Upgrade to Great Eastern Highway and Emu Fence Road Intersection Clearing Assessment Report – CPS 818

We're working for Western Australia.

Upgrade to Great Eastern Highway and Emu Fence Road Intersection

May 2021

D21#281593

Report Compilation & Review	Name and Position	Document Revision	Date
Author:	[Retracted] Graduate Environmental Scientist (AECOM)	Rev A	3/03/2021
Reviewer:	[Retracted] Team Lead – Environment (AECOM)		
Author:	[Retracted] Environmental Scientist (AECOM)	Rev B	5/03/2021
Reviewer:	[Retracted] Team Lead – Environment (AECOM)		
Author:	[Retracted] Environmental Scientist (AECOM)	Rev0	11/03/2021
Reviewer:	[Retracted] Team Lead – Environment (AECOM)		
Reviewer:	Main Roads Environment Officer	Rev 0	12/04/2021
Author:	[Retracted] Senior Environmental Scientist (AECOM)	Rev 1	29/04/2021
Author:	[Retracted] Senior Environmental Scientist (AECOM)	Rev 2	4/05/2021
Author:	[Retracted] Senior Environmental Scientist (AECOM)	Rev 3	7/05/2021
Author:	[Retracted] Senior Environmental Scientist (AECOM)	Rev 4	10/05/2021
Author:	[Retracted] Senior Environmental Scientist (MRL)	Rev 5	14/05/2021

Contents

1 PURPOSE

The purpose of this Clearing Assessment Report (CAR) is to provide a report detailing the assessment of native vegetation clearing that is proposed to be undertaken using the Statewide Clearing Permit CPS 818 issued to Main Roads Western Australia (Main Roads).

The CAR outlines the key activities associated with the project, the existing environment and an assessment of native vegetation clearing. This assessment provides an evaluation of the vegetation clearing impacts associated with the project using the ten Clearing Principles, and the strategies used to manage vegetation clearing.

2 SCOPE

2.1 Project Scope

Project Name: Upgrade to Great Eastern Highway and Emu Fence Road Intersection

Project Purpose / Components: The Project includes the upgrade of the existing road surface and installation of additional surface water management infrastructure to support an increase in activity in the region. The purpose of the Project is to ensure that increased truck operations entering the Great Eastern Highway (GEH) do not pose a safety risk to road traffic.

The proposed clearing undertaking using CPS 818 is: The project will involve the clearing of 3.8 ha of native vegetation within the 6.7 ha Development Envelope.

The proposed temporary clearing undertaking using CPS 818 is: none

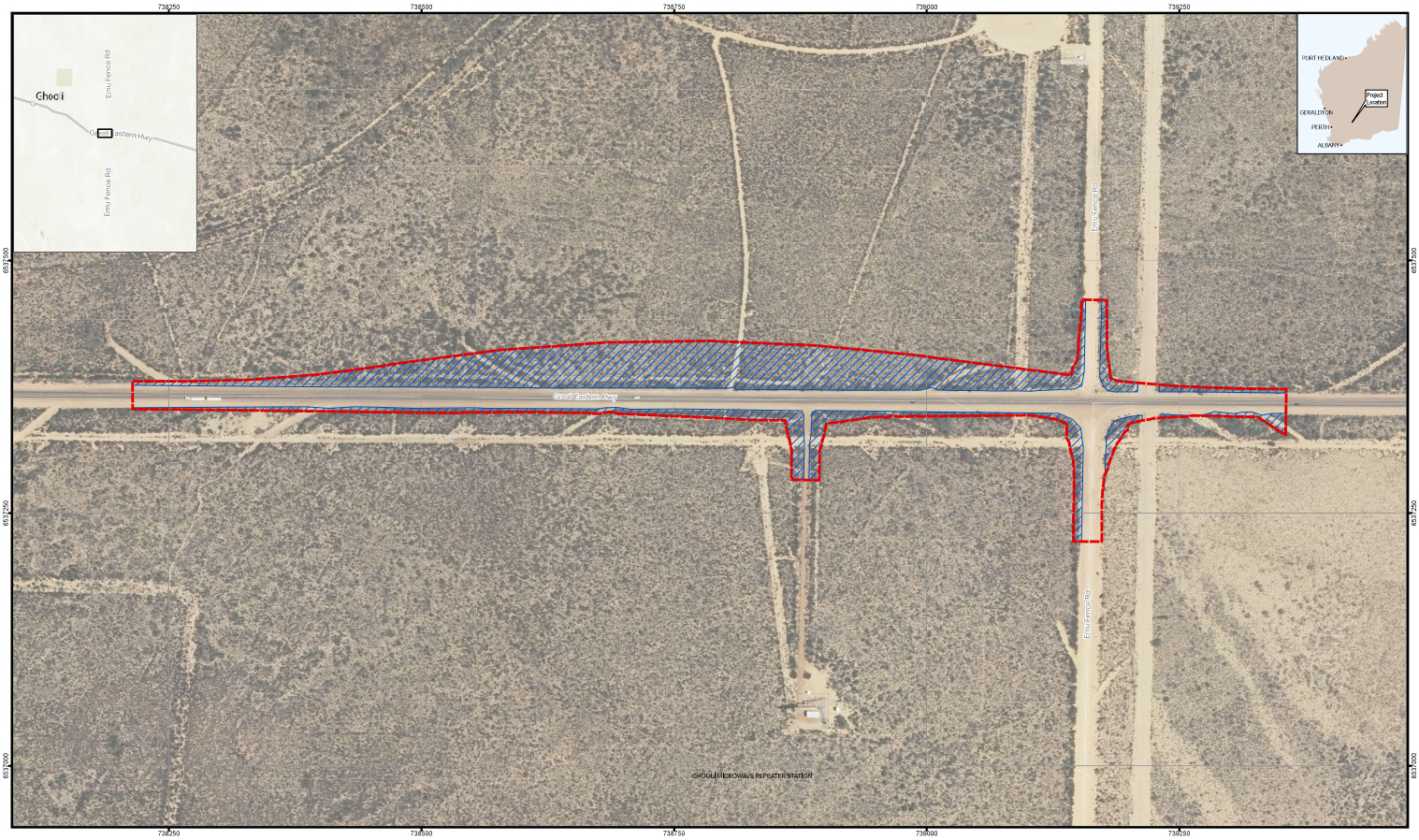
Project Location(s): The Project Area is located at the Great Eastern Highway and Emu Fence Road intersection. Construction activities will occur along a 1.1 kilometre (km) section of the Great Eastern Highway road reserve and a 0.2 km section of Emu Fence Road. Works will occur within 100 m of the existing roads. The Project is located in Southern Cross, Shire of Yilgarn, approximately 370 km east of Perth.

- MGA reference: 738250, 6537275

The location of the proposed works is provided in Figure 1.

2.2 Assessment Report Scope

The assessment area, see Figure 2, is confined to a local area of a 10 km radius surrounding the Development Envelope interrogated by the desktop study of the biological survey of the Development Envelope conducted by Phoenix Environmental (2021a).



PROJECT ID 60650191
CREATED BY WYATTK2
APPROVED BY PB
LAST MODIFIED 10 MAY 2021

AECOM
www.aecom.com

N
1:3,500 (when printed at A3)
DATUM
0 50 100 150 200
metres

Data sources:

Base Data © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate [2021], Geoscience Australia, Sinelpro

