



**mainroads**  
WESTERN AUSTRALIA

# Clearing Assessment Report – CPS 818

*We're working for  
Western Australia.*

## **Broome-Cape Leveque Road Upgrade**

SLK 0-13

December 2020

EOS 1018

Printed copies are uncontrolled unless marked otherwise. Refer to iRoads for current version.

D21#16944

# Document Control

<b>Owner</b>	Manager Environment
<b>Custodian</b>	Principal Environment Officer Policy
<b>Document Number</b>	D13#601143
<b>Issue Date</b>	07/10/20
<b>Review Frequency</b>	Annual

# Contents

<b>1</b>	<b>PURPOSE</b> .....	<b>5</b>
<b>2</b>	<b>SCOPE</b> .....	<b>5</b>
2.1	Project Scope .....	5
2.2	Assessment Report Scope.....	7
2.3	Alternatives to clearing.....	12
2.4	Measures to Avoid, Minimise, Reduce and Manage Project Clearing Impacts .....	12
2.5	Approved Policies and Planning Instruments .....	15
<b>3</b>	<b>SUMMARY OF SURVEYS</b> .....	<b>16</b>
3.1	Biological Survey .....	16
3.1.1	Summary of Biological Survey.....	16
3.2	Soils and Landforms .....	19
3.3	Hydrology .....	22
<b>4</b>	<b>VEGETATION DETAILS</b> .....	<b>24</b>
4.1.1	Project Site Vegetation Description.....	24
4.1.2	Surveyed Vegetation Types.....	25
<b>5</b>	<b>ASSESSMENT AGAINST THE TEN CLEARING PRINCIPLES</b> .....	<b>32</b>
<b>6</b>	<b>ADDITIONAL ACTIONS REQUIRED</b> .....	<b>45</b>
<b>7</b>	<b>STAKEHOLDER CONSULTATION</b> .....	<b>47</b>
<b>8</b>	<b>VEGETATION MANAGEMENT</b> .....	<b>47</b>
<b>9</b>	<b>REFERENCES</b> .....	<b>48</b>
<b>10</b>	<b>APPENDICES</b> .....	<b>51</b>
	Appendix 1: Greater Bilby Cumulative Habitat Impact Assessment.....	52

## List of Figures

Figure 1. Project Area.....	8
Figure 2. Study Area .....	9
Figure 3. Road Upgrade Envelope, Project Layout and Proposed Clearing Boundary .....	10
Figure 4. Typical Cross Sections at various construction phases.....	11
Figure 5. Soil Landscapes.....	21
Figure 6. Topography and Hydrology .....	23
Figure 7. Pre-European Vegetation Associations .....	27
Figure 8. Surveyed Vegetation Types and Conservation Significant Flora.....	28
Figure 9. Surveyed Vegetation Condition and Weeds .....	29
Figure 10. Surveyed Fauna Habitats and Records.....	30
Figure 11. Prospective Greater Bilby Habitat and Records.....	31

## List of Tables

Table 1. Measures undertaken to Avoid, Minimise, Reduce and Manage the Project Clearing Impacts.....	13
Table 2. Surveyed Fauna Habitats within the Project Area (Biota 2018a).....	18
Table 3. Land Systems / Soil Landscapes .....	19

Table 4. Summary of Mapped Pre-European Vegetation Associations in the RUE.....25  
Table 5. Pre-European Vegetation Representation .....25  
Table 6. Surveyed Vegetation Types and Proposed Clearing within the Project Area (Biota 2018) ...25

**List of Plates**

Plate 1: Existing Intersection of the Broome-Cape Leveque Road with Broome Highway..... 6  
Plate 2: Typical view of sealed section between SLK 0 and 13..... 6  
Plate 3: Man-made earth dam (Nimalaragan Dam) located at SLK 11.7.....22  
Plate 4: Typical view of the existing vegetation adjacent to the Broome-Cape Leveque Road (from Biota 2018) .....24

# Amendments

Report Compilation & Review	Name and Position	Document Revision	Date
Author	Environment Officer (Kimberley)	Draft v1	30/12/2020
Reviewer	Environment Officer	Draft v1	18/01/2021
Author	Environment Officer	Draft V2	22/01/2021
	Environment Officer (Kimberley)		
Reviewer	Environment Officer	Draft v2	8/03/2021
Author	Environment Officer	Final	9/03/2021
	Environment Officer (Kimberley)		

## 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:** Broome – Cape Leveque Road Upgrade (SLK 0 – 13).

#### **Project Purpose / Components:**

The Broome Cape Leveque Road (BCLR) is a 205 km local government road under the care and control of the Shire of Broome, that provides the main transport link through the Dampier Peninsula, enabling vehicle access to an estimated 1,425 people including 71 Aboriginal communities, pastoral stations, pearling industries and tourist destinations. The upper half of the Peninsula, serviced by the road is home to approximately 25% of all Aboriginal Communities in the State.

In historic times, the BCLR was an unsealed sand road approximately 200 km in length, linking the numerous Communities on the Peninsula with the township of Broome and the greater Kimberley. Over the life of the road, the surface has gradually become compressed and sits below the level of surrounding land (over 2 m lower in some areas). This, along with the natural tendency of pindan sands to become easily corrugated, makes travel along the Road extremely treacherous.

Upgrading the road was identified as a priority in the Dampier Peninsula Planning Strategy (WAPC 2015). The BCLR was also identified in the Northern Australia Infrastructure Audit as a Tourist road requiring upgrade (Australian Government 2015). The audit identifies the significant influx of tourists to the town of Broome during the months of June to October resulting in a tripling of the population from 13,000 to around 40,000 people.

In early 2017, the State and Federal Governments committed funding to seal the remaining 90 km of unsealed road. Construction on the SLK 25 – 102.6 section began in May of 2018. The construction of the SLK 13 to 25 section commenced in June 2019. See the following links, which provide additional information on the history of the upgrade of the BCLR:

- <https://project.mainroads.wa.gov.au/home/regional/northeast/broome/Pages/default.aspx>
- <https://thewest.com.au/news/broome-advertiser/cape-leveque-road-project-begins-ng-b88826222z>
- <https://www.mediastatements.wa.gov.au/Pages/McGowan/2018/05/Transport-Minister-inspects-Cape-Leveque-Road-progress.aspx>

Funding has been committed to upgrade the section of the BCLR between SLK 0 and 13 in 2021, which is the subject of this assessment. This section of the BCLR consists of an existing sub-standard sealed road. The Broome-Cape Leveque Road Upgrade (BCLRU) between SLK 0 to 13 involves the construction of a roundabout at SLK 0 at the intersection of the Broome Highway and Cape Leveque



Road and reconstruction and sealing of SLK 0 to 13 to improve road safety. Plate 1 and Plate 2 show the existing road between SLK 0 to 13 and is the focus of this assessment.



**Plate 1: Existing Intersection of the Broome-Cape Leveque Road with Broome Highway**



**Plate 2: Typical view of sealed section between SLK 0 and 13**

Main Roads propose to undertake the following works to bring the BCLR from SLK 0 – 13 up to a suitable standard:

- Clearing of native vegetation adjacent to the existing road;
- Clearing of native vegetation within fill extraction areas (borrow pits), located at one kilometre intervals;

- Clearing of native vegetation for the purpose of a temporary side track to allow traffic to be safely diverted during construction;
- Construction of an upgraded sealed road on the existing BCLR alignment between SLK 0 and 13 including the sealing and finishing of the road (signage, line marking etc.);
- Construction of a roundabout at SLK 0; and
- Redirecting traffic onto completed road.

This report assesses the following scope of works:

- Clearing of Native Vegetation to
  - facilitate the road upgrade and realignment;
  - establish a side track to safely divert traffic during construction; and
  - establish borrow (fill) material areas identified for use as a suitable road base.

Works are expected to commence in March 2021.

**The proposed clearing undertaken using CPS 818 is: 39.8 ha**

**The proposed temporary clearing undertaking using CPS 818 is: 0 ha.**

**Project Location(s):** The project is located on the Broome Highway and Broome-Cape Leveque Road within the Shire of Broome as shown in Figure 1.

- Latitude: -18.704830
- Longitude: 121.864291

The Broome-Cape Leveque Road Upgrade (BCLRU) Project SLK 0 – 13 (the Project) will occur at the following locations:

- Construction of an upgraded sealed road on the existing BCLR alignment between SLK 0 and 13; and
- Construction of a new roundabout intersection between the BCLR and the Broome Highway.

The location and boundaries of the study area (40 km radius) for the project are shown in Figure 2. The project area or Road Upgrade Envelope (RUE) and proposed clearing boundary under assessment are shown in Figure 3.

## 2.2 Assessment Report Scope

The assessment area, see Figure 2, is confined to a local area of a 40 km radius.



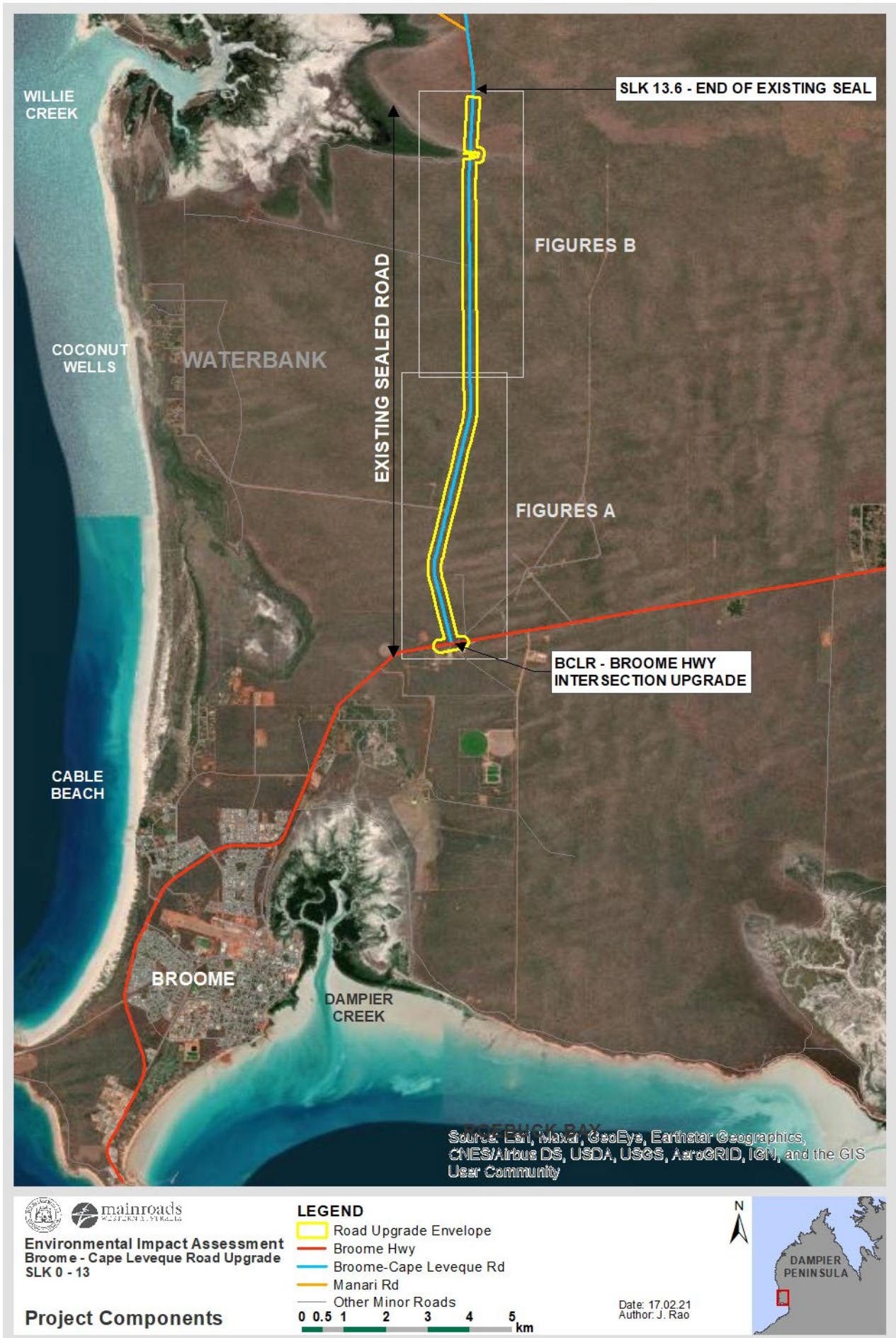
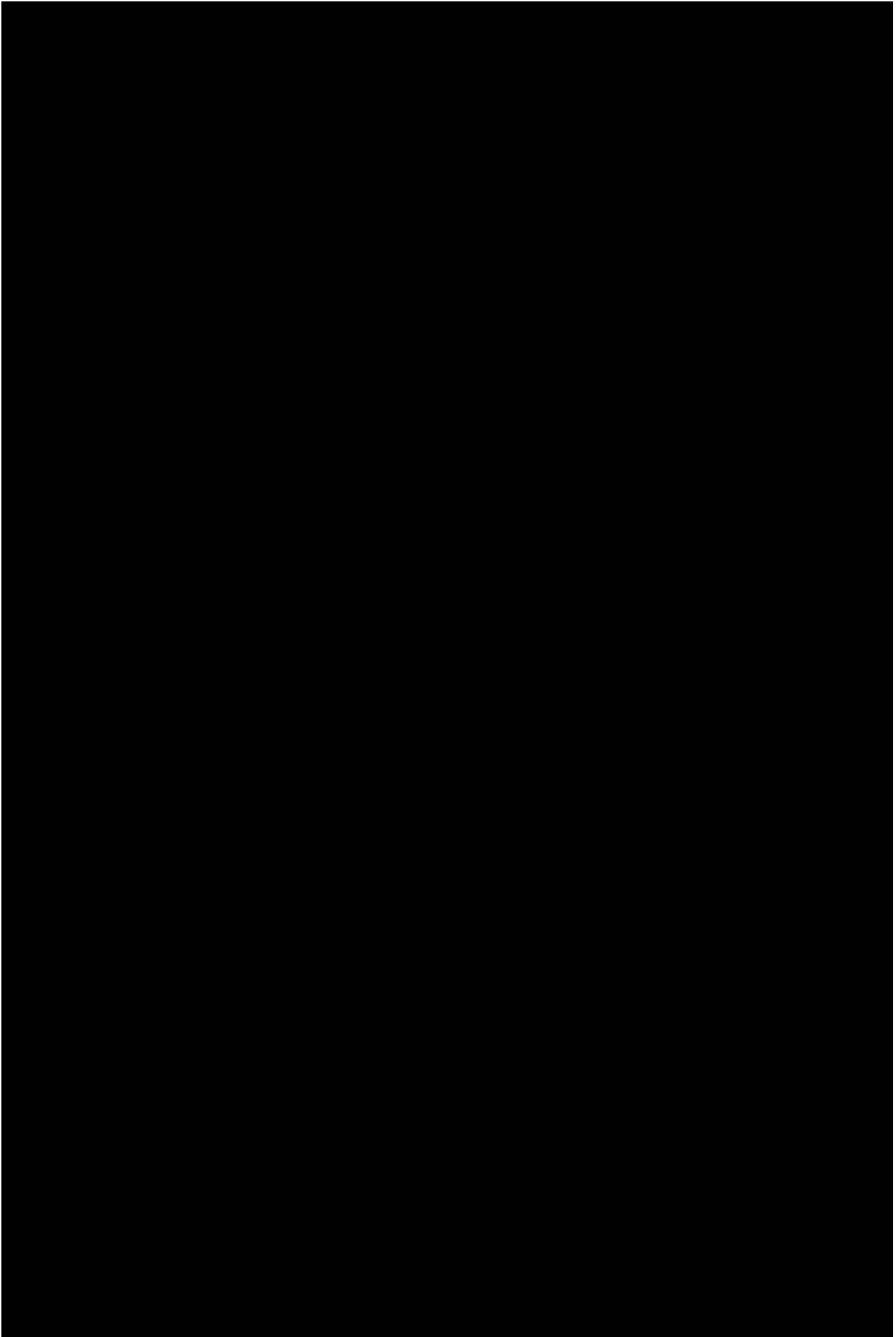


Figure 1. Project Area



**Figure 2. Study Area**



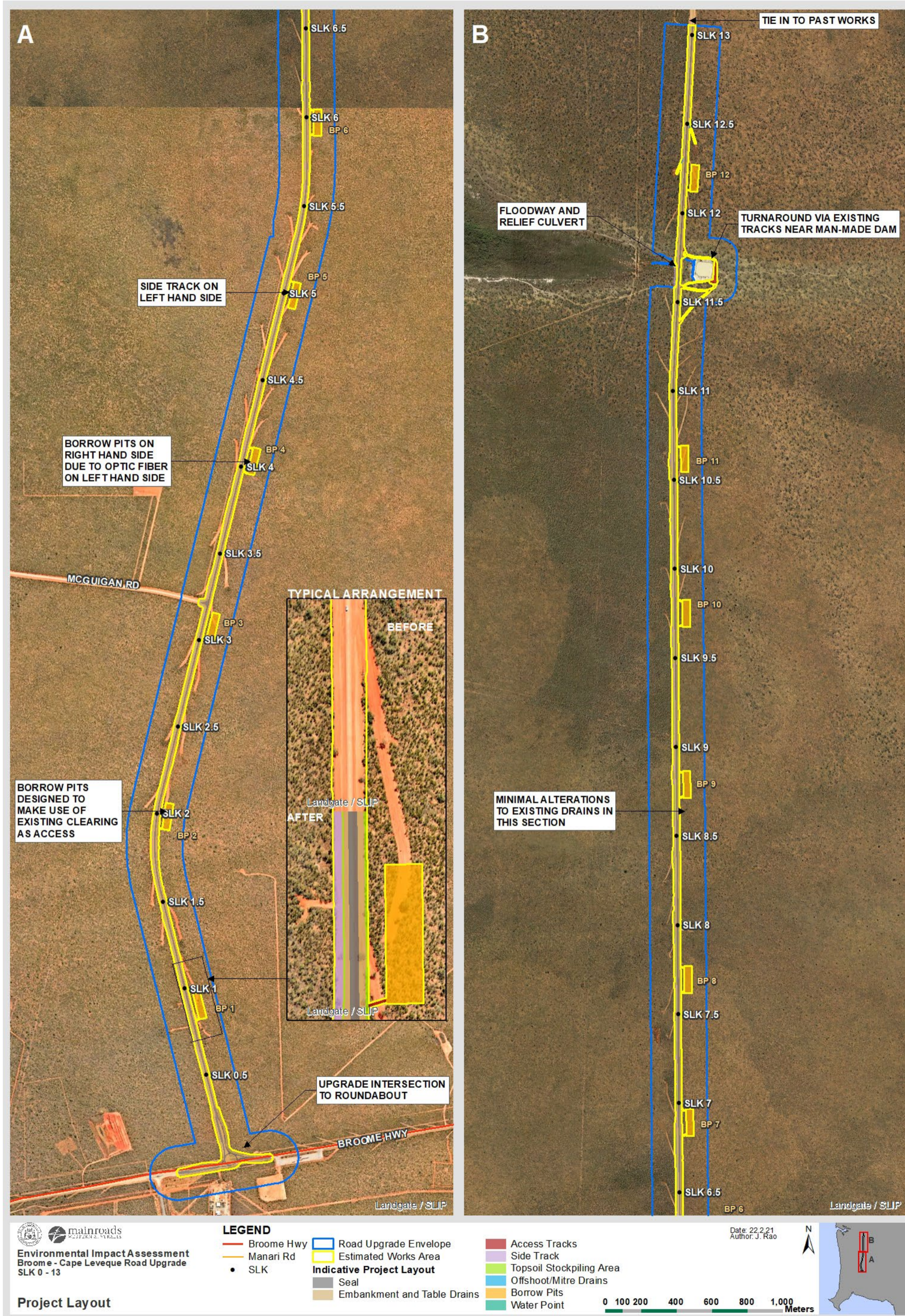
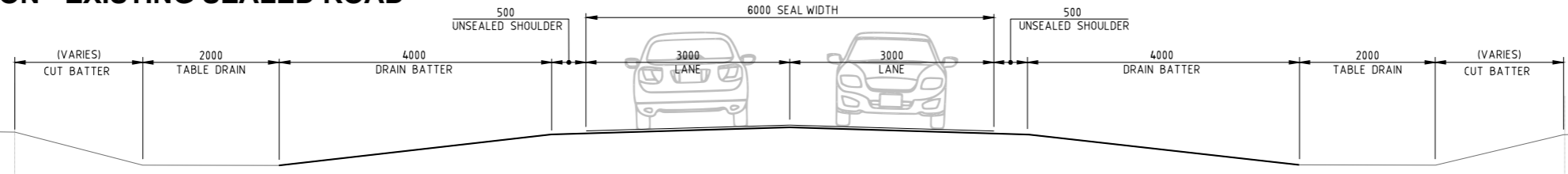


