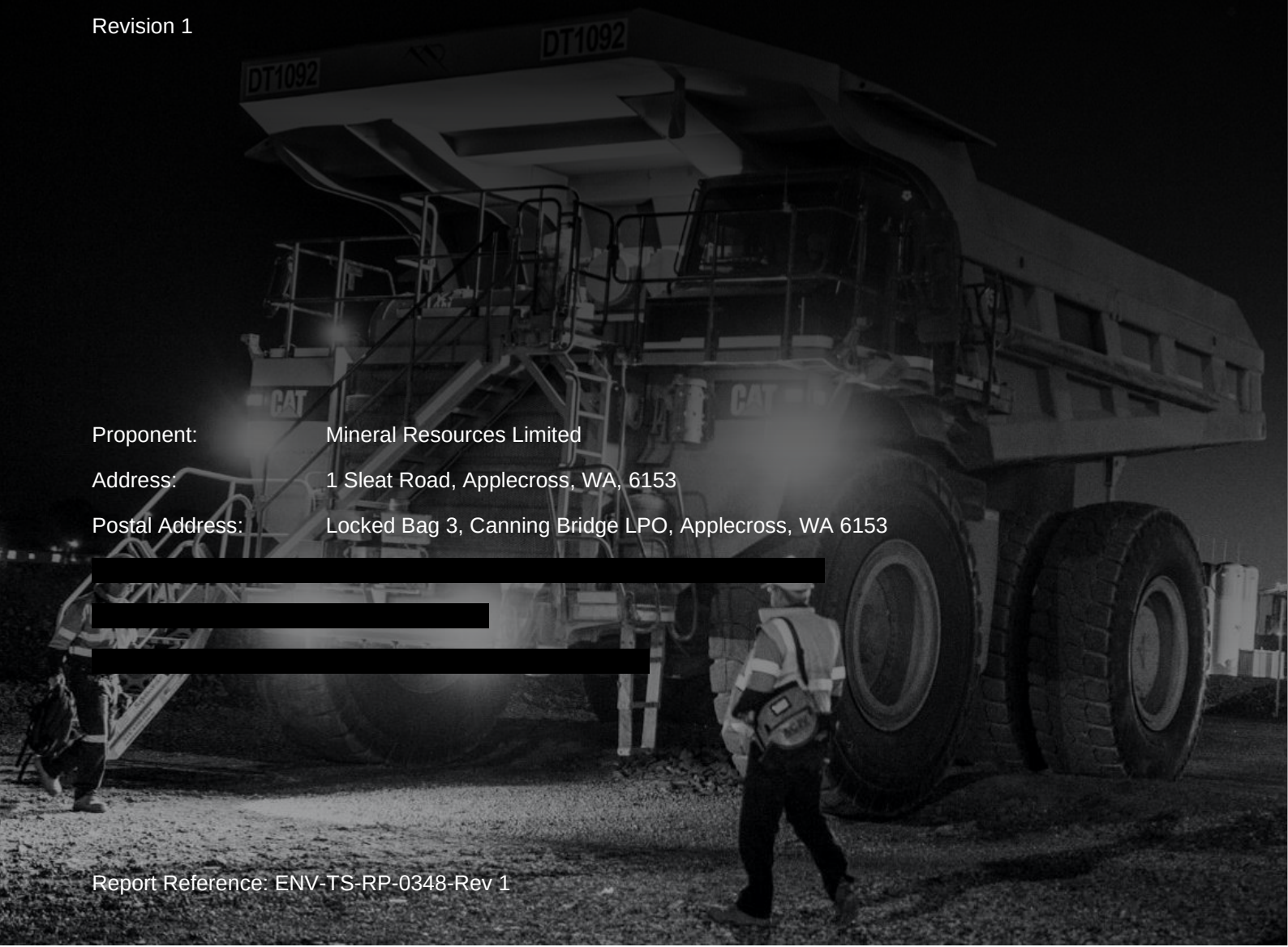
Mount Marion Lithium Project

West Hamptons Area 53

Supporting document for a native vegetation clearing permit application

7 December 2021

Revision 1



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EXECUTIVE SUMMARY

Mineral Resources Limited (MRL) operates the Mount (Mt) Marion Lithium Mine approximately 36 kilometres (km) south of Kalgoorlie in the Eastern Goldfields region, Western Australia (WA) (Figure 1). MRL proposes to explore for lithium in areas around the mine. This application is to support the clearing of up to 200 hectares (ha) of native vegetation at Hamptons West 53 on Exempt East Location 53 (EEL 53). The West Hamptons Area 53 is 5,215.3 ha. EEL 53 is freehold land issued pre-1899 and is 13,971.99 ha (DMIRS. n.d.(a)). The West Hamptons Area 53 is the proposed permit area (Figure 2).

This report comprises of the supporting document for the Native Vegetation Clearing Permit application to clear 200 ha of native vegetation in the permit area. It provides an assessment of the clearing of native vegetation in accordance with the Native Vegetation Clearing Regulations 2004, WA. The methods employed for this assessment have included a review of the biological assessments by GHD (2018), a review of publicly available data and information, and a Geospatial Information Systems (GIS) desktop analysis. The GIS desktop analysis has included the evaluation of data from the Shared Location Information Platform and GHD's biological survey data. The desktop review of publicly available information has included a review of the most recent Statewide Vegetation Statistics incorporating the Comprehensive Adequate Representative (CAR) Reserve Analysis (2019), a NatureMap search, a Protected Matters Search Tool (PMST) report, a review of land tenure types on TENGRAPH (DMIRS n.d. (a)), a review of mining proposals and sites on Minedex (DMIRS n.d.(b)), and Northern Star Resources Limited's (NSRL's) CPS 8235/1 Decision Report for the same area.

The permit area excludes any formal conservation reserves. The nearest conservation reserves are the Karramindie Forest on the north-eastern boundary and the Yallari Timber Reserve on the Southern Boundary (GHD, 2018) (Figure 1).

The results of the flora and vegetation assessment for the permit area concluded that the Pre-European vegetation associations present in the permit area are well represented at a state, regional and local government level (GHD, 2018) (Figure 5). The vegetation comprises mostly of Eucalyptus woodlands which are part of the Great Western Woodlands. The Great Western Woodlands is the largest remaining intact temperate woodland in the world (GHD, 2018). There were no Threatened or Priority Ecological Communities recorded in the permit area and no Threatened or Priority flora listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) or under the *Biodiversity Conservation Act 2016* (WA) (BC Act) recorded. GHD (2018) mapped a Granite Outcrop Community of mixed open shrubland over herb land (VT04) as Other Significant Vegetation (GHD, 2018). *"This community is considered as having potential to support local endemism in a restricted habitat (granite outcrop) with restricted distribution in the local and regional area"* (GHD, 2018. p. 1). None of the Threatened and Priority Flora species listed in a desktop assessment with potential to occur were not recorded during the survey. According to GHD (2018), two Priority 1 (P1) species were most likely to occur in the Granite Outcrop Community (Figure 6). These included *Acacia websteri* (Priority [P]1) and *Thryptomene* sp. Londonderry (P1) (R.H. Kuchel 1763 cited in GHD, 2018). One Declared Pest under the *Biosecurity and Agriculture Management Act 2007* was recorded (GHD, 2018) (Figure 7).

The fauna assessment recorded Malleefowl *Leipoa ocellata* in the survey area. Malleefowl is listed as Vulnerable under the EPBC Act and BC Act. The survey results also considered suitable habitat for Rainbow Bee-eater *Merops ornatus* was present. Rainbow Bee-eater is protected under International Agreement and the BC Act. Sixty-four habitat trees, 33 with hollows, were recorded in West Hamptons Area 53. The assessment of habitat trees with hollows was limited to transects of 3 km in total (GHD, 2018).

An assessment against the 10 principles for the clearing of native vegetation concluded that the clearing of up to 200 ha of native vegetation within Hamptons West 53 on EEL 53 is not at variance with Principles (A) to (J).

In summary, the environmental impacts of the proposal involving the clearing of native vegetation in the permit area will be temporary, can be adequately managed by MRL's Mt Marion Lithium Mine Environmental Management System. Furthermore, MRL has the environmental management resources to adequately enable this.

Other existing approvals in the West Hamptons Area 53 include a Native Vegetation Clearing Permit (CPS) 8235/1 held by NSRL for gold exploration. This assessment by MRL has considered the content of the CPS 8235/1 decision report and the conditions of this permit being an important precedent for this application.

This application for a Purpose Permit is for an identical proposal by MRL targeting tin, tantalum and lithium mineralisation instead of gold. This proposal is to clear 3.8% of the total permit area (5,215.3 ha) within the constraints of the existing Environmental Management System at Mt Marion Mine and the industry standards for exploration. Exploration rehabilitation is also expected to occur within six months of completion of the activity and thus, the disturbance proposed is considered minor and temporary. It is reasonable, therefore, to conclude that significant impacts by this proposal on flora, vegetation, fauna and fauna habitats are unlikely.

1. INTRODUCTION

MRL operates the Mt Marion Lithium Mine on behalf of Ganfeng Lithium (Ganfeng) (MRL, 2021). Ganfeng own 50 percent (%) of the Mt Marion Lithium Mine (MRL, 2021). The Mt Marion Lithium Mine is located 40 km southwest of Kalgoorlie (MRL, 2021). In March 2021, Westgold Resources (Westgold) sold its lithium assets including a royalty over the Mt Marion Lithium Mine, the exploration and developing rights on adjoining land tenure to Reed Industrial Minerals (RIM) (Westgold, 2021). The Project is managed and operated by Process Minerals International Pty Ltd (PMI), a 100% subsidiary of Mineral Resources Limited, under a Build-Own-Operate life-of-mine mining services contract. This project is jointly owned by PMI (50%) and Ganfeng Lithium (GFL) International Co. Ltd (50%) via a joint venture company, RIM. All mining tenure associated with this Proposal is held by RIM.

MRL intends to explore for tin, tantalum and lithium within the special land category area, EEL, Greater Hamptons, West Hamptons Area 53. This area is freehold land on Lot 105 Karramindie and comprises of 5,215.3 ha. Freehold land grants the landowner the right to retain the mineral rights, and therefore the provisions under the *Mining Act 1978* (Mining Act) do not apply. Exempt locations such as EEL 53 are governed under the *Mining on Private Property Act 1898* (Mining Act, Section 27(2)) (DMIRS, n.d.(a)).

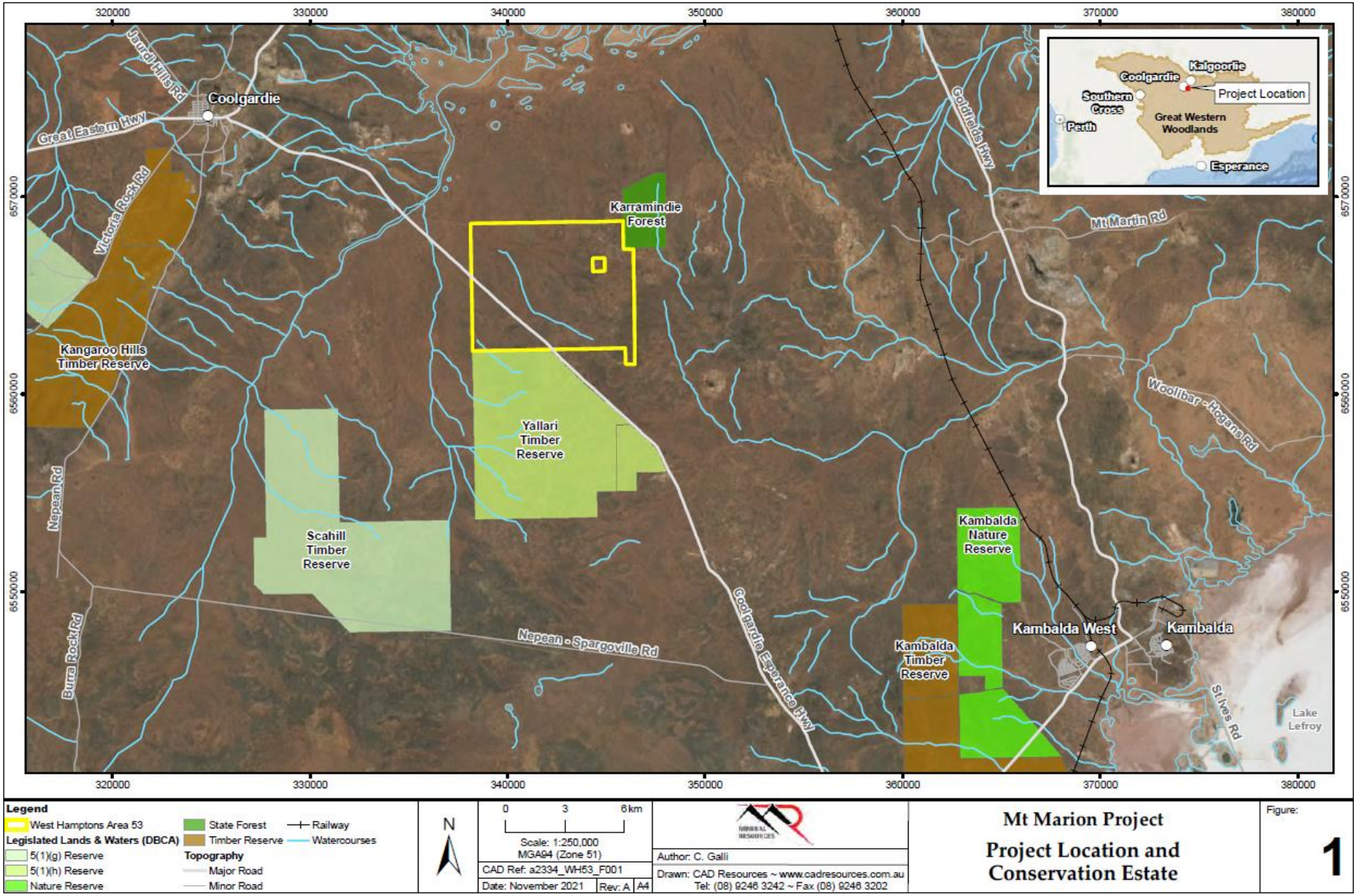
West Hamptons Area 53's environmental site name is Mt Marion Area 3 Pegmatite (S0021517) (DMIRS, n.d.(b)).

2. PURPOSE AND METHODOLOGY

The purpose of this document is to support a purpose permit application at West Hamptons Area 53 for clearing of 200 ha (Figure 1). The area excludes conservation estate or sites registered under the *Aboriginal Heritage Act 1972*.

The methods employed for this assessment have included a review of the biological assessments by GHD (2018) (Appendix A), a review of publicly available information including: a review of the most recent Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (2019); a NatureMap search and a Protected Matters Search Tool (PMST) report; a review of land tenure types on TENGRAPH (DMIRS n.d. (a)), a review of mining proposals and projects on Minedex (DMIRS n.d.(b)), and NSRL's CPS 8235/1 Decision Report for the same area. The GIS desktop analysis has included the evaluation of data from the Shared Location Information Platform and GHD's biological survey data.

Figure 1: Project location and reserve areas



3. SUMMARY OF ENVIRONMENTAL BASELINE SURVEY AND ASSESSMENT

GHD was commissioned by Westgold in 2018 to undertake flora, vegetation and fauna assessments of West Hamptons Area 53 (GHD, 2018). The total biological survey area[1] was 5,214.32 ha, being the entire West Hamptons Area 53. The Pre-European vegetation associations comprised of four units, all of which are well represented and above 70% of the Pre-European extent (GHD, 2018). Results of the vegetation survey identified seven vegetation communities, including: five Eucalyptus Woodlands, one tall shrubland of *Acacia* species (spp.) and *Meleleuca* spp., and one granite community. An assessment of vegetation in the only minor drainage line in the survey area excluded riparian vegetation (GHD, 2018). Results of the flora and vegetation assessment confirmed there were no flora listed under Commonwealth or State legislation recorded in the survey area (GHD, 2018). Two P1 listed taxa were identified in the desktop assessment and had potential to occur. These included *Acacia websteri* and *Thryptomene sp*. Londonderry (GHD, 2018).

Results of the fauna assessment by GHD (2018) recorded one Vulnerable species protected under Commonwealth and State legislation, malleefowl *Leipoa ocellata*. Sightings included a single bird and three malleefowl mounds. A second listed species, Rainbow Bee-eater *Merops ornatus* protected under International Agreement, was not recorded due to the timing of the surveys although was expected to occur (GHD, 2018). An assessment of the survey area recorded 64 habitat trees, of which 33 had hollows (GHD, 2018).

3.1 PRECEDENTS BY EXISTING NATIVE VEGETATION CLEARING PERMITS

NSRL currently holds a clearing permit (CPS 8235/1) for mineral exploration of gold in the Hampton Gold Mining Area, West Hamptons Area 53 (Figure 2) (DER, 2018). The clearing authorised by CPS 8235/1 at West Hamptons Area 53 is for 200 ha (DER, 2018) east and west on the EEL. The east area in the application was 4,269.50 ha and the west area was 5,214.32 ha, with a total combined area of 9,483.82 ha (DER, 2019). CPS 8253/1 was granted on 26 September 2019 and is valid until 26 September 2029 (GoW, 2019). No clearing is permitted beyond September 2024 (GoW, 2019).

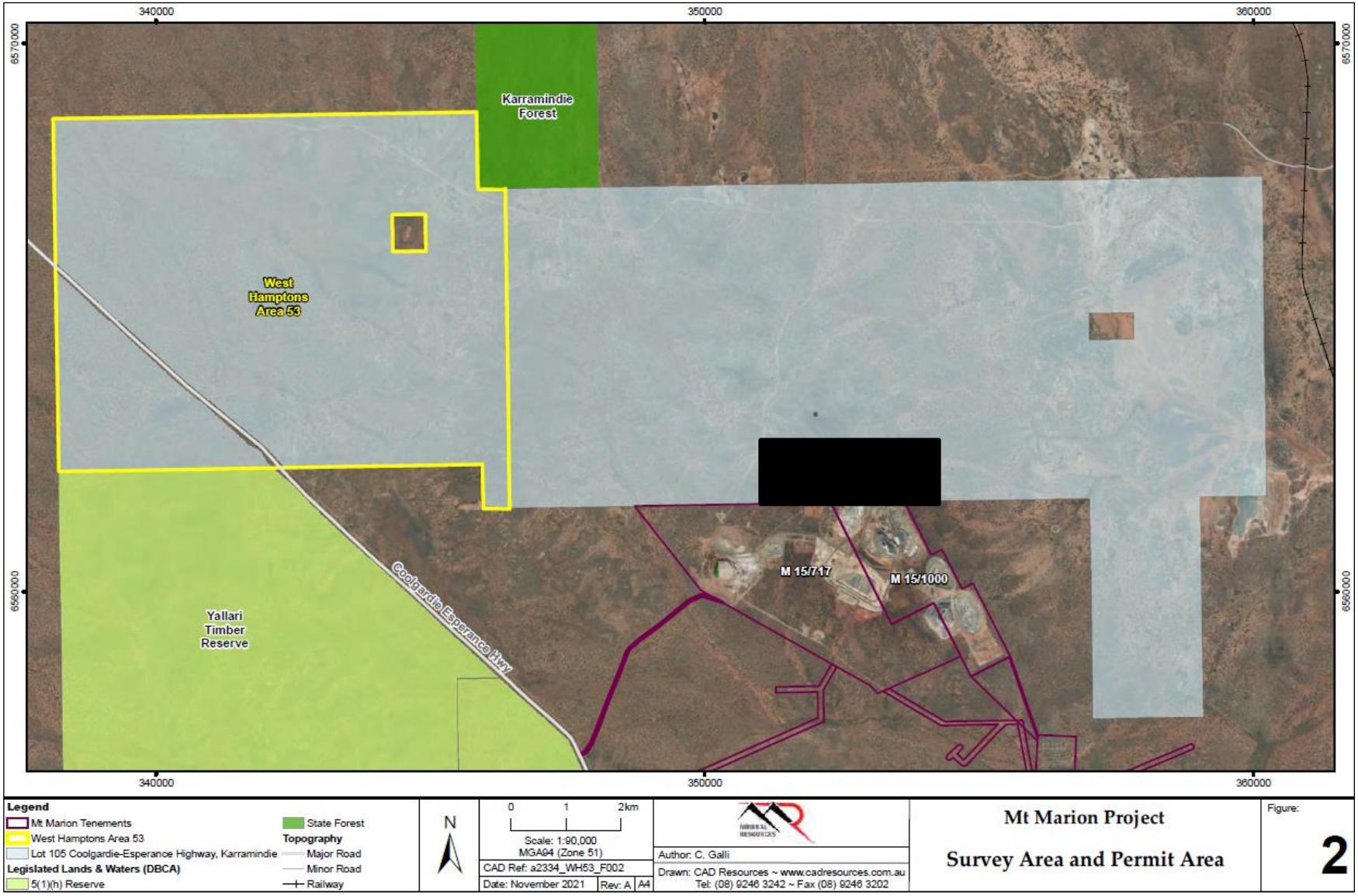
The biological surveys used to inform this application include the same biological surveys used in this assessment by GHD in 2018. The precedents by approval of CPS 8253/1 and the conditions of the permit are directly relevant to this application where the aim of this application is to assess the proposed clearing of up to 200 ha in 5,215.3 ha in the east of EEL, the West Hamptons Area 53 (Figure 2).

This application by MRL is targeting tin, tantalum and lithium mineralisation instead of gold. CPS 8235/1 is for the clearing of an equivalent 3.8% of 5,214.32 ha, which brings the total approved and proposed exploration disturbance to 4.2% of 9,483.82 ha. Significant cumulative impacts by the proposal are unlikely.

MRL's existing systems and procedures are considered sufficient to adequately mitigate any significant risk to the environment and to adequately mitigate risk to any of the factors assessed under the Native Vegetation Clearing Regulations (Appendix B). Exploration rehabilitation is also expected to occur within six months of completion of the activity and thus, disturbance is considered minor and temporary. It is reasonable, therefore, to conclude that significant impacts by this proposal on flora, vegetation and habitats are unlikely.

[1] Survey area is the 5,214.32 ha, see the glossary on page 32.

Figure 2: Permit area and survey area



4. PROJECT DESCRIPTION

The project description is discussed in Sections 4.1 to 4.4 below.

4.1 REGIONAL SETTING

West Hamptons Area 53 is located within the Eremaean Botanical Province of the Southwestern Interzone (GHD, 2018). The Eastern Goldfields subregion lies on the Yilgarn Craton's Eastern Goldfields Terrain and comprises of gently undulating plains interrupted in the west by low hills and ridges and a series of large playa lakes (GHD, 2018). The underlying geology of the subregion includes gneiss and granites eroded into a flat plane covered with tertiary soils with scattered exposures of bedrock. Calcareous earths dominate soil groups and cover most of the plains and greenstone areas (Cowan 2001, cited in GHD, 2018). The Eastern Goldfields subregion is dominated by Mallees, Acacia thickets and shrub heaths on sandplains (GHD, 2018). Diverse Eucalyptus woodlands occur around salt lakes, on ranges, and in valleys and dwarf shrublands of samphire are common in salt areas (Cowan 2001, cited in GHD,281). The survey area is also within the Great Western Woodlands comprising of approximately 16 million hectares from the Wheatbelt to Kalgoorlie-Boulder in the north to the deserts northeast of the Nullarbor Plain (Watson et al., 2008, Thomas-Dans et al., 2012, cited in GHD, 2018) (Figure 1).

4.2 SURVEY AREA AND PERMIT AREA

The survey area[1] in this report is Mt Marion Area 53 Pegmatite, referred to as West Hamptons Area 53. West Hamptons Area 53 is 5,214.32 ha.

The permit area[2] is also 5,214,32 ha.

The boundary of the permit area is the same as the survey area (Figure 2).

4.3 TENURE AND LAND ACCESS

The underlying tenure is freehold EEL 53. The permit area is West Hamptons Area 53, Lot 105, Karramindie on Deposited Plan 40396 (Table 1 and Figure 2). Lot 105 on Deposited Plan 40396, Volume 2668 Folio 420 is held by Northern Star (Hamptons Gold Mining Areas) Limited and is managed under Section 27 of the Mining Act (DMIRS, n.d.(a)).

[2] Refer to the glossary on page 32 for area definitions.

Table 1: Land tenure

Property	Polygon Identification No. (PIN)	Certificate of Title	Ownership
Lot 105.	P040396 105.	Deposited Plan 40396.	Northern Star (Hampton Gold Mining Areas) Limited.

Access to the site is via the Coolgardie-Esperance Highway (Figure 2).

4.4 PROXIMITY TO DBCA MANAGED LANDS

There are no Department of Biodiversity, Conservation and Attractions (DBCA) managed lands in the permit area, however, Karamindie Forest bounds the area to the northeast and Yallari Timber Reserve to the south. There are five additional DBCA managed lands located beyond the boundary of West Hamptons Area 53 (Figure 1). These are Kangaroo Hills Timber Reserve, Scahill Timber Reserve, Kambalda Timber and Kambalda Nature Reserve according to a 1:250,000 scale map (Figure 1).

5. ENVIRONMENTAL SETTING

The environmental setting for West Hamptons Area 53 is discussed in Sections 5.1 to 5.10 below.

5.1 CLIMATE

The region is characterised by hot summers and cold winters with low rainfall distributed throughout the year (approximately 270 millimetres (mm) per year) (BoM, 2021). The closest and most complete climate statistical data was obtained from Kalgoorlie Boulder Airport, Station Number 012038, (BoM, 2021) (Figure 3).

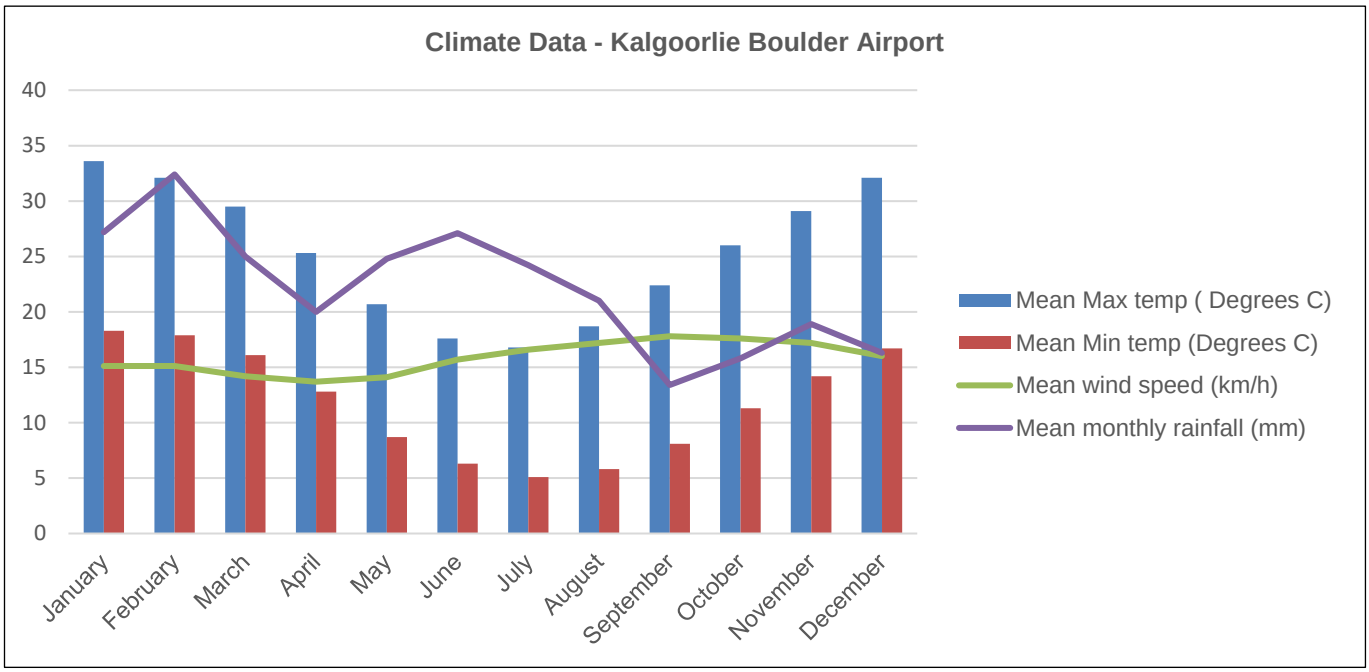


Figure 3: Monthly maximum and minimum temperatures, rainfall and windspeed (BoM, 2021)

5.2 UNDERLYING GEOLOGY

The underlying geology of the subregion is gneiss and granites that have eroded into a flat plane covered by tertiary soils and with scattered exposed bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas (Cowan, 2001, cited in GHD, 2018).

