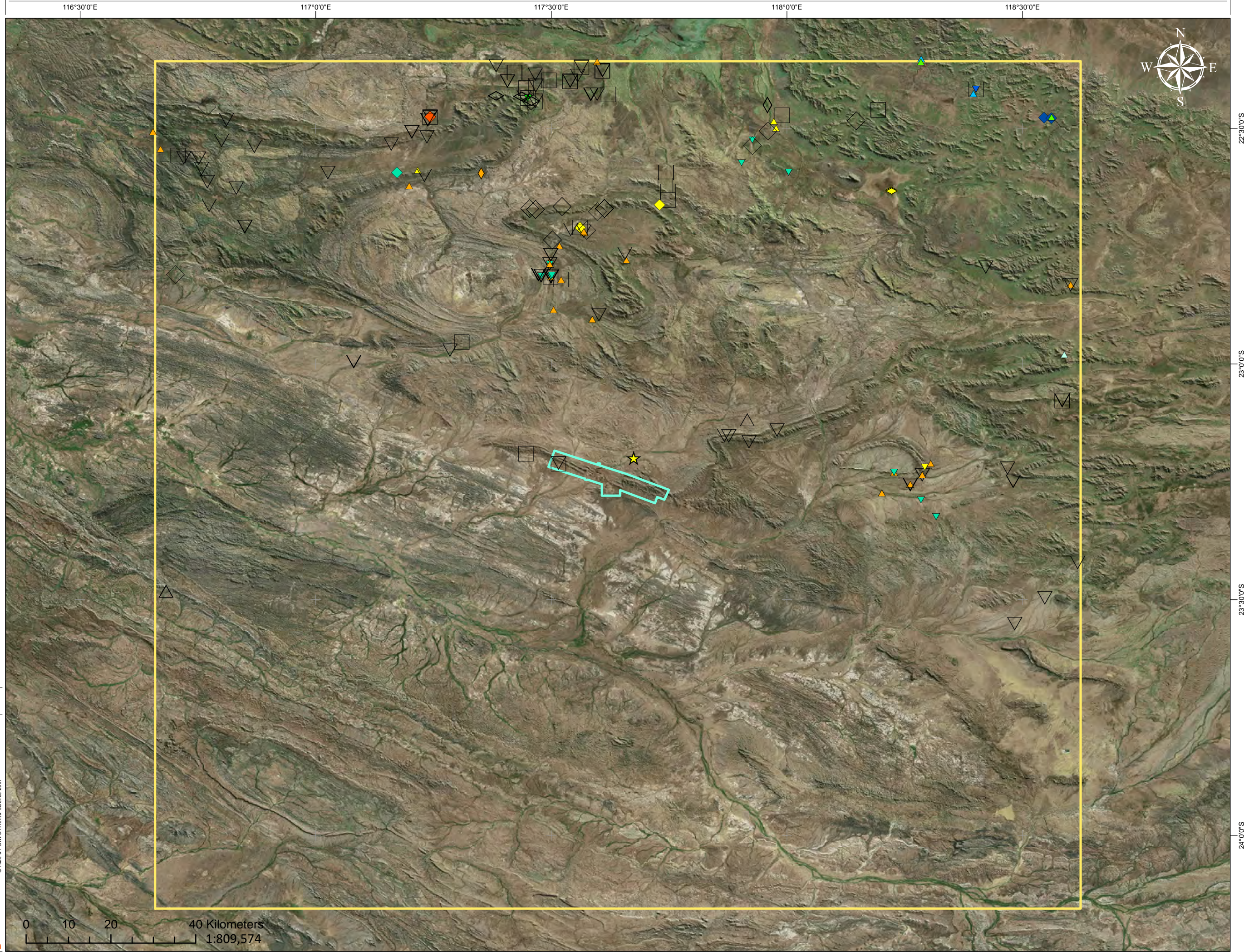
Figure 4.5

Figure title: Central Pilbara showing the distribution of SRE category Pseudoscorpiones records from the database Search Area. Number of records in Parentheses.

Pseudoscorpiones

- ▲ *Austrohorus* sp.(30)
- ▲ *Chernetidae* sp.(3)
- ▲ *Chthoniidae* sp.(2)
- ▲ *Cordylocheres* 'cf. dingo'(2)
- ▲ *Indohya* 'Mt Meharry'(1)
- ▲ *Indolpium* 'long chelal hand'(1)
- ▽ *Indolpium* sp.(92)
- *Olpidae* sp.(34)
- ▼ *Lagynochthonius* sp.(1)
- ▼ *Oratemnus* sp.(18)
- ▼ *Paratemnoides* sp.(2)
- △ *Pseudoscorpiones* sp.(3)
- ◆ *Synsphyronus* 'PSE069'(4)
- ◆ *Synsphyronus* 'PSE084'(3)
- ◆ *Synsphyronus* '8/1 Mt Brockman'(1)
- ◆ *Synsphyronus* '8/2 Pilbara'(2)
- ◇ *Synsphyronus* sp.(23)
- ◆ *Troglocheres* sp.(2)
- ◇ *Tyrannochthonius* sp.(1)
- ◆ *Xenolpium* 'PSE033'(4)
- ◇ *Xenolpium* sp.(3)
- ★ Paraburdoo
- Study Area
- Search Area

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4.1.4 Schizomida (short-tailed whip scorpions)

Schizomida is an order of Arachnida, that vaguely resemble small spiders, but are not related to them. They are more closely related to Uropygi (Wheeler & Hayashi 1998) which are not known from Australia. Australian schizomids are relatively well studied taxonomically ([Harvey 2002b](#); [Harvey et al. 2008](#); [Abrams and Harvey 2015](#)); however, numerous undescribed species are known. All Pilbara schizomids show very high levels of endemism and are all considered SREs.

The only known epigean species in the Pilbara is an undescribed species currently known as "*Draculoides* 'SCH053 epigean'" and is only known from Karijini National Park (Figure 4.6).

The presence of epigean schizomids cannot be ruled out from the study area, owing to the presence of both *Cryptops* sp. (from site SRE14) and *Trinemura* sp. (SRE17) which are both epigean representatives of taxa frequently encountered during subterranean fauna surveys.

4.1.5 Scorpiones (scorpions)

Scorpions are instantly recognisable arachnids and are represented by four families in Western Australia. Short-range endemic species are known from the families Buthidae, Urodacidae and Hormuridae. The Australian scorpion fauna is very poorly described with as much as 85% suspected of being undescribed ([Volschenk et al. 2000](#); [Volschenk 2008](#); [Volschenk et al. 2010](#); [Volschenk et al. 2012](#); [Harvey 2014](#)).

Species delineation in scorpions varies in complexity: species from the family Buthidae can be identified from all but 1st and 2nd instars; however, species identification of Bothriuridae, Urodacidae and Hormuridae is usually heavily dependent on characteristics only present in adult males. The families Buthidae and Urodacidae also contain several species complexes containing cryptic species, which can only be currently identified using DNA barcoding methods.

In Western Australia, the family Buthidae is represented by three genera, *Lychas*, *Isometroides* and *Isometrus*. Representatives of *Lychas* are frequently collected in surveys of WA and current investigations on the genus *Lychas* (WA Museum) indicates the presence of several species complexes, some of which appear to contain SREs.

The family Urodacidae is represented by two genera, *Urodacus* and *Aops*, the latter *Aops oncodactylus* is only known from a single specimen from Barrow Island ([Volschenk and Prendini 2008](#)). Most species of *Urodacus* appear to be relatively widespread but are often patchily distributed ([Volschenk et al. 2010](#)), meaning that their "distribution does not equate to their area of occupation. Several *Urodacus* species are also known to be SREs including the described species *Urodacus planimanus* and *Urodacus koolanensis* as well as several undescribed species from the Pilbara.

The Search Area contained 20 scorpion taxa, of which one was a named species, 14 were morphospecies and 5 were unidentified taxa (Table 4.4 and Figure 4.4). All were considered Potential SRE (DD) (Table 4.4).

Table 4.4. Table of SRE category Scorpiones identified from the area search of the WA Museum's Terrestrial Invertebrates Database

Family	Binomial	SRE-Category	Justification
Buthidae	<i>Buthidae sp.</i>	Potential SRE: DD	Family contains SRE representatives
Buthidae	<i>Lychas 'aitkeni'</i>	Potential SRE: DD	Few records, restricted distribution
Buthidae	<i>Lychas 'annulatus complex'</i>	Potential SRE: DD	Species complex containing SRE's
Buthidae	<i>Lychas 'bituberculatus complex'</i>	Potential SRE: DD	Species complex containing SRE's
Buthidae	<i>Lychas 'hairy tail complex'</i>	Potential SRE: DD	Species complex containing SRE's
Buthidae	<i>Lychas 'marandoo 1'</i>	Potential SRE: DD	Restricted distribution
Buthidae	<i>Lychas mjöbergi</i>	Potential SRE: DD	Restricted distribution, few records
Buthidae	<i>Lychas 'multipunctatus complex'</i>	Potential SRE: DD	Species complex containing SRE's
Buthidae	<i>Lychas 'paraburdoo'</i>	Potential SRE: DD	Restricted distribution
Buthidae	<i>Lychas 'racing stripe'</i>	Potential SRE: DD	Restricted distribution
Buthidae	<i>Lychas sp.</i>	Potential SRE: DD	Genus contains SRE representatives
Buthidae	<i>Lychas 'spiny hairy tail group'</i>	Potential SRE: DD	Restricted distribution
Urodacidae	<i>Urodacidae sp.</i>	Potential SRE: DD	Family contains SRE representatives
Urodacidae	<i>Urodacus 'armatus group'</i>	Potential SRE: DD	Species complex containing SRE's
Urodacidae	<i>Urodacus 'fat hands'</i>	Potential SRE: DD	Restricted distribution
Urodacidae	<i>Urodacus 'megamastigus complex'</i>	Potential SRE: DD	Species complex containing SRE's
Urodacidae	<i>Urodacus 'pilbara15'</i>	Potential SRE: DD	Restricted distribution
Urodacidae	<i>Urodacus 'SCO022'</i>	Potential SRE: DD	Restricted distribution
Urodacidae	<i>Urodacus sp.</i>	Potential SRE: DD	Genus contains SRE representatives

The field survey sampled six scorpion taxa from the family Buthidae. Four of these are potential SRE (DD) as they belong to species complexes that appear to contain SRE species: *Lychas 'aitkeni complex'*, *Lychas 'bituberculatus complex'*, *Lychas 'hairy tail complex'*, and *Lychas sp.* (Table 3.2, Table 3.3 and Figure 3.3) The presence of representatives of *Lychas 'aitkeni complex'* is particularly interesting since representatives of this complex are rarely sampled in the Pilbara. Only one record of this complex was retrieved from the database search, from approximately 24 km SE. of Paraburdoo (sample T79893). Those specimens were obtained using wet pitfall traps containing ethylene glycol and formalin as preservative; therefore, DNA sequences cannot be obtained from them for comparison. An assessment based on morphology may be possible; however, that would involve reviewing all the specimens within the *Lychas 'aitkeni complex'* in the WA Museum, including those collected outside of the Pilbara: a task well beyond the scope of this project.

Figure 4.6

Figure title: Central Pilbara showing the distribution of SRE category Scorpiones and Schizomida records from the database Search Area. Number of records in Parentheses.

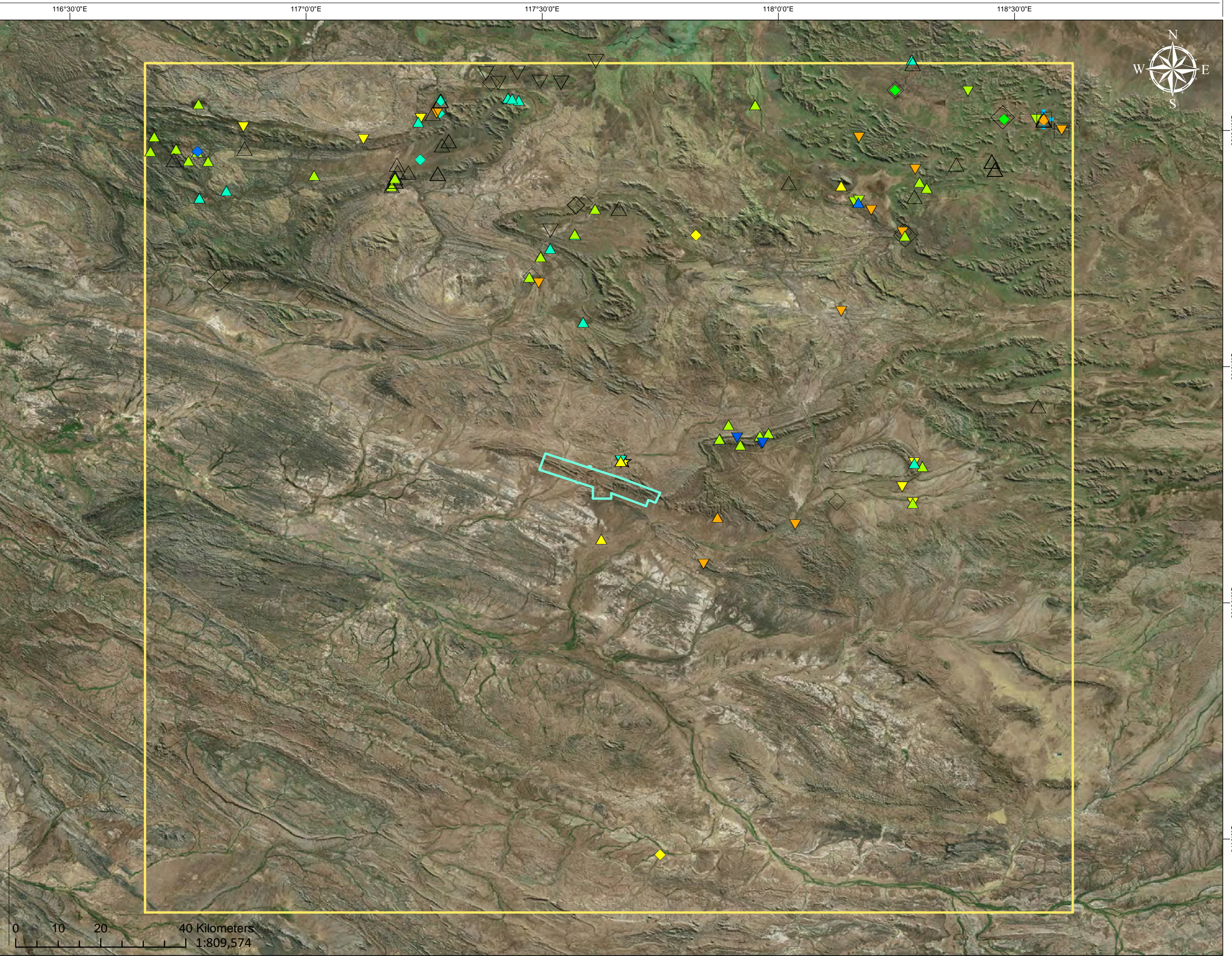
Scorpiones

- Buthidae sp.(2)
- ▲ *Lychas 'aitkeni'*(1)
- ▲ *Lychas 'annulatus complex'*(17)
- ▲ *Lychas 'bituberculatus complex'*(28)
- ▲ *Lychas 'hairy tail complex'*(15)
- ▲ *Lychas 'marandoo 1'*(1)
- ▲ *Lychas 'multipunctatus complex'*(10)
- ▲ *Lychas 'paraburdoo'*(7)
- ▲ *Lychas 'racing stripe'*(5)
- ▲ *Lychas 'spiny hairy tail group'*(3)
- ▲ *Lychas mjobergi'*(5)
- △ *Lychas sp.*(47)
- ▽ Scorpiones sp.(8)
- ◇ Urodacidae sp.(3)
- ◆ *Urodacus 'SCO022'*(2)
- ◆ *Urodacus 'armatus group'*(6)
- ◆ *Urodacus 'fat hands'*(2)
- ◆ *Urodacus 'megamastigus complex'*(3)
- ◆ *Urodacus 'pilbara15'*(1)
- ◇ *Urodacus sp.*(12)

Schizomida

- + *Draculoides 'SCH053 epigean'*(5)
- ★ Paraburdoo
- Study Area
- Search Area

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4.2 CHILOPODA (CENTIPEDES)

Two orders of centipedes from the Pilbara are known to contain SREs: Geophilomorpha (Earth Centipedes) and members of the order Scolopendromorpha within the family Cryptopidae. Both geophilomorphs and cryptopids are blind and strongly associated with rocky environments, surface soil and leaf litter microhabitats. They are usually encountered when turning over rocks or larger pieces of fallen wood/logs. Members of both groups are also frequently collected in subterranean fauna surveys where their presence as troglofauna or soil fauna is often debated. Regardless of their specific ecophysiological requirements, preliminary genetic studies (unpublished data) on several Pilbara cryptopid and geophilomorph taxa, both terrestrial and subterranean, indicates high incidence of local endemism.

The Search Area contained 12 centipede taxa, of which none were named species, six were morphospecies and six were unidentified taxa (Table 4.5 and Figure 4.7). All were considered Potential SRE (DD) (Table 4.5).

Table 4.5. Table of SRE category Chilopoda identified from the area search of the WA Museum's Terrestrial Invertebrates Database

Order	Family	Binomial	SRE-Category	Ecotype	Justification
Geophilomorpha	'Family indet.'	Geophilomorpha sp.	Potential SRE: DD	?epigean	Order contains SRE species
Geophilomorpha	Ballophilidae	Ballophilidae sp.	Potential SRE: DD	epigean	Poorly resolved taxonomy
Geophilomorpha	Chilenophilidae	Chilenophilidae sp.	Potential SRE: DD	epigean	Poorly resolved taxonomy
Geophilomorpha	Chilenophilidae	<i>Sepedonophilus</i> sp.	Potential SRE: DD	epigean	Genus known to contain SREs
Geophilomorpha	Mecistocephalidae	<i>Mecistocephalus</i> 'DNA04'	Potential SRE: DD	epigean	(Phoenix 2014a)
Geophilomorpha	Mecistocephalidae	<i>Mecistocephalus</i> 'DNA05'	Potential SRE: DD	epigean	(Phoenix 2014a)
Geophilomorpha	Mecistocephalidae	<i>Mecistocephalus</i> 'DNA06'	Potential SRE: DD	epigean	FMG Unpublished Data
Geophilomorpha	Mecistocephalidae	<i>Mecistocephalus</i> sp.	Potential SRE: DD	epigean	genus known to contain SREs
Geophilomorpha	Schendylidae	<i>Australoschendyla</i> 'cf. capensis'	Potential SRE: DD	epigean	(Phoenix 2012)
Scolopendromorpha	Cryptopidae	<i>Cryptops</i> 'DNA06'	Potential SRE: DD	epigean	FMG Unpublished Data
Scolopendromorpha	Cryptopidae	<i>Cryptops</i> 'DNA07'	Potential SRE: DD	epigean	FMG Unpublished Data
Scolopendromorpha	Cryptopidae	<i>Cryptops</i> sp.	Potential SRE: DD	epigean/ ?epigean	Genus contains many SREs

The field survey sampled eight different centipede taxa (Table 3.2, Table 3.3 and Figure 3.4), of which three are potential SRE (DD) *Mecistocephalus* sp., *Orphnaeus* sp. and *Cryptops* sp. (Table 3.3, Figure 3.4). The former two taxa (*Mecistocephalus* sp. and *Orphnaeus* sp.) belonging to the order Geophilomorpha which is

suspected of containing potential SRE based on unpublished genomic data ([Phoenix 2014a](#)). The taxonomic resolution of species is very poor for most of the geophilomorph genera. The genus *Cryptops* belongs to the order Scolopendromorpha and family Cryptopidae. While most scolopendromorph centipedes are regarded as widespread, representatives of Cryptopidae are notable exceptions and epigean representatives of the genus *Cryptops* are rarely sampled in the Pilbara since they live in relatively moist environments. The area search revealed two species based on molecular data, *Cryptops* 'DNA06' and *Cryptops* 'DNA07', in addition to unresolved species. Further resolution to the identity of the species from the present survey may be possible using DNA sequencing methods and should include troglobitic samples.

Figure 4.7

Figure title: Central Pilbara showing the distribution of SRE category Chilopoda records from the database Search Area. Number of records in Parentheses.

Geophilomorpha

- Australoschendyla* 'cf. capensis'(5)
- Ballophilidae* sp.(2)
- Chilenophilidae* sp.(4)
- Geophilomorpha sp.(1)
- Mecistocephalus* 'DNA04'(1)
- Mecistocephalus* 'DNA05'(1)
- Mecistocephalus* 'DNA06'(1)
- Mecistocephalus* sp.(12)
- Sepedonophilus* sp.(6)

Scolopendromorpha

- Cryptops* 'DNA06'(4)
- Cryptops* 'DNA07'(2)
- Cryptops* sp.(14)

Paraburdoo

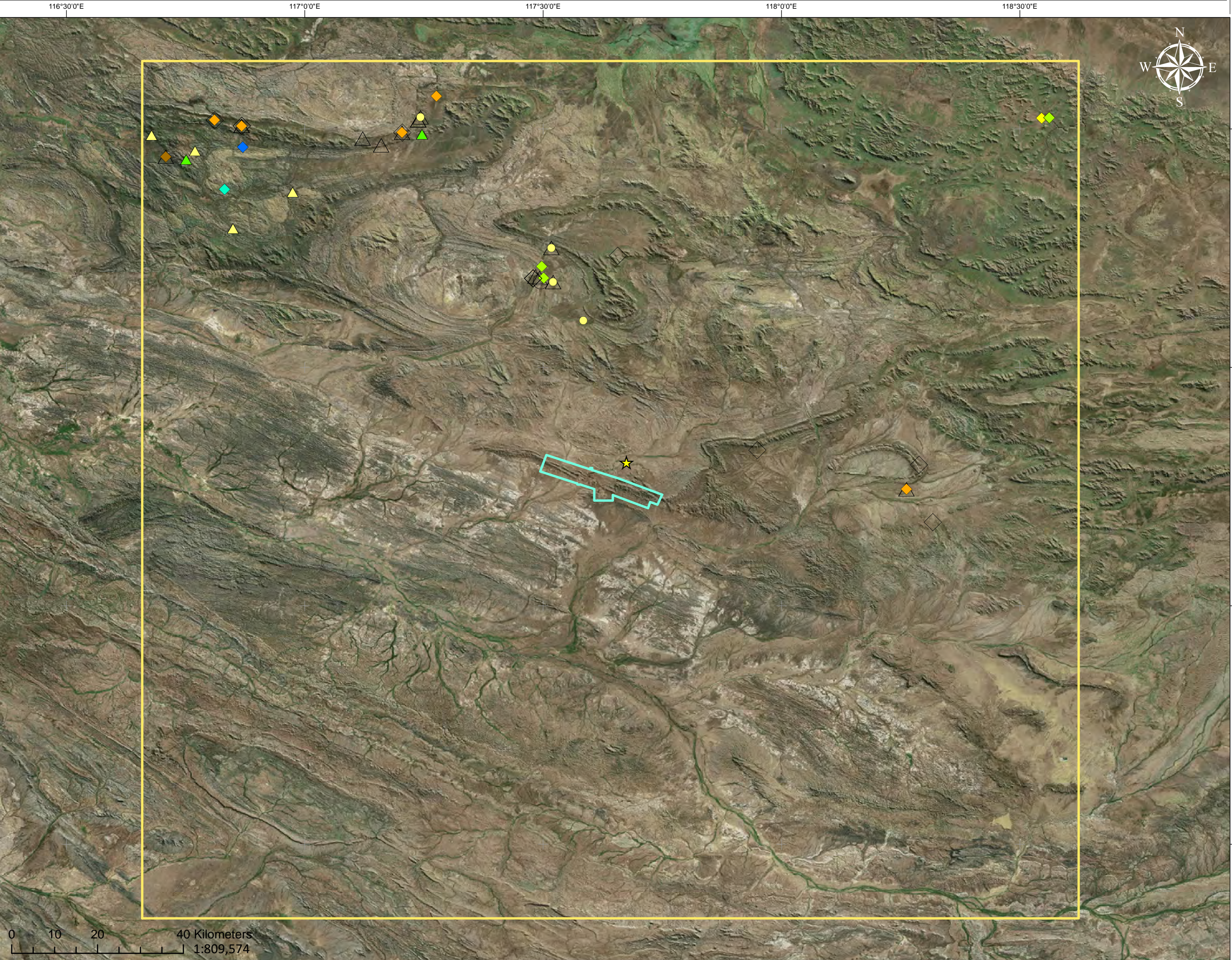
Study Area

Search Area

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4.3 DIPLOPODA (MILLIPEDES)

Diplopoda is a diverse class and in the Pilbara, it is represented by five orders: Polydesmida, Polyxenida, Polyzoniida, Spirobolida and Spirostreptida. Of these, only the order Polyxenida (pincushion millipedes) has mostly widespread epigean species ([Short and Huynh 2011](#), [2013](#)), Molecular data (unpublished) indicates several troglobitic species are SREs. The order Polydesmida (flatback millipedes) has received significant attention over recent years, particularly the family Paradoxosomatidae ([Car and Harvey 2013](#); [Car et al. 2013](#); [Car and Harvey 2014](#)). In the Pilbara, Paradoxosomatidae are represented by two described genera *Antichiropus* and *Boreohesperus*, both of which contain SRE representatives. Until recently, the Pilbara Spirobolida was thought to be represented by a single widespread species *Austrostrophus stictopygus* ([Hoffman 2003](#)) and the troglobitic genus *Speleostrophus* ([Hoffman 1994](#)). Recent molecular investigations into this group by the WA Museum indicate significant variation between some Pilbara populations of *Austrostrophus stictopygus* and which are consistent with species level divergences (MS Harvey Personal Communication). *Austrostrophus stictopygus* therefore appears to represent a complex of species, some of which may be SREs. This species is therefore regarded as a potential SRE here. The orders Polyzoniida (sucking millipedes) and Spirostreptida are very poorly known from the Pilbara; however, based on investigations of the fauna of SW Australia ([Harvey 2002b](#); [Moir et al. 2009](#); [Edward and Harvey 2010](#); [Harvey et al. 2011](#)), it seems likely that most Pilbara representatives will be SREs.

