

Rio Tinto

Flora, Vegetation and Fauna Habitat Assessment at
Juna Downs

Native Vegetation Clearing Permit – Supporting Report



(RTIO-HSE-0284378)

Hamersley Iron Pty Limited (a member of the Rio Tinto Group)

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Rio Tinto

152-158 St George’s Terrace

PERTH WA 6000

EXECUTIVE SUMMARY

Rio Tinto Iron Ore, on behalf of Hamersley Iron Pty Ltd, is proposing to undertake mineral exploration and geotechnical investigation and associated activities at Juna Downs.

The study area covers 546.4 hectares of undisturbed ground and intact native vegetation. The study area was surveyed by Rio Tinto botanists Scott Reiffer and Emma Carroll and consulting botanist Hayden Ajduk (360 Environmental) during October 2014, November 2014 and April 2015.

Six vegetation units were described from the study area. Four vegetation units were described from stony hills and lower slopes and two units from drainage lines.

None of the vegetation units occurring within the study area are listed as Threatened Ecological Communities under either the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* or under the WA State listing. None of the vegetation units represent Priority Ecological Communities. The vegetation units identified within the study area are not considered to hold conservation significance and are widely distributed both locally and throughout the Hamersley subregion.

A total of 186 flora taxa from 81 genera belonging to 38 families were recorded during the current survey. The number of taxa recorded by the current study is slightly less than similar sized surveys of the Juna Downs locality, which is attributed to the current study area not including the species rich loam and clay plains that surrounding surveys of the Juna Downs area have encompassed.

No species of Threatened Flora were recorded by the study, or expected to occur within the study area. Eight species of Priority Flora were recorded during the survey; *Eremophila* sp. Hamersley Range (K. Walker KW 136) (P1), *Tetradlea fordiana* (P1), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), *Solanum kentrocaule* (P3), *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3), *Acacia bromilowiana* (P4) and *Eremophila magnifica* subsp. *magnifica* (P4).

Internal Rio Tinto significant areas will be implemented covering the known *Tetradlea fordiana* locations and adjacent potential habitat. Due to the significant areas covering known locations and as this species was not recorded within the study area, the conservation significance of *Tetradlea fordiana* is unlikely to be impacted by the Proposal. The Proposal is unlikely to affect the conservation significance of the other seven Priority flora species recorded during the survey, due to their broad distribution across the Pilbara and the small scale of the Proposal.

One further conservation significant flora species was considered 'potentially' to occur within the habitats available in the study area. Due to this species not being recorded during field surveys and the small size of the Proposal it is considered unlikely the Proposal will negatively impact on the conservation status of this species.

One weed species was recorded within the study area; however is not a Declared plant listed by the Department of Agriculture and Food.

Three broad fauna habitat types were recorded within the study area – 'Rocky slopes', 'Undulating slopes' and 'Drainage line – minor'. These three habitats are not considered to be restricted at a local or regional level.

Northern Quoll (*Dasyurus hallucatus*) scats were recorded from fauna habitat unit 'S1 - Rocky slopes'. Fauna habitat 'S1 - Rocky slopes' is not restricted at a local or regional level, however it does contain habitat, in the form of rocky overhangs and small caves, which may provide suitable habitat to

support Northern Quolls. An internal Rio Tinto significant area has been proposed that includes the two recorded scat locations, nearby breakaway and cliff habitat that extends from the recorded location as well as the largest gullies, visible from the aerial imagery, within close proximity of the recorded scat locations.

Nine Western Pebble-mound Mouse mounds were recorded within the study area. All mounds were considered inactive. Given this species broad distribution, the small scale of the Proposal, and as all recorded mounds were observed not to be recently active, the conservation significance of this species is unlikely to be impacted by the Proposal.

A further five conservation significant fauna species were considered 'Likely' or 'Potential' to occur within the habitats available in the study area. It is unlikely the Proposal will negatively impact on the conservation status of any of these species on either a local or bioregional scale.

The Proposal was assessed against the 10 Clearing Principles as defined in Schedule 5 (Principles for Clearing Native Vegetation) of the Environmental Protection Act 1986. Assessment against the Principles concluded clearing may be at variance with one of the Principles, and providing significant areas are implemented, is unlikely to be at variance the remaining nine Clearing Principles.

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1 INTRODUCTION

1.1 PROJECT BACKGROUND AND STUDY AREA LOCATION

Rio Tinto Iron Ore (**Rio Tinto**), on behalf of Hamersley Iron Pty Ltd, the Proponent, is proposing to undertake resource evaluation / mineral exploration, geotechnical and associated activities at Juna Downs (the **Proposal**). Approval for clearing of native vegetation associated with the Proposal is required via a Native Vegetation Clearing Permit (**NVCP**) under Section 51A of *the Environmental Protection Act 1986 (EP Act)*.

Vegetation, flora and fauna assessments at Juna Downs (the **study area**) were required to address the 10 Clearing Principles as part of the NVCP application process.

The study area covers approximately 544.46 ha of undisturbed ground and intact native vegetation.

The study area is located approximately 76 km south east of Tom Price, within the Pilbara region of Western Australia (**WA**) (Figure 1-1).

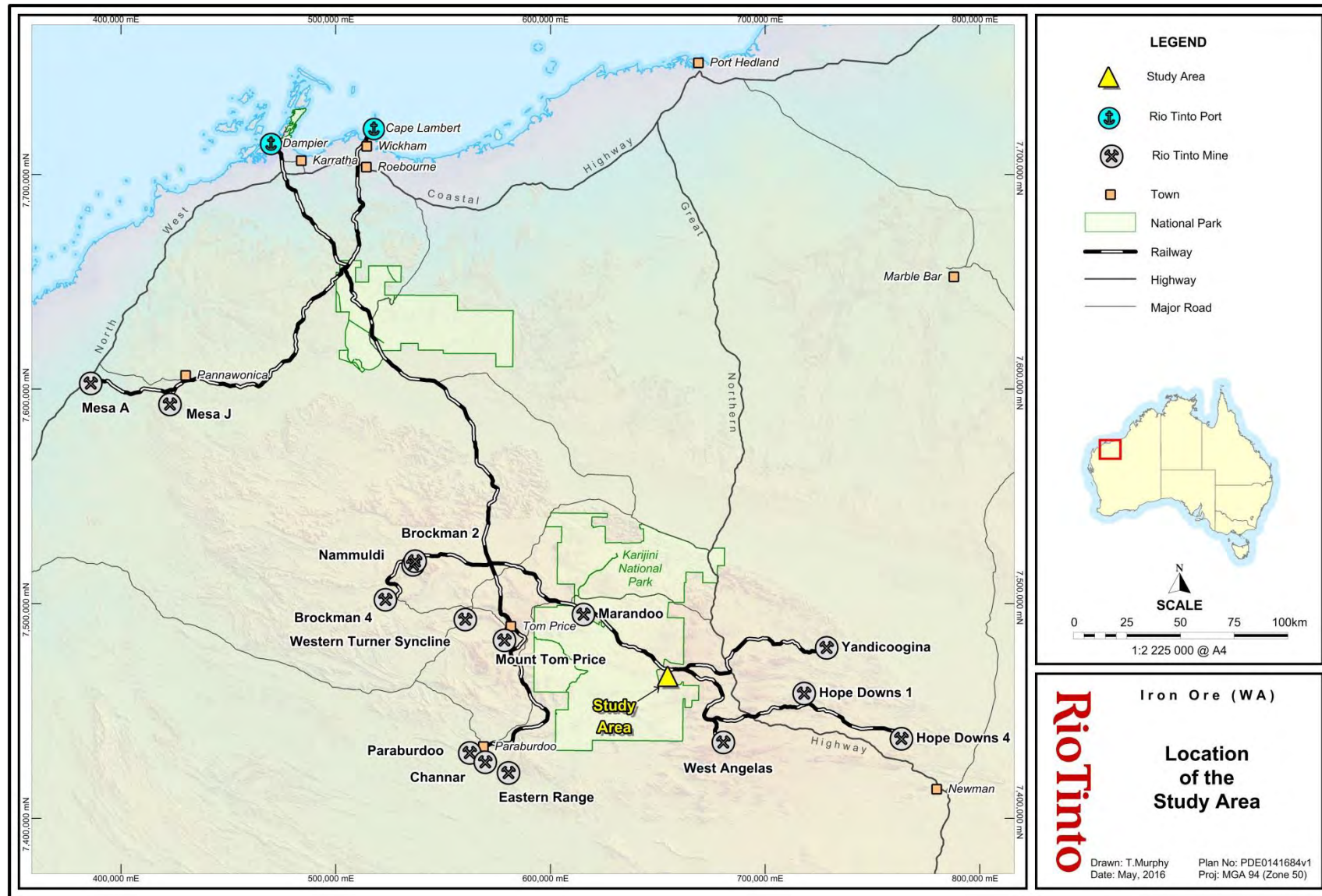


Figure 1-1: Location of the Study Area

1.2 SCOPE OF SURVEY

This report describes the methodology employed for the flora and vegetation and fauna habitat assessment of the study area, and documents the results of the survey. In particular, this report identifies vegetation, flora and fauna habitats of conservation significance relevant to the study area.

This report is intended as a supporting document for an NVCP application by Rio Tinto and has been prepared on the basis of a review of existing information for the study area, combined with a site field survey. A summary of key information pertaining to the survey is provided in Table 1-1.

Table 1-1: Summary of key information

Factor	Author	Survey / investigations name	Study area, type and timing	Study standard guidance and limitations
Vegetation and Flora	Biota (2008a)	A Vegetation and Flora Survey of the Rio Tinto Rail Duplication – Bellbird Siding to Juna Downs	9,008 ha Single phase field survey May 2008	EPA Guidance Statement No. 51 Level 2 assessment
Flora	ecologia (2012)	Rio Tinto Iron Ore Juna Downs Targeted Flora Assessment	837.8 ha Single phase field survey August 2012	EPA Guidance Statement No. 51 Level 1 assessment
Vegetation and Flora	Pilbara Flora (2012)	Flora and Vegetation Surveys for Drilling Areas at Juna Downs and NVCP Supporting Information	2,364 ha Single phase field survey October & November 2011	EPA Guidance Statement No. 51 Level 1 assessment
Vegetation and Flora	Rio Tinto (2009)	Botanical Survey for Tenement Exploration Drilling at Juna Downs South	377.1 ha Single phase field survey June 2009	EPA Guidance Statement No. 51 Level 1 assessment
Vegetation and Flora	Rio Tinto (2011)	Botanical Survey for an Exploration Drilling Program at Juna Downs South E47/1943 & Supporting Document to a NVCP Application	181.6 ha Single phase field survey October 2010	EPA Guidance Statement No. 51 Level 1 assessment
Vegetation and Flora	Rio Tinto (2013)	Flora and Vegetation Survey at Juna Downs South Detritals	91.8 ha Single phase field survey March & July 2013	EPA Guidance Statement No. 51 Level 1 assessment

Factor	Author	Survey / investigations name	Study area, type and timing	Study standard guidance and limitations
Flora	Rio Tinto (2015)	Systematic Flora Survey at Juna Downs AR-14-12278	108.4 ha Single phase field survey April 2015	EPA Guidance Statement No. 51 Level 1 assessment
Fauna	Biota (2008b)	Rio Tinto Rail Duplication Fauna Assessment: Bellbird Siding to Juna Downs	9,008 ha Single phase field survey May 2008	EPA Guidance Statement No. 56 Level 1 assessment
Fauna	ecologia (2014)	Rio Tinto Iron Ore Greater West Angelas Terrestrial Fauna Assessment	17,640 ha Two phase field survey September 2012 & March 2013	EPA Guidance Statement No. 56 Level 2 assessment

The report includes a description of the:

- local environment of the study area including flora, vegetation, fauna habitats, geology, landforms, and hydrology;
- methods employed during the field survey;
- locations and populations of conservation listed flora, including photographs and mapping;
- vegetation associations occurring in the study area, an assessment on their condition and conservation significance for the locality and subregion, including mapping;
- fauna habitats present, assessment of their significance for the locality and subregion, including mapping; and
- potential impacts of the Proposal on the local environment through application of the 10 Clearing Principles, as outlined in Schedule 5 of the EP Act.

1.3 LIMITATIONS

Limitations of the current survey of the study area are summarised in Table 1-2.

Table 1-2: Constraints and limitations of the current study

Constraint	Limitations
Sources of Information	The Pilbara bioregion has been relatively well surveyed, with increasing biological survey work occurring due to the resource expansion in the region. Numerous flora and fauna surveys have been undertaken in the wider locality and many within the Juna Downs area; therefore, a suitable number of survey reports are available. Sources of information are not considered a limitation in this assessment.
Scope of works	The survey requirements of a targeted terrestrial flora, vegetation and fauna survey for a NVCP application were met. No quadrat sampling or fauna trapping was undertaken, however, relevés were undertaken to record the vegetation associations in addition to traverses of the study area.
Completeness of survey	The study area was fully surveyed to the satisfaction of an equivalent Level 1 survey. No additional surveys were deemed necessary for the purpose of this assessment. Fungi and non-vascular flora (algae, mosses and liverworts) were not sampled.
Intensity of survey	The study area was surveyed by targeted traverses on foot. Habitats with potential to support conservation listed species were searched. All vegetation and fauna habitat types were inspected.
Timing, weather, season, cycle	The survey was conducted during October 2014, November 2014 and April 2015. Both trips during 2014 would be regarded as sub-average seasonal timing, whilst the April 2015 survey would be regarded as good seasonal timing. Due to the multiple trips, including the good conditions experienced in April 2015, it is likely a representative flora species list for the study area has been recorded.
Disturbances	The study area is predominately undisturbed. There have been no recent fires (<5 years) within the study area
Resources	<p>The biologists undertaking the surveys and subsequent reports consulted as part of the studies were suitably qualified to identify flora and fauna. Scott Reiffer (all field studies and report writing) has more than ten years' experience as a botanist/biologist in Western Australia, with significant experience working in the Pilbara. Emma Carroll (field studies November 2014) has more than ten years' experience as a botanist/biologist in Western Australia, with significant experience working in the Pilbara. Hayden Ajduk (field studies October 2014 & April 2015) has more than five years' experience as a botanist/biologist in Western Australia, with significant experience working in the Pilbara. There were no limitations noted in reports cited in the desktop assessment due to resourcing.</p> <p>The aerial imagery, available to complete the vegetation and fauna habitat mapping appears to have been captured in a manner that south facing slopes have clearer imagery than north facing slopes. The study area has a north facing aspect. As a result, it is difficult to define north aspect breakaways and cliff faces (that have a narrow horizontal footprint on the aerial imagery) from the standard north aspect rocky hill slopes. The breakaways and cliff faces are therefore unable to be split into their own vegetation and fauna habitat units and considered a slight limitation.</p>
Accessibility / remoteness	The study area was accessed by vehicle and on foot. The study area has been traversed on foot. No parts of the study area were inaccessible.

1.4 CLIMATE

The closest Meteorological station providing climate data for both rainfall and temperature is Wittenoom, located approximately 77.5 km north of the study area (Figure 1-1). Weather data from the Bureau of Meteorology (**BoM**) for Wittenoom is presented in Figure 1-2 (BoM 2016).

The regional climate is semi-arid to semi-tropical with a summer rainfall season and relatively dry winter season, which varies in frequency and volume from year to year. The summer wet months extend from November to April when temperatures can exceed 47°C. The remainder of the year is moderate to warm with a continental effect resulting in low minimum temperatures, below 10°C, in June and July. The closest data for Pan evaporation rates are in Port Hedland, which averages 3,500 mm per annum (Luke *et al.* 2003), exceeding annual rainfall averages.

Annual rainfall is variable with tropical lows producing large regional rainfall events (between 100 mm and 200 mm in a few days) to isolated thunderstorm events in the dry (winter) season. For Wittenoom the mean annual rainfall for the period 1949 to 2016 is 464.8 mm, with most precipitation occurring between December and April (coinciding with the cyclone season).

The Pilbara region received significant rainfall in March 2015 (Figure 1-2). Wittenoom received 167.6 mm during March 2015, with the majority falling 5.5 weeks before the April 2015 survey. There were no significant rainfall events leading up to the October 2014 and November 2014 surveys.

Maximum temperatures reflected a warm summer to winter period (BoM 2016). Temperatures recorded preceding the survey were within expected ranges and generally followed mean maximum temperatures (Figure 1-2).

Due to the multiple trips, including the good conditions experienced in April 2015, it is likely a representative flora species list for the study area has been recorded.

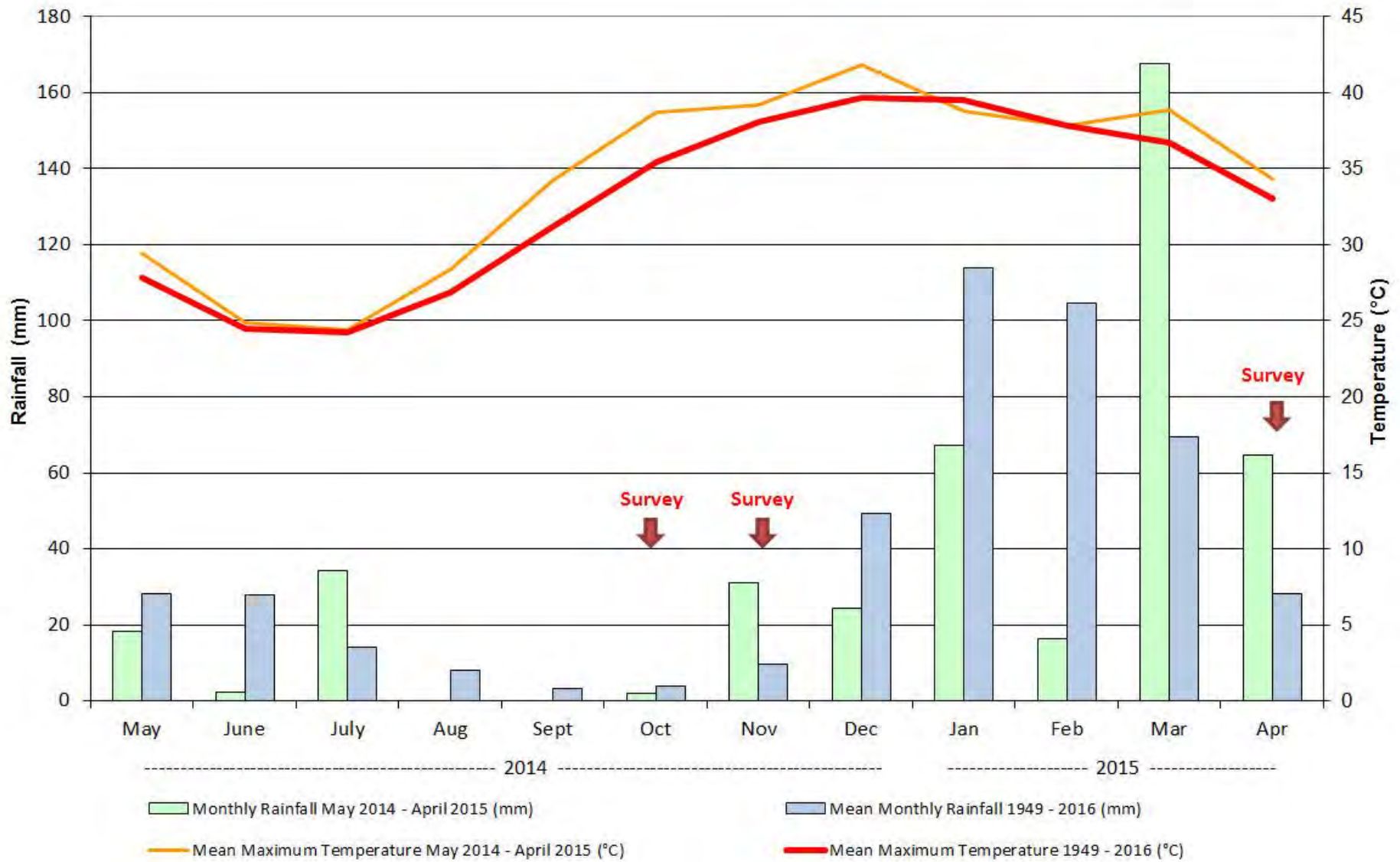


Figure 1-2: Comparison of Actual and Mean Monthly Maximum Rainfall and Temperatures for Wittenoom May 2014 – April 2015

1.5 GEOLOGY AND SOILS

The study area comprised of four major geological units based on 1: 250,000 scale map sheet (Martin *et. al.* 2014, Figure 1-3).

These geological units are:

- AHs: Mt McRae Shale – shale, siltstone and dolomitic shale some chert;
- Czc: Cainozoic – Colluvium- partly consolidated valley-fill deposits. Detritals;
- PHb: Brockman Iron – Banded jaspilite and chert with some shale dolomitic with riebeckite and crocidolite at Wittenoom Gorge and Dales Gorge. Contains stromatolites; and
- Qa: Cainozoic – Lacustrine deposits – clay, silt, saline in part, flood deposits. Unconsolidated fluvial and sheet – flood deposits in levees and river terraces.

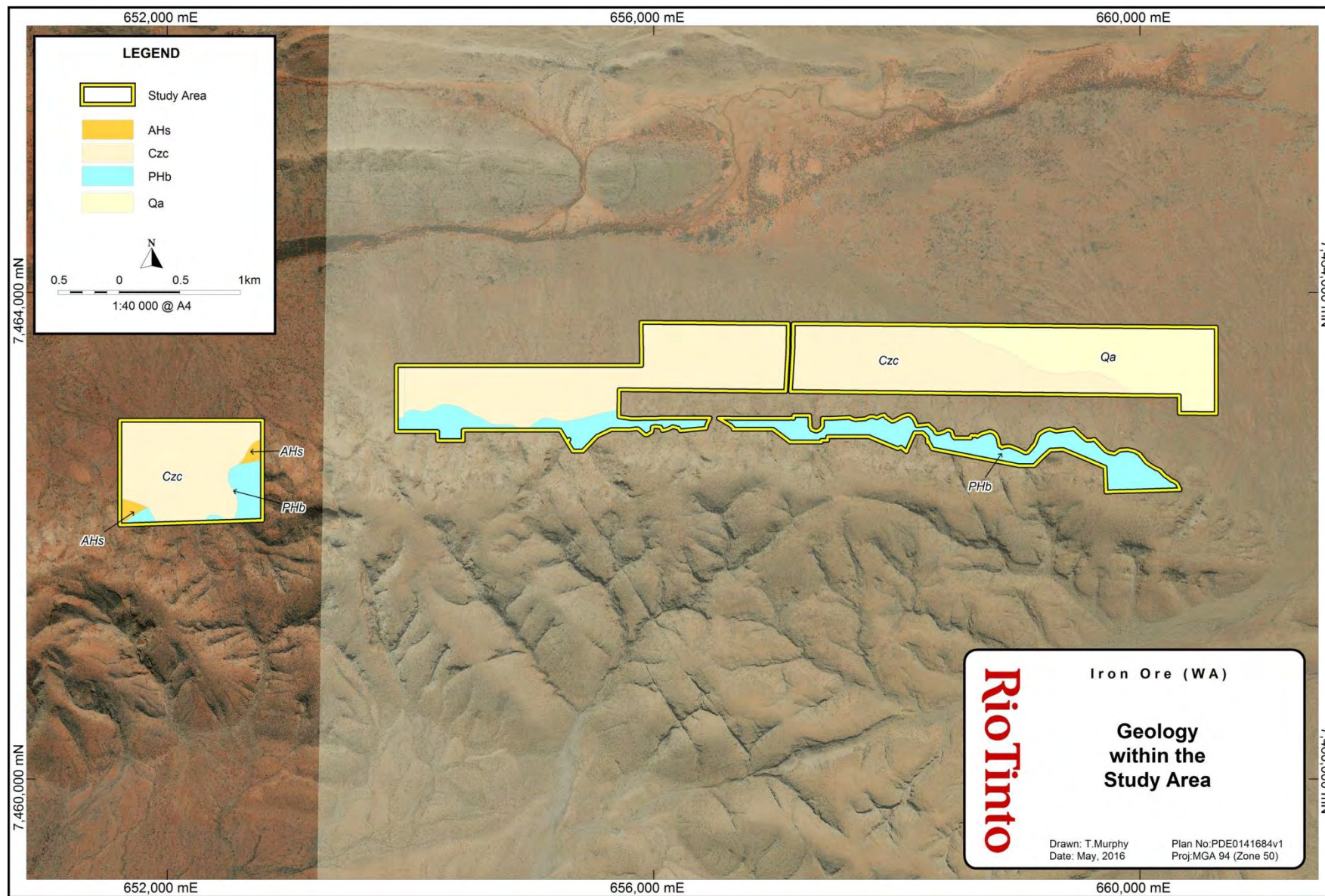


Figure 1-3: Geology units in proximity of the Study Area

1.6 SURFACE HYDROLOGY AND GROUNDWATER

The study area lies within the Ashburton River catchment zone. The study area lies 12 km east of De La Porte Creek and 20 km south of Marillana Creek. Small, minor ephemeral drainage lines, likely to flow after significant rainfall, are located within the study area. The study area lies 42 km south east of the Marandoo Water Reserve.

1.7 LAND SYSTEMS

Land system (rangeland) mapping is based on regional patterns in topography, soils and vegetation (Christian and Stewart 1953). The most recent land system mapping of the Pilbara bioregion, in which the study area lies, was completed by Van Vreeswyk *et al.* (2004). The mapping classifies the Pilbara region into 102 land systems.

The study area is located within two of the 102 Land Systems described for the Pilbara Bioregion by van Vreeswyk *et al.* (2004) and Payne *et al.* (1998) (Figure 1-4).

The Land Systems and their extent within the study area are presented below (Table 1-3).

- Boolgeeda Land System consists of stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands (van Vreeswyk *et al.* 2004). This unit is not susceptible to degradation or erosion.
- Newman Land System consists of rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands (van Vreeswyk *et al.* 2004). This unit is not susceptible to degradation or erosion.

Table 1-3: Land Systems occurring within the Study Area and their representation in the Pilbara bioregion (van Vreeswyk *et al.* 2004)

Land System (Map Code)	Total Area (ha) in Pilbara Bioregion	Area within study area (ha)	% of study area	Study area % of land system extent
Boolgeeda (BGD)	774,800	393.43	72.3	0.05
Newman (NEW)	1,458,000	151.03	27.7	0.01

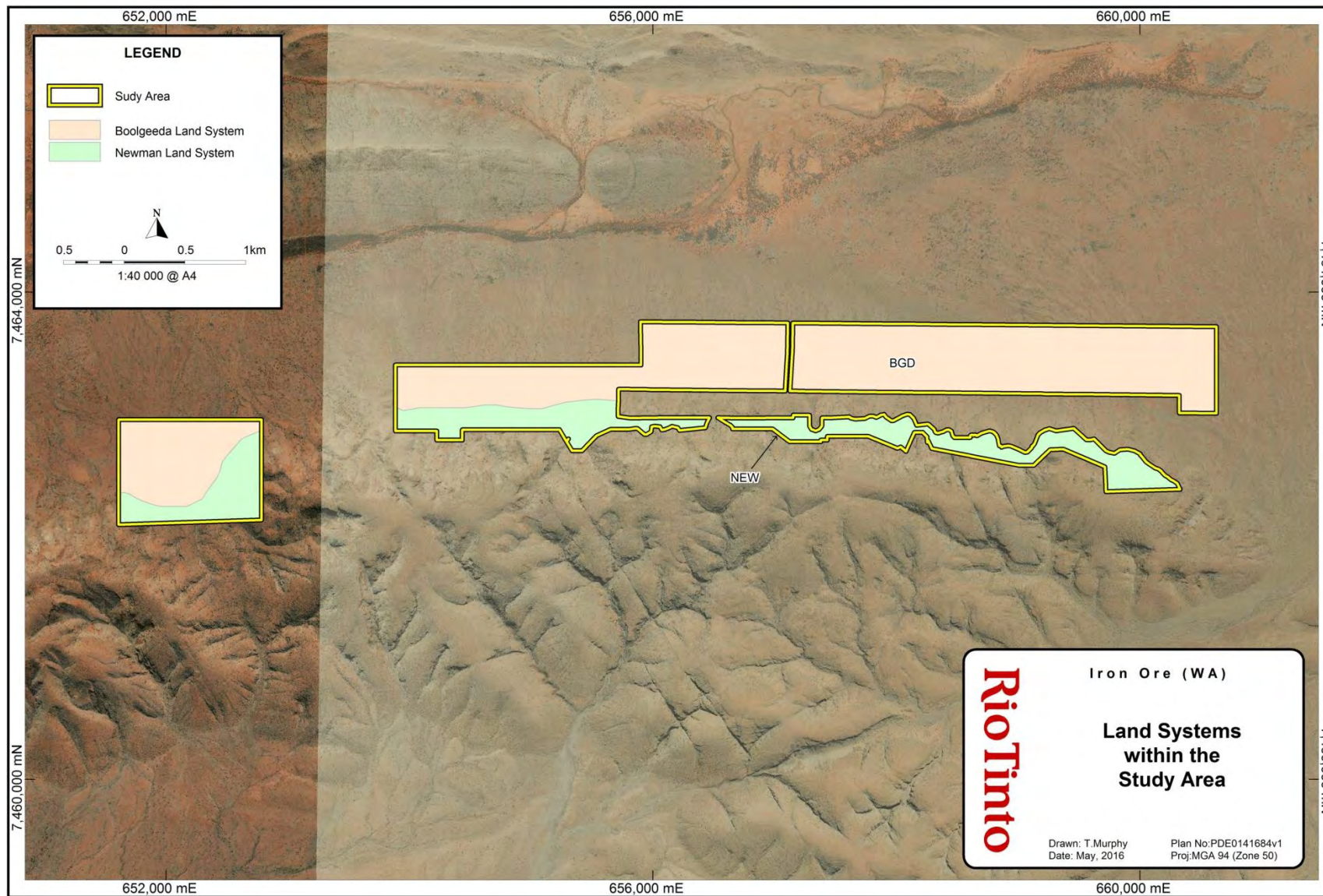


Figure 1-4: Land Systems in the proximity of the Study Area

1.8 VEGETATION

1.8.1 IBRA bioregions and subregions

The Interim Biogeographic Regionalisation of Australia (**IBRA7**) recognises 89 bioregions (DotE 2014). The study area is located in the Pilbara (PIL) bioregion as defined by IBRA. The Pilbara bioregion has been further subdivided into four subregions: Chichester (**PIL1**); Fortescue Plains (**PIL2**); Hamersley (**PIL3**); and Roebourne (**PIL4**). The study area falls within the Hamersley sub-region and is described by Kendrick (2001) as:

‘Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges. The climate is Semi-desert tropical, average 300 mm rainfall, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon. Drainage into either the Fortescue (to the north), the Ashburton to the south, or the Robe to the west’

1.8.2 Beard’s regional vegetation mapping

Vegetation type and extent has been mapped at a regional scale by Beard (1975) who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 1:1,000,000, the Department of Agriculture and Food WA (**DAFWA**) has compiled a list of vegetation extent and types across WA (Shepherd *et al.* 2002). The study area falls within two vegetation associations (Figure 1-5).