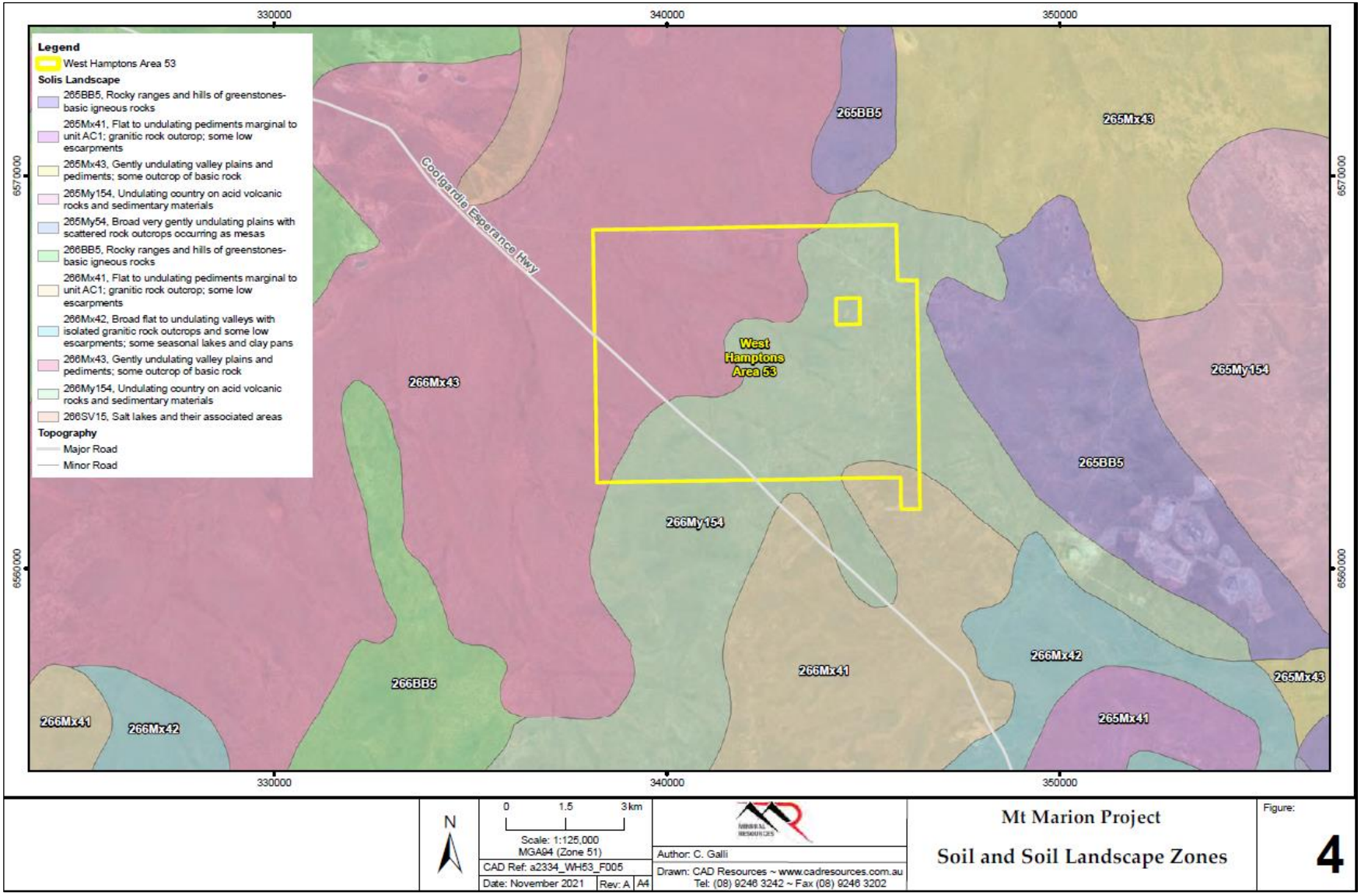
5.3 SOILS AND SOIL LANDSCAPES

The project is located in the Southern Cross Zone in Kalgoorlie Province. Valleys are broad and contain salt-lake chains with soils that are red, loamy to clayey and calcareous (Schoknecht et al., 2004, cited in GHD, 2018). Soil landscape mapping (GoWA, 2018a) identified three soil landscape types in the permit area (Figure 4).

The different soil landscapes include:

- Mx43 – Gently undulating valley plains and pediments; some outcrop of basic rock;
- My154 – Undulating country on acid volcanic rocks and sedimentary materials; and
- Mx41 – Flat to undulating pediments; granitic rock outcrop; some low escarpments.

Figure 4: Soils and soil landscapes



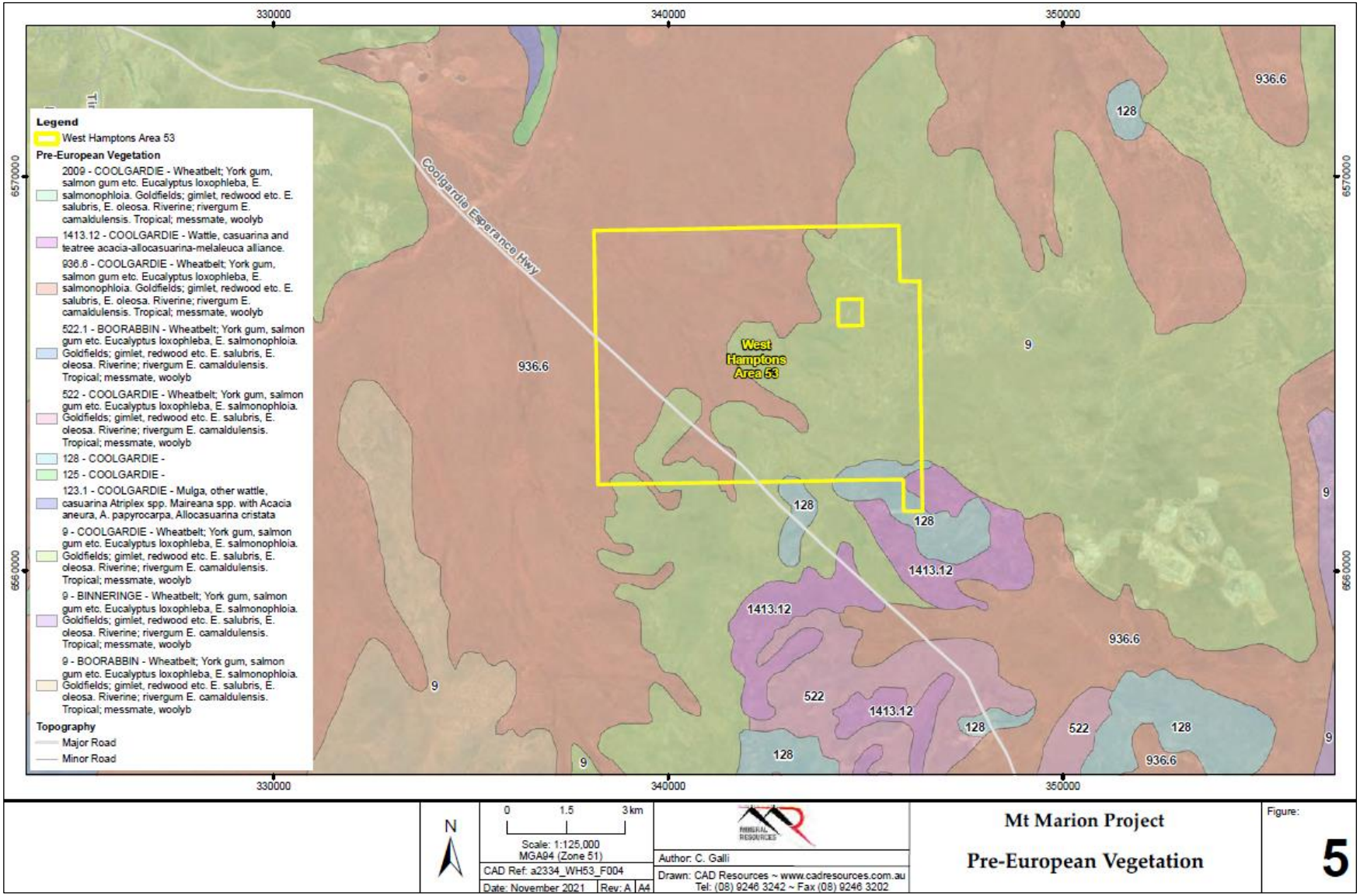
5.4 PRE-EUROPEAN VEGETATION

The broad scale (1:250,000) vegetation mapping by Beard (1972) indicates that there are four Pre-European vegetation associations in the permit area (Table 2 and Figure 5).

Table 2: Pre-European vegetation associations (GHD, 2018; DPIRD, 2019)

Vegetation association units (#)	Description
9	Medium woodland; Coral Gum (*Eucalyptus torquata*) and Goldfields Blackbutt (*E. lesouefii*) – intersects the eastern and southern sides of the survey area.
128	Bare areas; rock outcrops – intersects the south-eastern corner of the survey area.
936	Medium woodland; Salmon Gum – intersects the northern and western sides of the survey area.
1,413	Shrublands; Acacia, Casuarina and Melaleuca thicket – intersects the south-eastern corner of the survey area.

Figure 5: Pre-European vegetation



The analysis of the remaining extent of Beard's (1972) Vegetation Associations used the Statewide Vegetation Statistics incorporating the CAR Reserve Analysis from DBCA (GoWA, 2019) (Table 3). Table 3 provides details on the remaining extent of the four vegetation associations at the State, Interim Biogeographic Regionalisation for Australia (IBRA) bioregion, IBRA subregion and Local Government Authority (LGA) level. The representation of all four units is greater than 70% of the remaining Pre-European extent.

Table 3: Extent of vegetation associations mapped with the survey area (GoWA, 2019)

Vegetation association/ unit number	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% Current extent in all DBCA managed land
9	State: WA	240,509.33	235,161.94	97.78	7.89
	IBRA bioregion: Coolgardie	240,441.99	183,891.19	99.64	18.79
	IBRA subregion: Eastern Goldfields	235,047.15	229,757.07	97.75	8.08
	LGA: Coolgardie	166,572.37	163,720.39	98.29	9.65
128	State: WA	329,836.18	288,813.53	87.56	20.94
	IBRA bioregion: Coolgardie	184,549.90	183,891.19	99.64	18.79
	IBRA subregion: Eastern Goldfields	26,871.74	26,853.5	99.93	6.53
	LGA: Coolgardie	96,232.92	96,215.07	99.98	13.56
936	State WA	698,751.99	676,689.18	96.84	4.01
	IBRA bioregion: Coolgardie	586,792.22	584,336.1	99.58	3.08
	IBRA subregion: Eastern Goldfields	310,897.73	308,459.6	99.22	4.35
	LGA: Coolgardie	359,112.72	356,674.60	99.32	4
1,413	State WA	1,679,916.3	1,286,855.48	70.60	13.22
	IBRA bioregion: Coolgardie	1,061,212.28	1,042,553.76	98.24	18.18
	IBRA subregion: Eastern Goldfields	10,7974.55	107,727.81	99.77	4.35
	LGA: Coolgardie	334,488.08	334,256.36	99.93	8.15

5.5 FLORA AND VEGETATION

The flora and vegetation for West Hamptons Area 53 was assessed by GHD (2018). Refer to Sections 5.5.1 to 5.5.2 below.

5.5.1 Desktop assessment

The likelihood of occurrence assessment concluded two priority flora taxa are likely to occur, nine may occur and the remaining 15 taxa are unlikely to occur within the survey area (GHD, 2018, NatureMap, 2021; WAH, 1998). Species listed in the desktop assessment and the likelihood of occurrence assessment are in Table 4.

Table 4: Conservation significant flora (GHD, 2018; DBCA, 2021B; WAH, 1998)

Taxon	Code	Habitat	Location
Acacia websteri	P1	VT02: *Eucalyptus spp.* isolated trees over tall shrubland.	Taxa likely to occur.
Austrostipa blackii	P3	Sandy clay soils.	Possible: Species previously recorded within the study area[3] and some suitable habitat occurs in the survey area.
Chrysocephalum apiculatum subsp. norsemanense	P3	Yellow sandplains. Suitable habitat does not exist in the survey area	Unlikely: Species previously recorded >14 km from the survey area.
Diocirea acutifolia	P3	Clay loam, gravelly loam. Undulating flats.	Possible: Species previously recorded <10 km from the survey area and suitable habitat exists.
Gastrolobium graniticum	T (Wa) En (Cwlth)	Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines.	Unlikely: Species previously recorded >15 km from the survey area and no suitable species or species habitat may occur within area. In buffer area only.
Goodenia salina	P2	Silty sand, sandy clay. Lake margins, pools. Grows in seasonally wet situations,	Unlikely to occur due to the absence of salt lakes and seasonally wet areas. Salt lakes are >24 km away from the survey area.
Grevillea georgeana	P3	Stony loam/clay. Ironstone hilltops and slopes. There is no suitable habitat in the survey area.	Unlikely: Species previously recorded >14 km from the survey area.
Isolepsis australiensis	P3	Silty sand, sandy clay. Lake margins, pools.	Unlikely to occur due to the absence of salt lakes and seasonally wet areas. Salt lakes are >24 km away from the survey area.
Lepidium merrallii	P2	Clay loam, no description available	Possible.
Leucopogon sp. Kambalda (J. Williams s.n. PERTH 07305028)	P3	Exposed breakaways and granitic outcrops. Suitable habitat does not exist in the survey area.	Unlikely: Species previously recorded >13 km from the survey area.

1

Taxon	Code	Habitat	Location
Notisia intonsa	P3	Red-orange clayey sand. Ironstone and quartz gravel. Suitable habitat does not exist in the survey area.	Unlikely: Species previously recorded >16 km from the survey area.
Phebalium clavatum	P2	VTO2; Sandplains. No suitable habitat occurs in the survey area.	Previously recorded >12 km from the survey area.
Thryptomene sp. Coolgardie (E. Kelso s.n. 1902)	P1	No information regarding habitat is available, therefore this species cannot be overlooked.	Endemic to survey area (20 km buffer). Possible: Species previously recorded <14 km from the survey area.
Thryptomene sp. Londonderry (R.H. Kuchel 1763)	P1	VT02: *Eucalyptus spp.* isolated trees over tall shrubland.	Taxa likely to occur species previously recorded <2 km from the survey area and large areas of suitable habitat occur.

5.5.2 Field survey

The field survey recorded 83 plant taxa including three introduced species of which one, *Xanthium spinosum* (Bathurst Burr) was a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (GHD, 2018). There were no Weeds of National Significance recorded during the field survey.

There were no species listed under the EPBC Act or the BC Act recorded by the field survey (GHD, 2018).

5.5.3 Vegetation communities and condition

Five vegetation communities comprising of various Eucalyptus spp. woodlands were recorded (Figure 6) (GHD, 2018). The sixth vegetation community was tall shrubland of Acacia and Melaleuca sp (Figure 6). The seventh vegetation community was a granite community (Figure 6). No vegetation community's representative of any Commonwealth or State listed Threatened or Priority Ecological Communities were recorded in the area (GHD, 2018).

The granite outcrop community with mixed open shrubland over herb land (VT04) was considered Other Significant Vegetation (GHD, 2018) (Figure 6). This community supports local endemism in a restricted habitat (granite outcrop) and has a restricted distribution in the local and regional area (GHD, 2018). Within the survey area, there was one minor ephemeral drainage line of predominantly *Acacia* and *Eremophila* spp (GHD, 2018). Species in the drainage line were common to the larger survey area, and the vegetation was not considered riparian, or wetland vegetation (GHD, 2018).

The condition of vegetation in the area ranged from excellent to good (Table 5) (GHD, 2018). Majority of the survey area was in excellent condition. The adjustment from an excellent to a good condition rating in vegetation was associated with disturbance long the Coolgardie-Esperance Highway (GHD, 2018).

Table 5: Extent of vegetation condition ratings mapped within the permit area (GHD, 2018)

Vegetation condition	Extent in the permit area (ha)
Excellent	5,136.27
Good	10.86,
Disturbed tracks, roads, cleared	67.19

Figure 6: Vegetation community mapping (GHD, 2018)

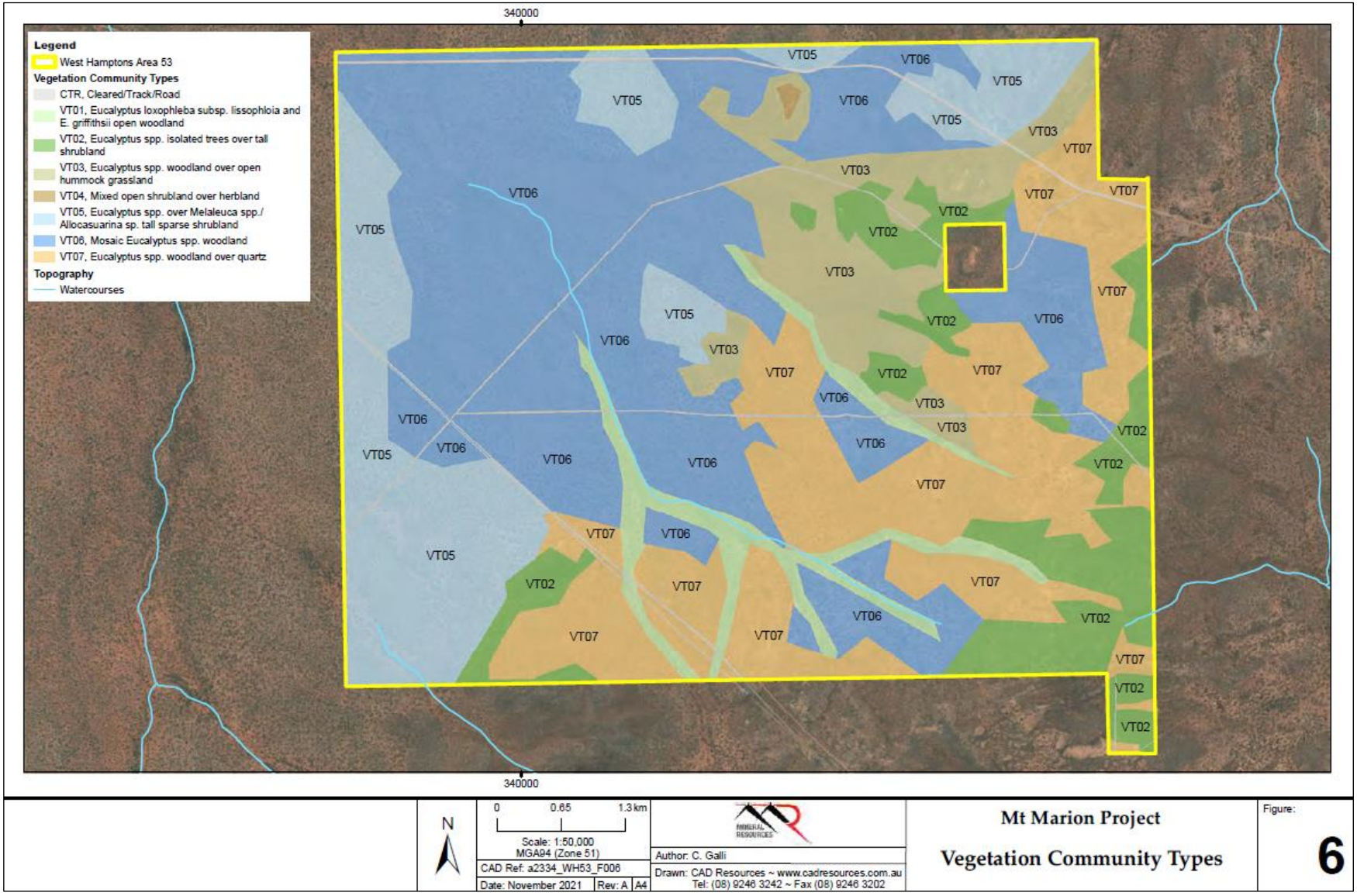
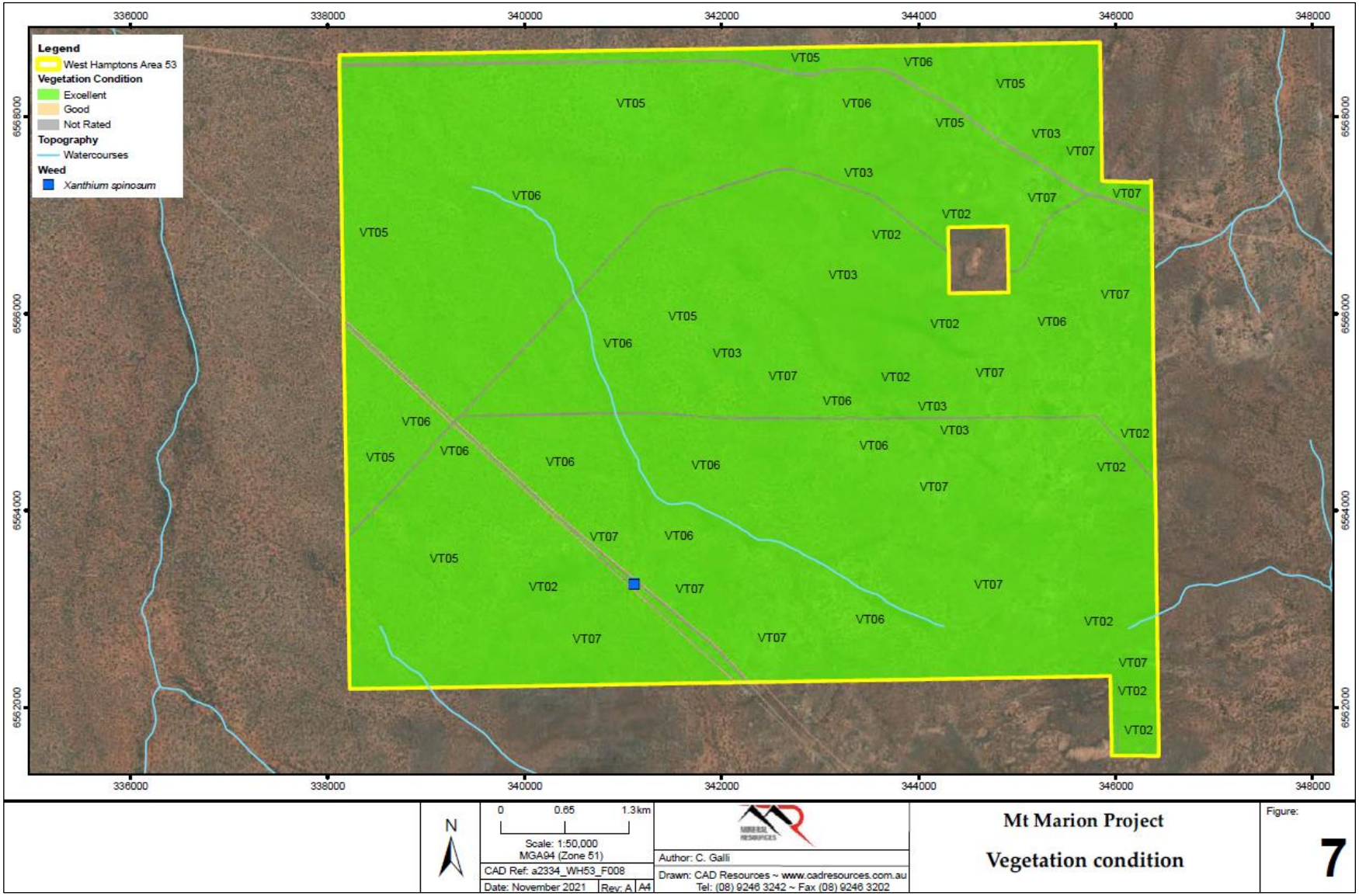


Figure 7: Vegetation condition and the Declared Weed locations (GHD, 2018)



5.6 FAUNA AND HABITAT

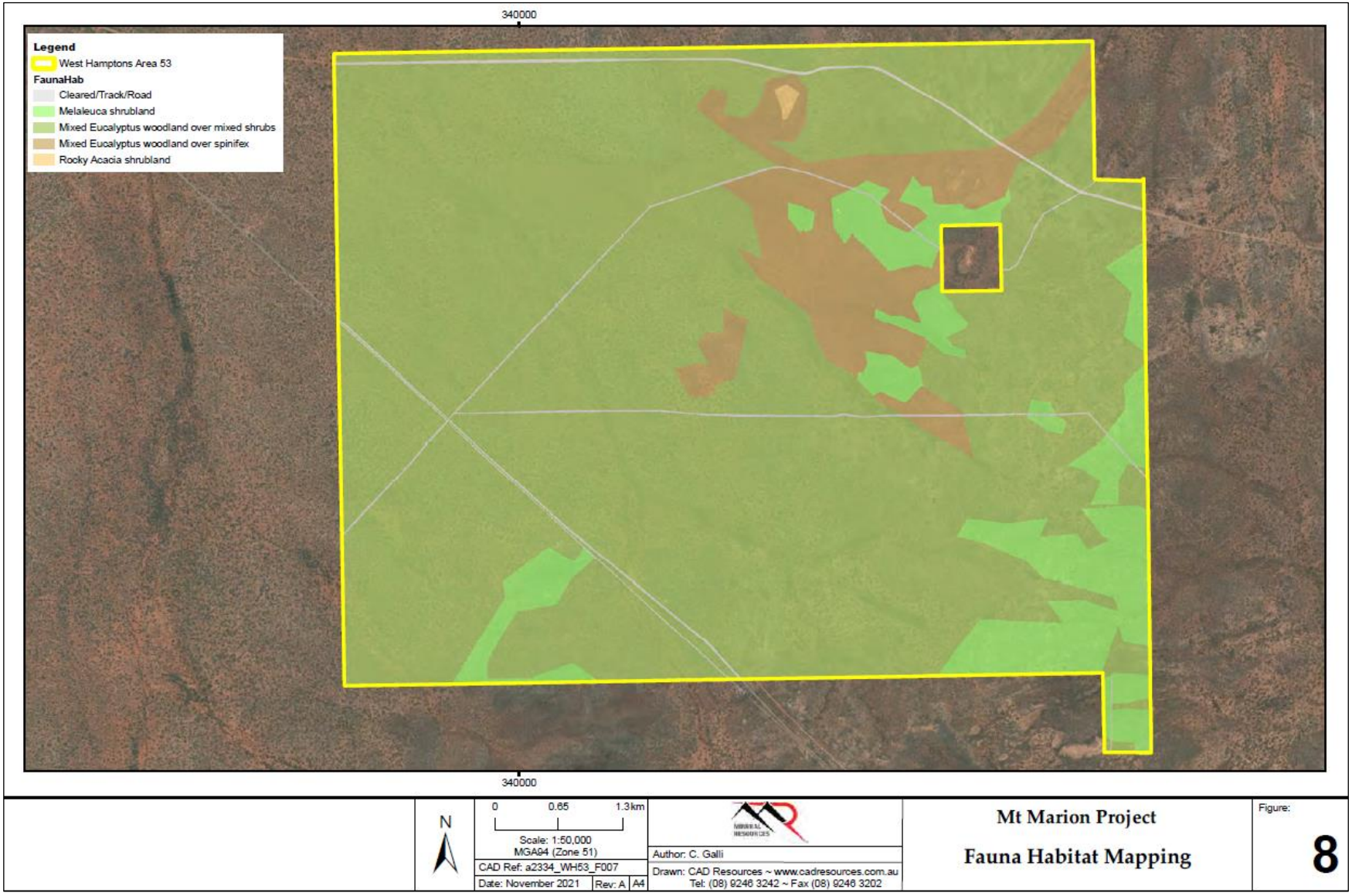
Forty-one fauna species were recorded in the field survey, including 30 birds, four mammals, and seven reptiles (GHD, 2018). Two of the species recorded were introduced including the Feral Cat *Felis catus* and European Rabbit *Oryctolagus cuniculus*. (GHD, 2018). The desktop assessment identified the presence or potential presence of 12 conservation significant fauna within the study area[1]. An assessment on the likelihood of occurrence found one conservation significant fauna species was recorded, one was likely to occur, and the remaining fauna species were unlikely or highly unlikely to occur. Malleefowl were recorded in the northern section of the survey area and three Malleefowl mounds were recorded within the survey area (GHD, 2018). The Rainbow Bee-eater was also considered likely to occur within the survey area (GHD, 2018) (Figure 8).