LEGEND

- Development Envelope
- Area to be Cleared

Project Area

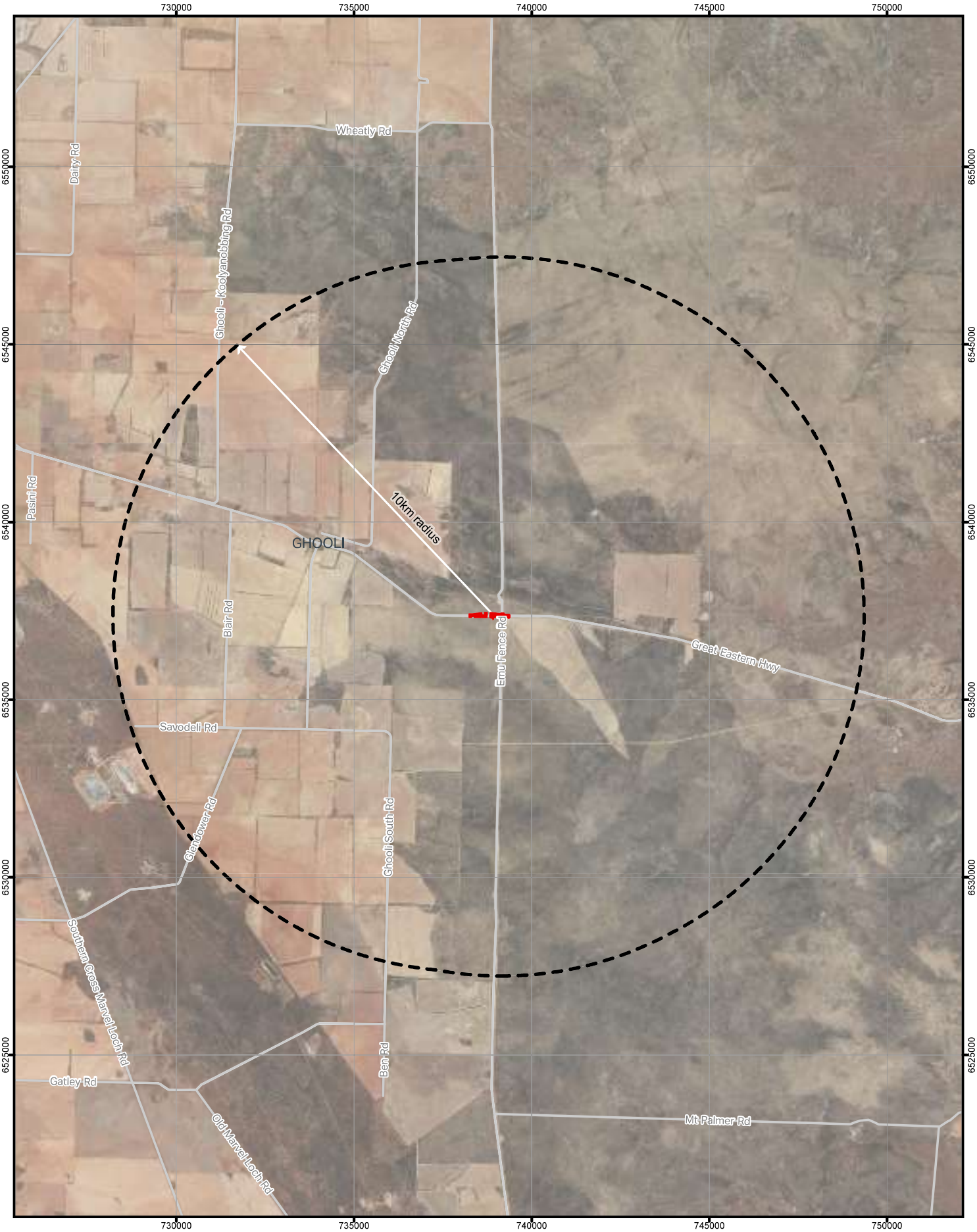
MAIN ROADS WA

UPGRADE TO GREAT EASTERN HIGHWAY AND EMU FENCE ROAD INTERSECTION ENVIRONMENTAL IMPACT ASSESSMENT

Figure 1

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\60\60650191\900_CAD_GIS\020_GIS\02_MXD\04_GreatEasternHwy_Emu_Fence_CAR_Figures\G60650191_GEH_Emu_Fence_CAR_Pro.aprx (WyattK2)

A3 size



PROJECT ID	60650191
CREATED BY	KAI.DU
APPROVED BY	PB
LAST MODIFIED	06 MAY 2021

AECOM
www.aecom.com

N

DATUM GDA 1994 MGA Zone 50

1:140,000 (when printed at A4)

0 1 2 3 4 Kilometers

Data sources: Landgate Imagery

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Road
- Development Envelope
- Research Area (Development Envelope 10 km Radius)

Assessment Area

MAIN ROADS WA

UPGRADE TO GREAT EASTERN HIGHWAY AND EMU FENCE ROAD INTERSECTION ENVIRONMENTAL IMPACT ASSESSMENT

Figure 2

Project File: \\AUPER1FP001.AU.AECOMNET.COM\Projects\606X\60650191\900_CAD_GIS\920_GIS\02_MXDs\04_GreatEasternHwy_Emu_Fence_CAR_Figures\G60650191_GEH_Emu_Fence_CAR_Pro.aprx (kai.du)
Layout: G60650191_Fig2_CAR_AssessmentArea_A4P_v1

A4 size

2.3 Alternatives to clearing

The primary alternative to clearing considered during the design phase was utilising existing tracks and roads where possible.

2.4 Measures to Avoid, Minimise, Reduce and Manage Project Clearing Impacts

The design and management measures implemented to avoid and minimise the clearing impacts by the project are provided in Table 1.

Further details on how the clearing impacts have been avoided and minimised include:

- Environmental and heritage requirements included in the site induction and pre-starts
- Demarcate clearing boundaries prior to clearing
- Clearing activities to ensure machinery stays within the approved clearing area
- Pre-Starts to detail the approved clearing areas and what they represent
- Infrastructure used to maintain surface drainage patterns, if required (e.g. culverts, diversions)
- Construction during rainfall avoided where practicable
- Before clearing, areas will be searched for any active Malleefowl mounds. If active mounds are identified in the proposed clearing area, no clearing of Malleefowl habitat will occur within 50 m during the breeding season (with such clearing to then be rescheduled until after the breeding season). Malleefowl habitat containing an 'active' nest mound will be demarcated to inform site personnel, as necessary.
- Before clearing, Priority flora to be retained shall be flagged with a 20 m exclusion zone, where practical.
- Clearing will be done as a front, allowing Chuditch and Malleefowl to move across the Development Envelope and relocate to other areas. Given the scale and nature of clearing, proximity to GEH and adequate searches pre-clearance for the species, it is unlikely that the clearing footprint will be utilised as habitat by these species
- Topsoil to be retained for rehabilitation by nearby stockpiles, where practicable
- Hygiene inspections conducted for all vehicles and machinery, prior to entry to site
- A hygiene inspection checklist will be used to record the results of hygiene inspections
- Inspections will be conducted to assess compliance with the Construction Environmental Management Plan (CEMP) during operations
- A practical completion inspection will be conducted to assess compliance at completion of clearing
- Results of CEMP inspections will be recorded using an inspection checklist

Table 1. Measures undertaken to Avoid, Minimise, Reduce and Manage the Project Clearing Impacts

Design or Management Measure	Applied to Current Design	Discussion and Justification
Installation of safety barriers	Yes	Installation of safety barriers will be conducted to meet safety in design requirements. Impacts to environmental values are not likely to be changed as a result of safety barrier installation.
Alignment to one side of existing road	No	The upgrade and widening of GEH will require works on both sides of the existing road.
Alternative alignment to follow existing road (or) to preferentially locate within pasture or a degraded area	No	As the Project is creating an intersection and widening an existing road, realignment outside of the existing road reserve is not applicable.
Installation of kerbing	Yes	Kerbing has been considered in the design and implemented where possible and appropriate.
Preferential use of existing cleared areas for access tracks, construction storage and stockpiling	Yes	Already cleared areas such as vehicle tracks will be utilised where possible to avoid additional clearing of native vegetation.
Drainage modification	Yes	Rainfall runoff will be managed through construction of appropriate drainage infrastructure to avoid erosion within the catchment. There are no existing drainage lines within the Development Envelope with the exception of the existing culvert which prevents road flooding. An additional culvert will be installed as per Rockwater (2020) recommendations to prevent infrastructure flooding. Erosion is unlikely because of the coarse nature of the local soils. Should it be required, erosion control will be fitted on drainage lines.

2.5 Approved Policies and Planning Instruments

The clearing of native vegetation in Western Australia is regulated under the *Environmental Protection Act Act* and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations)*.

In addition to the matters considered in accordance with section 51O of the EP Act (see Section 1.3), Main Roads has also had regard to the below instruments.