- Hamersley 18 (A1Li) - Low woodland; mulga (*Acacia aneura*); and
- Hamersley 82 (e16Lrt3Hi) - Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*.

Given the broad nature of Beard’s mapping; these units are only broadly applicable to the vegetation types occurring in the study area.

1.8.3 Pre-European Vegetation Extent

The pre-European and current extent of native vegetation associations in Western Australia has been interpreted by Shepherd *et al.* (2002) using data from Beard’s (1975) regional vegetation mapping and other vegetation mapping, as well as satellite imagery and orthophoto interpretation.

Shepherd *et al.* (2002) identified the Pilbara bioregion as having largely intact native vegetation owing to the lack of intensive agricultural land use practices. Although the native vegetation remains widespread and largely intact, the floristic composition and structural characteristics have almost certainly changed since European settlement by grazing and altered fire regimes (Shepherd *et al.* 2002).

Table 1-4 presents the pre-European and current extent of the two Beard mapping units across their range, as well as their extent in the study area.

Table 1-4: Beard's mapping unit occurring within the Study Area, its current and Pre-European extent within the Pilbara bioregion and its extent across the Study Area.

Beard's Mapping Unit (Shepherd vegetation association)	Pre-European extent (ha) (Government of WA 2014)	Current extent (ha) (Government of WA 2014)	Extent within the Study Area (ha) (% of current extent)
A1Li (Hamersley 18)	676,556	672,424	160.18 (0.02%)
e16Lr t3Hi (Hamersley 82)	2,563,583	2,550,898	384.28 (0.01%)

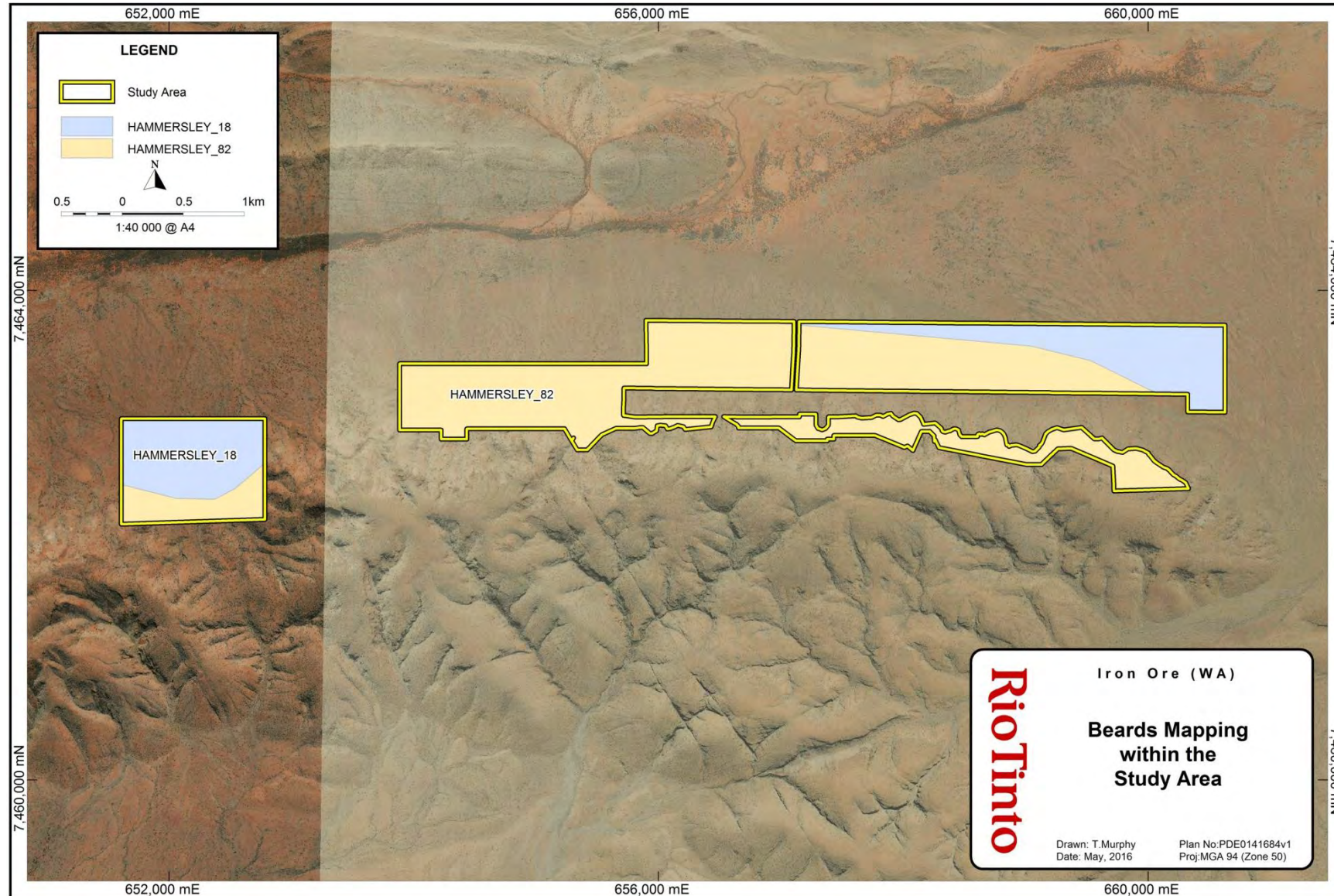


Figure 1-5: Beard's/Shepherd's vegetation units in proximity to the Study Area

1.9 CONSERVATION AREAS AND ENVIRONMENTALLY SENSITIVE AREAS

Environmentally Sensitive Areas (**ESAs**) are defined in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005 under section 51B of the WA state EP Act. ESAs include areas declared as: World Heritage; included on the Register of the National Estate; defined wetlands; vegetation containing rare (Threatened) flora; Threatened Ecological Communities (**TEC**); and Bush Forever sites.

The study area lies adjacent to, but outside of Karijini National Park (Figure 1-6).

The study area falls within the Register of National Estate boundary, which is classified as an Environmentally Sensitive Area.

The buffer boundary to the '*Themeda* grasslands on cracking clays (Hamersley Station)' TEC is located approximately 96 km north west of the study area. Due to the separation of this TEC, the Proposal is not expected to impact the environmental values of this TEC.

1.10 PRIORITY ECOLOGICAL COMMUNITIES

Priority Ecological Communities (**PECs**) are possible TECs that do not meet survey criteria or are not adequately defined for the TEC list by the Department of Parks and Wildlife (**Parks and Wildlife**), and are ranked in Priorities 1, 2 and 3 (1 being the highest). The nearest PEC to the study area is the 'Brockman Iron cracking clay communities of the Hamersley Range.' The buffer boundary of this Priority 1 ranked PEC is located 16 km south of the study area. Due to the separation of this PEC, the proposal is not expected to impact the environmental values of this PEC, or any others.

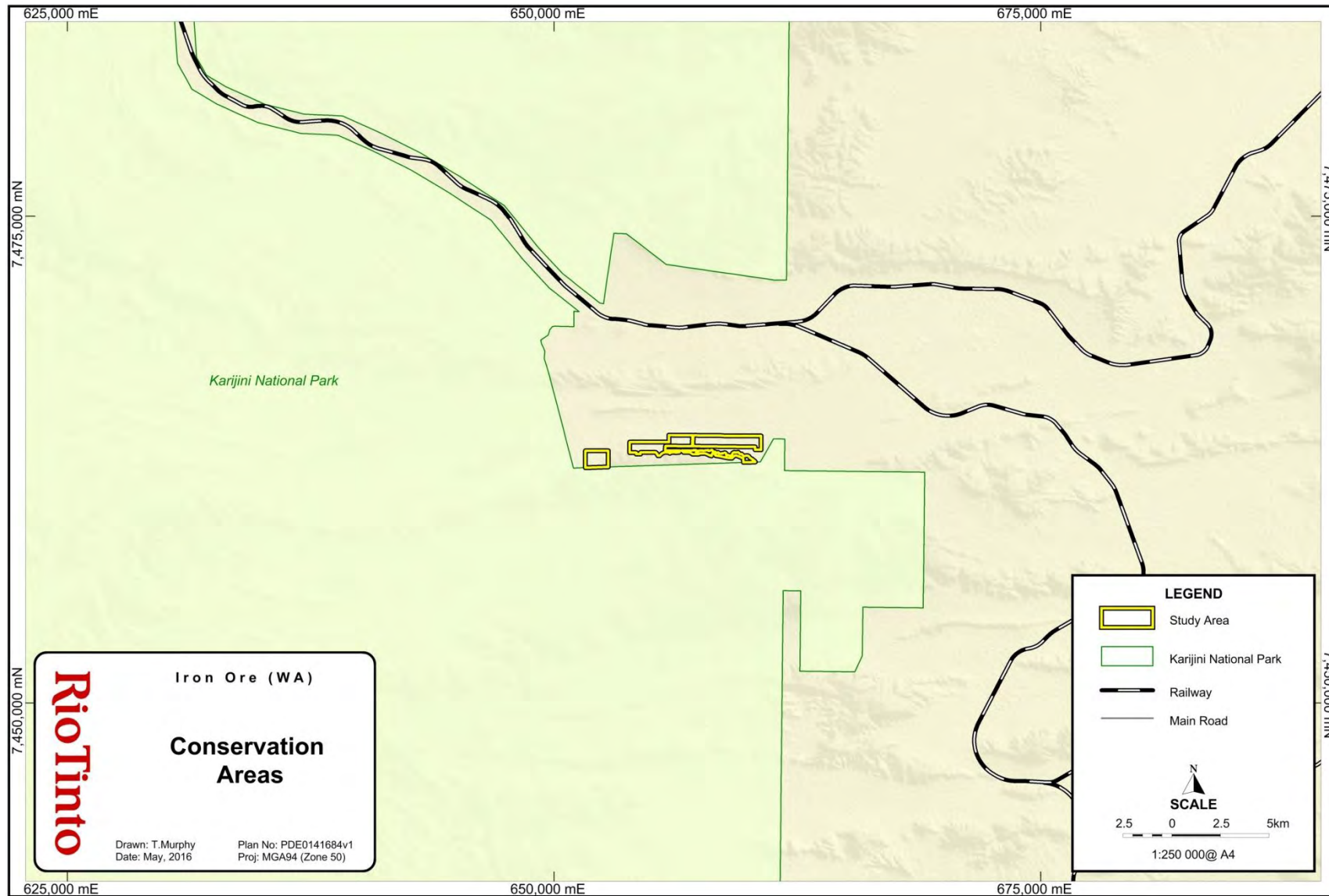


Figure 1-6: Conservation areas in the proximity of the Study Area

2 METHODOLOGY

2.1 LITERATURE REVIEW

Early systematic flora survey work in the Pilbara bioregion was undertaken by Burbidge (1959) and Beard (1975). These surveys involved the mapping of broad floristic formations and vegetation associations across the bioregion. More recently, the Department of Agriculture and Food Western Australia (**DAFWA**) conducted a regional inventory of flora, vegetation, vegetation condition, and land resources of the bioregion (Van Vreeswyk *et al.* 2004). In addition, the DEC (now Parks and Wildlife) undertook a comprehensive regional survey of the Pilbara (DEC 2011) which included counting, sampling, documenting, and mapping the way plant communities are distributed in relation to soil, climate, landforms and geology within the Pilbara.

Over recent decades there has been an expansion of resource development projects occurring within the Pilbara. As a result, there has been an increase in site-specific ecological surveys to fulfil the statutory requirements of the EP Act, the State Wildlife Conservation Act 1950 (**WC Act**), and the *Environmental Protection and Biodiversity Conservation Act, 1999* (**EPBC Act**).

Numerous flora, vegetation and fauna surveys have previously been conducted within and surrounding the study area (Figure 2-1). The findings of these surveys, in addition to the database searches, form the desktop study to determine conservation significant species that are known to, or may occur within the study area, as well as the flora, vegetation associations, ecosystems and fauna habitats.

2.1.1 Flora and Vegetation

Seven previous flora and vegetation surveys have been utilised as part of this flora and vegetation desktop assessment, Biota (2008a), ecologia (2012), Pilbara Flora (2012), Rio Tinto (2009, 2011, 2013 & 2015).

These reports have been consulted as part of the literature review to determine conservation significant species that may occur within the study area, as well as flora, vegetation units and ecosystems. A summary of the findings of each report primarily used in the desktop review is presented in Table 2-1.

A review of additional published and unpublished reports of relevance to the area was also conducted prior to completing the survey and report. These reports comprised mostly regional scale reports such as the Department of Agriculture Land Systems mapping (van Vreeswyk *et al.* 2004).

2.1.2 Fauna and fauna habitat

Three previous fauna reports were utilised as part of the fauna desktop assessment, Biota (2008b), ecologia (2014) and Rio Tinto (2013).

These reports were reviewed as part of the literature review to determine conservation significant species that may occur within the study area and fauna habitats. A summary of the findings is presented in Table 2-2.

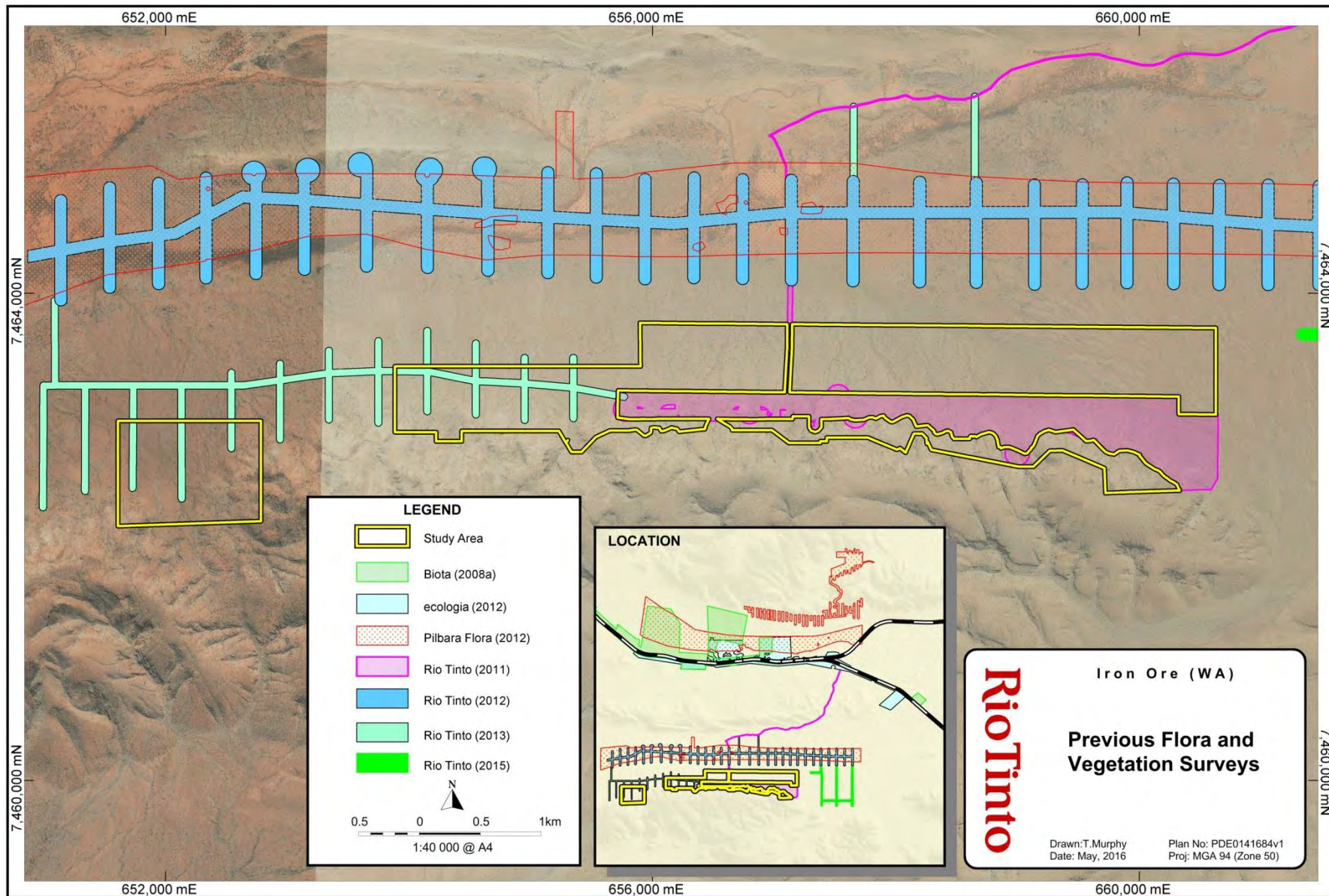


Figure 2-1: Previous flora and vegetation surveys in the vicinity of the study area

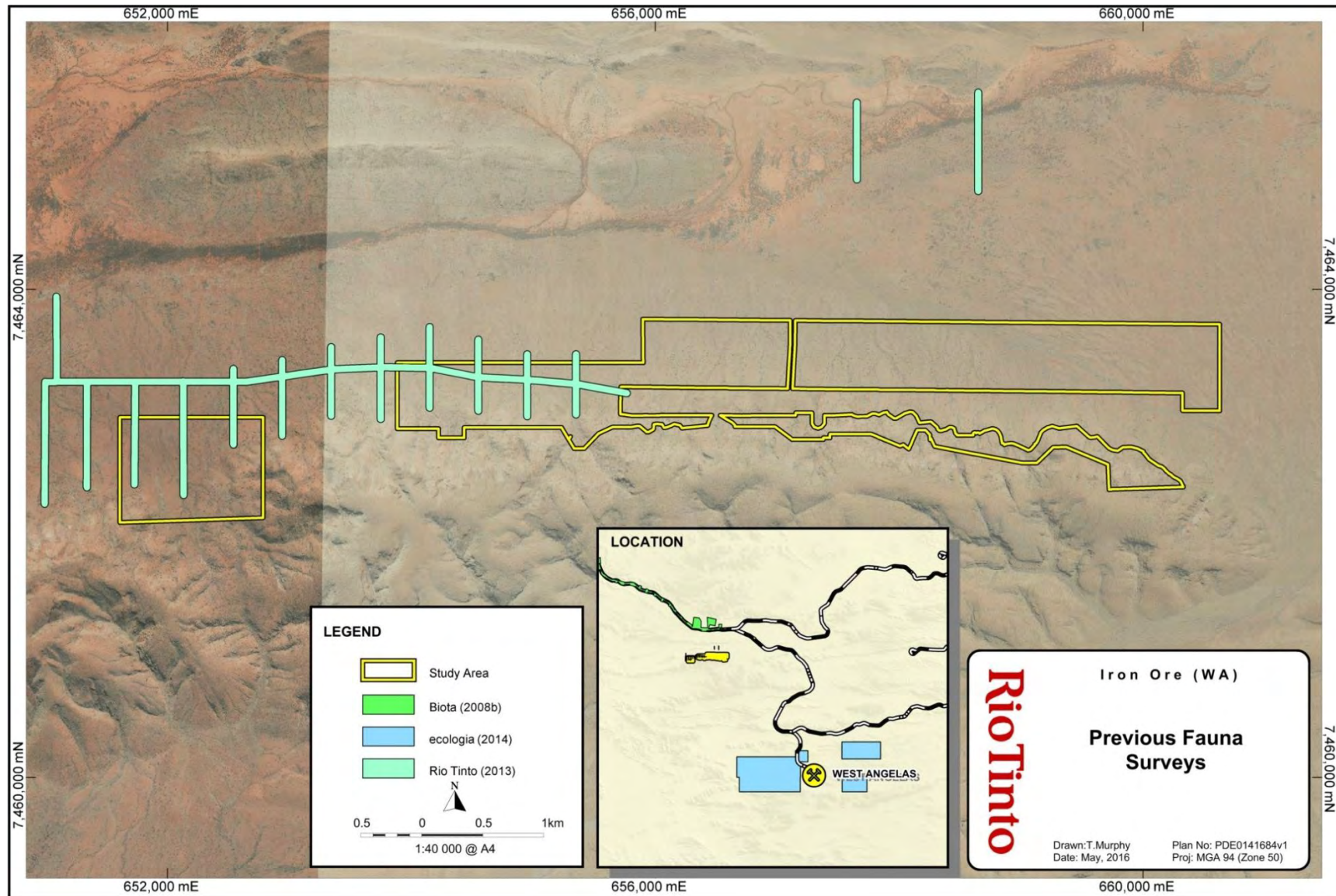


Figure 2-2: Previous fauna surveys in the vicinity of the study area

Table 2-1: Summary of previous flora and vegetation reports utilised for the desktop assessment

Report (& Level of Survey)	Size (ha)	Number of Taxa	Conservation listed flora	Weeds	Vegetation of Significance
Biota (2008a) A Vegetation and Flora Survey of the Rio Tinto Rail Duplication – Bellbird Siding to Juna Downs Baseline Survey	9008	320 Taxa	<i>Calotis squamigera</i> (P1); <i>Goodenia lyrata</i> (P3); <i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794) (P3); <i>Astrelba lappacea</i> (P3); <i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3). <i>Goodenia pasqua</i> (no longer a priority); <i>Ischaemum albobillosum</i> (no longer a priority), and <i>Polymeria</i> sp. Hamersley (M.E.Trudgen 11353) (now <i>Polymeria longifolia</i> – no longer a priority).	11 weed species. One species is listed as Declared, <i>Datura leichhardtii</i> .	No vegetation units were deemed to be TECs or PECs. Several Mulga and Major Drainage Line Units were deemed to have higher conservation significance.
ecologia (2012) Rio Tinto Iron Ore Juna Downs Targeted Flora Assessment Rare Flora Survey	837.8	271 Taxa	<i>Vittadinia</i> sp. Coondewanna Flats (S. van Leeuwen 4684) (P1); <i>Aristida jerichoensis</i> var. <i>subspinulifera</i> (P3); <i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794) (P3); <i>Brachyscome</i> sp. Wanna Munna Flats (S. van Leeuwen 4662) (no longer a priority); <i>Brunonia</i> sp. Long hairs (D.E. Symon 2440) (no longer a priority),	9 weed species. One species is listed as Declared, <i>Datura leichhardtii</i>	Not assessed.
Pilbara Flora (2012) Flora and Vegetation Surveys for Drilling Areas at Juna Downs and NVCP Supporting Information NVCP level survey	2364	298 Taxa	<i>Rhagodia</i> sp. Hamersley (M.E. Trudgen 17794) (P3); <i>Triodia</i> sp. Mt Ella (M.E Trudgen 12739) (P3); <i>Eremophila magnifica</i> subsp. <i>magnifica</i> (P4); <i>Brunonia</i> sp. long hairs (D.E. Symon 2440) (no longer a priority); and <i>Spartothamnella puberula</i> (no longer a priority),	9 weed species	No vegetation units were deemed to be TECs or PECs. No vegetation associations were considered to be rare, restricted or unique.
Rio Tinto (2009)	377.1	197	<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3)	4 weed	No vegetation units were deemed to

Report (& Level of Survey)	Size (ha)	Number of Taxa	Conservation listed flora	Weeds	Vegetation of Significance
Botanical Survey for Tenement Exploration Drilling at Juna Downs South NVCP level survey				species	be TECs or PECs. One Mulga unit was deemed to be of moderate significance.
Rio Tinto (2011) Botanical Survey for an Exploration Drilling Program at Juna Downs South E47/1943 & Supporting Document to a NVCP Application NVCP level survey	181.6	225	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P3); <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3)	3 weed species	No vegetation units were deemed to be TECs or PECs. Two Mulga units were deemed to be of moderate significance.
Rio Tinto (2013) Flora and Vegetation Survey at Juna Downs South Detritals NVCP level survey	91.8	205	<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3)	7 weed species	No vegetation units were deemed to be TECs or PECs. No units were deemed to be of elevated conservation significance.
Rio Tinto (2015) Systematic Flora Survey at Juna Downs AR-14-122278 Rare Flora Survey	108.4	151	<i>Aristida jerichoensis</i> var. <i>subspinulifera</i> (P3) <i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794) (P3); <i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3) <i>Stackhousia clementii</i> (P3) <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3); <i>Brachyscome</i> sp. Wanna Munna Flats (S. van Leeuwen 4662) (no longer Priority)	4 weed species	No vegetation units were deemed to be TECs or PECs. No units were deemed to be of elevated conservation significance

Table 2-2: Summary of previous fauna reports utilised for the desktop assessment

Report (& Level of Survey)	Size (ha)	Number of Taxa	Conservation listed fauna	Fauna Habitat of Significance
Biota (2008b) Rio Tinto Rail Duplication Fauna Assessment: Bellbird Siding to Juna Downs Baseline Survey	9008	120 vertebrate species, comprising of 67 avifaina, 18 mammals, 35 herpetofauna, 2 frogs and 33 reptiles.	Peregrine Falcon (<i>Falco peregrinus</i>) (S4) Australian Bustard (<i>Ardeotis australis</i>) – No longer Priority Star Finch (<i>Neochmia ruficauda subclarescens</i>) Western Pebble-mound Mouse (<i>Pseudomys chapmani</i> , P4) Rainbow Bee-eater (<i>Merops ornatus</i>) (Migratory)	No habitats were deemed to be TECs or PECs
ecologia (2014) Rio Tinto Iron Ore Greater West Angelas Terrestrial Fauna Assessment Baseline Survey	17,640	23 species of native mammal, two species of introduced mammal, 80 species of birds and 64 species of reptile.	<i>Rhinonictus aurantia</i> (Pilbara Leaf-nosed Bat, Vulnerable, Schedule 1, Vulnerable) <i>Apus pacificus</i> (Fork-tailed swift; Schedule 1) <i>Underwoodisaurus seorsus</i> (Pilbara Barking Gecko, P1) <i>Pseudomys chapmani</i> (Western Pebble-Mound Mouse, P4) <i>Ardeotis australis</i> (Australian Bustard)– No longer Priority <i>Burhinus grallarius</i> (Bush Stone-curlew, P4)	No habitats were deemed to be TECs or PECs or unique to the area
Rio Tinto (2013) Flora and Vegetation Survey at Juna Downs South Detritals NVCP level survey	91.8	Not assessed	<i>Pseudomys chapmani</i> (Western Pebble-Mound Mouse, P4)	No habitats were deemed to be TECs or PECs or unique to the area

2.2 DATABASE SEARCHES

A desktop assessment was undertaken before field surveys during October 2014 and updated in May 2016, in order to identify known or potential environmental constraints within or pertaining to the study area and surrounds.

The Parks and Wildlife and WA Museum's (**WAM**) NatureMap database (Parks and Wildlife 2014) was searched for Threatened and Priority flora and fauna that have the potential to utilise the habitats present within the study area.

The Commonwealth Department of the Environment (**DotE**) administered **EPBC Act**. Protected Matters Search Tool was also searched for Matters of National Environmental Significance (**MNES**) listed under the EPBC Act including Threatened flora and fauna and TECs.

Spatial data for conservation significant flora and fauna held and maintained by Rio Tinto was also searched as part of the desktop study. Any ESA, Reserves and/or conservation areas within or surrounding the study area were also identified using relevant GIS layers held by Rio Tinto.

The search coordinates used (118° 32' 25" E, 22 ° 56' 03" S) were at a central point within the study area. A buffer of 20 km was used for NatureMap and Rio Tinto database searches, and 10 km for the Protected Matters search tool. Results of NatureMap and Protected Matters searches undertaken are presented in Appendix 1.

2.2.1 Summary of NatureMap flora database search

Table 2-3 presents a summary of flora species returned by the NatureMap database searches.