The Search Area contained 13 millipede taxa, of which two were named species, five were morphospecies and six were unidentified taxa (Table 4.6 and Figure 4.9). Five of these species were SREs and the remainder were potential SRE (DD) (Table 4.6).

Table 4.6. Table of SRE category Diplopoda identified from the area search of the WA Museum's Terrestrial Invertebrates Database

Order	Family	Binomial	SRE-Category	Ecotype	Justification
Polydesmida	Paradoxosomatidae	<i>Antichiropus</i> 'DIP019'	SRE	epigean	http://www.museum.wa.gov.au/catalogues/waminals/antichiropus-dip019
Polydesmida	Paradoxosomatidae	<i>Antichiropus</i> 'DIP035'	SRE	epigean	http://museum.wa.gov.au/online-collections/names/antichiropus-dip035
Polydesmida	Paradoxosomatidae	<i>Antichiropus</i> 'DIP039'	SRE	epigean	http://museum.wa.gov.au/online-collections/names/antichiropus-dip039
Polydesmida	Paradoxosomatidae	<i>Antichiropus</i> 'DIP048'	SRE	epigean	http://museum.wa.gov.au/online-collections/names/antichiropus-dip048
Polydesmida	Paradoxosomatidae	<i>Antichiropus</i> sp.	Potential SRE: DD	epigean	Genus contains numerous SRE taxa: (Harvey 2002b ; Car and Harvey 2013 ; Car et al. 2013 ; Car and Harvey 2014)

Order	Family	Binomial	SRE-Category	Ecotype	Justification
Polydesmida	Paradoxosomatidae	Paradoxosomatidae sp.	Potential SRE: DD	epigean	Family contains numerous SRE taxa: (Harvey 2002b ; Car and Harvey 2013 ; Car et al. 2013 ; Car and Harvey 2014)
Polyxenida	Polyxenidae	<i>Unixenus karajinensis</i>	SRE	Epigean	(Short and Huynh 2011, 2013)
Polyxenida	Polyxenidae	<i>Unixenus</i> sp.	Potential SRE: DD	epigean	
Polyzoniida	Siphonotidae	Siphonotidae sp.	Potential SRE: DD	epigean	This group is poorly resolved but based on habitat association and mobility, likely to contain SRE's (Framenau et al. 2008)
Spirobolida		Spirobolida sp.	Potential SRE: DD	epigean	Order contains SRE taxa
Spirobolida	Trigoniulidae	<i>Austrostrophus</i> 'DIP053'	Potential SRE: DD	epigean	WAM data
Spirobolida	Trigoniulidae	<i>Austrostrophus</i> sp.	Potential SRE: DD	epigean	WAM data
Spirobolida	Trigoniulidae	<i>Austrostrophus stictopygus</i>	Potential SRE: DD	epigean	WAM data

The field survey collected one millipede taxon, *Austrostrophus* sp. (Table 3.2, Table 3.3 and Figure 3.4) Only one adult male was collected allowing confirmation of identity after examining the gonopods; however, that specimen was found dead in a receding pool adjacent to the sample sight SRE16. Three additional samples, a female and two subadults were also collected. A single species is currently described for this genus *Austrostrophus stictopygus* Hoffman 2003; however, unpublished data from the WA Museum indicates the presence of more than one species. The identity of this species may be further resolved using DNA-barcoding methods.

4.4 SYMPHYLA (GARDEN CENTIPEDES)

Symphylans are tiny, less than 1cm, centipede-like arthropods. Like centipedes, they have a multi-segmented body with one pair of legs per segment. They differ from centipedes in several ways, but most notably by the absence of the modified first pair of legs into poison claws, which is characteristic of all true centipedes. This group is poorly known and literature on the Australian species is very limited.

In the Pilbara, nearly all symphylans are recorded from subterranean habitats, where they are frequently SRE's. In the absence of a workable taxonomy for Pilbara symphylans, species identification is heavily dependent on DNA sequencing methods. While epigean records of symphylans from the Pilbara are very scarce, it is plausible for them to be present in deep gorges that retain moist soil and leaf litter throughout most of the year.

The database search identified two records of symphylans that were not identified beyond the rank of Class: Symphyla sp. Insufficient data were available to assess whether these were sampled from subterranean habitats or not, therefore they are tentatively considered to be epigean and potential SRE: DD (Figure 4.9).

No symphylans were sampled during these survey; however, their presence can not be ruled out. Suitable habitat was observed during survey two: in deep leaf litter under Eucalyptus trees (SRE05 and SRE12) and rocky scree slopes with leaf litter cover (SRE14, SRE15, SRE16 and SRE17). In dry conditions, it is likely that symphylans would move deep into rocky scree, following the retreating. The absence of symphylans from the field surveys may be due to the dry conditions observed during both field surveys.

Figure 4.8

Figure title: Central Pilbara showing the distribution of SRE category Diplopoda and Symphyla records from the database Search Area. Number of records in Parentheses.

Polydesmida

- ▲ *Antichiropus* 'DIP019'(1)
- ▲ *Antichiropus* 'DIP035'(2)
- ▲ *Antichiropus* 'DIP039'(1)
- ▲ *Antichiropus* 'DIP048'(3)
- △ *Antichiropus* sp.(3)
- ▽ Paradoxosomatidae sp.(2)

Polyzoniida

- ▽ Siphonotidae sp.(1)

Spirobolida

- ◆ *Austrostrophus* 'DIP053'(4)
- ◆ *Austrostrophus* sp.(9)
- ◆ *Austrostrophus stictopygus* (19)
- Helminthomorpha sp.(5)
- ◇ Spirobolida sp.(3)

Polyxenida

- *Unixenus karajinensis*(10)
- *Unixenus* sp.(3)

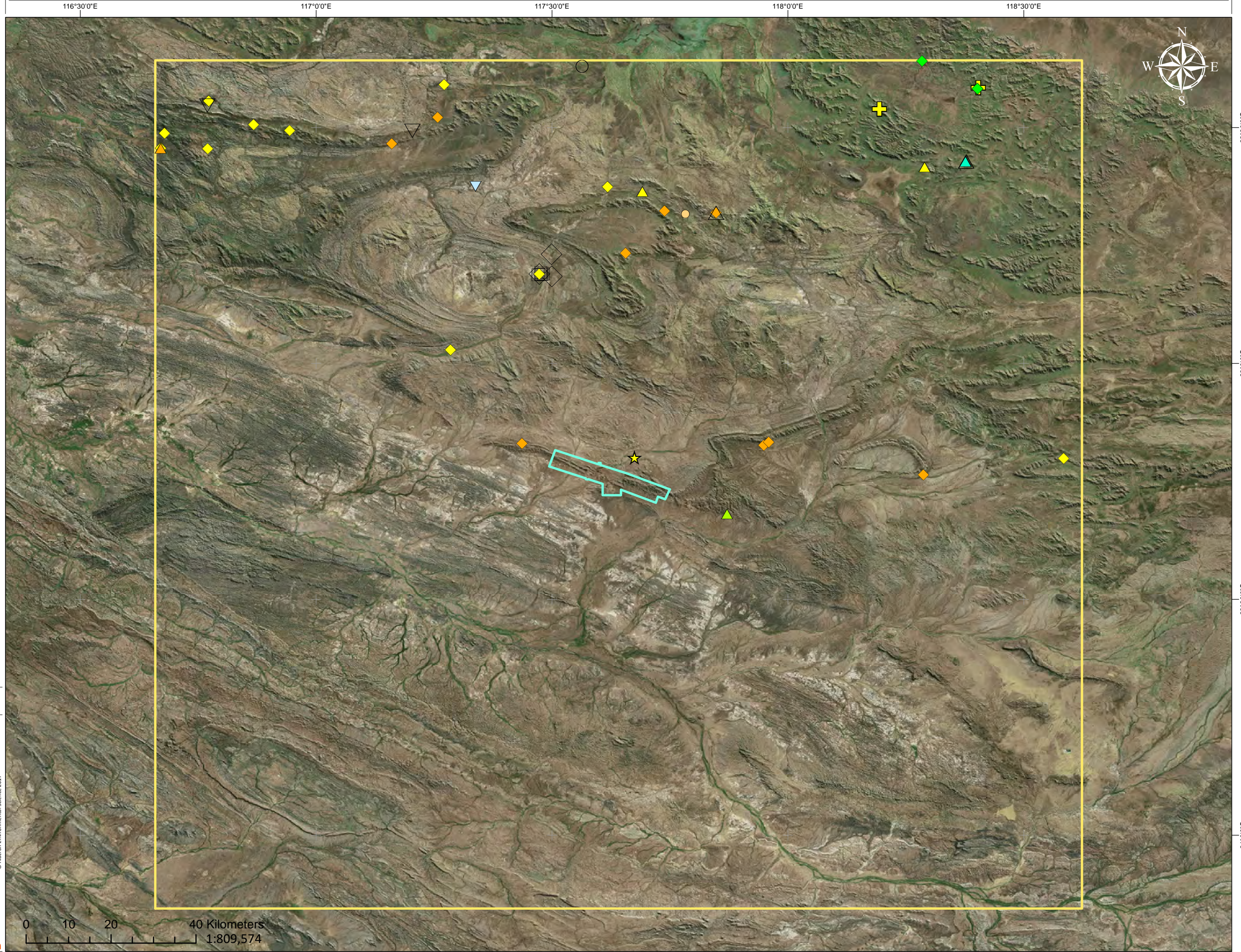
Symphyla

- ✚ Symphyla sp.(2)
- ★ Paraburdoo
- Study Area
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4.5 ZYGENTOMA (SILVERFISH)

Zygentoma is a primitive order of insects. Most are characterised by an abdomen containing short paired appendages on the ventral side and by the presence of three long filaments that extend from the terminal segment. The species is represented by three extant families: Lepismatidae, Ateluridae and Nicoletiidae. All three families are known from the Pilbara; however, Nicoletiidae are rarely collected from epigeal surveys of the Pilbara and for this reason are regarded as potential SRE (DD). They are often sampled from subterranean habitats where they are frequently SREs. Most of the Pilbara species are tentatively attributed to the genus *Trinemura* but their identity is nearly always assessed using DNA-barcoding methods ([Humphreys et al. 2013](#); [Phoenix 2014b](#)).

A single specimen of Zygentoma, tentatively identified to *Trinemura* sp., was sampled during this survey (Table 3.2, Table 3.3 and Figure 3.5). Further clarification to its identity and regional context of this record, may be obtained from DNA-barcoding analysis. The frequent occurrence of this family in subterranean fauna surveys means that reference sequences should also include subterranean taxa from the Pilbara.

4.6 ISOPODA (SLATERS OR WOOD LICE)

Isopoda represent the only order of epigeal crustaceans known to contain SREs. The suborder Oniscidae represents terrestrial and secondarily aquatic isopods with approximately 190 species described in Australia ([Martin et al. 2011](#)). The W.A. terrestrial isopod fauna is largely undescribed and is diverse ([Judd and Horwitz 2003](#); [Judd and Perina 2013](#)). Isopods have poor dispersal capabilities and often have specific habitat preferences, making them target SRE taxa in WA.

The Search Area contained 21 isopod taxa, of which none were named species, 16 were morphospecies and five were unidentified taxa (Table 4.7 and Figure 4.7). These taxa were potential SRE (DD) (Table 4.7).

Table 4.7. Table of SRE category terrestrial Isopoda from the area search of the WA Museum's Crustacea Database

Family	Binomial	SRE-Category	Ecotype	Justification
Armadillidae	<i>Buddelundia</i> sp.	Potential SRE: DD	epigeal	Taxonomic rank contains Potential SRE and SRE
Armadillidae	<i>Buddelundia</i> '13'	Potential SRE: DD	epigeal	species complex with uncertain taxonomy and may contain SRE species
Armadillidae	<i>Buddelundia</i> 'B47'	Potential SRE: DD	epigeal	(Ecologia 2014)
Armadillidae	<i>Buddelundia</i> 'B49'	Potential SRE: DD	epigeal	(Ecologia 2014)
Armadillidae	<i>Buddelundia</i> 'B50'	Potential SRE: DD	epigeal	(Ecologia 2014)
Armadillidae	<i>Buddelundia</i> 'B52'	Potential SRE: DD	epigeal	(Ecologia 2014)
Armadillidae	<i>Buddelundia</i> 'B53'	Potential SRE: DD	epigeal	(Ecologia 2014)
Armadillidae	<i>Buddelundia</i> 'B54'	Potential SRE: DD	epigeal	(Ecologia 2014)
Armadillidae	Armadillidae sp.	potential SRE: DD	?epigeal	Taxonomic rank contains SRE species

Family	Binomial	SRE-Category	Ecotype	Justification
Armadiillidae	<i>Barrowdillo</i> '1'	potential SRE: DD	epigean	WAM Data and assessment by Dr Simon Judd assessment
Armadiillidae	<i>Barrowdillo</i> '2'	potential SRE: DD	epigean	WAM Data and assessment by Dr Simon Judd assessment
Armadiillidae	<i>Buddelundia</i> '10'	Potential SRE: DD	epigean	Uncertain taxonomy of this group, but known to contain SRE species (<i>Buddelundia</i> '10ts')
Armadiillidae	<i>Buddelundia</i> '13'	Potential SRE: DD	epigean	species complex with uncertain taxonomy and may contain SRE species
Armadiillidae	<i>Buddelundia</i> '14'	Potential SRE: DD	epigean	species complex with uncertain taxonomy and may contain SRE species
Armadiillidae	<i>Buddelundia</i> '48'	Potential SRE: DD	epigean	restricted distribution
Armadiillidae	<i>Buddelundia</i> '50'	Potential SRE: DD	epigean	restricted distribution
Armadiillidae	<i>Buddelundia</i> '51'	Potential SRE: DD	epigean	restricted distribution
Armadiillidae	<i>Buddelundia</i> sp.	Potential SRE: DD	epigean	Taxonomic rank contains SRE species
Armadiillidae	Buddelundiinae sp.	Potential SRE: DD	epigean	Taxonomic rank contains Potential SRE and SRE
Philosciidae	Philosciidae 'B18'	Potential SRE: DD	epigean	(Bennelongia 2012)
Philosciidae	Philosciidae sp.	Potential SRE: DD	?epigean	All Philosciidae in Pilbara are considered potential SREs. They are rarely collected and are taxonomically unknown.

The field survey revealed seven isopod taxa, of which six are Potential SRE (DD) (Table 3.2, Table 3.3 and Figure 3.5). *Buddelundia* '50' and *Barrowdillo* '4' are potential SRE (DD) and both species are only known from restricted distributions in poorly surveyed areas. *Buddelundia* '47TS' and *Buddelundia* '10ts' both represent species complexes that are likely to contain SRE species and are also regarded as potential SRE (DD).

Two unresolved taxa include Buddelundiinae sp. and Philosciidae sp. The specimen of Buddelundiinae sp. from the first survey may represent an adult of Buddelundiinae 'pes999', which is thought to be widespread; however, it is distributed in three distinct populations which may represent cryptic species. Further resolution of these species may be possible using DNA-barcoding methods. The taxonomy of the Philosciidae in the Pilbara region is unknown and combined with their relative scarcity in collections and their requirement for mesic microhabitats, is the reason they are considered potential SRE taxa. Further resolution to the identity of these samples may be possible using DNA-barcoding methods.

Figure 4.9

Figure title: Central Pilbara showing the distribution of SRE category Isopoda records from the database Search Area. Number of records in Parentheses.

Isopoda

- *Buddelundia* '10'(1)
- *Buddelundia* '13'(4)
- *Buddelundia* '14'(19)
- *Buddelundia* '48'(1)
- *Buddelundia* '50'(1)
- *Buddelundia* '51'(1)
- ◆ *Buddelundia* 'B47'(1)
- ◆ *Buddelundia* 'B49'(8)
- ◆ *Buddelundia* 'B50'(6)
- ◆ *Buddelundia* 'B52'(2)
- ◆ *Buddelundia* 'B53'(5)
- ◆ *Buddelundia* 'B54'(2)
- Buddelundia* sp.(12)
- Buddelundiinae sp.(15)
- *Philosciidae* 'B18'(1)
- Philosciidae* sp.(2)

- ★ Paraburdoo
- Study Area
- Search Area

Client: Astron (Rio Tinto)
Project: Greater Paraburdoo - SRE
Project Number: 1712
Coordinate System: GCS WGS 1984
Projection: Transverse Mercator
Datum: WGS 1984
Author: E.S. Volschenk
Date: 13 Oct 2017



4.7 EUPULMONATA, MOLLUSCA (LAND SNAILS)

Land snails are a diverse group of invertebrates and most of Australia's snail fauna is endemic ([Beesley et al. 1998](#)). Their limited dispersal capabilities, often combined with specific habitat requirements, makes them one of the SRE target groups in Western Australia ([Harvey 2002b](#); [EPA 2009](#)). In the Pilbara region of WA, the families Camaenidae, Bothriembryonitidae and Succineidae are significant in containing SREs and potential SREs; however, much of the diversity is cryptic and dependent on molecular investigations to verify species boundaries ([Johnson et al. 2012](#); [Johnson et al. 2013](#); [Whisson and Kirkendale 2014](#)).

The Search Area contained 11 snail taxa, of which two were named species, four were morphospecies and five were unidentified taxa (Table 4.8 and Figure 4.10). All were considered potential SRE (DD) (Table 4.8).

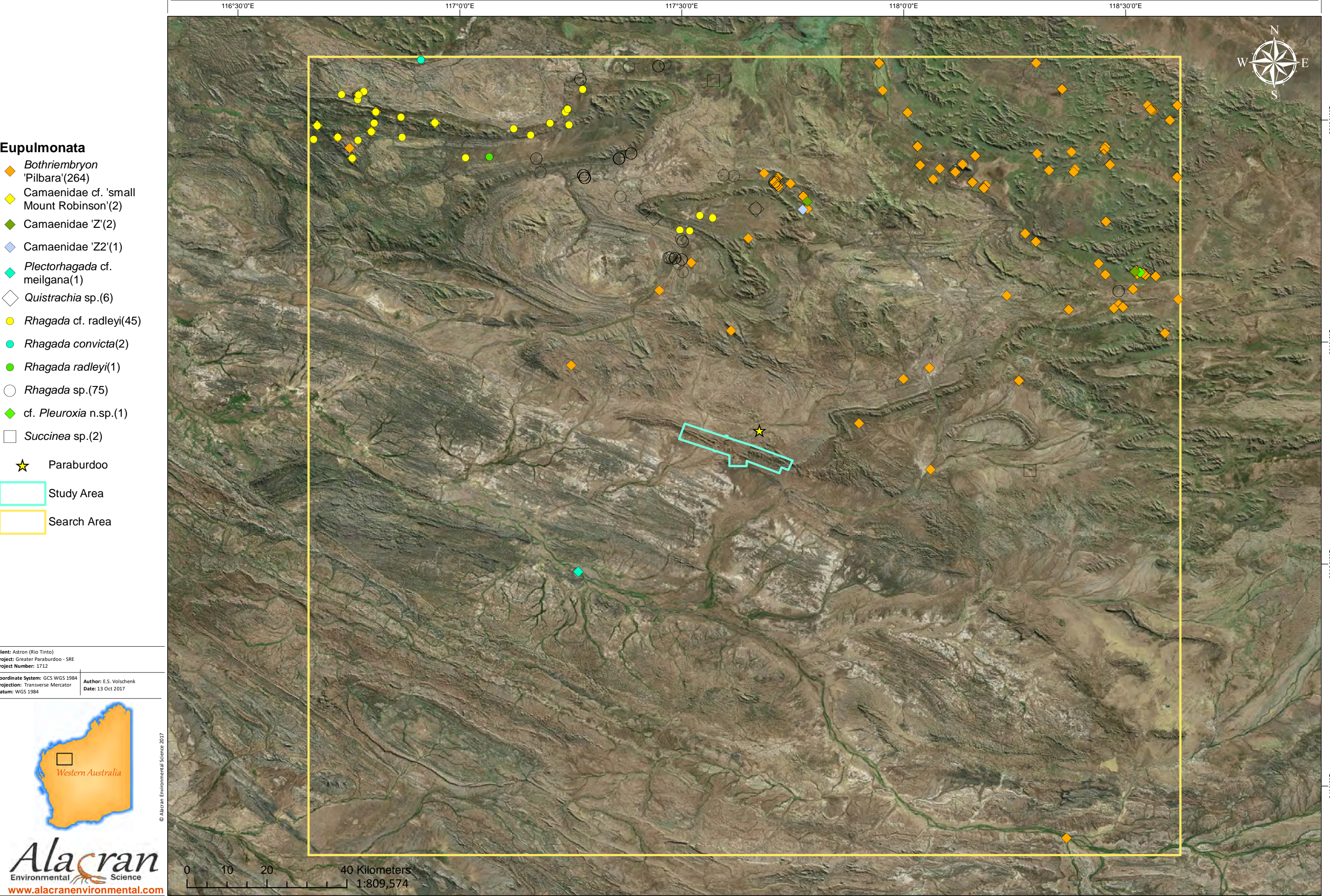
Table 4.8. Table of SRE category Eupulmonata from the area search of the WA Museum's Mollusca Database

Family	Binomial	SRE-Category	Ecotype	Justification
Bothriembryonitidae	Bothriembryon 'Pilbara'	Potential SRE: DD	epigean	(Whisson and Kirkendale 2014)
Camaenidae	Camaenidae cf. 'small Mount Robinson'	Potential SRE: DD	epigean	(Whisson and Kirkendale 2014)
Camaenidae	Camaenidae 'Z'	Potential SRE: DD	epigean	restricted distribution
Camaenidae	Camaenidae 'Z2'	Potential SRE: DD	epigean	restricted distribution
Camaenidae	cf. <i>Pleuroxia</i> n.sp.	Potential SRE: DD	epigean	restricted distribution
Camaenidae	<i>Plectorhagada</i> cf. <i>meilgana</i>	Potential SRE: DD	epigean	restricted distribution
Camaenidae	<i>Quistrachia</i> sp.	Potential SRE: DD	epigean	(Whisson and Kirkendale 2014)
Camaenidae	<i>Rhagada</i> cf. <i>radleyi</i>	Potential SRE: DD	epigean	poorly defined species, morphologically and genetically, requiring revision (Johnson et al. 2012)
Camaenidae	<i>Rhagada convicta</i>	Potential SRE: DD	epigean	Complex phylogenetic relationships identified by (Johnson et al. 2012) involving polyphyly!
Camaenidae	<i>Rhagada radleyi</i>	Potential SRE: DD	epigean	poorly defined species, morphologically and genetically, requiring revision (Johnson et al. 2012)
Camaenidae	<i>Rhagada</i> sp.	Potential SRE: DD	epigean	(Whisson and Kirkendale 2014)

The field surveys yielded four different snail taxa, of which only one was Potential SRE (DD): Bothriembryon 'Pilbara' (Table 3.2, Table 3.3 and Figure 3.3). The species was represented by long dead shells. The identity of Bothriembryon species in the Pilbara is entirely based on DNA sequence data, which cannot be obtained from dead shells. Until live representatives of this species are sampled, the Identity of this species will remain ambiguous. Both shells were collected near one another, suggesting that the species is likely to be present in the local vicinity.