Other Legislation of relevance for assessment of clearing and planning/other matters

- *Biodiversity Conservation Act 2016 (WA) (BC Act)*
- *Conservation and Land Management Act 1984 (WA) (CALM Act)*
- *Country Areas Water Supply Act 1947 (WA) (CAWS Act)*
- *Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)*
- *Planning and Development Act 2005 (WA) (P&D Act)*
- *Soil and Land Conservation Act 1945 (WA)*
- *Rights in Water and Irrigation Act 1914*
- *Aboriginal Heritage Act 1972 (WA)*
- *Town Planning and Development Act 1928*

Environmental Protection Policies

- *Environmental Protection (Peel Inlet - Harvey Estuary) Policy 1992*
- *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2011*

Other Relevant policies and guidance documents:

- *Environmental Offsets Policy (Government of Western Australia, 2011)*
- *A guide to the assessment of applications to clear native vegetation (DEC, December 2014)*
- *Procedure: Native vegetation clearing permits (DWER, October 2019)*
- *Environmental Offsets Guidelines (Government of Western Australia, August 2014)*
- *Technical guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016)*
- *Technical guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020)*
- Approved conservation advice under section 266B of the EPBC Act for threatened flora/fauna/vegetation communities
- Approved Recovery Plans for threatened species
- EPBC Act Referral guidelines for the three threatened black cockatoo species
- Strategic advice - EPA

3 SUMMARY OF SURVEYS

3.1 Biological Survey

Extensive, multiple targeted flora searches were undertaken within the Development Envelope area. Phoenix Environmental Sciences conducted flora and vegetation surveys within the Haul Road area (broader study area) including the Emu Fence Road/GEH intersection Development Envelope over several seasons involving detailed and targeted surveys in November 2019 and July 2020 with additional targets flora searches in September to October 2020 (Phoenix, 2021a). Level 1 fauna, targeted vertebrate fauna and short-range endemic (SRE) invertebrate surveys were conducted within the haul road study area in November to December 2019 and January 2020. Additional targeted SRE and level 1 fauna surveys were conducted in October 2020 to ensure full coverage of the Development Envelope following minor haul road design changes.

Section 3.1.1 contains the summary of the survey.

3.1.1 Summary of Biological Surveys

One native vegetation type, AsEcm was defined and mapped comprising 3.8 ha (56.7%) of the Development Envelope. . It is characterised as mid shrubland to closed shrubland of *Allocasuarina spinossissima*, *Hakea minyma* and *Micromyrtus erichensii*, over open sedgeland of *Ecdeiocola monostachya*, *Lepidobolus preissianus* and *Schoenus* spp. This vegetation type is considered locally significant as it provides primary habitat to Priority flora. Vegetation type (AsEcm) was considered to be in Pristine to Degraded condition. The remaining 2.9 ha (43.4%) of the Development Envelope was cleared, representing existing roads and tracks.

Sixty-five flora taxa were recorded within vegetation type AsEcm. Of these species recorded, four Priority flora were recorded within the Development Envelope. These are presented in Table 2.

Table 2. Priority species present in the Development Envelope

Species	Number recorded in Western Australia (Phoenix 2012b)	Number to be cleared	% to be cleared
Acacia desertorum var. *nudipes* (P3)	13,967	223	1.5
Lepidosperma lyonsii (P1)	21,079	89	0.4
Leucopogon sp. Yellowdine (P1)	71	1	1.4
Verticordia stenopetala (P3)	8,504	6	<0.1

In all cases, less than 2% of the plants regionally recorded will be cleared.

Further discussion of the flora and vegetation surveys is provided in Appendix A.

No Threatened flora were identified, and no Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) was recorded during the desktop assessment or survey (Phoenix, 2021a).

The Level 1 fauna, targeted vertebrate fauna and short-range endemic (SRE) invertebrate surveys were conducted in November – December 2019 and January 2020 (Phoenix, 2021a). An additional SRE and Level 1 fauna survey was conducted in October 2020 to ensure full coverage of the Development Envelope. One fauna habitat type was present; AsEcm, characterised by mid to tall shrubland.

No significant fauna species were recorded within the Development Envelope. Two Vulnerable fauna species under the EPBC Act and BC Act, Malleefowl (*Leipoa ocellata*) and Chuditch (*Dasyurus geoffroii)*, both listed as Vulnerable, have been recorded in the vicinity of the development envelope. Malleefowl have been recorded within 10 km of the Development Envelope. Chuditch have been recorded 21 km north and 22 km south of the Development Envelope. The Malleefowl may occur on occasion in the survey area but is unlikely to utilise it as core habitat due to proximity to the Great Eastern Highway. Similarly, the Chuditch is unlikely to occur in the survey area except as a transient visitor moving between core habitat patches. No Priority fauna were recorded during the survey.

SRE taxa are unlikely to be supported by the single widespread habitat (Phoenix 2021a).

3.1.2 Surface Water Assessment

Rockwater Hydrologeological and Environmental Consultants completed a hydrological assessment of the Project Area (Rockwater, 2020). The assessment included hydrological regimes, potential impacts to the surface water environment, sensitive receptors and mitigation measures to protect the proposed infrastructure.

No major or permanent water courses intersect the Project Area. Rainfall runoff associated with occasional cyclonic weather events are generally limited in duration. The Development Envelope does not currently have any culverts running under GEH with drainage infrastructure limited to existing swale drains on either side of GEH. The proposed works does not include any change to existing swale drains.

The surface water assessment of the Development Envelope conducted by Rockwater (2020) identified that installation of water management infrastructure including (culverts) north and south of GEH under the Emu Fence Road are required to prevent flooding under heavy rainfall events.

3.1.3 Desktop Soil Assessment

Mine Earth conducted a desktop soil assessment for the Project to assess the soils likely to be disturbed as part of the Project (Mine Earth, 2020).
General characteristics of the Development Envelope soils are:

- Classified as deep sandy gravels, duplex sandy gravels and deep sands
- Predominantly neutral pH and non-saline
- For duplex soils with sand over clay, alkalinity and salinity increase with depth
- For duplex soils, increasing clay content and potential clay dispersion with depth.

Soil-landscape units of the Development Envelope are of the soil type AC1, which is described as 'gently sloping to gently undulating plateau areas, or uplands, on granites, gneisses, and allied rocks, with long gentle slopes and, in places, abrupt erosional scarps', with deep yellow sands recorded in test pitting (Mine Earth, 2020). Such soils are anticipated to have a high infiltration rate with infrequent flooding.

4 VEGETATION DETAILS

4.1 Project Site Vegetation Description

The Project Area lies within the Coolgardie Bioregion in the Southern Cross (COO2) subregion. The Coolgardie Southern Cross subregion lies on the Southern Cross Terrane of the Yilgarn Craton. This subregion is characterised by gently undulating uplands dissected by broad valleys with bands of low greenstone hills (Cowan *et al*., 2001). Diverse Eucalyptus woodlands, rich in endemic eucalypts occur around salt lakes, on the low greenstone hills, valley alluvials and broad plains of calcareous earths (Cowan *et al*., 2001).

Pre-European vegetation mapping was undertaken by Beard (1981) who mapped one vegetation association that occurs within the Project Area. This vegetation association is the Boorabbin 1148 comprising shrublands; scrub-heath (Table 3). There is 99.15% of this pre-European vegetation remaining in the Coolgardie Bioregion, state and subregion level (Government of Western Australia, 2019).

Table 3 and Table 4 provide details of the Pre-European Vegetation Associations within the Project Area and the remaining extents of these associations. For a full description of the existing vegetation, refer to Appendix A.

Table 3. Summary of Mapped Pre-European Vegetation Associations in Project Area

Pre-European Vegetation Association(s)	Clearing Description	Vegetation Condition	Comments
Vegetation Association 1148: Mid shrubland to closed shrubland of *Allocasuarina spinosissima*, *Hakea minyma* and *Micromyrtus erichensii*, over open sedgeland of *Ecdeiocola monostachya*, *Lepidobolus preissianus* and *Schoenus* spp. (Government of Western Australia, 2019).	Clearing of up to 3.8 ha for road upgrades and surface water infrastructure at the intersection of Great Eastern Highway and Emu Fence Road.	Pristine to degraded	Vegetation description and condition determined from Phoenix baseline survey (Phoenix 2021)

Table 4. Pre-European Vegetation Representation

Pre-European Vegetation Association	Scale	Pre–European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA reserves
Veg Assoc No. 1148	**Statewide**	260,383.60	258,227.40	99.17	17.53
	IBRA Bioregion	254,931.80	252,775.60	99.15	17.13
	IBRA Sub-region	254,931.80	252,775.60	99.15	17.13
	Local Government Authority – Shire of Yilgarn	79,301.07	77,149.48	97.29	25.58

Source: Government of Western Australia (2019).