Table 2-3: Summary of flora species returned by NatureMap search

Group	Number
Families	49
Genera	143
Species	305
Conservation Listed	19
Weed	5

2.2.2 Summary of NatureMap fauna database search

Table 2-4 presents a summary of fauna species returned by the NatureMap database searches.

Table 2-4: Summary of terrestrial vertebrate fauna taxa potentially occurring in the study area

Fauna Group	Number of Potential Species
Amphibians	1
Reptiles	22

Fauna Group	Number of Potential Species
Avifauna	72
Mammals	10
Conservation Listed	6
Total	105

2.3 LIKELIHOOD OF OCCURRENCE ASSESSMENT

The results of the database searches were used to create a list of flora and fauna of conservation significance recorded, or with the potential to occur, within the study area. The likelihood of a flora or fauna species occurring within the study area was assessed through consideration of available habitats in the study area and each species' ecology. The fauna list will invariably include some species that do not occur in the study area, as some fauna have a limited or patchy distribution, high level of habitat specificity for habitat types not located in the study area, are locally extinct or were erroneously identified in previous surveys. These fauna were excluded from the list where relevant.

The likelihood of a flora species occurring within the study area was determined prior to the field survey based on the location of database records, availability of potentially suitable habitat and knowledge of the species ecology.

2.3.1 Conservation listed flora returned by desktop study

Twenty eight conservation listed flora species were returned by the database search (Appendix 1). There were one Threatened species, five Priority 1 species, five Priority 2 species, fifteen Priority 3 species and two Priority 4 flora species returned by the database search.

Two species were considered 'likely' and fifteen have the 'potential' to occur, eight species were considered 'unlikely' to occur and one species was considered a database error based on the criteria used to assess the pre-field likelihood of occurrence (Table 2-5, Appendix 2).

The likelihood rating of conservation listed flora returned by the database search was later updated post-field assessment (

Table 3-3), including factors such as if there was suitable habitat present within the study area; whether that species was likely to have been overlooked during the survey (e.g. a large perennial vs a small annual) or if the species may not have been present (e.g. the study area was not surveyed at a suitable time).

Two conservation listed flora species have been previously recorded within the study area.

Sida sp. Barlee Range (S. van Leeuwen 1642) (Priority 3) was recorded within the current study area by Rio Tinto (2009). *Sida* sp. Barlee Range (S. van Leeuwen 1642) has a range of approximately 372 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 266 km from the Rio Tinto database. This species has a total population count of 9,589 plants, from 1,427 records, within the Rio Tinto database. This species has previously been recorded from Mt Wall, Arrochar, Brockman, Western Range, Paraburdoo, Eastern Range, Channar, Capricorn, Koodaideri, West Angelas and Western Turner Syncline within the Rio Tinto database (Figure 3-8) and from Barlee Range Nature Reserve, Western Range, Mt Turner, Mt Brockman, Silvergrass, Karijini National Park, Koodaideri, Southern Flank and South Kunderong Range on NatureMap (Parks and Wildlife 2014).

Triodia sp. Mt Ella (M.E. Trudgen 12739) (Priority 3) was recorded within the current study area polygon by Rio Tinto (2009). *Triodia* sp. Mt Ella (M.E. Trudgen 12739) has a range of approximately 382 km on NatureMap, predominantly from the Hamersley Ranges, with one record south of Rudall River in the Little Sandy Desert IBRA region (Parks and Wildlife, 2014) and 182 km from the Rio Tinto database. This species has a total population count of 10,677 plants, from 431 records, within the Rio Tinto database. This species has previously been recorded from Indabiddy, Angelo River, West Angelas, Juna Downs, Hope Downs 1 and Shovelanna within the Rio Tinto database and from Kunderong Range, Indabiddy, Juna Downs, Angelo River, West Angelas and Rudall River in the Little Sandy Desert on NatureMap (Parks and Wildlife 2014) (Figure 3-10). Numerous records of this species have been made in the surrounding area on hills and in drainage lines running off hills.

Table 2-5: Conservation listed flora species returned by database searches, including Pre-Field Likelihood of Occurrence assessment of potential presence via habitat preference and proximity of previous recordings.

NM = Returned from NatureMap database search, RT= Returned from Rio Tinto database search

Species	Status	Database		Nearest known locality	Habitat and Discussion (Pre – field)	Likelihood of Occurrence (Pre - Field)
		NM	RT			
<i>Thryptomene wittweri</i>	T	x		4.9 km south east	Spreading or rounded shrub to 200 cm, occurring on skeletal red stony soils in high altitude areas. In the Pilbara, is known from the high altitude areas of Mt Meharry and nowhere else in the Pilbara. Representative high altitude areas do not occur in study area.	Unlikely
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	x	x	19.1 km south east	Shrub to 200 cm occurring on hill crests and cliff tops of ironstone hills. Habitat may occur on hills slopes.	Potential
<i>Hibiscus</i> sp. Mt Brockman (E. Thoma ET 1354)	P1		x	19.1 km north east	Spindly erect shrub to 300 cm occurring on rocky slopes, at the base of cliff faces and in steep gullies. Habitat may occur at base of breakaways	Potential
<i>Rhodanthe ascendens</i>	P1	x		16.4 km south	Ascending annual herb to 10 cm tall occurring on clay. No potential habitat.	Unlikely
<i>Triodia</i> sp. Karijini (S. van Leeuwen 4111)	P1	x		10.6 km north	Hummock grass to 70 cm occurring in high altitude areas on hill summits and steep upper slopes. A small amount of habitat, on hill slopes may extend into the study area.	Potential
<i>Vittadinia</i> sp. Coondewanna Flats (S. van Leeuwen 4684)	P1	x	x	4.5 km north	Erect, annual herb to 100 cm, occurring on loam – clay flats. Small amount of potential habitat	Potential
<i>Eremophila forrestii</i> subsp. Pingandy (M.E. Trudgen 2662)	P2	x	x	18.7 km south east	Shrub to 30 cm tall occurring on alluvial flats, usually in large numbers. Mulga provides potential habitat.	Potential
<i>Hibiscus</i> sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	P2				Spindly, erect shrub to 300 cm occurring on rocky slopes, at the base of cliff faces and in steep gullies. Habitat may occur at base of breakaways	Potential
<i>Oxalis</i> sp. Pilbara (M.E. Trudgen 12725)	P2	x		5 km south east	Annual herb to 20 cm, occurring in gullies and base of cliffs. Potential habitat present.	Potential

Species	Status	Database		Nearest known locality	Habitat and Discussion (Pre – field)	Likelihood of Occurrence (Pre - Field)
		NM	RT			
<i>Pentalepis trichodesmoides</i> subsp. <i>hispida</i>	P2	x		13 km north west	Multi-stemmed perennial shrub to 100 cm, occurring on slopes and low rises, particularly on basalt. No basalt hills occur in the study area, so unlikely.	Unlikely
<i>Thryptomene stenophylla</i>	P2	x		>400 km	Spreading shrub to 120 cm occurring on limestone hills and sandplains. Known from the Chapman Valley and Northampton areas.	No - erroneous record.
<i>Acacia dawweana</i>	P3	x		18 km north west	Spreading shrub to 150 cm with distinctive 'mini-ritchii' bark', occurring on rocky rises and along drainage lines. Potential habitat.	Potential
<i>Acacia effusa</i>	P3	x		7.1 km north	Low, dense shrub to 100 cm with distinctive 'mini-ritchii' bark', occurring on scree slopes of low ranges. Potential habitat.	Potential
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	P3		x	2.2 km east	Tussock grass to 80 cm occurring on hardpan plains. A small amount of suitable hardpan habitat may extend into the study area.	Potential
<i>Dampiera metallorum</i>	P3	x		5.5 km south east	Rounded, perennial herb to 50 cm tall, occurring on skeletal gravelly soil over banded ironstone on steep slopes and summits of hills. Upper slopes may provide habitat	Potential
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	P3	x		8.2 km south	Shrub to 150 cm occurring on skeletal soils over ironstone on summits. Potential habitat in study area.	Potential
<i>Goodenia lyrata</i>	P3		x	6.8 km north east	Prostrate, often intricate (elaborate), herb growing in sand and clay, usually on poorly drained flats often associated with various <i>Calandrinia</i> spp. and <i>Eucalyptus victrix</i> . Unlikely given the tiny amount of suitable habitat	Unlikely
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P3		x	16.5 km north east	Erect annual or biennial herb occurring on calcrete on low undulating plains. Unlikely to be suitable habitat	Unlikely
<i>Indigofera</i> sp. <i>Gilesii</i> (M.E. Trudgen 15869)	P3	x	x	10 km north east	Sparsely branched open shrub to 2 m tall. Recorded usually high in the landscape on skeletal soils overlaying massive banded iron of the Brockman Iron formation. Tops of breakaways may provide potential	Potential

Species	Status	Database		Nearest known locality	Habitat and Discussion (Pre – field)	Likelihood of Occurrence (Pre - Field)
		NM	RT			
					habitat.	
<i>Pilbara trudgenii</i>	P3	x		9 km south	Gnarled shrub to 100 cm occurring on skeletal ironstone soils, generally on west facing cliffs and scree slopes at the base of breakaways. Unlikely to be suitable habitat	Unlikely
<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794)	P3	x	x	2.1 km east	Shrub or scrambler to 400 cm with small lanceolate leaves. Recorded from mulga (<i>Acacia aneura</i>) and Snakewood (<i>A. xiphophylla</i>) vegetation on clay loam plains. Small amount of Mulga may provide habitat	Potential
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	x	x	2.1 km east	Herb or shrub to 30 cm tall occurring on protected areas near water courses, or along shaded rocky ridges, often in dry gullies and gorges. May occur at bases of breakaways and ridges.	Likely
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3		x	Previously recorded	Shrub to 50 cm tall occurring at the base of steep slopes, gullies, and gorges in ironstone ranges. Previously recorded	Recorded
<i>Solanum kentrocaule</i>	P3	x		5.6 km south east	Spindly shrub to 150 cm growing on high altitude slopes. May occur in rocky blowout areas.	Potential
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3		x	4.6 km north	Tussock perennial grass to 160 cm occurring on clay flats. No clay flats present.	Unlikely
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3		x	Previously recorded	Perennial hummock or tussock grass to 40 cm occurring amongst rocks and outcrops in gullies. Previously recorded	Recorded
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	x	x	7.5 km north	Shrub to 150 cm occurring on skeletal soils over ironstone. Suitable habitat throughout study area.	Likely
<i>Eremophila youngii</i> subsp. <i>lepidota</i>	P4	x		7 km south east	Shrub to 300 cm occurring on stony red sandy loams on flats, plains and floodplains, sometimes semi-saline. Unlikely to be suitable habitat	Unlikely

2.3.2 Conservation listed fauna returned by desktop study

Eighteen conservation listed fauna species were returned by the database search (Appendix 1). There was one species listed as Schedule 1 under the WC Act and Endangered under the EPBC Act, one species listed as Schedule 2 under the WC Act and Endangered under the EPBC Act, one species listed as Schedule 2 under the WC Act and Vulnerable under the EPBC Act, four species listed as Schedule 3 under the WC Act and Vulnerable under the EPBC Act, one species listed as Schedule 7 under the WC Act, eight species listed on Migratory agreements under the EPBC Act and two species listed as Priority under the WC Act.

One species was considered 'likely' to occur, six species considered to have 'potential' to occur within the study area and ten species considered 'unlikely' to occur based on the criteria used to assess the pre-field likelihood of occurrence (Appendix 2, Table 2-6).

One conservation listed fauna species have been previously recorded within the study area.

***Pseudomys chapmani* (Western Pebble Mound Mouse) – Priority 4**

Secondary evidence of the Western Pebble-Mound Mouse was recorded within the current study area polygon by Rio Tinto (2013). Four recently active mounds were recorded. These mounds had some cover of vegetation, and had slightly lost their dome formation. They were considered unlikely to have been used in recent years.

The likelihood rating of conservation listed fauna returned by the database search was later updated post field assessment (Table 3-6) including factors such as if there was suitable habitat present within the study area or if the species may not have been present (e.g. the study area was not surveyed at a suitable time).

Table 2-6: Conservation listed fauna species returned by database searches, including Pre-Field Likelihood of Occurrence assessment of potential presence via habitat preference and proximity of previous recordings.

NM = Returned from NatureMap database search, RT= Returned from Rio Tinto database search

Species	Common Name	Status		Database			Distance to nearest record	Habitat and Discussion (Pre – field)	Likelihood of occurrence (Pre – field)
		WC Act	EPB Act	NM	RT	EPBC			
<i>Pezoporus occidentalis</i>	Night Parrot	S1	En			x	101 km north east	This species inhabits treeless or sparsely wooded spinifex near water. This cryptic species is not known to occur from the area, and is unlikely to occur in the study area	Unlikely
<i>Dasyurus hallucatus</i>	Northern Quoll	S2	En			x	49 km north east	The Northern Quoll occurs in Northern Australia from the North-west Cape in Western Australia to south-east Queensland, but has declined in recent years. Its distribution is now restricted to six main areas including the northwest Kimberley and Pilbara regions of Western Australia (Braithwaite and Griffiths 1994). In the Pilbara region, the species tends to prefer the Rocklea, Macroy and Robe land systems (Biota 2008b) and occurs within gorges, breakaways and major drainage lines with large Eucalyptus trees. Potential habitat for this species may occur within study area.	Potential
<i>Rostratula australis</i>	Australian Painted Snipe	S2	Vu			x	450 km north east	The Australian Painted Snipe is a stocky wading bird that typically occupies shallow inland wetlands (DEH, 2003). Johnstone and Storr (1998) state this species is only a rare summer visitor to the north-west, and single birds have been infrequently recorded from man-made ponds. Aerial reveals there is unlikely to be any suitable habitat for this species.	Unlikely
<i>Liasis olivaceus</i> subsp. <i>barroni</i>	Pilbara Olive Python	S3	Vu	x		x	7.5 km south	Regarded as a Pilbara endemic, the Pilbara Olive Python has a known distribution that coincides roughly with the Pilbara bioregion (Environment Australia, 2012). This species typically shelters in logs, flood debris, caves, tree hollows and	Potential

Species	Common Name	Status		Database			Distance to nearest record	Habitat and Discussion (Pre – field)	Likelihood of occurrence (Pre – field)
		WC Act	EPB Act	NM	RT	EPBC			
								thick vegetation close to water and rock outcrops (Burbidge, 2004). Potential habitat within study area.	
<i>Macrotis lagotis</i>	Greater Bilby	S3	Vu			x	88 km north east	The Bilby prefers tall shrublands and open woodlands on sandy plains (van Dyck and Strahan 2008). Not known from rocky slopes and unlikely to be suitable habitat.	Unlikely
<i>Macroderma gigas</i>	Ghost Bat	S3	Vu	x			2.5 km south	Large caves, mines and deep rock fissures and is known to form large maternity roosting colonies. This species distribution is strongly influenced by the availability of suitable roost caves. Potential habitat within study area.	Potential
<i>Rhinonictoris aurantia</i>	Pilbara Leaf-nosed Bat	S3	Vu			x	49 km east	This species inhabits abandoned mine shafts, granite rock pile terrain of the east Pilbara and caves formed in gorges that dissect sedimentary geology in the west Pilbara (van Dyck and Strahan 2008). This species is more influenced by the availability of suitable roost caves than by habitat type and high humidity is particularly important to this species (Churchill 1998). Foraging habitat may exist within study area.	Potential
<i>Falco peregrinus</i>	Peregrine Falcon	S7		x			11.5 km south west	Generally found along rocky ledges, cliffs, watercourses or margins with cleared land. This species is highly mobile and the surrounding region has vast areas of land systems with preferential habitat types, most of which are undeveloped.	Potential
<i>Apus pacificus</i>	Fork-tailed Swift	S5	M			x	27.5 km south east	This species is entirely aerial within the Pilbara and thus does not utilise the terrestrial surface (Schodde and Tidemann 2003). This species may overfly the study area however will not be impacted by the Proposal.	Potential

Species	Common Name	Status		Database			Distance to nearest record	Habitat and Discussion (Pre – field)	Likelihood of occurrence (Pre – field)
		WC Act	EPB Act	NM	RT	EPBC			
<i>Ardea alba</i>	Great Egret		M			x	104 km north east	Utilises a range of wetland and riparian habitats (Schodde and Tidemann 2003). Unlikely to land as no permanent water in or near study area.	Unlikely
<i>Ardea ibis</i>	Cattle Egret	S5	M			x	111 km south east	Utilises a range of wetland and riparian habitats (Schodde and Tidemann 2003). Unlikely to land as no permanent water in or near study area.	Unlikely
<i>Charadrius veredus</i>	Oriental Plover	S5	M			x	183 km north west	The Oriental Plover is a non-breeding migrant in summer. Predominantly utilises beaches and tidal flats but also sparsely vegetated plains, short grass and recently burnt areas for foraging (Johnstone and Storr 1998). Unlikely to utilise habitat within study area.	Unlikely
<i>Hirundo rustica</i>	Barn Swallow	S5	M			x	280 km north	In Australia, this species can be recorded in open country in coastal lowlands, often near water, towns and cities. Birds are often sighted perched on overhead wires (Pizzey 2007; Blakers et al. 1984), and also in or over freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub thickets and tussock grassland (Schodde & Mason 1999). Unlikely to land as no permanent water in or near study area.	Unlikely
<i>Merops ornatus</i>	Rainbow Bee-eater	S5	M	x		x	16.5 km south east	This species occurs across much of mainland Australia, mainly in open forests and woodlands, shrubland and in various cleared or semi cleared habitats. It nests in small burrows in flat or sloping sandy ground often in the banks of rivers or creeks, and also in roadside cuttings and windrows (Schodde and Tidemann 2003). Potential habitat likely in the study area.	Likely

Species	Common Name	Status		Database			Distance to nearest record	Habitat and Discussion (Pre – field)	Likelihood of occurrence (Pre – field)
		WC Act	EPB Act	NM	RT	EPBC			
<i>Motacilla cinerea</i>	Grey Wagtail	S5	M			x	756 km north east	Rare visitor to northern Australia from the northern hemisphere. Species is unlikely to occur in the study area.	Unlikely
<i>Motacilla flava</i>	Yellow Wagtail	S5	M			x	672 km north east	Uncommon visitor to northern Pilbara region. Species is unlikely to occur in the study area.	Unlikely
<i>Leggadina lakedownensis</i>	Short-tailed Mouse	P4		x			17 km east	In Western Australia the distribution of this species includes the Pilbara and Kimberley regions (Menkhorst and Knight 2001). Regional records suggest that the primary mainland habitat comprises areas of cracking clay and adjacent habitats. Habitat unlikely to occur within study area.	Unlikely
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4		x	x		Previously Recorded	The Western Pebble-mound Mouse is endemic to the Pilbara region of Western Australia and occurs west to the McKay Range and south to the Collier Range (Menkhorst and Knight 2001). The species is patchily distributed on gentle colluvial slopes of rocky, hummock grassland with little or no soil and sparse shrub layer. Previously recorded within study area.	Previously Recorded

2.4 FLORA AND VEGETATION FIELD SURVEY

The study area was surveyed over three trips – on the 5th October 2014 by Rio Tinto botanist Scott Reiffer and consulting botanist Hayden Ajduk (360 Environmental), the 8 – 9th November 2014 by Rio Tinto botanists Scott Reiffer and Emma Carroll and on the 15th April 2015 by Rio Tinto botanist Scott Reiffer and consulting botanist Hayden Ajduk (360 Environmental).

The study area was searched and sampled systematically for flora and vegetation in accordance with Guidance Statement 51 (EPA 2002 2004a), which was current at the time of the surveys. Habitats with potential to support species of conservation significance, identified by the database search, were targeted searched.

Relevés (unpegged) survey sites, typically 50 x 50 m in size (to represent an estimated 2,500 m²) were established in representative areas of all vegetation associations within the study area. A botanical relevé is described as a vegetation sample that describes the structure and floristics, and associated physical attributes, flora and opportunistic fauna sightings. A total of 23 relevés were surveyed in representative vegetation associations. In addition, six relevés established in 2013 located within the polygon were utilised. The layout and co-ordinates of each relevé from the study are presented in Figure 2-3 and Appendix 4

At each relevé site, a location was recorded with a handheld GPS and photographs were taken. Data was collected on the flora species present, including: percentage cover; average height of each vegetation stratum; site slope; aspect; topography; soil texture and colour; and landform type and habitat features.

Recent orthorectified aerial photography covering the study area was reviewed whilst in the field to determine boundaries of vegetation communities. The location of each site where a vegetation record was taken was determined based on interpretation of aerial photography and a visit to the site for ground truthing. Determination of boundaries between vegetation associations was also undertaken using aerial photography and ground truthing whilst in the field. The mapping data gathered in the field was used to prepare a draft map of vegetation, utilising rectified 1:5,000 scale colour digital air photography as the background. The vegetation boundaries were digitised on-screen using MapInfo 11.0.

Locations of flora of conservation significance, flora of special interest, unknown flora, weeds and other observations including opportunistic fauna sightings were recorded using a hand-held GPS (WGS 84 datum). Where populations of conservation significant flora were encountered; estimates of density or numbers of individuals, habitats and associated flora were recorded. Density or numbers of individuals of introduced flora species were also recorded.

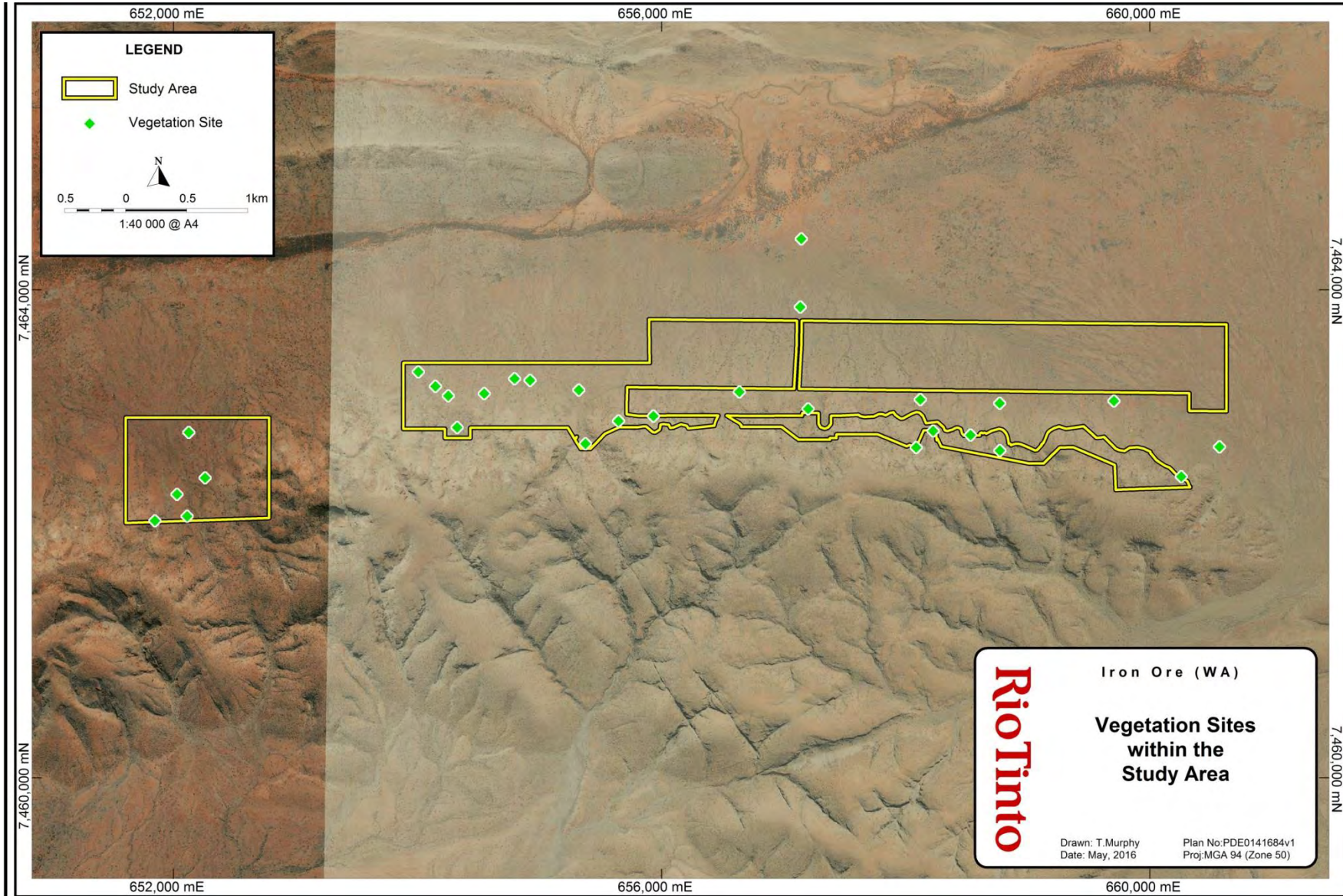


Figure 2-3: Vegetation survey sites in study area

2.5 VEGETATION DESCRIPTIONS, CONDITION ASSESSMENT AND MAPPING

Vegetation descriptions for the survey area were based on Specht (1970) with modification by Aplin (1979) (Appendix 3). Descriptions were taken at relevés and during traverses where changes in the vegetation structure were observed. A photograph of each vegetation association, and a location using a hand-held GPS (WGS84 datum) was taken. Assessment of the overall condition of each vegetation association was made based on Trudgen (1988) (Appendix 3).

The mapping notes gathered in the field were used to prepare a draft map of vegetation, utilising rectified colour digital air photography as the background. The vegetation boundaries were digitised on-screen using MapInfo 11.0.

The resulting polygons were attributed with the relevant information including the vegetation association, description and condition. Point locations of each relevé recorded were also uploaded into MapInfo, together with visual photographs which were used to assist with the finalising of vegetation boundaries.

Vegetation mapping created by this study, has intended to be analogous with Rio Tinto (2013).

2.6 FLORA IDENTIFICATION

An interim species list was compiled in the field covering common species identified with confidence by the botanist. Voucher samples of unknown and Priority flora were taken which were pressed and dried in the field. Each sample was assigned a unique reference identification sample number.

Flora samples collected in the field were identified using relevant taxonomic publications and compared to collections at the Western Australian Herbarium. Identification of samples was conducted by Parks and Wildlife taxonomist A. Perkins (WA Herbarium). Voucher quality specimens will be lodged with the Western Australian Herbarium (WAH) in the future. Nomenclature was cross-checked using the Parks and Wildlife's FloraBase (WAH 2016) website, and updated where required.

2.7 FAUNA HABITAT ASSESSMENT

Broad fauna habitats were identified and mapped based on landforms and vegetation associations identified during the current survey. Habitats were then assessed for their potential to support species of conservation significance, taking into account relevant State and Commonwealth Guidelines to support identification of 'potential' habitat. Supporting evidence such as sightings, the presence of microhabitats including caves, water holes, tree hollows and burrows were recorded throughout the study area. Representative traverses were also completed throughout all habitats present within the study area.

Further assessment on the 'likelihood' of the study area supporting fauna of conservation significance was undertaken based on the quality of habitat for fauna, and to a wider suite of fauna assemblages. Data was collected opportunistically throughout the study area and habitats were rated based on the likelihood of supporting conservation significant fauna species. Habitats were rated based on the likelihood of supporting conservation significant fauna species as 'likely', 'potential' or 'unlikely' (Appendix 2). Based on this assessment, significant areas for fauna were also mapped and described as needed.

Fauna habitats were assessed and mapped as per EPA Guidance Statement No. 56 (EPA 2004b); Fauna Technical Guide (EPA and DEC 2010); and EPA Position Statement No. 3 (EPA 2002), which were current at the time of the survey.

2.8 OPPORTUNISTIC FAUNA RECORDS

Opportunistic fauna sightings were recorded whilst surveying the study area with a focus on conservation significant species and supporting evidence. A location of each opportunistic fauna record was taken in the field using a hand-held GPS (WGS84 datum).

Potential fauna assemblages were based on the desktop review of previous surveys in the area and database searches.

2.9 OTHER VEGETATION OF SIGNIFICANCE

Vegetation not legally protected or classified as part of regulatory ratings may still be regarded as being of significance. Vegetation that may fall under this category includes (but is not limited to) vegetation supporting elevated floristic diversity, habitats supporting numerous conservation listed species, ecosystems at risk (Kendrick 2001), novel floristic associations, groundwater dependant ecosystems, uncommon vegetation and associations on novel landforms.

Vegetation associations or biological features assigned a significance classification are, for the purpose of this document, considered to be of elevated significance when compared to all other identified associations or features that are common or widespread and therefore well represented.

2.10 ENVIRONMENTALLY SIGNIFICANT AREAS

Rio Tinto manages all work, including clearing, through the Approvals Coordination System which ensures biological and heritage surveys are completed and all government regulatory approvals are in place prior to the commencement of works.

Environmentally significant features are uploaded into Rio Tinto's MapInfo database (GIS system) which includes a description highlighting the significance of these areas. Small populations or individuals are protected as buffered point locations, while larger spatial populations and significant habitat are protected as 'significant areas'. The GIS system is used as part of the Approvals Coordination System when reviewing the Proposal, thereby ensuring appropriate management conditions are in place.

3 RESULTS

3.1 VEGETATION OF THE STUDY AREA

Six vegetation associations were identified across two major landforms over the study area (Figure 3-1). The vegetation associations are summarised in Table 3-1 and are described in detail on the following pages, accompanied by mapping of the vegetation types (Figure 3-1).