Four transects, equivalent to 3 km, were completed to assess habitat trees. Habitat trees are important for many native species. Habitat trees with a Diameter Breast Height of more than 500 mm and 300 mm for *Eucalyptus salmonophloia* were recorded (GHD, 2018). The survey recorded 64 habitat trees, 33 of which had hollows (GHD, 2020). The frequency of habitat trees across the survey area was “five trees per hectare with an average of four hollow per tree” (GHD, 2018, p. ii). The assessment of habitat trees included the different habitat types:

- Rocky Acacia shrubland;
- Melaleuca shrubland;
- Mixed Eucalyptus woodland over spinifex;
- Mixed Eucalyptus woodland over mixed shrubs; and
- Cleared areas (GHD, 2018) (Figure 8).

There was no habitat tree or habitat tree with hollow data available for this assessment. The only available data from GHD’s assessment was the transect location data mentioned above. This is not a constraint to this assessment on the basis of the frequency of habitat trees across the survey area was five trees per hectare with an average of four hollows per tree (GHD, 2018). All habitats in the survey were considered widespread and not unique to the survey area (GHD, 2018). The quality of fauna habitat was regarded as high, with high connectivity, intact and contiguous vegetation strata (GHD, 2018).

Figure 8: Fauna habitat mapping (GHD, 2018)



5.7 SURVEY AREA

Table 6 summarises the species of conservation significance present or considered likely to occur in the survey area.

Table 6: Conservation significant taxa

Taxon	Conservation Status		Distribution and habitat	Likelihood of occurrence
	BC Act /DBCA	EPBC Act		
Malleefowl Leipoa ocellata	Vu	Vu	NatureMap PMST	Recorded in the survey area with suitable habitat.
Rainbow Bee-eater *Merops ornatus*	IA	Ma	NatureMap	Species known from the region. Suitable habitat present.

5.8 SURFACE WATER

The permit area is located within the Lake Lefroy Catchment (Lefroy Dundas Sub Area) (MRL, 2019). Lake Lefroy is a shallow lake located approximately 35 km southeast of the West Hamptons Area 53 (MRL, 2019). The lake is poorly developed and typically dry, requiring intense rainfall to fill (MRL, 2019). The only drainage lines are ephemeral and weakly defined. During rare periods of intense rainfall, flows occur from west to east (MRL, 2019).

5.9 GROUNDWATER

The West Hamptons Area 53 is within the Goldfields Groundwater Area and includes shallow ephemeral lakes or unconfined aquifers that are saline or hypersaline. The Mt Marion Lithium Mine has recorded groundwater quality with a pH of 6.4 and with Total Dissolved Solids (TDS) concentrations of 30,000 milligrams per litre (mg/L) to 40,000 mg/L. Deeper regional aquifers in the area host hypersaline water quality, typically of 140,000 mg/L TDS (MRL, 2019). Groundwater is typically 50 m below ground level (MRL, 2019).

5.10 LAND DEGRADATION

Land degradation can result from multiple processes including soil erosion, salinity, nutrient export, acidification, waterlogging, and flooding. Land degradation risk analysis within the proposal area using publicly available data was not possible due to the absence of acidity, salinity, erosion, waterlogging and flood risk data in this area. The Australian Soil Resource Information System indicates that the survey area has “No Known Occurrence” of acid sulphate soils (GHD, 2018).

An assessment of the project’s risk on land degradation has considered the landscape units which are Kambalda (265) and Norseman (266) (DPIRD, 2019b). Description of these landscape units, with the topographical and lithological features, are listed in Table 7 (DPIRD, 2019b). Both areas have similar topography with variations in calcareous loamy earths which when extensively cleared and left unrehabilitated are prone to erosion. The area is arid, and unlikely to flood or become waterlogged with minor ephemeral water courses recorded in vegetation surveys by GHD (2018). The risk by land degradation processes by this proposal is low. This proposal excludes clearing of extensive vegetation that will remain open for long periods, comprises of temporary clearing followed by rehabilitation within six months of commencement of the activity.

Table 7: Land degradation risk (DPIRD, 2019b)

Map unit ID	Name	Descriptions
265	Kambalda	Flat to undulating plains, hills and ranges on greenstones and granites of the Yilgarn Craton with Calcareous loamy earths, salt-lake soils and some red-brown hardpan shallow loams, and red sandy duplexes.
266	Norseman Zone	Undulating plains and uplands (with some sandplains and salt lakes) on granitic rocks of the Yilgarn Craton with Calcareous loamy earths, yellow sandy and loamy earths, red loamy earth, red deep sands and salt lakes.

6. ENVIRONMENTAL MANAGEMENT

MRL has an Environmental Management System applicable to the proposed exploration activities at West Hamptons Area 53. This system includes awareness training, plans, procedures and forms to avoid, minimise and ensure the effective management of environmental and heritage values. Strategies to avoid, minimise and manage environmental impacts include the maintaining of a 50 m buffer around habitat trees, malleefowl mounds, Rainbow Bee-eater burrows and Priority flora locations.

The list of procedures applicable to exploration are provided in Table 8. These are considered sufficient to ensure the effective management of environmental and heritage risk by the proposal.

Table 8: Mt Marion environmental management plan (MRL, 2019)

Document number	Document name
MRL-EN-PRO-0004	Land Clearing Procedure
MRL-EN-PRO-0005	Site Disturbance Procedure
MRL-EN-PRO-0001	Fauna Management Procedure
MRL-TS-WIN-0006	Clearing Work Instruction
MRL-EN-PRO-0007	Weed Hygiene and Control
MRL-EN-PRO-0009	Land Rehabilitation Procedure

7. ASSESSMENT AGAINST THE 10 CLEARING PRINCIPLES

In assessing whether the proposed clearing is likely to have a significant impact on the environment, the project was assessed against the 10 clearing principles (*EP Act 1986,* Schedule 5) (GHD, 2018). Each principle was assessed in accordance with Department of Environmental Regulation's (DER) "A Guide to the Assessment of Applications to Clear Native Vegetation" (DER, 2014). The proposed clearing is not at variance to Clearing Principles (A) to (J). Refer to the assessment below.

(A) NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT COMPRISES A HIGH LEVEL OF BIOLOGICAL DIVERSITY

Proposed clearing is at unlikely to be at variance to this Principle

The survey area is situated in the Eremaean Botanical Province of Western Australia (Beard, 1990 cited in GHD, 2018), within the Coolgardie bioregion and the Eastern Goldfields subregion. The flora of the Eastern Goldfields subregion is diverse with 1,613 recorded native vascular species. Vegetation in the survey is consistent with the surrounding vegetation, intact, high quality and contiguous (GHD, 2018).

Desktop searches by GHD (2018) identified 294 native plant taxa within the study area and the potential presence of 24 conservation significant flora taxa to occur in the study area The field survey recorded 83 native flora taxa and is considered to have a moderate level of flora biodiversity.

No threatened or Priority Flora taxa were recorded in the survey area.

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were recorded in the survey area.

Two Priority taxa have potential to occur within the survey area. There is suitable habitat for Acacia websteri and Thryptomene sp. Londonderry (both P1) (GHD, 2018; NatureMap, 2021, DAWE, 2021). Neither species was recorded by the survey although were expected to occur in the vegetation type VT02 - Eucalyptus spp. isolated trees over tall shrubland. There is 517.14 ha of VT02 in the survey area (GHD, 2018).

Acacia websteri is known from 21 records (Western Australian Herbarium, 1998) where limited records of this species would make the occurrence of A. websteri in the application area significant. Thryptomene sp. Londonderry (R.H. Kuchel 1763) is known from 20 records (WAM;1998 cited in GoW, 2019). As the habitat for T. sp Londonderry is present within the proposal area and the proposal occurs within the known range extent, records of this species would make the occurrence, significant (GoW, 2019).

Four broad-scale mapping vegetation associations occur in the survey area, of which all are well represented at local and regional scales, with greater than 76% of the pre-European extent remaining (Table 3). These include:

- Medium Woodland; coral gum and goldfields blackbutt (Association 9)
- Medium woodland; Salmon Gum and Goldfields Blackbutt (Association 468)
- Medium woodland; Salmon Gum (Association 936)
- Shrublands; Acacia, Casuarina and Melaleuca thicket (Association 1413) (GHD, 2018).

Seven vegetation types and disturbed areas were defined by the survey by GHD (2018). These included:

- VT01 – Eucalyptus loxophleba subsp. lissophloia and E. griffithsii open woodland;
- VT02 – Eucalyptus spp. isolated trees over tall shrubland;
- VT03 – Eucalyptus spp. woodland over open hummock grassland;
- VT04 – Mixed open shrubland over herb land;
- VT05 – Eucalyptus spp. over Melaleuca spp./ Allocasuarina sp. tall sparse shrubland;
- VT06 – Mosaic Eucalyptus spp. Woodland;
- VT07 – Eucalyptus spp. woodland over quartz; and
- Cleared/track/road.

Vegetation condition within the survey area was rated from Excellent to Good where majority of the area was in excellent condition with very little weed invasion. The area rated as good was due to disturbances, weed invasion and rubbish associated with the Coolgardie-Esperance Highway. The total disturbed area affected by cleared roads and tracks was equivalent to 1.3% of the total survey area (GHD, 2018).

Proposed clearing is at unlikely to be at variance to this Principle
The granite outcrop community Mixed Open Shrubland Over Herbland (VT04) (5.02 ha) was categorised as Other Significant Vegetation due to its restricted habitat (granite outcrops) (Figure 6). This community was considered by GHD (2018) as likely to support local endemism and has a restricted distribution in the local and regional area. No reserves, conservation areas or other DBCA Managed Estate are located within the survey area. The nearest DBCA managed land is Karamindie Forest on the boundary of the survey area and northeast, and Yallari Timber Reserve to the south. Both comprise of a high level of biological diversity. For the assessment against Principle (b), habitat for Malleefowl Leipoa ocellata Vulnerable was recorded by GHD (2018) and habitat for Rainbow Bee-eater Merops ornatus (BC Act, International Agreement) was considered present in the survey area. These species could be impacted the proposal, but this is unlikely given the limited duration that areas will be cleared for, the limited extent of clearing, the management measures available to avoid and effectively manage risk to these species. Clearing being only comprise of 3.8% of the permit area. Considering MRL has an appropriate environmental management system in place, risk to biodiversity values by this proposal are expected to be minimal. This assumes that in vegetation types suitable for Priority Flora and Threatened Fauna that MRL will conduct targeted species surveys or adopt similar precautionary measures to limit disturbance and impacts by exploration. This assessment recognises that exploration disturbance is temporary, and areas will be progressively rehabilitated within six months or less. Refer to Appendix B. MRL has an appropriate level of environmental management to adequately manage risk to Priority Flora, Other Significant Habitat, Vulnerable fauna and species protected under International Agreement.
Methodology: Beard (1972), DBCA (2007), DBCA database searches TPFL in GHD (2018), WA Herbarium (1998).

(B) NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT COMPRISES THE WHOLE OR A PART OF, OR IS NECESSARY FOR THE MAINTENANCE OF, A SIGNIFICANT HABITAT FOR FAUNA INDIGENOUS TO WESTERN AUSTRALIA.

Proposed clearing is unlikely to be at variance to this Principle
The desktop assessment indicated that 12 conservation significant fauna taxa may use the study area. These results exclude marine species as no marine habitat is present within the survey area (GHD, 2018). Malleefowl (Vulnerable) was recorded during the field survey. A single bird was sighted in the northern section of the survey area and three Malleefowl mounds were recorded within the survey area. The Rainbow Bee-eater was also considered as likely to occur within the survey area. The Malleefowl is the only Threatened fauna species listed under the EPBC Act and BC Act recorded in the survey area. This species is listed as Vulnerable under the EPBC Act. The habitats associated with the record were Rocky Acacia Shrubland and Melaleuca Shrubland (GHD, 2018) (Figure 8). Additional suitable habitat for Malleefowl foraging and breeding include Mixed Eucalyptus woodland over spinifex (450.49 ha) and Mixed Eucalyptus woodland over mixed shrubs (4,174.48 ha) (GHD, 2018) Any Malleefowl utilising habitat in the permit area are unlikely to exclusively rely on this area for all habitat resource requirements. However, it is likely that the individuals utilising the survey area for breeding may be disrupted by clearing (and exploration activities) within the survey area (GHD, 2018). The Rainbow Bee-eater may opportunistically occupy Mixed Eucalyptus woodland over spinifex and Mixed Eucalyptus woodland over mixed shrubs. The Rainbow Bee-eater utilises a wide range of habitats and is unlikely to exclusively rely on the survey area for all habitat resource requirements (GHD, 2018). Impacts to Malleefowl and Malleefowl mounds can be effectively managed through reconnaissance assessment of areas proposed for exploration by MRL's field or environmental technicians prior to exploration. Reconnaissance assessments should include checking areas for mallee mounds, recording the locations and placing a 50 m buffer for the exclusion of these areas to protect Malleefowl and their nesting sites. Similarly, impacts to Rainbow Bee-eaters that nest in the ground, habitat trees and habitat trees with hollows that can be managed the same way as described above.

Proposed clearing is unlikely to be at variance to this Principle
Habitats recorded in the permit area are present in the wider area and can be found at a regional and local scale in similar or better condition. Any clearing of the survey area will be temporary and will not significantly diminish the extent or quality of the habitats. The habitat types within the survey area are also well connected and part of a largely contiguous landscape. These are not fragmented or threatened by edge effect. The existing minor barriers within the survey area that are likely to restrict the movement of fauna include the Coolgardie-Esperance Highway, haul roads, tracks, and fence lines (GHD, 2018). MRL intends to avoid and minimise impacts to significant habitat for fauna. Clearing therefore is unlikely be at variance to this principle.
Methodology: DBCA (2007) cited in GHD (2018). DAWE (2021). Pizzey & Knight (2007).

(C) NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT INCLUDES, OR IS NECESSARY FOR THE CONTINUED EXISTENCE OF, RARE FLORA.

Proposed clearing is unlikely to be at variance to this Principle
Desktop searches identified the potential presence of one Endangered for a species listed under EPBC Act within the study area: *Gastrolobium graniticum*. This species is known from seven records in the Kalgoorlie and Wheatbelt regions (DEWHA, 2008). The likelihood of occurrence assessment considered the habitats present, the taxa's known distribution and previous records. This taxon favours *Allocasuarina huegeliana*, *Acacia lariocalyx* and *Eucalyptus eremophila* open woodland on sandy soils and in drainage lines on the edge of granite outcrops (DEWHA, 2008). Searches for this taxon and other conservation significant flora were undertaken during the field survey in March 2018 by GHD. The results concluded that *Gastrolobium graniticum* was not likely to occur. There were also no other threatened flora recorded in targeted species surveys by GHD (2018). The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: DAWE (2021). West Australian Herbarium (1998). DEWHA (2008.

(D) NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT COMPRISES THE WHOLE OR A PART OF OR IS NECESSARY FOR THE MAINTENANCE OF A THREATENED ECOLOGICAL COMMUNITY.

Proposed clearing is, unlikely to be at variance to this Principle
Desktop searches identified no TECs within 20 km of the survey area. No Commonwealth or State listed TECs were identified within the survey area during the field survey. The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: DBCA TEC/PEC databases cited in GHD (2018) DAWE (2021).

(E) NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT IS SIGNIFICANT AS A REMNANT OF NATIVE VEGETATION IN AN AREA THAT HAS BEEN EXTENSIVELY CLEARED.

Proposed clearing is, unlikely to be at variance to this Principle
The survey area is located within the Coolgardie IBRA bioregion (DSEWPAC, 2012). This IBRA bioregion has approximately 97% of its Pre-European extent remaining. Broad-scale vegetation mapping of the area undertaken by Beard (1972) identified four vegetation associations (Table 2): • Medium Woodland; coral gum and goldfields blackbutt (Association 9) • Medium woodland; Salmon Gum and Goldfields Blackbutt (Association 468) • Medium woodland; Salmon Gum (Association 936) • Shrublands; Acacia, Casuarina and Melaleuca thicket (Association 1413). The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: DPIRD (2019a).

(F) NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT IS GROWING IN, OR IN ASSOCIATION WITH, AN ENVIRONMENT ASSOCIATED WITH A WATERCOURSE OR WETLAND.

Proposed clearing is, unlikely to be at variance to this Principle
There are no permanent drainage channels or wetlands within or in the vicinity of the survey area. There is one minor ephemeral drainage line within the survey area represented by VT01 Eucalyptus *loxophleba subsp. lissophloia* and *E. griffithsii* open woodland. The flora taxa recorded within VT01 are not considered wetland or dampland species. The drainage line supported *Eucalyptus spp.* over a suite of *Acacia spp*. and *Eremophila spp* shrubs commonly found within the larger survey area. The vegetation recorded within VT01 is not considered riparian vegetation. The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: GHD (2018).

(G) NATIVE VEGETATION SHOULD NOT BE CLEARED IF THE CLEARING OF THE VEGETATION IS LIKELY TO CAUSE APPRECIABLE LAND DEGRADATION.

Proposed clearing is, unlikely to be at variance to this Principle
The Australian Soil Resource Information System indicates that the survey area has “No Known Occurrence” of acid sulphate soils (GHD, 2018). Any clearing of native vegetation within the survey area has the potential to cause soil and wind erosion. Clearing for this proposal for exploration purposes will be limited to pads, tracks and sumps and will exclude any requirement for the clearing of extensive contiguous areas. Clearing methods have also been developed to minimise erosion and reduce land rehabilitation costs. The potential for soil erosion and appreciable land degradation to occur from the implementation of this proposal is unlikely. The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: DPIRD (2019b).

(H) NATIVE VEGETATION SHOULD NOT BE CLEARED IF THE CLEARING OF THE VEGETATION IS LIKELY TO HAVE AN IMPACT ON THE ENVIRONMENTAL VALUES OF ANY ADJACENT OR NEARBY CONSERVATION AREA.

Proposed clearing is, unlikely to be at variance to this Principle
No reserves, conservation areas or other DBCA-managed estates are located within the survey area. Two conservation areas occur adjacent to the survey area: • Karamindie Forest, northeast • Yallari Timber Reserve, south. The proposal would not significantly impact upon either of the areas above or affect the values associated with these areas. This is due to the limited duration of the activity proposed, the scale and extent of exploration. The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: DBCA (2021a).

(I) 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.

Proposed clearing is, unlikely to be at variance to this Principle
The survey area is located in the *Rights in Water and Irrigation Act 1914* (RIWI Act) listed Goldfields Groundwater Area and the Salt Lake Basin Surface Water Management Area and Sub-area. No rivers or surface water bodies listed under the RIWI Act were identified within the survey area. There are minor ephemeral drainage lines located within the survey area. No lakes, wetlands or natural water bodies were recorded in the survey area. Average rainfall for the area is 265 mm and relatively evenly distributed throughout the year. However, rainfall is erratic from year to year. During heavy localised rainfall events erosion may occur in cleared areas leading to temporary soil erosion and/or sedimentation, particularly in the vicinity of ephemeral drainage lines. Clearing within or near a drainage line should be avoided. On this basis, clearing of vegetation in the permit area is unlikely to cause appreciable deterioration in the quality of surface or underground water. The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: BOM (2021).

(J). NATIVE VEGETATION SHOULD NOT BE CLEARED IF CLEARING THE VEGETATION IS LIKELY TO CAUSE, OR EXACERBATE, THE INCIDENCE OR INTENSITY OF FLOODING.

Proposed clearing is, unlikely to be at variance to this Principle
The climate of the region is described as semi-arid with an average annual rainfall of 265 mm. Rainfall is relatively evenly spread throughout the year but can occur in heavy localised falls. Based on an average daily evaporation rate of 7.2 mm, any surface water resulting from rainfall events is likely to be relatively short lived. In addition, the survey area is surrounded by remnant native vegetation, and it is likely that a large proportion of runoff will be absorbed by this natural environment. There are no permanent drainage channels or wetlands within or in the vicinity of the survey area. There is one minor ephemeral drainage line within the survey area that is only likely to flow following heavy rain. The survey area is characterised by flat to gently undulating plains with silty clay soils and occasional rocky rises scattered throughout the survey area. Any surface flow is expected to be minimal, and it is unlikely that clearing for exploration in the Permit Area will lead to an appreciable increase in runoff that could cause, or exacerbate, the incidence of flooding. According to GIS analysis and examination of aerial imagery of the area, vegetation is well represented in the local area and comprises of low woodland or low open woodland. There are no extensively cleared areas of riverbank, paddock, pasture or fallow land near the proposal area that could exacerbate flooding. The clearing of native vegetation is unlikely to be at variance to this principle.
Methodology: DPIRD (2019b)

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9. GLOSSARY

Exempt East Location	A land parcel in the Eastern Goldfields that had freehold issued prior to 1899 whereby the owner is entitled to retain the Minerals Rights where provisions under the Mining Act and Regulations 1981 do not apply.
Excellent	Vegetation structure intact; disturbance affecting individual species; weeds are non-aggressive species (GoW, 2019).
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by frequent fires; the presence of some very aggressive weeds at high density; partial clearing; dieback; grazing (GoW, 2019).
Habitat trees	Habitat trees are trees with a Diameter Breast Height of more than 500 mm and 300 mm.
Permit area	The within which up to 200 ha of clearing of native vegetation is proposed in the Hamptons West Area 53 comprising of 5,214,32 ha on EEL 53.
Priority 1 – Poorly known species	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey (DBCA, n.d.).
Survey area	The survey is the area surveyed by GHD in 2018 and included the Hamptons West Area 53 comprising of 5,214,32 ha on EEL 53.
Study area	The study area is the area referred by GHD (2018) to the area assessed in desk environmental impact assessment used to inform the field survey. This was a 20 km buffer around the survey area.

10. ABBREVIATIONS

BC Act	*Biodiversity Conservation Act 2016 (WA)*
CAR	Comprehensive Adequate Representative
CPS	Clearing Permit System
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DAWE	Australian Department of Agriculture, Water and the Environment
DER	Department of Environmental Regulation
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Western Australian Department of Water and Environmental Regulation (formerly DoW)
EEL 53	Exempt East Location 53
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP Act	*Environmental Protection Act 1986*
GIS	Geospatial Information Systems
GoWA	Government of Western Australia
ha	hectare(s)
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre(s)
LGA	Local Government Area
m	metre(s)
mg/L	milligrams per litre
Mining Act	*Mining Act 1978*
mm	millimetres
MRL	Mineral Resources Limited
Mt	Mount
NSRL	Northern Star Resources Limited
P	Priority
PEC	Priority Ecological Community
pH	measure
PMI	Process Minerals International Pty Ltd
PMST	Protected Matters Search Tool
RIM	Reed Industrial Minerals
TDS	total dissolved solids
TEC	Threatened Ecological Community
WA	Western Australia
Westgold	Westgold Resources
%	percent

APPENDICES

Appendix	Title
A	Westgold Location 53 West Flora and Fauna Assessment (GHD, May 2018)
B	Environmental Management Procedures

Appendix A
Westgold Location 53, Flora and Fauna Assessment (GHD, 2018)

WestGold

Location 53 West

Flora and Fauna Assessment

May 2018

Executive summary

WestGold Group (WestGold) owns the South Kalgoorlie Operations (SKO) located approximately 40 kilometres (km) south of Kalgoorlie in the Coolgardie region of Western Australia. As part of the SKO WestGold is proposing to undertake exploration and mine development activities on one of its tenements, Location 53 West. GHD Pty Ltd (GHD) was engaged by WestGold to undertake a vegetation, flora and fauna assessment of the tenement area to identify key ecological constraints and support future approvals documentation.

Vegetation and flora key findings

Broad scale vegetation mapping by Beard (1972) indicates four vegetation associations within the survey area:

- Medium woodland; Coral Gum and Goldfields Blackbutt (association 9)
- Medium woodland; Salmon Gum and Goldfields Blackbutt (association 468)
- Medium woodland; Salmon Gum (association 936)
- Shrublands; *Acacia*, *Casuarina* and *Melaleuca* thicket (association 1413)

All vegetation associations at the State, IBRA bioregion, IBRA subregion and Local Government Authority (LGA) scales have greater than 76 % of their pre- European extents remaining.

The survey area comprised of seven vegetation types: five vegetation types described variations in *Eucalyptus* spp. woodlands one describes a tall shrubland of *Acacia* sp. and *Melaleuca* sp., and one represents a granite community. The GHD vegetation types are not representative of any Commonwealth or State listed TECs or PECs. The granite outcrop community Mixed open shrubland over herbland (VT04) is considered other significant vegetation. This community supports local endemism in a restricted habitat (granite outcrop) and has a restricted distribution in the local and regional area.

Within the survey area there is one minor ephemeral drainage line. The vegetation recorded within the drainage line supported *Eucalyptus* spp. woodland over a suite of predominately *Acacia* spp*.* and *Eremophila* spp. commonly found within the larger survey area, therefore is not considered representative of riparian, or wetland vegetation

The vegetation condition of the survey area ranged from Excellent to Good. The majority of the survey area was in Excellent condition. The area rated as Good in condition was due to disturbances, such as weed invasion and rubbish, associated with the Coolgardie-Esperance Highway.

During the field survey 83 flora taxa were recorded; this comprised 80 native flora taxa and three introduced taxa, of which one taxon is listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007*. No *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)*, Wildlife Conservation Act 1950* (WC Act) or Department of Biodiversity, Conservation and Attractions (DBCA) Priority-listed flora taxa were recorded within the survey area during the field survey.

Desktop searches identified the presence/ potential presence of 24 conservation significant flora taxa. The likelihood of occurrence assessment of these 24 taxa concluded two taxa are likely to occur, eight may possibly occur and the remaining 14 taxa are unlikely to occur within the survey area. The taxa likely to occur were; *Acacia websteri* and *Thryptomene* sp. Londonderry (R.H. Kuchel 1763) (both P1).

Fauna key findings

There were five broad habitat types identified within the survey area; two habitat types represented various *Eucalyptus* woodlands, two were associated with *Acacia* and *Melaleuca* shrublands, the last represented cleared areas such as roads and tracks. No habitat types recorded are considered to be exclusive to the survey area. Locally and regionally, the habitat within the survey area is well connected to the habitat in surrounding areas and the broader region.

Forty one fauna species were recorded during the field survey; 30 birds, four mammals and seven reptiles. Two of these were introduced fauna species.

Desktop searches identified the presence/ potential presence of 12 conservation significant fauna within the study area. An assessment on the likelihood of occurrence deemed one conservation significant fauna species is known, one is likely and the remaining fauna species were unlikely or highly unlikely to occur. The fauna species know to occur was the Malleefowl (*Leipoa ocellata,* listed as Vulnerable under the EPBC Act). An individual was sighted in the northern section of the survey area and three Malleefowl mounds were recorded within the survey area. The Rainbow Bee-eater (*Merops ornatus*, listed as International Agreement under the WC Act) is considered likely to occur within the survey area. However, the timing of the field survey coincided with when bee-eaters migrate to northern Australia and may be the reason why this species was not recorded during the field survey

Four transects (3 km in total) were traversed throughout multiple habitat types within the survey area to record habitat trees. Sixty-four habitat trees, including 33 with hollows were identified within the four transect lines. This equates to approximately five habitat trees per ha, with an average of four hollows per tree.