5 ASSESSMENT AGAINST THE TEN CLEARING PRINCIPLES

In assessing whether the project's proposed clearing is likely to have a significant impact on the environment, the project was assessed against the ten Clearing Principles (*Environmental Protection Act 1986,* Schedule 5).

Each principle has been assessed in accordance with DWER's 'A Guide to the Assessment of Applications to Clear Native Vegetation' and other relevant CPS Decision Reports prepared by DWER.

The proposed clearing is not likely to be at variance with the 10 Clearing Principles.

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

Comments	Proposed clearing is not likely to be at variance to this Principle
	The Project is located within the Coolgardie Bioregion in the Southern Cross (COO2) subregion. The region is characterised by gently undulating uplands dissected by broad valleys with bands of low greenstone hills (Cowan et al., 2001). One vegetation association was mapped in the Project Area, Boorabbin 1148. This vegetation comprises shrublands and scrub-heath. There is 99.15% of this pre-European vegetation remaining in the Coolgardie Bioregion, state and subregion level (Government of Western Australia, 2019). Sixty-five flora taxa were recorded within vegetation type AsEcm. No Threatened flora listed under the EPBC Act or BC Act were identified within the Project Area. Five Priority flora species were identified within and near the Project Area, including: • *Acacia desertorum var. nudipes* (P3) – 223 plants recorded in the Development Envelope. A survey of the broader haul road survey area (including the Project Area (Phoenix 2021b)) recorded a total of 13,967 plants of this species in Western Australia. The proposed clearing will result in approximately 1.5% of the plants being taken. • *Lepidosperma lyonsii* (P1) – 89 plants recorded in the Development Envelope. A survey of the broader haul road area by Phoenix noted a total of 21,079 plants of this species in Western Australia (Phoenix 2021b). The proposed clearing will result in less than 0.5% of the plants being taken. • *Leucopogon* sp. Yellowdine (P1) – one plant recorded in the Development Envelope. Phoenix (2021b) identifies an additional 70 records of this species in Western Australia. 1.4% of plants will be taken as a result of the proposed clearing. • *Verticordia stenopetala* (P3) – six plants recorded in the Development Envelope. A total of 8,504 plants were recorded in Western Australia (Phoenix 2021b). Less than 0.1% of plants will be taken as a result of the proposed clearing. The AsEcm vegetation type appears to be relatively common in the area but has a moderate level of biodiversity in the context of the surrounding vegetation. Less than 2% of all priority plants recorded will be impacted by the clearing of the Development Envelope. No TECs or PECs were recorded within the Project Area during the biological assessments (Phoenix, 2021a). The vegetation in the Project Area is not considered representative of a TEC or PEC (Phoenix, 2021a).

Comments	Proposed clearing is not likely to be at variance to this Principle
	No significant fauna species were recorded within the Development Envelope. Two Vulnerable fauna species under the EPBC Act and BC Act, Malleefowl (*Leipoa ocellata*) and Chuditch (*Dasyurus geoffroii)*, have been recorded in the vicinity of the Development Envelope. Malleefowl have been recorded within 10 km of the Development Envelope. Chuditch have been recorded 21 km north and 22 km south of the Development Envelope. The Malleefowl may occur on occasion in the survey area but is unlikely to utilise it as core habitat due to proximity to the Great Eastern Highway. Similarly, the Chuditch is unlikely to occur in the survey area except as a transient visitor moving between core habitat patches. No Priority fauna were recorded during the surveys (Phoenix 2021a) and similarly, Priority fauna identified in the desktop review and the undescribed bandicoot species (*Isoodon* sp.), reported from secondary evidence (foraging diggings outside the Development Envelope), are unlikely to occur except as a transient visitor moving between core habitat patches. SRE taxa are unlikely to be supported by the single widespread habitat (Phoenix, 2021a). One fauna habitat was defined and mapped within the Project Area, comprising of a mid to tall shrubland, mostly of *Allocasuarina* and/or *Melaleuca* spp., without tree or mallee overstorey; mainly on sandplain. This habitat type covered 3.8 ha of the Development Envelope. A further 78 ha of AsEcm was recorded in the survey of an adjacent haul road study area, with an additional 356.4 ha interpolated as occurring around the haul road area (Phoenix 2021b). The loss of 3.8 ha represents the loss of less than 2% of this extrapolated area. The mid to tall shrubland fauna habitat is suitable for Malleefowl; however, proximity of the Great Eastern Hwy is likely to deter nest building and foraging in this area, although it may transit through on occasion (Phoenix, 2021a). Similarly, the Chuditch is unlikely to occur within the Development Envelope except as a transient visitor moving between core habitat patches. The development area vegetation is part of a broad vegetated area and thus the vegetation does not form an ecological linkage. The proposed area of clearing is 3.8 ha. Given the size of the area cleared, this clearing is not likely to impact on the diversity of the greater than 16,000,000 ha area of the Great Western Woodlands. The native vegetation within the clearing area is broadly representative of the vegetation from the surrounding area (Development Envelope and surrounds) and is not expected to comprise a high level of biological diversity (Phoenix, 2021a). It is therefore expected that the proposed clearing will not likely be at variance with this principle.
Methodology	Baseline flora and vegetation survey (Phoenix, 2021a and b) DBCA shapefiles Main Roads GIS Shapefiles Department of Natural Resources and Environment (2002) NatureMap (Accessed February 2021) EPA (2016, 2020) Government of WA (2013) DPLH Website (Accessed February 2021) Natural Resource Management SLIP Soil Systems (Accessed February 2021)

(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.

Comments	Proposed clearing is not at variance to this Principle
	No fauna of conservation significance were recorded during the survey of the Development Envelope (Phoenix, 2021a). One inactive/unused Malleefowl (*Leipoa ocellata*) nest was observed 650 m to the north of the Intersection, the nearest record of Chuditch (scats) was observed 21 km north of the Intersection (Phoenix, 2021a). No Priority fauna were recorded during the surveys (Phoenix 2021a) and similarly, the Priority fauna identified in the desktop review and the undescribed bandicoot species (*Isoodon* sp.), reported from secondary evidence (foraging diggings outside the Development Envelope), are unlikely to occur except as a transient visitor moving between core habitat patches. The biological survey undertaken by Phoenix (2021a) recorded one broad fauna habitat to occur within the clearing area: • 3.8 ha of Mid to tall shrubland, mostly Allocasuarina and./or Melaleuca spp; without tree or mallee overstorey; mainly on sandplain. Habitat for Malleefowl. • No Chuditch habitat was identified (Phoenix, 2021a). The habitat within the Development Envelope is of relatively poorer quality than the surrounding vegetation. The clearing of up to 3.8ha of native vegetation along the existing roadside is unlikely to provide quality habitat for significant fauna species with the surrounding, widespread, mostly pristine native vegetation providing much higher quality habitat. Due to the high vehicular activity of the Great Eastern Highway, it is not likely that Malleefowl will nest in the area or that Chuditch or the undescribed bandicoot species (*Isoodon* sp.), will utilise the habitat except as a pathway between other preferential habitat areas (Phoenix, 2021a). Therefore, the proposed Project works are expected to have negligible impacts on the significant fauna species. However, preclearance surveys of the Development Envelope will be completed for significant fauna species, particularly Malleefowl and Chuditch, to confirm their absence. Given the widespread availability of habitat suitable for the identified fauna species, within the IBRA subregion and the linear nature and proximity of the habitat to the road, the removal of up to 3.8 ha of habitat is not likely to be at variance with this principle.
Methodology	Biological Survey (Phoenix, 2021a) DBCA Shapefiles DBCA website EPA (2016, 2020)

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

Comments	Proposal is unlikely to be at variance to this Principle
	The desktop review identified no Threatened flora species listed under the EPBC Act or BC Act are likely to occur within 10 km of the Project Area (Phoenix, 2021a), nor were any Threatened flora recorded during surveys of the Project area. While *Isopogon robustus* (CR) has been recorded approximately 40km south of the Project area, there is no potential suitable habitat for this species (granite outcrops and ridges) occurring within the Development Envelope. As such, the proposed clearing is not at variance to this principle.
Methodology	Biological Survey (Phoenix, 2021a) DBCA shapefiles EPA (2016) Florabase (Accessed January 2021)

(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.