Four vegetation associations were described from stony hills and lower slopes and two units from drainage lines.

Table 3-1: Vegetation associations of the Study Area

Unit	Vegetation Description	Extent within the study area(ha)	Extent within the study area (%)
Vegetation of Hills and Lower Slopes			
S1	Low open woodland to scattered low trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> over tall open shrubland / mallee of <i>Acacia atkinsiana</i> and <i>Eucalyptus gamophylla</i> over open tussock grassland of <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835) with <i>Amphipogon sericeus</i> .	260.94	47.76
S2	Scattered low trees of <i>Corymbia deserticola</i> subsp. <i>deserticola</i> over scattered shrubs of <i>Acacia atkinsiana</i> , <i>Acacia ancistrocarpa</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> over open tussock grassland of <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835) with <i>Amphipogon sericeus</i> and <i>Triodia epactia</i> .	11.32	2.07
S3	Tall mallee shrubland of <i>Eucalyptus gamophylla</i> over scattered mixed shrubs over open tussock grassland of <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835) with <i>Triodia epactia</i> , <i>Paraneurachne muelleri</i> and <i>Themeda triandra</i> .	135.0	24.71
S4	Low open woodland to scattered low trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> over open hummock grassland of <i>Triodia epactia</i> and <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835).	101.58	18.59
Total		508.84	93.13
Vegetation of Drainage Lines			
D2	Low woodland to low open woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> over tall shrubland to shrubland of <i>Acacia atkinsiana</i> , <i>Gossypium robinsonii</i> , <i>Acacia tenuissima</i> , <i>Acacia ancistrocarpa</i> , <i>Acacia bivenosa</i> , <i>Acacia maitlandii</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> over tussock grassland to open tussock grassland of <i>Themeda triandra</i> and <i>Triodia epactia</i> with <i>Eriachne mucronata</i> .	37.26	6.82
D4	Low open woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia ferriticola</i> over tall open shrubland of <i>Acacia pyrifolia</i> , <i>Acacia tenuissima</i> and mixed shrubs over open tussock grassland of <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739), <i>Themeda triandra</i> , <i>Triodia epactia</i> and <i>Cymbopogon ambiguus</i> .	0.3	0.05
Total		37.56	6.87
GRAND TOTAL		546.4	100

Vegetation of Low Hills and Rises

S1	Low open woodland to scattered low trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>, <i>Corymbia hamersleyana</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> over tall open shrubland / mallee of <i>Acacia atkinsiana</i> and <i>Eucalyptus gamophylla</i> over open tussock grassland of <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835) with <i>Amphipogon sericeus</i>.
Landform and soils	This unit was recorded from red brown loams with a scattering of ironstone cobbles and pebbles. This unit was recorded from the lower undulating slopes at the base of the range, from the Boolgeeda and Newman Land Systems.
Distribution	This unit was recorded throughout the study area. It was recorded from 260.94 ha (47.76%)
Associated species	<u>Tall shrubs:</u> <i>Hakea chordophylla</i> <u>Shrubs:</u> <i>Acacia bivenosa</i> , <i>Acacia tenuissima</i> , <i>Acacia trudgeniana</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Senna glutinosa</i> subsp. <i>glutinosa</i> <u>Low shrubs:</u> <i>Corchorus lasiocarpus</i> , <i>Ptilotus astrolasius</i> , <i>Ptilotus calostachyus</i> , <i>Ptilotus rotundifolius</i> , <i>Ptilotus obovatus</i> , <i>Solanum elatius</i> , <u>Grasses:</u> <i>Cymbopogon ambiguus</i> , <i>Paraneurachne muelleri</i>
Conservation listed Flora	<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) (P1) <i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P3) <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3)
Condition	Excellent
Relevés	JD06, JD08, JD12, S4, S5, JEM02-13, JEM03-03, S004-13
Fire & Disturbance	This unit was not affected by fire. There was no disturbance recorded.
Photo	Plate 1



Plate 1: Representative photo of vegetation association S1 (foreground) (from 654253E, 7463141N)

S2	Scattered low trees of <i>Corymbia deserticola</i> subsp. <i>deserticola</i> over scattered shrubs of <i>Acacia atkinsiana</i> , <i>Acacia ancistrocarpa</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> over open tussock grassland of <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835) with <i>Amphipogon sericeus</i> and <i>Triodia epactia</i> .
Landform and soils	This unit was recorded from red brown loams with a scattering of ironstone cobbles and pebbles. This unit was recorded from the lower undulating slopes at the base of the range, from the Boolgeeda and Newman Land Systems.
Distribution	This unit was recorded from the western section of the study area. It was recorded from 11.32 ha (2.07%)
Associated species	<u>Trees:</u> <i>Hakea chordophylla</i> <u>Tall shrubs:</u> <u>Shrubs:</u> <i>Acacia bivenosa</i> , <i>Acacia trudgeniana</i> , <u>Low shrubs:</u> <i>Goodenia stobbsiana</i> , <i>Indigofera monophylla</i> , <i>Ptilotus calostachyus</i> , <i>Ptilotus rotundifolius</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Sida echinocarpa</i> , <i>Solanum lasiophyllum</i> , <u>Grasses:</u> <i>Paraneurachne muelleri</i> <u>Herbs:</u> <i>Bulbostylis barbata</i> , <i>Fimbristylis dichotoma</i>
Conservation listed Flora	
Condition	Excellent
Releves	S3
Fire & Disturbance	This unit was not affected by fire. There was no disturbance recorded.
Photo	Plate 2



Plate 2: Representative photo of vegetation association S2 (from 660571E, 7462723N)

S3	Tall mallee shrubland of <i>Eucalyptus gamophylla</i> over scattered mixed shrubs over open tussock grassland of <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835) with <i>Triodia epactia</i>, <i>Paraneurachne muelleri</i> and <i>Themeda triandra</i>.
Landform and soils	This unit was recorded from red brown loams with a scattering of ironstone cobbles and pebbles. This unit was recorded from lower undulating slopes at the base of the range, from the Boolgeeda Land Systems.
Distribution	This unit was recorded from the central and eastern sections of the study area. It was recorded from 135.0 ha (24.71%)
Associated species	<u>Trees:</u> <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> <u>Tall shrubs:</u> <i>Acacia aptaneura</i> , <i>Acacia atkinsiana</i> , <i>Acacia elachantha</i> , <i>Acacia maitlandii</i> , <i>Acacia steedmanii</i> , <i>Acacia tenuissima</i> , <i>Eremophila longifolia</i> <u>Shrubs:</u> <i>Acacia bivenosa</i> <u>Low shrubs:</u> <i>Ptilotus calostachyus</i> , <i>Ptilotus nobilis</i> , <i>Ptilotus rotundifolius</i> , <i>Senna artemisioides</i> subsp. <i>helmsii</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Senna glutinosa</i> subsp. <i>×luerssenii</i> , <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Solanum elatius</i> <u>Grasses:</u> <i>Amphipogon sericeus</i>
Conservation listed Flora	
Condition	Excellent
Relevés	JD01, JD03, JD10
Fire & Disturbance	This unit was not affected by fire. There was no disturbance recorded.
Photo	Plate 3



Plate 3: Representative photo of vegetation association S3 (from 660571E, 7462723N)

S4	Low open woodland to scattered low trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> over open hummock grassland of <i>Triodia epactia</i> and <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835).
Landform and soils	This unit was recorded from red brown skeletal loams with ironstone boulders, rocks and outcropping. This unit was recorded from the mid and lower slopes of the range, as well as breakaway rock faces, from the Newman Land System with a small amount of overlap onto the Boolgeeda Land System.
Distribution	This unit was recorded in the southern half of the study area. It was recorded from 101.58 ha (18.59%).
Associated species	<p><u>Trees:</u> <i>Hakea chordophylla</i></p> <p><u>Tall shrubs:</u> <i>Acacia pruinocarpa</i>, <i>Acacia tenuissima</i></p> <p><u>Shrubs:</u> <i>Acacia bivenosa</i>, <i>Astrotricha hamptonii</i>, <i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>, <i>Senna glutinosa</i> subsp. <i>glutinosa</i></p> <p><u>Low shrubs:</u> <i>Acacia marramamba</i>, <i>Corchorus lasiocarpus</i>, <i>Ptilotus calostachyus</i>, <i>Ptilotus obovatus</i>, <i>Ptilotus rotundifolius</i></p> <p><u>Grasses:</u> <i>Cymbopogon ambiguus</i>, <i>Cymbopogon obtectus</i>, <i>Eriachne mucronata</i>, <i>Themeda triandra</i>, <i>Triodia brizoides</i>, <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)</p> <p><u>Herbs:</u> <i>Bulbostylis barbata</i>, <i>Cassytha capillaris</i></p>
Conservation listed Flora	<p><i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) (P1)</p> <p><i>Tetradlea fordiana</i> (P1)</p> <p><i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3)</p> <p><i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P3)</p> <p><i>Solanum kentrocaule</i> (P3)</p> <p><i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3)</p> <p><i>Acacia bromilowiana</i> (P4)</p> <p><i>Eremophila magnifica</i> subsp. <i>magnifica</i> (P4)</p>
Condition	Excellent
Relevés	JD02, JD05, JD07, JD14, JD15, JD16, JD20, S1, S6
Fire & Disturbance	This unit was not affected by fire. There was no disturbance recorded.
Photo	Plate 4



Plate 4: Representative photo of vegetation association S4 (from 657201E, 7463034N)

Vegetation of Drainage Lines

D2	Low woodland to low open woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> over tall shrubland to shrubland of <i>Acacia atkinsiana</i>, <i>Gossypium robinsonii</i>, <i>Acacia tenuissima</i>, <i>Acacia ancistrocarpa</i>, <i>Acacia bivenosa</i>, <i>Acacia maitlandii</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> over tussock grassland to open tussock grassland of <i>Themeda triandra</i> and <i>Triodia epactia</i> with <i>Eriachne mucronata</i>.
Landform and soils	This unit was recorded from red brown loams with ironstone pebbles. This unit was recorded from drainage lines running off the range, from the Boolgeeda and Newman Land Systems.
Distribution	This unit was recorded throughout the study area. It was recorded from 37.26 ha (6.82%)
Associated species	<u>Tall shrubs:</u> <i>Acacia steedmanii</i> , <i>Acacia tenuissima</i> , <i>Eucalyptus gamophylla</i> <u>Shrubs:</u> <i>Stylobasium spathulatum</i> <u>Low shrubs:</u> <i>Keraudrenia velutina</i> subsp. <i>elliptica</i> , <i>Ptilotus calostachyus</i> , <i>Senna ferraria</i> <u>Grasses:</u> <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835), <i>Triodia wiseana</i>
Conservation listed Flora	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P3) <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3)
Condition	Excellent
Relevés	JD04, S2, JEM01-13, S001-13, S002-13
Fire & Disturbance	This unit was not affected by fire. There was no disturbance recorded.
Photo	Plate 5



Plate 5: Representative photo of vegetation association D2 (from 654796E, 7463281N)

D4	Low open woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia ferritcola</i> over tall open shrubland of <i>Acacia pyrifolia</i>, <i>Acacia tenuissima</i> and mixed shrubs over open tussock grassland of <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739), <i>Themeda triandra</i>, <i>Triodia epactia</i> and <i>Cymbopogon ambiguus</i>.
Landform and soils	This unit was recorded from red brown skeletal loams with ironstone outcropping, rocks and pebbles. This unit was recorded from drainage lines running off the range, from the Newman Land System
Distribution	This unit was recorded from the southern sections of the study area. It was recorded from 0.3 ha (0.05%)
Associated species	<u>Tall shrubs:</u> <i>Acacia aptaneura</i> , <i>Acacia paraneura</i> <u>Shrubs:</u> <i>Acacia bivenosa</i> , <i>Acacia maitlandii</i> , <i>Dodonaea pachyneura</i> , <i>Eremophila jucunda</i> subsp. <i>pulcherrima</i> , <i>Ficus brachypoda</i> , <i>Senna glutinosa</i> subsp. <i>glutinosa</i> <u>Low shrubs:</u> <i>Indigofera</i> sp. <i>Fractiflexa</i> (S. van Leeuwen 3773), <i>Jasminum didymum</i> subsp. <i>lineare</i> , <i>Ptilotus obovatus</i> , <i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925), <i>Solanum lasiophyllum</i> <u>Grasses:</u> <i>Aristida burbidgeae</i> , <i>Eriachne mucronata</i> , <i>Paraneurachne muelleri</i> , <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)
Conservation listed Flora	<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) (P3)
Condition	Excellent
Releves	JD13, JD17
Fire & Disturbance	This unit was not affected by fire. There was no disturbance recorded.
Photo	Plate 6



Plate 6: Representative photo of vegetation association D4 (from 655934E, 7462975N)

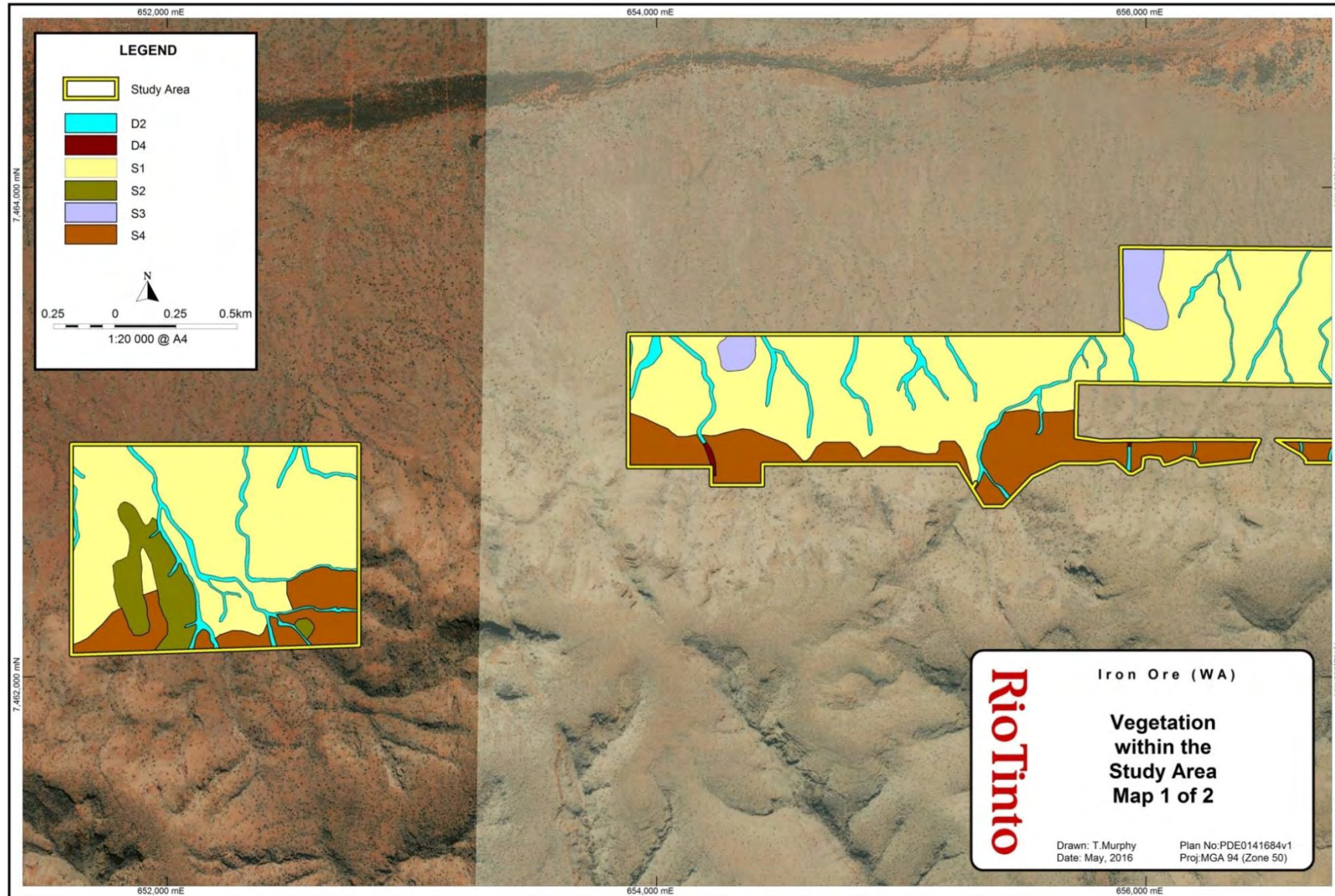


Figure 3-1: Vegetation Mapping of the Study Area (Map 1 of 2)

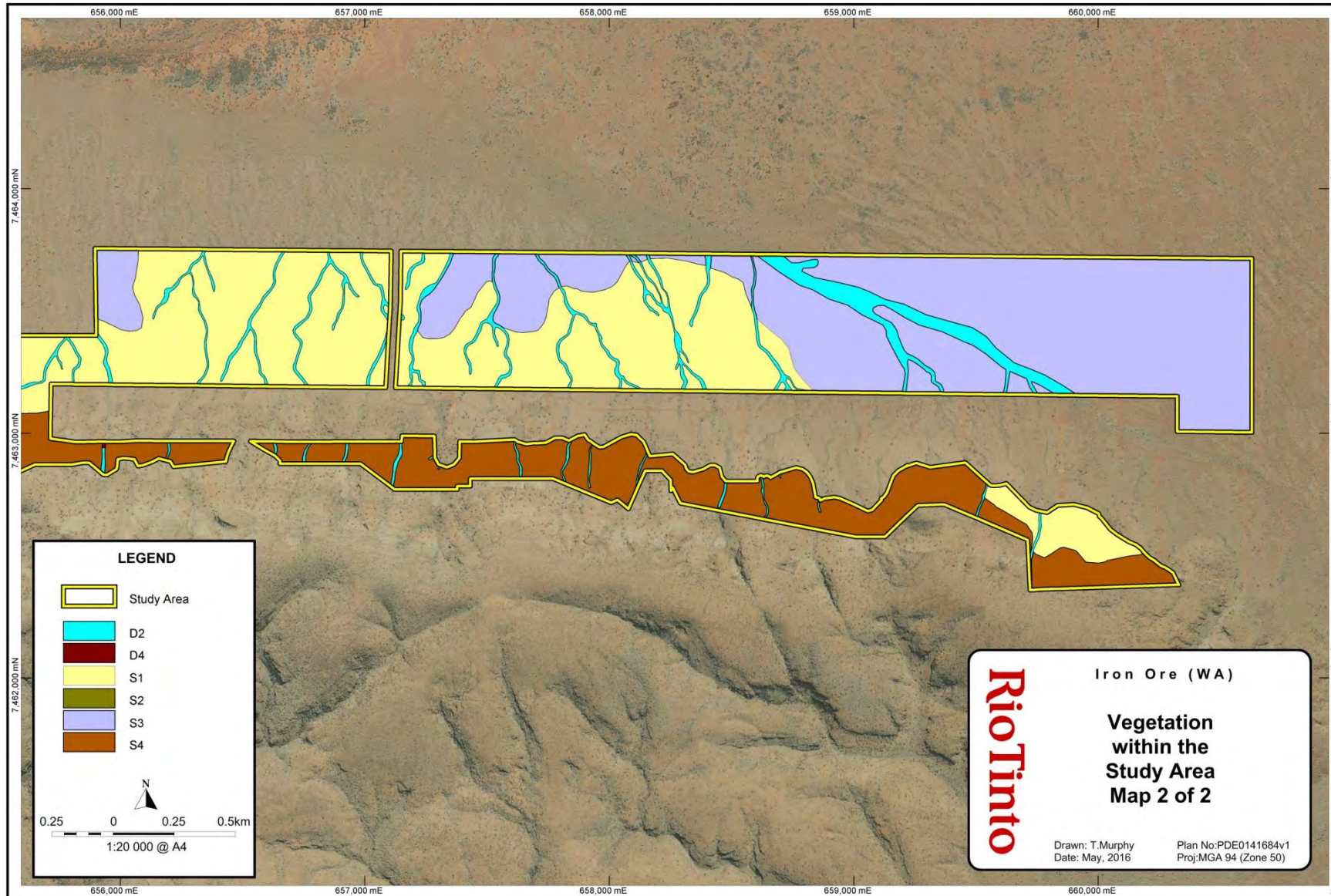


Figure 3-2: Vegetation Mapping of the Study Area (Map 2 of 2)

3.2 VEGETATION CONDITION

The condition of vegetation within the study area was rated as being in Excellent condition (Trudgen 1988, Figure 3-3). One introduced (weed) flora species was recorded within the study area, **Bidens bipinnata*, however its presence did not affect the condition of vegetation within the study area.

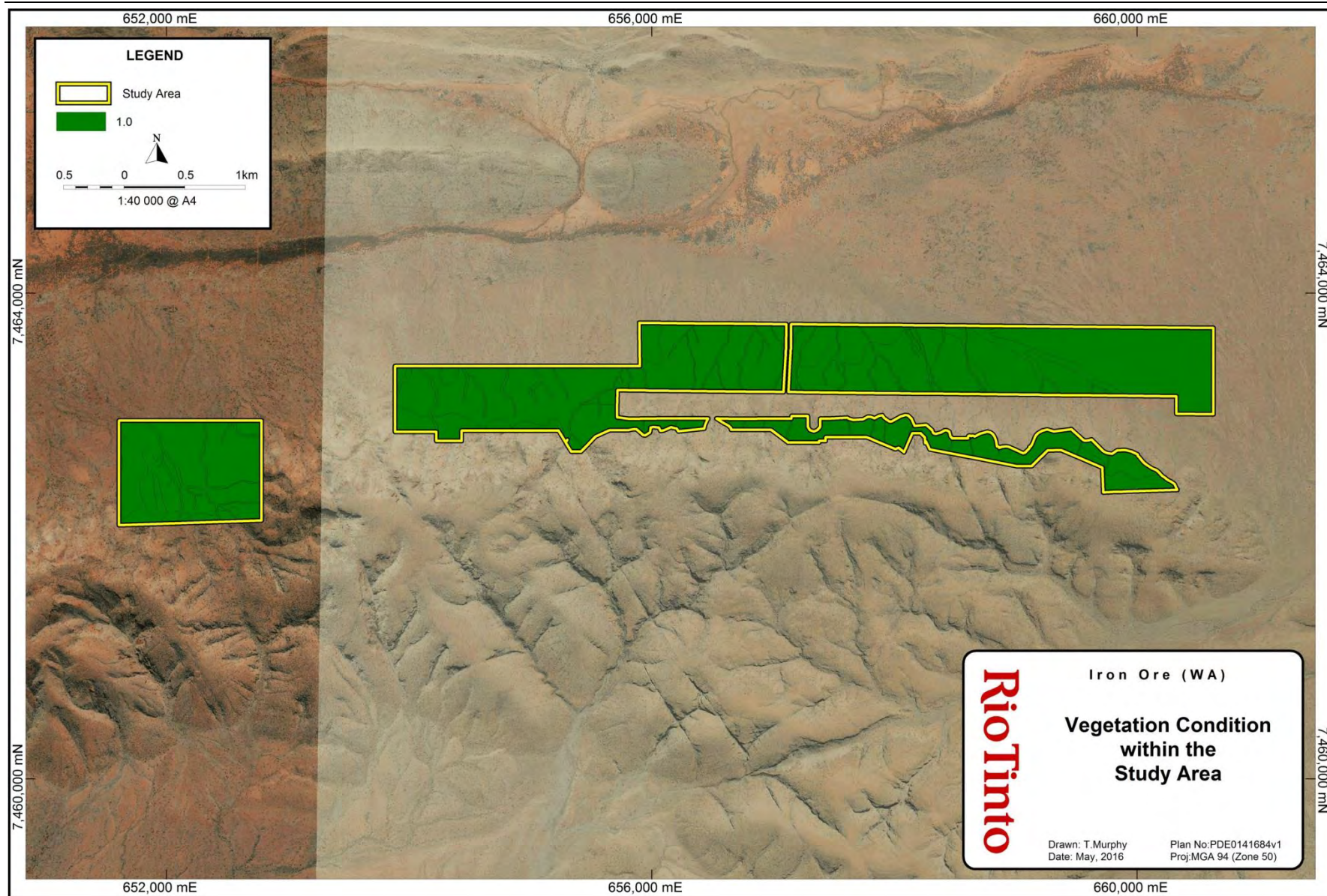


Figure 3-3: Vegetation Condition Mapping of the Study Area

3.3 VEGETATION OF CONSERVATION SIGNIFICANCE

None of the vegetation associations occurring within the study area correspond to any ecosystems listed as Threatened under the EPBC Act and none are consistent with ecosystems listed as TECs by Parks and Wildlife (2014).

None of the vegetation associations occurring within the study area are representative of listed PECs by Parks and Wildlife (2014).

3.4 OTHER VEGETATION OF SIGNIFICANCE

None of the vegetation units encountered within the study area are representative of Ecosystems at Risk (Kendrick 2001). None of the vegetation units encountered within the study area are of elevated significance.

The cliff and breakaway habitat that supports the recorded population of *Tetratheca fordiana*, would be considered locally and regionally significant. Although this species does not extend within the study area, an internal Rio Tinto significant area has been established that covers the recorded population of *Tetratheca fordiana*, as well as some nearby potential habitat, also outside the study area. The significant area is discussed further in Section 3.14.

3.5 NATIVE FLORA RECORDED DURING STUDY

A total of 186 taxa from 81 genera representing 38 families were recorded during the current survey (Table 3-2, Appendix 5).

The most taxon-rich families were Fabaceae (43 taxa), Poaceae (29 taxa), Malvaceae (22 taxa), Amaranthaceae (9 taxa) and Scrophulariaceae (8 taxa). The most species rich genera were *Acacia* (27 taxa), *Senna* (10 taxa), *Sida* (7 taxa), *Triodia* (6 taxa) and *Dodonaea* (6 taxa).

The dominant plant groups are consistent with other surveys of the Juna Downs locality. The number of taxa recorded by the current study is generally less than similar sized surveys of the Juna Downs locality [e.g. ecologia (2012), Rio Tinto (2009, 2011, 2013)]. This is to be expected, as the current study was restricted to hills and foot slopes. Other surveys of the Juna Downs locality included a higher diversity of land forms, including the species rich loam and clay plains.

Table 3-2: Total recorded numbers of families, genera, species, taxa, priority species and weeds recorded during study

Family	Number
Families	38
Genera	83
Species	191
Taxa	194
Priority species	8
Weed	1

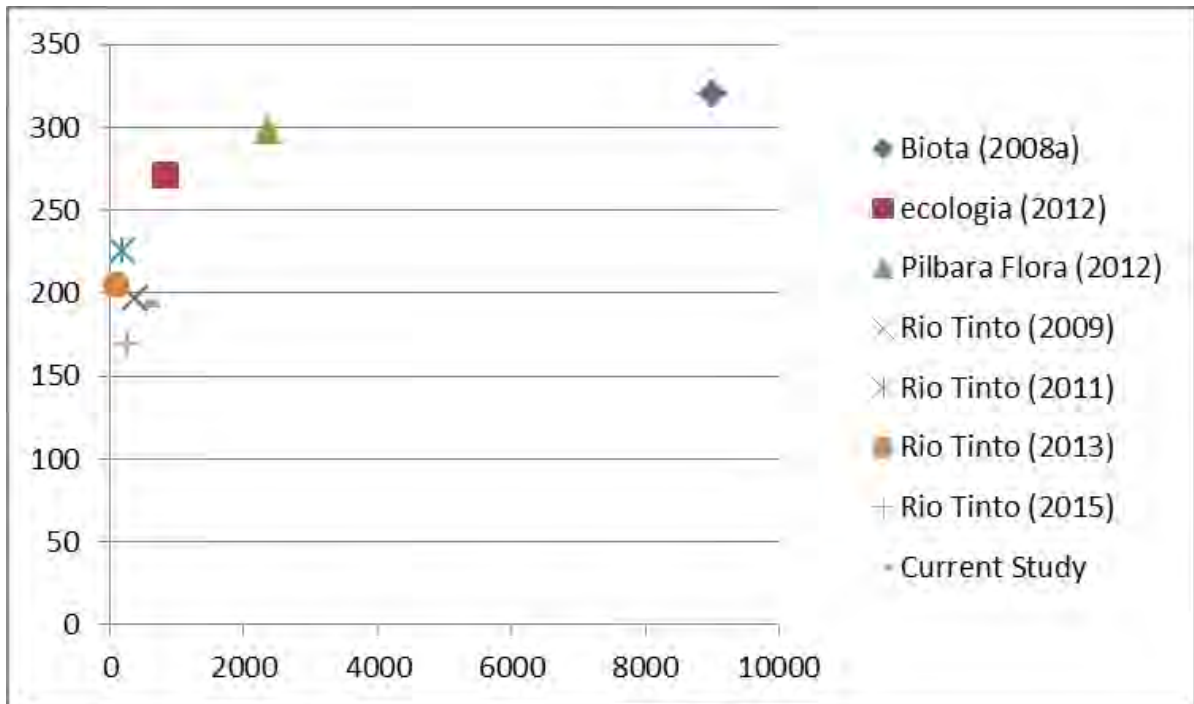


Figure 3-4: Comparison of number of taxa recorded during study to previous surveys

3.6 CONSERVATION LISTED FLORA RECORDED DURING STUDY

No Threatened flora species were recorded during the study.

A total of eight Priority flora species were recorded within the study area. These species are discussed in detail below, and locations of individuals are presented in Appendix 6.