Assessment against the 10 clearing principles

An assessment of proposed clearing against the 10 clearing principles determined that clearing within the survey area may be at variance with principle b), Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout the Report.

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Appendices

1. Introduction

1.1 Project background

WestGold Group (WestGold) owns the South Kalgoorlie Operations (SKO) located approximately 40 kilometres (km) south of Kalgoorlie in the Coolgardie region of Western Australia (WA). As part of the SKO WestGold is proposing to undertake exploration and mine development activities on one of its tenements, Location 53 West.

GHD Pty Ltd (GHD) was engaged by WestGold to undertake a vegetation, flora and fauna assessment of the tenement area to identify key ecological constraints and support future approvals documentation.

1.2 Purpose of this report

This report details a reconnaissance vegetation and flora survey and a Level 1 fauna assessment of Location 53 West. The purpose of the survey was to identify key ecological constraints within the tenement area to inform and support a native vegetation clearing permit application.

1.3 Survey area

The Location 53 West tenement (referred to as the 'survey area') is located approximately 32 km south-west of Kalgoorlie in the Goldfields region of WA. The survey area is approximately 8.2 km long, 6.3 km wide and covers 5214.32 hectares (ha). The location of the survey area is indicated on Figure 1, Appendix A.

A study area was defined for the biological desktop searches and includes a 20 km buffer of the survey area.

1.4 Scope of works

The scope of works, as detailed in the WestGold brief and GHD proposal was to:

- Undertake a desktop assessment of relevant ecological aspects and constraints
- Undertake an enhanced reconnaissance vegetation and flora survey of the survey area to provide:
  - Description and mapping of vegetation units and condition
  - Inventory of vascular flora taxa
  - Location and counts of conservation significant flora (Threatened and Priority Flora) and any Declared Pest taxa
- Undertake a Level 1 fauna survey of the survey area to provide:
  - Description and mapping of fauna habitat types
  - Inventory of vertebrate fauna taxa
  - Assessment of existing and potential habitat trees (DBH ≥500 mm), including tree height, height to hollow and hollow sizes
  - An indication of the presence or likelihood of occurrence of conservation significant fauna within the survey areas
- Prepare a report on the findings of the surveys
- Undertake an assessment of the survey area against the 10 Clearing Principles.

1.5 Relevant legislation, conservation codes and background information

In WA significant communities, and flora and fauna are protected under both Federal and State Government legislation. In addition, regulatory bodies also provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation and guidelines, conservation codes and background information relevant to this biological assessment are provided in Appendix B.

1.6 Report assumptions and limitations

This report has been prepared by GHD for WestGold and may only be used and relied on by WestGold for the purpose agreed between GHD and WestGold as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than WestGold arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by WestGold and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

This report has assessed the flora and fauna within the survey area (Figure 1, Appendix A). Should the survey area change or be refined, further assessment may be required.

2. Methodology

2.1 Desktop assessment

Prior to the commencement of the field survey a desktop assessment was undertaken to identify relevant environmental information pertaining to the study area and to assist in survey design.

This included a review of:

- The Department of the Environment and Energy (DEE) Protected Matters Search Tool (PMST) to identify communities and species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within the study area (DEE 2018a) (Appendix C)
- The Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Ecological Communities (TEC/PEC) database to determine the potential for TECs or PECs present within the study area
- The DBCA *NatureMap* database for flora and fauna species previously recorded within the study area (DBCA 2007–) (Appendix C)
- The DBCA Threatened (Declared Rare) and Priority Flora (TPFL) and WA Herbarium database (WAHERB) and for Threatened and Priority flora species listed under the *Wildlife Conservation Act 1950* (WC Act) and listed as priority by DBCA, previously recorded within the study area
- Identification of Environmentally Sensitive Areas and DBCA-managed conservation estates and reserves
- Existing datasets including previous broad-scale vegetation mapping of the survey area, aerial photography, geology/soils and hydrology information to provide background information on the variability of the environment, likely vegetation units and fauna habitats and to identify areas with the potential to contain TECs, PECs, and Threatened and Priority listed flora and fauna species.

2.2 Field survey

2.2.1 Vegetation and flora

GHD botanist Angela Benkovic (flora license no. SL012111) conducted an enhanced reconnaissance survey of the survey area from 21–23 March 2018. An enhanced reconnaissance survey involves moderate intensity sampling. The survey was undertaken to verify the results of the desktop assessment, determine the current composition and condition of vegetation present within the survey area, and identify and record vascular flora taxa present at the time of survey. In addition, an assessment of the potential for conservation flora to occur within the survey area was also undertaken.

The survey methodology employed by GHD was undertaken with reference to the Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a).

Data collection

Field assessment methodology involved traversing the survey area by vehicle and on foot to assess the vegetation present within the survey area. Twenty relevé (R) locations and 13 photo points (PP) were used to gather information during the survey. An approximate 20 m unbound radius was surveyed around each R location. Field data at each R location was recorded on a

pro-forma data sheet and included the parameters detailed in Table 1. Photo points were used to identify the dominant flora taxa from each structural layer at various locations to assist in vegetation mapping.

Table 1 Data collected during the field survey

Aspect	Measurement
Collection attributes	Personnel/recorder; date and photograph at R point.
Physical features	Aspect, soil attributes, ground surface cover, leaf and wood litter.
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 m.
Vegetation condition	Vegetation condition was assessed using the condition rating scale adapted by EPA (2016a) for the South West and Interzone Botanical Province.
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, exploration activities).
Flora	List of dominant flora from each structural layer. List of most species within the R including average height and cover (using the National Vegetation Information System (NVIS))

A flora inventory was compiled from taxa recorded within the survey area and is provided in Appendix D.

Vegetation units

Vegetation units were identified and boundaries delineated using a combination of aerial photography, topographical features, previous mapping (Beard 1972) and field data.

Vegetation units were described based on structure, dominant taxa and cover characteristics as defined by RA data and field observations. Vegetation unit descriptions follow NVIS and are consistent with NVIS Level V (Association). At Level V up to three taxa per stratum are used to describe the association (ESCAVI 2003).

Vegetation condition

The vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (devised by Keighery (1994) and adapted by EPA (2016a)). The scale recognises the intactness of vegetation and consists of six rating levels. The vegetation condition rating scale is outlined in Appendix B.

Flora identification and nomenclature

Species well known to the survey botanist were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. Plant species were identified with the use of local and regional flora keys and by comparison with the named species held at the Western Australian (WA) Herbarium.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium 1998–) and the EPBC Act Threatened species database provided by DEE (2018b). Nomenclature used in this report follows that used by the WA Herbarium as reported on *FloraBase* (WA Herbarium 1998–).

2.2.2 Fauna

GHD zoologist Melissa Jensen conducted a single season Level 1 (reconnaissance) fauna survey of the survey area on 21–23 March 2018. The field survey was undertaken to verify the accuracy of the desktop study, identify fauna habitat types, identify and record fauna taxa

present at the time of survey and assess habitat value and connectivity. An assessment of the likelihood of occurrence of conservation significant fauna and their habitats occurring within the survey area was also undertaken post field survey.

The majority of the survey area was traversed on foot and by vehicle over the course of nine days. The survey methodology employed by GHD was undertaken with reference to the EPA *Technical Guidance – Sampling methods for terrestrial vertebrate fauna* (EPA 2016b) and *Technical Guidance – Terrestrial Fauna Surveys* (EPA 2016c).

Habitat assessment

The survey area was assessed for habitat type, structural complexity, connectivity, disturbance, type and extent of resource availability and value for fauna. Specifically, the assessment included:

- Habitat structure (e.g. vegetation type, presence/absence of overstorey, midstorey, understorey, and ground cover).
- Presence/absence of refuge including: fallen timber (coarse woody debris), hollow-bearing trees and stags and rocks/breakaways, and the type and extent of each refuge
- Location of the habitat within the survey area in comparison to the habitat within the surrounding landscape
- Habitat connectivity and identification of wildlife corridors within and immediately adjacent to the survey area
- Identification and evaluation of key habitat features and types identified during the desktop assessment relevant to fauna of conservation significance
- Evaluation of the likelihood of occurrence of conservation significant fauna within the habitat (based on presence of suitable habitat)
- A representative photograph of each habitat type.

Opportunistic observations

Opportunistic fauna searches were conducted throughout the survey area and focussed on the following:

- Searching the survey area for tracks, scats, pellets, bones, diggings, feathers, nests and feeding areas indicating the current or recent presence of native and feral fauna
- Searching through microhabitats within the survey area, including turning over rocks and ground debris (e.g. leaf litter) and examining tree hollows (from the ground) and hollow logs for vertebrate fauna
- Opportunistic observations of species in the survey area, including visual and aural sightings
- Observed fauna were recorded and where conservation significant fauna were identified, photographs, GPS points and habitat data were recorded.

Habitat tree assessment

Habitat trees that contain hollows, or are of a suitable diameter at breast height (DBH) to develop a hollow in the future, are important breeding habitat for many native fauna species. For most tree species, suitable DBH is 500 mm. For Salmon Gum (*Eucalyptus salmonophloia*) and other smooth barked species, suitable DBH is 300 mm. Opportunistic searches for habitat trees were conducted along transects throughout the survey area to identify and record the locations of existing and potential habitat trees. Transects were either 500 m or 1 km long and all habitat

trees which contained, or have the potential to develop, hollows suitable for native fauna were identified and measured within 20 m either side of the transect line. Due to the mosaic nature of the landscape, transects were not restricted to one particular habitat type and instead traversed through multiple habitat types.

For each habitat tree, details of the tree species, DBH, tree height, the height to each hollow and the hollow sizes were recorded. The location of each habitat tree was recorded via GPS. Hollows were classified as either small (1–10 cm diameter), medium (11–20 cm diameter) or large (greater than 20 cm diameter). Evidence of hollow use and any other significant observations were also recorded.

Fauna nomenclature

Nomenclature used in this report follows that used by the WA Museum as reported on *NatureMap*. This nomenclature is deemed the most up-to-date species information for WA fauna, with the exception of birds, which follows Christidis and Boles (2008).

Fauna species identification

Identification of fauna species was made in the field using available field guides and electronic guides (e.g. Morcombe 2014). Where identification was not possible, photographs of specimens were collected to be later identified.

2.3 Limitations

2.3.1 Desktop limitations

The EPBC Act PMST is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of the species within the area. The records from the DBCA searches of threatened flora and fauna provide more accurate information for the general area. However, some records of collections, sightings or trappings cannot be dated and often misrepresent the current range of threatened species.

2.3.2 Field survey constraints and limitations

The EPA (2016a, 2016b) Technical Guides state that flora and fauna survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2.

Table 2 Survey constraints and limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information.	Nil	Adequate information is available for the survey area, this includes: • Broad scale (1:250 000) mapping by Beard (1972) and digitised by Shepherd et al. (2002) • Regional biogeography (Cowan 2001)
Scope (what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna were sampled during the survey. Non-vascular flora, invertebrate and aquatic fauna were not assessed as part of survey although opportunistic records were taken of invertebrate fauna when observed.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Nil	The reconnaissance vegetation and flora survey was undertaken 21–23 March 2018. The flora recorded from the field survey is detailed in section 3.6.3 and a full flora species list is provided in Appendix D. The portion of flora collected and identified was considered high, however, it is likely the survey under-recorded some grass species (Poaceae) and herb (annual/ ephemeral) species due to survey timing. The fauna survey was undertaken on 21–23 March 2018 and involved a Level 1 reconnaissance vertebrate fauna survey. The fauna assessment sampled those species that can be easily seen, heard or has distinctive signs, such as tracks, scats, diggings, etc. Many cryptic species would not have been identified during a reconnaissance survey and seasonal variation within species often requires targeted surveys at a particular time of the year. Of the fauna species recorded during the survey, all species were identified to a species level. The fauna assessment was aimed at identifying habitat types and terrestrial vertebrate fauna utilising the survey area. No targeted sampling for invertebrates or aquatic species occurred. Where fresh water fish and crustacean fauna were recorded opportunistically, these findings are mentioned in this report. However, this report is limited to an assessment of terrestrial vertebrate fauna, as the information available on the identification, distribution and conservation status fresh water fish and crustacean is generally less extensive than that of vertebrate species.
Flora determination	Minor	Flora determination was undertaken by the survey botanist in the field and at the WA Herbarium. Four flora collections could only be identified to family, six were identified to genus and three were tentatively identified to species level only due to lack of flowering and fruiting material required for identification. These collections showed no resemblance to any Threatened or Priority flora identified in the desktop assessment. Additionally, some species, particularly grasses (Poaceae) annuals and ephemerals, may have been overlooked due to lack of material; however this is unlikely to affect the results of the survey. The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation of Nature criteria.

Aspect	Constraint	Comment
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Minor	The majority of the survey area was accessed on foot or by vehicle over the survey period. Information gained from the survey was extrapolated across those small sections of the survey area not accessed by foot or vehicle during the field survey to assist with determining the vegetation and habitat types for the entire survey area. These areas consisted of remote sections of the survey area not accessible by vehicle and or a significant distance away by foot.
Mapping reliability	Nil	The vegetation was mapped using high resolution ESRI aerial imagery obtained from Landgate and field data. The distribution of sample sites is considered adequate for the definition of vegetation within the survey area. Data was recorded in the field using hand-held GPS tools (e.g. Samsung tablet and Garmin GPS). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within ±5 m on average. Therefore the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/ season/cycle	Minor	The field survey was conducted in March 2018. In the three months prior to the survey (December to February), Kalgoorlie-Boulder Airport weather station (No. 012038, Bureau of Meteorology (BoM) 2018 – located approximately 37 km from the survey area) recorded a total of 113.6 millimetres (mm) of rainfall. This rainfall total is greater than the Long Term Average (LTA) for the same period (December to February; 75.7 mm) (BoM 2018). The weather conditions during the March field survey (according to BoM weather stations No. 012038) included: • Daily maximum temperature ranging from 29.3 to 37.5 °C • Daily minimum temperature ranging from 17.9 to 20.2 °C • Daily rainfall – 0.2 mm of rainfall was recorded during the survey period The weather conditions recorded during the survey periods are considered unlikely to have impacted the vegetation, flora and fauna survey. The vegetation and flora survey was conducted during Autumn. Autumn is generally not considered the most optimal time of year for flora and fauna surveys in the Coolgardie Region, however, above average rainfall was received in January and February 2018.
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	No natural events or disturbances impacted the survey during the site visit.
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey area was sampled in accordance with the EPA (2016a) Technical guidance and terrestrial fauna sampled in accordance to EPA (2016b, 2016c) as required by the scope of works. The survey area was sufficiently covered by one botanist and one zoologist during the survey.
Resources	Nil	Adequate resources were employed during the field survey. A total of 4 person days were spent undertaking the survey using one dedicated botanist and one zoologist.

Aspect	Constraint	Comment
Access restrictions	Minor	No access restrictions were encountered during the field survey. The majority of the survey area was accessed on foot or by vehicle over the survey period. Information gained from the survey was extrapolated across those small sections of the survey area not accessed by foot or vehicle during the field survey to assist with determining the vegetation and habitat types for the entire survey area. These areas consisted of remote sections of the survey area not accessible by vehicle and or a significant distance away by foot.
Experience levels	Nil	The botanist and zoologist who executed the surveys were practitioners suitably qualified in their respective fields. Melissa Jensen (zoologist) has nine years' experience undertaking fauna surveys throughout Australia. Angela Benkovic (botanist) has over 11 years' experience undertaking flora and vegetation surveys within WA.

3. Desktop assessment

3.1 Climate

The climate of the Goldfields region is mostly hot and dry, with highly variable rainfall throughout the year. Kalgoorlie has a semi-arid climate with hot summers and mild winters, and an average rainfall of 267 mm relatively evenly distributed throughout the year. Rainfall can however be highly erratic year to year (BoM 2018).

The closest Bureau of Meteorology (BoM) weather recording station to the survey area with the most current available data is the Kalgoorlie-Boulder Airport (station number: 012038). A summary of the climatic data for this weather station in the 12 months preceding the survey (March 2017 – February 2018) are presented in Plate 1, along with long-term average climatic statistics (BoM 2018).

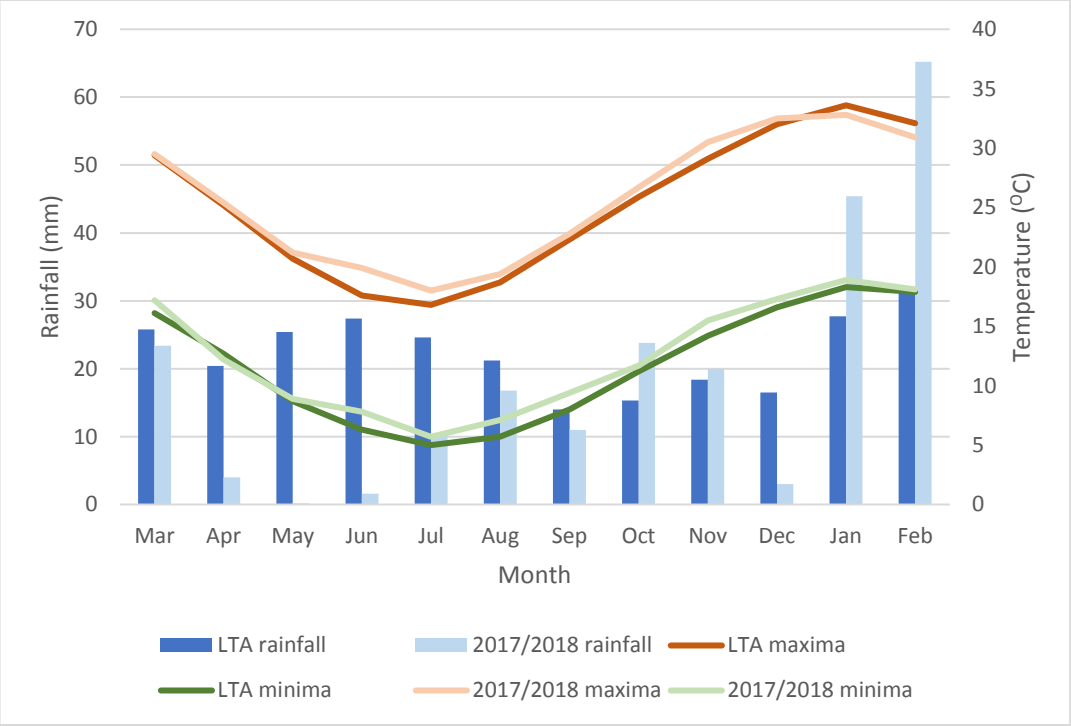

Plate 1 Climate data for Kalgoorlie-Boulder Airport (BoM 2018)

3.2 Regional biogeography

The survey area is situated in the Eremaean Botanical Province of Western Australia (Beard 1990), within the Coolgardie bioregion and the Eastern Goldfields subregion as described by the Interim Biogeographic Regionalisation of Australia (IBRA).

The Eastern Goldfields subregion lies on the Yilgarn Craton's 'Eastern Goldfields Terrains' and comprises gently undulating plains interrupted in the west by low hills and ridges and a series of large playa lakes. The underlying geology of the subregion is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas (Cowan 2001). The Eastern Goldfields subregion is dominated by Mallees, *Acacia* thickets and shrubheaths on sandplains. Diverse *Eucalyptus* woodlands occur around salt lakes, on ranges, and in valleys and dwarf shrublands of samphire are common in salt areas (Cowan 2001).

The survey area is also located in the Great Western Woodlands, which is the largest area of intact temperate woodland remaining on earth. The Woodlands cover almost 16 million

hectares, stretching from the edge of the Wheatbelt to Kalgoorlie-Boulder in the north, to inland deserts to the north east and the Nullarbor Plain to the east. The area has high floral diversity with more than 3000 species recorded and is a centre for eucalypt diversity (Watson *et al.* 2008, Thomas-Dans *et al.* 2012).

3.3 Landforms and soils

The survey area is located in the Southern Cross Zone of the Kalgoorlie Province. The Southern Cross Zone is described as rises and low hills on Archaean greenstones, with broad valleys often containing salt lake chains. Soils are usually red, loamy to clayey and calcareous (Schoknecht *et al.* 2004).

Soil landscape mapping (GoWA 2018a) indicates that three soil landscape types occur within the survey area:

- Mx43 – Gently undulating valley plains and pediments; some outcrop of basic rock
- My154 – Undulating country on acid volcanic rocks and sedimentary materials
- Mx41 – Flat to undulating pediments; granitic rock outcrop; some low escarpments.

3.4 Hydrology

One minor ephemeral drainage line intersects the survey area. No wetlands intersect the survey area.

3.5 Land use

3.5.1 DBCA-managed lands

No DBCA managed lands occur within the survey area, however two DBCA managed lands are located adjacent to the survey area. These are Karamindie Forest to the north-east and Yallari Timber Reserve to the south. There are five additional DBCA managed lands within the study area.

3.5.2 Environmentally Sensitive Areas

No Environmentally Sensitive Areas occur within or adjacent to the survey area.

3.6 Vegetation and flora

3.6.1 Broad vegetation associations and extent

Broad scale (1:250,000) vegetation mapping of the area was completed by Beard (1972) at an association level. Beard mapping indicates that four vegetation associations are present within the survey area. These vegetation associations include:

- Medium woodland; Coral Gum (*Eucalyptus torquata*) and Goldfields Blackbutt (*E. lesouefii*) (association 9) – intersects the eastern and southern sides of the survey area
- Bare areas; rock outcrops (association 128) – intersects the south-eastern corner of the survey area
- Medium woodland; Salmon Gum (association 936) – intersects the northern and western sides of the survey area
- Shrublands; *Acacia*, *Casuarina* and *Melaleuca* thicket (association 1413) – intersects the south-eastern corner of the survey area.

Beard mapping has been adapted and digitised by Shepherd *et al.* (2002). The extent of Beard's (1972) vegetation associations have been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (latest update December 2017 – GoWA, 2018b). As shown in Table 3, the extent of all vegetation associations at the State, IBRA bioregion, IBRA subregion and Local Government Authority (LGA) scales are greater than 76 % of the pre-European extent remaining.

3.6.2 Conservation significant ecological communities

A search of the EPBC *Protected Matters* database did not identify any federally listed TECs within the study area. Similarly, a search of the DBCA TEC/PEC databases did not identify any TECs or PECs within the study area.

Table 3 Extents of vegetation associations mapped with the survey area (GoWA 2018b)

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% current extent in all DBCA managed lands
9	State: WA	240,509.33	235,161.94	97.78	8.07
	IBRA bioregion: Coolgardie	240,441.99	235,100.97	97.78	8.07
	IBRA subregion: Eastern Goldfields	235,047.15	229,757.07	97.75	8.26
	LGA: Coolgardie	166,572.37	163,720.39	98.29	9.81
128	State: WA	329,836.19	288,813.54	87.56	23.91
	IBRA bioregion: Coolgardie	184,549.90	183,891.19	99.64	18.85
	IBRA subregion: Eastern Goldfields	26,871.74	26,853.58	99.93	6.53
	LGA: Coolgardie	96,232.93	96,215.07	99.98	13.55
936	State: WA	698,751.99	676,689.18	96.84	4.14
	IBRA bioregion: Coolgardie	586,792.22	584,336.13	99.58	3.10
	IBRA subregion: Eastern Goldfields	310,897.73	308,459.61	99.22	4.38
	LGA: Coolgardie	359,112.73	356,674.60	99.32	4.02
1413	State: WA	1,679,916.32	1,286,855.48	76.60	17.25
	IBRA bioregion: Coolgardie	1,061,212.30	1,042,553.78	98.24	18.50
	IBRA subregion: Eastern Goldfields	107,974.55	107,727.82	99.77	7.54
	LGA: Coolgardie	334,488.08	334,256.37	99.93	8.16

3.6.3 Flora diversity

A search of the *NatureMap* data base identified 291 plant taxa representing 51 families and 133 genera that have previously been recorded within the study area. This total comprises 282 native flora taxa and nine naturalised (non-native) flora taxa. Dominant families within this search included Myrtaceae (49 taxa), Fabaceae (37 taxa) and Asteraceae (32 taxa).

3.6.4 Conservation significant flora

Desktop searches identified the presence/potential presence of 24 conservation significant flora taxa within the study area. The desktop searches recorded:

- One taxon listed as Threatened under the EPBC Act and WC Act
- Seven Priority 1 taxa
- Four Priority 2 taxa
- Ten Priority 3 taxa
- Two Priority 4 taxa.

3.7 Fauna

3.7.1 Fauna diversity

The *NatureMap* database search identified 104 terrestrial vertebrate fauna species previously recorded within the study area. This total included 68 birds, 33 reptiles and 3 mammals. The remainder of species identified in each search were invertebrates and were not considered as part of this survey.

3.7.2 Conservation significant fauna

The EPBC Act PMST and *NatureMap* database identified the presence/potential presence of 12 conservation significant fauna species within the study area. The desktop searches recorded:

- Eleven EPBC Act/WC Act listed species
- One species listed as International Agreement under WC Act

These results exclude marine species as no marine habitat is present within the survey area.

4. Results

4.1 Vegetation and flora

4.1.1 Vegetation types

Seven vegetation types were identified and described for the survey area (Table 4 and Figure 3, Appendix A). Five vegetation types describe variations in *Eucalyptus* spp. woodlands, one describes a tall shrubland of *Acacia* sp. and *Melaleuca* sp., and one represents a granite community.

Vegetation type Mosaic *Eucalyptus* spp. woodland (VT06) dominated the survey area (1944.45 ha) this community was located mostly within the north western extent of the survey area. The vegetation mapped within the south eastern extent of the survey was a mosaic of VT01, VT02, VT06 and VT07.

Vegetation type *Eucalyptus loxophleba* subsp*. lissophloia* and *E. griffithsii open* woodland (VT01) (215.97 ha) represented drainage lines within the survey area. Vegetation type *Eucalyptus* spp*.* woodland over open hummock grassland (VT03) (450.49 ha) was unique in that it was the only vegetation type with *Triodia* sp. The most restricted vegetation type was Mixed open shrubland over herbland (VT04) (5.02 ha), this community was associated with granite outcrops over clay and was recorded in one location in the north of the survey area.