Figure 3. Road Upgrade Envelope, Project Layout and Proposed Clearing Boundary

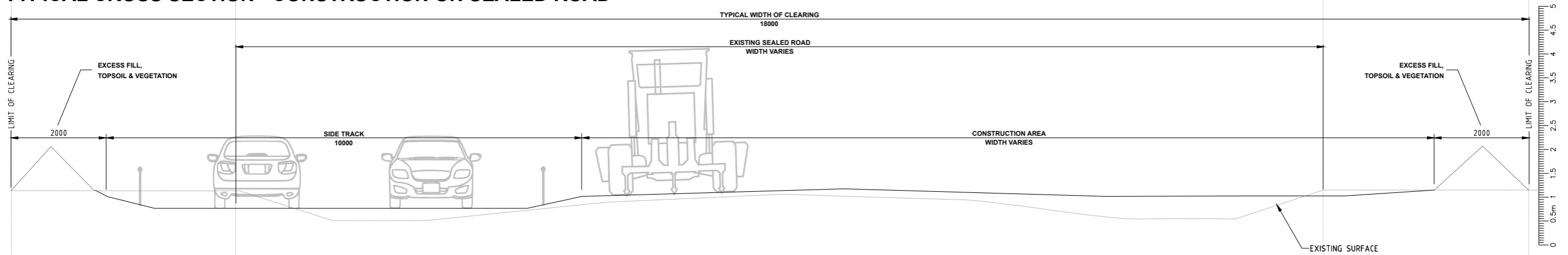


# SLK 0 - 13.6

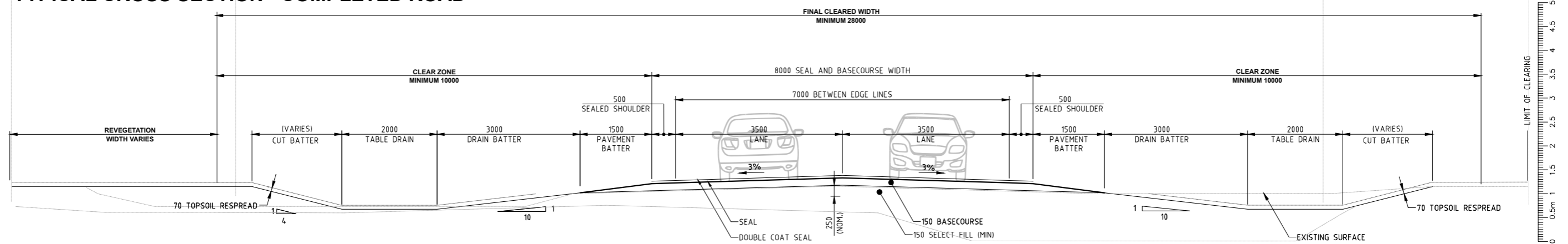
## TYPICAL CROSS SECTION - EXISTING SEALED ROAD



## TYPICAL CROSS SECTION - CONSTRUCTION ON SEALED ROAD



## TYPICAL CROSS SECTION - COMPLETED ROAD



DATE: 29/08/2018  
 DRAWN: JJ RAO (MRWA)  
 ADAPTED FROM KBR/AURECON 2018

Figure 4. Typical Cross Sections at various construction phases

## **2.3 Alternatives to clearing**

There is no alternative to avoid clearing, as the shoulder of the existing road must be widened for safety requirements of road users. This requires the drains to be offset to ensure a reduced chance of damage to the road during the wet seasons.

## **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.

Additionally, a number of general measures will be undertaken to minimise clearing impacts:

- Large trees that are located on the edge of the clearing boundary will be retained as long as they are located beyond 10 m from the edge line;
- A small amount of vegetation growing in association with a wetland environment has been excluded from the clearing boundary;
- A man-made dam which provides habitat for fauna and is likely connected to groundwater supporting nearby wetland vegetation and the Willie Creek Wetland system has been excluded from the clearing boundary; and
- Clearing works will use an avoidance-based strategy. The generous Road Upgrade Envelope (RUE) size allows flexibility for relocating of specific project components to avoid environmental values where appropriate to do so (Figure 3).

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

Design or Management Measure	Discussion and Justification
<b>Steepen batter slopes</b>	<p>Steepening of batter slopes is not considered an effective road design in the West Kimberley. Due to the topography, soils and lack of well-defined drainage, the large volumes of precipitation during the wet season typically form sheet flow in wide areas.</p> <p>Steep batters (typically anything less than 1:6) are prone to scouring due to increased runoff velocity when water flows off the pavement and over the shoulders and drainage batters. This continual scouring leads to increased material requirements for repairs, which indirectly leads to more clearing required for the development and extraction of new gravel pits. Suitable gravels are rare in the West Kimberley due to the extensive sandy landscape.</p> <p>Leaner batters (ideally between 1:8 and 1:10) generate a significantly lower runoff velocity, which significantly reduces the rate of scouring and erosion and is therefore the recommended design principle.</p>
<b>Installation of safety barriers</b>	<p>The installation of safety barriers would not reduce the clearing footprint due to the requirements of roadside drainage for the large volume of water during the wet season. Thus, this is not a suitable measure to avoid clearing. The wide drains also double as stopping areas in the event of vehicles running off the road or requiring to stop in an emergency.</p>
<b>Alignment to one side of existing road</b>	<p>MRWA Kimberley Region has chosen to design the upgrade to follow the existing road alignment. This significantly reduces the clearing requirements for the upgrade works.</p>
<b>Alternative alignment to follow existing road (or) to preferentially locate within pasture or a degraded areas</b>	<p>Where possible, elements such as borrow pits have been strategically located to make use of existing drains and tracks as access points. As designs are still in draft, there is a possibility that these pits may need to be moved, however MRWA will endeavour to align the design with other clearing requirements (for example, future drains) to reduce the overall clearing required for the Project.</p> <p>Furthermore, the location of the Material Source Areas was decided based on a review of existing cleared and degraded areas. The placement of some pits in areas that have already been cleared will likely reduce the clearing requirements of vegetation in good condition</p>
<b>Installation of kerbing</b>	<p>Kerbing is not usually implemented in the Kimberley Region due to the offsets required for road safety and drainage requirements.</p>



<b>Design or Management Measure</b>	<b>Discussion and Justification</b>
<b>Simplification of design to reduce number of lanes and/or complexity of intersections</b>	The design of the road is already as simple as possible, given the local context, traffic volumes and budget of the Project.
<b>Preferential use of existing cleared areas for access tracks, construction storage and stockpiling</b>	Existing cleared areas are planned to be reused for drainage upgrades, side tracks, access tracks and laydown areas.
<b>Drainage modification</b>	The drainage design for the Project is relatively simple, with one floodway and numerous offshoot drains, mostly in pre-existing drain locations.
<b>Use of a 'Clearing Envelope' methodology</b>	The use of a 'clearing envelope' in the form of the Road Upgrade Envelope (RUE) allows for flexibility in impact avoidance, should additional matters of environmental significant be found.

## 2.5 Approved Policies and Planning Instruments

The clearing of native vegetation in Western Australia is regulated under the *Environmental Protection Act 1986* (EP 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* (WA) (RIWI Act);
- *Aboriginal Heritage Act 1972* (WA); and
- *Town Planning and Development Act 1928*.

### **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; and
- Strategic advice – EPA.

## 3 SUMMARY OF SURVEYS

### 3.1 Biological Survey

Main Roads commissioned Biota Environmental Sciences to undertake a detailed and targeted flora and vegetation survey, a level 1 fauna survey and a targeted Bilby survey over the Project Area. The field component of this survey was completed in April 2018. Biota were commissioned to undertake a survey over an area that was larger than the current RUE, which included areas between SLK 13 and 25 as well as some areas within the Yawuru Birragun Conservation Park. Areas within the Conservation Park and between SLK 13 and 25 have since been excluded for this assessment, accounting for any difference in total areas/species counts between this document and the biological survey report.

Section 3.1.1 contains the summary of the findings of the biological survey with a focus on the RUE.

#### 3.1.1 Summary of Biological Survey

##### Vegetation Types

Biota (2018a) mapped three vegetation types in the RUE during the biological survey including:

- **Pindan Sandplains (P1):** *Bauhinia cunninghamii*, *Corymbia zygophylla*, (*C. greeniana*) scattered low trees to low open woodland over *Acacia eriopoda*, *Ficus aculeata* var. *indecora* tall shrubland over *Dodonaea hispidula* (*Breynia cernua*) open shrubland over *Corchorus sidoides* subsp. *sidoides* low open shrubland over *Chrysopogon pallidus*, *Aristida holathera* var. *latifolia*, *Eriachne obtusa* open tussock grassland over *Triodia caelestialis* scattered hummock grasses to very open hummock grassland.
- **Pindan Sandplains (P2):** *Eucalyptus tectifica*, *Corymbia* spp., *Bauhinia cunninghamii*, (*Brachychiton diversifolius* subsp. *diversifolius*) low woodland to low open woodland over *Acacia tumida* var. *kulparn* (*A. eriopoda*, *Ventilago viminalis*, *Persoonia falcata*) tall shrubland over *Breynia cernua*, *Dolichandrone occidentalis* (*Grewia retusifolia*) open shrubland over *Corchorus sidoides* subsp. *sidoides* scattered low shrubs over *Chrysopogon pallidus*, *Whiteochloa airoides*, *Sehima nervosum*, (*Aristida holathera* var. *latifolia*) tussock grassland over *Triodia caelestialis* open hummock grassland.
- **Clay Pans (P3):** *Eucalyptus tectifica*, *Bauhinia cunninghamii* low open woodland over *Sorghum plumosum* var. *plumosum*, (*Chrysopogon pallidus*) closed tussock grassland with *Zornia muelleriana* subsp. *congesta*, *Gossypium rotundifolium*, *Galactia tenuiflora* very open herbland.

Biota also mapped a fourth vegetation unit (Damplands D1) which has been excised from the RUE to avoid impacts to potential wetland related vegetation.

Additional information relating to vegetation is presented in Section 4.

##### Flora Diversity

Database searches indicated a total of 685 species of vascular flora present within the desktop assessment area (NatureMap 2020). The diversity is considered to be very high due to the presence of a large diversity of nearshore, coastal and inland environments. Actual flora diversity of the environments/habitats within the SLK 0-13 area is likely to be significantly lower. Biota (2018a) catalogued a total of 189 flora species during the field survey of the SLK 0 – 25 section.

##### Conservation Significant Flora

Database searches identified 19 conservation significant flora species within the desktop assessment area, consisting of one Declared Rare Flora (DRF) and 18 Priority species.

Despite searches, no Declared Rare Flora (DRF) were found within the RUE during Biota's survey. Six Priority Flora taxa were recorded within the RUE in the SLK 0 – 13 section:

- *Corymbia paractia* (Priority 1; 73 individuals from 27 locations);
- *Jaquemontia* sp. Broome (Priority 1; 700 individuals from 42 locations);
- *Bonamia oblongifolia* (Priority 3; unknown count from 4 locations);
- *Polymeria* sp. Broome (Priority 3; 137 individuals from 35 locations);
- *Stylidium pindanicum* (Priority 3; 147 individuals from 5 locations); and
- *Terminalia kumpaja* (Priority 3; 27 individuals from 9 locations).

The locations of these species are illustrated in Figure 8.

### **Threatened and Priority Ecological Communities (TEC/PEC)**

A number of TECs and PECs were found in desktop searches of the desktop study area:

- Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula (Vulnerable);
- Species-rich faunal community on the intertidal mudflats of Roebuck Bay (Vulnerable);
- *Corymbia paractia* dominated community on dunes (Priority 1);
- Dwarf pindan heath community of Broome coast (Priority 1);
- Relict dune system dominated by extensive stands of Minyjuru (Mangarr) *Sersalisia* (formerly *Pouteria sericia*) (Priority 1);
- Roebuck Land System (Priority 3);
- Kimberley Vegetation Association 37 (Priority 3);
- Kimberley Vegetation Association 67 (Priority 3);
- Kimberley Vegetation Association 73 (Priority 3);
- Eighty Mile Land System (Priority 3); and
- Nimalarica Claypan (previously Nimalaica) (Priority 4).

No vegetation types that constitute a TEC or PEC were found within the RUE during Biota's survey (2018a).

### **Weeds**

Database searches on the desktop study area identified a total of 107 weed species, 13 of which were recorded within the SLK 0-13 RUE by Biota (2018a):

- *\*Cenchrus ciliaris*;
- *\*Cenchrus setiger*;
- *\*Chloris barbata*;
- *\*Cynodon dactylon*;
- *\*Gomphrena celosioides*;
- *\*Mesosphaerum suaveolens*;
- *\*Passiflora foetida*;
- *\*Physalis angulata*;
- *\*Sida cordifolia*;
- *\*Sporobolus ?coromandelianus*;
- *\*Stylosanthes hamata*;
- *\*Tribulus terrestris*; and
- *\*Triumfetta pentandra*.

None of the weeds listed above are Declared Pests as listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). The locations of recorded weeds are illustrated in Figure 9.

### Fauna Habitats

Biota completed a Level 1 Fauna Survey and Targeted Bilby Survey in 2018. Three fauna habitats were mapped within the RUE (Table 2, Figure 10). The two dominant fauna habitats (*Corymbia* and *Bauhinia* Low Open Woodland on sandplain and *Melaleuca* woodland damplands) are considered regionally common and are not restricted (Biota 2018a). Whilst the man-made dam is artificial, it does represent a localised and uncommon habitat type within the study area that would attract a different suite of species including conservation significant species such as the Grey Falcon, Australian Painted Snipe, Oriental Pratincole or Barn Swallow, hence it has been removed from the clearing boundary (Biota 2018a).

**Table 2. Surveyed Fauna Habitats within the Project Area (Biota 2018a)**

Fauna Habitat	Description	Extent within RUE	Extent Within Clearing Boundary
<b>Corymbia and Bauhinia Woodland</b>	<i>Corymbia</i> and <i>Bauhinia</i> spp. low open woodland over mixed shrubland dominated by <i>Acacia</i> spp., <i>Corchorus sidoides</i> , <i>Flueggea virosa</i> and <i>Breynia cernua</i> shrubs over mixed tussock grassland dominated by <i>Chrysopogon pallidus</i> over <i>Triodia</i> species hummock grassland on sandplain.	<b>369.9 ha</b>	<b>39.8 ha</b>
<b>Melaleuca Woodland</b>	<i>Melaleuca alsophila</i> low woodland over scattered <i>Flueggea virosa</i> shrubs over mixed open heath and tussock grassland over open sedgeland dominated by <i>Fimbristylis</i> spp. on sandy damplands.	<b>3.1 ha</b>	<b>0 ha</b>
<b>Man-made Dam</b>	Permanent artificial water body fringed with sparse mixed grasses	<b>1.6 ha</b>	<b>0 ha</b>
<b>Cleared Areas</b>	Areas currently cleared as of 2018 (not included in total)	<b>39.5 ha</b>	<b>29.1 ha</b>
<b>TOTALS</b>		<b>374.6 ha</b>	<b>39.8 ha</b>

Note: Estimate based on most recent designs, including appropriate contingencies (added to permanent clearing). Totals do not include areas that are already cleared.

### Fauna Diversity

Database searches on the desktop study area identified a total of 846 native vertebrate fauna species within the desktop assessment area (NatureMap 2020). As with flora diversity, this is considered to be very high due to the presence of a large diversity of nearshore, coastal and inland habitats. Actual fauna diversity of the habitats within the SLK 0-13 area is likely to be significantly lower. Biota identified a total of 68 fauna species during the Level 1 field assessment of the SLK 0-25 section (Biota 2018a).

### Conservation Significant Fauna

Database searches identified a large number of conservation significant fauna species, including:

- 24 species listed as ‘Threatened’ under Sections 19(1) and 26(2) of the *Biodiversity Conservation Act 2016* (BC Act);
- One species listed as ‘Extinct’ under Section 23(1) of the BC Act;
- 70 Species listed as ‘Specially Protected’ under Section 13(1) of the BC Act;
- One species listed as Priority 1;
- Two species listed as Priority 2;
- Four species listed as Priority 3; and

- Ten species listed as Priority 4.

Three conservation significant species were detected within the RUE during the 2018 survey:

- *Macrotis lagotis* (Greater Bilby) – Vulnerable;
- *Ardea modesta* (Eastern Great Egret) – protected under International Agreement; and
- *Merops ornatus* (Rainbow Bee-eater) – protected under International Agreement.