***Eremophila* sp. Hamersley Range (K. Walker KW 136) (Priority 1)**

Eremophila sp. Hamersley Range (K. Walker KW 136) is a shrub to 200 cm occurring on hill crests and cliff tops of ironstone hills (Plate 7). This species was recorded during the current survey from eight locations for a total population of 30 plants. However only two records (2 plants) were located within the study area, the remaining locations were recorded from outside of the study area (Figure 3-6).

This species has a range of approximately 389 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 359 km from the Rio Tinto database. This species has a total population count of 3,057 plants, from 345 records, within the Rio Tinto database. This species has previously been recorded from Eastern Range, Channar, Turee Syncline, Karijini National Park, West Angelas, Angelo Central and Hope Downs 1 within the Rio Tinto database (Figure 3-8) and from West Angelas, Channar and near Newman on NatureMap (Parks and Wildlife 2014). There are seven specimens of *Eremophila* sp. Hamersley Range (K. Walker KW 136) within the collections at the Western Australian Herbarium, however numerous collections from Rio Tinto botanists are pending submission at the Western Australian Herbarium from multiple localities. (WAH 2016).

Given this species broad distribution, the majority of locations recorded are outside of the study area and the small scale of the Proposal, the conservation significance of this species is unlikely to be impacted by the Proposal.



Plate 7: Photo of *Eremophila* sp. Hamersley Range (K. Walker KW 136), from 656004E, 7462853N

***Tetratheca fordiana* (Priority 1)**

Tetratheca fordiana is a spreading sub-shrub to 40 cm, that grows out of crevices of exposed ironstone cliff faces (Plate 8, Plate 9). Twenty locations for a total count of 297 plants were recorded during the survey, however all plants were recorded outside of the study area and will not be impacted by the Proposal (Figure 3-5)..

After this species was initially recorded during the survey, potential habitat for this species was re-surveyed on foot, and additionally, potential habitat was searched utilising a spotting scope. Observations were made that this species occurs on breakaways and cliff faces situated in higher altitude areas than the study area occupies.

This species has a range of approximately 5 km on NatureMap (Figure 3-10). All six specimens in the Western Australian Herbarium are from the range to the south of West Angelas Mine Site, west of Mt Ella (WAH 2016). This recording increases the known range of this species to 37 km.

Internal Rio Tinto significant areas will be implemented covering the known *Tetratheca fordiana* locations and potential habitat in-between (Section 3.14). Due to the significant areas covering known locations and as this species was not recorded within the study area; the conservation significance of this species is unlikely to be impacted by the Proposal.



Plate 8: Photo of *Tetratheca fordiana* recoded at 656017E, 7462850N



Plate 9: Photo of *Tetratheca fordiana* growing out of ironstone cliff face

***Rostellularia adscendens* var. *latifolia* (Priority 3)**

Rostellularia adscendens var. *latifolia* is a herb or small shrub to 30 cm occurring in rocky gullies and gorges and at the base of breakaways. This species was recorded within the study area polygon during the current survey from two locations (Figure 3-5), for a total count of 23 plants.

This species has a range of approximately 420 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 392 km from the Rio Tinto database. This species has a total population count of 4,543 plants, from 205 records, within the Rio Tinto database. This species has numerous locations in the Rio Tinto database and on NatureMap, across the Pilbara (Figure 3-9). There are 35 specimens of *Rostellularia adscendens* var. *latifolia* within the collections at the Western Australian Herbarium (WAH 2016).

Given this species broad distribution and the small scale of the Proposal, the conservation significance of this species is unlikely to be impacted.

***Sida* sp. Barlee Range (S. van Leeuwen 1642) (Priority 3)**

Sida sp. Barlee Range (S. van Leeuwen 1642) is a shrub to 50 cm tall occurring at the base of steep slopes, gullies, and gorges in ironstone ranges. This species was recorded during the current study from 17 records (Figure 3-6) for a total count of 161 plants, as well as by Rio Tinto (2009).

This species has a range of approximately 372 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 266 km from the Rio Tinto database. This species has a total population count of 10,322 plants, from 1,511 records, within the Rio Tinto database. This species has numerous locations in the Rio Tinto database and on NatureMap (Parks and Wildlife 2014), across the Pilbara (Figure 3-9). There are 38 specimens of *Sida* sp. Barlee Range (S. van Leeuwen 1642) within the collections at the Western Australian Herbarium (WAH 2016).

Given this species broad distribution and the small scale of the Proposal, the conservation significance of this species is unlikely to be impacted.

***Solanum kentrocaule* (Priority 3)**

Solanum kentrocaule is a spindly shrub to 150 cm growing on high altitude slopes. This species was recorded during the current study from one record of a single plant (Figure 3-6).

This species has a range of approximately 210 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 140 km from the Rio Tinto database. This species has a total population count of 79 plants, from 17 records, within the Rio Tinto database. This relatively low count is to be expected, as this species has only been recently described. This species has previously been recorded from Western Turner Syncline, Turee Syncline, Western Hill, West Angelas, Angelo River and Mt Ella within the Rio Tinto database (Figure 3-9) and from Mt Robinson, Mt Nameless, Mt Meharry, Mt Bennett, Western Turner Syncline, West Angelas and Angelo River on NatureMap (Parks and Wildlife 2014). There are 16 specimens of *Solanum kentrocaule* within the collections at the Western Australian (WAH 2016).

Given this species broad distribution, the majority of locations recorded are outside of the study area and the small scale of the Proposal, the conservation significance of this species is unlikely to be impacted.

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

Triodia sp. Mt Ella (M.E. Trudgen 12739) is a perennial hummock or tussock grass to 40 cm occurring amongst rocks and outcrops in gullies. This species was recorded within the study area during the current study from 154 records (Figure 3-6) for a total count of 5,051 plants, as well as from Rio Tinto (2009).

This species has a range of approximately 382 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 182 km from the Rio Tinto database. This species has a total population count of 20,754 plants, from 732 records, within the Rio Tinto database. This species has numerous locations in the Rio Tinto database and on NatureMap (Parks and Wildlife 2014), across the Pilbara (Figure 3-10). There are 24 specimens of *Triodia* sp. Mt Ella (M.E. Trudgen 12739) within the collections at the Western Australian Herbarium (WAH 2016).

Given this species wide distribution and the small scale of the Proposal, the conservation significance of this species is unlikely to be impacted.



Plate 10: Photo of typical habitat of *Triodia* sp. Mt Ella (M.E. Trudgen 12739), growing at base of breakaway. (Note: *Triodia* sp. Mt Ella (M.E. Trudgen 12739) is the larger glossy green species, *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) the smaller, dull, pale green species)

***Acacia bromilowiana* (Priority 4)**

Acacia bromilowiana is a tree or tall shrub to 12 m occurring on stony loams, banded ironstone and basalt on rocky hills, breakaways, scree slopes, gorges and creek beds. This species was recorded during the current study from 8 records (Figure 3-5) for a total count of 104 plants.

This species has a range of approximately 389 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 359 km from the Rio Tinto database. This species has a total population count of 1,907 plants, from 132 records, within the Rio Tinto database. This species has previously been recorded from Brockman, Vivash, West Turner Syncline, Tom Price, Karijini National Park, Angelo River, West Angleas,

Minga Yard, Rhodes Ridge, Shovellana, Hope Downs and Noreena Downs from the Rio Tinto database (Figure 3-8) and from Balfour Downs, Ophthalmia Range, Hope Downs, West Angelas, Mt Lockyer, Karinjij National Park, Mt Nameless and Brockman on NatureMap (Parks and Wildlife 2014). There are 27 specimens of *Acacia bromilowiana* within the collections at the Western Australian (WAH 2016).

Given this species broad distribution and the small scale of the Proposal, the conservation significance of this species is unlikely to be impacted.

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

Eremophila magnifica subsp. *magnifica* is a shrub to 150 cm occurring on skeletal soils over ironstone on summits. This species was recorded during the current study from 5 records (Figure 3-5) for a total count of 39 plants.

This species has a range of approximately 289 km on NatureMap within the Pilbara region (Parks and Wildlife, 2014) and 333 km from the Rio Tinto database. This species has a total population count of 13,152 plants, from 940 records, within the Rio Tinto database. This species has numerous locations in Rio Tinto database and on NatureMap (Parks and Wildlife 2014) across the Pilbara (Figure 3-8). There are 38 specimens of *Eremophila magnifica* subsp. *magnifica* within the collections at the Western Australian Herbarium (WAH 2016).

Given this species broad distribution and the small scale of the Proposal, the conservation significance of this species is unlikely to be impacted.

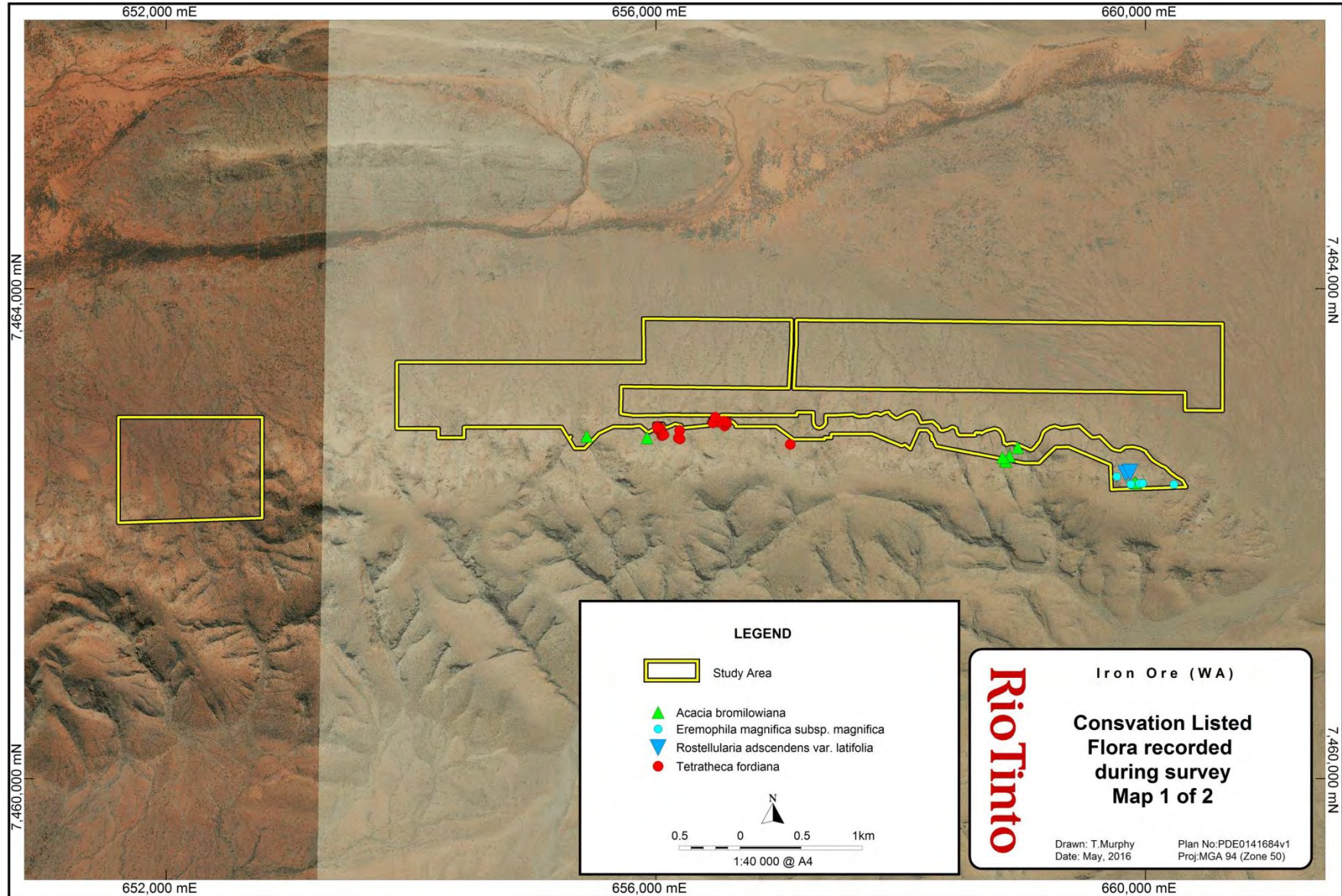


Figure 3-5: Conservation listed flora recorded during study (Map 1 of 2)

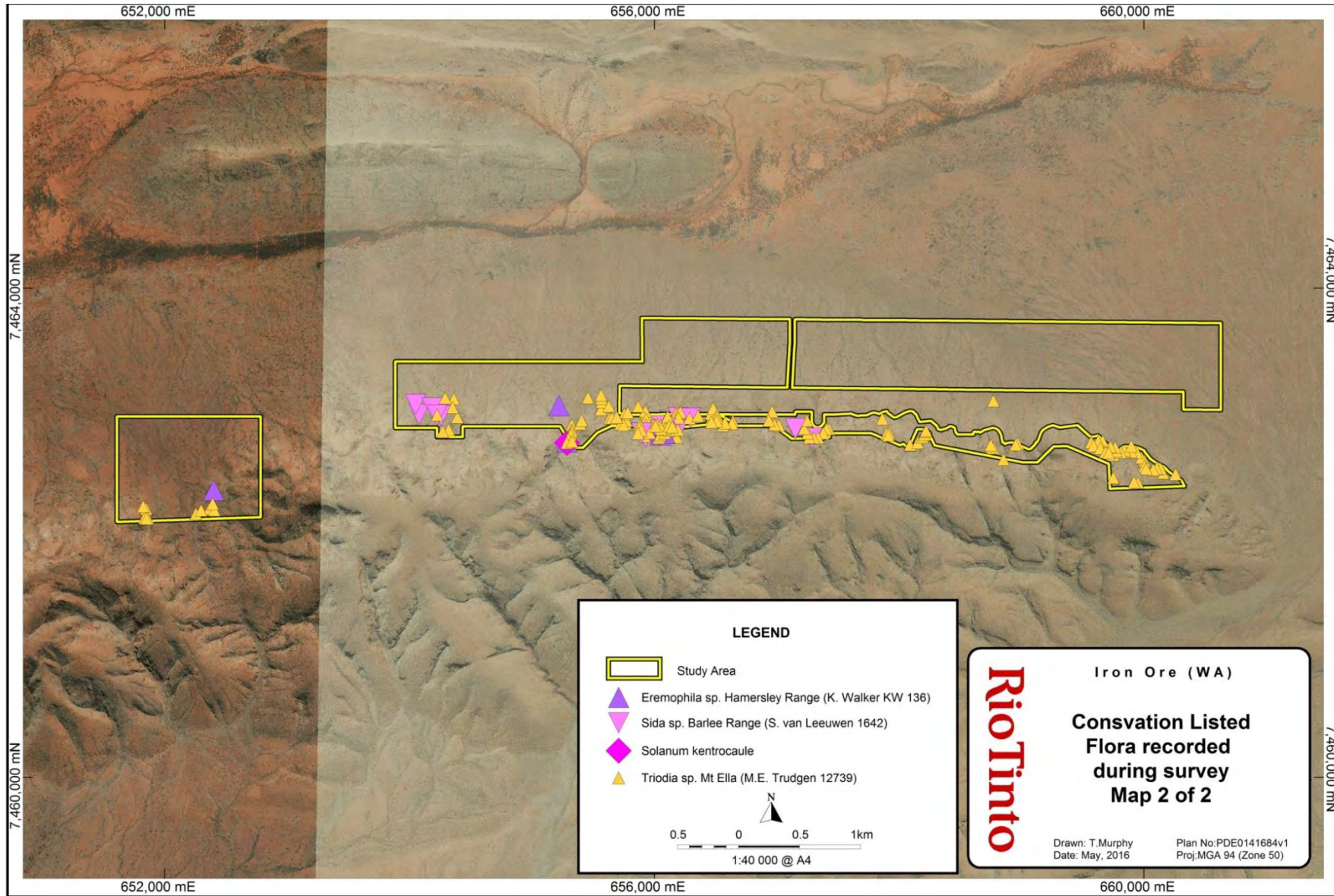


Figure 3-6: Conservation listed flora recorded during study (Map 2 of 2)

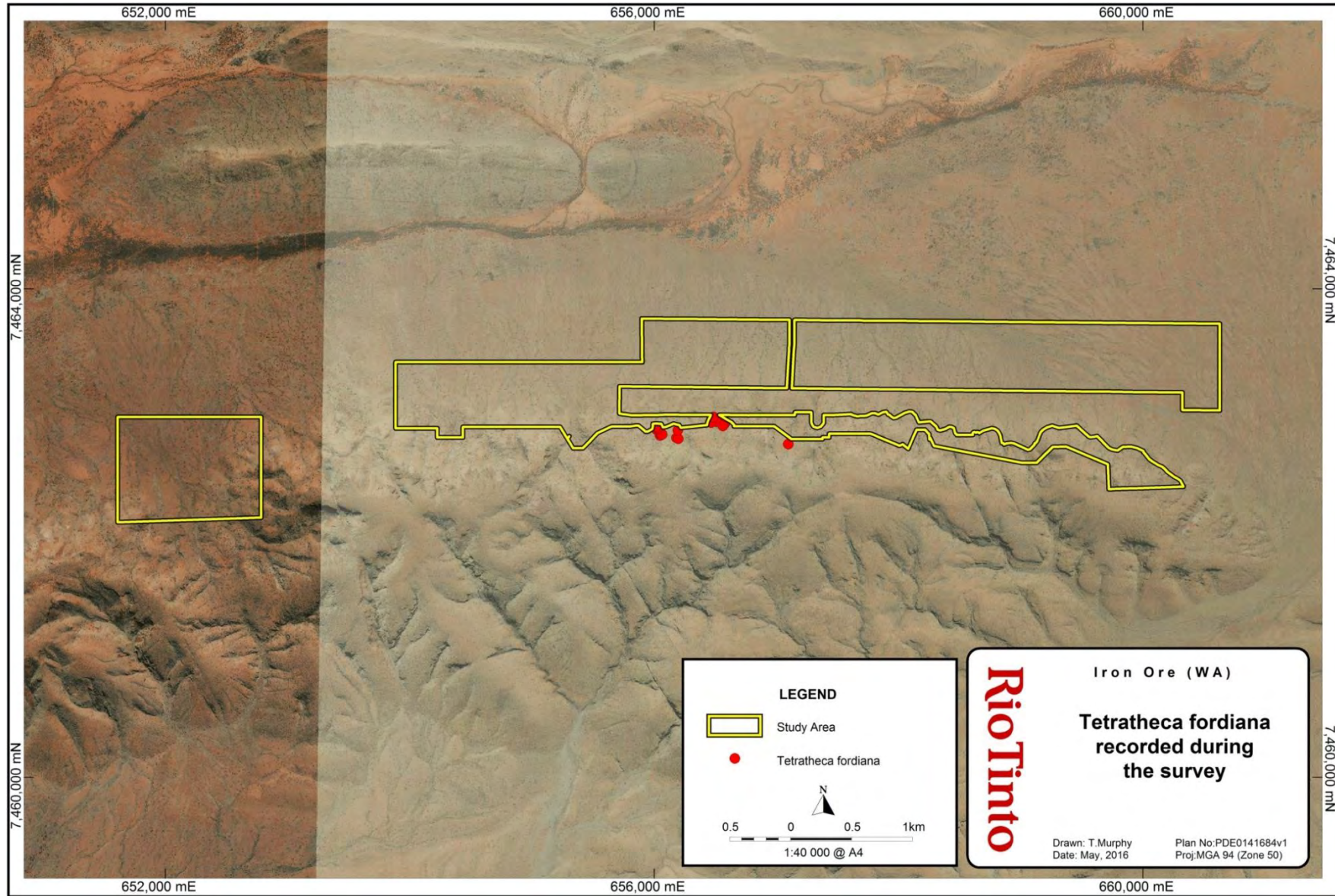


Figure 3-7: *Tetratheca fordiana* recorded during survey (note all locations are outside of the study area)

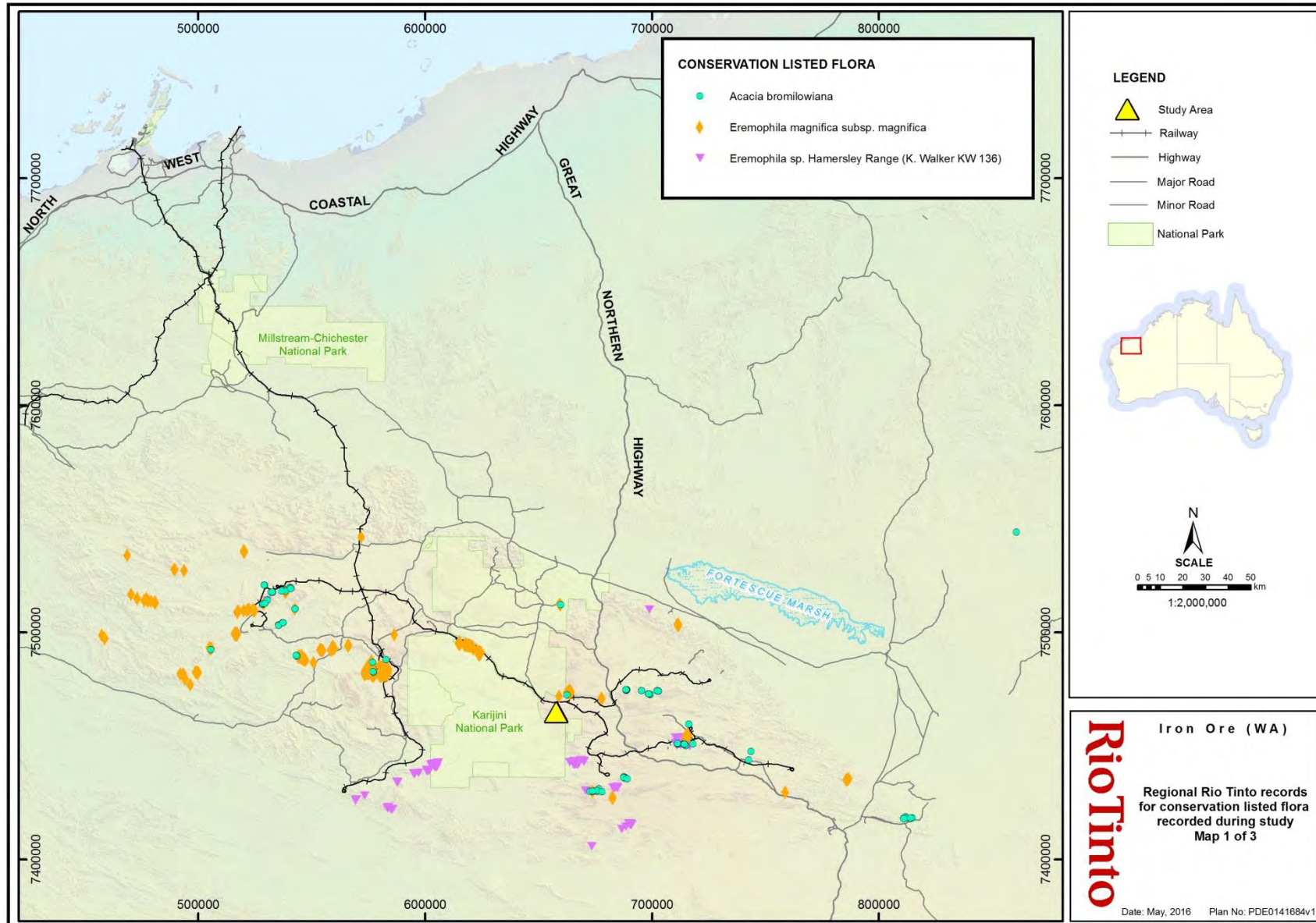


Figure 3-8: Regional Rio Tinto records for conservation listed flora recorded during study (Map 1 of 3)

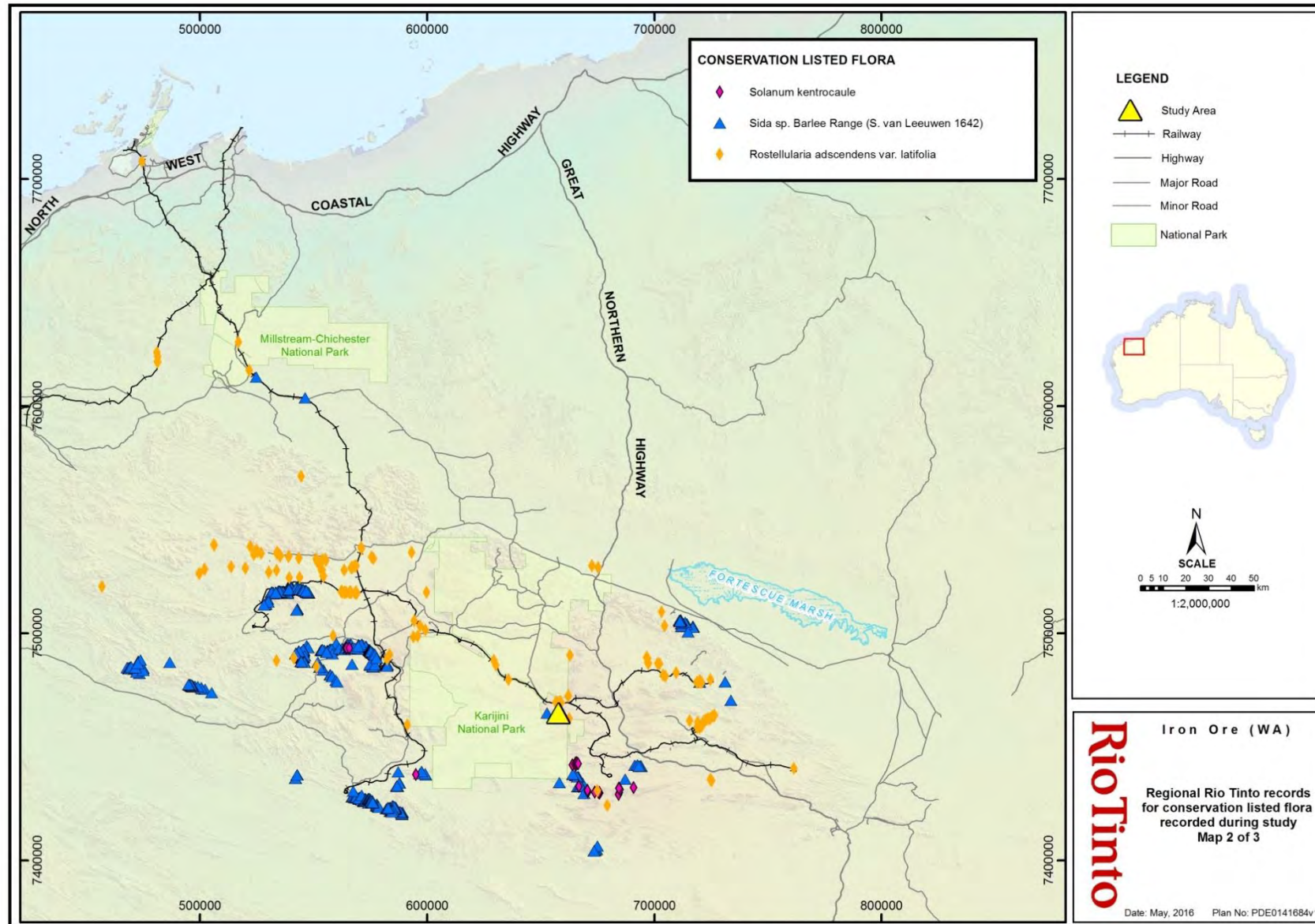


Figure 3-9: Regional Rio Tinto records for conservation listed flora recorded during study (Map 2 of 3)

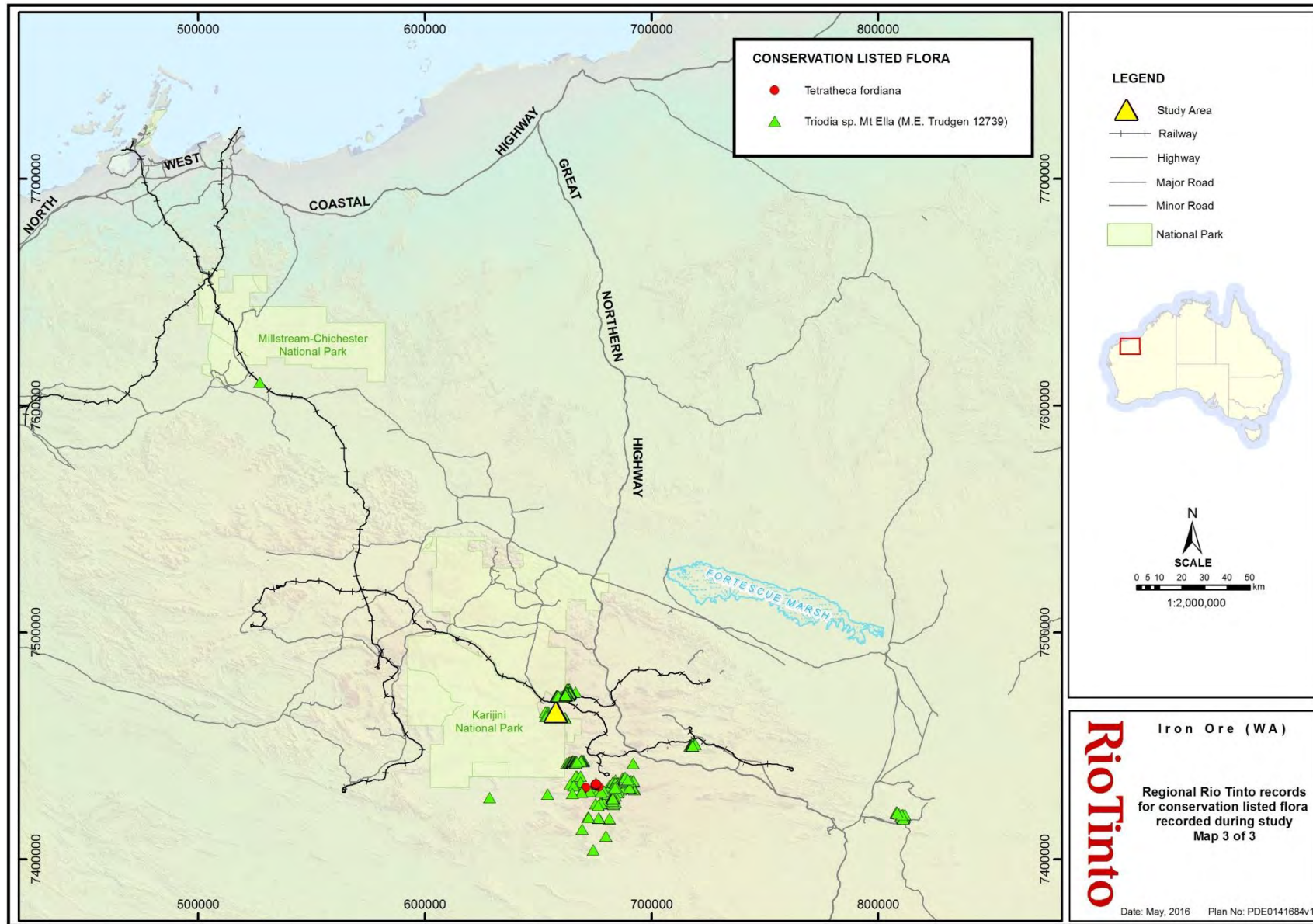


Figure 3-10: Regional Rio Tinto records for conservation listed flora recorded during study (Map 3 of 3)

3.7 POTENTIAL CONSERVATION LISTED FLORA OCCURRING IN THE STUDY AREA

Searches of Parks and Wildlife's Florabase Website (WAH 2016) confirm three State Listed Threatened flora species; *Lepidium catapycnon*, *Thryptomene wittweri* and *Aluta quadrata* occur in the Pilbara.