Table 4 Recorded vegetation types for the survey area

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha)	Vegetation Association, relevé and photo point reference	Photograph
Eucalyptus loxophleba subsp. *lissophloia* and *E. griffithsii* open woodland (VT01)	*Eucalyptus loxophleba* subsp. *lissophloia* and *E. griffithsii* open woodland over *Eremophila* spp., *Acacia* spp. mid shrubland	Drainage lines with silty orange soils	215.97	Associations: 9 & 936 Relevés: 48, 53 & 64 Photo Point: 28	
Eucalyptus spp. isolated trees over tall shrubland (VT02)	*Eucalyptus* spp. isolated trees over *Melaleuca uncinata, Acacia acuminata* tall shrubland over *Prostanthera grylloana* low open shrubland	Plains of silty orange soil	517.14	Association: 9 Relevés: 54 & 56 Photo Point: 20 & 22	
Eucalyptus spp. woodland over open hummock grassland (VT03)	*Eucalyptus* spp. woodland over *Acacia* spp., *Eremophila* spp. tall open shrubland over *Triodia* sp. open hummock grassland	Plains of silty orange soil	450.49	Association: 9 Relevés: 51, 55, 58 & 59 Photo Points: 18 & 19	

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha)	Vegetation Association, relevé and photo point reference	Photograph
Mixed open shrubland over herbland (VT04)	*Acacia acuminata, Melaleuca eleuterostachya, Eremophila serrulata* mid open shrubland over *Cheilanthes sieberi subsp. sieberi,* Asteraceae sp. open herbland	Granite outcrops over clay	5.02	Associations: 128 Relevés: 60	
Eucalyptus spp. over *Melaleuca* spp./ *Allocasuarina* sp. tall sparse shrubland (VT05)	*Eucalyptus* spp. open woodland over *Melaleuca sheathiana, M. lanceolata, Allocasuarina acutivalvis* subsp. *acutivalvis* tall sparse shrubland over *Senna artemisioides, Halgania andromedifolia* low open shrubland	Plain with silty orange soils	860.96	Association: 936 Relevés: 52, 61, & 62 Photo Points: 23, 24, 25 & 30	
Mosaic *Eucalyptus* spp. woodland (VT06)	*Eucalyptus* spp. woodland over *Acacia hemiteles*, *Eremophila* spp. tall shrubland over chenopod low open shrubland	Plain with silty orange soils	1,944.45	Association: 9 & 936 Relevé: 49, 50, 63, 65 & 67 Photo Points: 26 & 29	

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha)	Vegetation Association, relevé and photo point reference	Photograph
Eucalyptus spp. woodland over quartz (VT07)	*Eucalyptus spp.* open woodland over *Senna artemisioides, Eremophila scoparia, Atriplex vesicaria* mid shrubland	Silty orange soils with occasional quartz	1,153.09	Association: 9 Relevés: 57 & 66 Photo Points: 21 & 27	
Cleared/ track/ road	NA		67.19		

4.1.2 Vegetation condition

The vegetation condition within the survey area was rated Excellent to Good in condition. The extents of the vegetation condition ratings mapped within the survey area are detailed in Table 5 and mapped in Figure 4, Appendix A.

The majority of the survey area was in Excellent condition with very little weed invasion. The area rated as Good in condition was due to disturbances, such as weed invasion and rubbish, associated with the Coolgardie-Esperance Highway. Areas marked out as pipeline, roads and tracks were not give a condition rating.

Table 5 Extent of vegetation condition ratings mapped within the survey area

Vegetation Condition	Extent in survey area (ha)
Excellent	5,136.27
Good	10.86
Not rated – cleared, roads, tracks etc.	67.19
Total	**5,214.32**

4.1.1 Conservation significant ecological communities

The GHD vegetation types identified within the survey area during the field survey do not align with any known Commonwealth or State listed TECs or PECs.

4.1.2 Other significant vegetation

The granite outcrop community Mixed open shrubland over herbland (VT04) (5.04 ha) aligns with other significant vegetation as defined by the EPA (2016a). This community supports local endemism in a restricted habitat (granite outcrops) and has a restricted distribution in the local and regional area. Many of the herbs and annuals were spent at the time of the field survey, so the relevé data may have been depauperate in these species. The species recorded within VT04 differed from the other vegetation types in the survey area in terms of vegetation structure and species composition.

Vegetation type VT01 grows in association with ephemeral drainage lines. No water was present within the drainage lines during the field survey. Additionally the vegetation within VT01 is not considered to be wetland or riparian in nature. The drainage lines supported *Eucalyptus* spp. woodland over a suite of *Acacia* spp. and *Eremophila* spp. commonly found within the larger survey area. Therefore the vegetation of VT01 is not deemed riparian and not significant vegetation as defined by EPA (2016a).

4.2 Flora diversity

Eighty three flora taxa (including subspecies and varieties) representing 26 families and 44 genera were recorded from the survey area during the field survey. This total comprised of 80 native taxa and three introduced flora taxa.

Dominant families recorded from the survey area included:

- Scrophulariaceae (15 taxa)
- Myrtaceae (12 taxa).
- Chenopodiaceae & Fabaceae (9 taxa)

The survey area is considered representative of the floristic diversity in the area. The highest floristic diversity was recorded in VT05 (44 taxa). A taxa list for the survey area is provided in Appendix D.

4.2.1 Conservation significant flora

No EPBC Act, WC Act or DBCA Priority-listed flora were recorded within the survey area during the field survey.

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant flora taxa identified in the desktop assessment (Appendix D). This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment concluded two taxa are likely to occur, eight may possibly occur and the remaining 14 taxa are unlikely to occur within the survey area. The taxa likely to occur are *Acacia websteri* and *Thryptomene* sp. Londonderry (R.H. Kuchel 1763) (both P1). Vegetation type VT02 is considered suitable habitat for these taxa, there was 517.14 ha of suitable habitat within the survey area.

4.2.2 Other significant flora

No other significant flora as defined by the EPA (2016a) was identified within the survey area.

4.2.3 Introduced flora

Three introduced flora taxa were recorded from the survey area. Of the introduced taxa, one is listed as Declared Pest under the *Biosecurity and Agriculture Management Act 2007, *Xanthium spinosum* (Bathurst Burr).

No Weeds of National Significance (WONS) were recorded during the field survey. The remaining two introduced taxa recorded are considered environmental weeds and have been previously recorded within the Coolgardie IBRA bioregion. The locations of Bathurst Burr within the survey area are mapped in Figure 4, Appendix A

4.3 Fauna

4.3.1 Fauna habitats

Five broad fauna habitat types were identified in the survey area during the field survey. The broad habitat types correspond closely with the vegetation associations listed above and include:

- Rocky *Acacia* shrubland
- *Melaleuca* shrubland
- Mixed *Eucalyptus* woodland over spinifex
- Mixed *Eucalyptus* woodland over mixed shrubs
- Cleared areas.

No habitat types were recorded that are considered to be exclusive to the survey area. The fauna habitats are described in Table 6 and mapped in Figure 5, Appendix A.

Table 6 Fauna habitats within the survey area

Habitat type	Extent (ha)	Indicative photograph
Rocky *Acacia* shrubland This habitat incorporates vegetation types: VT04 This habitat is dominated by dense thickets of *Acacia* with an understory of mixed shrubs over claypans and large open exposed granite rock slabs and boulders. There is a range of micro-habitat features in this habitat type including small rocky outcrops, rock crevices, fallen branches, leaf litter and woody debris. This habitat provides foraging opportunities and refuge for birds and ground-dwelling fauna such as reptiles. Conservation significant fauna One conservation significant fauna species was recorded in this habitat type during this field survey, the Malleefowl. This species was identified as occupying this habitat via the sighting of an adult bird foraging amongst the thick *Acacias*.	5.02	

Habitat type	Extent (ha)	Indicative photograph
***Melaleuca* shrubland** This habitat incorporates vegetation types: VT02 This habitat is dominated by dense thickets of *Melaleuca* over an understory of mixed shrubs. There is a range of micro-habitat features in this habitat type including areas of good leaf litter cover and debris, fallen branches and a closed canopy. This habitat provides foraging opportunities and refuge for birds and reptiles. <u>Conservation significant fauna</u> One conservation significant fauna species was recorded in this habitat type during this field survey, the Malleefowl. This species was identified as occupying and breeding in this habitat type by the presence of two mounds, one of which was recently used for breeding.	517.14	

Habitat type	Extent (ha)	Indicative photograph
Mixed *Eucalyptus* woodland over spinifex This habitat incorporates vegetation types: VT03 This habitat is dominated by mallee eucalypts over a mid-layer of shrubs and spinifex. A range of age classes in most flora species and ground cover/ refuge including some logs, branches, patches of leaf litter (in a variety of patch size, type and thickness) was present. There is a range of micro-habitat features in this habitat type including fallen logs, branches and patches of leaf litter and the low growing clumps of *Triodia* sp. This habitat type is well represented in the survey area and broader area. <u>Conservation significant fauna</u> No conservation significant fauna were recorded in this habitat type during this field survey, although the Rainbow Bee-eater may opportunistically use this habitat for foraging. This habitat is also suitable Malleefowl foraging and breeding habitat.	450.49	

Mixed *Eucalyptus* woodland over mixed shrubs This habitat incorporates vegetation types: VT01, VT05, VT06, VT07 The majority of the survey area comprised a mosaic of *Eucalyptus* woodlands, consisting of *Eucalyptus salmonophloia*, *Eucalyptus loxophleba* subsp*. lissophloia*, and *E. griffithsii*, over mixed shrubs, including *Eremophila*, *Acacia*, *Melaleuca* and *Allocasuarina* species. The diversity of shrubby understory species provides a variety of different shelter and food resources, thereby increasing the availability of food sources for fauna throughout the year. There is a broad structural diversity in the survey area, including variation in tree canopy height and density, a variety of structural layers (trees, large and small shrubs, scattered grasses and herbs), a wide range of age classes in most flora species and ground cover/ refuge including logs, branches, patches of leaf litter (in a variety of patch size, type and thickness). Most of the *Eucalyptus* species in this woodland habitat readily form hollows that are utilised by fauna, particularly birds. Where these hollow branches fall to the ground, the fallen timber provides a valuable micro-habitat feature for ground-dwelling fauna. Fallen logs, branches and leaf litter are critical habitat components for many fauna species and are readily available in this habitat type throughout the survey area. The substrates within this habitat type vary throughout the survey area, from sandy loam to rocky quartz. This habitat type is well represented in the survey area and broader area. <u>Conservation significant fauna</u> One conservation significant fauna species was recorded in this habitat type during this field survey, the Malleefowl. This species was identified as occupying and breeding in this habitat type by	4174.48	 

Habitat type	Extent (ha)	Indicative photograph
the presence of an old mound. The Rainbow Bee-eater may also opportunistically use this habitat for foraging.		
Cleared areas This habitat incorporates vegetation types: Cleared/ track/ road Throughout the survey area there are highly modified areas that have been cleared or disturbed in the past for the development of mining access tracks, haul roads and fence lines. These areas cover a small percentage of the survey area and provide little to no habitat value for fauna species, and are largely devoid of native vegetation. There are trees and shrubs alongside these areas that provide cover for birds and reptiles. Feral cat tracks were recorded on vehicle access tracks in the south-east corner of the survey area.	67.19	

Fauna habitat disturbance

With the exception of haul roads, access tracks, fence lines, the pipeline corridor and a public access bitumen road, disturbance within the survey area is minimal.

Habitat quality and connectivity

Habitat connectivity is important to allow animals to move between areas of resource availability. They are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction. Locally, the habitat within the survey area is well connected to habitat in the surrounding area and broader region. There has been minimal clearing within the survey area, with the exception of clearing for infrastructure (such as the haul roads, access tracks, pipelines and fence lines). Several tracks intersect the survey area. All of these tracks are relatively minor and unlikely to restrict the movement of fauna. In addition, the majority of the fences within the survey area are also minor and unlikely to substantially restrict the movement of fauna. The fauna habitat quality and connectivity within the survey area is considered to be high, intact and contiguous within the region.

At a regional scale, the survey area retains habitat linkages to the surrounding area in all directions. In particular the habitat within the survey area is directly connected to two conservation areas and reserves in the region, including:

- Karamindie Forest to the north-east (780 ha)
- Yallari Timber Reserve to the south (6100 ha).

Connectivity to these reserves provides important linkages to patches of habitat which are protected, and likely to be maintained or managed for conservation.

4.3.2 Fauna diversity

Forty-one species, consisting of 30 birds, four mammals and seven reptiles were recorded within the survey area during the field survey. A fauna species list is provided in Appendix E.

4.3.3 Introduced fauna

A total of two introduced species were recorded within the survey area during the field survey, namely the Feral Cat (*Felis catus*) and European Rabbit (*Oryctolagus cuniculus*).

4.3.4 Conservation significant fauna

One conservation significant fauna species was recorded within the survey area during the field survey, the Malleefowl (listed as Vulnerable under the EPBC Act). The presence of this species within the survey are was determined via the sighting of a Malleefowl in the northern section of the survey area and the presence of three Malleefowl mounds within the survey area, one of which has been very recently used during the current breeding season (see Plate 2, Plate 3 and Figure 5, Appendix A). A total of 36 km was traversed on foot throughout the survey area in search of Malleefowl evidence, particularly in habitats which contain suitable habitat for Malleefowl, including the *Acacia* and *Melaleuca* shrublands, Mixed *Eucalyptus* woodland over spinifex, and mixed *Eucalyptus* woodland over mixed shrubs.

Plate 2 Recently used Malleefowl mound

Plate 3 Evidence of recent breeding at Malleefowl mound, including scats, feathers and eggshell

4.3.5 Habitat tree assessment

Four transects (2 x 500 m transects, 2 x 1 km transects = 3 km in total) were traversed through multiple habitat types throughout the survey area. Habitat trees were identified and measured within approximately 20 m either side of the transect line. 64 habitat trees were identified within the four transect lines. This equates to approximately 5 habitat trees per ha. Of these 64 trees identified, 33 contained hollows, with an average of four hollows per tree. This equates to approximately 11 hollows per ha. The habitat trees consisted of six *Eucalyptus* species and one stag, including *Eucalyptus salmonophloia, E. lesouefii, E. longicornis, E. yilgarnensis, E. transcontinentalis and E. loxophleba.*

Extrapolated across the survey area in areas of Eucalypt woodland (4,624.97 ha), it is estimated there are 23,124 habitat trees present.

Likelihood of occurrence

An assessment on the likelihood of conservation significant species occurring within the survey area was undertaken post-field survey via searches of the EPBC Act PMST and *NatureMap* databases (Appendix E). This assessment was based on species biology, habitat requirements, the quality and availability of suitable habitat, as determined during the field survey, and records of the species in the survey area and surrounding area.

One conservation significant fauna species is known and one is likely to occur within the survey area, with the remaining species were considered either as unlikely or highly unlikely to occur. It is considered unlikely that the survey area provides important habitat (e.g. breeding habitat or key foraging habitat) for any of the species deemed 'unlikely' to occur and that these other species may occasionally use the habitats of the survey area for temporary refuge and dispersal between other areas of habitat. Table 7 summarises the species of conservation significance present or considered likely to occur in the survey area.

Table 7 Summary of fauna likelihood of occurrence

Species	Status		Source	Likelihood of occurrence
	WC Act/ DBCA	EPBC Act		
Birds				
Malleefowl (*Leipoa ocellata*)	Vu	Vu	*NatureMap* EPBC PMST	**Known** Species known from the region and recorded within the survey area during the field survey. Suitable habitat present.
Rainbow Bee-eater (*Merops ornatus*)	IA	Ma	*NatureMap*	**Likely** Species known from the region. Suitable habitat present.

The Rainbow Bee-eater, which is listed as Schedule 5 (International Agreement) under the WC Act, is considered likely to occur within the survey area. However, the timing of the field survey coincided with when bee-eaters migrate to northern Australia (between February and April) and may be the reason why this species was not recorded during the field survey.

5. Assessment against the Ten Clearing Principles

In accordance with Section 20 of the EP Act, the Department of Mines, Industry Regulation and Safety (DMIRS), has been delegated authority for the administration of applications to clear native vegetation for mineral and petroleum activities regulated under the *Mining Act 1978*, the *Petroleum and Geothermal Energy Resources Act 1967*, the *Petroleum Pipelines Act 1969*, the *Petroleum (Submerged Lands) Act 1982*, and activities under State Agreements administered by the Department of State Development, in WA.

An assessment of the survey area against the 10 clearing principles was undertaken to determine whether the project is likely to be at variance to the Principles (Appendix F). These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

The assessment determined that the clearing of native vegetation within the survey areas may be at variance to principle b), Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.

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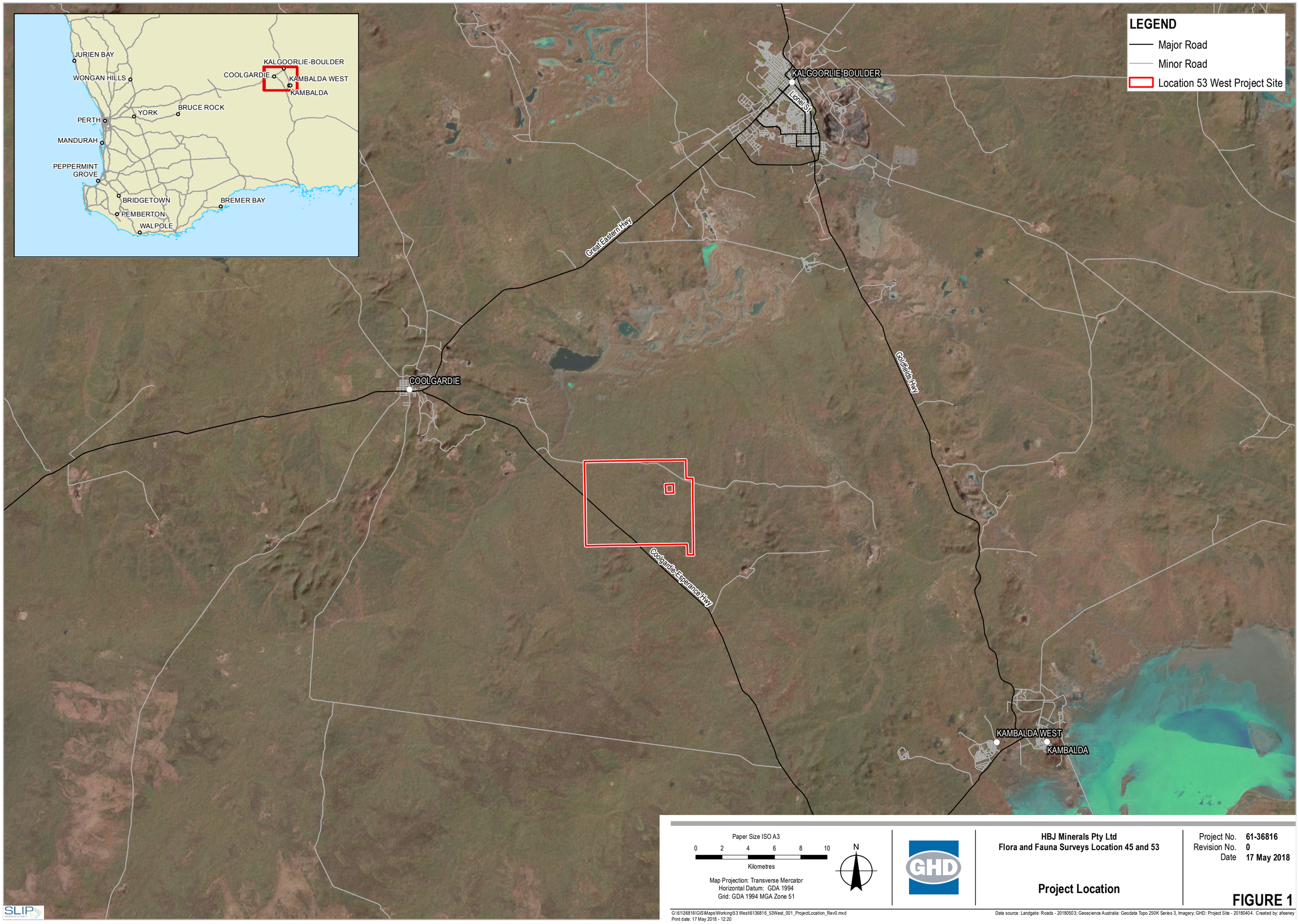
Appendices

Appendix A – Figures



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N

GHD

HBJ Minerals Pty Ltd
Flora and Fauna Surveys Location 45 and 53

Project Location

Project No. **61-36816**
Revision No. **0**
Date **17 May 2018**

FIGURE 1

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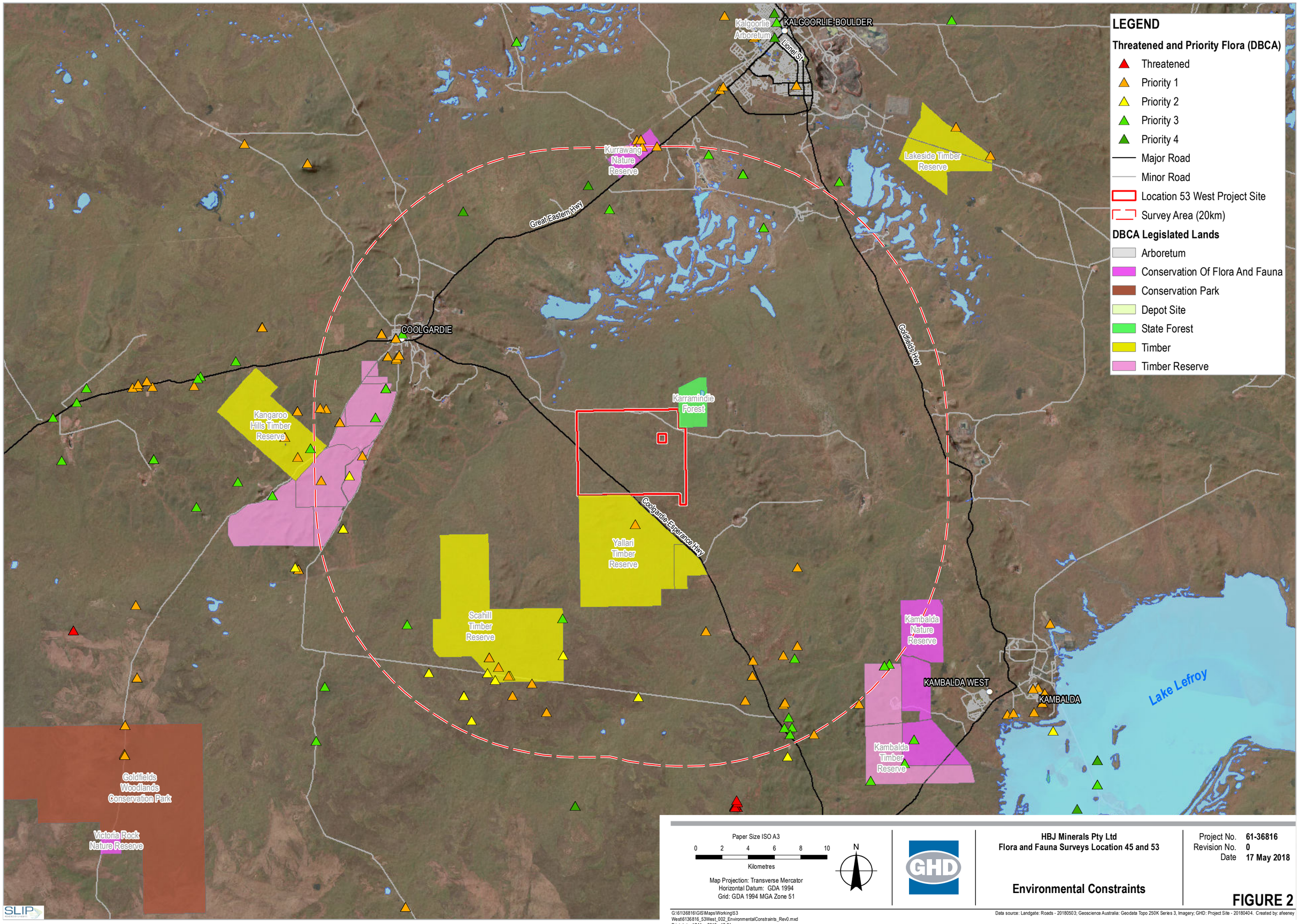

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N

GHD

HBJ Minerals Pty Ltd
Flora and Fauna Surveys Location 45 and 53

Environmental Constraints

Project No. **61-36816**
Revision No. **0**
Date **17 May 2018**

FIGURE 2

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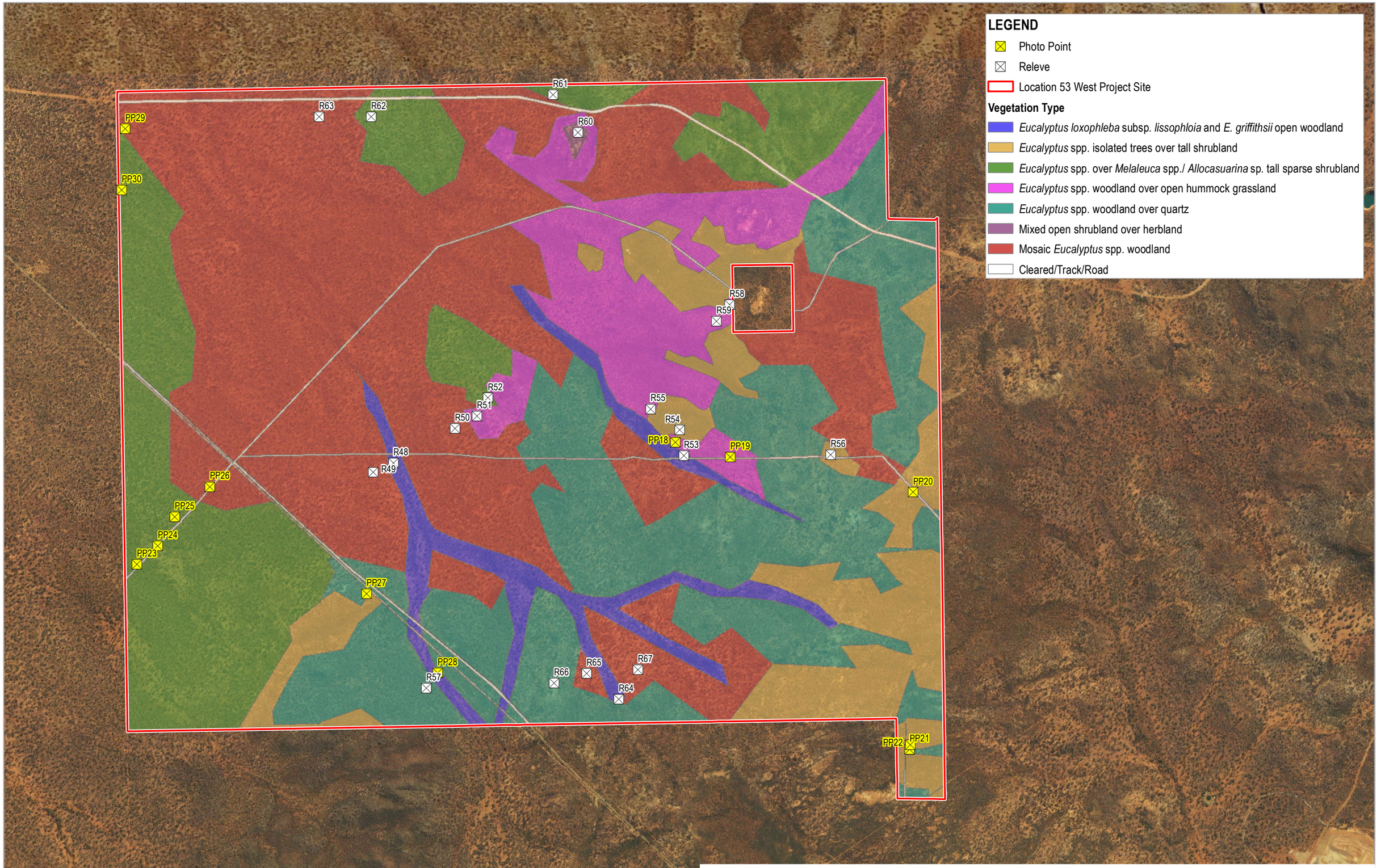