Figure 4.10

Figure title: Central Pilbara showing the distribution of SRE category Eupulmonata records from the database Search Area. Number of records in Parentheses.



4.8 SUMMARY

The database search results from within the Search Area yielded eight named species and 89 named morphospecies from SRE target groups. The high degree of morphospecies most likely reflects the poor level of taxonomic knowledge about SREs in this part of the Pilbara. This position is reflected by the high degree of data deficiency potential SREs (148) taxa, from the study area. Assessment of the distributions of these species also indicates very poor coverage of database records from within 10 km of the study area and nearly all the records are concentrated in the northern third of the Search Area.

The survey sampled most of the SRE groups expected from the Pilbara; however, the majority of these were sampled during the second survey and only one species (*Indolpium* 'long chela') was only recorded during the first survey.

Conditions during that survey were quite dry and because of this, the actual number of SRE species present may not have been comprehensively sampled. Sampling after good rainfall is likely to reveal species not recorded during this survey, such as Symphyla, Opiliones and pseudoscorpions belonging to the families Chthoniidae and Hyidae. Surveying shortly (within a 2 weeks) after good rains may also expand on the diversity and spatial distribution of geophilomorph and cryptopid centipedes, live snails and isopods. The second survey may have yielded more species because more energy was directed to sampling from deep within shaded and litter blanketed scree slopes: sites SRE14-SRE17. Additional survey effort in these microhabitats, and others like them, shortly after rain would be optimal for further surveying these habitats.

Overall, the composition of SRE taxa within this part of the Pilbara remains very poorly known. The present survey may have under sampled the actual species richness owing to suboptimal seasonal conditions; however, this survey clearly demonstrated that Paraburdoo range contains a significant diversity of Potential SRE species.

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APPENDICES

The following appendices are embedded within this document:

Appendix 1 – Short-range endemic records from an area search by the W.A. Museum.

Appendix 2 – Short-range endemic and target group records from the field survey.

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Appendix E: Fauna Species Lists

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Table E.1: Amphibian species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
HYLIDAE									
<i>Cyclorana maini</i>	Sheep Frog							x	x
<i>Cyclorana platycephala</i>	Water-holding Frog							x	
<i>Litoria rubella</i>	Little Red Tree Frog					x		x	x
MYOBATRACHIDAE									
<i>Uperoleia saxatilis</i>	Pilbara Toadlet					x			

Table E.2: Reptile species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
AGAMIDAE									
<i>Gowidon longirostris</i>						x		x	x
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon					x		x	x
<i>Ctenophorus isolepis</i>	Military Dragon					x			
<i>Ctenophorus nuchalis</i>	Central Netted Dragon					x		x	
<i>Ctenophorus reticulatus</i>	Western Netted Dragon					x			
<i>Pogona minor</i>						x		x	
<i>Tympanocryptis cephalus</i>	Pebble Dragon							x	
DIPLODACTYLIDAE									
<i>Crenadactylus ocellatus</i>	Clawless Gecko					x			
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko					x		x	
<i>Diplodactylus galaxias</i>	Northern Pilbara Beak-faced Gecko					x			
<i>Diplodactylus pulcher</i>						x			
<i>Diplodactylus savagei</i>	Southern Pilbara Beak-faced Gecko					x		x	
<i>Lucasium stenodactylum</i>						x		x	x
<i>Lucasium wombeyi</i>						x		x	x
<i>Oedura fimbria</i>	Marbled Velvet Gecko					x		x	x
<i>Strophurus elderi</i>								x	
<i>Strophurus strophurus</i>						x			
<i>Strophurus wellingtonae</i>								x	
<i>Strophurus wilsoni</i>						x			
CARPHODACTYLIDAE									
<i>Nephrurus levis</i>						x			

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
<i>Nephurus wheeleri</i>						x			x
GEKKONIDAE									
<i>Gehyra punctata</i>						x		x	x
<i>Gehyra purpurascens</i>						x			
<i>Gehyra variegata</i>						x		x	x
<i>Heteronotia binoei</i>	Bynoe's Gecko					x		x	x
<i>Heteronotia spelea</i>	Desert Cave Gecko					x		x	x
PYGOPODIDAE									
<i>Delma butleri</i>								x	
<i>Delma elegans</i>						x		x	
<i>Delma nasuta</i>						x		x	x
<i>Delma pax</i>									x
<i>Lialis burtonis</i>						x		x	
<i>Pygopus nigriceps</i>								x	
SCINCIDAE									
<i>Carlia munda</i>								x	
<i>Cryptoblepharus buchananii</i>						x		x	
<i>Cryptoblepharus plagiocephalus</i>								x	
<i>Cryptoblepharus ustulatus</i>									x
<i>Ctenotus duricola</i>						x		x	x
<i>Ctenotus grandis</i>								x	
<i>Ctenotus hanloni</i>						x			
<i>Ctenotus helenae</i>						x			x

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
<i>Ctenotus nigrilineatus</i>					P1	x			
<i>Ctenotus pantherinus</i>	Leopard Ctenotus					x		x	
<i>Ctenotus rubicundus</i>						x		x	x
<i>Ctenotus rutilans</i>						x		x	
<i>Ctenotus saxatilis</i>	Rock Ctenotus					x		x	x
<i>Ctenotus uber</i>						x		x	
<i>Cyclodomorphus melanops</i>	Slender Blue-tongue					x		x	
<i>Egernia formosa</i>						x		x	
<i>Lerista bipes</i>						x			
<i>Lerista clara</i>						x		x	
<i>Lerista flammicauda</i>						x		x	x
<i>Lerista muelleri</i>						x		x	
<i>Lerista rolfei</i>						x			
<i>Lerista verhmens</i>						x			
<i>Menetia greyii</i>						x		x	x
<i>Menetia surda</i>						x		x	
<i>Morethia ruficauda</i>						x			x
<i>Notoscincus butleri</i>					P4	x			
<i>Notoscincus ornatus</i>						x			
<i>Tiliqua multifasciata</i>	Central Blue-tongue							x	
VARANIDAE									
<i>Varanus acanthurus</i>	Spiny-tailed Monitor					x		x	
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor					x			
<i>Varanus bushi</i>	Pilbara Mulga Monitor					x		x	

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
<i>Varanus caudolineatus</i>						x		x	
<i>Varanus eremius</i>	Pygmy Desert Monitor					x			
<i>Varanus gouldii</i>	Bungarra or Sand Monitor					x		x	
<i>Varanus giganteus</i>	Perentie								x
<i>Varanus tristis tristis</i>	Racehorse Monitor					x		x	x
TYPHLOPIDAE									
<i>Ramphotyphlops ammodytes</i>								x	
<i>Ramphotyphlops grypus</i>								x	x
Boidae									
<i>Antaresia perthensis</i>	Pygmy Python					x		x	
<i>Aspidites melanocephalus</i>	Black-headed Python							x	
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python		VU	VU		x	x	x	
ELAPIDAE									
<i>Brachyuropsis approximans</i>						x		x	
<i>Demansia rufescens</i>	Rufous Whipsnake					x		x	x
<i>Furina ornata</i>	Moon Snake					x		x	x
<i>Parasuta monachus</i>								x	
<i>Pseudechis australis</i>	Mulga Snake							x	x
<i>Pseudonaja mengdeni</i>	Western Brown Snake					x			
<i>Pseudonaja modesta</i>	Ringed Brown Snake					x		x	
<i>Pseudonaja nuchalis</i>	Gwardar; Northern Brown Snake					x		x	
<i>Simoselaps bertholdi</i>	Jan's Banded Snake					x			
<i>Suta fasciata</i>	Rosen's Snake					x			
<i>Vermicella snelli</i>						x		x	

Table E.3: Bird species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
PHASIANIDAE										
<i>Coturnix ypsilophora</i>	Brown Quail					x		x	x	
Anatidae										
<i>Cygnus atratus</i>	Black Swan									x
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck					x		x	x	x
<i>Anas gracilis</i>	Grey Teal					x		x	x	x
<i>Anas superciliosa</i>	Pacific Black Duck					x		x	x	x
<i>Aythya australis</i>	Hardhead							x		x
PODICIPEDIDAE										
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe					x		x	x	x
<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe							x	x	x
COLUMBIDAE										
<i>Phaps chalcoptera</i>	Common Bronzewing					x		x	x	x
<i>Ocyphaps lophotes</i>	Crested Pigeon					x		x	x	x
<i>Geophaps plumifera</i>	Spinifex Pigeon					x		x	x	x
<i>Geopelia cuneata</i>	Diamond Dove					x		x	x	x
<i>Geopelia striata</i>	Peaceful Dove					x		x	x	
PODARGIDAE										
<i>Podargus strigoides</i>	Tawny Frogmouth					x		x	x	
Eurostopodidae										
<i>Eurostopodus argus</i>	Spotted Nightjar					x		x	x	x
AEGOTHELIDAE										
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar					x		x	x	x

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
APODIDAE										
<i>Apus pacificus</i>	Fork-tailed Swift		Mi	IA		x				
ANHINGIDAE										
<i>Anhinga novaehollandiae</i>	Australasian Darter					x		x		
PHALACROCORACIDAE										
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant					x		x		
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant							x		
PELECANIDAE										
<i>Pelecanus conspicillatus</i>	Australian Pelican							x		
ARDEIDAE										
<i>Ardea pacifica</i>	White-necked Heron							x	x	x
<i>Ardea modesta</i>	Eastern Great Egret					x				x
<i>Egretta novaehollandiae</i>	White-faced Heron					x		x	x	x
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron					x		x		x
THRESKIORNITHIDAE										
<i>Plegadis falcinellus</i>	Glossy Ibis		Mi	IA		x				
<i>Threskiornis molucca</i>	Australian White Ibis							x		
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					x		x	x	x
ACCIPITRIDAE										
<i>Elanus axillaris</i>	Black-shouldered Kite									x
<i>Haliastur sphenurus</i>	Whistling Kite					x		x	x	x
<i>Milvus migrans</i>	Black Kite					x		x	x	x
<i>Accipiter fasciatus</i>	Brown Goshawk					x		x	x	x
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk					x		x		

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
<i>Circus assimilis</i>	Spotted Harrier					x		x	x	x
<i>Circus approximans</i>	Swamp Harrier									x
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard									x
<i>Aquila audax</i>	Wedge-tailed Eagle					x		x	x	
<i>Hieraetus morphnoides</i>	Little Eagle							x	x	x
FALCONIDAE										
<i>Falco cenchroides</i>	Nankeen Kestrel					x		x	x	x
<i>Falco berigora</i>	Brown Falcon					x		x	x	x
<i>Falco longipennis</i>	Australian Hobby					x		x		x
<i>Falco hypoleucos</i>	Grey Falcon			VU		x				x
<i>Falco peregrinus</i>	Peregrine Falcon			OS		x		x		
RALLIDAE										
<i>Porphyrio porphyrio</i>	Purple Swamphen									x
<i>Fulica atra</i>	Eurasian Coot					x		x		x
OTIDIDAE										
<i>Ardeotis australis</i>	Australian Bustard					x		x	x	
RECURVIROSTRIDAE										
<i>Himantopus himantopus</i>	Black-winged Stilt					x		x		x
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet							x		
CHARADRIIDAE										
<i>Charadrius veredus</i>	Oriental Plover		Mi	IA			x			
<i>Elsyornis melanops</i>	Black-fronted Dotterel					x		x		x
<i>Erythronyx cinctus</i>	Red-kneed Dotterel							x		
ROSTRATULIDAE										

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
<i>Rostratula australis</i>	Australian Painted Snipe		EN	EN			x	x		
SCOLOPACIDAE										
<i>Gallinago megala</i>	Swinhoe's Snipe		Mi	IA		x				
<i>Tringa hypoleucos</i>	Common Sandpiper		Mi	IA		x	x	x		x
<i>Tringa glareola</i>	Wood Sandpiper		Mi	IA		x		x		
<i>Calidris ruficollis</i>	Red-necked Stint		Mi	IA		x				
<i>Calidris subminuta</i>	Long-toed Stint		Mi	IA		x		x		
<i>Calidris melanotos</i>	Pectoral Sandpiper		Mi	IA			x			
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		Mi	IA		x	x	x		
<i>Calidris ferruginea</i>	Curlew Sandpiper		CR	VU/IA			x			
TURNICIDAE										
<i>Turnix velox</i>	Little Button-quail					x		x	x	x
CACATUIDAE										
<i>Cacatua roseicapilla</i>	Galah					x		x	x	x
<i>Cacatua sanguinea</i>	Little Corella					x		x	x	x
<i>Nymphicus hollandicus</i>	Cockatiel					x		x	x	x
PSITTACIDAE										
<i>Platycercus zonarius</i>	Australian Ringneck					x		x		x
<i>Melopsittacus undulatus</i>	Budgerigar					x		x		x
<i>Pezoporus occidentalis</i>	Night Parrot		EN	CR		x	x			
CUCULIDAE										
<i>Centropus phasianinus</i>	Pheasant Coucal					x			x	
<i>Chalcites basal</i>	Horsfield's Bronze-Cuckoo					x			x	x
<i>Chalcites osculans</i>	Black-eared Cuckoo							x		

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
<i>Cacomantis pallidus</i>	Pallid Cuckoo					x		x		x
STRIGIDAE										
<i>Ninox connivens</i>	Barking Owl							x		
<i>Ninox novaeseelandiae</i>	Southern Boobook							x	x	x
HALCYONIDAE										
<i>Dacelo leachii</i>	Blue-winged Kookaburra					x		x	x	x
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher					x		x	x	x
<i>Todiramphus sanctus</i>	Sacred Kingfisher					x		x	x	x
MEROPIIDAE										
<i>Merops ornatus</i>	Rainbow Bee-eater					x		x	x	x
CLIMACTERIDAE										
<i>Climacteris melanura</i>	Black-tailed Treecreeper							x		
PTILONORHYNCHIDAE										
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird					x		x	x	x
MALURIDAE										
<i>Malurus leucopterus</i>	White-winged Fairy-wren					x		x	x	x
<i>Malurus lamberti</i>	Variegated Fairy-wren					x		x	x	x
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren								x	x
<i>Amytornis striatus</i>	Striated Grasswren					x		x	x	x
<i>Amytornis striatus striatus</i>	Striated Grasswren				P4	x				
ACANTHIZIDAE										
<i>Pyrrholaemus brunneus</i>	Redthroat					x		x	x	x
<i>Smicronis brevirostris</i>	Weebill					x		x	x	x
<i>Gerygone fusca</i>	Western Gerygone					x		x	x	

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill					x		x	x	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill							x		
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill					x		x	x	
<i>Acanthiza apicalis</i>	Inland Thornbill					x			x	x
PARDALOTIDAE										
<i>Pardalotus rubricatus</i>	Red-browed Pardalote									x
<i>Pardalotus striatus</i>	Striated Pardalote					x		x	x	
MELIPHAGIDAE										
<i>Lichenostomus virescens</i>	Singing Honeyeater							x	x	x
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater							x	x	x
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater							x	x	x
<i>Purnella albifrons</i>	White-fronted Honeyeater							x		
<i>Manorina flavigula</i>	Yellow-throated Miner					x		x	x	x
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					x		x	x	x
<i>Conopophila whitei</i>	Grey Honeyeater							x		
<i>Epthianura tricolor</i>	Crimson Chat					x		x	x	x
<i>Certhionyx variegatus</i>	Pied Honeyeater									x
<i>Sugomel niger</i>	Black Honeyeater							x		
<i>Lichmera indistincta</i>	Brown Honeyeater					x		x	x	x
POMATOSTOMIDAE										
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler					x		x	x	x
<i>Pomatostomus superciliosus</i>	White-browed Babbler					x		x	x	
EUPATRIDAE										
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush					x		x		

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
<i>Psophodes occidentalis</i>	Chiming Wedgebill									x
NEOSITTIDAE										
<i>Daphoenositta chrysoptera</i>	Varied Sittella							x		
CAMPEPHAGIDAE										
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					x		x	x	x
<i>Lalage sueurii</i>	White-winged Triller							x	x	
PACHYCEPHALIDAE										
<i>Pachycephala rufiventris</i>	Rufous Whistler					x		x	x	x
<i>Colluricincla harmonica</i>	Grey Shrike-thrush					x		x	x	x
<i>Oreoica gutturalis</i>	Crested Bellbird					x		x	x	x
ARTAMIDAE										
<i>Artamus personatus</i>	Masked Woodswallow					x		x		
<i>Artamus cinereus</i>	Black-faced Woodswallow					x		x	x	x
<i>Artamus minor</i>	Little Woodswallow					x		x	x	x
<i>Cracticus torquatus</i>	Grey Butcherbird					x		x	x	
<i>Cracticus tibicen</i>	Australian Magpie					x		x	x	
<i>Cracticus nigrogularis</i>	Pied Butcherbird					x		x	x	x
RHIPIDURIDAE										
<i>Rhipidura albiscapa</i>	Grey Fantail							x	x	
<i>Rhipidura leucophrys</i>	Willie Wagtail					x		x	x	x
CORVIDAE										
<i>Corvus bennetti</i>	Little Crow					x		x	x	
<i>Corvus orru</i>	Torresian Crow					x		x	x	x
MONARCHIDAE										

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
<i>Grallina cyanoleuca</i>	Magpie-lark					x		x	x	x
PETROICIDAE										
<i>Petroica goodenovii</i>	Red-capped Robin					x		x	x	x
<i>Melanodryas cucullata</i>	Hooded Robin					x		x	x	x
ALAUDIDAE										
<i>Mirafrja javanica</i>	Horsfield's Bushlark					x		x	x	
ACROCEPHALIDAE										
<i>Acrocephalus australis</i>	Australian Reed-Warbler					x		x	x	x
MEGALURIDAE										
<i>Cincloramphus mathewsi</i>	Rufous Songlark							x	x	
<i>Cincloramphus cruralis</i>	Brown Songlark							x		x
<i>Eremiornis carteri</i>	Spinifexbird					x		x	x	x
HIRUNDINIDAE										
<i>Hirundo rustica</i>	Barn Swallow		Mi	IA			x			
<i>Hirundo neoxena</i>	Welcome Swallow								x	
<i>Petrochelidon ariel</i>	Fairy Martin							x		x
<i>Petrochelidon nigricans</i>	Tree Martin					x		x	x	x
NECTARINIIDAE										
<i>Dicaeum hirundinaceum</i>	Mistletoebird					x		x	x	x
ESTRILDIDAE										
<i>Taeniopygia guttata</i>	Zebra Finch					x		x	x	x
<i>Neochmia ruficauda</i>	Star Finch								x	x
<i>Emblema pictum</i>	Painted Finch					x		x	x	x
MOTACILLIDAE										

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Birdlife	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA					
<i>Anthus novaeseelandiae</i>	Australasian Pipit							x		x
<i>Motacilla flava</i>	Yellow Wagtail		Mi	IA			x			
<i>Motacilla cinerea</i>	Grey Wagtail		Mi	IA			x			

Table E.4: Mammal species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
TACHYGLOSSIDAE									
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna					x			
DASYURIDAE									
<i>Dasykaluta rosamondae</i>	Little Red Kaluta					x		x	
<i>Dasyurus hallucatus</i>	Northern Quoll		EN	EN		x	x	x	x
<i>Ningau timealeyi</i>	Pilbara Ningau					x		x	x
<i>Planigale ingrami</i>	Long-tailed Planigale					x		x	x
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus					x			x
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart				P4	x			
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart					x			
THYLACOMYIDAE									
<i>Macrotis lagotis</i>	Bilby, Dalgyte		VU	VU			x		
MACROPODIDAE									
<i>Macropus robustus erubescens</i>	Euro, Biggada					x		x	x
<i>Macropus rufus</i>	Red Kangaroo, Marlu					x		x	x
<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby							x	x
MEGADERMATIDAE									
<i>Macroderma gigas</i>	Ghost Bat		VU	VU		x	x	x	x
HIPPOSIDERIDAE									
<i>Rhinonictis aurantia</i> (Pilbara form)	Pilbara Leaf-nosed Bat		VU	VU		x	x	x	x
EMBALLONURIDAE									
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat							x	x

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
<i>Taphozous georgianus</i>	Common Sheathtail-bat					x		x	x
<i>Taphozous hilli</i>	Hill's Sheathtail-bat					x		x	
VESPERTILIONIDAE									
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat					x		x	x
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat							x	x
<i>Scotorepens greyii</i>	Little Broad-nosed Bat					x		x	x
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat							x	x
MOLOSSIDAE									
<i>Chaerephon jobensis</i>	Northern Freetail-bat							x	x
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat							x	
<i>Ozimops lumsdenae</i>	Northern Freetail-bat								x
<i>Austronomus australis</i>	White-striped Freetail-bat							x	x
MURIDAE									
<i>Leggadina lakedownensis</i>	Short-tailed Mouse				P4	x			
<i>Mus musculus</i>	House Mouse	*				x	x	x	x
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse				P4	x		x	
<i>Pseudomys desertor</i>	Desert Mouse					x		x	
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse					x			x
<i>Zyzomys argurus</i>	Common Rock-rat					x		x	x
LEPORIDAE									
<i>Oryctolagus cuniculus</i>	Rabbit	*					x		
CANIDAE									
<i>Canis lupus dingo</i>	Dingo	*				x		x	x
<i>Canis lupus familiaris</i>	Dog	*					x	x	

Scientific name	Common name	Introduced	Conservation codes			Naturemap/ DBCA	EPBC PMST	Previous surveys	Current survey
			EPBC Act	WC Act	DBCA				
<i>Vulpes vulpes</i>	Red Fox	*					x		
FELIDAE									
<i>Felis catus</i>	Cat	*				x	x	x	x
EQUIDAE									
<i>Equus asinus</i>	Donkey	*					x		
<i>Equus caballus</i>	Horse	*					x		
CAMELIDAE									
<i>Camelus dromedarius</i>	Dromedary, Camel	*					x		
BOVIDAE									
<i>Bos taurus</i>	European Cattle	*							x

Previous surveys

Eastern Range Level 1 and Targeted Fauna Survey (Astron Environmental Services 2014)

Eastern Ranges Targeted Fauna Survey (Biota Environmental Sciences 2010)

Western Range Two-Phase Fauna Survey (Biota Environmental Sciences 2011)

Rio Tinto Paraburdoo Mine Area Botanical and Vertebrate Fauna Survey (ecologia Environment 2011)

Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment (Eco Logical Australia 2016)

Turee Syncline Project Vegetation, Flora and Fauna Baseline Surveys (GHD Pty Ltd 2009)

Flora, Vegetation and Vertebrate Fauna on 23E/42E Paraburdoo (Mattiske Consulting 1998)

Table E.5: Amphibian species recorded during the current surveys.