Aluta quadrata is a shrub to 260 cm that is known to occur 82 km to the south-west of the study area (WAH 2016). Due to the separation to the known populations of this restricted species, *Aluta quadrata* would not be expected to occur within the study area.

Pityrodia sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4) is a woody shrub occurring on sandstone and ironstone ranges (WAH 2016). This species is a recent addition to the Threatened Flora list, and is only known to occur in the Eastern Pilbara, approximately 190 km north-north-east of the study area. As such; *Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4) would not be expected to occur in the Juna Downs area.

Thryptomene wittweri is a rounded shrub to 150 cm, is restricted to mountain crests in high altitude areas (WAH 2016) and known to occur 4.9 km south east of the study area. Representative high altitude habitat does not occur within the study area for this species, as such; *Thryptomene wittweri* would not be expected to occur.

In addition, *Lepidium catapycnon* has been recently removed from the State's Threatened Flora List, but is still listed as Threatened under Commonwealth listings as a result of the review process closing before the downgrade to Priority 4 for the State. The closest record of this species occurs 34 km to the south east of the study area. No suitable habitat was recorded within the study area, as such; *Lepidium catapycnon* would not be expected to occur.

The desktop study, utilising previous survey results, a NatureMap database search, an EPBC Protected Matters search and searches of the Rio Tinto database, identified 28 conservation listed species (section 2.3.1).

Six of the 28 conservation listed species identified by the database search were recorded within the study area (Section 2.3.1). In addition, two species not returned by the database search, *Tetratheca fordiana* (P1) and *Acacia bromilowiana* (P4), were recorded during surveys. Twenty of the 28 conservation listed species identified by the database search were deemed unlikely to exist within the study area, due to the study area not supporting likely habitat or being large perennial species that were considered unlikely to have been overlooked during traverses of the study area (

Table 3-3). One of the 25 species returned by the desktop survey (other than those recorded by the field survey) was considered likely or have potential to occur on habitat types that occur within the study area, and may have been overlooked by the field survey. This species is described in further detail below:

***Oxalis* sp. Pilbara (M.E. Trudgen 12725) (Priority 2)**

Oxalis sp. Pilbara (M.E. Trudgen 12725) is an annual herb to 20 cm occurring in gullies and at the base of cliffs. This species is known to occur approximately 5 km south east of the study area, within a gully. According to NatureMap (Parks and Wildlife 2014), this species has a distribution of approximately 325 km, predominantly with records from the Hamersley Ranges, and one record from the Carnarvon Range on the boundary between the Gascoyne and Little Sandy Desert IBRA regions. Within the Rio Tinto Priority Flora database, this species has a range of 202 km, known from Nammuldi, Turee Syncline, West Angelas and Angelo River. Although this species has potential to occur within the study area, due to this species not being recorded during field surveys and the small scale of the Proposal; the conservation status of this species is unlikely to be impacted.

Table 3-3: Revised likelihood of occurrence of conservation listed flora species

Species	Status	Likelihood of Occurrence (Pre - field)	Post Field Rationale	Revised Likelihood of Occurrence (Post - field)
<i>Thryptomene wittweri</i>	T	Unlikely	Not expected and was not recorded during field surveys	Unlikely
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	Potential	Recorded during survey	Recorded
<i>Hibiscus</i> sp. Mt Brockman (E. Thoma ET 1354)	P1	Potential	Potential habitat at the bases of breakaways and rocky drainage lines was searched extensively. Unlikely to have been overlooked due to its large perennial form.	Unlikely
<i>Rhodanthe ascendens</i>	P1	Unlikely	Not expected and was not recorded during field surveys.	Unlikely
<i>Triodia</i> sp. Karijini (S. van Leeuwen 4111)	P1	Potential	Is only known from two localities in the Pilbara, both from high altitude high summits. Study area does not reach similar altitude, and unlikely to have been overlooked.	Unlikely
<i>Vittadinia</i> sp. Coondewanna Flats (S. van Leeuwen 4684)	P1	Potential	No potential habitat in study area	Unlikely
<i>Eremophila forrestii</i> subsp. Pingandy (M.E. Trudgen 2662)	P2	Potential	No potential habitat in study area	Unlikely
<i>Hibiscus</i> sp. Gurinbidy Range (M.E. Trudgen MET 15708)	P2	Potential	Potential habitat at the bases of breakaways and rocky drainage lines was searched extensively. Unlikely to have been overlooked due to its large perennial form.	Unlikely
<i>Oxalis</i> sp. Pilbara (M.E. Trudgen 12725)	P2	Potential	Small annual may have been overlooked due to its size.	Potential
<i>Pentalepis trichodesmoides</i> subsp. <i>hispida</i>	P2	Unlikely	Not expected and was not recorded during field surveys	Unlikely
<i>Thryptomene stenophylla</i>	P2	No - erroneous.	Erroneous data record.	No
<i>Acacia daweana</i>	P3	Potential	Potential habitat occurs in study are. Unlikely to have been overlooked due to its distinctive, large perennial form.	Unlikely

Species	Status	Likelihood of Occurrence (Pre - field)	Post Field Rationale	Revised Likelihood of Occurrence (Post - field)
<i>Acacia effusa</i>	P3	Potential	Potential habitat occurs in study are. Unlikely to have been overlooked due to its large perennial form.	Unlikely
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	P3	Potential	No potential habitat in study area	Unlikely
<i>Dampiera metallorum</i>	P3	Potential	Unlikely that study area reaches high enough altitude for this species, combined with field studies did not record this perennial species.	Unlikely
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	P3	Potential	Unlikely to have been overlooked due to its large perennial form.	Unlikely
<i>Goodenia lyrata</i>	P3	Unlikely	Not expected and was not recorded during field surveys	Unlikely
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P3	Unlikely	Not expected and was not recorded during field surveys	Unlikely
<i>Indigofera</i> sp. Gilesii (M.E. Trudgen 15869)	P3	Potential	Potential habitat occurs in study are. Unlikely to have been overlooked due to its large perennial form.	Unlikely
<i>Pilbara trudgenii</i>	P3	Unlikely	Not expected and was not recorded during field surveys	Unlikely
<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794)	P3	Potential	No potential habitat in study area	Unlikely
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	Likely	Recorded during survey	Recorded
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	Previously recorded	Recorded during survey	Recorded
<i>Solanum kentrocaule</i>	P3	Potential	Recorded during survey	Recorded
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3	Unlikely	Not expected and was not recorded during field surveys	Unlikely

Species	Status	Likelihood of Occurrence (Pre - field)	Post Field Rationale	Revised Likelihood of Occurrence (Post - field)
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	Previously recorded	Recorded during survey	Recorded
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	Likely	Recorded during survey	Recorded
<i>Eremophila youngii</i> subsp. <i>lepidota</i>	P4	Unlikely	Not expected and was not recorded during field surveys	Unlikely

3.8 INTRODUCED FLORA OCCURRING WITHIN THE STUDY AREA

One introduced (weed) species was recorded from the study area, **Bidens bipinnata* (Table 3-4, Figure 3-11, Appendix 7).

The ranking of this species as per the Parks and Wildlife Weed Prioritisation process (Parks and Wildlife 2013c) is shown in Table 3-4. This species is not listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), under category C3 (Management) (DAFWA 2014).

Strict weed hygiene protocols should be implemented during clearing of vegetation and subsequent earthworks to minimise the introduction and spread of weeds to or from the study area.

Table 3-4: Introduced species recorded in the study area and Parks and Wildlife weed prioritisation ranking.

Species	Ranking (Parks and Wildlife 2013)
<i>* Bidens bipinnata</i>	Low

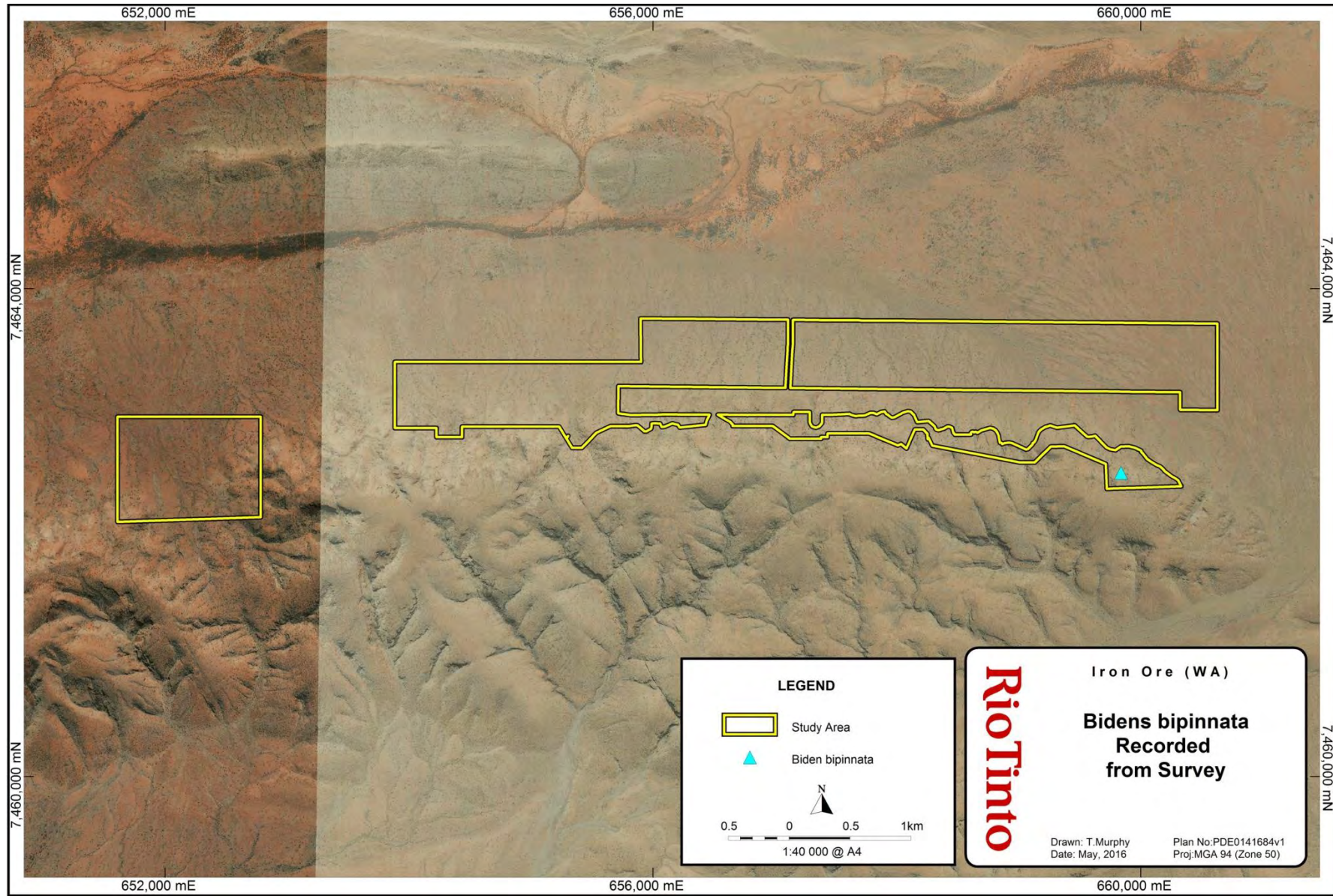


Figure 3-11: Map showing locations of Introduced Flora (weed) recorded within study area.

3.9 FAUNA HABITATS OF THE STUDY AREA

Three broad habitat types were described from the study area. The habitat types recorded are described below, accompanied by mapping of the habitat types (Table 3-5, Figure 3-12).

Table 3-5: List of habitat types within the study area including microhabitats and extent

Unit	Fauna Habitat Description	Significant Microhabitat	Extent within study area (ha)	Extent within study area (%)
S1	Rocky slopes consisted of scattered low trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> over open hummock grassland of <i>Triodia epactia</i> and <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835). This unit was recorded from red brown skeletal loams with ironstone boulders, rocks and outcropping. This unit was recorded from the mid and lower slopes of the range, as well including breakaway rock faces, from the Newman Land System, with a small amount of overlap onto the Boolgeeda Land System.	Rocky overhangs and small caves	102.02	18.74
S2	Undulating slopes consisted of low open woodland to scattered low trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> over tall open shrubland / mallee of <i>Acacia atkinsiana</i> and <i>Eucalyptus gamophylla</i> over open tussock grassland of <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835) and <i>Triodia epactia</i> . This unit was recorded from red brown loams with a scattering of ironstone cobbles and pebbles.	-	404.88	74.36
D1	Drainage line – minor consisted of low woodland to low open woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> over tall shrubland to shrubland of <i>Acacia atkinsiana</i> , <i>Gossypium robinsonii</i> , <i>Acacia tenuissima</i> , <i>Acacia ancistrocarpa</i> , <i>Acacia bivenosa</i> , <i>Acacia maitlandii</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> over tussock grassland to open tussock grassland of <i>Themeda triandra</i> and <i>Triodia epactia</i> with <i>Eriachne mucronata</i> . This unit was recorded from red brown loams with ironstone pebbles.	-	37.56	6.90
TOTAL			544.46	100

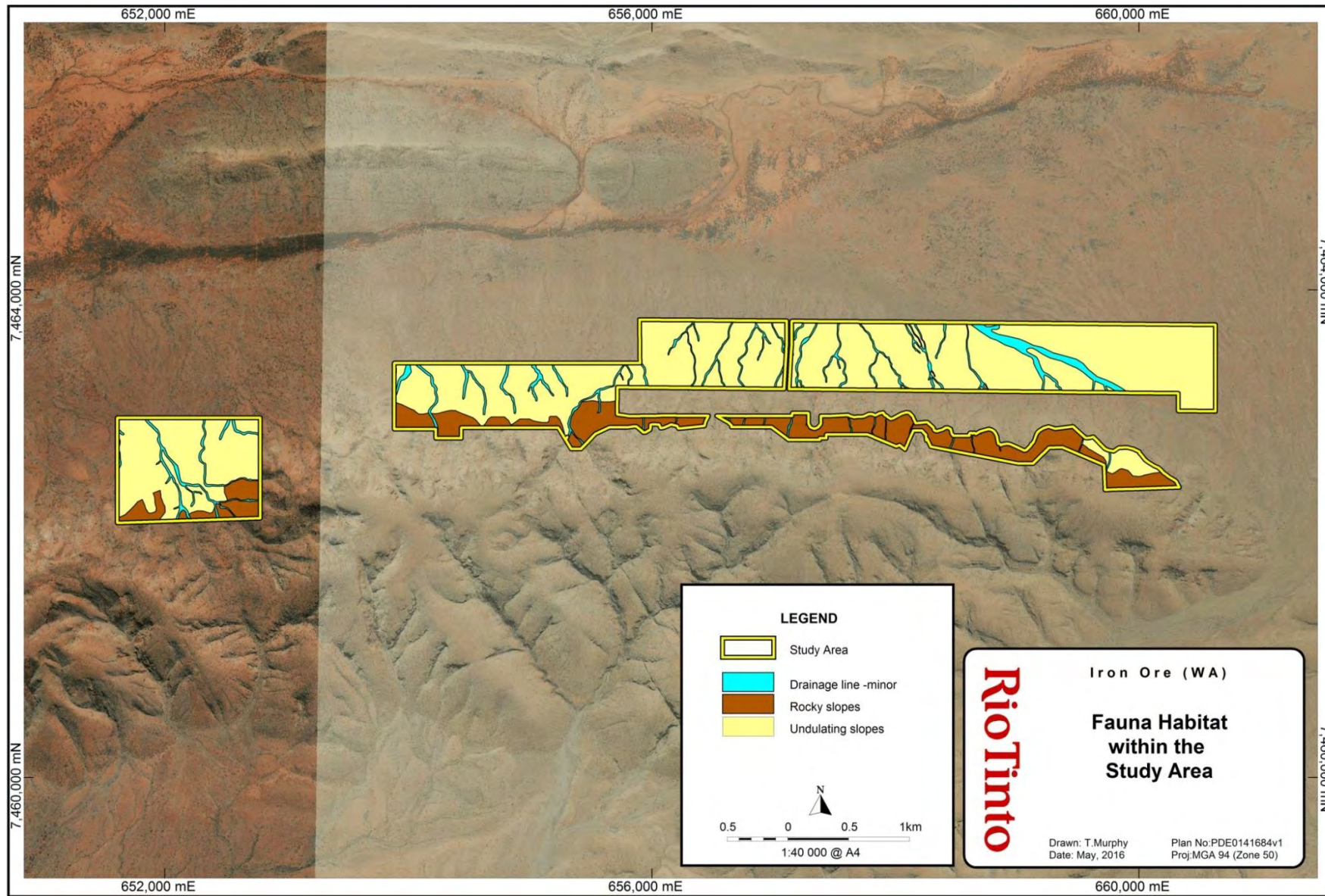


Figure 3-12: Fauna habitat mapping of the Study Area

3.10 FAUNA HABITATS OF SIGNIFICANCE

None of the fauna habitats occurring within the study area correspond to any ecosystems listed as Threatened under the EPBC Act and none are consistent with ecosystems listed as TECs by Parks and Wildlife (2015a).

None of the fauna habitats occurring within the study area are representative of listed PECs by Parks and Wildlife (2015b).

3.11 OTHER HABITATS OF SIGNIFICANCE

Two Northern Quoll scats were recorded from two locations within fauna habitat unit 'S1 - Rocky slopes'. This unit comprised the mid and lower slopes of the range adjoining the southern sections of the study area, covering 102.02 ha (18.74%) of the study area. Fauna habitat 'S1 - Rocky slopes' is not considered to be restricted at a local or regional level, however it does contain habitat, in the form of rocky overhangs and small caves, which may provide suitable denning habitat to support quolls.

The breakaway habitat that includes the rocky overhangs and small caves was not able to be differentiated from the broader 'S1 - Rocky Slopes' fauna habitat unit, as outlined in Section 1.3.

An internal Rio Tinto significant area has been proposed (Figure 3-14, Figure 3-16). The proposed significant area covers 15.57 ha, and includes the two recorded scat locations, nearby breakaway and cliff habitat that extends from the recorded location as well as the largest gullies, visible from the aerial imagery, within close proximity of the recorded scat locations. This habitat is thought to provide the most likely preferred habitat, for the Northern Quoll. The significant area is discussed further in Section 3.14.

3.12 CONSERVATION LISTED FAUNA RECORDED DURING STUDY

Evidence of two fauna species of conservation significance were recorded during the current study.

***Dasyurus hallucatus* (Northern Quoll) – Endangered, Endangered**

The Northern Quoll typically inhabits and is more abundant in dissected rocky escarpments, however, they will utilise a range of habitats and den sites from rock crevices, tree hollows and goanna burrows, to the roofs of buildings (Van Dyck and Strahan 2008). It is important to note that much of the ecological information for the Northern Quoll comes from studies in the Top End of the Northern Territory (e.g. Begg 1981; Oakwood 2002). Much of their ecology is likely to be similar in the Pilbara; however, differences in genetic structure and some demographic parameters have been observed (How *et al.*, 2009).

The Northern Quoll has a relatively large home-range size of up to 150 ha for males (35 ha for females). Movements between den sites on consecutive nights can be up to 1.85 km for males (Oakwood 2002). In the Northern Territory, mating occurs in late May to June and all males die after the mating season and females rear the young alone (Oakwood 2000).

Secondary evidence of the Northern Quoll, in the form of scats, was recorded. Two scats, located 85 m apart, were recorded from near the southern boundary of the study area. (Plate 11, Plate 12, Figure 3-13).

There are no records of the Northern Quoll within the Rio Tinto Database or on NatureMap within 40 km of the study area. However there are records 58 km to the south west, 44 km to the north-west, 60 km to the north east, 52 km to the east and 80 km to the south east of the study area.

Microhabitats, suitable for the Northern Quoll, are likely to exist within fauna habitat 'S1 - Rocky slopes.' The entirety of 'S1 - Rocky slopes' is not considered optimal habitat, however rocky overhangs and small caves, found along the breakaways within 'S1 - Rocky slopes' are likely to provide denning habitat for the Northern Quoll. The breakaway and cliff lines with 'S1 - Rocky slopes' were not able to be differentiated during the fauna habitat mapping process, as outlined in Section 1.3.

As the age of the scats was not able to be determined; an internal Rio Tinto significant area has been proposed that covers 15.57 ha, and includes the two recorded scat locations, nearby breakaway and cliff habitat that extends from the recorded location as well as the largest gullies, visible from the aerial imagery, within close proximity of the recorded scat locations.

It is likely that optimal habitat for the Northern Quoll exists in the large gullies, breakaways and cliff lines that occur within Karijini National Park situated to the south of the study area. This habitat is likely to be preferred to what occurs within the study area, due to the considerable size of the gullies, and the amount of denning habitat available in the expansive cliff lines and breakaways.

Given the small scale of the Proposal, the proposed significant area and the major gullies and gorges within Karijini National Park, to the south of the study area that provides optimal habitat for the Northern Quoll will not be affected by the Proposal, the Northern Quoll is unlikely to be adversely impacted by the Proposal.



Plate 11: Scat recorded from study area (1 of 2). Likely to be from Northern Quoll



Plate 12: Scat recorded from study area (2 of 2). Likely to be from Northern Quoll

***Pseudomys chapmani* (Western Pebble-Mound Mouse, Priority 4)**

The Western Pebble-mound Mouse is endemic to the Pilbara region of Western Australia and occurs west to the McKay Range and south to the Collier Range (Menkhorst and Knight 2001). The species is patchily distributed on gentle colluvial slopes of rocky, hummock grasslands with little or no soil and a sparse shrub layer

Nine Western Pebble-mound Mouse mounds were recorded within the study area. All mounds were considered to recently inactive, that is the mounds were covered in some vegetation, and had slightly lost their dome formation. These mounds are considered unlikely to have supported PMM in recent years. The locations of these records are presented in Figure 3-13 and Appendix 8.

Given this species broad distribution, the small scale of the Proposal, and as all recorded mounds were considered not to be recently active, the conservation significance of this species is unlikely to be impacted by the Proposal.

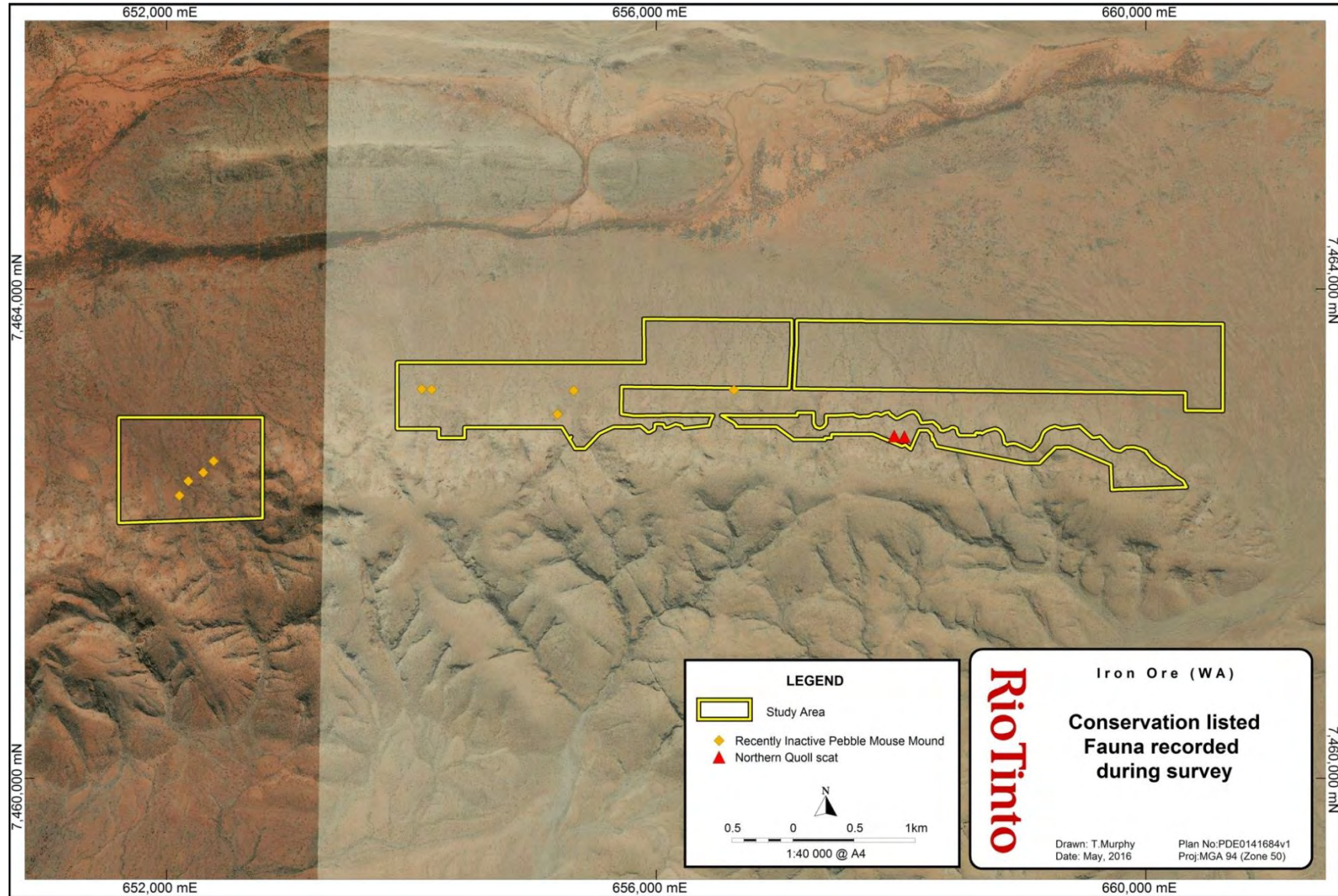


Figure 3-13: Map showing conservation listed fauna species recorded during study

3.13 POTENTIAL CONSERVATION LISTED FAUNA OCCURRING IN THE STUDY AREA

The desktop study, utilising previous survey results and various database searches identified 18 conservation significant fauna species that may occur within the vicinity of the study area. The likelihood of their occurrence is discussed in detail in Section 2.1.2 and is presented in Table 2-4. The initial likelihood of occurrence rating was based on pre-field information, mainly nearby records and species distributions.

The revised likelihood rating was conducted post field work and included a review of the habitats actually present in the study area and its suitability for these species. Eleven of the 18 conservation listed species identified by the database search were deemed unlikely to occur within the study area, due to the study area not supporting likely habitat (Table 3-6). One species is considered 'likely' to occur and a further four have the 'potential' to occur within the habitats available in the study area. Species that are likely or potential to occur within the study area are discussed below:

***Liasis olivaceus subsp. barroni* (Pilbara Olive Python) – Schedule 3, Vulnerable**

Regarded as a Pilbara endemic, the Pilbara Olive Python has a known distribution that coincides roughly with the Pilbara bioregion (Environment Australia, 2012). This species typically shelters in logs, flood debris, caves, tree hollows and thick vegetation close to water and rock outcrops (Burbidge, 2004). While there are rocky habitats within the study area, none are associated with permanent water sources.