Comments	Proposed clearing is not at variance to this Principle
	No Threatened Ecological Communities (TECs) occur within the Development Envelope and proposed area of native vegetation clearing. None of the vegetation identified is considered representative of a state or federal listed TEC. No TECs were located within 10 km of the Development Envelope. The vegetation within the clearing area is consequently not considered necessary for the maintenance of a TEC. No impacts are expected to occur to TECs, therefore, the proposed vegetation clearing will not be at variance with this principle.
Methodology	Baseline flora and vegetation survey (Phoenix, 2021a) DBCA shapefiles DAWE PMST Report EPA (2016)

(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.

Comments	Proposed clearing is not at variance to this Principle
	The proposed clearing area falls within the Coolgardie Bioregion of the Interim Biogeographic Regionalisation for Australia (IBRA) (DAWE, 2021). Approximately 97% of the pre-European vegetation still exists in the IBRA Coolgardie Bioregion (Government of Western Australia, 2019) (Table 3). The proposed clearing area is broadly mapped as Beard vegetation association Boorabbin 1148: Mixed heath with scattered tall shrubs of Acacia species, Proteaceae and Myrtaceae (Government of Western Australia, 2019). Approximately 99% of the pre-European extent of this vegetation association remains uncleared at the state, bioregion and subregion level (Government of Western Australia, 2019). The Shire of Yilgarn has approximately 81% vegetation remaining uncleared (Government of Western Australia, 2019). Therefore, the proposed clearing area does not represent a significant remnant of native vegetation in an area that has been extensively cleared and is not at variance to this principle.
Methodology	Aerial photography Baseline flora and vegetation survey (Phoenix, 2021) EPA (2016) Government of Western Australia (2017)

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

Comments	Proposed clearing is not at variance to this Principle
	No Ramsar Wetlands, nationally Important Wetlands or DBCA managed waters occur within the Development Envelope. Furthermore, no clearing of vegetation growing in, or in association with, a water course or wetland is required for the proposed works. The Project is not at variance with this principle.
Methodology	Baseline flora and vegetation survey (Phoenix, 2021a) DWER and DBCA shapefiles

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

Comments	Proposed clearing is not at variance to this Principle
	The Development Envelope is located within the Southern Cross Zone of the Kalgoorlie Soil-Landscape Province. The Kalgoorlie Province is characterised by a laterised plateau on Precambrian gneisses and granites with greenstone belts. The surface of the plateau is flat to gently undulating, below which shallow valley plains are formed on Quaternary alluvium and colluvium. These plains show little defined drainage with some seasonal lakes and claypans with isolated granitic and basic rock outcrops. Saline flats and chains of salt lakes occur lower in the landscape in broad flat valleys (Natural Resources Management in Western Australia, 2021a). There is potential for local soil erosion to occur, although topography is not steep and gullying would not be expected. As described in Table 3 there is extensive pre-European vegetation remaining around the proposed clearing area (>95%). Given the extent of remaining vegetation in the adjacent areas it is not expected that clearing of up to 3.8 ha of vegetation surrounding GEH will impact or cause salinity, eutrophication or flooding. Vegetation clearing will be minimised, and existing cleared and previously disturbed areas will be utilised where possible, to reduce the potential for land degradation. The Project will be managed in accordance with a Construction Environmental Management Plan (CEMP), with measures to mitigate and/or minimise potential environmental impacts that can cause appreciable land degradation such as soil erosion (Appendix B). With the minimisation of vegetation clearing and implementation of management measures, the proposed clearing is not at variance with this principle.
Methodology	Baseline flora and vegetation survey (Phoenix, 2021a) DWER and DBCA shapefiles Natural Resource Management in WA. (2020).

(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.

Comments	Proposed clearing is not at variance to this Principle
	The Great Eastern Highway and Emu Fence Road Intersection does not occur within or immediately adjacent to a conservation area. The closest conservation reserves to the Intersection are Yellowdine Nature Reserve located approximately 9.5 km to the east, Jilbadji Nature Reserve located approximately 14 km to the east, and DBCA Managed Nature Reserve R 36918 is approximately 8.5 km to the west of the proposed clearing area. Additionally, land surrounding the Intersection does not provide a buffer or ecological link to a conservation area. As there are no conservation estates or environmentally sensitive areas adjacent or near the clearing area, clearing of up to 3.8 ha of vegetation within the 3.8 ha Development Envelope, is not at variance to this principle.
Methodology	DBCA shapefiles EPA (2016) Baseline flora and vegetation survey (Phoenix, 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.

Comments	Proposed clearing is not at variance to this Principle
	There are no permanent watercourses or wetlands within the proposed clearing area and the upgrades to the Great Eastern Highway and Emu Fence Road Intersection will not intercept/disturb groundwater. The groundwater table is approximately 70 - 100 m below ground level across the area, with some isolated perched water tables nearer to the surface. Groundwater quality is generally highly saline. The risk of clearing causing further groundwater issues is negligible due to existing poor groundwater quality, depth and that the upgrades will not be intercepting groundwater. The Project Area is classified as being part of the Avon River basin (Yilgarn Branch) within the South-West Drainage Division (Rockwater, 2020). The Project Area is located in the eastern extent of the basin. This section of basin is characterised by low rainfall, ancient geology with little relief, slow flowing areas and large areas of salt lakes (Hennig and Kelsey 2015). Regional-scale catchments drain towards series of large and small salt lakes which typically contain surface water only following significant rainfall events (Rockwater, 2020). The region has poorly defined drainage and has no rivers or creeks. Any ephemeral flow due to rainfall quickly evaporates or infiltrates leaving minimal pooling. The region has poorly defined drainage with no rivers or permanent creeks. The majority of runoff from the proposed clearing area would occur as sheet flow with the occasional small, ill-defined creek lines existing in runoff areas along the ridge line. These northerly and easterly draining catchments would produce surface runoff predominantly away from the Intersection and inland towards to the string of salt lakes which occupy the valley floor and would flow only rarely following heavy rainfall (MineEarth, 2020). The risk of surface water quality deterioration occurring due to clearing is considered minimal due to erosion control measures being implemented and the sandy (low erodibility) nature of the local soils. Ephemeral surface water flows will be maintained through construction of appropriate drainage infrastructure to avoid erosion within the catchment. The project will source water for construction activities and dust suppression from a freshwater standpipe at Marvel Loch and the Kalgoorlie pipeline at Ghooli. Consequently, construction of water bores and taking of groundwater will not be required for the project. The proposed clearing is not expected to have an appreciable impact upon surface water and groundwater quality and therefore is not likely to be at variance with this principle.
Methodology	Baseline flora and vegetation survey (Phoenix, 2021) Parker Range Project Haul Road Surface Water Assessment (Rockwater, 2020). DWER and DBCA shapefiles EPA (2016)

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

Comments	Proposed clearing is not likely to be at variance to this Principle
	The climate of the region is semi-arid, characterised by hot summers and cool winters. The area has a low average rainfall of approximately 305 millimetres per year (BoM, 2021). There are no permanent watercourses or wetlands within the area proposed to be cleared. Soil-landscape units of the Development Envelope are of the soil type AC1, which is described as Gently sloping to gently undulating plateau areas, or uplands, on granites, gneisses, and allied rocks, with long gentle slopes and, in places, abrupt erosional scarps, with deep yellow sands recorded in test pitting (Mine Earth, 2020). Such soils are anticipated to have a high infiltration rate with infrequent flooding. This factor is not anticipated to change with the works in the Development Envelope. Only high intensity, prolonged rainfall events are considered as being likely to cause temporary and localised major surface flows and flood events (Rockwater, 2020). The Development Envelope is located on near the top of a ridgeline which forms a divide between two catchments (Rockwater, 2020). As such, the volumes of stormwater at this location will be small, even in large events. Ephemeral surface water flows will be maintained through construction of appropriate drainage infrastructure. The works are not anticipated to later the incidence or intensity of flooding. With the minimisation of vegetation clearing and implementation of management measures, the proposed clearing would not likely be at variance with this principle.
Methodology	Baseline flora and vegetation survey (Phoenix, 2021a) Parker Range Project Haul Road Surface Water Assessment (Rockwater, 2020). Natural Resource Management SLIP Soil Systems (Accessed January, 2021)