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
HYLIDAE										
<i>Cyclorana maini</i>					0, 5					
<i>Litoria rubella</i>					0, 5	0, 2				1, 1

Table E.6: Reptile species recorded during the current surveys.

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
AGAMIDAE										
<i>Gowidon longirostris</i>					5, 6					0, 1
<i>Ctenophorus caudicinctus</i>	0, 2	0, 2	0, 1			4, 1	3, 0		0, 1	
CARPHODACTYLIDAE										
<i>Nephurus wheeleri cinctus</i>				1, 0						
DIPOLODACTYLIDAE										
<i>Lucasium stenodactylum</i>							0, 3			
<i>Lucasium wombeyi</i>						0, 1	0, 2			
GEKKONIDAE										
<i>Gehyra punctata</i>									1, 1	
<i>Gehyra variegata</i>						0, 1				1, 1
<i>Heteronotia binoei</i>		1, 0		1, 0	5, 4		0, 2			
<i>Heteronotia spelea</i>				0, 1					1, 0	
PYGOPODIDAE										
<i>Delma nasuta</i>							1, 1			
<i>Delma pax</i>						0, 1	1, 0			
SCINCIDAE										
<i>Cryptoblepharus ustulatus</i>		0, 1								
<i>Ctenotus saxatilis</i>		2, 3	2, 3	3, 1	0, 2	6, 9				
<i>Ctenotus rubicundus</i>						1, 0				
<i>Ctenotus helenae</i>				0, 1						
<i>Ctenotus duricola</i>						0, 3				
<i>Lerista flammicauda</i>						0, 1	1, 0			
<i>Menetia greyii</i>				1, 0	0, 2		1, 0			

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
<i>Morethia ruficauda exquisita</i>	0, 1				0, 1			1, 1		
VARANIDAE										
<i>Varanus tristis tristis</i>	0, 1				1, 0					
<i>Varanus giganteus</i>										0, 1
TYPHLOPIDAE										
<i>Anilius grypus</i>					0, 1					
ELAPIDAE										
<i>Demansia rufescens</i>							0, 2			
<i>Furina ornata</i>					1, 0					
<i>Pseudechis australis</i>					0, 5					

Table E.7: Bird species recorded during the current surveys.

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
ANATIDAE										
<i>Cygnus atratus</i>										1, 1
<i>Malacorhynchus membranaceus</i>										1, 1
<i>Anas gracilis</i>										1, 1
<i>Anas superciliosa</i>										1, 1
<i>Aythya australis</i>										1, 1
PODICIPEDIDAE										
<i>Tachybaptus novaehollandiae</i>										1, 1
<i>Poliocephalus poliocephalus</i>										1, 1
COLUMBIDAE										
<i>Phaps chalcoptera</i>	1							1, 0	1, 0	1, 0
<i>Ocyphaps lophotes</i>										1, 1
<i>Geophaps plumifera</i>	0, 1	1, 0	0, 1		0, 1	1, 0	1, 0	1, 0		
<i>Geopelia cuneata</i>		1, 0		1, 0		1, 0		1, 1	1, 0	1, 0
EUROSTOPODIDAE										
<i>Eurostopodus argus</i>								0, 1	1, 0	
AEGOTHELIDAE										
<i>Aegotheles cristatus</i>		0, 2						1, 0		
ARDEIDAE										
<i>Ardea pacifica</i>										1, 1
<i>Ardea modesta</i>										0, 1
<i>Egretta novaehollandiae</i>	2, 0									1, 1
<i>Nycticorax caledonicus</i>	2, 0									1, 0
THRESKIORNITHIDAE										

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
<i>Threskiornis spinicollis</i>										1, 1
ACCIPITRIDAE										
<i>Elanus axillaris</i>										1, 0
<i>Haliastur sphenurus</i>										1, 1
<i>Milvus migrans</i>						0, 1				1, 0
<i>Accipiter fasciatus</i>		0, 2								1, 2
<i>Circus assimilis</i>										1, 0
<i>Circus approximans</i>										1, 1
<i>Hamirostra melanosternon</i>										0, 1
<i>Hieraaetus morphnoides</i>										1, 0
FALCONIDAE										
<i>Falco cenchroides</i>	0, 1	1, 0	1, 0		1, 0				1, 1	
<i>Falco berigora</i>					3, 0			1, 0	0, 1	
<i>Falco hypoleucos</i>										0, 1
<i>Falco longipennis</i>				1, 0						0, 1
RALLIDAE										
<i>Porphyrio porphyrio</i>										1, 1
<i>Fulica atra</i>										1, 1
OTIDIDAE										
<i>Himantopus himantopus</i>										1, 1
CHARADRIIDAE										
<i>Elseyornis melanops</i>										1, 1
SCOLOPACIDAE										
<i>Actitis hypoleucos (Tringa hypoleucos)</i>										0, 1
TURNICIDAE										

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
<i>Turnix velox</i>			0, 3			2, 0	2, 0			
CACATUIDAE										
<i>Eolophus roseicapillus</i>					0, 1					1, 0
<i>Cacatua sanguinea</i>										1, 0
<i>Nymphicus hollandicus</i>	0, 1		0, 1		0, 6					0, 1
PSITTACIDAE										
<i>Barnardius zonarius</i>		0, 2	1, 0		0, 1					1, 0
<i>Melopsittacus undulatus</i>		1, 0			0, 1					1, 0
CUCULIDAE										
<i>Chrysococcyx basalis</i>		0, 1			0, 1					
<i>Cacomantis pallidus</i>				1, 0						
STRIGIDAE										
<i>Ninox novaeseelandiae</i>									0, 1	1, 0
HALCYONIDAE										
<i>Dacelo leachii</i>	1, 0				0, 3					1, 0
<i>Todiramphus pyrrhopygius</i>										1, 1
<i>Todiramphus sanctus</i>										1, 1
MEROPIDAE										
<i>Merops ornatus</i>	2, 0	1, 0								2, 1
PTILONORHYNCHIDAE										
<i>Ptilonorhynchus guttatus</i>		0, 1						2, 0	1, 1	
MALURIDAE										
<i>Malurus leucopterus</i>	1, 0				1, 5	2, 0	0, 1			
<i>Malurus lamberti</i>					1, 3	0, 2				
<i>Stipiturus ruficeps</i>			0, 1							

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
<i>Amytornis striatus</i>		2, 0	1, 0	0, 2				3, 0	1, 0	
ACANTHIZIDAE										
<i>Pyrrholaemus brunneus</i>						1, 0				
<i>Smicromis brevirostris</i>					4, 2			2, 0		
<i>Acanthiza apicalis</i>										0, 1
PARDALOTIDAE										
<i>Pardalotus rubricatus</i>	1, 1									0, 1
MELIPHAGIDAE										
<i>Certhionyx variegatus</i>										0, 1
<i>Lichmera indistincta</i>										0, 1
<i>Epthianura tricolor</i>										0, 1
<i>Lichenostomus virescens</i>	2, 1	1, 1	2, 0	1, 3	2, 5	3, 3	2, 3	0, 1	1, 1	
<i>Lichenostomus keartlandi</i>				1, 0						
<i>Lichenostomus penicillatus</i>	4, 1				1, 2					0, 1
<i>Manorina flavigula</i>	2, 0				0, 1					
<i>Acanthagenys rufogularis</i>								2, 0	3, 0	
POMATOSTOMIDAE										
<i>Pomatostomus temporalis</i>	1, 0		1, 0	1, 0	0, 1	1, 0	1, 0		1, 0	
EUPATRIDAE										
<i>Psophodes occidentalis</i>						0, 1				1, 1
CAMPEPHAGIDAE										
<i>Coracina novaehollandiae</i>		1, 0			1, 1					
PACHYCEPHALIDAE										
<i>Pachycephala rufiventris</i>	1, 0				2, 1	1, 2		0, 1		
<i>Colluricincla harmonica</i>	1, 0	1, 3		1, 0	2, 2			3, 0	3, 0	0, 1

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
<i>Oreoica gutturalis</i>		1, 0	1, 1	1, 1		1, 1	1, 1			
ARTAMIDAE										
<i>Artamus cinereus</i>		1, 0	1, 5	1, 0	1, 0					0, 1
<i>Artamus minor</i>		1, 9	3, 1	1, 1		1, 0		1, 1	1, 0	
<i>Cracticus nigrogularis</i>	1, 1	0, 1							0, 1	
RHIPIDURIDAE										
<i>Rhipidura leucophrys</i>	3, 0	1, 0	1, 0		0, 3	1, 2	0, 3		0, 2	
CORVIDAE										
<i>Corvus bennetti</i>	2, 0					1, 1	1, 0		0, 1	
MONARCHIDAE										
<i>Grallina cyanoleuca</i>	4, 0								1, 0	0, 1
PETROICIDAE										
<i>Petroica goodenovii</i>										1, 0
<i>Melanodryas cucullata</i>					0, 1					1, 0
ACROCEPHALIDAE										
<i>Acrocephalus australis</i>										1, 0
MEGALURIDAE										
<i>Cincloramphus cruralis</i>	1, 0									
<i>Eremiornis carteri</i>			1, 0	1, 0	1, 0	0, 3				
HIRUNDINIDAE										
<i>Petrochelidon ariel</i>										1, 1
<i>Petrochelidon nigricans</i>										1, 0
NECTARINIIDAE										
<i>Dicaeum hirundinaceum</i>					3, 0					
ESTRILDIDAE										

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
<i>Taeniopygia guttata</i>	2, 1	3, 7	3, 31	0, 5	1, 6	3, 2	1, 13	2, 1	0, 2	0, 1
<i>Neochmia ruficauda</i>	3, 0									
<i>Emblema pictum</i>	0, 3	2, 10	2, 3	2, 0	5, 2		1, 0	5, 1	3, 0	
MOTACILLIDAE										
<i>Anthus novaeseelandiae</i>										1, 1

Table E.8: Non-volant mammal species recorded during the current survey.

Species name	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	Other
DASYURIDAE										
<i>Dasyurus hallucatus</i>										2, 0
<i>Ningaui timealeyi</i>						1, 2	1, 3			
<i>Planigale</i> sp. 1					2, 0	2, 0				
<i>Pseudantechinus woolleyae</i>										1, 0
MACROPODIDAE										
<i>Macropus robustus erubescens</i>	0, 1									1, 0
<i>Macropus rufus</i>					1, 0					1, 0
<i>Petrogale rothschildi</i>								1, 0	1, 1	1, 0
MURIDAE										
<i>Mus musculus</i>					1, 0					
<i>Pseudomys hermannsburgensis</i>							1, 0			
<i>Zyzomys argurus</i>	3, 0	1, 2	0, 1	6, 1	2, 3			2, 1	6, 2	
CANIDAE										
<i>Canis familiaris</i>						0, 1	1, 0		1, 0	1, 0
FELIDAE										
<i>Felis catus</i>							1, 0			
BOVIDAE										
<i>Bos taurus</i>										1, 1

Table E.9: Volant mammal (bat) species recorded during the current surveys.

Species name	BAT01	BAT02	BAT03	BAT04	BAT05	BAT6	BAT7	BAT8
MEGADERMATIDAE								
<i>Macroderma gigas</i>	2 possible calls							
RHINONYCTERIDAE								
<i>Rhinonictis aurantia</i> Pilbara form	Low (12 calls)			Low (1 call)		Low (3 calls)	Low (3 calls)	
EMBALLONURIDAE								
<i>Saccolaimus flaviventris</i>				Low		Low		
<i>Taphozous georgianus</i>	Low	Low	High	Low	Low	Low	Low	Low
VESPERTILIONIDAE								
<i>Chalinolobus gouldii</i>	Low	Low	Low	High	Low	Med	High	Low
<i>Nyctophilus geoffroyi</i>				Low			Low	
<i>Scotorepens greyii</i>	Low	Low		Low		Low	Low	
<i>Vespadelus finlaysoni</i>	Med	Med	Low	Low	Med	High	Low	Med
MOLOSSIDAE								
<i>Chaerophon jobensis</i>	Low	Low	Low	High	Low		Med	
<i>Ozimops lumsdenae</i>		Low	Low	Low				
<i>Austronomus australis</i>	Low	Low	Low	Low	Low	Low		

Table E.7: Collected species in SRE Groups. Potential SRE species are shaded grey.

Species name	GP03	GP05	GP06	GP07	GP08	GP09	SRE1	SRE2	SRE3	SRE4	SRE5	SRE6	SRE7	SRE8	SRE9	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	Opp
ARANEAE																								
<i>Aname mellosa</i>				0, 1																				
Selenopidae sp. indet.				1, 0	0, 1	1, 0						1, 0			1, 0		0, 3		0, 1	0, 1	0, 3	0, 1		
PSEUDOSCORPIONES																								
<i>Oratemnus</i> sp. indet.											5, 0							0, 1						
<i>Amblyolpium</i> sp.																		0, 1						
<i>Austrohorus</i> sp. indet.								1, 0												0, 2			0, 2	
<i>Beierolpium</i> '8/4'																	0, 2							
<i>Euryolpium</i> sp. indet.																					0, 2			
<i>Indolpium</i> 'long chela hand'								1, 0				1, 0												
<i>Indolpium</i> sp. indet.					0, 2						2, 0						0, 1		0, 1					
SCORPIONES																								
<i>Lychas</i> 'hairy tail complex'		0, 12			0, 3										1, 0					0, 1	0, 1		0, 1	0, 12
<i>Lychas</i> 'harveyi complex'				1, 0																				
<i>Lychas</i> 'aitkeni complex'			0, 2	0, 1																				

Species name	GP03	GP05	GP06	GP07	GP08	GP09	SRE1	SRE2	SRE3	SRE4	SRE5	SRE6	SRE7	SRE8	SRE9	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	Opp
<i>Lychas</i> 'bituberculatus complex'	0, 1	0, 2		0, 2					1, 0											0, 1			0, 2	0, 3
<i>Lychas</i> 'pilbara 1'																0, 1								
<i>Lychas</i> sp. indet.		0, 1		0, 1																				
GEOPHILOMORPHA																								
<i>Mecistocephalus</i> sp. indet.		0, 1			0, 1																			
<i>Orphnaeus</i> sp. indet.																				0, 2				
SCOLOPENDROMORPHA																								
<i>Arthrorhabdus mjobergi</i>												1, 0												
<i>Cryptops</i> sp. indet.																				0, 1				
<i>Arthrorhabdus paucispinus</i>				0, 1																				
<i>Cormocephalus bungalbiensis</i>																		0, 1						
<i>Scolopendra laeta</i>		0, 2																0, 1						
<i>Scolopendra morsitans</i>				0, 1																				
SCUTIGEROMORPHA																								
Scutigleromorpha sp. indet.		1, 0	1, 0	1, 0																				
SPIROBOLIDA																								

Species name	GP03	GP05	GP06	GP07	GP08	GP09	SRE1	SRE2	SRE3	SRE4	SRE5	SRE6	SRE7	SRE8	SRE9	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	Opp
<i>Austrostrophus</i> sp. indet.			0, 1																	0, 1	0, 1	0, 2		
THYSANURA																								
<i>Trinemura</i> sp. indet.																							0, 1	
EUPULMONATA																								
<i>Bothriembryon</i> 'Pilbara'																					0, 1			1, 0
<i>Stenopylis coarctata</i>											1, 0													
<i>Gastrocopta</i> sp. indet.									2, 0															
<i>Pupoides</i> sp. indet.			0, 1						1, 0		1, 0													
ISOPODA																								
<i>Buddelundia</i> '10ts'										4, 0									0, 5					
<i>Buddelundia</i> '47TS'		0, 2	3, 1	0, 1	0, 1																			
<i>Buddelundia</i> '50'		2, 0	0, 2		0, 15	4, 0			3, 0		5, 0	2, 0	2, 0	3, 0	2, 0			0, 9	0, 3	0, 23	0, 1	0, 6		1, 0
<i>Buddelundiinae</i> sp. indet.							1, 0													0, 1				
<i>Buddelundiinae</i> 'pes999'			0, 1																					
<i>Barrowdillo</i> '4'																					0, 1			
<i>Philosciidae</i> sp. indet.																		0, 5						

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Appendix F: Threatened and Priority Fauna Species Likelihood of Occurrence within the Survey Area

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Table F.1: Likelihood of occurrence of conservation listed vertebrate fauna species listed as potentially occurring in the vicinity of the survey area.

Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	WC Act	DBCA		Pre-survey	Post-survey
Reptiles						
<i>Ctenotus nigrilineatus</i>			P1	Known from spinifex plains adjacent to granite outcrops and watercourses.	Moderate	Moderate
<i>Notoscincus butleri</i> (Lined Soil-crevice Skink)			P4	Arid, rocky, near coastal Pilbara regions. Associated with spinifex-dominated areas near creeks and river margins.	Moderate	Moderate
<i>Liasis olivaceus barroni</i> (Pilbara Olive Python)	VU	VU		Generally rocky habitats in close association to permanent and semi-permanent water sources.	High – previously recorded within survey area	High
Birds						
<i>Apus pacificus</i> (Fork-tailed Swift)	Mi	IA		Largely aerial species independent of the terrestrial environment.	Moderate	Moderate
<i>Plegadis falcinellus</i> (Glossy Ibis)	Mi	IA		Wetland habitats such as fresh water marshes at the edges of lakes, rivers and wet swamp areas. This species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons.	Moderate	Moderate – may be seasonally present
<i>Falco hypoleucos</i> (Grey Falcon)		VU		Open habitats: semi-deserts, grassy inland plains, timbered watercourses, pastoral lands.	High – previously recorded within survey area	Recorded
<i>Falco peregrinus</i> (Peregrine Falcon)		OS		Cosmopolitan, will hunt in any habitat, soaring at height or from a perch; often near cliffs. Nests on rocky ledges in tall, vertical cliff faces and tall trees associated with drainage lines.	Moderate	Moderate
<i>Charadrius veredus</i> (Oriental Plover)	Mi	IA		Breeding habitat includes arid grasslands, salt pans; non-breeding habitat includes grasslands, salt-fields, and coastal regions.	Low	Moderate – may be seasonally present

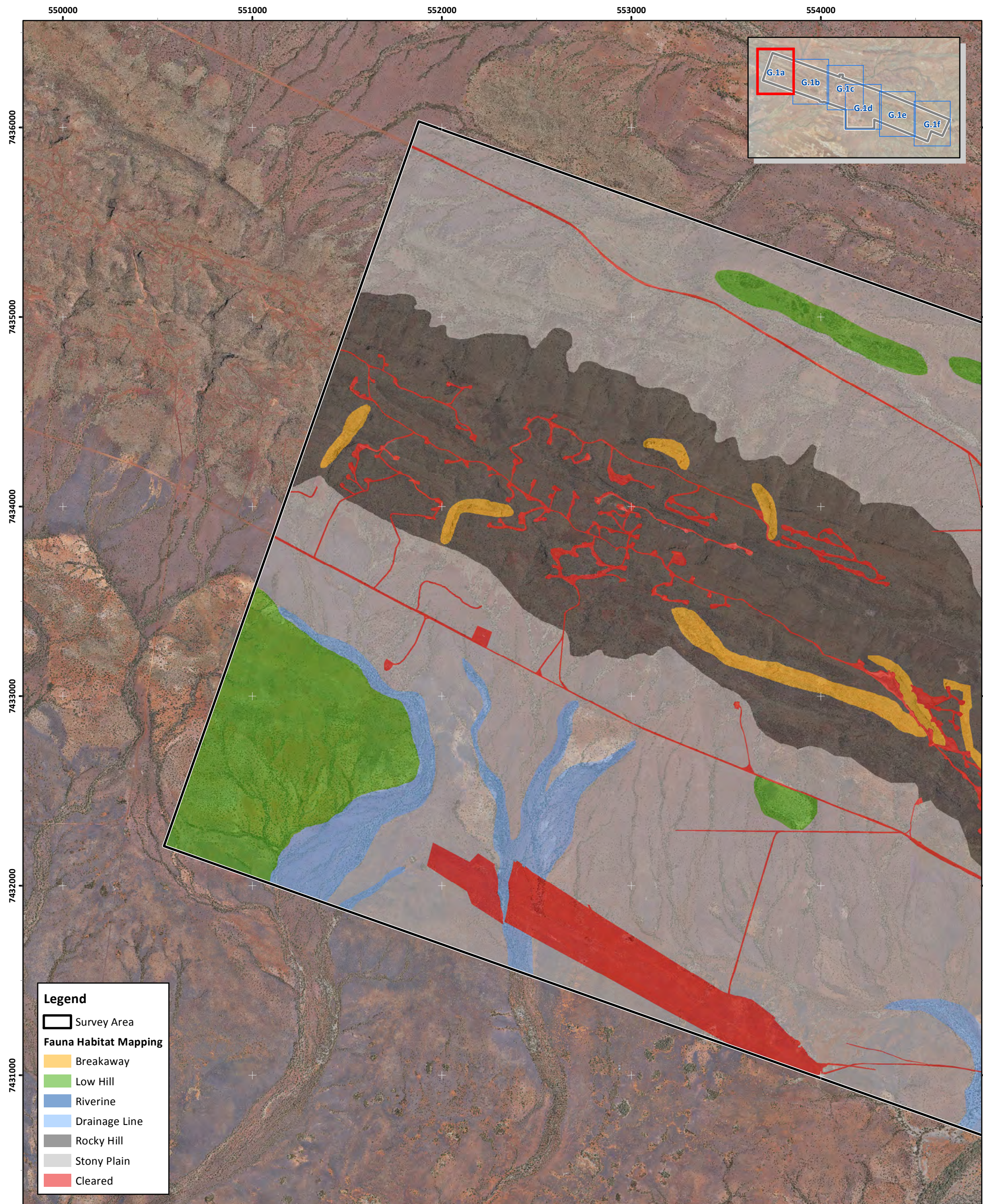
Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	WC Act	DBCA		Pre-survey	Post-survey
<i>Rostratula australis</i> (Australian Painted Snipe)	EN	EN		Inhabits shallow terrestrial freshwater wetlands, lakes, swamps and claypans. Also found in waterlogged grassland and saltmarsh. Typical sites include areas with emergent tussocks of grass, sedges or samphire; often scattered with clumps of lignum <i>Muehlenbeckia</i> , or canegrass or sometimes with tea-tree (<i>Melaleuca</i>).	Moderate	Moderate – may be seasonally present
<i>Gallinago megala</i> (Swinhoe's Snipe)	Mi	IA		Dense clumps of grass and rushes around edges of fresh and brackish wetlands.	Moderate	Moderate – may be seasonally present
<i>Actitis hypoleucos</i> (Common Sandpiper)	Mi	IA		Non-breeding migrant to a wide variety of habitats, such as riverbanks, estuaries, freshwater seeps on coastal shores, tidal creeks, mangrove swamps and saltmarshes.	Moderate	Recorded
<i>Tringa glareola</i> (Wood Sandpiper)	Mi	IA		This species uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops.	Moderate	Moderate – may be seasonally present
<i>Calidris ruficollis</i> (Red-necked Stint)	Mi	IA		This species is mostly found in coastal areas. It can also be found inland ephemeral or permanent shallow wetlands including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in salt flats.	Moderate	Moderate – may be seasonally present
<i>Calidris subminuta</i> (Long-toed Stint)	Mi	IA		Generally found in coastal environments such as coastal margins, lagoons, beaches and tidal flats.	Moderate	Moderate – may be seasonally present

Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	WC Act	DBCA		Pre-survey	Post-survey
<i>Calidris melanotos</i> (Pectoral Sandpiper)	Mi	IA		Mainly swamps, lagoons, river pools, irrigation channels and sewerage ponds. Also in samphire flats around estuaries and salt lakes.	Moderate	Moderate – may be seasonally present
<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)	Mi	IA		Muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass and low vegetation.	Moderate	Moderate – may be seasonally present
<i>Calidris ferruginea</i> (Curlew Sandpiper)	CR/Mi	VU/ IA		This species mainly occurs on intertidal mudflats in sheltered coastal areas and also around non-tidal swamps, lakes and lagoons near the coast. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.	Moderate	Moderate – may be seasonally present
<i>Pezoporus occidentalis</i> (Night Parrot)	EN	CR		Most habitat records are from <i>Triodia</i> grasslands and/or chenopod shrublands in the arid and semi-arid zones. <i>Astrebla</i> spp. (Mitchell grass), shrubby samphire and chenopod associations, scattered trees and shrubs, <i>Acacia aneura</i> (Mulga) woodland, treeless areas and bare gibber as associated with sightings of the species.	Moderate	Low
<i>Amytornis striatus striatus</i> (Striated Grasswren)			P4	Generally among clumps of spinifex in the mallee understory of inland arid regions (probable poor identification of Pilbara subspecies <i>A. s. whitei</i>).	Low	Low
<i>Hirundo rustica</i> (Barn Swallow)	Mi	IA		Coastal open country generally, especially near surface water and man-made structures such as bridges and power wires.	Moderate	Low

Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	WC Act	DBCA		Pre-survey	Post-survey
<i>Motacilla cinerea</i> (Grey Wagtail)	Mi	IA		Damp short-grass flats, rice stubbles and edge of swamps, sewage ponds, bore overflows, grazed or mowed grass and irrigated areas.	Low	Low
<i>Motacilla flava</i> (Yellow Wagtail)	Mi	IA		Mainly banks and rocks in fast-running freshwater habitats such as rivers, creeks, streams and around waterfalls.	Low	Low
Mammals						
<i>Dasyurus hallucatus</i> (Northern Quoll)	EN	EN		Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal.	High – previously recorded within survey area	Recorded
<i>Sminthopsis longicaudata</i> (Long-tailed Dunnart)			P4	Found in rocky scree and plateau areas, generally with little vegetation or in areas of spinifex hummock grassland, shrubs and open woodland.	Moderate	High
<i>Macrotis lagotis</i> (Greater Bilby, Dalgyte)	VU	VU		Sand or sandy-loam in hummock grassland (<i>Triodia</i> species) and or <i>Acacia</i> shrublands.	Low	Low
<i>Macroderma gigas</i> (Ghost Bat)	VU	VU		A wide range from rainforest, monsoon and vine scrub in the tropics to open woodlands and arid areas.	High – previously recorded within survey area	Recorded
<i>Rhinonictis aurantia</i> (Pilbara form) (Pilbara Leaf-nosed Bat)	VU	VU		Roosts in deep warm, humid caves or rock cracks, especially in proximity to water pools. Forages while flying low along watercourses and gorges and over <i>Triodia</i> grassland.	High – previously recorded within survey area	Recorded
<i>Leggadina lakedownensis</i> (Short-tailed Mouse, Karekanga)			P4	Open tussock and hummock grassland, <i>Acacia</i> shrubland and savannah woodland on alluvial clay / sandy soils.	Moderate	Moderate
<i>Pseudomys chapmani</i> (Western Pebble-mound Mouse)			P4	Gentle rocky slopes, hills and spurs with small pebble surface cover and sparse vegetation.	High – previously recorded within survey area	High

Appendix G: Fauna Habitat Mapping and Significant Areas

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Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.1a: Vertebrate fauna and SRE habitat mapping



Author: J. Trainer

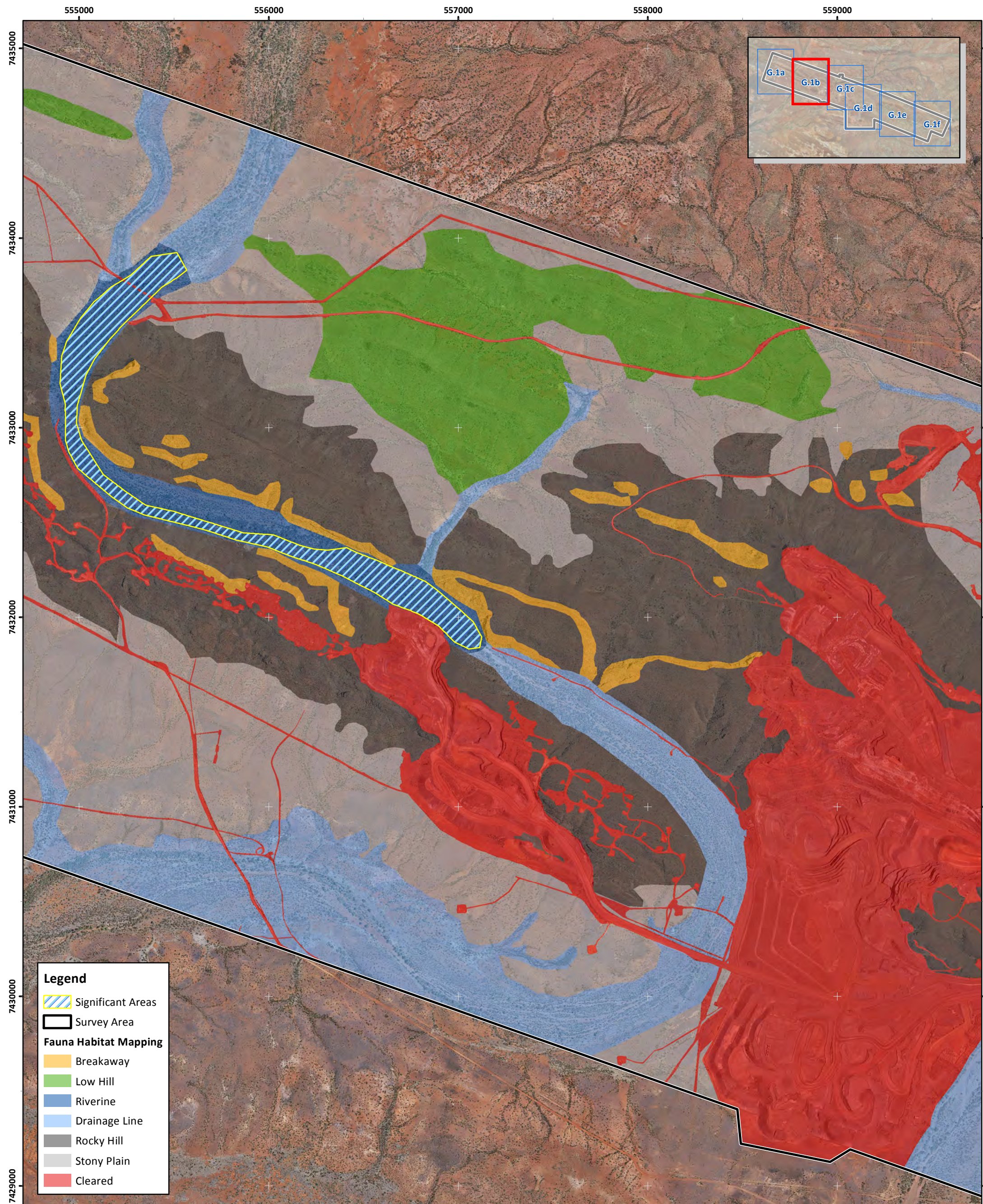
Date: 16-08-2018

Drawn: C. Dyde

Figure Ref: 14283-18-BIDR-2RevB_180816_FigG01_FaunaMap

Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres





Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018



Author: J. Trainer

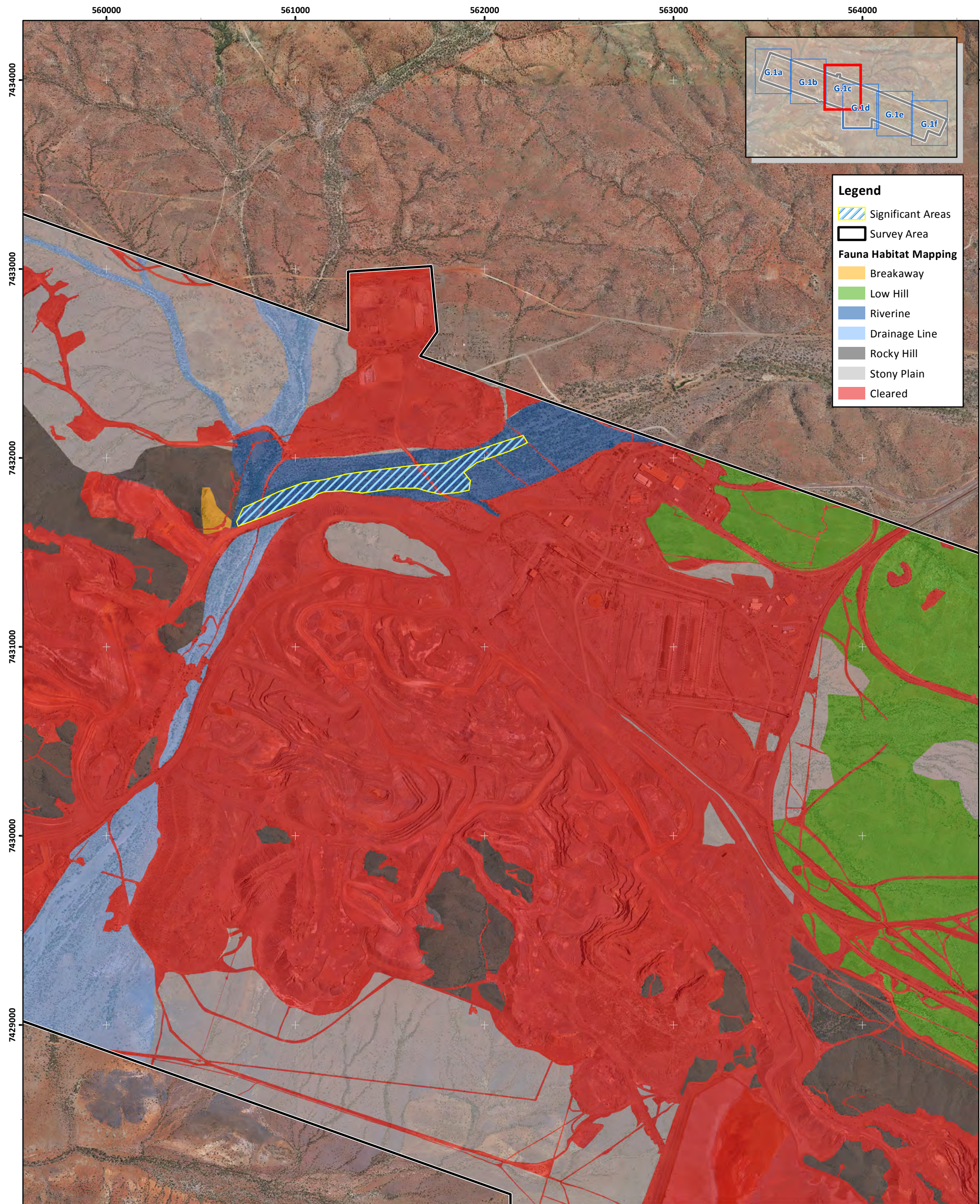
Date: 16-08-2018

Drawn: C. Dyde

Figure Ref: 14283-18-BIDR-2RevB_180816_FigG01_FaunaMap

Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres





Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.1c: Vertebrate fauna and SRE habitat mapping

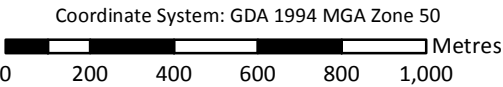


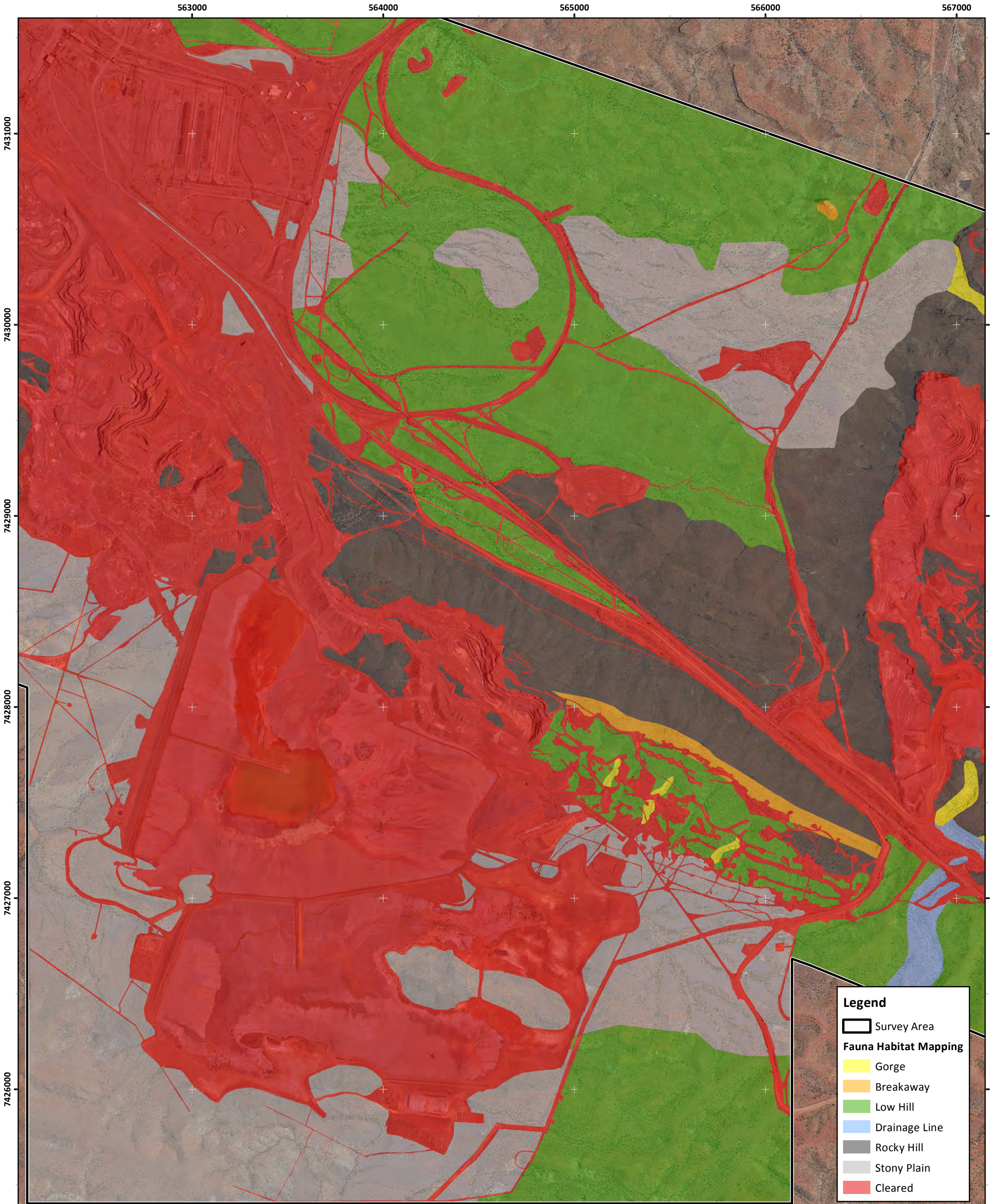
Author: J. Trainer

Date: 16-08-2018

Drawn: C. Dyde

Figure Ref: 14283-18-BIDR-2RevB_180816_FigG01_FaunaMap





Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.1d: Vertebrate fauna and SRE habitat mapping

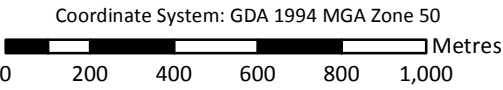


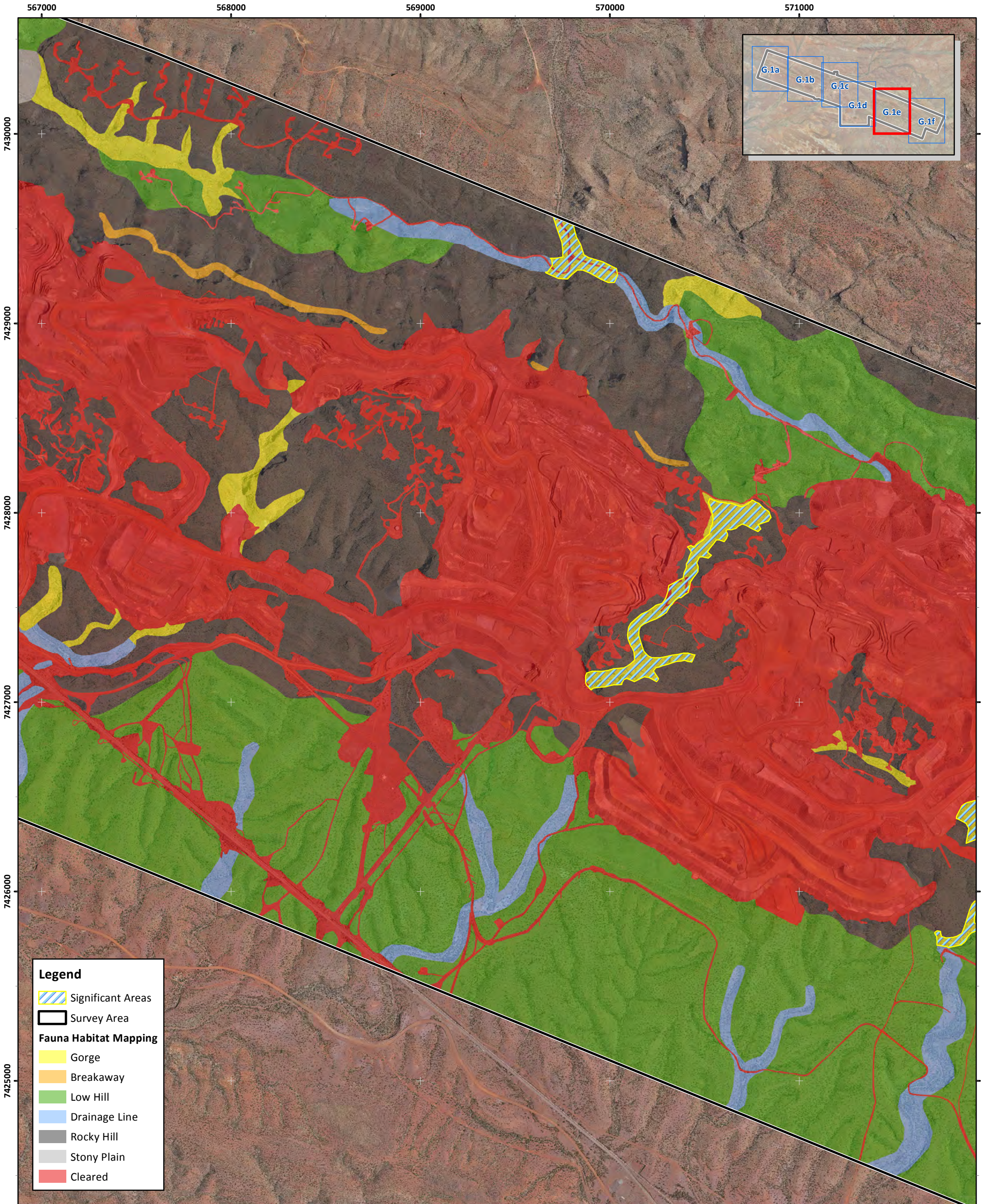
Author: J. Trainer

Date: 16-08-2018

Drawn: C. Dyde

Figure Ref: 14283-18-BIDR-2RevB_180816_FigG01_FaunaMap





Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.1e: Vertebrate fauna and SRE habitat mapping



Author: J. Trainer

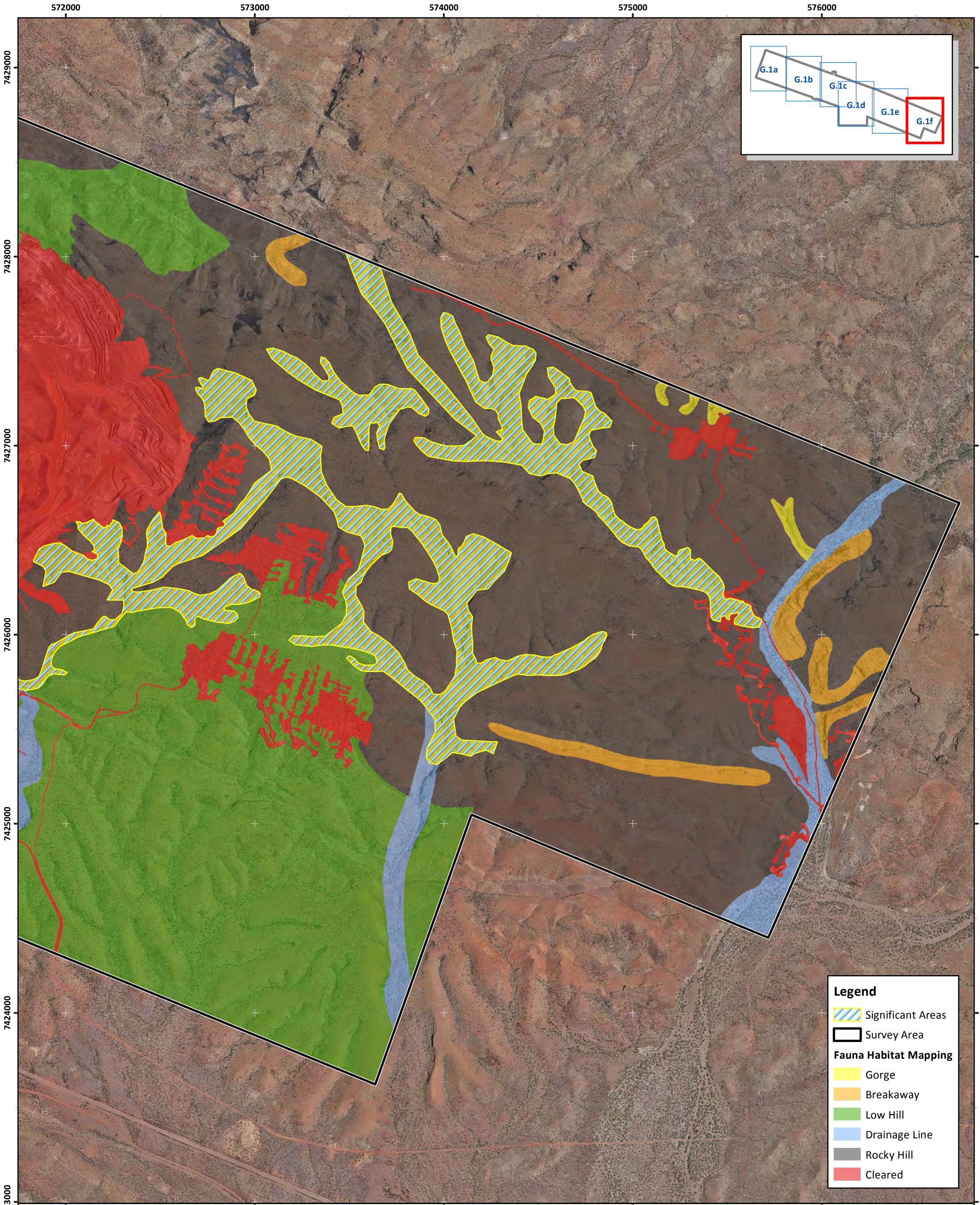
Date: 16-08-2018

Drawn: C. Dyde

Figure Ref: 14283-18-BIDR-2RevB_180816_FigG01_FaunaMap

Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres





Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.1f: Vertebrate fauna and SRE habitat mapping