While the Pilbara Olive Python may move through the study area at times, the relatively small scale of the Proposal would not be expected to alter the conservation status of this species.

***Macroderma gigas* (Ghost Bat) – Schedule 3, Vulnerable**

The Ghost Bat is Australia's largest microbat and is patchily distributed across the northern half of Australia. This species requires undisturbed roost sites which are often complex and contain multiple entrances; it has been known to utilise old abandoned mine shafts (Menkhorst and Knight 2011).

NatureMap results suggest that this species has been recorded with 5 km of the study area, within Karijini N.P. However, due to lack of core roost habitat and the small size of the Proposal it is considered unlikely the Proposal will negatively impact on the conservation status of this species on either a local or bioregional scale.

***Rhinonictis aurantia* (Pilbara Leaf-nosed Bat) – Schedule 3, Vulnerable**

The Pilbara Leaf-nosed Bat inhabits abandoned mine shafts, granite rock pile terrain of the east Pilbara and caves formed in gorges that dissect sedimentary geology in the west Pilbara (van Dyck and Strahan 2008). This species is more influenced by the availability of suitable roost caves than by habitat type and high humidity is particularly important to this species (Churchill 1998).

Due to the small size of the Proposal and as the Pilbara Leaf-nosed Bat is not currently known from the Juna Downs area, it is considered unlikely the Proposal will negatively impact on the conservation status of this species on either a local or bioregional scale.

***Falco peregrinus* (Peregrine Falcon) – Schedule 7**

The Peregrine Falcon is generally found along rocky ledges, cliffs, watercourses or margins with cleared land. Although the Peregrine Falcon may potentially utilise trees and other habitat within the

study area, due to the small size of the Proposal, it is considered unlikely the Proposal will negatively impact the conservation status of this highly mobile species.

***Merops ornatus* (Rainbow Bee-eater) –Schedule 5, Migratory**

The Rainbow Bee-eater occurs across much of mainland Australia, mainly in open forests and woodlands, shrubland and in various cleared or semi cleared habitats. It nests in small burrows in flat or sloping sandy ground often in the banks of rivers or creeks, and also in roadside cuttings and windrows. Given this species' highly mobile nature; individuals are unlikely to be impacted by the Proposal.

Table 3-6: Revised likelihood of occurrence of conservation listed fauna species

Species	Common Name	Status		Likelihood of Occurrence (Pre – field)	Habitat and Discussion (Pre – field)	Revised Likelihood of Occurrence (Post – field)
		WC Act	EPBC Act			
<i>Pezoporus occidentalis</i>	Night Parrot	Cr	En	Unlikely	No suitable habitat	Unlikely
<i>Dasyurus hallucatus</i>	Northern Quoll	En	En	Potential	Scats recorded	Recorded
<i>Rostratula australis</i>	Australian Painted Snipe	En	Vu	Unlikely	No suitable habitat	Unlikely
<i>Liasis olivaceus</i> subsp. <i>barroni</i>	Pilbara Olive Python	Vu	Vu	Potential	Rocky habitats occur within study area however none are associated with permanent water sources.	Potential
<i>Macrotis lagotis</i>	Greater Bilby	Vu	Vu	Unlikely	No suitable habitat	Unlikely
<i>Rhinonicteris aurantia</i>	Pilbara Leaf-nosed Bat	Vu	Vu	Potential	Suitable habitat for foraging exists within study area	Potential
<i>Macroderma gigas</i>	Ghost Bat	Vu		Potential	Suitable habitat for foraging exists within study area	Potential
<i>Falco peregrinus</i>	Peregrine Falcon	S1		Potential	Rocky ledges and cliffs occur with study area.	Potential
<i>Apus pacificus</i>	Fork-tailed Swift	M	M	Potential	Aerial species. Will not land in the study area (aerial species only)	Unlikely
<i>Ardea alba</i>	Great Egret		M	Unlikely	No suitable habitat	Unlikely
<i>Ardea ibis</i>	Cattle Egret	M	M	Unlikely	No suitable habitat	Unlikely
<i>Charadrius veredus</i>	Oriental Plover	M	M	Unlikely	No suitable habitat	Unlikely
<i>Hirundo rustica</i>	Barn Swallow	M	M	Unlikely	No suitable habitat	Unlikely

Species	Common Name	Status		Likelihood of Occurrence (Pre – field)	Habitat and Discussion (Pre – field)	Revised Likelihood of Occurrence (Post – field)
		WC Act	EPBC Act			
<i>Merops ornatus</i>	Rainbow Bee-eater	M	M	Likely	Drainage lines, shrublands and hummock grasslands.	Likely
<i>Motacilla cinerea</i>	Grey Wagtail	M	M	Unlikely	No suitable habitat	Unlikely
<i>Motacilla flava</i>	Yellow Wagtail	M	M	Unlikely	No suitable habitat	Unlikely
<i>Leggadina lakedownensis</i>	Short-tailed Mouse	P4		Unlikely	No suitable habitat	Unlikely
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4		Recorded	Recorded	Recorded

3.14 ENVIRONMENTALLY SIGNIFICANT AREAS

Internal Rio Tinto significant areas (restriction areas) will be established covering:

- the recorded *Tetratheca fordiana* locations and nearby suitable habitat (Figure 3-14, Figure 3-15). The establishment of the significant area, as the Proposal does not intersect with any known locations and the potential habitat has been searched for *Tetratheca fordiana* should ensure that this restricted species is not impacted at a local or regional level by the Proposal, and
- the two Northern Quoll scat locations and suitable habitat (Figure 3-14, Figure 3-16). The establishment of the significant area and as the Proposal is considered low impact is likely to minimise impacts upon the Northern Quoll so that this species is not impacted at a local or regional level.

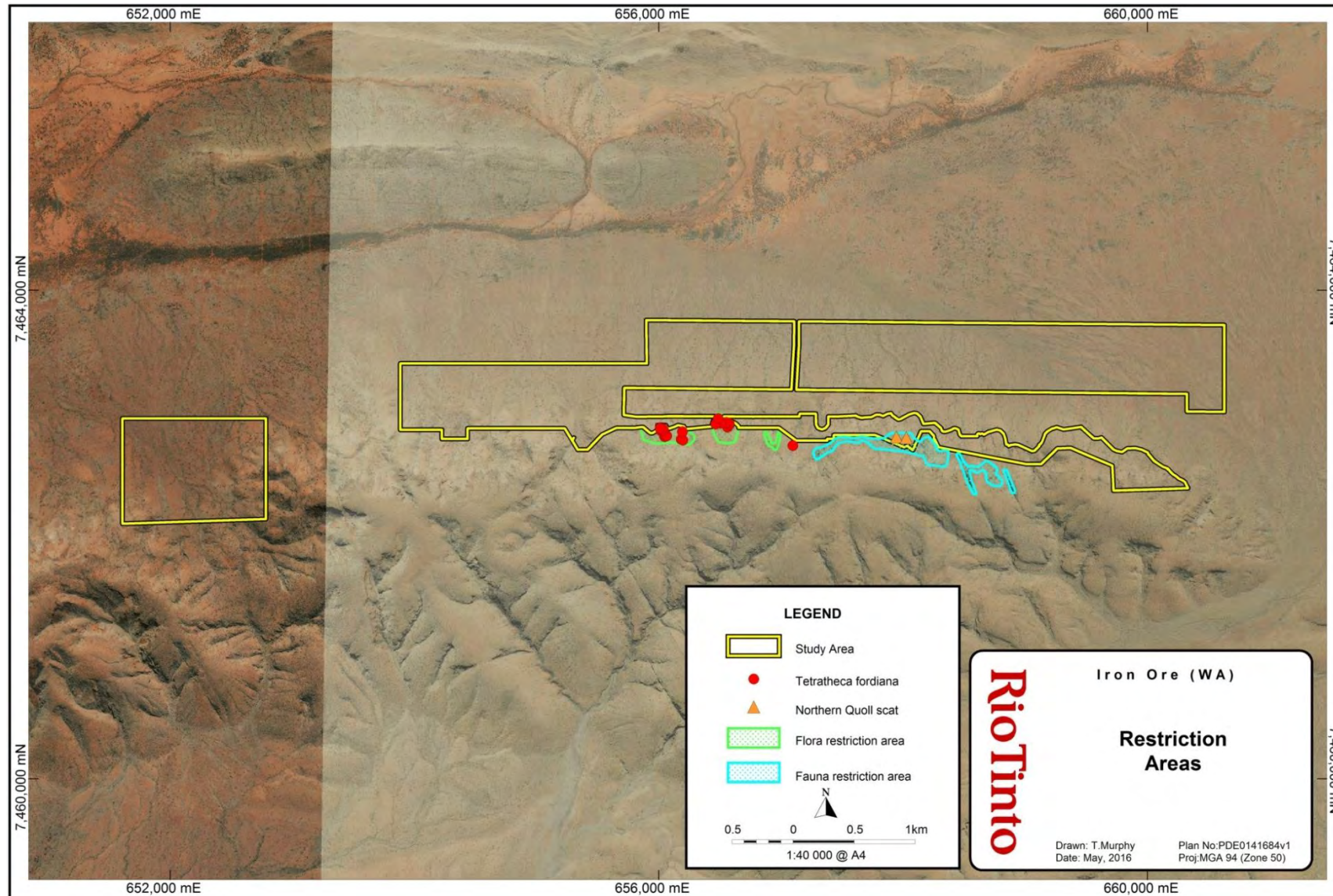


Figure 3-14: Proposed internal Rio Tinto significant areas covering recorded *Tetradleca fordiana* and Northern Quoll scat locations

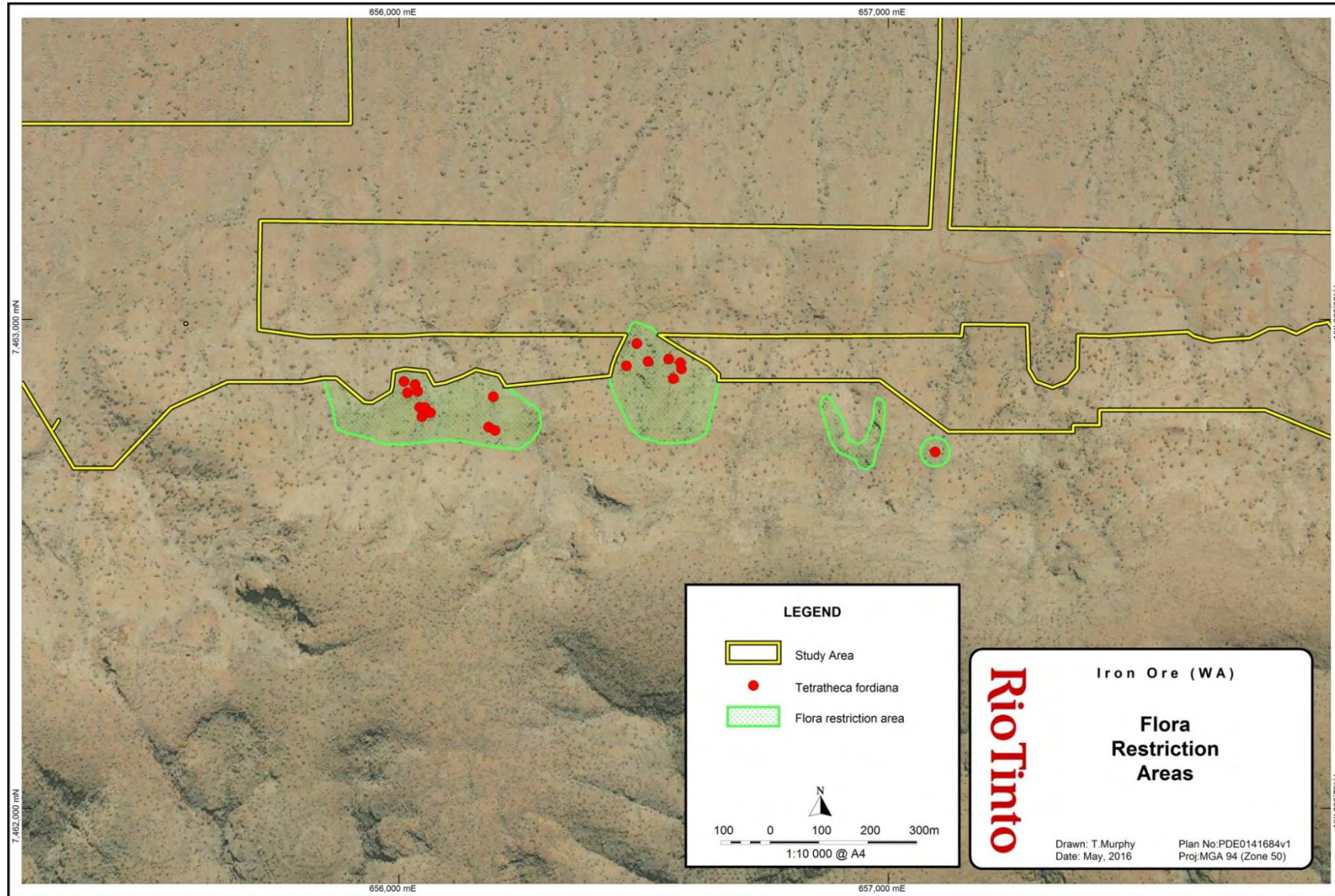


Figure 3-15: Proposed Rio Tinto significant areas, covering recorded *Tetradleca fordiana* locations and suitable habitat

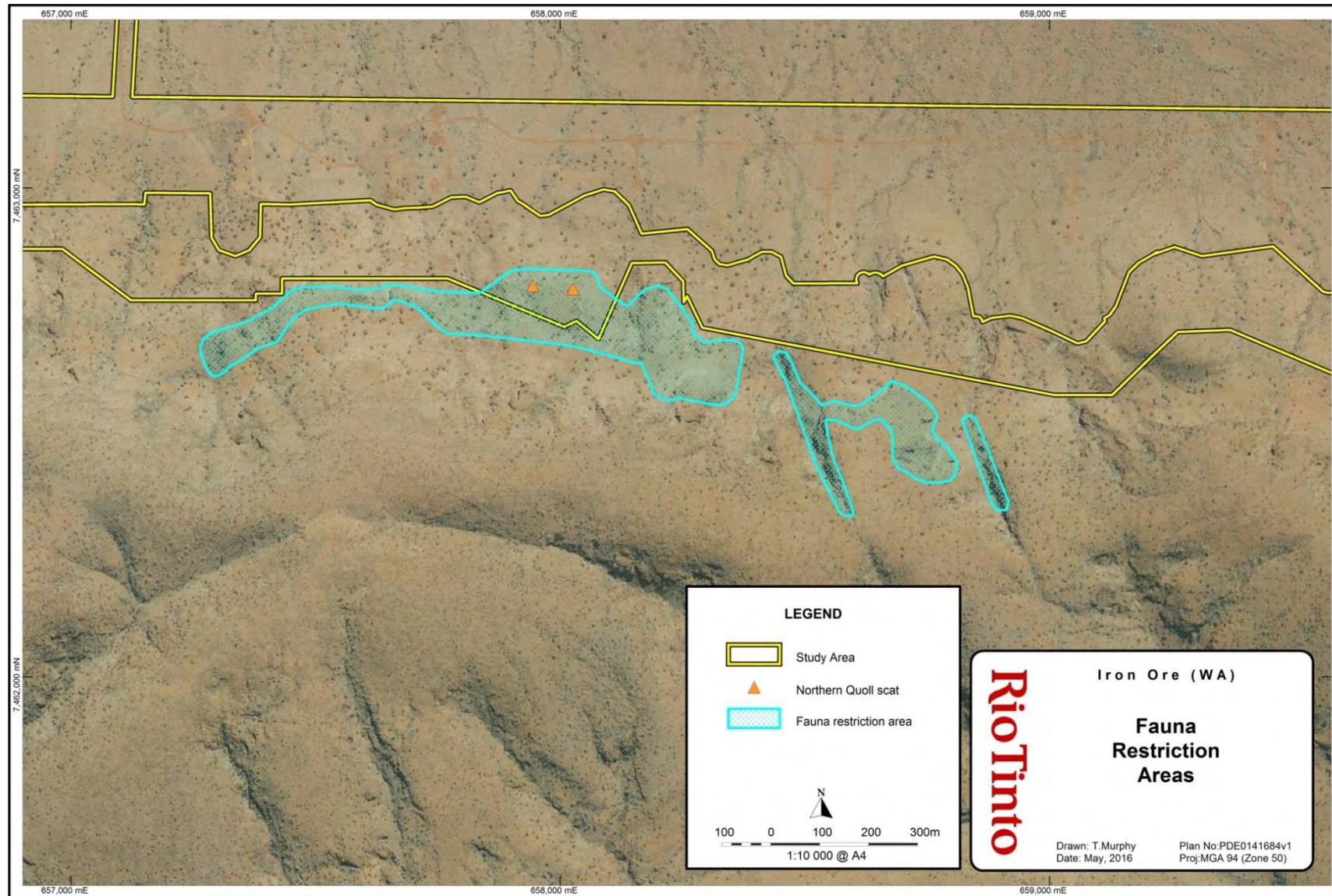


Figure 3-16: Proposed Rio Tinto significant areas, covering recorded Northern Quoll scat locations and suitable habitat

4 STATEMENT ADDRESSING THE 10 CLEARING PRINCIPLES

Rio Tinto proposes to undertake mineral exploration and geotechnical investigation activities within the Juna Downs study area in the Pilbara. The study area comprises 544.46 ha of native vegetation.

Based on specialist assessment of the study area and discussion below, it is deemed that the Proposal may be at variance with one of the Ten Clearing Principles under Schedule 5 of the EP Act.

4.1 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 (DSEWPaC 2012) and is a secondary centre of endemism and species richness for *Acacia*, *Triodia*, *Corymbia* and *Sida* in Western Australia (Maslin 2001, Kendrick 2001 and Maslin & van Leeuwen 2008). The Hamersley subregion of the Pilbara has been identified by the Threatened Species Scientific Committee for the Australian Government a Biodiversity Hotspots as it provides habitat for a number of threatened, endemic and fire-sensitive species and communities (DSEWPaC 2012).

The study area occurs within the Hamersley sub-region of the Pilbara bioregion. The Hamersley sub-region is described as: 'Mountainous area of Proterozoic sedimentary ranges and plateaux, supporting Mulga (*Acacia aneura*) low woodland over bunch grasses on fine textured soils, and *Eucalyptus leucophloia* woodlands over *Triodia brizoides* hummock grasslands on skeletal sandy soils' (Kendrick 2001).

Special features of the Hamersley sub-region include rare features such as gorges, centres of endemism including calcrete deposits, refugia and the *Themeda* grasslands TEC (Kendrick 2001). The buffer boundary for the 'Themeda grasslands on cracking clays (Hamersley Station)' TEC is located approximately 96 km north west of the study area, and due to the separation, will not be impacted by the Proposal.

Six vegetation units were described from the study area. Four vegetation units were described from stony hills and lower slopes and two units from drainage lines. None of the vegetation units occurring within the study area are listed as TECs under either the EPBC Act or under the State listing maintained by Parks and Wildlife. None of the units represent PECs under the State listing maintained by Parks and Wildlife.

The vegetation units identified within the study area are considered to be of low conservation value and are widely distributed both locally and throughout the Hamersley subregion.

A total of 186 taxa from 81 genera belonging to 38 families were recorded during the current survey. The number of taxa recorded by the current study is slightly less than similar sized surveys of the Juna Downs locality, which is attributed to the current study area not including the species rich loam and clay plains that other surveys of the Juna Downs area have encompassed.

Eight species of Priority Flora were recorded during the survey – *Eremophila* sp. Hamersley Range (K. Walker KW 136) (P1), *Tetratheca fordiana* (P1), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), *Solanum kentrocaule* (P3), *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3), *Acacia bromilowiana* (P4) and *Eremophila magnifica* subsp. *magnifica* (P4). Internal Rio Tinto significant areas will be implemented covering *Tetratheca fordiana* locations as well as potential habitat for *Tetratheca fordiana* (P1).

Three broad fauna habitat types were recorded within the study area – ‘Rocky slopes’, ‘Undulating slopes’ and ‘Drainage line – minor’. These three habitats are not considered to be restricted at a local or regional level.

Given the *Tetratheca fordiana* locations will not be impacted by the Proposal, the Proposal is unlikely to be considered at variance with this Principle.

4.2 POTENTIAL IMPACT TO ANY SIGNIFICANT HABITAT FOR FAUNA INDIGENOUS TO WESRN 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.

Secondary evidence of two species of conservation significance was recorded during the survey; *Dasyurus hallucatus* (Northern Quoll) and *Pseudomys chapmani* (Western Pebble-Mound Mouse).

Two scats, thought to be from the Northern Quoll were recorded from the southern boundary of the study area. An internal Rio Tinto significant area has been proposed, which covers 15.57 ha, and includes the two recorded scat locations, nearby breakaway and cliff habitat that extends from the recorded location as well as the largest gullies, visible from the aerial imagery, within close proximity of the recorded scat locations. This habitat is thought to provide the most likely preferred habitat for the Northern Quoll.

Nine mounds belonging to the Western Pebble Mound Mouse were recorded within the study area. All mounds were considered to be recently inactive, that is the mounds were covered in some vegetation, and had slightly lost their dome formation. These mounds are considered unlikely to have supported PMM in recent years.

A further five conservation significant fauna species were considered ‘Likely’ or ‘Potential’ to occur within the habitats available in the study area. These species were *Liasis olivaceus* subsp. *barroni* (Pilbara Olive Python), *Rhinonictis aurantia* (Pilbara Leaf-nosed Bat), *Macroderma gigas* (Ghost Bat), *Falco peregrinus* (Peregrine Falcon) and *Merops ornatus* (Rainbow Bee-eater). Due to the small size of the Proposal it is considered unlikely the Proposal will negatively impact on the conservation status of any of these species, on either a local or bioregional scale.

Provided the significant area that covers the two Northern Quoll scat locations as well as highlighted nearby breakaways, cliff habitat and gullies is avoided, the Proposal is unlikely to be considered at variance with this Principle.

4.3 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.

No Declared Rare / Threatened flora species were recorded, nor were any EPBC Act listed Threatened flora observed. It is considered highly unlikely that any Threatened Flora species would have been overlooked.

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

4.4 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 Parks and Wildlife or Commonwealth listed TECs within or near the study area.

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

4.5 SIGNIFICANCE ASA 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 study area lies within two of Beard's mapping units - Hamersley 18 (A1Li) and Hamersley 82 (e16Lr t3Hi).

The current extent of the Beard (1975) mapping units listed has been estimated to be over 99% of their pre-European extent remaining and is considered to be of 'least concern'. The vegetation types within the study area would not therefore represent remnant stands of extensively cleared vegetation.

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

4.6 IMPACT ON ANY WATERCOURSES 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.

Minor ephemeral creeklines that flow after significant rainfall events transect the study area. These flowlines are not considered to be significant watercourses or wetlands and therefore the Proposal is not at variance with this Principle.

4.7 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 lies within the Boolgeeda and Newman Land Systems. These Land Systems are generally not prone to degradation and not susceptible to erosion. The proposed clearing is not expected to result in soil erosion, nutrient export, water-logging/flooding, acidification, salinization or deep subsoil compaction.

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

4.8 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.

The southern boundary of the study area is situated adjacent to Karijini National Park. the Proposal is not expected to impact the environmental values of this conservation area given that the manner in

which the clearing of native vegetation is regulated, undertaken and rehabilitated is under various Government and Rio Tinto operational controls (**Error! Reference source not found.**). The Proposal is unlikely to be at variance with this Principle if potential impacts are mitigated through implementation of various Government and internal Rio Tinto operational controls.

4.9 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.

No permanent or semi-permanent water features occur in or adjacent to the study area. Given the small scale of Proposal, there is no reason to expect that the Proposal would affect groundwater quality in the region.

The Marandoo Water Reserve is the nearest Public Drinking Water Source area. This reserve is located 42 km north west of the study area and will not be impacted.

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

4.10 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. The small scale of cleared proposed is not expected to exacerbate the incidence or intensity of flooding in the area.

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

5 CONCLUSIONS

Rio Tinto's Proposal is to clear native vegetation to support mineral exploration and geotechnical investigation activities in the Juna Downs area.

The landforms, vegetation, and fauna habitats are well represented within the Juna Downs locality and the broader Hamersley sub-region. Six vegetation types were identified across the study area.

The study area does not contain any TECs or PECs. The study area lies adjacent to, but outside of Karijini National Park. The study area falls within the Register of National Estate boundary, which is classified as an Environmentally Sensitive Area. The vegetation units identified within the study area are considered to be of low conservation value and are widely distributed both locally and throughout the Hamersley subregion.

A total of 186 taxa from 81 genera belonging to 38 families were recorded during the survey. The number of taxa recorded by the current study is slightly less than similar sized surveys of the Juna Downs locality.

No species of Threatened Flora were recorded by the study, or expected to occur within the study area.

Eight species of Priority Flora were recorded during the survey – *Eremophila* sp. Hamersley Range (K. Walker KW 136) (P1), *Tetratheca fordiana* (P1) (all locations recorded from outside the study area), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), *Solanum kentrocaule* (P3), *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3), *Acacia bromilowiana* (P4) and *Eremophila magnifica* subsp. *magnifica* (P4). An internal Rio Tinto significant area will be implemented surrounding the *Tetratheca fordiana* locations, as well as potential habitat for this species.

One weed species was recorded within the study area. This species is not listed as a Declared plant by the Department of Agriculture and Food.

Three broad fauna habitat types were recorded within the study area – 'Rocky slopes', 'Undulating slopes' and 'Drainage line – minor'. These habitats are considered to be well represented both locally and regionally.

Northern Quoll (*Dasyurus hallucatus*) scats were recorded from fauna habitat unit 'S1 - Rocky slopes'. Fauna habitat 'S1 - Rocky slopes' is not considered to be restricted at a local or regional level, however it does contain habitat, in the form of rocky overhangs and small caves, which may provide suitable habitat to support Northern Quolls. An internal Rio Tinto significant area has been proposed that includes the two recorded scat locations, nearby breakaway and cliff habitat that extends from the recorded location as well as the largest gullies, visible from the aerial imagery, within close proximity of the recorded scat locations. Given the small scale of the Proposal, the proposed significant area and the major gullies and gorges within Karijini National Park, to the south of the study area that provides optimal habitat for the Northern Quoll, the Northern Quoll is unlikely to be adversely impacted by the Proposal.

Nine Western Pebble-mound Mouse mounds were recorded within the study area. All mounds were considered to be recently inactive. Given this species broad distribution, the small scale of the Proposal, and as all recorded mounds were considered not to be recently active, the conservation significance of this species is unlikely to be impacted by the Proposal.

The manner in which the clearing of native vegetation is regulated, undertaken and rehabilitated is under various Government and internal Rio Tinto operational controls. These operational controls are presented in Appendix 10, and will be followed during the course of the Proposal.

The Proposal is unlikely to be at variance with any of the 10 Clearing Principles under Schedule 5 of the Environmental Protection Act 1986.