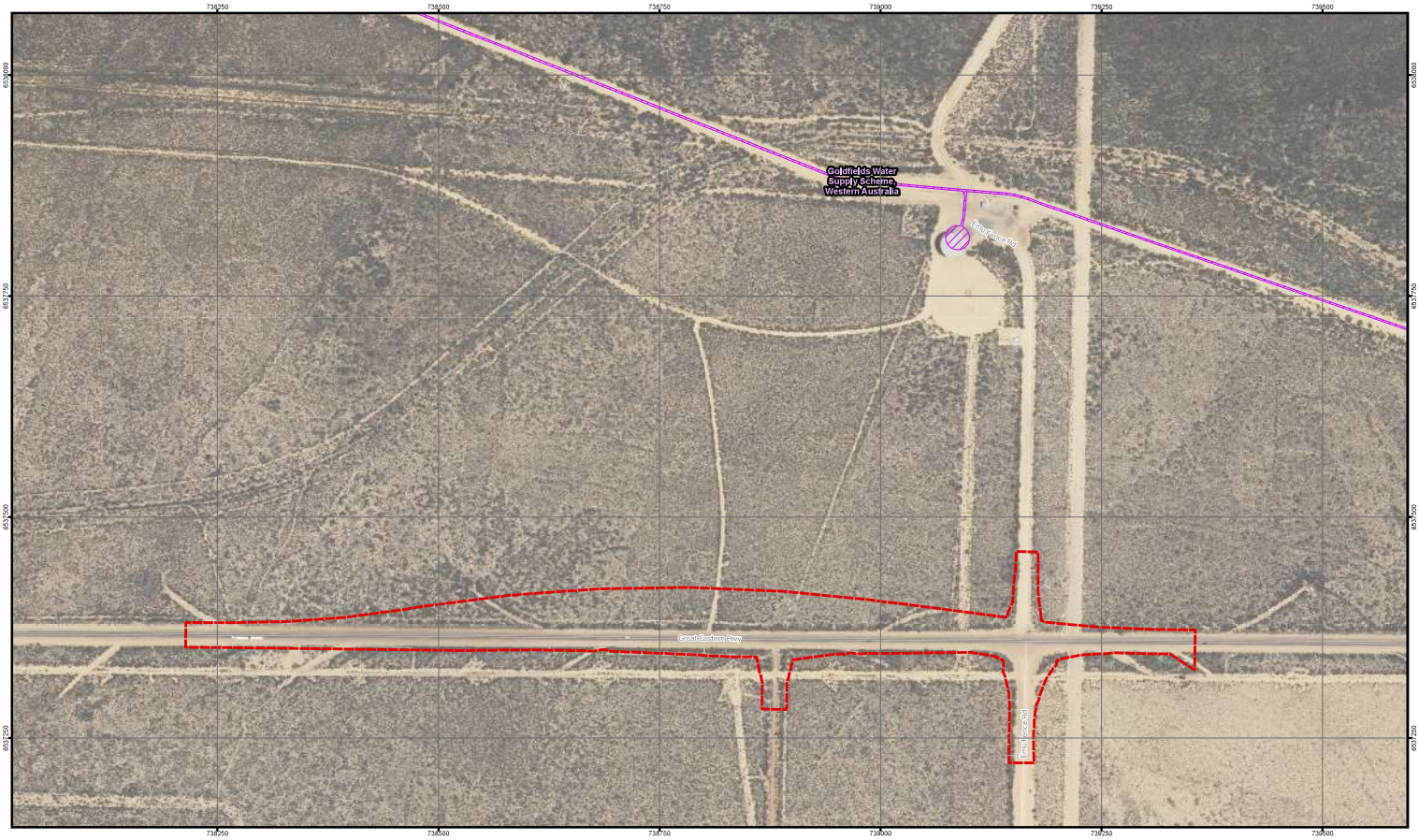
6 ADDITIONAL ACTIONS REQUIRED

Table 5 summarises what further pre-clearing impact assessment and vegetation management is required in accordance with CPS 818.

Table 5. Summary of Additional Management Actions Required by CPS 818

Impact of Clearing	Yes/No or NA	*Further Action Required*
1. The CAR indicates that the clearing is 'At Variance' or 'May be at Variance' with one or more of the Clearing Principles. Where the clearing is at variance or may be at variance to Clearing Principle (f) and no other Clearing Principle, and the area of the proposed clearing is less than 0.5 hectares in size and the Clearing Principle (f) impacts only relate to: (i) a minor non-perennial watercourse(s); (ii) a wetland(s) classed as a multiple use management category wetland(s); and/or (iii) a wetland that is not a defined wetland; the preparation of an Assessment Report, as required by condition 6(e), is not required.	**No**	No further action required.
2. Clearing is at variance or may be at variance with Clearing Principle (g) land degradation, (i) surface or underground water quality or (j) the incidence of flooding.	**No**	No further action required.
3. The project involves clearing for temporary works (as defined by CPS 818).	**No**	No further action required.
4 a. Project is within Region that: - Has rainfall greater than 400mm and - Is South of the 26th parallel and - Works are in 'Other than dry conditions' and - Works have potential for **uninfested** areas to be impacted	**No**	No further action required.
4b. Does the proposed works require clearing within or adjacent to DBCA estate in non-dry conditions?	**No**	No further action required.
5. Main Roads has been notified by DWER or an environmental specialist that the area to be cleared is susceptible to a pathogen other than dieback	**No**	No further action required.
6. The vegetation within the area to be cleared and/or the surrounding vegetation in a good or better condition and weeds likely to spread to and result in environmental harm to adjacent areas of native vegetation that are in good or better condition	**No**	Given the scale of work and lack of weeds found on the site, no further action is required.

7 CONSTRAINTS MAPPING



PROJECT ID	60650191
CREATED BY	KALOU
APPROVED BY	PB
LAST MODIFIED	06 MAY 2021

AECOM
www.aecom.com

1:4,000 (when printed at A3)
DATUM GDA 1994 MGA Zone 50
0 50 100 150 200
metres

Data sources:
Base Data © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate [2021], Geoscience Australia, Sinclair

LEGEND
- Development Envelope
- Goldfields Water Scheme Pipeline

European Heritage Values (Goldfields Water Scheme Pipeline)