The Eastern Great Egret and Rainbow Bee-eater are not listed under State conservation significant fauna lists and are therefore not considered in this assessment. Biota completed a targeted survey for Greater Bilby (Bilby) that included targeted searches for burrows, Bilby evidence (tracks, scats, diggings) and mapping of prospective habitat. The location of Bilby evidence and prospective habitat within the RUE is illustrated in Figure 11. Since the 2018 survey, records of Bilby within the vicinity provided by the DBCA on 28 October 2020 have been included.

### 3.2 Soils and Landforms

The Department of Agriculture and Food WA (DAFWA) has carried out rangelands surveys across most of Western Australia and collated soil landscape information into 'Land Systems' (Tille 2006, DPIRD 2021). Land System classification contains information on landforms, soils and associated vegetation.

Table 3 summarises key information relating to the Land Systems mapped within the SLK 0-13 RUE (Payne and Schoknecht 2011). These are also illustrated on Figure 5.

**Table 3. Land Systems / Soil Landscapes**

Land System / Soil Landscape	Vegetation	Statewide Extents	Clearing Description*
<b>Carpentaria Low System</b> Bare coastal mudflats, minor sandy margins and seaward margins	Little vegetation except for mangrove fringing thickets.	220,771 ha	<b>0.3 ha**</b>
<b>Wanganut System</b> Low-lying sandplain and dunefields with through-going drainage, pindan	Sandplains and linear dunes supporting pindan woodlands with acacias and bloodwoods and curly spinifex- ribbon grass, and broad low-lying swales supporting bloodwood-grey box woodlands with curly spinifex-ribbon grass.	699,097 ha	<b>16.3 ha</b>
<b>Yeeda System</b> Sandplain, deep red and yellow sands, pindan and tall woodlands	Pindan shrubland dominated by <i>Acacia eriopoda</i> , <i>A.colei</i> , <i>Bauhinia cunninghamii</i> , <i>Corymbia dichromophloia</i> and <i>Grevillea</i> spp. with <i>Triodia pungens</i> and <i>T. sp. Melaleuca acacioides</i> where sandplains border the coastal plains.	2,565,900 ha	<b>23.2 ha</b>
<b>TOTAL</b>			<b>39.8 ha</b>

\* Excludes areas that are currently already cleared as well as exclusion areas.

\*\*The area of the project mapped as being part of this system is likely to be incorrect. The Wanganut system is considered more appropriate for this area.

The entirety of the Project Area is generally flat. Payne & Schocknecht (2011) describe the geomorphology of the two land systems found within the Project area as:

- **Yeeda Land System:** Slopes mainly less than 1%, but up to 3% locally;



- **Wanganut System:** Slopes mainly less than 2%; and
- **Carpentaria Low System:** Slopes up to 1%.

These values are typical of sandplains and coastal areas on the Dampier Peninsula. Topographic mapping for the Project Area is available in Figure 6.

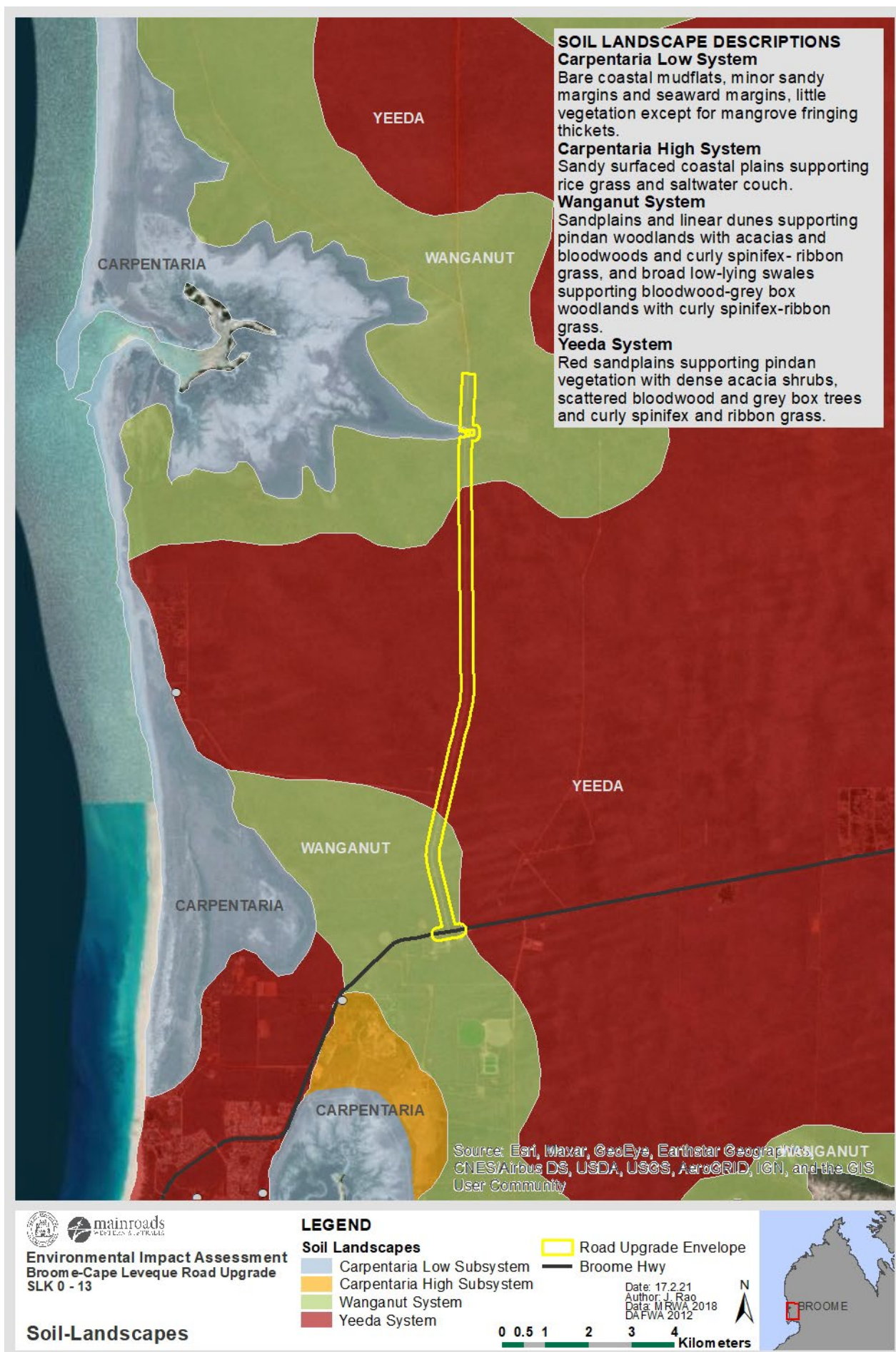


Figure 5. Soil Landscapes

### 3.3 Hydrology

A common characteristic of the West Kimberley sand plains is the general lack of defined watercourses, due to the well-draining characteristics of pindan. However, during periods of high rainfall, overland flows in low lying areas and sheet-flows may be experienced.

Figure 6 illustrates the extents of mapped watercourses (defined channels) surrounding the Project. For the purpose of environmental impact assessment, delineation of watersheds based on satellite derived topographic survey is also provided due to the variety of coastal ecosystems that may receive runoff from the Project.

The Project falls within three defined watersheds:

- **Willie Creek watershed:** drains to the west into Willie Creek, a tidal creek north of Broome. There are no defined drainage channels, however surface flows are generally confined to areas of the Carpentaria Low System.
- **Cable Beach watershed:** drains to the west towards Cable Beach. There are no defined drainage channels within the RUE in this area.
- **Dampier Creek watershed:** drains to the south towards Dampier Creek. There are no defined drainage channels within the RUE in this area.

The Project does not fall within the Roebuck Bay watershed (Figure 6).

A man-made dam is located at SLK 11.7. The dam is clay lined with relatively stable water levels indicating it is at least partially groundwater replenished particularly when considering the shallow water table known to be present in the area surrounding this dam from monitoring records on the DWER Water Information Reporting Tool (DWER 2021). The dam, whilst man-made, also provides fauna habitat. For these reasons, the man-made dam has been excluded from the clearing boundary and will not be utilised or impacted by the proposed activities. Plate 3 shows the man-made dam at SLK 11.7.



**Plate 3: Man-made earth dam (Nimalaragan Dam) located at SLK 11.7**

**Figure 6. Topography and Hydrology**



## 4 VEGETATION DETAILS

### 4.1.1 Project Site Vegetation Description

Vegetation across the RUE is relatively contiguous and consists of typical 'Pindan' vegetation of Scattered *Corymbia* overstorey over an *Acacia* dominated mid-storey and a grassy understorey, over deep red sands. Plate 4 shows the typical vegetation along the BCLR.



**Plate 4: Typical view of the existing vegetation adjacent to the Broome-Cape Leveque Road (from Biota 2018)**

Vegetation mapping is available for the RUE and are assessed in this document at two scales:

- Regional: pre-European vegetation associations mapped at 1:250,000 (Shepherd, Beeston and Hopkins 2002);
- Local: Site-specific biological surveys mapped at 1:10,000 (Biota 2018a).

The clear separation of scales allows for greater detail in the assessment of the regional and local significance of the proposed clearing.

The RUE falls entirely within one pre-European Vegetation Association: Association 750, which is described in Table 5 and presented in Figure 7.

**Table 4. Summary of Mapped Pre-European Vegetation Associations in the RUE**

Pre-European Vegetation Association(s)	Clearing Description	Vegetation Condition	Comments
<b>Vegetation Association 750</b> described as Shrublands, pindan; Acacia tumida shrubland with grey box & cabbage gum medium woodland over ribbon grass & curly spinifex (Government of Western Australia 2019)	Up to 39.8 ha	Very Good (Biota 2018a)	Vegetation description and condition determined from Main Roads site visit on 27 October 2017, biological survey from April 2018 and aerial imagery.

**Table 5. Pre-European Vegetation Representation**

Pre-European Vegetation Association	Scale	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA reserves
<b>Veg Assoc No. 750</b>	<b>Statewide</b>	1,231,155.5	1,225,687.52	99.56	2.77
	<b>IBRA Bioregion</b> <i>Dampierland</i>	1,229,182.16	1,225,280.52	99.68	2.78
	<b>IBRA Sub-region</b> <i>Pindanland</i>	1,221,734.45	1,217,843.72	99.68	2.79
	<b>Local Government Authority</b> <i>Shire of Broome</i>	1,115,559.36	1,110,131.18	99.51	3.06

#### 4.1.2 Surveyed Vegetation Types

Based on Biota’s survey, the Project (SLK 0-13) is expected to require the clearing of up to 39.8 ha of native vegetation, comprising three separate vegetation types.

Table 6 provides details on the type, extent and expected impacts on these vegetation types within the RUE and clearing boundary for the BCLRU SLK 0 – 13 section. None of these vegetation types constituted a Threatened or Priority Ecological Community (TEC / PEC). The extent of these units within the Project Area is provided in Figure 8. Surveyed vegetation types were generally consistent with the descriptions of the pre-European vegetation types, reflective of the relatively low level of alteration since European colonisation (<1% cleared) (Biota 2018).

**Table 6. Surveyed Vegetation Types and Proposed Clearing within the Project Area (Biota 2018)**

Vegetation Type	Description	Extent within RUE	Proposed Clearing Area
P1	<b>Pindan Sandplains</b> <i>Bauhinia cunninghamii</i> , <i>Corymbia zygophylla</i> , ( <i>C. greeniana</i> ) scattered low trees to low open woodland over <i>Acacia eriopoda</i> , <i>Ficus aculeata</i> var. <i>indecora</i> tall shrubland over <i>Dodonaea hispidula</i> ( <i>Breynia cernua</i> ) open shrubland over <i>Corchorus sidoides</i> subsp. <i>sidoides</i> low open shrubland over <i>Chrysopogon pallidus</i> , <i>Aristida holathera</i> var. <i>latifolia</i> , <i>Eriachne obtusa</i> open tussock grassland over <i>Triodia caelestialis</i> scattered hummock grasses to very open hummock grassland.	<b>308.6 ha</b>	<b>34.8</b>



Vegetation Type	Description	Extent within RUE	Proposed Clearing Area
P2	<p><b>Pindan Sandplains</b>  <i>Eucalyptus tectifica</i>, <i>Corymbia</i> spp., <i>Bauhinia cunninghamii</i>, (<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>) low woodland to low open woodland over <i>Acacia tumida</i> var. <i>kulparn</i> (<i>A. eriopoda</i>, <i>Ventilago viminalis</i>, <i>Persoonia falcata</i>) tall shrubland over <i>Breynia cernua</i>, <i>Dolichandrone occidentalis</i> (<i>Grewia retusifolia</i>) open shrubland over <i>Corchorus sidoides</i> subsp. <i>sidoides</i> scattered low shrubs over <i>Chrysopogon pallidus</i>, <i>Whiteochloa airoides</i>, <i>Sehima nervosum</i>, (<i>Aristida holathera</i> var. <i>latifolia</i>) tussock grassland over <i>Triodia caelestialis</i> open hummock grassland.</p>	58.1 ha	4.5
P3	<p><b>Clay Plains</b>  <i>Eucalyptus tectifica</i>, <i>Bauhinia cunninghamii</i> low open woodland over <i>Sorghum plumosum</i> var. <i>plumosum</i>, (<i>Chrysopogon pallidus</i>) closed tussock grassland with <i>Zornia muelleriana</i> subsp. <i>congesta</i>, <i>Gossypium rotundifolium</i>, <i>Galactia tenuiflora</i> very open herbland.</p>	3.25 ha	0.5
<b>Cleared Areas</b>	Areas currently cleared as of 2018 (not included in total)	41.16 ha	29.5 ha
<b>TOTALS</b>		<b>373 ha</b>	<b>39.8 ha</b>