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GHD

HBJ Minerals Pty Ltd
Flora and Fauna Surveys Location 45 and 53

Vegetation Units and Sample Locations

Project No. **61-36816**
Revision No. **0**
Date **17 May 2018**

FIGURE 3

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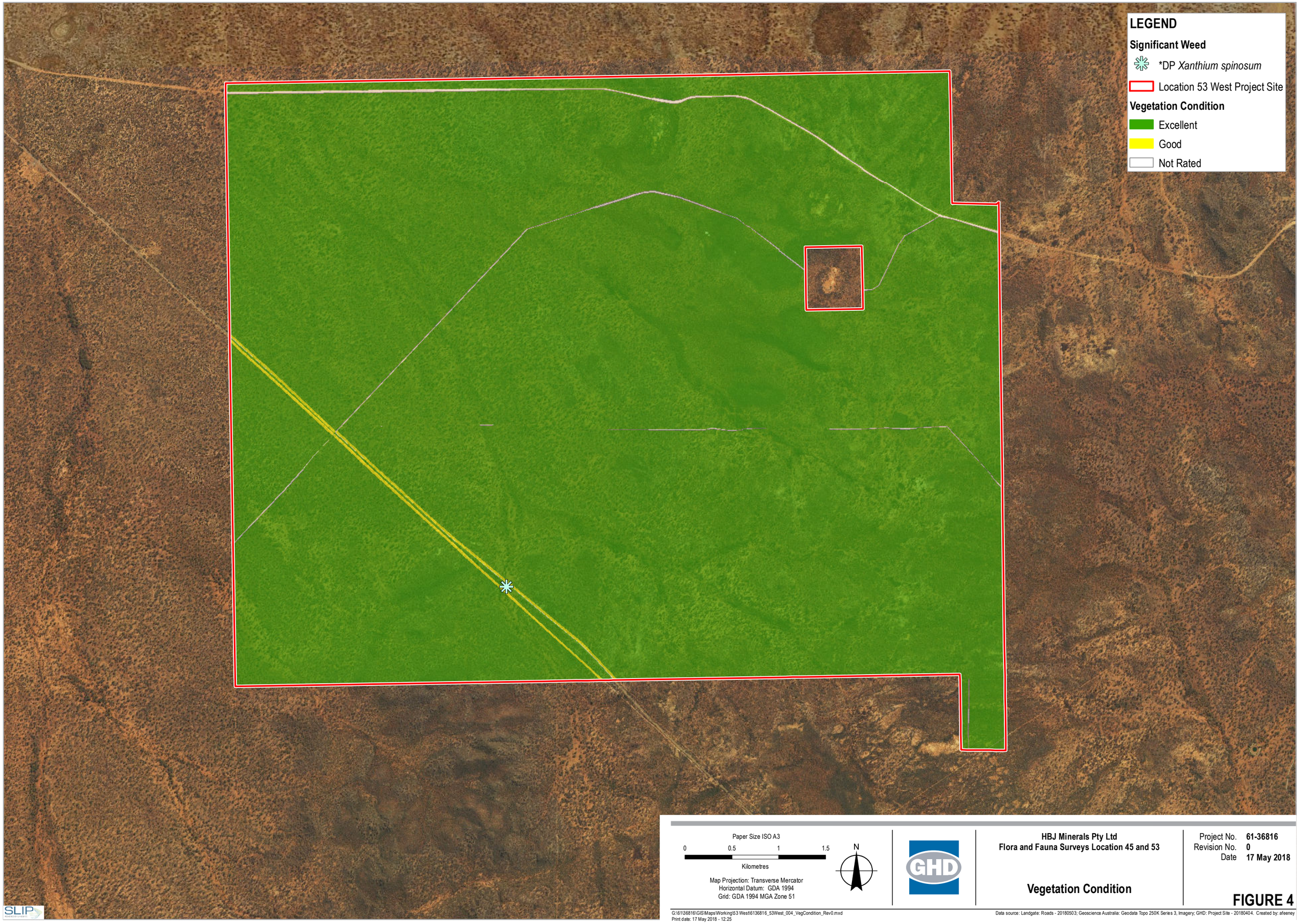

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Kilometres

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HBJ Minerals Pty Ltd
Flora and Fauna Surveys Location 45 and 53

Vegetation Condition

Project No. **61-36816**
Revision No. **0**
Date **17 May 2018**

FIGURE 4

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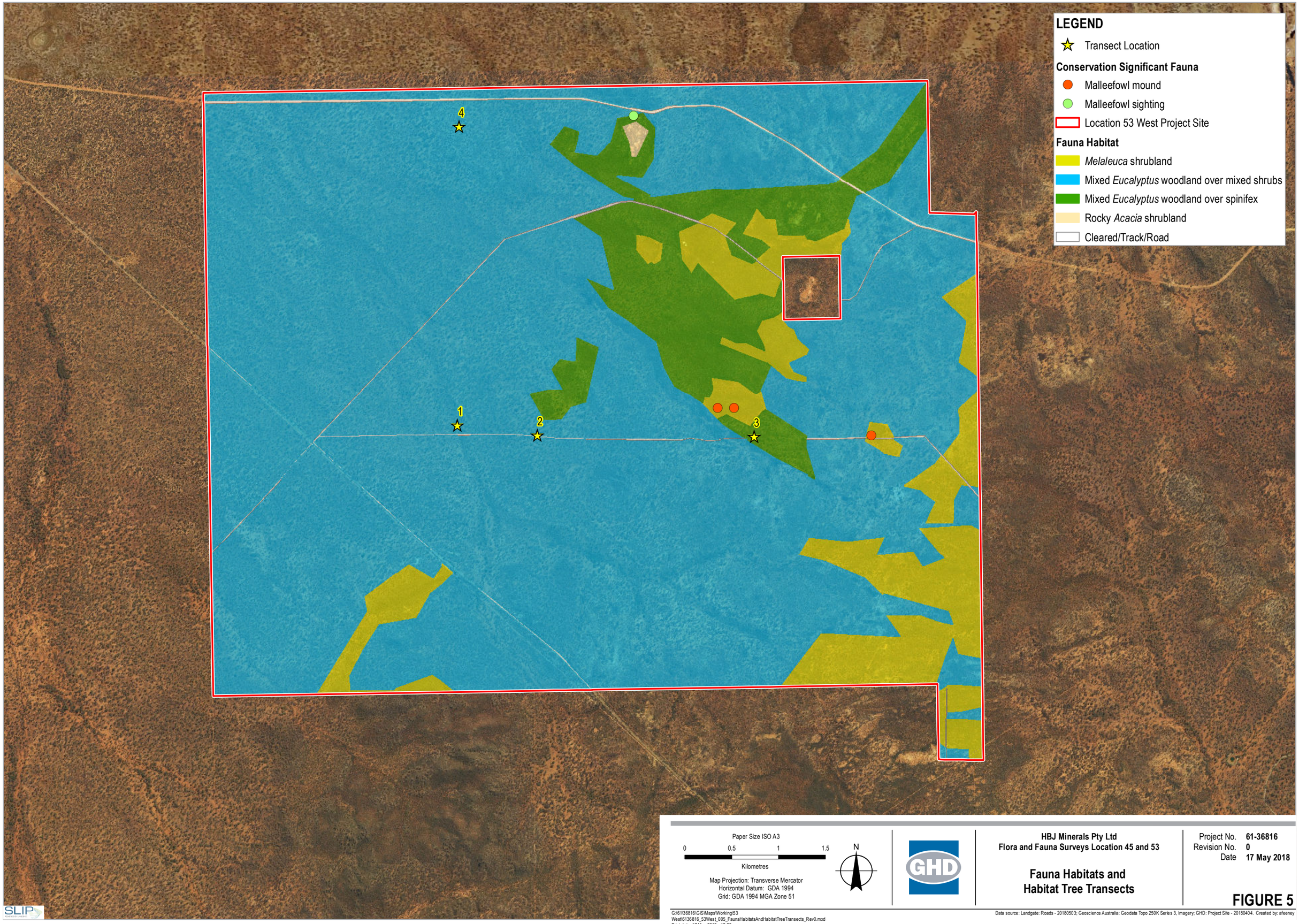

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Kilometres

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Grid: GDA 1994 MGA Zone 51

HBJ Minerals Pty Ltd
Flora and Fauna Surveys Location 45 and 53

Fauna Habitats and Habitat Tree Transects

Project No. **61-36816**
Revision No. **0**
Date **17 May 2018**

FIGURE 5

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Appendix B – Background information, relevant legislation and conservation codes

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities
- Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of the Environment and Energy (DoEE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DoWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DoWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

a) Native vegetation should not be cleared if it comprises a high level of biodiversity.

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

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

d) Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.

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

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

g) 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.

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

i) 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.

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

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State *Biodiversity and Conservation Act 2016*

The Biodiversity Conservation Bill 2015 was introduced to State Parliament in November 2015, and passed in September 2016. The Bill became the *Biodiversity Conservation Act 2016* (BC Act) upon receiving Assent on 21 September 2016. The BC Act will eventually fully replace both the *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act).

Several parts of the BC Act were proclaimed by the State Governor in the Government Gazette and came into effect on 3 December 2016. However, provisions that replace those existing under the WC Act and Sandalwood Act (including threatened species listings and controls over the taking and keeping of native species) and their associated Regulations cannot be brought into effect until the necessary Biodiversity Conservation Regulations have been made. It is hoped the new Regulations will be completed and ready to commence by late 2017.

State *Wildlife Conservation Act 1950*

The WC Act provides for the conservation and protection of wildlife. It is administered by the Department of Biodiversity, Conservation and Attractions (DBCA) and applies to both flora and fauna. Any person wanting to capture, collect, disturb or study fauna requires a permit to do so. A permit is required under the WC Act if removal of threatened species is required.

State *Biosecurity and Agriculture Management Act 2007*

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976.* The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

DPIRD Categories for Declared Pests under the BAM Act

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

Background information

Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the EP Act. The Table below outlines the aspects of areas declared as ESA in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005.

Aspects of ESAs

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the EPBC Act.
An area that is included on the Register of the National Estate (RNE), because of its natural values, under the *Australian Heritage Commission Act 1975* of the Commonwealth (the RNE was closed in 2007 and is no longer a statutory list – all references to the RNE were removed from the EPBC Act on 19 February 2012).
A defined wetland and the area within 50 m of the wetland. Defined wetlands include Ramsar wetlands, conservation category wetlands and nationally important wetlands.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a Threatened Ecological Community.
A Bush Forever Site listed in "Bush Forever" Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission.
The areas covered by the *Environmental Protection (Gnangara Mound Crown Land) Policy 1992*.
The areas covered by the *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002*.
The areas covered by the lakes to which the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes) applies.
Protected wetlands as defined in the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*.

Reserves and conservation areas

Department of Biodiversity, Conservation and Attractions managed lands and waters

DBCA manages lands and waters throughout Western Australia to conserve ecosystems and species, and to provide for recreation and appreciation of the natural environment. DBCA managed lands and waters include national parks, conservation parks and reserves, marine parks and reserves, regional parks, nature reserves, State forest and timber reserves. DBCA managed conservation estate, is vested with the Conservation Commission of Western Australia. Access to, or through, some areas of DBCA managed lands may require a permit or could be restricted due to management activities. Proposed land use changes and development proposals that abut DBCA managed lands will generally be referred to DBCA throughout the assessment process.

Wetlands

Wetlands include not only lakes with open water, but areas of seasonally, intermittently or permanently waterlogged soil.

Ramsar Listed Wetlands

The Convention of Wetlands of International Importance was signed in 1971 at the Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar Listed wetlands are “sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity … because of their ecological, botanical, zoological, limnological or hydrological importance” (DoEE 2017b). Once a Ramsar Listed Wetland is designated, the country agrees to manage its conservation and ensure its wise use. Under the Convention, wise use is broadly defined as “maintaining the ecological character of a wetland” (DoEE 2017b).

Nationally important wetlands

Wetlands of national significance are listed under the Directory of Important Wetlands in Australia. Nationally important wetlands are wetlands which meet at least one of the following criteria (DoEE 2017a):

- It is a good example of a wetland type occurring within a biogeographic region in Australia
- It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
- It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail
- The wetland supports one percent or more of the national populations of any native plant or animal taxa
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level
- The wetland is of outstanding historical or cultural significance

Vegetation extent and status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia’s biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia’s Biological Diversity (ANZECC 2000).

The extent of remnant native vegetation in WA has been assessed by Shepherd et al. (2002) and the GoWA (2016), based on broadscale vegetation association mapping by Beard (various publications). The GoWA produces Statewide Vegetation Statistics Reports that are used for a number of purposes including conservation planning, land use planning and when assessing development applications. The reports are updated at least every two years.

Vegetation condition

The vegetation condition can be assessed in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA 2016A). The scale recognises the intactness of vegetation and consists of six rating levels as outlined below.

Vegetation condition rating scale for the South West and Interzone Botanical Provinces

Condition	South West and Interzone Botanical Provinces description
Pristine	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native trees or shrubs.

Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State WC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Ecological communities

Conservation significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The DBCA also maintains a list of TECs for Western Australia; some of which are also protected under the EPBC Act. TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable.

Possible TECs that do not meet survey criteria are added to the DBCA Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

Conservation codes and definitions for TECs listed under the EPBC Act or endorsed by the WA Minister for the Environment

Categories	Definition
Federal Government Conservation Categories (EPBC Act)	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Endangered (EN)	An ecological community if, at that time: A) is not critically endangered; and B) is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Vulnerable (VU)	An ecological community if, at that time: A) is not critically endangered or endangered; and B) is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Western Australia Conservation Categories	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

Categories	Definition
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

Conservation categories and definitions for PECS as listed by the DBCA

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

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

Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016b) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a refuge
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in ‘pristine’ condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range)
- Being poorly reserved

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Flora and fauna

Conservation significant flora and fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the WC Act can warrant referral to the DoEE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for Conservation of Nature (IUCN).

The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

The State conservation level of Threatened flora and fauna has been published as Specially Protected under the WC Act, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2015 for Threatened Fauna and under Schedules 1 to 4 of the Wildlife Conservation (Rare Flora) Notice 2015 for Threatened (Declared Rare) Flora. The schedules align with the categories of the EPBC Act Threatened Fauna and Threatened Flora Lists. Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

For the purposes of this assessment, all species listed under the EPBC Act, WC Act and DBCA Priority species are considered conservation significant.

Conservation categories and definitions for EPBC Act listed flora and fauna species

Conservation category	Definition
Extinct	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A) A species known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or B) A species that has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	A species facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Endangered	A) A species not critically endangered; and B) A species facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Conservation category	Definition
Vulnerable	A) A species not critically endangered or endangered; and B) A species facing a high risk of extinction in the wild in the medium-term, as determined in accordance with the prescribed criteria.
Conservation Dependent	A) The species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or B) The following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that Section 180 provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Conservation codes and descriptions for WC Act listed flora and fauna species

Conservation category	Schedule and definition
Threatened species (T)	Published as Specially Protected under the WC Act, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora. **Threatened fauna** is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the WC Act. **Threatened flora** is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the WC Act.
Critically Endangered (CR)	Schedule 1: Threatened species considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Schedule 2: Threatened species considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Schedule 3: Threatened species considered to be facing a high risk of extinction in the wild.
Presumed Extinct (EX)	Schedule 4: Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
International Agreement (IA)	Schedule 5: Migratory birds protected under an international agreement
Conservation Dependent (CD)	Schedule 6: Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Other Specially Protected (OS)	Schedule 7: Fauna otherwise in need of special protection to ensure their conservation.

Conservation codes for DBCA listed Priority flora and fauna

Priority category	Definition
Priority 1	Poorly-known taxa Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	Poorly-known taxa Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	Poorly-known taxa Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	Rare, Near Threatened and other taxa in need of monitoring A. Rare: Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. B. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. C. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.

Other significant flora

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than a statutory listing. The EPA (2016b) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened or Priority flora or fauna species, or large populations representing a considerable proportion of the local or regional total population of a species
- Relictual status, being representation of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
- Anomalous features that indicate a potential new discovery
- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)

- The presence of restricted subspecies, varieties, or naturally occurring hybrids
- Local endemism (a restricted distribution) or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- Being poorly reserved

Other significant fauna

Fauna species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed (EPA 2010).

Introduced plants (weeds)

Declared Pests

Information on species considered to be Declared Pests is provided under *State Biosecurity and Agriculture Management Act 2007.*

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Australian state and territory governments have identified thirty-two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

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Appendix C – Desktop searches

EPBC Act PMST report

NatureMap flora report (20 km buffer)

NatureMap fauna report (20 km buffer)

Australian Government
Department of the Environment and Energy

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.

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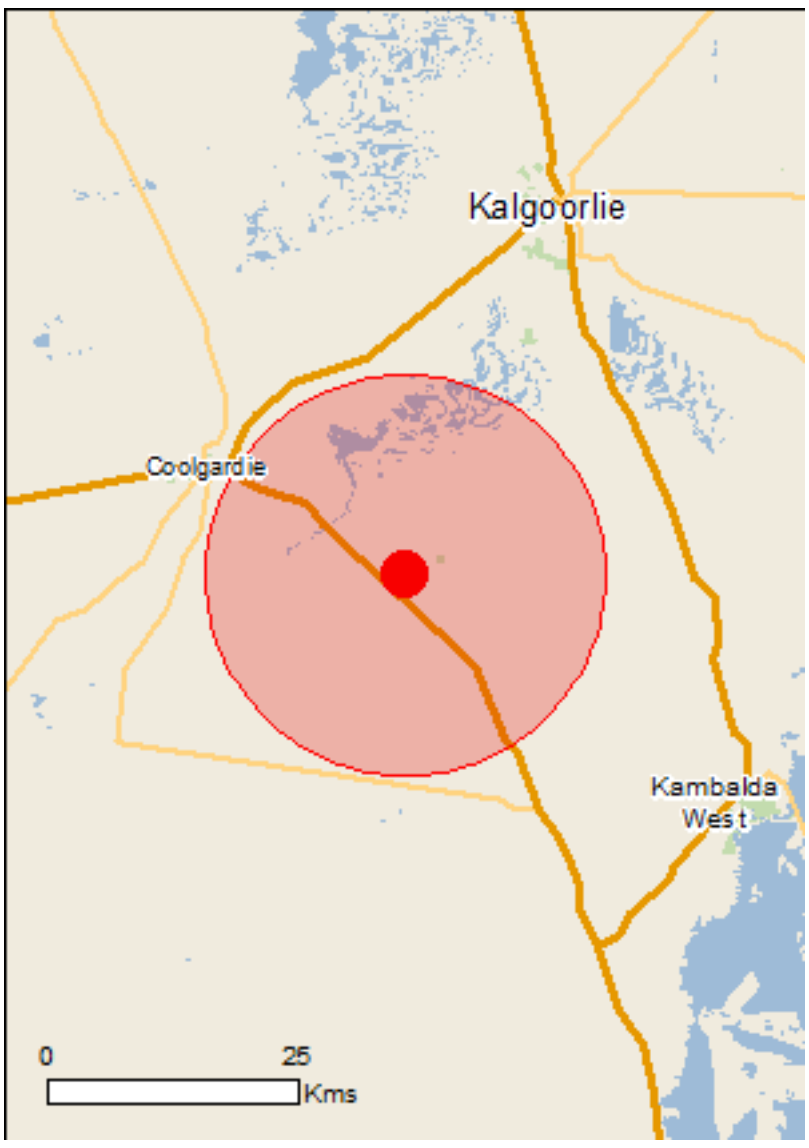

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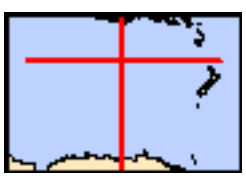

Summary

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:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	6
Listed Migratory Species:	7

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:	11
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:	14
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Historic		
Goldfields Water Supply Scheme, Western Australia	WA	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Insects		
Ogyris subterrestris petrina		
Arid Bronze Azure [77743]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Plants		
Gastrolobium graniticum		
Granite Poison [14872]	Endangered	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		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		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		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
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
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
[Tringa nebularia](#)		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Scahill Timber Reserve	WA
Yallari Timber Reserve	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 Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus		
Goat [2]		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

Name	Status	Type of Presence
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		
Carrichtera annua Ward's Weed [9511]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-31.03656 121.34004

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 22/02/2018

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 121° 20' 48" E,31° 02' 27" S
Buffer 20km
Group By Family