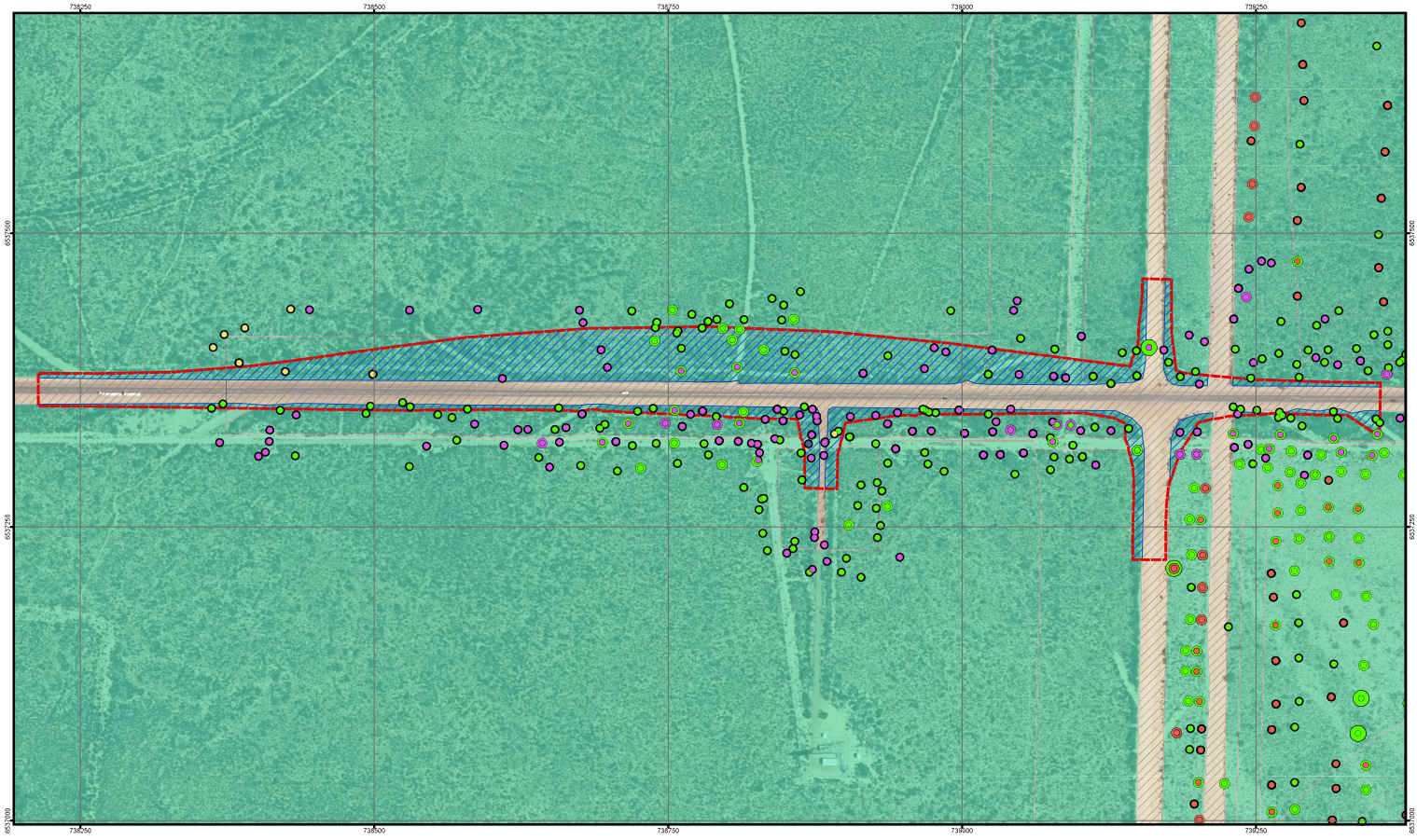
MAIN ROADS WA

UPGRADE TO GREAT EASTERN HIGHWAY AND EMU FENCE ROAD INTERSECTION ENVIRONMENTAL IMPACT ASSESSMENT

Figure 3

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\60\60650191\900_CAD_GIS\02_GIS\02_MXD\04_GreatEasternHwy_Emu_Fence_CAR_Figures\G60650191_GEH_Emu_Fence_CAR_Pro.aprx (kai.du)

A3 size



PROJECT ID 60650191
CREATED BY WYATTK2
APPROVED BY PB
LAST MODIFIED 10 MAY 2021

AECOM
www.aecom.com

1:3,000 (when printed at A3)
DATUM GDA 1994 MGA Zone 50
0 40 80 120 160
metres

Data sources:
Base Data © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate [2021], Geoscience Australia, Sinelpro

LEGEND

- *Acacia desertorum var. nudipes* (P3)
- *Lepidosperma lyonsii* (P1)
- *Lepidosperma lyonsii* (P4)
- *Leucopogon sp. Yellowdine* M. Hislop and F. Hort MH 3194 (P1)
- *Verticordia stenopetala* (P3)

Development Envelope
Area to be Cleared

Vegetation Community
Mid shrubland to closed shrubland of Allocasuarina spinosissima, Hakea minyma, and Micromyrtus ericensis, over open sedgeland of Ecdeiocolia monostachya, Lepidobolus preissianus, and Schoenus spp.
Cleared of vegetation (roads, farmland, borrow pits, mined areas, and other).

Abundance
1 - 5
6 - 25
> 25

Conservation Significant Flora and Vegetation Communities

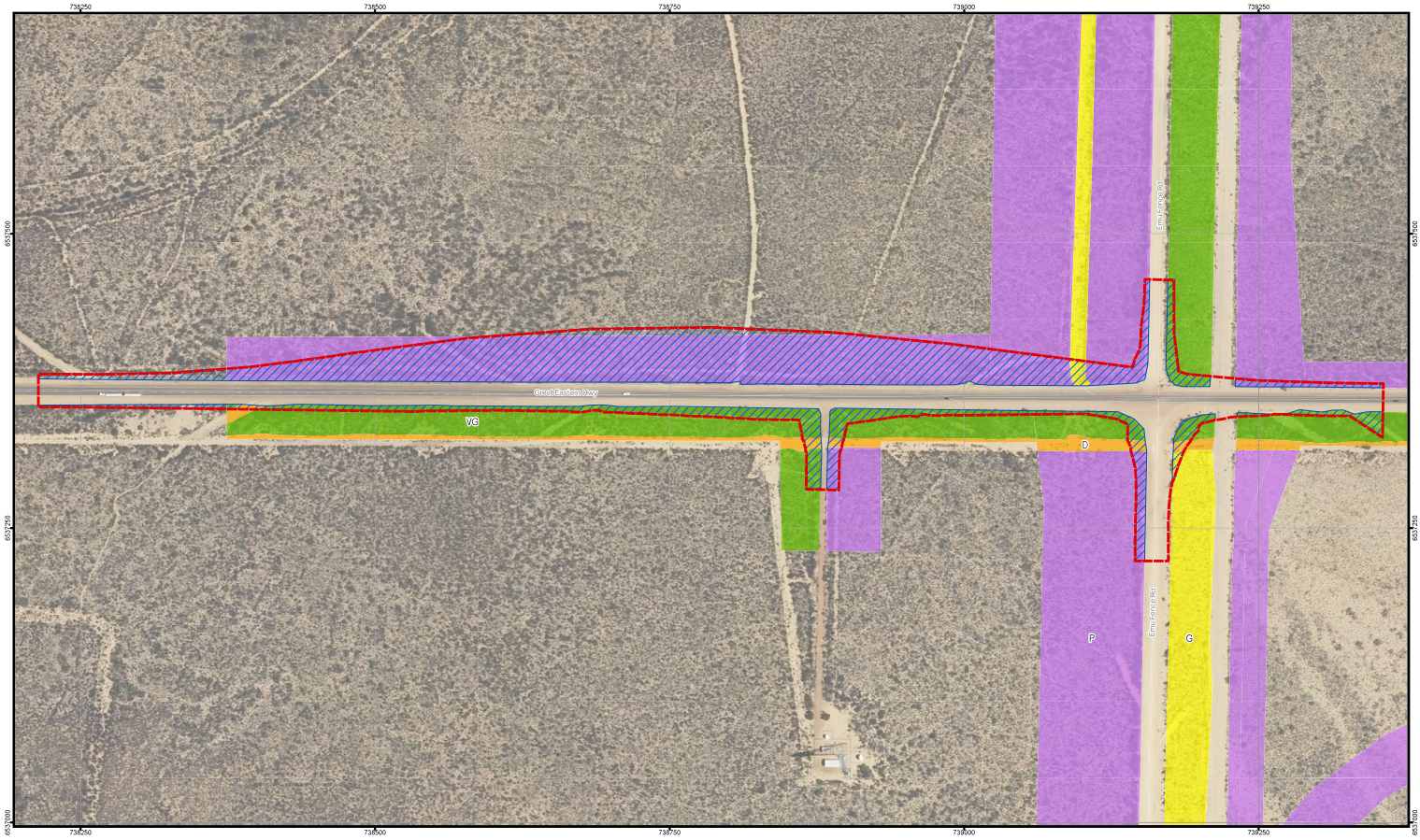
MAIN ROADS WA

UPGRADE TO GREAT EASTERN HIGHWAY AND EMU FENCE ROAD INTERSECTION ENVIRONMENTAL IMPACT ASSESSMENT

Figure **4**

Map Document: \\AUPER1FP001\All_AECOMNET_COM\Projects\60\60650191900_CAD_GIS\620_GIS\02_MXDs\03_GreatNorthernHwy_Emu_Fence_EIA_Figures\G60650191_GreatNorthernHwy_Emu_Fence_EIA_Figures.aprx (WyattK2)

A3 size



PROJECT ID	60650191
CREATED BY	WYATTK2
APPROVED BY	PB
LAST MODIFIED	10 MAY 2021

AECOM
www.aecom.com

N
1:3,000 (when printed at A3)
DATUM GDA 1994 MGA Zone 50
0 40 80 120 160
metres

Data sources:

Base Data © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate [2021], Geoscience Australia, Sinelpro