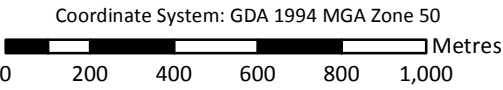


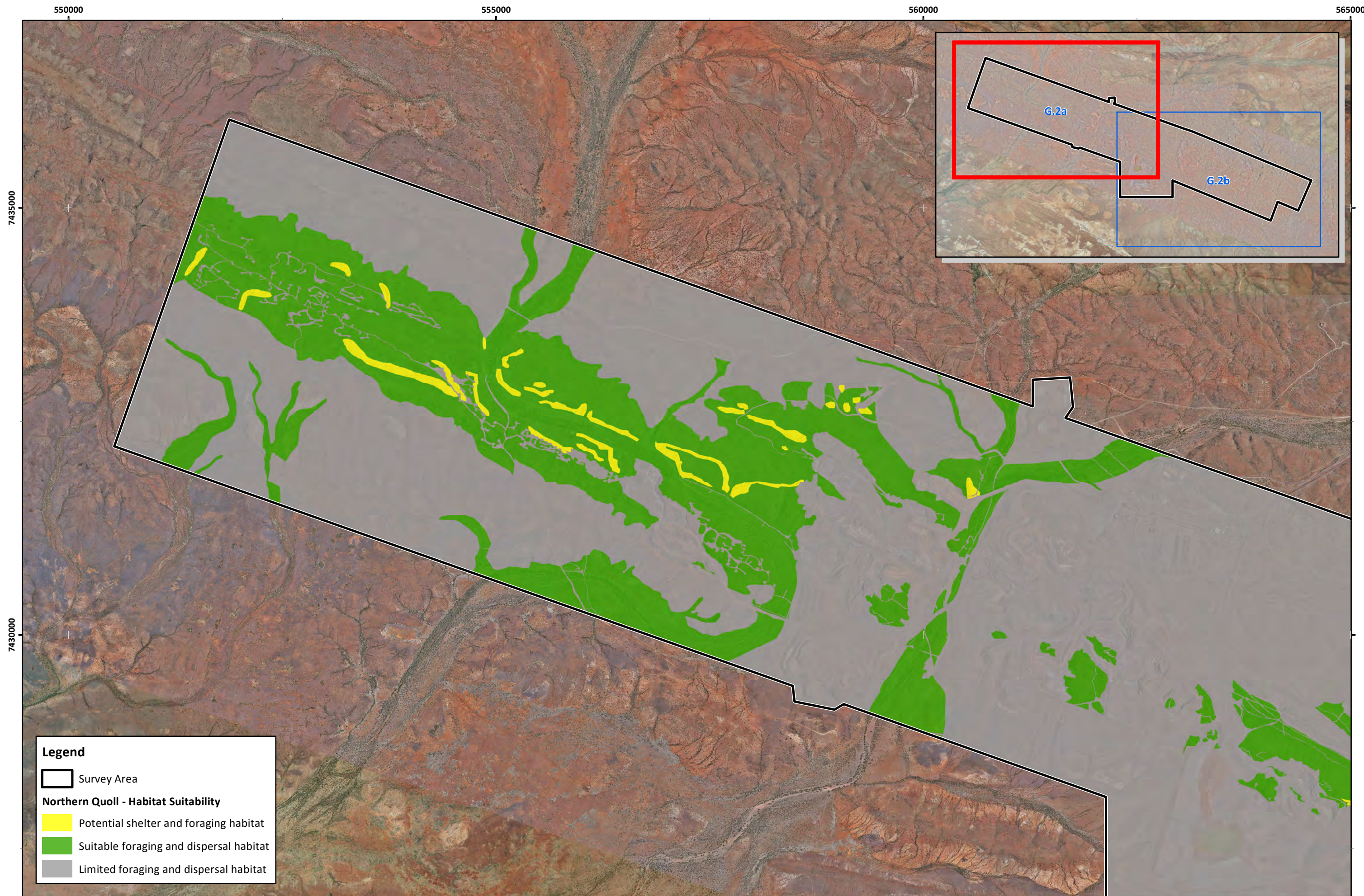
Author: J. Trainer

Date: 16-08-2018

Drawn: C. Dyde

Figure Ref: 14283-18-BIDR-2RevB_180816_FigG01_FaunaMap





Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.2a: Northern Quoll habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

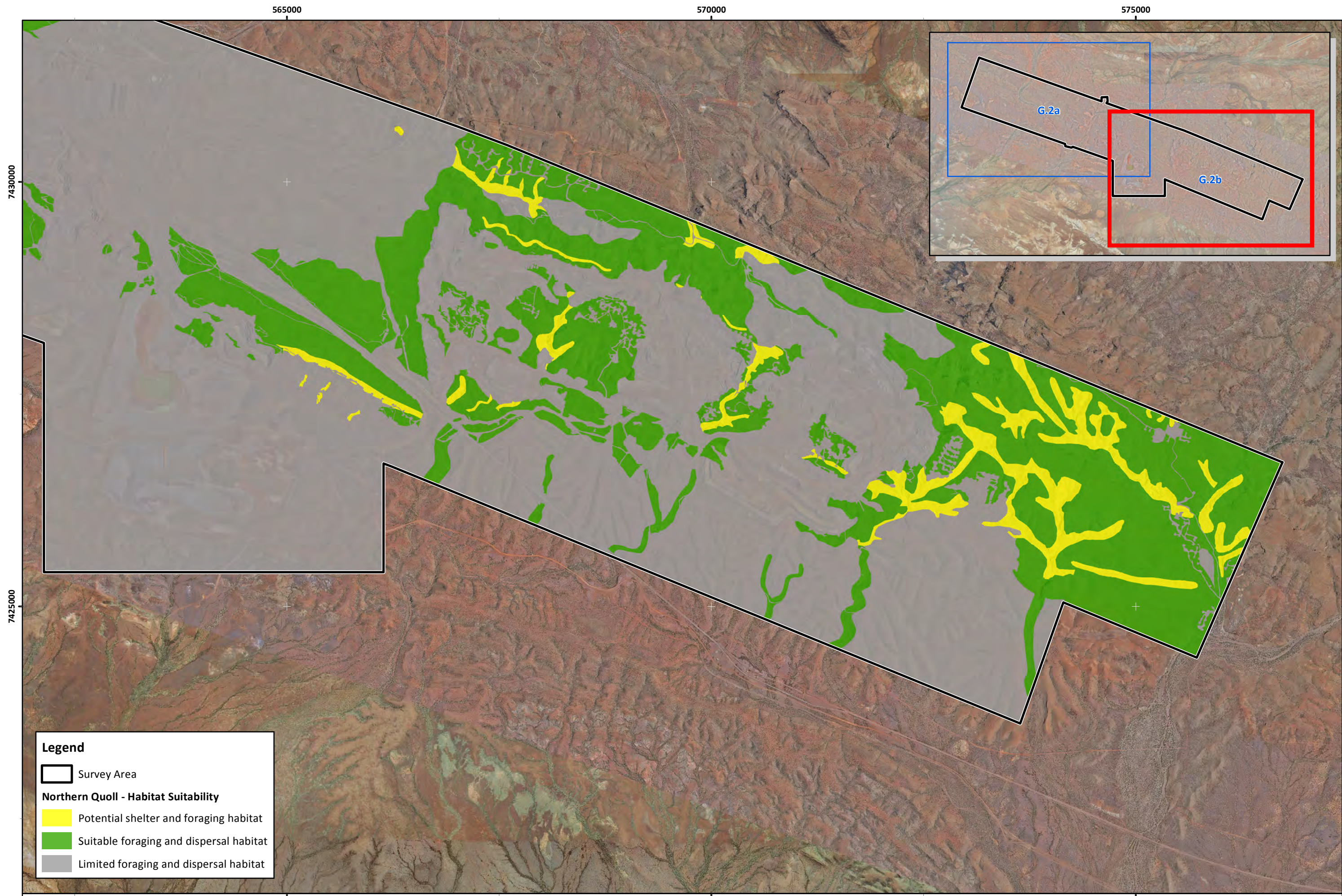
Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



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Figure Ref: 14283-18-BIDR-2RevB_180817_FigG02a_NQ



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Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.2b: Northern Quoll habitat suitability mapping

Author: J. Trainer

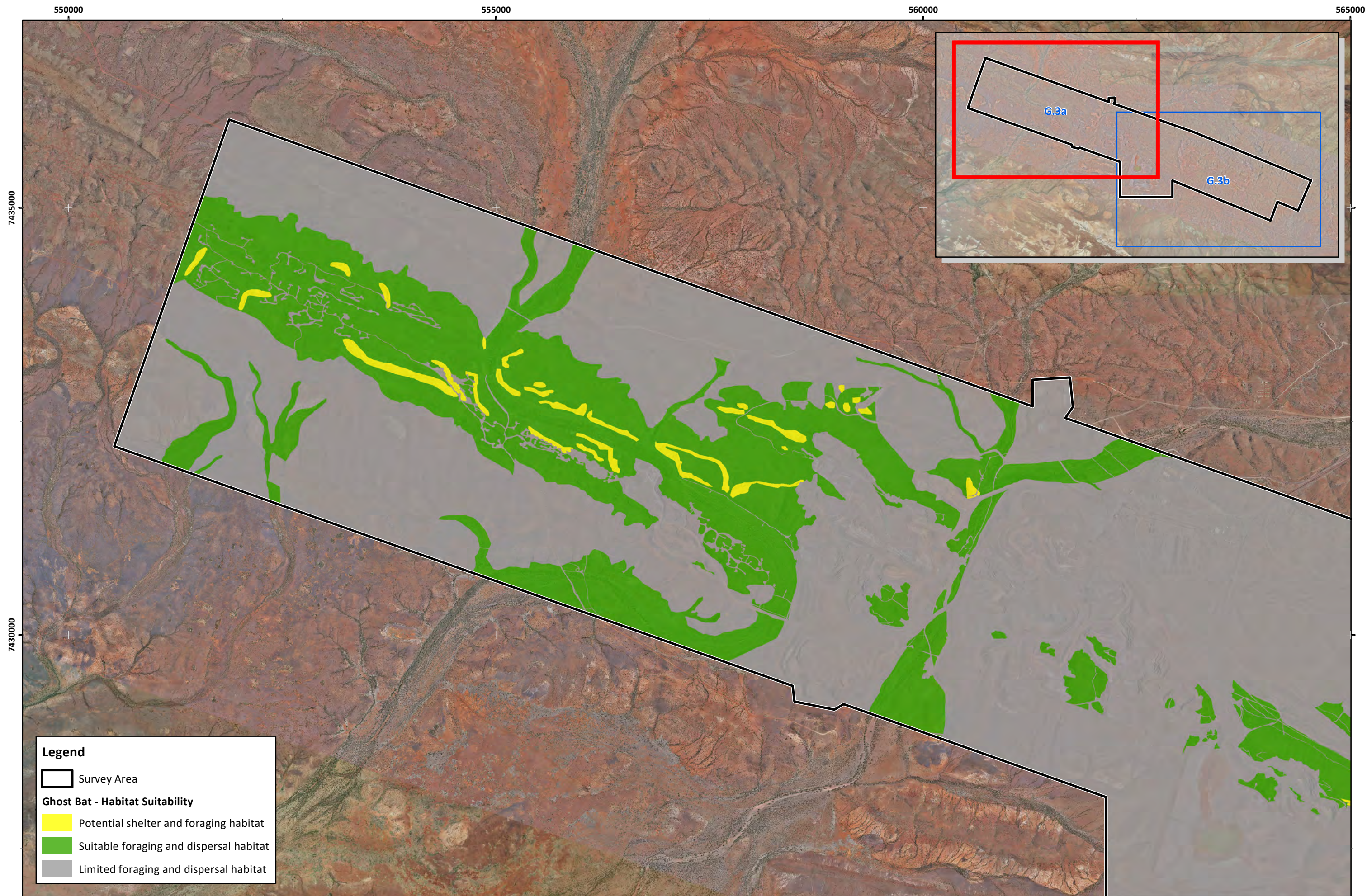
Drawn: C. Dyde

Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



Figure Ref: 14283-18-BIDR-2RevB_180817_FigG02b_NQ



Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

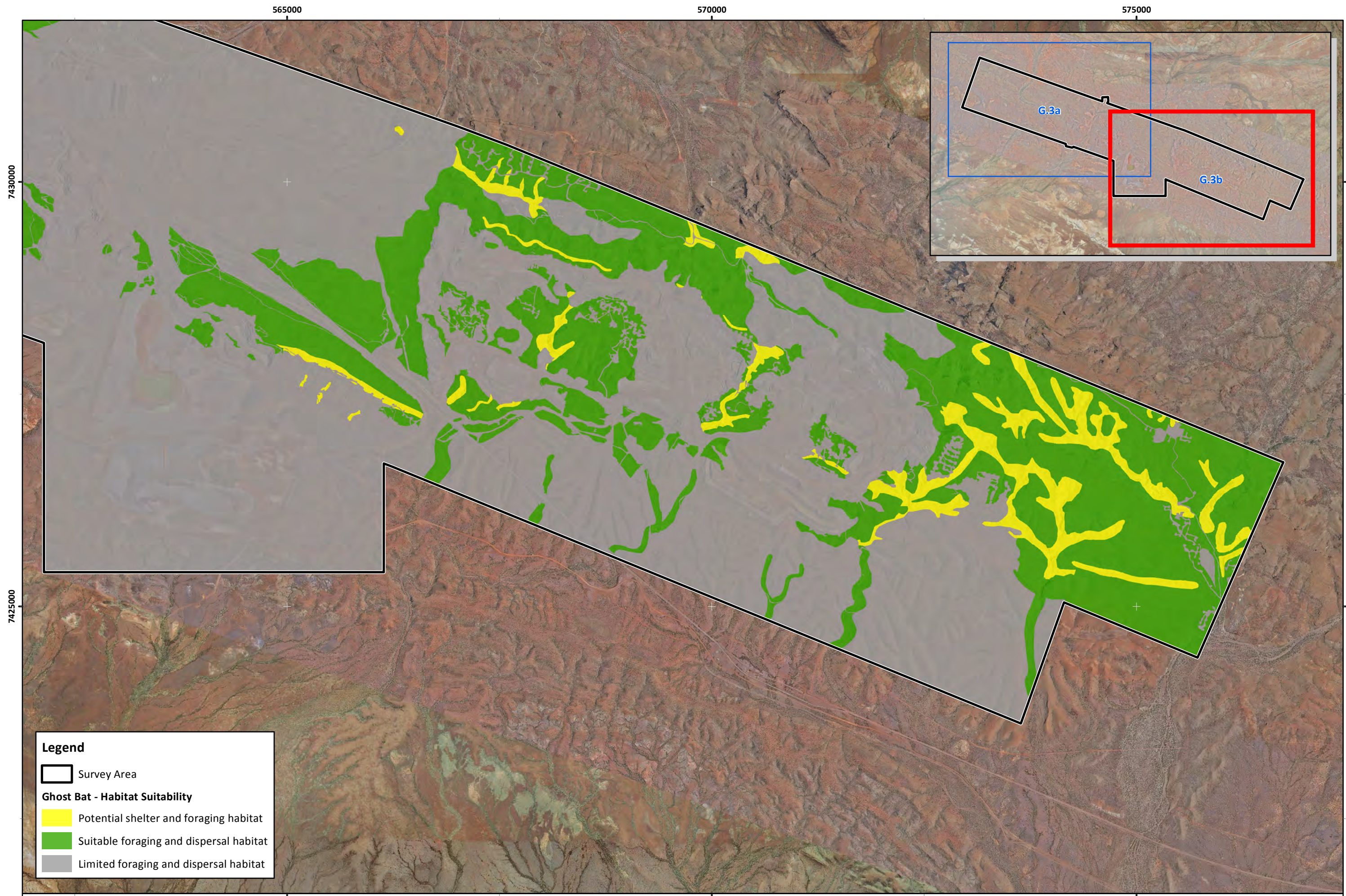
Figure G.3a: Ghost Bat habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

Date: 17-08-2018

Figure Ref: 14283-18-BIDR-2RevB_180817_FigG03a_GB



Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.3b: Ghost Bat habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

Date: 17-08-2018

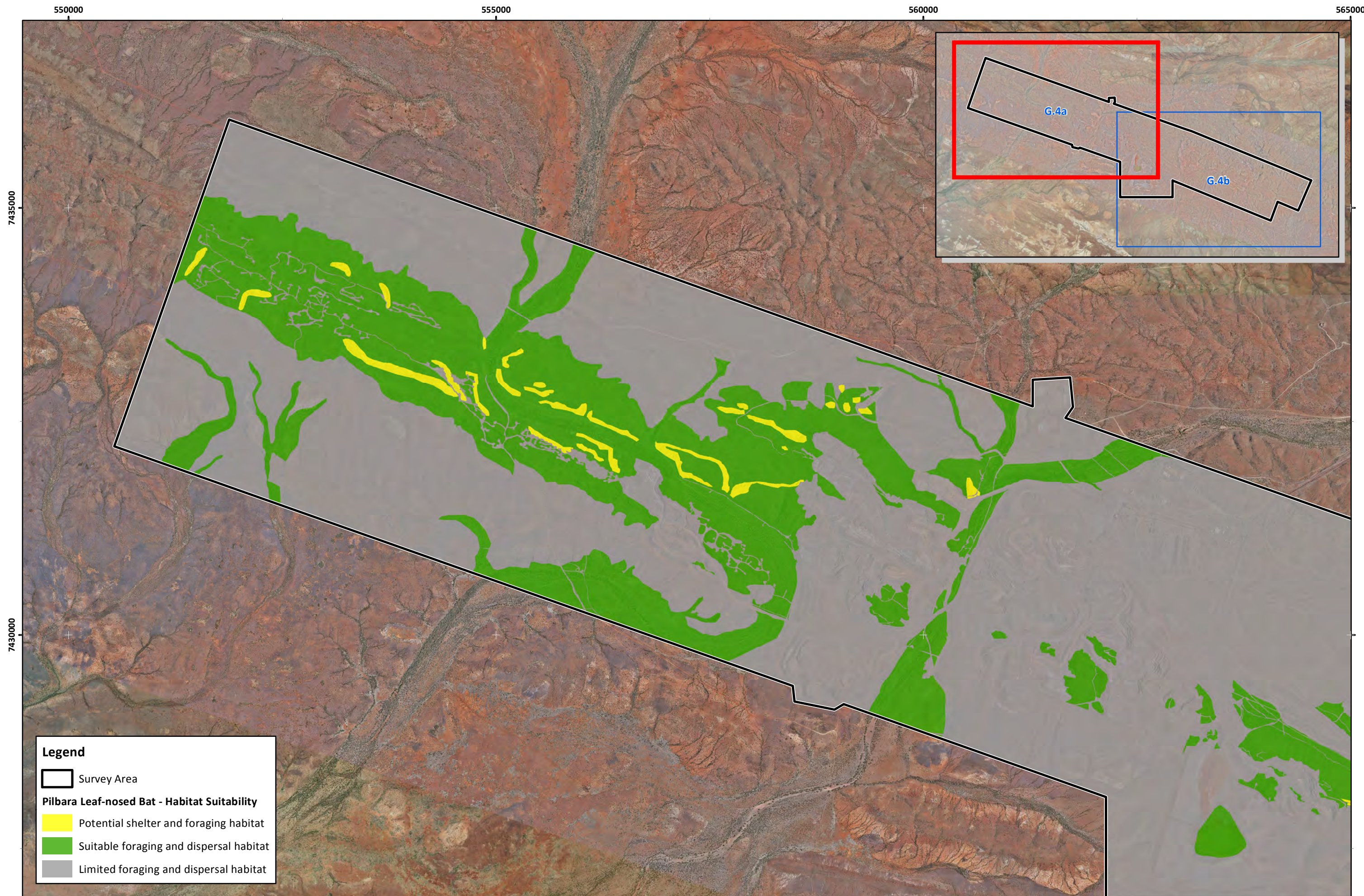
Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 Metres



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Figure Ref: 14283-18-BIDR-2RevB_180817_FigG03b_GB



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Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.4a: Pilbara Leaf-nosed Bat habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

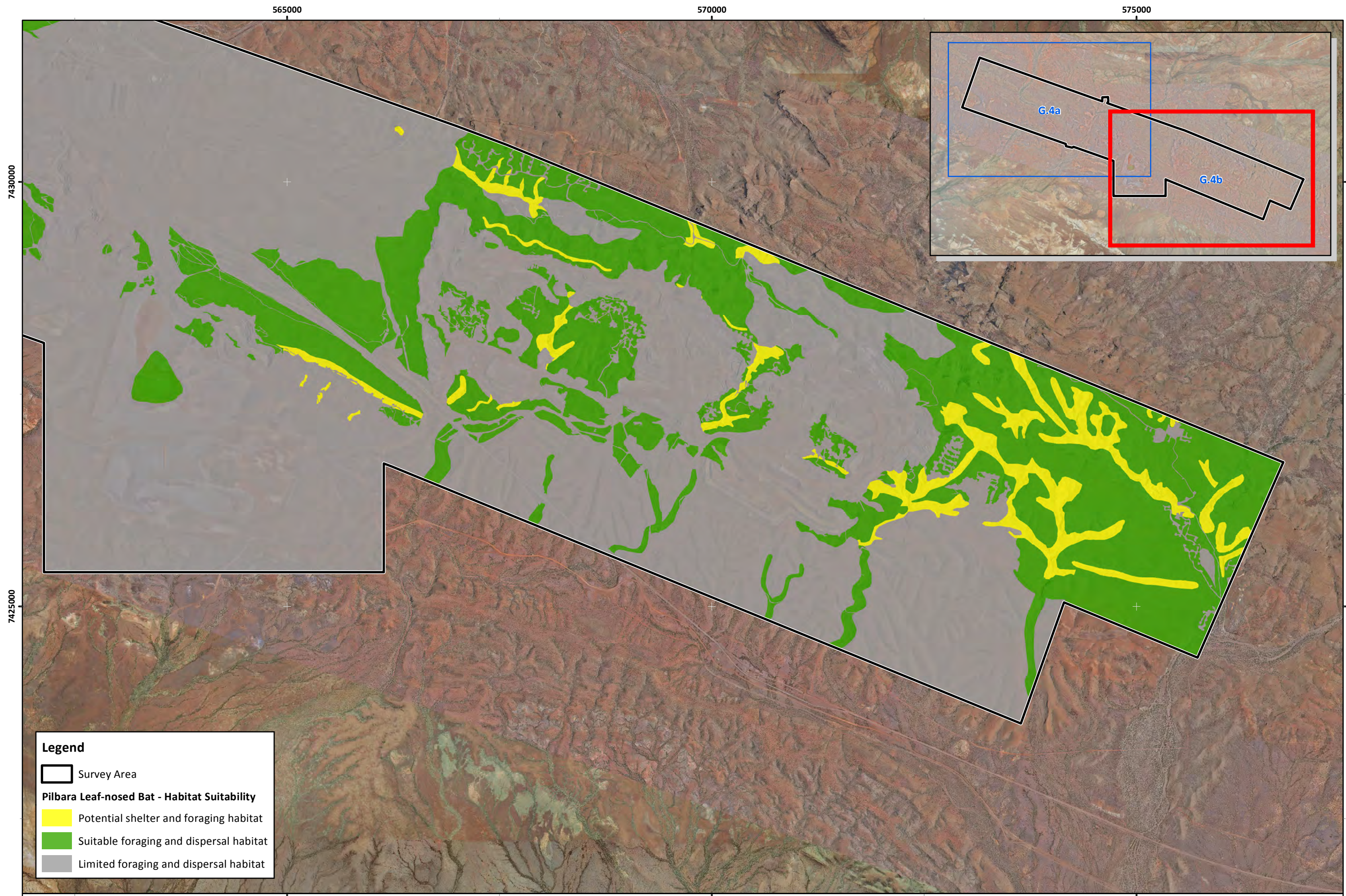
Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