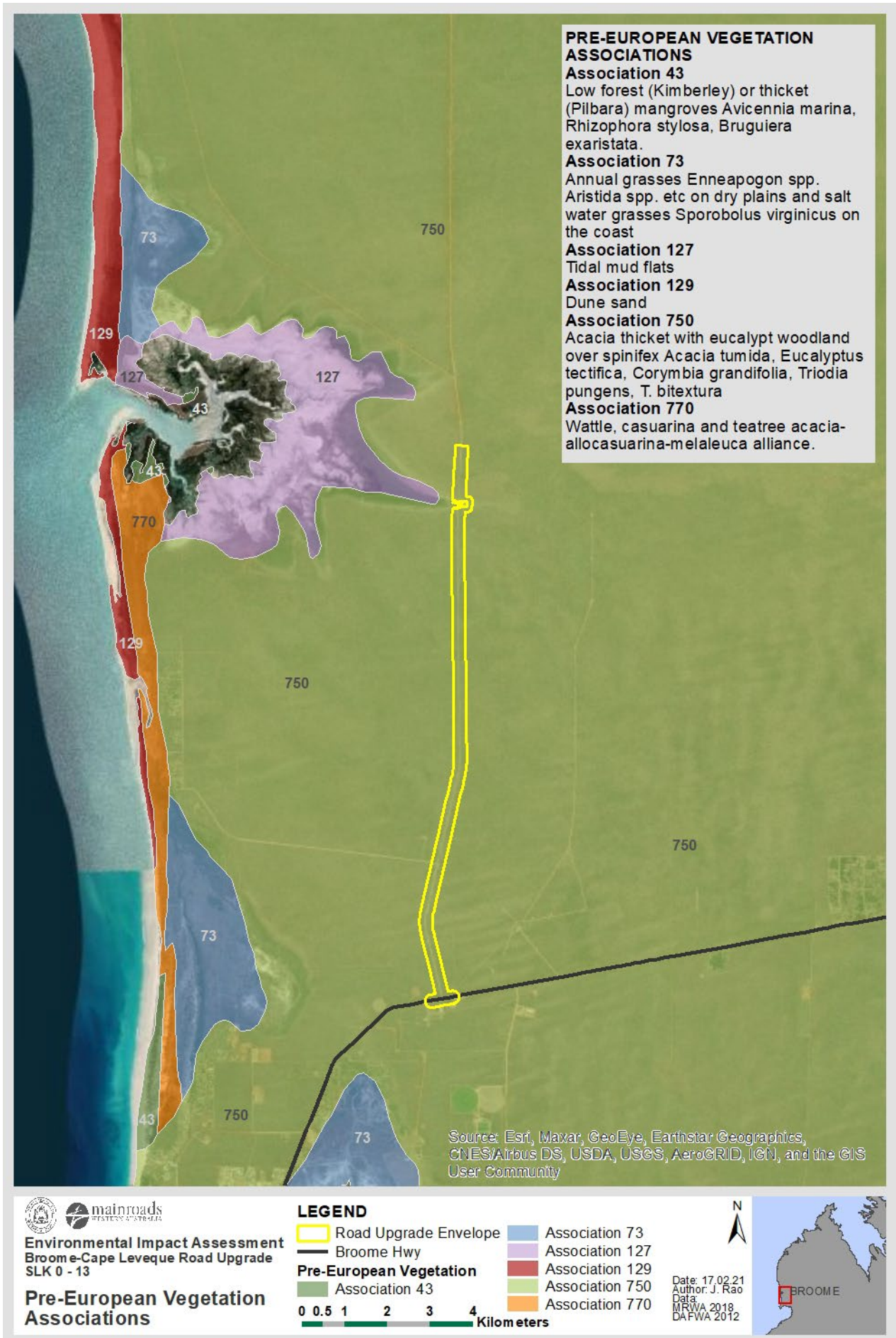
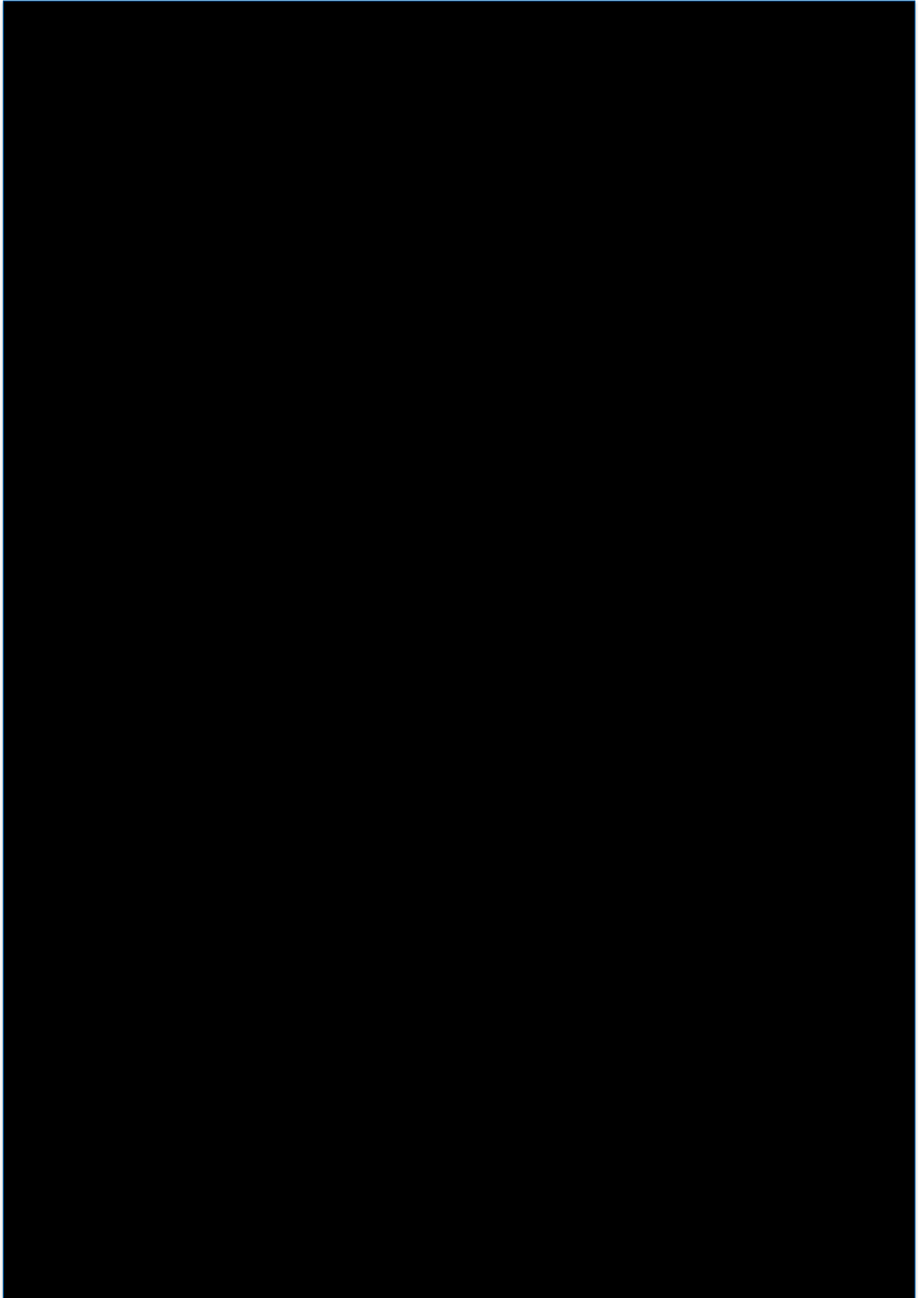
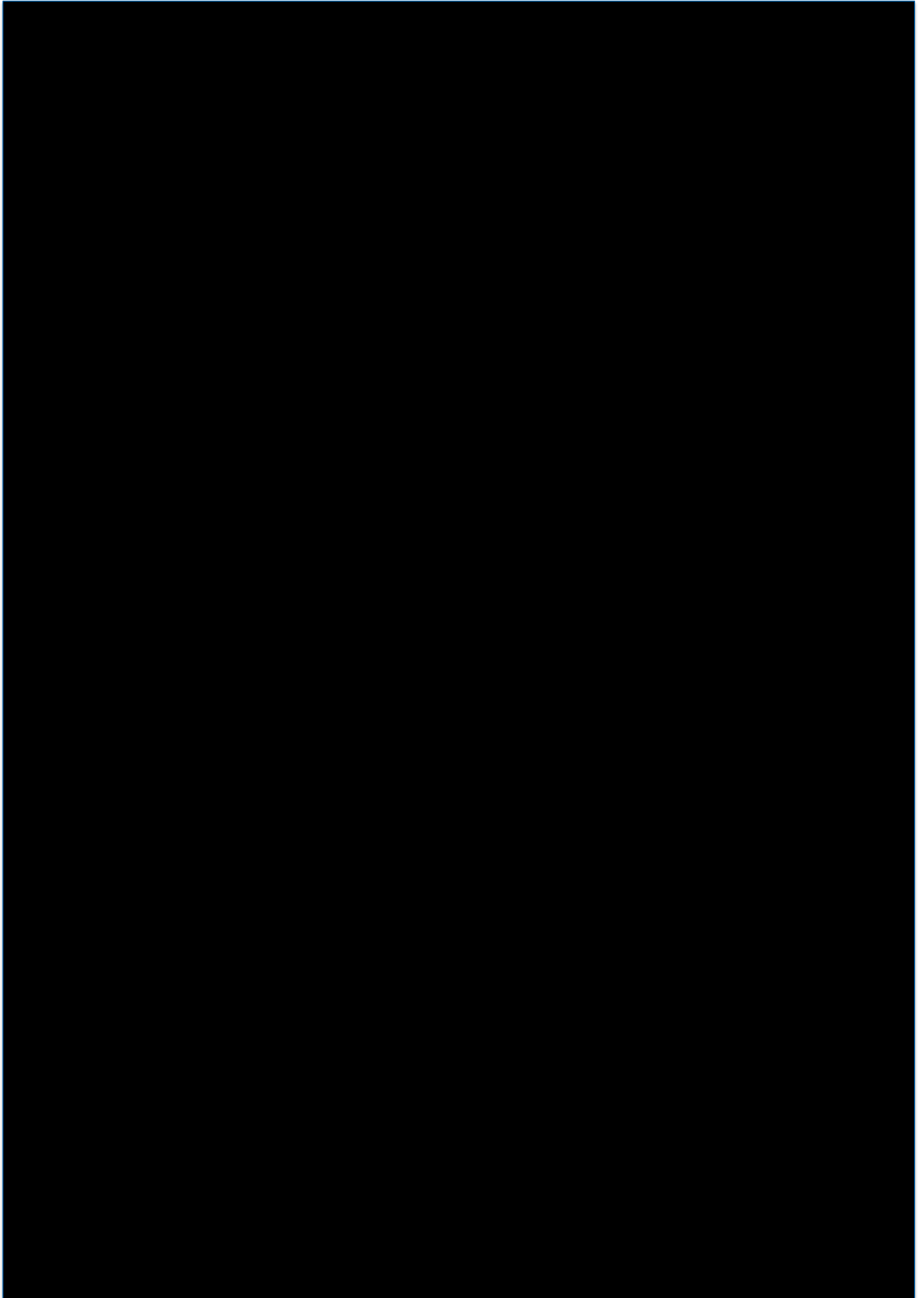


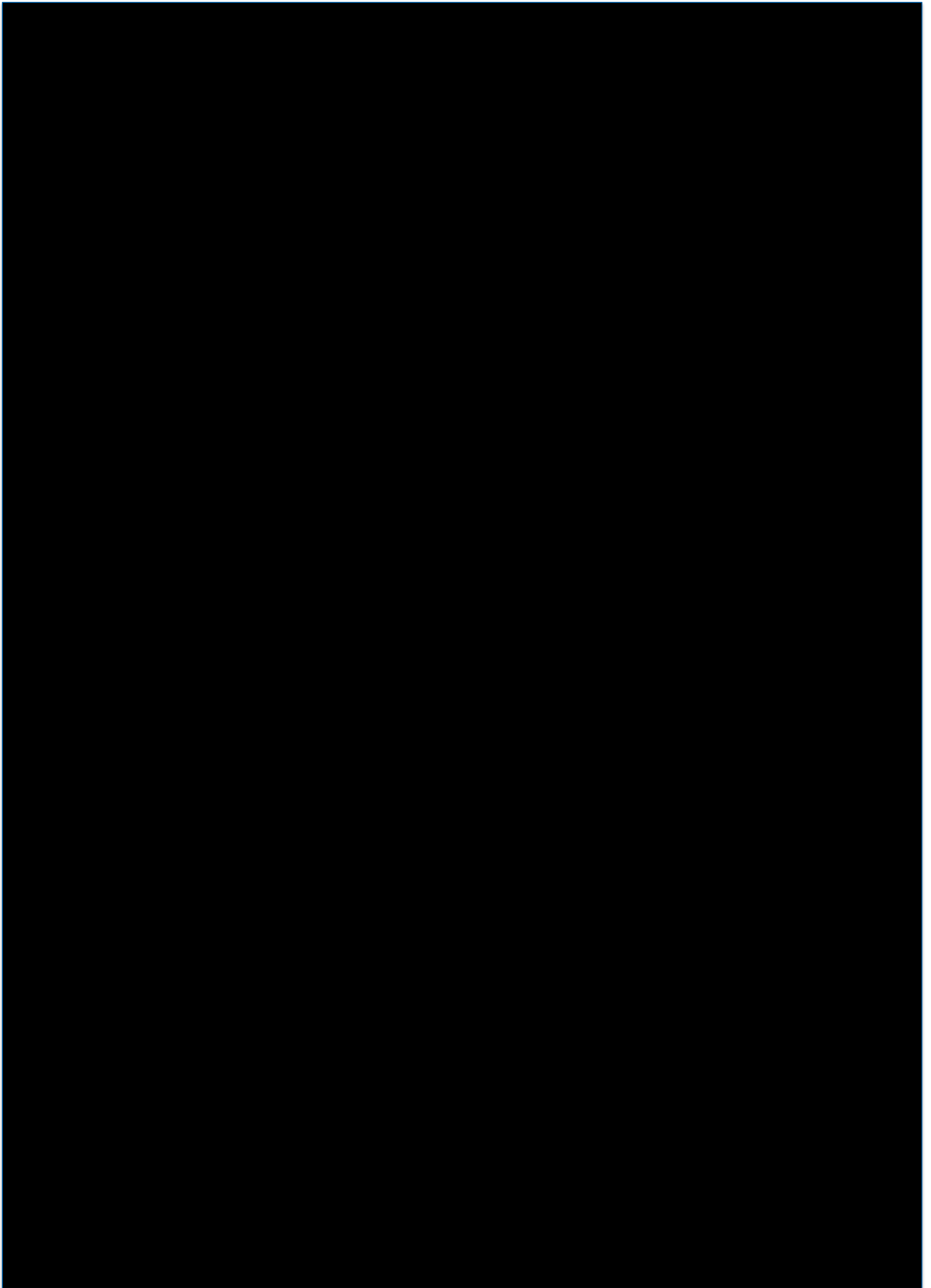
Figure 7. Pre-European Vegetation Associations



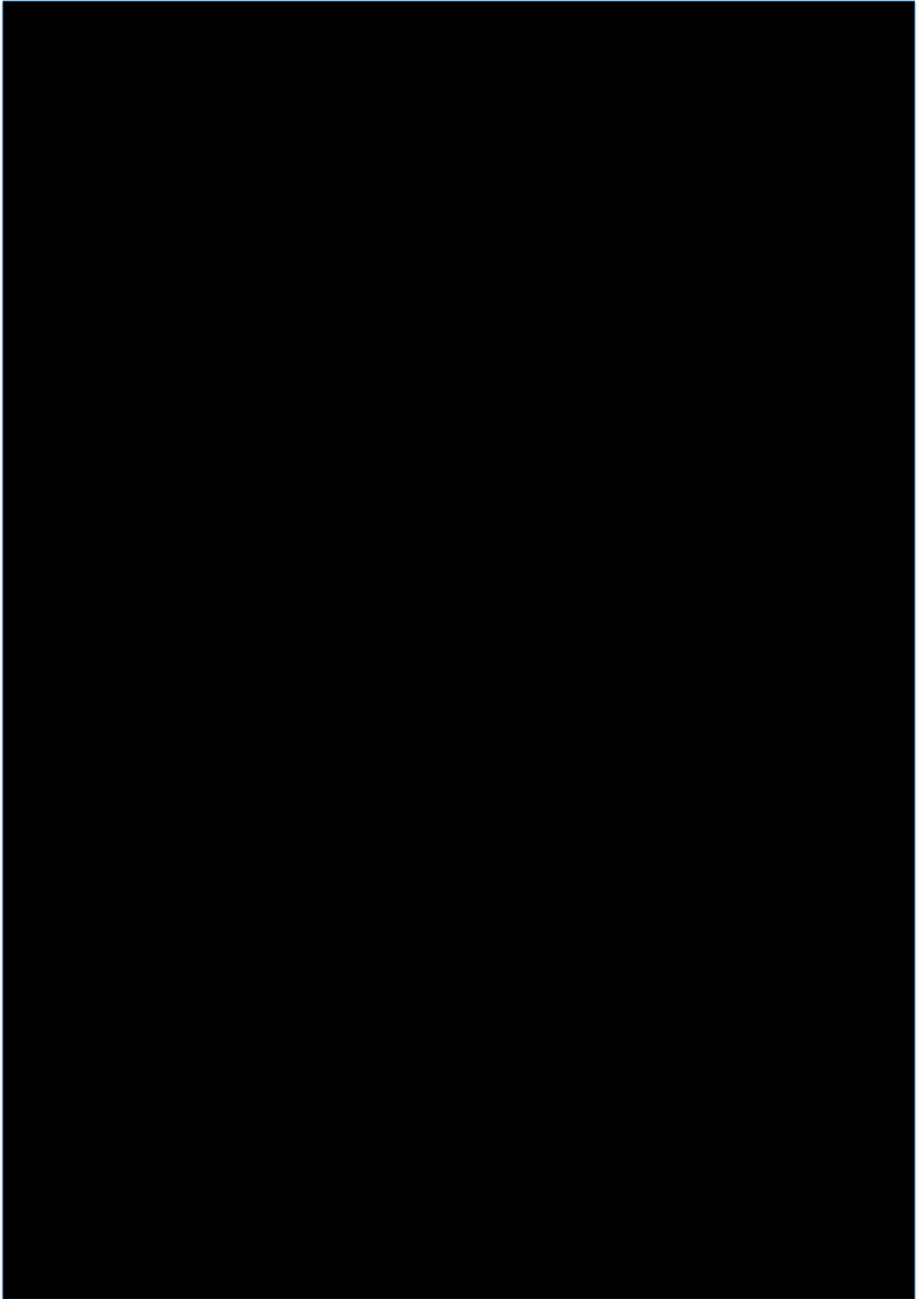
**Figure 8. Surveyed Vegetation Types and Conservation Significant Flora**