LEGEND

- Development Envelope
- Area to be Cleared

Vegetation Condition

- Pristine
- Very Good
- Good
- Degraded

Vegetation Condition

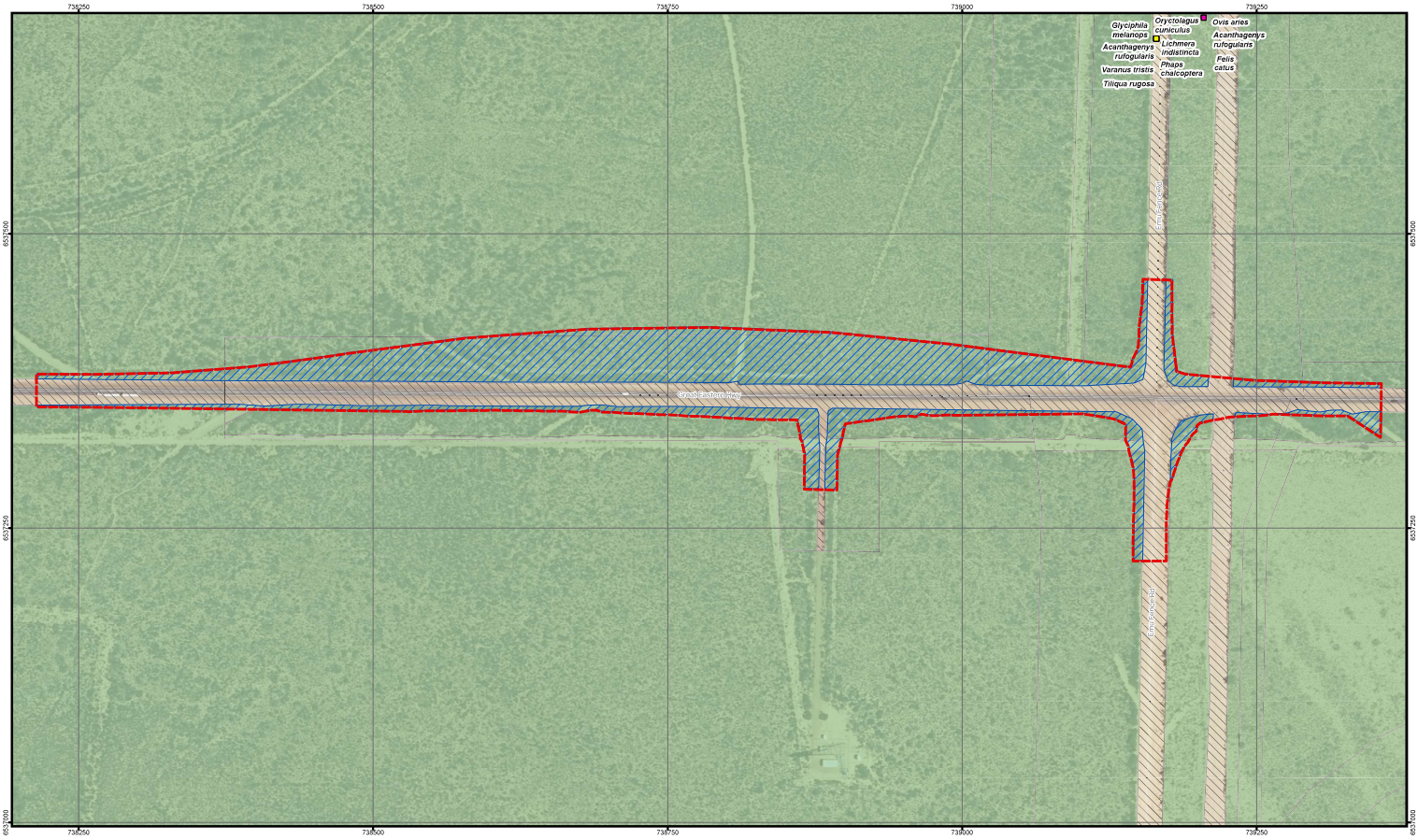
MAIN ROADS WA

UPGRADE TO GREAT EASTERN HIGHWAY AND EMU FENCE ROAD INTERSECTION ENVIRONMENTAL IMPACT ASSESSMENT

Figure **5**

A3 size

Map Document: \\AUPER1FP001\All\AECOMNET\COM\Projects\60\60650191\900_CAD_GIS\020_GIS\02_MXD\s03_GreatNorthernHwy_Emu_Fence_EIA_Figures\G60650191_GreatNorthernHwy_Emu_Fence_EIA_Figures.aprx (WyattK2)



PROJECT ID 60650191
CREATED BY WYATTK2
APPROVED BY PB
LAST MODIFIED 10 MAY 2021

AECOM
www.aecom.com

N
1:3,000 (when printed at A3)
DATUM GDA 1994 MGA Zone 50
0 40 80 120 160
metres

Data sources:

Base Data © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2021), Geoscience Australia, Sinelpro

LEGEND

- *Acanthagenys rufogularis*
- *Felis catus*
- *Glyciphila melanops*
- *Lichmera indistincta*
- *Oryctolagus cuniculus*
- *Ovis aries*
- *Phaps chalcoptera*
- *Tiliqua rugosa*
- *Varanus tristis*

Development Envelope
Area to be Cleared
Fauna Habitat
Mid to tall shrubland
Cleared

Fauna Habitats and Observations

MAIN ROADS WA

UPGRADE TO GREAT EASTERN HIGHWAY AND EMU FENCE ROAD INTERSECTION ENVIRONMENTAL IMPACT ASSESSMENT

Figure 6

A3 size

Map Document: \\AUPER1FP001\All_AECOMNET_COM\Projects\60\60650191\900_CAD_GIS\020_GIS\02_MXD\03_GreatNorthernHwy_Emu_Fence_EIA_Figures\G60650191_GreatNorthernHwy_Emu_Fence_EIA_Figures.aprx (WyattK2)

8 REFERENCES

Beard J. S, (1981), Vegetation of Western Australia. Forests Department, Perth.

Cowan, M., Graham, G. & Mckenzie, N. (2001). Coolgardie 2 (COO2—Southern Cross subregion). In: May, J. E. & McKenzie, N. L. (eds) *A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002*. Department of Conservation and Land Management, Perth, WA, pp. 143–155.

Department of Biodiversity, Conservation and Attractions (2012). NatureMap, WA Department of Biodiversity, Conservation and Attractions, Perth. Available online from: h https://naturemap.dbca.wa.gov.au/. Accessed April 2021.

Department of Natural Resources and Environment (2002). Biodiversity Action Planning. Action planning for native biodiversity at multiple scales; catchment bioregional, landscape, local. Department of Natural Resources and Environment, Victoria.

Environmental Protection Authority (2016). *Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (eds. K Freeman, G Stack, S Thomas and N Woolfrey). Perth, Western Australia.

Environmental Protection Authority (2020). Technical Guidance – Terrestrial vertebrate fauna surveys for Environmental Impact Assessment. Perth, Western Australia.

Government of Western Australia. (2019). 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of December 2017. WA Department of Biodiversity, Conservation and Attractions, Perth. Available online from: https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Government of Western Australia. (2017). 2016 South West Vegetation Complex Statistics. Current as of December 2016. WA Department of Parks and Wildlife, Perth.

Government of Western Australia (2019). Native Vegetation Clearing Permits. Application, assessment, and management requirements under Part V Division 2 of the Environmental Protection Act 1986. Department of Water and Environmental Regulation.

Government of Western Australia (2014). A guide to the assessment of applications to clear native vegetation Under Part V Division 2 of the Environmental Protection Act 1986. Department of Environmental Regulation.

Government of Western Australia (2014). WA Environmental Offset Guidelines. Perth, Western Australia.

Havel, J.J. and Mattiske, E.M. (2000) Vegetation Mapping of South West Forest Regions of Western Australia. Prepared for CALMSCIENCE, Department of Conservation and Land Management and Environment Australia

Hennig K and Kelsey P 2015, Avon Basin hydrological and nutrient modelling, Water Science Technical Series, report no. 74, Water Science Branch, Department of Water, Perth, Western Australia.

MineEarth. (2020). Desktop Soil Assessment Park Range Transport Corridor. Report prepared for Mineral Resources Ltd.

Natural Resource Management in WA. (2021). SLIP portal, Soil-Landscape Mapping. Available online from: http://maps.agric.wa.gov.au/nrminfo/framesetup.asp. Accessed January 2021

Phoenix Environmental Sciences. (2021a). Baseline Flora, Vegetation and Fauna Surveys for the Great Eastern Hwy and Emu Fence Rd Intersection Upgrade. Prepared for Minerals Resources Ltd.

Phoenix (2021b) Baseline Flora, Vegetation and Fauna Surveys for the Parker Range Haul Road Project. Prepared for Minerals Resources Ltd. Prepared for Minerals Resources Ltd.

Rockwater. (2020). Parker Range Project Haul Road Surface Water Assessment. Report prepared for Mineral Resources Ltd.

9 APPENDICES

Appendix	Title
Appendix A	Phoenix Biological Report

Appendix A: Phoenix Biological Report