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Figure Ref: 14283-18-BIDR-2RevB_180817_FigG04a_PLNB



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Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.4b: Pilbara Leaf-nosed Bat habitat suitability mapping

Author: J. Trainer

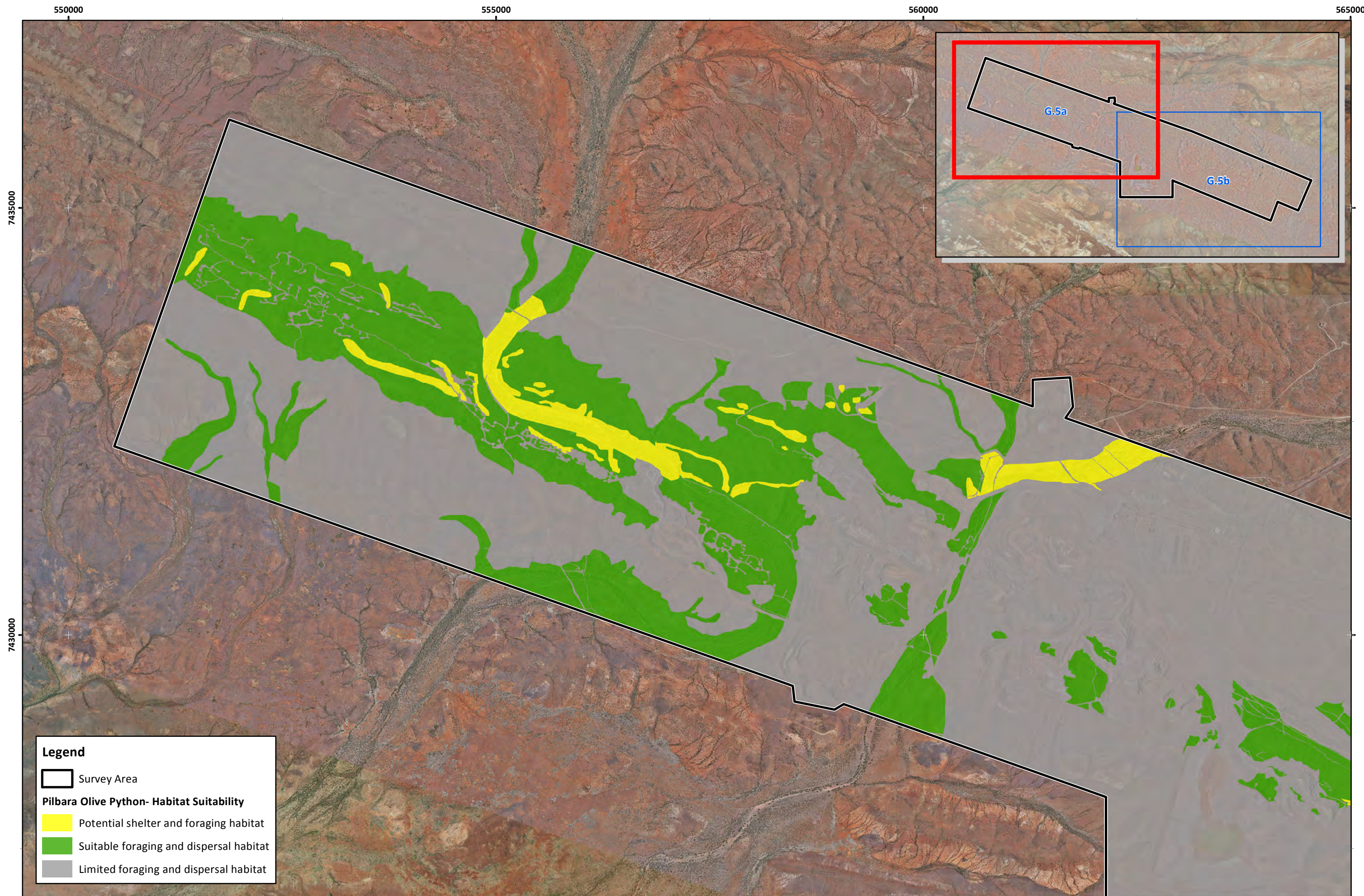
Drawn: C. Dyde

Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
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Figure Ref: 14283-18-BIDR-2RevB_180817_FigG04b_PLNB



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Greater Paraburdoo Level 2 Fauna Survey, April 2018

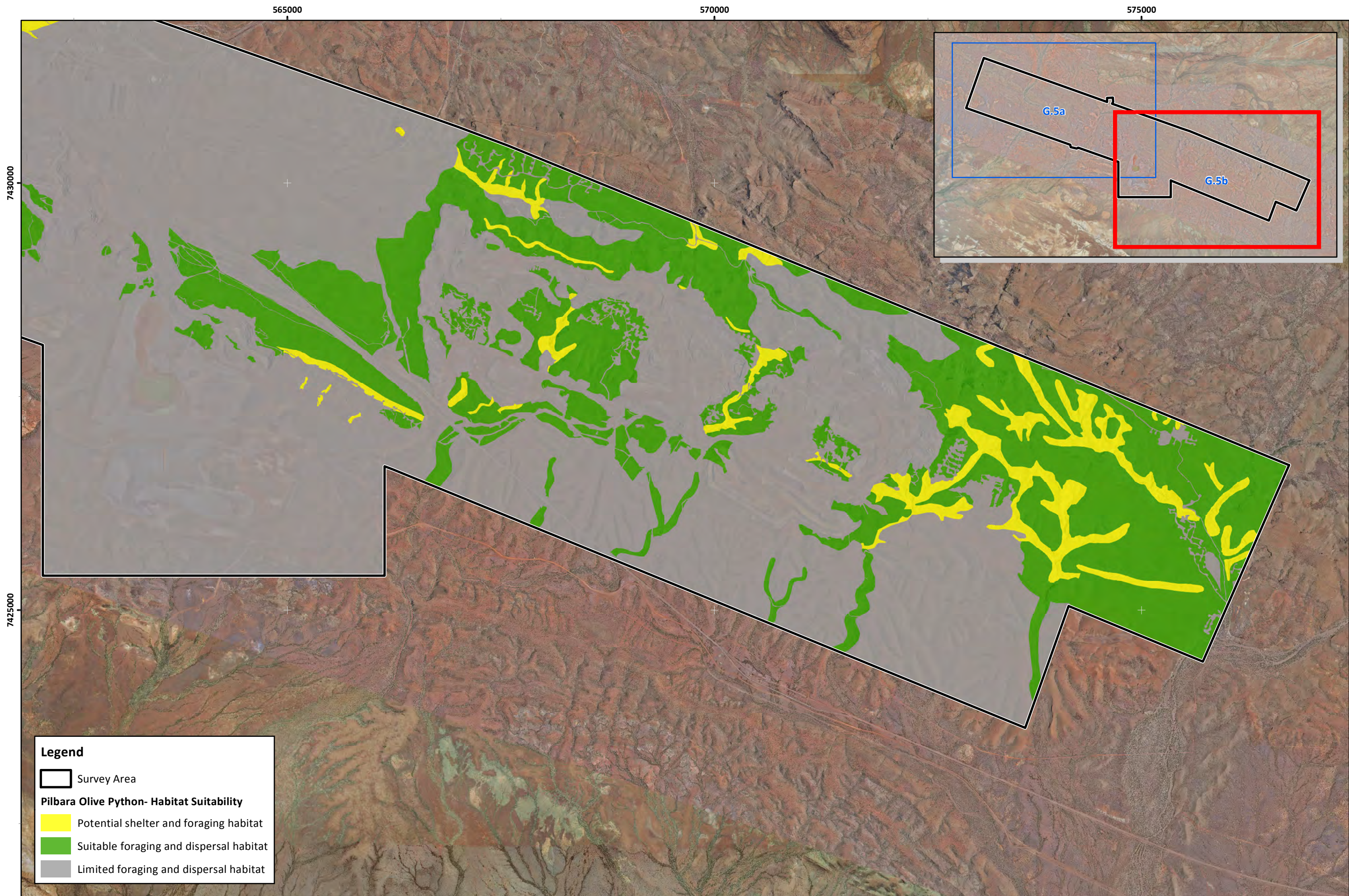
Figure G.5a: Pilbara Olive Python habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

Date: 17-08-2018

Figure Ref: 14283-18-BIDR-2RevB_180817_FigG05a_POP



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Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.5a: Pilbara Olive Python habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



Figure Ref: 14283-18-BIDR-2RevB_180817_FigG05b_POP



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Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure G.6a: Night Parrot habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

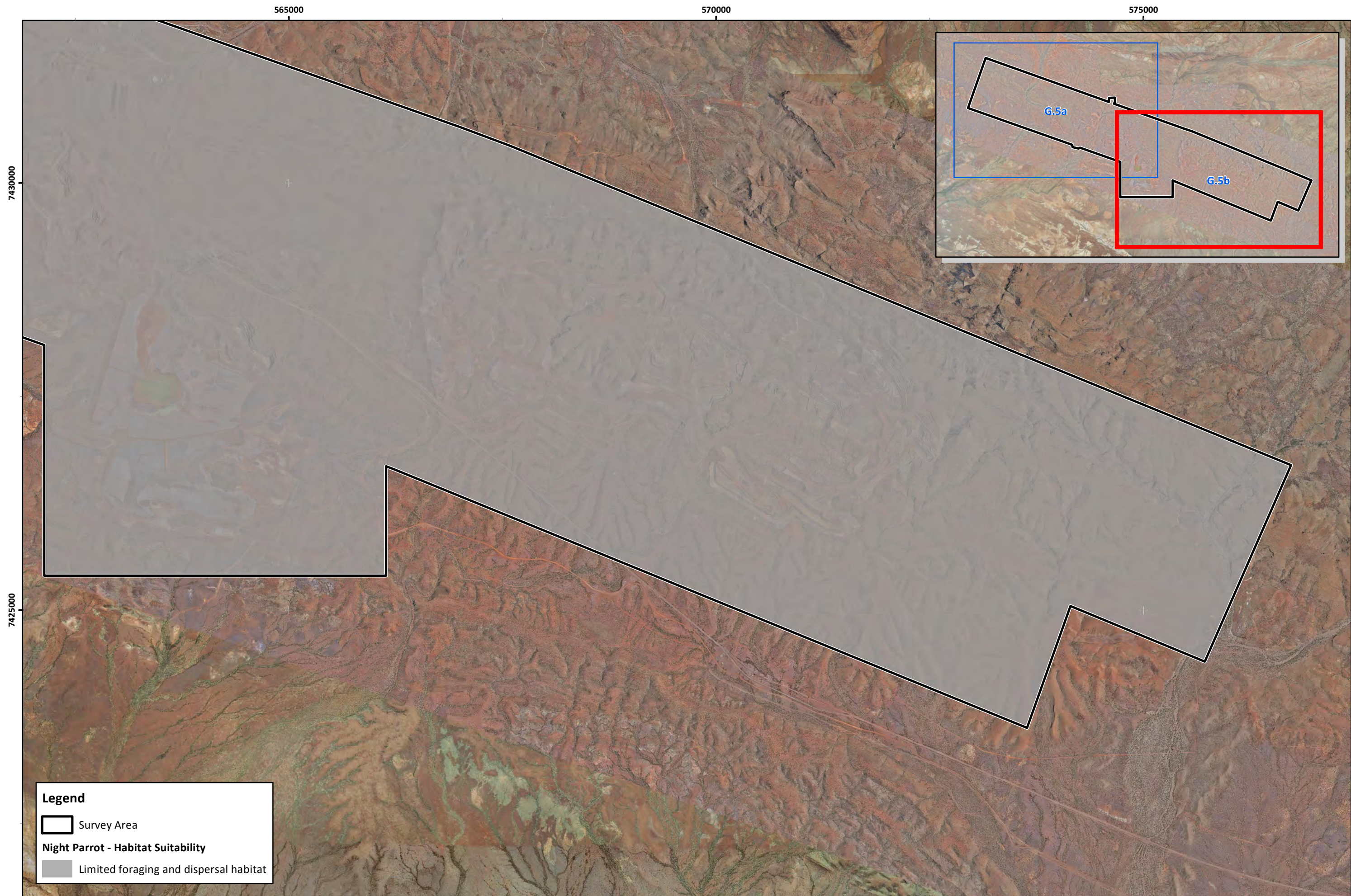
Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50


0 500 1,000 1,500 2,000 Metres




Figure Ref: 14283-18-BIDR-2RevB_180817_FigG06a_NP



Legend

 Survey Area

Night Parrot - Habitat Suitability

 Limited foraging and dispersal habitat

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Greater Paraburdoo Level 2 Fauna Survey, April 2018

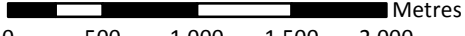
Figure G.6b: Night Parrot habitat suitability mapping

Author: J. Trainer

Drawn: C. Dyde

Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50



 Metres







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Figure Ref: 14283-18-BIDR-2RevB_180817_FigG06b_NP

Table G.1: Location of significant areas recorded during the Astron field surveys.

Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
Ratty Springs	555003	7433288	Permanent water pools, likely to support MNES bat species and other conservation significant fauna species.	
Seven Mile Creek	561755	7431933	Semi-permanent water pools, likely to support MNES bat species and other conservation significant fauna species.	

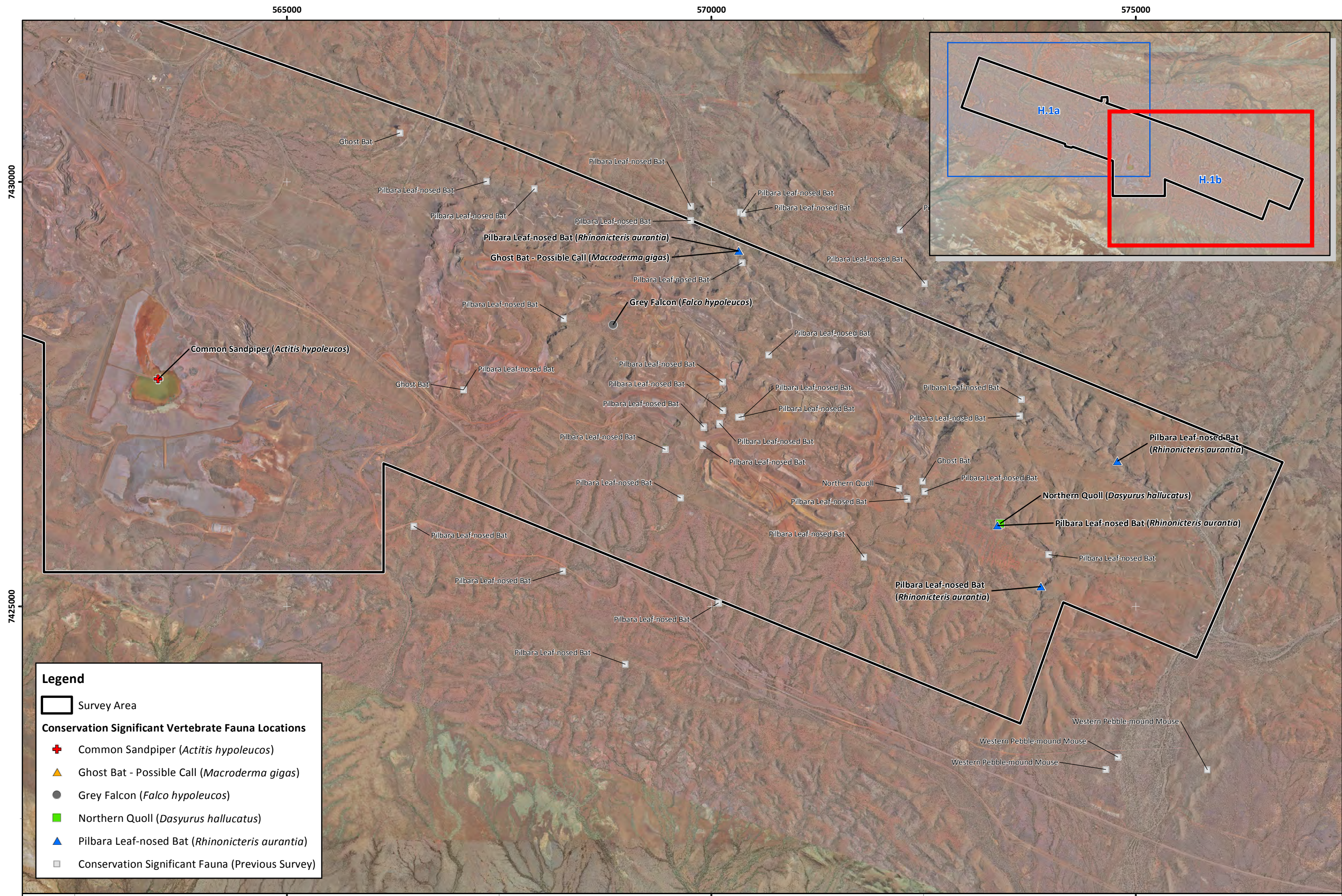
Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
Eastern Range Gorge	570175	7427207	Ephemeral water pools, likely to support MNES bat species, SRE species and other conservation significant fauna species.	
Eastern Range Gorge	575464	7426216	Ephemeral water pools, likely to support MNES bat species, SRE species and other conservation significant fauna species.	

Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
Eastern Range Gorge	573613	7425931	Ephemeral water pools, likely to support MNES bat species, SRE species and other conservation significant fauna species.	
Mount Misery Access track Gorge	569793	7429360	South facing gorge system that contains caves, overhangs, dense vegetation, substantial amounts of leaf litter and provides a refuge for moisture. Habitat is likely to support MNES bat species, SRE species and other conservation significant fauna species.	

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Appendix H: Conservation Listed and SRE Fauna Locations

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Legend

Survey Area

Conservation Significant Vertebrate Fauna Locations

- Common Sandpiper (*Actitis hypoleucos*)
- Ghost Bat - Possible Call (*Macroderma gigas*)
- Grey Falcon (*Falco hypoleucos*)
- Northern Quoll (*Dasyurus hallucatus*)
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)
- Conservation Significant Fauna (Previous Survey)

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Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure H.1b: Previous and current conservation significant vertebrate fauna locations

Author: J. Trainer

Drawn: C. Dyde



Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres

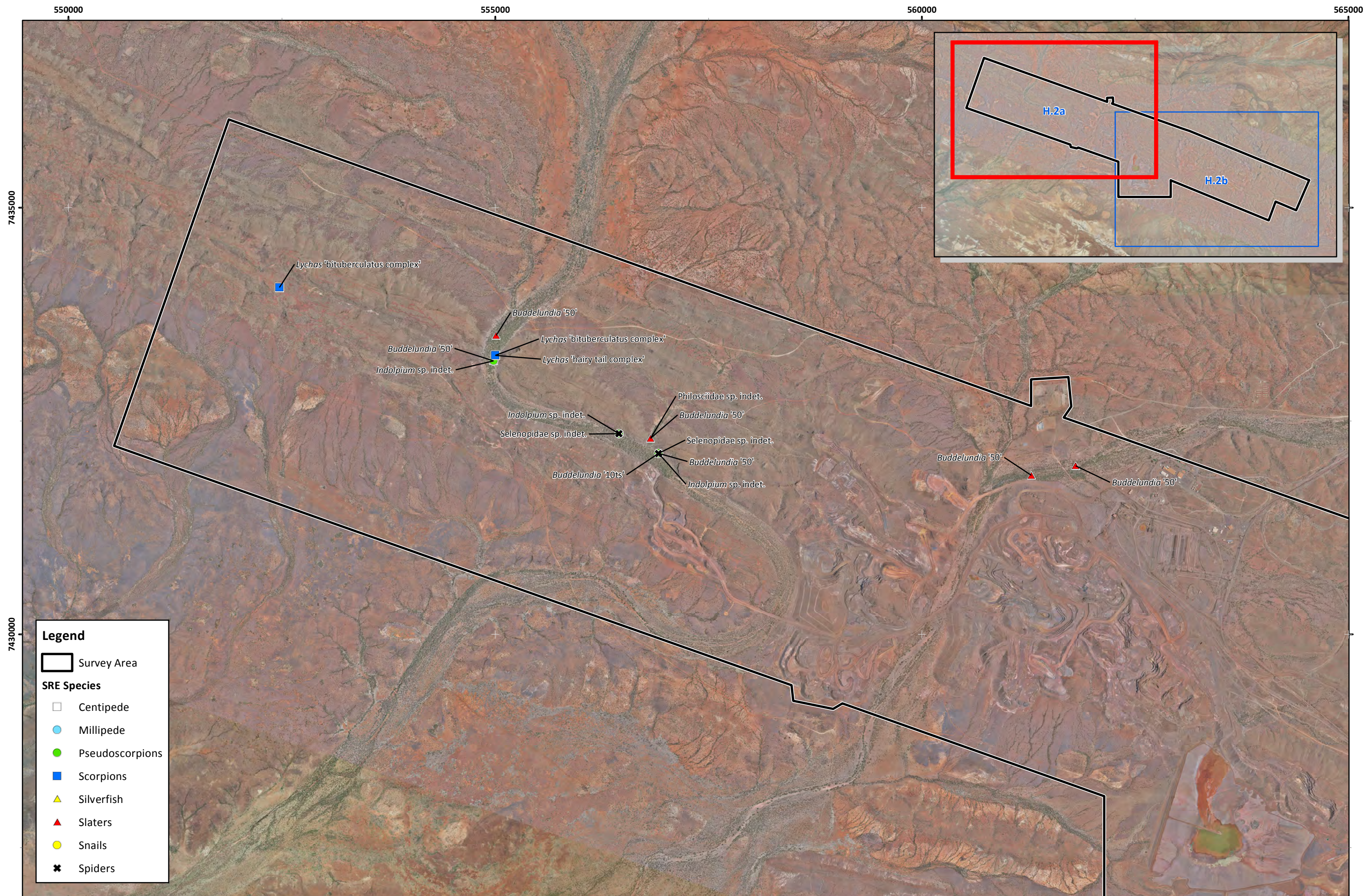


Figure Ref: 14283-18-BIDR-2RevB_180817_FigH01b_FaunaSites

Table H.1: Locations of vertebrate conservation listed species recorded during the current survey.