Family	Species	Records
Amaranthaceae	5	24
Anacardiaceae	1	1
Apiaceae	2	3
Apocynaceae	2	22
Araliaceae	1	2
Asparagaceae	1	5
Asteraceae	32	69
Boraginaceae	2	6
Brassicaceae	6	16
Campanulaceae	1	2
Casuarinaceae	3	11
Celastraceae	1	1
Chenopodiaceae	16	59
Convolvulaceae	1	1
Crassulaceae	1	1
Cupressaceae	1	4
Cyperaceae	3	4
Dilleniaceae	1	1
Ericaceae	1	1
Euphorbiaceae	6	14
Fabaceae	37	114
Frankeniaceae	2	4
Geraniaceae	2	5
Goodeniaceae	8	38
Gyrostemonaceae	1	1
Haloragaceae	2	8
Lamiaceae	9	27
Loranthaceae	2	2
Lythraceae	1	1
Malvaceae	5	10
Montiaceae	2	10
Myrtaceae	49	159
Orchidaceae	1	1
Pittosporaceae	1	1
Plantaginaceae	2	2
Plumbaginaceae	1	1
Poaceae	16	41
Portulacaceae	1	1
Pottiaceae	2	3
Proteaceae	11	21
Pteridaceae	1	2
Restionaceae	1	1
Rhamnaceae	3	13
Rutaceae	4	7
Santalaceae	3	25
Sapindaceae	6	37
Scrophulariaceae	19	90
Solanaceae	5	13
Stylidiaceae	2	2
Violaceae	1	2
Zygophyllaceae	4	15
TOTAL	**291**	**904**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Amaranthaceae					
1.	41505	*Ptilotus gaudichaudii subsp. eremita*			
2.	2729	*Ptilotus grandiflorus*			
3.	2732	*Ptilotus holosericeus*			
4.	2747	*Ptilotus obovatus (Cotton Bush)*			
5.	41000	*Ptilotus sp. Goldfields (R. Davis 10796)*			
Anacardiaceae					
6.	17056	*Schinus molle var. areira*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Apiaceae					
7.	6218	*Daucus glochidiatus (Australian Carrot)*			
8.	6252	*Platysace effusa*			
Apocynaceae					
9.	6565	*Alyxia buxifolia (Dysentery Bush)*			
10.	12949	*Marsdenia australis*			
Araliaceae					
11.	6279	*Trachymene ornata (Spongefruit)*			
Asparagaceae					
12.	1338	*Thysanotus manglesianus (Fringed Lily)*			
Asteraceae					
13.	7846	*Asteridea athrixioides*			
14.	7871	*Brachyscome ciliaris*			
15.	7882	*Brachyscome perpusilla*			
16.	7903	*Calotis hispidula (Bindy Eye)*			
17.	7922	*Cephalipterum drummondii (Pompom Head)*			
18.	7924	*Ceratogyne obionoides (Wingwort)*			
19.	12612	*Chrysocephalum apiculatum*			
20.	13138	*Chrysocephalum puteale*			
21.	20074	*Conyza sumatrensis*	Y		
22.	7950	*Cratystylis microphylla (Small-leaved Grey Bush)*			
23.	12742	*Hyalosperma demissum*			
24.	15447	*Hyalosperma glutinosum subsp. glutinosum*			
25.	19237	*Leiocarpa websteri*			
26.	12628	*Lemooria burkittii*			
27.	29418	*Monoculus monstrosus*	Y		
28.	8140	*Olearia muelleri (Goldfields Daisy)*			
29.	8145	*Olearia pimeleoides (Pimelea Daisybush, Burrobunga)*			
30.	8177	*Podolepis lessonii*			
31.	13306	*Rhodanthe battii*			
32.	13241	*Rhodanthe chlorocephala subsp. rosea*			
33.	13301	*Rhodanthe floribunda*			
34.	13293	*Rhodanthe haigii*			
35.	13249	*Rhodanthe oppositifolia subsp. oppositifolia*			
36.	13253	*Rhodanthe rubella*			
37.	8200	*Schoenia cassiniana (Schoenia)*			
38.	25881	*Senecio lacustrinus*			
39.	8236	*Streptoglossa cylindriceps*			
40.	8238	*Streptoglossa liatroides*			
41.	13298	*Thiseltonia gracillima*			
42.	12652	*Trichanthodium skirrophorum*			
43.	8253	*Triptilodiscus pygmaeus*			
44.	8273	*Vittadinia sulcata*			
Boraginaceae					
45.	6684	*Halgania andromedifolia*			
46.	31117	*Halgania cyanea var. Charleville (R.W. Purdie +111)*			
Brassicaceae					
47.	31876	*Arabidella chrysodema*			
48.	2992	*Arabidella trisecta*			
49.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
50.	3008	*Carrichtera annua (Ward's Weed)*	Y		
51.	3076	*Stenopetalum filifolium*			
52.	3077	*Stenopetalum lineare (Narrow Thread Petal)*			
Campanulaceae					
53.	7386	*Wahlenbergia gracilenta (Annual Bluebell)*			
Casuarinaceae					
54.	1721	*Allocasuarina campestris*			
55.	1730	*Allocasuarina helmsii*			
56.	12658	*Casuarina pauper (Black Oak)*			
Celastraceae					
57.	4725	*Psammomoya choretroides*			
Chenopodiaceae					
58.	11516	*Atriplex nummularia subsp. spathulata (Old Man Saltbush)*			
59.	2481	*Atriplex vesicaria (Bladder Saltbush)*			
60.	2511	*Enchylaena tomentosa (Barrier Saltbush)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
61.	2514	*Eriochiton sclerolaenoides (Woolly Bindii)*			
62.	2543	*Maireana eriosphaera*			
63.	2544	*Maireana georgei (Satiny Bluebush)*			
64.	2545	*Maireana glomerifolia (Ball Leaf Bluebush)*			
65.	2555	*Maireana pentatropis*			
66.	2561	*Maireana radiata*			
67.	11662	*Maireana tomentosa subsp. tomentosa*			
68.	2568	*Maireana trichoptera (Downy Bluebush)*			
69.	2581	*Rhagodia drummondii*			
70.	2609	*Sclerolaena diacantha (Grey Copperburr)*			
71.	2610	*Sclerolaena drummondii*			
72.	2615	*Sclerolaena fusiformis*			
73.	2625	*Sclerolaena obliquicuspis (Limestone Bindii)*			
Convolvulaceae					
74.	6612	*Convolvulus clementii*			
Crassulaceae					
75.	11709	*Crassula colorata var. acuminata*			
Cupressaceae					
76.	96	*Callitris preissii (Rottnest Island Pine, Maro)*			
Cyperaceae					
77.	31760	*Lepidosperma diurnum*			
78.	993	*Schoenus hexandrus*			
79.	1015	*Schoenus subaphyllus*			
Dilleniaceae					
80.	19779	*Hibbertia glomerosa var. glomerosa*			
Ericaceae					
81.	29493	*Leucopogon sp. Kambalda (J. Williams s.n. PERTH 07305028)*		P3	
Euphorbiaceae					
82.	4598	*Beyeria lechenaultii (Pale Turpentine Bush)*			
83.	34276	*Beyeria sulcata var. brevipes*			
84.	34257	*Beyeria sulcata var. sulcata*			
85.	4664	*Monotaxis luteiflora*			
86.	4701	*Ricinocarpos stylosus*			
87.	4704	*Ricinocarpos velutinus*			
Fabaceae					
88.	3200	*Acacia acuminata (Jam, Mangard)*			
89.	14584	*Acacia ancistrophylla var. ancistrophylla*			
90.	3216	*Acacia andrewsii*			
91.	3236	*Acacia beauverdiana (Pukkati)*			
92.	3248	*Acacia burkittii (Sandhill Wattle)*			
93.	3249	*Acacia calcarata*			
94.	44514	*Acacia collegialis*			
95.	3264	*Acacia colletioides (Wait-a-while)*			
96.	3269	*Acacia coolgardiensis (Spinifex Wattle)*			
97.	3291	*Acacia dempsteri*			
98.	32118	*Acacia effusifolia*			
99.	3324	*Acacia erinacea*			
100.	15282	*Acacia gibbosa*			
101.	3366	*Acacia hemiteles*			
102.	3393	*Acacia jennerae*			
103.	3440	*Acacia merrallii*			
104.	3452	*Acacia murrayana (Sandplain Wattle)*			
105.	3463	*Acacia nyssophylla*			
106.	3478	*Acacia pachypoda*			
107.	3495	*Acacia prainii (Prain's Wattle)*			
108.	3513	*Acacia resinimarginea*			
109.	3514	*Acacia resinistipulea*			
110.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
111.	3600	*Acacia websteri*		P1	
112.	15292	*Acacia yorkrakinensis subsp. acrita*			
113.	18427	*Bossiaea cucullata*			
114.	3802	*Daviesia croniniana*			
115.	3813	*Daviesia grahamii*			
116.	3829	*Daviesia pachyloma*			
117.	10777	*Gompholobium gompholobioides*			
118.	4043	*Kennedia prorepens*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
119.	17641	*Leptosema cervicorne*			
120.	17645	*Senna artemisioides*			
121.	12276	*Senna artemisioides subsp. filifolia*			
122.	12315	*Senna pleurocarpa var. angustifolia*			
123.	4220	*Swainsona canescens (Grey Swainsona)*			
124.	35840	*Templetonia ceracea*			
Frankeniaceae					
125.	5204	*Frankenia interioris*			
126.	5212	*Frankenia setosa (Bristly Frankenia)*			
Geraniaceae					
127.	4334	*Erodium crinitum (Corkscrew)*			
128.	4335	*Erodium cygnorum (Blue Heronsbill)*			
Goodeniaceae					
129.	19069	*Brunonia sp. Goldfields (K.R. Newbey 6044)*			
130.	7419	*Coopernookia strophiolata*			
131.	7456	*Dampiera luteiflora (Yellow Dampiera)*			
132.	7477	*Dampiera stenostachya (Narrow-spiked Dampiera)*			
133.	13158	*Dampiera tenuicaulis var. curvula*			
134.	13159	*Dampiera tenuicaulis var. tenuicaulis*			
135.	7514	*Goodenia havilandii*			
136.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
Gyrostemonaceae					
137.	2778	*Codonocarpus cotinifolius (Native Poplar, Kundurangu)*			
Haloragaceae					
138.	33620	*Glischrocaryon angustifolium*			
139.	6180	*Haloragis trigonocarpa*			
Lamiaceae					
140.	6747	*Cyanostegia angustifolia (Tinsel-flower)*			
141.	6771	*Dicrastylis parvifolia*			
142.	6779	*Lachnostachys coolgardiensis*			
143.	6812	*Pityrodia lepidota*			
144.	15822	*Prostanthera althoferi subsp. althoferi*			
145.	6912	*Prostanthera campbellii*			
146.	6916	*Prostanthera grylloana*			
147.	6917	*Prostanthera incurvata*			
148.	9247	*Westringia rigida (Stiff Westringia)*			
Loranthaceae					
149.	2369	*Amyema benthamii*			
150.	2380	*Amyema miquelii (Stalked Mistletoe)*			
Lythraceae					
151.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
Malvaceae					
152.	17725	*Hannafordia bissillii subsp. latifolia*			
153.	41544	*Malva weinmanniana*			
154.	4964	*Radyera farragei (Knobby Hibiscus)*			
155.	4970	*Sida calyxhymenia (Tall Sida)*			
156.	16924	*Sida spodochroma*			
Montiaceae					
157.	2846	*Calandrinia calyptrata (Pink Purslane)*			
158.	2853	*Calandrinia eremaea (Twining Purslane)*			
Myrtaceae					
159.	5581	*Eucalyptus campaspe (Silver Gimlet)*			
160.	14300	*Eucalyptus celastroides subsp. celastroides (Mirret)*			
161.	5607	*Eucalyptus corrugata (Rough-fruited Mallee)*			
162.	5612	*Eucalyptus cylindrocarpa (Woodline Mallee)*			
163.	5665	*Eucalyptus griffithsii (Griffith's Grey Gum)*			
164.	5673	*Eucalyptus horistes*			
165.	15682	*Eucalyptus leptophylla (Narrow-leaved Red Mallee)*			
166.	13056	*Eucalyptus leptopoda subsp. subluta*			
167.	5697	*Eucalyptus lesouefii (Goldfields Blackbutt)*			
168.	5701	*Eucalyptus longicornis (Red Morrel, Moril)*			
169.	20802	*Eucalyptus longissima*			
170.	5726	*Eucalyptus oleosa (Giant Mallee)*			
171.	20091	*Eucalyptus oleosa subsp. oleosa*			
172.	5742	*Eucalyptus petraea (Granite Rock Box)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
173.	5745	*Eucalyptus pileata (Capped Mallee)*			
174.	18580	*Eucalyptus planipes*			
175.	5747	*Eucalyptus platycorys (Boorabbin Mallee)*			
176.	19064	*Eucalyptus prolixa*			
177.	12380	*Eucalyptus ravida (Silver-topped Gimlet)*			
178.	5761	*Eucalyptus rigidula (Stiff-leaved Mallee)*			
179.	12693	*Eucalyptus salicola (Salt Gum)*			
180.	5766	*Eucalyptus salmonophloia (Salmon Gum, Wurak)*			
181.	5767	*Eucalyptus salubris (Gimlet)*			
182.	5780	*Eucalyptus stricklandii (Strickland's Gum)*			
183.	5792	*Eucalyptus torquata (Coral Gum)*			
184.	5793	*Eucalyptus transcontinentalis (Redwood, Pungul)*			
185.	18293	*Eucalyptus urna*			
186.	5798	*Eucalyptus websteriana (Webster's Mallee)*			
187.	5802	*Eucalyptus yilgarnensis (Yorrell)*			
188.	16722	*Euryomyrtus maidenii*			
189.	5815	*Homalocalyx thryptomenoides*			
190.	5847	*Leptospermum erubescens (Roadside Teatree)*			
191.	5848	*Leptospermum fastigiatum*			
192.	12692	*Leptospermum subtenue*			
193.	5865	*Malleostemon roseus*			
194.	5866	*Malleostemon tuberculatus*			
195.	15063	*Melaleuca acuminata subsp. acuminata*			
196.	19486	*Melaleuca hamata*			
197.	5922	*Melaleuca lanceolata (Rottnest Teatree, Moonah)*			
198.	5925	*Melaleuca lateriflora (Gorada)*			
199.	5966	*Melaleuca sheathiana (Boree, Buri)*			
200.	5984	*Melaleuca uncinata (Broom Bush, Kwidjard)*			
201.	20287	*Melaleuca zeteticorum*			
202.	19787	*Micromyrtus monotaxis*			
203.	6002	*Micromyrtus stenocalyx*			
204.	19699	*Thryptomene australis subsp. brachyandra*			
205.	36017	*Thryptomene sp. Londonderry (R.H. Kuchel 1763)*		P1	
206.	6068	*Thryptomene urceolaris*			
207.	6113	*Verticordia pritzelii (Pritzel's Featherflower)*			
Orchidaceae					
208.	18657	*Pterostylis sp. inland (A.C. Beauglehole 11880)*			
Pittosporaceae					
209.	19744	*Pittosporum angustifolium*			
Plantaginaceae					
210.	7300	*Plantago drummondii (Sago Weed)*			
211.	14198	*Plantago sp. Mt Magnet (A.S. George 6793)*			
Plumbaginaceae					
212.	6489	*Limonium sinuatum (Perennial Sea Lavender)*	Y		
Poaceae					
213.	207	*Aristida contorta (Bunched Kerosene Grass)*			
214.	17232	*Austrostipa blackii*		P3	
215.	17237	*Austrostipa elegantissima*			
216.	17238	*Austrostipa eremophila*			
217.	17246	*Austrostipa nitida*			
218.	17247	*Austrostipa platychaeta*			
219.	17251	*Austrostipa scabra*			
220.	17255	*Austrostipa trichophylla*			
221.	290	*Dactyloctenium radulans (Button Grass)*			
222.	356	*Enneapogon avenaceus (Bottle Washers)*			
223.	417	*Eriachne pulchella (Pretty Wanderrie)*			
224.	490	*Monachather paradoxus*			
225.	552	*Phalaris paradoxa (Paradoxa Grass)*	Y		
226.	40425	*Rytidosperma caespitosum*			
227.	40427	*Rytidosperma setaceum*			
228.	18326	*Urochloa panicoides*	Y		
Portulacaceae					
229.	2884	*Portulaca oleracea (Purslane, Wakati)*			
Pottiaceae					
230.	32346	*Didymodon torquatus*			
231.	32444	*Tortula atrovirens*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Proteaceae					
232.	1949	*Grevillea acuaria*			
233.	2009	*Grevillea georgeana*		P3	
234.	19435	*Grevillea hookeriana subsp. hookeriana*			
235.	19541	*Grevillea nematophylla subsp. nematophylla*			
236.	15981	*Grevillea obliquistigma subsp. obliquistigma*			
237.	13458	*Grevillea sarissa subsp. sarissa*			
238.	2104	*Grevillea teretifolia (Round Leaf Grevillea)*			
239.	2157	*Hakea erecta*			
240.	2163	*Hakea francisiana (Emu Tree)*			
241.	2182	*Hakea minyma*			
242.	14446	*Petrophile arcuata*			
Pteridaceae					
243.	12818	*Cheilanthes sieberi subsp. sieberi*			
Restionaceae					
244.	1074	*Lepidobolus deserti*			
Rhamnaceae					
245.	16183	*Cryptandra aridicola*			
246.	4815	*Pomaderris forrestiana*			
247.	16986	*Trymalium myrtillus subsp. myrtillus*			
Rutaceae					
248.	11274	*Boronia coerulescens subsp. spinescens*			
249.	4498	*Phebalium clavatum*		P2	
250.	4500	*Phebalium filifolium (Slender Phebalium)*			
251.	4504	*Phebalium tuberculosum*			
Santalaceae					
252.	10977	*Exocarpos aphyllus (Leafless Ballart)*			
253.	2356	*Santalum acuminatum (Quandong, Warnga)*			
254.	2359	*Santalum spicatum (Sandalwood, Wilarak)*			
Sapindaceae					
255.	11730	*Alectryon oleifolius subsp. canescens*			
256.	4769	*Dodonaea lobulata (Bead Hopbush)*			
257.	4770	*Dodonaea microzyga*			
258.	12034	*Dodonaea microzyga var. acrolobata*			
259.	4780	*Dodonaea stenozyga*			
260.	11247	*Dodonaea viscosa subsp. angustissima*			
Scrophulariaceae					
261.	7180	*Eremophila alternifolia (Poverty Bush)*			
262.	16377	*Eremophila caerulea subsp. caerulea*			
263.	7189	*Eremophila clarkei (Turpentine Bush)*			
264.	17156	*Eremophila clavata*			
265.	7193	*Eremophila decipiens (Slender Fuchsia)*			
266.	14895	*Eremophila decipiens subsp. decipiens*			
267.	7195	*Eremophila dempsteri*			
268.	7212	*Eremophila gibbosa*			
269.	14340	*Eremophila glabra subsp. glabra*			
270.	7219	*Eremophila granitica (Thin-leaved Poverty Bush)*			
271.	15112	*Eremophila interstans subsp. interstans*			
272.	7226	*Eremophila ionantha (Violet-flowered Eremophila)*			
273.	14632	*Eremophila oblonga*			
274.	15003	*Eremophila oldfieldii subsp. angustifolia*			
275.	18570	*Eremophila oppositifolia subsp. angustifolia*			
276.	14594	*Eremophila parvifolia subsp. auricampa*			
277.	10780	*Eremophila psilocalyx*			
278.	7264	*Eremophila saligna (Willowy Eremophila)*			
279.	7267	*Eremophila scoparia (Broom Bush ()*			
Solanaceae					
280.	6966	*Duboisia hopwoodii (Pituri, Kundugu)*			
281.	6967	*Lycium australe (Australian Boxthorn)*			
282.	7013	*Solanum hoplopetalum (Thorny Solanum)*			
283.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
284.	7023	*Solanum nummularium (Money-leaved Solanum)*			
Stylidiaceae					
285.	7685	*Stylidium arenicola*			
286.	7740	*Stylidium induratum (Desert Triggerplant)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Violaceae					
287.	11973	*Hybanthus floribundus subsp. curvifolius*			
Zygophyllaceae					
288.	4385	*Zygophyllum apiculatum (Gallweed)*			
289.	4388	*Zygophyllum compressum*			
290.	4389	*Zygophyllum eremaeum*			
291.	4394	*Zygophyllum ovatum (Dwarf Twinleaf)*			

Conservation Codes
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S - Other specially protected fauna
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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 22/02/2018

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	121° 20' 24" E,31° 02' 12" S
Buffer	20km
Group By	Species Group

Species Group	Species	Records
Bird	70	241
Invertebrate	16	20
Mammal	3	4
Reptile	34	92
TOTAL	**123**	**357**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Bird					
1.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
2.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
3.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
4.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
5.	24312	*Anas gracilis (Grey Teal)*			
6.	24316	*Anas superciliosa (Pacific Black Duck)*			
7.	24561	*Anthochaera carunculata (Red Wattlebird)*			
8.	24318	*Aythya australis (Hardhead)*			
9.		*Barnardius zonarius*			
10.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
11.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
12.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
13.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
14.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
15.	24399	*Columba livia (Domestic Pigeon)*	Y		
16.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
17.	24416	*Corvus bennetti (Little Crow)*			
18.	25592	*Corvus coronoides (Australian Raven)*			
19.	25593	*Corvus orru (Torresian Crow)*			
20.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
21.	25595	*Cracticus tibicen (Australian Magpie)*			
22.	25596	*Cracticus torquatus (Grey Butcherbird)*			
23.	24322	*Cygnus atratus (Black Swan)*			
24.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
25.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
26.	24470	*Dromaius novaehollandiae (Emu)*			
27.	24650	*Drymodes brunneopygia (Southern Scrub-robin)*			
28.		*Egretta novaehollandiae*			
29.		*Elanus axillaris*			
30.		*Eolophus roseicapillus*			
31.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
32.	25621	*Falco berigora (Brown Falcon)*			
33.	24471	*Falco berigora subsp. berigora (Brown Falcon)*			
34.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
35.	25623	*Falco longipennis (Australian Hobby)*			
36.	25727	*Fulica atra (Eurasian Coot)*			
37.	25530	*Gerygone fusca (Western Gerygone)*			
38.	24443	*Grallina cyanoleuca (Magpie-lark)*			
39.	24295	*Haliastur sphenurus (Whistling Kite)*			
40.	25734	*Himantopus himantopus (Black-winged Stilt)*			
41.	24491	*Hirundo neoxena (Welcome Swallow)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
42.	24557	*Leipoa ocellata (Malleefowl)*		T	
43.	25659	*Lichenostomus leucotis (White-eared Honeyeater)*			
44.	25661	*Lichmera indistincta (Brown Honeyeater)*			
45.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
46.	24551	*Malurus pulcherrimus (Blue-breasted Fairy-wren)*			
47.	24583	*Manorina flavigula (Yellow-throated Miner)*			
48.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
49.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
50.	25693	*Microeca fascinans (Jacky Winter)*			
51.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
52.	24618	*Oreoica gutturalis (Crested Bellbird)*			
53.	24619	*Pachycephala inornata (Gilbert's Whistler)*			
54.	25682	*Pardalotus striatus (Striated Pardalote)*			
55.	48061	*Petrochelidon nigricans (Tree Martin)*			
56.	24659	*Petroica goodenovii (Red-capped Robin)*			
57.	24409	*Phaps chalcoptera (Common Bronzewing)*			
58.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
59.	25703	*Podargus strigoides (Tawny Frogmouth)*			
60.	24683	*Pomatostomus superciliosus (White-browed Babbler)*			
61.	24769	*Porzana fluminea (Australian Spotted Crake)*			
62.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
63.	24278	*Pyrrholaemus brunneus (Redthroat)*			
64.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
65.	30948	*Smicrornis brevirostris (Weebill)*			
66.	25597	*Strepera versicolor (Grey Currawong)*			
67.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
68.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
69.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
70.	24851	*Turnix velox (Little Button-quail)*			
Invertebrate					
71.		*Allodessus bistrigatus*			
72.		*Aname armigera*			
73.		*Anidiops villosus*			
74.		*Backobourkia heroine*			
75.		*Berosus nutans*			
76.		*Enochrus elongatulus*			
77.		*Eriophora biapicata*			
78.		*Lampona cylindrata*			
79.		*Lamponina scutata*			
80.		*Latrodectus hasseltii*			
81.		*Nicodamus mainae*			
82.	33987	*Ogyris subterrestris subsp. petrina (Arid Bronze Azure Butterfly)*		T	
83.		*Ostracoda (unident.)*			
84.		*Ozestheria packardi (formerly Caenestheriella)*			
85.		*Scolopendra morsitans*			
86.		*Tamopsis circumvidens*			
Mammal					
87.	24108	*Sminthopsis crassicaudata (Fat-tailed Dunnart)*			
88.	24109	*Sminthopsis dolichura (Little long-tailed Dunnart)*			
89.	24206	*Vespadelus regulus (Southern Forest Bat)*			
Reptile					
90.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
91.	30893	*Cryptoblepharus buchananii*			
92.	24871	*Ctenophorus cristatus (Bicycle Dragon)*			
93.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
94.	24886	*Ctenophorus reticulatus (Western Netted Dragon)*			
95.	24888	*Ctenophorus salinarum (Salt Pan Dragon)*			
96.	25465	*Ctenotus uber (Spotted Ctenotus)*			
97.	25080	*Ctenotus uber subsp. uber (Spotted Ctenotus)*			
98.	24995	*Delma australis*			
99.	25247	*Demansia psammophis subsp. psammophis (Yellow-faced Whipsnake)*			
100.	25469	*Diplodactylus granariensis*			
101.	25092	*Egernia depressa (Southern Pygmy Spiny-tailed Skink)*			
102.	25094	*Egernia formosa*			
103.	25109	*Eremiascincus richardsonii (Broad-banded Sand Swimmer)*			
104.	24957	*Gehyra purpurascens*			
105.	24959	*Gehyra variegata*			
106.	25115	*Hemiergis initialis subsp. initialis*			
107.	42408	*Hesperoedura reticulata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
108.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
109.	25155	*Lerista muelleri*			
110.	25162	*Lerista picturata*			
111.	42411	*Lerista timida*			
112.	30935	*Lucasium maini*			
113.	24904	*Moloch horridus (Thorny Devil)*			
114.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
115.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
116.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
117.	24923	*Strophurus assimilis (Goldfields Spiny-tailed Gecko)*			
118.	24927	*Strophurus elderi*			
119.	25269	*Suta fasciata (Rosen's Snake)*			
120.	30814	*Tympanocryptis cephalus (Pebble Dragon)*			
121.	39408	*Tympanocryptis lineata (Lined Earless Dragon)*			
122.	24983	*Underwoodisaurus milii (Barking Gecko)*			
123.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			

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

Appendix D – Flora data

Flora species list

Flora likelihood of occurrence assessment guidelines

Flora likelihood of occurrence assessment

Flora species list

Family	*Taxon*	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Amaranthaceae	*Ptilotus obovatus*		x	x	x	x	x	x	
Apocynaceae	*Alyxia buxifolia*		x	x	x		x	x	x
Apocynaceae	*Rhyncharrhena linearis*		x	x			x		
Asparagaceae	*Lomandra effusa*				x				
Asteraceae	Asteraceae sp.				x	x			
Asteraceae	Asteraceae sp.2						x	x	x
Asteraceae	*Cratystylis microphylla*								x
Asteraceae	*Olearia muelleri*			x	x		x	x	x
Asteraceae	*Xanthium spinosum*	*DP	x					x	x
Boraginaceae	*Halgania andromedifolia*				x		x		x
Casuarinaceae	*Allocasuarina acutivalvis* subsp. *acutivalvis*			x	x		x		
Chenopodiaceae	*Atriplex nummularia* subsp. *spathulata*							x	x
Chenopodiaceae	*Atriplex vesicaria*						x	x	x
Chenopodiaceae	*Enchylaena tomentosa*		x			x	x	x	x
Chenopodiaceae	*Maireana suaedifolia*		x						
Chenopodiaceae	*Maireana triptera*		x				x	x	x
Chenopodiaceae	*Maireana villosa*						x	x	
Chenopodiaceae	*Rhagodia drummondii*		x		x	x	x		x
Chenopodiaceae	*Sclerolaena brevifolia*						x	x	
Chenopodiaceae	*Tecticornia halocnemoides*						x		
Cupressaceae	*Callitris preissii*				x				
Cyperaceae	*Lepidosperma sanguinolentum*				x				
Fabaceae	*Acacia acuminata*		x	x	x	x	x		
Fabaceae	*Acacia colletioides*		x		x			x	x
Fabaceae	*Acacia erinacea*								x
Fabaceae	*Acacia hemiteles*		x	x	x		x	x	x

Family	*Taxon*	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Fabaceae	*Acacia jennerae*		x						
Fabaceae	*Acacia merrallii*						x		
Fabaceae	*Acacia* sp.		x		x				
Fabaceae	*Acacia tetragonophylla*		x	x	x		x		
Fabaceae	*Senna artemisioides*		x	x	x		x	x	x
Goodeniaceae	*Scaevola spinescens*		x	x	x	x	x	x	x
Hemerocallidaceae	*Dianella revoluta* var. *divaricata*				x				
Lamiaceae	*Prostanthera grylloana*			x				x	
Lamiaceae	*Prostanthera* sp.			x					
Lamiaceae	*Salvia verbenaca*	*	x				x	x	x
Lamiaceae	*Westringia rigida*				x				
Loranthaceae	*Amyema* sp.		x				x		x
Loranthaceae	*Amyema* sp.1			x					
Malvaceae	*Lawrencia squamata*		x						
Myrtaceae	*Eucalyptus celastroides* subsp. *celastroides*						x	x	x
Myrtaceae	*Eucalyptus griffithsii*		x	x	x		x		x
Myrtaceae	*Eucalyptus lesouefii*			x			x	x	x
Myrtaceae	*Eucalyptus longissima*			x	x		x	x	
Myrtaceae	*Eucalyptus loxophleba* subsp. *lissophloia*		x		x		x	x	
Myrtaceae	*Eucalyptus oleosa* subsp. *oleosa*			x	x		x	x	x
Myrtaceae	*Eucalyptus salmonophloia*						x	x	
Myrtaceae	*Melaleuca acuminata*				x				
Myrtaceae	*Melaleuca eleuterostachya*					x			
Myrtaceae	*Melaleuca lanceolata*						x		
Myrtaceae	*Melaleuca sheathiana*						x		
Myrtaceae	*Melaleuca uncinata*			x					
Oxalidaceae	*Oxalis pes-caprae*	*	x				x	x	x
Poaceae	*Austrostipa* sp.		x						

Family	*Taxon*	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Poaceae	Poaceae sp.		x		x	x			
Poaceae	Poaceae sp.1		x						
Poaceae	*Rytidosperma* sp.		x						
Poaceae	*Triodia* sp.				x		x		
Proteaceae	*Grevillea acuaria*		x		x			x	x
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*					x			
Rhamnaceae	*Pomaderris forrestiana*				x		x		
Rutaceae	*Phebalium canaliculatum*			x					
Santalaceae	*Exocarpos aphyllus*		x				x	x	x
Santalaceae	*Santalum acuminatum*						x	x	x
Santalaceae	*Santalum spicatum*		x		x		x		
Sapindaceae	*Dodonaea lobulata*		x	x	x	x	x		
Scrophulariaceae	*Eremophila ?caperata*		x	x	x	x			
Scrophulariaceae	*Eremophila ?granitica*				x				
Scrophulariaceae	*Eremophila ?rugosa*		x						
Scrophulariaceae	*Eremophila alternifolia*		x						
Scrophulariaceae	*Eremophila caperata*				x	x			x
Scrophulariaceae	*Eremophila decipiens* subsp. *decipiens*		x		x			x	
Scrophulariaceae	*Eremophila georgei*					x			
Scrophulariaceae	*Eremophila glabra* subsp. *glabra*				x		x	x	x
Scrophulariaceae	*Eremophila interstans* subsp. *virgata*							x	x
Scrophulariaceae	*Eremophila ionantha*		x				x	x	
Scrophulariaceae	*Eremophila oppositifolia* subsp. *angustifolia*		x	x	x		x	x	x
Scrophulariaceae	*Eremophila parvifolia* subsp. *auricampa*						x		
Scrophulariaceae	*Eremophila pustulata*							x	x
Scrophulariaceae	*Eremophila scoparia*		x		x		x	x	x
Scrophulariaceae	*Eremophila serrulata*			x		x			
Solanaceae	*Lycium australe*		x						

Family	*Taxon*	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Solanaceae	*Solanum nummularia subsp. spathulata*						x	x	
Grand Total	83		38	23	37	14	44	35	32

Flora likelihood of occurrence assessment guidelines

Likelihood of occurrence	Guideline
Known	Species recorded within the survey area from field survey results.
Likely	Species previously recorded within the study area and large areas of suitable habitat occur in the survey area.
Possible	Species previously recorded within the study area and areas of suitable habitat occur/may occur in the survey area.
Unlikely	Species previously recorded within the study area, but suitable habitat does not occur in the survey area.
Highly unlikely	Species not previously recorded within the study area, suitable habitat does not occur in the survey area and/or the survey area is outside the natural distribution of the species.
Other considerations	Intensity of survey, availability of access, growth form type, recorded flowering times, cryptic nature of species

Source information - desktop searches

PMST – DEE Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area

DBCA – DBCA (2007–) records of threatened flora, database search within the study area (accessed February 2018)

NM – DBCA NatureMap (accessed February 2018)

Flora likelihood of occurrence assessment for conservation significant flora

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DEE 2018)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
Fabaceae	*Gastrolobium graniticum*	T	En	Erect, open shrub, to 2.5 m high. Flower yellow and orange and red, Aug to Sep. Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines.	Unlikely: species previously recorded > 15 km from the survey area and no suitable habitat exists	PMST DBCA
Fabaceae	*Acacia coatesii*	P1		Dense, compact, circular, low-domed, very rigid sub-shrub 10-20 cm tall and ca 1 m diameter. Red-brown shallow sandy clay soils	Possible: Species previously recorded < 15 km from the survey area and some suitable habitat exists	DBCA
Fabaceae	*Acacia websteri*	P1		Shrub, 1.2-5 m high, bark fibrous. Fl. yellow. Red sand, clay or loam. Low-lying areas, flats.	Likely: Species previously recorded < 15 km from the survey area and	*NatureMap* DBCA

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DEE 2018)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
					suitable habitat exists	
Goodeniaceae	*Dampiera plumosa*	P1		Erect perennial, herb, 0.15-0.2 m high. Fl. blue, Oct. Red sandy soils.	Possible: Species previously recorded < 15 km from the survey area and some suitable habitat exists	DBCA
Scrophulariaceae	*Eremophila praecox*	P1		Broom-like shrub, 1.5-3 m high. Fl. purple, Oct or Dec. Red/brown sandy loam. Undulating plains.	Possible: Species previously recorded < 19 km from the survey area and some suitable habitat exists	DBCA
Myrtaceae	*Eucalyptus websteriana* subsp*. norsemanica*	P1		Spreading mallee, to 3 m high, bark 'minniritchi'. Fl. yellow, Sep to Nov. Rocky rises.	Unlikely: species previously recorded > 18 km from the survey area and no suitable habitat exists	DBCA
Myrtaceae	*Thryptomene* sp. Coolgardie (E. Kelso s.n. 1902)	P1		None available	Possible: Species previously recorded < 14 km from the survey area. No information regarding habitat is available, therefore this species can't be overlooked	DBCA
Myrtaceae	*Thryptomene* sp. Londonderry (R.H. Kuchel 1763)	P1		Shrub 1.5 m high x 1 m wide. Small pink/white flowers.	Likely: species previously recorded < 2 km from the survey area and large areas of suitable habitat occur	DBCA *NatureMap*