**Figure 9. Surveyed Vegetation Condition and Weeds**



**Figure 10. Surveyed Fauna Habitats and Records**



**Figure 11. Prospective Greater Bilby Habitat and Records**

## 5 ASSESSMENT AGAINST THE TEN CLEARING PRINCIPLES

The proposed clearing is not likely to be at variance with any of 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																																																																												
<p>Vegetation in the Project Area is typical of 'pindan' vegetation types, consisting of dense <i>Acacia</i> woodland with sparse Eucalypt overstorey over deep red sands, with small variations in composition depending on fire age, landforms, soils and hydrology.</p> <p>A significant portion of the Project Area is already cleared, from the existing Broome-Cape Leveque Road, other local roads and disturbance.</p> <p>Key biodiversity statistics for the RUE, as well as the expected impacts from clearing on biodiversity are provided in the table below. This information is summarised from the results of biological surveys (Biota 2018a), as well as the latest design information for the Project.</p>	<table border="1"> <thead> <tr> <th>Desktop Study Area (40 km radius) NatureMap and EPBC PMST</th> <th>Road Upgrade Envelope (Biota 2018a)</th> <th>Expected Impacts*</th> </tr> </thead> <tbody> <tr> <td colspan="3"><b>Number of (native) vascular flora taxa</b></td> </tr> <tr> <td>549</td> <td>189 species</td> <td>Loss of 39.8 ha of habitat</td> </tr> <tr> <td colspan="3"><b>Number of (native) vertebrate fauna taxa</b></td> </tr> <tr> <td>846</td> <td>68 species</td> <td>Loss of 39.8 ha of habitat</td> </tr> <tr> <td colspan="3"><b>Priority Flora (State)</b></td> </tr> <tr> <td>1. <i>Acacia monticola x tumida</i> var. <i>kulparn</i> (P3)</td> <td>ND (Unlikely to Occur)</td> <td rowspan="4">No Impacts Expected</td> </tr> <tr> <td>2. <i>Aphyllodium glossocarpum</i> (P3)</td> <td>ND (May Occur)</td> </tr> <tr> <td>3. <i>Aphyllodium parvifolium</i> (P1)</td> <td>ND (Unlikely to Occur)</td> </tr> <tr> <td>4. <i>Bonamia oblongifolia</i> (P3)</td> <td>Detected: at 4 locations</td> </tr> <tr> <td><b>5. <i>Corymbia paractia</i> (P1)</b></td> <td><b>Detected: 73 individuals at 27 locations</b></td> <td><b>2 individuals</b></td> </tr> <tr> <td>6. <i>Glycine pindanica</i> (P2)</td> <td>ND (May Occur)</td> <td rowspan="3">No Impacts Expected</td> </tr> <tr> <td>7. <i>Gomphrena pusilla</i> (P2)</td> <td>ND (Unlikely to Occur)</td> </tr> <tr> <td>8. <i>Goodenia byrnesii</i> (P3)</td> <td>ND (Unlikely to Occur)</td> </tr> <tr> <td><b>9. <i>Jacquemontia</i> sp. Broome (P1)</b></td> <td><b>Detected: 700 individuals at 42 locations</b></td> <td><b>29 individuals</b></td> </tr> <tr> <td>10. <i>Lophostemon grandifloras</i> subsp. <i>grandifloras</i> (P3)</td> <td>ND (Unlikely to Occur)</td> <td rowspan="3">No Impacts Expected</td> </tr> <tr> <td>11. <i>Nicotiana heterantha</i> (P3)</td> <td>ND (Unlikely to Occur)</td> </tr> <tr> <td>12. <i>Pittosporum moluccanum</i> (P4)</td> <td>ND (Unlikely to Occur)</td> </tr> <tr> <td><b>13. <i>Polymeria</i> sp. Broome (P3)</b></td> <td><b>Detected: 137 individuals at 35 locations</b></td> <td><b>5 individuals</b></td> </tr> <tr> <td>14. <i>Seringia katatona</i> (P3)</td> <td>ND (Unlikely to Occur)</td> <td rowspan="4">No Impacts Expected</td> </tr> <tr> <td>15. <i>Stylidium pindanicum</i> (P3)</td> <td>Detected: 147 individuals at 5 locations</td> </tr> <tr> <td>16. <i>Terminalia kumpaja</i> (P3)</td> <td>Detected: 27 individuals at 9 locations</td> </tr> <tr> <td>17. <i>Tetragonia oronata</i> (P3)</td> <td>ND (Unlikely to Occur)</td> </tr> <tr> <td>18. <i>Thespidium basiflorum</i> (P1)</td> <td>ND (Unlikely to Occur)</td> <td></td> </tr> <tr> <td colspan="3"><b>Rare Flora</b></td> </tr> <tr> <td>1. <i>Seringia exastia</i></td> <td>ND (Unlikely to Occur)</td> <td>No impacts expected</td> </tr> <tr> <td colspan="3"><b>Priority Ecological Communities (State)</b></td> </tr> <tr> <td><i>Corymbia paractia</i> dominated community on dunes (P1)</td> <td>ND (Unlikely to Occur)</td> <td>No impacts expected</td> </tr> </tbody> </table>			Desktop Study Area (40 km radius) NatureMap and EPBC PMST	Road Upgrade Envelope (Biota 2018a)	Expected Impacts*	<b>Number of (native) vascular flora taxa</b>			549	189 species	Loss of 39.8 ha of habitat	<b>Number of (native) vertebrate fauna taxa</b>			846	68 species	Loss of 39.8 ha of habitat	<b>Priority Flora (State)</b>			1. <i>Acacia monticola x tumida</i> var. <i>kulparn</i> (P3)	ND (Unlikely to Occur)	No Impacts Expected	2. <i>Aphyllodium glossocarpum</i> (P3)	ND (May Occur)	3. <i>Aphyllodium parvifolium</i> (P1)	ND (Unlikely to Occur)	4. <i>Bonamia oblongifolia</i> (P3)	Detected: at 4 locations	<b>5. <i>Corymbia paractia</i> (P1)</b>	<b>Detected: 73 individuals at 27 locations</b>	<b>2 individuals</b>	6. <i>Glycine pindanica</i> (P2)	ND (May Occur)	No Impacts Expected	7. <i>Gomphrena pusilla</i> (P2)	ND (Unlikely to Occur)	8. <i>Goodenia byrnesii</i> (P3)	ND (Unlikely to Occur)	<b>9. <i>Jacquemontia</i> sp. Broome (P1)</b>	<b>Detected: 700 individuals at 42 locations</b>	<b>29 individuals</b>	10. <i>Lophostemon grandifloras</i> subsp. <i>grandifloras</i> (P3)	ND (Unlikely to Occur)	No Impacts Expected	11. <i>Nicotiana heterantha</i> (P3)	ND (Unlikely to Occur)	12. <i>Pittosporum moluccanum</i> (P4)	ND (Unlikely to Occur)	<b>13. <i>Polymeria</i> sp. Broome (P3)</b>	<b>Detected: 137 individuals at 35 locations</b>	<b>5 individuals</b>	14. <i>Seringia katatona</i> (P3)	ND (Unlikely to Occur)	No Impacts Expected	15. <i>Stylidium pindanicum</i> (P3)	Detected: 147 individuals at 5 locations	16. <i>Terminalia kumpaja</i> (P3)	Detected: 27 individuals at 9 locations	17. <i>Tetragonia oronata</i> (P3)	ND (Unlikely to Occur)	18. <i>Thespidium basiflorum</i> (P1)	ND (Unlikely to Occur)		<b>Rare Flora</b>			1. <i>Seringia exastia</i>	ND (Unlikely to Occur)	No impacts expected	<b>Priority Ecological Communities (State)</b>			<i>Corymbia paractia</i> dominated community on dunes (P1)	ND (Unlikely to Occur)	No impacts expected
	Desktop Study Area (40 km radius) NatureMap and EPBC PMST	Road Upgrade Envelope (Biota 2018a)	Expected Impacts*																																																																										
	<b>Number of (native) vascular flora taxa</b>																																																																												
	549	189 species	Loss of 39.8 ha of habitat																																																																										
	<b>Number of (native) vertebrate fauna taxa</b>																																																																												
	846	68 species	Loss of 39.8 ha of habitat																																																																										
	<b>Priority Flora (State)</b>																																																																												
	1. <i>Acacia monticola x tumida</i> var. <i>kulparn</i> (P3)	ND (Unlikely to Occur)	No Impacts Expected																																																																										
	2. <i>Aphyllodium glossocarpum</i> (P3)	ND (May Occur)																																																																											
	3. <i>Aphyllodium parvifolium</i> (P1)	ND (Unlikely to Occur)																																																																											
	4. <i>Bonamia oblongifolia</i> (P3)	Detected: at 4 locations																																																																											
	<b>5. <i>Corymbia paractia</i> (P1)</b>	<b>Detected: 73 individuals at 27 locations</b>	<b>2 individuals</b>																																																																										
	6. <i>Glycine pindanica</i> (P2)	ND (May Occur)	No Impacts Expected																																																																										
	7. <i>Gomphrena pusilla</i> (P2)	ND (Unlikely to Occur)																																																																											
	8. <i>Goodenia byrnesii</i> (P3)	ND (Unlikely to Occur)																																																																											
	<b>9. <i>Jacquemontia</i> sp. Broome (P1)</b>	<b>Detected: 700 individuals at 42 locations</b>	<b>29 individuals</b>																																																																										
	10. <i>Lophostemon grandifloras</i> subsp. <i>grandifloras</i> (P3)	ND (Unlikely to Occur)	No Impacts Expected																																																																										
	11. <i>Nicotiana heterantha</i> (P3)	ND (Unlikely to Occur)																																																																											
	12. <i>Pittosporum moluccanum</i> (P4)	ND (Unlikely to Occur)																																																																											
	<b>13. <i>Polymeria</i> sp. Broome (P3)</b>	<b>Detected: 137 individuals at 35 locations</b>	<b>5 individuals</b>																																																																										
	14. <i>Seringia katatona</i> (P3)	ND (Unlikely to Occur)	No Impacts Expected																																																																										
	15. <i>Stylidium pindanicum</i> (P3)	Detected: 147 individuals at 5 locations																																																																											
	16. <i>Terminalia kumpaja</i> (P3)	Detected: 27 individuals at 9 locations																																																																											
17. <i>Tetragonia oronata</i> (P3)	ND (Unlikely to Occur)																																																																												
18. <i>Thespidium basiflorum</i> (P1)	ND (Unlikely to Occur)																																																																												
<b>Rare Flora</b>																																																																													
1. <i>Seringia exastia</i>	ND (Unlikely to Occur)	No impacts expected																																																																											
<b>Priority Ecological Communities (State)</b>																																																																													
<i>Corymbia paractia</i> dominated community on dunes (P1)	ND (Unlikely to Occur)	No impacts expected																																																																											



Dwarf pindan heath community of Broome coast (P1)		
Relict dune system dominated by extensive stands of Minyjuru (Mangarr) <i>Sersalisia</i> (formerly <i>Pouteria</i> ) <i>sericea</i> (P1)		
Roebuck land system (P3)		
Vegetation Association 67 as defined by John Beard's vegetation mapping for the Kimberley (Beard 1979) (P3)		
Vegetation Association 73 as defined by John Beard's vegetation mapping for the Kimberley (Beard 1979) (P3)		
Nimalaica Claypan Community (previously Nimalaica) (P4)		
<b>Vegetation Condition</b>		
Generally, in Very Good condition with some areas in Good-Poor condition.	<p><b>Very Good</b> 368.4 ha (88.9%)</p> <p><b>Good</b> 2.24 ha (0.5%)</p> <p><b>Poor</b> 2.4 ha (0.6%)</p> <p><b>Disturbed/Cleared</b> 41.16 ha (9.9%)</p>	<p><b>Very Good</b> Up to 39.7 ha (56.3%)</p> <p><b>Poor</b> 0.1 ha (0.2%)</p> <p><b>Disturbed/Cleared</b> 30.7 ha (43.5%)</p>
<p>* Estimated impacts have been calculated from the indicative clearing footprint. Cleared areas are included to demonstrate clearing minimisation efforts.</p> <p>** ND: Not Detected</p>		
<p><b>Flora Diversity</b></p> <p>Desktop searches through both the NatureMap and PMST databases (NatureMap 2020, DAWE 2021) identified a large number of flora (685). The large diversity present is likely due to the immensely varied environments that are present within the desktop assessment area which covers a 40 km radius and includes pindan woodlands, damplands, coastal dunes, calcrete and limestone outcrops, a variety of wetland types, mud flats, mangroves and marine environments.</p> <p>The RUE itself only consists of two general environments, pindan woodlands, and claypans (Biota 2018a). Biota also recorded 189 species of native flora within the RUE and 68 fauna species. As the proposed clearing is immediately adjacent to existing cleared areas, it is expected that flora diversity in these areas will be significantly lower than that of the surrounding areas. The environments present in the RUE are not considered to be rare and occur more widely in the region (Biota 2018a). Therefore, it is unlikely that the proposed clearing will have a significant impact on general levels of biological diversity when considering the environmental context of the Project and surrounding area.</p>		
<p><b>Conservation Significant Flora</b></p> <p>The proposed clearing will impact three Priority flora taxa :</p> <ul style="list-style-type: none"> <li>• <i>Corymbia paractia</i> (Priority 1): 2 individuals may be cleared for safety reasons</li> <li>• <i>Jacquemontia</i> sp. Broome (Priority 1): 29 individuals may be cleared</li> <li>• <i>Polymeria</i> sp. Broome (Priority 3): 5 individuals may be cleared</li> </ul> <p>A further three Priority flora species are present in the RUE, but outside the proposed clearing boundary and therefore will not be impacted.</p> <p><i>Corymbia paractia</i> is an endemic species that only occurs on the Broome Peninsula. A significant amount of work has been carried out on this species to map its distribution and abundance (Reynolds, et al. 2018, Willing and Beames 2015). There are approximately 2,800 individual trees mapped within its area of occurrence, and it is estimated that the range of</p>		

	<p>the species extends to the southern end of the RUE, where the species was also detected by Biota. The Project is expected to result in the loss of up to two individuals, although all efforts will be made to avoid this impact. For the purpose of this impact assessment, two trees are assumed to be removed. This impact is not considered to be significant, because:</p> <ul style="list-style-type: none"> <li>• The estimated loss of two individuals is 0.07% of the total mapped individuals;</li> <li>• The RUE is located on the fringes of the species’ distribution, where occurrence is relatively sparse and is therefore unlikely to affect the long-term viability of the local populations.</li> </ul> <p>MRWA have preferentially located disturbances including borrow pits and laydown areas outside of the buffer zone of known locations of <i>C. paractia</i> to minimise impacts to this species and the local population. Given the proximity of these individuals to the road centreline, they may need to be removed to ensure the safety of road users. Should the opportunity be available to avoid the two individuals that may be cleared this will be considered further.</p> <p>With regard to <i>Jacquemontia</i> sp. Broome, Main Roads does not consider the impacts as being significant because:</p> <ul style="list-style-type: none"> <li>• The number of individuals being cleared for this Project represent less than 5% of the total number of individuals found in the RUE SLK 0 – 13 section by Biota (2018a);</li> <li>• This species has been consistently detected in other surveys on the Dampier Peninsula, indicating that it is widespread; most notably detected by GHD who found 9,940 individuals in a 128 ha site near Broome (GHD 2013; GHD 2016);</li> <li>• The estimated loss of 29 individuals is less than 0.3% of the total mapped individuals; and</li> <li>• The species is a capable disturbance specialist, which is likely to be a reason that the species has been detected within the proposed clearing boundary (due to the level of existing disturbance present). It appears to be common in the wider locality and does not warrant being treated as a site constraint (Biota 2018a)</li> </ul> <p>Finally, the Project is expected to result in the loss of 5 detected individuals of <i>Polymeria</i> sp. Broome. Main Roads does not consider the impacts as being significant because:</p> <ul style="list-style-type: none"> <li>• The number of individuals which would be removed for this Project represent less than 5% of the total number of individuals found in the SLK 0 – 13 section by Biota (2018a);</li> <li>• The species is noted to be widespread across the southern Dampier Peninsula, having been detected in other surveys in the locality, and more recently, the nearby La Grange region. As of 2018, an estimated 1022 individuals have been detected, resulting in a less than 0.5% loss of known individuals from this Project (Markey, et al. 2018, Biota 2018b, Wells 2018). It appears to be common in the wider locality and does not warrant being treated as a site constraint (Biota 2018a)</li> </ul> <p>Although the Project will result in the removal of several Priority flora species, the numbers of individuals cleared is relatively low in comparison to the known distribution and the size of their populations.</p> <p>No Threatened Flora species were detected within the RUE despite targeted search efforts (Biota 2018).</p> <p><b>Priority Ecological Communities</b> No priority ecological communities were detected within the RUE (Biota 2018a).</p>
--	---

**Groundwater Dependent Vegetation**

The Damplands (D1) vegetation type mapped by Biota has been identified as a groundwater dependent ecosystem, and is important to the maintenance and functioning of the Nimalarica claypan PEC (formerly Nimalaica), at the eastern end of the Willie Creek Wetland system (Biota 2018a). The extent of this vegetation type within the road upgrade envelope is 2.9 ha and has been excluded from the clearing boundary. No direct impacts are proposed to this vegetation type. Vegetation Types P2 and P3 are also considered to be potentially groundwater dependent (Biota 2018a). All vegetation units (D1, P2 and P3) extend to the north and west fringing the Willie Creek Wetland system in areas outside the surveyed area and are likely to occur more widely in the regional area.

**Vegetation Condition**

The Project may result in the loss of 39.7 ha of native vegetation in Very Good condition and 0.1 ha in Poor condition.

It should be noted that the works are predominantly within areas that are already cleared. This is evident when comparing the proportion of Vegetated areas to Cleared areas within the RUE (90:10 respectively), and the estimated proportion that is expected to be cleared under the proposed project layout (~57:43 respectively). Furthermore, although 39.7 ha of vegetation is in Very Good condition, this represents only 10.8% of vegetation of this quality within the RUE alone, and significantly less when considering the surrounding areas immediately outside the RUE. Therefore, the clearing is within vegetation condition that is representative of surrounding areas, and will not affect the overall condition of vegetation in the local area negatively.

**Fauna Diversity**

Database searches of the desktop assessment area identified 846 species of native fauna. The high diversity is likely due to the varied habitats in the desktop assessment area. Biological surveys by Biota (2018a) identified 68 fauna species within three fauna habitat types (Figure 10).

**Conservation Significant Fauna**

The Project may have some minor localised impacts on habitat availability for the Greater Bilby, Dampierland Burrowing Snake and Dampierland Goanna. However, the current known distribution of these species and abundance of suitable habitat in the greater region suggest that the proposed clearing does not comprise habitat that is necessary for the maintenance of important populations. These impacts are discussed further under Principle (b).

**Summary**

Although the clearing will result in the loss of up to 39.8 ha of native vegetation in Very Good condition, it does not constitute a high level of biological diversity given:

- Species diversity is relatively lower than the surrounding area (Biota 2018a), primarily due to the proximity of the clearing to the road and the limited habitat types affected.
- The number of Priority flora that may be cleared is minimal in comparison to the known distribution and population estimates of those species.
- No PECs will be affected by the proposed clearing.
- It does not comprise habitat that is necessary for the maintenance of significant fauna populations.
- Although the majority of the proposed clearing will occur in 'Very Good' quality vegetation, vegetation that is of this quality is abundant in the RUE and in adjacent areas on the Dampier Peninsula.

	The vegetation to be cleared contains biodiversity values that are typical of the local and regional area. As the vegetation to be cleared does not contain biodiversity values that are higher than other nearby areas, the proposed clearing is unlikely to be at variance to this principle.
<b>Methodology</b>	Main Roads Site Inspection (26/10/2017) (Main Roads Western Australia 2017) DBCA shapefiles Main Roads GIS Shapefiles NatureMap (NatureMap 2020) EPA Technical Guidance (EPA, 2020; EPA, 2016) EPBC Protected Matters Search Tool, Department of Energy and the Environment (DAWE 2021) Biota Biological Survey (Biota 2018a)

**(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.**

<b>Comments</b>	<b>Proposed clearing is not likely to be at variance to this Principle</b>		
	The table below summarises key statistics relating to the occurrence and extent of fauna habitat present within the Road Upgrade Envelope, as well as the expected impact.		
	<b>Desktop Study Area (40 km radius) NatureMap and EPBC PMST</b>	<b>Road Upgrade Envelope (Biota 2018a)</b>	<b>Expected Impacts*</b>
	<b>Number of (native) vertebrate fauna taxa</b>		
	846	68 species	Loss of 39.8 ha of habitat
	<b>Fauna Habitats</b>		
	1. Corymbia and Bauhinia Woodland	370 ha	39.8 ha loss
	2. Melaleuca Woodland	3.1 ha	No Impact Expected
	<b>Conservation Significant Fauna Records</b>		
	1. <i>Dasyurus hallucatus</i> (Northern Quoll)	Schedule 2	ND (Unlikely to Occur) No Impacts Expected
	2. <i>Rostratula australis</i> (Australian Painted Snipe)	Schedule 2	ND (May Occur) No Impacts Expected
	3. <i>Falco hypoleucos</i> (Grey Falcon)	Schedule 3	ND (May Occur) 39.8 ha of habitat loss
	4. <i>Isoodon auratus</i> (Golden Bandicoot)	Schedule 3	ND (Unlikely to Occur) No Impacts Expected
	5. <i>Liopholis kintorei</i> (Great Desert Skink)	Schedule 3	ND (Unlikely to Occur) No Impacts Expected
	6. <i>Macrotis lagotis</i> (Greater Bilby)	Schedule 3	Detected 39.4 ha of habitat loss, no expected impacts to active burrows
	7. <i>Phascogale tapoatafa</i> (Kimberley Brush-tailed Phascogale)	Schedule 3	ND (Unlikely to Occur) No Impacts Expected
	8. <i>Trichosurus vulpecula</i> (Northern Brushtail Possum)	Schedule 3	ND (Unlikely to Occur) No Impacts Expected
	9. <i>Anas querquedula</i> (Garganey)	Schedule 5	ND (May Occur) No Impacts Expected
	10. <i>Apus pacificus</i> (Fork-tailed Swift)	Schedule 5	ND (May Occur) 39.8 ha of habitat loss
	11. <i>Cecropis daurica</i> (Red-rumped Swallow)	Schedule 5	ND (May Occur) No Impacts Expected
	12. <i>Cuculus optatus</i> (Oriental Cuckoo)	Schedule 5	ND (Unlikely to Occur) No Impacts Expected
	13. <i>Gallinago stenura</i> (Pin-tailed Snipe)	Schedule 5	ND (May Occur) No Impacts Expected
	14. <i>Gallinago megala</i> (Swinhoe's Snipe)	Schedule 5	ND (May Occur) No Impacts Expected

15. <i>Glareola maldivarum</i> (Oriental Pratincole)	Schedule 5	ND (May Occur)	
16. <i>Hirundo rustica</i> (Barn Swallow)	Schedule 5	ND (May Occur)	39.8 ha of habitat loss
17. <i>Motacilla cinerea</i> (Grey Wagtail)	Schedule 5	ND (May Occur)	
18. <i>Motacilla tschutschensis</i> (Eastern Yellow Wagtail)	Schedule 5	ND (May Occur)	
19. <i>Plegadis falcinellus</i> (Glossy Ibis)	Schedule 5	ND (May Occur)	No Impacts Expected
20. <i>Pandion cristatus</i> (Eastern Osprey)	Schedule 5	ND (May Occur)	39.8 ha of habitat loss
21. <i>Falco peregrinus</i> (Peregrine Falcon)	Schedule 7	ND (May Occur)	
22. <i>Ozimops cobourgianus</i> (Northern Coastal Free-tailed Bat)	Priority 1	ND (Unlikely to Occur)	No Impacts Expected
23. <i>Tyto novaehollandiae</i> (Masked Owl)	Priority 1	ND (Unlikely to Occur)	
24. <i>Varanus sparnus</i> (Dampierland Goanna)	Priority 1	ND (Likely to Occur)	39.8 ha of habitat loss
25. <i>Lerista separanda</i> (Dampierland Plain Slider)	Priority 2	ND (Unlikely to Occur)	No Impacts Expected
26. <i>Simoselaps minimus</i> (Dampierland Burrowing Snake)	Priority 2	ND (May Occur)	39.8 ha of habitat loss
27. <i>Ctenotus angusticeps</i> (Airlie Island Ctenotus)	Priority 3	ND (Unlikely to Occur)	No Impacts Expected
28. <i>Lagorchestes conspicillatus</i> (Spectacled Hare-wallaby)	Priority 3	ND (May Occur)	39.8 ha of habitat loss
29. <i>Saccolaimus saccolaimus</i> (Bare-rumped Sheath-tailed Bat)	Priority 3	ND (May Occur)	
30. <i>Wyulda squamicaudata</i> (Scaly-tailed Possum)	Priority 3	ND (Unlikely to Occur)	No Impacts Expected
31. <i>Erythrura gouldiae</i> (Gouldian Finch)	Priority 4	ND (May Occur)	39.8 ha of habitat loss
32. <i>Hydromys chrysogaster</i> (Water-rat)	Priority 4	ND (Unlikely to Occur)	No Impacts Expected
33. <i>Mesembriomys macrurus</i> (Golden-backed Tree-rat)	Priority 4	ND (Unlikely to Occur)	

\* Estimated impacts have been calculated from the indicative clearing footprint. Fauna that are known to be highly mobile and likely to be present only have an impact estimate expressed in area of suitable habitat lost.