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7 APPENDICES

Appendix 1: Results of NatureMap, EPBC Protected Matters and Parks and Wildlife Database Searches

Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	118° 32' 25" E, 22° 56' 03" S
Buffer	20km
Group By	Conservation Status

Conservation Status	Species	Records
Other specially protected fauna	1	2
Priority 1	4	7
Priority 2	5	8
Priority 3	10	38
Priority 4	5	48
Protected under international agreement	1	1
Rare or likely to become extinct	2	8
TOTAL	28	108

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct				
1.	25238 <i>Liasis olivaceus</i> subsp. <i>barroni</i> (Pilbara Olive Python)		T	
2.	6069 <i>Thryptomene wittweri</i>		T	
Protected under international agreement				
3.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
Other specially protected fauna				
4.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
Priority 1				
5.	40643 <i>Eremophila</i> sp. <i>Hammersley Range</i> (K. Walker KW 136)		P1	
6.	13290 <i>Rhodanthe ascendens</i>		P1	
7.	41101 <i>Triodia</i> sp. <i>Karjiri</i> (S. van Leeuwen 4111)		P1	
8.	33026 <i>Vittadinia</i> sp. <i>Coondewanna Flats</i> (S. van Leeuwen 4694)		P1	
Priority 2				
9.	20768 <i>Eremophila forrestii</i> subsp. <i>Pingandy</i> (M.E. Trudgen 2662)		P2	
10.	40560 <i>Hibiscus</i> sp. <i>Gurinbiddy Range</i> (M.E. Trudgen MET 15708)		P2	
11.	30374 <i>Oxalis</i> sp. <i>Pilbara</i> (M.E. Trudgen 12725)		P2	
12.	42006 <i>Pentstemon trichodesmoides</i> subsp. <i>hispidus</i>		P2	
13.	6066 <i>Thryptomene stenophylla</i>		P2	
Priority 3				
14.	3316 <i>Acacia effusa</i>		P3	
15.	17918 <i>Aristida jerichoensis</i> var. <i>subspinulifera</i>		P3	
16.	20378 <i>Dampiera metallorum</i>		P3	
17.	14894 <i>Eremophila magnifica</i> subsp. <i>velutina</i>		P3	
18.	26381 <i>Goodenia</i> sp. <i>East Pilbara</i> (A.A. Mitchell PRP 727) (O'Meara's Goodenia)		P3	
19.	17716 <i>Indigofera gilesii</i>		P3	
20.	20311 <i>Pilbara trudgenii</i>		P3	
21.	20168 <i>Rhagodia</i> sp. <i>Hammersley</i> (M. Trudgen 17794)		P3	
22.	11556 <i>Rostellularia adscendens</i> var. <i>latifolia</i>		P3	
23.	42542 <i>Solanum kentrocaule</i>		P3	
Priority 4				
24.	14893 <i>Eremophila magnifica</i> subsp. <i>magnifica</i>		P4	
25.	16040 <i>Eremophila youngii</i> subsp. <i>lepidota</i>		P4	
26.	24217 <i>Leggadina lakedownensis</i> (Short-tailed Mouse, Karekanga)		P4	
27.	24180 <i>Macroderma gigas</i> (Ghost Bat)		P4	
28.	24233 <i>Pseudomys chapmani</i> (Western Pebble-mound Mouse, Ngadji)		P4	

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: 02/05/16 13:02:26

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

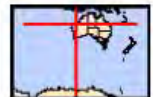
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 10.0Km



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:	8
Listed Migratory Species:	8

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	9
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:	2
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		
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area
Rhinonictis aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Plants		
Lepidium catapycnon Hamersley Lepidium, Hamersley Catapycnon [9397]	Vulnerable	Species or species habitat likely to occur within area
Thryptomene wittweri Mountain Thryptomene [16645]	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		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
Migratory Wetlands Species		
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
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
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
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

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Karjini	WA
Unnamed WA41696	WA

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 Resources 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
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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

-22.93417 118.54028

Appendix 2: Likelihood of occurrence criteria for flora and fauna species

Likelihood of occurrence criteria for flora and fauna species:

- Likelihood: Previously recorded.
 - The species has previously been recorded within study area from DEC database search results and/or from previous surveys of the study area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
- Likelihood: Likely.
 - The species has not previously been recorded from within the study area. However:
 - the species has been recorded in proximity (<5 km) to the study area, and occurs in similar habitat to that which occurs within the study area
 - core habitat and suitable landforms for the species occurs within the study area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present
 - there is a medium to high probability that a species uses the study area.
- Likelihood: Potential.
 - The species has not previously been recorded from within the study area. However,
 - targeted surveys may locate the species based on records occurring in proximity to the study area (5-15 km) and suitable habitat occurring in the study area
 - the study area has been assessed as having potentially suitable habitat through habitat modelling
 - the species is known to be cryptic and may not have been detected despite extensive surveys
 - the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys.
 - The species has been recorded in the study area by a previous consultant survey or there is historic evidence of species occurrence within the study area. However,
 - doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution)
 - coordinates are doubtful.
- Likelihood: Unlikely.
 - The species has been recorded locally through DEC database searches. However, it has not been recorded within the study area and
 - it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded
 - it is unlikely to occur due to few historic record/s and no other current collections in the local area.

- The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the study area through DEC database searches.
- The species has not been recorded in the study area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.
- Likelihood: No.
 - The species is not known to occur within the IBRA bioregion based on current literature and distribution.
 - The study area lacks important habitat for a species that has highly selective habitat requirements.
 - The species has been historically recorded within study area or locally; however it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators.

Appendix 3: Vegetation Structural Classification* and Condition Rating Scale**Vegetation Structural Classification**

Stratum	Canopy Cover (%)				
	70-100%	30-70%	10-30%	2-10%	<2%
Trees over 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 under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs over 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 under 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

*Based on (Muir 1977), and Aplin's (1979) modification of the vegetation classification system of Specht (1970):

Aplin T.E.H. (1979). The Flora. Chapter 3 In O'Brien, B.J. (ed.) (1979). *Environment and Science*. University of Western Australia Press;

Specht R.L. (1970). Vegetation. In *The Australian Environment*. 4th edn (Ed. G.W. Leeper). Melbourne.

Vegetation Condition Scale for use on Pilbara surveys*

E = Excellent (=Pristine of BushForever)
Pristine or nearly so; no obvious signs of damage caused by the activities of European man.
VG = Very Good (= Excellent of BushForever)
Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as <i>*Ursinia anthemoides</i> or <i>*Briza</i> spp., or occasional vehicle tracks.
G = Good (= Very Good of BushForever)
More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as <i>*Ehrharta</i> spp.
P = Poor (= Good of BushForever)
Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some more aggressive ones such as <i>*Ehrharta</i> spp.
VP = Very Poor (= Degraded of BushForever)
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 including very aggressive species.
D = Completely Degraded (= Completely Degraded of BushForever)
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 4: GPS Coordinate of quadrats and relevés recorded within the Study Area

Site	Type	Easting	Northing
JD01	Releve	660571	7462723
JD02	Releve	660258	7462480
JD03	Releve	659706	7463099
JD04	Releve	658770	7463080
JD05	Releve	658532	7462819
JD06	Releve	658121	7463110
JD07	Releve	657201	7463034
JD08	Releve	656638	7463174
JD10	Releve	657137	7463869
JD11	Releve	657146	7464428
JD12	Releve	655323	7463188
JD13	Releve	658087	7462718
JD14	Releve	658225	7462853
JD15	Releve	655377	7462749
JD16	Releve	655648	7462935
JD17	Releve	655934	7462975
JD20	Releve	658772	7462692
S1	Releve	651850	7462118
S2	Releve	652114	7462155
S3	Releve	652030	7462334
S4	Releve	652261	7462470

Site	Type	Easting	Northing
S5	Releve	654253	7463141
S6	Releve	654326	7462882

Appendix 5: Flora Species recorded during study

Family	Species	Conservation Ranking
Acanthaceae	<i>Dipteracanthus australasicus</i>	
	<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3
Amaranthaceae	<i>Alternanthera nana</i>	
	<i>Gomphrena canescens</i>	
	<i>Gomphrena cunninghamii</i>	
	<i>Ptilotus astrolasius</i>	
	<i>Ptilotus calostachyus</i>	
	<i>Ptilotus clementii</i>	
	<i>Ptilotus nobilis</i>	
	<i>Ptilotus obovatus</i>	
	<i>Ptilotus rotundifolius</i>	
Apocynaceae	<i>Rhyncharrhena linearis</i>	
Araliaceae	<i>Astrotricha hamptonii</i>	
Asteraceae	* <i>Bidens bipinnata</i>	
	<i>Chrysocephalum pterochaetum</i>	
	<i>Olearia xerophila</i>	
	<i>Pterocaulon serrulatum</i>	
	<i>Pterocaulon sphaeranthoides</i>	
Asteraceae	<i>Rhodanthe margarethae</i>	
Boraginaceae	<i>Heliotropium pachyphyllum</i>	
	<i>Heliotropium tenuifolium</i>	
	<i>Trichodesma zeylanicum</i>	
Brassicaceae	<i>Lepidium pedicellosum</i>	
Campanulaceae	<i>Lobelia heterophylla</i> subsp. <i>pilbarensis</i>	
Capparaceae	<i>Capparis lasiantha</i>	
	<i>Capparis mitchellii</i>	
	<i>Capparis umbonata</i>	
Caryophyllaceae	<i>Polycarpaea holtzei</i>	
	<i>Polycarpaea longiflora</i>	
Celastraceae	<i>Maytenus</i> sp. Mt Windell (S. van Leeuwen 846)	
Chenopodiaceae	<i>Dysphania kalpari</i>	
	<i>Maireana georgei</i>	
	<i>Maireana villosa</i>	
	<i>Rhagodia eremaea</i>	
	<i>Salsola australis</i>	
	<i>Sclerolaena deserticola</i>	
Cleomaceae	<i>Cleome viscosa</i>	

Family	Species	Conservation Ranking
Convolvulaceae	<i>Bonamia pilbarensis</i>	
	<i>Duperreya commixta</i>	
	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
Cucurbitaceae	<i>Cucumis variabilis</i>	
Cyperaceae	<i>Bulbostylis barbata</i>	
	<i>Fimbristylis dichotoma</i>	
Elaeocarpaceae	<i>Tetradthea fordiana</i>	P1
Euphorbiaceae	<i>Euphorbia australis</i>	
	<i>Euphorbia biconvexa</i>	
	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
Fabaceae	<i>Acacia adoxa</i> var. <i>adoxo</i>	
	<i>Acacia adsurgens</i>	
	<i>Acacia ancistrocarpa</i>	
	<i>Acacia aneura</i>	
	<i>Acacia aptaneura</i>	
	<i>Acacia arida</i>	
	<i>Acacia atkinsiana</i>	
	<i>Acacia bivenosa</i>	
	<i>Acacia bromilowiana</i>	P4
	<i>Acacia colei</i>	
	<i>Acacia dictyophleba</i>	
	<i>Acacia elachantha</i>	
	<i>Acacia exilis</i>	
	<i>Acacia fuscanaura</i>	
	<i>Acacia inaequilatera</i>	
	<i>Acacia maitlandii</i>	
	<i>Acacia marramamba</i>	
	<i>Acacia mulganeura</i>	
	<i>Acacia orthocarpa</i>	
	<i>Acacia pachyacra</i>	
	<i>Acacia paraneura</i>	
	<i>Acacia pruinocarpa</i>	
<i>Acacia pyrifolia</i>		
<i>Acacia steedmanii</i>		
<i>Acacia tenuissima</i>		
<i>Acacia tetragonophylla</i>		
<i>Acacia trudgeniana</i>		

Family	Species	Conservation Ranking
	<i>Indigofera georgei</i>	
	<i>Indigofera monophylla</i>	
	<i>Indigofera</i> sp. <i>Fractiflexa</i> (S. van Leeuwen 3773)	
	<i>Rhynchosia minima</i>	
	<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
	<i>Senna ferraria</i>	
	<i>Senna glaucifolia</i>	
	<i>Senna glutinosa</i> subsp. <i>xluerssenii</i>	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
	<i>Senna notabilis</i>	
	<i>Senna pleurocarpa</i>	
	<i>Senna venusta</i>	
<i>Tephrosia rosea</i> var. Fortescue creeks		
<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)		
Goodeniaceae	<i>Dampiera candicans</i>	
	<i>Goodenia cusackiana</i>	
	<i>Goodenia micrantha</i>	
	<i>Goodenia stobbsiana</i>	
	<i>Goodenia triodiophila</i>	
	<i>Scaevola acacioides</i>	
	<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	
	<i>Scaevola spinescens</i>	
<i>Velleia connata</i>		
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>	
Haloragaceae	<i>Haloragis gossei</i>	
Lamiaceae	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
	<i>Prostanthera albiflora</i>	
Lauraceae	<i>Cassytha capillaris</i>	
Malvaceae	<i>Abutilon fraseri</i>	
	<i>Abutilon otocarpum</i>	
	<i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)	
	<i>Androcalva luteiflora</i>	
	<i>Corchorus crozophorifolius</i>	
	<i>Corchorus lasiocarpus</i>	
	<i>Corchorus parviflorus</i>	

Family	Species	Conservation Ranking
	<i>Gossypium robinsonii</i>	
	<i>Hibiscus burtonii</i>	
	<i>Hibiscus coatesii</i>	
	<i>Hibiscus goldsworthii</i>	
	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	
	<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
	<i>Melhania oblongifolia</i>	
	<i>Sida arsiniata</i>	
	<i>Sida echinocarpa</i>	
	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3
	<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)	
	<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)	
	<i>Sida</i> sp. Shovelanna Hill (S. van Leeuwen 3842)	
	<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	
<i>Triumfetta leptacantha</i>		
Moraceae	<i>Ficus brachypoda</i>	
Myrtaceae	<i>Corymbia deserticola</i>	
	<i>Corymbia ferriticola</i>	
	<i>Corymbia hamersleyana</i>	
	<i>Eucalyptus gamophylla</i>	
	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
Nyctaginaceae	<i>Boerhavia coccinea</i>	
	<i>Boerhavia gardneri</i>	
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>	
Poaceae	<i>Dichanthium sericeum</i>	
	<i>Eulalia aurea</i>	
	<i>Paraneurachne muelleri</i>	
	<i>Amphipogon caricinus</i>	
	<i>Amphipogon sericeus</i>	
	<i>Aristida burbridgeae</i>	
	<i>Aristida contorta</i>	
	<i>Aristida holathera</i> var. <i>holathera</i>	
	<i>Aristida ingrata</i>	
	<i>Aristida latifolia</i>	
	<i>Chrysopogon fallax</i>	
	<i>Cymbopogon ambiguus</i>	
<i>Cymbopogon obtectus</i>		

Family	Species	Conservation Ranking
	<i>Enneapogon caerulescens</i>	
	<i>Enneapogon lindleyanus</i>	
	<i>Enneapogon polyphyllus</i>	
	<i>Eragrostis eriopoda</i>	
	<i>Eriachne lanata</i>	
	<i>Eriachne mucronata</i>	
	<i>Eriachne pulchella</i>	
	<i>Panicum decompositum</i>	
	<i>Schizachyrium fragile</i>	
	<i>Themeda triandra</i>	
	<i>Triodia brizoides</i>	
	<i>Triodia epactia</i>	
	<i>Triodia melvillei</i>	
	<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)		
<i>Triodia wiseana</i>		
Proteaceae	<i>Grevillea berryana</i>	
	<i>Grevillea striata</i>	
	<i>Grevillea wickhamii</i>	
	<i>Hakea chordophylla</i>	
	<i>Hakea lorea</i>	
Pteridaceae	<i>Cheilanthes lasiophylla</i>	
Rubiaceae	<i>Psydrax latifolia</i>	
	<i>Psydrax suaveolens</i>	
Santalaceae	<i>Santalum spicatum</i>	
Sapindaceae	<i>Dodonaea amblyophylla</i>	
	<i>Dodonaea coriacea</i>	
	<i>Dodonaea lanceolata</i>	
	<i>Dodonaea pachyneura</i>	
	<i>Dodonaea petiolaris</i>	
Scrophulariaceae	<i>Eremophila cuneifolia</i>	
	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	
	<i>Eremophila fraseri</i>	
	<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	
	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	
	<i>Eremophila longifolia</i>	
	<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4

Family	Species	Conservation Ranking
	<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1
Solanaceae	<i>Solanum elatius</i>	
	<i>Solanum ferocissimum</i>	
	<i>Solanum horridum</i>	
	<i>Solanum kentrocaule</i>	P3
	<i>Solanum lasiophyllum</i>	
	<i>Solanum piceum</i>	
Surianaceae	<i>Stylobasium spathulatum</i>	
Zygophyllaceae	<i>Tribulus suberosus</i>	

Appendix 6: Conservation Listed Flora recorded during survey

Species	Status	Easting	Northing	Population Size
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	652399	7462347	1
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	655220	7463040	1
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	655286	7462741	6
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	656055	7462876	3
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	655989	7462838	5
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	656004	7462853	8
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	656047	7462801	5
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136)	P1	656084	7462816	1
<i>Tetradthea fordiana</i>	P1	656561	7462879	8
<i>Tetradthea fordiana</i>	P1	656577	7462899	26
<i>Tetradthea fordiana</i>	P1	656575	7462912	16
<i>Tetradthea fordiana</i>	P1	656551	7462919	18
<i>Tetradthea fordiana</i>	P1	656509	7462914	2
<i>Tetradthea fordiana</i>	P1	656465	7462905	6
<i>Tetradthea fordiana</i>	P1	656486	7462951	12
<i>Tetradthea fordiana</i>	P1	656017	7462850	80
<i>Tetradthea fordiana</i>	P1	656047	7462801	8
<i>Tetradthea fordiana</i>	P1	656054	7462814	19
<i>Tetradthea fordiana</i>	P1	656042	7462820	4
<i>Tetradthea fordiana</i>	P1	656053	7462820	4
<i>Tetradthea fordiana</i>	P1	656064	7462809	8
<i>Tetradthea fordiana</i>	P1	656038	7462853	7
<i>Tetradthea fordiana</i>	P1	656033	7462867	9
<i>Tetradthea fordiana</i>	P1	656010	7462873	10
<i>Tetradthea fordiana</i>	P1	656183	7462780	30

Species	Status	Easting	Northing	Population Size
<i>Tetradlea fordiana</i>	P1	656196	7462773	25
<i>Tetradlea fordiana</i>	P1	656193	7462842	3
<i>Tetradlea fordiana</i>	P1	657096	7462729	2
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	659837	7462491	13
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	659872	7462503	10
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	654048	7463050	3
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	654183	7463021	15
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	654258	7462957	4
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	654225	7462964	3
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	654078	7462967	8
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	657286	7462775	6
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	657152	7462851	20
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	655895	7462816	3
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	655928	7462784	10
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656047	7462801	10
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656084	7462816	5
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656091	7462852	5
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656056	7462850	10
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656010	7462873	27
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656193	7462842	7
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656196	7462940	20
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	656297	7462937	5
<i>Solanum kentrocaule</i>	P3	655286	7462736	1
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	651849	7462196	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	651833	7462123	150

Species	Status	Easting	Northing	Population Size
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	651862	7462117	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	652254	7462156	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	652297	7462184	
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	652363	7462196	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	652404	7462185	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	652392	7462237	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	654319	7462844	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	654270	7462828	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	651824	7462216	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	654361	7463098	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	654291	7463103	14
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	654351	7463026	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	654390	7462946	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	654225	7462964	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	651850	7462118	
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660258	7462480	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660258	7462480	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658770	7463080	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658087	7462718	
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655648	7462935	
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655934	7462975	300
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658772	7462692	
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657862	7462932.14	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657917	7462817.13	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657898	7462809.95	14

Species	Status	Easting	Northing	Population Size
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657912	7462796.88	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658088	7462719.36	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658152	7462737.15	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658190	7462782.89	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658206	7462803.03	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658214	7462828.77	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658218	7462836.12	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658967	7462732.26	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658952	7462721.35	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658853	7462600.58	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658755	7462701.28	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	658748	7462717.96	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655325	7462882	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655326	7462841	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655323	7462828	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655316	7462802	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655296	7462769	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655286	7462736	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655328	7462747	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655394	7462892	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655405	7462918	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655458	7463105	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655562	7463008	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655573	7463036	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655571	7463069	15

Species	Status	Easting	Northing	Population Size
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655568	7463099	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655565	7463126	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655629	7463035	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655633	7462935	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655765	7462891	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655770	7462922	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655755	7462972	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655782	7462983	25
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655866	7463033	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655926	7462995	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655932	7462931	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655931	7462883	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655985	7462886	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655992	7462881	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656005	7462878	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656023	7462884	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656052	7462876	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656093	7462908	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656096	7462931	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656108	7462949	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656187	7463000	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656171	7462967	75
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656189	7462971	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656212	7462986	300
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656464	7462974	30

Species	Status	Easting	Northing	Population Size
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656480	7463018	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656512	7462931	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656510	7462964	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655654	7462938	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655693	7462946	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655723	7462890	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655746	7462884	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655881	7462885	17
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655880	7462861	45
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655892	7462837	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655865	7462814	150
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655920	7462791	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	655961	7462818	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656036	7462779	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656047	7462801	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656053	7462820	150
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656084	7462816	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656118	7462840	75
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656091	7462852	100
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656056	7462850	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656010	7462873	100
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656120	7462875	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656145	7462866	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656183	7462780	75
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656173	7462878	140

Species	Status	Easting	Northing	Population Size
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656193	7462842	100
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656196	7462940	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656287	7462937	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656357	7462956	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659950	7462410	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659919	7462416	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659750	7462451	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657425	7462850	9
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657404	7462850	12
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657379	7462816	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657336	7462778	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657302	7462777	60
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657265	7462778	12
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657252	7462815	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657223	7462853	45
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657245	7462918	12
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	657015	7462878	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656980	7462887	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656962	7462992	3
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656934	7462918	6
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656641	7462913	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656633	7462894	12
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656561	7462879	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656577	7462899	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656511	7462943	26

Species	Status	Easting	Northing	Population Size
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656509	7462914	25
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656465	7462905	8
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	656486	7462951	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660159	7462490	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660136	7462525	60
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660102	7462526	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660075	7462517	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660005	7462590	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659980	7462615	7
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659942	7462656	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659895	7462665	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659841	7462675	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659809	7462659	40
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659774	7462668	60
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659765	7462699	30
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659726	7462705	28
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659896	7462710	50
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659664	7462749	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659627	7462748	12
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659569	7462740	15
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659588	7462712	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659643	7462692	20
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659686	7462661	5
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659711	7462654	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	659750	7462638	18

Species	Status	Easting	Northing	Population Size
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660003	7462543	10
<i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739)	P3	660017	7462525	21
<i>Acacia bromilowiana</i>	P4	658955	7462704.71	4
<i>Acacia bromilowiana</i>	P4	658888	7462633.44	10
<i>Acacia bromilowiana</i>	P4	658856	7462591.32	10
<i>Acacia bromilowiana</i>	P4	658829	7462622.98	10
<i>Acacia bromilowiana</i>	P4	655435	7462796	19
<i>Acacia bromilowiana</i>	P4	655928	7462784	30
<i>Acacia bromilowiana</i>	P4	659922	7462414	13
<i>Acacia bromilowiana</i>	P4	659912	7462418	8
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	659878	7462404	3
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	659764	7462466	1
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	659950	7462410	5
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	660230	7462401	4
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	659976	7462410	26

Appendix 7: Introduced flora (weed) species recorded during study

Species	Easting	Northing	Population Size
<i>*Bidens bipinnata</i>	659837	7462491	30

Appendix 8: Conservation listed fauna species locations recorded during study

Species	Common Name	WC Act	EPBC	Observation	Easting	Northing
<i>Dasyurus hallucatus</i>	Northern Quoll	S2	En	Scat	657944	7462800
<i>Dasyurus hallucatus</i>	Northern Quoll	S2	En	Scat	658026	7462793
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4	-	Inactive recent	652174	7462430
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4	-	Inactive recent	652176	7462431
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	652298	7462501
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	652383	7462594
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	652104	7462312
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	654082	7463182
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	654164	7463179
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	656633	7463176
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	655324	7463171
<i>Pseudomys chapmani</i>	Western Pebble-Mound Mouse	P4		Inactive recent	655192	7462978

Appendix 9: Framework for Conservation Significance Ranking for Flora and Fauna Species
Legislative Framework for Conservation Significant Flora *Wildlife Conservation Act 1950*

All native flora in Western Australia is protected under the state *Wildlife Conservation Act 1950*. Protected flora which are deemed to be at risk of extinction, rare, or otherwise in need of special protection are listed as “Rare Flora” and published in the *Wildlife Conservation (Rare Flora) Notice 2008*. Specific written approval by the Minister for the Environment is required to take or harm species listed in Schedule 1 or 2 of the *Wildlife Conservation (Rare Flora) Notice 2008*. Flora species which may be rare or threatened in Western Australia but which have not been adequately surveyed for are included in a supplementary conservation list called the Priority Flora List.

In addition to state legislation, some Western Australian native plant species are protected under federal law, namely the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In the Pilbara, two species *Lepidium catapycnon* and *Thryptomene wittweri* are currently listed as “Vulnerable” under the EPBC Act. Proposals that are considered likely to have a significant impact on EPBC Act listed threatened flora are required to be referred to the Federal Minister of Environment for approval.

Categories of conservation significance for flora species under the *Wildlife Conservation Act 1950* (Atkins 2006)

Declared Rare Flora - Extant Taxa- Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection

Declared Rare Flora - Presumed Extinct Taxa- Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently,

Priority One - Poorly known Taxa- Taxa which are known from one or a few (generally <5) populations which are under threat.

Priority Two - Poorly Known Taxa- Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.

Priority Three - Poorly Known Taxa- Taxa which are known from several populations, and the taxa are not believed to be under immediate threat.

Priority Four - Rare Taxa- Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors.

Legislative Framework for Conservation Significant Fauna *Wildlife Conservation Act 1950-1979*

Native fauna species that are rare, threatened with extinction, or have high conservation value are specially protected by law under the Western Australian *Wildlife Conservation Act 1950-1979* (WC Act). The *Wildlife Conservation (Special Protected Fauna) Notice* classifies rare and endangered fauna using four distinct conservation codes or schedules (see below).

In addition to the above schedules, the DEC produces a supplementary list of Priority Fauna. Priority Fauna are species that have been identified as requiring further survey and evaluation of their conservation status before deciding whether to list them as Schedule Fauna. Five Priority codes are recognised by the DEC and are presented below

DEC Priority Fauna codes

Priority One: Taxa with few, poorly known populations on threatened lands. Taxa which are known from a few specimens or sight records from one or a few localities on lands not managed for conservation. The taxa needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Two: Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Three: Taxa with several, poorly known populations, some on conservation lands. Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Four: Taxa in need of monitoring. Taxa which are considered to have been adequately circumstances change. These taxa are usually represented on conservation surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could be if present lands. Taxa which are declining significantly but are not yet threatened.

Priority Five: Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* affords protection to species, populations and ecological communities threatened at a national level or to species listed as migratory under various international agreements (e.g. CAMBA, JAMBA RoKAMBA, Bonn Convention). Categories relevant to the current study include:

Endangered – Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable – Taxa facing high risk of extinction in the wild in the medium-term.

Under the EPBC Act, a proposal which is likely to have a significant impact on threatened species, populations or ecological communities or migratory species must be referred to DEWHA for a decision by the Commonwealth Minister for the Environment. A significant impact is determined through application of Significant Impact Criteria (DEWHA 2000).

Categories of conservation significance for fauna species under the *Wildlife Conservation Act 1950* (Atkins 2006)

Native fauna species that are rare, threatened with extinction, or have high conservation value are specially protected by law under the Western Australian *Wildlife Conservation Act 1950-1979* (WC Act). The *Wildlife Conservation (Special Protected Fauna) Notice* classifies rare and endangered fauna using four distinct conservation codes or schedules.

Schedule 1 – Fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection.

Schedule 2 – Fauna which are presumed to be extinct and are declared to be fauna in need of special protection.

Schedule 3 – Birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, which are declared to be fauna in need of special protection, and

Schedule 4 – Fauna that are in need of special protection, otherwise than for the reasons mentioned in Schedules 1, 2 or 3.

EPBC Act Significant Impact Criteria

Conservation Code	Significant Impact Criteria
<i>Critically Endangered and Endangered Species</i>	<p>An action is likely to have a significant impact on critically endangered or endangered species if there is a real chance or possibility that it will:</p> <ul style="list-style-type: none"> Lead to a long-term decrease in the size of a <i>population</i>, or Reduce the area of occupancy of the species, or Fragment an existing <i>population</i> into two or more populations, or Adversely affect habitat critical to the survival of a species, or Disrupt the breeding cycle of a population, or Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat, or Interfere with the recovery of the species.
<i>Vulnerable species</i>	<p>An action is unlikely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p> <ul style="list-style-type: none"> Lead to a long-term decrease in the size of an important population of a species, or Reduce the area of occupancy of an important population, or Fragment an existing important population into two or more populations, or Adversely affect habitat critical to the survival of a species, or Disrupt the breeding cycle of an important population, or Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat, or Interferes substantially with the recovery of the species

Conservation Code	Significant Impact Criteria
<p><i>Critically endangered and endangered ecological communities</i></p>	<p>An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:</p> <ul style="list-style-type: none"> ○ Reduce the extent of a community, or ○ Fragment or increase fragmentation of the community, for example by clearing vegetation for roads or transmission lines, or ○ Adversely affect habitat critical to the survival of an ecological community which consists of, or includes, fauna species, or ○ Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community’s survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns, or ○ Cause a substantial change in the species composition of an occurrence of an ecological community, including, but not limited to: <ul style="list-style-type: none"> ▪ Assisting invasive species, that are harmful to the listed ecological community, to become established; and ▪ Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or ○ Interfere with the recovery of an ecological community
<p><i>Listed Migratory Species</i></p>	<p>An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:</p> <ul style="list-style-type: none"> ○ Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or ○ Result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or ○ Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

Appendix 10: Government and Rio Tinto internal operational controls for Environmental Management

Operational Controls for Environmental Management

The manner in which the clearing of native vegetation is regulated, undertaken and rehabilitated is under various Government and internal RTIO operational controls. These operational controls are discussed below.

State Agreement Act Terms and Conditions

The Nammuldi mine, for example, operates under the Iron Ore (Hamersley Range) Agreement Act 1963. This mine is regulated by the DoMP and is subject to assessment of new proposals by DoMP and to the Annual Environmental Report (“AER”) inspection system. The AER inspections are carried out by DoMP Environmental Inspectors.

Environmental Protection Authority Guidance Statements

Where possible and/or practical, biological survey and restoration of the areas affected by mining is undertaken in accordance with the following EPA Position and Guidance Statements:

Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA 2002).

Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.

Guidance Statement No. 51 (EPA 2004a).

Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (EPA 2004b).

Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA-DEC 2010).

Rehabilitation of Terrestrial Ecosystems. Guidance Statement No. 6 (EPA 2006).

RTIO Operational Controls

RTIO is part of the Rio Tinto group of companies and is obliged to comply with the 10 Rio Tinto global environmental standards, the first of which requires a certified Environmental Management System. RTIO has developed and implemented over 100 Operational Control Procedures (“OCP”) to manage environmental issues relating to mining and exploration. A number of these OCPs are of direct relevance in managing and controlling land clearing activities, and include:

- Approvals Permit Guidelines and Procedure;
- IEMS Procedure - Ground Disturbance;
- Rehabilitation Handbook;
- IEMS Weed Management Plan;
- IEMS Procedure - Soil Resource Management;
- IEMS Procedure – Erosion Monitoring; and
- IEMS Weed Field Sheets.