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DEE 2018)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
Poaceae	*Austrostipa* sp. Dowerin (G. Wiehl F 8004)	P2		Perennial caespitose grass, 0.3 m x 0.2 m. Flowers brown. Dry red sand / loam	Possible: Species previously recorded < 17 km from the survey area and suitable habitat exists	DBCA
Goodeniaceae	*Goodenia salina*	P2		Annual, herb, 0.02-0.2 m high. Well-drained, saline, grey or brown loamy clay. Low gypseous dunes near salt pans	Unlikely: suitable habitat doesn't exist in the survey area	DBCA
Rutaceae	*Phebalium clavatum*	P2		Upright shrub, 0.5-1.5 m high. Fl. white, Aug to Sep. Sandy soils. Sandplains.	Unlikely: species previously recorded > 12 km from the survey area and no suitable habitat occurs in the survey area	*NatureMap* DBCA
Brassicaceae	*Lepidium merrallii*	P2		Erect to spreading annual (possibly ephemeral), herb, 0.03-0.15 m high. Moist clay/ loam, valley floors	Unlikely: suitable habitat doesn't exist in the survey area	DBCA
Poaceae	*Austrostipa blackii*	P3		Tufted perennial, grass-like or herb, 1 m high. Fl. Sep to Nov. Sandy clay soils	Possible: species previously recorded within the study area and some suitable habitat occurs in the survey area	*NatureMap* DBCA
Apocynaceae	*Alyxia tetanifolia*	P3		Erect, rigid, pungent shrub, 1-2 m high, to 2.5 m wide. Fl. white-cream, May to Jun or Nov. Sandy clay, loam, concretionary gravel. Drainage lines, near lakes.	Unlikely: species previously recorded > 18 km from the survey area and suitable habitat doesn't exist in the survey area	DBCA
Asteraceae	*Chrysocephalum apiculatum* subsp. *norsemanense*	P3		Erect annual herb 40 cm high. Flowers yellow. yellow sandplains	Unlikely: species previously recorded > 14 km from the	DBCA

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DEE 2018)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
					survey area and suitable habitat doesn't exist in the survey area	
Scrophulariaceae	*Diocirea acutifolia*	P3		Low, dense, rounded shrub, 0.3-0.8 m high. Fl. white, Nov to Dec. Clay loam, gravelly loam. Undulating flats.	Possible: Species previously recorded < 10 km from the survey area and suitable habitat exists	DBCA
Proteaceae	*Grevillea georgeana*	P3		Erect to widely spreading shrub, 1-3 m high, up to 4 m wide. Fl. red/red & pink & cream, Jan or Mar or Sep to Nov. Stony loam/clay. Ironstone hilltops and slopes..	Unlikely: species previously recorded > 14 km from the survey area and suitable habitat doesn't exist in the survey area	*NatureMap* DBCA
Cyperaceae	*Isolepis australiensis*	P3		Annual, grass-like or herb (sedge), 0.03-0.055 m high. Fl. Jun or Sep. Silty sand, sandy clay. Lake margins, pools.	Unlikely: species previously recorded > 14 km from the survey area and suitable habitat doesn't exist in the survey area	WA Herb
Ericaceae	*Leucopogon* sp. Kambalda (J. Williams s.n. PERTH 07305028)	P3		Compact shrubs to 70 cm high x 80 cm wide. Fl white. Exposed breakaways and granitic outcrops.	Unlikely: species previously recorded > 13 km from the survey area and suitable habitat doesn't exist in the survey area	*NatureMap* DBCA
Asteraceae	*Notisia intonsa*	P3		Prostrate clumping annual. Red-orange clayey sand. Ironstone and quartz gravel	Unlikely: species previously recorded > 16 km from the survey area and	DBCA

Family	Taxon	Status		Description and closest record information (if available) (WA Herbarium 1998–, DEE 2018)	Likelihood of Occurrence	Source
		WC Act	EPBC Act			
					suitable habitat doesn't exist in the survey area	
Brassicaceae	*Phlegmatospermum eremaeum*	P3		Prostrate to spreading annual, herb, 0.02-0.1(-0.2) m high. Fl. white-cream, Jun or Aug to Oct. Stony loam.	Unlikely: species previously recorded > 15 km from the survey area and suitable habitat doesn't exist in the survey area	DBCA
Stylidiaceae	*Stylidium choreanthum*	P3		Creeping perennial, herb, 0.01-0.03 m high, to 0.3 m wide. Fl. pink/white, Sep to Nov. White/yellow or red sand. Plain.	Unlikely: species previously recorded > 18 km from the survey area and suitable habitat doesn't exist in the survey area	DBCA
Myrtaceae	*Eucalyptus jutsonii* subsp. *jutsonii*	P4		Mallee, 4-7 m high, bark rough over most stems, grey to light grey-brown. Red to pale orange deep sands. Undulating areas and on dunes.	Unlikely: species previously recorded > 16 km from the survey area and suitable habitat doesn't exist in the survey area	DBCA
Scrophulariaceae	*Eremophila caerulea* subsp. *merrallii*	P4		Spreading or sprawling shrub, to 0.35 m high, to 0.8 m wide. Fl. blue-purple, Oct to Dec. Sand, clay or loam. Undulating plains.	Possible: species previously recorded > 17 km from the survey area and some suitable habitat exists in the survey area	DBCA

Appendix E – Fauna data

Fauna species list

Fauna likelihood of occurrence assessment guideline and definitions

Fauna likelihood of occurrence assessment

Fauna species list

Family	Scientific Name	Common Name	Conservation Listing
Birds			
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill	
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	
Acanthizidae	*Acanthiza uropygialis*	Chestnut-rumped Thornbill	
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat	
Acanthizidae	*Smicrornis brevirostris*	Weebill	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow	
Artamidae	*Cracticus torquatus*	Grey Butcherbird	
Artamidae	*Strepera versicolor*	Grey Currawong	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	
Climacteridae	*Climacteris rufa*	Rufous Treecreeper	
Columbidae	*Phaps chalcoptera*	Common Bronzewing	
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	
Dromaiidae	*Dromaius novaehollandiae*	Emu	
Maluridae	*Malurus pulcherrimus*	Blue-breasted Fairy-wren	
Maluridae	*Malurus splendens*	Splendid Fairy-wren	
Megapode	*Leipoa ocellata*	Malleefowl	Vu
Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater	
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	
Meliphagidae	*Lichenostomus leucotis*	White-eared Honeyeater	
Meliphagidae	*Lichenostomus ornatus*	Yellow-plumed Honeyeater	
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner	
Oreoicidae	*Oreoica gutturalis*	Crested Bellbird	
Pachycephalidae	*Pachycephala inornata*	Gilbert's Whistler	
Petroicidae	*Microeca fascinans*	Jacky Winter	
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	
Psittaculidae	*Barnardius zonarius*	Australian Ringneck	
Psittaculidae	*Glossopsitta porphyrocephala*	Purple-crowned Lorikeet	
Psittaculidae	*Psephotus varius*	Mulga Parrot	
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	
Reptiles			
Agamidae	*Ctenophorus cristatus*	Crested Dragon	
Agamidae	*Ctenophorus isolepis*	Central Military Dragon	
Agamidae	*Ctenophorus maculatus*	Spotted Military Dragon	
Scincidae	*Ctenotus leonhardii*	Leonhardi's Ctenotus	
Scincidae	*Egernia depressa*	Southern Pygmy Spiny-tailed Skink	
Scincidae	*Menetia greyii*	Common Dwarf Skink	
Varanidae	*Varanus gouldii*	Sand Goanna	
Mammal			
Felidae	*Felis catus*	Feral Cat	Int
Leporidae	*Oryctolagus cuniculus*	European Rabbit	Int
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo	
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna	

Fauna likelihood of occurrence assessment guidelines

Assessment outcome	Description
Present	Species recorded during the field survey or from recent, reliable records from within or close proximity to the survey area.
Likely	Species are **likely** to occur in the survey area where there is suitable habitat within the survey area and there are recent records of occurrence of the species in close proximity to the survey area. OR Species known distribution overlaps with the survey area and there is suitable habitat within the survey area.
Unlikely	Species assessed as **unlikely** include those species previously recorded within 10 km of the survey area however: • There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the survey area. • The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area. OR Those species that have a known distribution overlapping with the survey area however: • There is limited habitat in the survey area (i.e. the type, quality and quantity of the habitat is generally poor or restricted). • The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area.
Highly unlikely	Species that are considered **highly unlikely** to occur in the survey area include: • Those species that have no suitable habitat within the survey area. • Those species that have become locally extinct, or are not known to have ever been present in the region of the survey area.

Source information - desktop searches

NM – DBCA *NatureMap* (accessed February 2018)

DBCA – SWA – DBCA (2007–) records of threatened fauna, database search within the SWA study area (accessed February 2018)

PMST – DEE Protected Matters Search Tool (PMST) to identify fauna listed under the EPBC Act potentially occurring within the study area (accessed February 2018)

Definitions

Term	Description
study area	a 20 km buffer around the survey area
survey area	the area subject to the current survey
region	the area within an approximate 20 km radius of the survey area
Cr	Critically endangered
En	Endangered
Vu	Vulnerable
IA	International agreement
Mi	Migratory
Ma	Marine
CD	Conservation dependent
OS	Other specially protected fauna
P1 – P4	Priority 1 – Priority 4

Fauna likelihood of occurrence assessment

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	*NatureMap*	EPBC PMST		
Birds							
Leipoa ocellata	Malleefowl	Vu	Vu	X	X	The Malleefowl generally occurs in semi-arid areas of Western Australia, from Carnarvon to south east of the Eyre Bird Observatory (southeast Western Australia). It occupies shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine *Callitris* woodlands, *Acacia* shrublands, *Melaleuca uncinata* vegetation or coastal heathlands. The nest is a large mound of sand or soil and organic matter (Jones and Goth 2008; Morcombe, 2004). They prefer vegetation with a dense understorey of shrubs and their breeding habitat is characterized by light soil and an abundant leaf litter, which is used in the construction of nesting mounds. Density of the canopy cover is an important feature associated with high breeding densities, with grazed areas generally have much lower densities. In the WA Wheatbelt, Malleefowl distribution is associated with landscapes with lower rainfall, greater amounts of mallee and shrubland that occur as large remnants, and lighter soil surface textures.	**Known** Species was recorded during the survey. Suitable habitat present.
Merops ornatus	Rainbow Bee-eater	IA	Ma	X		The Rainbow Bee-eater is found throughout the state except in desert regions, particularly in open forests and woodlands, with sandy, loamy soil, but also sandridges, sandpits, riverbanks, mangroves, rainforest shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. They also inhabit sand dune systems in coastal areas and at inland sites that are in close proximity to water (Morcombe 2004; Pizzey and Knight 2012). They dig out nests in open areas where there is relatively soft but firm sands, either on	**Likely** Species known from the region. Suitable habitat present.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	*NatureMap*	EPBC PMST		
						flat ground or in the side of a sandy bank (Nevill 2013).	
Calidris ferruginea	Curlew Sandpiper	Vu	CR, Mi		X	Curlew Sandpipers mainly occur in areas with soft mud conditions, including intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around nontidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are found inland less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. In WA, they are widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division, but are more sparsely distributed between Carnarvon and Dampier Archipelago (DEE 2018). They are common on the Swan Coastal Plain, particularly near large drying lakes like Thompson and Forrestdale, and Peel Inlet. They are less common along the southern coast to Esperance (Nevill 2013).	**Unlikely** Although the species has been recorded approximately 50 km to the north and north-west, the species has not been recorded within the survey area and there is no suitable habitat.
Pezoporus occidentalis	Night Parrot	CR	En		X	The Night Parrot is a highly elusive nocturnal ground dwelling parrot found in the arid and semi-arid zones of Australia. The night parrot was thought to be extinct but in 2013 it was rediscovered in Queensland (Pullen Pullen Reserve). Subsequently, the species has been found in Goneaway National Park and Diamantina National Park in Queensland and near Broome in Western Australia. The Night Parrot's habitat consists of stony rises, scattered trees and shrubs, Mulga woodland, sandy lowlands, salt lakes, clay plans, and bare gibber, with shrubby glasswort, chenopod, seeding spinifex, *Astrebla*, shrubby samphire, saltbush, bluebush, and Bassia	**Highly unlikely** The species has not been recorded in the region.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	*NatureMap*	EPBC PMST		
						associations (Pizzey and Knight 2012; TSSC 2016). They are likely to occur anywhere from inland WA west to the Pilbara and the west coast (Pizzey and Knight 2012).	
Apus pacificus	Fork-tailed Swift	IA	Mi		X	The Fork-tailed Swift is common in coastal and sub coastal areas between Carnarvon and Augusta including near and offshore islands. There are scattered records along south coast from Denmark east to Cocklebiddy on the Great Australian Bight, and sparsely scattered records inland. They are found across a range of habitats, from inland open plains to wooded areas. They are most often observed over inland plains in Australia, but sometimes recorded over coastal cliffs and beaches as well as urban areas. They have been recorded well out to sea as well as from offshore islands especially when on passage from Indonesia. This species is almost exclusively aerial (DEE 2018).	**Unlikely** Although the species has been recorded approximately 90 km to the west, they have not been recorded within the survey area.
Motacilla cinerea	Grey Wagtail	IA	Mi		X	The Grey Wagtail is an opportunistic migrant to Australia. The species typically migrates to Indonesia occasionally landing in Australia. Most records for the species are from Northern Australia and South Australia (Morcombe 2004). The non-breeding habitat only of the Grey Wagtail has a strong association with water, particularly rocky substrates along water courses but also lakes and marshes (DEE 2018). It can be found mainly in banks and rocks in fast-running freshwater habitats: rivers, creeks, streams, and around waterfalls, both in forest and open country; but occurs almost anywhere during migration (Johnstone and Storr 2004).	**Highly unlikely** The species is not known from the region.
Actitis hypoleucos	Common Sandpiper	IA	Mi		X	The Common Sandpiper is found along all coastlines of Australia and uses a wide range of coastal	**Unlikely**

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	*NatureMap*	EPBC PMST		
						wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around often narrow and steep muddy margins or rocky shores. The species has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, mangroves, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. It is often found near mangroves, and sometimes in areas of mud littered with rocks or snags (DEE 2018). They are somewhat uncommon in the south west, but can be found on Rottnest and Penguin Islands, and along the south coast all the way to the Esperance region, including the inland lakes like Lake Warden (Nevill 2013). This species is widespread and scattered, common on the north and west coasts and uncommon in the south-east and interior (Morcombe 2004).	Although the species has been recorded approximately 82 km to the north-west, the species has not been recorded within the survey area. No suitable habitat present within survey area.
Calidris acuminata	Sharp-tailed Sandpiper	IA	Mi		X	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. Sometimes they occur on rocky shores (DEE 2018). They are found throughout many wetlands on the Swan Coastal Plain, in Perth lakes with wet grassed margins and receding waters, Vasse and Harvey Estuaries, and	**Unlikely** Although the species has been recorded approximately 36 km north-west near Kopai Lake, the species has not been recorded within the survey area. No suitable habitat present within survey area.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	*NatureMap*	EPBC PMST		
						the Busselton wetlands, but are less common on the south coast until the Esperance region (Nevill 2013).	
Calidris melanotos	Pectoral Sandpiper	IA	Mi		X	In Australia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum (DEE 2018). The bird can be seen on the Swan Coastal Plain but is rare to scarce on Lake Thompson, and as well on any freshwater wetland in the southwest with shallow, well-grassed margins. They are seen at Lake Warden, Esperance, and at Lake McLarty (Nevill 2013).	**Highly unlikely** Species not known from the region.
Tringa nebularia	Common Greenshank	IA	Mi		X	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetland and has the widest distribution of any shorebird in Australia (DEE 2018).	**Highly unlikely** Although the species has been recorded approximately 40 km north, the species has not been recorded within the survey area. No suitable habitat present within the survey area.
Mammals							

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	*NatureMap*	EPBC PMST		
Dasyurus geoffroii	Western Quoll / Chuditch	Vu	Vu		X	The Chuditch inhabits eucalypt forest (especially Jarrah, *Eucalyptus marginata*), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows (Van Dyke and Strahan 2008). The species can travel large distances, has a large home range and is sparsely populated through a large portion of its range.	**Unlikely** Suitable habitat present, however the species was last recorded in the region in 1974, approximately 30 km to the south-east, near Lake Lefroy. However, the species is a wide ranging species, capable of travelling long distances.
Invertebrates							
Ogyris subterrestris subsp. petrina	Arid Bronze Azure Butterfly	Vu	CR	X	X	The arid bronze azure is also restricted to mallee vegetation on sandy soil, often near flood plains, in which nests of the associated ant are established at the base of eucalypts (Braby 2000). The arid bronze azure is known only from two localities in Western Australia: one in the wheatbelt region and the other in the goldfields region in the inland south-west (Williams et al., pers. comm. 2011). The goldfields population is within a recreation reserve (vested in the Shire of Boulder) at Lake Douglas, 12 km Southwest of Kalgoorlie. This population is reported to have become extinct in about 1993 (Braby 2000). The second, and the only known current population, was discovered in 2006 in the Avon Wheatbelt, in remnant vegetation within a road and rail reserve adjacent to Barbalin Nature Reserve, and within the	**Highly unlikely** The species is considered extinct from the region. It was last recorded 23 km to the north in 1991.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	*NatureMap*	EPBC PMST		
						reserve itself (Williams *et al.* pers. comm., 2011). This locality is approximately 11 km west of Mukinbudin, 250 km northeast of Perth. These populations are several hundred kilometres apart and so effectively isolated given the likely limited dispersal ability of the butterfly. Adults are generally restricted to breeding areas, with occasional dispersal events (Williams *et al*., pers. comm. 2011).	

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- *Calidris acuminata* — Sharp-tailed Sandpiper, http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=874
- *Calidris ferruginea* — Curlew Sandpiper, http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=856
- *Calidris melanotos* — Pectoral Sandpiper, http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=
- *Motacilla cinerea* — Grey Wagtail, http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=
- *Tringa nebularia* — Common Greenshank, Greenshank, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=832

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Appendix F – Ten Clearing Principle Assessment

Principle	Assessment	Outcome	Data sources
a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.	The survey area is situated in the Eremaean Botanical Province of Western Australia (Beard 1990), within the Coolgardie bioregion and the Eastern Goldfields subregion. The flora of the Eastern Goldfields subregion is diverse with 1613 recorded native vascular species. Desktop searches identified 291 native plant taxa within the study area. The field survey recorded 83 native flora taxa; the survey area is considered to have a moderate level of flora biodiversity. Desktop searches identified the presence/potential presence of 24 conservation significant flora taxa within the study area. No EPBC Act or WC Act-listed flora taxa were recorded within the survey area during the field survey. No DBCA-listed Priority Flora taxa were identified within the survey area during the GHD survey. However, a likelihood of occurrence assessment concluded two taxa are likely to occur within the survey area; *Acacia websteri* and *Thryptomene* sp. Londonderry (R.H. Kuchel 1763) (both P1). Broad scale vegetation mapping of the area undertaken by Beard (1972) identified four vegetation associations within the survey area: • Medium Woodland; coral gum and goldfields blackbutt (association 9) • Medium woodland; Salmon Gum and Goldfields Blackbutt (association 468) • Medium woodland; Salmon Gum (association 936) • Shrublands; Acacia, Casuarina and Melaleuca thicket (association 1413) All vegetation associations are considered well represented at local and regional scales (i.e. state, IBRA bioregion, IBRA subregion and LGA) with greater than 76 % of the pre-European extents remaining. Eleven vegetation types and additional areas that described modifications in the landscape were described within the survey area, these were: VT01 – *Eucalyptus loxophleba* subsp. *lissophloia* and *E. griffithsii* open woodland VT02 – *Eucalyptus* spp. isolated trees over tall shrubland VT03 – *Eucalyptus* spp. woodland over open hummock grassland VT04 – Mixed open shrubland over herbland VT05 - *Eucalyptus* spp. over *Melaleuca* spp./ *Allocasuarina* sp. tall sparse shrubland VT06 – Mosaic *Eucalyptus* spp. woodland VT07 – *Eucalyptus* spp. woodland over quartz Cleared/ track/ road	Not likely to be at variance to this Principle	Beard (1990) DBCA (2007–) DBCA TEC and PEC databases DBCA TPFL and WAHERB WA Herbarium (1998–) EPA (2016a)

Principle	Assessment	Outcome	Data sources
	Vegetation condition within the survey area was rated from Excellent to Good. The majority of the survey area was in Excellent condition with very little weed invasion. The area rated as Good in condition was due to disturbances, such as weed invasion and rubbish, associated with the Coolgardie-Esperance Highway. No Commonwealth or State listed TECs or PECs were identified in the desktop searches or within the survey area. The granite outcrop community Mixed open shrubland over herbland (VT04) (5.02 ha) is deemed to be other significant vegetation due to its restricted habitat (granite outcrops). This community supports local endemism and has a restricted distribution in the local and regional area. No reserves, conservation areas or other DBCA-managed estates are located within the survey area, two DBCA managed lands are located adjacent to the survey area; Karamindie Forest to the north-east and Yallari Timber Reserve to the south. Desktop assessments identified 104 native fauna taxa within the study area. A survey of the survey area recorded 41 fauna taxa, including 30 birds, four mammals and seven reptiles. The species recorded in the survey area have been previously been recorded in the Coolgardie IBRA bioregion and are not considered to be dependent on the resources in the survey area. The survey area does not contain vegetation in better condition than that in the surrounding region. Nor is the survey area considered to comprise a high level of biological diversity.		
b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA	The desktop assessment indicated that 12 conservation significant fauna taxa may use the study area. These results exclude marine species as no marine habitat is present within the survey area. Malleefowl (listed as Vulnerable under the EPBC Act) was recorded within the survey area during the field survey. An individual was sighted in the northern section of the survey area and three Malleefowl mounds were recorded within the survey area. The Rainbow Bee-eater is also considered likely to occur within the survey area. However, the timing of the field survey coincided with bee-eater migration to northern Australia (between February and April), this may be the reason why this species was not recorded during the field survey. The Malleefowl is the only threatened fauna species listed under the EPBC Act and WC Act that was recorded in the survey area. An individual was sighted in the Rocky *Acacia* shrubland (5.02 ha), Malleefowl mounds were recorded within *Melaleuca* shrubland (517.14 ha). Additional suitable habitat for foraging and breeding include: Mixed *Eucalyptus* woodland over spinifex (450.49 ha) and Mixed *Eucalyptus* woodland over mixed shrubs (4174.48 ha). Any Malleefowl individuals utilising the habitat in the survey area are unlikely to exclusively rely on the survey area for all habitat resource requirements. However, it is likely that the	May be at variance to this Principle	DEE (2018) DBCA (2007–)

Principle	Assessment	Outcome	Data sources
	individuals utilising the survey area for breeding may be disrupted by clearing (and exploration activities) within the survey area. The Rainbow Bee-eater may opportunistically use; Mixed *Eucalyptus* woodland over spinifex and Mixed *Eucalyptus* woodland over mixed shrubs. The Rainbow Bee-eater utilises a wide range of habitats and is unlikely to exclusively rely on the survey area for all habitat resource requirements. Habitats recorded in the survey area are not exclusive to the survey area and are found in the regional and local area in similar or better condition. Any clearing of the survey area will not significantly diminish the extent of the recorded habitats on a regional or local scale. The habitat types within the survey area are well connected and part of a largely contiguous landscape. Existing minor barriers within the survey area that may restrict movement of fauna is the Coolgardie-Esperance Highway, haul road, tracks and fence lines.		
(c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	Desktop searches identified the presence/potential presence of one EPBC Act listed flora taxon within the study area; *Gastrolobium graniticum*. A likelihood of occurrence assessment, which takes into account the habitats present, known taxa distribution and previous records, was completed for the EPBC Act listed flora taxon identified in the desktop assessment. This assessment concluded that *Gastrolobium graniticum* was not likely to occur within the survey area. Searches for conservation significant flora were undertaken during the GHD field survey. No Threatened flora taxa were recorded during the survey.	Not likely to be at variance to this Principle.	DEE (2018) DBCA (2007–) DBCA TPFL and WAHERB WA Herbarium (1998–)
d) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	Desktop searches identified no TECs within 20 km of the survey area. No Commonwealth or State listed TECs were identified within the survey area during the field survey.	Not likely to be at variance to this Principle.	DEE (2018) DBCA TEC and PEC databases
(e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an	The survey area is located within the Coolgardie IBRA bioregion. This IBRA bioregion has approximately 97% of its pre-European extent remaining Broad scale vegetation mapping of the area undertaken by Beard (1972) identified four vegetation associations within the survey area: • Medium Woodland; coral gum and goldfields blackbutt (association 9)	Not likely to be at variance to this Principle.	Beard (1972) GoWA (2017)

Principle	Assessment	Outcome	Data sources
area that has been extensively cleared	• Medium woodland; Salmon Gum and Goldfields Blackbutt (association 468) • Medium woodland; Salmon Gum (association 936) • Shrublands; Acacia, Casuarina and Melaleuca thicket (association 1413) These associations are considered well-represented at all levels (state, IBRA bioregion, IBRA sub-region and LGA) with greater than 76 per cent of their pre-European extents remaining. The survey area is surrounded by intact native vegetation and is well connected to the surrounding vegetation		
(f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	There are no permanent drainage channels or wetlands within or in the vicinity of the survey area. There is one minor ephemeral drainage line within the survey area represented by VT01 *Eucalyptus loxophleba* subsp*. lissophloia* and *E. griffithsii* open woodland. The flora taxa recorded within VT01 are not considered wetland or dampland species. The drainage line supported *Eucalyptus* spp. over a suite of *Acacia* spp. and *Eremophila* spp shrubs commonly found within the larger survey area. The vegetation recorded within VT01 is not considered riparian vegetation.	Not likely to be at variance to this Principle.	GoWA (2018)
(g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The Australian Soil Resource Information System (ASRIS) indicates that the survey area has 'No Known Occurrence' of Acid Sulphate Soils (ASS). Any clearing of native vegetation within the survey area has the potential to cause soil and wind erosion. However, as the area will be managed as a mining area the potential degradation is likely to be minimised and managed through mitigation measures including staged clearing, revegetation of temporarily disturbed areas and the implementation of drains and bunds where necessary.	Not likely to be at variance to this Principle.	ASRIS (2013) (
(h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any	No reserves, conservation areas or other DBCA-managed estates are located within the survey area. Two conservation areas occur adjacent to the survey area: • Karamindie Forest, north-east • Yallari Timber Reserve, south The survey area is largely surrounded by remnant native vegetation and if cleared would not be considered a significant barrier to fauna movement or to impact upon the ability of the surrounding vegetation to provide a habitat linkage. Clearing of the survey area is unlikely to impact on the environmental values of any adjacent or nearby conservation areas.	Not likely to be at variance to this Principle.	DBCA Estate spatial dataset

Principle	Assessment	Outcome	Data sources
adjacent or nearby conservation area.			
(i) – 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.	The survey area is located in the RIWI Act listed Goldfields Groundwater Area and the Salt Lake Basin Surface Water Management Area and Sub-area. No rivers or surface water bodies listed under the RIWI Act were identified within the survey area. There is one minor ephemeral drainage line located within the survey area. No lakes, wetlands or natural water bodies were recorded in the survey area. Average rainfall for the area is 267 mm and relatively evenly distributed throughout the year. However, rainfall can also be highly erratic year to year. During heavy localised rainfall events erosion may occur in cleared areas leading to temporary soil erosion and/or sedimentation, particularly in the vicinity of these ephemeral drainage lines. Clearing of the survey area is unlikely to cause appreciable deterioration in the quality of surface or underground water.	Not likely to be at variance to this Principle.	BOM (2018) GoWA (2018)
(j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	The climate of the region is described as semi-arid with an average annual rainfall of 267 mm. Rainfall is relatively evenly spread throughout the year, but can occur in heavy localised falls. Based on an average annual evaporation rate of 144 millimetres, any surface water resulting from rainfall events is likely to be relatively short lived. In addition the survey area is surrounded by remnant native vegetation and it is likely that a large proportion of runoff will be absorbed by this natural environment. There are no permanent drainage channels or wetlands within or in the vicinity of the survey area. There is one minor ephemeral drainage line within the survey area that is only likely to flow following heavy rain. The survey area is characterised by predominantly flat to gently undulating plains with predominately silty clay soils and occasional rocky rises scattered throughout the survey area. Any surface flow is expected to be minimal, and it is unlikely that any clearing in the survey area will lead to an appreciable increase in run off that will cause, or exacerbate, the incidence of flooding.	Not likely to be at variance to this Principle.	BOM (2018)

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Appendix B
Environmental Management Procedures