Species name (common name)	Status	Site ID	MGA Zone 50 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
Birds							
<i>Falco hypoleucos</i> (Grey Falcon)	VU	Communications Tower	568841	7428317	One adult and a fledged juvenile (2)	Cleared	No Photo
<i>Actitis hypoleucos</i> (Common Sandpiper)	Mi / IA	Tailings Dam	563484	7427675	Individual (1)	Tailings Dam	No Photo
Mammals							
<i>Dasyurus hallucatus</i> (Northern Quoll)	EN / EN	QS1	573402	7425974	Scat	Gorge	
		QS2	551522	7434331	Scat	Breakaway	

Species name (common name)	Status	Site ID	MGA Zone 50 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
<i>Rhinonicteris aurantia</i> (Pilbara Leaf-nosed Bat)	VU / VU	BAT1	570321	7429185	Acoustic recording (12)	Gorge	No photo
		BAT4	559872	7429811	Acoustic recording (1)	Drainage Line	
		BAT6	557671	7433147	Acoustic recording (3)	Drainage Line	
		BAT7	561897	7431989	Acoustic recording (3)	Riverine	
		BAT13	573371	7425951	Acoustic recording (7)	Gorge	
		BAT14	573883	7425233	Acoustic recording (6)	Gorge	
		BAT15	574783	7426711	Acoustic recording (9)	Gorge	
<i>Macroderma gigas</i> (Ghost Bat)	VU / VU	BAT1	570321	7429185	Acoustic recording (2 possible)	Breakaway	No photo



Rio Tinto
Greater Paraburdoo Level 2 Fauna Survey, April 2018

Figure H.2a: Potential SRE Locations

Author: J. Trainer

Drawn: C. Dyde

Date: 17-08-2018

Coordinate System: GDA 1994 MGA Zone 50
0 500 1,000 1,500 2,000 Metres



Figure Ref: 14283-18-BIDR-2RevB_180817_FigH02a_SRE

Table H.2: Locations of Potential SRE species recorded during the current survey.

Species	WAM SRE Category	Site(s)	Landform	MGA Zone 50 K		Status
				Easting (mE)	Northing (mE)	
Spiders						
Selenopidae sp. indet.	Potential SRE – Data Deficient	GP07	Low Hill	571937	7425173	This group is known to contain SREs and or potential SRE species.
		GP08	Gorge	575464	7426216	
		GP09	Gorge	573613	7425931	
		SRE6	Breakaway	576251	7425769	
		SRE9	Gorge	573909	7425635	
		SRE11	Breakaway	556452	7432350	
		SRE13	Breakaway	556916	7432119	
		SRE14	Gorge	569785	7429460	
		SRE15	Gorge	570304	7429132	
		SRE16	Gorge	575209	7426344	
Pseudoscorpions						
Austrohorus sp. indet.	Potential SRE – Data Deficient	SRE2	Gorge	570625	7429128	This group is known to contain SREs and or potential SRE species.
		SRE14	Gorge	569785	7429460	
		SRE17	Gorge	575791	7426252	
Indolpium 'long chela hand'	Potential SRE – Data Deficient	SRE2	Gorge	570625	7429128	This group is known to contain SREs and or potential SRE species.
		SRE6	Breakaway	576251	7425769	
Indolpium sp. indet.	Potential SRE – Data Deficient	GP08	Gorge	575464	7426216	This group is known to contain SREs and or potential SRE species.
		SRE5	Riverine	554980	7433204	
		SRE11	Breakaway	556452	7432350	
		SRE13	Breakaway	556916	7432119	
Scorpions						
Lychas 'hairy tail complex'	Potential SRE – Data Deficient	GP05	Drainage Line	575727	7426094	While members of these complexes are known from most of the Pilbara, some of the ‘species’ contained within these complexes appear to be range restricted.
		GP08	Gorge	575464	7426216	
		SRE9	Gorge	573909	7425635	
		SRE14	Gorge	569785	7429460	
		SRE15	Gorge	570304	7429132	
		SRE17	Gorge	575791	7426252	
		Opp	Riverine	555001	7433270	
Lychas 'aitkeni complex'	Potential SRE – Data Deficient	GP06	Low Hill	569979	7425957	While members of these complexes are known from most of the Pilbara, some of the ‘species’ contained within these complexes appear to be range restricted.
		GP07	Low Hill	571937	7425173	

Species	WAM SRE Category	Site(s)	Landform	MGA Zone 50 K		Status
				Easting (mE)	Northing (mE)	
<i>Lychas</i> 'bituberculatus complex'	Potential SRE – Data Deficient	GP03	Rocky Hill	552472	7434066	While members of these complexes are known from most of the Pilbara, some of the 'species' contained within these complexes appear to be range restricted.
		GP05	Drainage Line	575727	7426094	
		GP07	Low Hill	571937	7425173	
		SRE3	Gorge	575082	7426496	
		SRE14	Gorge	569785	7429460	
		SRE17	Gorge	575791	7426252	
		Opp	Riverine	555001	7433270	
<i>Lychas</i> sp. indet.	Potential SRE – Data Deficient	GP05	Drainage Line	575727	7426094	While members of these complexes are known from most of the Pilbara, some of the 'species' contained within these complexes appear to be range restricted.
		GP07	Low Hill	571937	7425173	
Centipedes						
<i>Mecistocephalus</i> sp. indet.	Potential SRE – Data Deficient	GP05	Drainage Line	575727	7426094	Poor taxonomic resolution of genus and is suspected of containing potential SRE species.
		GP08	Gorge	575464	7426216	
<i>Orphnaeus</i> sp. indet.	Potential SRE – Data Deficient	SRE14	Gorge	569785	7429460	Poor taxonomic resolution of genus and is suspected of containing potential SRE species.
<i>Cryptops</i> sp. indet.	Potential SRE – Data Deficient	SRE14	Gorge	569785	7429460	Poor taxonomic resolution of genus and is suspected of containing potential SRE species.
Millipedes						
<i>Austrostrophus</i> sp. indet.	Potential SRE – Data Deficient	GP06	Low Hill	569979	7425957	A single species is currently described for this genus, however unpublished data from the WA Museum indicates the presence of more than one species.
		SRE14	Gorge	569785	7429460	
		SRE15	Gorge	570304	7429132	
		SRE16	Gorge	575209	7426344	
Silverfish						
<i>Trinemura</i> sp. indet.	Potential SRE – Data Deficient	SRE17	Gorge	575791	7426252	Members belonging to this family are frequently classified as SRE when sampled from subterranean habitats and rarely collected from epigean surveys of the Pilbara.
Snails						
<i>Bothriembryon</i> 'Pilbara'	Potential SRE – Data Deficient	SRE15	Gorge	570304	7429132	The taxonomy of <i>Bothriembryon</i> in the Pilbara is complex and heavily reliant on DNA sequence data.
		Opp	Gorge	570700	7429035	

Species	WAM SRE Category	Site(s)	Landform	MGA Zone 50 K		Status
				Easting (mE)	Northing (mE)	
Slaters						
<i>Buddelundia</i> '10ts'	Potential SRE – Data Deficient	SRE4	Riverine	555468	7432555	This specimen is representative of a species complex containing one or more suspected SRE species.
		SRE13	Breakaway	556916	7432119	
<i>Buddelundia</i> '47TS'	Potential SRE – Data Deficient	GP05	Drainage Line	575727	7426094	This specimen is representative of a species complex containing one or more suspected SRE species.
		GP06	Low Hill	569979	7425957	
		GP07	Low Hill	571937	7425173	
		GP08	Gorge	575464	7426216	
<i>Buddelundia</i> '50'	Potential SRE – Data Deficient	Opp	Riverine	555013	7433502	This species is known from a restricted distribution in poorly surveyed areas.
		GP05	Drainage Line	575727	7426094	
		GP06	Low Hill	569979	7425957	
		GP08	Gorge	575464	7426216	
		GP09	Gorge	573613	7425931	
		SRE3	Gorge	575082	7426496	
		SRE5	Riverine	554980	7433204	
		SRE6	Breakaway	576251	7425769	
		SRE7	Riverine	561285	7431862	
		SRE8	Riverine	561802	7431974	
		SRE9	Gorge	573909	7425635	
		SRE12	Riverine	556819	7432296	
		SRE13	Breakaway	556916	7432119	
		SRE14	Gorge	569785	7429460	
		SRE15	Gorge	570304	7429132	
		SRE16	Gorge	575209	7426344	
<i>Buddelundiinae</i> sp. indet	Potential SRE – Data Deficient	SRE1	Gorge	567216	7430100	This specimen is representative of a species complex containing one or more suspected SRE species.
		SRE14	Gorge	569785	7429460	
<i>Barrowdillo</i> '4'	Potential SRE – Data Deficient	SRE15	Gorge	570304	7429132	This species is known from a restricted distribution in poorly surveyed areas.
<i>Philosciidae</i> sp. indet.	Potential SRE – Data Deficient	SRE12	Riverine	556819	7432296	This specimen is representative of a species complex containing one or more suspected SRE species.

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Appendix I: Bat Call WA Pty Ltd Report

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**Rio Tinto,
Greater Paraburdoo, Pilbara WA,
July 2017 and April 2018**

Acoustic Survey of Bat and Night Parrot Activity.

Prepared for Astron Environmental Services

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Document Revision History

Issue	Date	Revision History
A	12 Aug 2017	Initial draft prepared for Astron review
1	31 Aug 2017	First formal issue
2	3 Oct 2017	Second Issue
3	3 May 2018	Third Issue including Phase 2 results and client comments.

Summary

Bat and Night Parrot (*Pezoporus occidentalis*) presence, with an estimate of activity level, is presented for twenty sites in the greater Paraburdoo area, in the Pilbara, WA. Astron Environmental Services (Astron) carried out an echolocation based survey in two phases during July 2017 and April 2018. Eight sites were reviewed for ultrasonic bat calls in each phase. Bat Call WA has reviewed the recordings made and provided species lists and activity levels for the bats present. Bat Call has also reviewed recordings from four sites targeting Night Parrot calls.

Ten species of echolocating bats were confirmed present including one of two EPBC Act listed species in the Pilbara, the Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) (PLNb). PLNb calls were detected in low numbers at seven sites. Two possible calls of the other EPBC Act listed species, Ghost bat (*Macroderma gigas*) were recorded at a breakaway (site BAT1) in July 2017. A summary of PLNb call numbers and timing is provided. Activity levels for the common species are provided by site.

No Night Parrot calls were detected

Habitats

The sites for the survey were chosen by Astron. Details of the sites are presented in table 1. All sites are in the greater Paraburdoo area. Of the bat sites, five are on breakaways, four are in gorges, four are on drainage lines, two are on rocky hill sites and one is in a riverine area. Three of the Night Parrot sites are on stony plains while the fourth is on a low hill. The locations are shown in relation to local features in figure 1.

Characteristics of the bat calls recorded are presented in table 2.

Results of bat fauna survey

An assemblage of ten echolocating bat species was confirmed as present at the study sites including the PLNb, table 4. Species activity levels were low to very high, which is expected for the study area habitat and the times of year, see criteria below.

PLNb were detected at seven sites, three gorges, two drainage line sites, one breakaway and the riverine site. All detections were in low numbers indicating foraging bats away from their roost. Three sites surrounding the Paraburdoo mine pit complex are within five kilometres of the known Ratty Spring PLNb roost. Four sites to the north and east of the Eastern Range pit complex are within 5 kilometres of the East Paraburdoo PLNb roost inferred from earlier echolocation data and believed to be located north of the pit complex (author's and Astron's unpublished data).

Two possible calls of the Ghost bat were recorded at a breakaway site BAT1 in July 2017.

Five common species, *Chalinolobus gouldii*, *Chaerephon jobensis*, *Scotorepens greyii*, *Taphozous georgianus* and *Vespadelus finlaysoni* dominated bat presence in the area. In addition, *Austronomus australis* was widespread during the July 2017 survey which is expected for this species in the Pilbara uplands during the winter months (Bullen and McKenzie 2005).

Taxonomy presented herein is after Reardon *et al.* (2014) and Jackson and Groves (2015).

Results of Night Parrot survey.

No Night Parrot calls were detected

Timing, Moon Phase and Weather

The echolocation surveys were conducted between 25th to 30th July 2017 and 9th to 14th April 2018.

July sampling evenings were cool and dry with minimum overnight temperatures around 10°C. No rain fell during this phase. The moon in this period was new to first quarter. April sampling evenings were warm and dry with minimum overnight temperatures between 20 and 25°C. No rain fell during this phase. The moon in this period was last quarter to new.

Survey Team

Sites were chosen and detectors placed by Astron ecologists. Bob Bullen of Bat Call WA completed analysis of audio and echolocation recordings.

Sampling

The survey consisted of completing a total of thirty eight overnight bat sound recordings, beginning at twilight, at eight locations within the survey area. A total of ten acoustic survey nights were completed at four sites for Night Parrot. The recordings were “continuous” (Hyder *et al.* 2010) made using ultrasonic SM2BAT+ SongMeter and acoustic SM4A SongMeter (both by Wildlife Acoustics Inc, USA) detectors. The jumper and audio settings used followed the manufacturer’s recommendations contained in the user manuals.

For the ultrasonic recordings, once reformatted as .wav files, COOL EDIT 2000 (now available as AUDITION from Adobe Systems Inc.) was used to display each sequence for identification. Calls were identified manually. Only good quality call sequences were used. Details of calls analysed are provided in Table 2 as recommended by Australasian Bat Society (ABS 2006). Reference data for the species identified are available in Bullen and McKenzie 2002, McKenzie and Bullen 2003 and McKenzie and Bullen 2009.

Bat activity was then characterised as “Low”, “Medium” , “High” or “Very High” based on the rate of call sequences recorded.

- Low species activity is referred when a species is recorded with call spacing less often than ten minutes,
- Medium species activity refers to call recordings more often than 10 minutes but less often than two minutes apart for a at least an hour followed by sporadic records for the remainder of the session.
- High species activity refers to call recording more often than two minutes apart for at least two hours followed by reasonably regular records for the remainder of the session.
- Very High species activity refers to call recording more often than two minutes apart for at least four hours followed by regular records for the remainder of the session.

For the acoustic recordings, each was reviewed both manually and using an automatic scan technique for Night Parrot calls. Candidate calls were compared with the author’s confirmed reference calls from two Western Australian arid zone locations.

Survey Limitations

The sites surveyed were accessible on foot and the detectors, using omnidirectional microphones, were set on the ground with the microphone horizontal. Species are unlikely to be under-represented as a result.

Bat species density away from cave or adit entrances is impossible to estimate from echolocation records. Bat activity is therefore substituted as an approximate guide to the relative numbers of each species using the study area.

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Table 1 Microbat Site Specific details.

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 1					
BAT1	26-30 July	Five overnight recordings using SM2 SN 13975	Breakaway	570321	7429185
BAT2	26-30 July	Five overnight recordings using SM2 SN 14546	Gorge	570623	7429132
BAT3	25-26 July	Two overnight recordings using SM4 0043	Breakaway	551526	7434320
BAT4	27-28 July	Two overnight recordings using SM4 0043	Drainage line	559872	7429811
BAT5	29-30July	Two overnight recordings using SM4 0043	Drainage line	576002	7425343
BAT6	25-26 July	Two overnight recordings using SM2 12791	Drainage line	557671	7433147
BAT7	27-28 July	Two overnight recordings using SM2 12791	Riverine	561897	7431989
BAT8	29-30July	Two overnight recordings using SM2 12791	Drainage line	575700	7425994
Phase 2					
BAT9	9-10 April	Two overnight recordings using SM2 SN 11793	Breakaway	552154	7434641
BAT10	13-14 April	Two overnight recordings using SM2 SN 11793	Rocky hill	567081	7430488
BAT11	11-12 April	Two overnight recordings using SM2 SN 11793	Breakaway	569816	7429479
BAT12	12-13 April	Two overnight recordings using SM2 SN 7566	Rocky hill	573345	7426713
BAT13	9-10 April	Two overnight recordings using SM2 SN 15337	Gorge	573371	7425951
BAT14	12-13 April	Two overnight recordings using SM2 SN 12791	Gorge	573883	7425233
BAT15	9-10 April	Two overnight recordings using SM2 SN 7566	Gorge	574783	7426711
BAT16	9-10 April	Two overnight recordings using SM2 SN 12791	Breakaway	576217	7425801

Note 1: Coordinates are Zone 50K

Table 2 Night Parrot Site Specific details.

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 2					
NP SM1	9-11 April	Three overnight recordings using SM4A SN 4717	Stony plain	552263	7432603
NP SM2	12-13 April	Two overnight recordings using SM4A SN 5295	Stony plain	552769	7435100
NP SM3	12-13 April	Two overnight recordings using SM4A SN 4717	Low hill	554523	7434738
NP SM4	9-11 April	Three overnight recordings using SM4A SN 5295	Stony plain	554773	7431719

Note 1: Coordinates are Zone 50K

Table 3: Summary of Echolocation call characteristics for microbat species present.

Genus species Authority	Common name	Typical F_{peak} kHz Note 1	Ave. Q Note 1	Typical Duration msec	Typical Call Shape
<i>Austronomus australis</i> (Gray 1838) Note 2	White-striped free-tailed bat	12	7	12 - 23	CF– shallow FM
<i>Chaerephon jobensis</i> (Miller 1902)	Northern free-tailed bat	22	5	8 - 15	Shallow FM
<i>Chalinolobus gouldii</i> (Grey 1841)	Gould’s wattled bat	32	10	7 - 11	FM
<i>Macroderma gigas</i> (Dobson 1880)	Ghost bat	20 – 52 variable	2 – 20 variable	variable	Complex FM
<i>Nyctophilus geoffroyi</i> Leach 1821	Lesser long-eared bat	48	3	5	Steep FM
<i>Ozimops lumsdenae</i> Reardon <i>et al.</i> 2014	Northern free-tailed bat	26	10	8 - 13	Shallow FM
<i>Rhinonictis aurantia</i> (Gray 1845)	Pilbara leaf-nosed bat	120	30	5 - 8	CF
<i>Saccolaimus flaviventris</i> (Peters 1867)	Yellow-bellied sheath-tailed bat	18	9	12 - 21	CF - FM
<i>Scotorepens greyii</i> (Gray 1843)	Little broad-nosed bat	38	10	7 - 13	FM
<i>Taphozous georgianus</i> Thomas 1915	Common sheath-tailed bat	24.5	14	9 - 18	CF– shallow FM
<i>Vespadelus finlaysoni</i> (Kitchener, Jones and Caputi 1987)	Inland cave bat	55	14	4 - 8	FM

Note 1: F_{peak} and Q are defined in McKenzie and Bullen 2003, 2009.

Note 2: Taxonomy follows Jackson and Groves (2015). *A. australis* was recently *Tadarida australis*. *O. lumsdenae* was recently *Mormopterus beccarii*.

Table 4. Survey microbat lists presented by site.

Site	<i>Austronomus australis</i>	<i>Chaerephon jobensis</i>	<i>Chalinolobus gouldii</i>	<i>Macroderma gigas</i>	<i>Nyctophilus geoffroyi</i>	<i>Ozimops lumsdenae</i>	<i>Rhinonicteris aurantia</i>	<i>Saccolaimus flaviventris</i>	<i>Scotorepens greyii</i>	<i>Taphozous georgianus</i>	<i>Vespadelus finlaysoni</i>
Phase 1 – July 2017				2 possible calls			Low (12 calls)		Low	Low	Med
BAT1	Low	Low	Low						Low	Low	Med
BAT2	Low	Low	Low			Low			Low	Low	Med
BAT3	Low	Low	Low			Low				High	Low
BAT4	Low	High	High		Low	Low	Low (1 call)	Low	Low	Low	Low
BAT5	Low	Low	Low							Low	Med
BAT6	Low		Med				Low (3 calls)	Low	Low	Low	High
BAT7		Med	High		Low		Low (3 calls)		Low	Low	Low
BAT8			Low							Low	Med
Phase 2 – April 2018											
BAT9		Low	Low			Low		Low	Low	Low	Low
BAT10		Low							Med	High	Low
BAT11			Low						Low	Low	Low
BAT12		Low	Low						Low	High	Low
BAT13		Low	Low				Low (7 calls)		High	High	Low
BAT14		Low	High				Low (6 calls)		Med	High	High
BAT15		Low	Low				Low (9 calls)		Low	High	V High
BAT16		Low	Low							V High	Med

Figure 1. Detector sites in relation to features in the study area. The orange pins denote sites where PLNb (Ra) were detected. PLNb call numbers and timing of the closest calls to civil twilight are also noted. Yellow pins denote sites where microbat calls were recorded but no PLNb were detected. Green pins denote sites where acoustic detectors were placed to record Night Parrot calls.

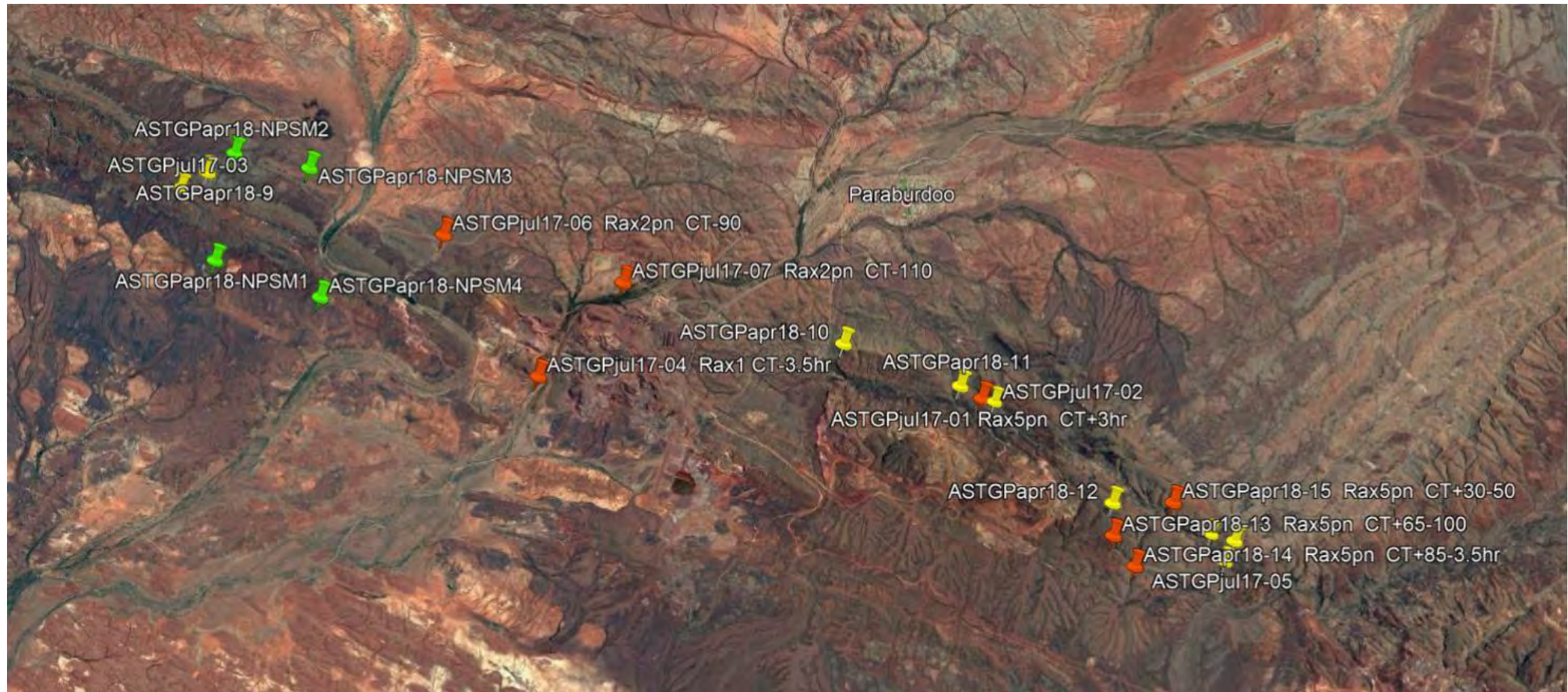


Figure 2. Temporal patterns of PLNb calls detected