\*\*ND: Not Detected

**Fauna Diversity**

Database searches of the desktop assessment area identified 846 species of native fauna. This is likely due to the varied habitats in the desktop assessment area. Biological surveys by Biota (2018a) identified 68 fauna species within three fauna habitat types (Figure 10). Only one of these habitats is present within the clearing area (Corymbia and Bauhinia Woodland). This habitat type is not considered rare or restricted to the RUE and occurs more widely within the region. Conservation significant species with potential to occur may utilise this habitat for foraging, commuting or nesting on occasion, but are unlikely to rely solely upon it (Biota 2018a). Therefore, it is unlikely that the Project will have any impacts on fauna diversity of the area.

**Conservation Significant Fauna**

The Project occurs in the range of a number of conservation significant fauna.

Surveys carried out on the Project (Biota 2018a) indicated the following conservation significant species were 'likely' to occur or were detected during surveys:

- *Macrotis Lagotis* (Greater Bilby; Vulnerable): detected by GHD (2016) and Biota (2018a) at various locations; and
- *Varanus sparnus* (Dampierland Goanna; Priority 1).

As indicated by the table above, a number of other species were determined as potentially occurring; however, these were predominantly species with very broad distributions or habitat preference and are unlikely to rely solely upon habitat values in the RUE.

	<p>This assessment considers that the Project will cause the following impacts:</p> <ul style="list-style-type: none"> <li>• Loss of up to 39.4 ha of habitat for the Greater Bilby (as mapped by Biota as high prospective habitat).</li> <li>• Loss of 39.8 ha of potential habitat for the Dampierland Goanna and Dampierland Burrowing Snake as these species are known to prefer Pindan Woodland habitat types; and</li> <li>• Loss of up to 39.8 ha of potential habitat for the Grey Falcon, Fork-tailed swift, Red-rumped Swallow, Barn Swallow, Grey Wagtail, Eastern Osprey, Peregrine Falcon, which due to their aerial nature, could possibly use all habitats in the RUE.</li> </ul> <p><b>Greater Bilby</b></p> <p>Mapping by Biota (2018a) suggests that there is 370 ha of high prospective Bilby habitat within the RUE alone. Approximately 39.4 ha occurs within the clearing boundary.</p> <p>At a regional scale, mapping undertaken by Main Roads indicates that there is approximately 5,376,409 ha of high prospective Bilby habitat in the Pindanland Bioregion (see Appendix 1). This Project may result in the loss of 0.0006% of high quality habitat within the Bioregion. Cumulative impacts to habitat in the Pindanland Bioregion currently sits at 0.18% (see Appendix 1). Therefore, the direct loss of habitat from the Project from clearing is considered minimal.</p> <p>The Project will not result in the loss of any of the burrows detected by Biota in April 2018. However, Bilby are known to be highly mobile and will travel considerable distances in search of suitable habitat. It is thought that habitat suitability is generally a function of not only broad characteristics such as vegetation types and substrate, but also highly unpredictable factors such as climate/rainfall, predation pressures and fire age. As such, it is impossible to estimate the specific numbers of burrows that could be impacted if clearing is carried out several years following survey. To address this uncertainty, pre-clearing surveys will be conducted within two weeks of the commencement of works and a construction environmental management plan, which includes fauna management components, will be implemented to avoid significant impacts to this species. This is already being done for other sections of the BCLR where works are occurring.</p> <p><b>Dampierland Goanna and Dampierland Burrowing Snake</b></p> <p>Both species are thought to prefer sandy habitats such as those found in Pindan and Savannah Woodlands (Doughty, et al. 2014, Ellis, et al. 2017). Based on habitat mapping by Biota, approximately 39.8 ha of this habitat is expected to be lost.</p> <p>Little is known about the Dampierland Goanna, as the species has only recently been described in 2014. Furthermore, it has sometimes been recorded and misidentified as <i>Varanus brevicauda</i>, a similar species. As a result, there is very little information on the range and extent of the species, although Doughty et. al (2014) suggests the species is restricted to the Dampier Peninsula. Sheffield Resources recorded the species at their Thunderbird Mineral Sands Project, 87 km east of the Project. In its assessment of the Thunderbird Project, the EPA concluded that the species was unlikely to be significantly impacted, given the known distribution and habitat availability of the species (EPA 2017). It is worth noting that Sheffield’s proposal involved the clearing of over 1,600 ha of habitat (326 ha permanently). Therefore, it is highly unlikely that 39.8 ha of clearing proposed for the BCLRU will significantly impact this species.</p> <p>Impacts to the Dampierland Burrowing Snake are also likely to be minimal as the species is thought to have a very wide distribution, potentially in excess of 2 million hectares (Ellis, et al. 2017).</p>
--	--



	<p><u>Other Species</u></p> <p>With regard to all other significant species listed above as potentially occurring within the project area, the assessment found that none of the impacts are considered significant. These species are highly mobile and/or their known distributions cover a very large area, of which the proposed clearing is unlikely to cause any significant impact (distribution is Australia wide, or covers the northern half of the country or arid areas and/or there exists large amounts of suitable habitat outside of the RUE. (DAWE 2021, NatureMap 2020, ALA 2020).</p> <p>Main Roads considers that the clearing for this Project is not likely to be at variance to Clearing Principle (b). While minor localised impacts on habitat availability for the Greater Bilby, Dampierland Burrowing Snake and Dampierland Goanna will occur, their currently known distribution and abundance of suitable habitat in the greater region suggest that the project area does not comprise habitat that is necessary for the maintenance of these species. Furthermore, Bilby management measures proposed and already accepted by DWER for adjacent projects in the region mean that impacts to habitat availability are unlikely to significantly affect any Bilby individuals.</p>
<b>Methodology</b>	<p>Main Roads Site Inspection (26/10/2017) (Main Roads Western Australia 2017)</p> <p>DBCA shapefiles</p> <p>Main Roads GIS Shapefiles</p> <p>NatureMap (NatureMap 2020)</p> <p>EPA Technical Guidance (EPA, 2020; EPA, 2016)</p> <p>EPBC Protected Matters Search Tool (DAWE 2021)</p> <p>Biota Biological Survey (Biota 2018a)</p>

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

<b>Comments</b>	<b>Proposal is not likely to be at variance to this Principle</b>									
	<p>Database searches identified <i>Seringia exastia</i> within the 40km radial desktop study area, the closest of which is 8 km from the RUE.</p> <p>The table below summarises the results of site surveys for this species.</p> <table border="1" data-bbox="368 1451 1442 1554"> <thead> <tr> <th data-bbox="368 1451 756 1487">Desktop Study Area</th> <th data-bbox="756 1451 1193 1487">Road Upgrade Envelope (Biota 2018)</th> <th data-bbox="1193 1451 1442 1487">Expected Impacts</th> </tr> </thead> <tbody> <tr> <td colspan="3" data-bbox="368 1487 1442 1518"><b>Rare flora taxa</b></td> </tr> <tr> <td data-bbox="368 1518 756 1554"><i>Seringia exastia</i></td> <td data-bbox="756 1518 1193 1554">ND (Unlikely to Occur)</td> <td data-bbox="1193 1518 1442 1554">No impacts expected</td> </tr> </tbody> </table> <p>*ND = Not Detected</p> <p>Biota (2018a) completed a targeted search for this species. It was noted that if this species was present within the RUE, it would have been detected, as survey timing was ideal.</p> <p>Clearing is therefore not likely to be at variance to this principle.</p>	Desktop Study Area	Road Upgrade Envelope (Biota 2018)	Expected Impacts	<b>Rare flora taxa</b>			<i>Seringia exastia</i>	ND (Unlikely to Occur)	No impacts expected
Desktop Study Area	Road Upgrade Envelope (Biota 2018)	Expected Impacts								
<b>Rare flora taxa</b>										
<i>Seringia exastia</i>	ND (Unlikely to Occur)	No impacts expected								
<b>Methodology</b>	<p>DBCA shapefiles</p> <p>Florabase (Accessed 10 September 2020) (Western Australian Herbarium 2020)</p> <p>Main Roads Site Inspection (26 October 2017) (Main Roads Western Australia 2017)</p> <p>Biota Biological Survey (Biota 2018a)</p> <p>EPA Technical Guidance (EPA, 2016)</p>									

**(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.**

<b>Comments</b>	<b>Proposed clearing is not at variance to this Principle</b>
	<p>The area surrounding the proposed clearing is known to contain examples of the Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula Threatened Ecological Community (TEC).</p> <p>Biological Surveys of the Road Upgrade Envelope by Biota (2018a) found no vegetation types that comprise this TEC. Correspondence with Environs Kimberley, who have been involved with monitoring of this TEC indicated that it is unlikely that it would be found in the Project Area.</p> <p>Clearing is therefore not at variance to this Principle.</p>
<b>Methodology</b>	<p>DBCA shapefiles</p> <p>Main Roads Site Inspection (26 October 2017) (Main Roads Western Australia 2017)</p> <p>Biota Biological Survey (Biota 2018a)</p>

**(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.**

<b>Comments</b>	<b>Proposed clearing is not at variance to this Principle</b>																											
	<p>The table below summarises details on the representation of the vegetation within the RUE.</p> <table border="1" data-bbox="375 1131 1436 1512"> <thead> <tr> <th>Pre-European Vegetation Association</th> <th>Scale</th> <th>Pre-European (ha)</th> <th>Current Extent (ha)</th> <th>% Remaining</th> <th>% Remaining in DBCA reserves</th> </tr> </thead> <tbody> <tr> <td rowspan="4"><b>750</b></td> <td><b>Statewide</b></td> <td>1,231,155.5</td> <td>1,225,687.52</td> <td>99.56</td> <td>2.78</td> </tr> <tr> <td><b>IBRA Bioregion</b> Dampierland</td> <td>1,229,182.16</td> <td>1,225,280.52</td> <td>99.68</td> <td>2.78</td> </tr> <tr> <td><b>IBRA Sub-region</b> Pindanland</td> <td>1,221,734.45</td> <td>1,217,843.72</td> <td>99.68</td> <td>2.80</td> </tr> <tr> <td><b>Local Government Authority</b> Shire of Broome</td> <td>1,115,559.36</td> <td>1,110,131.18</td> <td>99.51</td> <td>3.07</td> </tr> </tbody> </table> <p><b>Pre-European Vegetation Representation</b></p> <p>At least 99.5% of association 750's pre-European extent currently remains at all scales. The proposed clearing is only expected to cause the loss of 0.003% of the current extent of vegetation association 750 within the Shire of Broome alone.</p> <p>Clearing is not at variance to this Principle because:</p> <ul style="list-style-type: none"> <li>• The vegetation type to be cleared is not a remnant of an area that has been extensively cleared; and</li> <li>• The percentage of area to be cleared relative to the current extents of vegetation types is negligible.</li> </ul>	Pre-European Vegetation Association	Scale	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA reserves	<b>750</b>	<b>Statewide</b>	1,231,155.5	1,225,687.52	99.56	2.78	<b>IBRA Bioregion</b> Dampierland	1,229,182.16	1,225,280.52	99.68	2.78	<b>IBRA Sub-region</b> Pindanland	1,221,734.45	1,217,843.72	99.68	2.80	<b>Local Government Authority</b> Shire of Broome	1,115,559.36	1,110,131.18	99.51	3.07
Pre-European Vegetation Association	Scale	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA reserves																							
<b>750</b>	<b>Statewide</b>	1,231,155.5	1,225,687.52	99.56	2.78																							
	<b>IBRA Bioregion</b> Dampierland	1,229,182.16	1,225,280.52	99.68	2.78																							
	<b>IBRA Sub-region</b> Pindanland	1,221,734.45	1,217,843.72	99.68	2.80																							
	<b>Local Government Authority</b> Shire of Broome	1,115,559.36	1,110,131.18	99.51	3.07																							
<b>Methodology</b>	<p>EPA Technical Guidance (EPA, 2016) Main Roads Site Inspection (26 October 2017) (Main Roads Western Australia 2017)</p> <p>Statewide Vegetation Statistics (Government of Western Australia, 2019)</p> <p>Shepherd Report (Shepherd, Beeston, &amp; Hopkins, 2002) Aerial photography</p>																											

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

<b>Comments</b>	<b>Proposed clearing is not at variance to this Principle</b>
	<p>The Project does not intersect any mapped watercourses, nor does it intersect any vegetation that is growing in association with a watercourse or wetland (Biota 2018a). Vegetation type D1 has been identified as a groundwater dependent ecosystem, and may be important to the functioning of the Nimalarica (previously Nimalaica) wetland, located on the eastern fringes of the Willie Creek Wetland system (Biota 2018a). The extent of this vegetation type has been excluded from the RUE and the clearing boundary. No direct impacts are proposed to this vegetation type.</p> <p>Therefore, the proposed clearing is not at variance to this Principle.</p>
<b>Methodology</b>	<p>Biota Biological Survey (Biota 2018a)                  DWER and DBCA shapefiles                  Main Roads Site Inspection (26 October 2017) (Main Roads Western Australia 2017)</p>

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

<b>Comments</b>	<b>Proposed clearing is not likely to be at variance to this Principle</b>										
	<p>Soil landscape mapping for the Project area indicates that the RUE falls within the Yeeda Land System, Wanganut System and the Carpentaria Low System (considered as part of the Wanganut System in this assessment). Known information on land degradation potentials for these systems is summarised below.</p> <table border="1" data-bbox="368 1205 1441 1787"> <thead> <tr> <th>Project Area</th> <th>Soil Description (Cotching 2005)</th> <th>Erosion Risk*</th> <th>Expected Impact</th> </tr> </thead> <tbody> <tr> <td rowspan="2"><b>Road Upgrade Envelope</b></td> <td><b>Yeeda System</b> Earthy sands; dark reddish brown loamy sand or dark red sand topsoil over red sand to coarse sandy loam subsoils; and Earthy sands; dark reddish brown loamy sand topsoil over red loamy sand subsoils</td> <td><b>Water Erosion</b> Very Low (0%) <b>Wind Erosion</b> Very High (83%)</td> <td rowspan="2">Temporary increase in minor wind erosion following clearing. Erosion levels should fall significantly once the construction of the road is complete and the site vegetation regrows.</td> </tr> <tr> <td><b>Wanganut System</b> Sandplain and dunefields with through-going drainage: sandplain, mainly in the upper parts, with stable dunefields, lowlying sandplain, and scattered pans and depressions; sparse to moderately dense branching drainage pattern; relief up to 9 m.</td> <td><b>Water Erosion</b> Low (12%) <b>Wind Erosion</b> Very High (84%)</td> </tr> </tbody> </table> <p>Although both Yeeda and Wanganut systems suggest a very high level of erosion potential from wind, STRM (Shuttle Radar Topography Mission) elevation data suggest that the clearing will occur on a landscape with a very low gradient (Geoscience Australia 2008). The average slope of the Project Area is approximately 0.2 – 0.5%.</p> <p>As with all construction and clearing works, there is the risk of further spread of weeds / invasive species into the area, which can cause appreciable land degradation. Surveys by Biota (2018a) identified a number of weed species; however, none were listed as Declared</p>	Project Area	Soil Description (Cotching 2005)	Erosion Risk*	Expected Impact	<b>Road Upgrade Envelope</b>	<b>Yeeda System</b> Earthy sands; dark reddish brown loamy sand or dark red sand topsoil over red sand to coarse sandy loam subsoils; and Earthy sands; dark reddish brown loamy sand topsoil over red loamy sand subsoils	<b>Water Erosion</b> Very Low (0%) <b>Wind Erosion</b> Very High (83%)	Temporary increase in minor wind erosion following clearing. Erosion levels should fall significantly once the construction of the road is complete and the site vegetation regrows.	<b>Wanganut System</b> Sandplain and dunefields with through-going drainage: sandplain, mainly in the upper parts, with stable dunefields, lowlying sandplain, and scattered pans and depressions; sparse to moderately dense branching drainage pattern; relief up to 9 m.	<b>Water Erosion</b> Low (12%) <b>Wind Erosion</b> Very High (84%)
Project Area	Soil Description (Cotching 2005)	Erosion Risk*	Expected Impact								
<b>Road Upgrade Envelope</b>	<b>Yeeda System</b> Earthy sands; dark reddish brown loamy sand or dark red sand topsoil over red sand to coarse sandy loam subsoils; and Earthy sands; dark reddish brown loamy sand topsoil over red loamy sand subsoils	<b>Water Erosion</b> Very Low (0%) <b>Wind Erosion</b> Very High (83%)	Temporary increase in minor wind erosion following clearing. Erosion levels should fall significantly once the construction of the road is complete and the site vegetation regrows.								
	<b>Wanganut System</b> Sandplain and dunefields with through-going drainage: sandplain, mainly in the upper parts, with stable dunefields, lowlying sandplain, and scattered pans and depressions; sparse to moderately dense branching drainage pattern; relief up to 9 m.	<b>Water Erosion</b> Low (12%) <b>Wind Erosion</b> Very High (84%)									

	<p>Pests or Weeds of National Significance (due to their relatively lower level of fecundity, aggressiveness and resulting ecosystem impact). It is expected that the spread of weeds can be minimised by standard weed hygiene practices</p> <p>Due to the relatively small scale of impact, the proposed timing and the nature of the site, clearing is not likely to be at variance to this Principle because:</p> <ul style="list-style-type: none"> <li>• Clearing will be immediately followed by topsoil stripping and earthworks (compaction), therefore reducing the probability of further land degradation (it is expected that the sealed road will be less environmentally damaging in terms of land degradation than the unsealed road);</li> <li>• The clearing is linear in nature and some areas will become revegetated within 1-2 years, therefore no large cleared areas will remain cleared for extended periods; and</li> <li>• The land degradation as a result of these activities is well understood and manageable via standard management measures.</li> </ul>
<b>Methodology</b>	<p>Main Roads Site Inspection (26 October 2017)</p> <p>Soil Landscape Mapping (DPIRD, 2021)</p> <p>Soil-landscapes of Western Australia's rangelands and arid interior (Tille, 2006)</p> <p>ASRIS (ASRIS, 2011)</p> <p>Elevation Information System (Geoscience Australia 2008)</p> <p>An inventory of rangelands in part of the Broome Shire (Cotching 2005)</p>

**(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.**

<b>Comments</b>	<b>Proposed clearing is not likely to be at variance to this Principle</b>
	<p>Impacts from clearing that may impact on environmental values of surrounding land are considered to be:</p> <ul style="list-style-type: none"> <li>• Direct loss of native vegetation; and</li> <li>• Spread of weeds into surrounding areas.</li> </ul> <p>The closest conservation area located directly adjacent to the RUE is the Yawuru Birragun Conservation Park. The RUE has been specifically amended to exclude the Conservation Park. Therefore, clearing is unlikely to be carried out in close proximity to the Conservation Park.</p> <p>Main Roads considers the proposed clearing is not likely to be at variance to this Principle because:</p> <ul style="list-style-type: none"> <li>• No clearing will be occurring within conservation areas, no direct impacts on conservation areas are expected; and</li> <li>• Indirect impacts can be managed under a Construction Environmental Management Plan, and if implemented, will not result in an impact to environmental values of conservation areas.</li> </ul>
<b>Methodology</b>	<p>DBCA shapefiles</p> <p>Biota Biological Survey (Biota 2018a)</p> <p>Main Roads Site Inspection (26 October 2017) (Main Roads Western Australia 2017)</p>



**(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 likely to be at variance to this Principle
	<p>The Project is located on the edge of the Broome Town Water Reserve, which is also a Priority 1 Public Drinking Water Source Area. Main Roads will continue to consult with DWER to ensure best practice management is implemented to ensure the water quality within the drinking source area is not affected by the Project.</p> <p><b>Contamination Risks</b> It is expected that the upgraded road will lower the risk of contamination events in the future, due to the smoother running surface and less wear on vehicles. The clearing works themselves are not expected to cause a deterioration in the quality of surface and groundwater and the risk of impacts due to spills will be effectively managed under Main Roads standard Environmental Management Systems.</p> <p><b>Acidification Risks</b> The soils that are present in the area around SLK 11.7 are potentially acid forming. However, clearing works under this project will not occur in this area.</p> <p>Main Roads considers that the clearing proposed is unlikely to cause deterioration in the quality of water because:</p> <ul style="list-style-type: none"> <li>• Risks of contamination during clearing are relatively minor and their management measures well understood; and</li> <li>• The clearing will not affect any acid forming soils that existing in the RUE.</li> </ul>
<b>Methodology</b>	<p>Biota Biological Survey (Biota 2018a) Main Roads Site Inspection (26 October 2017) (Main Roads Western Australia 2017) Groundwater Resource Review (DoW 2012) ASRIS (ASRIS, 2011) DWER and DBCA shapefiles</p>

**(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 at variance to this Principle														
	<p>The table below summarises known characteristics of the Project Area in relation to potential waterlogging risks.</p>														
	<table border="1"> <thead> <tr> <th data-bbox="365 1682 553 1711">Project Area</th> <th data-bbox="561 1682 963 1711">Soil Description (Cotching 2005)</th> <th data-bbox="963 1682 1193 1711">Waterlogging Risk</th> <th data-bbox="1193 1682 1447 1711">Expected Impact</th> </tr> </thead> <tbody> <tr> <td data-bbox="365 1711 553 1966" rowspan="2"> <b>Road Upgrade Envelope</b> </td> <td data-bbox="561 1711 963 1966"> <b>Yeeda System</b> Earthy sands; dark reddish brown loamy sand or dark red sand topsoil over red sand to coarse sandy loam subsoils; and Earthy sands; dark reddish brown loamy sand topsoil over red loamy sand subsoils                 </td> <td data-bbox="963 1711 1193 1966" rowspan="2">                     Very Low (1%)                 </td> <td data-bbox="1193 1711 1447 1966" rowspan="2">                     23.2 ha of clearing. No impacts to flooding from clearing expected.                 </td> </tr> <tr> <td data-bbox="561 1966 963 2092"> <b>Wanganut System</b> Sandplain and dunefields with through-going drainage: sandplain, mainly in the upper parts, with stable                 </td> <td data-bbox="963 1966 1193 2092">                     Very Low (3%)                 </td> <td data-bbox="1193 1966 1447 2092">                     16.6 ha of clearing. No impacts from clearing expected.                 </td> </tr> </tbody> </table>	Project Area	Soil Description (Cotching 2005)	Waterlogging Risk	Expected Impact	<b>Road Upgrade Envelope</b>	<b>Yeeda System</b> Earthy sands; dark reddish brown loamy sand or dark red sand topsoil over red sand to coarse sandy loam subsoils; and Earthy sands; dark reddish brown loamy sand topsoil over red loamy sand subsoils	Very Low (1%)	23.2 ha of clearing. No impacts to flooding from clearing expected.	<b>Wanganut System</b> Sandplain and dunefields with through-going drainage: sandplain, mainly in the upper parts, with stable	Very Low (3%)	16.6 ha of clearing. No impacts from clearing expected.			
Project Area	Soil Description (Cotching 2005)	Waterlogging Risk	Expected Impact												
<b>Road Upgrade Envelope</b>	<b>Yeeda System</b> Earthy sands; dark reddish brown loamy sand or dark red sand topsoil over red sand to coarse sandy loam subsoils; and Earthy sands; dark reddish brown loamy sand topsoil over red loamy sand subsoils	Very Low (1%)	23.2 ha of clearing. No impacts to flooding from clearing expected.												
	<b>Wanganut System</b> Sandplain and dunefields with through-going drainage: sandplain, mainly in the upper parts, with stable			Very Low (3%)	16.6 ha of clearing. No impacts from clearing expected.										

		<p>dunefields, lowlying sandplain, and scattered pans and depressions; sparse to moderately dense branching drainage pattern; relief up to 9 m.</p>		
<p><b>Methodology</b></p>	<p>A typical characteristic of the Yeeda and Wanganut Land Systems is a lack of defined drainage (Figure 6). Low areas of the landscape do experience periods of sheetflow. Soils within these areas are generally well draining, leading to extensive, unconfined superficial aquifers. Depending on the volume of rain received and the level of the aquifer, some low lying areas may experience periods of waterlogging. Clearing is not expected to alter this pattern as the area to be cleared is a long, narrow corridor, directly adjacent to an already cleared and compacted road.</p> <p>Clearing is not at variance to this Principle because:</p> <ul style="list-style-type: none"> <li>• Soils present in the Road Upgrade Envelope are generally well draining, as evident by the low waterlogging risk; and</li> <li>• Clearing works are to be immediately followed by the Road upgrade, which is expected to be complete prior to the wet season, making flooding as result of clearing unlikely.</li> </ul> <p>Biota Biological Survey (Biota 2018a)                  Main Roads Site Inspection (26 October 2017) (Main Roads Western Australia 2017)                  An inventory of rangelands in part of the Broome Shire (Cotching 2005)</p>			

## 6 ADDITIONAL ACTIONS REQUIRED

Table 7 summarises what further pre-clearing impact assessment and vegetation management is required in accordance with CPS 818.

**Table 7. Summary of Additional Management Actions Required by CPS 818**

Impact of Clearing	Yes/No or NA	Further Action Required
<p><b>1.</b> The CAR indicates that the clearing is 'At Variance' or 'May be at Variance' with one or more of the Clearing Principles.</p> <p>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:</p> <ul style="list-style-type: none"> <li>(i) a minor non-perennial watercourse(s);</li> <li>(ii) a wetland(s) classed as a multiple use management category wetland(s); and/or</li> <li>(iii) a wetland that is not a defined wetland;</li> </ul> <p>the preparation of an Assessment Report, as required by condition 6(e), is not required.</p>	<b>No</b>	No further action required.
<p><b>2.</b> 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.</p>	<b>No</b>	No further action required. Specified vegetation management actions will need to be prepared in consultation with the Office of the Commissioner of Soil and Land Conservation, to manage land degradation, water quality deterioration or flooding and provided in the VMP.
<p><b>3.</b> The project involves clearing for temporary works (as defined by CPS 818).</p>	<b>No</b>	No further action required.
<p><b>4 a.</b> Project is within Region that:</p> <ul style="list-style-type: none"> <li>- Has rainfall greater than 400mm and</li> <li>- Is South of the 26<sup>th</sup> parallel and</li> <li>- Works are in 'Other than dry conditions' and</li> <li>- Works have potential for <b>uninfested</b> areas to be impacted</li> </ul>	<b>No</b>	Proceed with standard Vehicle and Plant management actions from PEMR's and Vehicle and Plant Hygiene Checklists.

Impact of Clearing	Yes/No or NA	<i>Further Action Required</i>
<p><b>4b.</b> Does the proposed works require clearing within or adjacent to DBCA estate in non-dry conditions?</p>	<p><b>No</b></p>	<p>No further action required.</p>
<p><b>5.</b> 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</p>	<p><b>No</b></p>	<p>No further action required.</p>
<p><b>6.</b> 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</p>	<p><b>No</b></p>	<p>Specific weed management and monitoring measures will be incorporated into the contract through the CEMP.</p>

## **7 STAKEHOLDER CONSULTATION**

Main Roads has not undertaken stakeholder consultation in accordance with CPS 818/15 Condition 8 due to the works not being at variance to any clearing principle.

Main Roads has consulted with numerous stakeholders regarding the alignment of the BCLR in general. No comments were received that related to clearing impacts.

## **8 VEGETATION MANAGEMENT**

Main Roads will avoid clearing native vegetation where possible. Where clearing cannot be avoided, it will be kept to a minimum. A Vegetation Management Plan (VMP) is not required due to the Project not being at variance to any clearing principle.



## 9 REFERENCES

- AECOM. 2011a. *Browse LNG Precinct Access Road - Flora and Fauna Survey*. Prepared for Main Roads Western Australia.
- AECOM. 2011b. *Browse LNG Precinct Access Road - Targeted Fauna Survey: Greater Bilby*. Prepared for Main Roads Western Australia.
- ALA. 2020. *Atlas of Living Australia*. <https://www.ala.org.au/>.
- ASRIS. 2011. *ASRIS - Australian Soil Resource Information System*. Accessed January 7, 2021. <http://www.asris.csiro.au/>.
- Australian Government. 2015. *Northern Australia Audit: Infrastructure for a Developing North*. Infrastructure Australia.
- Biota. 2010. "A vegetation and flora survey of James Price Point: Wet Season 2009. Appendix C-18 Browse Liquefied Natural Gas Precinct Strategic Assessment Report."
- Biota. 2018b. *Asian Renewable Energy Hub Detailed Flora and Vegetation Survey*. . Available at: <https://asianrehub.com/wp-content/uploads/2019/05/Appendix-5-Flora-and-Vegetation-Rev-0.pdf>: Prepared for NW Interconnected Power.
- Biota. 2018a. *Cape Leveque Road Upgrade Biological Survey*. Prepared for MRWA.
- BirdLife Australia. 2020. *Bird Profiles*. <https://www.birdlife.org.au/all-about-birds/australias-birds/find-a-bird>.
- Bureau of Meteorology. 2021. *Climate Statistics for Australian Locations - Broome Airport*.
- Cotching, W. 2005. *An inventory of rangelands in part of the Broome Shire, Western Australia. Technical Bulletin 93*. Perth, WA: Department of Agriculture and Food, Western Australia.
- DAWE. 2021. "Protected Matters Search Tool Report." Department of Agriculture, Water and the Environment. Accessed November 2020. <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst-coordinate.jsf>.
- DAWE. 2020. *Species Profiles and Threats Database (SPRAT)*. Department of Agriculture, Water and the Environment, Commonwealth of Australia. Available online at <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.
- Doughty, P, L Kealley, A Fitch, and S Donnellan. 2014. "A new diminutive species of *Varanus* from the Dampier Peninsula, western Kimberley region, Western Australia." *Records of the Western Australian Museum* (WA Museum) 29: 128-140.
- DoW. 2012. *Groundwater resource review – Dampier Peninsula. Hydrogeological record series. Report no. HG57 March 2012*. . Government of Western Australia.
- DPIRD. 2021. *Soil Landscape Mapping - Best Available (DPIRD-027)*. Accessed 07/01/2021: Department of Primary Industries and Regional Development.
- DWER. 2020. *Clearing Permit Map System*. Department of Water and Environment Regulation, WA.

- DWER. 2021. *Water Information Reporting Tool*. Available online:  
<https://www.water.wa.gov.au/maps-and-data/monitoring/water-information-reporting>.
- Dziminski, M, and K Bettink. 2017. *The conservation and management of the Greater Bilby (Macrotis lagotis) on the dampier peninsula, WA*. Government of Western Australia.
- Ellis, R, G Shea, H Cogger, and J Zichy-Woinarski. 2017. "Simoselaps minimus. The IUCN Red List of Threatened Species 2017."
- EnviroWorks Consulting. 2018. *Pardoo Irrigated Agriculture Project - Stage 3 Environmental Management Plan*. Available at:  
[http://www.epa.wa.gov.au/sites/default/files/Referral\\_Documentation/Supporting%20Document%20-%20Appendices%20A-D.PDF](http://www.epa.wa.gov.au/sites/default/files/Referral_Documentation/Supporting%20Document%20-%20Appendices%20A-D.PDF), Pardoo Beef Corporation Pty Ltd.
- EPA. 2017. *Report and recommendations of the Environmental Protection Authority – Thunderbird Mineral Sands Project*. Available at:  
[http://www.epa.wa.gov.au/sites/default/files/EPA\\_Report/EPA%20Report%201606%20-%20Thunderbird%20Mineral%20Sands%20Project%20%28PER%29.pdf](http://www.epa.wa.gov.au/sites/default/files/EPA_Report/EPA%20Report%201606%20-%20Thunderbird%20Mineral%20Sands%20Project%20%28PER%29.pdf) : Environmental Protection Authority WA.
- EPA. 2020. *Technical Guidance - Terrestrial Bertebrate Fauna Surveys for Environmental Impact Assessment*. Perth, WA: Environmental Protection Authority.
- EPA. 2016. *Technicla Guidance - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment*. Perth, WA: Environmental Protection Authority.
- Geoscience Australia. 2008. *ELVIS – Elevation Information System*. Commonwealth of Australia.
- GHD. 2015. *Greater Bilby Management Plan – Cape Leveque Road Upgrade SLK 25 – 102.6*. . Prepared for Main Roads Western Australia.
- GHD Pty Ltd. 2016. *LandCorp Broome Motorplex Environmental Site Investigation*. . Available at:  
[ftp://ftp.dwer.wa.gov.au/permit/8042/CPS%208042\\_1%20-%20Environmental%20Report%20for%20Broome%20Motorplex.PDF](ftp://ftp.dwer.wa.gov.au/permit/8042/CPS%208042_1%20-%20Environmental%20Report%20for%20Broome%20Motorplex.PDF) .
- Government of Western Australia. 2019. *2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report)*. Perth, Western Australia: Department of Biodiversity, Conservation and Attractions. Available online from:  
<https://www2.landgate.wa.gov.au/web/guest/downloader>.
- Government of Western Australia. 2014. *A guide to the assessment of applications to clear native vegetation under Part V Division 2 of the EP Act 1986*. Department of Environmental Regulation.
- Government of Western Australia. 2019. *Native Vegetation Clearing Permits. Application, Assessment and Management Requirements under Part V Division 2 of the EP Act 1986*. Department of Water and Environmental Regulation.
- Higgins, P, and S Davies. 1996. *Handbook of Australian, New Zealan and Antarctic Birds*. Melbourne, VIC: Oxford University Press.

Main Roads Western Australia. 2017. "Site Inspection Report – Broome-Cape Leveque Road Upgrade SLK 0 – 25. 26 October 2017. ."

Markey, AS, CF Wilkins, RA Coppen, and MN Lyons. 2018. *Targeted Rare and Priority Flora Survey: La Grange Project Area, Department of Biodiversity, Conservation and Attractions, Government of Western Australia*. Available at: <https://library.dbca.wa.gov.au/static/FullTextFiles/072317.pdf>, Perth, WA: Department of Biodiversity, Conservation and Attractions. Government of Western Australia.

NatureMap. 2020. *NatureMap: Mapping Western Australia's Biodiversity. Online Database*. Government of Western Australia: Department of Biodiversity, Conservation and Attractions.

Payne, A, and N Schoknecht. 2011. *Land Systems of the Kimberley Region, Western Australia. Technical Bulletin 98*. Perth, WA: Department of Agriculture and Food.

Reynolds, S, L Beames, T Willing, and C Parker. 2018. *Distribution, ecology and cultural importance of Gunurru or Cable Beach Ghost Gum Corymbia paractia in the Broome area, Western Australia*. Broome, WA: Environs Kimberley.

Shepherd, D P, G R Beeston, and A J.M Hopkins. 2002. *Native Vegetation in Western Australia: extent, type and status. Resource Management Technical Report 249*. Department of Agriculture.

Tille, P. 2006. *Soil-landscapes of Western Australia's rangelands and arid interior. Report 313*. Perth, WA: Department of Agriculture and Food.

WAPC. 2015. *Dampier Peninsula Planning Strategy, Final Report*. WA Planning Commission.

Wells, G. 2018. *Memo - Targeted flora survey for Shamrock Station Irrigation Project*. Memorandum for Argyle Cattle Company. Available at: [https://www.epa.wa.gov.au/sites/default/files/Additional\\_Assessment\\_Information/CMS17189-Targeted%20Flora%20Survey.pdf.pdf](https://www.epa.wa.gov.au/sites/default/files/Additional_Assessment_Information/CMS17189-Targeted%20Flora%20Survey.pdf.pdf)

Western Australian Herbarium. 2020. "Florabase - The Western Australian Flora." Department of Biodiversity, Conservation and Attractions. Available at <https://florabase.dpaw.wa.gov.au/>.

Willing, T, and L Beames. 2015. "Priority Ecological Community Mapping and Condition Assessment: Cable Beach Ghost Gum Community (Corymbia paractia) within the Broome townsite."

## 10 APPENDICES

Appendix	Title
Appendix 1	Greater Bilby Cumulative Habitat Impact Assessment

## Appendix 1: Greater Bilby Cumulative Habitat Impact Assessment

The Threatened Species Scientific Committee currently identifies the following (direct) threats related to the clearing of native vegetation for the Greater Bilby as (Threatened Species Scientific Committee 2016):

- Potential habitat loss and fragmentation of habitat from land clearing and infrastructure development

Roadkill is considered a subset of the impact listed above and is assessed here, but only in relation to clearing activities (roadkill during operations is not assessed here). There are a number of other threats to the species that are not related to clearing which are not considered here.

### Habitat Fragmentation

The BCLRU is not expected to cause additional fragmentation as the new road will follow the existing alignment of the road (Figure 3).

### Habitat Loss

Mapping by Biota (2018) suggests that there is 370 ha of high prospectivity Bilby habitat within the RUE (Figure 11). The estimated impact of 39.4 ha means that at a local level, the Project will result in the loss of approx. 10.6% of high quality habitat in the immediate surrounds (within a 200m radius of the upgraded road's centreline). Note that high prospectivity indicates suitable habitat for the species over time and does not mean that all areas are being used at present.

In 2017, Main Roads undertook an assessment of suitable vegetation and substrate types in the Pindanland Bioregion (Figure 12; DAFWA 2012). The aim of the mapping was to estimate the availability of suitable habitat for the species by combining broad vegetation mapping with soil landscape data as key habitat criteria. Areas that contained both suitable substrate and vegetation were given a high quality rating while areas that did not meet either criteria, low. Areas which met one of the criteria but not the other were given a medium quality rating.

Once areas that are already cleared are accounted for, the assessment showed that there is currently 5,376,409 ha of high prospectivity habitat in the Pindanland Bioregion (Figure 12). To ensure the habitat suitability model reflected real-world species occurrence data, the mapping was cross-referenced against confirmed Bilby sighting locations (DBCA 2017a; DBCA 2018b; Nyul Nyul Rangers 2017; Biota 2018). 88.9% of all known records were found in areas with high quality habitat, 10.7% in areas of moderate quality habitat and 0.4% in areas with low quality habitat. While not suitable for modelling micro-conditions associated with short term habitat favourability, this habitat modelling is adequate for estimating the extent of available habitat for the purposes of EIA.

The habitat model was then compared with the direct impact of various actions in the Bioregion to estimate cumulative impacts on habitat loss. A number of sources were used to identify areas approved for clearing, or under assessment:

- The DWER's Clearing Permit Mapping System; and
- The EPA's list of active assessments and ministerial statements.

Table 8 provides the findings of the assessment, in relation to the contribution of the BCLRU. It includes all estimates of clearing, regardless if areas are rehabilitated.



**Table 8. Cumulative clearing impacts to Greater Bilby habitat in the Pindanland Bioregion**

No	Instrument	Project / Proposal / Holder	Approved/ Assessed Area	% Total habitat loss*
1	Various permits	Various Permits - CPS 190/1, 3658/1, 3912/1, 4011/1, 4055/1, 4274/1, 4543/1, 5490/1, 5532/1, 5581/1, 5786/1, 5646/1, 5659/1, 6136/1, 6136/1, 6340/1, 6407/1, 6425/1, 7215/1, 7255/1, 7441/1, 7596/1, 7687/1, 8326/1, 8368/1	83.79	0.0016%
2	CPS 896/2	Blina Diamonds NL (Mineral Exploration)	11	0.0002%
3	CPS 2925/1	Department Of Corrective Services	85	0.0016%
4	CPS 3104/5	Broome Port Authority	24.55	0.0005%
5	CPS 3129/2	Kimberley Diamond Company Pty Ltd	364	0.0068%
6	CPS 3421/1	Fysen and Morris (Horticulture)	120	0.0022%
7	CPS 3422/1	Galwey Horticultural Pty Ltd	81.7	0.0015%
8	CPS 3516/1	Forshaw Pastoral Company Pty Ltd	350	0.0065%
9	CPS 3771/4	Woodside Energy (Geotechnical Investigation)	25	0.0005%
10	CPS 4063/1	Mowanjum Aboriginal Community (Extractive Industry)	32.2	0.0006%
11	CPS 4335/1	Burrjuk Aboriginal Corporation	40.4	0.0008%
12	CPS 4354/1	Woodside Energy Limited	27	0.0005%
13	CPS 4390/1	Futura Asset Pty Ltd (Pastoral Diversification)	25	0.0005%
14	CPS 4763/1	Shire of Broome (Stockpile / Bulk Earth)	10.4	0.0002%
15	CPS 4834/2	J Francis, J Elizabeth and J. Cowdrey (Horticulture)	27	0.0005%
16	CPS 5166/1	Futura Asset Pty Ltd (Cropping)	210	0.0039%
17	CPS 5252/1	Marphil Holdings Pty Ltd (Industrial)	13.61	0.0003%
18	CPS 5411/1	Kimberley Quarry Pty Ltd (Mineral Exploration)	10	0.0002%
19	CPS 5485/1	Department of Water (Bore Construction)	4.84	0.0001%
20	CPS 5486/1	Kimberley Quarry Pty Ltd (Mineral Production)	45	0.0008%
21	CPS 5517/1	Sawa Pty Ltd (Cropping)	450	0.0084%
22	CPS 5565/1	Kimberley Quarry Pty Ltd (Mineral Production)	65	0.0012%
23	CPS 5690/1	Peter Connolly (Mineral Production)	18.38	0.0003%
24	CPS 5833/1	Department of Water (Pipeline)	77.8	0.0014%
25	CPS 6026/1	Bidyadanga Aboriginal Community	10.57	0.0002%
26	CPS 6037/1	Yeeda Pastoral Company Pty Ltd (Cropping)	67	0.0012%
27	CPS 6078/2	Main Roads WA Broome-Cape Leveque Road Upgrade SLK 25 - 102.6	297	0.0055%
28	CPS 6084/4	Mowanjum Aboriginal Community (Cropping)	116	0.0022%
29	CPS 6241/1	Mamabulanjin Aboriginal Corporation (Horticulture)	13.1	0.0002%
30	CPS 6318/1	Jamie Burton (Pastoral Diversification)	142.5	0.0027%
31	CPS 6334/2	Jamie Burton (Pastoral Diversification)	493.13	0.0092%
32	CPS 6697/1	Greenleigh Pty Ltd	75	0.0014%
33	CPS 7122/1	Forshaw Pastoral Company Pty Ltd	250	0.0046%
34	CPS 7270/1	Anna Plains Cattle Co. Pty Ltd	120	0.0022%
35	CPS 7311/1	Kimberley Asparagus (Pastoral Diversification)	165	0.0031%
36	CPS 7313/1	Greenleigh Pty Ltd	450	0.0084%
37	CPS 7342/1	Forshaw Pastoral Company Pty Ltd	200	0.0037%
38	CPS 7451/1	Kimberley Ports Authority	21.73	0.0004%

No	Instrument	Project / Proposal / Holder	Approved/ Assessed Area	% Total habitat loss*
39	CPS 7906/1	POZ Minerals Limited	80	0.0015%
40	CPS 7931/2	Shelamar Leasing Company (Pastoral Diversification)	490	0.0091%
41	CPS 7953/2	Nyamba Buru Yawuru	422	0.0078%
42	CPS 8042/1	Landcorp	34.51	0.0006%
43	CPS 8013/1	Mandora Cattle Company Pty Ltd	100	0.0019%
44	CPS 8042/1	West Australian Land Authority	30	0.0006%
45	CPS 8180/1	Mamabulanjin Aboriginal Corporation (Horticulture)	30	0.0006%
46	CPS 8241/1	Kimberley Quarry Pty Ltd	98	0.0018%
47	CPS 8511/1	Forshaw Pastoral Company Pty Ltd	250	0.0046%
48	Ministerial Statement 1079	Pardoo Irrigated Agriculture Project Stage 3	280	0.0052%
49	Ministerial Statement 1080	Thunderbird Mineral Sands Project	1954.5	0.0364%
50	Ministerial Statement 1086	Shamrock Station Irrigation Project	650	0.0121%
51	CPS 818/12	Main Roads WA Gibb River Road SLK 9.44-62.5 (actual areas cleared)	81.83	0.0015%
52	CPS 818/13	Main Roads WA Broome-Cape Leveque Road Upgrade SLK 13.6-25	37.8	0.0007%
53	CPS 818/13	Main Roads WA Bidyadanga Road Upgrade	20.5	0.0004%
54	CPS 818/13	Main Roads WA Gibb River Road SLK 62.5-120 Stage 1 and 2 (SLK 110-119.2 & 70-80)	60.5	0.0011%
55	CPS 818/14	Main Roads WA Great Northern Highway Material Pit Investigation (SLK 2070)	20	0.0004%
56	CPS 818/14	Main Roads WA Gibb River Road SLK 62.5-120 Stage 3 (SLK 80-90)	17.7	0.0003%
57	CPS 818/14	Main Roads WA Great Northern Highway Material Pit Investigation (SLK 1935)	20	0.0004%
58	CPS 818/14	Main Roads WA Great Northern Highway Material Pit Investigation (SLK 1967)	20	0.0004%
59	CPS 818/14	Main Roads WA Great Northern Highway Material Pit Investigation (SLK 2021)	20	0.0004%
<b>60</b>	<b>CPS 818/14</b>	<b>Main Roads WA Broome-Cape Leveque Road Upgrade SLK 0-13</b>	<b>39.4</b>	<b>0.0007%</b>
<b>TOTAL</b>			<b>9,379.44</b>	<b>0.1745%</b>

In addition to loss of overall habitat, no active burrows are directly affected by the Project as of 2018. However, as Bilby often move between areas and can excavate burrows in a relatively short amount of time, further management will be undertaken to ensure no direct impacts as a result of clearing activities will occur in the future.



**Plate 6. Greater Bilby burrows located at SLK 17.25**

Bilby are semi-nomadic and their density and distribution is strongly linked to the availability of food resources, which are in turn linked to fire history (Southgate 2005). Despite the large number of diggings recorded by Biota, it is important to note that the absence of other sign (tracks or scats) or age indicates that the majority of diggings are of low to moderate certainty. High certainty diggings and tracks were only detected at a few locations, usually in proximity to an active burrow. Furthermore, there was no indication that 'hotspots' of activity (in particular burrowing) exist along the BCLR. A review of Bilby survey data from 2011, 2015 and 2018 by Southgate (2018) did not identify any clusters of activity over time (AECOM 2011b; GHD 2015; Biota 2018).

Furthermore, recent assessments of habitat loss for the Thunderbird Mineral Sands Mine by the EPA (2017) concluded, "...habitat for both the Greater Bilby and Dampier Peninsula goanna extends beyond the development envelope, and these species are unlikely to be impacted significantly at a regional scale when considering the known distribution and habitat availability of these species." The Thunderbird Project is expected to result in the loss of 1,961.1 ha of habitat (326.1 ha permanently; EPA 2017).

Based on the evidence and assessment provided above, habitat loss as a result of the BCLRU is not significant from a Bioregion perspective because:

- The project will only cause the loss of under 0.001% of high quality habitat in the Bioregion, and 10.6% of the habitat available in the immediate surrounds (within 200m of the Project);
- The project contributes to a very small proportion of cumulative clearing impacts in the Bioregion; and
- Previous decisions by the EPA on clearing that is significantly higher than this project acknowledged the relatively low level of impact in relation to available habitat.

### **Mortality during Clearing Works**

Based on typical Main Roads activities, mortality during construction may be from:

- Fatal interactions from construction equipment (e.g. roadkill); or
- Destruction of an occupied burrow resulting in death of an animal.

Mortality from construction equipment is considered highly unlikely due to Bilby being crepuscular in nature. Main Roads will not be carrying out any night works, and works are typically carried out between 6am and 5pm. Interactions between Bilbys and construction equipment is therefore unlikely. Main Roads has been



working on BCLR between SLK 25 and 102.6 since August 2017, no interaction between Bilby and construction equipment was recorded in this period.

The project will not result in the loss of any of the burrows detected by Biota in April 2018 as current designs have successfully avoided these locations. However, Bilby are known to be highly mobile and will travel considerable distances in search of suitable habitat. It is thought that habitat suitability is generally a function of not only broad characteristics such as vegetation types and substrate, but also highly unpredictable factors such as climate/rainfall, predation pressures and fire age. As such, it is impossible to estimate the specific numbers of burrows that could be impacted if clearing is carried out several years following assessment. Therefore, Main Roads will be carrying out pre-clearing Bilby surveys using best practice methods, and endeavour to conduct clearing activities as soon as possible to minimise impacts to the species.

Pre-clearing surveys carried out on the SLK 25 – 102.6 section detected a number of 'fresh' burrows, but based on monitoring, all burrows were not being occupied at that time. Bilby are known to excavate a number of burrows and may use multiple burrows over the course of a single night. It is possible that Bilbies could have moved to another burrow before monitoring activities, based on the disturbance caused by heavy machinery in nearby areas (noise and vibrations).

Therefore, mortality during clearing and construction is considered unlikely because:

- Main Roads will not be carrying out any night works;
- Management measures are in place to avoid and manage any Bilby activity within the works area (Greater Bilby Management Plan); and
- Signposted speed limits will be in place around areas of active construction (between 40 – 80 km/h).

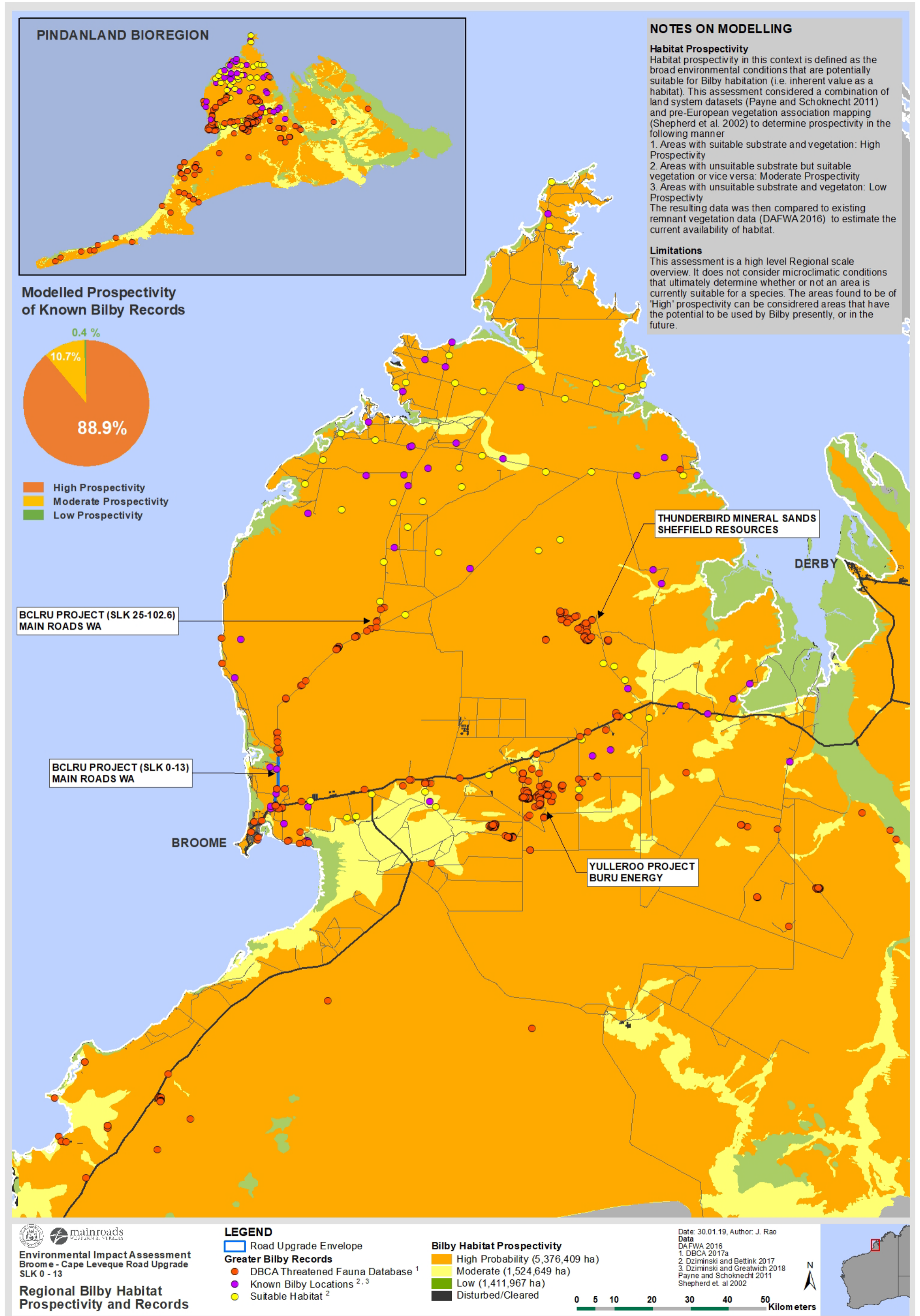


Figure 12. Greater Bilby Habitat Prospectivity and Record